

INVESTIGATION OF γ -RAY SPECTROMETER BASED ON SCINTILLATION PHOSWICH-DETECTORS

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A method for registering high-energy γ -rays using the array of $9 \times \text{CeBr}_3\text{-NaI(Tl)}$ phoswich-detectors [1] is investigated. The technique makes it possible to identify high-energy γ -rays formed during the γ -decay of giant dipole resonances (GDR) from cascades of low-energy "yrast" γ -rays with a similar total energy. The main characteristics of gamma-ray spectrometer: the energy resolutions ΔE , the total registration efficiency $\delta\gamma$ and the registration efficiency at the peak of the total absorption δPEAK , depending on the energies E_γ of the registered γ -rays and on the distances to the source are presented. The measurements of the γ -spectrometer characteristics were carried out using the VME DAQ-system [2] by tagging γ -ray method. Complex forms of scintillation signals of phoswich-detectors were studied using digital (Mesytec MDPP-16) and analog (Mesytec MADC-32, MQDC-32) electronics [2]. Both approaches (analog and digital) made it possible to clearly separate the CeBr_3 and NaI(Tl) components of scintillations. The characteristics of the γ -ray spectrometer in the Compton suppression mode are measured based on the analysis of the scintillation signal's shapes. The experimental data were compared with the calculations (see Fig. 1) carried out by the Monte Carlo method of the GEANT4 program [3].

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Fig. 1. The total efficiency δTOTAL (left) and peak efficiency δPEAK (right) as a function of distance to γ -source ^{60}Co . The measurements for tagging γ -rays with $E_\gamma = 1173$ keV.

1. <https://scionix.nl/scintillation-detectors/> - website of the manufacturer of scintillation detectors Scionix;
2. <https://www.mesytec.com/> - website of Mesytec;
3. <https://geant4.web.cern.ch/support/download> - GEANT4 (CERN).

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