T 68: Detector Systems 2

Time: Wednesday 16:15–18:15 Location: T-H27

T 68.1 Wed 16:15 T-H27

Design and construction of a neutron imaging detector based on a neutron sensitive MCP on Timepix3 ASICs — •Saime Gürbüz[1], Markus Gruber[1], Jochen Kaminski[1], Markus Köhli[2], Michael Lupberger[1], Divya Pal[1], Laura Rodríguez Gómez[1], and Klaus Desch[1] — [1]Physikalisches Institut, Rheinsiche Friedrich-Wilhlems-Universität Bonn, Bonn — [2]Physikalisches Institut, Ruprecht-Karls-Universität Heidelberg, Heidelberg

The non-invasive method of neutron imaging has applications from medicine to engineering. With its unique capabilities, we can image elements that can not be distinguished via X-rays.

At the University of Bonn, we have been developing neutron detectors with different configurations and specifications. One of the neutron imaging detectors that has been studied is based on neutron sensitive Microchannel plate (nMCP) in combination with a Timepix3 ASIC. Previous studies show that neutron sensitive ^{10}B and Gd enriched MCPs have up to 10 μm spatial resolution and neutron detection efficiency of up to 70%. The readout will be achieved using four Timepix3 ASICs with 55 μm pixels covering (28 x 28) mm^2 active area. The readout has a timing resolution of up to 1.5 ns.

By combining the efficiency of the MCP with the good time and spatial resolution of Timepix3, we aim to achieve excellent instrument performance in both domains. Such a detector can be used for many neutron imaging applications such as neutron tomography or time-of-flight imaging. In this talk, the current status as well as the principles of the detector will be presented.

T 68.2 Wed 16:30 T-H27

Wavelength-shifter coated polystyrene as a low-cost plastic scintillator detector — Alessia Brignoli[1], Andrew Conaboy[1], •Doramas Jimeno[1,2], Heiko Lacker[1], Christian Scharf[1], and Jakob Schmidt[1] — [1]Humboldt-Universität zu Berlin, Berlin, Germany — [2]Universitat de Barcelona, Barcelona, Spain

Plastic scintillator detectors are widely used in particle physics for detecting charged particles crossing the scintillating material, converting the excitation energy into fluorescence radiation. We studied the light yield of pure polystyrene plates uncoated, and coated with a wavelength-shifting dye, coupled to a photomultiplier, using beta particles from a Sr-90 source. The results with the coated polystyrene plate show around four times higher photoelectron yield compared to the uncoated plate. To estimate the fraction of Cherenkov radiation, we compared it to the light yield of an uncoated and a coated plate of a non-scintillating material (PMMA). These results motivate future studies for the development of easy-to-build, low-cost, polystyrene-based plastic scintillator detectors.

T 68.3 Wed 16:45 T-H27

Simulation of the Beam Conditions Monitor for the upgrade of the LHCb experiment — Johannes Albrecht, Elena Dall'Occo, and •David Rolf — Experimentelle Physik 5, TU Dortmund

The LHCb experiment is currently undergoing a major upgrade, preparing for the next period of data taking (Run 3) starting in 2022. The instantaneous luminosity in Run 3 will increase by a factor of five with respect to the previous runs. To ensure a safe operation of the experiment, simulation studies are performed for the Beam Conditions Monitor (BCM), responsible of protecting the LHCb detector against possible damage from the beam. Should an adverse beam scenario occur, the BCM will request a beam dump, thus preventing the beam from damaging the detector.

In this talk the impact of the changed beam conditions and configurations of the LHCb subdetectors on the BCM settings is evaluated, by studying the BCM response under both nominal and failing beam scenarios. Under nominal conditions the currents of the diamond sensors of the BCM detector are simulated and new settings for the beam dump logic are determined.

The effectiveness of the new proposed BCM settings are then investigated in critical beam scenarios. Simulations are performed under a beam scraping scenario to ensure the BCM will dump the beam before the beam drifts too far from its nominal position and starts to damage the sensitive detector parts.

T 68.4 Wed 17:00 T-H27

Development of a real-time track reconstruction for the proposed LumiTracker detector — Johannes Albrecht, Lukas Calefice, Elena Dall'Occo, •Lukas Rolf, and Holger Stevens — Experimentelle Physik 5, TU Dortmund

Measuring the luminosity is a vital task performed at the LHCb experiment. The luminosity is used as feedback for the LHC and as input for many analyses. The main goal of the proposed LumiTracker detector is to provide a measurement of luminosity by operating independently from the rest of the LHCb experiment. The LumiTracker measures luminosity by reconstructing and counting tracks and to provide an online measurement of luminosity per bunch every few seconds, the reconstruction needs to be performed in real-time. This contribution will present the current status of the pattern recognition and track fitting algorithms developed. The overall performance of the track reconstruction will be compared between a CPU and a GPU implementation, with the latter bringing the advantage of greater parallelism.

