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Implementation of a portable PET scanner for proton therapy beam quality assessment

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In Proton Therapy (PT), the highly conformal dose irradiation of the tumors makes this technique very powerful, resulting in better treatment outcomes, survival rates, and overall quality of life for cancer patients. However, the characteristics of the depth-dose profile (Bragg-Peak) demands for an extremely precise beam control since the dose profile is much more sensitive to spatial uncertainties than in conventional radiotherapy, potentially delivering unwanted doses to healthy tissues if the treatment is unproperly planned and controlled. Therefore, it is mandatory to measure the beam profile during PT quality control and treatment procedures. Several imaging techniques have been proposed to that purpose based on secondary particle detection originated from the interaction of the beam particles in the tissues. One of the most promising ones is Positron Emission Tomography (PET) which is being widely studied for clinical practice and real-time assessment of beam interaction in the body. EasyPET is a cost-effective benchtop PET system using an innovative and patented acquisition method, with a spatial resolution of less than 1 mm. Its major advantages are its high compactness and portability, contrary to typically bulky PET scanners, allowing the mobility and integration in different Proton Therapy Centers (PTC) locations. This work aims to develop a benchtop, portable, and high-performance PET prototype based on easyPET technology for 3D quality assessment of proton beam delivery in PTCs.
In this talk an introduction to the framework of the phD project will be presented, as well as its state of the art and work plan. The project is being developed in collaboration with the Center for Proton Therapy at the Paul Scherrer Institute (PSI –Switzerland).

Keywords: Positron Emission Tomography, easyPET, Proton Therapy, proton beam quality control, range uncertainties.

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