HK 29: Instrumentation V

Time: Wednesday 14:00–16:00 Location: J-HS C

Group Report HK 29.1 Wed 14:00 J-HS C

Pulse-Shape Analysis and Position Resolution in Highly Segmented HPGe Detectors — •Lars Lewandowski, Peter Reiter, Jürgen Eberth, Herbert Hess, and Rouven Hirsch for the AGATA-Collaboration — Institut für Kernphysik, Köln

The performance of the Pulse-Shape Analysis (PSA) in AGATA HPGe detectors was investigated and improved employing a γ-ray source measurement based on e^+e^- annihilation radiation after decays of ^{22}Na by β^+ decay. The first interaction positions of the two 511 keV γ rays were determined and the connecting line of these two positions was compared to the known source position as a measure for the PSA performance. The position resolution and its dependence on the PSA parameters were investigated by varying most relevant input quantities: the charge carrier mobility of the holes, the response of the employed measuring electronics especially the preamplifier rise time. The relative statistical weight of charge signals and transient signals was scrutinized. The optimal distance metric of the grid-search algorithm and its impact on the position resolution was determined.

HK 29.2 Wed 14:30 J-HS C

Latest development of KoalaSoft for KOALA experiment — •Yong Zhou and Huagen Xu — Institute for Nuclear Physics (IKP), Forschungszentrum Jülich, Germany

The KOALA experiment will measure the antiproton-proton elastic scattering differential cross-section over a wide range of four-momentum transfer |t| from 0.0008 to 0.1 $(GeV/c)^2$ at the upcoming HESR ring of FAIR. It aims to provide key input parameters for PANDA's luminosity determination. KoalaSoft is the simulation software for KOALA experiment. It is developed based on FairRoot and combines the simulation, reconstruction and analysis tasks into one framework. Several new features are developed in KoalaSoft for the KOALA beam test experiment at COSY. First, a new type of FairSource based on raw binary data from the data acquisition system is implemented so that KoalaSoft can now decode the beam test data directly and streamline the analysis process smoothly. Second, all tasks are transformed into FairMQ-based tasks so that configuring the topology of KoalaSoft simulation job or analysis job is more convenient and flexible in a parallel environment. A new online program is also developed based on these new tasks. Finally, a more realistic digitization task of the recoil detector is developed in KoalaSoft to study the differences of event features between elastic scattering and other background reactions. Based on this study, an effective selection procedure for elastic scattering events has been developed and applied to the latest beam test data. All these new developments and a comparison between the simulation and the beam test result are presented in this talk.

HK 29.3 Wed 14:45 J-HS C

Crystal Barrel Trigger Upgrade — •Peter Klassen for the CBELSA/TAPS-Collaboration — Helmholtz-Institut für Strahlen- und Kernphysik, Nussallee 14-16, 53115 Bonn

The excitation spectrum of baryons consists of many resonances, which contribute to distinct decay channels. In the CBELSA/TAPS experiment such resonances can be generated using real photons impinging on a polarizable target. The experimental setup is well-suited to observe their decays into final states with uncharged mesons and a proton. To improve the trigger efficiency for purely neutral reactions off neutrons the main calorimeter, the Crystal Barrel detector, was included into the first level trigger.

To achieve this, the frontend electronics were upgraded to an avalanche photo diode (APD) based readout, which allowed for the introduction of a previously non-existent Crystal Barrel timing branch. Core component of the timing branch is an FPGA-based, dual threshold discriminator board. At trigger level, the FPGA reduces the time walk of the digitized signals. These are afterwards processed by a free running clustering algorithm with a latency of 80 ns and an update rate of 5 ns. The cluster information is then passed on to the central experiment trigger. Furthermore, within the FPGA both thresholds are recorded by a multi-hit TDC for an improved offline time walk correction. In this talk the design and achieved performance of the new Crystal Barrel trigger will be presented.

