T 63: Detectors 6 (calorimeters)

Time: Wednesday 16:00–17:45 Location: Geb. 30.23: 2/1

T 63.1 Wed 16:00 Geb. 30.23: 2/1

The SHADOWS calorimeter — •Claudia Caterina Delogu for the SHADOWS-Collaboration — Johannes Gutenberg Universität Mainz

The SHADOWS experiment, proposed for the 400 GeV/c proton beam at CERN SPS, is dedicated to exploring feebly interacting particles (FIPs) generated during proton interactions. This contribution specifically focuses on advancements related to the electromagnetic calorimeter of SHADOWS. In addressing the challenge of reconstructing particles that decay into photons, we present a conceptual design study of a plastic scintillator-based calorimeter designed to provide energy and direction measurements. As part of the ongoing experimental development, efforts are underway to study the SHADOWS electromagnetic calorimeter technology, including activities related to calorimeter and module design, scintillator-SiPM coupling, readout concept, prototyping, and test measurements. The pointing capability is essential for FIP detection and has been validated through GEANT4 simulations.

T 63.2 Wed 16:15 Geb. 30.23: 2/1

Development of a SplitCAL Prototype — •Matei Climescu and Rainer Wanke — Johannes Gutenberg Universität Mainz

The SplitCAL is a mixed electromagnetic calorimeter designed to provide both energy reconstruction through layers of scintillating strips read out by wavelength shifting fibres and shower direction information through high-precision layers. This enables particular precision in the reconstruction of photon final states e.g. arising from Dark Matter decays in fixed target experiments. The development accounts for low rates but a large dynamic range to allow for reconstruction of both electromagnetic showers and MIPs. The focus of this presentation will be the design and building of the SplitCAL calorimeter as well as the evaluation of its readout electronics.

T 63.3 Wed 16:30 Geb. 30.23: 2/1

Time response of a position-sensitive wavelength-shifting fibre structured plastic scintillator detector (CheapCal) — Alessia Brignoli[1], Valery Dormenev[2], Karl Eichhorn[3], Jan Friedrich[3], Heiko Markus Lacker[1], Martin J. Losekamm[3], Anupama Reghunath[1], Christian Scharf[1], Ben Skodda[1], Valerian von Nicolai[1], •Ida Wöstheinrich[1], and Hans-Georg Zaunick[2] — [1]Humboldt-Universität zu Berlin — [2]Justus-Liebig-Universität Gießen — [3]Technische Universität München

The goal of the CheapCal project is to build a low-cost and easy-to-build detector for charged-particle detection with a spatial resolution of about 1 cm or better. The detector is made from an extruded plastic scintillator plate of short light attenuation length, with wavelength-shifting fibres embedded into it at a fibre-to-fibre distance of 1.5 cm. The fibres on the front side and the backside of the plate are oriented perpendicular to each other and are optically coupled at each end to silicon photomultipliers. We report on the timing performance of the detector measured with a Sr-90 beta source. We acknowledge the support from BMBF via the High-D consortium.

T 63.4 Wed 16:45 Geb. 30.23: 2/1

First test beam measurements of a position-sensitive wavelength-shifting fibre structured plastic scintillator detector (CheapCal) — Alessia Brignoli[1], Andrew Picot Conaboy[1], Valery Dormenev[2], Christian Dreisbach[3], Karl Eichhorn[3], Jan Friedrich[3], Heiko Markus Lacker[1], Martin J. Losekamm[3], Anupama Reghunath[1], Christian Scharf[1], Ben Skodda[1], •Valerian von Nicolai[1], Ida Wöstheinrich[1], and Hans-Georg Zaunick[2] — [1]Humboldt-Universität zu Berlin — [2]Justus-Liebig-Universität Gießen — [3]Technische Universität München

The CheapCal project aims to develop a low-cost and easy-to-build detector for charged particle detection with a spatial resolution of about a centimetre or better. The detector is based on a $(25 \times 25)\,\mathrm{cm}^2$ extruded plastic scintillator with a short light attenuation length, which is structured with wavelength-shifting fibres embedded into the material at a fibre-to-fibre distance of 1.5 cm. The fibres are read-out at each end by a silicon photomultiplier (SiPM). After proof-of-principle measurements in the laboratory with a Sr-90 source, we constructed a first detector with fibres in orthogonal orientation on the front and back of the scintillator. We successfully tested this prototype with a 100 GeV muon beam at the AMBER experiment at CERN, using a beam telescope consisting of silicon-strip detectors for tracking. The initial results of this test campaign will be presented. We acknowledge the support from BMBF via the High-D consortium.

