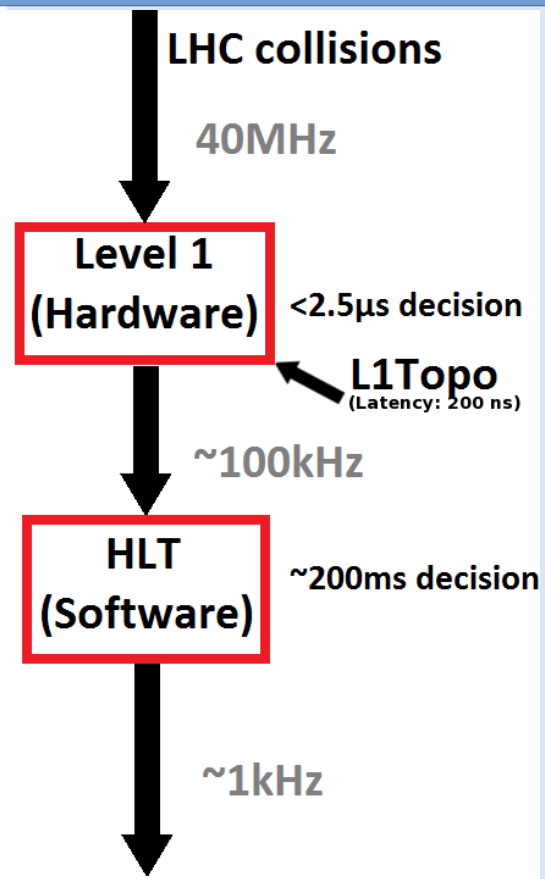


Simulation and Validation of the ATLAS Level-1 Topological Trigger

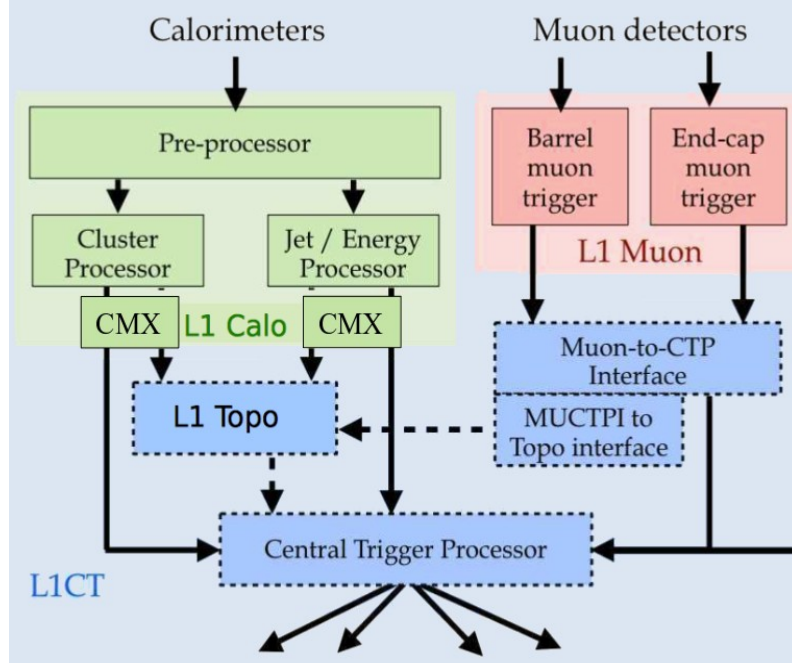
The ATLAS experiment has recently commissioned a new component of its first-level trigger: the L1 topological trigger. This system, using state-of-the-art FPGA processors, improves event selection by applying topological requirements, and calculate kinematic quantities involving clusters, jets, muons, and total transverse energy.

ATLAS Trigger System



The ATLAS trigger system is organized in two levels, with increasing degree of detail and accuracy

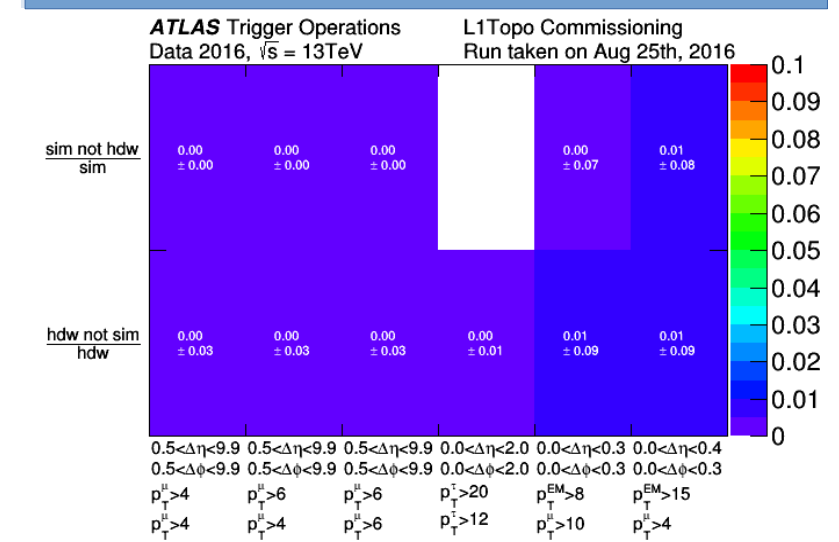
L1Topo is an addition to the Level 1 system and ensures manageable trigger rates **requiring only Level 1 information**.



