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STATUS OF EXPERIMENT AT THE CAT DEVICE *)

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A new experimental device, Compact Axisymmetric Toroid (CAT), has been put into operation at the Budker INP. It is an axially symmetric mirror configuration with injection of powerful neutral beams. The project develops a relevant direction in the physics of mirror magnetic systems — confinement of plasma with high beta (the ratio of the transverse plasma pressure to the magnetic field pressure). This concept uses the progress in technology of powerful neutral beam injection achieved at INP [1]. Numerical simulation showed that the transverse injection of atomic beams with an energy of 15 keV and a current of 2×100 equiv.A into the plasma in a short mirror cell allows beta values of order unity in a compact plasmoid [2]. Efficient accumulation of the azimuthal fast ion current is possible if the target plasma has an electron temperature of 20–50 eV and a linear density of $(2–5)\times10^{14}$ cm^{-2}. A plasma with such parameters is produced by a pulsed arc gas-discharge source with a radial electric field and an axial magnetic field [3]. The radial non-uniformity of the angular velocity E×B drift drives instability of the target plasma and increases the average ion energy to 100–200 eV, and ion-electron collisions lead to the simultaneous electron heating.

The scientific experimental program aims at studying methods of accumulation, confinement and stabilization of the plasma with extremely high pressure. The results obtained on the CAT device will be used in the project of the next generation mirror machine GDMT [4], which is currently under development at the Budker INP.

The report presents the experimental results on optimization of the density and radial profile of the electron temperature of the target plasma and the study of their influence on the accumulation rate of fast ions. Measurements of the energy content of the target plasma and of the compact plasmoid during neutral beam injection are given. Relaxation of the energy of fast ions during their accumulation is studied using a 45-degree neutral particle analyzer.

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