

§15. LHD Langmuir Probe System

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Langmuir probes have been proved to be useful tool for measuring edge plasma of Tokamaks. Since the edge plasma affects the performance of the fusion plasma for various reasons, it is now very important to study. In LHD, which is Heliotron/Torsatron type device, it is not easy to access edge region from available ports; LHD plasma is surrounded by helical winding and insertable probe must go through the divertor legs (FSP in Fig.1), where probe system can be damaged by the heat load.

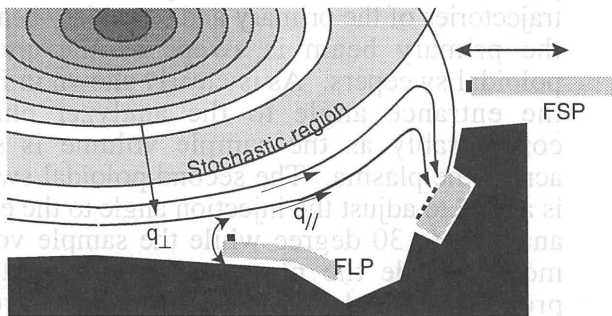


Fig.1 Concept of LHD probe systems.

We are planning to build a Langmuir probe system (FLP) which is fixed in the vacuum vessel to study the SOL region of LHD plasma. This system should be movable if we want to avoid the damage of the probe, since the thickness of the SOL plasma will be less than 10 mm due to the the short connection length (~ 1 m) of the LHD magnetic configuration. Magnetic field can be used for driving source there, whereas other type of drivers, e.g. magnetic motor or air cylinder, will not function in harsh circumstances (strong magnetic field ~ 4 T and high temperature from the radiation). A prototype of our system is shown in Fig.2. A probe head (right upper part of Fig. 2) is supported by a coil shaped frame. The $j \times B$ force from the current flows in this coil rotates the system. If we control the current properly, we can control the position of the probe head. A primitive calculation of the needed current when we swing the probe by 30 degrees (~ 10 cm at probe head) is

shown in Fig. 3. This calculation is based on the standard magnetic field in the 3 T operation. It is shown that we only need 20 A at maximum if we want to insert/pull out the probe system within 100 ms. This value is not difficult to be realized.

Developments of the current controller with feed back and the test of the whole system is scheduled in 1998.

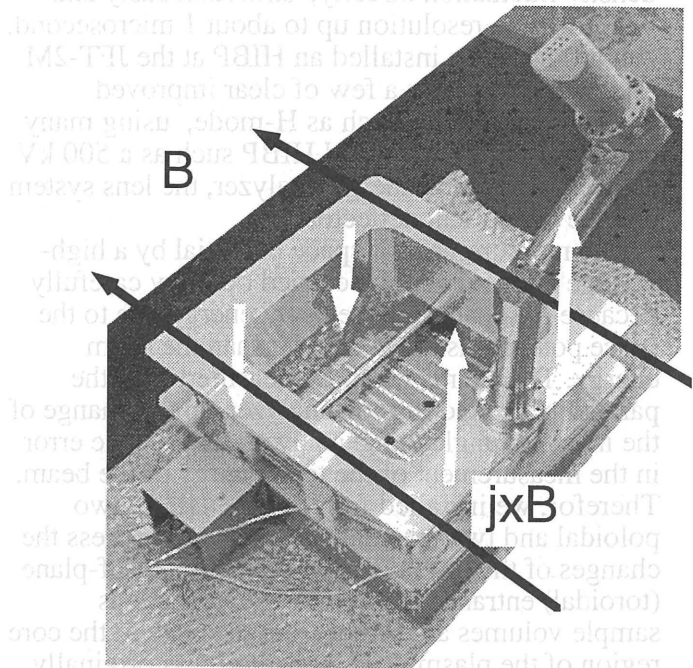


Fig.2: Prototype of LHD Langmuir probe.

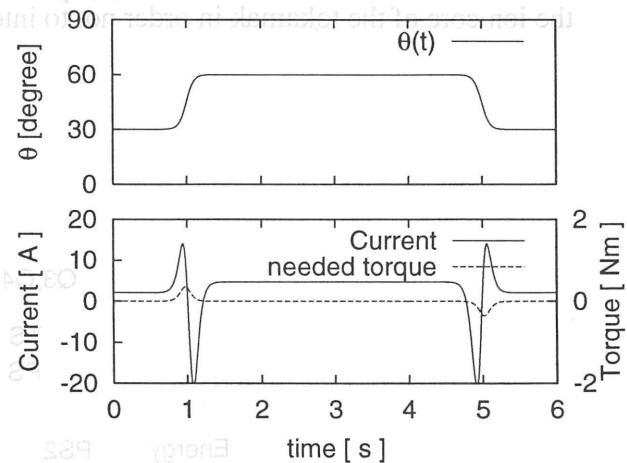


Fig.3: Angle of probe and needed currents for this system.