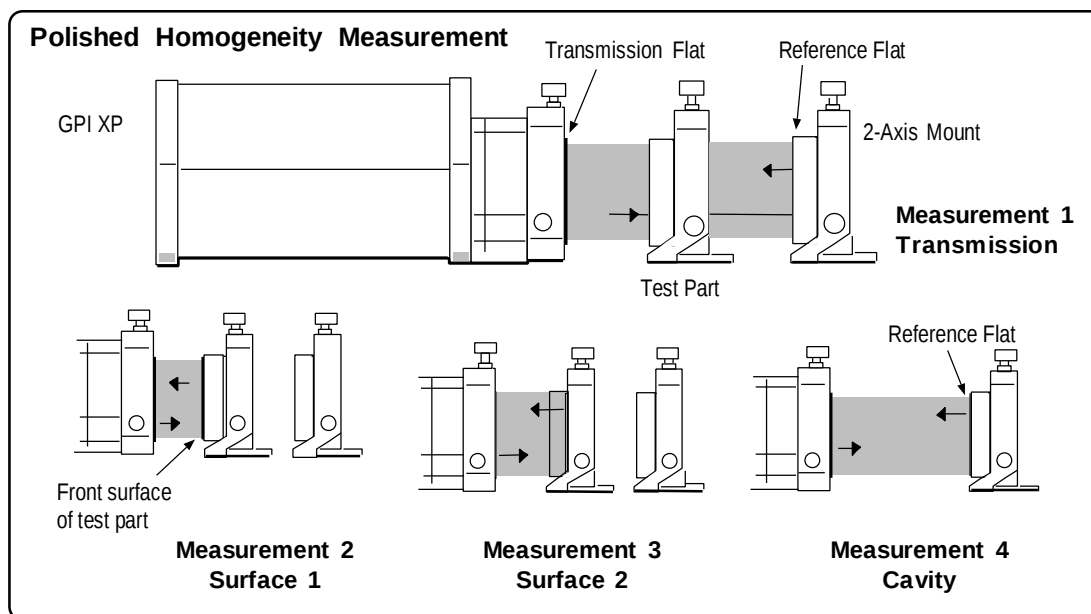


This booklet is a quick reference; it assumes that you are familiar with MetroPro software and the instrument. Information on MetroPro is provided in *Getting Started With MetroPro*, OMP-0346 or OMP-0398, and the *MetroPro Reference Guide*, OMP-0347. For information on the instrument, please refer to the Zygo manual(s) included with your instrument.

The Polished Homogeneity Application

The Zygo Polished Homogeneity or PHom Application is used to measure the homogeneity of polished glass; the polished glass test part must have wedge. Homogeneity is a measure of the variation in the refractive index within a material. The PHom measurement removes errors in the test cavity as well as errors from both surfaces of the sample. It provides information about the internal quality of glass by identifying optical imperfections. PHom is frequently used as a measurement for raw material that will undergo additional manufacture before becoming part of an optical system.

Four measurements are required for PHom data. For the first measurement, the beam passes through the Transmission Flat and the test part, and is reflected off a Reference Flat. During the second measurement, the beam passes through the Transmission Flat and is reflected off the front of the part. The third measurement is like the second, except that the beam reflects off the back side of the test part. For the fourth measurement, the test part is removed and the cavity is measured.

