

Post- doctoral position at LCAE laboratory in CEA, FRANCE

A post-doctoral position is available for 18 months at CEAⁱ Saclay within the ASTROLABE project, which aims at developing fast scintillator based device coupled to silicon photomultiplier (SiPM) sensor for on line FLASH beam dosimetry.

New cancer treatment modalities are needed in order to improve the dose delivery to the tumor with normal tissue being spared from radiation damage as much as possible. This could be done by various approaches as for example the use of spatial fractionation with very small beams, or temporal optimization with the use of very high dose rate (FLASH) irradiation. In that particular case, recent investigations showed that FLASH with electrons was as efficient as gamma rays for tumor inhibition while less damaging for healthy tissue. These promising results open extremely interesting prospects in clinical radiation oncology, but developments are still limited due to the difficulties to perform an accurate dosimetry. For these particular beams, instantaneous dose-rates or doses-per-pulse are up to several orders of magnitude greater than those produced by conventional radiation sources. Standard active dosimeters (e.g. diode or ionization chamber) saturate at very high pulse dose rates (VHDR) irradiation, therefore preventing on-line dosimetry of the beam with such devices.

The goal of this post-doctoral research work is to provide a suitable dosimeter for measurements of charged particle beams with VHDR, i.e. with high doses per pulse or with ultrashort pulse duration (from mGy to Gy per pulse, from ns to μ s pulse durations). The specific objectives are:

- To develop a dedicated dosimeter based on an ultra-fast plastic scintillator coupled to a silicon photomultiplier (SiPM) sensor.
- To adapt this system for on line measurement.

This work is the core of ASTROLABE project funded by INSERM in which two laboratories are involved, LCAEⁱⁱ from CEA and IC-CPOⁱⁱⁱ from Institut Curie.

The LCAE chemistry team group will perform the development of ultra-fast plastic scintillator. The post-doc fellow will have to develop the system of plastic scintillator coupled to SiPM. Monolithic or pixelated plastic scintillator will be coupled directly to SiPM matrix and will be tested in laboratory with electron source as well as on electron beam from Elekta accelerator (DOSEO platform at CEA). This will enable characterizing the set-up before evaluation with VHDR beams of electrons from IC-CPO platform. This process can be iterative in order to find the optimized characteristics of the device regarding the plastic scintillator intrinsic properties, shape, size, coupling to SiPM. Next, the post-doctoral researcher will develop a second generation of device to be adapted for on-line measurement.

Candidate profile:

- Physics and instrumentation with experience in nuclear measurements and scientific programming and modelling (Matlab, Python, Monte Carlo modelling) and interested in detector design.

- Highly motivated to work within a multidisciplinary project

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