

PhD position in nuclear instrumentation

3-dimensional scintillation dosimetry for small irradiation fields control in proton therapy

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 cm³) 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 × 10 × 10 cm³ and two ultra-fast cameras recording the scintillation from different points of view to reconstruct 3-dimensional dose maps. The current reconstruction method uses a library of preliminary beam measurements.

The objective of this PhD thesis will be to develop a new method directly converting scintillation maps into dose maps. This includes, in the first stage of the thesis, the study of the energy dependence of the scintillation yield with proton beams. The new reconstruction method will then be evaluated and compared to ionization chamber and dosimetry films measurements. Finally, the dosimetric system will be used to study dose uncertainties during treatment plan. This project will be done at GANIL in collaboration with the LPC Caen. It will involve experimental work, Monte Carlo simulation and data analysis.

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 prototype optimization. He/she will perform experimental characterizations and evaluations as well as Monte Carlo simulations and data analysis. The candidate must thus have an interest for experimentation as well as 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.

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