

A BOLT-ON SINGLE-OBJECTIVE LIGHT-SHEET DESIGN WITH UNCOMPROMISED NUMERICAL APERTURE

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ABSTRACT: Spinning disk confocal modules are “core facility friendly”; they insert conveniently between a commercial microscope base and camera, improve image quality and add no significant drawbacks. In contrast, high numerical aperture (NA) light sheet microscopy often requires radical sample modification, substantial user re-training and fully customized hardware. We present a “core-facility friendly” light-sheet: a “black box” that inserts between a commercial microscope base and camera, greatly reducing photo-toxicity without degrading image quality or breaking compatibility with existing sample preparation.

In 2008, based on the ingenious ‘Remote-Refocus’ of Botcherby/Wilson [1], Dunsby [2] invented a brilliant single-objective light sheet technique called ‘Oblique Plane Microscopy’ (OPM) that bypassed many typical light sheet drawbacks. However his theoretical NA of 0.74 for a water immersion objective was significantly lower than the 1.33 limit for an aqueous sample. In 2018 Yang/Huang [3] made a clever modification to OPM to achieve an NA of 1.06 and incorporated the elegant galvo-based volumetric scanning method invented by Bouchard/Hillman [4].

Building on this work, we present a simple, robust and modular light sheet design with an NA in the 1.2-1.3 range, and discuss the key concepts and considerations for high NA single objective light sheet.

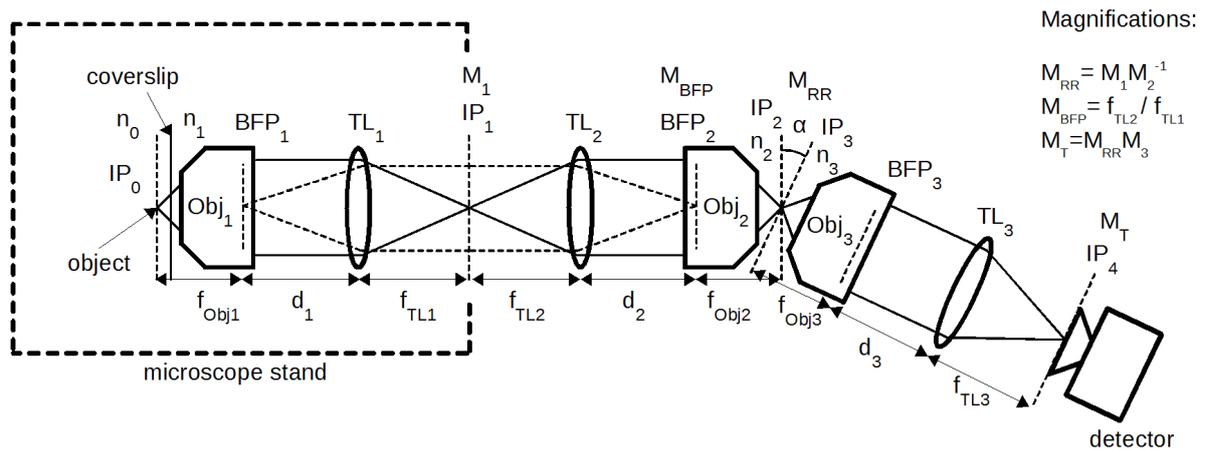


Figure 1: Generalized design diagram for an OPM emission path

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