



Goniometric Radiometer Models

LD 8900TM and LD 8900RTM



Installation and Operation Manual

Model # _____
Serial # _____
Date: _____

For Sales, Service or Technical Support

Phone: (435) 753-3729

Fax: (435) 753-5231

Service Email

service@us.ophiropt.com

Sales Email

sales@us.ophiropt.com

Ophir-Spiricon, LLC

3050 N 300 W

N. Logan, Utah 84341

©2012 Ophir-Spiricon, LLC, All rights reserved

! CAUTION !

Always plug the system components, i.e., the Personal Computer (PC) installed with the Goniometric Radiometer 880GS Controller Card, and the Model LD 8900 or LD 8900R Motion Control Unit, into a **grounded** power outlet strip with **surge protection**. Spiricon does not warrant damage due to power line surges.

ALWAYS BE SURE the AC power is OFF when connecting or disconnecting anything to or from the instrument and or the PC.

The 880X Card can be damaged by electrostatic discharge (ESD). To prevent ESD damage that can occur when handling electronic equipment, it is recommended to use a ground strap or similar device when performing this installation procedure and in general handle the card without touching the gold fingers. Use standard laboratory safe ESD practices.

When measuring high power laser sources, start at low power and approach higher laser powers slowly from low to high power; Spiricon does not warrant damage due to high power laser sources.

Be sure to connect the 9-pin D-subminiature cables to the proper places. Accidentally connecting the RS-232 cable from the PC to the Scan Head may cause damage to the motion control system motor!

Verify that the software you received is compatible with your PC Operating System. The Goniometric Radiometer Acquisition and Analysis Software is designed for use with the most current version of Microsoft Windows® Operating System.

Measurement Accuracy and Repeatability

The accuracy and repeatability of results obtained with the Goniometric Radiometer depend on the **mode of operation** and the **positioning and alignment of your diode** or optical source.

Trademarks

The Goniometric Radiometer Model LD 8900™, LD 8900R™ and Goniometric Radiometer Acquisition And Analysis Software™ are trademarks of Ophir-Spiricon, LLC.

MS Windows® is a registered trademark of Microsoft Corporation.

Patents

The Goniometric Radiometer Model LD 8900/LD 8900R is protected under US Patent #5,949,534.

This page intentionally left blank.

Table of Contents

! CAUTION !	2
Measurement Accuracy and Repeatability	2
Trademarks	3
Patents	3
Table of Contents	5
1. Introduction	10
1.1. System Overview	10
1.2. Product Description	12
2. System Inspection	14
2.1. Inspection	14
2.2. Packing List	14
3. System Setup	16
3.1. PC Requirements	16
3.2. Software and PCI card Installation	16
3.2.1. Driver Installation for 880X PCI Interface Card	18
3.2.2. 880X PCI Installation	20
3.2.3. 880X PCI Configuration	23
3.2.4. Goniometric Radiometer Acquisition and Analysis Software Installation	25
3.3. Hardware Installation	27
3.3.1. LD 8900/LD 8900R Scan Unit Mounting	27
3.3.2. Component Connections	28
3.4. Software Configuration	30
4. Diode Installation	31
4.1. Instrument Optical Axis Alignment Relative to Reference Datum Plane	31
4.2. LD 8900/LD 8900R Diode Mount Considerations	31
5. System Measurement Overview	35
5.1. Scan Modes	35
5.2. Field of View	36
5.3. Acquired Scan Data	36
5.4. Processed 3D Scan Data	37
5.5. Blind Spots	37

5.6.	Blind Spot Correction	39
5.7.	Device Positioning and Pointing.....	40
5.8.	Operation of the Goniometric Radiometer with Pulsed Sources	41
5.9.	Summary.....	42
6.	LD 8900 Acquisition and Analysis Software.....	43
6.1.	Quick Start	43
6.2.	Advanced Use.....	46
6.3.	Scan Modes	47
6.3.1.	Single Axis Mode	47
6.3.2.	Perpendicular Axes Mode	47
6.3.3.	3D Scan Mode	47
6.4.	Viewing Data.....	48
6.5.	Pull-Down Menus.....	49
6.5.1.	File Menu	49
6.5.2.	Edit Menu.....	53
6.5.3.	View Menu	53
6.5.4.	Options Menu.....	53
6.5.5.	Data Collection Menu.....	54
6.5.6.	Window Menu	58
6.5.7.	Help Menu.....	59
6.6.	Window Descriptions	60
6.6.1.	Rectangular View.....	60
6.6.2.	Polar View.....	63
6.6.3.	3D Polar View	65
6.6.4.	3D Rectangular View	68
6.6.5.	Topographic View	71
6.6.6.	Beam Statistics	73
6.6.7.	Time Statistics.....	78
6.6.8.	Power.....	82
6.6.9.	Notes	85
6.7.	Status Bar	85
6.8.	Toolbars.....	85
6.9.	System Messages.....	87
6.10.	ActiveX Automation.....	91
6.10.1.	ApertureSourceDistance	91
6.10.2.	AutoGain	92
6.10.3.	BlindSpotCorrection	92
6.10.4.	DataIncrement	92
6.10.5.	Exit.....	92
6.10.6.	GetCenter	92
6.10.7.	GetCurrentPhi	93

6.10.8.	GetNA	93
6.10.9.	GetNumPts	93
6.10.10.	GetPeakIrradiance	93
6.10.11.	GetPeakPosition.....	94
6.10.12.	GetPeakWidth	94
6.10.13.	GetProfileAngle	94
6.10.14.	GetProfileData.....	94
6.10.15.	Go90Deg	95
6.10.16.	GoToPhiAngle	95
6.10.17.	IncrementPhi	95
6.10.18.	IsSaturated	96
6.10.19.	MotorGoHome.....	96
6.10.20.	PulsedMode	96
6.10.21.	ScanAcquisition.....	96
6.10.22.	ShowWindow.....	97
6.10.23.	SignalGain.....	97
6.10.24.	SourceFrequency	97
6.10.25.	Sample file for ActiveX	97
7.	LD 8900R Acquisition and Analysis Software	99
7.1.	Quick Start	99
7.2.	Advanced Use.....	102
7.3.	Scan Modes	102
7.3.1.	Single Axis Mode	103
7.3.2.	Perpendicular Axes Mode	103
7.3.3.	3D Scan Mode	103
7.4.	Viewing Data	103
7.5.	Pull-Down Menus.....	106
7.5.1.	File Menu	106
7.5.2.	Edit Menu.....	109
7.5.3.	View Menu	109
7.5.4.	Options Menu.....	109
7.5.5.	Data Collection Menu.....	110
7.5.6.	Window Menu	114
7.5.7.	Help Menu.....	115
7.6.	Window Descriptions	116
7.6.1.	Rectangular View.....	116
7.6.2.	Polar View.....	119
7.6.3.	3D Polar View	122
7.6.4.	3D Rectangular View	125
7.6.5.	Topographic View	128
7.6.6.	Beam Statistics	130
7.6.7.	Time Statistics.....	136
7.6.8.	Power.....	140
7.6.9.	Notes	142

7.7. Status Bar	142
7.8. Toolbars	143
7.9. System Messages.....	144
7.10. Active X Automation.....	148
7.10.1. AngularLimit.....	148
7.10.2. ApertureSourceDistance	149
7.10.3. AutoGain	149
7.10.4. BlindSpotCorrection	149
7.10.5. DataIncrement	149
7.10.6. Exit.....	149
7.10.7. GetCenter	150
7.10.8. GetCurrentPhi	150
7.10.9. GetMFD	150
7.10.10. GetNA.....	150
7.10.11. GetNumPts.....	151
7.10.12. GetPeakIrradiance	151
7.10.13. GetPeakPosition.....	151
7.10.14. GetPeakWidth	151
7.10.15. GetProfileAngle	152
7.10.16. GetProfileData.....	152
7.10.17. Go90Deg	152
7.10.18. GoToPhiAngle	153
7.10.19. IncrementPhi	153
7.10.20. IsSaturated	153
7.10.21. MotorGoHome.....	154
7.10.22. PulsedMode	154
7.10.23. ScanAcquisition	154
7.10.24. ShowWindow.....	154
7.10.25. SignalGain.....	155
7.10.26. SourceFrequency	155
7.10.27. Wavelength	155
7.10.28. Sample file for ActiveX	155
7.10.29. Sample file for C#.....	156

This page intentionally left blank.

1. Introduction

1.1. System Overview

The Model LD 8900/LD 8900R Goniometric Radiometers are “real time” angular scanning optical instruments designed to rapidly measure the intensity distribution of widely divergent optical sources such as non-collimated Laser Diode sources and Light Emitting Diodes.

These instruments are based on a patented proprietary scanning technique where neither the detector nor the light source moves. Using this method, full goniometric scans are performed in fractions of a second, allowing for complete hemispherical intensity distribution measurements in times on the order of about a minute. Measurements of this type used to take hours, days, or even weeks.

These instruments provide:

- ◆ Fast and accurate measurement of radiation pattern from highly divergent light sources;
- ◆ Angular sampling interval of 0.055° , with 3241 data points per scan;
- ◆ Azimuth sampling at intervals of 0.225° ;
- ◆ Single Azimuth Scans at 5 Hz rate;
- ◆ Orthogonal Azimuth Scans at 1 update every two seconds;
- ◆ Full 3D characterization with 200 azimuth scans at 0.9° intervals, (648,000 data points) in less than 2 minutes;

The LD8900/LD 8900R is a modular unit intended for use in research and development, in manufacturing environments, and for custom applications. The design allows unobstructed access to the instrument entrance aperture and provides the greatest flexibility for integration into any inspection system. It is ideally suited for testing of a wide variety of sources, such as laser diodes mounted onto large heat sinks or on test bars or even at the wafer level. The system is available with either a Silicon detector or an InGaAs Detector:

- The Silicon Detector is for sources emitting between 320nm and 1100nm wavelength.
- InGaAs Detector is for sources emitting between 800nm and 1700nm wavelength.

The detectors cannot be easily changed.

The LD 8900 systems use an 8-bit Analog-to-Digital Converter (ADC); the LD 8900R systems have a 16-bit ADC.

The LD 8900/LD8900R can be used to measure both CW and pulsed sources; however the measurement of pulsed beams should be undertaken with care. Due to the way that the signal amplifier circuits operate there are some pulsed conditions that yield erroneous results. Spiricon offers a pulsed operation option to alleviate this problem. Please refer to the Chapter 5.8 “Operation of the Goniometric Radiometer with Pulsed Sources” for more information on this subject.

Knowledge of MS Windows Operating Systems Prerequisite for Use

The Goniometric Radiometer Acquisition and Analysis Software for MS Windows is easy to learn and use. However, it is assumed that users have at least a basic working knowledge of the MS-Windows Operating Systems. As such, **this manual does not address the basics of MS Windows operations**. First-time users of MS Windows will need to spend some time becoming familiar with the basics of Windows. For further assistance on MS Windows, consult your MS Windows manuals, tutorials, or Help.

1.2. Product Description

The Model LD 8900/LD 8900R System consists of:

- ✓ The Scan Unit;
- ✓ The Motion Controller Module;
- ✓ The Model 880GSX Scan and Data Acquisition Controller;
- ✓ The Model 880X PCI Interface Card
- ✓ Goniometric Radiometer Acquisition and Analysis Software with the most current Windows® operating system CD.
- ✓ Power and Instrument Cables.

The LD8900/LD 8900R Scan Unit is a component that requires two (2) user-provided mounts before operation of the system. One is to mount the instrument itself, and the second is to mount the device to be tested. Detailed engineering drawings are provided to aid in this design.

Initial unpacking, system configuration, system startup, and operation of the LD8900/LD 8900R are described in detail in this manual.

This page intentionally left blank.

2. System Inspection

2.1. Inspection

Your Goniometric Radiometer has been carefully tested, inspected and packaged before shipment. Spiricon performs extensive testing to ensure that the unit is in proper working order. Upon receipt of your Goniometric Radiometer, please do the following:

- ✓ If you have not already done so, inspect the shipping container for any damage. Please report any damage found immediately to the shipping company. ***Spiricon does not warrant damage that occurs as a result of shipment.***
- ✓ Check the contents of your shipment against the packing slip attached to the shipping box. Please note any discrepancy.

2.2. Packing List

1. LD 8900/LD 8900R Goniometric Scan Unit.
2. LD 8900/LD 8900R Motion Controller Module.
3. 880GSX Digital I/O Interface Unit (LD 8900 with 8-bit Scan and Data Acquisition Controller inside; LD 8900R with 16 bit Scan and Data Acquisition Controller inside).
4. 880X PCI Interface Card
5. LD 8900/LD 8900R Goniometric Radiometer Acquisition and Analysis Software CD.
6. RS-232 Communication Cable, 9-pin D-subminiature male to 9-pin D-subminiature female.
7. Scan Unit Signal Cable (Black – ~3m length), 37-pin D-subminiature male to 37-pin D subminiature female.
8. 880GSX Scan and Data Acquisition Controller Signal Cable (Beige/Gray - ~1m length); 37-pin D-subminiature female to 37-pin D subminiature female.
9. Motion Controller cable, 9-pin D-subminiature male to 9-pin D-subminiature female.
10. AC Power Cable.
11. USB to RS232 serial COM port adapter. (p/n 7E10040)

This page intentionally left blank.

3. System Setup

Setting up the LD 8900/LD 8900R Goniometric Radiometer requires Software installation, Hardware installation, and Component configuration.

3.1. PC Requirements

The following are the minimum PC requirements for the LD 8900/LD 8900R Goniometric Radiometer software. The minimum requirements for different versions of Windows may be different, in this case use the higher system requirements.

- CPU:** 1 GHz Pentium 4 Celeron, or better
- OS:** Windows Vista Business or Windows 7 Business or Professional, 32 or 64 bit.
- PCI:** 1 Open slot
- RAM:** 2 GB
- Video:** Minimum resolution of 1024x768

3.2. Software and PCI card Installation

Note: The following software installation must be performed prior to installing and connecting any of the supplied Gonio hardware.

There may be minor differences to what is written here depending on the version of windows and the PC's auto launch settings. The procedure described here reflects Windows 7 (except where noted).

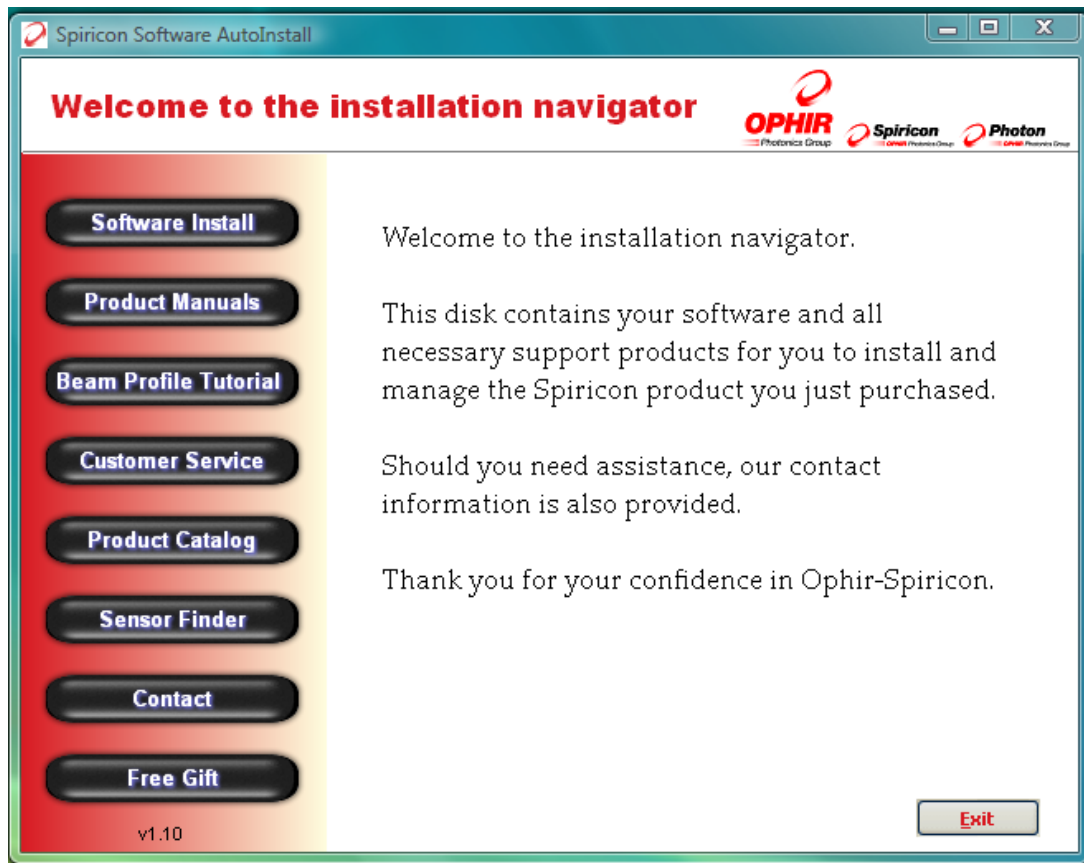
Note: This software must be installed with Administrator Privileges.

The Software installation requires these steps:

1. Driver Installation for 880X PCI Interface Card
2. 880X PCI card installation and configuration
3. Goniometric Radiometer Acquisition and Analysis Software Installation
4. Software Configuration

Insert the supplied DVD; if the installer doesn't start automatically, navigate to the DVD drive and double-click on the file named **Amplayer.exe**.

Click on the **Software Install** button.

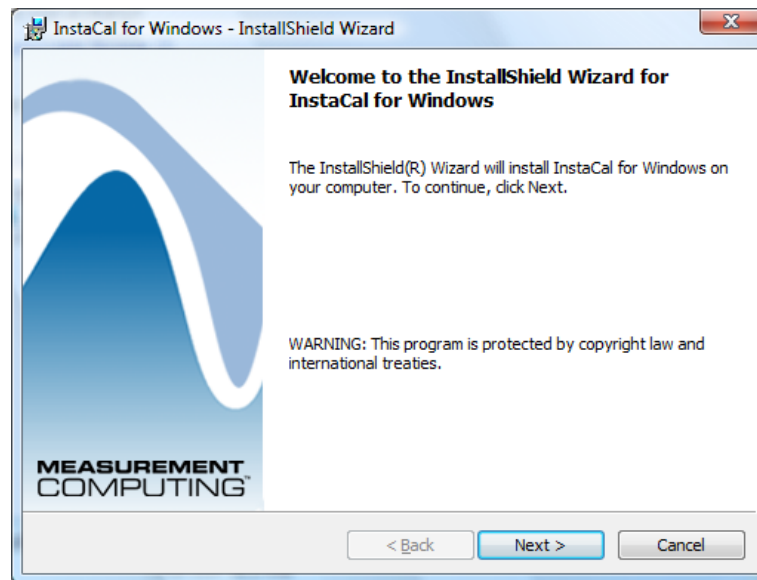
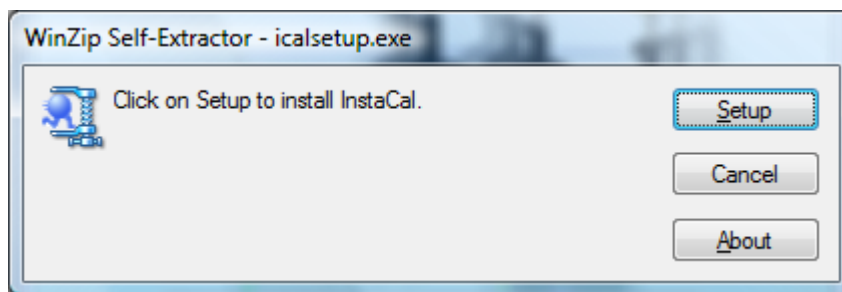
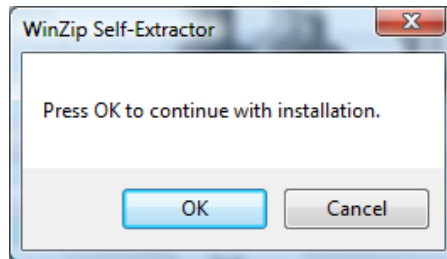


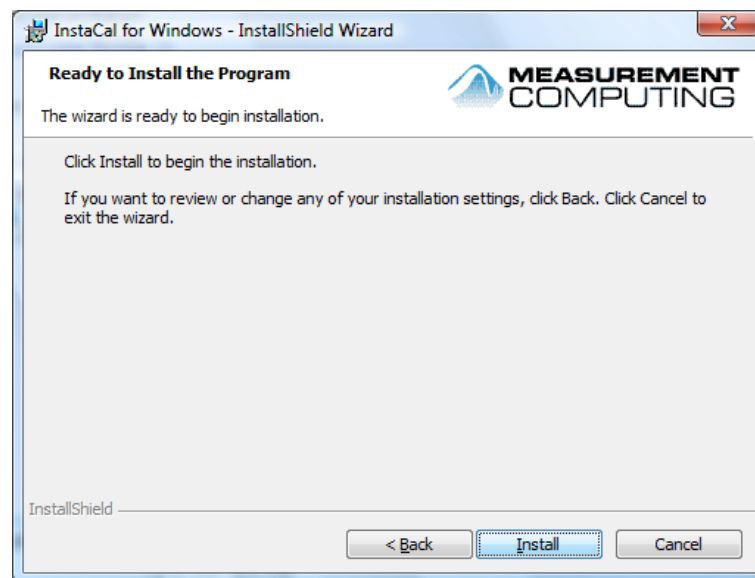
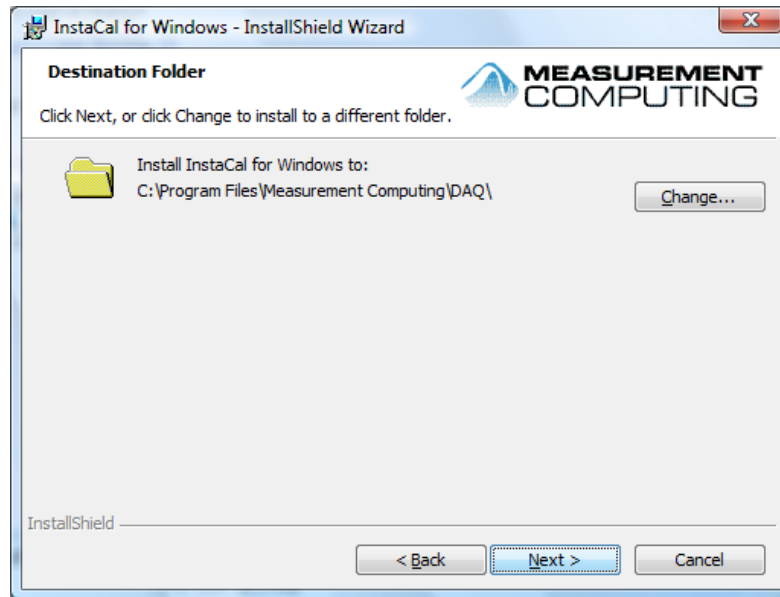
Click on the **1. Install Driver** button.



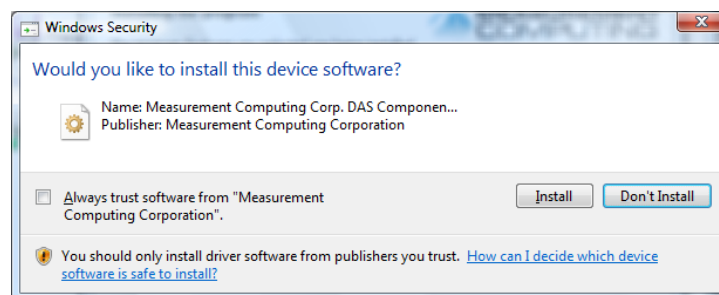
3.2.1. Driver Installation for 880X PCI Interface Card

On the following five screens, click **OK**, **Setup**, **Next**, **Next**, **Install**.

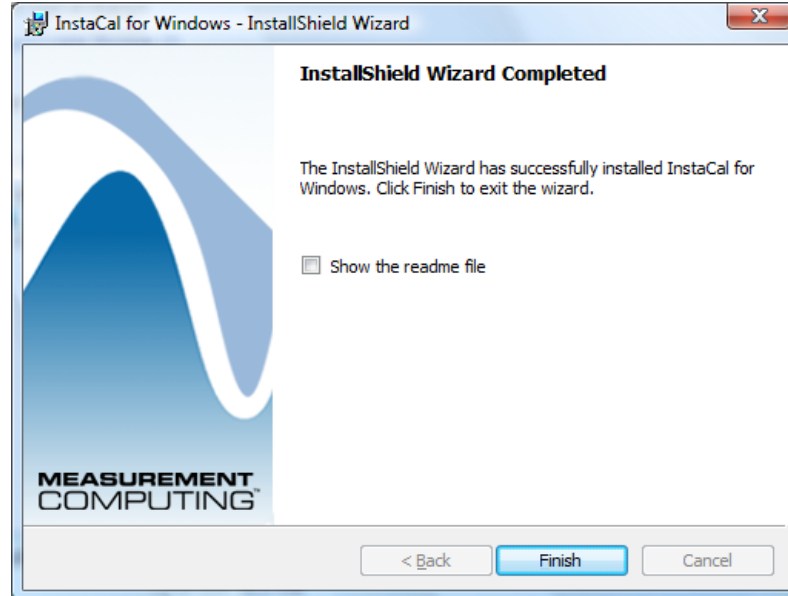




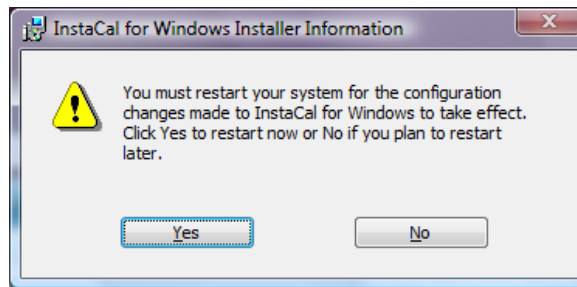
Depending on the operating system you may see several of the following type of message, Click **Install** on each one.



Click **Finish**.



When prompted to restart your PC select **No**.



3.2.2. 880X PCI Installation

Close all open programs, turn off your PC, and remove the case to allow access to the motherboard.

1. Install the **Goniometric Radiometer PCI 880X** card in any available PCI slot. This card may be marked PCI-DIO24.
2. Do not connect the cable to the card at this time.
3. Close the PC case, turn your PC back on, and allow it to fully reboot.

Windows 7: You will see some notifications that the driver is being installed. The driver installation requires no user action. Wait until the final notification is received before continuing on to step 3.2.3 880X PCI Configuration.



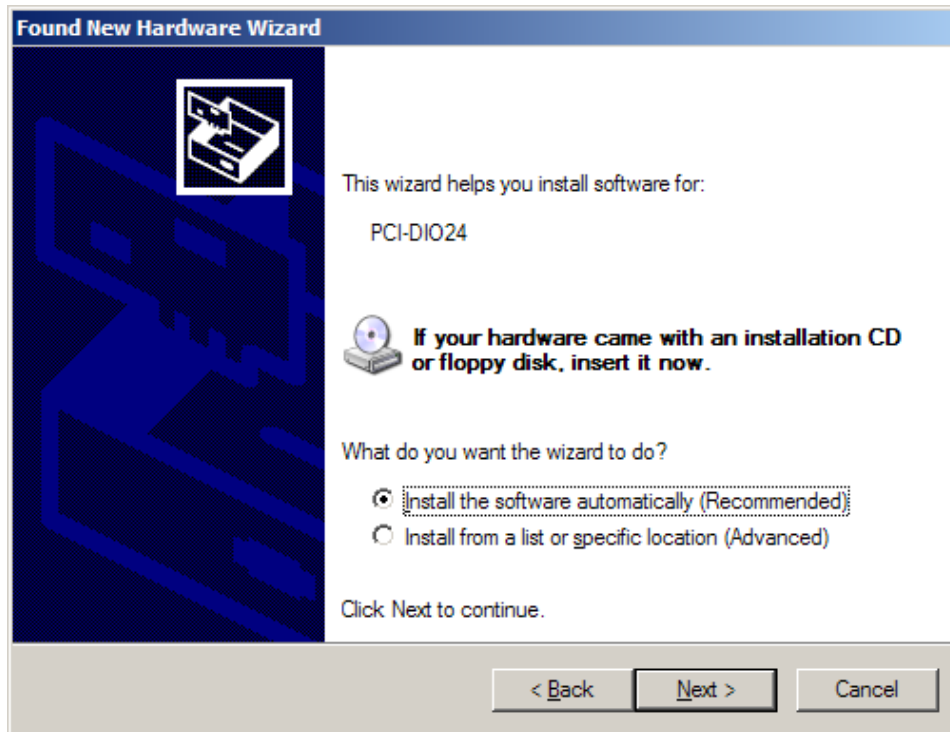
Windows XP: After booting up, Windows will automatically detect the board and the **Found New Hardware** dialog box will appear stating that a new PCI Device has been detected and will be installed:



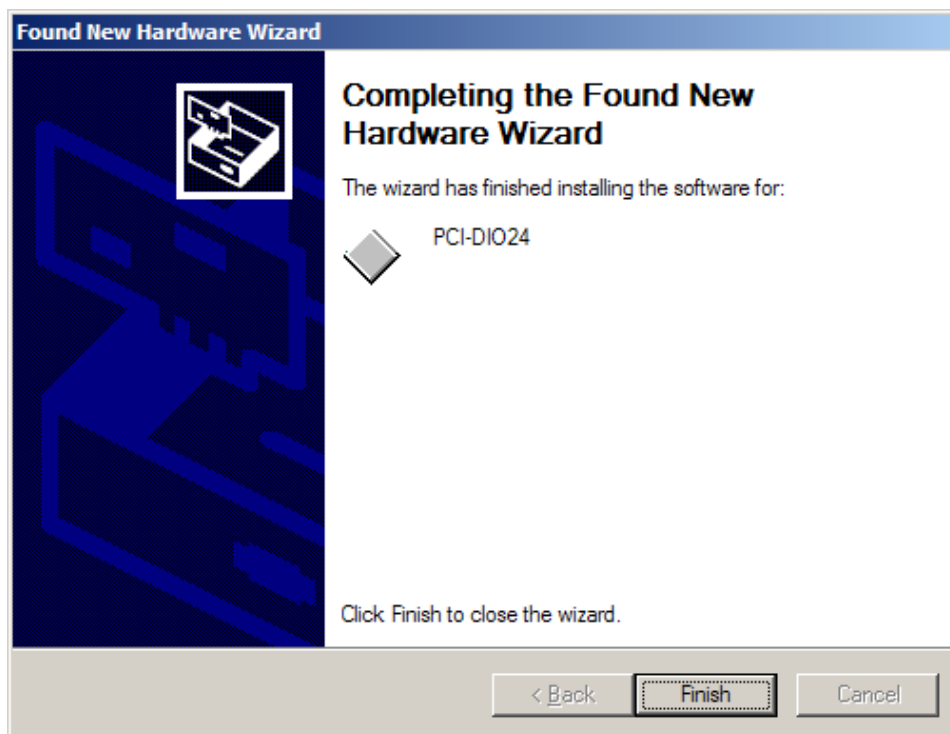
When the **Found New Hardware Wizard** starts, Windows XP may present a dialog box asking you if it can connect to Windows Update to search for the driver. Choose **No, not this time**. Windows update does not have drivers for this card.



Select **Install the software automatically (Recommended)** and then click **Next**:



Windows will detect the appropriate drivers for your card, and install them for your card, when it is done click **Finish**.

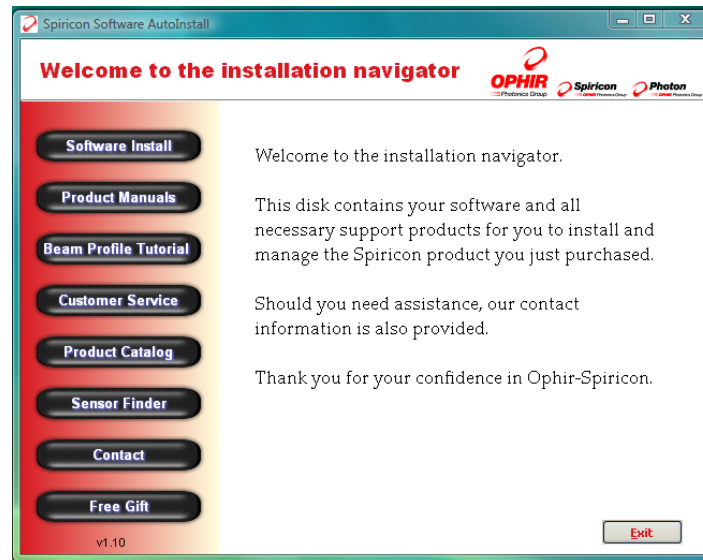


The **Found New Hardware Wizard** will exit and windows will display a message box stating that your new hardware is installed and ready to use.

3.2.3. 880X PCI Configuration

Navigate to the DVD drive and double-click on the file named **Amplayer.exe**

The following window will appear. Click **Software Install**.



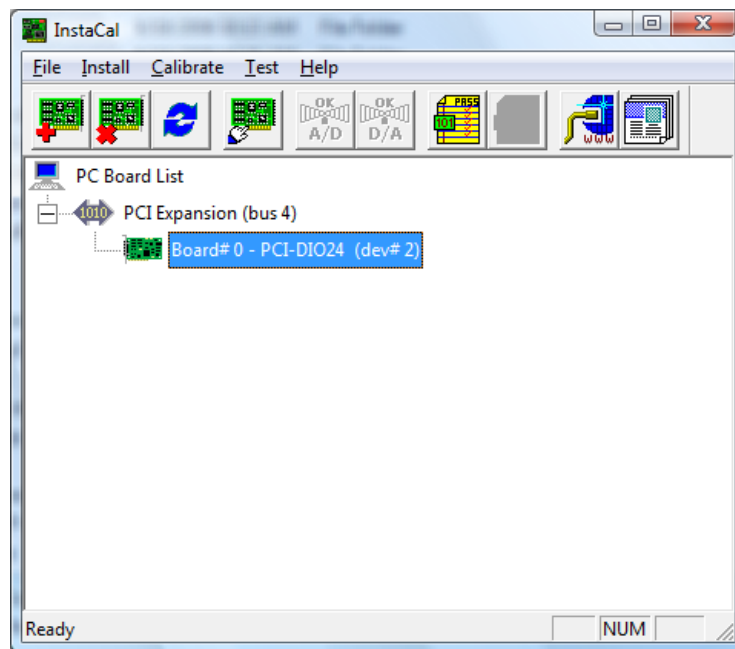
Click on the **2. InstaCal** button.



The **Plug-and-play Board Detection** dialog box will pop up after a few moments. Click **OK** to select the indicated card.



The following main window from the **InstaCal** software will appear. Take note of the board number assigned to the card. Normally it should be #0.



Close the **InstaCal** software main window. You will not need to run this software again, but in order for the **Goniometric Radiometer** software to run properly this software must remain installed on the PC.

