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Part 1

Getting Started

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Introduction

This manual has been written to give new users a step-by-step guide to collecting, storing, and processing data from your Princeton Instruments system. The manual is divided into the following three parts:

- **Part 1, *Getting Started***, is primarily intended for the first time user or for the experienced user who wants to review. These chapters lead the user through hardware setup, experiment setup, data collection, file handling, wavelength calibration, spectrograph setup and calibration and data display procedures.
- **Part 2, *Advanced Topics***, goes on to discuss ancillary topics such as ROI, binning, data correction techniques, printing, gluing spectra, Y:T analysis, processing options, pulser operation and customizing the toolbar. These chapters are more informational and less procedural than those in Part 1.
- **Part 3, *Reference***, contains a chapter having alphabetically arranged detailed descriptions of all menus, windows, dialog boxes and tab pages. This detailed information complements that provided in Parts 1 and 2. Part 3 also contains appendices which provide additional useful information, such as the Hg, Ar, Ne calibration spectrum data and graph provided in Appendix A, and the data-structure information provided in Appendix B. Other appendices discuss the wavelength calibration algorithm and installation work-arounds for situations where the CCD ROM doesn't support long file names.

A software hardware setup wizard guides you through the critical hardware selections the first time you select Setup – Hardware. To properly respond to the wizard's queries, you may have to refer to your ordering information, such as exact detector model, A/D converters, etc. Keep this information handy.

Even though the wizard will assist you in getting started, it will still be necessary to read through this manual to familiarize yourself with the many data-collection and analysis options available.

Note: Throughout the manual references are made to the PI-MAX camera/detector. This camera/detector was previously called the I-MAX and the ICCD-MAX.

Summary of Chapter Information

Part 1, *Getting Started*

Introduction describes the contents of this manual as well as other information sources including online help and other documentation files.

Chapter 1 **Installing WinSpec/32** lists system requirements and describes how to install the WinSpec/32 software.

- Chapter 2** **The Graphical Interface** describes the essentials of the WinSpec/32 graphical interface and its operation. Included are discussions of the Greeting Screen, Main Menu, Title Bar, Status Bar, Cursor and Mouse operations, Standard and Custom Tool Bars, and Image Windows.
- Chapter 3** **Hardware Setup** provides detailed instructions on how to configure WinSpec/32 for operation with the hardware in your particular system.
- Chapter 4** **Initial Spectroscopic Data Collection** provides a procedure for initial spectroscopic data collection, allowing users to gain some operating familiarity before going on to more complex measurements.
- Chapter 5** **Initial Imaging Data Collection** provides a procedure for initial imaging data collection, allowing users to gain some operating familiarity before going on to more complex measurements.
- Chapter 6** **Opening Closing and Saving Data Files** describes how to open, close and save data files in WinSpec/32.
- Chapter 7** **Wavelength Calibration** describes how to calibrate the WinSpec/32 software for one position of the spectrograph grating.
- Chapter 8** **Spectrograph Setup** describes how to install and set up the spectrograph.
- Chapter 9** **Spectrograph Calibration** discuss how to calibrate the WinSpec/32 software for any position of the spectrograph gratings.
- Chapter 10** **Displaying the Data** describes the data file display options.
- Part 2, Advanced Topics***
- Chapter 11** **ROI & Binning Options** describes binning, the summing together in hardware of charge from several pixels. Simple or more advanced binning options can be configured easily with WinSpec/32. The chapter also describes how to set a region of interest (ROI), so that data is only collected from the specified portion of the CCD array.
- Chapter 12** **Correction Techniques** explains correction options such as background subtraction and flatfield correction.
- Chapter 13** **Spectra Math** covers WinSpec/32's mathematical processing features.
- Chapter 14** **Y:T Analysis** provides an overview of how to use the Y:T analysis function to track changes in a process with time.
- Chapter 15** **Gluing Spectra** discusses gluing existing files or combining the data acquisition and gluing operations under spectrograph control.
- Chapter 16** **Process Mask Operations** describes digital mask-operations that can be performed on the acquired data. Discussed are Edge Enhancement, Sharpening, Smoothing, Custom Filter and Morphological functions.
- Chapter 17** **Additional Post Processing Options** describes additional operations that can be performed on an acquired data set. Functions cover include Threshold and Clipping, Cross Section, Binning and Skipping, and Histogram.


- Chapter 18 Printing** describes printing features of WinSpec/32. WinSpec/32 can print directly to almost any Windows printer driver.
- Chapter 19 Pulsar Operation** describes the operation of the Pulsers that can be used with WinSpec/32.
- Chapter 20 Custom Toolbar Settings** describes the Custom Toolbar and explains how to add/remove the available button icons.

Part 3, Reference

- Chapter 21 Menus and Dialog Boxes** is an alphabetically arranged detailed reference describing the WinSpec/32 menus, windows, tab pages and dialog boxes.
- Appendix A Calibration Lines** contains wavelength tables and a detailed spectrum for Mercury-Argon.
- Appendix B Data Structure** contains descriptions of the data structure for both WinView/WinSpec 1.43 and for 1.6. *The data structure for WinView/32 and WinSpec/32 is the same as that for WinView/WinSpec 1.6.*
- Appendix C Auto-Spectro Wavelength Calibration** discusses the WinSpec/32 wavelength calibration algorithm.
- Appendix D CCD Failure Work-Arounds** provides advice on how to successfully complete the installation in situations where the CCD ROM doesn't support long file names.

Online Help

The information in this manual is also available as a Windows online help file. The file WINSPEC.HLP is installed in the same directory as the file WINSPEC.EXE. The Help menu gives several ways of accessing WinSpec/32 Help. Clicking on Contents opens the WinSpec/32 Information Desk, which contains three tab pages, **Contents**, **Index** and **Find**. **Contents** works like a table of contents. Organized into books and topics, it displays a conveniently organized list of the topics in the Help system. **Index** provides a list of alphabetically arranged keywords, allowing topics of interest to be rapidly accessed. **Find** is a search function that allows users to quickly zero in on information relating to the subject of interest.

Clicking on the menu item **Help On** gives help on the current item (like F1). **Context Help** is equivalent to selecting the context-sensitive Help button  on the Standard Toolbar. **How to Use Help** calls WinHelp.hlp, which gives information on using the Help system. Last, **About WinSpec** provides WinSpec/32 version and licensing information, as well a report on the amount of free memory and disk space.


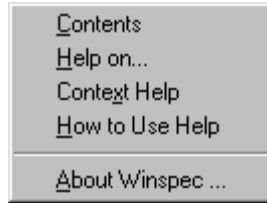
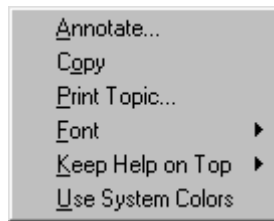
There are several options for accessing context sensitive help. One way is to press the F1 key at any menu selection. Another is to click on the standard toolbar context-sensitive help button  (or on **Context Help** in the Help menu) and then click on the item for which you'd like to have additional information. A third is to click the Help button on those windows and dialog boxes which have one.

Figure 1. The Help menu.



Note that once a Help window has been opened, right-clicking in the window will open a menu (Figure 2) that provides additional control options, including changing the font size, using the system colors, and determining whether the Help window will always be on top.

Figure 2. Auxiliary Help menu.



Tool Tips and Status Bar Messages

Placing the mouse cursor on a button and resting it there for a few seconds causes a brief tool-tip message to appear that describes the button's function. Tool tips are also provided for the individual panes of the Status Bar. Note that tool-tips only appear at the desktop level. They are not provided for the buttons on the individual dialog boxes and tab pages. However, most of these have a Help button which accesses context sensitive Help. Tool tips are also provided for the individual panes of the Status bar.

More detailed descriptions for each button at the desktop level are provided on the Status Bar itself. Status bar help messages are also provided for the menu selections.

Additional Documentation

Text files installed with the software contain information of a technical nature. Unless otherwise indicated, these files are found in the \WINSPEC32 directory on the hard drive where WinSpec/32 was installed. Among the text files that *could* be included are:

- README.TXT** This is a read-me file that contains the latest information on new features, fixed problems, and work-arounds for issues not yet solved.
- WINHEAD.TXT** This file contains documentation on the header structure for WinSpec/32 or WinSpec/32Data Files.

These TXT files can be opened with any ASCII text editor.

Chapter 1

Installing WinSpec/32

To ensure that the computer you have can operate the Princeton Instruments equipment, please first read the system requirements below carefully. WinSpec/32's requirements differ from those of previous versions of WinSpec.

After confirming that your computer meets all hardware and software requirements, install WinSpec/32 according to the instructions in this chapter. Do not attempt to run the software until you have read Chapters 3, 4 and 5, which discuss important hardware-setup and data acquisition issues. Also, it is recommended that you install the Princeton Instruments interface board in your computer before running the software. Instructions for installing the interface board are provided in your Princeton Instruments hardware manuals.

Note: If your computer and system were purchased together from Roper Scientific, the Interface card will have been installed at the factory.

System Requirements

The following information lists the system hardware and software requirements.

Hardware requirements

- Princeton Instruments ST series controller and a PI camera.
- Princeton Instruments high speed PCI serial card or ISA serial card. *Computers purchased from Roper Scientific are shipped with the card installed.*
- Minimum of 32 Mbyte total RAM for CCDs up to 1.4 million pixels. Collecting larger images at full frame or at high speed may require 128 Mbytes or more of RAM.
- Hard disk with a minimum of 80 Mbytes available. A complete installation of the program files takes about 6 Mbytes, and the remainder is required for data storage. Collection of large images may require additional hard disk storage, depending on the number of images collected and their size. Disk level compression programs are not recommended.
- Minimum is AT compatible computer with 80486 (or higher) processor (50 MHz or faster); Pentium or better recommended.

ATTENTION

Not all computers are able to satisfy the software and data-transfer performance requirements of PI systems. If you purchased a computer through Roper Scientific, it will have already been tested for proper operation with a Princeton Instruments system and will have the Interface card installed.

- Super VGA monitor and graphics card supporting at least 256 colors with at least 1 Mbyte of memory. Memory required will depend on desired display resolution.
- Two-button Microsoft compatible serial mouse or Logitech three-button serial/bus mouse.

Operating System requirements

Windows 95 (or higher) or Windows NT (ver. 4.0 or higher). WinSpec/32 is *not* supported under OS/2. Nor will it run under Windows 3.1 or 3.11.

Installing WinSpec/32

WinSpec/32 must be installed under Windows. It cannot be installed on a computer only running DOS, or from the DOS shell.

WinSpec/32 is normally provided on a CD that contains the standard files necessary to run WinSpec/32. Also supplied are sample data files, any options purchased separately from Roper Scientific, and the hardware initialization file, if any. It is also distributed via Roper Scientific's FTP site, which requires a password that registered users can obtain from the company's Tech Support department.

Note: When WinSpec/32 is installed, it modifies the Windows Registry file. If for any reason you reinstall Windows, the Registry file may be replaced, and WinSpec/32 may not run correctly. Reinstall WinSpec/32 to correct this problem.

Note: If installing under Windows NT, you *must* be logged on as administrator of the NT Workstation. If you are not logged on as the administrator, the required Registry changes cannot be made and the installation will fail. A warning is provided. Note that the actual failure doesn't occur until the installation process is almost complete.

Following are the steps to install WinSpec/32 on your computer.

- ◆ Exit any software currently running. This will speed the installation of WinSpec/32.

Installation from CD

- ◆ Insert the WinSpec/32 CD into your CD drive. Win/95 will detect the CD and the installation will begin automatically. A message will appear (Figure 4) indicating that the Install Shield Setup program is loading.

Note: If the auto-start feature has been disabled on your computer, click the desktop **Start** button, select **Run**, key **x:\Setup** (where "x" is the letter designating your CD drive) and press the **Enter** key on your keyboard. The install sequence will begin.

CAUTION

If your CD drive doesn't support the Win'95 long filename conventions, attempting the installation causes the file names to be truncated and the installation fails, generating an error message like:

An error occurred during the move data process: -113
Component: Application\WinXSystem
File Group: WinXSystem

If this should happen, see Appendix D for workarounds.

Figure 3.
Running the
Setup program.

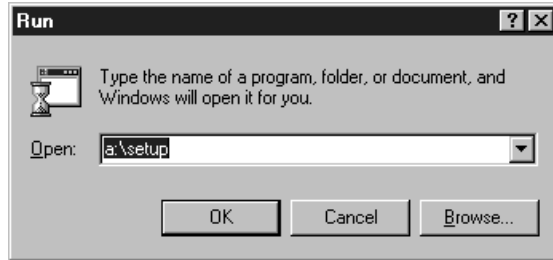
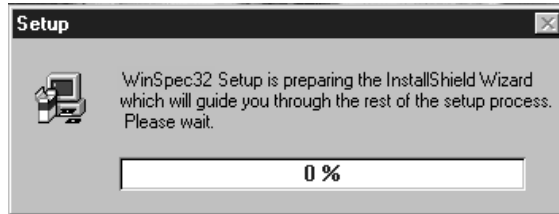


Figure 4.
InstallShield
Setup loading
message.



- ◆ The WinSpec/32 Setup Program Welcome dialog box will appear as shown in Figure 5. To quit without installing the software, click on Cancel. To continue installing the WinSpec/32 software, click on Next.
- ◆ Proceed to **Steps Common to Installations from CD and FTP Site** (page 38).

Figure 5. Setup
Welcome dialog
box.



Installation from FTP Site

- ◆ Log onto the FTP site.
- ◆ If installing the Windows 95 version of the software, execute the program WinSpec95.exe. If installing the Windows NT version of the software, execute the program WinSpecNT.exe. Executing either program will cause the WinSpec/32 Welcome screen to appear as shown in Figure 6.

Note: If you aren't sure how to access the FTP site, contact Roper Scientific's Technical Support Department for assistance. Contact information follows.

Roper Scientific
3660 Quakerbridge Road
Trenton, NJ 08619 (USA)

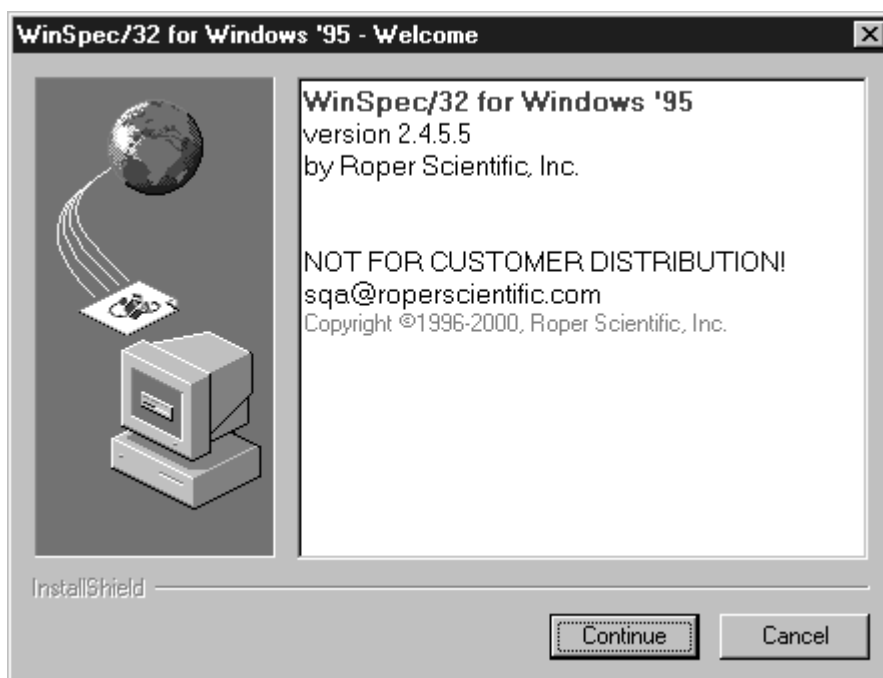
Tel: 609-587-9797

Fax: 609-587-1970

Tech Support E-mail: techsupport@roperscientific.com

For technical support and service outside the United States, see our web page at www.roperscientific.com. An up-to-date list of addresses, telephone numbers, and e-mail addresses of Roper Scientific's overseas offices and representatives is maintained on the web page.

Figure 6.
WinSpec/32
Welcome
screen.



- ◆ Click **Next** to continue. You will then be asked to supply the required password, as shown in Figure 7. Initially the **Next** button will be grayed out. When the correct password has been entered, the button will become selectable and you will be able to continue.

Figure 7.
Password Entry
Screen.



- ▶ Click on **Next**. WinSpec will read and unpack (Figure 8), the Install Shield setup (Figure 9) will run and the WinSpec Setup Welcome screen will appear (Figure 10).

Figure 8.
WinSpec '95
Reading and
Unpacking
Messages.

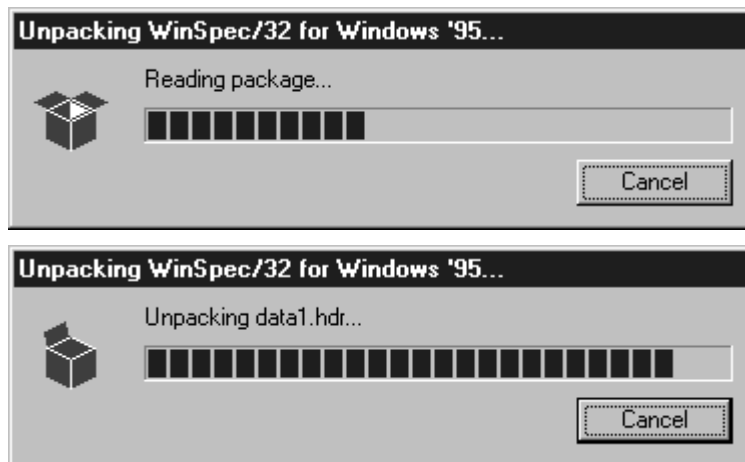


Figure 9.
Install Shield
Setup message.

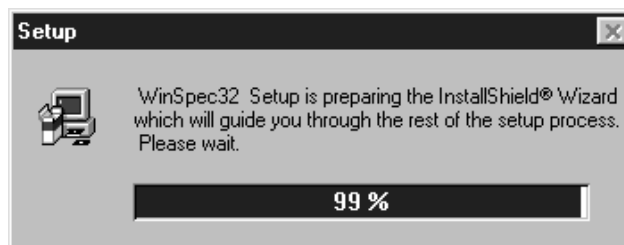


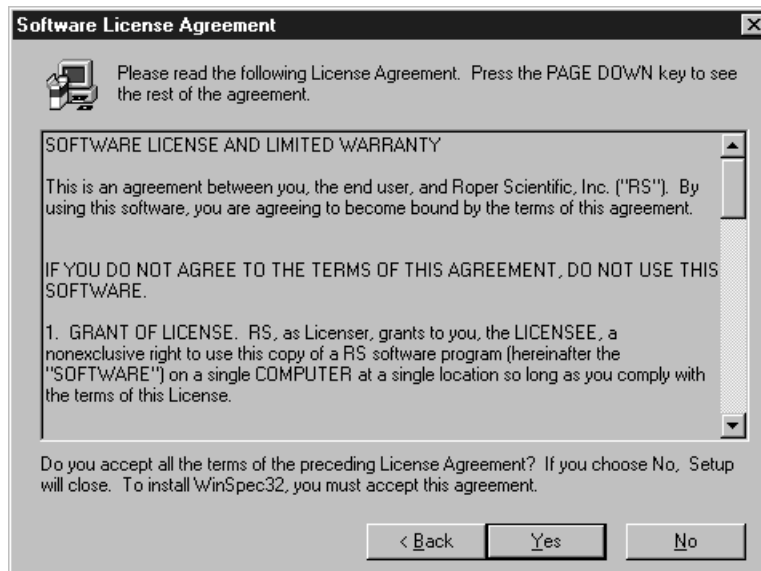
Figure 10.
WinSpec'95
Setup Window.



Steps Common to Installations from CD and FTP Site

- ▶ The Software License Agreement (Figure 11) will appear next. Click Yes to continue. Click No to abort the installation or Back to return to the previous screen.

Figure 11.
Software
License
Agreement.



- ▶ The User Information dialog box (Figure 12) will appear next. To continue, enter your name and organization. Then click Next.

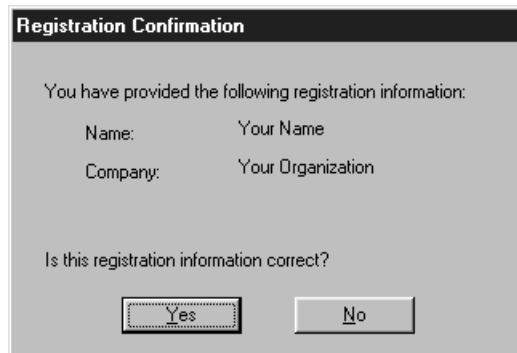
Figure 12.
User
Information
dialog box.



The dialog box is titled "User Information" and contains a small graphic of a computer system and a globe. The text reads: "Please enter your name and the name of the company for whom you work." There are two input fields: "Name:" with the text "Your Name" and "Company:" with the text "Your Organization". At the bottom, there are three buttons: "< Back", "Next >", and "Cancel".

- ◆ You are next asked to confirm your registration information via the following dialog box. Select Yes if the displayed information is correct and you wish to continue or No to return to the User Information box to make any necessary changes.

Figure 13.
Registration
information
confirmation
box.



The dialog box is titled "Registration Confirmation" and contains the text: "You have provided the following registration information:" followed by "Name: Your Name" and "Company: Your Organization". Below this, it asks "Is this registration information correct?" and has two buttons: "Yes" and "No".

- ◆ Next the Choose Destination Location dialog box will appear, as shown in Figure 14. This dialog box allows you to specify the directory where you wish the WinSpec/32 files to be installed. A default location, C:\Program Files\Princeton Instruments\WinSpec32, is suggested as shown in Figure 14 and Figure 15.

CAUTION

Do not install both WinSpec/32 and WinView/32 software packages in the same directory. Some files for these programs have the same name, but different content. If you install WinSpec/32 and WinView/32 in the same directory the last files installed will overwrite previous files of the same name.

You can install an upgrade of WinSpec/32 in a different directory from a previous version. Details for this procedure are found beginning on page 47.

Figure 14. The Choose Destination Location dialog box.

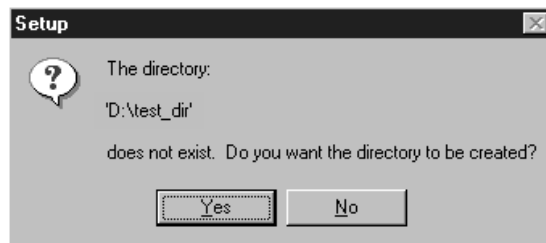


- ▶ To specify a different location, click on **Browse**. Then either select new directory or enter its name (with path information) in the entry box and click on **OK**. If you enter the name of a directory that doesn't exist, Install will offer to create it for you (Figure 16). Clicking on **Yes** in the Create Directory dialog box or **OK** in the Choose Directory dialog box will return you to the Choose Location dialog box. From there click on **Next** to continue.

Figure 15. Setting the destination path.



Figure 16. Create Directory dialog box.



Note: Data files are not limited to being placed in the directory shown in the Installation dialog box. Data files can be written to almost any logical drive where the computer has write access. The directory shown in the Installation dialog box is only the default directory, where WinSpec/32 will initially look for data files.

- Next the Setup Type dialog box (Figure 17) appears. You are given the following choices.

Standard PCI: Installs the Application, DLLs, Help, Sample and PCI Interface driver.

Standard ISA: Installs the Application, DLLs, Help, Sample and ISA Interface driver.

Standard: Installs the Application, DLLs, Help and Sample files, but no interface driver.

Custom: Allows user to choose files to be installed.

If your system has a PCI interface, **Standard PCI** is the best choice. If your system has an ISA interface, **Standard ISA** is the best choice. **Standard** doesn't provide the interface drivers, making it the installation of choice if the system is to be used solely to post-process images.

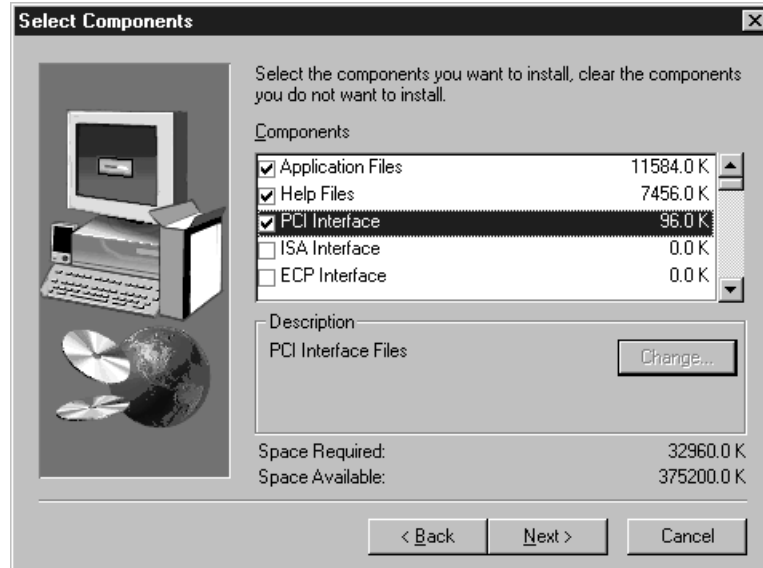
Figure 17.
Setup Type
dialog box.



- If you select **Custom**, the Select Components dialog box (Figure 18) will appear. All checked file types are selected for installation. An item is selected for installation if there is a check in the associated check box. Clicking on a check box acts as a toggle, either selecting or deselecting the item as indicated by the presence or absence of the check.

Users are advised to *deselect* the Interface, either PCI or ISA, that does *not* apply to their system. Because a substantial amount of memory is allocated for each interface, by selecting only the one that matches your specific hardware, the WinSpec/32 memory allocation will be minimized.

Figure 18.
Select
Components
dialog box.



A brief description of the selections follows.

Application Files: The actual WinSpec/32 files.

Help Files: Help System, includes both general and context-sensitive Help.

PCI Interface: Loads the drivers for the PCI Interface card.

ISA Interface: Loads the drivers for the ISA Interface card.

ECP Interface: Loads the drivers for the ECP Interface card.

Sample SPE Data Files: Creates a directory **Data** containing sample *.SPE files. This directory is located beneath the one containing the WinSpec/32 files.

V/ICCD Option: Provide the drivers needed for controlling a V/ICCD.

Documentation: Loads information files as well as the complete instruction manual in PDF format into the Documentation directory, which is located one level below the directory containing WinSpec/32 application files.

PI Screen Saver: Loads the PI Screen Saver. *See page 443 for description.*

PI Shell Extension: Provides additional SPE file properties pages. *Right click on SPE file name and select Properties. With PI Shell Extension deselected, only the standard Windows'95 file property page will appear. With PI Shell Extension selected, additional property pages will appear as described on page 419.*

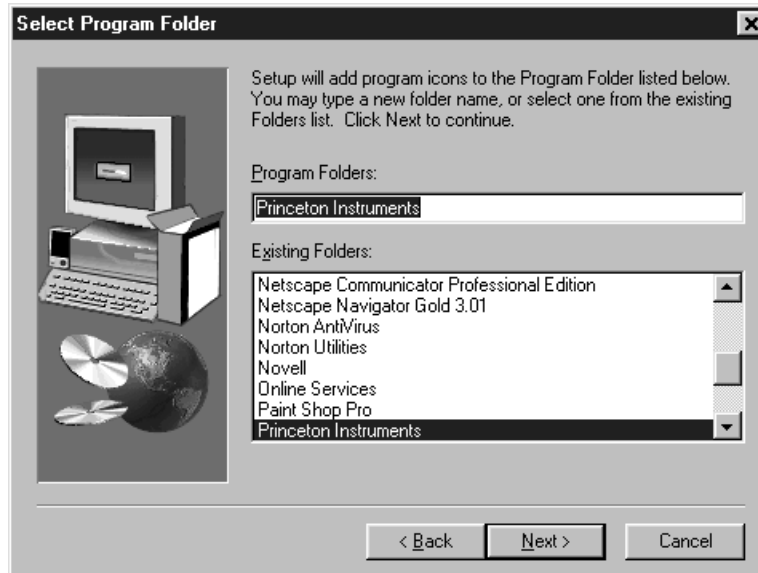
Visual Basic User Interface: Allows DLLs programmed using Visual Basic 5 or higher to be executed from WinSpec/32.

Diagnostic Program: Loads the diagnostics program pidiag32.exe. It is located in the directory containing the WinSpec/32 application files and can be executed by double clicking on pidiag32.exe via the Windows Explorer.

Pulser Support: Loads the pulser drivers. Currently supported pulsers include the PG-200 and the DG-535 Timing Generator (drives the PI-MAX pulsing circuits).

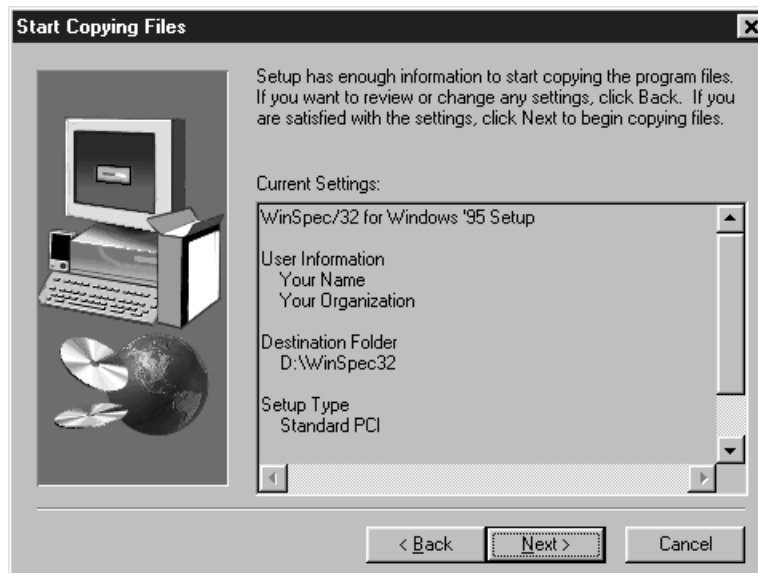
- ▶ Clicking on **Next** from either the Select Type or Select Components dialog box brings up the Select Program Folder dialog box (Figure 19). You can either select an existing folder or key in the name of a new one. Note that this is *not* the folder where the files are to be installed, but rather the Start Menu folder from which WinSpec/32 can be launched. After making your selection, click on **Next** to continue.

Figure 19.
Select Program
Folder dialog
box.



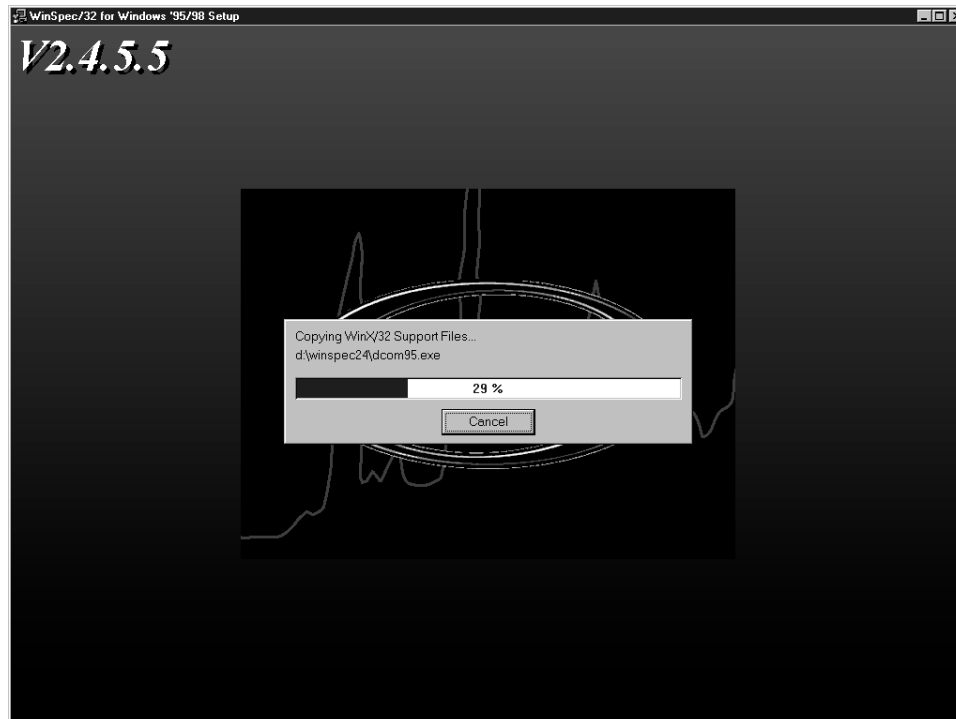
- ▶ The Start Copying Files dialog box will appear next. It lists the User Information, the Destination Folder, the Setup Type and the Program Folder. Click on **Next** to initiate the actual installation in which the files will be decompressed and placed in the specified directory. Click on **Back** if you wish to make any changes or on **Cancel** to exit the procedure.

Figure 20.
Start Copying
Files dialog
box.



- ▶ The File Installation screen depicted in Figure 21 appears next. The names of the individual files appear in the message box as they are loaded and the installation progress in percent is continuously displayed. Completing the installation for each floppy causes a message to appear directing you to remove that disk and insert the next one.

Figure 21. File installation screen.



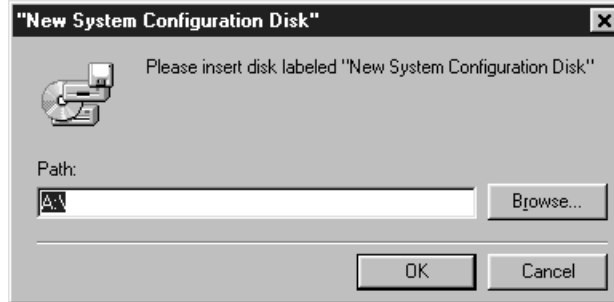
- ▶ Next the Configuration Disk query appears as shown in Figure 22. The disk referred to is shipped with each *new hardware system*. It is not part of the WinSpec/32 package. This disk contains the file `pihwdef.ini`, which lists all of the system components that are normally specified via the Hardware Setup Wizard by the user during the Hardware Setup procedure (Chapter 3). If `pihwdef.ini` is loaded, the required information is read directly from `pihwdef.ini` and the Wizard doesn't run.

Select **No** if you don't have the Configuration Disk (Wizard will run during Hardware Setup allowing the required hardware information to be specified). Select **Yes** if you do have the Configuration Disk. Then insert the Configuration Disk as directed so that `pihwdef.ini` will be copied to the directory containing the WinSpec/32 application files.

Figure 22. Configuration Disk Query.

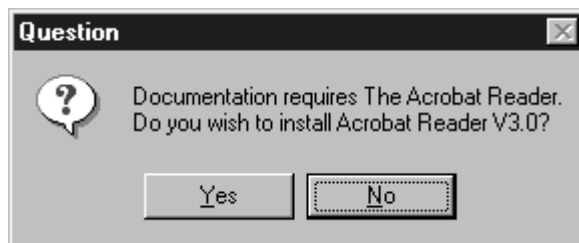


Figure 23.
Insert Disk
Instruction.



- ▶ After all files have been loaded, the Setup Complete dialog box (Figure 24) appears. Selecting **Finish** completes the WinSpec installation. Then you are given the opportunity to install Acrobat Reader. If you want to install Acrobat Reader, click on **Yes**. Otherwise, click on **No** after the Question dialog box appears.

Figure 24.
Setup Complete
and Question
dialog boxes.



Default Directories

A full installation of WinSpec/32 copies the following files into the directories listed below. The local drive is assumed to be C:.

Note: WinSpec/32 is fully compatible with Win 95 long file names, but for backward compatibility, file names have been kept short.

C:\Princeton Instruments\WinSpec32: Executable WinSpec/32 file, WINSPEC.EXE. This is the file that is run when you click on the WinSpec/32 icon.

Supporting files

Help Files: primarily WINSPEC.HLP and WINSPEC.CNT.

Documentation Updates

C:\Princeton Instruments\WinSpec32\Data: Default directory for data files. Sample data files, with the .SPE extension, are loaded if this option is selected during installation.

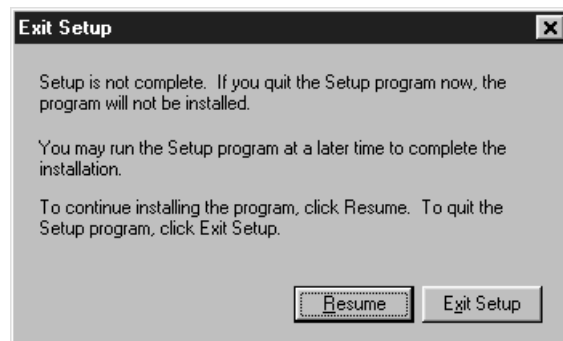
C:\Princeton Instruments\WinSpec32\Documentation: Contains read-me information files as well as the complete instruction manual in PDF format (requires Adobe Acrobat Exchange or Acrobat Reader to view; the Reader is a free download from www.adobe.com).

C:\Princeton Instruments\WinSpec32\Snap-In Examples: Contains one or more sample Snap-Ins, accessory programs written in Visual C++ that extend WinSpec/32's capabilities.

Aborting the WinSpec/32 Installation

- ▶ Clicking on the **Cancel** button anytime during installation will cause the dialog box in Figure 25 to appear.

Figure 25. The Quit dialog box.



- ▶ Click on the **Exit Setup** button to cancel the installation of the software. No part of the software will be installed. Click on the **Resume** button to return to the installation at the point where **Cancel** was selected so that installation can be completed.

Installing Some WinSpec/32 Files at a Later Time

You can install some WinSpec/32 files at first, and other files at a later time. Simply repeat the installation procedure, taking care to select Custom as the installation type. Then select the file type(s) to be installed and proceed as previously described.

Installing More than One Version of WinSpec/32

You can install more than one version of WinSpec/32, WinView/32 or any combination of the two on a single computer. In the Custom Installation dialog box simply change all the paths listed from C:\WINSPEC32 to a new directory such as C:\WINSPEC32B. The install program will automatically create the new directory, if necessary.

CAUTION

Do not install both the WinSpec/32 and WinView/32 software packages in the same directory.

CAUTION

Although several different versions of WinSpec/32 and/or WinView/32 can be installed on the same computer without conflicts, you should not run more than one version at any one time. The manner in which PI software allocates memory for data collection in precludes collecting data using two software packages at once.

It is also possible to install both 16-bit and 32-bit versions of the software in the same computer. However, keep in mind that WinSpec/32 will not operate under Windows 3.1 or 3.11. Similarly, the device drivers for the 16-bit version of WinSpec will not function properly under Win 95 or NT.

PIHWDEF.INI & SESSION.DAT

The hardware initialization file PIHWDEF.INI, is included with *16-bit versions of WinSpec software*. The file contains the all of the hardware settings necessary to get started and is read the first time WinSpec is executed. At the end of the first operating session, the settings in effect are written to SESSION.DAT, which is read the next time WinSpec software is operated so that the new session will begin with the same settings that were in effect at the end of the previous one.

Windows Registry and WinSpec/32: WinSpec/32 doesn't require PIHWDEF.INI or SESSION.DAT, but rather automatically stores the settings in the registry at the end of each operating session. However, WinSpec/32 will read the WinSpec/16 PIHWDEF.INI or SESSION.DAT if they are copied to the directory containing the WinSpec/32 software. This allows users who are upgrading from a 16-bit version of WinSpec to WinSpec/32 to readily transfer their previous operating settings to the new software. However, there are constraints. If there are settings in the registry, that is, if WinSpec/32 has been operated at least once, the software won't read PIHWDEF.INI or SESSION.DAT unless the file date is newer than the date of the stored registry settings. This problem can be avoided by simply copying PIHWDEF.INI or SESSION.DAT to the WinSpec/32 directory *before* operating it the first time. If that opportunity is lost, a newer SESSION.DAT can be created by booting the 16-bit WinSpec software and then exiting the program in the usual manner. Similarly, a text editor could be used to open/edit a copy of PIHWDEF.INI and then save it so that it has the current date.

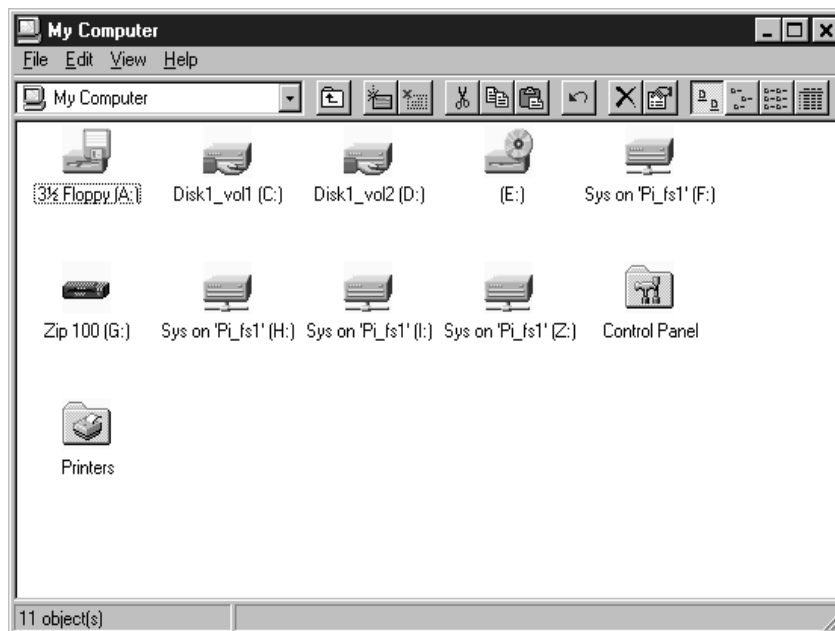
Uninstalling and Reinstalling

If you suspect any of the WinSpec/32 files have become corrupt, you should first delete all WinSpec/32 files, then reinstall the software from the original floppy disks. Follow the steps below to remove WinSpec/32. Note that some files may remain. They will have to be removed manually. *To reinstall, follow the procedure as described beginning on page 33.*

WinSpec/32 includes provision for automatically deinstalling the software. To deinstall WinSpec/32 from your computer, proceed as follows.

- ◆ From the Windows 95 desktop, click on My Computer. This will bring up the dialog box shown in Figure 26.

Figure 26.
Your Computer
dialog box.



- ◆ Double click on Control Panel to bring up the Control Panel dialog box (Figure 27).

Figure 27.
Control Panel
dialog box.

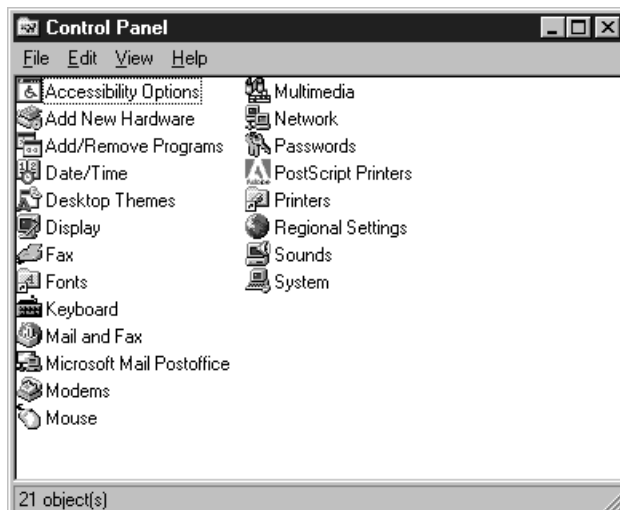
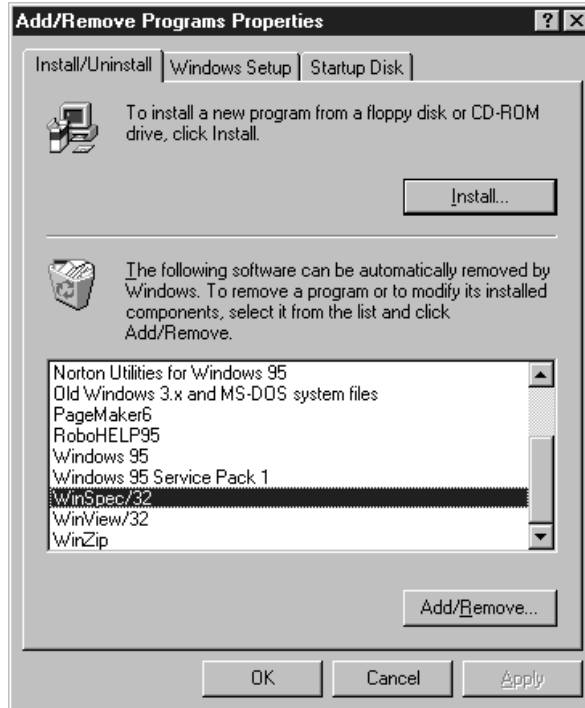


Figure 28.
Add/Remove
Programs
Properties
dialog box.



- ◆ Double click on Add/Remove Programs to bring up the Add/Remove Programs Properties dialog box (Figure 28).
- ◆ Select WinSpec/32 so that it is highlighted as shown in Figure 28.
- ◆ Select WinSpec/32 and click on the Add/Remove button. The Remove Confirmation dialog box (Figure 29) will appear.
- ◆ Click on **Yes** and WinSpec/32 will be removed. The Remove Confirmation dialog box will then disappear.

Notes:

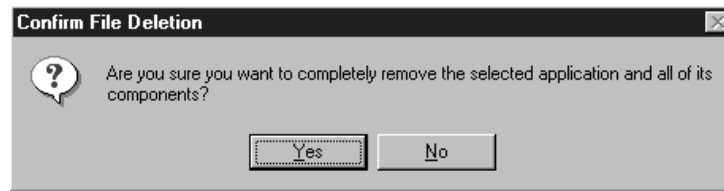
The directory in which WinSpec/32 was originally installed will remain, as will any files it contains which were not placed there during the original installation.

The Data directory created during the original installation may also be deleted. Any data files it contains that you wish to save should be copied to a safe location before uninstalling.

The Version # and User identification will be removed from the registry. However, the registry also contains much information that was placed there in the course of setting up and operating the software. That information will remain and will be available for use if WinSpec/32 is later reinstalled.

- ◆ On the Add/Remove Programs Properties dialog box (Figure 28), click on **OK** to complete the process.
- ◆ Close the open windows to return to the “clean” desktop.

*Figure 29.
Remove
Confirmation
dialog box.*



To later reinstall the software, follow the Installing WinSpec/32 instructions provided earlier in this chapter. Use the original installation disks and any options disks purchased separately.

The Graphical Interface

Introduction

WinSpec/32 follows the Windows 95 graphical interface conventions. When the software is booted, the splash screen shown in Figure 30 is displayed while the software is loading and initializing. Then the Main Menu appears as shown in Figure 31. From there the program's functions are readily accessed. This chapter gives a quick overview of the structure and features of the graphical interface. Detailed operating instructions are provided in the chapters that follow.

*Figure 30.
Splash screen.*

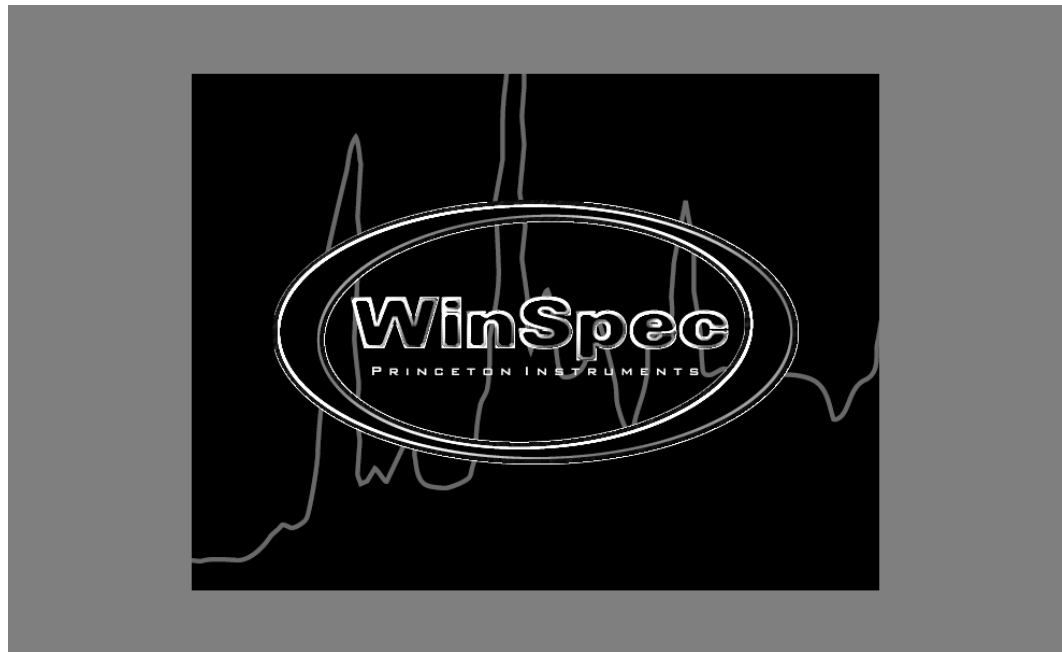
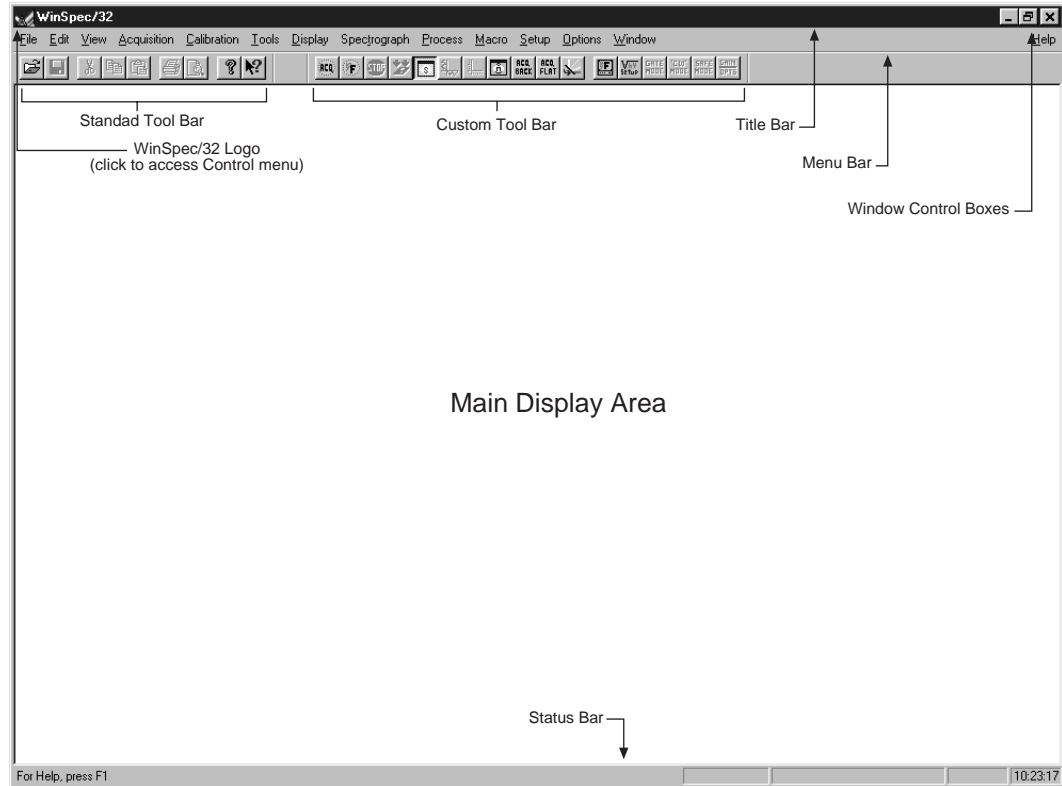


Figure 31.
Main Menu.



Cursor

Values, labels, and alphanumeric data in general are entered from the keyboard. Selections and screen control operations are generally done using a mouse or other graphical I/O device, although keyboard selection shortcuts are provided. Selections are made with the mouse by simply positioning the mouse cursor on the selection item and clicking the left mouse button. If selecting a filename, clicking the *right* mouse button brings up a special menu (Figure 37) that allows additional file operations to be performed. The appearance of the mouse varies according to its location. Most of the time it is simply a selection pointer. If located at the edge of a screen element that can be resized by dragging the edge, it becomes a double arrow pointing in the directions the edge can be dragged. In a data entry box it becomes a vertical bar crossed at the top and bottom. Clicking in a data entry box causes the keyboard insertion-point editing cursor to appear so that data can be entered. For more information on cursors, see Cursors on page 306.

Main Menu Structure

Title Bar

Referring to Figure 31 above, note the Title Bar at the top of the menu. The program icon and name are at the left end of the bar. Clicking on the icon opens the Control menu. At the right end of the Title Bar are the Window Control boxes. The Control menu and Window Control boxes provide window control functions as follows.

Control Menu

Figure 32.
Control menu.



Restore: Return the active window to the size and position it had before you chose the Maximize or Minimize command.

Move: Allows you to move the active window or dialog box with the arrow keys. *Move command is unavailable if the window is maximized.*

Size: Allows you to size the active window with the arrow keys. *Size command is unavailable if the window is maximized.* See Control Menu on page 299 for additional information.

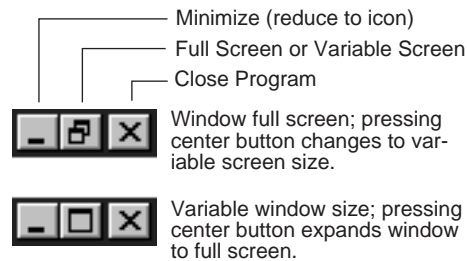
Minimize: Reduces the WinSpec/32 window to an icon.

Maximize: Enlarges the active window to fill the available space.

Close: Closes the active window or dialog box.

Window Control Boxes

Figure 33.
Window
Control Boxes.



As shown in Figure 33, there are three control boxes. The leftmost button minimizes the window, reducing it to an icon on the Task bar. A minimized window can be expanded by clicking on the icon that represents it. The center button determines whether the window will be in the full-screen or variable-screen configuration and the button's appearance changes accordingly as shown in the figure. In the variable size configuration, you can click on a corner or edge of the window and drag it to size the window to match your requirement. In the full-screen configuration, the window simply expands to where it occupies all available screen space. The right hand button closes the program.

Menu Bar



Below the Title bar is the Menu Bar, which allows you to open the menus that control the various WinSpec/32 functions. Menus having to do with basic WinSpec/32 functions

are located to the left. The Help menu is at the far right. Note that one letter of each of the menu names is underlined. The underlined letter indicates the *shortcut key* for that menu, allowing it to be opened from the keyboard by simultaneously pressing the ALT key and the shortcut key. For example, to open the Setup menu you would press the ALT key and then the S key, which would cause the Setup menu (Figure 34) to appear. Alternatively, a menu can be opened by clicking on the menu name with the mouse.

If Visual C++ Snap-Ins or Visual Basic Add-Ons have been installed, a **Tools** selection will appear on the menu bar. Clicking on Tools will drop a menu listing the available Snap-Ins and Add-Ons. If more than one version of WinSpec/32 and/or WinView/32 has been installed, the **Tools** selection and listed Snap-Ins and Add-Ons will be available to each.

Figure 34.
Setup Menu.



When a menu is opened, you will note that one letter is also underlined in each of the listed function names. These also designate a *shortcut key*, with the difference that, once a menu is open, it is only necessary to press the indicated key alone (without ALT or any other key) to activate the associated function. Also, note that some menu selections are followed by an ellipsis (three dots) and others by an arrow. An ellipsis after a selection indicates that it leads to a dialog box. For example, selecting **C**ustom **T**oolbar... on the Setup Menu causes the Customize Toolbar dialog box (Figure 35) to appear. An arrow after a selection indicates that it leads to another menu. For example, selecting **T**oolbars on the View Menu opens the Toolbar Selection menu (Figure 36).

Figure 35.
Tool Box
Customize
dialog box.

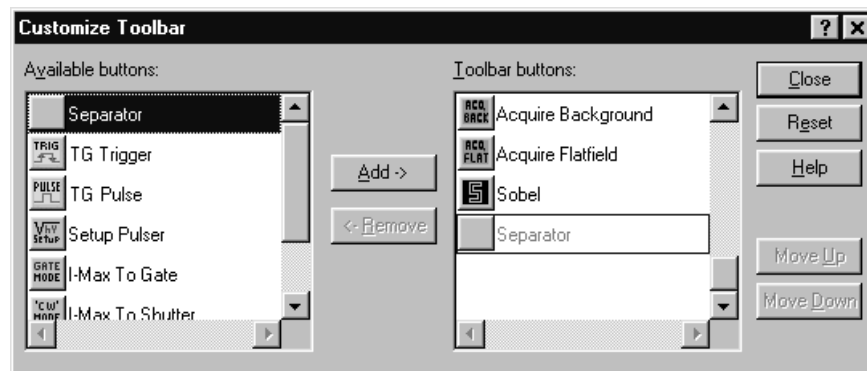
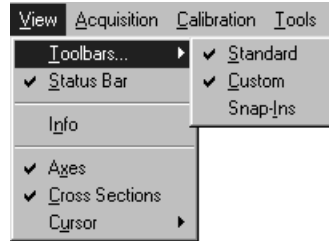


Figure 36.
Toolbar
selection menu.



Note: Some menu selections may not be active, as determined by the installed components, setup, system status, previous selections and revision level of the software. Inactive selections appear “grayed out” and are unresponsive.

Right-Click menus Accessed from Open window

Two Windows 95 menus can be opened from the Open window. Right clicking on a directory or file name in the Open window opens the secondary menu shown in Figure 37. Similarly, right clicking in the Open window area, but not on a directory or file name, opens the menu in Figure 38. These menus provide additional window and file control functions.

Figure 37.
“Right-Click”
File Operations
Menu.

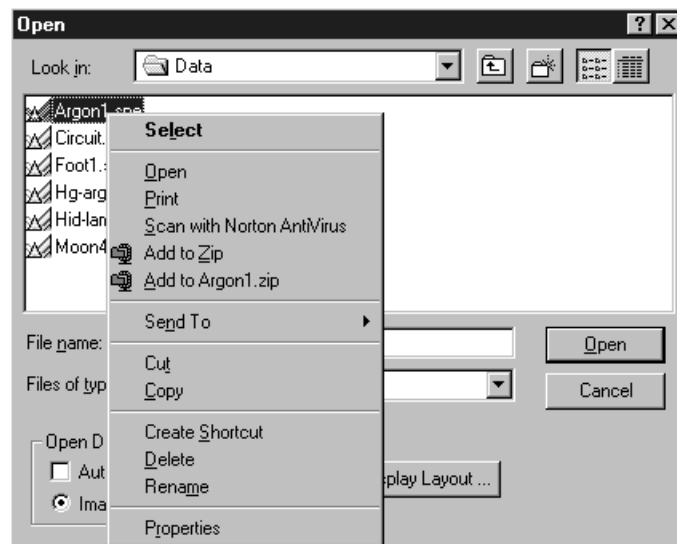
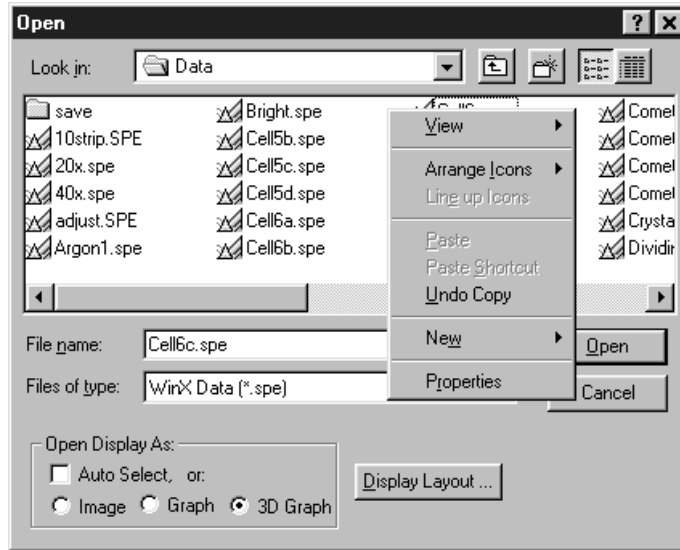


Figure 38.
"Right-Click"
Window
Control menu.



Toolbars (Standard and Custom)



Below the Menu Bar is the Standard Toolbar, which contains buttons for nine of the basic Windows 95 functions that WinSpec/32 provides. To the right of the Standard Toolbar in the above illustration is the Custom Toolbar, which provides an additional set of buttons for selecting WinSpec/32 specific functions. Note that these toolbars are separate entities. Each has its own Title Bar and each can be moved anywhere on the screen by clicking and dragging. In doing this, take care not to click on a button or the corresponding function will be activated. It is generally convenient to click on the bar in the narrow region below one of the buttons. If either bar is moved to where it contacts the Menu Bar or Status Bar, it docks, that is, it attaches to the Menu Bar (or Status Bar) and its Title Bar disappears (see Figure 31).

In addition to being able to control the location of the Toolbars, you can control each bar's configuration. By simply clicking and dragging a corner, the aspect ratio of the bar can be changed while retaining the individual button groupings. For example, you may wish to arrange the buttons in a vertical column as shown below. See page 452 for descriptions of the Standard Toolbar Buttons. Descriptions of the Custom Toolbar buttons begin on page 308.

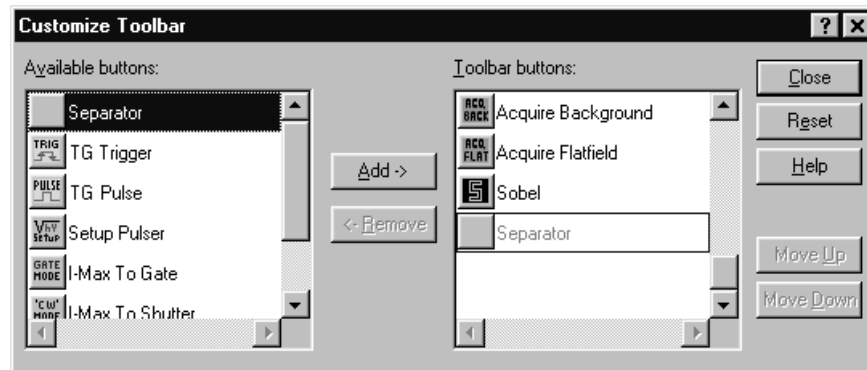
Figure 39.
Standard
toolbar
arranged
vertically.



Customizing the Custom Toolbar

The CustomizeToolbar dialog box (Figure 40), accessed by selecting Custom Toolbar on the Setup menu, allows a number of other buttons to be added to the Custom Toolbar at the user's discretion. See Chapter 20 (page 259) for a detailed description of how to customize the toolbar.

Figure 40.
Customize
Toolbar dialog
box.



Dialog Boxes

Most WinSpec/32 selections and operations are performed from dialog boxes. A dialog box may be opened from a menu or from another dialog box. A dialog box may consist of a single page or contain two or more separate tab pages. Each page is selected by clicking on the tab. Additionally, there may be function buttons associated with the dialog box window itself and not to any of the individual tab pages. Within the dialog boxes, WinSpec/32 uses a number of graphical devices to make selections and text entry.

Data Entry & Parameter Selection Devices

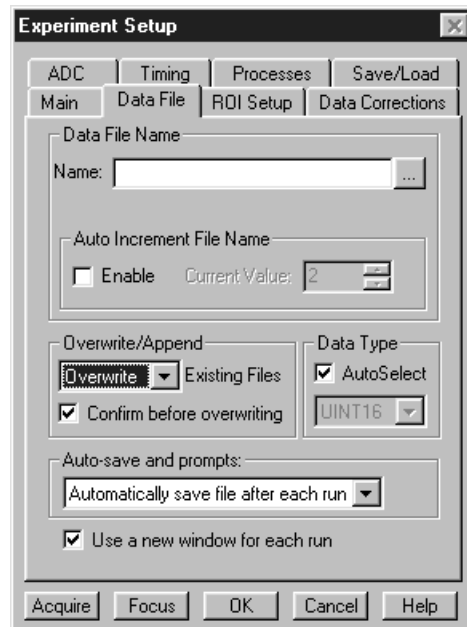
Edit Boxes and Text Boxes

An edit box or text box is one into which you can enter information. When you move the mouse pointer to an edit box and click the mouse, an insertion point (flashing vertical bar “|”) appears. Characters can then be keyed specifying the entry. Text boxes can have ancillary selection devices, such as dialog access buttons and spin buttons.

Dialog Box Access Buttons

These are square buttons imprinted with an ellipsis (series of three dots) and located at the end of an Edit/Text box. The ellipsis indicates that clicking on the button will open another dialog box. A down arrow on a button indicates that clicking on it expands the box to the full range of possible selections, and may include opening a browser function.

Figure 41.
Exit/Text boxes.



Spin Buttons

These are small buttons imprinted with up and down arrows and located at the end of a text/edit box. These buttons allow you quickly step through the available values for the selected parameter. Usually, each click of the up arrow spin button causes the next higher value to appear; clicking the down arrow spin button causes the next lower value to appear. The spin buttons in Figure 41 can be used to set the Current Value of the Auto-Increment File Name.

Slider

Sliders allow a parameter value to be set by clicking and dragging the slider’s pointer to the position on the “track” that corresponds to the parameter value. Clicking on the track to the right of the pointer increments the value. Clicking on the track to the left of the pointer decrements it. The parameter value is displayed in an associated Edit/Text box. It may also be possible to directly enter the parameter value in the box. The Interactive

Camera Operation dialog box (Figure 42) uses a slider to set the Exposure Time, RS170 Intensity Scaling and Offset.

Figure 42.
Slider used to
set parameter
value.



List Boxes and List Views

A list box displays a selection from a list. An arrow button at the end of the box causes the list of available choices to drop down. It may be a simple list of the available selections, such as those in Figure 44, or a more complex one such as that in Figure 43. In Figure 43, the Look In list box displays the selected folder. Clicking on the button at the end of the box opens a browser that allows any folder (directory) to be selected. The contents of a list box selection may additionally be listed in a list view, as in Figure 43, where all of the files in the Data directory are listed. Figure 44 illustrates the use of list boxes to select the Timing Mode, Shutter Control and Edge Trigger.

There may be additional display and selection options, such as those provided by the four icons to the right of the Look In list box as shown in Figure 43. From left to right, the first one moves one selection higher in the directory tree, the second one creates a new folder, the third one selects the minimum information list view, and the fourth one the detailed list view. These four icons are common to all list views. Within the list view, there may be right-click mouse functions as well. Right clicking in the view area but not on a file name opens a menu that gives additional selections for the organization and display in the list view. Right clicking on a file name opens a menu of operations that can be performed on the selected file.

If there are more choices than can fit in the list view, scrollbar(s) appear that you can use to move the unseen choices into view.

Figure 43. List box and list view with scroll bars in File Open dialog box.

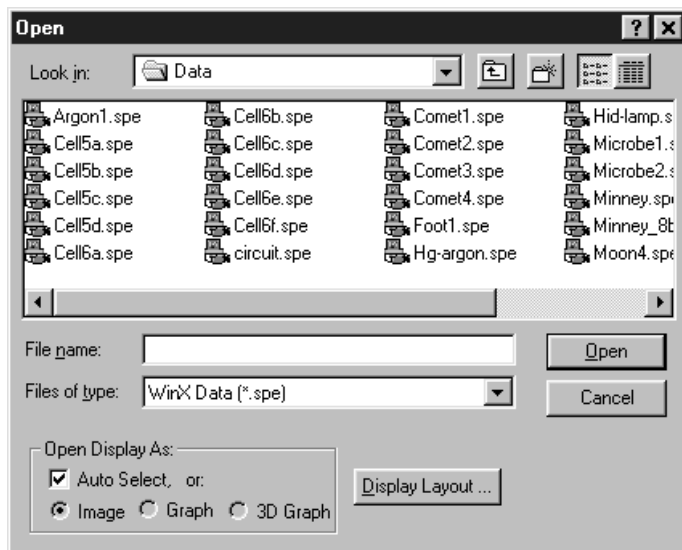
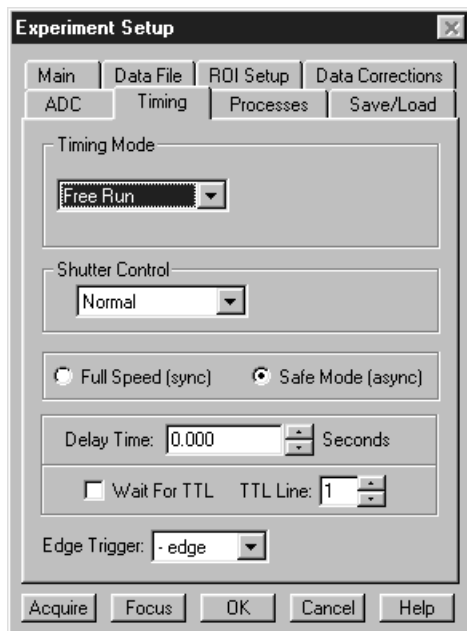


Figure 44. List boxes, check boxes, radio buttons and spin buttons.



Check Boxes

Check boxes allow independent functions to be switched on or off by clicking the mouse pointer on the box. When a check box is selected, it contains a ✓. Each time you click on a check box the existing condition reverses. In Figure 44 note that the Wait for TTL function is selected by means of a check box.

Radio Buttons

Radio buttons allow you to make one choice from a list of possibilities. Within the group of radio buttons that apply to any particular function, only one at a time will be selected. The selected radio button contains a black dot. Selecting a different option by clicking

on a different button in the group will deselect the formerly selected button. In Figure 44 radio buttons are provided to choose between the Full Speed and Safe timing modes.

Scroll Bars

Scroll bars appear on a window if the list or other material to be viewed is too large to fit in a window. Clicking on the arrow button at each end of the scroll bar will incrementally move the material being scrolled in the selected direction. Alternatively you can click and drag the scroll bar button, which can be positioned anywhere on the bar to move quickly through the range. A third possibility is to simply click on the bar on either side of the button. This moves the material in larger increments than clicking on the end buttons. Figure 43 illustrates a list box with scroll bars.

Command Buttons

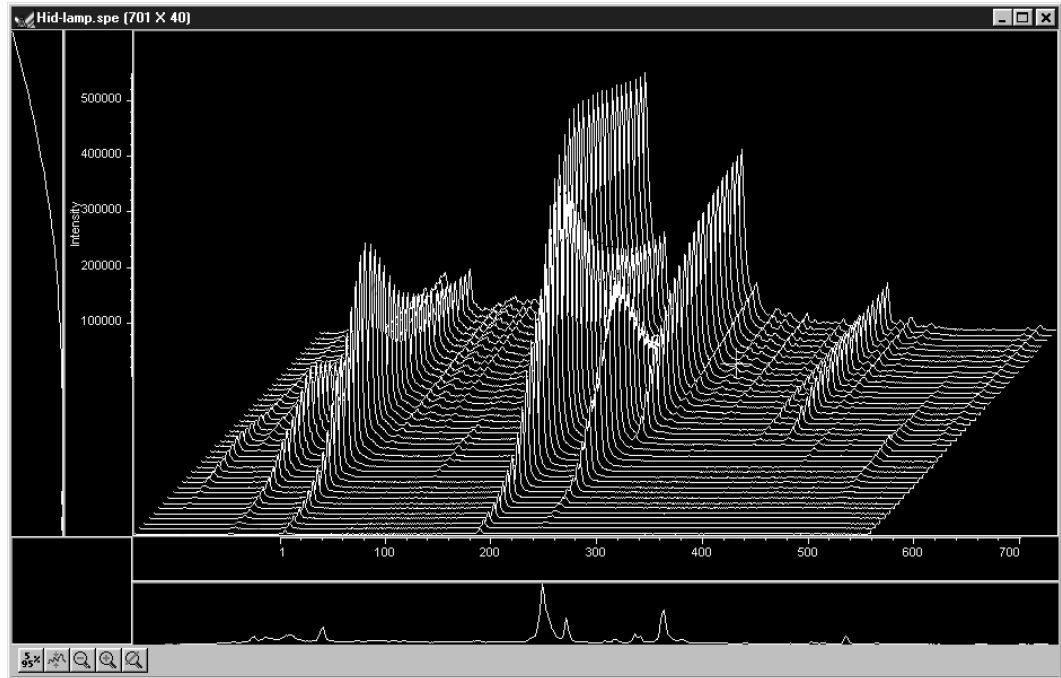
These are buttons used to initiate actions after you finish making your selections, adjusting values, or typing information. For example, in many situations, clicking on **OK** will cause your selections and value adjustments to be activated. Examples of other Command buttons include **Acquire**, **Cancel**, **OK**, **Help**, **Close** and **Store**. Almost every WinSpec/32 screen has one or more command buttons.

Data File Display

If a data file is opened, it will be displayed in a data-file window as shown in Figure 45. Either an image or graphical display can be selected. Labeled axes and cross-sectional display of the image intensity can be also be added. Icons beneath the display give additional control of how the data is displayed. See Chapter 10, *Displaying the Data*, for detailed descriptions.

The number of data files that can be opened is limited only by the amount of available memory. The size and location of individual data windows can be changed. Any data-file window can be minimized, expanded or closed by means of the control boxes in its Title Bar.

Figure 45.
Data File
Display
Window.



Hardware Setup

Introduction

This chapter will provide detailed instructions on how to configure the hardware selections using the WinSpec/32 dialog boxes and tab pages. Hardware Setup dialog boxes and tab pages are called from the Setup menu, shown in Figure 46. This chapter begins with a discussion of the Setup Wizard. The remainder of the chapter is divided into sections according to the controller types. Each section illustrates the tab pages provided for the corresponding controller and discusses the available selections. After all the setup dialog boxes have been configured, experiment parameters such as exposure time and timing mode must be set. Experiment setup considerations and initial data acquisition are discussed in the following two chapters.

Figure 46.
Setup menu.



Setup Wizard

The Hardware Setup Wizard runs the first time you select Setup – Hardware. The Wizard directly leads you through the controller type, detector chip type and interface selections. It then exits to the Hardware Setup dialog box, where you can make the remaining selections and review those made using the Wizard.

Note: If a PIHWDEF.INI file has been copied to your WinSpec/32 directory, the selections specified in the PIHWDEF.INI will be implemented and the Setup Wizard won't run.

Controller Selection

The first Setup Wizard dialog box (Figure 47) selects the Controller Type. The selected Controller Type appears in the text box. Clicking on the button at the end of the box causes the list of available controllers to appear. The new selection is made by simply clicking on the type designation. The Controller Type selection is critical because it determines the nature and type of the other selections that will be available, including the detector or camera type, display orientation options, interface type, cleans & skips, and user defined chip parameters. No single controller provides all possible selections, and only the ones applicable to the selected controller are listed on the Hardware Setup dialog box tab pages. The buttons are as follows.

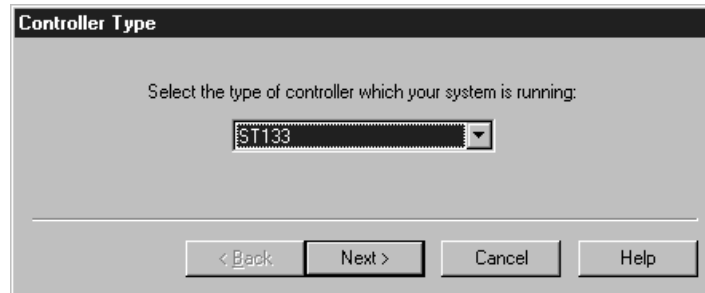
Back: (Not active on first wizard screen.)

Next: Advance to second wizard screen.

Cancel: Closes the wizard; previous selections remain in effect.

Help: Accesses context-sensitive help.

*Figure 47.
Controller Type
Setup Wizard
dialog box.*



Detector/Camera/CCD Selection

The second Setup Wizard dialog box (Figure 48) selects the Detector/Camera/CCD type. The selected Detector, Camera, or CCD appears in the text box. Clicking on the button at the end of the box causes the list of available selections to drop down. The new selection is made by simply clicking on the type designation. The buttons are as follows.

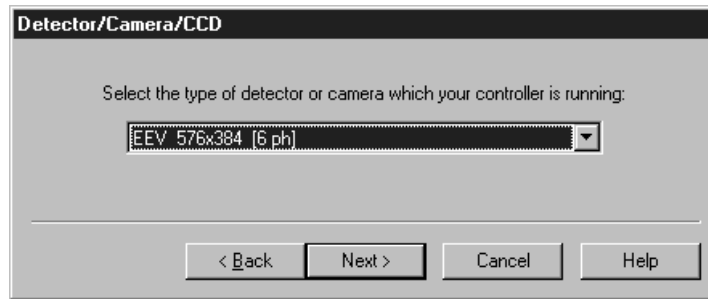
Back: Returns to the previous (Controller Type) wizard screen.

Next: Advance to third (Interface) wizard screen.

Cancel: Closes the wizard; previous selections remain in effect.

Help: Accesses context-sensitive help.

Figure 48.
Detector/Camera
selection Setup
Wizard dialog
box.



Interface Selection

The third Setup Wizard dialog box (Figure 49) selects the Interface Card. The selected Interface appears in the text box. Clicking on the button at the end of the box causes the list of available selections to drop down. The new selection is made by simply clicking on the type designation. The buttons are as follows. *See page 92 for a discussion of each of the available selections.*

Back: Returns you to the previous wizard screen.

Finish: Implements all wizard selections and exits to Hardware Setup dialog box.

Cancel: Closes the wizard; previous selections remain in effect.

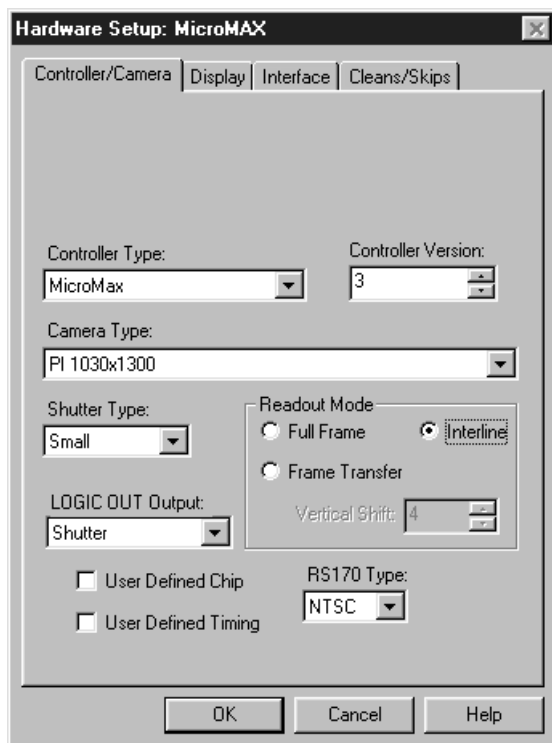
Help: Accesses context-sensitive help.

Figure 49.
Interface Setup
Wizard dialog
box.



MicroMAX

Figure 50.
MicroMAX
Hardware
Setup window.



Controller/Detector page

Controller Type: Select MicroMAX

Controller Version: Set to match the version of your controller. *Later versions of the MicroMAX have features unavailable in earlier ones. For proper operation, version selection must match the actual controller version.*

Camera Type: Select the camera type installed in your system.

Shutter Type: There are five selections, None, Small, Large, Remote and Electronic. For most MicroMAX cameras, the correct setting is Small. In the case of a camera having a very large CCD, such as the Kodak 2k × 2k, a large shutter may have been installed, in which case the correct setting will be Large. The Remote setting would not normally apply to the MicroMAX, since Remote is primarily intended for spectroscopy applications where an external shutter would be placed ahead of the entrance slit. Electronic only applies to operation with an Intensified camera, which would normally not be equipped with a mechanical shutter. This selection would apply to both the Gate and Shutter/CW modes of the IIC-100 or MCP-100. If the MicroMAX has no shutter (frame-transfer or interline CCD array), select None.

Readout Mode: The selections are Full Frame, in which the entire chip can be read out, Frame Transfer, in which only the unmasked area of the chip can be read out, and Interline, which provides 100% duty cycle operation. Note that frame transfer is only available if the camera has a frame-transfer chip such as the EEV 512×1024 . Similarly, interline is only available with a camera having an interline chip such as the PI 1030×1300 and if the Controller Version is 3 or higher.

Vertical Shift: In Frame-Transfer operation, determines the speed of the image transfer from the exposed area of a frame-transfer chip to the masked area. Setting a lower value increases the shift speed. A higher value gives a slower shift. If the shift is too fast, not all of the charge will be transferred. If too slow, image smearing will be increased due to the exposure that takes place while the transfer is in progress. The default value gives good results in most measurements.

Logic Out Output: Allows you to select either NOT SCAN or SHUTTER MONITOR as the signal provided at the MicroMAX's SCAN Output. In Gated operation SHUTTER MONITOR is the correct choice and the signal should be applied to the inhibit input of the pulser to prevent pulsing during readout.

Note: This parameter is not available for all versions of the MicroMAX. If the **Logic Out** selection doesn't appear on the tab page, the choice of output is done via an internal jumper. The default selection is SHUTTER MONITOR. For information on how to set the jumper, contact factory Tech Support.

User Defined Chip: See User Defined Chip discussion on page 89.

User Defined Timing: See User Defined Timing discussion on page 90.

RS170 Type: Selections are NTSC (US video standard) and PAL (European).

Display page

See Display tab page discussion on page 91.

Interface page

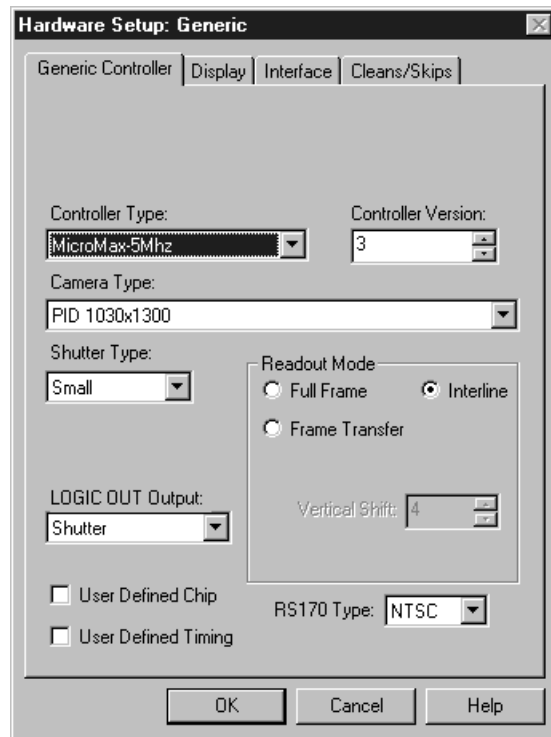
See the Interface tab page discussion on page 92.

Control Buttons:

OK, Cancel & Help: These three buttons apply to the Hardware Setup window. Clicking **OK** implements the selections from all pages. Clicking **Cancel** closes the Hardware Setup window, leaving the original settings intact. **Help** opens context-sensitive Help for the active tab page.

5 MHz MicroMAX

Figure 51.
5 MHz
MicroMAX
Controller/Cam-
era selection.



Controller/Detector page

Controller Type: Select MicroMAX 5 MHz

Controller Version: Set to match the version of your controller. *It is essential that the version setting be correct for proper operation.*

Camera Type: Select the camera type installed in your system.

Shutter Type: There are five selections, None, Small, Large, Remote and Electronic. The 5 MHz MicroMAX ordinarily doesn't operate with a shutter, in which case the correct setting is **None**. If an optional shutter is installed, the setting will depend on the shutter type. *See the shutter specifications in the 5MHz MicroMAX manual.*

Readout Mode: Because the 5 MHz MicroMAX is only available with Interline CCDs, the Interline radio button is always selected.

Note: As other chip types able to operate at 5 MHz become available, the Readout Mode choices provided will be expanded to accommodate them.

Logic Out Output: Allows you to select either NOT SCAN or SHUTTER MONITOR as the signal provided at the MicroMAX's SCAN Output. In Gated operation SHUTTER MONITOR is the correct choice and the signal should be applied to the inhibit input of the pulser to prevent pulsing during readout.

Note: This parameter is not available for all versions of the ST-133 (MicroMAX) Controller. If the **Logic Out** selection doesn't appear on the tab page, the selection is done by changing the setting of an internal jumper. The default selection is SHUTTER MONITOR. Contact factory Tech Support for information on how to change the jumper setting.

User Defined Chip: See User Defined Chip discussion on page 89.

User Defined Timing: See User Defined Timing discussion on page 90.

RS170 Type: Selections are NTSC (US video standard) and PAL (European).

Display page

See Display tab page discussion on page 91.

Interface page

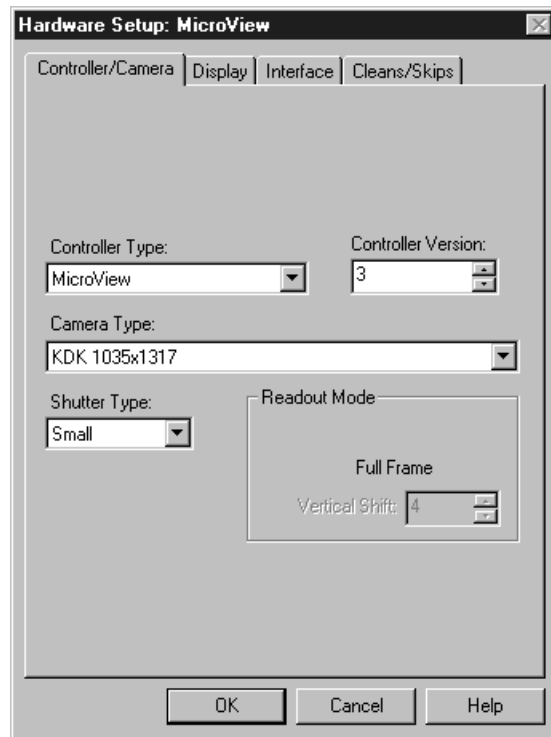
See the Interface tab page discussion on page 92.

Control Buttons:

OK, Cancel & Help: These three buttons apply to the Hardware Setup window. Clicking **OK** implements the selections from all pages. Clicking **Cancel** closes the Hardware Setup window, leaving the original settings intact. **Help** opens context-sensitive Help for the active tab page.

MicroView

Figure 52.
MicroView
Hardware
Setup
Controller
Camera tab
page.



Controller/Detector page

Controller Type: Select MicroView

Controller Version: Set to match the version of your controller. *Later versions of the MicroView have features unavailable in earlier ones. For proper operation, version selection must match the actual controller version.*

Camera Type: Select the camera type installed in your system.

Shutter Type: There are five selections, None, Small, Large, Remote and Electronic. For most cameras, the correct setting is Small. The Remote setting would not normally apply to the MicroView, since Remote is primarily intended for spectroscopy applications where an external shutter would be placed ahead of the entrance slit. Electronic only applies to operation with an Intensified camera, which would normally not be equipped with a mechanical shutter. If the camera has neither a mechanical shutter nor provision for electronic shuttering, select None.

Readout Mode: Full Frame is the only available readout mode.

Display page

See Display Page discussion on page 91.

Interface page

See the Interface tab page discussion on page 92.

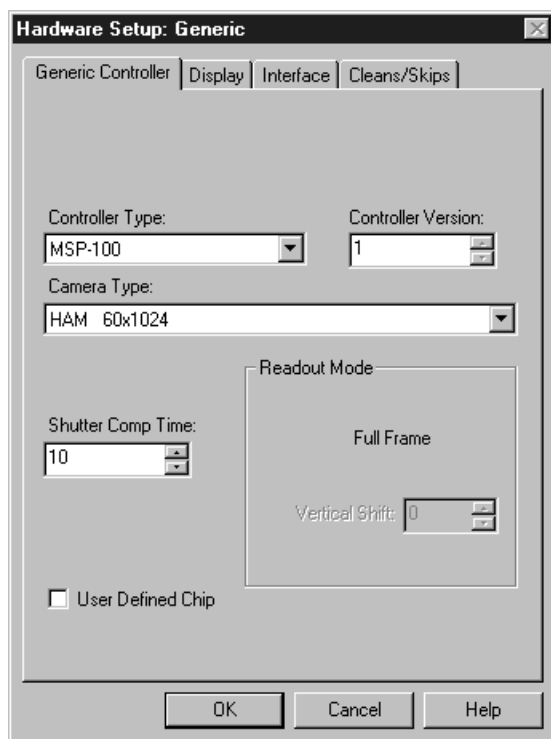
Control Buttons:

OK, Cancel & Help: These three buttons apply to the Hardware Setup window.

Clicking **OK** implements the selections from all pages. Clicking **Cancel** closes the Hardware Setup window, leaving the original settings intact. **Help** opens context-sensitive Help for the active tab page.

MSP-100

Figure 53.
MSP-100
Controller/
Camera
selection.



Controller page

Controller Type: Select MSP-100

Controller Version: Set to match the version of your controller.

Camera Type: Select the camera type installed in your system.

Shutter Compensation Time: Delays the readout long enough for the shutter (if present) to close. This prevents the smearing that could occur if the readout started while the shutter was still open. The setting range is 0 to 30 ms. For single-strip spectroscopic measurements, a setting of "0" is recommended.

Readout Mode: Full Frame is the only available readout mode.

User Defined Chip: See User Defined Chip discussion on page 89.

Display page

See Display Page discussion on page 91.

Interface page

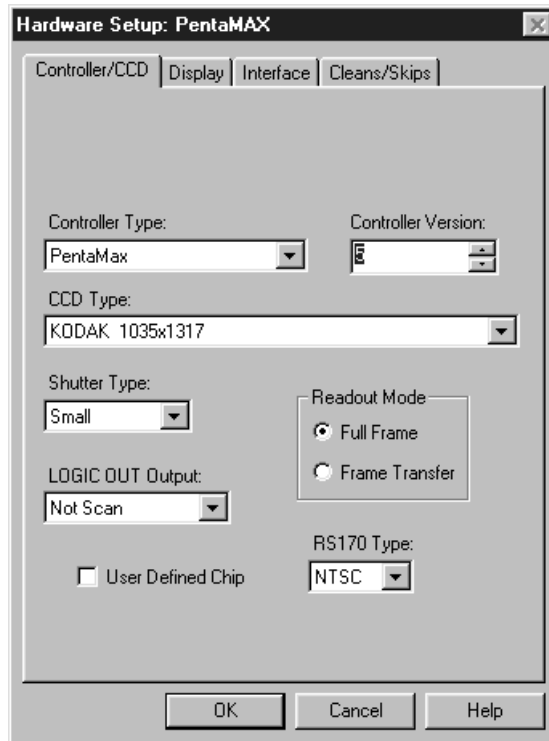
See the Interface tab page discussion on page 92.

Control Buttons:

OK, Cancel & Help: These three buttons apply to the Hardware Setup window. Clicking **OK** implements the selections from all pages. Clicking **Cancel** closes the Hardware Setup window, leaving the original settings intact. **Help** opens context-sensitive Help for the active tab page.

PentaMAX

Figure 54.
PentaMAX
Hardware
Setup
Controller
CCD tab page.



Controller/Detector page

Controller Type: Select PentaMAX

Controller Version: Set to match the version of your controller. *Later versions of the PentaMAX have features unavailable in earlier ones. For proper operation, version selection must match the actual controller version..*

CCD Type: Select the CCD type installed in your PentaMAX.

Shutter Type: There are five selections, Small, Large, Remote and Electronic. For most PentaMAX cameras, the correct setting is Small. In the case of a camera having a very large CCD, such as the Kodak 4k × 4k, a large shutter may have been installed, in which case the correct setting will be Large. The Remote setting is primarily intended for spectroscopy applications where an external shutter would be placed ahead of the entrance slit. Electronic only applies to operation with an Intensified PentaMAX.

If the PentaMAX has no shutter select **None**.

Readout Mode: The selections are Full Frame, in which the entire chip can be read out, and Frame Transfer, in which only the unmasked area of the chip can be read out. Note that frame transfer is only available if the camera has a frame-transfer chip, such as the EEV 512 × 1024.

Logic Out Output: Beginning with Version 5, any of several different signals can be selected to appear at the PentaMAX's back panel Logic Out BNC connector. Available choices include:

Cleaning: This signal is high when an array Clean cycle is in progress and otherwise low.

Logic 0: Establishes a TTL logic 0 at the **Logic Out** connector.

Logic 1: Establishes a TTL logic 1 at the **Logic Out** connector.

Note: LOGIC 0 and LOGIC 1 can be used to control an external device using the application software.

Not FT Image Shift: This signal is low when a frame-transfer shift is in progress and otherwise high.

Not Ready: After a Start Acquisition command, this output changes state on completion of the array cleaning cycles that precede the *first* exposure. Initially high, it goes low to mark the beginning of the *first* exposure. In free run operation it remains low until the system is halted. If a specific number of frames have been programmed, it remains low until all have been taken, then returns high.

Not Scan: Reports when the controller is finished reading out the CCD array. SCAN is high when the CCD array is not being scanned, then drops low when readout begins, returning to high when the process is finished.

Shutter: This signal is low when the shutter is closed and goes high when the shutter is activated, dropping low again after the shutter closes.

User Defined Chip: See User Defined Chip discussion on page 89.

RS170 Type: Selections are NTSC (US video standard) and PAL (European video standard).

Display page

See Display Page discussion on page 91.

Interface page

See the Interface tab page discussion on page 92.

Cleans/Skips page

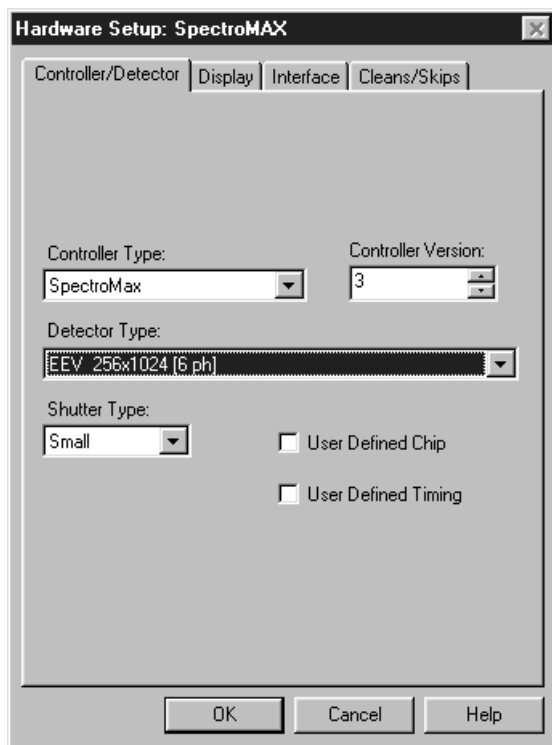
See Clean/Skips tab page discussion on page 291.

Control Buttons:

OK, Cancel & Help: These three buttons apply to the Hardware Setup window. Clicking **OK** implements the selections from all pages. Clicking **Cancel** closes the Hardware Setup window, leaving the original settings intact. **Help** opens context-sensitive Help for the active tab page.

SpectroMAX

Figure 55.
SpectroMAX
Controller/
Camera
selection.



Controller/Detector page

Controller Type: Select SpectroMAX

Controller Version: Set to match the version of your SpectroMAX. *Later versions of the SpectroMAX have features unavailable in earlier ones. For proper operation, version selection must match the actual controller version.*

Detector Type: Select the detector type installed in your system, such as EEV 256 × 1024.

Shutter Type: There are five selections, None, Small, Large, Remote and Electronic. The Remote setting is primarily intended for spectroscopy applications where an external shutter would be placed ahead of the entrance slit and thus is typically the correct choice for the SpectroMAX. If there is no shutter, select None.

Logic Out Output: Allows you to select either NOT SCAN or SHUTTER MONITOR as the signal provided at the SpectroMAX's SCAN Output. In Gated operation SHUTTER MONITOR is the correct choice and the signal should be applied to the inhibit input of the pulser to prevent pulsing during readout.

Note: This parameter is not available for all versions of the SpectroMAX. If the **Logic Out** selection doesn't appear on this tab page, the output selection is done via an internal jumper. The default selection is SHUTTER MONITOR. For information on how to set the jumper, contact factory Tech Support.

User Defined Chip: See User Defined Chip discussion on page 89.

User Defined Timing: See User Defined Timing discussion on page 90.

Display page

See Display Page discussion on page 91.

Interface page

See the Interface tab page discussion on page 92.

Cleans/Skips page

See Clean/Skips tab page discussion on page 291.

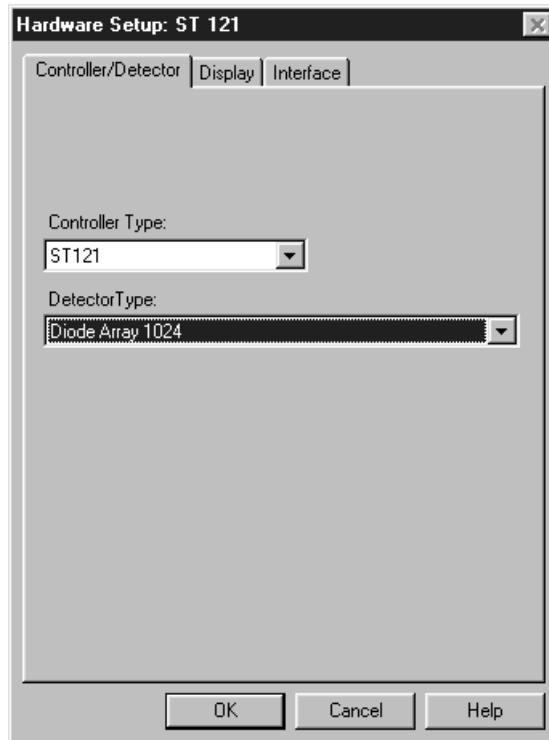
Control Buttons:

OK, Cancel & Help: These three buttons apply to the Hardware Setup window.

Clicking **OK** implements the selections from all pages. Clicking **Cancel** closes the Hardware Setup window, leaving the original settings intact. **Help** opens context-sensitive Help for the active tab page.

ST-121

Figure 56. ST-121 Hardware Setup Controller Detector tab page.



Controller/Detector page

Controller Type: Select ST-121

Detector Type: Select the diode array type installed in your detector.

Display page

Reversal: This check box reverses the x-axis sense as indicated in the thumbnail graphics. The left one shows the default and the right one shows effect of the selection. If no change is selected, both thumbnails will be the same.

Interface page

See the Interface tab page discussion on page 92.

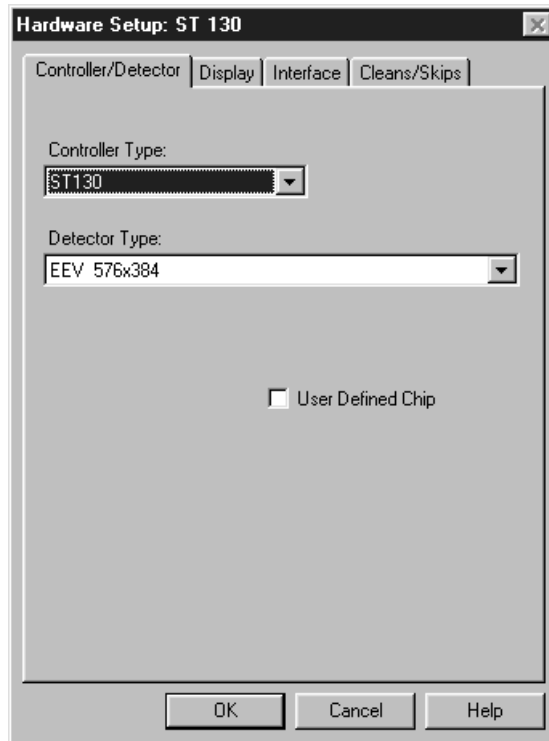
Control Buttons:

OK, Cancel & Help: These three buttons apply to the Hardware Setup window. Clicking **OK** implements the selections from all pages. Clicking **Cancel** closes the Hardware Setup window, leaving the original settings intact. **Help** opens context-sensitive Help for the active tab page.

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ST-130

Figure 57.
ST-130
Hardware
Setup
Controller
Detector tab
page.



Controller/Detector page

Controller Type: Select ST-130

Detector Type: Select the detector type installed in your system.

User Defined Chip: See User Defined Chip discussion on page 89.

Display page

See Display Page discussion on page 91.

Interface page

See the Interface tab page discussion on page 92.

Cleans/Skips page

See Clean/Skips tab page discussion on page 291.

Control Buttons:

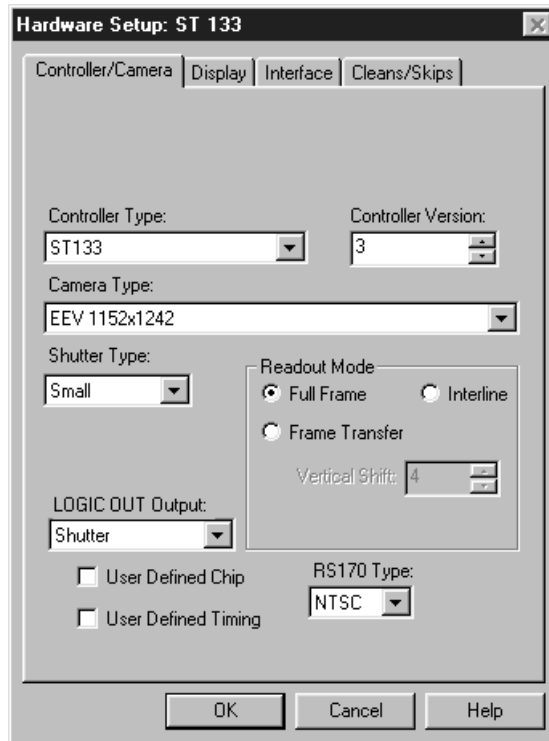
OK, Cancel & Help: These three buttons apply to the Hardware Setup window.

Clicking **OK** implements the selections from all pages. Clicking **Cancel** closes the Hardware Setup window, leaving the original settings intact. **Help** opens context-sensitive Help for the active tab page.

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ST-133

Figure 58.
ST-133
Hardware
Setup
Controller
Camera tab
page.



Controller/Detector page

Controller Type: Select ST-133

Controller Version: Set to match the version of your controller. *Later versions of the ST-133 have features unavailable in earlier ones. For proper operation, version selection must match the actual controller version.*

Camera Type: Select the camera type installed in your system. *PI-MAX camera requires ST-133 controller selection.*

Shutter Type: There are five selections, None, Small, Large, Remote and Electronic. For most cameras, the correct setting is Small. In the case of a camera having a very large CCD, such as the Kodak 4k × 4k, a large shutter may have been installed, in which case the correct setting will be Large. The Remote setting is primarily intended for spectroscopy applications where an external shutter would be placed ahead of the entrance slit. Electronic only applies to operation with an Intensified camera, which would normally not be equipped with a mechanical shutter. If the ST-133 has a frame-transfer chip and no shutter, select **None**.

Readout Mode: The selections are Full Frame, in which the entire chip can be read out, Frame Transfer, in which only the unmasked area of the chip can be read out, and Interline, which provides 100% duty cycle operation. Note that frame transfer is only available if the camera has a frame-transfer chip such as the EEV 512×1024 . Similarly, interline is only available with a camera having an interline chip such as the PI 1030×1300 and if the Controller Version is 3 or higher.

Logic Out Output: Allows you to select either NOT SCAN or SHUTTER MONITOR as the signal provided at the ST-133's SCAN Output. In Gated operation SHUTTER MONITOR is the correct choice and the signal should be applied to the inhibit input of the pulser to prevent pulsing during readout.

Note: This parameter is not available for all versions of the ST-133. If the **Logic Out** selection doesn't appear on the tab page, the choice of output is done via an internal jumper. The default selection is SHUTTER MONITOR. For information on how to set the jumper, contact factory Tech Support.

User Defined Chip: See User Defined Chip discussion on page 89.

User Defined Timing: See User Defined Timing discussion on page 90.

RS170 Type: Selections are NTSC (US video standard) and PAL (European video standard).

Display page

See Display Page discussion on page 91.

Interface page

See the Interface tab page discussion on page 92.

Cleans/Skips page

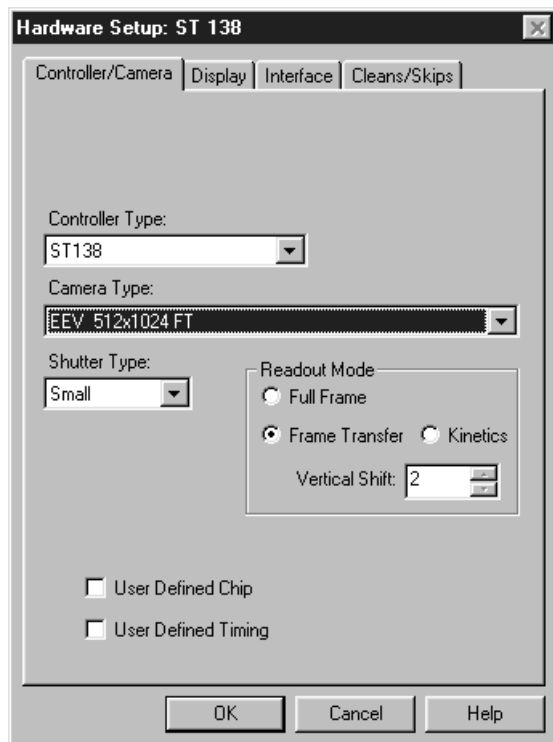
See Clean/Skips tab page discussion on page 291.

Control Buttons:

OK, Cancel & Help: These three buttons apply to the Hardware Setup window. Clicking **OK** implements the selections from all pages. Clicking **Cancel** closes the Hardware Setup window, leaving the original settings intact. **Help** opens context-sensitive Help for the active tab page.

ST-138

Figure 59.
ST-138
Hardware
Setup tab
pages.



Controller/Detector page

Controller Type: Select ST-138

Camera Type: Select the camera type installed in your system.

Shutter Type: There are five selections, None, Small, Large, Remote and Electronic.

For most cameras, the correct setting is Small. In the case of a camera having a very large CCD, such as the Kodak 4k × 4k, a large shutter may have been installed, in which case the correct setting will be Large. The Remote setting is primarily intended for spectroscopy applications where an external shutter would be placed ahead of the entrance slit. Electronic only applies to operation with an Intensified camera, which would normally not be equipped with a mechanical shutter. This selection would apply to both the Gate and Shutter/CW modes of the IIC-100, IIC-200 or MCP-100. If the ST-138 has no shutter (e.g. frame-transfer chip) select **None**.

Readout Mode: The selections are Full Frame, in which the entire chip can be read out, Frame Transfer, in which only the unmasked area of the chip can be read out, and Kinetics. Note that frame transfer is only available if the camera has a frame-transfer chip such as the EEV 512 × 1024.

Kinetics is a special type of operation in which most of the CCD is mechanically or optically masked, leaving a small section open to light. This section is then read out very quickly. See the ST-138 Controller manual for more details on the CCD aspects of this readout mode.

Vertical Shift: Determines the speed of the image transfer. This is particularly critical in frame-transfer and kinetics operation where the image is transferred from the exposed area of the chip to a masked area. If the shift is too fast, not all of the charge will be transferred. If too slow, image smearing will be increased due to the exposure that takes place while the transfer is in progress. The default value gives good results in most measurements.

User Defined Chip: See User Defined Chip discussion on page 89.

User Defined Timing: See User Defined Timing discussion on page 90.

Display page

See Display Page discussion on page 91.

Interface page

See the Interface tab page discussion on page 92.

Cleans/Skips page

See Clean/Skips tab page discussion on page 291.

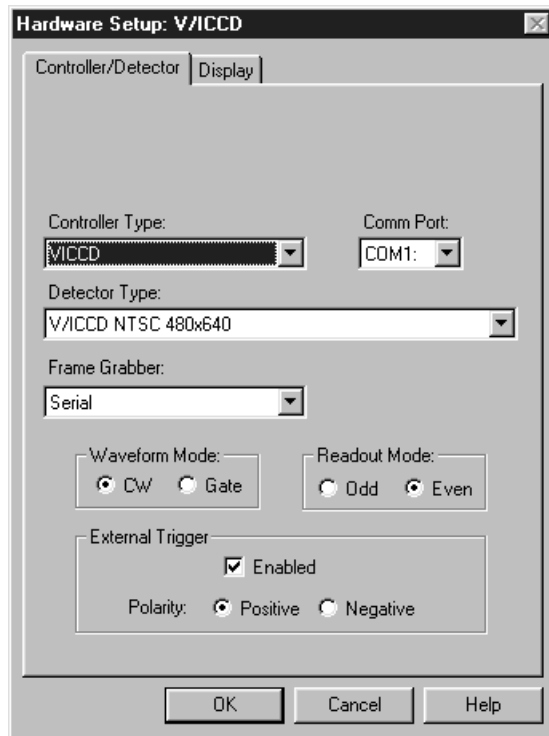
Control Buttons:

OK, Cancel & Help: These three buttons apply to the Hardware Setup window.

Clicking **OK** implements the selections from all pages. Clicking **Cancel** closes the Hardware Setup window, leaving the original settings intact. **Help** opens context-sensitive Help for the active tab page.

V/ICCD

Figure 60.
V/ICCD
Hardware
Setup
Controller
Detector tab
page.



Controller/Detector page

Controller Type: V/ICCD

Note: V/ICCD Box and V/ICCD are very different selections. If you have the V/ICCD camera only, without the Control Box, you should select V/ICCD. If you have the V/ICCD camera *and* the Control Box, then you should select V/ICCD Box, which allows you to set the Control Box parameters via the Acquisition Menu **Video Focus** Window.

Comm Port: Set to the computer COM port used to interface to the V/ICCD.

Detector Type: Select the detector type either NTSC (RS-170) or CCIR.

Frame Grabber: Select Serial or Data Translation (3152), whichever applies. *See V/ICCD manual for additional information.*

Waveform Mode: For gated operation select Gate. Otherwise select CW.

Readout Mode: Selects either the Odd or Even video field to be valid.

External Trigger

Enabled: Enables or disables an external event trigger.

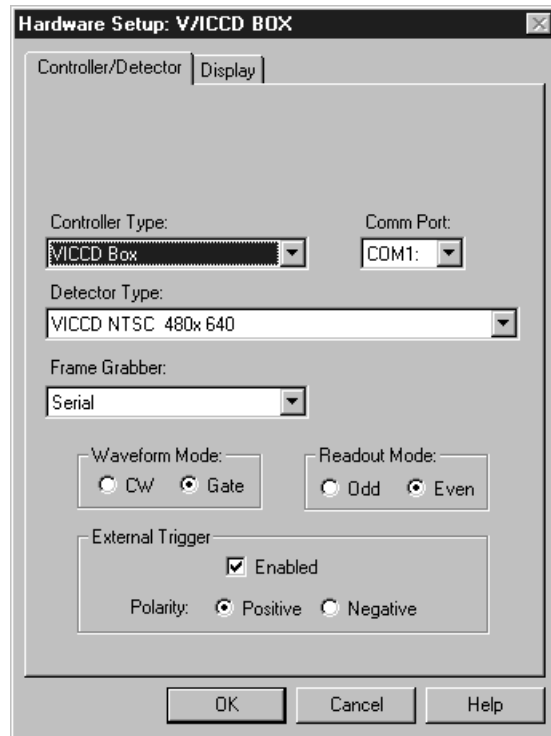
Polarity: Selects the polarity of the external event trigger.

Control Buttons:

OK implements the selections from all pages. **Cancel** closes the Hardware Setup window, leaving the original settings intact. **Help** opens context-sensitive Help.

V/ICCD Control Box

Figure 61.
V/ICCD
Control Box
Hardware
Setup
Controller
Detector tab
page.



Controller/Detector page

Controller Type: VICCD Box

Note: V/ICCD Box and V/ICCD are very different selections. If you have the V/ICCD camera only, without the Control Box, you should select V/ICCD. If you have the V/ICCD camera and the Control Box, then you should select V/ICCD Box, which will allow you to set the Control Box parameters via the Acquisition Menu Focus Window.

Comm Port: Set to the computer COM port used to interface to the V/ICCD.

Detector Type: Select your detector type, either NTSC (RS-170) or CCIR.

Frame Grabber: Select Serial or Data Translation (3152), whichever applies. *See V/ICCD manual for additional information.*

Waveform Mode: For gated operation select Gate. Otherwise select CW.

Readout Mode: Selects either the Odd or Even video field to be valid.

External Trigger

Enabled: Enables or disables an external event trigger.

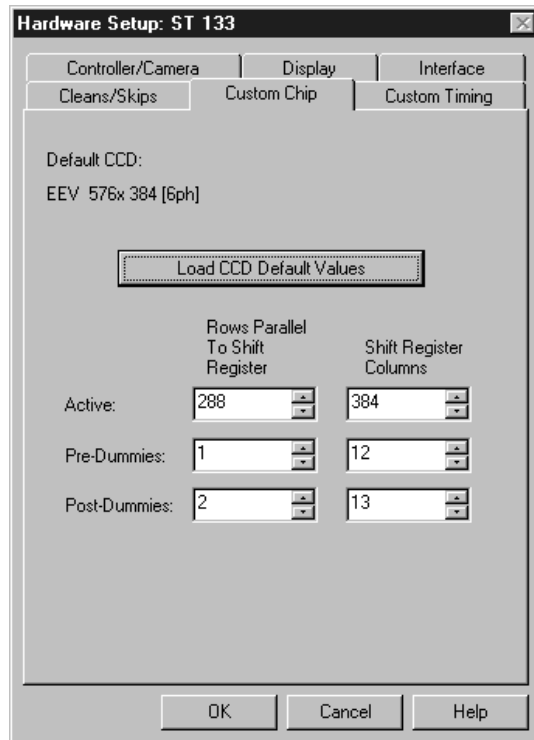
Polarity: Selects the polarity of the external event trigger.

Control Buttons:

OK implements the selections from all pages. **Cancel** closes the Hardware Setup window, leaving the original settings intact. **Help** opens context-sensitive Help.

User Defined Chip

Figure 62.
Custom Chip
tab page.



Introduction

Selecting User Defined Chip on the Controller/Camera tab page makes the Custom Chip tab page appear. If brought to the front, the Custom Chip selections become available as shown in Figure 62. The default values conform to the physical layout of the CCD array and are optimum for most measurements.

CAUTION

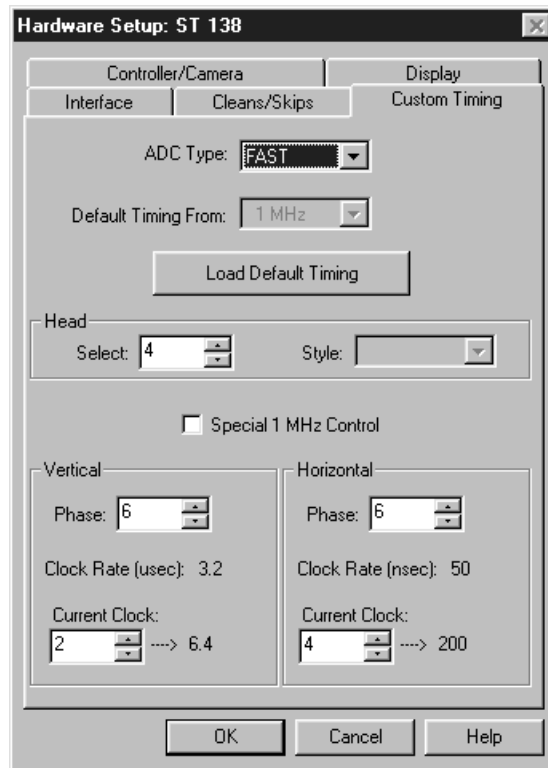
Roper Scientific does not encourage users to change these parameter settings. For most applications, the default settings will give the best results. We **strongly advise** contacting the factory for guidance before customizing the chip definition.

Normally in a CCD array, not all of the pixels are exposed and read out. There is a small region of “dummy” pixels that bound the active area. These dummy pixels are usually masked. Although these masked pixels are not normally read out, they could be read out by changing the chip definition in software. For example, in the case of the EEV 576 × 384 chip illustrated in Figure 62, the 576 active rows are preceded by one dummy row and followed by 2 dummy rows. In addition, there are 12 dummy columns on one side of the active region and 13 dummy columns on the other side. By changing the chip definition to increase the active area while decreasing the dummy settings, the dummy cells would be read out. By doing so, one could measure the dark charge with every readout.

It is also possible to increase image acquisition speed by reducing the size of the active area in the definition. The result will be faster but lower resolution data acquisition. Operating in this mode would ordinarily require that the chip be masked so that only the reduced active area is exposed. This will prevent unwanted charge from spilling into the active area or being transferred to the output register.

User Defined Timing

Figure 63.
Custom Timing
tab page.



Introduction

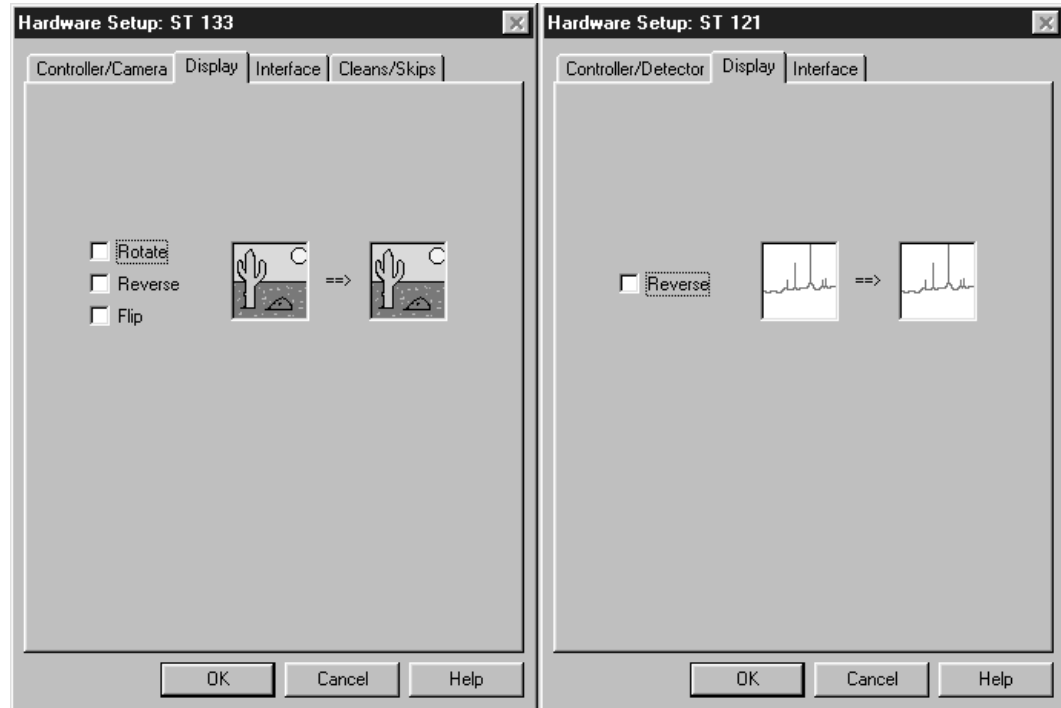
Selecting User Defined Timing on the ST-138 Controller/Camera tab page causes the Custom Timing tab page to appear. If brought to the front, the Custom Timing selections become available as shown in Figure 63. The default timing parameter values have been determined to give the fastest possible performance without compromising data acquisition performance.

CAUTION

Roper Scientific does not encourage users to change these parameter settings. For most applications, the default settings will give the best results. Changing them can adversely affect performance, sometimes in subtle ways that will not be immediately obvious. We **strongly advise** contacting the factory for guidance before customizing the chip timing parameter settings.

Display Tab Page

Figure 64. Display tab page; left graphic applies to all controllers except ST-121; right graphic applies to ST-121 only.



With the exception of the ST-121, the Display Tab Page is the same for all controllers. Three display options, Rotate, Reverse and Flip, are provided. Before and after thumbnail illustrations show the effect of each selection. If no option is selected, the thumbnails will be the same. Any orientation can be achieved with the proper combination of Rotate, Reverse, and Flip. In the case of the ST-121, Reverse only is provided.

Rotate: Rotates the image 90° counterclockwise.

Reverse: Reverses the image horizontally.

Flip: Flips the image vertically.

Control Buttons:

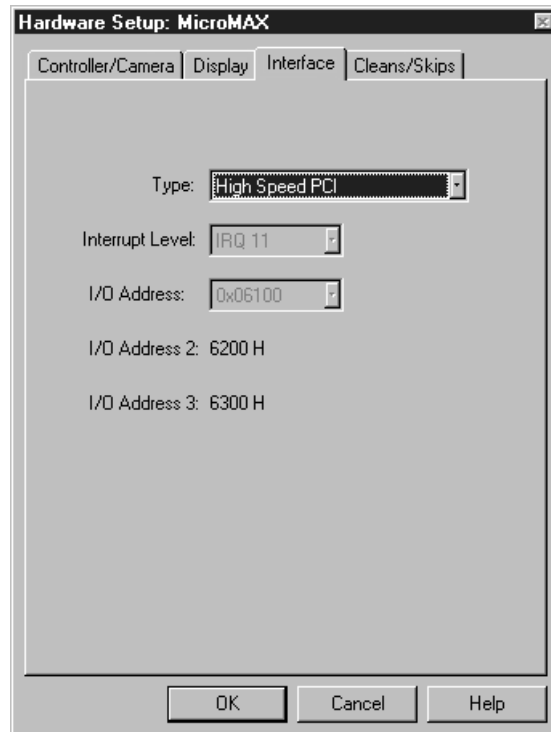
OK, Cancel & Help: These three buttons apply to the Hardware Setup window.

Clicking **OK** implements the selections from all pages. Clicking **Cancel** closes the Hardware Setup window, leaving the original settings intact. **Help** opens context-sensitive Help for the active tab page.

Interface Tab Page

With the exception of the V/ICCD and the V/ICCD Control Box, the Interface Tab Page is the same for all controllers and the selections are as follows. *In the case of V/ICCD and V/ICCD Control Box, the only Hardware Setup tab pages are Controller/Camera and Display.*

Figure 65.
Interface tab
page.



Type: Select the communications type that will be used to transmit data from the controller to the computer. All communications types are not available for all controllers and computers. The Demo selection, which allows the software to be exercised but which doesn't support data transfer to the computer, would not ordinarily be used in the field.

High Speed ISA: Select if PI ISA high-speed serial Interface card is installed in the computer in an ISA slot.

High Speed PCI: Select if PI PCI high-speed serial Interface card is installed in your computer and you wish data transfer to be interrupt driven. This choice would give the highest performance in most situations.

PCI Timer: Allows data transfer to be controlled by a polling timer if using PCI high-speed serial Interface card. Useful for troubleshooting possible interrupt problems (computer crashes or system fails to return data). Note that data transfer is slower in PCI Timer mode and data overrun more likely. Also PCI Timer cannot be used to continuously acquire small Regions of Interest in asynchronous operation. PCI Timer isn't compatible with **Use Interrupts** operation (described on page 464), a timing mode available when using the ST-138 Controller.

ECP: Provided for the MSP-100 only. Requires that the computer have an ECP (Extended Capability Port), which is a type of enhanced-performance parallel port.

Demo: Allows the software to be exercised without being connected to a controller. This mode is used primarily for demo purposes and could not be used in an actual measurement.

