HK 74: Poster

Time: Thursday 17:30–19:00 Location: HSZ EG

HK 74.1 Thu 17:30 HSZ EG

Mimicking an Fe55 Source with X-Ray Fluorescence — •Philip Hauer, Alexander Rachev, and Bernhard Ketzer — Helmholtz-Institut für Strahlen- und Kernphysik, Universität Bonn

With its low-energetic and well-known X-ray spectrum, Fe55 is a commonly used radioactive source to calibrate particle detectors. The X-ray spectrum does not originate from the radioactive decay directly. Instead, Fe55 decays via electron capture into the excited state Mn55*. This excited state lacks one electron (typically from the K-shell) which is filled by an electron from an outer shell (typically the L- or M-shell) and an X-ray photon is emitted.

This process can be mimicked by X-ray fluorescence. If pure manganese (which consists to 100% of the isotope Mn55) is irradiated with X-rays, the excited state Mn55* is created as well (if the energy of the X-rays exceed the binding energy of the K-shell). In the relaxation process, the same spectrum as the one of an Fe55 source is emitted.

In order to confirm these considerations with measurements, we set up an X-ray tube which irradiated a piece of manganese. Two different detectors were used to analyse the emitted spectra. The first one is a semiconductor detector and the second one is a gaseous detector. With the performed measurements, we could show that a clean Fe55 spectrum can be observed with the X-ray fluorescence method.

On this poster, the measurements of X-ray fluorescence at manganese compared to Fe55 spectra are shown. Furthermore, the advantages and disadvantages of this method are discussed.

Supported by BMBF.

HK 74.2 Thu 17:30 HSZ EG

Laser Spectroscopy of Thulium-169 — •Hendrik Bodnar, Julian Palmes, Wilfried Nörtershäuser, and Kristian König — Institut für Kernphysik, TU Darmstadt

Laser spectroscopy is an established way to obtain information about the charge radius and the electromagnetic moments of a nucleus and has been applied to many isotopes all across the nuclear chart. In preparation for the investigation of short-lived Tm isotopes at the proton dripline [1], the stable 169-Tm was investigated at the Collinear Apparatus for Laser Spectroscopy and Applied Physics (COALA) at the Institute of Nuclear Physics at TU Darmstadt. Singly charged thulium was produced with a surface ionization source. Several transitions from the ionic ground state in the wavelength range between 340 nm and 425 nm have been studied and the hyperfine structure was analyzed. This allowed the selection of a suitable transition for efficient studies of rare isotope beams. Funding from the BMBF under contracts 05P21RDCI1 and 05P21RDFN1 is acknowledged. [1] B. Cheal et al., CERN-INTC-2022-041 / INTC-1-245 (2022)

HK 74.3 Thu 17:30 HSZ EG

Towards the Establishment of an Electrofission Experiment at the S-DALINAC — •Gerhart Steinhilber[1], Michaela Arnold[1], Jonny Birkhan[1], Michael Block[2], Martha Liliana Cortès[1], Tetyana Galatyk[1], Pavlos Koseoglou[1], Norbert Pietralla[1], and Maximilian Spall[1] — [1]IKP, Technische Universität Darmstadt — [2]GSI Helmholtzzentrum für Schwerionenforschung

To account for the observed abundances of heavy elements, the rapid-neutron capture process is essential [1]. It was first proposed more than six decades ago but is still not completely understood. The r-process is thought to occur in very neutron rich environments such as neutron star mergers, where the fission yields play an important role in determination of the final abundances. The fission yields depend on the excitation energy of the compound nucleus, which is not well studied. To increase our understanding of fission processes, a new setup for electron-induced fission is in development at the S-DALINAC electron accelerator at TU Darmstadt. Combining the established large acceptance QCLAM electron spectrometer which provides the excitation energy of the nucleus with fission fragment detector modules (FFDM) allows for a coincident measurement of fission fragments with an excellent mass resolution as a function of the excitation energy. The FFDMs which will be placed around the actinide target will provide precise timing information and the kinetic energy of the fission fragments. This poster will present the design of the setup.

This work is supported by the Hessian cluster project ELEMENTS.

[1] J. J. Cowan et al., Rev. Mod. Phys. 93, 015002 (2021).

HK 74.4 Thu 17:30 HSZ EG

Analysis of the bremsstrahlung contribution in electron-gamma coincidence experiments at the S-DALINAC — •Bastian Hesbacher, J. Birkhan, I. Brandherm, J. Isaak, I. Jurosevic, N. Pietralla, M. Singer, M. Spall, and G. Steinhilber — IKP, Technische Universität Darmstadt

The all-electromagnetic $(e, e'\gamma)$ reaction had first been used for nuclear structure measurements in the 1980s [1]. Since then very few experiments were based on this reaction. One of the challenges of this measurement technique lies in the coincident bremsstrahlung, which - apart from the angular distribution - can not be distinguished from the γ-radiation of decaying nuclei after excitation by inelastic electron scattering. In 2021 a successful $^{96}\mathrm{Ru}(e, e'\gamma)$ measurement was performed at the S-DALINAC with 35 times improved resolution [2]. The scattered electrons were registered with the QCLAM spectrometer. The γ-radiation was detected by 6 $LaBr_3$:Ce detectors. The double differential cross section of the bremsstrahlung contribution is computed within PWBA and combined with GEANT4 simulations to model pure bremsstrahlung spectra. A subtraction of the bremsstrahlung background will be applied to the $^{96}\mathrm{Ru}(e, e'\gamma)$ data and allow for the extraction of ground-state γ-decays of excited states. Preliminary results on treating the bremsstrahlung contribution will be presented.

This work is supported by the Research Training Group GRK 2128 and the Hessian cluster project ELEMENTS.

[1] C. N. Papanicolas et al., Phys. Rev. Lett. 54 (1985).
[2] G. Steinhilber, Ph.D. thesis, TU Darmstadt (2022).

HK 74.5 Thu 17:30 HSZ EG

A distributed network of cosmic shower detectors — •Lara Dippel[1], Kai-Thomas Brinkmann[1], Hans-Georg Zaunick[1], Simon Glennemeier-Marke[1], Marvin Peter[1], Lukas Nies[2], and Katharina Dort[1] — [1]II. Physikalisches Institut, Giessen, Deutschland — [2]EP Department, CERN

The MuonPi project is a distributed network of Raspberry Pi-based Internet-of-Things (IoT) detector stations for measuring muon showers caused by the interaction of ultrahigh-energy particles of the primary cosmic rays with earth's atmosphere. By connecting the detectors to the global navigation network (GNSS), the individual events can be time-stamped with nanosecond-time accuracy. Thus, further information, such as shower geometry and possibly energy, can be obtained from the time correlations between the detectors. Among others, the project offers students, teachers, makers, HAMs and interested laymen an insight into the research field of astroparticle physics of the highest energies in the cosmos. The individual detector stations have also proven to be efficient in measuring charged particles on parabolic flights and stratospheric balloon missions.

*supported by ELJEN Technology

HK 74.6 Thu 17:30 HSZ EG

New Electronics for the HADES Drift Chambers — •Jan Michel[1], Ole Artz[1], Thomasz Gniadzdowski[3], Christian Müntz[1], and Christian Wendisch[2] for the HADES-Collaboration — [1]Goethe-Universität Frankfurt am Main — [2]GSI Helmholtzzentrum für Schwerionenforschung — [3]Warsaw University of Technology

The drift chambers (MDC) of the HADES Experiment at GSI, Darmstadt form the main tracking system of the spectrometer. Being designed more than twenty years ago, we are currently replacing the whole electronics read-out chain with state-of-the-art electronics.

The new analog signal processing is based on the PASTTREC ASIC, originally developed at AGH Krakow for the PANDA Straw Tube Tracker. The digitization of data happens in FPGA-based TDCs before data is sent on an optical link to the event server farm.

The main challenges of the project are the strict spatial constraints given by the experiment setup and the noise sensitivity of the large area gas detectors. In addition, the power consumption needed to be kept low to ease cooling of the electronics.

This work has been supported by BMBF (05P21RFFC2), GSI, and HFHF.

