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FACULTY OF PHYSICS
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MEDICAL PHYSICS
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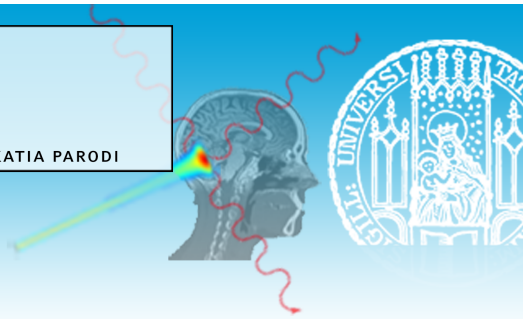

Fabrication and characterization of a PVDF array for ionoacoustics-based dose reconstruction during small animal proton irradiation

1 MSc project available

Background

Particle therapy with protons and heavier ion beams is rapidly emerging as a promising radiation therapy modality due to the superior ability to concentrate energy deposition in the tumor, while better sparing normal tissue and critical organs compared to widely established photons. Despite considerable recent technological advances, full clinical exploitation of the favorable ballistic properties of ion beams is still hampered by the yet unsolved problem of range uncertainties in tissue. In this context, ionoacoustics has been revealed over the last years as a promising modality to localize the maximum energy deposition (so-called Bragg peak) [1]. However, strength and shape of the ionoacoustic signal crucially depend on the spatial distribution and temporal structure of the heating process, i.e., dose deposition. In clinical scenarios, this leads to weak pressures (up to some mPa) in the tenth of kHz frequency range [2], making the detection of the ionoacoustic waves a technological challenge.

The Chair of Experimental Physics – Medical Physics in the Faculty for Physics of the Ludwig-Maximilians-Universität München (LMU) is currently developing an ionoacoustic detection system to monitor the proton dose during small animal irradiation [3]. In this context, broadband polyvinylidene fluoride (PVDF) detectors are being investigated. A first sensor prototype has recently been validated during experiments at a clinical facility. The fabrication and characterization of the final sensor array based on an optoacoustic setup reproducing ionoacoustic emissions will be pursued in the framework of the present Master thesis.

Your tasks

Within the Chair of Medical Physics of the LMU in Garching, you will take part in the current effort on ionoacoustic detector development, including:

- The fabrication of the PDVF array which consists in patterning the PVDF electrodes (photolithography and chemical etching), the array assembly, and programming of the software interface with the acquisition system.
- The fabrication of optoacoustic targets and phantoms to emulate ionoacoustic signals in small animal.
- The characterization of the sensor array and validation of its design for ionoacoustics-based dose reconstruction during small animal proton irradiation.

Fluent English knowledge is required, experience in instrumentation or programming (preferably Matlab or Python) is desirable but not mandatory.

Contact

If you are interested in the Master thesis, please send us your application (letter of motivation and curriculum vitae) *via* email to **J.Lascaud@physik.uni-muenchen.de**.

References

[1] K. Parodi and W. Assmann 2015 Mod. Phys. Lett. A 30 1540025

[2] S. Lehrack *et al* 2017 Phys. Med. Biol. 62 L20

[3] K. Parodi *et al* 209 Acta Onc., 58(10), 1470-1475