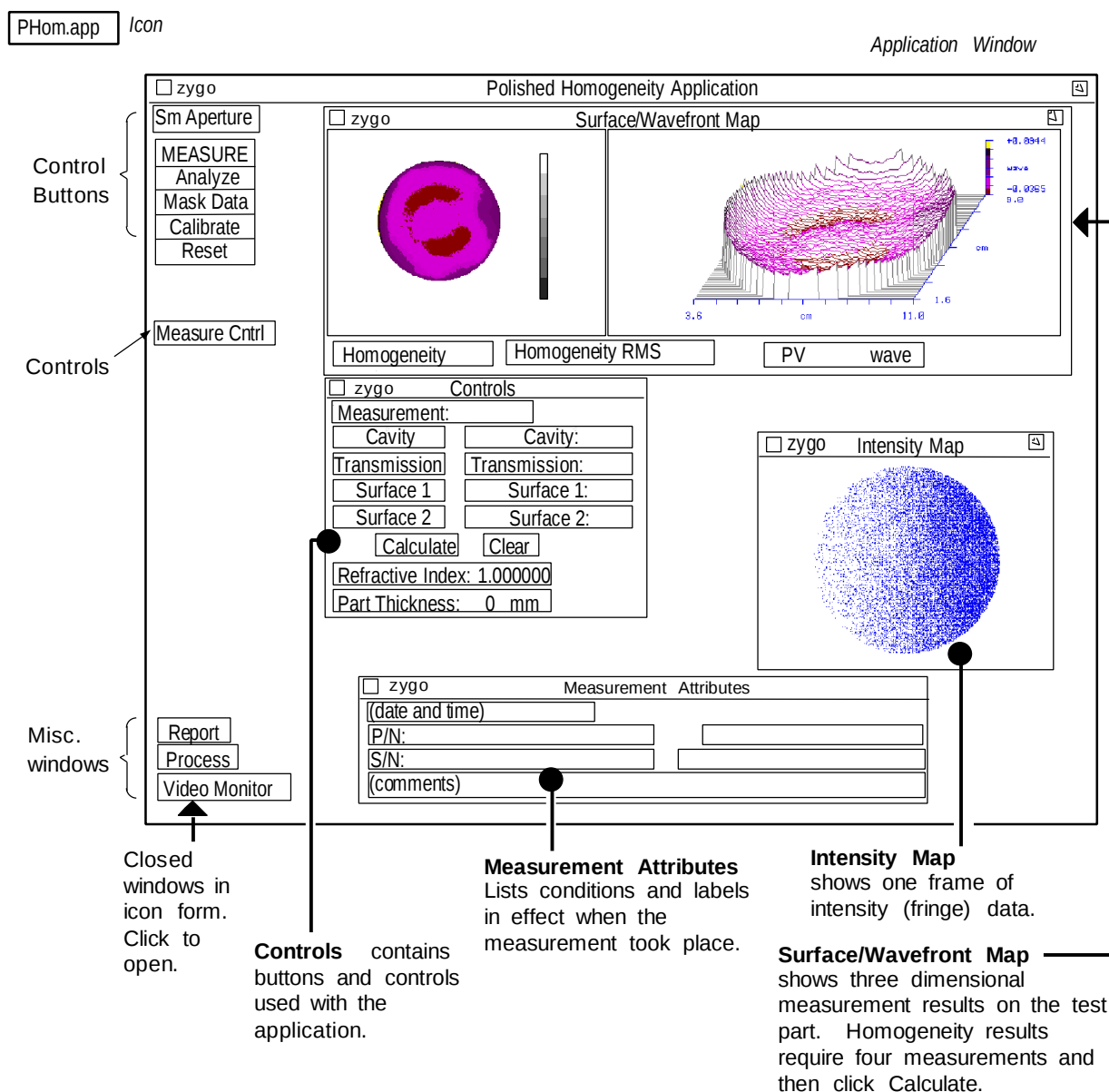


PHom Application

The Polished Homogeneity Application supports the Zygo GPI XP and the Mark IV_{xp} interferometers. The application requires licensing to take measurements or load data. It is licensed as a separate line item in the Edit/View Licenses window. For information on licensing, see *Getting Started With MetroPro*.

The Application Screen

To start MetroPro, refer to *Getting Started With MetroPro*. To open the application, click on the icon. If the icon is not on the MetroPro base window, then use the Load Application command from the MetroPro Window menu to first load the application icon.



Guidelines

- *Hardware Requirements* - The following items are required: a Transmission Flat, a Reference Flat, a 2-Axis Mount for the Reference Flat, and some means for mounting and adjusting the test part. A second 2-Axis Mount with a Self Centering Element Holder may be used for mounting the part when using 4-inch or 6-inch aperture.
- *Nominal Test Part Specifications* - The test part should have sufficient wedge in order to allow measuring the two surfaces independently. Nominal test part specifications are listed in the table below.

Surface Finish	Polished, $1/2 \lambda$ PV
Aspect Ratio (thickness to diameter ratio)	Less than or equal to 6:1
Wedge	4-inch part: 5 to 25 arc minutes 6-inch part: 3.5 to 35 arc minutes 12-inch part: 2 to 66 arc minutes 18-inch part: 1 to 85 arc minutes

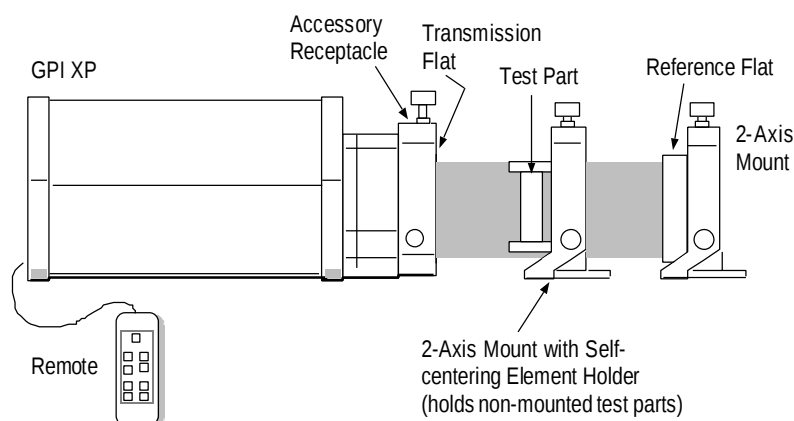
- *Testing Environment* - A vibration isolation system must be used to reduce vibration from the floor. To minimize air turbulence, the test cavity should be as short as possible; the cavity may be enclosed with a sheet of plastic or other material to minimize this effect. Care must be taken that stratification of the air does not occur. The temperature of the testing environment should be stable; long term changes should be less than 0.1°C per hour. All optics must be allowed to come to thermal equilibrium before being measured.

