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Performance of the ATLAS RPC detector and L1 Muon Barrel trigger at 13 TeV

Resistive Plate Chambers (RPCs) are fast gaseous detectors that are employed by the Level-1 muon trigger system in the barrel region of the ATLAS muon spectrometer. The Level-1 muon trigger system selects muon candidates produced in proton-proton collisions at the Large Hadron Collider (LHC). Muon candidates are associated by the Level-1 system with the correct LHC bunch crossing and assigned to one of the six transverse momentum thresholds. The RPCs are arranged in three concentric double layers and consist of approximately 3700 gas volumes, with a total surface of more than 4000 square meters. They operate in a toroidal magnetic field of approximately 0.5 Tesla and provide up to 6 position measurements along the muon trajectory, with a space-time resolution of about 2 cm x 2 ns. This contribution will discuss performance of the RPC detector and Level-1 muon barrel trigger system measured using proton-proton collision data at a centre-of-mass energy of 13 TeV. New measurements of RPC cluster size, detector efficiency and time resolution will be presented. Trigger efficiency, measured using Z boson decays to a muon pair, and trigger rate measurements will be summarised, as well as the composition of the accepted RPC muon candidates. Measurements of RPC currents as a function of the voltage and of the environmental parameters will be also presented, both with and without beams in the LHC. Similarly, RPC background counting rates are measured as a function of the instantaneous luminosity up to $2 \times 10^{34} \text{ cm}^{-2} \text{ s}^{-1}$. Measurements of the average avalanche charge for background events will be also presented. Results of the extrapolations of the RPC detector response to the expected luminosity of the High Luminosity LHC will be shown. Finally, measurements of the RPC detector response at different high voltage and threshold settings will be discussed, also in the context of expected detector response at the High Luminosity LHC.

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Collaboration / Activity

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