project of diagnostic 60 kv, 2 А, 1 sec nbi for upgraded t-15 tokamak

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In frame of upgrade of the T-15 tokamak the injector of fast atoms of multy-second pulse length was designed and manufactured at the Budker Institute of Nuclear Physics for spectroscopic diagnostics of the ion temperature profile.

The ion source is designed on the basis of the arc generator with cold cathode [1] with an improved cooling system, designed for arc current up to 600 A. The multy-hole four-electrode ion-optical system of the injector has 160 mm in diameter and has the geometric focusing. The ion source designed to work in long pulse mode and cooled by water on the electrodes periphery. The main parameters of the injector are following:

* Working gas is hydrogen
* Energy of the fast atoms is 60 keV
* Extracted ion current is 6.1 A
* The flow of atoms in the full energy fraction is 2 equiv. A
* Focal length is 4 m
* Beam anglular divergence is 0,6°
* Beam radius at the 1/e level in focal point is 4 cm
* The total beam-duty injection pulse width is 1 s
* Minimum pulse duration is 5 ms at a duty ratio of 1:1 ÷ 1:10.

Because of the large longitudinal and transverse scattered magnetic fields in the placement of the injector, the special measures have been taken to ensure the proper magnetic shielding in beam shaping region and in beam tract. Also in design of the deflected residual ion beam dump (after the neutralizer) it was taken into account the influence of the T-15 magnetic field.

The results of the injector tests held in Budker Institute are presented.

References

1. P. P. Deichuli, A. A. Ivanov, and N. V. Stupishin.Long-pulse arc-discharge plasma source with cold cathode for diagnostic neutral beam injector. Review of scientific instruments **79**, 02C106, **2008**.