To sub-detector front-end / read-out electronics
The Level 1 trigger is a **fixed-latency, pipelined system**. L1Topo uses input information from the **calorimeter** and the **muon** detectors.



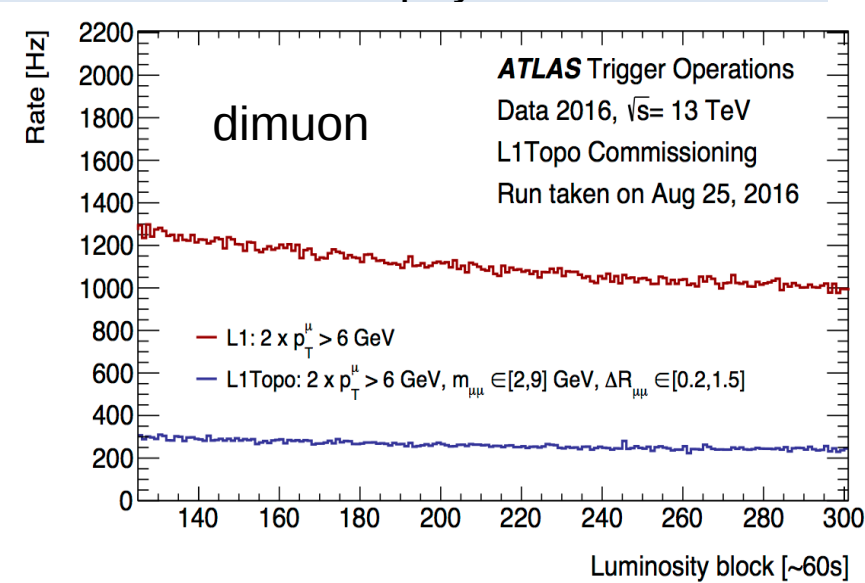
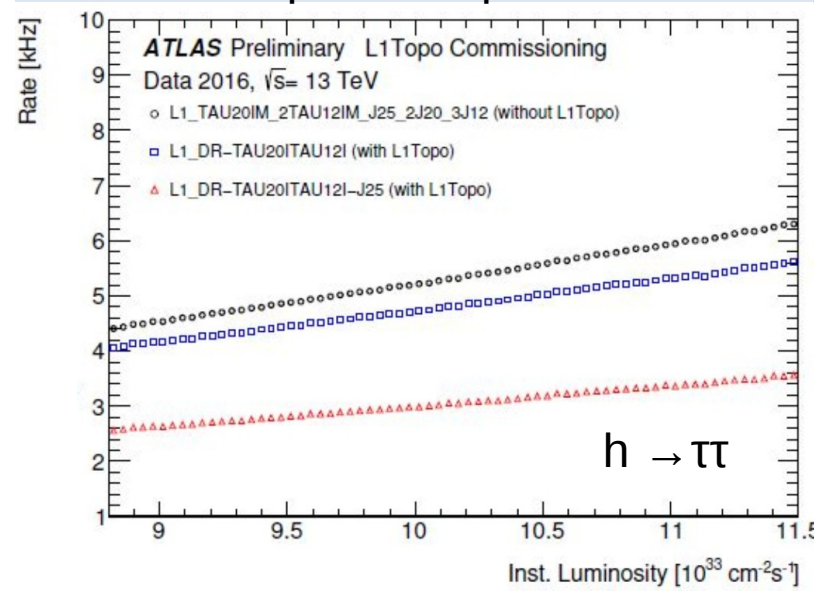
Simulation Validation Plots



L1Topo algorithms have been validated and the accuracy of their simulation is understood within a few percent.

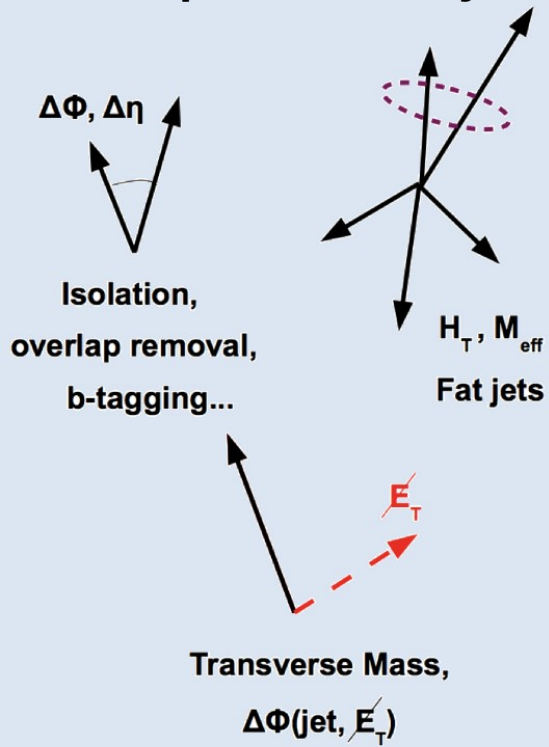
L1Topo In Action

For example, L1Topo can efficiently select $h \rightarrow \tau$ and b-physics events.

