§74. Progress of the Remote Data Acquisition and Sharing in "Fusion Virtual Laboratory (FVL)" Based on 10 Gbps SINET4

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The LHD data acquisition and archiving system, namely "LABCOM system", has been applied for the QUEST experiment at Kyushu University and also for the GAMMA10 at University of Tsukuba since 2008. It has been developed as the common data sharing platform for the "Fusion Virtual Laboratory (FVL)" project [1], of which remote access is constructed on the fusion-research dedicated virtual private network "SNET" [2]. It is virtually set up on the Japanese academic network backbone SINET4 operated by National Institute of Informatics (NII). Fig. 1 shows the schematic structure of FVL on SNET.

At the QUEST experiment, seven data acquisition (DAQ) nodes are running which are always operated and monitored remotely by NIFS LABCOM group. As for the GAMMA10 experiment, three DAQ nodes are running with the same manner and the rest of raw data acquired by legacy local systems are also transferred and registered to the LABCOM data system once a year after the end of GAMMA10 annual campaign.

The whole data amount accumulated in LABCOM archive has gone up about 0.7 Peta-bytes. QUEST data occupy double of 2.6 TB between shot #1 and #25876, and GAMMA10 does double of 1.4 TB from shot #207771 to #229544, respectively. The acquired raw data amount for each shot has kept growing at QUEST since 90 MB/shot in 2008, 300 MB in 2009, 350 MB in 2010, 620–800 MB in 2011– 2012, and finally up to 1.2 GB/shot in 2013 FY.

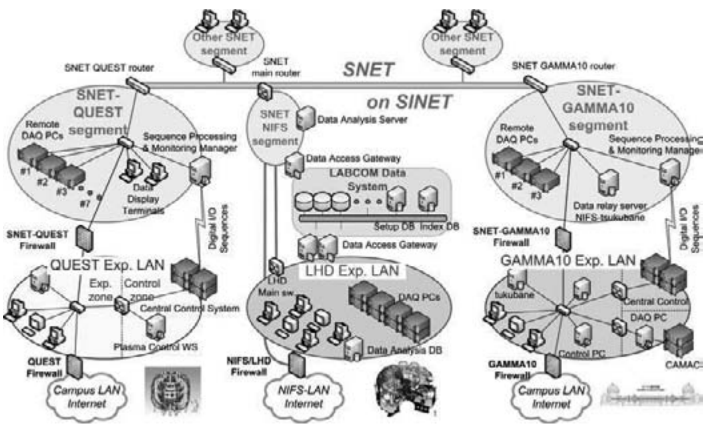

Fig. 1 Schematic network diagram of "Fusion Virtual Laboratory" participating sites and SNET: LHD, QUEST, and GAMMA10 are equivalently connected to each other through the SNET on SINET4.

In addition, the new 'raw2ana-quest' service has been started since 2013 QUEST campaign, which enables the automatic data analyses synchronously triggered by the first appearance of diagnostic raw data. It can considerably help the physics analysts to be free from the human interactive data post-processing for each plasma shot.

As well as other fusion experimental sites, above mentioned both labs have needed a cost reasonable isolation amplifier for a long time. Easily obtainable commercial products are usually more expensive due to the requirement mismatch for the plasma diagnostics. Due to the significant requests to develop and distribute a homemade one to the Japanese fusion community, we have been examining the optimized isolation circuit design for some years.

We first challenged to apply the light energy conversion, directly to obtain the primary-side DC voltage, by using LED and solar cells. However, the output power is not enough to drive the photo coupler at the primary-side circuit. Therefore, we secondly tested an isolated DC-DC converter module, from which we could not eliminate the switching noises not suitable for analog amplifier circuit. Consequently, we finally decided to use the regulator circuit with a toroidal transformer that is expected to provide somewhat better isolation than usual EI-formed ones. Inside view of our homemade prototype of 8-channel isolation amplifiers can be seen in Fig. 2 in which a toroidal transformer and the power supply is independently installed for each channel. We have installed it on GAMMA10 experiment and verified the noise levels on the site.

1) H. Nakanishi, *et al.*: Fusion Eng. Des. **87** (2012) 2189.
2) T. Yamamoto, *et al.*: Fusion Eng. Des. **85** (2010) 637.

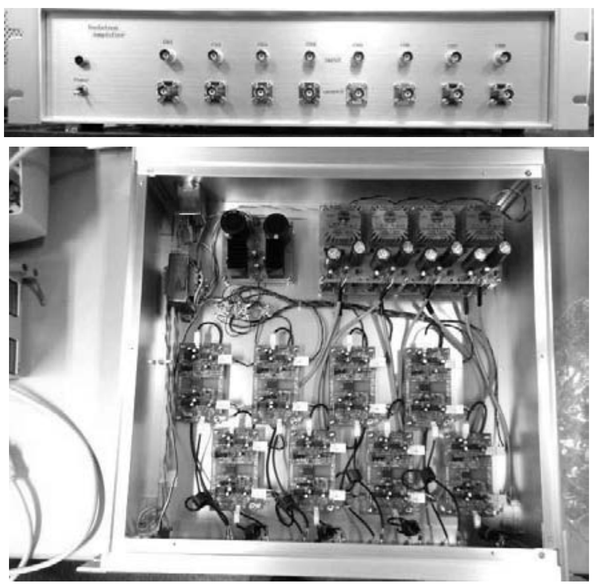

Fig. 2 Front and inside photos of the new 8-channel isolation amplifier: Primary-side power supply is independently implemented for each channel, whereas the secondary-side one is shared with a common (chassis) ground.