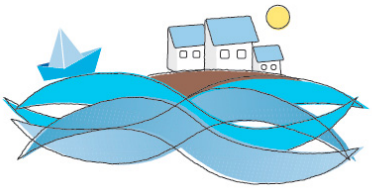

Mediterranean Thematic Workshops in Advanced Molecular Imaging

Contribution ID: **64** Type: **Oral**

Full-beam PET monitoring in particle therapy with the INSIDE scanner: first measurements

Tuesday 3 May 2016 15:00 (20 minutes)

In-beam PET is one of the options for real-time monitoring of the Bragg peak depth in hadron-therapy sessions, which would allow hypofractionation and the treatment of multiple lesions.
The INSIDE collaboration has recently completed the building of a PET scanner, featuring two 10x25 cm2 planar heads at a default distance of 25 cm from the iso-centre, that will soon be complemented by a tracker for prompt charged particles and will operate at the CNAO synchrotron facility (Pavia, Italy).
Testing with monoenergetic proton beams of 68, 72, 77 and 105 MeV targeted to PMMA phantoms placed inside the FOV was performed at the CNAO synchrotron, in order to fine-tune the detector performance in controlled conditions.
Data acquisition was successful in both in-spill (1s) and inter-spill (4s) modality, with a Coincidence Time Resolution (CTR), measured without a fine time calibration, of about 480 ps.
The inter-spill image profiles along the beam axis for the 68 and 72 MeV beams show the characteristic distal activity fall-off, with a measured proton range difference in PMMA (3.6+-0.3 mm) that is compatible with the expected value (3.64 mm) within few hundred microns. Similarly, for 77 and 105 MeV beams delivered sequentially on the same phantom, the measured distance is (30.2+-0.3) mm, to be compared to an expected value of 31.2 mm. Submillimetric bias induced by disuniformity in the detector efficiency, geometrical acceptance or reconstruction software the are being investigated with simulated data.
When comparing inter-spill and in-spill data, it is observed that the fall-off slope is steeper (as expected) and shorter (about 2 mm) for inter-spill data,.
The effect, likely caused by pair production far from the target followed by annihilation, is being investigated, since its contribution is relevant when an absolute measurement is required. In order to reject the neutron-induced contribution, a filter that exploits the 700 μs bunch structure during the beam delivery was developed.
Data acquisition with carbon beam on PMMA was successfully tested at the beginning of April 2016.
Standard proton-based treatment plans were also delivered on PMMA phantoms, reconstructed and successfully compared to previously simulated data.
In order to start testing with patients, the integration of CT and PET data is being completed, so as to be able to generate simulated profiles, which will be compared to data in real-time, during the treatment delivery.

Summary

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