High Speed Type B: Select if PI ISA high-speed serial Interface card is installed in the computer in an *EISA slot*. *Type B is not available for all controllers.*

Serial: Provided for the V/ICCD. When V/ICCD is selected, since serial is the *only* possibility, serial is selected by default and the Interface tab page is not provided.

Interrupt Level: Can only be changed with High Speed ISA or ECP interface. The selected interrupt level *must* correspond to that set by the jumpers on the High Speed ISA card or assigned to the parallel port (ECP). The default for the High Speed ISA card is IRQ 10. In the case of a PCI interface, the interrupt level is reported but cannot be changed.

I/O Address: Can only be changed with High Speed ISA or ECP interface. The selected address *must* correspond to that set by jumpers on the High Speed ISA card or assigned to the parallel port (ECP). The factory default address for the High Speed ISA card is 0A00. In the case of a PCI interface, the I/O Address is displayed but cannot be changed.

I/O Address 2 and 3: Applies to High Speed PCI only. These addresses are reported but cannot be changed; address selection is automatic and under computer control. With other interfaces, these addresses are not displayed.

DMA Channel: Provided for the MSP-100 only. The DMA Channel selection must match that assigned to the ECP parallel port at the computer.

Control Buttons:

OK, Cancel & Help: These three buttons apply to the Hardware Setup window. Clicking **OK** implements the selections from all pages. Clicking **Cancel** closes the Hardware Setup window, leaving the original settings intact. **Help** opens context-sensitive Help for the active tab page.

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Initial Spectroscopic Data Collection

Introduction

The procedure in this chapter will enable you to begin collecting real data promptly. Minimum requirements are assumed. If your system is more complex, e.g., requiring consideration of complex timing and synchronization issues, you will have to carefully study the other chapters of this manual as well as the manuals provided for the system hardware components before data acquisition that addresses those needs will be possible. Nevertheless, it will be advantageous to begin with the simplest possible operating mode. It will give you operating experience and familiarity that will prove very valuable when you go to make more complex measurements. For additional information about the various menus and dialog boxes, see Chapter 21, *Menus and Dialog Boxes*. Note that controllers and cameras ordinarily used for imaging are not discussed in this chapter, but rather in the next chapter, *Initial Imaging Data Collection*.

Underlying assumptions for the following procedure are that the hardware installation, including mounting the camera to the spectrograph, has been completed. A further assumption is that the hardware setup as discussed in Chapter 3 has been completed. The last assumption is that a suitable spectrographic source be available. The mercury lines produced by ordinary fluorescent lights can be used. However, it will be better to begin with a low-pressure gas-discharge lamp such as neon, mercury, or mercury-argon, if one is available.

Note that there are two data collection modes, *Acquire* and *Focus*. The following data collection procedures are done in the *Focus* mode. In *Focus* mode operation, no frames of data are stored until **Start Storage** is selected. This mode is particularly convenient for familiarization and setting up. For ease in focusing, the screen refresh rate should be as rapid as possible, achieved by operating with axes and cross-sections off.

In *Acquire* mode, every frame of data collected is stored. This mode would ordinarily be selected during actual data collection. One limitation on Acquire mode operation is that if data acquisition continues at too fast a rate for it to be stored, data overflow will eventually occur. This could only happen in Synchronous (Full Speed) operation.

WARNING

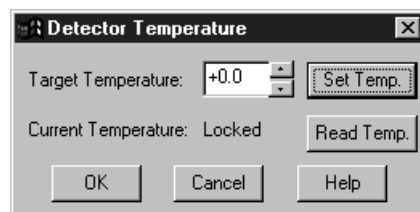
If using an intensified camera, note that data collection in following procedure will be done in the CW/Shutter mode, in which light overload can easily occur. Before powering the controller and camera, reduce the room light to reduce the risk of damage. Note that intensifiers are particularly at risk in pulsed laser operation, where overload spot damage can occur without raising the average current to where the overload detection circuits will be activated. It is far better to be careful than sorry. *Before proceeding, take the time to carefully read the manual for your intensified camera.*

Also, take particular care that your intensified camera is connected properly for shutter-mode operation. Cabling and peripheral considerations for intensified cameras are more complex than for unintensified cameras. *Again, read your camera manual.*

Temperature Control

Before continuing, the array temperature should be set to some easily achieved value in the operating range and Temperature lock should be established. The way this is done depends on the controller. With an ST-121, ST-130 or ST-138, the temperature is set by means of a dial on the front panel of the Controller. In the PentaMAX it is set from the front panel of the Power Supply. In the case of MicroView, the temperature is solely under software control and can not be set by the user. With the MicroMAX, ST-133 or V/ICCD (or V/ICCD Control Box) the temperature is set via software. To set the temperature with one of these controllers, open the WinSpec/32 Setup menu and click on Detector Temperature. This will cause the Temperature dialog box to appear as shown in Figure 66. Then set the **Target Temperature** to the desired value (0° suggested for initial data acquisition) and click the SET button. When the **Current Temperature: Unlocked** message changes to **Current Temperature: Locked**, temperature lock will have been established. Note that both the MicroMAX and the ST-133 additionally have a **Temp Lock** LED on the panel of the Analog/Control module that visually indicates when temperature lock occurs. In the case of the V/ICCD or V/ICCD Control Box, you can also set the temperature from the **Video Focus** dialog box.

Figure 66.
Temperature
dialog box.



Skips & Cleans

With some controllers, specifically the PentaMAX, ST-130, ST-133 and ST-138, there is a Cleans/Skips tab page in the Hardware Setup window. For the procedures that follow, load the default values for these parameters by bringing the Cleans/Skips tab page to the front, and then clicking on **Load Defaults** followed by **Yes**.

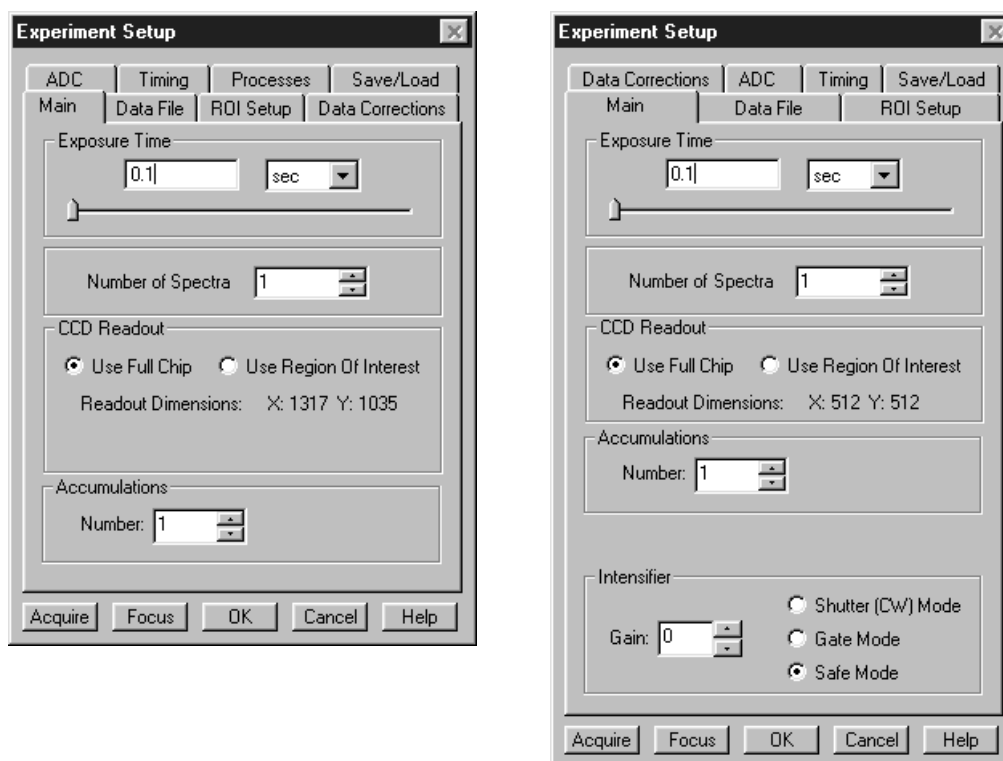
Spectrograph

Before a spectrum can be acquired, it is necessary that the spectrograph be powered and properly installed as described in Chapter 8. It is not necessary to *calibrate* the spectrograph. The default settings will be close enough for initial familiarization purposes. However, it will be necessary to *install* the spectrograph. This is the procedure whereby the WinSpec/32 software is informed of the spectrograph model, selected gratings, slit-width and port selections if applicable. It is also necessary to establish successful communications between the computer and the spectrograph. These considerations are all discussed in Chapter 8. Additional information for the individual spectrometer setup and dialog boxes is provided in Chapter 21.

Experiment Setup Procedure

- ◆ Open the Experiment Setup window (Figure 67) from the Acquisition menu.

Figure 67.
Experiment
Setup Window
Main tab page;
left, all but PI-
MAX; right, PI-
MAX.



- ◆ On the **Main** tab page, set the following parameters.

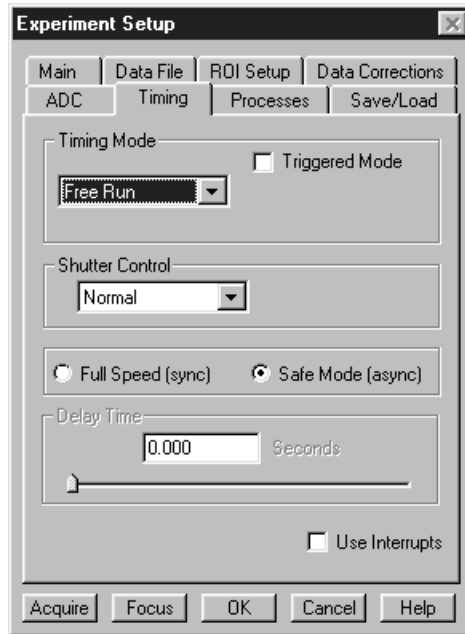
Exposure time: 0.1 seconds
Number of Spectra: 1
Use Full Chip: selected
Accumulations: 1
Gain (PI-MAX only): 128

Preamplifier Node (PI-MAX only): High Speed
Camera State (PI-MAX only): Safe

WARNING

Intensified Cameras: If working with an intensified camera, the room light should be subdued so as to allow *safe* shutter-mode operation. *Intensified cameras are quite susceptible to damage from light overload in shutter-mode operation and particularly subject to damage from light overload in gated operation with high-intensity pulsed light sources. See your camera manual for detailed information.*

Figure 68.
 Experiment
 Setup Window,
 Timing tab
 page.



- ◆ On the **Timing** tab page (Figure 68) set the following parameters. *Depending on the Controller, not all parameters listed below will be available. Simply ignore any that don't appear in the dialog box.*

Timing Mode: Free Run

Triggered Mode: not checked

Continuous Cleans: not checked

Shutter Control: Normal

Pre Open: Not checked

Safe Mode: selected

External Trigger: not checked

Edge Trigger: + edge

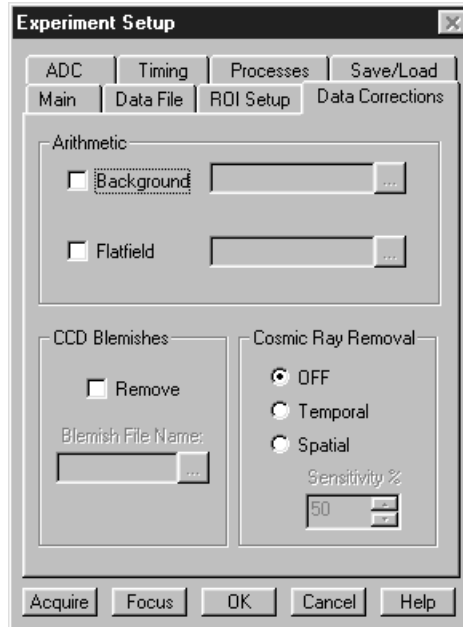
Delay time: 0

Use Interrupt: not checked

Note: Not all of these parameters are provided for every controller model. Ignore parameters that don't apply to your system.

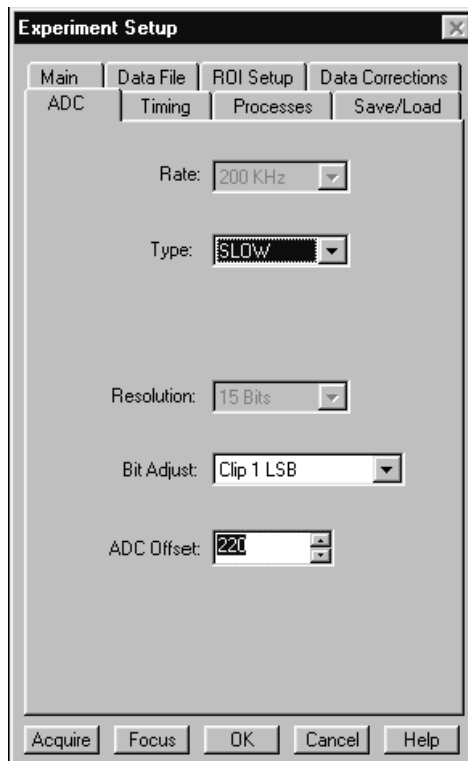
- ◆ On the **Data Corrections** tab page (Figure 69) all of the correction functions should be OFF.

Figure 69.
Data
Corrections tab
page.



- ▶ On the **ADC** tab page (Figure 70), set the parameters as they apply to your particular system. Parameters that might be listed, depending on the controller type, include:

Figure 70.
ST-138 ADC
tab page.



Type: For systems having more than one A/D converter, both FAST and SLOW will be available. Make this selection before selecting the rate or resolution.

Rate: ADC converter rate. Only those rates available for your A/D controller will be displayed, making it necessary to designate the A/D type

first. Select the maximum speed allowed by the converter. If the controller is an ST-130, confirm that the internal hardware jumpers of their controller are properly set for the desired speed. *See ST-130 manual for details.*

Resolution: Number of bits. Choices limited by A/D type selection.

Controller Gain: Set to Gain 3

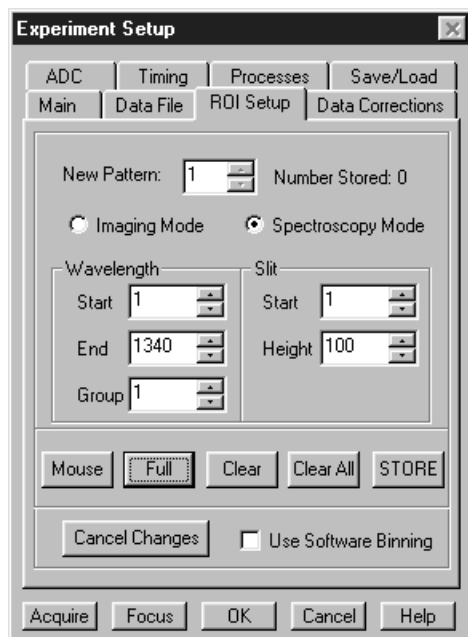
Bit Adjust: Set to No Clip

Note: Not all of these parameters are provided for every controller model. Ignore parameters that don't apply to your system.

- ▶ On the **ROI** tab page select Spectroscopic as shown in Figure 71. The Use Full Chip selection on the Main tab page overrides any ROI settings that may be present.

Note: The choice of Spectroscopic or Imaging on the ROI page will only be provided if the WinSpec/32 Imaging option is installed. If this choice isn't present, the default state is Spectroscopic and Imaging is not available.

Figure 71. ROI dialog box.

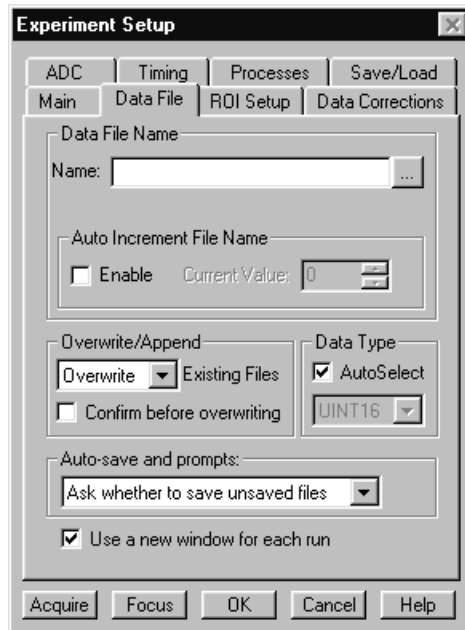


- ▶ On the **Processes** tab page, neither **On-Line Absorbance, Thresholding** nor **Y:T Analysis** should be selected.
- ▶ On the **Data File tab page**, make the following selections.
 - Auto Increment File Name Enable:** should be OFF.
 - Overwrite/Append Existing Files:** Select Overwrite (data file will overwrite an existing file having the same name).
 - Overwrite Confirmation:** Check this box so that you will be warned that the specified file name is already in use. If not checked, the old data file will be overwritten by the new one. No warning is provided.
 - Data Type AutoSelect:** Should be selected.

Auto-save and prompts: Select **Don't auto-save or ask to save**. With this selection, the user won't receive a prompt when a file is closed as a result of starting a data collection. A prompt will still be issued if the user closes the file explicitly and it has not been saved since being collected.

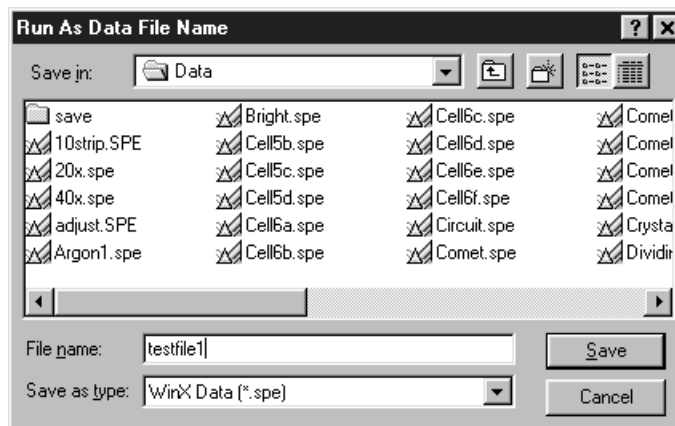
Use a New Window for each run: Leave unchecked.

Figure 72.
Data File
dialog box.



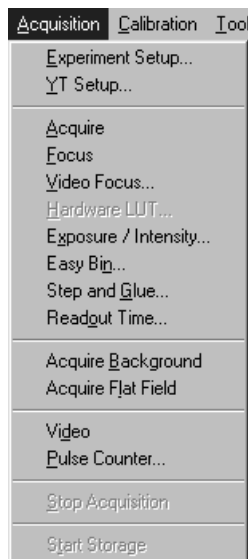
- ▶ Click on the bottom at the right of the **Name** text box. This will open a browse box as shown in the graphic below. Select the directory where you want the stored file to go. In the example illustrated, the file name is TESTFILE1 and it will be stored in a directory named Data. *If the file name doesn't automatically appear in the browse box, type it in.* The file type should be Princeton Instruments WinX (*.SPE).
- ▶ Click on the Browse box **Save** button to save the entered information and return to the Experiment Setup window.

Figure 73. File
Browse box.



- ◆ Click on OK. This will close the Experiment Setup window.
- ◆ Once again, click on Acquisition in the Menu bar. Again, the Acquisition Menu will appear as shown in Figure 74.

Figure 74.
Acquisition
menu.

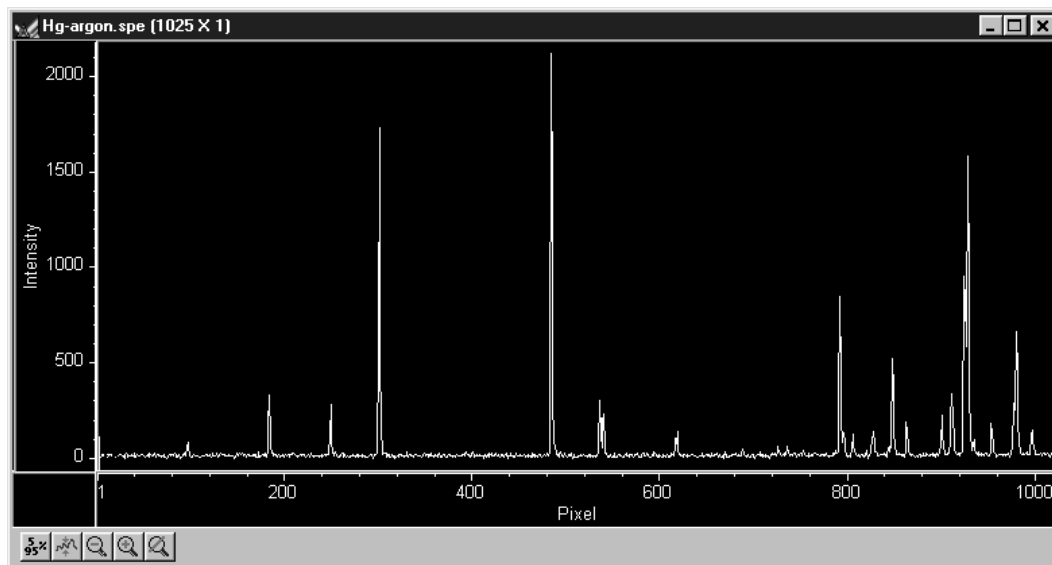


Data Collection

The following data collection procedure works for all controllers. An underlying assumption is that a suitable light source is available. Although fluorescent room lighting may be adequate, it will probably prove more instructive to use a standard lamp, such as a mercury-argon lamp that provided the spectrum illustrated in Figure 75.

- ◆ Click on **Focus** to begin collecting data. An acquisition can be initiated by means of the **Focus** button in the Experiment Setup window, by clicking on **Focus** on the Acquisition Menu, or by clicking on the **Focus** button on the Custom Toolbar. Data will be continuously acquired and displayed.
- ◆ While observing the displayed data, adjust the system optics for the best possible spectrum (lines as high and narrow as possible). Figure 75 shows a typical mercury-argon spectrum. Your results could appear different depending on the spectrograph grating used.

Figure 75.
Typical
Mercury-Argon
Spectrum.



- ◆ To store the most recent data set, click Start Storage on the Acquisition menu or click on the Start Store icon on the **Custom Toolbar** (see description on page 308). Data acquisition will halt and the most recent image will be stored in a file having the name specified on the Data File tab page.
- ◆ If you wish to initiate another data acquisition, select **Focus** again. To store the new data to disk, again click Start Storage on the Acquisition menu or click on the Store icon. This completes the initial spectroscopy data acquisition routine which should work with any PI Controller.

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Initial Imaging Data Collection

Introduction

ATTENTION

Imaging is only possible if the WinSpec/32 software you are using has the Imaging Option installed.

The procedure in this chapter will enable you to begin collecting real image data promptly. Minimum requirements are assumed. If your system is more complex, e.g., requiring consideration of complex timing and synchronization issues, you will have to carefully study the other chapters of this manual as well as the manuals provided for the system hardware components before data acquisition that addresses those needs will be possible. Nevertheless, it will be advantageous to begin with the simplest possible operating mode. It will give you operating experience and familiarity that will prove very valuable when you go to make more complex measurements. For additional information about the various menus and dialog boxes, see Chapter 21, *Menus and Dialog Boxes*.

Underlying assumptions for the following procedure are that the hardware has been installed per the instructions in the hardware manual(s) and that the hardware setup as discussed in Chapter 3 has been completed. A further assumption is that a good imaging subject is available. Often, a picture or optical target mounted on a wall or lab bench will give good results. If initial data collection is to be done using a microscope, be sure to read the chapter on microscopy in your controller manual before attempting data collection.

Note that there are two data collection modes, *Acquire* and *Focus*. The following data collection procedures are done in the *Focus* mode. In *Focus* mode operation, no frames of data are stored until **Start Storage** is selected. This mode is particularly convenient for familiarization and setting up. For ease in focusing, the screen refresh rate should be as rapid as possible, achieved by operating with axes and cross-sections off, and with Zoom 1:1 selected.

In *Acquire* mode, every frame of data collected is stored. This mode would ordinarily be selected during actual data collection. There is one limitation on Acquire mode operation to keep in mind. If data acquisition continues at too fast a rate for it to be stored, data overflow will eventually occur. This could only happen in Synchronous (Full Speed) operation.

WARNING

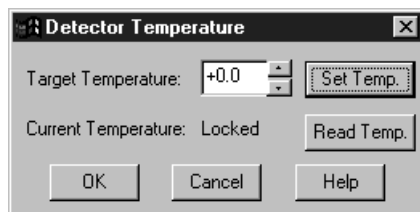
If using an intensified camera, note that data collection in the following procedure will be done in the Shutter mode, in which the camera can be damaged if exposed to light overload. Before powering the controller and camera, reduce the room light to reduce the risk of damage. Note that intensifiers are particularly at risk in pulsed laser operation, where overload spot damage can occur without raising the average current to where the overload detection circuits will be activated. It is far better to be careful than sorry. *Before proceeding, take the time to carefully read the manual for your intensified camera.*

Also, take particular care that your intensified camera is connected properly for shutter-mode operation. Cabling and peripheral considerations for intensified cameras are more complex than for unintensified cameras. *Again, read your camera manual.*

Temperature Control

Before continuing, the array temperature should be set to some easily achieved value in the operating range and Temperature lock should be established. The way this is done depends on the controller. With an ST-130 or ST-138, the temperature is set by means of a dial on the front panel of the Controller. In the PentaMAX it is set from the front panel of the Power Supply. In the case of MicroVIEW, the temperature is solely under software control and can not be set by the user. With the MicroMAX, ST-133 or V/ICCD (or V/ICCD Control Box) the temperature is set via software. To set the temperature with one of these controllers, open the Setup menu and click on Detector Temperature. This will cause the Temperature dialog box to appear as shown in Figure 76. Then set the **Target Temperature** to the desired value (0° suggested for initial data acquisition) and click the SET button. When the **Current Temperature: Unlocked** message changes to **Current Temperature: Locked**, temperature lock will have been established. Note that both the MicroMAX and the ST-133 additionally have a **Temp Lock LED** on the panel of the Analog/Control module that visually indicates when temperature lock occurs. In the case of the V/ICCD or V/ICCD Control Box, you can also set the temperature from the **Video Focus** dialog box.

Figure 76.
Temperature
dialog box.



Skips & Cleans

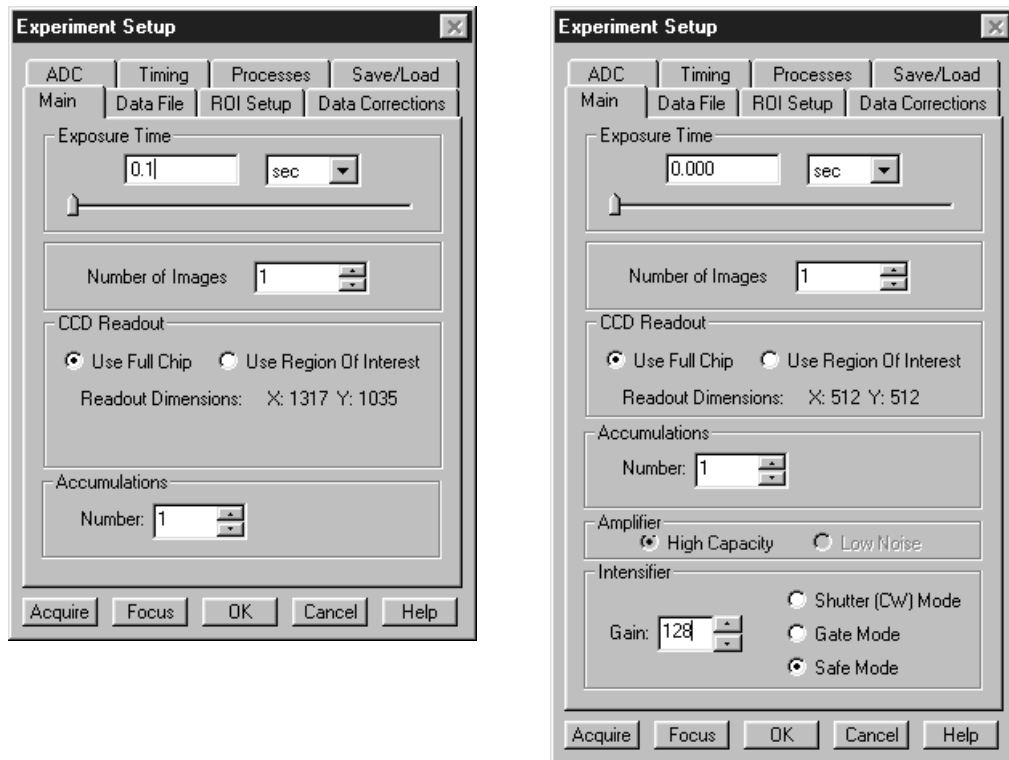
With some controllers, specifically the PentaMAX, ST-130, ST-133 and ST-138, there is a Cleans/Skips tab page in the Hardware Setup window. For the procedures that follow, load the default values for these parameters by bringing the Cleans/Skips tab page to the front, and then clicking on **Load Defaults** followed by **Yes**. **Exception:** With a PI-MAX camera, Cleans should be set to 1 and Strips per Clean to 4.

Experiment Setup Procedure (all controllers)

- ◆ Open the Experiment Setup window (Figure 77) from the Acquisition menu.

Note: The ROI Setup page won't be present if the selected controller is a V/ICCD or V/ICCD Control Box. Nor will there be an ADC page. However, if a system that includes a Data Translation 3152 Frame Grabber, there will be an A/D DT3152 tab page, providing the DT 3152 was selected during the Hardware Setup.

Figure 77.
Experiment
Setup Window
Main tab page;
left, all but PI-
MAX; right, PI-
MAX.



- ◆ On the **Main** tab page, set the following parameters.

Exposure time: 0.1 seconds

Number of Images: 1

Use Full Chip: selected (*selection not available with V/ICCD*)

Accumulations: 1

Gain (PI-MAX only): 128

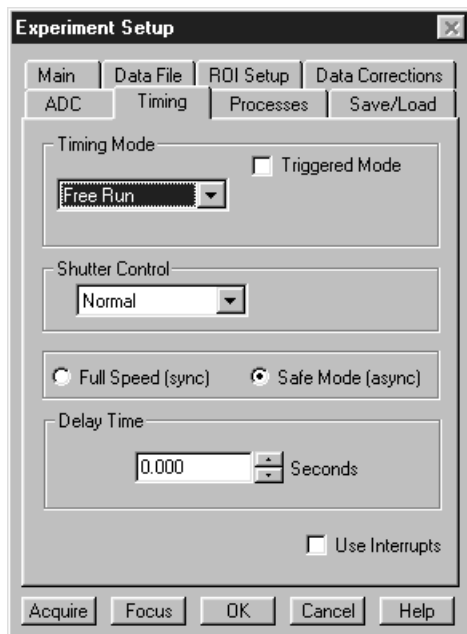
Preamplifier Node (PI-MAX with Thomson 512 only): High Capacity. *This is a reported parameter value. To set it, select FAST on the A/D tab page.*

Camera State (PI-MAX only): Safe Mode

WARNING

Intensified Cameras: If working with an intensified camera, the room light should be subdued so as to allow *safe* shutter-mode operation. *Intensified cameras are quite susceptible to damage from light overload in shutter-mode operation and to intensifier spot damage in gated operation with high-intensity pulsed light sources. See your camera manual for detailed information.*

Figure 78.
Experiment
Setup Window,
Timing tab
page.



- ▶ On the **Timing** tab page (Figure 78) set the following parameters.

Note: Not all of these parameters are provided for every controller model. Ignore parameters that don't apply to your system.

Timing Mode: Free Run

Triggered Mode: not checked

Continuous Cleans: not checked

Shutter Control: Normal

Internal Sync (PI-MAX with PTG only): selected

Pre Open: Not checked

Safe Mode (async): selected

External Trigger: not checked

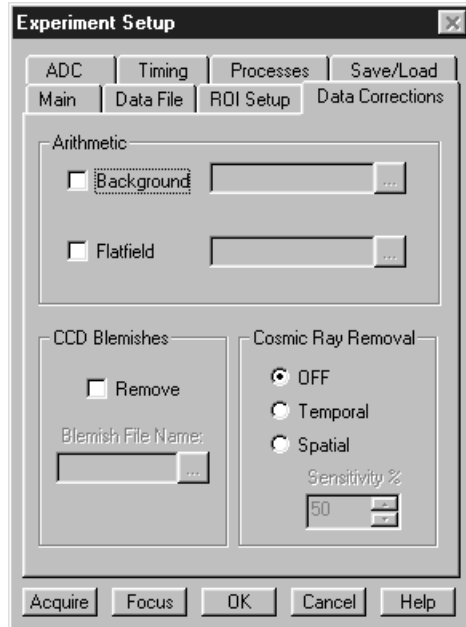
Edge Trigger: + edge

Delay time: 0

Use Interrupt: not checked

- ▶ On the **Data Corrections** tab page (Figure 79) all of the correction functions should be OFF.

Figure 79.
Data
Corrections tab
page.



- ▶ On the **ADC** tab page (Figure 80), set the parameters as they apply to your particular system. Parameters that might be listed follow:

Type: For systems having more than one A/D converter, both FAST and SLOW will be available. Make this selection before selecting the rate or resolution.

Rate: ADC converter rate. Only those rates available for your A/D controller will be displayed, making it necessary to designate the A/D type first. Select the maximum speed allowed by the converter. If camera is a PI-MAX with a Thomson 512 CCD, select FAST. ST-130 owners must confirm that the internal hardware jumpers of their controller are properly set for the desired speed. *See ST-130 manual for detailed information.*

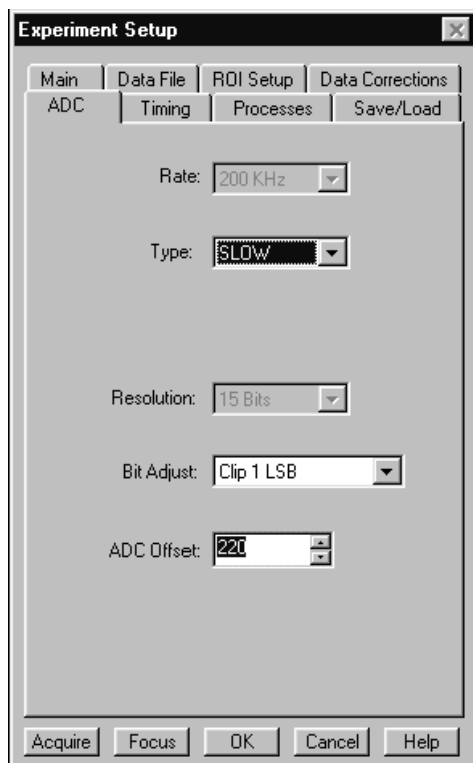
Resolution: Number of bits. Choices limited by A/D type selection.

Controller Gain: Set to Gain 3

Bit Adjust: Set to No Clip

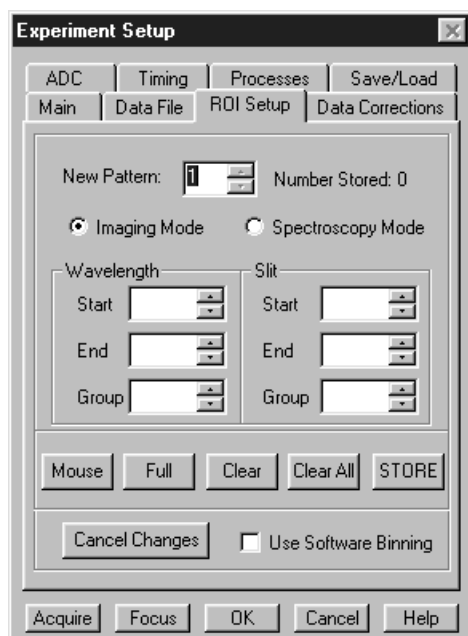
Note: Not all of these parameters are provided for every controller model. Ignore parameters that don't apply to your system. Further note that the ADC tab page won't be present if the controller is a V/ICCD or V/ICCD Control Box. There may be an A/D DT3152 page. If present, disregard it.

Figure 80.
ST-138 ADC
tab page.



- ▶ On the **ROI** tab page (Figure 81), select Imaging Mode. WinSpec/32 operated in Imaging Mode always uses the full chip area and ROI considerations do not apply.

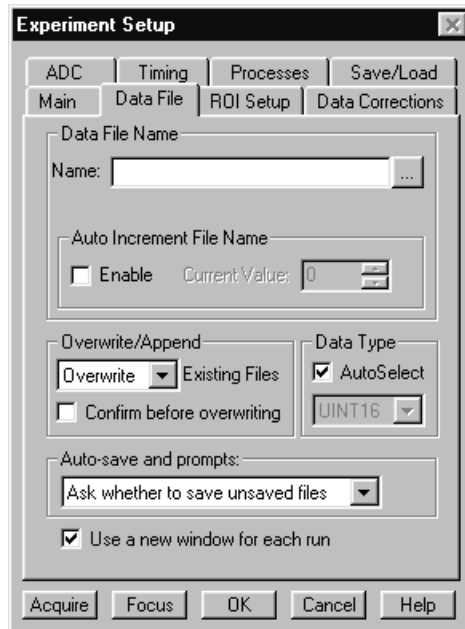
Figure 81. ROI
tab page -
imaging
selected.



- ▶ No **Processes** tab page function should be selected.

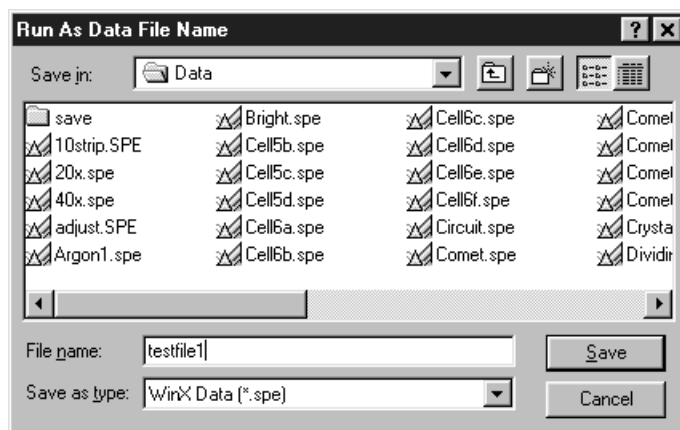
- ▶ On the **Data File tab page**, make the following selections.
 - Auto Increment File Name Enable:** should be OFF.
 - Overwrite/Append Existing Files:** Select Overwrite (data file will overwrite an existing file having the same name).
 - Overwrite Confirmation:** Check this box so that you will be warned that the specified file name is already in use. If not checked, the old data file will be overwritten by the new one. No warning is provided.
 - Data Type AutoSelect:** Should be selected.
 - Auto-save and prompts:** Select **Don't auto-save or ask to save**. With this selection, the user won't receive a prompt when a file is closed as a result of starting a data collection. A prompt will still be issued if the user closes the file explicitly and it has not been saved since being collected.
 - Use a New Window for each run:** Leave unchecked.

Figure 82.
Data File
dialog box.



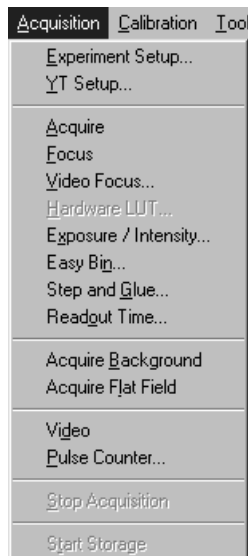
- ▶ Click on the bottom at the right of the **Name** text box. This will open a browse box as shown in the graphic below. Select the directory where you want the stored file to go. In the example illustrated, the file name is TESTFILE1 and it will be stored in a directory named Data. *If the file name doesn't automatically appear in the browse box, type it in.* The file type should be Princeton Instruments' WinX (*.SPE).
- ▶ Click on the Browse box **Save** button to save the entered information and return to the Experiment Setup window.

Figure 83. File
Browse box.



- ▶ Click on **OK**. This will close the **Experiment Setup** window.
- ▶ Once again, click on **Acquisition** in the Menu bar. Again, the Acquisition menu will appear as shown in Figure 74.

Figure 84.
Acquisition
menu.



Data Collection Procedures (controller specific)

MicroMAX or ST-133

The procedure that follows for these controllers is in two parts, **Video Focusing** and **Data Collection**. In focusing, images are displayed on the video monitor (not the computer monitor) and no data is collected. This allows rapid and easy adjustment of the system optics. Once the settings have been optimized, data collection begun can begin.

Focusing

This procedure applies for a MicroMAX or ST-133 system that includes a video monitor connected to the Video port (BNC connector) on the controller. If your system doesn't

include a video monitor, go to the **Data Collection - All Controllers** section, which begins on page 118.

- ◆ Select **Video** on the Acquisition menu. This will allow live data to be displayed on your video monitor.
- ◆ Select **Video Focus** from the Acquisition Menu. The **Interactive Camera** dialog box (Figure 85) will open.

Figure 85.
MicroMAX or
ST-133
Interactive
Camera dialog
box.



- ◆ Click on the **RUN** button in the Interactive Camera dialog box. The camera will begin acquiring pictures at the fastest possible rate and the image will be displayed on the video monitor. *Note that the image will not be displayed on the computer monitor while the Interactive Camera dialog box is open.*
- ◆ Focus the system optics and set the Interactive Camera dialog box **Exposure Time**, **RS170 Scaling** and **Offset** adjustments for the best viewed image. In addition to the Exposure Time, Intensity Scaling and Offset parameters, the Pattern parameters determine *which* CCD pixels will be displayed on the video monitor. *Note that, in Focus mode, the images will not appear at the computer but only at the video monitor.* If the number of pixels on the CCD is very much larger than the number of video pixels, you can use the Pan function to select any one of nine different subsets to display. The Zoom function gives additional control. One-to-one mapping from the selected region to the screen occurs with 2× selected. You may additionally have the option of selecting Binning, in which a wider view is achieved by combining adjacent pixels, or Decimation, in which pixels are discarded according to an algorithm.

The exposure time will be the same as that set via the Experiment Setup **Main** tab page. *The two exposure settings track. Changing it at either location should update the other setting automatically.* The Intensity Scaling, together with the Offset, determines how the image data is mapped to the 256 gray-scale levels. Begin with the Intensity Scaling set to “1 to 4096” (slider all the way to the right). Similarly, the Offset setting should initially be set to 2 (slider all the way to left).

- ◆ When no further improvement in the observed image can be obtained, click on **Stop** in the Interactive Camera Operation dialog box to halt focus-mode operation.

- ◆ Click on **Close** to close the Interactive Camera Operation dialog box and return to the Experiment Setup window.

Data Collection

- ◆ Click on **Focus** to begin collecting data. A Run can be initiated by means of the **Focus** button in the Experiment Setup window, by clicking on **Focus** on the Acquisition Menu, or by clicking on the **Focus** icon of the Custom Toolbar. Images will be continuously acquired and displayed on the computer screen and on the video monitor.
- ◆ To store the most recent image, click **Start Storage** on the Acquisition menu or click on the **Start Store** icon on the *Custom Toolbar* (see description on page 308). Data acquisition will halt and the most recent image will be stored in a file having the name specified on the **Data File** tab page.
- ◆ If you wish to initiate another data acquisition, select **Focus** again. To store the new data to disk, again click **Start Storage** on the Acquisition menu or click on the **Start Store** icon. This completes initial data acquisition with a MicroMAX or an ST-133 Controller.

PentaMAX

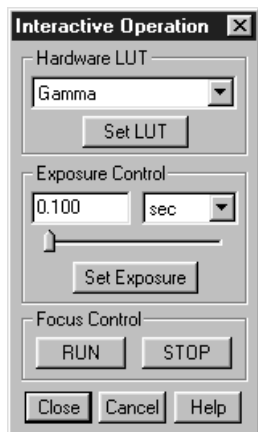
The procedure that follows for the PentaMAX Controller is in two parts, **Focusing** and **Data Collection**. In focusing, images are displayed on the video monitor and no data is collected. This allows rapid and easy adjustment of the system optics. Once the settings have been optimized, focus mode operation should be ended and data collection performed.

Focusing

This procedure applies for a PentaMAX system that includes a video monitor connected to the Video port (BNC) of the PentaMAX. If your system doesn't include a video monitor, go to the **Data Collection - All Controllers** section, which begins on page 118.

- ◆ Select **Video** from the Acquisition menu. This will allow live data to be displayed on your video monitor.
- ◆ Select **Video Focus** from the Acquisition Menu. The Interactive Operation dialog box illustrated in Figure 85 will open.

Figure 86.
PentaMAX
Interactive
Operation
dialog box.



- ◆ Note the Hardware LUT window. This selection sets the scaling of the video display only. Unless the signal is very weak, the best LUT choice will be Gamma.
- ◆ Click on the **RUN** button in the Interactive Operation dialog box. Data acquisition at the fastest possible rate will commence immediately and the image will be displayed on the video monitor. *Note that the image will not be displayed on the computer monitor while the Interactive Operation dialog box is open.*
- ◆ Focus the system optics and, if necessary, adjust the **Exposure Time** in the Interactive Camera dialog box for the best viewed image. The exposure time will be the same as that set via the Experiment Setup **Main** tab page. *The two exposure settings track. Changing it at either location should update the other setting automatically.*
- ◆ When no further improvement in the observed image can be obtained, click on **Stop** in the Interactive Operation dialog box to halt focus mode operation.
- ◆ Click on **Close** to close the Interactive Operation dialog box and return to the Experiment Setup window.

Data Collection

- ◆ Click on **Focus** to begin collecting data. Data collection can be initiated by means of the **Focus** button in the Experiment Setup window, by clicking on **Focus** on the Acquisition Menu, or by clicking on the **Focus** icon of the Custom Toolbar. Images will be continuously acquired and displayed on the computer screen.
- ◆ To store the most recent image, click **Start Storage** on the Acquisition menu or click on the **Start Store** icon on the Custom Toolbar (see description on page 308). Data acquisition will halt and the most recent image will be stored in a file having the name specified on the **Data File** tab page.
- ◆ If you wish to initiate data acquisition, select **Focus** again. To store the new data to disk, again click **Start Storage** on the Acquisition menu or click on the **Start Store** icon. This completes initial data acquisition with a PentaMAX Controller.

V/ICCD

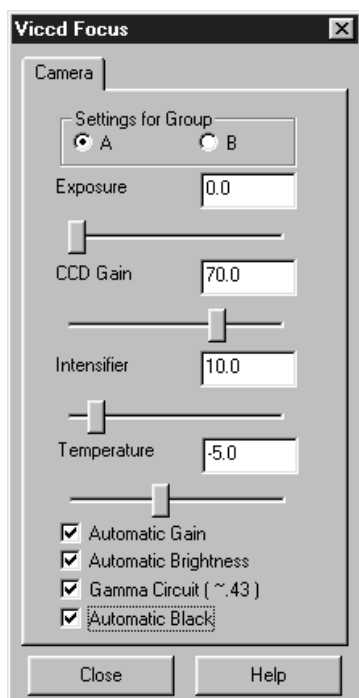
Focusing

- ▶ Select **Video Focus** from the Acquisition Menu. The **V/ICCD Focus** window will open as illustrated in Figure 87. Whenever the V/ICCD is powered, image data is applied to the video monitor. *If **Acquire** or **Focus** is selected, it will as well be displayed at the computer. With the V/ICCD, the number of data bits to the video monitor and to the computer is always the same.*
- ▶ Adjust the camera optics and the V/ICCD **Camera** parameters for the best displayed image. The exposure time will be the same as that set via the Experiment Setup **Main** tab page. *The two exposure settings track. Changing it at either location should update the other setting automatically.* The other selections and values shown are the defaults and will give good results in most instances.
- ▶ When no further improvement in the image can be obtained, click on **Close** to close the dialog box.

Data Collection

- ▶ Click on **Focus** or on the **Focus** icon of the Custom Toolbar. Images will be continuously displayed at the computer monitor as they are acquired.
- ▶ To store the most recent image, click **Start Storage** on the Acquisition menu or click on the **Start Store** icon on the **Custom Toolbar** (see description on page 308). Data acquisition will halt and the most recent image will be stored in a file having the name specified on the **Data File** tab page.
- ▶ If you wish to initiate data display at the computer again, select **Focus**. To store the new data to disk, again click **Start Storage** on the Acquisition menu or click on the **Start Store** icon. This completes initial data acquisition with a V/ICCD.

Figure 87.
V/ICCD Focus
window.



Control Box (V/ICCD)

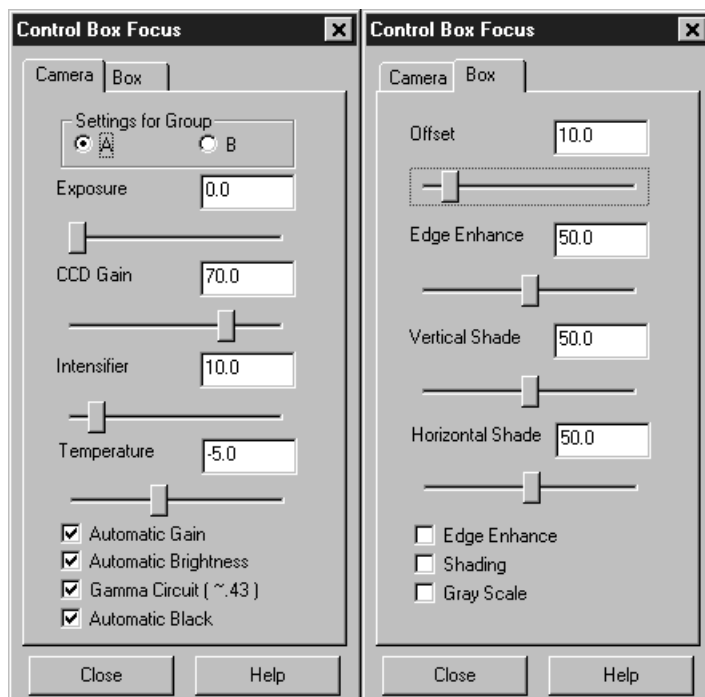
Focusing

- ▶ Select **Video Focus** from the Acquisition Menu. The **Control Box Focus** window will open with two tab pages as illustrated in Figure 88. Whenever the V/ICCD is powered, image data is applied to the video monitor. *If **Focus** or **Acquire** is clicked, data will also be displayed at the computer.*
- ▶ Adjust the camera optics and the Control Box **Camera** parameters for the best displayed image. *Leave the Control Box parameters set to their default values. The exposure time will be the same as that set via the Experiment Setup **Main** tab page. The two exposure settings track. Changing it at either location will update the other setting automatically.* The other selections and values shown are the defaults and will give good results in most instances.
- ▶ When no further improvement in the image can be obtained, click on **Close** to close the dialog box.

Data Collection

- ▶ Click on **Focus** or on the **Focus** icon of the Custom Toolbar. Images will be continuously displayed at the computer monitor as they are acquired.
- ▶ To store the most recent image, click **Start Storage** on the Acquisition menu or click on the **Start Store** icon on the **Custom Toolbar** (see description on page 308). Data acquisition will halt and the most recent image will be stored in a file having the name specified on the **Data File** tab page.

Figure 88.
Control Box
Focus tab
pages.



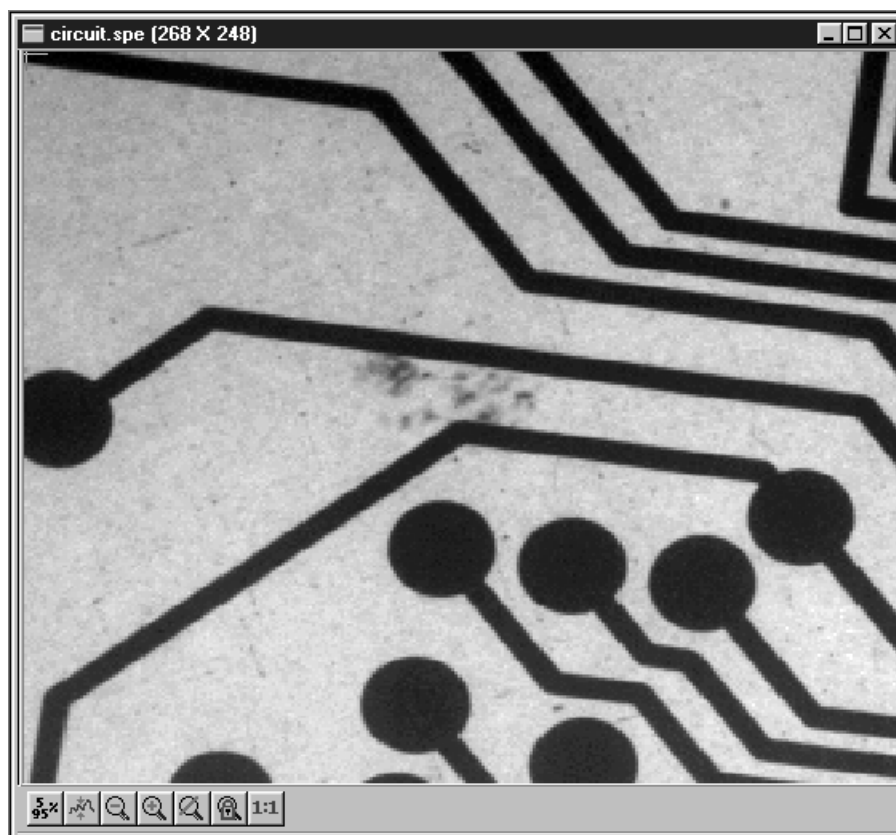
If you wish to initiate data display at the computer again, select **Focus**. To store the new data to disk, again click **Start Storage** on the Acquisition menu or click on the **Start Store** icon. This completes initial data acquisition with a V/ICCD Control Box.

Data Collection - All Controllers

The following data collection procedure works for all controllers. However, it doesn't exercise some of the special features, such as video monitor support, available on certain controller models.

- ▶ Click on **Focus** to begin collecting data. Data collection can be initiated by means of the **Focus** button in the Experiment Setup window, by clicking on **Focus** on the Acquisition Menu, or by clicking on the **Focus** icon of the Custom Toolbar. Images will be continuously acquired and displayed.
- ▶ Observe the displayed data and adjust the system optics for the best possible image. *It may be necessary to readjust the Exposure Time (Experiment Setup **Main** page).*

Figure 89.
Typical Data
Acquisition
Image.



- ▶ To store the most recent image, click **Start Storage** on the Acquisition menu or click on the **Start Store** icon on the **Custom Toolbar** (see description on page 308). Data acquisition will halt and the most recent image will be stored in a file having the name specified on the **Data File** tab page.
- ▶ If you wish to initiate another data acquisition, select **Focus** again. To store the new data to disk, again click **Start Storage** on the Acquisition menu or click on the **Start Store** icon. This completes the initial data acquisition routine, which should work with any PI Controller.

Opening, Closing, and Saving Data Files

Introduction

This chapter discusses how to open, close, and save existing data files to disk. Options for saving and deleting files will be explained. Data files created with temporary file names should be saved to disk periodically. Files should be closed completely to conserve RAM for data collection.

Data files can be deleted directly from WinSpec/32, without using the File Manager or any other file utility.

Note: WinSpec/32 can read data files acquired with earlier versions of WinSpec. Versions of WinSpec prior to 1.6 cannot read WinSpec/32 data files. Neither can versions prior to 1.6 read data files that were collected with earlier versions and then opened, modified and saved using WinSpec/32. This should be considered carefully before modifying and *saving* old data files with WinSpec/32.

Opening Data Files

In WinSpec/32 files are opened according to Win 95 conventions, as follows.

- ◆ Click on Open in the File menu. The File Open window will appear (Figure 90).
- ◆ Open the directory containing the data files. Clicking on the button at the right of the Look In box opens a browser function, allowing you to quickly and easily access the correct folder. As shown in Figure 90, the data files will be listed below.
- ◆ If you want the software to control how the data will be displayed when the file is opened, check **Auto Select**. Leave **Auto Select** unchecked if you want to retain control over whether the data will be displayed as an **Image, Graph** or **3D Graph**.

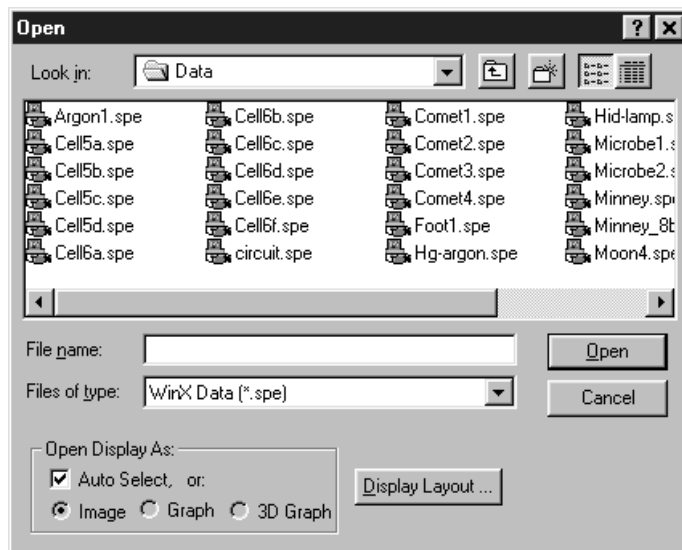
Auto Select is the factory default selection.* In addition, one of the three radio buttons, **Image, Graph** or **3D Graph**, will be selected but grayed out if Auto Select is checked. If Auto Select is unchecked, the grayed out selection will become active and govern how the file is opened.

- When Auto Select is checked, the way the data is displayed depends on the number of data strips it contains.

* The open/display default selection can be changed and saved from the Display Layout window.

- ⇒ If there are eleven or more strips of data, they will be displayed as a normal image, such as that shown in Figure 143 (page 172).
 - ⇒ If there are at least three data strips but less than eleven, the data will be plotted as a 3D Graph as shown in Figure 121 (page 156).
 - ⇒ If there are only two strips of data, they will be displayed as graphs stacked in a two-dimensional plot, the same as for a 3D Graph of two strips. See Figure 122 (page 157).
 - ⇒ A single strip **will always** be plotted as a simple X vs. Y plot. Note that from two to ten strips, the intensity (Y axis) scale shifts position as required to read true for the selected strip.
- If **Image** is selected, all data points will be plotted as a function of the strip and pixel number.
 - If **3D Graph** is selected, multiple data strips will be plotted as a function of intensity versus pixel number, the actual number of data strips plotted depending on the 3D Layout display parameter settings. All of the strips could come from the same frame, or, in the case of a file containing multiple frames, the same numbered strip could come from each frame.
 - If **Graph** is selected, the selected data strip only will be plotted as a function of intensity versus pixel number.
- ◆ Note the Files of Type text box, which allows you to select files for listing according to their type. If **WinXData (*.spe)** is selected, only files of type *.spe will be listed. This is the native WinSpec/32 format. If **TIFF** or **8-bit TIFF File (*.tif)** is selected, only files of the type *.tif will be listed. If **All Files (*.*)** is selected, all files in the folder will be listed. WinSpec/32 can open either *.spe files or *.tif files (8-bit or 16-bit). Select type **8-bit TIFF File** to open an 8-bit TIFF file. Select type **TIFF File** to open a 16-bit TIFF file.

Figure 90.
Open window.



- ▶ Either double click on the name of the file you want to open or single-click on the name and then click on the Open button. For example, with 3D Graph selected, double clicking on Hid-lamp.spe would open that file, producing the display shown in Figure 91. Note that there are many different ways of controlling how the image will be displayed, as described in Chapter 10.

Multiple Files: It is also possible to open multiple files at the same time by using the Win95 Shift Click and Control Click selection features. To select a *range of contiguously listed files* for opening:

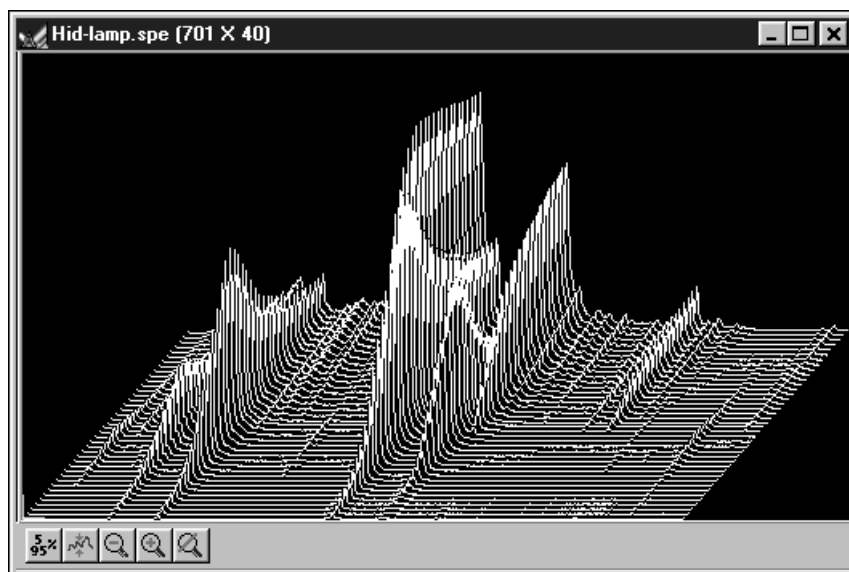
- Hold the Shift key down and click on the first file in the range. The file will be selected.
- Then hold the Shift key down again and click on the last file in the range. That file *and all the files between the two designated files* will be selected.

To select multiple files which are *not* listed contiguously:

- hold down the **Ctrl** key and then click on the first file. That file will be selected.
- Then hold down the **Ctrl** key again and click on the second file. That file will also be selected.
- Proceed in similar fashion to select each file to be opened.

Once all files to be opened have been selected, click on **Open** (or double click on a selected file) and all of the selected files will be opened.

Figure 91.
High-Intensity
lamp spectrum.



There are a number of additional options and operations that can be performed from the Open dialog box. For example, clicking the Display Layout button will directly open the Display Layout window, described in Chapter 10. In addition, options for the organization of the Open dialog box itself can be selected by means of the icons to the right of the Look In text box, or by right clicking the mouse anywhere in the file listing area of the box (*but not on a file name*).

Right clicking *on a file name* opens a File Operations menu that provides a number of additional operations, including open, delete, print, properties, and edit operations such as copy and cut. These are explained in more detail in Chapter 21.

Saving Data Files

Data files must be saved to disk before exiting the software. It is also recommended that you save periodically when making measurements to minimize the overall risk of data loss. If you exit and there are unsaved data files, you will be prompted to save them. The File menu provides three Save commands, as follows.

1. **Save:** Saves the active data file using the original file name and type and in the original directory (folder).
2. **Save As:** The Save As dialog box is used to save the active data file to a user-specified file name and directory. The file type can be changed.
3. **Save All:** Saves all open data files using the original file names and directories (folders).

Sometimes during data collection or processing, windows will be opened and display data with an <untitled #> title. These are temporary files, and they must be saved to disk if you want to keep them. The Save As dialog box performs this function. The Save As dialog box also allows you to open a file and save it with a different name.

Saving temporary data files

The WinSpec/32 software allows you to work with temporary files, files with names like <untitled 1>. To save these files, or to save any file to a new filename, perform the following steps.

- ◆ Select Save As from the File menu. The Data File Save As dialog (Figure 93) appears.
- ◆ Open the directory where you want the file saved. Clicking on the button at the right of the Save In text box opens a browser function that will allow you to quickly and easily select the target directory.
- ◆ Type in a name for the file. Windows 95 long file-name convention applies. It is not necessary to add the .spe extension. it will be added automatically according to the specified file type.

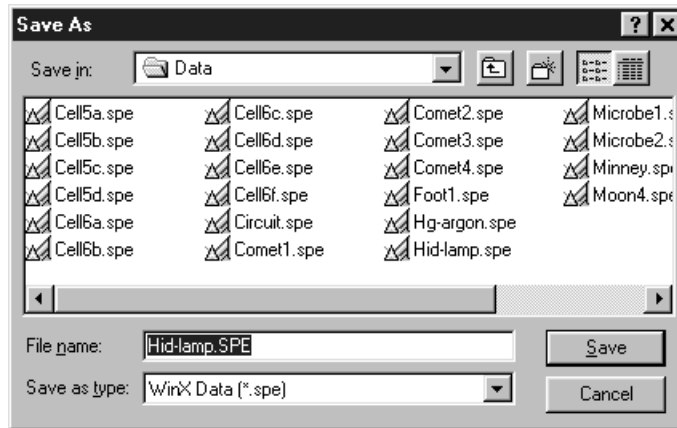
Save as type: Indicates the file type. The data types currently supported are listed in Figure 92. If All Files (*.*) is selected, you will be able to save the file with any extension. The file, however, will be saved in the *.SPE file type format. *Note that the data only is saved. This could have some unexpected effects. For example, if you save a graph as a *.TIF file, and then open the file with an image editor, you will see the data presented as a single strip image, not as a graph.*

Figure 92.
Save As Data
Types.



- Click on OK to save the file, or Cancel to close the Data File Save As dialog without saving the file.

Figure 93. The
Data File Save
As dialog box.



Data File tab page


The Data File tab page, described in detail on page 313, provides the user with additional control and great flexibility in naming and saving newly collected data. It also provides for auto-saving and for auto-incrementing the file name defined via a template. In addition, there is provision for selecting the data type manually or of having it automatically selected.

Closing a data file

An open data window can be closed by clicking on the box at the upper right of the window or by clicking on Close in the File menu. An open data window can be removed from view by clicking on the box at the upper right of the window. The file will be reduced to an icon on the task bar but the data will remain loaded in RAM. There may be situations where you would want to do this to reduce desktop clutter. Unless you intend to expand the file for display again, it is ordinarily better to actually close the file so that the RAM it is using will be freed for other use. If the file hasn't been saved, you will be prompted.

There are several ways of closing an open data window. These differ in subtle ways as follows.

- The box at the upper right of the data window will close that window only.

- The  box at the upper right of the window will also remove the data window from view by reducing it to an icon on the task bar. There may be situations where you would want to do this to reduce desktop clutter. However, the data will remain loaded in RAM, reducing the memory available for data collection. Unless you intend to expand the file for display again, it is ordinarily better to actually close the file so that the RAM it is using will be freed for other use.
- **Close** in the File menu closes all windows using the data set displayed in the active data window. This may be important if New in the Window menu or in the Data Window Context menu has been used to open additional windows with the same data. Simply clicking on Close in the File menu will close all windows containing the same data, regardless of how it is displayed.
- **Close** in the Control menu, accessed by clicking on the WinSpec/32 icon at the left end of the Title bar, closes WinSpec/32, as does double clicking on the WinSpec/32 icon. Similarly, the key combination ALT+F4 also closes WinSpec/32.
- **Close All** in the Window menu closes *all* open data files.
- The key combination **CTRL+F4** closes the active window only.

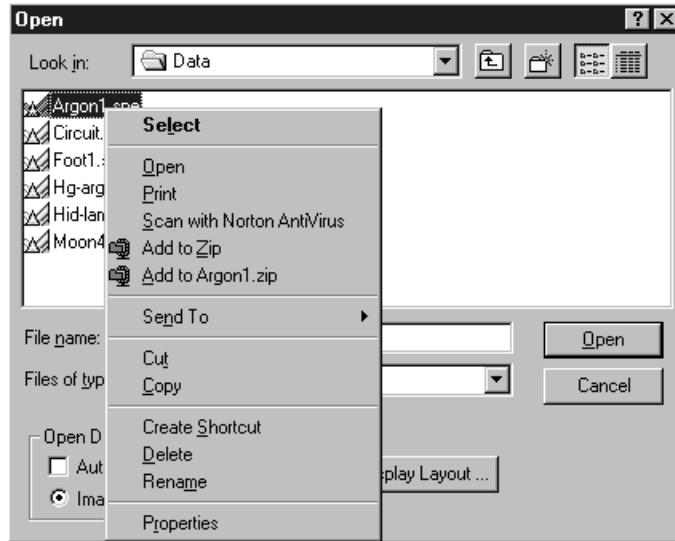
Deleting Data Files

You can delete data files directly from within WinSpec/32, without having to close WinSpec/32, and without having to use the Windows 95 Explorer or another file utility. This is achieved using the File Operations menu, accessed by right-clicking on the file name in the Open dialog box, as explained below.

- ◆ Click on Open in the File menu. *Only files with the selected data type, *.spe or *.tif, will be listed.*
- ◆ Position the mouse cursor on the name of the file you want to delete and click the *right* mouse button. This will open the “right-click” File operations menu, as shown in Figure 94.
- ◆ Click on Delete. Then answer yes to the query asking whether you wish to send the file to the recycling bin. The file will be deleted and the File Operations menu will close.

Note: Click on the Open dialog box Cancel button to exit the dialog box without deleting any files.

Figure 94. The right-click File Operations menu.



Multiple Files: It is also possible to delete multiple files at the same time by using the Win95 Shift Click and Control Click selection features. To select a *range of contiguously listed files* for deleting:

- Hold the Shift key down and click on the first file in the range. The file will be selected.
- Then hold the Shift key down again and click on the last file in the range. That file *and all the files between the two designated files* will be selected.

To select multiple files which are *not* listed contiguously:

- Hold down the **Ctrl** key and then click on the first file. That file will be selected.
- Then hold down the **Ctrl** key again and click on the second file. That file will also be selected.
- Proceed in similar fashion to select each file to be deleted.

Once all files to be deleted have been selected, *right click* on a selected file to open the File Operations menu. Then click on **Delete** to delete all of the selected files.

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Wavelength Calibration

Introduction

You can calibrate the WinSpec/32 software either by using the spectrograph stepper motor position (Spectrograph calibration) or by performing a wavelength calibration. Spectrograph calibration, described in Chapter 8, precisely calibrates the movement of the spectrograph gratings. Wavelength Calibration is good for one position of the grating only. Once you move the grating (by hand or by controlling the stepper motor) a different wavelength calibration must be performed for that spectrograph position.

Note: Even after the spectrograph setting is fixed, moving the sample, refocusing, or almost any adjustment of the input optics can have an effect on the wavelength calibration. For the most accurate calibration possible, Roper Scientific recommends recalibrating the system after *any* optical adjustment.

Changing the WinSpec/32 Calibration Method

Switching between Wavelength Calibration and Spectrograph Calibration is controlled using the Usage dialog box. This dialog box determines whether calibration is turned on or off, and which type of calibration is used. The display can be calibrated by controlling the stepper motor of the spectrograph, called Spectrograph Calibration (discussed in Chapter 8), or the display can be calibrated for a fixed spectrograph position by entering the position of known peaks from a known source such as a mercury or neon lamp. The calibration of the spectrograph for a fixed position is called Wavelength Calibration and is described in this chapter.

Adding the Calibration Button to the Toolbox

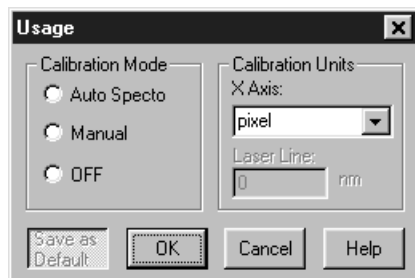
If you have not already added the Calibration button to the Toolbox, you may find it convenient to add it now. Clicking on the Calibration button is equivalent to selecting Usage on the Calibration menu. Chapter 20, *Custom Toolbar Settings*, contains instructions for adding or removing buttons from the custom toolbar.

Changing the Calibration Method

- ▶ Select Usage from the Calibration menu, or click on the Calibration button (Custom toolbar). The dialog in Figure 95 will be displayed.
- ▶ Select the desired method of calibration.
 - **Auto Spectro** selects Spectrograph Calibration as described in Chapter 8. A spectrograph supported by WinSpec/32 must be installed for this selection to be available.
 - **Manual** applies the wavelength calibration to the active data. The calibration is performed using the Default Calibration Setup dialog box, accessed by selecting **Setup** on the Calibration menu.
 - **Off** selects uncalibrated operation.
- ▶ Select the desired X Axis units. *This option is only available if the data set is calibrated.* If **relative wave numbers** are selected, it will additionally be necessary to enter the wavelength of the laser line.
- ▶ Click on OK.

See the discussion of the Calibration Usage dialog box in Chapter 21 (page 289) for details concerning the Calibration Usage dialog box selections.

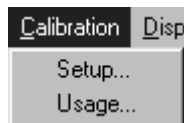
Figure 95.
Calibration
Usage dialog
box.



The Calibration Menu

The Calibration menu, which can be called by clicking on Calibration in the menu bar, is shown in Figure 96. The Calibration menu contains two items, Setup and Usage, which call the Calibration Setup and Calibration Usage dialog boxes. Brief descriptions follow.

Figure 96. The
Calibration
menu.



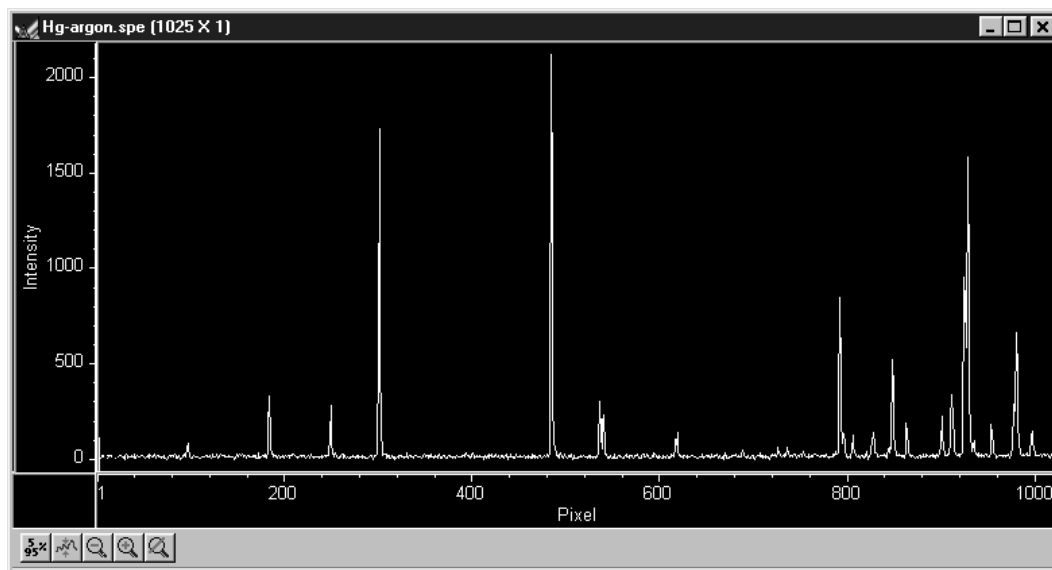
Setup: Once a single spectrum has been acquired or loaded, the menu item **Setup** opens the Calibration Setup dialog box (page 286). A calibration session consists of finding the peaks, marking the known peaks to be used for calibration, and saving the calibration data as the default or applying it to the active data set only.

Usage: Selects the Calibration mode and Units. Once the wavelength calibration has been performed, it can be applied by selecting **Manual**, or turned off by selecting **Off**. Selections can either be saved as default power-up parameters or be applied to the active data set only. For more information, see the discussion of the Calibration Usage dialog box on page 289.

Wavelength Calibration Procedure

Before a wavelength calibration can be performed, it is necessary to either load a spectrum or acquire one. For good calibration results, the spectrum should have well defined peaks for which you know the wavelength. A calibration requires at least two points defined by pixel and by units. Naturally the more points used, the more accurate the calibration. The ideal calibration spectrum would have one peak at the start of the array (or region of interest), one at the end of the array or region of interest, and one midway between the end peaks. In real life, the ideal spectrum is seldom available, but the closer you can come to this ideal the better the calibration results will be. Figure 97 shows a mercury-argon spectrum that could serve as the basis for a good calibration in many situations. *Appendix A contains wavelength tables for Argon, Neon and Mercury, together with a detailed spectrum for Hg-Argon.*

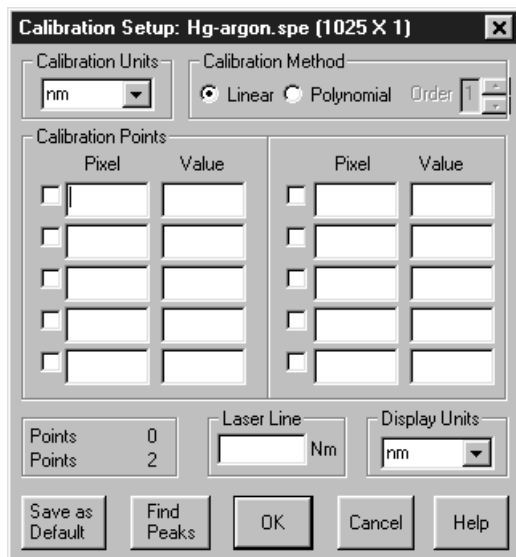
Figure 97. Hg-Argon spectrum.



Once you have the calibration spectrum displayed on the screen as the active data set, proceed as follows.

- ◆ Click on **Setup** in the Calibration menu to open the Calibration Setup dialog box. If a previous calibration had been saved, the calibration values would be listed. If no previous calibration had been saved as the default, no values would be listed and the dialog box would appear as shown in Figure 98. *For a detailed description of the Calibration Setup dialog box, see the discussion on page 286.*

Figure 98.
Calibration
Setup dialog
box.



- Click on **Find Peaks**. An automatic peak finding routine will be performed. The *maximum* number of peaks is equal to one quarter the number of displayed pixels. The pixel values for the 10 highest peaks will be shown in the Pixel boxes in the Calibration Setup dialog box as shown in Figure 99. Note that the Find Peaks routine causes a small red arrow to be displayed above each peak found in the spectrum together with a notation indicating the peak location in pixels.

Note: Each time the Find Peaks routine is initiated the *displayed* peak heights will decrease. Clicking on the data window Autoscale icon will restore their original displayed height.

Figure 99.
Calibration
Setup dialog
box after
running Find
Peaks routine
on Hg-Argon
spectrum.

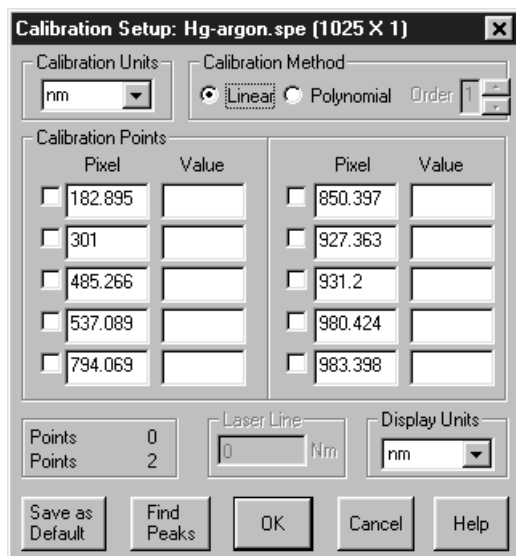
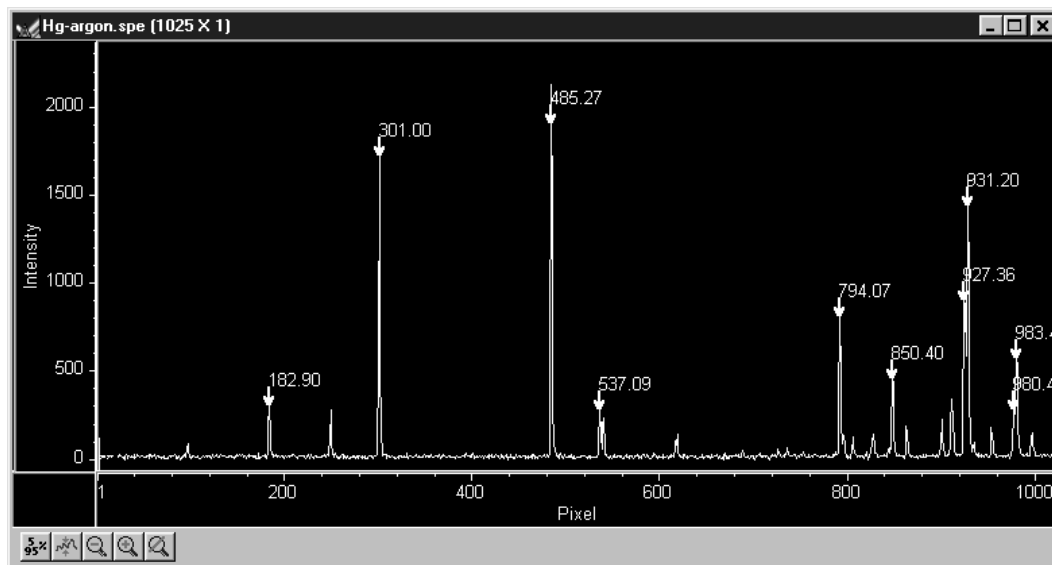


Figure 100.
Spectrum after
running Find
Peaks routine.



- ◆ Select the calibration points. For the example being considered, the peaks at 182.90, 301.00, 485.27 and 931.20 would be good choices. *The decimal point locations are based on the calculated center of peak, and not necessarily the largest intensity position.*
- ◆ Select the Calibration Units (if not nanometers) and select the Display Units. Both the Calibration Units and the Display Units are nm (the default) in the example.
- ◆ Manually enter the wavelength of the selected peaks. *Appendix A contains wavelength tables and a detailed spectrum for Hg-Argon.* In our example, the wavelengths for the selected peaks would be:

Peak Location (Pixels)	Peak Location (Wavelength in nm)
182.90	365.02
301.00	435.83
485.27	546.07
931.20	811.53

- ◆ Once the wavelengths have been entered for the selected peaks, check the selection box to the left of the Pixel box for each peak selected. (Figure 101). A checkmark in the box indicates that the peak is selected. *Note that wavelength values must be entered for these peaks before the selection box can be checked.*
- ◆ Click on OK. This completes the wavelength calibration and the dialog box will close. At the same time, the Calibration Mode selected in the Usage dialog box will automatically change from Off to Manual.

Note the appearance of the data display. The peak find routine display data (arrows and pixel number of each peak found) does not change. The x-axis units will however change to reflect the display units.

Figure 101.
Setup
Calibration
screen after
selecting peaks
and entering
calibration
wavelengths.

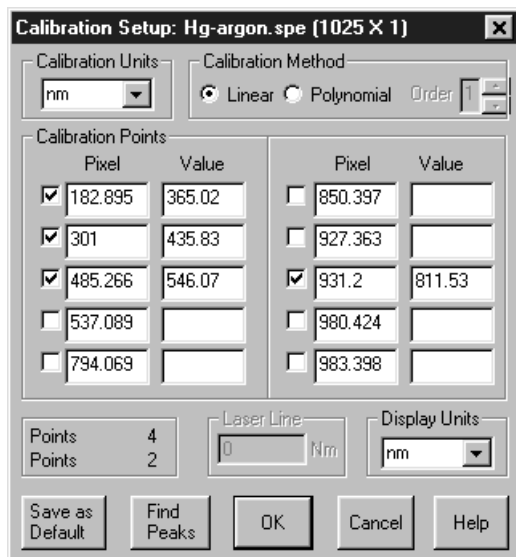
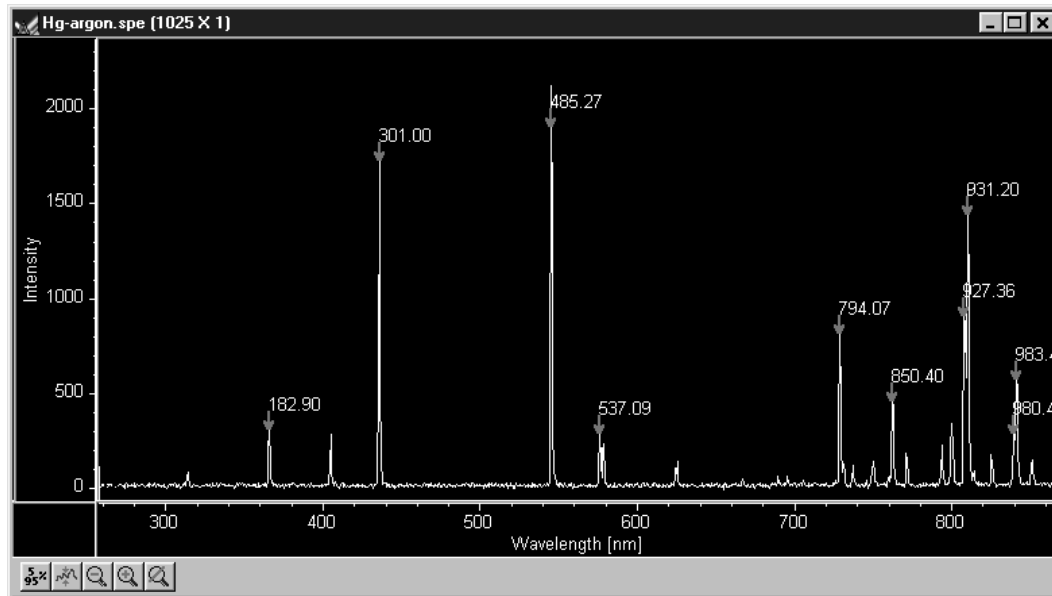


Figure 102.
Spectrum after
calibrating.



Save as Default

The Save as Default button in the Calibration Setup dialog box determines whether a calibration is temporary or permanent (until changed). Once a calibration has been saved as the default, it will be automatically applied to subsequently acquired data. ***It will not be applied to data files recalled from disk.***

Note: The default state of the button, not only with respect to the button setting but also with respect to whether it is disabled (grayed out and not user settable) depends on the situation, as follows.

No Data

If you open the Calibration Setup menu and there is no data, Save as Default will appear be pressed and disabled (grayed), that is, it will be inaccessible to the user.

Not Live Data

If there is data in the active window when you open the Calibration Setup menu, but the data isn't live, such as would be the case if it were recalled from disk, Save as Default is under user control, with "not pressed" as the default state. Note that if the opened data file was saved in a calibrated state, that calibration will be in effect when the file is opened, the calibration values will be loaded in the calibration setup, and the data displayed.

Live Data

If the active window is displaying live data, Save as Default will be under user control but in the selected or "pressed" state. If Save as Default is selected and you click on OK, the calibration will be stored and will be automatically applied to all subsequent acquired data, unless a new calibration is performed. If Save as Default is unselected and you click on OK, the calibration in effect, that is, in the Calibration Setup dialog box, will apply to the active data file only.

Calibration and Display Units

The default units are nanometers (nm). These units can be changed, with the change taking effect immediately. Calibration units to choose from are nm (nanometers), cm-1 (wavenumbers), rel. cm-1 (relative wavenumbers), and user units (units other than above). For relative wavenumbers only, the wavelength of the excitation laser must be entered in the Laser Wavelength box in nm. Display unit choices are the same, with the additional selection of pixels.

The Display Units selection can be different from the Calibration units, except in the case of User Units. Under Display Units, the options are pixels, nm (nanometers), cm-1 (wavenumbers), and rel. cm-1 (relative Raman shift wavenumbers). The display units are the values shown on the X-axis whenever calibrated spectra are displayed. To display files without calibration, even files collected with a specific calibration, select the pixel option under Display Units.

User Units allow the operator to scale the spectra to any arbitrary unit.

Calibration Method

A calibration requires at least two points defined by pixel and by units. Naturally the more points used, the more accurate the calibration. The points must always be defined by pixel number, but nanometers can be changed to another unit if desired.

Two mathematical models can be used to fit the calibration to the data. The first, Least Square, calculates a linear approximation of the fit by minimizing the sum of the squares of the errors between the fit and the calibration points. Linear approximation is generally sufficient. The Polynomial method uses a higher order function of the form $a + bx + cx^2 + \dots$ where the “order” of the polynomial is the highest power of x used. The general rule is:

$$\begin{aligned} (\# \text{ Cal Peaks} - 1) &= \text{Order} \\ \text{maximum order} &= 5 \end{aligned}$$

If four peaks are active in the Calibrate dialog, the order of the polynomial can be 2 or 3. Even if ten peaks are used, the maximum order of the Polynomial is 5 (up to x^5). As a general guide, we advise calibrating using the Linear calibration method with widely separated peaks as previous described. If the available peaks are clustered, a Polynomial fit (using the smallest order possible) may give a good fit in the region of the calibration peaks, but have increasing large deviation the further you get from them. In an extreme case, there may even be two values for the same pixel, a clearly impossible condition which will result in an error message.

With the Linear calibration method, at least two peaks are required to calibrate. For a Polynomial calibration, the number of peaks must be at least one higher than the order of the polynomial. This information is displayed at the lower left of the Calibration Setup dialog box. The lower Points value is the number of peaks required. The upper points value is the number available for calibration. A peak is available if it has been found, its known value has been entered, and the adjacent checkbox has been checked.

Spectrograph Setup

Introduction

WinSpec/32 allows the user to control several types of spectrographs. More than one spectrograph can be installed in the system at one time. The total number of spectrographs is limited only by the number of free communication ports.

The following spectrograph operations can be performed.

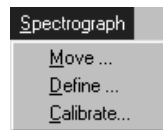
- Moving the spectrograph grating
- Automatic calibration of acquired data according to the spectrograph position
- Changing to a different grating for some spectrographs
- Changing the entrance slit size and/or the selected port for some spectrographs

The Spectrograph Menu

The Spectrograph menu allows you to install one or more Spectrographs, then use the WinSpec/32 software to control the stepping motor. After each move, the wavelength values will be displayed along the horizontal axis of the data window.

Three items appear on the Spectrograph menu, Move, Define and Calibrate (see Figure 103).

Figure 103.
The
Spectrograph
menu.

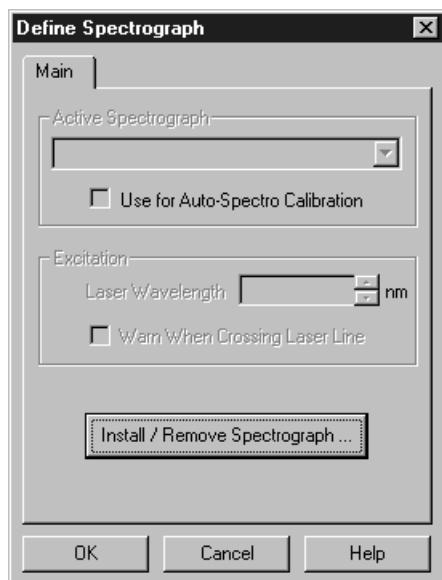


Installing the Spectrograph

The following steps explain how to install a spectrograph. You must correctly install a spectrograph before you can control any of its functions through WinSpec/32.

- ◆ Make sure that the spectrograph is correctly connected to a port and switched on. Wait for the spectrograph to finish initializing.
- ◆ Select Define on the Spectrograph menu. This will open the Define Spectrograph dialog box (Figure 104).

Figure 104.
The Define
Spectrograph
dialog box.



- ◆ On the Main tab page, note the Active Spectrograph text entry box. If spectrographs have previously been installed, the active one will be indicated. If no spectrograph has been previously installed, the box will be blank. Note there is a checkbox that allows you to designate a particular spectrograph as the one that will be used for doing an Auto-Spectro Calibration.
- ◆ Click on the Install/Remove button. This will open the Install/Remove Spectrographs dialog box as shown in Figure 105. The lower window lists the supported Spectrographs. The upper window lists those installed. To install a spectrograph, it is only necessary to select it from the list in the lower window and press the Install Selected Spectrograph button. The installed spectrograph will then appear in the upper window. In the case of the example depicted in Figure 105, the selected spectrograph is an Acton SP300i.

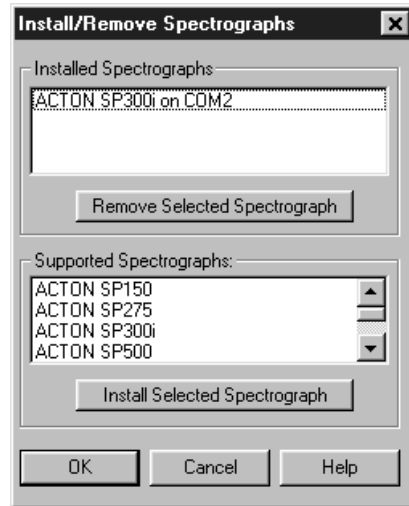
Notes:

1. Be sure the Spectrograph has been turned on and allowed to fully initialize before installing it. If this isn't done, although you will be able to install the spectrograph, it will not be possible to establish communications and an error message will result.
2. When you clicked the Install Selected Spectrograph button to install the spectrograph, WinSpec/32 attempted to connect the spectrograph automatically to the COM2 serial port. If this was successful, the list entry will include the port name, such as *ACTON SP300i on COM2:* (see Figure 105). If the connection fails, then no port name will be appended to the spectrograph name, such as *ACTON SP300i.*
3. To install another spectrograph, simply repeat the installation procedure.

4. Removing a spectrograph is equally simple. To remove one you would select it in the upper box and press the Remove Selected Spectrograph button. The spectrograph's name will then disappear from the upper window.

- ◆ Click on OK to close the Install/Remove Spectrographs dialog box.

Figure 105.
Install/Remove
Spectrographs.



Ports and Comm Parameters

If the spectrograph is not connected to COM2, or if there was an error message during installation, specify the communications parameters and then assign a COM port to the active spectrograph. These steps are done as follows.

- ◆ From the Define Spectrograph dialog box, click on the **Connect** tab to move the Connect tab page (Figure 107) to the front.
- ◆ Next click on the Comm Settings button (Connect tab page). This will open the Comm Settings dialog box as shown in Figure 106.
- ◆ Set the connection preferences *according to the requirements of your spectrograph. For Acton Spectrographs, use the settings shown in Figure 106.*
- ◆ Click on **OK** to close the Comm Settings dialog box.

Note: A port can only be connected with one spectrograph.

Figure 106.
Comm Settings
dialog box.

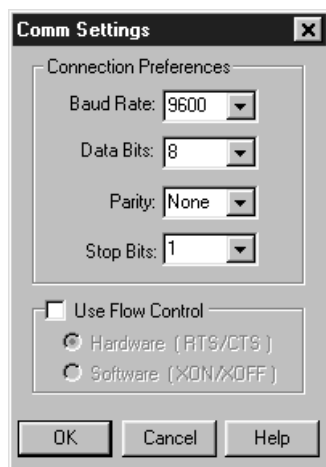
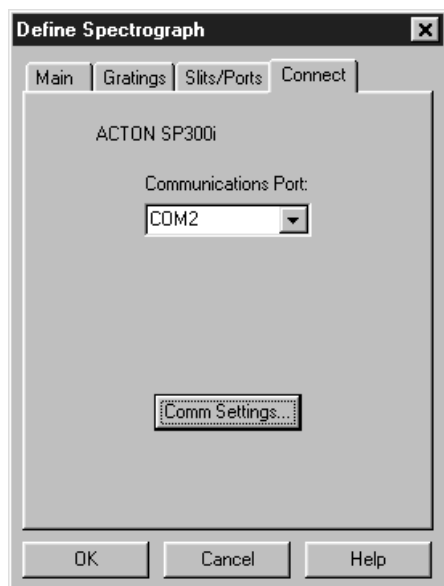


Figure 107.
Connect tab
page.



- ◆ Note the COM port indication in the Communications Port window of the Connect tab page. If it is not the one you want to use for the active spectrograph, click on the down-arrow at the right of the text box and change the com port selection. The selections are COM1 through COM8 and Demo.

Note: If more than one spectrograph is installed, the parameters should be separately set for each one. All parameters will be stored and automatically restored whenever WinSpec/32 is booted.

Specifying the Active Spectrograph

If you have installed more than one spectrograph, you need to define the Active (controlled) Spectrograph. If there is only one spectrograph, that one is the active one. If there is more than one, than you must designate the active one. This can be done via the Define Spectrograph Main tab page, the Move Gratings tab page (to access, click on Move in the Spectrograph menu) and via the Calibrate Spectrograph dialog box (to

access click on Calibrate in the Spectrograph menu). On the Define Spectrograph Main page the selection is called **Active Spectrograph**, on the Move Gratings tab page it is called **Spectrograph to Move**, and in the Calibrate Dialog box it is called **Spectrograph to Calibrate**. In all three locations the function is simply to specify the active spectrograph, and changing the selection in one location is equivalent to changing it in all three. If only one spectrograph has been installed, the box won't appear in the Move or Calibrate dialog boxes, but the spectrograph model will be reported.

Grating Setup and Selection

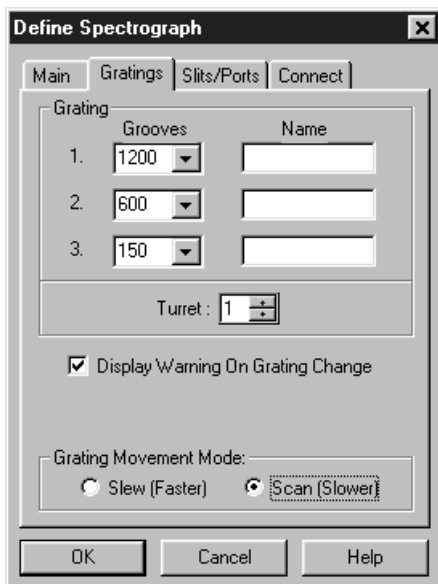
Once you have installed a spectrograph, you may need to enter the grating information for the spectrograph if the spectrograph can't supply them automatically. This is information that WinSpec/32 needs to move and calibrate the spectrograph correctly. *Grating information is supplied automatically for automated Acton spectrographs, as stored in the spectrograph's electronics..*

Grating parameters

The grating values are required for the dispersion calculation and for the selection of the active grating. Some spectrographs have interchangeable grating turrets, each able to mount up to 3 gratings. Where this is the case, the grating information may have to be separately specified for each turret that may be installed. These parameters are specified on the Gratings tab page (Figure 108) of the Define Spectrograph dialog box. *Again, grating information is automatically supplied for automated Acton spectrographs.*

- ◆ If there is more than one turret, enter the number of the turret for which the grating parameters are to be specified.
- ◆ If the entries are missing or incorrect, select the correct grooves/mm value for each grating. Make sure that the gratings are listed in the proper order, Grating 1 listed first, etc.
- ◆ You can also enter a Name for each grating. This option is required if you are using two gratings with the same groove density. If, for example, you have two gratings with 300 grooves/mm, one blazed at 300 and one blazed at 500, you could enter BLZ300 and BLZ500 in the Name boxes as identifiers. *These are the Acton default names.* Then, when you subsequently go to the Move Spectrograph dialog box to select the active grating, they would then be listed as 300/BLZ300 and 300/BLZ500 and there would be no possibility of confusing them.
- ◆ If your spectrograph has more than one turret, the first one you install and calibrate will be called Turret 1. Replace the turret, then change the Turret value to 2 and enter the new grating information. WinSpec/32 will store and recall the different sets of grating information for each turret.
- ◆ Note that there is a check box for displaying a warning during a grating change. Since the time to change a grating can vary widely, depending on the spectrograph, this message could be very helpful.
- ◆ You can also choose the rate, either faster (slew) or slower (scan), if two rates are available for your particular spectrograph. Again, the actual rate will depend on the spectrograph. Depending on the spectrograph manufacturer and model, there may or may not be a difference in wavelength setting accuracy for the two speeds.

Figure 108.
Gratings tab
page - setting
the grating
parameters.



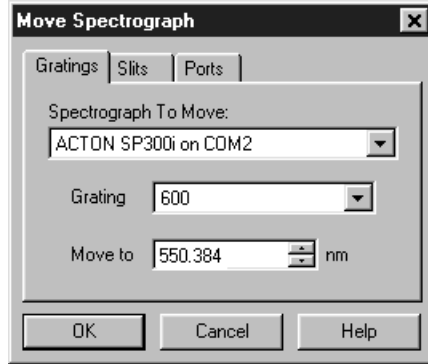
Selecting and Moving the Grating

Once the required groove and turret information has been entered on the Define Spectrograph Gratings tab page, the next step is to select and move the grating. These operations are performed using the Gratings tab page (Figure 109) of the Move Spectrograph dialog box. The procedure follows.

- ◆ Open the Move Spectrograph dialog box by selecting Move from the Spectrograph menu.
- ◆ On the Gratings tab page, first check to be sure the indicated active spectrograph is the correct one. Then note the grating selection. If the grating selection is incorrect, click on the down arrow at the right of the Grating selection box. The available gratings as previously entered via the Define Spectrograph Gratings tab page should be listed. Select the correct one.
- ◆ To move the grating, simply enter the desired wavelength in the Move to box and click on OK to execute the selections. The grating will come to rest with the selected wavelength at the center of the CCD array.

Note: There may well be some finite error in the final position. This error is measured and compensated for using the Spectrograph Calibrate procedure.

Figure 109.
Move
Spectrograph
Gratings tab
page.



Slit and Port Selections

Some spectrometers allow you to control the slit width and/or do port selection under software control. Where this is the case, the Slits/Ports tab page (Figure 110) in the Define Spectrograph dialog box is used to specify the controllable slits and selectable ports. Actually setting the slit width and specifying which port is the entrance and which the exit is accomplished via additional tab pages provided in the Move Spectrograph dialog box as shown in Figure 111. Once the selections are made, simply press OK to execute them.

Figure 110.
Define
Spectrograph
Slits/Ports tab
page.

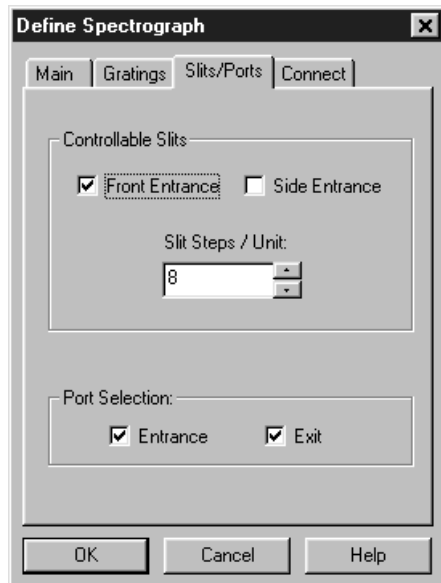
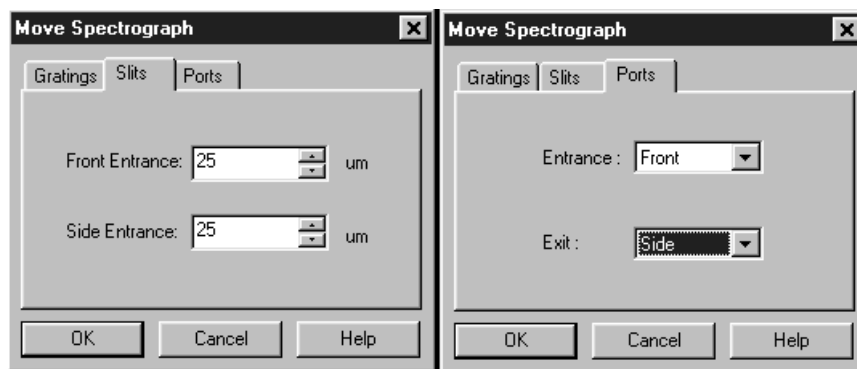


Figure 111.
Slit width and
port selection
tab pages -
Move
Spectrograph
dialog box.



Laser excitation information

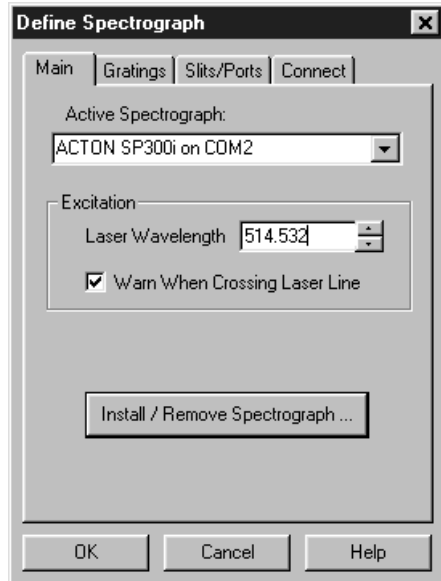
If you wish to be warned if the laser will shine directly on the CCD, you need to enter the Laser Wavelength. This is done via the Main tab page in the Define Spectrograph dialog box as shown in Figure 112. The **Warn When Crossing Laser Line** selection tells WinSpec/32 to display a message whenever the grating is moved to where the laser light would be visible to the detector. This is critical for detectors that could be damaged if exposed to high light levels. Also, it will be necessary to enter the laser wavelength if you plan to work with units of relative wavenumbers.

- ◆ To allow WinSpec/32 to display in units of relative wavenumbers, enter a Laser Wavelength in nanometers, to as many significant digits as desired.
- ◆ If you have a bright laser line check the Warn when Crossing Laser Line box and enter the Laser Wavelength in nm. WinSpec/32 will display a warning message whenever the wavelength range viewable by the detector might fall on or pass through the laser line.

WARNING

The **Warn When Crossing Laser Line** is no guarantee that the detector will not be damaged by overexposure. The correct display of the warning depends on all calibration parameters being set correctly. **Changing or moving gratings** may cause the laser to shine on the detector. Always block the source when moving or changing the grating to avoid damage.

Figure 112.
Entering the
laser line -
Define
Spectrograph
Main tab page.



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Spectrograph Calibration

Introduction

You can calibrate the WinSpec/32 software by either using the spectrograph stepper motor position (Spectrograph calibration) or by manual wavelength calibration. Spectrograph calibration is achieved using the Calibrate selection on the Spectrograph menu, and is described in detail in this chapter. Wavelength calibration, which is only good for one position of the grating, is explained in Chapter 7.

The spectrograph calibration routine requires you to enter certain default values into a series of dialogs. You are also required to have a known source, such as a mercury lamp, placed near the entrance slit of the spectrograph. Once you have completed the following calibration procedure, any movement of the spectrograph will be accounted for in the display of spectral information.

Notes:

The spectrograph **MUST** be focused and aligned properly before a good calibration can be achieved. Spectrograph focusing and alignment is an art unto itself and is beyond the scope of this manual. Basically it consists of filling the aperture from a broad light source and adjusting the focusing mirror for the sharpest image (narrowest possible symmetrical peak) on the CCD. Focusing can also be accomplished by moving the detector in and out. Different detectors and/or spectrographs will have different means for doing this. In addition, it may be necessary to rotate the detector so that the spectral line is perfectly vertical on the CCD.

The Offset, Adjust and Dispersion parameter values for WinSpec/32 will not be the same as they were with earlier versions of WinSpec. This is true even if the same spectrograph is used. You cannot simply enter values you may have recorded when using the earlier (16-bit) WinSpec versions. If you do, very large calibration errors will be introduced. The calibration must be performed using the following procedure.

Preparation

- ◆ Install the spectrograph, mounting it to the detector per the instructions in the Detector manual, and turn it on. You may have to restart the WinSpec/32 software after turning on the spectrograph.
- ◆ Mount a suitable light source (mercury lamp preferred) near the entrance slit of the spectrograph so that the light passes through the spectrograph onto the detector.

- ◆ Review the Define Spectrograph selections and settings to be sure they are correct for the calibration to be performed.
- ◆ The Experiment Setup parameters must be set so that a spectrum can be acquired. Using Easy Bin, select a single strip of several rows near the center of the CCD and an exposure time between 0.1 and 0.5 seconds.
- ◆ A filename should have been entered for the test acquisitions using the Data File tab page (Experiment Setup dialog box). Also, Overwrite Confirmation should be turned off so that won't see warning messages about overwriting data files. Exit the Experiment Setup dialog box by clicking on the **OK** button.
- ◆ Acquire some data and display the data as a graph. Next position and size the data window. We suggest locating it at the upper left and sizing it so that it doesn't extend more than half way across the screen. Then select **Keep Window Placement** on the Display Layout General tab page, followed clicking on OK. This operation assures that all data windows will fall in precisely the same spot and will be precisely the same size, a configuration that conveys a significant convenience advantage when calibrating.

Notes:

1. You must use the supplied cable to control the Acton spectrograph. Do not use a standard 9-pin serial cable, even if it worked with an earlier version of WinSpec.
2. If the spectrograph does not move or you get an error message such as "Communication Error with Spectrograph", the spectrograph setup is probably incorrect. Check the power on the spectrograph, the cable connections, and the settings in the Spectrograph dialog. Also try turning off and back on the spectrograph, then closing and reopening the WinSpec/32 software.
3. If wavelength direction is reversed, you won't be able to calibrate successfully. However, a warning message will be displayed. If this happens, open the Hardware Setup dialog box and select the Display tab page. If Rotate is selected, toggle the Flip box. If Rotate is not selected, toggle the Reverse box. Click on OK and then begin Offset calibration again.

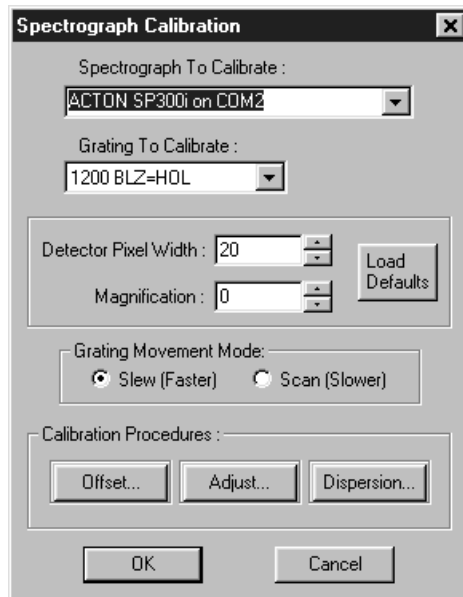
Calibration Parameters

- ◆ Select **Auto Spectro** on the Usage dialog box (to open, select Usage on the Calibration menu). *If the **Use for Auto-Spectro Calibration** check box on the Define Spectrograph Main tab page was used to designate a particular spectrograph as the one to be used for calibration purposes, that spectrograph will be automatically selected.*
- ◆ If the **Save as Default** button on the Usage dialog box isn't already selected, select it now.
- ◆ Select **Calibrate** on the Spectrograph menu. This will open the Spectrograph Calibration dialog box (Figure 113).
- ◆ Be sure the correct **Spectrograph to Calibrate** is selected. If another spectrograph is indicated, click on the down arrow at the right of the selection box to

display all of the installed spectrographs and make the correct selection. *If only one spectrograph has been installed, the selection box won't appear but the spectrograph model will be reported.*

- ◆ Be sure the correct **Grating to Calibrate** is selected. Calibration is grating specific. If the indicated grating is incorrect, click on the arrow at the right of the selection box to display the available gratings and make the correct selection.
- ◆ Be sure the indicated value for the **Detector Pixel Width** in microns is correct. The default value will depend on the type of CCD chip installed. Note that some design factors, such as a tapered fiber optic ahead of the chip, will change *the pixel size seen by the spectrograph* and so will have to be taken into account in determining the value to be entered.

Figure 113.
Spectrograph
Calibration
dialog box.



- ◆ Be sure the indicated **Magnification** value is correct for your spectrograph. This parameter is determined by the geometry of the spectrograph. Contact your spectrograph manufacturer if you have any questions about the magnification parameter value.
- ◆ Select the Grating Movement Mode, **Slew** or **Scan**. Operation with Slew selected will be significantly faster than with Scan selected.

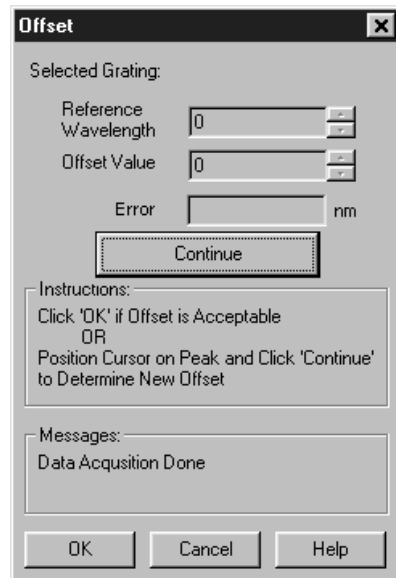
Offset

CAUTION

You must begin calibration with the **Offset** procedure and end with the **Dispersion** procedure. Performing the steps in this order is absolutely necessary for correct calibration.

Theoretically, if you were to move your spectrograph to the zero order peak or any other known peak, the peak would fall exactly on the center of the array. In the real world, the mechanical tolerances of the mounting will probably result in the peak being a few pixels off. The Offset procedure that follows allows you to correct for this small offset error.

Figure 114.
Offset dialog
box.



- ◆ Select **Info** on the View menu. The Info Window should be visible. This will help indicate the status of spectrograph movement and data collection.
- ◆ In the Spectrograph Calibration dialog box, click on the **Offset** button. This will open the Offset dialog box (Figure 114).
- ◆ The dialog box that appears has a Reference Wavelength entry box. This is the wavelength where the spectrograph is set for the offset measurement. All Acton spectrographs use the zero order, that is, a setting of “0.”
- ◆ Click on the **Start Offset Procedure** button. The spectrograph should now move to the reference wavelength and data acquisition will commence. Then a peak-find will be performed and the resulting data will be displayed.
- ◆ Figure 116 illustrates a typical Offset data acquisition. The reference peak should appear near the center of the display and the cursor should be near or on the highest point of the peak. If the peak is saturated, cancel, lower the exposure time, and repeat the operation. The display X-axis should be calibrated (any units other than pixels). *If the X-axis is calibrated in pixels, select the desired units as the calibration units on the Usage dialog box (opened by selecting Usage from the Calibration menu).*

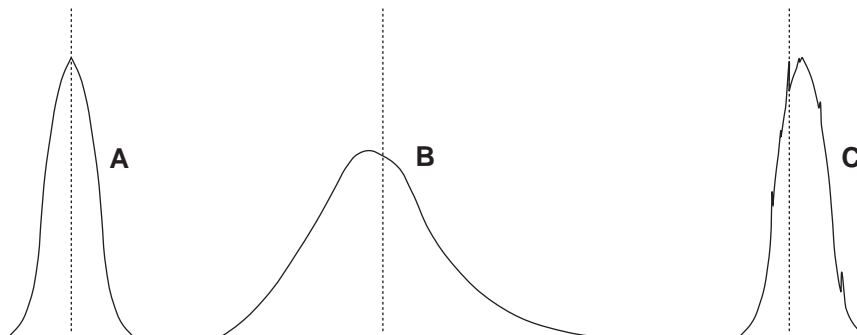
Peak Locator

Before going on, you have to make a judgment regarding the location of the cursor on the peak. There may be situations where you will need to readjust the cursor position to get it precisely on the correct location. Although this should be a relatively uncommon event, it could happen, and it is important to take a moment to understand how the peak locator works, how it may appear to be in error when it in fact it is not, and how it could come to be in error and require manual intervention to correct the cursor position.

The peak locator works by taking the second derivative of the spectrum to find the peaks. Each peak found is then divided in two so that the area to the left of the divider equals the area to the right of the divider. The cursor is located at precisely

the point where the divider intersects the peak. Note that, depending on the shape of the peak, the cursor may or may not end up precisely on the highest point. Figure 115 shows three possible peaks, and illustrates the action of the peak finder in each case.

Figure 115.
Peak locator
examples.



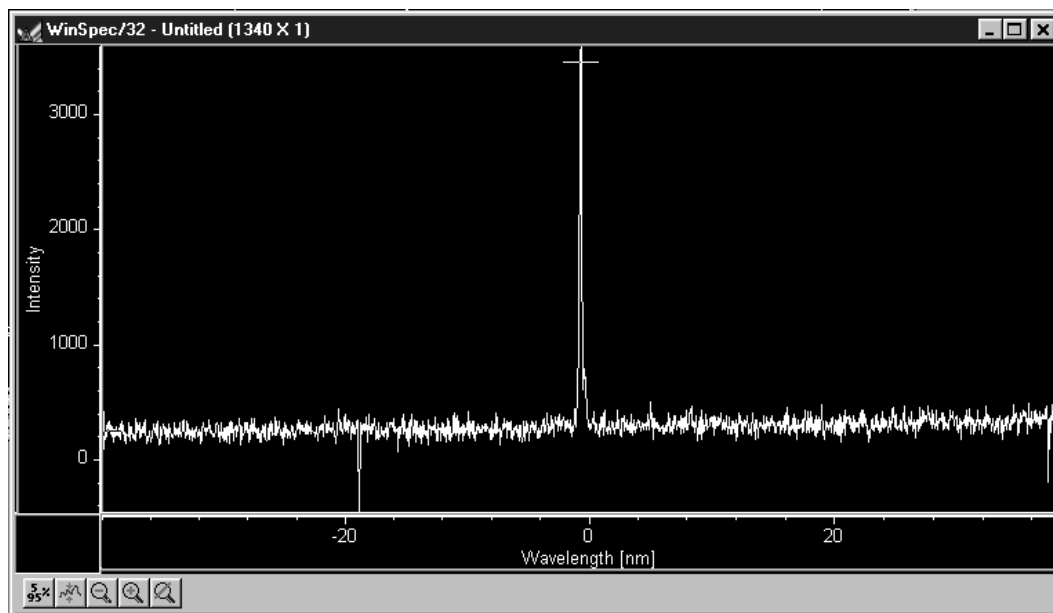
Peak **A** is perfectly symmetrical. As you would expect, dividing it into two equal areas and locating the cursor at the intersection of the divider with the peak will put the cursor precisely at the highest point. Peak **B**, on the other hand, is not symmetrical but rather extends further to the right than to the left. As a result, the final cursor position is a little to the right of the highest point. *This is the correct peak location. Any attempt to “improve” it by manually moving the cursor to precisely the highest point will degrade the offset computation. Note that moving the cursor immediately changes the reported Error. Do not assume that this means the cursor wasn’t optimally located. Rather it indicates a possible optical problem and the spectrograph may need to be realigned.* Peak **C** is like peak **A** but is accompanied by a number of noise spikes. The peak finder is quite sensitive and might well select one of these spikes as the real peak and incorrectly place the cursor on the noise spike as shown in **C**. If this happens, the correct action would be to manually adjust the cursor position to the right so that it is on the true peak before going on.

Doublets are also a problem. At any stage of the calibration procedure the peak finder might find the wrong peak of a doublet. For example, if using the 579.066 nm mercury line in doing the Dispersion Calibration, you need to take care to check that the peak finder hasn’t selected the 576.96 nm line instead. If it does, it is a simple matter to manually move the cursor to the correct peak. *Note that the zoom function can also be controlled using the data window icons.*

If it is difficult to see the precise cursor position, simply press the keyboard **Insert** key to expand the display about the cursor position. The key may have to be pressed several times to achieve the desired resolution. *(Use the Delete key to return to the original display.)* If you do decide to move the cursor, note that each time a cursor-positioning arrow key is pressed, the cursor will move one data point. Assuming no horizontal binning is in effect, one data point will correspond to one pixel on the array.

As a final comment, even if you should move the cursor when it wasn’t necessary, repeating the Calibration Offset cycle a few times will still achieve an optimum offset adjustment.

Figure 116.
Offset Spectrum
for zero-order
measurement.



- ◆ Note the reported **Error** value in the Offset dialog box. The value is reported in nm. Transposed to pixels it should be less than one pixel. *The number of nm represented by one pixel will depend, of course, on the dispersion of the grating.*
- ◆ Press **Continue** to initiate another offset computation cycle. The reported error should decrease. Repeat the cycle two or three times – until no further reduction in the error can be achieved. The final error value achieved may wander a bit with each cycle repetition, reflecting the noise content of the spectrum.
- ◆ Click **OK** to close the Offset dialog box and return you to the Spectrograph Calibrate dialog box.

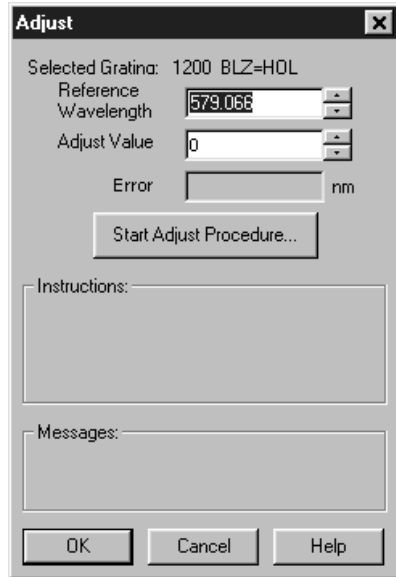
Adjust

Once you have adjusted the Offset for a reference wavelength (or for the zero order peak) other wavelengths may still be improperly calibrated. To see why this is so, think of the calibration in terms of the linear general equation:

$$y = mx + b$$

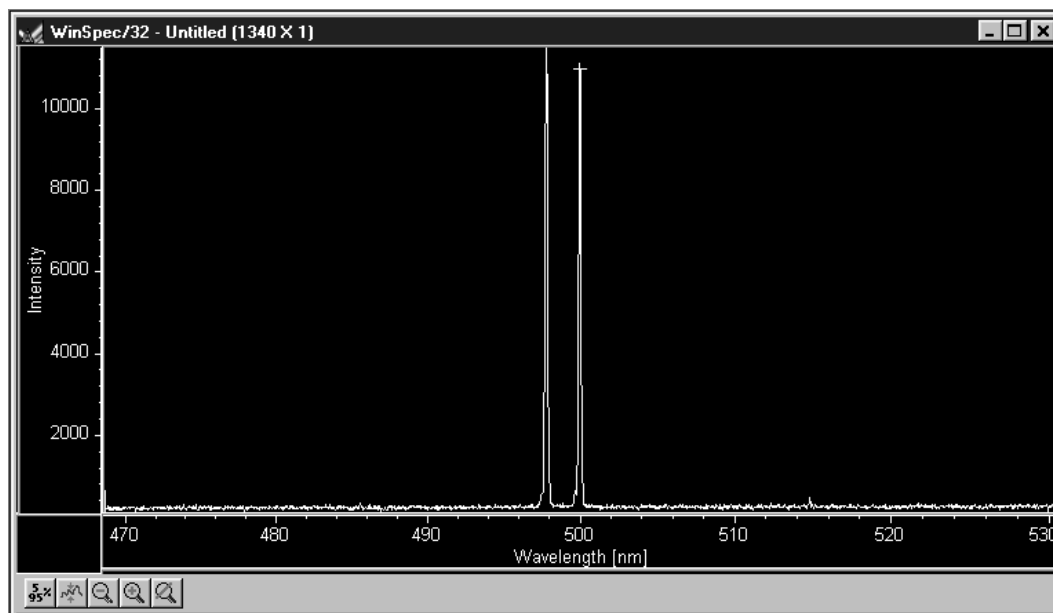
Although this is a simplified model, it suffices to show the basic relationships. The “b” term can be thought of as the offset, which is adjusted to place the reference at precisely the center of the array. The location of points away from the offset reference will be determined by the “m” or slope term (as well as “b”) and the Adjust procedure allows “m” to be set so that adjusting the spectrograph to other wavelengths will result in this wavelength falling on the center of the array.

Figure 117.
Adjust dialog
box.



- ◆ Click on the Adjust button to open the Adjust dialog box.
- ◆ Enter as the Reference Wavelength a known line in the observed spectrum, such as 579.066 for Mercury. Next click the **Start Adjust Procedure** button.
- ◆ The spectrograph will move to the reference wavelength and collect a spectrum. It will also perform a peak-find operation and display the acquired data. The reference peak should appear somewhere near the center of the display and the cursor should be on the peak at or near the highest point.
- ◆ Figure 118 illustrates a typical Adjust data acquisition. The reference peak should appear near the center of the display and the cursor should be near or on the highest point of the peak.
- ◆ As was the case for the Offset adjustment, before going on, you have to make a judgment regarding the location of the cursor on the peak. Take particular care that the proper peak has been found. If, for example, the peak finder places the cursor on the 576 peak, manually move the cursor to the 579 peak. For additional information, refer to the earlier discussion of how the peak finder works in the Calibration Offset procedure.

