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Comparison of measurements and simulation results of dose for the FLASH radiation therapy beamline at PITZ

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The high-brightness electron beam at the Photo Injector Test facility at DESY in Zeuthen (PITZ) is now also used for FLASHlab@PITZ: an R&D platform for studying radiation biology and the FLASH effect in radiation therapy. The available parameter space of the electron beam with a momentum of 22 MeV/c allows bunch charges from 10 pC up to 5nC, bunch durations of 0.1–60ps, and bunch train lengths up to 1 ms. The number of bunches in the single train can currently be varied between 1 and 1000 bunches, with an upgrade to 4500 foreseen in 2023. Radiation biology studies require accurate dose prediction, therefore Monte Carlo simulations based on the FLUKA code were performed. According to estimations, dose delivery of 0.002 Gy (low charge case 0.1pC) and 10Gy (high charge case 5nC) is possible, if the beam is confined to a circular area with a radius of 5 mm with a lead collimator. For the Monte Carlo simulations, the experimental setup was accurately modeled, including the exit window, lead collimator, etc. Dose measurements were used to compare simulations with experiments. Dose profiles were experimentally measured with Gafchromic films and then compared with Monte Carlo simulations. The first experiments at FLASHlab@PITZ in 2023 have demonstrated flexible dose options for studying the FLASH effect and radiation biology studies

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Footnotes

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Yes

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