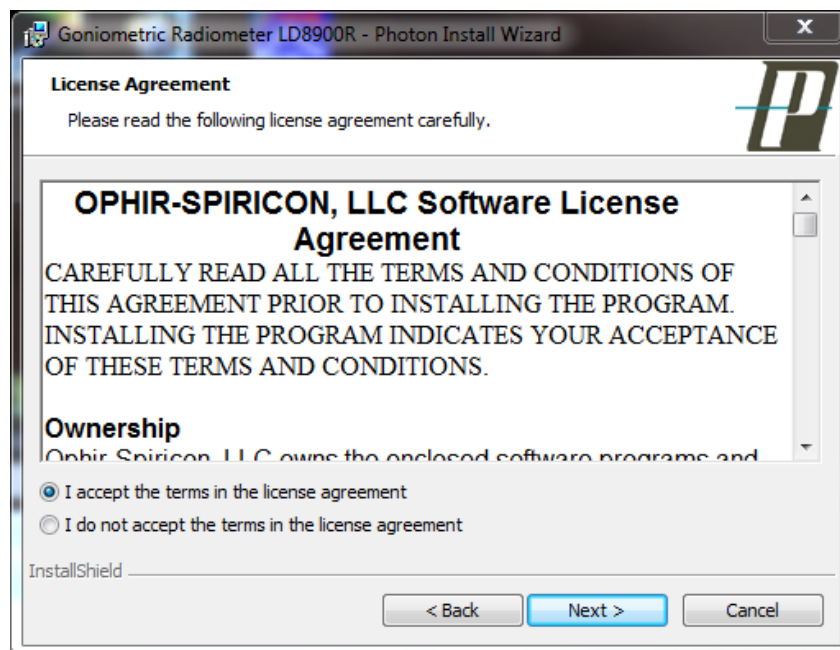
3.2.4. Goniometric Radiometer Acquisition and Analysis Software Installation

Click on the **3. Install Software** button.



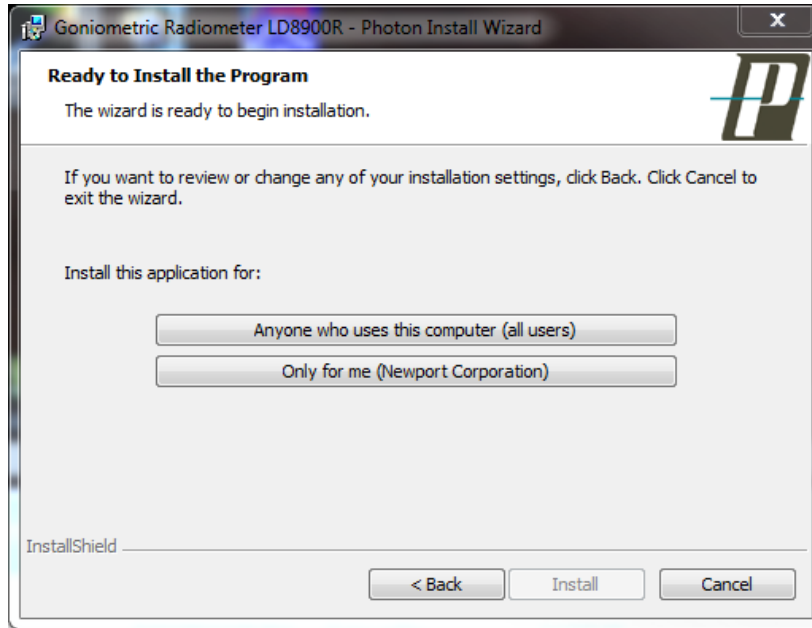
On the following screens click **Next**, then **Next** again.

Read through the Ophir-Spiricon license agreement. If you agree to abide by the license terms and conditions, accept by choosing the **I accept the terms in the license agreement** button.

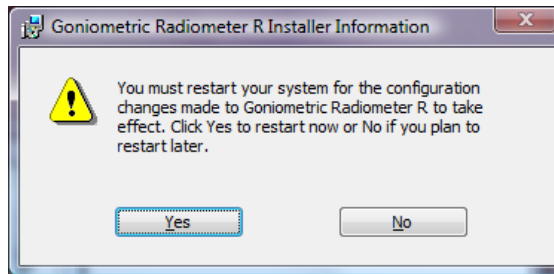


Click **Next**, then **Next** again.

On the following screen choose either **Anyone who uses this computer** or **Only for me**. If you are unsure of the correct option, ask your system administrator.



Wait for the installer to complete, then click **Finish**. You will be asked again to reboot. At the following prompt click **No**.



Select **Quit** on the Photon Installer, eject the install CD, close all programs, and turn off the PC before proceeding to the next section.

3.3. Hardware Installation

The PCI 880X card and driver must have already been installed during the previous software installation sections

3.3.1. LD 8900/LD 8900R Scan Unit Mounting

Before applying power to the LD 8900/LD 8900R system, it must have all cables securely and properly connected; and the scan head must be mounted securely (for example, an optical table or stable mechanical fixture). Failure to do this may cause damage to the unit.

WARNING: Never connect or disconnect the motor drive cable with power applied to the Motion Controller. Doing so may cause permanent damage to the controller.

WARNING: Verify that the Motion Controller's line voltage switch is correctly set to match the local AC mains. Connecting the Motion Controller to a 220V 50 Hz supply with the mains switch set to 110V will immediately damage the controller.

NOTICE:

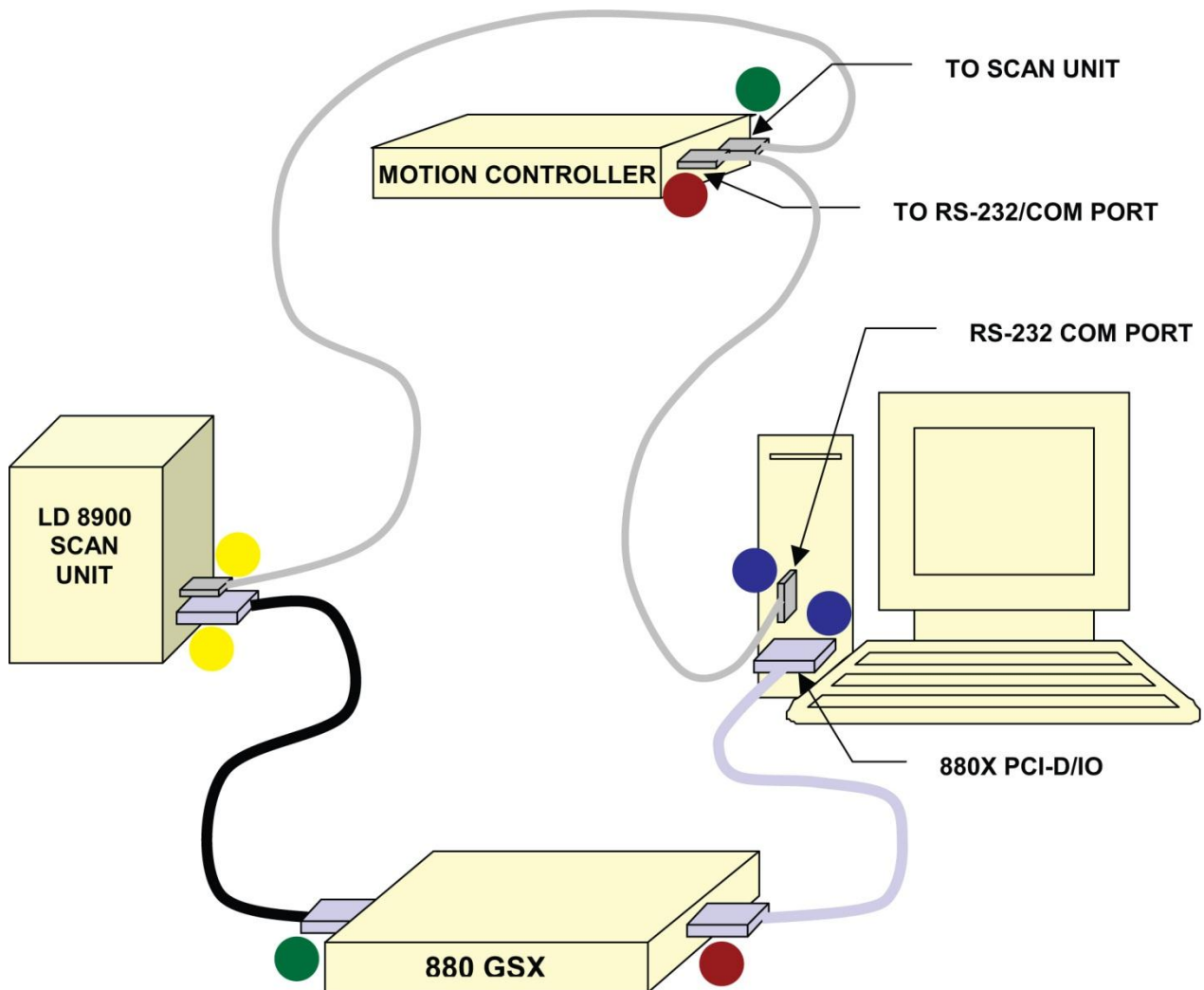
The Motion Controller may be fitted with an externally accessible fuse. Never replace this fuse under any conditions. Doing so may cause permanent damage. Return the unit to Spiricon for servicing. The Motion Controller contains no user serviceable parts.

3.3.2. Component Connections

Make the following component cable connections according to the diagram below **with all AC power off**. Or you can use the written instructions on the following page.

CAUTION! VERY IMPORTANT! CAUTION!

Be careful to make the proper connections: Please match the color dot on the connector to the same color dot on the proper component! Improper connections will cause serious damage to the system!



After all of the above cable connections are securely made, proceed to step 9 in the following instructions.

LD 8900 and LD 8900R Goniometric Radiometer Cable Connections

1. Connect the female end of the 37-pin Black Signal Cable to the LD 8900/LD 8900R Scan Unit
2. Connect the male end of the 37-pin Black Signal Cable to the Model 880GSX Scan and Acquisition Controller connector labeled "SCAN UNIT". **CAUTION!** Never connect this cable to the "880X PCI D/IO" connector.
3. Connect one female end of the 37-pin Beige/Gray Signal Cable to the Model 880GSX Scan and Acquisition Controller connector labeled "880X PCI D/IO". **CAUTION!** Never connect this cable to the "SCAN UNIT" connector.
4. Connect the other female end of the 37-pin Beige/Gray Signal Cable to the "880X PCI D/IO" card installed in the PC.
5. Connect the female end of the 9-pin RS232 cable to the PC COM1 or COM2 serial port. (Spiricon supplies a USB to RS232 adapter for PC's that lack a serial COM ports.)
6. Connect the male end of the 9-pin RS232 cable to the LD 8900/LD 8900R Controller. **CAUTION!** Never plug the RS232 cable into the LD 8900/LD 8900R Scan Unit. It may damage the unit.
7. Connect the female end of the 9-pin Motion Controller cable to the LD 8900/LD 8900R Controller.
8. Connect the male end of the 9-pin Motion Controller cable to the LD 8900/LD 8900R Scan Unit.
9. Connect AC power cords from the PC and the LD 8900/LD 8900R Motion Controller to a power outlet strip with surge protection.
10. Connect your monitor power cord to the power outlet strip.
11. Connect the power outlet strip to a properly grounded AC power outlet.
12. Turn on the power outlet strip.
13. Turn on the PC & Monitor.
14. Turn on the LD 8900/LD 8900R Motion Controller.

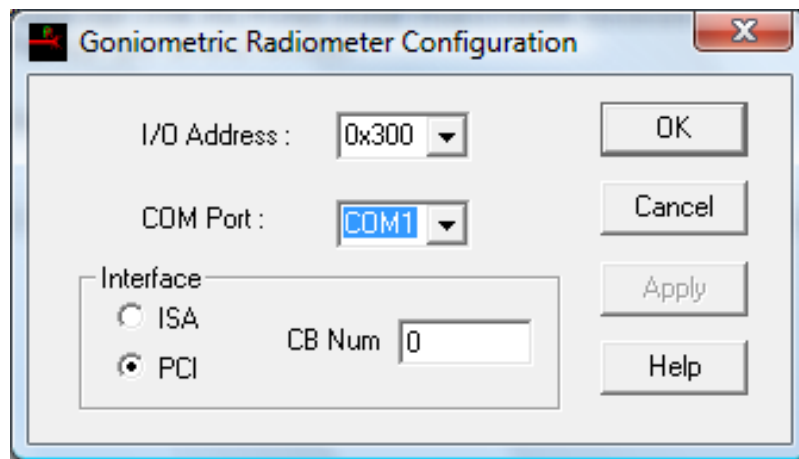
Note that the LD 8900/LD 8900R Scan Unit is powered via the cables connecting it to the PC system.

3.4. Software Configuration

After reboot is complete the **Goniometric Radiometer Configuration** dialog will open as shown below. If this dialog fails to appear you may start it manually. Go to Start->All Programs->Photon->Gonio Configuration.

Choose the **PCI** Interface. Enter the board number you noted earlier from **InstaCal** into the **CB Num** edit box. Choose the COM# that you have connected to your motion controller. (If you are using the supplied USB to RS232 adapter the default serial port is normally COM4.)

Set the I/O Address to match the indication on the **880 GSX unit**. Click **OK** to save the settings.



This completes the software and hardware installation procedures.

4. Diode Installation

The Model LD 8900/LD 8900R is a modular unit intended primarily for use in manufacturing environments and for custom applications. The design allows unobstructed access to the instrument entrance aperture and provides the greatest flexibility for integration into any inspection system. It is ideally suited for testing of a wide variety of sources, such as laser diodes mounted onto large heat sinks or on test bars, or even at the wafer substrate level.

4.1. Instrument Optical Axis Alignment Relative to Reference Datum Plane

The mechanical alignment of the Optical Axis of the LD 8900/LD 8900R relative to the Datum Reference Plane due to the RMS mechanical tolerances has an RMS specification of better than $\pm 0.2^\circ$. Device mounting is very important if you want results that are accurate relative to the instrument optical axis.

4.2. LD 8900/LD 8900R Diode Mount Considerations

With the LD 8900/LD 8900R it is first necessary to securely attach the Scan Unit to some stable mechanical surface or part. Second, it is necessary to design and incorporate a Custom Diode Mounting Fixture to position diodes for test at the instrument Entrance Aperture and point them along the instrument Optical Axis. Figure 4-1, Figure 4.2, and Figure 4-3 provide the information necessary for mounting the LD 8900/LD 8900R and for the design of Custom Diode Mounting Fixtures.

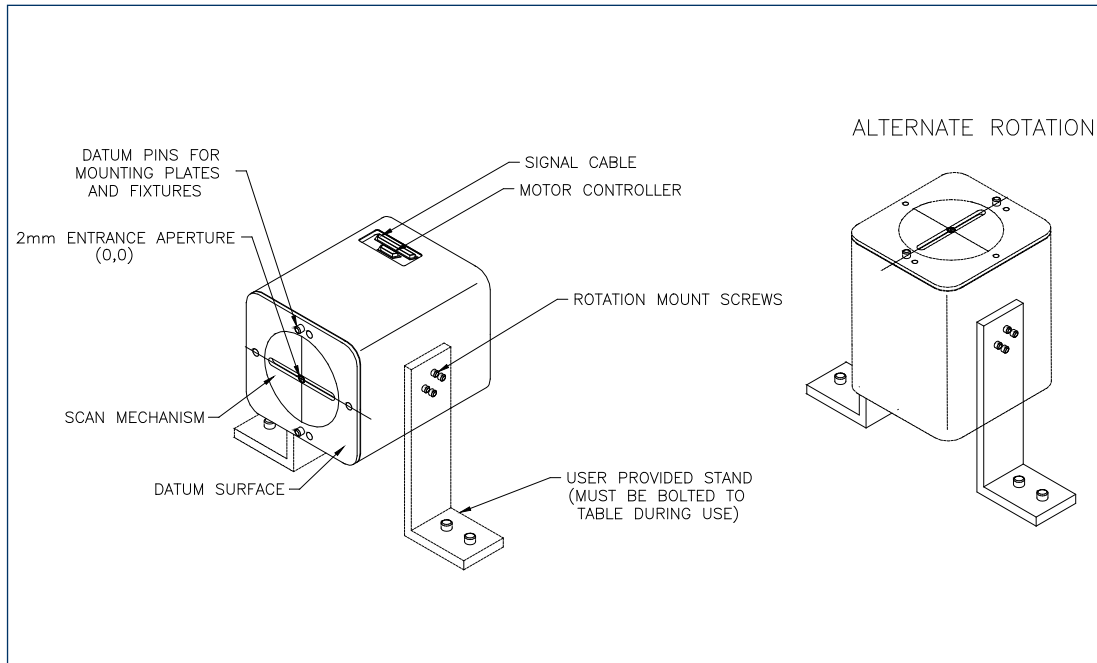


Figure 4-1. Illustration of the LD 8900/LD 8900R Mounted in 2 Different Orientations.

The illustration shows the Entrance Aperture Datum Surface, the locations of the Alignment Dowel Pins, and the Signal and Motion Controller Connectors.

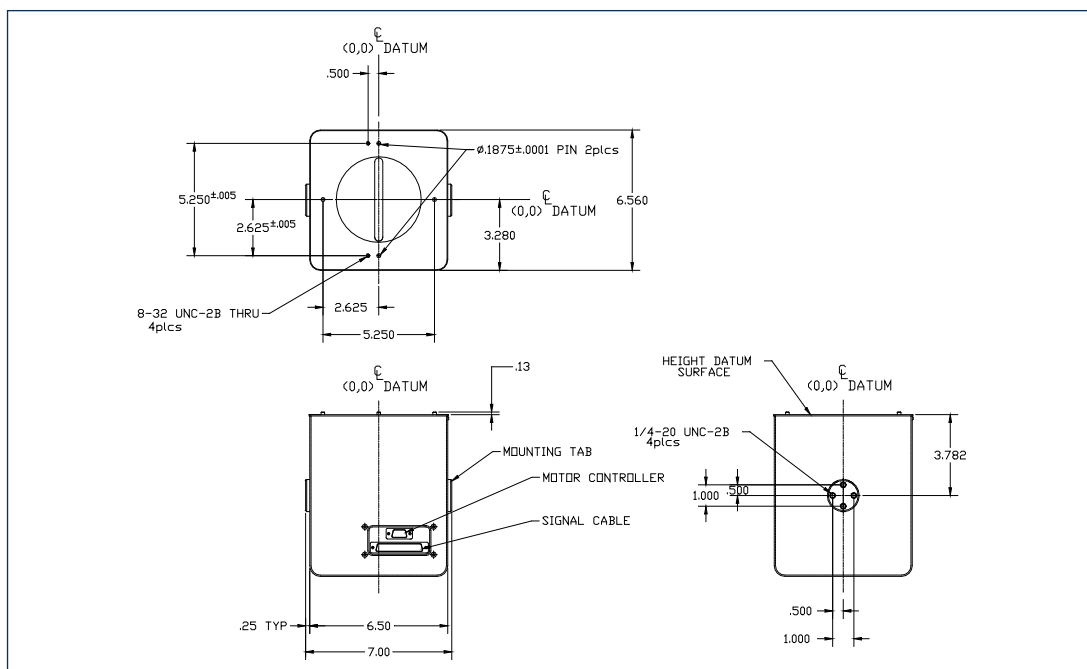


Figure 4-2. Detailed Mechanical Drawing showing the Dimensions of the LD 8900/LD 8900R Scan Unit

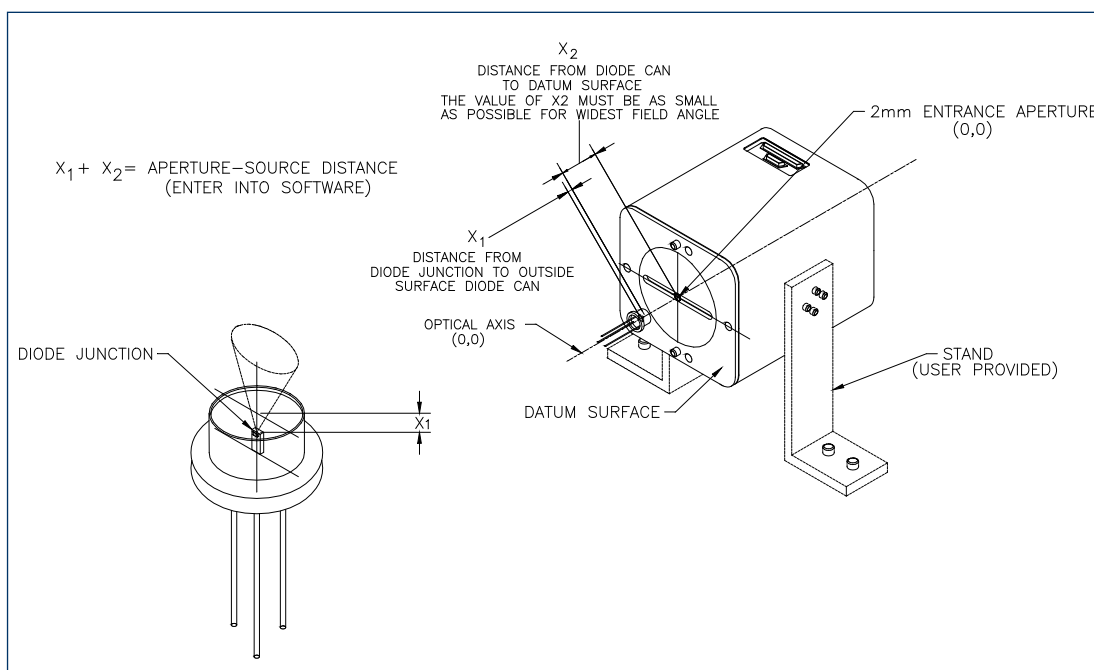


Figure 4-3. Illustration showing the positioning of a diode at the Entrance Aperture of the LD 8900/LD 8900R, and the determination of the Aperture-Source Distance for a low divergence diode source

Lateral positioning with respect to the Optical Axis should be accurate to tolerances on the order of ± 0.127 mm (± 0.005 "). The instrument will then provide the most accurate measures of angular widths and pointing. Measurements of pointing accuracy are significantly affected by lateral positioning errors, but angular width is not.

Pointing positioning with respect to the Optical Axis should also be as accurate as possible. Similar to lateral positioning errors, pointing positioning errors affect measurements of pointing but **not** angular width. **Note! Typical diode header tolerances are $\pm 1^\circ$, not including the mounting tolerances of an actual emitting junction.**

This page intentionally left blank.

5. System Measurement Overview

This chapter is an overview describing the basic mechanical and operating features of the LD 8900/LD 8900R hardware and software features that affect the measurements and the reported parameters. Users should be fully aware of these features first to understand the measurements performed and second in order to ensure the highest possible measurement accuracy.

Measurements made using the LD 8900/LD 8900R depend on the scan mode, user entered parameters, system algorithms and the positioning and pointing of the device under test.

5.1. Scan Modes

The Goniometric Radiometer acquires data in 1 of 3 scanning modes:

1. Single Axis Scan Mode
2. Perpendicular Axes Scan Mode, or
3. 3D Scan Mode.

The Single Axis and Perpendicular Axes Modes provide the fastest data updates. However, the data obtained are strongly dependent on how well the device under test is positioned relative to the optical axis of the LD 8900/LD 8900R instrument, and also on the pointing of the device.

In all three modes, the scans are made about the optical axis of the instrument. The scan geometry is eccentric; hence the raw scan data is not obtained at constant radius from the source. Therefore, to obtain the intensity at constant radius from the source, geometric corrections are applied to the raw data. This geometric correction depends on the **Aperture-Source Distance** parameter, which the user must enter into the software. It is extremely important to enter the proper value in order that the reported angular widths and positions are accurate. The nominal scan distance is (8.27 cm + Aperture-Source Distance).

5.2. Field of View

The Aperture-Source Distance determines the instrument field of view. The maximum field of view of $\pm 72^\circ$ is when the Aperture-Source Distance is zero, i.e., the source is positioned at the datum reference plane. As the source is moved away from the reference datum, the field of view decreases. Table 5-1 gives the field of view for different Aperture Source Distances

**Table 5-1. Goniometric Radiometer Field of View
for Various Values of the Aperture-Source Distance**

Aperture-Source Distance (cm)	Field of View (degrees)	Aperture-Source Distance (cm)	Field of View (degrees)
0	± 72.01	3.5	± 39.97
0.1	± 70.99	4.0	± 35.84
0.2	± 69.99	4.5	± 32.55
0.3	± 69.00	5.0	± 29.84
0.4	± 68.02	6.0	± 25.63
0.5	± 67.06	7.0	± 22.50
0.6	± 66.11	8.0	± 20.06
0.7	± 65.17	9.0	± 18.11
0.8	± 64.25	10.0	± 16.51
0.9	± 63.34	11.0	± 15.17
1.0	± 62.45	12.0	± 14.05
1.5	± 58.20	13.0	± 13.06
2.0	± 54.30	14.0	± 12.21
2.5	± 50.75	15.0	± 11.46
3.0	± 45.35	20.0	± 8.79

5.3. Acquired Scan Data

The scan data is acquired about the instrument optical axis, with the different ϕ azimuth angles specified relative to this axis. The data taken for each azimuth angle is a set of sampled signal amplitude values and corresponding scan angles, designated by the θ scan angles.

For each scan mode, the data acquired in each scan for a given ϕ azimuth angles consists of 3241 data points taken at $\sim 0.055^\circ$ increments in the θ scan angle. A 3D scan with 200 azimuthal scans yields a data set with 648,200 data points.

Data acquired when operating the system in either Single Axis or Perpendicular Axes Scan Modes can be displayed in real-time in the Rectangular View or Polar View windows of the Goniometric Radiometer

Analysis Software. Data acquired in the 3D Scan Mode can be viewed in various 3D image formats, or individual scan data can be viewed using the Replay feature of the software. These software features are discussed in Chapters 6 (LD8900) and Chapter 7 (LD8900R).

5.4. Processed 3D Scan Data

After a 3D scan acquisition, the data is first processed to compute the 3D Centroid of the intensity distribution. Next, the 2 principle axes of the distribution about this centroid, also known as the major and minor axes, are determined. These principal axes, together with the centroid axis, define 2 principal planes. These planes are then used in an algorithm to generate scan data along the major and minor axes, or along any axis through the 3D Centroid. This is done by interpolating the original scan data acquired about the optical axis. The processed data generated in this way can be viewed using the 3D Centroid Replay feature of the software, discussed in section Chapters 6 (LD8900) and Chapter 7 (LD8900R).

5.5. Blind Spots

The scanning mechanism of the Goniometric Radiometer incorporates two support structures, which cause blind spots in the scan for a limited range of ϕ azimuth angles. These blind spots are approximately 3.7° wide and occur at different ranges of θ angles in the scan data depending on the ϕ azimuth angle. Also, the angular positions of the blind spots are a function of the Aperture-Source Distance.

The blind spots are present for ϕ azimuth angles ranging from greater than 97° to less than 353° . Consequently, data taken at the nominal azimuthal scan angles of 0° and 90° are not affected. Furthermore, for data acquired at ϕ azimuth angles in the range from 97° to 353° , depending on the angular width of the source, the blind spots may or may not affect the scan data. For example, for $\phi = 108^\circ$, the blind spot occurs in the scan data from approximately $\theta = -65.8^\circ$ to $\theta = -69.5^\circ$. So, if the source extends only to 25° , the blind spot will not affect the data. However, if it extends to 68° , the data will be affected.

An example of scan data with blind spots, displayed in the Rectangular View window, is given in Figure 5-1. The azimuth angles for these scans are 135° and 225° . An example of a 3D acquisition with blind spots, displayed in the Topographic View window, is given in Figure 5-2. Here the effect of the blind spots can be seen as a void spiraling away from the center of the image.

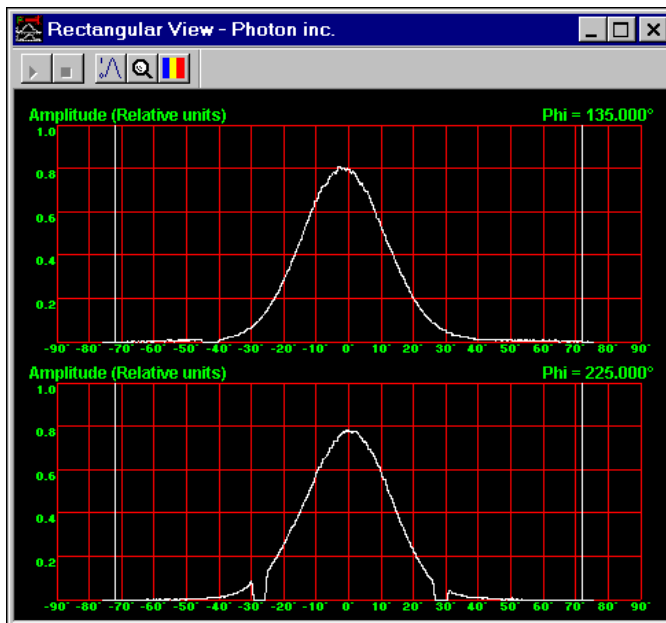
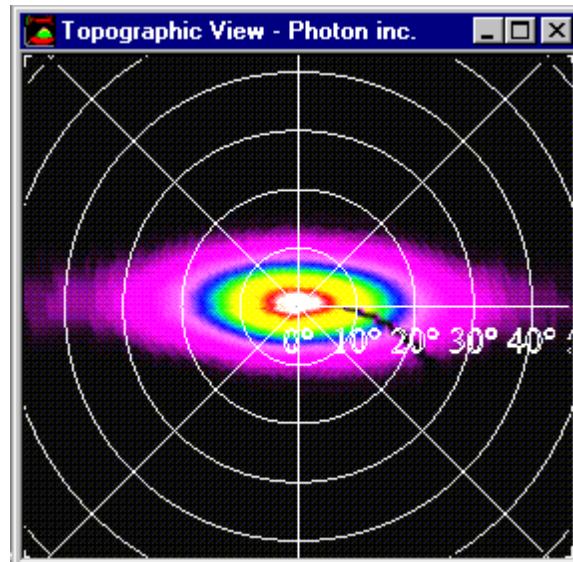


Figure 5-1. An example of scan data with blind spots, displayed in the Rectangular View window. One blind spot is visible in the 135° azimuth scan and 2 blind spots are visible in the 225° azimuth scan.

Figure 5-2. An example of a 3D acquisition with blind spots, displayed in the Topographic View window. Here the effect of the blind spots can be seen as a void spiraling away from the center of the image to the lower right.



The presence of blind spots will affect the results of all analyses in the Goniometric Radiometer analysis program, but to varying degrees. For example, angular width measurements will be affected if the clip level amplitude includes the blind spot. In this case the width would be reduced by at most the blind spot width. Therefore, the percent error will be inversely proportional to the width of the source, with a lower percent error for a broader source. Amplitude measures will be totally in error if the blind spot falls at the location at which amplitude is reported. Power calculations will also be affected, with the percent error once again inversely proportional to the width of the source pattern. Typical errors in the power calculation are conservatively estimated to be at most at the 3-5% level. This estimate is

based on an analysis of an intensity distribution that is uniform over all azimuth angles ($0^\circ \dots 360^\circ$), in which case the two 3.7° blind spots decrease the total power integral by only 2%.

To further reduce errors associated with the blind spots, an algorithm, called “Blind Spot Correction”, can be implemented in the Goniometric Radiometer Analysis Software. This algorithm is described in the next section.

5.6. Blind Spot Correction

Blind Spot Correction is an algorithm to partially correct the data in the blind spots. The algorithm first locates the position of the blind spots depending on the azimuth angle ϕ and the Source-Aperture Distance. Then, a linear interpolation is made between valid data points on either side of the blind spot.

Data with blind spot correction applied is given in Figure 5-3 and Figure 5-4. For comparison, Figure 5-3 shows data for the same source as that in Figure 5-1 except with blind spot correction applied. Similarly, the data in Figure 5-4 is for the same source as that shown in Figure 5-2 except with blind spot correction applied.

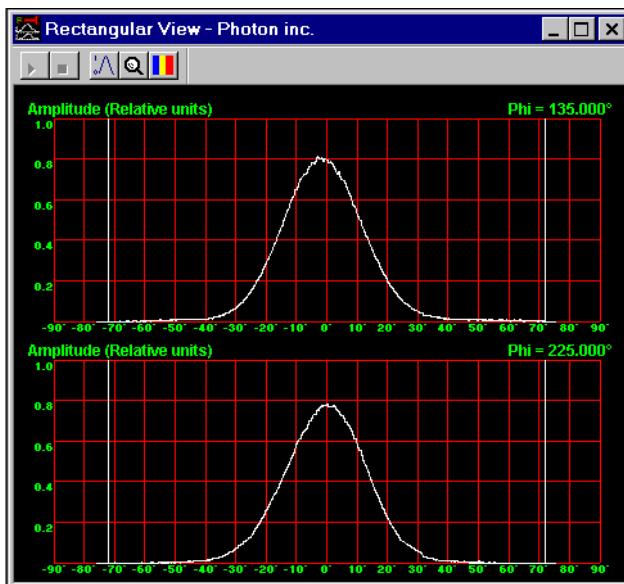


Figure 5-3. An example of scan data with Blind Spot Correction applied, displayed in the Rectangular View window. For comparison, this data is for the same source as that in figure 5-1 except with Blind Spot Correction applied.

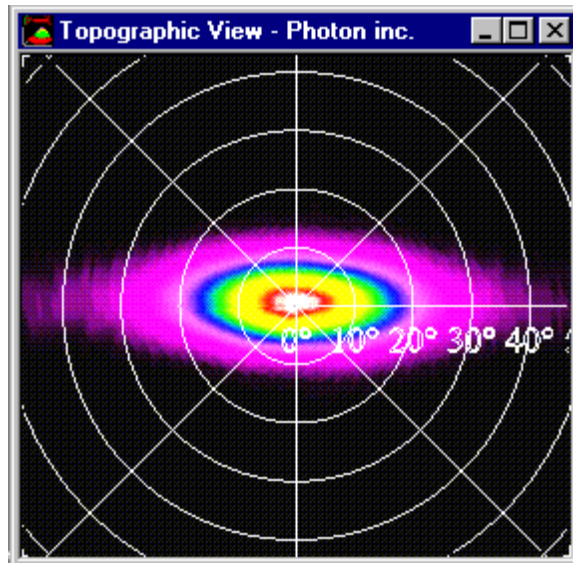


Figure 5-4. An example of a 3D acquisition with Blind Spot Correction applied, displayed in the Topographic View window. For comparison, this data is for the same source as that in Figure 5-2 except with Blind Spot Correction applied. Here the blind spot void is no longer visible.

5.7. Device Positioning and Pointing

The acquired data and the values of reported parameters are strongly dependent on the positioning and pointing of the source relative to the Goniometric Radiometer. The user must supply the source mount, and to facilitate the positioning of the mount, alignment pins with location tolerances of $\pm 0.127\text{mm}$ ($\pm 0.005''$) are provided.

