HK 51: Poster (a)

Time: Thursday 16:30–18:30 Location: Zelt

HK 51.1 Thu 16:30 Zelt

Feasibility study for the applicability of multiparticle correlations in flow analyses at CBM — •Ante Bilandzic for the CBM-Collaboration — Technical University of Munich, Germany

Analyses techniques based on multiparticle azimuthal correlations are widely used at RHIC and LHC experiments in the measurements of anisotropic flow and related phenomena. These techniques are a precision tool only in the environment characterized both by a large number of produced particles and large values of flow harmonics, for instance in mid-central heavy-ion collisions at relativistic energies. This limitation originates from the fact that in flow results obtained with multiparticle correlations both the statistical error and the most important sources of systematic error scale with inverse powers of multiplicity and flow.

In this poster, we present the outcome of the first Monte Carlo studies for the feasibility of using multiparticle azimuthal correlations in the Compress Baryonic Matter experiment at GSI.

HK 51.2 Thu 16:30 Zelt

Charge diffusion coefficient calculations of the hot hadron gas — •Philip A. Karan[1,2], Jean-Bernard Rose[1,2], Jan A. Fotakis[2], Moritz Greif[2], Hannah Elfner[1,2,3], Carsten Greiner[2], and Jan Hammelmann[1,2] — [1]Frankfurt Institute for Advanced Studies, Ruth-Moufang-Strasse 1, 60438 Frankfurt am Main, Germany — [2]Institute for Theoretical Physics, Goethe University, Max-von-Laue-Strasse 1, 60438 Frankfurt am Main, Germany — [3]GSI Helmholtzzentrum für Schwerionenforschung, Planckstrasse 1, 64291 Darmstadt, Germany

To characterize the hot and dense nuclear matter, transport coefficients like the baryon, electric and strangeness charge diffusion are important to know. The interaction of these different charges lead to a diffusion matrix which has been previously suggested in Fotakis et. al. [1711.08680v1] as the cross-charge diffusion. We calculate the coefficients at temperatures in and below the region of the expected phase transition to the QGP using the SMASH transport code that simulates the hadron gas and the Green-Kubo formalism to extract the coefficients. After validating the approach for simple systems we gradually increase the number of degrees of freedom until we reach the full hadronic resonance gas as described by our current knowledge. Our results show that there are significant differences in the temperature dependence of the different components of the diffusion matrix and that a charge*s diffusion current is strongly not only affected by the gradients of their corresponding charge current, but also by the other charges* gradients. This result can be used to provide input to hydrodynamics which take conserved charges into account.

HK 51.3 Thu 16:30 Zelt

Response functions for the fluid dynamics of heavy ion collisions — Andreas Kirchner[1], •Daniel Boness[1], Stefan Floerchinger[1], and Eduardo Grossi[2] — [1]Institut für Theoretische Physik, Heidelberg, Deutschland — [2]Stony Brook University, Stony Brook, USA

We present a way to describe a quark gluon plasma in its fluid dynamical regime using Israel Stewart type hydrodynamic equations of motion with the self written Mathematica package FluiduM. In the package we implemented a background-fluctuation splitting together with a mode expansion technique to solve the equations.

FluiduM enables us to calculate response functions which can be used to compare experimental data for pions, kaons and protons at LHC energies with our theoretical model.

HK 51.4 Thu 16:30 Zelt

Omega Meson Production in $\sqrt{s} = 13$ TeV pp collisions with ALICE — •Marvin Hemmer for the ALICE-Collaboration — Institut für Kernphysik, Goethe-Universität Frankfurt

A hot and dense medium, the so-called quark-gluon plasma (QGP), is believed to be created in ultra-relativistic heavy-ion collisions. The dedicated heavy-ion experiment ALICE at LHC is designed to study the properties of the QGP. Measurements in pp collisions function as a baseline for the measurements in Pb-Pb collisions and further provide insights in the particle production processes. A comparison of neutral pion (π^0) and omega meson (ω) production allows for a study of the mass dependence of the production mechanisms of particles with similar quark content. In the ALICE experiment, omega mesons are measured via the decay channels $\omega \to \pi^+\pi^-\pi^0$ and $\omega \to \pi^0\gamma$. The $\pi^0\gamma$ decay channel is measured facilitating the photon conversion method (PCM) and the electromagnetic calorimeter (EMCal).

In this poster, we report on the current status of the $\omega \to \pi^0\gamma$ measurement in pp collisions at $\sqrt{s} = 13$ TeV.

Supported by BMBF and the Helmholtz Association.

HK 51.5 Thu 16:30 Zelt

Σ^+ production in pp collisions at $\sqrt{s} = 13\ TeV$ in ALICE — •Steven Merkel for the ALICE-Collaboration — Institut für Kernphysik, Goethe-Universität Frankfurt

The ALICE experiment at the CERN LHC investigates the properties of the quark-gluon plasma (QGP) which is believed to be produced in ultra-relativistic heavy-ion collisions at high collision energies. Hadron production measurements in pp collisions provide information about the underlying QCD processes and fragmentation functions. Furthermore, pp results provide an important baseline for the interpretation of ultra-relativistic heavy-ion collisions.

A proper description of the production of strange particles still poses a challenge for Monte Carlo generators like PYTHIA. The measurement of the production of strange hadrons like Σ^+ can help to better constrain the theoretical models. In the ALICE experiment, Σ^+ can be measured via the decay channel $\Sigma^+ \to \mathrm{p} + \pi^0$. π^0 can be measured via the two-photon decay channel, utilizing the calorimeters EMCal and PHOS; protons can be measured with the TPC.

In this poster, a new study of the measurement $\Sigma^+ \to \mathrm{p} + \pi^0$ in ALICE is presented for pp collisions at $\sqrt{s} = 13\ TeV$.

Supported by BMBF and the Helmholtz Association.

