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Perfromance of the ATLAS Trigger and DAQ system

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The ATLAS Trigger and Data Acquisition (TDAQ) system is responsible for reducing the event rate from the design bunch-crossing rate of 40 MHz to an average recording rate of 200 Hz.

The ATLAS trigger is designed to select signal-like events from a large background in three levels: a first-level (L1) implemented in custom-built electronics, as well as the two levels of the high level trigger (HLT) software triggers executed on large computing farms. The first-level trigger is comprised of calorimeter, muon and forward triggers to identify event features such as missing transverse energy, as well as candidate electrons, photons, jets and muons. Input signals from these objects are processed by the L1 Central Trigger to form a L1 Accept (L1A) decision. L1A and timing information is consequently sent to all sub-detectors, which push their data to DAQ buffers. The first part of the HLT system (called Level 2) pulls the data from the buffers on demand, while the second part (called Event Filter) works with the whole event at hand.

We will demonstrate that the ATLAS trigger performed smoothly throughout 2010 and 2011, evolving with increasing LHC luminosity in order to maintain a high selection efficiency whilst operating at an overall data acquisition efficiency of 96%. The ATLAS first-level trigger rate has already reached 40 kHz, roughly half of the design rate. Concurrently, the Level 2 and Event Filter rates reached and consequently exceeded the design performance. We will also discuss the achievements and problems encountered during the 2010 and 2011 data taking periods, with an overview of challenges and plans for adapting to the upcoming upgrade of LHC running.

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