# Potential measurements with the 6-MeV Heavy Ion Beam Probe in the internal transport barrier of LHD

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In the Large Helical Device (LHD), an internal transport barrier (ITB) is observed in the case that strong electron cyclotron heating (ECH) is applied to plasma [1]. The ITB is considered to be produced by the strong shear flow. Since, the shear flow suppresses the turbulence in the plasma, by which the anomalous transport is reduced and the confinement property is improved. Therefore, measurements of the poloidal flow are important to study physics of ITB. The poloidal flow is related to the radial electric field through $E \times B$ drift in torus plasmas, so we measure the radial profile of plasma potential by using a 6-MeV Heavy Ion Beam Probe (HIBP) [2,3] in LHD. When the electron cyclotron heating is applied to the plasma, an ITB is observed in the electron temperature profile obtained from Thomson scattering diagnostics. The potential at the center of the plasma is positive. The radial structure of potential is similar to the electron temperature. However the difference of the potential between at the center and in the outside of transport barrier is small compared with that of electron temperature. The electron temperature is 2.7 keV at the center, and 1.3 keV in the outside of transport barrier ($\rho$~0.2). The difference is 1.4 keV in this case. The potential is 2.2 kV at the center of plasma measured with the HIBP, and 1.9 kV in the outside of transport barrier. The difference is 0.3 kV, which is smaller than expected from the electron temperature in this case. One possible reason is that the radial observed region in HIBP may not coincide with the accurate central region of plasma, because the width of ITB in this case is narrow and the small error in the diagnostic position makes an effect on profile measurements of potential. In order to measure potential profile accurately, we will try to measure the potential two dimensionally.

In helical devices, the radial electric field is dominated by the non-ambipolar particle flux in the context of neoclassical theory. Therefore the comparison of the experimental results with the theory is also important. Detail results of potential measurements in ITB and the comparison of experimental results with the theory will be shown in this presentation.

[1] T. Shimozuma, S. Kubo, H. Idei *et al*., Nucl. Fusion **45** (2005) 1396.
[2] A. Shimizu, T. Ido, M. Nishiura, H. Nakano *et al*., J. Plasma Fusion Res. **2** (2007) S1098.
[3] T. Ido, A. Shimizu, M. Nishiura, H. Nakano, S. Ohshima, S. Kato *et al*., Rev. Sci. Instrum. **79** (2008) 10F318.