Monte Carlo simulation of response function of organic scintillators to gamma rays and neutrons using FLUKA, MCNPX and SCINFUL code

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Abstract
In organic scintillators, the energy distribution of gamma photons and neutrons is indirectly measured by the pulse height distribution of output light produced through gamma ray and neutron reactions in the detectors. Accurate estimate of gamma and neutrons interactions with scintillators in the detector, production of charged secondary particles and subsequently the production of scintillation light in different energy levels of gamma, especially neutron, are the most important factors in the calculation of scintillator response function. The complexity of the light generation on these scintillators makes modeling their response function with standard Monte Carlo method difficult. This paper reports on the calculation of the response function of an NE102 plastic scintillator when exposed to Cs gamma rays, and mono-energetic neutrons as well as response function of a BC501A liquid scintillator to mono-energetic and Am-Be neutrons using the EVENTBIN card of the FLUKA code and the PTRAC card of the MCNPX code. The comparison between simulated and experimental response functions show that both FLUKA and MCNPX codes generated distributions are in good agreement with SCINFUL code simulation and the corresponding experimental results.

Keywords: neutrons, response function, organic scintillators detector, FLUKA, MCNPX

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