

## 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  ${}^6\text{Li}(n,\alpha){}^3\text{H}$  reaction. A detector with a stable  ${}^6\text{LiF}$  layer has been produced and tested, while a detector designed to use a pure  ${}^6\text{Li}$  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  ${}^6\text{Li}$  and  ${}^6\text{LiF}$  layers for maximum neutron detection efficiency and gamma rejection. The response of a detector (with  ${}^6\text{LiF}$  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  $\sim 20\%$ ).

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