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Overview and Future Developments of the intelligent, FPGA-based DAQ (iFDAQ) of COMPASS

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COMPASS is a fixed-target experiment at the Super Proton Synchrotron (SPS) at CERN dedicated to the study of hadron structure and spectroscopy. In 2014, an intelligent, FPGA-based data acquisition system (iFDAQ) was deployed. Its hardware event builder consisting of nine custom designed FPGA-cards replaced 30 distributed online computers and around 100 PCI cards increasing compactness and scalability of the system. As a result, the iFDAQ provides higher bandwidth and better reliability. By buffering data on different levels, the system exploits the spill structure of the SPS beam and averages the maximum on-spill data rate of 1.5 GB/s over the whole SPS duty cycle to a sustained data rate of 500 MB/s.

From 2015, all involved point-to-point high-speed links between front-end electronics, the hardware event builder, and the readout computers are wired via a fully programmable crosspoint switch. This enables the user to remotely customize the network topology via a dedicated software when data taking is interrupted and hence simplifies compensation for hardware failure and optimization for load balancing. In a second step, the intelligent hardware will recognize load imbalance and malfunctioning hardware nodes by itself and will automatically replace broken nodes or initiate reconfiguration for optimum load balance. By distributing the needed information synchronously via the trigger and timing network, the highly reliable intelligent event builder can change its topology on-the-fly. The talk focuses on the performance of the system under data taking conditions and outlines the future upgrades for an intelligent system.

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