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P4.1062 Preliminary experimental scaling of the helical mirror confinement effectiveness

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Advanced plasma confinement in open magnetic mirrors features high relative pressure (Beta about 60%), mean energy of hot ions of 12 keV and the electron temperature up to 0.9 keV in quasistationary regime [1]. In modern concepts simple mirror ratio of ~1520 and improved longitudinal confinement are proposed [2, 3]. Existing method of multiple-mirror suppression of the axial flux combined with gas-dynamic central cell [4] can provide effective mirror ratio of the order of 100, which gives feasible fusion gain appropriate at least for neutron source. New idea of the helical mirror confinement was suggested in [5]. This concept considers a flow of a rotating plasma through a linear magnetic system with helical corrugation that looks like a straightened stellarator. Periodical variations of helicoidal magnetic field moving upstream in plasma's frame of reference transfer momentum to trapped particles and lead to plasma pumping towards the central trap. The helical mirror traps should have two important improvements over the classical multiple-mirrors: the exponential (instead of the quadratic) law of the confinement improvement with the system length and the radial pinch of ions that can counteract the diffusive broadening of the plasma stream. Concept exploration device «SMOLA» with a helical mirror system was put in operation in the end of 2017 in BINP [6, 7]. Plasma flux suppression by the helical sections was demonstrated in the first experimental campaign [8]. This work presents the preliminary experimental results on the dependences of the suppression effectiveness on guide magnetic field, mean corrugation ratio, plasma density and rotation velocity.

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