HK 51.6 Thu 16:30 Zelt

Comparison of charged-particle production in ALICE with Monte Carlo simulations using RIVET — •Kristina Schmitt for the ALICE-Collaboration — Institut für Kernphysik, Goethe Universität, Frankfurt

The ALICE experiment at CERN-LHC is dedicated to study the properties of the so-called Quark-Gluon Plasma by investigating high-energy pp, p-Pb and Pb-Pb collisions. The comparison of the data with theoretical models is crucial to understand the underlying physical processes of these collisions.

The RIVET toolkit provides an interface between theoretical models, implemented in Monte Carlo generators, and experimental analyses, allowing for a wide range comparison between experiment and theory.

In this poster, we present a systematic comparison of measured transverse momentum (p_T) distributions of charged particles as a function of charged-particle multiplicities for different center of mass energies with a range of different theoretical models, employing the RIVET toolkit.

Supported by BMBF and the Helmholtz Association.

HK 51.7 Thu 16:30 Zelt

Low-p_T π^0 and η reconstruction via their Dalitz decay in pp collisions at $\sqrt{s}$=13 TeV with ALICE — •Florian Eisenhut for the ALICE-Collaboration — Institut für Kernphysik, Goethe-Universität Frankfurt

At the Intersecting Storage Rings (ISR) at CERN, an excess of dielectron pairs over the expectation from known dielectron sources had been measured at low invariant mass and small pair $p_{\mathrm{T,ee}}$ in pp collisions at $\sqrt{s} = 63$ GeV. With the ALICE experiment a similar measurement can be performed by reducing the magnetic field of the central barrel solenoid. However, in order to conclude on such an excess an independent measurement of the η meson by ALICE at LHC energies is crucial as it represents the dominating contribution to the hadronic background in the LMR region.

In this poster, first results of the π^0 and η measurement via its Dalitz decay channel in pp collisions at $\sqrt{s} = 13$ TeV with reduced magnetic field will be presented. This alternative approach allows a reconstruction of these mesons at lower momentum compared to similar analysis using calorimeters while trying to reduce the systematic uncertainties compared to the analysis of the two-photon decay channel via conversions. Thus, it could help to answer the question of a possible excess of the dielectron production at LHC energies.

Supported by BMBF and the Helmholtz Association.

HK 51.8 Thu 16:30 Zelt

Pad-by-Pad gain calibration of the ALICE TPC using reconstructed particle tracks — •Matthias Kleiner for the ALICE-Collaboration — Institut für Kernphysik, Goethe-Universität Frankfurt

The Time Projection Chamber (TPC) is the main tracking and particle identification detector of the ALICE experiment at the CERN LHC. For RUN 3 starting in 2021, interaction rates of 50 kHz in Pb-Pb collisions require a major upgrade of the TPC readout system. The MultiWire Proportional Chambers (MWPCs) are replaced by stacks of four Gas Electron Multiplier (GEM) foils. Due to manufacturing tolerances, the hole diameters vary over the surface of the foils. This leads to variations in the electron amplification.

In this poster, a new self-normalizing method to calculate topological gain variations using particle tracks is presented. This method together with the high data rates allows to study variations of the gain as a dependence of time.

Supported by BMBF and the Helmholtz Association.

HK 51.9 Thu 16:30 Zelt

Quality Assurance and Spark Detection of GEMs for the ALICE-TPC-Upgrade. — •Thomas Block, Philip Hauer, Markus Ball, and Bernhard Ketzer — University of Bonn, Helmholtz-Institut für Strahlen- und Kernphysik, Bonn, Germany Germany

The MWPC-based readout of the ALICE-TPC is limited to a trigger rate of 3.5 kHz. In order to make full use of the increased luminosity after the Long Shutdown 2, which will result in a minimum-bias interaction rate of 50 kHz, currently an upgrade of the TPC to GEM-based readout chambers is being performed.

For the upgrade more than 800 GEM foils were produced. A rigorous quality assurance scheme was developed and followed to guarantee an excellent quality of the GEMs.

In this poster a summary of the production, the QA scheme, the yields and the most common defects found during chamber construction are presented.

In order to simplify high-voltage tests of GEM foils a webcam-based Spark Detection System (SDS) was developed in Bonn. Discharges, recorded optically with a webcam, can give information about manufacturing defects or dust remnants, which may result in an increased number of discharges and ultimately in short circuits. The design and capabilities of the SDS used for the large ALICE-TPC-GEMs and of a 3D-printable SDS for $10 \times 10\text{cm}^2$ GEMs is presented.

Supported by BMBF.

HK 51.10 Thu 16:30 Zelt

Gas gain calibration of the ALICE TPC with X-rays — •Tim Geiger for the ALICE-Collaboration — Institut für Kernphysik, Goethe-Universität Frankfurt

The ALICE experiment at LHC is a heavy-ion experiment designed to create and study the properties of a so-called quark-gluon plasma (QGP). The QGP is a hot and dense state of matter presumed to be created in heavy-ion collisions. The main tracking and particle identification detector of ALICE is a large volume time projection chamber (TPC). Particle identification is achieved by simultaneous reconstruction of momentum and specific energy loss. To obtain the desired precision, a proper calibration is required. One important calibration is the equalization of topological gain variations over the readout area. The variation can be measured via releasing a fixed amount of charge into the amplification region. So far this was done by releasing radioacitve ^{83}Kr into the gas volume of the TPC. Using X-rays instead could provide a faster and easier way measuring the gas amplification.

In this poster, we present a feasibility study of gas gain calibration via X-rays.

Supported by BMBF and the Helmholtz Association.

