Plasma imaging by using a high-speed camera in the GAMMA10 tandem mirror

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The two-dimensional (2-D) imaging of turbulent structure in the GAMMA 10 Tandem Mirror was measured by using a high-speed camera. The observation with the high-speed camera can capture the instantaneous 2-D structure and provide useful information about the shape, the position and the motion of plasma. Therefore the 2-D imaging diagnostics with the high-speed camera has been employed in many experimental devices [1-3].
The high-speed camera (MEMRECAM fx-K5, NAC Inc.) was mounted at the GAMMA10 central-cell midplane. As the parameters of the high-speed camera, we used 192x144 pixels of measuring size in 40000 frames per second. The camera observed the plasma behavior on the machine axis through a horizontal port. At the GAMMA10 central cell, the central limiter is fixed and visible light is emitted strongly by the interaction between a plasma and the central limiter[4,5]. Observing and analyzing the motion of the visible light emission, we can obtain the characteristics of the plasma behavior such as the fluctuation and the rotation. For example, we clarified the frequency spectrum of the plasma fluctuation by the Fourier analysis and investigated the direction of the plasma rotation by the phase analysis. In the phase analysis, we analyzed the frequency spectrum of the 2-D image in all pixels, and investigate the phase contrast of the frequency spectrum from a standard pixel in each pixel. We can obtain some approach to understand how plasma rotates.
Recently, in order to optimize the 28GHz-500kW ECRH (Electron Cycrotron Resonance Heating) launching condition experimentally [6], the antenna has been upgraded as a vertical steering functional from a fixed type. We investigated the influence on the plasma condition of each position of the antenna of the gyrotron and observed this plasma behavior by using the high-speed camera in dedail. The analysis of 2-D imaging of turbulent structure clarified that the position of the antenna has an influence on the plasma behavior.

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