PLASMA MOTION DYNAMICS IN the OPEN helical mirror trap SMOLA [[1]](#footnote-1)\*)

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The open mirror trap SMOLA was created at the Budker Institute of Nuclear Physics (BINP SB RAS) for studying the physics of plasma flow confinement and acceleration [1]. The plasma rotates in crossed the E × B fields. In the rotating plasma frame, the longitudinal velocity of the magnetic mirrors is comparable to the longitudinal velocity of the plasma flow. The configuration of the plasma flow confinement or acceleration is controlled by the magnetic field direction.

The longitudinal velocity of the plasma in the helical section is determined by diagnostics based on the Mach probe. These are two asymmetric double probes separated from each other by the ceramic partition. This construction allow us to simultaneously measure the saturation currents of ions moving strictly in the plasma flow direction and against it. The radial dependences of the longitudinal velocity on the main plasma parameters were obtained in the helical section.

In the plasma flow confinement regime, the longitudinal velocity decreases with the increase in the cross-sectional average mirror ratio. In the acceleration regime, the maximum longitudinal velocity was achieved under conditions that provide the maximum integral flow over the section. It was calculated from the measurements of the probes installed at the helical section outlet and in the outlet expander. The direction of plasma flow motion relative to the leading magnetic field was determined.

In the output expander the velocity is determined by the high spatial resolution spectrometer based on MDR-23 [2] installed at the 30°angle to the plasma axis. The measurement of the plasma velocity distribution is carried out by determining the Doppler shift of the plasma radiation. The maximum longitudinal velocity at the center of the plasma column is Vz~3·106 cm/s. Longitudinal motion velocities obtained due to optical and probe diagnostics are consistent with each other and lie in the same range. The longitudinal plasma velocities obtained due to optical and probe diagnostics are consistent with each other.

The report will present the experimentally obtained dependences of the longitudinal velocity on the plasma parameters and the magnetic field configuration in the plasma flow confinement and acceleration regimes.

References

1. A.V. Sudnikov et al. // Plasma flow suppression by the linear helical mirror system // Journal of Plasma Physics, 88(1), 905880102 (2022)
2. А.А. Inzhevatkina et al. Investigation of Plasma Rotation in SMOLA Helical Open Trap// Plas. Ph. Rep., Т. 47. № 8. p. 706-715 (2021).

1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/L/Mu/ru/BT-Inzhevatkina.docx) [↑](#footnote-ref-1)