

Abstract

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Extracting Neutron Energy Spectra Using a Handheld Dual Particle Imager

A handheld dual particle imager (H2DPI) composed of stilbene and LYSO(Ce) pillars (6x6x6 mm³) coupled to silicon photomultipliers has been built and shown to be capable of imaging neutrons and gamma rays emitted by special nuclear material. Neutron imaging in the H2DPI is performed by reconstructing neutron double-scatter events, which makes the system a fast-neutron spectrometer. The spectroscopic capability of the system was tested by imaging a Cf-252 and PuBe source separated by 55.6° to see if the sources could be individually identified by their emitted neutron spectra. Imaging results showed that the two sources could be resolved in imaging space and a methodology was implemented for determining if a given neutron originated from one of the resolved locations. Spectroscopic results found an average neutron energy emitted by the Cf-252 source to be 2.90 MeV and 3.91 MeV from the PuBe source. The sources were also individually measured and the measured spectra for a single source present agreed well with the extracted spectra for each source with both sources present. These results demonstrate that the H2DPI can image and identify multiple neutron sources in the same field-of-view.