HK 51.11 Thu 16:30 Zelt

Simulation Of Ionization Energy Loss In Gases — •Philipp Bielefeldt, Ankur Yadav, Markus Ball, and Bernhard Ketzer — Universität Bonn, Helmholtz-Institut für Strahlen- und Kernphysik, Bonn, Germany

Accurate tracking of charged particles in particle detectors can be achieved with Time Projection Chambers (TPC). A frequently used amplification stage are Micro-Pattern Gaseous Detectors, such as Gas Electron Multipliers (GEM). Examples of such devices include the ALICE GEM-TPC at LHC, and the future charged-particle tracking system in the CBELSA/TAPS experiment. Characterization of the GEM-TPC requires a thorough comprehension of the physics processes involved in signal creation. This can be vastly improved using Monte-Carlo Simulations of all processes that contribute to the detector signal.

A full detector simulation chain is developed based on the Geant4 platform. Geant4 describes physics processes in complementary models tailored for varying requirements. Different energy loss representations are used, including the phenomenological Photoabsorption Ionization model and the Bethe-Bloch energy deposition model developed by the NA49 collaboration.

A comparison of the ionisation energy deposition straggling between different representations is given. The results are compared to experimental data on ionization energy loss and results from microscopic simulations. Monte-Carlo calculations for the spatial distribution of ionization clusters in thin absorbers are presented.

HK 51.12 Thu 16:30 Zelt

Pre-Commissioning of the ALICE TPC and Common Mode Analysis — •Panagiota Chatzidaki for the ALICE-Collaboration — Physikalisches Institut der Universität Heidelberg

In order to operate the ALICE Time Projection Chamber (TPC) in continuous mode, recording the full minimum-bias interaction rate of 50 kHz in Pb−Pb, as anticipated at the LHC in Run 3 (2021−2023) and beyond, the gated Multi Wire Proportional Chambers (MWPCs) were replaced by GEM-based readout chambers (Gas Electron Multipliers). After the assembly and before commissioning of the TPC underground, a pre-commissioning in the clean room at the LHC Point 2 was performed during November 2019−February 2020, in order to ensure the functionality of all readout chambers (ROCs) and Front End Electronics (FEE). During that time, dedicated pedestal and noise measurements, calibration pulser measurements, as well as measurements with the TPC laser system were essential in developing algorithms that will perform online and offline corrections during the normal TPC operation with beam. Crucial is the correction of the Common Mode Effect, which, if not accounted for, results in a significant deterioration of the $\mathrm{d}E/\mathrm{d}x$ resolution, and therefore the particle identification performance of the TPC. We describe the pre-commissioning steps, and present the status of the analysis of the Common Mode Effect, by studying non-zero-suppressed laser events.

HK 51.13 Thu 16:30 Zelt

New GEM Detectors for COMPASS/COMPASS++ — Emorfili Terzimpasoglou[1], •Karl Jonathan Flöthner[1], Dimitri Schaab[1], Christian Honisch[1], Igor Konorov[2], Markus Ball[1], and Bernhard Ketzer[1] — [1]Universität Bonn, Helmholtz-Institut für Strahlen- und Kernphysik, Bonn, Germany — [2]Technische Universität München, E18, München, Germany

The COmmon Muon Proton Apparatus for Structure and Spectroscopy (COMPASS) came into operation in 2001 and is one of the longest running experiments at CERN. Its phase II is scheduled to be completed in 2021 with a measurement of transverse-momentum dependent PDFs in deep inelastic scattering of muons on a deuterium target. A new proposal for a future QCD facility at the M2 beamline has been submitted recently. Running under the name COMPASS++/AMBER, the plans include, among others, a measurement of the proton radius in elastic muon-proton scattering and studies of the pion PDFs using the Drell-Yan process. The upcoming experiments require an upgrade of the existing GEM tracking system. In the long run, new large-size GEM detectors with pixel readout in the central region are planned. In addition, the front-end electronics should allow for a self-triggered readout of signal channels. As a first step, an improved version of medium-size GEM detectors will be constructed in order to replace some of the existing detectors. The poster will report on the design of these detectors and on studies comparing the existing APV25 front-end chip with the new VMM-3 ASIC. Supported by BMBF.

HK 51.14 Thu 16:30 Zelt

A laser-system for field calibration studies of the Time Projection Chamber at the CBELSA/TAPS experiment — •Fabian Metzger, Dimitri Schaab, Markus Ball, and Bernhard Ketzer for the CBELSA/TAPS-Collaboration — Universität Bonn, Helmholtz-Institut für Strahlen- und Kernphysik, Bonn, Germany

The calibration of the electric field of a Time Projection Chamber

(TPC) is of central importance since deviations from a homogeneous field in the drift region would otherwise lead to imprecise track reconstructions and detereorate the spatial resolution. For that reason, a proper correction is crucial for the detector performance.
For the CBELSA-TPC, a calibration system is planned, whose idea is adopted from the T2K experiment. Here, the calibration principle makes use of the photoelectric effect. With the help of laser light pulses which are coupled into the detector through optical fibre bundles, electrons are extracted from known positions on the cathode. The measurement of these electrons shows the integrated field distortions between anode and cathode.
The poster will present the optical setup with its components, a control system for the laser as well as the produced fibre profiles. Here, special attention is paid to a homogeneous illumination of the cathode.

HK 51.15 Thu 16:30 Zelt

Implementation of a MiniTAPS Trigger Board for the CBELSA/TAPS Experiment — •Lisa Richter, Annika Thiel, Janis Hoff, and Christian Honisch for the CBELSA/TAPS-Collaboration — Helmholtz-Institut für Strahlen- und Kernphysik, Universität Bonn

Baryon spectroscopy is performed with the CBELSA/TAPS experiment through the study of reactions that are produced with a photon beam impinging on a nucleon target. The detector setup is optimized for the production of neutral mesons which decay mainly in photons.
The MiniTAPS calorimeter is located in the forward region and is therefore one of the central parts of the detector system. It covers the forward angle between 1° and 12° and can capture photons with energies between 10 MeV and 2.0 GeV.
The detector consists of 216 hexagonal BaF_2 crystals which are read out via photomultiplier tubes. To avoid wrong information due to overlapping clusters, the crystals are arranged in four sectors and the number of hits in a sector in one event is determined by the trigger.
The new MiniTAPS trigger is currently developed to replace the old MCU (multiple coincidence unit) electronics. It will be realized by a single FPGA in a VME module. This will not only simplify the electronics but also allow for more sophisticated trigger algorithms including e.g. a fast cluster finder.
The new setup of the trigger and first results of the analysis will be presented on this poster.

