HK 23: Poster

Time: Tuesday 17:30–19:00 Location: Foyer Physik

HK 23.1 Tue 17:30 Foyer Physik

The effects of gamma irradiation on some properties of CR-39 detectors — •Kahalil Thabayneh[1] and Marwa Shoeib[2] for the PANDA-Collaboration — [1]Hebron University, Hebron, Palestinian Occupied Territories — [2]Hebron University, Hebron, Palestinian Occupied Territories

In this study, the bulk etch rate, bulk activation energy, track density, and the degree of crystallinity percentage were analyzed for CR-39 samples irradiated with γ-rays from a 60Co source at doses ranging from 0 to 200 kGy. After irradiation, the samples were exposed to zirconium sand to collect α-particle tracks. The samples were then etched in a 6.25 N NaOH solution for 4 hours at temperatures of 60, 65, 70, 75, and 80°C. The results showed that the bulk etch rate increased with higher γ- doses at all etching temperatures. Additionally, both the bulk activation energy and track density decreased as the γ-dose increased. The degree of crystallinity was also examined for both etched and unetched samples at various γ doses. The observed increase in bulk etch rate, alongside the decrease in both bulk activation energy and track density with rising γ- doses, is attributed to the degradation of the CR-39 polymeric material.

HK 23.2 Tue 17:30 Foyer Physik

Charge-changing cross sections of oxygen isotopes for biomedical applications — Daria Kostyleva[1] and •Alexander Vitantzakis[2] for the Super-FRS Experiment-Collaboration — [1]GSI Helmholtzzentrum für Schwerionenforschung GmbH, 64291 Darmstadt, Germany — [2]Goethe-Universität Frankfurt, 60323 Frankfurt am Main, Germany

Charge-changing cross-sections, σ_{cc}, are nuclear properties with significant importance in both basic research and applied physics. One practical application is hadron therapy, which relies on precise knowledge of σ_{cc} to ensure accurate depth-dose calculations. Specifically, Monte Carlo transport codes such as FLUKA and GEANT4 incorporate these properties of ions into their nuclear reaction models to optimize therapy planning. At GSI, σ_{cc} of oxygen isotopes have been studied as part of the BARB ERC grant. This project, titled Biomedical Applications of Radioactive ion Beams (BARB), aims to assess the technical feasibility and explore the potential advantages of using beams of positron-emitting carbon and oxygen isotopes for hadron therapy. A key goal of BARB was to perform the first in-vivo treatment with radioactive ion beams. In this context, beams of ^{15}O and ^{16}O isotopes at 370 MeV/u were produced using the FRS fragment separator. The σ_{cc} of these isotopes were measured in carbon, water, and polyethylene targets. This work presents the details of the experiment, the data analysis, and preliminary results.

This study was supported by the ERC Advanced Grant 883425 (BARB) to M. Durante.

HK 23.3 Tue 17:30 Foyer Physik

Exploring Few-Body Systems, Nucleon Structure, and More with MAGIX at MESA — •Sören Schlimme for the MAGIX-Collaboration — Institute for Nuclear Physics, Johannes Gutenberg University Mainz, Germany

The upcoming MAGIX experiment at the MESA accelerator combines a high-intensity electron beam with a windowless gas jet target and high-resolution magnetic spectrometers. This advanced setup enables a broad and innovative experimental program in nuclear, hadron, and particle physics at low energies.

The exceptionally clean experimental environment at MAGIX allows for precise investigations into hadron structure. A key focus is the measurement of proton electromagnetic form factors at low momentum transfers, aimed at addressing the proton charge radius puzzle. In nuclear physics, MAGIX will provide high-precision electron scattering data, particularly on few-body systems, which serve as stringent tests for nuclear dynamics models. These systems are ideal for benchmarking effective field theories at low energies, where theoretical predictions are most reliable. Furthermore, the low-density target allows the detection of nuclear recoil fragments in coincidence with scattered electrons, enabling detailed studies of exclusive reactions. This capability is also crucial for exploring reaction cross sections relevant to nuclear astrophysics, including time-reversed radiative capture reactions. In addition, MAGIX will also contribute to the search for dark matter by performing world-class searches for dark photons, investigating both visible and invisible decay modes.

HK 23.4 Tue 17:30 Foyer Physik

Lifetime measurements in ^{96}Zr using the Coincidence Doppler-Shift Attenuation Method — •Elias Binger, Anna Bohn, Sarah Prill, Tobias Langel, Michael Weinert, and Andreas Zilges — University of Cologne, Institute for Nuclear Physics, Germany

The Coincidence Doppler-Shift Attenuation Method (CDSAM) [1,2] is a technique for determining nuclear level lifetimes in the subpicosecond range. Using the SONIC@HORUS [3] setup at the University of Cologne, the Doppler-shifted γ rays can be detected in coincidence with the scattered beam particles, enabling background reduction, precise transition selection and feeding exclusion.

As part of a series of lifetime measurements in the mass region $A = 100$, a (p,p'γ) experiment was performed on ^{96}Zr. Through the analysis of the recorded data, the lifetimes of many excited states could be determined. The results of this experiment are presented in this contribution.

Supported by the DFG (ZI 510/9-2).

[1] A. Hennig *et al.*, Nucl. Instr. Meth. A **758**, 171 (2015).
[2] S. Prill *et al.*, Phys. Rev. C **105**, 034319 (2022).
[3] S. G. Pickstone *et al.*, Nucl. Instr. Meth. A **875**, 104 (2017).

HK 23.5 Tue 17:30 Foyer Physik

Lifetime measurements of ^{98}Ru using the Reverse Coincidence Doppler-Shift Attenuation Method — •Tobias Langel, Elias Binger, Anna Bohn, Sarah Prill, Michael Weinert, and Andreas Zilges — University of Cologne, Institute for Nuclear Physics, Germany

The Coincidence Doppler-Shift Attenuation Method (CDSAM) has been successfully used for many years at the University of Cologne to determine lifetimes of excited states in the sub-picosecond regime [1,2]. Inelastic scattering experiments are performed, where both the scattered projectile and the Doppler-shifted photon(s) are detected in coincidence at the SONIC@HORUS detector array [3] in Cologne. Due to the nature of coincident detection, a higher degree of background reduction as well as feeding exclusion can be achieved.
To improve this method for weak transitions, the new Reverse CDSAM approach has been developed in recent years. Among several other $A \approx 100$ isotopes, a (p,p$'\gamma$) experiment was performed on ^{98}Ru to determine a variety of lifetimes using both approaches of the CDSA Method. This contribution presents the experimental results and compares the two analysis approaches.
Supported by the DFG (ZI 510/9-2).

[1] A. Hennig *et al.*, Nucl. Instr. Meth. A **758**, 171 (2015).
[2] S. Prill *et al.*, Phys. Rev. C **105**, 034319 (2022).
[3] S. G. Pickstone *et al.*, Nucl. Instr. Meth. A **875**, 104 (2017).

