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HYDROGEN INJECTION FROM A COAXIAL PLASMA ACCELERATOR INTO A GAS DYNAMIC TRAP *)

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This paper presents the results of experiments on the injection of hydrogen from a coaxial plasma accelerator into a gas dynamic trap (GDT).

GDT [1] is an axisymmetric open trap with a two-component plasma. The first component is fast ions with an average energy of about 10 keV. They are created by injecting beams of neutral atoms with an energy of 20 keV. The second component is a relatively cold target plasma with an average energy of about 100 eV. This component performs several functions. Firstly, it serves as a target for capturing beams of neutral atoms. Secondly, it serves to stabilize drift-cone instabilities caused by the disequilibrium of the distribution function of fast ions associated with the lack of filling of the cone of losses for collisionless fast ions in open traps. [2] The target plasma fills the loss cone by stabilizing instabilities due to high collisibility. And thirdly, the flow of target plasma through magnetic plugs maintains electrical contact between the trap plasma and the end plasma receivers, allowing the use of a radial electric field to stabilize MHD plasma instabilities by vortex confinement. [3] In this case, the target plasma freely leaves the trap in the collisional gas dynamic mode. The total equivalent loss current of the target plasma in the GDT can be estimated at 1 kA. Thus, the task of maintaining the balance of the target plasma arises, especially during the transition to quasi-stationary plasma existence times in an open trap.

To solve this problem, it was decided to use plasma injection into the GDT using a coaxial plasma accelerator, also known as a Marshall gun. [4] In an accelerator with a diameter of 4 cm between two coaxial electrodes, about 10^{20} hydrogen ions are accelerated to an energy of about 100 eV. The density of the resulting jet of matter is about 10^{15}-10^{16} cm^3. As it was shown in the previous work [5], when moving in the accelerator, the plasma jet is actively neutralized and at the output of the accelerator, most of the energy of the accelerated jet of matter is in the neutral component.

During the experiment, a jet of hydrogen was injected across the magnetic field of the installation, where the magnitude of the magnetic field is about 7 kGs. The paper presents the results of measurement of GDT parameters by various diagnostics before and after injection.

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