HK 74.7 Thu 17:30 HSZ EG

Evolution of the KATRIN energy scale measured with ^{83m}Kr — •Justus Beisenkötter for the KATRIN-Collaboration — Institut

für Kernphysik, WWU Münster

The KATRIN experiment has the aim to measure or exclude the effective electron neutrino mass to $0.2\,\mathrm{eV/c^2}$ (90% C.L.) by measuring the tritium beta spectrum near its endpoint. To study the energy scale of KATRIN, which is influenced by beamline workfunctions and plasma effects in the gaseous tritium source, ^{83m}Kr conversion electron lines are used. Gaseous ^{83m}Kr is inserted into the tritium source, which allows to measure energy shifts and broadenings that would also affect the beta spectrum. This poster gives an overview of the time evolution of the line position of the L_3-32 and N_{23}-32 lines, which were measured many times over the course of the KATRIN operation. This work is supported by BMBF under contract number 05A20PMA.

HK 74.8 Thu 17:30 HSZ EG

Studies on Alternative Sensor Carrier Concepts for the CBM MVD* — •Fabian Hebermehl for the CBM-MVD-Collaboration — Goethe-Universität Frankfurt

The Micro Vertex Detector (MVD), part of the Compressed Baryonic Matter (CBM) Experiment at the future FAIR facility, comprises four detector stations, of four 0.3−0.5% X_0 thin quadrants, respectively. As the MVD will be operating in vacuum, efficient thermal management by the carrier of the sensors is mandatory. For this reason, the carrier materials chosen are Thermal Pyrolitic Graphite (TPG) for the larger stations and pCVD diamond for the smallest, first station. Studies have been conducted on alternative concepts for the TPG stations to balance thermal performance, material budget and production yield. The station production yield is driven by the need to populate both carrier sides with large-area MIMOSIS sensors to minimize inactive areas inside the detector acceptance. The options to (i) integrate ladders rather then carrier plates and (ii) separate front and back side sensor integration have been studied. The contribution will summarize the findings and gives a recommendation of which design is best suited for refining MVD station concept accordingly.

*This work has been supported by BMBF (05P21RFFC2) and EURIZON.

HK 74.9 Thu 17:30 HSZ EG

Lifetime measurement of low-lying states of ^{170}W — •K.E. Ide[1], V. Werner[1], A. Goasduff[2,3], J. Wiederhold[1], P.R. John[1], D. Bazzacco[3], M. Beckers[4], J. Benito[5], M. Berger[1], D. Brugnara[2,3], M.L. Cortés[3], L.M. Fraile[5], C. Fransen[4], A. Gozzelino[3], E.T. Gregor[3], A. Illana[3], J. Jolie[4], L. Knafla[4], R. Menegazzo[3], D. Mengoni[2,3], C. Müller-Gatermann[4,6], O. Papst[1], G. Pasqualato[7], C.M. Petrache[8], N. Pietralla[1], F. Recchia[2,3], D. Testov[2,7], J.J. Valiente-Dobón[3], and I. Zanon[2,3,9] — [1]IKP, TU Darmstadt — [2]U Padova, Italy — [3]INFN, LNL, Italy — [4]IKP, U Köln — [5]U Madrid, Spain — [6]ANL, USA — [7]INFN, Padova, Italy — [8]U Paris-Saclay, France — [9]U Ferrara, Italy

Previous experiments in the region of the Hf and W isotopic chains have shown a change in the first 2^+ states' mean lifetimes in comparison to the literature values due to advancements in experimental techniques. A sudden increase of the $2_1^+ \rightarrow 0_1^+$ $E2$ transition strength in the W isotopic chain between $N = 96$ and $N = 98$ is significant and not seen in the neighboring isotopic chains. Therefore, a measurement of the low-lying level lifetimes of ^{170}W ($N = 96$) with the RDDS method was performed at LNL. The GALILEO array and the GALILEO plunger device were used. Lifetimes for the first 2^+, 4^+ and 6^+ state were obtained and the deduced $E2$ transition strengths compared to predictions of the CBS model.

*Supported by the BMBF under Verbundprojekt 05P2021 (ErUM-FSP T07) under Grant Nos. 05P21RDFN9, 05P21RDFN1 and 05P21PKFN1.

HK 74.10 Thu 17:30 HSZ EG

Evaluation of coincidence time resolution of YAG, LuAG, GAGG, YSO, LYSO, LSO, YAP and LuAP scintillators — •Dzmitry Kazlou, Valerii Dormenev, Kai-Thomas Brinkmann, Markus Moritz, Rainer Willi Novotny, and Hans-Georg Zaunick — 2nd Physics Institute, Justus Liebig University, Giessen, Germany

Development of new or optimization of already widely used scintillation materials for fast timing applications have become a very important research activity during the last decade. A significant progress with cerium doped inorganic materials has been made in the improvement of the timing characteristics of the scintillation pulse. Here we present test results of garnets YAG/LuAG/GAGG, lutetium-yttrium oxyorthosilicates YSO/LYSO/LSO and orthoaluminate perovskites YAP/LuAP with different types of doping. Samples have two types of dimensions: 3x3x3 and/or 3x3x20 $\mathrm{mm^3}$. The main activity was concentrated on the measurements of the coincidence time resolution (CTR) with the help of an oscilloscope by offline analysis of recorded signals and the dependence on temperature and the sample shape. Measurements were performed inside a climate camber and done with SiPM readout and commercial evaluation kits from different producers as well as with own developments.

The work was supported by funding from BMBF Projects 05K2019, UFaCal, EFRE, the High-D consortium and in the spirit of the Crystal Clear Collaboration.

HK 74.11 Thu 17:30 HSZ EG

Influence of detector settings on the EPICAL-2 response — •Johannes Keul — Institut fuer Kernphysik Frankfurt

In context of the proposed ALICE-FoCal detector, a prototype of a digital electromagnetic pixel calorimeter, EPICAL-2, has been developed. EPICAL-2 consists of 24 layers with alternating tungsten absorbers and silicon sensors facilitating monolithic active pixel sensors (MAPS). The design features an active area of $30\,\mathrm{x}\,30\,\mathrm{mm^2}$ and a depth of 20 radiation lengths with a total of 25 million pixels.

An EPICAL-2 test-beam measurement has been performed at the CERN-SPS facility in September 2021, including measurements with different detector settings.

In this poster, an overview of the structure and functionality of EPICAL-2 is presented. Furthermore a study of the differences in detector response as e.g. the size of pixel clusters at different detector settings is presented.

Supported by BMBF and the Helmholtz Association.

HK 74.12 Thu 17:30 HSZ EG

Correlation of hit and particle densities in EPICAL-2 — •Jan Schöngarth — Institut für Kernphysik, Goethe Universität Frankfurt

A prototype of a digital electromagnetic pixel calorimeter, EPICAL-2, consisting of alternating tungsten absorber and silicon sensor layers has been developed. EPICAL-2 has been designed in the context of the proposed ALICE-FoCal detector. High granular ALPIDE sensors are employed in EPICAL-2 and will be utilized in two layers of the FoCal detector.

The measurement of the electromagnetic shower energy E with EPICAL-2 is based on the number N_{part} of charged shower particles. The number N_{hits} of pixel hits is considered as a measure of N_{part} and thus E, as long as the particle density is low. In order to understand the relation between N_{hits} and N_{parts} under varying density conditions, both observables have been investigated per local area, as well as their correlation, in Allpix^2 simulation, which includes the propagation of deposited charge carriers.

In this poster, the correlation of hit and particle densities is presented, aiming to provide input for EPICAL-2 to investigate saturation effects in areas of high particle density and for FoCal to circumvent detailed charge carrier propagation in simulation. The poster will present the current status of this analysis.

Supported by BMBF and the Helmholtz Association.

HK 74.13 Thu 17:30 HSZ EG

Triton Emission from Ag+Ag Collisions at 1.58A GeV — •Wojciech Trynda for the HADES-Collaboration — Goethe-Universität Frankfurt

Multi-differential emission rates of triton are part of the investigation of statistic data from Ag(1.58A GeV)+Ag collisions, measured in March 2019.

Triton candidates are selected out of all charged particle tracks by using the specific energy loss in the detector material.

The final count rates are extracted multi-differential in an m_t-y grid using the reconstructed particle mass. The background under the triton signal is estimated by an iterative interpolation method between the minimum of the signal peaks of other charged particle tracks and the tail of the triton signal peak. Based on full scale Geant-detector response simulation the extracted signals are corrected with response coefficients. The corrected triton signals are used to determine the multi-differential emission rate per event depending on center-of-mass rapidity and transverse mass. The obtained phase-space distribution of triton is put into context of available published data.

