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## First Fragmentation Cross Section Measurements with the Full FOOT setup

The main goal of FOOT is to measure double differential fragmentation cross sections of light elements ( $Z \leq 10$ ) in the energy range of 100–1000 MeV/nucleon, of interest both in medical and space-related fields. Particle Therapy is a medical treatment that uses charged particles with a tuned Bragg Peak to maximize the dose to tumors while minimizing damage to healthy tissue. However, ion fragmentation along the beam path can alter dose distribution, making precise cross section measurements for accurate treatment planning. In space, cosmic rays interact with spacecraft materials, producing secondary radiation that can affect astronauts and electronics. Thus, accurate cross section measurements are crucial also for improving shielding strategies in Space Radioprotection.

The FOOT electronic setup is a multi-detector system designed for precise fragment identification. In addition to measuring energy loss ( $\Delta E$ ), time of flight ( $TOF$ ), and kinetic energy ( $E_k$ ), its core component is a magnetic spectrometer that combines permanent magnets with silicon detectors. A Kalman filter algorithm is employed to reconstruct fragment tracks and compute their momentum ( $p$ ) from track deflections. This identification method improves the scintillator-based techniques previously used by FOOT, which did not include a magnetic field. In particular, it reduces erroneous reconstructions caused by secondary fragmentation in air, accounts for multiple scattering effects and improves resolution without requiring dedicated background data acquisition.

After an overview of the apparatus, the full tracking procedure is described, focusing on experimental data from the 2024 CNAO campaign. Results on resolution are then presented, followed by preliminary cross section measurements, enabling a comparison between the potential of this method and that of the conventional scintillator-based approach.

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