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RADIAL ELECTRIC FIELD ON THE GLOBUS-M2 TOKAMAK: EXPERIMENTAL DATA AND MODELING*)

[1]Kukushkin K.A., [1,2]Yashin A.Yu., [1]Rozhansky V.A., [1]Kaveeva E.G., [2]Khromov N.A., [2]Kiselev E.O., [1]Dolgova K.V., [1]Ponomarenko A.M., [2]Kurskiev G.S., [2]Zhiltsov N.S., [2]Tkachenko E.E., [2]Miroshnikov I.V.

[1]Peter the Great St. Petersburg Polytechnic University, St. Petersburg, Russia, office@spbstu.ru
[2]Ioffe Institute, St. Petersburg, Russia, post@mail.ioffe.ru

The radial electric field in tokamak devices is of great interest to study within high-temperature plasmas physics, since the L-H transition was shown to be caused by the suppression of turbulent plasma perturbations by the shear of the plasma drift velocity in the radial electric field. [1].

Doppler backscattering (DBS) diagnostics was successfully applied to study perpendicular plasma velocity and radial electric field. In the tokamak ASDEX Upgrade perpendicular drift velocity and radial electric field data were obtained using this method. A comparison of neoclassical calculations for the radial electric field and DBS data showed a good agreement between the two methods for different operation regimes of the tokamak [2]. For the same purposes, similar diagnostics have been successfully applied at the LHD [3], EAST [4] and other devices.

DBS was greatly developed on the spherical tokamak Globus-M and later its modernized version Globus-M2. Two multi-frequency reflectometers with tilted antennas are installed on the tokamak. Different probing frequencies allow to investigate both the peripheral ($0.8 < \rho < 1.1$) and more central regions of the plasma ($0.4 < \rho < 0.8$). Diagnostics measures the perpendicular plasma velocity by calculating the Doppler shift of microwave radiation backscattered on plasma fluctuations, which allows the investigation of the radial electric field profile E_r [5]. The idea arose to compare the obtained results with the results of numerical modeling.

In this work, the SOL plasma of the Globus-M2 tokamak was modeled with the SOLPS-ITER 3.0.8 code, which includes the hydrodynamic code B2.5 and the Monte Carlo code for neutral particles EIRENE. SOLPS-ITER has already been successfully applied for radial electric field modeling in ASDEX-Upgrade and ITER tokamaks [6]. For the new calculation, the geometry of the Globus-M2 device used to construct the code calculation grid was updated using the latest data on the dimensions of the tokamak vacuum chamber. Magnetic equilibrium data were obtained using the pyGSS code from the experimental data of the simulated discharge. To obtain more accurate results, the calculation was corrected using Thomson scattering and divertor probes data collected in the simulated discharge.

The radial electric field profiles obtained by different methods: DBS during experiments, SOLPS-ITER modeling, by the neoclassical formula from toroidal rotation velocity measurements and transport modeling at the tokamak center were compared.

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