



Contribution ID: 20

Type: **Talk**

Design and construction of the Outer Tracker for the CMS Phase-2 Upgrade

Monday 17 February 2025 16:10 (20 minutes)

The High Luminosity LHC (HL-LHC) is expected to deliver an integrated luminosity of $3000\text{--}4000\text{ fb}^{-1}$ after 10 years of operation with peak instantaneous luminosity reaching about $5\text{--}7.5 \times 10^{34}\text{ cm}^{-2}\text{ s}^{-1}$. During Long Shutdown 3, several components of the CMS detector will undergo major changes, called Phase-2 upgrades, to be able to operate in the challenging environment of the HL-LHC. The current CMS tracker will be replaced. The Phase-2 Outer Tracker (OT) will have high radiation tolerance, higher granularity, and the capability to handle higher data rates. Moreover, the OT will provide tracking information to the Level-1 trigger, for the first time at hadron colliders, allowing trigger rates to be kept at a sustainable level without sacrificing physics potential. For this, the OT will be made of modules with two closely spaced silicon sensors read out by front-end ASICs, which can correlate hits in the two sensors creating short track segments (stubs), used for tracking in the L1 track finder. The modules come in two flavors: strip-strip (2S) and pixel-strip (PS), containing different sensor configurations and multiple ASICs. This contribution will present the design of the Phase-2 OT, the first results with pre-production devices, and the quality assurance procedures used to ensure the functionality of the modules: from fulfilling the precision specification of the module assembly procedure to ensuring the proper communication among the module's ASICs.

Primary experiment

CMS collaboration

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Session Classification: Plenary Experiment upgrades

Track Classification: Systems