U054-P066 **Room: Poster Session Hall** **Time: May 15**

Plasma diagnostic system using optical fibers with high numerical aperture

Yasuyuki Nogi[1]; Yuki Kanamaru[2]; Toshiyuki Fujino[2]; Yoshinori Hasegawa[2]; Kayoko Fujimoto[3]; Hiroshi Gota[4]; Yasunori Ohkuma[5]; Tomohiko Asai[6]; Tsutomu Takahashi[7]

[1] CST,Nihon Univ.; [2] CST,Nihon Univ; [3] JAEA; [4] Univ. of Washington; [5] Tec., TUAT; [6] College of Sci. & Tech., Nihon Univ; [7] CST Nihon Univ.

Optical fibers are useful tool for constructing an optical system to detect a radiation from a plasma. A collimator with a convex lens is commonly attached in front facet of each fiber to limit the viewing angle and improve the spatial resolution of the optical system. To diagnose the structure of the plasma, contrived arrays using many numbers of the fibers are constructed and arranged around the plasma. The optical syatems in the visible light range have been successfully used in field-reversed-configuration plasma experiments to study the magnetohydrodynamic motions and the internal structures of the plasma.

If the collimator is removed from the fiber, the radiation from all plasmas included in the viewing angle enters into the fiber. When the maximum viewing angle called numerical aperture, NA, is large enough to cover the entire plasma, the strength of the radiation into the fiber depends on the position and structure of the plamsa. It is proposed in the present report that a deformation of the cross section and an internal structure of the plasma can be known from optical gains of the fibers arranged around the plasma with axial symmetry. The NA of the fiber is needed to be sufficiently high since the distance between the plasma and the fibers is very close in most plasma experiments. Fortunately, many kinds of fibers with a high viewing angle of NA=0.6-0.9 are recently fabricated to use to light up exhibits in museum and for fluorescent monitoring.

In this report, theoretical forms are first derived to know the structure of the plasma from optical gains of the fibers with a high NA. Second, the numerical aperture is attempted to measure by a simple method using a circular fluorescent lamp. Third, the theoretical forms are ascertained by a mock-up experiemnt where a light source representing a model plasma is constructed by a matrix array of straight fluorescent lamps. In this experiment, an effect of a reflection light from a wall of a vacuum vessel is investigated. Finally, the optical system is applied to the field-reversed-configuration plasma. Obtained structures of the plasma for n=1 and 2 toroidal mode numbers are compared with the results of the conventional method using the fibers with convex lenses. The former results agree well with the latter ones in spite of the use of one-sixth the number of fibers in the latter method.