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A new approaching method of PSD technique on charge integration ratio to improve neutron/gamma discrimination in low-energy region for EJ-299-33 plastic scintillation detector

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Charge integration ratio (Qratio), method in the Pulse Shape Discrimination (PSD) technique has been widely used to discriminate between fast neutron and gamma in organic scintillation detectors. In this method, for neutron signals, in low-energy region of less than hundred keVee, Qratio of scintillation detectors has highly energy dependence. This leads to Figure of Merit (FOM), a quantity characterizing for neutron/gamma separation, worse. In this work, we introduce a new approaching method of PSD technique on the charge integration ratio to improve the FOM quantity in the low-energy region threshold. The technique of this new method is to normalize Qratio of neutron signals to be as a constant, or independently, versus energy.
We study for an EJ-299-33 plastic scintillator of (14x40x14)mm3, a commercial product of ELJEN technology, which is known for its good performance of separating gamma and fast neutron signals on the basis of their timing characteristics. We conduct an experiment on Cf-252 radioisotope source. A comparison of conventional method and new method of charge integration ratio is carried out in energy thresholds from 100keVee to 1000keVee to evaluate the neutron/gamma discrimination.

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