

## RF Plasma Emitter of Diagnostic Neutral Beam Injector for W7-X Stellarator

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A diagnostic neutral beam injector (DNBI) is being developed in the Budker INP (Novosibirsk, Russia) for the neutral particle diagnostics in the stellarator W7-X in Greifswald (Germany). The injector ion source is planned to provide a proton beam with a current of up to 10A, energy up to 65 keV and pulse duration up to 10s. This paper describes the results of the development of the radio-frequency (RF) plasma emitter of the ion source. The plasma emitter should provide the ion current density about 100mA/cm<sup>2</sup> at the plane of plasma grid within a circle 20cm in diameter. This version of the plasma emitter appreciably differs from the previous versions made for the diagnostic injectors of TEXTOR (Germany) [1] and TCV (Switzerland) tokamaks [2]. The plasma box consists of a driver and plasma expansion chamber. The driver generates plasma inside a ceramic cylinder with the external RF coil. The expansion chamber is attached to the driver. This chamber has a conic form and is surrounded by permanent magnets for plasma confinement. The driver produces high density highly ionized plasma diverging inside the expansion chamber connected to the electrostatic accelerator with four grids. During the plasma expansion its density falls down to the desired value. It allows to reduce molecular species in the plasma and, accordingly, to obtain high full energy component in the extracted ion beam.

This paper presents the experimental results obtained during the plasma emitter testing. Also the first results of experiments with the extraction of the ion beam are presented. Using a four-grid ion optic system, which permits to extract ion beam current up to 2.4A, the beam composition was measured by Doppler shift spectroscopy. The measurements were done for the fixed beam energy of 50keV and beam current variable up to 2.4A. According to the measurements, the full energy beam component is about 80% for the required ion current density of the plasma emitter.

1.Ivanov A.A., Davydenko V.I., Deichuli P.P. et al, Rev. Sci. Instrum., 2000, vol.71, No 10, p.3728-3735.

2.Alexander N. Karpushov et al, Fusion Engineering and Design, 2003, vol. 66-68, p.899-904, Proceedings of 22nd Symposium on Fusion Technology (Finland, 2002).