ANALYSIS OF THE CHARACTERISTICS OF LACL3 FOR THE PURPOSE OF NEUTRON DIAGNOSTICS OF DEUTERIUM PLASMA [[1]](#footnote-1)\*)

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A new method for registration of DD-neutrons using LaCl3(Ce) scintillation detector is proposed in [1]. Detection of fast neutrons is based on registration of protons from 35Cl(n,p)35S reaction. A digital method of pulse shape discrimination (PSD) for LaCl3(Ce) is described in this work. Such a discrimination allows for separation of γ-rays, neutrons and α-particles, enabling reliable measurements of fast neutron energy distribution.

Over the course of the experiment the following was achieved: the intrinsic radiation spectrum of the LaCl3(Ce) crystal was obtained, the response to a flux of DD-neutrons from the ING-07D fast neutron generator was measured, optimal PSD parameters were discerned based on the measurements. These steps allowed for building a well-discriminated spectrum for α-, γ- and neutron radiation. The α/β and p/β ratios, the characteristics of LaCl3(Ce) light output, were calculated for multiple energies of neutrons, which was achieved by placing the detector at several positions around the DD-neutron generator target, and for multiple energies of the intrinsic α-particles.

The experimental results show the significant potential for the LaCl3 detector application to the fast DD-neutron measurements... An opportunity for calibration of a LaCl3-based detector using the crystal’s intrinsic radiation is also demonstrated [2].

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References

1. Kormilitsyn T. et al., “On the fast neutron detection with the LaCl3(Ce) scintillation detector”, *Physics of Elementary Particles and Atomic Nuclei, Letters*, 2021, Т.18, №1(233), 86-97.
2. Hartwell, J.K., & Gehrke, R.J. (2005). Observations on the background spectra of four LaCl3(Ce) scintillation detectors. *Applied Radiation and Isotopes*, *63*(2), 223–228. <https://doi.org/10.1016/j.apradiso.2005.02.009>
1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/XLVIII/E/ru/HW-Pankratenko.docx) [↑](#footnote-ref-1)