

GAMMA 10 におけるセントラル部とエンド部の揺動相関 Correlation of fluctuations between plasmas in the central-cell and the end region on GAMMA 10

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Recently, the diverter simulation experiments have been performed in the tandem mirror device GAMMA 10. A diverter simulation experimental module (D-module) was installed in the west end region as shown in Fig.1. The Langmuir probes are set on the V-shaped target in the D-module. In this experiment, we measured the ion saturation current (i.e. plasma density) at the end region. On the other hand, the plasma potential and electron density as well as their fluctuations in the central cell plasma were measured with the Gold Neutral Beam Probe (GNBP).

The plasma initially generated by a plasma gun and then maintained by ion cyclotron range of frequency (ICRF) waves excited in the central cell and anchor cells. From $t \sim 145$ ms to ~ 155 ms, the coherent fluctuations with 3.2 kHz are found at both the central-cell and end region plasmas as shown in Fig.2.

The cross correlation is calculated by the following equation:

$$R_{xy}(\tau) = \frac{\langle x(t)y(t+\tau) \rangle}{\sqrt{\langle x^2 \rangle} \sqrt{\langle y^2 \rangle}},$$

where $x(t)$, $y(t)$ are the beam current of the GNBP and the ion saturation current of the probe of the D-module, respectively. The result shows high coherence of both fluctuations. The correlation coefficient is 0.78 at the maximum at the time lag $\tau_{\max} \sim 80$ μ s as shown in Fig.3. It is found that the fluctuation generated in the central cell plasma propagated to the west region. The propagation velocity estimated by the distance of the GNBP and probe (9.8 m) and τ_{\max} is 1.2×10^5 m/s in the axial direction. The propagation of the fluctuation in the radial direction will also be discussed.

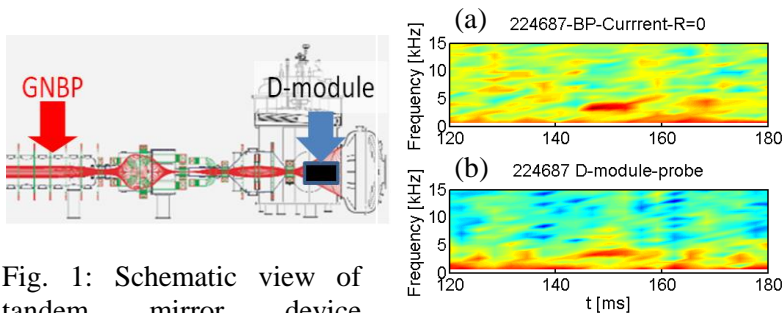


Fig. 1: Schematic view of tandem mirror device GAMMA 10 west-side compartment. The distance from GNBP to D-module is 9.8 m.

Fig.2: Time evolution of fluctuations of (a) beam current of GNBP and (b) ion saturation current of probes in D-module. The frequency resolution is 650 Hz.

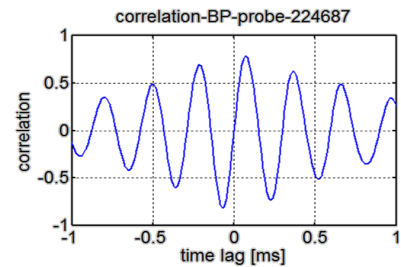


Fig.3: The cross correlation R_{xy} of the fluctuations between plasmas in the central-cell and the end region .