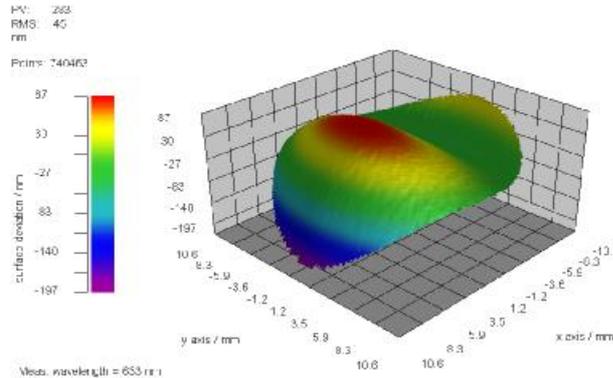


Feature: Scaling of Graphical Result Windows

General

The described feature is available for all μShape versions.

The μShape software displays measurement results in several tabular and graphical windows. By default the coordinate axes of the graphical windows are scaled in pixels representing the resolution of the detector camera. If absolute units of length for the axes (resp. angular units in the case of spherical setups) are desired, the system has to be scaled.



1 Set the Scaling

By scaling the system the μShape software is told how many pixels represent a defined length in absolute units like mm or inch. There are two possibilities to scale the interferometer: automatically and manually. The following descriptions are intended for surface measurements in reflection but can be used for transmission setups too.

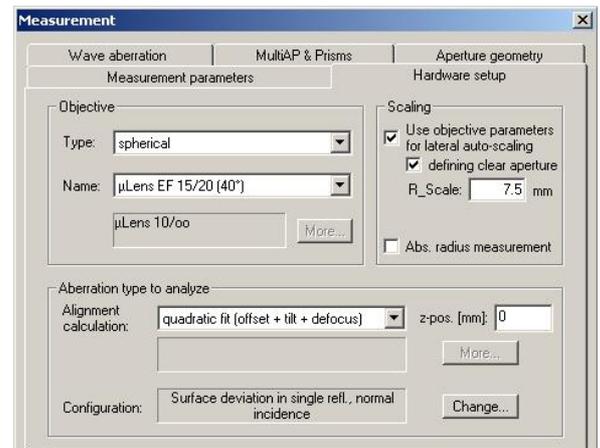
1.1 Automatic Scaling

The automatic scaling is the most convenient way to present the lateral axes of graphical result windows (2D, 3D or Line plot) in absolute units like mm, or inch. For that, you have to specify the interferometer setup first. This is done by using the hardware setup dialog (see right). This dialog is activated by pressing the Measurement Con-

trols button  on the Control Toolbar, or selecting Hardware setup... in the Control menu in measurement mode. By using the drop down menu *Type* the test objective type can be specified (e.g. spherical). Select the actual objective from the drop down menu *Name* below. If the objective used is not listed you must update the objective list in your working directory¹.

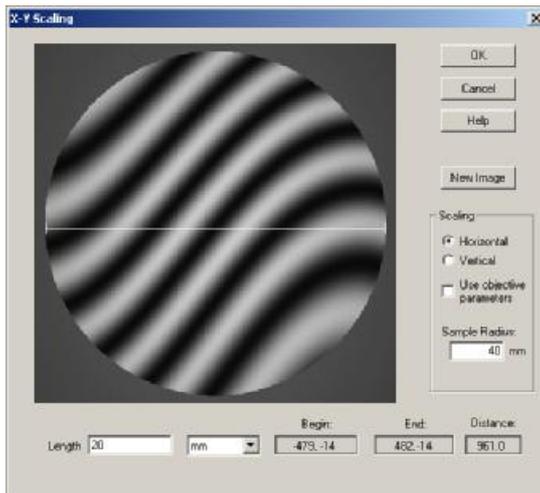
Finally you have to check “Use objective parameters...” to activate automatic scaling.

To get absolute length units for spherical setups the radius of curvature of the spherical test sample has to be defined additionally. Otherwise only angular units (degree or radian) are available beside pixels. To get the length dimensions as projection measure check “defining clear aperture” (see also section 1.3).



¹ See knowledge base paper [K1] for details.

1.2 Manual Scaling



This feature is always possible even if no objective is available in the objective list used for specifying the hardware setup.

For manual scaling press the X-Y Scaling button



on the Control Toolbar, or select “X-Y Scaling” in the Control menu. The X-Y Scaling dialog (see left) opens. An interferogram is displayed and you can specify a length represented by a straight line in desired units. Position, length, and orientation of the line can be changed.