For a device, which is pointing perfectly along the optical axis, changes in lateral position relative to the optical axis will have a significant effect on the reported centroid (pointing) values. A lateral shift in position of 1mm will result in a shift in centroid value of 0.68° . A lateral shift to the other side of the optical axis by 1 mm will result in a centroid value of -0.68° . So, with the same device, a spread in centroid value of 1.36° can be obtained, even though, we know that the device was pointing perfectly, i.e., at 0° . This example highlights the importance that positioning plays in the interpretation of measurement results. It is extremely important to position your device as close to the optical axis as possible in order to obtain the highest quality data.

The effect of lateral translation on the reported angular width parameters depends on whether the translation is along the scan direction or perpendicular to it. If the translation is along the scan direction, angular width parameters are not affected. If the translation is perpendicular to the scan direction, the variation in the reported angular width depends on the source distribution.

For a device that is positioned exactly at the optical axis, but which points at some off-axis angle, the scans made in the Single Axis and Perpendicular Axes Modes may not capture the principle axes of the source radiation pattern. For example, scan data acquired for a laser diode device pointing at

an angle of 5° to the optical axis and with the fast and slow axes oriented along the 45° and 135° azimuth angles will not capture the “proper” scans. The resulting numeric data will not faithfully represent the radiation pattern of the source. In cases like this, the 3D scan mode should be used. Although it takes more time, the data acquired can completely characterize the source, with analysis yielding the 3D Centroid of the spatial light distribution, as well as the mathematically reconstructed scans through the principle axes as described previously.

5.8. Operation of the Goniometric Radiometer with Pulsed Sources

Some customers may want to operate laser diode sources in the pulsed mode for measurement in order to eliminate the need for cooling of the chips. To operate in this way, either:

1. Define the actual operating space, i.e., the pulse width, frequency and power level that you will be operating with and contact Spiricon for advice on the application.
2. Or alternatively, try your application in the pulsed mode and compare your results with CW operation. If it is the same, use it, but be aware that even slight changes to the operating conditions can cause the results to be in error.

We have discovered that measuring pulsed sources with the goniometric radiometer is not straightforward. Although pulsed operation is possible, there are some parameter combinations that can cause inaccurate measurements. Because there can be unidentified saturation of some internal stages of the preamplifiers in the systems, some frequencies, pulse widths, duty cycles and power levels will work fine and others, which are scarcely different will create erroneous results. InGaAs and Silicon detector systems have different responses and operating spaces, but they both can generate erroneous results under some conditions.

The Photon Goniometric Radiometer Software has a pulsed operation mode that asks the user to input the pulse frequency. This software feature will accept values as low as 100Hz. Although the system will work and give no error messages, it is possible that the results obtained in this mode will be inaccurate. Spiricon provides a hardware upgrade for pulsed operation of the Goniometric Radiometer, which has corrected the errors inherent in the electronics and is guaranteed to give accurate results for pulsed sources operating at or above 10 kHz. Operation below this frequency is possible, but care must be taken to ensure that the results are accurate. One should always compare the pulsed results with those obtained while running the source in CW mode. Any differences observed will be the result of errors introduced by the combination of the pulse rate and the power. It should be

possible to find a combination of these parameters that result in accurate measurements, but Spiricon recommends that pulsed sources be measured only with the Pulsed Option installed and with the source operated at 10kHz or above.

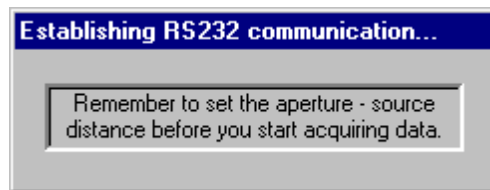
5.9. Summary

The interpretation of data acquired using the LD 8900/LD 8900R Goniometric Radiometer depends on the mode of operation, the positioning and pointing of the device under test, and user entered parameters. Use the Single Axis and Perpendicular Axes Scan Modes to acquire data at the fastest rates and when the distribution of the source is already well known. These modes are very useful for autonomously acquiring statistical data of devices over long periods of time, during burn-in or life testing for example. Use the 3D Scan Mode to provide the most complete characterization of a source. Finally, to obtain accurate angular width and pointing data, be sure to enter the proper value of the Source-Aperture Distance.

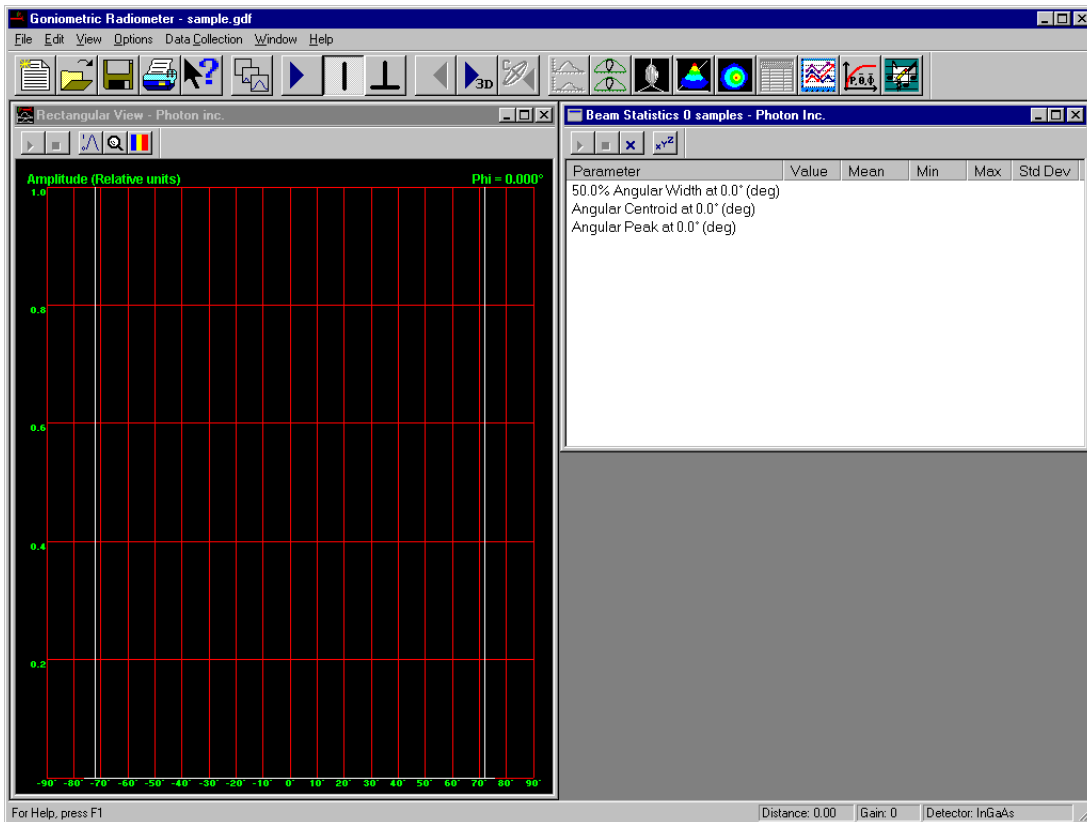
6. LD 8900 Acquisition and Analysis Software

6.1. Quick Start

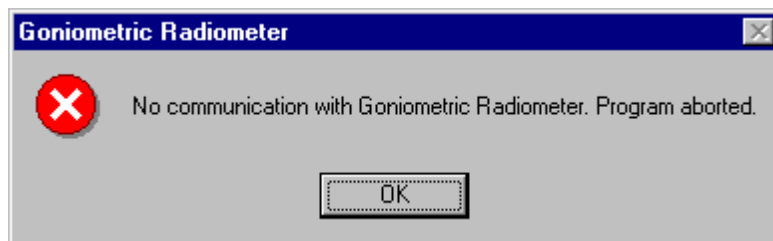
1. Turn on the PC.
2. Turn on the Goniometric Radiometer.
3. Start the Goniometric Radiometer Program by double-clicking on the program icon on your monitor screen; or, from the Windows Start menu, select Programs, then PHOTON, and then Goniometric Radiometer.
4. After a few moments a message will appear informing the user that the RS-232 Communication link is being established, with a reminder to set the Aperture-Source Distance.



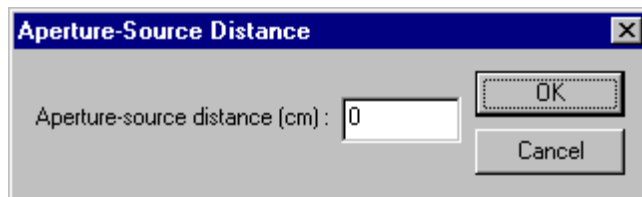
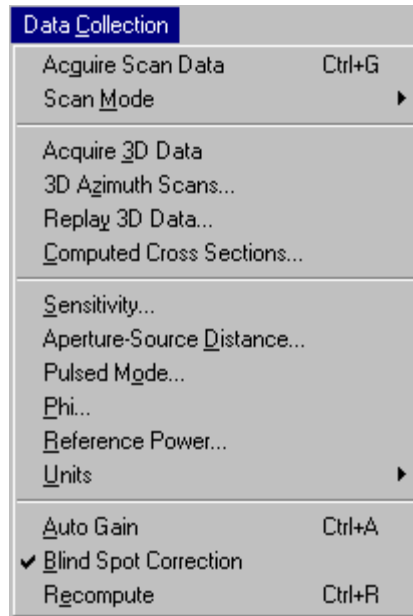
5. If RS-232 communication is established, the program will start after a few more moments. The main window will appear with the Rectangular View window and the Beam Statistics windows open, as shown below. The system will be in the Single Scan Mode.




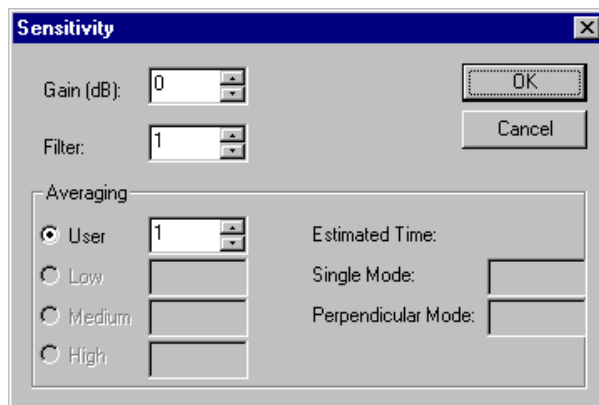
6. If RS-232 communication is not established, the following message will appear after approximately 30 seconds. In this case, click “OK”, then check that the RS-232 cable is securely connected, verify the COM port connection, and ensure the Goniometric Radiometer is powered on. Then go back to step 3 above. If the problem persists, contact Spiricon.



7. Set the Aperture-Source Distance in the Aperture-Source Distance dialog box accessed under the Data Collection Menu.



8. Turn on data acquisition by selecting **Acquire Scan Data** under the Data Collection Menu, or by clicking the left mouse button on the Data Collection icon  located on the main toolbar.
9. Set the Scan Amplifier gain in the Sensitivity Dialog box, accessed under the Data Collection Menu. Make sure your Device Under Test is powered on.



10. Increase the gain setting until you observe a signal in the Rectangular View window. Continue increasing the gain

until just below saturation to achieve the best vertical resolution.

11. The values for the 50% angular width, the Peak angle and the Centroid angle will be displayed in the Beam Statistics window. You are now acquiring data at the default azimuth scan angle of 0°. It's that simple.

6.2. Advanced Use

The previous **Quick-Start** procedure utilizes only the very basic features of the Goniometric Radiometer software program. The program is very powerful and flexible, allowing users to configure the analyses and the information display windows to suit their individual needs. Users can arrange and size multiple windows as required, and these screens can be saved as files for future use. Also, data can be exported to spreadsheets, math and statistical analysis programs, and process/instrumentation programs by logging data to files or COM ports, or shared using ActiveX.

At this point, take a few minutes to read the rest of this section, which includes detailed descriptions of the software features that control the various scanning modes and ways to analyze, display and log data. The software is also described in the On-line Help. A little time spent in advance learning the features of the system will go a long way in making the Goniometric Radiometer an invaluable resource for far field source characterization.

6.3. Scan Modes

There are 3 scan modes for data acquisition. The 3 scan modes are:

1. Single Axis Mode,
2. Perpendicular Axes Mode, and
3. 3D Mode

The Scan Mode is selected under the Data Collection Menu, or by clicking the tool bar icons:



Selects the Single Axis Scan Mode



Selects the Perpendicular Axes Scan Mode



Selects the 3D Scan Mode

The Single Axis and Perpendicular Axes Modes provide the most rapid characterization of a source. The 3D Mode takes more time but provides the most complete characterization.

6.3.1. Single Axis Mode

In the Single Axis Mode, the system performs scans along 1 azimuth angle. The angle of the scan can be set using the Phi Angle dialog box. This dialog is accessed under the Data Collection Menu by selecting “Phi...” Offset angles ranging from 0 to 180° in increments of 0.225° can be selected from the list in the Dialog box. The default Phi angle is 0°.

6.3.2. Perpendicular Axes Mode

In the perpendicular axes mode, the system performs two scans in orthogonal directions. The first scan is made at the angle set in the PHI Angle dialog box. The second scan is made at this angle plus 90°.

6.3.3. 3D Scan Mode

In the 3D mode, a series of measurements are made at incremental azimuth (Phi) angles ranging from 0° to 180°. The incremental angles available are 18°, 9°, 3.6°, 1.8° and 0.9°. Respectively, the number of scans made for these 3D measurements are 10, 20, 50, 100, and 200.

6.4. Viewing Data

The acquired data can be viewed in various ways using the different windows. The windows are:

1. Rectangular View;
2. Polar View;
3. Beam Statistics;
4. Time Statistics (up to 15 can be opened);
5. 3D Rectangular View;
6. 3D Polar View;
7. Topographic View;
8. Power View.

Data acquired in the Single Axis and Perpendicular Axes Modes can be displayed in the following Windows:

Rectangular View	The Rectangular View window displays a graph of amplitude or intensity vs. scan angle in Cartesian coordinates of the data sets acquired for either one or both scans.
Polar View	The Polar View window displays a graph of amplitude or intensity vs. scan angle in polar coordinates of the data sets acquired for either one or both scans.
Beam Statistics	The Beam Statistics window displays numerical values of parameters obtained from the scan data. The parameters are angular beam width, numerical aperture, angular beam width ratios, centroid angle, peak angle, centroid amplitude, peak amplitude, amplitude at user specified angles. It also displays the Mean, Minimum, Maximum, and Standard Deviation values, and the Maximum Limit and the Minimum Limit for parameter limit testing.
Time Statistics	The Time Statistics windows are displays of parameter values versus the sample number. Up to 15 Time Statistics windows can be opened.

Data Acquired in 3D Mode can be displayed in the following windows:

3D Rectangular View	The 3D Rectangular View window displays a representation of the source profile in cylindrical coordinates, with the data as the height or “z” value, above the (θ , ϕ) plane. The view perspective is looking toward the source.
3D Polar View	The 3D Polar View window displays the data in spherical coordinates, with the data as the radius from the origin. The perspective of this view is looking toward the source.
Topographic View	The Topographic View window displays the relative amplitude of the data acquired in a 3D scan in a false-color format on a polar grid of θ and ϕ . The perspective of this view is looking from the source.
Rectangular View	The Rectangular View window is used to display data after a 3D acquisition. Select the Replay Mode or the Centroid Replay Mode from the Data Collection Menu, or click the Replay or Centroid Replay icon.
Polar View	The Polar View window is used to display data after a 3D acquisition. Select the Replay Mode or the Centroid Replay Mode from the Data Collection Menu, or click the Replay or Centroid Replay icon.
Power	The Power window displays a graph of the cumulative angular power, numerical values (up to 3) of the power within specified cone angles, numerical values (up to 3) of the cone angles containing specified percentages of the total power, and the θ and ϕ values of the angular 3D centroid of the profile. The cumulative power graph and associated parameters are determined along either the instrument optical axis or the 3D centroid axis.

6.5. Pull-Down Menus

6.5.1. File Menu

The “**File**” Menu is used for opening and closing files, saving files, setting preferences at program startup, and for printing. When “File” on the Menu Bar is clicked, the pull-down menu below appears:



New	Halts data collection, closes all open windows, and then opens a new file with the Rectangular View window displayed.
Open...	Opens the File Open dialog box. It lists Data Files from the current working directory. To open a data file, select one from the list and then select the Open button. All windows will be closed and the new file will be loaded. The data, windows and computed statistics from the file will be displayed.
Close	Halts data collection and closes all open windows.
Save	Saves the current data and windows configuration in the currently active folder. The name of this file is displayed on the main window title bar.
Save As...	Opens the File Save As dialog box. It lists Data Files from the current working directory. Either select an existing file from the list or enter a new name in the File Name edit box. To save as a data file, simply select the Save button. Otherwise, select the desired file type from the Save As Type combo box. There are 5 different file types, identified by their extensions:
*.GRD	Goniometric Radiometer Acquisition and Analysis Program Data File. This file can only be used by the Goniometric Radiometer software. The configuration of the screens, system settings, and the beam measurements (data) are saved.
*.CFG	Configuration File. This file can only be used by the Goniometric Radiometer software. The

configuration of the screens and the system settings are saved.

**.PRW*

3D Data File. This file is in binary format and contains data from the last 3D Acquisition. It is provided for users to perform custom off-line analysis using their own code. This file type cannot be imported back into the Goniometric Radiometer Software. The structure of the file is:

number of scans, stored as unsigned short type (2 bytes);

number of points, stored as unsigned short type (2 bytes);

Theta Angles: “number of points” values stored in radians, as float type (4 bytes).

Data: “number of scans × number of points” values, stored as short type (2 bytes). Data are stored scan after scan (each scan has “number of points” values corresponding to the Theta Angles). The value of the Phi Angle (deg) is $180^\circ / (\text{number of scans}) \times (\text{number of current scan} - 1)$.

**.ASC*

ASCII File. The file contains profile data and the data from each view in ASCII format.

**.BMP*

Bitmap File. Saves the program screen as a Bitmap File.

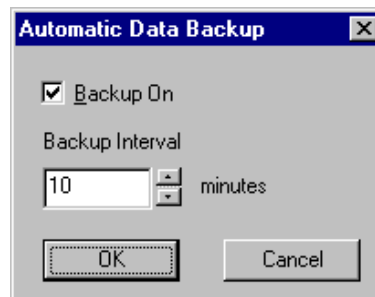
Preferences

Configures user preferences on startup and exit.



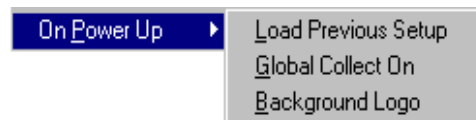
Timed Backup...

Opens the **Automatic Data Backup** dialog box, for configuring if and when backups are to occur. If the **Backup On** checkbox is selected, then all data will be saved automatically at the specified interval. Use this feature when collecting data over extended periods to prevent data loss in the event of a power outage or other catastrophe. When the program is restarted after such an event, the backup file will load and data collection will resume from the point of the last automatic save.



On Power Up

Opens a menu with the following selections:



Load Previous Setup

When checked, the last saved data file will automatically load at startup.

Global Collect On

When checked, data collection resumes at startup.

Background Logo

When checked, the Photon Logo appears as the background for the main window.

On Exit

Opens a menu with the following selections:



Save Setup

When checked, the user is prompted to save the latest data as a .GRD or configure as a .CFG file upon exit.

Prompt

When checked, the user is prompted with the message "**Leaving Already?**" upon exit.

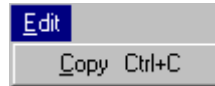
Print...

Opens the **Print** dialog box, used for printing the program screen.

Print Setup...	Opens a dialog box for selecting and configuring printers.
Exit	Exits the program.

6.5.2. Edit Menu

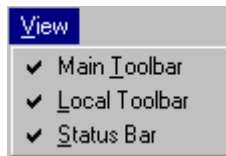
When “**Edit**” on the Menu Bar is clicked, the pull-down menu below appears:



Copy	Copies the active window to the Windows clipboard as a bitmap image. From there, the bitmap can be pasted into other program applications.
-------------	--

6.5.3. View Menu

When “**View**” on the Menu Bar is clicked, the pull-down menu below appears:



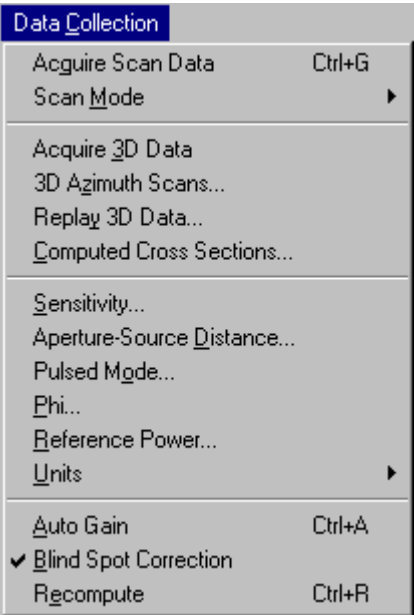
Main Toolbar	When checked, the toolbar on the main window is visible.
Local Toolbar	When checked, the toolbar of the currently active view is visible, if available.
Status Bar	When checked, the status bar at the bottom of the main window is visible.

6.5.4. Options Menu

Various options associated with the window views can be selected under the “**Options**” menu when that particular window is active. The list of options are unique for each window type. The options list can be found under the window descriptions.

6.5.5. Data Collection Menu

The “**Data Collection**” menu includes selections, which determine or affect the collection of data. When “Data Collection” on the Menu Bar is clicked, the pull-down menu below appears:



Acquire Scan Data

Turns data acquisition on or off when operating in either Single Axis or Perpendicular Axes scan modes.

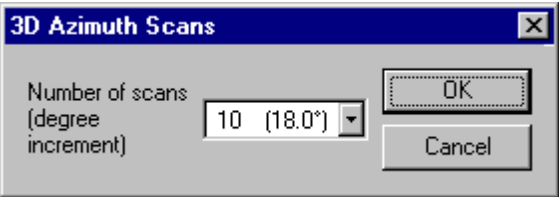
Scan Mode

Selects either the Single Axis or Perpendicular Axes Scan Modes.



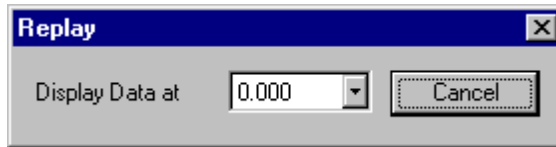
**Acquire 3D Data
3D Azimuth Scans...**

Starts 3D data acquisition.
Opens a dialog for selecting the number of azimuthal scans for a 3D acquisition, either 10, 20, 50, 100 or 200. The corresponding angular increments are 18°, 9°, 3.6°, 1.8° and 0.9°.



Replay 3D Data...

Turns on the Replay Mode, where data acquired in the last 3D scan can be viewed in either the Rectangular View, Polar View or Beam Statistics window. The azimuth angle of the scan is selected in the combo box. To exit the Replay mode, press the Cancel button.



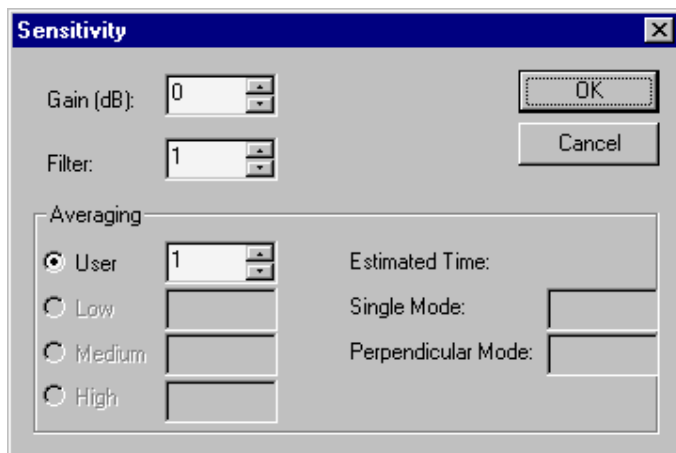
Computed Cross Sections...

Turns on the Computed Cross Sections Replay Mode. In this mode, orthogonal cross sections computed using the scan data obtained from the last 3D acquisition are displayed in either the Rectangular View or Polar View. The parameters for the computed cross sections are displayed in the Beam Statistics window. The computed cross sections can be through either the 3D Centroid, the 3D Peak, or through an Arbitrary Vector. This selection is made in the Computed Cross Sections dialog which appears after selecting the Computed Cross Sections Replay Mode. The offset azimuth angle of the first computed cross section is entered in the edit box. For offset "0", the computed orthogonal cross sections are in the directions of the major and minor axes of the Centroid intensity distribution. To exit the Computed Cross Sections Replay Mode, press the Close button.



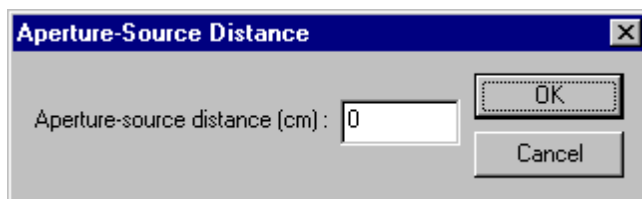
Sensitivity...

Opens the Sensitivity Dialog Box. This dialog box is used to manually set the Gain, Filter and Average settings for data presentation. The gain can be set over the range from 0 to 139 dB for InGaAs detectors and from 0 to 159 dB for Silicon detectors. The filter value sets the number of points used in a consecutive sum smoothing filter used in data analysis and display. Values from 0 to 99 are allowed. The Averaging Value sets the number of scans to be averaged together before analysis and displays. User selected values can range from 1 to 10,000. The Low, Medium and High selections are not presently available and are inactive.



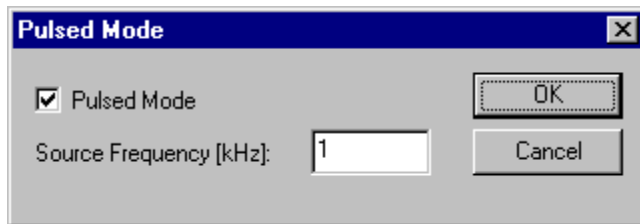
Aperture-Source Distance...

Opens the Aperture-Source Distance Dialog Box. This dialog box is used to enter the value of the Aperture-Source Distance, i.e. distance between the datum plane of the entrance aperture and your source. The value is in centimeters (cm). Resetting the value of the Aperture-Source Distance will reset / void all previously acquired data. A dialog box alerts the user to this impending action.



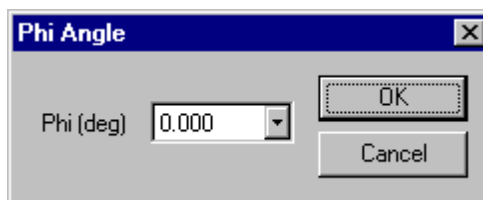
Pulsed Mode...

Opens the Pulsed Mode Dialog Box. If you are using a pulsed source, use this dialog box to set the Pulsed Mode of operation and to enter the pulse repetition frequency of the source. When operating in Pulsed Mode, the peaks of the individual pulses in the profile are connected to form a smooth profile. All parameter computations will be performed on the resulting smooth profile. The allowable frequency range is 0.1 – 20 kHz.



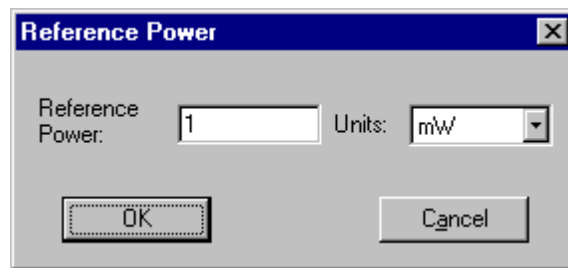
Phi...

Opens the Phi Angle Dialog Box. This dialog box is used to select an offset Azimuth Scan Angle for Single Axis and Perpendicular Axes Scan modes. When operating in the Single Scan mode, the scan will be performed at the selected Phi angle. In Perpendicular Axes mode, the first scan will be made at this angle and the second scan will be made at $\text{Phi} + 90^\circ$. The values available for selection range from 0° to 80° in 0.225° increments.



Reference Power...

Opens the Reference Power dialog box. Enter the value of the measured reference power in the edit box and select the units— μW , mW or W, in the combo box.



Units

Opens the Units submenu for selecting the units for the Rectangular View, Polar View, Beam Parameters, and Time Statistics windows. Choices available are Relative (%), 0-100%, Counts, 0-255, or Intensity (W/sr). The Intensity (W/sr) selection is only available if a 3D acquisition has been performed.



Auto Gain

Automatically sets the amplifier gain when operating in either Single Axis Scan Mode or Perpendicular Axes Scan Mode.

Blind Spot Correction

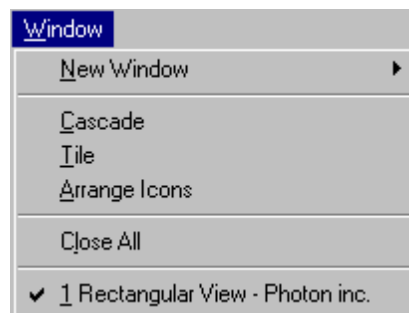
Turns Blind Spot Correction on or off.

Recompute

Use Recompute to reanalyze acquired scan data or computed cross section data for either the previous acquisition or for saved data files.

6.5.6. Window Menu

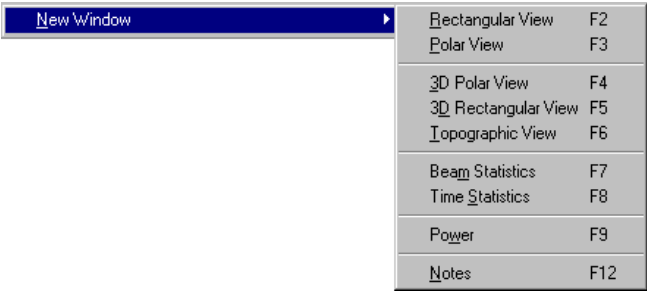
When “**Window**” on the Menu Bar is clicked, the pull-down menu below appears:



The Window menu is used to open new windows, to arrange windows and window icons and to close all open windows. The list at the bottom of the menu shows which windows are open with the currently active window checked.

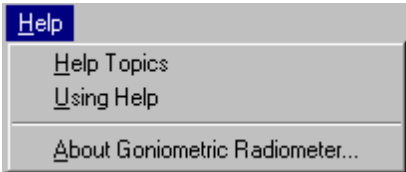
New Window

Opens a submenu for opening windows available for viewing.



6.5.7. Help Menu

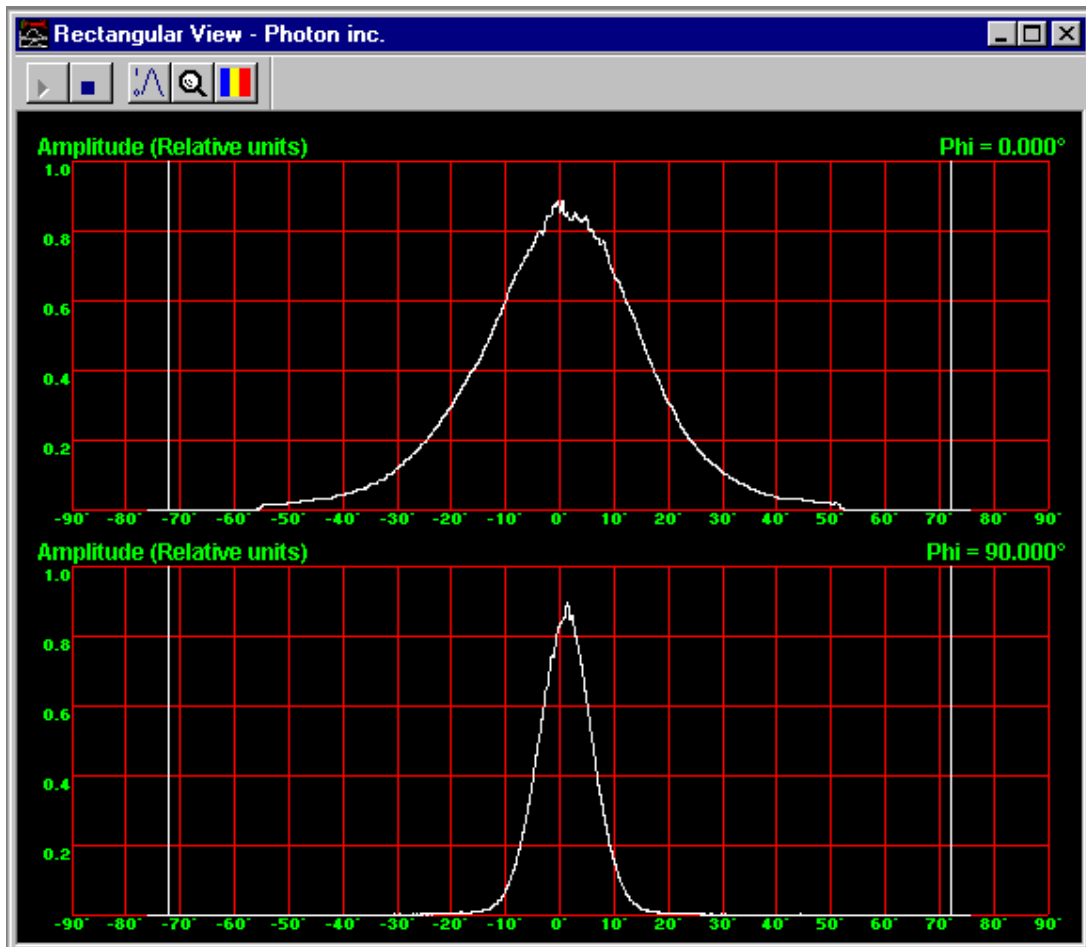
Use the “**Help Menu**” to access Help Topics, directions on how to use the On-line Help, and Goniometric Radiometer software version information.



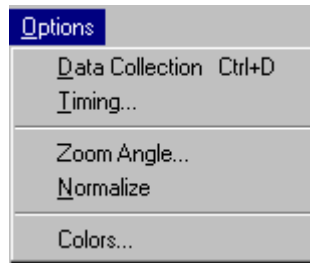
6.6. Window Descriptions

6.6.1. Rectangular View

Open the Rectangular View window. This window displays the data from either a single axis scan or perpendicular axes scans with measured amplitude vs. angle in rectangular coordinates. Options for this menu are accessed through the Options menu when the Rectangular View window is active.



The **Options Menu** available when the Rectangular View window is active is shown below. The selections are:

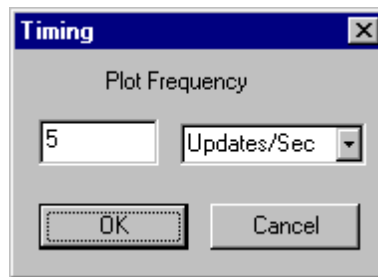


Data Collection

Turns data collection on and off.

