§2. Study of Divertor Simulation Using Open Magnetic Field Configuration

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As a future research plan of Plasma Research Center, University of Tsukuba, making use of the advantage of open magnetic field configuration, we have started a study of divertor simulation under the closely resemble to actual fusion plasma circumstances and to directly contribute the solution for realizing the divertor in toroidal devices. In this study, the investigation on the characteristics of plasma flow from the end-mirror exit of GAMMA 10 is performed to validate its applicability to the divertor simulation studies.

Figure 1 shows the schematic view of the vacuum vessel in the west end-mirror region, together with the location of the diagnostic equipment. In order to perform a simultaneous measurement of heat and particle fluxes, a set of calorimeter and directional probe has been inserted from the bottom of the vacuum vessel (z_{EXIT} = 30 cm) up to the center axis of GAMMA 10. A set of movable target plates was also made to obtain a visible spectroscopic data from the interactions between the plasma and the target materials (z_{EXIT} = 70 cm). Recently direct energy analysis of end-loss ions was started using end loss ion energy analyzer (ELIEA) located at the end-tank (z_{EXIT} = 300 cm).

In Fig. 2 the parallel ion temperature $T_{i//}$, which is determined from the probe and calorimeter, is plotted as a function of ICRF power for plasma heating in the central-cell (RF2). $T_{i//}$ directly measured with ELIEA is also plotted in Fig.2. Achieved high ion temperature (100 - 400 eV) is almost comparable to SOL plasma parameters in toroidal devices and is controlled by changing the RF2 power, which cannot be attained in the conventional linear divertor simulators. It is also found that both data determined from different diagnostics agree with each other and have linear relationship with the ICRF power.

Figure 3 shows the axial distribution of the heat and particle fluxes measured at the different positions on z-axis in only ICRF plasmas. Data points with connected lines represent the calculation results of the heat and particle fluxes by taking into account of the effect of the density reduction due to the expansion of magnetic flux tube in the downstream side from the end-mirror exit. Each value measured at the different axial positions locates between the

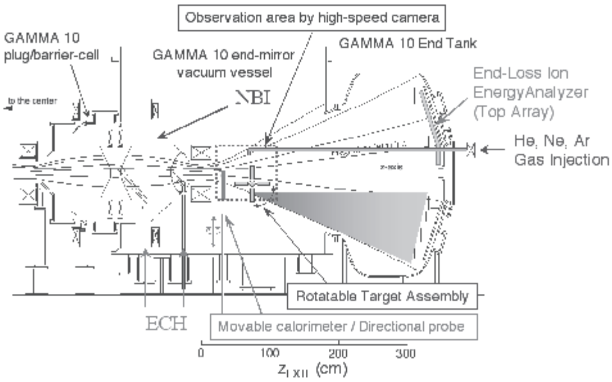

Fig. 1. Schematic view of west end-mirror vacuum vessel and the location of diagnostic equipment.

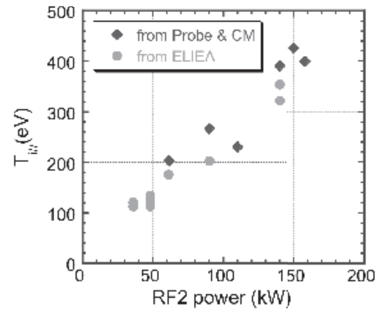

Fig. 2 Dependence of parallel ion temperature on DMcc.

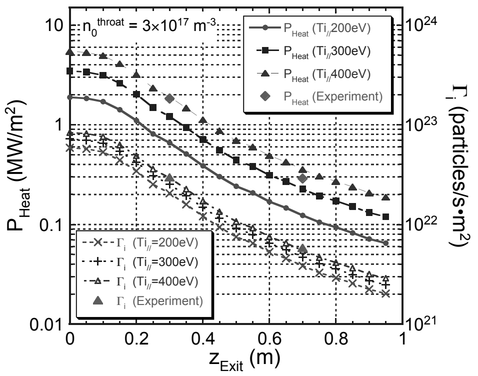

Fig. 3 Axial profile of heat and particle fluxes ◆: heat flux measurements, ▲: particle flux measurements, lines: calculation.

two calculation lines ($T_{i//}$ = 300 eV and 400 eV). These results give a good agreement with the calculation.

The publications from this collaborative research are listed below:

1) Y. Nakashima, et al., 2nd Int. Workshop on Plasma Material Interaction Facilities, Sept. 19-21, 2011, Juelich, Germany.
2) Y. Nakashima, et al., Trans. Fusion Sci. Technol. **59** No.1T (2011) 61-66.
3) Y. Nakashima, et al., J. Nucl. Mater. **415** (2011) S996-S1000.
4) H. Takeda, Y. Nakashima, et al., 21st Int. Toki Conf. Nov. 28 – Dec. 1, 2011, Toki, Japan.