International Nuclear Physics Conference INPC2013: 2-7 June 2013, Firenze, Italy

Fragmentation cross sections at intermediate energies for Hadrontherapy and Space radiation protection

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Nuclear fragmentation measurements are of great interest in many fields of interest, form the hadrontherapy, the new frontier for cancer therapy, to the space exploration. In hadrontherapy, the capability to predict how the beam fragmentation modifies the delivered dose and the biologicall effectiveness is crucial for a correct tumor treatment [1]. Similarly, an effective shielding and a correct evaluation of the radiological risks for the astronauts require the knowledge of the radiation field inside the space vehicles and the human body generated by the galactic cosmic rays fragmentation [2]. In order to obtain realistic fragmentation predictions, the only way to overcome the shortcomings of analytical calculations is the use of reliable Monte Carlo simulations. However, the physical models used in such codes need to be tuned and validated by experimental fragmentation data. Since a limited set of experimental fragmentation cross sections is available and in particular, to our knowledge, no double differential fragmentation cross sections at intermediate energies are present in literature, we have started a campaign of fragmentation measurements at the INFN - Laboratori Nazionali del Sud (LNS) in Catania. The double differential cross sections and the angular distributions of the secondary fragments produced by the interaction of a 62AMeV ^{12}C beam on thin ^{12}C [3] and ^{197}Au targets have been measured over a wide angular range. Moreover, we have measured secondary fragments produced in conditions closer to the clinical case, i.e. using thick tissue-like target materials. In this contribution, together with the experimental results, we will also discuss the comparison between the measured fragmentation cross sections and the Geant4 Monte Carlo predictions. In particular, two Geant4 nuclear reaction models, the Binary Light Ions Cascade and the Quantum Molecular Dynamic, have been compared and validated.

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