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Testing New Fast Neutron Scintillators with a D-T Neutron Generator

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Prototype scintillator screens were fabricated in various formats and variations, and tested with fast neutrons from a D-T neutron generator at Adelphi Technology in Redwood City, CA. The scintillators were designed with combinations of plastics+scintillator in which the hydrogen in the plastic acts as a converter for the fast neutrons producing a proton recoil reaction to yield photons within the scintillator. Both mixed and layered plastic/scintillators were tested. Mixed scintillators were made with polystyrene and ZnS:Cu, and layered scintillators included polystyrene, HDPE (high density polyethylene), coated with a layer of ZnS:Cu scintillator. The various scintillator samples were lens-coupled to an Andor EMCCD detector for imaging with the D-T neutron source that produces 14.1 MeV neutrons with a neutron output of 10^8 neutrons/second.

The mixed scintillator screens of polystyrene/ ZnS:Cu produced the best results and images could be acquired on the time scale of minutes with scintillators on the order of 3 mm thick. Imaging performance was similar to Tritec PP/ZnS screens that were included for comparison. Of the layered scintillators, 3 mm polystyrene and 100 micron ZnS:Cu produced the best results. The complete imaging results will be presented. GEANT 4 simulations were also performed to optimize the thickness of conversion and scintillator layers.

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