



Detector and Upgrades

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CT-PPS Detector

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Detector and Upgrades

The CMS-Totem Precision Proton Spectrometer

► Focuses on a special-class of interactions at the LHC

- ► Use the LHC as a photon/gluon collider
- ► The forward protons are scattered at small angles

► Use LHC magnets as a proton spectrometer:

TCL 6

Need detectors very close to the beamline: ~3-4 mm

2 new horizontal

cylindrical RPs (1 in LS1)



2 horizontal box-shaped RPs









- ► CT-PPS has been in operation since 2016
- Operates a variety of different particle detectors:
 - Silicon Strips (measure position along one direction, combine two in perpendicular directions to measure a position on a plane)
 - 3D Silicon Pixels (measure 2D position on a plane, 3D pixel design is radiation hard)
 - Diamond detectors (less granular than pixels, but great time response)
 - Ultra Fast Silicon Detectors (used for time measurement)







- ► CT-PPS is a new detector:
 - Still under active development: This year (2018) will operate under a new configuration
 - Trigger systems under active development
- ► Physics analysis:
 - ➤ Initial state has well defined quantum numbers → strong constraints on the properties of the final state
 - Study quartic gauge interactions (γγ→WW), searching for deviations from the SM
- ► CT-PPS operates very close to the beam:
 - ► Devices have to sustain high doses of radiation → Using new detector systems
 - ➤ Some detectors currently used in CT-PPS are being considered for the upgrades for HL-LHC in CMS → CT-PPS provides the opportunity to acquire experience in these new systems





Upgrades



LHC Schedule





Year





- The Unprecedented luminosity of the HL-LHC poses a challenge for CMS
 - Increased pile-up
 - Increased radiation damage
- ➤ In order to cope, some of the detector systems have to be upgraded:
 - ► Tracker
 - Endcap calorimeters
 - ► ECAL electronics
 - ► L1 Trigger system
 - New detector: Barrel Timing Layer
 - Upgrade DAQ for increased bandwidth and computing power





- The upgrades are prompted by the L1 latency and rate requirements for CMS Phase II
- The opportunity will be taken to optimize the system, adjust for radiation-induced noise and add timing information
- ➤ The ADC sampling rate will also be increased







- To handle the high radiation environment in the forward region, the calorimeters will be replaced by a high granularity sampling calorimeter, the HGCAL
- HGCAL will produce 3D information of the energy shower produced within the calorimeter
- A radiation resistant LVR is being designed for this detector
- The L1 trigger, exploiting the information from this detector is under development







- In the presence of pile-up, the timing information of individual tracks helps identify from which collision each track originates
- ➤ This will be added with the BTL detector
- The BTL, will be placed within a tight space 6.8cm, constraining the design of the detector
 - Scintillator
 - Photomultiplier
 - Readout electronics







Questions?