Contribution ID: **31** Type: **Oral**

Upgrade of the CMS Tracker for the High Luminosity LHC

Monday, 27 May 2024 09:40 (20 minutes)

The LHC machine is planning an upgrade program which will bring the luminosity to about 5-7.5$\times$ 10^{34} cm^{-2} s^{-1}, to possibly reach an integrated luminosity of 3000-4000 fb^{-1} in ten years of operation. This High Luminosity LHC scenario, HL-LHC, will require an upgrade program of the LHC detectors known as Phase-2 upgrade. The current CMS Silicon Strip Tracker, already running beyond design specifications, and CMS Phase-1 Pixel Detector will not be able to survive HL-LHC radiation conditions and CMS will need completely new devices, in order to fully exploit the highly demanding conditions and the delivered luminosity. Both the Phase-2 Pixel system (Inner Tracker, IT) and the Outer Tracker (OT) will feature a higher detector granularity with respect to the present Tracker, more radiation hard sensors and read-out chips, and the capability of handling higher data rate and longer trigger latency. In particular, the Phase-2 Inner Tracker (IT) will feature 3D and planar n-in-p sensors, bump-bonded to read-out chips in 65 nm CMOS technology. The new Tracker has been designed to ensure at least the same performances of the Phase-1, in terms of tracking and vertexing capabilities, at the high pileup expected at HL-LHC. Another key feature of the OT will be to provide tracking information to the Level-1 trigger, allowing trigger rates to be kept at a sustainable level without sacrificing physics potential. For this, the OT will be made out of modules which have two closely spaced sensors read-out by a common front-end ASIC, which can correlate hits in the two sensors creating short track segments called “stubs”. The stubs will be used for tracking in the L1 trigger stage. This report is focusing on the replacement of the CMS Tracker system, describing the technological choices together with some highlights on the start of the production activity.

Collaboration

CMS

Role of Submitter

I am the presenter

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Session Classification: Integration and Detector Systems - Oral session

Track Classification: T8 - Integration and Detector Systems