HK 23.6 Tue 17:30 Foyer Physik

Amplitude Measurements with ALICE ITS3 MAPS Detectors — •Henrik Fribert, Berkin Ulukutlu, Roman Gernhäuser, and Laura Fabbietti for the ALICE Germany-Collaboration — TUM School of Natural Sciences, Technische Universität München, Munich, Germany

Monolithic Active Pixel Sensors (MAPS) are becoming increasingly important in future particle physics experiments due to their ease of integration, high spatial resolution, and low material budget. While MAPS have mostly been used for tracking where only binary hit information is stored, measuring signal amplitude could enable particle identification (PID) and enhance tracking capabilities. In this contribution, the feasibility of amplitude measurements using two promising techniques is assessed: time-encoded Time-over-Threshold (ToT), where pixels send a pulse at a signal's rising and falling edge to measure the ToT, and digital oversampling, which samples the signal multiple times above threshold. The methods were tested on two prototype sensors developed for the ALICE ITS3 upgrade: the Digital Pixel Test Structure chiplet (DPTS) and the larger babyMOSS sensor. Additionally, Geant4 simulations are carried out to assess the achievable PID performance of these methods in large-scale detectors. This research

was supported by the Excellence Cluster ORIGINS funded by the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) under Germany's Excellence Strategy EXC-2094390783311 and the DFG through the Grant SFB 1258 "Neutrinos and Dark Matter in Astro and Particle Physics".

HK 23.7 Tue 17:30 Foyer Physik

Investigation of the internal conversion lifetime of ^{229m}Th on various metallic surfaces — •Daniel Moritz, Georg Holthoff, Kevin Scharl, Tamila Teschler, Markus Wiesinger, and Peter G. Thirolf — Ludwig Maximilians Universität München

With its exceptionally low energy of about 8.4 eV, the first isomeric state of ^{229}Th, denoted ^{229m}Th, is in the focus of current research as the presently only suitable nuclear transition accessible with current laser technology to serve as basis for a nuclear clock. For neutral ^{229m}Th, its decay is dominated by internal conversion (IC). One of the isomer's properties still to be investigated is the dependence of the IC lifetime on the electronic environment as hinted at in [1]. This will now be evaluated systematically by neutralizing ^{229m}Th ions on various sputter-cleaned metallic surfaces with different work functions. This poster presents the current status of this experimental campaign at LMU.

This work has been supported by the ERC Synergy Grant "Thorium-NuclearClock" (Grant Agreement 856415).

[1] B. Seiferle, Diss. LMU (2019)

HK 23.8 Tue 17:30 Foyer Physik

Lifetime measurements of excited states in ^{101}Pd — •Sven Wagner, Maximilian Droste, Peter Reiter, Casper-David Lakenbrink, Christoph Fransen, and Franziskus von Spee — Institut für Kernphysik, Universität zu Köln

The ^{101}Pd nucleus is located four protons and five neutrons away from the double-shell closure at ^{100}Sn. Nuclei in this part of the Segrè chart have historically been considered prototypical examples of vibrational nuclei, exhibiting characteristic level schemes in their first excited states. Lifetimes and transition strength values of excited states in ^{101}Pd are scarcely known, and independently evaluated results for the first excited state are contradictory [1,2]. A precise lifetime measurement, serving as a complementary method for determining reduced transition strengths in ^{101}Pd, was performed at the FN Tandem accelerator of the IKP Cologne using the Recoil-Distance Doppler-Shift (RDDS) technique. The excited states of ^{101}Pd were populated via the fusion-evaporation reaction ^{92}Zr(^{12}C,3n)^{101}Pd at a beam energy of 50 MeV. First lifetime values obtained from this study will be presented, providing new insights into the nuclear structure of ^{101}Pd.

[1] D. Ivanova et al., Phys. Rev. C. 105, 034337 (2022)
[2] M. Droste et al., Phys. Rev. C. 106, 024329 (2022)

HK 23.9 Tue 17:30 Foyer Physik

Automated Signal-to-Noise Ratio Optimizations for the ToASt-based Silicon-Strip-Detectors of the PANDA MVD — •Raphael Ratz[1], Kai-Thomas Brinkmann[1], Marvin Peter[1], Nils Tröll[1], Hans-Georg Zaunick[1], Giovanni Mazza[2], Michele Caselle[3], and Daniela Calvo[2] for the PANDA-Collaboration — [1]Justus Liebig University Gießen, Gießen, Germany — [2]Istituo Nazionale di Fisica Nucleare - Sezione di Torino, Turin, Italy — [3]Karlsruhe Institute of Technology, Karlsruhe, Germany

The silicon strip detectors as part of the Micro Vertex Detector of the PANDA experiment are read out by the ToASt ASIC and have a multitude of parameters for the correct execution of Time-over-Threshold (ToT) measurements. Some of these parameters severely affect the noise and the signal, making a calibration for optimal settings necessary.

This contribution presents a system for the automated optimization procedures of a selected set of parameters regarding the Signal-to-Noise Ratio (SNR) using the integrated test pulser of the ToASt chip. The parameters considered were measured pairwise to retrieve the SNR for all available register combinations. With this data, the correlation between different parameters, the behavior of different channels, and the stability and reproducibility of this approach can be investigated.

Lastly, a different approach for measuring the noise, using an S-curve scan, is considered. This is achieved by counting the amount of measured pulses from a set quantity of applied pulses, depending on the test pulser amplitude. *Supported by BMBF.*

HK 23.10 Tue 17:30 Foyer Physik

Simulation Studies with the digital calorimeter EPICAL-2. — •Jan Schöngarth — Institut für Kernphysik Frankfurt, Goethe-Universität Frankfurt

The EPICAL-2 detector has been designed and constructed within the endeavour to develop a novel electromagnetic calorimeter based on a SiW sampling design using silicon pixel sensors with binary readout. The R\&D is performed in the context of the proposed Forward Calorimeter upgrade within the CERN-ALICE experiment and is strongly related to proton CT imaging studies as well as applicable to future collider projects.\par EPICAL-2 consists of alternating W absorber and Si sensor layers employing the ALPIDE sensor developed for the ALICE-ITS upgrade. EPICAL-2 has been successfully tested with cosmic muons as well as in test-beam campaigns at DESY and CERN-SPS. Monte Carlo simulations have been performed using Allpix$\^2$, a generic simulation framework for semiconductor detectors.\par In this poster, the performance of EPICAL-2 in simulation, using different energy proxies, i.e. the number of pixel hits, clusters or charged shower particles per event, is presented. Additionally, the measured particle composition of the CERN-SPS test-beam is presented.\par Supported by BMBF and the Helmholtz Association.

