IMAGING LIVE CELLS BEYOND THE DIFFRACTION LIMIT USING STRUCTURED ILLUMINATION MICROSCOPY AND STATISTICAL IMAGE RECONSTRUCTION

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ABSTRACT

Imaging live cells with super-resolution structured illumination microscopy (SR-SIM) for more than a few time points remains a challenge due to the requirement to acquire multiple images to reconstruct a single high resolution image, and also due to inflexibility in acquisition protocols present in the currently available commercialized instruments for SR-SIM. Much of the recent progress in SR-SIM has involved alternative strategies for illumination and for data analysis. Here we demonstrate super-resolution imaging of live U2-OS cells expressing LAMP1-GFP in long image sequences using MAP-SIM, an alternative reconstruction method for SIM based on super-resolution image reconstruction using maximum *a posteriori* methods [1,2]. To estimate image resolution, we evaluated the power spectral density in the reconstructed results. We also evaluated the signal to noise ratio in the reconstructed images with respect to exposure time, providing a quantitative evaluation of realistic imaging rates. Finally, we demonstrate that MAP-SIM enhances single particle tracking applications, allowing us to better track fast moving particles with low signal to background ratios.

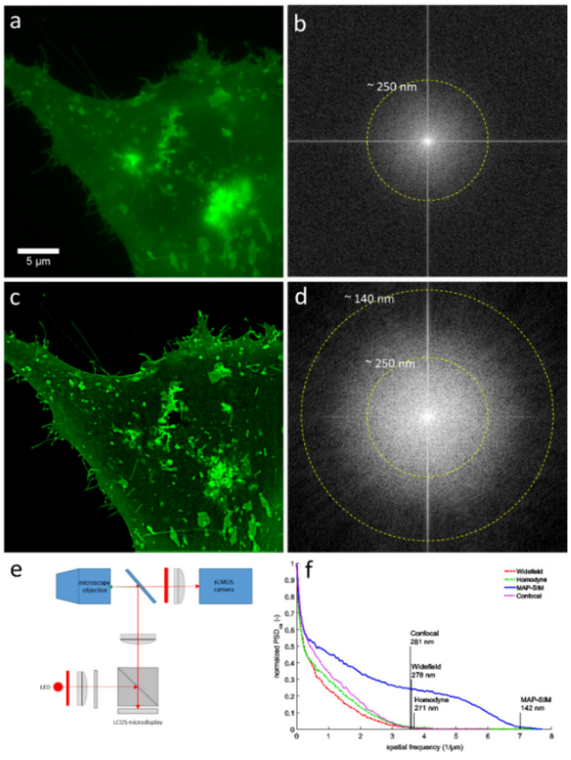

Figure 1: Preliminary live cell SIM data. **A,** U2-OS cells expressing LAMP1-GFP; WF **B,** FFT of WF **C**, MAP-SIM **D,** FFT of MAP-SIM indicating enhanced resolution **E,** optical setup **F,** resolution measurements.

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