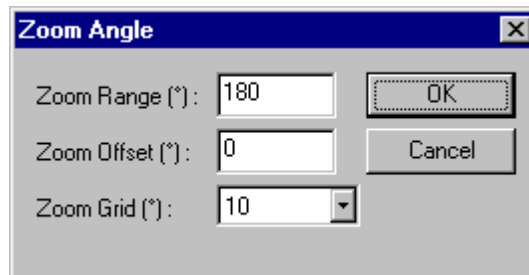
Timing...

Opens a dialog box for selection of the profile update rate.



Zoom Angle...

Opens the Zoom Angle Dialog Box. The Zoom Angle Dialog box allows zooming to view a section of the scan data in greater detail. It is used to select the Angular Range, the Zoom Offset Angle and the Grid Spacing. All values are in degrees.



Normalize

Scales the profile amplitude to have a peak value of 1, i.e. full scale. (In Perpendicular Axes Scan mode the normalization will be for the largest amplitude scan).

Colors...

Opens a Colors dialog box, used for selecting the color scheme for the displayed graph. Colors for the background, text, grid and data can be independently set. To change a color, click on the appropriate color “button” to open a Windows color selection dialog box.



Some of the options can also be selected using the icons on the Rectangular View window toolbar:



Starts Data Collection



Stops Data Acquisition



Normalize the Display



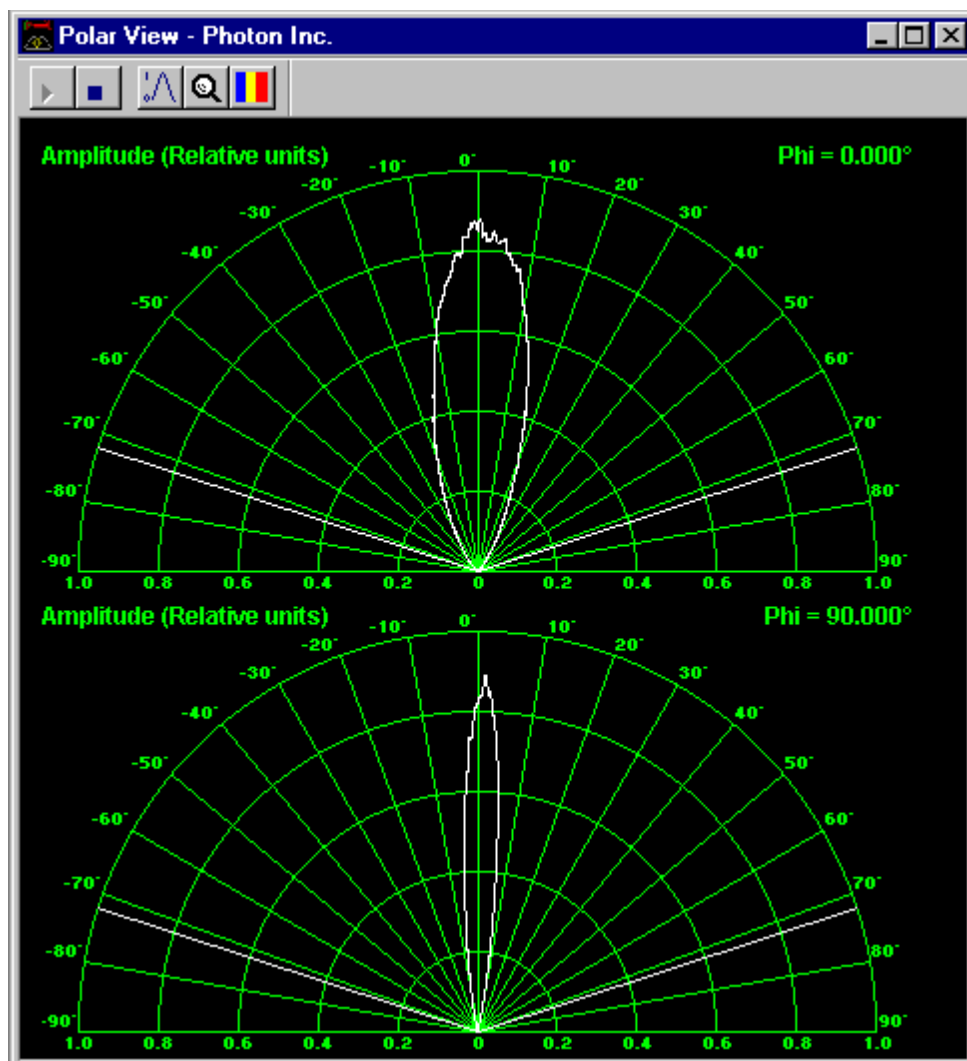
Opens the Zoom Angle Dialog Box



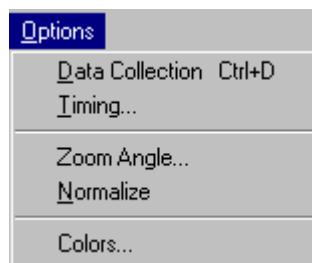
Opens the Color Selection Dialog Box

6.6.2. Polar View

Open the Polar View window. This window displays the data from either a single axis scan or perpendicular axes scans with measured amplitude vs. angle in polar coordinates.



The **Options Menu** available when the Polar View window is active is shown below. The selections are:

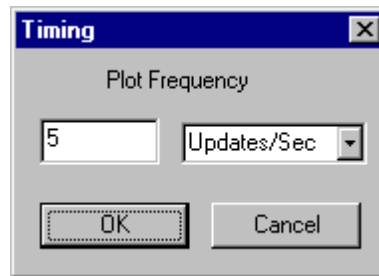


Data Collection

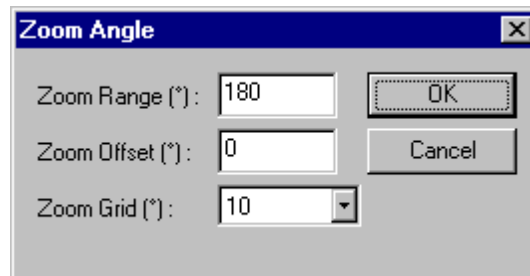
Turns data collection on and off.

Timing...

Opens a dialog box for selection of the profile update rate.

**Zoom Angle...**

Opens the Zoom Angle Dialog Box. The Zoom Angle Dialog box is used to select the Angular Range, the Zoom Offset Angle and the Grid Spacing. All values are in degrees.

**Normalize**






Scales the profile amplitude to have a peak value of 1, i.e. full scale. (In Perpendicular Axes Scan mode the normalization will be for the largest amplitude scan).

Colors...

Opens a Colors dialog box, used for selecting the color scheme for the displayed graph. Colors for the background, text, grid and data can be independently set. To change a color, click on the appropriate color "button" to open a Windows color selection dialog box.

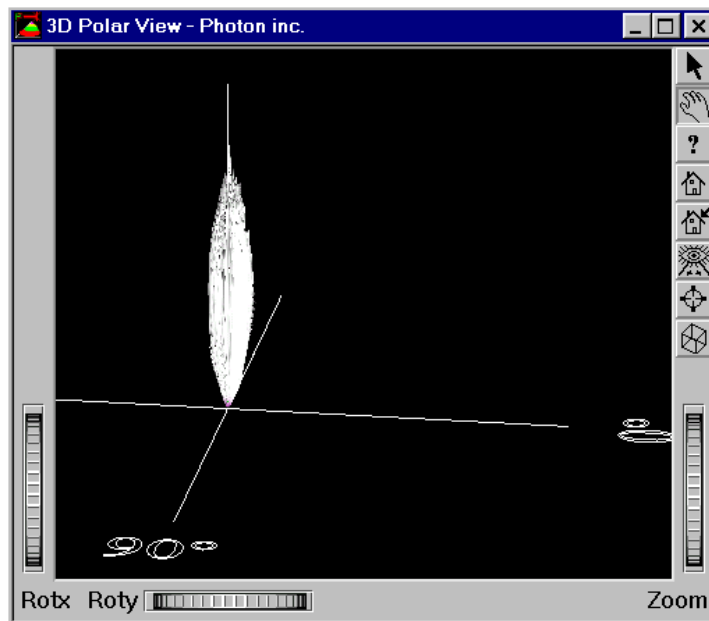


Some of the options can also be selected using the icons on the Rectangular View window toolbar:

- | | |
|---|---------------------------------|
|  | Starts Data Collection |
|  | Stops Data Acquisition |
|  | Normalize the Display |
|  | Opens the Zoom Angle Dialog Box |
|  | Opens the Color Dialog Box |

6.6.3. 3D Polar View

Open the 3D Polar View window. This window displays data from 3D acquisitions in a “3-dimensional” viewing format in spherical coordinates. The image can be rendered with either a wireframe or solid surface. The view perspective is looking toward the source.



The **Options Menu** available when the Polar View window is active is shown below. The selections are:



Solid Surface

When selected, the image will have a solid surface. When not selected, the image will be rendered as wireframe.

Clip Level...

Not presently available.

Clip Legend

Not presently available.

Resolution

Opens a submenu for selecting the resolution of the 3D image, either Low (120 points per scan), Medium (270 points per scan), or High (540 points per scan).



The toolbar at the right border of the window contains 8 buttons used to select several viewing and image manipulation features. These buttons are, from top to bottom:



Chooses the “Arrow” cursor. Allows image manipulation only using the mouse and the thumbwheel controls.



Chooses the “Hand” cursor. Allows image manipulation using the mouse directly in the image or by using the thumbwheel controls. (When the mouse is moved to the window border the Hand cursor changes to the Arrow cursor.)



This Help menu is inactive. Please use the main Help menu.



Resets the view to a preset “Home” default position, size and orientation.



Sets the default settings for the “Home” button.



Restores the view to include the entire image.



Activates the “Seek” cursor. After positioning this cursor on a selected point in the image and clicking the left mouse button, a close-up zoom to that point will be performed automatically. Also, the center of rotation will be set to that point.



Toggles between the Orthographic and Perspective projection modes.



There are also several “thumbwheels” along the window border, designated “Zoom”, “Dolly”, “Rotx”, and “Roty”, which are used to zoom and rotate the 3D image.

The image can be rotated, translated, panned, and zoomed using the mouse with the Arrow cursor and the “thumbwheel” control knobs or using the mouse with the Hand cursor, as described below.

Rotation

Rotate the image using the mouse and the Arrow cursor with the thumbwheels labeled ROTX and ROTY. Alternatively, use the mouse and the Hand cursor to directly rotate the image; Position the hand cursor over the image, depress the left mouse button, and drag the mouse to obtain the desired orientation.

Pan/Translate

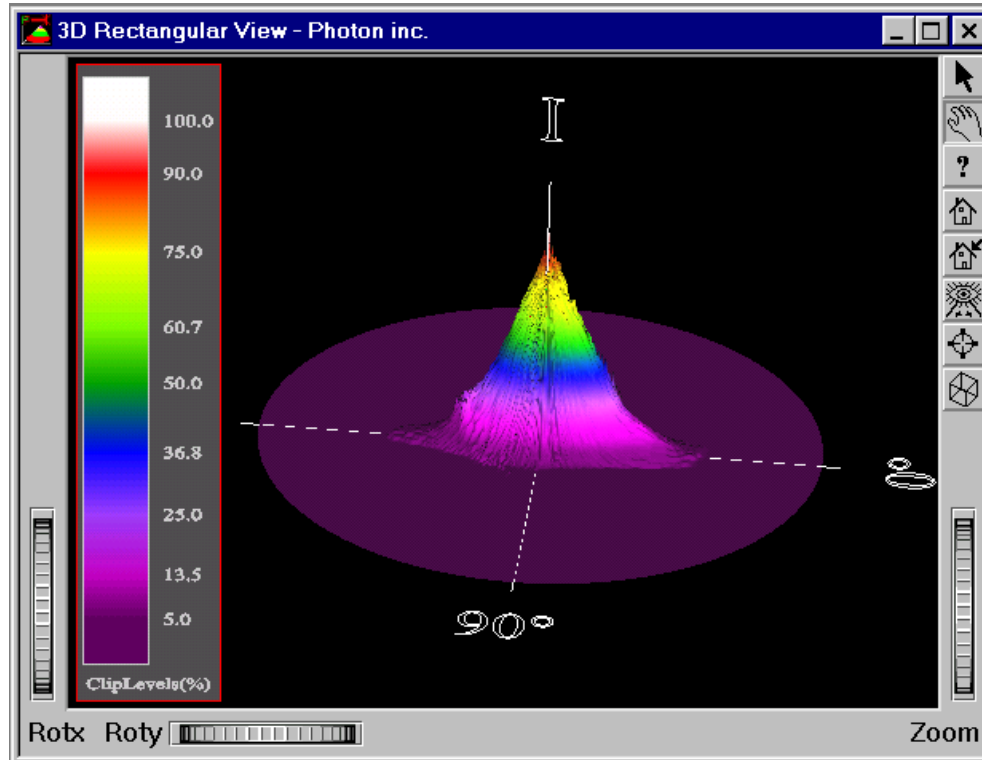
While depressing the control key <CTRL>, use the mouse and the Hand cursor to directly pan the image. Position the hand cursor over the image, depress the left mouse button, depress the control key, and drag the mouse to move the image to the desired location.

Zoom

The method for zooming the image depends on the type of display projection selected. In the Perspective projection mode, use either the zoom control arrows at the bottom of the window, or use the Dolly thumbwheel at the lower right border of the window. In the Orthographic projection mode, use the Zoom thumbwheel at the lower right border of the window.

6.6.4. 3D Rectangular View

Open the 3D Rectangular View window. The 3D Rectangular View window displays the source intensity pattern in a “3-dimensional” viewing format in cylindrical coordinates. The image can be rendered with either a wireframe or solid surface, with user selected clip levels and colors. The perspective of this view is looking toward the source.



The **Options Menu** available when the 3D Rectangular View window is active is shown below. The selections are:

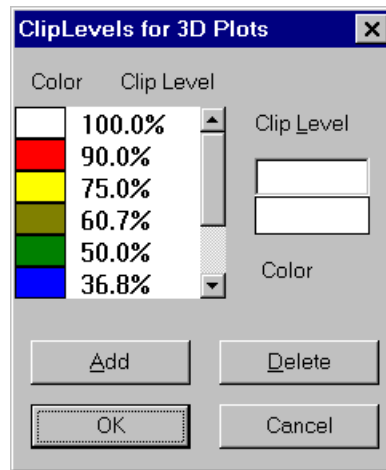


Solid Surface

When selected, the image will have a solid surface. When not selected, the image will be rendered as wireframe.

Clip Level...

Opens a dialog box for selecting clip level contours and their colors.

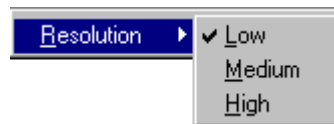


Clip Legend

When selected, the clip level legend will be displayed in the 3D window.

Resolution

Opens a submenu for selecting the resolution of the 3D image, either Low (120 points per scan), Medium (270 points per scan), or High (540 points per scan).



The toolbar at the right border of the window contains 8 buttons used to select several viewing and image manipulation features. These buttons are, from top to bottom:



Chooses the “Arrow” cursor. Allows image manipulation only using the mouse and the thumbwheel controls.



Chooses the “Hand” cursor. Allows image manipulation using the mouse directly in the image or by using the thumbwheel controls. (When the mouse is moved to the window border the Hand cursor changes to the Arrow cursor.)



This Help menu is inactive. Please use the main Help menu.



Resets the view to a preset “Home” default position, size and orientation.



Sets the default settings for the “Home” button.



Restores the view to include the entire image.



Activates the “Seek” cursor. After positioning this cursor on a selected point in the image and clicking the left mouse button, a close-up zoom to that point will be performed automatically. Also, the center of rotation will be set to that point.



Toggles between the Orthographic and Perspective projection modes.



There are also several “thumbwheels” along the window border, designated “Zoom”, “Dolly”, “Rotx”, and “Roty”, which are used to zoom and rotate the 3D image.

The image can be rotated, translated, panned, and zoomed using the mouse with the Arrow cursor and the “thumbwheel” control knobs or using the mouse with the Hand cursor, as described below.

Rotation

Rotate the image using the mouse and the Arrow cursor with the thumbwheels labeled Rotx and Roty. Alternatively, use the mouse and the Hand cursor to directly rotate the image; Position the hand cursor over the image, depress the left mouse button, and drag the mouse to obtain the desired orientation.

Pan/Translate

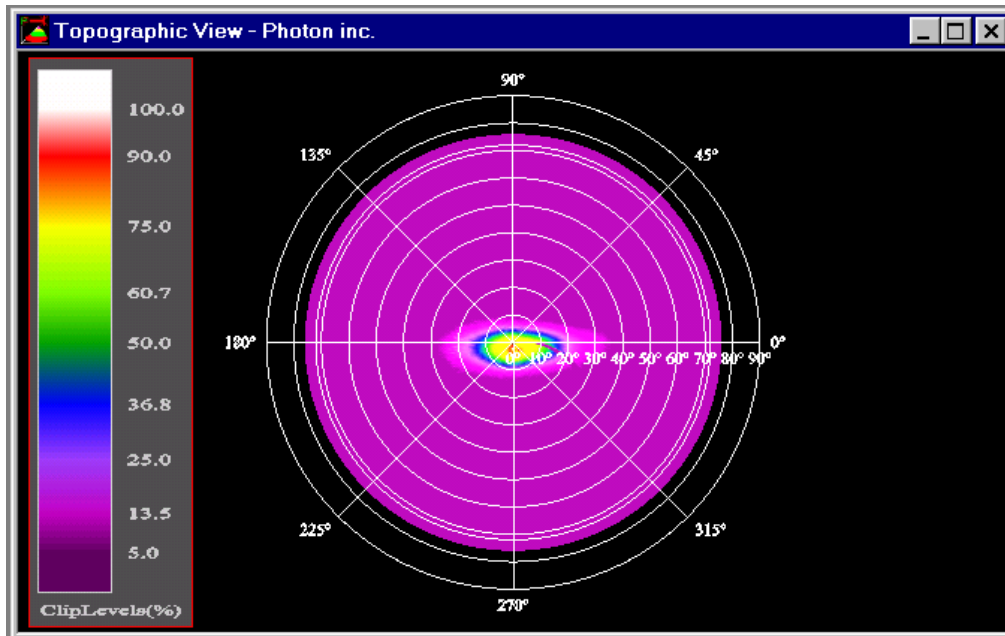
While depressing the control key <CTRL>, use the mouse and the Hand cursor to directly pan the image. Position the hand cursor over the image, depress the left mouse button, depress the control key, and drag the mouse to move the image to the desired location.

Zoom

The method for zooming the image depends on the type of display projection selected. In the Perspective projection mode, use either the zoom control arrows at the bottom of the window, or use the Dolly thumbwheel at the lower right border of the window. In the Orthographic projection mode, use the Zoom thumbwheel at the lower right border of the window.

6.6.5. Topographic View

Open the Topographic View window. This window displays the data from 3D acquisitions with false color in polar coordinates. The perspective of this view is looking from the source.

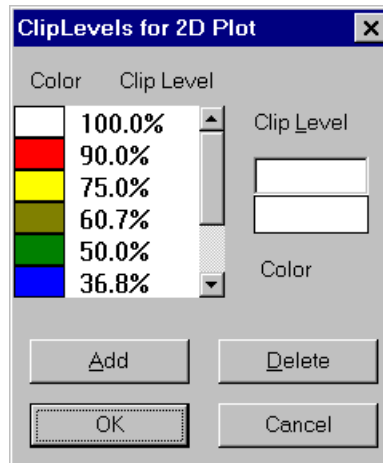


The **Options Menu** available when the Topographic View window is active is shown below. The selections are:



Clip Level...

Opens a dialog box for selecting clip level contours and their colors.



Clip Legend

When selected, the clip level legend will be displayed in the 3D window.

Resolution

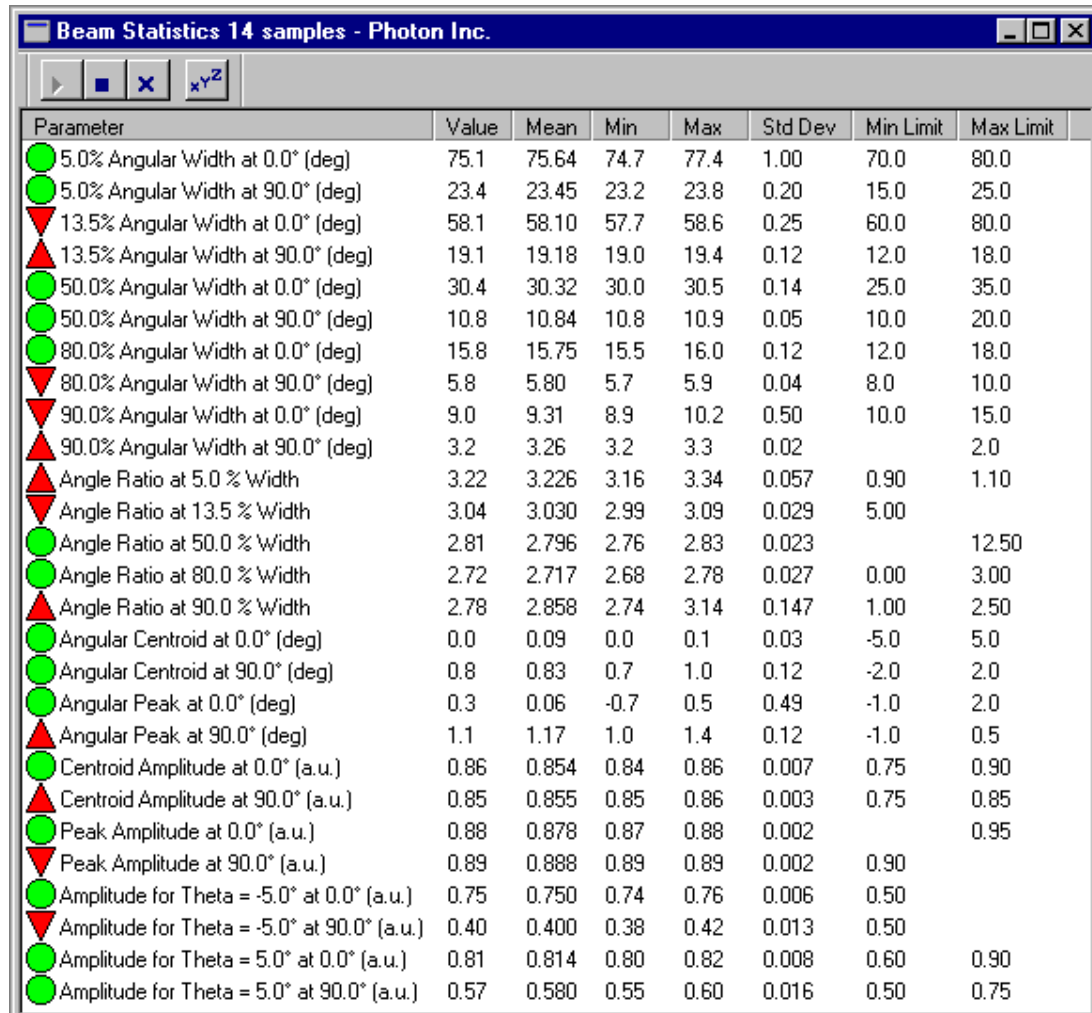
Opens a submenu for selecting the resolution of the 3D image, either Low (120 points per scan), Medium (270 points per scan), or High (540 points per scan).

**Zoom**

To Zoom in, click and hold down the left mouse button while dragging the mouse away from the center. To Zoom out, click and hold down the left mouse button while dragging the mouse toward the center. To translate up, down, left and right, simultaneously press the Ctrl key and the Left Mouse Button, and drag the mouse to move the image to the desired location.

6.6.6. Beam Statistics

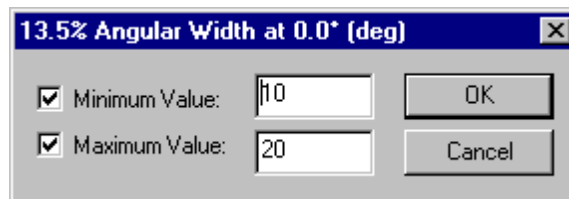
Open the **Beam Statistics** window. This window displays a tabular summary of beam parameters and statistics. It is also used for **Limit Analysis**. The parameters for viewing are selected in the **Beam Statistics Parameters** dialog box.



Parameter	Value	Mean	Min	Max	Std Dev	Min Limit	Max Limit
5.0% Angular Width at 0.0° (deg)	75.1	75.64	74.7	77.4	1.00	70.0	80.0
5.0% Angular Width at 90.0° (deg)	23.4	23.45	23.2	23.8	0.20	15.0	25.0
13.5% Angular Width at 0.0° (deg)	58.1	58.10	57.7	58.6	0.25	60.0	80.0
13.5% Angular Width at 90.0° (deg)	19.1	19.18	19.0	19.4	0.12	12.0	18.0
50.0% Angular Width at 0.0° (deg)	30.4	30.32	30.0	30.5	0.14	25.0	35.0
50.0% Angular Width at 90.0° (deg)	10.8	10.84	10.8	10.9	0.05	10.0	20.0
80.0% Angular Width at 0.0° (deg)	15.8	15.75	15.5	16.0	0.12	12.0	18.0
80.0% Angular Width at 90.0° (deg)	5.8	5.80	5.7	5.9	0.04	8.0	10.0
90.0% Angular Width at 0.0° (deg)	9.0	9.31	8.9	10.2	0.50	10.0	15.0
90.0% Angular Width at 90.0° (deg)	3.2	3.26	3.2	3.3	0.02		2.0
Angle Ratio at 5.0 % Width	3.22	3.226	3.16	3.34	0.057	0.90	1.10
Angle Ratio at 13.5 % Width	3.04	3.030	2.99	3.09	0.029	5.00	
Angle Ratio at 50.0 % Width	2.81	2.796	2.76	2.83	0.023		12.50
Angle Ratio at 80.0 % Width	2.72	2.717	2.68	2.78	0.027	0.00	3.00
Angle Ratio at 90.0 % Width	2.78	2.858	2.74	3.14	0.147	1.00	2.50
Angular Centroid at 0.0° (deg)	0.0	0.09	0.0	0.1	0.03	-5.0	5.0
Angular Centroid at 90.0° (deg)	0.8	0.83	0.7	1.0	0.12	-2.0	2.0
Angular Peak at 0.0° (deg)	0.3	0.06	-0.7	0.5	0.49	-1.0	2.0
Angular Peak at 90.0° (deg)	1.1	1.17	1.0	1.4	0.12	-1.0	0.5
Centroid Amplitude at 0.0° (a.u.)	0.86	0.854	0.84	0.86	0.007	0.75	0.90
Centroid Amplitude at 90.0° (a.u.)	0.85	0.855	0.85	0.86	0.003	0.75	0.85
Peak Amplitude at 0.0° (a.u.)	0.88	0.878	0.87	0.88	0.002		0.95
Peak Amplitude at 90.0° (a.u.)	0.89	0.888	0.89	0.89	0.002	0.90	
Amplitude for Theta = -5.0° at 0.0° (a.u.)	0.75	0.750	0.74	0.76	0.006	0.50	
Amplitude for Theta = -5.0° at 90.0° (a.u.)	0.40	0.400	0.38	0.42	0.013	0.50	
Amplitude for Theta = 5.0° at 0.0° (a.u.)	0.81	0.814	0.80	0.82	0.008	0.60	0.90
Amplitude for Theta = 5.0° at 90.0° (a.u.)	0.57	0.580	0.55	0.60	0.016	0.50	0.75

Limit Analysis

Limit analysis can be performed on any of the parameters reported in the Beam Statistics window. The parameters are checked against user specified maximum and/or minimum values and the result of the analysis is displayed using icons in the Beam Statistics window, as shown above. To configure the analysis, either double click with the left mouse button on the desired parameter, or, alternatively, use the Up/Down Arrow keys to highlight the parameter and then press the Space key. This will open the following dialog box for setting the parameter limits for the analysis.



Either one or both limits can be set. The icons for reporting the analysis are:



Parameter value is within the set limit or limits.

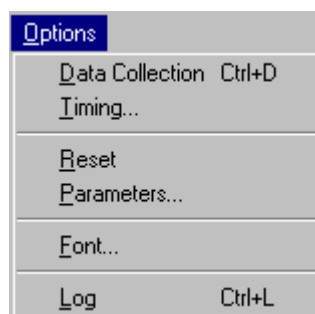


Parameter value is greater than the maximum limit.



Parameter value is less than the minimum limit.

The **Options Menu** available when the Beam Statistics window is active is shown below. The selections are:

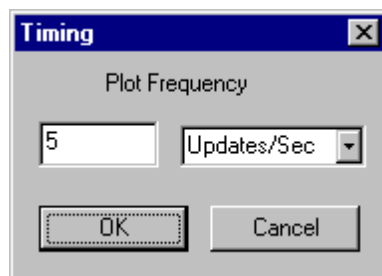


Data Collection

Turns data collection on and off.

Timing...

Opens a dialog box for selection of the window update rate.



Reset

Resets the values on the **Beam Statistics** window.

Parameters...

Opens the **Beam Statistics Parameters** dialog box.

Beam Statistics Parameters

Angular Width / Numerical Aperture

☒ 5% ☒ 5%

☒ 13.5% ☒ 13.5%

☒ 50.0% ☒ 50.0%

☒ User% 80 ☒ User%

☒ User% 90 ☒ User%

Angular Width Ratio

☒ 5%

☒ 13.5%

☒ 50.0%

☒ User% 80

☒ User% 90

Angular Position

☒ Centroid

☒ Peak

Amplitude

☒ Centroid

☒ Peak

☒ User Angle(deg) 0

☒ User Angle(deg) -5

Statistics

☐ Continuous

☐ Rolling 10

☒ Finite 100

Display

☒ Value

☒ Mean

☒ Min

☒ Max

☒ Std Dev

☒ Min Limit

☒ Max Limit

Logging

Output

☐ None

☒ File log

☐ Port COM1:

Delimiter: Comma

☒ Date

☒ Time

☒ Serial Number: 001

OK Cancel

Selection choices in the **Beam Statistics Parameters** Dialog box are:

Angular Width

- | | |
|---------------|--|
| 5% | Angular width at the 5% clip level (% of peak). |
| 13.5% | Angular width at the 13.5% clip level (% of peak). |
| 50% | Angular width at the 50% clip level (% of peak). |
| User % | Angular width at the user specified clip level %. |
| User % | Angular width at the user specified clip level %. |

Numerical Aperture

- | | |
|--------------|---|
| 5% | Numerical aperture at the 5% clip level (% of peak). |
| 13.5% | Numerical aperture at the 13.5% clip level (% of peak). |

50%	Numerical aperture at the 50% clip level (% of peak).
User %	Numerical aperture at a user specified clip level %.
User %	Numerical aperture at a user specified clip level %.
<i>Angular Width Ratio</i>	In Perpendicular Axes Scan Mode, the ratio of the angular width at angle ϕ to the angular width at angle $\phi + 90^\circ$.
5%	Angular width ratio at the 5% clip level (% of peak).
13.5%	Angular width ratio at the 13.5% clip level (% of peak).
50%	Angular width ratio at the 50% clip level (% of peak).
User %	Angular width ratio at the user specified clip level (% of peak).
User %	Angular width ratio at the user specified clip level (% of peak).
<i>Angular Position</i>	
Centroid	Value of the angular scan first moment
Peak	Angular value of the peak.
<i>Amplitude</i>	
Centroid	Signal amplitude at the centered.
Peak	Signal amplitude at the peak.
User Angle(deg)	Signal amplitude at the user specified scan angle. The angle range is $[-90^\circ, 90^\circ]$.
User Angle(deg)	Signal amplitude at the user specified scan angle. The angle range is $[-90^\circ, 90^\circ]$.
<i>Statistics</i>	
Continuous	Selects a continuous average of data samples.
Rolling	Selects a rolling average with user specified number of samples.

Finite	Selects a finite average with user specified number of samples.
Value	Selects display of the present value of the beam parameter.
Mean	Selects display of the mean value of the beam parameter.
Min	Selects display of the minimum value of the beam parameter.
Max	Selects display of the maximum value of the beam parameter.
Std Dev	Selects display of the standard deviation of the beam parameter.
Min Limit	Selects display of the minimum limit value of the beam parameter set in Limit Analysis.
Max Limit	Selects display of the maximum limit value of the beam parameter set in Limit Analysis

Logging

Output

Delimiter	Selects the delimiter format for the logged data.
None	No data logging.
File	Data logging to specified file.
Port	Data logging to serial port COM1 or COM2.
Date	If selected, the date is attached to the logged file.
Time	If selected, the time is attached to the logged file.
Serial No.	If selected, the specified serial number is attached to the logged file.

Font... Opens the Font Selection dialog box. This allows the user to change the font of the text in the Beam Statistics window.

Log

If data logging is enabled, one additional set of data is acquired and then displayed and/or logged to the file. If data collection is disabled for the Beam Statistics window, it allows the user to take individual data one set at a time and log it to a file. The Hot Key “Ctrl+L” enables logging even if another window is active as long as the Beam Statistics is open.

Some of the options can also be selected using the icons on the Beam Statistics View window toolbar:



Starts Data Collection.



Stops Data Acquisition.



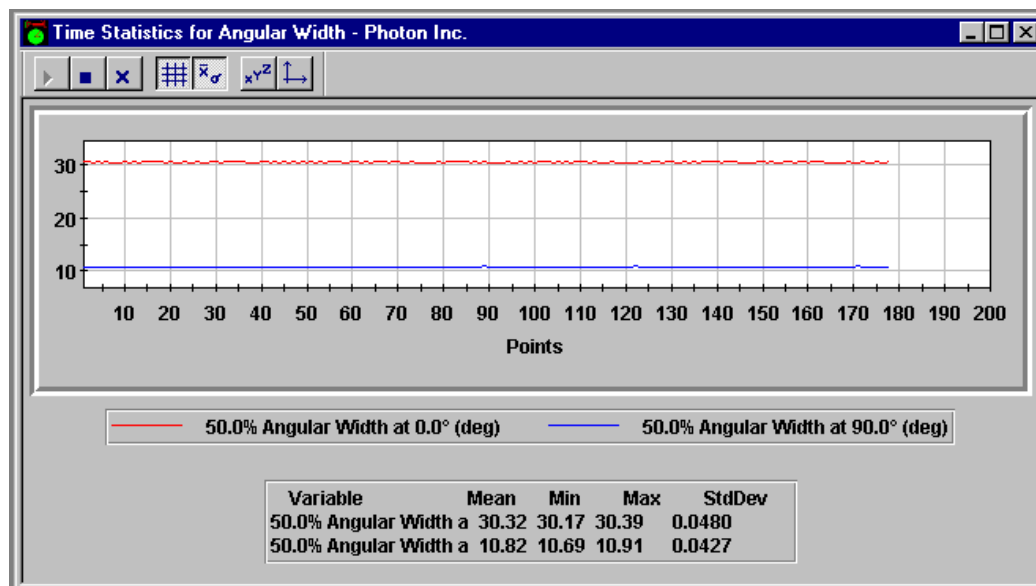
Clears and Resets the Beam Statistics Window.