HK 23.11 Tue 17:30 Foyer Physik

The MAGIX spectrometer setup — •David Markus for the MAGIX-Collaboration — Institute for Nuclear Physics, Johannes Gutenberg University Mainz, Germany

The **MA**inz **G**as **I**njection Target E**X**periment has initiated the installation of its advanced spectrometers. In conjunction with with the **M**ainz **E**nergy-Recovering **S**uperconducting **A**ccelerator, MAGIX will perform electron scattering measurements on different gases ranging from hydrogen over helium to argon using an internal gas jet target. With a design luminosity reaching 10^{35} cm^{-2} s^{-1} at beam energies of up to 105 MeV, MAGIX is capable of providing valuable insights into a number of different areas of physics ranging from the S-factor of the alpha capture of carbon-12 to the electromagnetic form factors of the proton.

The scattered electrons will be measured with two identical high resolution magnetic spectrometers, each equipped with a Time Projection Chamber placed around their focal plane and plastic scintillators underneath to serve as a trigger veto system. The complete MAGIX setup, from the internal gas jet target in its scattering chamber over the spectrometers to the TPC, is designed to maximally reduce the material budget and therefore limit multiple scattering. This poster presents an overview of the components of MAGIX and how they will work together to achieve the proposed physics program.

HK 23.12 Tue 17:30 Foyer Physik

Accelerating Femtoscopic Studies with Machine Learning for Source Function Modeling — •Carla Zeyn — Technische Universitaet Muenchen

Femtoscopy probes the strong interaction between hadrons via two-particle correlation functions. The ALICE collaboration has recently measured these functions with unprecedented precision, including those involving strange (Λ, Ξ, Ω) and charm ($D^{\pm}$) quarks. Extracting the final-state interactions requires solving the Schrödinger equation, with the accurate modeling of the source function—describing particles' relative emission distances—posing a key challenge. Advanced models like CECA (Common Emission in CATS) improve our understanding of emission processes but are computationally intensive, limiting simultaneous fits. For the first time, we propose leveraging machine learning (ML) to model the source. The ML model will emulate CECA, providing fast, accurate source modeling and efficient computation of correlation functions, by significantly expediting the analysis of correlation data.

HK 23.13 Tue 17:30 Foyer Physik

Study of rescattering effects in 3π final states with application to CP violation — •Athanasios Kotarelas, Miriam Penners, Dominik Stamen, and Bastian Kubis — Helmholtz-Institut für Strahlen- und Kernphysik (HISKP), 53115 Bonn, Germany

CP violation in the Standard Model is known to originate from phases in the CKM matrix. When hadronic decays are considered, the amount of CP violation is determined by the interplay of these weak phases with the phases of the strong final-state interactions. So far, a com-

monly used approach to study these interactions is the so-called isobar model, where one of the decay products is assumed to be a spectator and the interactions of the other two are described by resonances. In this poster, we present an improved formalism which employs phase shifts directly, making use of the Omnès formalism, and attempt to include cross-channel effects as well, using the framework of Khuri-Treiman (KT) equations that is well established for low-energy decay processes such as the three-pion decays of kaons, eta, omega, or phi."

HK 23.14 Tue 17:30 Foyer Physik

SONIC@HORUS - A setup for particle-gamma-coincidence measurements at the Cologne Tandem accelerator — •Henrik Boras, Elias Binger, Anna Bohn, Tobias Langel, Markus Müllenmeister, Sarah Prill, Michael Weinert, and Andreas Zilges — University of Cologne, Institute for Nuclear Physics, Cologne, Germany

SONIC [1] is a particle spectrometer used for various experiments at the 10 MV FN-Tandem accelerator at the University of Cologne. In its latest version SONIC is equipped with 12 silicon detectors that can be employed as stand-alone units or in a ΔE-E telescope configuration for particle identification, providing a total solid angle coverage of 9%. Coupled with the HORUS [2] γ-ray spectrometer, SONIC facilitates particle-γ coincidence measurements, allowing detailed investigations of inelastic scattering and transfer reactions across a wide range of nuclear masses. This contribution will outline the features of the SONIC spectrometer and highlight recent experimental campaigns. Supported by the DFG (ZI 510/10-1).

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

HK 23.15 Tue 17:30 Foyer Physik

ALPACA: A novel setup for enhanced angular and particle coincidence measurements — •Leonardo Berisha, Christian Diefenbach, Markus Müllenmeister, Michael Weinert, and Andreas Zilges — University of Cologne, Institute for Nuclear Physics, Germany

The ALPACA (Array for anguLar PArticle Coincidence Analysis) setup, developed at the University of Cologne, enhances the study of nuclear reactions by offering precise angular and particle coincidence measurements [1]. This setup, designed to operate alongside the 10 MV FN Tandem accelerator, complements the existing SONIC@HORUS setup [2,3]. Twelve silicon ($\Delta E-E$) telescopes, mounted on a rotatable plate, provide flexible angular coverage, while a high-resolution HPGe detector in the chamber lid allows for accurate γ-ray measurements. The chamber is equipped with a height-adjustable target ladder. The modular design of the detector mounts, featuring 3D-printed sleds and adjustable rails, ensures precise positioning of the detectors and ease of modification for future experiments. In this contribution, ALPACA and first commissioning experiments will be presented.

[1] G. Huppelsberg, Master's thesis (2024), University of Cologne
[2] S. G. Pickstone *et al.*, Nucl. Instr. and Meth. A **875** (2017) 104
[3] L. Netterdon *et al.*, Nucl. Instr. and Meth. A **754** (2014) 94

HK 23.16 Tue 17:30 Foyer Physik

Verifying the NeuLAND Calibration Algorithm via the Simulation of the Cosmic Radiation. — •Paula Ulrich, Yanzhao Wang, and Andreas Zilges — Department of Physics, University of Cologne, Germany

The goal of this work is to validate the calibration algorithms using an existing simulation of the NeuLAND detector, which is composed of several scintillators and PMTs. The data acquisition system provides data at different levels from the detection of particle interactions inside the detector. The calibration aims to convert the data into physical values that can be used for further analysis. In this Poster the results of validation will be presented based on calibrating the simulated data of the cosmic radiation.

HK 23.17 Tue 17:30 Foyer Physik

Assessing Ge-Detector Efficiency in Cylindrical Geometries Using GEANT4: Correlation with Radioactive Surface Standard Measurements — •Diandra Richter, Jonny Birkhan, and Norbert Pietralla — IKP, Darmstadt, Germany

Clearence measurements for radiation protection purposes are often done by γ-spectrometric analysis of volumetric environmental samples. This requires calibration of the detection efficiency of the measurement setup using appropriate calibration sources. These sources are generally prepared through the so-called spiking method, in which material is impregnated with a multi-element solution. This method is time-consuming and expensive. An alternative calibration method involves the preparation of a surface standard, made from a circular filter paper sandwiched between two foils [1]. This standard is typically used to estimate the efficiencies for filled Petri dishes, accounting for sample attenuation. Measurements are conducted with the foil placed either between the detector and the sample or directly on the sample. This foil method provides results that are compatible with the spiking method, but its application is limited to flat samples, like for example Petri dishes. In this study, GEANT4 simulations were used to investigate how many stacked Petri dishes can still produce sufficiently accurate results with the foil method compared to the spiking method. Clearence measurements would be simplified, because more material could be measured with the foil method simultaneously. [1] Vahlbruch, Jan-Willem: Dissertation, Uni Hannover, 2004.

