# HK 54: Instrumentation XV

Zeit: Donnerstag 14:00–15:45 Raum: S1/01 A2

HK 54.1 Do 14:00 S1/01 A2

**The COMPASS trigger for Drell-Yan Measurements** — •Benjamin Veit — For the COMPASS collaboration — Institut für Kernphysik, Johannes Gutenberg-Universität Mainz, Johann-Joachim-Becher-Weg 45, 55128 Mainz

In 2014/15 the COMPASS experiment measured double-muon-production in the reaction of negative pions of 190 GeV/c with a polarised ammonia target. This process is called Drell-Yan process. The final state consists of two muons and a hadronic state. The hadrons and remaining beam pions were removed by an absorber directly behind the target, the remaining muon pairs were detected in the double stage COMPASS spectrometer. For a symmetric acceptance for positive and negative muons, the single muon trigger system had to be modified. The necessary modifications on the single muon trigger and the performance of the new trigger will be presented.

HK 54.2 Do 14:15 S1/01 A2

**Improvements of the ALICE High Level Trigger for LHC Run 2 to facilitate online reconstruction, QA, and calibration** — •David Rohr for the ALICE-Collaboration — Frankfurt Institute for Advanced Studies, Ruth-Moufang-Str. 1, 60438 Frankfurt

ALICE is one of the four major experiments at the Large Hadron Collider (LHC) at CERN. Its main goal is the study of matter under extreme pressure and temperature as produced in heavy ion collisions at LHC. The ALICE High Level Trigger (HLT) is an online compute farm of around 200 nodes that performs a real time event reconstruction of the data delivered by the ALICE detectors. The HLT employs a fast FPGA based cluster finder algorithm as well as a GPU based track reconstruction algorithm and it is designed to process the maximum data rate expected from the ALICE detectors in real time. We present new features of the HLT for LHC Run 2 that started in 2015. A new fast standalone track reconstruction algorithm for the Inner Tracking System (ITS) enables the HLT to compute and report to LHC the luminous region of the interactions in real time. We employ a new dynamically reconfigurable histogram component that allows the visualization of characteristics of the online reconstruction using the full set of events measured by the detectors. This improves our monitoring and QA capabilities. During Run 2, we plan to deploy online calibration, starting with the calibration of the TPC (Time Projection Chamber) detector's drift time. First proof of concept tests were successfully performed using data-replay on our development cluster and during the heavy ion period at the end of 2015.

HK 54.3 Do 14:30 S1/01 A2

**Rejection of late conversions in the ALICE TRD trigger** — •Ole Schmidt[1], Felix Rettig[2], Jochen Klein[3], Uwe Westerhoff[4], and Guido Willems[4] for the ALICE-Collaboration — [1]Physikalisches Institut, University of Heidelberg — [2]FIAS, University of Frankfurt — [3]CERN — [4]IKP, University of Munster

The ALICE Transition Radiation Detector (TRD) provides various level-1 trigger contributions based on the information of individual tracks. Chamber-wise track segments are merged in the Global Tracking Unit (GTU) and used for the on-line reconstruction of transverse momentum (pt) and electron identification. Based on this information, versatile and flexible trigger conditions were implemented.

Amongst others, several triggers on high-pt electrons were used during Run 1. The dominant background originates from photon conversions in the material in front of the TRD. For the reconstruction of the transverse momentum, the GTU performs a straight line fit under the assumption that the tracks point to the primary vertex. However, electrons from conversions at large radii can falsely point close to the primary vertex and fake high-pt particles.

In our improved tracking algorithm, the local curvature of the tracks is exploited to reject electrons from late conversions by approximating their sagitta. After successful tests in simulations, the algorithm was implemented in the GTU preserving the 7 us latency of the trigger decision relative to a level-0 trigger. We present the performance of the late conversion rejection and show prospects for TRD triggers for data-taking in 2016.

