AbstractID: 3872 Title: Simulation of dosimetric properties of very-high energy laser-accelerated electron beams

Purpose:
The dosimetric properties of "quasi-monoenergetic" very-high energy (170MeV+-20MeV) laser-accelerated electrons are studied to evaluate the adequacy for radiotherapy.
Method and Materials:
The experimental properties of a laser-accelerated electron beam are used. The Gaussian shaped high-energy part of the spectrum and the divergence of 10 mrad at FWHM are used as the initial phase space for Monte Carlo simulations.
The dose distribution in a water phantom of an electron beam produced by one single laser shot is computed. The simulations are performed with Geant4 and include electro-magnetic interactions and electron-/photon-nuclear processes.
The depth dose curve and the lateral profiles are determined. Furthermore penumbras of a 6x6 cm^2 treatment field and absolute dose values are given. In addition the dose deposition by electron- and photon-nuclear processes is quantified.
Results:
The depth dose curve shows a maximum at a depth of 19.2 cm. The lateral fluence profiles can be characterized by a sum of a Gaussian distribtution, which results from multiple Coulomb scattering, and a Lorentzian distribution.
The widths of the distributions increases from 3.0 mm at the beginning of the phantom to approximately 10.0 mm at a depth of 15.0 cm.
The penumbra defined as the distance between 80% and 20% dose for depths of 10 cm, 20 cm and 30 cm are 9.0 mm, 18.0 mm and 28.0 mm respectively.
The dose on the central axis for the treatment field, measured at the maximum of the depth dose curve, is 18 Gy. One way to reduce this dose is to vary the electron gas density. The reduction by a factor of 10 has been seen experimentally while a further reduction has to be investigated.
Conclusions:
In order to investigate the clinical potential of very-high energy laser-accelerated electron beams the dosimetric characteristics will be implemented in a treatment planning system.