HK 58: Instrumentation XIV

Time: Thursday 14:00–15:30 Location: HK-H3

HK 58.1 Thu 14:00 HK-H3

First steps towards the development of a spatially resolving detector for ultra-cold neutrons — •Konrad Franz for the tauSPECT-Collaboration — Department of Chemistry, Johannes Gutenberg University Mainz

One of the challenges in neutron detection is to convert the electrically inert neutron into an electrical signal. In the presented detector design this is achieved by employing a conversion layer stacked with a scintillation layer, in which the neutron induced α-particle generates a light pulse. This scintillation light is then guided onto an array of silicon photomultipliers (SiPM). Spatial resolution can be achieved by reading out every SiPM individually. A main advantage of this setup is its compatibility with high magnetic fields, which allows for in-situ detection of ultra-cold neutrons (UCN) in such environments. Combining spatial resolution with a magnetic field gradient UCN energy determination is possible.

The talk will give an overview of the proposed detector design and its advantages will be outlined. Furthermore, the first steps of the development will be presented and the main challenges moving forward will be discussed.

HK 58.2 Thu 14:15 HK-H3

The powering scheme of the CBM Silicon Tracking System — •Anton Lymanets[1], Oleksandr Kshyvanskyi[2], and Maksym Teklishyn[1,2] for the CBM-Collaboration — [1]GSI Helmholtzzentrum für Schwerionenforschung GmbH — [2]Kiev Institute for Nuclear Research, Ukraine

The Silicon Tracking System (STS) is the principal tracking detector of the future CBM experiment at FAIR. It will perform charged-particle track measurement with momentum resolution better than 2% in a 1 Tm dipole-magnetic field. A main challenge for the STS is to maintain high track reconstruction efficiency throughout the projected lifetime of the experiment which means being exposed to an accumulated fluence of up to 10^{14} n_{eq}/cm^2, expected to be reached in beam-target interaction rates of 10 MHz. Therefore, front-end electronics with self-triggering architecture needs to have sufficient signal-to-noise ratio (S/N>10) which requires an ultra-low noise system design.

The STS will consist of eight tracking stations comprising 876 double-sided silicon detector modules with a total of 1.8 million readout channels. Operation of the system requires a detailed understanding of the electrical scheme at different hierarchical levels, including: low and high voltage systems, copper data lines from the front-end electronics to the read-out and data combiner boards, signal path, as well as grounding and shielding concepts. The performance parameter of the system is equivalent noise charge (ENC) value measured by the front-end electronics. The electrical scheme of the system as well as its experimental validation in the laboratory and beam will be presented.

HK 58.3 Thu 14:30 HK-H3

Mechanical and thermal studies of various components of the Silicon Track- ing System — •Shaifali Mehta for the CBM-Collaboration — Eberhard Karls Universität Tübingen(UT-PIT)

The Silicon Tracking System (STS) located in the aperture of the dipole magnet is designed to perform the charged particle tracking to achieve a momentum resolution better then 2 micro strip sensors, distributed on 8 tracking stations. The stations are made from mechanical half units onto which 106 ultra-light carbon fibre support structures, referred as ladders, are mounted which hold the modules. During the assembly of modules, different glues are used at various steps of the assembly and it is very important to test for the thermal and mechanical properties of the glue. Once the modules are prepared, they are transferred to the ladder using a standard procedure. A well defined technique has been developed to mount the modules on a ladder to achieve the precision in order of 100 μm. Two full ladders and one half ladder has been assembled so far within the required mounting precision. The results from the thermal cycling of the different glues used in module assembly and the concept of mounting the modules onto the ladder for the STS within the defined mechanical precision will be presented in this talk.

HK 58.4 Thu 14:45 HK-H3

Lifetime and Performance of the very latest Microchannel-Plate Photomultipliers — •Daniel Miehling, Merlin Böhm, Katja Gumbert, Steffen Krauss, and Albert Lehmann for the PANDA-Collaboration — Physikalisches Institut, Universität Erlangen-Nürnberg

Two DIRC detectors will be used for particle identification and in particular pion/kaon separation at the PANDA experiment at FAIR. The focal planes of both DIRCs will reside in a magnetic field of up to 2 Tesla. This and other constraints leave the usage of Microchannel-Plate Photomultipliers (MCP-PMTs) as the only option. A few years ago the most limiting parameter was the lifetime of the MCP-PMTs. During operation feedback ions produced in the residual gas and during electron multiplication at the MCP walls are accelerated towards the photo cathode and may damage it. This leads to a sizable quantum efficiency (QE) drop with increasing integrated anode charge. Coating the MCPs by applying an atomic-layer deposition technique (ALD) increased the lifetime drastically. Another important parameter is the detective quantum efficiency (DQE) which is the product of the QE and the difficult to measure collection efficiency (CE). This should also be as high as possible to detect as many Cherenkov photons as possible. Recently tubes with CE values of close to 100% are available. In this talk the results of these performance parameters will be presented and discussed along with an overview of the general performance of the very latest ALD-coated 2x2 inch^2 MCP-PMTs with 8x8 anode pixels from Photek and PHOTONIS. - Funded by BMBF and GSI -

HK 58.5 Thu 15:00 HK-H3

Low Gain Avalanche Diode based T0 Detector in HADES — •Wilhelm Krüger[1], Tetyana Galatyuk[1,2], Vadym Kedych[1], Sergey Linev[2], Jan Michel[3], Jerzy Pietraszko[2], Adrian Rost[1,4], Michael Träger[2], Michael Traxler[2], and Christian Joachim Schmidt[2] — [1]TU Darmstadt, Germany — [2]GSI GmbH, Darmstadt, Germany — [3]Goethe-Universität Frankfurt, Germany — [4]FAIR GmbH, Darmstadt, Germany

HADES at SIS18, GSI (Darmstadt, Germany), is going to use a Low Gain Avalanche Diode (LGAD) based reaction time (T0) detector in the upcoming high rate (10^8 p/s) pp experiment in February 2022. For the HADES physics program a T0 determination better than $\sigma_{T0} < 70$ ps is necessary, in order to ensure a precise particle identification using time of flight information. In addition, the T0 detector will be used for beam monitoring, which requires a position resolution better than 5 mm. As the detector will be placed in-beam, a high radiation hardness is also required. The recently emerged LGAD technology is a suitable candidate to fulfill all the above listed requirements.

In this contribution the performance of HADES T0-LGADs in a beam test at COSY in Jülich in November 2021 will be presented. The LGADs were tested w.r.t. their timing precision and efficiency, employing different front end electronics. The preliminary performance of the T0 detector during the beam time in February 2022 will be presented as well.

HK 58.6 Thu 15:15 HK-H3

HADES Driftchambers Electronics Upgrade: Power Supply — •Ole J. Artz for the HADES-Collaboration — Goethe-Universität Frankfurt

The readout electronics of the drift chamber tracking system of HADES will be upgraded in the comming year to allow for handling higher trigger rates in future experiments at SIS18 and SIS100. The upgrade is also aiming at an improved robustness w.r.t. electronic noise and the ability to resolve multiple hits in drift cells.

An important part of this activity is improving the power scheme both w.r.t. load and noise immunity. Due to the sensitivity of the detector, switching voltage regulators can not be installed on the front-end electronics, but need to be placed further away. These regulators will be remotely controllable using an Ethernet-capable micro-controller.

As a side-project, the same controller will be employed for flexible read-out of various sensors for the detectors' gas system.

This work has been supported by BMBF(05P19RFFCA), Cremlin-PLUS, GSI and HIC for FAIR.