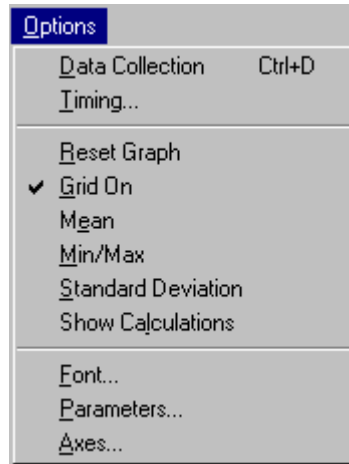
Opens the Beam Statistics Parameter Dialog Box.

6.6.7. Time Statistics

Open the **Time Statistics** window. The Time Statistics window displays strip charts of beam parameters versus sample number or time. Any or all of the computed beam parameters may be viewed in this way. Up to 15 Time Statistics windows can be opened. Several overlays are available in the options menu, including grids, statistical markers, and numerical statistical summaries.



The **Options Menu** available when the Time Statistics window is active is shown below. The selections are:

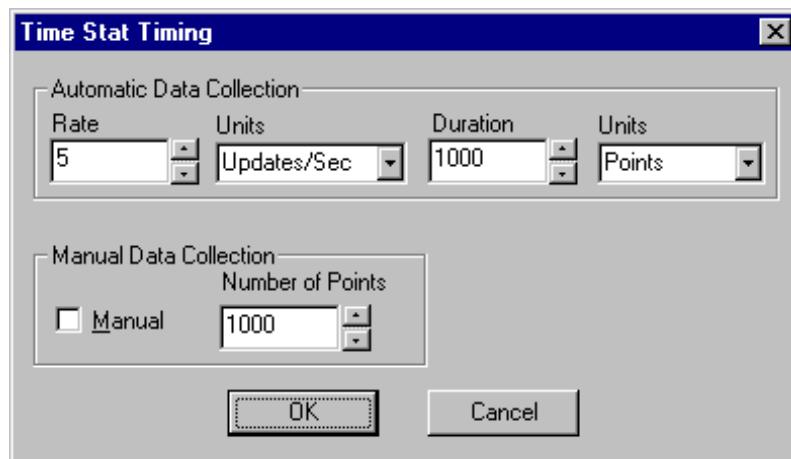


Data Collection

Turns data collection on and off.

Timing...

Opens a dialog box for selection of the window update rate.



Reset Graph

Resets the chart.

Grid On

Turns the grid overlay On or Off.

Mean

Displays an overlay on the chart at the mean value.

Min/Max

Displays overlays on the chart at the minimum and maximum values.

Standard Deviation

Displays overlays on the chart at the standard deviation value.

Show Calculation

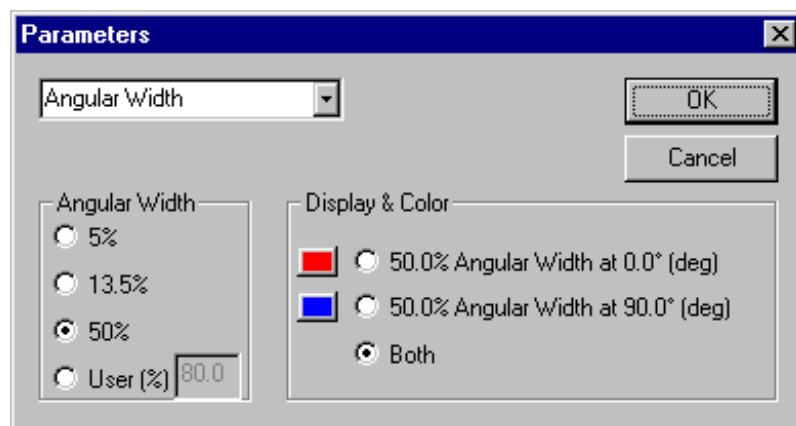
Turns the Statistics Calculation Overlay Text On or Off. The overlay, displayed at the bottom of the chart, shows the values for mean, minimum, maximum and standard deviation.

Font...

Opens the Font dialog box. This allows the user to change the font of the text in the Time Statistics window.

Parameters...

Opens the Time Statistics Parameters dialog box for selecting chart parameters and the color of the graph.



Selection choices in the **Time Statistics Parameters** Dialog box are:

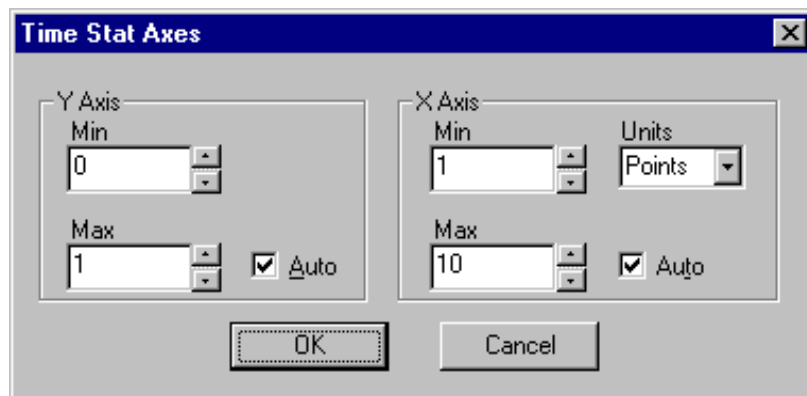
Angular Width

- | | |
|---------------|---|
| 5% | Angular width at the 5% clip level (% of peak). |
| 13.5% | Angular width at the 13.5% clip level (% of peak). |
| 50% | Angular width at the 50% clip level (% of peak). |
| User % | Angular width at the user specified clip level % (% of peak). |








Numerical Aperture

- | | |
|--------------|---|
| 5% | Numerical aperture at a 5% clip level (% of peak). |
| 13.5% | Numerical aperture at a 13.5% clip level (% of peak). |
| 50% | Numerical aperture at a 50% clip level (% of peak). |

User %	Numerical aperture at a user specified clip level %.
Angular Centroid	Value of the first moment of angular scan data
Angular Peak	Angular value of the peak
Angle Ratio	In Perpendicular Axes Scan Mode, the ratio of the angular width at angle ϕ to the angular width at angle $\phi + 90^\circ$.
5%	Angular width ratio at the 5% clip level (% of peak).
13.5%	Angular width ratio at the 13.5% clip level (% of peak).
50%	Angular width ratio at the 50% clip level (% of peak).
User %	Angular width ratio at the user specified clip level (% of peak).
Amplitude	
Centroid	Signal amplitude at the centroid.
Peak	Signal amplitude at the peak.
User(deg)	Signal amplitude at the user specified scan angle. The angle range is $[-90^\circ, 90^\circ]$.
Axes...	Opens the Time Statistics Axes dialog box for setting the chart axes.

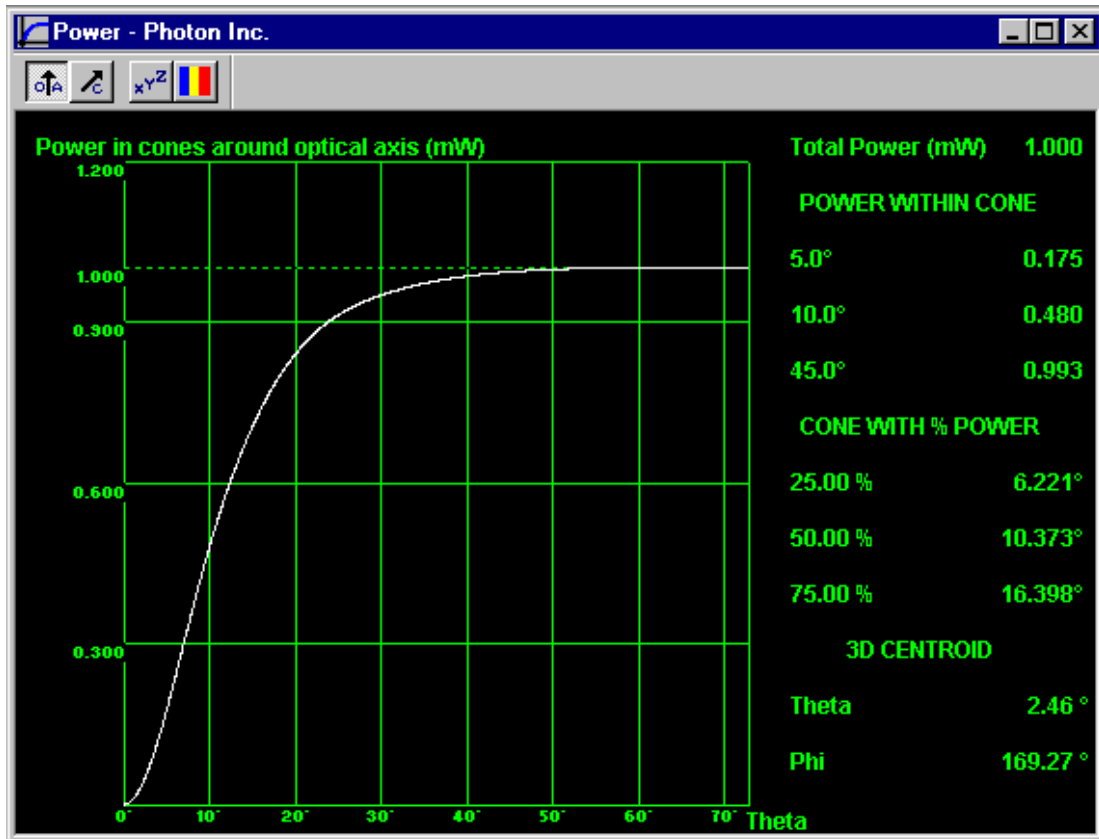


Some of the options can also be selected using the Time Statistics window toolbar.

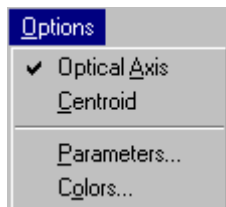
	Starts Data Collection.
	Stops Data Acquisition.
	Clears and Resets the Time Statistics Window.
	Turns the Grid Overlay On or Off.
	Turns the Statistic Calculation Overlay Text On or Off.
	Opens the Time Statistics Parameter Dialog Box.
	Turns the Axes Overlay On or Off.

6.6.8. Power

Open the Power window. The Power window displays a graph of the cumulative angular power, numerical values (up to 3) of the power within specified cone angles, numerical values (up to 3) of the cone angles containing specified percentages of the total power, and the θ and ϕ values of the angular 3D centroid of the profile. The cumulative power graph and associated parameters are determined along either the instrument optical axis or the 3D centroid axis.



The **Options Menu** available when the Power window is active is shown below. The selections are:



Optical Axis

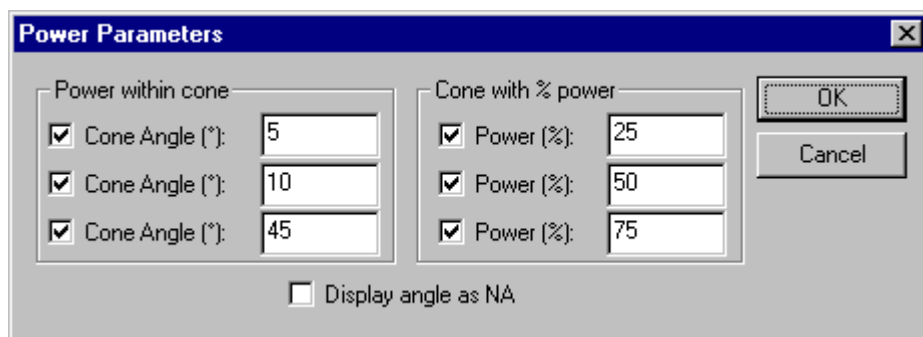
When selected, the power calculations are performed about the instrument optical axis.

Centroid

When selected, the power calculations are performed about the 3D centroid axis.

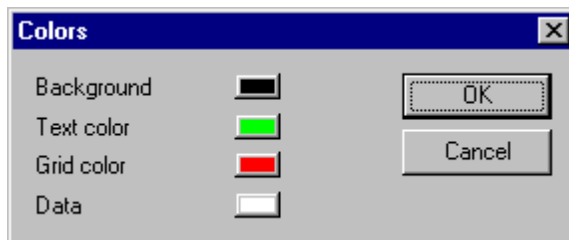
Parameters...

Opens the Power Parameters dialog for selecting up to 3 cone angles for reporting "Power within cone", and up to 3 percentages of the total power for reporting the "Cones with % power". Angles can be entered in degrees or as Numerical Aperture if the "Display angle as NA" box is checked. In this case the angles will also be reported as NA in the Power window.



Colors...

Opens a Colors dialog box, used for selecting the color scheme for the Power window. Colors for the background, text, grid and data can be independently set. To change a color, click on the appropriate color "button" to open a Windows color selection dialog box.



The options can also be selected using the Power window toolbar.



When selected, the power calculations are performed about the instrument optical axis.



When selected, the power calculations are performed about the 3D centroid axis.



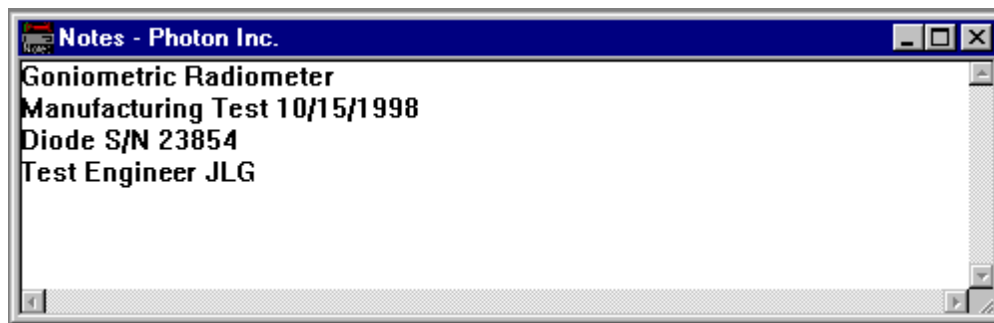
Opens the Power Parameters Dialog Box.



Opens the Color Selection Dialog Box.

6.6.9. Notes

Opens the Notes Window used for entering user information.



6.7. Status Bar

The Status Bar, shown below, appears at the bottom of the main window. The value for the Aperture-Source Distance, the gain setting, and the detector type are reported here.



6.8. Toolbars

Toolbars are provided to speed access to some of the most commonly used operations and features of the Goniometric Radiometer program. Instead of accessing these features through the pull-down menus, simply click on the appropriate icon buttons on the toolbars. The operations and features include: opening windows, turning data collection on and off, selecting the scan mode, and selecting options. In addition, some file handling operations such as opening and saving files, opening new files, and printing can be initiated in this way. General program features are accessed on the main toolbar, while options features specific to each window are accessed on

local window toolbars. For user convenience and preference, toolbars can be placed at different screen locations by “dragging and dropping”.

The main toolbar and descriptions of the icon buttons and functions are given below. The local window options toolbars were described previously under the individual window descriptions.



New File, opens a new file



File Open, opens a stored file



Saves the current file



Prints the current screen



Opens the Help Menu



Turns Auto Gain On or Off



Starts/Stops Data Collection for Single Axis and Perpendicular Axes Scan Mode



Selects Single Axis Scan Mode



Selects Perpendicular Axes Scan Mode



Replay 3D Scan Data



3D Scan Mode; starts a 3D Acquisition



Replay 3D Centroid Data



Opens the Rectangular View Window



Opens the Polar View Window



Opens the 3D Polar View Window



Opens the 3D Rectangular View Window



Opens the Topographic View Window



Opens the Beam Statistics Window



Opens the Time Statistics window, up to 15 can be opened



Opens the Power window



Opens the Notes window

6.9. System Messages

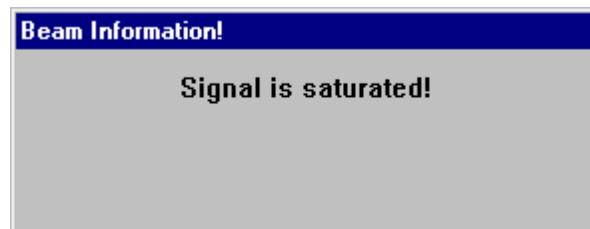
System messages alert the user to system actions, out-of-bound conditions, and errors.

1. Scan Control and Data Acquisition Card Not Initialized



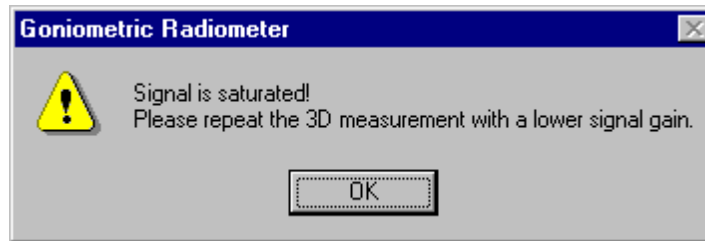
If after several attempts to start the program, this message continues to appear, contact Spiricon.

2. Signal Saturated (Single Axis and Perpendicular Axes scan modes)



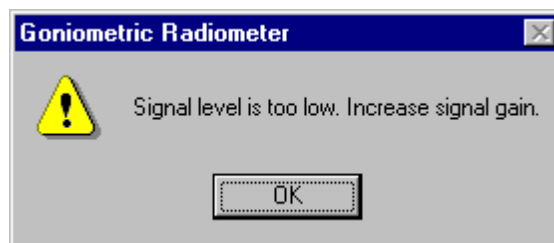
Decrease the signal gain.

3. **Signal Saturated** (3D Scan Mode)



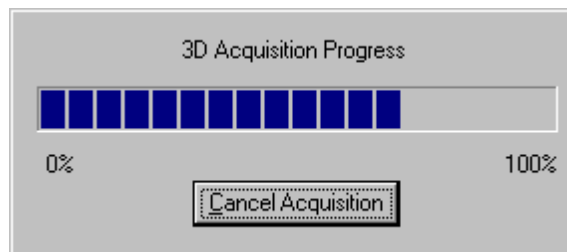
Decrease the signal gain.

4. **Signal Level too Low** (3D Scan Mode)



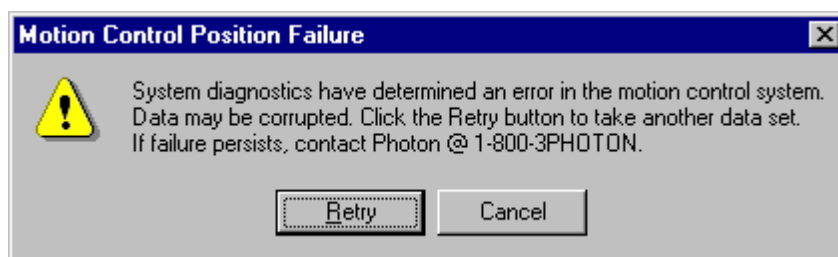
Increase the signal gain.

5. **3D Acquisition Progress Bar**

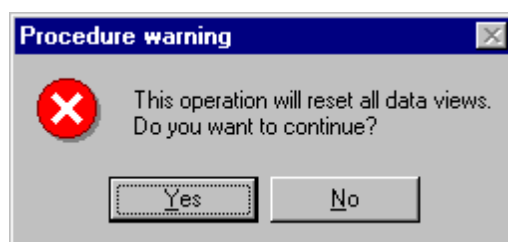


The acquisition can be cancelled by clicking on the "Cancel Acquisition" button.

6. **Motion Control Error** (3D Scan Mode)

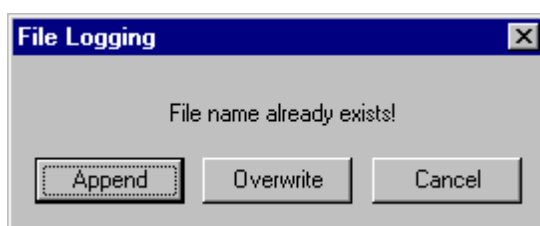


7. **Reset Procedure Warning**



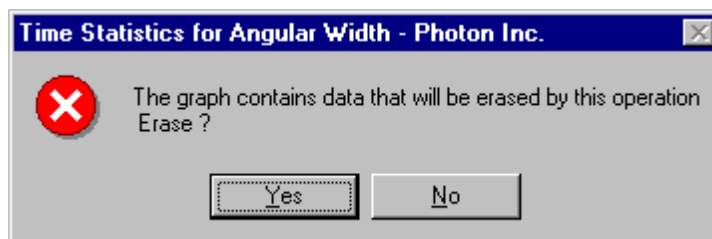
Selecting "Yes" will void all previously acquired data.

8. **File Logging**



Data log file already exist.

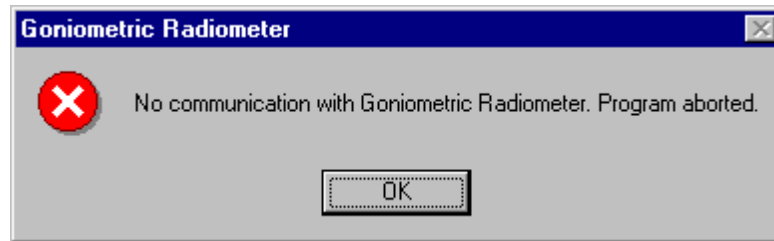
9. **Graph Reset**



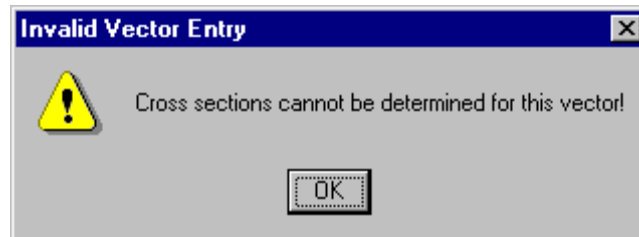
10. **Program Prompt**



11. **RS-232 Communication Failure**



12. **Invalid Vector Entry**



The vector entered is out of bounds and the Computed Cross Sections cannot be determined. Either make another selection or close the Computed Cross Sections dialog.

6.10. ActiveX Automation

It is possible to start, control and exit the Goniometric Radiometer Acquisition and Analysis Software using ActiveX Automation. The software is an automation server. You need to start the software at least once so that the appropriate information can be added to your Windows registration database. After that, you can start and operate the software using any ActiveX Automation compliant client application.

The gonio32.tlb file in the Automation folder where the software has been installed contains the prototypes of the interface function. You can open and view the Type Library with an OLE2viewer program.

A sample file, GonioOLE2.xls, is written in Visual Basic for Applications using Microsoft Excel 95. It demonstrates the use of some of the automation methods the Goniometric Radiometer Acquisition and Analysis Software exposes (see section 6.9.25).

The interface methods and properties that the Goniometric Radiometer Acquisition and Analysis Software exports are explained below.

Note: This version of the Automation interface exports only the data from the current scan. The current scan (scan at the current “Phi” angle) is characterized by:

- the number of data points in the scan (profile). A typical value is 3241. This number is returned by the **GetNumPts** method;
- the amplitude of each data point. The array of data point value (amplitude) in the current scan is returned by the **GetProfileData** method;
- the “Theta” angle that corresponds to each data point. The array of angles in the current scan of each data point is returned by the **GetProfileAngle** method.

6.10.1. ApertureSourceDistance

Property Type:

VT_R4 - aperture source distance in cm

Remarks:

Sets or retrieves the value of the distance between the datum plane of the entrance aperture and your source. For a detailed description of the significance of the aperture source distance, please read section 4.1.9.

6.10.2. AutoGain

Method Return Value:

VT_EMPTY - none

Method Parameter List:

VTS_NONE - none

Remarks:

Perform an Auto Gain (which automatically sets the amplifier gain) for the scan from the current Phi (azimuth) angle.

6.10.3. BlindSpotCorrection

Property Type:

VT_BOOL - blind spot correction

Remarks:

Enables / disables blind spot correction. For a description of the “blind spot”, please refer to section 5.5 and section 5.6.

6.10.4. DataIncrement

Property Type:

VT_I2 - increment to decimate scan data / angle

Remarks:

Set or retrieve the increment value for decimate scan data / angle. For example, if you will set the increment to 10, data (angle) exported through GetProfileData (GetThetaAngle) will be (usually) data from indexes 0, 10, 20, 30, 40, 50, ..., 3240. GetNumPts will return the real number of exported points (which in this case will be 324 instead of 3241)

6.10.5. Exit

Method Return Value:

VT_EMPTY - none

Method Parameter List:

VTS_NONE - none

Remarks:

Closes the Goniometric Radiometer software application.

6.10.6. GetCenter

Method Return Value:

VT_R4 - centroid position

Method Parameter List:

VTS_NONE - none

Remarks:

Returns the centroid position in degrees.

This version of the Automation interface exports only the data from the current scan.

6.10.7. GetCurrentPhi

Method Return Value:

VT_R4 – current Phi angle in degrees

Method Parameter List:

VT_NONE - none

Remarks:

Returns the current azimuth scan (Phi) angle in degrees.

This version of the Automation interface exports only the data from the current scan.

6.10.8. GetNA

Method Return Value:

VT_R4 - numerical aperture

Method Parameter List:

VT_R4 - cliplevel used for numerical aperture computation as a percent value (e.g. 13.5 for 13.5%).

Remarks:

Returns the numerical aperture.

This version of the Automation interface exports only the data from the current scan.

6.10.9. GetNumPts

Method Return Value:

VT_I2 - number of points.

Method Parameter List:

VT_NONE - none

Remarks:

Returns how many data points are in the current scan.

This version of the Automation interface exports only the data from the current scan. This value can be changed by setting an increment with **DataIncrement**.

6.10.10. GetPeakIrradiance

Method Return Value:

VT_I2 - value of the irradiance of the peak.

Method Parameter List:

VT_NONE - none

Remarks:

Returns the irradiance of the peak in counts. Possible value are 0...255.

This version of the Automation interface exports only the data from the current scan.

6.10.11. GetPeakPosition

Method Return Value:

VT_R4 - peak position

Method Parameter List:

VT_NONE - none

Remarks:

Returns the peak position in degrees.

This version of the Automation interface exports only the data from the current scan.

6.10.12. GetPeakWidth

Method Return Value:

VT_R4 - angular width

Method Parameter List:

VT_R4 - cliplevel used for angular width computation as a percent value (e.g. 13.5 for 13.5%).

Remarks:

Returns the angular width in degrees.

This version of the Automation interface exports only the data from the current scan.

6.10.13. GetProfileAngle

Method Return Value:

VT_VARIANT - profile angle array

Method Parameter List:

VT_NONE - none

Remarks:

Returns an array of angle value points that represents the angle in radians for each data point. The number of points in the returned data array is the number returned by the **GetNumPts** method. Please note that the array of angle values changes each time you change the aperture-source distance, because the latter parameter affects the Field of View (refer to section 5.2).

This version of the Automation interface exports only the data from the current scan.

6.10.14. GetProfileData

Method Return Value:

VT_VARIANT - profile data array

Method Parameter List:

VT_NONE - none

Remarks:

Returns an array of data points that represents the profile in counts. The number of points in the returned data array is the number returned by the **GetNumPts** method. To get the correct distribution of the data, you need to

call **GetProfileAngle**, to get the theta angle value that corresponds to each data point.

This version of the Automation interface exports only the data from the current scan.

6.10.15. Go90Deg

Method Return Value:

VT_EMPTY - none

Method Parameter List:

VT_BOOL – direction flag

Remarks:

Changes the azimuth scan angle by + or – 90° for data acquisition and computing. When the parameter is TRUE the azimuth scan angle increases by 90° (e.g. from 0° to 90°) and when the parameter is FALSE the azimuth scan angle decreases by 90° (e.g. from 90° to 0°). This function operates without any home checking routine. It is recommended occasionally to check for “Home Position” with MotorGoHome.

6.10.16. GoToPhiAngle

Method Return Value:

VT_EMPTY - none

Method Parameter List:

VT_BOOL - value of phi angle in degrees. Possible values are 0°...180°.

Remarks:

Selects the azimuth scan angle for which data will be acquired and computed. When the Goniometric Radiometer software is running as an ActiveX server, the scanning data mode should be set to the default value of “Single Axis Scan”. The “current” data acquired is the data for the selected phi (azimuth) angle. Phi values are from 0° to 180°, in increments of 0.225°. If the Phi value used as parameter is not a multiple of 0.225°, the closest value smaller than the selected Phi value will be used.

6.10.17. IncrementPhi

Method Return Value:

VT_EMPTY - none

Method Parameter List:

VT_BOOL – number of azimuthal scans intended to be performed for a 3D acquisition. Possible values are 10, 20, 50, 100, or 200.

Remarks:

Incrementally moves the entrance aperture by the Phi angle corresponding to the specified number of scans (e.g. 18° for 10 scans, 9° for 20 scans etc.), useful for 3D data acquisition. After the entrance aperture is moved the system automatically acquires and processes one scan at the previously set gain, independent of the status of **ScanAcquisition**. As a consequence, the user can get the new data set without switching **ScanAcquisition** on and

off. At the end of a 3D acquisition sequence it is recommended to return the entrance aperture to the “Home Position” with **MotorGoHome** and check the return value in order to ensure the data was acquired at the proper azimuth angles.

6.10.18. IsSaturated

Method Return Value:

VT_BOOL - saturation flag

Method Parameter List:

VTS_NONE - none

Remarks:

Returns TRUE if signal is saturated, FALSE otherwise.

6.10.19. MotorGoHome

Method Return Value:

VT_BOOL - flag

Method Parameter List:

VTS_NONE - none

Remarks:

Sets the system to the 0° azimuth angle. The difference between **MotorGoHome** and **GoToPhiAngle** with an input value of 0° is that during the **MotorGoHome** routine, an extra hardware check insures the correctness of the 0° azimuth angle. The FALSE value returned in flag specifies if there has been detected an error in the motion control system when trying to move the motor from the previously selected Phi angle to the home position. You may want to call this function in your program to check the motion control system is working properly. You should call this function after a call to **GoToPhiAngle** with a Phi parameter value different than 0. If this function consistently returns FALSE, contact Ophir-Spiricon.

6.10.20. PulsedMode

Property Type:

VT_BOOL – pulsed mode

Remarks:

Set or retrieve the pulsed mode of operation.

6.10.21. ScanAcquisition

Property Type:

VT_BOOL - global data acquisition

Remarks:

Sets or retrieves the status of data acquisition. If the value is TRUE, the system is acquiring data.

6.10.22. ShowWindow

Property Type:

VT_BOOL – show flag

Remarks:

Shows or hides the Goniometric Radiometer Acquisition and Analysis Software main window. Call this function with FALSE as parameter to hide the Goniometric Radiometer Software. Call this function with TRUE if you want to show the Goniometric Radiometer window.

6.10.23. SignalGain

Property Type:

VT_I2 - signal gain value in dB

Remarks:

Sets or retrieves the value of the signal gain in dB.

Possible values are 0...139 for InGaAs detector and 0...159 for Si detector.

6.10.24. SourceFrequency

Property Type:

VT_R4 – source frequency in kHz

Remarks:

Set or retrieve the pulse repetition frequency of the source.

6.10.25. Sample file for ActiveX

Please note that in order to get correct numbers, you need to

- Setup the software to acquire data
- Set the correct aperture-source distance
- Select a reasonable signal gain
- Determine and set the azimuth angle for which data is acquired and computed

Now, you can query the Goniometric Radiometer software for computed values as angular width, centroid and peak position of the distribution, raw scan data for a selected azimuth angle.

These are fragments from Visual Basic code that show how to use some of the automation interface functions:

```
Dim Gonio As Object

Sub OpenSW()
    Set Gonio = GetObject("", "Gonio.Document")
    ' start Goniometric Radiometer application and
    ' get a reference to the ActiveX object
```

```

Gonio.ScanAcquisition True
    ' start (enable) data acquisition
Gonio.ApertureSourceDistance 0.1
    ' tell software that the distance between the
    ' source and the aperture is 0.1cm
Gonio.SignalGain 77
    ' set the signal gain to 77dB
Gonio.GoToPhiAngle 90
    ' go to azimuth angle phi=90°. (set the software
    ' to
    ' acquire data for an azimuth angle of 90 deg)

End Sub

Sub CloseSW()
    Gonio.Exit
    ' close the Goniometric Radiometer software
End Sub

Sub GetWidth()
    ActiveSheet.Cells(1,1).Formula =
    Gonio.GetPeakWidth(13.5)
    ' get the angular width at 13.5% and display it in
    ' a cell in the active spreadsheet. The return
    ' value can also be written to a variable and
    ' used later in the program
End Sub

Sub GetCenter()
    ActiveSheet.Cells(2, 1).Formula = Gonio.GetCenter()
    ' get the centroid position and display it in a
    ' cell in the active spreadsheet. The return
    ' value can also be written to a variable and
    ' used later in the program
End Sub

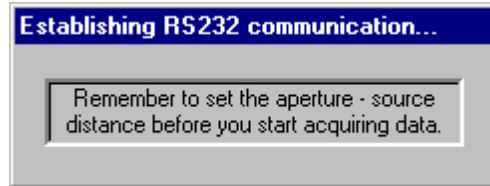
```

+For a detailed example written in Visual Basic, please refer to the *GonioActiveX.xls* file located under Automation, in the folder where the software has been installed.

