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Development of new data acquisition system for COMPASS experiment

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This paper presents development and recent status of the new data acquisition system of the COMPASS experiment at CERN with up to 50 kHz trigger rate and 36 kB average event size during 10 second period with beam followed by approximately 40 second period without beam. In the original DAQ, the event building is performed by software deployed on switched computer network, moreover the data readout is based on deprecated PCI technology; the new system replaces the event building network with a custom FPGA-based hardware. The custom cards are introduced and advantages of the FPGA technology for DAQ related tasks are discussed.

In this paper, we focus on the software part that is mainly responsible for control and monitoring. The most of the system can run as slow control; only readout process has realtime requirements. The design of the software is built on state machines that are implemented using the Qt framework; communication between remote nodes that form the software architecture is based on the DIM library and IPBus technology. Furthermore, PHP and JS languages are used to maintain system configuration; the MySQL database was selected as storage for both configuration of the system and system messages. The system has been design with maximum throughput of 1500 MB/s and large buffering ability used to spread load on readout computers over longer period of time. Great emphasis is put on data latency, data consistency, and even timing checks which are done at each stage of event assembly. System collects results of these checks which together with special data format allows the software to localize origin of problems in data transmission process. A prototype version of the system has already been developed and tested – the new system fulfills all given requirements. It is expected that the full-scale version of the system will be finalized in June 2014 and deployed on September provided that tests with cosmic run succeed.

Summary

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