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# Development of a facility for fast neutron spectrometry using a plastic scintillator EJ-276 with PSD capability

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The paper presents the development stage of an installation for fast neutron spectrometry using an EJ-276 plastic organic scintillator including the results and processing of measurements of mixed gamma-neutron spectra of an ING-07T pulsed neutron generator, calibration of the spectrometer, and unfolding of neutron spectra. Separation of signals from gamma and neutron radiation was carried out on a CAEN-DT5730 digitizer using the pulse shape discrimination (PSD) method. The obtained experimental results are compared with the results of mathematical modeling in the GEANT4.

The PSD spectra of the ING-07T pulsed neutron generator with and without a neutron moderator were measured, as well as the spectra of the spontaneous fission source Cf-252. As a result it was possible to successfully separate the mixed signal of the neutron generator into signals generated by gamma and neutron radiation with acceptable quality (parameter Figure of Merit (FoM) ˜ 1.5 at a radiation detection threshold of 200 keV). At the same time, PSD separation with FoM> 1 is considered to be of high quality.

The spectrometer based on an organic scintillator was calibrated. Calibration in this case is an independent task due to the absence of full absorption peaks in the energy spectrum and is carried out along the Compton edges by using simulated spectra. In addition, it was shown that, due to the different light outputs from neutron and gamma radiation, calibration should be carried out separately for each type of radiation (in this case, according to the electrons and protons of the recoil). At the same time, neutron calibration was carried out based on our own experiment and published data on measuring the light output in an EJ-299 plastic scintillator (analogous to EJ-276) [1-3].

Moreover, the neutron energy spectra of a pulsed neutron generator and a spontaneous fission source Cf-252 were unfolded using least squares method and maximum entropy method (MAXED program). It is shown that results of unfolding are correct and, therefore, this technique will allow us to restore spectra from other types of neutron sources.

References:

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