

# Knowledge Base: Smoothing

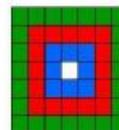
## General

This paper describes the different types of smoothing available in the μShape™ and where you can use them.

### 1 Aberration Smoothing

This smoothing is applied during the calculation chain determining the aberration map from the primarily measured phase map. It smooth data by locally averaging data points. It effectively reduces or eliminates the influence of individual extreme data values and results in a more representative PV value.

The central pixel of the chosen square is replaced by the mean value of the adjacent nxn-pixels. μShape™ uses a special arithmetic mean value filter, that differs especially at the aperture edge from a conventional filter. While a conventional filter always averages the number of valid values in a window of static size (e.g. 3x3), μShape™ uses a dynamic window size. If the static window contains invalid data points, the window is automatically increased until the number of valid points inside the window is equal or larger than the number of data points in the static window. That means a 3x3 filter with adaptive window size averages always at least 8 values.



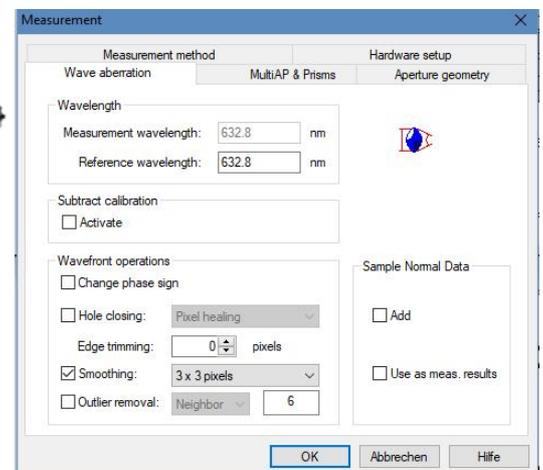
*Adaptive Filter = arithmetic mean filter*  
 Filter 3x3 → mean value of 8 pixels  
 Filter 5x5 → mean value of 24 pixels  
 Filter 7x7 → mean value of 48 pixels

### Set Smoothing

The smoothing is set in the setting dialog window of the μShape™. Open the setting window with the button 

At the Wave aberration page you find the check box smoothing where you can activate it and choose the appropriate filter size.

Aberration smoothing is available for aberration maps in measurement mode as well as in calibration mode. It is recommend to use filters carefully especially in case of using different smoothing filter in both modes.



### 2 Image Smoothing

This filter operates on the camera live image. During the measurement each acquired image is smoothed with a conventional arithmetic mean value filter. The size of the filter area is set by the drop down control Method. The size can only be changed if the filter has been activated via the check box.

This smoothing filter is not applied to the live image display. That means, only the grabbed images for the phase measurement are smoothed. The displayed fringe image always shows the original camera data.

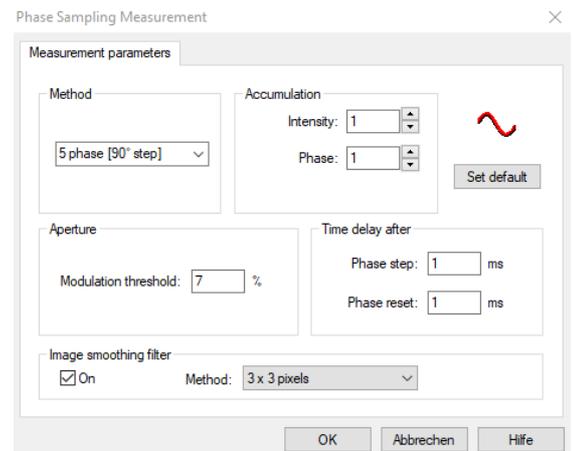
### Set Image Smoothing

The smoothing is set in the setting dialog window of the μShape™. Open the setting window with the  button.

Under Measurement parameters you find the check box image smoothing where you can activate it and choose the appropriate filter.

You can find this setting in the measurement mode as well as in the calibration mode. It is recommend to use the same smoothing filter for both modes especially in the case of fast fringe measurement.

Additionally you find in the calibration mode settings a register called Phase shifter calibration. There you also can choose the image smoothing filter used only for the phase shifter calibration.



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

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