T 122: DAQ Systems

Time: Thursday 15:50–16:50 Location: POT/0106

T 122.1 Thu 15:50 POT/0106

Performance of the ATLAS Level-1 Calorimeter Trigger in Run 3 — •Thomas Junkermann — Kirchhoff-Institut für Physik, Heidelberg

The Phase-I Upgrade of the ATLAS Level-1 Calorimeter Trigger adapts the finer granularity of the spatial information of energy, provided by the upgraded front-end electronics of the Liquid-Argon calorimeter. To process the higher amounts of data a new digital trigger is installed. The new trigger has three feature extractors which each specialize on different calorimeter objects. They identify electrons, photons, taus, jets and missing energy.
The upgraded front-end components for the new digital trigger effect the old trigger system and re-calibration of it is needed as it will be run in Run 3 (started in July 2022) parallel to the new system.
The re-calibrated legacy trigger is the natural candidate to compare the new system to and offers many possibilities to compare and ultimately optimize the new system. Different calibrations are performed and eventually efficiencies and rates will give a deep insight into whether the re-calibration of the old system worked as expected and commissioning and calibration of the new system was succesful.
The new trigger is being comissioned during Run 3 and took part in first data taking. With stable running making comparisons possible, the calibration as well as efficiency studies are presented.

T 122.2 Thu 16:05 POT/0106

Anomaly detection for the level 1 trigger system of the CMS experiment — •Sven Bollweg, Karim El Morabit, Lars Emmrich, Gregor Kasieczka, and Artur Lobanov — University of Hamburg, Germany

There exist strong hints for the existence of physics beyond the standard model (BSM). At the CMS experiment, the first event selection step is the Level 1 (L1) trigger system, which decides whether an event is stored for further analysis. Assuming that BSM events differ from standard model (SM) events, a trigger decision could then utilize this difference to detect anomalous event properties instead of being fully based on model specific criteria.

This talk discusses such an anomaly detection trigger based on neural networks. An autoencoder (AE) network is trained to reproduce typical collision events. It is found that the reconstuction quality of anomalous events, such as BSM events or rare SM events, is decreased. This decrease in reproduction quality can then be used as a basis for the trigger decision. Since the L1 trigger has a very limited time for the decision, the AE needs to be deployed on dedicated hardware in the form of field programmable gate arrays which presents additional challenges.

T 122.3 Thu 16:20 POT/0106

Online Track Reconstruction for the Mu3e Experiment — •Haris Avudaiyappan Murugan for the Mu3e-Collaboration — Institute of Nuclear Physics, Johannes Gutenberg University of Mainz, Germany

The Mu3e experiment aims to observe or exclude the rare decay of a positive muon into two positrons and an electron. Such an observation would be a violation of charged lepton flavour conservation and thus a clear signal of new physics. In the first phase, it will observe 10^8 muon decays per second using a thin pixel detector complemented by scintillating timing detectors. The data rate from the detector subsystems is estimated at about 100 Gb/s and is mostly comprised of background processes from other decay channels of the muon. To store the data for physics analysis, it needs to be reduced by a factor of 100. This can be achieved by selecting the potential signal events through online track and vertex reconstruction on graphics processing units (GPUs). The talk discusses the algorithm employed on the GPUs and the achieved performance.

T 122.4 Thu 16:35 POT/0106

Dilepton trigger selections for Run 3 at the LHCb Experiment — Johannes Albrecht, •James Gooding, and Biljana Mitreska — TU Dortmund University, Dortmund, Germany

Lepton flavour-violating processes in B decays are amongst the key curiosities studied at the LHCb Experiment. Measurements of such processes rely on high-quality selection of leptons, in particular of lepton pairs arising from B decays. These selections typically rely on cuts to essential kinematic and topological variables.

During the LHC Run 3 data-taking period, the LHCb Experiment will receive collisions at a rate of 30 MHz. The full detector readout at this rate produces 5 TB/s of data, though only 10 GB/s can be recorded. To reduce the amount of data recorded, LHCb will employ an entirely software-based trigger system to select events in real time. Within this framework, an inclusive cut-based trigger is being developed to select dilepton events (i.e. events containing a lepton pair).

In this talk, the status of the inclusive cut-based dilepton trigger is presented, and its performance is evaluated within the context of the Run 3 LHCb trigger system.