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Characterisation and Modelling of a Thick Segmented Cadmium Tungstate Scintillator Array

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A thick segmented cadmium tungstate scintillator array has been developed at the Rutherford Appleton Laboratory in partnership with the University of Surrey. The array was 1.2 cm x 1.1 cm x 4.4 mm and consisted of 25x24 segments with a 400 μm pitch. This array was created using a novel laser ablation technique. The GATE Monte-Carlo simulation package was used to understand key aspects of its measured performance, in particular the effect of segment pitch and thickness on the mean path length of scintillation photons and the number of reflections that the scintillation photons undergo in the segment. It was found that the mean path length of a scintillation photon was dominated by the optical coupling method which is key in high refractive index scintillators such as cadmium tungstate. The effect of the atomic number and density of the material separating each segment was studied. The higher density, higher atomic number materials had a signal enhancement effect and also reduced amount of cross-talk due to secondary radiation. The measured performance of the prototype array is shown and compared to an ideal array modelled using GATE.

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Primary author: Mr RICHARDS, Sion (University of Surrey)

Co-authors: LOHSTROH, Annika (University of Surrey); Dr BAKER, Mark (Univeristy of Surrey); WILSON, Matthew (STFC); SELLER, Paul (RAL)

Presenter: Mr RICHARDS, Sion (University of Surrey)

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