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Performance and characterisation of the Phase-2 CMS Inner Tracker Endcap pixel detector

The High Luminosity Large Hadron Collider (HL-LHC) at CERN is expected to collide protons at 14 TeV center-of-mass energy and to reach the unprecedented peak instantaneous luminosity of 7.5 x 10^34 cm^-2 s^-1 with an average number of pileup events of 200. This will allow the ATLAS and CMS experiments to collect integrated luminosities up to 4000 fb^-1 during the project's lifetime. To cope with this extreme scenario, the CMS detector will be substantially upgraded before the HL-LHC phase, a plan known as the CMS Phase-2 upgrade. The entire CMS Inner Tracker (IT) detector will be replaced, and the new detector will feature increased radiation hardness, higher granularity, capability to handle higher data rates and longer trigger latency. The upgraded IT will be composed of a barrel part, TBPX, and small and large forward disks, TFPX and TEPX. The novel scheme of serial powering will be deployed to power the pixel modules, and new technologies will be used for a high bandwidth readout system. The TEPX detector has four large disks on each end, extending the tracking coverage up to |eta| < 4.0. Each disk employs a thin pcb which carries the data and power from/to the modules. In this contribution, the design of the new TEPX detector will be presented, focusing on the disk characterization. The performance of the CMS ReadOut Chip (CROC_v1) quad modules, either digital or with planar sensors, will be discussed, with a focus on the comparison between the behaviour stand-alone or in a TEPX disk serial power chain, in terms of noise and threshold uniformity. The final design of the TEPX disk pcb is evaluated by testing the modules connected to the disk, in terms of data transmission quality compared to the standalone case.

Collaboration / Activity

CMS

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