

Mapping of Magnetic Field of SPIDER by a Three-Axis Automatic Positioning System

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Abstract:

SPIDER is the prototype of the ion source of the neutral beam injector (NBI) for ITER, and is currently in operation at the Neutral Beam Test Facility (NBTF), Consorzio RFX, Padova, Italy. The magnetic field is important in SPIDER and, in general, in negative ion sources. It is required for filtering the fast electrons in the plasma source (magnetic filter field), thus for enhancing the negative ion production rate, and for suppressing the coextracted electrons in the accelerator (electron suppression field). In order to measure and map the magnetic field in SPIDER, a positioning system has been designed and realized, then applied with success during 2018. A three-axis system holds a Hall probe, and can be controlled manually or remotely by a graphical user interface. Once the three-axis system is installed on SPIDER, it can be programmed to automatically move through the 1280 accelerator apertures and acquire magnetic field profiles. The development of this programmable system allowed saving a considerable amount of time. This article describes the design and the realization of the magnetic field mapping system, along with the results of the measuring campaigns carried out in 2018 and the comparison with numerical models.