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Implementation of the ATLAS trigger within the ATLAS MultiThreaded Software Framework AthenaMT

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We present an implementation of the ATLAS High Level Trigger that provides parallel execution of trigger algorithms within the ATLAS multithreaded software framework, AthenaMT. This development will enable the ATLAS High Level Trigger to meet future challenges due to the evolution of computing hardware and upgrades of the Large Hadron Collider, LHC, and ATLAS Detector. During the LHC datataking period starting in 2021, luminosity will reach up to three times the original design value. Luminosity will increase further, to up to 7.5 times the design value, in 2026 following LHC and ATLAS upgrades. This includes an upgrade of the ATLAS trigger architecture that will result in an increase in the High Level Trigger input rate by a factor of 4 to 10 compared to the current maximum rate of 100 kHz.

The current ATLAS multiprocess framework, AthenaMP, manages a number of processes that process events independently, executing algorithms sequentially in each process. AthenaMT will provide a fully multithreaded environment that will enable concurrent execution of algorithms also within an event.This has the potential to significantly reduce the memory footprint on future manycore devices. An additional benefit of the High Level Trigger implementation within the AthenaMT is that it facilitates the integration of offline code into the High Level Trigger. The trigger must retain high rejection in the face of increasing numbers of pileup collisions. This will be achieved by greater use of offline algorithms that are designed to maximize the discrimination of signal from background. Therefore a unification of the High Level Trigger and offline reconstruction software environment is required. This has been achieved while at the same time retaining important High Level Trigger-specific optimisations that minimize the computation performed to reach a trigger decision. Such optimizations include early event rejection and reconstruction within restricted geometrical regions.

We report on a High Level Trigger prototype in which the need for High Level Trigger-specific components has been reduced to a minimum. Promising results have been obtained with a prototype that includes the key elements of trigger functionality including regional reconstruction and early event rejection. We report on the first experience of migrating trigger selections to this new framework and present the next steps towards a full implementation of the ATLAS trigger within this framework.

Tertiary Keyword (Optional)

Parallelization

Secondary Keyword (Optional)

Data processing workflows and frameworks/pipelines

Primary Keyword (Mandatory)

Trigger

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