§27. Measurement of 3-D Thermal Flux by Soft X-ray CT

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Although Soft X-ray Computerized Tomography has been quite effective to investigate MHD phenomena in toroidal plasmas, it has been applied so far only to single toroidal location and the resultant SXCT images have been analysed assuming toroidal symmetry of the plasmas and quasi-helical symmetry of MHD modes. In helical systems such as LHD, however, plasmas have no toroidal symmetry, which may require multi-SXCT systems at different toroidal location. In tokamaks where plasmas have been naturally assumed to have toroidal symmetry, an interesting idea that magnetic reconnection during sawteeth crash may occur at a localized toroidal location is proposed to explain the various aspects of sawteeth crash.1) In these circumstances, we are developing a three-toroidal-location SXCT system from the single-toroidal-location SXCT system on the WT-3 tokamak at Kyoto University in order to develop a method for investigating 3 dimensional thermal flux and MHD phenomena in toroidal plasmas.

The planned system is schematically shown in Fig.1. Sub SXCT system at each toroidal location consists of five SX cameras, one camera looking plasma from a top port, three from a radial port, and one from a bottom port. Each camera has a diode detector array with 20 channels and a narrow rectangular collimator with a thin Be absorber. Each array has built-in pre-amplifires, and the signals are transferred through buffer amplifires attached just outside of the camera to CAMAC A/D converters in the CAMAC crate. Then the data are acquired by a personal computer operated by Linux OS through a CAMAC serial highway and analyzed by another computer. The total amount of data for single shot of tokamak discharge will be 21 M byte and total transfer time from the A/D converters to the data acquisition computer will be 50 seconds. The time resolution is $\sim$ 1 μ sec.

Now, the eighth and third port systems are completed and the test operation has been done, where the planned performance, including data transfer time and time resolution described above, has been confirmed for OH discharges with sawteeh oscillations. The fifteenth port system will be completed next summer 1999. Along with the completion of the total system, we will search for toroidal asymmetry phenomena in various discharges with sawteeh crash, major disruption and neon impurity puffing.

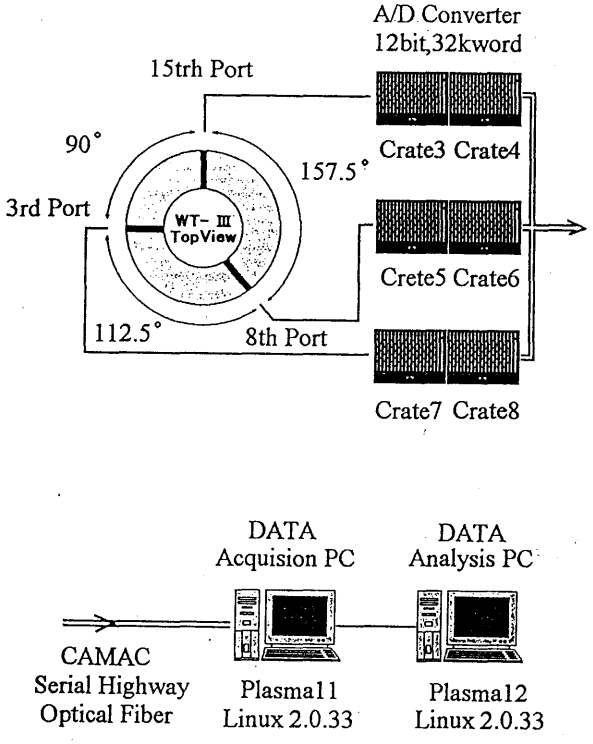

Fig.1 Schematic diagram of three-toroidal-location SXCT system

References

1) Nagayama, Y., Journal of Plasma and Fusion Research (in Japanese) 74, (1998) 1158