Making Measurements

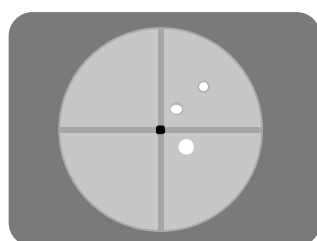
1. Turn on the interferometer, start MetroPro, and open the application.
2. Click on the Aperture button until it displays the aperture in use.

The image shows a screenshot of the MetroPro application window. The window title is 'Application Window'. Inside the window, there is a 'zygo' logo in the top right corner. Below the logo, there is a button labeled 'Sm Aperture'. An arrow points from the text 'Aperture Button' to this button.
3. Install the Transmission Flat in the interferometer accessory receptacle and align the flat. Press the ALIGN/VIEW button on the Remote. Adjust the tip and tilt knobs on the accessory receptacle until the brightest spot is superimposed on the alignment crosshairs.

PHom Application

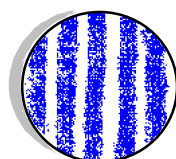


4. Mount the test part and the Reference Flat and position them to determine spacing for the cavity. Keep the cavity as short as possible.
5. Press the Remote ALIGN/VIEW button to switch back to the view mode. You should be able to see an image on the video monitor. Adjust the size of the test part image by pressing the Remote ZOOM buttons. Once you've established the image size and cavity, remove the test part.
6. Align the Reference Flat to the Transmission Flat. Press the ALIGN/VIEW button on the Remote. Adjust the tip and tilt knobs on the 2-Axis Mount until the brightest spot is superimposed on the alignment crosshairs. Switch back to the view mode.
7. Return the test part to the cavity. Visually center the part to the output beam of the Transmission Flat. Switch the Remote to the align mode. Adjust the Reference Flat to the Transmission Flat so there is interference through the material. Make sure that the alignment reflections from surface 1 or surface 2 are not aligned, either to each other or to the Transmission Flat. The apertures should be coincident and not vignetted.

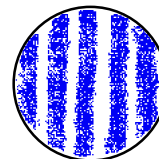


Video Monitor
Align Mode

The brightest dot is from the Reference Flat. The two smaller dots are reflections from the front and back surfaces of the test part; do not align these dots to the Transmission Flat.



Vignetted Image
(Misalignment)



Coincident Image
Good

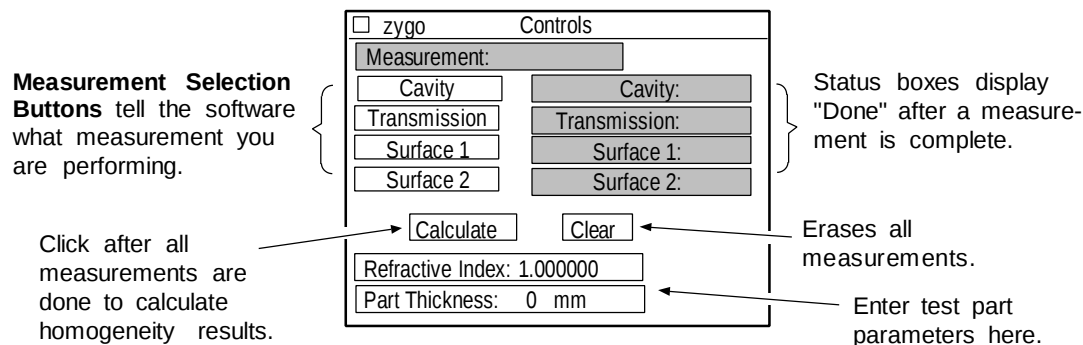
8. Define a circular Acquisition mask to include the part, but exclude the edges. Click the Mask Data button to open the Mask Editor. To draw the mask, click Circle, press the left mouse button and drag the mouse over the image. The Move or Resize buttons are used to change the location or size of the circle. Click the BG Inc button to change it to BG Exc and the background is excluded. Click the Acq button and then the Define button to define the mask. More information is located in the *MetroPro Reference Guide*, under “Mask Editor”.

