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Hadron therapy: from the conventional approach to laser-driven applications

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Hadron-therapy is the most advanced, still pioneering, external radiation therapy approach nowadays available for tumor irradiation.

Charged particle acceleration using ultra-intense and ultra- short laser pulses 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, in particular, medical applications.

One of the biggest challenges consists of using, in a future perspective, high-intensity laser-target interaction to generate high-energy ions for therapeutic purposes, eventually replacing the old paradigm of acceleration, characterized by huge and complex machines.

The peculiarities of laser-driven beams led to develop new strategies and advanced techniques for transport, diagnostics and dosimetry of the accelerated particles, due to the wide energy spread, the angular divergence and the extremely intense pulses. In this framework, INFN-LNS (Italian Institute of Nuclear Physics, Catania (I)) in collaboration with ELI-Beamline Institute (Dolny Brezany, CZ) will realized an installed in 2018 the ELIMED (ELI-Beamlines MEDical and multidisciplinary applications) beam-line.

ELIMED will be the first Users'addressed transport beam-line dedicated to the medical and multidisciplinary studies with laser-accelerated ion beams and completely open to the scientific community wishing to perform experiments with these new beams.

The beam-line will permit in-air irradiation of controlled laser-driven ion beams to perform typical multidisciplinary experiments, from biological irradiation to detector tests and general samples irradiation.

In this talk, we will discuss, with a didactic approach, which is the status of Hadron-therapy around the world and which are the potentialities offered by laser-driven beams for its future developments

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