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Gigabit Ethernet Daisy-Chain on FPGA for COMET Read-out Electronics

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The COMET experiment at J-PARC aims to search for the neutrinoless transition of a muon to an electron (μ -e conversion). Since μ -e conversion is strictly forbidden in the Standard Model, it would be the clear evidence of the new physics if it is found. We have developed the readout electronics board called ROESTI for the COMET straw tube tracker. We plan to install the ROESTI in the gas manifold of the detector. The number of vacuum feedthroughs needs to be reduced due to space constraints and cost. In order to decrease the number of vacuum feedthroughs drastically, we developed a daisy-chain function of Gigabit Ethernet to the FPGA on the ROESTI. Data transfer throughput on the daisy-chain is required to be close to the maximum rate of Gigabit Ethernet. The function to set parameter is also required. In order to satisfy these requirements, two SiTCs are implemented in the FPGA of the ROESTI. We connected up to five ROESTIs with the daisy-chain and measured a data transfer speed by TCP/IP communication. In the result, we found that the daisy-chain function worked properly and the throughput satisfied our requirement. All the ROESTIs on the daisy-chain can receive the setting parameter directly from the data acquisition PC by UDP/IP communication. In this presentation, we will describe the details of the implementation of the daisy-chain function and the result of performance measurements of throughput, stability and data loss rate.

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