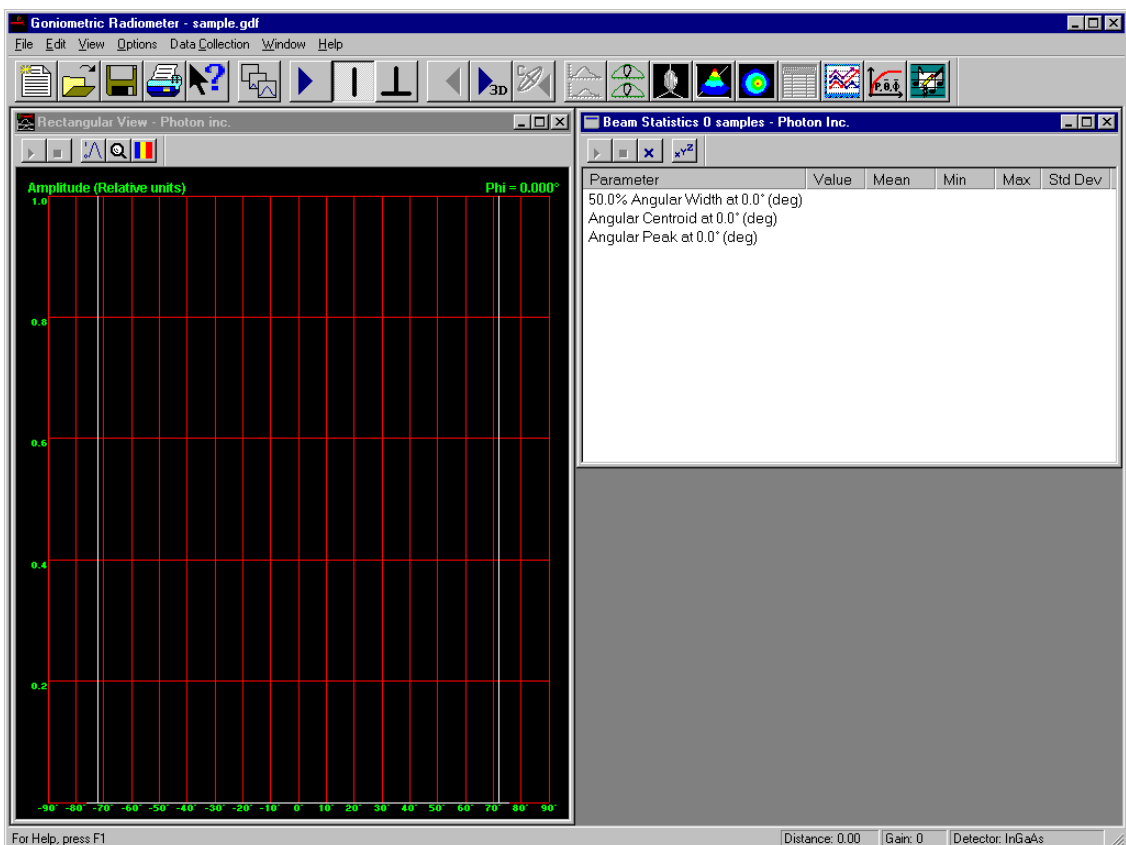
7. LD 8900R Acquisition and Analysis Software

7.1. Quick Start

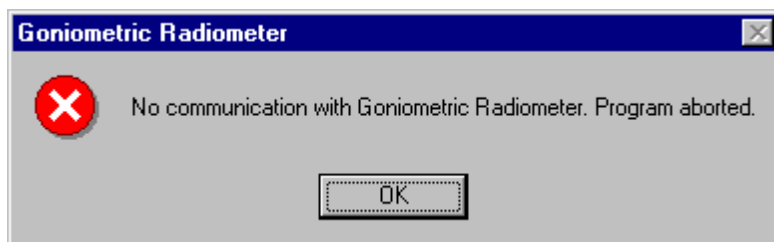
12. Turn on the PC.
13. Turn on the Goniometric Radiometer.
14. Start the Goniometric Radiometer Program by double-clicking on the program icon on your monitor screen; or, from the Windows Start menu, select Programs, then PHOTON, and then Goniometric Radiometer.
15. After a few moments a message will appear informing the user that the RS-232 Communication link is being established, with a reminder to set the Aperture-Source Distance.



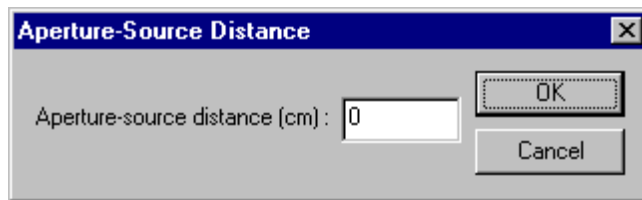
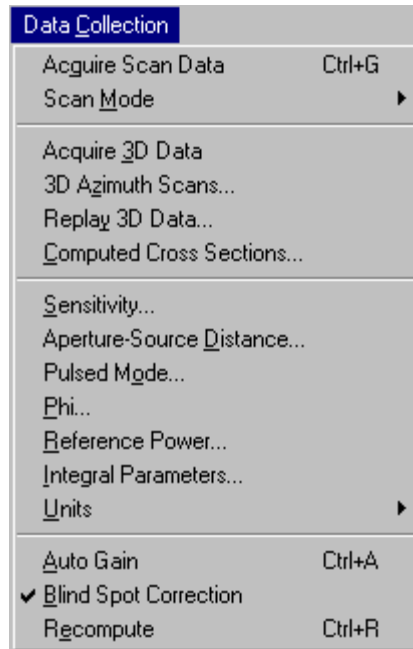
16. If RS-232 communication is established, the program will start after a few more moments. The main window will appear with the Rectangular View window and the Beam Statistics windows open, as shown below. The system will be in the Single Scan Mode.




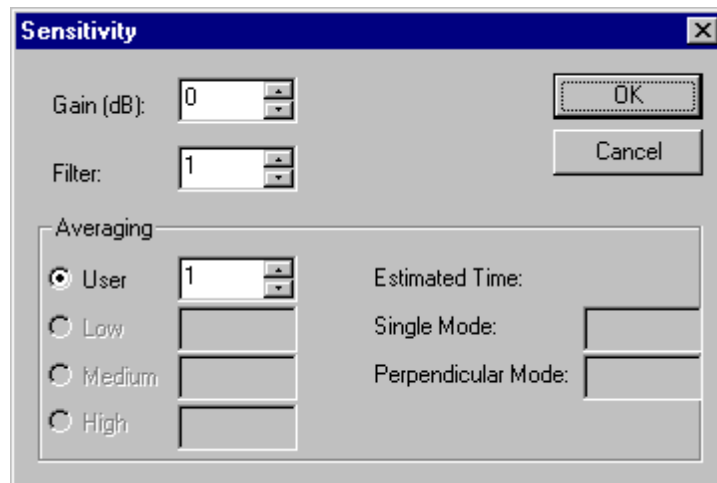
17. If RS-232 communication is not established, the following message will appear after approximately 30 seconds. In this case, click “OK”, then check that the RS-232 cable is securely connected, verify the COM port connection, and ensure the Goniometric Radiometer is powered on. Then go back to step 3 above. If the problem persists, contact Spiricon.



18. Set the Aperture-Source Distance in the Aperture-Source Distance dialog box accessed under the Data Collection Menu.



19. Turn on data acquisition by selecting **Acquire Scan Data** under the Data Collection Menu, or by clicking the left mouse button on the Data Collection icon  located on the main toolbar.
20. Set the Scan Amplifier gain in the Sensitivity Dialog box, accessed under the Data Collection Menu. Make sure your Device Under Test is powered on.



21. Increase the gain setting until you observe a signal in the Rectangular View window. Continue increasing the gain until just below saturation to achieve the best vertical resolution.
22. The values for the 50% angular width, the Peak angle and the Centroid angle will be displayed in the Beam Statistics window. You are now acquiring data at the default azimuth scan angle of 0°. It's that simple.

7.2. Advanced Use

The previous **Quick-Start** procedure utilizes only the very basic features of the Goniometric Radiometer software program. The program is very powerful and flexible, allowing users to configure the analyses and the information display windows to suit their individual needs. Users can arrange and size multiple windows as required, and these screens can be saved as files for future use. Also, data can be exported to spreadsheets, math and statistical analysis programs, and process/instrumentation programs by logging data to files or COM ports, or shared using ActiveX.

At this point, take a few minutes to read the rest of this section, which includes detailed descriptions of the software features that control the various scanning modes and ways to analyze, display and log data. The software is also described in the On-line Help. A little time spent in advance learning the features of the system will go a long way in making the Goniometric Radiometer an invaluable resource for far field source characterization.

7.3. Scan Modes

There are 3 scan modes for data acquisition. The 3 scan modes are:

4. Single Axis Mode,
5. Perpendicular Axes Mode, and
6. 3D Mode

The Scan Mode is selected under the Data Collection Menu, or by clicking the tool bar icons:



Selects the Single Axis Scan Mode



Selects the Perpendicular Axes Scan Mode



Selects the 3D Scan Mode

The Single Axis and Perpendicular Axes Modes provide the most rapid characterization of a source. The 3D Mode takes more time but provides the most complete characterization.

7.3.1. Single Axis Mode

In the Single Axis Mode, the system performs scans along 1 azimuth angle. The angle of the scan can be set using the Phi Angle dialog box. This dialog is accessed under the Data Collection Menu by selecting “Phi...” Offset angles ranging from 0 to 180° in increments of 0.225° can be selected from the list in the Dialog box. The default Phi angle is 0°.

7.3.2. Perpendicular Axes Mode

In the perpendicular axes mode, the system performs two scans in orthogonal directions. The first scan is made at the angle set in the PHI Angle dialog box. The second scan is made at this angle plus 90°.

7.3.3. 3D Scan Mode

In the 3D mode, a series of measurements are made at incremental azimuth (Phi) angles ranging from 0° to 180°. The incremental angles available are 18°, 9°, 3.6°, 1.8° and 0.9°. Respectively, the number of scans made for these 3D measurements are 10, 20, 50, 100, and 200.

7.4. Viewing Data

The acquired data can be viewed in various ways using the different windows. The windows are:

9. Rectangular View;
10. Polar View;
11. Beam Statistics;
12. Time Statistics (up to 15 can be opened);
13. 3D Rectangular View;
14. 3D Polar View;
15. Topographic View;
16. Power View.

Data acquired in the Single Axis and Perpendicular Axes Modes can be displayed in the following Windows:

Rectangular View

The Rectangular View window displays a graph of amplitude or intensity vs. scan angle in Cartesian coordinates of the data sets acquired for either one or both scans.

Polar View

The Polar View window displays a graph of amplitude or intensity vs. scan angle in polar coordinates of the data sets acquired for either one or both scans.

Beam Statistics

The Beam Statistics window displays numerical values of parameters obtained from the scan data. The parameters are angular beam width, numerical aperture, angular beam width ratios, centroid angle, peak angle, centroid amplitude, peak amplitude, amplitude at user specified angles. It also displays the Mean, Minimum, Maximum, and Standard Deviation values, and the Maximum Limit and the Minimum Limit for parameter limit testing.

Time Statistics

The Time Statistics windows are displays of parameter values versus the sample number. Up to 15 Time Statistics windows can be opened.

Data Acquired in 3D Mode can be displayed in the following windows:

3D Rectangular View	The 3D Rectangular View window displays a representation of the source profile in cylindrical coordinates, with the data as the height or “z” value, above the (θ , ϕ) plane. The view perspective is looking toward the source.
3D Polar View	The 3D Polar View window displays the data in spherical coordinates, with the data as the radius from the origin. The perspective of this view is looking toward the source.
Topographic View	The Topographic View window displays the relative amplitude of the data acquired in a 3D scan in a false-color format on a polar grid of θ and ϕ . The perspective of this view is looking from the source.
Rectangular View	The Rectangular View window is used to display data after a 3D acquisition. Select the Replay Mode or the Centroid Replay Mode from the Data Collection Menu, or click the Replay or Centroid Replay icon.
Polar View	The Polar View window is used to display data after a 3D acquisition. Select the Replay Mode or the Centroid Replay Mode from the Data Collection Menu, or click the Replay or Centroid Replay icon.
Power	The Power window displays a graph of the cumulative angular power, numerical values (up to 3) of the power within specified cone angles, numerical values (up to 3) of the cone angles containing specified percentages of the total power, and the θ and ϕ values of the angular 3D centroid of the profile. The cumulative power graph and associated parameters are determined along either the instrument optical axis or the 3D centroid axis.

7.5. Pull-Down Menus

7.5.1. File Menu

The “**File**” Menu is used for opening and closing files, saving files, setting preferences at program startup, and for printing. When “File” on the Menu Bar is clicked, the pull-down menu below appears:



New

Halts data collection, closes all open windows, and then opens a new file with the **Rectangular View** window displayed.

Open...

Opens the **File Open** dialog box. It lists Data Files from the current working directory. To open a data file, select one from the list and then select the **Open** button. All windows will be closed and the new file will be loaded. The data, windows and computed statistics from the file will be displayed.

Close

Halts data collection and closes all open windows.

Save

Saves the current data and windows configuration in the currently active folder. The name of this file is displayed on the main window title bar.

Save As...

Opens the **File Save As** dialog box. It lists Data Files from the current working directory. Either select an existing file from the list or enter a new name in the **File Name** edit box. To save as a data file, simply select the **Save** button. Otherwise, select the desired file type from the **Save As Type** combo box. There are

5 different file types, identified by their extensions:

**.grs* Goniometric Radiometer Acquisition and Analysis Program Data File. This file can only be used by the Goniometric Radiometer software. The configuration of the screens, system settings, and the beam measurements (data) are saved.

**.cfg* Configuration File. This file can only be used by the Goniometric Radiometer software. The configuration of the screens and the system settings are saved.

**.prw* 3D Data File. This file is in binary format and contains data from the last 3D Acquisition. It is provided for users to perform custom off-line analysis using their own code. This file type cannot be imported back into the Goniometric Radiometer Software. The structure of the file is:
number of scans, stored as unsigned short type (2 bytes);
number of points, stored as unsigned short type (2 bytes);
Theta Angles: “number of points” values stored in radians, as float type (4 bytes).

Data: “number of scans × number of points” values, stored as short type (2 bytes). Data are stored scan after scan (each scan has “number of points” values corresponding to the Theta Angles). The value of the Phi Angle (deg) is $180^\circ / (\text{number of scans}) \times (\text{number of current scan} - 1)$.

**.asc* ASCII File. The file contains profile data and the data from each view in ASCII format.

**.bmp* Bitmap File. Saves the program screen as a Bitmap File.

Preferences

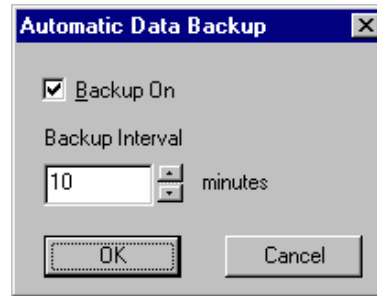
Configures user preferences on startup and exit.



Timed Backup...

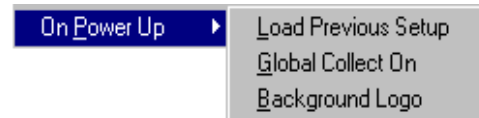
Opens the **Automatic Data Backup** dialog box, for configuring if and when backups are to occur.

If the **Backup On** checkbox is selected, then all data will be saved automatically at the specified interval. Use this feature when collecting data over extended periods to prevent data loss in the event of a power outage or other catastrophe. When the program is restarted after such an event, the backup file will load and data collection will resume from the point of the last automatic save.



On Power Up

Opens a menu with the following selections:



Load Previous Setup

When checked, the last saved data file will automatically load at startup.

Global Collect On

When checked, data collection resumes at startup.

Background Logo

When checked, the Photon Logo appears as the background for the main window.

On Exit

Opens a menu with the following selections:



Save Setup

When checked, the user is prompted to save the latest data as a .GRD or configure as a .CFG file upon exit.

Prompt

When checked, the user is prompted with the message “**Leaving Already?**” upon exit.

Print...

Opens the **Print** dialog box, used for printing the program screen.

Print Setup...

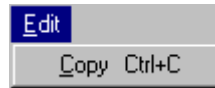
Opens a dialog box for selecting and configuring printers.

Exit

Exits the program.

7.5.2. Edit Menu

When “**Edit**” on the Menu Bar is clicked, the pull-down menu below appears:

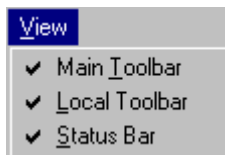


Copy

Copies the active window to the Windows clipboard as a bitmap image. From there, the bitmap can be pasted into other program applications.

7.5.3. View Menu

When “**View**” on the Menu Bar is clicked, the pull-down menu below appears:



Main Toolbar

When checked, the toolbar on the main window is visible.

Local Toolbar

When checked, the toolbar of the currently active view is visible, if available.

Status Bar

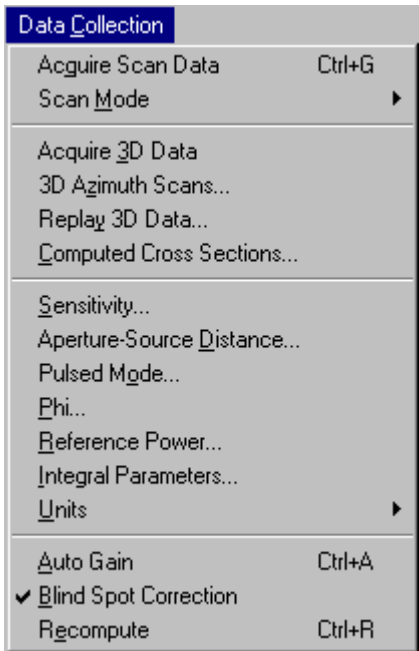
When checked, the status bar at the bottom of the main window is visible.

7.5.4. Options Menu

Various options associated with the window views can be selected under the “**Options**” menu when that particular window is active. The list of options are unique for each window type. The options list can be found under the window descriptions.

7.5.5. Data Collection Menu

The “**Data Collection**” menu includes selections, which determine or affect the collection of data. When “Data Collection” on the Menu Bar is clicked, the pull-down menu below appears:



Acquire Scan Data

Turns data acquisition on or off when operating in either Single Axis or Perpendicular Axes scan modes.

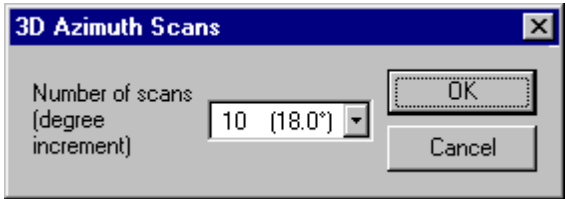
Scan Mode

Selects either the Single Axis or Perpendicular Axes Scan Modes.



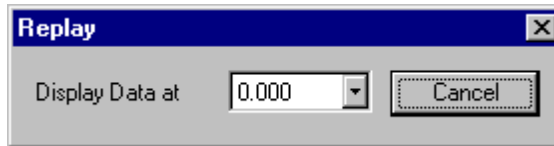
**Acquire 3D Data
3D Azimuth Scans...**

Starts 3D data acquisition.
Opens a dialog for selecting the number of azimuthal scans for a 3D acquisition, either 10, 20, 50, 100 or 200. The corresponding angular increments are 18°, 9°, 3.6°, 1.8° and 0.9°.



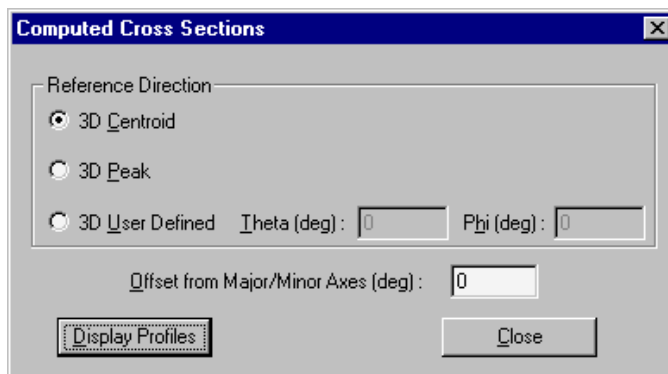
Replay 3D Data...

Turns on the Replay Mode, where data acquired in the last 3D scan can be viewed in either the Rectangular View, Polar View or Beam Statistics window. The azimuth angle of the scan is selected in the combo box. To exit the Replay mode, press the Cancel button.



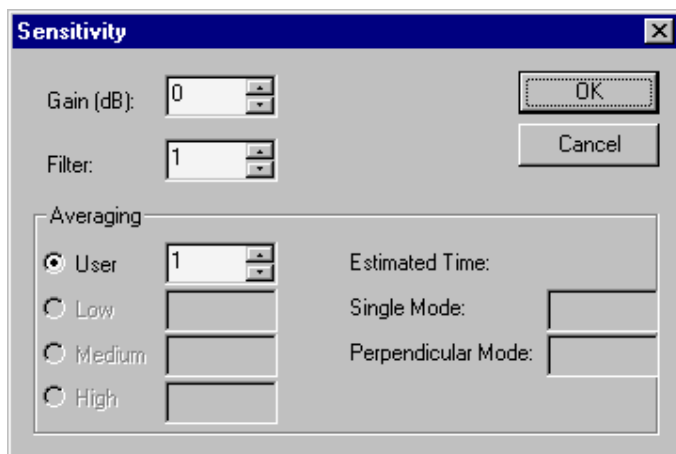
Computed Cross Sections...

Turns on the Computed Cross Sections Replay Mode. In this mode, orthogonal cross sections computed using the scan data obtained from the last 3D acquisition are displayed in either the Rectangular View or Polar View. The parameters for the computed cross sections are displayed in the Beam Statistics window. The computed cross sections can be through either the 3D Centroid, the 3D Peak, or through an Arbitrary Vector. This selection is made in the Computed Cross Sections dialog, which appears after selecting the Computed Cross Sections Replay Mode. The offset azimuth angle of the first computed cross section is entered in the edit box. For offset "0", the computed orthogonal cross sections are in the directions of the major and minor axes of the Centroid intensity distribution. To exit the Computed Cross Sections Replay Mode, press the Close button.



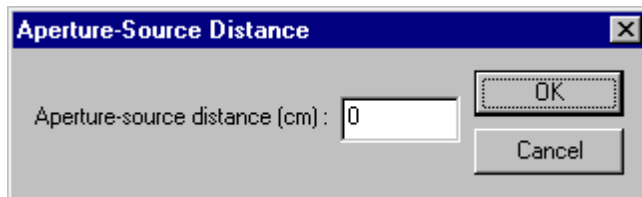
Sensitivity...

Opens the Sensitivity Dialog Box. This dialog box is used to manually set the Gain, Filter and Average settings for data presentation. The gain can be set over the range from 0 to 139 dB for InGaAs detectors and from 0 to 159 dB for Silicon detectors. The filter value sets the number of points used in a consecutive sum smoothing filter used in data analysis and display. Values from 0 to 99 are allowed. The Averaging Value sets the number of scans to be averaged together before analysis and displays. User selected values can range from 1 to 10,000. The Low, Medium and High selections are not presently available and are inactive.



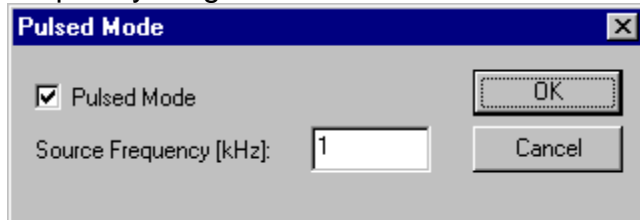
Aperture-Source Distance...

Opens the Aperture-Source Distance Dialog Box. This dialog box is used to enter the value of the Aperture-Source Distance, i.e. distance between the datum plane of the entrance aperture and your source. The value is in centimeters (cm). Resetting the value of the Aperture-Source Distance will reset / void all previously acquired data. A dialog box alerts the user to this impending action.



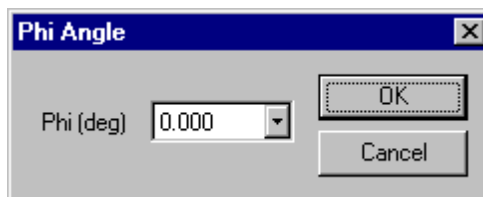
Pulsed Mode...

Opens the Pulsed Mode Dialog Box. If you are using a pulsed source, use this dialog box to set the Pulsed Mode of operation and to enter the pulse repetition frequency of the source. When operating in Pulsed Mode, the peaks of the individual pulses in the profile are connected to form a smooth profile. All parameter computations will be performed on the resulting smooth profile. The allowable frequency range is 0.1 – 20 kHz.



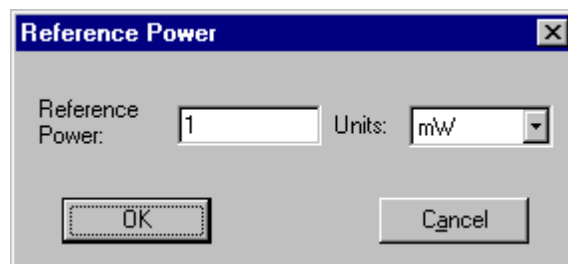
Phi...

Opens the Phi Angle Dialog Box. This dialog box is used to select an offset Azimuth Scan Angle for Single Axis and Perpendicular Axes Scan modes. When operating in the Single Scan mode, the scan will be performed at the selected Phi angle. In Perpendicular Axes mode, the first scan will be made at this angle and the second scan will be made at $\text{Phi} + 90^\circ$. The values available for selection range from 0° to 180° in 0.225° increments.



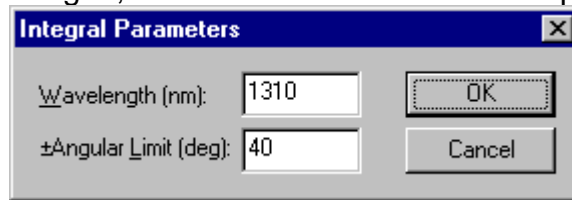
Reference Power...

Opens the Reference Power dialog box. Enter the value of the measured reference power in the edit box and select the units, either μW , mW or W, in the combo box.



Integral Parameters...

Opens the Integral Parameters dialog box. The dialog box is used to set Wavelength and Angular Integral Limits for the Petermann II Integral, in Mode-Field Diameter Computation.



Units

Opens the Units submenu for selecting the units for the Rectangular View, Polar View, Beam Parameters, and Time Statistics windows. Choices available are Relative (%), 0-100%, Counts, 0-65535, or Intensity (W/sr). The Intensity (W/sr) selection is only available if a 3D acquisition has been performed.



Auto Gain

Automatically sets the amplifier gain when operating in either Single Axis Scan Mode or Perpendicular Axes Scan Mode.

Blind Spot Correction

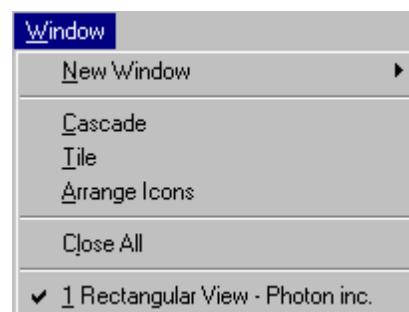
Turns Blind Spot Correction on or off.

Recompute

Use Recompute to reanalyze acquired scan data or computed cross section data for either the previous acquisition or for saved data files.

7.5.6. Window Menu

When “**Window**” on the Menu Bar is clicked, the pull-down menu below appears:

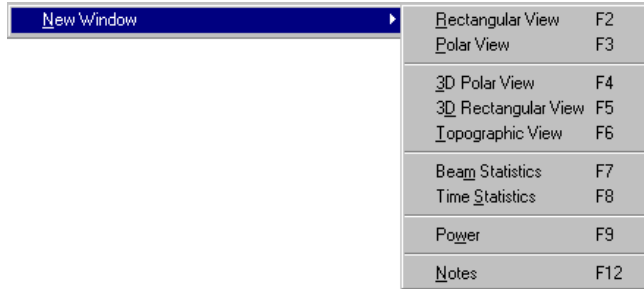


The Window menu is used to open new windows, to arrange windows and window

icons and to close all open windows. The list at the bottom of the menu shows which windows are open with the currently active window checked.

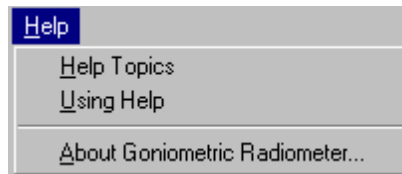
New Window

Opens a submenu for opening windows available for viewing.



7.5.7. Help Menu

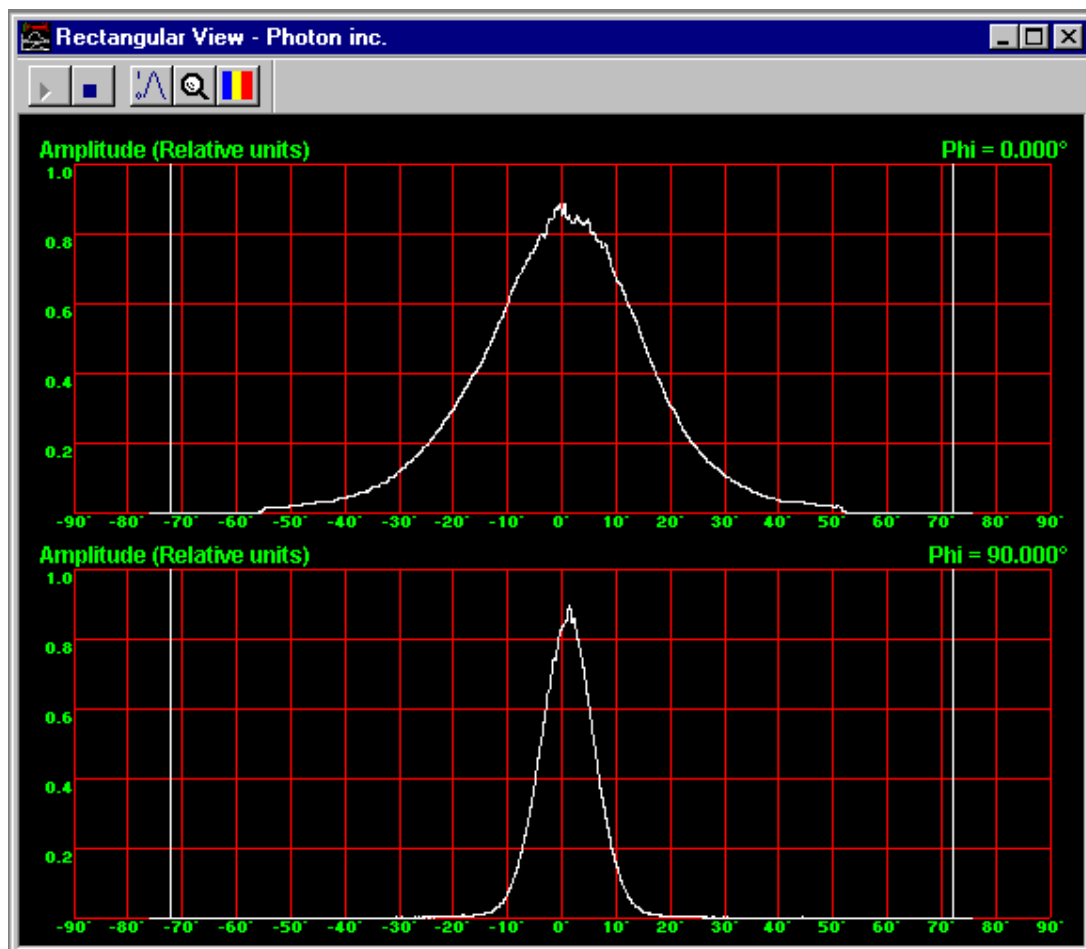
Use the “**Help Menu**” to access Help Topics, directions on how to use the On-line Help, and Goniometric Radiometer software version information.



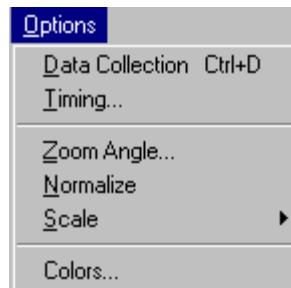
7.6. Window Descriptions

7.6.1. Rectangular View

Open the Rectangular View window. This window displays the data from either a single axis scan or perpendicular axes scans with measured amplitude vs. angle in rectangular coordinates. Options for this menu are accessed through the Options menu when the Rectangular View window is active.



The **Options Menu** available when the Rectangular View window is active is shown below. The selections are:

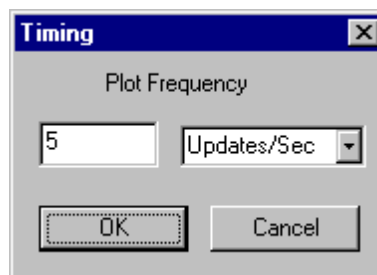


Data Collection

Turns data collection on and off.

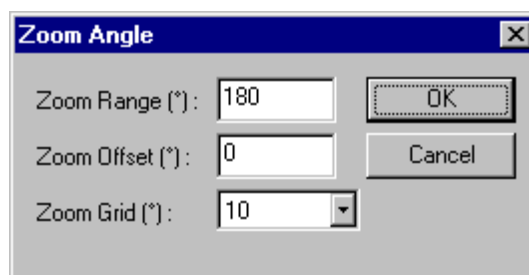
Timing...

Opens a dialog box for selection of the profile update rate.



Zoom Angle...

Opens the Zoom Angle Dialog Box. The Zoom Angle Dialog box allows zooming to view a section of the scan data in greater detail. It is used to select the Angular Range, the Zoom Offset Angle and the Grid Spacing. All values are in degrees.



Normalize

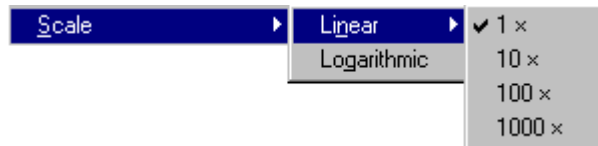
Scales the profile amplitude to have a peak value of 1, i.e. full scale. (In Perpendicular Axes Scan mode the normalization will be for the largest amplitude scan).

Scale

Opens a submenu for selecting the scaling of the vertical axis, either Linear or Logarithmic.



When Linear is selected, a second submenu appears for selecting the scale of the vertical axis, either 1×, 10×, 100×, or 1000×.



Some of the options can also be selected using the icons on the Rectangular View window toolbar:



Starts Data Collection



Stops Data Acquisition



Normalize the Display



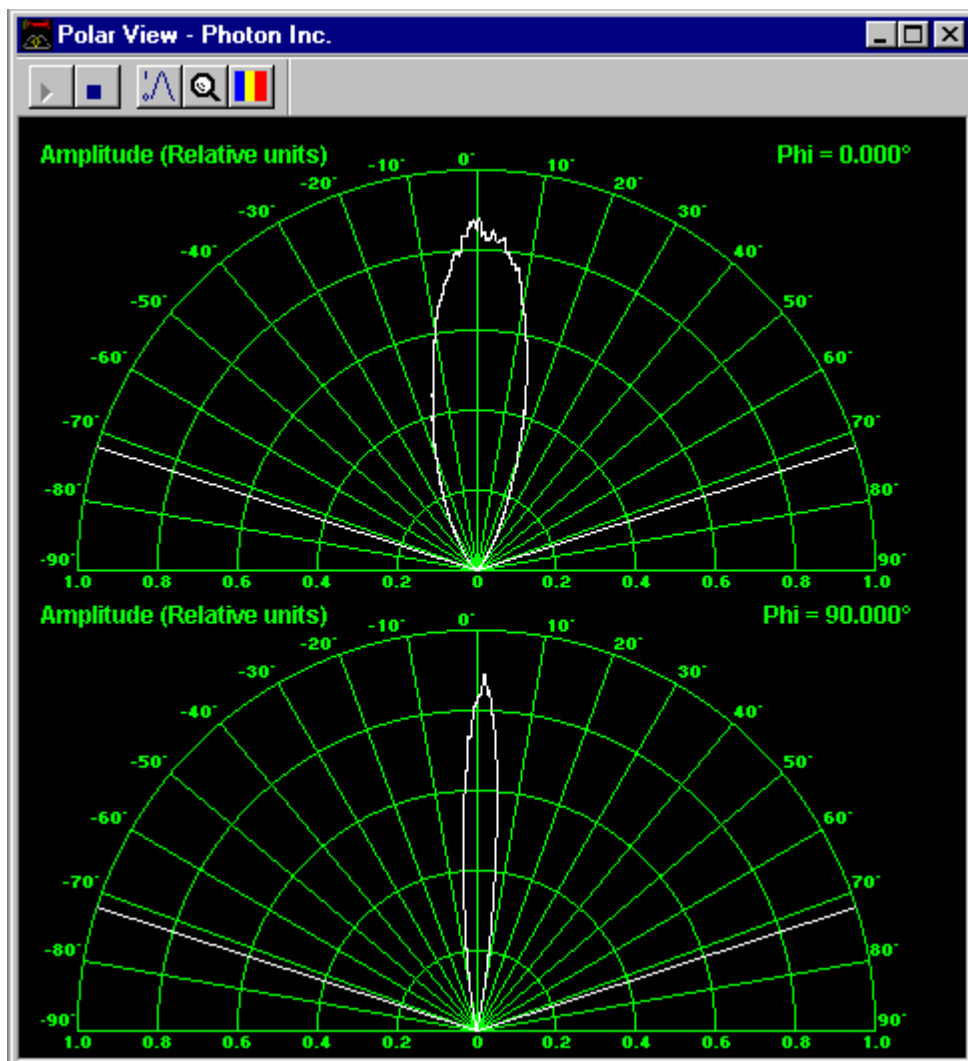
Opens the Zoom Angle Dialog Box



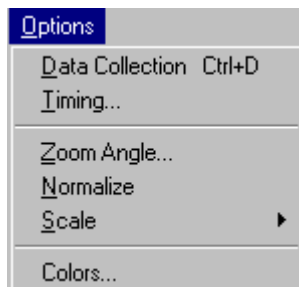
Opens the Color Selection Dialog Box

7.6.2. Polar View

Open the Polar View window. This window displays the data from either a single axis scan or perpendicular axes scans with measured amplitude vs. angle in polar coordinates.



