



Contribution ID: 185

Type: **Poster presentation**

Study of Fast Data Access Based on Hierarchical Storage for EAST Tokamak

Friday, June 10, 2016 10:30 AM (1h 35m)

The Experimental Advanced Superconducting Tokamak (EAST) is a large fusion research device which aims at long-term and high parameters plasma operation. A distributed and continuous data acquisition system based on PXI/PXI Express technology has been developed for EAST. At present the system has more than 50 data acquisition units and more than 2000 raw channels, the maximum data throughput is about 5GBytes/s. In case of long-term discharge mode, the raw data of one shot is more than 1TBytes, and the total data of one campaign is more than 100TBytes. How to access the large amount of data as fast as possible becomes a big problem. And meanwhile the data access frequency of different shot and signals are different. There are currently commercial tiered storage production, but they are very expensive and difficult to be customized according to the characteristic of fusion experimental data. So we planned to design a special hierarchical data storage system for EAST. The system is composed of 4 storage tiers. The tier1 is based on PCIe SSD storage which provide the data access cache, including three types of data, the most important signals, the latest shot data, and the high access frequency data. The tier2 is the local SAS raid on MDSplus server cluster for real-time data collection from the DAQ units. The tier3 is Lustre storage which stored all the current campaign data and can provide fast parallel data access for data processing. The tier4 is NAS storage for historic data achieving. A schedule program is designed to control the data flow between tier1 and tier2/tier3/tier4. The system has been designed and will be adopted in the next campaign and the system details will be given in the paper.

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Session Classification: Poster Session 2

Track Classification: Data Acquisition