§20. Local Heat Flux Measurement on the Divertorleg of Both Attached and Detouched Plasmas

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Characteristics of heat and particle flow in divetor are important issues for controlled thermonuclear fusion reasearch. In LHD configuration, four diverter leg connect the elgodic region surrounding the core plasma and diverter plate, and their behaviors affect global confinement property of the core plasma, for example diverter detachment. Moreover the closed diverter experiment will be carried out in LHD in the near future, and the importance of divertor ohenomena becomes large.

In order to investigate the heat and particle flow characteristics in the diverter leg, the hybrid probe which was installed in the outbourd side of LHD (see Fig. 1) was utilized. The hybrid probe can measure local heat flux due to calorimetric method utilizing thermocouple mounted on the probe tip and local particle flux due to conventional Langmuir probe method.

Figure 2 shows the ion saturation current profile measured at the divertor leg position. Since the direction of magnetic field line at the measuring position is almost radial direction, both co- and ctr- channels can observe ion flux at the nallow region with the $1/e$ half width of 7 mm, which are shown by solid lines in Fig. 2. The spatial resolution of the hybrid probe is 6 mm, which is limited by the size of probe tip. The improvement of spatial resolution of the probe measurement is required for detailed profile measurement of diverter led.

The probe measurement was carried out in the diverter detouchment experiments. The ion saturation current is much larger than the capacity of power supply of probe circuit. Thus the floating potential was measured at the diverter leg position, which is shown in Fig. 3. The diverter detouchment occured at $t = 2.1$ sec of shot No. 85880 and sustained by the end of measurement. During the diverter detouchment, the diverter leg was electrically isolated with vacuum chamber (zero floating potential), indicating the disappearance of particle flux. On the other hand, the attached plasma with similar operation (85877) shows the finite floating potential. The averaged heat flux on the diverter leg is 10 MW/m^2 for the attached plasma, which is almost zero during the diverter detouchment.

In the 11th and 12th campaign, the preliminary experiments to measure the diverter leg properties were carried out and the demonstration of probe measurement was successful. The minor change of the hybrid probe is planed to improve spatial resolution and to prevent from current saturation of power supply of the probe circuit, which will make significant progress of diverter measurement in 13th campaign.

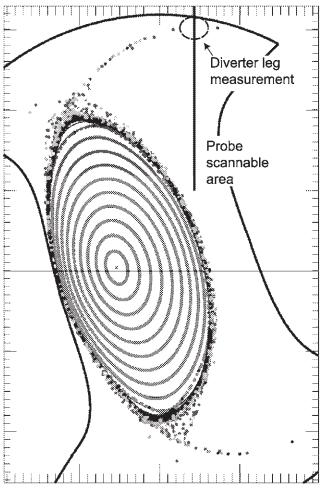

Fig. 1: The Poincare plot of the magnetic field lines on the cross section at the probe position. The position of diverter leg measurement and probe scannable region are also shown.

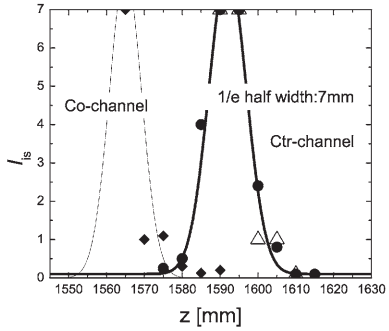

Fig. 2: Ion saturation current profiles measured by the co- and ctr-channel of the hybrid probe.

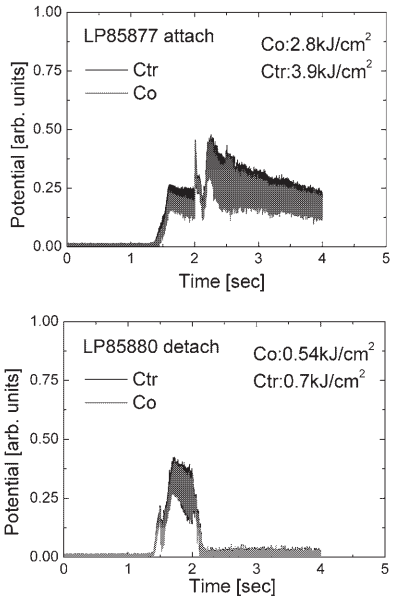

Fig. 3: Time evolution of floating potential of attached (85877) and detouched (85880) plasmas measured at the diverter leg potision.