

Structure and Cooling for the CMS Phase II Tracker Forward Pixel Detector

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The High Luminosity LHC will reach an instantaneous luminosity of $5 \times 10^{34} \text{ cm}^{-2} \text{ s}^{-1}$ with 140 to 200 pp collisions per bunch crossing and collect a total of 3 ab^{-1} of 14 TeV data. To cope with these challenging data conditions, the CMS Inner Tracker will be rebuilt for Phase II Upgrades. To limit particle occupancy to the per mille level and improve track resolution, we will increase the granularity of the sensors. This will result in power dissipation of approximately 50 kW. For sensors to survive the radiation close to the beam pipe, we will need to maintain them around -20 C. Thus, cooling the detector will be of paramount importance. We present a vision for the structural support and cooling services of the Tracker Forward Pixel Detector that has been studied through finite element analyses. The simulations are informed by experimental measurements of the thermal transport properties of bulk and interface materials performed in novel, custom-made apparatuses. We also present progress with fabrication of prototypes for some of the structural parts, and plans for the rest.

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