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Geant4 simulation of the ELIMED transport and dosimetry beamline for high-energy laser-driven ion beam multidisciplinary applications

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The ELIMED (ELI-Beamlines for MEDical and multidisciplinary application) beamline is being developed at LNS-INFN with the aim of focus, transport and select in energy proton and ion beams accelerated by laser-matter interaction at ELI-Beamlines (Prague, CZ). A Monte Carlo simulation has been developed to support the design of the beamline in terms of particle transport efficiency, optimize the beam parameters at the irradiation point in air and predict transport element parameters to deliver controlled dose distributions at the final irradiation point. The application has been developed with the Geant4 Monte Carlo toolkit and has been designed in a modular way in order to easily switch on/off geometrical components according to different experimental setups and User's requirements. Energy distributions, lateral beam profiles and longitudinal dose distributions in the in-air final section have been simulated selecting proton beams with energies ranging between 5 and 60 MeV and adopting laser-driven proton source generated by PIC (Particle In Cell) code able to simulate PW class laser system. Moreover, in order to produce longitudinal dose distributions of clinical relevance, preliminary simulations, for active-modulation of the beam energy varying the energy selector magnetic field, have been performed.

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