T 62: Trigger 1

Zeit: Mittwoch 16:45–19:00 Raum: G.10.06 (HS 6)

T 62.1 Mi 16:45 G.10.06 (HS 6)

Inbetriebnahme und Monitoring der neuen Multi-Chip-Module des ATLAS Level-1 Kalorimeter Triggers — •Hanno Meyer zu Theenhausen — Kirchhoff-Institut für Physik, Im Neuenheimer Feld 227, 69120 Heidelberg

Der Level-1 Kalorimeter Trigger (L1Calo) ist eine der Hauptkomponenten der ersten Stufe des dreistufigen ATLAS Triggersystems. Vorbereitend auf die erhöhte Schwerpunktsenergie und instantane Luminosität des LHC im kommenden Run 2, erhielt L1Calo wichtige Upgrades, von denen auch der PreProcessor (PPr) signifikant profitierte. Herzstück des PPr Upgrades ist das neue Multi-Chip-Modul (nMCM), das nun u.a. die Möglichkeit einer dynamischen Korrektur von Pile-Up Effekten, differenzierte Energiekalibrationsmethoden und eine verbesserte Identifikation der korrekten Strahlkreuzung bietet. Dieser Vortrag berichtet vom Verlauf des PPr Upgrades, den Tests der Hardware, ersten Daten mit kosmischen Myonen und vom Monitoring der neuen Funktionen.

T 62.2 Mi 17:00 G.10.06 (HS 6)

Studien zur Verwendung des äußeren Hadronkalorimeters im Level-1-Trigger bei CMS — Yusuf Erdogan[1], Günter Flügge[1], Thomas Hebbeker[2], •Andreas Künsken[1], Markus Merschmeyer[2], Oliver Pooth[1], Florian Scheuch[2], Achim Stahl[1] und Simon Weingarten[1] — [1]III. Physikalisches Institut B, RWTH Aachen University, D-52056 Aachen — [2]III. Physikalisches Institut A, RWTH Aachen University

Mit dem Upgrade des äußeren Hadronkalorimeters (HO) von CMS auf SiPM-Auslese besteht dank eines besseren Signal-zu-Rausch-Verhältnisses die Möglichkeit, die Detektorinformation in den Level-1-Myontrigger von CMS zu integrieren. Dazu muss sichergestellt sein, dass die Effizienz des bereits bestehenden Triggersystems unter Hinzunahme der HO-Information verbessert wird. Weiterhin wird untersucht, ob bei vorhandenem Myon ein Teilchendurchgang in den HO-Signalen detektiert werden kann, auch wenn dass Myonsystem nicht auslöst.

T 62.3 Mi 17:15 G.10.06 (HS 6)

Einbau und Inbetriebnahme des Level-1 Topologischen Prozessors beim ATLAS-Experiment — Bruno Bauss, Volker Büscher, Reinholde Degele, Christian Kahra, Ulrich Schäfer, Eduard Simioni, Stefan Tapprogge und •Alexander Vogel — ETAP - Johannes-Gutenberg Universität, Mainz, Deutschland

Nach der Wiederinbetriebnahme des LHC Anfang 2015 wird dieser mit einer Schwerpunktsenergie von bis zu 14 TeV und einer Luminosität von über 10^{34} cm^{-2} s^{-1} betrieben werden. Die resultierende Ereignisrate ist zu hoch um sie mit der vorhandenen ersten Stufe des Triggersystems effizient verarbeiten zu können. Deshalb wurde diese modifiziert und ein Topologischer Prozessor integriert, welcher das System dabei unterstützt die hohe Ereignisrate zu verarbeiten. Dies geschieht durch topologische Algorithmen, zum Beispiel durch Schnitte auf Winkeldifferenzen zwischen Triggerobjekten.

