



Contribution ID: 160

Type: **Oral presentation**

A Fast Neutron Scintillation Detector in Homeland Security Applications

Thursday, 7 July 2011 09:05 (20 minutes)

A neutron scintillation detector based on high-pressure He-4 has been developed and demonstrates excellent response to elastic scattering of fast neutrons. The detector removes the need for moderation allowing the preservation of neutron spectral information. Neutrons from three different sources, AmBe, Cf-252, and from the ambient background, have been measured with clearly distinct energy spectra. Exposing the detector to different levels of gamma radiation up to 1 mSv/h from a Co-60 source has demonstrated that gamma exposure does not affect neutron detection performance within measurement statistics. Presented simulations and measurements show that even for shielded neutron sources, a finite number of fast neutrons punch through shielding without undergoing scattering processes. Since fast neutron detectors can reject background neutrons on the basis of spectral information, the detection of only a small number of neutrons can rapidly provide a significant signal relative to all backgrounds allowing the detection of even weak sources. Furthermore, fast neutron detectors can distinguish industrial neutron sources, such as AmBe, from potentially critical fission sources, such as Pu-239, allowing responders to take appropriate threat adapted procedures. Preliminary results of the detectors imaging capabilities for source localization are presented.

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Session Classification: Applications III

Track Classification: Applications