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First fragmentation measurements with the ΔE-TOF detector of the FOOT experiment

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The FOOT experiment was designed to identify the fragments produced in the human body during hadrontherapy and to measure their production cross-section. The ΔE-TOF detector of the FOOT apparatus estimates the atomic number Z and velocity β of the fragments by measuring the energy deposited (ΔE) in two layers of orthogonal plastic scintillator bars and the time-of-flight (TOF) with respect to a trigger detector. The detector performances have been already evaluated in a previous study at the CNAO hadrontherapy center of Pavia, obtaining 50 ps time resolution and 6% energy resolution, for 100-400 MeV/u carbon ions. In this work, the results of the first fragment identification measurements performed at CNAO are presented. A plastic target was irradiated with carbon ions of 330 MeV/u. Two plastic scintillator bars coupled to silicon photomultipliers were placed at a ˜8° angle with respect to the beam line to remove the primary beam component and measure fragments interactions only. Events that triggered both bars were recorded with a WaveDAQ-based electronics. The energy deposited in the two bars and the TOF between them were measured. The atomic number of the detected fragments was determined, indicating that particles with Z=1 and Z=2 were detected at a ˜8° angle. Currently, we are reproducing the experimental set-up with Monte Carlo simulations, and a preliminary comparison confirms these results.

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