Concept OF thermal helium beam diagnostics for T-15MD [[1]](#footnote-1)\*)

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Plasma-wall interaction has a significant impact on the confinement conditions and the achievement of high plasma parameters in fusion devices, therefore, studying the edge plasma is an urgent task. For that reason, thermal helium beam (THB) diagnostics is widely used for measuring electron density and temperature profiles in the separatrix region and so-called scrape-off layer (SOL). Thermal helium beam diagnostics has been proposed to be installed for measurements in the plasma edge region and divertоr of the tokamak T-15MD.

THB method defining *ne* and *Te* is based on analysis of singlet and triplet lines ratios of the locally injected helium atoms. To investigate the applicability of this diagnostic, expected line intensities have been calculated. For this purpose, a stationary collisional-radiative model (CRM) of the helium atom was developed, which describes populations at 19 lower HeI states (ground state and 18 excited states up to n ≤ 4) and assumes a local collisional-radiative equilibrium. Since electron collisional processes are the main mechanism for increasing and decreasing populations of excited states in the edge region and divertor plasma of tokamaks, only the processes of spontaneous radiation, electron-impact excitation and ionization are taken into account in the CRM. Based on the calculation results, the most suitable HeI lines were selected to measure *ne* and *Te* in the expected range of SOL and divertor parameters. The density and temperature dependence of the line intensity ratios were compared with other works [3, 4]. To test the method of determining *ne* and *Te*, an experiment with a helium gas discharge lamp was conducted.

THB diagnostics can be used for measurements of edge electron temperature and density with high temporal (about 100 kHz) and spatial (about several mm) resolutions. It’s planned to develop a non-stationary CRM for measuring by THB diagnostics on the tokamak Globus-M2 and synthetic modeling for the tokamak T-15MD.

References

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