DEEP-TISSUE 3D SUPER-RESOLUTION MICROSCOPY USING FLUORESCENCE PHASE IMAGING

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Self-interferences (SI) in optics is widely applied in different field of applications (laser characterisation, optical setup alignment…). It furnishes powerful results in the particular scope of quantitative phase microscopy (QPM). QPM with SI has been previously developed for label-free white light illumination, and we have shown that when imaging absorbing particles, the phase signal unravels the axial position of each particle while the intensity gives the lateral position, far beyond the diffraction limit [1]. We now extend the concept of SI to fluorescent molecules for 3D super-resolution microscopy [2].

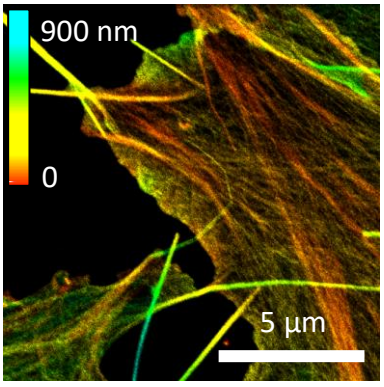

Figure 1 : F-actin of fibroblast cells reconstruction using quantitative phase imaging of fluorescent dSTORM super-resolution

In particular, we will show that SI is a unique approach for 3D dSTORM or U-PAINT imaging in thick tissue. The robustness of this approach against optical aberrations (e.g. those introduced by the sample itself) will be demonstrated. In particular, we demonstrate that in thick sample the use of adaptive optics can be avoided to perform 3D super-resolution. We have currently achieved super-resolution imaging of F-actin filaments -labelled with phalloidin-Alexa647- at 50µm depth inside a biological tissue spheroid.

[1] P. Bon, N. Bourg, S. Lécart, S. Monneret, E. Fort, J. Wenger and S. Lévêque-Fort, "Three-dimensional nanometre localization of nanoparticles to enhance super-resolution microscopy", Nat. Comm., 2015
[2] P. Bon, J. Linares et al, *to be submitted*