Beam Tracking Simulations for Stage 1 of the Laser-hybrid Accelerator for Radiobiological Applications (LhARA)

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The Laser-hybrid Accelerator for Radiobiological Applications (LhARA) is a unique and flexible facility proposed for radiobiological studies. The first stage of LhARA consists of an intense laser source interacting with a thin foil target producing a large flux of protons with energies up to 15 MeV. Particles will propagate through a combination of plasma (Gabor) lenses and magnetic elements to an achromat arc delivering the beam vertically to an *in-vitro* end station. An end-to-end simulation from the laser source to the end station is required to verify the conceptual design of the beamline. The laser-plasma interaction is simulated with Smilei (a particle-in-cell code) to produce a two dimensional (2D) distribution of particles. Whilst it is possible to simulate the laser plasma interaction in three dimensions (3D), access to the computing resources needed to run highly resolved simulations was not available. A sampling routine will be described which samples the 2D distribution to generate a 3D beam. The Monte Carlo simulation programs BDSIM and GPT were used to track the beam. Results of the simulations will be shown and compared to results of an idealised Gaussian beam.