HK 23.18 Tue 17:30 Foyer Physik

Lifetime measurements of excited states in ^{99}Pd using the recoil-distance Doppler-shift method — •Ramona Burggraf, Peter Reiter, Andrey Blazhev, Maximilian Droste, Arwin Esmaylzadeh, Christoph Fransen, Jan Jolie, Hannah Kleis, Casper-David Lakenbrink, Mario Ley, Franziskus Spee, and Michael Weinert — IKP, Universität zu Köln, Germany

Lifetime studies in Pd isotopes have been performed to test the nuclear structure of transitional nuclei south-east of doubly-magic ^{100}Sn. Nuclei in this region of the nuclear chart have been considered prototypical examples of vibrational nuclei. Recent lifetime measurements have caused doubt about this behaviour for even-even Pd isotopes (e.g. [1]). Information on lifetimes are surprisingly scarce in odd-mass Pd isotopes. The first excited state of ^{99}Pd has been investigated by Ivanova et al. [2], but no lifetimes of higher-lying states are available. Precise lifetime values for excited nuclear states were determined in ^{99}Pd, which was populated in a ^{90}Zr(^{12}C, $3n$) fusion-evaporation reaction at a beam energy of 55 MeV at Cologne. The Cologne plunger device was employed, surrounded by the recently commissioned Cologne CATHEDRAL spectrometer, an efficient detector array consisting of 24 HPGe and eight LaBr detectors. The recoil-distance Doppler-shift method was employed and γ-γ coincidence data were analyzed using the differential decay-curve method in order to determine lifetime values. New lifetime results of excited states in ^{99}Pd will be presented.

[1] M. Droste et al., Phys. Rev. C 106, 024329 (2022)
[2] D. Ivanova et al., Phys Rev. C 105, 034337 (2022)

HK 23.19 Tue 17:30 Foyer Physik

Cooling studies for the ALICE3 Outer Tracker barrel layers — •Lena Kirchner for the ALICE Germany-Collaboration — Technische Universität München, Munich, Germany

The ALICE3 upgrade will feature a new Outer Tracker (OT) detector system based on Monolithic Active Pixel Sensor (MAPS) technology. Four cylindrical layers will form the OT barrel with the support structure segmented into staves similar to the current ALICE Inner Tracking System (ITS2) but significantly scaled up. An effective thermal management is critical to ensure the performance and longevity of this large area silicon detector.

We present a cooling strategy being developed for the OT barrel and experimental investigations to optimize the air cooling system, which is the basis for a modular system that allows for industrial scalability and a cost effective implementation. With a full scale demonstrator setup we can directly compare our measurements to simulations and extrapolate to the final implementation of the OT.

This research was supported by the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) under Germany's Excellence Strategy EXC-2094-390783311 and the Bundesministerium für Bildung und Forschung, BMBF-05P24WO4 ALICE.

HK 23.20 Tue 17:30 Foyer Physik

Direct-Photon-Jet Correlations in Pythia Simulations for ALICE — •Julius Kinner — Universität Münster, Germany

Ultrarelativistic collisions of protons and heavy ions are measured with ALICE, which for instance allows the study of quantum chromodynamics and the quark-gluon plasma (QGP). Two interesting observables are jets, collimated hadrons created from the outgoing partons of a hard scattering, and direct photons, which do not stem from particle decays and transverse the QGP unchanged after their production, not interacting via the strong force.

Correlations between jets and photons can be studied with two-particle correlations by collecting the difference $\Delta\varphi$ and $\Delta\eta$ between trigger and associated particles in a correlation function. Hard-charged triggers can be used as a proxy for jets and photons can be used as associated particles. This is done as a phenomenological study with Pythia simulations for pp collisions at $\sqrt{s} = 13\,\text{TeV}$, focusing on photons of different origins. Namely, the decays of π^0, η, and ω into photons are considered, and correlation functions of these associated hadrons are converted to those of their decay photons. All this is done in the context of a possible measurement of direct photons with a subtraction method. Furthermore, a comparison between two parton-shower models in Pythia (Simple and Vincia) is made. The current state of the analysis using experimental data from ALICE will also be shown.

HK 23.21 Tue 17:30 Foyer Physik

Investigating anisotropic flow in Run 3 Pb-Pb collisions at ALICE — •Luca Italiano for the ALICE Germany-Collaboration — Technical University of Munich, Munich, Germany

In heavy ion collisions, the generation of final-state particle spectra is influenced by the collective expansion of the system in the quark-gluon plasma (QGP) phase, in addition to other non-collective effects. This collectivity is quantified experimentally by determining the v_n harmonics from the Fourier decomposition of the azimuthal spectra. Monte Carlo simulations can also supplement the analysis by providing insights to the initial geometry of the collision events. In this study, observables sensitive to collective anisotropic flow are extracted for Run 3 Pb-Pb collision data, with a focus on how these values are related to the detector occupancy and interaction rates.

HK 23.22 Tue 17:30 Foyer Physik

GEM production and quality assurance at the FTD in Bonn — •Shania Müller[1], Tim Schüttler[1,2], Markus Ball[1,2], Yevgen Bilevych[2], Philip Hauer[1,2], Dimitri Schaab[2], and Bernhard Ketzer[1,2] — [1]Helmholtz-Institut für Strahlen- und Kernphysik, Universität Bonn — [2]Forschungs- und Technologiezentrum Detektorphysik, Universität Bonn

Gas Electron Multipliers (GEMs) are commonly used for amplification in modern gaseous detectors. A GEM consists of a 50 μm thick polyimide foil coated with copper layers of 5 μm on both sides in which microscopic holes are etched using photolithographic techniques.
A reliable process for producing standard 10×10 cm^2 GEM foils was recently established at the Research and Technology Center Detector Physics (FTD) at Bonn University. The production process was developed in close cooperation with the CERN EP-DT-MPT group.
For the procedure the laboratories at the FTD offer wet benches, a dry film laminator and UV exposition machines. The processing infrastructure is hosted exclusively in clean rooms of classes ISO5-7.
With the equipment and the new procedure, it was possible to successfully produce several standard GEM foils and classify them using an established quality assurance procedure. Furthermore, the completed GEMs were installed in a test detector for a first series of measurements to investigate their properties. In this poster I will give an overview of the GEM production process and present the results of both the QA and test detector measurements.
Supported by BMBF.

HK 23.23 Tue 17:30 Foyer Physik

Hypertriton three-body decay reconstruction with ALICE at the LHC — •Carolina Reetz for the ALICE Germany-Collaboration — Physikalisches Institut Universität Heidelberg

Among the thousands of particles produced in high energy heavy-ion collisions at the LHC, light (anti-)hypernuclei are of special interest. Studying their internal structure provides a unique opportunity to probe the strong interaction between hyperons and nucleons. The lightest known (anti-)hypernucleus, the (anti-)hypertriton, is a bound state of a proton, a neutron, and a Λ hyperon. A precise measurement of its three-body decay into a proton, a pion, and a Λ hyperon gives insight into its internal structure and, particularly in small collision systems, allows to discriminate between different production models for (anti-)hypernuclei.

