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The upgrade of the CMS electromagnetic calorimeter: future prospects for precision timing and energy measurements at the High Luminosity LHC

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The Compact Muon Solenoid (CMS) electromagnetic calorimeter (ECAL) is made of about 75,000 scintillating lead tungstate crystals arranged in a barrel and two endcaps. The scintillation light is read out by avalanche photodiodes (APDs) in the barrel and vacuum phototriodes in the endcaps. The fast signal from the crystal scintillation, amplified and sampled at 40 MHz by the on-detector electronics, enables precision energy, as well as timing, measurements for electrons and photons. The High Luminosity upgrade of the LHC (HL-LHC) at CERN will provide unprecedented instantaneous and integrated luminosities of around 5 x 10ˆ34 cmˆ-2 sˆ-1 and 3000/fb, respectively. An average of 140 to 200 collisions per bunch-crossing (pileup) is expected. This poses a major challenge to the CMS event reconstruction. The CMS detector is therefore undergoing an extensive Phase-II upgrade program to prepare for these demanding/severe conditions. In the barrel region of the CMS ECAL, the lead tungstate crystals will continue to perform well. The APDs which detect the scintillation light will also continue to be operational, with some increase in noise due to radiation-induced dark currents. This will be mitigated by reducing the temperature at which ECAL is operated. Nonetheless, the entire readout and trigger electronics will need to be replaced to cope with the harsh conditions and increased trigger latency requirements at the HL-LHC. The upgraded detector will have a 25 fold improved readout granularity and a sampling rate increase by a factor of 4. The upgraded ECAL will preserve the calorimeter energy resolution, and will much improve the time resolution for photons and electrons with energies above 10 GeV. The timing precision is used in important physics measurements and it is speculated that further improved time information could be exploited for pileup mitigation and for the photons assignment to the correct collision vertex. In this talk the status of the ongoing R&D activities for the ECAL upgrade will be presented.

Internet talk

Is this abstract from experiment?

Yes

Name of experiment and experimental site

CMS

Is the speaker for that presentation defined?

Yes

Details

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