T 126: Gas-Detecors, Detector Systems

Time: Thursday 15:50–17:20 Location: WIL/A120

T 126.1 Thu 15:50 WIL/A120

Measurement Analysis of Micromegas detectors — •Eshita Kumar, Otmar Biebel, Valerio D'Amico, Florian Egli, Stefanie Götz, Ralf Hertenberger, Christoph Jagfeld, Katrin Penski, Maximilian Rinnagel, Nick Schneider, Chrysostomos Valderanis, and Fabian Vogel — LMU München

MICRO MEsh GAseous Structure (Micromegas) detectors are micro patterned gaseous detectors that have high rate capability due to the fast evacuation of positive ions and excellent spatial resolution due to a small scale readout strip pitch. These detectors are used for the track reconstruction of ionizing particles. To test the performance and resilience of such detectors under high background, multiple detectors are irradiated by a 10 GBq Americium-Beryllium neutron source: measurements with different shielding materials of varying thicknesses placed in front of the source are used to disentangle the detector response for gamma and neutron radiation. A Geant4 simulation to determine the interaction probability from the background radiation is carried out. Comparison of the analysis of the detector output to the simulation results for the final charge obtained from the gammas and the neutrons will be shown.

T 126.2 Thu 16:05 WIL/A120

Development of a Segmented GEM Readout (SGR) Detector — •Christoph Jagfeld, Otmar Biebel, Valerio D'Amico, Stefanie Götz, Ralf Hertenberger, Katrin Penski, Maximilian Rinnagel, Chrysostomos Valderanis, and Fabian Vogel — LMU, München

In Micromegas detectors the primary charges are amplified by electron avalanches between a planar anode and a mesh in 120 μm distance. For resistive Micromegas detectors the signal is read out via readout strips below the anode. A 2D position is reconstructed using two perpendicular readout strip layers below the resistive anode structure.
Using a standard 2D resistive Micromegas readout structure, a unique 2D particle position reconstruction is possible if the detector is hit by one particle at the same time. Ambiguities occur if multiple particles arrive at the same time. A unique X-Y assignment is not possible.
This issue can be solved by replacing the mesh with a GEM foil, which is segmented into 0.5 mm wide strips on both sides. The GEM strips must be turned by 45° with respect to the Micromegas readout strips. Thus the detector has four readout strip directions (X, Y, U, V).
A prototype of such a Segmented GEM Readout detector is built with GEM strips and readout strips perpendicular to each other. Test beam measurements with this detector were performed using 120 GeV muons. The GEM and Micromegas strips show a similar pulse height. For perpendicular incident particles a position reconstruction efficiency better than 90% is reached on both the GEM - and the readout strips. A resolution better than 80 μm for the GEM and readout strips is achieved.

T 126.3 Thu 16:20 WIL/A120

Efficiency and time resolution of a large-size WOM-SiPM-based liquid-scintillator detector — •Alessia Brignoli for the SHiP-SBT-Collaboration — Humboldt Universität zu Berlin

Within the BMBF-funded generic R&D consortium High-D, a multi-cell large area liquid-scintillator detector, where each cell is equipped with two wavelength-shifting optical modules (WOMs) viewed by a ring-array of silicon photomultipliers (SiPMs) is being developed. The aim is to reconstruct particles crossing the detector using the time and light-yield response. Such a detector type has been proposed for the Surround Background Tagger for the SHiP experiment proposal at the CERN SPS. In a first step, we are studying the characteristics of a one-cell detector using data taken during a testbeam campaign in October 2022 with a positron beam at the DESY testbeam facility in Hamburg. We will present results on the detector cell efficiency as well as on the time resolution of the detector as function of particle beam position at the detector cell.

We acknowledge the support from BMBF via the High-D consortium.

T 126.4 Thu 16:35 WIL/A120

Readout of Wavelength-shifting Optical Modules — •Johannes Alt for the SHiP-SBT-Collaboration — Albert-Ludwigs-Universität Freiburg

Wavelength-shifting optical modules (WOMs) are a low-cost way to capture the scintillation light produced in a liquid scintillator volume. These WOM tubes connected to Silicon Photomultipliers are proposed to be used in the large-area Surrounding Background Tagger (SBT) of the proposed general-purpose Search for Hidden Particles (SHiP) experiment. In this talk, the current status of the research and development on the WOM readout will be presented. This work is funded by BMBF.

T 126.5 Thu 16:50 WIL/A120

Photon exit angles of Wavelength-Shifting Optical Modules for the SHiP-SBT — •Florian Rehbein for the SHiP-SBT-Collaboration — RWTH Aachen University

This contribution will present simulations of the photon exit angle distributions of a Wavelength-Shifting Optical Module (WOM) for the SHiP experiment. These simulations are compared to first measurements taken with a DSLR camera on a laboratory test stand.

WOMs present a novel optical sensor for numerous applications, combining a well-designed light guide with a wavelength-shifting coating. They will be used as an integral part of the Surrounding Background Tagger (SBT) in SHiP (Search for Hidden Particles), a proposed general-purpose fixed target experiment at the SPS accelerator of the CERN facility. The SBT acts as a discriminator against external particle interactions and is composed of many cells utilizing liquid scintillator and tube-shaped WOMs made of PMMA to detect traversing particles. The coating of the WOMs absorbs the scintillation photons and re-emits wavelength-shifted photons, which are then detected by an array of SiPMs coupled to one end of the WOM.

T 126.6 Thu 17:05 WIL/A120

Reflective Coating for the SHiP Surround Background Tagger — •Patrick Deucher for the SHiP-SBT-Collaboration — Johannes Gutenberg Universität Mainz

The Surrounding Background Tagger (SBT) is a liquid scintillator-based detector in the SHiP Experiment. Divided into segments and embedded into the Corten steel structure of the Hidden Sector decay vessel, the SBT's main task will be the discrimination against beam-induced backgrounds. The efficiency of such a detector type can be increased by optimizing the light detection equipment, lowering the attennuation length of the scintillator (purification and addition of different fluorophores) and increasing the reflectivity of the inner detector walls. Following results of Photon Transport Simulations the application of a diffuse and highly reflective Bariumsulfate-based (OPRC by Berghof*Fluoroplastic*Technology*GmbH) coating to the inner detector walls is studied. After extensive reflectivity-, stability- and compatibility tests the reflective coating was applied to the SBT test cell for the test beam 2022 at the DESY facilities. This talk will discuss results of a first large scale application of the reflective coating in a liquid-scintillator detector cell.