T 64: Kalorimeter 2

Zeit: Mittwoch 16:45–18:45 Raum: G.10.03 (HS 8)

T 64.1 Mi 16:45 G.10.03 (HS 8)

Improvements of the fast simulation of the CMS detector — •Maximilian Knut Kiesel — 1. Physikalisches Institut B, RWTH Aachen University

In todays experimental elementary particle physics, a reliable simulation of particle interactions is a key aspect. The interactions of particles from high energy collisions and their decay products with the CMS detector can be simulated using the GEANT4 framework. This approach is precise but time-consuming, therefore a faster simulation of the detector is used in several analyses.

In this talk, this faster simulation is discussed, focusing on the simulation of particles transversing the electromagnetic calorimeter. Furthermore, the challenges for the fast simulation in the next run period of the LHC are discussed and improvements to the simulation are presented.

T 64.2 Mi 17:00 G.10.03 (HS 8)

Calibration of the CMS HCAL Outer SiPMs with cosmic muons — •Artur Lobanov and Benjamin Lutz — DESY, Hamburg

The CMS Outer Hadron Calorimeter (HO) is the first large-scale hadron collider detector to use Silicon Photomultipliers (SiPMs), replacing previously used Hybrid Photodiodes (HPDs). The upgrade of the readout electronics was performed during the first long shutdown of the LHC. By April 2014 the installation of 2376 channels has been completed. We report on the system design, installation and commissioning of the detector.

In addition to the commissioning, the installation is verified using cosmic muons. These cosmic data has been taken exploiting the HO's self-trigger ability, which also allows to perform an initial cosmic-muon calibration, preceding the calibration with pp-collision data during the 2015 LHC run. We also report on a muon calibration obtained from global runs including the CMS muon system, where we show a good agreement with the previous results.

T 64.3 Mi 17:15 G.10.03 (HS 8)

Energy Calibration of the Electromagnetic Forward Calorimeters in ATLAS — Frank Ellinghaus, •Simon Schmitz, and Stefan Tapprogge for the ATLAS-Collaboration — Institut für Physik, Johannes-Gutenberg Universität Mainz

The electromagnetic forward calorimeters of the ATLAS detector are responsible for the measurement of the energy of electrons in the region from $2.5 < |\eta| < 4.9$. In this so called forward region tracking coverage is not available implying that electrons need to be reconstructed and identified by calorimetric information only. A calibration of the electromagnetic forward calorimeters is of importance for many electroweak measurements and searches for new physics.

The energy calibration is based on an integrated luminosity of 20.3 fb^{-1} of proton-proton collision data at $\sqrt{s} = 8$ TeV recorded with the ATLAS detector in 2012. A selection of $Z \to ee$ events with one electron in the forward region and one electron in the more central region is performed to compare the shape of the Z resonance in data and simulations. This talk discusses the detailed approach to accomplish the calibration of the electromagnetic forward calorimeters in ATLAS.

T 64.4 Mi 17:30 G.10.03 (HS 8)

Optimization of the track-cluster matching procedure for the particle flow algorithm in ATLAS — Ian C. Brock and •Irina Cioară — Physikalisches Institut, University of Bonn

Particle flow algorithms aim to combine information from all the components of a detector in order to have the best possible measurement of the particles that interact with it. The most significant improvements are expected for jet reconstruction and the measurement of missing transverse momentum.

In ATLAS, especially at low energies, a better performance compared to the default methods has been observed in jet resolution when the particle flow algorithm is included in the event reconstruction.

A simplified description of the ATLAS particle flow algorithm consists of: matching each track to an energy deposit in the calorimeter, checking if the ratio between the energy of the cluster and momentum of the track is consistent and if yes, replacing the cluster energy with the tracking measurement. A further algorithm that covers cases where the particle creates more than one cluster is also applied.

In order to further improve its performance, studies are ongoing for optimizing every step of the algorithm. This contribution presents the work invested in the optimization of the track-cluster matching procedure.

