

Add-on: Lateral stitching

General

This document describes a module for determining the surface topography of large flat and spherical samples which cannot be recorded by a single aperture measurement due to its size. This is done by lateral stitching. For the stitching procedure a second software μ Stitch™ is used which controls the μ Shape™ measurement software and performs the actual stitch analysis. Required measurements, displaying the stitch result, doing further analyses and documentation are executed by μ Shape™.

The stitching module requires the add-on module *External Interface* and recommends the add-on module *Sample Normal Data* (see [A1], [A2]).

1. Lateral Stitching

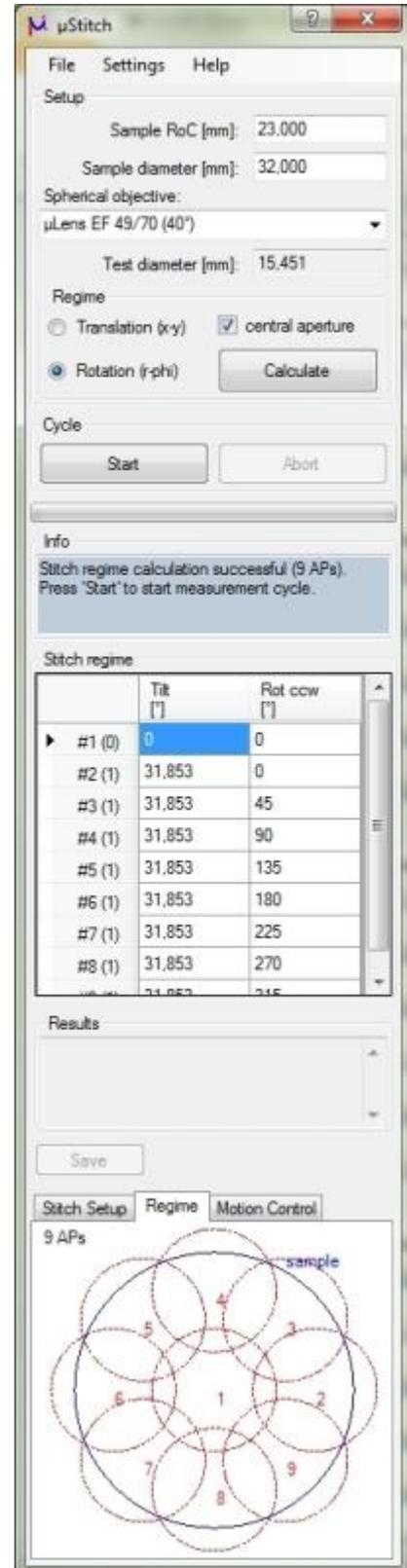
To collect data from the entire sample it has to be measured in several sub-apertures recording data from each sample area. Each area has to be part of at least one sub-measurement. Finally these sub-measurements have to be assembled to a single surface showing the deviations of the entire sample as measured in a single measurement.

2. μ Stitch™ Control Software

μ Stitch™ offers several functions. It calculates an appropriate stitch regime covering the entire sample and controls the measurement of the individual sub-apertures. Finally it connects the individual sub-aperture measurements to a single data map.

Stitch Regime Determination

After specifying the sample parameters (size and radius) and the test setup (test objective and regime type) an appropriate stitch regime can be calculated. Two regime types are available: a translation regime, where the individual sub-areas are reached by translation along two perpendicular directions (x and y) along the sample surface. Using the rotation regime the sub-areas are reached by shifting along a central cross line and rotating around the sample center. The calculated regime is presented in tabular form and as visual sketch (see right).



For stitching sample and interferometer have to be moved relative to each other. In practice the movement can be realized in different ways. μ Stitch™ can handle all movements: moving sample when the interferometer is installed fixed, shifting/rotating interferometer when the sample is fixed and shifting/rotating sample and interferometer when both are movable.

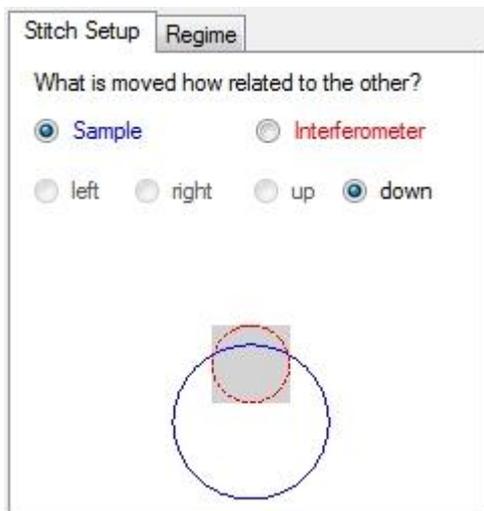
Stitch Measurement

After the stitch regime has been determined the measurement can be started. If a compatible stage controller is connected μ Stitch™ automatically positions the sample at the next measurement aperture according to the stitch regime. Otherwise the user is requested to positioning the sample manually. After confirming the adjustment μ Stitch™ addresses μ Shape™ to carry out a measurement at this aperture according its current settings and stores the result temporarily for later analysis. The software continues until all positions are measured.

Stitch Analysis

After collecting the measurement data from all regime positions, μ Stitch™ combines the temporarily stored sub-aperture measurements and calculates a single data map considering the actual measurement positions. The stitch result is given as 10th order Zernike map. The result map can be transferred automatically to μ Shape™ as sample normal data (see [A2]).

3. Test Setups



Several test setups are possible. Whether the interferometer is fixed and the sample is positioned in front, or the sample is fixed and the interferometer is moved to the corresponding position. Finally it is also possible that interferometer as well as sample are moved to realize the required test positions. Important for the analysis is to know the correct sub-aperture movement. Therefore it has to be specified in which direction the radial shift is done.

4. Stitch Algorithm

The stitching algorithm uses a description of the entire sample aperture by Zernike polynomials. The size of the final result map (number of points) is the same as of an individual sub-aperture measurement.

The result map is calculated by a Zernike fit of the entire sample aperture. For the fit all available measurement values, covering the individual interpolation nodes, are used. Beside the set of Zernike coefficients, finally describing the sample aberration, sets of adjustment terms, giving the adjustment of each sub measurement, will be determined simultaneously.

The final stitch result map corresponds to a measurement of the whole sample aperture that is analyzed by a Zernike fit. Caused by the Zernike description high-frequency and local aberrations will only be detectable in the sub-aperture measurements.

Alternatively the calculated sets of adjustment terms for the individual sub measurements can be used to correct these measurements and create the result map by using the original measurement data at the interpolation nodes. In overlapping areas the mean value of all sub measurements are used.

5. Reference Documents

- [A1] Add-on Module External Interface ("Addon_ExtInterface.pdf")
- [A2] Add-on Module Sample Normal Data ("Addon_SND.pdf")

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