HK 42: Instrumentation XIII

Zeit: Mittwoch 16:30–18:00 Raum: Audimax H1

HK 42.1 Mi 16:30 Audimax H1

Expected Performance of NeuLAND in FAIR Phase 0 — •Jan Mayer[1], Konstanze Boretzky[2], Michael Heil[2], Elena Hoemann[1], Dmytro Kresan[2], and Andreas Zilges[1] for the R3B-Collaboration — [1]Institute for Nuclear Physics, University of Cologne — [2]GSI Gesellschaft für Schwerionenforschung GmbH, Darmstadt

At least 13 out of the planned 30 double planes of the New Large Area Neutron Detector NeuLAND will be available for the R^3B experiment in FAIR Phase 0. Here we present an overview about the progress in simulations, reconstruction, and the expected performance of this startup version.

The original multi-neutron multiplicity recognition depends on the calorimetric properties of the full detector. Simulations have shown that the separation of the individual neutron multiplicities is heavily affected by the reduced detector depth, which subsequently affects the interaction point reconstruction. We have developed a method based on scoring hit patterns to find the primary neutron interaction points, working around this limitation. This method can suppress secondary hits (false positives) with high precision at the expense of efficiency.

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HK 42.2 Mi 16:45 Audimax H1

Instrumentation and optimization studies for a Beam Dump Experiment (BDX) @ MESA — •Mirco Christmann for the MAGIX-Collaboration — Institut für Kernphysik - Johannes Gutenberg Universität, Mainz, Deutschland

At the Institute for Nuclear Physics in Mainz the new electron accelerator MESA will go into operation within the next years. In the extracted beam operation (155 MeV, 150 μA) the P2 experiment will measure the weak mixing angle in electron-proton scattering in 10,000 hours operation time. Therefore the high-power beam dump of this experiment is ideally suited for a parasitic dark sector experiment.

In an ongoing MadGraph cross section generation and Geant4 simulation this beam dump experiment is studied. In theory dark photons A' are generated in the beam dump by a process analog to electromagnetic bremsstrahlung and they decay invisible to pairs of dark matter particles $\chi\,\overline{\chi}$. In a calorimeter behind the beam dump electrons, scattered off by dark matter particles, can be detected.

For an efficient experiment the number of produced dark photons and the probability of detecting dark matter particles has to be optimized. One topic of this talk is the optimization of the existing beam dump with a tungsten target. The quantity of high energy photons can be increased with this additional target. For the detection of the dark matter particles the performance of possible calorimeter materials (CsI(Tl), PbF_2, BGO and lead-glass) was investigated.

HK 42.3 Mi 17:00 Audimax H1

Using CAD models in Geant4 and ROOT — •Elena Hoemann, Jan Mayer, and Andreas Zilges — Institute for Nuclear Physics, University of Cologne

Monte-Carlo simulations of experiments require precise implementation of geometries. Creating these from scratch in Geant4 or ROOT is difficult, time-consuming, and error-prone. Although in nearly all cases exact CAD files exist, integration of the geometry is often done manually. Through the usage of tessellated and tetrahedral elements (solids), it is possible to include CAD figures into Geant4 [1]. To carry on we are expanding the ROOT framework by a dedicated tetrahedron class to enable the usage of CAD files as well.

We have compared the different methods in contrast to manually implemented geometries by including simple figures like spheres and boxes, as well as real setups such as the HORUS and SONIC spectrometer at the University of Cologne.

Supported by the BMBF (05P15PUEN9/ELI-NP)

[1] C.M. Poole, I. Cornelius, J.V. Trapp, C.M. Langton, Australas Phys Eng Sci Med 35 (2012) 329

HK 42.4 Mi 17:15 Audimax H1

Development of KoalaSoft for the KOALA experiment — •Yong Zhou and Huagen Xu for the PANDA-Collaboration — Institute for Nuclear Physics (IKP), Forschungszentrum Jülich, Germany

The KOALA experiment will measure antiproton-proton elastic scattering in a range of four-momentum transfer |t| from 0.0005 to 0.1 $(GeV/c)^2$ at the upcoming HESR ring of FAIR. It aims to provide key input parameters for PANDA's absolute luminosity determination. KoalaSoft is the dedicated simulation software package for the KOALA experiment. It is develped based on FairRoot. Due to the flexibility of FairRoot, KoalaSoft combines the simulation, reconstruction and analysis tasks into one framework. The full geometry of KOALA setup is realized using the ROOT geometry package. Digitization of the Recoil Detector is also finished and the results are compared directly with the test beam data. The latest results are presented in this talk.

HK 42.5 Mi 17:30 Audimax H1

ALICE HLT hardware cluster finding in Run 2 and HLS evaluations for Run 3 — •Heiko Engel for the ALICE-Collaboration — IRI, Universität Frankfurt am Main

The ALICE High Level Trigger (HLT) is a computing cluster for online reconstruction, compression and calibration of detector data. The main input and output interface of the HLT are PCI-Express based FPGA readout boards with serial optical links. The HLT uses these FPGAs for online data preprocessing of detector data already in the input FPGA. A cluster finding algorithm processes data from the Time Projection Chamber (TPC) detector on the fly. This cluster finding algorithm was extended to provide improved noise resiliance and increased data compression capabilities. In combination with software based adjustments these development raised the overall data compression ratio of the HLT from a factor of around 4 to above 7. This contribution describes the improvements of the existing ALICE HLT hardware cluster finder for Run 2 as well as cluster finder developments for the Run 3 ALICE readout evaluating High Level Synthesis (HLS/OpenCL) for data preprocessing in FPGAs.

HK 42.6 Mi 17:45 Audimax H1

Data-flow Conjugate Gradient Solver for Lattice QCD Calculations on FPGA Accelerator — •Thomas Janson and Udo Kebschull — IRI ,Goethe-Universität Frankfurt am Main, Senckenberganlage 31, 60325 Frankfurt am Main, Germany

In this talk, we discuss the Lattice QCD Conjugate Gradient solver as data-flow graph. Such a data-flow graph is described in the high-level language MaxJ from Maxeler, which is an openSPL based programming language, to deploy the algorithm on an FPGA accelerator. We show that such an implementation is power efficient and present first power measurement results. In this framework, all operators like the Dslash operator and the spinor field scalar product are deployed as data-flow kernels. Each kernel is a deep arithmetic pipeline and exposes the maximal possible parallelism, thus we reach a high arithmetic intensity. Such a kernel forms a basic block where each block is deployed as piece of hardware and a manager state machine orchestrates the data streams between. In addition, we discuss also the usage of mixed precision number representation like floating point and fixed-point, and present first numerical analysis and convergence tests.