HK 69: Instrumentation 19

Time: Friday 14:30–16:30 Location: M/HS1

Group Report HK 69.1 Fri 14:30 M/HS1

Triggering with the ALICE TRD: Results and Prospects — •Jochen Klein[1], Yvonne Pachmayer[1], and Uwe Westerhoff[2] for the ALICE-Collaboration — [1]Physikalisches Institut, University of Heidelberg — [2]Institut fuer Kernphysik, Universitaet Muenster

The ALICE Transition Radiation Detector provides multiple level-1 trigger contributions. The signatures are based on tracks which are reconstructed in an FPGA array from chamber-wise track segments. The latter are calculated on the detector-mounted frontend electronics. The massive parallelization allows for the low latency trigger 8 us after the interaction.

We will show the performance of the triggers on electrons and jets during LHC Run 1. Further, we will discuss improvements and prospects for Run 2. In particular, an online calculation of the distance of closest approach to the primary vertex shall be used to reject the dominant background from the conversion of photons at large radii. The combination of tracks over stack and sector boundaries will help to improve the efficiency of the jet trigger.

HK 69.2 Fri 15:00 M/HS1

Development of a Pico-Second Start Counter — •Michael Dickescheid, Matteo Cardinali, Oliver Corell, Matthias Hoek, Werner Lauth, Sören Schlimme, Concettina Sfienti, and Michaela Thiel — Institut für Kernphysik, Johannes Gutenberg Universität Mainz.

The goal is to develop a hodoscope with a time resolution of less than 50 ps. To achieve this level of precision, the obvious choice is to use the Cherenkov effect because of the prompt photon-production. The detector itself consists of 64 fused-silica radiator bars ($5 \times 5 \times 140\, mm^3$) in an 8×8 matrix attached to an microchannel plate photomultiplier tube with 64 pixels (one bar per pixel). The segmented radiator design allows improving the time resolution depending on the number of traversed radiator bars. Also the number of detected photons per pixel is important as it improves the time resolution. Signal discrimination will be done using custom-made front-end electronics and a TRB3 system [1] will be used for data acquisition.

The performance of the detector will be determined using a low intensity electron beam at the MAMI accelerator in Mainz with a momentum of 855 MeV/c. The obtained data will be compared to detailed Monte Carlo simulations. In this contribution the experimental setup will be described in more detail. Also first preliminary results from the test experiment will be shown.

[1] A. Neisser et al., INST 8 C12043 (2013).

HK 69.3 Fri 15:15 M/HS1

The CBM First-level Event Selector Input Interface — •Dirk Hutter and Volker Lindenstruth 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 has to combine the data from all given input links to self-contained, overlapping processing intervals and distribute them to compute nodes. This task can be performed efficiently by partitioning the detector data streams into specialized containers. The FLES Interface Board (FLIB), implemented as a custom FPGA board, receives these containers via optical links, prepares them for subsequent interval building, and transfers the data via DMA to the PC's memory.

A prototype of the FLIB has been implemented. The inclusion of features foreseen for other parts of the CBM read-out chain allows the evaluation of the interval building concept. Performance studies demonstrated high read-out bandwidth with low overhead. In addition, the FLIB has been used successfully as a readout device in test-beams and lab setups. An overview of the FLES Interface Board as well as results from latest studies will be presented.

HK 69.4 Fri 15:30 M/HS1

Test einer neuen Auslesekette für den CBM RICH Detektor — •Jörg Förtsch und Christian Pauly für die CBM-Kollaboration — Bergische Universität Wuppertal, Germany

Das Compressed Baryonic Matter experiment (CBM), welches derzeit als Teil der Facility for Antiproton and Ion Research (FAIR) aufgebaut wird, dient der Vermessung des QCD-Phasendiagramms bei hohen Netto-Baryonendichten und moderaten Temperaturen, sowie der Charakterisierung des Phasenübergangs hadronischer Materie zum Quark-Gluon Plasma. Eine wesentliche Komponente des CBM-Detektors ist ein Ring abbildender Cherenkov-Detektor (RICH), in welchem das Cherenkov-Licht schneller Teilchen ($v > c/n$) über sphärische Spiegel ringförmig auf den Photodetektor abgebildet wird. Die ortsaufgelöste Auslese der Cherenkov Photonen soll mittels Multianoden Photomultipliern oder MCPs erfolgen. Im Rahmen einer kürzlich durchgeführten Teststrahlzeit am CERN-PS Beschleuniger im November 2014 wurde hierfür eine neue Auslesekette getestet, basierend auf PADIWA frontend boards zur Signal Diskriminierung, und TRB3 FPGA-TDC boards zur Digitalisierung und Zeitmessung der Sensor Signale. Die Nutzung von standard FPGAs für Diskriminierung, Digitalisierung und Datentransport verspricht hierbei eine kostengünstige Lösung, welche eine sehr gute Zeitauflösung bietet (begrenzt durch den Sensor selbst). Die Messung der Signalamplitude soll hierbei über eine Time-over-Threshold Messung erfolgen. Wir berichten über Erfahrungen und erste Ergebnisse, welche im Rahmen der Strahlzeit gewonnen wurden. *gefördert durch BMBF 05P12PXFCE und GSI

