HK 14: Instrumentation III

Zeit: Montag 16:30–18:30 Raum: S1/01 A3

HK 14.1 Mo 16:30 S1/01 A3

The detector response simulation for the CBM Silicon Tracking System as a tool for hit error estimation — •Hanna Malygina[1,2,3], Friese Volker[3], and Maksym Zyzak[3] for the CBM-Collaboration — [1]Goethe Universität Frankfurt — [2]KINR, Kyiv, Ukraine — [3]GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt

The Compressed Baryonic Matter experiment(CBM) at FAIR is designed to explore the QCD phase diagram in the region of high net-baryon densities. As the central detector component, the Silicon Tracking System (STS) is based on double-sided micro-strip sensors. To achieve realistic modelling, the response of the silicon strip sensors should be precisely included in the digitizer which simulates a complete chain of physical processes caused by charged particles traversing the detector, from charge creation in silicon to a digital output signal.

The current implementation of the STS digitizer comprises non-uniform energy loss distributions (according to the Urban theory), thermal diffusion and charge redistribution over the read-out channels due to interstrip capacitances. Using the digitizer, one can test an influence of each physical processes on hit error separately. We have developed a new cluster position finding algorithm and a hit error estimation method for it. Estimated errors were verified by the width of pull distribution (expected to be about unity) and its shape.

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HK 14.2 Mo 16:45 S1/01 A3

CBM First-level Event Selector Input Interface — •Dirk Hutter for the CBM-Collaboration — Frankfurt Institute for Advanced Studies, Goethe University, Frankfurt, Germany

The CBM First-level Event Selector (FLES) is the central event selection system of the upcoming CBM experiment at FAIR. Designed as a high-performance computing cluster, its task is an online analysis of the physics data at a total data rate exceeding 1 TByte/s.

To allow efficient event selection, the FLES performs timeslice building, which combines the data from all given input links to self-contained, overlapping processing intervals and distributes them to compute nodes. Partitioning the input data streams into specialized containers allows to perform this task very efficiently.

The FLES Input Interface defines the linkage between FEE and FLES data transport framework. Utilizing a custom FPGA board, it receives data via optical links, prepares them for subsequent timeslice building, and transfers the data via DMA to the PC's memory. An accompanying HDL module implements the front-end logic interface and FLES link protocol in the front-end FPGAs. Prototypes of all Input Interface components have been implemented and integrated into the FLES framework. In contrast to earlier prototypes, which included components to work without a FPGA layer between FLES and FEE, the structure matches the foreseen final setup. This allows the implementation and evaluation of the final CBM read-out chain.

An overview of the FLES Input Interface as well as studies on system integration and system start-up will be presented.

HK 14.3 Mo 17:00 S1/01 A3

Control software for the CBM readout chain — •Pierre-Alain Loizeau — GSI Helmholtzzentrum für Schwerionenforschung GmbH

The Compressed Baryonic Matter (CBM) experiment, which will be built at FAIR, will use free-streaming readout electronics to acquire high-statistics data-sets of physics probes in fixed target heavy-ion collisions. Since no simple signatures suitable for a hardware trigger are available for most of them, reconstruction and selection of the interesting collisions will be done in software, in a computer farm called First Level Event Selector (FLES).

The raw data coming from the detectors is pre-processed, pre-calibrated and aggregated in a FPGA based layer called Data Preprocessing Boards (DPB).

IPbus will be used to communicate with the DPBs and through them with the elements of the readout chain closer to detectors. A slow control environment based on this software is developed by CBM to configure in an efficient way the DPBs as well as the Front-End Electronics and monitor their performances.

This contribution will present the layout planned for the slow control software, its first implementation and corresponding test results.

HK 14.4 Mo 17:15 S1/01 A3

Weiterentwicklung des ALICE-Tier2-Betriebs bei GSI — •Sören Fleischer und Kilian Schwarz für die ALICE-Kollaboration — GSI, Darmstadt, Deutschland

Die GSI betreibt seit 2004 ein Tier2-Zentrum für das ALICE-Experiment. Zur Verfügung gestellt werden derzeit 1000 TB Speicherplatz sowie 13400 HEP-SPEC06 an Rechenleistung durch z.Zt. AMD Opteron 6238 CPUs. Das Storage-Backend basiert auf einem Lustre-Dateisystem. Der Zugriff von sowohl lokalen als auch externen Clients findet, wie in der gesamten ALICE-Umgebung, über das xrootProtokoll statt.

Ein Upgrade auf ein neues Cluster mit Intel Xeon E5-2660 v3 CPUs steht z.Zt. an. Dieses wird sich im Green IT Cube, dem neuen Rechenzentrum für FAIR, befinden.

Um die Zuverlässigkeit und Skalierbarkeit des Tier2-Betriebs zu erhöhen, wurden etliche Verbesserungen vorgenommen, sowie einige Workflows zur Automatisierung in den Gebieten Monitoring (monit), Konfigurationsmanagement (chef), und Versionsverwaltung (git) implementiert, die in dieser Präsentation vorgestellt werden.

