study of LOW-FREQUENCY LARGE-SCALE MHD MODES IN THE T-10 TOKAMAK

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To study low-frequency (1-5 kHz) large-scale MHD modes (tearing instabilities) at first time we use the heavy ion beam probing (HIBP) diagnostic in the T-10 tokamak (*B* = 1.5—2.5 T, *R* = 1.5 m, *a* = 0.3 m) [1]. This diagnostic has unique possibility of direct local measurements of the electric potential  in the plasma. The potential is equal to increment of the probing particle energy in the point of secondary ionization relatively to its primary energy. Also HIBP diagnostic in T-10 allows us to conduct the relative measurements of plasma density oscillations *n*/*n* using oscillations of current of the probing particles passed through the plasma *I*/*I*, and oscillations of poloidal magnetic field *B*/*B* using the toroidal shift of beam oscillations *Z*/*Z* [1]. All the three parameters are measured independently and simultaneously with the temporal resolution up to 300 kHz.

The large-scale MHD oscillations were studied in different regimes with the safety factor at the plasma edge *q*(*a*)~3. Behavior and the mode structure of MHD oscillations were reliably defined with the poloidal set of magnetic probes. In regimes under study the poloidal mode number was   
*m* < 3. We simultaneously observed the studied oscillations at all three signals of HIBP diagnostic. For modes *m* = 2 and *m* = 3 the density oscillations *n*/*n* were as large as 1 − 4 %, and the oscillations of toroidal shift *Z*/*Z* reach 8%. Note that large-scale MHD oscillations with frequency 2-3 kHz have considerable electric component, up to  = 40 V. This distinguish the low-frequency large-scale MHD oscillations from the medium-scale tearing modes with typical frequency 7 kHz, *m* = 2 and without pronounced electrical component.

In the report we present data about spatial localization and temporal dynamics of studied modes during the discharge, and results of poloidal rotation measurements obtained with the multislit HIBP analyzer.

References

1. DnestrovskijYu.N. et al., IEEE Trans. Plasma Sci., 1994, **22**, 310.
2. Melnikov A.V. et al., Nucl. Fusion, 2014, **54,** 123002.