

T 94: DAQ, Exp. Methods

Time: Wednesday 17:30–19:00

Location: POT/0106

T 94.1 Wed 17:30 POT/0106

Development of a Detector Response Model and an Autonomous Trigger for the Detection of Air-Shower Radio Emission — ●JELENA PETEREIT, TIM HUEGE, MARKUS ROTH, and LUKAS GÜLZOW — Karlsruhe Institute of Technology, Germany

Radio detection of air-showers has proven to be very advantageous for the measurement of ultra-high energy cosmic rays. As a consequence, a new generation of radio detectors is now evolving at much larger scales. The Giant Radio Array for Neutrino Detection (GRAND) is planned as an array of wide-band radio antennas, which will cover a total area of 200 000 km². In order to reliably distinguish air-shower events from noise for such large arrays, an efficient and autonomous multi-level radio trigger is developed*. The first-level trigger selects an antenna signal according to expected signal shapes, whereas the second-level trigger refines this selection according to information of all antennas triggered during the same event.

While the deployment of GRAND is in progress, a digital detector model is being developed. It will include a sufficiently accurate instrument response and signal processing methods. It will then make it possible to analyze the detector response and determine significant parameters that are needed for building this novel trigger method. This talk will cover the approaches to build a realistic response model and the multi-level radio trigger needed for large-scale experiments like GRAND. * *NUTRIG project, supported by the ANR-DFG Funding Programme (RO 4165/2-1)*

T 94.2 Wed 17:45 POT/0106

Event builder and online monitoring of OSIRIS pre-detector of JUNO — ●RUNXUAN LIU^{1,2}, KAI LOO⁴, LIVIA LUDHOVA^{1,2}, CORNELIUS VOLLBRECHT^{1,2}, ANITA MERAVIGLIA^{2,3}, NIKHIL MOHAN^{2,3}, LUCA PELICCI^{1,2}, MARIAM RIFAI^{1,2}, and APEKSHA SINGHAL^{1,2} — ¹Forschungszentrum Jülich GmbH, Institut für Kernphysik IKP-2, Jülich, Germany — ²III. Physikalisches Institut B, RWTH Aachen University, Aachen, Germany — ³GSi Helmholtz Centre for Heavy Ion Research, Darmstadt, Germany — ⁴Cluster of Excellence PRISMA+, Johannes Gutenberg University Mainz, Mainz, Germany

JUNO is a 20 kt liquid scintillator detector under construction in Jiangmen, China. The installation is expected to be completed in 2023. Its main goal is to determine the neutrino mass hierarchy with the measurement of reactor anti-neutrinos from the two nuclear power plants in the proximity. This requires stringent limits on the radiopurity of the liquid scintillator. The OSIRIS (Online Scintillator Internal Radioactivity Investigation System) pre-detector is designed to monitor the liquid scintillator during the several months of filling the large volume of JUNO. OSIRIS will contain 18 tons of scintillator and will be equipped with 76 20-inch PMTs. It will be sensitive for the ²³⁸U/²³²Th decay rates via tagging of the Bi-Po coincidence decays in the ²³⁸U/²³²Th decay chain. This talk will present the trigger strategies of OSIRIS and its updated event builder software. The online monitoring software for OSIRIS is needed for a live measurement of scintillator radiopurity during filling and it will also be presented in this talk.

T 94.3 Wed 18:00 POT/0106

Writing photons to disk - The triggerless DAQ-System of XENONnT — ●ROBIN GLADE-BEUCKE for the XENON-Collaboration — Physikalisches Institut, Universität Freiburg, 79104 Freiburg, Germany

The XENONnT experiment is an ultra low-background liquid xenon TPC for WIMP direct detection which is taking data at LNGS (Italy). Its triggerless data acquisition (DAQ) system allows for fast and storage-efficient recording with a very low threshold, accepting signals as small as from individual photons. Custom-developed FPGA firmware on the read-out digitizers and on auxiliary logic boards, e.g., a high energy veto to remove high-energy events during detector calibration, makes the data-taking in the triggerless paradigm possible.

In this talk, I will present the system and its performance.

T 94.4 Wed 18:15 POT/0106

Improving Particle Flow Reconstruction in the CMS HGCAL — ●ABHIRIKSHMA NANDI¹, WAHID REDJEB^{1,2}, FELICE PANTALEO², MARCO ROVERE², and ALEXANDER SCHMIDT¹ — ¹III. Physikalisches Institut A, RWTH Aachen University, Aachen, Germany — ²CERN, Geneva, Switzerland

The CMS calorimeter endcaps will be completely replaced by the High Granularity Calorimeter (HGCAL) as part of the Phase-2 upgrades. The large number of simultaneous collisions (pile-up) and the novelty of the detector makes physics object reconstruction a challenging task. A new, modular framework, called The Iterative Clustering (TICL), is under development for reconstruction in HGCAL. Its granularity and the capability to obtain 5D (x,y,z,t,E) measurements, make HGCAL an ideal candidate for particle flow reconstruction - where information from different parts of the detector are matched to improve the global event description. Moreover, accumulating separate objects reconstructed inside the calorimeter, from the secondary components of a particle shower, is also necessary. This talk discusses a linking algorithm that was introduced in TICL as a first attempt to solve these problems. A complementary approach of learning functions on a graph of clustered energy deposits and detecting communities in it, will also be presented.

T 94.5 Wed 18:30 POT/0106

The Heterogeneous TICL Framework — ●WAHID REDJEB^{1,2}, ABHIRIKSHMA NANDI¹, ALEXANDER SCHMIDT¹, FELICE PANTALEO², MARCO ROVERE², and ANTONIO DI PILATO³ — ¹III. Physikalisches Institut A, RWTH Aachen University, Aachen, Germany — ²CERN, Geneva, Switzerland — ³University of Geneva, Geneva, Switzerland

The High-Granularity Calorimeter (HGCAL) is a sampling calorimeter with both lateral and longitudinal fine granularity designed for the High-Luminosity LHC. The calorimeter will use silicon sensors, in the high radiation regions, providing high pile-up mitigation, and scintillators in the low radiations regions. For the physics object reconstruction a dedicated framework for HGCAL is currently under development: The Iterative Clustering (TICL), which utilizes the 5D (x,y,z,t,E) information from the reconstructed hits and returns particle properties and probabilities. Heterogeneous computing will play a fundamental role in the physics object reconstruction software to fully exploit the reach of the HL-LHC. Performance Portability libraries allow performance portability across different hardware architectures with a single code basis. In this talk we present and overview of the TICL framework and we show how heterogeneous computing has been integrated in the framework, exploiting the Alpaka library to achieve Performance Portability and being able to run core parts of the Framework on GPU and on CPU with a single source code.

T 94.6 Wed 18:45 POT/0106

Updated jet energy scale calibration using Monte Carlo samples for ATLAS — ●GEDIMINAS GLEMŽA and CHRISTIAN SANDER — DESY, Notkestr. 85, 22607 Hamburg, Germany

An updated simulation-based jet energy scale calibration utilising the newest ATLAS software release version and updated Run-2 Monte Carlo samples is presented. The calibration restores the jet energy scale back to particle level jets. The jets are reconstructed using particle-flow objects and clustered using the anti- k_t jet algorithm with a radius parameter of 0.4. The presented calibration accounts for in-time and out-of-time residual pile-up effects, calibrates the absolute jet energy scale and pseudorapidity, as well as provides additional corrections based on global jet observables. The presented procedure is based on similar simulation-based calibrations carried out during the period of Run-2 and their performance comparison is discussed.