HK 55: Instrumentation XIV

Time: Thursday 14:00–15:30 Location: SCH/A251

Group Report HK 55.1 Thu 14:00 SCH/A251

Different applications of Low Gain Avalanche Detectors — •Felix Ulrich-Pur[1], Tetyana Galatyuk[1,2], Wilhelm Krüger[2], Sergey Linev[1], Jan Michel[3], Jerzy Pietraszko[1], Adrian Rost[4], Michael Traeger[1], Michael Traxler[1], and Christian Joachim Schmidt[1] — [1]GSI GmbH, Darmstadt, Germany — [2]Technische Universität Darmstadt, Darmstadt, Germany — [3]Goethe-Universität, Frankfurt, Germany — [4]FAIR GmbH, Darmstadt, Germany

Low Gain Avalanche Detectors (LGADs) are fast silicon detectors especially designed for high-rate environments. Due to their high spatial granularity ($\leq 100\mu$m) and excellent intrinsic time resolution ($\leq$ 100ps), LGADs allow the reconstruction of single particle tracks even at very high track densities.
Within this contribution, we will present several applications of LGAD strip sensors, which were produced at Fondazione Bruno Kessler (FBK). This includes the reaction time (T0) detector for the High Acceptance Di-Electron Spectrometer (HADES) at GSI in Darmstadt, Germany, a beam-structure monitor for the Superconducting Darmstadt LINear Accelerator (S-DLINAC) at the Technische Universität Darmstadt and an ion imaging experiment conducted at the MedAustron cancer therapy and research centre in Wiener Neustadt, Austria. After discussing first results, we will outline planned upgrades of the current systems and possible future projects at the GSI and FAIR facilities.

HK 55.2 Thu 14:30 SCH/A251

LGAD based Start Detector in HADES — Tetyana Galatyuk[1,2], Vadym Kedych[1], •Wilhelm Krüger[1], Sergey Linev[2], Jan Michel[3], Jerzy Pietraszko[2], Adrian Rost[4], Christian Joachim Schmidt[2], Michael Träger[2], Michael Traxler[2], and Felix Ulrich-Pur[2] — [1]Technische Universität Darmstadt — [2]GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt — [3]Goethe Universität Frankfurt — [4]FAIR GmbH

The High Acceptance Di-Electron Spectrometer (HADES) experiment has designed and used a Low Gain Avalanche Detector (LGAD) based in-beam detector for its high rate 4.5 GeV pp production beam time in February 2022. As LGADs offer high-precision timing measurements with high spatial granularity and high radiation hardness, they were the sensors of choice for the in-beam detector.
The detector consisted of two FBK LGADs with a form factor of 2 x 2 cm^2 and 96 half-strips each. It was used for beam monitoring purposes during the beam time and will assist in particle identification by providing a precise reaction time (T0).
This contribution will present the calibration procedure of the detector as well as its performance with respect to the reached timing precision.

HK 55.3 Thu 14:45 SCH/A251

Beam monitoring and T0 system for the CBM experiment at FAIR — •Adrian Rost for the CBM-Collaboration — Facility for Antiproton and Ion Research in Europe GmbH, Darmstadt, Germany

A beam detector system for the CBM experiment at the FAIR accelerator complex has been developed. The system will be used for T0 measurements with a precision in the order of 50 ps and for beam monitoring purposes i.e. beam halo particle measurements. The concept has been prepared and will consist of two detector stations, one used for beam monitoring and the second for the T0 measurement. Both detector stations are planned to utilize poly-crystal CVD diamond technology. But also new technologies like the Low Gain Avalanche Detectors (LGADs) are under investigation in collaboration with the HADES experiment at GSI. The sensors will be mounted on dedicated printed circuit boards, equipped with amplifier and shaping circuits. The detector stations are located in standard vacuum elements which are integrated into the CBM beamline. Two pcCVD diamond based prototype sensors have been prepared for tests at the mCBM experiment at the SIS18 accelerator. The read-out system will utilize the PADI discriminator and the GET4 TDC ASICs. In this contribution the BMON concept and the current status of the project will be presented.

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HK 55.4 Thu 15:00 SCH/A251

Studies of the Unified Tracking Station for the Proton Radius Measurement in High-Energy Elastic Muon-Proton Scattering at AMBER* — •Christian Dreisbach, Karl Eichhorn, Jan Friedrich, Igor Konorov, Martin Losekamm, Stephan Paul, and Thomas Pöschl for the AMBER-Collaboration — Technische Universität München, Physik-Department E18, Garching, Germany

The proton radius can be determined by measuring the slope of the electric form factor G_E at small squared four-momentum transfer Q^2. Numerous elastic scattering and laser spectroscopy measurements of the proton radius have been performed with contradicting results – the so-called proton radius puzzle. We propose to measure the proton radius in high-energy elastic muon-proton scattering at the M2 beam line of CERN's Super Proton Synchrotron in the year 2023. A high-precision measurement at low Q^2 realized with a high-pressure hydrogen TPC can contribute to a solution of the puzzle, especially in view of the systematics of this approach compared to electron scattering. In addition to the precise measurement of the recoil proton provided by the TPC, novel unified tracking stations (UTS) are foreseen for an accurate measurement of the muon trajectory. Scintillating Fiber Hodoscopes joint with monolithic silicon-pixel detectors will be combined in this UTS. A first prototype was built and a beam test was performed in 2022. We present ongoing studies and results on the tracking capability of the UTS.

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HK 55.5 Thu 15:15 SCH/A251

Scintillating Fiber Hodoscopes for the Proton Radius Measurement at AMBER — Christian Dreisbach, •Karl Eichhorn, Jan Friedrich, Igor Konorov, Martin Losekamm, Stephan Paul, and Thomas Poeschl for the AMBER-Collaboration — Technische Universität München, Physik-Department, Garching, Germany

The AMBER collaboration aims to measure the proton charge radius in an elastic scattering experiment using high energy muons provided by the M2 secondary beamline at CERN's Super Proton Synchrotron using an active hydrogen target. For muon tracking, novel Unified Tracking Stations equipped with monolithic active pixel silicon detectors in combination with a Scintillating Fiber Hodoscope (SFH) will be used. The SFH consists of 500 μm thin scintillating plastic fibers read out with SiPMs, covering an active area of (9x9) cm^2. We present ongoing studies and results from a test beam experiment performed in 2022 with a detector prototype.
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