

# 7. SNET Collaborative Research

SNET is a cluster of logical network circuits dedicated for the Japanese fusion research collaborations, *i.e.*, Fusion Virtual Laboratory (FVL) in Japan. It consists of layer-2 and layer-3 virtual private networks (L2/L3-VPN) which directly connect the collaborative universities and institutes via the national academic network backbone SINET5 of National Institute of Informatics (NII). NIFS started the SNET operation for the “remote participation for LHD experiment” in March 2002. Since 2005 fiscal year (FY), “remote use of supercomputer” and “bilateral collaboration” categories have been added. SNET had 17 participating nodes in 2017 FY.

On the other hand, a new technology of on-demand point-to-point connection, secure socket layer (SSL) VPN, has come into wide use with drastically improved network throughputs than before. Therefore, NIFS has decided that the above-mentioned three SNET categories be unified into one “bilateral collaboration for remote data acquisition and archiving,” and the other categories should move onto the NIFS SSL-VPN service. The existing VPN circuits have been operating for the service continuity. However, the invitation for new applications has been stopped for those two SNET categories since the 2018 FY collaboration.

As for the bilateral collaboration, a new experimental site, TST-2 of the University of Tokyo, has been joined to SNET and successfully started the operation of remote data acquisition since March 2018.

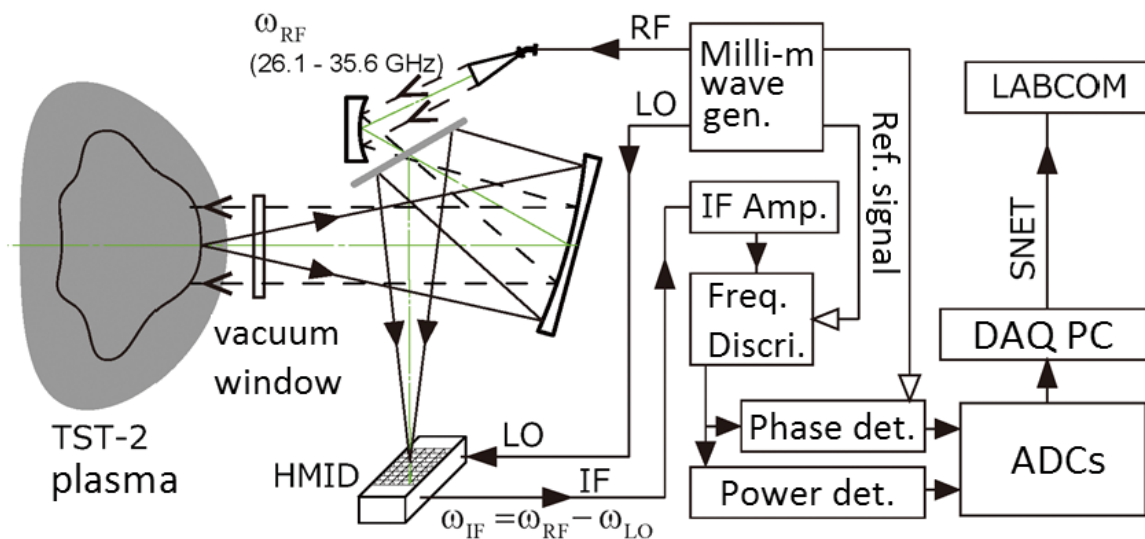


Fig. 1 Schematic diagram of TST-2 MIR remote data acquisition

# Research highlights

Large volumes of the whole LHD data were successfully replicated to the ITER Remote Experimentation Centre (REC) in Rokkasho at unprecedented speeds. Major advances in the technical groundwork have been made for remote data archiving, under the collaboration with the National Institutes for Quantum and Radiological Science and Technology (QST) and the National Institute of Informatics (NII). The data traffic passed through Toki – Gifu DC – Hirosaki DC – Rokkasho L2VPN on SNET. Since SINET5 connects every prefectural DC each other with 100 Gbps, it can make full use of 10 Gbps bandwidth of both sites' uplinks.

From 1 to August 3, 2017, in the final week of the 19th experimental campaign of LHD, the technical verification tests of on-sequence full data replication have been performed from the LHD data storage at the NIFS Toki site to the SSD-based data receiver installed at the REC site, almost 1 000 km away from NIFS LHD. All the plasma pulse data of each shot was successfully replicated to the REC receiver storage within 2 minutes in every 3 minute repetitive sequences of real LHD operations.

Another massive data transfer test was carried out in which more than 400 TB of the whole LHD plasma data were to be replicated into 500 TB magnetic tape library of REC at once. To absorb the speed differences between fast network and data reading/storing, the intermediate sender/receiver PCs had been reinforced with three of 1.2 TB PCI Express 3.0 × 4 lanes SSDs for fast data buffers providing about 3 GB/s throughput.

By optimizing the throughput on each stage of pipelined data streaming, the total throughput of about 400 MB/s (= 3.2 Gbps) was successfully sustained during the entire data replication. The performance bottleneck exists in the staging HDD array of the REC tape library because such the intermediate buffer devices require double I/O performance of the actual data stream for processing reads and writes concurrently.

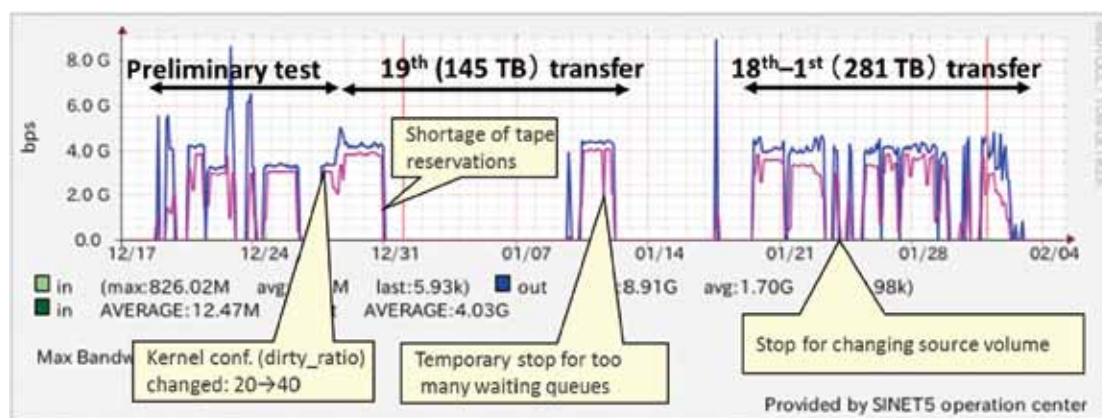


Fig. 2 Network traffic during the LHD → REC full data replication test.

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