Um dies umzusetzen ist unter anderem eine hohe Datenrate von 1 Tb/s notwendig. Zur Bewältigung dieser wurde in Mainz ein Elektronikmodul entwickelt, welches optische Daten sendet und empfängt und die Berechnungen mit Hochlesitungs FPGAs durchführt. Eine weitere Herausforderung ist, dass inklusive Übertragung und Berechnung, nur ein Zeitfenster von 250 ns zur Verfügung steht. Damit diese hohen Anforderungen erreicht werden, wird mit FGPAs und darin enthaltenen Multi-Gigabit-Transceivern, sowie optoelektrischer Mehrkanaldatenübertragung gearbeitet. In diesem Vortrag werden die Resultate der ausführlichen Tests von Prototyp und Produktion Modul vorgestellt, sowie der Einbau und die Inbetriebnahme am Experiment erläutert

T 62.4 Mi 17:30 G.10.06 (HS 6)

Optimisation of the Level-1 Calorimeter trigger at ATLAS for Run II — •Stanislav Suchek for the ATLAS-Collaboration — Kirchhoff-Institute for Physics, Im Neuenheimer Feld 227, 69120 Heidelberg

The Level-1 Calorimeter Trigger (L1Calo) is a central part of the ATLAS Level-1 Trigger system, designed to identify jet, electron, photon, and hadronic tau candidates, and to measure their transverse energies, as well total transverse energy and missing transverse energy.

The optimisation of the jet energy resolution is an important part of the L1Calo upgrade for Run II. A Look-Up Table (LUT) is used to translate the electronic signal from each trigger tower to its transverse energy. By optimising the LUT calibration we can achieve better jet energy resolution and better performance of the jet transverse energy triggers, which are vital for many physics analyses. In addition, the improved energy calibration leads to significant improvements of the missing transverse energy resolution. A new Multi-Chip Module (MCM), as a part of the L1Calo upgrade, provides two separate LUTs for jets and electrons/photons/taus, allowing to optimise jet transverse energy and missing transverse energy separately from the electromagnetic objects. The optimisation is validated using jet transverse energy and missing transverse energy triggers turn-on curves and rates.

T 62.5 Mi 17:45 G.10.06 (HS 6)

Studies on the Belle II L1 CDC track trigger's z-vertex resolution with neural networks — •Sebastian Skambraks[1], Sara Neuhaus[1], Fernando Abudinen[2], Yang Chen[1], and Christian Kiesling[2] — [1]Technische Universität München — [2]Max-Planck-Institut für Physik, München

We present the use of a neural network ensemble for the first level (L1) track trigger subsystem of Belle II. Our method employs hit and drift time information from the Central Drift Chamber (CDC). Estimating the z-coordinates of the vertex positions improves the signal to background ratio in the recorded data. Especially beam induced background can clearly be rejected, allowing to relax the 2D trigger conditions and thus enhancing the physics gain for low multiplicity events (e.g. tau pair production).

Neural networks enable an improvement of the z-vertex resolution compared to linear least squares track fitting. As general function approximators, they are capable of learning nonlinearities solely from a training dataset. We propose a combined setup, integrating the benefits of the linear fit and enriching it with the nonlinear prediction capabilities of the neural networks. The precise z-vertices of single tracks are estimated by an ensemble of local expert neural networks, specialized to sectors in the track parameter phase space. A comparison is presented, demonstrating the differences of the linear fit and the neural network approach.

T 62.6 Mi 18:00 G.10.06 (HS 6)

The Data Handling Processor of the Belle II DEPFET Detector — •Leonard Germic, Tomasz Hemperek, Testsuichi Kishishita, Hans Krüger, Florian Lütticke, Carlos Marinas, and Norbert Wermes for the Belle II-Collaboration — Physikalisches Institut, Universität Bonn, Deutschland

A two layer highly granular DEPFET pixel detector will be operated as the innermost subsystem of the Belle II experiment, at the new Japanese super flavor factory (SuperKEKB). Such a finely segmented system will allow to improve the vertex reconstruction in such ultra high luminosity environment but, at the same time, the raw data stream generated by the 8 million pixel detector will exceed the capability of real-time processing due to its high rate. For this reason a new ASIC, the Data Handling Processor (DHP) is designed to provide full functionality of data processing at the level of the front-end electronics and to cover the task of controling the pixel read-out scheme. In this contribution, the description of the latest prototype chip in TSMC 65 nm technology together with the latest test results of the interface functionality are presented.

