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A Inclined Slot-excited Circular Plasma Source with a Cusp Magnetic Field

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A inclined slot-excited plasma source is newly designed and constructed for higher flux HNB (Hyperthermal Neutral Beam) generation. The present source is different from the vertical SLAN (SLot ANtenna) sources [1] in two aspects. One is that the slots are inclined, and the other is that the magnetic field is configured to a cusp type. These modifications are intended to make the source plasma operated in sub-milli-torr pressure regime and as thin as possible, both of which is to get higher HNB flux by decreasing the re-ionization rate of the reflected atoms from the neutralizer [2]. The plasma is generated in a quartz tube of internal diameter 170 mm enclosed in a aluminum application chamber of larger diameter 250 mm. The microwave power is fed to the plasma chamber by 8 inclined slots cut into the application chamber wall. The slots are coupled the chamber to a WR280 waveguide wound around it to form a ring resonator. In order to make two slots $\lambda_g/2$ apart in phase, the adjacent slots are rotated in opposite directions. The rotation angle of the slots are set to 60° from the chamber axis. Between the quartz chamber and the aluminum cylindrical chamber 8 NdFeB magnets are equally spaced and fixed to form the cusp magnetic field confinement and ECR (Electron Cyclotron Resonance) field.

In this presentation, the magnetic and electromagnetic simulations, and the measured plasma parameters are given for both the inclined and the vertical slot-excited plasma sources. We also discuss how the sources can be tailored to suit better-performing HNB sources.

[1] D. Korzec, F. Werner, R. Winter, and J. Engemann, Plasma Sources Sci. Technol. **5**, 216 (1996).
[2] S. J. Yoo et al, Rev. Sci. Instrum. **79**, 02C301 (2008).