DOI: 10.34854/ICPAF.51.2024.1.1.075

MEASUREMENTS OF THE ANISOTROPIC IONS RELATIVE PRESSURE IN THE GDT IN MAGNETIC CONFIGURATIONS WITH SHIFTED TURNING POINTS *)

[1,2]Shmigelsky E.A., [1,2]Lizunov A.A., [1,2]Soldatkina E.I., [1,2]Prikhodko V.V., [1,2,3]Solomakhin A.L., [1]Pinzhenin E.I., [1]Meyster A.K.

[1]*Budker Institute of Nuclear Physics, Novosibirsk, Russia,*
[2]*Novosibirsk State University, Novosibirsk, Russia,*
[3]*Institute of Applied Physics, Nizhny Novgorod, Russia*
E.A.Shmigelskiy@inp.nsk.su

Research for the fast ions confinement in the regimes with enhanced relative pressure β are being conducted in the Gas Dynamic Trap (GDT, BINP) at present. The fast ions pressure gain is provided by symmetric offset of their turning points towards the GDT central plane via corresponding modification of the magnetic field axial profile. Magnetic system of the trap can be changed to provide configurations with fast ions movement region reduced by 1.5 and 2 times relative to the standard GDT configuration. It was shown in [1] that magnetic flux excluded by the plasma increases by 30% when the distance between the turning points shrinks by a factor 1.5. In addition, values of β averaged over the plasma central cross-section in the cases of the standard configuration and configurations with 1.5-fold and 2-fold decrease of the fast ions movement region equal 8%, 10% and 18% respectively.

This report presents measurements of the magnetic field inside the plasma in the GDT central plane in three mentioned magnetic configurations using spectral MSE diagnostic [2]. The diagnostic allows to measure magnetic field near the trap axis 10 times during the discharge with the period no less than 0.5 ms. Additionally, measurements at the other four radially distributed points are carried out once during the discharge. Obtained data were used to trace β evolution and to determine its radial distribution that helps to interpret an increase in averaged β under shrinking of the fast ions movement region [1]. Thomson scattering system [3] was used at the same time to register electron temperature and density radial profiles in the central plane.

Alfvén ion-cyclotron instability (AICI) [4, 5] regularly develops under confinement with increased pressure and causes fast ions scattering. MSE diagnostic allows determining the AIC instability β threshold in the both non-standard configurations and elucidate the reason for the AICI frequency change during the discharge.

References

[1]. Shmigelsky E.A. et al. High-β Plasma Confinement Studies in GDT: Recent Results and Planned Experiments // 13th International Conference on Open Magnetic Systems for Plasma Confinement. — 2023.
[2]. Lizunov A.A. et al. Rev. Sci. Instrum. **84**, 086104 (2013).
[3]. Lizunov A.A. et al. Rev. Sci. Instrum. **94**, 033509 (2023).
[4]. Zaytsev K.V. et al. Phys. Scr. **161**, 014004 (2014).
[5]. Anikeev A.V. et al. Plasma Physics Reports **41**, 773-782 (2015).

*) abstracts of this report in Russian