Start of Plasma Operations in GOL-NB with Central Trap

V. V. Postupaev, V. I. Batkin, A. V. Burdakov, V. S. Burmasov, I. A. Ivanov, K. N. Kuklin, N. A. Melnikov, K. I. Mekler, A. V. Nikishin, A. F. Rovenskikh, and E. N. Sidorov

Budker Institute of Nuclear Physics, 630090 Novosibirsk, Russia

The GOL-NB multiple-mirror trap [1] is a moderate-scale linear confinement system (open trap) that enters the final assembly and commissioning. This experiment is the physical prototype of the GDMT reactor-grade open confinement system. The latter is in the preliminary design stage in the Budker Institute of Nuclear Physics [2]. GOL-NB is the first device that will combine a central gasdynamic trap with two attached multiple-mirror sections and two end magnetic flux expanders. The main physical task of the experiment is to validate the theory predictions on the confinement improvement with the activation of the multiple-mirror sections in regimes with moderate collisionality. Other goals are to demonstrate effective plasma stabilization methods in the non-*min-B* magnetic configuration and to find an experimental technique that will extend good multiple-mirror confinement into the low-collisionality domain.

Modular design of GOL-NB enables to improve the device capabilities with addition of new modules. In 2019, we reported results of the first plasma campaign in the start configuration of GOL-NB [3,4]. The device consisted of a 4m-long high-field section and both expander tanks. In this configuration, the propagation of $\sim 10^{20}$ m^{-3}, 6 eV start plasma from an arc gun through the high-field section was studied in solenoidal and multiple-mirror configurations. Since then, the efficiency of plasma transport was improved with proper biasing of in-vessel limiters and plasma receiver endplates. A major upgrade of the device began in February 2020. The main central module that is a 2.5-m-long gasdynamic trap with the mirror ratio up to R = 15 will be installed. Two 0.75 MW, 25 keV neutral beams will be relocated to their final positions. Results from the first experiments in this configuration will be presented.

[1] V.V. Postupaev, et al., Nuclear Fusion, **57**, 036012 (2017).
[2] P.A. Bagryansky, A.D. Beklemishev, V.V Postupaev, J. Fusion Energy, **38**, 162 (2019).
[3] V.V. Postupaev, et al., Proc. EPS-2019 (Milan, 2019), paper P4.1063.
[4] V.V. Postupaev, et al., Plasma Phys. Control. Fusion, **62**, 025008 (2020).