ENERgy loss measurements from confined plasma via various channels in the gas dynamic trap [[1]](#footnote-1)\*)

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The research on the Gas Dynamic Trap (GDT), a magnetic mirror plasma trap, is being continued in the Budker Institute of Nuclear Physics. One of the main research goals at the GDT experiment is to reduce the energy losses from the plasma. The importance of this goal is due to the possibility of development of a fast neutron source for material science or a thermonuclear fusion reactor based on a magnetic mirror device [1].

In the GDT experiment, a divergence in the energy balance of the GDT has been observed. While 5 MW of neutral beam power are injected into the GDT, of which 2-3 MW are captured by the plasma, only a few hundred kW of longitudinal losses through the magnetic mirrors are observed. The magnitude of these longitudinal losses is consistent with theoretical gas-dynamic confinement predictions, which necessitates the search for other possible energy loss channels.

Therefore, two hypothetical loss channels have been experimentally studied. The first hypothesis suggested that the injected neutral beams primarily heat up the edges of the plasma column, which are then lost on the limiters of the GDT. The second hypothesis suggested that the injected power is lost via charge-exchange of the fast ions on the neutral gas pumped into the GDT to upkeep the material balance of the confined plasma.

To test these hypotheses, a new diagnostic limiter and a bolometric loss measurer were installed into the GDT; additionally, the longitudinal loss measurement system at one of the plasma absorbers was employed [2]. The findings of the study were presented in this report.

References

1. Bagryansky P. A. et al. Recent progress of plasma confinement and heating studies in the gas dynamic trap //AIP Conference Proceedings. – AIP Publishing LLC, 2016. – Т. 1771. – №. 1. – p. 020003.
2. Bagryansky P.A. et al. Energy and particle flux measurement system for the GDT experiment. // XLVII Zvenigorod International Conference On Plasma Physics And Controlled Fusion. – 2020. – p. 96-96.

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