

Upgrade of data acquisition and control system for microwave reflectometry on Experimental Advanced Superconducting Tokamak

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Upgrade of reflectometry is ongoing on Experimental Advanced Superconducting Tokamak (EAST) for more comprehensive measurement of plasma density profile and fluctuation. To satisfy requirements of upgraded reflectometry, a new Data Acquisition and Control System(DACS) has been developed.

The profile reflectometry works in 30-110GHz (X-mode) and 40-90GHz(O-mode) with 5 receivers. Each receiver outputs in-phase and quadrature signals simultaneously, so 10 signals need be acquired. Considering beat frequency of 4-10MHz, sampling rate is set as 60 MSPS, and total data rate is 1.2 GB/S. The PXIe-based DACS includes two 8-channel 14-bit 250MSPS digitizers. Data from digitizers is stored in a disk array (RAID 0) with data throughput capacity of 3.6 GB/S. Meanwhile, selected data is transported to a FPGA based real-time computing module, which utilize a pre-trained neural network to invert raw data to plasma density profile. A dedicated 5-channel 250MSPS arbiter waveform generator (AWG) is developed to control voltage control oscillators for frequency sweep. A timing module receive the trigger and clock signal from central controller and synchronize all the digitizers and AWG.

The fluctuation reflectometry operates on 16 fixed frequency points in 50-110GHz (X-mode) and 20-60GHz (O-mode). Receiving antennas are placed on two different poloidal positions to do corelation measurement. Totally, there are 64 signals to be acquired. 8 8-channel 14-bit 60MSPS digitizers are added. The sample rate is 4 MSPS and total data rate is 512 MB/S.

Now the new reflectometry is being installed on EAST, and Its performance will be tested in experimental campaign of 2018.

Minioral

Yes

Description

reflectometry

Speaker

Fei Wen

Institute

IPP Hefei

Country

China

Primary authors: WEN, Fei (Institution of Plasma Physics, Chinese Academy of Sciences); Dr TAO, Zhang (Institution of Plasma Physics, Chinese Academy of Sciences); Mr HAOMING, Xiang (Institution of Plasma Physics,

Chinese Academy of Sciences); Mr KANGNING, Geng (Institution of Plasma Physics, Chinese Academy of Sciences); Mr HAO, Qu (Institution of Plasma Physics, Chinese Academy of Sciences); Mr FUBIN, Zhong (Institution of Plasma Physics, Chinese Academy of Sciences); Dr YUMING, Wang (Institution of Plasma Physics, Chinese Academy of Sciences); Dr XIANG, Han (Institution of Plasma Physics, Chinese Academy of Sciences); Prof. XIANG, Gao (Institution of Plasma Physics, Chinese Academy of Sciences)

Presenter: WEN, Fei (Institution of Plasma Physics, Chinese Academy of Sciences)

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