CMS MIP Timing Detector

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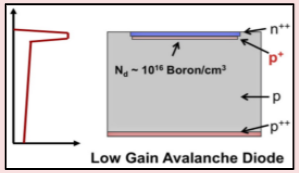
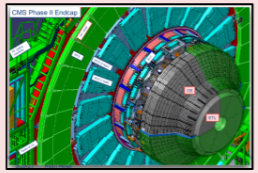
Different Conditions, Different Technologies

Endcap Timing Layer

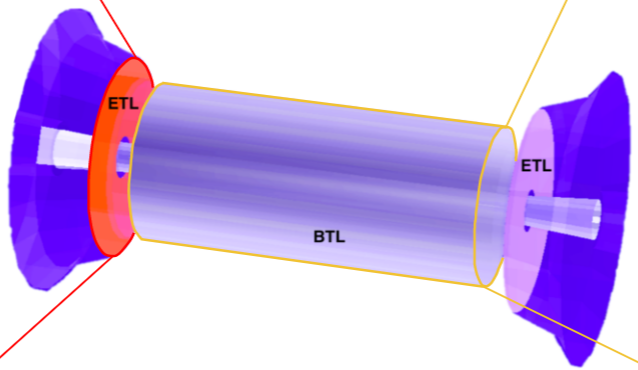
The Endcap Timing Layer (ETL) detects charged particles with Low-Gain Avalanche Diodes (LGADs), which are silicon sensors with 10–30x internal gain that provide low-jitter, quickly rising pulse edges for precise time measurements.





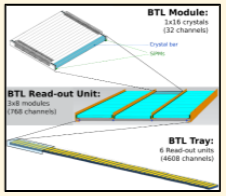
Each ETL endcap is composed of two disks of LGAD sensors. A single-particle time resolution of < 35 ps is achieved by combining < 50 ps resolution measurements from each disk.

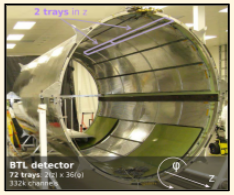
Different radiation environments, detector areas, and upgrade schedules motivate different detector technologies in the CMS barrel and endcap regions.



Barrel Timing Layer

The Barrel Timing Layer (BTL) uses bars of scintillating LYSO crystal coupled to silicon photomultipliers (SiPMs) to measure particle arrival time with a precision of 30-40 ps at the start of operation.





Thermoelectric coolers (TECs) will enable -45 °C operation to minimize SiPM dark current and +40 °C annealing to reduce the effects of radiation damage.