Development of a High Speed VUV Camera System for 2-Dimensional Imaging of Turbulent Structures in LHD

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In fusion plasmas, a turbulent transport effects greatly on a plasma confinement. In order to clarify the role of the turbulent transport, measurements of fluctuations with high time and spatial resolutions are necessary. In this case, if 2-dimensional structures are observed, the more detailed characteristics of turbulence can be clarified, since a propagation direction of the fluctuations and the mode number are found in visually. In a large helical device (LHD), an edge transport barrier (ETB) plasma and an internal diffusion barrier (IDB) plasma are observed and researched in recently. The clarification of the turbulent structure in the plasmas is important to clarify physical mechanisms of these transport barriers.

Therefore, a high speed vacuum ultraviolet (VUV) camera system for 2-dimensional imaging of turbulent structures was developed and installed in LHD. This optical system is composed of 2 multi-layer mirrors made of Mo / Si and a micro-channel plate (MCP) as shown Fig. 1. An emission from plasma reflects at the multi-layer mirrors with high reflectivity and images on the MCP. The VUV emission near 13.5 nm of impurity carbon (n = 4-2 line of C VI) can be observed. This emission reflects an impurity fluctuation, and a fluctuation of an electron density can be estimated as a result. This system has an advantage that a light intensity is larger than that of a pinhole type optical system. In analysis of the camera image, an inverse transformation of the line-integrate data is required for the deviation of the turbulent structure. In this paper, the constitution of this VUV camera system and an analytical method are described in detail, and moreover preliminary results observed in LHD are shown.

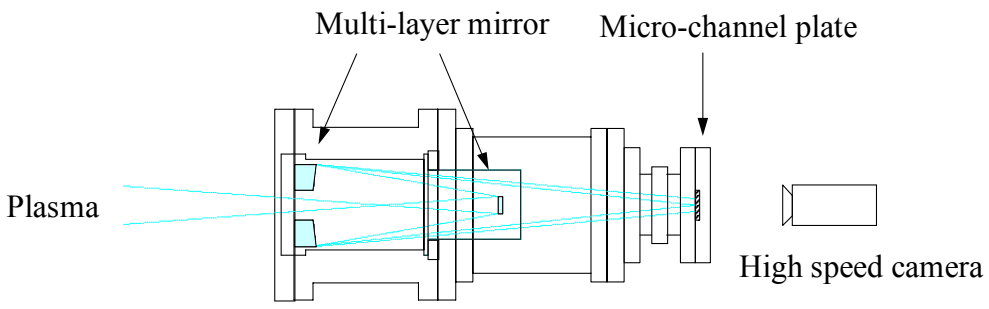

Fig. 1 Schematic view of a high speed VUV camera system for 2-dimensional imaging of turbulent structures.