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ATLAS TDAQ Phase-2

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The ATLAS experiment at CERN will be upgraded for the "High Luminosity LHC", with collisions due to start in 2029. In order to deliver an order of magnitude more data than previous LHC runs, 14 TeV protons will collide with an instantaneous luminosity of up to 7.5 x 10e34 cm^-2s^-1, resulting in higher pileup and data rates. This increase brings new requirements and challenges for the trigger and data acquisition system (TDAQ), as well as for the detector and computing systems.

The design of the TDAQ upgrade comprises:
- a hardware-based low-latency real-time Trigger operating at 40 MHz,
- data acquisition which combines custom readout with commodity hardware and networking to deal with 4.6 TB/s input, and
- an Event Filter running at 1 MHz which combines offline-like algorithms on a large commodity computing service with the potential to be augmented by commercial accelerators.
Commodity servers and networks are used as far as possible, with custom ATCA boards, high speed links and powerful FPGAs deployed in the low-latency parts of the system. Offline-style clustering and jet-finding in FPGAs, as well as accelerated track reconstruction are designed to combat pileup in the Trigger and Event Filter respectively.

This contribution will report recent progress on the design, technology and construction of the system. The physics motivation and expected performance will be shown for key physics processes.

Significance

This contribution will report recent progress on the design, technology and construction of the ATLAS Trigger and Data Acquisition system for LHC Phase-2. The physics motivation and expected performance will be shown for key physics processes.

References

Experiment context, if any

ATLAS, CERN

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