Figure 118.
Calibration
Adjust
spectrum.



- ◆ Note the reported **Error** value in the Adjust dialog box. The value is reported in nm. Transposed to pixels it should be less than one pixel. *The number of nm represented by one pixel will depend, of course, on the dispersion of the grating. The nm/pixel can be approximated by picking the difference in the location of the two peaks while in pixel mode, and dividing the difference reported in calibration units in the calibration mode.*

Note: The absolute value of the peak is reported in the Info box. If it is not already open, open it by selecting Info on the View menu.

- ◆ Press **Continue** to initiate another Adjust computation cycle. The reported error should decrease. Repeat the cycle two or three times – until no further reduction in the error can be achieved. The final error value achieved may wander a bit with each cycle repetition, reflecting the noise content of the spectrum.
- ◆ Click **OK** to close the Adjust dialog box and return you to the Spectrograph Calibrate dialog box.

Dispersion

Now that Offset and Adjust are complete, the spectrograph can move a target peak very close to the center of the display. The final step is to calibrate the wavelength scaling so that peaks on the far left or the far right in the window are also accurately calibrated. This is called the Dispersion calculation, and again it is automated in WinSpec/32.

To adjust the Dispersion calculation you will make two measurements in the lower spectral range (253.652 for Mercury); one measurement with the peak at the left edge of the display and one with the peak at the right edge. Then you will make two measurements in the upper spectral range (579.066 for Mercury). After these steps, WinSpec/32 then tries to find the combination of Focal Length, Inclusion Angle, and Detector Angle that minimizes the error.

Note: Some CCDs have very little response at 253.652. If this is the case for your detector, it will be necessary to use a peak having a longer wavelength as the low value. For mercury, the 435.833 line should prove suitable.

Figure 119.
Dispersion
dialog box.

- ◆ Click on the Dispersion button to open the Dispersion dialog box. If you have never calculated the Dispersion before, click on the Default button. This provides standard values for Focal Length, Inclusion Angle, and Detector Angle based on the manufacturer's data for the active spectrograph. If you have already run the Dispersion calculation before and it provided satisfactory values, they will be displayed and should be used as your starting values.
- ◆ Enter the Lower and Higher Reference Wavelengths. For the mercury spectrum, use 253.652 (low) and 579.066 (high). *Again, if your CCD doesn't have sufficient response to calibrate at 253.652, it will be necessary to use a different peak.* It isn't necessary to enter a Target Wavelength. It will be calculated during the procedure.

Note: In the following steps, four data sets will be taken, each initiated by the user. The **Start Procedure** button initiates the first, and the same button, named **Continue** once the first data set has been taken, is used to initiate each of the other three. After each data set is taken, the user has the option of adjusting the cursor position on the peak. However, as previously explained, this will not be required or advisable in most instances. *See the Peak Finder discussion in the Calibration Offset procedure.* The order in which the data sets are taken is as follows.

- Low peak (253.652) at the left of the display.
- Low peak (253.652) at the right of the display.
- High peak (579.066) at the left of the display.

- High peak (579.066) at the right of the display.
- ◆ Click on the **Start Procedure** button.
- WinSpec/32 will acquire the first data set and display it. It will also calculate the Target Wavelength so that the Lower Reference Wavelength peak appears near the left edge of the display. *The Target Wavelength is the wavelength the spectrograph must move to in order for the reference wavelength to be properly located near the edge of the display.*
 - If the peak is outside the display you should enter a Target Wavelength which might be better and click the **Reposition** button. If the peak is too close to the center of the display you should enter a slightly higher Target Wavelength and click on the **Reposition** button. Once the peak appears near the left edge, check, and if necessary adjust, the cursor position on the peak using the same criteria as for the Offset and Adjust operations. Then click on **Continue to Step 2** to initiate the second data acquisition.
 - The spectrograph will acquire the second spectrum. If the peak is close to the right edge of the display as expected, click on **Continue to Step 3** to initiate the third data set acquisition. If the peak is not in the right position, use the **Reposition** button to move the spectrograph as required to position the low peak near the right edge of the display. Then click on **Continue to Step 3** to initiate acquisition of the third data set.
 - The spectrograph will acquire the third spectrum, this time positioning the cursor on the high peak at 579.066. If the peak is close to the left edge of the display as expected, click on **Continue to Step 4** to initiate the fourth data set acquisition. If the peak is not in the correct position, use the **Reposition** button to move the spectrograph as required to position the high peak near the left edge of the display. Then click on **Continue to Step 4** to initiate acquisition of the fourth data set.
 - After completion of the fourth data set, once again check to be sure the cursor is on the correct peak and manually move it if it is not.

After all four reference points are taken, WinSpec/32 begins an iterative process to find the best values. This process is initiated by clicking on the **Calculate Results** button. You will see the parameters change as WinSpec/32 performs the calculations. The program stops when the best parameters are displayed in the Dispersion dialog box. If satisfied with the calibration, simply click on OK to make the save the final dispersion parameters as part of the calibration data for the grating. Click Cancel to revert back to previously saved parameters. Note that you can also change the parameters manually and click on OK to save them.

Having completed the calibration for one grating, select the next grating and repeat the procedure. Continue until all available gratings have been calibrated.

Displaying the Data

Introduction

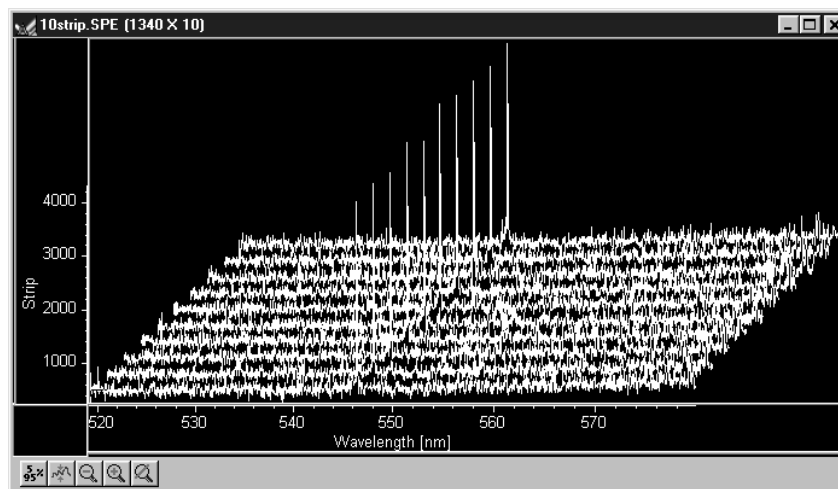
WinSpec/32 can display data as an image, as a two dimensional graph, or as a 3 D Graph (multiple strips from the same graph or the same strip from multiple frames). You can choose to allow the software control how the data will be displayed or make the selection yourself. To have WinSpec/32 control the data-display mode, simply select the **Auto-Select** check box provided in the File Open dialog box and also in the Display Layout window. The Auto Select algorithm makes the selection depending on the number of data strips as follows.

- ⇒ If there are eleven or more strips of data, they will be displayed as a normal image, such as that shown in Figure 143 (page 172).
- ⇒ If there are at least three data strips but less than eleven, the data will be plotted as a 3D Graph as shown in Figure 120 (page 155).
- ⇒ If there are only two strips of data, they will be displayed as graphs stacked in a two-dimensional plot, the same as for a 3D Graph of two strips. See Figure 122 (page 157).

A single strip *will always* be plotted as a simple graph. Note that from two to ten strips, the intensity (Y axis) scale shifts position as required to read true for the selected strip.

The file Open dialog box and Display Layout window both contain the three display-mode select radio buttons, **Image**, **Graph** and **3D Graph**. If you wish to control the data-display mode yourself, simply leave Auto Select unchecked and the display mode will correspond to whichever of the three radio buttons is selected.

Figure 120. 3D Image display of ten data strips.



Screen Refresh Rate

The Screen Refresh Rate is an important but oft overlooked display performance parameter. At times, such as when focusing, by making the screen refresh rate as rapid as possible, the focusing operation may be much easier to perform than it would be with a slow refresh rate. To obtain the fastest possible refresh rate, simply operate with the axes and cross-sections both switched off (View menu) and with the Zoom factor set to 1:1. *Note that the Zoom 1:1 button on the Data Window toolbar is only present when viewing an image.* To check the refresh rate, click on the Status bar (bottom of screen)

Collection Status pane, which is immediately to the left of the Timer pane (right end of Status bar). The refresh rate will be displayed in the Collection Status pane. Do not confuse the screen refresh rate with the data collection rate.

Data Displayed as a 3D Graph

Data files can be opened as 3D graphs from the Open dialog box. Figure 121 shows a 3D graph with five data strips. Figure 122 shows a 3D graph with two data strips. Both examples illustrate the behavior of the **Auto-Select** algorithm as discussed on page 155. The following paragraphs contain procedures for opening and displaying data in graphical format.

Figure 121. 3D graph with five data strips.

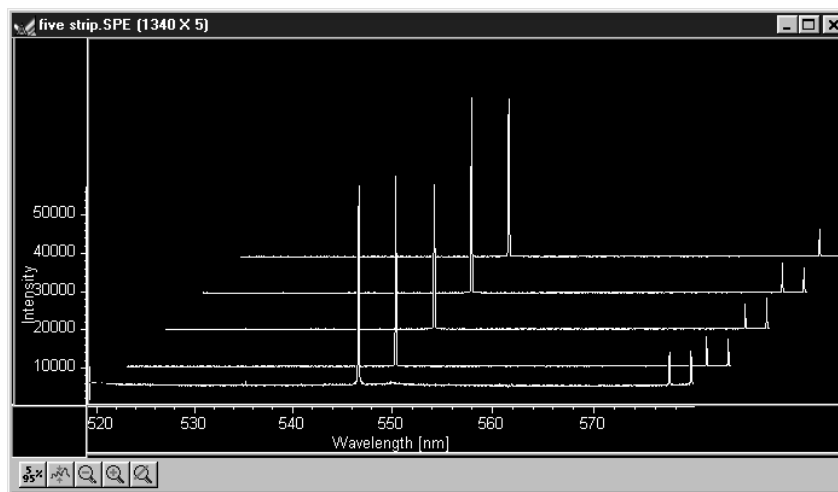
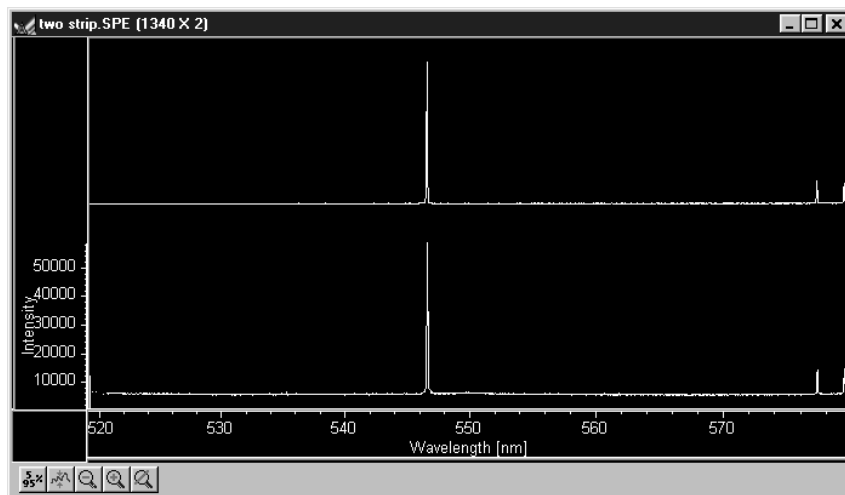


Figure 122. 3D graph with two data strips.

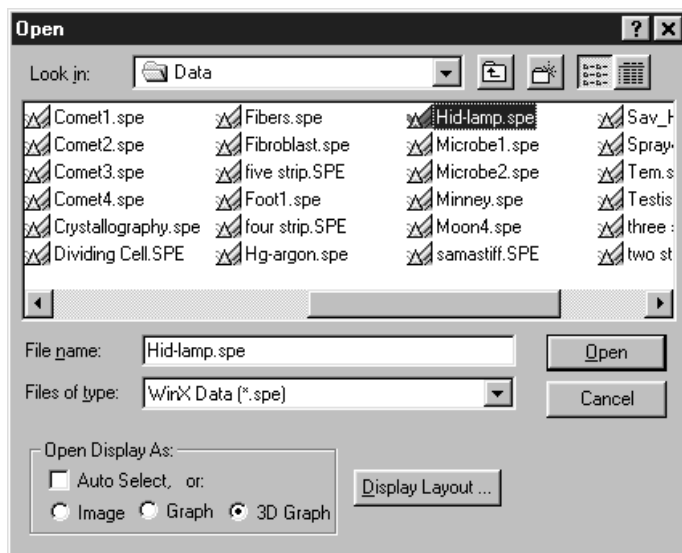


Displaying Hid-lamp.spe

The data file used in this exercise is Hid-lamp.spe, one of the data files supplied with your WinSpec/32 software.

- From the File menu select Open. The Open dialog box (Figure 123) will appear, allowing you to select the image to be opened. The Look-In box provides a browser function so that the directory where the images are located can be easily accessed. The default directory is C:\Princeton Instruments\WinSpec\data. Files of the specified type (the WinSpec/32 data type is *.spe) in the current directory and any subdirectories are listed in the box below the directory name.

Figure 123. Open dialog box.

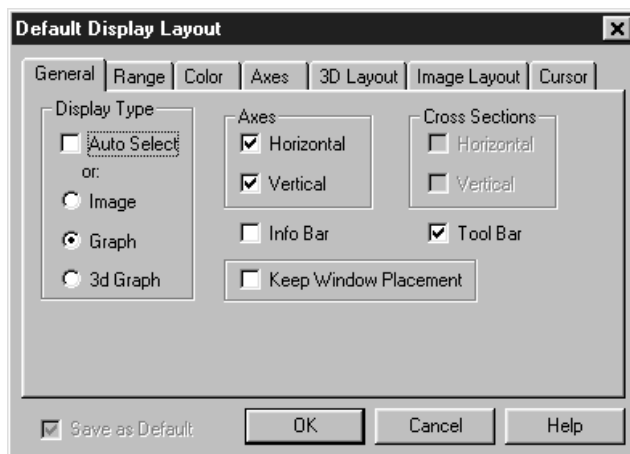


- The Image, Graph and 3D Graph radio buttons at the bottom of the box allow you to select whether the file will be opened and displayed as an image, two dimensional graph or as a 3D graph. Select **3D Graph**. (Auto Select should not be checked.)
- From the data directory select the image file called Hid-lamp.spe. Click on the **OK** button. A window of the appropriate dimensions should appear immediately. The

graph display may take a few seconds, depending on the speed of the computer. The initial appearance of the display may vary depending on the initial Display Layout parameter settings.

- ▶ Select Layout on the Display menu. The Display Layout window will open as shown in Figure 124.

Figure 124.
The Display
Layout window.



- ▶ Check and, if necessary set, the following parameter selections on each tab page.

General tab page

Display As: 3d Graph

Auto Select: unchecked

Axes: both boxes checked

Cross Sections: both boxes checked

Keep Window Placement: unchecked

Range tab page

Initial Autoscale: checked

Set to Full Range: checked

Frame: 1

Color tab page: no changes

Axes tab page

Horizontal axis: checked

Horizontal label: checked

Horizontal label string: Pixel

Vertical axis: checked

Vertical label: checked

Vertical label string: Intensity

3D Layout

3D Mode: Multi-strip; same frame selected

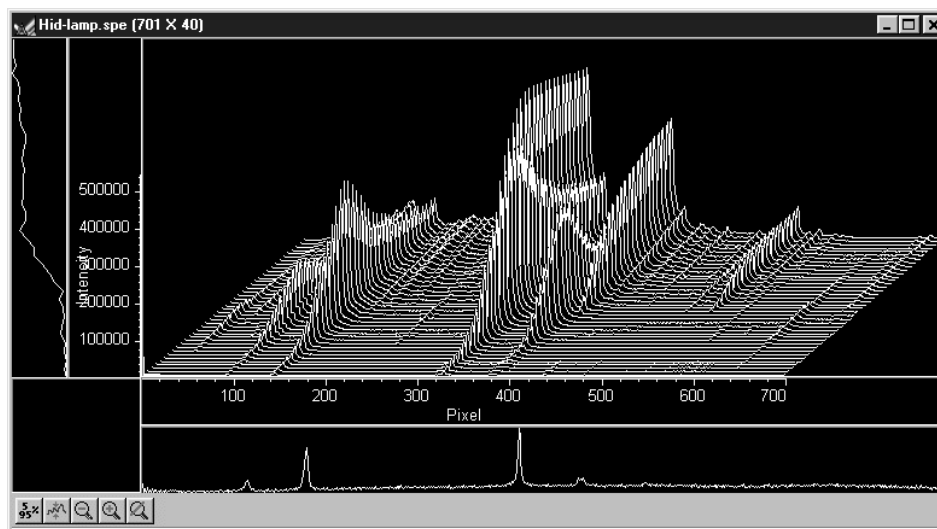
3D Properties: Remove Hidden Line checked; other two boxes unchecked.

Z Axis Endpoint: %X set to 20; %Y set to 40

3D Marker curves: Marker Curves unchecked; Curve set to 5


- ◆ Click on **OK**. The Display Layout window will close and the data display, exclusive of the intensity profiles, should appear as shown in Figure 125. Each strip is displayed as a plot of intensity vs. pixel number. The first strip is at the front and the last strip is at the back. Initially the cursor will be at the lower left. Use the up arrow key to move to a higher numbered strip and the right arrow key to move to a higher numbered pixel on the strip. Then click the Intensity Autoscale key to scale the intensity profiles. *Note that clicking the mouse button at different points on the display will change the pixel selection but not the strip.*
- ◆ Press the **Insert** key repeatedly. Each time it is pressed the display expands about the cursor position. Then press the **Delete** key repeatedly to contract the display, restoring the appearance of the data display.
- ◆ Note the cross sectional displays in Figure 125. The vertical cross-section profiles the intensity at the same point on each successive strip. The horizontal cross-section profiles the intensity at each point on the same strip. If the large cursor is selected, cursor projections will intersect the cross section to show indicate the cursor position. These projections may not be visually aligned with the cursor position on the main plot. This effect will be particularly noticeable with a long Z axis. Because of perspective effects, the higher numbered strips will be further away and visually smaller. The axes automatically adjust so that they read true for the strip on which the cursor is located. However, because the cross-section profiles expand to use all of the available space, they will not be in alignment visually with the cursor. The profile shapes will be correct, and the point on the profiles intersected by the large cross-hair extensions will accurately indicate the cursor position. Also, the information box will accurately report the pixel number and intensity at the cursor position.

Figure 125.
Hid-lamp.spe
3-D Graph.



5%-95% display range

- ◆ Click the button. The data display will shift so that it only fills the 5% to 95% region of the window range. Had the data initially extended all the way to the window boundary, the data display would have been slightly compressed to fit within the 5%-95% range.

- ◆ Click on , restoring the image to its initial appearance.
- ◆ Before advancing to the next topic, open the View menu. Then select the Small cursor and deselect Cross-Sections.

Selecting a region of interest



- ◆ Using the mouse, drag a rectangular region on the image as shown in Figure 126.
- ◆ Click the  (Zoom In) button. The view will change so that only the selected region is displayed as shown in Figure 127.
- ◆ Click the  (Undo All Zoom-In) button. The original view will be restored.

Figure 126.
Hid-lamp.spe
3D graph with
region selected
for viewing.

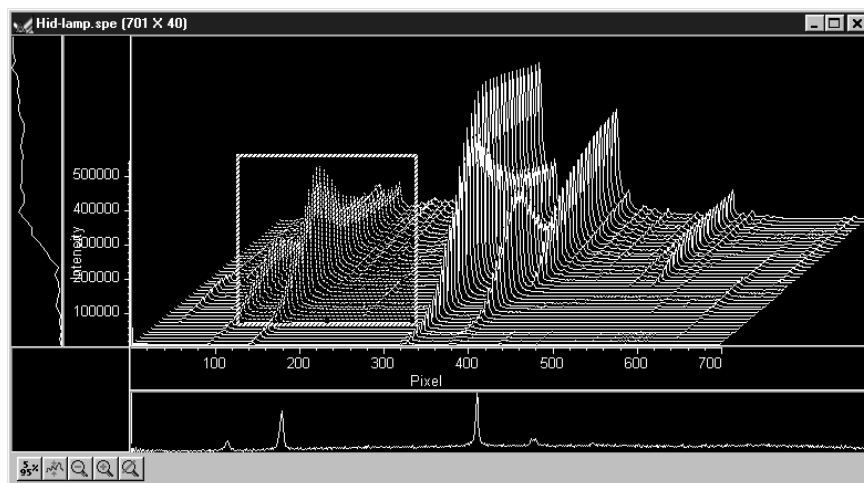
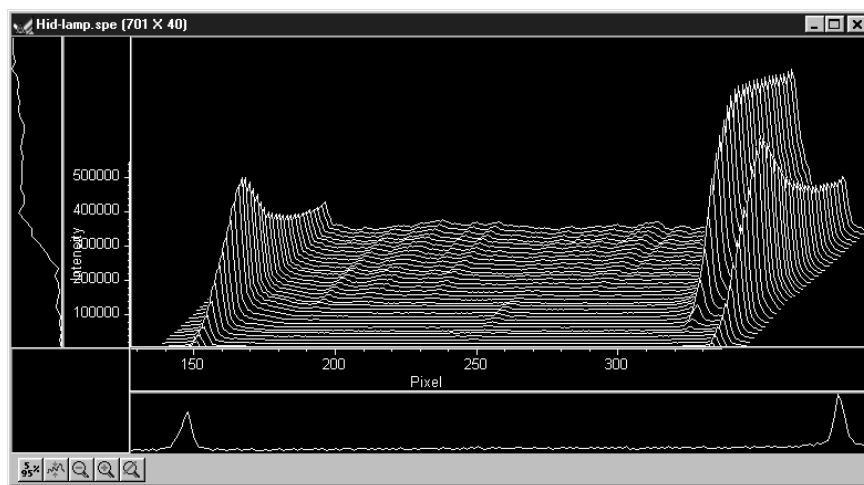


Figure 127.
Hid-lamp.spe
3D graph
expanded to
show defined
region.



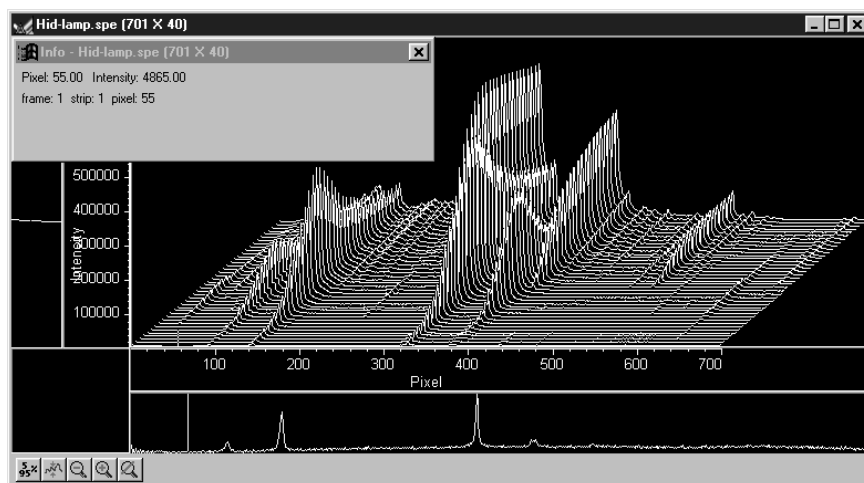
The information box

- ◆ On the View menu, select Info. The information box should appear as shown in Figure 128. The first line reports the intensity and pixel number at the cursor position. The second line reports the frame number, strip number, and the pixel

number. The intensity in A/D counts is reported at the X and Y position corresponding to the cursor position. If a region is defined by dragging the mouse cursor, the region coordinates, length and height will also be reported. *You may have to lengthen the Information box for all this information to appear.*

Note: When you open the information box, it becomes the active window. To perform operations in the data display window, such as changing the selected strip, you must again make the data display window active by clicking the mouse cursor anywhere in the data box. The data-window title bar will become highlighted, indicating that it is the active window, and the cursor positioning functions will become operative again. The data displayed in the information box will continue to be updated automatically.

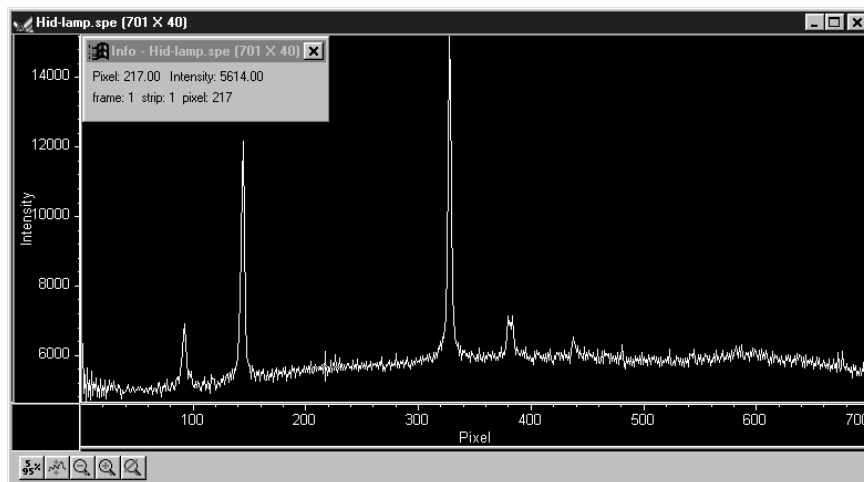
Figure 128.
Graphical
display with
Information
box.



Displaying a single strip

- ◆ Open the Display Layout window by selecting Layout on the Display menu.
- ◆ On the General tab page, with Auto Select unselected, click on the Display Type **Graph** radio button and then on OK. The single data curve for the strip on which the cursor is positioned will be displayed.

Figure 129.
Single strip
displayed
graphically.



- ◆ Try operating the cursor positioning keys to demonstrate their effect. The left/right arrow key move the cursor along the strip, and the up/down keys move it from strip to strip. The Home and End keys move the cursor to the strip ends, and Shift Home and Shift End move it the first strip and last strip respectively. The Insert and Delete keys expand or contract the data about the cursor position.

Restore the 3D display by selecting 3D Graph on the Display Layout General tab page.

Cursor

The cursor's appearance and behavior are a bit different with graphical plots than with image plots, as detailed in the following table.

*Table 1.
Cursor
appearance
and behavior
for images
and graphs.*


Selection	Image Plot	Graph	3D Graph
None	No Cursor	No Cursor	No Cursor
Small	Small cross; both mouse and arrow keys can place cursor at any pixel on image. Home and End keys move cursor to end points on strip. Shift Home moves cursor to first strip. Shift End moves it to the last strip.	Small cross; left/right arrow keys select pixel on strip; up/down arrow keys select strip to be displayed. Home key moves to first pixel, End key to last pixel.	Small cross; left/right arrow keys change selected pixel on strip; Home key moves to first pixel, End key to last pixel. Up/down arrow keys move cursor from strip to strip. Shift Home moves to first strip, Shift End to last. Strips may all be from same frame or each may be from a different frame.
Large	Large cross; rays extend to edges of data set; with projections through the cross-section profiles if displayed. both mouse and arrow keys can place cursor at any pixel on image. Home and End keys move cursor to end points on strip. Shift Home moves cursor to first strip. Shift End moves it to the last strip.	Same as Small Cursor and Graph combination.	Same as Small Cursor and 3D Graph except that cursor ray projections through the cross-section profiles are provided. These will not necessarily be visually aligned with the cursor.


Strip Selection


As described above, when displaying data as a graph, the up/down arrow keys can be used to select a higher or lower numbered strip. This is true if displaying multiple strips


or a single strip. For additional utility where a large change is required, **Shift Home** can be used to move the selection to the first strip and **Shift End** to move it to the last one.

Four of the Custom Toolbar buttons similarly allow the selected strip to be changed when data is displayed as a graph.

 Selects the first strip.

 Selects the last strip.

 Selects the next strip.

 Selects the previous strip.

Note that these buttons have no effect on the strip selection when viewing data as an image. Instead they select the first, last, next and previous frame respectively if the data set contains multiple frames.

Note: When displaying the data as a graph, to view data from multiple frames, it is necessary to select **Same Strip - Multi Frame** on the 3D Layout tab page of the Display Layout window.

It might further be noted that these buttons do not appear on the default Custom Toolbar. Instead they must be added using the Customize Toolbar dialog box, accessed by selecting Custom Toolbar on the Setup menu.

Cursor Curve and Marker Curves

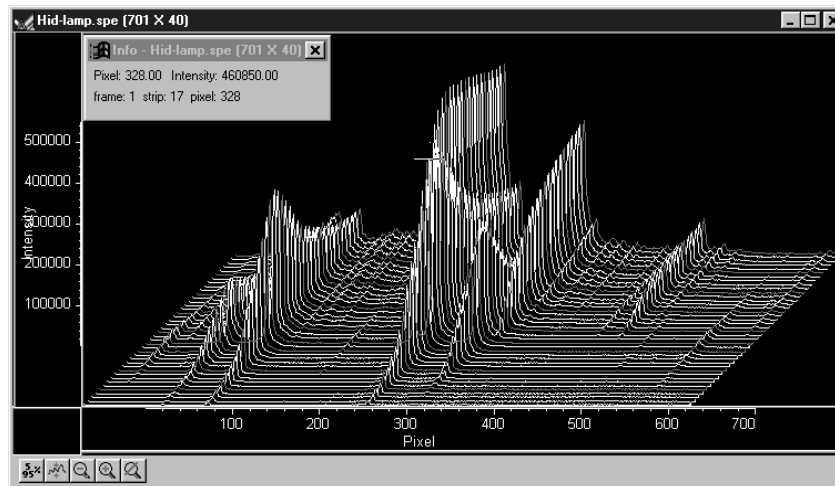
In analyzing a data display, it is often desirable to highlight the cursor curve and to have every n th curve displayed in a different color as a convenient marker. WinSpec/32 provides these functions as demonstrated in the following procedure.

- ◆ On the 3D Layout tab page, select **Highlight Cursor Curve** and **Marker Curves On**. Then press **OK**. The cursor curve and marker curves should be clearly delineated. Note that on a color monitor they would be in contrasting colors and much easier to see than in a black and white print as shown in Figure 130.

Note that displaying the data with Highlight Cursor Curve displayed affects the time required to step the cursor from curve to curve. If Highlight Cursor Curve is OFF, the cursor can step without updating the entire display. If Highlight Cursor Curve is ON, the entire display updates with each step, a considerably slower operation.

- ◆ If the Cursor Curve and Marker Curves don't appear, the problem may be with the assigned colors, which should be different from the normal graph color and different from the background color. On the Display Layout Color tab page, it the **Active 3D Graphs** button that allows the cursor-curve color to be set. The **Marker Graphs** button is used to set the marker-curves color.

Figure 130. 3D display with cursor curve and marker curves.



Hidden surfaces

You may wish to shift the view to show the hidden or underside of the display, as illustrated in the following procedure.

- ◆ Open the Display Layout window and make the following changes.

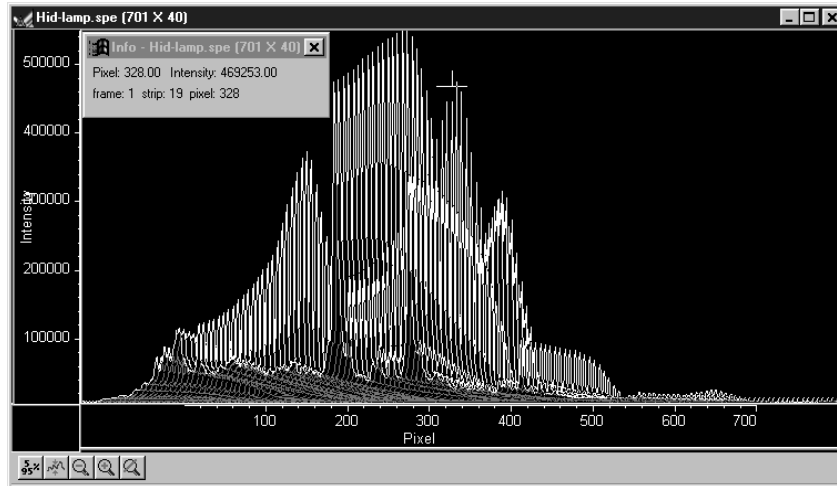
Range: Change Y so that the range is “from 40 to 1” (not “from 1 to 40”).

3D Layout: Select **Show Hidden Surface** and deselect **Highlight Cursor Curve** and **Marker Curves On. Remove Hidden Lines** should be selected. Change the Z Axis Endpoint to X% 25 and Y% 0.

The Z Axis Endpoint can be set by entering values up to 80% X (either polarity) and 80% Y (positive only) or graphically by using the mouse. If you click on Adjust Z Graphically and then on OK, the Z Axis Adjust screen (Figure 230) will appear. To make the adjustment, simply click in the graph area. The data set will appear immediately so that the effects of dragging the axis will be evident, allowing the desired display to be achieved in seconds without need for repeated tries. When working with a high-density data set, every n th line will be suppressed during the adjustment so that the process remains fast. When the data is displayed as desired, releasing the button will cause the complete data set to be displayed with the new orientation. Note that you need not confine the drag operation to the data screen area, and in fact, it may be necessary to go outside the area to achieve the desired display. Thus reducing the size of the data window before readjusting the z-axis can make the operation simpler.

- ◆ Click on **OK**. The data should be redisplayed as shown in Figure 131, with the hidden surface clearly visible (darker lines in Figure 131).

Figure 131.
3D plot with
hidden
surfaces.

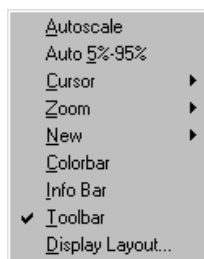


- ◆ If the hidden surfaces aren't clearly delineated, it may be necessary to change the color assigned to them, which should be different from the normal graph and background colors. The Normal Hidden Surface button on the Display Layout Color tab page allows the hidden-surface color to be selected. *Note that the Marker Hidden Surface button allows the color of the marker curves in hidden surface regions to be set.*

Data Window Context menu

For user convenience, the essential data window functions have been gathered into a single menu, illustrated in Figure 132. This menu, which is available whether the data is displayed as an image, graph, or 3D graph, can be accessed by right clicking anywhere in the data display area. See the discussion of the Context menu on page 319 for descriptions of the provided functions.

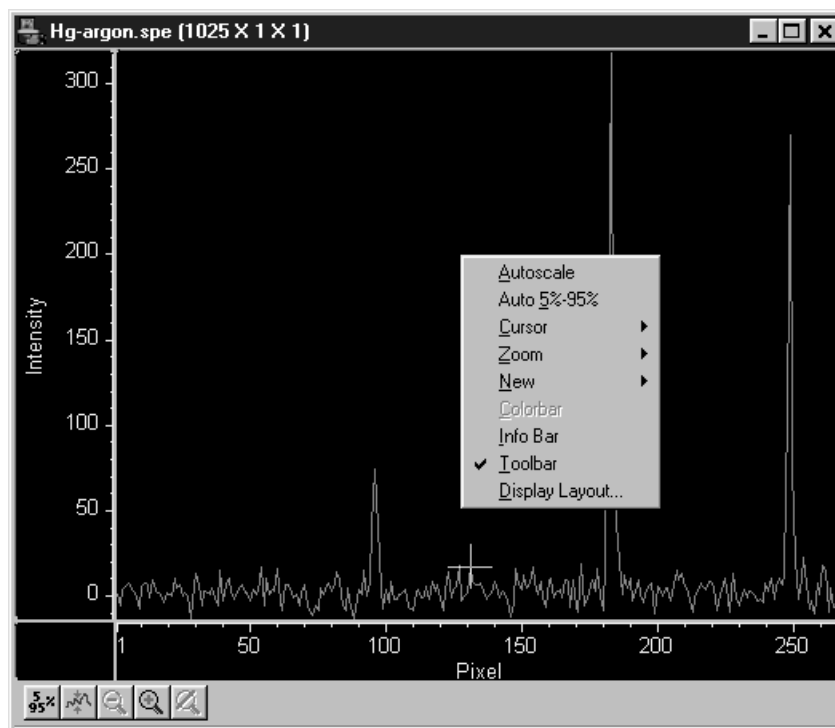
Figure 132.
Data window
Context menu.



Labeling Graphs and Images

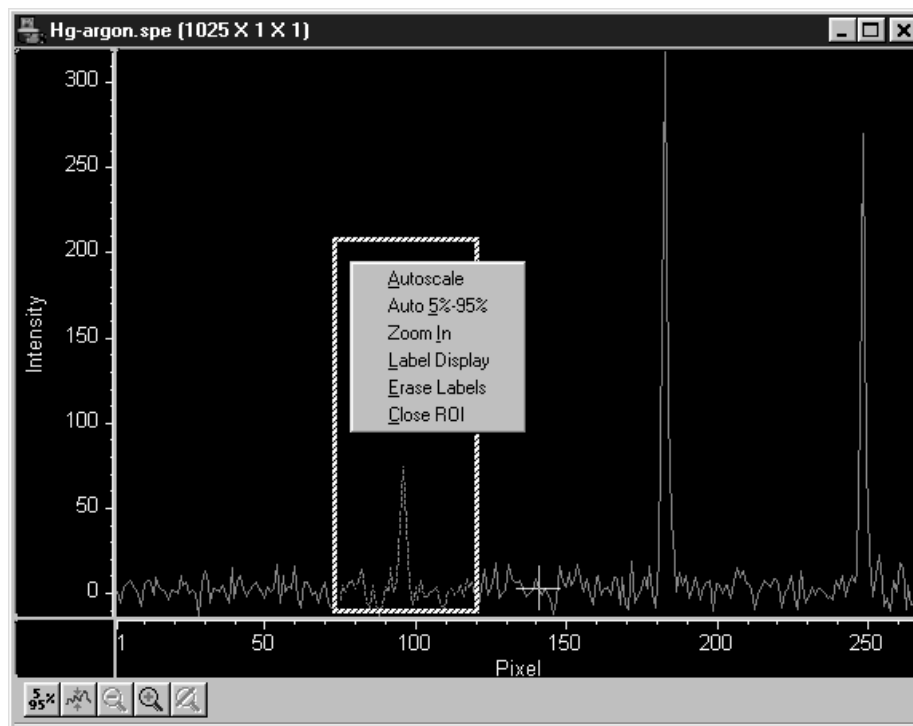
For graphs and images, the normal context menu (right click) is as shown in Figure 133.

Figure 133.
Normal context
menu.



This menu was changed for ROI's. If there is an ROI, and if the mouse is right clicked in the ROI, the context menu changes to that shown in Figure 134.

Figure 134.
ROI context
menu.



If the mouse is right clicked outside the ROI, the normal menu (Figure 133) appears. The ROI context menu (Figure 134) contains the usual actions pertaining to the ROI (autoscaling on the region inside the ROI, and zooming in to the ROI region) plus three new actions:

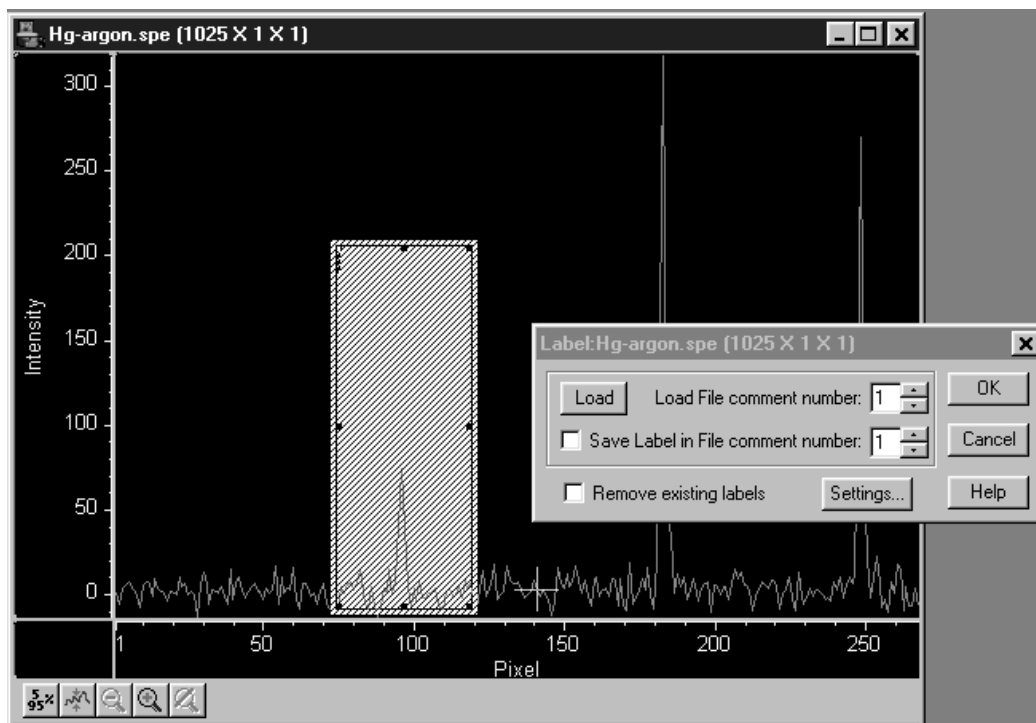
Label Display: which allows user labels to be placed on the display,

Erase Labels: which removes ALL user labels from the display, and

Close ROI: which erases the ROI with no other action (it doesn't move the cursor!).

The **Label Display** action brings up a dialog box and opens an Edit box - *Inside the ROI!* as shown in Figure 135.

Figure 135.
Label Display
action.

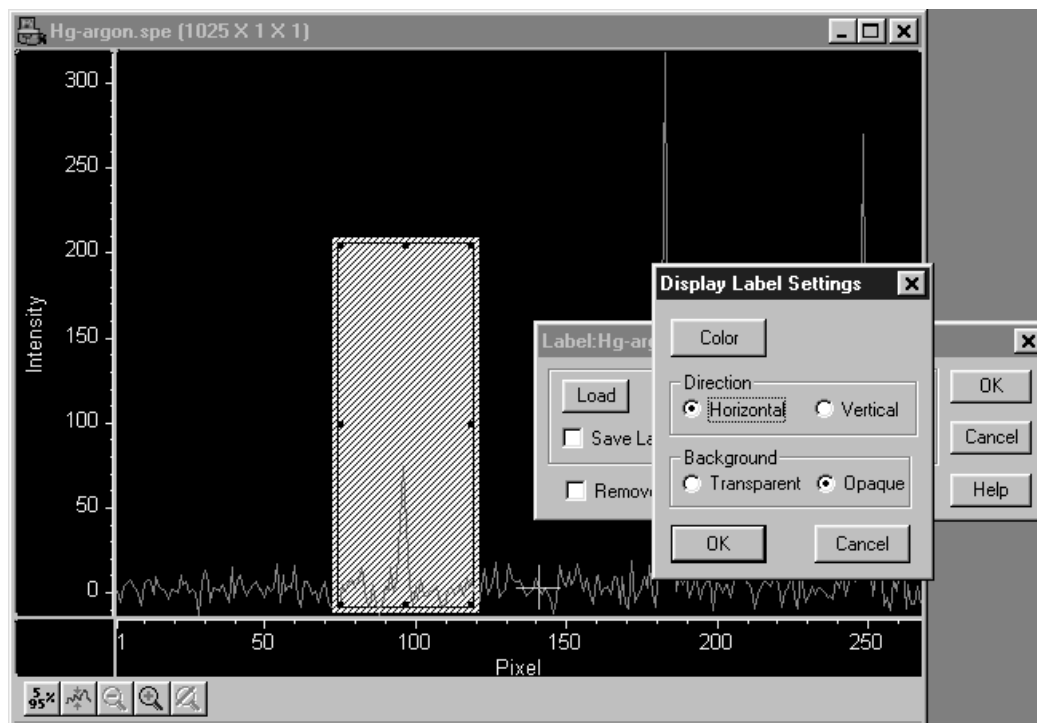


The dialog box allows loading a previously saved label (from one on the SPE file's 5 comment fields); alternatively the user can type the label into the edit box. The label can be saved into a file's comment field (when OK is clicked). The source comment field and the destination comment field can be different.

Clicking **Remove existing labels** will erase all previous labels from the display before adding the current label.

The **Settings** button brings up a subdialog with options for the label itself (Figure 136).

Figure 136.
Label options
subdialog box.



The **Settings** dialog allows you to change the color of the label text, to choose between an opaque (white) background and a transparent background, and choose whether the labels are to run vertically or horizontally. The opaque background works well with images, where the label can get lost inside the image.

The simplest way to label a display, would be to place the ROI where the label should appear (the origin starts at the top left corner of the ROI box), right click inside the ROI box, type the label text, and click OK. Figure 137 shows a label as entered in the label text entry box. Figure 138 shows the same label as it will appear with the data after clicking on OK.

Figure 137.
Label text entry
box.

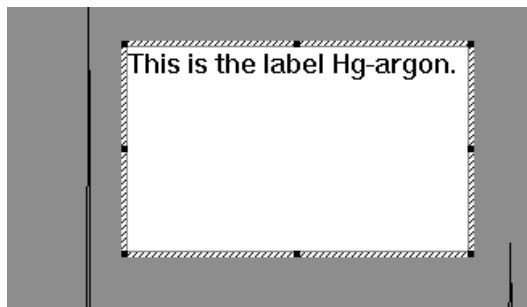
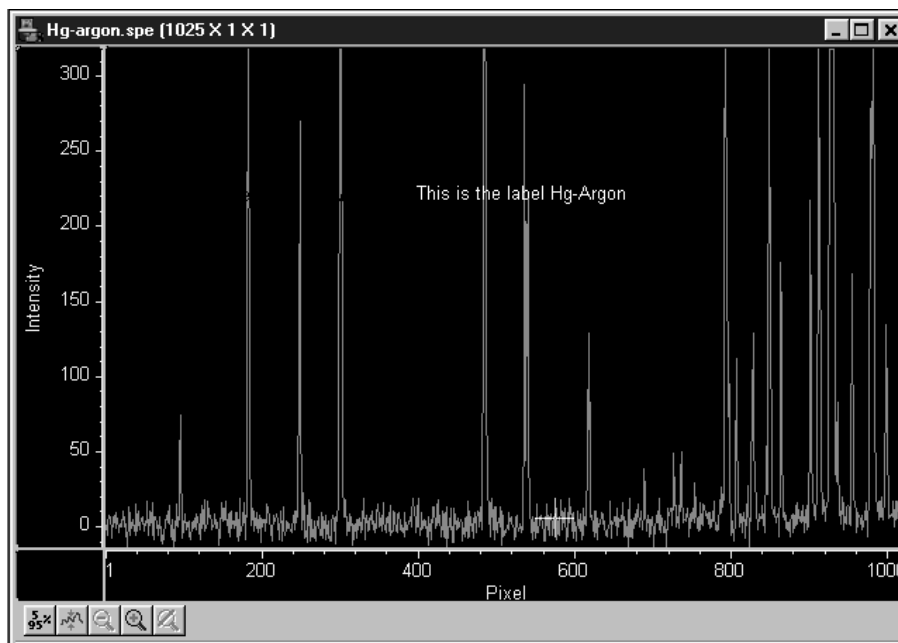


Figure 138.
Data with
finished label.



Generally it is advisable to save the label in a comment field; otherwise, once the label is printed and the display is closed, the label will be lost. In fact, once the label is on the display, it cannot be edited. However, if it has been saved, it can be edited, as follows.

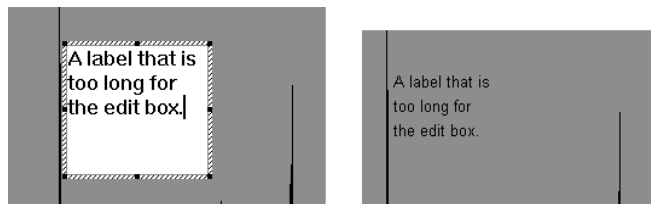
- ◆ Erase labels.
- ◆ Call up the display label menu.
- ◆ Load the label.
- ◆ Edit the label in the edit box.
- ◆ Check the **Save Label** box to save the changes.
- ◆ Click **OK** to print the corrected label.

Labels are printed with the same font as is used for the axes. To change fonts, use the Display Layout, Axes dialog, and select Fonts... (this works even if axes are not displayed).

The ROI (and Edit) box can be moved or resized before OK is clicked to reposition the label. To move the box, however, requires positioning the mouse very near the edge of the box, because further in, the Edit box will capture the mouse. Resizing is done in the usual way with the ROI box handles. If the ROI box is accidentally erased, just redraw a new one in the desired location, and the Edit box will reappear.

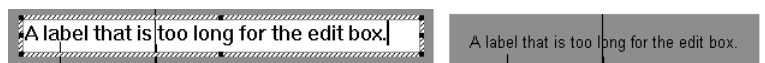
The Edit box wraps lines at the end of the box, and the Label function will display the label as it appears in the box (Figure 139)

Figure 139.
Edit box with
line-wrapped
label and
finished label
with same line
wraps.



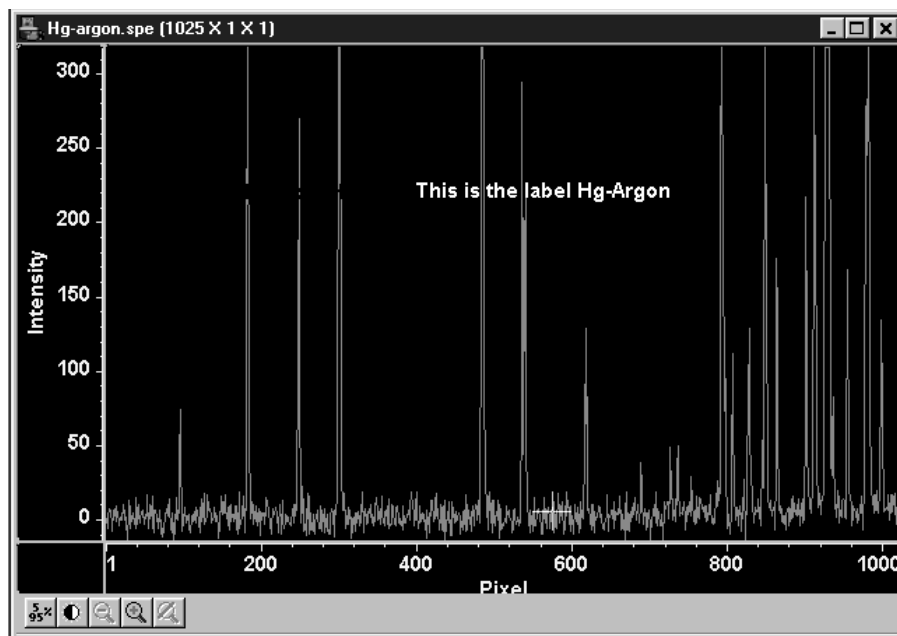
To correct the line-wrapping, simply resize the ROI as shown in Figure 140.

Figure 140.
ROI resized to
correct line-
wrapping.



The font can be changed after the label is printed on the display:

Figure 141.
Display after
changing font
selection.



To change the background or color, the label must be erased and reprinted; it can only be altered inside the edit box.

Data Displayed as an Image

WinSpec/32 can display data as an image, as a two dimensional graph, or as a 3 D Graph (multiple strips from the same graph or the same strip from multiple frames). You can choose to allow the software control how the data will be displayed or make the selection yourself. To have WinSpec/32 control the data-display mode, simply select the **Auto-Select** check box provided in the File Open dialog box and also in the Display Layout window. The Auto Select algorithm makes the selection depending on the number of data strips as described on page 155.

Displaying circuit.spe

The image used in this exercise is circuit.spe, one of the images supplied with your WinSpec/32 software. Once you become comfortable working with this image, you should have little difficulty in working with images from actual measurement data.

- ◆ From the File menu select Open. The Open dialog box (Figure 142) will appear, allowing you to select the image to be opened. The Look-In box provides a browser function so that the directory where the images are located can be easily accessed. The default directory is C:\Princeton Instruments\WinSpec\data. Files of the specified type (the WinSpec/32 data type is *.spe) in the current directory and any subdirectories are listed in the box below the directory name. *The WinSpec/32 data type is WinXData (*.spe).*

Note: The directory can be changed by changing the selection in the Look-In box. The next time the Open dialog box is opened, the new folder name will appear in the box and its contents will be listed below.

- ◆ If the **Auto-Select** check box contains a check, deselect it. Then select **Image**.
- ◆ From the data directory select the image file called CIRCUIT.SPE. Click on the **OK** button. A window of the appropriate dimensions should appear immediately. The image display (Figure 143) may take a few seconds, depending on the speed of the computer.

Figure 142.
Open dialog
box.

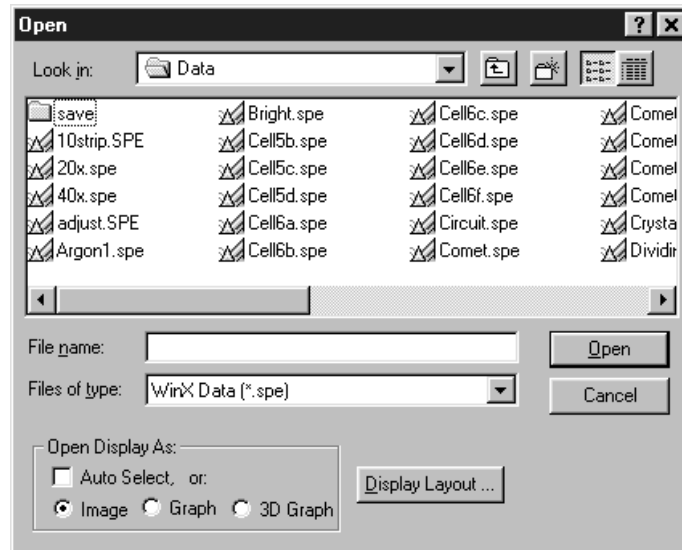
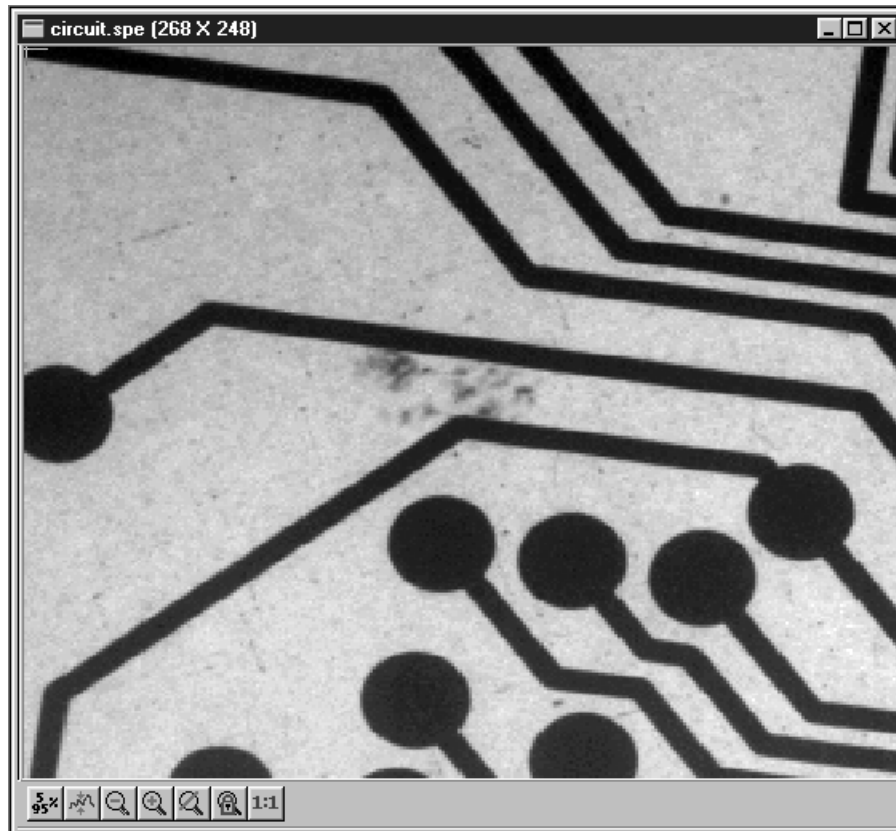




Figure 143.
Circuit.spe
image.



Changing the brightness range

- ◆ Click the  (5%-95%) button (located beneath the displayed image as shown in Figure 143). You will observe a moderate brightening of the image as it autoscales on the central 90% of the image histogram. The brightest (pixels with high dark charge) and the darkest pixels (pixels with low response) are ignored.
- ◆ Click on the  (Autoscale) button, restoring the image to its initial appearance.

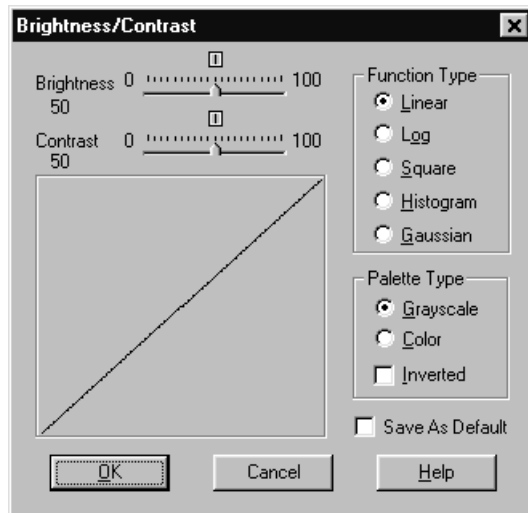
Brightness/Contrast control

Select Palette on the Display menu. This will open the Brightness/Contrast dialog box (Figure 144). Note that the window includes a plot of display brightness (Y axis) versus data value (X axis). As settings are changed, the displayed curve change to reflect the change in the transfer function. (See **Brightness/Contrast dialog box** on page 283 for a detailed discussion of the palette and transfer function options.)

- ◆ Change the brightness and contrast settings to obtain the most pleasing image display. Note that clicking on the small square above the Brightness scale and above the Contrast scale will restore the default brightness and contrast values (50).
- ◆ Try different Function and Palette Type selections to see the effect on the displayed image. Note that the displayed curve will also change, reflecting the change in the brightness transfer function. Until you gain more operating experience, we suggest you leave the Function Type set to Linear, the Palette to Grayscale, and the Brightness and Contrast both to 50.

- ▶ Click on OK to close the box. Any setting changes will be applied.

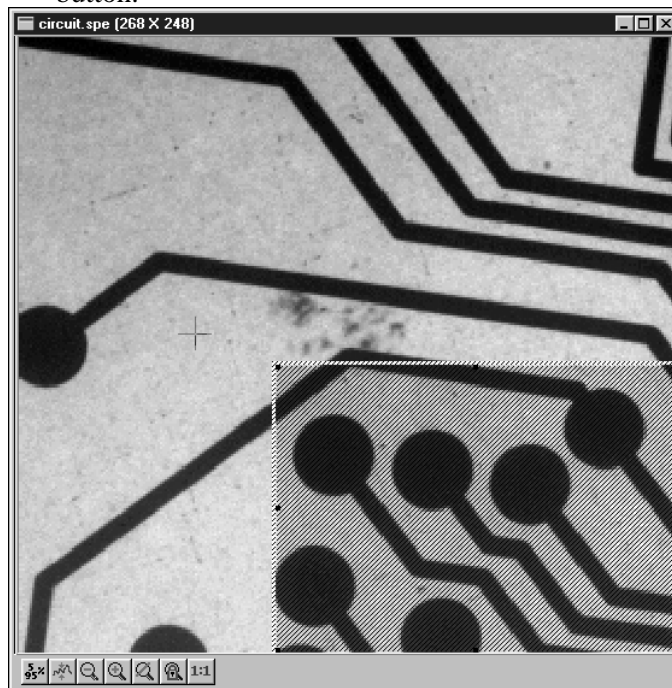
Figure 144.
Brightness/Contrast dialog box.




Selecting a region of interest

- ▶ Using the mouse, drag a rectangular region on the image as shown in Figure 145. To do so, first position the mouse cursor at one corner of the region to be defined. Next press the left mouse button and, while it is held down, drag the mouse to the diagonally opposite corner of the region being defined. Then release the mouse button.

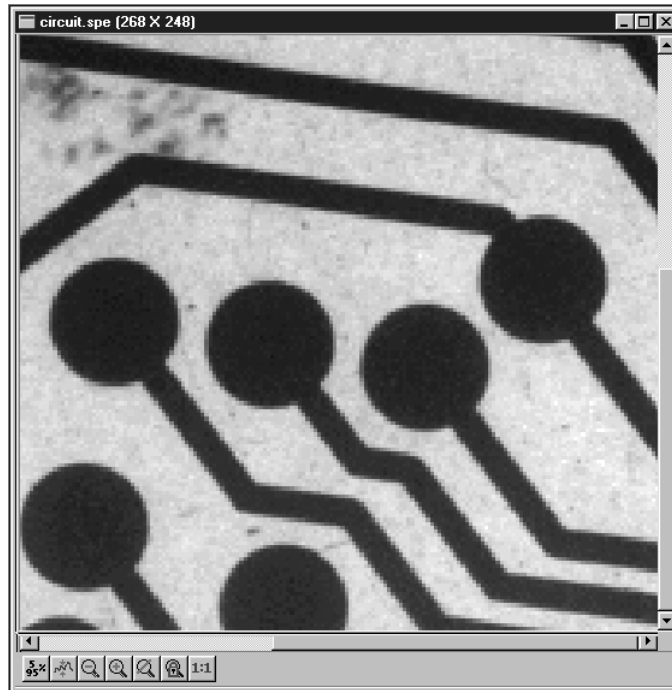
Figure 145.
Circuit.spe with region selected for viewing.



- ▶ Click on the  (Zoom In) button. The view will change so that only the selected region is displayed as shown in Figure 146.

Note: The Display Layout Cursor tab page (page 305) provides means for changing how the ROI region is displayed.

Figure 146.
Circuit.spe
expanded to
show defined
region.

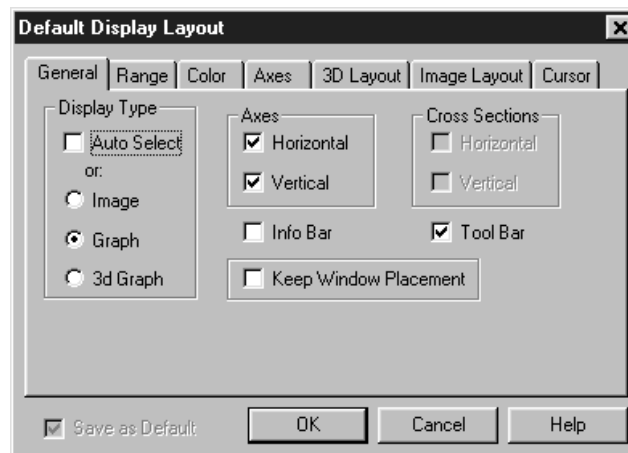


- ▶ Click on the  (Undo Zoom-In) Button. The original view will be restored.

Opening the Display Layout window

- ▶ With the image still open, select Layout from the Display menu. The Display Layout window will open (Figure 147). *Note that you can also access the Display Layout window by clicking on the Display Layout button of the Open dialog box.*

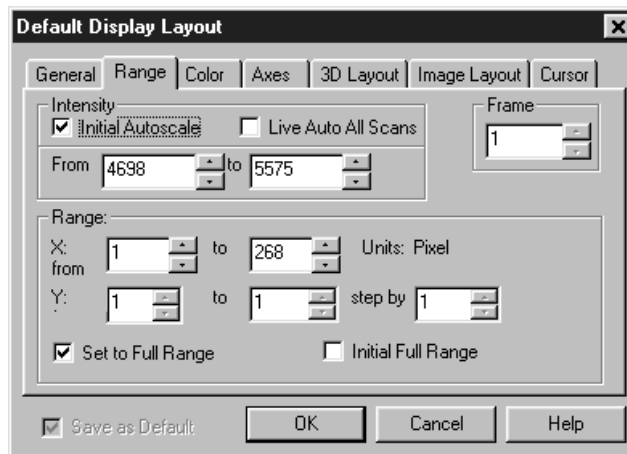
Figure 147.
The Display
Layout window.



Viewing axes and cross sections

- ◆ Still in the Display Layout window, select Axes Horizontal, Axes Vertical, Cross Sections Horizontal and Cross Sections Vertical. *Chapter 21 contains additional information on Axes and Cross Sections.*
- ◆ Click on the **Range** tab to move the Range tab page (Figure 148) to the front. **Initial Autoscale** and **Set to Full Range** should be selected. The Frame number should be “1.”

Figure 148.
Range tab
page.




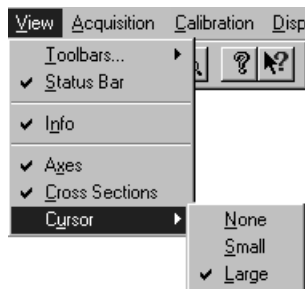
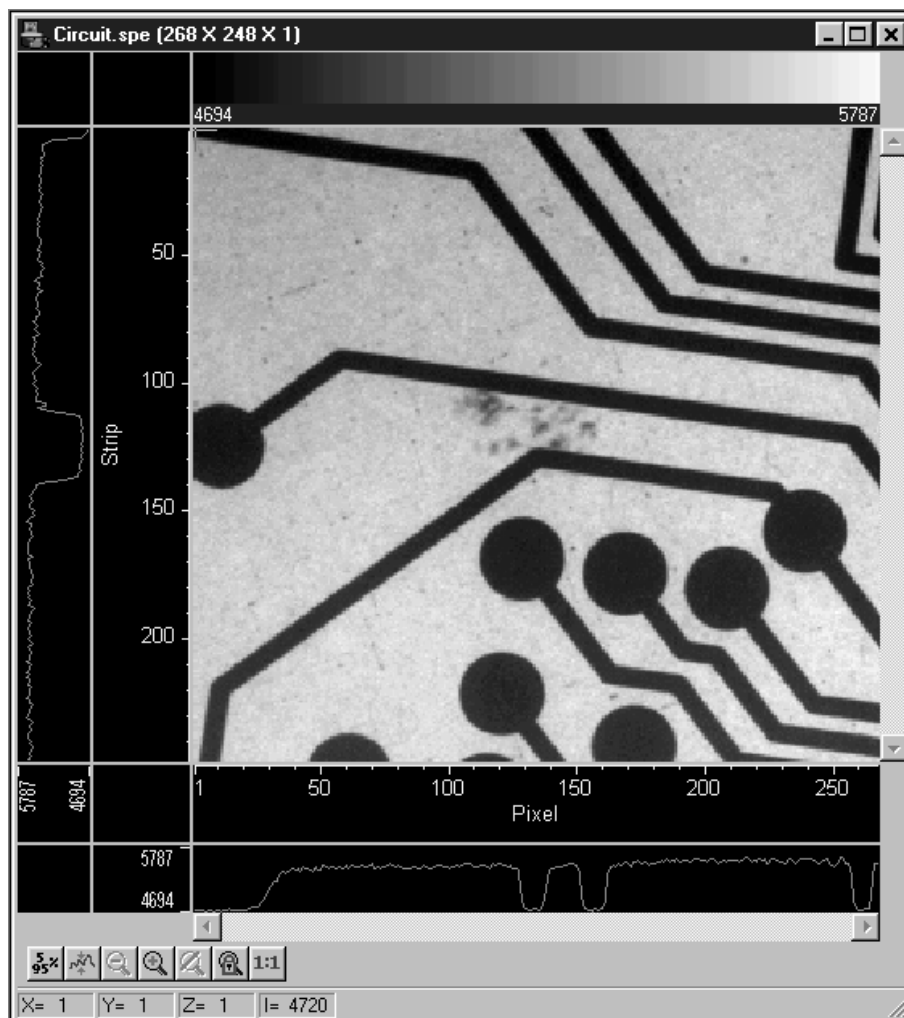
- ◆ Click on the **OK** button. The Display Layout window will close.
- ◆ Click on the  (Autoscale) button at the bottom of the image window. Then select the large cursor by clicking on Cursor on the View menu and then on Large as shown in Figure 149.

Figure 149.
Selecting the
large cursor.



- ◆ The display should now appear as shown in Figure 150. The axes will be labeled in image pixels and strips with respect to the CCD chip used to acquire the image. The vertical image intensity profile at the cursor position will be displayed to the left and the horizontal image intensity profile at the bottom. The minimum and maximum values for each profile are indicated. Note that you can use the mouse and drag the axes and profile boundaries to change the size of the profile display regions. To change the cursor location simply click the mouse at the new spot. The cross-sectional graphs will change to reflect the profiles at the new location.

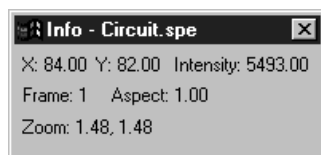
Figure 150.
Circuit.spe with
axes and cross-
sections.



The information box



- On the View menu, select Info. The information box should appear as shown in Figure 151. The intensity in A/D counts is reported at the X and Y position corresponding to the cursor position. Also reported are the Frame number, Aspect ratio, and X and Y Zoom in effect. If a region is defined by dragging the mouse cursor, the region coordinates and diagonal length will also be reported.

Figure 151.
Information
box.



Autoranging the intensity in a ROI

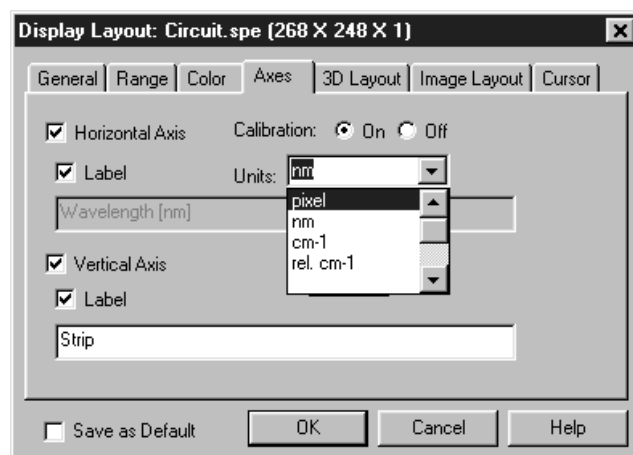
- Drag the mouse cursor to define a rectangular region of interest on the displayed image.

- ▶ Click the  (Autoscale) button. The display will autorange to the intensity range in the defined region. The effect will be an increase in contrast in the observed image. Throughout the image, pixels darker or lighter than those in the defined region will be displayed as black or white.
- ▶ Click the mouse anywhere in the displayed image and click  again to restore the original image view.

Relabeling the axes

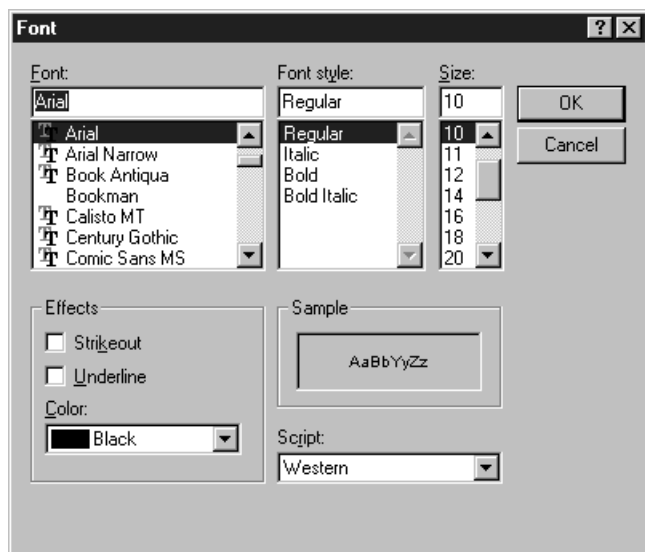
- ▶ Again open the Display Layout window by clicking on Layout in the Display menu. Then click on the Axes tab to bring the Axes tab page (Figure 152) to the front. Note that Horizontal Axis, Vertical Axis, and the Label box for each are all checked (If unchecked, the corresponding axis or label would not be displayed.)

Figure 152.
Axes tab page.



- ▶ Change the axis label for both axes. Then click on OK. The displayed axes will no longer be named **Pixel** and **Strip**, but rather the new labels.
- ▶ Try selecting different fonts to see the effect. Only True-type or Type 1 (Postscript) fonts will work correctly. To select a different font, press the Fonts button. This will open the Fonts dialog box. Try changing the Font, the Font Style, and the Size to see the effect. Each time you change the settings, it will be necessary to click on OK in both the Fonts dialog box and in the Axes tab page see the effect. Leave the selection set to 10 pt Arial Regular.

Figure 153.
Fonts dialog
box.



- ◆ Return to the Axes tab page again and change the axis labels back to their original designations (**P**ixel for horizontal; **S**trip for vertical).

Changing the Color of the Axes and Labels

- ◆ Click on the Color tab to bring the Color tab page to the front. Note that there is a button for each item to which a color can be assigned and that the current color for each item is indicated in a color swatch to the right of the button. The default for the Axis is yellow.
- ◆ Click on the Axis button. The color palette will open as shown in Figure 154.

Figure 154.
Color tab page.

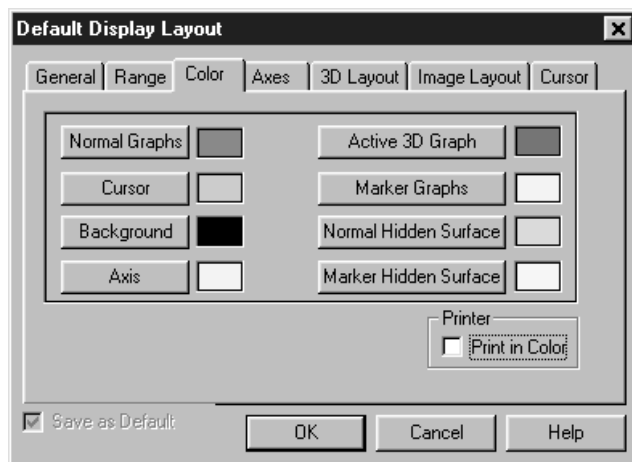
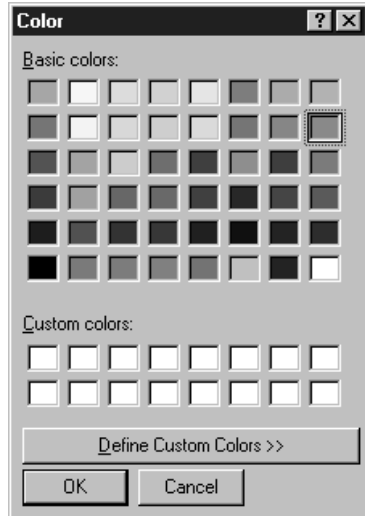


Figure 155.
Display layout
color palette.



- ◆ Select a different color by clicking on the swatch of the desired color in the Palette. Then click on OK to close the Palette dialog box and on OK again to close the Display Layout window. The axes and colors will now appear with the new color.
- ◆ Repeating the process, open the Palette dialog box again and restore the default color. Again, click on OK to close the Palette dialog box and on OK again to close the Display Layout window. The axes and labels will now be displayed in the original color.

Specifying a new ROI and intensity range

- ◆ Open the Display Layout Range tab page. Note that you can change the displayed intensity range as well as the X-Y range.
- ◆ Try entering more restricted ranges and note how the displayed image changes. Changing the X-Y range by entering new values is functionally equivalent to changing the displayed area by dragging the cursor as previously described. Selecting a narrower intensity range results in pixels brighter and darker than the range limits being displayed as white and black respectively. The effect is to increase the contrast of the image. Each time a change is made, click on OK to close the Display Layout window and observe the effect of the change.
- ◆ On completing your display experiments, restore the defaults (Autoscale Intensity and Full Range checked). Last, close the data file.

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Part 2

Advanced Topics

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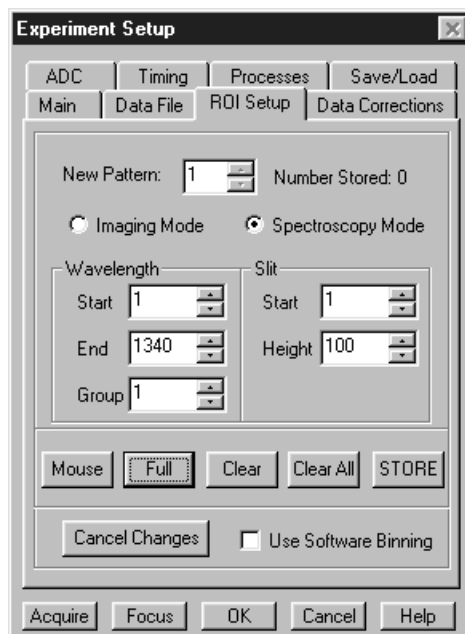
ROI & Binning Options

Overview

The ROI Experiment Setup tab page (*not available with all controller types*) allows you to define one or more rectangular subregions of the CCD for readout. The remaining pixels will be discarded. Each area of interest is defined by in the X and Y direction by a start pixel, an end pixel and a group (binning) factor. Note that for AutoRange processing, Background Subtraction, etc., the images must be *exactly* the same size.

The ROI setup is done from the ROI Setup tab page (Figure 156), accessed by selecting Experiment Setup on the Acquisition menu. Referring to the figure, note the radio buttons **Imaging Mode** and **Spectroscopy Mode**. These will only be present if you have the Imaging option. Although ROI setup considerations are always the same for spectroscopy, for imaging they are very different depending on whether the Imaging option is installed. Without the option, chip ROI simply doesn't apply to imaging and the software is limited to reading out full-chip images. With the option, the user can specify regions for readout as explained in the following pages.

Figure 156.
The ROI Setup
tab page.



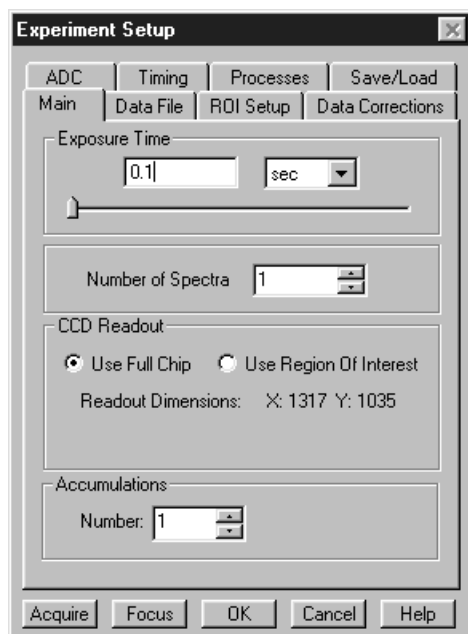
ROI in Spectroscopy

Overview

Y axis binning is the key factor that distinguishes spectroscopy readout from imaging readout. In spectroscopy, whether you're reading out the entire chip or a specified ROI, *all* pixels in each column are *automatically binned*. The effect is to generate a single strip of data. This data set is then displayed as one spectrum. Imaging requires that there be many strips of data. Although modest binning may be employed to increase the sensitivity, there is a tradeoff in that it adversely affects the image resolution. As a result, binning when imaging is normally limited to a few pixels vertically and horizontally. Note that one may also do horizontal binning in spectroscopy to improve the signal-to-noise ratio at the expense of resolution. However, in many instances a longer exposure time, higher light level, or use of an intensified system may prove to be better ways of improving the signal-to-noise ratio in that they don't degrade the resolution.

Note: You can acquire a full-chip data set without losing your access pattern. To do so, simply click on the Use Full Chip radio button on the Experiment Setup Main tab page. As long as Use Full Chip is selected, the ROI setup parameters are ignored and data collection will result in full frame data sets. To switch back to a defined access pattern, click on the Use Region of Interest radio button on the Experiment Setup Main tab page.

Figure 157.
Main tab page -
Use Full Chip
vs. Use Region
of Interest.
selections.



Defining a Single Region

- ◆ Access the ROI Setup tab page (Figure 156) by opening the Experiment Setup window from the Acquisition menu and then clicking on the ROI Setup tab.
- ◆ If your software includes the Imaging option, select **Spectroscopy Mode**. *If you don't have the Imaging option, the Imaging Mode and Spectroscopy Mode radio buttons will not be present.*

- ◆ Before defining a single region for readout, you must first make sure that the Number Stored parameter shows 0 or 1. A “1” indicates that a pattern is already stored and you are going to edit it. *The text window to the left of Number Stored will read Edit Pattern.* A “0” for Number Stored indicates that there is no defined region, in which case the text window to the left of Number Stored will read New Pattern.

If Number Stored is greater than one, it means that multiple patterns have been defined. If this is the case, click on the Clear All button to remove them. The Number Stored parameter will change to 0 and the text box name will be New Pattern.

- ◆ A region can be defined by either of two ways. The first is simply to enter values for the X and Y Start, End, and Group parameters from the keyboard. The second is drag the mouse cursor on a displayed image to define a rectangular region and then click the Mouse button.

Note that ROIs are not limited to full width like the one depicted in Figure 162. There are no restrictions on the width of an ROI or on its location on the chip. Figure 163 shows a partial-width ROI.

Figure 158. Full-width single ROI.

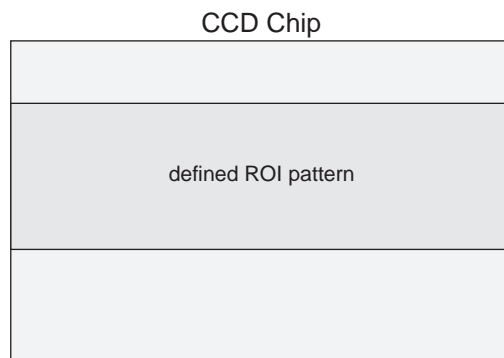
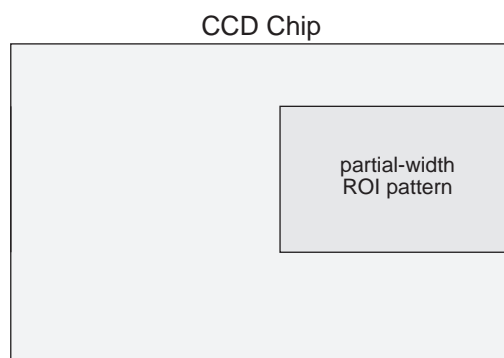


Figure 159. Partial-width single ROI.



- ◆ After defining the ROI pattern, click the Store button to save the newly defined ROI.

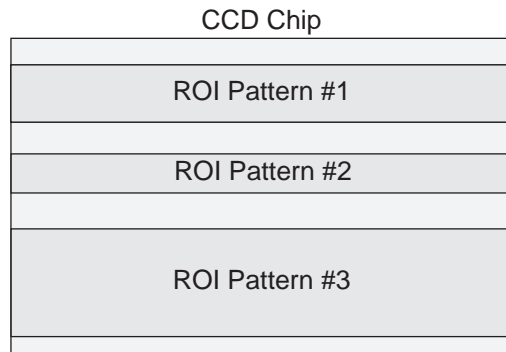
Note: To scan the full CCD chip at any time, simply click the Use Full Chip radio button on the Main tab page.

Definition of multiple regions

Multiple ROIs can be defined. The number of ROIs stored is given by the Number Stored indication. The Edit Pattern data box allows any stored pattern to be selected and its parameters changed. The Start, End and Group values for the selected pattern are displayed. To add another pattern to those already defined and stored, the Edit Pattern must be set to one higher than the indicated Number Stored. When this is done, "Edit Pattern" changes to "New Pattern," indicating that the parameter values for the pattern to be added can be entered.

There are two constraints in defining multiple ROIs in spectroscopy. First, ROIs cannot overlap. This places restrictions on the Y values that can be specified. For example, if Pattern 1 had a Y Start value of 1 and a Y End value of 100, the Start value for the next ROI would have to be greater than 100. *If a Full pattern is selected and stored, it overlaps all others, causing all data collections to be full-chip.* Figure 164 illustrates multiple full-width ROIs.

Figure 160.
Multiple full-width ROIs.



The second constraint is that once the first pattern is defined, all subsequent patterns are automatically assigned the same X axis starting and ending values. The first pattern need not be full width - any values in the chip range can be entered, but once stored, those values will apply as well to subsequently defined patterns.

Any single ROI can be deleted without affecting other ROIs. Simply select that pattern in the Edit Pattern entry box and press the Clear button. The definition for that pattern disappears and the ones above it "move down." For example, if there were five stored patterns and pattern number three were deleted, the pattern that had previously been number four would become number three, and the one that had previously been number five would become number four. The Clear All button removes *all* ROI definitions.

Graphical input (the Mouse button)

Often you can easily identify a region of interest by visually inspecting the full-chip image. When this can be done, it is very easy to define the ROI graphically as follows.

- ◆ First, click on the Use Full Chip radio button on the Experimental Setup Main tab page so that a full-chip image will be acquired. Then click on Run. Alternatively, if you already have an image, open this image and display it on screen.
- ◆ Next click on the Use Region of Interest radio button (Main tab page). Then click on the ROI Setup tab to display the ROI Setup tab page. If there are already access

regions stored, you will now see them displayed as rectangles in the displayed image.

- ◆ Click on the Pattern entry-box up-arrow spin button until the box label says New Pattern (as opposed to Edit Pattern).
- ◆ Use the mouse to drag an ROI box over the desired region in the image display. Click the ROI tab page button labeled Mouse to enter the ROI information. Change the Group X or Group Y value if necessary. Then click Store to save the new pattern.

The display of the selected areas of interest is automatically updated when patterns are added or cleared.

Binning (the Group parameter)

Binning is the process of adding the data from adjacent pixels together to form a single pixel. In the case of WinSpec/32 doing spectroscopy, Y axis (slit) binning of all pixels occurs automatically. X-axis (Wavelength) binning is controlled by the Group parameter. A value of 1 indicates no binning. Higher values indicate the number of pixels being binned to increase the sensitivity at the expense of resolution. Binning is available for any CCD detector.

Note: If you have a PCI card, and your controller is other than a MicroMAX or PentaMAX, you must ensure that the number of pixels to be read out is always an even number. A warning will appear if this is not the case. If you are doing binning, the number of pixels digitized (after hardware binning is complete) must be an even number.

Hardware binning is performed *before* the signal is read out by the preamplifier. For signal levels that are readout-noise limited this method improves S/N ratio linearly with the number of pixels grouped together. For signals large enough so that the detector is photon shot noise limited, and for all fiber-coupled ICCD detectors, the S/N ratio improvement is roughly proportional to the square-root of the number of pixels binned.

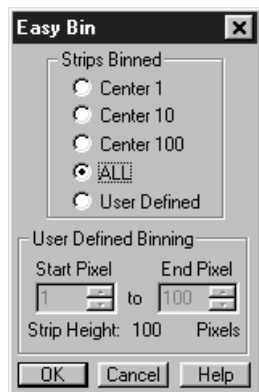
Binning also reduces readout time and the burden on computer memory, but at the expense of resolution. Since shift register pixels typically hold only twice as much charge as image pixels, hardware binning of large sections may result in saturation and “blooming,” spilling charge into adjacent pixels.

Note that binning can also be done in software by checking **Use Software Binning** on the ROI Setup tab page. Software binning will prevent saturation of the CCD chip output register pixels but is not as fast as hardware binning.

Easy Bin

The Easy Bin dialog box (Figure 161), which is opened by selecting Easy Bin on the Acquisition menu, allows a single ROI to be quickly and easily defined. An Easy Bin ROI is always vertically centered on the chip. There are five selections, Center 1, Center 10, Center 100, All, and User Defined. Selecting Center 1 establishes an ROI one pixel high, Center 10 establishes an ROI 10 pixels high and Center 100 establishes an ROI 100 pixels high. ALL selects the full chip height. Selecting User Defined allows the user to set the Y axis (slit) Start and End pixels. With all of these choices the ROI will be the full chip width.

Figure 161.
Easy Bin dialog
box.



Saving the Access Pattern(s)

As is the case for most dialog-box settings, the access pattern(s) are stored on disk when you exit the program. These settings are loaded automatically the next time you start the program.

Note: The Experiment Setup Save/Load tab page allows *all* experiment set parameters, including ROI, to be saved in a user-designated file for later recall. See the discussion of the Save/Load tab page in Chapter 21.

ROI in Imaging

Overview

Imaging with WinSpec/32 is very much a function of whether the Imaging option has been installed. If the Imaging option isn't present, the **Imaging Mode** and **Spectroscopy Mode** radio buttons will not appear on the ROI Setup tab page, and the only way imaging can be accomplished is to select **Use Full Chip** on the Main tab page. This will result in as many data strips as there are pixel strips on the chip, allowing a full frame image to be acquired. If **Use Region of Interest** is selected, the automatic Y-axis binning characteristic to spectroscopic data acquisition will occur, resulting in a single data strip with no possibility of acquiring a usable image.

On the other hand, if the Imaging option is installed, you need only select **Imaging Mode** to implement both full-frame and ROI imaging operation, which works as described in the following paragraphs.

Defining a single region

- ◆ Access the ROI Setup tab page (Figure 156) by opening the Experiment Setup window from the Acquisition menu and then clicking on the ROI Setup tab.
- ◆ Select Imaging Mode on the ROI Setup tab page.
- ◆ For defining only one region for readout, you must make sure that the Number Stored parameter shows 0 or 1. A "1" indicates that a pattern is already stored and you are going to edit it. *The text window to the left of Number Stored will read Edit Pattern.* A "0" for Number Stored indicates that there is no defined region, in which case the text window to the left of Number Stored will read New Pattern.

If Number Stored is greater than one, it means that multiple patterns have been defined. If this is the case, click on the Clear All button to remove them. The Number Stored parameter will change to 0 and the text box name will be New Pattern.

- ◆ A region can be defined by either of two ways. The first is simply to enter values for the X and Y Start, End, and Group parameters from the keyboard. The second is drag the mouse cursor on a displayed image to define a rectangular region and then click the Mouse button. Graphically defining an ROI using the mouse is explained in greater detail on page 191.

Note that ROIs are not limited to full width like the one depicted in Figure 162. There are no restrictions on the width of an ROI or on its location on the chip. Figure 163 shows a partial-width ROI.

Figure 162. Full-width single ROI.

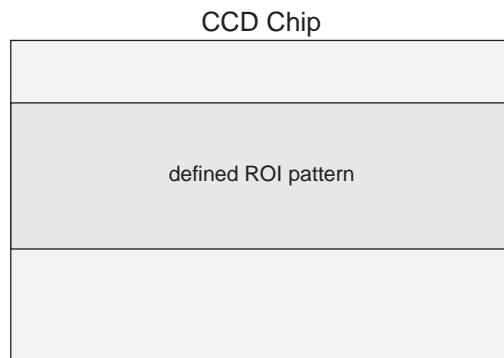
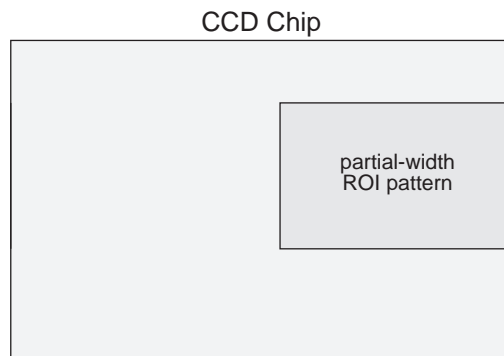


Figure 163. Partial-width single ROI.



- ◆ After defining the ROI pattern, click the Store button to save the newly defined ROI.

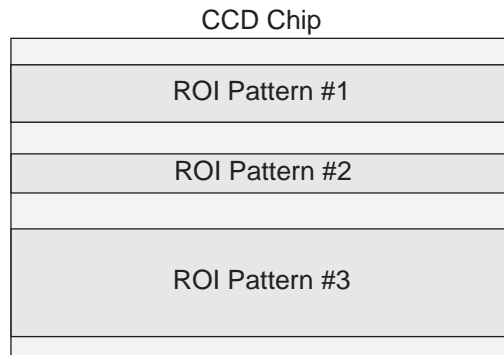
Note: To scan the full CCD chip at any time, simply click the **Use Full Chip** radio button on the Main tab page.

Definition of multiple regions

Multiple ROIs can be defined. The number of ROIs stored is given by the Number Stored indication. The Edit Pattern data box allows any stored pattern to be selected and its parameters changed. The Start, End and Group values for the selected pattern are displayed. To add another pattern to those already defined and stored, the Edit Pattern must be set to one higher than the indicated Number Stored. When this is done, “Edit Pattern” changes to “New Pattern,” indicating that the parameter values for the pattern to be added can be entered.

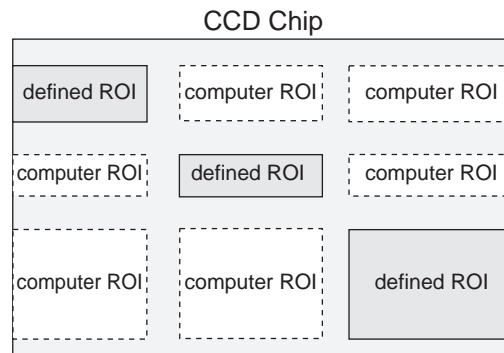
In defining multiple ROIs for imaging, there is one constraint that must be observed, and that is that ROIs cannot overlap. This places restrictions on the Y values that can be specified. For example, if Pattern 1 had a Y Start value of 1 and a Y End value of 100, the Start value for the next ROI would have to be greater than 100. *If a Full pattern is selected and stored, it overlaps all others, causing all data collections to be full-chip.* Figure 164 illustrates multiple full-width ROIs.

Figure 164.
Multiple full-width ROIs.



Imaging ROIs need not be full width. There are no restrictions on the width of an ROI or on its location on the chip. Figure 165 shows a situation where three imaging ROIs of differing widths have been defined. This figure also shows how the computer automatically generates six “side-effect” ROIs in the regions where *extensions* of the strips and columns of the defined ROIs intersect. Both the defined and computer generated ROIs will be stored and the data for both will be displayed. Generation of the side-effect ROIs is necessary to accommodate hardware limitations.

Figure 165.
Multiple ROIs
with different
widths.



Any single ROI can be deleted without affecting other ROIs. Simply select that pattern in the Edit Pattern entry box and press the Clear button. The definition for that pattern disappears and the ones above it “move down.” For example, if there were five stored patterns and pattern number three were deleted, the pattern that had previously been number four would become number three, and the one that had previously been number five would become number four. The Clear All button removes *all* ROI definitions.

Graphical Input (the Mouse button)

Often you can easily identify a region of interest by visually inspecting the full-chip image. When this can be done, it is very easy to define the ROI graphically as follows.

- ◆ First, click on the Use Full Chip radio button on the Experimental Setup Main tab page so that a full-chip image will be acquired. Then click on Run. Alternatively, if you already have an image, open this image and display it on screen.
- ◆ Next click on the Use Region of Interest radio button (Main tab page). Then click on the ROI Setup tab to display the ROI Setup tab page. If there are already access regions stored, you will now see them displayed as rectangles in the displayed image.
- ◆ Click on the Pattern entry-box up-arrow spin button until the box label says New Pattern (as opposed to Edit Pattern).
- ◆ Use the mouse to drag an ROI box over the desired region in the image display. Click the ROI tab page button labeled Mouse to enter the ROI information. Change the Group X or Group Y value if necessary. Then click Store to save the new pattern.

The display of the selected areas of interest is automatically updated when patterns are added or cleared.

Note: Right clicking inside an ROI opens the ROI Context menu, which, in addition to providing auto-scale and zoom functions, enables the labeling of image and graphical data.

Binning (the Group parameter)

Binning is the process of adding the data from adjacent pixels together to form a single pixel (sometimes called a super-pixel). When operating with WinSpec/32, binning is accomplished in hardware. Rectangular groups of pixels of any size may be binned together, subject to some hardware limitations. Binning is available for any CCD detector.

Note: If you have a PCI card, and your controller is other than a MicroMAX or PentaMAX, you must ensure that the number of pixels to be read out is always an even number. A warning will appear if this is not the case. If you are doing binning, the number of pixels digitized (after hardware binning is complete) must be an even number.

Hardware binning is performed *before* the signal is read out by the preamplifier. For signal levels that are readout-noise limited this method improves S/N ratio linearly with the number of pixels grouped together. For signals large enough so that the detector is photon shot noise limited, and for all fiber-coupled ICCD detectors, the S/N ratio improvement is roughly proportional to the square-root of the number of pixels binned.

Binning also reduces readout time and the burden on computer memory, but at the expense of resolution. Since shift register pixels typically hold only twice as much

charge as image pixels, the binning of large sections may result in saturation and “blooming”, or spilling of charge back into the image area.

Software binning, which can be selected by checking **Use Software Binning** on the ROI Setup tab page, avoids output register saturation due to binning, but is slower.

Note that separate Group parameter values can be entered in the X and Y direction for every defined parameter to give the user the greatest possible flexibility in controlling the readout.

Saving the Access Pattern

As is the case for most dialog-box settings, the access pattern is saved to disk when you exit the program. These settings are loaded automatically the next time you start the program.

Note: The Experiment Setup Save/Load tab page allows *all* experiment set parameters, including ROI, to be saved in a user-designated file for later recall. See the discussion of the Save/Load tab page in Chapter 21.

Correction Techniques

Introduction

Advanced data collection includes background subtraction, flatfield correction, CCD blemishes removal and Cosmic Ray removal. The skillful use of these techniques can significantly enhance measurement capabilities. *Note that not all of these techniques will be available in early releases of the software.*

Background Subtraction

Princeton Instruments systems are adjusted so that data have a small offset. This offset assures that small signals won't be missed. This offset can be subtracted after the signal is acquired to prevent it from having any influence on the data.

Background subtraction allows you to automatically subtract any constant background in your signal. This includes both constant offsets caused by the amplifier system in the controller as well as time-dependent (but constant for a fixed integration time) buildup of dark charge. Some users collect background spectra with the shutter open, including ambient light in their background data. The background subtract equation is:

$$(\text{Raw image data} - \text{Background}) = \text{Corrected image data.}$$

When background and flatfield operations are both performed, background subtraction is always performed first. The equation is the following:

$$(\text{Raw image data} - \text{Background})/\text{Flatfield} = \text{Corrected image data.}$$

Below are instructions for collecting and using background data files.

Acquiring background files

This operation is similar to normal data acquisition.

- ◆ Use exactly the same temperature setting as will be used in data collection. Wait at least 30 minutes after the detector has reached operating temperature to ensure stability.
- ◆ Set the same binning parameters, ROI and Exposure.
- ◆ Select **Acquire Background** from the Acquisition menu. This will immediately acquire a background file using the Experiment Setup parameters, only the shutter will remain closed for most applications.

To acquire a background with the shutter open, or if the Acquire Background feature is too restrictive in some other way, a background file can be collected as a normal data

file. Once the file is collected and stored, enter the filename in the Background Subtract filename box on the Experiment Setup Data Corrections tab page (see Figure 166).

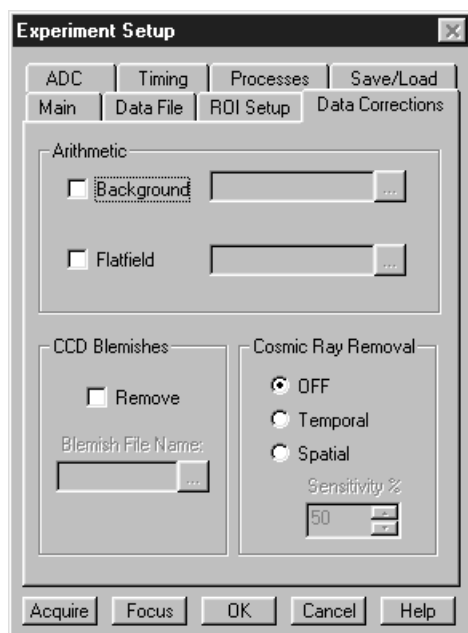
Setting automatic background subtraction

These steps instruct the software to automatically subtract a previously stored background file from each new data acquisition.

- ◆ Select Experiment Setup from the Acquisition menu. This will open the Experiment Setup dialog box.
- ◆ Click on the Data Corrections tab. The Data Corrections tab page will be selected (Figure 166).
- ◆ Click on the Background checkbox to turn on background subtraction. Type in the name of a background file if it is in the current directory. Alternatively, click on the button at the end of the entry window to open the file browser to select the background file if it is in a different directory.
- ◆ Once the Background filename has been entered, click on the **OK** button. This saves the background filename for all future data acquisitions, or until the Background is turned off.

The filename entered in the Background box will be subtracted from each new file before it is displayed or stored. If both Flatfield and Background are selected, the background will be subtracted first, before the flatfield correction.

Figure 166.
Data
Corrections tab
page.



Background Subtraction with Intensified Detectors

To properly perform background subtraction with an intensified detector, a new background must be acquired whenever the intensifier gain setting is changed. This is necessary because changing the intensifier gain also affects the dark charge of the intensifier (EBI).

Flatfield Correction

Flatfield correction allows the user to divide out small nonuniformities in gain from pixel to pixel. The instructions below set the flatfield correction to be performed before data are saved to RAM or disk.

Acquiring a flatfield file

This operation is similar to normal data acquisition.

- ◆ Use exactly the same temperature setting as will be used in data collection. Wait at least 30 minutes after the detector has reached operating temperature to ensure stability.
- ◆ Set the same binning parameters and ROI. If you plan to use a background file with data collection, on the Experiment Setup dialog select Background and enter the name of the background file. This background file will be subtracted from the flatfield file before it is saved to disk.
- ◆ Illuminate the detector uniformly. The accuracy of this uniformity will be translated into an accurate flatfield correction.
- ◆ Select **Acquire Flatfield** from the Acquisition menu (Figure 84). This will immediately acquire a flatfield file using the Experiment Setup parameters. Unlike background subtraction, the shutter will open and close normally.
- ◆ If background subtraction was selected, the background file will be subtracted from the flatfield file before it is saved to disk.

If the Acquire Flatfield feature is found to be too limiting in some way, a flatfield file can be collected as a normal data file. Once the file is collected, enter the filename in the Flatfield Correction filename box on the Experiment Setup Data Corrections tab page see (Figure 166).

Automatic flatfield correction

These steps instruct the software to automatically divide each new data file, pixel-by-pixel, by the specified flatfield file.

- ◆ Select Experiment Setup from the Acquisition menu. This will open the Experiment Setup dialog box.
- ◆ Click on the Data Corrections tab to select the Data Corrections tab page (Figure 166).
- ◆ Click on the Flatfield check box to turn on Flatfield correction. Type in the name of a flatfield correction file in the current directory. Alternatively, click on the button at the end of the entry window to open the file browser to select the flatfield correction file if it is in a different directory.
- ◆ Once the Flatfield filename has been specified, click on the **OK** button. This saves the flatfield filename for all future data acquisitions, or until the Flatfield correction is turned off.

Each pixel in a new file will be divided by the corresponding pixel in the Flatfield file. If both Flatfield and Background are selected, the background will be subtracted first, before the flatfield correction.

CCD Blemishes

The columns specified as bad in the blemish removal file will be replaced by interpolated data as the data is collected. The selected blemish pattern file appears in the textbox. Clicking on the button at the right of the box opens a browse dialog box to facilitate file selection. Note that blemish removal requires that a proper blemish pattern file be available. The blemish removal pattern is defined by the user and can be specified for any device. *Note: CCD Blemishes removal may not be implemented in early releases of the software.*

Cosmic Ray Removal

Causes highly localized spikes, such as would be caused by cosmic rays interacting with the silicon of the CCD, to be removed from the data after it is acquired but before it is stored. Two different techniques (in addition to OFF) can be selected. The spatial technique compares the data with the set threshold level. The temporal technique compares a series of spectra and requires no user parameters. Radio buttons allow you to select Off, Temporal, and Spatial. If Spatial is selected, the Threshold setting determines how large a data spike must be to be identified as a cosmic ray effect. A setting of 50 will give good results in most situations. Cosmic ray data is replaced by interpolated before-and-after data.

Spectra Math

Introduction

Selecting Spectra Math on the Process Menu opens the Math dialog box (Figure 167), which allows mathematical operations to be performed on one file or between two data files with the result written to a third. The Math dialog box contains four tab pages, one for each of the three possible files, **A**, **B**, and **C**, and the other, **Operation**, for selecting the operation to be performed, which is always mathematically displayed at the top of the dialog box. There are four buttons at the bottom of the dialog box, Mouse, Process, Cancel and Help. Their function is as follows.

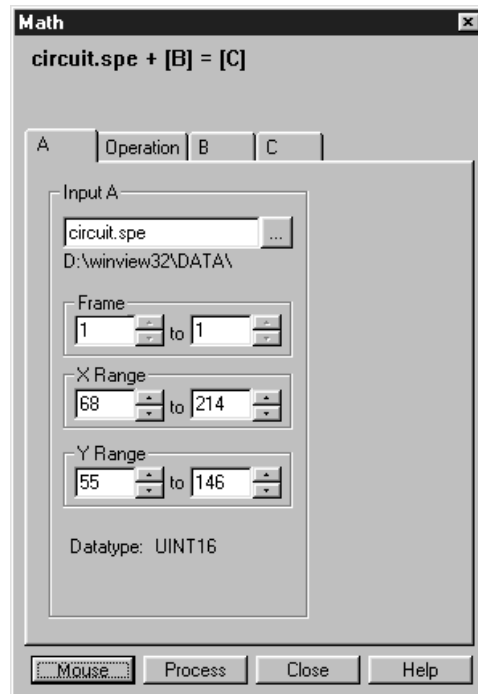
Mouse: Allows you to specify a region to be processed using the mouse. Simply drag a box in the data region of the active window and then click on **Mouse**. The **Frame** and **Range** parameters will assume the values of the defined region. Note that the **Mouse** button is only active when the **A** or **B** tab page is selected.

Process: Causes the specified operation to be performed.

Cancel: Exits the dialog box without performing any processing. Any changes to the dialog are lost.

Help: Accesses context-sensitive Help for the page.

Figure 167.
Math dialog
box.



File tab pages

As many as three data files can be involved in math operations and there is a corresponding tab page for each of them, **A**, **B**, and **C**. **A** and **B** are Input Files. **C** is always the Output File. Every operation requires at least one Input File and an Output File. Thus every operation will require using tab pages **A** and **C**. In those cases where a second Input File (or a constant) is required, tab page **B** will additionally need to be considered. See Chapter 21 for detailed descriptions of the individual Math file pages.

Parameters

With but a few exceptions, the parameters on the three file tab pages are the same. Brief descriptions follow.

Frame: If an input file contains multiple frames, you can specify the ones to be processed. The default is to process all frames. You additionally have the option of choosing not to write all of the frames processed to the Output File.

X and Y Range: You can specify the input file pixels to be processed. The default is to process all pixels. You additionally have the option of restricting the X and Y pixel range data written to the Output File.

Input (Output) File Name: All three tab pages have a text box for entering the name of the file. In each case there is a button at the end of the box which, when pressed, opens a browser to make selecting and specifying file names and locations as simple as possible. In the case of the **B** tab page, there is additionally a text box for entering a constant. Radio buttons are provided that activate one or the other of the two text boxes. Either a constant value or a file name can be entered, but not both.

Data Type: For the **A** and **B** tab pages, the data type is reported only and cannot be changed. In the case of the **C** (output) tab page, the data type can be specified by the user. Data types include:

Byte: 8 bits; best suited to use with V/ICCD. Can be used with other controller selections too but only the eight least significant data bits (levels 0 to 255) will be saved.

UnInt: Unsigned integer; 16 bits (0 to 65535)

Int: Signed integer; 16 bits (-32768 to 32767)

Long: Signed integer; 32 bits (-2,147,483,648 to 2,147,483,647)

Float: Floating point; 32 bits ($-1.75494351e^{-38}$ to $3.402823466e^{38}$)

Display Result: This checkbox appears on the **C** page only. If checked, it causes the output image to be displayed as soon as the processing is complete.

Single File Operations

When working with a single file, the specified operation is performed on each pixel value of **A** and the result written to the corresponding pixel of the Output File, **C**. The following operations can be performed.

- Log10
- Natural Log
- Square Root
- Squared
- Absolute Value
- Bitwise Complement
- Binary NOT

Operations Using a Single File and a Constant

When working with a single file and a constant, the operation will be performed on each pixel value of **A**, using the constant specified on the **B** tab page, and the result written to the corresponding pixel of the Output File, **C**.

- Addition
- Subtraction
- Multiplication
- Division
- Min
- Max
- Bitwise AND
- Bitwise OR
- Bitwise Exclusive OR

Operations Using Two Files

When working with two files, corresponding pixels from the two files, **A** and **B**, are operated on and the result written to the corresponding pixel of the Output File, **C**. The operations that can be performed are the same as for a Single file and Constant described above.

Operation Descriptions

Linear Operations

Addition: The **A** file is added, pixel by pixel, to the **B** file and the results written to the **C** file. It is also possible to add a constant entered on the **B** tab page to each point on the **A** file, with the results written to the **C** file.

Subtraction: The **B** file is subtracted, pixel by pixel, from the **A** file and the results are written to the new file. It is also possible to subtract a constant entered on the **B** tab page from each point on the **A** file, with the results written to the **C** file.

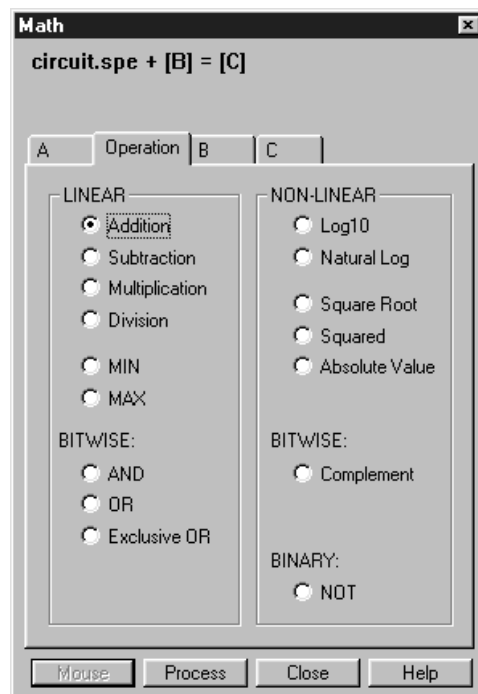
Multiplication: The **A** file is multiplied, pixel by pixel, by the **B** file and the results written to the **C** file. It is also possible to multiply each pixel of the **A** file by a constant entered on the **B** tab page, with the results written to the **C** file.

Division: The **A** file is divided, pixel by pixel, by the **B** file and the results written to the **C** file. It is also possible to divide each pixel of the **A** file by a constant entered on the **B** tab page, with the results written to the **C** file.

MIN: The **A** file is compared, pixel by pixel, with the **B** file and the smaller of the two values written to the **C** file. It is also possible to compare each pixel of the **A** file with a constant entered on the **B** tab page, with the smaller of the two values written to the **C** file.

MAX: The **A** file is compared, pixel by pixel, with the **B** file and the larger of the two values written to the **C** file. It is also possible to compare each pixel of the **A** file with a constant entered on the **B** tab page, with the larger of the two values written to the **C** file.

Figure 168.
Operation tab
page.



Non-Linear Operations

Log10: The Log10 of the **A** file is computed pixel by pixel and the results written to the **C** file.

Natural Log: The natural log of the **A** file is computed pixel by pixel and the results written to the **C** file.

Square Root: The square root of each point in the **A** file is computed and the result written to the corresponding point of the **C** file.

Squared: Each point in the **A** file is squared and the result written to the corresponding point of the **C** file.

Absolute: The absolute value of each point in the **A** file is computed and the result written to the corresponding point of the **C** file.

Bitwise Operations

AND: A bitwise AND operation is performed on the binary representation of each pixel of the **A** file and each pixel of the **B** file, with the result written to the **C** file. A twelve-bit example follows.

	Bits	Decimal Value
Pixel value in A	0 1 0 1 0 1 0 1 0 1 0 1	1365
Corresponding pixel value in B	0 0 0 0 0 0 1 1 1 1 1 1	63
Result written to C	0 0 0 0 0 0 1 0 1 0 1	21

OR: A bitwise OR operation is performed on the binary representation of each pixel of the **A** file and each pixel of the **B** file, with the result written to the **C** file. An eight-bit example follows.

	Bits	Decimal Value
Pixel value in A	0 1 0 1 0 1 0 1 0 1	1365
Corresponding pixel value in B	0 0 0 0 0 0 1 1 1 1 1 1	63
Result written to C	0 1 0 1 0 1 1 1 1 1 1 1	1407

Exclusive OR: A bitwise Exclusive OR operation is performed on the binary representation of each pixel of the **A** file and each pixel of the **B** file, with the result written to the **C** file. An eight-bit example follows.

	Bits	Decimal Value
Pixel value in A	0 1 0 1 0 1 0 1 0 1	1365
Corresponding pixel value in B	0 0 0 0 0 0 1 1 1 1 1 1	63
Result written to C	0 1 0 1 0 1 1 0 1 0 1 0	1386

Complement: For each pixel value n in the **A** file, the corresponding value in the output file **C** is set to $-1-n$. Otherwise stated, each 0 becomes a 1 and each 1 a 0.

Binary Operations

NOT: For each pixel in the **A** file, all non-zero values yield a zero, and all zero values (only) yield a one. The resulting values are written to the corresponding point of the **C** file.

Procedure

- ◆ Select the operation to be performed on the Operation tab page.
- ◆ Enter the first input filename on the **A** tab page.
- ◆ If the operation involves two files or one file and a constant, enter the second file name on the **B** tab page or enter the value of the constant on the **B** tab page.
- ◆ If you wish to process only part of the input images, change the Frame, X Range, and Y Range values on the **A** tab page, and also on the **B** tab page if two files are involved. Alternatively specify a data region in the active window using the mouse and click the **Mouse** button at the bottom of the window to enter those values.
- ◆ Enter the name of the output file on the **C** tab page. If you wish to restrict the output data range, change the Frame, X Range, and Y Range values as appropriate.
- ◆ Select the output file datatype.
- ◆ If you wish the output file to be displayed as soon as the processing is complete, check the Display Result box.
- ◆ Click on **OK** to begin processing, or **Cancel** to cancel the operation.

Y:T Analysis

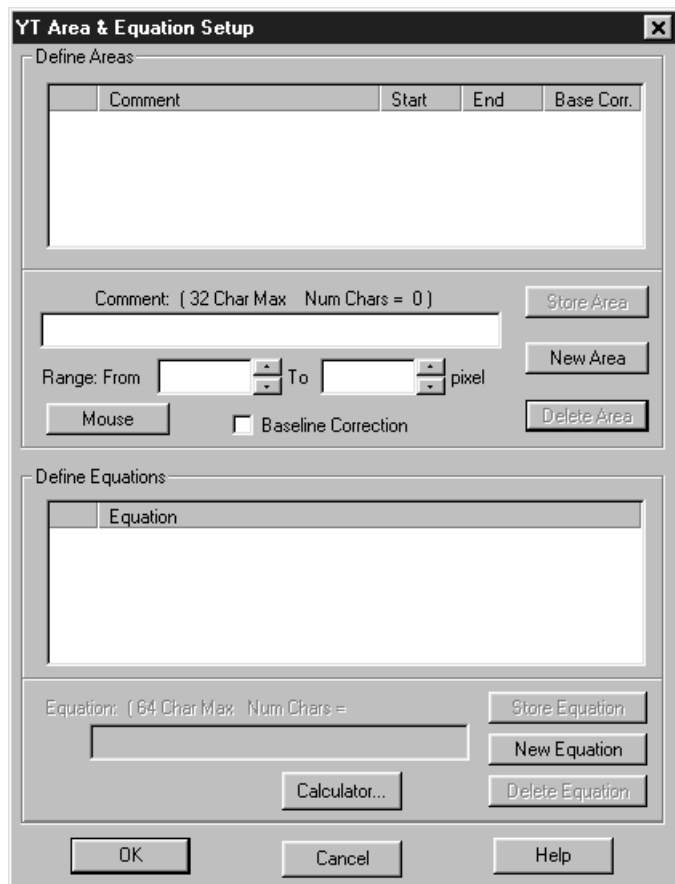
Introduction

Y:T Analysis allows users to easily monitor and study the way *spectral* data changes as a function of time. This is particularly useful in characterizing time-dependent processes. Y:T Analysis provides for defining *areas* on the data, where each area is a region bounded by a starting and ending wavelength and containing a certain number of pixels whose wavelength values lie within the region. The value of an area is the sum of the intensities of the pixels in the area. For example, if the process under study produces spectral lines that changes with time, it could be quite useful to define a separate area for each line of interest, where each line is precisely spanned by its area. The value of each area can be the sum of the total intensities defined with respect to the baseline, or the values can be *baseline corrected*, in which case the value of each area is the sum of the intensities with respect to an imaginary line joining the first and last pixels of the area. *This latter method is more accurate with a sloping baseline.* These areas can then be mathematically operated on as specified in user defined *equations*. Through these equations, the user can add, subtract, multiply, divide or otherwise manipulate up to eight areas. Equations can additionally contain constants or *even other equations*. Several Y:T analysis modes are provided, giving the user control of when the equation calculations will be performed, how many will be performed, and on which acquired data they will be performed. Each time equation calculations are performed, one Y:T analysis value is produced for each equation. For example, in a one hour experiment with one Y:T equation and a Y:T sample time of one minute, at the end of the hour a Y:T analysis curve sixty points in length would have been taken and stored. If two equations had been defined for the same experiment, at the end of the hour there would be two Y:T curves, each sixty points in length. *An additional Y:T curve for the time will always be provided as well.* These Y:T curves are stored and can be displayed, printed or processed the same as any other data.

Y:T Analysis Procedure

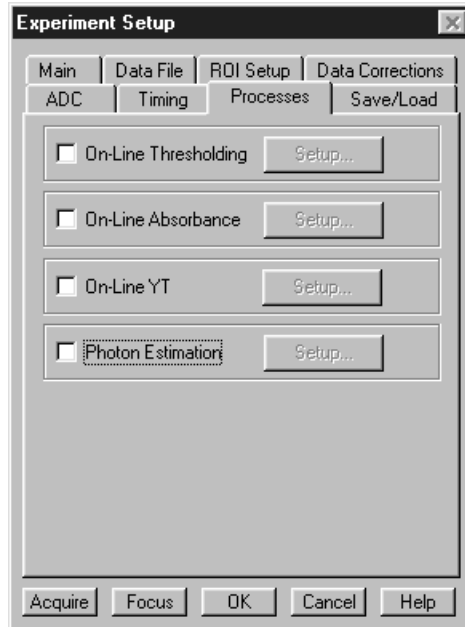
- ◆ Establish the **Experiment Setup** parameters for acquiring the data on which the Y:T analysis is to be performed.
- ◆ Select **Y:T Analysis** on the **Acquisition** menu. This will open the **Y:T Area and Equation Setup** dialog box (Figure 169).

Figure 169.
Y:T Area and
Equation Setup
dialog box.



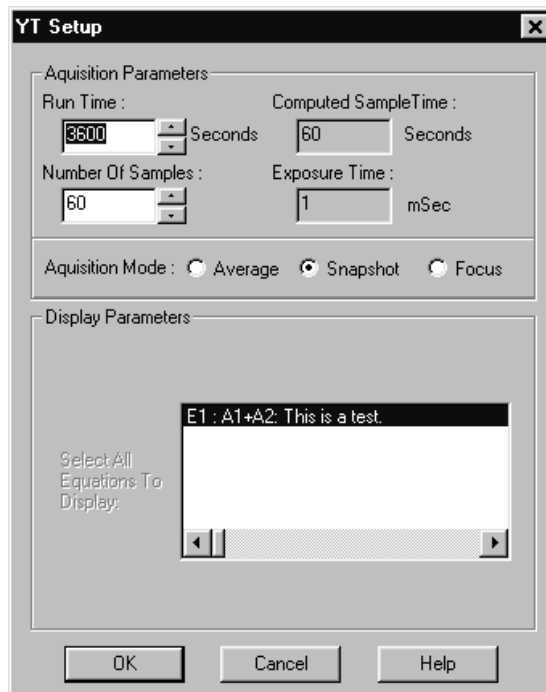
- ◆ Define the Areas and Equations for the Y:T analysis. A detailed discussion of the Y:T Area and Equation Setup dialog box and the process of setting Areas and Equations begins on page 480.
- ◆ Click **OK** in the Y:T Area and Equation Setup dialog box to close the dialog box.
- ◆ Select **Experiment Setup** on the **Acquisition** menu.
- ◆ Click on the **Processes** tab to move the **Processes** tab page (Figure 170) to the front.

Figure 170.
Processes tab
page.



- ▶ Click the **On-Line Y:T** check box so that there is a check in the box and so that the **Y:T Setup** button become active. *Checking the box turns on Y:T analysis. It will take place during any data acquisition run initiated with this box checked.*
- ▶ Click the **Y:T Setup** button to open the **Y:T Setup** dialog box (Figure 174).

Figure 171.
Y:T Setup
dialog box.



- ◆ Set the **Y:T Acquisition** mode, **Focus**, **Snapshot** or **Average** and set the **Y:T Analysis** parameters. *A detailed discussion of the Y:T Acquisition modes and parameters begins on page 484.*
- ◆ Click on **OK** to close the box.
- ◆ Initiate data acquisition. As the data is acquired, Y:T points will be computed and stored as described in the Y:T Acquisition mode discussions on page 484. If multiple equations were defined, they would be computed in order and there would be a separate Y:T curve for each. Selecting **3D Graph** on the **Display Layout Main** page would allow all five to be viewed simultaneously. If the selection is **Graph**, only one would be visible. The keyboard cursor up/down arrow keys can be used to select the Y:T curve to be viewed and the Info box shows which strip is being displayed.

Gluing Spectra

Introduction

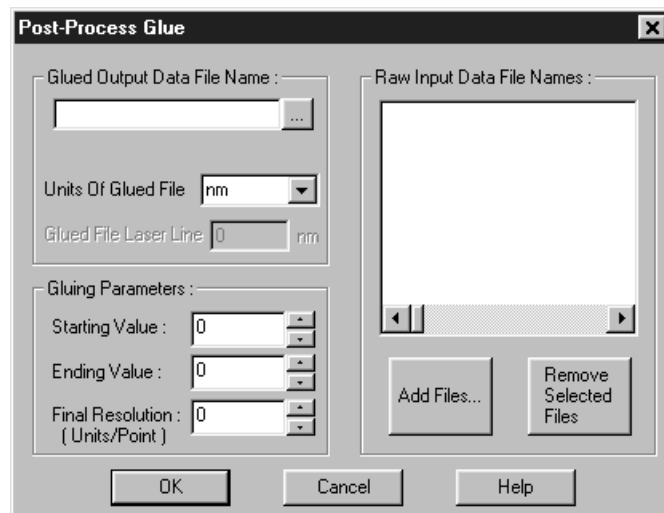
There are two ways to glue together multiple exposures into a single contiguous spectra. The first is to take existing spectra that have already been calibrated and have the WinSpec/32 software connect the spectra at the appropriate points. The second method requires spectrometer control. With correctly calibrated spectrometer control, the WinSpec/32 software can collect spectra and move the spectrometer, automating the process of collecting a spectrum whose wavelength range can extend the full spectral range of the detector.

