HK 41 Instrumentation und Anwendungen

Zeit: Mittwoch 14:00–16:00 Raum: TU MA041

HK 41.1 Mi 14:00 TU MA041

First Front-end Electronics Integration Test Results of the ALICE TRD — •Marcus Gutfleisch for the ALICE TRD collaboration — Kirchhoff-Institut für Physik, Universität Heidelberg, Heidelberg, Germany

The Transition Radiation Detector (TRD) of ALICE incorporates 1.2 million channels which are individually read out and processed. This is accomplished by highly integrated full custom front-end electronics containing an analog preamplifier and shaper (PASA) and a mixed-signal chip performing event buffering and local tracking (TRAP). Both chips are combined on small multi-chip modules (MCM). 65664 of these will be integrated on the detector.

The main task of the TRAP chip is online pattern recognition of segments of particle tracks (tracklet). It contains four CPUs and a tracklet preprocessor. To improve tracking resolution a digital filter is implemented performing nonlinearity, baseline and gain correction, signal symmetrisation (tail cancellation) and crosstalk suppression. The low power 10 Bit 10 MHz ADCs are integrated on the chip.

Tracklet information and raw data is shipped by an 8 Bit 120 MHz double data rate network interface merging its own data and that of neighboring TRAP chips into a common data stream which is organized in a tree structure.

Results of a first integration test under beam conditions using a six layer detector stack with 128 data taking and 11 merging MCMs at the Proton Synchrotron (PS) at CERN are presented.

This project is supported by the BMBF (06HD9551).

HK 41.2 Mi 14:15 TU MA041

New Test Results for the ALICE High Level Trigger — •Timm M. Steinbeck, Heinz Tilsner, and Volker Lindenstruth for the ALICE collaboration — Kirchhoff Institut für Physik, Ruprecht-Karls-Universität Heidelberg, Im Neuenheimer Feld 227, D-69120 Heidelberg, Germany

The ALICE heavy-ion experiment's High Level Trigger (HLT) will consist of a PC cluster with 400 to 500 nodes. Approximately 250 of these will receive data produced by front-end electronics in the detectors via the DAQ system. Further data which is derived by the HLT from its input data can be sent to DAQ in addition to the detectors' data. In the HLT processing cluster the data is transported by a fault tolerant data transport software framework that easily allows to construct different data flow configurations in the HLT. This software and the two interfaces to the DAQ system for receiving and sending have been tested and used in several scenarios. Results will be presented of three of these scenarios: Two testbeam participations as well as one larger scale integration test of TPC and DiMuon detector specific HLT software components. Work on the ALICE High Level Trigger has been financed by the German Federal Ministry of Education and Research (BMBF) as part of its program "Förderschwerpunkt Hadronen- und Kernphysik - Großgeräte der physikalischen Grundlagenforschung".

HK 41.3 Mi 14:30 TU MA041

Cinderella: an Online Filter for the COMPASS experiment † — •Thiemo Nagel, Annemarie Dinkelbach, Jan Friedrich, Roland Kuhn, Stephan Paul, and Lars Schmitt — TU München, Physik Department E18

In the 2004 COMPASS beam time, for the first time the Cinderella Online Filter (2^{nd}-level trigger) was used in production. By partially removing 1^{st}-level trigger impurities, the limited storage and bandwidth are utilized better, allowing to take more physics data. The ability to reconstruct a beam track is demanded when filtering muon data, while for hadron data, track multiplicities in hodoscopes and silicon microstrip detectors are used for event selection.

Data reduction of 25% of undesired events is achieved at loss of less than 1% of useful data. The workload of $\sim$5000 events per second is processed on a cluster with 26 CPUs in parallel.

† This work is supported by the BMBF and the Maier-Leibnitz-Labor, Garching.

HK 41.4 Mi 14:45 TU MA041

Prototype of a Dedicated Multi-Node Data Processing System for Realtime Trigger and Analysis Applications — •Daniel Kirschner, Marco Destefanis, Ingo Fröhlich, Camilla Gilardi, Wolfgang Kühn, Francesca Ottone, Vladimir Pechenov, and Tiago Perez for the HADES collaboration — II. Phys. Inst. Giessen, Heinrich-Buff-Ring 14, 35392 Giessen

Modern experiments in hadron physics like the HADES detector at GSI-Darmstadt produce a large amount of data that has to be distributed, stored and analyzed. Analysis of this data is very time consuming due to the large amount of data and the complex algorithms needed. This problem can be addressed by a dedicated multi-node and multi-CPU computing architecture interconnected by Gigabit-Ethernet. Dedicated hardware has the advantages over "Grid-Computers" in skaleability, price per computational unit, predictability of time behavior (possibility of real time applications) and ease of administration. Gigabit-Ethernet provides an efficient and standardized infrastructure for data distribution. This infrastructure can be used to distribute data in an experiment as well as to distribute data in a multi-node computing environment. The prototype VME-Bus card has of two major units: a network unit featuring two Gigabit Ethernet over Copper connections and a computational part featuring a TigerSHARC Digital Signal Processor. The discussion will concentrate the real-life performance of Gigabit Ethernet as the main topic. Supported by: BMBF 06 GI 144, BMBF 06 GI 145.

