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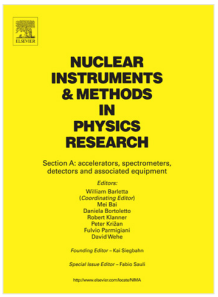

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Simulations of Si-PIN Photodiode Based Detectors for Underground Explosives Enhanced by Ammonium Nitrate

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Abstract

Massive Ammonium Nitrate (NH_4-NO_3) based explosives buried underground are commonly used in terror attacks. These explosives can be detected using neutron scattering method with some limitations. Simulations are very useful tools for designing a possible detection system for these kind of explosives. Geant4 simulations were used for generating neutrons at 14 MeV energy and tracking them through the scattering off the explosive embedded in soil. Si-PIN photodiodes were used as detector elements in the design for their low costs and simplicity for signal readout electronics. Various neutron-charge particle converters were applied on to the surface of the photodiodes to increase the detection efficiency. Si-PIN photodiodes coated with ^{6}LiF provided the best result for a certain energy interval. Energy depositions in silicon detector from all secondary particles generated including photons were taken into account to generate a realistic background. Humidity of soil, one of the most important parameter for limiting the detection, was also studied.

Keywords: Geant4, Explosives, Si-PIN Photodiodes, Neutron Detection, Monte Carlo Simulations, Ammonium Nitrate

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