

FLASH Range QA Measurements with the Quality Assurance Range Calorimeter (QuARC)

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To ensure optimal patient safety with Proton Beam Therapy (PBT), several beam properties are measured as part of Quality Assurance (QA), with the proton range in water being a key parameter. Due to time restrictions in daily QA, comprehensive measurements are not made. Among many other technical challenges in realising FLASH PBT, current methods for range QA become unusable at the required high dose rates.

The QuARC is a compact detector for proton range measurements under development at UCL. The detector utilises a series of optically isolated scintillator sheets where each is coupled individually to a photodiode in order to sample the proton depth-light distribution. Fitting to an analytical depth-light model, the original depth-dose curve is reconstructed, and the proton range is measured in real-time to sub-mm precision, without any optical artefacts. Due to the nanosecond decay time of the plastic scintillator and the large dynamic range of the detector, range measurements are also possible at FLASH dose rates.

Presented are FLASH range QA measurements made with the QuARC at The Christie in Manchester, UK and UMCG PARTREC in Groningen, Netherlands at beam intensities up to 50 nA. These show excellent agreement with clinical current depth-light measurements made between 1–10 nA, all while providing real-time water-equivalent ranges accurate to 0.5 mm from 70–245 MeV. The results show a promising integrated QA solution for both, clinical and FLASH PBT.

Collaboration

Role of Submitter

I am the presenter

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