HK 52: Poster - Instrumentation I

Zeit: Mittwoch 16:45–16:45 Raum: HSZ 2.OG

HK 52.1 Mi 16:45 HSZ 2.OG

Development and Test of the Readout System for the CBM-MVD Prototype* — •Borislav Milanović, Bertram Neuman, Michael Wiebusch, Samir Amar-Youcef, Ingo Fröhlich, and Joachim Stroth for the CRESST-Collaboration — Institut fur Kernphysik, Goethe-Universität Frankfurt - for the CBM-MVD Collaboration

The CBM Experiment at FAIR aims towards better understanding of the QCD phase-diagram and in-medium properties of matter under high densities. In order to enhance the detection of rare probes via their secondary decay vertices and to support the primary tracking system, the CBM Micro Vertex Detector (MVD) is foreseen.

Recently, the MVD Prototype has been developed at the IKF in Frankfurt. The module contains one quarter of the first MVD station featuring four prototype-sensors MIMOSA-26 AHR thinned down to 50 μm. The prototype has been tested at the CERN SPS accelerator with high energetic pions in November 2012.

This contribution discusses the stability and scalability of the DAQ, slow-control and monitoring routines during the beamtime, as well as sensor behavior under high load of up to 700 000 particles per second. The readout system partially uses hardware from the HADES detector which will also run at FAIR. Readout rates of 98 MB/s at the limit of gigabit ethernet have been achieved showing no sign of data loss or corruption.

*supported by BMBF grants 06FY9099I and 06FY7113I

HK 52.2 Mi 16:45 HSZ 2.OG

Differentielle, winkelkontinuierliche Doppler Shift Attenuation Method: Eine Lebensdauer-Messmethode für relativistische, radioaktive Ionenstrahlen — •Marc Lettmann, Christian Stahl und Norbert Pietralla — Institut für Kermphysik, Technische Universität Darmstadt

Mit der Doppler-Shift Attenution Method (DSAM) werden Lebensdauern angeregter Kernzustände von ca. 10fs-10ps durch Analyse der Doppler-verbreiterten Linienform emittierter Gammastrahlung während des Abbremsvorgangs ihrer Emitter in Materie bestimmt. Dazu werden berechnete Linienformen an experimentelle Spektren gefittet, mit der Lebensdauer als Fitparameter. Um die DSAM für Experimente mit relativistischen, radioaktiven Ionenstrahlen zu verwenden, müssen besondere Anforderungen berücksichtigt werden. Diese umfassen u.a. breite Strahlprofile sowie die Notwendigkeit, den Strahl nicht im Target zu stoppen, um die Akkumulation von Aktivität im Target zu vermeiden und die Identifikation der Ionen hinter dem Target zu ermöglichen. Breite Strahlprofile und eventuelle Abregung der Ionen hinter dem Target machen geometrische Korrekturen der von den Gamma-Detektoren abgedeckten Raumwinkel nötig. Die Effektivität der Methode kann durch Doppler-Korrektur der Gamma-Energie mithilfe der messbaren Geschwindigkeits- und Ortsvektoren der aus dem Target austretenden Ionen gesteigert werden. Außerdem ergibt sich durch die mögliche Abregung außerhalb des Targets ein neuer Sensitivitätsbereich der DSAM für längere Lebensdauern. Gefördert durch das BMBF unter 05P12RDFN8.

HK 52.3 Mi 16:45 HSZ 2.OG

A New Avalanche Photo Diode Readout for the Crystal Barrel Calorimeter — •Martin Urban for the CBELSA/TAPS-Collaboration — Helmholtz-Institut für Strahlen- und Kernphysik, Nussallee 14-16, 53115 Bonn

The CBELSA/TAPS experiment at ELSA measures double polarisation observables in meson photoproduction off protons and neutrons. To be able to measure purely neutral reactions on a polarized neutron target with high efficiency, the main calorimeter has to be integrated into the first level trigger. This requires to exchange the existing PIN photo diode by a new avalanche photo diode (APD) readout.

The new electronics, including a whole new timing readout branch, will provide a fast trigger signal down to 10 MeV energy deposit per crystal. A 3x3 CsI crystal matrix, assembled with the complete new APD readout electronics, has been tested at the tagged photon beam facilities at ELSA and MAMI. This poster presents the results of these test measurements including energy resolution, time resolution and the active gain stabilization of the new APD readout electronics.

Supported by the Deutsche Forschungsgemeischaft (SFB/TR16) and Schweizerischer Nationalfonds.

HK 52.4 Mi 16:45 HSZ 2.OG

Commissioning of the FrontEnd Electronics for the BGO-OD Tagger Detector — •Francesco Messi for the BGO-OD-Collaboration — Physikalisches Institut, Bonn, Germany

The BGO-OD experiment, presently under construction at the electron accelerator ELSA at Bonn university, is intended for the systematic investigation of the photo-production of mesons off the nucleon. The experiment will use bremsstrahlung photons from an e^- beam incident upon a thin metal radiator. The photon energy will be measured via the deflection of the electrons in the magnetic field of a photon tagger.

The electrons are detected in a 120 channel hodoscope with an expected rate up to 10MHz per single channel and 50MHz for the total detector. A coincidence between two neighboring channels is required to suppress background. Additional to the measurement of the photon energy, time information from the detection of the deflected electrons will be used for coincidence measurements in the BGO-OD experiment.

To match these requirements, a new tagger electronics was developed and installed. The final detector and the full electronics are under commissioning. Results will be presented in this poster.