For a precise decay reconstruction and an effective background suppression, the novel strangeness tracking technique can be employed. It makes use of the upgraded silicon tracker (ITS2) of the ALICE detector in LHC Run 3, allowing to directly track (anti-)hypernuclei and weakly decaying charged strange hadrons in the silicon layers closest to the beam pipe prior to their decay.

This contribution presents the hypertriton three-body decay reconstruction performance with the upgraded ALICE detector in Run 3 proton-proton collisions.

HK 23.24 Tue 17:30 Foyer Physik

Exploring the particle emission source in proton-proton collisions via collective expansion — •Sebastian Wind — Technische Universität München

While the formation of Quark-Gluon Plasma (QGP) and associated collective behavior are well-established in heavy-ion collisions, their existence in proton- proton (pp) collisions remains unknown. Recent femtoscopic measurements have revealed signatures typically associated with collective behavior in pp collisions, challenging our understanding of small system collisions.

In this research, we investigate the mT scaling behavior via collective expansion using the analytically solvable hydrodynamical Gubser solution. By comparing our predictions to ALICE collaboration data and contrasting them with non-hydrodynamical model calculations, we try to understand whether the observed mT scaling behaviour can be related to the collective expansion. This work provides insights into potential QGP formation in small system collisions and the applicability of hydrodynamics in describing pp collisions. In particular it helps to bridge the gap between our understanding of heavy-ion and proton-proton collisions

HK 23.25 Tue 17:30 Foyer Physik

Investigation of strange dibaryons in the weak non-leptonic decay topologies with ALICE — •Zhanna Khuranova for the ALICE Germany-Collaboration — Institut für Kernphysik, Goethe Universität Frankfurt

Searches for exotica is currently a very active field at the LHC. LHCb has for instance discovered the pentaquark candidates $P_c(4312)^+$, $P_c(4380)^+$, $P_c(4450)^+$ and the tetraquark state T_{cc}^+. They all contain at least one charm quark. We are searching for strange exotics in high-energy nuclear collisions that should be produced abundantly at the LHC. These searches within the ALICE Collaboration include currently pentaquarks and dibaryons. The presented investigation focuses on the decay mode of $(\Xi^0\text{p})_b$ into Λp. Whereas, the reconstruction is utilizing topological and kinematical selections. The analysis is currently performed in Run 2 data and will be conducted in Run 3 data in the next step. The main motivation for this particular search is connected to the H-dibaryon ($uuddss$), which was investigated in ALICE at the LHC and is expected to lie close to the Ξp threshold. The production from a formed QGP, well described within the thermal model, should admit an observation of such exotic states.

HK 23.26 Tue 17:30 Foyer Physik

Recomission of a conversion electron spectrometer with stacked Si pad detectors — •Matthias Kilb, Han-Bum Rhee, Steffen Meyer, Ilja Homm, and Thorsten Kröll — TU Darmstadt, Darmstadt, Germany

De-excitation of an excited nucleus can occur in several ways. In competition with the emission of a gamma ray, the excitation energy can also be transferred directly to a close electron, which is then emitted. In order to be able to measure such transitions, a conversion electron spectrometer is used, which uses a magnetic transport and filter system, called Mini-Orange (MO), as a central unit [1]. The MO consists of 6 wedge-shaped permanent magnets symmetrically arranged around a lead absorber with a copper cap. The resulting magnetic field makes it possible to focus electrons of a specific energy range from a wider solid angle onto a comparatively small area and to suppress interfering factors. The setup offers the possibilty to vary the distances between source, MO and detector, allowing to maximize the transmission of different electron energies.

Due to the damage of the Si(Li) detectors used previously, which were several millimeters thick, the concept of two stacked 1mm and 1.5mm thick Si pad detectors, which are easier to handle, is now being investigated. The data is read out using a digital DAQ. The results of a measurement with a ^{207}Bi source and the transmission curve for electrons of approximately 975 keV of the MO are presented.

[1] D. Gassmann, Dissertation, LMU München, 2003

HK 23.27 Tue 17:30 Foyer Physik

Neural network approach for energy estimation of the digital calorimeter EPICAL-2. — •Jan Scharf — Institut für Kernphysik, Goethe Universität Frankfurt, Frankfurt am Main, Deutschland

The EPICAL-2 prototype has been designed and constructed to study a concept of electromagnetic digital pixel calorimeters. The detector is based on a SiW sampling design using 24 layers, each composed of a W absorber and two ALPIDE chips featuring $\sim 30 \times 30\ \mu m^2$ sized pixels. This results in a high spatial resolution of the detector, making it possible to measure three-dimensional shapes of electromagnetic showers. To estimate the energy of a particle depositing energy in the detector, pixel hits or clusters of pixel hits can be counted as a proxy. The energy resolution of the detector is thereby affected by the energy estimation capability of the proxy used.

In this poster, we present the current status of an effort to employ neural networks to estimate the energy of single initial particles from the three-dimensional pattern of hits or clusters that they generate in the detector. Features and patterns in data used to train the neural network, the network's architecture and its design will be discussed. The energy estimate and effect of the new approach on the energy resolution of the detector for simulated data will be presented. Finally, the potential of neural networks for fast and efficient simulations of electromagnetic showers in digital calorimeters will be addressed.

Supported by BMBF and the Helmholtz Association.

HK 23.28 Tue 17:30 Foyer Physik

Measurement of the particle emitting source in pp collisions at 13.6 TeV using p-Λ correlations with ALICE — •Jaime Gonzalez for the ALICE Germany-Collaboration — Technical University of Munich, Germany

The femtoscopic technique allows the study of the hyperon-nucleon interaction with much lower relative momenta and higher precision compared to conventional scattering experiments. Throughout the years it has helped understand the interaction of stranger and unstable hadrons in greater detail, with the goal of shedding some light on the equation of state (EoS) of neutron stars. This was in previous studies during the Run 2 period of the LHC at the ALICE experiment done by modeling the particle-emitting source which was found to share a common transverse mass mT dependence for all hadron-hadron systems. The latest Run 3 of the LHC has provided a much larger minimum bias data set of pp collisions and for the first time allows the introduction of an event multiplicity dependence of the mT dependent source. This contribution showcases the multiplicity dependent mT scaling of p-Λ pairs in small collision systems, whose interaction is modeled using the state-of-the-art χEFT calculations and its prospect is to help understand the EoS of neutron stars. Furthermore, these results complement similar source size measurements using p-p pairs and overall aim to build the foundation for future femtoscopic studies with ALICE in Run 3.

