T 96: Detectors IX (Calorimeters)

Time: Friday 9:00–10:30 Location: VG 2.101

T 96.1 Fri 9:00 VG 2.101

Quality Control of the Tileboards for the High Granularity Calorime- ter upgrade of the CMS experiment — •Anurag Sritharan — Deutsches Elektronen-Synchrotron DESY, Notkestraße 85, 22607 Hamburg, Germany

The CMS experiment will be upgrading its detectors in lieu of higher luminosities and collision rates during the High-Luminosity era of the LHC (HL-LHC). One key upgrade of the CMS detector will be its endcap calorimeters, which will be fitted with the new High Granularity Calorimeter (HGCAL). Since the HL-LHC will have 10 times more luminosity, the HGCAL will have improved radiation hardness and better background rejection that is caused due to much higher pile-up. It will consist of both the Electromagnetic and Hadronic calorimeters. Furthermore, the Hadronic calorimeter is split into two different technologies owing to the amount of radiation damage. The SiPM-on-Tile technology consists of small scintillator tiles that are linked to SiPMs (Silicon Photo-multiplier) on the PCB. The PCB without any scintillators on it is known as a tileboard. A tileboard will house 1 or 2 readout ASICs (called HGCROCs), and each HGCROC can read out 72 channels. The production tileboards have already started to be made. To test and certify the boards and the functionality of the HGCROCs, a robust quality control procedure is needed. The QC procedure, as well as some of the results, will be discussed in this presentation.

T 96.2 Fri 9:15 VG 2.101

Simulation of a cosmic muon test stand for the the CMS HGCAL upgrade — •Mohammed Adnan Ali, Andreas Hinzmann, and Freya Blekman — DESY, Notkestr. 85, 22607 Hamburg

The CMS High Granularity Calorimeter (HGCAL) upgrade requires thorough quality control during the production of its components. A cosmic muon test stand for fully assembled boards equipped with scintillator tiles, SiPMs and read-out-electronics is setup to verify that all detector components operate as expected. In this talk we present a GEANT4-based simulation in CMSSW of this test stand allowing to study energy deposition patterns, reconstructed angle accuracy, and minimum ionizing particle light yields to help the design of the test stand and for comparison to the collected data.

T 96.3 Fri 9:30 VG 2.101

Multi-Tilemodule test system using cosmic rays for the CMS HGCAL upgrade — •Jia-Hao Li — Deutsches Elektronen-Synchrotron DESY, Hamburg, Germany

The CMS experiment plans to upgrade its calorimeter endcap for the high luminosity phase of the LHC with the High Granularity Calorimeter (HGCAL). The Tilemodule is one of the basic elements in the hadronic calorimeter part of the HGCAL. It uses small scintillator tiles directly coupled to SiPMs (SiPM-on-tile technology) and it is the first step in the production sequence providing an object capable of detecting particles. The Tilemodule is equipped with one or two HGCROC ASICs for data readout. To test and calibrate the Tilemodules, a cosmic ray setup capable of testing up to 9 Tilemodules simultaneously is developed for quality control and a better understanding of the property of the Tilemodules. The presentation will discuss the idea and current status of the cosmic test setup at DESY.

T 96.4 Fri 9:45 VG 2.101

Fast Hadron Shower Simulation using a Distance Based Sorting for Calorimeter Tiles with the CALICE AHCAL Prototype — •Zobeyer Ghafoor, André Wilhahn, and Stan Lai — II. Physikalisches Institut, Georg-August Universität Göttingen

The simulation of particle showers in calorimeters plays a critical role in high-energy physics research. As calorimeter precision and resolution improve, the complexity and volume of data increase substantially. This growth presents significant challenges for computational resources, data storage, and analysis, underscoring the need for innovative simulation algorithms. This talk outlines a data-driven fast simulation approach. By optimising computational efficiency, this method aims to significantly reduce the total number of hits for the simulation, thereby optimising computational efficiency. However, the reduction must preserve critical calorimeter and shower information. This study uses data from a 2018 test beam with pion beams and the CALICE AHCAL. The calorimeter features 38 active layers, each comprising 24×24 tiles that are read out individually. For the fast simulation, a distance-sorting algorithm was employed, which orders the tiles in each layer based on their distance from the event's centre-of-gravity, sorted from smallest to largest. This helps avoid complications due to necessary geometrical transformations when simulating energies based upon radial distances from the shower centre. To enhance efficiency, limitations were imposed on both the number of tiles and layers, effectively reducing the total number of readout channels while maintaining essential information for accurate event reconstruction.

T 96.5 Fri 10:00 VG 2.101

Integrated Cooling Solutions for a Highly Granular Scintillator-Based Hadronic Calorimeter and Advances in 3D-Printed Scintillators — •Andre Klotzbücher[1], Lucia Masetti[1], Bohdan Dudar[1], Quirin Weitzel[2], Steffen Schönfelder[2], Fabian Piermaier[2], and Konrad Briggl[3] — [1]Institut für Physik, Johannes Gutenberg Universität Mainz — [2]Prisma+ Detektorlabor, Johannes Gutenberg Universität Mainz — [3]Kirchhoff-Institut für Physik, Universität Heidelberg

This talk discusses the adaptation of the analogue hadronic calorimeter (AHCAL), originally developed by the CALICE collaboration for the International Linear Collider (ILC), to meet the demanding requirements of future circular colliders. For the linear collider environment, no integrated cooling system was necessary, as power consumption was effectively managed through power pulsing. However, this approach is no longer feasible due to the significantly higher interaction rate in circular colliders, requiring the electronics to remain continuously powered. To address this challenge, an integrated cooling system is being developed, and the latest progress will be presented.

Additionally, advances in 3D-printed scintillators are opening new possibilities for detector design. Following successful tests of basic printed tiles, efforts now focus on structured scintillators with optimized surface properties for improved light collection and performance. Preliminary results on performance and key characteristics will be discussed, highlighting the potential of these technologies for next-generation detectors.

T 96.6 Fri 10:15 VG 2.101

Calorimetry in searches for collider electron neutrinos at SND@LHC — •Matei Climescu and Rainer Wanke — Johannes Gutenberg Universität Mainz

SND@LHC is an experiment located in the TI18 tunnel at LHC which leverages its unique off-axis positioning to observe outgoing neutrinos of all flavours produced at the ATLAS interaction point with knowledge of the production mechanism. Electron neutrinos are of particular interest as their emerge primarily from charm decays and may be searched for in emulsion detectors which are utilized as very-high spatial resolution calorimeters, enabling unique reconstruction techniques. These searches are presented here with a focus on calorimetric reconstruction of charged and neutral current collider neutrino interactions.