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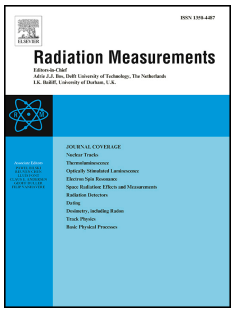

Feasibility study of a novel multi-strip silicon detector for use in proton therapy range verification quality assurance

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Feasibility study of a novel multi-strip silicon detector for use in proton therapy range verification quality assurance

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HIGHLIGHTS

- A multi-strip silicon detector has been designed for proton range verification.
- Detector response has been experimentally characterised at the INFN CATANA facility.
- Geant4 studies have been performed to theoretically characterise the detector response.

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ABSTRACT

The characterisation of a novel multi-strip silicon detector, the serial Dose Magnifying Glass, to incident 60MeV mono-energetic proton beams, typical for ocular melanoma treatment, was performed by means of Geant4 simulations and experimental methods. Geant4 simulations were performed to determine the applicability and potential of the detector for proton beam range verification with high spatial resolution. Experimental characterisation was performed using the CATANA beam line to confirm the Monte Carlo feasibility study and determine the detector response to incident proton beams of 5 mm, 13 mm, 25 mm and 36 mm diameter, in addition to the detector response when PMMA slabs are positioned between the detector and the beam nozzle. Results indicate the suitability of the detector for proton beam range verification in proton therapy Quality Assurance.

1. Introduction

Since the publication of R. Wilson's seminal paper (Wilson, 1946) discussing the potential use of protons as a therapeutic alternative to conventional X-ray radiotherapy to today, research into the benefits of this treatment has progressed at a significant rate. Reflecting this, the number of facilities providing proton therapy, and the number of patients treated, has grown at an increasing rate (Jermann, 2015). The benefit of using protons for cancer treatment is the reduction of the total integral dose delivered to normal tissue while achieving a very conformal dose in the tumor target. This is due to the finite range of

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