Abstract

Felicia Sutanto
University of Michigan
fsutanto@umich.edu

SANDD: A directional antineutrino detector with segmented 6Li-doped pulse-shape-sensitive plastic scintillator

We present a complete characterization of components of a small (9-liter) and mobile 6Li-doped pulse-shape-sensitive plastic scintillator antineutrino detector called SANDD (Segmented AntiNeutrino Directional Detector), constructed for the purpose of near-field reactor monitoring. The central module of SANDD comprises an 8×8 array of 40 cm long scintillator rods, each with a square cross section of 5.4 mm × 5.4 mm, coupled to two 64-channel SiPM arrays. The central module is surrounded by a layer of larger cross section bars of the same material, each 2.5 cm x 2.5 cm x 40 cm and surrounded again by another layer of bars, each 2.5 cm x 5 cm x 40 cm. Each bar is coupled to a pair of 1” PMTs. The central module and the large cross section bars have been characterized. A detailed Monte Carlo simulation code was developed and validated to model the performance of each of the detector elements. The performance of the full detector was investigated using a Monte Carlo simulation. Analysis cuts were developed to strike a balance between the antineutrino detection efficiency and the misclassified background rate. The antineutrino detection efficiency and the background rate will be used to study the feasibility of an aboveground deployment at a nuclear reactor.