HK 52.5 Mi 16:45 HSZ 2.OG

Datenaufnahmekonzept und eine neue Generation Driftkammern für das QCLAM-Spektrometer am S-DALINAC — •Andreas Köhler, Simela Aslanidou, Jonny Birkhan, Uwe Bonnes, Thilo Egenolf, Joachim Enders, Christoph Kremer, Andreas Krugmann, Peter von Neumann-Cosel und Norbert Pietralla — Institut für Kernphysik, Technische Universität Darmstadt, Germany

Im Elektronenstreuexperiment ELISe der FAIR sollen mit Driftkammern betriebene Magnetspektrometer zum Einsatz kommen. Diese sollen mit eigens entwickelten Elektronikmodulen auf FPGA-Basis und Multi-Hit TDCs ausgelesen werden. Das QCLAM-Magnetspektrometer für Elektronenstreu- und Koinzidenzexperimente am supraleitenden Darmstädter Linearbeschleuniger S-DALINAC wurde mit solchen Driftkammern ausgestattet. Erste Ergebnisse der Performancetests mit den neuen Driftkammern werden präsentiert. Die entwickelten Systeme sollen auf die Anforderungen für Drahtkammerauslese bei GSI/FAIR übertragbar sein.

Gefördert durch die DFG (SFB 634), durch das LOEWE-Zentrum HIC for FAIR des Landes Hessen, durch das BMBF (06DA9040I) und den TU-Darmstadt-GSI-Kooperationsvertrag.

HK 52.6 Mi 16:45 HSZ 2.OG

Kalibration und Inbetriebnahme eines Faserdetektors für das Kaos-Spektrometer — •Adrian Weber für die A1-Kollaboration — Institut für Kernphysik, Johannes Gutenberg-Universität, Mainz

Der Faserdetektor des Kaos-Spektrometers am Mainzer Mikrotron, MAMI, besteht aus zwei Faserebenen, die je ca. 1,94 m lang sind, mit jeweils 2304 Kanälen, die von 144 PMTs ausgelesen werden.

Zur Optimierung der Ortsauflösung des Detektors wurden die PMTs kalibriert. Dabei wurde die Verstärkung jedes Kanals gemessen, wie auch die Abhängigkeit der Verstärkung jedes PMTs von der angelegten Hochspannung. Die Hochspannungen der PMTs werden so angepasst, dass alle PMTs die gleiche Verstärkung aufweisen. Außerdem werden die Schwellenwerte der Doppelschwellendiskriminatoren (DTD), so gesetzt, dass das gesamte Detektorsystem möglichst homogen arbeitet. Aus den gewonnenen Daten der Kalibration kann zudem eine Korrektur der Faserposition durchgeführt werden. Die differentielle Nichtlinearität beträgt ca. 0,03 mm pro Ebene.

Zur Verbesserung der Bestimmung der Durchtrittszeit von Teilchen durch den Detektor wurden die DTDs hinsichtlich ihrer Zeitschwankung untersucht. Diese betrug bei idealen Schnitten ca. 300 ps für die fallende Flanke des Ausgangssignals und ca. 3 ns für die steigende. Für die Bestimmung der Durchtrittszeit durch den Detektor wird nur die fallende Flanke des Ausgangssignals benutzt.

Die Vorbereitungen für den erstmaligen Betrieb des gesamten Faserdetektors im Kaos-Spektrometer an MAMI laufen.

HK 52.7 Mi 16:45 HSZ 2.OG

Characterization of a $LaBr_3$ crystal with multi-anode PMT

readout* — •Saad Aldawood[1,2], Christian Lang[1], Dieter Habs[1,3], Ludwig Maier[4], Katia Parodi[1], and Peter G. Thirolf[1] — [1]LMU München — [2]King Saud University, Riyadh, Saudi Arabia — [3]MPI f. Quantenoptik, Garching — [4]TU München

A Compton camera is presently under construction in Garching, aiming to allow for monitoring the ion-beam range and activity distribution from ion-beam irradiations of bio-medical samples via position-resolved prompt γ-ray detection. The Compton camera consists of a stack of six double-sided Si-strip detectors (50 x 50 mm^2, 0.5 mm thick, pitch 390 μm) acting as scatterers, while the absorber is formed by a $LaBr_3$ scintillator crystal (50 x 50 x 30 mm^3), read out by a multi-anode PMT. Results from characterization measurements will be presented, covering energy, time, and spatial resolution. In order to characterize the position resolution, a strong and collimated ^{137}Cs source (662 keV) was used to scan the 8 x 8 PMT pixel structure of the crystal.

* Supported by the DFG Cluster of Excellence, MAP (Munich-centre for Advanced Photonics), King Saud University(Saudi Arabia).

HK 52.8 Mi 16:45 HSZ 2.OG

Measurement of the e^- beam polarization and photon flux at the BGO-OD Experiment* — •Thomas Zimmermann for the BGO-OD-Collaboration — Physikalisches Institut, Universität Bonn

The BGO-OD experiment, presently under construction at the electron accelerator ELSA at Bonn university, is intended for the systematic investigation of the photo-production of mesons off the nucleon.

Polarized photon beams are routinely used. To determine the degree of circular polarization, the polarization of the e^- beam will be measured in-situ by a Møller polarimeter. The photon flux will be monitored simultaneously with data taking, using a flux monitor consisting of two parts: a total- and a partial-absorption detector.

*Supported by the DFG (SFB/TR-16)

HK 52.9 Mi 16:45 HSZ 2.OG

The B-FrED board — •Francesco Messi for the BGO-OD-Collaboration — Physikalisches Institut Uni-Bonn, Bonn, Germany

The B-FrED is a 16 channel *double-threshold discriminator and shaper* board designed as Front-End Electronics for the new Tagger detector of the BGO-OD experiment. It is a 6U-VME form factor card based on commercial components.
The analog input stage has a Slew Rate of $4580V/\mu s$. The Output stage provides a LVDS signals with a fan-out of two and an expected time jitter of $\sim 10ps$ with respect to the input signal.
The threshold settings are managed by a micro-controller which is remotely accessible through Ethernet.

