Contribution ID: **175** Type: **Oral**

On novel front-end electronics for the ATLAS BI RPC upgrade at HL-LHC developed in SiGe BiCMOS technology with a high-resolution rad-hard Time-To-Digital converter embedded

Friday, 31 May 2024 16:50 (20 minutes)

The High Luminosity phase of LHC will require a huge improvement on the ATLAS detector in terms of performance, being the entire apparatus operated in much harsher conditions. The BI project is one of the ATLAS Phase-2 approved upgrades, ensuring the demands coming from the physics for the next 20 years. In this framework, a novel dedicated Front-End electronics has been developed, which exploits a BJT-based preamplifier, a fast discriminator and a high resolution (<100ps) Time-To-Digital converter in SiGe BiCMOS technology, to vastly enhance the detector rate capability.
This front-end electronics is integrated for the first time within the detector faraday cage, largely reducing the effects of spurious noise and allowing a minimum effective charge threshold on the induced signal of 1-2 fC. The integration of the front-end electronics directly within the detector Faraday cage is also permitted by the low power consumption of 15 mW/ch.
The RPC coupled with this novel front-end electronics represents a new generation of large area timing detectors, granting a record time resolution of 350 ps on a single gas gap of 1 mm with 1.4 mm electrodes thickness and operated with the ATLAS standard gas mixture. The effect of the extremely low threshold has also an impact on the gas mixture, enabling the usage of eco-friendly gas mixtures which would not be usable elsewise. The latest performance of this newly developed front-end electronics along with the results achieved with RPC detector coupled with it will be shown.

Collaboration

ATLAS Muon

Role of Submitter

The presenter will be selected later by the Collaboration

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Session Classification: Electronics and On-Detector Processing - Oral session

Track Classification: T7 - Electronics and On-Detector Processing