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## Thermal studies for the CMS Phase II Tracker Forward Pixel detector

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Thermal finite element analyses (FEA) of representative and realistic structures in the CMS Phase II Tracker Forward Pixel detector are presented. The high granularity of the sensors and associated readout electronics (modules) necessary to take data at the High Luminosity LHC will generate 60 kW of heat that needs to be extracted for the sensors to be maintained around -20C. The FEA of representative structures for the module mounts serve to identify thermal bottlenecks in transporting heat from the modules to the mixed phase carbon dioxide cooling pipes. Using the representative structure, we explore various candidate geometries and materials to optimize the heat transfer. The FEA of realistic structures are used to estimate the temperature profile within the detector for optimal running and failure modes of the readout chips to anticipate, and thus avoid, thermal runaways in the real detector.

**Author:** KOSHY, Abraham Mathew (Purdue University (US))

**Presenter:** KOSHY, Abraham Mathew (Purdue University (US))