This work has been supported by BMBF (05P21RFFC2) and GSI.

HK 74.14 Thu 17:30 HSZ EG

Impact of the charm fragmentation fractions on the dielectron spectrum in pp collisions at the LHC — •Emma Ege for the ALICE Germany-Collaboration — Institut für Kernphysik, Goethe-Universität Frankfurt, Germany

Charm and anti-charm quarks are produced abundantly in pp collisions at LHC energies. Until recently, it was assumed that the hadronization process, i.e. the formation of charm hadrons from the partonic matter, can be described by universal fragmentation functions. Measurements performed by the ALICE Collaboration have nevertheless shown an enhancement of the relative charm-baryon contributions with respect to the ones observed in e^+e^- collisions. This suggests a significant difference of the fragmentation fractions in hadronic collisions at the LHC compared to e^+e^- and ep collisions at lower energies. The PYTHIA event generator is able to reproduce part of these findings by including string fragmentation beyond the leading color approximation.

On this poster, we will discuss how sensitive the dielectron yield from correlated open-charm hadron decays is from the charm hadronization process. For this purpose, predictions with the PYTHIA generator using different tunes will be compared. Additionally, the consequences on the heavy-flavour cross section measurements via the dielectron channel will be shown.

HK 74.15 Thu 17:30 HSZ EG

Setup of high-precision voltage dividers for collinear laser spectroscopy experiments at TU Darmstadt and ISOLDE/CERN — •Finn Köhler[1], Kristian König[1], Johann Meisner[2], Wilfried Nörtershäuser[1], and Stephan Passon[2] — [1]Institut für Kernphysik, TU Darmstadt, Germany — [2]Physikalische Technische Bundesanstalt, Braunschweig, Germany

Collinear laser spectroscopy is a well-established technique to investigate ground-state properties of stable and short-lived isotopes. By accelerating an ion beam electrostatically to 20-60 keV, the Doppler width is drastically reduced to the order of the natural linewidth, which enables measurements with high resolution. To achieve a high accuracy in the isotope shift measurements, the acceleration voltage of the ions needs to be precisely known to account for the Doppler shift of the ions.

To determine this voltage, three high-voltage dividers inspired by precision dividers of the Physikalisch-Technische Bundesanstalt were set up and calibrated against a reference divider. With active temperature stabilization a relative accuracy of 5 ppm was achieved. At ISOLDE the voltage of the beam preparation trap and of the MIRACLS multi-reflection electrodes are measured and at TU Darmstadt, it is used to actively stabilize the voltage of the ion source. We additionally report on an upgrade of the 25m deep-UV laser-light transport to COLLAPS.
Support from BMBF under contract 05P21RDCI1 is acknowledged.

HK 74.16 Thu 17:30 HSZ EG

Silicon pixel sensors for the PANDA luminosity detector — •Niels Boelger, Stephan Bökelmann, Florian Feldbauer, René Hagdorn, Stephan Maldaner, Gerhard Reicherz, and Miriam Fritsch — On behalf of the PANDA Collaboration — Ruhr University Bochum AG Physics of Hadrons and Nuclei, 44780 Bochum

The PANDA experiment is one of the key experiments at the future FAIR accelerator facility in Darmstadt. Its purpose is to study the properties of hadronic states in detail and to search for exotic states of matter.

The PANDA detector will have a luminosity detector 11 meters downstream from the interaction point. This detector, consisting of two retractable half-detectors, uses silicon pixel sensors to measure the distribution of elastically scattered antiprotons as a function of the scattering angle, from which the luminosity is determined. The MuPix sensors intended for track reconstruction in the luminosity detector are High-Voltage Monolithic Active Pixel-Sensor (HV-MAPS), which offer two advantages over conventional pixel sensors: The active sensor part and the readout electronics are combined on the same chip. Secondly, due to the high voltage, the charge transport is much faster. The production of sensor modules consisting of several pixel sensors, as well as the data acquisition system prepared for this setup will be presented.
This project is supported by the BMBF - Gefördert durch das BMBF

HK 74.17 Thu 17:30 HSZ EG

A comparison of initial condition models for hydrodynamic evolutions in heavy ion collisions — •Lucas Constantin[1,2], Hannah Elfner[1,2,3], and Niklas Götz[1,2] — [1]Goethe Universität Frankfurt am Main — [2]Frankfurt Institute for Advanced Studies — [3]GSI Helmholtzzentrum für Schwerionenforschung

For a hydrodynamical description of the quark-gluon plasma created during a heavy ion collision, initial conditions of a thermalized system are needed. In this work, a comparison between three initial conditions models (SMASH, TRENTo, and IP-Glasma) is made. General quantities of the collision such as the number of participants and the number of binary nucleon collisions are determined, and the transverse plane energy densities from the different models are compared, along with their eccentricity distributions, for different collision systems at RHIC and LHC energies. The collisions in SMASH have slightly fewer participants and significantly fewer binary nucleon collisions. TRENTo not only produces lower eccentricities, but also has smaller event by event fluctuations. In addition, the elliptic flow from SMASH is shown, as well as the momentum anisotropy, found to be higher in SMASH than in IP-Glasma.

HK 74.18 Thu 17:30 HSZ EG

Feasibility studies for measuring electrical conductivity in heavy ion collisions with ALICE 3 — •Clara Peter for the ALICE Germany-Collaboration — Goethe University, Frankfurt, Germany

The ability of matter to transport electrical charges is described by its electrical conductivity. For the medium produced in heavy-ion collisions this fundamental property has, up to now, no experimental constraints, while theoretical predictions give a large range of possible values. This transport coefficient is not only of great interest in itself, but also an important input for the model calculations. The dielectron production rate in the hot partonic and hadronic phase of the collision is directly related to the electrical conductivity of the medium at vanishing mass and pair p_{T}. For this reason precise dielectron measurements in this phase space would be of great interest.

In this contribution we will explain the challenges to achieve such measurements focusing in particular on possible processes contributing to the irreducable physical background. Further we will discuss how the unique features of the ALICE 3 detector, planned at the LHC beyond 2030s, could enable dielectron measurements at very low invariant mass and pair p_{T}.

HK 74.19 Thu 17:30 HSZ EG

KATRIN like MINI MAC-E Filter with a tritium source for the advanced physics lab course — •Sarah Untereiner for the KATRIN-Collaboration — Karlsruhe Institute of Technology (KIT), Wolfgang-Gaede-Str. 1, 76131 Karlsruhe, Germany

The KATRIN experiment at the Karlsruhe Intitute of Technology (KIT) aims to determine the effective neutrino mass using the kinematics of electrons from the tritium β-decay. The integral energy spectrum of the electrons is measured by an electro-static high-pass filter, using the MAC-E filter principle (Magnetic Adiabatic Collimation and Energy filter). Only electrons with energies above the retarding potential of the filter are counted at the detector at the end of the MAC-E spectrometer. In order to give students the opportunity to learn more about the experimental principles behind KATRIN, a smaller version of the MAC-E filter setup, called MiniMACE, has been built, which will be used in the advanced physics lab course at KIT. With a scale of approximately 1:20 the MiniMACE experiment includes all the major components of KATRIN: a tritium source, the spectrometer with adjustable high voltage, a high resolution detector and the magnetic guiding field. Other than KATRIN, the source uses two implanted disks with tritium and ^{83m}Kr that can be exchanged inside the ultra-high vacuum source chamber. This poster shows the design of the physics lab setup and reports on first results.
This project has been supported by RIRO (Research Infrastructure in Research-Oriented teaching), which is part of the ExU project at KIT.

HK 74.20 Thu 17:30 HSZ EG

First pp correlation function with data taken by ALICE in Run 3 — •Anton Riedel and Georgios Mantzaridis for the ALICE Germany-Collaboration — Technical University of Munich (TUM), Garching, Germany

Femtoscopy has proven itself as a precise tool to constrain the strong interaction between hadrons in previously inaccessible sectors. When the source of particles in a collision is known, it is possible to probe the interaction potential between two particles. Already during Run 2 of the LHC an universal source of hadrons in pp collisions has been identified and benchmarked by studying the correlations of the produced proton-proton pairs. With this result as a foundation it was possible

to probe the strong force between many different pairs of hadrons like p-Λ, p-Ω, p-ϕ and many more. With the recently started LHC Run 3 and the upgraded ALICE detector, femtoscopic studies can now be performed with an even greater precision and even more exotic interactions can be experimentally constrained for the first time. The proton-proton correlation function will be the starting point for gauging the universal hadron emission source in the new available data.