Optional Step

Calibration establishes the lateral measurement resolution of each camera pixel. Click the Calibrate button. Press the left mouse button and move the mouse to draw a line across the image area. The line should match up to some portion of the image for which you know the dimension. Release the mouse button and enter dimension of the line in millimeters and then press return. Close the Calibrator window. For more information, refer to “Calibration” in the *MetroPro Reference Guide*.

Note: Do not change the interferometer zoom setting or focus, or calibration must be done over.

9. Enter values for the part thickness and refractive index of the test part material in the software controls.



10. Click the Transmission button to match the test setup. Press F1 to measure.

Note: Multiple measurements of a test setup can be made until you obtain the best possible data. You can track the measurement in the Process window by making a Control Chart of the PV result. Stop measuring at a given test setup when the PV result is stable and minimized.

PHom Application

11. Misalign the Reference Flat by turning the Tip/Tilt knobs on the 2-Axis Mount until there are no fringes displayed on the Video Monitor. Do not move the 2-Axis Mount.
12. Align the front surface of the test part to the Transmission Flat. Click the Surface 1 button to match the test setup. Press F1 to measure.
13. Align the back surface of the test part to the Transmission Flat using the Tip/Tilt knobs on the mount. Do not remove the part from the mount and do not move the mount. Click the Surface 2 button to match the test setup. Press F1 to measure.
14. Remove the test part from the cavity. Realign the Reference Flat. Click the Cavity button to match the test setup. Press F1 to measure.
15. Click the Calculate button to calculate homogeneity results.
16. To save your results, click the Save Data button. In the File Handler, enter a name for the file, ending with “.dat” and press Return. Then click the Done button.

Software Controls and Buttons

Controls of interest for the PHom Application are listed. For controls not listed, or for greater detail, refer to the *MetroPro Reference Guide*.

<i>Control</i>	<i>Function</i>
Refractive Index	Specifies the refractive index of the test part. An entry is required so a scale factor for measuring surface 2 can be determined.
Part Thickness	Specifies the thickness of the test part. An entry is required to calculate Homogeneity.
Comment	User entry for comments. Can be a company name, the person doing the measurement, a comment on the test setup, or whatever you want. Entry is limited to 60 characters.
Part Number	User entry for part identification.
Phase Avgs	Specifies the number of phase averages to perform during measurements to improve repeatability. The default setting is 0.

Software Controls and Buttons (continued)

<i>Button</i>	<i>Function</i>
Cavity Transmission Surface 1 Surface 2	Click to select the current measurement. In the Cavity setup, the test part is removed and the measurement beam reflects off the Reference Flat. In the Transmission measurement, the beam travels through the test part and reflects off the Reference Flat. For the Surface 1 measurement, the beam reflects off the front of the test part; for Surface 2, it reflects off the back surface of the part.
Calculate	Calculates the homogeneity results based on four measurements. Click after all measurements are complete.
Clear	Erases all current measurement information. Click to start a new measurement series.

Results

<i>Result</i>	<i>Description</i>
Homogeneity	A measure of the uniformity or purity of an optical material. The lower the Homogeneity, the better the uniformity. Homogeneity is given by: $\Delta n = [n (T - C) - (n-1) (S2 - S1)] / t$ Where n is the refractive index, t is the part thickness, and T, C, S1, and S2 are the measurements.
Homogeneity RMS	The root-mean-square deviation of all points from a plane fit to the test part surface.
PV	The height between the lowest and the highest point on the test part surface. 

PHom Application

Other Operations

<i>Operation</i>	<i>How to</i>
Print	Click the word zygo in the window you want to print or select the Print command from the window's menu. Then click the Print button in the Print Panel.
Saving changes made to controls, plots, results, and windows.	You must save the application under a new name. Select the Save Application command from the Application Window menu. In the File Handler, enter a name for the file, ending with ".app" and press Return. Then click the Done button.
Turn off the system	Warning! Improper shutdown may damage the instrument. For instruments running under UNIX, select the Shutdown command from the MetroPro menu; turn off power after the system halted message appears. For instruments running under Windows, select the Quit command from the MetroPro menu; turn off power after you have shut down from within Windows.

Troubleshooting

<i>Symptom</i>	<i>Possible Cause and Fix</i>
Application not functional.	The application is not licensed; contact Zygo for licensing information. The hardware key or ID Module is not installed. Install the hardware key and restart the computer.
No data error, or graphic displays appear incomplete or with holes.	The instrument is not properly focused or the fringes are not nulled. Focus the instrument and null the fringes. The Min Mod (%) control is set too high; decrease the value.
Poor repeatability of results.	Parts moving during measurement. Check part fixturing. Noisy environment. Look at the video monitor for fringe drift or vibration; these signs indicate a noisy environment. Check for air drafts; ensure that the computer is not contributing noise to the vibration isolation system.



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