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COMPACT NEUTRON CALIBRATION SOURCE BASED ON 252Cf RADIONUCLIDE AND A SILICON SEMICONDUCTOR DETECTOR

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This work will demonstrate the operation of a model of compact neutron calibration source. Compact neutron calibration source is highly needed for calibration and response function determination of WIMP-oriented dark matter detectors and electron antineutrino detectors. This could be done with neutron calibration source with either known neutron energy spectrum, or by time-of-flight (ToF) neutron energy reconstruction.
Suggested neutron calibration source is based on Californium-252 radionuclide which undergoes spontaneous fission producing neutrons with a continuous spectrum and a semiconductor detector. The latter upon registration of fission fragments signal provides a time reference of the moment of neutron creation.
For registration of the fission fragments signal we used a silicon semiconductor detector with thin entrance window. Performed investigations have proved that such a detector may withstand exposure of up to 10ˆ9 of fission fragments before the critical degradation of its operating parameters occurs [1]. The spectra of neutrons and γ-quanta produced during the spontaneous fission of 252Cf nuclei were recorded with help of PMMA scintillator equipped with photomultipliers of type 97. The scintillator represents a cylinder with a wall thickness of 7 cm and an internal diameter of 13 cm. In the center of scintillator cylinder a 252Cf source and a semiconductor detector were placed.
These two registration channels for neutrons and fission fragments, respectively, operates in the coincidence mode in order to establish the correlation between the fission fragments and neutron / γ-quanta signals, which, in turn, can be separated by accounting the delay time of the neutron arrival. Therefore, the possibility of using a combination of the semiconductor detector and 252Cf radionuclide as a compact neutron calibration source will be demonstrated.

1. S.V. Bakhlanov, A.V. Derbin, I.S. Drachnev, O.I. Konkov, I.M. Kotina, A.M. Kuzmichev, I.S. Lomskaya, M.S. Mikulich, V.N. Muratova, N.V. Niyazova, D.A. Semenov, M.V. Trushin, E.V. Unzhakov, Journal of Physics: Conference Series 2103, 012138 (2021).

The speaker is a student or young scientist

No

Section

1. Design and development of charged particle accelerators and ionizing radiation sources

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