T 146: DAQ Systems, Exp. Methods

Time: Thursday 17:30–19:00 Location: POT/0106

T 146.1 Thu 17:30 POT/0106

Real-time alignment and calibration for Run 3 at the LHCb experiment — •Biljana Mitreska and Johannes Albrecht — TU Dortmund University, Dortmund, Germany

The real-time alignment and calibration procedure is a fully automatic procedure at LHCb that is executed at the beginning of each fill of the LHC. The alignment estimates the position of detector elements and the correct alignment contributes to improving the data for offline analysis. Its importance in Run 3 is even more enhanced due to having a fully software trigger at LHCb. The procedure is implemented for the full tracking system at LHCb with the event reconstruction run as a multithreaded process. The operational and technical point of view of this procedure during the Run 3 data-taking is discussed with the focus on performance and optimisations done regarding the new computing framework and the new detectors.

T 146.2 Thu 17:45 POT/0106

Online data reduction with the FPGA-based DATCON track reconstruction system at the Belle II Detector — Florian Bernlochner, Bruno Deschamps, Jochen Dingfelder, •Ralf Farkas, and Botho Paschen for the Belle II-Collaboration — Physikalisches Institut der Rheinischen Friedrich-Wilhelms-Universität Bonn

The DATCON system is a set of 15 FPGAs, deployed at the Belle II detector at the KEK facility in Tsukuba, Japan. Its purpose is the real-time reduction of the data stream of the two innermost PXD detector layers, by defining regions of interest (ROI) on them. Only the hit information of the pixels located inside these ROIs are to be further processed and saved. DATCON uses the information of the SVD layers of the detector, finds tracks using a Hough Transformation-based track reconstruction algorithm and extrapolates them towards the center of the detector, to the PXD layers. While the track reconstruction algorithm itself has already been validated both on Hardware and Software, further work is required to improve the stability and reliability of the system. This talk will highlight the recent changes and improvements of DATCON.

T 146.3 Thu 18:00 POT/0106

Techniques for the investigation of segmented sensors using the Two Photon Absorption – Transient Current Technique — •Sebastian Pape[1,2], Michael Moll[1], Esteban Curras[1], and Marcos Fernandez Garcia[1,3] — [1]CERN — [2]TU Dortmund University — [3]Instituto de Física de Cantabria

The Two Photon Absorption - Transient Current Technique (TPA-TCT) is a technique for the characterisation of radiation detectors with three dimensional resolution. The TPA-TCT setup at CERN is designed for the investigation of silicon based detectors and uses a 430 fs pulse fiber lasers, with a wavelength of 1550 nm, which is in the quadratic absorption regime of silicon. Highly focusing optics are used to only generate excess charge carriers in a small volume (approximately 1μm $\times$ 1μm $\times$ 20μm) around the focal point of the laser beam, which enables a resolution in all three spatial directions. This three dimensional resolution is particular useful for the investigation and characterisation of segmented detectors. This talk introduces to the TPA-TCT and the setup at CERN. Further, the weighted prompt current method is presented, which allows to investigate the electric field of segmented sensors. The method is demonstrated on various segmented sensors: a HV-CMOS CCPDv3, a Micron strip detector, and a passive CMOS strip detector. Further, the mirror technique is presented, which exploits a reflection of the rear side, to probe below front surface metallisations.

T 146.4 Thu 18:15 POT/0106

Prototype studies of a liquid organic TPC for the detection of low energy antineutrinos — Malte Göttsche, •Niklas Herrmann, Thomas Radermacher, Stefan Roth, and Yan-Jie Schnellbach — RWTH Aachen University - Physics Institute III B, Aachen, Germany

Liquid organic time projection chambers, LOr-TPCs, can potentially be used to detect and measure low energy antineutrinos. One application would be monitoring antineutrinos from nuclear waste via inverse beta decay. Using an organic liquid as drift medium has the advantage of room temperature operation, but the measurement is very sensitive to impurities. Therefore, we set up a prototype including a purification system, which contains a turbomolecular pump, a boiler, a condenser and filters. The status of the prototype setup is presented.

T 146.5 Thu 18:30 POT/0106

Detection of Low-Energy Antineutrinos with Liquid-organic Time Projection Chambers — Marike Ellerbroek[1], Malte Göttsche[1,2], Niklas Herrmann[1], •Thomas Radermacher[1,2], Stefan Roth[1], and Yan-Jie Schnellbach[1,2] — [1]RWTH Aachen University - Physics Institute III B, Aachen, Germany — [2]RWTH Aachen University - Nuclear Verification and Disarmament, Aachen, Germany

The region of antineutrino energy of a few MeV is of special interest for physics research and for the application of antineutrino-monitoring in the nuclear safeguards regime. Typically, scintillation detectors are used to detect these low-energy antineutrinos via the inverse beta decay (IBD) by reconstructing the time-correlated light signals of the positron annihilation and the neutron capture. A novel detection concept utilizing a time projection chamber (TPC) filled with an organic liquid (LOr) could enable a background-minimized detection of the antineutrino since it allows the reconstruction of all final state particles in the IBD event. From the positron track the antineutrino's initial energy and its vertex can be determined. If the energy deposition of the neutron-induced proton recoils can be detected it offers the possibility to reconstruct the antineutrino direction on an event-by-event basis. We are investigating the IBD signature with a Geant4-based simulation together with a subsequent modelling of the electron drift. Additionally, we are working on prototype measurements and simulations to study the feasibility of such a LOr-TPC. This talk presents the status of our studies.

T 146.6 Thu 18:45 POT/0106

Stimulated de-excitation of Rydberg atoms in KATRIN using THz radiation* — •Shivani Ramachandran, Enrico Ellinger, and Klaus Helbing for the KATRIN-Collaboration — Bergische Universität Wuppertal (BUW)

The key requirement for the KArlsruhe TRItium Neutrino experiment (KATRIN) to reach its goal sensitivity of 200 meV at 90 % (C.L.) in measuring the effective electron anti-neutrino mass is minimal background. Several background suppression methods have already been implemented to achieve that and eliminate some known contributors. The most dominant contribution to the background in the measured signal is electrons produced by the thermal ionization of Rydberg atoms. They originate due to the sputtering of ^{210}Pb from inherent radioactivity from the walls of the KATRIN main spectrometer. A plausible method is using THz and microwave radiation (method developed by ASACUSA CERN) for dedicated stimulated de-excitation which can lead to a shorter lifetime of Rydberg atoms. The influence of THz light source in the main spectrometer along with the state and spatial evolution of the Rydberg atoms is presented via simulations. The effect of the properties of the ionization electrons on the de-excitation method is discussed.

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