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Design of Magnetic Filter Field in the High Power Negative Ion Beam Source with Large Area for CRAFT NNBI

Neutral beam injection (NBI) is an indispensable auxiliary heating method used in thermonuclear magnetic confinement fusion devices. The Comprehensive Research Facility for Fusion Technology (CRAFT) needs a well-matched neutral beam injection system for experimental research. The condition that a high current beam with high beam energy is needed in the process of fusion can be satisfied by a giant Negative ion based Neutral Beam Injection (NNBI) system. However, negative ions can be destroyed by electrons with high energy in the plasma generator and expansion chamber of beam source easily, so the electron energy should be decreased to reduce the losses of negative ions by collision. A magnetic filter field (MFF) in front of the plasma grid (PG) can be introduced to cool down the electron temperature. A MFF generated by a current flowing through the PG and 6 conductors was designed based on the simulation results that the electron temperature can be decreased from 7eV to 1eV. Furthermore, this system can make the field flexible and comprehensive in value and space distribution than the permanent magnets. The design can provide a reference for the development of MFF applied on the negative beam source for CRAFT NNBI.

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