T 45: Si-Strips, Pixel

Time: Tuesday 17:00–18:30 Location: WIL/A124

T 45.1 Tue 17:00 WIL/A124

Strip sensor characterization for the ATLAS ITk tracker — •Elizaveta Sitnikova — DESY, Hamburg, Germany

Before the start of High Luminosity LHC the Inner Detector of the ATLAS detector will reach the end of its operating life. It will be replaced by a new Inner Tracker (ITk), more suitable for high luminosity. Building the ITk requires a lot of effort from many institutes in the collaboration, and DESY is one of the main contributing institutes. One of the two strip ITk endcaps will be assembled at DESY. During production, the main sensing units of the tracker, the silicon microstrip sensors, have to pass a number of tests to ensure that they are suitable for becoming part of the detector. One of these tests is measuring the IV sensor characteristic. In this talk the importance and the procedure of measuring strip sensor IV curves at DESY Hamburg will be discussed, as well as a detailed study of whether the number of required IV testing can be reduced, done using high statistics provided by the current data stored in the ITk production database.

T 45.2 Tue 17:15 WIL/A124

Producing high quality and long-lasting modules for the ATLAS ITk strip detector — •Ben Brüers — Deutsches Elektronen-Synchrotron DESY, Zeuthen, Germany

For the high luminosity phase of the LHC, the ATLAS collaboration plans to upgrade its current tracking detector with a new, all silicon pixel and strip detector, referred to as Inner Tracker (ITk). Core components of the ITk strip detector are modules that consist of sensors and printed circuit flex boards carrying the read-out and powering chips. To ensure reliable operation of the ITk strip detector, all module components are extensively tested and characterised before module building. After and during module assembly, the quality of the modules is additionally assessed to verify that they fulfil the high standards determined to lead to the required quality by the ATLAS collaboration. This talk will give an overview of the means of ensuring this level of quality for the modules and their components. Special focus will be on stress-tests of ASIC stuffed printed circuit boards and on temperature cycling of modules. During the quality assessment of a module and its components it is paramount to not damage the wire-bonds connecting the ASICs and the printed circuit boards, e.g. through resonances induced by the cooling or vibrations. A new approach to determine the resonance frequency of the wire-bonds is presented in this talk. Knowledge of this frequency is also relevant to prevent damages due to wire-bond oscillations excited by currents through the wires in the 2 T magnetic field of the ATLAS detector.

T 45.3 Tue 17:30 WIL/A124

Characterisation and test beam data analysis of passive CMOS strip sensors — •Naomi Davis for the CMOS Strip Detectors-Collaboration — Deutsches Elektronen Synchrotron DESY, Hamburg, Germany

In high-energy physics, upgrades for particle detectors, as well as studies on future particle detectors are largely based on silicon sensors as tracking devices. The surface that needs to be covered by silicon sensors is constantly increasing so that they become an immense cost driver in particle physics experiments. Consequently, there is a need to investigate new silicon sensor concepts that can realise large-area coverage and cost-efficiency. A promising technology is found in passive CMOS sensors, based on CMOS imaging technology. They provide a lowered sensor cost by being produced in commercial chip processing lines. Since passive CMOS sensors do not contain any active elements they also allow for a large choice of possible vendors and easy portation from one CMOS process to another.

The passive CMOS project at DESY is investigating passive CMOS strip sensors fabricated at LFoundry in a 150nm technology. Two different strip formats of the n-in-p sensor are achieved by the process of stitching. An electrical sensor characterisation is realised by measuring the change in the sensor current and capacitance with the applied bias voltage. In addition, the sensor performance is evaluated based on test beam measurements conducted at the DESY II test beam facility. This presentation will provide a characterisation of passive CMOS strip sensors and results of the test beam data analysis.

T 45.4 Tue 17:45 WIL/A124

Test beam analysis of irradiated, passive CMOS strip sensors — •Fabian Lex for the CMOS Strip Detectors-Collaboration — Albert-Ludwigs Universität, Freiburg, Germany

Nearly all envisioned future high-energy particle detectors will employ silicon sensors as their main tracking devices. Due to the increased demand in performance, large areas of the detectors will have to be covered with radiation hard silicon, facilitating the need for silicon sensors produced in large quantities, reliably and cost-efficiently.

A possible solution to these challenges has been found in the utilization of the CMOS process, which is an industrial standard, offering the advantage of a large choice of vendors and reduced production costs. To create the larger sensor structures typical for silicon strip trackers, the stitching process has to be used.

Currently three variations of passive CMOS strip sensors, produced by LFoundry in a 150 nm process, are being investigated. In order to examine the radiation hardness of the design and any possible effect of the stitching on position resolution, detection efficiency or charge collection efficiency, a test beam measurement at the Test Beam Facility at DESY Hamburg has been conducted, using the ALiBaVa (Analogue Liverpool, Barcelona, Valencia) system for DUT (Device under test) readout. In the course of the analysis, a new module to process the ALiBaVa data in the Corryvreckan Test Beam Data Reconstruction Framework has been developed. A summary of the results of this test beam analysis will be presented in this talk.

T 45.5 Tue 18:00 WIL/A124

Tests of the first TRISTAN 166 pixel detector modules in a MAC-E filter environment — •Daniel Siegmann — Technical University Munich, James-Franck-Straße 1, 85748 Garching bei München

Sterile neutrinos are a natural extension of the Standard Model of particle physics. If their mass is in the keV range, they are a viable dark matter candidate. One way to search for sterile neutrinos in a laboratory-based experiment is via tritium beta decay. A sterile neutrino with a mass up to 18.6 keV would manifest itself in the decay spectrum as a kink-like distortion. The objective of the TRISTAN project is to extend the KATRIN experiment measurement range with a novel multi-pixel silicon drift detector and readout system to search for a keV-scale sterile neutrino signal. In this presentation will an overview of the first measurements of a 166 pixel TRISTAN detector module inside a KATRIN-like MAC-E filter environment at the Monitor Spectrometer using an implanted ^{83m}Kr source will be shown.

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T 45.6 Tue 18:15 WIL/A124

A hot cathode electron gun to test and characterize silicon drift detector arrays for the KATRIN experiment — •Korbinian Urban for the KATRIN-Collaboration — Technical University Munich, James-Franck-Straße 1, 85748 Garching bei München

The KATRIN (Karlsruhe Tritium Neutrino) experiment investigates the kinematic endpoint of the tritium beta-decay spectrum to determine the effective mass of the electron anti-neutrino. Its unprecedented tritium source luminosity and spectroscopic quality make it a unique instrument to also search for physics beyond the standard model such as sterile neutrinos. For these searches a new silicon drift detector array is being developed to replace the current silicon detector in KATRIN. Key features of the new detector are the high rate capability and good energy resolution for electrons. This talk presents a setup where these properties of the new detector modules can be tested with electrons of up to 20 keV kinetic energy from a hot cathode electron gun.

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