In this poster we present the first steps in the femtoscopy campaign of ALICE in Run 3, namely the proton proton correlation function, measured in pp collisions at $\sqrt{s} = 13.6$ TeV at the ALICE experiment at the LHC.

This project has been funded by the DFG under Germany's Excellence Strategy - EXC2094 - 390783311 and by BMBF Verbundforschung (05P21WOCA1 ALICE).

HK 74.21 Thu 17:30 HSZ EG

Studying (anti)nuclei formation in heavy ions using an advanced coalescence model — •David Casado — Technical University Munich

Coalescence is a major model used to describe the formation of light (anti)nuclei in high energy collisions. It is based on the assumption that two nucleons close in phase-space can coalesce and form a nucleus. Antideuteron and antihelium nuclei have been proposed as a detection channel for dark matter annihilations and decays in the Milky Way, due to the low astrophysical background expected. In order to correctly interpret any future antinuclei measurement in space, the production of antinuclei has to be well understood. In this presentation a more advanced approach is employed combining event-by-event Monte Carlo simulations with a microscopic coalescence picture based on the Wigner function formalism. The antiproton production in the event generator EPOS 3 is compared to measurements from the STAR Collaboration.

This work was supported by BMBF.

HK 74.22 Thu 17:30 HSZ EG

Studying the strong interactions in proton-deuteron at LHC — •Bhawani Singh for the ALICE Germany-Collaboration — TUM, Munich Germany

In the journey to explore the strong interaction among hadrons, ALICE has for the first time extended its femtoscopic studies to nuclei. The large data sample of high-multiplicity pp collisions at $\sqrt{s} = 13\,\text{TeV}$ allows the measurement of the proton-deuteron (p-d) momentum correlations. The femtoscopic study of such systems opens the door to investigate the interaction in three-body systems as well as formation mechanism of the light nuclei in hadron-hadron collisions. In this contribution, the measured momentum correlation function for p-d is presented. The measured p-d correlation shows a shallow depletion at low relative momenta while the model calculation which assumes the interaction of two point-like particles shows a clear discrepancy with respect to the data. This discrepancy can be resolved by employing a full three body wave function that accounts for the internal structure of the deuteron including all relevant partial waves and quantum statistical effects. This demonstrates that the study of correlations among light nuclei provides access to the details of the many-body system's wave function at the LHC. Funded by BMBF Verbundforschung (05P21WOCA1 ALICE).

HK 74.23 Thu 17:30 HSZ EG

Measurement of ^{3}H and ^{3}He production in pp collisions at $\sqrt{s} = 13$ TeV with ALICE at the LHC — •Matthias Herzer for the ALICE Germany-Collaboration — Institut für Kernphysik, Goethe-University, Frankfurt

The production of (anti)nuclei in pp collisions at the LHC has become a major topic in the high-energy physics community. In fact, there is a huge overlap between different research directions, from astrophysics, particle and nuclear physics. For instance, the observation of antinuclei in space is considered as possible signature for dark matter, since they would originate from collisions of potential dark matter candidates among each other.

We show the study of the production of ^{3}H and ^{3}He in pp collisions at 13 TeV in two data sets that were taken in LHC Run 2, i.e. in high-multiplicity events and one from a dedicated online trigger on nuclei. Furthermore, we will show the measurement of the ratio of these nuclei. This is an important test of isospin symmetry, which is expected to hold at LHC energies, but can not be tested directly since neutrons are not accessible experimentally.

HK 74.24 Thu 17:30 HSZ EG

Collisional broadening in a transport model — Hannah Elfner[1,2,3,4], Renan Hirayama[1,2], and •Branislav Balinovic[2,3] — [1]Helmholtz Forschungsakademie Hessen für FAIR (HFHF), GSI Helmholtzzentrum für Schwerionenforschung, Campus Frankfurt — [2]Frankfurt Institute for Advanced Studies (FIAS) — [3]Institut für Theoretische Physik, Goethe Universität — [4]GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt

In this work, we study the effect of collisional broadening in different hadron species, for both resonances and stable particles, using different temperatures in the hadronic transport approach SMASH (Simulating-Many-Accelerated-Strongly-Interacting-Hadrons). In SMASH the information about the phase space and interactions is available at all times, which makes the lifetimes and mass distributions of particles directly accessible. Our set up simulates a thermalized hadron gas, used to study the absorption of particles in equilibrium. The collisional broadening is measured using effective widths, which are a measure for decay plus absorption probabilities. We also calculate the corresponding dynamical spectral functions, which are interesting from theoretical perspective, since they can be an indicator of chiral symmetry restoration. Moreover, we investigate the impact on collisional broadening of different assumptions for the mass dependence of vacuum decays, finding that a mass-dependent vacuum experiences a stronger collisional broadening than the mass-independent case.

HK 74.25 Thu 17:30 HSZ EG

Signal-to-noise ratio in the ALICE TPC with GEMs — •Janis Noah Jäger for the ALICE Germany-Collaboration — Institut für Kernphysik, Goethe-Universität Frankfurt

A major aspect of the recent ALICE upgrade is the upgrade of the Time Projection Chamber (TPC). The TPC is the main tracking and particle identification device of ALICE. By replacing the Multi-Wire Proportional Chambers (MWPC) with stacks of four Gas Electron Multiplier (GEM) foils, continuous readout of the TPC is achieved. Furthermore the installation of the GEMs implies specific design goals, such as the intrinsic noise of the electronics channels as well as the signal-to-noise ratio at the nominal gas gain of 2000. Different pad area and trace length result in variations of the properties. Additionally, external influences cause local variations of the noise.

In this poster the intrinsic noise together with the signal-to-noise ratio for minimum ionizing particles, measured in first pp collisions in LHC Run3, will be presented for the different pad regions of the TPC. The results will be compared with the design goals.

HK 74.26 Thu 17:30 HSZ EG

Background-Corrected Collinear Saturation Spectroscopy at COALA — •Julien Spahn, Phillip Imgram, Kristian König, Patrick Müller, and Wilfried Nörtershäuser — Institut für Kernphysik, TU Darmstadt

All-optical determinations of nuclear charge radii in He-like systems will come into reach with increasing accuracy in atomic structure calculations of He-like systems. To this end, the $1s2s\,^3S_1 \rightarrow 1s2p\,^3P_J$ transitions in He-like $^{12}C^{4+}$ and $^{13}C^{4+}$ were measured at the Collinear Apparatus for Laser Spectroscopy and Applied Physics (COALA) at the Institute of Nuclear Physics of TU Darmstadt. The C^{4+} ions are produced with an electron-beam ion source (EBIS) and collinear/anticollinear laser spectroscopy was performed using Doppler tuning. Variations in the background signal, caused by fluctuations in the collinear laser beam position, significantly contributed to the uncertainty of the measured transition frequencies, especially at high dwell times. Additionally, the residual Doppler broadening is still rather large compared to the natural linewidth of the transitions due to the initial energy spread of the ions inside the EBIS. This contribution will present and compare the improvements obtained by implementing a laser-beam position stabilization system and a voltage modulation of the fluorescence detection region. Moreover, a first attempt of background-corrected collinear saturation spectroscopy – a method that allows to overcome the limitations imposed by the residual Doppler broadening – will be presented.
This project is supported by DFG (Project-ID 279384907 - SFB 1245).

HK 74.27 Thu 17:30 HSZ EG

HYDRA: HYpernuclei Decay at R^{3}B Apparatus — •Simone Velardita[1], Hector Alvarez-Pol[2], Yassid Ayyad[2], Meytal Duer[1], Alexandru Enciu[1], Liancheng Ji[1], Alexandre Obertelli[1], and Yelei Sun[1] for the R3B-Collaboration — [1]Technische Universität Darmstadt, Fachbereich Physik, Darmstadt,

64289, Germany — [2]Universidade de Santiago de Compostela, Santiago de Compostela, E-15782, Spain

HYDRA is a physics program within the R^{3}B collaboration to study the decay spectroscopy of hypernuclei produced from heavy-ion collisions at GSI/FAIR. The program aims at measuring with high resolution the in-flight pionic decay of light and medium mass hypernuclei. To achieve that, a pion tracker is conceived as a time projection chamber inside the GLAD magnet of the R^{3}B setup.