HK 54.4 Do 14:45 S1/01 A2

**ALICE High-Level Trigger Readout and FPGA Processing in Run 2** — •Heiko Engel and Udo Kebschull for the ALICE-Collaboration — IRI, Goethe-Universitaet Frankfurt

The ALICE experiment uses the optical Detector Data Link (DDL) protocol to connect the detectors to the computing clusters of Data Acquisition (DAQ) and High-Level Trigger (HLT). The interfaces between the clusters and the optical links are realized with FPGA boards. HLT has replaced all of its interface boards with the Common Read-Out Receiver Card (C-RORC) for Run 2. This enables the read-out of detectors at higher link rates and allows to extend the data pre-processing capabilities, like online cluster finding, already in the FPGA. The C-RORC is integrated transparently into the existing HLT data transport framework and the cluster monitoring and management infrastructure. The board is in use since the start of LHC Run 2 and all ALICE data from and to HLT as well as all data from the TPC and the TRD is handled by C-RORCs. This contribution gives an overview on the firmware and software status of the C-RORC in the HLT.

HK 54.5 Do 15:00 S1/01 A2

**The CBM First-level Event Selector, Timeslice Building and Availability Studies** — •Helvi Hartmann, Jan de Cuveland, and Volker Lindenstruth for the CBM-Collaboration — Frankfurt Institute for Advanced Studies, Goethe University, Frankfurt, Germany

The Compressed Baryonic Matter (CBM) experiment is a fixed target high energy physics experiment collecting all produced data - no triggers are involved. This causes a very high data rate of 1 TByte/s. The First-level Event Selector (FLES) denotes a high performance computer cluster that will process all data and performs a full online event reconstruction. For this purpose the raw detector data is accessed in time intervals referred to as Timeslices. In the process of Timeslice building data from all input links are distributed via a high-performance Infiniband network to the compute nodes.

In order to ensure that the FLES is available the whole time while the detectors are running fault tolerance is inevitable. The questions is how often are incidents going to occur (Mean Time between Failure MTBF) and how long will they pause Timeslice building and hence physics analysis (Mean Time to Repair MTTR). These two factors make up the availability of the FLES. I would like to present a detailed analysis of possible sources of errors and their influence on the availability. Furthermore, I will discuss the development of Timeslice building on the basis of MPI with respect to the availability of the FLES. I will compare this approach to a low-level native Infiniband Verbs implementation combined with a socket-based error handling system.

HK 54.6 Do 15:15 S1/01 A2

**Background Suppression by Pulse Shape Discrimination in the CALIFA Calorimeter** — •Benjamin Heiss, Roman Gernhäuser, Philipp Klenze, Patrick Remmels, and Max Winkel for the R3B-Collaboration — Technische Universität München

The $4\pi$-calorimeter CALIFA is one of the major detectors of the $R^3B$-experiment at the upcoming Facility for Antiproton and Ion Research (FAIR) in Darmstadt. This calorimeter with 2464 CsI(Tl) crystals and 96 Phoswich detectors ($LaBr_3$(Ce) and $LaCl_3$(Ce)) plays a major role in the realization of kinematically complete measurements. General demands on CALIFA are a high efficiency, good energy resolution of about 5 % at 1 MeV $\gamma$ energies and a large dynamic range, allowing a simultaneous measurement of $\gamma$-rays at $E > 100$ keV and scattered protons up to $E < 700$ MeV. Due to the very high energies of the light charged particles at the relativistic beam energies, especially in the forward direction of CALIFA, a significant fraction triggers nuclear reactions in the detector material. This talk will present the methods of the background suppression by pulse shape discrimination based on an experiment with protons at kinetic energies up to $E = 480$ MeV at the TRIUMF Laboratory in Vancouver, Canada. Supported by BMBF(05P12 WOFNF,05P15 WOFNA) and TRIUMF Vancouver.

HK 54.7 Do 15:30 S1/01 A2

**A real-time high level trigger system for CALIFA** — Roman Gernhäuser, Benjamin Heiss, •Philipp Klenze, Patrick Remmels, and Max Winkel — Physik Department, Technische Universität München

The CALIFA calorimeter with its about 2600 scintillator crystals is a key component of the $R^3B$ setup. For many experiments CALIFA will have to perform complex trigger decisions depending on the total energy deposition, $\gamma$ multiplicities or geometrical patterns with a minimal latency. This selection is an essential tool for the accurate preselection of relevant events and provides a significant data reduction.

The challenge is to aggregate local trigger information from up to 200 readout modules. The trigger tree transport protocol ($T^3P$) will use dedicated FPGA boards and bus systems to collect trigger information and perform hierarchical summations to ensure a trigger decision within $1\,\mu$s. The basic concept and implementation of $T^3P$ will be presented together with first tests on a prototype system.

Supported by BMBF (05P12WOFNF and 05P12WOFNA) and GSI (TMLFRG1316).