HK 8: Instrumentation II

Zeit: Montag 14:00–16:00 Raum: S1/01 A3

Gruppenbericht HK 8.1 Mo 14:00 S1/01 A3

Fast and Convenient Data Analysis Software at the BGO–OD Experiment — •Oliver Freyermuth for the BGO-OD-Collaboration — Physikalisches Institut, Universität Bonn

The BGO–OD experiment located at the ELSA accelerator in Bonn is using the electron beam with energies up to 3.2 GeV for the investigation of meson photoproduction off the nucleon. The setup combines a central highly segmented BGO crystal calorimeter with a forward magnetic spectrometer complemented by ToF walls. In total over 5000 channels of diverse detectors are connected to the readout system.

The data analysis for this complex setup is handled by a modular software derived from the ROOT-based analysis framework ExPlORA, originally developed by the CB-ELSA/TAPS collaboration in Bonn.

This framework has now been heavily extended with a set of generic tools which can be used without knowledge of its internal design or extensive programming experience, while achieving the execution speed of compiled code. The underlying concept as well as its performance will be presented.

Secondly, methods of data preprocessing will be discussed. Since the analysis chain is based on object-oriented data structures, it can be easily segmented by storing intermediate preprocessed datasets. A technique to prune lower-level information was developed.

Finally, it will be illustrated that ExPlORA is closely entangled with recent and upcoming developments on C++ and ROOT. On this basis it is equipped with tools assisting in development and testing.

This work is supported by the DFG (SFB/TR-16).

HK 8.2 Mo 14:30 S1/01 A3

Investigation of a Huffman-based compression algorithm for the ALICE TPC read-out in LHC Run 3 — •Sebastian Klewin for the ALICE-Collaboration — Physikalisches Institut, University of Heidelberg

Within the scope of the ALICE upgrade towards the Run 3 of the Large Hadron Collider at CERN, starting in 2020, the ALICE Time Projection Chamber (TPC) will be reworked in order to allow for a continuous read-out. This rework includes not only a replacement of the current read-out chambers with Gas Electron Multiplier (GEM) technology, but also new front-end electronics. To be able to read out the whole data stream without loosing information, in particular without zero-suppression, a lossless compression algorithm, the Huffman encoding, was investigated and adapted to the needs of the TPC. In this talk, an algorithm, adapted for an FPGA implementation, is presented. We show its capability to reduce the data volume to less than 40% of its original size.

HK 8.3 Mo 14:45 S1/01 A3

Time-based cluster and hit finding for the STS detector in the CBM experiment at FAIR — •Grigory Kozlov[1,2,3,4] and Ivan Kisel[1,2,3] for the CBM-Collaboration — [1]Goethe University, Frankfurt am Main, Germany — [2]Frankfurt Institute for Advanced Studies, Frankfurt am Main, Germany — [3]GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany — [4]Joint Institute for Nuclear Research, Dubna, Russia

The goal of the future CBM experiment at FAIR is to explore the QCD phase diagram in the region of high baryon densities using high-energy nucleus-nucleus collisions. An important feature of the experiment is the real time reconstruction and physical analysis. It will allow select important events immediately after the collision and increase the quality of the data. In this case, the data are supplied to processing in form of time slices containing a large number of collisions. Preprocessing of the time-based results requires special algorithms that take into account not only the coordinates, but also the time of flight of each particle. Clustering algorithm for the STS detector has been designed and integrated into the CBMROOT framework. It enables data processing with high efficiency for the time slices of any length at frequencies of 107 and over collisions per second. The algorithm has a high speed and it can operate in event-based mode as well as in time-based.

HK 8.4 Mo 15:00 S1/01 A3

Offline Event-Building based on Free-Streaming CBM-TRD Prototype DAQ Systems in 2015 CERN-SPS Beamtest Data — •Philipp Kähler for the CBM-Collaboration — Institut für Kernphysik, WWU Münster, Deutschland

The detectors of the Compressed Baryonic Matter (CBM) experiment at FAIR will be operated with unprecedented particle rates of up to 100kHz/cm^2. Transition Radiation Detector (TRD) prototypes have been tested at particle rates of several kHz in Novemver 2015 at the CERN-SPS under the use of a lead target in a 30 AGev lead ion beam. The rate capabilities of the currently developed *Self-triggered Pulse Amplification and Digitization ASIC* (SPADIC) have been investigated in this beamtest. The SPADIC boards of two TRD prototypes were operated in a time-synchronised mode. This talk will focus on the time-based offline event building. Especially first time-correlation studies between two aligned detectors will be shown.