The full experimental setup has been simulated within the R3BROOT framework, to optimize the geometry and define conditions for the forthcoming accepted experiment which will take place at R^{3}B in 2024. The first experiment aims at the mass-radius of hypernuclei such as the hypertriton, predicted to be halo, from measurements of its interaction cross-section. The experimental method developed for the measurement will be presented in the poster, together with first results from a tracking algorithm that will be used to reconstruct the decayed particle trajectories.

HK 74.28 Thu 17:30 HSZ EG

Characterization of prototypes of an active Transverse Energy Filter (aTEF) — •Kyrill Blümer[1,4], Kevin Gauda[1,4], Sonja Schneidewind[1,4], Christian Gönner[1,4], Volker Hannen[1,4], Hans-Werner Ortjohann[1,4], Wolfram Pernice[2,3], Lukas Pöllitsch[1,4], Richard Salomon[1,4], Maik Stappers[2], and Christian Weinheimer[1,4] — [1]Institute for Nuclear Physics, University of Münster — [2]CeNTech and Physics Institute, University of Münster — [3]Kirchhoff-Institute for Physics, University of Heidelberg — [4]KATRIN Collaboration

In the Karlsruhe Tritium Neutrino Experiment (KATRIN) the mass of the electron neutrino is intended to be measured directly by precision energy spectroscopy of the tritium β-decay electrons in its endpoint region. To achive the target sensitivity of $0.2\,\mathrm{eV/c^2}$, a reduction of background electrons, assumed to be caused by Rydberg atoms and autoionizing states, is needed. An active transverse energy filter (aTEF, Eur. Phys. J. C 82, 922 (2022)) distinguishes electrons due to their angle to a magnetic field line. It preferentially detects signal electrons with a broad angular distribution rather than background electrons with a small angular distribution. This poster presents insight in the testing procedures and characterization of aTEF-prototypes in dedicated test environments.

This work is supported by BMBF under contract number 05A20PMA.

HK 74.29 Thu 17:30 HSZ EG

(Anti)nuclei production in ALICE — •Rafael Manhart for the ALICE Germany-Collaboration — Technische Universität München

High-energy hadronic collisions at accelerators create a suitable environment for the production of light (anti)(hyper)nuclei. Precise measurements of the antinuclei production at accelerators are essential to study the different sources of antinuclei in our Universe and to correctly interpret any future measurement of antinuclei in space. (Anti)nuclei production measurements are also interesting to investigate their production mechanisms, which are under intense debate in the scientific community. The description of the experimental measurements is currently based on two competing phenomenological models: the statistical hadronisation model and the coalescence approach. The production of (anti)nuclei, up to A=4, has been measured with ALICE in the last 10 years, from small collision systems (i.e., pp and p*Pb) to heavy-ion collisions (i.e., Xe*Xe and Pb*Pb). In 2022, LHC Run 3 has started and pp collisions at top centre-of-mass energy of $\sqrt{s} = 13.6$ TeV have been recorded with the unprecedented luminosity of $18\ pb^{-1}$. In this contribution, new measurements of (anti)nuclei from Run 3 data will be shown, together with a review of (anti)nuclei results from Run 1 and 2.

This work is funded by BMBF Verbundforschung (05P21WOCA1 ALICE).

HK 74.30 Thu 17:30 HSZ EG

Machine Learning Approach to the Sexaquark Search in ALICE — •Sven Hoppner for the ALICE Germany-Collaboration — Physikalisches Institut, Heidelberg, Germany

The sexaquark was proposed by G. Farrar in 2017 to be a compact, stable and neutral particle consisting of six quarks with a quark content of *uuddss*. Its charge neutrality, stability, and expected production rate in the QCD phase transition in the early universe make it an interesting dark matter candidate within the standard model, while its similarity to the neutron in experimental settings could explain why it has not been discovered so far. A new search for the sexaquark S in heavy- ion collisions at the Large Hadron Collider (LHC) using the ALICE detector started in 2022 which will look for characteristic decay chains in the annihilation of the anti-S with the detector material. The search benefits from the excellent tracking and particle identification (PID) capabilities of ALICE, especially for low momenta. Based on Monte Carlo simulations it is investigated how the sexaquark search with ALICE can be improved with a decision tree based machine learning approach using XGBoost.

HK 74.31 Thu 17:30 HSZ EG

The ComPWA project: speeding up amplitude analysis with a Computer Algebra System — •Remco de Boer[1], Miriam Fritsch[1], Wolfgang Gradl[2], Stefan Pflüger[1], and Leonard Wollenberg[1] — [1]Ruhr-Universität Bochum — [2]Johannes Gutenberg Universität Mainz

In the ideal world, we describe our models with recognizable mathematical expressions and directly fit those models to large data samples with high performance. It turns out that this can be done with a CAS, using its symbolic expression trees as a template to computational back-ends like JAX. The CAS can in fact further simplify the expression tree, which can result in speed-ups in the numerical backend.

The ComPWA project offers Python libraries that use this principle to formulate large expressions for amplitude analysis, so that the user has the flexibility to quickly implement different formalisms and can easily perform fast computations on large data samples. The CAS additionally allows the project to standardise and automatically document these formalisms as they are being implemented.

HK 74.32 Thu 17:30 HSZ EG

Detector response simulations for the CBM-TRD — •Lena Rossel for the CBM-Collaboration — Institut für Kernphysik, Goethe Universität, Frankfurt am Main

To ensure the best functionality of the Transition Radiation Detector (TRD) of the Compressed Baryonic Matter (CBM) experiment at the future Facility for Antiproton and Ion Research (FAIR), it is crucial to simulate the detector response as precisely as possible. Simulations are an instrument to optimize the detector design and account for possible challenges in the extraction of physics observables affected by design decisions.

After the event generation, the propagation of the particles through the detector setup is simulated with GEANT3. The detector behavior, including signal generation and collection, is simulated. This includes handling of transition radiation photons, energy deposition in the detector gas and signal-digitization.

In this contribution the general process of the detector response simulation is carried out with CbmRoot for the CBM-TRD. The focus lies on the reconstruction of the specific energy loss for charged particles. In addition, DESY test beam data of one TRD module will be compared to the simulation results. This work is supported by the BMBF-grant 05P21RFFC3.

HK 74.33 Thu 17:30 HSZ EG

Study of the $\pi^-\pi^+$ subsystem with $J^{PC} = 1^{--}$ in the diffractively produced $\pi^-\pi^-\pi^+$ final state at COMPASS * — •Martin Bartl for the COMPASS-Collaboration — Physik-Department E18, Technische Universität München

The COMPASS experiment is a fixed-target experiment at CERN fed by the SPS beam. The flagship spectroscopy analysis is based on the diffractive process $\pi^- p \to \pi^-\pi^-\pi^+ p$, for which a large data sample of 46×10^6 events has been collected.

This large data sample allows us to apply the so-called freed-isobar partial-wave analysis method, which extracts the amplitudes of the decay process with well-defined J^{PC} quantum numbers for the $\pi^-\pi^+$ subsystem, as well as for the 3π system. The $\pi^-\pi^+$ amplitudes are extracted in a quasi-model-independent way as a function of 2π mass, 3π mass, and squared four-momentum transfer. This highly detailed information allows us not only to test the assumptions of the isobar model, but also to perform in-depth studies of the 2π resonances that appear in the 3π system.

We study the 2π amplitudes with $J^{PC} = 1^{--}$. These 2π amplitudes are dominated by the well-known $\rho(770)$ resonance, but may also contain signals from excited ρ states, which are still elusive. The employed approach allows us to extract the pole positions, i.e. masses and widths, of these resonances and study their systematics.

*funded by the DFG under Germany's Excellence Strategy - EXC2094 - 390783311 and BMBF Verbundforschung 05P21WOCC1 COMPASS.

HK 74.34 Thu 17:30 HSZ EG

Reflectivity measurements with VUV light in xenon and vacuum — •Robert Braun, Lutz Althüser, and Johanna Jakob for the XENON-Collaboration — Institut für Kernphysik, WWU Münster

Rare event searches as performed with liquid xenon (LXe) detectors demand a precise knowledge of the employed materials. Measurements of optical properties at the xenon scintillation wavelength in the VUV regime are required for accurate simulations and detector characterization. The Reflectivity Setup in Münster has a focused light beam from deuterium lamp with a VUV monochromator to select the wavelength and as detector a PMT capable of 290° angular movement, allowing to study the reflectivity and transmission properties of a sample. The sample is placed in a quartz tube and can be studied in vacuum, in gaseous or in liquid xenon, which is kept stable by the built-in cold-head.

