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Operation and Performance of the ATLAS Level-1 Calorimeter and Level-1 Topological Triggers in Run 2 at the LHC

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In Run 2 at CERN's Large Hadron Collider, the ATLAS detector uses a two-level trigger system to reduce the event rate from the nominal collision rate of 40 MHz to the event storage rate of 1 kHz, while preserving interesting physics events. The first step of the trigger system, Level-1, reduces the event rate to 100 kHz with a latency of less than 2.5 μ s. One component of this system is the Level-1 Calorimeter Trigger (L1Calo), which uses coarse-granularity information from the electromagnetic and hadronic calorimeters to identify regions of interest corresponding to electrons, photons, taus, jets, and large amounts of transverse energy and missing transverse energy. In this talk, we will discuss the improved performance of the L1Calo system in the challenging, high-luminosity conditions provided by the LHC in Run 2.

As the LHC exceeds its design luminosity, it is becoming even more critical to reduce event rates while preserving physics. A new feature of the ATLAS trigger system for Run 2 is the Level-1 Topological Trigger (L1Topo), which uses four FPGAs to process information from the L1Calo and Level-1 Muon trigger systems, performing kinematic and angular selections with a latency of 200 ns. The physics motivation for L1Topo, as well as its implementation and performance in the ATLAS trigger system in Run 2, will be discussed.

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