

## Hexagonal SIM with pattern distortion correction and iterative pattern artifact reduction

Martin Schropp, Rainer Uhl  
Till I.D. GmbH

E-mail: [schropp@till-id.com](mailto:schropp@till-id.com)

**Key Words:** Structured Illumination Microscopy, 3D Superresolution SIM, quasi-confocal SIM, pattern distortions, pattern artifacts

In most SIM evaluation techniques, the pattern parameters i.e. the pattern frequency vectors as well as the pattern phases are critical parameters. Because of increasing camera chip sizes, distortions of the pattern image, which can be described as a field dependent phase function in the illumination become more important.

We present an easy way to determine excitation pattern distortions in the sample and compensate the corresponding phase errors across the image field in the SIM evaluation. For hexagonal SIM[1,2], these pattern distortions can be determined once before the measurement.

Furthermore, we present an iterative method for SIM pattern artifact reduction in the evaluated SIM image. In contrast to artifact removal by Fourier filters, which can introduce new artifacts, this method allows to account for pattern artifact distortions across the image field

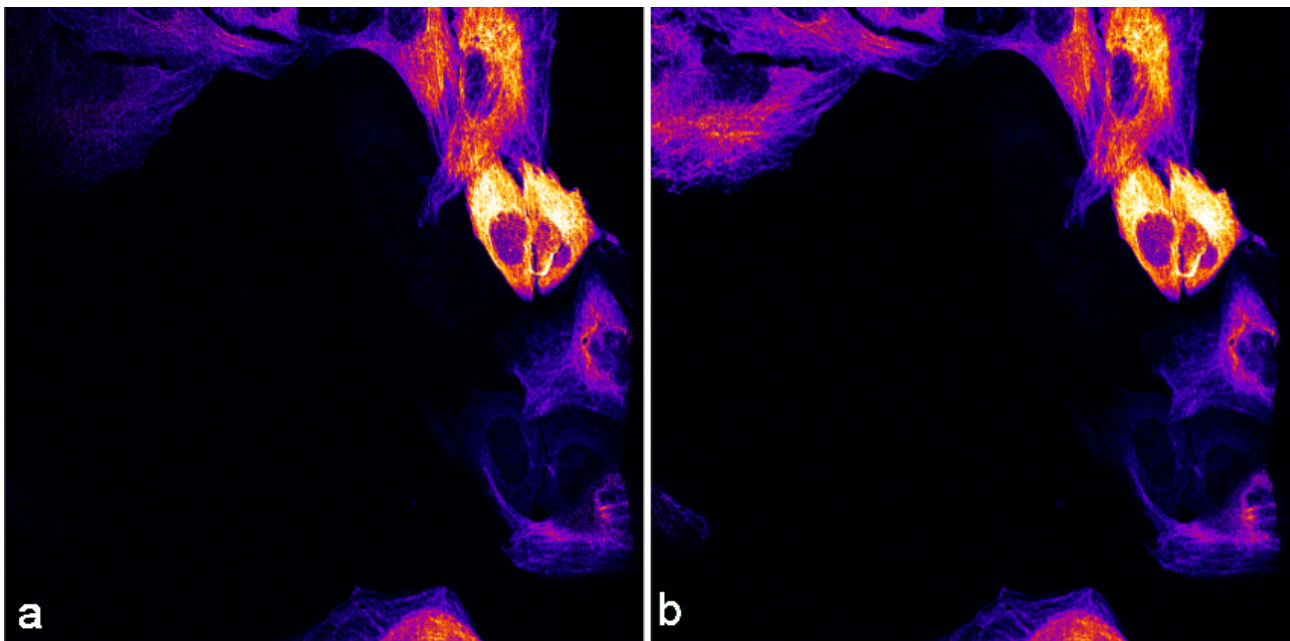


Figure 1: Example for pattern distortion correction: a) SIM image without correction. The pattern distortions lead to an obscured image field in the upper left. b) Accounting for pattern distortion corrects this effect.

[1] Schropp, M.; Uhl, R. Two-dimensional structured illumination microscopy. *J. Microsc.* 2014, 256, 23–36.

[2] Schropp, M.; Seebacher, C.; Uhl, R. XL-SIM: Extending Superresolution into Deeper Layers. *Photonics* 2017, 4, 33.