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Real-time data compression for data acquisition systems applied to the ITER Radial Neutron Camera

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The aim of the ITER Radial Neutron Camera Data Acquisition prototype is to sustain a 2 MHz peak event for each channel with 128 samples of 16 bits per event. The data is acquired and processed using an IPFN FPGA Mezzanine Card (FMC-AD2-1600) with 2 digitizer channels of 12-bit resolution sampling up to 1.6 GSamples/s, based on a PCIe evaluation board from Xilinx (KC705) installed in the host PC.
The acquired data in the event-based data-path is streamed to the host through the PCIe x8 Direct Memory Access (DMA) channels and the maximum data throughput per channel is ~0.5 GB/s of raw data (event base), ~1 GB/s per digitizer.
The prototype architecture comprises one host PC with two KC705 modules and four channels, producing up to ~2 GB/s in event mode and up to ~3.2 GB/s in continuous mode. To reduce the produced data throughput from host to ITER databases, the real-time data compression was evaluated using the LZ4 lossless compression algorithm, which provides compression speed up to 400 MB/s per core.
This contribution presents the architecture, implementation and test of the parallel real-time data compression system running in multiple isolated CPU cores. The average space saving and the performance results for long term acquisitions up to 30 minutes, using different data block size and different number of CPUs, are also presented.

Minioral

Yes

Description

Neutron camera DAQ

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