§3. Millimeter-Wave Remote Experiment System Using Super-SINET

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In the end of FY 2002, the remote experiment system using super science information network (super-SINET) has been introduced to electron cyclotron emission imaging (ECEI) and ultra-short pulse reflectometry (USRM) installed in LHD as collaborating research programs. Bandwidth of the main backbone and branch line is 10 Gbps and 1 Gbps, respectively. We can now participate in the LHD experiment via remote control system and transfer the experimental data for online data processing from NIFS to Kyushu. In this paper, the present state of the system is reported.

The schematic of the LHD-ECEI system using the super-SINET is shown in Fig. 1. The second-harmonic ECE signals in the extraordinary mode are mixed with an LO power on the detector array. The IF signals are amplified by a chain of amplifiers (0.5-8 GHz bandwidth and 73 dB gain) and subsequently separated into 4-8 channels. Each signal is then band pass filtered. A range of filters is available with center frequency from 1 to 8 GHz at 1 GHz intervals; each has a 3 dB bandwidth of 300 MHz. The signals are then fed to the LABCOM data processing system and transferred to Kyushu University via the super-SINET. In Fig. 1 is also shown the time evolution of the ECE signals obtained from two different detectors and IF channels. The data analysis is performed as a cross-correlation spectrum between two detectors at the same IF channel and between two IF channels at the same detector. The former shows the poloidal correlation and the latter shows the radial one.

In the present stage the data of 3-5 Mbyte is transferred to Kyushu University in a shot. The transfer speed is approximately 50-60 Mbps. The data will expand to 50-60 Mbyte/shot in the next experimental campaign (FY2004). In addition to the above ECEI system, the TV conference system can also be operated via the super-SINET.

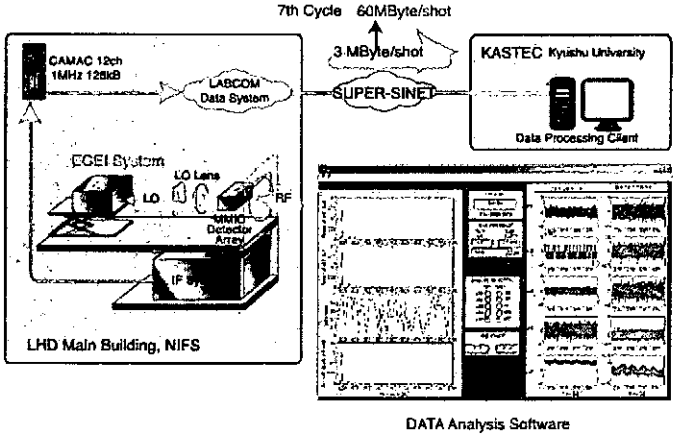

Fig. 1. LHD-ECEI system.

Remote control system using the super-SINET has also been introduced to an USRM system as shown in Fig. 2. The detail of the experimental setup was shown in elsewhere. The control client can operate the control server by using this network. The general-purpose interface bus (GPIB) card is installed in the control server. The remote console, which has graphical user interface (GUI) as shown in Fig. 2, is prepared to control the instruments of USRM via GPIB. The operations such as adjustment of supply voltage fed to amplifiers and the doubler, timing control of the impulse, data acquisition and monitoring can be performed from the remote site (Kyushu University). We are now preparing movable antennas for the adjustment of the incident and receiving angle in order to maximize the reflected wave from the cutoff layer. In the next campaign, we shall be able to control the antennas from Kyushu during the shot.

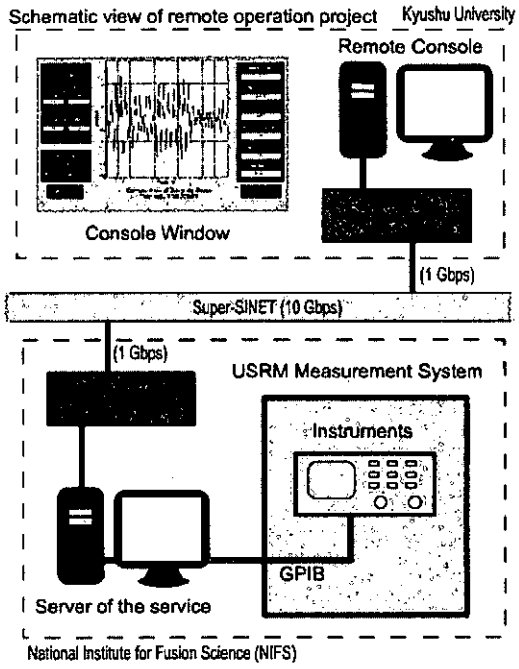

Fig. 2. Remote operation system utilizing super-SINET.