EXPERIMENTS ON ADDITIONAL STABILIZATION OF PLASMA AT ECR-HEATING in Gas Dynamic trap

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In a series of experiments performed in 2014-2015 at GDT (gas dynamic trap) in conditions with additional ECR heating, a record value of the electron temperature Te ~ 1 keV was reported for quasi-stationary magnetic traps of an open type [1, 2]. This result was obtained under conditions when the microwave power absorption was concentrated in a narrow near-axis region of the plasma column. This led to the formation of an electron temperature and the plasma potential radial profiles, which were spiked on the axis, this caused the development of the MHD instability associated with the high azimuthal rotation speed of the near-axis region due to the ExB drift. The development of instability occurred in ~ 0.5 ms after the of microwave radiation injection start. The instability was a factor limiting the duration of effective ECR heating.

To suppress the influence of MHD instability on the efficiency of ECR heating, it was decided to create a control system for the radial profile of the plasma potential in the trap. The main element of this system is the sectioned electrodes installed behind the magnetic plugs in the areas of the expanding magnetic field. These electrodes consist of a set of concentric rings mounted on insulators. A special electronic module allows to have a required electric bias at each ring.

This feature made it possible to have a stable plasma confinement time up to 2.5 ms under conditions of efficient heating ECR. This time is now determined by the period of magnetic field stability near the cyclotron resonance surface. At the same time, the achieved value of the electron temperature increased by ~ 20% in comparison with the maximum value reached in regimes with the development of MHD-instability.

The report will present the results of these studies and the achieved parameters.

References

1. P.A. Bagryansky, et al. Phys. Rev. Lett. 114, 205001 (2015);
2. P.A. Bagryansky, et al. Nucl. Fusion 55 (2015) 053009.