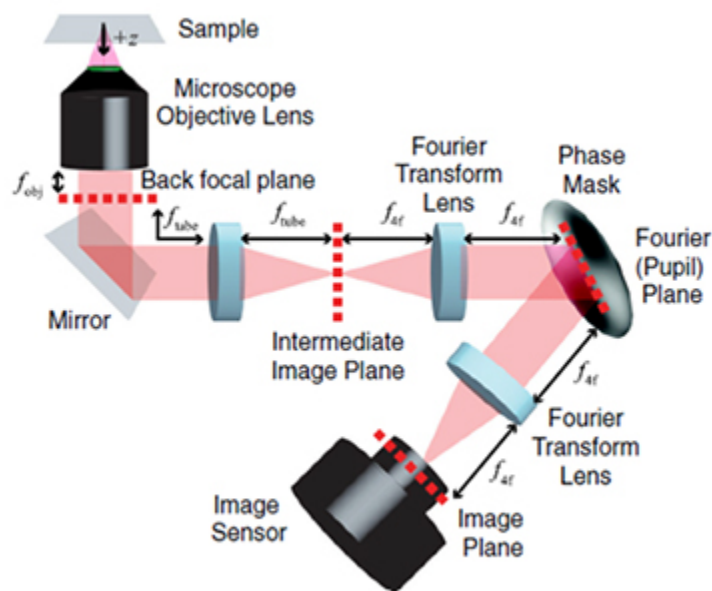


# Tetrapod Phase Mask Microscopy

Stanford researchers at the Moerner Lab have designed a family of point spread functions (PSFs), the Tetrapod PSFs, for high precision three-dimensional position measurement of individual particle positions over a large, customizable depth range in optical microscopy. These designs have a tunable depth range up to an unprecedented 20  $\mu\text{m}$ , which is over 7x larger than current state of the art.

As proof-of-concept, the team performed flow profiling in a microfluidic channel and showed scan-free tracking of single quantum-dot-labeled phospholipid molecules on the surface of living, thick mammalian cells. This invention is primarily aimed at researchers in the life sciences.

## Figure



**Phase Mask can be simply implemented with a tilted light-sheet microscope (LSM)**

**Stage of Research**

- **Proof of concept** Demonstrated experimentally the applicability of these Tetrapod PSFs in micro-fluidic flow profiling over a 20 $\mu$ m z range, and in tracking under noisy biological conditions.

## Applications

- **Thick tissue super-resolution microscopy:**
  - Sub-wavelength imaging
  - Simultaneous multiple particle tracking
- Microfluidics - flow profiling
- Simple, tunable depth of field microscopy
- Bio-film (thick sample) imaging
- Background reduction – light sheet microscopy
- Microscope calibration (for depth induced aberrations)

## Advantages

- New phase masks with **extremely large depth range up to 20 $\mu$ m** (about 7 times larger than current state of the art)
- Allow simple **z range tunability**
- **Easily tailored and optimized** to a required depth range.
- **Simple implementation** with a tilted light-sheet microscope (LSM)

## Publications

- U.S. Published Patent Application 20160301915, ["APPARATUSES AND METHODS FOR THREE-DIMENSIONAL IMAGING OF AN OBJECT"](#).
- Shechtman, Yoav, Lucien E. Weiss, Adam S. Backer, Steffen J. Sahl, and W. E. Moerner. ["Precise 3D scan-free multiple-particle tracking over large axial ranges with Tetrapod point spread functions."](#) Nano letters (2015).
- Anna-Karin Gustavsson, Petar N. Petrov, Maurice Y. Lee, Yoav Shechtman, W. E. Moerner. ["3D Single-Molecule Super-Resolution Microscopy With A Tilted Light Sheet"](#). The Preprint Server for Biology.

## Patents

- Published Application: [20160301915](#)
- Published Application: [20190246092](#)
- Issued: [10,187,626 \(USA\)](#)
- Issued: [10,638,112 \(USA\)](#)

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