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Construction and commissioning of the Phase I upgrade of the CMS pixel detector

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The Phase I upgrade of the CMS pixel detector, installed by the CMS collaboration during the recent extended end-of-year technical stop, is built out of four barrel layers (BPIX) and three forward disks in each endcap (FPIX). It comprises a total of 124M pixel channels, in 1,856 modules and it is designed to withstand instantaneous luminosities of up to 2 x 10^34 cm-2 s-1 with increased detector acceptance and additional redundancy for the tracking, while at the same time reducing the material budget.
These goals are achieved using a new readout chip and modified powering and readout schemes, one additional tracking layer both in the barrel and in the disks, and new detector supports including a CO2 based evaporative cooling system.
Different parts of the detector have been assembled over the last year and later brought to CERN for installation inside the CMS tracker. At various stages during the assembly tests have been performed to ensure that the readout and power electronics, and the cooling system meet the design specifications. After tests of the individual components, system tests have been performed before the installation inside CMS.
This contribution will review the design and technological choices of the Phase I detector, with a focus on the challenges and difficulties encountered, and present results from system tests and from the final commissioning of the detector in-situ using the central CMS DAQ system.

Experimental Collaboration

CMS

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