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The Design and Performance of the Real-time Software Architecture for the ITER Radial Neutron Camera

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The neutron detection system for characterization of emissivity in ITER Tokamak during DD and DT experiments poses serious challenges to the performance of the diagnostic control and data acquisition system (CDAcq). Ongoing design of the ITER Radial Neutron Camera(RNC) diagnostic comprises 26 lines-of-sight(LOS) for complete plasma inspection. CDAcq system aims at meeting ITER requirements of delivering neutron emissivity profile real-time measurement with time resolution and control cycle time of 10ms at peak event rate of 2MEvents/s per LOS, with neutron spectra generation, neutron/gamma discrimination and pile up rejection. Neutron spectra can be totally processed in the host CPU or using processed data from the system FPGA[1]. The number of neutron counts extracted from the spectra is then used to calculate the neutron emissivity profile using an inversion algorithm. Moreover, it is required that the event based raw data acquired for post processing which can go up to 0.5GB/s per channel data throughput, is made available to the ITER data network without local data storage. The evaluation of real-time data compression techniques in RNC is depicted in another contribution to this conference[2].

To meet the demands of the project a CDAcq prototype has been used to design and test high-performance distributed software architecture taking advantage of multi-core CPU technology capable of coping with requirements. This submission depicts the real-time design architecture, real-time control cycle for ITER advanced plasma control, spectra construction algorithm and inversion algorithm to calculate the emissivity profile. Preliminary system's performance results with synthetic data are presented.

Minioral

Yes

Description

RT architecture

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