HK 23.29 Tue 17:30 Foyer Physik

HI-TREX: Compact, high resolution particle detection system for ISOLDE — Roman Gernhäuser, •Sergei Golenev, and Robert Neagu for the MINIBALL collaboration — Technische Universität München, Germany

HI-TREX is an advanced particle detection system designed for the HIE-ISOLDE facility at CERN, optimized for studying transfer reactions with radioactive ion beams. The system features thin double-sided silicon strip detectors (DSSSD), high-resolution front-end electronics based on SKIROC ASICs, and a custom FPGA-based readout board integrated into the fiber-based TRB data acquisition system.
Detector performance was evaluated in a successful system test in Delft with low-energy particles from the ^{6}Li(n,α)^{3}H reaction. The series production of detectors has already started, and we will present the first data, highlighting its enhanced capabilities and potential to enable advanced research opportunities.
(supported by BMBF 05P21WOCI1)

HK 23.30 Tue 17:30 Foyer Physik

New PIXE in-air setup at the 10 MV FN-Tandem accelerator — •Ilias Alexandridis, Markus Schiffer, and Dennis Mücher — Institute for Nuclear Physics, University of Cologne, Germany

In order to determine the material composition of geological and archaeological samples studied by different groups at the University of Cologne, a PIXE in-air setup will be installed at the FN-Tandem accelerator of the Institute of Nuclear Physics. Here, the X-rays induced by irradiation with ionized particles are measured using an SDD(Silicone-Drift-Detector) detector. Conclusions can be drawn about the atomic components of the sample from the characteristic x-rays present in the spectrum. As a non-destructive measurement method, PIXE is particularly suitable for the intended samples. The measurement in air also allows for a large number of potential samples to be measured while minimizing the amount of beamtime being spend. In this contribution we will present the new setup and first measurements of elementary metal samples.

HK 23.31 Tue 17:30 Foyer Physik

A simulation-based feasibility study of the measurement of K_L^0 in ALICE — •Laura Gans-Bartl for the ALICE Germany-Collaboration — Institut für Kernphysik, Goethe-Universität Frankfurt

The ALICE experiment is designed to study the characteristics of hot and dense nuclear matter created in heavy-ion collisions. The measurement of a large variety of identified particles can help to better understand the underlying physics processes at play, while particle production in proton proton (pp) collisions serves as a baseline for these measurements. Charged pions, for example, can be measured with the main tracking detectors of the experiment, while neutral pions can be reconstructed from decay photons measured with electromagnetic calorimeters. The production of one of the eigenstates of the neutral Kaon, K_S^0, has already been measured in pp collisions by the ALICE collaboration[1]. The K_L^0 has not been measured so far, as the measurement is more challenging due to the long flight time of the K_L^0.
In this contribution, a simulation-based feasibility study of $K_L^0 \rightarrow \pi^+\pi^-\pi^0, \pi^0 \rightarrow \gamma\gamma$ in pp collisions with ALICE is presented. Based on a PYTHIA simulation, the impact of the efficiency and acceptance of the ALICE experiment on the measurement probability of K_L^0 is studied. An estimate of the K_L^0 yield with ALICE Run2 statistics is discussed.
Supported by BMBF and the Helmholtz Association.
[1] e.g. *Eur. Phys. J. C 81 (2021) 256*

HK 23.32 Tue 17:30 Foyer Physik

Analysis of the Composition of the Beam from a Penning Ion Source at COALA — •Daniela Tandara, Kristian König, Imke Lopp, and Wilfried Nörtershäuser — IKP, Darmstadt, Germany

High-resolution collinear laser spectroscopy enables precise measurements of nuclear quantities such as the charge radius and magnetic moments through observations of isotopic shifts and hyperfine splittings. The preparation of ion beams with low energy spread is critical for such studies as it contributes to the observed linewidth. Therefore, Penning ionization gauge (PIG) sources are a viable choice for generating ions, particularly from metals. In line with the successful deployment of a comparable source at the BECOLA facility at the Facility for Rare Isotope Beams (FRIB) for the purpose of iron ionisation, a PIG source was constructed for the COALA setup at TU Darmstadt. In this work, first studies on stable Fe^+ were performed to investigate suitable optical transitions for measurements on short-lived isotopes at FRIB. A velocity filter was installed downstream of the source in order to separate ion species by their mass-to-charge ratio and identify the produced ions. Initial measurements identified a significant fraction of Fe^+ among other ionized species, with Fe^+ intensities exceeding expectations from prior literature. These results were corroborated by time-of-flight mass spectroscopy. Laser spectroscopy in $^{54,56}Fe^+$ was performed using the $3d^64s\,{}^6D_{9/2} \rightarrow 3d^6p\,{}^6D^o_{9/2}$ transition at 259.94 nm, demonstrating the suitability of measurements in the Fe^+ ion for future measurements at online facilities. This project is supported by the German Research Foundation (Project-ID: 279384907 - SFB 1245).

HK 23.33 Tue 17:30 Foyer Physik

Triples extension to Bogoliubov Coupled Cluster theory — •Urban Vernik[1,2], Pepijn Demol[4], Alexander Tichai[1,2,3], and Thomas Duguet[5] — [1]Technische Universität Darmstadt, Department of Physics — [2]ExtreMe Matter Institute EMMI, GSI Helmholtzzentrum für Schwerionenforschung GmbH — [3]Max-Planck Institut für Kernphysik, Heidelberg — [4]KU Leuven, Instituut voor Kern- en Stralingsfysica — [5]IRFU, CEA, Université Paris-Saclay

The field of ab initio many-body nuclear physics is advancing steadily, enabling the description of heavier and more exotic nuclei. A key factor is the improved understanding of symmetry breaking in singly open-shell nuclei, which inspired new many-body methods like the Bogoliubov coupled-cluster (BCC). BCC leverages U(1) global gauge symmetry breaking to calculate semi-magic isotopic chains.

BCC calculations are defined by truncation of the cluster operator. Previous implementations were limited to singles and doubles (BCCSD). This work extends the method to include triple excitations, developing BCCSDT. While full self-consistent triples remain compu-

tationally prohibitive, approximate non-iterative corrections systematically account for their effects on nuclear observables.

These approximations are implemented in large model spaces for realistic calculations. Applications to the oxygen and calcium isotopic chains demonstrate improved binding energy accuracy. Including triples in BCC thus represents a step forward, offering enhanced predictive power for nuclear observables in semi-magic nuclei.

*Funded by LOEWE Top Professorship

HK 23.34 Tue 17:30 Foyer Physik

Upgrade of a general-purpose data logging system for detector laboratories — •Benedikt Ferdinand Peter, Philip Hauer, and Bernhard Ketzer — Helmholtz-Institut für Strahlen- und Kernphysik, Universität Bonn

Measurements in laboratories are often prone to variations of environmental conditions such as changes in temperature T, pressure p and humidity H. Therefore, it is indispensable to measure and log these parameters as precisely and reliably as possible.

This is especially important for gaseous detectors, where variations in T and p are known to strongly affect the gas gain. In order to monitor environmental conditions as well as the properties of the detector gases, we have developed a data logger that can be placed in the vicinity of the experiment, inside the gas system or inside the detector to directly measure T, p and H of the active medium during the experiments.

