§5. Analysis of Edge Plasma Turbulence Based on Two-dimensional Visible Image Measurement in Open Magnetic Field Configuration Plasmas

Nishino, N. (Hiroshima Univ.),
Nakashima, Y., Yoshikawa, M., Miyata, Y., Yonenaga, R.,
Hosoi, K., Ozawa, H. (Tsukuba Univ.),
Shoji, M.,
Kobayashi, S. (Kyoto Univ.)

GAMMA 10 is a minimum-B anchored tandem mirror device with axisymmetric mirrors on both ends [1]. Figure 1 shows the schematic of GAMMA 10 device and location of a fast camera. The fast camera views the central plasma with horizontal port. Typical photograph of high potential discharge is shown in Fig.2. In the figure the elliptic bright region at the left side is the central limiter. The central limiter limits the plasma diameter in the central-cell, and from the central limiter the filament structure extended to the right direction. In figure the white circle is the bright region on the limiter board during discharge. Using the center pixel data of this circle the time-dependent FFT (TD-FFT) was calculated. Figure 3 shows the power spectra, the results of TD-FFT. From ~165ms to 180ms the low frequency perturbation were found and the frequency range of this perturbation will be wider. Actually the frequency would be up to 20kHz. In the images m=2, 6kHz rotation was observed this time. From 165-180ms ECH using high-power gyrotrons (<1MW) at the plug/barrier-cells and central-cell were applied to the plasma. In the images filament and/or central plasma rotated at 2.5kHz, and relatively higher turbulence is generated due to ECH during this period.

In this experiment the electron density during ECH does not change so much and it kept 4-4.5x$10^{13}$$cm^{-2}$. Also, the diamagnetic signal, which indicates the confinement energy, raised 0.8x10^{-4} Wb to 1.0x10^{-4} Wb until 175ms. After that the diamagnetic signal dropped to the original value.

Probably in the high potential discharge the electron density was low to produce the high potential easily, therefore, the recycling should be low rate. That causes the low turbulence plasma. Phenomenology this interpretation was valid comparison this results and that of the high-density discharge (the recycling should be large rate, and the turbulence was larger level).

Anyway we demonstrated successfully that peripheral turbulence is important for the energy confinement in GAMMA 10 plasma. However, the relationship between turbulence in the open field confined plasma and in the circular magnetic confined plasma is still unknown, and this is the ultimate aim of this study.

The study of peripheral turbulence in GAMMA 10 was begun recently, and the fast camera was very useful tool to visualize these turbulence. In the future behavior of peripheral turbulence will be investigated under various condition of plasma production and heating.

1) M. Inutake *et al.*, Phys. Rev. Lett. 55 (1985) 939

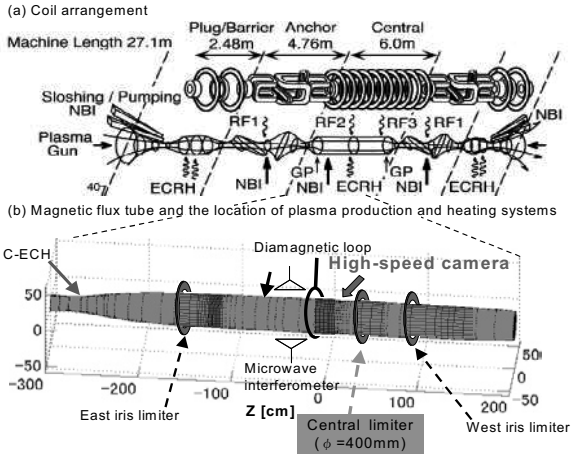

Fig.1 Schematic of GAMMA 10 and camera location

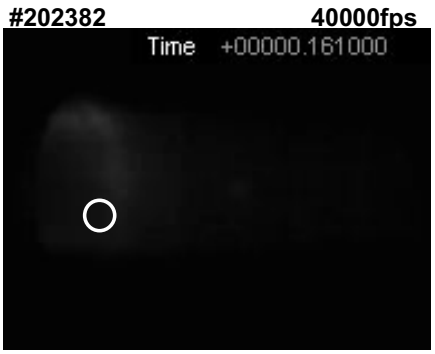

Fig.2 Raw image of high potential discharge

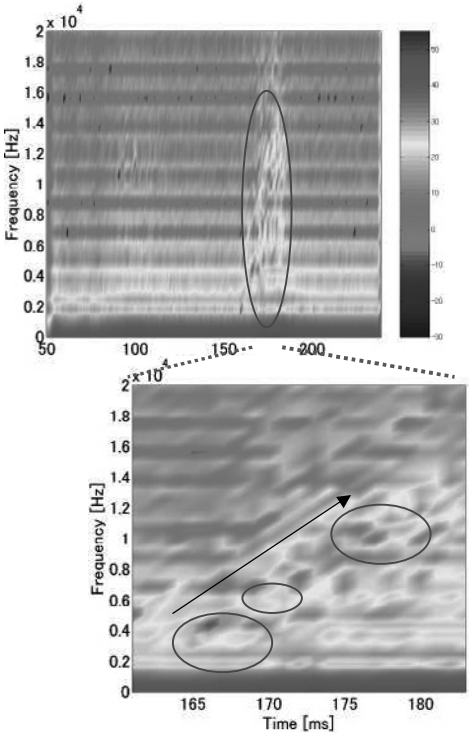

Fig.3 Power spectra of camera image
Time-dependent FFT was applied to the data of specific pixel in the white circle shown in Fig.2