The **Options Menu** available when the Polar View window is active is shown below. The selections are:

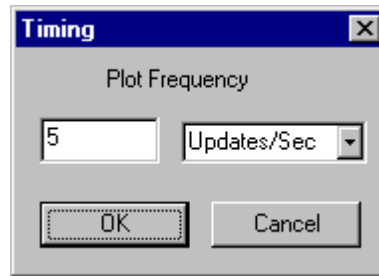


Data Collection

Turns data collection on and off.

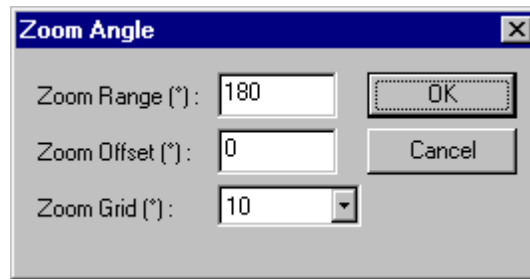
Timing...

Opens a dialog box for selection of the profile update rate.



Zoom Angle...

Opens the Zoom Angle Dialog Box. The Zoom Angle Dialog box is used to select the Angular Range, the Zoom Offset Angle and the Grid Spacing. All values are in degrees.



Normalize

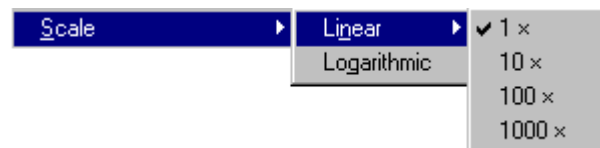
Scales the profile amplitude to have a peak value of 1, i.e. full scale. (In Perpendicular Axes Scan mode the normalization will be for the largest amplitude scan).

Scale

Opens a submenu for selecting the scaling of the vertical axis, either Linear or Logarithmic.



When Linear is selected, a second submenu appears for selecting the scale of the vertical axis, either 1×, 10×, 100×, or 1000×.



Colors...

Opens a Colors dialog box, used for selecting the color scheme for the displayed graph. Colors for the background, text, grid and data can be independently set. To change a color, click on the appropriate color “button” to open a Windows color selection dialog box.



Some of the options can also be selected using the icons on the Rectangular View window toolbar:



Starts Data Collection



Stops Data Acquisition



Normalize the Display



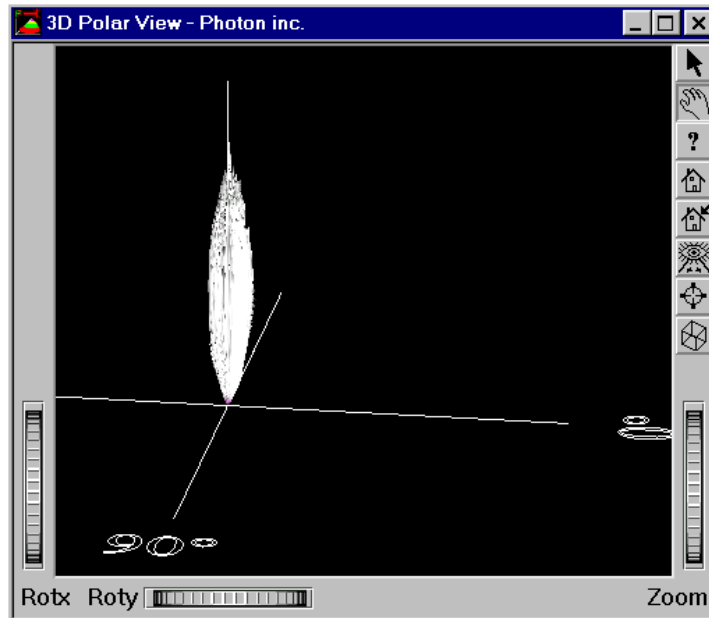
Opens the Zoom Angle Dialog Box



Opens the Color Dialog Box

7.6.3. 3D Polar View

Open the 3D Polar View window. This window displays data from 3D acquisitions in a “3-dimensional” viewing format in spherical coordinates. The image can be rendered with either a wireframe or solid surface. The view perspective is looking toward the source.



The **Options Menu** available when the Polar View window is active is shown below. The selections are:



Solid Surface

When selected, the image will have a solid surface. When not selected, the image will be rendered as wireframe.

Clip Level...

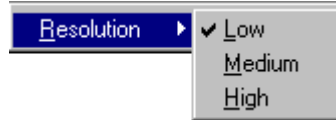
Not presently available.

Clip Legend

Not presently available.

Resolution

Opens a submenu for selecting the resolution of the 3D image, either Low (120 points per scan), Medium (270 points per scan), or High (540 points per scan).



Scale

Opens a submenu for selecting the scaling of the data in the display, either Linear or Logarithmic.



The toolbar at the right border of the window contains 8 buttons used to select several viewing and image manipulation features. These buttons are, from top to bottom:



Chooses the “Arrow” cursor. Allows image manipulation only using the mouse and the thumbwheel controls.



Chooses the “Hand” cursor. Allows image manipulation using the mouse directly in the image or by using the thumbwheel controls. (When the mouse is moved to the window border the Hand cursor changes to the Arrow cursor.)



This Help menu is inactive. Please use the main Help menu.



Resets the view to a preset “Home” default position, size and orientation.



Sets the default settings for the “Home” button.



Restores the view to include the entire image.



Activates the “Seek” cursor. After positioning this cursor on a selected point in the image and clicking the left mouse button, a close-up zoom to that point will be performed automatically. Also, the center of rotation will be set to that point.



Toggles between the Orthographic and Perspective projection modes.



There are also several “thumbwheels” along the window border, designated “Zoom”, “Dolly”, “Rotx”, and “Roty”, which are used to zoom and rotate the 3D image.

The image can be rotated, translated, panned, and zoomed using the mouse with the Arrow cursor and the “thumbwheel” control knobs or using the mouse with the Hand cursor, as described below.

Rotation

Rotate the image using the mouse and the Arrow cursor with the thumbwheels labeled ROTX and ROTY. Alternatively, use the mouse and the Hand cursor to directly rotate the image; Position the hand cursor over the image, depress the left mouse button, and drag the mouse to obtain the desired orientation.

Pan/Translate

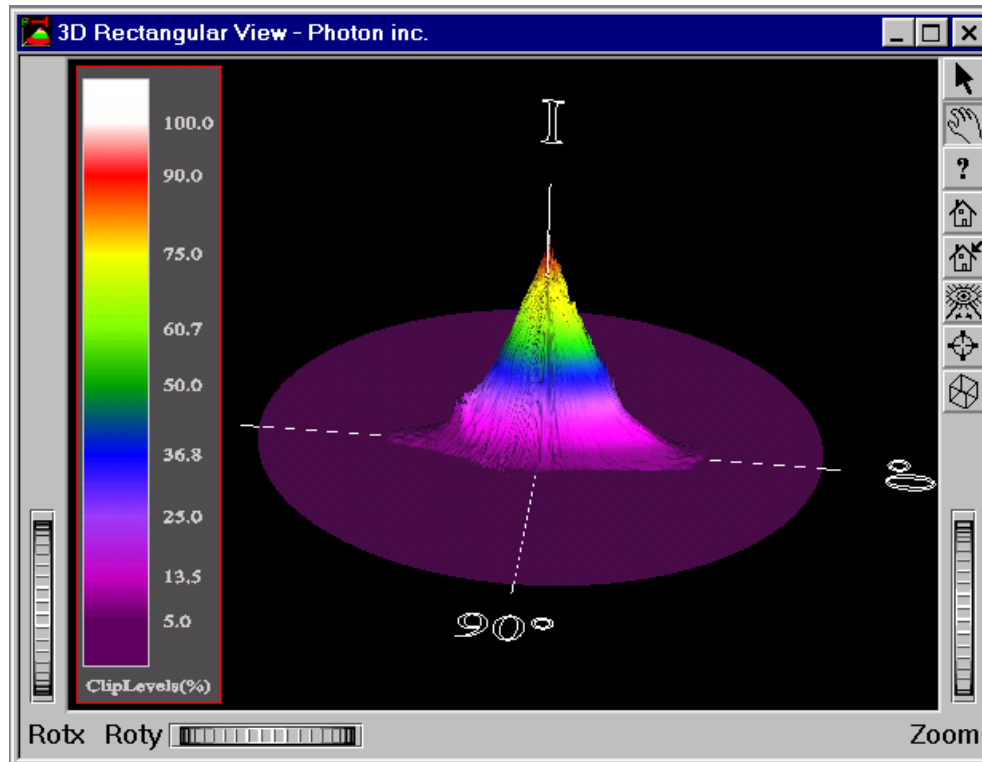
While depressing the control key <CTRL>, use the mouse and the Hand cursor to directly pan the image. Position the hand cursor over the image, depress the left mouse button, depress the control key, and drag the mouse to move the image to the desired location.

Zoom

The method for zooming the image depends on the type of display projection selected. In the Perspective projection mode, use either the zoom control arrows at the bottom of the window, or use the Dolly thumbwheel at the lower right border of the window. In the Orthographic projection mode, use the Zoom thumbwheel at the lower right border of the window.

7.6.4. 3D Rectangular View

Open the 3D Rectangular View window. The 3D Rectangular View window displays the source intensity pattern in a “3-dimensional” viewing format in cylindrical coordinates. The image can be rendered with either a wireframe or solid surface, with user selected clip levels and colors. The perspective of this view is looking toward the source.



The **Options Menu** available when the 3D Rectangular View window is active is shown below. The selections are:

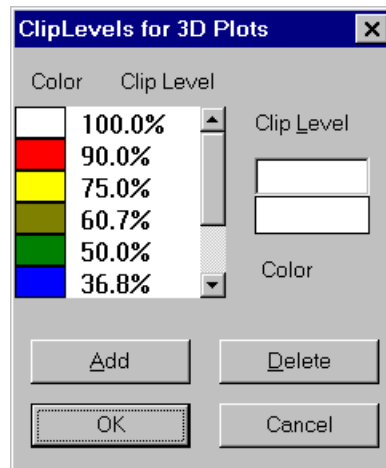


Solid Surface

When selected, the image will have a solid surface. When not selected, the image will be rendered as wireframe.

Clip Level...

Opens a dialog box for selecting clip level contours and their colors.

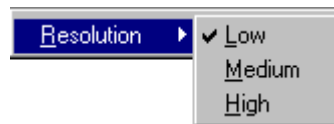


Clip Legend

When selected, the clip level legend will be displayed in the 3D window.

Resolution

Opens a submenu for selecting the resolution of the 3D image, either Low (120 points per scan), Medium (270 points per scan), or High (540 points per scan).



Scale

Opens a submenu for selecting the scaling of the data in the display, either Linear or Logarithmic.



The toolbar at the right border of the window contains 8 buttons used to select several viewing and image manipulation features. These buttons are, from top to bottom:



Chooses the “Arrow” cursor. Allows image manipulation only using the mouse and the thumbwheel controls.



Chooses the “Hand” cursor. Allows image manipulation using the mouse directly in the image or by using the thumbwheel controls. (When the mouse is moved to the window border the Hand cursor changes to the Arrow cursor.)



This Help menu is inactive. Please use the main Help menu.



Resets the view to a preset “Home” default position, size and orientation.



Sets the default settings for the “Home” button.



Restores the view to include the entire image.



Activates the “Seek” cursor. After positioning this cursor on a selected point in the image and clicking the left mouse button, a close-up zoom to that point will be performed automatically. Also, the center of rotation will be set to that point.



Toggles between the Orthographic and Perspective projection modes.



There are also several “thumbwheels” along the window border, designated “Zoom”, “Dolly”, “Rotx”, and “Roty”, which are used to zoom and rotate the 3D image.

The image can be rotated, translated, panned, and zoomed using the mouse with the Arrow cursor and the “thumbwheel” control knobs or using the mouse with the Hand cursor, as described below.

Rotation

Rotate the image using the mouse and the Arrow cursor with the thumbwheels labeled Rotx and Roty. Alternatively, use the mouse and the Hand cursor to directly rotate the image; Position the hand cursor over the image, depress the left mouse button, and drag the mouse to obtain the desired orientation.

Pan/Translate

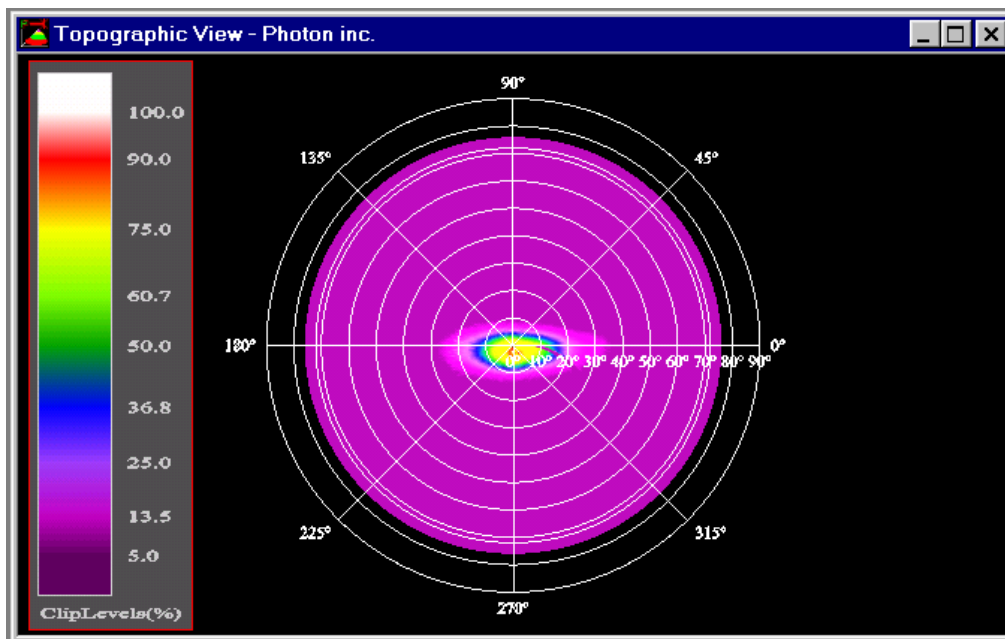
While depressing the control key <CTRL>, use the mouse and the Hand cursor to directly pan the image. Position the hand cursor over the image, depress the left mouse button, depress the control key, and drag the mouse to move the image to the desired location.

Zoom

The method for zooming the image depends on the type of display projection selected. In the Perspective projection mode, use either the zoom control arrows at the bottom of the window, or use the Dolly thumbwheel at the lower right border of the window. In the Orthographic projection mode, use the Zoom thumbwheel at the lower right border of the window.

7.6.5. Topographic View

Open the Topographic View window. This window displays the data from 3D acquisitions with false color in polar coordinates. The perspective of this view is looking from the source.

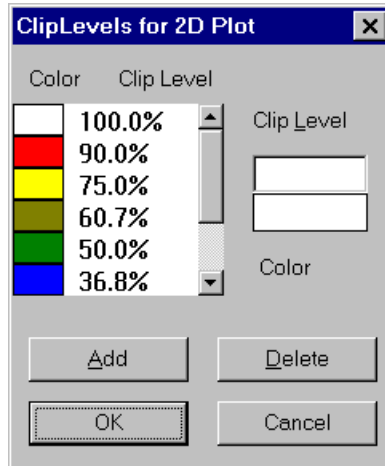


The **Options Menu** available when the Topographic View window is active is shown below. The selections are:



Clip Level...

Opens a dialog box for selecting clip level contours and their colors.

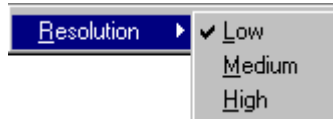


Clip Legend

When selected, the clip level legend will be displayed in the 3D window.

Resolution

Opens a submenu for selecting the resolution of the 3D image, either Low (120 points per scan), Medium (270 points per scan), or High (540 points per scan).



Scale

Opens a submenu for selecting the scaling of the data in the display, either Linear or Logarithmic.

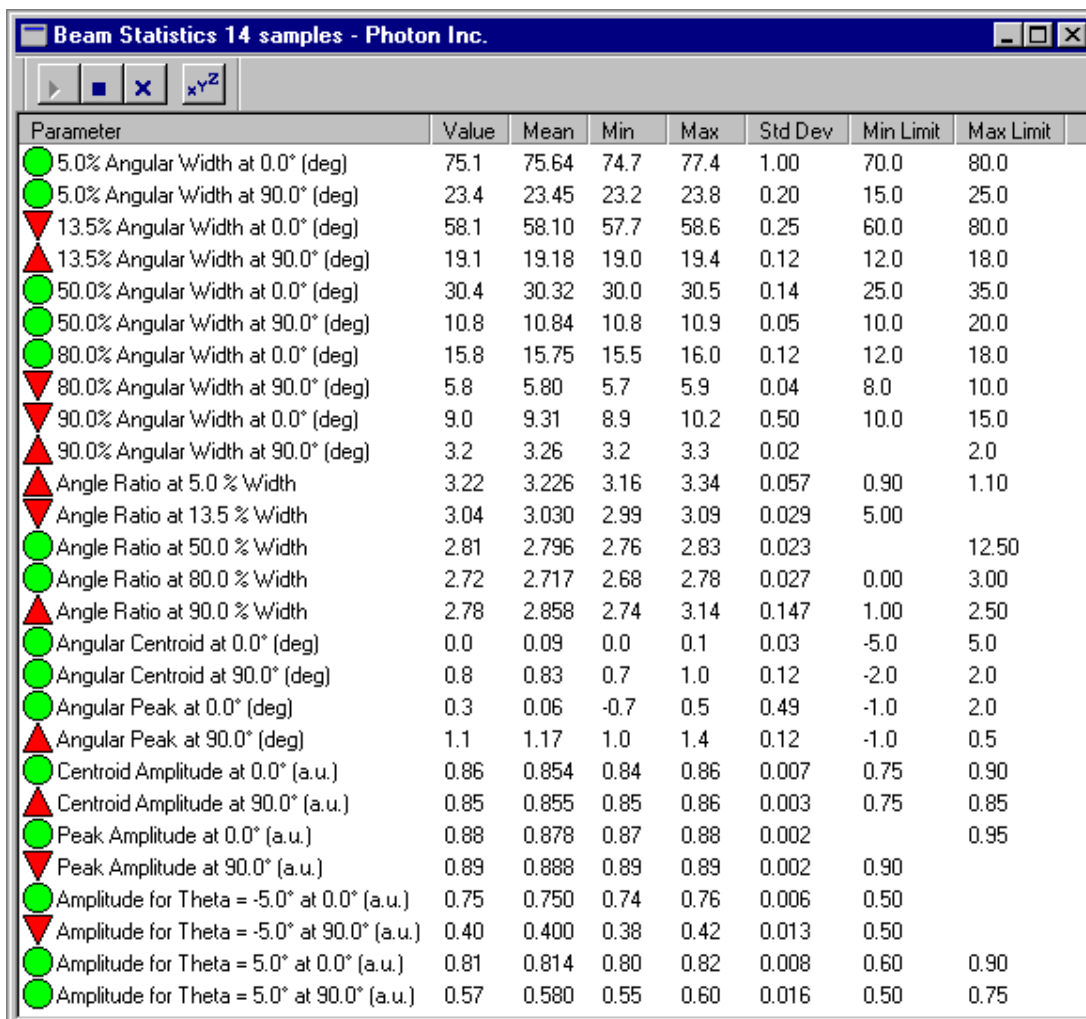


Zoom

To Zoom in, click and hold down the left mouse button while dragging the mouse away from the center. To Zoom out, click and hold down the left mouse button while dragging the mouse toward the center. To translate up, down, left and right, simultaneously press the Ctrl key and the Left Mouse Button, and drag the mouse to move the image to the desired location.

7.6.6. Beam Statistics

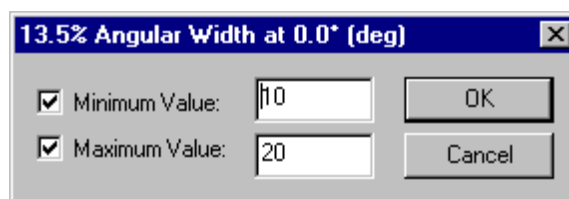
Open the **Beam Statistics** window. This window displays a tabular summary of beam parameters and statistics. It is also used for **Limit Analysis**. The parameters for viewing are selected in the **Beam Statistics Parameters** dialog box.



Parameter	Value	Mean	Min	Max	Std Dev	Min Limit	Max Limit
5.0% Angular Width at 0.0° (deg)	75.1	75.64	74.7	77.4	1.00	70.0	80.0
5.0% Angular Width at 90.0° (deg)	23.4	23.45	23.2	23.8	0.20	15.0	25.0
13.5% Angular Width at 0.0° (deg)	58.1	58.10	57.7	58.6	0.25	60.0	80.0
13.5% Angular Width at 90.0° (deg)	19.1	19.18	19.0	19.4	0.12	12.0	18.0
50.0% Angular Width at 0.0° (deg)	30.4	30.32	30.0	30.5	0.14	25.0	35.0
50.0% Angular Width at 90.0° (deg)	10.8	10.84	10.8	10.9	0.05	10.0	20.0
80.0% Angular Width at 0.0° (deg)	15.8	15.75	15.5	16.0	0.12	12.0	18.0
80.0% Angular Width at 90.0° (deg)	5.8	5.80	5.7	5.9	0.04	8.0	10.0
90.0% Angular Width at 0.0° (deg)	9.0	9.31	8.9	10.2	0.50	10.0	15.0
90.0% Angular Width at 90.0° (deg)	3.2	3.26	3.2	3.3	0.02		2.0
Angle Ratio at 5.0 % Width	3.22	3.226	3.16	3.34	0.057	0.90	1.10
Angle Ratio at 13.5 % Width	3.04	3.030	2.99	3.09	0.029	5.00	
Angle Ratio at 50.0 % Width	2.81	2.796	2.76	2.83	0.023		12.50
Angle Ratio at 80.0 % Width	2.72	2.717	2.68	2.78	0.027	0.00	3.00
Angle Ratio at 90.0 % Width	2.78	2.858	2.74	3.14	0.147	1.00	2.50
Angular Centroid at 0.0° (deg)	0.0	0.09	0.0	0.1	0.03	-5.0	5.0
Angular Centroid at 90.0° (deg)	0.8	0.83	0.7	1.0	0.12	-2.0	2.0
Angular Peak at 0.0° (deg)	0.3	0.06	-0.7	0.5	0.49	-1.0	2.0
Angular Peak at 90.0° (deg)	1.1	1.17	1.0	1.4	0.12	-1.0	0.5
Centroid Amplitude at 0.0° (a.u.)	0.86	0.854	0.84	0.86	0.007	0.75	0.90
Centroid Amplitude at 90.0° (a.u.)	0.85	0.855	0.85	0.86	0.003	0.75	0.85
Peak Amplitude at 0.0° (a.u.)	0.88	0.878	0.87	0.88	0.002		0.95
Peak Amplitude at 90.0° (a.u.)	0.89	0.888	0.89	0.89	0.002	0.90	
Amplitude for Theta = -5.0° at 0.0° (a.u.)	0.75	0.750	0.74	0.76	0.006	0.50	
Amplitude for Theta = -5.0° at 90.0° (a.u.)	0.40	0.400	0.38	0.42	0.013	0.50	
Amplitude for Theta = 5.0° at 0.0° (a.u.)	0.81	0.814	0.80	0.82	0.008	0.60	0.90
Amplitude for Theta = 5.0° at 90.0° (a.u.)	0.57	0.580	0.55	0.60	0.016	0.50	0.75

Limit Analysis

Limit analysis can be performed on any of the parameters reported in the Beam Statistics window. The parameters are checked against user specified maximum and/or minimum values and the result of the analysis is displayed using icons in the Beam Statistics window, as shown above. To configure the analysis, either double click with the left mouse button on the desired parameter, or, alternatively, use the Up/Down Arrow keys to highlight the parameter and then press the Space key. This will open the following dialog box for setting the parameter limits for the analysis.



Either one or both limits can be set. The icons for reporting the analysis are:



Parameter value is within the set limit or limits.

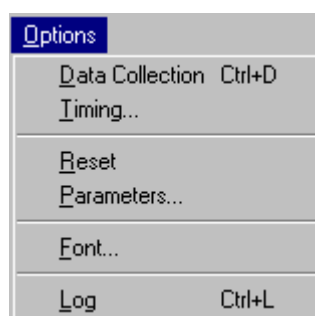


Parameter value is greater than the maximum limit.



Parameter value is less than the minimum limit.

The **Options Menu** available when the Beam Statistics window is active is shown below. The selections are:

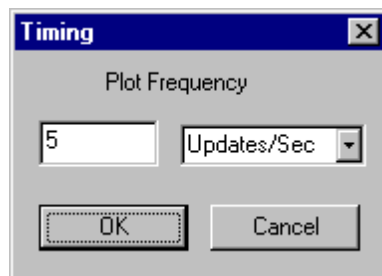


Data Collection

Turns data collection on and off.

Timing...

Opens a dialog box for selection of the window update rate.

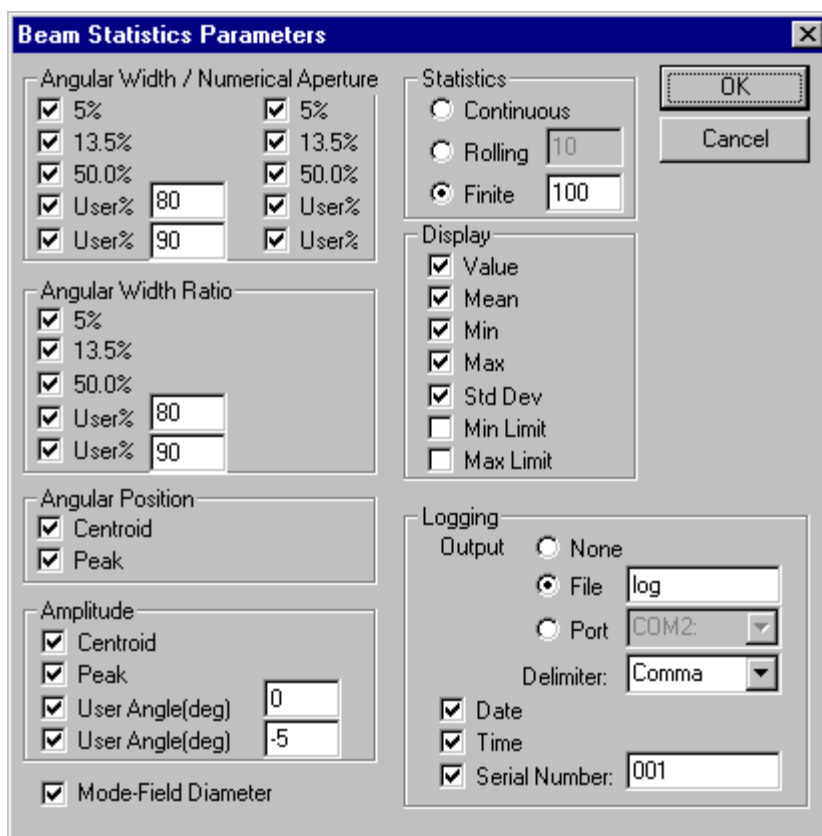


Reset

Resets the values on the **Beam Statistics** window.

Parameters...

Opens the **Beam Statistics Parameters** dialog box.



Selection choices in the **Beam Statistics Parameters** Dialog box are:

Angular Width

5%

Angular width at the 5% clip level (% of peak).

13.5%

Angular width at the 13.5% clip level (% of peak).

50%	Angular width at the 50% clip level (% of peak).
User %	Angular width at the user specified clip level %.
User %	Angular width at the user specified clip level %.
<i>Numerical Aperture</i>	
5%	Numerical aperture at the 5% clip level (% of peak).
13.5%	Numerical aperture at the 13.5% clip level (% of peak).
50%	Numerical aperture at the 50% clip level (% of peak).
User %	Numerical aperture at a user specified clip level %.
User %	Numerical aperture at a user specified clip level %.
<i>Angular Width Ratio</i>	In Perpendicular Axes Scan Mode, the ratio of the angular width at angle ϕ to the angular width at angle $\phi + 90^\circ$.
5%	Angular width ratio at the 5% clip level (% of peak).
13.5%	Angular width ratio at the 13.5% clip level (% of peak).
50%	Angular width ratio at the 50% clip level (% of peak).
User %	Angular width ratio at the user specified clip level (% of peak).
User %	Angular width ratio at the user specified clip level (% of peak).
<i>Angular Position</i>	
Centroid	Value of the angular scan first moment
Peak	Angular value of the peak.
<i>Amplitude</i>	

Centroid	Signal amplitude at the centered.
Peak	Signal amplitude at the peak.
User Angle(deg)	Signal amplitude at the user specified scan angle. The angle range is [-90°, 90°].
User Angle(deg)	Signal amplitude at the user specified scan angle. The angle range is [-90°, 90°].
Mode-Field Diameter	Value of the MFD computed according to FOTP 191.

Statistics





Continuous	Selects a continuous average of data samples.
Rolling	Selects a rolling average with user specified number of samples.
Finite	Selects a finite average with user specified number of samples.
Value	Selects display of the present value of the beam parameter.
Mean	Selects display of the mean value of the beam parameter.
Min	Selects display of the minimum value of the beam parameter.
Max	Selects display of the maximum value of the beam parameter.
Std Dev	Selects display of the standard deviation of the beam parameter.
Min Limit	Selects display of the minimum limit value of the beam parameter set in Limit Analysis.
Max Limit	Selects display of the maximum limit value of the beam parameter set in Limit Analysis

Logging

Output	
Delimiter	Selects the delimiter format for the logged data.
None	No data logging.

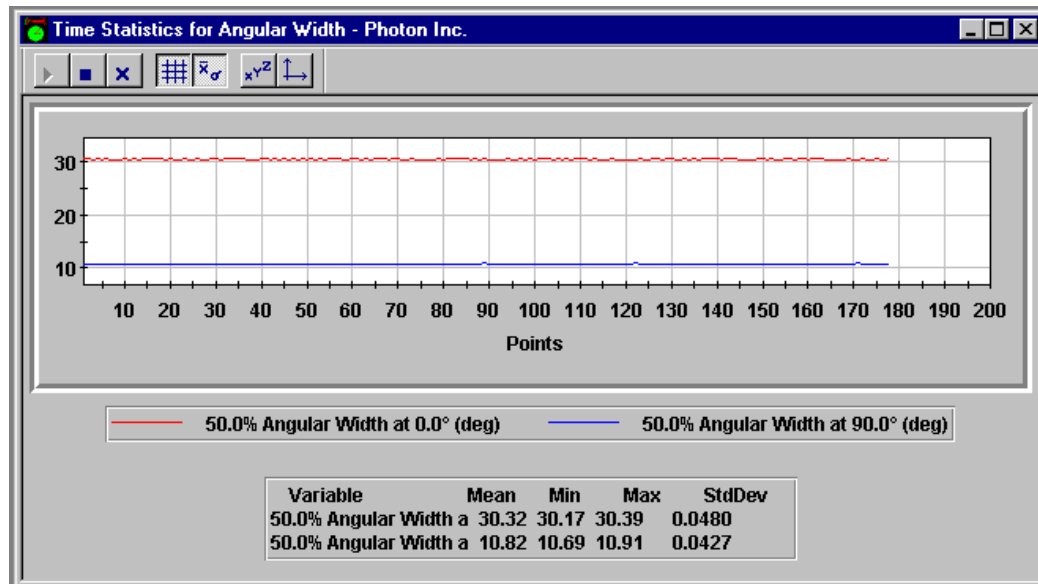
File	Data logging to specified file.
Port	Data logging to serial port COM1 or COM2.
Date	If selected, the date is attached to the logged file.
Time	If selected, the time is attached to the logged file.
Serial No.	If selected, the specified serial number is attached to the logged file.
Font...	Opens the Font Selection dialog box. This allows the user to change the font of the text in the Beam Statistics window.
Log	If data logging is enabled, one additional set of data is acquired and then displayed and/or logged to the file. If data collection is disabled for the Beam Statistics window, it allows the user to take individual data one set at a time and log it to a file. The Hot Key "Ctrl+L" enables logging even if another window is active as long as the Beam Statistics is open.

Some of the options can also be selected using the icons on the Beam Statistics View window toolbar:

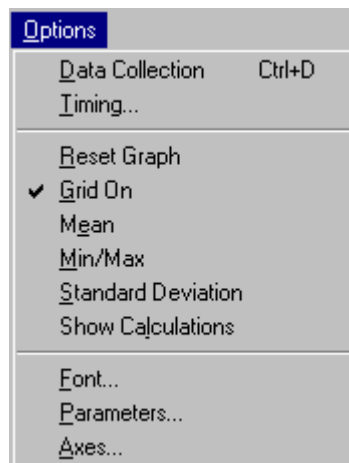
	Starts Data Collection.
	Stops Data Acquisition.
	Clears and Resets the Beam Statistics Window.
	Opens the Beam Statistics Parameter Dialog Box.