Gluing Existing Spectra

You can glue any series of existing data files, providing that they all have been properly calibrated in nm. The files should overlap some in order to provide complete spectral data, but this is not required by the software. Any collection of calibrated single spectrum files can be used to create a glued file. The only requirements are that:

- The files have been wavelength calibrated (either manually or using “AutoSpectro”).
- The files have the same number of *frames* and *strips* (it is *not* necessary that they have the same number of pixels).

Figure 172.
The Post-Process Glue dialog box.



- ◆ Take the series of data files you would like to glue and use the file manager to rename them as a series such as EXP001.SPE, EXP002.SPE, etc. You do not have to

arrange these files in any particular order. These data files will not be altered in any way by the following procedure.

- ◆ From the Process menu select **Glue**. This will open the Post-Process Glue dialog box (Figure 172). See **Post Process Glue dialog box** on page 409 for more information.
- ◆ Use the browser to select the files (multiple files can be selected using the Windows method: <CTRL> click and the <SHIFT> Up and Down arrow keys. The Add Files button opens a browser to facilitate file selection.
- ◆ Enter the starting and ending wavelength values for the resulting file. If your wavelength range includes values that are not covered by any of the files in your series, the resulting spectrum will have some zero values. Any area where valid data was available will be used to create the glued data.
- ◆ Enter the final resolution you would like the final data file to have. This value is in units per data point in the output file, so the lower the number the higher the resolution and the more data points the glued file will contain. For a 2400 groove per mm grating and a 0.3 m spectrometer a good final resolution would be about 0.1 nm per pixel. For a 1200 groove per mm grating this value would be 0.15 to 0.2 nm per pixel. The total number of data points in the resulting file cannot exceed 65,535.
- ◆ Enter the Glued Data File Name in the box provided. The glued data will be contained in a single file.
- ◆ Click on SET to execute the glue operation.

Step and Glue

If you have spectrometer control through the WinSpec software, the easiest way to create a glued spectrum is to let the software control both the data collection and the movement of the spectrometer. The software will take an exposure, then while the shutter is closed the spectrometer is moved to the next position. Unlike a monochromator with a single point detector, the wavelength calibration will not depend on the speed and timing of the stepper motor, only on its final position.

In this case you must set the amount of overlap you would like the spectra to have. The overlapping data will be averaged for a smooth transition from one exposure to the next. In addition to the glued data file, the numbered series of individual exposures remain in the computer for later processing.

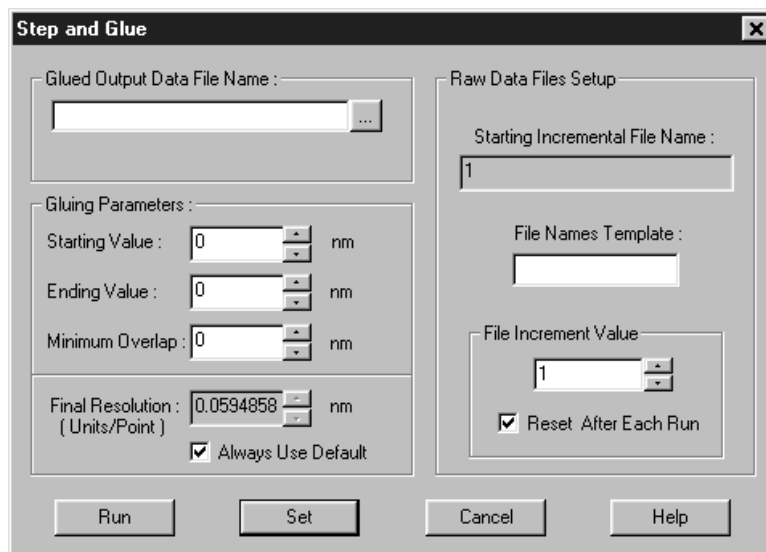
- ◆ Make sure that you have a spectrometer already installed and properly calibrated. This stepping and gluing procedure depends on having correct spectrometer calibration.
- ◆ Click on Calibration on the menu bar and then on **Usage** to open the Usage dialog box.
- ◆ Select **Auto-Spectro** in the Usage dialog box. Then select the **Calibration units** (nm, cm^{-1} or rel. cm^{-1}). Be sure the **Save as Default** button is clicked ON. Then click on OK to close the Usage dialog box.

- ◆ From the Acquisition menu, select **Step and Glue**. The Step and Glue dialog box (Figure 173) will appear. See **Step and Glue dialog box** on page 458 for additional information.

Note: Again, you must have **Auto Spectro** and either **nm**, **cm⁻¹** or **rel. cm⁻¹** selected as the **Calibration Units** on the Usage dialog box (Calibration menu) in order for the Step and Glue dialog box to open. Failure to satisfy this prerequisite will generate an error message.

- ◆ The glued data will be collected as a series of incremental files. These files will then be used to create a single glued data file. Enter the name of the File Name Template, such as EXP, in the File Names Template box. There is provision for setting the starting File Increment Value. As each incremental file is taken, the File Increment Value will increment by one. If the Reset After Each Run box is checked, the File Increment Value will reset to one and the subsequent set of incremental files will overwrite the first. If the Reset After Each Run box is unchecked, the File Increment Values assigned to the next and subsequent runs will start with the next digit after the last one used. No files will be overwritten.

Figure 173.
The Step and
Glue Setup
dialog box.



- ◆ Enter the Starting Value, the Ending Value, and the Minimum Overlap in the units selected. A good overlap would be about ten times the coverage of a single pixel. To determine the coverage of a single pixel; click on the **Always Use Default**; the minimum resolution will be displayed in the **Final Resolution** edit box (the resolution changes as the wavelength changes, decreasing at higher wavelengths).
- ◆ Enter a final resolution for the resulting file. Unless you require a certain resolution, it is easiest to let the computer calculate the final resolution, based on the spectrometer calibration and other known quantities. In the resulting file, each point does *not* represent a physical pixel. The total number of data points in the resulting file cannot exceed 65,536.
- ◆ Click on **SET** to store the Step and Glue parameters. If the experiment is ready to run, click on the **RUN** button to begin collecting data. The software will collect one

exposure at each spectrometer position. It will automatically move the spectrometer to the next position (with the correct amount of overlap) and collect the next exposure. The software will collect as many exposures as needed.

During data collection individual spectra may or may not be displayed, depending on the time between spectra.

Theory

The Glue operation is done in two stages. First the data in an input file is converted into an intermediate file with the calibration of the output file, and then the converted file is glued onto the output file.

The algorithm for the file conversion is based on the fact that the pixels have small but finite dimensions; this means that each pixel has some wavelength coverage and is not just a wavelength point. When WinSpec reports the wavelength of a pixel, it is actually the wavelength at the center of the pixel. Since WinSpec uses a polynomial wavelength calibration, the wavelength at the center of a pixel “x” is:

$$\text{Wavelength (center)} = A_0 + A_1x + \dots + A_nx^n;$$

and the wavelengths at the edges are given by:

$$\text{Wavelength (edges)} = A_0 + A_1(x \pm 1/2) + \dots + A_n(x \pm 1/2)^n,$$

where the “+” is for one edge and the “-“ for the other.

The intermediate and output file data points also have a finite wavelength coverage, given by the Final Resolution item on the Step and Glue or Post Process Glue dialog. For example, with a Starting Value of 400 nm, Ending Value of 700 nm, and Final Resolution of 1 nm, the Output File will have 301 data points, each with a coverage of 1 nm (The file itself will actually cover the range from 399.5 nm to 700.5 nm). The data point at 500 nm will have a wavelength coverage from 499.5 nm to 500.5 nm. The wavelength calibration of the Output File will be linear, and the wavelength at point “x” given by:

$$\text{Wavelength (center of point x)} = \text{Starting Value} + \text{Final Resolution} * (x - 1).$$

For each point in the Intermediate File, the conversion routine sums in values from all pixels whose wavelength range overlaps the wavelength range of the data point. If the pixel lies entirely within the range of the data point, then 100 % of its value is added; if a pixel partially lies in the data point’s range, then the percentage of its value that is added is equal to the percentage of the pixel’s wavelength range lying in the data point range. In the above example, if an input file pixel had a value of 1234 and a wavelength range of 498.9 nm to 499.6 nm, then the amount summed into the 500 nm point (499.5-500.5) would be

$$\{(499.6 - 499.5) / (499.6 - 498.8)\} * 1234 = 154.25,$$

where (499.6 - 499.5) is the amount of pixel in data point range, (499.6 - 498.8) is the coverage of the pixel, and 1234 the pixel’s value.

This algorithm, unlike a simple interpolation or curve fitting followed by interpolation, maintains both the general spectral shape and the intensity content of the original files (Interpolation could totally remove a peak if it were between two adjacent output data

point wavelengths). The algorithm is general, and doesn't depend on the input files having the same wavelength resolution or the same number of pixels.

In the second stage of the operation, the intermediate file is glued into the output file. The gluing is done in increasing wavelength point by point, based on the wavelength value of the point. Initially the output file contains all zeroes. Files are glued into the output using several rules, as follows.

- For cases with no overlap between data in the intermediate file and the output file, the intermediate file is just copied to the output file, point by point (pixels in the input file that are outside the wavelength range of the output file are discarded).
- For cases where the intermediate data overlaps the output data, the data from the two files are gradually blended over the overlap region. The most common overlap case for step and glue will be where the intermediate file starts after the output file has data, but before the output data has ended:

```
Output file ..... x x x x x x x x 0 0 0 0 0 0 0 0 0 0 0 0 ...
Intermediate file      | | | | |
                       y y y y y y y y y y y y y y y y ...
```

There are five points in the above overlap region, and the result of the blending would be (left to right):

overlap point number blending result

1	$(5/6)x + (1/6) y$
2	$(4/6)x + (2/6) y$
3	$(3/6)x + (3/6) y$
4	$(2/6)x + (4/6) y$
5	$(1/6)x + (5/6) y$

(If there is only 1 point in the overlap region then it would have $(1/2)x + (1/2) y$.)

- Another case occurs when the intermediate file starts before the output and ends after the output file has data. In this case also the data is blended across the overlap region.
- Since the glue is a general algorithm, there will be cases such as the following:

```
Output file      .... x x x x x x x x ... x x x x x x x x x x x ...
Intermediate file | | | | |
                   y y y y y y ... y y y y y y
```

or

```
Output file      ...000000x x x ... x x x x0000000...
Intermediate file y | | | | | y y y y
```

In these cases, the composition of the result will be 50% Intermediate and 50% Output.

One of the effects of the above rules is that multiple copies of the same file can be glued and the result will be the same as if only one copy had been used. The blending allows a smooth transition for files with broad spectra.

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Post Acquisition Processing Mask Operations

Several post-acquisition mask-process options, including Edge enhancement, Sharpening, Smoothing, a Custom Filter and Morphological Erode and Dilation operations, are provided in the WinSpec/32 software, but only if the Imaging Option is installed. If present, these options appear on the Process menu (Figure 174).

Figure 174.
The Process
menu.

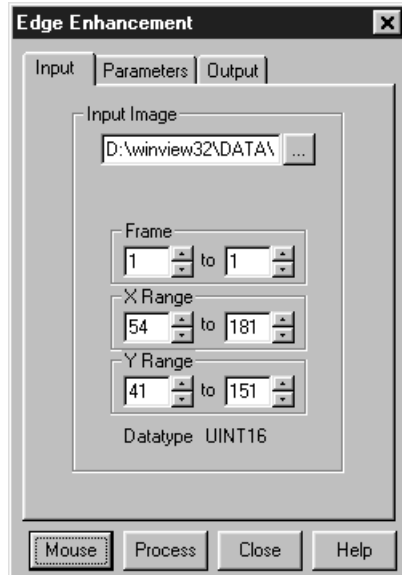


Edge Enhancement

Input tab page

The Input tab page selects the data to be operated on. The user can specify the data file, the frames within the file, and the X and Y range on the CCD. The input data-type is reported. Note that the Mouse button at the bottom of the window allows you to use the mouse to specify the region to be processed. Simply drag a box in the data region of the active window and then click on **Mouse**. The **Frame** and **Range** parameters will assume the values of the defined region. *The **Mouse** button is only active when the **Input** tab page is selected.*

Figure 175.
Edge
Enhancement
Input tab page.



Parameters tab page

Edge enhancement is accomplished by mask operations defined by parameters entered on the Parameters tab page. These functions can enhance edges, sharpen or smooth features, or erode or dilate an image. How these images are processed is briefly described below.

A mask is an $n \times n$ matrix (n is 3 for all WinSpec/32 operations) that is placed over every $n \times n$ subsection of the image. Each parameter in the mask is multiplied by the corresponding value of the image. The results are summed and placed in the central position in the output file. An example will help illustrate the process.

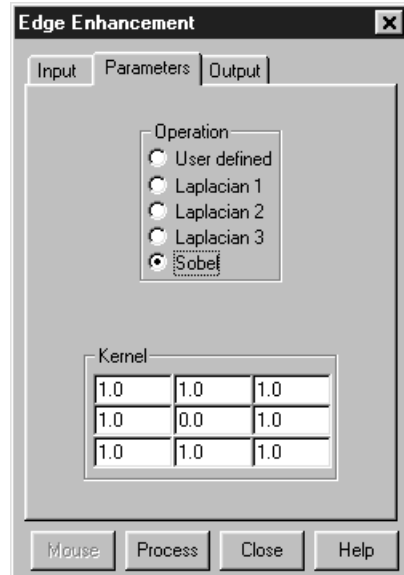
The following is the Laplacian 1 mask, used to enhance edges.

$$\begin{array}{ccc} -1 & -1 & -1 \\ -1 & 8 & -1 \\ -1 & -1 & -1 \end{array}$$

Here is an example of a 3×3 subsection of an image. The middle pixel has the coordinates 100, 100.

$$\begin{array}{ccc} 20 & 20 & 19 \\ 20 & 21 & 20 \\ 20 & 19 & 20 \end{array}$$

Figure 176.
Edge
Enhancement
Parameters tab
page.



Multiply each pair of corresponding numbers, and sum the products.

$$(-1 \times 20) + (-1 \times 20) + (-1 \times 19) + (-1 \times 20) + \\ (8 \times 21) + (-1 \times 20) + (-1 \times 20) + (-1 \times 19) + (-1 \times 20) = 10$$

The result is placed at position 100, 100 in the output image file. The mask is now placed over the 9 pixels centered at 101, 100, and the procedure is repeated.

Laplacian masks

The three Laplacian masks on the Edge Enhancement window operate just as described above. Since the sum of the mask coefficients of the Laplacians sum to zero, the result of a Laplacian operation on a region of uniform density is zero. Boundary features are enhanced by varying degrees.

Sobel edge detection

The Sobel edge detection method is more involved, but produces greatly enhanced features. Number the squares of the subregion of the image as follows:

$$\begin{array}{ccc} A_0 & A_1 & A_2 \\ A_7 & & A_3 \\ A_6 & A_5 & A_4 \end{array}$$

The replacement for the center cell, called R, is¹

$$R = [X^2 + Y^2]^{1/2}$$

where

¹Pratt, William K., Digital Image Processing, John Wiley & Sons, New York, 1978, pp. 487-488.

$$X = (A_2 + 2A_3 + A_4) - (A_0 + 2A_7 + A_6)$$

$$Y = (A_0 + 2A_1 + A_2) - (A_6 + 2A_5 + A_4)$$

Figure 177 illustrates the effect of edge detection on an image.

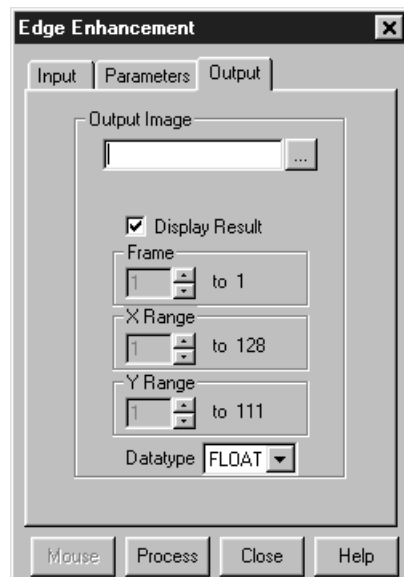
Figure 177.
Original image
(left) and edge-
detected image
(right).



Output tab page

The Output tab page allows you to name the output file. It additionally allows you to select whether the modified data is to be displayed and to select the data type. The frame and X-Y range are reported information only.

Figure 178.
Edge
Enhancement
Output tab
page.



Edge Enhancement Procedure

Use the following procedure to perform Edge Enhancement on an image.

- ◆ Select **Edge Enhancement** from the Process menu.
- ◆ Enter the Input Image and Output Image names.
- ◆ On the **Input** tab page, select the data frame containing the data on which the operation is to be performed.

- ◆ If you wish to process only part of the Input Image, enter the appropriate X-Y range values. Alternatively specify a data region in the active window using the mouse and click the **Mouse** button at the bottom of the window to enter those values.
- ◆ Select one of the Operations. Since image features vary widely, it is best to simply try the different operations to determine the best one.
- ◆ To set a specialized 3×3 mask, select User Defined and change the Kernal parameters to their new values.

Click on **Process** to begin processing.

Control Buttons:

Mouse: Allows you to specify a region to be processed using the mouse. Simply drag a box in the data region of the active window and then click on **Mouse**. The **Frame** and **Range** parameters will assume the values of the defined region. Note that the **Mouse** button is only active when the **Input** tab page is selected.

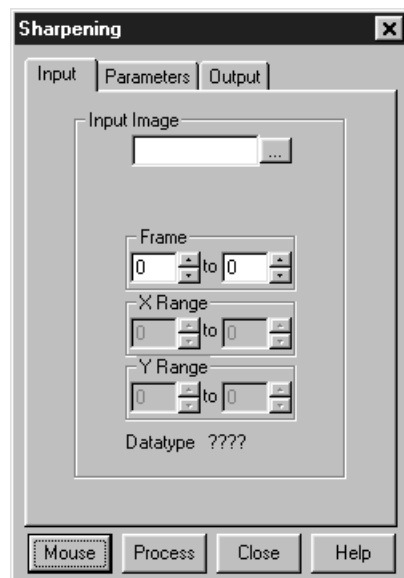
Process: Initiates the process selected via the Parameters tab page. The selected process is performed on the data specified on the Input tab page and saved using the file name and data type specified on the Output tab page.

Close: Closes the window with no action taken.

Help: Opens context-sensitive help for the active tab page.

Sharpening Functions

Figure 179.
Sharpening
Input tab page.



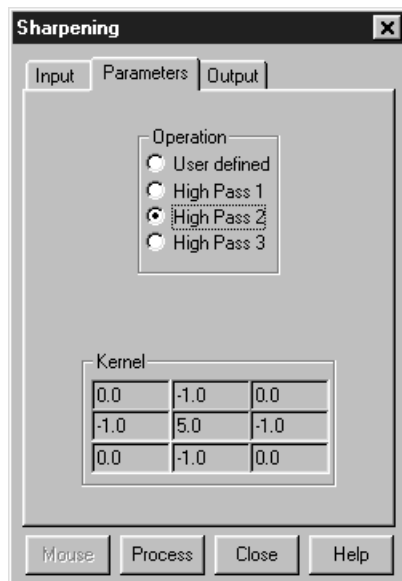
Input tab page

The Input tab page selects the data to be operated on. The user can specify the data file, the frames within the file, and the X and Y range on the CCD. The input datatype is reported. Note that the **Mouse** button at the bottom of the window allows you to use the mouse to specify the region to be processed. Simply drag a box in the data region of the active window and then click on **Mouse**. The **Frame** and **Range** parameters will assume the values of the defined region. *The **Mouse** button is only active when the **Input** tab page is selected.*

Parameters tab page

Sharpening is also accomplished by mask operations, in this case parameters entered on the Sharpening Parameters tab page. These masks, sometimes called high pass filters, enhance regions of high contrast while not affecting regions of low contrast.

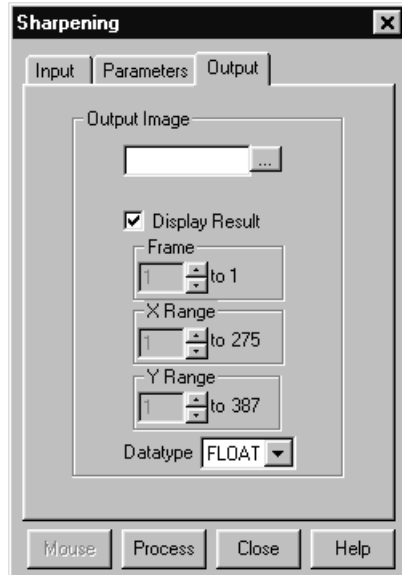
*Figure 180.
Sharpening
Parameters tab
page.*



Output tab page

The Output tab page allows you to name the output file. It additionally allows you to select whether the modified data is to be displayed and to select the data type. The frame and X-Y range are reported information only.

Figure 181.
Sharpening
Output tab
page.



Sharpening Procedure

Use the following procedure to sharpen an image.

- ◆ Select **Sharpening** from the Process menu.
- ◆ Enter the Input Image and Output Image names.
- ◆ On the **Input** tab page, select the data frame containing the data on which the operation is to be performed.
- ◆ If you wish to process only part of the Input Image, enter the appropriate X-Y range values. Alternatively specify a data region in the active window using the mouse and click the **Mouse** button at the bottom of the window to enter those values.
- ◆ Select one of the Operations. Since image features vary widely, it is best to simply try the different operations to determine the best one.
- ◆ To set a specialized 3×3 mask, select User Defined and change the Kernel parameters to their new values.
- ◆ Click on **Process** to begin processing.

Control Buttons:

Mouse: Allows you to specify a region to be processed using the mouse. Simply drag a box in the data region of the active window and then click on **Mouse**. The **Frame** and **Range** parameters will assume the values of the defined region. Note that the **Mouse** button is only active when the **Input** tab page is selected.

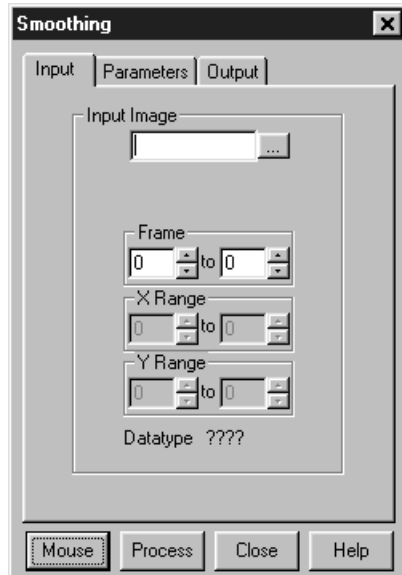
Process: Initiates the process selected via the Parameters tab page. The selected process is performed on the data specified on the Input tab page and saved using the file name and data type specified on the Output tab page.

Close: Closes the window with no action taken.

Help: Opens context-sensitive help for the active tab page.

Smoothing Functions

Figure 182.
Smoothing
Input tab page.

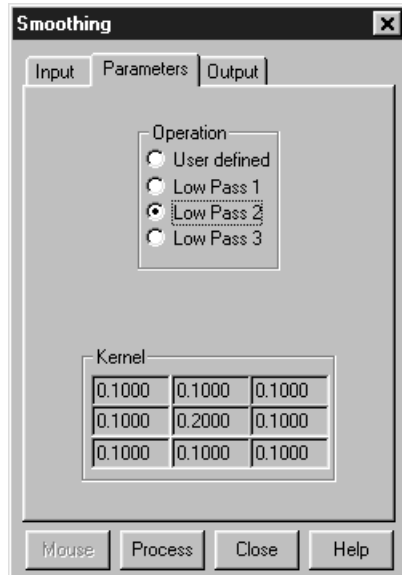


Input tab page

The Input tab page selects the data to be operated on. The user can specify the data file, the frames within the file, and the X and Y range on the CCD. The input datatype is reported. Note that the **Mouse** button at the bottom of the window allows you to use the mouse to specify the region to be processed. Simply drag a box in the data region of the active window and then click on **Mouse**. The **Frame** and **Range** parameters will assume the values of the defined region. *The **Mouse** button is only active when the **Input** tab page is selected.*

Parameters tab page

Figure 183.
Smoothing
Parameters tab
page.



Smoothing is also accomplished by mask operations, in this case parameters entered on the Smoothing Parameters tab page. These masks, sometimes called low pass filters, attenuate regions with high contrast, while leaving pixels in regions of low contrast almost unchanged. Figure 184 illustrates the smoothing filter effect.

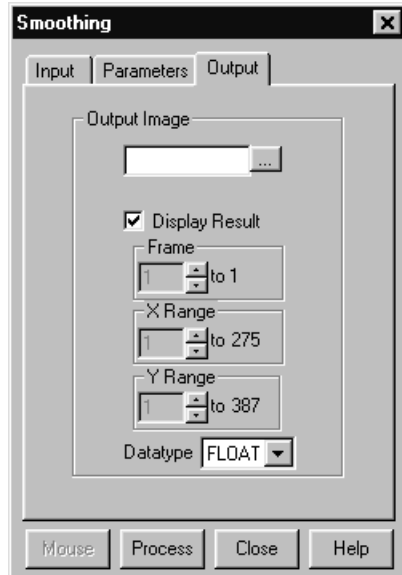
Figure 184.
Original image
(left) and
smoothed
image (right).



Output tab page

The Output tab page allows you to name the output file. It additionally allows you to select whether the modified data is to be displayed and to select the data type. The frame and X-Y range are reported information only.

Figure 185.
Smoothing
Output tab
page.



Smoothing Procedure

Use the following procedure to smooth an image.

- ◆ Select **Smoothing** from the Process menu.
- ◆ Enter the Input Image and Output Image names.
- ◆ On the **Input** tab page, select the data frame containing the data on which the operation is to be performed.
- ◆ If you wish to process only part of the Input Image, enter the appropriate X-Y range values. Alternatively specify a data region in the active window using the mouse and click the **Mouse** button at the bottom of the window to enter those values.
- ◆ Select one of the Operations. Since image features vary widely, it is best to simply try the different operations to determine the best one.
- ◆ To set a specialized 3×3 mask, select User Defined and change the Kernal parameters to their new values.
- ◆ Click on **Process** to begin processing.

Control Buttons:

Mouse: Allows you to specify a region to be processed using the mouse. Simply drag a box in the data region of the active window and then click on **Mouse**. The **Frame** and **Range** parameters will assume the values of the defined region. Note that the **Mouse** button is only active when the **Input** tab page is selected.

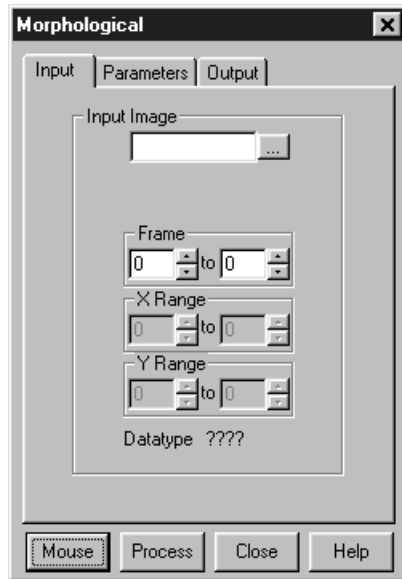
Process: Initiates the process selected via the Parameters tab page. The selected process is performed on the data specified on the Input tab page and saved using the file name and data type specified on the Output tab page.

Close: Closes the window with no action taken.

Help: Opens context-sensitive help for the active tab page.

Morphological Functions

Figure 186.
Morphological
Input tab page.



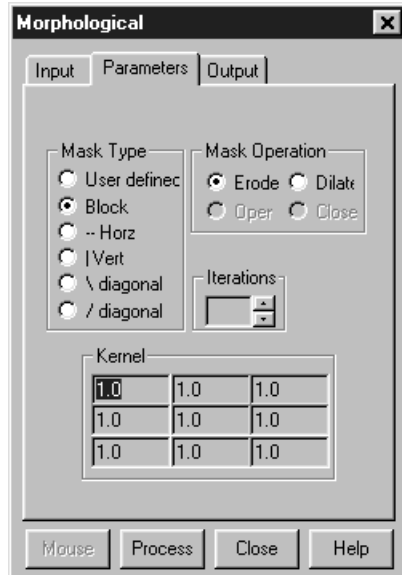
Input tab page

The Input tab page selects the data to be operated on. The user can specify the data file, the frames within the file, and the X and Y range on the CCD. The input datatype is reported. Note that the **Mouse** button at the bottom of the window allows you to use the mouse to specify the region to be processed. Simply drag a box in the data region of the active window and then click on **Mouse**. The **Frame** and **Range** parameters will assume the values of the defined region. *The **Mouse** button is only active when the **Input** tab page is selected.*

Parameters tab page

Morphological operations are also accomplished by mask operations, in this case parameters entered on the Morphological Parameters tab page. There are two basic morphological mask operations, Erode and Dilate. The effect of the Erode process is to reduce the size of a white region, while Dilation increases it. The number of iterations is set by the user. All the options except for Block and User Defined perform the operation in a specific direction only. Block performs the operation in all directions. Two other choices are Open and Close. Open is simply a number of erodes (specified by Iterations) followed by the same number of dilates. Close performs the dilates first, then the erodes.

Figure 187.
Morphological
Parameters tab
page.



Examples of some morphological operations follow. References are found at the end of this chapter. In each case the same binary image is shown to the left and the morphologically processed image is shown to the right.

Figure 188.
Original image
(left) and
dilated image
(right).



Figure 189.
Original image
(left) and
eroded image
(right).



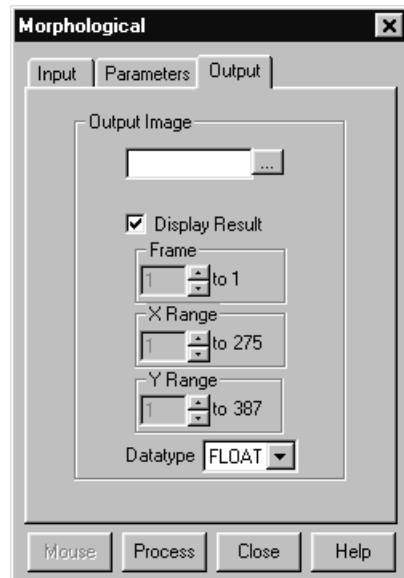
Figure 190.
Original image
(left) and
opened image
with three
iterations
(right).



Output tab page

The Output tab page allows you to name the output file. It additionally allows you to select whether the modified data is to be displayed and to select the data type. The frame and X-Y range are reported information only.

Figure 191.
Morphological
Output tab
page.



Morphological Procedure

Use the following procedure to morphologically process an image.

- ◆ Select **Morphological** from the Process menu.
- ◆ Enter the Input Image and Output Image names.
- ◆ On the **Input** tab page, select the data frame containing the data on which the operation is to be performed.
- ◆ If you wish to process only part of the Input Image, enter the appropriate X-Y range values. Alternatively specify a data region in the active window using the mouse and click the **Mouse** button at the bottom of the window to enter those values.
- ◆ Select the desired Mask Type and Mask Operation.

- ◆ To set a specialized 3×3 mask, select User Defined and change the Kernel parameters to their new values.
- ◆ Click on **Process** to begin processing.

Control Buttons:

Mouse: Allows you to specify a region to be processed using the mouse. Simply drag a box in the data region of the active window and then click on **Mouse**. The **Frame** and **Range** parameters will assume the values of the defined region. Note that the **Mouse** button is only active when the **Input** tab page is selected.

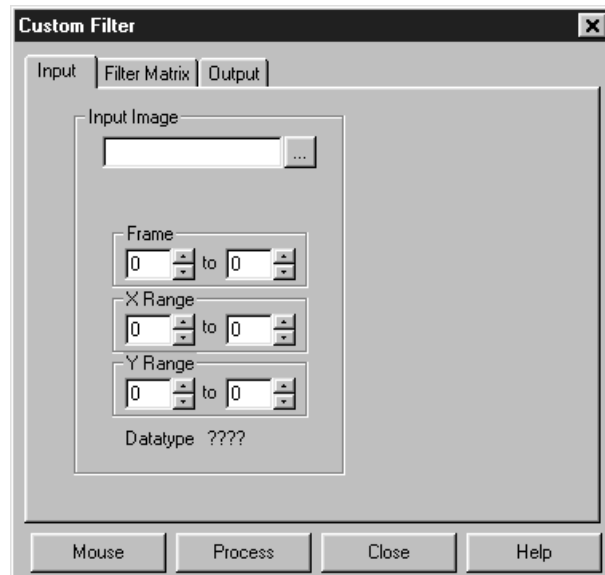
Process: Initiates the process selected via the Parameters tab page. The selected process is performed on the data specified on the Input tab page and saved using the file name and data type specified on the Output tab page.

Close: Closes the window with no action taken.

Help: Opens context-sensitive help for the active tab page.

Custom Filter

Figure 192.
Custom Filter
Input tab page.

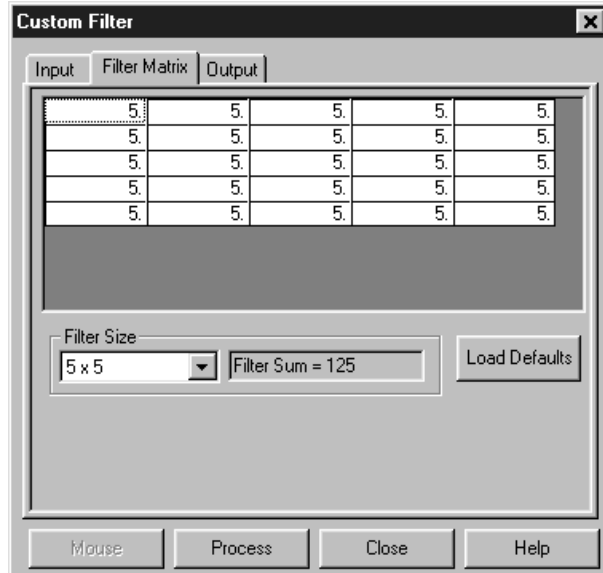


Input tab page

The Input tab page selects the data to be operated on. The user can specify the data file, the frames within the file, and the X and Y range on the CCD. The input data type is reported. Note that the **Mouse** button at the bottom of the window allows you to use the mouse to specify the region to be processed. Simply drag a box in the data region of the active window and then click on **Mouse**. The **Frame** and **Range** parameters will assume the values of the defined region. *The **Mouse** button is only active when the **Input** tab page is selected.*

Filter Matrix tab page

Figure 193.
Filter Matrix
tab page.



The Custom-Filter Filter-Matrix tab page allows you to set the filter matrix parameter values. The filter is applied to the data-set specified via the Custom Filter Input tab page (page 362). The processed data is saved in the file specified by the Custom Filter Output tab page (page 386).

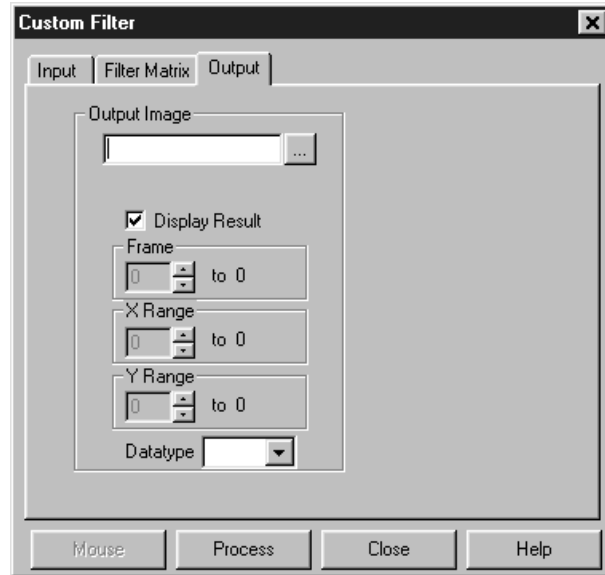
Filtering is accomplished by mask operations defined by parameters entered in the matrix. These functions can enhance edges, sharpen or smooth features, or erode or dilate an image. How these images are processed is briefly described below.

A mask is an $n \times n$ matrix (n is 5, 7, 9 or 11) that is placed over every $n \times n$ subsection of the image. Each parameter in the mask is multiplied by the corresponding value of the image. The results are summed and placed in the central position in the output file. Users can specify the Filter Size (5x5, 7x7, 9x9 or 11x11). The Filter Sum is displayed in the adjacent box. The **Load Defaults** button sets the matrix parameters to their factory-default values.

Output tab page

The Output tab page allows you to name the output file. It additionally allows you to select whether the modified data is to be displayed and to select the data type. The frame and X-Y range are reported information only.

Figure 194.
Custom Filter
Output tab
page.



Custom Filter Procedure

Use the following procedure to apply a custom filter to an image.

- ◆ Select **Custom Filter** from the Process menu.
- ◆ Enter the Input Image and Output Image names.
- ◆ On the **Input** tab page, select the data frame containing the data on which the operation is to be performed.
- ◆ If you wish to process only part of the Input Image, enter the appropriate X-Y range values. Alternatively specify a data region in the active window using the mouse and click the **Mouse** button at the bottom of the window to enter those values.
- ◆ Define the filter by entering the appropriate values in the Filter Matrix.
- ◆ Click on **Process** to begin processing.

Control Buttons:

Mouse: Allows you to specify a region to be processed using the mouse. Simply drag a box in the data region of the active window and then click on **Mouse**. The **Frame** and **Range** parameters will assume the values of the defined region. Note that the **Mouse** button is only active when the **Input** tab page is selected.

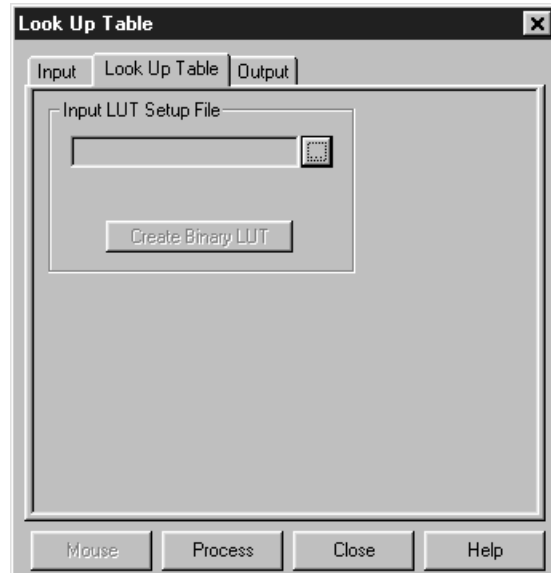
Process: Initiates processing of the image using the filter defined by the Filter Matrix. The custom filter processes the data specified on the Input tab page. The resulting data set is saved using the file name and data type specified on the Output tab page.

Close: Closes the window with no action taken.

Help: Opens context-sensitive help for the active tab page.

Look Up Table

Figure 195.
Look-Up Table.



Input tab page

The Input tab page selects the data to be operated on. The user can specify the data file, the frames within the file, and the X and Y range on the CCD. The input data type is reported. Note that the **Mouse** button at the bottom of the window allows you to use the mouse to specify the region to be processed. Simply drag a box in the data region of the active window and then click on **Mouse**. The **Frame** and **Range** parameters will assume the values of the defined region. *The **Mouse** button is only active when the **Input** tab page is selected.*

Look-Up Table tab page

This page allows the selected input data values to be mapped to different output values using a look-up table (LUT). The data format must be unsigned integer (0 to 65,000) and there can be as many as 65,000 value pairs (Input and Output) in the table. Values below zero are converted to zero. Values above 65 k are converted to 65 k. Minimum and maximum values can be specified. LUTs are ordinary text files. The text entry box and associated browser button facilitate accessing the LUT. However, before a LUT can be used to process data, it must be converted to binary, accomplished by clicking on the **Create Binary LUT** button.

Output tab page

The Output tab page allows you to save the processed data to disk. It additionally allows you to select whether the modified data is to be displayed and to select the data type. The frame and X-Y range are reported information only.

Look-Up Table Procedure

Use the following procedure to process data using the LUT.

- ◆ Select **Look Up Table** from the Process menu.
- ◆ Using the **Input** and **Output** tab pages, enter the Input and Output file names.
- ◆ On the **Input** tab page, select the data frame containing the data on which the operation is to be performed.

If you wish to process only part of the Input Image, enter the appropriate X-Y range values. Alternatively specify a data region in the active window using the mouse and click the **Mouse** button at the bottom of the window to enter those values.
- ◆ Load the LUT. *LUT files must be of the type *.TXT.* The file name can be entered directly or selected by using the browser (clicking on the button at the end of the text box opens the browser).
- ◆ Click on the **Create Binary LUT** button to convert the text-LUT to binary.
- ◆ Click on **Process** to begin convert the input data values to the output values specified per the LUT.

Control Buttons:

Mouse: Allows you to specify a region to be processed using the mouse. Simply drag a box in the data region of the active window and then click on **Mouse**. The **Frame** and **Range** parameters will assume the values of the defined region.
*Note that the **Mouse** button is only active when the **Input** tab page is selected.*

Process: Initiates the process selected via the Parameters tab page. The selected process is performed on the data specified on the Input tab page and saved using the file name and data type specified on the Output tab page.

Close: Closes the window with no action taken.

Help: Opens context-sensitive help for the active tab page.

References

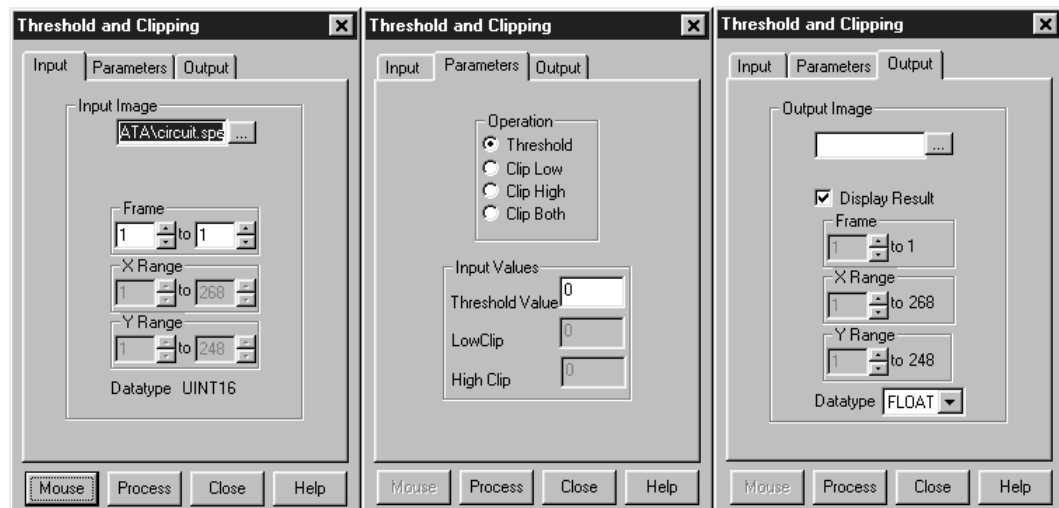
To explore in further detail the theory and techniques of digital image processing, the user is referred to the following texts:

1. *Digital Image Processing*, Gregory A. Baxes, Cascade Press, Denver, CO, 1984. ISBN: 0-945591-00-4.
2. *Digital Image Processing*, R. C. Gonzalez, P. Wintz, Addison-Wesley, Reading, MA, 1977. ISBN: 0-201-11026-1.
3. *Digital Picture Processing*, A. Rosenfeld, A. C. Kak, Vol. 1 & 2, Academic Press, New York, 1982. ISBN (Vol. 1): 0-12-1597-301-2, ISBN (Vol. 2): 0-12-597-302-0.
4. *Digital Image Processing*, W. K. Pratt, John Wiley, New York, 1978. ISBN: 0-471-01888-0.

Additional Post-Acquisition Processing Options

Threshold and Clipping

Figure 196. Clipping and Threshold tab pages.



The Threshold and Clipping option is only provided if the Imaging Option has been installed.

Clipping an image causes pixels outside the specified range to be changed. When **Clip High** is selected, all pixels with values greater than the Clip High value will be changed to the Clip High value. When **Clip Low** is selected, all pixels with values less than the Clip Low value will be changed to the Clip Low value. Selecting **Clip Both** will use both Clip High and Clip low values during the same processing step.

The **Threshold** function converts an image to binary (black and white). All intensity values below the threshold setting are zero (black). All those above become ones (white).

Procedure

- ◆ Select **Clipping/Threshold** from the Process menu.
- ◆ On the **Input** tab page, if the correct input image does not appear in the Input Image box, enter the complete file name or search for a file using the browser, accessed by the button to the right of the text box.

- ◆ On the **Input** tab page, select the data frame containing the data on which the operation is to be performed.
- ◆ If you wish to process only part of the Input Image, enter the appropriate X-Y range values. Alternatively specify a data region in the active window using the mouse and click the **Mouse** button at the bottom of the window to enter those values.
- ◆ On the **Parameters** tab page, if a clipping operation is to be performed, select the clipping option as described above. For a threshold operation, set the threshold level to the desired value.
- ◆ Enter the name of the Output Image on the **Output** tab page. *In later editions of the software, it will additionally be possible to specify an output frame and data range.*
- ◆ Click on **Process** to begin processing.

Control Buttons:

Mouse: Allows you to specify a region to be processed using the mouse. Simply drag a box in the data region of the active window and then click on **Mouse**. The **Frame** and **Range** parameters will assume the values of the defined region. Note that the **Mouse** button is only active when the **Input** tab page is selected.

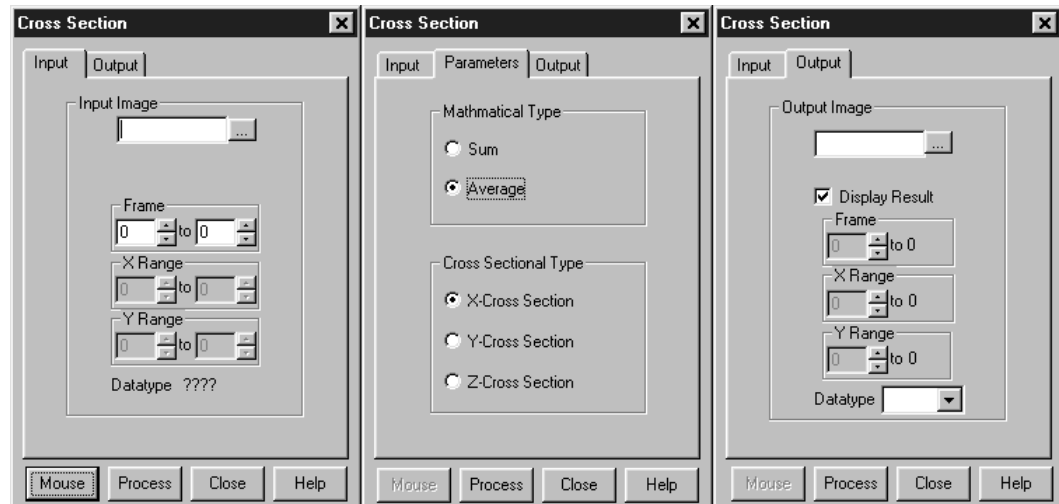
Process: Initiates the process selected via the Parameters tab page. The selected process is performed on the data set specified on the Input tab page and saved using the file name and data type specified on the Output tab page.

Close: Closes the window with no action taken.

Help: Opens context-sensitive help for the active tab page.

Cross Section

Figure 197.
Process Cross-
Section tab
pages.



Introduction

Selecting **Cross Section** on the Process menu opens the Cross Section window, which allows you to separately display and store horizontal and vertical cross sections of an image.

Procedure

- ◆ Select **Cross Section** from the Process menu.
- ◆ On the **Input** tab page, if the correct input image does not appear in the Input Image box, enter the complete file name or search for a file using the browser, accessed by the button to the right of the text box.
- ◆ On the **Input** tab page, select the data frame containing the data on which the operation is to be performed.
- ◆ If you wish to process only part of the Input Image, enter the appropriate X-Y range values. Alternatively specify a data region in the active window using the mouse and click the **Mouse** button at the bottom of the window to enter those values.
- ◆ On the **Parameters** tab page, select either **Sum** or **Average**. If Sum is selected, all pixel values in the X, Y or Z direction, according to whether X-Cross Section, Y-Cross Section or Z-Cross Section is selected, will be summed to generate the output. If Average is selected, the average of all of the pixel values in the X, Y, or Z direction will be summed to produce the output.
- ◆ On the Parameters tab page, select either **X-Cross Section**, **Y-Cross Section** or **Z-Cross Section**, whichever is wanted.
- ◆ Enter the name of the Output file on the **Output** tab page. *In later editions of the software, it will additionally be possible to specify an output frame and data range.*
- ◆ Click on **Process** to begin processing.

Control Buttons:

Mouse: Allows you to specify a region to be processed using the mouse. Simply drag a box in the data region of the active window and then click on **Mouse**. The **Frame** and **Range** parameters will assume the values of the defined region. Note that the **Mouse** button is only active when the **Input** tab page is selected.

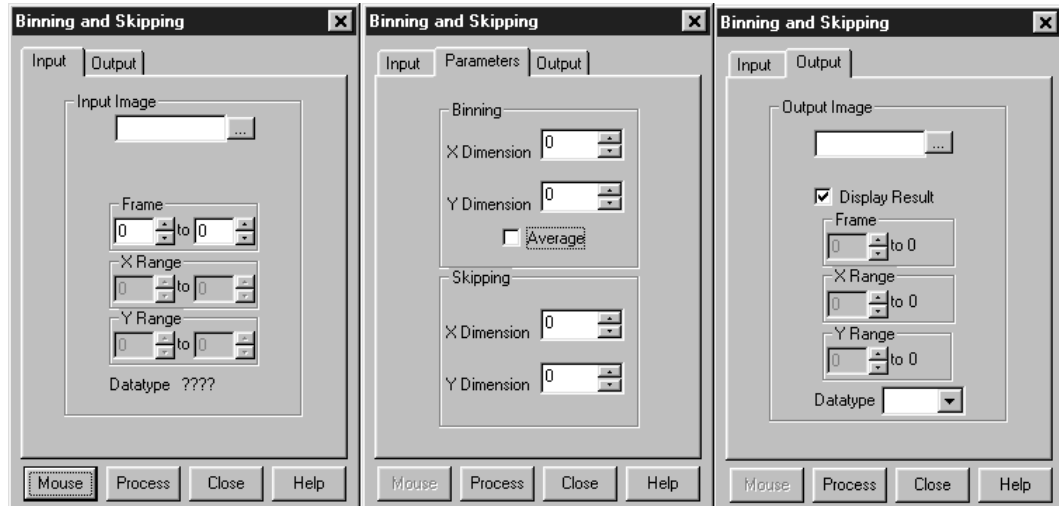
Process: Initiates the process selected via the Parameters tab page. The selected process is performed on the data set specified on the Input tab page and saved using the file name and data type specified on the Output tab page.

Close: Closes the window with no action taken.

Help: Opens context-sensitive help for the active tab page.

Binning and Skipping

Figure 198.
Postprocessing
Binning and
Skipping tab
pages.



Introduction

Selecting Binning on the Process menu opens the Binning and Skipping window, which allows binning to be accomplished in software after the data has been collected. The Parameters tab page allows the bin size to be set independently in the X and Y directions. The Skipping parameter allows you to define the interval between binned regions. The Skipping parameter size can be independently set for X and Y. There is also provision for either averaging or summing the binned data points. If Average is selected, each output data value will be the average of the binned data values in each region. If Average is unselected, each output data value will be the sum of the binned data values. The procedure follows.

Procedure

- ◆ Select **Binning and Skipping** from the Process menu.
- ◆ On the **Input** tab page, if the correct input image does not appear in the Input Image box, enter the complete file name or search for a file using the browser, accessed by the button to the right of the text box.
- ◆ On the **Input** tab page, select the data frame containing the data on which the operation is to be performed.
- ◆ If you wish to process only part of the Input Image, enter the appropriate X-Y range values. Alternatively specify a data region in the active window using the mouse and click the **Mouse** button at the bottom of the window to enter those values.
- ◆ On the **Parameters** tab page, set the X and Y bin size.
- ◆ On the Parameters tab page, select **Average** if the binned data values are to be averaged. If the Average box is left unchecked, the binned values will be summed.
- ◆ On the Parameters tab page, set the Skip X and Y values. Data points that fall in the skip zones do not contribute to the output. Skip values of zero are allowable, that is,

no points will be skipped. Left over points at the end of a strip or column are discarded.

- ◆ Enter the name of the Output file on the **Output** tab page. *In later editions of the software, it will additionally be possible to specify an output frame and data range.*
- ◆ Click on **Process** to begin processing.

Restrictions and limitations

The following are some restrictions and limitations of the Binning and Skipping function.

- This function can resize an image down to a minimum of 1 pixel but WinSpec/32 cannot display an image less than 2×2 pixels.
- May cause data overflow in the output image if the output data type is selected as “integer”. If data to be binned will exceed 32,000 counts select Unint or Long.
- The maximum binning and skipping size is the size of the input image. When the maximum is reached, to increase the binning size the user must first decrease the skipping size, then increase the binning size.

Control Buttons:

Mouse: Allows you to specify a region to be processed using the mouse. Simply drag a box in the data region of the active window and then click on **Mouse**. The **Frame** and **Range** parameters will assume the values of the defined region. Note that the **Mouse** button is only active when the **Input** tab page is selected.

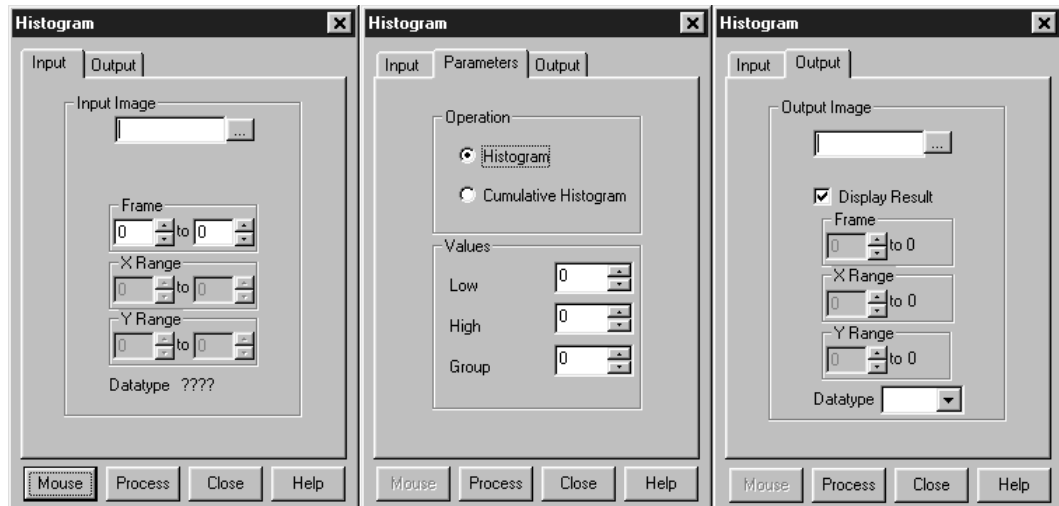
Process: Initiates the process selected via the Parameters tab page. The selected process is performed on the data set specified on the Input tab page and saved using the file name and data type specified on the Output tab page.

Close: Closes the window with no action taken.

Help: Opens context-sensitive help for the active tab page.

Histogram Calculation

Figure 199.
Postprocessing
Histogram tab
pages.



Introduction

Two types of histograms are available for graphing the distribution of intensities of an image. The **Histogram** operation groups pixels of a similar intensity together. The X-axis indicates the intensity, and the Y-axis displays the number of pixels in that intensity range.

The **Cumulative Histogram** operation groups pixels of a similar intensity together, once again using the X-axis to show intensity. This time, however, the Y-axis indicates the total number of pixels with intensity less than or equal to the range. Thus the Cumulative Histogram is always an increasing function.

Procedure

- ◆ Select **Histogram** from the Process menu.
- ◆ On the **Input** tab page, if the correct input image does not appear in the Input Image box, enter the complete file name or search for a file using the browser, accessed by the button to the right of the text box.
- ◆ On the **Input** tab page, select the data frame containing the data on which the operation is to be performed.
- ◆ If you wish to process only part of the Input Image, enter the appropriate X-Y range values. Alternatively specify a data region in the active window using the mouse and click the **Mouse** button at the bottom of the window to enter those values.
- ◆ On the **Parameters** tab page, select either **Histogram** or **Cumulative Histogram**, whichever is wanted.
- ◆ On the Parameters tab page, under **Values**, enter the **Low Intensity** and **High Intensity** values. These are the Y-Max and Y-min. Then enter the **Group Size**, which is the range of intensity that the software will group together as a single data

point. In other words, if the Group Size is 50, pixels having an intensity in the range of 1-50 will be counted and graphed as a single point on the histogram.

- ◆ Enter the name of the Output file on the **Output** tab page. *In later editions of the software, it will additionally be possible to specify an output frame and data range.*
- ◆ Click on **Process** to begin processing.

Control Buttons:

Mouse: Allows you to specify a region to be processed using the mouse. Simply drag a box in the data region of the active window and then click on **Mouse**. The **Frame** and **Range** parameters will assume the values of the defined region. Note that the **Mouse** button is only active when the **Input** tab page is selected.

Process: Initiates the process selected via the Parameters tab page. The selected process is performed on the data set specified on the Input tab page and saved using the file name and data type specified on the Output tab page.

Close: Closes the window with no action taken.

Help: Opens context-sensitive help for the active tab page.

This page intentionally left blank.

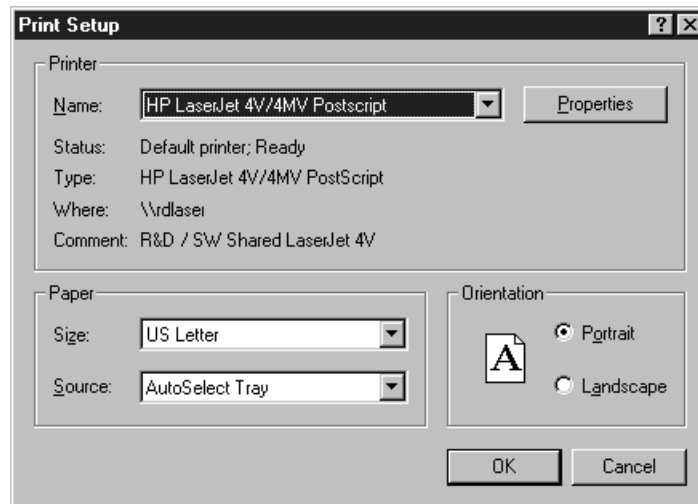
Printing

Introduction

The current version of WinSpec/32 can be used to print images directly. Methods are listed below both for direct printing and for using the clipboard to transfer the image to another program for printing.

Printing Directly from WinSpec/32

Figure 200.
The Print Setup dialog.



- ◆ Open the file you want to print. Make sure that window is the active one. From the File menu, open the Print Setup window (Figure 200).
- ◆ The Print Setup Dialog box is similar to that found in many Windows programs. You can use the default printer or select a specific printer from the list of installed devices. For information on installing printer drivers, consult the Windows documentation. The Options button shows more features of the selected printer driver – again, a standard Windows feature.
- ◆ Select the Paper Size and Source. The Landscape format (where the paper is wider than it is tall) is probably the best way to print out data.
- ◆ Click on OK to execute the printer setup selections or Cancel to exit the dialog leaving the original settings unchanged.
- ◆ From the File menu, open the Print window (Figure 201).

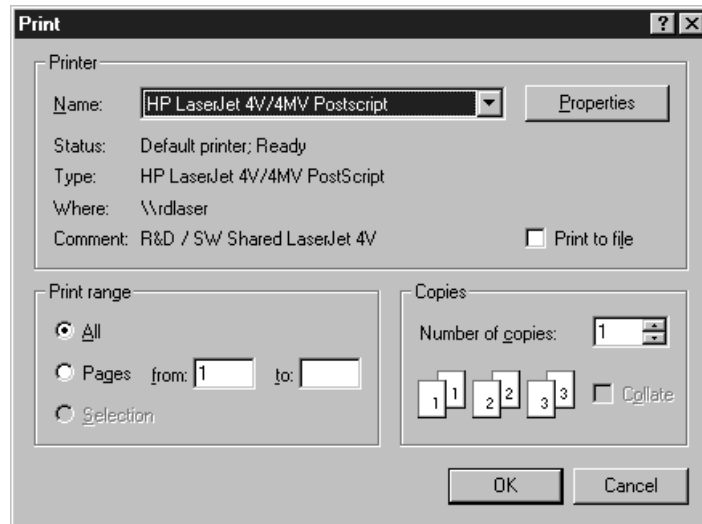
- ◆ Select the number of copies and pages (if a file contains multiple frames, each will be printed as a separate page).
- ◆ Click on OK to initiate the print.

Notes:

Once the Print Setup is properly configured, you can print the active window simply by selecting Print from the File menu (shortcut Alt, F, P) or by clicking on the print icon in the standard toolbar.

Color mapping to the printer may differ from that shown on the screen. To obtain the desired output color mapping, you may wish to do a screen capture and then paste the image into a graphics program for final adjusting before printing.

Figure 201.
Print window.



Print Preview

The Print Preview function gives you a quick idea of how the printed image will look. It produces an “on-screen print” that looks as closely as possible like a “real” print, allowing changes in the printer setup to be made quickly and conveniently. Figure 202 illustrates the Print Preview screen. The function of the individual buttons is as follows.

Print...: Opens the Print screen so that a print can be initiated.

Next Page: If the file contains multiple frames, each one will occupy a different page. The Next Page button allows you to step forward sequentially through all available pages. If the file contains only one image, the Next Page button will be grayed out.

Prev Page: Allows you to step backwards sequentially through the pages of a multiple image file.

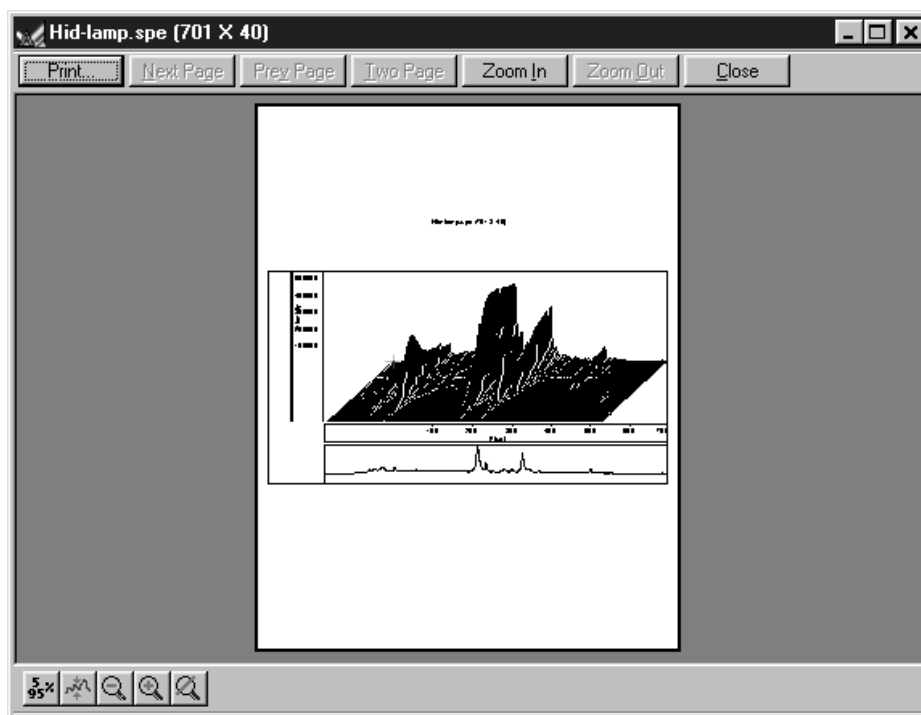
Two Page: Causes two pages to be displayed at a time in a side-by-side layout.

Zoom In: Allows you to zoom in on the previewed page, allowing a selected area to be examined in detail. There are two zoom levels. Note that, if not at full zoom, the cursor becomes a “magnifying glass” if positioned on the image area.

Zoom Out: Allows you to return to the normal (unzoomed) preview display.

Close: Closes the Preview window and returns you to the normal WinSpec/32 display.

Figure 202.
Print PreView
screen.



Printing a Screen Capture

It is also possible to do a screen capture of the entire WinSpec/32 window. This is the best way to capture such information as cross sections, scaling, and color lookup tables. A limitation of screen shots is that the resulting image is based on the resolution of the monitor, not the resolution of the image. For a 1 million pixel CCD, even a 600×800 video mode is not enough to show all the pixel information.

- ◆ Display the desired image or images in WinSpec/32. Click once on the title bar of WinSpec/32 to make this the active window.
- ◆ Hit Alt + Print Screen. This copies the entire contents of the WinSpec/32 window, including image or graph displays and dialog windows, to the clipboard.

Note: Alternatively, key Ctrl C or select Copy on the Edit menu to copy an image to the clipboard. *This function only works on image displays and only on the image itself, i.e., scales and cross section information is not transferred. However, it has an advantage in that the full resolution of the image is retained.*

Many text editors and graphics programs allow images to be pasted directly from the clipboard. Paint Shop Pro, a shareware program, is one example of an inexpensive program that can edit and save clipboard screen shots.

- ◆ Open the application. Open a new file within that application.
- ◆ Select Paste from the Edit menu. This will place the contents of the clipboard into the application. If the image seems cut off, try opening a bigger blank image before pasting the clipboard. The image is now an 8-bit color or grayscale image.
- ◆ Crop the image, if desired. This feature is available in almost any image editing program.
- ◆ Select Print from the File menu. Print the file.
- ◆ Save the file, if desired. TIFF is an excellent image format for either grayscale or color shots.

Note: Screen-capture images lose the high dynamic range of the original. The Copy function (Ctrl C) retains the full resolution of the data file.

Saving as TIF and Printing

It is also possible to save an image file directly to the TIFF format by using the Save As function on the File menu. The resulting *.tif file could then be copied to a graphics editing program for further processing and then printed.

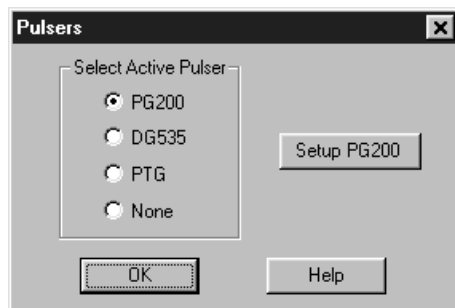
Chapter 19

Pulser Operation

Three different pulser/timing generators are available for use with WinSpec/32. To be available, pulser support must have been installed as described in the Installation chapter. Pulser support is then accessed by selecting **Pulsers** on the **Setup** menu and then selecting the pulser to be used with the system. Available selections include the PI PG-200 Pulser, the PI Programmable Timing Generator (PTG) plug-in module for the ST-133 (high power ver 3+) and the Stanford Research Systems DG-535 Digital Delay/Pulse Generator with Inhibit Option.

The Model PG-200 is available for all Princeton Instruments intensified detectors except the PI-MAX Intensified CCD Camera, which requires the PTG or DG-535. All three pulser/timing generators are programmable from WinSpec/32. Consult the applicable hardware manuals for detailed instructions on setup and connection to other devices.

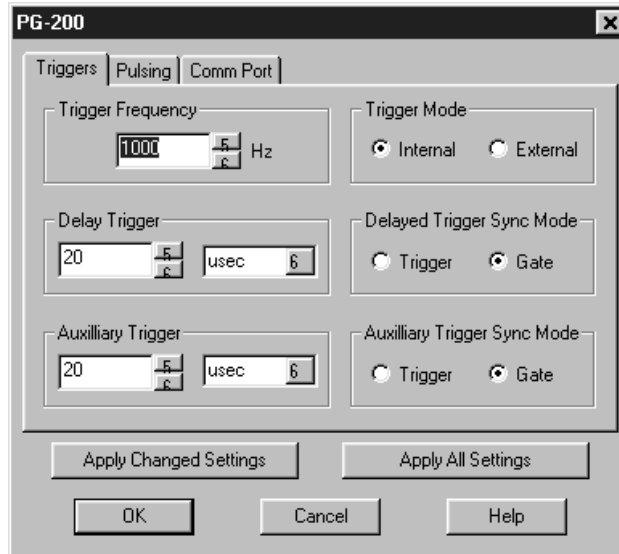
Figure 203.
Pulsers dialog
box.



PG-200 Programmable Pulse Generator

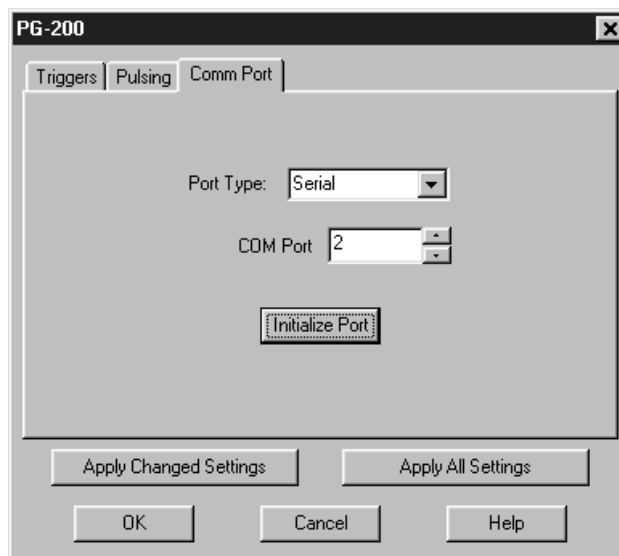
The PG-200 is programmed via one of the serial ports of the computer, such as COM1 or COM2. The choices provided by the tab pages are the same ones that are available using the PG-200 front panel. Basic PG-200 operation is reviewed in the following procedure.

Figure 204.
PG-200
window.



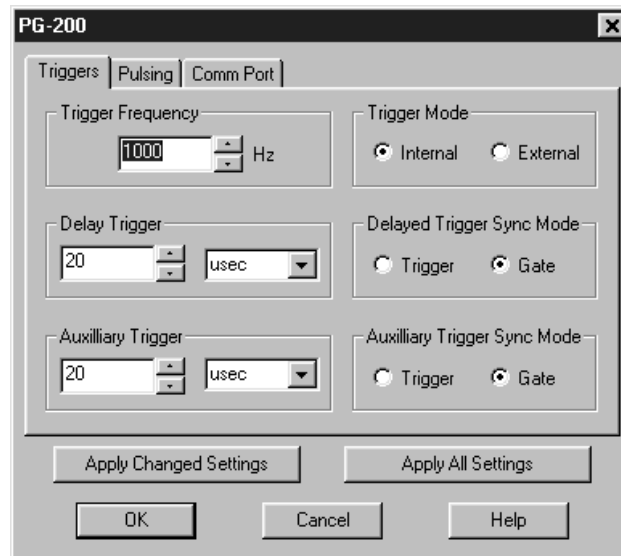
- ◆ Make sure the PG-200 is connected to one of the serial ports of the computer. Later you will tell WinSpec/32 the name of this port (COM1, COM2, etc.). The software cannot automatically detect the location of the PG-200.
- ◆ Following the intensifier precautions listed in the hardware manuals, turn on the PG-200 Pulser and wait for it to initialize. If the PG-200 isn't turned on, the WinSpec/32 software cannot program it.
- ◆ Select **Setup**, then **Pulsers**, then **PG-200**. Then click on the **Setup PG-200** button to open the PG-200 window (Figure 204). *If PG-200 is grayed out on the **Pulsers** dialog box, PG-200 pulser support has not been installed.*
- ◆ Click on the **Comm Port** tab to bring the Comm Port tab page to the front (Figure 205).

Figure 205.
PG-200 Comm
Port tab page.



- ◆ Select the Comm Port type, **Serial** or **Demo**. **Serial** must be selected to control the PG-200.
- ◆ Select the PG-200 Comm Port. Generally, the mouse is connected to COM1 and the Pulser is connected to COM2. COM ports 1 through 8 can be selected.
- ◆ Once you have selected the correct port, click on **Initialize Port**, which will cause the software to search for the pulser. If it can't find the pulser on the specified port, such as would occur if the pulser were not turned on or if it were connected to a different port, you will get an error message. If this happens, check the cable connections, check that the pulser is powered, or try a different Comm port.
- ◆ Click on the **Triggers** tab to bring the Triggers tab page to the front (Figure 206).

Figure 206.
PG-200
Triggers tab
page.



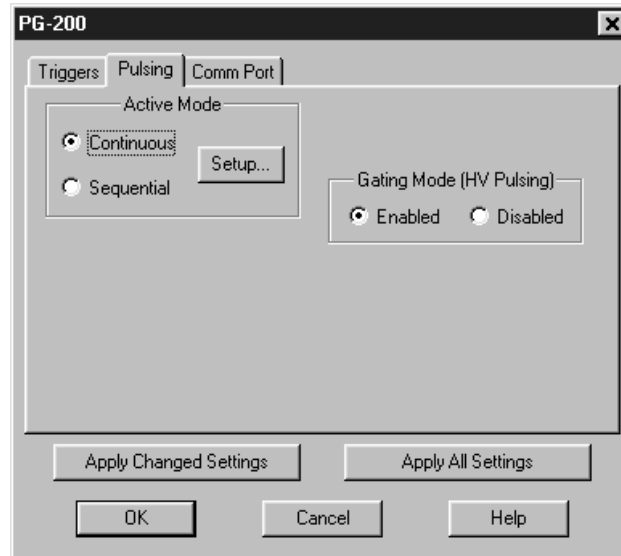
- ◆ Select the Trigger mode, either **Internal**, in which the PG-200 free runs, or **External**, in which it is triggered from an external source.
- ◆ If operating in the Internal trigger mode, set the **Trigger Frequency** in Hz. Consult the PG-200 Manual to determine the maximum Trigger Frequency for a given set of conditions.

The PG-200 **Delay Trigger** and **Auxiliary Trigger** outputs, are programmed from the Triggers tab page. They produce trigger outputs that are synchronized to and delayed from the trigger (**Trigger Sync** mode) or from the trailing edge of the gate pulse (**Gate Sync** mode). In the Gate Sync mode, as the gate pulse changes its position and width, the trigger outputs remain synchronized with the gate, moving with it. In the Trigger Sync mode, the trigger outputs do not sweep with the gate but maintain their initial position. The Delayed Trigger and Auxiliary Trigger outputs are independently programmable.

- ◆ Set the **Delay Trigger** and **Aux Trigger** initial delay.
- ◆ Set the **Delay Trigger** output to be synchronized to either the **Trigger** or the **Gate** pulse.

- ▶ Set the **Aux Trigger** output to be synchronized to either the **Trigger** or the **Gate** pulse.
- ▶ Click on the **Pulsing** tab to bring the Pulsing tab page to the front (Figure 207).

Figure 207.
PG-200
Pulsing tab
page.



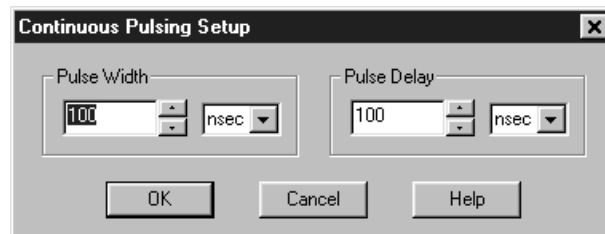
- ▶ Select **Continuous** or **Sequential** and then click on the adjacent **Setup** button. For safety, the **Gating Mode (HV Pulsing)** selection should be **Disabled**.

Note: In setting the PG-200 pulsing parameters, whether for Continuous or Sequential operation, see your PG-200 Manual for pulse width and delay limitations. Note that gate pulses are capacitively coupled in many Princeton Instruments intensified detector heads, so high duty cycles and pulse widths longer than 1 ms may lead to reduced gating efficiency.

Continuous Mode

If **Continuous** is selected, the Continuous Pulsing setup dialog box will appear as shown in Figure 208. In the Continuous pulsing mode, the Pulse Width and Pulse Delay remain constant over the course of the measurement. *See page 297 for additional information.* Set the Pulse Width and Pulse Delay to the desired values and click on **OK**. The Continuous Pulsing Setup dialog box will close and you will return to the PG-200 window.

Figure 208.
Continuous
Pulsing Setup
dialog box.



Sequential Mode

If Sequential is selected, the Pulse Sequence Setup dialog box will appear as shown in Figure 209. In the Sequential Pulsing mode, the Pulse Width and Pulse Delay do not remain constant but change either linearly (**Fixed**) or exponentially as the measurement progresses. **Fixed** is suited to sweeping over a time interval to locate and recover an event that takes place at the same time with each iteration. **Exponential** is well suited to fluorescence decay experiments where the effect under study changes rapidly at the start of an experiment and then slower and slower, following a logarithmic curve, as the experiment progresses. *See page 400 for a detailed discussion of the pulse sequence setup parameters.* In any case, if the measurement is to be done in the sequential pulsing mode, set the pulsing parameters as appropriate for your intended measurement and click on **OK**. The Pulse Sequence Setup dialog box will close and you return to the PG-200 window.

Figure 209.
PG-200 Pulse
Sequence Setup
dialog box.

- ◆ Click on the **Pulsing** tab to bring the Pulsing tab page to the front.
- ◆ Select **Gating Mode (HV Pulsing) Enabled** to start gating the intensifier. Be sure you have followed all intensifier precautions stated in the hardware manuals before making this selection.
- ◆ Click the **Apply Changed Settings** button. This writes all changed parameters to the PG-200. It may take several seconds, depending on the number of parameters that have been changed. To set *all* of the parameters, click on the **Apply All Settings** button.
- ◆ Click on **OK** to close the window.

Programmable Timing Generator (PTG)

Unlike the PG-200 and the DG-535, the PTG is not a free-standing instrument but rather a plug-in module designed for installation in a special version of the ST-133 Controller. This novel and highly integrated approach to timing generator design, with its advanced high-speed electronics, low insertion delay and programmable functions, achieves superior performance as the ultimate gate controller for the PI-MAX Intensified Camera.

Basic PTG operation is reviewed in the following procedure. The individual tab page selections are discussed in detail in Chapter 21, *Menus and Dialog Boxes*.

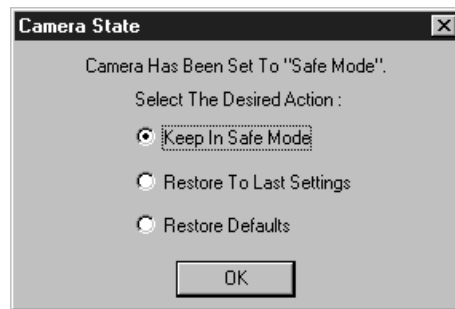
Note: The gate functions of the PI-MAX camera are controlled by the PTG. If the system is equipped with a PI-MAX camera, the Camera State dialog box (Figure 219) will appear when the software is started. Although the software always initially places the PI-MAX in Safe mode, the user has the option of restarting with the last settings or reverting to the factory defaults, which are:

Mode: Safe

Exposure Time: 10 ms

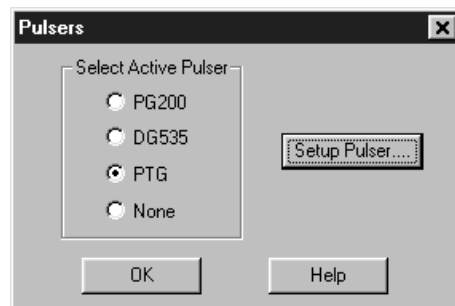
Intensifier Gain: precisely midrange (128 on arbitrary 1 to 256 Intensifier Gain scale).

Figure 210.
Camera State
dialog box.



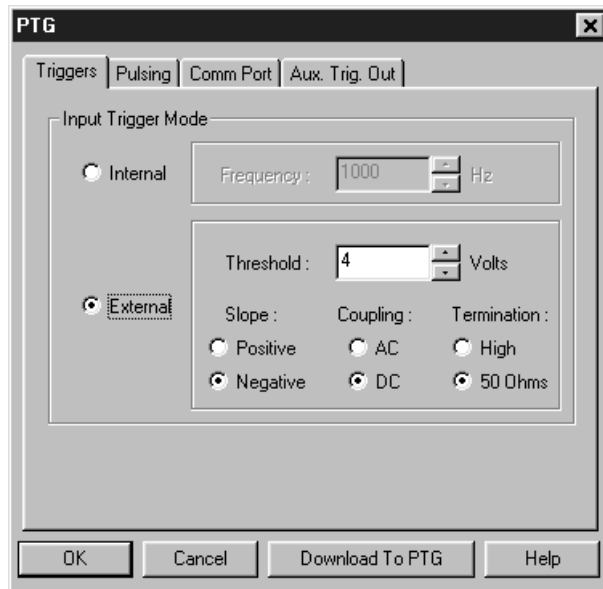
- ◆ Following the intensifier precautions stated in the hardware manuals, turn on the Controller (PTG installed). *If the Controller isn't turned on, the WinSpec/32 software won't be able to control the PTG.*
- ◆ On the **Setup** menu select **Pulsers** to open the Pulsers dialog box.

Figure 211.
Pulsers dialog
box.



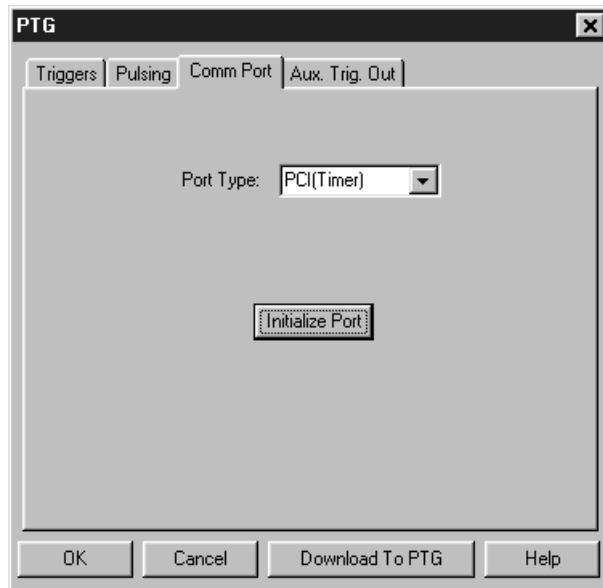
- ▶ Select **PTG**. Then click on the **Setup Pulser** button. The PTG window (Figure 212) will open. *If PTG is grayed out on the **Pulsers** dialog box, PTG support has not been installed.*

Figure 212.
PTG window.



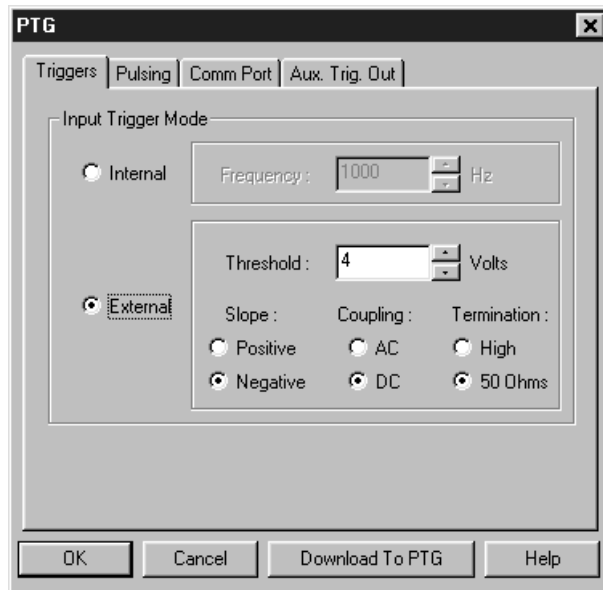
- ▶ Click on the **Comm Port** tab to bring the Comm Port tab page (Figure 213) to the front.
- ▶ Make the Port Type selection. *Interface selections are described in detail on page 92.*

Figure 213.
PTG Comm
Port tab page.



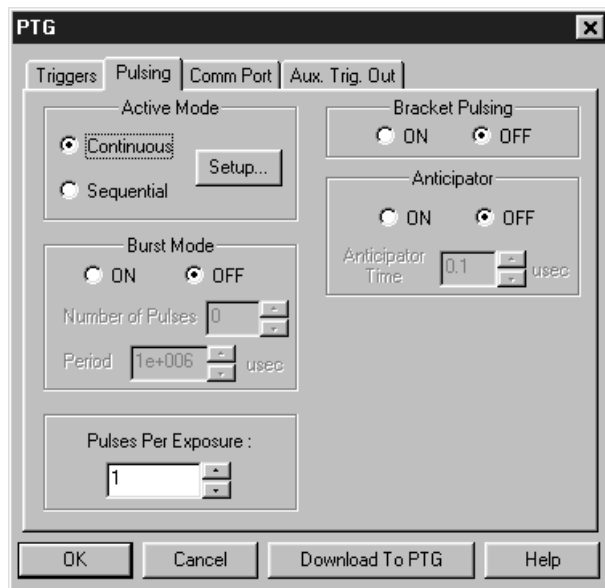
- ▶ Click on **Initialize Port**. If the software cannot find the PTG to initialize it, you will get an error message. If this happens, check the cable connections and check that the Controller is powered.
- ▶ Click on the **Triggers** tab to bring the Triggers tab page (Figure 214) to the front.

Figure 214.
PTG Triggers
tab page.



- ▶ Select the Trigger mode, either **Internal**, in which the PTG free runs, or **External**, in which it is triggered from an external source.
- ▶ If operating in the **Internal** trigger mode, set the trigger **Frequency** in Hz. .
- ▶ If operating in the **External** trigger mode, specify the **Threshold**, **Slope**, **Coupling** and **Impedance** appropriate for the trigger source.
- ▶ Click on the **Pulsing** tab to bring the Pulsing tab page to the front.

Figure 215.
PTG Pulsing
tab page.



- ▶ Select **Bracket Pulsing On** or **Off**.

Note: Bracket pulsing is only useful in low duty factor gated measurements in the UV with the PI-MAX (ICCD-MAX) camera. See your PI-MAX manual (formerly ICCD-MAX manual) for detailed information.

- ▶ If you select Bracket Pulsing ON, next select Anticipator ON or OFF. If ON is selected, then set the Anticipator time.

Note: The Anticipator allows Bracket Pulsing with repetitive external trigger sources. The Anticipator measures the trigger period and then turns on the bracketing pulse timed to lead the photocathode gate pulse by the set interval. For proper operation, the bracketing pulse must begin at least 500 ns before the gate pulse.

The minimum Anticipator Time is 500 ns (or the minimum PI-MAX bracket lead time from EEPROM) *minus* the minimum Pulse Delay time. For example, with a minimum Pulse Delay time of 200 ns, the software would automatically set the Anticipator time to 300 ns.

- ▶ For Burst operation, in which each trigger initiates a burst of gate pulses, select Burst Mode ON and set the number of pulses in the burst and their period.

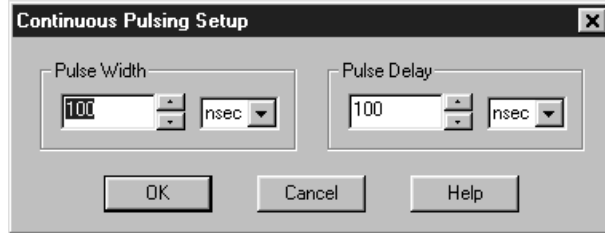
Note: If bracket pulsing and Burst Mode are both selected, the entire burst will be bracketed but not the individual pulses within a burst.

- ▶ Select **Continuous** or **Sequential** and then click on the adjacent **Setup** button.

Continuous Mode

If Continuous is selected, the Continuous Pulsing setup dialog box will appear as shown in Figure 216. In the Continuous pulsing mode, the Pulse Width and Pulse Delay remain constant over the course of the measurement. *See page 297 for additional information.* If operating in the Continuous Pulsing mode, simply set the Pulse Width and Pulse Delay to the desired values and click on **OK**. The Continuous Pulsing Setup dialog box will close and you will return to the PTG window.

Figure 216.
Continuous
Pulsing setup.



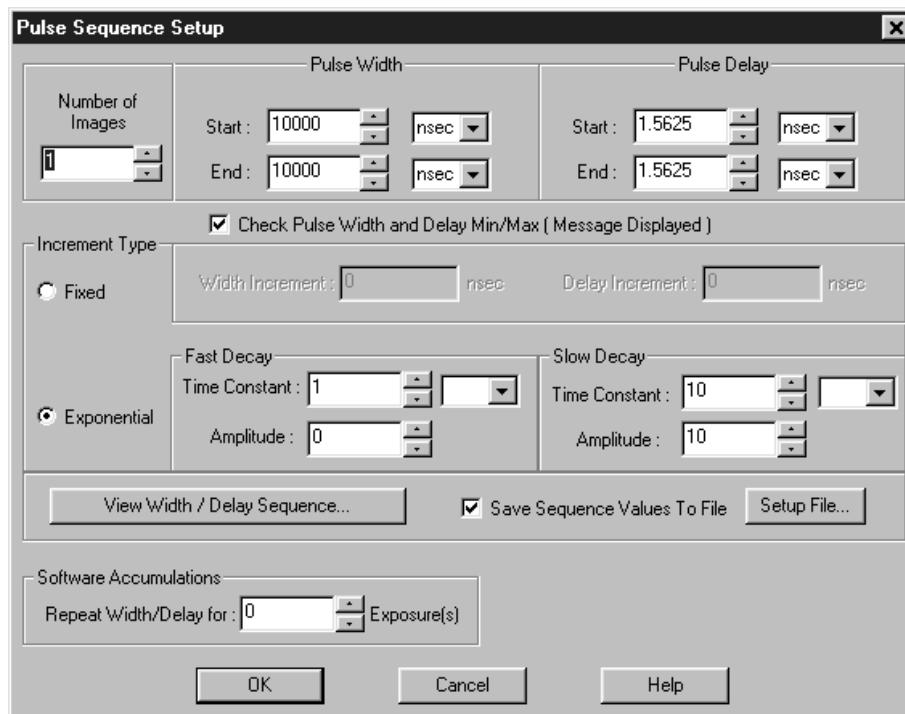
Sequential Mode

If Sequential is selected, the Sequential Pulsing setup dialog box will appear as shown in Figure 217. In the Sequential Pulsing mode, the Pulse Width and Pulse Delay do not remain constant but change either linearly (**Fixed**) or exponentially as the measurement progresses. **Fixed** is suited to sweeping over a time interval to locate and recover and event that takes place at the same time with each iteration. **Exponential** is well suited to fluorescence decay experiments where the effect under study changes rapidly at the start of an experiment and then slower and slower, following a logarithmic curve, as the experiment progresses. *See page 426 for a detailed discussion of the Sequential Pulsing setup parameters.* In any case, if the measurement is to be done in the sequential pulsing mode, set the pulsing parameters as appropriate for your intended measurement and click on **OK**. The Pulse Sequence Setup dialog box will close and you return to the PTG window.

- Click the **Download to PTG** button. This writes all of the parameter values to the PTG.

Note: The PTG can also be controlled interactively as data is being collected. For more information, see the discussion of this feature starting on page 460.

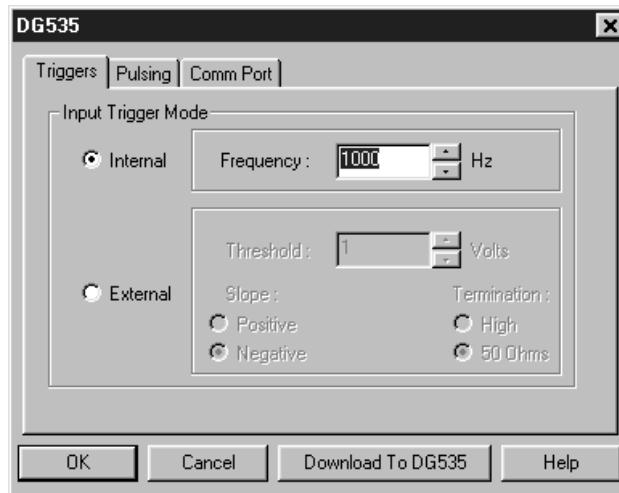
Figure 217.
Pulse Sequence
Setup box.



DG-535 Digital Delay/Pulse Generator

The DG-535 is programmed via the IEEE-488 GPIB port of the computer (default GPIB address is 15). The choices provided by the tab pages are the same ones that are available using the DG-535 front panel. Basic DG-535 operation is reviewed in the following procedure. The individual tab page selections are discussed in detail in Chapter 21, *Menus and Dialog Boxes*.

Figure 218.
DG-535
window.



Note: The DG-535 is used to control the PI-MAX gate functions. If the system is equipped with a PI-MAX camera, the Camera State dialog box (Figure 219) will appear when the software is started. Although the software always initially places the PI-MAX in Safe mode, the user has the option of restarting with the last settings or reverting to the factory defaults, which are:

Mode: Safe

Exposure Time: 10 ms

Intensifier Gain: precisely midrange (128 on arbitrary 1 to 256 Intensifier Gain scale).

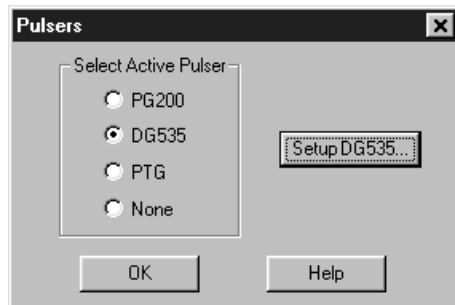
Figure 219.
Camera State
dialog box.



- ◆ Make sure the DG-535 is connected to the computer's IEEE-488 GPIB port. Later you will tell WinSpec/32 the DG-535's GPIB address. *The default setting is 15.*

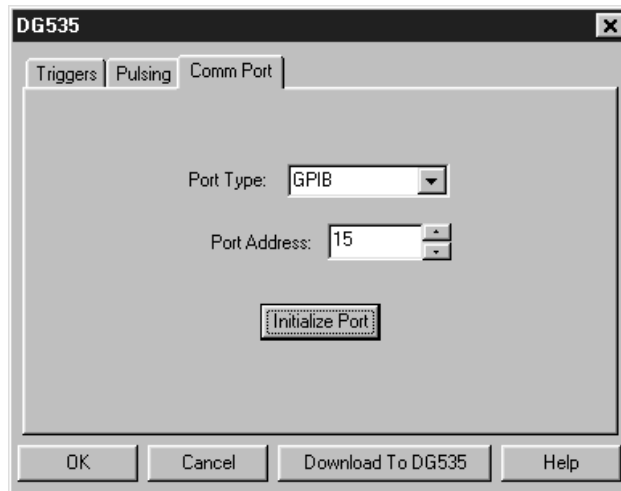
- ▶ Following all intensifier precautions listed in the hardware manuals, turn on the DG-535 and wait for it to initialize. If the DG-535 isn't turned on, the WinSpec/32 software won't be able to program it.
- ▶ Select **Setup** and then **Pulsers** to open the Pulsers dialog box.

Figure 220.
Pulsers dialog
box.



- ▶ Select **DG-535**. Then click on the **Setup DG-535** button. The DG-535 window shown in Figure 221 will open.
- ▶ Click on the **Comm Port** tab.
- ▶ For the Port Type select GPIB. Then set the **Port Address** to the GPIB address of the DG-535. *Default setting is 15.*
- ▶ Once you have selected the correct port address, click on **Initialize Port**. If the software cannot find the pulser on this port, such as if the pulser is not turned on or if the address setting incorrect, you will get an error message. If this happens, check the address, check the cable connections and check that the pulser is powered.

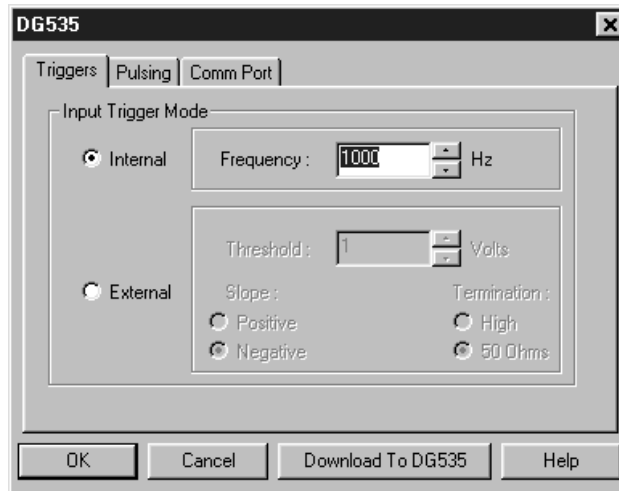
Figure 221.
DG-535
window.



- ▶ Click on the **Triggers** tab to bring the Triggers tab page (Figure 222) to the front.
- ▶ Select the Trigger mode, either **Internal**, in which the DG-535 free runs, or **External**, in which it is triggered from an external source.

- ▶ If operating in the **Internal** trigger mode, set the **Trigger Frequency** in Hz. Consult the DG-535 Manual to determine the maximum Trigger Frequency that can be used in your application.
- ▶ If operating in the **External** trigger mode, specify the **Slope**, **Threshold**, and **Termination** appropriate for the trigger source.

Figure 222.
DG-535
Triggers tab
page.



- ▶ Click on the **Pulsing** tab to bring the Pulsing tab page to the front.
- ▶ Select **Bracket Pulsing On** or **Off**.

Note: Bracket pulsing is only useful in low duty factor gated measurements in the UV with the PI-MAX (ICCD-MAX) camera. See your PI-MAX manual (formerly ICCD-MAX manual) for detailed information.

- ▶ Select **Continuous** or **Sequential** and then click on the adjacent **Setup** button.

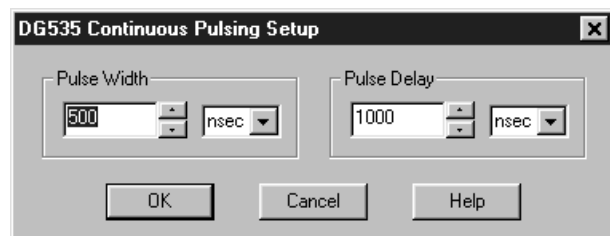
Figure 223.
DG-535
Pulsing tab
page.



Continuous Mode

If Continuous is selected, the Continuous Pulsing setup dialog box will appear as shown in Figure 224. In the Continuous pulsing mode, the Pulse Width and Pulse Delay remain constant over the course of the measurement. *See page 297 for additional information.* If operating in the Continuous Pulsing mode, simply set the Pulse Width and Pulse Delay to the desired values and click on **OK**. The Continuous Pulsing Setup dialog box will close and you will return to the DG-535 window.

Figure 224.
DG-535
Continuous
Pulsing setup.



Sequential Mode

If Sequential is selected, the Sequential Pulsing setup dialog box will appear as shown in Figure 225. In the Sequential Pulsing mode, the Pulse Width and Pulse Delay do not remain constant but change either linearly or exponentially as the measurement progresses. **Linear** is suited to sweeping over a time interval to locate and recover and event that takes place at the same time with each iteration. **Exponential** is well suited to fluorescence decay experiments where the effect under study changes rapidly at the start of an experiment and then slower and slower, following a logarithmic curve, as the experiment progresses. *See page 328 for a detailed discussion of the Sequential Pulsing setup parameters.* In any case, if the measurement is to be done in the sequential pulsing mode, set the pulsing parameters as appropriate for your intended measurement and click on **OK**. The Pulse Sequence Setup dialog box will close and you return to the DG-535 window.

Figure 225.
DG-535 Pulse
Sequence Setup
dialog box.

Pulse Sequence Setup

Number of Images: 1

Pulse Width
Start: 500 nsec
End: 10000 nsec

Pulse Delay
Start: 1000 nsec
End: 100000 nsec

Check Pulse Width and Delay Min/Max (Message Displayed)

Increment Type
 Fixed
Width Increment: 0 nsec
Delay Increment: 0 nsec

Exponential
Fast Decay
Time Constant: 1 usec
Amplitude: 0

Slow Decay
Time Constant: 10 usec
Amplitude: 10

View Width / Delay Sequence... Save Sequence Values To File Setup File...

Software Accumulations
Repeat Width/Delay for: 0 Exposure(s)

OK Cancel Help

- ▶ Click the **Download to DG-535** button. This writes all of the parameter values to the DG-535.
- ▶ Click on **OK** to close the window.

Note: The DG-535 can also be controlled interactively as data is being collected. See the discussion of the timing generator interactive functions starting on page 460.

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Custom Toolbar Settings

Introduction

The Custom Toolbar feature of WinSpec/32 allows the user one-button access to many features or combinations of features available through the software. The Custom Toolbar layout and the number of buttons displayed on the Custom Toolbar can easily be changed.

Displaying the Custom Toolbar

- ◆ To make the Custom Toolbar visible, select Toolbars and then Custom on the View menu. The Custom Toolbar will appear on the desktop and its default configuration will be as shown in Figure 226. See **Custom Toolbar button descriptions** on page 308 for information about the button functions.
- ◆ The position of the Custom Toolbar, its layout, and the number of buttons it contains can be changed by the user.

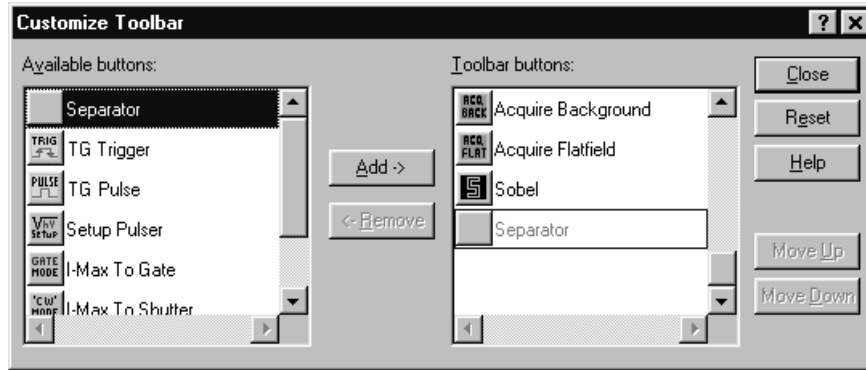
Figure 226.
The default
Custom
Toolbar.



Customizing the Toolbar

Although the Custom Toolbar defaults with the buttons shown in Figure 226, many additional buttons are in fact available and can be added to the button using the Customize Toolbar dialog box (Figure 227). Buttons can be added or removed at any time and the new configuration will be saved when the dialog box is closed.

Figure 227.
The Customize
Toolbar
assignment
dialog box.



Adding an Available Button

- ◆ Open the Customize Toolbar dialog by clicking on Custom Toolbar in the Setup menu.
- ◆ Referring to Figure 227, note that the buttons available for placement on the Custom Toolbar are listed on the left. Buttons already on the toolbar are on the right.
- ◆ To add an available button to the Custom Toolbar, first select it from the left-hand list. You may have to scroll through the list of available buttons to find the one you want. You can choose where to place the button by selecting a button on the *right* side (which will then be highlighted). The new button will be placed *before* the highlighted one.
- ◆ Click on the Add button. The button will disappear from the list of Available buttons and will be added to the list of Toolbar buttons.
- ◆ Click on Close to close the dialog box.

Removing a Button

- ◆ Open the Customize Toolbar dialog by clicking on Customize Toolbar in the Setup menu.
- ◆ Referring to Figure 227, note that buttons already on the toolbar are listed on the right. Available but unused buttons are listed on the left.
- ◆ To remove an available button from the Custom Toolbar, first select it from the right-hand list. You may have to scroll through the listed buttons to find the one you want.
- ◆ Click on the Remove button. The button will disappear from the list of Toolbar buttons and will be added to the list of Available buttons.
- ◆ Click on Close to close the dialog box.

Individual Dialog Item Descriptions

Available Buttons: You can select the button you wish to add to the Custom Toolbar from this section. Many buttons, each with its own preassigned function as described below, are available.

Toolbar Buttons: These are the buttons that will actually appear on the Custom Toolbar.

Add: Causes the selected button on the Available buttons list to be transferred to the Toolbar buttons list before the selected button.

Remove: Causes the selected button on the Toolbar list to be transferred to the Available buttons list.

Close: This button closes the Custom Toolbar Assignment dialog box and implements changes made to the Custom Toolbar.

Reset: Restores the default Custom Toolbar configuration.

Help: This button opens the online help for the Custom Toolbar.

Move Up: Together with Move Down, Move Up determines the position of a given button on the Custom Toolbar. Each time this button is clicked, the selected button on the Toolbar buttons list moves up one position.

Move Down: Together with Move Up, Move Down determines the position of a given button on the Custom Toolbar. Each time this button is clicked, the selected button on the Toolbar buttons list moves down one position.

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Part 3

Reference

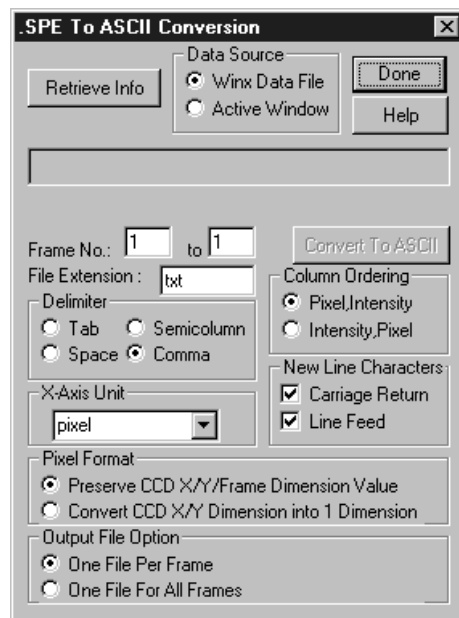
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Menus and Dialog Boxes

.SPE to ASCII Conversion dialog box

Figure 228.
.SPE to ASCII
Conversion.



The WinX32 .SPE to ASCII Conversion Snap-In converts WinX *.spe image files to ASCII.

Note: When frames are converted and the output option is **One File Per Frame**, the resulting filenames will include the frame numbers. For example, an input file of HID-LAMP, selection of frames 4-6, and **One File Per Frame** will result in output names of HID-LAMP[4], HID_LAMP[5] , and HID_LAMP[6] (some versions of this Snap-In append the frame number as _# instead of [#]). If a set of frames is specified and **One File For All Frames** is selected, the output filename will not include a number.

Parameters and Buttons:

Data Source: The selected radio button determines whether the data source will be the currently active WinX32 window or an .SPE file selected via the browser.

Retrieve Info: Retrieves the information from the currently active window or opens a browser for file selection. Located below the button is the text window where the selected file name appears or where it can be entered directly.

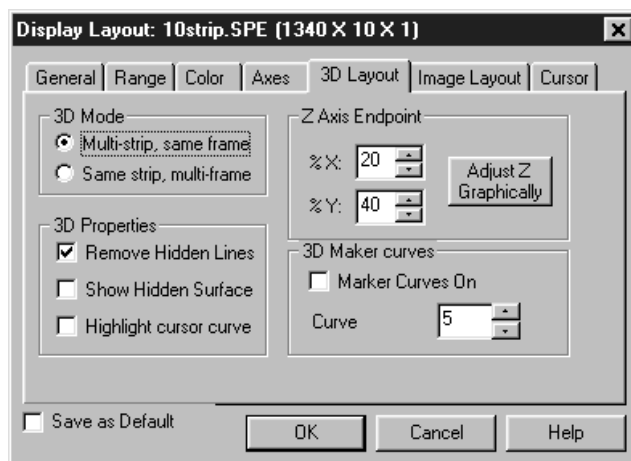
File Box: Displays the name of the file to be converted.

- Frame No.:** Enter the first and last frame number of the frame set to be converted.
- File Extension:** Displays the extension that will be appended to filename. The default is **txt** but a different extension can be entered.
- Delimiter:** The choice of **Tab**, **Space**, **Semicolumn**, or **Comma** radio button determines which one of these delimiters will be used to separate the data words.
- Column Ordering:** Data is converted as two columns (Pixel and Intensity) separated by a delimiter. The **Pixel,Intensity** and **Intensity,Pixel** radio buttons allow you to choose which column will contain the pixel data and which the intensity data.
- New Line Characters:** A check in one or both of these check boxes determines whether a **Carriage Return**, a **Line Feed**, or both will be placed at the end of each line.
- X-Axis Unit:** Select pixels, wavelength, wave numbers, or relative wave numbers for the X-axis units. If the data has not been calibrated, select pixels.
- Pixel Format:** The pixel format will be one of the following, depending on the radio button selection.
- Preserve CCD X/Y/Frame Dimension Value:** Creates a two-dimensional matrix that includes the frame information.
- Convert CCD X/Y Dimension into 1 Dimension:** Removes the frame information.
- Output File Option:** The output data will be stored in one or more files depending on the radio button selected.
- One File Per Frame:** Each frame will be stored in a separate file. If a set of frames was specified, the output filename for each frame will contain the appropriate frame number.
- One File For All Frames:** All frames in the specified frame set will be stored in a single file.
- Convert to ASCII:** Active after data source selection. This button initiates the conversion process.
- Done:** This button closes the dialog box.
- Help:** Opens the context-sensitive help window for the *.SPE to ASCII conversion Snap-In.

3D Layout tab page

When a data file is opened, it can be displayed as an image, as a two dimensional graph (one strip plotted as a function of intensity vs. pixel number), or as a three-dimensional graph (many strips plotted as a function of intensity vs. pixel number), as selected on the Open dialog box or via the Display Layout General page. If 3D Graph is selected, the appearance of the display will be governed by the selections on the 3D Layout tab page. *See Chapter 10 for a general discussion of data display.*

Figure 229. 3D
Layout tab
page.



3D Mode

Multi-Strip, Same Frame: Each curve in the 3D display represents a different strip on the selected frame. Strip one has the lowest Z axis value and the last strip the highest.

Same Strip, Multiframe: Each curve in the 3D display represents the same strip but from different frames. Strip one comes from the first frame and the last strip from the highest.

3D Properties

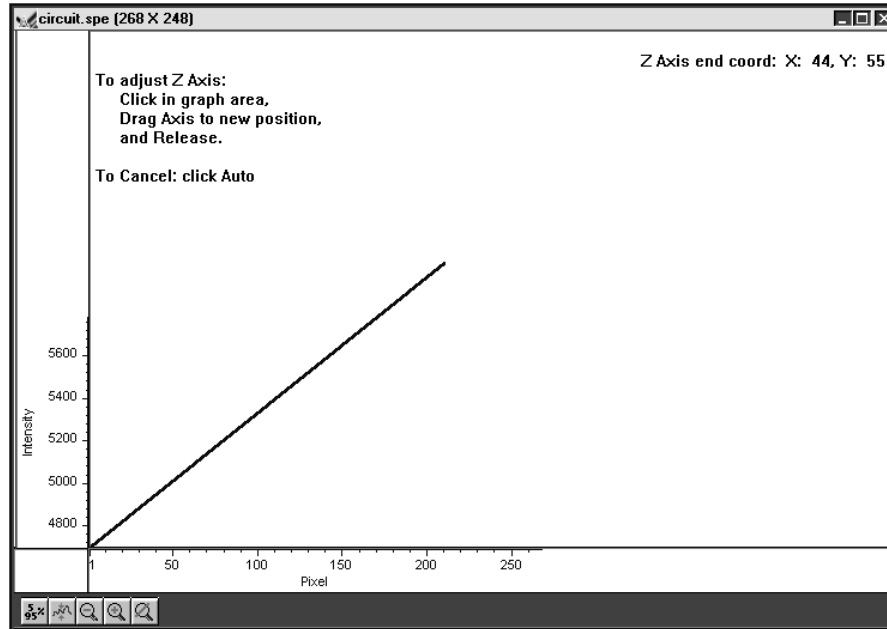
Remove Hidden Line: Prevents hidden lines from displaying (often preferable).

Show Hidden Surface: Causes hidden (underside) surfaces to be displayed in the Normal Hidden Surface color.

Highlight cursor curve: Causes the curve on which the cursor is positioned to be displayed in the Active 3D Graph color.

Z Axis Endpoint: The Z Axis Endpoint can be set by entering values up to 80% X (either polarity) and 80% Y (positive only) or graphically by using the mouse. If you click on Adjust Z Graphically and then on OK, the Z Axis Adjust screen (Figure 230) will appear. To make the adjustment, simply click in the graph area. The data set will appear immediately so that the effects of dragging the axis will be evident, allowing the desired display to be achieved in seconds without need for repeated tries. When working with a high-density data set, only a subset of the data will be displayed during the adjustment so that the process remains fast. When the data is displayed as desired, releasing the button will cause the complete data set to be displayed with the new orientation. Note that you need not confine the drag operation to the data screen area, and in fact, it may be necessary to go outside the area to achieve the desired display. Thus reducing the size of the data window before readjusting the z-axis can make the operation simpler.

Figure 230.
Z Axis Adjust
screen.



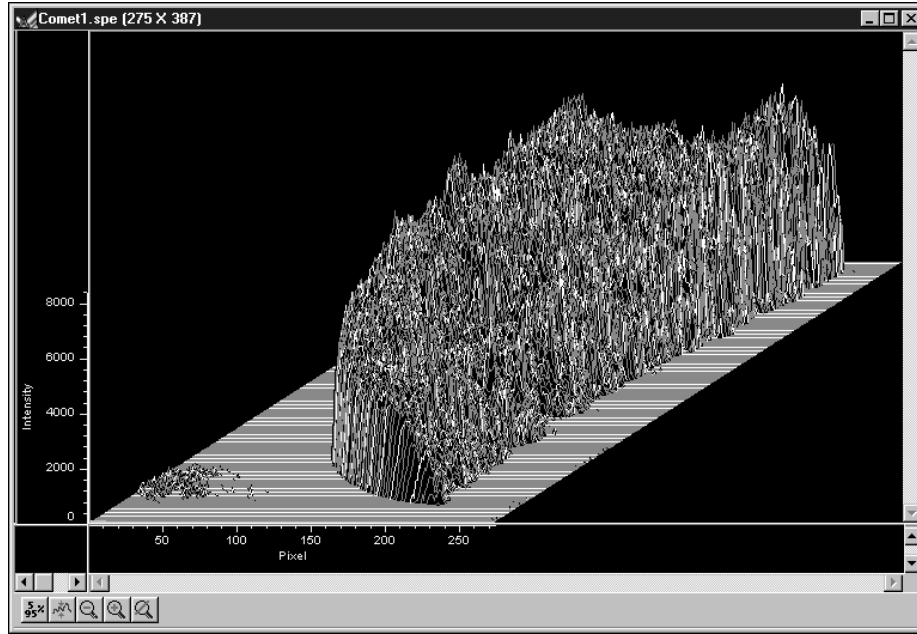
Marker Curves On: Checking the Marker Curves On box will cause every n th curve, where n is the number set in the Curve box, to be drawn in the Marker Graphs color.

Note that the marker graph curves as viewed on the display may not appear to be evenly spaced. This effect stems from the limitations of the display itself. Typically, there are simply not enough pixel rows on the display for each data strip of a 3D display to be assigned a unique row of pixels on the display. When more than one strip is assigned to a row of pixels, some marker curves will be overwritten and not appear. Those that do show may seem to be arranged in clusters as a result of the interference pattern between the array of data strips and display pixel strips.

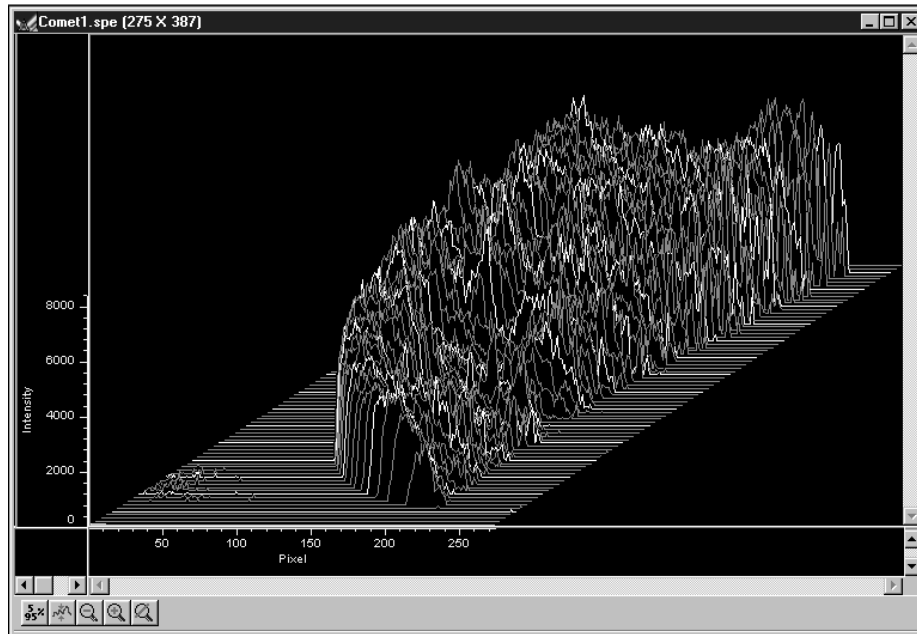
If this is a problem, one solution is to reduce the number of data strips displayed. Figure 231 is a full-range 3D display that shows the phenomenon described above. Figure 232 is a 3D display of the same data file with the same Y range specified, but with the Step By parameter on the Display Layout tab page set to 5. This reduces the number of data curves to be displayed to one fifth their previous number, well within the range of what the display can handle. As can be seen from the figure, the marker curves now appear evenly spaced.

An alternative solution would be to display a subset of the range. For example, instead of displaying a range of 1 to 387, as was the case for these examples, one could, for example, display the data in subsets of 50 lines (1...50, 51...100, 101...150, etc.).

*Figure 231.
Full-range 3D
display, with
markers.*



*Figure 232.
Stepped-range
3D display,
with markers.*



Save as Default check box: Saves settings on all Display Layout tab pages. These settings will be automatically established when the software is started.

Control Buttons:

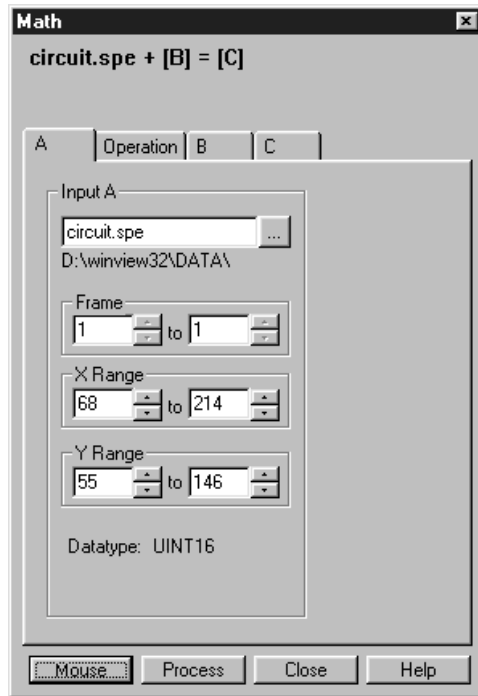
OK: Executes the selections for all tab pages and closes the dialog box.

Cancel: Closes the dialog box without executing any changes.

Help: Opens context-sensitive help for whichever tab page is on top.

A page

Figure 233.
Math A tab
page.



All math operations involve performing operations on the curve specified via the **A** file page. A description of the items on this page follows. *See Chapter 13 for a general discussion of the Math operations.*

Parameters:

Input A: The name of the file to be operated on is entered in this text box. The button at the end of the box opens a browser to facilitate locating and selecting the file.

Frame: If the Input file contains more than one frame, you can select which frames are to be processed. The number of frames in the Output Image will be adjusted to match. The default is to process all frames.

X Range: If you do not want to process the entire Input range, select the range of X values you would like to process. The Output X range will adjust automatically to match. The default is to process all points.

Y Range: If you do not want to process the entire Input data range, select the range of Y values you would like to process. The Output Y range will adjust automatically to match. The default is to process all points.

Datatype: The datatype of the **A** file is reported and cannot be changed.

Control Buttons:

Mouse: Allows you to specify a region to be processed using the mouse. Simply drag a box in the data region of the active window and then click on **Mouse**. The **Frame** and **Range** parameters will assume the values of the defined region. An ROI mismatch error message will appear if the absolute values of the A and B data regions aren't the same. Note that the **Mouse** button is only active when the **A** or **B** tab page is selected.

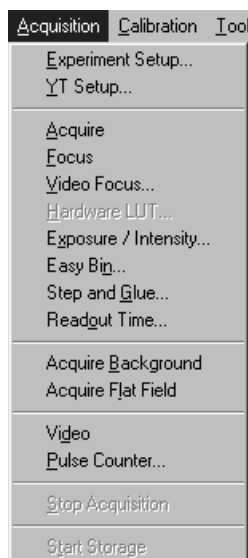
Process: Initiates the selected operation.

Close: Closes the window with no action taken.

Help: Opens context-sensitive help for the active tab page.

Acquisition menu

Figure 234.
Acquisition
Menu.



Experiment Setup...: Opens the Experiment Setup window (page 345).

Y:T Setup...: Opens the Y:T Area and Equations Setup dialog box (page 480).

Acquire: Initiates a data-acquisition run. Equivalent to clicking the Acquire button on the Experiment Dialog box or of clicking on the Custom Toolbar ACQ icon. When selected, every frame of data collected is stored. This mode would ordinarily be selected during actual data collection. One limitation of the mode, however, is that if data acquisition continues too rapidly for data storage to keep up, buffer overflow will eventually occur. This can only happen in Synchronous (Full Speed) operation.

Focus: Initiates a data-acquisition run. Equivalent to clicking the Focus button on the Experiment Dialog box or of clicking on the Custom Toolbar FOCUS icon. When selected, no data is stored until Start Storage is selected. This mode is particularly convenient for familiarization and setting up.

Video **Focus:** On MicroMAX and ST-133 systems with video monitor, opens the Interactive Camera Operation dialog box (page 365) to optimize live data acquisition and allow rapid focusing. Data is not displayed on the computer monitor in Video Focus mode operation.

On PentaMAX systems with a video monitor, opens the Interactive Operation dialog box (page 368) to optimize live data acquisition and allow rapid focusing. Data is not displayed on the computer monitor in Focus mode operation.

On V/ICCD systems, opens the V/ICCD Focus window (page 468) for convenient focusing and image optimization. The image is continuously available at both the video monitor and at the computer monitor.

Hardware **LUT...:** On PentaMAX systems with a video monitor, opens Hardware Look-Up Table selection dialog box (page 356) which determines how video will be mapped to video monitor display. The digital data is not affected.

Exposure/I**ntensity (**M**icroMAX and **S**T-133 only):** Opens the Exposure/Intensity dialog box (page 346), which allows the exposure time and video mapping parameters to be adjusted *while data acquisition is in progress*. The Exposure Time can be adjusted at any time. If RS170 is checked on the Acquisition menu, the RS170 Scaling and offset parameters can also be adjusted.

Easy **Bin:** Opens the Easy Bin dialog box (page 342), which allows a single ROI to be quickly and easily defined.

Step and **Glue:** Opens the Step and Glue dialog box (page 458), which allows the software to control data collection and the movement of the spectrometer to create a glued spectrum. The glued data is collected as a series of incremental files. These files are then glued to create a single glued data file.

Readout **Time:** Opens the Readout Time box (page 435), which displays the calculated Readout Time exclusive of the Exposure Time.

Acquire **Background:** Initiates acquisition of a background data set which can then be subtracted from subsequent experimental data acquisitions. The background acquisition should be done with all parameters set to their data-acquisition values, but without an actual signal source (camera lens capped). *See Chapter 12 for additional information.*

Acquire **Flat **F**ield:** Initiates acquisition of the flat-field data set, which can be used to correct for lack of uniformity over the image area. The flat-field acquisition should be done using an absolutely uniform source of illumination. *See Chapter 12 for additional information.*

Video (M**icroMAX, **S**T-133 or **P**entaMAX only):** Enables live display of the data on a video monitor. In the case of the PentaMAX, data mapping to the monitor is selected via the Hardware LUT dialog box. With a MicroMAX or ST-133 Controller, video mapping is done in software as selected from the Exposure/Intensity dialog box.

