LIVE-CELL SUPER-RESOLUTION 4D IMAGING USING MULTIFOCUS 3D SIM

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1. MULTIFOCUS 3D SIM Volumetric acquisition speed is a major challenge in the nascent field of live-cell super-resolution microscopy. Three-dimensional Structured Illumination Microscopy (3D-SIM) provides optical sectioning capability and improvement of lateral and axial resolution. 3D-SIM has been applied in living specimens for 3D time-lapse (4D) imaging at moderate acquisition rates (seconds per image) [1, 2]. By constructing an imaging system that integrates 3D-SIM with the instant 3D imaging method Multifocus Microscopy (MFM) [3] we have created a microscope that pushes the acquisition speed of 3D-SIM by an order of magnitude. We demonstrate that MF-SIM provides unique possibilities for 4D super-resolution imaging of dynamic processes in living specimens.

2. HUMAN EMBRYONAL KIDNEY CELL IMAGED USING MF-SIM

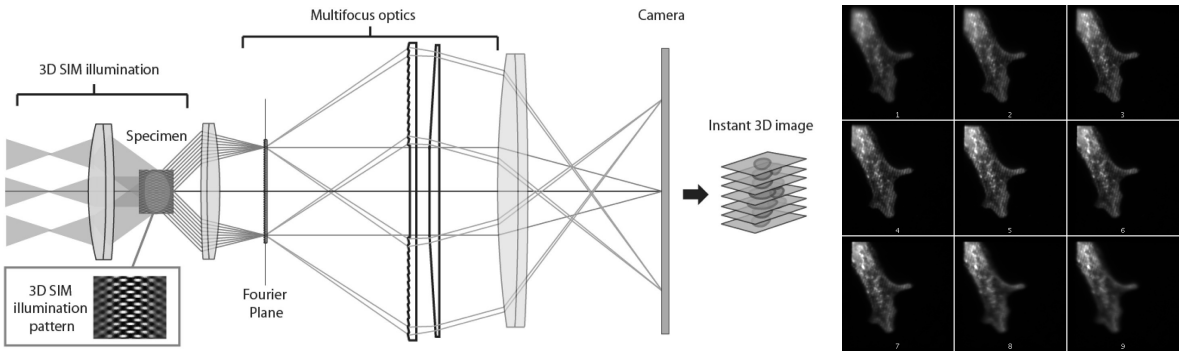

Figure 1: MF-SIM data set of a HEK cell (GFP mitochondria) simultaneously recorded from 9 focal planes. Instead of 9x15 = 135 images, as would be required in conventional 3D SIM, only fifteen images of the illumination sequence are now required for a full reconstruction of the 3D volume.

References;
[1] R. Fiolka *et al*., "Time-lapse two-color 3D imaging of live cells with doubled resolution using structured illumination," *PNAS*, **109,** 5311-5315 (2012).
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