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# First tests for in-beam carbon therapy treatment monitoring with a planar PET system at CNAO

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One of the most promising new radiotherapy techniques is using charged particles like protons and carbon ions, rather than photons. At present, there are more than 50 particle therapy centers operating worldwide, and many new centers are being constructed. Positron Emission Tomography (PET) is considered a well-established technique to monitor the delivered dose to the patient particle treatments non-invasively. Nuclear interactions of the charged hadrons with the patient tissue lead to the production of beta+ emitting fragments (mainly 15O and 11C), that decay with a short lifetime producing a positron. The two 511 keV annihilation photons can be detected with a PET detector. In-beam PET is particularly interesting because it could allow to monitor the ions range.
A large area dual head PET prototype was built and tested. The system is based on an upgraded version of the previously developed DoPET prototype. Each head covers now about 15x15 cm2 and is composed by 9 (3x3) independent modules. Each module consists of an H8500 PMT coupled to a 23x23 LYSO crystal matrix (2 mm pitch) and is readout by custom front-end and a FPGA based data acquisition electronics.
Data taken at the CNAO treatment facility in Pavia from proton and carbon beams impinging on various phantoms will be presented with particular attention to the evaluation of the activity depth in the phantoms. The comparison of these data to the one obtained using the FLUKA Monte Carlo will be also presented.

**Primary author:** ROSSO, Valeria (PI)

**Co-authors:** KRAAN, Aafke Christine (PI); DEL GUERRA, Alberto (PI); Dr FERRARI, Alfredo (CERN); SPORTELLI, Giancarlo (PI); BATTISTONI, Giuseppe (MI); CAMARLINGHI, Niccolo' (PI); BELCARI, Nicola (PI); SALA, Paola (MI); MOLINELLI, Silvia (CNAO); FERRETTI, Stefano (PI); LUCENO', Stefano (PI)

**Presenter:** ROSSO, Valeria (PI)

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