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# Data transmission performance and characterization of TEPX disks of Phase-2 CMS Inner Tracker

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Before starting the High-Luminosity Large Hadron Collider (HL-LHC) runs, the CMS detector will be substantially upgraded to cope with the significant increase in instantaneous luminosity. The entire CMS Inner Tracker (IT) detector will be replaced, and the new detector will feature increased radiation hardness, higher granularity, and the capability to handle higher data rates and longer trigger latency. In this contribution, the new TEPX detector - a large forward disk detector - will be presented, with an emphasis on disk characterization in terms of the data transmission quality along with the performance of CROCv2 modules.

## Summary (500 words)

The High Luminosity Large Hadron Collider (HL-LHC) at CERN is expected to collide protons at a center-of-mass energy of 14 TeV and to reach the unprecedented peak instantaneous luminosity of 7.5 x 10ˆ34 cmˆ-2 sˆ-1 resulting in a number of 200 collisions per bunch crossing. During the project lifetime, this will allow both the ATLAS and CMS experiments to collect integrated luminosities up to 4000 fbˆ-1 each.

The CMS detector will be substantially upgraded before starting the HL-LHC to cope with this extreme scenario, 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, and the 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, and has the longest serial power chain in IT with 11 modules. Each disk uses a 5-layer, 400µm thick, PCB that carries the power and the data to and from the modules.

In this talk, the new TEPX detector will be presented with an emphasis on disk characterization. The performance of the CMS ReadOut Chip quad modules (both with the prototype CROCv1 and the final CROCv2 chips), either digital or with planar sensors, will be discussed 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 the data transmission quality and finding the optimal pulse shape. It will be shown that even for the longest data lines, the bit error rate (BER) of the optical chain up to the port-cards is less than 10ˆ-10.

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