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An integrated system for the on-line monitoring of particle therapy treatments accuracy

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The quality assurance in particle therapy is a still-open issue that can be addressed with reliable monitoring techniques of treatment accuracy.

The INSIDE (INnovative SolutIons for DosimEtry in hadrontherapy) project aims at the development of an integrated on-line monitoring system based on a dedicated PET scanner and a tracking system. It is designed to operate in-beam and provide an immediate feedback on the particle range.

The PET system is composed of two planar heads ($10 \times 20 \text{ cm}^2$), placed at 25 cm from the isocenter and made of LSF pixel crystals ($3 \times 3 \times 20 \text{ mm}^3$) coupled one to one to MPPCs.

The tracking system is composed of 6 planes of orthogonal squared scintillating fibers coupled to a 1 mm^2 SiPM combined with an electromagnetic calorimeter made of LYSO crystals coupled to Position Sensitive PMTs.

Monte Carlo simulations cover an important role both in the system development, by confirming the design feasibility, and in the system operation, by understanding data.

To reduce simulation time in signal generation on PET detectors, a novel FLUKA-based two-step simulation has been implemented: first the treatment beam is simulated with partial statistics, then the scored isotopes activation is used as generator for a second full-statistics step. With this technique the simulation time is reduced of about 70x.

This work presents the INSIDE project and provides an up-date of the system development and simulations.

Collaboration

on behalf of the INSIDE collaboration

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