HK 52.10 Mi 16:45 HSZ 2.OG

Ein Kühlsystem für den PANDA-Luminositätsdetektor — •Heinrich Leithoff[1,2], Florian Feldbauer[1,2], Miriam Fritsch[1,2], Prometeusz Jasinski[1,2], Anastasia Karavdina[2], Mathias Michel[1,2], Stefan Pflüger[1,2] und Tobias Weber[1,2] — [1]Helmholtz Institut Mainz — [2]Johannes Gutenberg Universität Mainz

Der Luminositätsdetektor für das PANDA-Experiment (Teil der neuen FAIR-Beschleunigeranlage, Darmstadt) wird die Luminosität anhand der Winkelverteilung der elastisch gestreuten Antiprotonen bei sehr kleinen Winkeln extrahieren. Für die Messung der Antiprotonen-Spuren werden vier Ebenen von HV-MAPS (High Voltage Monolithic Activ Pixel Sensoren) verwendet. Für die angestrebte Genauigkeit der Luminositätsmessung muss die Vielfachstreuung minimiert werden; deshalb befindet sich das gesamte Detektorsystem im Vakuum. Dies impliziert, dass die HV-MAPS aktiv gekühlt werden müssen, da die von den Halbleiterdetektoren erzeugte Wärme nicht über Konvektion abgeführt werden kann. Um die Materialbelegung gering zu halten, werden die Sensoren auf 200 μm dünnen Diamantscheiben aufgebracht, die an einem Aluminiumträger befestigt sind. Dieser soll durch ein eingeschmolzenes Edelstahlrohr gekühlt werden, damit ein möglichst guter thermischer Übergang zwischen der Kühlflüssigkeit und der Auflage der Diamantscheiben gewährleistet wird.

Präsentiert wird ein Überblick über den Status des Kühlsystems und seine erwartete Leistungsfähigkeit sowie die mechanische Stabilität der tragenden Struktur.

HK 52.11 Mi 16:45 HSZ 2.OG

HV-MAP (High Voltage Monolithic Active Pixel) Sensoren für den PANDA-Luminositätsdetektor* — •Tobias Weber, Florian Feldbauer, Miriam Fritsch, Prometeusz Jasinski, Anastasia Karavdina, Heinrich Leidhoff und Mathias Michel für die PANDA-Kollaboration — Institut für Kernphysik, Universität Mainz und Helmholtz-Institut Mainz

Das PANDA-Experiment, das am Antiprotonenstrahl der geplanten Beschleunigeranlage FAIR in Darmstadt aufgebaut wird, ist für Fragen der Hadronspektroskopie optimiert. Diese Fragen werden zum einen mit Messungen bei hoher Luminosität und zum anderen mit Messungen hoher Präzision des einlaufenden Antipotronenstrahls angegangen. In beiden Fällen wird für die Bestimmung der absoluten Messgrößen und für die Methode der Energie-Scans die präzise Messung der Luminosität benötigt.
Das Konzept des Luminositätsdetektors sieht vor, die Luminosität durch Messung der Verteilung der elastisch gestreuten Antiprotonen in unmittelbarer Strahlnähe (3-8 mrad) zu bestimmen. Hierzu kommen 4 Lagen sehr dünner Siliziumpixelsensoren (HV-MAPS) zum Einsatz, die in Kollaboration mit der Mu3e-Gruppe Heidelberg entwickelt werden.
Das Konzept der Luminositätsmessung bei PANDA und Studien zu HV-MAP Sensoren und Auslese-Elektronik werden vorgestellt.

*gefördert durch BMBF, DFG und HGF

HK 52.12 Mi 16:45 HSZ 2.OG

A high resolution germanium detector array for hypernuclear studies at $\overline{\text{P}}$ANDA — Sebastian Bleser[1], Jürgen Gerl[2], Felicce Iazzi[3], Ivan Kojouharov[2], Josef Pochodzalla[4], Kai Rittgen[4], Cihan Sahin[4], Alicia Sanchez Lorente[1], and •Marcell Steinen[1] for the PANDA-Collaboration — [1]Helmholtz-Institut Mainz — [2]GSI Darmstadt — [3]Politecnico and INFN, Torino — [4]Institute for nuclear physics, JGU Mainz

The $\overline{\text{P}}$ANDA experiment, planned at the FAIR facility in Darmstadt, aims at the high resolution γ-spectroscopy of double Λ hypernuclei. For this purpose a devoted detector setup is required, consisting of a primary nuclear target, an active secondary target and a germanium detector array for the γ-spectroscopy. Due to the limited space within the $\overline{\text{P}}$ANDA detector a compact design is required. In particular the conventional LN_2 cooling system must be replaced by an electro-mechanical device and a new arrangement of the crystals is needed.

This poster shows the ongoing development of the germanium detectors. Test measurements of a single crystal prototype with an improved cooling concept are shown. Thermal simulations for a triple crystal detector are presented. Aditionally studies of the optimization of the detector arrangement inside the $\overline{\text{P}}$ANDA barrel spectrometer are shown. Finally the status on digital pulse shape analysis is presented which will be necessary to deal with high counting rates and to recover the high original energy resolution in case of neutron damage.

HK 52.13 Mi 16:45 HSZ 2.OG

Study for the online data processing with the MVD prototype* — •Qiyan Li, Samir Amar-Youcef, Michael Deveaux, Christian Muentz, and Joachim Stroth for the CBM-MVD-Collaboration — Goethe-Universität,Frankfurt

The CBM experiment at FAIR will explore the structure and properties of nuclear matter under extreme conditions namely highest net baryon densities. As the one subdetector of the CBM experiment, the Micro-Vertex-Detector (MVD) will provide precise vertexing to identify the short-lived open charm particles.

Because of the expected high hit densities, the DAQ system of the MVD will have a heavy burden with data transmission and storage. To reduce it two essential aspects are considered, on-chip zero suppression and online cluster finding and classification. The latter will be implemented on FPGAs, which are arranged directly after the front-end electronics.

As a first approach into that direction the MVD prototype was tested at CERN SPS with high energy pion beams. The setup was chosen, that the device under test was referenced with 4 alike additional stations. All stations were equipped with thinned MIMOSA-26 AHR CMOS sensors. This contribution discusses the dedicated cluster finding algorithm and the investigation of cluster shapes at various experimental conditions.

