When dealing with living samples it is often desirable to keep the illumination intensity as low as possible. The price for this is a low contrast and a bad signal-to-noise ratio resulting in a decreased effective image resolution. Light sheet fluorescence microscopy (LSFM) or single plane illumination microscopy (SPIM) solves this problem by separating the optical illumination and detection paths and arranging them orthogonally. The sample is illuminated with an elliptic light sheet or a scanned circular beam [1]. Nevertheless, LSFM reaches its limits in situations, where light scattering deteriorates image quality and reduces contrast and resolution. In the past, several methods have been proposed to solve this problem. Some rely on sequential image acquisition and post processing [2], others on descanning and spatial filtering [3] or combinations of these techniques [4]. Here we present a novel way to combine confocal slit imaging with selective plane illumination. This was accomplished by utilizing the rolling shutter of a scientific CMOS camera as moving slit detector over the complete chip size and synchronizing it with the motion of a scanned Gaussian beam. Thus, no additional optical elements had to be introduced into the imaging path of the instrument, what optimizes its light efficiency [5]. The data could be acquired without compromises in frame rate or limits in dynamic range. We will demonstrate the tremendous gain in contrast and signal-to-noise ratio, which can be employed to image fine sample features deep inside living specimen or to further reduce bleaching and photo toxicity.


