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Design of High Speed Digital Acquisition for Beam Current Monitor

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As a part of the Proton Improvement Plan –II (PIP-II) at Fermilab, instrumentation systems are being modernized to take advantage of the higher speeds and ease of use offered by standardized embedded systems like MicroTCA. A rear-transition module (RTM) is being designed to interface with said embedded systems. In each of the four identical channels on the RTM, the differential signal from an alternating-current current transformer transimpedance amplifier will again be amplified by a differential operation-amplifier then filtered by a low-pass topology. The conditioned signal is then digitized at a maximum of 10 MS/s by an analog to digital converter (ADC) integrated circuit. After digitization, the ADC passes the data to an off the shelf AdvancedMC (AMC) Xilinx FPGA module using low voltage differential signals. Once in the AMC, the FPGA filters, decimates, and packages the data before transferring it via the AXI bus to the SoC CPU, which then uploads it to a server. The processed data is subsequently used to calculate secondary measurements such as intensity and current, which are presented alongside waveform data in Fermilab's ACNET as Process Variables (PVs) to users.

Footnotes

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