HK 51.16 Thu 16:30 Zelt

Design Studies on cryopumps for $\overline{\text{P}}$ANDA at FAIR — •Christian Mannweiler, Daniel Klostermann, Benjamin Hetz, Daniel Bonaventura, and Alfons Khoukaz — Westfälische Wilhelms Universität, Münster, Deutschland

The $\overline{\text{P}}$ANDA experiment at the future HESR accelerator at FAIR will aim to explore open questions about the strong interaction, the existence of exotic particles as well as other topics by utilising anti-proton-proton collisions. For these studies, optimal vacuum conditions are crucial for event reconstruction, background suppression as well as antiproton beam lifetime.

To this end, novel cryopump geometries for a possible installation at the HESR beam pipe were studied and simulated. A cryopump employs a different operating principle from other conventional pumps such as turbo- or roots pumps. In a cryopump, a suitable medium such as activated charcoal is cooled to cryogenic temperatures of well below 20 K. At these temperatures atoms and even hydrogen molecules which impinge on the carbon surface are adsorbed without being desorbed later, creating a pumping mechanism.

Design studies were performed to identify a cryopump geometry which is suited best to $\overline{\text{P}}$ANDA's unique needs before simulating these pumps with the MOLFLOW+ software package.

These design studies as well as the obtained simulation results will be presented and discussed.

This project has received funding from BMBF (05P19PMFP1) and GSI F & E

HK 51.17 Thu 16:30 Zelt

Untersuchung der Beschleunigerstrahlqualität und -lebensdauer an COSY mit dem $\overline{\text{P}}$ANDA Cluster-Jet Target — •Hanna Eick, Philipp Brand, Benjamin Hetz, Daniel Klostermann und Alfons Khoukaz für die PANDA-Kollaboration — Institut für Kernphysik, Westfälische Wilhelms-Universität Münster, 48149 Münster, Germany

Das interne, fensterlose $\overline{\text{P}}$ANDA Cluster-Jet Target der WWU Münster wird das *Phase-One* Target des im Aufbau befindlichen Antiprotonen Speicherings HESR der zukünftigen GSI/FAIR-Anlage sein. Mit einer Targetdichte von mehr als 2×10^{15} Atome/cm^2 ohne zeitliche Substrukturen und einem Abstand der Targetdüse von mehr als 2 m vom Wechselwirkungspunkt ist es für Experimente mit hoher Luminosität bestens geeignet. Von besonderem Interesse während der Test-Strahlzeiten an COSY sind Untersuchungen der Strahl-Target-Wechselwirkung. Besonderes Augenmerk wurde im August 2019 auf Messungen der Beschleunigerstrahlqualität und -lebensdauer in Verbindung mit dem $\overline{\text{P}}$ANDA Target und den ebenfalls an COSY installierten Elementen der stochastischen Kühlung des HESR gelegt. Einen Überblick über das $\overline{\text{P}}$ANDA Cluster-Jet Target und die im August 2019 durchgeführten Messungen an COSY werden im Rahmen dieses Posters präsentiert.
Dieses Projekt wurde durch das BMBF (05P19PMFP1) und das GSI F&E Programm gefördert.

HK 51.18 Thu 16:30 Zelt

Impact of Laval Nozzle Length on Properties of Cluster Beams — •Sophia Vestrick, Philipp Brand, Silke Grieser, and Alfons Khoukaz for the PANDA-Collaboration — Institut für Kernphysik, Westfälische Wilhelms-Universität Münster, 48149 Münster, Germany

The understanding of cluster formation processes within Laval nozzles is from highest interest for targets for high luminosity experiments, e.g. for the $\overline{\text{P}}$ANDA cluster-jet target with a thickness of more than 2×10^{15} atoms/cm^2 in a nozzle distance of > 2 m. One important parameter is the nozzle length. With a smaller nozzle length the typically challenging fabrication process becomes easier and therefore nozzles of higher quality can be produced.

The influence of the nozzle length on the cluster formation process and the quality of the resulting cluster beam were investigated at the $\overline{\text{P}}$ANDA cluster-jet target prototype at the University of Münster using a 35 μm nozzle by shortening its diverging outlet section. In comparison to these measurements, computational fluid dynamics (CFD) is used to simulate the gas flow through the used nozzle in dependence of different nozzle lengths and stagnation conditions. The results of these measurements and simulations together can give further insights into the cluster production process and an optimized nozzle length.

This project has received funding from BMBF (05P19PMFP1) and GSI F&E.

HK 51.19 Thu 16:30 Zelt

Mechanics of PANDA Backward End-Cap of the Electromagnetic calorimeter in the Phase 0 — •David Rodriguez Pineiro[1], Luigi Capozza[1], Alaa Dbeyssi[1], Alexander Greiner[1], Samet Katilmis[1], Frank Maas[1,2,3], Julian Moik[1], Oliver Noll[1], Paul Schöner[1], and Sahra Wolff[1,2] for the PANDA-Collaboration — [1]Helmholtz-Institut Mainz, Mainz, Germany — [2]Institute of Nuclear Physics, Mainz, Germany — [3]PRISMA Cluster of Excellence, Mainz, Germany

The PANDA experiment will be one of the key projects of the new accelerator facility FAIR in Darmstadt. With its mature detector system, it will be able to observe a variety of physical channels. Thus it will make a huge contribution to the understanding of the strong interaction. The electromagnetic process group (EMP) in Mainz is developing the backward end-cap (BWEC) of the electromagnetic calorimeter. This detector will be first installed at the Mainz Microtron facility (MAMI) for the Phase 0. Due to the lack of geometrical constraints around it a greater number of crystals will be used (640). Crystals will be mounted in submodules of 16 units, equipping them with 16, and 8 crystals assemblies which will be later used in the phase 1. Mass production for these components has been started. New cooling system will be developed which also will also serve as a test bench to be optimized for Phase 1.

