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Newly developed digital signal acquisition and processing platform for beam instruments at IMP

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A new digital signal acquisition and processing platform for beam instruments at IMP is designed and realized based on Zynq MPSoC FPGA. Two FMC mezzanine slots are featured for analogue front-end electronics and analogue-to-digital converting, as well as for the WR timing. The real-time data communication between different platforms is realized through multi-gigabit links. To facilitate the real-time data transmission from PL to PS, an universal technology for high-speed, multi-channel data transmission is developed, where two channels can achieve a transmission rate of up to 2 GB/s in a 64-bit data stream with a maximum clock of 250 MHz per channel, and the other two can achieve a data-throughput of 1.28 GB/s in a 512-bit width with a maximum clock of 20 MHz individually. This technology has been verified by the synchrotron BPMs for simultaneous transmission of the raw data with a sampling rate of 250 Msps from each electrode, the turn-by-turn trajectory data, as well as the orbit data without any conflict. Additionally the trajectory data are processed on an Arm Cortex-R5F real-time processor integrated on the MPSoC to get a real-time tune measurement. Till now the platform is implemented and operated at IMP machines for all beam instruments such as beam current, BPMs, beam loss measurement and so on. From on-line operation, the platform have an excellent performance and good long-term stability. Also the platform is utilized for the HIAF machine protection system.

Footnotes

Funding Agency

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Yes

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