T 62.7 Mi 18:15 G.10.06 (HS 6)

A Neural Network z-Vertex Trigger for Belle II — •Sara Neuhaus[1], Sebastian Skambraks[1], Fernando Abudinen[2], Yang Chen[1], and Christian Kiesling[2] for the Belle II-Collaboration — [1]Technische Universität München — [2]Max-Planck-Institut für Physik, München

In the Belle II experiment the efficiency of the track trigger could be increased by reconstructing the z-coordinate of track vertices at the first trigger level and rejecting tracks not coming from the interaction region, which form a large part of the machine background. The presented method employs neural networks to estimate the z-vertex without explicit track reconstruction. Input data is taken from the central drift chamber, using both the wire coordinates and the drift times for each hit. Neural networks are general function approximators that can learn nonlinear dependencies from real data without the need of an explicit model. However, using a priori knowledge about the track in a meaningful way can help to train more efficient networks, in terms of both prediction quality and network size. Such input information is provided by the Belle II 2D track trigger and is used explicitly in the calculation of the input values for the neural network. The algorithms for the input representation will be presented together with estimations for the trigger efficiency and the rejection capability.

T 62.8 Mi 18:30 G.10.06 (HS 6)

Installation of the pocket ONSEN sytsem to the Belle II DAQ-testbench at KEK High Energy Accelerator Research Organization — •Klemens Lautenbach, David Münchow, Thomas Gessler, Wolfgang Kühn, Jens Sören Lange, and Björn Spruck for the Belle II-Collaboration — Universität Gießen

The future Belle II experiment will reach a total luminosity of $8 \cdot 10^{35} cm^{-2} s^{-1}$. With such high luminosities, the innermost detector, the Pixeldetector (PXD), will produce raw data rates of up to 20 GB/s. In order to reduce these rates, a high bandwidth data aquisition and data reduction system for the PXD is required. The so-called ONline SElection Node (ONSEN)-system will consist of 32 ATCA based Compute Nodes (CN) with Xilinx Virtex-5 FPGA's. These will perform a Region Of Interest (ROI) selection based upon online track extrapolation from the outer detectors. A reduction factor >10 is planned. We present performance results of a first test with a "pocket-ONSEN" system, which represents a prototype system containing three CN (a ROI merger, a ROI processor and a data outsender) assembled in one μTCA-shelf and was implemented as a testbench at KEK, Japan.This work was supported by the German Bundesministerium fur Bildung und Forschung under grant number 05H12RG8.

T 62.9 Mi 18:45 G.10.06 (HS 6)

The Region-of-Interest Distribution of the Online Selection Nodes (ONSEN) — •Dennis Getzkow, Thomas Gessler, Leonard Koch, Wolfgang Kühn, Sören Lange, Klemens Lautenbach, David Münchow, and Björn Spruck — Justus-Liebig-Universität Gießen, II. Physikalisches Institut

The new pixel detector (PXD) of the Belle II experiment is based on DEPFET technology. It has an estimated maximum occupancy of 3% which causes a output data rate of more than 20 GB/s. Before storage, the data is reduced using regions-of-interest (ROIs) calculated by two independent algorithms. The ROIs are defined by extrapolating tracks from the outer tracking detectors to the PXD. The buffering of the PXD data during ROI calculation and the data reduction are performed by the Online Selection Nodes (ONSEN) system that consists of 32 FPGA "Selector" modules. Each Selector processes data for a particular PXD section and event number. A FPGA "Merger" module processes the incoming ROIs, distributes and sends them to the corresponding Selector Nodes.

Test results from a laboratory setup with up to seven FPGA boards will be presented. PXD data and ROIs were emulated, processed by the test system and compared to expected outputs. These tests were used to verify the ROI distribution and the pixel reduction mechanism.

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