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Contrast enhancement in spectral domain optical coherence tomography.

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Optical Coherance Tomography (OCT) is an interferometric technique, which allows for non-invasive in vivo diagnostic medical imaging. It is a powerful tool in ophthalmology since it is able to produce high-resolution 2D profiles or 3D reconstructions of ocular structures to aide in the early diagnosis of ocular diseases. The main advantages associated with OCT are its high resolution and depth of penetration, which are in the micron and millimeter ranges respectively. OCT typically makes use of a low coherence light source, in order to obtain high depth resolution. Typical light sources found in commercial systems include super luminescent diodes and super continuum pulsed sources based on anomalous dispersion photonic crystal fibers. The phase instabilities associated with these sources contribute to noise and diminish the signal to noise ratio. The University of Stellenbosch are currently developing a multimodal laser microscopy setup, which will make use of an All Normal Dispersion Photonic Crystal Fibre (ANDi-PCF) developed at the Laser Research Institute (LRI). This source does not suffer from the inherent phase instabilities found in conventional OCT sources, which makes it the ideal source for OCT applications.

The main purpose of this research is to observe the effects of the critical parameters, identified using our SD-OCT system simulation, has on the system resolution and signal to noise ratio. In this presentation, results from the setup using the ANDi-PCF will be compared to those from conventional LED sources, thereby highlighting the expected improvement in signal to noise obtained from using the ANDi-PCF.

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