HK 2: Instrumentation I

Time: Monday 16:30–18:00 Location: SCH/A251

Group Report HK 2.1 Mon 16:30 SCH/A251

Aufbau und Kalibration der Vorwärtsendkappe des elektromagnetischen Kalorimeters des $\overline{\text{P}}$ANDA-Experimentes am COSY in Jülich — •Lukas Linzen für die PANDA-Kollaboration — Ruhr Universität Bochum, Germany

Das $\overline{\text{P}}$ANDA-Experiment wird eines der Schlüsselexperimente an der sich im Bau befindlichen Beschleunigeranlage FAIR. Dort werden Kollisionen von Antiprotonen in einem Impulsbereich zwischen 1,5 GeV/c und 15 GeV/c mit verschiedenen Targets untersucht. Der $\overline{\text{P}}$ANDA-Detektor ist ein vielseitiger Detektor mit präziser Spurrekonstruktion und der Möglichkeit neutrale, sowie geladenen Teilchen zu detektieren.

Das homogene elektromagnetische Kalorimeter (EMC) des Target-Spektrometers besteht aus einem fassförmigen Mittelteil und zwei Endkappen. Es stellt eine zentrale Detektorkomponente für die Bestimmung der Energien von e^-, e^+ und γ dar. Als Szintillator wird Bleiwolframat ($PbWO_4$) unter anderem wegen seiner hohen Strahlenhärte, kurzen Abklingzeit und kurzen Strahlungslänge eingesetzt. Zur Verbesserung der Lichtausbeute wird das EMC auf $-25\,^\circ$C gekühlt.

Es wird ein Überblick über den Aufbau der Vorwärtsendkappe und die Vorbereitung für die am COSY geplante Vorkalibration gegeben. Hierbei wird auf die finalen Detektorkomponenten und die Entwicklung des Datenerfassungssystems näher eingegegangen. Zur Kalibration werden Photonen aus π^0- und η-Zerfällen verwendet, welche in pp- und pn-Kollisionen erzeugt werden. Dazu wird ein Protonenstrahl mit einer Energie von 2,5 GeV und ein PET-Target verwendet.

Gefördert durch das BMBF.

HK 2.2 Mon 17:00 SCH/A251

Performance studies of pixel layers for the ALICE-FoCal detector — •Youssef El Mard Bouziani for the ALICE Germany-Collaboration — Institut für Kernphysik, Goethe-Universität Frankfurt

The upgrade of the ALICE experiment at CERN-LHC for LHC-Run 4 includes the expansion of the physics program with a study of small-x gluon distributions via prompt photon production.

To facilitate this study a highly granular Si+W electromagnetic calorimeter combined with a conventional sampling hadronic calorimeter covering pseudorapidities of $3.4 < \eta < 5.8$ has been proposed: the FoCal detector. The FoCal-E subdetector will consist of a Si+W sampling calorimeter hybrid design using two different Si readout technologies, pad layers, and pixel layers based on ALPIDE-chip technology. The pixel layers have been successfully tested within the framework of the EPICAL-2 prototype detector.

In this talk, we report on studies of the shower measurements with the EPICAL- 2 design. Furthermore, simulation studies of performance tests of the implementation of the pixel layers in the FoCal detector setup will be discussed.

Supported by BMBF and the Helmholtz Association.

HK 2.3 Mon 17:15 SCH/A251

Performance of the EPICAL-2 ultra-high granularity electromagnetic calorimeter prototype — •Tim Sebastian Rogoschinski for the ALICE Germany-Collaboration — Institut für Kernphysik, Goethe-Uni Frankfurt

The EPICAL-2 detector has been designed and constructed within the endeavour to develop a novel electromagnetic calorimeter based on a SiW sampling design using silicon pixel sensors with binary readout. The R&D is performed in the context of the proposed Forward Calorimeter upgrade within the CERN-ALICE experiment and is strongly related to proton CT imaging studies as well as applicable to future collider projects.

EPICAL-2 consists of alternating W absorber and Si sensor layers employing the ALPIDE sensor developed for the ALICE-ITS upgrade. It has a total thickness of 20 radiation lengths, an area of $30\,\text{mm} \times 30\,\text{mm}$, and 25 million pixels of size $\sim 30 \times 30\,\mu\text{m}^2$. EPICAL-2 has been successfully tested with cosmic muons as well in test-beam campaigns at DESY and CERN-SPS.

We will report on results on calibration from cosmic muons and on the combined energy measurement performance obtained at both DESY and SPS. Furthermore, we will present results on the electromagnetic shower shape description. Both the performance and the shape description can be reproduced by simulation.

Supported by BMBF and the Helmholtz Association.

HK 2.4 Mon 17:30 SCH/A251

Tuning of GFlash for COMPASS calorimeter simulations — •Henri Pekeler, Laney Klipphahn, David Spülbeck, Mathias Wagner, and Bernhard Ketzer — Universität Bonn, Helmholtz-Institut für Strahlen- und Kernphysik, Bonn, Germany

Monte-Carlo simulations of detector setups are an essential element of physics analyses. At COMPASS, we use a high-level Monte Carlo program called TGEANT, which is based on GEANT4, to determine the acceptance of the detector system. For final states with photons from π^0 or η decays, the correct response of the electromagnetic calorimeter in the simulations is essential.

Instead of tracking every single particle in a shower, which is computationally very expensive, the GFlash algorithm is used. It models the energy distribution and the extend of the shower, which should change for different calorimeter module types.

The COMPASS calorimeters are a combination of homogeneous and sampling calorimeter modules and it is of great importance to verify that reality is described well enough by GFlash. During this talk, we present how we tuned GFlash in order to match the shower shape of real events in the different COMPASS calorimeter modules and showcase the improved photon reconstruction after the tuning.

Supported by BMBF.

HK 2.5 Mon 17:45 SCH/A251

A Feature Extraction Ansatz for the PANDA Forward-Endcap EMC — •Celina Frenkel — HISKP, Uni Bonn

The forward endcap of the electromagnetic calorimeter of the PANDA experiment consists of 3856 lead tungstate crystals. These are either readout by VPTTs in the high rate regime ($\theta \lesssim 13^\circ$) or by 2 APDs per crystal at larger angles. The signals are then digitized using sampling ADCs.

A feature extraction algorithm implemented on the FPGAs on the SADC boards is used to extract energy and time information from the SADC signals online in real-time. The expected particle rate in forward direction of the experiment reaches ~500 kHz such that pile-up is a relevant aspect. A signal deconvolution can be used to shorten the pulse in time and reduce the probability of pile-up.

The central topic of this talk is the investigation of an online feature extraction ansatz making use of the Pulse Shape Deconvolution (PSD). With this ansatz it is possible to even remove unwanted properties of the signal shape and provide a clean signal for the following extraction of the signal's features using a peakfinder algorithm.

Finally, the performance of the new PSD ansatz is compared to the less FPGA resource demanding moving window deconvolution based feature extraction, currently implemented.