HK 51.20 Thu 16:30 Zelt

Optimierung eines Droplet Targets für kryogene Gase — •Christina Westphälinger, Daniel Bonaventura, Christian Mannweiler, Lana Söltzer und Alfons Khoukaz — Institut für Kernphysik, WWU Münster, 48149 Münster, Germany

Droplet Targets bieten für eine Vielzahl von Beschleunigerexperimenten in der Hadronen-, Leptonen- und Laserphysik eine interessante Alternative zu Gas- und Cluster-Jet Targets. Hierbei sind die Interaktionspunkte zwischen Beschleunigerstrahl und Target wegen der festen Dropletfrequenz und der kleinen lokalen Ausdehnung der Streuzentren individuell rekonstruierbar. Gleichzeitig ist eine hohe Dichte und damit eine hohe Ereignisrate vorhanden. Dazu wird mittels mikrometerfeiner Düsen und i.d.R. kryogen verflüssigten Gasen ein laminarer Flüssigkeitsstrahl aus z.B. Argon oder Wasserstoff erzeugt, der mittels erzwungener Düsenschwingungen im Vakuum zu Tröpfchen aufbricht und einen kontinuierlichen, periodischen Tröpfchenstrahl liefert. Die Optimierung des bestehenden Prototypen bezüglich einzelner Komponenten und Betriebsparameter im Hinblick auf Langzeitstabilität steht dabei im Vordergrund. Insbesondere werden beim verwendeten Düsensystem systematische Studien durchgeführt, um Düsenverstopfungen zu vermeiden. Des Weiteren werden Droplet-Beleuchtung und optische Auswertung optimiert. Der aktuelle Stand des Targetaufbaus sowie die Eigenschaften der erzeugten Droplets werden im Folgenden dargestellt und diskutiert. Dieses Projekt wurde mit Mitteln des EU Horizon 2020 Forschungs- und Innovationsprogramms No 824093 gefördert.

HK 51.21 Thu 16:30 Zelt

SONIC III - The improved particle spectrometer for particle-gamma experiments at the Cologne Tandem accelerator — •Florian Kluwig, Anna Bohn, Vera Everwyn, Michelle Färber, Miriam Müscher, Sarah Prill, Philipp Scholz, Max Steffan, Michael Weinert, Julius Wilhelmy, and Andreas Zilges — Institute for Nuclear Physics, University of Cologne

The particle spectrometer SONIC [1] at the 10 MV FN-Tandem accelerator of the University of Cologne has been continuously enhanced in the last years. In its recent and third version, SONIC consists of 12 silicon detectors which can be mounted as single detectors or ΔE-E telescopes, and reaches a total solid angle coverage of 9%. Combined with the γ-ray detector array HORUS [2], particle-γ coincidence measurements are performed to investigate inelastic scattering or transfer reactions in a wide mass region. In this contribution, SONIC III and recent experimental campaigns will be presented.

A.B. and M.S. are supported by the Bonn-Cologne Graduate School for Physics and Astronomy.

[1] S. G. Pickstone *et al.*, Nucl. Instr. and Meth. A **875** (2017) 104
[2] L. Netterdorn *et al.*, Nucl. Instr. and Meth. A **754** (2014) 94

HK 51.22 Thu 16:30 Zelt

Development of a HPGe-BGO Pair Spectrometer for ELI-NP — •Ilja Homm and Thorsten Kröll — Technische Universität Darmstadt, Germany

The new European research facility called ELI-NP (The **E**xtreme **L**ight **I**nfrastructure - **N**uclear **P**hysics) is being built in Bucharest-Magurele, Romania. ELI-NP will offer unprecedented opportunities for photonuclear reactions with high intensity, brilliant and fully polarized photon beams at energies up to 19.5 MeV.

The 8 HPGe CLOVER detectors of ELIADE are important instruments for the gamma spectroscopic study of photonuclear reactions. We investigate the possibility to operate an advanced version of an anti-Compton shield (AC shield) as escape γ-rays pair spectrometer for one of the ELIADE CLOVERS. This should improve the performance at high energies where the pair production process dominates. The BGO shield operated as a stand-alone device can also be used as intensity monitor and to investigate the cross section for pair production near the threshold. The main tasks are to develop and test such an AC shield consisting of BGO crystals with SiPM (silicon photomultiplier) readout. The results of prototype testing are reported. First measurements with high energy photons are planned for 2020.

This work is supported by the German BMBF (05P15RDENA) and the LOEWE-Forschungsschwerpunkt “Nukleare Photonik”.

HK 51.23 Thu 16:30 Zelt

Dead region correction of HPGe detectors in Geant4 — •Markus Müllenmeister, Jan Mayer, Philipp Scholz, and Andreas Zilges — Institute for Nuclear Physics, University of Cologne

Dead regions can develop in HPGe detectors over time. For the nearly 20 year old coaxial detectors of the SONIC@HORUS spectrometer [1], we assume that the efficiency loss can be modeled by a cylindrical inactive region around the inner contact, as the inner contact poses a greater chance of introducing defects into the detecting crystal volume.

Geant4 simulations with varying thickness of the inactive zone were conducted in G4Horus [2]. The differences from the calibration data were compared via the χ^2-method.

It was found that the cylindrical inactive region reproduces experimental data very well. The changes for this adaptation of the detectors is minuscule and easy to implement in existing simulations. The inclusion of inactive regions should be considered for simulations of older detectors.

