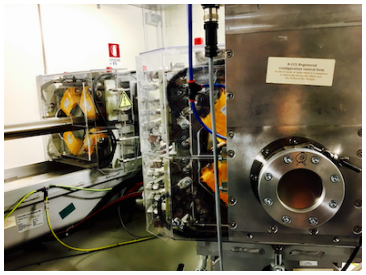

Contribution ID: **23** Type: **not specified**

MoVeIT detectors characterization at Trento Proton Beam Line Facility

Monday, 9 November 2020 13:50 (10 minutes)

Within the MoVeIT project of the National Institute for Nuclear Physics (INFN), the University of Torino and the INFN are investigating Ultra-Fast Silicon Detectors (UFSD) for proton beam monitoring in order to replace ionization chambers currently in use in Hadrontherapy.
Two devices are being developed based on UFSD: one for measuring the beam energy using Time-of-Flight (ToF) techniques, and the other aiming at counting single particles up to 100 MHz/cm^2. Strip sensors of two geometries {20 strips of 2.25 mm^2 (150 μm width x 15000 μm length, 216 μm pitch); 30 strips of 2.40 mm^2 (80 μm width x 30000 μm length, 146 μm pitch)} produced by FBK (Fondazione Bruno Kessler, Trento, Italy) were used for counting, while pads (80 μm active thickness, 3x3 mm^2 sensitive area) produced by HPK (Hamamatsu Photonics K.K., Japan), and strip sensors (600 μm pitch, 50 μm active thickness, 2.2 mm^2 sensitive area) produced by FBK were used for energy measurement. Tests for preliminary characterization were performed in the experimental room of the Trento Proton Therapy Center (Azienda Provinciale per i Servizi Sanitari, APSS), with 60-250 MeV clinical proton beams at 10^6 – 10^9 p/s fluxes. Varying the flux at different energies, the particle rate was measured and compared with the one estimated by a pin-hole ionization chamber. The energy was obtained using ToF measurements from the telescope of two UFSDs sensors placed at a specific distance between each other and aligned along the beam direction.
The achieved efficiency of the counter prototype was greater than 98 % up to 10^8 p/s*cm^2 and few hundreds of keV deviations from nominal energies were achieved for all beam energies at 67 and 97 cm distance between the sensors corresponding to < 1 mm range.
These promising results demonstrate that UFSD could be a viable option to improve the conventional monitors and further improvements are therefore being developed. Among them, a new detector geometry is being produced by FBK to cover a sensitive area of 2.74 x 2.74 cm^2 and will be tested in the coming months, it features 146 strips of 114 μm width x 26214 μm length, 180 μm pitch.

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Session Classification: Medical Physics Applications