HK 69: Instrumentation XIX

Time: Thursday 16:00–17:30 Location: HK-H5

HK 69.1 Thu 16:00 HK-H5

The CALIFA trigger system — Leyla Atar[1], Tobias Jenegger[2], Roman Gernhäuser[2], •Philipp Klenze[2,3], and Lukas Ponnath[2] for the R3B-Collaboration — [1]Technische Universität Darmstadt — [2]Technische Universität München — [3]Gesellschaft für Schwerionenforschung, Darmstadt

With the recent completion of the forward region of the R^3B calorimeter, CALIFA now features 1504 channels. While previously each channel of CALIFA was operated in free-running mode, recent beamtimes have shown that this puts a huge load on the downstream processing facilities especially in experiments using high rate uranium beams.

Due to the slow signals of the calorimeter CsI(Tl) crystals special procedures have been established not to compromise efficiency. Using the White Rabbit Time Stamps (WRTS) differences of various detector systems, it is easy to verify that this is actually the case.

Additionally, we will discuss the ability of CALIFA to provide a high level trigger based on proton multiplicities or position to ancilliary detectors with limited readout capability in R^3B.

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HK 69.2 Thu 16:15 HK-H5

Magnet simulations for HISPEC position tracking detector — •Michael Armstrong and Gereon Hackenberg — University of Cologne

Future in-flight spectroscopy of radioactive heavy ion beams in HISPEC (HIgh resolution in-flight SPECtroscopy) experiments at GSI/FAIR will require highly precise beam tracking and timing [1]. For these experiments a pair of Secondary Electron Detector (SED) using Multi-Channel Plate (MCP) detectors are being designed to fulfil these requirements. In order to achieve the necessary precision the MCP's must be enveloped in a homogenous 100 gauss magnetic field. In this poster the design of a prototype permanent magnet is presented including simulations of the magnetic field it should be capable of providing.

This work was supported by GSI under F&E grant KJOLIE1820.

[1] - "Technical Report for the Design, Construction and Commissioning of the HISPEC/DESPEC Beam Line, Infrastructure and Tracking Detectors". HISPEC/DESPEC Collaboration. FAIR PAC NUSTAR. 11 May 2020.

HK 69.3 Thu 16:30 HK-H5

aTEF: Background reduction at KATRIN via an active transverse energy filter — •Kevin Gauda[1], Volker Hannen[1], Alexey Lokhov[1], Hans-Werner Ortjohann[1], Wolfram Pernice[2], Richard Salomon[1], Sonja Schneidewind[1], Maik Stappers[2], and Christian Weinheimer[1] — [1]Institut für Kernphysik, Universität Münster, Germany — [2]Physikalisches Institut, Universität Münster, Germany

The Karlsruhe Tritium Neutrino Experiment (KATRIN) aims at the direct measurement of the electron antineutrino mass with $0.2\,\mathrm{eV/c^2}$ sensitivity from precision spectroscopy of the tritium beta decay. The analysis of its first two science runs yields a new upper limit of $m_\nu < 0.8\,\mathrm{eV}$ (90 % C.L.).

Even in the shifted-analysis-plane (SAP) mode it is required to further lower the background rate to reach the target sensitivity. The background rate is dominated by electrons originating from ionisation of highly-excited (Rydberg) atoms produced by α-decays in the spectrometer walls. Thus, they cannot be distinguished from the signal electrons by energy but they possess much smaller angles w.r.t. the beam axis and, thus, much smaller cyclotron radii in the magnetic fields of KATRIN. The aTEF idea is to construct a detector by microstructuring that is mainly sensitive to the signal electrons because of their larger cyclotron radii. Investigations of first prototypes based on microstructured silicon PIN detectors are presented in this talk.

