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Development of the readout system for Triple-GEM detectors for the CMS forward muon upgrade

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For the LHC high luminosity phases new triple-GEM detectors should be installed in the CMS muon endcap spectrometer, together with a new readout system. The functional requirements on the system are to provide both triggering and tracking information. In addition the system will be designed to take full advantage of current generic developments introduced for the LHC upgrades: CERN GLIB boards host in micro-TCA crates, the Versatile Link with the GBT chipset, etc. In this contribution the physics goals, the hardware architectures and expected performance of the CMS GEM readout system, including preliminary timing resolution simulations will be presented.

Summary

In this contribution we will report on the progress of the design of the readout system being developed for triple-GEM detectors that should be installed in the CMS muon endcap system for the LHC high luminosity phases. The functional requirements on the system are to provide both triggering and tracking information. In addition the system will be designed to take full advantage of current generic developments introduced for the LHC upgrades. The current design is based on the use of CERN GLIB boards host in micro-TCA crates for the off-detector electronics and the Versatile Link with the GBT chipset to link the FE electronics to the GLIB boards. In this contribution we will describe the physics goals, the hardware architectures and report on the expected performance of the CMS GEM readout system, including preliminary timing resolution simulations.

In 2009, a dedicated CMS R&D program was launched to study the feasibility of using micro-pattern gaseous detectors (MPGD) for the instrumentation of the $|\eta| > 1.6$ region in the CMS muon endcap system. The proposed detector for CMS is a triple-GEM trapezoidal chamber, equipped with 1D readout, with dimensions (990x440-220) mm2. Triple-GEM detectors can provide precision tracking and fast trigger information, contributing on one hand to provide missing redundancy in the high-eta region and on the other hand to the improvement of the CMS muon trigger.

The challenges for the readout system are numerous: the time resolution should be as good as 5ns, to unambiguously identify each LHC bunch crossing, the best spatial resolution, ˜100 µm, should be ensured at the first level of the CMS trigger system which has a latency of 3.2 µs and the data acquisition should sustain a very high data throughput, of the order of 100 MB/s of trigger data per detector at high LHC luminosity.

The CMS GEM Collaboration has launched a complete R&D program to develop a new Front-End chip, which should be flexible enough to be used with various MPGDs, as well as a trigger and data acquisition system based on the most recent developments from the telecommunication industry (µ-TCA), in line with the other CMS upgrade projects. In this contribution we will report on the design and the expected performance of the CMS GEM readout system, including preliminary timing resolution simulations.

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