§74. Plasma Flow and Trigger Mechanism of Blob in the SOL Region

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Non-linear particle transports such as blob have been observed in SOL of spherical tokamak plasmas and intensively studied using high speed cameras. Behaviors of trapped energetic electrons in this SOL are very important for formation of tokamak configuration and non-inductive current drive using electron cyclotron wave heating. In this study, non-linear particle transports and the trigger mechanism were investigated using a directional probe installed in QUEST.

Figure 1 shows the probe head structure. Four thermal probe are mounted around probe body with an interval of 90 degrees, and three electrostatic Langmuir probe channels are linearly located at the center of the probe head. The probe position can be controlled with 2 steps linear drives. The longer one is slowly driven by an electrical motor, and the other is quickly driven by pressured air during a shot. Recently, the probe head had been replaced with a different structure of the channel array, which will be reported in another paper.

In the quasi-steady state operation of QUEST tokamak plasma, spontaneous oscillation of plasma current has been observed. Figure 2 shows the time evolutions of plasma current, plasma position in major radius, Hα emission intensity, and the repetitive oscillation of plasma current with slow increase and quick decrease was observed in every 50msec (typical frequency is 20Hz). The responses of ion saturation current, poloidal rotation and toroidal rotation to the plasma current oscillation in the different manner were observed with the probe measurement in the SOL region, which are also shown in Fig. 2. The timing at which the change starts is different and the toroidal plasma flow changes at first, then plasma current decreases quickly. This observation suggests that the collapse of the plasma current is triggered by the plasma dynamics in the SOL.

Hard-X ray was also observed to increase responding to the quick collapse of the plasma current, and the loss of energetic electrons carrying plasma current seems to be occurs at the decay of the plasma current. It is noted that these observations indicate the linkage between plasma flow dynamics and the intermittent energetic electron transport.

In this year, the plasma current oscillation was observed and linkage with plasma flow dynamics in SOL region was discussed. The linkage of blob and plasma dynamics in the SOL will be investigated in near the future.

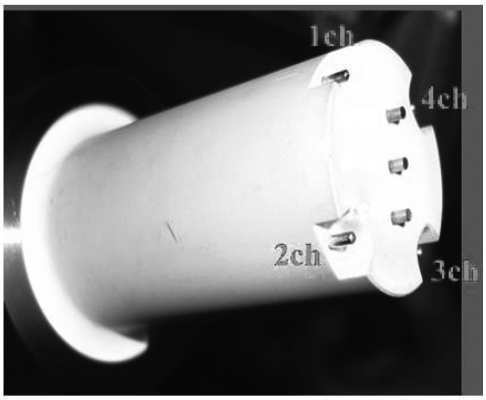

Fig. 1 Schematic and picture of probe head.

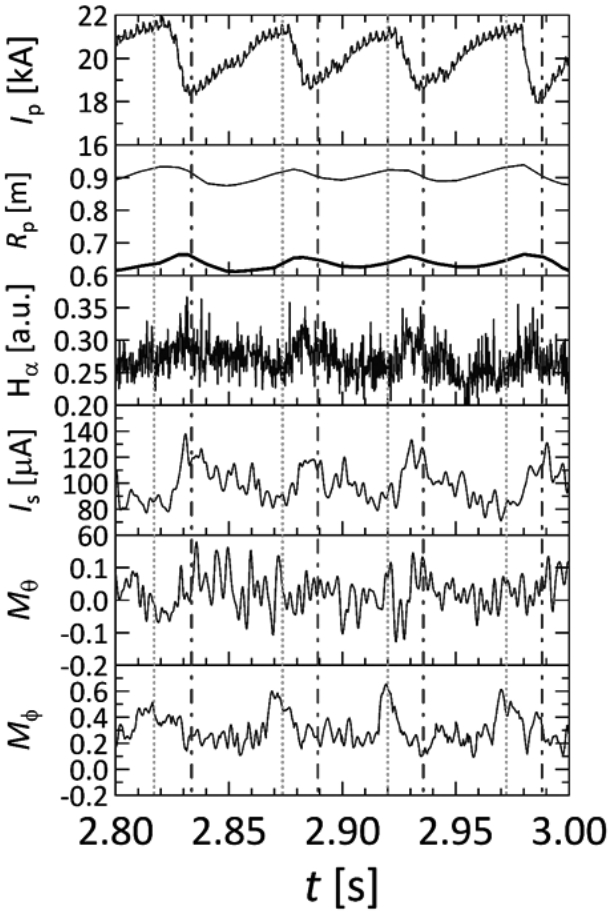

Fig. 2 Time evolutions of plasma current, plasma location in major radius, Ha intensity, ion saturation current measured by the probe, poloidal and toroidal rotation velocity.