

A Novel Widefield&TIRF Structured Illumination Microscopy with Scanning galvo mirrors

Youhua Chen,^{1,2} Ruizhi Cao,¹ Dazhao Zhu,¹ Wenjie Liu,¹ Zhiming Zhang,¹
Cuifang Kuang^{1,3*} and Xu Liu^{1,3}

¹State Key Laboratory of Modern Optical Instrumentation, College of Optical Science and Engineering, Zhejiang University, Hangzhou 310027, China

²Key Laboratory of Instrumentation Science & Dynamic Measurement of Ministry of Education, North University of China, Taiyuan 030051, China

*E-mail: cfkuang@zju.edu.cn

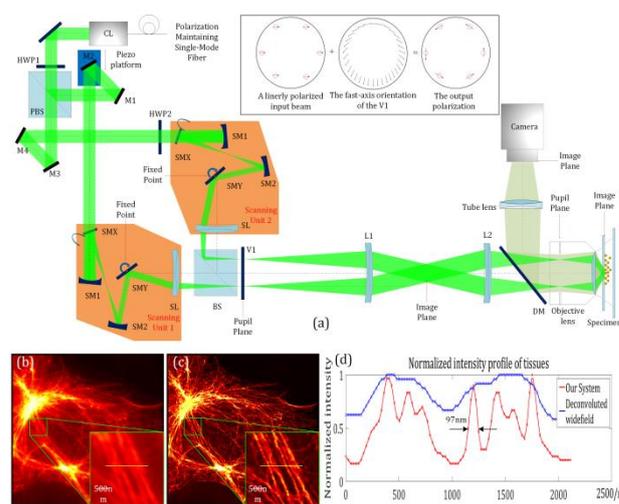
KEY WORDS: Super-resolution imaging, multi-angle total internal reflection fluorescence microscopy, structured illumination microscopy.

1. PRINCIPLE

The superior of SIM to other super-resolution techniques is the speed and suitability for live samples, and is a widefield non-scanning techniques, requiring only several images to reconstruct a high-resolution image, without high and harmful illumination intensities, and meanwhile doubles the resolution of conventional microscopes.

We provide a novel approach to realize high modulation depth patterns (s-polarization interference) SIM system using galvo mirrors, piezo-platform and polarization converter. It can arbitrarily increase the angle of incidence of the illumination light up to the TIR and shifting the phase of pattern at a very high speed (depends the speed of response of the galvo mirror), making it easier to switch between widefield & TIRF-SIM, offering more convenience in adapting the penetration depth of the biological tissues, and giving the potential for SR imaging of live biological samples.

2.EXPERIMENT RESULTS



Using this prototype [Fig. 1(a)], we obtain the deconvolved conventional TIRF image [Fig. 1(b)], Reconstructed super-resolution image [Fig. 1(c)] of microtubules. The proposed system produces a striking resolution improvement over deconvolved conventional TIRF image. The FWHM of isolated microtubules reaches 97 nm in the TIRF-SIM reconstruction, and Fig. 1(d) shows a typical cross-section profile of the data.

Figure 1: (a) Optical scheme of the system. (b) Deconvolved widefield-TIRF result; (c) Reconstructed result of TIRF-SIM using the proposed system; (d) The cross profile of the region marked by yellow line in (b) and (c).

REFERENCE :

1. Demmerle J, Innocent C, North A J, et al. Strategic and practical guidelines for successful structured illumination microscopy.[J]. Nature Protocols, 2017, 12(5):988-1010.