

## CAPTURING LIGHT FIELDS IN LIGHT SHEET MICROSCOPES

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The benefits of fluorescence light sheet microscopy include fast volumetric imaging with relatively low photo-bleaching which has led to a rapid increase of its use in developmental biology and neuroscience [1]. There are, however, experiments which require greater spatio-temporal resolution than can be achieved using typical light sheet microscopes.

The acquisition rates of light sheet microscopy can be increased by capturing light fields; that is, capturing angular information in addition to intensity counts. Raw light fields are collected on a two-dimensional sCMOS sensor using an array of microlenses placed in the image plane [2] of an existing light sheet setup. We have developed an efficient workflow in which four-dimensional light fields are automatically extracted from two-dimensional experimental data sets and manipulated to generate volumetric images.

Further, we demonstrate the benefits of optimising the form of light sheet illumination for enhancing reconstructions of fluorescent beads and also model organisms such as drosophila larvae and zebrafish which require fast volumetric imaging for developmental studies.

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[2] M. Broxton, L. Grosenick, S. Yang, N. Cohen, A. Andalman, K. Deisseroth, and M. Levoy, "Wave optics theory and 3-D deconvolution for the light field microscope," *Opt. Express* **21**, 25418-25439 (2013).