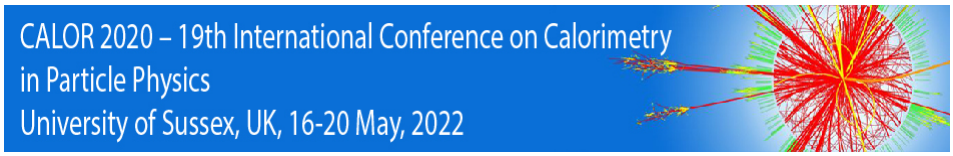

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Laser response variation during 10 years of CMS ECAL operation and prospects for HL-LHC

The CMS Electromagnetic Calorimeter (ECAL) is made of 75848 lead-tungstate scintillating crystals. The excellent intrinsic energy resolution of the CMS ECAL is preserved with the aid of a precise light monitoring system. The high radiation doses from the LHC collisions in the ECAL crystals and photodetectors affects the light output. Crystal and photodetector response changes are monitored in real time by a sophisticated apparatus using lasers and LEDs. Soon after data are collected, a computer farm processes the laser and LED monitoring events and computes precise corrections to be used in the event reconstruction within 48 hours of data-taking. Similar corrections are also applied at trigger level.

The ECAL light monitoring system has been operational since the start of LHC Run 1 (2010-2013). During LHC Run 2 (2015-18), CMS recorded data corresponding to an integrated luminosity of more than 160 fb-1 at 13 TeV. The Run 2 luminosity increase compared to Run 1 has caused correspondly higher response losses, which have been tracked and corrected for using this system.

High-Luminosity running at the LHC, which is planned for 2028 and beyond, will imply an order of magnitude increase in radiation levels and particle fluences with respect to the present LHC running conditions. The mitigation of ageing is an important goal for the upgrade of the laser light monitoring system. This talk describes the key components of the ECAL monitoring system, discusses the evolution of the response of the ECAL crystals and photodetectors in Run 1 and Run 2 data, the monitoring plans for LHC Run 3 (2022-25) and outlines the proposed monitoring system upgrade for HL-LHC (2028-).

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