Fully characterized, low-cost, open-source Optical Projection Tomography

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The study of biological mesoscopic samples (those with characteristic dimensions of 1-10 mm) benefits from techniques that can analyse and depict both functional and anatomical information. Optical Projection Tomography (OPT) uses visible light to image and generate 3D data of mesoscopic objects at micron-level resolution [1]. It can image large volumes that encompass whole organisms (mouse embryos, for instance) with fast acquisition times, and yields contrast for fluorescent and non-fluorescent samples.
We present a fully integrated (hardware, software, and wetware) and characterized, low-cost (≤£5000) open-source OPT solution to interrogate optically transparent specimens at high resolution (~10 μm lateral resolution), including all necessary reconstruction routines as ImageJ plugins. Among other test samples, we combine this technique with expansion microscopy [2] on *C. elegans* samples to visualize finer details in fluorescent samples while retaining anatomical cues. We will discuss the assembly of the system, its implementation, and future applications. Our principal aim is to make this technology accessible to groups without a strong instrumentation background, as this technique proves increasingly useful the registration of 3D mouse embryo images [3], and could be instrumental in the automation of mouse embryo phenotyping efforts of the International Mouse Phenotyping Consortium (IMPC) [4].

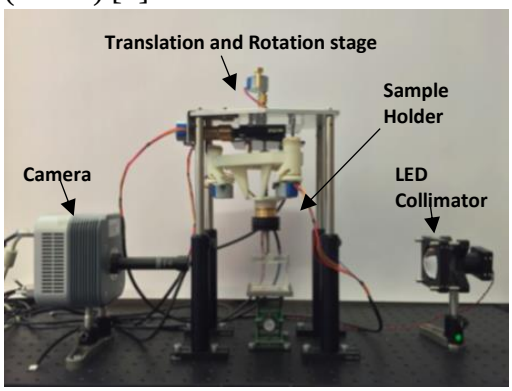

Figure 1: Picture of the current OPT set-up. An Andor CLARA camera is placed on the far left, the 3D-printed motion stage and sample holder in the center, and the transmission illumination system on the right.

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