

Internship in nuclear instrumentation

3-dimensional scintillation dosimetry for small irradiation fields control in protontherapy

Radiotherapy is an important modality in treatment cancer. In this domain, proton beams have ballistic superiority against photon beams. Nevertheless, the use of protontherapy to treat small volume tumors (typically less than 27 cm^3) is limited because of the lack of well adapted dosimetry tools for small irradiation fields quality assurance. To answer this issue, an innovative dosimetry system has been developed. It is based on a scintillating block of $10 \times 10 \times 10 \text{ cm}^3$, a mirror and two ultra-fast cameras recording the scintillation from different points of view to reconstruct 3-dimensional dose maps.

The objective of this internship will be to study the prototype developed by the GANIL and the LPC Caen from measurements performed on the IBA Proteus®ONE irradiation system in 2021 and 1st semester of 2022.

In a first step, he/she will analyze scintillation acquisitions and compare them to beam profiles measured with a 2-dimensionnal detector such as the IBA Lynx detector. This investigation will allow to determine the effect of the perspective and the optical artifacts of the system on the beam shape measurements.

In a second time, the impact of the beam shape on the dose distribution calculation will be evaluated and corrections methods will be developed and implemented if necessary.

Expected skills

The student must have a formation in nuclear physics with a good knowledge of the detection of radiations and their interactions with matter. Knowledge in radiotherapy and dosimetry would be a plus.

The student will participate to the acquisition, the analysis and the treatment of the scintillation images to achieve 3-dimensional dosimetry. The candidate must thus have strong interest for data analysis and simulation, and will have to develop skill in image manipulation, programming and Monte Carlo simulations.

The candidate will need to be able to work in an interdisciplinary domain with people from other research fields such as biology, medical physics or medicine.

This work can be pursued by a PhD-thesis

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