HK 45: Instrumentation X and Applications

Zeit: Mittwoch 16:30–18:30 Raum: HS 12

Gruppenbericht HK 45.1 Mi 16:30 HS 12

Multi-neutron detection with NeuLAND — •J. Mayer and A. Zilges for the R3B- and the NeuLAND-SAMURAI-Collaboration — Institute for Nuclear Physics, University of Cologne

The high-resolution, large-acceptance time-of-flight spectrometer NeuLAND is the new neutron detector for the R^3B setup (Reactions with Relativistic Radioactive Beams) at FAIR. NeuLAND is dedicated to the detection of high-energy neutrons up to 1 GeV.

In this talk, we will give an overview on construction, experiments, and software: NeuLAND consists of plastic scintillator bars (5 cm x 5 cm x 250 cm) which are arranged to so-called double planes. An experimental campaign with four double planes was performed at the SAMURAI setup at RIKEN, Japan, from 2015 to 2017 [1]. We verified simulations of the detector with this experimental data and studied the detector response for the upcoming experiments in FAIR Phase 0. To extract the multiplicity and the interaction points of primary neutrons, analysis software was prepared. Here we present different event reconstruction algorithms and their performance for simultaneous detection of up to five neutrons.

Supported by the BMBF (05P15RDFN1, 05P19PKFNA, 05P15RFFN1), the DFG (SFB 1245), and the GSI-TU Darmstadt cooperation agreement.

[1] J. Kahlbow *et al.*, GSI-FAIR Scientific Report 2017 (RESEARCH-NUSTAR-KR-3)

HK 45.2 Mi 17:00 HS 12

Simulating the high-rate performance of MRPC detectors for the CBM TOF wall — •Christian Simon and Norbert Herrmann for the CBM-Collaboration — Physikalisches Institut, Ruprecht-Karls-Universität Heidelberg, D-69120 Heidelberg

The large-area time-of-flight (TOF) wall of the future Compressed Baryonic Matter (CBM) experiment is composed of multi-gap resistive plate chambers (MRPC). In CBM, heavy nuclei are accelerated to kinetic energies of up to 11 AGeV (SIS100) and interact in a fixed-target geometry at unprecedented rates of up to 10 MHz which generates strongly varying particle fluxes on the TOF wall. Closer to the beam pipe where several tens of kHz/cm^2 are expected, low-resistive glass will serve as resistive material for the MRPC detectors while the periphery of the rectangular 120 m^2 wall has been designed with float-glass counters which do not need to (and can intrinsically not) cope with fluxes of more than a kHz/cm^2. To facilitate the analysis and interpretation of results from in-beam rate tests of MRPC prototypes, equipped with both types of glass, a dedicated MRPC rate-response simulation has been developed in the CbmRoot software framework. The parametric description of the detector response function with respect to incident particle flux allows for reproducing and predicting the MRPC performance under a given load once the model parameters are derived from experimental test beam data. An exemplary simulation of an MRPC in-beam test at CERN/SPS in 2015/16 will be presented. The project is partially funded by BMBF 05P15VHFC1.

HK 45.3 Mi 17:15 HS 12

Detector simulation developments in ALICE in view of LHC Runs 3 and 4 — •Benedikt Volkel for the ALICE-Collaboration — CERN, Switzerland — Ruprecht-Karls-Universität Heidelberg, Germany

With an expected increase of acquired data by two orders of magnitude in ALICE Runs 3 and 4, the simulation requirements will also notably increase. For the planned physics programme involving multiple analysis topics, it is estimated that the simulation requirements will increase by a factor of 20 with respect to the current production. Most of this increase is planned to be met by using fast or parametrised Monte-Carlo simulations. Simulations performed for Runs 1 and 2 employ the transport codes GEANT3, GEANT4 and FLUKA used through the Virtual Monte Carlo (VMC) interface and a common geometry modeller and navigator within the ROOT software package.

In addition to using one transport code in the event simulation, core extensions of the VMC package will be presented which allow to share the simulation of a single event among different transport codes. This provides the possibility to combine advantages of multiple transport engines depending on the simulation requirements.

Furthermore, first preliminary performance results of fast simulation implementations will be presented.

