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The Muon High Level Trigger of the ATLAS experiment

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The ATLAS experiment CERN's Large Hadron Collider has been projected and realized for new discoveries in High Energy Physics as well as for precision measurements of Standard Model parameters. To satisfy the limited data acquisition capability, at the LHC project luminosity, the ATLAS trigger system will have to select a very small rate of physically interesting events (˜200 Hz) among about 40 million events per second.
In the case of events containing muons, as described in this work, the first hardware-based level (LVL1) starts from measurements of the Muon Spectrometer trigger chambers to select Regions of Interest (RoI) where muons produce significant activity. Such RoIs are used as seeds for the two subsequent trigger levels (LVL2 and Event Filter), running on dedicated online farms, which constitute the High Level Trigger (HLT). This seeding strategy is crucial to drastically reduce the total processing time.
Within the Muon HLT, few algorithms are implemented in different steps according to predefined sequences of Feature Extraction (FEX) and Hypothesis (HYPO) algorithms, whose goal is to validate the previously selected muon objects. The ATLAS muon trigger system, thanks to its particular design and to the peculiar structure of the Muon Spectrometer, is able to provide muon stand-alone event trigger decisions, that can be furtherly refined by exploiting the muon information coming from the other ATLAS subdetectors. Muon HLT algorithms are described here in terms of working functionality and performance (memory leaks, data volume, code testing and validation) both on simulated and real data, including non-standard trigger configurations (like cosmic data and LHC start-up scenarios).

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