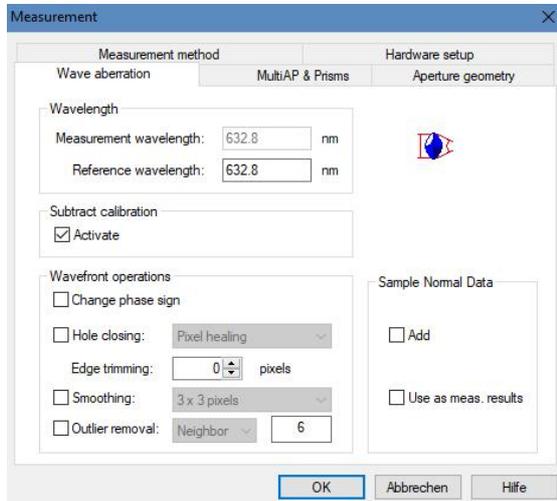


# Feature: Wave Aberration Setup Dialog

## General



The described feature is available in all μShape™ versions.

The dialog is part of the measurement controls. This dialog offers various settings, all influencing the final measurement results.

The raw measurement data are not modified. So you can evaluate different settings and see how they modify the result.

Note: Usage of these options influence your result data. It is strictly recommended to use it very carefully and with respect to the measurement task and desired information.

## 1. Wavelength

In interferometry the primary aberration is always measured in multiples of the measurement wavelength [G1]. Knowing the measurement wavelength enables the software to convert the aberration into absolute units like nm or microns. If you are interested to get the result displayed in multiples of a different wavelength you can enter its value as reference wavelength.

Note: When measuring optics with chromatic errors, changing the result display to reference wavelength won't give the corresponding result, because the aberration is still measured using the measurement wavelength.

The measurement wavelength displayed in measurement mode is only informationally and cannot be changed. It is defined in the calibration controls and can be modified by a supervisor user [G2].

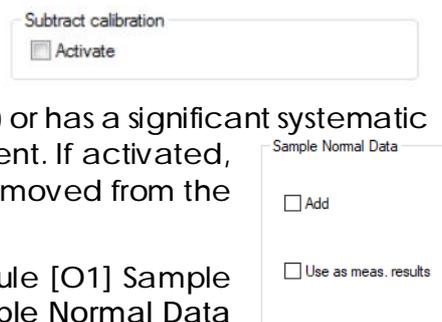
For displaying a result in relative units of wavelength, change the unit in the corresponding views and select *unit(meas.)* or *unit(ref.)*.

## 2. Consideration of additional data maps

Depending on the current program mode additional data maps can be considered.

### 2.1. Measurement mode

In measurement mode you can consider two additional data maps. Checking Activate will subtract a data map acquired in calibration mode. This is recommended if your system is of the Twyman-Green interferometer type (e.g. μPhase) or has a significant systematic error, which can be determined by a calibration measurement. If activated, this error, determined in calibration mode, is automatically removed from the measurement carried out in measurement mode.



The second option is only available when the add-on module [O1] Sample Normal data [A1] is activated. If licensed you can add Sample Normal Data to the measurement result. This can be used e.g. to generate a null test setup.

If you know your test setup has to result in a specific aberration, the inverse target aberration can be added. If you get a zero map, your sample is ok.

As hidden feature option [C1] it is also possible to use a sample normal data file directly as measurement data and to ignore the current measurement data.

## 2.2. Calibration mode

In calibration mode you have the option to consider normal data either in addition or instead of a calibration measurement. To add normal data check **Activate**. Normal data will be added to the calibration measurement. To use the normal data instead of the calibration result also check **Disable calibration data**. The calibration result is defined by the normal data only.

## 3. Wavefront operations

In some cases it is necessary to rectify the measurement results to eliminate errors which are not caused by the sample but by the measurement. Such errors in measurement data can occur e.g. by dust particles on the sample or diffraction effects.

### 3.1. Change phase sign

This operation allows you to change the sign of the topography, which means to make a peak to a valley and vice versa. This is especially necessary if the phase shifting is done in the “wrong” direction or you are using a special optical setup which inverts the wave front.

### 3.2. Hole closing

Occasionally no modulation data is received from some pixels during a measurement. This may occur for various reasons, although very often it will be caused by dust or dirt on the test sample. If *Hole closing* is not activated then the bad data will appear as holes on the measurement image. Select *Hole closing* to fill these gaps with the values of adjacent pixels. The software offers various kinds of *Hole closing* methods. *Pixel healing* fills single pixels with the mean value of the adjacent 8 pixels, whereas *Dilatation+Erosion* is used for larger gaps. As the name implies the process takes two steps. At first dilatation increases the aperture by adding data calculated by the adjacent existing data values. Afterwards the aperture is decreased again to the original size by erosion. The erosion only works at no-value data points. If a hole is closed by dilatation there is no point where the erosion can apply and the hole remains closed. Option *Big Holes* interpolates missing data points by the four next valid data along the data grid, by default up to 20 pixels distance.

### 3.3. Edge trimming

Edge trimming removes data values from aperture edges. This can be the real sample edge as well as isolated defects. It is useful for removing bad data points from the measurement, such as those caused by diffraction at the sample edges. Edge trimming is applied peel by peel. The number of peels is set by the user. Per peel all data points that have at least one neighbor pixel with no-value are set to no-value too.

You find a more detailed technical description of all these wave aberration operations in the integrated direct help by pressing the help button in the dialog shown above or ‘F1’ at the keyboard.

### 3.4. Smoothing [K1]

This effectively reduces or eliminates the influence of individual extreme data values caused by e.g. noise and results in a PV value no longer dominated by single outliers. Instead of a conventional median or Gauss filter an adaptive filter is used. This filter ensures that always a defined number of pixels for averaging is used.

### 3.5. Outlier removal

Spikes or single bad pixels can increase the PV value dramatically although these pixels are not real but measurement errors. Therefore μShape™ offers this option. Contrary to smoothing, always operating on all data points, outlier removal operates only on specific disruptions. There can be detected by two methods. One operating locally (Neighbor), the other globally (RMS). In both cases the value behind the method combo box is used to define the outlier threshold.

## 4. Reference Documents

- [A1] Add-on Module Sample Normal Data ("Addon\_SND.pdf")
- [C1] Settings: Hidden Features inside μShape™ (Config\_HiddenFeature.pdf)
- [G1] Feature: Phase Determination ("mShape\_PhaseDetermination.pdf")
- [G2] Feature: User Levels ("mShape\_UserLevels.pdf")
- [O1] Overview μShape™ Add-on modules ("Overviews\_Modules.pdf")
- [K1] Knowledge Base: Smoothing ("KB\_Smoothing.pdf")

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

If you need more information don't hesitate to contact us at [software@trioptics-berlin.com](mailto:software@trioptics-berlin.com).