

Real-Time Processing the MSE data with GPGPU in KSTAR

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The KSTAR has MSE (Motional Stark Effect) diagnostics devices for measurement of plasma current density distribution. Real-time MSE is an essential diagnostic for advanced control over the q-profile in tokamaks [1]. The KSTAR MSE diagnostic data measurement system measures and stores a total of 25 signals and 2 reference signals at a rate of 2MHz sample per second. The KSTAR has developed the uTCA.4 form factor controller, KMCU-Z35 and KMCU-Z30, for KSTAR digitizer standardization, it has been used in some diagnostic data acquisition systems from 2016. The KMCU-Z30 can simultaneously transmit the same data in three directions from a single ADC digitizer (one PCIe and two SFP+), allowing device configurations to be configured individually for real-time control without interfering with raw data storing device system. In the 2018 KSTAR campaign, we plan to apply the KMCU-Z30's data branching function and digital lock-in algorithm for real-time MSE which we plan to implement using GPGPU for fast data processing of high sampling data. This paper introduces a detailed design concept of real-time MSE DAQ system using GPGPU and their performance results. This paper will describe the overall structure of the MSE DAQ system and performance of the real-time MSE data in KSTAR.

References

[1] De Bock, M. F. M., et al. "Real-time MSE measurements for current profile control on KSTAR." Review of Scientific Instruments 83.10 (2012): 10D524.

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