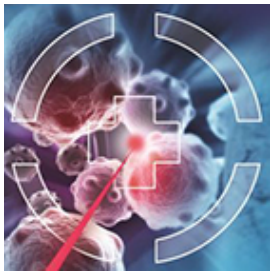

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FOOT: FragmentatiOn Of Target experiment

Charged Particle Therapy (CPT) is a highly effective method for treating several types of solid tumours. However, in heavy ion therapy nuclear inelastic interactions of the incident beam with the patient tissues lead to the break-up of the incident ion. The produced fragments of projectile have a longer range with respect to the primaries and lead to an undesirable dose deposition beyond the Bragg peak. On the other hand, in proton therapy, the nuclear inelastic interactions results in the fragmentation of the target nuclei, producing fragments with low energy and high Linear Energy Transfer (LET) which may alter the estimated local dose deposition, especially in the entry region. At present there is still a lack of complete and reliable experimental measurements of nuclear reaction cross sections of fragments produced by 60-250 MeV protons and 100-400 MeV/u carbon, helium and oxygen ions impinging on tissues nuclei (H, C, Ca, O, N). These data is important to develop a new generation of high quality treatment planning systems for CPT. Further interest in this type of measurements derives from the radioprotection in long duration and far from earth space missions, in which the particle energy to be considered is close to 1 Gev/u. In particular, nuclear fragmentation induced by proton and light nuclei is a relevant issue for the choice of the spacecraft shielding material, since the evaluation of radiation doses induced by the exposure to galactic cosmic rays are evaluated by means of Monte Carlo simulation codes, without a complete benchmark of dedicated experimental data.
The FOOT (FragmentatiOn Of Target) experiment is conduct by 15 institutions from 4 countries. The main goal is to perform a set of measurements of nuclear fragmentation cross sections relevant for CPT and radioprotection in space. Concerning target fragmentation, an inverse kinematic approach will be applied to overcome the difficulties related to the short fragments range (~μm). Moreover, the final cross section on Hydrogen will be obtained with the technique of subtraction of cross sections, adopting a double target separately made of C and C2H4. FOOT consists of two different setups for the detection of heavy and light fragments: the former are detected by a high precision tracking system in magnetic field, a time of flight measurement system and a calorimeter, while the latter are measured by a separated emulsion cloud chamber detector. Both the experimental setups are designed as portable detector that can easily operate in different clinical and experimental facilities. The optimization and the performance analysis of the setups have been studied by means of FLUKA Monte Carlo code and different detectors have been tested separately. A first data taking with both of the experimental setups has been performed at the GSI (Darmstadt, Germany) laboratory on April 2019.
An overview of the FOOT experiment and a report on the detector performances will be presented.

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