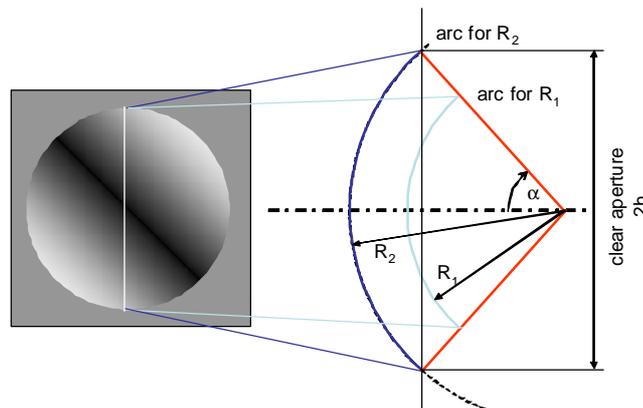
When a setup is already specified, also automatic scaling as described in the previous section can be activated in that X-Y scaling dialog: just check the box “Use objective parameters”.

The example left illustrates a manual aperture definition of 20mm for a sample with a radius of curvature of 40mm.

1.3 Scaling of Curved Surfaces (Clear aperture)

As mentioned above scaling of a system is necessary to connect the aperture size on the detector given in number of pixels with the physical size of the sample in absolute units like mm or inch. For collimated setups this relation is rather clear. Since the relation between aperture size and physical sample size is more complicated in case of curved setups (spherical, cylindrical, etc.) it is explained in the following.

In the example screenshot above a distance of 961 pixels is assigned to 20 mm for a sample radius of 40 mm. What does that mean?



In a spherical setup we have a “radial view”, that means we look along rays which meet in the focus. So each point in the interferogram represents one ray. What is seen as grey value is the phase difference according to the best fitting sphere along the individual rays. This reference sphere has the same distance to the focus along all rays. So, all graphical views show the deviation from the best fitting surface. In case of non-plane setups the horizontal or vertical size is curved and hence they are representing arcs.

While the aperture angle 2α as well as the display size of the interferogram is not changing with the sample radius, the illuminated sample size itself depends on the sample radius. But usually you are not interested in the size measured along the (curved) surface but in its projection to the x/y-plane, because diameters of spherical surfaces e.g. in technical drawings are usually defined as clear aperture value ($2h$) which is the diameter in the projection plane.

The connection between arc length and projection measure (clear aperture of 2h) is given by

$$\text{arc length} = 2R_{\text{sample}} \arcsin \frac{h}{R_{\text{sample}}}$$

In the example the difference between clear aperture and arc size is about 1% (19.792 mm vs. 20 mm).

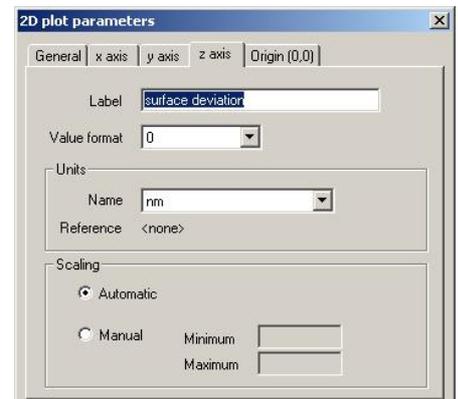
Depending on the given parameters the axes represent the dimension on the surface or the projection size. To get sizes in projection plane you have to check “defining clear aperture” in case of automatic scaling or enter the clear aperture value as Length value in case of manual scaling.

2 Use the scaling

2.1 Changing of Units of Coordinate Axes

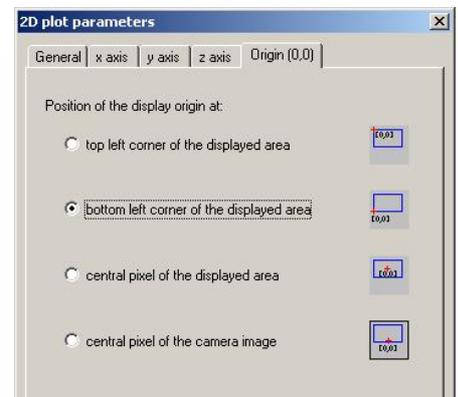
Before absolute units of length can be selected, the hardware setup must be scaled (see section 1).

To change the units of the coordinate axes you must right-click on the according graphical window to open a pop-up menu presenting several entries. Click on *Options* to open the Plot Parameters dialog (see right). Select the desired unit from the drop down menu on the corresponding coordinate axis page. If no absolute units are available, check whether the setup is specified and the system is scaled. Each axis can be scaled independently.



2.2 Selecting the scale origin

The graphical views Color Plot, 3D Plot and Line Plot allow the window specific setting of the scale origin (0,0). On the *Origin* setup tab of the view settings dialog you define the scale origin in your plot window (see right). The one most often used is the second option (left bottom corner), but it may also be useful, especially for scaled axes, to set (0,0) into the middle of the displayed area.



3 Reference Documents

[K1] Knowledge Base: μShape Objective List (“KB_ObjectiveList.pdf”)

The references can be found in our download area (www.trioptics-berlin.com/download).

If you need more information don't hesitate to contact us at software@trioptics-berlin.com.