The logger employs different sensors that are connected to a microcontroller which has a built-in WiFi chip. This connects to a local wireless network that is created by a Raspberry Pi. Via the MQTT protocol, the recorded data is sent to the Raspberry Pi, which forwards the data to a database for long-term storage.

The second iteration of these devices first includes a translation of the source code from C to Python, for the purpose of better readability and maintenance. The DHT22 sensor was replaced by the BME280 due to its better resolution and ease of implementation. Secondly, a PCB was designed to plug into the gas tubing.

HK 23.35 Tue 17:30 Foyer Physik

Proton Emission in Ag+Ag Collisions at 1.23 *A*GeV measured at HADES — •Elisabeth van Engelen for the HADES-Collaboration — Goethe University Frankfurt

The HADES experiment investigates the QCD phase diagram at moderate temperatures and high net-baryon densities by analyzing particles emitted in heavy-ion collisions at approximately 1 *A*GeV. Understanding hadronic behavior under these extreme conditions is crucial for advancing our knowledge of the strong interaction at high densities. This poster presents a comprehensive differential yield analysis of protons emitted in Ag+Ag collisions at 1.23 *A*GeV. The analysis is based on measurements taken by HADES in March 2019, during which a smaller sample was recorded at 1.23 *A*GeV alongside the high-statistics sample collected at 1.58 *A*GeV. Combined with the data sample of Au+Au collisions at 1.23 *A*GeV, the collected data will allow for detailed investigations of the energy and system size dependence of proton emission. As the most frequently emitted hadrons at this energy, protons provide a unique opportunity for in-depth analysis with exceptional statistical precision. Their study offers valuable insights into the dynamics of dense nuclear matter, addressing previously underexplored aspects of these collisions.

HK 23.36 Tue 17:30 Foyer Physik

Large-Scale XYZ Digital Microscope — •Konstantin Münning[1], Philip Hauer[1,2], Jonathan Kunecke[2], Jan Paschek[1,2], Benedikt Peter[2], and Bernhard Ketzer[1,2] — [1]Helmholtz-Institut für Strahlen- und Kernphysik, Universität Bonn, Germany — [2]Forschungs- und Technologiezentrum Detektorphysik, Universität Bonn, Germany

Micropatterned structures are widely used for precise particle detection and identification. An example are Gas Electron Multiplier (GEM) foils or patterned readout electrodes. A process for producing such microstructured flex circuits has recently been implemented at the Research and Technology Center Detector Physics (FTD) of the University of Bonn. An important step in the production is a rigorous Quality Assurance (QA) process, including optical measurements. Commercially available digital microscopes don't cover the sizes of recent large-scale structures. Therefore a large-scale digital microscope for cleanroom operation was developed to fill this gap and to allow manual and automatic QA procedures. The XYZ-positioning features 25 μm precision covering $1400 \times 1400\,\mathrm{mm}^2$ area to fully utilize commercially available granite tables. The 20 Mpixel camera with replaceable optics allows to select suitable resolutions, currently up to 1 μm/pixel. By applying image stitching techniques a full image of up to $2{\cdot}10^{12}$ pixels is possible.

The poster introduces the current setup of the microscope with its unique features and presents recent results of GEM foil QA.

HK 23.37 Tue 17:30 Foyer Physik

K0s production in p+p collisions at 4.5 GeV beam energy with the HADES experiment — •Chris Takatsch for the HADES-Collaboration — JLU Gießen, Gießen, Germany

In February 2022 p+p collisions with a kinetic beam energy of 4.5 GeV were recorded with the HADES (High Acceptance DiElectron Spectrometer) experiment at the GSI Helmholtzzentrum für Schwerionenforschung in Darmstadt, Germany. This measurement makes it possible to investigate strangeness production in p+p collisions at low energies and can be taken as a reference measurement for later AA collisions at FAIR. Kaons are the lightest particles that carry strangeness and are therefore ideal to investigate strangeness production at this energy. The K0s primarily decays weakly into pi+ and pi- (off vertex decay) and can be reconstructed with a good significance. Hence the objective of this work is to calculate the multiplicity of K0s in p+p collisions at 4.5 GeV through their decay into two charged pions and compare it with world data. This multiplicity is calculated via a multi-differential analysis of the invariant mass spectra of charged pion pairs in transverse momentum and rapidity.

HK 23.38 Tue 17:30 Foyer Physik

The FRS Virtual Messhütte — •Nicolas Hubbard for the Super-FRS Experiment-Collaboration — GSI, Darmstadt, Germany

The FRS (FRagment Seperator) is a high-resolution magnetic spectrometer located at the GSI Helmhholtzzentrum fur Schwerionenforschung in Darmstadt, Germany. Using the FRS secondary beams of exotic nuclei can be produced by impinging high energy primary beams from the SIS-18 synchotron onto production targets. In order to help the operation of the FRS, to provide long-term recording of the operating conditions during an experiment, and to allow people to monitor and participate in experiments remotely, a remote monitoring system is under development, termed the FRS "Virtual Messhütte", and available using a standard web-browser to authorised users. This poster will highlight some of the developments of the Virtual Messhütte.

HK 23.39 Tue 17:30 Foyer Physik

Energy loss and stopping power of alpha particles in graphenic carbon and areal density measurements — •Konstantina Botsiou for the Super-FRS Experiment-Collaboration — GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany

A method for measuring areal densities based on alpha particle energy loss was undertaken. It was applied to graphenic carbon (GC) foils from two manufacturers, KETEK and Applied NanoTech. The method is highly precise for thin foils, but the accuracy depends on the stopping power model.

Experimental stopping power data, deduced from the energy loss measurements of alpha particles (in the energy range 5–5.8 MeV) in foils of known areal density (measured from mass and area), was used for selecting the stopping power model. The Bethe formulation, with the respective corrections for this energy regime, was used to describe the stopping power data. The free parameter of the fit was the adjusted mean excitation energy, I_{adj}, defined as $\ln[I_{\mathrm{adj}}] = \ln[I_m] + (C/Z)_{\beta=1}$, where C/Z the shell correction. With this method, accuracies of $0.5 \pm 2\%$ for KETEK foils and $0.01 \pm 0.4\%$ for Applied NanoTech foils with areal densities of 0.2 $\mathrm{mg/cm}^2$ were demonstrated.

This study was motivated by the need for a non-destructive method to measure the areal densities of GC foils produced by KETEK GmbH. This is particularly relevant for components like vacuum windows and stripper foils in accelerator systems, as well as for production targets and degraders in radioactive ion beam facilities.

