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Position Sensitive Organic Glass Scintillator Bars for Neutron Time of Flight Spectroscopy

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Neutron time of flight spectroscopy is a valuable tool for a wide range of nuclear physics experiments. These include direct measurements of astrophysical (α,n) or (p,n) reactions; nuclear spectroscopy through transfer reactions such as (d,n); and decay spectroscopy of neutron-unbound states. Such experiments require fast neutron detectors with high detection efficiency, sub-ns timing resolution, and position sensitivity on the order of a few centimetres. In many cases, neutron/γ-ray discrimination capabilities are also required to eliminate prompt and random γ-ray backgrounds.

Recently, a new scintillaor material, composed of an organic glass (organic glass scintillator, OGS) has been exploited for neutron detection. This material has good efficiency for detecting $gtrsim1$ MeV neutrons, fast timing capabilities, and excellent n/γ pulse shape discrimination properties. As a glass, the material can be cast in a mold, allowing a wide range of detector geometries. This talk reports our recent efforts to characterize extended $1'' \times 1'' \times 5''$ bars of OGS, read out by a photo-multiplier tube on either end. The talk focuses on bench-top measurements with γ-ray and neutron sources characterizing the detector's energy resolution, position sensitivity, timing resolution, and n/γ separation capabilities. Possible applications of these bars to future nuclear physics measurements will also be discussed.

Keyword-1

neutron spectroscopy

Keyword-2

nuclear instrumentation

Keyword-3

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