7.6.7. Time Statistics

Open the **Time Statistics** window. The Time Statistics window displays strip charts of beam parameters versus sample number or time. Any or all of the computed beam parameters may be viewed in this way. Up to 15 Time Statistics windows can be opened. Several overlays are available in the options menu, including grids, statistical markers, and numerical statistical summaries.



The **Options Menu** available when the Time Statistics window is active is shown below. The selections are:

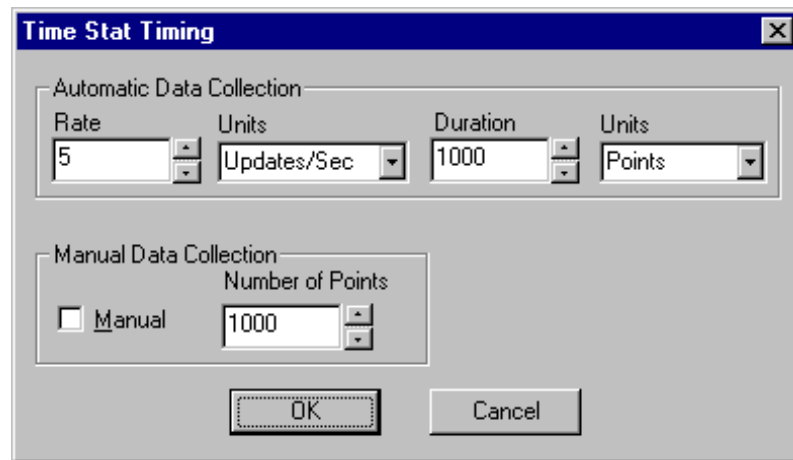


Data Collection

Turns data collection on and off.

Timing...

Opens a dialog box for selection of the window update rate.

**Reset Graph**

Resets the chart.

Grid On

Turns the grid overlay On or Off.

Mean

Displays an overlay on the chart at the mean value.

Min/Max

Displays overlays on the chart at the minimum and maximum values.

Standard Deviation

Displays overlays on the chart at the standard deviation value.

Show Calculation

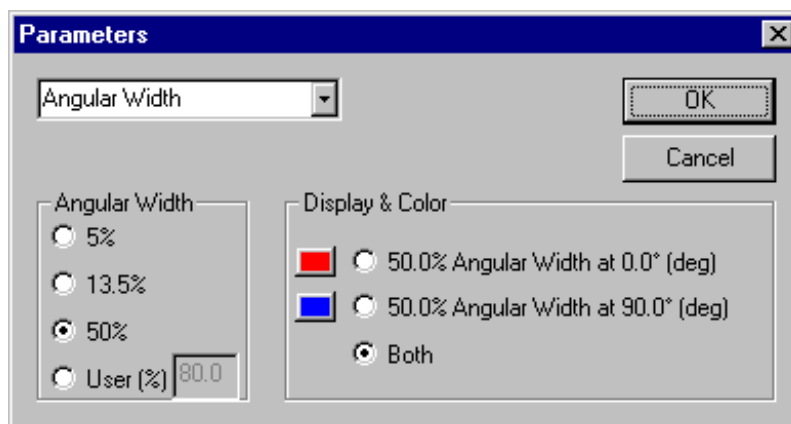
Turns the Statistics Calculation Overlay Text On or Off. The overlay, displayed at the bottom of the chart, shows the values for mean, minimum, maximum and standard deviation.

Font...

Opens the Font dialog box. This allows the user to change the font of the text in the Time Statistics window.

Parameters...

Opens the Time Statistics Parameters dialog box for selecting chart parameters and the color of the graph.



Selection choices in the **Time Statistics Parameters** Dialog box are:

Angular Width

- | | |
|---------------|---|
| 5% | Angular width at the 5% clip level (% of peak). |
| 13.5% | Angular width at the 13.5% clip level (% of peak). |
| 50% | Angular width at the 50% clip level (% of peak). |
| User % | Angular width at the user specified clip level % (% of peak). |

Numerical Aperture

- | | |
|---------------|---|
| 5% | Numerical aperture at a 5% clip level (% of peak). |
| 13.5% | Numerical aperture at a 13.5% clip level (% of peak). |
| 50% | Numerical aperture at a 50% clip level (% of peak). |
| User % | Numerical aperture at a user specified clip level %. |

Angular Centroid

Value of the first moment of angular scan data

Angular Peak

Angular value of the peak

Angle Ratio

In Perpendicular Axes Scan Mode, the ratio of the angular width at angle ϕ to the angular width at angle $\phi + 90^\circ$.

5%

Angular width ratio at the 5% clip level (% of peak).

13.5%

Angular width ratio at the 13.5% clip level (% of peak).

50%

Angular width ratio at the 50% clip level (% of peak).

User %

Angular width ratio at the user specified clip level (% of peak).

Amplitude**Centroid**

Signal amplitude at the centroid.

Peak

Signal amplitude at the peak.

User(deg)

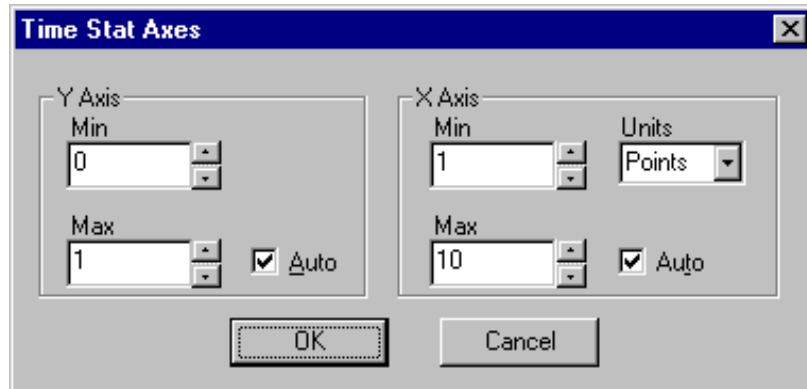
Signal amplitude at the user specified scan angle. The angle range is $[-90^\circ, 90^\circ]$.

Mode Field Diameter








Value of the MFD computed according to FOTP191.

Axes...

Opens the Time Statistics Axes dialog box for setting the chart axes.

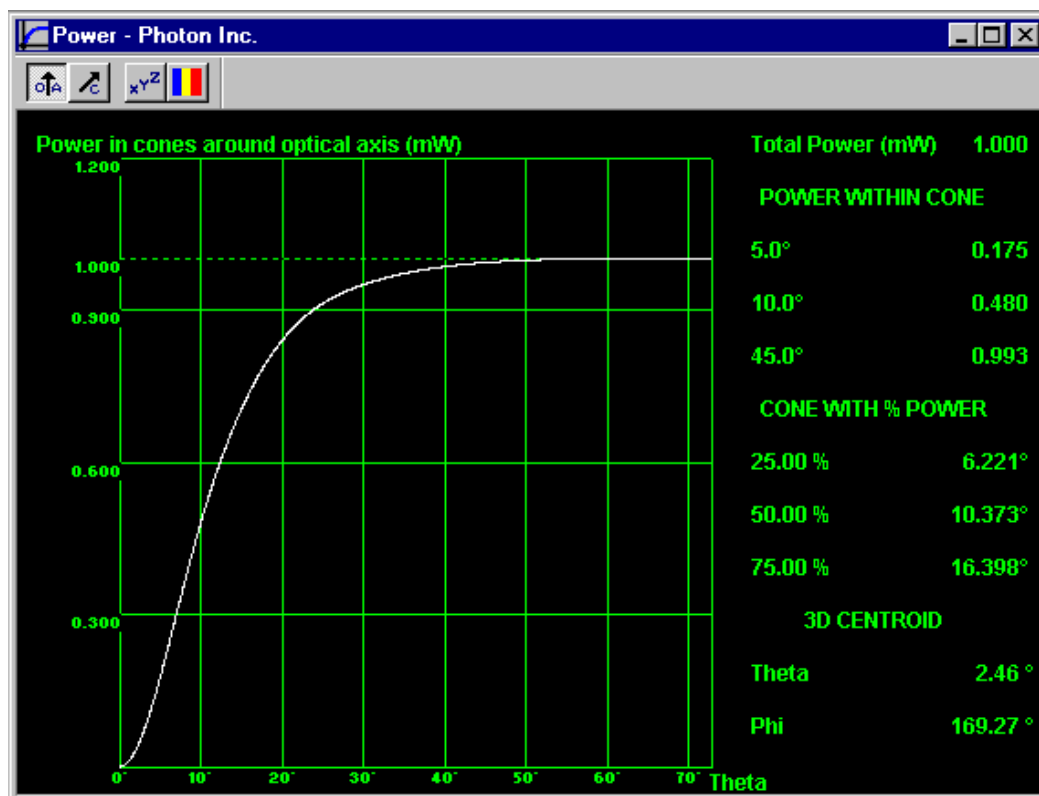


Some of the options can also be selected using the Time Statistics window toolbar.

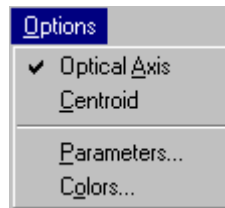
	Starts Data Collection.
	Stops Data Acquisition.
	Clears and Resets the Time Statistics Window.
	Turns the Grid Overlay On or Off.
	Turns the Statistic Calculation Overlay Text On or Off.
	Opens the Time Statistics Parameter Dialog Box.
	Turns the Axes Overlay On or Off.

7.6.8. Power

Open the Power window. The Power window displays a graph of the cumulative angular power, numerical values (up to 3) of the power within specified cone angles, numerical values (up to 3) of the cone angles containing specified percentages of the total power, and the θ and ϕ values of the angular 3D centroid of the profile. The cumulative power graph and associated parameters are determined along either the instrument optical axis or the 3D centroid axis.



The **Options Menu** available when the Power window is active is shown below. The selections are:



Optical Axis

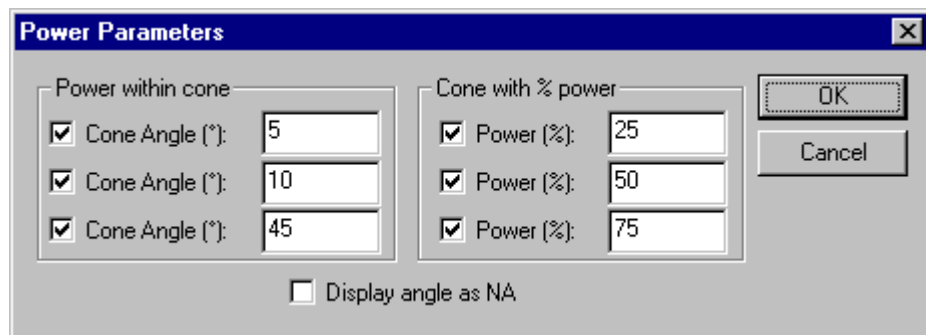
When selected, the power calculations are performed about the instrument optical axis.

Centroid

When selected, the power calculations are performed about the 3D centroid axis.

Parameters...

Opens the Power Parameters dialog for selecting up to 3 cone angles for reporting "Power within cone", and up to 3 percentages of the total power for reporting the "Cones with % power". Angles can be entered in degrees or as Numerical Aperture if the "Display angle as NA" box is checked. In this case the angles will also be reported as NA in the Power window.



Colors...

Opens a Colors dialog box, used for selecting the color scheme for the Power window. Colors for the background, text, grid and data can be independently set. To change a color, click on the appropriate color “button” to open a Windows color selection dialog box.



The options can also be selected using the Power window toolbar.



When selected, the power calculations are performed about the instrument optical axis.



When selected, the power calculations are performed about the 3D centroid axis.



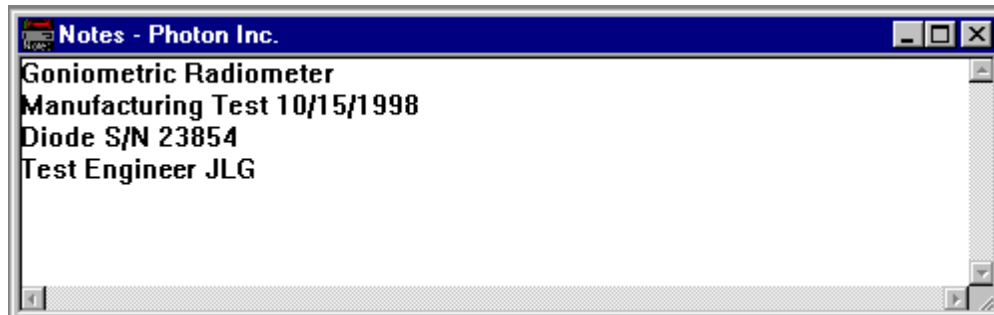
Opens the Power Parameters Dialog Box.



Opens the Color Selection Dialog Box.

7.6.9. Notes

Opens the Notes Window used for entering user information.



7.7. Status Bar

The Status Bar, shown below, appears at the bottom of the main window. The value for the Aperture-Source Distance, the gain setting, and the detector type are reported here.



7.8. Toolbars

Toolbars are provided to speed access to some of the most commonly used operations and features of the Goniometric Radiometer program. Instead of accessing these features through the pull-down menus, simply click on the appropriate icon buttons on the toolbars. The operations and features include: opening windows, turning data collection on and off, selecting the scan mode, and selecting options. In addition, some file handling operations such as opening and saving files, opening new files, and printing can be initiated in this way. General program features are accessed on the main toolbar, while options features specific to each window are accessed on local window toolbars. For user convenience and preference, toolbars can be placed at different screen locations by “dragging and dropping”.

The main toolbar and descriptions of the icon buttons and functions are given below. The local window options toolbars were described previously under the individual window descriptions.



New File, opens a new file



File Open, opens a stored file



Saves the current file



Prints the current screen



Opens the Help Menu



Performs an AutoGain



Starts/Stops Data Collection for Single Axis and Perpendicular Axes Scan Mode



Selects Single Axis Scan Mode



Selects Perpendicular Axes Scan Mode



Replay 3D Scan Data



3D Scan Mode; starts a 3D Acquisition



Replay 3D Centroid Data



Opens the Rectangular View Window



Opens the Polar View Window



Opens the 3D Polar View Window



Opens the 3D Rectangular View Window



Opens the Topographic View Window



Opens the Beam Statistics Window



Opens the Time Statistics window, up to 15 can be opened



Opens the Power window

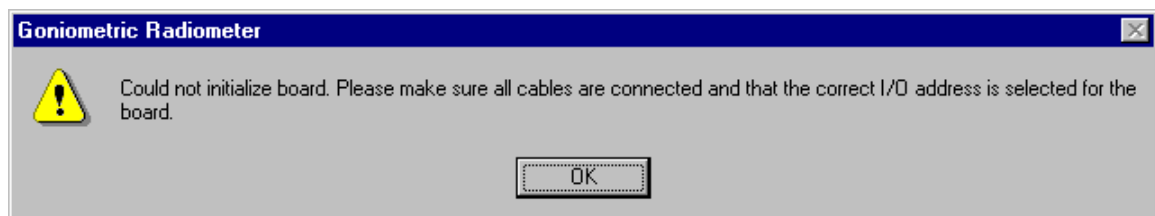


Opens the Notes window

7.9. System Messages

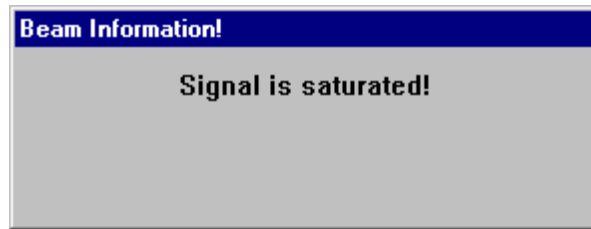
System messages alert the user to system actions, out-of-bound conditions, and errors.

1. Scan Control and Data Acquisition Card Not Initialized



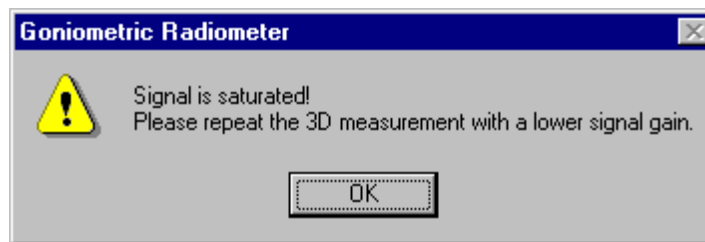
If after several attempts to start the program, this message continues to appear, contact Spiricon.

2. Signal Saturated (Single Axis and Perpendicular Axes scan modes)



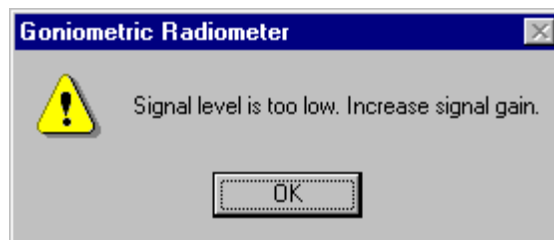
Decrease the signal gain.

3. **Signal Saturated** (3D Scan Mode)



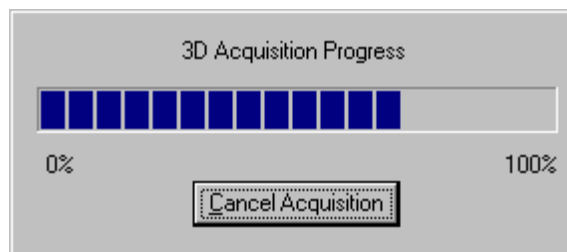
Decrease the signal gain.

4. **Signal Level too Low** (3D Scan Mode)



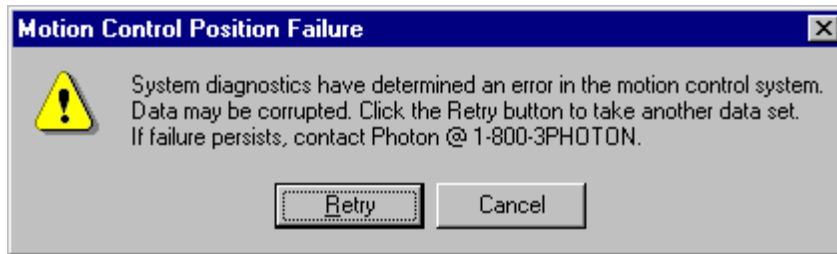
Increase the signal gain.

5. **3D Acquisition Progress Bar**

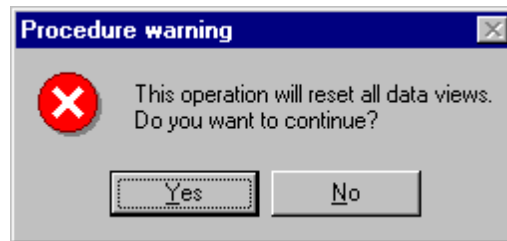


The acquisition can be cancelled by clicking on the "Cancel Acquisition" button.

6. **Motion Control Error** (3D Scan Mode)

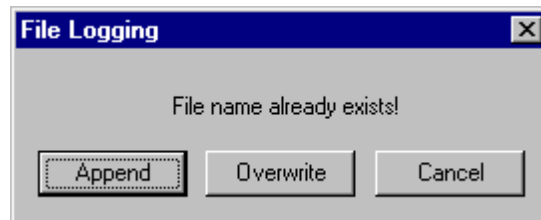


7. **Reset Procedure Warning**



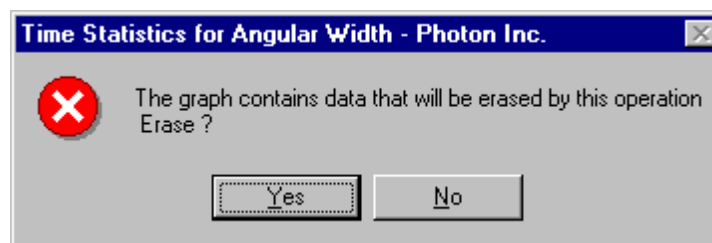
Selecting "Yes" will void all previously acquired data.

8. **File Logging**

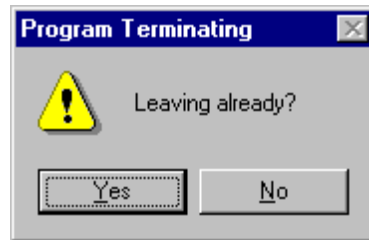


Data log file already exist.

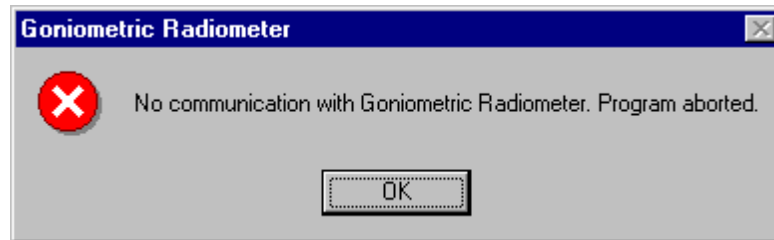
9. **Graph Reset**



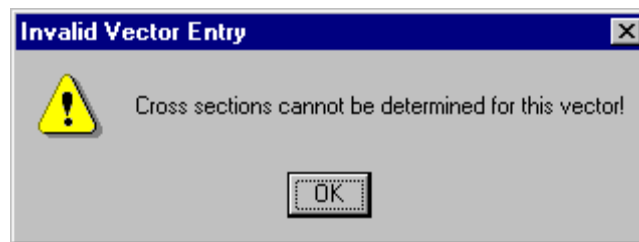
10. **Program Prompt**



11. **RS-232 Communication Failure**

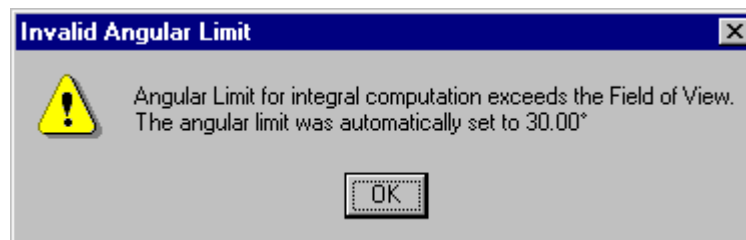


12. **Invalid Vector Entry**



The vector entered is out of bounds and the Computed Cross Sections cannot be determined. Either make another selection or close the Computed Cross Sections dialog.

13. **Invalid Angular Limit**



The Integral Angular Limit is greater than the Field of View for the set Aperture-Source Distance. Use the angular limit value to automatically set or enter a new value.

7.10. Active X Automation

It is possible to start, control and exit the Goniometric Radiometer Acquisition and Analysis Software using ActiveX Automation. The software is an automation server. You need to start the software at least once so that the appropriate information can be added to your Windows registration database. After that, you can start and operate the software using any ActiveX Automation compliant client application.

The gonio32.tlb file in the Automation folder where the software has been installed contains the prototypes of the interface function. You can open and view the Type Library with an OLE viewer program.

A sample file, GonioRActiveX.xls, is written in Visual Basic for Applications using Microsoft Excel. It demonstrates the use of some of the automation methods the Goniometric Radiometer Acquisition and Analysis Software exposes (see section 7.10.28).

The interface methods and properties that the Goniometric Radiometer Acquisition and Analysis Software exports are explained below.

Note: This version of the Automation interface exports only the data from the current scan. The current scan (scan at the current “Phi” angle) is characterized by:

- the number of data points in the scan (profile). A typical value is 3241. This number is returned by the **GetNumPts** method;
- the amplitude of each data point. The array of data point value (amplitude) in the current scan is returned by the **GetProfileData** method;
- the “Theta” angle that corresponds to each data point. The array of angles in the current scan of each data point is returned by the **GetProfileAngle** method.

7.10.1. AngularLimit

Property Type:

VT_R4 – Degrees value

Remarks:

Sets or retrieves the angular limits of integration of the Peterman II Integral (Mode - Field Diameter computation). For example, a value of 60 means the integral is computed from -60° to 60° .

This property is only available with the LD8900R Model.

7.10.2. ApertureSourceDistance

Property Type:

VT_R4 - aperture source distance in cm

Remarks:

Sets or retrieves the value of the distance between the datum plane of the entrance aperture and your source. For a detailed description of the significance of the aperture source distance, please read section 4.1.9.

7.10.3. AutoGain

Method Return Value:

VT_EMPTY - none

Method Parameter List:

VTS_NONE - none

Remarks:

Perform an Auto Gain (which automatically sets the amplifier gain) for the scan from the current Phi (azimuth) angle.

7.10.4. BlindSpotCorrection

Property Type:

VT_BOOL - blind spot correction

Remarks:

Enables/disables blind spot correction. For a description of the “blind spot”, please refer to section 5.5 and section 5.6.

7.10.5. DataIncrement

Property Type:

VT_I2 - increment to decimate scan data / angle

Remarks:

Set or retrieve the increment value for decimate scan data / angle. For example, if you will set the increment to 10, data (angle) exported through GetProfileData (GetThetaAngle) will be (usually) data from indexes 0, 10, 20, 30, 40, 50, ..., 3240. GetNumPts will return the real number of exported points (which in this case will be 324 instead of 3241)

7.10.6. Exit

Method Return Value:

VT_EMPTY - none

Method Parameter List:

VTS_NONE - none

Remarks:

Closes the Goniometric Radiometer software application.

7.10.7. GetCenter

Method Return Value:

VT_R4 - centroid position

Method Parameter List:

VT_S_NONE - none

Remarks:

Returns the centroid position in degrees.

This version of the Automation interface exports only the data from the current scan.

7.10.8. GetCurrentPhi

Method Return Value:

VT_R4 – current Phi angle in degrees

Method Parameter List:

VT_S_NONE - none

Remarks:

Returns the current azimuth scan (Phi) angle in degrees.

This version of the Automation interface exports only the data from the current scan.

7.10.9. GetMFD

Method Return Value:

VT_R4 – MFD value

Method Parameter List:

VT_S_NONE – none

Remarks:

Computes and returns the mode-field diameter value.

If an error occurred, the returned mode-field diameter value will be 0.

This method is only available with the LD8900R model.

7.10.10. GetNA

Method Return Value:

VT_R4 - numerical aperture

Method Parameter List:

VT_S_R4 - cliplevel used for numerical aperture computation as a percent value (e.g. 13.5 for 13.5%).

7.10.11. GetNumPts

Method Return Value:

VT_I2 - number of points.

Method Parameter List:

VTS_NONE - none

Remarks:

Returns how many data points are in the current scan.

This version of the Automation interface exports only the data from the current scan. This value can be changed by setting an increment with **DataIncrement**.

7.10.12. GetPeakIrradiance

Method Return Value:

VT_R4 - value of the irradiance of the peak.

Method Parameter List:

VT_S_NONE - none

Remarks:

Returns the irradiance of the peak in counts. Possible value are 0...65535.

This version of the Automation interface exports only the data from the current scan.

7.10.13. GetPeakPosition

Method Return Value:

VT_R4 - peak position

Method Parameter List:

VT_S_NONE - none

Remarks:

Returns the peak position in degrees.

This version of the Automation interface exports only the data from the current scan.

7.10.14. GetPeakWidth

Method Return Value:

VT_R4 - angular width

Method Parameter List:

VT_S_R4 - cliplevel used for angular width computation as a percent value (e.g. 13.5 for 13.5%).

Remarks:

Returns the angular width in degrees. This version of the Automation interface exports only the data from the current scan.

7.10.15. GetProfileAngle

Method Return Value:

VT_VARIANT - profile angle array

Method Parameter List:

VT_NONE - none

Remarks:

Returns an array of angle value points that represents the angle in radians for each data point. The number of points in the returned data array is the number returned by the **GetNumPts** method. Please note that the array of angle values changes each time you change the aperture-source distance, because the latter parameter affects the Field of View (refer to section 5.2). This version of the Automation interface exports only the data from the current scan.

7.10.16. GetProfileData

Method Return Value:

VT_VARIANT - profile data array

Method Parameter List:

VT_NONE - none

Remarks:

Returns an array of data points that represents the profile in counts. The number of points in the returned data array is the number returned by the **GetNumPts** method. To get the correct distribution of the data, you need to call **GetProfileAngle**, to get the theta angle value that corresponds to each data point.

This version of the Automation interface exports only the data from the current scan.

7.10.17. Go90Deg

Method Return Value:

VT_EMPTY - none

Method Parameter List:

VT_BOOL – direction flag

Remarks:

Changes the azimuth scan angle by + or – 90° for data acquisition and computing. When the parameter is TRUE the azimuth scan angle increases by 90° (e.g. from 0° to 90°) and when the parameter is FALSE the azimuth scan angle decreases by 90° (e.g. from 90° to 0°). This function operates without any home checking routine. It is recommended occasionally to check for “Home Position” with MotorGoHome.

7.10.18. GoToPhiAngle

Method Return Value:

VT_EMPTY - none

Method Parameter List:

VTS_R4 - value of phi angle in degrees. Possible values are 0°...180°.

Remarks:

Selects the azimuth scan angle for which data will be acquired and computed. When the Goniometric Radiometer software is running as an ActiveX server, the scanning data mode should be set to the default value of "Single Axis Scan". The "current" data acquired is the data for the selected phi (azimuth) angle. Phi values are from 0° to 180°, in increments of 0.225°. If the Phi value used as parameter is not a multiple of 0.225°, the closest value smaller than the selected Phi value will be used.

7.10.19. IncrementPhi

Method Return Value:

VT_EMPTY - none

Method Parameter List:

VTS_I2 – number of azimuthal scans intended to be performed for a 3D acquisition. Possible values are 10, 20, 50, 100, or 200.

Remarks:

Incrementally moves the entrance aperture by the Phi angle corresponding to the specified number of scans (e.g. 18° for 10 scans, 9° for 20 scans etc.), useful for 3D data acquisition. After the entrance aperture is moved the system automatically acquires and processes one scan at the previously set gain, independent of the status of **ScanAcquisition**. As a consequence, the user can get the new data set without switching **ScanAcquisition** on and off. At the end of a 3D acquisition sequence it is recommended to return the entrance aperture to the "Home Position" with **MotorGoHome** and check the return value in order to ensure the data was acquired at the proper azimuth angles.

7.10.20. IsSaturated

Method Return Value:

VT_BOOL - saturation flag

Method Parameter List:

VTS_NONE - none

Remarks:

Returns TRUE if signal is saturated, FALSE otherwise.

7.10.21. MotorGoHome

Method Return Value:

VT_BOOL - flag

Method Parameter List:

VTS_NONE - none

Remarks:

Sets the system to the 0° azimuth angle. The difference between **MotorGoHome** and **GoToPhiAngle** with an input value of 0° is that during the MotorGoHome routine, an extra hardware check insures the correctness of the 0° azimuth angle. The FALSE value returned in flag specifies if there has been detected an error in the motion control system when trying to move the motor from the previously selected Phi angle to the home position. You may want to call this function in your program to check the motion control system is working properly. You should call this function after a call to GoToPhiAngle with a phi parameter value different than 0. If this function consistently returns FALSE, contact Ophir-Spiricon.

7.10.22. PulsedMode

Property Type:

VT_BOOL – pulsed mode

Remarks:

Set or retrieve the pulsed mode of operation.

7.10.23. ScanAcquisition

Property Type:

VT_BOOL - global data acquisition

Remarks:

Sets or retrieves the status of data acquisition. If the value is TRUE, the system is acquiring data.

7.10.24. ShowWindow

Property Type:

VT_BOOL – show flag

Remarks:

Shows or hides the Goniometric Radiometer Acquisition and Analysis Software main window. Call this function with FALSE as parameter to hide the Goniometric Radiometer Software. Call this function with TRUE if you want to show the Goniometric Radiometer window.

7.10.25. SignalGain

Property Type:

VT_I2 - signal gain value in dB

Remarks:

Sets or retrieves the value of the signal gains in dB.

Possible values are 0...139 for InGaAs detector and 0...159 for Si detector.

7.10.26. SourceFrequency

Property Type:

VT_R4 – source frequency in kHz

Remarks:

Set or retrieve the pulse repetition frequency of the source.

7.10.27. Wavelength

Property Type:

VT_R4 – Wavelength value

Remarks:

Sets or retrieves the wavelength value used in computations.

This property is only available with the LD8900R Model.

7.10.28. Sample file for ActiveX

Please note that in order to get correct numbers, you need to

- Setup the software to acquire data
- Set the correct aperture-source distance
- Select a reasonable signal gain
- Determine and set the azimuth angle for which data is acquired and computed

Now, you can query the Goniometric Radiometer software for computed values such as angular width, centroid and peak position of the distribution, raw scan data for a selected azimuth angle, etc.

These are fragments from Visual Basic code that show how to use some of the automation interface functions:

```
Dim Gonio As Object

Sub OpenSW()
    Set Gonio = GetObject("", "Gonio.Document")
                                ' start Goniometric Radiometer application and
                                ' get a reference to the ActiveX object
    Gonio.ScanAcquisition True
                                ' start (enable) data acquisition
    Gonio.ApertureSourceDistance 0.1
                                ' tell software that the distance between the
```

```

' source and the aperture is 0.1cm
Gonio.SignalGain 77
' set the signal gain to 77dB
Gonio.GoToPhiAngle 90
' go to azimuth angle phi=90°. (set the
software to
' acquire data for an azimuth angle of 90 deg)
End Sub

Sub CloseSW()
Gonio.Exit
' close the Goniometric Radiometer software
End Sub

Sub GetWidth()
ActiveSheet.Cells(1,1).Formula =
Gonio.GetPeakWidth(13.5)
' get the angular width at 13.5% and display it
in
' a cell in the active spreadsheet. The return
' value can also be written to a variable and
' used later in the program
End Sub

Sub GetCenter()
ActiveSheet.Cells(2, 1).Formula = Gonio.GetCenter()
' get the centroid position and display it in a
' cell in the active spreadsheet. The return
' value can also be written to a variable and
' used later in the program
End Sub

```

For a detailed example written in Visual Basic, please refer to the GonioRActiveX.xls file located under Automation, in the folder where the software has been installed.

7.10.29. Sample file for C#

An example is provided that utilizes the .NET runtime engine. Developers utilizing .NET technologies will find this example useful for interfacing with the Goniometric Radiometer whether they are using C# or another .NET programming language.

To run this example you will need Visual Studio 2012. Microsoft provides a free version, Visual Studio 2012 Express, which can be found at:

<<http://www.microsoft.com/visualstudio/eng/products/visual-studio-express-products>>

This example demonstrates a subset of all of the ActiveX methods using the Gonio_Interop.dll library. The interop library must be referenced in your automation project. The interop library exposes the COM accessible methods and properties normally available in the Goniometric Radiometer to strongly-typed languages such as C#.

Also provided in this example is a file named Imports.cs. The imports file provides access to each of the methods and properties exposed by the Gonio_Interop. In a C# project this file may be included and deployed with your automation project. In other .NET languages a similar import file must be generated, using the imports file as a template.

This example should provide the programmer with an understanding of how to use the remaining methods.

Please note that in order to get correct numbers, you need to

- Setup the software to acquire data
- Set the correct aperture-source distance
- Select a reasonable signal gain
- Determine and set the azimuth angle for which data is acquired and computed