In the past, the setup was used for transmission measurements of polytetrafluorethylen (PTFE) (JINST 15 (2020) P12021), which is a common material to encapsulate the active volume in LXe detectors as used by the XENON dark matter project. In the near future, the setup will be used for reflectivity measurements of PTFE samples from the XENONnT experiment. This poster gives an overview of the Reflectivity Setup in Münster and the reflectivity and transmission measurements taken with it.

HK 74.35 Thu 17:30 HSZ EG

Correlation of flow coefficients measured in Au+Au collisions at 1.23 AGeV with HADES — •Laura Lauf for the HADES-Collaboration — Institut für Kernphysik, Frankfurt am Main, Deutschland

HADES has a large acceptance as well as excellent particle identification capabilities and therefore allows the study of dielectron, hadron, and light nuclei production in heavy-ion collisions with great precision. The harmonic flow coefficients v_n of the order $n = 1 - 6$ are measured with HADES as a function of centrality, transverse momentum, and rapidity in Au+Au collisions at 1.23 AGeV. Combining them allows to construct for the first time a complete, multi-differential picture of the emission pattern as a function of rapidity and transverse momentum. The predictions of ideal hydrodynamic simulations, confirmed by transport model calculations, suggest a scaling between various flow coefficients. For protons at mid-rapidity the ratio v_4/v_2^2 is found to be close to 0.5. The correlations of flow coefficients are investigated based on an event-by-event selection of the mid-rapidity final state elliptic flow of protons. The correlations are compared to the results of transport models and to eccentricity calculations within the Glauber Monte Carlo approach.

This work is supported by the Helmholtz Forschungsakademie HFHF

HK 74.36 Thu 17:30 HSZ EG

Noise Calibration of the ALICE-TRD in Run03 — •Archita Rani Dash for the ALICE Germany-Collaboration — Westfälische Wilhelms- Universität Münster

The ALICE Transition Radiation Detector (TRD) provides excellent electron identification and is part of the global tracking in the central barrel of ALICE. The operation data taking and the calibration of the ALICE TRD is one of the important aspects of the experiment.While the TRD calibration procedure involves four basic parameters,namely time offset, drift velocity, gain, and noise, this poster presentation is chiefly focused on the noise aspects of the detector. Short pedestal/noise runs are taken roughly once per month during data taking period, recording the data without the usually-applied zero suppression. As a result, we determine the status of each of the more than 1 million readout channels, calculating the noise value for every channel. This is obtained by calculating mean and rms of the ADC valuesfor each channel. In this work, we look at the latest noise run data of December 2022, obtaining the noise map of the whole detector.

Supported by BMBF in the ErUM Framework and DFG GRK2149.

HK 74.37 Thu 17:30 HSZ EG

Stability Tests for a Pulsed LED Gain Monitoring System for CALIFA — •Carl Georg Boos, Christian Sürder, and Thorsten Kröll for the R3B-Collaboration — Institut für Kernphysik, TU Darmstadt

The CALIFA array is part of the R3B set-up used for kinematically complete measurements of nuclear reactions. Those measurements are conducted at GSI and later FAIR, Darmstadt. The CALIFA is one of the core elements, functioning both as a calorimetre and a spectrometre for gamma-rays and light charged particles. It is built out of over 2000 CsI(Tl) crystals connected to APDs. As the gain is not constant for these detector systems - e. g. through possible ageing of the scintillation crystals and the temperature dependencies of the APDs - an Pulsed LED Gain Monitoring System is currently tested. The stability is examined to understand, to which extend the LEDs shift and to identify the reasons. Parameters investigated are pulse lengths and frequencies, the mimicing of the spill structure of the beam as well as the coupling of the fibres. In addition to lab test, a long measurement was started at the CALIFA array at GSI for possible correlations with temperature. This work was supported by BMBF 05P19RDFN1 and 05P21RDFN2.

HK 74.38 Thu 17:30 HSZ EG

Constraining the interaction between Λ and Kaons with femtoscopy at LHC — •Emma Chizzali for the ALICE Germany-Collaboration — Technical University of Munich, Munich, Germany

The meson-baryon interaction among short-lived strange particles as Λ and kaons is very challenging to be accessed in scattering experiments. Recently, an alternative approach to access the strong interaction in these systems was provided by measuring of two-body momentum correlations. Of special interest is the ΛK- interaction, which is characterized by the presence of the Xi(1620) state, recently observed by Belle, which can couple to ΛK- and lies just above the threshold. The ΛK+,- correlation function, already studied by the ALICE Collaboration in Pb-Pb collisions, has now been measured in pp Collisions at sqrt(s)=13 TeV. The small size of the particle-emitting source produced in this colliding system makes it possible to study short-ranged strong potentials with much higher precision. The results show that the ΛK+ interaction is repulsive and dominated by elastic processes. The measured ΛK- correlation function indicates an attractive interaction composed of a resonant contribution, through the Xi(1620) resonance, and a non resonant one.

Funded by DFG Projekt "C^3ATS: Effekte aufgrund der Kopplung der Kanäle im Analysis Tool für Korrelationen das die Schrödinger Gleichung verwendet" (MA 8660/1-1), BMBF Verbundforschung (05P21WOCA1 ALICE) and MPP IMPRS

HK 74.39 Thu 17:30 HSZ EG

Performance investigation of a DSSSD coupled to SKIROC2 ASICs — •Steffen Meyer[1], Thorsten Kröll[1], Roman Gernhäuser[2], Sergei Golenev[2], Corinna Henrich[1], and Han-Bum Rhee[1] — [1]TU Darmstadt — [2]TU Munich

Double-sided silicon-strip detectors (DSSSD) have been in use at the Coulomb excitation and transfer setup at the ISOLDE facility (CERN) for many years. Recently a new transfer setup, HI-REX, has been designed, which employs a FPGA-based GEAR platform to read out data of SKIROC2 ASICs [1].

Here, this new SKIROC ASIC-based DAQ is tested with a standard DSSSD. The TREX setup is known to face challenges with noise due to cabling and grounding. ASICs of the SKIROC family allow to minimize and eliminate such sources, because they are able to preamplify, filter, shape and digitize on-chip. To have comparable data, first tests with an MADC-32 module by Mesytec and FEBEX3 cards, designed at GSI, are performed.

The current status will be presented.

This work is supported by the German BMBF under contract 05P21RDCI2.

[1] C. Berner et al., Nuclear Inst. and Methods in Physics Research, A 987 (2021) 164827

HK 74.40 Thu 17:30 HSZ EG

Physics Performance Studies of K_s^0 with the CBM Experiment — •Felix Fidorra for the CBM-Collaboration — Institut für Kernphysik WWU Münster, Münster, Germany

The Compressed Baryonic Matter (CBM) is a fixed target heavy-ion experiment which is currently under construction at FAIR in Darmstadt. It will explore the QCD phase diagram at high net-baryon densities ($\mu B > 500\,\mathrm{MeV}$). A key element for the investigation of the dense baryonic matter are the measurements of the strange hadron yields, the most often produced K_s^0 and Λ as well as rare (multi-)strange hyperons and their antiparticles. To reconstruct the decays of these particles, a particle finder, based on the Kalman Filter, is used. A boosted

decision tree machine learning model has been trained to distinguish between signal and background. Simulations using two different event generators, UrQMD and DCM-QGSM-SMM, are used for this study. Since K_s^0 decay with the highest probability symmetrically into two soft pions of opposite charge, their reconstruction gives insights into the performance of the CBM detector. This poster will be about the status of K_s^0 analysis. The aim is to maximize the signal significance of the K_s^0 decay candidates selection using the machine learning algorithms and validate the multi-step and multi-differential fitting routine for K_s^0 yield extraction.

HK 74.41 Thu 17:30 HSZ EG

CBM-TRD tracking performance studies for mCBM 2022 — •Axel Puntke for the CBM-Collaboration — Institut für Kernphysik, WWU Münster

The Compressed Baryonic Matter (CBM) experiment at the future Facility for Antiproton and Ion Research (FAIR) will explore the QCD phase diagram in the region of very high net baryon densities. The Transition Radiation Detector (TRD) is an important subdetector of the final CBM experiment and is used to identify electrons at high momenta, contributes to tracking of particles and supports the identification of light nuclei via their specific energy loss.

