§57. Study of Hydrogen Recycling and Neutral Particle Behavior in Spherical Torus Plasmas

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In magnetically confining plasma devices, investigation of hydrogen recycling and neutral transport is an important subject for understanding edge plasma behavior and for the estimation of particle confinement characteristics. In spherical torus plasmas, such as compact torus devices, the analysis of neutral transport becomes complex due to the three-dimensional configuration of the system. The objective of this study is to investigate the behavior of hydrogen recycling based on the Hα line-emission measurement and 2-D image measurement using high-speed CCD camera in the spherical tokamak CPD.

Figure 1 shows the photograph of the CCD camera mounted in front of the horizontal view port of CPD. The CCD camera (HAS-220, DITECT Inc.) captures 2-D plasma light-emission with the frame rate of 1 kHz. An interference filter with Hα wave range is attached in front of a lens so that only Hα-emission related to the neutral particles in the plasma can be observed.

In Fig. 2, a schematic view of a monitoring system using the above CCD camera is simply described. The CCD camera is connected to the PC in the machine room. Three types of software (camera-control software, mouse-control software and image-view software) are installed in the PC. With the trigger signal, camera-control software starts to capture the 2-D images and save into the PC's memory. The mouse-control software automatically controls a mouse function. It automatically labels the 2-D images with a name of the plasma discharge number and saves into the hard disk.

In Fig. 3, an example of 10 captured images of the plasma discharges from the display of the PC are shown. This monitoring system is much convenient for comparing the trend of plasma behavior shot by shot and makes an significant contribution to plasma optimization in the CPD experiments.

By using this system, a phenomenon of the current jump was clearly observed in ECH produced CPD plasmas and precise parameter dependence was investigated. This results show that the 2-D image measurements is a powerful tool for the investigation of plasma motion and plasma edge behavior.

1) T. Yoshinaga, eta l., 2nd Korea-Japan workshop on heating technology of Fusion plasmas, August 16-17, 2007 KOREA,Jeju.
2) T. Yoshinaga, et al., The 13th International Workshop on Spherical Torus 2007,Tsukushi campus, Univ. Kyushu.
3) H. Kawano, Y. Nakashima, *et al.,* J. Plasma Fus. Res. **2** (2007) S1126.
4) Y. Nakashima, *et al.*, Plasma and Fusion Research **2**, (2007) S1056.
5) Y. Higashizono, Y. Nakashima, *et al.*, to be published in Jpn. J. Appl. Phys.

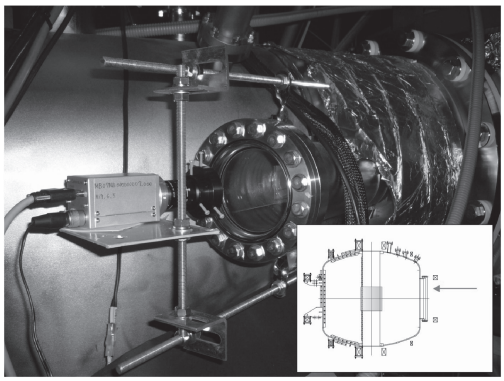

Fig. 1 Photograph of the CCD camera mounted in front of the horizontal view port of CPD.

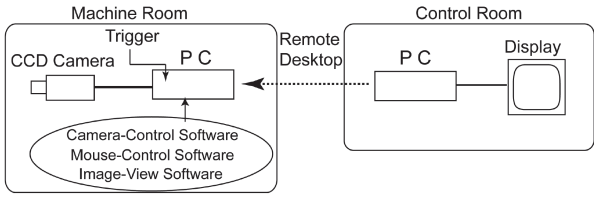

Fig. 2 Schematic diagram of a monitoring system with a CCD camera. and PC's.

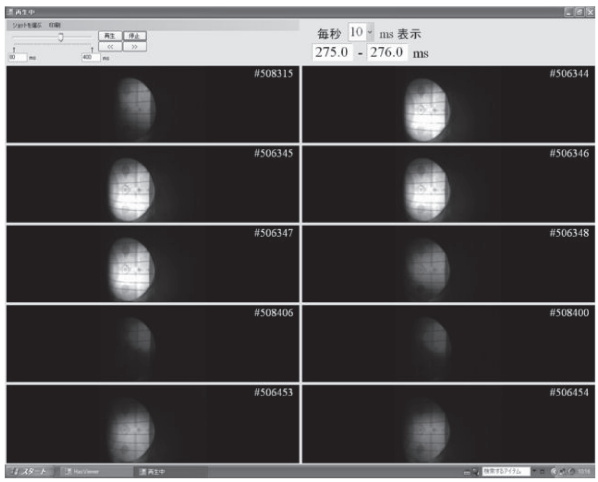

Fig.3 An example of monitoring display of CPD plasmas by the monitor system.