A standard fluorescence microscope, complemented with a digital micro-mirror device (DMD), is capable of producing images which are qualitatively similar to confocal or structured illumination microscopy [1-3]. We report on a DMD-based fluorescence microscope that generates sectioned images by projecting multi-spot patterns onto the sample. The out-of-focus light is rejected by applying digital pinholing to the spots in each camera frame.

We assess the optical quality of the microscope by measuring its modulation transfer function (MTF). The MTF is measured from edge profiles and line profiles, which are created by projecting DMD patterns onto a thin fluorescent layer. Furthermore, in a DMD-based microscope the precise correspondence between each DMD pixel and its image on the camera has to be established. To this end, we describe a method of microscope calibration by projecting a multi-spot DMD pattern onto a thin homogeneously fluorescent layer.

The sectioning capabilities of a DMD-based microscope improve with increasing pitch $p$ of the projected pattern and decreasing width $\sigma$ of the pinholing mask. However, increasing $p$ results in longer image acquisition times and decreasing $\sigma$ results in reduced signal-to-noise ratio. (see Fig.1) The optimal $p$ and $\sigma$ parameters are found from a trade-off between the sectioning strength, speed of image acquisition and signal-to-noise ratio.