HK 31: Instrumentation 11

Time: Tuesday 17:00–19:00 Location: M/HS2

HK 31.1 Tue 17:00 M/HS2

Der Myonen-Detektor des CBM Experiments bei FAIR@SIS100 — •Anna Senger für die CBM-Kollaboration — GSI, Darmstadt, Deutschland

Eine der Herausforderungen des CBM Experiments ist die Messung von Myonenpaaren aus Zerfällen von Low-Mass-Vektormesonen (ρ, ω, ϕ), aus QGP Emission, aber auch aus Zerfällen von J/ψ und ψ', die in Schwerionenstößen erzeugt werden. Die Multiplizität der Myonenpaare (Multiplicität x Branching Ratio) 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 um die Spuren aller geladenen Teilchen rekonstruieren. 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 den FAIR Energien von 4 bis 10 AGeV für realistische Experimentbedingungen werden vorgestellt.

HK 31.2 Tue 17:15 M/HS2

Performance study of the Projectile Spectator Detector for the CBM Experiment — •Ilya Selyuzhenkov[1], Andrej Kugler[2], Vasilij Kushpil[2], Vasily Mikhaylov[2,3], Selim Seddiki[1], and Pavel Tlusty[2] for the CBM-Collaboration — [1]GSI Helmholtzzentrum für Schwerionenforschung, Planckstr. 1, 64291 Darmstadt — [2]Nuclear Physics Institute, Academy of Sciences of the Czech Republic, Řež, Czech Republic — [3]Czech Technical University (CTU), Prague, Czech Republic

The expected performance of the Projectile Spectator Detector (PSD) for the CBM experiment at the future FAIR facility will be presented. The PSD is a compensating lead-scintillator calorimeter designed to measure the energy distribution of the projectile nuclei fragments (spectators) and forward going particles produced close to beam rapidity. The main purpose of the PSD is to provide an experimental estimate of heavy-ion collision centrality and reaction (symmetry) plane orientation.

A sample of heavy-ion collisions simulated with realistic modeling of nuclei fragment production, directed and elliptic flow of produced particles and transported through the GEANT Monte-Carlo of the CBM detector geometry is used to study the PSD performance. The performance of the centrality and reaction plane determination is explored with the PSD as a standalone detector and in a combination with other CBM subsystems.

HK 31.3 Tue 17:30 M/HS2

Symmetric Møller/Bhabha luminosity monitor for the OLYMPUS experiment — Luigi Capozza[2,3], Colton O'Connor[4], Jürgen Diefenbach[6], Boris Gläser[6], •Dmitry Khaneft[1,2], Yue Ma[3,5], Frank Maas[2,3], Roberto Pérez Benito[2,3], and David Rodríguez Piñeiro[2,3] — [1]Johannes Gutenberg-Universität Mainz, Mainz, Germany — [2]Helmholtz-Institut Mainz, Mainz, Germany — [3]GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany — [4]Massachusetts Institute of Technology, Cambridge, MA, USA — [5]Currently at Advanced Meson Laboratory, Nishina Centre, RIKEN, Japan — [6]Institut für Kernphysik, Mainz, Germany

The OLYMPUS experiment is motivated by the discrepancy between the proton electric to magnetic form factor ratio measured using unpolarized and polarized electron scattering. This discrepancy can be explained by a two-photon exchange (TPE) contribution in lepton-hadron scattering. Measuring the ratio of electron-proton and positron-proton elastic scattering cross sections the contribution of the TPE can be determined. For this purpose, very precise measurements of the relative luminosity have to be performed. The symmetric Møller/Bhabha luminosity monitor, made of calorimetric lead fluoride (PbF_2) Cherenkov detectors, provides precise data from counting coincidences Møller and Bhabha events. High sensitivity to the geometrical acceptance and alignment requires accurate study of systematic uncertainties.

HK 31.4 Tue 17:45 M/HS2

Simulation Studies for the PANDA Endcap Disc DIRC — •Mustafa Schmidt[1], Klim Biguenko[1], Michael Düren[1], Klaus Föhl[2], Avetik Hayrapetyan[1], Benno Kröck[1], Oliver Merle[1], and Julian Rieke[1] for the PANDA-Collaboration — [1]II. Physikalisches Institut, Justus-Liebig-Universität, Gießen, Deutschland — [2]CERN, Genf, Schweiz

The physics program of the PANDA detector at the future FAIR facility at GSI requires excellent particle identification. For the Panda forward endcap region a novel detector type called "Disc DIRC" has been designed. It covers the angular range between 5 and 22 degrees and uses internally reflected Cherenkov light in order to separate pions, kaons and protons up to a momentum of 4 GeV/c.