Furthermore the high voltage currents of the chamber anode wires have been monitored with a high frequency. First steps of a high voltage analysis and implications to the chamber design with respect to the field geometry will be discussed.

HK 8.5 Mo 15:15 S1/01 A3

Simulation kosmischer Höhenstrahlung in hochsegmentierten AGATA-HPGe-Detektoren — •David Schneiders, Benedikt Birkenbach, Peter Reiter und David Rosiak für die AGATA-Kollaboration — IKP, Universität zu Köln

Der AGATA-HPGe-Detektor ermöglicht den Nachweis von hochenergetischen γ-Quanten und geladenen Teilchen bis zu einer Energie von 180 MeV. Durch die Segmentierung des Detektors ist es möglich, partielle Energiedepositionen ortssensitiv aufzulösen. In einer Langzeitmessung wurden Energien bis 160 MeV von hochenergetischen Teilchen aus der kosmischen Höhenstrahlung nachgewiesen. Energieverlustrechnungen sind konsistent mit dem Myonenanteil der einfallenden Höhenstrahlung. Dazu wurden die Messungen mit den Ergebnissen einer GEANT4-Simulation, die auf der CRY-Bibliothek basiert, verglichen. Die guten Übereinstimmungen zeigen, dass natürliche kosmische Höhenstrahlung zur Kalibration des Messsystems genutzt werden kann und AGATA-HPGe-Detektoren über das Energieverlustsignal in der Lage sind, Teilchenidentifikation zu erzielen.

HK 8.6 Mo 15:30 S1/01 A3

Impact of the *genfit*2 Kalman-Filter-based algorithms on physics simulations performed with PandaRoot. — •Elisabetta Prencipe and James Ritman for the PANDA-Collaboration — Forschungszentrum Jülich IKP1, Jülich (DE)

$\overline{\text{P}}$ANDA is a planned experiment at FAIR (Darmstadt) with a cooled antiproton beam in a range [1.5; 15] GeV/c, allowing a wide physics program in nuclear and particle physics. It is the only experiment worldwide, which combines a solenoid field (B=2T) and a dipole field (B=2Tm) in an experiment with a fixed target topology, in that energy regime. The tracking system of $\overline{\text{P}}$ANDA involves the presence of a high performance silicon vertex detector, a GEM detector, a Straw-Tubes central tracker, a forward tracking system, and a luminosity monitor. The offline tracking algorithm is developed within the PandaRoot framework, which is a part of the FAIRRoot project. The algorithm here presented is based on a tool containing the Kalman Filter equations and a deterministic annealing filter (*genfit*). The Kalman-Filter-based algorithms have a wide range of applications; among those in particle physics they can perform extrapolations of track parameters and covariance matrices. The impact on physics simulations performed for the $\overline{\text{P}}$ANDA experiment is showed for the first time, with the PandaRoot framework: improvement is shown for those channels where a good low momentum tracking is required (p_T <400 MeV/c), i.e. D mesons and Λ reconstruction, of about a factor 2.

HK 8.7 Mo 15:45 S1/01 A3

An FPGA-based Sampling-ADC Readout for the Crystal Barrel Calorimeter — •Johannes Müllers[1] and Pawel Marciniewski[2] for the CBELSA/TAPS-Collaboration — [1]Helmholtz-Institut für Strahlen- und Kernphysik, Bonn, Germany — [2]Angströmlaboratoriet, Uppsala, Sweden

The CBELSA/TAPS experiment at the electron accelerator ELSA (Bonn) investigates the photoproduction of mesons off protons and neutrons. The Crystal Barrel Calorimeter has been upgraded replacing its photodiode readout by APDs, which allows the integration of the calorimeter into the first level trigger. Since the possible DAQ rate

is currently limited by the digitization stage (LeCroy QDC1885F) to $\approx 2\,\mathrm{kHz}$, the implementation of a new Sampling-ADC (SADC) readout is the second important step in the upgrade of the detector system.

Based on the 64-channel PANDA-SADC, the design was modified, adapting it to the needs of the CBELSA/TAPS experiment. The CB-SADC offers 64 channels in one NIM module with up to 14 bit@125 MHz, accompanied by a modular analog input stage and power supply. Data processing and reduction are realized with Kintex7 FPGAs. Readout is possible via gigabit ethernet links. Using an FPGA provides a multitude of possibilities for online feature extraction, such as the determination of the energy deposited in the crystal, TDC capabilities and pile-up detection and recovery. The SADC development will be discussed and first measurements performed in comparison to the presently used LeCroy QDC will be presented.

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