



Contribution ID: 40

Type: **not specified**

A scintillator-based range telescope for quality assurance in proton therapy

Monday 8 April 2019 15:00 (15 minutes)

In particle therapy, range measurements are an integral part of the daily quality assurance (QA) process. Most treatment centres use water phantoms or Multi-Layer Ionisation Chambers for the range QA. A system is under development at University College London to provide fast, robust and cost-effective range QA measurements based on a plastic scintillator range telescope. This detector would be easy to set up and allow the verification of all range steps of a typical particle therapy centre within the time of delivery.

The results of proof-of-principle experiments with clinical particle beams are presented. A prototype was built at UCL and tested in multiple treatment centres across Europe with protons, Helium and Carbon ions. The range reconstruction of protons has an uncertainty of 0.15 mm, complying with clinical standards for quality assurance detectors. During a radiation damage assessment a dose of 6,000 Gray was delivered to the range telescope, corresponding to approximately a year's worth of integrated dose. Although a reduction in the scintillator light output of a few percent was observed, there was no quantifiable impact on the range measurement itself.

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Session Classification: Parallel stream 3