Dosimetry development for extreme dose rate electron beams from laser-driven particle sources

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Radiotherapy is one of the primary modalities of cancer treatment. Flash radiotherapy (FLASH-RT) is a novel technique where the delivery of ultra-high dose rate irradiation maintains tumour control without harming surrounding healthy tissue. At present, FLASH-RT is recognized as one of the most promising breakthrough in radiation oncology; despite that, the underlying physical and biological mechanisms remain still unclear.

Laser-driven particle sources are promising sources for FLASH RT as they are able to deliver ultra-high dose rate due to their extremely short duration. Characterizing the delivered dose using these extremely short laser-driven particle sources forms an integral part of the comprehension of the physical mechanisms that trigger the FLASH effect. In this framework, we developed and tested an extremely sensible dosimeter system based on physicochemical reactions, especially suited for low charge beams. We will present the experimental developments obtained on UHI100 laser facility at CEA-Saclay. We will also discuss the perspectives of this work on our new facility, in the framework of INanoTheRad, a research consortium gathering different laboratories at the University Paris-Saclay aiming to develop innovative strategies in the fight against cancer, based on new irradiation sources and use of tumor target nano-agents and drugs to improve the effects of radiation.

References

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