

Secondary Charged Fragments Tracking for On-Line Beam Range Monitoring in Particle Therapy

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Abstract : In Particle Therapy (PT) treatments a large amount of secondary particles, whose emission point is correlated to the dose released in the crossed tissues, is produced. The measurement of the secondary charged fragments component could represent a valid technique to monitor the beam range during the PT treatments, that is a still missing item in the clinical practice. A sub-millimetrical precision on the beam range measurement is required to significantly optimise the technique and to improve the treatment quality. In this contribution, a detector, named Dose Profiler (DP), is presented. It is specifically planned to monitor on-line the beam range exploiting the secondary charged particles produced in PT Carbon ions treatment. In particular, the DP is designed to track the secondary fragments emitted at large angles with respect to the beam direction (mainly protons), with the aim to reconstruct the spatial coordinates of the fragment emission point extrapolating the measured track toward the beam axis. The DP is currently under development within of the INSIDE collaboration (Innovative Solutions for In-beam Dosimetry in hadrontherapy). The tracker is made by six layers ($20 \times 20 \text{ cm}^2$) of BCF-12 square scintillating fibres (500 μm) coupled to Silicon Photo-Multipliers, followed by two plastic scintillator layers of 6 mm thickness. A system of front-end boards based on FPGAs arranged around the detector provides the data acquisition. The detector characterization with cosmic rays is currently undergoing, and a data taking campaign with protons will take place in May 2017. The DP design and the performances measured with using MIPs and protons beam will be reviewed.

Keywords : fragmentation, monitoring, particle therapy, tracking

Conference Title : ICBMP 2017 : International Conference on Biophysics and Medical Physics

Conference Location : Stockholm, Sweden

Conference Dates : July 13-14, 2017