The ATLAS Run 2 Trigger: Design, Menu, Performance and Operational Aspects

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The LHC, at design capacity, has a bunch-crossing rate of 40 MHz whereas the ATLAS experiment at the LHC has an average recording rate of about 1000 Hz. To reduce the rate of events but still maintain a high efficiency of selecting rare events such as physics signals beyond the Standard Model, a two-level trigger system is used in ATLAS. Events are selected based on physics signatures such as presence of energetic leptons, photons, jets or large missing energy. Despite the limited time available for processing collision events, the trigger system is able to exploit topological information, as well as using multi-variate methods. In total, the ATLAS trigger system consists of thousands of different individual triggers. The ATLAS trigger menu specifies which triggers are used during data taking and how much rate a given trigger is allocated. This menu reflects not only the physics goals of the collaboration but also takes the instantaneous luminosity of the LHC, the design limits of the ATLAS detector and the offline processing Tier0 farm into consideration.

We describe the criteria for designing the ATLAS trigger menu used for the LHC Run 2 period. Furthermore, we discuss the different phases of the deployment of the trigger menu for data-taking: validation, decision on allocated rates for different triggers (ahead of running, or during data-taking in case of sudden rate changes), and monitoring during data-taking itself. Additionally the performance of the high-level trigger algorithms used to identify leptons, hadrons and global event quantities which are crucial for event selection and relevant to wide range of physics analyses is presented at hand of a few examples.

Tertiary Keyword (Optional)

Reconstruction

Secondary Keyword (Optional)

Algorithms

Primary Keyword (Mandatory)

Trigger

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