T 20: Pixel ITk, Si-Strips/Other

Time: Monday 16:30–17:45 Location: WIL/A317

T 20.1 Mon 16:30 WIL/A317

ITk-Pixel Pre-production Sensor QA Measurements Including Testbeam — Jörn Grosse-Knetter, Arnulf Quadt, •Yusong Tian, and Hua Ye — II. Physikalisches Institut, Georg-August-Universität Göttingen

In the ATLAS detector upgrade for the High-Luminosity LHC (HL-LHC), the current Inner Detector will be upgraded to an all-silicon Inner Tracker (ITk), to operate under higher occupancy (instantaneous luminosity $7.5\times10^{34}\,\mathrm{cm}^{-2}\,\mathrm{s}^{-1}$, corresponding to approximately 200 inelastic pp collisions per bunch crossing) and radiation damage (fluence $2\times10^{16}\ \mathrm{n_{eq}/cm^2}$). The data taking is planned to start in 2029 and last for 10 years. The pixel detector is the inner-most layer of the ITk, it consists of modules equipped with planar or 3D sensors, and is currently in the pre-production stage. To be assured that specifications will be met during production, sensors from different vendors were sent to different ITk sites for testing, and some modules were assembled for beam test. This talk shows ITkPix pre-production planar sensor quality assurance (QA) measurements and testbeam.

T 20.2 Mon 16:45 WIL/A317

ATLAS ITk Module Testing Quality Control — •Yannick Dieter, Fabian Hügging, Florian Hinterkeuser, Hans Krüger, Maximilian Mucha, Matthias Schüssler, Thomas Senger, and Jochen Dingfelder — Physikalisches Institut der Universität Bonn

With the upgrade of the Large Hadron Collider (LHC) to the High-Luminosity LHC (HL-LHC), the instantaneous luminosity will increase by a factor of 5 with respect to its design value from 2029 onward. The resulting unprecedented hit rates and radiation levels require major upgrades of the detectors located at the HL-LHC to meet the new challenging requirements.

For the upgrade of the ATLAS detector, a new all-silicon inner tracking detector (ITk detector) consisting of silicon strip and pixel modules will be installed to replace the currently operated Inner Detector. In total, approximately 10 000 new pixel detector modules have to be built and tested carefully to ensure that only fully functional detector modules are installed. Approximately 1000 pixel detector modules will be built and tested at the Forschungs- und Technologiezentrum Detektorphysik (FTD) in Bonn during the production of the ATLAS ITk pixel detector. For testing the electrical functionality of the detector modules an intensive quality control (QC) with dedicated testing setups was developed.

This talk gives an overview of the electrical QC for ATLAS ITk pixel detector modules in Bonn, with a focus on the newly developed test setup and first testing results.

T 20.3 Mon 17:00 WIL/A317

Status update of the Cell Integration Site for ATLAS ITk Pixel Detector in Bonn — •Alexandra Wald, Klaus Desch, Matthias Hamer, Florian Hinterkeuser, Fabian Hügging, and Hans Krüger for the ATLAS-Collaboration — Physikalisches Institut, University of Bonn, Germany

In conjunction with the high luminosity upgrade of the Large Hadron Collider (HL-LHC) at CERN, the current tracking system of the ATLAS experiment will be replaced by the Inner Tracker (ITk), an all-silicon detector consisting of 5 layers of pixel detectors and 4 layers of strip detectors. More than 8000 modules are installed in the pixel layers, which together have an active area of approx. $13\mathrm{m}^2$ and cover a pseudorapidity of up to 4. In order to built such a large detector in time, the integration of the ITk Pixel modules on their local support structures, as well as the quality control of individual loaded local supports will be distributed over many institutes. One of the assembly lines for loaded local supports will be setup at the University of Bonn. Due to the powering scheme of the ITk Pixel Detector, the quality control of a loaded local support is challenging in several aspects: loaded modules cannot be tested standalone, as the implemented serial powering scheme only allows for the simultaneous operation of a significant fraction of all modules on a loaded local support. In this presentation, the current status of the cell integration line in Bonn is presented, with a particular focus on the data acquisition infrastructure required for the QC setup, which is based on a FELIX server (Front-End LInk eXchange).

T 20.4 Mon 17:15 WIL/A317

Commissioning and Testing of a QC-Setup for the ATLAS ITK-Pixel Outer Barrel Bare Cell — •Nico Klein[1], Matthias Hamer[1], Klaus Desch[1], Florian Hinterkeuser[1], Diego Alvarez Feito[2], Alexandre Lacroix[2], and Nicola Pacifico[2] — [1]Universität Bonn — [2]CERN

The high-luminosity upgrade of the Large Hadron Collider at CERN requires a complete redesign of the current tracking detector of the ATLAS experiment. The new Inner Tracker, the ITk Detector, will consist of a silicon pixel detector and a silicon strip detector. The ITk Pixel Detector is divided into three subsystems, the Outer Barrel (OB), Outer Endcaps and Inner System. In the OB, modules are loaded on cells (pyrolytic graphic tiles that are glued to an aluminum-graphite cooling block) before they are mounted on the local supports. These cells play a crucial role in the thermal performance of the modules, as they provide the connection between the modules and the cooling system. In order to meet the demanding requirements that are placed on the cooling system of the ITk Pixel Detector, bare cells must be tested for their thermal conductivity before silicon modules are loaded onto them. In this contribution, a setup for the thermal quality control of the bare cells is presented, as well as measurements of the thermal performance of prototype cells with this setup.

T 20.5 Mon 17:30 WIL/A317

Humidity Studies on Silicon Strip Sensors — •Ilona-Stefana Ninca — Deutsches Elektronen-Synchrotron (DESY), Zeuthen, Germany

Silicon strip sensors for the ATLAS Upgrade showed a strong dependence of the breakdown voltage on varying levels of relative humidity. This study aims to investigate the same behavior on test structures that are produced on "half moons" of the same wafers as the sensors. The test structures are first imaged in breakdown conditions: high bias voltage and 20% - 50% relative humidity. Using an infrared camera the location of the avalanche breakdown on the surface of the test structures was captured. Afterwards, the test structures are investigated using the transient current technique (TCT). The region of the avalanche breakdown is investigated in the TCT setup by scanning a focused, pulsed 660 nm laser beam along the surface of the test structure and recording the resulting current transients. Using the TCT data, the electric field at the breakdown point can be estimated. In the future, hopefully with a better understanding of the origin of the humidity sensitivity we wish to be able to propose changes for new sensors reducing the humidity impact.