HK 41.5 Mi 15:00 TU MA041

Performance of the HADES Tracking System in experiment and simulation — •Yvonne Pachmayer for the HADES collaboration — Institut für Kernphysik, Univ. Frankfurt, Germany

The High Acceptance Di-Electron Spectrometer (HADES) operational at GSI is designed to study electron pair emission in collisions of heavy ions and elementary reactions in the 1-2 AGeV incident energy range. Good invariant mass resolution or equivalently high momentum resolution require a high precision tracking system. The pair detection efficiency is maximized by covering polar angles from 18^o to 85^o and practically the full azimuth. The tracking system is composed of 24 low-mass, high-granular multiwire drift chambers, which provide an active area of 30m^2 and are positioned before and after the magnetic field. The low-mass constraint on the active area is ensured by using Helium-based gas mixtures and Aluminum cathode and field wires. It will be demonstrated that the design goal of 150 μm for the intrinsic spatial resolution compares well with the results from in-beam data from C+C and p+p collisions.

HK 41.6 Mi 15:15 TU MA041

FPGA based Pre-/Coprocessors for the ALICE HLT — •Torsten Alt and Volker Lindenstruth for the ALICE collaboration — Kirchhoff-Institute of Physics, University of Heidelberg

The Time Projection Chamber (TPC) of the ALICE experiment is one of its main tracking detectors. It produces up to 75 MByte of compressed raw data per event. If the raw data is stored directly to tape, the tape bandwidth of 1.25 GByte/s limits the event rate to 20 Hz. In order to achieve higher rates or to trigger on specific events the raw data needs to be processed online (compression/selection), thereby reducing the data volume significantly without losing physical information.

This processing is done by a cluster of commodity PCs, the High Level Trigger (HLT). To access the raw data dedicated nodes of the HLT are equipped with PCI-cards which receive the data via optical links, the so called Detector Data Link (DDL). Each of the cards possesses an FPGA, a programmable device, which allows processing of the data in customized hardware. In preprocessor mode the raw data is processed and the result is written directly to the main memory of the node. In coprocessor mode the data is read from the main memory, processed and rewritten to the memory. By using FPGAs the processing logic can be adapted to different requirements and reprogrammed within a few milliseconds.

In addition to the physical motivation and the principles of FPGA pre-/coprocessors an ALICE specific algorithm, the ClusterFinder, is introduced.

HK 41.7 Mi 15:30 TU MA041

Improving on FPGA Radiation Tolerance — •Gerd Tröger and Udo Kebschull for the ALICE collaboration — Kirchoff-Institut für Physik, Universität Heidelberg

In recent years, FPGAs have become an alternative to ASICs for experiment electronics due to their computational power, flexibility and cost efficiency. However, SRAM-based FPGAs are even more sensitive to irradiation than other electronics. Several methods for compensation exist (expensive flash technology, redundancy, bit-scrubbing).

We will present results from irradiation tests of Xilinx Virtex-II Pro devices performed at the cyclotrons in Oslo and Uppsala, comparing them to previous tests of Altera APEX devices. Adding a simple repair technique called 'bit-scrubbing', which is using the active partial reconfiguration feature of the Virtex FPGAs, shows promising improvements. In combination with classical redundancy methods we can demonstrate improvements in radiation tolerance by an order of magnitude.

HK 41.8 Mi 15:45 TU MA041

New Pion Beam Detectors for HADES — •B. Spruck for the HADES collaboration — 2. Physikalisches Institut, Universität Gießen

One of the upcoming experiments with HADES will be the study of pion induced reactions. The quality of the secondary π^- beam was investigated in a test beam time in may 2004. A scintillating fiber X/Y array of 1mm granularity was used to measure the beam dimension near the target position. The momentum of an individual pion is determined by its position in the dispersive plane behind the first dipol in the beam line, obtained from two plastic scintillator hodoscopes with 1cm broad rods. With this granularity the hodoscopes will not cope with the expected high secondary beam intensities. Based on the design of the fiber beam monitor two new hodoscopes are being developed consisting of 64 2mm fibers read out with multianode photomultipliers on both sides. The results of the commissioning beam time and the progress on the new pion trackers will be presented.

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