§21. Measurement of Magnetic Field Fluctuations near Plasma Edge with Movable Magnetic Probe-Array

Oike, T., Kitachi, K. (Dep. Energy Eng. Science, Nagoya Univ.)
Toi, K., Ohdachi, S., CHS Group

The H-mode was discovered in the heliotron /torsatron device, CHS, when the rotational transform profile was controlled by inducing a net plasma current. This clearly suggests that the magnetic field structure near the edge has a strong effect on plasma confinement. In order to clarify the effect, we have made a movable magnetic probe-array which can be inserted shot by shot well-inside the last closed flux surface(LCFS).

Figure 1 shows the schematic drawing of the movable magnetic probe-array. This is installed on the top of the vacuum vessel of CHS where the magnetic surface is formed as shown in Fig.1. Magnetic probes are set inside the stainless steel (SUS) pipe of 13 mm diameter and 1 mm thickness. For protection from plasma bombardment the top of SUS pipe is covered with a cap of carbon-carbon composite with 20 % boron. Although the size of the carbon cap is 30 mm diameter and 30 mm length, this movable magnetic probe-array has no serious effect on plasma performance. Moreover, this cap reduces impurity level by the help of boron evaporated from it. The probe array consists of fourteen probes: seven probes for the measurement of poloidal field component and the other seven ones for radial field component. The magnetic probe installed closest to the plasma can be inserted up to ~130 mm height from the equatorial plane of the plasma, which corresponds to the ratio of averaged radial position to the minor plasma radius <r>/<a> ~0.5 . The SUS pipe electrically floated from the vacuum vessel may be employed to be a single Langmuir probe.

Figure 2 shows time evolutions of magnetic fluctuations detected with the magnetic probe-array in the NBI heated plasma with about 20 kA plasma current. In this discharge, the head of the carbon cap is inserted just inside LCFS, where the probe "MP-T2" is at Z~293 mm, and the probe "MP-r1" at Z~282 mm. In Fig.2, we also show the time evolution of magnetic fluctuations detected with the magnetic probe installed near the vessel wall in the different toroidal location (MP6). These three signals of magnetic fluctuations are similar each other, but there are some differences in fine structure. Floating potential of the carbon cap, which corresponds to the value averaged over 30 mm in radial direction, is in -20 V to 0 V during NBI heating.

We are going to study the change of magnetic field structure near the edge in the H-mode.

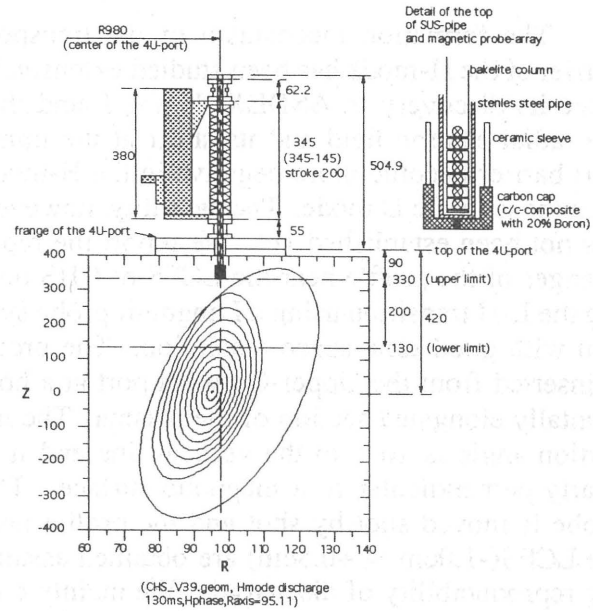

Fig.1 Schematic drawing of the movable magnetic probe-array.

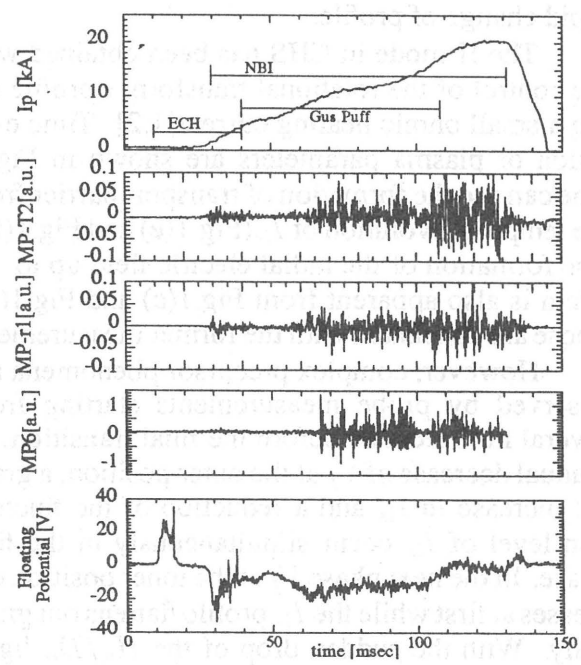

Fig.2 Time evolution of magnetic fluctuations detected with the magnetic probe-array in the NBI heated plasma ,where the plasma current Ip is increased up to ~20kA,the toroidal field Bt~0.9T and line averaged density $\bar{n}_e \sim 2.2\times10^{13}cm^{-3}$.