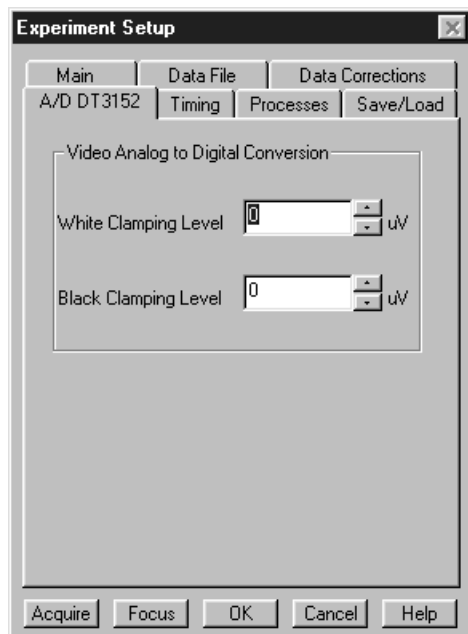
Pulse **Counter:** Opens the Pulse Counter dialog box, which reports the number of PTG gate pulses generated (main plus burst).

Stop **Acquisition:** Terminates data acquisition in progress. Equivalent to clicking on the Custom Toolbar STOP icon.

Start Storage: If acquiring data but not storing it, this selection can be used to initiate data storage. Equivalent to clicking on the *Custom Toolbar* Store (disk) icon.

A/D 3152 tab page

A/D 3152 tab page.



This page only appears in the Experiment Setup Window if the controller is a V/ICCD or a V/ICCD Control box **and** if a Data Translation DT3152 Frame Grabber has been selected as the Frame Grabber type on the Hardware Setup V/ICCD Controller/Detector tab page.

Note: This selection should only be made if the 3152 Frame Grabber has, in fact, been installed in the computer.

A frame grabber digitizes video that falls between the defined *black level* and the *white level*. Any signal below the black level is digitized to black and any that lies above the white level is digitized to white. Voltages in between the two levels are digitized so that they are evenly distributed throughout the range of the A/D converter.

The nominal white level is 1 V and the nominal black level is 0 V. The actual levels are reported on the A/D DT3152 tab page if the Frame Grabber is installed. The nominal levels can be changed by entering the new value directly in the **White Clamping Level** and **Black Clamping Level** text boxes or by using the associated spin buttons.

Control Buttons:

Acquire: Clicking on Acquire initiates a data-collection run in which all data frames are stored.

Focus: Clicking on Focus initiates a data-collection run in which the data is not stored until Start Storage is selected.

OK: Click on OK to save the changes and close the Experiment Setup window without initiating a data collection run.

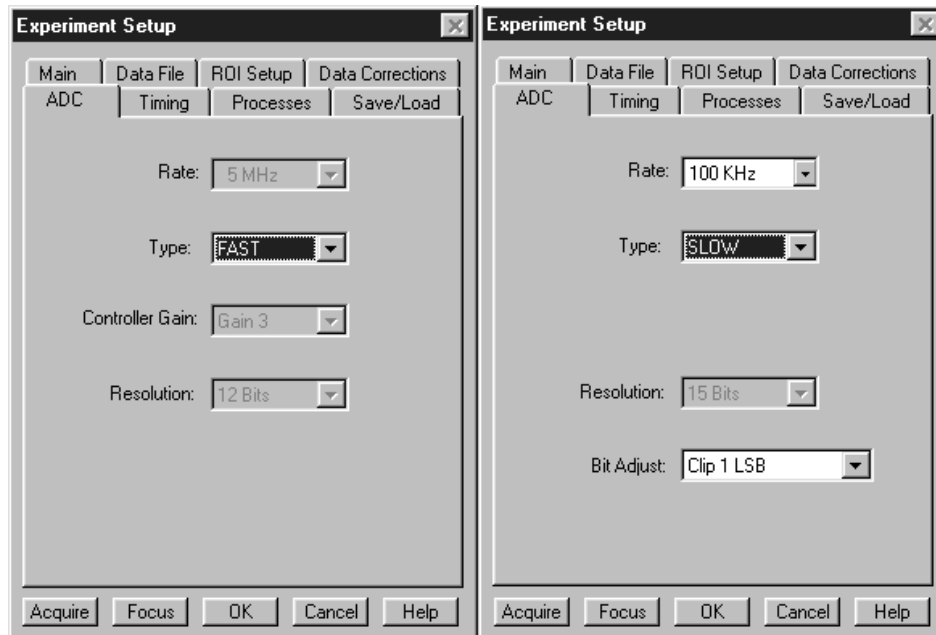
Cancel: Click on this button to close the Experiment Setup window without making any changes.

Help: Opens context-sensitive help for whichever tab page is on top.

ADC tab page

This tab page allows you to make the analog-to-digital (ADC) selections for your system. If your controller has more than one ADC, you will be able to select FAST or SLOW. This selection in turn determines the available rate and resolution selections. A few controllers allow additional ADC parameter control. Note that this page is not provided for all controllers. Specifically, it is not available if the selected controller is a V/ICCD, or V/ICCD Controller Box. Also, where the page is provided, not all parameters will be available for all controller models.

Figure 235.
ADC tab page
(PentaMAX left
and ST-138
right).



Type: If the controller has two ADCs, you will have the choice of selecting FAST or SLOW. If you only have one ADC, FAST or SLOW, whichever applies, will be displayed. Should you attempt to select an uninstalled type, an error message will be displayed. Note that the type selection determines the available values in the rate and resolution selection lists. With a PI-MAX camera, selecting FAST on the A/D page causes the High Capacity preamplifier node to be selected. Conversely, selecting SLOW on the A/D page causes the Low Noise preamplifier node to be selected. The node selection is indicated on the Main page.

Rate: The selected rate is displayed in the box. Clicking on the button at the right of the box drops the list of the available rate selections for the selected ADC to be displayed so that another setting can be selected. Note that not all ADCs offer multiple rates. With a PI-MAX camera, selecting FAST on the A/D page causes the High Capacity preamplifier node to be selected. Conversely, selecting SLOW on the A/D page causes the Low Noise preamplifier node to be selected. The node selection is indicated on the Main page.

Resolution: The selected resolution in bits is displayed in the box. Clicking on the button at the right of the box drops the list of the available resolution selections in bits for the selected ADC to be displayed so that another setting can be selected. Note that not all ADCs offer multiple resolutions.

Controller Gain (PentaMAX only): Displays the controller gain setting. Clicking the button drops down the list of available gain settings so that the setting can be optimized for your particular experiment. Gain 3 is the default setting and gives good results in most measurements.

Bit Adjust (ST-138 only): When reading out data from a 16-bit ADC, the user can choose to discard data bits. If the data is low level, never reaching more than 30,000 counts, then the top bit (the most significant bit or MSB) can be discarded. If the sensitivity at the low end of the detector is not important, then one or two least significant bits can be discarded.

ADC Offset (5 MHz MicroMAX only): The 5 MHz MicroMAX (ST-133) controllers used with the interline cameras employ a programmable DAC (Digital to Analog Converter) to set the offset.* The adjustment can be set directly from software beginning with the release WinSpec/32 ver 2.2. In early 5 MHz controllers, the Offset value will have to be reset at the start of every new software session, change in ADC selection, or if a different offset is desired. In later units, the most recently set Offset value will be stored in non-volatile RAM located in the controller making it unnecessary to change the setting at the start of every software operating session.

Note: There is no recommended offset value at present. It is suggested that adjustments in increments of 50 be used until the mean offset under dark, short exposure conditions is in the range of 10-50 counts. Fine tuning is not essential.

Setting the offset to compensate for long-exposure dark current or to compensate for high signal levels is not recommended, due to the 'apparent' loss of linearity (shown with zero intensities on low, non-zero light levels).

There is no calibration or meaningful units on the Parameter Value, although it tracks the reported counts fairly closely.

* This function was previously performed on the standard MicroMAX with the 'F' and 'S' adjustment screws on the Analog Module panel.

Control Buttons:

Acquire: Clicking on Acquire initiates a data-collection run in which all data frames are stored.

Focus: Clicking on Focus initiates a data-collection run in which the data is not stored until Start Storage is selected.

OK: Click on OK to save the changes and close the Experiment Setup window without initiating a data collection run.

Cancel: Click on this button to close the Experiment Setup window without making any changes.

Help: Opens context-sensitive help for whichever tab page is on top.

Adjust dialog box

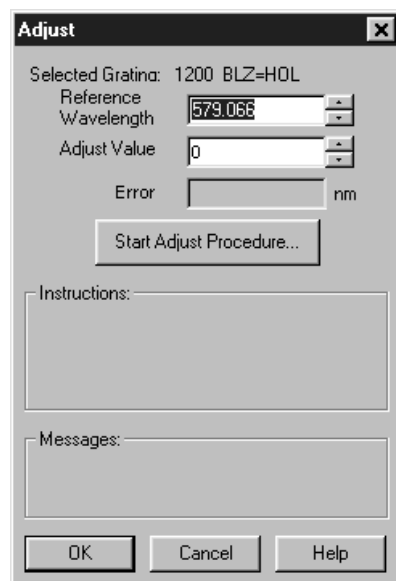
Allows the slope term of the spectrograph calibration to be optimized. Although the linear general equation:

$$y = mx + b$$

is a simplified model of the calibration process, it suffices to show the basic relationships. The “b” term can be thought of as the offset, which is adjusted to place the reference at precisely the center of the array. The location of points away from the reference will be determined by the “m” or slope term (as well as “b”) and the Adjust procedure allows “m” to be set so that adjusting the spectrograph to other wavelengths will result in the those wavelengths falling on the center of the array as well.

Note: The Adjust function is not available for all spectrographs.

Figure 236.
Adjust dialog
box.



Reference Wavelength: This is the setting at which the adjust procedure will be performed. Any atomic line available in the spectrum you're working with can be used. When working with a mercury lamp, after doing the offset adjustment at the zero order, 579.066 is a suitable selection. However, since it is a doublet, it is necessary to check each time that the peak finder has in fact selected the 579.066 line and not the 576 line.

Adjust Value: The correct initial value for this parameter is zero. Do not enter the adjust value provided in the spectrograph manual. The adjust value will be calculated and displayed during the Adjust procedure.

Error: This is the computed error in nm. Usually you will want to repeat the Adjust computation at least two or three times to get the error as small as possible. It should be possible to reduce it to much less than a pixel, keeping in mind that the number of nm represented by a single pixel will depend on the pixel size and on the grating dispersion.

Start Adjust Procedure: Click on this button to initiate the Adjust procedure. Note that the name of the button changes to **Continue** after the first Adjust cycle is completed.

Control Buttons:

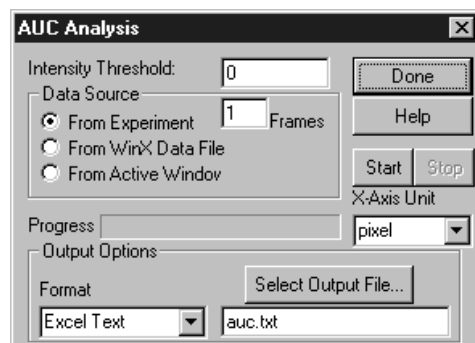
OK: Closes the dialog box and saves the adjust data for the selected grating in the Registry.

Cancel: Closes the dialog box without executing any selections or changes.

Help: Opens context sensitive help for the dialog box.

Area Under Curve dialog box

Figure 237.
Area Under
Curve dialog
box.



The Area Under Curve (AUC) Snap-In computes the area of every pixel that is above the set threshold. The computation results, including the sum of the individual areas, are reported in a data window that can be saved as either an Excel text file or as a standard text file.

Parameters

Intensity Threshold: Sets the level above which areas will be computed.

Data Source

From Experiment: Data will be taken directly from the experiment. The associated Frames box allows the user to specify the number of data frames for which the area calculations are to be made.

From WinX Data File: Data will be taken from a previously stored file. This selection extends the AUC dialog box to include a browser so that the data file can be selected.

From Active Window: Data will be taken from active window. *If there are multiple data windows open, the active one is the one having the highlighted title bar.*

X-Axis Units: Pixels, wavelength (nm), wave numbers (cm^{-1}) or relative wave numbers (rel cm^{-1}) can be selected.

Start: Click on this button to begin the area computations.

Stop: Click on this button to halt the area computations.

Output Options:

Format: You have the choice of two output formats, Standard Text File or Excel Text File.

Select Output File: Opens a browser a convenience in naming the output file. File name can also be directly entered via the adjacent text entry window.

Progress: Indicates calculations progress.

Help: Opens context-sensitive help for the AUC Analysis snap-in.

Aux Trig Out tab page

See **PTG Aux Trig Out** tab page on page 420.

Axes

Data displayed as an image or as a graph can be displayed with scaled axes. In the case of an image display, the X axis is scaled in pixels and the Y axes in strips. For data displayed as a graph, the X axis is scaled in pixels as the default and the Y axis in intensity. For spectroscopy, the user may choose more convenient units, such as nm or wave numbers. Axes can be turned on or off via the Axes selection on the View menu, via the Display Layout General tab page, or via the Display Layout Axes tab page. The Display Layout Axes tab page additionally allows the axes labels to be specified by the user. Note that the font used for the scales and labels is that selected via the Font dialog box, accessed by selecting **Fonts** on the Display Layout Axes tab page. True type and Type 1 (PostScript) fonts are automatically rotated 90° for Y axis labels. In general, the Arial font has been shown to be a suitable selection. Figure 238 shows a typical image display with axes and cross-sections. The color bar and info bar are also shown.

If **Colorbar** has been selected on the Display menu, the Data Window Context menu or on the Image Display tab page, a colorbar containing the image colors appears above the image with numbers that indicate the actual range. Similarly, if **Infobar** has been selected on the Display menu, Display Layout General tab page, or Data Window Context menu, the X, Y, Z and Intensity values at the cursor position will be listed on the infobar, which is located directly beneath the Data Window button bar. *The infobar information is displayed for both image and intensity (graph) displays and appears even if the cursor isn't displayed.*

Figure 239 similarly shows a 3D graph display with axes and cross sections. The X, Y, Z and I values at the cursor position are also indicated below the Data Window button bar when displaying the data graphically. *See Chapter 10 for additional information on data display.*

Figure 238.
Typical Image
display with
axes and cross-
sections.

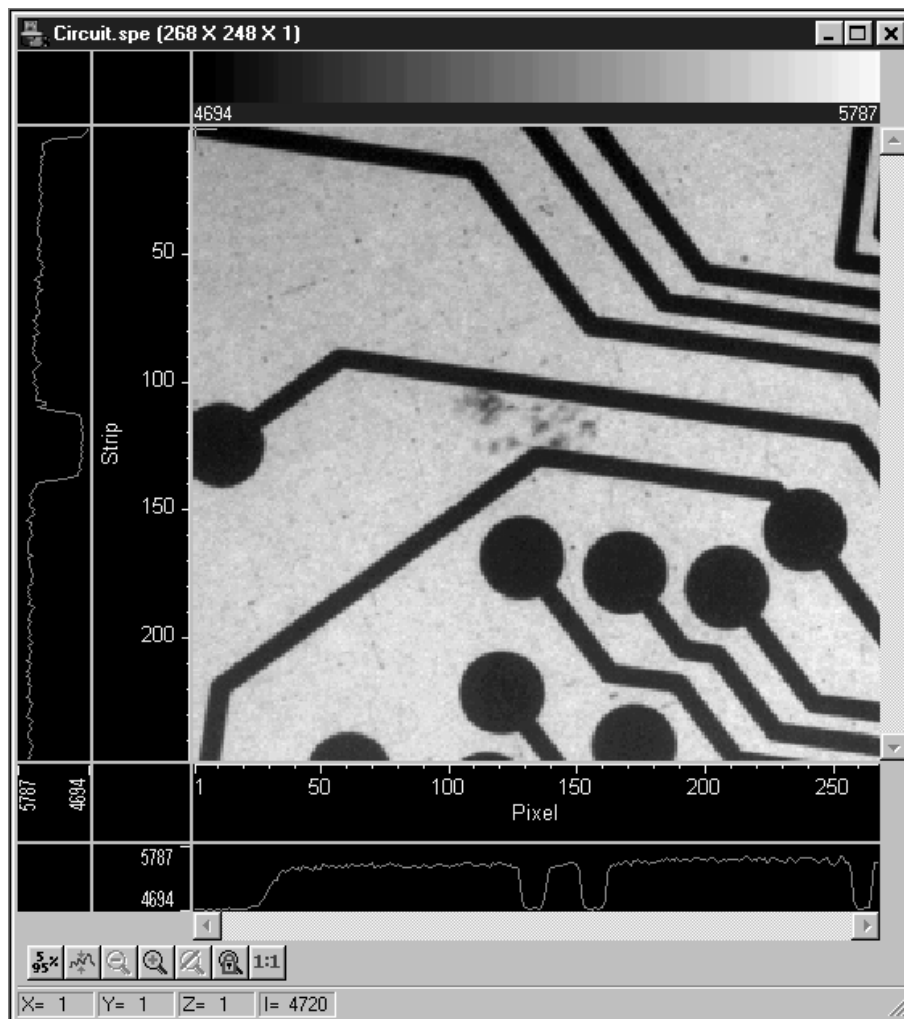
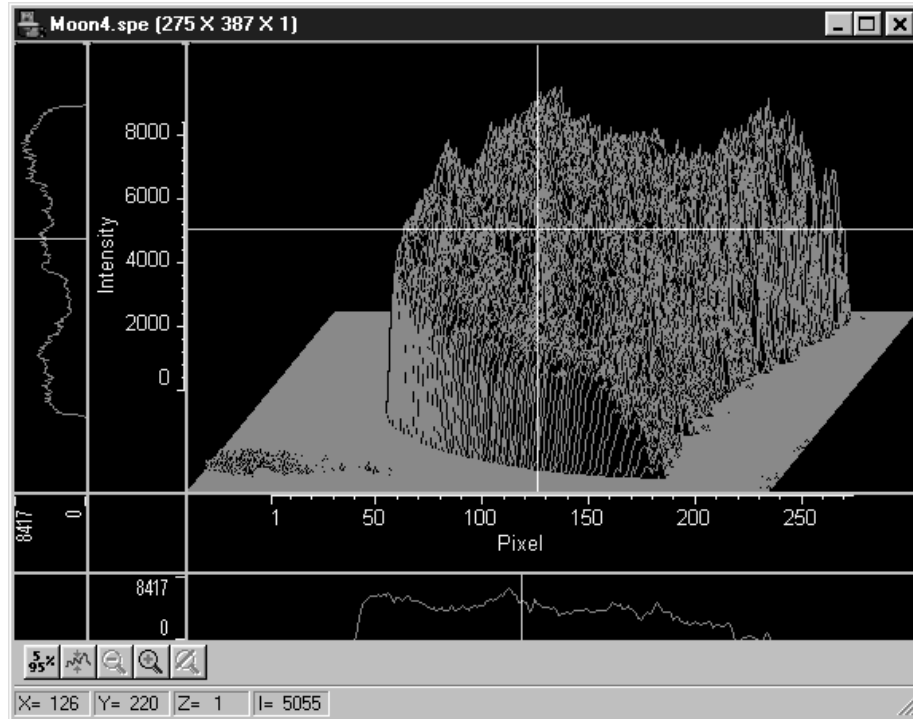


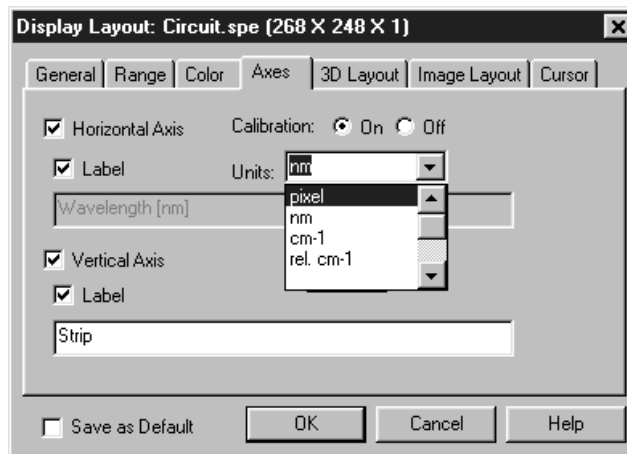
Figure 239.
Typical data
display as
graph with
cross-sections.



Axes display layout tab page

This page allows you to select whether the axes will be displayed. If displayed, it also allows you to specify a label string for each axis. *See Chapter 10 for additional information on data display.*

Figure 240.
Axes display
layout tab
page.



Horizontal Axis & Vertical Axis check boxes: If either box is checked, both axes will be displayed. This is equivalent to checking either axis box on the Display Layout General tab page.

Calibration On/Off radio buttons: Allows the axis calibration to be turned **On** or **Off** when displaying data as a graph. If **On**, additionally allows you the choice of **pixels**, **wavelength**, **wave numbers** or **relative wave numbers**.

Label: If the axes are selected for display, the label boxes become active. If checked, the label string entered in the accompanying text box will be displayed on the corresponding axis.

Fonts: Opens the Fonts selection dialog box. The selected font type and style is used for the axes labels and scales. Only TrueType and Type 1 (Postscript) fonts can be rotated.

Save as Default check box: Saves settings on all pages. These settings will be automatically established when software is started.

Control Buttons and Functions:

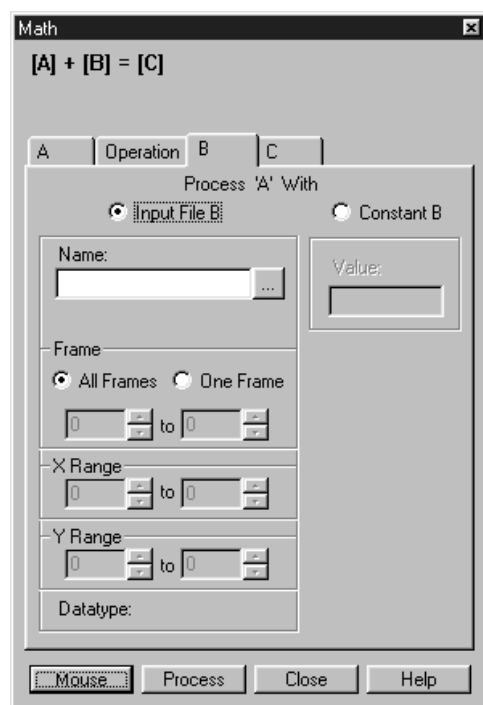
OK: Executes the layout settings and closes the Display Layout window.

Cancel: Closes the Display Layout window without implementing any of the changes.

Help: Opens context-sensitive help for whichever tab page is on top.

B page

Figure 241.
Math B tab
page.



In those math operations which involve two files or one file and a constant, the second input file (or the constant) is specified via the **B** tab page. A description of the items on this page follows. See Chapter 13 for a discussion of the Math operations.

Note: When performing math with two files, the length and width of the data regions to be processed must be the same. The two regions don't have to be congruent, but their length and width must be equal.

Parameters

Input File B vs. Constant B: These radio buttons determine whether **B** will be a file or a constant. If **Constant B** is selected, the value of the constant can be entered in the associated box. If **Input File B** is selected, the name of the second input file is entered in the **Name** text box. The button at the end of the box opens a browser to facilitate locating and selecting the file.

Frame: If the **B** Input data file contains more than one frame, you can select which frames are to be processed. The number of frames in the Output file will be adjusted to match. The default is to process all frames.

X Range: If you do not want to process the entire Input data range, select the range of X values you would like to process. The Output X range will adjust automatically to match. The default is to process all points.

Y Range: If you do not want to process the entire Input data range, select the range of Y values you would like to process. The Output Y range will adjust automatically to match. The default is to process all points.

Datatype: The datatype of the **B** file is reported and cannot be changed.

Control Buttons:

Mouse: Allows you to specify a region to be processed using the mouse. Simply drag a box in the data region of the active window and then click on **Mouse**. The **Frame** and **Range** parameters will assume the values of the defined region. An ROI mismatch error message will appear if the absolute values of the A and B data regions aren't the same. Note that the **Mouse** button is only active when the **A** or **B** tab page is selected.

Process: Initiates the selected operation.

Close: Closes the window with no action taken.

Help: Opens context-sensitive help for the active tab page.

Binning and Skipping (post processing)

General discussion: Chapter 17.

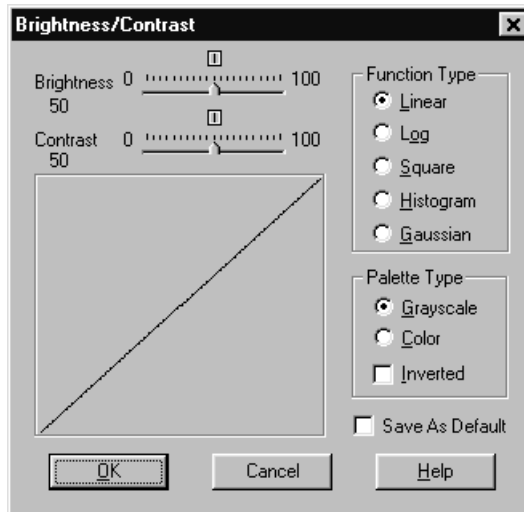
Input tab page: pg. 362

Parameters tab page: pg. 387

Output tab page: pg. 386

Brightness/Contrast dialog box

Figure 242.
Brightness/Contrast dialog box.



The Brightness/Contrast dialog box, opened by selecting Palette on the Display menu, allows you to adjust the brightness and contrast of the active image. Five different transfer functions of monitor-brightness versus pixel value can be selected. Because CCD images can span a very wide brightness range and may contain complex features in both the brightest and faintest areas, linearly mapping pixel values to display brightness may not provide the best display of all of an image's features. The five transfer functions provided allow the display to be tailored to the characteristics of the image, allowing the more obscure features to be better observed than might otherwise be the case.

A plot of the function selected that includes the effect of the brightness and contrast settings is displayed. The effect of changing the contrast/brightness or selecting a different transfer function can immediately be seen in the displayed image. At the same time, the displayed transfer function curve changes to reflect the settings. It is important to keep in mind that these adjustments have no effect on the actual data, but rather only affect how it is presented on the screen. The default settings for contrast and brightness are 50 and the default transfer function is linear.

You can also select the Palette Type, Grayscale, Color, or Inverted. Again, the selection made has no effect on the actual data but only on how it appears on the computer monitor.

Parameters

Brightness: Adjusts overall image brightness. Range is 0 to 100 with 50 as the default. The default can be restored at any time by clicking on the small square above the center of the brightness scale.

Contrast: Adjusts overall image contrast, that is, increases the brightness difference between pixels with different intensity values. Range is 0 to 100 with 50 as the default. The default can be restored at any time by clicking on the small square above the center of the brightness scale.

Function Type

Linear: Pixel values are linearly mapped to display gray levels.

Log: This option changes the display of the image from linear, where changes in intensity of the image are mapped equally to the display gray levels, to logarithmic, where changes in intensity on the dark end are more pronounced. This is helpful for an image with a very high dynamic range. Since CCD detectors can have three orders of magnitude more dynamic range than a computer display, this option can map both faint and bright signals more appropriately.

Square Root: This option computes the square root of each pixel value before mapping to the display gray levels. The effect is similar to that provided by the log selection but less pronounced. *Note that the function is labeled "Square" in the Brightness/Contrast dialog box.*

Histogram: Uses the "histogram equalization technique" to give the best mapping between data intensity and display gray level or color. Result depends on setting of brightness and contrast. Takes longer than other methods since it must build the histogram from the data.

Gaussian: Takes the equalized histogram and modifies it with a Gaussian function, which tends to compress the representation of bright values and expand darker ones.

Save As Default: When this box is checked, the Brightness/Contrast settings will be saved as the default. These settings will be automatically established the next time the software is booted.

Palette Type

Grayscale: Image is mapped into 256 levels of gray. Luminance range extends from black to white.

Color: Image appears as 256 color false-color display. In Pseudo Color mode colors are mapped to the 256 levels of the monitor. It does not show actual color. Only one color mapping is available. However, the color appearance of the image can change dramatically depending on the Function Type selection.

Inverted: This option reverses the mapping of grayscale or pseudocolor images. When Inverted is not selected the pixels with the lowest intensities are black. Pixels with the highest intensities are white. With Inverted selected, pixels with the lowest intensities are white, and pixels with the highest intensities are black. In Pseudo Color mode, low intensity pixels are normally black-blue, while high intensity pixels are red-white. When inverted, low intensity pixels are black-blue, and high intensity pixels are red-white.

Control Buttons:

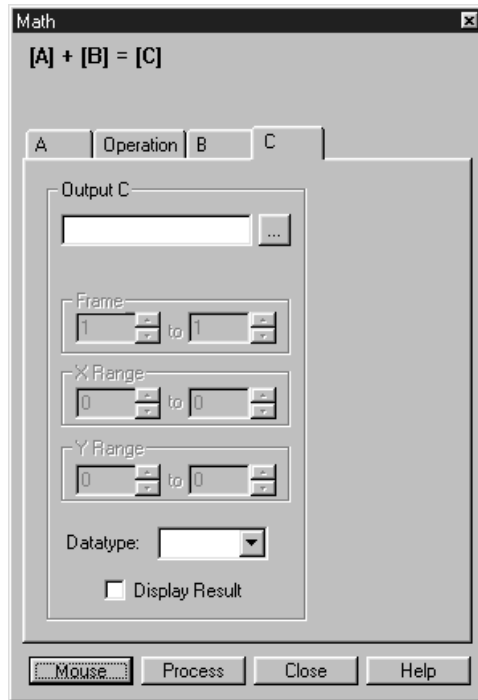
OK: Applies the settings and closes the dialog box.

Cancel: Closes the dialog box without applying any changes.

Help: Accesses context-sensitive help for the Brightness/Contrast dialog box.

C page

Figure 243.
Math C tab
page.



All math operations involve writing the results to the output file specified via the **C** file page. A description of the items on this page follows. *See Chapter 13 for a general discussion of Math operations.*

Parameters

Output C: The name of the output file is entered in this text box. The button at the end of the box opens a browser to assist in assuring that the file will be saved in the proper directory (folder).

Frame: Allows the user to set the number of frames of output data to be saved in the **C** file. The default is to save all frames processed.

X Range: Allows the user to set the X output data range to be saved in the **C** file. The default is to save all data processed.

Note: The length and width of the output data region cannot be larger than that of the A and B data regions.

Y Range: Allows the user to set the Y output data range to be saved in the **C** file. The default is to save all data processed.

Note: The length and width of the output data region cannot be larger than that of the A and B data regions.

Datatype: The datatype of the **C** file can be specified by the user.

Display Result: Checking this box will cause the resulting image to be displayed after processing is complete.

Control Buttons:

Mouse: Allows you to specify a region to be processed using the mouse. Simply drag a box in the data region of the active window and then click on **Mouse**. The **Frame** and **Range** parameters will assume the values of the defined region. An ROI mismatch error message will appear if the absolute values of the A and B data regions aren't the same. Note that the **Mouse** button is only active when the **A** or **B** tab page is selected.

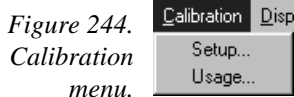
Process: Initiates the selected operation.

Close: Closes the window with no action taken.

Help: Opens context-sensitive help for the active tab page.

Calibrate Spectrograph dialog box

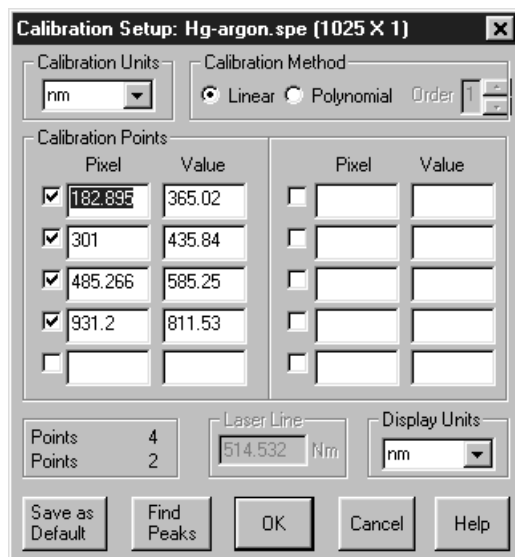
See *Spectrograph Calibration dialog box* on page 449.

Calibration menu

The Calibration menu accesses the Setup and Usage dialog boxes, used to perform a Wavelength Calibration. These dialog boxes are discussed in the following paragraphs.

Calibration Setup dialog box

Figure 245.
Calibration
Setup dialog
box.



The Calibration menu item **Setup** opens the Calibration Setup dialog box. A calibration session consists of finding the peaks, marking the known peaks to be used for calibration, and saving the calibration data as the default or applying it to the active data set only.

Before a wavelength calibration can be performed, it is necessary to either load a spectrum or acquire one. The spectrum should have well defined peaks for which you know the wavelength. The greater the number of points used, the more accurate the calibration will be. *See Chapter 7 for a detailed calibration procedure.*

Individual Dialog Item Descriptions

Calibration Units: These are the units of the values which are entered for each calibration point. The current selections are: nm (nanometers), cm-1 (wavenumbers), rel. cm-1 (relative wavenumbers), and user units (Units other than above). For relative wavenumbers the correct laser wavelength (Laser Line parameter) must be entered (see below).

When User Units is the Calibration Units selection, the User Units label is displayed over the Values edit boxes in this dialog box and on the X axis when data is displayed. User Units allow the operator to scale the spectra to any arbitrary unit. Unlike units such as nm, if the calibration points are in User Units, then the Display Units must also be in User Units.

Calibration Method: This is the method used to calculate the calibration coefficients. The current selections are: Least Square, for a Least Squares linear fit; and Polynomial, where a polynomial spline fit between each pair of points with the number of points used in each interpolation chosen via the **Order** edit box.

Two mathematical models can be used to fit the calibration to the data. The first, Least Square, calculates a linear approximation of the fit by minimizing the sum of the squares of the errors between the fit and the calibration points. The Polynomial method uses a higher order function of the form $a + bx + cx^2 + \dots$ where the “order” of the polynomial is the highest power of x used. If four peaks are active in the Calibrate dialog, the order of the polynomial can be 2 or 3. Even if ten peaks are used, the maximum order of the Polynomial is 5 (up to x^5). Linear calibration is sufficient in many measurements with widely separated peaks as previous described. If the available peaks are clustered, a Polynomial fit (using the smallest order possible) may give a good fit in the region of the calibration peaks, but have increasing large deviation the further you get from them. In an extreme case, there may even be two values for the same pixel, a clearly impossible condition which will result in an error message.

With the Linear calibration method, at least two peaks are required to calibrate. For a Polynomial calibration, the number of peaks must be at least one higher than the order of the polynomial. This information is displayed at the lower left of the Calibration Setup dialog box. The lower Points value is the number of peaks required. The upper points value is the number available for calibration. A peak is available if it has been found, its known value has been entered, and the adjacent checkbox has been checked.

Order: The order of the polynomial fit selected in *Calibration Method*.

Calibration Points Table: The calibration data are listed in a ten-point table. *Ten because the Find Peaks function will find a maximum of ten peaks.* When the peak finder runs, the location of each peak in pixels appears in the Pixel cells. The corresponding peak location value in Calibration Units is manually entered. Those peaks which are to be used for the calibration are selected by means of the check box associated with each.

Pixel: This is the pixel number of a calibration point. It is the position of the point on the X axis and is found automatically by the Find Peaks function.

Value: This is the calibration value which is manually assigned to the pixel position of a calibration point. The units are the user selected calibration units.

Calibration Point Checkboxes: Next to each Pixel peak-location cell in the Calibration Points table is a checkbox. This allows the user to choose if this point is to be included in the final calibration. If the box is checked, the point will be included. If it is not checked, the point will be ignored. When calibration is complete, only active points will be saved.

Points/Points box: This box reports two point number values. The upper one is the number of points selected (calibration point checkboxes). The lower one is the number required to perform the calibration using the selected Calibration Method and Order.

Laser Line: This is the wavelength in nanometers of the laser line. This input box is only enabled (and valid) when the calibration units are relative wavenumbers.

Display Units: These are the units in which data will be displayed. The selected Display Units need not match the Calibration Units. Conversions are done between the calibration units and the display units as necessary. The current selections are: pixels (same as no calibration), nm (nanometers), cm-1 (wavenumbers), rel. cm-1 (relative wavenumbers) and User Units.

Save as Default: The Save as Default button in the Calibration Setup dialog box determines whether a calibration is temporary or permanent (until changed). Once a calibration has been saved as the default, it will be automatically applied to subsequently acquired data. ***It will not be applied to data files recalled from disk.*** The default state of the button, not only with respect to the button setting but also with respect to whether it is disabled (not user settable) depends on the situation, as described in the *Save as Default* discussion that begins on page 288.

Find Peaks: This button will perform a simple peak find on the spectrum displayed in the data window. Note that the algorithm used will only work on clearly defined peaks. Click on **Find Peaks**. An automatic peak finding routine will be performed and the pixel values for the 10 highest peaks will be shown in the Pixel boxes in the Calibration Setup dialog box. *The maximum number of peaks that can be found equals 1/4 the number of displayed pixels.* Note that the Find Peaks routine causes a small red arrow to be displayed above each peak found in the spectrum together with a notation indicating the peak location in pixels.

Control Buttons:

OK: This button will end the calibration session. The calibration will be checked for validity and, unless a new calibration is performed, the calibration will be applied to all data acquired during the current operating session.

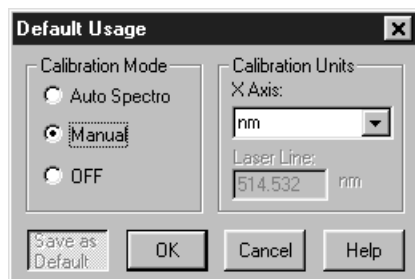
Help: This button will bring up the help for this dialog box.

Cancel: This button will end the calibration session without storing any calibration data.

Calibration Usage dialog box

This dialog box determines whether calibration is turned on or off, and which type of calibration is used. Note that name of the box changes to **Default Usage** once a calibration has been performed and saved.

Figure 246.
Usage dialog
box.

**Parameters**

Auto Spectro: When selected, WinSpec/32 will calculate the current calibration based on the spectrograph stepper motor position. When the stepper motor of the spectrograph is moved, the calibration will be updated. If, after the spectrograph is moved, you load a wavelength calibration file (.CAL), the wavelength calibration file will override the spectrograph calibration until the spectrograph is moved again.

Manual: This setting will always use the loaded calibration data, even if the spectrograph is moved. It then becomes the user's responsibility to enter new calibration data for a correct calibration.

Off: This setting will turn off all calibration. Data will only be displayed with pixel numbers.

Calibration Units: These are the units of the values which are entered for each calibration point. The current selections are: nm (nanometers), cm⁻¹ (wavenumbers), rel. cm⁻¹ (relative wavenumbers), and user units (Units other than above). For relative wavenumbers the correct laser wavelength (Laser Line parameter) must be entered (see below).

When User Units is the Calibration Units selection, the User Units label is displayed over the Values edit boxes in this dialog box and on the X axis when data is displayed. User Units allow the operator to scale the spectra to any arbitrary unit. Unlike units such as nm, if the calibration points are in User Units, then the Display Units must also be in User Units.

Laser Line: Text entry box for entering laser wavelength, required if relative wavenumbers are selected as the Display Units.

Control Buttons:

Save as Default: Saves the Usage dialog box selections so that they will be restored when the system is next powered up. *For a more detailed description, see the discussion of the Save as Default button on page 288.*

OK: Click on **OK** to execute the changes and close the dialog box. Note that the changes will only apply to the active data set. To make them apply to all data sets, it is necessary to click on **Save as Default**.

Cancel: Click on this button to close the dialog box without making any changes.

Help: Click on this button to open the online help for this dialog box.

Camera State dialog box

Figure 247.
Camera state
dialog box.



In a system having the PI-MAX camera, this dialog box appears when the software is booted. It allows the user to set the camera start-up state. The three selections are:

Keep in Safe Mode: This is the default. Whenever the software is booted, the Safe mode is established, biasing the PI-MAX intensifier's photocathode off. The intensifier gain and exposure time in effect when the software was last shut down are retained.

Restore Last Settings: Making this selection followed by clicking on OK will put the camera in the gate mode in effect when the software was last shut down. Thus, clicking on the radio button could put the camera in **Safe** mode, **Shutter** mode or **Gate** mode, whichever was the active state at the time of shutdown. In addition, the intensifier gain in effect when the software was shut down is also restored, as is the exposure time.

Restore Defaults: Making this selection followed by clicking on OK establishes **Safe** mode and an **Intensifier Gain** setting of 128. *Intensifier gain range is 0 to 256*

arbitrary units. The mid-range setting of 128 works well in many measurement. It additionally sets the Exposure Time to 10 ms.

Once the selection has been made, the user can easily change the gate mode via the Experiment Setup **Main** page. In systems having the PI-MAX camera, the Experiment Setup **Main** page allows the user to directly select **Safe** mode, **Shutter** mode or **Gate** mode.

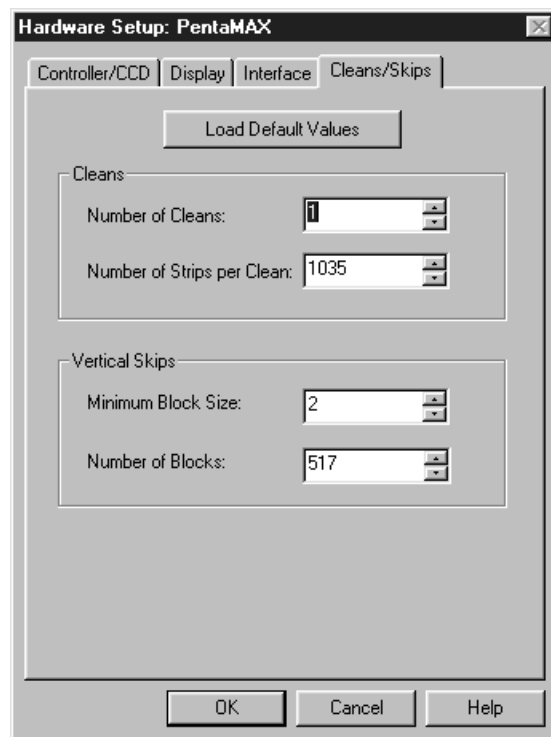
Cleans/Skips tab page

The Cleans/Skips tab page, accessed by selecting Hardware on the Setup menu, allows the user to change the clean and skip parameters from their default values. Descriptions follow.

CAUTION

Roper Scientific does not encourage users to change these parameter settings. For most applications, the default settings will give the best results. **Exception:** With a PI-MAX camera, we suggest settings of Cleans 1 and Strips per Clean 4, Minimum Block Size 16 and Number of Blocks 32.

Figure 248.
Cleans/Skips
tab page.



Cleans

During cleans, the charge on the CCD chip is transferred to the output register and discarded to prevent charge buildup from occurring. On completion of a setup, successive clean cycles occur normally. The Number of Cleans and Number of Strips per Clean parameters allow you to program additional clean cycles that will be performed after initiating the run but before any data is taken.

Number of Cleans: For most applications the default value should be used. Clicking on the Load Default Values button and then selecting Yes will install the default value. Values other than the default can be directly entered in the text box or selected via the spin buttons.

Number of Strips per Clean: Sets the number of CCD data strips to be transferred and discarded during each clean. The maximum valid setting is limited by the chip size. The default value will generally give good results.

Vertical Skips

When the region of interest is less than the full chip, Vertical Skips allows you to bin and quickly transverse the strips that precede and follow the ROI. The strips to be processed and discarded are binned into blocks, each containing a number of strips, with the Number of Blocks parameter determining how many blocks there will be before and after the ROI.

The block size determines how quickly the region preceding and following the ROI will be traversed. If the blocks are large, the region will be traversed quickly but there is the possibility of overloading the output register and causing blooming. With small blocks, the risk of blooming will be minimized but the time to traverse will be large.

WinSpec/32 uses an exponential algorithm to simultaneously achieve rapid traversing with minimal risk of blooming. The first block, specified in strips, is large. Each successive block is a factor of two smaller than the one preceding until the minimum block size is reached. All remaining blocks are the minimum block size. By making the first block as large and subsequent blocks increasingly small, the region preceding and following the region of interest is transversed as rapidly as possible while minimizing risk of the output register becoming saturated.

Minimum Block Size: Sets the size, in strips, of the skip blocks that immediately precede the data. The default value will generally give good results.

Number of Blocks: Sets the number of binned “skip” blocks preceding and following the region of interest. The default value will generally give good results.

Control Buttons:

OK: The operation specified will be performed.

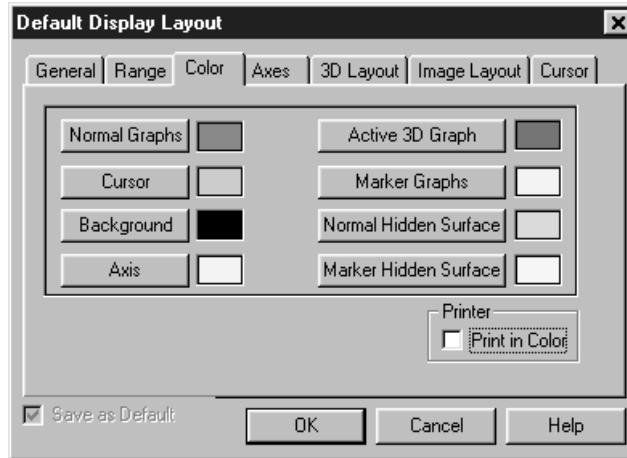
Cancel: Exits the window without performing any operations. Any changes will be lost.

Help: Opens context-sensitive help for whichever tab page is on top.

Color display layout tab page

Sets the colors that will be used for the various data display items. A different button is provided for each display item and the color assigned to each is displayed to the right of the pushbutton. *See Chapter 10 for additional information on data display.*

Figure 249.
Color display
layout tab
page.



Display Item Select Buttons

There are eight buttons that allow the color of the different display items to be selected. Pressing any of these buttons causes the Palette dialog box (Figure 250) to open, providing a wide range of different colors for selection. Once the color has been selected, pressing OK closes the palette dialog box and returns you to the Display Layout Color tab page. The selected color will appear in the swatch to the right of the item button. A description of each button follows.

Normal Graphs: Applies to the normal graphical data. Also applies to intensity profiles if displayed when viewing the data as an image.

Cursor: The cursor color selection applies for both graphical and image data.

Background: The background color has no effect on image data but it does set the color of the axes and cross-section regions outside the image area.

Axis: The axis color selection applies for both graphical and image data.

Active 3D Graph: Applies to 3D graphical display only. Note that Highlight Cursor curve must be selected on the 3D Display Layout tab page for the Active 3D curve to be seen. Also, the assigned color must differ from the background color.

Marker Graphs: Applies to 3D graphical display only. Note that Marker Curves On must be selected on the 3D Display Layout tab page for the Marker curves to be seen. Also, the assigned color must differ from the background color.

Normal Hidden Surface: Applies to 3D graphical display only. Note that Show Hidden Surface must be selected on the 3D Display Layout tab page for hidden surfaces to be displayed.

Marker Hidden Surface: Applies to 3D graphical display only. Defines the color of the marker curves in regions of displayed hidden data. Both Show Hidden Surface and Marker Curves On must be selected on the 3D Display Layout tab page for these curves to be seen.

Save as Default check box: Saves settings of all Display Layout tab pages. These settings will be automatically established when software is started.

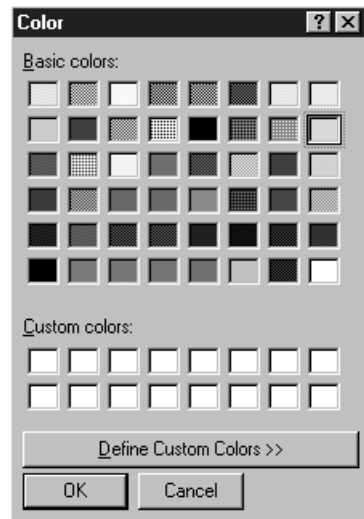
Control Buttons:

OK: Executes the layout settings and closes the Display Layout window.

Cancel: Closes the Display Layout window without implementing any of the changes.

Help: Opens context-sensitive help for Display Layout window.

Figure 250.
Display layout
color selection
chart.

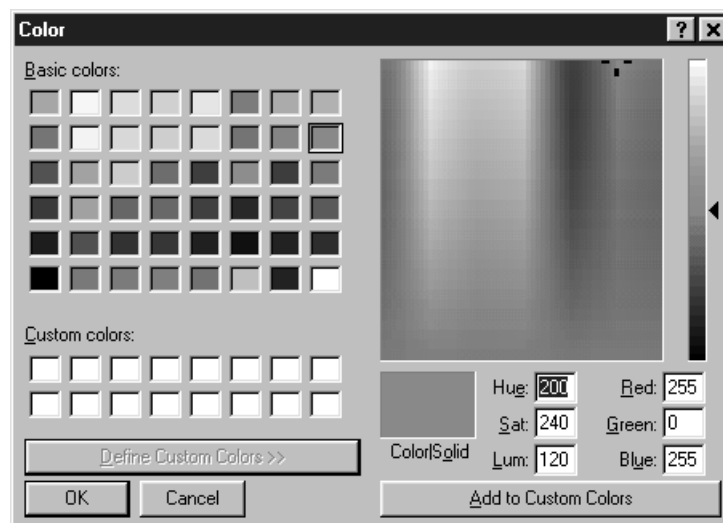
**Palette Dialog Box Buttons:**

Define Custom Colors: Opens the extended Color Palette box (Figure 251), allowing custom colors to be defined in RGB or HSL conventions. The **Add to Custom Colors** button transfers the selected color to one of the Custom Colors boxes of the basic Palette dialog box.

OK: Applies selected color. Active color swatch on Color tab page changes to match selection.

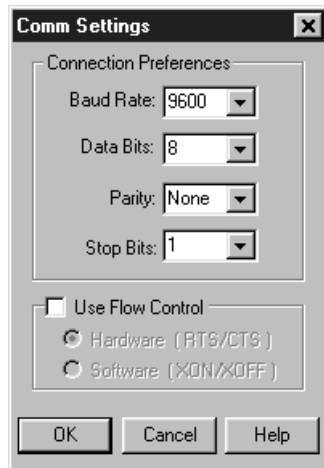
Cancel: Closes window without making any changes.

Figure 251.
Custom color
selection
extension of
palette window.



Comm Settings dialog box

Figure 252.
Comm Settings
dialog box.



This dialog box, accessed by clicking the **Comm Settings** button on the Define Spectrograph **Connect** tab page, is used to match the serial communications parameters of WinSpec/32 to those *required by the Spectrograph*. A description of each item follows.

Baud Rate: Baud rate selections are provided from 110 baud to 256,000 baud.

Data Bits: The choices are 4, 5, 6, 7 or 8 data bits.

Parity: Choices include none, even, odd, mark and space.

Stop Bits: Choices are 1, 1.5 and 2.

Flow Control check box: You have the choice of operating with flow control (box checked) or without flow control (box unchecked). If your spectrograph requires flow control, you can select either Hardware (RTS/CTS) or Software (XON/XOFF).

Control Buttons:

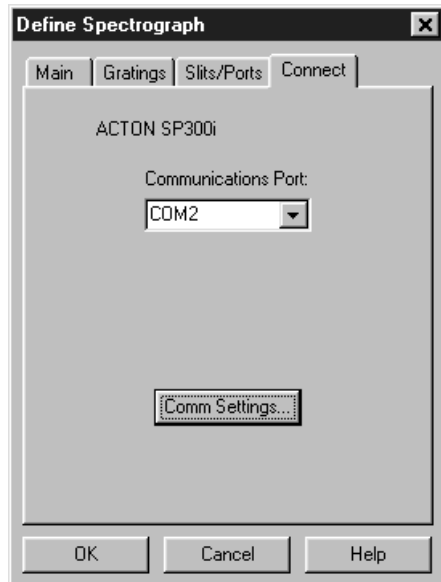
OK: The comm parameter selections are executed and saved and the dialog box is closed.

Cancel: The dialog box is closed without implementing any changes that might have been made.

Help: Opens context sensitive help for the Comm Settings dialog box.

Connect tab page

Figure 253.
Connect tab
page.



The Connect tab page allows you to specify which COM port the spectrograph is connected to. Note that there is a notation of the active spectrograph on the page. If multiple spectrographs have been installed, the active one is the specified on the Define Spectrograph **Main** tab page.

Communications Port: All available COM ports are listed. You should pick the one to which the active spectrograph is connected.

Comm Settings: Opens the Comm Settings dialog box (see discussion on page 295), used to specify the serial communications parameters for the active spectrograph.

Control Buttons:

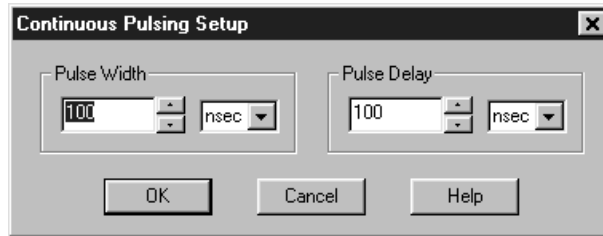
OK: The COM port selection is executed and saved and the dialog box is closed.

Cancel: The dialog box is closed without implementing any changes that might have been made.

Help: Opens context-sensitive help for whichever tab page is on top.

Continuous Pulsing Setup dialog box

Figure 254.
Continuous
Pulsing setup
dialog box.



When Continuous pulsing, the Pulse Width and Pulse Delay remain constant at the values specified. They can be entered directly or you can use the spin wheels to set the wanted settings. The units are selected from the drop-down boxes to the right of the data-entry windows.

Control Buttons:

OK: Enters the specified values and closes the dialog box, returning you to the PTG, DG-535 or PG-200 window.

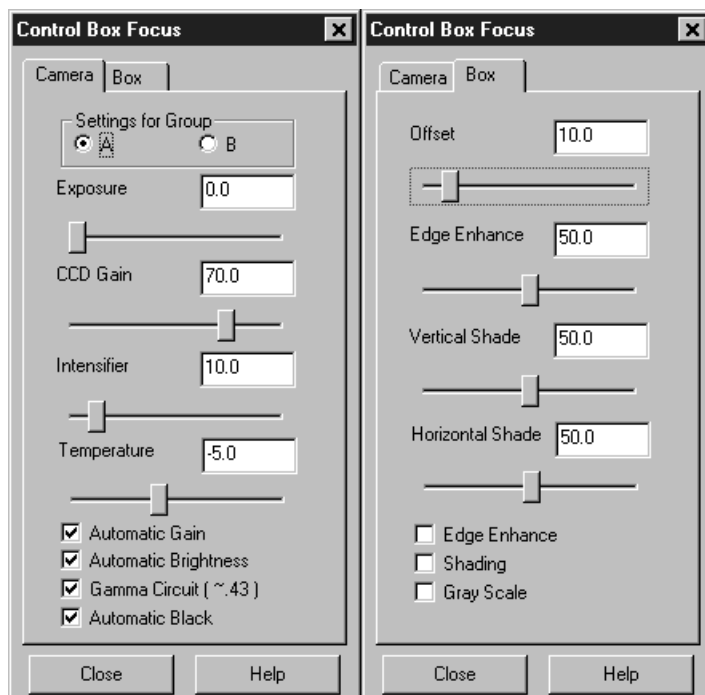
Cancel: Closes the dialog box leaving the original settings in effect.

Help: Opens context-sensitive help for the Continuous Pulsing Setup dialog box.

Control Box Focus Window

Selecting **Video Focus** on the Acquisition Setup menu with V/ICCD Control Box as the selected controller opens the Control Box window (Figure 255). This window contains two tab pages, Camera and Box. The Camera tab page is identical to the V/ICCD Focus Camera tab page. The Box tab page gives software control over the Control Box parameters as described in the following paragraphs.

Figure 255.
Control Box
Focus tab
pages.



Parameters

Offset: The Offset parameter allows the video to be shifted negatively. The range is in arbitrary units from 0 to 99 and the default setting is 10.0. The higher the setting, the larger the offset that will be subtracted from every pixel in the image, in effect shifting the entire image towards black. Used in conjunction with the intensifier gain setting, this is particularly useful in applications where images have very low contrast. You can offset the gray level down to black and then increase the intensifier gain to bring up the residual contrast for the best possible image. Note, however, that CCD well capacity limitations constrain the amount of contrast enhancement that can be achieved.

The Automatic Gain and Automatic Black function should be OFF for the Offset function to have any significant effect.

Edge Enhance: This function increases the video high-frequency response, causing edges in the image to become crisper. The range is 0 to 99 and the default setting is 50. Note that the Edge Enhance box must be checked as well to activate the Edge Enhance function.

Vertical Shade & Horizontal Shade: These parameters allow you to independently set the amount of vertical and horizontal shading to be applied to the image to compensate for illumination non-uniformity. The range is 0 to 99 and the default is 50 for both parameters. With respect to actual screen illumination, the range is nominally 30%. If the field illumination non-uniformity exceeds this range, it will be necessary to correct it at the experiment level. The Shading box must be checked for the shading to be applied.

Edge Enhance box: Checking this box causes the edge-enhance function to be applied.

Shading: Checking this box causes the horizontal and vertical shading functions to be applied.

Gray Scale: When checked, causes a full-range grayscale bar image to be displayed. This display is very convenient in setting the monitor's brightness and contrast controls. For the best image in most situations, the darkest bar should be black and the brightest should be full white.

Control Buttons:

Close: Implements any setting changes and closes the window.

Help: Displays context-sensitive help for the V/ICCD (Focus) tab page.

Control menu

Figure 256.
Control menu.



This menu is accessed by clicking on the icon at the far left in the Title bar. It provides basic control of the WinSpec/32 software via the following selections.

Restore: Use this command to return the active window to the size and position it had prior to using the Maximize or Minimize command.

Move: Use this command to display a four-headed arrow so you can move the active window or dialog box with the arrow keys.

Note: This command is unavailable if you maximize the window.

Size: Use this command to display a four-headed arrow so you can size the active window with the arrow keys.

After the pointer changes to the four-headed arrow:

- ◆ Press one of the DIRECTION keys (left, right, up, or down arrow key) to move the pointer to the border you want to move.
- ◆ Press a DIRECTION key to move the border.
- ◆ Press ENTER when the window is the size you want.

Note: This command is unavailable if you maximize the window.

Size Shortcut: Using the mouse, drag the size bars at the corners or edges of the window.

Minimize: Use this command to reduce the WinSpec/32 window to an icon.

Minimize Shortcut: Click the minimize icon on the title bar.

Maximize: Use this command to enlarge the active window to fill the available space.

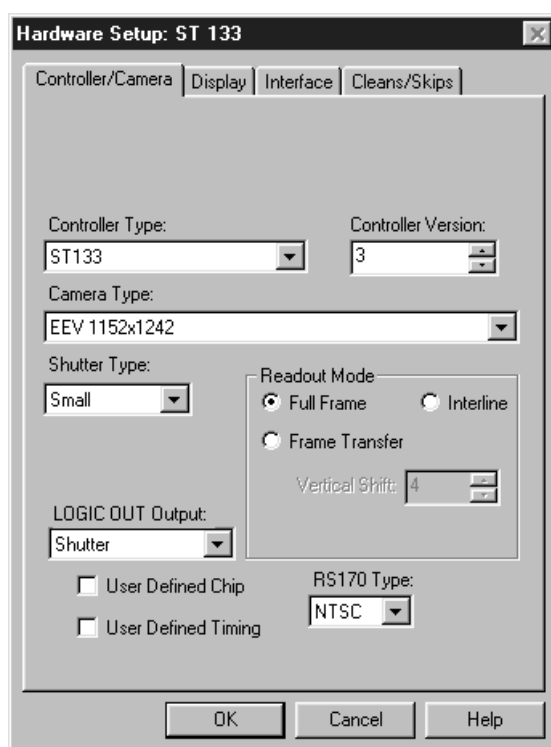
Maximize Shortcut: Click the maximize icon on the Title bar or double-click the Title bar.

Close: The Control menu Close command closes WinSpec/32. Note that double clicking on the WinSpec/32 icon at the left end of the Title bar will also close the application, as does the key sequence ALT+F4. To close the active data file only, key CTRL+F4. Note that the File menu Close command closes all windows using the data file displayed in the active window.

Close Shortcuts: CTRL+F4 closes the active data file window only. ALT+F4 closes the application

Controller/Camera tab page

Figure 257.
Controller/
Camera tab
page.



The Controller/Camera tab page (*may also be named Controller/Detector tab page depending on the Controller type*) is used to select the Controller Type, the Camera Type and some of the Controller/Camera type parameters, such as Shutter Type and Readout Mode. The Controller and Camera Type selections are perhaps the most fundamental and important of all hardware selection decisions and directly influence the appearance of many other WinSpec/32 screens and the selections provided on them. As a result, setting up the software for use in any system should always begin with the Controller selection. Although all possible Controller/Camera tab page selections are discussed in the following paragraphs, not all of them will be present for any particular controller model.

Controller Type: The selected Controller Type is displayed in this text box. Clicking on the button at the end of the box drops the selection list so that the selected controller can be changed.

Controller Version: In the case of the ST-133 and PentaMAX controllers, different versions have been released having different capabilities. The available software selections will correctly reflect these differences when the proper version number is specified in this box.

Camera Type: The selected Camera Type is displayed in this text box. Clicking on the button at the end of the box drops the selections list so that the selected camera type can be changed. Note that the listed camera types depend on the controller selection, requiring that the controller type be specified first.

Shutter Type: There are five possible selections, **Small, Large, Remote, Electronic** and **None**. *Not all controllers provide all five selections.* For most cameras, the correct setting is **Small**. In the case of a camera having a very large CCD, such as the Kodak 4k × 4k, a large shutter may have been installed, in which case the correct setting will be **Large**. The **Remote** setting is primarily intended for spectroscopy applications where an external shutter would be placed ahead of the entrance slit. **Electronic** only applies to operation with an Intensified camera, which would normally not be equipped with a mechanical shutter. This selection would apply to both the **Gate** and **Shutter or CW** modes of the IIC-100 or MCP-100. If using a frame-transfer or interline CCD array and no shutter, select **None**.

Readout Mode: The possible selections are:

Full Frame: The entire chip can be read out

Frame Transfer: Only the unmasked area of the chip can be read out. Frame transfer is only available if the camera has a frame-transfer chip such as the EEV 512 × 1024.

Interline: Provides 100% duty cycle operation. Interline is only available with a camera having an interline chip such as the PI 1300 × 1030.

Kinetics: Kinetics is a special type of operation in which most of the CCD is mechanically or optically masked, leaving a small section open to light. This section is then read out very quickly. See the ST-138 Controller manual for more details on the CCD aspects of this readout mode.

Vertical Shift: Determines the speed of the image transfer from the exposed area of a frame-transfer chip to the masked area. Also sets the speed of image transfer when operating in the Kinetics mode. Setting a lower value increases the shift speed. A higher value gives a slower shift. If the shift is too fast, not all of the charge will be transferred. If too slow, image smearing will be increased due to the exposure that takes place while the transfer is in progress. The default value gives good results in most measurements.

User Defined Chip: Selecting User Defined Chip makes the Custom Chip tab page appear. The Custom Chip tab page is described in detail on page 89. Perhaps the most important thing to keep in mind is that the default values conform to the physical layout of the CCD array and are optimum for most measurements.

User Defined Timing: Selecting User Defined Timing makes the Custom Timing tab page appear. The Custom Timing tab page is described in detail on page 90.

CAUTION

Roper Scientific does not encourage users to change the chip timing settings. For most applications, the default settings will give the best results. Changing them can adversely affect performance, sometimes in subtle ways that will not be immediately obvious. We *strongly advise* contacting the factory for guidance before customizing the chip timing parameter settings.

LOGIC OUT Output: In a PentaMAX, determines the signal provided at the back panel Logic Out connector. In a MicroMAX or ST-133, determines the signal provided at the SCAN connector. Selections with an ST-133 or MicroMAX are Shutter Monitor and Scan only. *In some ST-133s, the selection cannot be made via software but must instead be made by means of an internal jumper.* In the PentaMAX, all of the following are provided.

Cleaning: TTL Logic 1 during cleaning cycle.

Logic 0: TTL Logic 0

Logic 1: TTL Logic 1

Not FT Image Shift: TTL Logic 0 during frame-transfer image shift.

Not Ready: After a Start Acquisition command, this output changes state on completion of the array cleaning cycles that precede the *first* exposure. Initially high, it goes low to mark the beginning of the *first* exposure. In free run operation it remains low until the system is halted. If a specific number of frames have been programmed, it remains low until all have been taken, then returns high.

Not Scan: TTL 0 when reading out the array.

Shutter: TTL 1 when the shutter is open.

Following parameters only apply with V/ICCD or V/ICCD Control Box

Comm Port: Set to the computer COM port used to interface to the V/ICCD.

Frame Grabber: Used to select Serial or Data Translation (3152), whichever applies.

Waveform Mode: Select Gate for gated operation. Otherwise select CW.

Readout Mode: Selects either the Odd or Even video field to be valid.

External Trigger

Enabled: Enables or disables an external event trigger.

Polarity: Selects the polarity of the external event trigger (if enabled).

Control Buttons:

OK: Executes the selections for all tab pages and closes the dialog box.

Cancel: Closes the dialog box without executing any changes.

Help: Opens context-sensitive help for whichever tab page is on top.

Controller Registers dialog box

See discussion of the **Diagnostics: Controller Registers dialog box** on page 334.

Cross-Sections

Whether displayed as an image or 3D Graph, data can be displayed with cross-section profiles. Cross-section profiles are not available if the data is displayed as a simple two-dimensional graph. If the data is displayed as an image as shown in Figure 258, the vertical cross-sectional profile shows the intensity vs. strip number along the vertical crosshair and the horizontal cross section shows the intensity vs. pixel number along the horizontal crosshair.

Cross-section tick marks: The min and max values for each cross section profile are indicated. These values are only displayed if the axes are also turned on. They are displayed at the left of the horizontal profile and below the vertical profile. Both axes and cross-sections must be ON for the minimums and maximums to be shown. Each time the cursor is moved, the cross-sectional display will change. Clicking on the Autoscale button will restore full-range scaling.

Note that the axes, as well as the boundary of each profile display area, can be dragged to change the size of the profile display areas. Each time this is done, click the autoscale button to restore proper scaling. In general, it is best to use the Large Cursor (selected via the View menu) when displaying cross sections because the large cursor allows the crosshair coordinates to be precisely read from the scaled axes. *See Chapter 10 for additional information on displaying the data.*

Figure 258.
Typical image display
with
axes and cross-
sections.

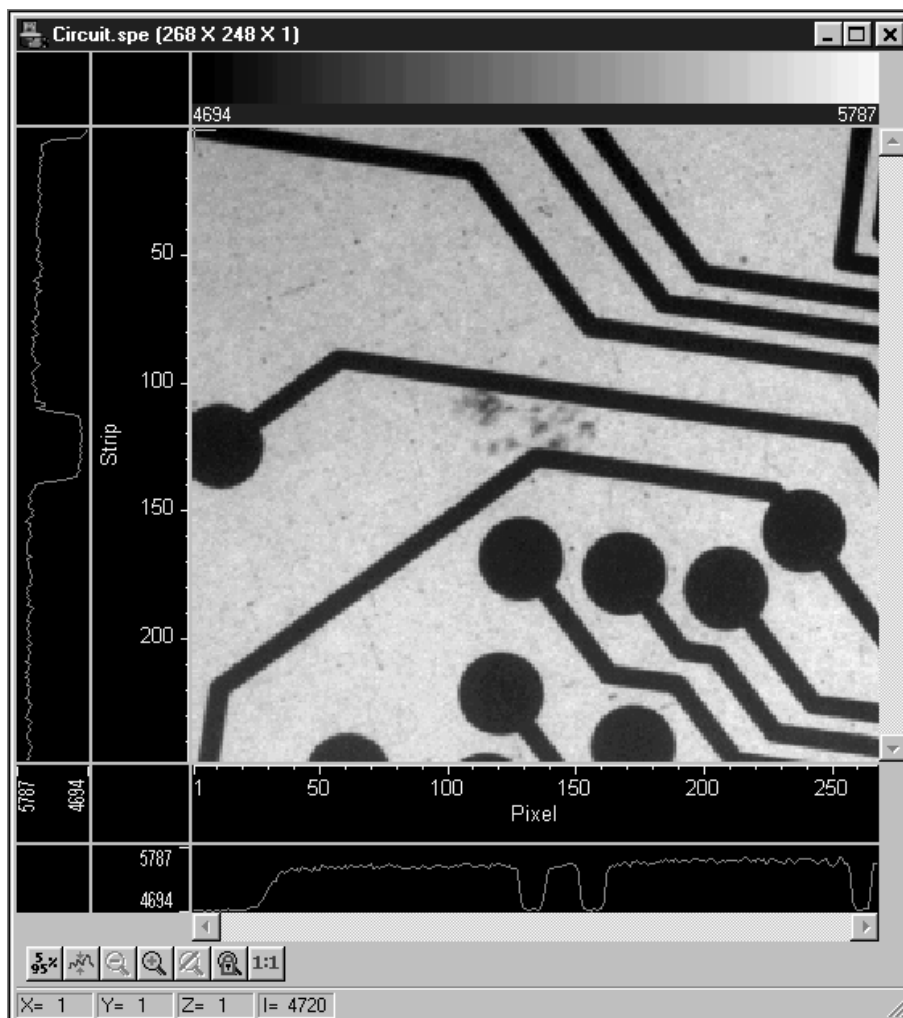
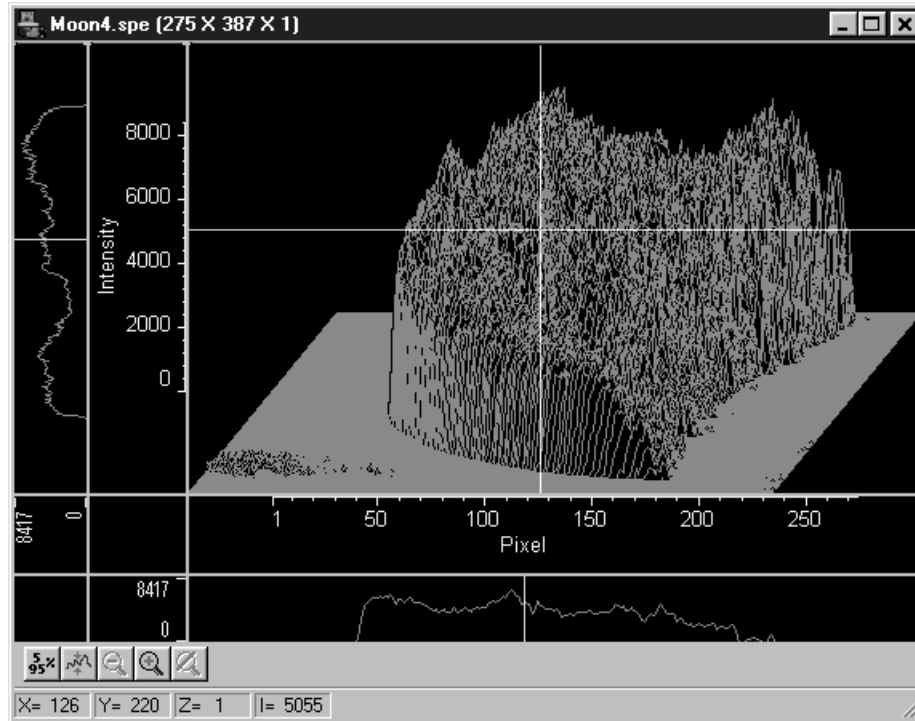


Figure 259 shows cross-sectional profiles with a 3D Graph. The vertical cross-section profiles the intensity at the same point on each successive strip. The horizontal cross-section profiles the intensity at each point on the same strip. If the large cursor is selected, cursor projections will intersect the cross section to show indicate the cursor position. These projections may not be visually aligned with the cursor position on the main plot. This effect will be particularly noticeable with a long Z axis. Because of perspective effects, the higher numbered strips will be further away and visually smaller. The axes automatically adjust so that they read true for the strip on which the cursor is located. However, because the cross-section profiles expand to use all of the available space, they will not be in alignment visually with the cursor. The profile shapes will be correct, and the point on the profiles intersected by the large cross-hair extensions will accurately indicate the cursor position. Also, the information box will accurately report the pixel number and intensity at the cursor position.

Figure 259.
Moon4.spe
graph, Large
cursor selected.



Cross Sections (post processing)

General discussion: Chapter 17.

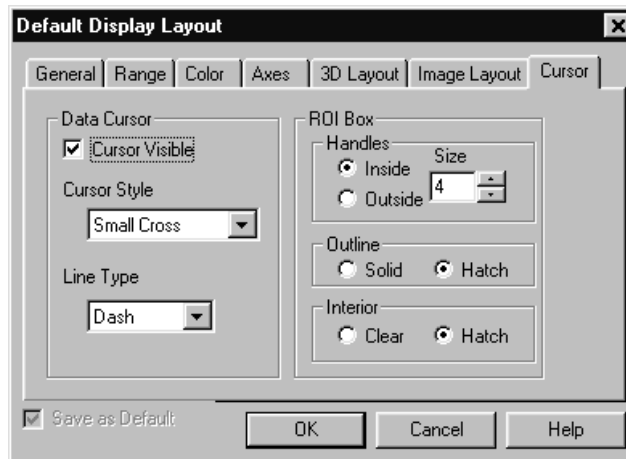
Input tab page: pg. 362

Parameters tab page: pg. 388

Output tab page: pg. 386

Cursor tab page

Figure 260.
Cursor tab
page.



The Display Layout Cursor tab page allows the data cursor style and type to be changed. It additionally allows the user control over how an ROI box will be displayed.

Data Cursor Display

Cursor Visible: If checked, the cursor will appear. If unchecked, the data cursor will not appear.

Cursor Style: Choices are **Small Cross**, **Large Cross**, **Horizontal Line** and **Vertical Line**. Note that **Cursor Visible** must be checked for the Cursor Style choices to be available.

Line Type: Choices are **Solid**, **Dash**, **Dot**, **Dash Dot** and **Dash Dot Dot**.

ROI Box Display

Handles: There are eight handles, one at each corner and one at the midpoint of each side. By clicking and dragging a corner handle, the ROI shape can be changed in the *X and Y* directions simultaneously. The mid-point handles allow the box to be resized in the *X or Y* direction. You can choose to have the handles appear inside or outside the ROI region. The size range is 0 (no handles) to 15.

Outline: The ROI outline can be Solid or Hatched, as selected.

Interior: The interior of the ROI can be Hatched or Clear, as selected.

Save as Default check box: Saves settings of all Display Layout tab pages. These settings will be automatically established when software is started.

Control Buttons:

OK: Executes the layout settings and closes the Display Layout window.

Cancel: Closes the Display Layout window without implementing any of the changes.

Help: Opens context-sensitive help for Display Layout window.

Cursors

Mouse Cursor: The mouse cursor position corresponds to the position of the mouse and indicates the focus point for an action or selection. It follows standard Windows conventions and may take different forms depending on the situation.

Text Cursor: Clicking the mouse inside a text box causes the text cursor, a thin vertical line, to appear. This cursor indicates where the next character will be inserted or deleted. The cursor's position is determined by the cursor-positioning keys. This cursor follows standard Windows conventions.

Data Cursor: A data cursor is always available whenever data is displayed. This is true both for data displayed as an image or as a graph. The cursor can take either of two forms, a small cross, or a cross-hair. The selection is made via the View menu which allows you to choose the Small Cursor (small cross), Large Cursor (cross-hair) or None (no cursor displayed). The cross-hair cursor, which extends all the way to the boundaries of the data-display area with an image display, is particularly advantageous for reading the cursor's coordinates from the axes

scales. Some cursor functions differ depending on whether image or graphed data is being displayed. For example, with a 3D Graph display, the appearance of the large cursor in the data area is the same as for the small cursor. However, if Cross Sections are displayed, a projections of the large cursor will be displayed on the profiles so that the values at the cursor position can be read accurately.

Image Display: Clicking the mouse cursor on the image at any point moves the data cursor to that point. The left/right arrow keys will move the cursor laterally and the up/down arrow keys will move it vertically. The Home key moves the cursor all the way to the left and the End key moves it all the way to the right. If the Information box is displayed, the cursor coordinates are continuously reported.

Graphed Display:

Single Strip Graph: The left/right arrow keys move the cursor laterally along the strip. Clicking the mouse on the display selects a different point on the same curve. The Home and End keys move the cursor to the strip ends. The up/down arrow keys select and display a different strip. Shift Home and Shift End move the cursor to the first strip and last strip respectively. If the Information box is displayed, the cursor coordinates are continuously reported.

The Insert key expands the display about the cursor position. The Delete key contracts the data if it has been expanded, allowing the original display to be restored.

3D Graph: Same as for single graph except that cursor position is projected onto cross-section profiles if displayed.

Custom chip tab page

This tab page, accessed by selecting Hardware on the Setup menu, allows user redefinition of the chip which could be advantageous in certain measurement situations. See page 89 for a detailed discussion of the Custom Chip tab page.

CAUTION

Roper Scientific does not encourage users to change these parameter settings. For most applications, the default settings will give the best results. We ***strongly advise*** contacting the factory for guidance before customizing the chip definition.

Custom Filter window

Contains the Input tab page (page 362), Filter Matrix tab page (page 348) and Output tab page (page 386), used to control the Custom Filter function. *See Chapter 16 for additional information.*

Custom timing tab page

This tab page, accessed by selecting Hardware on the Setup menu, allows user redefinition of the basic chip timing options. See page 90 for a detailed discussion of the Custom Timing tab page.

CAUTION

Roper Scientific does not encourage users to change these parameter settings. For most applications, the default settings will give the best results. Changing them can adversely affect performance, sometimes in subtle ways that will not be immediately obvious. We **strongly advise** contacting the factory for guidance before customizing the chip timing parameter settings.

Custom Toolbar button descriptions

The Custom Toolbar gives one-button access to many WinSpec/32 control and image processing functions, some of which can only be reached through the Custom Toolbar. The View menu Toolbar function determines whether the Custom Toolbar will be displayed. Chapter 2 discusses the toolbars as elements of the graphical interface. Chapter 20 explains how to add to the Custom Toolbar or delete buttons from it. Detailed descriptions of the available Custom Toolbar buttons follow. *Note that some functions may not be implemented in early releases of the software.*



Start: Initiates data collection in which all frames are stored. Equivalent to selecting **Acquire** from the Acquisition menu or to pressing **Acquire** button in the Experiment Setup window.



Run Focus: Initiates data collection in which data is not stored until Start Store is selected. Equivalent to selecting **Focus** from the Acquisition menu or to pressing the **Focus** button in the Experiment Setup window. This mode is particularly convenient for familiarization and setting up. For ease in focusing, the screen refresh rate should be as rapid as possible, achieved by operating with axes and cross-sections off, and with Zoom 1:1 selected.



Stop: Stops the experiment after completion of the exposure/readout in progress. Equivalent to selecting **Stop Acquisition** from the Acquisition menu.



Start Store: Begins storage of data as it is acquired. Equivalent to checking or unchecking **Start Storage** from the Acquisition menu.



Status Bar On/Off: Allows display of the Status bar to be turned on or off. Equivalent to checking or unchecking **Status** from the View menu.



Online ET: Opens the **On-Line Exposure** dialog box, allowing the exposure to be changed while data is being collected. Equivalent to selecting **Exposure/Intensity** from the Acquisition menu.

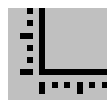


B&W / Pseudocolor: Toggles between a 256 *grayscale* display and a 256 *pseudocolor* display. Equivalent to selecting and deselecting **Pseudo** on the Palette/Intensity dialog. In Pseudo Color mode, colors are mapped to the 256 levels of the monitor. It does not show *true* colors. To see the color bar used

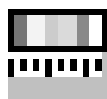
for the color mapping, toggle the Color Bar Toolbox button. Only one color mapping is provided.



Cross sections On/Off: Adds or removes *cross sections* in the current image. The Y cross section appears to the left of the image and the X cross section appears below the image. The cursor position defines the column and row that are profiled in the cross section displays. Cursor projections intersect the cross sections to show the relative intensity of the pixel corresponding to the cursor position.



Axes On/Off: Adds or removes scaled X and Y axes to the current image. Equivalent to checking or unchecking **Axes** on the View menu. The scales indicate the image size in pixels.



Color Bar: Adds or removes the *color bar* from above the current image. The Color Bar shows the scaling from the lowest pixel values (black) to the highest pixel values (white). This works for both grayscaling and pseudocolor scaling. In the Pseudo Color mode, low intensity pixels are normally black-blue while high-intensity pixels are red-white. **Note:** *Color Bar is not provided in early releases of the software.*



Info Box On/Off: Opens or closes the **Info** window; equivalent to selecting or deselecting Info from the View menu.



Cursor Size: Changes the cursor to *Smallcross* or *Crosshair*. Equivalent to changing the **Cursor Size** selection on the View menu. The crosshair can be particularly useful, for example, if the scale function is active. The precise pixel position of the cursor can be read from the scales using the crosshair.



Lin/Log Scaling: Changes the image lookup table between *linear* and *logarithmic*. Equivalent to selecting or deselecting **Log** on the Palette/Intensity dialog. With linear selected, changes in intensity are mapped equally to the display gray levels. With logarithmic selected, changes in intensity on the dark end are more pronounced. Since CCD detectors have three orders of magnitude more dynamic range than the computer display, this option can map both faint and bright signals most appropriately.



Start Frame/Strip: Views the *first* exposure in a file containing more than one exposure. There is no menu equivalent to this function.



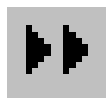
Reverse 10 Frames: Views *ten exposures earlier*. If the current exposure is exposure number 18 in the file, this button moves to exposure 8. There is no menu equivalent to this function.



Previous: Views the *previous* exposure in a file containing more than one exposure. There is no menu equivalent to this function.



Next: Views the *next* exposure in a file containing more than one exposure. There is no menu equivalent to this function.



Forward 10 Frames: Views *ten exposures later*. If the current exposure is exposure number 13 in the file, this button moves to exposure 23. There is no menu equivalent to this function.



Last Frame/Strip: Views the *last* exposure in a file containing more than one exposure. There is no menu equivalent to this function.



Calibrate On/Off: Opens the **Calibration Usage** dialog box, which allows you to select whether wavelength calibration is turned on or off, and also the manner in which the calibration is to be accomplished. You can also select the units of wavelength calibration. Clicking on this button is equivalent to selecting **Usage** from the **Calibration** menu. *Calibrate button is not provided in early releases of the software.*



Move: Opens the Move dialog box, used to change the position of the spectrograph grating; equivalent to selecting Move on the Spectrograph menu.



Statistics: Processes *statistics* on the current data file. If a subregion is selected, only processes the subregion. Equivalent to selecting **Statistics** from the Process menu.



Start Video Focus: For those controllers which have provision for rapid focusing (MicroMAX, ST-133, PentaMAX and V/ICCD), opens the Interactive Camera, Interactive Operation or Focusing dialog box.



Acquire Background: This button acquires a *background* file. It is equivalent to clicking on Acquire Background from the Acquisition menu.



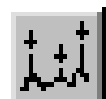
Acquire Flatfield: This button acquires a *flatfield* file. It is equivalent to clicking on Acquire Flatfield from the Acquisition menu.



ROI/Line: Causes a cross section vs. intensity plot of the pixels lying along the line defined by the *line mode* function. Intensity is plotted on the Y axis and pixel number on the horizontal axis. The first pixel of the line is pixel #1 and the highest pixel number simply corresponds to the number of pixels along the line. *ROI/Line is not available in early releases of the software.*



Smooth: Applies the *smoothing* function (low-pass filter). The effect is to attenuate regions with high contrast, while leaving pixels in regions of low contrast almost unchanged. *Smoothing is not available in early releases of the software.*



Peak Find: Opens the **Peak Find** dialog box (page 395).



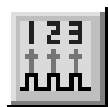
Sobel Edge Detection: This button initiates Sobel edge detection. This is equivalent to selecting *Sobel* on the Edge Enhancement Parameters tab page and then clicking on **Process**.



Timing Generator Interactive Pulse Width and Delay: Allows you to control the Pulse Width and Pulse Delay parameters of the PTG or DG-535 Timing Generator while acquiring data.



Timing Generator Interactive Trigger Setup: Allows you to select the Timing Generator's Trigger mode (Internal or External) and, if Internal, to set the Frequency, all while acquiring data.



Pulse Counts: Opens the Pulse Counter dialog box, which reports the number of **PTG gate pulses** generated (main plus burst). Clicking this button is equivalent to selecting **Pulse Counter** on the **Acquisition** menu.



Setup Pulser: Opens the Setup window for the active pulser.



PI-MAX to Safe: Establishes the PI-MAX Safe mode, biasing the PI-MAX intensifier's photocathode off. The intensifier gain and exposure are retained. If pressed during data acquisition, data acquisition will halt before the Safe mode is established.



PI-MAX to CW: Establishes the PI-MAX Shutter mode, in which the photocathode is held biased on, allowing the PI-MAX to see light continuously. Except that the signal is intensified, the camera works the same as an unintensified unshuttered CCD camera and the exposure time is entirely a function of the Exposure Time parameter set with software. Note that this button is inactive while data acquisition is in progress.



PI-MAX to Gate: Puts the PI-MAX in the Gate mode, in which pulses from the DG-535 applied to the PI-MAX gating circuits determine when the PI-MAX photocathode is gated on, allowing the camera to "see" for the interval between the DG-535 Start and Stop pulses. Note that this button is inactive while data acquisition is in progress.



PI-MAX Gain/Options: Opens the on-line **Intensifier Gain** dialog box, which allows the PI-MAX intensifier gain to be adjusted, even while data acquisition is in progress. The setting range is 1 to 256 on an arbitrary scale. The default setting of 128 will work well in many situations.



Separator: Acts as spacer between buttons, allowing them to be arranged in functional groups.

Customize Toolbar dialog box

This box, opened by clicking on Custom Toolbar on the Setup menu, allows the user to select which buttons will be provided on the Custom Toolbar. Chapter 20 discusses the Customize Toolbar dialog box and its use in detail.

Data Corrections tab page

The Data Corrections tab page governs the four basic types of data correction provided for all controllers, Background Subtraction, Flatfield Correction, CCD Blemishes Removal and Cosmic Ray Removal. The following paragraphs describe the Data Corrections selections. For more detailed information about the significance of these selections and how the operations are performed. See Chapter 12, *Advanced Data*

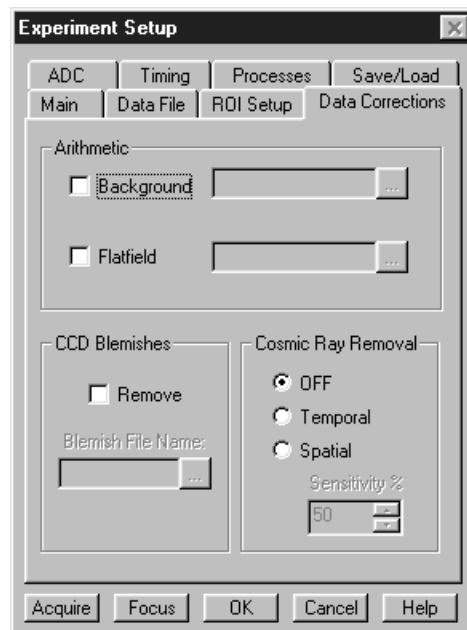
Collection. Note that not all of these data correction functions may be available in early releases of the software.

Background: If the checkbox is selected, the selected background subtraction file will be subtracted point-by-point from the data as it is collected. The selected filename appears in the textbox. Clicking on the button at the right of the box opens a browse dialog box to facilitate file selection. Note that for background subtraction to be performed, a background file must have been collected. See Chapter 12 for detailed information.

Flatfield: If the checkbox is selected, the data will be divided point-by-point by the selected flatfield correction file as the data is collected. The selected filename appears in the textbox. Clicking on the button at the right of the box opens a browse dialog box to facilitate file selection. Note that for flatfield correction to be performed, a flatfield correction file must have been collected. See Chapter 12 for detailed information.

CCD Blemishes: If checked, the columns specified as bad in the blemish removal file will be replaced by interpolated data as the data is collected. The selected blemish pattern file appears in the textbox. Clicking on the button at the right of the box opens a browse dialog box to facilitate file selection. Note that blemish removal requires that a proper blemish pattern file be available. The blemish removal pattern is defined by the user and can be specified for any device. *This feature not implemented in early releases of the software.*

Figure 261.
Data
Corrections tab
page.



Cosmic Ray Removal: Causes highly localized spikes, such as would be caused by cosmic rays interacting with the silicon of the CCD, to be removed from the data after it is acquired but before it is stored. Two different techniques (in addition to OFF) can be selected. The spatial technique compares the data with the set threshold level. The temporal technique compares a series of spectra and requires no user parameters. Radio buttons allow you to select Off, Temporal, and Spatial. If Spatial is selected, the Threshold setting determines how large a data spike must be to be identified as a cosmic ray effect. A setting of 50 will give good results in most situations. Cosmic ray data is replaced by interpolated before-and-after data.

Control Buttons:

Acquire: Clicking on Acquire initiates a data-collection run in which all data frames are stored.

Focus: Clicking on Focus initiates a data-collection run in which the data is not stored until Start Storage is selected.

OK: Click on OK to save the changes and close the Experiment Setup window without initiating a data collection run.

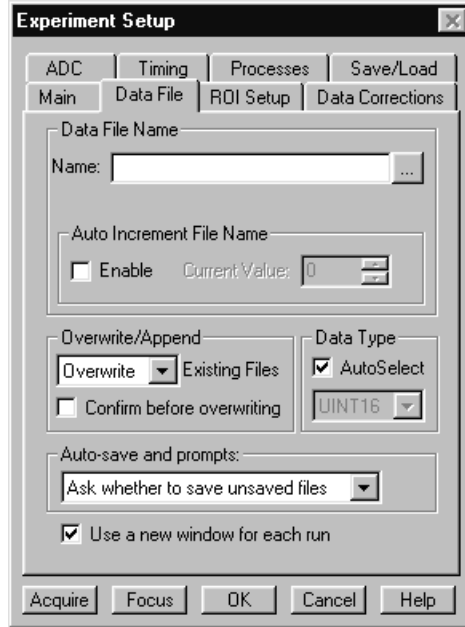
Cancel: Click on this button to close the Experiment Setup window without making any changes.

Help: Opens context-sensitive help for whichever tab page is on top.

Data File tab page

The Data File tab page allows you to name the data file that will be used to save collected data. The settings on this page only affect documents created by clicking on the **Focus** or **Acquire** menu items or toolbar buttons. In other words, these settings are for data collection, not post-processes. It also provides for auto-saving and for auto-incrementing the file name defined via a template. In addition, there is provision for selecting the data type manually or of having it automatically selected.

Figure 262.
Data File tab
page.



Data File Name: Enter a template name for the data you are about to collect. Use standard Windows 95 long-name conventions, and WinSpec/32 will add the .SPE extension. If no Datafile name is used, a temporary name will be assigned.

There is only one name template for both the "auto-increment" and "non-auto-increment" cases. If "auto-increment" is enabled, then the current value is added to the template name, otherwise the template name is used "as-is". If there is no template name then the template name "Untitled" is used.

It is essential that directory information be provided. Otherwise the data file (or files) will be stored in the last directory accessed. The easiest way to designate a directory is to click on the button at the right end of the Data File Name box. This will open a Windows 95 browse dialog box, which you can use to quickly select the "Save In" directory where the data file is to be stored. Note that you must also enter the file name in the File Name box of the browse dialog box.

Auto Increment File Name Enable: This box turns on the File Increment option. With File Increment, filenames such as EXP1.SPE, EXP2.SPE, etc. will be created as new data are collected. This name is based on the Data File Name and the Current Value settings. For example, if you were to enter EXP in the File Template Name box with a Current Value setting of "1," the first file would be named EXP1.SPE, the second would be named EXP2.SPE, the third EXP3.SPE, etc.

Current Value: If File Increment is enabled, filenames such as EXP1.SPE, EXP2.SPE, etc. will be created as new data are collected. The Current Value is the number in the filename, 1, 2, 3, etc., and will be incremented automatically.

Overwrite/Append Existing Files: If Overwrite is selected, the data file will overwrite an existing file having the same name. If Append is selected, the data will be appended to an existing file having the same name. In Append mode, the **Confirm before overwriting** check box is disabled, indicating that the user will *not* be asked to confirm appending to existing files.

Overwrite Confirmation: Check this box if you wish to be warned that the specified file name is already in use. If not checked, the old data file will be overwritten by the new one. No warning is provided.

Data Type AutoSelect: Computer examines the data and automatically make the data type determination.

Data Type (manual): User selects data type from the following choices:

Byte: 8 bits; best suited to use with V/ICCD. Can be used with other controller selections too but only the eight least significant data bits (levels 0 to 255) will be saved.

Int16: Signed integer; 16 bits (-32768 to 32767)

Long: Signed integer; 32 bits (-2,147,483,648 to 2,147,483,647)

Float: Floating point; 32 bits (-1.75494351e⁻³⁸ to 3.402823466 e³⁸)

UInt16: Unsigned integer; 16 bits (0 to 65535)

Auto-save and prompts: There are three possible settings for this field:

Ask whether to save unsaved files: With this choice, whenever a file is about to be closed, and if it was not saved since it was acquired, the user will get the standard **Save changes to Filex?** dialog with **Yes**, **No**, and **Cancel**. A file can be closed by:

- Clicking on the **Close** gadget of the only window displaying the file.
- Choosing the **Close** item from the system menu of the only window displaying the file.
- Activating a window displaying the file and choosing the **Close** item on the **File** menu.
- Starting a data collection, the new data file will have the same name as an open file, **Auto-increment File Name** is not enabled, and **Append/Overwrite** is set to **Overwrite**.
- Selecting the **Window...Close All** menu item. With this selection, all open files are closed without prompting regardless of the settings here.

Automatically save file after each run: With this choice, after every run is complete, if the user has entered a filename template, the file will automatically be saved with the "SPE" file extension. After a file is saved, there will be no further prompt when the file is closed. Note that if there is not a filename template, the file will not be autosaved (i.e. Untitled.SPE will not be created).

Don't auto-save or ask to save: With this selection, the user won't receive a prompt when a file is closed as a result of starting a data collection. A prompt

will still be issued if the user closes the file explicitly and it has not been saved since being collected.

Use a New Window for each run: This item tells the program whether to create a "new window" for each run. If **New Window** is *not* checked, then:

- Every run without a template filename will use the name **Untitled**.
- Every run with a template filename will use the template filename.
- If Auto-increment Filename is enabled, the name will have the current value appended to it.

In all of these cases, the window will retain its former size and position as much as possible (i.e. if the user didn't change the pixel binning and also require a fixed aspect ration in the display, etc.)

If **New Window IS** checked, then:

- Each run without a template filename will have the name Untitled1, Untitled 2, etc., whether auto-increment filename is on or not.
- Each run with a template filename will use the template filename. If auto-increment filename is on, the current value will be added to the template filename.

In both cases, the window position will step down for each new window created.

Control Buttons:

Acquire: Clicking on Acquire initiates a data-collection run in which all data frames are stored.

Focus: Clicking on Focus initiates a data-collection run in which the data is not stored until Start Storage is selected.

OK: Click on OK to save the changes and close the Experiment Setup window without initiating a data collection run.

Cancel: Click on this button to close the Experiment Setup window without making any changes.

Help: Opens context-sensitive help for whichever tab page is on top.

Data window

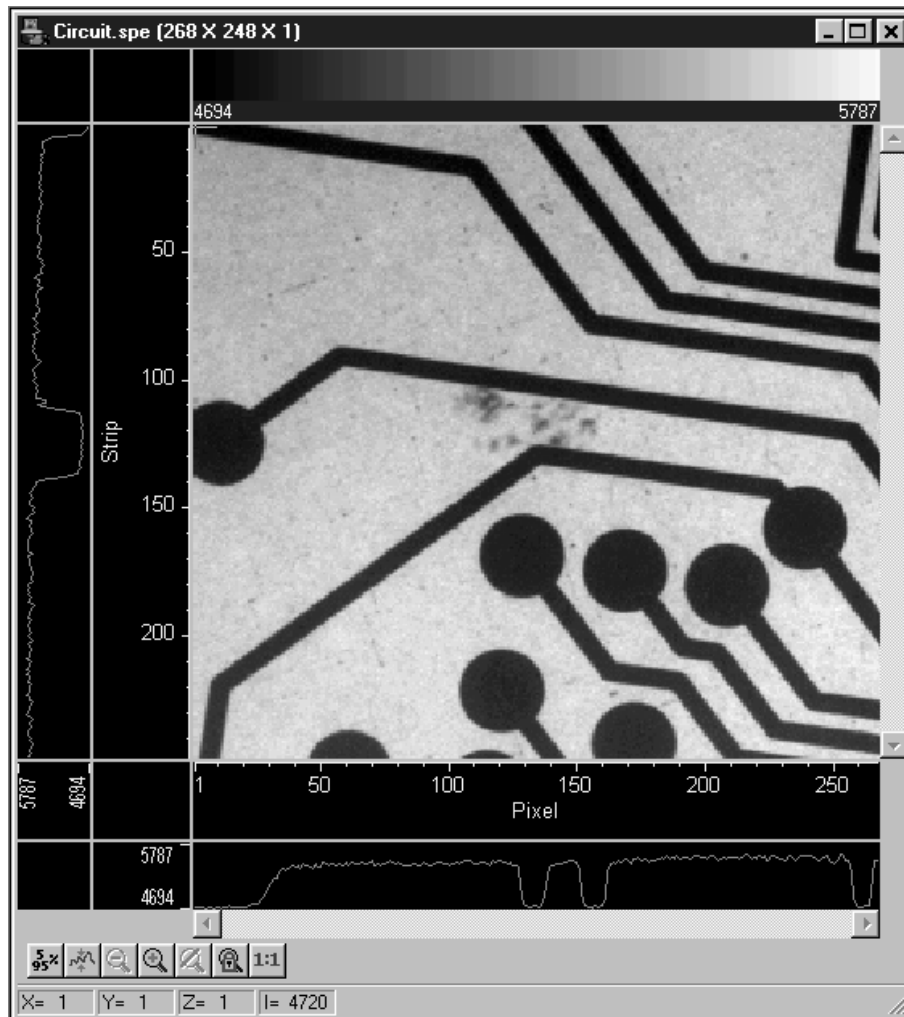
Opening a data file or collecting data opens a data window. Any number (consistent with system memory) can be open at once but only one is active. Clicking on a window makes it active, as indicated by its title bar becoming highlighted. Data can be displayed as an image, graph or 3D graph as selected via the Display Layout Main tab page or from the Open file dialog box. Figure 263 shows a typical image display.

If **Colorbar** has been selected on the Display menu, Data Window Context menu or on the Image Display tab page, a colorbar containing the image colors appears above the image with numbers that indicate the actual range. Similarly, if **Infobar** has been selected on the Display menu, Display Layout General tab page, or Data Window Context menu, the X, Y, Z and Intensity values at the cursor position will be listed on the

info bar, which is located directly beneath the Data Window toolbar. *The info bar information is displayed for both image and intensity (graph) displays and appears even if the cursor isn't displayed.*

Figure 264 shows a typical display of data as a 3-D graph. Note that the image is shown with axes and cross-sections. Axes labels are specified via the Display Layout Axes page. Cross-sections can be shown in both image and 3D graph displays, but not in a simple two-dimensional display. *See Chapter 10 for additional information on data display.*

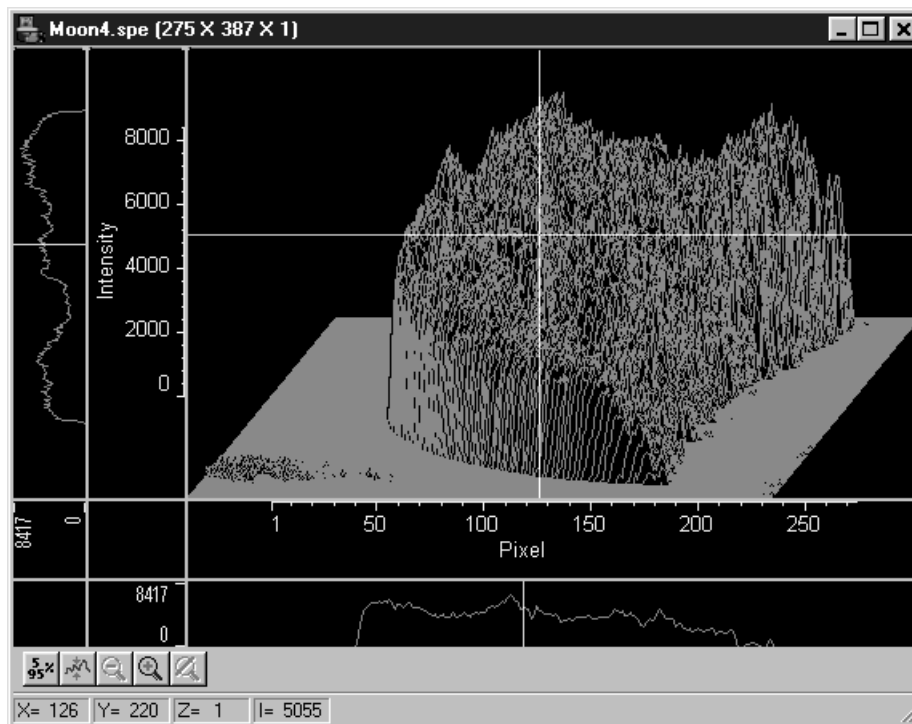
Figure 263.
Typical image
display.



Data windows can be moved, maximized, minimized to an icon on the task bar, or resized in accordance with standard windows conventions. Selections on the Display Layout Image-Layout tab page determine whether the aspect and zoom ratios will be fixed or allowed to vary.

Data displayed as a graph tracks changes in the window dimensions. If the window is stretched or compressed horizontally or vertically, the data display will stretch or compress with it.

Figure 264.
Typical graph
display.



The Data window button bar contains the following buttons. *Note that **Toggle Fixed Zoom Factor On/Off** and **Zoom 1:1** are only provided for image viewing.*



Auto: Intensity levels are mapped to display, which generally displays 256 (8 bits) levels. This gives a fast on-scale overview of the data. Different scaling can then be used to examine regions of particular interest more closely.



5%-95%: Function depends on whether data is being displayed as an image or as a graph. If an image, only data in the 5% to 95% range are displayed. Data with more than 95% of the maximum intensity are displayed as white, while those with less than 5% of the maximum intensity are displayed as black. If displayed as a graph, the data intensity scale is shifted so that it begins at 5% of range above the X axis and ends at 95% of the Y axis. This assures that there will be some separation between the data display and the data region boundaries.



Zoom In: Allows a rectangular region of the displayed data, selected by the mouse, to expand to fill the display area so that it can be examined in detail. To select the data, position the mouse cursor at one corner of the region to be defined. Next press the left mouse button and, while it is held down, drag the mouse to the diagonally opposite corner of the region being defined. Then release the mouse button and click on In.



Zoom Out: Zooms outward one step.



UnZoom All: Removes the effect of any number of Zoom-In operations, restoring the original view.



Toggle Fixed Zoom Factor On/Off: When pressed, Fixed Zoom Factor is On; equivalent to selecting Fixed Zoom Factor on the Display Layout **Image Layout** tab page. In released position, Fixed Zoom Factor is Off; equivalent to

leaving Fixed Zoom Factor on the Display Layout Image Layout tab page unselected. For more information, see the discussion of the Image Layout tab page on page 359. *Note that this button is only provided when viewing a data set as an image.*



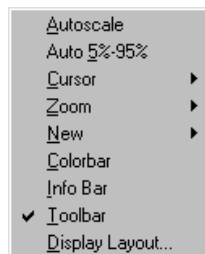
Zoom 1:1 button: Clicking this button attempts to set the zoom factor to 1:1. If the window is in scroll mode, (fixed zoom) this should always succeed, although you may have to scroll to see the entire image if it is too big to fit into the data window. If the window is in stretch mode (variable zoom) then it may be impossible to set the zoom to 1:1 if this would make the window too big to fit into the application window. In this case the zoom factor is set as close to 1:1 as possible. The Zoom 1:1 button will be in the pressed position as long as the zoom factor is 1:1, whether this happens as a result of clicking the button or from setting the zoom factor some other way. *Note that this button is only provided when viewing a data set as an image.*

Data Window Context menu

For user convenience, the essential data window functions have been gathered into a single menu, the Data Window Context menu, illustrated in Figure 265. This menu, which is available whether the data is displayed as an image or as a graph, can be accessed by right clicking anywhere in the data display area. Brief descriptions of the provided functions follow.

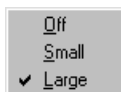
Note: Right clicking inside an ROI will open the ROI context menu, described on page 436.

Figure 265.
Data Window
Context menu.

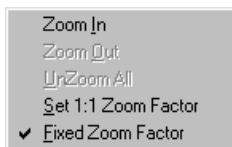


AutoScale: All of the data intensity levels are mapped to the display, which are ordinarily capable of displaying 256 (8 bits) gray levels. This gives a fast on-scale overview of the data. Different scaling can then be used to examine regions of particular interest more closely.

Auto 5%-95%: Function depends on whether data is being displayed as an image or as a graph. If displayed as an image, only data in the 5% to 95% range are displayed. Data with more than 95% of the maximum intensity are displayed as white, while those with less than 5% of the maximum intensity are displayed as black. If displayed as a graph, the data intensity scale is shifted so that it begins at 5% of range above the X axis and ends at 95% of the Y axis. This ensures that there will be some separation between the data display and the data region boundaries.



Cursor: Equivalent to selecting the Cursor on the View menu; gives choice of small, large, or no cursor. The crosshair (large) cursor can be particularly useful, for example, if the scale function is active. The precise pixel position of the cursor can be read from the scales using the crosshair.



Zoom: Provides the same zoom functions as are present on the data screen toolbar. They are:

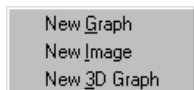
Zoom In: Allows a rectangular region of the displayed data, selected by the mouse, to expand to fill the display area so that it can be examined in detail. To select the data, position the mouse cursor at one corner of the region to be defined. Next press the left mouse button and, while it is held down, drag the mouse to the diagonally opposite corner of the region being defined. Then release the mouse button.

Zoom Out: Zooms out one step.

UnZoom All: Restores the original view if the Zoom In function has been used repeatedly.

Set 1:1 Zoom Factor: This selection attempts to set the zoom factor to 1:1. If the window is in scroll mode, (fixed zoom) this should always succeed, although you may have to scroll to see the entire image if it is too big to fit into the app window. If the window is in stretch mode (variable zoom) then it may be impossible to set the zoom to 1:1 if this would make the window too big to fit into the application window. In this case the zoom factor is set as close to 1:1 as possible. The Zoom 1:1 button will be in the pressed position as long as the zoom factor is 1:1, whether this happens as a result of clicking the button or setting the zoom factor some other way. *Active when viewing an image only.*

Fixed Zoom Factor: When selected, the mapping of image pixels to the monitor cannot be changed. As a result, the image size remains constant, although the window size can be adjusted by dragging the window's corner or an edge. Scrollbars allow all portions of the image to be viewed. *Active when viewing an image only.*



New: If a data file is open and active, selecting New Graph, New Image or New 3D Graph will cause a second window containing the selected data to be displayed in the selected format.

Colorbar: Causes a colorbar containing the image colors to appear above the image with numbers that indicate the actual data range. The Colorbar is only available when viewing an image.

InfoBar: Causes the X, Y, Z and Intensity values at the cursor position to be listed on the Information Bar, which is located directly beneath the Data Window button

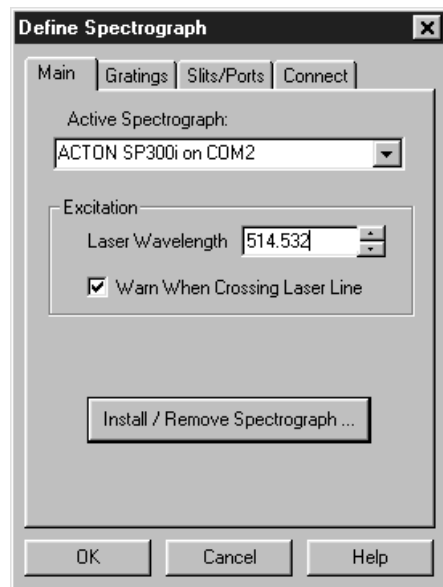
bar. The infobar information is displayed for both image and intensity (graph) displays and appears even if the cursor isn't displayed.

Toolbar: Allows the Data Window button bar to be switched on or off.

Display Layout: Opens the Display Layout dialog box.

Define Spectrograph dialog box

Figure 266.
Define Spectrograph dialog box.



The Define Spectrograph dialog box contains the tab pages for specifying the Spectrograph properties. It additionally has three control buttons that apply for all spectrographs.

For Additional Information

Main tab page: pg. 375

Gratings tab page: pg. 354

Slits/Ports tab page: pg. 448

Connect tab page: pg. 296

Control Buttons:

OK: The COM port selection is executed and saved and the dialog box is closed.

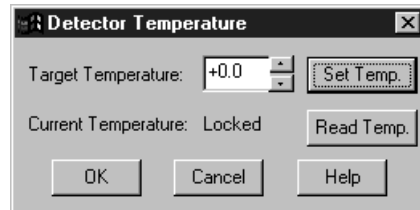
Cancel: The dialog box is closed without implementing any changes that might have been made.

Help: Opens context sensitive help for whichever tab page is on top.

Detector Temperature dialog box

If the selected controller is a MicroMAX, ST-133 or V/ICCD (or control box), clicking Detector Temperature on the Setup menu will open the Detector Temperature dialog box (Figure 267), which is used to set the detector temperature with these controller models. In addition to allowing the user to set the detector temperature, this dialog box indicates whether temperature lock has been established. If the controller is a V/ICCD or V/ICCD Control box, it is also possible to set the temperature from the Focus dialog box. *See Temperature Control on page 106 for additional information.*

Figure 267.
Temperature
dialog box.



Target Temperature: Used to set the detector temperature, which can be directly keyed or set using the spin wheels. The detector isn't instructed to go to the new temperature until the Set Temp button is clicked.

Set Temp: Pressing this button directs the detector to go to the new Target Temperature.

Current Temperature: Followed by **Locked** or **Unlocked** to indicate whether temperature lock has been established. This indication is automatically updated every two seconds. Alternatively, clicking on the Read Temp button will force an immediate update.

Read Temp: Forces an immediate update of the Current Temperature Locked/Unlocked indication.

Control Buttons:

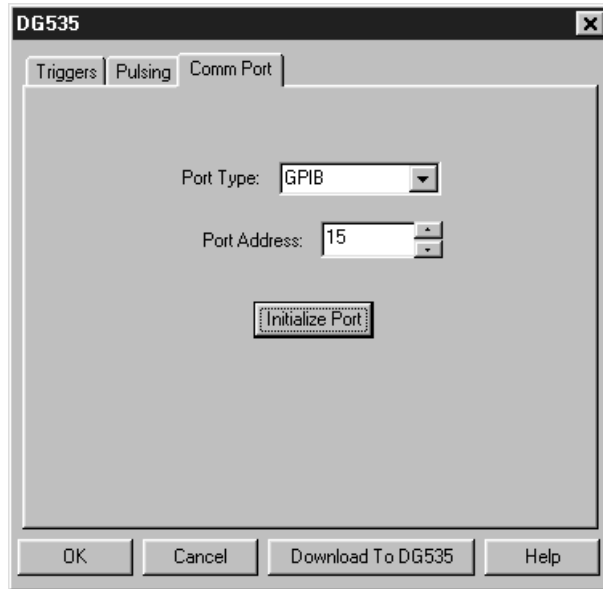
OK: Closes the Detector Temperature dialog box.

Cancel: Closes the Detector Temperature dialog box.

Help: Opens the context sensitive help for the Detector Temperature dialog box.

DG-535 Comm Port tab page

Figure 268.
DG-535 Comm
Port tab page.



Allows you to set the communications port and parameters for communications between the computer and the pulser/timing generator. Additionally provides for initializing the port. *See Chapter 19 for additional information.*

Parameters

Port Type: Determines which type port will be used. Select GPIB for communications with the DG-535.

Init: Immediately initializes the selected Comm Port. If the pulser/timing generator is not correctly connected to that Comm port or not turned on, an error message will appear.

Control Buttons:

Download to DG-535: Clicking on this button immediately sends all current dialog values to the DG-535. *Selecting **Download to DG-535** also changes the name on the **Cancel** button to **Close**, indicating that canceling is no longer an option.*

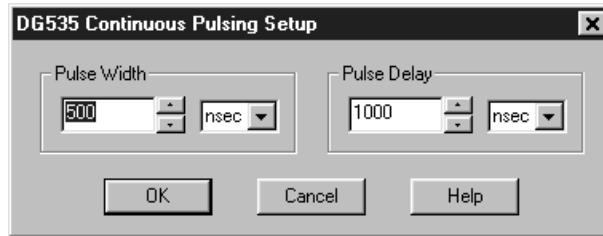
OK: Click on this button to close the dialog. Selecting this button does *not* automatically program the pulser/timing generator. To program the selected values into the timing generator you must click on **Download to DG-535**.

Cancel: The Cancel button exits the dialog without saving any settings. *The pulser is reprogrammed with the new values when you execute **Download to DG-535**. Selecting **Download to DG-535** also changes the name on the **Cancel** button to **Close**, indicating that canceling is no longer an option.*

Help: Click on this button to open the online help for this window.

DG-535 Continuous Pulsing Setup dialog box

Figure 269.
DG-535
Continuous
Pulsing setup.



When Continuous pulsing, the Pulse Width and Pulse Delay remain constant at the values specified. They can be entered directly or you can use the spin wheels to achieve the wanted settings. The units are selected from the drop-down boxes to the right of the data-entry windows.

Control Buttons:

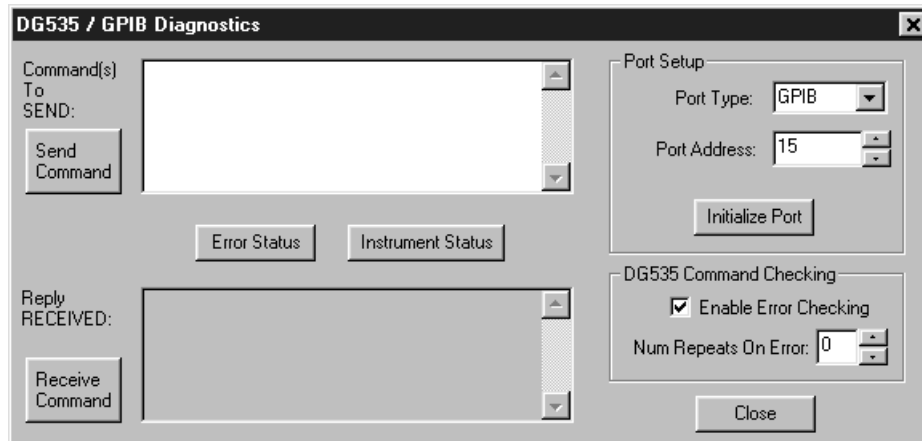
OK: Enters the specified values and closes the dialog box, returning you to the DG-535 window. Note that the DG-535 parameters aren't transmitted to the DG-535 until you click on Download to DG-535 (DG-535 window).

Cancel: Closes the dialog box leaving the original settings in effect.

Help: Opens context-sensitive help for the Continuous Pulsing Setup dialog box.

DG-535/GPIB diagnostics dialog box

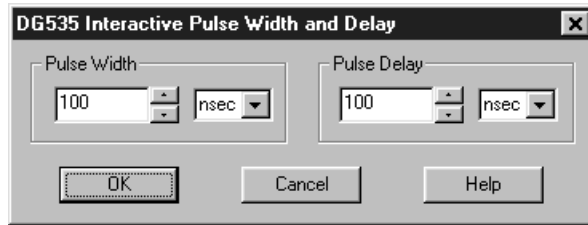
Figure 270.
DG-535/GPIB
diagnostics
dialog box.




This window allows DG-535 commands as defined in the DG-535 instruction manual to be transmitted to the DG-535. The response is displayed in the lower window. Note that this window can also be used to set the Port Type and Address, and to initialize the port. *The DG-535/GPIB Diagnostics dialog box is primarily intended as a factory hardware development tool and may not be included in user software.*

DG-535 Interactive Pulse Width and Delay dialog box

Figure 271.
DG-535
Interactive
Pulse Width
and Delay
dialog box.



The DG-535 Interactive Pulse Width and Delay dialog box, accessed with the  button of the Custom toolbar, allows you to control the Pulse Width and Pulse Delay parameters of the DG-535 or PTG pulser while acquiring data.

Parameters

Pulse Width: The pulse width is the duration of the pulse applied to the PI-MAX intensifier to gate the photocathode. The units available are nanoseconds (nsec), microseconds (μ sec), or milliseconds (msec). Because only certain specific values are allowed, the timing generator adjusts the input value to the nearest allowable value.

Pulse Delay: The pulse delay is the time between the beginning of the trigger pulse (either internal or external) and the beginning of the photocathode gate pulse. The units available are nanoseconds (nsec), microseconds (μ sec), or milliseconds (msec). Because certain specific values only are allowed the timing generator adjusts the input value to the nearest allowable value.

Control Buttons:

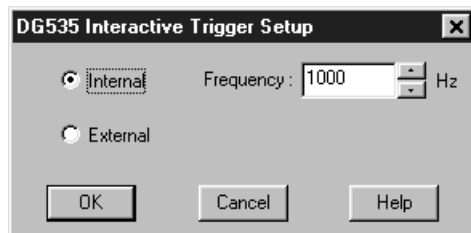
OK: Click on this button to close the Interactive Pulse Width and Delay dialog box. On clicking on OK, the new parameter values are sent to the timing generator.


Cancel: The Cancel button exits the Interactive Pulse Width and Delay dialog box without saving any settings.

Help: Click on this button to open the online help for this window.

DG-535 Interactive Trigger Setup dialog box

Figure 272.
Interactive
Trigger Setup
dialog box.



The Interactive Trigger Setup dialog box, accessed by clicking on the  button of the Custom toolbar, allows you to select the Trigger mode (Internal or External) and, if Internal is selected, to set the Frequency, all while acquiring data.

Parameters

Trigger Frequency: The trigger frequency is used with internal triggering. *See the DG-535 manual for valid frequency values.*

Trigger Mode radio buttons: The trigger mode determines whether the timing generator will create its own trigger signals (**Internal** selected), or will itself be triggered by trigger signals that originate in an external piece of equipment (**External** selected). *See the DG-535 manual for a description of the external trigger input on the DG-535.*

Control Buttons:

OK: Click on this button to close the Interactive Trigger Setup dialog box. On clicking on OK, the new parameter values are sent to the timing generator.

Cancel: The Cancel button exits the Trigger Setup dialog box without saving any settings.

Help: Click on this button to open the online help for this window.

DG-535 Pulsing tab page

Figure 273.
DG-535
Pulsing tab
page.



Selects the Continuous or Sequential Pulsing mode and allows access to the setup screens for Continuous or Sequential Pulsing. Allows bracket pulsing of the PI-MAX MCP to be switched ON or OFF. *See Chapter 19 for additional information on controlling a pulser/timing generator.*

Parameters

Continuous: Opens the Continuous Pulsing dialog box. *See discussion on page 297 for detailed information.*

Sequential: Opens the Sequential Pulsing dialog box. *See discussion on page 328 for detailed information.*

Bracket Pulsing On/Off radio buttons: Selecting ON activates the MCP bracket gating of the PI-MAX detector. This technique enhances the PI-MAX intensifier's on/off ratio in UV measurements. The width and delay are adjusted automatically to always bracket the photocathode gate pulse. Keep in mind that the on/off switching of the MCP bracket pulsing is slow, taking about 500 ns to turn on and 200 ns to turn off. Selecting OFF switches off bracket pulsing of the PI-MAX detector. Photocathode gating continues to be provided.

Control Buttons:

Download to DG-535: Clicking on this button immediately sends all current dialog values to the DG-535. *Selecting **Download to DG-535** also changes the name on the **Cancel** button to **Close**, indicating that canceling is no longer an option.*

OK: Click on this button to close the dialog. Selecting this button does *not* automatically program the pulser/timing generator. To program the selected values into the timing generator you must click on **Download to DG-535**.

Cancel: The Cancel button exits the dialog without saving any settings. *The pulser is reprogrammed with the new values when you execute **Download to DG-535**. Selecting **Download to DG-535** also changes the name on the **Cancel** button to **Close**, indicating that canceling is no longer an option.*

Help: Click on this button to open the online help for this window.

DG-535 Pulse Sequence Setup dialog box

Figure 274.
DG-535
Sequential tab
page.

The screenshot shows the 'Pulse Sequence Setup' dialog box with the 'Sequential' tab selected. The dialog is organized into several sections:

- Number of Images:** A spinner box set to 1.
- Pulse Width:** Start: 500 nsec, End: 10000 nsec.
- Pulse Delay:** Start: 1000 nsec, End: 100000 nsec.
- Check Pulse Width and Delay Min/Max:** A checked checkbox with the text '(Message Displayed)'.
- Increment Type:**
 - Fixed:** Selected with a radio button. Width Increment: 0 nsec, Delay Increment: 0 nsec.
 - Exponential:** Unselected with a radio button.
- Fast Decay (under Exponential):** Time Constant: 1 usec, Amplitude: 0.
- Slow Decay (under Exponential):** Time Constant: 10 usec, Amplitude: 10.
- Buttons:** 'View Width / Delay Sequence...', 'Save Sequence Values To File' (checked), and 'Setup File...'.
- Software Accumulations:** Repeat Width/Delay for: 0 Exposure(s).
- Bottom Buttons:** 'OK', 'Cancel', and 'Help'.

In Pulse Sequential operation, the Pulse Width and Pulse Delay change over the course of the measurement. This sweep can be accomplished linearly (**Fixed** Increment type) or exponentially (**Exponential** Increment type). Linear sequential operation is well suited to locating and recovering a transient effect that always occurs at the same time with respect to T_0 . Exponential sequential operation is used to study decay processes, where the effect changes rapidly at the start of the measurement, and then changes slower and slower as the measurement progresses. The sweep is controlled so as to take many exposures in the region where the effect is changing rapidly, and fewer and fewer as the measurement progresses and the data changes more and more slowly. The resulting data points can be spline-fitted to generate the complete curve so that the decay constant can be calculated, even where the data derives from two decay processes occurring simultaneously.

Parameters

Number of Spectra: *With an Accumulations setting of one*, Number of Spectra equals the number of exposures, each of which is followed by a readout. After each exposure, the Pulse Width and Pulse Delay change as programmed before the next exposure occurs. *If multiple Accumulations are programmed*, each exposure is repeated n times, where n is the number of accumulations specified. Every accumulation is processed before the pulse delay and width change for the next shot. The total number of exposures equals the specified Number of Spectra times the number of Accumulations.

