7th Asia-Pacific Conference on Plasma Physics, 12-17 Nov, 2023 at Port Messe Nagoya

Diagnostics design for three-dimensional magnetic field measurements in SPERF experiments

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The Space Plasma Environment Research Facility (SPERF), an important component of Space Environment Simulation Research Infrastructure (SESRI), is a ground experimental platform to reproduce the near earth magnetosphere for investigating fundamental processes during interactions between solar wind and Earth's magnetosphere, such as energetic particles transportation and the interaction with waves in magnetosphere, and also the three dimensional magnetic reconnection at magnetopause and magnetotail. The facility has three subsystems, Asymmetric Reconnection EXperiment (AREX), Dipole Research EXperiment (DREX), and Tail Research EXperiment (T-REX). AREX is mainly focused on the three dimensional (3D) dayside magnetopause reconnection [1], and DREX mainly investigates acceleration/loss and wave-particle interaction of energetic particles and also the influence of magnetic storms on the inner magnetosphere [2], while T-REX mainly investigates the hydromagnetic waves excited by high speed flows and the dipolarization process, as well as 3D magnetic reconnection processes. The schematic of SPERF is shown in Figure 1. The plasma is produced by an electron cyclotron resonance (ECR) source to generate a background "artificial radiation belt" and seed electrons, and then enhanced by a biased cold cathode to generate the plasma in high density [3]. In addition, a hot cathode (LaB_6) plasma source is also used to produce plasma with high density.

The diagnostics are essential parts for SPERF to achieve its scientific goals. As for the diagnostic, two kinds of probes, including electrostatic probes and magnetic probes, and also interferometer, including HCN interferometer and polarization interferometer, as well as spectroscopy and high speed camera will be applied to diagnose the equilibrium and fluctuation parameters of plasma during different physical processes in SPERF.

Excellent port access (several 1500×150 mm and more than three hundreds of Φ160 mm) and high laser power of interferometers would promise a profile measurement across the whole plasma section with good quality. In this work, a detailed diagnostics design for three-dimensional magnetic field measurements as well as some preliminary results in SPERF experiment will be presented.

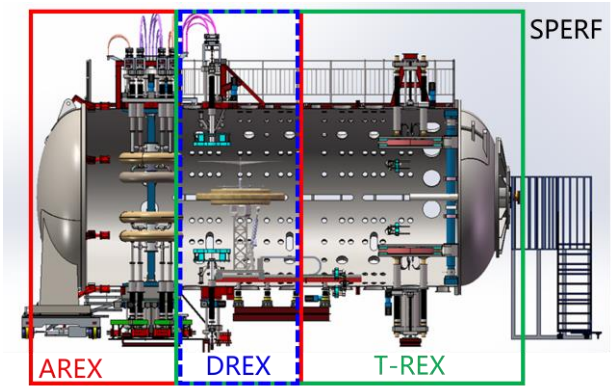

Figure 1 The schematic of SPERF device with AREX, DREX and T-REX shown

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