Project 3.6 Phase sensitive spatio- temporal optical coherence imaging

Supervisor: dr Andrea Curatolo / prof. dr hab. Maciej Wojtkowski
Institute: of Physical Chemistry
Unit: Research group No. 3. Physical Optics and Biophotonics Group - prof. dr hab. Maciej Wojtkowski
www: www.icter.pl

Background:

Making a spatial map of biological tissue function, i.e. functional imaging, and of tissue mechanical properties, i.e., elastography, in in vivo organs, like the eye, is at the forefront of innovative techniques for early detection of diseases and therapy monitoring. At the core of either of these techniques lies a structural imaging system that will record at least two snapshots in time of the tissue status, i.e., with and without visible light stimulation, or with and without some mechanical stimulation/compression.

Optical coherence tomography (OCT) is a non-invasive, high-resolution, three-dimensional biomedical imaging technique that is highly suited to being the core structural imaging technique for eye functional imaging and elastography. Two requirements are needed for its successful use: high sensitivity to tissue constituents displacements, down to single nanometers, and high temporal resolution between snapshots. However, standard flying-spot OCT system implementation do not meet both requirements, limiting its potential in functional eye imaging and eye elastography.

Aim:

In this project we propose to develop Fourier-Domain Full-field OCT, and more specifically, Spatio-Temporal Optical Coherence Tomography (STOC-T) as the first structural imaging technique to both fulfill the displacement sensitivity and imaging speed requirements for successful deployment in both functional eye imaging and elastography. Stimulation setups will have to be designed and experimentally built and tested.

Requirements:

- Master's degree in physics, engineering or similar, with experience in optical system design, and experiments dealing with both free space and fibre optics,
- any experience in OCT will be considered a plus.