Computer Simulation Process of Neutron Transport in Liquid Scintillator Filled Multi-Module Neutron Detector

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Investigation of (Prompt Fission Neutrons) PFN is important in study of process of scission of nuclei, due to PFN multiplicity carry information on nucleus excitation energy. For detailed study of fission fragments mass and excitation energy distributions in along with properties of prompt fission neutrons in reactions ^{235}U(n,f), ^{237}Np(n,f), ^{239}Pu(n,f), induced by resonance neutrons and in spontaneous fission of ^{252}Cf, the neutron detector, consisted of 32 PFN detectors modules manufactured by SIONICS (Netherlands) company was located in resonance neutron beam of IREN Facility of JINR in Dubna (Russian Federation). PFN emitted in fission, induced by the neutrons in the resonance energy range irradiated the U-235 target, located on the common cathode of a double Frisch-gridded ionization chamber (IC). Exited fission fragments emitted PFNs, which were detected PFN detector modules. Fission fragments were detected in IC, where their kinetic energies and emission angles were measured. For each fission event the following information was obtained: event time stamp, fission fragment (FF) emission angle, its kinetic energy and pulse shape information. PFN detector was able to separate PFN from background gamma radiation. Multi-module structure of PFN detector gives the advantage of high detector efficiency value, from the one hand and the multiple scatterings creates drawback of false multiplicity of events. In that situation we need to determine the share of events created by multiple scattering, using computer simulation of process neutron travelling inside the detector body. To do that we developed computer program, generated 20 scenarios with 500000 events with PFN emissions in each scenario. In these calculations we determine the possible systematic errors level connected with multiple scattering does not exceed the level of 5%. In our calculations we took into account the share of neutrons reflected from surroundings, especially from the floor.

$N^{real} \sim 0.95 \cdot N^{visible}$, where $N^{visible}$ is the number of events registered by neutron detector, N^{real} is the actual number of neutrons detected in the system.