*supported by HIC for FAIR,the GSI Helmholtzzentrum fär Schwerionenforschung, BMBF grants 06FY9100I and 06FY7114I, IPHC,Strasbourg.

HK 52.14 Mi 16:45 HSZ 2.OG

Mechanical integration of the Prototype of the CBM Micro Vertex Detector* — •Tobias Tischler, Michal Koziel, Christian Müntz, and Joachim Stroth for the CBM-MVD-Collaboration

— Goethe Universität, Frankfurt

For the reconstruction of Open Charm Hadrons with the CBM experiment a Micro Vertex Detector (MVD) with an excellent resolution of the secondary decay vertex ($< 70\ \mu$m along the beam axis) is required. To achieve this vertex resolution a material budget of a few 0.1% X_0 is mandatory for the individual detector stations positioned downstream in close vicinity to the target. To further reduce the multiple scattering the MVD operates in vacuum.

The need of prototyping and characterizing the CBM-MVD motivated the construction of an ultra-low mass, high precision detector setup comprising several prototype stations. Each station contains 2 (single-sided station) or 4 (double-sided station) 50 μm thick thinned CMOS sensors (MIMOSA-26 AHR). The sensors are glued to CVD diamond carriers which provide at the same time a mechanical support and efficient heat evacuation.
This contribution presents the in-beam performance of the prototype stations, with emphasis on the doubled-sided, ultra-thin (0.3% x/X_0) micro-tracking station which was tested at CERN SPS in November 2012.
*supported by HIC for FAIR, the GSI Helmholtzzentrum für Schwerionenforschung, BMBF grants 06FY9100I and 06FY7114I, IPHC, Strasbourg

HK 52.15 Mi 16:45 HSZ 2.OG

Pulse shape analysis using CsI(Tl) Crystals* — •Joel Silva[1,2], Enrico Fiori[1,2], Johann Isaak[1,2], Bastian Loher[1,2], Deniz Savran[1,2], Matjaz Vencelj[3], and Roland Wirth[1,2] — [1]ExtreMe Matter Institute EMMI and Research Division, GSI Helmholtzzentrum, Darmstadt, Germany — [2]Frankfurt Institute for Advanced Studies FIAS, Frankfurt, Germany — [3]Jozef Stefan Institute, Ljubljana, Slovenia

The decay time of CsI(Tl) scintillating material consists of more than a single exponential component. The ratio between the intensity of these components varies as a function of the ionizing power of the absorbed particles, such as gamma-rays or protons, and the temperature. This property can therefore be used for particle discrimination and for temperature monitoring, using pulse shape analysis.

An unsupervised method that uses fuzzy clustering algorithms for particle identification based on pulse shape analysis is presented. The method is applied to discriminate between photon- and proton-induced signals in CsI(Tl) scintillator detectors.

The first results of a method that uses pulse shape analysis for correcting the temperature-dependent gain effect of the detector are also presented. The method aims at conserving a good energy resolution in a temperature varying environment without the need to measure the temperature of the detector externally.

* Supported by the Alliance Program of the Helmholtz Association (HA216/EMMI)

HK 52.16 Mi 16:45 HSZ 2.OG

Untergrundunterdrückung im KATRIN-Experiment mit Hilfe magnetischer Pulse — •Jan David Behrens für die KATRIN-Kollaboration — Westfälische Wilhelms-Universität, Münster

Durch das **KA**rlsruhe **TRI**tium **N**eutrino-Experiment soll die Masse des Elektron-Antineutrinos mit einer Sensitivität von 200 meV/c^2 (90% C.L.) vermessen werden. Die Vermessung der Form des Tritium-β-Spektrums im Endpunktbereich ermöglicht eine modellunabhängige Bestimmung dieses wichtigen Parameters.

Die Energieanalyse der Zerfallselektronen erfolgt beim KATRIN-Experiment in einem elektrostatischen Spektrometer, das nach dem Prinzip des MAC-E-Filters arbeitet. Im Spektrometer können in Penningfallen gespeicherte Elektronen und Ionen zu einem erhöhten Untergrund führen.

Eine Möglichkeit zum Entfernen von gespeicherten Elektronen ist die Erzeugung eines magnetischen Pulses, der die Speicherbedingungen aufhebt. Dazu muss das Magnetfeld der Luftspulen am Hauptspektrometer über eine Brückenschaltung (*H-Bridge*) invertiert werden. Das Poster stellt die Methode des magnetischen Pulses sowie eine erste technische Umsetzung der Brückenschaltung vor.

Dieses Projekt wird unter dem Kennzeichen 05A11PM2 durch das BMBF gefördert.

HK 52.17 Mi 16:45 HSZ 2.OG

The Cluster-Jet Target for PANDA — •Ann-Katrin Hergemöller, Esperanza Köhler, Silke Grieser, Alexander Töschner, Hans-Werner Ortjohann, Daniel Bonaventura, and Alfons Khoukaz — Institut für Kernphysik, Westfälische Wilhelms-Universität Münster, 48149 Münster, Deutschland

A cluster-jet target will be the first one of two planned internal targets for the PANDA experiment at FAIR. At the University of Münster the target prototype was built up in complete PANDA geometry and successfully set into operation. Areal target densities of more than 2×10^{15} atoms/cm^2 at a distance of 2.1 m behind the nozzle were achieved by the installation of a new tilting system. This device allows for an adjustment of the nozzle relative to the experimental setup. The thickness is reproducible, constant in time, and variable over several orders of magnitude by the adjustment of the stagnation pressure and temperature before the nozzle. Depending on the experimental program the target beam size and shape should be variable and should guarantee a low residual gas background. That can be realized with the application of special shaped skimmers for the target beam preparation. The cluster beam shape can be visualized by a new monitoring system based on a Micro Channel Plate. This enables a direct observation of an ionized cluster beam at a phosphor screen in combination with a CCD camera. In this presentation an overview of the cluster-jet target, various special features, and images of the cluster beam will be presented and discussed. Supported by EU (FP7), BMBF, and GSI F+E.

