



Contribution ID: 19

Type: Oral presentation

Multi-disciplinary research activities and beam diagnostic detector developments at the Bern medical cyclotron

Friday, 22 September 2017 09:25 (25 minutes)

The cyclotron laboratory at the Bern University Hospital was conceived for both industrial production of radio-pharmaceuticals and multi-disciplinary research activities. It is based on an IBA CYCLONE 18 MeV proton cyclotron equipped with a 6 m long research beam line accessible by a separate bunker. Studies on accelerator and detector physics, radiation protection, radiation hardness of components for physics experiments and space missions, and novel PET radioisotopes are on-going. The production of radioisotopes via the irradiation of highly enriched materials in form of powders (as enriched calcium for scandium 43 and 44) is challenging and a specific method based on a compact 60 cm long mini beam line equipped with an active beam diagnostic system and a solid target station is being developed. Research on non-destructive beam monitoring detectors is pursued. The UniBEaM is based on doped silica fibers passed through the beam to obtain beam profiles in a large intensity range from 1 pA to 20 uA. Four optical beam profilers of this kind were used to build a specific instrument to measure the transverse beam emittance on-line and to study its behavior as a function of several cyclotron parameters. A two-dimensional non-destructive beam profiler based on a 4 um ultra-thin phosphor screen read out by a CCD camera was conceived and a prototype built. The first results are promising in view of several applications of ion beams such as radioisotope production and hadrontherapy.

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Session Classification: Session 3