INFLUENCE OF ion ACCELERATION ON potential PROFILE IN expander of OPEN MAGNETIC TRAP [[1]](#footnote-1)\*)

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An expander for open magnetic configurations is an analogue of a divertor in toroidal systems: plasma expansion in a decreasing magnetic field is successfully used to suppress the longitudinal heat flux in most large-scale mirror traps for fusion studies [1-3]. Plasma expansion in a diverging magnetic field is also important for more compact traps used in a number of technological applications [4–6]. In addition to decreasing the energy flux density, the nonuniformity of the magnetic field leads to a variation in the electrostatic potential along the field lines. The variation in the potential leads to the reflection of part of the electrons leaving the trap back, preventing them from reaching the end wall of the expander.

Qualitatively, the physics of potential formation in the expander region is well known and generalized by Ryutov in the review [7]. Nevertheless, there are a number of discrepancies between the results of this consideration and experimental data. In particular, the theoretical estimates of the potential drop in the Debye sheath near the end wall of the expander presented in [7] are an order of magnitude higher than the potential drop measured at the GDT facility at the Budker Institute, Novosibirsk [8]. The discrepancy is traditionally explained by the interaction of plasma with a neutral gas. However, this is not consistent with recent experiments, which demonstrate a weak dependence of plasma parameters on the background density of neutrals in the expander [9].

To explain this discrepancy, a rather simple analytical model was proposed in the framework of which we were able to describe the ion acceleration in the expander and the formation of the ambipolar potential in a self-consistent way [10]. It was shown that taking into account ion acceleration significantly reduces the potential drop in the Debye sheath near the expander wall. In addition to removing the contradictions between theory and experiment, this result softens the requirements for the size of the expander of the next generations of traps, predicting the absence of arcing near the wall at lower expansion.

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