[1] S. G. Pickstone *et al.*, Nucl. Instr. and Meth. A 875 (2017) 104
[2] J. Mayer, https://gitlab.ikp.uni-koeln.de/jmayer/g4horus

HK 51.24 Thu 16:30 Zelt

Recent development of the LED based monitoring system for CALIFA CALorimeter for In flight detection of γ rays and high energy charged pArticles — •Christian Sürder, Anna-Lena Hartig, Alexander Ignatov, Thorsten Kröll, and Han-Bum Rhee for the R3B-Collaboration — Institut für Kernphysik, Technische Universität Darmstadt, Darmstadt, Deutschland

CALIFA is part of the R^3B setup of the future FAIR facility. The used detector units consisting out of an Avalanche Photo Diode and a CsI(Tl) scintillation crystal. With these detector units it is possible to built a high resolution calorimeter, which is insensitive to present magnetic fields. It is common to monitor the properties of a calorimeter with a corresponding monitoring system. For CALIFA it was decided to implement a LED based monitoring system, which delivers a light pulse via plastic optical fibers to monitor the detection process starting from the scintillation crystal. To have control over the LED source, a reference system with a detector and a standard radioactive source runs alongside. The recent status and the developments of this system will be presented.

HK 51.25 Thu 16:30 Zelt

Event identification electronics for low count-rate thermal neutron proportional counters — •Benjamin Brauneis[1], Jannis Weimar[1], Markus Köhli[1,2], and Ulrich Schmidt[1] — [1]Physikalisches Institut, Heidelberg University, Germany — [2]Physikalisches Institut, University of Bonn, Germany

Thermal neutron proportional counters are used in low-count rate environments such as experimental halls for monitoring the beam luminosity or the cosmic-ray induced environmental radiation. However, in order to provide substantially good statistics, such instruments have to be large. This makes gaseous detectors susceptible to background like protons, (Compton) electrons, gammas, myons and nuclear fragments which are emitted from the wall material. Furthermore, due to the helium-3 crisis the baseline technology shifted towards boron-lined detectors, which have an energy spectrum continuously extended downwards to 0 eV. An event from thermal neutron conversion, however, can be distinguished from non-signal events by the drift time characteristics of the ionization track in the gas. Within the COSMIC Sense collaboration we are developing readout electronics for large-scale neutron detectors based on microcontrollers which act as digitizers as well as a triggered data acquisition. The frontend features a pulse-shape analysis for signal height and time over threshold including rise time discrimination using the built-in 10 bit analog-to-digital converter. We present the current status of the frontend electronics DAQ and measurements of the separation efficiency for this readout.

HK 51.26 Thu 16:30 Zelt

Installation of CALIFA@R3B (GSI) — •Han-Bum Rhee, Anna-Lena Hartig, Noel Merkel, Thorsten Kröll, and Christian Sürder for the R3B-Collaboration — Institut für Kernphysik, Darmstadt,Germanny

CAIFA is a part of the R3B experiment at GSI and the future FAIR facility. It is a calorimeter and spectrometer that aims to detect gamma rays and light charged particles. CALIFA is divided into a cylindrical barrel and a forward endcap. The forward endcap comprises two distinct detection systems: iPhos and CEPA. The CALIFA barrel and iPhos consist of 2464 CsI(Tl) scintillating crystals, which are individually read out with Avalanche Photodiodes (APDs).

As first versions of CALIFA, the collaboration has built demonstrator arrays and has done several campaigns with these. In preparation of the second FAIR-Phase0 campaign in 2020, the crystals are mounted on the final CALIFA frame and this frame is now located in R3B setup.

Before assembly of the detectors, the temperature dependency on the gain of the APDs was tested. The assembled detector units were characterized regarding the light-output non-uniformity and the energy resolution.

This work is supported by German BMBF(05P15DFN1,05P19RDFN1), HIC for FAIR and GSI-TU Darmstadt cooperation contract.

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Cold Field Emission Electron Source for the PUMA Ion Trap — •Jonas Fischer and Noritsugu Nakatsuka for the PUMA-Collaboration — TU Darmstadt, Darmstadt, Germany

The goal of the PUMA (antiProton Unstable Matter Annihilation) experiment is to investigate the neuron and proton density distribution in short-lived nuclei. This is to be achieved by the annihilation of antiprotons with the outermost nucleons of the nucleus. To make these measurements possible, one has to transport antiprotons to a radioactive ion beam facility. PUMA will first collect antiprotons at the AD (Antiproton Decelerator) and then transport them to the radioactive ion beam facility ISOLDE at CERN. For the storage of the antiprotons and the collision with the nuclei a cryogenic Penning trap is being designed and built. Approximately one billion antiprotons will be stored in the trap, but since their energy will be to high to keep them in the trap for a sufficiently long time, they will be cooled by means of sympathetic cooling using electrons. To create a sufficient amount of electrons without introducing an additional heat load, a cryogenic field emission electron source will be incorporated into the trap system. In this contribution the design and test of such an electron source will be presented. This contribution is supported by ERC-COG through grand no. 726276.

HK 51.28 Thu 16:30 Zelt

Towards the PUMA pion tracker — •Sabrina Zacarias for the PUMA-Collaboration — Institut für Kernphysik, TU Darmstadt

The PUMA project (antiProton Unstable Matter Annihilation) aims at using low energy antiprotons to probe the tail of the radial density of short-lived nuclei. With PUMA, the ratio of proton and neutron annihilations after capture will be determined, giving access to a new observable to quantify the ratio of proton to neutron densities at the nuclear periphery. To accomplish it, PUMA aims at transporting one billion low-energy antiprotons (produced at CERN/ELENA) to the CERN/ISOLDE facility where short-lived nuclei are produced. In the poster, the detection system (consisting of a time projection chamber and a trigger barrel) and the readout electronics development will be detailed.