For commissioning and performance measurements, the TRD takes part in the mCBM high-rate beam measurement campaigns at the SIS18 accelerator, which are part of the FAIR-Phase 0 program. Together with the TOF, STS, RICH and MuCH detectors, also TRD is connected to the full CBM DAQ, making data available for common analysis.

In this poster, TRD data QA as, e.g., a first tracking approach using straight tracks is presented and its results are shown.

This work is supported by BMBF grant 05P21PMFC1.

HK 74.42 Thu 17:30 HSZ EG

Deuteron emission from Ag+Ag Collisions at 1.58A GeV — •Carl-Philipp Roy for the HADES-Collaboration — Goethe-Universität Frankfurt

A high statistics data sample of Ag(1.58A-GeV)+Ag events recorded in scope of the FAIR phase 0 program in March 2019 is used to study multi-differential emission rates of deuteron.

In this contribution, we discuss details of the extraction of deuteron signals from the bulk of reconstructed charged particle tracks. The extracted deuteron signals are corrected with simulated detector response coefficients and then used to calculate the multi-differential emission rate per event as a function of transverse mass and center-of-mass rapidity. The obtained phase-space distribution of deuteron yields is fitted with thermally motivated model functions and extrapolated to phase-space not covered by the detector geometry. The results are discussed in context of available world data.

*This work has been supported by bmbf (05P21RFFC2) and gsi.

HK 74.43 Thu 17:30 HSZ EG

Arduino-based readout electronics for particle detectors — •Markus Köhli[1], Jannis Weimar[1], Fabian Schmidt[2], Jochen Kaminski[2], Klaus Desch[2], and Ulrich Schmidt[1] — [1]Physikalisches Institut, Heidelberg University — [2]Physikalisches Institut, University of Bonn

Open Hardware-based microcontrollers, especially the Arduino platform, have become a comparably easy-to-use tool for rapid prototyping and implementing creative solutions. Such devices in combination with dedicated frontend electronics can offer low-cost alternatives for student projects, slow control and independently operating small scale instrumentation. The capabilities can be extended to data taking and signal analysis at decent rates. We present two projects, which cover the readout of proportional counter tubes and of scintillators or wavelength shifting fibers with Silicon Photomultipliers. With the SiPMTrigger we have realized a small-scale design for SiPMs as a trigger or veto detector. It consists of a custom mixed signal frontend board featuring signal amplification, discrimination and a coincidence unit for rates up to 200 kHz. The nCatcher board transforms an Arduino Nano to a proportional counter readout with pulse analysis - time over threshold measurement and a 10-bit analog-to-digital converter for pulse heights. The device is therefore suitable for low to medium rate environments, where a good signal to noise ratio is crucial - in case presented here to monitor thermal neutrons.

HK 74.44 Thu 17:30 HSZ EG

Ultra-clean magnetically-coupled piston pump for noble gas experiments. — •Andria Michael[1], Lutz Althüser[1], David Koke[1], Christian Huhmann[1], Michael Murra[1,2], Philipp Schulte[1], Henning Schulze Eissing[1], and Christian Weinheimer[1] for the XENON-Collaboration — [1]Institut für Kernphysik, Universität Münster, Germany — [2]Columbia University, New York, USA

The high performance magnetically-coupled piston pump is interesting for the usage in low background experiments dealing with noble gases as target. In such ultra-clean experiments, pumps are used for the circulation of the target material. Therefore, the reduction of radioactive emanating materials such as radon is of great importance. For this purpose, a radon-free, hermetically sealed, ultra-clean magnetically-coupled piston pump was developed (JINST 16 (2021) P09011) to be operated as a xenon gas compressor for the XENONnT experiment.

The magnetically-coupled piston pump is made of four cylinders connected in parallel, featuring a high flow by keeping high pressure differences for a good compression. The custom-made control gives the possibility to operate the system with different configurations and to monitor the status of each pump during the operation.

In this poster the function and the operation experience with this magnetically-coupled piston compressor is presented.

This research was partially supported by BMBF under contract 05A20PM1.

HK 74.45 Thu 17:30 HSZ EG

CBM-TRD Component Database — •Philipp Munkes for the CBM-Collaboration — Institut für Kernphysik WWU Münster, Münster, Germany

The Compressed Baryonic Matter (CBM) experiment is an upcoming heavy-ion physics experiment at the future Facility for Anti-proton and Ion Research (FAIR) which will investigate the low-temperature and high baryonic density region of the Quantum-ChromoDynamic (QCD) phase diagram.

The Transition Radiation Detector (TRD), one of the sub-detectors of the CBM experiment, will be used to provide particle identification information on electrons and pions at high momenta and light nuclei, as well as tracking information for charged particles.

For long-running experiments it is important to keep track of all of their components already during production of the detector, as soon as they have been assigned an identity. This enables not only full QA processes of those components, but also correlating the product behavior to the components and/or to the production process, if necessary at some point. For this reason, a long-term stable database for production data needs to be implemented, deployed, and tested.

In this poster, the design of the CBM-TRD Component Database concept and its current status will be presented.

This work is supported by BMBF grant 05P21PMFC1.

HK 74.46 Thu 17:30 HSZ EG

pp correlation in e^+e^- collisions at Belle to study the particle emitting source — •Maria Leibelt[1], Laura Serksnyte[1], Umberto Tamponi[2], and Laura Fabbietti[1] — [1]TU München, Garching, Germany — [2]INFN, Sezione di Torino, Turin, Italy

The light antinuclei cosmic rays are considered as a promising probe for the searches of Weakly Interacting Massive Particles (WIMPs) - one of the dark matter candidates. The antinuclei can be produced in dark matter annihilations and detected by experiments near Earth. Understanding the antinuclei fluxes requires knowledge about how light antinuclei are formed. One of the available models is coalescence which suggests that first antinucleons are formed as degrees of freedom and then they coalesce to antinuclei. The probability for the antinucleons to create a bound state depends on the relative momentum in the pair rest frame and the distance at which they are produced. The latter can be constrained with femtoscopic correlation measurements, currently available only for pp and heavy-ion collisions. As a proxy to constrain the source for antinuclei production in the dark matter annihilation, e^+e^- collisions are preferred since electrons are point-like particles and do not interact strongly. In this poster, we will show the first results on femtoscopic p-p correlations in e^+e^- collisions measured by Belle at the KEKB collider. The obtained correlation function is then modeled using well known interaction potentials and the size of the source for nucleon pairs is extracted.

HK 74.47 Thu 17:30 HSZ EG

A new TPC with a hybrid GEM-Micromegas detector

— •Liancheng Ji[1], Meytal Duer[1], Alexandru Enciu[1], Bastian Löher[2], Alexandre Obertelli[1], Yelei Sun[1], Simone Velardita[1], Piotr Gasik[2], and Joerg Hehner[2] for the R3B-Collaboration — [1]Technische Universität Darmstadt, Institut für Kernphysik, 64289, Darmstadt, Germany — [2]GSI, Helmholtzzentrum für Schwerionenforschung, 64291 Darmstadt

HYDRA (HYpernuclei Decay at R^3B Apparatus), a physics program within the R^3B collaboration at GSI/FAIR, is dedicated to studying the production of light and medium mass hypernuclei in ion-ion collisions by measuring their pionic decay. With HYDRA day-one experiment in 2024 the mass radius of the hypertriton, the lightest hypernucleus will be extracted for the first time. The main tracking detector, a time projection chamber (TPC) is being developed and will be operated inside an inhomogeneous magnetic field of the GLAD large-acceptance dipole magnet at the R^3B setup.

As the first step, a prototype GEM-Micromegas hybrid TPC has been built to implement all the technologies proposed for the full TPC. It covers an active area of 256 x 88 mm^2 , with a 300 mm drift distance. A two-layer wired field cage holds up the electric field. Along with it, a laser system is employed to generate reference tracks with which the homogeneity of the drift field can be quantified and calibrated.

Currently the prototype is being tested at TU Darmstadt. Simulations and first test results will be presented in the poster.