HK 52.18 Mi 16:45 HSZ 2.OG

Field Programmable Gate Array Based Data Digitisation with Commercial Elements — Cahit Ugur[1], Wolfgang Koenig[1], •Jan Michel[2], Grzegorz Korcyl[3], Marek Palka[3], and Michael Traxler[1] — [1]GSI Helmholtz Centre for Heavy Ion Research, Germany — [2]Goethe-University Frankfurt, Germany — [3]Jagiellonian University, Poland

One of the most important aspects of particle identification experiments is the digitisation of time, amplitude and charge data from detectors. These conversions are done mostly with Application Specific ICs (ASICs). However, the recent developments in Field Programmable Gate Array (FPGA) technology allow us to use commercial electronic components for the required Front-End Electronics (FEE) and do the digitisation in the FPGA. It is possible to do Time-of-Flight (ToF), Time-over-Threshold (ToT), amplitude and charge measurements with converters implemented in FPGA. We call this principle COME & KISS: Use COMplex COMmercial Elements & Keep It Small and Simple.

HK 52.19 Mi 16:45 HSZ 2.OG

Detection systems for forward emitted XUV photons from relativistic ion beams at the ESR — Ch. Geppert[2,3], V. Hannen[1], R. Jöhren[1], Th. Kühl[2,3,4], W. Nörtershäuser[2,3], H.-W. Ortjohann[1], R. Sánchez[3], Th. Stöhlker[3,4,5], •J. Vollbrecht[1], Ch. Weinheimer[1], and D. Winters[3] — [1]Institut für Kernphysik, Uni Münster — [2]Institut für Kernchemie, Uni Mainz — [3]GSI, Darmstadt — [4]Helmholtz Institut Jena — [5]Uni Jena

Laser spectroscopy experiments with stored relativistic heavy ions can test atomic structure calculations by exploiting the large Doppler "boost" of the transitions. However, this "boost" also strongly shifts the fluorescence from the ions, and directs it into a narrow forward cone (searchlight). This renders the need for a moveable detection system, which collects the light around the ion beam in vacuo. We would now like to study effects of electron-electron correlations in Be-like krypton ($^{84}Kr^{32+}$) via a laser spectroscopic measurement of the $^3P_1 - ^3P_0$ transition. Based on the successful design for a previous ESR experiment, a new detection system for forward emitted XUV photons will be constructed. The Krypton ions are stored at high velocities ($\beta \approx 0.69$) in the ESR, therefore the wavelength for de-excitation to the ground state is Doppler shifted from $\lambda_0 \approx 17$ nm to $\lambda \approx 9$ nm. When these photons hit a metal collector they will produce secondary electrons at low energies (≈ 3 eV). The electrons will be electrostatically guided onto a MCP detector. The underlying principles as well as the current design of the XUV detection system will be presented on this poster. This work is supported by BMBF under contract number 06MS7191.

HK 52.20 Mi 16:45 HSZ 2.OG

The TIGER Trigger Processor for the CAMERA Detector at COMPASS-II — Tobias Baumann, Maximilian Büchele, Horst Fischer, Matthias Gorzellik, Tobias Grussenmeyer, Florian Herrmann, Philipp Jörg, Paul Kremser, Tobias Kunz, Christoph Michalski, •Sebastian Schopferer, and Tobias Szameitat — Physikalisches Institut der Universität Freiburg

In today's nuclear and high-energy physics experiments the background-induced occupancy of the detector channels can be quite high; therefore it is important to have sophisticated trigger subsystems which process the data in real-time to generate trigger objects for the global trigger decision. In this work we present a FPGA based low-latency trigger processor for the COMPASS-II experiment.

TIGER is a high-performance trigger processor that was developed to fit perfectly in the GANDALF framework and extend its versatility. It is designed as a VXS module and is allocated to the central VXS switch slot, which has a direct link from every payload slot. The synchronous transfer protocol was optimized for low latencies and offers a bandwidth of up to 8 Gbit/s per link. The centerpiece of the board is a Xilinx Virtex-6 SX315T FPGA, offering vast programmable logic, embedded memory and DSP resources. It is accompanied by DDR3 memory, a COM Express CPU and a MXM GPU. Besides the VXS backplane ports, the board features two SFP+ transceivers, 32 LVDS inputs and 32 LVDS outputs to interface with the global trigger system and a Gigabit Ethernet port for configuration and monitoring.

Supported by BMBF and EU FP7 (Grant Agreement 283286).

HK 52.21 Mi 16:45 HSZ 2.OG

Development of a cooling system and vacuum chamber for the pion tracker for HADES — •Joana Wirth for the HADES-Collaboration — Excellence Cluster "Universe", TU München, Boltzmannstr. 2, 85748 Garching, Germany

One of the future experiments planned at SIS18 with the HADES spectrometer in GSI Darmstadt envisages the employment of pion beam colliding on LH2 or nuclear target. Due to the fact that secondary pion beam has high momentum spread, since the precise knowledge of pion momentum is mandatory to carry out the planned exclusive measurements, we have to measure the momentum for each individual pion.

For this purpose our group is developing a pion beam tracking system, which consists of two silicon detectors. Both detectors are located in the beamline and therefore have to cope the high-intensity secondary beam. Cooling of a silicon detector strongly improves its radiation hardness and performance. It reduces the leakage current and thus the noise, which is important for the detection of MIPs like pions.

We have designed and built a complete prototype system of vacuum chamber and detector cooling. With use of the Finite Element Method we simulated the mechanical and thermal properties of the prototype.

The proposed poster will show the current status and performance of the cooling system for a test-detector, focusing on the reduction of the leakage current and the noise.

