HK 15: Instrumentation IV

Zeit: Montag 16:30–18:00 Raum: S1/01 A2

Gruppenbericht HK 15.1 Mo 16:30 S1/01 A2

The Silicon Tracking System of the CBM Experiment at FAIR — •Anton Lymanets for the CBM-Collaboration — GSI Darmstadt, Germany

The Compressed Baryonic Matter experiment will investigate the phase diagram of strongly interacting matter in nucleus-nucleus collisions at highest net baryon densities using a number of rare probes and bulk observables. Its key component – the Silicon Tracking System – will reconstruct up to 1000 charged particle trajectories per Au+Au collision at up to 10 MHz interaction rate and will measure their momenta. The system design employs high-granularity sensors matching the non-uniform track density and fast self-triggering electronics with a the free streaming data acquisition system and online event selection. The required momentum resolution of $\Delta p/p \sim 1.5\%$ dictates the need of the low-mass design with material budget of 0.3-1%X_0 per station.

The eight tracking stations of the STS operating in the aperture of a dipole magnet with 1 T field will cover the polar angles between 2.5° and 25°. The stations with a total sensor area of 4.2 m^2 will comprize about 1000 detector modules consisting of double-sided silicon microstrip sensors, ultra-thin readout cables and front-end electronics that are mounted onto lightweight carbon fiber support strctures.

The progress with the final components will be discussed, in particular sensors, readout cables and readout ASICs. The assembly of the detector module components into full-scale prototypes and the engineering of the mechanical structure of the STS will be presented.

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HK 15.2 Mo 17:00 S1/01 A2

Quality assurance of the silicon microstrip sensors for the CBM experiment — •Iaroslav Panasenko[1,2] and Pavel Larionov[3] for the CBM-Collaboration — [1]Physikalisches Institut, Universität Tübingen, Germany — [2]Institute for Nuclear Research, Kiev, Ukraine — [3]University of Frankfurt, Germany

The CBM experiment at FAIR will investigate the properties of nucler matter at extreme conditions created in ultrarelativistic heavy-ion collisions. Its core detector — the Silicon Tracking System (STS) — will determine the momentum of charged particles from beam-target interactions. The track multiplicity will reach up to 700 within the detector aperture covering the polar angle 2.5° and 25°. High track density as well as stringent requirements to the momentum resolution (∼1%) require a system with high channel granularity and low material budget.

The STS will be constructed of about 1200 double-sided silicon microstrip sensors with 58 μm pitch and a total area of $\sim$4 m^2 with all together 2.1 million channels will be read out.

In this talk the quality assurance of double-sided silicon microstrip sensors will be discussed. This includes both visual and electrical characterization. For this purpose dedicated equipment has been set up in the clean rooms of the GSI Detector Laboratory and at Tübingen University. Results of the electrical characterization of prototype microstrip sensors CBM06 will be presented.

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HK 15.3 Mo 17:15 S1/01 A2

Systematic study of radiation hardness of single crystal CVD diamond material investigated with an Au beam and IBIC method. — •Jerzy Pietraszko[1], Antoine Draveny[2], Tetyana Galatyuk[2], Veljko Grilj[3], Wolfgang Koenig[1], and Michael Träger[1] for the HADES-Collaboration — [1]GSI, Darmstadt, Germany — [2]TU, Darmstadt, Germany — [3]RBI, Zagreb, Croatia

For the future high rate CBM experiment at FAIR a radiation hard and fast beam detector is required. The detector has to perform precise T0 measurement (sigma < 50ps) and should also offer decent beam monitoring capability. These tasks can be performed by utilizing singlecrystal Chemical Vapor Deposition (ScCVD) diamond based detector. A prototype, segmented, detector have been constructed and the properties of this detector have been studied with a high current density beam (about $3{\cdot}10^6/s/mm^2$) of 1.23 A GeV Au ions in HADES. The irradiated detector properties have been studied at RBI in Zagreb by means of IBIC method. Details of the design, the intrinsic properties of the detectors and their performance after irradiation with such beam will be reported.

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HK 15.4 Mo 17:30 S1/01 A2

Gamma-Imaging mit hochsegmentierten HPGe-Detektoren — •Tim Steinbach[1], Rouven Hirsch[1], Benedikt Birkenbach[1], Jürgen Eberth[1], Roman Gernhäuser[2], Herbert Hess[1], Lars Lewandowski[1], Ludwig Maier[2], Peter Reiter[1], Michael Schlarb[2], Benedikt Weiler[2] und Max Winkel[2] — [1]IKP Universität zu Köln, Köln, Deutschland — [2]E12 Technische Universität München, München, Deutschland

Mit ortsempfindlichen hochsegmentierten HPGe-Detektoren und einem Double-Sided-Silicon-Strip-Detector (DSSSD) wird eine Compton-Kamera für die Bildgebung von γ-Strahlung am IKP betrieben. Die Compton-Streuereignisse werden für den Nachweis des Emissionsortes der γ-Strahlung sowohl im koinzidenten Betrieb der beiden Detektoren als auch im Einzelbetrieb des HPGe-Detektors selektiert. Die für die Bildgebung notwendige Bestimmung der Wechselwirkungsorte der γ-Strahlung im großvolumigen HPGe-Detektor wird mittels Impulsformanalyse (PSA) der 37 Detektorsignale erreicht. Die Ortsauflösung ist für die Lokalisierung der γ-Quelle ebenso entscheidend wie die hervorragende Energieauflösung des HPGe-Detektors. Die PSA aus dem AGATA Projekt wurde mit Hinblick auf eine bestmögliche Winkelauflösung der Compton-Kamera bei maximaler Nachweiseffizienz optimiert. Gefördert durch BMBF Projekt 02MUK013D und 02NUK013F.

HK 15.5 Mo 17:45 S1/01 A2

Pulse Shape Analysis Optimization with segmented HPGe-Detectors — •Lars Lewandowski, Peter Reiter, and Benedikt Birkenbach for the AGATA-Collaboration — Institut für Kernphysik Universität zu Köln

Measurements with the position sensitive, highly segmented AGATA HPGe detectors rely on the gamma-ray-tracking GRT technique which allows to determine the interaction point of the individual gamma-rays hitting the detector. GRT is based on a pulse shape analysis PSA of the preamplifier signals from the 36 segments and the central electrode of the detector. The achieved performance and position resolution of the AGATA detector is well within the specifications. However, an unexpected inhomogeneous distribution of interaction points inside the detector volume is observed as a result of the PSA even when the measurement is performed with an isotropically radiating gamma ray source. The clustering of interaction points motivated a study in order to optimize the PSA algorithm or its ingredients. As a main result the impact of the transient signals of neigboring segments on the final PSA result was enhanced by introducing a weighting factor in the χ^2 minimization. The final result shows a significant improvement of the angular resolution and PSA performance in general. Supported by the German BMBF (05P12PKFNE TP4)