This work is a feasibility study of a radiation treatment unit with laser-driven protons based on a state-of-the-art energy selection system employing four dipole magnets in a compact shielded beamline. The secondary radiation emitted from the beamline and its energy selection system and the resulting effective dose to the patient are assessed. Further, it is evaluated whether or not such a compact system could be operated in a conventional treatment vault for clinical linear accelerators under the constraint of not exceeding the effective dose limit of 1 mSv per year to the general public outside the treatment room. The Monte Carlo code Geant4 is employed to simulate the secondary radiation generated while irradiating a hypothetical tumor. The secondary radiation inevitably generated inside the patient is taken into account as well, serving as a lower limit. The results show that the secondary radiation emanating from the shielded compact therapy system would pose a serious secondary dose contamination to the patient. This is due to the broad energy spectrum and in particular the angular distribution of the laser-driven protons, which make the investigated beamline together with the employed energy selection system quite inefficient. The secondary radiation also cannot be sufficiently absorbed in a conventional linear accelerator treatment vault to enable a clinical operation. A promising result, however, is the fact that the secondary radiation generated in the patient alone could be very well...
shielded by a regular treatment vault, allowing the application of more than 100 fractions of 2 Gy per day with protons. It is thus theoretically possible to treat patients with protons in such treatment vaults. Nevertheless, the results show that there is a clear need for alternative more efficient energy selection solutions for laser-driven protons.