§15. Development of SINET Online Data Acquisition and Share System

Ono, Y., Tanabe, H., Ii, T., Ito, S., Sakamoto, T., Yamada, T., Inomoto, M. (Univ. Tokyo, Dept. Advanced Energy), Narihara, K., Nagayama, Y.

The Doppler broadening method is the most reliable diagnostics for ion temperature measurement and its two dimensional (2-D) measurement is expected to solve magnetic reconnection in TS-4 merging experiment. We have developed a new 2-D ion temperature measurement system by combining the Doppler spectroscopy with computer tomography technique. As shown in Fig. 1, the 2-D (3x3) measurement system is composed of three polychromators with ICCD cameras and 108 optical fibers connected with collecting lens system. It enables us to develop the first 2-D ion temperature measurement system for toroidal plasmas. This system digitizes three images of 256x1064 data every three millisecond, indicating that the SINET system is useful for their data analyses. Figure 2 shows a CCD image of 35 H_{β} line spectrums measured by 7x5 optical fibers (top) and transformation of the line-integrated line spectrums into local line spectrums using Abel inversion at each wavelength (bottom). We sucessfully measured the 2-D contours of ion temperature pf merging tokamak plasmas.

We also developed 2-D electron temperature measurement system, so called 2-D Thomson scattering system using the multiple reflection of laser light and time-of-flight measurement of scattering lights. We measured for the first time the 3x3 Thomson scattered signals without using any plasma reproducibility. Its laser beam was reflected three times by the mirror to cover the center area of out TS-4 spherical tomamak (ST) plasma. The Thomson scattering signals from the 3x3 measuring points were successfully measured by those collecting optics and polychromator system. Each three scattering signals were measured as a time series signals with interval time of 30nsec, which corresponds to laser flight length of 12m. The time axis indicates the axial position because of the time-of-flight measurement. Those signals are used to calculate the electron temperature by Gaussian fitting. Finally, 2-D contour of electron temperature were obtained. This successful result supports the validity of our 2-D Thomson scattering method by multiple reflection and time-of-flight of laser. The efficient data transfer is also demonstrated by the SINET system.

1) T. Yamada, R. Imazawa, S. Kamio, R. Hihara, K. Abe, Q. H. Cao, H. Sakakita, H. Koguchi, S. Kiyama, Y. Hirano, C. Z. Cheng, M. Inomoto, Y. Takase, Y. Ono, "Double Null Merging Start-up Experiments in the University of Tokyo Spherical Tokamak", Fusion Energy 2010.

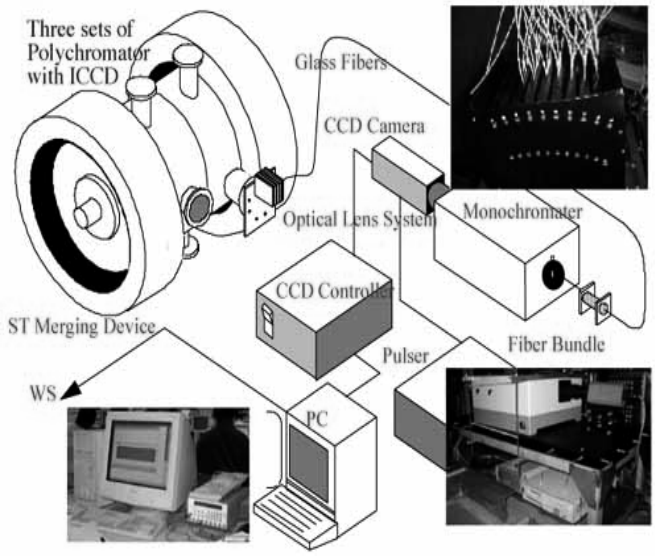

Fig. 1 2-D ion temperature measurement system composed of 108 optical fibers and three polychromators with ICCD cameras.

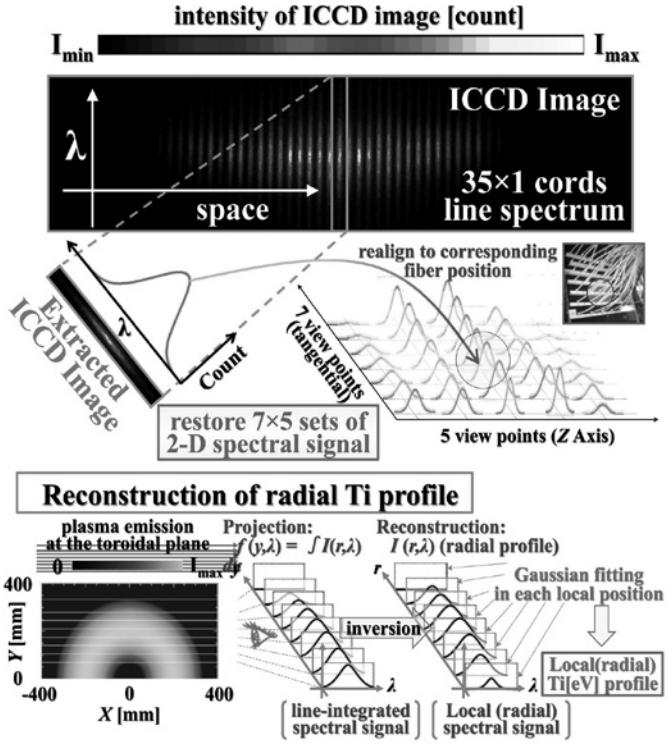

Fig. 2 A CCD image of 35 H_{β} line spectrums measured by 7x5 optical fibers (top) and transformation of the line-integrated line spectrums into local line spectrums using Abel inversion at each wavelength (bottom).