HK 28: Instrumentation und Anwendungen

Zeit: Mittwoch 11:15–12:45 Raum: B

HK 28.1 Mi 11:15 B

A highly integrated low-cost readout system for the COMPASS RICH detector — Bernhard Ketzer, Heinz Angerer, Sergei Gerassimov, •Igor Konorov, Alexander Mann, and Stephan Paul — Technische Universität München, Physik Department, 85748 Garching, Germany

Particle identification at high multiplicities is a key feature of the COMPASS experiment at CERN's SPS. Hadrons up to 50 GeV/c are identified by a RICH detector with a large horizontal and vertical acceptance of ±250 mrad and ±180 mrad, respectively. Cherenkov photons created in the C_4F_{10} radiator gas are focused by a mirror wall onto the photon detectors. While the central region is equipped with multi-anode photomultiplier tubes, the remaining 75% of the total active area are covered by MWPCs with CsI photocathodes.

In order to improve the performance of the detector at very high beam intensities, more than 62000 channels of a new analog readout system of the MWPCs, based on the APV25 chip, were developed and installed in 2006. The new system features good single photon detection efficiency due to its low noise, negligible dead time at trigger rates up 50 kHz, and low cost. In addition, sampling of the MWPC signal allows us to measure the signal time with a resolution of $\sim$ 30 ns or better, thus considerably reducing the background due to pile-up.

The architecture of the new readout system as well as first results on the performance of the RICH detector in 2006 will be discussed.

This work is supported by BMBF and Maier-Leibnitz-Labor der TU und LMU München.

HK 28.2 Mi 11:30 B

Low noise ASIC preamplifier for the PANDA EMC — •Peter Wieczorek für die PANDA-Kollaboration — GSI Darmstadt, Deutschland

For the electromagnetic calorimeter (EMC) of the PANDA experiment a preamplifier and shaper ASIC is under development. Studies of lead tungstate ($PbWO_4$) for the first time done in the low energy region have shown that an extreme low noise front-end is mandatory. The charge sensitive amplifier (CSA) is optimized for the readout of APDs with a capacitance of 300 pF and has to cover a dynamic range of 1 MeV to 10 GeV. Test results of a first prototype realized in a 350 nm CMOS technology shows an excellent noise performance and good agreement to simulation results.

The design of the prototype and test results will be presented. This work is supported by the EU (contract number: RII3-CT-2004-506078).

HK 28.3 Mi 11:45 B

Signalverarbeitung zur Zeitrekonstruktion aus Sampling ADC Daten für Positronen Emissions Tomographie — •Alexander Mann[1], Igor Konorov[1], Stephan Paul[1], Virginia Spanoudaki[2] und Sibylle Ziegler[2] — [1]Physik-Department E18, Technische Universität München — [2]Nuklearmedizinische Klinik und Poliklinik, Klinikum Rechts der Isar, Technische Universität München

Zur Datenerfassung in einem neuartigen Kleintier-Positronen-Emissions-Tomographen wurde ein Sampling ADC basiertes Datenerfassungssystem entwickelt. Jeder der 1152 möglichen Detektorkanäle wird dabei kontinuierlich mit 80 MHz abgetastet und die anfallenden Daten in FPGAs weiterverarbeitet. Um die abzuspeichernde Datenmenge zu reduzieren, enthalten die FPGAs Algorithmen zur Trigger-Detektion und zur genauen Zeitbestimmung der Detektorsignale. Nach dem Abspeichern der Eventdaten erfolgt noch eine Kalibrierung bezüglich Teilchenenergie und Signalpfadverzögerung. Das System wurde erfolgreich mit Signalen von Avalanche-Photodioden und Silicon-Photomultipliern getestet.

Diese Arbeit wird unterstützt vom Maier-Leibnitz-Labor, Garching und FutureDAQ (EU I3HP, RII3-CT-2004-506078).

HK 28.4 Mi 12:00 B

The TRD Super Module Unit and its implementation — •Stefan Kirsch for the ALICE TRD-Collaboration — Kirchhoff-Institut für Physik, Universität Heidelberg

The Transition Radiation Detector (TRD) of the ALICE Experiment at the LHC provides experimental raw data as well as tracklet information. On basis of the latter, the Global Tracking Unit (GTU) contributes to the Level-1 trigger decision. Providing the possibility to read out both, data and tracklets, at rates up to 2.16Tb/s inflicts high demands on the GTU.