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HK 69.4 Thu 16:45 HK-H5

Influence of the fluorescence detection region on the determination of nuclear moments — •Patrick Müller[1,2], Phillip Imgram[1], Bernhard Maass[3], and Wilfried Nörtershäuser[1,2] — [1]Institut für Kernphysik, TU Darmstadt, Germany — [2]Helmholtz Forschungsakademie Hessen für FAIR, TU Darmstadt, Germany — [3]Argonne National Laboratory, Chicago, IL, USA

Collinear laser spectroscopy (CLS) is usually used at online facilities such as CERN or NSCL to determine isotope shifts as well as nuclear moments of neutron-deficient or -rich nuclei. At the COALA experiment at the Technische Universität Darmstadt, high-precision CLS is used to provide reference values of atomic transition frequencies and nuclear moments in stable isotopes required for online experiments, but also to test new measurement schemes or technical equipment. By recording fluorescence spectra of electric dipole transitions whose linewidths are of the order of the natural linewidth, small effects which shift or deform the classical Lorentzian profile become visible, such as quantum interference or photon recoils.

We report on measurements with a new lens-based fluorescence detection region (FDR) for COALA using Ca^+. Due to its well-defined positional and easy to adjust angular detection range, the FDR is particularly useful for investigating the influence of such geometric effects on fluorescence spectra and, therefore, on extracted nuclear moments.

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HK 69.5 Thu 17:00 HK-H5

Improvement of Pulse Shape Simulations for Highly Segmented HPGe Detectors — •Rouven Hirsch, Rainer Abels, Jürgen Eberth, Kai Henseler, Herbert Hess, Darius Luyken, and Peter Reiter — Institut für Kernphysik, Universität zu Köln

36-fold segmented high purity germanium detectors are the basis for the Advanced GAmma Tracking Array (AGATA). In contrast to conventional γ-ray spectrometers, AGATA utilizes the γ-ray tracking method which reconstructs the path of the γ rays through the detector array. Essential for the tracking is the determination of the γ-ray interaction positions with a sub-segment position resolution. This is obtained via pulse-shape analysis (PSA) of the 37 preamplifier signals. Simulated signal shapes are compared with the measured signals to match the interaction positions. Therefore, the final position resolution strongly depends on the quality and accuracy of the detector signal simulation. Simulated data bases of position dependent signals were generated for a cylindrical 36-fold segmented single ended coaxial HPGe detector employing the AGATA Detector Library [1] and Solid-StateDetectors.jl [2]. Systematic deviations were identified at the crystal borders and segmentation lines by comparing simulated pulse shapes and measured signals for both approaches. The impact of simulation input variables to the pulse shapes was investigated to improve the overall PSA performance. Supported by BMBF Project 05P18PKFN9 and 05P21PKFN9

[1] B. Bruyneel et al. Eur. Phys. J. A (2016) **52**: 70
[2] I. Abt et al. 2021 JINST **16** P08007

HK 69.6 Thu 17:15 HK-H5

Preparation of the hyperatom studies at $\overline{\mathrm{P}}$ANDA — Patrick Achenbach[1,2], Sebastian Bleser[1], •Michael Bölting[1], Josef Pochodzalla[1,2], Falk Schupp[1], and Marcell Steinen[1] — [1]Helmholtz Institute Mainz, 55099 Mainz — [2]Johannes Gutenberg University, 55099 Mainz

The antiproton beam of the HESR at FAIR will allow to produce various hyperon-antihyperon pairs. The dedicated target system of the $\overline{\mathrm{P}}$ANDA hyperatom setup will allow to bind negatively-charged (anti)hyperons and form heavy hyperatoms. First experiments with a ^{208}Pb target aim at studying X-ray transitions of atomically bound Ξ^-, Σ^- and possibly even $\overline{\Sigma}^-$.

The required target system needs to be integrated in the HESR beam pipe and the $\overline{\mathrm{P}}$ANDA target spectrometer. Consequently, it must not only be vacuum-tolerant but also radiation hard and compatible with the present strong magnetic field within $\overline{\mathrm{P}}$ANDA. Within this environment the required redundancy of the target setup can only be achieved by multiple primary targets exchangeable by a system of piezomotors.

In this contribution we will present the final design of the two-staged target system. First tests of the reliability and the precision of the system will be presented.

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