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# Rapid volumetric imaging with dynamic Fourier-domain full-field optical coherence tomography

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Fourier-domain full-field optical coherence tomography (FD-FF-OCT) enables rapid three-dimensional imaging by acquiring depth profiles at all camera pixels in parallel. An implementation with reduced spatial coherence has been used for in vivo structural imaging of the human retina and choroid [1]. Here, we follow the complex OCT signal over time to derive dynamic contrast associated with intracellular motion [2], enabling label-free volumetric imaging of fresh mouse gut and kidney in 3.3 s.

An 803–878 nm swept source illuminates a Linnik interferometer with 20×, NA = 0.5 water-immersion objectives. A deformable membrane and multimode fibre reduce spatial coherence to suppress coherent crosstalk. A camera operating at 60,000 frames/s records 512 spectral images per volume, providing 117.2 volumes/s over a 512 × 448 μm field of view sampled by 512 × 448 pixels [2]. Fourier transformation of the spectral interferograms reconstructs the complex volumes. Spatial filtering and digital refocusing improve image quality and extend the usable axial range beyond the optical depth of focus. Temporal Fourier analysis of 389 consecutive volumes generates dynamic RGB contrast, with colour representing relative fluctuation frequency.

In the small intestine, dynamic images reveal villi from the mucosal side and crypts from the serosal side, as shown in Fig. 1 (a) and (b), respectively. Kidney images show putative renal tubules in transverse, oblique and longitudinal orientations, shown in Fig. 1(c). These results demonstrate rapid, label-free volumetric imaging of tissue architecture and intracellular dynamics across a wide field of view.

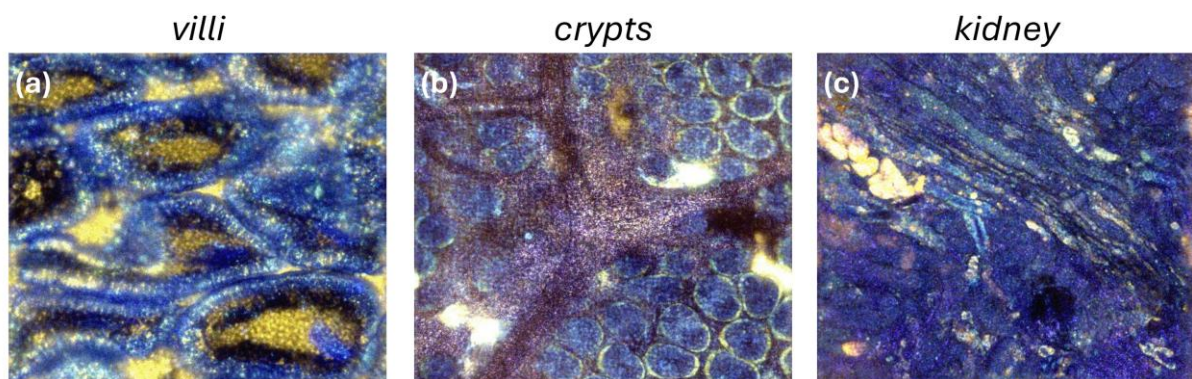


Fig. 1. Dynamic FD-FF-OCT images of mouse intestinal villi (a, 40 μm depth), crypts (b, 40 μm) and kidney (c, 30 μm). Field of view: 512 × 448 μm per panel. Colour encodes fluctuation frequency.

## REFERENCES

- [1] E. Aukorius et al., "Spatio-temporal optical coherence tomography provides full thickness imaging of the chorioretinal complex," *iScience* 25 (2022) 105513.
- [2] A. Trečiokaitė, E. Tarvydas and E. Aukorius, "Dynamic Fourier-domain full-field optical coherence microscopy," *Optics Letters* 51 (2026) pp. 3581–3584.