Data is transmitted via 1080 optical fibres and received by the GTU's Track Matching Units (TMU). In order to operate the GTU, 18 Super Module Units (SMU) decode and monitor control information provided by the TTC (Timing, Trigger and Control) utilising high performance Virtex-4 FPGAs. Further tasks concern the identification and reporting of errors, as well as event matching. Data belonging to multiple interlaced trigger sequences can be managed according to decisions made by ALICE's Central Trigger Processor (CTP). Having concentrated and shaped enquired data from five TMUs to match the requested DDL format, each SMU forwards to the data acquisition system using a dedicated optical link.

This presentation addresses the difficulties arising from the above mentioned requirements and focuses on the implementation of the SMU.

HK 28.5 Mi 12:15 B

Steuerung der Übergangsstrahlungdetektor-Ausleseeinheit — •Marcel Schuh für die ALICE TRD-Kollaboration — Kirchhoff-Institut für Physik, Universität Heidelberg, Deutschland

Das Auslesen des Übergangsstrahlungdetektors (TRD), einem der Hauptdetektoren im ALICE-Experiment, wird von der Global Tracking Unit (GTU) übernommen. Innerhalb von 6μs müssen die Daten ausgelesen und analysiert werden, um eine Triggerentscheidung zu treffen. Danach werden die Daten gegebenenfalls an das Datenaufnahme-System (DAQ) gesendet. Dies ist nur durch extreme Parallelisierung und Einsatz von sehr schnellen, komplexen Einzelmodulen möglich.

Auf den Platinen der GTU werden leistungsstarke FPGAs mit zwei Power-PC-Prozessoren (Xilinx Virtex-4 FX100) eingesetzt. Diese insgesamt 220 Prozessorkerne können für das Steuern und Überwachen der GTU eingesetzt werden. Hierbei kommen speziell entwickelte Programme zur Diagnostik und Steuerung zur Ausführung, als Speichererweiterung dienen DDR2-RAM und SD-Karten. Die Kommunikation zwischen Einzelkomponenten erfolgt über diverse serielle Protokolle, in der Betriebsphase lässt sich das System global via Ethernet administrieren und überwachen.

Dieser Beitrag befasst sich mit der Implementierung des oben vorgestellten Steuerungssystem. Besonderes Augenmerk liegt auf der zeitnahen Berechnung und Visualisierung relevanter, momentabhängiger Systemgrößen.

HK 28.6 Mi 12:30 B

Joint tests of ALICE TRD Track Matching Units and Front End Electronics — •Felix Rettig für die ALICE TRD-Kollaboration — Kirchhoff-Institut für Physik, Universität Heidelberg

The Transition Radiation Detector (TRD) is one of the main detectors of the ALICE experiment at the LHC. One of its primary objectives is to trigger on high momentum electrons. Based on data from 1.2 million analog channels, event reconstruction must be performed within 6 μs to contribute to the Level-1 trigger decision.

A hardware architecture has been developed to achieve the processing in the required time by means of massive parallelism. Analog data preprocessing, track segment detection and parametrization is performed by the front end electronics. Optical multi-gigabit links providing a total bandwidth of 2.7 TBit/s transfer parametrization data to the Global Tracking Unit (GTU) with tight latency requirements. The GTU reconstructs tracks from up to 20000 segments, calculates particle momenta based on track curvatures and produces the trigger contribution. In case of a Level-1 accept, compressed analog data is shipped to and buffered in the GTU for transmission to the data acquisition system. The GTU consists of 108 dedicated CompactPCI boards based on Xilinx Virtex-4 FX chips which offer integrated multi-gigabit deserializers, sufficient logic resources as well as PowerPC cores for monitoring purposes. A number of TMU prototypes were built and joint tests with the detector's first supermodule conducted at CERN. This presentation focuses on the data shipping and buffering system with its low latency requirements and summarizes the current test results.