

§59. Particle Transport Measurements in the LHD Edge and Divertor Plasma Region

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Particle transport is an essential general issue and of particular importance for the proper functioning of the divertor. Both of plasma flow and ion temperature (T_i) are the key parameters for characterizing the transport in the edge and divertor plasmas. Many sophisticated studies have been done by electron temperature and electron density measurements for the divertor region of the LHD. However, plasma flow and T_i profile in this region are not enough understood. In this study, we focus on the behavior of plasma particles in the LHD edge and divertor region by means of plasma flow and T_i measurement.

So far, we have been measured T_i using an Ion Sensitive Probe (ISP) [1] in the divertor leg in LHD during 4th, 5th and 6th experimental cycles. The prototype-ISP for LHD was installed to the fast scanning probe system and the measurement system was established [2]. In this experimental campaign, we have done spatial profile measurements of ion saturation current in the edge plasma by means of the fast scanning probe located on the U-port of LHD. It is important to know the relationship between the magnetic field structure and the profile of ion saturation current since the directions of magnetic field line of the edge region of LHD change drastically within the movable range of the fast scanning probe. We have obtained ion saturation current profiles of the edge plasma for several magnetic conditions. Figure 1 shows an example of results for 3.75m magnetic axis. The results of EMC3-EIRENE simulation for same conditions are also shown. Measured ion saturation current profile is consistent with the structure of the connection length of the magnetic field lines. An inconsistent profile of measured ion saturation current with the simulation result was observed at the inside of $Z=0.9$ m.

In addition to usual Langmuir probe measurement, we are preparing a new probe head, which has Mach probes and an ISP. Mach probes are used for plasma flow measurement.

ISP is applied for measuring T_i , which have important role of particle transport in the edge and divertor regions. The structure of the probe head has been taken into account the change of the incident angle of the field lines on the orbit of the probe head when it is scanned.

During this experimental campaign, we have also done preliminary test of Mach probes in the Nagano Liner Test Plasma Device in order to evaluate the performance of the probe for flow measurement in detached plasma [3].

In the next experimental campaign, a new probe head will be installed. We will focus to the flow profile measurement in the ergodic layer. The experimental results will be compared with EMC3-EIRENE simulation.

References

- 1) Katsumata, I., Contrib. Plasma Phys. **36**, (1996) S, 73.
- 2) Ezumi, N. et al., J. Nucl. Mater. **313-316**, (2003) 696.
- 3) Ezumi, N. et al., 16th Int. Toki Conf. on Advanced Imaging and Plasma Diagnostics, abstracts (2006) P8-05.

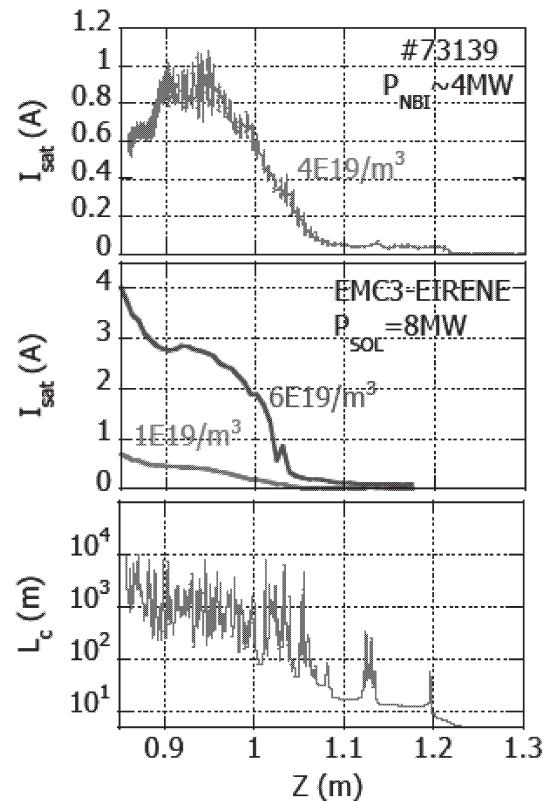


Fig. 1. Comparison between measured (up) and calculated (middle) ion saturation current profiles. The connection length profile of magnetic field line is for reference (Bottom).