Ion beam source upgrade of the neutron source at IAP RAS [[1]](#footnote-1)\*)

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A boron-neutron capture therapy (BNCT) technology development is restrained because of a lack of available neutron sources. The solution of the problem is a compact neutron source which satisfies the BNCT requirements. A compact neutron source based on gasdynamic ECR ion source [1] was developed at IAP RAS. High neutron yield was achieved due to higher ion beam current (several hundreds mA) compared to accelerators (several mA).

Ion beam source upgrade of the neutron source is described in this work. A new magnetic trap and ion beam extraction system was developed. It allows the formation of ion beams with total current about 500 mA and energy up to 100 keV in continuous wave (CW) mode.

The magnetic trap design is based on a CW mode ion source GISMO [2]. The plasma transverse section was increased. The magnet mass was reduced using a plasma chamber with variable inner diameter along the symmetry axis. The magnetic trap plug was moved closer to an expansion of the magnet. It allows the extractor to be placed inside the wide part of the magnet. Magnetic trap consists of NdFeB(N48) permanent magnets with axial and radial magnetization. The magnet has two parts because of the chamber design. Magnetic field was calculated using a modeling software COMSOL Multiphysics.

A three-electrode extraction system (with an additional shielding electrode) with magnetic lens is used for the ion beam formation. The beam space charge compensation at the level of 90% was taken into account. An extraction system capable of deuterium ion beam with 500 mA total current and 100 keV energy was developed. The initial ion beam current density reached several hundreds of mA/cm2. The beam simulations are made using the computational package IBSimu [3].

References

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