Contribution ID: **147** Type: **Oral talk (15 min + 5 min questions)**

Neutron response function of CeBr3-NaI(Tl) phoswich spectrometer for 1.0 ÷ 5.5 MeV neutron energy range

Wednesday, 13 July 2022 18:30 (20 minutes)

The γ-spectrometer [1] which was assembled from 9 CeBr3-NaI(Tl) phoswich detectors [2] is a unit of the MULTI facility at the FLNR, JINR (Dubna) for studying the γ-emission in exotic decay of neutron-rich weakly bound nuclei like β-decay through giant dipole and pygmy resonances. It was reported [1] a high time and energy resolution, high peak and suppression efficiency of this spectrometer operated in the Compton suppression mode. This report is devoted to neutron detection efficiency and influence of neutron background on γ-spectra, particularly spectra obtained in the Compton suppression mode.
The energy dependence of neutron detection efficiency at En = 1.0 5.5 MeV energy range has been investigated. The measurements were carried out by the method of tagged neutrons and 239Pu/9Be source. The α-decay of 239Pu is not accompanied by γ emission. Only γ quanta Eγ = 4.43 MeV from the 9Be(α, n)12C* reaction can accompanied the neutrons in about 60% of reaction events. These γ quanta can be used as a trigger in the method of tagged neutrons and for En measuring by Time-of-Flight.
The main characteristics of the γ-ray spectrometer are presented: energy resolutions ΔE, n-γ detection efficiency δγ(E) and δn(E) depending on the γ and n energy, respectively. The special attention was focused on the studying of neutron detection efficiency δn(E) of the CeBr3 component of phoswich detectors for Compton suppression mode. The pulse shape analysis of phoswich detector scintillation pulses was carried out by VME unit Mesytec MDPP-16 QDC pulse processor [3]. The neutron detection efficiency was obtained from tagged neutron spectra normalized to published [4] neutron spectra from a 239Pu/9Be source.

1. Zh. Zeinulla, Yu.G. Sobolev, S.S. Stukalov, I. Sivacek, Yu.E. Penionzhkevich, Gamma-ray spectrometer assembled from 9 CeBr3-NaI(Tl) phoswich detectors, Acta Physica Polonica B, Vol.14, N4, pp.. 755-760, (2021);
2. M. Gierlik et al., IEEE Transactions on Nuclear Science 53, 1737 (2006).
3. A. Ruben et al., «A New, Versatile, High-performance Digital Pulse Processor with Application to Neutron/Gamma-Ray Pulse-Shape Discrimination in Scintillator Detectors», DOI:10.13140/RG.2.2.14187.18727.
4. Van der Zwan, L. 1968. Can. J. Phys., 46, 1527.

The speaker is a student or young scientist

Yes

Section

1. Applications of nuclear methods in science and technology

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