HK 74.48 Thu 17:30 HSZ EG

A GEANT4 simulation of gamma clustering in CsI. — •Philipp Klenze[1], Leyla Atar[2], and Roman Gernhäuser[1] for the R3B-Collaboration — [1]Technische Universität München — [2]Technische Universität Darmstadt

With over 1500 CsI(Tl) crystals, the CALIFA calorimeter is one of the cornerstones of the upcoming R^3B experiment at the FAIR accelerator complex. One of its tasks will be the detection of gamma rays in the range from 100 keV to 30 MeV. Due to the high granularity of CALIFA, these energy deposit of gamma rays will generally be spread over multiple crystals. In this work a simplified geometry model in GEANT4 is used to study both the quantitative behavior of photons in CsI, cluster sizes and shapes, and energy and position reconstruction efficiency.

HK 74.49 Thu 17:30 HSZ EG

Pulse-shape analysis with the new Miniball triple-cluster detector — •Kai Henseler, Darius Luyken, Jasper Wehlitz, Rainer Abels, Jürgen Eberth, Herbert Hess, Rouven Hirsch, and Peter Reiter — IKP Universität zu Köln, Cologne, Germany

The Miniball (MB) array is a high-resolution γ-ray spectrometer used for low multiplicity experiments with low-intensity radioactive ion beams at HIE-ISOLDE, CERN. It consists of eight triple-cryostats, each housing three n-type six-fold segmented HPGe crystals. New preamplifier electronics was implemented in the cold part of the cryostat and the feedback loop is now coupled to the AGATA preamplifier [1]. The seven preamplifier outputs from one crystal are digitized at a rate of 100 MHz using 14-bit ADCs [2]. The new electronics yield comparable energy resolution results with respect to standard analog electronics and enable pulse-shape analysis of all channels simultaneously. Measurements with a collimated γ-ray source of ^{137}Cs were conducted to produce data sets of interactions along one line, so called 'pencil beams'. These pulses are filtered and analyzed with respect to the deposited energy, rise time and pulse shapes. Aim of the PSA is to identify the location of individual interaction points. Especially along the detector axis three dimensional position information is crucial for improved Doppler correction. First results will be presented and discussed. Supported by BMBF Projects 05P18PKCI1, 05P21PKCI1.
[1] S. Akkoyun *et al.*, Nucl. Inst. Meths. Phys. Res. A 668 (2012) 26
[2] A. Pullia *et al.*, IEEE NSS MIC Record (2012) 819-823

HK 74.50 Thu 17:30 HSZ EG

High-energy gamma calibration of CALIFA with a Pu-C source — •Phuong Nguyen, Leyla Atar, Christian Suerder, and Thorsten Kroell for the R3B-Collaboration — Institut für Kern- physik, TU Darmstadt, Darmstadt, Germany

CALIFA (CALorimeter for In-Flight detection of gamma-rays and high energy charged pArticles) is the scintillator based calorimeter of the R3B (reactions with relativistic radioactive beams) experiment at FAIR that surrounds the target. It currently consists of 1528 scintillation CsI(Tl) crystals and detects gamma-rays and light charged particles simultaneously. The energy calibration of CALIFA crystals is done using different sources, from low energy-gamma peaks (22Na) to high energy-gamma peaks (Pu-C) reaching from 511 keV up to 6.1 MeV. This is essential due to the high dynamic range (100keV to 300MeV) of CALIFA. To improve the calibration quality, various gamma sources are combined in the calibration procedure and automated by a Python script.

This work is supported by BMBF under contract 05P19RDFN1 and 05P21RDFN2 and the Helmholtz Research Academy Hesse for FAIR - HFHF.

HK 74.51 Thu 17:30 HSZ EG

New evidence for alpha clustering structure in the ground state band of ^{212}Po — •Martin von Tresckow for the IFIN212Po-Collaboration — IKP TU Darnstadt, Schlossgartenstraße 9, 64289 Darmstadt

^{212}Po has two-protons and neutrons outside the doubly-magic nucleus ^{208}Pb and it may be assumed that the nuclear structure can be well described within the shell-model. But various experimental properties, such as the short-lived ground state, are better described by an α-clustering model. The B(E2) values of the decays of the low-lying yrast states are an important finger print to describe the structure of ^{212}Po. Especially the missing B(E2; $4_1^+ \rightarrow 2_1^+$) value is important in this discussion. We have performed an α-transfer experiment to investigate excited states of ^{212}Po and determine the lifetimes using the ROSPHERE γ-ray detector array at IFIN-HH in Magurele, Romania. This array consisted of 15 HPGe detectors and 10 $LaBr_3$(Ce) scintillator detectors and was supplemented with the SORCERER particle-detector array. The combination of γ-ray and the particle detectors was an important tool to determine the mean lifetimes of all ground-state band levels up to the 8^+ state applying the fast-timing method [Ma. von Tresckow et al., PLB 821, 136624 (2021)]. I will present our lifetime analysis and discuss the results within the shell-model and α-clustering model. *Supported by BMBF under Verbundprojekt 05P2021 (ErUM-FSP T07) via grant 05P21RDFN1

HK 74.52 Thu 17:30 HSZ EG

CBM-TRD hit time extraction — •Philipp Kähler[1], Marius Kunold[2], and David Schledt[2,3] for the CBM-Collaboration — [1]Institut für Kernphysik, WWU Münster — [2]Institut für Kernphysik, Goethe-Universität Frankfurt — [3]Infrastruktur und Rechnersysteme in der Informationsverarbeitung, Goethe-Universität Frankfurt

The Transition Radiation Detector (TRD) of the upcoming CBM experiment will be based on Multi-Wire Proportional Chambers (MWPCs), which are read-out via their segmented cathode pad-planes. The incoming charge from hits is amplified and shaped in the analogue part of the read-out ASICs, i.e. the SPADIC chip. The resulting shaper signals are digitised directly in its integrated sampling ADC. As the transmission function of the shaper is well known, the signal arrival time can be extracted from the transmitted ADC samples with a precision well below the sampling frequency of 16 MHz.

This poster shows implementations of the time value extraction for measured signals, which is used in the chain to TRD hit reconstruction. Different methods, based on a look-up table approach as well as on direct calculation, have been tested on real data from mCBM measurements (FAIR phase 0 programme) at the SIS18 accelerator. Implementations for online application of the time extraction in the Common Readout Interface (CRI) FPGA of our system will be covered. This work is supported by BMBF grants 05P21RFFC1 and 05P21PMFC1.

HK 74.53 Thu 17:30 HSZ EG

Magnetic field dependence of dielectron measurements with ALICE 3 — •Zafar Momtaz for the ALICE Germany-Collaboration — Institut für Kernphysik, Goethe-Universität Frankfurt

Ultra-relativistic heavy-ion collisions are used to study strongly interacting matter under extreme conditions, i.e. high temperature and energy density, where a deconfined state of quarks and gluons is formed and chiral symmetry is expected to be restored. At the LHC, a next-generation heavy-ion experiment, called ALICE 3, is planned beyond the 2030s to address the remaining fundamental questions still open. In particular, ALICE 3 should enable precise measurements of the temperature evolution of the quark-gluon plasma created in heavy-ion collisions via dielectron analyses. Moreover it should allow us to study the mechanisms of chiral symmetry restoration from the spectrum of dielectron created in the medium in the vicinity of the transition temperature via the spectral function of the ρ - meson. In order to achieve these physics goals, the ALICE 3 detector setup would include an ultra-light tracker, covering the pseudorapidity range of of $|\eta| < 4$ and installed within a superconducting magnet system.

This poster will show the expected dielectron measurement performance with ALICE 3 for different magnetic fields. In particular, we will focus on the tracking and electron identification efficiencies for different detector configurations and explain how they influence the predicted uncertainties of the temperature measurements of the fireball.

HK 74.54 Thu 17:30 HSZ EG

Development of a Muon Tagger System for the future MuonEDM Experiment — •Dhruv Chouhan, Melike Akbiyik, Elisa Ruiz Choliz, Francesco Fallavolita, and Matthias Schott — Johannes Gutenberg University of Mainz, Germany

The future MuonEDM experiment aims to search for an electric dipole moment of the muon based on the frozen-spin technique. With the advent of the new high intensity muon beam, HIMB, and the cold muon source, muCool, at PSI the sensitivity of the search for the muon EDM could be improved by several orders of magnitudes. In this context, the latest developments on a muon-tagger system for the MuonEDM experiment are discussed. Special focus is drawn on a straw-tube based approach as well as a Micromegas based TPC detector.