Innovative handling and transport solutions for laser-driven ion beams

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Nowadays, laser-driven proton beams generated by the interaction of high power laser with solid targets represent a fascinating attractive in the field of the new acceleration techniques. In the last decades a great effort, both from theoretical and experimental point of view, has been devoted to charged particle acceleration using high power lasers. Several acceleration regimes have been investigated so far in literature aiming to overcome the experimental limits achieved up to now and to generate proton beams characterized not only by very high intensity and high energy but also by small energy and angular spread [1-7]. Moreover, in order to characterize in terms of focusing, transmission and energy selection the laser-generated ion beams and to make them suitable for multidisciplinary applications, investigating also the possibility of using laser-driven proton beams in the clinical field, an adequate beam transport line must be developed and tested.

In the framework of the ELIMED project [8], we started to design and realize a first prototype of a beam transport line (BTL) that will allow to deliver laser-accelerated proton beams with optimize properties and sufficient repetition rates in order to perform first dosimetric and radiobiological irradiations with such kind of beams [9-10]. In particular, we have already developed a first prototype of a key element of the beam transport system, i.e. an Energy Selector System (ESS), based on permanent dipoles, capable to control and select in energy laser-accelerated proton beams. Montecarlo simulation and some preliminary experimental tests have been already performed to characterize the device. A calibration of the ESS system with a conventional proton beam will be performed in September at the LNS in Catania.

In this contribution a description of different solutions studied for the BTL development depending on transmission efficiency and on energy spread and preliminary ESS calibration results together with the Monte Carlo simulations performed on the ESS will be discussed.

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