Design, Implementation, and Characterization of a Michelson Objective Based Full Field Optical Coherence Tomography Microscope with Stock Components and Arduino Acquisition Control

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Full Field Optical Coherence Tomography (FF-OCT) provides a higher resolution and potentially more cost effective solution when compared with other beam scanning OCT methods. This becomes especially important for cellular imaging in the Biomedical field where FF-OCT images can be acquired prior to histological analysis to provide additional data for analysis [1]. The majority of FF-OCT systems discussed in publications and available commercially are based on a Linnik interferometer, requiring two microscope objectives. The Michelson objective based system employs a single objective [2]. This simplifies the alignment and positioning of critical components necessary to achieve the required interference with a low coherence light source. The ease and stability of alignment of this Michelson Objective based FF-OCT system also reduces the difficulty of working with the system on a daily basis. Commercially available, Linnik based, FF-OCT systems require, expensive, high precision automated alignment systems to ensure ease of use. However, the Michelson Objective based system remains aligned over long periods and can be quickly realigned manually when necessary. The Michelson Objective based FF-OCT system can be relatively easily constructed with largely stock optics and optomechanics. The acquisition control and reference mirror position are controlled via an Arduino to further reduce costs.

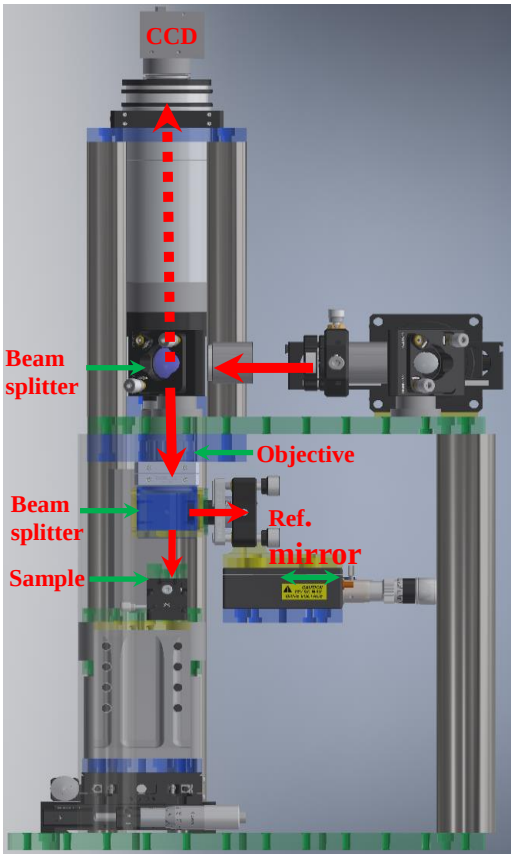

Figure 1: Model of Michaelson objective based FF-OCT system with major components and light path shown.

[1] K. Grieve, L. Palazzo, E. Dalimier, P. Vielh, M. Fabre, "A feasibility study of full-field optical coherence tomography for rapid evaluation of EUS-guided microbiopsy specimens", *Gastrointest Endosc.*,8(2), 342-50 (2014).
[2] B. Heise, S. Schausberger and D. Stifter, "Full Field Optical Coherence Microscopy: Imaging and Image Processing for Micro-Material Research Applications", Chapter 8, (InTechOpen, London, 2013).