ATTENTION

Accumulations can be set on the DG-535 Pulse Sequence Setup dialog box and on the Experiment Setup Main tab page. The two settings must be the same for proper operation.

Pulse Width: The starting and ending pulse widths are independently set. The first Shot will have the **Starting** pulse width and the last Shot will have the **Ending** pulse width. This is true for both the Fixed and Exponential increment type.

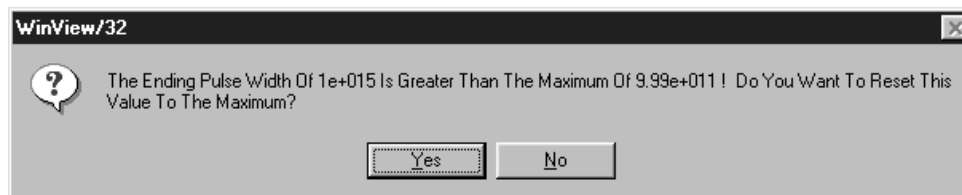
Pulse Delay: The starting and ending pulse delay values are independently set. The first Shot will be taken at the **Starting** delay with respect to T_0 and the last Shot will occur at the **Ending** delay with respect to T_0 . This is true for both the Fixed and Exponential increment type.

ATTENTION

Although the T_0 output of the DG-535 marks the start of each DG-535 timing cycle, the precise timing of both the gate and signal at the camera will additionally depend on a number of different delay mechanisms that can significantly affect the experiment. These are discussed for the PI-MAX camera in some detail in *Tips and Tricks* chapter of the PI-MAX instruction manual.

Check Pulse Width and Delay Min/Max (Message Displayed): If this box is checked and you specify a pulse width or delay outside the allowable range, a warning message (Figure 278) will be displayed. Clicking **Yes** will cause the parameter in question to be set to the limit value. Clicking **No** will cause the parameter *setting* to be retained, but the *actual* value will still be the applicable minimum or maximum. If the box isn't checked, the applicable minimum or maximum will be established automatically.

Figure 275.
Range Limits
Exceeded
warning.



Fixed Increment Type: With this selection, the increment or change in Pulse Width and Pulse Delay is the same from shot to shot. The actual increments depend on the specified starting and ending values and on the Number of Images. The increment values are calculated and reported in the associated text boxes.

Exponential Increment Type: With this selection, the increment or change in Pulse Width and Pulse Delay changes from shot to shot. The precise delay and width of each shot with respect to T_0 is determined by the values entered for the Fast Decay and Slow Decay **Time Constant** and **Amplitude** parameters. In fluorescent decay experiments, for example, there will typically be two species contributing to the output data, one of which decays much faster than the other. For example, there might be a fast fluorophor with a decay time of at most a few nanoseconds, and a slower one with a decay time of perhaps a hundred nanoseconds. By sweeping both the delay *and* the width, and making provision for entering time constant and amplitude information for two species, the sequential exponential algorithm is ideally suited to making this type of measurement. At the start of the decay where the amplitude is high but the decay is rapid, the gate pulses are narrow and close

together. Towards the end of the decay where the decay is slow, the gate pulses are further apart but much wider to accommodate the lower signal amplitude. The result is output data that is relatively constant in intensity over the decay time. This data can be easily normalized by dividing each point by the exposure time and then using a spline fit to recover the curve. The logarithm (base e) can then be taken to obtain a straight line (or two lines successive line segments, each with a different slope for two species). Tangents can be fitted to each segment to determine the rate constant for each species.

Fast Decay

Time Constant: In a two species system, enter the *decay time* of the faster of the two species. Note that it is not *essential* that you enter a value. If you have the decay time information, you will get better data if the information is entered, but acceptable results can be obtained in many situations by using the default. If there is only one species, or if you wish to discard the fast decay process, simply enter zero for the *Amplitude*.

Note that the Pulse Width and Pulse Delay values need to be selected with some care in fluorescence decay experiments. Typically the starting pulse width will be very narrow, perhaps 2 ns, and the final pulse amplitude should be wider by about the ratio of the anticipated signal amplitude decrease over the course of the measurement timebase. Similarly, the starting pulse delay has to take the various insertion delays into account, and the final delay value might typically be set to a value on the order of five times the anticipated decay time of the process.

Amplitude: This is the *relative* amplitude of the fast decay with respect to the slow one. For example, if you know that the amplitude of the fast decay signal is typically five times the amplitude of the slow decay signal, you could enter “5” for the fast decay amplitude and “1” for the slow decay amplitude. Keep in mind that it is the *ratio* that is being expressed. For example, there is no difference between entering fast and slow amplitude values of “5” and “1” and entering fast and slow amplitude values of “50” and “10.” Note that the default values will give satisfactory results in many measurements.

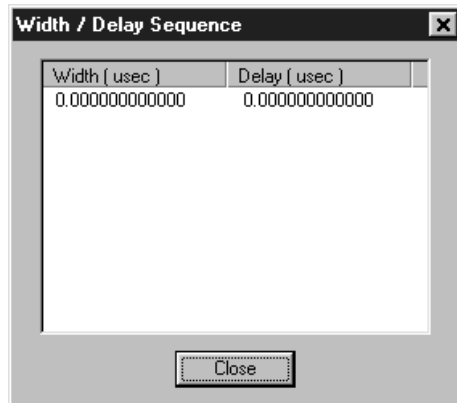
Slow Decay

Time Constant: In a two species system, enter the *decay time* of the slower of the two species. Note that it is not *essential* that you enter a value. If you have the decay time information, you will get better data if the information is entered, but acceptable results can be obtained in many situations by using the default. If there is only one species, or if you wish to discard the fast decay process, simply enter zero for the *fast decay Amplitude*.

Amplitude: This is the *relative* amplitude of the slow decay with respect to the fast one. For example, if you know that the amplitude of the slow decay signal is typically one fifth the amplitude of the fast decay signal, you could enter “1” for the slow decay amplitude and “5” for the fast decay amplitude. Keep in mind that it is the *ratio* that is being expressed. For example, there is no difference between entering slow and fast amplitude values of “1” and “5” and entering fast and slow amplitude values of “10” and “50.”

View Width/Delay Sequence: Opens a window listing the currently programmed sequence of pulse width and pulse delay values.

Figure 276.
Pulse
width/delay
sequence list
box.



Save Sequence Values to File: When this box is checked, the sequence values will be saved *on completion of the run*. The values saved are those actually used to take the data. The file could be recalled later and used for data normalization or other purposes.

Setup File: Opens the Sequence Values File dialog box (Figure 277), which enables the following:

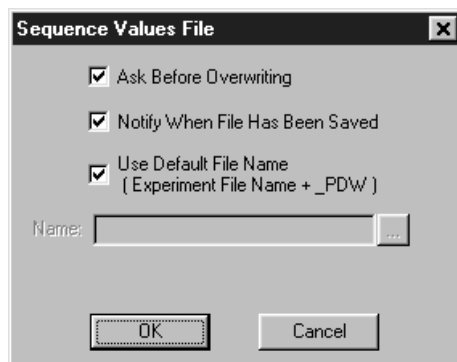
Ask Before Overwriting: If checked, user will be queried before a new sequence value file overwrites an existing one. If unchecked, overwriting can occur without warning.

Notify When File Has Been Saved: The file is saved at the end of the data-acquisition run. User will be notified that this has occurred if this box is checked.

Use Default File Name: If checked, sequence value file name will be experiment file name, but with the extension **PDW**. If unchecked, user must enter the name in the **Name** text box.

Name: If not using the default name for the sequence value file, enter the file name in the provided text box. The button at the end of the box opens a browser to facilitate assigning the file location.

Figure 277.
Sequence
Values File
dialog box.



Software Accumulations: Sets the number of exposures to be taken for each Shot.

Note that the number of Accumulations set here must be the same as the value set on the Experiment Setup Main tab page for proper operation.

Control Buttons:

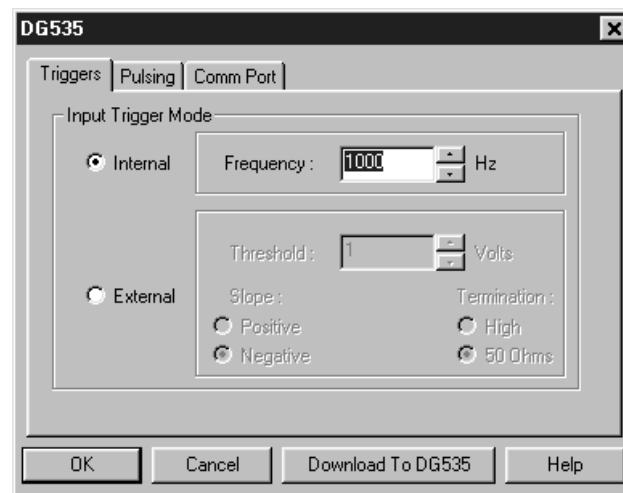
OK: Saves the specified parameter values and closes the dialog box, returning you to the DG-535 window.

Cancel: Closes the dialog box without saving any of the specified values.

Help: Accesses context-sensitive help for this window.

DG-535 Triggers tab page

Figure 278.
DG-535
Triggers tab
page.



The DG-535 Triggers tab page allows selection of the Input Trigger mode, Input or External, and additionally allows the applicable parameters for the modes to be set.

Parameters

Trigger Frequency: The trigger frequency is used with internal triggering. See the DG-535 manual for valid frequency values.

Trigger Mode radio buttons: The trigger mode determines whether the DG-535 will create its own trigger signals (**Internal**), or will itself be triggered by trigger signals that originate in an external piece of equipment (**External**). See the DG-535 manual for a description of the external trigger input on the DG-535.

Threshold: In the External trigger mode, **Threshold** sets the required height the applied trigger must be to trigger the DG-535.

Slope: In the External trigger mode, the **Slope** radio buttons allow you to choose whether the DG-535 will be triggered on the positive-going or negative-going edge of the applied trigger.

Termination: In the External trigger mode, the Termination radio buttons allow you to choose whether the trigger applied to the DG-535 will see a termination impedance of **50 Ω** or **High**.

Control Buttons:

Download to DG-535: Clicking on this button immediately sends all current dialog values to the DG-535. Selecting **Download to DG-535** also changes the name on the **Cancel** button to **Close**, indicating that canceling is no longer an option.

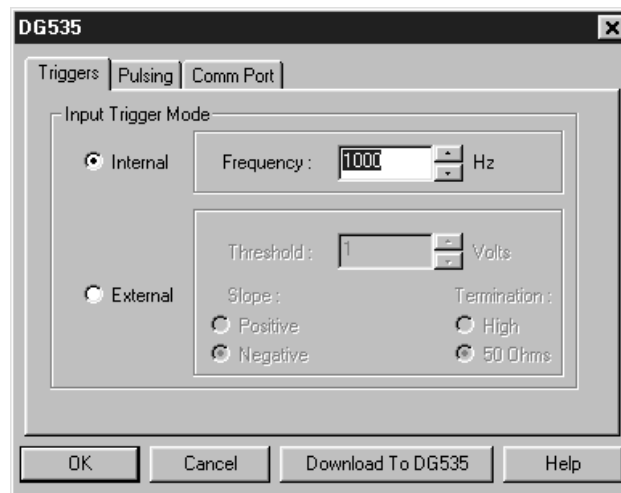
OK: Click on this button to close the dialog. Selecting this button does *not* automatically program the pulser/timing generator. To program the selected values into the timing generator you must click on **Download to DG-535**.

Cancel: The Cancel button exits the dialog without saving any settings. *The pulser is reprogrammed with the new values when you execute **Download to DG-535**.* Selecting **Download to DG-535** also changes the name on the **Cancel** button to **Close**, indicating that canceling is no longer an option.

Help: Click on this button to open the online help for this window.

DG-535 window

Figure 279.
DG-535
window.



Operation of the DG-535 Pulser becomes available when you select **Pulsers** from the Setup menu, next click on the **DG-535** radio button and then click on **Setup DG-535** button. This opens the DG-535 window as shown above. Note that pulser support must be selected when installing the WinSpec/32 software for DG-535 control to be available.

The DG-535 parameters are set via the IEEE-488 GPIB link between the computer and the DG-535 Pulser. The choices provided by the tab pages correspond to those provided by the DG-535 front panel, and are described below and in detail in the DG-535 manual. The DG-535 window contains three tab pages and the four buttons that are always present independent of the selected tab page.

Control Buttons:

Download to DG-535: Clicking on this button immediately sends all current dialog values to the DG-535. *Selecting **Download to DG-535** also changes the name on the **Cancel** button to **Close**, indicating that canceling is no longer an option.*

OK: Click on this button to close the dialog. Selecting this button does *not* automatically program the pulser/timing generator. To program the selected values into the timing generator you must click on **Download to DG-535**.

Cancel: The Cancel button exits the dialog without saving any settings. *The pulser is reprogrammed with the new values when you execute **Download to DG-535**. Selecting **Download to DG-535** also changes the name on the **Cancel** button to **Close**, indicating that canceling is no longer an option.*

Help: Click on this button to open the online help for this window.

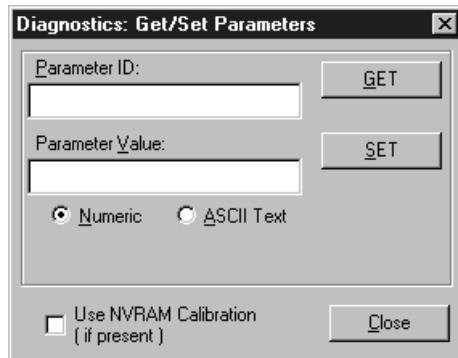
Diagnostics: Controller Registers

Figure 280.
Diagnostics:
Controller
Registers
dialog box.

The Diagnostics Controller Registers dialog box is primarily intended as a factory hardware development tool.

Diagnostics: Get/Set Parameter

Figure 281.
Get/Set
Parameter
dialog box.



The Diagnostics Get/Set Parameters dialog box allows the value of a parameter for which you have the ID to be entered directly. This function is primarily used as a factory development tool.

Diagnostics menu

Figure 282.
Diagnostics
menu.



The Diagnostics menu, which is accessed by selecting Diagnostics on the Setup menu, allows access to a number of diagnostics functions. *Some of the listed diagnostics functions are primarily intended for factory hardware development.*

For Additional Information

TTL dialog box: pg. 466

Get/Set Parameters dialog box: pg. 335

Controller Registers dialog box: pg. 334

Versions and More dialog box: pg. 467

Manual Scan Patterns: pg. 376

DG535/GPIB: pg. 324

PTG Get/Set Parameter: *Do not disturb except with factory guidance.*

Dispersion dialog box

The dispersion procedure calibrates the wavelength scaling so that peaks on the far left or the far right in the window are also accurately calibrated. The Dispersion calculation requires that you work with two lines, one low and the other high. When working with a mercury source, 253.652 is convenient as the low line and 579.066 as the high line. Four measurements are made. The first one is with the low line near the left edge of the display and the second with the low line positioned near the right edge of the display. Then the measurements are repeated with the high line, again making one measurement with the line near the left edge of the display and the second with it near the right edge of the display. After these steps, WinSpec/32 then tries to find the combination of Focal Length, Inclusion Angle, and Detector Angle that minimizes the error.

Note: Some CCDs have very little response at 253.652. If this is the case for your detector, it will be necessary to use a peak having a longer wavelength as the low value. For mercury, the 435.84 line should prove suitable.

Focal Length (mm): This is the focal length of the spectrograph, one of the three Geometrics parameters. The initial value is established by the Load Defaults button and will be the manufacturer's stated value for the active spectrometer. The Geometrics parameters may change value as a result of the Dispersion procedure.

Inclusion Angle: This is the inclusion angle of the spectrograph, one of the three Geometrics parameters. The initial value is established by the Load Defaults button and will be the manufacturer's stated value for the active spectrometer. The Geometrics parameters may change value as a result of the Dispersion procedure.

Figure 283.
Dispersion
dialog box.

Dispersion

Selected Grating: 1200 BLZ=HOL

Geometrics

Focal Length (mm) 275

Inclusion Angle 21.7

Detector Angle 2

Load Defaults

Dispersion Calibration

Lower Reference Wavelength 253.652

Higher Reference Wavelength 579.066

Next Target Wavelength 253.806

Start Procedure Reposition Target

Instructions:

Click 'Start Procedure' to Move
Lower Reference Wavelength to Left of View Area

Messages:

OK Cancel Help

Detector Angle: This is the detector angle of the spectrograph, one of the three Geometrics parameters. The initial value is established by the Load Defaults button and will be the manufacturer's stated value for the active spectrometer. The Geometrics parameters may change value as a result of the Dispersion procedure.

Lower Reference Wavelength: This is the shorter wavelength line of the two being used to do the dispersion correction.

Higher Reference Wavelength: This is the longer wavelength line of the two being used to do the dispersion correction.

Next Target Wavelength: The target wavelength is the wavelength to which WinSpec/32 sets the spectrograph in order to position the reference line at the left or right of the data window. It may be that the resulting position of the reference line will not be ideal. It may be too far from the edge of the data display, or even out of sight beyond the data display boundary. If this is the case, change the wavelength value in the Next Target Wavelength box a few nm in the necessary direction and press the **Reposition Target** button. The spectrograph will move to the new setting, moving the reference line an equivalent number of nm.

Start Procedure: This button initializes the dispersion calculation cycle. Note that there are two name changes. It is initially **Start Procedure**. After the first data set has been collected, the name changes to **Continue**. After the last data set is taken the name changes to **Calculate Results**.

Control Buttons:

OK: Saves the dispersion calculation results and closes the dialog box.

Cancel: Closes the dialog box without implementing any changes.

Help: Opens context-sensitive help for the dialog box.

Display Label Settings dialog box

Figure 284.
Display Label
Settings dialog
box.

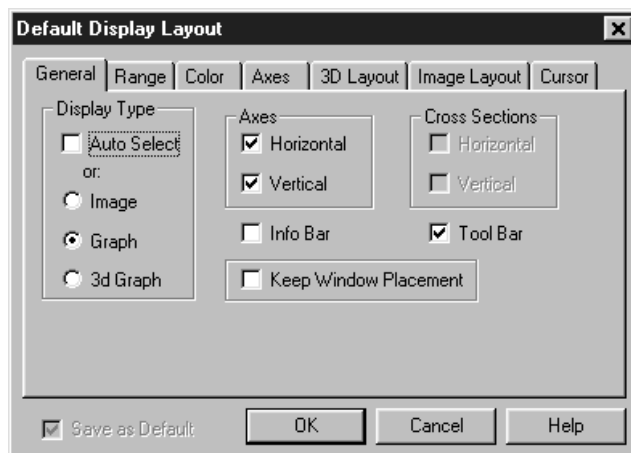


Clicking the Settings button on the Label dialog box opens the **Display Label Settings** dialog box (Figure 284), which determines the appearance of the label. Clicking on **Color** opens the color palette, allowing the label color to be selected. The **Horizontal** vs. **Vertical** selection determines whether the label lettering will be vertical

or horizontal. Similarly, the **Transparent** and **Opaque** radio buttons allow you to choose whether the text background will be transparent or opaque. **OK** executes the selections and closes the dialog box. **Cancel** closes the dialog box without executing any changes.

Display Layout window

Figure 285.
Display Layout
window.



The Display Layout window, which can be opened by selecting Layout on the Display menu, by clicking on the Layout Button of the File Open window, or by clicking on Display Layout on the Data Window Context menu, contains the display layout tab pages (separately described) and three Window Control buttons.

Note: If the Display Layout window is opened by clicking on **Display Layout** in the **Open File** dialog box, the **Range** tab page will not be displayed because the data file hasn't been opened yet.

Additional Information

General tab page: pg. 352

Range tab page: pg. 433

Color tab page: pg. 292

Axes tab page: pg. 280

3D Layout tab page: pg. 266

Image Layout tab page: pg. 359

Cursor tab page: pg. 305

Save as Default check box: Saves settings on all pages. These settings will be automatically established when software is started.

Control Buttons:

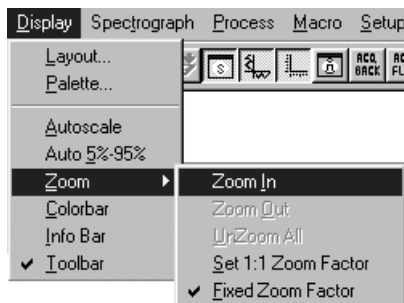
OK: Executes the layout settings and closes the Display Layout window.

Cancel: Closes the Display Layout window without implementing any of the changes.

Help: Opens context-sensitive help for whichever tab page is on top.

Display menu

Figure 286.
Display menu.



Menu Selections

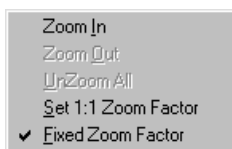
The selections on this menu determine how data files will be displayed. The following selections are available.

Layout: Opens the Display Layout window (page 338), which contains the tab pages specifying how the data is to be displayed.

Palette: Opens the Brightness/Contrast dialog box, which allows you to adjust the brightness and contrast of the active image. Five different transfer functions are provided. These adjustments have no effect on the actual data, but rather only affect how it is presented on the screen.

AutoScale: All of the data intensity levels are mapped to the display, which are ordinarily capable of displaying 256 (8 bits) gray levels. This gives a fast on-scale overview of the data. Different scaling can then be used to examine regions of particular interest more closely.

Auto 5%-95%: Function depends on whether data is being displayed as an image or as a graph. If displayed as an image, only data in the 5% to 95% range are displayed. Data with more than 95% of the maximum intensity are displayed as white, while those with less than 5% of the maximum intensity are displayed as black. If displayed as a graph, the data intensity scale is shifted so that it begins at 5% of range above the X axis and ends at 95% of the Y axis. This ensures that there will be some separation between the data display and the data region boundaries.



Zoom: Opens the secondary Zoom menu. Selections are as follows.

Zoom In: Allows a rectangular region of the displayed data, selected by the mouse, to expand to fill the display area so that it can be examined in detail. To select the data, position the mouse cursor at one corner of the region to be defined. Next press the left mouse button and, while it is held down, drag the mouse to the diagonally opposite corner of the region being defined. Then release the mouse button.

Zoom Out: Zooms out one step if the Zoom In function has been used.

UnZoom All: Restores the original view if the Zoom In function has been used repeatedly.

Set 1:1 Zoom Factor: This selection attempts to set the zoom factor to 1:1. If the window is in scroll mode, (fixed zoom) this should always succeed, although you may have to scroll to see the entire image if it is too big to fit into the app window. If the window is in stretch mode (variable zoom) then it may be impossible to set the zoom to 1:1 if this would make the window too big to fit into the application window. In this case the zoom factor is set as close to 1:1 as possible. The Zoom 1:1 button will be in the pressed position as long as the zoom factor is 1:1, whether this happens as a result of clicking the button or setting the zoom factor some other way. *Active when viewing image only.*

Fixed Zoom Factor: When selected, the mapping of image pixels to the monitor cannot be changed. As a result, the image size remains constant, although the window size can be adjusted by dragging the window's corner or an edge. Scrollbars allow all portions of the image to be viewed. *Active when viewing image only.*

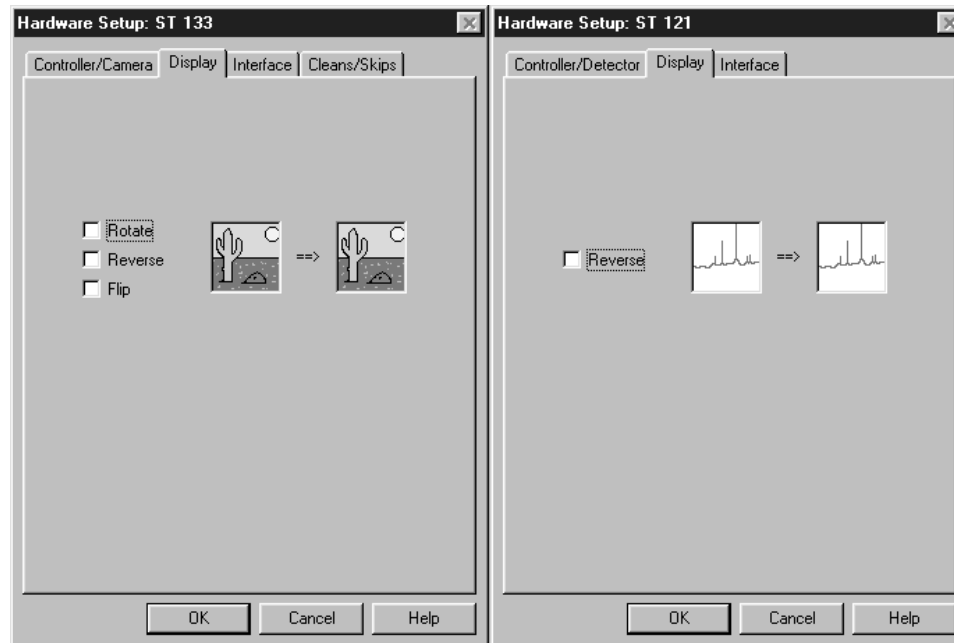
Colorbar: When **Colorbar** is selected on the Display menu or on the Image Display tab page, the colorbar appears above the image with numbers that indicate the actual range.

Infobar: When **Infobar** is selected, the X, Y, Z and Intensity values at the cursor position are listed on the infobar, which is located directly beneath the Data Window toolbar. *The infobar information is displayed for both image and intensity (graph) displays and appears even if the cursor isn't displayed.*

Toolbar: Allows the Data Window button bar to be switched on or off.

Display tab page

Figure 287.
Display tab
page; left
graphic applies
to all
controllers
except ST-121;
right graphic
applies to ST-
121 only..



The Display tab page, accessed by selecting Hardware on the Setup menu, determines the basic orientation of the data display.

Parameters

Thumbnail Graphics: There are two. The one on the left represents the actual orientation of an image or spectrum. The one to the right shows the effect on the display of applying one or more of the display orientation algorithms. Note that any orientation can be achieved with the proper combination of Rotate, Reverse, and Flip. **Exception:** Reverse is the only choice with an ST-121 Controller.

Rotate: Rotates the image 90° counterclockwise.

Reverse: Reverses the image horizontally.

Flip: Flips the image vertically.

Control Buttons:

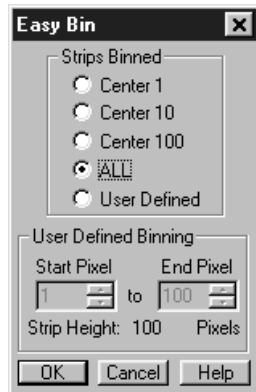
OK: Click on OK to save the changes and close the Hardware Setup window.

Cancel: Click on this button to close the Hardware Setup window without making any changes.

Help: Opens context-sensitive help for whichever tab page is on top.

Easy Bin dialog box

Figure 288.
Easy Bin dialog
box.



The Easy Bin dialog box (Figure 288), which is opened by selecting Easy Bin on the Acquisition menu, allows a single ROI to be quickly and easily defined. An Easy Bin ROI is always vertically centered on the chip, unless **User Defined** is selected, in which case the beginning and end of the region to be binned can be set by the user to be at any height on the chip. There are five binning selections, Center 1, Center 10, Center 100, All, and User Defined. With all of these choices the ROI will be the full chip width.

Strips Binned: A set of five radio buttons that determines the number of strips to be binned, as follows.

Center 1: Establishes an ROI one pixel high.

Center 10: Establishes an ROI 10 pixels high.

Center 100: Establishes an ROI 100 pixels high.

ALL: Selects the full chip height.

User Defined: Allows the user to set the Y axis (slit) Start and End pixels. The End Pixel value must be larger than the Start Pixel, and the region defined must not exceed the chip boundaries.

Control Buttons:

OK: Executes the selections and closes the dialog box.

Cancel: Closes the dialog box without executing any changes.

Help: Opens Help for Easy Bin dialog box.

Edge Enhancement (provided with Imaging Option only)

General discussion: Chapter 16.

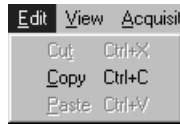
Input tab page: pg. 362

Parameters tab page: pg. 389

Output tab page: pg. 386

Edit menu

Figure 289.
Edit menu.

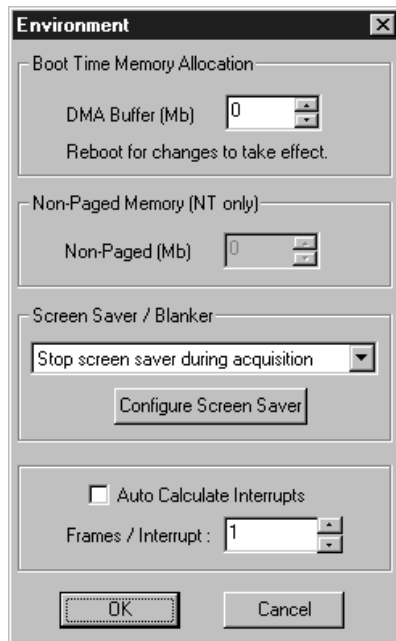


The Copy function (Ctrl C) allows *image data* to be transferred to the clipboard for easy transfer to other programs. Copy can not be used to transfer data displayed as a graph. *The Cut and Paste functions are not implemented in early releases of the software.*

Environment dialog box

The Environment dialog box (Figure 290), accessed from the Setup menu, determines the amount of memory that will be placed in the DMA buffer for data acquisition when the computer is next booted. The amount of RAM available to the PI software is a function of the amount of RAM required to operate Windows (usually from 6-12 Mbytes) and the amount of RAM used by other applications (varies greatly by application). Even when mail, fax, or other programs are minimized they still allocate RAM, and can interfere with the operation of the PI software. To maximize the amount of RAM available to the PI software, exit these programs before starting the PI software.

Figure 290.
Environment
dialog box.



Optimizing the system for data collection

Optimizing for data collection is usually necessary with high speed (5 MHz) imaging systems or where the data will consist of a long series of full-frame image files. For example, a series of 20 images with an exposure time of 200 msec would require

optimizing for data collection. An indication of this need would be if you have data overrun errors with the Environment default values.

The Acquisition buffer needs to be large enough to hold at least 3 frames, but should be calculated for as many frames as needed in a single burst. For example, if 10 frames are needed in rapid succession, calculate the Acquisition Buffer for 10. The upper limit of the number of frames will be the Available Memory.

Multiply the number of pixels in a frame by 2 (2 bytes per pixel) then by the number of frames and add a bit for overhead. For example, for a CCD with 1,400,000 pixels where 10 frames are needed, set the DMA Buffer to 3 Mbytes or higher. The Acquisition Buffer cannot be bigger than the Available Memory. The default value of 8 Mbytes is suitable for measurements. With an ISA interface, the highest possible setting is 14 Mbytes. With a PCI interface, you are limited solely by the amount of memory available.

NT Non-Paged Memory

This parameter only applies to operation under the NT operating system. The non-paged memory setting must be at least as large as the memory allocated for the buffer. No harm is done if the non-paged memory setting is larger than the memory allocated for the buffer.

Screen Saver

The Environment dialog box also controls the screen blanking function, which allows the screen to be blanked during acquisition.

A selection combo box to determine how the program controls the screen saver. There are three selections:

- Don't control screen saver; screen saver functions as configured, independent of WinSpec/32 status.
- Stop screen saver during acquisition; screen saver will not appear during data acquisition.
- Run screen saver during acquisition; the program launches the current screen saver during data acquisition (and stops it afterward). This selection facilitates darkened lab operation.

Clicking on the **Configure Screen Saver** button opens the PI screen saver's configuration dialog box (page 443).

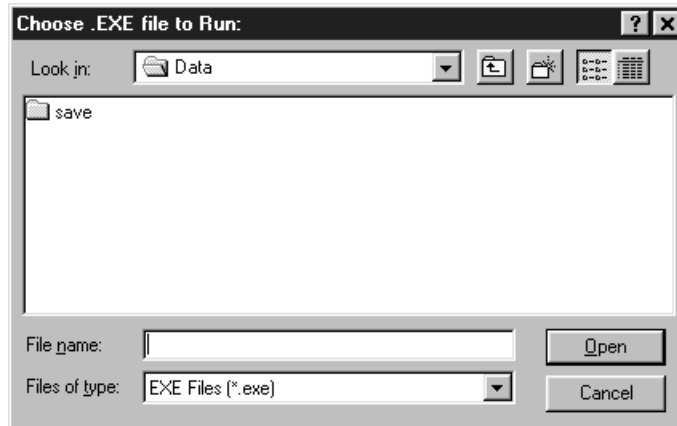
Control Buttons:

Cancel: The **Cancel** button closes the Environment Setup dialog without changing any settings.

OK: The **OK** button saves changes to the Environment Setup dialog and closes the dialog. Changes do not take effect until the *computer is rebooted*.

Execute dialog box

Figure 291.
Execute dialog
box.

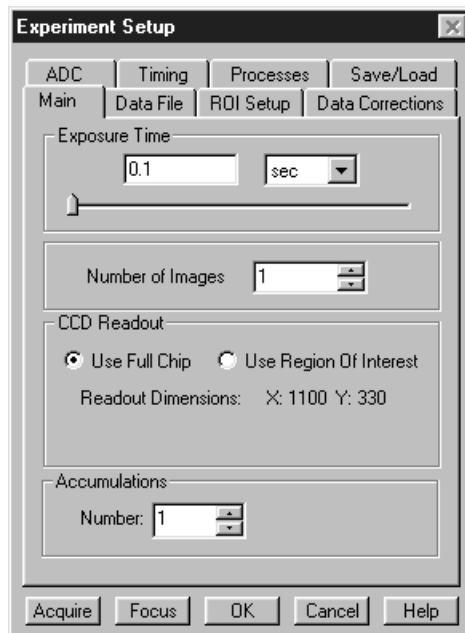


This dialog box, accessed by selecting **Execute Macro** on the **Macro** menu, allows you to run any executable program, including *.exe, *.bat and *.com programs, from inside WinSpec/32.

Experiment setup window

The Experiment Setup Window, opened by clicking on **Experiment Setup** on the Acquisition menu, contains the Experiment Setup tab pages (all described separately) and four window control buttons that are always present independent of the selected tab page.

Figure 292.
Experiment
Setup window
(ST-138
Controller).



For Additional Information

Main tab page: pg. 372

Data File tab page: pg. 313

ROI Setup tab page: pg. 436

Data Corrections tab page: pg. 311

A/D 3152 tab page: pg. 273

ADC tab page: pg. 274

Timing tab page: pg. 462

Processes tab page: pg. 415

Save/Load tab page: pg. 441

Control Buttons:

Acquire: Clicking on Acquire initiates a data-collection run in which all data frames are stored.

Focus: Clicking on Focus initiates a data-collection run in which the data is not stored until Start Storage is selected.

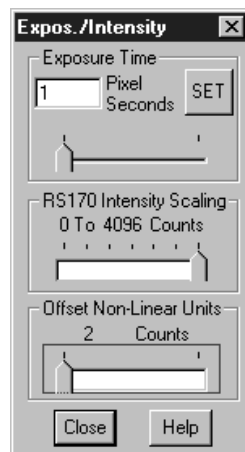
OK: Click on OK to save the changes and close the Experiment Setup window without initiating a data collection run.

Cancel: Click on this button to close the Experiment Setup window without making any changes.

Help: Opens context-sensitive help for whichever tab page is on top.


Exposure/Intensity dialog box (MicroMAX and ST-133)

Figure 293.
Intensity/Exposure
dialog box
(MicroMAX &
ST-133).



This dialog box, accessed by selecting Exposure/Intensity on the Acquisition menu, is like the Interactive Camera Operation dialog box with the following differences.

- Allows the Exposure time, Intensity Scaling, and Offset to be adjusted when not acquiring data. The Interactive Camera Operation dialog box, on the other hand, allows the parameter settings to be changed *while the data is being collected*.

- The Pattern functions are not available, nor are the Run, Stop, or Store buttons provided.
- Allows the Exposure time, Intensity Scaling, and Offset to be adjusted *while the data is being collected*.
- Since Intensity Scaling and Offset only affect the video as observed at a video monitor, unless **Video** is selected on the Acquisition Menu, these parameters will be grayed out.
- It is necessary to click the **Exposure Time SET** button before a change in Exposure Time can be saved.
- The **Close** button saves the settings and closes the dialog box. However, the Exposure Time won't be saved unless designated by clicking the **SET** button. To close the box without saving the settings, click on the Close button  at the right end of the box's title bar.

Control Buttons:

Close: Saves the settings and closes the dialog box. However, the Exposure Time won't be saved unless designated by clicking the SET button. To close the box without saving the settings, click on the Close button at the right end of the box's title bar.

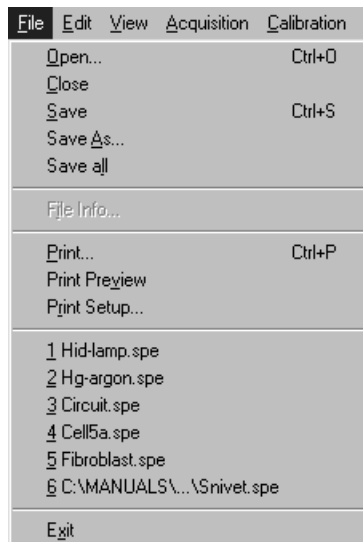
Help: Opens context-sensitive help for the Exposure/Intensity dialog box.

Factory Defaults dialog boxes

See page 371.

File menu

Figure 294.
File Menu.



This menu (Figure 294) provides the basic file functions as follows.

Open: Accesses the Open dialog box (pg. 381), allowing previously saved data files to be opened for display or processing.

Close: Closes all windows using the file displayed in the active data window.

Save: Saves the active data file using the original name and directory (folder).

Save as: Opens the Save As dialog box (pg. 439) , allowing the active data file to be saved under a name and location specified by the user.

Save All: Saves all open data files.

Print: Opens the Print dialog box. *See Chapter 18 for additional information; also page 410..*

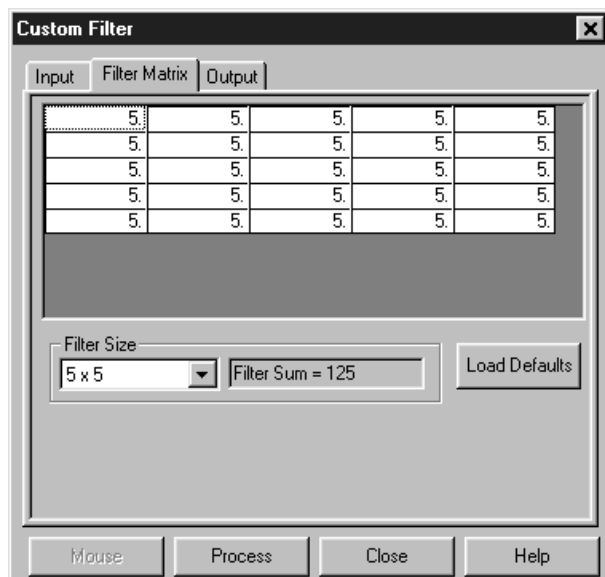
Print Preview: Opens the Print Preview window. *See Chapter 18 for additional information; also page 411.*

Print Setup: Opens the Print Setup dialog box. *See Chapter 18 for additional information; also page 412.*

Exit: Exits the WinSpec/32 software.

Filter Matrix tab page

Figure 295.
Custom Filter
Filter-Matrix
tab page.



The Custom-Filter Filter-Matrix tab page allows you to set the filter matrix parameter values. The filter is applied to the data-set specified via the Custom Filter Input tab page (page 362). The processed data is saved in the file specified by the Custom Filter Output tab page (page 386).

Filtering is accomplished by mask operations defined by parameters entered in the matrix. These functions can enhance edges, sharpen or smooth features, or erode or dilate an image. How these images are processed is briefly described below.

A mask is an $n \times n$ matrix (n is 5, 7, 9 or 11) that is placed over every $n \times n$ subsection of the image. Each parameter in the mask is multiplied by the corresponding value of the image. The results are summed and placed in the central position in the output file. Users can specify the Filter Size (5×5, 7×7, 9×9 or 11×11). The Filter Sum is displayed in the adjacent box. The **Load Defaults** button sets the matrix parameters to their factory-default values.

Control Buttons:

OK: Click on **OK** to close the dialog.

Cancel: Click on **Cancel** to exit the dialog.

Apply: Applies the parameters.

Help: Click on this button to open the online help for this topic.

Focus Helper

Figure 296.
Focus Helper
dialog box.



Selecting **Focus Helper** on the Process menu opens the dialog box shown in Figure 296. This dialog box allows control of the Focus Helper function, which can automatically locate peaks and generate a report on peak characteristics *during live data acquisition*. Once activated, the Focus Helper will start at the left of the displayed spectrum and automatically move from left-to-right across the screen until it detects a peak, where a peak is defined as an intensity value greater than 10% of the full-scale intensity range. Unlike the Peak Finder function, which locates peaks by examining the second derivative of a displayed spectrum, the Focus Helper makes its determinations from intensity values. The width of the Focus Helper is specified in pixels, and, as it moves across the data until it locates and straddles a peak, its motion is rather like that of a caterpillar. Several parameters for the found peak are determined and reported to the screen as shown in Figure 297. Reported are:

Center Pixel: number of the pixel at the center of the peak.

Half Width: the width of the peak at half the maximum value. A white line is drawn across the peak at the half-width point.

Number over 50%: number of pixels higher than the 50% of the peak height.

Area: Uncorrected area; includes contribution from offset of spectrum above baseline. *An area is defined as the sum of the intensities of the pixels in the area.*

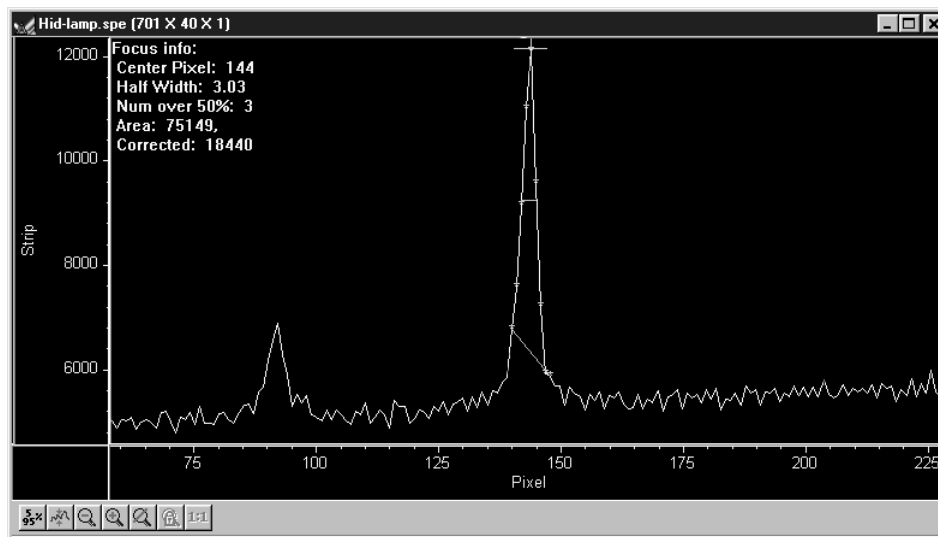
Corrected Area: Only includes area of peak above the line connecting the first and last point of the Focus Helper.

This information continues to be updated throughout the acquisition. If the peak position or amplitude changes as data acquisition continues, the Focus Helper will automatically adjust its position so that it remains on the peak and the reported values are updated so that current information is always displayed.

If the first peak found is not of primary interest, the Focus Helper can be moved to the next one simply by clicking on the peak to be examined. The Focus Helper will immediately move to the new peak, adjust its position automatically, and report the values for that peak if **Full Report** has been selected in the dialog box.

Although primarily intended to be used with live data, the Focus Helper can also be used to determine the area of curves recalled from storage. However, the function doesn't operate automatically on static curves. Its position is set by clicking on the peak of interest and then forcing the screen to update, such as by clicking on the Expand button or dragging a window edge.

Figure 297.
Focus Helper
on peak.



Helper Active: Must be checked for Focus Helper to be functional.

Width: Width of the Focus Helper “caterpillar” in pixels.

Graphics Only: Focus Helper graphics are displayed but no values are reported.

Full Report: Both the Focus Helper graphics and report are displayed.

Control Buttons:

OK: Saves the settings and closes the dialog box.

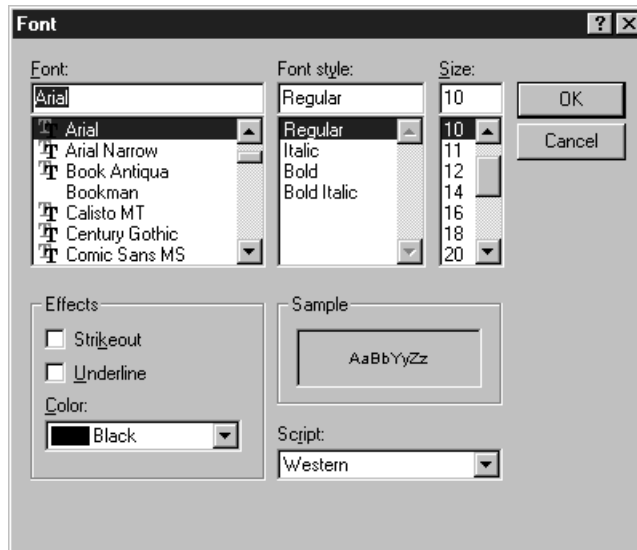
Cancel: Closes the dialog box without implementing any setting changes.

Help: Opens context-sensitive help for the Focus Helper dialog box.

Note: The Function key **F12** can also be used to toggle Focus Helper On and Off.

Font dialog box

Figure 298.
Font dialog
box.



The Font dialog box (Figure 298), which opens when you select **Fonts** on the **Display Layout Axes** tab page, determines the font that will be used for the data window axis labels and scales. Note that not all fonts allow rotated Y axis labels. If the selected font is True Type (clearly identified on the list) or Type 1 (Postscript), the Y axis label will be rotated. Bitmap fonts such as System will result in horizontal labels on both axes. The font choice affects all data windows as soon as you make the selection and click on OK.

Parameters

Font: All of the fonts installed in the computer are listed. Clicking on a font name in the list will select it. The selection is executed when you click the **OK** button.

Font Style: You can choose Regular, Italic, Bold or Bold Italic.

Size: Allows you to select the type size. In the case of True Type and Type 1 fonts, sizes are generally available from 8 points to 72 points. With bit-mapped fonts (not recommended), the range of available sizes is more restricted.

Effects: Strikeout and Underline are both supported.

Color: Intended for user-draw function - not supported in early releases of the software.

Sample: Displays a sample of the type as it will appear; takes into account selected font, style, size, effects and color.

Script: Only Western is provided.

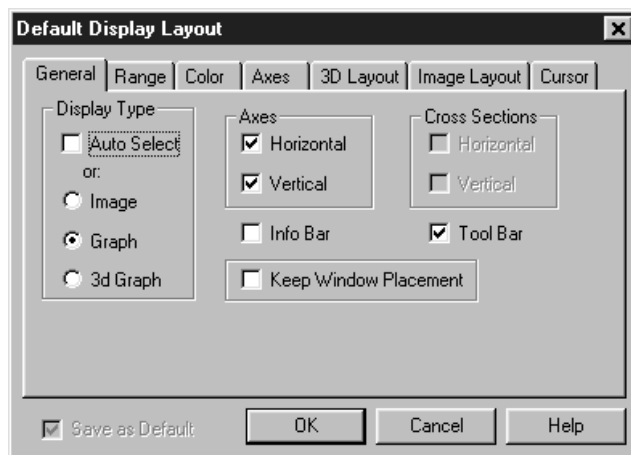
Control Buttons:

OK: Executes the selections and closes the dialog box.

Cancel: Exits the dialog box without executing any changes.

General Display Layout tab page

Figure 299.
General display
layout tab
page.



Allows you to specify the most basic display functions, with the option of saving them as the default. Descriptions follow. See Chapter 10 for examples and additional information.

Display Type: Any data set can be opened as an image graph or 3D graph, as selected via the Open file dialog box. The Display Type selections on the Display Layout General tab page allow you to change the initial display selection.

If you access the Display Layout window by clicking Display Layout on the File Open dialog box, you can specify **Image**, **Graph** or **3D Graph**. When you then click on OK, select the file and click on Open, the data file will be opened in the selected display format.

If you want the software to control how the data will be displayed when the file is opened, check **Auto Select**. Leave **Auto Select** unchecked if you want to personally retain control over whether the data will be displayed as an **Image**, **Graph** or **3D Graph**.

Auto Select is the factory default selection.* When the Auto Select check box contains a check, the three radio buttons, Image, Graph and 3D Graph, will be grayed out and inactive, although one will be selected. If Auto Select is unchecked, the Image, Graph and 3D Graph buttons will no longer be grayed out and the selected button will govern how the file is opened.

When Auto Select is checked, the way the data is displayed depends on the number of data strips it contains.

- ⇒ If there are eleven or more strips of data, they will be displayed as a normal image.
- ⇒ If there are at least three data strips but less than eleven, the data will be plotted as a 3D Graph as shown in Figure 120 (page 155).

* The open/display default selection can be changed and saved from the Display Layout window.

⇒ If there are only two strips of data, they will be displayed as graphs stacked in a two-dimensional plot, the same as for a 3D Graph of two strips. See Figure 122 (page 157).

A single strip *will always* be plotted as a simple X vs. Y plot. Note that from two to ten strips, the intensity (Y axis) scale shifts position as required to read true for the selected strip.

Axes: There are two check boxes, horizontal and vertical. If a box is checked, the corresponding axis will be plotted.

Cross Sections: There are two check boxes, horizontal and vertical, allowing cross-sectional intensity profiles to be displayed for either or both axes. The vertical image intensity profile at the cursor position will be displayed to the left and the horizontal image intensity profile at the bottom. If the cursor position is changed by clicking the mouse a new location, the cross-sectional graphs will change to reflect the profiles at the new coordinates. After each change, auto-scale so that the profile will be properly scaled.

Info Bar: Causes the information bar, which contains the X, Y, Z coordinates and the intensity at the cursor position to be displayed beneath the data window.

Tool Bar: Causes the Data Window Toolbar to be displayed beneath the data window. See page 318 for detailed information about the Data Window Toolbar buttons.

Keep Window Placement: Fixes the window size and position for graph and 3-D Graph displays. *Does not work with image displays.* To use this feature, it is first necessary to display a data set as a graph. Then size and position the data box as desired and click on OK. All subsequent data windows will then be sized and located the same as the first, instead of being cascaded or tiled. Unselect the box to restore normal display behavior.

When you leave the Display Layout General page with the Keep Window Placement checked, it will remember the location of the active window at that time (before you had to close the window to store the location). It will also update the location when the window is closed. Finally, it will remember the last location of "live" data (just before "STOP" is clicked).

Save as Default check box: Saves settings on all pages. These settings will be automatically established when software is started.

Control Buttons:

OK: Executes the layout settings and closes the Display Layout window.

Cancel: Closes the Display Layout window without implementing any of the changes.

Help: Opens context-sensitive help for whichever tab page is on top.

Get/Set Parameters dialog box

See **Diagnostics: Get/Set Parameters dialog box** discussion on page 335.

Gluing Files

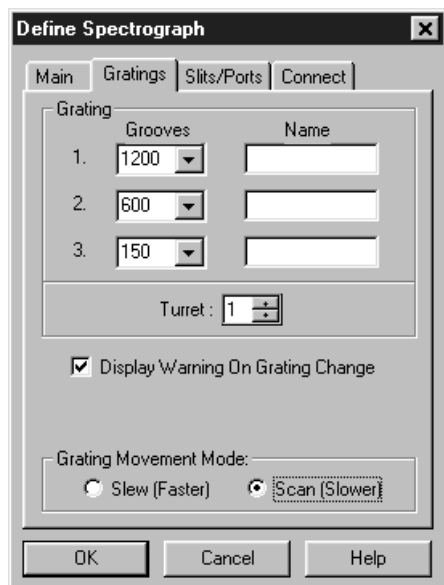
See:

Post Process Glue dialog box discussion on page 409.

Step and Glue dialog box discussion on page 458.

Gratings tab page (Define Spectrograph)

Figure 300.
Gratings tab
page.



The Define Spectrograph Gratings dialog box allows you to specify the available gratings, name them if necessary, specify the turret on which they are mounted, choose to display a grating change warning and set the Grating Movement mode. In addition, there are three control buttons that are available for all of the Define Spectrograph tab pages. Details follow.

Grating: There is provision for specifying up to three gratings for each turret. Gratings are specified by grooves per mm, with a supplemental name, if desired. The naming feature is handy for distinguishing between gratings having the same groove density but a different blaze.

Turret: Some spectrographs have an interchangeable turret feature. Each turret carries one or more gratings and one turret is installed at a time. This parameter allows you to associate the gratings parameters with a particular turret, allowing specifications for any number of gratings to be specified.

Display Warning on Grating Change check box: Good operating practice generally includes not trying to do other operations while a grating change is in progress. Checking this box will cause a warning to be displayed during a grating change. Note that grating selection is made via the Move Spectrograph Gratings dialog box (page 355). The actual change operation begins when the **OK** button on the Move Spectrograph dialog box is actuated.

Grating Movement Mode radio buttons: Either of two modes can be selected, **Slew (Faster)** or **Scan (Slower)**. The actual grating movement speed will depend on the make and model of your spectrograph.

Control Buttons:

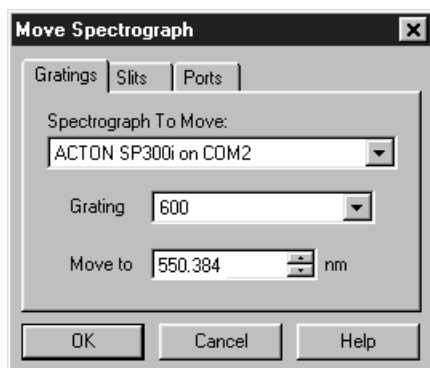
OK: Executes the selections for all tab pages and closes the dialog box.

Cancel: Closes the dialog box without executing any selections.

Help: Opens context-sensitive help for whichever tab page is on top.

Gratings tab page (Move Spectrograph)

Figure 301.
Move
Spectrograph
Gratings tab
page.



The Gratings tab page has three functions. First, it allows you to select the active spectrograph. Second, it allows you to select the grating to be moved. Third, it allows you to change the grating setting. In addition, there are three window control buttons which are present for all of the Move Spectrograph tab pages. Note that if no values appear in the parameter selection boxes, it means that successful communications with the spectrograph have not been established.

Spectrograph to Move: Selects the active spectrograph. If only one spectrograph has been installed (see discussion on page 363), it will be the active spectrograph by default. If more than one has been installed, simply click on the down arrow at the end of the Spectrograph to Move selection box and select the spectrograph to be designated as active from the drop-down list. *If only one spectrograph has been installed, the selection box won't appear but the spectrograph model will be reported.*

Grating: Allows you to select the grating to be moved. Click on the down arrow at the end of the selection box and make your selection from those listed. Note that the available gratings are specified on the Define Spectrograph Gratings tab page, described below.

Move to: This is where the wavelength setting to which you want the spectrograph to should be entered.

Control Buttons:

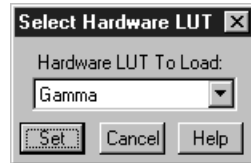
OK: Executes the changes on all of the Move Spectrograph tab pages and closes the dialog box.

Cancel: Closes the dialog box without executing any of the changes.

Help: Opens context sensitive help for whichever tab page is on top.

Hardware LUT dialog box (PentaMAX)

Figure 302.
Hardware LUT
dialog box.



The Hardware LUT dialog box (Figure 302) is opened by clicking on Hardware LUT on the Acquisition menu. Its purpose is to determine how video will be mapped to a video monitor display. The selection doesn't affect the data in any way, but rather only in the way it is displayed on a video monitor. A brief description of the available selections follows.

Gamma: Turns on the gamma function. The function compensates for phosphor non-linearities. The effect is an overall brightening of the mid-range values in the picture while decreasing the brightest portions.

Linear: The 12-bit data are linearly mapped to the 256 gray-scale levels. Pixels with the lowest intensity value (0) are black. Pixels with the highest intensity value (4095) are white.

Inverse Linear: Linear mapping is implemented but with pixels having the lowest intensities mapped to white and pixels with the highest intensities mapped to black.

Log: This option changes the display of the image from linear, where changes in intensity of the image are mapped equally to the display gray levels, to logarithmic, where changes in intensity on the dark end are more pronounced. This is helpful for an image with a very high dynamic range. Since CCD detectors can have three orders of magnitude more dynamic range than a computer display, this option can map both faint and bright signals most appropriately. Once again, this box does not change any data values in the image, rather it displays the logarithm of the data.

Inverse Log: Computes the inverse log for each value and maps the resulting values to the display.

Square Root: Computes the square root of each value and maps the resulting values to the display. Frequently provides a more pleasing display, particularly of darker detail, of images having a wide dynamic range.

Bit Range 0-64: Displays the bottom 64 gray levels. Best for very low light level images.

Bit Range 0-128: Displays the bottom 128 gray levels. Suited to viewing low light level images.

Bit Range 0-256: Displays the bottom 256 gray levels. Suited to viewing low light level images.

Bit Range 2-512: Displays 256 gray levels corresponding to data values from 2 to 512.

Bit Range 4-1024: Displays 256 gray levels corresponding to data values from 4 to 1024.

Bit Range 8-2048: Displays 256 gray levels corresponding to data values from 8 to 2048.

Bit Range 16-4096: displays 256 gray levels corresponding to data values from 16 to 4096.

Control Buttons:

Set: Must be pressed for a setting change to be saved.

Cancel: Closes the dialog box without executing any changes. Clicking on Set changes button function from Cancel to Close.

Close: Closes the dialog box and saves setting in effect when Set was pressed. Note that the Close button is named Cancel until you click on Set.

Help: Accesses on-line help for the Hardware LUT dialog box.

Hardware Setup window

The Hardware Setup Window, opened by clicking on Hardware on the Setup menu, contains the Hardware Setup tab pages (all described separately) and three Control buttons that are always present independent of the selected tab page.

For Additional Information

Controller/Camera tab page: pg. 300

Display tab page: pg. 341

Interface tab page: pg. 92

Cleans/Skips tab page: pg. 291

Custom Chip tab page: pg. 89

Custom Timing tab page: pg. 90

Control Buttons:

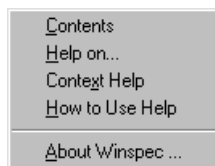
OK: Click on **OK** to save the changes and close the Hardware Setup window.

Cancel: Click on this button to close the Hardware Setup window without making any changes.

Help: Opens context-sensitive help for whichever tab page is on top.

Help menu


Figure 303.
The Help menu.



The Help menu (Figure 303) provides several ways of accessing WinSpec/32 Help.


Contents: Clicking on Contents opens the WinSpec/32 Information Desk, which contains three tab pages, Contents, Index and Find. **Contents** works like a table of contents. Organized into books and topics, it displays a conveniently organized list of the topics in the Help system. **Index** provides a list of alphabetically arranged keywords, allowing topics of interest to be rapidly accessed. **Find** is a search function that allows users to quickly zero in on information relating to the subject of interest.

Help On: Gives help on the current menu selection (like F1).

Context Help: Equivalent to selecting the context-sensitive Help button  on the Standard Toolbar.

How to Use Help: Calls WinHelp.hlp, which gives help on using the Help system.

About WinSpec: Provides WinSpec/32 version and licensing information, as well a report on the amount of free memory and disk space.

Note that there are several options for accessing context sensitive help. One way is to press the F1 key at any menu selection. Another is to click on the standard toolbar context-sensitive help button  or on Context Help in the Help menu and then click on the item for which you'd like to have additional information. A third is to click the Help button on those windows and dialog boxes which have one.

Note: Some dialog boxes, such as File Open, Save As, and Font, don't have Help buttons. These dialog boxes are provided by Windows 95 and, as such, are inaccessible to WinSpec/32's context-sensitive Help. Context sensitive Help provided by Windows 95 is nevertheless available for these dialog boxes. To access it, simply place the mouse cursor on the item for which you would like to have additional information and press the F1 key.

Histogram (post processing)

General discussion: Chapter 17.

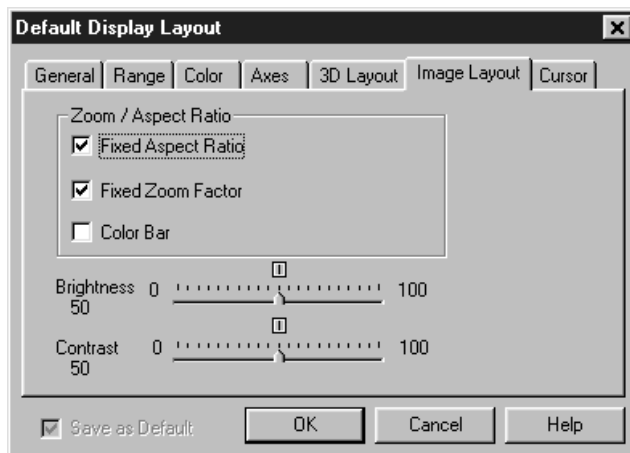
Input tab page: pg. 362

Parameters tab page: pg. 390

Output tab page: pg. 386

Image Layout tab page

Figure 304.
Image Layout
tab page.



This page allows you to select how the image and zoom aspect ratios are controlled. It additionally allows the image contrast and brightness to be changed.

Color Bar: If checked, causes the color bar to appear above the image display. The color bar shows the complete range of colors or grayscales contained in the displayed image. The endpoint values are indicated numerically on the colorbar.

Aspect Ratio Fixed: If checked, aspect ratio of the image remains constant. In many situations this mode is preferred because all Princeton Instruments cameras have square pixels. If unchecked, image aspect ratio can be changed.

Fixed Zoom Factor: If checked, the mapping of image pixels to the monitor cannot be changed. As a result, the image size remains constant, although the window size can be adjusted by dragging the window's corner or an edge. Scrollbars allow all portions of the image to be viewed.

Combinations

Aspect Ratio Fixed and Zoom Factor Fixed: Image size cannot be changed. Window size can be adjusted by dragging a corner or edge. As the window is made smaller, only a portion of the image can be seen. Scrollbars allow you to see the "hidden" portions.

Aspect Ratio Fixed and Zoom Factor Variable: Image size changes (zoom factor changes) if window size is changed. Entire image remains in view, filling the window. Window aspect ratio remains unchanged when dragging corner or edge to change window size.

Aspect Ratio Variable and Zoom Factor Fixed: Image size cannot be changed. Window size can be adjusted by dragging a corner or edge. As the window is made smaller, only a portion of the image can be seen. Scrollbars allow you to see the "hidden" portions. *Additional features will be added to this combination in later editions of the software.*

Zoom Factor Variable and Aspect Ratio Variable: Image size changes if window is resized by dragging corner or one of the edges, which can be dragged independently. Complete image remains in window but it distorts as required to fill the window.

Brightness and Contrast

Brightness: Adjusts overall image brightness. Range is 0 to 100 with 50 as the default. Equivalent to adjusting the brightness from the Brightness- Contrast dialog box.

Contrast: Adjusts overall image contrast, that is, increases the brightness difference between pixels with different intensity values. Range is 0 to 100 with 50 as the default. Equivalent to adjusting the contrast from the Brightness- Contrast dialog box.

Save as Default check box: Saves settings on all pages. These settings will be automatically established when software is started.

Control Buttons:

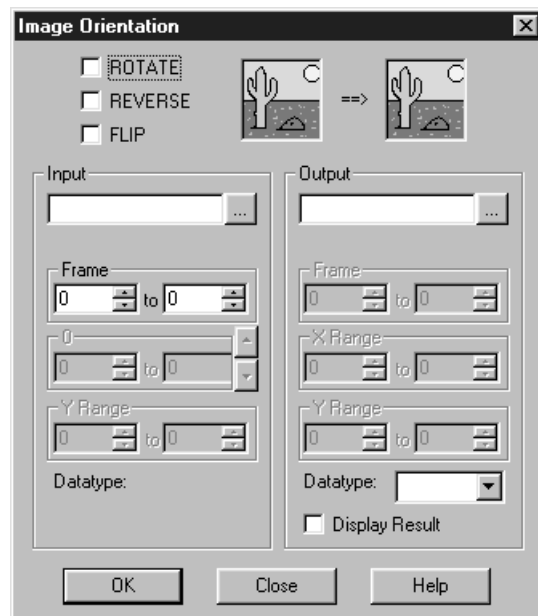
OK: Executes the layout settings and closes the Display Layout window.

Cancel: Closes the Display Layout window without implementing any of the changes.

Help: Opens context-sensitive help for Display Layout window.

Image Orientation dialog box

Figure 305.
Image
Orientation
dialog box.



The Image Orientation dialog box, present only if the Imaging Option is installed, allows a data set to be reoriented, displayed and saved using a user specified location and name. Rotate, Reverse, and Flip can be selected and applied in any combination. Thumbnail images show the effect of the selected changes. If the data set contains multiple frames,

you can specify which frames are to be reoriented. Image orientation can be applied to data displayed as an image, graph or 3D Graph.

Rotate: Clicking on this check box causes the image to be rotated 90° ccw.

Reverse: Clicking on this check box causes the image to be reversed from left to right.

Flip: Clicking on this check box causes the image to be flipped vertically.

Input: If there is an active data window, it's name will appear in the Input text box. You can also directly select a data file using a browser, which can be accessed by clicking on the button at the end of the Input data window.

Frame: The two text boxes allow the frame range to be specified. If the data set contains one frame, the indicated range will be 1 to 1. If the data set contains multiple frames, the default is to select all frames. For example, if there were 10 frames, the frame range would be 1 to 10. Either value can be changed. For example, if you only wanted the reorientation to be applied to frames three through seven, it would only be necessary to change the Frame range values to 3 and 7 respectively.

X Range and Y Range: In early releases of the software, simply indicates the frame size of the data set. The values cannot be changed.

Datatype (input): The input file datatype is displayed but cannot be changed.

Output: You can name the Output file. The browser opened by the button at the right of the Output text box allows the location and name to be more conveniently specified.

Note: If you use the browser, it is necessary to click on the browser button Save and then on OK in the Image Orientation dialog box before the file is saved.

Datatype (output): The output data type can be selected from the drop-down list.

Display Result: Checking this box will cause the output data set to be displayed when the **OK** button is pressed. If an Output filename has been specified, it will be displayed with that name. If a name has not been specified, the name will simply be "Untitled".

Control Buttons:

OK: Causes the selected orientation operations to be performed. If an output file name has been specified, file will be saved.

Close: Closes the dialog box without making any changes.

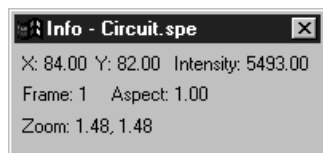
Help: Accesses context sensitive help for this function.

Information box

If **Info** is selected on the **View** menu and data is displayed, an information box for the active data window will appear on the desktop. For image displays, the intensity in A/D counts is reported at the X and Y position corresponding to the cursor position. Also reported are the Frame number, Aspect ratio, and X and Y Zoom in effect. If a region is

defined by dragging the mouse cursor, the region coordinates and diagonal length will also be reported. Figure 306 illustrates a typical image display data box.

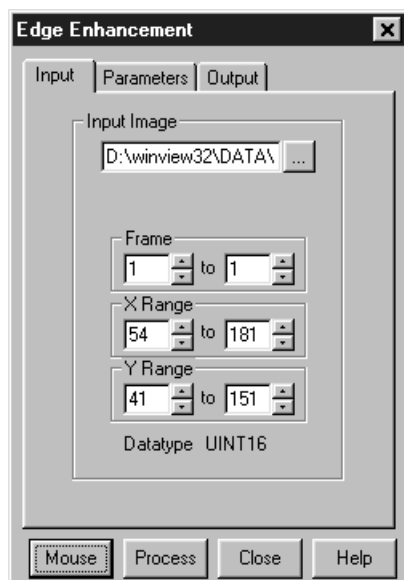
Figure 306.
Information
box for data
displayed as
image.



If the data is being displayed as a graph, the first line reports the intensity and pixel number at the cursor position. The second line reports the frame number, strip number, and the pixel number. The intensity in A/D counts is reported at the X and Y position corresponding to the cursor position. If a region is defined by dragging the mouse cursor, the region coordinates, length and height will also be reported. *You may have to lengthen the Information box for all this information to appear.*

Input tab page (Edge Enhancement, Sharpening, Smoothing, Morphological, Custom Filter, Look Up Table, Threshold and Clipping Cross Sections, Binning and Skipping Histogram)

Figure 307.
Input tab page.



The Input tab page is the same for all of the post-acquisition operations, **Edge Enhancement, Sharpening, Smoothing, Morphological, Custom Filter, Look Up Table, Threshold/Clipping, Binning and Skipping, Cross Sections** and **Histogram**. The page allows you to select the input data file and, if the file contains multiple frames, the frame to be processed. You can also specify the X and Y range of the data to be processed. Last, the data type of the selected file is reported.

Control Buttons:

Mouse: Allows you to specify a region to be processed using the mouse. Simply drag a box in the data region of the active window and then click on **Mouse**. The **Frame** and **Range** parameters will assume the values of the defined region. Note that the **Mouse** button is only active when the **Input** tab page is selected.

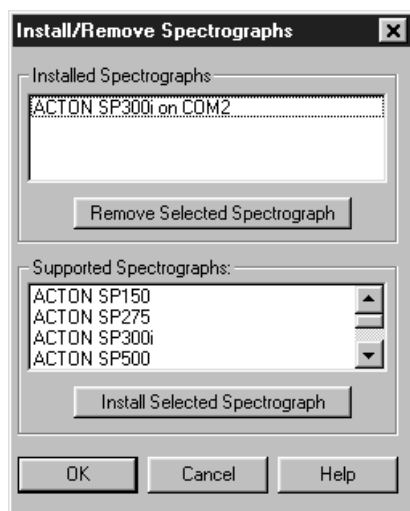
Process: Initiates the process selected via the Parameters tab page. The selected process is performed on the data specified on the Input tab page and saved using the file name and data type specified on the Output tab page.

Close: Closes the window with no action taken.

Help: Opens context-sensitive help for the active tab page.

Install/Remove Spectrograph dialog box

Figure 308.
Install/Remove
Spectrograph
dialog box.



The Install/Remove Spectrographs dialog box, which is opened by selecting the Install/Remove Spectrograph button on the Define Spectrograph Main tab page, allows you to install spectrographs supported by WinSpec/32 or to remove a spectrograph which has been previously installed. Installing a spectrograph in this sense means making the set of drivers and parameter settings that apply to that spectrograph available to WinSpec/32. A spectrograph is installed by selecting it from the list of Supported Spectrographs and then clicking the Install Selected Spectrograph button. A previously installed spectrograph can be removed by selecting it from the list of Installed Spectrographs and then clicking on the Remove Selected Spectrograph button. If only one spectrograph is installed, then that spectrograph is the active one. If more than one is installed, then the active spectrograph must be selected from the Define Spectrograph Main tab page.

Supported Spectrographs: These are Spectrographs supported by the WinSpec/32 software. Of course only spectrographs with stepper motors will appear on the list, as these are the only spectrographs that can be *controlled* through the WinSpec/32 software.

Install Selected Spectrograph: Selecting a spectrograph from the supported spectrographs list and then keying this button will cause the selected spectrograph to be installed. It's name will then appear in the upper window, which lists the installed spectrographs.

Installed Spectrographs: These are spectrographs that have been installed, and can now be calibrated or moved by WinSpec/32.

Remove Selected Spectrograph: Selecting a spectrograph from the installed spectrographs list and then keying this button causes the selected spectrograph to be removed. It's name will disappear from the installed spectrographs window and it will no longer be possible for WinSpec/32 to calibrate or control it.

Control Buttons

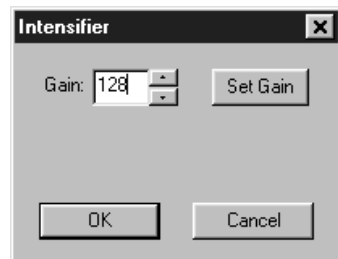
OK: Closes the dialog box and cause the changes to be saved and executed.

Cancel: Closes the dialog box without saving or executing the changes.

Help: Opens context-sensitive help for the Install/Remove Spectrographs dialog box.

Intensifier Gain dialog box (PI-MAX)

*Figure 309.
Intensifier Gain
dialog box.*



Allows the intensifier gain of a PI-MAX camera to be set from software, even when acquiring data. The gain setting range extends from 1 to 256 (arbitrary scale). A midrange setting of 128 generally proves a good value to start with. To change the value, it is necessary to key the setting, click on the **Set Gain** button, and then click on **OK**. The **OK** button closes the dialog box and implements any changes providing the **Set Gain** button has been pressed. **Cancel** simply closes the dialog box without making any changes.

Interactive Camera Operation dialog box (MicroMAX or ST-133)

Figure 310.
Interactive
Camera
Operation
dialog box.



If the controller is a MicroMAX or ST-133, clicking on **Video Focus** from the Acquisition menu will open the Interactive Camera Operation dialog box. This dialog box allows focusing to be quickly accomplished in “real time” by making the adjustments while observing the image on a video monitor connected to the controller’s video output as described in the MicroMAX or ST-133 instruction manual. Note that data collection doesn’t take place and the image will not appear at the computer monitor as long as the interactive dialog box is open.

Parameters

Exposure Time: The Exposure Time is the amount of time the shutter will open to collect data. For example, setting Exposure Time to 4 will set the exposure to 4 seconds. If no shutter is present, the Exposure Time will be the time between readouts. There is no difference between setting the Exposure Time from this dialog box and setting it from the Main tab page of the Experiment Setup window.

RS170 Intensity Scaling: Together with the Offset, the Scaling determines how the image data is mapped to the 256 gray-scale video levels of the RS170 (EIA) or CCIR video monitor. Its effect is only visible when active data acquisition is in progress. There are seven scaling selections, ranging from “0 to 64” (slider to left) to “0 to 4096” (slider to right). With a setting of “0 to 4096”, the entire A/D output range is mapped to video. Lower settings may result in a more pleasing (brighter) image. However, it is a good idea to begin with the “0 to 4096” setting so that no information will be overlooked and then readjust afterwards for the best image. The mapping of the A/D output to gray-scale as a function of the selected gain is listed in Table 1.

Offset: The Offset adjustment allows precise adjustment of the image brightness by enabling counts to be subtracted from every data point in the image. The higher the offset setting, the larger the values that are subtracted and the darker the image becomes. Offset subtraction can be used to bring off-scale (clipped) values into the gray-scale range. Where the result of the offset subtraction is zero or negative, the darkest video level (black) is displayed. Note that active data-acquisition must be in progress to see the effect of changing the Offset setting.

The offset setting range is 0 to 3812 counts. The offset is non-linear, with the increment size varying from a low of 2 at the low (left) end to a high of 256 at the high (right) end.

Together, the Gain and Offset dials are used to obtain the best possible video image. The following technique frequently gives good results.

- ◆ Begin with a Scaling setting of 0 to 4096 and an Offset setting of 2 (minimum).
- ◆ Decrease the Scaling setting to where the displayed image is *one click too bright*.
- ◆ Increase the Offset setting as required to darken the image and obtain the most pleasing image display.

Table 1. Video mapping vs. scaling setting.

Scaling Setting	Mapping
0 to 4096	Data in entire A/D range (0 to 4095) are mapped to gray-scale.
0 to 2048	A/D data from 0 to 2047 (after offset subtraction) are mapped. Higher values are clipped to 2047 (white).
0 to 1024	A/D data from 0 to 1023 (after offset subtraction) are mapped. Higher values are clipped to 1023 (white).
0 to 512	A/D data from 0 to 511 (after offset subtraction) are mapped. Higher values are clipped to 511 (white).
0 to 256	A/D data from 0 to 255 (after offset subtraction) are mapped. Higher values are clipped to 255 (white).
0 to 128	A/D data from 0 to 127 (after offset subtraction) are mapped. Higher values are clipped to 127 (white).
0 to 64	A/D data from 0 to 63 (after offset subtraction) are mapped. Higher values are clipped to 63 (white).

Zoom: The 1× setting indicates that the CCD image will be binned or decimated so that the video monitor shows the entire CCD image at reduced resolution. The 2× setting shows a portion of the CCD image, but at approximately 1:1 resolution. Since you cannot see the entire CCD image, the Pan feature becomes available. The 4× setting uses pixel replication to zoom in and enlarge a smaller region of the CCD image. The availability of the Zoom and Pan functions depends on the array size relative to the size of the video display (756 × 486 for RS170; 741 × 576 for CCIR). Note that it isn't *necessary* to close the dialog box for the changes to take effect.

Pan: The Pan box allows you to select which area of the CCD image you would like to view on the video monitor. It is available in the 2× or the 4× mode. Changes to the Pan box are effective immediately if the camera is running.

Binning: In the 1× mode, pixels can be binned or decimated to fit the image from a large CCD chip onto the video display. For low light level experiments, the Binning option is recommended.

Decimation: In the 1× mode, pixels can be binned or decimated to fit the image from a large CCD chip onto the video display. Do not use decimation if you have very low light levels.

Control Buttons:

Close Button: Closes the dialog box and saves the setting changes.

Cancel: Click on **Cancel** to exit the Interactive Camera Operation dialog box without saving the changes.

Help: Opens context-sensitive help for the Interactive Camera operation dialog box.

Run: Click on **Run** to begin Interactive Camera operation.

Stop: Click on **Stop** to end Interactive Camera operation.

Store: Click on **Store** to begin storing data. From the Interactive Camera Operation dialog box, **Store** suspends data acquisition, returns to normal mode, and takes one frame.

Interactive Camera Operation dialog box (PentaMAX)

Figure 311.
Interactive
Camera
Operation
dialog box
(PentaMAX).



This box is opened by clicking on **Video Focus** from the Acquisition menu (PentaMAX Controller). This dialog box allows focusing to be quickly accomplished in “real time” by making the adjustments while observing the image on a video monitor connected to the controller’s video output as described in the PentaMAX manual. Note that data collection doesn’t take place and the image will not appear at the computer monitor as long as the interactive dialog box is open.

Parameters

Hardware LUT: Determines how video will be mapped to a video monitor display.

There is no difference between selecting the Hardware LUT transfer function from the Interactive Operation dialog box or from the Acquisition menu. The individual video mapping functions are described in the Hardware LUT dialog box discussion which begins on page 356. Note that Hardware LUT selection doesn’t affect the data in any way, but rather only in the way it is displayed on a video monitor. For the Hardware LUT selection to be saved when you close the Interactive Operation dialog box, it is first necessary to click on the Set LUT button.

Exposure Time: The Exposure Time is the amount of time the shutter will open to collect data. For example, setting Exposure Time to 4 will set the exposure to 4 seconds. If no shutter is present, the Exposure Time will be the time between readouts. There is no difference between setting the Exposure Time from this dialog box and setting it from the Main tab page of the Experiment Setup window.

Zoom (ver 5 or higher): The 1× setting indicates that the CCD image will be binned or decimated so that the video monitor shows the entire CCD image at reduced resolution. The 2× setting shows a portion of the CCD image, but at approximately 1:1 resolution. Since you cannot see the entire CCD image, the Pan feature becomes available. The 4× setting uses pixel replication to zoom in and enlarge a smaller region of the CCD image. The availability of the Zoom and Pan functions depends on the array size relative to the size of the video display (756 × 486 for RS170; 741 × 576 for CCIR). Note that it isn't *necessary* to close the dialog box for the changes to take effect.

Pan (ver 5 or higher): The Pan box allows you to select which area of the CCD image you would like to view on the video monitor. It is available in the 2× or the 4× mode. Changes to the Pan box are effective immediately if the camera is running.

Binning (ver 5 or higher): In the 1× mode, pixels can be binned or decimated to fit the image from a large CCD chip onto the video display. For low light level experiments, the Binning option is recommended.

Decimation (ver 5 or higher): In the 1× mode, pixels can be binned or decimated to fit the image from a large CCD chip onto the video display. Do not use decimation if you have very low light levels.

Control Buttons:

Run: Click on Run to begin Interactive operation.

Stop: Click on Stop to end Interactive operation.

Close Button: Closes the dialog box and saves the setting changes.

Cancel: Click on Cancel to exit the Interactive Operation dialog box without saving the changes.

Help: Click on this button to open the online help for this dialog box.

Interactive Trigger Setup

See Timing Generator Interactive Trigger Setup discussion on page 461.

Interactive Pulse Width and Delay

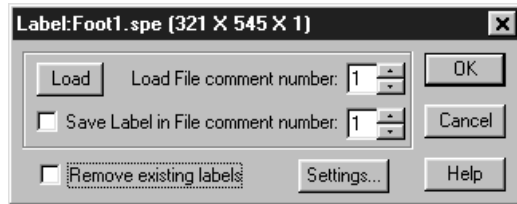
See Timing Generator Interactive Pulse Width and Delay discussion on page 460.

Interface tab page

The Interface tab page, accessed by selecting Hardware on the Setup menu, is used to set the data transfer communications parameters. See page 92 for a detailed discussion of this page.

Label dialog box

Figure 312.
Label dialog
box.

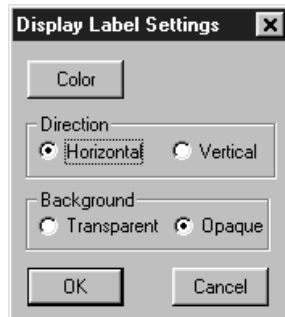


Right clicking inside an ROI causes the ROI context menu to appear. Selecting **Label Display** on the ROI context menu opens the Label dialog box (Figure 312) inside the ROI. The Label dialog box allows loading a previously saved label (from one on the SPE file's 5 comment fields); alternatively the user can type the label into the edit box. The label can be saved into a file's comment field (when OK is clicked). The source comment field and the destination comment field can be different.

Clicking **Remove existing labels** will erase all previous labels from the display before adding the current label.

The **Settings** button opens the **Display Label Settings** dialog box (Figure 313), which allows the appearance of the label to be set. Clicking on **Color** opens the color palette, allowing the label color to be selected. Also, the **Transparent** and **Opaque** radio buttons allow you to choose whether the text background will be transparent or opaque.

Figure 313.
Display Label
Settings dialog
box.



Load Factory Defaults dialog box

Figure 314.
Load Factory
Defaults dialog
box.



This dialog box, which is opened by selecting **Load Factory Defaults** on the **Setup** menu, and then selecting **From INI File** allows the factory supplied *.INI file to be reloaded to re-establish the parameter values in effect when the software was shipped. Because any *.INI file can be specified, it additionally allows users to have alternative *.INI files optimized for different measurements. By simply loading the proper *.INI file, setup time can be significantly reduced.

Features

INI File Name: The name of the *.INI file is entered in this box. The factory default INI file is PIHWDEF.INI. The file name can be keyed in or selected using the browser activated by pressing the button to the right of the entry box.

Load Defaults: This button causes the faults in the selected file to be loaded.

View Factory Defaults: This button displays the contents of the loaded default file so that they can be reviewed.

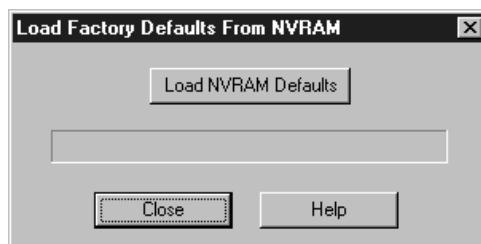
View Comments: This button allows user comments to be viewed.

Close: Closes the dialog box.

Help: Opens context-sensitive help for the Load Factory Defaults dialog box.

Load Factory Defaults from NVRAM dialog box

Figure 315.
Load Factory
Defaults from
NVRAM dialog
box.



This dialog box, which is opened by selecting **Load Factory Defaults** on the **Setup** menu, and then selecting **From Controller** allows the values stored in the Controller's NVRAM to be reloaded.

Features

Load NVRAM Defaults: This button causes the faults in the selected file to be loaded.

View NVRAM Defaults: This button displays the contents of the NVRAM so that they can be reviewed.

Close: Closes the dialog box.

Help: Opens context-sensitive help for the Load Factory Defaults dialog box.

Look-Up Table tab page (Process menu)

See *Look-Up Table* discussion on page 229.

Macro menu

Figure 316.
Macro menu.



With the exception of Execute macro, these functions are not fully operational in software releases prior to 2.5.

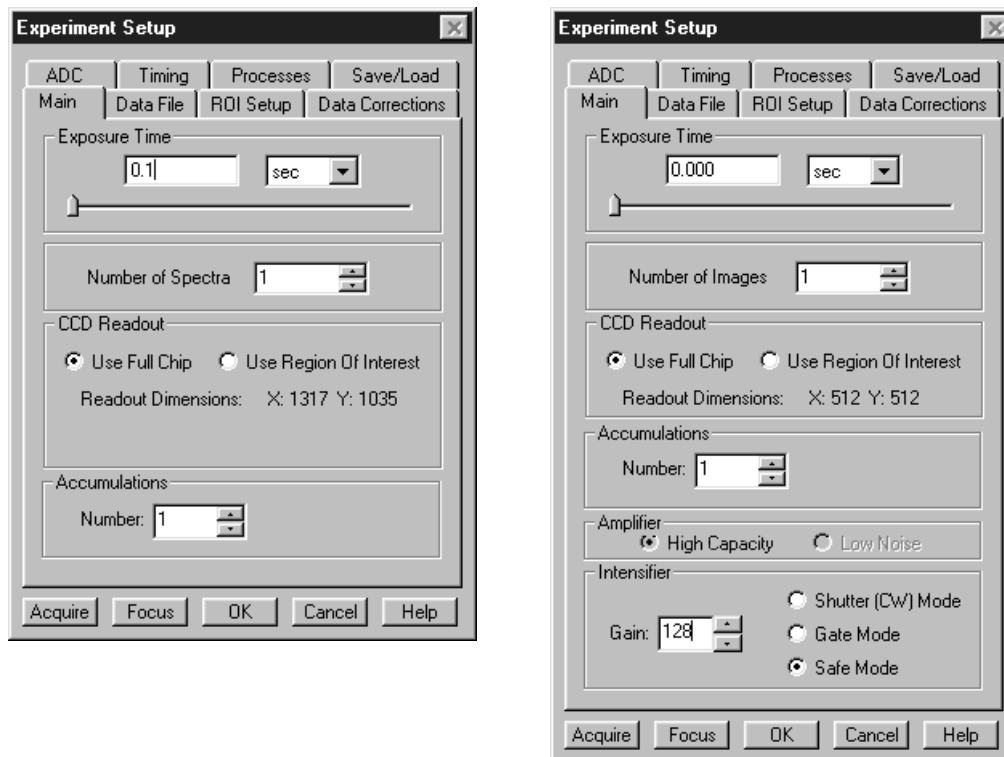
Record macro: Opens the Record Macro window (page 436) and allows Visual Basic script macros to be recorded. *Record Macro function not fully operational in software releases prior to Version 2.5.*

Execute macro: Opens the Execute dialog box (page 345), which allows executable programs to be run from inside WinSpec/32.

Main tab page (Experiment Setup)

The Experiment Setup Main tab page is used to specify the most essential acquisition parameters. These include the Exposure Time, Number of Images, Number of Accumulations and the choice of Full Chip or Region of Interest readout. *The Full Chip vs. ROI choice is not available if the selected controller is a V/ICCD or V/ICCD Control Box.* Other selections are additionally provided when using a PI-MAX camera as described below.

Figure 317.
Main tab page;
left, all but PI-
MAX; right, PI-
MAX.



Parameters

Exposure Time: The Exposure Time is the amount of time the shutter will open to collect data. If no shutter is present, the Exposure Time will be the time between readouts.

of Images: This is the number of sequential images the software will collect and store in a single file. Each image will be digitized and stored, but all images will be in a single file. A single image may contain data from more than one region of interest as defined via the ROI Setup tab.

If the Accumulations value is greater than one, each *stored* image will contain summed data sets from two or more exposures. The number of separate images stored will be the same as it would be for Accumulations equal one, but the total number of exposures required would be the product of the # of Images parameter times the Accumulations value.

Use Full Chip: Data will be collected from complete chip. ROIs previously defined are not disturbed and can be accessed by deselecting Use Full Chip.

Use Region of Interest: Data will be collected from region(s) defined on ROI Setup Tab. *The full chip or the sum of the active region(s) as defined on the ROI tab is displayed.*

Accumulations: WinSpec/32 can collect more than one exposure and sum the exposures together before saving to disk. This allows larger signals to be achieved with improved signal-to-noise ratio. The resulting file will be about the same size as that for a single exposure. This value is independent of the # of Images value, so the total number of exposures is the product of # of Images and Accumulations.

Accumulations are done in software with most controllers. However, with some models, you have the option of doing the accumulation summing in hardware or software. Where this is the case, radio buttons labeled Software and Hardware are provided for making the choice. Accumulating in hardware is faster.

Amplifier (PI-MAX): If the CCD is a Thomson 512×512 CCD array, either the high-capacity (fast) or the low-noise array output node can be selected. The actual selection is made by selecting FAST (high capacity) or SLOW (low noise) on the Experiment Setup A/D tab page. The parameter indications **High Capacity** and **Low Noise** on the Experiment Setup Main page are reported values only. This feature enhances the PI-MAX's ability to provide outstanding performance in a wide variety of applications. *The default setting is read from non-volatile RAM in the PI-MAX. If the selection is changed, the new setting is written to the non-volatile RAM and becomes the new starting default.*

High Capacity: Allows the camera to collect 16-bit images at a readout rate of up to 1 million pixels per second.

Low Noise: When operating at a lower speed, the camera provides superior noise performance.

Intensifier Gain: Sets the intensifier gain when operating with a PI-MAX intensified camera. The range is in arbitrary units from 1 to 256 and the default setting, which will give good results in many applications, is 128.

Intensifier Shutter (CW) Mode: In Shutter mode operation, the intensifier's photocathode is biased on for the set Exposure Time (down to 1 ms), and off during each readout of the array. If the image is too bright, the exposure time can be shortened or the light falling on the intensifier reduced. *See PI-MAX manual (formerly ICCD-MAX manual) for additional information.*

Intensifier Gate Mode: Selecting this radio button puts PI-MAX in gate mode, in which the photo-cathode is biased on by pulses generated in the timing generator. *See PI-MAX manual (formerly ICCD-MAX manual) for additional information.*

Intensifier Safe Mode: Selecting this radio button puts PI-MAX in the Safe mode, in which the photocathode is continuously biased off until either Shutter mode or Gate mode is selected. Note that Safe mode is the turn-on default. *In a system having the PI-MAX camera, when the software is booted, a dialog box appears that allows you to change the PI-MAX start-up gate mode.*

Control Buttons:

Acquire: Clicking on Acquire initiates a data-collection run in which all data frames are stored.

Focus: Clicking on Focus initiates a data-collection run in which the data is not stored until Start Storage is selected.

OK: Click on OK to save the changes and close the Experiment Setup window without initiating a data collection run.

Cancel: Click on this button to close the Experiment Setup window without making any changes.

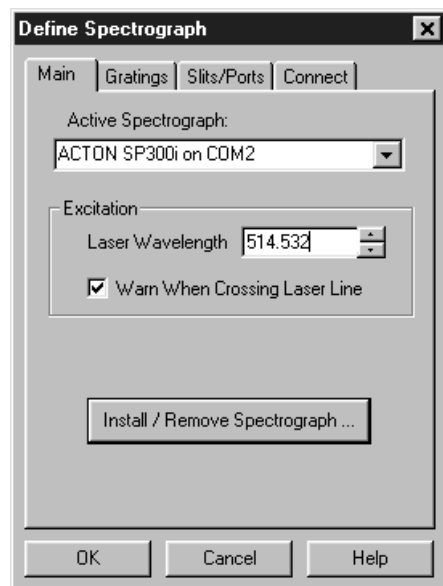
Help: Opens context-sensitive help for whichever tab page is on top.

Main tab page (Define Spectrograph)

The Main Define Spectrograph tab page provides several functions. It allows you to choose the active spectrograph, to specify the Laser Wavelength and to decide whether you want a warning message displayed when crossing the laser line. It additionally makes provision for opening the Install/Remove Spectrograph dialog box, which is used to install a spectrograph or remove one which was previously installed.

Active Spectrograph: This is the spectrograph whose grating position will determine the wavelength calibration and whose stepper motor(s) will be controlled from the Move Spectrograph dialog box. If only one spectrograph has been installed, it is automatically designated as active and there is no decision to make. If more than one has been installed, the list of installed spectrographs drops down when you click on the down arrow at the end of the selection box. Simply click on the one that you intend to use. It will be designated as active and its name will appear in the selection box.

Figure 318.
Define
Spectrograph
Main tab page.



Laser Excitation Information: If you plan to work with units of relative wavenumbers you need to input the Laser Wavelength. Also, whenever the system includes a bright laser, it is a good policy to provide this information. The **Warning When Crossing Laser Line** checkbox gives you the option of telling WinSpec/32 to display a message whenever the grating is moved and the laser light would be visible by the detector. This is critical for detectors that may be damaged if exposed to high light levels. Summarizing:

- ◆ To allow WinSpec to display in units of relative wavenumbers, enter a Laser Wavelength in nanometers, to as many significant digits as desired.
- ◆ If you have a bright laser line check the Warning when Crossing Laser Line box and enter the Laser Wavelength. WinSpec will display a warning message whenever the wavelength range viewable by the detector might pass through the laser line.

Note: The Warning When Crossing Laser Line is no guarantee that the detector will not be damaged by overexposure. The correct display of the warning depends on all calibration parameters being set correctly. Always take care when moving the grating to avoid damage.

Install/Remove Spectrograph: Selecting this button opens the Install/Remove dialog box, described on page 363.

Control Buttons:

OK: Executes selections for all tab pages and closes the dialog box.

Cancel: Closes the dialog box without executing any changes that were made.

Help: Opens context sensitive help for whichever tab page is on top.

Manual Scan Patterns dialog box

Figure 319.
Manual Scan
Pattern
Download
dialog box.

The screenshot shows a dialog box titled "Manual Scan Pattern Download". It has a standard Windows-style title bar with a close button (X). The dialog is organized into three main sections:

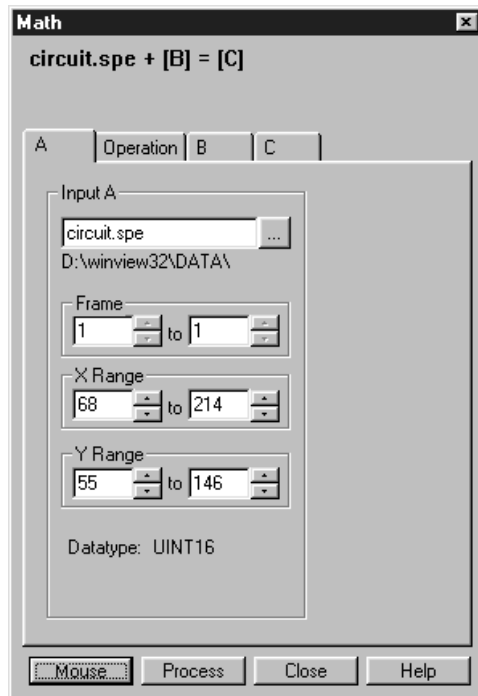
- Scan Pattern:** Contains a "Filename" text box with a browse button (three dots) and an "Address (Hex)" text box containing "0x0".
- Clean Pattern:** Contains a "Filename" text box with a browse button and an "Address (Hex)" text box containing "0x7e00".
- Dimensions:** Contains two spinners: "X Dimension" set to "1317" and "Y Dimension" set to "1035".

At the bottom of the dialog, there is a checkbox labeled "Use Manual Pattern" which is currently unchecked. Below the checkbox are two buttons: "Download" and "Cancel".

The Manual Scan Pattern Download dialog box is primarily intended as a factory hardware development tool.

Math dialog box

Figure 320.
Math dialog
box.



Selecting Image Math on the Process Menu opens the Image Math dialog box (Figure 320), which allows mathematical operations to be performed on a file, or between two data files, with the result written to an output file. The Image Math dialog box contains four tab pages. One is for each of the three possible files, **A**, **B**, and **C**. The fourth, **Operation**, is used to select the operation to be performed, which is always mathematically displayed at the top of the dialog box. See Chapter 13 for a discussion of Spectra Math.

For Additional Information

A tab page: pg. 270

B tab page: pg. 281

C tab page: pg. 285

Operation tab page: pg. 384

Control Buttons:

Mouse: Allows you to specify a region to be processed using the mouse. Simply drag a box in the data region of the active window and then click on **Mouse**. The **Frame** and **Range** parameters will assume the values of the defined region. Note that the **Mouse** button is only active when the **A** or **B** tab page is selected.

Process: Initiates the selected operation.

Close: Closes the window with no action taken.

Help: Opens context-sensitive help for the active tab page.

Menu bar

Figure 321.
Menu bar.



Below the Title bar is the Menu Bar, which allows you to open the menus that control the various WinSpec/32 functions. Menus having to do with basic WinSpec/32 functions are located to the left. The **H**elp menu is at the far right. Note that one letter of each of the menu names is underlined. The underlined letter indicates the *shortcut key* for that menu, allowing it to be opened from the keyboard by simultaneously pressing the ALT key and the shortcut key. For example, to open the **S**etup menu you would press the ALT key and then the S key, which would cause the **S**etup menu to appear. Alternatively, a menu can be opened by clicking on the menu name with the mouse.

If Visual C++ Snap-Ins or Visual Basic Add-Ons have been installed, a **T**ools selection will appear on the menu bar. Clicking on **T**ools will drop a menu listing the available Snap-Ins and Add-Ons. If more than one version of WinView/32 and/or WinSpec/32 has been installed, the **T**ools selection and listed Snap-Ins and Add-Ons will be available to all of them.

Morphological (Provided with Imaging Option only)

General discussion: Chapter 16.

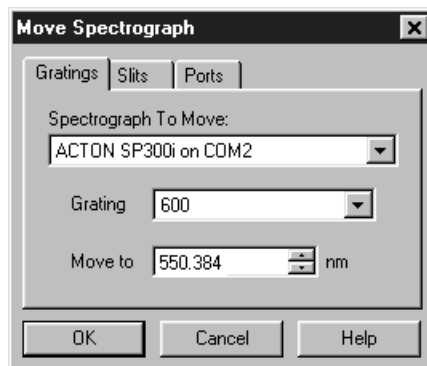
Input tab page: pg. 362

Parameters tab page: pg. 391

Output tab page: pg. 386

Move Spectrograph dialog box

Figure 322.
Move Spectrograph dialog box.



The Move Spectrograph dialog box contains the tab pages that allows computer control of the Spectrograph adjustments. In addition, there are three control buttons that apply for all of the tab pages.

For Additional Information

Gratings tab page: pg. 355

Slits tab page: pg. 448

Ports tab page: pg. 408

Control Buttons:

OK: Executes the selections for all tab pages and closes the tab page.

Cancel: Closes the tab pages without executing any selections or changes.

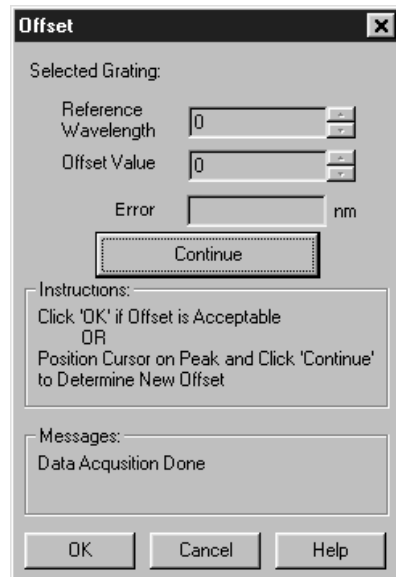
Help: Opens context sensitive help for whichever tab page is on top.

Offset dialog box

The Offset adjustment allows the software to compensate for mechanical misalignment between the spectrograph and the detector. Theoretically, if you were to move your spectrograph to the zero order peak or any other known peak, the peak would fall exactly on the center of the array. In the real world, the mechanical tolerances of the mounting may result in the peak being a few pixels off. The Offset procedure corrects for this small offset error.

Note: The offset correction function is not available for all spectrographs.

Figure 323.
Offset dialog
box.



Reference Wavelength: This is the wavelength setting at which the offset adjustment will be performed. In the case of Acton spectrographs, the correct setting is zero (zero order). It is, of course, possible to enter any atomic line you wish. However, by convention, offset adjustments are almost always done at zero.

Offset Value: The software is configured for a correct starting value of zero. Note that offset information is generally supplied with the spectrograph. The value provided for the spectrograph should not be entered. Begin instead with a setting of zero. The actual offset will be computed and displayed during the procedure.

Error: This is the computed error in nm. Usually you will want to repeat the Offset computation at least two or three times to get the error as small as possible. It should be possible to reduce it to much less than a pixel, keeping in mind that the number of nm represented by a single pixel will depend on the pixel size and on the grating dispersion.

Start Offset Procedure: Click on this button to initiate the Offset procedure. Note that the name of the button changes to **Continue** after the first offset cycle is completed.

Control Buttons:

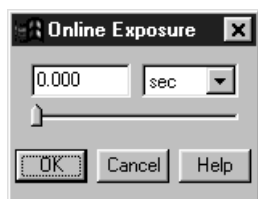
OK: Closes the dialog box and saves the offset data for the selected grating in the Registry.

Cancel: Closes the dialog box without executing any selections or changes.

Help: Opens context sensitive help for the dialog box.

Online Exposure dialog box

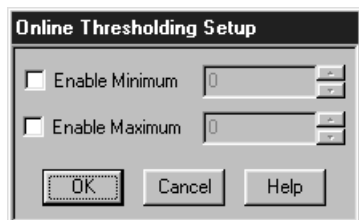
Figure 324.
Online
Exposure
dialog box.



This dialog box, which is opened by pressing the Δt button on the custom toolbar, allows the Exposure Time to be adjusted while data acquisition is in progress.

Online Threshold Setup

Figure 325.
Online
Threshold
Setup dialog
box.



Selecting On-Line Thresholding **Setup** on the Experiment Setup **Processes** tab page opens the **Online Thresholding Setup** dialog box. This box allows you to independently enable the Minimum and Maximum threshold tests and set the threshold values.

Parameters

Min: The text entry box allows the minimum threshold level to be set to any positive or negative value in the range of possible intensities (*note that background subtraction can force negative values*), providing the setting is lower than the **Max** setting. The check box allows the minimum threshold function to be switched ON or OFF. If the box contains a check, the function is ON, and any intensity value below the **Min** setting will return a **0**. Intensities higher than the **Min** setting will return a **1**, unless they also exceed the **Max** setting, in which case they will return a **0**. If the **Min** box is unchecked, all values below the **Max** threshold setting return a **1**; intensities that exceed **Max** return **0**.

Max: The text entry box allows the maximum threshold level to be set to any positive or negative value in the range of possible intensities (*note that background subtraction can force negative values*), providing the setting is higher than the **Min** setting. The check box allows the maximum threshold function to be switched ON or OFF. If the box contains a check, the function is ON, and any intensity value above the set value will return a **0**. If the box is unchecked, the function is OFF, and all intensities higher than **Min** will return a **1**.

Control Buttons:

OK: Saves the changes and closes the window.

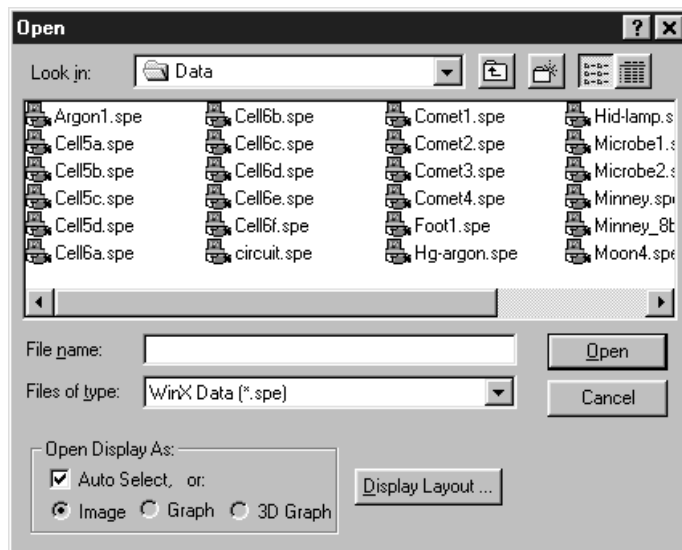
Cancel: Closes the window without making any changes.

Help: Opens context-sensitive help for the window.

Open dialog box

Selecting Open on the File menu opens the Open dialog box (Figure 326). This box gives information about the data files that have been saved and allows you to select them for display and processing. Scrollbars appear if the number of titles exceeds what can be listed.

Figure 326.
Open dialog
box.



Features and Selections

Look In: Indicates the selected folder. The contents are listed in the space below the Look In box. Clicking on the button at the right of the Look In box opens a browser, allowing you to easily move to the folder containing the data files.



Button: Moves you higher in the directory tree.



Button: Creates a new directory.



Button: Selects list view; file-names and directory folders only.



Button: Selects detailed view; includes Name, Size, File Type and Date Modified.

File Name: Indicates the file name that will be opened when you click on the Open button. You can key in the name directly or simply click on the name in the list above. Double clicking a name will both select a file and open it.

Files of type: Indicates the file type. Currently Princeton Instruments' WinX (*.SPE) and *.TIF are the formats supported.

Open Display As: Radio buttons give choice of **Image**, **Graph** or **3D Graph** display.

If you want the software to control how the data will be displayed when the file is opened, check **Auto Select**. Leave **Auto Select** unchecked if you want to retain control over whether the data will be displayed as an **Image**, **Graph** or **3D Graph**.

Auto Select is the factory default selection.* In addition, one of the three radio buttons, **Image**, **Graph** or **3D Graph**, will be selected but grayed out if Auto Select is checked. If Auto Select is unchecked, the grayed out selection will become active and govern how the file is opened.

* The open/display default selection can be changed and saved from the Display Layout window.

When Auto Select is checked, the way the data is displayed depends on the number of data strips it contains.

- ⇒ If there are eleven or more strips of data, they will be displayed as a normal image, such as that shown in Figure 143 (page 172).
- ⇒ If there are at least three data strips but less than eleven, the data will be plotted as a 3D Graph as shown in Figure 121 (page 156).
- ⇒ If there are only two strips of data, they will be displayed as graphs stacked in a two-dimensional plot, the same as for a 3D Graph of two strips. *See Figure 122 (page 157).*
- ⇒ A single strip *will always* be plotted as a simple X vs. Y plot. Note that from two to ten strips, the intensity (Y axis) scale shifts position as required to read true for the selected strip.

If **Image** is selected, all data points will be plotted as a function of the strip and pixel number.

If **3D Graph** is selected, multiple data strips will be plotted as a function of intensity versus pixel number, the actual number of data strips plotted depending on the 3D Layout display parameter settings. All of the strips could come from the same frame, or, in the case of a file containing multiple frames, the same numbered strip could come from each frame.

If **Graph** is selected, the selected data strip only will be plotted as a function of intensity versus pixel number.

Display Layout: Opens the Display Layout window; equivalent to selecting Layout on the Display menu except that the Range tab page isn't available.

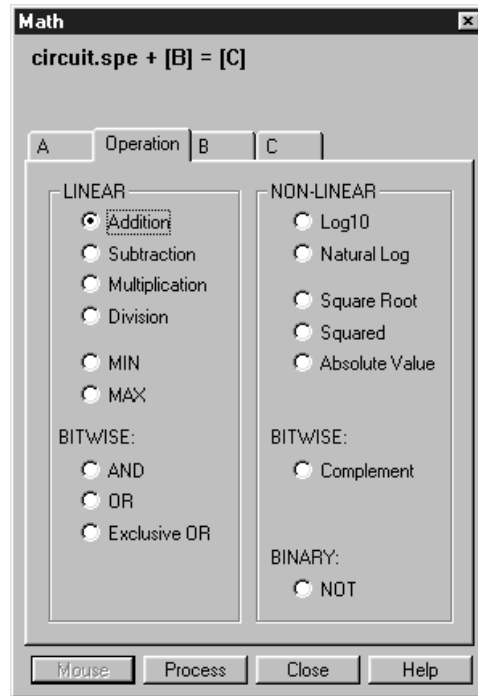
Open Button: Opens the selected file and closes the Open dialog box.

Cancel: Closes the Open dialog box without opening a file.

Right Click Shortcut Menus: The Open dialog box supports the standard Windows 95 right-click shortcut menus. Right clicking anywhere in the box but not on a filename opens a menu that allow you to tailor the box functions and appearance. Right clicking on a filename provides a shortcut menu of file operations. *See page 55 for additional information.*

Operation tab page

Figure 327.
Operation tab
page.



See Chapter 13 for additional information.

Linear Operations

Addition: The **A** file is added, pixel by pixel, to the **B** file and the results written to the **C** file. It is also possible to add a constant entered on the **B** tab page to each point on the **A** file, with the results written to the **C** file.

Subtraction: The **B** file is subtracted, pixel by pixel, from the **A** file and the results are written to the new file. It is also possible to subtract a constant entered on the **B** tab page from each point on the **A** file, with the results written to the **C** file.

Multiplication: The **A** file is multiplied, pixel by pixel, by the **B** file and the results written to the **C** file. It is also possible to multiply each pixel of the **A** file by a constant entered on the **B** tab page, with the results written to the **C** file.

Division: The **A** file is divided, pixel by pixel, by the **B** file and the results written to the **C** file. It is also possible to divide each pixel of the **A** file by a constant entered on the **B** tab page, with the results written to the **C** file.

MIN: The **A** file is compared, pixel by pixel, with the **B** file and the smaller of the two values written to the **C** file. It is also possible to compare each pixel of the **A** file with a constant entered on the **B** tab page, with the smaller of the two values written to the **C** file.

MAX: The **A** file is compared, pixel by pixel, with the **B** file and the larger of the two values written to the **C** file. It is also possible to compare each pixel of the **A** file with a constant entered on the **B** tab page, with the larger of the two values written to the **C** file.

Non-Linear Operations

Log10: The Log10 of the **A** file is computed pixel by pixel and the results written to the **C** file.

Natural Log: The natural log of the **A** file is computed pixel by pixel and the results written to the **C** file.

Square Root: The square root of each point in the **A** file is computed and the result written to the corresponding point of the **C** file.

Squared: Each point in the **A** file is squared and the result written to the corresponding point of the **C** file.

Absolute: The absolute value of each point in the **A** file is computed and the result written to the corresponding point of the **C** file.

Bitwise Operations

AND: A bitwise AND operation is performed on the binary representation of each pixel of the **A** file and each pixel of the **B** file, with the result written to the **C** file. A twelve-bit example follows.

	Bits	Decimal Value
Pixel value in A	0 1 0 1 0 1 0 1 0 1 0 1	1365
Corresponding pixel value in B	0 0 0 0 0 0 1 1 1 1 1 1	63
Result written to C	0 0 0 0 0 0 0 1 0 1 0 1	21

OR: A bitwise OR operation is performed on the binary representation of each pixel of the **A** file and each pixel of the **B** file, with the result written to the **C** file. An eight-bit example follows.

	Bits	Decimal Value
Pixel value in A	0 1 0 1 0 1 0 1 0 1 0 1	1365
Corresponding pixel value in B	0 0 0 0 0 0 1 1 1 1 1 1	63
Result written to C	0 1 0 1 0 1 1 1 1 1 1 1	1407

Exclusive OR: A bitwise Exclusive OR operation is performed on the binary representation of each pixel of the **A** file and each pixel of the **B** file, with the result written to the **C** file. An eight-bit example follows.

	Bits	Decimal Value
Pixel value in A	0 1 0 1 0 1 0 1 0 1 0 1	1365
Corresponding pixel value in B	0 0 0 0 0 0 1 1 1 1 1 1	63
Result written to C	0 1 0 1 0 1 1 0 1 0 1 0	1386

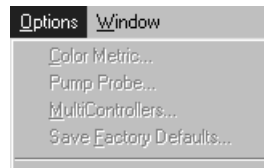
Complement: For each pixel value n in the **A** file, the corresponding value in the output file **C** is set to $-1-n$. Otherwise stated, each 0 becomes a 1 and each 1 a 0.

Binary Operations

NOT: For each pixel in the **A** file, all non-zero values yield a zero, and all zero values (only) yield a one. The resulting values are written to the corresponding point of the **C** file.

Options menu

Figure 328.
Options menu.

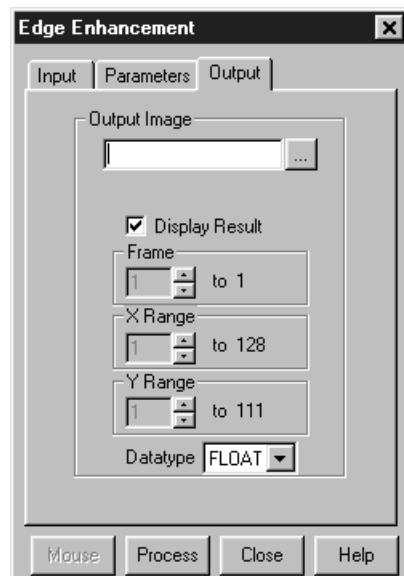


Allows selection of available option so that the control functions and parameters can be set for the selected option.

Not all Options listed are active in early releases of the software.

Output tab page (Edge Enhancement, Sharpening, Smoothing, Morphological, Custom Filter, Look Up Table, Threshold and Clipping Cross Sections, Binning and Skipping, Histogram)

Figure 329.
Output tab page.



The Output tab page is the same for all of the post-acquisition operations, **Edge Enhancement, Sharpening, Smoothing, Morphological, Custom Filter, Look Up Table, Clipping/Threshold, Cross Section** and **Binning and Skipping**. The page allows you to name the output file. It additionally allows to select whether the processed image will be displayed and what the file data type will be. *The Frame, X and Y Range setting features are not active in early releases of the software.*

Control Buttons:

Mouse: Allows you to specify a region to be processed using the mouse. Simply drag a box in the data region of the active window and then click on **Mouse**. The **Frame** and **Range** parameters will assume the values of the defined region. Note that the **Mouse** button is only active when the **Input** tab page is selected.

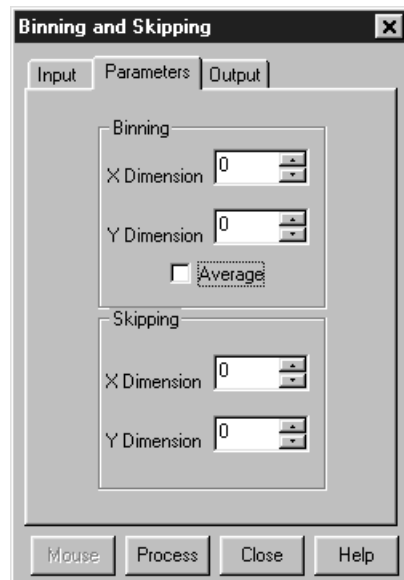
Process: Initiates the process selected via the Parameters tab page. The selected process is performed on the data specified on the Input tab page and saved using the file name and data type specified on the Output tab page.

Close: Closes the window with no action taken.

Help: Opens context-sensitive help for the active tab page.

Parameters tab page (Binning and Skipping)

Figure 330.
Binning and
Skipping
Parameters tab
page.



The Binning and Skipping Parameters tab page allows the bin size to be set independently in the X and Y directions.

The Skipping parameter sets the interval between bins. The Skipping parameter size can be independently set for X and Y. Data points that fall in the skip zones do not contribute to the output. Skip values of zero are allowable, that is, no points will be skipped. Left over points at the end of a strip or column are discarded.

There is also provision for either averaging or summing the binned data points. If **Average** is selected, each output data value will be the average of the binned data values in each region. If Average is *unselected*, each output data value will be the sum of the binned data values. *See Chapter 17 for additional information.*

Control Buttons:

Mouse: Allows you to specify a region to be processed using the mouse. Simply drag a box in the data region of the active window and then click on **Mouse**. The **Frame** and **Range** parameters will assume the values of the defined region. Note that the **Mouse** button is only active when the **Input** tab page is selected.

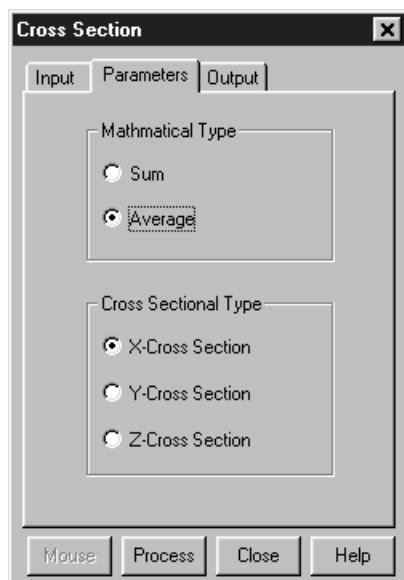
Process: Initiates the process selected via the Parameters tab page. The selected process is performed on the data specified on the Input tab page and saved using the file name and data type specified on the Output tab page.

Close: Closes the window with no action taken.

Help: Opens context-sensitive help for the active tab page.

Parameters tab page (Cross Section)

Figure 331.
Cross Section
Parameters tab
page.



Allows selection of either **Sum** or **Average** and X, Y or Z Cross Sections. If **Sum** is selected, all pixel values in either the X, Y or Z direction, according to whether **Y-Cross Section**, **X-Cross Section** or **Z-Cross Section** is selected, will be summed to generate the output. If **Average** is selected, the average of all of the pixel values in either the X, Y or Z direction will be summed to produce the output. *See Chapter 17 for additional information.*

Control Buttons:

Mouse: Allows you to specify a region to be processed using the mouse. Simply drag a box in the data region of the active window and then click on **Mouse**. The **Frame** and **Range** parameters will assume the values of the defined region. Note that the **Mouse** button is only active when the **Input** tab page is selected.

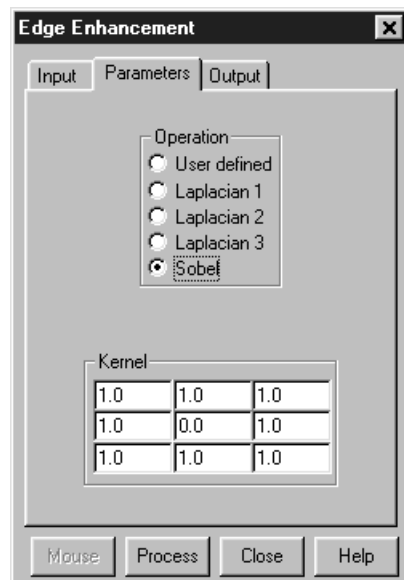
Process: Initiates the process selected via the Parameters tab page. The selected process is performed on the data specified on the Input tab page and saved using the file name and data type specified on the Output tab page.

Close: Closes the window with no action taken.

Help: Opens context-sensitive help for the active tab page.

Parameters tab page (Edge Enhancement)

Figure 332.
Edge
Enhancement
Parameters tab
page.



The Parameters tab page, which is provided only with the Imaging Option, allows you to select any one of four pre-defined edge-enhancement operations. Alternatively, you can select User Defined and specify your own values in the Kernel matrix. *See Chapter 16 for additional information.*

Control Buttons:

Mouse: Allows you to specify a region to be processed using the mouse. Simply drag a box in the data region of the active window and then click on **Mouse**. The **Frame** and **Range** parameters will assume the values of the defined region. Note that the **Mouse** button is only active when the **Input** tab page is selected.

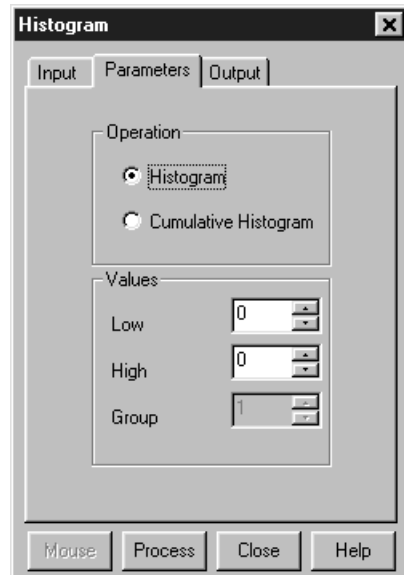
Process: Initiates the process selected via the Parameters tab page. The selected process is performed on the data specified on the Input tab page and saved using the file name and data type specified on the Output tab page.

Close: Closes the window with no action taken.

Help: Opens context-sensitive help for the active tab page.

Parameters tab page (Histogram)

Figure 333.
Histogram
Parameters tab
page.



Two types of histograms are available for graphing the distribution of intensities of an image. The **Histogram** operation groups pixels of a similar intensity together. The X-axis indicates the intensity, and the Y-axis displays the number of pixels in that intensity range.

The **Cumulative Histogram** operation groups pixels of a similar intensity together, once again using the X-axis to show intensity. This time, however, the Y-axis indicates the total number of pixels with intensity less than or equal to the range. Thus the Cumulative Histogram is always an increasing function.

The **Low Intensity** and **High Intensity** parameters set the Y-Max and Y-min values. **Group Size** is the range of intensity that the software will group together as a single data point. In other words, if the Group Size is 50, pixels having an intensity in the range of 1-50 will be counted and graphed as a single point on the histogram. *See Chapter 16 for additional information.*

Control Buttons:

Mouse: Allows you to specify a region to be processed using the mouse. Simply drag a box in the data region of the active window and then click on **Mouse**. The **Frame** and **Range** parameters will assume the values of the defined region. Note that the **Mouse** button is only active when the **Input** tab page is selected.

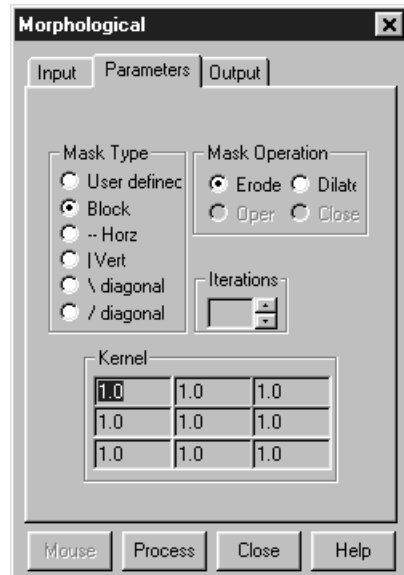
Process: Initiates the process selected via the Parameters tab page. The selected process is performed on the data specified on the Input tab page and saved using the file name and data type specified on the Output tab page.

Close: Closes the window with no action taken.

Help: Opens context-sensitive help for the active tab page.

Parameters tab page (Morphological)

Figure 334.
Morphological
Parameters tab
page.



The Parameters tab page, which is provided only with the Imaging Option, allows you to select the parameters for the morphological operations. The morphological operations Erode and Dilate are also accomplished by masking the data. The effect of the Erode process is to reduce the size of a white region, while Dilation increases it. The number of iterations is set by the user. All the options except for Block and User Defined perform the operation in a specific direction only. Block performs the operation in all directions. Two other choices are Open and Close. Open is simply a number of erodes (specified by Iterations) followed by the same number of dilates. Close performs the dilates first, then the erodes. Alternatively, you can select User Defined and specify your own values in the Kernel matrix. *See Chapter 16 for additional information.*

Mask Type: Specifies the direction of the operation. Choices include Horizontal, Vertical, the two diagonals and Block, in which the operation is performed in all directions. The final choice is User Defined, in which the mask values are set by the user.

Mask Operation: Selects the morphological operation to be performed, Open, Dilate, Open or Close.

