T 52: Invited Topical Talks II-A

Time: Wednesday 14:00–15:20 Location: HSZ/AUDI

Invited Topical Talk T 52.1 Wed 14:00 HSZ/AUDI
Commissioning of the new LHCb trigger system — •Marian Stahl — European Organization for Nuclear Research (CERN), Geneva, Switzerland

Since 2022 the upgraded LHCb experiment uses a triggerless readout system collecting data at an event rate of 30 MHz and a data rate of 4 Terabytes/second. A software-only heterogeneous High Level Trigger (HLT) enables unprecedented flexibility for reconstruction and selections. Compared to Run2 (2015-18), the amount of data to be processed by the HLT increased by a factor 60 due to operating at five times higher luminosity and the removal of the hardware trigger. The GPU-based first stage (HLT1) reduces the event rate to 1 MHz by selections based on charged particle tracking, vertexing, photon reconstruction and lepton identification. At the CPU-based second stage (HLT2), full offline quality event reconstruction and user-friendly configuration provides the flexibility that has allowed analysts to implement more than 1500 inclusive and exclusive selection algorithms. Real-time alignment and calibration directly after HLT1 ensures best detector performance in HLT2's full event reconstruction. I will describe how LHCb's Real-Time-Analysis project addresses performance and code portability challenges associated with heterogeneous computing at this scale and how the new trigger, alongside with the upgraded detector, have been commissioned in 2022.

Invited Topical Talk T 52.2 Wed 14:20 HSZ/AUDI
Alignment of the CMS Tracker: Automation is Key — •Marius Teroerde — 1. Physikalisches Institut B, RWTH Aachen, Germany

The inner tracker is the central part of the Compact Muon Solenoid (CMS) detector at the Large Hadron Collider (LHC). In order to ensure excellent physics performance, it is necessary to have precise knowledge of the tracker geometry, so that tracks and vertices can be accurately reconstructed.

The measurement of the tracker geometry using particle tracks, called 'alignment', is a very complex task. It involves tracking the time dependent position of about 15000 detector modules. Radiation damage to the modules influences the position measurements. The best data quality is therefore achieved if the tracker geometry is frequently updated based on recent data and if the granularity of the alignment is fine enough to account for biases in individual modules. An automated procedure, including automated quality control, is key to meet these requirements. In this talk, an introduction to tracker alignment strategies at CMS is given and recent developments of automatic alignment are discussed. Future prospects for the era of the High-Luminosity LHC are also touched upon.

Invited Topical Talk T 52.3 Wed 14:40 HSZ/AUDI
ITk – ATLAS tracker upgrade — •Dennis Sperlich — Albert-Ludwigs-Universität Freiburg

For the LHC Phase-II upgrade, the ATLAS Experiment needs to upgrade the new whole tracking system. ITk will be able to cope with the higher pileup up to 200 and integrated luminosities up to $4000\,fb^{-1}$. It will replace the current Pixel, SCT and TRT detector with an all silicon detector comprised of Pixel and Strip subdetectors. The Pixel detector will consist of five barrel layers and a number of endcap-region rings to provide hermetic coverate and tracking up to $|\eta| < 4$. The Strip detector will consist of four barrel layers and six discs per endcap. With the R&D concluding in the system tests of bigger Pixel and Strip structures and the production starting, this talk will show the current state of the two subprojects and gives and outlook towards production and integration.

Invited Topical Talk T 52.4 Wed 15:00 HSZ/AUDI
Role of simulation in silicon tracker sensors R&D — •Anastasiia Velyka — DESY Hamburg

Experiments at possible future colliders require, among others, lightweight detectors with a single-point resolution of a few micrometers. These requirements are addressed with various silicon tracker sensor R&D projects. Optimisation of the sensor design requires precise simulations, which can be achieved by combining computer-aided design (TCAD) and Monte Carlo methods. TCAD is used to simulate an accurate electric field of a sensor via static simulations. The response of the sensor is simulated using the Monte Carlo software.

The examples of sensor optimisation are shown for the hybrid Enchanted Lateral Drift (ELAD) sensor and the monolithic small collection electrode CMOS sensor.