

Three-dimensional measurement using tomography systems in a magnetized plasma in linear cylindrical geometry

K. Yamasaki¹, A. Fujisawa^{1,2}, Y. Nagashima^{1,2}, C. Moon^{1,2}, S. Inagaki^{1,2}, M. Sasaki^{1,2},
Y. Kosuga^{1,2}, T. Yamada^{2,3}, N. Kasuya^{1,2}

¹ *Research Institute for Applied Mechanics, Kyushu University, Kasuga, Fukuoka, Japan*

² *Research Center for Plasma Turbulence, Kyushu University, Kasuga, Fukuoka, Japan*

³ *Faculty of Arts and Science, Kyushu University, Fukuoka, Fukuoka, Japan*

Three-dimensional structure of plasma emission and its fluctuations have been successfully measured using three tomography systems in a linear cylindrical plasma device, PANTA, which is designed for investigating the fundamental processes and mechanisms of structure formation and dynamics of turbulent plasmas. The tomography systems, each of which is equipped with more than 120 lines of sights (totally 382) and placed by 25cm apart in axial direction, have been developed as the principal diagnostics that can observe the spatial patterns of the emission and fluctuations over the entire plasma cross-sections, without any perturbation, with spatial resolution comparable to gyro-radius of Ar plasma of PANTA (1 cm) whose radius and length are 5 cm and 4 m, respectively [1] (see Fig.1).

The advanced tomography needs new analysis methods for the 2D plasma images, thus, many have been developed; a fast tomography reconstruction technique [2], an optimization method of the Fourier-Bessel function bases for structural analysis [3], Fourier-Rectangular function analysis for extracting the local feature of the emission and fluctuation patterns [4] and Stokes parameter analysis for fluctuation mode dynamics [5]. The 3D measurement of tomography has started to show many interesting findings; azimuthal asymmetry and axial inhomogeneity of emission profile, creation and annihilation of turbulent vortices, the interaction of a solitary wave with the asymmetric structure, and so on.

The paper will present the observation results of structure and fluctuations of a linear cylindrical magnetized plasma in PANTA with details of the 3D tomography systems and newly developed analyzing techniques.

References

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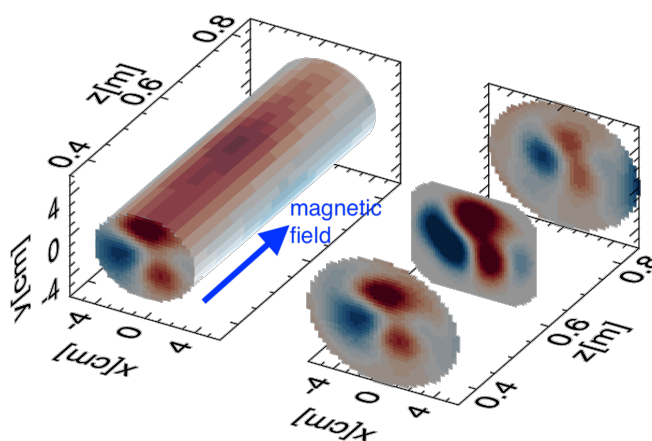


Figure 1. An example of 3D tomography measurement.