§39. Experimental Study of Compact Plasma Wall Interaction Experimental Device (CPD)

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1. Introduction

Spherical tokamak (ST) is a candidate for cost-effective fusion reactor and the improvement of the plasma performance of ST has been tried in many institutes. University of Tokyo has been executed the RF heating experiments on TST-2. The plasma start up without ohmic heating coil by RF current drive has been developed on LATE constructed by the experimental group of Kyoto University. One of the effective ways to provide fuel into plasma is compact toroid (CT) injection, which has been proceeded in University of Hyogo. Steady state operation is also a key issue to realize a fusion reactor. In the research of tokamaks, steady state operation will become crucial point and the trials to do long pulse operations in a large tokamak, JT-60U started. The experimental group of Kyushu University has many experiences to sustain the plasma current by use of RF current drive.

The cooperation of these experimental groups under the assistance with NIFS had the possibility to make a new way to realize the fusion reactor using steady state operation of ST. In 2003, we executed the collaboration, which TST-2 moved tentatively to Kyushu University and the RF injection experiment to TST-2 were done successfully (TST-2@K project) [1-5]. A compact ST called compact plasma wall interaction experimental device (CPD) was constructed on the site of TST@K under the framework in by-directional collaboration program organized by NIFS and the collaborated program in the experiments are started in 2005. The purposes of CPD are 1) confirmation of the effect of EBWCD, 2) investigation of the effect of wall temperature to PWI, 3) CT injection to ST, 4) study of the active control of PWI, 5) confinement study of energetic particles in ST, 6) role in the platform of innovative concept. In 2005, the system of compact toroid (CT) injection produced by the group of Hyogo University is installed.

2. Installation of the CT injection system

The CT injection system was developed by the experimental group of Hyogo University and it was installed on JFT-2M site in JAERI. The power supply of the system was provided by the JAERI group in JFT-2M. The experiments on JFT-2M had been shut-down and the CT injection system was consigned to the group of Hyogo University. In JFT-2M, the high applied voltage for plasma acceleration is required to inject CT to the plasma because of high magnetic field. In CPD, the operated magnetic filed will be one-forth of one in JFT-2M and the applied voltage become to be mild. Therefore the operation region of the CT will be wide, which is effective to understand the physical mechanism of CT injection. A photograph after the installation of the CT system is shown in Fig. 1.

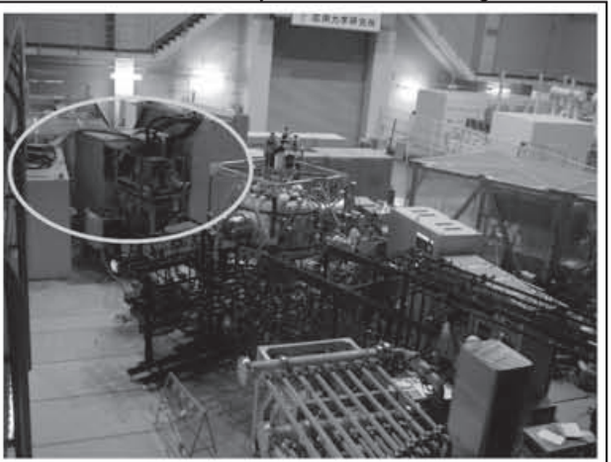

Fig. 1 A photograph around CPD. Blue circle shows the compact toroid (CT) injection system installed on CPD.

3. Installation of the antenna system of an 8.2 GHz microwave

To develop a current drive method by use of electron Bernstain wave (EBW), an antenna system is installed on CPD as shown in Fig. 2. The system is composed of eight horn antennas. Four horns will be used as X-mode antennas and the others as O-mode ones. As in the case of O-mode injection, the injection angle to the magnetic field is a key to excite EBW in the plasma, two mirrors are installed to control the injection angle.

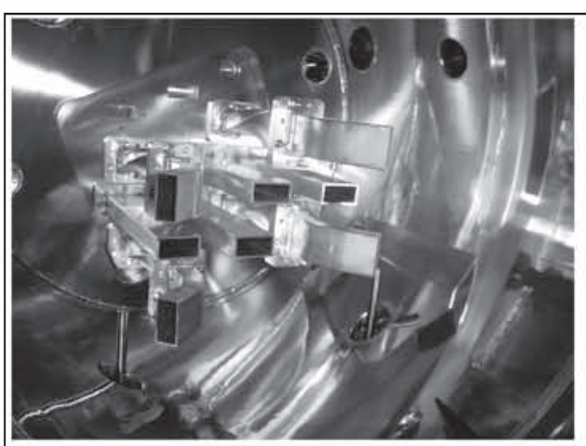

Fig. 2 The photograph of the CPD during vacuum leak check at the experimental hall of TRIAM-1M.

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