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Dose Simulation of Ultra-High Energy Electron Beams for Novel FLASH Radiation Therapy Applications

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The synchrotron-based ELSA facility delivers up to 3.2 GeV electrons to external experimental stations. In a new setup the irradiation of tumor cells with doses of up to 50 Gy by ultra-high energy electrons (UHEE) in time windows of microseconds up to milliseconds (FLASH) is currently investigated. This technique may enable highly efficient treatment of deep-seated tumors alongside optimal sparing and protection of healthy tissue. In a preliminary setting electrons with an energy of 1.2 GeV are used to irradiate cell samples which are located inside a water volume, representing the human body. The relative biological effectiveness (RBE) can be determined by assessing the cell survival of healthy and tumor tissues. For precise dose determination, simulations by Geant4 reproduce the electromagnetic shower process, taking the extracted electron pulse properties into account. The water volume consists of voxels of different sizes for precise investigation in the volume of interest. Various properties such as particle types, deposited energy and the energy spectra of the particle shower can be extracted. The method and first results in comparison to measured data will be presented.

Funding Agency

Footnotes

I have read and accept the Privacy Policy Statement

Yes

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