Volumetric Imaging

Overview: In order to understand biological functions at a system level it is necessary to image interconnectivity of processes in real time. This is particularly relevant in neuroscience, where the BRAIN initiative is funding research to understand how the brain functions, and how that function is altered by disease. This requires imaging with single cell resolution within a volume as large as possible. There are multiple approaches to volumetric imaging. Light sheet microscopy enables low intensity illumination across a plane of the sample such that large field of view imaging with minimized optical heating is achieved. Similarly scanning a Bessel beam throughout a volume enables compression of a volume of activity into a single plane for deep tissue large field-of-view high-speed imaging.

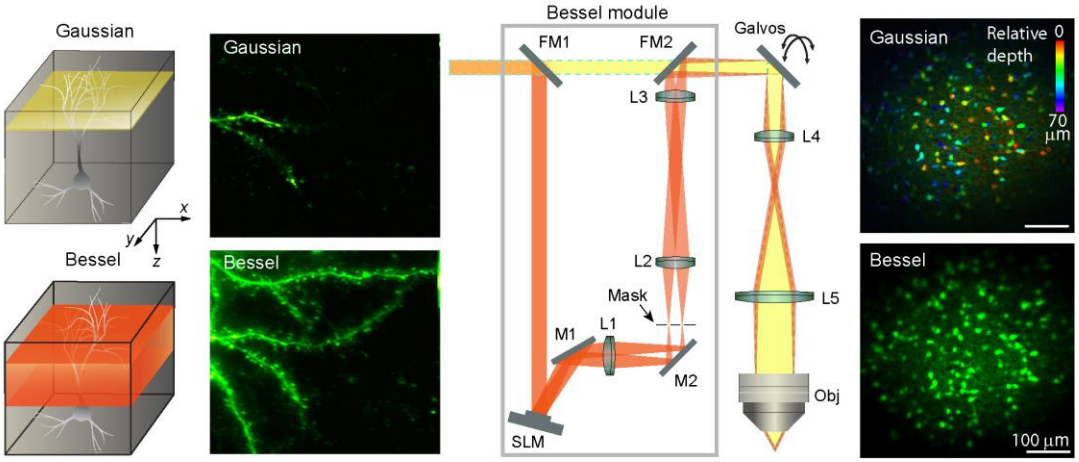

Figure 1. Lu, R., Sun, W., Liang, Y., Kerlin, A., Bierfeld, J., Seelig, J. D., ... & Koyama, M. (2017). Video-rate volumetric functional imaging of the brain at synaptic resolution. Nature neuroscience, 20(4), 620

Critical requirements: For this market the SLM must offer high resolution, and high speed switching. The SLM resolution allows the axial intensity of the illumination to be tuned to compensate for losses when imaging through highly scattering tissue. The switching speed of the SLM determines the rate at which the illumination can be scanned axially to extend the volume of imaging.

Recommended References:

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6. Upadhya, A., Zheng, Y., Li, L., & Lee, W. M. (2019). Structured Back focal plane interferometry (SBfpi). *Scientific Reports*, *9*(1), 1-10.
7. Lu, R., Sun, W., Liang, Y., Kerlin, A., Bierfeld, J., Seelig, J. D., ... & Koyama, M. (2017). Video-rate volumetric functional imaging of the brain at synaptic resolution. *Nature neuroscience*, *20*(4), 620.