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Upgrade of data acquisition and control system for microwave reflectometry on EAST

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Reflectometry system on EAST provides density profile and fluctuation measurement. The profile reflectometry worked under Q, V and W band, and the fluctuation reflectometry operated at fixed points in V band with 8 poloidal correlation channels. In present, an upgrade of reflectometry is being carried out on EAST. The U and E band profile reflectometry will be added into the current system. A new 4-channel poloidal correlation reflectometry working under W band will be developed. Owing the development of new reflectometry, the data acquisition and control system also need to be upgraded.

The upgraded profile reflectometry has 10 signal channels. Each signal channel requires a 14-bit 60 MSPS digitizer. So the total data rate is 1200 MB/s. A PXIe-based data acquisition system is designed to satisfy the requirement. Five dual-channel 14-bit 100MSPS digitizers (PXIe-5122) are used to digitize the signals. The generated data are transported via the backplane bus of chassis. The PXIe chassis (PXIe-1085) provides 16 slots and 4 GB/s dedicated bandwidth for each slot. A RAID0 disk array (HDD-8266) collects all the data from digitizers. The disk array consists of 24 SSD drivers and its maximum data rate is 3.6GB/s. A timing module receives the clock signal from central control system and distributes the clock signal to 5 digitizers for synchronization.

The new fluctuation reflectometry has 24 signal channels. The sample rate would be no more than 2 MSPS per channel, so the maximum total data rate is 96 MB/s. Three 8-channel 12-bit 60MSPS digitizers (PXIe-5015) are applied to digitize the 24 signals. The mechanical hard disk on the controller is replaced by SSD disk to attain higher writing data rate.

A dedicated 6-channel arbiter waveform generator (AWG) is developed to control the VCO module of profile reflectometry. The AWG outputs control signals with amplitude of 24V and data rate of 250 MSPS. The AWG can also receive clock signal from timing module to synchronize with central clock.

For remote control, control software for power supply is applied, when all the power supplies of reflectometry are connected via USB to the controller in PXI chassis. Reflectometry can be switched on/off remotely by hand, or automatically at a set time.

Now part of development work is still ongoing. According to the plan, all the system will be installed to EAST before the autumn/winter campaign of 2017.

Eligible for student paper award?

No

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