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Development of a pin-hole collimated camera: The CoNG (Compact Neutron-Gamma) Imager

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Detectors in the field of Nuclear Security are generally of the larger static format, however, complementary measurements provided by more portable and compact systems are often essential. Similarly, in environmental radiation situations it is necessary to quickly determine the location of an unknown source, and of particular interest is the ability to discriminate between neutron and gamma ray interactions. To provide a solution to these issues the mature technique of pin-hole collimation is combined with recent developments in scintillation, photomultiplier, and digital data acquisition technologies.

The imager itself comprises a position sensitive Hamamatsu PMT coupled to the new EJ299-33 plastic scintillator. EJ299-33 has been specifically developed to take advantage of the pulse shape discrimination (PSD) phenomena for neutron-gamma separation. The multi-anode readout of the PMT allows for a coarse degree of position resolution in an X-Y plane with 6 anodes in each direction, whereas the plastic scintillator exhibits the PSD phenomena allowing for detection, and separation, of both neutron and gamma-ray signals. The detector readout is provided by a fast CAEN digitiser system with analysis performed offline to take advantage of our parallel investigations into a variety of PSD algorithms.

We report the gamma spectroscopic performance as a function of PMT anode, and basic imaging functionality for known locations of standard laboratory sources (241-Am, 22-Na, 57-Co, 60-Co, 137-Cs) along with the preliminary results of a mixed radiation (fast neutron –gamma ray) field survey.

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