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HK 29.4 Wed 15:00 J-HS C

Entwicklung und Inbetriebnahme eines neuen (e,e'x)-Datenaufnahmesystems für das QCLAM-Spektrometer am S-DALINAC * — •Maxim Singer, Antonio D'Alessio und Peter von Neumann-Cosel — Institut für Kernphysik, TU Darmstadt

Am supraleitenden Elektronenbeschleuniger S-DALINAC wurde für das hochauflösende QCLAM-Magnetspektrometer ein neues Datenaufnahmesystem für (e,e'x)-Elektronenstreuexperimente entwickelt. Das Detektorsystem des Spektrometers besteht aus drei Vieldrahtdriftkammern zur Elektronenbahnbestimmung und einem Triggerdetektor. Die Driftkammersignale und die Koinzidenzdetektoren werden durch ein VME-basiertes, auf drei Crates verteiltes System ausgelesen. Gezeigt wird das Konzept der Datenaufnahme, sowie das speziell darauf zugeschnittene Online-Monitoring-Programm QCLAMon. Die Funktionsfähigkeit des Systems wird anhand von Messergebnissen aus einer aktuellen Strahlzeit präsentiert.

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HK 29.5 Wed 15:15 J-HS C

A new streaming DAQ for future measurements at the M2 beam line at CERN — •Benjamin Moritz Veit[1,2], Igor Konorov[3], Stefan Huber[3], Martin Zemko[2], Matthias Gorzelik[5], and Vladimir Frolov[4] — [1]Institut für Kernphysik der Johannes Gutenberg-Universität, Mainz, Deutschland — [2]CERN — [3]Technische Universität München — [4]Joint Institute for Nuclear Research — [5]University of Freiburg

Currently proposals are under revision at CERN for future measurements with muon and hadron beams at the M2 beam line of the CERN SPS. For this experiments it is planned to transform the current classical triggered DAQ approach to a free running DAQ scheme which is based on an trigger-less read-out of all detectors, and later online and offline data reduction stages based on FPGA and x86 filter technologies (High Level Triggers). One of the first experiments is the measurement of the proton radius by elastic muon proton scattering. For this experiment two data taking phases are foreseen. For the first phase, with an low intensity muon beam a full, not reduced data sample will be written to disk. This allows a complete un-biased data analysis and the validation of an filter scheme which needed for a possible later high intensity data taking period to reduce the amount of data. The DAQ and Trigger/Filtering scheme and requirements for both of these measurements will be presented.

HK 29.6 Wed 15:30 J-HS C

Energy Sum Trigger for the Crystal Barrel Detector — •Bence Mitlasoczki for the CBELSA/TAPS-Collaboration — Universität Bonn

The CBELSA/TAPS experiment at the ELSA accelerator in Bonn performs baryon spectroscopy measurements. The 1320 crystals of the main calorimeter, the Crystal Barrel, are included in the trigger system via discriminators, and a cluster finder is utilized to trigger on the number of clusters.

For reactions with small cross sections the trigger selectivity is the main limiting factor to the acquisition of relevant events due to background reactions using up a large part of the readout capacity. The inclusion of the total energy into the trigger system will provide an improvement.

In this talk, I will present an improved design and first performance tests of the recently installed energy sum modules. To be able to precisely set an energy threshold, the difference in amplitudes of the responses to deposited energy of each crystal needs to be accounted for. For this purpose, a weighting of individual signals is needed. The summing modules use multiplying DACs to provide this weight adjusting capability. A DAC is used for removing the offset in the sum signal. Communication with the modules is possible via I2C.

HK 29.7 Wed 15:45 J-HS C

Conceptual Studies on a Beam Abort System for HADES — •Florian Marx for the HADES-Collaboration — Goethe-Universität Frankfurt

The physics cases studied with the HADES experiment at SIS-18 (GSI Darmstadt) require high beam intensities of several MHz well focused on a target. During the beam time, there is a risk of the beam not

hitting the target but rather its surroundings, potentially harming the detectors and electronics. Reasons may be bad beam alignment or failure of guiding magnets for the particle beam. The aim of this work is to design and realize an FPGA based monitoring system, which is able to analyze the relevant hit rates in various detectors and compare them to a preset default. A dedicated algorithm can assess whether the rates significantly exceed the given limits and cause a possible thread for the detectors and/or electronics. As a results various follow-up actions can be triggered, including aborting the beam on a short time scale. This talk will present the implementation and first test results. This work has been supported by BMBF (05P19RFFCA) and GSI.