T 64.5 Mi 17:45 G.10.03 (HS 8)

Vergleich von zwei hoch-granularen hadronischen Kalorimeter-Konzepten — •Coralie Neubusüser für die CALICE-D-Kollaboration — Deutsches Elektronen Synchrotron (DESY)

Innerhalb der CALICE (Calorimeter for International Linear Collider) Kollaboration werden verschiedene Kalorimeter-Konzepte, alle optimiert für Particle Flow Algorithmen, für einen zukünftigen e^+e^- Linearbeschleuniger getestet. Zwei der hadronischen Kalorimeter Konzepte, das auf Wiederstandsplattenkammern (RPCs) basierende digitale hadronische Kalorimeter DHCAL mit einer Granularität von (1x1) cm^2 und digitaler Datenauslese, als auch das analoge hadronische Kalorimeter AHCAL welches Plastik-Scintillatoren analog mit einer Granularität von (3x3) cm^2 ausliest, werden hier vorgestellt. Beide Kalorimeter wurden in 1 m^3 Prototypen realisiert und mit Fe-Absorber in Teststrahl-Kampagnen getestet. Anhand der aufgenommenen Daten werden Kalibration und Energieauflösung analysiert und mit GEANT4 Simulationen verglichen.

T 64.6 Mi 18:00 G.10.03 (HS 8)

A Design of Scintillator Tiles Read Out by Surface-Mounted SiPMs for a Future Hadron Calorimeter — •Yong Liu, Bruno Bauss, Volker Büscher, Julien Caudron, Phi Chau, Reinhold Degele, Karl-Heinrich Geib, Lucia Masetti, Ulrich Schäfer, Stefan Tapprogge, and Rainer Wanke — Institut für Physik and PRISMA Detector Lab, Johannes Gutenberg-Universität Mainz

Precision calorimetry using highly granular sampling calorimeters is being developed based on the particle flow concept within the CALICE collaboration. One design option of a hadron calorimeter is based on silicon photomultipliers (SiPMs) to detect photons generated in plastic scintillator tiles. Driven by the need of automated mass assembly of around ten millions of channels stringently required by the high granularity, we developed a design of scintillator tiles directly coupled with surface-mounted SiPMs. A cavity is created in the center of the bottom surface of each tile to provide enough room for the whole SiPM package and to improve collection of the light produced by incident particles penetrating the tile at different positions. The cavity design has been optimized using a GEANT4-based full simulation model to achieve high response to Minimum Ionizing Particles (MIPs) and also good areal uniformity. Cosmic-ray measurements confirms high 1-MIP response for scintillator tiles with an optimized cavity design. Uniformity measurements by scanning the tile area using focused electrons from a beta source show exellent response uniformity. This optimized design is well beyond the requirements for a precision hadron calorimeter.

T 64.7 Mi 18:15 G.10.03 (HS 8)

A Design of Scintillator Tiles Read Out by Surface-Mounted SiPMs for a Future Hadron Calorimeter — •Yong Liu, Lennart Adam, Volker Büscher, Julien Caudron, Phi Chau, Sascha Krause, Lucia Masetti, Ulrich Schäfer, Rouven Spreckels, Stefan Tapprogge, and Rainer Wanke — Institut für Physik and PRISMA Detector Lab, Johannes Gutenberg-Universität Mainz

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T 64.8 Mi 18:30 G.10.03 (HS 8)

Calibration of the CALICE Analog Hadronic Calorimeter (AHCAL) — •Sarah Schröder, Marco Ramilli, Sebastian Laurien, Michael Matysek, Peter Buhmann und Erika Garutti für die CALICE-D-Kollaboration — Institute for Experimental Physics, Hamburg University, Luruper Chaussee 149, D-22761 Hamburg, Germany

The CALICE AHCAL technological prototype is a hadronic calorimeter prototype for a future e^+e^- - collider (ILC and CLIC). It is designed as a sampling calorimeter alternating tungsten or steel absorber plates and active readout layers, segmented in single plastic scintillator tiles of $3 \times 3 \times 0.3\,\mathrm{cm}^3$ volume. Each tile is individually coupled to a silicon photomultiplier, read out by a dedicated ASIC with energy measurement and time stamping capability. The high granularity is meant to enable imaging and separation of single showers, for a Particle Flow approach to the jet energy measurement. The prototype aims to establish this technology as a scalable solution for an ILC detector. The first 14 layers of this prototype have been assembled and commissioned. The first 10 layers in the stack are used as tracker to determine the position of the first hard interaction of a pion shower in the first interaction length (λ) of the calorimeter. Four full size layers ($72 \times 72\,\mathrm{cm}^2$) are distributed between 1 and 3 λ depth in the steel absorber. Data has been collected with muon, electron and pion beams at the CERN PS (2014). The first results on energy calibration with muons are presented, together with a comparison to the bench calibration obtained during tile production.