RECENT STUDIES TOWARD AN EFFECTIVE USE OF LASER-DRIVEN VERY HIGH ENERGY ELECTRONS FOR RADIOTHERAPY:

Feasibility assessment of advanced irradiation schemes and perspectives for FLASH

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The use of Very High Energy Electrons (VHEE) for radiotherapy is deserving a growing attention, due, in particular, to the potential to provide doses/dose rates of interest for the FLASH radiotherapy.

In this scenario, laser-driven electron acceleration is regarded as one of the most promising routes for the development of compact and reliable devices with the required parameters for a medical use. Laser driven electron beams, due to their ultrashort duration, also feature a peculiar time structure, with ultrahigh instantaneous dose rate, whose role and potential in radiobiology is still to be addressed.

We report on recent experiments aimed at assessing dose deposition for deep seated tumors with laser driven VHEEs. Beam dosimetry with pencil beams as well as advanced irradiation configurations will be discussed.

The measurements showed control of localized dose deposition and modulation, suitable to target volumes at depths 5-10 cm with mm resolution. Monte Carlo simulations provided additional data for further experiments. Based on these experimental findings and on numerical simulations, we discuss features and potentialities of laser-driven VHEE sources for radiotherapy. Perspectives for near term radiobiology experiments will be outlined, as well as the main requirements and the perspectives for a longer term translation of a laser-driven electron radiotherapy into the real clinical practice.

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