T 68.5 Wed 17:15 T-H27

Commissioning of the SND@LHC detector — •Andrew Picot Conaboy — Humboldt-Universität zu Berlin, Berlin, Deutschland

The Scattering and Neutrino Detector at the LHC (SND@LHC) is a compact experiment installed 480 m from the ATLAS interaction point. SND@LHC allows for a novel investigation of all three neutrino flavours in the pseudo-rapidity range $7.2 < \eta < 8.6$, with energies from 100 GeV to the TeV scale. Crucial for the reconstruction of neutrino charged current events, is the identification of the outgoing lepton: SND@LHC will reconstruct muons using iron blocks interleaved with planes of plastic scintillators coupled to silicon-photomultipliers. This technology will also be used to perform hadronic calorimetry. In the CERN north area, the muon system was installed for pion and muon test beams of energies in the 100 GeV to 300 GeV range. Presented in this contribution is the current status of muon system analyses from CERN test beams.

T 68.6 Wed 17:30 T-H27

Commissioning and Results of a Scintillator Based Beam Abort and Machine Protection System at SuperKEKB — •Ivan Popov, Hendrik Windel, and Frank Simon for the Belle II-Collaboration — Max-Planck-Institut für Physik, München, Deutschland

The asymmetric-energy collider SuperKEKB started its physics operation in March 2019. The usage of the nano-beam scheme enables collisions of electrons and positrons at record-breaking luminosities, but requires continuous particle injections at a rate of 50 Hz. These injections result in periods of high backgrounds, which can negatively affect the operation of Belle II subdetectors. In order to monitor and mitigate such backgrounds, the CLAWS detector system, consisting of scintillator tiles read out by silicon photomultipliers, has been in operation in various forms since 2016. Beginning with the first physics run in 2019, 32 sensors have been distributed along the final focusing magnets. Over the course of SuperKEKB's run time in 2020 they have proven to reliably observe disturbances in the particle beam which can result in catastrophically high backgrounds and quenches of the final focusing magnets. An electronics upgrade together with the implementation of a smart trigger logic enables the generation of a beam abort trigger within 200 ns after the occurrence of excessive background, thus ensuring the safe operation of the experiment. The CLAWS have been operating as a beam abort system since May 2021. In this report, the commissioning of the system and results achieved are discussed, and an outlook on plans for its further expansion is given.

T 68.7 Wed 17:45 T-H27

Detector system and simulation of the 155 MeV Hydro-Møller polarimeter at MESA — •Michail Kravchenko for the P2-Collaboration — PRISMA+ Cluster of Excellence and Institute of Nuclear Physics, Johannes Gutenberg University Mainz

The Mainz Energy-recovering Superconducting Accelerator (MESA) is an electron accelerator, which is currently under construction at the Johannes Gutenberg University Mainz. One aim for the MESA is the precise measurement of the weak mixing angle $sin^2\theta_w$, an important parameter of the Standard Model, with a relative uncertainty of 0.14%. The measurement will be performed by the P2 experiment by measuring the parity-violating asymmetry in elastic electron-proton scattering at low momentum transfer Q^2. MESA will provide a 150 μA beam of alternatingly polarized 150 MeV electrons with excellent beam stability. In order to achieve the goal of the P2 experiment, the beam polarization must be measured online with a very low systematic error ($< 0.5\%$ relative). The 155 MeV Møller polarimeter using a polarized atomic hydrogen target, known as the Hydro-Møller polarimeter, as proposed by V. Luppov and E. Chudakov opens the opportunity for achieving these requirements. The current design of the detector system for the Hydro-Møller polarimeter and the results of the simulation with Geant4 are presented.

T 68.8 Wed 18:00 T-H27

Fast neutron and gamma tomography with a stilbene-based multi-pixel detector — •Nina Höflich and Oliver Pooth — RWTH Aachen University - Physics Institute III B, Aachen, Germany

The neutron detectors group at the Physics Institute III B, RWTH Aachen University, develops a multi-pixel detector for a compact fast neutron imaging setup. Since the interactions of fast neutrons in matter differ from those of X-rays and gamma rays, imaging with fast neutrons in addition to X- or gamma ray imaging can provide complementary information about the object of interest.
Our current detector prototype uses cuboids of the organic scintillator stilbene as active material, coupled to a SiPM array. The pixel size is 6×6 mm^2. The usage of stilbene allows to distinguish neutron- and gamma-induced signals in the detector.
An Americium-Beryllium neutron source delivers fast neutrons of up to 11 MeV as well as gamma rays of 4.44 MeV for our measurements.
The talk will focus on recent results from tomographic test measurements of simple objects. Strategies for image reconstruction and image processing will be presented. Additionally, possible improvements will be discussed, based on Geant4 simulation results.