Analysis of the lacl3 detector response function during measurements of fast neutrons [[1]](#footnote-1)\*)

DOI: 10.34854/ICPAF.2023.50.2023.1.1.242

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The work presents the study of the response function of a new fast neutron scintillation spectrometer based on the LaCl3(Ce) crystal and its comparison with the model. The method proposed in [1] for detecting neutrons in the energy range of 2–5 MeV using this detector has significant potential for modern fusion facilities operating with deuterium plasma. Registration of fast neutrons is based on the use of the 35Cl(n,p)35Sg.s. reaction.

The response function of a detector based on a crystal Ø25.4×25.4 mm in size was studied in two experiments: in the radiation field of the ING-07D neutron generator as well as during an experimental campaign at the Ioffe Institute cyclotron. There, a discrete energy distribution of neutrons was produced in the 9Be(α,n)12C reaction, with the source being a beryllium target irradiated with alpha particles. In both experiments, the detector signal was digitized by a fast ADC with a sampling rate of 500 MHz and a 14-bit capacity.

In preparation, the energy scale of the detector was calibrated using standard OSGI γ-sources and using the intrinsic background of α-radiation. Utilizing the digital pulse-shape discrimination method, the neutron components of the signal were separated. The obtained amplitude spectra, as well as the results of modeling the detector response using the GEANT4 software [2], make it possible to estimate the p/β ratio for this crystal, evaluate the sensitivity and energy resolution of the spectrometer, and also analyze the spectrum and determine the observed reactions. The achieved neutron resolution is 7% and the p/β coefficient ~0.8.

The results demonstrate that the LaCl3(Ce) detector can be successfully used for the purpose of fast neutron spectrometry in the DD-neutron energy range, including experiments with deuterium plasma on operating tokamaks.

The work was carried out within the framework of the implementation of the Working Agreement No. 1 (ITER ref. IO/21/CT/4300002685) between the International Organization ITER, the Private Institution "ITER-Center" and the Federal State Unitary Enterprise "VNIIA".

References

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1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/L/E/ru/JV-Pankratenko.docx) [↑](#footnote-ref-1)