T 22: Trigger und DAQ I

Zeit: Montag 11:00–12:30 Raum: VMP11 HS

T 22.1 Mo 11:00 VMP11 HS

Implementierung und Verifizierung einer Oszilloskop-Auslese für Driftrohre — •Robin Boshuis, Raimund Ströhmer und Stefan Weber — Universität Würzburg

Eine Auslesemethode zur Auswertung von Driftzeitspektren kosmischer Myonen mittels eines Oszilloskops wurde implementiert und eine Analyse-Methode entwickelt.

Die Myonen wurden mit Hilfe einer Driftröhre detektiert, welche baugleich zu den MDTs im ATLAS-Myonenspektrometer ist und sich in einem lokal aufgebauten Höhenstrahlungsteststand der Julius-Maximilians-Universität Würzburg befindet. Die Auslese und Datennahme der Driftzeiten wurde mit Hilfe eines digitalen Speicheroszilloskops durchgeführt. Die daraus resultierenden Spektren wurden statistisch analysiert und Aussagen über Länge der Spektren und deren Ansteigszeiten getroffen. Die Datennahme mit dem Oszilloskop wurde weiterhin gegen eine Ausleselektronik auf Basis eines Time-To-Digital-Converters verifiziert.

T 22.2 Mo 11:15 VMP11 HS

Data Acquisition for the CALICE engineering prototype of the Analog Hadronic Calorimeter for the International Linear Collider. — •Adrian Irles for the CALICE-D-Collaboration — Deutsches Elektronen-Synchrotron DESY, Notkestraße 85, 22607 Hamburg

The engineering prototype of the Analogue Hadronic Calorimeter, developed by the CALICE collaboration for future linear colliders, consists in a set of high granularity layers of scintillator tiles readout by a silicon photo-multiplier (SiPM) and is housed in steel cassettes which can be interleaved with different absorber plates. The readout is done with a dedicated front-end SiPM readout system: the SPIROC ASIC. The current data acquisition (DAQ) framework used for the engineering prototype of the AHCAL is fruit of several years of improvement and exhaustive testing in the laboratory and in different test beams and has been designed to be scalable to the full detector size ($\sim 8 \cdot 10^6$ channels) making use of a new Link Data Aggregator. Current efforts in the DAQ development aims to gain in flexibility to include other subsystems in common test beams. The solution that is presented here is based on the use of the EUDAQ software which is a DAQ framework designed to be modular and portable and that has strong suppport from the ILC community.

T 22.3 Mo 11:30 VMP11 HS

Konzepte zur Datenauslese des ATLAS Inner Tracker (ITk) — •Marius Wensing, Carsten Dülsen, Tobias Flick und Wolfgang Wagner — Bergische Universität Wuppertal, Deutschland

Der ATLAS-Detektor am CERN wird für das HL-LHC-Upgrade (Phase-II) im Jahr 2022 mit einem komplett neuen inneren Detektor (Inner Tracker, ITk) ausgestattet. Bedingt durch die wesentlich höhere Luminosität von $5 \times 10^{34}\,\mathrm{cm}^{-2}\mathrm{s}^{-1}$ werden deutlich höhere Auslesebandbreiten als bisher benötigt. Für die innerste Pixel-Lage wird die Datenrate pro Detektormodul im Bereich von etwa 5 Gbit/s liegen. Zur Auslese der Detektormodule müssen daher Konzepte für neuartige FPGA-basierte Auslesekarten entwickelt werden. Ein wesentlicher Aspekt aller Konzepte ist die Integration in das globale ATLAS Auslesesystem (TDAQ). Aufgezeigt werden erste Konzeptentwürfe und Entwicklungen basierend auf diesen Entwürfen.

T 22.4 Mo 11:45 VMP11 HS

Data Acquisition at the Front-End of the Mu3e Pixel Detector — •Ann-Kathrin Perrevoort for the Mu3e-Collaboration — Physikalisches Institut, Universität Heidelberg

The Mu3e experiment—searching for the lepton-flavour violating decay of the muon into three electrons at an unprecedented sensitivity of one in 10^{16} decays—is based on a pixel tracking detector. The sensors are High-Voltage Monolithic Active Pixel Sensors, a technology which allows for very fast and thin detectors, and thus is an ideal fit for Mu3e where the trajectories of low-momentum electrons at high rates are to be measured.

The detector will consist of about 275 million pixels and will be operated at up to 10^9 muon stops per second. Therefore, a fast and trigger-less data readout is required. The pixel sensors feature zero-suppressed data output via high-speed serial links. The data is then buffered and sorted by time on a FPGA on the front-end before being processed to the following readout stage.

In this talk, the readout of the Mu3e pixel detector at the front-end will be introduced. Furthermore, a first firmware implementation of this concept in a beam telescope consisting of the current pixel sensor prototype MuPix7 will be presented.

T 22.5 Mo 12:00 VMP11 HS

Fast optical readout for Mu3e experiment — •Qinhua Huang for the Mu3e-Collaboration — Institut für Kernphysik, Universität Mainz, Mainz, Germany

Charged lepton flavour violation is highly suppressed in the Standard Model, which results in a prediction for the branching ratio of $\mu^+ \to e^+e^+e^-$ below $\mathcal{O}(10^{-54})$. The Mu3e experiment will search for this rare decay with a sensitivity of 10^{-16}. An observation would be a clear sign for new physics. A high muon stopping rate of $2 \cdot 10^9$ Hz is required so that sufficient statistics can be accumulated in about one year of data taking. The high event rate and the requirement of a full online track reconstruction demand a fast readout system which should provide a bandwidth above 1 Tbit/s. Reconfigurable devices, namely FPGAs, can easily parallelise the data processing, so it becomes possible to sort, merge, pack and route the data with low latency at high throughput. Optical fibres are the only option for the interconnection between different FPGA-based boards. The fibres also reduce the crosstalk and signal attenuation, especially over long distance links. As part of the readout system prototyping, firmware for synchronous merging of different data streams is being developed. In addition, the optical links have been tested and show a bit error rate below $\mathcal{O}(10^{-16})$ at 6.4 Gbit/s for a single fibre.

T 22.6 Mo 12:15 VMP11 HS

Histogramming in the LATOME-Firmware for the Phase-1 Upgrade of the ATLAS LAr Calorimeter Readout — •Philipp Horn, Rainer Hentges, and Arno Straessner — Institut für Kern- und Teilchenphysik, Dresden, Germany

Due to the increased luminosity and the higher effective event rate after the phase 1 upgrade the ATLAS LAr detector needs new trigger electronics. The so-called LATOME-Board was designed as a LAr Digital Processing Blade (LPDB) to reconstruct the energy deposited by the particles and is an important part of the read out system. A prototype has already been build and the firmware for the on-board FPGA is under development. The insertion of a histogram-builder in this device gives the unique opportunity to look at untriggerd data. This talk provides an insight in the LATOME-firmware and shows the different possibilities to implement the histogramm-builder.