HK 51: Instrumentierung

Zeit: Donnerstag 16:30–18:45 Raum: HZ 9

Gruppenbericht HK 51.1 Do 16:30 HZ 9

Upgrade of the ALICE TPC for high-rate operation — •Jens Wiechula for the ALICE-Collaboration — Physikalisches Institut, Eberhard Karls Universität Tübingen

After the second long shutdown the LHC will provide substantially higher collision rates of up to 50 kHz in Pb–Pb. The dedicated heavy-ion experiment, ALICE, at the LHC will record every interaction, leading to an inspected integrated luminosity of $\mathcal{L}_{\mathrm{int}} = 10\,\mathrm{nb}^{-1}$ during the RUN 3 data taking phase. This will result in a significant improvement on the sensitivity of rare probes that are considered key observables to characterise the hot and dense QCD matter created in such collisions.

In order to cope with these collision rates, ALICE plans an upgrade of the detectors and the online computing systems. The main detector for track reconstruction and particle identification is a large volume Time Projection Chamber (TPC). Currently, the usage of conventional multi-wire proportional chambers (MWPCs) limits the readout rate to 3.5 kHz, due to the need of a triggered ion gate. To overcome this limitation, the MWPCs will be exchanged by innovative Gas Electron Multipliers (GEMs), allowing for a continuous readout. The ALICE TPC will be the first continuously operated detector of its kind running in a high luminosity, high track-density environment.

Challenges and implications of the detector upgrade as well as the current status of the R&D will be reported.

HK 51.2 Do 17:00 HZ 9

Integrating a gas chromatograph for measuring gas compositions in ALICE — •Martin Fleck — Physikalisches Institut, University of Heidelberg, Im Neuenheimer Feld 226

The ALICE Time Projection Chamber and Transition Radiation Detector operate with gases whose exact composition affect substantially their performance. In particular, the gas composition determines drift velocity and gas gain of these detectors and therefore its precise knowledge is crucial, both for detector calibration and for online monitoring and trigger generation.

The analysis of the gas components and contaminants from air is a challenging task. Most of the sensors available on the market are insufficient or require frequent and tedious calibration.

A solution is the use of a gas chromatograph customary configured for the detection of the concerned gases, mainly noble gases, CO_2, and the rest of the natural air components.

We present an approach of how such an instrument, after proper calibration, can be reliably operated to provide frequent samples of the gas composition. The results are subsequently transported and integrated into the detector's control system for monitoring and archiving and for immediate use in calibration procedures.

HK 51.3 Do 17:15 HZ 9

The CBM time of flight wall - System aspects — •Ingo Deppner and Norbert Herrmann for the CBM-Collaboration — Physikalisches Institut der Universität Heidelberg

The Compressed Baryonic Matter spectrometer (CBM) is a future heavy ion experiment located at the Facility for Anti-proton and Ion Research (FAIR) in Darmstadt, Germany. The main goal of CBM is the investigation of the phase diagram of strongly interacting matter in the region of the highest baryon densities. In order to measure the necessary observables with unprecedented precision an excellent particle identification is required. The key element providing hadron identification at incident energies between 2 and 35 AGeV is a 120 m^2 large Time-of-Flight (ToF) wall composed of Multi-gap Resistive Plate Chambers (MRPC). In this contribution we will illustrate the current conceptual design of the ToF-wall which is based on a modular structure composed of super modules (SM). The various proposed RPC configurations in particular a prototype developed in Heidelberg as well as the resulting system aspects will be discussed. Work was supported partially by BMBF 05PRVHC7 and by EU/FP7-HadronPhysics3/WP19

HK 51.4 Do 17:30 HZ 9

The HADES RPC Time of Flight Wall performance in Au+Au Collisions at 1.23 AGeV — •Georgy Kornakov — TU Darmstadt

The HADES Resistive Plate Chamber (RPC) detector measures the time-of-flight of charged particles in the innermost part of the High Acceptance Di-Electron Spectrometer located at GSI, Darmstadt, Germany. Its main goal is to provide lepton identification at low momenta (p<400MeV/c) as well as identification of pi, K, p, He3, d/He4, t, studied by the experiment.

For the Au+Au beam time, a major improvement of the spectrometer in terms of granularity and particle identification capability was achieved by replacing the old TOFino detector by the new shielded timing RPC time-of-flight detectors. The gold beam provided by the SIS 18 accelerator with energy of 1.23 AGeV was colliding with a segmented gold target, creating in the RPC region mean multiplicities of 72 charged particles per event and in the most central ones of 150 charged particles.

Results show a RPC efficiency above 95 % and a mean time accuracy below 70 ps. In here we will describe the design and performance characteristics required to achieve the goal as well as the methods and algorithms used for calibration and correction of the data.

HK 51.5 Do 17:45 HZ 9

Der Myonen-Detektor des CBM Experiments bei FAIR — •Anna Senger[1], Partha Pratim Bhaduri[2] und Shabir Bhat[3] für die CBM-Kollaboration — [1]GSI, Darmstatd, Deutschland — [2]VECC, Kolkata, Indien — [3]Kashmir University, Srinagar, Indien

Eine der Herausforderungen des CBM Experiments ist die Messung von Myonenpaaren aus Zerfällen von Vektormesonen (ρ, ω, ϕ, J/ψ, ψ'), die in Schwerionenstößen erzeugt werden. Die Multiplizität der Myonenpaare variiert zwischen 10-3 und 10-9 pro zentralem Au+Au Stoß, wobei in jeder Reaktion bis zu 1000 geladene Hadronen emittiert werden. Die Unterdrückung der Hadronen und der Nachweis der Myonen werden durch ein aktives Absorbersystem erreicht, das aus mehreren Lagen Eisen und Detektorebenen besteht und die Spuren aller geladenen Teilchen rekonstruiert. Die Nachweis-Effizienzen und die Signal-zu-Untergrund Verhältnisse werden in Simulationsrechnungen untersucht, basierend auf realistischen Annahmen bezüglich der Teilchenmultiplizitäten und der Detektoreigenschaften. Die Ergebnisse der Simulationen für FAIR Energien von 8 bis 25 AGeV für realistische Experimentbedingungen werden vorgestellt.

