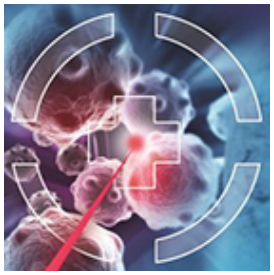

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The upcoming European Joint Research Project "Metrology for advanced radiotherapy using particle beams with ultra-high pulse dose rates"

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Several animal studies demonstrated that delivering radiation dose in a short time, i.e. with only a few beam pulses of ultra-high dose per pulse, may dramatically reduce adverse side effects, while the anti-tumoural efficacy is preserved. Due to this so-called FLASH effect, the prescribed dose could also be increased resulting in a more effective tumour control. The future application of FLASH radiation therapy requires that its performance, safety and effectiveness are reliably measured and optimised. Accurate dosimetry is vital in delivering successful radiotherapy.

Additionally, laser-driven accelerators are being considered as the next generation of cost-effective accelerators for radiotherapy, which enable further alternative advanced treatment modalities. Furthermore, novel laser wakefield accelerators allow the cost-effective generation of very high energy electrons (VHEE) which enable further alternative advanced treatment modalities, as for e.g. VHEE radiotherapy. The pulse duration of laser-driven beams is much shorter than that of conventional clinical accelerators and the dose rate in the pulse can be orders of magnitude higher.

FLASH radiotherapy, VHEE radiotherapy as well as laser-driven beams, cause significant metrological challenges related to the ultra-high pulse dose rates, which need to be addressed to enable the translation of these advanced radiotherapy techniques to clinical practice. The complexity and the resources needed for research in advanced radiation therapy using particle beams with ultra-high pulse dose rates requires wide, multidisciplinary scientific approaches that go beyond the capabilities of a single research institute. In the framework of the European Metrology Programme for Innovation and Research (EMPIR) the Joint Research Project "Metrology for advanced radiotherapy using particle beams with ultra-high pulse dose rates"will address this problem.

This work outlines the challenges and approaches at dosimetry for particle beams with ultra-high pulse dose rates and introduces the partners of the EMPIR research consortium as well as their task allocation.

Primary author: Dr SCHÜLLER, Andreas (Physikalisch-Technische Bundesanstalt (PTB))

Co-author: Dr KAPSCH, Ralf-Peter (PTB)

Presenter: Dr SCHÜLLER, Andreas (Physikalisch-Technische Bundesanstalt (PTB))