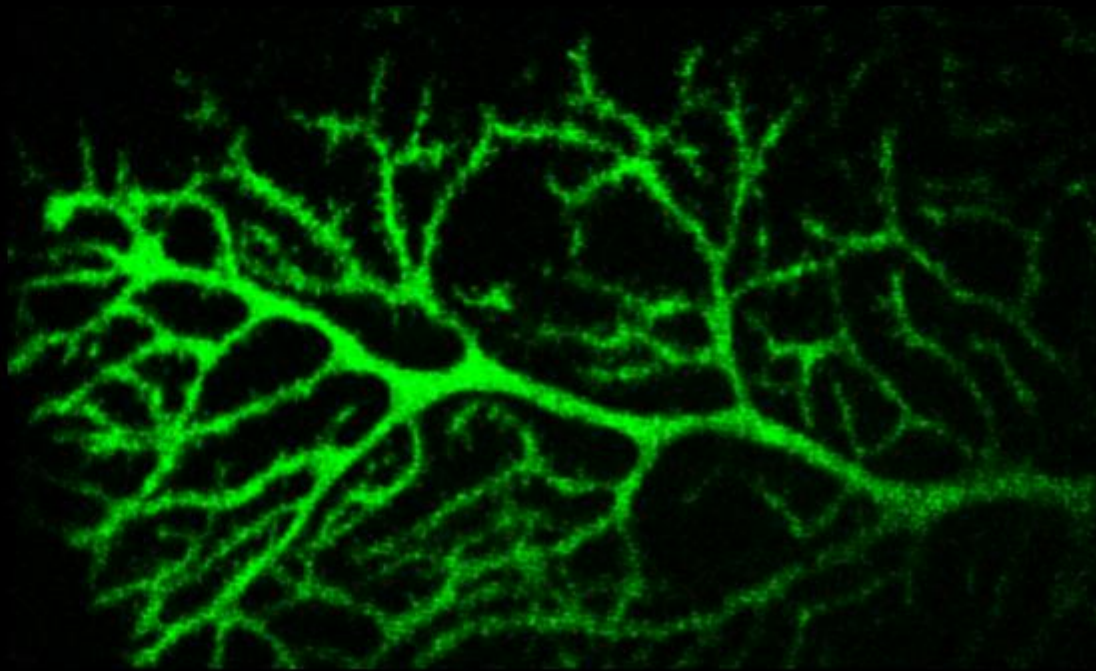


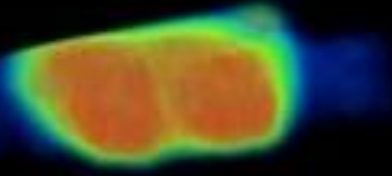
Adaptive Fluorescence Microscopy

CSI²

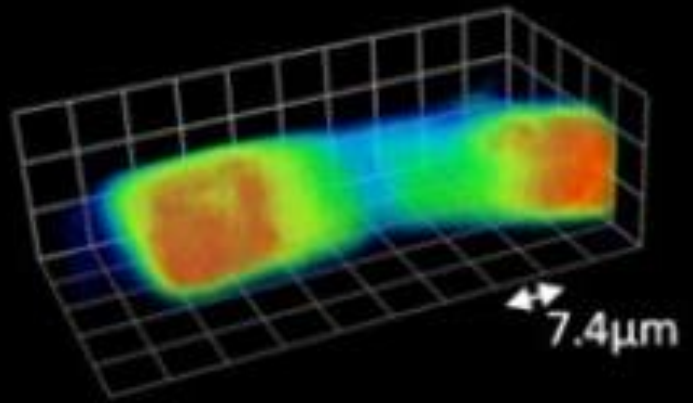
Delft University of Technology



T = 17.367s



T = 17.600s



Adaptive Fluorescence Microscopy

Dr. Paolo Pozzi, Dean Wilding & Prof. Michel Verhaegen

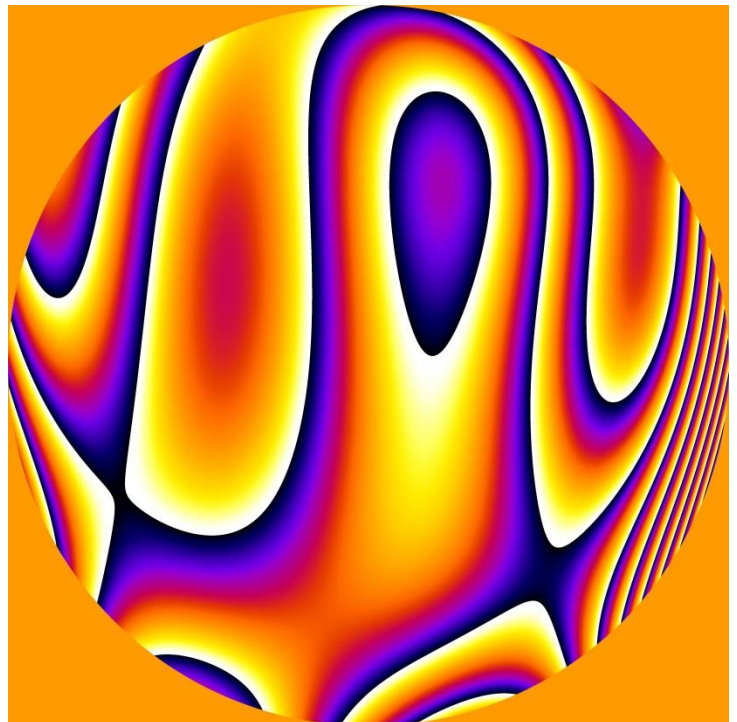
Room Numbers	34 C-1-290, 34 C-1-330
Email	P.Pozzi@tudelft.nl, D.Wilding@tudelft.nl
Project Term	2014-15, 2015-16
Keywords	Adaptive Optics, Microscopy, Imaging, Fluorescence
Level	Bachelor's or Master's



Introduction

The acquisition of images is an extremely important part of biological research. While images of nanometric and sub-nanometric structures can be efficiently acquired through electron microscopy and atomic force microscopy, such techniques generally require complex sample treatments, usually undermining its functionality.

Optical microscopy, while only being able to resolve micrometric structures, is still the most widely used imaging technique in biological research, due to its relative simplicity, and its compatibility with the use of living samples. While there are a number of techniques to acquire images of light transmitted or reflected by the sample, often the structures of biological interest do not provide any contrast in this kind of images. High contrast images of specific structures can be acquired through *fluorescence microscopy*.



