DYNAMIC FULL-FIELD OPTICAL COHERENCE MICROSCOPY FOR LIVE TISSUE IMAGING

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Dynamic full-field optical coherence microscopy (d-FF-OCM) is a label-free imaging technique that allows to visualize cells and their intracellular activity in various fresh biomedical tissues. Images acquired by using these methods provide crucial information in various biophysical and biomedical research areas. However, d-FF-OCM systems do not come without their challenges when imaging biomedical, highly scattering tissues [1, 2]. In this work we present a high-resolution d-FF-OCM system (Fig. 1a) which overcomes most of the challenges and generates enhanced contrast images (Fig. 1b, c) without the need of any sort of fluorescence dyes [3].

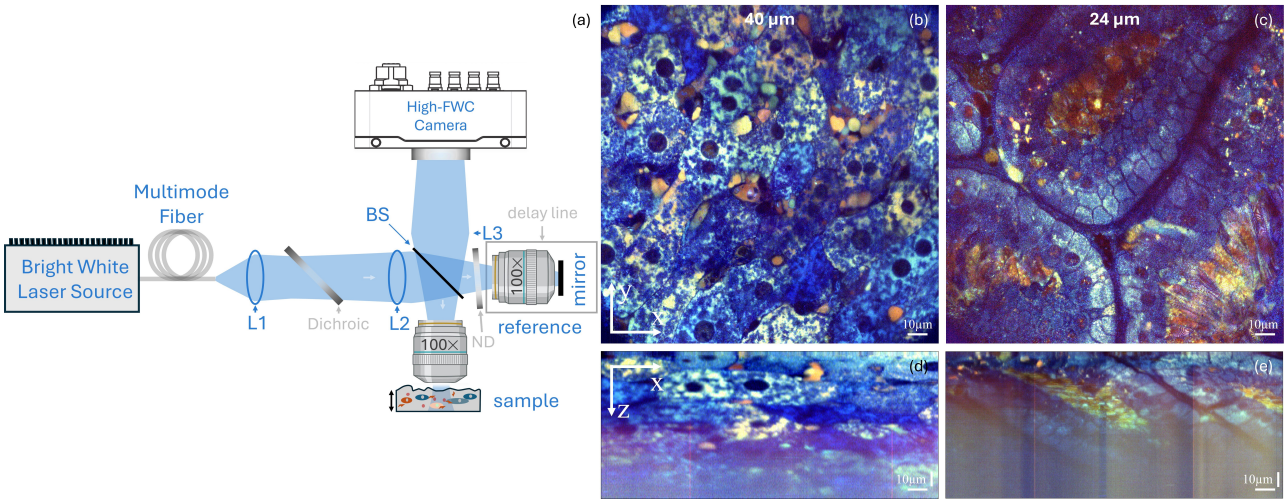

Fig. 1. Principle scheme of high-resolution FF-OCM system (a). Fluorescent like images acquired with d-FF-OCM system (b-c). Image (b) depicts liver tissue and hepatocytes, image (c) showcase mouse intestinal tissue imaged from villus side of the intestinal wall. (c) and (d) images - mathematically reconstructed axial views. Blue corresponds to low vibration frequencies (1 Hz), green to middle range (1-100 Hz) and red – high frequencies (100-250 Hz).

System is equipped with 100× oil-immersion objectives (NA=1.25) and a high-intensity, laser-pumped incoherent white light source which allowed us to achieve high resolution images in high-scattering tissues up to 120 µm deep. With this system we were able to acquire fresh ex vivo mouse liver (Fig. 1b, d) and small intestine (Fig. 1c, e) images with extended depth and detail. In these tissues, the dynamic contrast clearly revealed fine structures not visible with conventional OCT—for example, the sinusoidal microvasculature and organized cell layers in the liver, as well as neural plexuses, crypts and microvilli in the intestine—all visualized label-free.

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Keywords: OCT, d-FF-OCM, microscopy, dynamics

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