



Contribution ID: 236

Type: **not specified**

New generation of RPC detector the the ATLAS Muon detector upgrade

Monday 26 August 2019 17:15 (25 minutes)

The architecture of the present ATLAS Muon spectrometer was designed for a luminosity of $10^{34} \text{ cm}^{-2} \text{ s}^{-1}$ with a security factor of 5 with respect to the simulated background rate, now confirmed by the LHC Run 1 results. Since HL-LHC will have a 5 times higher luminosity and a one order of magnitude bigger background, the demand in terms of performances increases, being the detector operated in a much harsher conditions.

The BI project is one of the LHC Phase-2 approved upgrades, in order to ensure the demands coming from the physics for the next 20 years. It consists in the installation of an entire new layer of Resistive Plate Chamber detectors inside the Inner Barrel of the ATLAS experiment. This will ensure higher redundancy and robustness of the trigger system, almost complete acceptance and an improved momentum selectivity.

The BIS78 upgrade, scheduled for LHC Phase-1, is the pilot project for the BI RPCs installation. It aims at the installation of 10% of the BI RPCs in the transition region between the endcap and the Inner Barrel of ATLAS experiment. This barrel region is the one with the highest background and for this reason is an excellent test bench for the BI upgrade. The BIS78 position will also help in the reduction of the fake muons produced upstream with respect to the cryostats.

The BI RPCs represent a new generation of RPCs, basing their largely improved performances on a new and highly performing Front-End electronics, which is able to detect 10 times smaller signals leading to an increase in rate capability of a factor 10, and on gas gap of 1 mm with 1.2 mm electrodes thickness, granting a time resolution of 350ps and less space occupancy.

The BI project will be illustrated along with the performances of the prototype of this new generation of RPC detectors.

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Session Classification: Mini Workshop on Instruments and Methods in HEP