Aberration induced phase patterning across the aperture of a lens.

Research Question

All optical systems are imperfect and variations in refractive index of the sample and misalignments in the system introduce errors in the phase profile of the wavefronts known as aberrations. The use of adaptive elements in the optical system can be used to correct these aberrations and improve the images taken using a microscope.

The vast majority of the work done on adaptive optics is with confocal fluorescence microscopy. We are seeking to begin implementing adaptive elements on other cutting-edge fluorescence microscopy techniques and therefore, improve their imaging capability.

Approach

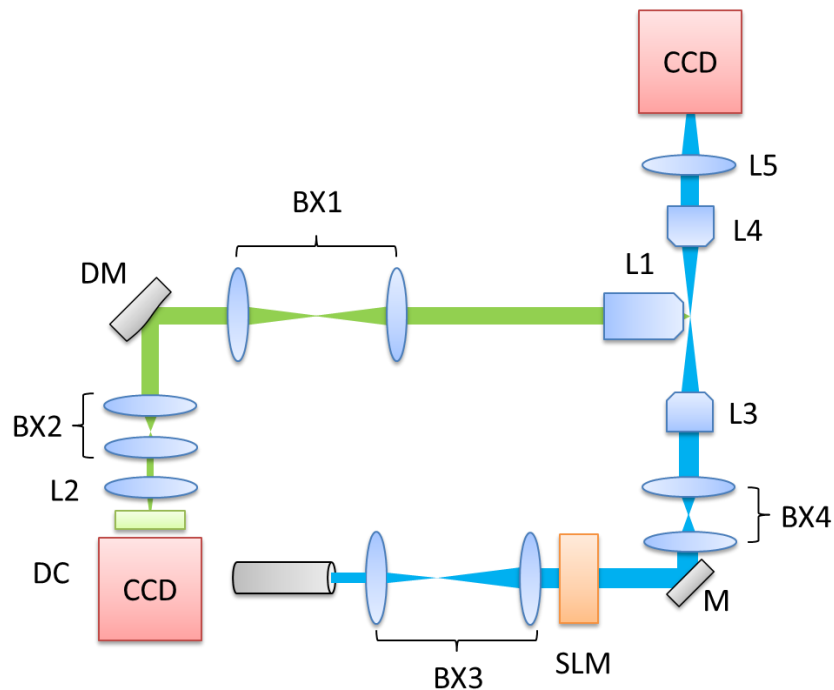
The main the areas that a student could participate in are:

- Development of optimization schemes for adaptive microscopy
- Computational simulation of theoretical microscopes
- Experimental development of test systems

Thesis Projects

Please contact us if you would like to discuss working alongside us on a number of possible research projects.

We plan on doing adaptive optics for: Light Sheet Microscopy, Confocal Microscopy, Wide-field Fluorescence Microscopy, and Structured Illumination Microscopy



A proposed adaptive SPIM system.

