

Development of Accurate Dosimetry SiPM-based Detectors for FLASH RT

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Radiotherapy (RT) using X-rays is the main treatment strategy employed to treat human tumors with ~50% of all cancer patients receiving RT. The major drawback of RT treatment is that in order to deliver a lethal dose to cancerous cells, short- and long-term adverse side-effects are evident due to the irradiation of the surrounding normal healthy tissues that can severely impact the health and quality of life of the cancer patient.

One way to circumvent the irradiation of the surrounding tissue is through Proton Beam Therapy (PBT) where instead of photons, protons are used to deliver the radiation with higher precision, thanks to their favorable ratio of Relative dose to Depth (Bragg Peak).

Another way is through FLASH radiotherapy and particle therapy. Both are performed with the delivery of ultra-high dose rate radiation (UHDR), specifically a dose rate higher than 40 Gy/sec. The advantage of FLASH compared to conventional therapy (CONV) is based on the “FLASH effect”: improved normal tissue sparing while still maintaining tumor control. Accurate dosimetry and real-time beam monitoring are critical for its clinical translation, but current detectors suffer from saturation effects in the signal production and signal read-out when dealing with fast and intense beams.

We report on our development and preliminary tests of a novel dosimeter for Ultra high-dose rate particle therapy, based on advanced Silicon Photomultiplier (SiPM) detectors coupled with scintillating fibers (SciFi). The SciFi detector aims towards an improved time and space resolution, with respect to the present commercial readout system. It will be suitable for both CONV and UHDR irradiations.

We will describe the present status of the devices and facilities used for FLASH RT. We will show the preliminary design of the detector that is expected to be tested using a proton UHDR beam with the beam's energy ranging from 70 MeV (CONV) to 228 MeV (FLASH RT). The ultimate goal is a detector suited both for FLASH PBT and for Conventional RT, with good sensitivity, as well as spatial and energy resolution.

Workshop topics

Detector systems

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