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Characterisation of a pixellated CsI detector for gamma-ray imaging

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The Distinguish collaboration is developing a technique capable of detecting and imaging hidden illicit substances such as explosives or narcotics in luggage and vehicles in transit [1]. To this end there is a requirement for a detection technique that is highly sensitive and highly specific. Pulsed Fast Neutron Analysis (PFNA) techniques [2] are used to stimulate the emission of characteristic gamma-rays, leading to the determination of the concentrations of the light elements (Oxygen –Eg = 6.13MeV, Carbon –Eg = 4.43MeV) that are normally used as primary components of explosive materials. This work is based on the Compton Camera principle [3] which aims to produce a 3D image of sources located in space. Compton Camera measurements are to be undertaken using a planar High purity Germanium (Ge) detector for scattering and an 8 x 8 pixel Caesium Iodide (CsI) detector as an absorber that is coupled to a Hamamatsu H8500 multianode. The CsI has been scanned to measure and characterise its performance. Detector characterisation allows quantification of the position dependant response of such a device. Principles of the experiment, testing procedures and some initial Ge/CsI Compton Camera images will be presented.

[1] M. Farahmand et al. "Detection of explosive substances by tomographic inspection using neutron and gamma-ray spectroscopy", NIMB 261 (2007) 396-400

[2] Gozani, T., "Novel applications of fast neutron interrogation methods", Nucl. Instr. and Meth. A. 353 (1994) 635

[3] D. B. Everett, J. S. Fleming, R. W. Todd, and J. M. Nightingale, "Gamma-radiation imaging system based on the Compton effect", Proc. ZEE, Vol. 124, pp. 995-1000, 1977.

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