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Neutron detection efficiency of scintillation detectors

NEUTRON DETECTION EFFICIENCY
OF SCINTILLATION DETECTORS
The results of measurements of neutron detection efficiency ε(En), En ≈ 0.1 ÷ 6 MeV for detectors of MULTI setup [1, 2] are presented. The measurements of ε(En) for scintillation detectors (CeBr3, NaI(Tl), CsI(Tl), stilbene) were carried out by tagged neutron method using
239Pu/9Be and 238Pu/13C n-γ sources and Trigger-detector (see 2 in Fig.1). Trigger-detector was used for registering γ-quanta with Eγ = 4.43 MeV and 6.13 MeV from sources 239Pu/9Be and 238Pu/13C respectively. Neutron energy values was taken from the time of flight TOF. Time scale of TOF was calibrated by γ-γ coincidence measuring (Single escape and Double escape peaks in Trigger detector and annihilation γ-peak in tested detectors).
The measurements have shown that CeBr3, NaI(Tl), and CsI(Tl) detectors have a relatively high neutron detection efficiency which is weakly dependent on the energy at En ≈ 0.5 ÷ 6 MeV and can be used for neutron detection by TOF. For example, efficiency is ε(En) ≈ 36% at En = 0.5 ÷ 6 MeV for CeBr3 5×5×5см3 detector.
Stilbene detectors have good n-γ pulse shape separation, but sharp energy dependence of the efficiency ε(En) at energy range En ≈ 0.5 ÷ 6 MeV (ε ≈ 50% and 10% for En = 0.5 MeV and 6.0 MeV, respectively).
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Section

Applications of nuclear methods in science, technology, medicine and radioecology

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