T 150: Gas-Detecors, Pixel/TANGERINE

Time: Thursday 17:30–19:00 Location: WIL/A120

T 150.1 Thu 17:30 WIL/A120

Cosmic test stand gas studies with a small-strip Thin Gap Chamber quadruplet — •Ksenia Solovieva, Jose Antonio Fernandez Pretel, Patrick Scholer, Vladislavs Plesanovs, and Ulrich Landgraf — Albert-Ludwigs University, Freiburg

The small-strip Thin Gap Chamber (sTGC) technology has been implemented in the New Small Wheel upgrade of ATLAS for improved triggering and tracking in a higher particle rate environment. For the purpose of investigating readout, trigger and gas parameters, a quadruplet was set up in a cosmic muon test stand in Freiburg and read out with the final ATLAS NSW readout system and the final gas mixture. With the unique opportunity of this setup to study analog signals before digitisation and to closely monitor various properties of the gas and HV, it lends itself to studies of the properties of the sTGC gas mixture. This presentation discusses the goals and challenges of the dedicated setup, as well as presenting the results of investigations into the behaviour of signals with varying gas mixtures. Some technical details of the mixing procedure to obtain the gas mixture (45:55 n-pentane: CO2) will be included as part of the results.

T 150.2 Thu 17:45 WIL/A120

Test of ATLAS Micromegas detectors with a ternary gas mixture at the CERN GIF++ facility — •Fabian Vogel, Otmar Biebel, Valerio D'Amico, Florian Egli, Stefanie Götz, Ralf Hertenberger, Christoph Jagfeld, Eshita Kumar, Katrin Penski, Maximilian Rinnagel, Nick Schneider, and Chrysostomos Valderanis — LMU München

The ATLAS collaboration at LHC has chosen the resistive Micromegas technology, along with the small-strip Thin Gap Chambers (sTGC), for the high luminosity upgrade of the first muon station in the high-rapidity region, the New Small Wheel (NSW) project. Achieving the requirements for these Micromegas detectors revealed to be even more challenging than expected. One of the main features being studied is the HV stability of the detectors. Several approaches have been tested in order to enhance the stability, among them the use of different gas mixtures. A ternary Argon-CO_2-iC_4H_{10} mixture has shown to be effective in dumping discharges and dark currents. It allows the operation of the Micromegas detectors at safe working points with high cosmic muon detection efficiency. The presence of Isobutane in the mixture required a set of aging studies, ongoing at the GIF++ radiation facility at CERN, where the expected HL-LHC background rate is created by a ^{137}Cs 14 TBq source of 662 keV photons. Preliminary aging results and muon reconstruction efficiencies under photon background of the ternary mixture will be shown.

T 150.3 Thu 18:00 WIL/A120

Measurement of the first Townsend coefficient using UV light — •Paolina Noll, Thomas Radermacher, Stefan Roth, David Smyczek, and Nick Thamm — RWTH Aachen University - Physics Institute III B, Aachen, Germany

In gaseous ionization detectors primary electrons are accelerated in high electric fields and hence generate secondary ion pairs. These electron avalanches are described by the first Townsend coefficient which is the number of electrons produced per unit path length per primary electron. In a test setup a UV LED produces primary electrons via the photoelectric effect. The Townsend coefficient is extracted from the anode current measured in relation to the voltage applied. The experimental setup and first results are presented.

T 150.4 Thu 18:15 WIL/A120

TANGERINE Project: Transient Simulation Studies — •Manuel Alejandro Del Rio Viera for the Tangerine-Collaboration — Deutsches Elektronen-Synchrotron (DESY)

The goal of the TANGERINE project is to develop the next generation of monolithic silicon pixel detectors using a 65 nm CMOS imaging process, which offers a higher logic density and overall lower power consumption compared to previously used processes. In order to understand the processes and parameters that are involved in the development in the new 65 nm technology, a combination of Technology Computer-Aided Design (TCAD) and Monte Carlo (MC) simulations are used. Transient simulations allow to study the response of the sensor over time, such as the signal produced after a charged particle passes through the sensor. The study of these signals is important to understand the magnitude and timing of the response from the sensors and improve upon them.

While TCAD simulations are accurate, the time required to produce a single pulse is large compared to a MC and TCAD combination approach, which reduces the simulation time and allows for high statistics studies. Electrostatic fields from TCAD are imported into the Allpix Squared framework, a simulation framework for semiconductor radiation detectors, and through the use of the Shockley-Ramo Theorem, the pulses induced from charges moving in the sensor are calculated.

In this talk, the advantages of this approach, the resulting pulses and the integrated charge obtained from the MC and TCAD simulations used as validation between the two methods will be presented.

T 150.5 Thu 18:30 WIL/A120

Monte Carlo Simulations of Detector Prototypes Designed in a 65 nm CMOS Imaging Process — •Sara Ruiz Daza for the Tangerine-Collaboration — DESY, Hamburg, Germany

Monolithic CMOS sensors enable the development of detectors with a low material budget and a low fabrication cost. Moreover, using a small collection electrode results in a small sensor capacitance, a low analogue power consumption, and a large signal-to-noise ratio. These characteristics have become very attractive in the development of new silicon sensors for charged particle tracking at future experiments. One of the goals of the Tangerine Project (Towards Next Generation Silicon Detectors) is to develop a telescope setup consisting of detector prototypes designed in a 65 nm CMOS imaging process. This contribution presents the Monte Carlo simulations of such detector prototypes using the Allpix Squared framework.

T 150.6 Thu 18:45 WIL/A120

Simulations and Test Beam Results of a MAPS in a 65 nm CMOS Imaging Technology — •Adriana Simancas for the Tangerine-Collaboration — Deutsches Elektronen-Synchrotron, Hamburg, Deutschland — Universität Bonn, Bonn, Deutschland

Monolithic CMOS sensors produced in a 65 nm imaging technology are being investigated for an application in particle physics for the first time. Their main characteristic is the integration of an active sensor and readout circuit in the same silicon wafer, which provides a reduction in material budget. Compared to the previously investigated 180 nm process, the 65 nm technology offers a significant improvement in the logic density of the pixels. The small collection electrode sensor is characterized by a low input capacitance, granting a high signal to noise ratio and a low power consumption. The Tangerine Project aims to use this technology for vertex detectors at future lepton colliders. TCAD Device and Monte Carlo simulations are used to develop an understanding of the sensor technology and provide important insight into performance parameters of the sensor. Testing prototypes in laboratory and test beam facilities allows to study their charge collection, spatial resolution and efficiency. Combining results from all these studies it is possible to optimize the sensor layout. This contribution will present the first comparison of simulation results to test beam data of a 65 nm CMOS sensor with a small collection electrode.