

§20. The Next-Generation Technology of Data Acquisition and Analysis Environment for Fusion Experiments

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LHD diagnostic information system is always expected to take the head of research and development in fusion experiments of the world, and even in such the ITER-BA remote experiment center and All-Japan ST research project. In 2006 LHD renewed the world record of acquired data amount with 90 GB/shot again¹⁾, however, the tendency of substantial data increase is quite common in these several years. As this problem becomes quite remarkable in large scale experiments, innovative data processing technology is urgently needed to be fit for practical use. It would be indispensable to attain above-mentioned concrete goals.

Here, research subjects which are considered to be quite urgent;

1. Handling of huge data and massive-sized database²⁾
2. Application technology of long fat network (LFN)
3. Remote experimental environment (framework)

were intensively examined in this study. Their output will be applied and verified in LHD experiment. We aim to establish the next-generation technology to advance the remote collaboration experiments.

DAQ Workshop for Fusion Experiments

From February 28th to March 1st 2006, the DAQ (data acquisition) workshop was held in NIFS (Table I). It had four sessions within two days, and thirteen oral speakers gave presentations about new technology for DAQ and remote participation (RP), in addition to the upcoming related conference, i.e. IAEA-TM.

In this workshop, positive arguments were done about more intensive use of CPU and storage resources and the introduction of Grid computing technology for the sake of reducing the management burden of the drastically growing experimental data. Problems in long-distance Internet data transfer and its solution have been also discussed. Thus we could effectively explore some possible directions for our future research and development.

Especially, the joint development between the fusion experimental data system and ITBL (IT-based laboratory), which is a Japanese Grid technology, was deeply discussed. To link the LHD and JT-60 DAQs with the new ITBL network middleware has been chosen as the first task there. We could also obtain the opportunity to start cooperation relationship to contribute to All-Japan ST research project.

To support collaborators' communication and document sharing, the necessity of having a "collaboration groupware" tool has been pointed out. Therefore, a new Wiki page, named as "DAQ Wiki", has been opened at

<http://oku.edu.mie-u.ac.jp/daq/>

to make the collaboration-related information sharable.

Another big fruit of this study is that we examined the most effective algorithm for loss-less image archives to finally find the JPEG-LS method is the best in both the processing speed and the compression ratio. Compared with "zlib" single-block compression, it can deflate/inflate image data frame by frame to archive/retrieve one by one. It is more convenient for normal client PCs to retrieve image data by frame, because they do not have enough memory to process a full-length movie.

The output of these collaborating works would become applicable to LHD experiment and newer fusion projects.

References

- 1)Nakanishi, H. et al.: J. Plasma Fusion Res. **82** (2006) 171.
- 2)Nakanishi, H. and Okumura, H.: J. Plasma Fusion Res. **81** (2005) 112.

Table I Presentation Program of DAQ Workshop in NIFS

Session I. New Challenges and Recent Topics (Feb. 28 th 13:30~15:15)	
Okumura H. (Mie Univ.)	Introduction
Sueoka M. (JAEA)	Database Construction of JT-60 Plasma Image Database and its Web Distribution
Wang F. (Kyushu Univ.)	Plasma Shape Reproduction of Spherical Tokamak by Using CCS Method
Nishihara K. (Osaka Univ.)	DAQ System in ILE Osaka Univ., and Collaborating Simulation Grid Portal for Developing the EUV Light Source
Session II. 6 th IAEA TM for Control, Data Acquisition, and Remote Participation for Fusion Research (15:30~16:00)	
Nagayama Y. (NIFS)	Report of 1 st Executive Committee Meeting and Request for Further Cooperation
Session III. RP Technology and Broadband Application (16:00~17:30)	
Hasegawa M. (Kyushu Univ.)	DAQ and RP Environment for All-Japan ST Research Project
Emoto M. (NIFS)	File Transfer through SuperSINET
Yamamoto T. (NIFS)	Data Transfer Technology through the Long Fat Network (LFN)
Session IV. Framework for DAQ System (Mar.1 st 9:00~12:00)	
Ohsuna M. (NIFS)	Total Package of LHD DAQ System
Okada H. (Kyoto Univ.)	Heliotron-J DAQ and its S-SINET Utilization
Ueshima Y. (JAEA)	Data Management Technique Based on XML
Nakanishi H. (NIFS)	Attempt for Constructing a New DAQ Framework
Suzuki Y. (JAEA)	ITBL Application for Fusion Research Grid