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FLASHlab@PITZ: current status and further development

An R&D platform for electron FLASH radiation therapy and radiation biology is being prepared at the Photo Injector Test facility at DESY in Zeuthen (FLASHlab@PITZ) [1]. This platform is based on the unique beam parameters available at PITZ: ps scale electron bunches of 6 to 22 MeV with up to 5 nC bunch charge at MHz bunch repetition rate in bunch trains of up to 1 ms in length repeating at 1 to 10 Hz. It can provide an extremely wide dose and dose rate parameter range tunable to user requests, from conventional dose rate of a few Gy/min up to ultra-high dose rates (UHDR) of 106 Gy/s (averaged over the pulse) and even up to 1012 Gy/s (averaged over the bunch). FLASHlab@PITZ will be used to systematically study dosimetry at UHDR and the FLASH effect in animals in order to optimize it for the benefit of cancer patients

A startup beamline has been put into operation at PITZ since 2022 for dosimetry studies and first in vitro experiments on chemical, biochemical and biological samples such as water, biopolymer, cancer and normal cells with various doses at conventional and ultra-high dose rates. A newly installed animal lab will allow studying FLASH effects with small animals such as zebrafish embryos and mice. In addition, a dedicated beamline for FLASHlab@PITZ has been designed and is being built to fully use the outstanding properties of the high brightness electron beams generated at PITZ. One highlight of the new setup will be a 2D kicker system to scan the tiny beams across the whole sample within less than 1 ms. Start-to-end simulations have been performed, showing that sub-mm RMS beam size (20 – 300 μm at exit window) can be reached in a huge charge range (sub-pC to 5 nC). In our contributions to the workshop we will present first in vitro studies and the preparation of the full FLASHlab@PITZ beamline. The potential radiation field distributions of a few cm width from a scattering foil and/or from pencil beam scanning provided by the upgraded beamline will be discussed.

The head of the PITZ facility is Frank Stephan (frank.stephan@desy.de). For beam time requests please contact Matthias Gross (matthias.gross@desy.de). A beam time request form will be available under https://pitz.desy.de/research_and_development

[1] F. Stephan et al., Physica Medica 104 (2022): 174-187.

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