

Organic scintillators remain underexplored and underutilized in reactor field characterization and monitoring experiments, with no recent examples found in literature. Nuclear reactor monitoring, nuclear safeguards, and other nonproliferation activities may benefit from the dual particle detection capabilities of organic scintillators. To address this knowledge gap, we recently performed experiments in the fast neutron beam port of the Ohio State Research Reactor (OSURR), a light water moderated MTR-type reactor that may be operated at up to 500 kW. We used two types of detectors, namely organic glass scintillator (OGS) and stilbene, to investigate their performance for pulse shape discrimination (PSD), efficiency, and gamma-ray versus neutron pulse height spectra. We further compared different detector sizes, specifically a 51 mm stilbene to 25 mm OGS and stilbene as well as OGS 6 mm cubes. We show that the gamma pulse height spectra show distinct Compton edges that may correspond to gamma-ray emission lines from the reactor, for example H(n,g). We also discuss how reactor power and detector volume impact the energy dependent efficiency for neutrons and gamma rays.