HK 69.5 Fri 15:45 M/HS1

SRAM-Detektor gestützte Positionierung für Elektronik-Strahltests — •Christian Stüllein, Andrei-Dumitru Oancea, Jano Gebelein, Sebastian Manz und Udo Kebschull für die CBM-Kollaboration — Infrastruktur und Rechnersysteme in der Informationsverarbeitung (IRI), Goethe-Universität, Senckenberganlage 31, 60325 Frankfurt am Main

Die korrekte Ausrichtung von DUTs (device under test) auf den Strahl ist eine wichtige und zeitintensive Tätigkeit. Desweiteren ist eine Nachführung während des Experiments nicht ohne Weiteres möglich. Hierfür ist eine Unterbrechung des Strahls notwendig, wodurch auch andere parallel laufende Experimente beeinflusst werden. Ausserdem bedeutet ein manueller Eingriff eine zusätzliche Strahlenbelastung.

Durch das hier vorgestellte Projekt kann die Positionierung aus der Ferne gesteuert und überwacht werden. Der Aufbau ermöglicht eine genaue Ausrichtung der DUTs in x- und z-Richtung mittels durch Schrittmotoren angetriebener Linearachsen. Ein auf SRAM basierender Detektor ermöglicht durch kontinuierliche Erfassung von Single-Event Upsets (SEUs) eine Positionsbestimmung des Strahls zur Laufzeit. Dadurch können DUTs bei Bedarf entsprechend nachgeführt werden. Hiermit kann auch der Ausfall oder eine ungewollte Verschiebung des Strahls erkannt, und entsprechende Maßnahmen eingeleitet werden.

HK 69.6 Fri 16:00 M/HS1

A PandaRoot Interface for Binary Data in the PANDA Prototype DAQ System — •Sören Fleischer, Sören Lange, Wolfgang Kühn, Christopher Hahn, and Milan Wagner for the PANDA-Collaboration — 2. Physikalisches Institut, Uni Giessen

The PANDA experiment at FAIR will feature a raw data rate of more than 20 MHz. Only a small fraction of these events are of interest. Consequently, a sophisticated online data reduction setup is required, lowering the final output data rate by a factor of roughly 10^3 by discarding data which does not fulfil certain criteria. The first stages of the data reduction will be implemented using FPGA-based Compute Nodes.

For the planned tests with prototype detectors a small but scalable system is being set up which will allow to test the concept in a realistic environment with high rates.

In this contribution, we present a PandaRoot implementation of a state-machine-based binary parser which receives detector data from the Compute Nodes via GbE links, converting the data stream into the PandaRoot format for further analysis and mass storage.

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HK 69.7 Fri 16:15 M/HS1

Studies on high performance Timeslice building on the CBM

FLES — •Helvi Hartmann for the CBM-Collaboration — Frankfurt Institute for Advanced Studies, Goethe University, Frankfurt, Germany

In contrast to already existing high energy physics experiments the Compressed Baryonic Matter (CBM) experiment collects all data untriggered. The First-level Event Selector (FLES), which denotes a high performance computer cluster, processes the very high incoming data rate of 1 TByte/s and performs a full online event reconstruction. For this task it needs to access the raw detector data in time intervals referred to as Timeslices. In order to construct the Timeslices, the FLES Timeslice building has to combine data from all input links and distribute them via a high-performance network to the compute nodes.

For fast data transfer the Infiniband network has proven to be appropriate. One option to address the network is using Infiniband (RDMA) Verbs directly and potentially making best use of Infiniband. However, it is a very low-level implementation relying on the hardware and neglecting other possible network technologies in the future. Another approach is to apply a high-level API like MPI which is independent of the underlying hardware and suitable for less error prone software development.

I would like to present the given possibilities and to show the results of benchmarks ran on high-performance computing clusters. The solutions are evaluated regarding the Timeslice building in CBM.