

Master's Thesis or Student Project and Bachelor's Thesis

Adapting and Validating an OCT Simulation Framework for Experimental Phantoms

Motivation

Optical Coherence Tomography (OCT) has become a central imaging technique in biomedical research, providing non-invasive, high-resolution insights into tissue structure and function. For developing and testing new algorithms, simulated OCT data is especially valuable: it allows controlled variation of parameters, enables the independent study of individual influencing factors, and provides reliable ground truth. We plan to extend an existing OCT simulator [1] so that it accurately reproduces the characteristics of our system and experimental phantoms. This will establish a direct link between simulation and experiment and create a basis for exploring advanced extensions such as OCT angiography (OCTA).

Area of Research

Optical Technologies in
Medicine and Life Science

Project

Quantifying Blood Volume
Flow Using Optical Methods

Research Orientation:

Signal Processing, Software
Development, Algorithmics,
and Experimental Studies

Course of Study

Computer Science
Electrical Engineering

Starting Date

starting immediately



Contact person

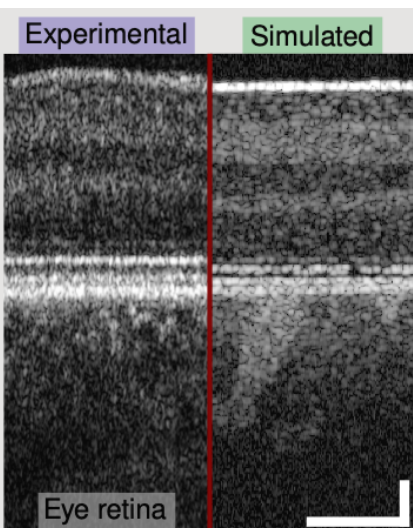
M.Sc. Miriam Weiß
Geb. 30.33, Raum 519

eMail:

miriam.weiss@kit.edu

Telefon:

+49 721 608-41579



Task description

The project focuses on adapting and validating the OCT simulator with respect to our experimental setup and phantom measurements. The main steps include:

- Modeling experimental samples (milk-water suspensions, layered tissue-mimicking media).
- Preparing the ground for extensions such as repeated B-scans for OCT angiography

Requirements:

- Programming experience in MATLAB (or Python with scientific libraries).
- Ability to study and adapt existing code.
- Basic knowledge in optics and OCT principles.
- Interest in image/signal processing and simulation.

[1] Ruiz-Lopera S., Bouma B.E., Uribe-Patarroyo N., *An Efficient Simulation Tool for Optical Coherence Tomography*, Proc. SPIE 12830 (2024), 128301O. <https://doi.org/10.1117/12.3005755>