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Frontend and backend electronics for the New Small Wheel Upgrade of the ATLAS muon spectrometer

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The present ATLAS small wheel muon detector will be replaced with a New Small Wheel detector in 2019. The frontend electronics will be implemented in about 8000 boards including the design of 4 custom ASICs capable of driving trigger and tracking primitives to the backend trigger processor and readout system. The large number of readout channels, short time available to prepare and transmit trigger data, large volume of output data, harsh radiation environment, and the need of low power consumption all impose great challenges on the system design. We will present the design and status of the whole system.

Summary

The present ATLAS endcap muon small wheel detectors will be replaced by the New Small Wheels (NSW) to handle large trigger and readout data rates in a harsh radiation environment expected at high luminosity runs. The NSW will use two different technologies, resistive micromegas (MM) and the small-strip Thin Gap Chambers (sTGC), for both muon precision tracking and triggering.The total number of readout channels is about 2.4 millions, and the overall power consumption is expected to be about 95 kW. The electronics design will be implemented in some 8000 front-end boards including the design of four custom front-end ASICs capable to drive trigger and tracking primitives with high speed sterilizers to drive trigger candidates to the backend trigger processor system. Tasks such as time, trigger and control signal distribution and readout are performed by the GBTx (Gigabit transceiver) ASIC, Slow Control ASIC, and an Front End Link Interface eXchange (FELIX) system. Prototype of all components have been developed in the past few years and we will present the design and current prototype status.

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