Design and status of the ELIMAIA beam transport line for laser-driven ion applications

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Charged particle acceleration using ultra-intense and ultra-short laser pulses, in the last few decades, has gathered a strong interest in the scientific community and it is now one of the most attractive topics in the relativistic laser-plasma interaction research. Indeed, it could represent the future of particle acceleration and open new scenarios in multidisciplinary fields as, in particular, medical applications.

One of the biggest challenges consists in using high intensity laser-target interaction to generate high-energy ions for medical purposes, eventually replacing the old paradigm of acceleration, characterized by huge and complex machines. Optically accelerated particle beams are, indeed, characterized by some extreme features, not suitable for many applications, as high peak current, poor shot-to-shot reproducibility and wide energy and angular distributions. Therefore, coupled to the investigations carried out on innovative target technologies and structures, aiming to improve the laser-driven beam peculiarities at the source, a lot of efforts have been recently devoted to develop new strategies and advanced techniques for transport, diagnostics and dosimetry of the accelerated particles.

In order to investigate the feasibility of using optically accelerated ion beams for multidisciplinary application, a dedicated transport beam-line coupled with diagnostics and dosimetric systems will be installed at the ELI-Beamlines facility in Prague (CZ), as a part of the secondary source beam-line dedicated to the ion acceleration and to their potential applications, called ELIMAIA. The beam transport and dosimetric approaches proposed for the ELIMAIA realization will allow adapting and combining the devices depending on the different project phases and the different User's requirements.

In this contribution an overview of the beam-line design and status together with a detailed description of the main transport and diagnostics elements will be presented. Moreover, some recent results obtained with transport and diagnostics prototypes, developed at the LNS-INFN of Catania (I), using both conventional and laser-driven ion beams will be discussed.