Iterations: Number of times the selected operation is to be performed.

Control Buttons:

Mouse: Allows you to specify a region to be processed using the mouse. Simply drag a box in the data region of the active window and then click on **Mouse**. The **Frame** and **Range** parameters will assume the values of the defined region. Note that the **Mouse** button is only active when the **Input** tab page is selected.

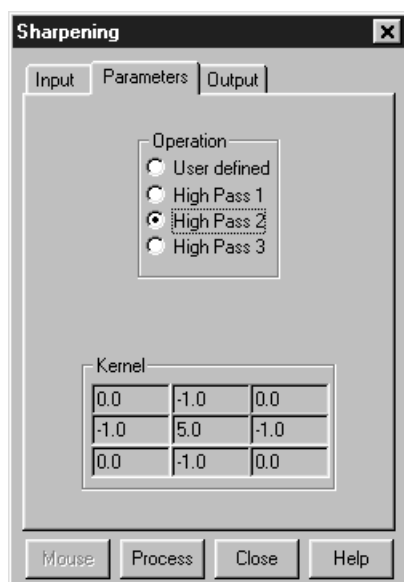
Process: Initiates the process selected via the Parameters tab page. The selected process is performed on the data specified on the Input tab page and saved using the file name and data type specified on the Output tab page.

Close: Closes the window with no action taken.

Help: Opens context-sensitive help for the active tab page.

Parameters tab page (Sharpening)

Figure 335.
Sharpening
Parameters tab
page.



The Sharpening Parameters tab page allows you to select any one of three pre-defined sharpening operations. Alternatively, you can select User Defined and specify your own values in the Kernel matrix. *See Chapter 16 for additional information.*

Control Buttons:

Mouse: Allows you to specify a region to be processed using the mouse. Simply drag a box in the data region of the active window and then click on **Mouse**. The **Frame** and **Range** parameters will assume the values of the defined region. Note that the **Mouse** button is only active when the **Input** tab page is selected.

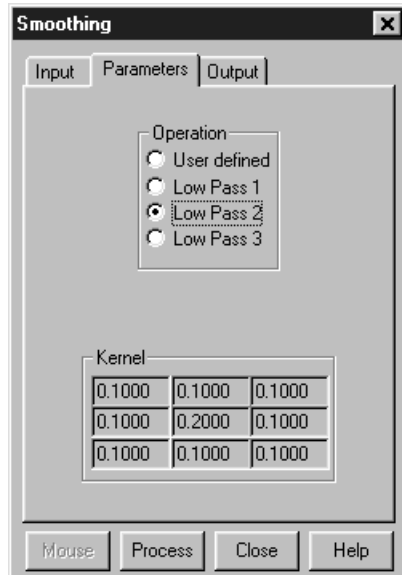
Process: Initiates the process selected via the Parameters tab page. The selected process is performed on the data specified on the Input tab page and saved using the file name and data type specified on the Output tab page.

Close: Closes the window with no action taken.

Help: Opens context-sensitive help for the active tab page.

Parameters tab page (Smoothing)

Figure 336.
Smoothing
Parameters tab
page.



The Smoothing Parameters tab page, allows you to select any one of three pre-defined smoothing operations. Alternatively, you can select User Defined and specify your own values in the Kernel matrix. *See Chapter 16 for additional information.*

Control Buttons:

Mouse: Allows you to specify a region to be processed using the mouse. Simply drag a box in the data region of the active window and then click on **Mouse**. The **Frame** and **Range** parameters will assume the values of the defined region. Note that the **Mouse** button is only active when the **Input** tab page is selected.

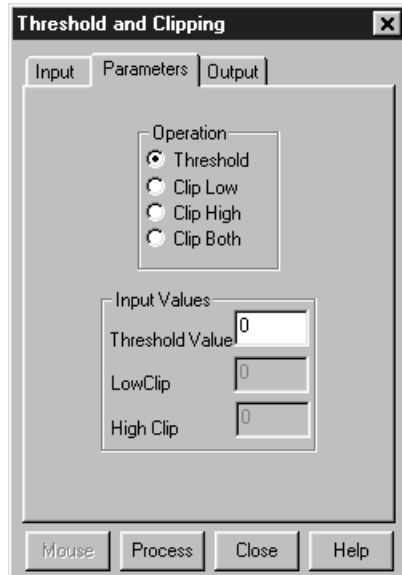
Process: Initiates the process selected via the Parameters tab page. The selected process is performed on the data specified on the Input tab page and saved using the file name and data type specified on the Output tab page.

Close: Closes the window with no action taken.

Help: Opens context-sensitive help for the active tab page.

Parameters tab page (Threshold and Clipping)

Figure 337.
Threshold and
Clipping
Parameters tab
page.



The Parameters tab page, which is provided only with the Imaging Option, allows you to control the Clipping and Threshold functions. Clipping an image causes pixels outside the specified range to be changed. When Clip High is selected, all pixels with values greater than the Clip High value will be changed to the Clip High value. When Clip Low is selected, all pixels with values less than the Clip Low value will be changed to the Clip Low value. Selecting Clip Both will use both Clip High and Clip low values during the same processing step.

The Threshold function converts an image to binary (black and white). All intensity values below the threshold setting are zero (black). All those above become ones (white).

Control Buttons:

Mouse: Allows you to specify a region to be processed using the mouse. Simply drag a box in the data region of the active window and then click on **Mouse**. The **Frame** and **Range** parameters will assume the values of the defined region. Note that the **Mouse** button is only active when the **Input** tab page is selected.

Process: Initiates the process selected via the Parameters tab page. The selected process is performed on the data specified on the Input tab page and saved using the file name and data type specified on the Output tab page.

Close: Closes the window with no action taken.

Help: Opens context-sensitive help for the active tab page.

Peak Find dialog box

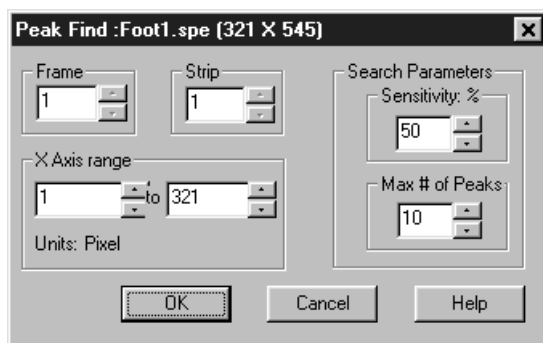
The Peak Find dialog box, which is opened from the Process menu (page 413), allows peaks to be found and labeled on any displayed spectrum. The maximum number of peaks equals $\frac{1}{4}$ the number of displayed pixels. The peak locator works by taking the second derivative of the spectrum to find the peaks. Each peak found is then divided in two so that the area to the left of the divider equals the area to the right of the divider. The cursor is located at precisely the point where the divider intersects the peak. Note that, depending on the shape of the peak, the cursor may or may not end up precisely on the highest point.

Frame and Strip: Allow you to choose the Frame and Strip on which the peak find is to be performed.

X Axis range: Specifies the range on the X axis over which the peak search is to be performed.

Search Parameters Sensitivity: The relative sensitivity for the Peak Find function is adjustable over a range of 0 to 100, with 0 being least sensitive and 100 being most sensitive. Experience indicates that 50 is the best setting for most situations.

Figure 338.
Peak Find
dialog box.



Maximum Number of Peaks: Can be set to any value in the range of 1 to 10.

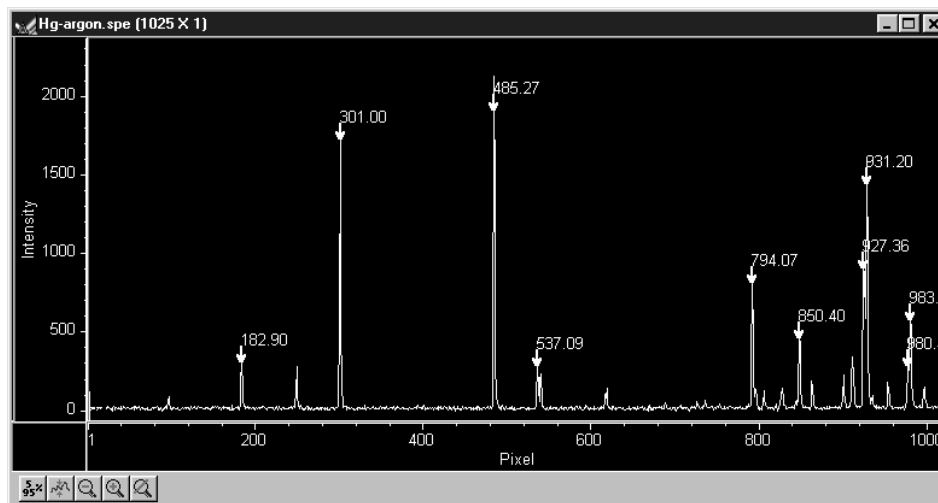
Control Buttons:

OK: Initiates the peak find and closes the dialog box. The located peaks will be marked as shown in Figure 339.

Cancel: Closes the dialog box without initiating a peak find.

Help: Opens context-sensitive help for the peak-find function.

Figure 339.
Spectrum with
peaks marks
using Peak
Find function.

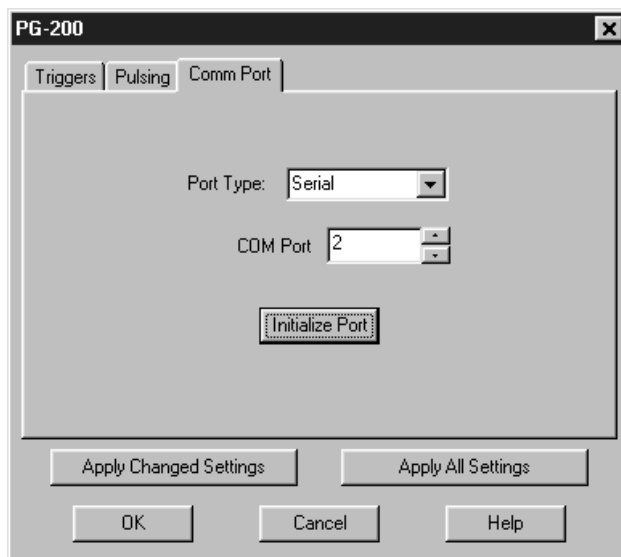


Cancel: Closes the dialog box without initiating a peak find.

Help: Opens context-sensitive help for the Peak Find dialog box.

PG-200 Comm Port tab page

Figure 340.
PG-200 Comm
Port tab page.



Allows you to set the communications port and parameters for communications between the computer and the PG-200. Additionally provides for initializing the port. See *Chapter 19* for additional information.

Parameters

Port Type: Determines which type port will be used. Select **Serial** for communications with the PG-200.

COM Port: Selects the serial Comm Port to be used for communications with the PG-200. The range is 1 to 8. Be sure the selection you make corresponds with the physical reality of the computer. Generally, the mouse is connected to COM1 and the Pulser is connected to COM2.

Initialize Port: Immediately initializes the selected Comm Port. If the pulser/timing generator is not correctly connected to that Comm port or not turned on, an error message will appear.

Control Buttons:

Apply Changed Settings: Clicking on this button immediately sends any changed dialog values to the PG-200 Pulser. For example, if the Pulse Width and Trigger Frequency have been changed since the last time the pulser was programmed, only those values will be sent to the pulser. This is faster than using the **Apply All Settings** button, which sends all the PG-200 Setup values to the pulser, and can take several seconds.

Apply All Settings: Clicking on this button immediately sends all current dialog values to the PG-200. Reprogramming of the PG-200 will take several seconds. If you have only changed one or two dialog items, it is better to click on the **Apply Changed Settings** button, which sends only the new parameters to the PG-200.

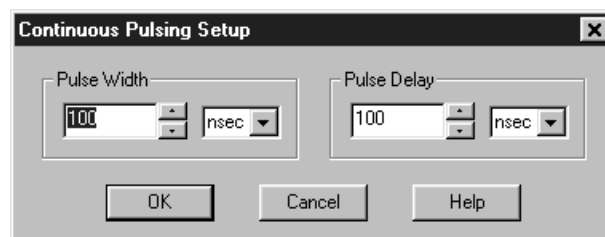
OK: Click on this button to close the dialog. Selecting this button does *not* automatically program the pulser/timing generator. To program the selected values into the timing generator click on **Apply Changed Settings** or **Apply All Settings**.

Cancel: The **Cancel** button exits the dialog without saving any settings. This does *not* mean, however, that the pulser was not reprogrammed. The pulser is reprogrammed when you click on **Apply Changed Settings** or **Apply All Settings**. If you do this and then click **Cancel**, the new values will already have been programmed into the pulser/timing generator.

Help: Click on this button to open the online help for this window.

PG-200 Continuous Pulsing Setup dialog box

Figure 341.
Continuous
Pulsing setup
dialog box.



When Continuous pulsing, the Pulse Width and Pulse Delay remain constant at the values specified. They can be entered directly or you can use the spin wheels to set the wanted settings. The units are selected from the drop-down boxes to the right of the data-entry windows.

Control Buttons:

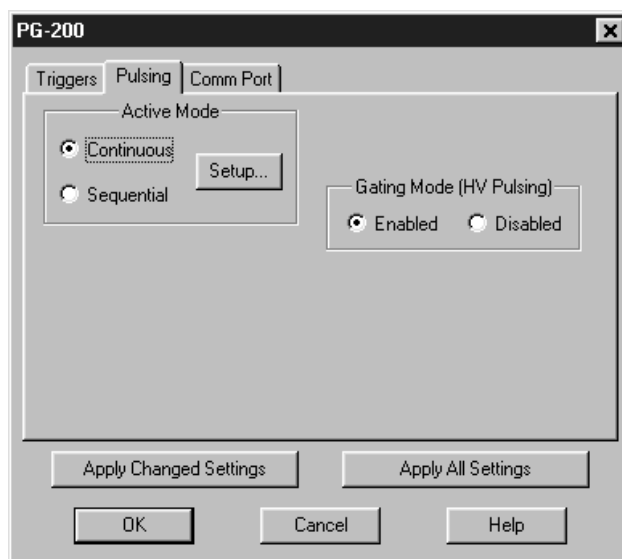
OK: Enters the specified values and closes the dialog box, returning you to the PG-200 window. Note that the parameter values aren't transmitted to the pulser/timing generator until you select **Apply Changed Settings** (or **Apply All Settings**) and click on **OK**.

Cancel: Closes the dialog box leaving the original settings in effect.

Help: Opens context-sensitive help for the Continuous Pulsing Setup dialog box.

PG-200 Pulsing tab page

Figure 342.
PG-200
Pulsing tab
page.



The Pulsing tab page sets the gate pulse characteristics of the PG-200 Pulser. It allows you to set the pulse width and the delay between application of a trigger and the time the output pulse is generated. It additionally allows the output to be enabled or disabled. The associated window buttons are active for all of the PG-200 tab pages. *See Chapter 19 for additional information.*

Parameters

Pulse Width: The pulse width is the duration of the high voltage pulse to the intensifier. The units available are nanoseconds (nsec), microseconds (μ sec), or milliseconds (msec). Only some values are allowed, so the PG-200 will adjust the input value to the nearest allowable value. See the PG-200 manual for details.

Pulse Delay: The pulse delay is the time between the beginning of the trigger pulse (either internal or external) and the beginning of the high voltage pulse. The units available are nanoseconds (nsec), microseconds (μ sec), or milliseconds (msec). Only some values are allowed, so the PG-200 will adjust the input value to the nearest allowable value. See the PG-200 manual for details.

Enable/Disable radio buttons: Gating is only possible with **Enabled** selected. Read all cautions and warnings in the hardware manuals before selecting **Enabled**. After **Enable** is selected you must click on **Apply Changed Settings** or **Apply All Settings** and click on OK for the change to take effect.

Control Buttons:

Apply Changed Settings: Clicking on this button immediately sends any changed dialog values to the PG-200 Pulser. For example, if the Pulse Width and Trigger Frequency have been changed since the last time the pulser was programmed, only those values will be sent to the pulser. This is faster than using the **Apply All Settings** button, which sends all the PG-200 Setup values to the pulser, and can take several seconds.

Apply All Settings: Clicking on this button immediately sends all current dialog values to the PG-200. Reprogramming of the PG-200 will take several seconds. If you have only changed one or two dialog items, it is better to click on the **Apply Changed Settings** button, which sends only the new parameters to the PG-200.

OK: Click on this button to close the dialog. Selecting this button does *not* automatically program the pulser/timing generator. To program the selected values into the timing generator click on **Apply Changed Settings** or **Apply All Settings**.

Cancel: The **Cancel** button exits the dialog without saving any settings. This does *not* mean, however, that the pulser was not reprogrammed. The pulser is reprogrammed when you click on **Apply Changed Settings** or **Apply All Settings**. If you do this and then click **Cancel**, the new values will already have been programmed into the pulser/timing generator.

Help: Click on this button to open the online help for this window.

PG-200 Pulse Sequence Setup dialog box

Figure 343.
Pulse Sequence
Setup dialog
box.

In Pulse Sequential operation, the Pulse Width and Pulse Delay change over the course of the measurement. This sweep can be accomplished linearly (**Fixed** Increment type) or exponentially (**Exponential** Increment type). Linear sequential operation is well suited to locating and recovering a transient effect that always occurs at the same time with respect to T_0 . Exponential sequential operation is used to study decay processes, where the effect changes rapidly at the start of the measurement, and then changes slower and slower as the measurement progresses. The sweep is controlled so as to take many exposures in the region where the effect is changing rapidly, and fewer and fewer as the measurement progresses and the data changes more and more slowly. The resulting data points can be spline-fitted to generate the complete curve so that the decay constant can be calculated, even where the data derives from two decay processes occurring simultaneously.

Parameters

Number of Images: With a Software Accumulations setting of one, Number of Images equals the number of exposures, each of which is followed by a readout. After each exposure, the Pulse Width and Pulse Delay change as programmed before the next exposure occurs. If multiple Accumulations are programmed, each exposure is repeated n times, where n is the number of software accumulations specified. Every accumulation is processed before the pulse delay and width change for the next shot. The total number of exposures equals the specified Number of Spectra times the number of Accumulations.

ATTENTION

Accumulations can be set on the PG-200 Pulse Sequence Setup dialog box and on the Experiment Setup Main tab page. The two settings must be the same for proper operation.

Pulse Width: The starting and ending pulse widths are independently set. The first Shot will have the **Starting** pulse width and the last Shot will have the **Ending** pulse width. This is true for both the Fixed and Exponential increment type.

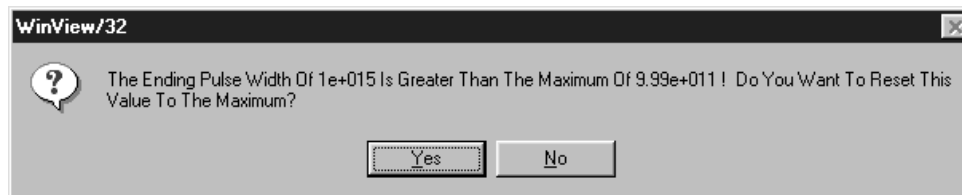
Pulse Delay: The starting and ending pulse delay values are independently set. The first Shot will be taken at the **Starting** delay with respect to T_0 and the last Shot will occur at the **Ending** delay with respect to T_0 . This is true for both the Fixed and Exponential increment type.

ATTENTION

The precise timing of both the gate and signal at the camera will additionally depend on a number of different delay mechanisms that can significantly affect the experiment. These are discussed for the PI-MAX camera in some detail in *Tips and Tricks* chapter of the PI-MAX instruction manual.

Check Pulse Width and Delay Min/Max (Message Displayed): If this box is checked and you specify a pulse width or delay outside the allowable range, a warning message will be displayed as shown below. Clicking **Yes** will cause the parameter in question to be set to the limit value. Clicking **No** will cause the parameter *setting* to be retained, but the *actual* value will still be the applicable minimum or maximum. If the box isn't checked, the applicable minimum or maximum will be established automatically.

Figure 344.
Range Limits
Exceeded
warning.



Fixed Increment Type: With this selection, the increment or change in Pulse Width and Pulse Delay is the same from shot to shot. The actual increments depend on the specified starting and ending values and on the Number of Images specified. The increment values are calculated and reported in the associated text boxes.

Exponential Increment Type: With this selection, the increment or change in Pulse Width and Pulse Delay changes from shot to shot. The precise delay and width of each shot with respect to T_0 is determined by the values entered for the Fast Decay and Slow Decay **Time Constant** and **Amplitude** parameters. In fluorescent decay experiments, for example, there will typically be two species contributing to the output data, one of which decays much faster than the other. For example, there might be a fast fluorophor with a decay time of at most a few nanoseconds, and a slower one with a decay time of perhaps a hundred nanoseconds. By sweeping both the delay *and* the width, and making provision for entering time constant and amplitude information for two species, the sequential exponential algorithm is ideally suited to making this type of measurement. At the start of the decay where the amplitude is high but the decay is rapid, the gate pulses are narrow and close together. Towards the end of the decay where the decay is slow, the gate pulses are

further apart but much wider to accommodate the lower signal amplitude. The result is output data that is relatively constant in intensity over the decay time. This data can be easily normalized by dividing each point by the exposure time and then using a spline fit to recover the curve. The logarithm (base e) can then be taken to obtain a straight line (or two lines successive line segments, each with a different slope for two species). Tangents can be fitted to each segment to determine the rate constant for each species.

Fast Decay

Time Constant: In a two species system, enter the *decay time* of the faster of the two species. Note that it is not *essential* that you enter a value. If you have the decay time information, you will get better data if the information is entered, but acceptable results can be obtained in many situations by using the default. If there is only one species, or if you wish to discard the fast decay process, simply enter zero for the *Amplitude*.

Note that the Pulse Width and Pulse Delay values need to be selected with some care in fluorescence decay experiments. Typically the starting pulse width will be very narrow, perhaps 2 ns, and the final pulse amplitude should be wider by about the ratio of the anticipated signal amplitude decrease over the course of the measurement timebase. Similarly, the starting pulse delay has to take the various insertion delays into account, and the final delay value might typically be set to a value on the order of five times the anticipated decay time of the process.

Amplitude: This is the *relative* amplitude of the fast decay with respect to the slow one. For example, if you know that the amplitude of the fast decay signal is typically five times the amplitude of the slow decay signal, you could enter “5” for the fast decay amplitude and “1” for the slow decay amplitude. Keep in mind that it is the *ratio* that is being expressed. For example, there is no difference between entering fast and slow amplitude values of “5” and “1” and entering fast and slow amplitude values of “50” and “10.” Note that the default values will give satisfactory results in many measurements.

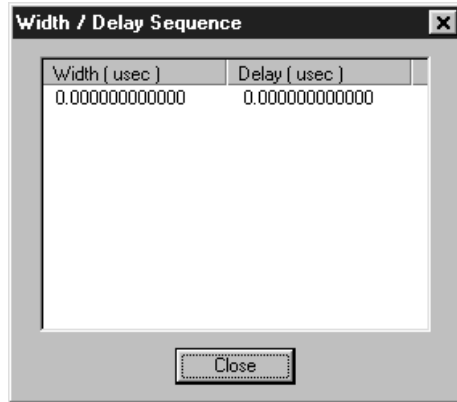
Slow Decay

Time Constant: In a two species system, enter the *decay time* of the slower of the two species. Note that it is not *essential* that you enter a value. If you have the decay time information, you will get better data if the information is entered, but acceptable results can be obtained in many situations by using the default. If there is only one species, or if you wish to discard the fast decay process, simply enter zero for the *fast decay Amplitude*.

Amplitude: This is the *relative* amplitude of the slow decay with respect to the fast one. For example, if you know that the amplitude of the slow decay signal is typically one fifth the amplitude of the fast decay signal, you could enter “1” for the slow decay amplitude and “5” for the fast decay amplitude. Keep in mind that it is the *ratio* that is being expressed. For example, there is no difference between entering slow and fast amplitude values of “1” and “5” and entering fast and slow amplitude values of “10” and “50.”

View Width/Delay Sequence: Opens a window listing the currently programmed sequence of pulse width and pulse delay values as shown in the following figure.

Figure 345.
Pulse
width/delay
sequence list
box.



Save Sequence Values to File: When this box is checked, the sequence values will be saved *on completion of the run*. The values saved are those actually used to take the data. The file could be recalled later and used for data normalization or other purposes.

Setup File: Opens the Sequence Values File dialog box (Figure 346), which enables the following:

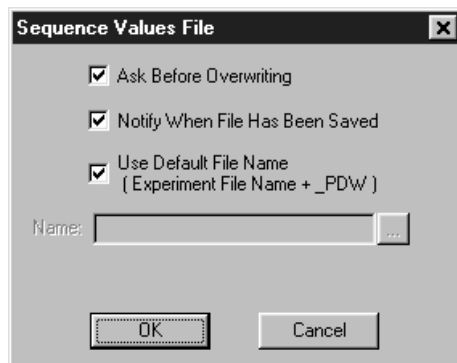
Ask Before Overwriting: If checked, user will be queried before a new sequence value file overwrites an existing one. If left unchecked, overwriting can occur without the warning being displayed.

Notify When File Has Been Saved: The file is saved at the end of the data-acquisition run. User will be notified that this has occurred if this box is checked.

Use Default File Name: If checked, sequence value file name will be experiment file name, but with the extension **PDW**. If unchecked, user must enter the name in the **Name** text box.

Name: If not using the default name for the sequence value file, enter the file name in the provided text box. The button at the end of the box opens a browser to facilitate assigning the file location.

Figure 346.
Sequence
Values File
dialog box.



Software Accumulations: Sets the number of exposures to be taken for each Shot. Note that the number of Accumulations set here must be the same as the value set on the Experiment Setup Main tab page for proper operation.

Control Buttons:

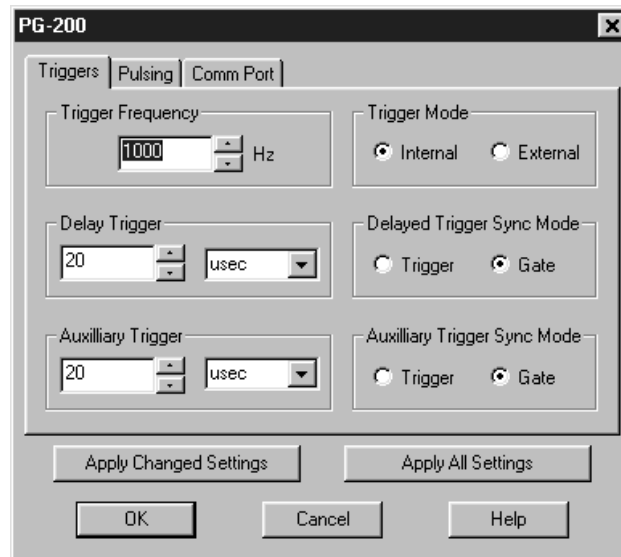
OK: Saves the specified parameter values and closes the dialog box, returning you to the PG-200 window.

Cancel: Closes the dialog box without saving any of the specified values.

Help: Accesses context-sensitive help for this window.

PG-200 Triggers tab page

Figure 347.
PG-200
Triggers tab
page.



The Triggers tab page provides for user control of the PG-200 triggering functions, as described in the following paragraphs. *See page 406 for additional information about operation with the PG-200 Pulser.*

Parameters

Trigger Frequency: The trigger frequency is usually used with internal triggering of the pulser. The Trigger Mode should then be set to Internal, and the pulser would act as its own frequency generator. See the PG-200 manual for valid frequency values.

Trigger Mode radio buttons: The trigger mode determines whether the PG-200 will create its own trigger signals (**Internal**), or will gate based on trigger signals that originate in an external piece of equipment (**External**). See the PG-200 manual for a description of the external trigger input on the PG-200.

Delay Trigger: The Delay Trigger setting determines the width of the Delay Trigger from the pulser. The units available are nanoseconds (nsec), microseconds (usec), or milliseconds (msec). Only some values are allowed, so the PG-200 will adjust the input value to the nearest allowable value. See the PG-200 manual for details.

Delayed Trig Sync Mode radio buttons: The Delayed Trigger Synchronization Mode allows for a signal to be sent from the PG-200 a fixed time after either the

Trigger or the **Gate** pulse. Not only is there a delay between the Trigger and the Gate pulse, but some timing modes allow for a series of gate pulses of varying widths and delays. For these reasons it is important to determine whether the Delayed Trigger timing should be based on the Trigger pulse or the Gate pulse.

Aux Trigger: The Auxiliary Trigger setting determines the width of the Auxiliary Trigger from the pulser. The units available are nanoseconds (nsec), microseconds (μ sec), or milliseconds (msec). Only some values are allowed, so the PG-200 will adjust the input value to the nearest allowable value. See the PG-200 manual for details.

Aux Trig Sync Mode radio buttons: The Auxiliary Trigger Synchronization Mode allows for a signal to be sent from the PG-200 a fixed time after either the **Trigger** or the **Gate** pulse. Not only is there a delay between the Trigger and the Gate pulse, but some timing modes allow for a series of gate pulses of varying widths and delays. For these reasons it is important to determine whether the Auxiliary Trigger timing should be based on the Trigger pulse or the Gate pulse.

Control Buttons:

Apply Changed Settings: Clicking on this button immediately sends any changed dialog values to the PG-200 Pulser. For example, if the Pulse Width and Trigger Frequency have been changed since the last time the pulser was programmed, only those values will be sent to the pulser. This is faster than using the **Apply All Settings** button, which sends all the PG-200 Setup values to the pulser, and can take several seconds.

Apply All Settings: Clicking on this button immediately sends all current dialog values to the PG-200. Reprogramming of the PG-200 will take several seconds. If you have only changed one or two dialog items, it is better to click on the **Apply Changed Settings** button, which sends only the new parameters to the PG-200.

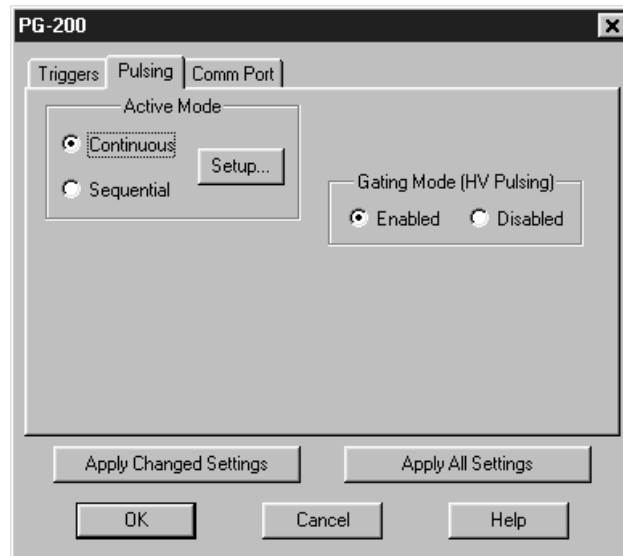
OK: Click on this button to close the dialog. Selecting this button does *not* automatically program the pulser/timing generator. To program the selected values into the timing generator click on **Apply Changed Settings** or **Apply All Settings**.

Cancel: The **Cancel** button exits the dialog without saving any settings. This does *not* mean, however, that the pulser was not reprogrammed. The pulser is reprogrammed when you click on **Apply Changed Settings** or **Apply All Settings**. If you do this and then click **Cancel**, the new values will already have been programmed into the pulser/timing generator.

Help: Click on this button to open the online help for this window.

PG-200 Window

Figure 348.
PG-200
window.



Operation of the PG-200 Pulser becomes available when you select Pulsers and then PG-200 from the **Setup** menu. Note that pulser support must be selected when installing the WinSpec/32 software for PG-200 control to be available.

The PG-200 parameters are set via the serial link between the computer and the PG-200 Pulsers. The choices provided by the PG-200 tab pages correspond to those provided by the PG-200 front panel, and are described below and in detail in the PG-200 manual. The PG-200 window contains the three PG-200 tab pages and the five buttons that are always present independent of the selected tab page.

Control Buttons:

Apply Changed Settings: Clicking on this button immediately sends any changed dialog values to the PG-200 Pulser. For example, if the Pulse Width and Trigger Frequency have been changed since the last time the pulser was programmed, only those values will be sent to the pulser. This is faster than using the **Apply All Settings** button, which sends all the PG-200 Setup values to the pulser, and can take several seconds.

Apply All Settings: Clicking on this button immediately sends all current dialog values to the PG-200. Reprogramming of the PG-200 will take several seconds. If you have only changed one or two dialog items, it is better to click on the **Apply Changed Settings** button, which sends only the new parameters to the PG-200.

OK: Click on this button to close the dialog. Selecting this button does *not* automatically program the pulser/timing generator. To program the selected values into the timing generator click on **Apply Changed Settings** or **Apply All Settings**.

Cancel: The **Cancel** button exits the dialog without saving any settings. This does *not* mean, however, that the pulser was not reprogrammed. The pulser is

reprogrammed when you click on **Apply Changed Settings** or **Apply All Settings**. If you do this and then click **Cancel**, the new values will already have been programmed into the pulser/timing generator.

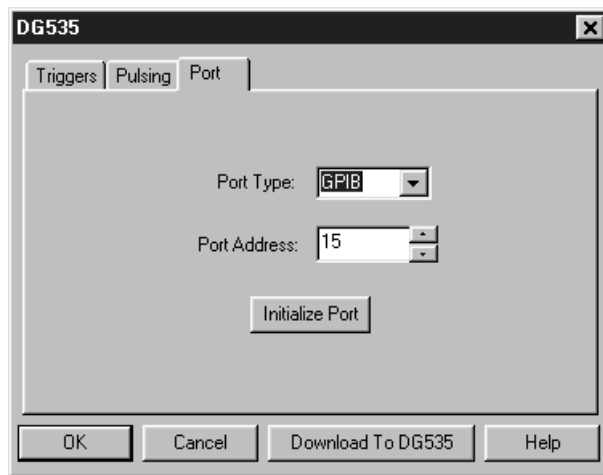
Help: Click on this button to open the online help for this window.

PI Shell Extension

See discussion of **Properties Window** on page 419.

Port tab page

Figure 349.
Port tab page.



Allows the DG-535 Port Type and Address to be selected. Also allows initialization of the port. See page 333 for additional information about the DG-535 Pulser.

Parameters

Comm Port: The Port address setting determines which GPIB address the computer will use in communications with the DG-535 Pulser. Selections include 1 through 30 plus Demo, which allows the DG-535 software routines to be exercised even though a DG-535 isn't connected. The selected address must match the one selected at the DG-535 and the default value is 15. After you select the correct COM port click on the INIT button to initialize that port.

INIT: Clicking on INIT immediately initializes the GPIB port. If the DG-535 is not correctly connected or not turned on, an error message will appear.

Control Buttons:

Download to DG535: Clicking on this button immediately sends all current dialog values to the DG-535.

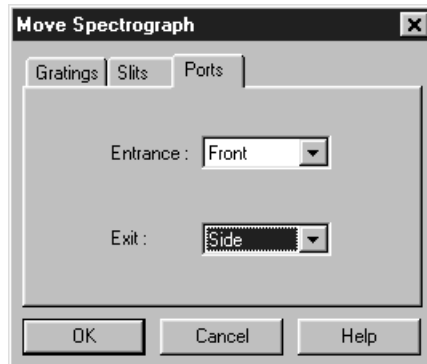
OK: Click on this button to close the DG-535 Setup dialog. Selecting this button does *not* automatically program the DG-535 To program the selected values into the DG-535 click on the **Download to DG535** button, then click on **OK**.

Cancel: The **Cancel** button exits the DG-535 Setup dialog without saving any settings. This does *not* mean, however, that the pulser was not reprogrammed. The pulser is reprogrammed when the **Download to DG535** button is used. If you click on the **Download to DG535** button and then click on **Cancel**, you have already programmed the new values into the pulser.

Help: Click on this button to open the online help for this window.

Ports tab page

Figure 350.
Ports tab page.



If the active spectrograph has movable ports, the Move Spectrograph Ports tab page allows you to set the front and side port assignments. Note that, before the port assignments can be changed, they must first have been designated as controllable via the Define Spectrograph Ports/Slits tab page.

Entrance: Specify front or side.

Exit: Specify front or side.

Control Buttons:

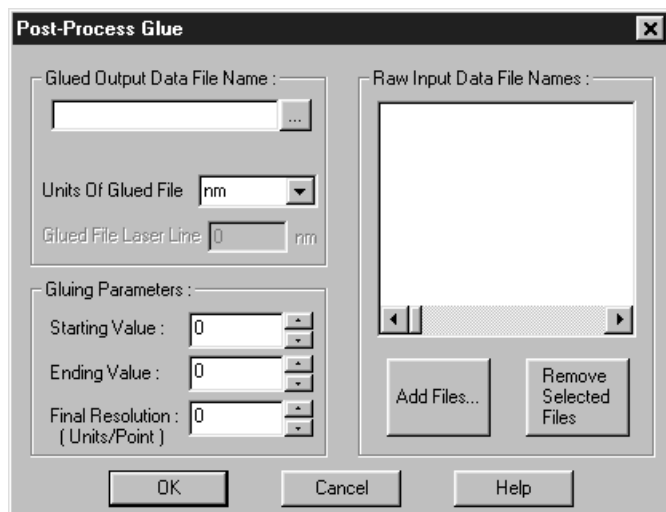
OK: Executes the selections for all tab pages and closes the tab page.

Cancel: Closes the tab pages without executing any selections or changes.

Help: Opens context sensitive help for whichever tab page is on top.

Post Process Glue dialog box

Figure 351.
Post Process
Glue dialog
box.



The Post Process Glue dialog box allows you to take existing spectra that have already been calibrated and have the WinSpec software connect the spectra at the appropriate points. You can glue any series of existing data files, providing that they all have been properly calibrated in nm. The files should overlap some in order to provide complete spectral data, but this is not required by the software. Any collection of calibrated single spectrum files can be used to create a glued file. The only requirements are that:

- The files have been wavelength calibrated (either manually or using “AutoSpectro”).
- The files have the same number of *frames* and *strips* (it is *not* necessary that they have the same number of pixels).

Raw Input Data File Names: These are the file names of the spectra to be glued.

Clicking on the **Add Files** button will open a browser to make file selection as convenient as possible. As each file is selected, its name will be added to the list. The **Remove Selected Files** button can be used to remove file names from the list of files to be glued.

Glued Output Data File Name: This is the name you wish to assign to the file containing the spectra to be glued together.

Units of Glued File: The individual spectra files to be glued together need not be in the same units. The Output file will be in the units you select, either nm, cm^{-1} , or rel. cm^{-1} .

Glued File Laser Line: Allows you to enter the laser line in nm if the selected units are rel. cm^{-1} .

Starting and Ending Values: These are the starting and ending wavelength values for the resulting file. If your wavelength range includes values that are not covered by any of the files in your series, the resulting spectrum will have some zero values. Any area where valid data was available will be used to create the glued data.

Final Resolution in Units per Point: Enter the final resolution you would like the final data file to have. This value is in units per data point in the output file, so the lower the number the higher the resolution and the more data points the glued file will contain. For a 2400 groove per mm grating and a 0.3 m spectrometer a good final resolution would be about 0.1 nm per pixel. For a 1200 groove per mm grating this value would be 0.15 to 0.2 nm per pixel. The total number of data points in the resulting file cannot exceed 65,535.

Control Buttons:

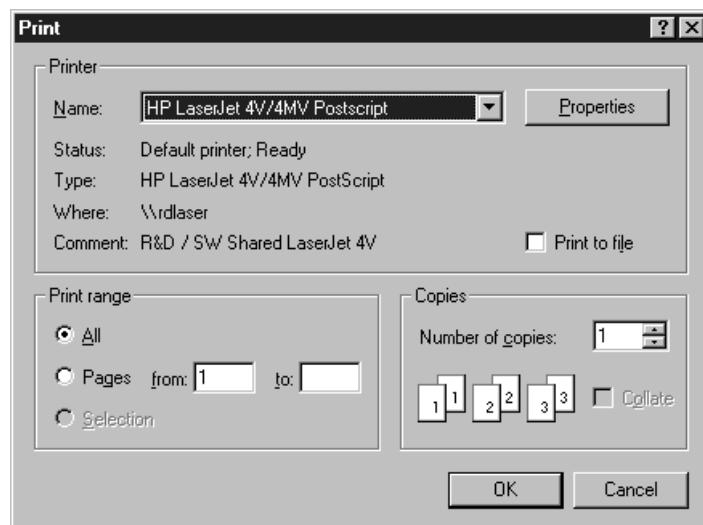
OK: Executes the selections. The listed files are glued, the output file is saved, and the dialog box closes

Cancel: Closes the dialog box without executing any selections or changes.

Help: Opens context sensitive help for the Post-Process Glue dialog box.

Print dialog box

Figure 352.
Print dialog
box.



Selecting Print on the file menu opens a standard Windows 95 Print dialog box like that in Figure 352. The box is used to select the printer, configure the printer settings, select the pages to print and the number of copies. You also have the option of printing to a file. The options provided by the Properties box allow user selection of the printer's capabilities. Note that these selections are derived from the printer driver and are unique to the particular printer selected. Once all selections have been made, clicking the **OK** button will initiate the print. The Cancel button will close the dialog box without printing. *See Chapter 18 for additional information.*

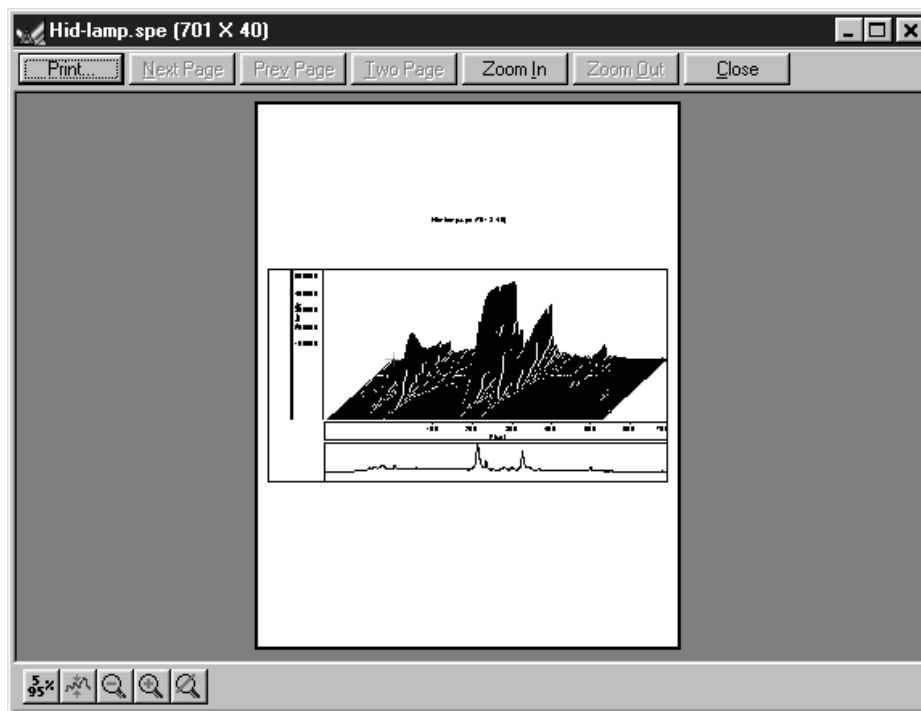
Control Buttons:

OK: Initiates the print and closes the dialog box.

Cancel: Closes the dialog box without initiating the print.

Print Preview screen

Figure 353.
Print PreView
screen.



The Print Preview function gives you a quick idea of how the printed image will look. It produces an “on-screen print” that looks as closely as possible like a “real” print, allowing changes in the printer setup to be made quickly and conveniently. Figure 353 illustrates the Print Preview screen. *See Chapter 18 for additional information.* The function of the individual buttons is as follows.

Print...: Opens the Print screen so that a print can be initiated.

Next Page: If the file contains multiple frames, each one will occupy a different page. The Next Page button allows you to step forward sequentially through all available pages. If the file contains only one image, the Next Page button will be grayed out.

Prev Page: Allows you to step backwards sequentially through the pages of a multiple image file.

Two Page: Causes two pages to be displayed at a time in a side-by-side layout.

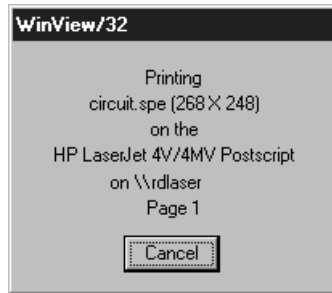
Zoom In: Allows you to zoom in on the previewed page, allowing a selected area to be examined in detail. There are two zoom levels. Note that, if not at full zoom, the cursor becomes a “magnifying glass” if positioned on the image area.

Zoom Out: Allows you to return to the normal (unzoomed) preview display.

Close: Closes the Preview window and returns you to the normal WinSpec /32 display.

Print Progress box

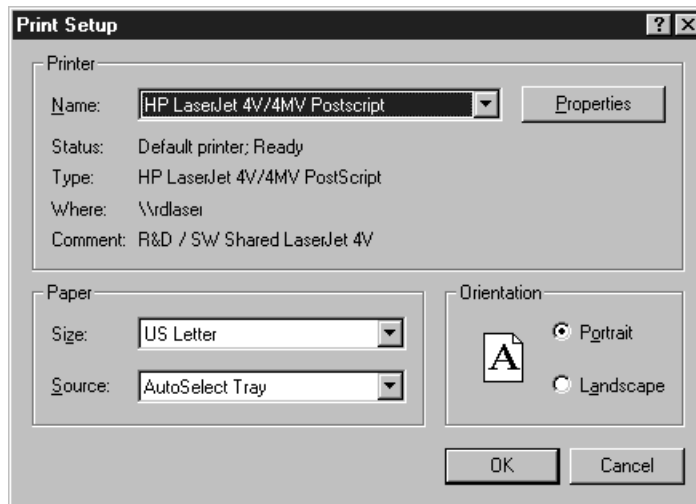
Figure 354.
Print Progress
box.



The Printing progress box is shown during the time that WinSpec/32 is sending output to the printer. The page number indicates the progress of the printing. To abort printing, choose Cancel. *See Chapter 18 for additional information.*

Print Setup dialog box

Figure 355.
Print Setup
dialog box.



Selecting Print Setup on the File menu opens the Print Setup dialog box such as that in Figure 355. This box allows you to select the printer and make basic operating selections for it, such as paper size and source, and orientation (portrait vs. landscape). Properties allows you to access the full range of user-controllable printer functions. Note that the selections provided under properties are derived from the printer driver and will be unique for the particular printer selected. *See Chapter 18 for additional information.*

Control Buttons:

OK: When all selections have been made, clicking on the **OK** button will store the selections and close the dialog box.

Cancel: The **Cancel** button will simply close the dialog box and restore the original configuration.

Process menu

Figure 356.
Process menu.



Allows selection of processes that can be applied to a data set. Processes available in early releases of the software include:

Spectra Math: Allows a variety of mathematical operations to be performed on data files. *See Chapter 13, Spectra Math, for additional information.*

Image Orientation: This command opens the Image Orientation dialog box which allows a data set to be reoriented, displayed and saved using a user specified location and name. *See discussion on page 360 for additional information.*

Glue: Allows you to glue any series of existing data files, providing that they all have been properly calibrated in nm. The files should overlap some in order to provide complete spectral data, but this is not required by the software. Any collection of calibrated single spectrum files can be used to create a glued file. There are two ways to glue together multiple exposures into a single contiguous spectra. The first is to take existing spectra that have already been calibrated and have the WinSpec/32 software connect the spectra at the appropriate points.

The second method requires spectrometer control. With correctly calibrated spectrometer control, the WinSpec software can collect spectra and move the spectrometer, automating the process of collecting a spectrum whose wavelength range can extend the full spectral range of the detector. *See Chapter 15, Gluing Spectra, for additional information.*

Edge Enhancement: Opens the Edge Enhancement window, which contain the tab pages that control the Edge Enhancement function. *See Chapter 16 for additional information.*

Sharpening: Opens the Sharpening window, which contains the tab pages that control the Sharpening function. *See Chapter 16 for additional information.*

Smoothing: Opens the Smoothing window, which contains the tab pages that control the Smoothing function. *See Chapter 16 for additional information.*

Morphological: Opens the Morphological window, which contains the tab pages that control the Morphological Erode and Dilation functions. *See Chapter 16 for additional information.*

Absorbance: The Absorbance function can be used determine the amount of light transmitted or absorbed by a specimen. This function operates by dividing a transmission image by a reference image leaving only the light transmitted or absorbed by the specimen in the resulting image. *Note that the Absorbance function may not be implemented in early releases of the software.*

Dual Beam Absorbance: The Dual Beam Absorbance function takes two spectra, contained in one file, divides the specified transmission spectrum by the reference spectrum, and places the resulting spectrum in an output file. *Note that the Dual Beam Absorbance function may not be implemented in early releases of the software.*

Custom Filter: Opens the Custom Filter window, which allows image data to be processed by a user-defined filter. *See Chapter 16 for additional information.*

Look Up Table: Opens the Look Up Table window, which allows the selected data values to be mapped to different output values using a look-up table (LUT). *See Chapter 16 for additional information.*

Clipping/Threshold: Opens the Clipping/Threshold window, which contains the tab pages that control the Threshold and Clipping functions. *See Chapter 17 for additional information.*

Cross Section: Allows selection of either **Sum** or **Average** and X, Y or Z Cross Sections. *See Chapter 17 for additional information.*

Binning and Skipping: The Binning and Skipping Parameters tab page allows the bin size to be set independently in the X and Y directions. It also allows the value of the Skipping parameter to be set. This parameter sets the interval between bins. *See Chapter 17 for additional information.*

Savitzky Golay Smoothing: The Savitzky-Golay Smoothing function performs a Savitzky-Golay smoothing on an input image or spectrum and places the resulting image or spectrum in an output file.

Note that the Savitzky-Golay Smoothing function may not be implemented in early releases of the software.

Area Under Curve: The Area Under Curve function computes the sum of the intensities, within a specified subregion, of an input spectrum and displays the result as tabulated text.

There are two different ways of performing the Area Under Curve process. The first, and preferred way, requires a graph window to be displayed with an ROI selected containing the peak of interest. The other method does not require a graph window to be displayed. Instead the graph and peak of interest may be specified solely from within the dialog box.

Note that the Area Under Curve function may not be implemented in early releases of the software.

Peak Find: Opens the Peak Find dialog box, which allows peaks on a spectrum to be located and marked. *See discussion of the Peak Find dialog box on page 395.*

Focus Helper: Opens the Focus Helper dialog box, which allows peaks to be located and analyzed *during live acquisition*. *See page 349 for additional information.*

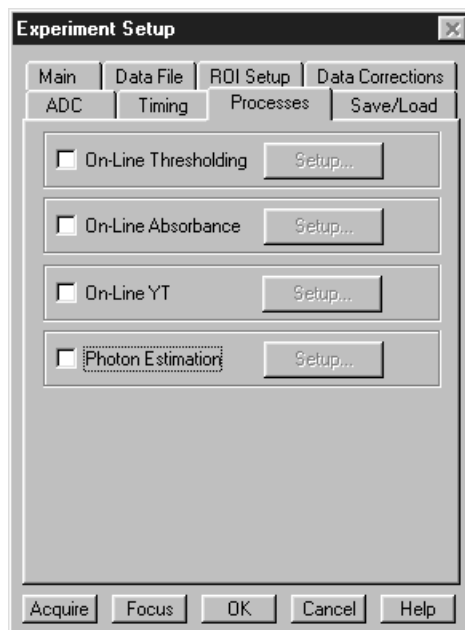
Histogram: Computes and displays a histogram of the spectrum data. Two types of histograms are available for graphing the distribution of intensities of an image. In the first, pixels of a similar intensity are grouped together. In the second or *cumulative* histogram operation, pixels of a similar intensity are grouped together, once again using the X-axis to show intensity. This time, however, the Y-axis indicates the total number of pixels with intensity less than or equal to the range. Thus the Cumulative Histogram is always an increasing function. *See Chapter 17 for additional information.*

Statistics: This command opens the Statistics dialog box which allows basic statistics to be calculated on a data file, or on a specified region of the data, and the resulting report saved to a text file. *See discussion on page 453 for additional information.*

Cancel: Halts process in progress. *Cancel is not active in early releases of the software.*

Processes tab page

Figure 357.
Processes tab
page.

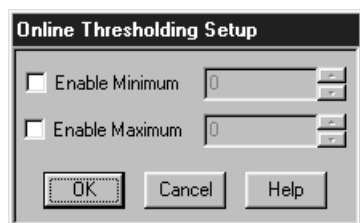


Allows any of several processes to be selected by clicking on the associated **checkbox**. This activates the **Setup** button which is used to open the setup dialog box dedicated to that function. The available processes are described in the following paragraphs.

On-Line Thresholding

Allows a threshold test to be performed on data as it is acquired. The threshold test is performed after background subtraction and flatfield correction but before software accumulation. Data that falls within the threshold range returns a **1**, data that falls below the minimum threshold or above the maximum returns a **0**. In an experiment containing n accumulations, only one data set is stored, but with the data added from each accumulation. Thus, if a given bit contained data within the threshold range on 7 of 10 iterations, the value of the bit in the acquired data set would be **7**.

Figure 358.
On-Line
Thresholding
Setup box.



The Online Thresholding Setup dialog box (Figure 358) allows the minimum and maximum levels can be independently set. Checkboxes allow the minimum and maximum threshold functions to be independently toggled on or off.

Thresholding Parameters

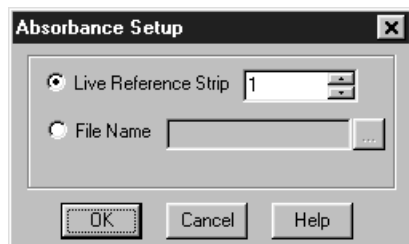
Min: The text entry box allows the minimum threshold level to be set to any positive or negative value in the range of possible intensities (*note that background subtraction can force negative values*), providing the setting is lower than the **Max** setting. The check box allows the minimum threshold function to be switched ON or OFF. If the box contains a check, the function is ON, and any intensity value below the **Min** setting will return a **0**. Intensities higher than the Min setting will return a **1**, unless they also exceed the Max setting, in which case they will return a **0**. If the **Min** box is unchecked, all values below the **Max** threshold setting return a **1**; intensities that exceed **Max** return **0**.

Max: The text entry box allows the maximum threshold level to be set to any positive or negative value in the range of possible intensities (*note that background subtraction can force negative values*), providing the setting is higher than the **Min** setting. The check box allows the maximum threshold function to be switched ON or OFF. If the box contains a check, the function is ON, and any intensity value above the set value will return a **0**. If the box is unchecked, the function is OFF, and all intensities higher than **Min** will return a **1**.

On-Line Absorbance

Absorbance is defined as the $\text{Log}_{10} I_0/I$, where I_0 is the reference spectrum and I is the sample spectrum. Absorbance is also defined as the log of the inverse of the transmission. Thus increasing absorbance means the transmission is decreasing and an absorbance of zero means that $I_0 = I$.

Figure 359.
On-Line
Absorbance
Setup box.



The **Absorbance Setup** dialog box (Figure 359) allows either of two absorbance modes to be selected, depending on the reference used. The reference signal I_0 can be either live (**Live Reference Strip** selected), or taken from a file (**File Name** selected and entered). If live, then the experiment generally will have 2 strips, one reference and one sample (there can be more than 2, up to n , with 1 reference and $n-1$ samples). Any strip in the ROI can be selected. If taken from a file, then the file must have the same dimension as the live data, and in this case, every strip in the file will be the reference for the corresponding strip in the live data. The button at the right of the file name entry box opens a browser to facilitate locating the file.

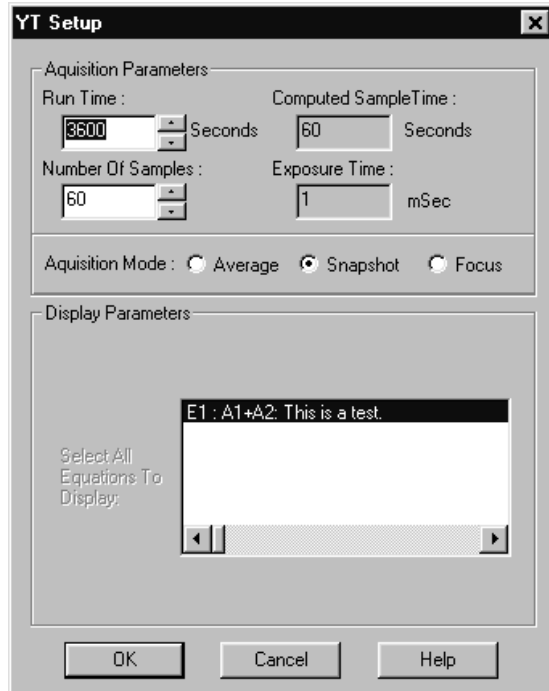
The largest signal for absorbance (live) is when the reference is full scale and the sample is 1 and you are using an 18-bit A/D. With this configuration the largest signal for absorbance (live) is the $\text{Log}_{10}(262,144/1) = 5.42$. The software therefore limits the signal to 5.5. If the sample goes to zero or negative (background subtract), 5.5 is used as the answer.

In the live mode, because I_0 equals I for the reference strip, this strip will always have an absorbance of zero.

On-Line Y:T

Y:T Analysis allows users to easily monitor and study the way *spectral* data changes as a function of time. This is particularly useful in characterizing time-dependent processes. Y:T Analysis provides for defining *areas* on the data, where each area is a region bounded by a starting and ending wavelength and containing a certain number of pixels whose wavelength values lie within the region. When data is taken, Y:T analysis will be performed in accordance with the settings of the **Y:T Setup** dialog box (page 484) and **Y:T Areas and Equations** dialog box (page 480). See Chapter 14 (page 203) for an in-depth discussion of Y:T analysis.

Figure 360.
Y:T Setup
dialog box.

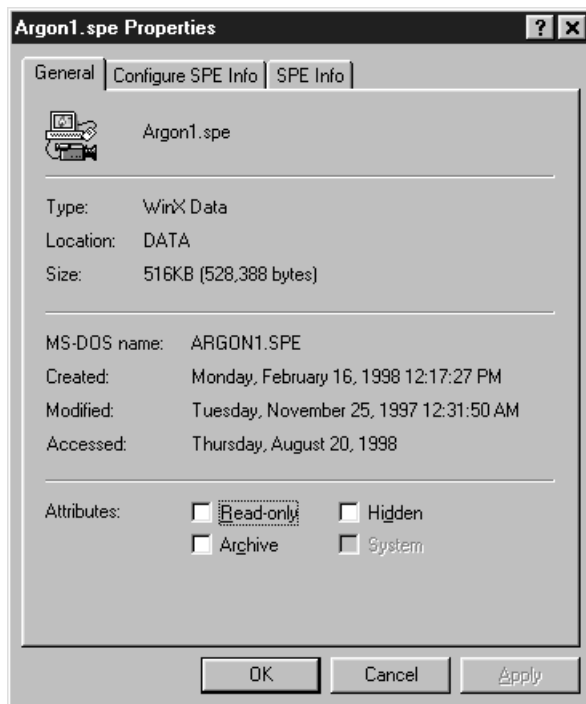


Photon Estimation

Photon Estimation, which may appear as a Processes tab page function, is not functional in early releases of the software.

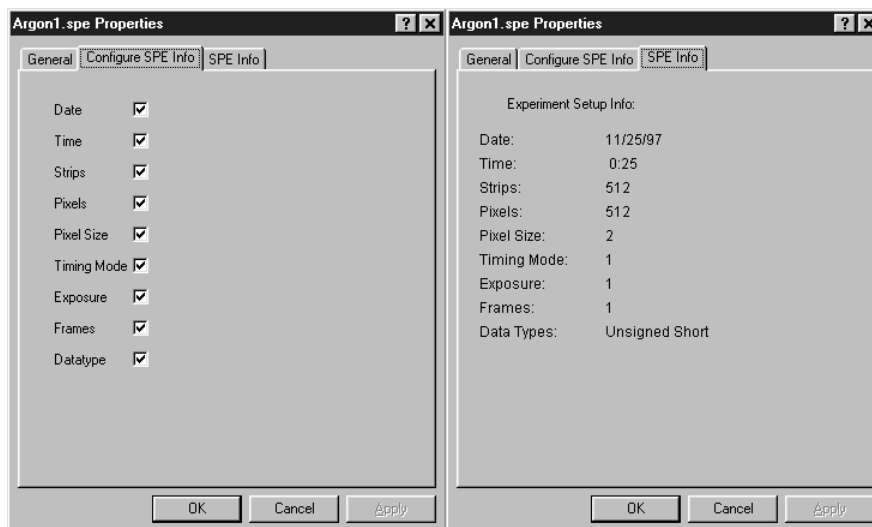
Properties window

Figure 361.
Properties
window.



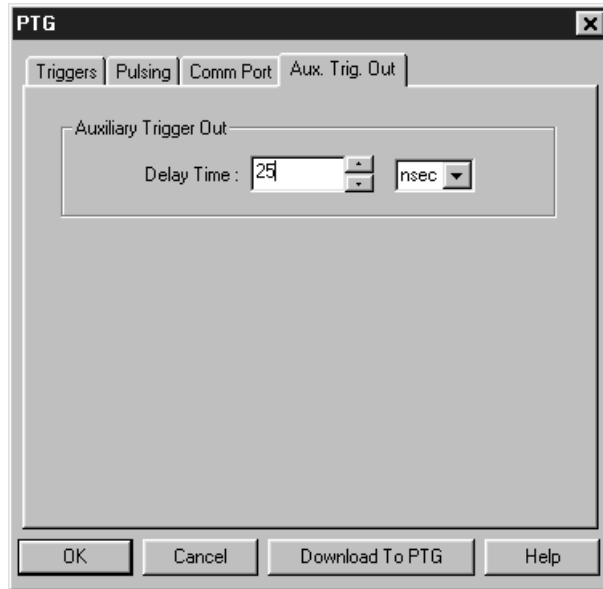
Right clicking on a file name (Open dialog box or Explorer) and selecting Properties will open the Properties window as shown in Figure 361. If **PI Shell Extension** was installed as described in Chapter 1, there will be three file property pages, the standard Windows'95 pages as shown in Figure 361 and the two Extension pages, which provide additional information about the file as shown in Figure 362. If **PI Shell Extension** was not installed, only the standard page is provided.

Figure 362.
Extension
Properties
pages.



PTG Aux Trig Out tab page

Figure 363.
PTG Auxiliary
Trigger Out tab
page.



Sets the delay to the Auxiliary Trigger Output with respect to the PTG trigger time. The minimum delay is 15 ns and the longest is 10 ms. The resolution is 0.04 ns.

Control Buttons:

Download to PTG: Clicking on this button immediately sends all current dialog values to the PTG. Selecting **Download to PTG** also changes the name on the **Cancel** button to **Close**, indicating that canceling is no longer an option.

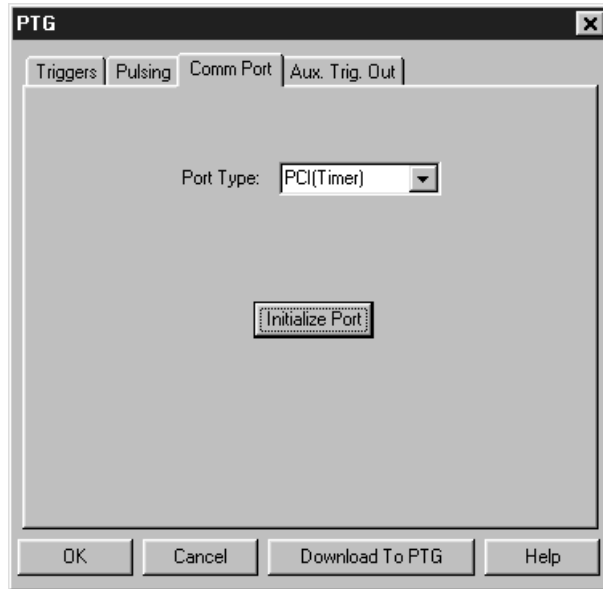
OK: Click on this button to close the dialog. Selecting this button does *not* automatically program the pulser/timing generator. To program the selected values into the timing generator you must click on **Download to PTG**.

Cancel: The **Cancel** button exits the dialog without saving any settings. *The pulser is reprogrammed with the new values when you execute **Download to PTG**.* Selecting **Download to PTG** also changes the name on the **Cancel** button to **Close**, indicating that canceling is no longer an option.

Help: Click on this button to open the online help for this window.

PTG Comm Port tab page

Figure 364.
PTG Comm
Port tab page.



Allows you to set the communications port and parameters for communications between the computer and the pulser/timing generator. Additionally provides for initializing the port. *See Chapter 19 for additional information.*

Parameters

Port Type: Determines which type port will be used. Select **High Speed PCI** or **PCI (Timer)** for communications between the computer and the PCI.

Init: Immediately initializes the selected Comm Port. If the pulser/timing generator is not correctly connected to that Comm port or not turned on, an error message will appear.

Control Buttons:

Download to PTG: Clicking on this button immediately sends all current dialog values to the PTG. *Selecting **Download to PTG** also changes the name on the **Cancel** button to **Close**, indicating that canceling is no longer an option.*

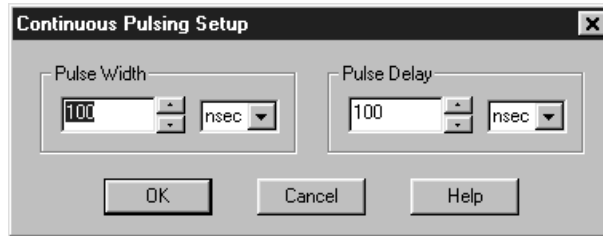
OK: Click on this button to close the dialog. Selecting this button does *not* automatically program the pulser/timing generator. To program the selected values into the timing generator you must click on **Download to PTG**.

Cancel: The **Cancel** button exits the dialog without saving any settings. *The pulser is reprogrammed with the new values when you execute **Download to PTG**. Selecting **Download to PTG** also changes the name on the **Cancel** button to **Close**, indicating that canceling is no longer an option.*

Help: Click on this button to open the online help for this window.

PTG Continuous Pulsing Setup dialog box

Figure 365.
PTG
Continuous
Pulsing setup.



When Continuous pulsing, the Pulse Width and Pulse Delay remain constant at the values specified. They can be entered directly or you can use the spin wheels to achieve the wanted settings. The units are selected from the drop-down boxes to the right of the data-entry windows.

Control Buttons:

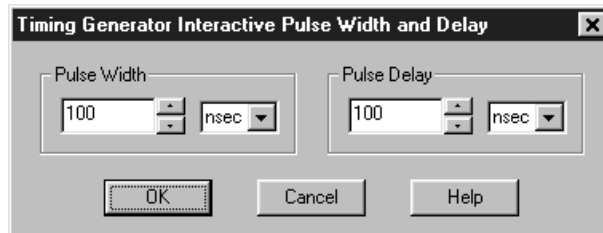
OK: Enters the specified values and closes the dialog box, returning you to the PTG window. Note that the PTG parameters aren't transmitted to the PTG until you click on Download to PTG (PTG window).


Cancel: Closes the dialog box leaving the original settings in effect.

Help: Opens context-sensitive help for the Continuous Pulsing Setup dialog box.

PTG Interactive Pulse Width and Delay dialog box

Figure 366.
PTG Interactive
Pulse Width
and Delay
dialog box.



The Interactive Pulse Width and Delay dialog box, accessed with the  button of the Custom toolbar, allows you to control the Pulse Width and Pulse Delay parameters of a DG-535 or PTG pulser while acquiring data.

Parameters

Pulse Width: The pulse width is the duration of the pulse applied to the PI-MAX intensifier to gate the photocathode. The units available are nanoseconds (nsec), microseconds (μ sec), or milliseconds (msec). Only some values are allowed, so the timing generator will adjust the input value to the nearest allowable value.

Pulse Delay: The pulse delay is the time between the beginning of the trigger pulse (either internal or external) and the beginning of the photocathode gate pulse. The units available are nanoseconds (nsec), microseconds (μ sec), or milliseconds (msec). Only some values are allowed, so the timing generator will adjust the input value to the nearest allowable value.

Control Buttons:

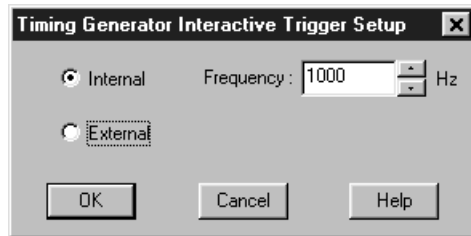
OK: Click on this button to close the Interactive Pulse Width and Delay dialog box. On clicking on **OK**, the new parameter values are sent to the timing generator.


Cancel: The **Cancel** button exits the Interactive Pulse Width and Delay dialog box without saving any settings.

Help: Click on this button to open the online help for this window.

PTG Interactive Trigger Setup dialog box

Figure 367.
Interactive
Trigger Setup
dialog box.



The Interactive Trigger Setup dialog box, accessed by clicking on the  button of the Custom toolbar, allows you to select the Trigger mode (Internal or External) and, if Internal is selected, to set the Frequency, all while acquiring data.

Parameters

Trigger Frequency: The trigger frequency is used with internal triggering.

Trigger Mode radio buttons: The trigger mode determines whether the timing generator will create its own trigger signals (**Internal** selected), or will itself be triggered by trigger signals that originate in an external piece of equipment (**External** selected).

Control Buttons:

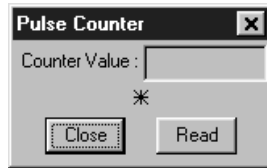
OK: Click on this button to close the Interactive Trigger Setup dialog box. On clicking on **OK**, the new parameter values are sent to the PTG.

Cancel: The **Cancel** button exits the Trigger Setup dialog box without saving any settings.

Help: Click on this button to open the online help for this window.

PTG Pulse Counter

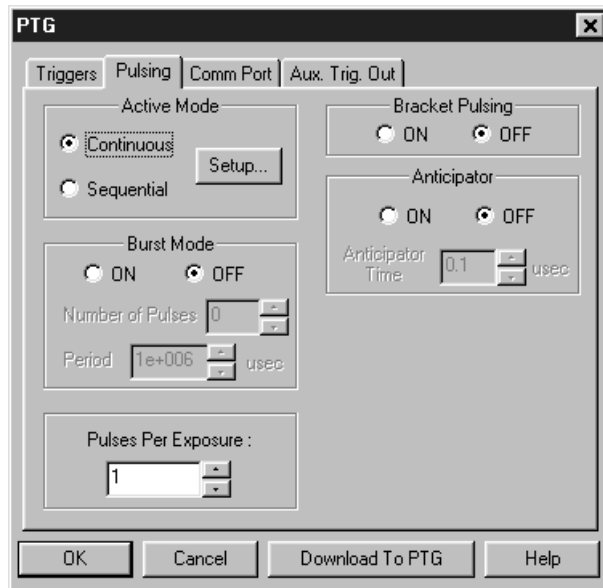
Figure 368.
PTG Pulse
Counter dialog
box.



The Pulse Counter dialog box, which is opened by clicking on **Pulse Counter** on the **Acquisition** menu, reports the number of gate commands sent to the PI-MAX by the PTG. A new reading is taken each time the **Read** button is clicked. Both main and burst gate commands are counted. The **Close** button closes the box.

PTG Pulsing tab page

Figure 369.
PTG Pulsing
tab page.



Selects the Continuous or Sequential Pulsing mode and allows access to the setup screens for Continuous or Sequential Pulsing. Allows bracket pulsing of the PI-MAX MCP to be switched ON or OFF. Additionally enables the Anticipator and Burst functions. *See Chapter 19 for additional information on controlling a pulser/timing generator.*

Parameters

Continuous: Opens the Continuous Pulsing dialog box. *See discussion on page 297 for detailed information.*

Sequential: Opens the Sequential Pulsing dialog box. *See discussion on page 328 for detailed information.*

Bracket Pulsing On/Off radio buttons: Selecting ON activates the MCP bracket gating of the PI-MAX detector. This technique enhances the PI-MAX intensifier's on/off ratio in UV measurements. The width and delay are adjusted automatically to always bracket the photocathode gate pulse. Keep in mind that the on/off switching of the MCP bracket pulsing is slow, taking about 500 ns to turn on and 200 ns to turn off. Selecting OFF switches off bracket pulsing of the PI-MAX detector. Photocathode gating continues to be provided.

Anticipator On/Off radio buttons: The Anticipator allows Bracket Pulsing with repetitive external trigger sources. What it does is measure the period of the trigger and then time the bracket-on pulse to lead the photocathode gate pulse by the set interval. For proper operation, the bracket-on pulse must begin at least 500 ns before the gate pulse.

The minimum Anticipator Time is 500 ns (or the minimum PI-MAX bracket lead time from EEPROM) *minus* the minimum Pulse Delay time. For example, with a minimum Pulse Delay time of 200 ns, the software would automatically set the Anticipator time to 300 ns.

Burst On/Off radio buttons: For Burst operation, in which each trigger initiates a burst of gate pulses, select Burst Mode **On** and set the number of pulses in the burst and their period.

Note: Bracket Pulsing the burst brackets an entire burst but not the individual pulses within a burst.

Control Buttons:

Download to PTG: Clicking on this button immediately sends all current dialog values to the PTG. *Selecting **Download to PTG** also changes the name on the **Cancel** button to **Close**, indicating that canceling is no longer an option.*

OK: Click on this button to close the dialog. Selecting this button does *not* automatically program the pulser/timing generator. To program the selected values into the timing generator you must click on **Download to PTG**.

Cancel: The **Cancel** button exits the dialog without saving any settings. *The pulser is reprogrammed with the new values when you execute **Download to PTG**. Selecting **Download to PTG** also changes the name on the **Cancel** button to **Close**, indicating that canceling is no longer an option.*

Help: Click on this button to open the online help for this window.

PTG Pulse Sequence Setup dialog box

Figure 370.
PTG Pulse
Sequence Setup
tab page.

In Pulse Sequential operation, the Pulse Width and Pulse Delay change over the course of the measurement. This sweep can be accomplished linearly (**Fixed** Increment type) or exponentially (**Exponential** Increment type). Linear sequential operation is well suited to locating and recovering a transient effect that always occurs at the same time with respect to T_0 . Exponential sequential operation is used to study decay processes, where the effect changes rapidly at the start of the measurement, and then changes slower and slower as the measurement progresses. The sweep is controlled so as to take many exposures in the region where the effect is changing rapidly, and fewer and fewer as the measurement progresses and the data changes more and more slowly. The resulting data points can be spline-fitted to generate the complete curve so that the decay constant can be calculated, even where the data derives from two decay processes occurring simultaneously.

Parameters

Number of Images: With a Software Accumulations setting of one, Number of Images equals the number of exposures, each of which is followed by a readout. After each exposure, the Pulse Width and Pulse Delay change as programmed before the next exposure occurs. If multiple Accumulations are programmed, each exposure is repeated n times, where n is the number of software accumulations specified. Every accumulation is processed before the pulse delay and width change for the next shot. The total number of exposures equals the specified Number of Spectra times the number of Accumulations.

ATTENTION

Accumulations can be set on the PTG Pulse Sequence Setup dialog box and on the Experiment Setup Main tab page. The two settings must be the same for proper operation.

Pulse Width: The starting and ending pulse widths are independently set. The first Shot will have the **Starting** pulse width and the last Shot will have the **Ending** pulse width. This is true for both the Fixed and Exponential increment type.

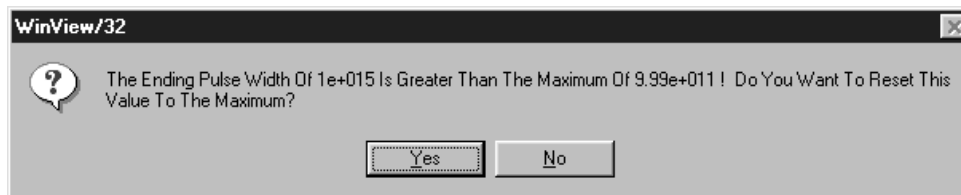
Pulse Delay: The starting and ending pulse delay values are independently set. The first Shot will be taken at the **Starting** delay with respect to T_0 and the last Shot will occur at the **Ending** delay with respect to T_0 . This is true for both the Fixed and Exponential increment type.

ATTENTION

The precise timing of both the gate and signal at the camera will additionally depend on a number of different delay mechanisms that can significantly affect the experiment. These are discussed for the PI-MAX camera in some detail in *Tips and Tricks* chapter of the PI-MAX instruction manual.

Check Pulse Width and Delay Min/Max (Message Displayed): If this box is checked and you specify a pulse width or delay outside the allowable range, a warning message will be displayed as shown below. Clicking **Yes** will cause the parameter in question to be set to the limit value. Clicking **No** will cause the parameter *setting* to be retained, but the *actual* value will still be the applicable minimum or maximum. If the box isn't checked, the applicable minimum or maximum will be established automatically.

Figure 371.
Range Limits
Exceeded
warning.



Fixed Increment Type: With this selection, the increment or change in Pulse Width and Pulse Delay is the same from shot to shot. The actual increments depend on the specified starting and ending values and on the Number of Images specified. The increment values are calculated and reported in the associated text boxes.

Exponential Increment Type: With this selection, the increment or change in Pulse Width and Pulse Delay changes from shot to shot. The precise delay and width of each shot with respect to T_0 is determined by the values entered for the Fast Decay and Slow Decay **Time Constant** and **Amplitude** parameters. In fluorescent decay experiments, for example, there will typically be two species contributing to the output data, one of which decays much faster than the other. For example, there might be a fast fluorophor with a decay time of at most a few nanoseconds, and a slower one with a decay time of perhaps a hundred nanoseconds. By sweeping both the delay *and* the width, and making provision for entering time constant and amplitude information for two species, the sequential exponential algorithm is ideally suited to making this type of measurement. At the start of the decay where the amplitude is high but the decay is rapid, the gate pulses are narrow and close together. Towards the end of the decay where the decay is slow, the gate pulses are

further apart but much wider to accommodate the lower signal amplitude. The result is output data that is relatively constant in intensity over the decay time. This data can be easily normalized by dividing each point by the exposure time and then using a spline fit to recover the curve. The logarithm (base e) can then be taken to obtain a straight line (or two lines successive line segments, each with a different slope for two species). Tangents can be fitted to each segment to determine the rate constant for each species.

Fast Decay

Time Constant: In a two species system, enter the *decay time* of the faster of the two species. Note that it is not *essential* that you enter a value. If you have the decay time information, you will get better data if the information is entered, but acceptable results can be obtained in many situations by using the default. If there is only one species, or if you wish to discard the fast decay process, simply enter zero for the *Amplitude*.

Note that the Pulse Width and Pulse Delay values need to be selected with some care in fluorescence decay experiments. Typically the starting pulse width will be very narrow, perhaps 2 ns, and the final pulse amplitude should be wider by about the ratio of the anticipated signal amplitude decrease over the course of the measurement timebase. Similarly, the starting pulse delay has to take the various insertion delays into account, and the final delay value might typically be set to a value on the order of five times the anticipated decay time of the process.

Amplitude: This is the *relative* amplitude of the fast decay with respect to the slow one. For example, if you know that the amplitude of the fast decay signal is typically five times the amplitude of the slow decay signal, you could enter “5” for the fast decay amplitude and “1” for the slow decay amplitude. Keep in mind that it is the *ratio* that is being expressed. For example, there is no difference between entering fast and slow amplitude values of “5” and “1” and entering fast and slow amplitude values of “50” and “10.” Note that the default values will give satisfactory results in many measurements.

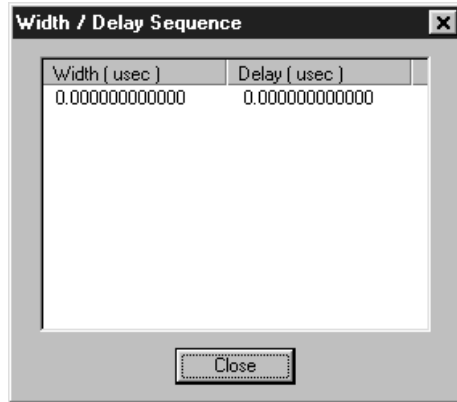
Slow Decay

Time Constant: In a two species system, enter the *decay time* of the slower of the two species. Note that it is not *essential* that you enter a value. If you have the decay time information, you will get better data if the information is entered, but acceptable results can be obtained in many situations by using the default. If there is only one species, or if you wish to discard the fast decay process, simply enter zero for the *fast decay Amplitude*.

Amplitude: This is the *relative* amplitude of the slow decay with respect to the fast one. For example, if you know that the amplitude of the slow decay signal is typically one fifth the amplitude of the fast decay signal, you could enter “1” for the slow decay amplitude and “5” for the fast decay amplitude. Keep in mind that it is the *ratio* that is being expressed. For example, there is no difference between entering slow and fast amplitude values of “1” and “5” and entering fast and slow amplitude values of “10” and “50.”

View Width/Delay Sequence: Opens a window (shown below) that lists the currently programmed sequence of pulse width and pulse delay values.

Figure 372.
Pulse
width/delay
sequence list
box.



Save Sequence Values to File: When this box is checked, the sequence values will be saved *on completion of the run*. The values saved are those actually used to take the data. The file could be recalled later and used for data normalization or other purposes.

Setup File: Opens the Sequence Values File dialog box (Figure 373), which enables the following:

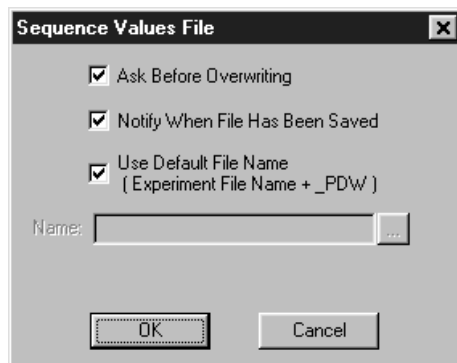
Ask Before Overwriting: If checked, user will be queried before a new sequence value file overwrites an existing one. If unchecked, overwriting can occur without warning.

Notify When File Has Been Saved: The file is saved at the end of the data-acquisition run. User will be notified that this has occurred if this box is checked.

Use Default File Name: If checked, sequence value file name will be experiment file name, but with the extension **PDW**. If unchecked, user must enter the name in the **Name** text box.

Name: If not using the default name for the sequence value file, enter the file name in the provided text box. The button at the end of the box opens a browser to facilitate assigning the file location.

Figure 373.
Sequence
Values File
dialog box.



Software Accumulations: Sets the number of exposures to be taken for each Shot. Note that the number of Accumulations set here must be the same as the value set on the Experiment Setup Main tab page for proper operation.

Control Buttons:

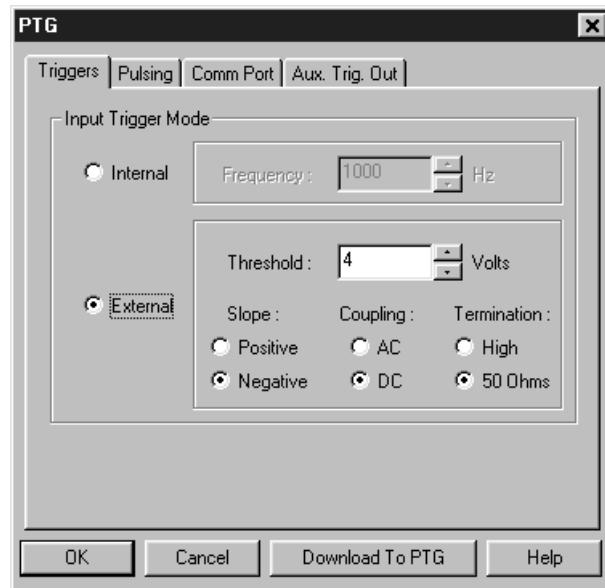
OK: Saves the specified parameter values and closes the dialog box, returning you to the PTG window.

Cancel: Closes the dialog box without saving any of the specified values.

Help: Accesses context-sensitive help for this window.

PTG Triggers tab page

Figure 374.
Triggers tab
page (PTG).



The PTG Triggers tab page allows selection of the Input Trigger mode, Input or External. It additionally allows the Frequency (Internal Trigger mode) and Trigger Selection parameters (External Trigger mode) to be set. *See Chapter 19 for additional information on pulser/timing generator operation.*

Parameters

Trigger Frequency: The trigger frequency is used with internal triggering.

Trigger Mode radio buttons: The trigger mode determines whether the PTG will create its own trigger signals (**Internal**), or will itself be triggered by trigger signals that originate in an external piece of equipment (**External**).

Threshold: In the External trigger mode, **Threshold** sets the required height the applied trigger must be to trigger the PTG.

Coupling: Allows you to select whether the trigger will be ac or dc coupled.

Slope: In the External trigger mode, the **Slope** radio buttons allow you to choose whether the PTG will be triggered on the positive-going or negative-going edge of the applied trigger.

Termination: In the External trigger mode, the Termination radio buttons allow you to choose whether the trigger applied to the PTG will see a termination impedance of **50 Ω** or **High**.

Control Buttons:

Download to PTG: Clicking on this button immediately sends all current dialog values to the PTG. Selecting **Download to PTG** also changes the name on the **Cancel** button to **Close**, indicating that canceling is no longer an option.

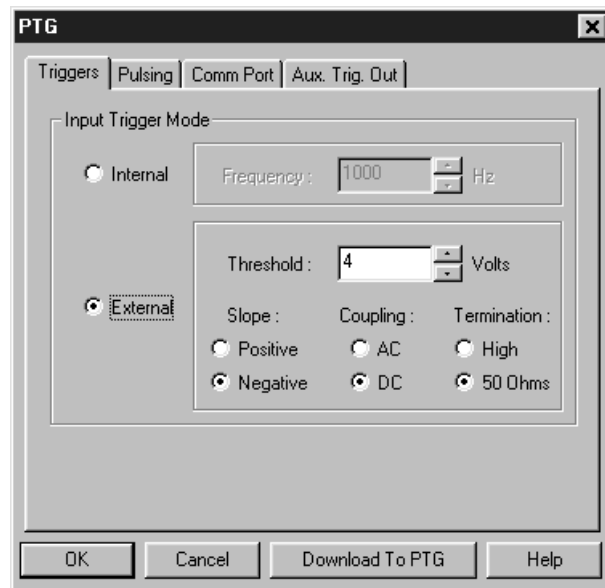
OK: Click on this button to close the dialog. Selecting this button does *not* automatically program the pulser/timing generator. To program the selected values into the timing generator you must click on **Download to PTG**.

Cancel: The **Cancel** button exits the dialog without saving any settings. *The pulser is reprogrammed with the new values when you execute **Download to PTG**.* Selecting **Download to PTG** also changes the name on the **Cancel** button to **Close**, indicating that canceling is no longer an option.

Help: Click on this button to open the online help for this window.

PTG window

Figure 375.
PTG window.



Operation of the PTG Pulser becomes available when you select **Pulsers** from the Setup menu, followed by clicking on the **PTG** radio button and then click on the **Setup PTG** button. This opens the PTG window as shown above. Note that pulser support must be selected when installing the WinSpec/32 software for PTG control to be available.

The PTG window contains three tab pages and the four buttons that are always present independent of the selected tab page.

Control Buttons:

Download to PTG: Clicking on this button immediately sends all current dialog values to the PTG. Selecting **Download to PTG** also changes the name on the **Cancel** button to **Close**, indicating that canceling is no longer an option.

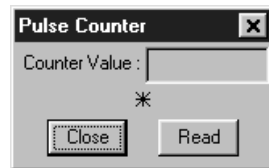
OK: Click on this button to close the dialog. Selecting this button does *not* automatically program the pulser/timing generator. To program the selected values into the timing generator you must click on **Download to PTG**.

Cancel: The **Cancel** button exits the dialog without saving any settings. *The pulser is reprogrammed with the new values when you execute **Download to PTG**.* Selecting **Download to PTG** also changes the name on the **Cancel** button to **Close**, indicating that canceling is no longer an option.

Help: Click on this button to open the online help for this window.

Pulse Counter

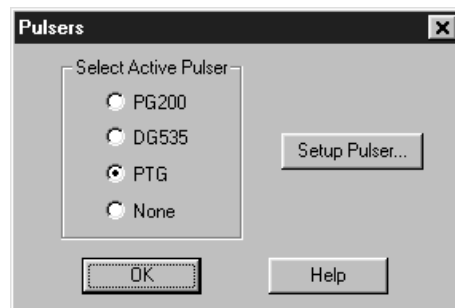
Figure 376.
Pulse Counter
dialog box.



The Pulse Counter dialog box, which is opened by clicking on **Pulse Counter** on the **Acquisition** menu, reports the number of gate commands the PTG sends to the PI-MAX. The reading is updated each time the **Read** button is clicked. Both main and burst gate commands are counted. The **Close** button closes the box.

Pulsers dialog box

Figure 377.
Pulsers dialog
box.



The Pulsers dialog box, which opens when **Pulsers** is selected on the **Setup** menu, allows the user to choose whether the software is configured to run a PG-200 Pulser, a DG-535 Timing Delay Generator, a PTG Timing Generator plug-in module or no pulser. To the right of the pulser-selection radio buttons is the **Setup** button that gives access to the pulser setup screens.

Control Buttons:

OK: Executes the selection and closes the dialog box.

Help: Access context-sensitive help for the Pulsers dialog box.

Pulsing tab page

See:

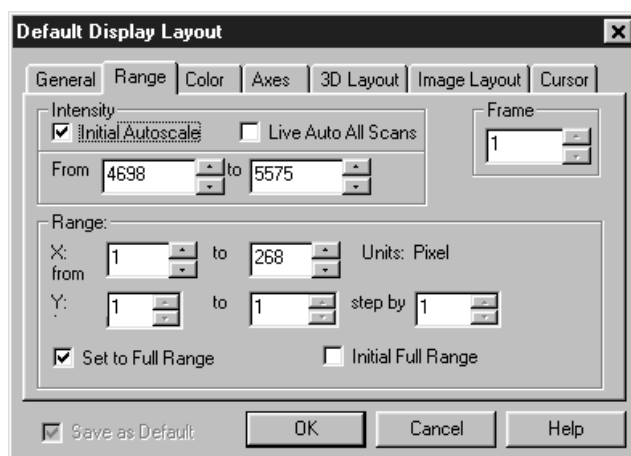
DG-535 Pulsing tab page: pg. 326

PG-200 Pulsing tab page: pg. 398

PTG Pulsing tab page: pg. 424

Range Display Layout tab page

Figure 378.
Range display
layout tab
page.

**Introduction**

Allows you to turn **Initial Autoscale** On or Off. When On, on opening a file but before displaying the data, the intensity range is automatically adjusted to a value that allows the full intensity range of the data to be displayed. Additionally, this page allows you to manually set the intensity mapping for the displayed data. There is also provision for selecting **Live Auto All Scans**, in which every scan is auto-scaled. This can be particularly advantageous when focusing or making other system adjustments with live data.

If a file contains multiple frames, you can select the frame that will be displayed. You can also select the X and Y pixel range of the data to be *displayed*. Note that is not the same as ROI, which sets the pixel range of the data that will be *captured*. These and other features are discussed in the following paragraphs.

Parameters

Intensity: If displaying the data as an image, allows you to set the range of data that will be mapped to the display. Displays generally are capable of displaying 256 (8 bits) gray levels. Depending on the makeup of your particular system and the experiment, there could be a far larger number of intensities, perhaps thousands, represented in the data. As a result, actual intensity levels are mapped to the display so that each display intensity level represents a rather wide range of actual intensity levels. If you set the number of intensity levels to be mapped to the display, all pixels of higher intensity will be displayed as white and those of lower intensity as black. The effect is to increase the contrast over the specified intensity range.

If displaying the data as a graph with **Initial Autoscale ON**, the intensity axis is automatically set to a range that allows the full range of intensities to be shown on opening a new file. You can also set the intensity range manually. As explained below, this can be particularly advantageous when comparing spectra.

Initial Autoscale: This checkbox allows Initial Autoscaling to be turned on and off. The ability to set the intensity range and to be able to turn initial auto-scaling On and Off can be very helpful in comparing two spectra because it allows you to set the same intensity scaling for both. For example, suppose you had two spectra, **A** and **B** that were to be displayed so that they could be compared. Before loading spectrum **A**, you could go to the Display Layout Range page and select **Initial Autoscale**. When spectrum **A** is loaded, an initial autoscale would occur and the spectrum would be displayed. Suppose this were done and a cursory examination showed the highest peak to be ~6000. If you knew from experience that the highest intensity in spectrum **B** wouldn't exceed 10,000, you might decide to fix the display range at 0 to 10,000. You would do this by entering "0" in the **From** box and 10000 in the **To** box. You would then deselect **Initial Autoscale** and check **Save as Default**. *Checking Save as Default after deselecting Initial Autoscale will "fix" the Intensity Range and prevent Initial Autoscale from being switched back on automatically when you close the Range box.*

CAUTION

If you turn Initial Autoscale Off and then Save as Default, when you next open a file, the usual initial autoscale will not occur. If the intensity range of the data in the file is dramatically different from the Intensity Range settings in effect, the display will appear abnormal. You might not even be able to see the data at all and conclude that the software is malfunctioning, when in fact this is not the case.

The next step would be to close the Display Layout window and load spectrum **B**. Because the intensity range had been fixed at 0 to 10000 for spectrum **A**, spectrum **B** would be displayed with that same range, allowing the two displayed spectra to be easily compared. To enhance the comparison further, you could select **Tile Vertical** on the **Window** menu to display **A** and **B** side-by-side.

Live Auto All Scans: This special feature allows live data to be displayed so that each and every scan is separately auto-scaled. It is particularly useful when focusing or making other adjustments in that the data is always

displayed “on screen.” To see why this is useful, consider the case where you are attempting to do spectrograph adjustments. Suppose that initially little more than dark noise is displayed. With this low signal level, the auto-scale algorithm sets the gain to a high value to display the data. As the adjustment proceeds, the point might be reached where the data includes a peak that is thousands of counts in amplitude. With **Live Auto All Scan** selected, the intensity scaling would immediately lower the gain so as to display the peak “on screen” allowing the adjustment to be easily made.

Frame: If the data file contains data from multiple exposures (frames), the Frame parameter allows you to specify which of these will be displayed.

Set to Full Range: If checked, data from the full read-out region of the chip will be displayed. If unchecked, you can choose to display a subset of this region by specifying the appropriate X and Y coordinates.

Initial Full Range: When checked, causes all subsequently opened files to be displayed at their full x and y range (if the Save as Default box is also checked); it has no effect on a file that is presently opened (use the **Set to Full Range** selection to affect the active window).

Step by: When displaying a range of data strips graphically in **3D Graphics**, the appearance and utility of the display can frequently be enhanced by displaying not every strip but rather every *n*th strip as specified via the Step parameter.

Save as Default check box: Saves settings on all pages. These settings will be automatically established when software is started. They will be used when opening subsequent files or doing data acquisition.

Control Buttons:

OK: Executes the layout settings and closes the Display Layout window.

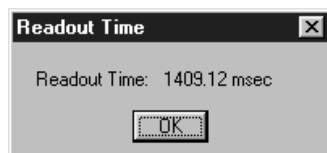
Cancel: Closes the Display Layout window without implementing any of the changes.

Help: Opens context-sensitive help for whichever tab page is on top.

Readout Time box

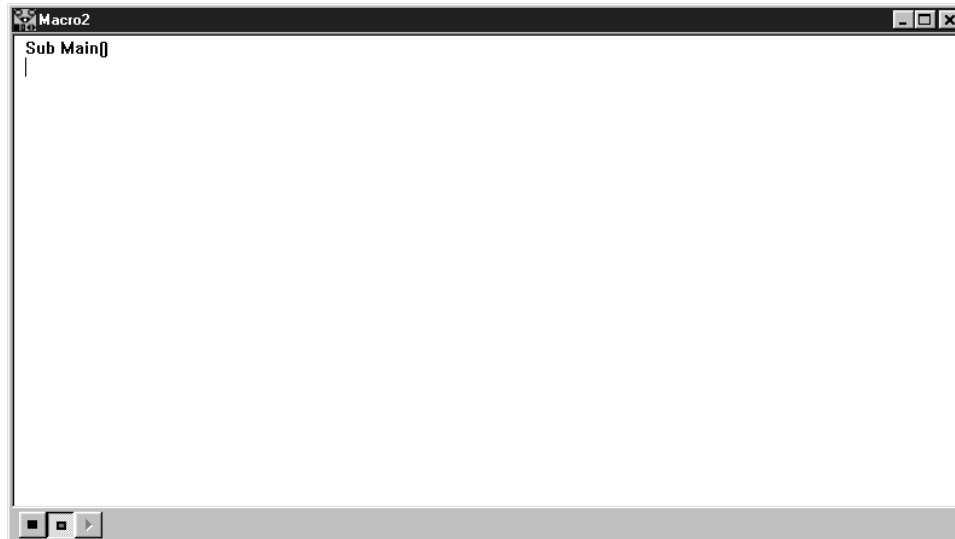
Selecting Readout Time on the Acquisition menu causes the Readout Time box to be displayed. This box reports the calculated Readout Time. The value reported does not include the Exposure Time.

Figure 379.
Readout Time
box.



Record Macro dialog box

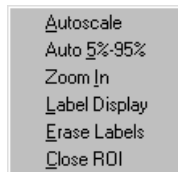
Figure 380.
Record Macro
dialog box.



Allows Visual Basic script macros to be entered and recorded.
Not fully functional prior to software version 2.5.

ROI Context menu

Figure 381.
ROI Context
menu.



If the mouse is right clicked outside the ROI, the normal context menu appears. The ROI context menu contains the usual actions pertaining to the ROI (autoscaling on the region inside the ROI, and zooming in to the ROI region) plus three new actions:

Label Display: which allows user labels to be placed on the display,

Erase Labels: which removes ALL user labels from the display, and

Close ROI: which erases the ROI with no other action (it doesn't move the cursor!).

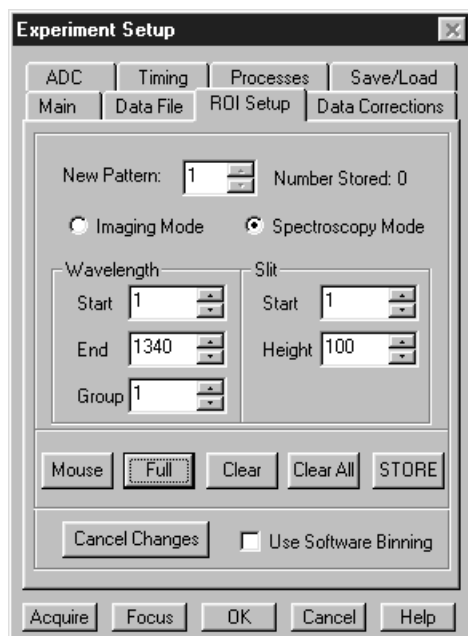
Graph and image labeling are discussed starting on page 165.

ROI Setup tab page

Brief descriptions of the ROI Setup Tab page selections follow. See Chapter 11 for a detailed discussion of how these parameters are used to define one or more rectangular subregions of the CCD for readout.

Note: If you have a PCI card and a Model ST-138 Controller, you must ensure that the number of pixels to be read out is always an even number. A warning will appear if this is not the case. If you are doing binning (Group parameter), the number of pixels digitized (after hardware binning is complete) must be an even number.

Figure 382.
Experiment
Setup Window,
ROI Setup tab
page.



Parameters

Edit/New Pattern: Multiple readout patterns can be defined. The Starting Pixel, Ending Pixel, and Group (binning) parameters are displayed for the pattern selected with Edit Pattern. Incrementing one higher than the number of patterns stored changes the button from Edit Pattern to New Pattern, indicating that the pattern values entered are for a new pattern, that is, one that hasn't been stored. Any number of patterns can be stored with different Start, End and Group (binning) parameter values for each.

Imaging Mode vs. Spectroscopy Mode: These radio buttons will only appear if the Imaging option has been installed. Selecting **Imaging Mode** allows images to be taken. When **Spectroscopy Mode** is selected, automatic vertical binning occurs that would preclude image acquisition.

Number Stored: The defined patterns can be stored for automatic recall. The number of patterns stored are reported.

Mode: If the Imaging option is installed, the Imaging Mode and Spectroscopy Mode radio buttons will appear. To set up an ROI with image data, select Imaging Mode. For Spectroscopy data, select Spectroscopy Mode. If the Imaging mode isn't available, these buttons will not appear and full Y-axis binning will occur.

X Start and Y Start: Set the starting X and Y pixel for the pattern selected via Edit (New) Pattern. In the X direction, pixels are counted from left to right; in the Y direction, they are counted from the top - down.

X End and Y End: Set the last X and Y pixel for the pattern selected via Edit (New) Pattern. In the X direction, pixels are counted from left to right; in the Y direction, they are counted from the top - down.

Group: Defines pixel binning for the selected pattern. The specified number of pixels in each direction will be combined to form super pixels for greater sensitivity. Rectangular groups of pixels of any size may be binned together, subject to some hardware and software limitations. For all CCD based systems the binning can be accomplished in hardware or, alternatively, in software as a postprocessing option. If Group parameter values are specified, binning will be performed in software if the **Use Software Binning** check box is checked. Otherwise, it is done in hardware.

Note: Hardware binning is not available for all controllers.

With postprocessing binning the original data can remain intact and unchanged. Hardware binning offers advantages in speed and noise performance, but is limited by the well capacity of the chip's readout register, making it best suited for use with weak signals. *Hardware binning with strong signals may be possible if the signal is first attenuated by filters ahead of the camera.*

Hardware binning is performed *before* the signal is read out by the preamplifier. For signal levels that are readout-noise limited, this method improves S/N ratio linearly with the number of pixels grouped together. For signals large enough so that the detector is photon shot-noise limited, and for all fiber-coupled ICCD detectors, the S/N ratio improvement is roughly proportional to the square-root of the number of pixels binned.

Hardware binning also reduces readout time and the burden on computer memory, but at the expense of resolution. Since shift register pixels typically hold only twice as much charge as image pixels, the binning of large sections may result in saturation and "blooming" (spilling of charge back into the image area).

Although it is always better to bin in hardware whenever possible for speed and noise considerations, the ability to change to software binning may actually be more suitable for some experiments. Software binning also provides additional capability for experiment troubleshooting.

Tab Page Buttons

Mouse: If a rectangular region has been defined on an open image by dragging the mouse cursor, clicking the Mouse button will install that region as the ROI.

Full: Clicking the Full button loads the full size of the chip into the edit boxes. The values can then be edited to match your experimental requirements. If a full chip ROI is present along with other ROIs, the full size takes precedence and the other ROIs are not seen.

Clear: Deletes the selected pattern from storage. Has no effect on pattern values that have not been stored.

Clear All: Deletes all patterns from storage. The value for the Number Stored goes to zero and New Pattern 1 is indicated. No values are displayed until entered.

STORE: Causes the displayed pattern values to be stored and the Edit (New) Pattern number to increment by one. If storing will overwrite already stored parameter values, you are queried for confirmation.

Cancel Changes: Restores the pattern values to what they were when the Experiment Setup window was opened.

Control Buttons:

Acquire: Clicking on **Acquire** initiates a data-collection run in which all data frames are stored.

Focus: Clicking on **Focus** initiates a data-collection run in which the data is not stored until Start Storage is selected.

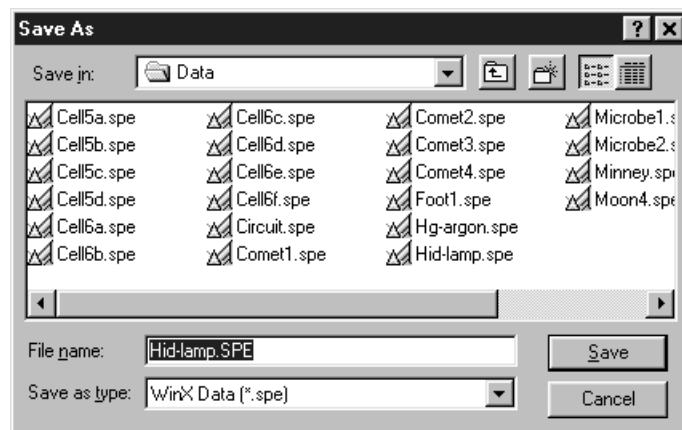
OK: Click on **OK** to save the changes and close the Experiment Setup window without initiating a data collection run.

Cancel: Click on this button to close the Experiment Setup window without making any changes.

Help: Opens context-sensitive help for whichever tab page is on top.

Save As dialog box

Figure 383.
Save As dialog
box.



Selecting Save As on the File menu opens the Save As dialog box (Figure 383). This box allows you to save the active data file under the name you specify and in the selected directory.

Save In: Indicates the accessed folder. The folder contents are listed in the space below the Save In box. Clicking on the button at the right of the Save In box opens a browser, allowing you to easily move to the directory where the file is to be saved.



Button: Moves you higher in the directory.



Button: Creates a new directory.



Button: Short-form listing; file-names and directory folders only.

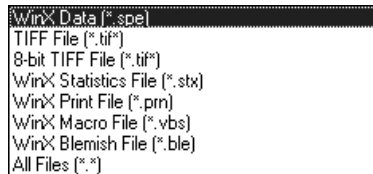


Button: Long-form listing; includes Name, Size, File Type and Date Modified.

File Name: Type a new filename to save a data file with a different name. A filename can contain up to eight characters and an extension of up to three characters. WinSpec/32 adds the extension you specify in the Save File As Type box.

Save as type: Indicates the file type. The data types currently supported are listed in Figure 384. If All Files (*.*) is selected, you will be able to save the file with an extension other than *.SPE or *.TIF. The file, however, will be saved in the *.SPE file type format. *Note that the data only is saved. This could have some unexpected effects. For example, if you save a graph as a tif file, and then open the file with an image editor, you will see the data presented as a single strip image, not as a graph.*

Figure 384.
Save As Data
Types.



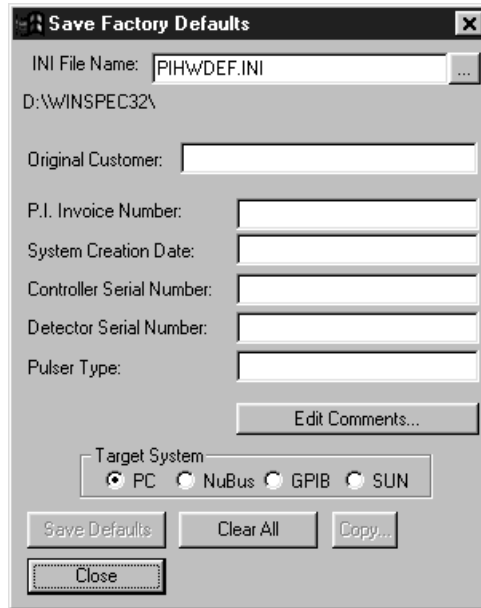
Save: Save the active data file under the specified name.

Cancel: Closes the Save As dialog box without saving the file.

Right Click Shortcut Menus: The Save As dialog box supports the standard Windows 95 right-click shortcut menus. Right clicking anywhere in the box but not on a filename opens a menu that allow you to tailor the box functions and appearance. Right clicking on a filename provides a shortcut menu of file operations.

Save Factory Defaults

Figure 385.
Save Factory
Defaults dialog
box.



The Save Factory Defaults option is used for factory hardware and software development. This option does not ordinarily appear on software distributed to customers.

Save/Load Setup tab page

The Save/Load tab page allows you to save a complete experiment setup or load a previously saved one from disk.

Save: Clicking the Save button allows you to save to disk all of the Experiment Setup parameters as specified on the Experiment Setup tab pages. When the button is clicked, a browser dialog box (Figure 387) opens, allowing the setup file name and target directory to be easily specified. Note that setup files are automatically given the extension EXS.

Load: Clicking on Load allows you to load a previously saved setup file. Because a loaded setup overwrites the existing settings, a warning is provided when the Load button is clicked. Proceeding from that point opens a browse dialog box like that shown in Figure 387.

Figure 386.
Save/Load
Setup tab page.

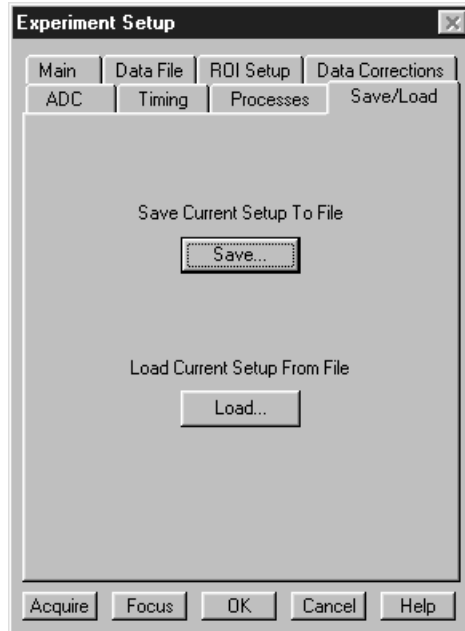
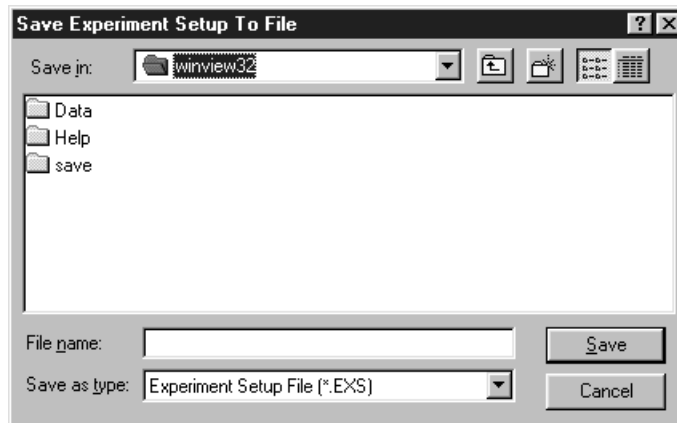


Figure 387.
Save/Load
Setup browser
dialog box.



Control Buttons:

Acquire: Clicking on **Acquire** initiates a data-collection run in which all data frames are stored.

Focus: Clicking on **Focus** initiates a data-collection run in which the data is not stored until Start Storage is selected.

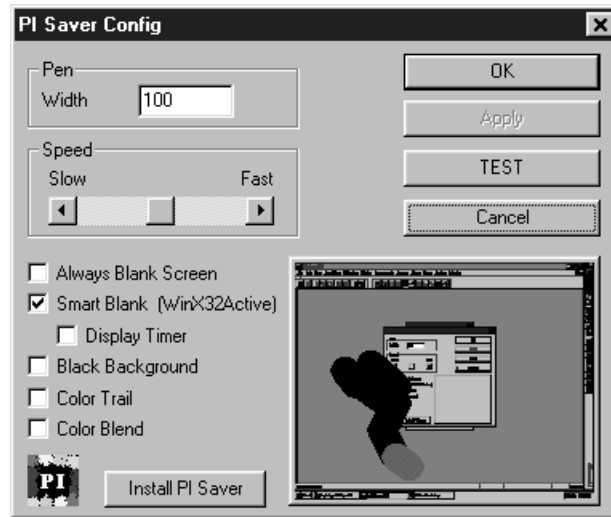
OK: Click on **OK** to save the changes and close the Experiment Setup window without initiating a data collection run.

Cancel: Click on this button to close the Experiment Setup window without making any changes.

Help: Opens context-sensitive help for whichever tab page is on top.

Screen Saver Configuration dialog box

Figure 388.
Screen Saver
Configuration
dialog box.



This dialog box sets the parameters for the PI Screen Saver.

Pen Width: Sets the width of the randomly directional trail that will be traced on the monitor screen. Default setting is 100.

Speed: Sets the speed at which the trail advances.

Always Blank Screen: If checked, screen will be blanked when screen saver activates and remain blanked until keyboard or mouse activity takes place.

Smart Blank: Screen is blanked during data acquisition. When data is not being collected, random trail screen saver function is active.

Display Timer: Causes elapsed time to be displayed on otherwise blanked screen. Note clicking in the time cell of the status bar will initiated a count-down timer display mode.

Black Background: Trail will be plotted on black background. Otherwise original background color is preserved.

Color Trail: Ongoing trail continues to be displayed with the color at any location that which was active when that portion of the trail was plotted.

Color Blend: Portion of trial being currently plotted is in color, with the color blending into black as the trail develops.

OK: Current settings are saved (but not installed) and configuration screen closes.

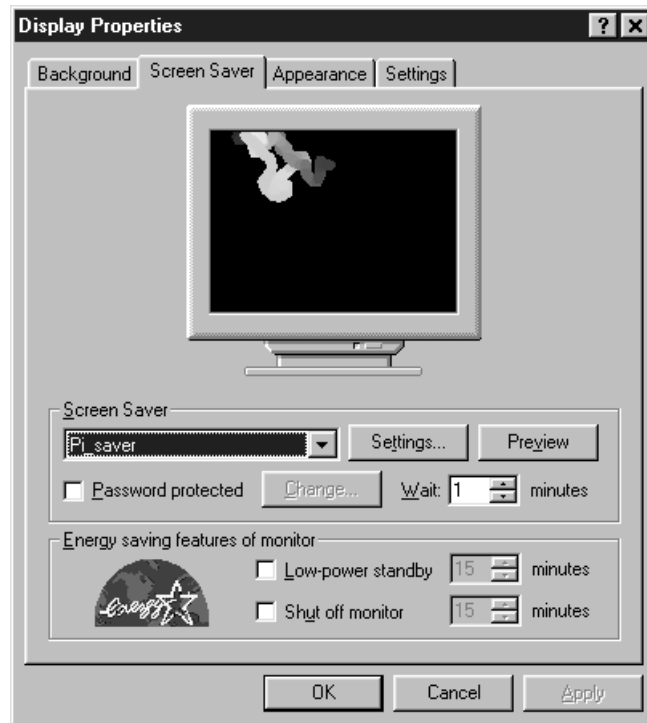
Apply: Current settings are saved (but not installed) and configuration screen remains open.

Test: Screen saver operates on overall screen for a few seconds so that its action can be evaluated.

Clear: Screen closes with original settings intact.

Install PI Saver: Open the Win/95 Control Panel Display Properties Screen Saver tab page, shown below. This screen allows you to select the screen saver you wish to have active (presumably PI saver for operation with WinSpec/32) and to set the timer that controls the wait before the screen saver activates. When satisfied with the settings, press **OK**.

Figure 389.
Display
Properties
screen-saver
page.



Sequential Pulsing Setup

See:

DG-535: pg. 328

PG-200: pg. 400

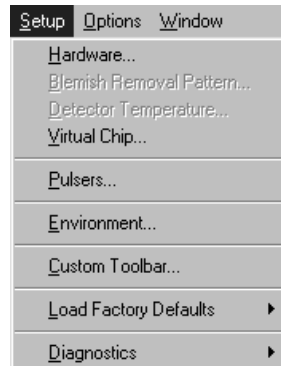
PTG: pg. 426

Setup dialog box (calibration)

See Calibration Setup dialog box discussion on page 286.

Setup menu

Figure 390.
Setup menu.



Hardware: Opens the Hardware Setup window (page 357), which contains the tab pages that tailor the software to the user's particular system components.

Blemish Removal Pattern: *Not fully functional in early releases of the software.*

Detector Temperature...: Opens the Detector Temperature dialog box, used to set the detector temperature if the controller is a MicroMAX, ST-133, or V/ICCD. *See discussion on page 322 for additional information.*

Virtual Chip...: Opens the Virtual Chip dialog box (page 472), which allows data acquisition in excess of 100 frames per second in appropriately configured systems.

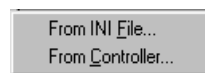
Pulsers...: Opens a secondary menu that allows the specific pulser to be selected. *See Chapter 19 (page 243) for additional information.*

Environment...: This selection opens the Environment dialog box. The Environment dialog box determines the amount of memory that will be placed in the DMA buffer for data acquisition when the computer is next booted. *See discussion on page 343 for additional information.*

Custom Toolbar...: Opens the Customize Toolbar dialog box, used to specify the buttons to be included on the Custom Toolbar. *See discussion on page 311 for additional information.*

Load Factory Defaults...: This selection gives you the choice (Figure 391) of restoring the parameter setting defaults from an *.INI file or of reading them from the controller's non-volatile RAM (NV RAM). *See discussion on page 371 for additional information.*

Figure 391.
Defaults source
selection.



Diagnostics: This command opens the Diagnostics menu, which allows the different diagnostics commands to be selected. *See discussion of Diagnostics menu on page 335 for additional information.*

Setup Wizard

The Hardware Setup Wizard runs the first time you select Setup – Hardware. The Wizard directly leads you through the Controller type, detector chip type and interface selections. It then exits to the Hardware Setup dialog box, where you can make the remaining selections and review those made via the Wizard.

Note: If a PIHWDEF.INI file has been copied to your WinSpec/32 directory, the selections specified in the PIHWDEF.INI will be implemented and the Setup Wizard won't run.

Controller Selection

The first Setup Wizard dialog box (Figure 392) selects the Controller type. The selected Controller type appears in the text box. Clicking on the button at the end of the box causes the list of available controllers to drop down. The new selection is made by simply clicking on the type designation. The buttons are as follows. The Controller type selection is critical because it determines and nature and type of the other selections that will be available, including the detector or camera type, display orientation options, interface type, cleans & skips, and user defined chip parameters. No single controller provides all possible selections, and only the ones applicable to the selected controller are listed on the Hardware Setup dialog box tab pages.

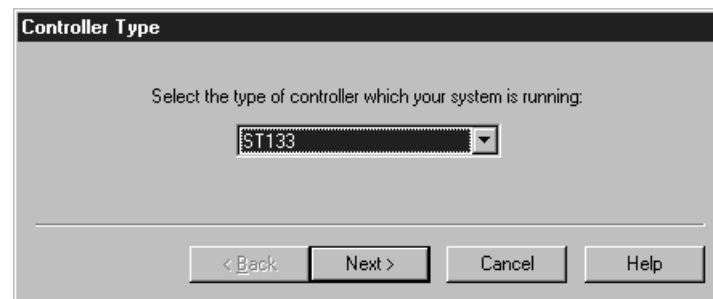
Back: Not active on first wizard screen.

Next: Advance to second wizard screen.

Cancel: Closes the wizard; previous selections remain in effect.

Help: Accesses context-sensitive help.

Figure 392.
Controller Type
Setup Wizard
dialog box.



Detector/Camera/CCD Selection

The second Setup Wizard dialog box (Figure 393) selects the Detector/Camera type. The selected Detector, Camera, or CCD appears in the text box. Clicking on the button at the end of the box causes the list of available selections to drop down. The new selection is made by simply clicking on the type designation. The buttons are as follows.

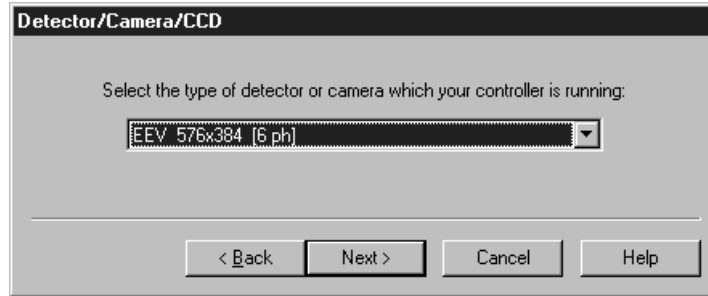
Back: Returns to the first (Controller Type) wizard screen.

Next: Advance to third (Interface) wizard screen.

Cancel: Closes the wizard; previous selections remain in effect.

Help: Accesses context-sensitive help.

Figure 393.
Detector/Camera
selection Setup
Wizard dialog
box.



Interface Selection

The third Setup Wizard dialog box (Figure 394) selects the Interface Card. The selected Interface appears in the text box. Clicking on the button at the end of the box causes the list of available selections to drop down. The new selection is made by simply clicking on the type designation. The buttons are as follows.

Back: Returns you to the previous wizard screen.

Finish: Implements all wizard selections and exits to Hardware Setup dialog box.

Cancel: Closes the wizard; previous selections remain in effect.

Help: Accesses context-sensitive help.

Figure 394.
Interface Setup
Wizard dialog
box.



Sharpening

General discussion: Chapter 16.

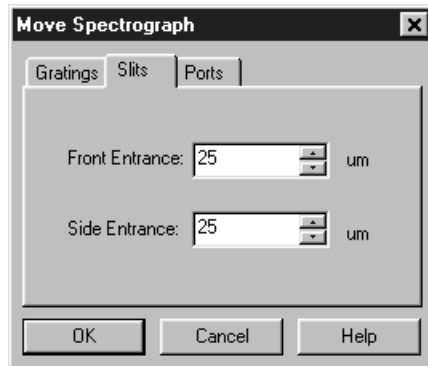
Input tab page: pg. 362

Parameters tab page: pg. 392

Output tab page: pg. 386

Slits tab page

Figure 395.
Slits tab page.



If your spectrograph has computer-controllable slits, the Move Spectrograph Slits tab page can be used to change the slit width at both the front and side entrances. The width is in μm . Note that before the slit width can be adjusted in this way, it is first necessary to let WinSpec/32 know that your spectrograph has the feature and to specify the adjustment sensitivity. This is done via the Define Spectrograph Slits/Ports tab page, as described on page 448.

Control Buttons:

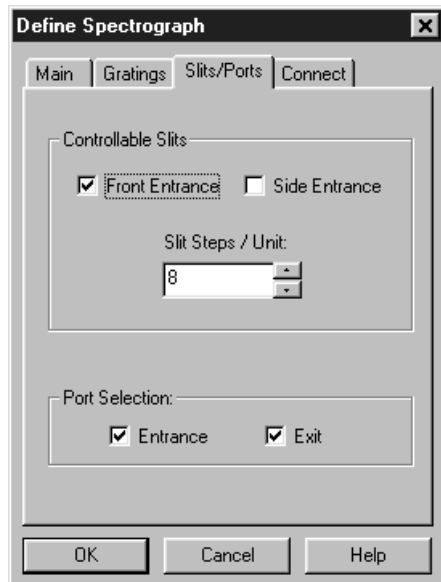
OK: Executes the selections for all of the Move Spectrograph tab pages and closes the dialog box.

Cancel: Closes the dialog box without executing any setting changes.

Help: Opens context-sensitive help for whichever tab page is on top.

Slits/Ports tab page (Define Spectrograph)

Figure 396.
Slits/Ports tab page.



The Slits/Ports tab page allows you to specify whether your spectrograph has programmable slits and/or ports. If it has programmable slits, it also allows you to set the control sensitivity for the slit adjustment.

Controllable Slits: Check boxes are provided for both the Front and Side entrances. Either or both can be selected for control. There is also provision for adjusting the Slit Steps/Unit. Consult your Spectrometer documentation for the correct setting.

Port Selection: Check boxes are provided for controlling the Entrance and Exit port mirrors. Either or both can be selected. Note that the actual adjustments are set and executed from the **Move Spectrograph** dialog box (pg. 378).

Control Buttons:

OK: Executes the selections for tab pages and closes the dialog box.

Cancel: Closes the dialog box without executing any changes.

Help: Opens context-sensitive help for whichever tab page is on top.

Smoothing

General discussion: Chapter 16.

Input tab page: pg. 362

Parameters tab page: pg. 393

Output tab page: pg. 386

Snap-Ins Toolbar

Figure 397.
Snap-Ins
Toolbar



The Snap-Ins Toolbar provides quick mouse-access to the installed snap-ins if suitable icons have been provided.

