EXPERIMENTAL MEASUREMENTS OF THE NEUTRON YIELD AT THE GLOBUS-M2 TOKAMAK [[1]](#footnote-1)\*)

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The first measurements of neutron fluxes emitted from the tokamak plasma were started at the Globus-M facility and continued after its upgrade to Globus-M2. The production of neutrons at these facilities is mainly due to the reactions of nuclear DD fusion during the interactions of high-energy particles that arise during plasma injection heating with thermal particles, as well as with each other. Thus, the neutron flux is an integral value that reflects the processes occurring with high-energy ions in plasma.

In the summer of 2022, the reconstruction of the neutron diagnostics of the Globus-M2 tokamak was completed, consisting of two corona counters in a polyethylene moderator (SNM-11 using the 10B isotope) and two BC-501A neutron spectrometers (based on a liquid organic scintillator). The modernization consisted in the manufacture of collimators from lead and polyethylene, which made it possible to regulate the neutron load of the detectors, as well as their line of sight. After modernization, the in situ calibration of the neutron detectors was repeated using a reference neutron source [1]. Thus, the diagnostics was adapted to the new operating conditions with significantly increased fields of neutron and hard X-ray radiation.

In this work, the calculated values of the neutron yield [2] are compared with the experimentally measured values for different operation modes of Globus-M2: the value of the toroidal magnetic field varied in the range of 0.5–0.9 T, plasma current – in the range of 0.2–0.4 MA, the average electron concentration varied in the range of 1019–1020 m-3 at the energy and injection power in the range from 20 keV 250 kW to 48 keV 1400 kW. The reasons for the discrepancy between the results of calculations and the results of experiments are also considered. In addition, new measurements made it possible to verify the predictions [3-5] about the neutron yield for the Globus-M2 facility when it reaches the design parameters.

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References

1. Skrekel O.M. et al. Technical Physics, 2022, Vol. 92, No. 1
2. Skrekel O.M. et al. Technical Physics Letters, 2021, Vol. 47, No. 2
3. Bakharev N.N. et al. Nucl. Fusion 55 (2015) 043023
4. Kornev V.A. et al. Nucl. Fusion 57 (2017) 126005
5. Minaev V.B. et al. Nucl. Fusion 57 (2017) 066047
1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/L/Mu/ru/BL-Skrekel.docx) [↑](#footnote-ref-1)