HK 52.22 Mi 16:45 HSZ 2.OG

Data-driven calibration procedure for the HADES electromagnetic calorimeter — •Dimitar Mihaylov for the HADES-Collaboration — Excellence Cluster "Universe", Boltzmannstr. 2, 85748, Garching, Germany

The High Acceptance Di-Electron Spectrometer (HADES) is dedicated to study the dense nuclear matter. Currently the HADES detector system is not capable to detect photons. In order to improve the situation an electromagnetic calorimeter (EMC) has been proposed. It will enable the identification of the neutral pseudoscalar mesons (π^0, η) via their decay into two photons. The reconstruction of those particles is achieved by analyzing the invariant mass spectrum (IMS) of the detected photons.

The existing photon reconstruction procedure delivers systematical errors to the momenta of the photons which lead to inaccuracies in the IMS. A calibration procedure capable of improving the IMS of the photons was developed and will be presented. This procedure has been implemented in a standalone C++ program. The calibration procedure is based on an algorithm that allows to correct the momenta of the individual photons by using the π^0 mass as a reference. The accuracy of procedure has been tested on simulated data.

HK 52.23 Mi 16:45 HSZ 2.OG

Development of a time projection chamber for Crystal Ball at MAMI — •Oliver Steffen, Martin Wolfes, and Wolfgang Gradl for the A2-Collaboration — Institut für Kernphysik, Johannes Gutenberg-Universität Mainz, D-55099 Mainz

The Crystal Ball Collaboration uses energy tagged bremstrahlung photons produced from the MAMI electron beam to study photo-induced reactions on nucleons and nuclei. The Crystal Ball/TAPS 4π calorimeter setup is optimized for the detection of neutral final states. Charged particles are identified and measured by the inner detector system including a two layer MWPC. The increased rate of charged particles in current and future experiments exceeds the rate capability of these MWPCs.

We are developing a small Time Projection Chamber with triple GEM readout meeting the stringent space requirements of the Crystal Ball experiment. This new tracking detector will feature higher rate capabilities and allows better track reconstruction. A small GEM-TPC prototype has successfully been tested in the MAMI electron beam, showing good first results on rate capability and track reconstruction. Additional simulation studies on track resolution, detector geometry and acceptance are done to optimize the design.

This poster will give an overview of the current status of the project and present the latest results.

HK 52.24 Mi 16:45 HSZ 2.OG

CALIFA at R^3B: LED-based gain monitoring system and gamma-ray energy reconstruction algorithm — •Han-Bum Rhee, Lucas Lutz, Timo Bloch, Alexander Ignatov, Stoyanka Ilieva, Thorsten Kröll, and Mirko von Schmid — Technische Universität Darmstadt, Darmstadt, Germany

CALIFA is a calorimeter and spectrometer that aims to detect gamma-rays and light charged particles. It is a part of the R^3B experiment at the future FAIR facility. CALIFA is a highly segmented detector surrounding the target to allow measurement of the emission angle and energy of reaction products. The CALIFA barrel consists of CsI(Tl) scintillating crystals, which are individually read out with Avalanche Photodiodes. Therefore, a gain monitoring system is needed. In this work we propose to use light signals from a pulsed LED, distributed to the detector elements via optical fibres, to monitor gain variations. Another part of the work concerns the detection of gamma-rays and the reconstruction of its initial energy. Gamma-ray typically deposits its energy in several crystals and gets Lorenz-boosted while being emitted by a relativistic ion. An algorithm to reconstruct the multiplicity and the initial energy of gamma-rays using R^3BRoot simulation package is investigated.

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HK 52.25 Mi 16:45 HSZ 2.OG

Fully-automated field mapping of a dipole magnet of a multi-passage spectrometer (MPS) [*] — •Robert Meissner, Peter Thirolf, and Christine Weber — Fakultät für Physik, LMU - München

MLLTRAP is a Penning-trap mass-spectrometer facility, which is currently being commissioned at the Maier-Leibnitz Laboratory in Garching. Here, atomic mass values are determined by measuring cyclotron frequencies of stored ions in a strong magnetic field. In the future, highly-charged ions should be utilized for an improvement in the achievable mass accuracy. For this purpose, singly-charged ions will have to be injected into a charge-breeding device, such as an EBIT, and transferred back towards the Penning traps, while being q/A selected. To fulfill these tasks a multi-passage-spectrometer (MPS) is being built. It consists of a fast-ramping, round-pole dipole magnet with an electrostatic mirror system. A basic requirement for building the MPS is a detailed knowledge on the magnetic field produced by the magnet. It is necessary to simulate the trajectories of the ions and gain knowledge on the design and geometry of the electrostatic mirror system and the vacuum chamber. For this purpose, a robot was designed, which - powered by three step motors - measures the magnetic field fully automated. The robot moves a Hall probe within three dimensions with a resolution of 1 mm and an uncertainty of 0.5 mm. In this presentation, the development of the robot, its control and data acquisition via LabView and the results will be presented.

[*] Supported by DFG under HA 1101/14-1.

HK 52.26 Mi 16:45 HSZ 2.OG

Design of the Magnetic Shielding for PERC — •Philip Haiden[1], Jacqueline Erhart[1], Harald Fillunger[1], Miklos Horvath[1], Gertrud Konrad[1], Martin Moser[1], Xiangzun Wang[1], Carmen Ziener[2], and Hartmut Abele[1] for the PERC-Collaboration — [1]Atominstitut, TU Wien, Austria — [2]Universität Heidelberg, Germany

The new facility PERC is a novel source of neutron decay products, currently under development by an international collaboration. Its main component is a more than 11 m long superconducting magnet system (up to 6 T). In order not to disturb other experiments in the vicinity of PERC, we have designed a magnetic shielding. The finite element method (COMSOL Multiphysics) has been used to determine the most suited geometry for the shielding. The following considerations were taken into account: the magnetic stray field is suppressed to the cardiac pacemaker level (0.5 mT at less than 3.0 m), the internal magnetic field and its homogeneity (up to 10^{-4}) are not disturbed, the additional forces onto the coils are not destructive, and the shielding deals with the limited space conditions. For experimental reasons, the magnet geometry is non-axisymmetric and therefore has to be simulated in 3D. To reduce the computing time and simultaneously increase the numerical accuracy, we simulated only one half of the geometry, taking advantage of the symmetry both of magnet and shielding. However, to study the influence of the shielding on the particle trajectories we had to simulate the full geometry. The magnetic and the mechanical design of the magnetic shielding for PERC will be presented.