HK 45.4 Mi 17:30 HS 12

TGeoArbN: A ROOT class for tessellated geometries — •Ben William Salisbury for the PANDA-Collaboration — Helmholtz-Institut für Strahlen- und Kernphysik, Bonn

Simulations of particle physics experiments require a simulatable geometry representation of the experiment's detector system, such as the forward endcap of the $\bar{P}$ANDA experiment. A new geometry object called TGeoArbN was implemented which uses a tessellated approximation of a CAD-shape. It is intended to be used as addition to the ROOT framework, allowing to simulate any geometry without the overhead of having to combine ROOT-geometry primitives to form an approximation of a complex shape. The tessellated approximation is stored as a mesh consisting of simple planar geometries, such as triangles. This mesh is then processed during the simulation to determine the relative location of a point (particle position) to the approximated geometry. An optimization scheme in form of a partition structure (Octree) was implemented to reduce processing time by determining the relevant mesh part for a specific point. In this talk a short overview of the concepts used by TGeoArbN and processing time determinations are presented.

Funded by the BMBF.

HK 45.5 Mi 17:45 HS 12

Performance simulations of the Silicon Tracking System of the CBM Experiment at FAIR — •Evgeny Lavrik for the CBM-Collaboration — Facility for Antiproton and Ion Research, Germany

The Compressed Baryonic Matter (CBM) experiment at the future Facility for Antiproton and Ion Research (FAIR) aims to study the properties of nuclear matter at high net-baryon densities and moderate temperatures.

The Silicon Tracking System (STS) is the key detector to reconstruct with a high efficiency up to 1000 charged particle trajectories created in heavy-ion collisions at interaction rates of up to 10 MHz. It will determine the momentum of the particles with a momentum resolution $\Delta p/p \approx$ 1-2% which requires low detector material budget of 0.3-1% X_0 per detection layer. The detector comprise eight layers of double-sided silicon micro-strip sensors and will be placed inside the 1 Tm superconducting magnet.

This contribution describes the simulated analog and digital response of the STS and its performance with regard to different geometries, sensor layouts and varied sensor thicknesses. Key metrics such as track and primary vertex reconstruction efficiencies, momentum resolution will be presented. In addition the effect of delta-electrons originating from beam-target interactions on the detector performance and read-out data rates will be shown.

HK 45.6 Mi 18:00 HS 12

Validating the Digitization in the O^2 TPC Simulation — •Thomas Klemenz for the ALICE-Collaboration — Technische Universität München, Physik Department E62, Excellence Cluster 'Universe', Garching

The ALICE detector will be upgraded in the course of the LHC high luminosity upgrade starting 2019. In particular, the present readout of the ALICE TPC will not be able to cope with the enhanced interaction rates provided by the LHC in Run3. Therefore, the readout will rely on continuously read out GEM-based readout chambers. This upgrade will also severely affect the data processing. The new Online-Offline computing system, O^2, will replace the current framework, AliRoot, to cope with the continuous readout.

The upgrade of the readout demands an update of the implementation of the signal formation in all sub-detectors, and mostly relevant for this work, the TPC. Therefore, the digitization of the TPC was validated with data from a test beam of electrons and pions that was taken with a 4-GEM inner readout chamber from the pre-production stage at the CERN PS in 2017.

This research was supported by the DFG cluster of excellence 'Origin and Structure of the Universe', BMBF, HGF and the SFB 1258.

HK 45.7 Mi 18:15 HS 12

Dark photon search at MAGIX — •Pepe Gülker for the MAGIX-Collaboration — JGU Mainz

The multi-purpose MAGIX experiment at the future electron accelerator MESA will be perfectly suited to extend the search for invisible dark photon decays to an unprecedented parameter range. We plan to perform scattering experiments on a windowless gas-jet target with low-energy electron probes delivered by MESA. They are produced in an energy-recovering acceleration mode, which yields a beam current of 1 mA. By this we will, in theory, be able to take data with very high accuracy.

To find suitable kinematics and get estimations for the sensitivity, a dedicated Monte-Carlo-simulation of the signal- and most relevant background-processes was performed and will be presented in this contribution.