HK 61: Instrumentation XIV

Time: Thursday 15:45–17:15 Location: HBR 14: HS 1

Group Report HK 61.1 Thu 15:45 HBR 14: HS 1

LGAD Applications in High Energy, Accelerator and Medical Physics — •Wilhelm Krüger[1], Thomas Bergauer[2], Tetyana Galatyuk[1,3,4], Albert Hirtl[5], Vadym Kedych[1], Yevhen Kozymka[1], Sergey Linev[3], Jan Michel[3], Jerzy Pietraszko[3], Adrian Rost[6], Christian Joachim Schmidt[3], Michael Träger[3], Michael Traxler[3], and Felix Ulrich-Pur[3] — [1]Technische Universität Darmstadt — [2]Austrian Academy of Sciences, Institute of High Energy Physics — [3]GSI Helmholtzzentrum für Schwerionenforschung GmbH — [4]Helmholtz Forschungsakademie Hessen für FAIR — [5]TU Wien, Atominstitut — [6]FAIR Facility for Antiproton and Ion Research in Europe GmbH

Their outstanding timining capabilities, in combination with a high rate capability and high radiation hardness, makes Low Gain Avalanche Diodes (LGADs) excellent candidates for various applications in different fields.

These applications include the in-beam detector for beam monitoring and reaction time reconstruction in high intensity, 4.5 GeV proton beams at HADES, resolving the bunch time-structure at the S-DALINAC for operation in energy recovery mode, and the development of a time-of-flight-based ion computed tomography demonstrator system aimed at improving the treatment planning quality for ion beam therapy in the future.

This group report will present the LGAD calibration procedures, the acquired timing precisions and reached performance of the mentioned applications.

HK 61.2 Thu 16:15 HBR 14: HS 1

Diamond based beam monitoring and T0 systems for the CBM and HADES experiments — •Adrian Rost[1], Tetyana Galatyuk[1,2,3], Vadym Kedych[1], Mladen Kis[1], Yevhen Kozymka[1], Wilhelm Krüger[1], Jerzy Pietraszko[2], and Felix Ulrich-Pur[2] — [1]TU Darmstadt, Darmstadt, Germany — [2]GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany — [3]Helmholtz Forschungsakademie Hessen für FAIR

Experiments with high-intensity heavy ion beams require fast and radiation-hard beam detection systems. For these purposes, chemical vapor deposition (CVD) diamond sensors are widely used. Its radiation hardness and excellent timing characteristics make the diamond material an almost ideal choice for in-beam applications.

A beam detector system (BMON) based on poly-crystal CVD diamond technology has been developed for the CBM experiment at the FAIR accelerator complex. The system will be used for T0 measurements with a time precision of 50 ps and for beam monitoring purposes.

For the upcoming HADES beamtimes at the SIS18 accelerator, a T0 and veto system has been developed and installed, which is based on pcCVD diamond sensors.

This contribution will present the CBM BMON concept and the current status of the project. Furthermore, the HADES T0 and veto system will be introduced, and first insights into its performance will be shown.

HK 61.3 Thu 16:30 HBR 14: HS 1

A beam position detector for the Mainz Microtron MAMI — •Jannik Petersen — Institut für Kernphysik Mainz

The topic of this contribution is the development and construction of a beam position detector designed for MAMI, which can also be used at other accelerator facilities. In contrast to conventional beam telescopes, the detector is to be placed in the beam pipe and can be moved perpendicular to the beam. This makes it possible to measure the beam invasively only when necessary. The aim is to realize a compact and cost-efficient detector in a manageable development time, which determines the position of the beam with a precision of $< 50\,\mu$m in the coordinate system of a respective experiment. Therefore, where possible, it is based on adapted standard components as well as parts and techniques developed for other experiments. The PANDA luminosity detector and the Mu3e experiment have a major influence here. At the heart of the detector are three layers of silicon pixel sensors (HV-MAPS), which can be thinned down to $50\,\mu$m. The concepts and status of cooling, mechanical implementation, and sensor readout will be presented.

HK 61.4 Thu 16:45 HBR 14: HS 1

LISA: LIfe-time measurements with Solid Active targets — •Elisa Maria Gandolfo — GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany

Understanding the nuclear structure and the emergence of collectivity in nuclei is a major open quest in nuclear physics. The collectivity of a nucleus can be evaluated through electromagnetic transition probabilities which can be experimentally accessed through lifetimes of excited states. The latter can be measured in in-beam γ-ray spectroscopy experiments using Doppler-shift techniques. LISA (LIfetime measurement with Solid Active targets) proposes a new approach to measure excited states lifetimes. The main novelty lies in the usage of a multi-layered active target made of single-crystal diamond detectors. Here, each layer serves simultaneously as reaction target and detector. The excellent energy resolution of diamond detectors allows for layer-by-layer Z identification and vertex reconstruction enabling precise Doppler correction despite using thick targets. A first two-layer prototype of LISA has been constructed and its performances has been evaluated with source measurements and in-beam tests at the GSI and HIMAC facilities with beams of ^{238}U and ^{132}Xe. The goal of these tests was to characterize the energy resolution, the influence of the metalization on the performance, the unique Z identification as well as its capabilities as active target. In this contribution, I will present the current status of the project, first results of the experiments, and an outlook to future developments. This project is funded by the European Research Council under ERC-CoG LISA-101001561).

HK 61.5 Thu 17:00 HBR 14: HS 1

Effects of heavy ions irradiation on polycrystalline diamond detectors — •Matteo Alfonsi, Chiara Nociforo, Mladen Kiš, Michael Träger, Joshua Galvis Tarquino, Tobias Blatz, Christos Karagiannis, Martin Winkler, and Haik Simon — GSI Helmholtzzentrum für Schwerionenforschung GmbH Planckstraße 1, 64291 Darmstadt, Germany

The Super Fragment Separator at the FAIR accelerator complex will adopt Chemical Vapor Deposition diamond detectors as radiation-hard, high rate counters. They must monitor and optimize the beam transmission for ions rates up to 10^7 ions/spill, and calibrate the other beam diagnostics devices in duty at higher beam intensities. The target vacuum chamber hosts a 7×7 mm^2 single crystal diamond and a 25×25 mm^2 polycrystalline diamond: they are required to detect crossing particles with high efficiency ($> 98\%$) in case of heavy species (Ar to U), and to survive several years accumulating, due to the target proximity, a dose of few MGy per year. Laboratory measurements and beam test campaigns were arranged in the past years for the validation of the proposed sensors, in particular for the polycrystalline technology. Here we report the outcome of the irradiation of a sensor based on a 20×20 mm^2 polycrystalline diamond produced by Element Six, with high intensity 1 GeV/nucleon Pb and U beams at GSI (Darmstadt). The detector signal shape characteristics and the ion counting efficiency have been monitored by interleaving periods of low ions rates in which we evaluate possible damages or performance degradation, during and after a total bombardment of almost 10^{12} heavy ions.