Compact dual path-dual focus SS-OCT system for whole-anterior segment and retinal imaging

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Introduction

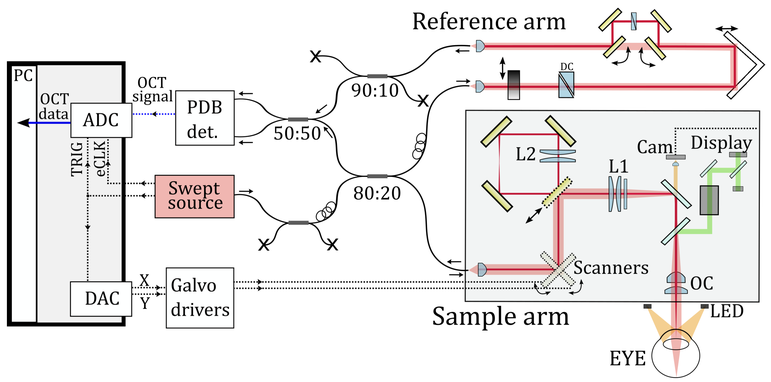
Swept source optical coherence tomography (SS-OCT) opens the possibility of imaging the whole eye. Different strategies have been proposed in this line, such as dual path configurations exploiting coherence revival [1] [2], tunable lens technology [3] or interlaced detection [4].

In this work we present a compact dual path-dual focus SS-OCT system that can image sequentially both the whole anterior segment, from corneal apex to posterior face of the lens, and the retina with a FOV of 21º, featuring a novel configuration.

Methods

Scheme of the Anterior / Posterior segment SS-OCT

The proposed configuration consists of a dual path-dual focus sample arm that switches between anterior segment and retinal imaging modalities employing a flip mirror. The system is composed by three spectral channels: OCT signal, anterior segment and retinal (1050 nm), eye tracking (850 nm) and vision channel (vis.)



Swept Source: Short cavity swept laser, 50 kHz, 1050nm (Axsun)

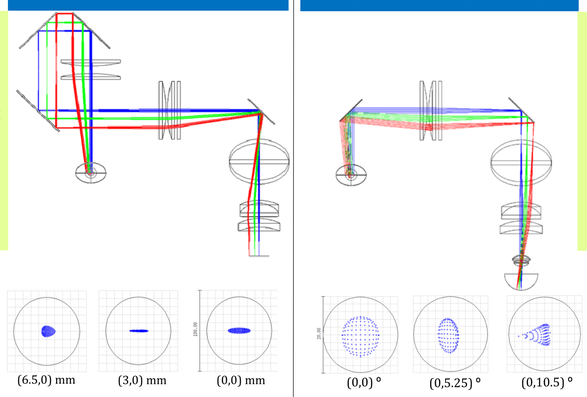
Detector: PDB481C-AC (Thorlabs)

Digitizer: 12 bit, 1GS/s (ATS9371, Alazar)

Optical performance

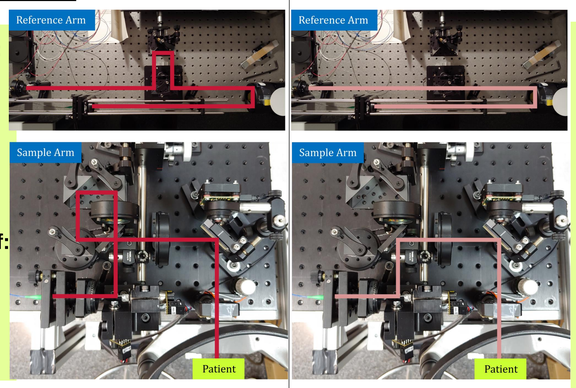
The optical interfaces have been designed and optimized with optical simulation software (Zemax, *Radiant Zemax, LLC*)

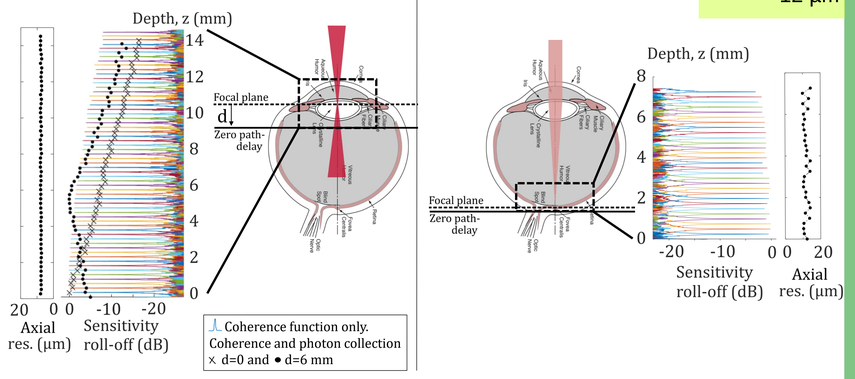
	AS INTERFACE	RETINAL INTERFACE
FOV:	13 x 13 mm	21º
Lateral res.:	40 µm	12 µm
DOF:	4 mm	0.5 mm



Characterization

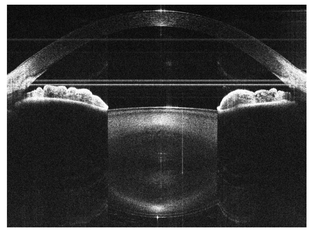
Acquisition:	8192 sps	2048 sps
	0.8 GS/s	k-CLKed
		(~ 250 MHz)
Sensitivity:	98 dB	104 dB
6 dB Roll off:	14 mm	
Depth range:		7.4 mm
Axial res.:	8 µm	12 µm

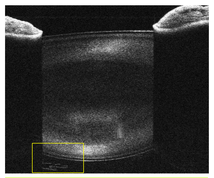




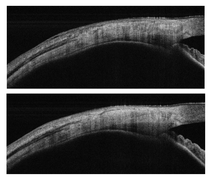
Results

A group of volunteers have been imaged with the system in a laboratory environment to assess its performance.

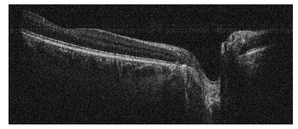




Vitreous structures close to posterior face of the lens

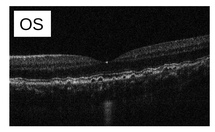


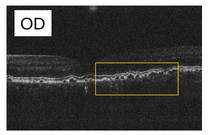
Corneo-scleral region of a healthy volunteer



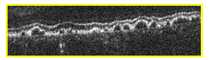
AS: 2000 A-scans/B-scan

Retina: 1500 A-scans/B-scan





35yo, asymptomatic, drusen-like structures in both eyes



Conclusions

We have developed a SS-OCT capable of imaging the whole anterior segment and the retina with a dual path configuration. The first measurements on a group of volunteers have shown the potential of the system. A full clinical validation, including eyes with retinal and anterior segment pathologies, will be conducted at IMO.

References

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