

DOI: 10.34854/ICPAF.51.2024.1.1.034

POWERFUL NEUTRAL BEAM INJECTION SYSTEM AT THE CAT DEVICE ^{*)}

¹Gamov V.V., ¹Stupishin N.V., ^{1,2}Kolesnichenko K.S., ¹Voskoboynikov R.V.,
¹Zubarev P.V., ¹Moiseev D.V., ¹Khilchenko A.D., ¹Vakhrushev R.V., ^{1,3}Kravets E.A.,
¹Murakhtin S.V.

¹*Budker Institute of Nuclear Physics SB RAS*

²*Novosibirsk State University*

³*Novosibirsk State Technical University*

The CAT facility (Compact Axisymmetric Toroid) has been built at BINP. The CAT is an axisymmetric mirror device with a two-component plasma, consist of a relatively cold and dense target plasma ($T_e=50$ eV, $n_e=10^{13}$ cm³), and a population of fast ions with thermonuclear parameters. The scientific program of work at the CAT targets on optimizing parameters of the target plasma, working out methods for retaining and a plasmoid stabilization with a high relative pressure $\beta \approx 1^1$ (diamagnetic confinement). The creation of a population of fast ions is key to the successful completion of this task. To generate a population of fast ions, a powerful neutral beam injection (NBI) system is created, the beams of which are captured by the target plasma of the mirror and converted into fast ions.

Due to the progress achieved in the BINP in the construction of powerful heating injectors [1], it is planned to obtain a current density of 2 eq.A/cm² on the plasma surface (for comparison - 1.6 eq.A/cm² on 2XIIB [2]). The NBI system consists of two powerful injectors with ballistic beam focusing. The injectors set in the central plane to perpendicular Z-axis. The energy of injected particles - 15 keV, the current ions - 140 A, the beam duration - 4 ms.

We show the operation of NBI and main achieved parameters: injected power, current density and angular divergence.

References

- [1]. P. Deychuli, V. Davydenko, A. Ivanov, S. Korepanov, V. Mishagin, A. Smirnov, A. Sorokin and N. Stupishin. Low-energy, powerful neutral hydrogen beam for plasma heating. Review of Scientific Instruments, Volume 86, 2015, 113509, doi:10.1063/1.4936292.
- [2]. Munan Lin, Ming Liu, Guanhui Zhu, Peiyun Shi, Jian Zheng, Quanmin Lu, Xuan Song. Experiments on field reversal in a mirror machine with neutral beam injection // Review of scientific instruments, volume 88, 2017, doi: 10.1063/1.5001313.
- [3]. R. Ulemann, R.S. Hemsworth, G. Wang, H. Juringer. Mixtures of hydrogen and deuterium ions and the power fraction of the injected TEXTOR-Pinis neural beam for 20-60 kV, determined by the method of Doppler shift spectroscopy // Rev. Sci. Instrument. – 1993. – Volume 64. – No. 4.– pp.974-982; doi: 10.1063/1.1144100/.

^{*)} [abstracts of this report in Russian](#)

¹ $\beta=8\pi P_{\perp}/B^2$ - ratio plasma pressure to the magnetic field pressure.