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Development of a segmented fast neutron spectrometer based on ^{6}Li-loaded liquid scintillator for measuring neutron background CHRISTOPHER BASS, CRAIG HEIMBACH, JEFF NICO, National Institute of Standards and Technology, ELIZABETH BEISE, HERBERT BREUER, DYLAN ERWIN, TOM LANGFORD, University of Maryland — Fast neutrons induced by natural radioactivity and cosmic rays are important sources of background for low-background experiments such as direct detection of dark matter, neutrinoless double beta decay, and solar neutrinos. One technique for measuring neutron flux employs a delayed coincidence between recoil protons and thermal capture in a liquid scintillator loaded with ^{6}Li, which ensures that the fast neutron energy is fully absorbed in the scintillator. Fast neutrons are efficiently thermalized in the liquid scintillator, and the recoil protons provide energy information of the incident neutron. The subsequent neutron capture on ^{6}Li provides a clean unambiguous signal at 530 keV$_{ee}$ that the incident particle was a neutron rather than a background event. Good energy resolution is achieved by compensating the nonlinear light yield of the scintillator with optically segmented sections, which minimize the number of multiple recoil protons per scintillator element. We discuss characteristics and development of a segmented detector, including calibration and associated analysis tools.

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