



Internship – Biomedical Engineering (Duration: Six months Part-time)
Task Proposal

Optical acoustic-field measurement for tissue classification using a fiber Bragg grating

BLOG (Biomedical Laser and Optics Group) develops a fiber based laser with feedback system which guarantees for extremely precise cuts of almost all shapes in minimal invasive surgery. Currently, bone saws can only achieve medium precision, which is connected to relatively reduced implant stability and relatively longer recovery times. BLOG's fiber laser will enable controlled contactless bone ablation leading to faster bone healing and less thermal damage compared to conventional mechanical osteotomes. To further extend the advantages of laserosteotomes over conventional osteotomes, also real-time opto-acoustical feedback sensor on type of tissues being cut would be desirable to immediately shut down the laser in case there is no bone tissue left to cut.

The aim of this piece of work is to ablate hard and soft bone, muscle, fat, skin and nerve tissues using a microsecond pulsed Er:YAG laser at $2.94\mu\text{m}$. The intern will measure the emitted acoustic shock wave (ASW) using an optoacoustic sensor-based fiber Bragg grating system. He will also classify the ablated tissues using some custom-made algorithms. An alternative will be to measure ASWs using a costumed made fiber Perot system.

Qualifications:

- Bachelor's degree in Electronic/Optoelectronic Engineering/Applied Physics or closely related field.
- Excellent Bachelor's/Master's grades.
- Programming skills (e.g. Matlab, LabVIEW) are desirable.
- Prior experience in signal processing and optoelectronics is a plus (not mandatory).
- Applicants are expected to have excellent language skills in English.

Tasks:

- Basic research
- To investigate acoustic parameters in the time domain using both lasers (i.e. Rising and Falling Time / Pulse-Width etc.) for different tissue samples.
- To investigate the measured acoustic signal by looking at the amplitude-frequency band which provides the best accuracy.
- To classify the ablated tissue based on the PCA combined with either Mahalanobis distance method or cubic support vector machine method to differentiate tissue types.

We offer:

- Opportunity to work in a highly innovative Flagship project with up to 30 researchers.
- You will learn how to build and perform optoacoustic spectroscopy precisely for medical applications.
- Opportunity to enjoy Basel, Basel is a city on the Rhine River in northwest of Switzerland. Located where the Swiss, French and German borders meet.

Supervisor:

Hervé Nguendon Kenhagho

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Advisor:

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Contact

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