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Trigger Level Analysis in ATLAS

The vast disparity between the LHC collision rate (~ 40 MHz) and data storage capacity (~ 1 kHz) forces the ATLAS Trigger to implement stringent cuts on high transverse momentum. These restrictions, such as the prescale on single-jet triggers severely limit physics sensitivity and discard many low-mass events (e.g., dijet below 1 TeV).

To recover these signatures, ATLAS implemented the Trigger-object Level Analysis (TLA) approach during Run 3. TLA records only a reduced set of information from the trigger system, occupying less than 1% of the total bandwidth. This successfully provides access to previously restricted kinematic regions.

Our group is engaged in enhancing the TLA strategy for Run 4. This work focuses on optimizing the dataflow to ensure the high rate of “small” TLA events does not compromise the performance of the new data acquisition system, and on identifying specific physics channels that will maximally profit from this low-latency, high-frequency approach.

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