T 63.5 Wed 17:00 Geb. 30.23: 2/1

Fast Hadron Shower Simulation using Generative Adversarial Networks with the CALICE AHCAL Prototype — •André Wilhahn, Julian Utehs, and Stan Lai for the CALICE-D-Collaboration — II. Physikalisches Institut, Georg-August-Universität Göttingen, Deutschland

Extensive simulations of particle showers are crucial for high energy physics experiments, since they allow for a sensible interpretation of recorded calorimeter data. As many calorimeters are designed with increasing granularity, while having to cope with higher energy deposits and higher luminosity conditions, the accurate simulation of particle showers in a computationally efficient manner is of utmost importance. This talk describes preliminary investigations into a data-driven fast calorimeter simulation, based on machine learning techniques, that is meant to describe particle showers accurately.

We start by investigating pion showers in the CALICE AHCAL (Analog Hadron Calorimeter) prototype, which is a highly granular hadronic calorimeter comprising a total of 38 active layers embedded in a stainless-steel absorber structure. Each active layer contains a grid of 24×24 scintillator tiles that are read out individually via silicon photomultipliers. Based on energy distributions, Generative Adversarial Networks have been trained on testbeam data, aiming at creating a neural network that is able to generate and recreate energy distributions from random input noise, while also preserving correlation factors between individual detector layers.

T 63.6 Wed 17:15 Geb. 30.23: 2/1

Results of the Megatile prototype for the CALICE AHCAL — •Anna Rosmanitz for the CALICE-D-Collaboration — Johannes-Gutenberg Universität Mainz

The CALICE collaboration develops several highly granular calorimeter concepts for a future e^+e^- collider, that are designed for Particle Flow Algorithms. The current design for the Analog Hadronic Calorimeter (AHCAL) consists of 3x3 cm^2 scintillator tiles read out by silicon photomultipliers (SiPM). Each tile is individually wrapped in reflective foil and glued to the boards. The final AHCAL detector would contain 8 million channels.

To facilitate the assembly process, the Megatile design is developed at the University of Mainz. It is made from a large scintillator plate which houses 12x12 channels at once. The channels are separated by tilted trenches filled with a mixture of glue and TiO_2 for reflectivity and optical insulation. Optical tightness is achieved by gluing reflective foil on both faces and varnishing the edges. Until now, ten prototypes have successfully been built, continuously monitored in a cosmic test-stand in Mainz and tested in several test beam campaigns at DESY and CERN. This talk presents the latest technical developments and preliminary results from electron test beam measurements.

This includes a high-resolution scan of the megatile performance in the inter-channel region across the tilted TiO_2 trenches, utilizing a beam telescope to study MIP-like energy depositions without any absorber material.

T 63.7 Wed 17:30 Geb. 30.23: 2/1

Quality control of the pre-series scintillator tiles of the High Granularity Calorimeter upgrade of the CMS experiment — •Daria Selivanova — Deutsches Elektronen-Synchrotron DESY, Notkestraße 85, 22607 Hamburg, Germany

As the High Luminosity era of LHC approaches, it is important to finalise production techniques for the components of the upgrades of the collider experiments and CMS is no exception. The CMS endcap calorimeters are getting a high granularity upgrade (HGCAL), which promises to improve energy resolution by reducing background via pileup rejection. This is done through use of both intrinsic timing capabilities of the sensors and front-end electronics design as well as unprecedented transverse and longitudinal segmentation. HGCAL consists of electromagnetic and hadronic compartments, the latter of which is divided into two by the different technologies used in its construction. One of them, SiPM-on-tile, will make up ~250 000 channels: scintillator tiles optically coupled to SiPMs soldered onto a PCB with readout electronics. All of such channels will need to withstand harsh radiation conditions of HL-LHC to be able to continue with physics searches until the end of life (integrated luminosity ~ 3000 fb-1) and even beyond. Assurance of that is tackled by the Tile Assembly Center (TAC) at DESY performing quality control (QC) checks for all components of the SiPM-on-tile section of the HGCAL. Results of QC of scintillator tiles are discussed. Tiles under investigation are pre-series tiles the study of which aids the finalising of the production techniques. This part is essential for start and ease of the final production phase.