HK 23.40 Tue 17:30 Foyer Physik

Measurement of Energy Loss in the Silicon Tracking System of the CBM experiment and potential for PID — •David Gutierrez Menendez for the CBM-Collaboration — GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany — Goethe University of Frankfurt, Germany

The Silicon Tracking System (STS) in the Compressed Baryonic Mat-

ter (CBM) Experiment at FAIR's SIS100 accelerator, aims to precisely track charged particles and determine their momenta. Its 876 double-sided micro*strip sensors are the means to accomplish this task in the high multiplicity environment of heavy ion collisions with high spatial, temporal and momentum resolution. A scaled down version of CBM is installed at the SIS18 accelerator and it serves as a full-system test-setup for the capabilities of the future experiment. The m(ini)CBM experiment has shown promising results in the operational and scientific realms, in beamtime campaign with heavy-ion collisions at 1-2 AGeV. At the core of mCBM resides mSTS, with 3 stations and a total of 12 sensors is able to contribute to the global track reconstruction. The goal of this work is to explore the particle identification (PID) capabilities of mSTS by measuring the collected charge from traversing ionizing particles, this task relies on a correct charge calibration and noise suppression of mSTS data. In the absence of a magnetic field, momentum measurements are not possible, but using the Time Of Flight (TOF) detector of mCBM we can extract the particle velocity and correlate it with dE/ dx data from mSTS to show the behavior of multiple particle species.

HK 23.41 Tue 17:30 Foyer Physik

A side access system to the KATRIN beamline — •Kyrill Blümer, Christian Gönner, Kevin Gauda, Volker Hannen, Hans-Werner Ortjohann, Sonja Schneidewind, Leo Wesseler, and Christian Weinheimer for the KATRIN-Collaboration — Universität Münster, Institut für Kernphysik

The KATRIN experiment aims to measure the neutrino mass via spectroscopy of the tritium β-decay. An upper limit $m_\nu < 0.45\,\mathrm{eV/c^2}$ (90% C.L.) was published in 2024 (arXiv:2406.13516). Despite implementation of efficient countermeasures, an elevated experimental background is observed, which needs to be reduced to reach the design sensitivity. Radioactive decays in the stainless steel vessel of the main spectrometer produce highly-excited Rydberg or autoionizing states of atoms in the spectrometer volume, which release low-energetic electrons. These are energetically indistinguishable from β-electrons at the detector. Their angular distribution, however, is significantly sharper. The "active Transverse Energy Filter" (aTEF) concept was invented to reduce this background by discrimination of electrons in a large magnetic field based on their pitch angle (EPJ C 82 (2022) 922) and successfully tested as a modification of commercial Si-PIN diodes. The presented side-access system to the KATRIN beamline allows in-situ tests of the aTEF-prototypes and can provide direct measurements of the angular distribution of the KATRIN background electrons. Further, it can serve as a platform for calibration tools for the so-called TRISTAN-upgrade of the detector. This work is supported by BMBF ErUM-Pro 05A23PMA.

HK 23.42 Tue 17:30 Foyer Physik

"LowRad"-project: Background Reduction for next generation Dark Matter experiments — •Hannah Ginkel, Lutz Althüser, Robert Braun, Volker Hannen, Christian Huhmann, David Koke, Philipp Schulte, Patrick Alexander Unkhoff, Daniel Wenz, and Christian Weinheimer — Institute for Nuclear Physics, University of Münster

Next-generation dark matter experiments using liquid xenon are advancing the search for Weakly Interacting Massive Particles (WIMPs), a leading dark matter candidate, as well as other rare events such as solar neutrinos, neutrinoless double beta decay, and solar axions, among others. Achieving ultra-low background event rates is essential for probing WIMPs down to the neutrino fog. The "LowRad"-project aims to reduce the background levels below $0.1\,\mu$Bq/kg by developing innovative techniques, such as active cryogenic distillation methods for the next generation of krypton and radon removal systems (RRS), utilizing differences in vapor pressure. A cryogenic heat pump is being developed to handle the increased throughput of the RRS and provide O(20) kW for the evaporation and reliquefaction processes. Current krypton removal systems suffer from substantial off-gas losses of several tonnes of xenon, hindering continuous operation during data-taking. To address this, LowRad is developing a staged distillation, which aims to reduce the off-gas losses during krypton removal to a few kilograms over the lifetime of the XLZD observatory. This poster presents the current status of the developed systems.

Supported by the ERC Advanced Grant "LowRad" (101055063).

HK 23.43 Tue 17:30 Foyer Physik

Charged kaon SIDIS with CLAS12 — •Áron Kripkó[1], Stefan Diehl[1,2], and Kai-Thomas Brinkmann[1] — [1]Justus Liebig Universität Gießen, 35390 Gießen, Germany — [2]University of Connecticut, Storrs, CT 06269, USA

A multidimensional study of the structure function ratios $F_{LU}^{\sin(\phi)}/F_{UU}$, $F_{UU}^{\cos(\phi)}/F_{UU}$ and $F_{UU}^{\cos(2\phi)}/F_{UU}$ has been performed for charged kaons. It uses the high statistics data recorded with the CLAS12 spectrometer at Jefferson Laboratory. The 10.6 GeV longitudinally polarized electron beam interacted with an unpolarized liquid hydrogen target during the experiment. $F_{LU}^{\sin(\phi)}$ and $F_{UU}^{\cos(\phi)}$ are twist-3 objects that encode information about the quark-gluon-correlations in the proton. $F_{UU}^{\cos(2\phi)}$ is a twist-2 quantity, providing a direct access to the Boer-Mulders function.
The poster presents an analysis of the charged kaon final states $eK^{\pm}X$ using machine learning improved particle identification, over a large kinematic range with virtualities Q^2 ranging from 1 GeV^2 to 8 GeV^2. The precise multidimensional measurement was performed in a large range of z, x_B, p_T and Q^2 for the first time in the valence quark region. The structure function ratios were extracted by beam spin asymmetry and by direct cross section measurements.
This work is funded by DFG (Project No: 508107918).

HK 23.44 Tue 17:30 Foyer Physik

Development of a gas system for the Transition Radiation Detector of the CBM experiment — •Nikolai Podgornov[1], James Ritman[1,2], Peter Wintz[2], and Felix Fidorra[3] for the CBM-Collaboration — [1]Ruhr-Universität Bochum — [2]Forschungszentrum Jülich — [3]Westfälische Wilhelms-Universität Münster

One of the crucial components of the Compressed Baryonic Matter (CBM) experiment is the Transition Radiation Detector (TRD), which is essential for identifying electrons with a momentum above p>1 GeV/c. A high detection efficiency of better than 90% is also required. The TRD uses a mixture of the noble gas xenon and the quenching gas CO2. Since xenon is an expensive gas, a critical part of the TRD is its gas system, which must maintain a stable and optimal gas mixture in a closed circuit. The design of this gas system also involves considerations of gas mixture purity, flow rates, and pressure stability to ensure efficient charged particle and transition radiation detection. To accurately identify electrons amidst a high background of other particles, the gas overpressure in the TRD must be precisely controlled and kept within a range of about 0.2 - 0.6 mbar. This report discusses the gas system requirements, the status of a gas system prototype, and plans for its development into a full-size system, including the design of the gas distribution and circulation system and the implementation of monitoring systems. My contribution to the prototype's development will also be presented. This includes testing stability under various conditions such as power failure, pump failure, and gas leaks, as well as testing the calibration procedure for gas pressure sensors.