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# Time of flight plastic-scintillator based proton radiography

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Proton radiography is a transmission imaging modality that measures the energy loss in an object to reconstruct a map of water-equivalent path lengths. Imaging systems typically feature a calorimeter to measure the residual kinetic energy of particles exiting the target, combined with one or more position-sensitive devices, providing the proton position or track. Recently, a new approach to retrieve the proton kinetic energy by measuring their Time Of Flight (TOF) has been proposed. The TOFpRad project aims to assess the viability of a TOF proton radiography system based on plastic scintillators read-out by Silicon Photomultipliers. The proposed system will consist of two tracking units made of plastic scintillating fibers, which will provide the proton coordinates when entering and exiting the target, while the TOF system will be composed of two thin plastic-scintillator-based detectors approximately ˜2 m apart. So far, a test has been performed at the CNAO hadrontherapy center with 62-227 MeV protons. A preliminary system composed of a plastic-scintillating-fiber-based beam monitor, and two TOF detectors was employed. A TOF resolution in the range 150-170 ps standard deviation was achieved. The capability of the system to detect a few-mm thick air gap at different depths in a water-equivalent phantom was also demonstrated. In this contribution, details about the project, the FLUKA Monte Carlo simulation studies and the results of the data taking will be presented.

## Primary experiment

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