# §13. Study of Divertor Simulation Using End-region of a Tandem Mirror

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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 we directly contribute the solution for realizing the divertor in toroidal devices.

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). 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 high heat-flux generation experiments, net heat flux density during the ECH pulse was investigated According to the increasing ECH power, the heat flux continues to increase and, in this year, superimposing the ECH pulse of 380 kW, 5 ms attained the maximum heat-flux more than 10 MW/m$^2$ at 30 cm downstream from the end-mirror coil on axis. This value comes up to the heat-load of the divertor plate of ITER, which gives a clear prospect of generating the required heat density for divertor studies by building up the heating systems.

A large-scale divertor simulation experimental module (D-module) was installed at the exit of west end-mirror and plasma irradiation experiments onto a new V-shaped target in D-module were started. The photograph of D-module is shown in Fig. 2. This experimental module consists of rectangular chamber (cross-section of 500×500 mm, 700 mm in length) with an inlet aperture of ϕ200 mm and two tungsten plates (350×300 mm) are mounted in V-shaped with their opening angle from 15 degree to 80 degree. Two gas injection lines are prepared for

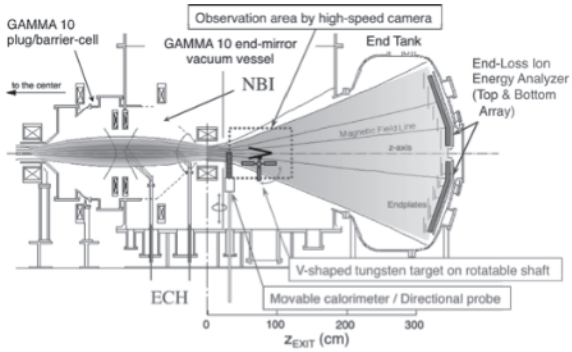


Fig. 1 Schematic view of west end-mirror vacuum vessel and the location of diagnostic equipment.

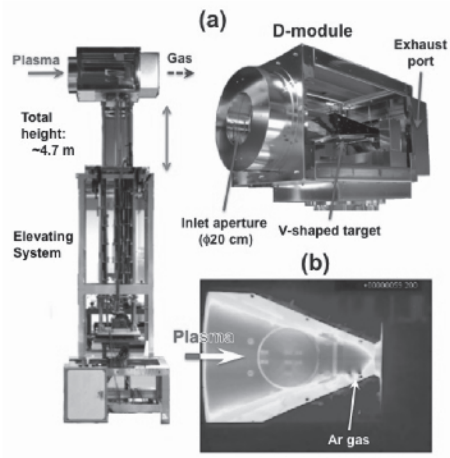


Fig.2 Photographs of (a) newly installed divertor simulation experimental module (D-module) and (b) 2-D visible image of light emission due to plasma-target interactions in the V-shaped target.

investigation of radiation cooling mechanism and realization of plasma detachment in D-module. In Fig. 2 (b), the two-dimensional image of light emission is shown that is captured with the high-speed camera for the first time in the V-shaped target during Ar gas injection. From spectroscopic measurements, a strong concentration of Hα emission together with Ar line emission is observed in the module, which indicates significant neutral compression and enhancement of recycling.

The presentations and publications from this collaborative research are listed below:

1) Y. Nakashima, et al., 20th Int. Conf. Plasma Surface Interactions, Aachen, Germany (May 2012) P1-29.
2) Y. Nakashima, et. al., Joint Int. Conf. OS2012 & PMIF2012, Tsukuba, Japan (September 2012) I-15.
3) H. Takeda, et al., ibid, P/PMIF-8.
4) K. Ichimura, et al., ibid, O/PMIF-13.
5) Y. Nakashima, et al., Proc. of IAEA FEC2012, San Diego, USA (October 2012) FTP/P1-11.
6) Y. Nakashima, et al., 22nd Int. Toki Conf. Toki, Japan (November 2012) O8-3.