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Feasibility of thermal neutron detection using boron doped graphene films coupled to Silicon Photon Multiplier detector

Efficient neutron detection is essential in medical physics, materials science, and nuclear security. However, the global shortage of ^{3}He has motivated the development of alternative neutron converters, such as boron based materials.
In this work a study was conducted using Monte Carlo methods and an experimental setup to investigate the possibility of detecting thermal neutrons using boron-doped graphene films. Geant4 was used to simulate an Americium-Beryllium neutron source, lead shielding, a paraffin moderator, a boron-doped graphene converter, and the subsequent detection of the reaction products in a scintillator material coupled to a SiPM. Experimental data were taken with a CAEN SP5600 kit® and an AmBe source to validate the simulation.
The simulated and experimental data were compared showing a good agreement. The results indicate that a Boron-graphene coupled to a scintillator and SiPM detector system, optimized and validated through Geant4 simulations, represents a compact and cost-effective platform for thermal neutron detection.

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