Scintillation dosimetry 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 beams quality assurance.

To answer this issue, a research project has been funded by the Normandie Region to develop an innovative dosimetry system based on a scintillating block of $10 \times 10 \times 10\ cm^3$ and an ultra-fast camera. The camera is able to register the scintillation produced by 7 µs beams at a frequency of 1 kHz. By recording the scintillation from several points of view (thanks to mirrors or several cameras), the system will provide 3 dimensional dose distributions with a sub-millimeter spatial resolution.

Nevertheless, scintillation dosimetry presents several difficulties such as optical deformation and scintillation quenching which occurs with particles of high linear energy transfer (LET).

The objective of this training will be to study a prototype developed by the GANIL and the LPC Caen. He/She will perform measurements with proton beams at various energies to determine the scintillation yield as a function of energy. The comparison of these measurements with Monte Carlo simulations will allow to study the effect of scintillation quenching on dose measurement.

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 perform experimental characterizations and evaluations as well as Monte Carlo simulations. The candidate must thus have an interest for experimentation as well as simulation and will have to develop skills in instrumentation, image analysis and Monte Carlo simulations.

This training should be followed by a PhD thesis.

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