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Optics Study for Differential Pumping and Beaming Cancellation for PUMA — Audric Husson, •Clara Klink, and Alexandre Obertelli for the PUMA-Collaboration — TU Darmstadt, Darmstadt, Germany

The PUMA (AntiProton Unstable Matter Annihilation) project at CERN focuses on observing the ratio of neutrons to protons in the nuclear density tail of exotic nuclei using antiprotons. The antiprotons will be accumulated at the deceleration ring ELENA, where up to one billion antiprotons will be trapped and stored in the Penning trap of PUMA, and then transported to ISOLDE. At ISOLDE, annihilations between the antiprotons and nucleons in the nuclear density tail are investigated. The antiproton storage trap operates at extreme high vacuum (XHV). PUMA requires a vacuum of 10^{-11} mbar at the entrance of the device. A differential pumping is needed to isolate PUMA from the ISOLDE beam line at approx. 10^{-6} mbar. The beaming effect of the differential pumping system shapes the residual gas velocity towards the beam line direction and therefore increases the flux of neutral particles towards the PUMA trap. This effect has to be cancelled to reduce the amount of residual gas entering the PUMA trap and to avoid unwanted annihilations of antiprotons with neutral particles. In this poster, preliminary beam-optics simulations for a differential pumping section of the beam line designed to reduced beaming of neutral particles are presented.

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Geometry Optimization of a Scintillation Detector for Detection of Cosmic Air Showers — •Sven Peter, Hans-Georg Zaunick, Markus Moritz, Lukas Nies, Marvin Peter, and Kai-Thomas Brinkmann — II. Physikalisches Institut, JLU Gießen

The geometry of a plastic scintillator for the detection of air showers was optimized using a Geant4 simulation with explicit treatment of optical photons. Starting from a rectangular shape of the scintillator, the corners were cut-off at various angles relative to the short sides of the rectangle. A SiPM at one of the short sides of the rectangle was used as a read-out. A teflon wrapping was simulated using the GODDeSS extension for Geant4. To study the spatially resolved efficiency, minimum ionizing muons that traverse the scintillator at various positions were simulated.

For certain configurations of the cut-off angles, the effect of the reduced scintillator area was overcompensated by the increased light yield due to a focusing effect. A muon detection efficiency of 84% was reached. The spatial homogeneity of the detection efficiency was improved as well. The well-known positive effect of silicone oil as optical coupling between scintillator and the SiPM could be quantified. It doubles the number of detected photons. Furthermore, the light collections efficiency with roughened surfaces was found to be 10 to 15% lower than the efficiency of a perfectly polished one.

HK 51.31 Thu 16:30 Zelt

Photon interaction position determination in monolithic scintillators via Neural Network algorithms — •Maria Kawula[1], Tim Binder[1,2], Silvia Liprandi[1], Katia Parodi[1], and Peter G. Thirolf[1] — [1]Ludwig-Maximilians-Universität München — [2]KETEK GmbH München

Monolithic scintillators are an attractive alternative to pixelated crystals as a part of multiple-component photon detectors like Compton cameras. We propose a novel algorithm for determining the position of γ-ray interactions in a monolithic scintillation crystal, based on Supervised Machine Learning involving Convolutional Neural Networks (CNN). The new method is an alternative to well-established algorithms such as "k-Nearest Neighbours" (kNN), which suffers from long computation time and high memory requirements. Two crystals, $LaBr_3$:Ce and $CeBr_3$, of size 50 mm×50 mm×30 mm were examined. The spatial resolution of the CNN algorithms was tested for three energies of the initial γ quanta: 662 keV (^{137}Cs), 1.17 MeV and 1.33 MeV (^{60}Co). A spatial resolution of the algorithm of 1.04 (±0.04 stat. ± 0.2 sys.) mm at 662 keV and 0.90 (±0.02 stat. ± 0.2 syst.) mm at 1.3 MeV for $LaBr_3$:Ce and $CeBr_3$, respectively, was achieved. The new reconstruction scheme is compatible with CPUs and GPUs and can reconstruct up to $2 \cdot 10^4$ events/s, which is four orders of magnitude faster than the kNN. Memory requirements are reduced by ≈1/1000. This work was supported by the DFG Cluster of Excellence MAP (Munich Centre for Advanced Photonics) and the Bayerische Forschungsstiftung.

HK 51.32 Thu 16:30 Zelt

HI-TREX - A highly integrated Setup for Transfer experiments at REX-HIE-ISOLDE — •Christian Berner — Technische Universität München - Nukleare Astrophysik, 85748 Garching, Deutschland

HI-TREX is the acronym for a highly integrated setup for transfer experiments at REX-HIE-ISOLDE. HI-TREX is the upgraded successor of TREX. As there is a close interplay between a detector and its electronics, the main upgraded components feature two basic developments going hand-in-hand with each other: The silicon detector upgrade and the accompanying custom made electronics. For the first part, the newly developed, very thin, AC-coupled DSSSDs are a technological novelty and many efforts have been made in meeting the specifications. A concept for a triple-stack detector setup has been evaluated, enabling a two-fold energy sampling and thus extending the partidle-identification capabilities. As for the electronics part, the integration of the custom-made ASICs SKIROC has been done successfully by the GEneric Asic Readout board GEAR, which was developed within this work. The back-end integration, as well as the development of any peripheral components resulted in a working prototype for the full HI-TREX setup.

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A superfluid liquid helium target for low-momentum electron scattering experiments at the S-DALINAC — •Michaela Hilcker, Jonny Birkhan, Antonio D'Alessio, Tobias Klaus, Peter von Neumann-Cosel, Norbert Pietralla, Maxim Singer, and Gerhart Steinhilber — Institut für Kernphysik, TU Darmstadt

At the Institute for Nuclear Physics of the TU Darmstadt, high-resolution inelastic electron scattering is used to investigate the nuclear structure at low momentum transfers. The QCLAM spectrometer, one of the two large magnetic spectrometers, is used to determine the momentum of the scattered electrons.

