§6. Plasma Flow Measurement at a Peripheral Region of the Central Cell in GAMMA10

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Recently, a plasma flow has been recognized to play an important role in magnetically confined plasmas, especially in open magnetic systems. The relation between radial electric field and azimuthal plasma rotation should be investigated for the confinement study in high power ICRF heating. We have measured ion Mach number M_i and flow direction at the peripheral region of the confined plasma in GAMMA10 by using a 4-tip type Mach probe. The purpose of the research is to investigate the E×B drift and diamagnetic drift and to clarify the effect of plasma flow on a radial electric field in the high power ICRF regime.

4-tip type Mach probes were set at 1.28m apart from the center of GAMMA10 and moved radially in the peripheral region. It has four probe tips and Mach number and flow direction can be derived from the four signals[1),2)]

In GAMMA10 high T_i mode were observed with high power ICRF heating using RF antennas（RF1: 10MHz, RF2: 6.4MHz） set at the central region. We have measured the Mach number M_i and pitch angle φ of the ICRF heated plasma at r=18cm in the GAMMA10 device.[3),4)] Figure 1 shows the pitch angle, total Mach number, azimuthal and axial component of Mach number as a function of the RF2 power. As the ICRF power increased, M_i increased from 0.3 to 0.6 and both of azimuthal and axial components of M_i increased with keeping the pitch angle constant at 60 degree. This indicated that the central plasma rotates azimuthally in the direction of E×B drift and flows to the end cell region.

When the ECRH power was applied to the ICRF heated plasma at the plug/barrier region, an increase of a Mach number and a change of flow direction were observed with the increase of diamagnetic signal. Figure 2 shows temporal waveforms of diamagnetic signal (DMCC), line integrated density (NLCC), M_i and φ derived from the 4-tip Mach probe. Mach number gradually increased with the ECRH injection. The diamagnetic signal increased with suppression of drift wave fluctuation. When the flute-like fluctuation enhanced, the diamagnetic signal decreased drastically with a sudden decrease of pitch angle of the plasma flow.

We should investigate a driving force of the axial plasma flow and the effect of the flow to the plasma confinement in GAMMA10. The effect of high-power RF heating on the plasma flow and the formation of radial electric field in the plasma should be pursued further.

1) Ando, A., et al., Contributions to Plasma Phys., **46** (2006) 335. J. Plasma and Fusion Res., **81** (2005) 451.
2) Ando, A., et al., Trans. of Fusion Science and Tech., **51** (2007) 217.
3) Nemoto, K., et al., *ibid,* **51** (2007) 223.
4) H.Muro et al., Fusion Science and Technology **55** (2009) 172.

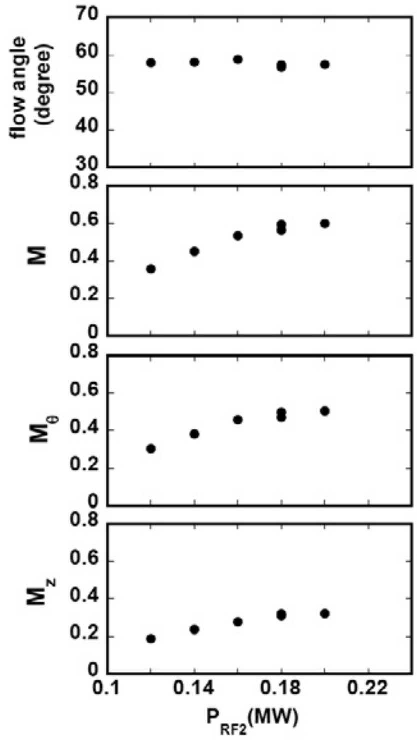

Fig. 1 Pitch angle φ of the flow to the magnetic axis, total Mach number M_i, azimuthal and axial components of M_i as a function of P_{RF2}.

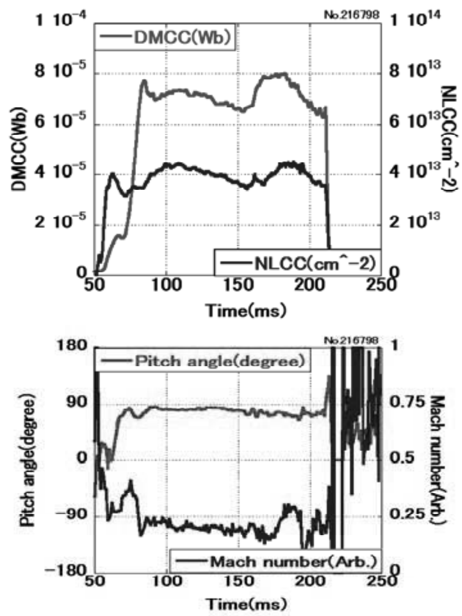

Fig. 2 Waveform of diamagnetic signal, line integrated density, and Mach probe signal M_i and φ. ECRH was applied to the plug/ barrier region from 160 to 180ms.