During the design phase, extensive detector simulations have been performed to optimize and evaluate the design. The simulations were done using Geant4 and the PandaRoot framework in addition with a dedicated reconstruction software. An important aspect was the optimization of the imaging while taking the geometrical tolerances of the manufacturing process of the final detector into account. The main focus lies on the optimization process of the cylindrical and polynomial focussing optics at the edges of the detector plate, which has been performed with the merit function of a raytracer called PyOptics, written by one of the group members.

HK 31.5 Tue 18:00 M/HS2

Development of a CO_2 Cooling System for the CBM Silicon Tracking System — •Jorge Sanchez Rosado[1], Burak Degirmenciler[1], Johann Heuser[1], Anton Lymanets[2], Hans Rudolf Schmidt[2], and Christian Sturm[1] — [1]GSI Helmholtzzentrum für Schwerionenforschung GmbH — [2]Eberhard Karls Universität Tübingen

The demanding requirements of current high-energy physics experiments curiously bring back the idea of using a well-known and present refrigerant in nature: CO_2. As an outcome of previous studies and effort made within the current upgrade programs of detectors like ATLAS or CMS, this refrigerant is the optimum solution. Due to its highest volumetric heat transfer coefficient, it fulfills the requirements in this kind of detectors such as reduction of mass budget and the use of smaller diameter for cooling pipes.

A two-phase (evaporative) CO_2 cooling system is taken as the first choice to extract the 42 kW dissipated by the electronics of the Silicon Tracking System, the central detector of the CBM experiment at FAIR that will be installed in the gap of the 1 T super-conducting dipole magnet in a confined volume of 2 m^3. As a step towards the final design of this a cooling system, a 1 kW cooling unit called TRACI-XL was conceived at GSI in cooperation with CERN. This scaled prototype allows gaining insight into the behavior of the full system with valuable conclusions in terms of thermodynamics, process engineering and automation.

HK 31.6 Tue 18:15 M/HS2

Simulation study of STS-XYTER front-end electronics in overload situations for the Silicon Tracking System in the CBM experiment — •Tomas Balog for the CBM-Collaboration — GSI, Darmstadt, Germany

In high-rate experiments, as the CBM Experiment at FAIR, a situation can occur in which the data rate temporarily exceeds the available bandwidth. With self-triggered front end electronics such overload situations would lead, without further measures, to uncontrolled data losses and potentially a large number of incomplete events. Mechanisms needed to control data losses and to ensure the collection of complete events can be understood via simulations performed with the hardware description language SystemC. Results from simulations of a simplified front-end electronics for the CBM Silicon Tracking System, based on the STS-XYTER ASIC, will be presented. Performed simulations give first insight in the behavior of data flow and data losses in the DAQ system of the CBM experiment. Options and solutions for the data throttling mechanisms at beam conditions required by the CBM experiment will be discussed.

HK 31.7 Tue 18:30 M/HS2

The contribution of cables to the material budget of the

CBM-MVD — •Philipp Klaus, Jan Michel, and Joachim Stroth for the CBM-MVD-Collaboration — Goethe-Universität Frankfurt

The Micro-Vertex Detector (MVD) for the CBM experiment will be used for a very high vertexing resolution. Making the destinction between primary and secondary vertices is crucial to finding rare and quickly decaying particles such as D-mesons.

For three out of four stations, the electrical connections have to placed inside the acceptance of the detector. Those cables make up about 1/3 of the total material budget. This contribution will describe the progress of reducing the material of the MVD detector stations by using Aluminium traces instead of Copper traces for the flat readout cables. The effect of the resulting lower material budget on the physics performance of the detector is being evaluated with simulations and will be shown.

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HK 31.8 Tue 18:45 M/HS2

Development of an alignment system for the CBM rich — Claudia Höhne, Tariq Mahmoud, and •Jordan Bendarouach for the CBM-Collaboration — Justus Liebig University, Gießen

The Compressed Baryonic Matter (CBM) experiment at the future FAIR complex will investigate the phase diagram of strongly interacting matter at high baryon density and moderate temperatures in A+A collisions from 4-35 AGeV.

One of the key detector components required for the CBM physics program is the RICH detector, which is developed for efficient and clean electron identification and pion suppression. Main detector components are a CO2 gaseous radiator, MAPMT or MCP photo-detectors and spherical glass mirror tiles, used as focusing elements, with spectral reflectivity down to the UV range. An important aspect to guarantee a stable operation of the RICH detector is the alignment and continuous monitor of the mirrors. CLAM (Continuous Line Alignment Monitoring), an alignment procedure developed by the COMPASS experiment, is planned to be used also for the RICH mirror system. A smaller-scale version has been implemented in the CBM RICH prototype detector and tested at the Cern PS/T9 beamline in November 2014.

Using a grid and target dots made of retro-reflective material, it is possible to align the mirrors and monitor their displacements over time by analyzing and applying mathematical calculations on photographic images of the grid and targets reflected on the mirrors. The concept, first data and results of image processing will be presented and discussed.