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Designing the ATLAS trigger menu for high luminosities

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The LHC, at design capacity, has a bunch-crossing rate of 40 MHz whereas the ATLAS detector has an average recording rate of about 300 Hz. To reduce the rate of events but still a maintain high efficiency of selecting rare events such as Higgs Boson decays, a three-level trigger system is used in ATLAS. Events are selected based on physics signatures such as events with energetic leptons, photons, jets or large missing energy. In total, the ATLAS trigger systems consists of more than 300 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 must reflect not only the physics goals of the collaboration but also take into consideration the instantaneous luminosity of the LHC and the design limits of the ATLAS detector. We describe the criteria for designing the trigger menu for different LHC luminosities that spanned many orders of magnitude during the 2010 and 2011 running periods. We discuss how the trigger menu is tested and validated before being used for data taking, how the prescale values for different triggers are determined and how the menu as a whole is monitored during data taking itself.

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