HK 52.27 Mi 16:45 HSZ 2.OG

Untersuchung der Rückstreuung von Elektronen zur Verbesserung der Energieauflösung bei PERC — •Martin Moser, Jacqueline Erhart, Philip Haiden, Gertrud Konrad, Claus Kovacs und Hartmut Abele für die PERC-Kollaboration — Atominstitut, TU Wien, Austria

Das freie Neutron zerfällt auf Grund der schwachen Wechselwirkung. Über die Winkelkorrelationen der Zerfallsteilchen ist es möglich, die Gültigkeit des Standardmodells der Teilchenphysik zu überprüfen. Das neue Instrument PERC ermöglicht es, die Korrelationskoeffizienten zwischen dem Neutronenspin und den Impulsen der Zerfallsprodukte in noch nie dagewesener Präzision zu messen. Das zum Einsatz kommende Elektronenspektrometer basiert dabei auf dem Detektionsprinzip von PERKEO III. In Wien wird einer der Detektoren von PERKEO III charakterisiert und dessen für die Elektronenspektroskopie relevanten Systematiken untersucht. Die Energiedetektion erfolgt dabei über einen Szintillator mit Photomultiplierauslese. Auf Grund ihrer kurzen Auslesezeit und hohen Zeitauflösung ist es möglich, bei besonders hohen Zählraten zu arbeiten, was gerade für PERC von großer Bedeutung ist. Zusätzlich wird auch die Stabilität des Messsystems erhöht und charakterisiert. Ergänzend werden auch MC Berechnungen durchgeführt, die sowohl das Rückstreuverhalten als auch die Elektronenabsorption und -transmission am Szintillationsmaterial untersuchen, und zwar mit CASINO und PENELOPE. So können wir Energieverluste, die bei der Detektion von Elektronen mit dem Szintillator auftreten, beschreiben und die gemessenen Energiespektren korrigieren.

HK 52.28 Mi 16:45 HSZ 2.OG

Development of a Flexible Trigger System for FAIR — •Manuel Penschuck[1], Jan Michel[1], Joachim Stroth[1], and Michael Traxler[2] — [1]Goethe-Universität, Frankfurt — [2]GSI Gesellschaft für Schwerionenforschung, Darmstadt

In the scope of experimental set-ups for the upcoming FAIR experiments, a general purpose trigger and read-out board (TRB3) has been developed which is already in use in several detector set-ups. For on- and off-board communication between the DAQ's subsystems, TrbNet, a specialized high-speed, low-latency network protocol developed for the DAQ system of the HADES detector, is used. Communication with any computer infrastructure is provided by Gigabit Ethernet.

The TRB3 can be operated as a stand-alone board for small detectors, in combination with other TrbNet-enabled frontends, or as a subsystem of an existing DAQ infrastructure. In order to support these different scenarios, a flexible and modular central trigger system was developed. Trigger criteria can range from basic trigger strobes, internal pulser signals to complex data streams from other, foreign trigger systems. Additional features include detection of coincidence from several input signals with adjustable time delays and windows. A precise time information of all input signals with 20 ps precision is foreseen in the design.

In this contribution the design of the new trigger system and its web-based control and monitoring tools will be presented.

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HK 52.29 Mi 16:45 HSZ 2.OG

Characterization of APDs for single photon counting — Wladimir Buglak[1], Volker Hannen[1], Raphael Jöhren[1], •Martin Surholt[1], Jonas Vollbrecht[1], Wilfried Nörtershäuser[2,3], Rodolfo Sánchez[3], and Christian Weinheimer[1] — [1]Institut für Kernphysik, Universität Münster — [2]Institut für Kernchemie, Universität Mainz — [3]GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt

For the SPECTRAP experiment at GSI, Germany, a detector system with single-photon counting capability operating in the wavelength region from 300 nm up to 1100 nm has been developed at the University of Münster. The detector system utilises a silicon avalanche photo diode (APD) cooled to liquid nitrogen temperatures and operated near the breakdown voltage to obtain high gain values. While the current setup uses a 2×2 mm^2 APD (type RMD S0223), it would be advantageous to have a larger active area for easier adjustment of the experiment optics. On the other hand a larger active area is accompanied by increased thermal noise which might harm the photon counting performance of the device. The characterization of a 8×8 mm^2 APD (RMD S0814) is the subject of this poster.
Furthermore a signal analysis software was developed to supress noise signals, e.g. caused by microphonic effects. The software processes signal waveforms recorded by a Flash ADC and should allow for a lower trigger threshold and thus higher detection efficiency.

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HK 52.30 Mi 16:45 HSZ 2.OG

Pattern Recognition for the $\bar{\text{P}}$ANDA Forward Tracking System* — •Martin J. Galuska, Jifeng Hu, Wolfgang Kühn, J. Sören Lange, Yutie Liang, David Münchow, and Björn Spruck for the PANDA-Collaboration — II. Physik. Inst., JLU Gießen

The $\bar{\text{P}}$ANDA experiment is planned to start operation in 2017 as part of the future FAIR facility. $\bar{\text{P}}$ANDA is particularly suited to perform resonance scans of exclusively produced charmonium(-like) states. As it is a fixed target experiment a large fraction of final state particles will be boosted toward forward angles. The key challenges for forward tracking arise from the beam momentum dependent magnetic fields: $\bar{\text{P}}$ANDA is comprised of a barrel part with a solenoid field of $B_z = 2$ T and a forward detector with a dipole field of $B \cdot L = 2$ Tm. The interference of the aforementioned magnetic fields leads to complex particle tracks making accurate matching of hits challenging. A Hough Transform alorithm for pattern recognition in the Forward Tracking System based upon a parabola track model was developed. The performance of a proof-of-concept implementation was studied with detailed PandaRoot simulations. Results for momentum resolution, efficiency and ghost rate will be discussed.