HK 14.5 Mo 17:30 S1/01 A3

Common barrel and forward CA tracking algorithm — •Pugach Mykhailo[1,2,3], Sergey Gorbunov[1,2], and Ivan Kisel[1,2] for the PANDA-Collaboration — [1]Goethe-Universität, Frankfurt — [2]Frankfurt Institute for Advanced Studies, Frankfurt — [3]KINR, Kyiv, Ukraine

There are complex detector setups which consist of barrel (cylindrical) and forward parts, and such systems require a special approach in the registered charged particles track finding procedure. Currently the tracking procedure might be performed in both parts of such detector independently from each other, but the final goal on this direction is a creation of a combined tracking, which will work in both parts of the detector simultaneously.

The basic algorithm is based on Kalman Filter (KF) and Cellular Automata (CA). And the tracking procedure in such a complex system is rather extraordinary as far as it requires 2 different models to describe the state vector of segments of the reconstructed track in the mathematical apparatus of the KF-algorithm. To overcome this specifics a mathematical apparatus of transition matrices must be developed and implemented, so that one can transfer from one track model to another. Afterwards the work of the CA is performed, which reduces to segments sorting, their union into track-candidates and selection of the best candidates by the chi-square criteria after fitting of the track-candidate by the KF.

In this report the algorithm, status and perspectives of such combined tracking are described.

HK 14.6 Mo 17:45 S1/01 A3

Parallel Algorithms for Online Trackfinding at PANDA — •Ludovico Bianchi[1], Andreas Herten[2], James Ritman[1], and Tobias Stockmanns[1] for the PANDA-Collaboration — [1]IKP, Forschungszentrum Jülich GmbH — [2]JSC, Forschungszentrum Jülich GmbH

The PANDA experiment, one of the four scientific pillars of the FAIR facility currently in construction in Darmstadt, is a next-generation particle detector that will study collisions of antiprotons with beam momenta of 1.5–15 GeV/c on a fixed proton target.

Because of the broad physics scope and the similar signature of signal and background events, PANDA's strategy for data acquisition is to continuously record data from the whole detector and use this global information to perform online event reconstruction and filtering. A real-time rejection factor of up to 1000 must be achieved to match the incoming data rate for offline storage, making all components of the data processing system computationally very challenging.

Online particle track identification and reconstruction is an essential step, since track information is used as input in all following phases. Online tracking algorithms must ensure a delicate balance between high tracking efficiency and quality, and minimal computational footprint. For this reason, a massively parallel solution exploiting multiple Graphic Processing Units (GPUs) is under investigation.

The talk will present the core concepts of the algorithms being developed for primary trackfinding, along with details of their implementation on GPUs.

HK 14.7 Mo 18:00 S1/01 A3

Time-based MRPC detector response simulations for the CBM time-of-flight system — •Christian Simon and Norbert Herrmann for the CBM-Collaboration — Physikalisches Institut und Fakultät für Physik und Astronomie, Ruprecht-Karls-Universität Heidelberg, 69120 Heidelberg, Deutschland

The design goal of the future Compressed Baryonic Matter (CBM) experiment is to measure rare probes of dense strongly interacting matter with an unprecedented accuracy. Target interaction rates of up to 10 MHz need to be processed by the detector. The time-of-flight (TOF) wall of CBM which should provide hadron identification at particle fluxes of up to a few tens of kHz/cm^2 is composed of high-resolution timing multi-gap resistive plate chambers (MRPCs). Due to the self-triggered digitization and readout scheme of CBM comprising online event reconstruction preparatory Monte Carlo (MC) transport and response simulations including the MRPC array need to be carried out in a time-based fashion. While in an event-based simulation mode interference between MC tracks in a detector volume owing to rate effects or electronics dead time is confined to a single event, time-based response simulations need to take into account track pile-up and interference across events. A proposed time-based digitizer class for CBM-TOF within the CbmRoot software framework will be presented.

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HK 14.8 Mo 18:15 S1/01 A3

Simulation and Optimisation of a Position Sensitive Scintillation Detector with Wavelength Shifting Fibers for Thermal Neutrons — •Matthias Herzkamp[1], Thomas Brückel[2], Günter Kemmerling[2], Achim Stahl[3], and Stefan van Waasen[1,4] — [1]ZEA-2, Forschungszentrum Jülich, Deutschland — [2]JCNS, Forschungszentrum Jülich, Deutschland — [3]III. Physikalisches Institut B, RWTH Aachen, Deutschland — [4]Faculty of Engineering, University of Duisburg-Essen, Deutschland

In neutron scattering experiments it is important to have position sensitive large scale detectors for thermal neutrons. A detector based on a neutron scintillator with wave length shifting fibers(WLSF) is a new kind of such a detector. We present the simulation of the detector in its entirety, taking into account the microscopic structure of the scintillation material as well as the WLSF attachment.

The scintillator consists of a converter and a scintillation powder bound in a matrix. In our case lithium-6 converts thermal neutrons into high energetic alpha and triton particles. The scintillation material is silver doped zinc sulfide. The WLSFs are positioned next to the scintillator plate in an orthogonal grid and are bent back at the edges to guide the light to PMTs. This arrangement drastically reduces the necessary number of light detection devices, which enables to build cost-efficient large-area detectors.

With our complete model of the detector it is possible to optimize its microscopic and macroscopic parameters with regard to detection efficiency and position sensitivity.