We plan to perform an electron scattering experiment at low momentum transfer to investigate the first excited 0^+ state of ^{4}He, since previous experiments [1] deviate strongly from current 'ab initio' calculations in chiral EFT [2], and also the longitudinal response function at excitation energies above 22 MeV, since the effect of 3 body forces is particularly visible there. The use of superfluid helium as target material is necessary to obtain sufficiently good statistics and to keep experimental uncertainties of the target density under control. A suitable setup will be presented and the results of a commissioning experiment [3] will be shown.

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HK 51.34 Thu 16:30 Zelt

Development of detector read-out electronics for the P2 experiment at MESA — Sebastian Baunack[1], Michael Gericke[3], Kathrin Imai[1], •Rahima Krini[1], Werner Lauth[1], Frank Maas[1,2], David Rodriguez Pineiro[2], and Malte Wilfert[1] — [1]Institute for Nuclear Physics, Mainz, Germany — [2]Helmholtz Institute Mainz, Germany — [3]University of Manitoba, Canada

The Mainz Energy recovering Superconducting Accelerator (MESA) is being built at the Institute for Nuclear Physics in Mainz. At MESA the P2 experiment is planned for a precision measurement of the weak mixing angle. The upcoming measurement of MESA-P2 will be one of the most challenging and most precise experiments of a parity violating asymmetry in electron scattering of order $20{\cdot}10^{-9}$ with a relative uncertainty of $\frac{\Delta A^{PV}}{A^{PV}} \approx 2.41\%$.

The Cherenkov ring detector consist of fused silica bars equipped with photomultiplier tubes with high quantum efficiency. The challenge is to control the integrating detector signal chain and all sources of electronics noise within the whole experimental P2 set-up. The first prototype is developed and first tests at the MAMI accelerator were performed. This allows for a determination of the weak mixing angle with an accuracy of 0.15% and a test for new physics up to a mass scale of 49 TeV.

HK 51.35 Thu 16:30 Zelt

Precision Stabilization of KATRIN's Retarding Potential — •Caroline Rodenbeck[1], Julius Hartmann[3], Thomas Thümmler[2], and Sascha Wüstling[3] for the KATRIN-Collaboration — [1]Institut für Kernphysik, WWU Münster — [2]IKP, Karlsruher Institut für Technologie — [3]IPE, Karlsruher Institut für Technologie

The Karlsruhe Tritium Neutrino (KATRIN) experiment aims to determine the neutrino mass by measuring the tritium beta spectrum using a MAC-E filter type spectrometer. The spectrometer's energy defining retarding voltage needs to be stable within 60 mV for KATRIN to reach its sensitivity target of $0.2\,\mathrm{eV/c^2}$ (90% C.L.). This translates to a stability requirement of 3 ppm for the high voltage system creating the retarding potential of $-18.6\,\mathrm{kV}$ inside the spectrometer.

KATRIN's high voltage system meets these stability requirements on a wide range of time scales ranging from several months down to $1\,\mu$s (1 MHz). Dedicated calibration methods ensure a long-term stability of the precision high voltage dividers, measuring the retarding potential. A stabilization on shorter time scales is ensured by a custom-built post regulation system. With a new feedback loop between one of the precision high voltage dividers and the post regulation a sub-ppm stabilization of the retarding potential for longer than 30 hours is achieved.

The poster will give an overview of KATRIN's high voltage system with a focus on the post regulation and its perfomance during the recent KATRIN neutrino mass runs. This project is supported by BMBF under contract number 05A17PM3.

HK 51.36 Thu 16:30 Zelt

Prototype of the Detector Control System for the mSTS/mCBM experiment — •Marcel Bajdel for the CBM-Collaboration — Goethe University Frankfurt am Main

One of the major steps towards completion of the STS (Silicon Tracking System) construction in the CBM (Compressed Baryonic Matter) experiment at FAIR is the mCBM (mini-CBM) experiment which is considered as a FAIR Phase-0 activity. The mCBM experiment aims to test and optimize the performance of the detector subsystems including the software and hardware aspects. The Detector Control System (DCS) is a crucial part of the whole system which enables the supervision over a large range of devices and observables including high voltage, low voltage power supplies, cooling thermostats and environment sensors. Moreover, the DCS allows for error and alarm recognition and handling, as well as archives operational parameters of the detector. To realize this task many advanced solutions are being used including EPICS (Experimental Physics and Industrial Control System), Control System Studio and Docker. An overview on the prototype of the detector control system for mSTS detector, which will be scaled upfor the STS detector, will be presented.

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Evaluation and test of the CBM-TRD readout-ASIC at the DESY testbeam facility. — •Dennis Spicker for the CBM-Collaboration — Institut für Kernphysik Frankfurt, Goethe-Uni-Frankfurt, Max-von-Laue-Straße 1, 60438 Frankfurt

At the future Facility for Antiproton and Ion Research (FAIR) the Compressed Baryonic Matter experiment (CBM) is supposed to measure particles from heavy-ion collisions at very high interaction rates. For this purpose, the data acquisition will run in a free-streaming mode without an hierarchical trigger system. For the Transition Radiation Detector (TRD), which will provide tracking and particle identification information, the readout system is based on the Self-triggered Pulse Amplification and Digitization ASIC (SPADIC). It features a charge-sensitive Amplifier, a continuously sampling ADC, a programmable digital filter and a hit detection logic. The latest version is SPADIC 2.2, which was submitted in early 2019. It introduces new switchable features such as a low-gain mode, an additional shaping order and digital baseline tracking.

In August 2019, test measurements were performed at the Deutsches Elektronen-Synchrotron (DESY) with two TRD readout-chambers, equipped with SPADIC 2.2 ASICs, mounted on prototype single-chip front-end boards. In an electron beam with a momentum of 1 to 4 GeV/c, among other measurements also the new features of the SPADIC have been tested and results will be presented in this contribution. Supported by the German BMBF-grants 05P15RFFC1 and 05P19RFFC1.