§17. Fast Potential Change at H-mode Transition on JFT-2M Tokamak Measured by a 500 keV HIBP

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H-mode transition has been so effective in improving the confinement of hot plasmas. Therefore, it has been the targets of intensive experimental and theoretical research in plasma physics. Up to now, it has been claimed experimentally and theoretically that the radial electric field plays key roles for causing the transition. So far the highly time-resolved and direct measurement of the potential or electric field has not been performed, and it was difficult to establish the causality between the potential change and H-mode transition. The heavy ion beam probe (HIBP) is particularly suited for fast and the local measurement of the plasma potential. The local plasma potential can be obtained by the measurement of the change of the secondary beam energy generated at the sample volume. The intensity of the secondary beam is the indicator of the local density although the attenuation along the trajectory must be taken into account. In order to study the physics of H-mode transition, we installed a 500 keV heavy ion beam probe on the JFT-2M tokamak under collaboration program between NIFS and JAERI. The analyzer system which has 7 detector sets for 7 point simultaneous measurement of potential and the 500 keV electrostatic accelerator for thallium beam were transferred from JIPP-TIIU tokamak1). The high-voltage generator of the accelerator has a very low ripple voltage of about 2 V out of 500 kV. The frequency response of the detector extends to about 100 kHz at 3 dB down. Figure 1 shows a very interesting behavior of the potential and the fluctuation. In this case, the sample volume is very close to the separatrix. The interesting point is that at 749.8 msec the change of the very rapid drop of the potential is observed together with the drop of the fluctuation in the secondary beam intensity and the magnetic probe data of dBp /dt. The power of the fluctuation integrated from 10 to 50kHz drops about one order. It is difficult to discuss the causality between them, they seem to occur simultaneously. Since the number of the observation with fixing the sample volume to this position is very limited, we need further study to find the relation between the rapid drop of the potential and the fluctuation. It is left for the future work.

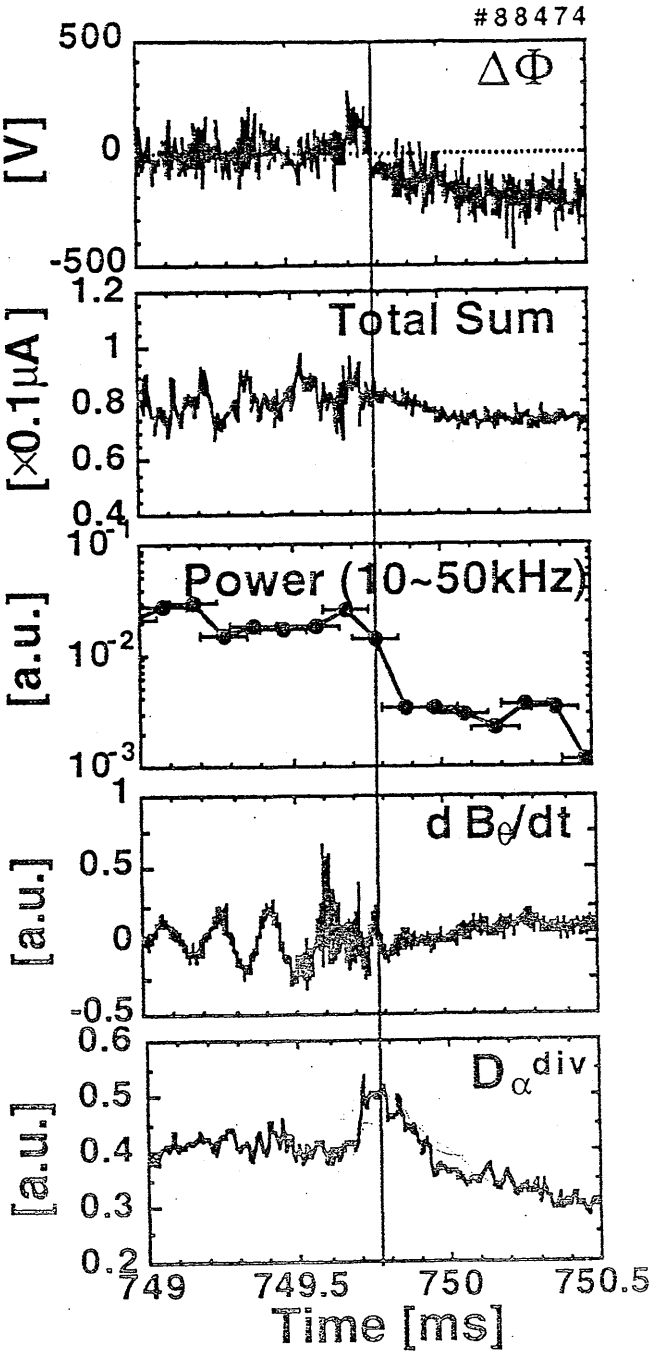

Fig.1. Fast time behaviors at the H-modetransition. The plasma potential(ΔΦ), the secondary beam intensity (Total Sum), the power of the fluctuation in the beam intensity integrated from 10 to 50kHz, the magnetic probe signal of dBp /dt and D α intensity when the sample volume is very close to the separatrix.