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HK 52.31 Mi 16:45 HSZ 2.OG

Verbessertes Design der Schutzdioden für supraleitende Magnete im KATRIN-Experimen — •Alexander Jansen für die KATRIN-Kollaboration — KIT, IKP, Postfach 3640, 76021 Karlsruhe

Die absolute Neutrinomasse ist sowohl für die Astroteilchenphysik, als auch für die Kosmologie von großer Bedeutung. Ziel des KATRIN-Experiments ist die modellunabhängige Messung der Neutrinomasse mit einer Sensitivität von $0.2eV/c^2(90\%C.L.)$ über die Kinematik des Tritium-β-Zerfalls. Hierzu werden die Zerfallselektronen aus der fensterlosen, gasförmigen Tritiumquelle (WGTS) über eine differentielle Pumpstrecke (DPS) und eine kryogene Pumpstrecke (CPS) zum Spektrometerbereich (MAC-E-Filter) geführt, wo ihre Energie mit hoher Präzision gemessen wird.

Die Aufgabe der Transportstrecke (DPS und CPS) ist es, das gesamte Tritiumgas abzupumpen, bevor es das Spektrometer erreichen kann. Gleichzeitig werden die Zerfallselektronen adiabatisch zum Spektrometer geleitet. Der Elektronentransport erfolgt dabei mit Hilfe magnetischer Felder, die durch supraleitende Magnete erzeugt werden. Der sichere Betrieb der Anlage erfordert besondere Maßnahmen zum Schutz der Magnete im Quenchfall. Dabei muss die im Magnetfeld gespeicherte Energie sicher abgeführt werden. Hierzu wurde ein neues Design für die Schutzdioden mit verbesserter Wärmeankopplung konzipiert. Das Poster gibt einen Überblick über den Quell- und Transportbereich und stellt erste Testdaten der neuen Schutzdioden vor.

Dieses Projekt wird vom BMBF unter dem Kennzeichen 05A11VK3 und von der Helmholtz-Gemeinschaft gefördert.

HK 52.32 Mi 16:45 HSZ 2.OG

General readout scheme for the HADES Electromagnetic Calorimeter: status and perspectives — •Behruz Kardan[1], Adrian Rost[2], and Ondřej Svoboda[3] for the HADES-Collaboration — [1]Goethe-Universiät, Frankfurt am Main — [2]TU Darmstadt, Darmstadt — [3]Nuclear Physics Institute of ASCR, Rez, Czech Republic

The HADES spectrometer is located at the SIS18 accelerator at the GSI Helmholtz Center for Heavy Ion Research in Darmstadt. An electromagnetic calorimeter for the HADES experiment is currently under design.

The calorimeter allows to measure neutral meson (π^0 and η) production, which is essential for interpretation of dilepton data, but up to now unknown in heavy-ion reactions in the energy range of the planned FAIR experiments at SIS100.

In order to investigate the optimal functionality of the calorimeter module properties a series of dedicated test experiments of the prototype frontend-electronics in combination with different PMT types have been performed. In this contribution we present details of the detector layout, the module properties, the readout system and its performance studies.

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HK 52.33 Mi 16:45 HSZ 2.OG

Investigations of the MCP Detector of a Time-Of-Flight Detector for IMS at the FRS-ESR — •Christine Hornung[1], Marcel Diwisch[1], Hans Geissel[1,2], Natalia Kuzminchuk-Feuerstein[1], Wolfgang Plass[1,2], and Christoph Scheidenberger[1,2] — [1]Justus- Liebig-Universität Gießen — [2]GSI, Darmstadt

The Isochronous Mass Spectrometry at the FRS-ESR facility at GSI can be used to perform high-precision mass measurements of exotic nuclei. The mass values are obtained from measuring the revolution time of the ions in the storage ring with a time-of-flight detector. The ions pass a thin carbon foil in the detector and release secondary electrons. These electrons are guided by electric and magnetic fields to two MCP detectors. Their number is amplified by micro channel plates and the resulting current is detected by an anode. In order to achieve an accurate time signal, the timing performance of the MCP detector is very important.

The timing performance and the signal shape of the detector setup has been improved by including a new anode design. At the same time, the detector performance dependence on the magnetic field and the electron velocity inside of the MCP-detector was tested. The new detector design and the test results will be presented.

HK 52.34 Mi 16:45 HSZ 2.OG

A Laser Ablation Ion Source for the FRS Ion Catcher — •Ann-Kathrin Rink[1], Timo Dickel[1,2], Jens Ebert[1], Hans Geissel[1,2], Wolfgang Plass[1,2], Martin Petrick[1], Sivaji Purushothamen[2], Pascal Reiter[1], and Christoph Scheidenberger[1,2] — [1]Justus-Liebig Universität Giessen — [2]GSI Darmstadt

The FRS Ion Catcher was developed to serve as test bench for the low energy branch of the Super FRS to slow down exotic nuclei and prepare them for further measurements/ experiments. It consists of a cryogenic stopping cell to thermalise the ions, a diagnostic unit for stopping cell characterisation and various radiofrequency quadrupole structures to guide the ions to the Multiple-Reflection Time-of-Flight Mass Spectrometer for mass measurements, α spectroscopy and isobar separation. To characterise the extraction times of the stopping cell, which is one of the main performance parameters of such a cell, a laser ablation ion source has been develped and tested. This ion source provides a sharply defined starting point of the ions for the extraction time measurement. In the future this source will provide reference ions to calibrate the mass spectrometer for accurate mass measurements.