HK 44: Instrumentation X

Time: Thursday 14:00–15:30 Location: SR Exp1B Chemie

HK 44.1 Thu 14:00 SR Exp1B Chemie

The MAGIX Trigger Veto System — •Hannah Kessler for the MAGIX-Collaboration — Institute for Nuclear Physics, Johannes Gutenberg University Mainz, Germany

The MAGIX experiment, located at the new MESA accelerator at the University of Mainz, is designed for high-precision electron scattering studies. Its scientific goals include exploring dark sector particles, investigating the structure of hadrons and few-body systems, and studying reactions relevant to nuclear astrophysics. The experimental setup features a windowless scattering chamber with an internal gas jet target, two rotatable magnetic spectrometers, and advanced detector systems at their focal planes. A central component of these detectors is the MAGIX Trigger Veto System, which comprises plastic scintillators and passive lead absorbers. The veto part of the system is essential for particle identification and the trigger layer provides accurate timing information to support the tracking detector, a time projection chamber. To enhance the veto system's performance, various readout approaches have been investigated, including the use of readout cards and individual silicon photomultipliers. Laboratory tests with a Cobalt-60 source provided valuable insights into the signal processing capabilities. Further evaluations during a beam time at the Mainz Microtron (MAMI) allowed for a detailed comparison of the different readout methods under real experimental conditions.

In this presentation, I will introduce the MAGIX Trigger Veto System, outline the readout techniques explored, and share the results of the experimental investigation.

HK 44.2 Thu 14:15 SR Exp1B Chemie

Scintillating Fiber Hodoscopes for the Proton Radius Measurement at AMBER — •Karl Eichhorn, Jan Friedrich, Igor Konorov, Martin J. Losekamm, and Stephan Paul — School of Natural Sciences, Technical University of Munich, Garching, Germany

The AMBER collaboration aims to measure the proton-charge radius using elastic muon-proton scattering at the M2 beamline at CERN's Super Proton Synchrotron. The recoil of the proton will be measured in an active hydrogen target (TPC) while the scattering angle of the muon is reconstructed using novel Unified Tracking Stations (UTS). Each UTS contains ALPIDE pixel sensors and a Scintillating Fiber Hodoscope for timing. The SFH consists of four layers of scintillating fibers read out with silicon photomultipliers and provides precise timing information for reconstructing scattered muons. We present the detector design and results from a beam test with a detector prototype from 2024.

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HK 44.3 Thu 14:30 SR Exp1B Chemie

Calibration Procedure of the START Detector for the HADES Experiment — •Henrik Flörsheimer[1], Ashish Bisht[4], Tetyana Galatyuk[1,2,3], Mladen Kis[2], Yevhen Kozymka[1], Wilhelm Krüger[1], Sergey Linev[2], Jan Michel[2], Jerzy Pietraszko[2], Christian Joachim Schmidt[2], Michael Träger[2], Michael Traxler[2], Felix Ulrich-Pur[2], and Matteo Centis Vignali[4] for the HADES-Collaboration — [1]Technische Universität Darmstadt — [2]GSI Helmholtzzentrum für Schwerionenforschung GmbH — [3]Helmholtz Forschungsakademie Hessen für FAIR — [4]Fondazione Bruno Kessler, Centre of Materials and Microsystems

HADES is a fixed-target experiment installed at SIS18 accelerator and addressing a very broad range of research topics based on studying reactions resulting from the interactions of pion, proton, and heavy ion beams with targets. A key component of particle identification is the time-of-flight measurement performed by the META detectors in combination with a reaction time detector (START). For the experiment with the proton beam, novel Low Gain Avalanche Detectors (LGAD) technology was used in HADES as a START detector. The detector consisted of two LGAD stations for high-precision start-time measurements with a precision below 100 ps and could be operated with rates of up to 10^8/s.

This talk will outline the START detector setup and the calibration steps needed to obtain the required performance. In addition, a possibility of improving the calibration procedure will be discussed.

HK 44.4 Thu 14:45 SR Exp1B Chemie

An overview of data calibration algorithms of NeuLAND in the R3B setup — •Yanzhao Wang[1], Paula Ulrich[1], Igor Gasparic[2], and Andreas Zilges[1] — [1]University of Cologne, Institute for Nuclear Physics, Germany — [2]GSI Helmholtzzentrum für Schwerionenforschung, Germany

The New Large-Area Neutron Detector NeuLAND, as part of the R^{3}B experiment at FAIR, aims at providing a high detection efficiency and spatial-temporal resolution of neutrons generated from a high-intensity radioactive beam[1]. Calibration processes of NeuLAND rely heavily on the reconstruction of local muon tracks from cosmic radiation. In this talk, we introduce the calibration algorithms that calculate the energy, time and position of particle interactions inside this detector based on the output data of TAMEX 3, a newly designed digitizer at GSI. Calibration results using the output of the cosmic radiation simulation will also be used to demonstrate the correctness of the algorithms.

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[1] K. Boretzky *et al.*, Nucl. Instrum. Methods Phys. Res. A1014 (2021) 165701

HK 44.5 Thu 15:00 SR Exp1B Chemie

Upgrade of the time readout of the Crystal Barrel detector — •Florian Taubert for the CBELSA/TAPS-Collaboration — University of Bonn

The CBELSA/TAPS experiment in Bonn conducts baryon spectroscopy utilizing linearly or circularly polarized photon beams impinging on a target, which can be polarized longitudinally or transversally. With this setup it is possible to obtain information on single and double polarization observables of photoproduction processes of single or multiple neutral mesons, e.g. $\gamma p \rightarrow p\pi^0$.

The main detector system consists of the Crystal Barrel (CB) and MiniTAPS calorimeters, combined with scintillators and scintillating fibers for charged particle detection. The Crystal Barrel is made up of 1320 CsI(Tl) crystals, which are arranged in a barrel shape around the target. Together with MiniTAPS covering the forward direction the system can cover a solid angle of almost 4π.

The readout of the CB detector consists of one energy and one timing branch. The time readout is incorporated on a VMEbus module with a Spartan6 FPGA and is done by a local VMEbus-CPU. To reduce deadtime and increase readout speed each module, 16 in total, was extended by a gigabit interface to overcome the limited transfer rate over VMEbus.

This talk presents details of the gigabit upgrade including implementation and achieved performance.

HK 44.6 Thu 15:15 SR Exp1B Chemie

Recent achievements with the FRS DAQ upgrade — •Nicolas Hubbard for the Super-FRS Experiment-Collaboration — GSI, Darmstadt, Germany

The FRS (FRagment Seperator) is a high-resolution magnetic spectrometer located at the GSI Helmhholtzzentrum fur Schwerionenforschung in Darmstadt, Germany. Using the FRS secondary beams of exotic nuclei can be produced by impinging high energy primary beams from the SIS-18 synchotron onto production targets. These secondary beams are identified with the FRS using the Brho-dE-TOF method, using a variety of particle detectors. As the desired nuclei get more and more exotic, one of the limiting factors in identification of produced particles is due to the data acquisition (DAQ), which necessarily takes some time to digitise and read-out detector signals (the so-called dead time). Recently the FRS DAQ system has been upgraded to use a new FPGA-based VME controller from Mesytec, MVLC, which enables faster detector read-out and lower latency processing, in addition to conversion time and related read-out optimizations. Last year test measurements were performed with beam to accurately measure the dead time and acquisition rate of the improved DAQ system under real conditions. This talk will discuss the results from these test measurements and the resulting improvements to the maximum acquisition rate of the FRS.