§7. Plasma Flow Measurement at 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. Measurement of Mach number in GAMMA10 plasma has been performed with high power ICRF and ECRH at plug/barrier section.

4-tip type Mach probes were set in both east and west side 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 of the ICRF heated plasma at r=18cm in the GAMMA10 device.[3),4)] Figure 1 shows typical waveforms of Mach number M_i of axial and azimuthal componensts, M_z and M_θ, with a diamagnetic signal. Additional ICRF (RF3) was applied at 140ms in order to heat ions at the central region of GAMMA10. The direction of the flow is outward in axial direction and ion diamagnetic rotation in azimuthal direction, which corresponds to the direction of E×B drift in the central region.

When the additional ICRF power (RF3) was applied at 140ms, increases of M_z and M_θ were observed as shown in Fig.1. These increases were related with the ion heating in the plasma. We have found the phenomena that the flow direction was reversed axially and azimuthally. Figure 2 shows a typical waveform when the reversal phenomena was occurred. Plasma density and diamagnetic signal decreased simultaneously, which indicate that the plasma confinement was affected by the change of plasma flow direction. We should investigate further the effect of high power RF heating to the plasma flow and plasma confinement in the central region.

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.

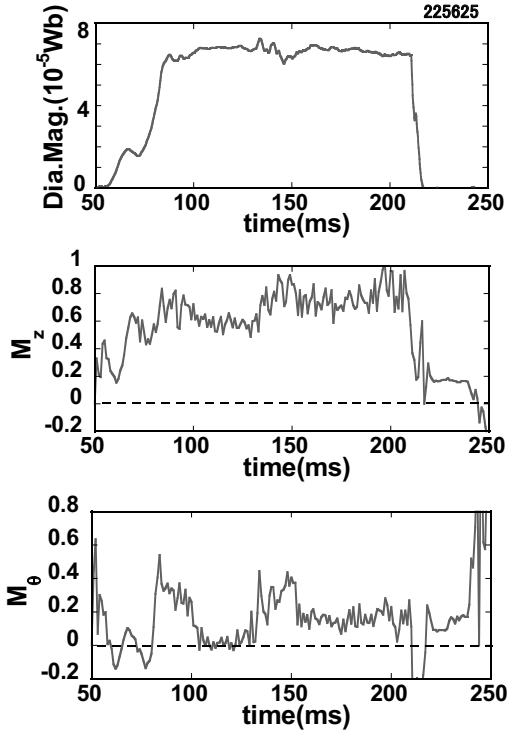

Fig. 1 Waveforms of diamagnetic signal and Mach number M derived from 4-tip Mach probe. Axial and azimuthal components, M_z and M_θ are shown. ICRH (RF3) was applied at 140 ms.

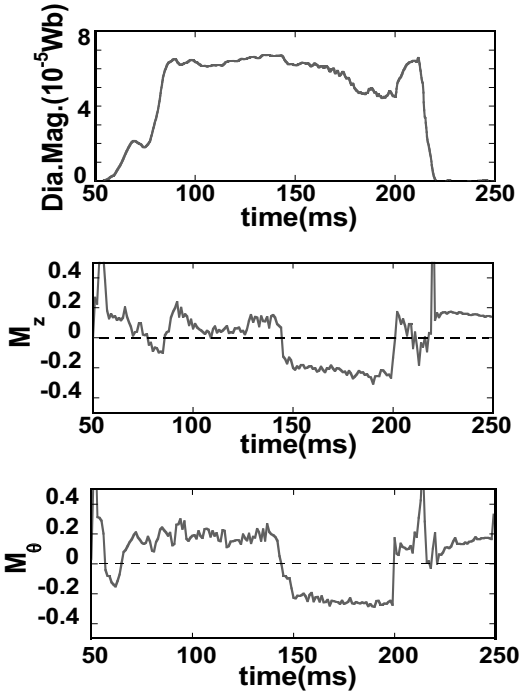

Fig. 2 Waveforms of diamagnetic signal, M_z and M_θ, in the condition that the flow directions reversed with ICRH (RF3) applied at 140 ms.