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# Development of a gamma-blind neutron-efficient detector using silicon detectors and a reactive lithium film.

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The use of silicon detectors with neutron-reactive films provides a compact technology for thermal-neutron detection. A thermal-neutron detector has been developed utilizing the 6Li(n,alpha)3H reaction. A detector with a stable 6LiF layer has been produced and tested, while a detector designed to use a pure 6Li metal film is nearing completion. The challenge for this latter design is to prevent the chemical degradation of the highly reactive lithium layer and keep a stable detector/lithium assembly for long term operations.

In order to reliably identify thermal neutron capture reactions even when gamma radiation is present, techniques for gamma-ray suppression have been investigated. By having the suitably thin reactive layer sandwiched between two silicon detectors, it has been possible to detect alpha-triton coincidences, which is being explored as an efficient method of gamma-ray suppression. The identification of alpha-triton pairs through methods of pulse-height discrimination in both detectors has been investigated.

Geant4 simulations of this configuration have been performed to optimize the thickness of the 6Li and 6LiF layers for maximum neutron detection efficiency and gamma rejection. The response of a detector (with 6LiF coating) to thermal neutrons and gamma rays has been compared with simulation results.

New electronics and DAQ boards required for a multi-layer detector have been designed which will allow the targeted high neutron-detection efficiencies (of ˜20%).

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