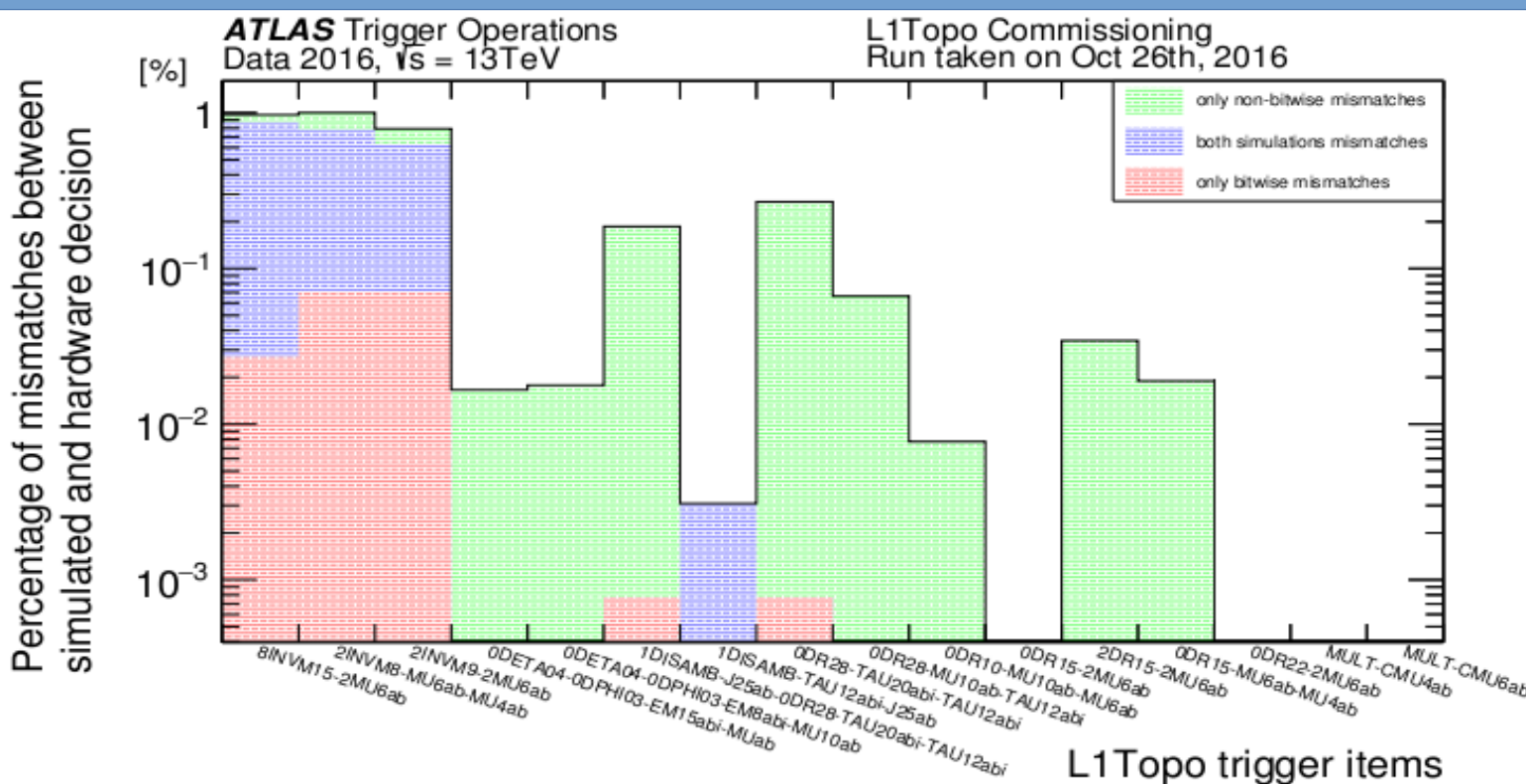


L1Topo Functionalities

Some examples of calculations that can be performed by L1Topo:



Bitwise Simulation Performance



Comparison of the L1Topo decision for several trigger items between the hardware, bitwise-correct simulation and the non-bitwise one.

Summary

- The new L1Topo trigger system was successfully commissioned in 2016.
- It adds new capabilities, such as combining muon and calorimeter information at Level 1.
- The bitwise-correct implementation significantly improves the accuracy of the L1Topo simulation.