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Nuclear fragmentation cross section measurements with the FOOT experiment

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Hadrontherapy employs high-energy beams of charged particles (protons and heavier ions) to treat deep-seated tumours: these particles have a favourable depth-dose distribution in tissue characterized by a low dose in the entrance channel and a sharp maximum (Bragg peak) near the end of their path.
Moreover, Carbon and Oxygen ions have an enhanced biological effect allowing to successfully treat radioresistant tumours.
In these treatments nuclear interactions have to be considered: beam particles can fragment in the human body releasing a non-zero dose beyond the Bragg peak while fragments of human body nuclei can modify the dose released in healthy tissues. These effects are still in question given the lack of interesting cross section data.

Also space radioprotection can profit by fragmentation cross section measurements: the interest in long-term manned space missions beyond Low Earth Orbit is growing in these years but it has to cope with major health risks due to space radiation.
To this end, risk models which are highly dependent on underlying physical models are under study: however, huge gaps in fragmentation cross section data are currently present preventing an accurate benchmark of deterministic and Monte Carlo codes.
To fill these gaps in data, the FOOT (FragmentatiOn Of Target) experiment
was proposed. It is composed of two independent and complementary setups, an Emulsion Cloud Chamber and an electronic setup composed by several subdetectors providing redundant measurements of kinematic properties of fragments produced in nuclear interactions between a beam and a target. FOOT was designed to detect, track and identify nuclear fragments and aims to measure double differential cross sections both in angle and kinetic energy which is the most complete information to address existing questions.
The FOOT experimental setups, the experimental program and a first cross section analysis of 400 MeV/u ^{16}O beam on Carbon target data acquired in July 2021 at GSI (Darmstadt, Germany) will be presented.

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