To display or hide the Snap-Ins Toolbar, choose **Toolbars** and then **Snap-Ins** from the View menu. Note that the toolbar's configuration can be changed by clicking and dragging a corner.

Snap-Ins Toolbar Buttons



Convert to ASCII: Opens the .SPE to ASCII Conversion dialog box, used to convert a WinX .SPE image file into an ASCII file.



Area Under Curve Analysis: The Area Under Curve (AUC) Snap-In computes the area of every pixel in a data set that is above the set threshold. The computation results, including the sum of the individual areas, are reported in a data window that can be saved as either an Excel text file or as a

standard text file.



Movie Playback: Opens the WinX32 Data Playback dialog box. This Snap-In plays back as movies multiple-frame image files collected using the WinX32 program.



Grams: WinX32 Grams Snap-In is a flexible and easy to use software package written specifically for converting or exporting an image file using the WinX32 program.



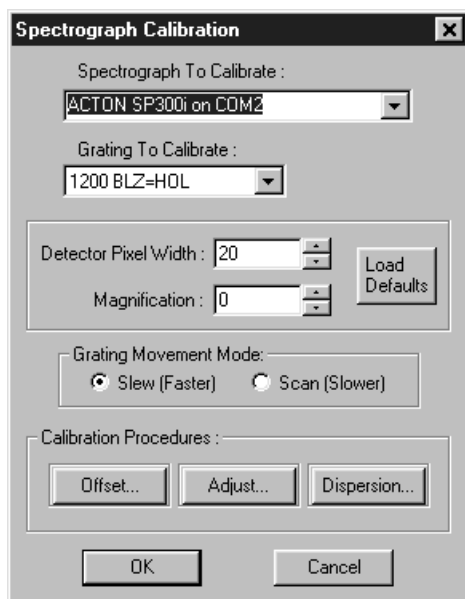
Split Frames: Split Frames Snap-In is used to split a file into its component frames, each of which is saved in a separate file.



Zap to Grams: This Snap-In transfers the data set in the active window directly to Grams. *The Grams software must already be open*

Spectrograph Calibration dialog box

Figure 398.
Spectrograph
Calibration
dialog box.



The Spectrograph Calibrate dialog box, which is opened by selecting Calibrate on the Spectrograph menu, allows the spectrograph to be calibrated so that accurate spectra can be taken for any position of the grating. Each grating is calibrated separately and the calibration data is saved in the computer Registry.

Note that a calibration is performed in three steps, Offset, Adjust, and Dispersion. This is the sequence that must be followed to get a valid calibration. Some spectrographs don't allow all three operations. If this is the case, maintain the sequence but skip the operation or operations that aren't provided.

Spectrograph to Calibrate: Selects the active spectrograph. Note that the spectrograph must be installed and communicating for a calibration to be performed. *If only one spectrograph has been installed, the selection box won't appear but the spectrograph model will be reported.*

Grating to Calibrate: This selection window allows you to select the grating to be calibrated. Each grating must be calibrated separately. Note that identification information for the gratings available on the active spectrograph must have already been entered via the Define Spectrograph Gratings dialog box.

Detector Pixel Width: This is the pixel width as seen by the spectrograph. In most systems, this is identically the CCD pixel size, which you will know from the data for the chip installed in your particular detector. However, in some systems the pixel size as seen by the spectrograph could be different. For example, if there is a tapered fiber-optic bundle between the detector and the spectrograph, its effect would have to be taken into account.

Magnification: This parameter is determined by the geometry of the spectrograph and should be provided in the spectrograph manual.

Load Defaults: This button enters 20 μm as the pixel size and 0 as the magnification.

Gating Movement Mode: Some spectrographs give you the choice of two grating movement speeds, Slew (fast) and Scan (slow). With a slow scan, you have more time to see the messages that will be displayed during a calibration. With a fast scan, all operations take place much more quickly.

Offset: Opens the Offset dialog box, which is used to perform the Offset adjustment of the calibration procedure.

Adjust: Opens the Adjust dialog box, which is used to perform the Adjust part of the calibration procedure.

Dispersion: Opens the Dispersion dialog box, which is used to perform the Dispersion part of the calibration procedure.

Control Buttons:

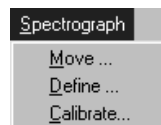
OK: Executes the selections, saves the data in the Registry, and closes the dialog box.

Cancel: Closes the dialog box without executing any changes.

Help: Opens context-sensitive help for whichever tab page is on top.

Spectrograph menu

Figure 399.
Spectrograph
menu.



The items on the Spectrograph menu open the dialog boxes that allow you to define the spectrograph, move its controllable functions such as its ports, slits, and gratings, and calibrate it.

For Additional Information, see:**Move:** pg. 378**Define:** pg. 321**Calibrate:** pg. 449**Split Frame dialog box**

Figure 400.
Split-Frame
dialog box.



Allows you to split a multi-frame file into its constituent frames. The original file is retained, and each frame is saved in a separate located in the same folder as the original. Numbers are appended to indicate the frame number. For example, if the original file contained ten frames and was named **Minney.spe**, the individual frame files would be named **Minney1.spe**, **Minney2.spe**... **Minney10.spe**.

Control Buttons:

Browse: Opens a browser to aid in selecting the file to be split. When selected, the name of the file will appear in the adjacent text box. Alternatively, the file name may be directly entered in the text box.

OK: Once the file to be split has been specified, clicking on **OK** will initiate the split routine, which then runs until all of the frames have been split. A message indicating completion of the split process is displayed.

Standard Toolbar buttons

Open: Open an existing datafile.



Save: Save the active datafile.



Cut: Cut the selection and put it on the clipboard. *Not operational in early releases of the software.*



Copy: Copy the selection and put it on the clipboard.



Paste: Insert the clipboard contents. *Not operational in early releases of the software.*



Print: Print the active data file.



Print Preview: Display full pages.



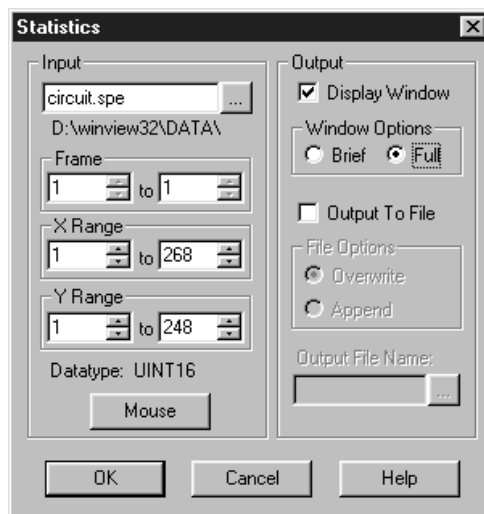
Help Topics: List Help Topics. Equivalent to selecting Search for Help On on the Help menu.



Context Sensitive Help: Note that this is a two-step operation. The first step is to click on this button. The second is to click on the menu item, button, or dialog box selection for which you would like to have additional information.

Statistics dialog box

Figure 401.
Statistics dialog
box.



This box allows basic statistics to be calculated on a data file, or on a specified region of the data, and the resulting report saved to a text file. Reported are the:

Rectangular Region Area
Location of Center of Mass
Location of maximum intensity
Location of minimum intensity
Number of Pixels in Region
Intensity
 maximum
 minimum
 total
 average and
 sigma

The ROI for which the statistics are calculated can be entered directly or specified by dragging a mouse. If the data file contains multiple frames, you can specify the frames for which the statistics are to be calculated, with the default being all. The report can be displayed and/or saved to a file. If there is a statistics report with the same name, you have the option of appending or overwriting it.

Input Parameters

Name: The file for which the statistics are to be calculated appears in the Input text box. If there is an active data file, its name will be automatically selected. If not, you can use the browser accessed by clicking the button at the end of the text box to conveniently specify the name and location of the file. This information is indicated below the Input text box.

Frame: The two Frame text boxes allow the frame range to be specified. If the data set contains one frame, the indicated range will be 1 to 1. If the data set contains multiple frames, the default is to select all frames. For example, if there were 10 frames, the frame range would be 1 to 10 and statistics would be reported for all. Either value can be changed. For example, if you only wanted statistics for frames three through seven, it would only be necessary to change the Frame range values to 3 and 7 respectively.

X Range and Y Range: The statistics can be computed for the full data set (default) or for a specified subset. For the latter, you can enter the range values directly or define an ROI by using the mouse. The data set must be displayed and a region defined by dragging the mouse to specify the desired ROI. *See discussion of Mouse parameter below.* Clicking on the button labeled **Mouse** will cause the X and Y range values for the ROI to be entered in the X Range and Y Range text boxes.

Datatype: The datatype of the file is reported and cannot be changed.

Mouse: Clicking on this button causes the mouse-defined ROI values to be entered in the X and Y range text boxes. It is first necessary that the file be displayed and that the ROI be defined. To define an ROI with the mouse:

- ◆ Position the mouse cursor at one corner of the region to be defined.
- ◆ Press the left mouse button and, while it is held down, drag the mouse to the diagonally opposite corner of the region being defined.
- ◆ Release the mouse button.

Output Parameters

Display Window: Checking this box causes the statistics report to be displayed on the computer monitor.

Window Options

Brief: Statistics are provided with minimum explanation.

Full: Statistics are provided with expanded explanation.

Output to File: Check this box if you want the statistics report to be saved as an ASCII text file. Saving does not actually take place until the **OK** button is pressed.

File Options

Overwrite: If writing to an existing file, this radio button causes the new report to overwrite the old one.

Append: If writing to an existing file, this radio button causes the new report to be appended to the old one.

Control Buttons:

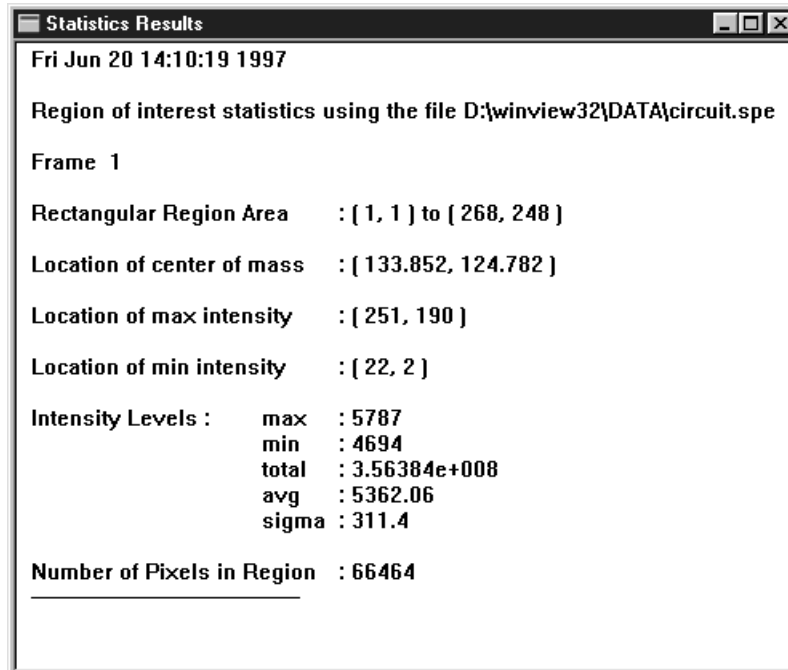
OK: Implements Statistics selections. If Display Window is selected, report will be displayed. If an output file was designated, report will be written to disk. Both output to file and output to window can be selected.

Cancel: Closes Statistics window without implementing any selections.

Help: Accesses context-sensitive help for the Statistics window.

Statistics Report

Figure 402.
Statistics report
sample; Full.



Frame: The frame for which the ROI statistics are being reported. If the file contains only one frame, the reported value will be "1." If the file contains multiple frames, the reported value will be a number from 1 to n, where n is the number of frames in the file.

Rectangular Region Area: The coordinates that define the ROI are reported; first are the minimum X and Y values - then the maximum X and Y values.

Location of center of mass: X,Y coordinate of the "balance point." If you think of the intensity at each point in the ROI as being expressed in units of mass, there will be some point on the X and Y plane of the ROI data where the plane could be balanced on an imaginary needle. Points outside the ROI have no influence.

Location of max intensity: X-Y Coordinate of the pixel in the ROI with the highest intensity.

Location of min intensity: X-Y Coordinate of the pixel in the ROI with the lowest intensity.

Intensity Levels

Max: Maximum intensity level in the ROI.

Min: Minimum intensity level in the ROI.

total: Sum of all intensity values in the ROI.

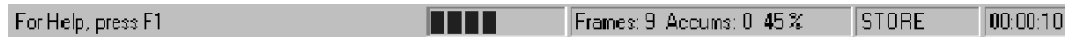
avg: Sum of all intensity values divided by the number of pixels.

sigma: Standard deviation of all the intensity values in the ROI.

Number of Pixels in Region: Number of pixels in the ROI.

Status bar

Figure 403.
Status bar.



The status bar is displayed at the bottom of the WinSpec/32 window. To display or hide the status bar, use the Status Bar command in the View menu.

The Status bar displays a variety of different kinds of information about the system status and data collection. The bar is divided into sections or panes. Progressing from left to right, the information provided in each section is as follows.

Prompts and Hints: The left section of the bar provides prompts and tips. More specifically, this section of the status bar describes actions of menu items as you use the arrow keys to navigate through menus. This area similarly shows messages that describe the actions of toolbar buttons as you depress them, before releasing them. If after viewing the description of the toolbar button command you wish not to execute the command, then release the mouse button while the pointer is off the toolbar button.

Progress bar: Next is the progress bar, which advances in increments as the measurement progresses. The experiment progress can be gauged by the length of the progress bar. For example, when the bar reaches half of the pane width, the measurement will be approximately half complete.

Progress Messages: The next pane reports the measurement progress in terms of Frames, Accumulations and % completion.

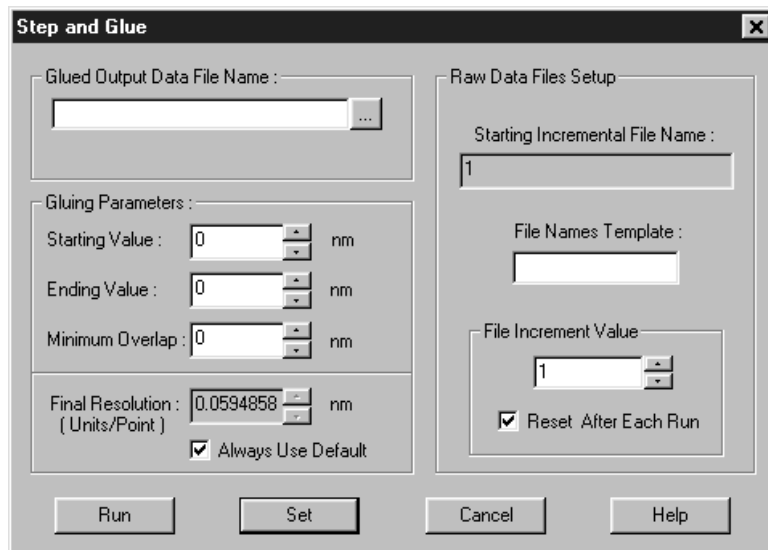
Collection Status: The next pane reports the run status. Typical messages you might see in this pane would include RUNNING, STORING, COMPLETE, and OVERRUN. Left-clicking on the Collection Status pane will cause it to display the rate at which the currently active window is being refreshed during data collection (most useful for focus mode). The fastest possible refresh rate is obtained by setting the Zoom to 1:1 and having both the axes and cross-sections display OFF.

Clicking again will revert to the collection status message (RUNNING or STORING). The pane always shows COMPLETE or OVERRUN when data collection is stopped.

Timer: The right-most pane is the Data Collection Timer. During an acquisition, it reports the elapsed time since initiating the run. Otherwise it reports the computer clock time. Clicking on this pane allows you to toggle the count up or down.

Step and Glue dialog box

Figure 404.
Step and Glue
dialog box.



The Step and Glue dialog box allows the software to control data collection and the movement of the spectrometer to create a glued spectrum. The software will take an exposure. Then, while the shutter is closed, the spectrometer moves to the next position. Unlike a monochromator with a single point detector, the wavelength calibration will not depend on the speed and timing of the stepper motor, only on its final position. The glued data is collected as a series of incremental files. These files will then be used to create a single glued data file.

Items

Glued Output Data File Name: This is the name you wish to assign to the file containing the spectra in the Incremental Data files.

Starting and Ending Values: These are the starting and ending wavelength values for the resulting file.

Minimum Overlap: Sets the amount by which the incremental data files are overlapped. The overlapping data will be averaged for a smooth transition from one exposure to the next. A good overlap would be about ten times the coverage of a single pixel.

Final Resolution: This is the resolution in nm per data point (not a *physical* pixel) in the output file. The lower the value the higher the resolution and the more data points the glued file will contain. For a 2400 groove per mm grating and a 0.3 m spectrometer a good final resolution would be about 0.1 nm per pixel. For a 1200 groove per mm grating this value would be 0.15 to 0.2 nm per pixel. The total number of data points in the resulting file cannot exceed 65,535. Unless you require a certain resolution value, it is easiest to click on **Always Use Default** and let the computer calculate the final resolution based on the spectrometer calibration and other known quantities. To determine the coverage of a single data point; click on **Always Use Default**; the minimum resolution will be

displayed in the **Final Resolution** edit box (the resolution changes as the wavelength changes, decreasing at higher wavelengths).

Starting Incremental File Name: This is a displayed item determined from the File Name Template and File Increment Value. For example, if the File Increment Value is “1” and the name entered in the File Name Template box is “EXP,” the Starting Incremental File Name would be “EXP1.” The next Incremental File would be named “EXP2,” the next “EXP3,” etc.

File Name Template: This is the part of the Incremental File Name that all of the incremental files will have in common, as illustrated in the example from the preceding discussion of the Starting Incremental File Name.

File Incremental Value: This is the number that delineates one incremental file from another, as illustrated in the example from the preceding discussion of the Starting Incremental File Name. The data to be glued are collected as a series of incremental files. These files are then glued to create the Output Data File. Enter the name of the File Name Template, such as EXP, in the File Names Template box. This parameter allows you to set the starting File Increment Value. As each incremental file is taken, the value increments by one. If the **Reset After Each Run** box is checked, the File Increment Value will reset to “1” and the subsequent set of incremental files will overwrite the first. If the Reset After Each Run box is left unchecked, the File Increment Values assigned to the next and subsequent runs will start with the next digit after the last one used and no files will be overwritten.

Control Buttons:

SET: Stores the Step and Glue parameters without initiating data collection. If the experiment is ready to run, click on the **RUN** button to begin collecting data.

RUN: Initiates data collection. The software will collect one exposure at each spectrometer position. It will automatically move the spectrometer to the next position (with the correct amount of overlap) and collect the next exposure. The software will collect as many exposures as needed.

Cancel: Closes the dialog box without executing any selections or changes.

Help: Opens context sensitive help for the Step and Glue dialog box.

Temperature

See **Detector Temperature dialog box** on page 322.

Threshold and Clipping (Provided with Imaging Option only)

General discussion: Chapter 17.

Input tab page: pg. 362

Parameters tab page: pg. 394

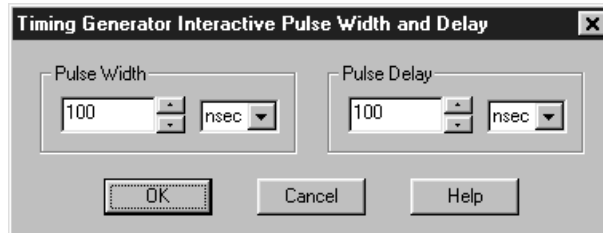
Output tab page: pg. 386


Thresholding

See *Processes tab page discussion on page 415*.

Timing Generator Interactive Pulse Width and Delay dialog box

Figure 405.
Timing
Generator
Interactive
Pulse Width
and Delay
dialog box.



The Interactive Pulse Width and Delay dialog box, accessed with the  button of the Custom toolbar, allows you to control the Pulse Width and Pulse Delay parameters of a PTG or DG-535 Timing Generator while acquiring data.

Parameters

Pulse Width: The pulse width is the duration of the pulse applied to the PI-MAX intensifier to gate the photocathode. The units available are nanoseconds (nsec), microseconds (μ sec), or milliseconds (msec). Only some values are allowed, so the Timing Generator will adjust the input value to the nearest allowable value.

Pulse Delay: The pulse delay is the time between the beginning of the trigger pulse (either internal or external) and the beginning of the photocathode gate pulse. The units available are nanoseconds (nsec), microseconds (μ sec), or milliseconds (msec). Only some values are allowed, so the Timing Generator will adjust the input value to the nearest allowable value.

Control Buttons:

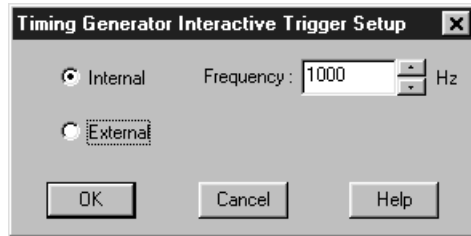
OK: Click on this button to close the Timing Generator Interactive Pulse Width and Delay dialog box. On clicking on OK, the new parameter values are sent to the Timing Generator.


Cancel: The **Cancel** button exits the Timing Generator Interactive Pulse Width and Delay dialog box without saving any settings.

Help: Click on this button to open the online help for this window.

Timing Generator Interactive Trigger Setup dialog box

Figure 406.
Timing
Generator
Interactive
Trigger Setup
dialog box.



The Timing Gen Interactive Trig Setup dialog box, accessed by clicking on the  button of the Custom toolbar, allows you to select the PTG or DG-535 Trigger mode (Internal or External) and, if Internal is selected, to set the Frequency, while acquiring data.

Parameters

Trigger Frequency: The trigger frequency is used with internal triggering.

Trigger Mode radio buttons: The trigger mode determines whether the Timing Generator will create its own trigger signals (**Internal** selected), or will itself be triggered by trigger signals that originate in an external piece of equipment (**External** selected).

Control Buttons:

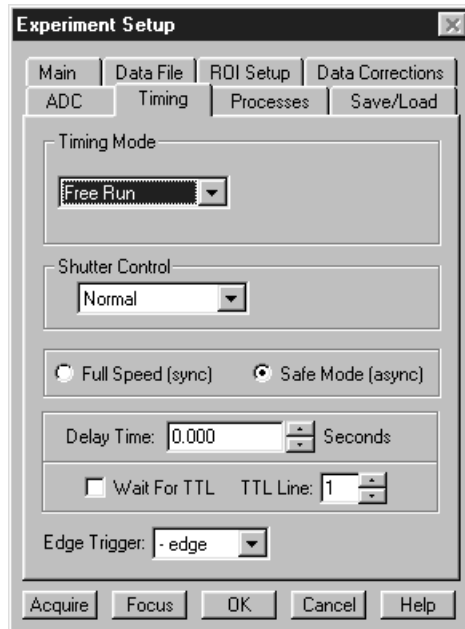
OK: Click on this button to close the Timing Generator Interactive Trigger Setup dialog box. On clicking on **OK**, the new parameter values are sent to the Timing Generator.

Cancel: The **Cancel** button exits the Timing Generator Trigger Setup dialog box without saving any settings.

Help: Click on this button to open the online help for this window.

Timing tab page

Figure 407.
Timing tab
page.



This page controls the controller timing parameters. Although all of the possible selections are discussed in the following paragraphs, note that not all of them will be available with any particular controller model.

Timing Mode: The Timing Mode determines how the system will respond to external TTL signals. The choices are:

Free Run: Collects data continuously without need for synchronization with an external signal.

External Sync: Data acquisition is synchronized with an externally derived signal. Best suited to synchronized acquisition of repetitive signals. See controller or system hardware manual for information on how this is done with your particular system.

IEC (Internal Exposure Control): Applies only to the special Double Image MicroMAX, which can capture two fast full-frame images before reading out. In this timing mode, capture of the first mode begins on application of an external trigger. The second capture immediately follows the first. The exposure time is that set via the Experiment Setup **Main** tab page.

EEC (External Exposure Control): Applies only to the special Double Image MicroMAX, which can capture two fast full-frame images before reading out. In this timing mode, timing of an externally derived trigger sets the exposure time of the first image, while the Experiment Setup **Main** tab page **Exposure Time** parameter sets the exposure time of the second image. The second image capture follows immediately after the first.

ESABI (Electronic Shutter Active Between Images): Applies only to the special Double Image MicroMAX, which can capture two fast full-frame

images before reading out. In this timing mode, the Experiment Setup **Main** tab page sets the exposure time of the both images. Two triggers are required, one that initiates the first image capture and a second one to initiates the second image capture, thus allowing the second capture to be delayed after completion of the first one.

Continuous Cleans: In addition to the standard “cleaning” of the array that occurs after the controller is enabled, Continuous Cleans will remove any charge from the array until External Trigger pulse is detected. Continuous cleaning stops as soon as the current row is shifted and frame collection begins. See the hardware manual for additional information.

Triggered Mode (ST-130, ST-138): Triggered Mode operates in conjunction with External Trigger operation. It facilitates experiments where a single event is to be captured. The system continuously acquires and discards data until a TTL trigger is applied to the Controller’s Trigger In connector. The data from the acquisition following trigger detection is stored. Note that this mode and Continuous Cleans provide two different ways of conditioning the array before externally triggered acquisition in single-event experiments.

Note: This mode formerly was referred to as the Store Strobe mode and may be identified by that name in your hardware manuals.

Shutter Mode: There are three shutter-control modes, as follows.

Open: Shutter is held continuously open.

Closed: Shutter is held continuously closed.

Normal: Shutter opens and closes synchronously with the system timing.

Pre Open: For most experiments, the shutter should remain open until the trigger or sync signal is received telling the system to collect an exposure. In experiments where the event occurs before the shutter would have time to open, Pre Open operation can be selected to open the shutter before a signal is received. The shutter will be opened as soon as the system is ready to collect data without waiting for a synchronizing signal. This mode is best suited to capturing single “flash” events with a dark field. PreOpen is not available in free-run operation.

Full Speed (sync): When Full Speed is selected, the system collects data according to hardware timing. Once collection begins, the system is not controlled by the computer. The computer will store data and display it as quickly as possible but may lag behind.

Full Speed data collection therefore is used when actual data is being collected, that is, when data collection has the highest top priority. During setup or initial data collection, it will generally prove more convenient to select Safe Mode operation. See the controller or system hardware manual for a complete description of this function.

Note: In previous versions of WinSpec, this mode was called Synchronous, and may still be identified by that term in your hardware manuals.

Safe Mode (async): When Safe Mode is selected, the computer controls the system. Each exposure is collected, stored, and displayed. Only then is the system allowed to collect the next exposure. This is the recommended mode for initial data collection so that the display will have high priority and adjustments will be simpler.

Note: In previous versions of WinSpec, this mode was referred to as Asynchronous or “operation with Synchronous deselected” and may still be identified in that way in your hardware manuals.

Delay Time: Allows delay to be inserted between successive frame acquisitions. This parameter is only active in Safe Mode (asynchronous) operation, in which each frame must be completely processed before the next one can be taken. The Delay Time inserts an additional delay after the computer has finished processing the previous frame before the next one can be acquired.

Edge Trigger (PentaMAX, V/ICCD, V/ICCD Controller Box): When using External Sync function, determines whether synchronization will take place on the positive-going or negative-going edge of the External Sync signal.

Use Interrupt (ST-138 only): With the ST-138, the user has the option of allowing data transfer to be controlled by a timer or by the computer interrupts. If there are no conflict problems, using the interrupts will give faster speed. If any reliability problems occur while operating under interrupt control, the Use Interrupt box should be left unchecked.

Wait for TTL (ST-133, MicroMAX & PentaMAX): When checked, acquisition won't begin until a TTL 1 is detected on the specified line of the Controller's TTL In/Out connector. For example, suppose **Wait for TTL** and **TTL Line 2** were selected, and you then clicked on **Focus** or **Acquire**. Data collection would not begin until additionally, a TTL 1 were detected on TTL Line 2 of the controller's TTL In/Out connector. Note that data acquisition, once initiated, cannot be halted by reversing the TTL state on the selected line. Note also that, in the case of the PentaMAX, TTL Line selection is not available.

With **Wait for TTL** selected in **Ext. Sync.** mode operation, after detecting a TTL 1 on the specified line, the system still waits for the External Sync edge before data acquisition is initiated.

TTL Line: Specifies the line which will be monitored for the TTL level.

Control Buttons:

Acquire: Clicking on **Acquire** initiates a data-collection run in which all data frames are stored.

Focus: Clicking on **Focus** initiates a data-collection run in which the data is not stored until **Start Storage** is selected.

OK: Click on **OK** to save the changes and close the Experiment Setup window without initiating a data collection run.

Cancel: Click on this button to close the Experiment Setup window without making any changes.

Help: Opens context-sensitive help for whichever tab page is on top.

Tools

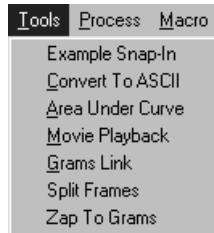
Figure 408.
Menu bar with
Tools.



If Visual C++ Snap-Ins or Visual Basic Add-Ons have been installed, the **Tools** selection will appear on the menu bar as shown in Figure 408. Clicking on Tools will drop a menu listing the available Snap-Ins and Add-Ons. If more than one version of WinView/32 and/or WinSpec/32 has been installed, the **Tools** selection and listed Snap-Ins and Add-Ons will be available to all.

Tools Menu

Figure 409.
Tools menu.



Lists the Snap-Ins and Add-Ons that have been installed. Clicking on an Add-On or Snap-In name will open the dialog box for the selection or execute it directly.

See:

Convert to ASCII: pg. 265

Area Under Curve: pg. 277

Movie Playback: pg. 478

Grams Link: pg. 479

Split Frames: pg. 452

Zap to Grams: pg. 487

Triggers tab page

See:

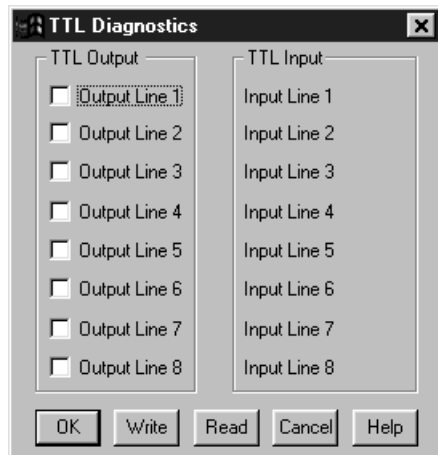
DG-535 Triggers tab page: pg. 332.

PG-200 Triggers tab page: pg. 404.

PTG Triggers tab page: pg. 430.

TTL Diagnostics dialog box

Figure 410.
TTL
Diagnostics
dialog box.



This screen allows the Controller's TTL communications to be tested. This function would ordinarily be used in conjunction with an external TTL Test box which would be connected to the TTL port of the Controller. Once this is done, you can use the TTL Diagnostics dialog box to write to the TTL port or to read the TTL levels applied to it.

TTL In

The user controls the 8 TTL Input lines from an external source, setting them high (+5 V; TTL 1; bit ON) or low (0 V; TTL 0; bit OFF). When the lines are read, the state of each bit can be read from the TTL Diagnostics dialog box. An ON or OFF will appear after each Input Line designation to show that bit's state.

Buffered vs. Latched Inputs

In controlling the TTL IN lines, users also have the choice of two input-line states, *buffered* or *latched*. In the buffered state, the line levels must remain at the intended levels until they are read. In the latched state, the applied levels continue to be available until read, even if they should change at the TTL IN/OUT connector.

This control is accomplished using the EN/CLK TTL input (pin 6). If EN/CLK is open or high, *buffered* operation is established and the levels reported will be those in effect when the READ is made. If, on the other hand, EN/CLK were made to go low while TTL IN 1 and TTL IN 2 were high, the value values would be *latched* for as long as EN/CLK remained low.

TTL Out

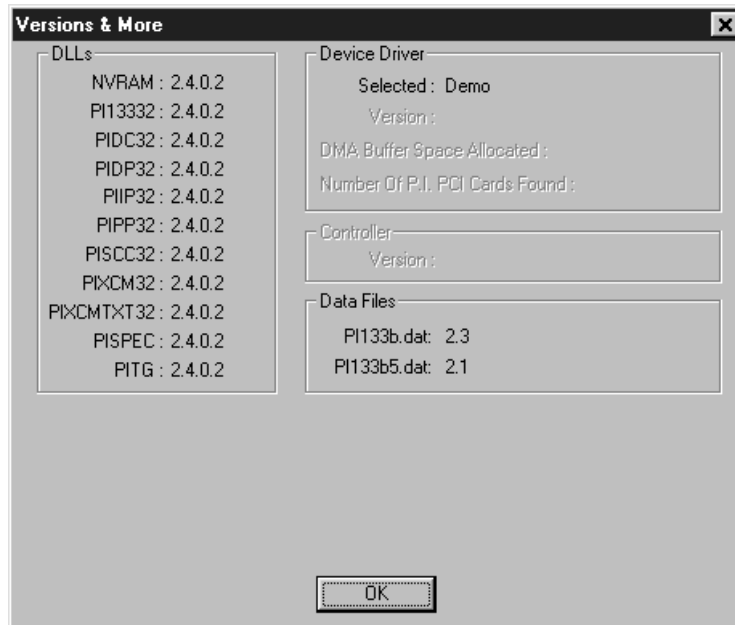
The state of the TTL OUT lines can be set from the TTL Diagnostics dialog box. Checking the box associated with an output bit designation sets it's level high (+5 V; bit ON). If the box is left unchecked, the output bit is low (0 V; bit OFF).

Usage dialog box

See *Calibration Usage dialog box discussion on page 289.*

Versions & More box

Figure 411.
Versions &
More box.



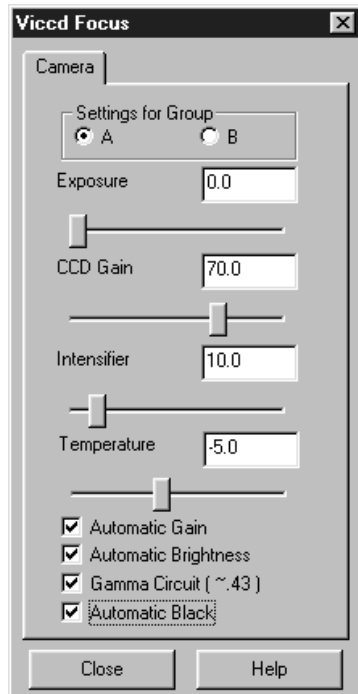
This box reports a variety of kinds of ancillary information, including the installed DLL versions, selected device driver and its version, DMA buffer space allocated, and the number of PCI cards found. The Controller version is also reported. This information would not ordinarily be required by an operator, but could prove invaluable when contacting Roper Scientific's Technical Support department for assistance.

Not all of the indicated information is reported in early versions of the software.

OK: Closes the dialog box.

V/ICCD Focus - Camera tab page

Figure 412.
V/ICCD Focus
Camera tab
page.



This tab page (Figure 412), accessed by selecting **Video Focus** on the Acquisition Setup menu with V/ICCD as the selected controller, gives you software control over the basic V/ICCD operating parameters.

Parameters

Exposure: There is no difference between setting the exposure time here or setting it from the Main tab page of the Experiment Setup window.

CCD Gain: This is the post-CCD preamplifier gain. The default setting is 70. Users are advised not to change the CCD Gain without first carefully reviewing the V/ICCD manual to obtain a thorough understanding of all possible consequences.

Intensifier: This sets the intensifier gain. Users are advised not to change the default value of 10 without first carefully reviewing the V/ICCD manual to obtain a thorough understanding of all possible consequences.

Temperature: Sets the control temperature. The default temperature setting is -5° .

Automatic Gain: When checked, Automatic Gain Control (AGC) adjusts video gain to bring peak white level of signal up to nearly 100% of the standard RS170 signal.

Automatic Brightness: When checked, Automatic Brightness Control (ABC) adjusts the intensifier's MCP voltage in response to changes in the input light conditions up to 80% of maximum voltage.

Gamma Circuit: When checked, turns on the gamma function, displaying the video with a gamma of nominally 0.45. The effect is an overall brightening of the mid-range values in the picture. In effect, the brightness scaling of the scene is compressed to achieve greater dynamic range at the expense of linearity. For quantitative work, it is generally better to leave the gamma unchecked, since the 0.45 value is nominal only. Cameras may need to be individually calibrated. Note that the amount of post CCD gain also affects gamma.

Automatic Black: When checked, together with AGC, provides an automatic contrast stretch function. It attempts to darken the darkest portions of the image to black. Although its range is limited by hardware constraints and its usefulness depends on scene contrast, it can be quite helpful in viewing low contrast images.

Control Buttons:

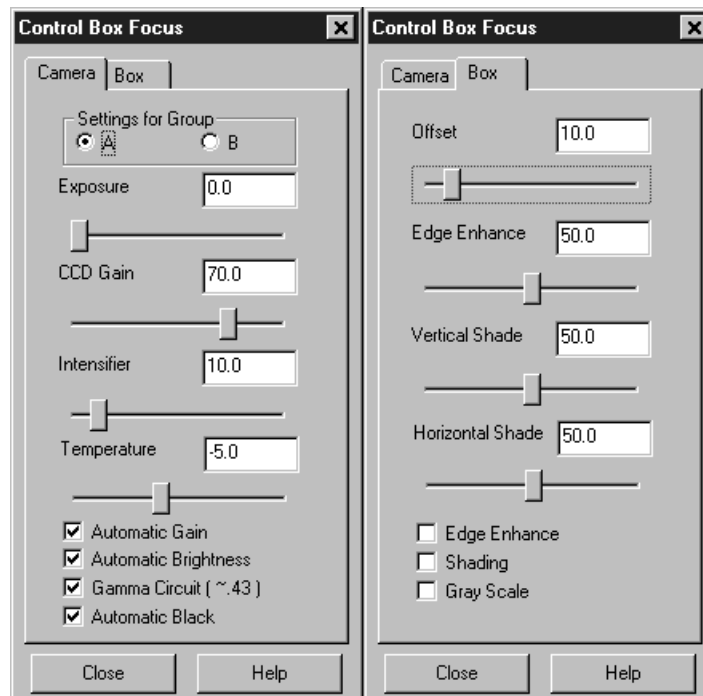
Close: Implements any setting changes and closes the window.

Help: Displays context-sensitive help for the V/ICCD (Focus) tab page.

V/ICCD Control Box Focus Window

Selecting **Video Focus** on the Acquisition Setup menu with V/ICCD Control box as the selected controller opens the Control Box window (Figure 255). This window contains two tab pages, Camera and Box. The Camera tab page is identical to the V/ICCD Focus Camera tab page previously described. The Box tab page gives software control over the V/ICCD Control Box parameters as described in the following paragraphs.

Figure 413.
V/ICCD
Control Box
Focus tab
pages.



Parameters

Offset: The Offset parameter allows the video to be shifted negatively. The range is in arbitrary units from 0 to 99 and the default setting is 10.0. The higher the setting, the larger the offset that will be subtracted from every pixel in the image, in effect shifting the entire image towards black. Used in conjunction with the intensifier gain setting, this is particularly useful in applications where images have very low contrast. You can offset the gray level down to black and then increase the intensifier gain to bring up the residual contrast for the best possible image. Note, however, that CCD well capacity limitations constrain the amount of contrast enhancement that can be achieved.

The Automatic Gain and Automatic Black function should be OFF for the Offset function to have any significant effect.

Edge Enhance: This function increases the video high-frequency response, causing edges in the image to become crisper. The range is 0 to 99 and the default setting is 50. Note that the Edge Enhance box must be checked as well to activate the Edge Enhance function.

Vertical Shade & Horizontal Shade: These parameters allow you to independently set the amount of vertical and horizontal shading to be applied to the image to compensate for illumination non-uniformity. The range is 0 to 99 and the default is 50 for both parameters. With respect to actual screen illumination, the range is nominally 30%. If the field illumination non-uniformity exceeds this range, it will be necessary to correct it at the experiment level. The Shading box must be checked for the shading to be applied.

Edge Enhance box: Checking this box causes the edge-enhance function to be applied.

Shading: Checking this box causes the horizontal and vertical shading functions to be applied.

Gray Scale: When checked, causes a full-range grayscale bar image to be displayed. This display is very convenient in setting the monitor's brightness and contrast controls. For the best image in most situations, the darkest bar should be black and the brightest should be full white.

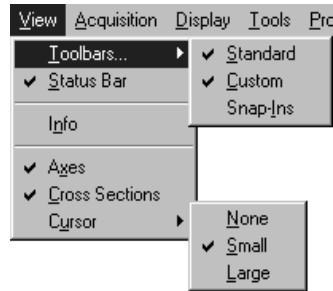
Control Buttons:

Close: Implements any setting changes and closes the window.

Help: Displays context-sensitive help for the V/ICCD (Focus) tab page.

View menu

Figure 414.
View Menu.



This menu (Figure 414) provides user control over the items that will appear on the WinSpec/32 desktop. A description of each function follows.

Toolbars: Allows you to choose which toolbar(s) will be displayed.

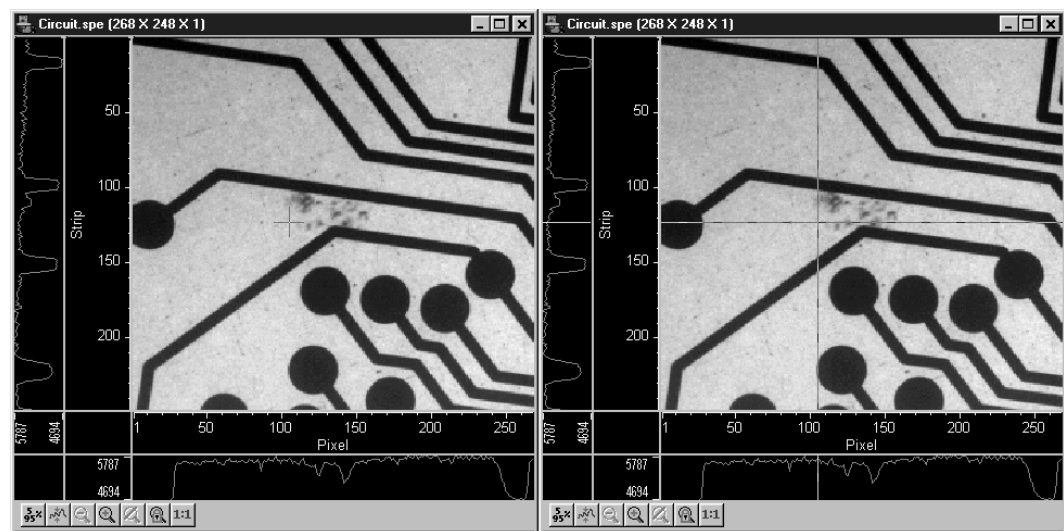
Status Bar: Determines whether the Status bar at the bottom of the WinSpec/32 desktop will be displayed.

Info: If checked, Information box will be displayed. This box provides information about the image. *See page 361 for additional information.*

Axes: Adds or removes scaled X and Y axes to the current image. In an image display, the X axis is scaled in pixels and the Y axis in strips. In a graph display, the X axis is scaled in pixels and the Y axis in intensity. *See page 280 for additional information.*

Cursor: Determines whether an image cursor will be displayed. Choices are None, Small, and Large. The large “crosshair” cursor can be particularly useful, for example, if the scale and/or cross-section functions are active. As shown in Figure 415, the precise pixel position of the cursor can be read from the scales using the crosshair. *See page 306 for additional information.*

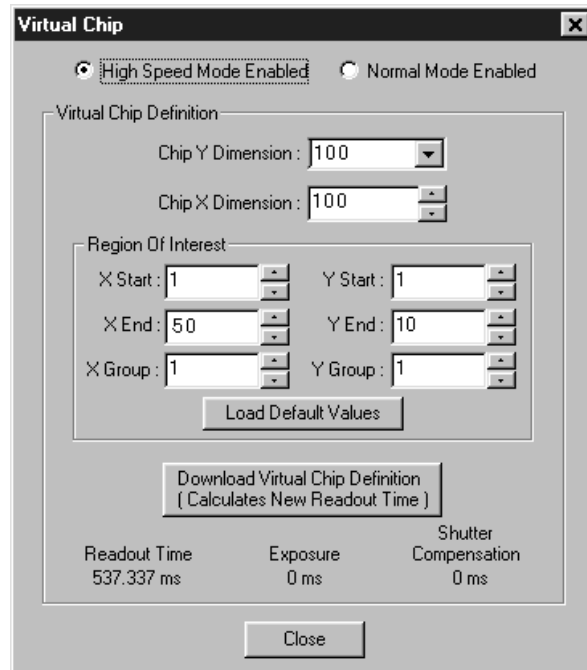
Figure 415.
Small cross
(left) and large
crosshair
(right) cursor
selections.



Cross Sections: Adds or removes cross sections in the current image. The Y cross section appears to the left of the image and the X cross section appears below the image. The cursor position defines the column and row that are profiled in the cross section displays. Cursor projections intersect the cross sections to show the relative intensity of the pixel corresponding to the cursor position. *See 303 for additional information.*

Virtual Chip dialog box

Figure 416.
Virtual Chip
dialog box.



Clicking **Virtual Chip** on the Setup menu opens the Virtual Chip dialog box as shown in Figure 416. This screen is used to set the parameters for Virtual Chip operation, a special fast-acquisition technique that allows frame rates in excess of 100 fps to be obtained. For the Virtual Chip selection to be present, it is necessary that:

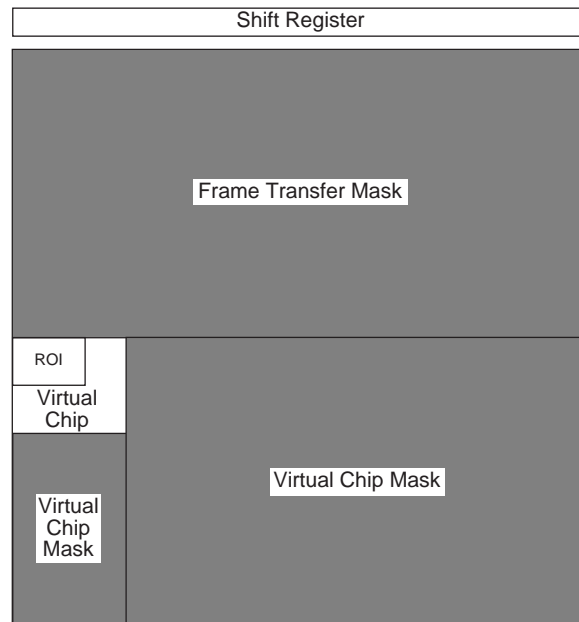
- the system be a PentaMAX, MicroMAX (1 MHz or 5 MHz) or ST-133,
- that the camera have a **frame transfer chip** such as the EEV 512 × 1024 FT, and,
- that the file WXvchip.opt be present in the same directory as the executable WinSpec/32 program. *Contact Tech Support for information regarding the availability of Wxvchip.opt.*

This method of data acquisition requires that the chip be masked as shown in Figure 417. The mask can be a static one (fixed dimensions) in which case, multiple masks should be made to accommodate a variety of imaging conditions. Alternatively, a more flexible mask can be manufactured by taking two thin metal sheets with a square hole the size of the exposed region of the CCD cut in the center. This would be 512 x 512 pixels at 15 microns per pixel = 7.68 mm x 7.68 mm for the non-intensified PentaMAX. *For cameras with a fiber-optic taper, the aperture will have to be larger since the intensifier*

is coupled via a taper. These masks should be anodized black to prevent reflections in the optical system and they should be very flat. These two sheets can then be slid relative to one another to achieve any rectangular shape required. The sheets should be placed flat in the optical plane and their openings should be centered on the optical axis. Ideally they should be able to move with an accuracy of 2-3 pixels per step (30-45 microns for non-intensified and 46-70 microns in the intensified PentaMAX) in the X and Y directions.

In operation, images are continually piped down the CCD at extraordinarily high rates. The mini-frame transfer region is defined by an ROI as illustrated in Figure 417. The charge from this ROI is shifted under the frame-transfer mask, followed by a readout cycle of an ROI sized region under the mask. Since the ROI is far from the serial register, the stored image is just shifted repeatedly with the read out and the first few images collected will not contain useful data. After the readout period (which is also the exposure period), the next frame is shifted under the mask and another ROI sized frame is read out. The net result is a series of images, separated by spacer regions, streaming up the CCD under the mask.

Figure 417.
Virtual chip
functional
diagram.



Mode: Radio buttons allow the choice of **High Speed Mode Enabled** and **Normal Mode Enabled**. In the normal mode, the external masks would ordinarily be withdrawn, allowing normal frame-transfer operation. All of the parameter settings on the screen are grayed out if **Normal Mode Enabled** is selected. When **High Speed Mode Enabled** is selected, high speed frame rates using the virtual chip can be obtained as described above.

Chip Y Dimension: This is the Y range established by the external mask.

Chip X Dimension: This is the X range established by the external mask.

ROI: The X and Y Start, End and Binning (Group) values can be entered. The ROI can be as large as the virtual chip area established by the external mask or a subregion.

Load Default Values: Establishes the default virtual chip parameter values.

Download Virtual Chip Definition: Sends the virtual chip parameter values to the Controller's non-volatile. If a virtual chip definition is already stored there, you will be given an overwrite warning.

Readout Time: Reported readout time that will result with the current virtual-chip parameter values.

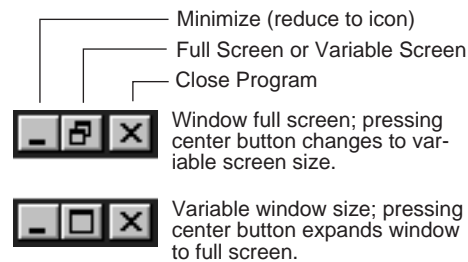
Exposure Time: Reported current exposure time that will result with the current parameter values.

Shutter Compensation Time: Reported value; depends on selected shutter type.

Close: Closes Virtual Chip dialog box.

Window Control Boxes

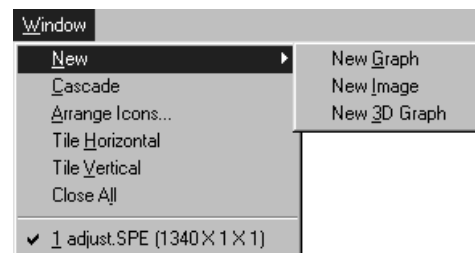
Figure 418.
Window
Control Boxes.



As shown in Figure 418, there are three control boxes. The leftmost button minimizes the window, reducing it to an icon on the Task bar. A minimized window can be expanded by clicking on the icon that represents it. The center button determines whether the window will be in the full-screen or variable-screen configuration and the button's appearance changes accordingly as shown in the figure. In the variable size configuration, you can click on a corner or edge of the window and drag it to size the window to match your requirement. In the full-screen configuration, the window simply expands to where it occupies all available screen space. The right hand button closes the program.

Window menu

Figure 419.
Window menu.



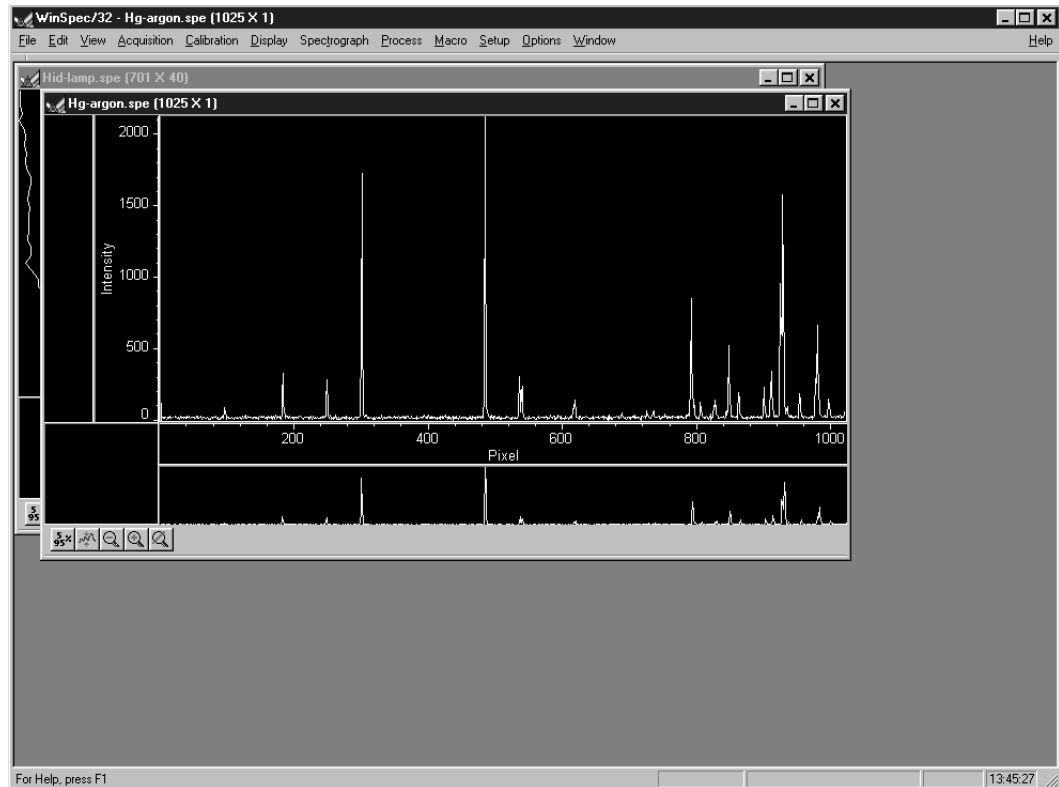
The Window menu (Figure 419) is primarily concerned with how data windows are displayed on the desktop. Descriptions follow.



New: If a data file is open and active, selecting New Graph, New Image or New 3D Graph will cause a second window containing the selected data to be displayed in the selected format.

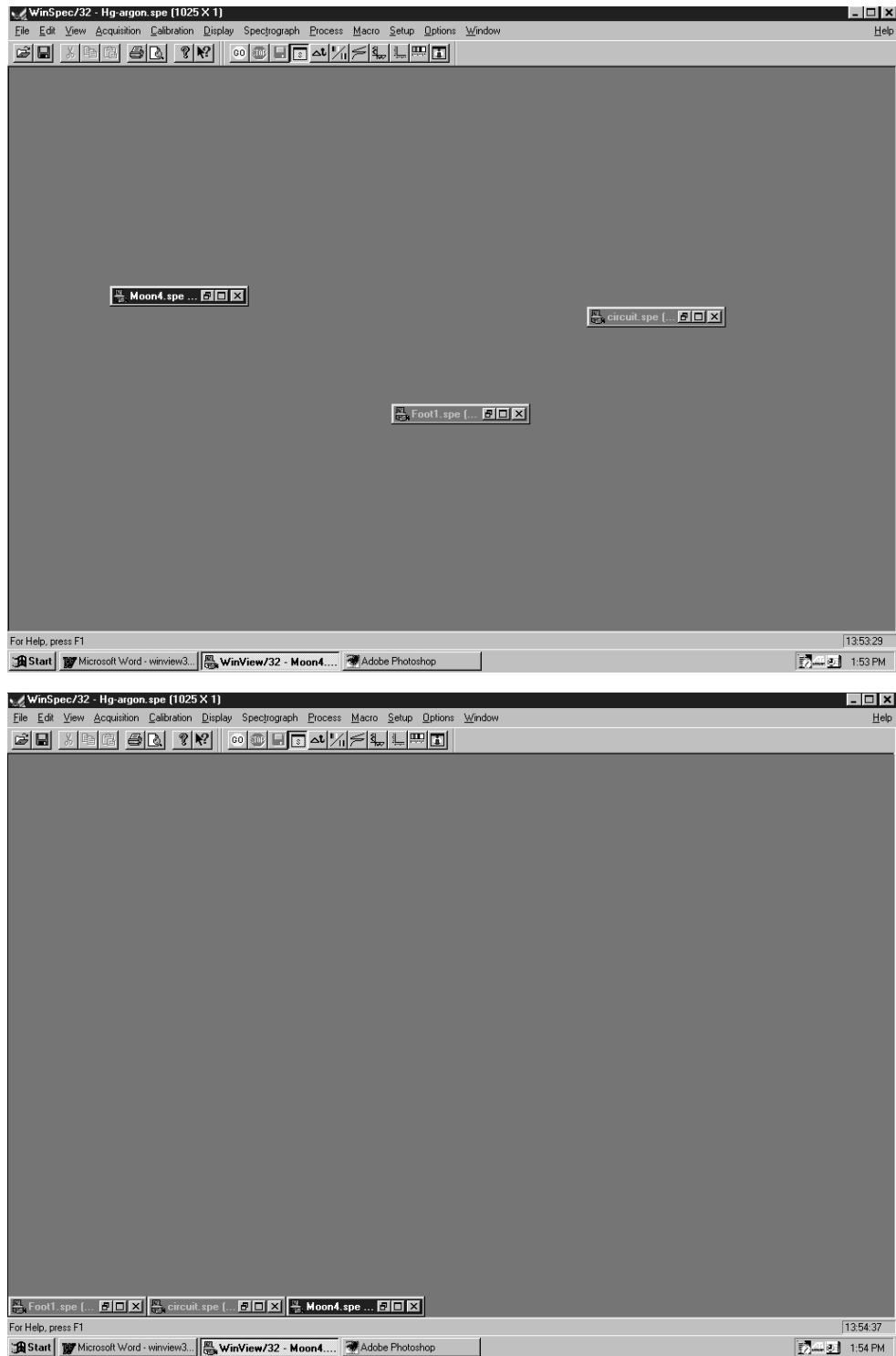
Cascade: If multiple data files are open, selecting Cascade will cause them to be arranged in an overlapping fashion as depicted in Figure 420.

Figure 420.
Cascaded
images.



Arrange Icons: If images have been reduced to icons by minimizing them, selecting Arrange Icons will arrange the icons in a neat row at the bottom of the desktop. If there is an open data file window at the bottom of the main window, then some or all of the icons may not be visible because they will be underneath this data file window. Figure 421 shows three iconized images randomly positioned (left) and after executing Arrange Icons (right).

Figure 421.
Randomly
located
iconized images
(above) and
locations after
executing
Arrange Icons
(below).



Tile Horizontally: If multiple data files are open, selecting Tile Horizontally will arrange the data windows one beneath the other and compressed vertically so that they all fit on the screen. The aspect ratio of image data windows is constrained and the windows may not be full screen width. In the case of windows containing data displayed as a graph, on the other hand, there are no constraints, allowing full-width data windows. Figure 422 shows three image files tiled horizontally.

Figure 422.
Horizontally
tiled data
windows.



Tile Vertically: If multiple data files are open, selecting Tile Vertically will arrange the data windows side by side and compressed horizontally so that they all fit on the screen. Figure 423 shows three image files tiled vertically.

Figure 423.
Vertically tiled
data windows.



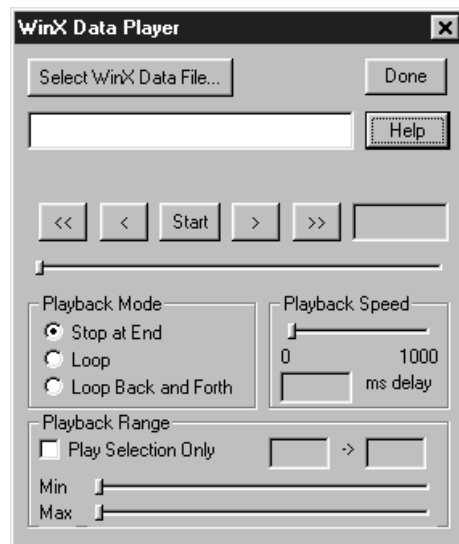
Close All: This selection closes *all* open data windows.

1, 2, 3.....: Open files are listed in numerical sequence at the end of the menu. Selecting a file on the list, either by clicking on the name of the file or by simply keying the file number with the menu displayed, will make that file the active one. It will become uppermost on the display and its title bar will be highlighted.

The Next (CTRL+F6) and Previous (SHIFT+CTRL+F6) commands supplement the numerical selection list. **Next** selects the next file in the list to be active while **Previous** selects the preceding file to be active. For example, suppose there were five files in the list and File 3 was active. CTRL+F6 would make File 4 active. SHIFT+CTRL+F6 would make File 2 active.

WinX Data Player dialog box

Figure 424.
WinX Data
Player dialog
box.



The WinX32 Data Playback Snap-In is used to play back in movie mode a multiple-frame image file collected with the WinX32 program. The “movie” is displayed in the standard Data Window.

Parameters and Buttons:

Select WinX Data File: Opens a browser that can be used to select the data file to be viewed. The name of the file appears in the associated text box. Alternatively, the file name can be directly entered in the text box.

Done: Closes the dialog box.

Help: Opens context-sensitive help for the WinX Data Player dialog box.

<<: Sets the view to frame one.

>>: Sets the view to the last frame.

<: Steps the view one frame at a time moving towards the start of the file.

>: Steps the view one frame at a time moving towards the end of the file.

Start: Initiates the movie playback. *This button is named **Stop** while a playback is in progress.*

Stop: Halts a movie playback in progress. *This button is named **Start** when a playback is not taking place.*

Playback Mode: There are three playback modes as follows.

Stop at End: Movie plays through once and then stops.

Loop: Movie plays from beginning to end until halted with **Stop** button.

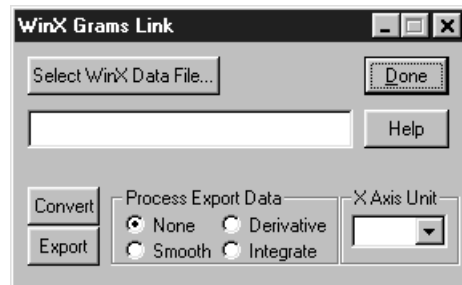
Loop Back and Forth: Movie playback cycles from beginning to end and then from the end to the beginning. Cycling repeats until halted with **Stop** button.

Playback Speed: Determines the playback speed by inserting a delay of the specified interval between each frame. Delay setting appears in the associated box.

Playback Range: Allows a contiguous subset of the frames to be specified. The **Min** and **Max** sliders set the range. The **Playback Selection Only** check box must be checked for the subset to be played. If not checked, all frames are played back.

WinX Grams Link dialog box

Figure 425.
WinX Grams
Link dialog
box.



The WinX32 Grams Snap-In is used to convert or export a WinX32 image file to Grams.

Parameters and Buttons:

Select WinX Data File: Click to open dialog box used to select data file for conversion or export.

Text Box: Used to select the WinX data file path.

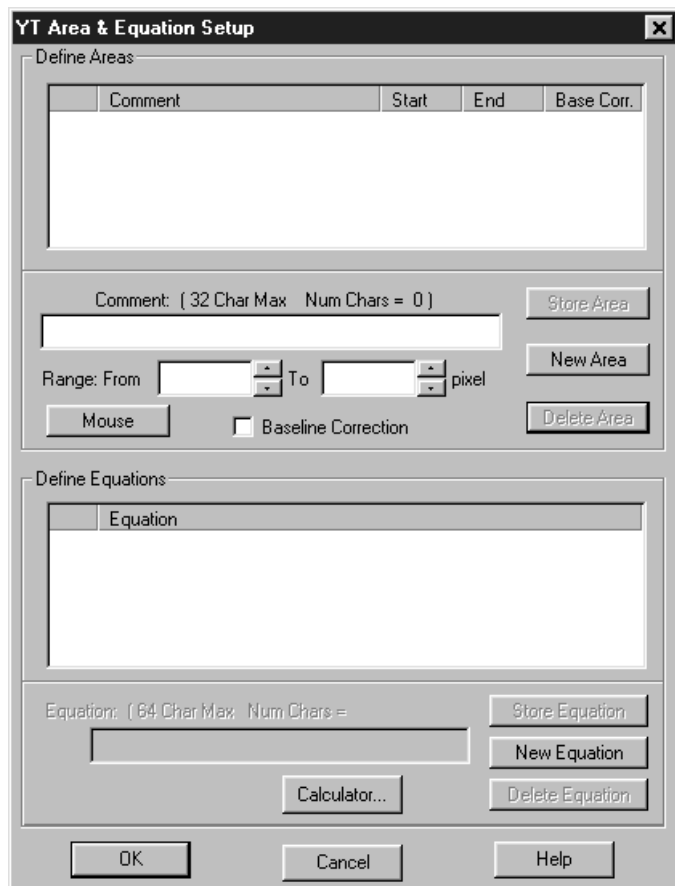
Convert: Click to convert to Grams format.

Export: Click to export to Grams.

Process Export Data radio buttons: Export with data processing options, **Smooth**, **Derivative** or **Integrate**.

Y:T Area and Equation Setup dialog box

Figure 426.
Y:T Area and
Equation Setup
dialog box.



This dialog box is used to define the areas and equations to be used in performing Y:T analysis of spectral data as it is acquired. There can be as many as eight areas and four equations. For any given analysis, you can use previously stored equations or define new ones. Note that Y:T analysis will not take place unless the Y:T check box on the Experiment Setup **Processes** dialog box is checked. Descriptions of the Y:T Area and Equation Setup dialog box parameters and buttons follow.

Parameters and Buttons:

Define Areas

Area Listing Box: Observing Figure 426, note the large upper box in the **Define Areas** section of the window. The left-most item for each area listing is the Area designator, A_n , where n is an integer in the range of 1 to 8. To the right of the designator is space for a user comment, which can be as long as 32 characters. To the right of the user comment are the X Start and End points. The last space is used to indicate whether Baseline Correction is to be implemented for that area, either **Yes** or **No**. Note that information cannot be directly entered in the box. The definition is actually performed using the boxes and buttons directly beneath the Area Listing box. Once the definition is complete, it will appear in the listing box.

Note: An asterisk appearing before an area designator, e.g. *A2, indicates that the range of A2 is outside the wavelength calibrated range of the detector.

New Area button: The first step in defining an area is to press the **New Area** button, necessary before the area parameters can be defined. Note that clicking on New Area doesn't cause an immediate change in the listing box. Newly entered area information doesn't appear there until the **Store Area** button is pressed. Ordinarily you wouldn't do that until all of the parameters for the area have been specified.

Comment box: A user defined comment as long as 32 characters can be keyed as part of the area definition process. The comment will appear in the area listing box when **Store Area** is pressed. Once the comment has been keyed, simply click in the left **Range From** box or click on the keyboard Tab key to move the data entry cursor to the left **Range From** entry box so that the range can be specified.

Range From: These two boxes are used to specify the X range of the area. The left box is used to specify the start of the range and the right box is used to specify the end of the range. The units are those specified in the spectrograph **Calibration Usage** dialog box. Making both the start and end values the same defines an area of one data point. Note that the area range is always stored internally in wavelength units. This assures that, if the area is used for Y:T analysis on ROIs spanning different pixel range, the starting and ending wavelengths for the area range will remain correct. In the same manner as for the other parameters, the values entered don't appear in the area listing box until the **Store Area** button is pressed.

Mouse: The area range can also be specified using the mouse. To do this, display a data set and use the mouse to delineate a rectangular data region on the data. The height of the rectangle is not important. Only the X dimensions are of interest, although for reasons of convenience you may wish to position the rectangle on a peak or at some other location. It is generally helpful to have the **Information** box displayed at the same time so you can see the precise values of the start and end points for the range. When satisfied that the rectangular region correctly spans the region of interest, click the button labeled **Mouse** in the Y:T Area and Equation Setup dialog box. The mouse selected start and end points will then appear in the Range From boxes and will be copied to the area list box when the **Store Area** button is pressed.

Baseline Correction: The value of each area is the sum of the intensities over the area's specified range. The value of an area can be calculated using the intensity heights with respect to the baseline or using the intensity heights with respect to a straight line segment drawn between the start and end points of the specified range. The latter results in a corrected area which is the part of the total area above this line. **Baseline Correction** gives more accurate results on sloping baselines.

Baseline correction is calculated by taking the uncorrected value of the area and subtracting the area below the baseline. This calculation may be expressed as:

$$Correction_{Base} = Area_U - \frac{C_{First} + C_{Last}}{2} \times Pixels$$

Where:

Area_U is the uncorrected value of the area.

C_{First} is the first channel of the specified range.

C_{Last} is the last channel of the specified range.

Pixels is the number of pixels in the area.

Store Area button: Once the area parameters have been keyed, the **Store Area** button is used to store them and cause them to appear in the area listing box. If you click on the **OK** key and close the window without first pressing the **Store Area** button, the entries for the area will not be stored and the area will not be available for Y:T analysis.

Note: The parameters for an area can be changed by clicking on that area's designator in the area listing box and then keying new values for the parameter to be changed. The changes do not take effect until the **Store Area** button is pressed.

Delete Area button: Areas defined and listed in the area listing box can be deleted using this button. To delete an area, simply click on the area's designator in the area listing box and press the **Delete Area** button. Then you must press **OK** to close the box and assure that the deleted area will be gone when the software is next booted.

Define Equations

Equation Listing Box: Observing Figure 426, note the large box in the **Define Equations** section of the window. Each defined and stored equation is listed here. Equations can include areas, constants, parentheses, operands and *even other equations*. The left-most item for each equation listing is the Equation designator, E_n, where *n* is an integer in the range of 1 to 4.

Note: An asterisk appearing before an equation designator, e.g. *E3, indicates that E3 contains areas that lie outside the calibration range of the detector.

To the right of the designator is the space allocated for the equation, which can be up 64 characters in length. This includes space for a user comment. Optional user comments are inserted by entering a colon ":" after the equation and then keying the comment text. Expressions for the equation are keyed into the text entry box located below the listing box. For example, suppose two areas, A1 and A2, had been defined, and you wished define the equation E1=A1+A2, followed by the comment, "This is a test." The sequence would be:

- ◆ Click on the **New Equation** button.
- ◆ Click in the text entry box below the equation listing box to insert the text cursor.
- ◆ Key "A1+A2: This is a test." (do not key the quotation marks)

- ◆ Click on the **Store Equation** button. The new equation, with the comment, would appear in the equation listing box.
- ◆ Click on **OK** to close the window and make the equation available for Y:T analysis. Note that this equation would be stored so that it would also be available the next time the software is booted.

New Equation button: The first step in defining an equation is to press the **New Equation** button, necessary before the equation parameters can be defined. Note that clicking on **New Equation** doesn't cause an immediate change in the listing box. A newly keyed equation doesn't appear there until the **Store Equation** button is pressed. Ordinarily you wouldn't do that until all of the expressions for the equation have been specified.

Store Equation button: Once the equation expressions have been keyed, the **Store Equation** button is used to store them and cause them to appear in the equation listing box. If you click on the **OK** key without first pressing the **Store Equation** button, the entries for the equation will not be stored and that equation will not be available for Y:T analysis.

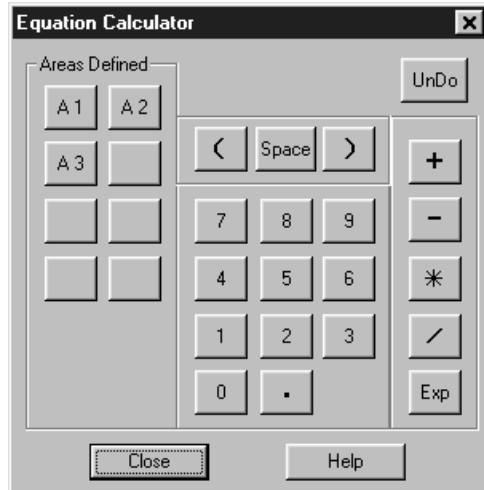
Note: The expressions for an equation can be changed by clicking on that equation's designator in the equation listing box and then keying new values for the parameter to be changed. The changes do not take effect until the **Store Equation** button is pressed.

Delete Equation button: Equations defined and listed in the equation listing box can be deleted using this button. To delete an equation, simply click on the equation's designator in the equation listing box and press the **Delete Equation** button.

Calculator button: This button opens the **Equation Calculator** as shown in Figure 427. This calculator offers an alternative way of defining equations. Note that eight buttons are provided for defined areas. As areas are defined, these buttons become labeled A1 through A8 to indicate which button calls which area. The numerical keypad used to specify constants provides 0 through 9, parentheses, a space and a decimal point. To the right are the five operands, + (addition), - (subtraction), *(multiplication), /(division) and Exp (exponent). Also provided are Undo, Close and Help.

In using the calculator, you should press the **New Equation** button first, then the **Calculator** button. As the equation is keyed with the calculator, the expressions will appear in the text entry box beneath the equation listing box. On completing the definition, close the calculator and press **Store Equation** to transfer the equation to the equation listing box, completing the definition.

Figure 427.
Equation
Calculator.



Y:T Areas and Equation Setup Window Control Buttons:

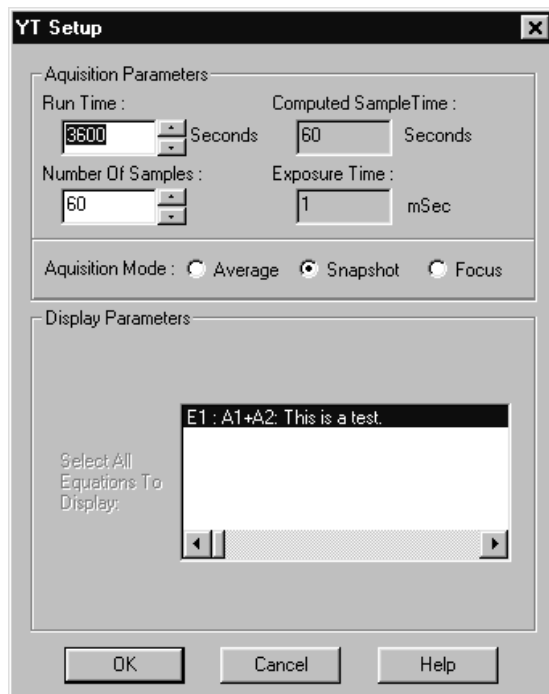
OK: Closes the window. When the program is shut down, all defined areas and equations will be stored on disk so that they will be available the next time the software is booted.

Cancel: Closes the window without retaining any of the definitions and changes.

Help: Opens context sensitive help for the window.

Y:T Setup dialog box

Figure 428.
Y:T Setup
dialog box.



The Y:T Setup dialog box (Figure 428) settings determine how the Y:T analysis will be performed using the areas and equations defined via the **Y:T Areas and Equations Setup** dialog box (page 480). The Y:T Setup dialog box contains four text boxes and three radio buttons. Of the four text boxes, only **Run Time** and **Number of Samples** are user entries. Computed **Sample Time** and **Exposure Time** are reported values only. The radio buttons set the Y:T acquisition mode, **Average**, **Snapshot** and **Focus**. If **Focus** mode is selected, the upper two text boxes, **Run time** and **Computed Sample Time** are not displayed. These parameters and selections are discussed in the following paragraphs.

Acquisition Modes

Focus: In this mode the user sets the Y:T **Number of Samples** only. The Exposure Time indication is simply that set on the Experiment Setup **Main** tab page. For example, suppose you had established two areas, A1 and A2, and one equation $E1 = A1 + A2$. A1 would be the sum of the intensities over one specified range of data points and A2 the sum of the intensities over a second specified range of data points on the spectrum. Adding the two together yields one value for E1. Assume a Number of Samples value of 1,000. On starting data acquisition, for each and every acquired data set, the Equation E1 calculations would be performed and the resulting Y:T value stored. This process would continue until the specified Y:T **Number of Samples** have been taken, or until the data acquisition is terminated. *Once the specified number of Y:T points have been calculated and stored, data sets will continue to be taken according to the Experiment Setup parameters but no more YT calculations will be performed.* There would be 1,000 points in the Y:T curve, each equal to $A1 + A2$. The data set(s) and the Y:T curve would be displayed in separate windows. If multiple equations had been defined, they would be computed in order and there would be a separate Y:T curve for each. Selecting 3D Graph on the Display Layout Main page would allow all five to be viewed simultaneously. If the selection is Graph, only one would be visible. The keyboard cursor up/down arrow keys can be used to select the Y:T curve to be viewed.

An advantage of Focus mode is that no data is missed. A disadvantage is that the amount of Y:T data stored can quickly become quite large, and much of it might be of limited value when studying a process that is changing slowly. Focus mode can be quite useful for making an initial evaluation of a process. Inspection of the Y:T focus-mode results might then suggest more productive Y:T analyses that could then be made using either the Snapshot mode or the Average mode.

Snapshot: In this mode the user sets the Y:T **Run Time** and the Y:T **Number of Samples** that will be taken. The Snapshot mode allows convenient Y:T analyses of long processes to be easily performed. Although data might be taken at short intervals for a long period of time, a Y:T analysis is only done on the most recent data set at specified intervals. Most of the data sets taken over the course of the experiment are skipped. For Y:T analysis purposes, you only have access to the first strip of data if acquiring multiple strips.

To better understand this process, assume an experiment designed to characterize a process that will take about an hour. Assume a 0.1 s Exposure Time and a repetition rate that is high relative to the Y:T Sample Time. Since the experiment is expected to last an hour, a reasonable Y:T Run Time setting might

be 3600 seconds. Further suppose that you wanted each Y:T curve to be 60 points long, accomplished by setting the Y:T Number of Samples to 60. The Calculated Sample Time would then be 60 seconds. In other words, a Y:T calculation would be performed on the most recent single data set at the end of each minute, regardless of how many data sets were acquired during that minute.

Note: The Computed Sample Time (interval between Y:T calculations) indication does not update instantly when the Run Time and Number of Samples are keyed. To force the update, modify Run Time, and then either press the Tab key or click on another control.

On starting data acquisition, after one minute, the first Y:T analysis would be made, with one Y:T value computed for each equation defined. The timer would reset to zero and begin counting the second minute. At the end of that minute the second Y:T value would be computed for each equation defined. This process would continue for 3600 seconds (one hour). At the end of that time n Y:T curves, n being the number of equations, each 100 points in length, will have been acquired and stored. These could be displayed in the same manner as for the Y:T Focus mode, previously described. As was the case for the Focus mode, data acquisition will continue until terminated.

Average: In this mode, as in the Snapshot mode, the user sets the Y:T **Run Time** and the Y:T **Number of Samples** that will be taken. Also, as in the Snapshot mode, the Average mode allows convenient Y:T analyses of long processes to be easily performed. Unlike the Snapshot mode, however, *no data is skipped*, even though only the specified number of Y:T calculations are performed at the computed intervals. The difference is that *all* of the acquired data is stored in a buffer space over each interval. When the Y:T calculation is performed, it is done on the *average* of all the data acquired over the preceding interval. For example, if doing a one hour run with once a minute Y:T calculations, the data buffer would store all of the data acquired for one minute. Then the Y:T computations would be done on the average of the stored data to develop one Y:T point for each equation. After that the buffer would be cleared and data storage for the next interval would begin anew. As with the Focus and Snapshot modes, for Y:T analysis purposes, if there is more than one data strip, only the first data one is available for Y:T analysis purposes.

At the end of our hypothetical one hour run, n Y:T curves, n being the number of equations, each 100 points in length, will have been acquired and stored. These could be displayed in the same manner as for the Y:T Focus and Snapshot modes, previously described. As is the case for the Focus and Snapshot modes, data acquisition will continue until terminated.

Note: Generally data acquisition does not occur at exactly even times. With a 0.1 second exposure time, there is still the readout time for each data set to consider. In reality, the Y:T point will be calculated from the first data set processed on or after the Y:T sample time expires. The actual time the Y:T sample is taken is read using the system clock relative to the start of data acquisition, and the *times are stored with the Y:T data as the last Y:T curve*. Since data acquisition is done using DMA under the timing of the detector controller, the timing coming into the DMA buffer is very precise. However, Y:T time is taken as the data is transferred from the DMA buffer and processed for background subtraction and flat field. This is under the program control and may be less precise; for longer sample times, this will probably not be noticeable.

Y:T Setup Window Control Buttons:

OK: Closes the window. When the program is shut down, all defined areas and equations will be stored on disk so that they will be available the next time the software is booted.

Cancel: Closes the window without retaining any of the definitions and changes.

Help: Opens context sensitive help for the window.

Zap to Grams

This selection on the Tools menu transfers the data set in the active window directly to Grams. *The Grams software must already be open.*

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Appendix A

Calibration Lines

MERCURY	184.91	226.22	302.15	404.66*	507.30*	625.14	730.04	
	194.17	237.83	312.57*	407.78	(2x253.65)	(2x312.57)	(2x365.02)	
		248.20	313.17	434.75				
		253.65**	334.15	435.84*	546.07*	626.34	760.95	
		265.20	365.02*		576.96	(2x313.17)	(3x253.65)	
		280.35	365.44		579.07			
		289.36	366.33					
		296.73						
ARGON			394.90	404.44		696.54*	706.72	800.62
				415.86*			727.29	801.48
				416.42			738.40	810.37
				418.19			750.39	811.53*
				419.10			751.46	826.45
				420.07*			763.51**	840.82
				425.94			772.38*	842.46
				427.22			794.82	
				430.01				
				433.36				
NEON			336.99		533.08	603.00	702.41	837.76
			341.79		534.11	607.43	703.24*	849.54
			344.77		540.06	609.62*	705.91	863.46
			346.66		585.25**	614.31*	717.39	865.44
			347.26		588.19	616.36	724.52	878.20
			352.05*		594.48	621.73	743.89	878.38
			359.35		597.55	626.65	748.89	885.39
						630.48	753.58	
						633.44	754.41	
						638.30*		
						640.23*		
						650.65*		
						653.29		
						659.90		
						667.83*		
						671.70		
					692.95			

100

200

300

400

500

600

700

800

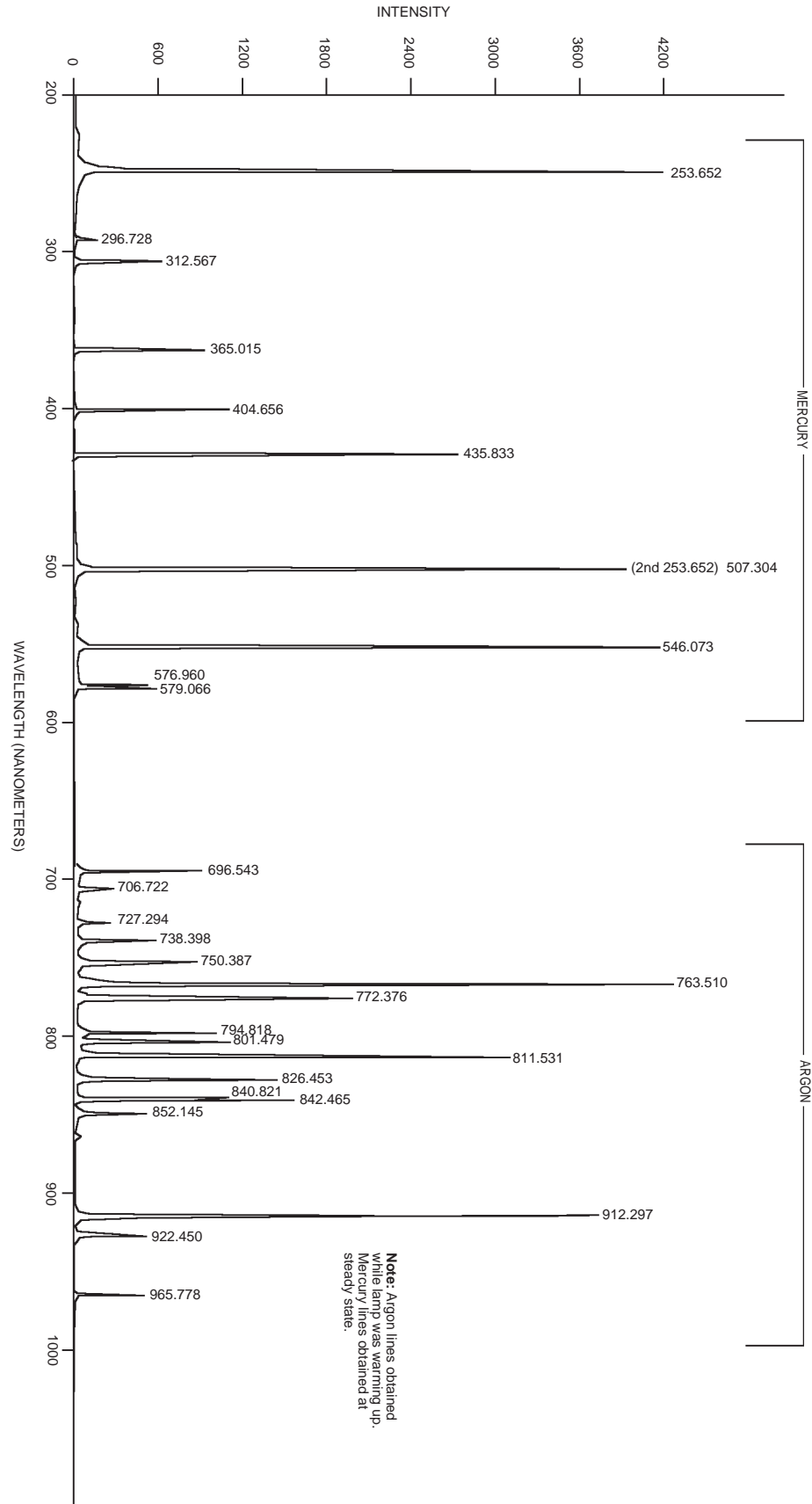
Table 2. Wavelength Calibration Lines (in nanometers)

* indicates strong line within a wavelength group

**indicates strongest line for the element

() indicates 2nd or 3rd order

Figure 429.
Wavelength
calibration
spectrum.



Appendix B

Data Structure

Version 1.43 Header

All WinView or WinSpec files (version 1.43) must begin with the following 4100 byte header:

```
typedef WINKHEAD {
0      int dioden;          /* CCD X dimension.          */
2      int avgexp;         /* Not used by WinView      */
4      int exposure;      /* exposure if -1 see lexpos */
6      int datarange;     /* Not used by WinView      */
8      int mode;          /* Not used by WinView      */
10     float wexsy;        /* Not used by WinView      */
14     int asyavg;         /* Not used by WinView      */
16     int asyseq;         /* Not used by WinView      */
18     int linefreq;      /* Not used by WinView      */
20     int date0;         /* Not used by WinView      */
22     int date1;         /* Not used by WinView      */
24     int date2;         /* Not used by WinView      */
26     int date3;         /* Not used by WinView      */
28     int date4;         /* Not used by WinView      */
30     int ehour;         /* Not used by WinView      */
32     int eminute;       /* Not used by WinView      */
34     int noscan;        /* # of stripes collected if -1 see
                          /* lnoscan.                  */
36     int fastacc;       /* Not used by WinView      */
38     int avgtime;       /* Not used by WinView      */
40     int dmatotal;      /* Not used by WinView      */
42     int faccount;      /* X dimension : Actual dim of image. */
44     int stdiode;       /* Not used by WinView      */
46     float nanox;       /* Not used by WinView      */
50     float calibdio[10]; /* Not used by WinView      */
90     char fastfile[16]; /* fast access file. Not used by WinView */
106    int asynen;        /* Not used by WinView      */
108    int datatype;      /* 0 -> float (4 byte)
                          /* 1 -> long integer (4 byte)
                          /* 2 -> integer (2 byte)
                          /* 3 -> unsigned integer (2 byte)
                          /* 4 -> String/char (1 byte)
                          /* 5 -> double (8 bytes) Not implemented
                          /* 6 -> byte (1 byte)
                          /* 7 -> unsigned byte (1 byte)
110    float calibnan[10]; /* Not used by WinView      */
```

```

150         int rtanum;           /* Not used by WinView          */
152         int astdiode;        /* Not used by WinView          */
154         int int78;          /* Not used by WinView          */
156         int int79;          /* Not used by WinView          */
158         double calibpol[4];  /* Not used by WinView          */
190         int int96;          /* Not used by WinView          */
192         int int97;          /* Not used by WinView          */
194         int int98;          /* Not used by WinView          */
196         int int99;          /* Not used by WinView          */
198         int int100;         /* Not used by WinView          */
200         char exprem[5][80];  /* comments                      */
600         int int301;         /* Not used by WinView          */
602         char label[16];     /* Not used by WinView          */
618         int gsize;         /* Not used by WinView          */
620         int lfloat;         /* Not used by WinView          */
622         char califile[16];  /* calibration file. Not used by WinView */
638         char bkgdfile[16]; /* background file. Not used by WinView */
654         int srccmp;        /* Not used by WinView          */
656         int stripe;        /* number of stripes per frame   */
658         int scramble;      /* 0 - scramble, 1 - unscramble  */
660         long lexpos;       /* exposure val 32-bits(when exposure=-1) */
664         long lnoscan;      /* no. of scan 32-bits(when noscan = -1) */
668         long lavgexp;     /* no. of accum 32-bits(when avgexp = -1) */
672         char stripfil[16]; /* strip file. Not used by WinView */
688         char version[16]; /* SW version & date "01.000 02/01/90" */
704         int controller_type; /* 1-new st120, 2-old st120,
                               /* 3-st130 type 1, 4-st130 type 2,
                               /* 5-st138, 6-DC131, and ST133.
                               */

/* YT_FILE_HEADER */
/* The YT variables are not used by WinView.
int     yt_file_defined;    /* set TRUE for YT data file
708     int     yt_fh_calib_mode; /* calibration type
710     int     yt_fh_calib_type; /* time-unit (calibration type)
712     int     yt_fh_element[12]; /* element number
736     double  yt_fh_calib_data[12]; /* data
832     float   yt_fh_time_factor; /* time-factor
836     float   yt_fh_start_time; /* start time
840     int     reverse_flag; /* set to 1 if data should be
                               /* reversed, 0 don't reverse
};

```

Version 1.6 Header

All WinView/WinSpec files (version1.6) and WinView/32 and WinSpec/32 data files must begin with the following 4100 byte header. Data files created under previous versions of WinView/WinSpec *can still be read correctly*. However, files created under the new versions (1.6 and higher) **cannot** be read by previous versions of WinView/WinSpec.

Header Structure Listing

Decimal Byte

		Offset		

unsigned int	dioden;	/*	0	num of physical pixels (X axis) */
int	avgexp;	/*	2	number of accumulations per scan */
		/*		if > 32767, set to -1 and */
		/*		see lavgexp below (668) */
int	exposure;	/*	4	exposure time (in milliseconds) */
		/*		if > 32767, set to -1 and */
		/*		see lexpos below (660) */
unsigned int	xDimDet;	/*	6	Detector x dimension of chip */
int	mode;	/*	8	timing mode */
float	exp_sec;	/*	10	alternative exposure, in secs. */
int	asyavg;	/*	14	number of asynchron averages */
int	asyseq;	/*	16	number of asynchron sequential */
unsigned int	yDimDet;	/*	18	y dimension of CCD or detector. */
char	date[10];	/*	20	date as MM/DD/YY */
int	ehour;	/*	30	Experiment Time: Hours (as binary) */
int	eminute;	/*	32	Experiment Time: Minutes(as binary)*/
int	noscan;	/*	34	number of multiple scans */
		/*		if noscan == -1 use lnoscan */
int	fastacc;	/*	36	*/
int	seconds;	/*	38	Experiment Time: Seconds(as binary)*/
int	DetType;	/*	40	CCD/DiodeArray type */
unsigned int	xdim;	/*	42	actual # of pixels on x axis */
int	stdiode;	/*	44	trigger diode */
float	nanox;	/*	46	*/
float	calibdio[10];	/*	50	calibration diodes */
char	fastfile[16];	/*	90	name of pixel control file */
int	asynen;	/*	106	asynchron enable flag 0 = off */
int	datatype;	/*	108	experiment data type */
		/*		0 = FLOATING POINT */
		/*		1 = LONG INTEGER */
		/*		2 = INTEGER */
		/*		3 = UNSIGNED INTEGER */
float	calibnan[10];	/*	110	calibration nanometer */
int	BackGrndApplied;	/*	150	set to 1 if background sub done */
int	astdiode;	/*	152	*/
unsigned int	minblk;	/*	154	min. # of strips per skips */
unsigned int	numminblk;	/*	156	# of min-blocks before geo skps */
double	calibpol[4];	/*	158	calibration coefficients */
		*/		
unsigned int	ADCrate;	/*	190	ADC rate */
unsigned int	ADctype;	/*	192	ADC type */
unsigned int	ADCresolution;	/*	194	ADC resolution */
unsigned int	ADCbitAdjust;	/*	196	ADC bit adjust */
unsigned int	gain;	/*	198	gain */
char	exprem[5][80];	/*	200	experiment remarks */
unsigned int	geometric;	/*	600	geometric operations rotate 0x01 */
		/*		reverse 0x02, flip 0x04 */
char	xlabel[16];	/*	602	Intensity display string */
unsigned int	cleans;	/*	618	cleans */
unsigned int	NumSkpPerCln;	/*	620	number of skips per clean. */
char	califile[16];	/*	622	calibration file name (CSMA) */
char	bkgdfile[16];	/*	638	background file name */

```

int          srccmp;          /* 654 number of source comp. diodes */
unsigned int ydim;           /* 656 y dimension of raw data. */
int          scramble;      /* 658 0 = scrambled, 1 = unscrambled */
long        lexpos;         /* 660 long exposure in milliseconds */
/*          used if exposure set to -1 */
long        lnoscan;        /* 664 long num of scans */
/*          used if noscan set to -1 */
long        lavgexp;        /* 668 long num of accumulations */
/*          used if avgexp set to -1 */
char        stripfil[16];   /* 672 stripe file (st130) */
char        version[16];    /* 688 version & date:"01.000 02/01/90" */
int         type;           /* 704 1 = new120 (Type II) */
/*          2 = old120 (Type I ) */
/*          3 = ST130 */
/*          4 = ST121 */
/*          5 = ST138 */
/*          6 = DC131 (PentaMAX) */
/*          7 = ST133 (MicroMAX/SpectroMax), */
/*          8 = ST135 (GPIB) */
/*          9 = VICCD */
/*          10 = ST116 (GPIB) */
/*          11 = OMA3 (GPIB) */
/*          12 = OMA4 */
int         flatFieldApplied; /* 706 Set to 1 if flat field was applied */
int         spare[8];       /* 708 reserved */
int         kin_trig_mode   /* 724 Kinetics Trigger Mode */
char        empty[702];    /* 726 EMPTY BLOCK FOR EXPANSION */
float       clkspd_us;     /* 1428 Vert Clock Speed in micro-sec */
int         HWaccumFlag;   /* 1432 set to 1 if accum done by Hardware */
int         StoreSync;    /* 1434 set to 1 if store sync used. */
int         BlemishApplied; /* 1436 set to 1 if blemish removal applied */
int         CosmicApplied; /* 1438 set to 1 if cosmic ray removal done */
int         CosmicType;    /* 1440 if cosmic ray applied, this is type */
float       CosmicThreshold; /* 1442 Threshold of cosmic ray removal. */
long        NumFrames;     /* 1446 number of frames in file. */
float       MaxIntensity;  /* 1450 max intensity of data (future) */
float       MinIntensity;  /* 1454 min intensity of data (future) */
char        ylabel[LABELMAX]; /* 1458 y axis label. */
unsigned int ShutterType;  /* 1474 shutter type. */
float       shutterComp;   /* 1476 shutter compensation time. */
unsigned int readoutMode;  /* 1480 Readout mode, full, kinetics, etc. */
*/
unsigned int WindowSize;  /* 1482 window size for kinetics only. */
unsigned int clkspd;      /* 1484 clock speed for kinetics & */
/*          frame transfer. */
unsigned int interface_type; /* 1486 computer interface (isa-taxi, */
/*          pci, eisa, etc.) */
unsigned long ioAdd1;     /* 1488 I/O address of interface card. */
unsigned long ioAdd2;     /* 1492 if more than one address for card. */
unsigned long ioAdd3;     /* 1496 */
unsigned int intLevel;    /* 1500 interrupt level interface card */
unsigned int GPIBadd;     /* 1502 GPIB address (if used) */
unsigned int ControlAdd;  /* 1504 GPIB controller address (if used) */
unsigned int controllerNum; /* 1506 if multiple controller system will */

```

```

/*      have controller # data came from. */
/*      (Future Item) */
unsigned int  SWmade; /* 1508 Software which created this file */
int          NumROI; /* 1510 number of ROIs used. if 0 assume 1 */
/* 1512 - 1630 ROI information */
struct ROIinfo {
/*      */
  unsigned int startx; /* left x start value. */
  unsigned int endx; /* right x value. */
  unsigned int groupx; /* amount x is binned/grouped in hw. */
  unsigned int starty; /* top y start value. */
  unsigned int endy; /* bottom y value. */
  unsigned int groupy; /* amount y is binned/grouped in hw. */
} ROIinfoblk[10]; /*      ROI Starting Offsets: */
/*      ROI 1 = 1512 */
/*      ROI 2 = 1524 */
/*      ROI 3 = 1536 */
/*      ROI 4 = 1548 */
/*      ROI 5 = 1560 */
/*      ROI 6 = 1572 */
/*      ROI 7 = 1584 */
/*      ROI 8 = 1596 */
/*      ROI 9 = 1608 */
/*      ROI 10 = 1620 */
char          FlatField[120]; /* 1632 Flat field file name. */
char          background[120]; /* 1752 Background sub. file name. */
char          blemish[120]; /* 1872 Blemish file name. */
float         software_ver; /* 1992 Software version. */
char          UserInfo[1000]; /* 1996-2995 user data. */
long          WinView_id; /* 2996 Set to 0x01234567L if file was */
/*      created by WinX */

```

Calibration Structures

There are three structures for the calibrations

- The Area Inside the Calibration Structure (below) is repeated two times.

```

xcalibration, /* 3000 - 3488 x axis calibration */
ycalibration, /* 3489 - 3977 y axis calibration */

```

Start of X Calibration Structure

```

double        offset; /* 3000 offset for absolute data scaling */
double        factor; /* 3008 factor for absolute data scaling */
char          current_unit; /* 3016 selected scaling unit */
char          reserved1; /* 3017 reserved */
char          string[40]; /* 3018 special string for scaling */
char          reserved2[40]; /* 3058 reserved */
char          calib_valid; /* 3098 flag if calibration is valid */
char          input_unit; /* 3099 current input units for */

```

```

/*      "calib_value"      */
char      polynom_unit;    /* 3100 linear UNIT and used      */
/*      in the "polynom_coeff"      */
char      polynom_order;   /* 3101 ORDER of calibration POLYNOM      */
char      calib_count;     /* 3102 valid calibration data pairs      */
double    pixel_position[10]; /* 3103 pixel pos. of calibration data      */
double    calib_value[10]; /* 3183 calibration VALUE at above pos      */
double    polynom_coeff[6]; /* 3263 polynom COEFFICIENTS      */
double    laser_position;  /* 3311 laser wavenumber for relativ WN      */
char      reserved3;       /* 3319 reserved      */
unsigned char new_calib_flag; /* 3320 If set to 200, valid label below      */
char      calib_label[81]; /* 3321 Calibration label (NULL term'd)      */
char      expansion[87];   /* 3402 Calibration Expansion area      */

```

Start of Y Calibration Structure

```

double    offset;         /* 3489 offset for absolute data scaling      */
double    factor;         /* 3497 factor for absolute data scaling      */
char      current_unit;   /* 3505 selected scaling unit      */
char      reserved1;     /* 3506 reserved      */
char      string[40];     /* 3507 special string for scaling      */
char      reserved2[40];  /* 3547 reserved      */
char      calib_valid;    /* 3587 flag if calibration is valid      */
char      input_unit;    /* 3588 current input units for      */
/*      "calib_value"      */
char      polynom_unit;   /* 3589 linear UNIT and used      */
/*      in the "polynom_coeff"      */
char      polynom_order;  /* 3590 ORDER of calibration POLYNOM      */
char      calib_count;    /* 3591 valid calibration data pairs      */
double    pixel_position[10]; /* 3592 pixel pos. of calibration data      */
double    calib_value[10]; /* 3672 calibration VALUE at above pos      */
double    polynom_coeff[6]; /* 3752 polynom COEFFICIENTS      */
double    laser_position; /* 3800 laser wavenumber for relativ WN      */
char      reserved3;     /* 3808 reserved      */
unsigned char new_calib_flag; /* 3809 If set to 200, valid label below      */
char      calib_label[81]; /* 3810 Calibration label (NULL term'd)      */
char      expansion[87];   /* 3891 Calibration Expansion area      */

```

End of Calibration Structures

```

char      Istring[40];    /* 3978 special Intensity scaling string      */
char      empty3[80];     /* 4018 empty block to reach 4100 bytes      */
int       lastvalue;     /* 4098 Always the LAST value in the header      */

```

WINX Header Structure (with actual offsets)

(12-June-96)

```

dioden ..... 0 0
avgexp ..... 2 2

```


exposure	4	4
xDimDet	6	6
mode	8	8
exp_sec	10	A
asyavg	14	E
asyseq	16	10
yDimDet	18	12
date	20	14
ehour	30	1E
eminute	32	20
noscan	34	22
fastacc	36	24
seconds	38	26
DetType	40	28
xdim	42	2A
stdiode	44	2C
nanox	46	2E
calibdio (10 x float)	50	32
fastfile	90	5A
asynen	106	6A
datatype	108	6C
calibnan (10 x float)	110	6E
BackGrndApplied	150	96
astdiode	152	98
minblk	154	9A
numminblk	156	9C
calibpol (4 x double)	158	9E
ADCrate	190	BE
ADctype	192	C0
ADCresolution	194	C2
ADcbtAdjust	196	C4
gain	198	C6
exprem[0] (comment 1)	200	C8
exprem[1] (comment 2)	280	118
exprem[2] (comment 3)	360	168
exprem[3] (comment 4)	440	1B8
exprem[4] (comment 5)	520	208
geometric	600	258
xlabel	602	25A
cleans	618	26A
NumSkpPerCln	620	26C
califile	622	26E
bkgdfile	638	27E
srccmp	654	28E
ydim	656	290
scramble	658	292
lexpos	660	294
lnoscan	664	298
lavgexp	668	29C
stripfil	672	2A0
version	688	2B0
type	704	2C0
flatFieldApplied	706	2C2
spare	708	2C4
kin_trig_mode	724	2D4
empty	726	2D6
clkspd_us	1428	594
HWaccumFlag	1432	598
StoreSync	1434	59A
BlemishApplied	1436	59C
CosmicApplied	1438	59E
CosmicType	1440	5A0
CosmicThreshold	1442	5A2
NumFrames	1446	5A6
MaxIntensity	1450	5AA
MinIntensity	1454	5AE

ylabel	1458	5B2
ShutterType	1474	5C2
shutterComp	1476	5C4
readoutMode	1480	5C8
WindowSize	1482	5CA
clkspd	1484	5CC
interface_type	1486	5CE
ioAdd1	1488	5D0
ioAdd2	1492	5D4
ioAdd3	1496	5D8
intLevel	1500	5DC
GPIBadd	1502	5DE
ControlAdd	1504	5E0
controllerNum	1506	5E2
SWmade	1508	5E4
NumROI	1510	5E6
ROIinfoblk[1] - startx	1512	5E8
ROIinfoblk[1] - endx	1514	5EA
ROIinfoblk[1] - groupx	1516	5EC
ROIinfoblk[1] - starty	1518	5EE
ROIinfoblk[1] - endy	1520	5F0
ROIinfoblk[1] - groupy	1522	5F2
ROIinfoblk[2] - startx	1524	5F4
ROIinfoblk[2] - endx	1526	5F6
ROIinfoblk[2] - groupx	1528	5F8
ROIinfoblk[2] - starty	1530	5FA
ROIinfoblk[2] - endy	1532	5FC
ROIinfoblk[2] - groupy	1534	5FE
ROIinfoblk[3] - startx	1536	600
ROIinfoblk[3] - endx	1538	602
ROIinfoblk[3] - groupx	1540	604
ROIinfoblk[3] - starty	1542	606
ROIinfoblk[3] - endy	1544	608
ROIinfoblk[3] - groupy	1546	60A
ROIinfoblk[4] - startx	1548	60C
ROIinfoblk[4] - endx	1550	60E
ROIinfoblk[4] - groupx	1552	610
ROIinfoblk[4] - starty	1554	612
ROIinfoblk[4] - endy	1556	614
ROIinfoblk[4] - groupy	1558	616
ROIinfoblk[5] - startx	1560	618
ROIinfoblk[5] - endx	1562	61A
ROIinfoblk[5] - groupx	1564	61C
ROIinfoblk[5] - starty	1566	61E
ROIinfoblk[5] - endy	1568	620
ROIinfoblk[5] - groupy	1570	622
ROIinfoblk[6] - startx	1572	624
ROIinfoblk[6] - endx	1574	626
ROIinfoblk[6] - groupx	1576	628
ROIinfoblk[6] - starty	1578	62A
ROIinfoblk[6] - endy	1580	62C
ROIinfoblk[6] - groupy	1582	62E
ROIinfoblk[7] - startx	1584	630
ROIinfoblk[7] - endx	1586	632
ROIinfoblk[7] - groupx	1588	634
ROIinfoblk[7] - starty	1590	636
ROIinfoblk[7] - endy	1592	638
ROIinfoblk[7] - groupy	1594	63A
ROIinfoblk[8] - startx	1596	63C
ROIinfoblk[8] - endx	1598	63E
ROIinfoblk[8] - groupx	1600	640
ROIinfoblk[8] - starty	1602	642
ROIinfoblk[8] - endy	1604	644
ROIinfoblk[8] - groupy	1606	646
ROIinfoblk[9] - startx	1608	648
ROIinfoblk[9] - endx	1610	64A

ROIinfoblk[9] - groupx	1612	64C
ROIinfoblk[9] - starty	1614	64E
ROIinfoblk[9] - endy	1616	650
ROIinfoblk[9] - groupy	1618	652
ROIinfoblk[10] - startx	1620	654
ROIinfoblk[10] - endx	1622	656
ROIinfoblk[10] - groupx	1624	658
ROIinfoblk[10] - starty	1626	65A
ROIinfoblk[10] - endy	1628	65C
ROIinfoblk[10] - groupy	1630	65E
FlatField	1632	660
background	1752	6D8
blemish	1872	750
software_ver	1992	7C8
UserInfo	1996	7CC
WinView_id	2996	BB4
X Calib: offset	3000	BB8
X Calib: factor	3008	BC0
X Calib: current_unit	3016	BC8
X Calib: reserved1	3017	BC9
X Calib: string	3018	BCA
X Calib: reserved2	3058	BF2
X Calib: calib_valid	3098	C1A
X Calib: input_unit	3099	C1B
X Calib: polynom_unit	3100	C1C
X Calib: polynom_order	3101	C1D
X Calib: calib_count	3102	C1E
X Calib: pixel_position[1]	3103	C1F
X Calib: pixel_position[2]	3111	C27
X Calib: pixel_position[3]	3119	C2F
X Calib: pixel_position[4]	3127	C37
X Calib: pixel_position[5]	3135	C3F
X Calib: pixel_position[6]	3143	C47
X Calib: pixel_position[7]	3151	C4F
X Calib: pixel_position[8]	3159	C57
X Calib: pixel_position[9]	3167	C5F
X Calib: pixel_position[10]	3175	C67
X Calib: calib_value[1]	3183	C6F
X Calib: calib_value[2]	3191	C77
X Calib: calib_value[3]	3199	C7F
X Calib: calib_value[4]	3207	C87
X Calib: calib_value[5]	3215	C8F
X Calib: calib_value[6]	3223	C97
X Calib: calib_value[7]	3231	C9F
X Calib: calib_value[8]	3239	CA7
X Calib: calib_value[9]	3247	CAF
X Calib: calib_value[10]	3255	CB7
X Calib: polynom_coeff[1]	3263	CBF
X Calib: polynom_coeff[2]	3271	CC7
X Calib: polynom_coeff[3]	3279	CCF
X Calib: polynom_coeff[4]	3287	CD7
X Calib: polynom_coeff[5]	3295	CDF
X Calib: polynom_coeff[6]	3303	CE7
X Calib: laser_position	3311	CEF
X Calib: reserved3	3319	CF7
X Calib: new_calib_flag	3320	CF8
X Calib: calib_label	3321	CF9
X Calib: expansion	3402	D4A
Y Calib: offset	3489	DA1
Y Calib: factor	3497	DA9
Y Calib: current_unit	3505	DB1
Y Calib: reserved1	3506	DB2
Y Calib: string	3507	DB3
Y Calib: reserved2	3547	DDB
Y Calib: calib_valid	3587	E03
Y Calib: input_unit	3588	E04

Y Calib: polynom_unit	.....	3589	E05
Y Calib: polynom_order	.....	3590	E06
Y Calib: calib_count	.....	3591	E07
Y Calib: pixel_position[1]	....	3592	E08
Y Calib: pixel_position[2]	....	3600	E10
Y Calib: pixel_position[3]	....	3608	E18
Y Calib: pixel_position[4]	....	3616	E20
Y Calib: pixel_position[5]	....	3624	E28
Y Calib: pixel_position[6]	....	3632	E30
Y Calib: pixel_position[7]	....	3640	E38
Y Calib: pixel_position[8]	....	3648	E40
Y Calib: pixel_position[9]	....	3656	E48
Y Calib: pixel_position[10]	...	3664	E50
Y Calib: calib_value[1]	.....	3672	E58
Y Calib: calib_value[2]	.....	3680	E60
Y Calib: calib_value[3]	.....	3688	E68
Y Calib: calib_value[4]	.....	3696	E70
Y Calib: calib_value[5]	.....	3704	E78
Y Calib: calib_value[6]	.....	3712	E80
Y Calib: calib_value[7]	.....	3720	E88
Y Calib: calib_value[8]	.....	3728	E90
Y Calib: calib_value[9]	.....	3736	E98
Y Calib: calib_value[10]	.....	3744	EA0
Y Calib: polynom_coeff[1]	....	3752	EA8
Y Calib: polynom_coeff[2]	....	3760	EB0
Y Calib: polynom_coeff[3]	....	3768	EB8
Y Calib: polynom_coeff[4]	....	3776	EC0
Y Calib: polynom_coeff[5]	....	3784	EC8
Y Calib: polynom_coeff[6]	....	3792	ED0
Y Calib: laser_position	.....	3800	ED8
Y Calib: reserved3	.....	3808	EE0
Y Calib: new_calib_flag	.....	3809	EE1
Y Calib: calib_label	.....	3810	EE2
Y Calib: expansion	.....	3891	F33
Istring	.....	3978	F8A
empty3	.....	4018	FB2
lastvalue	.....	4098	1002

Start of Data

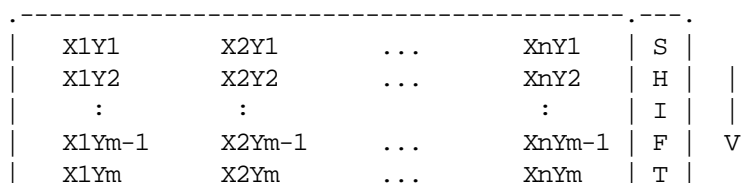
The data follows the header beginning at offset 4100.

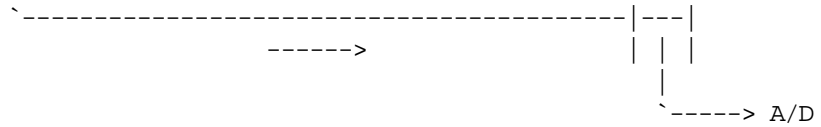
In WinView/WinSpec, the data is always stored exactly as it is collected. The order of the data depends on the placement of the shift register.

In the diagram below, the shift register is on the RIGHT SIDE of the chip. Each COLUMN of data is first shifted RIGHT into the shift register and then DOWN. The data is read (and stored) in this order:

First column read: $X_n Y_m, X_n Y_{m-1}, \dots, X_n Y_2, X_n Y_1$

Last column read : $X_1 Y_m, X_1 Y_{m-1}, \dots, X_1 Y_2, X_1 Y_1$

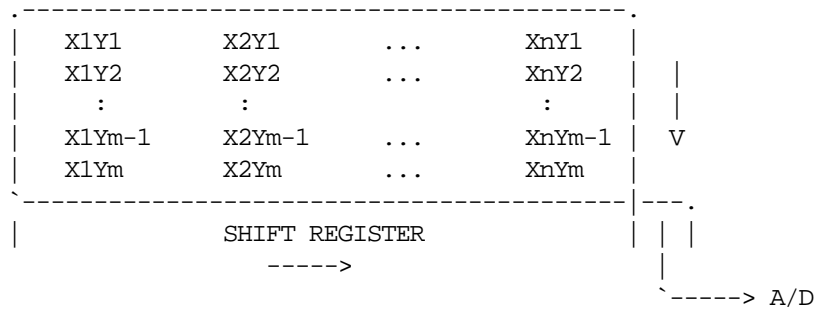




In the diagram below, the shift register is on the **BOTTOM** of the chip. Each **ROW** of data is first shifted **DOWN** into the shift register and then **RIGHT**. The data is read (and stored) in this order:

First row read: $X_n Y_m, \dots, X_2 Y_m, X_1 Y_m$

Last row read : $X_n Y_1, \dots, X_2 Y_1, X_1 Y_1$



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Auto-Spectro Wavelength Calibration

Equations used in WinSpec Wavelength Calibration

WinSpec/32 wavelength calibration is based on the grating equation for Czerny-Turner or Ebert spectrographs (see Figure 430).

$$(\mathbf{m}/\mathbf{d})\lambda = \sin \alpha + \sin \beta, \text{ or } \lambda = (\mathbf{d}/\mathbf{m})(\sin \alpha + \sin \beta), \quad (1)$$

where: λ = wavelength at the center of the image plane,

\mathbf{m} = diffraction order

\mathbf{d} = distance between grooves (the inverse of grooves per mm), and

α, β = angles of the incident and exit beam relative to the grating normal.

The angles α and β are related to the inclusion angle, γ , and the rotational angle of the grating, ψ :

$$\alpha = \psi - \gamma/2, \text{ and } \beta = \psi + \gamma/2.$$

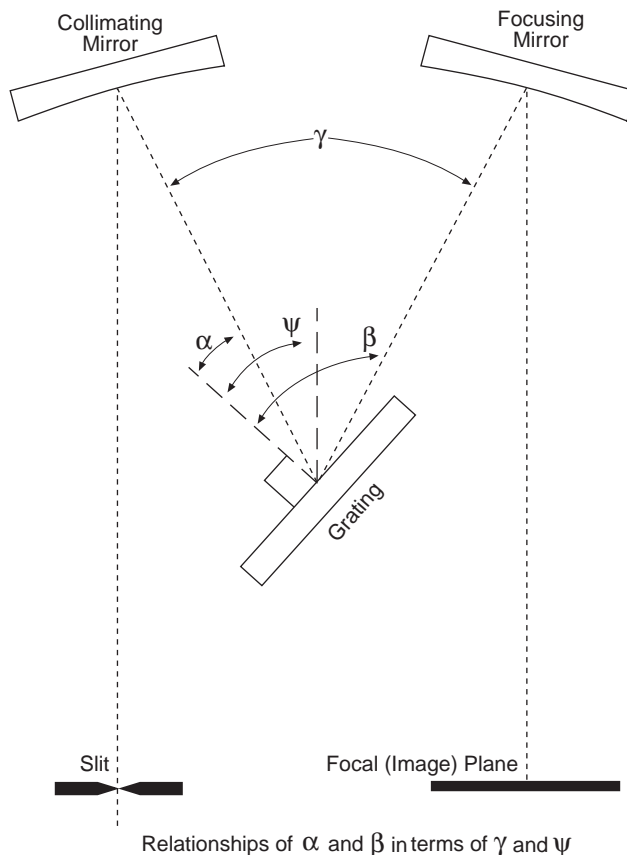
Thus the grating equation can be written as:

$$(\mathbf{m}/\mathbf{d}) \lambda = \sin (\psi - \gamma/2) + \sin (\psi + \gamma/2) = 2 \sin \psi \cos (\gamma/2),$$

and the grating angle is given by:

$$\psi = \text{asin} \{ \mathbf{m}\lambda / (2\mathbf{d} \cos (\gamma/2)) \}. \quad (2)$$

Figure 430.
Relationships of
 α and β in
terms of ψ and
 γ .



Note that the wavelength at the **center** of the exit plane does not depend on the focal length, **f**. However, the wavelength at points off center depends on both the focal length and the detector angle, δ (the angle of the image plane relative to the plane perpendicular to the spectrograph focal axis at the center of the image plane; see Figure 431). For some wavelength λ' relatively close to λ (at the same grating angle),

$$\begin{aligned}\lambda' &= (\mathbf{d}/\mathbf{m})(\sin \alpha + \sin \beta') = (\mathbf{d}/\mathbf{m})(\sin \alpha + \sin (\beta + \xi)) \\ &= (\mathbf{d}/\mathbf{m})\{\sin (\psi - \gamma/2) + \sin (\psi + \gamma/2 + \xi)\}.\end{aligned}\quad (3)$$

The angle ξ depends on the focal length **f**, the detector angle δ , and the distance of λ' from the center of the image plane, **nx**, where **n** is the number of pixels from the center and **x** is the pixel width; the relationship is given by:

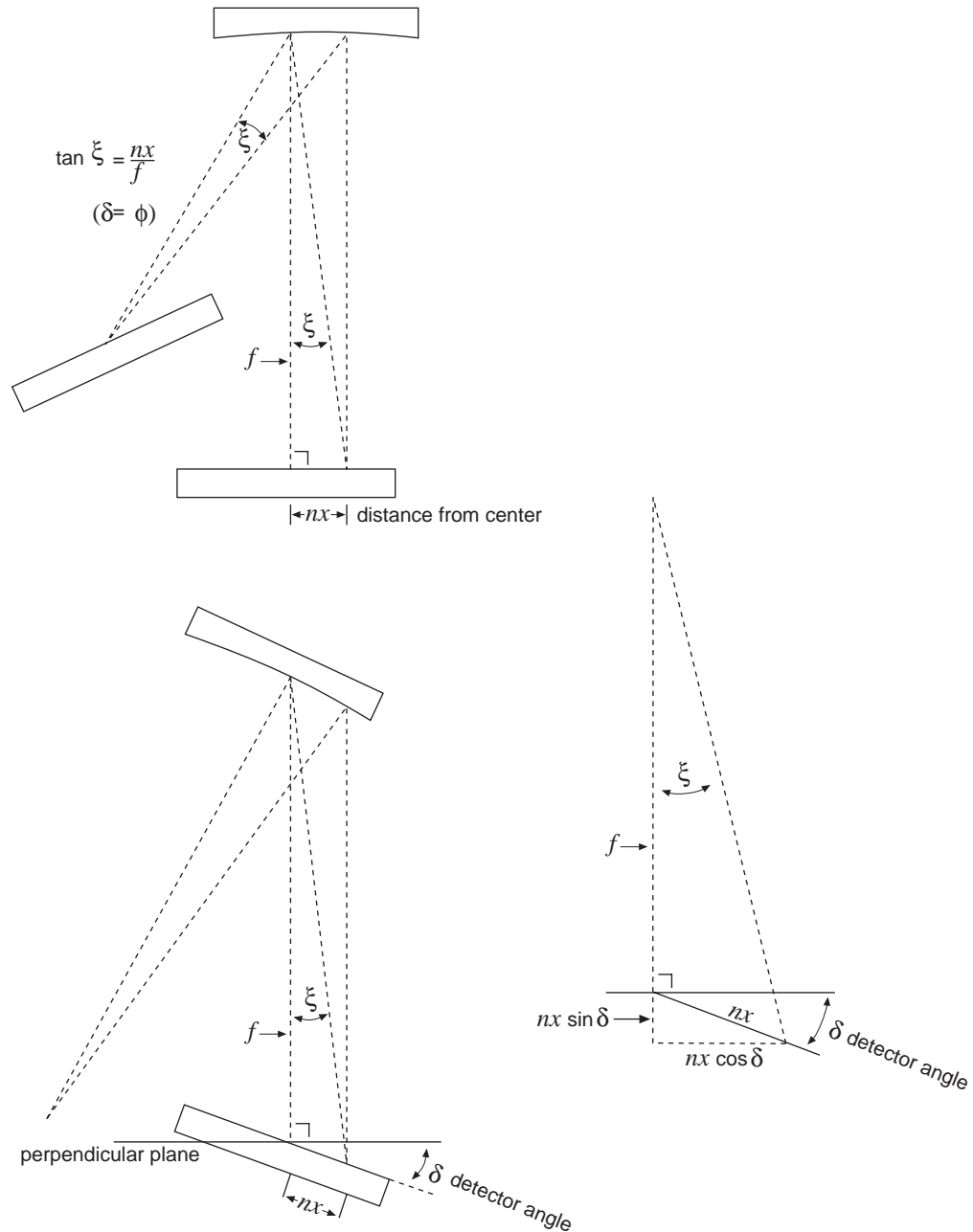
$$\tan \xi = (\mathbf{nx} \cos \delta) / (\mathbf{f} + \mathbf{nx} \sin \delta), \text{ as shown in Figure 431.} \quad (4)$$

When the image plane is perpendicular, $\delta = 0$, and this reduces to:

$$\tan \xi = (\mathbf{nx} / \mathbf{f})$$

Using the known parameters of focal length **f**, detector angle δ , number of pixels from center **n**, and pixel width **x**, first calculate the angle ξ from equation 4. The grating angle ψ can be calculated using the known parameters center wavelength λ , diffraction order **m**, grating grooves per mm $1/\mathbf{d}$, and inclusion angle γ , from equation 2. Finally, the wavelength at pixel **n** is calculated using equation 3.

Figure 431.
Relationship
between ξ and
the focal
length, detector
angle, and the
distance of λ'
from image
plane.



WinSpec X Axis Auto Calibration

When "Calibration Usage" is set to "Auto Spectro" in WinSpec/32, the X Axis calibration is done in the following steps after a wavelength change. First the wavelength is calculated at each end of the array using the method above. Then these two points, plus the third center wavelength point, are automatically fit to a 2nd order polynomial using the wavelength calibration functions.

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CD ROM Failure Work-arounds

Although not common, there are CD drives that are not compatible with the Win '95 long filename convention. Attempting to install on such a system causes the filenames to be truncated and the install fails, causing a message like:

**An error occurred during the move data process: -113
Component: Application\WinXSystem
File Group: WinXSystem**

Fortunately there are a couple of workarounds, both involving copying the install files to the customer's hard drive first, then installing the software from that location.

1. If possible, copy the files to the customer's hard drive via another computer that supports long file names. If the customer's computer is part of a network then the files can be copied first to the hard drive of a computer that supports long file names, then transferred through the network to the customer's hard drive. Check the list of files below to make sure that the long filenames remain intact. Then install the software from this location on the hard drive.
2. Copy the files to the customer's hard drive from the customer's CD-ROM, then fix the names of the files that were truncated. There are only 7 files that are not DOS compatible (8 + 3), so this at most a 10 minute job. Here are their abbreviated and full filenames. (Not all of these files are used in the standard installation but all are present on the CD.)
 - CLSSNA~1.CLS, rename to clsSnapIn.cls
 - PIXCMT~1.DLL, rename to PIXCMTXT32.dll
 - WINX_R~1.DOC, rename to WinX_readme.doc
 - WINX32~1.BAS, rename to Winx32Test.bas
 - WINX32~1.DOC, rename to Winx32 Automation - VB Version.doc
 - WINX32~1.FRM, rename to Winx32Test.frm
 - WINX32~1.FRX, rename to Winx32Test.frx

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