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Design and performance of the FOOT calorimeter with particle-ID capabilities

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Fragmentation cross sections in beam-tissue nuclear interactions are crucial for clinical treatment-planning systems in **hadron therapy**. The FOOT experiment will fill the gap in differential cross- section measurements for the production of secondary fragments in such interactions with beam energies up to 400 MeV/u. Extending this range up to 800 MeV/u it will also be indispensable for studies on **radioprotection in space** to optimise shielding of future spacecrafts.

The **calorimeter of the FOOT experiment** is designed to provide linear response over the wide dynamic range from tens of MeV to about 10 GeV with an energy resolution below 2% for the identification of heavy fragments in a

reverse-kinematics configuration. The detector will be composed of 320 BGO crystals coupled to SiPM photosensors and read out by the WaveDAQ data- acquisition system, allowing **pulse-shape analysis for particle-type estimation**.

This contribution presents an overview of the FOOT calorimeter design and detailed performance results obtained in a series of experimental measurements with proton and carbon beams at CNAO (Pavia, Italy). Furthermore, an **algorithm for compensation of thermal variations** on the detector response is described, which eliminates the need for a dedicated temperature-stabilisation system. Finally, the **effect of the ion penetration depth** has been carefully studied using both experimental data and Monte Carlo simulations, taking into account the optical propagation of scintillation photons. The developed correction of this effect is presented, which is an **essential component of the future particle-identification algorithm** in the FOOT experiment.

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