

Master of Science – Biomedical Engineering  
Thesis Proposal

**Automatic Alignment of OCT and Laser Ablation:**

Laser technologies have been widely used in modern medicine. Laser osteotomy is introduced to overcome the challenges accompanied by conventional methods for cutting the bone. The main advantages feature that laser could offer in the medical field of osteotomy include contactless and potentially minimally invasive for bone surgery. Despite the unique advantages introduced by laser, the main drawback accompanied by laser during surgery is the lack of a feedback system to measure the depth of the incision in real-time.

One method to monitor the incision depth is by integrating the laser ablation with Optical coherence tomography (OCT) imaging system. However, aligning the OCT with the ablation laser is challenging, the sensitivity of the optical setup to vibration may shift the alignment at every beginning of the ablation procedure. Therefore, an automatic alignment system between the OCT and the ablation laser is needed. The system will increase the accuracy of the measurement for every surgical procedure.

This master project focuses on the development of an automatic alignment system between the Er: YAG laser and OCT. The work steps are defined as:

- (1) Literature review on image processing and analysis for OCT images.
- (2) Defining the required optics and designing the optical setup (with the guidance of the advisors)
- (3) Defining the image processing step and analysis for object detection.
- (4) Implementation for real-time object detection and alignment correction.
- (5) Testing and evaluating the automatic system for consistency and accuracy.

**Benefits:**

Gain practical experience with designing and using optical setups for biomedical applications.

Learn to work with lasers and interferometers.

Work in a highly interdisciplinary team of physicists, engineers, and medical doctors.

**Nature of the Thesis**

Experimental: 40%

Programming: 40%

Documentation: 20%

**Specific Requirements:**

Solid background in biomedical engineering, physics, or a related field

Basic knowledge of optics, image processing, and machine learning.

Prior knowledge in working with optical setups and working with Python is a plus but not strictly required

**Supervisor & Contact**

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