HK 51.6 Do 18:00 HZ 9

RPC test with heavy-ion beams — •Christian Simon and Norbert Herrmann for the CBM-Collaboration — Physikalisches Institut und Fakultät für Physik und Astronomie, Ruprecht-Karls-Universität Heidelberg, D-69120 Heidelberg, Deutschland

The Time-of-Flight (ToF) wall of the Compressed Baryonic Matter (CBM) experiment, conceptualized on the basis of high-resolution timing Multi-gap Resistive Plate Chambers (MRPCs), is intended to account for concise hadron identification at an unprecedented event rate of 10 MHz in Au+Au collisions. Comprehensive performance tests of several purpose-built multi-strip MRPC prototypes forseen for different rate regions of the planned 120 m^2 ToF wall are an essential instrument to study the response and the limitations of the current design. Such evaluation studies were carried out both under SIS-18 heavy-ion beam load at GSI in the fall of 2012 and under cosmic irradiation in the lab throughout the year 2013. Particle flux conditions of up to a few tens of kHz/cm^2 as expected to impinge on the ToF wall in future CBM runs can be provided at the SIS-18 accelerator. A generic calibration scheme for MRPCs with strip read-out has been developed and will be described. Preliminary results concerning key characteristics like efficiency and timing resolution of a multi-strip MRPC demonstrator will be presented, as well as an outlook to the specifications and requirements of a planned high-rate in-beam test at GSI in 2014. The project is partially funded by BMBF 05PRVHFC7 and by EU/FP7-HadronPhysics3/WP19.

HK 51.7 Do 18:15 HZ 9

Detection efficiency of the neutron detector BELEN-48 measured at the PTB Braunschweig — •Michele Marta[1,2], Jorge Agramunt[3], Roger Caballero-Folch[4], Guillem Cortés[4], Iris Dillmann[1,2,5], Martin Erhard[6], Luis M. Fraile[7], Ulrich Giesen[6], Ralf Nolte[6], Albert Riego[4], Stefan Röttger[6], and Jose Luis Taín[3] — [1]GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany — [2]II. Physikalisches Institut, Justus-Liebig Universität Giessen, Germany — [3]IFIC-CSIC University of Valen-

cia, Valencia, Spain — [4]INTE-DFEN, Universitat Politecnica de Catalunya, Barcelona, Spain — [5]TRIUMF, Vancouver, Canada — [6]Physikalisch-Technische Bundesanstalt (PTB), Braunschweig, Germany — [7]Universidad Complutense de Madrid, Spain

The BEta-deLayEd Neutron detector BELEN-48 is a highly efficient detector of β-delayed neutrons, for nuclear structure, nuclear astrophysics and reactor studies. It consists of 48 ^{3}He proportional counters arranged in a polyethylene matrix in a way that the detection efficiency remains constant for neutron energies from thermal up to a few MeV. In order to validate MCNPX simulations, the detection efficiency has been calibrated with well-known (p,n) and (α,n) reactions on ^{7}Li, ^{13}C and ^{51}V producing neutrons with energies between 0.1 and 5 MeV. The experiment has been performed at the neutron metrology facility of PTB, which allowed the measurement of yields and angular distributions with a calibrated monitor. The new results indicate anisotropies, which are not reported in literature and have been taken into account to obtain the experimental efficiencies for BELEN.

HK 51.8 Do 18:30 HZ 9

Comissioning of a 1-m distillation plant to remove krypton out of xenon — •Stephan Rosendahl[1], Ethan Brown[1], Ion Cristescu[2], Alexander Fieguth[1], Christian Huhmann[1], Michael Murra[1], and Christian Weinheimer[1] — [1]Institut für Kernphysik, Wilhelm-Klemm Strasse 9, 48149 Münster, Germany — [2]Karlsruher Institut für Technologie, Tritium Laboratory, Hermann-von-Helmholtz-Platz 1, 76344 Eggenstein-Leopoldshafen, Germany

The XENON1T experiment aims for the direct detection of dark matter in the form of Weakly Interacting Massive Particles (WIMPS) and is now under construction. For this purpose a dual-phase TPC, filled with xenon is used, aiming for a fiducial volume of 1 ton to increase the sensitivity to WIMP-nucleon cross section by 1.5 orders of magnitude compared to current experiments. One dominant radioactive contamination, which one needs to reduce to reach the sensitivity, is ^{85}Kr, which has a beta-becay with an endpoint energy of 687keV. Therefore, the xenon has to be purified to a concentration of <0.1ppt (parts per trillion) natural krypton in xenon. This talk reports about the commissioning of a cryogenic distillation plant to remove krypton out of xenon, using 1m of package material, as a milestone on the way to a distillation column using 3m package material. Different diagnostics tools, like a ^{83m}Kr tracer method and cold trap-enhanced mass spectrometry, allow to characterize the efficiency of the system.

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