PRAGUE: Proton RAnGe measure Using silicon carbidE

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Monitoring of the Percentage Depth-Dose (PDD) distribution is a fundamental step in beam quality control programs with clinical proton beams, due to its correlation with the beam range, which is closely involved in the patient's treatment plan definition. The uncertainties in the estimation of the proton range in the biological tissue lead to the extension of the treatment volume, with a consequent increase in the total absorbed dose. We will present the work done within the PRAGUE (Proton Range Measurement Using Silicon Carbide) project funded by the H2020 and Fyzikální ústav AV ČR v.v.i. in the framework of the MSCA-IF IV program, and by the INFN in the framework of the program for young researcher grant. The main goal of PRAGUE was the design, simulation, realization, and characterization of a real-time depth-dose distribution detector system based on thin Silicon Carbide multilayers for conventional and flash proton beams in the energy range between 30 MeV to 150 MeV. A new generation of SiC detectors based on p-n junction with an active layer of 10 um, fully depleted 15x15 mm^2 square, were adopted. The electronic readout is based on the chip TERA08, designed by the INFN-To and commercialized by the DE.TEC.TOR company. The chip is able to manage up to 64 input channels converting the incoming charge in counts with a wide range of sensibility. A detector prototype was already realized, simulated, and tested with 30 and 70 MeV conventional proton beams. The obtained results indicate the SiC device as suitable detector for relative dosimetry with charged particles. It showed, in fact, a stable and reproducible response and an extremely good behavior in terms of linearity as respect to absorbed dose was found. The negligible dependence of its response against energy and dose-rate and the high radiation hardness represent advantageous features as respect other commercial solid-state detectors for ion beams dosimetry.