T 44: Pixel/LHCb, Si-Strips/CMS

Time: Tuesday 17:00–18:30 Location: WIL/A317

T 44.1 Tue 17:00 WIL/A317

LHCb MightyPix - First measurements and ongoing developments — •Hannah Schmitz, Can-Deniz Arslan, Klaas Padeken, Niclas Sommerfeld, and Sebastian Neubert — Rheinische Friedrich-Wilhelms Universität Bonn

With the upgrade of the LHC to the HL-LHC in LS4, the instantaneous luminosity at the LHCb detector will be increased from $2 \times 10^{33}\text{cm}^{-2}\text{s}^{-1}$ to $1.5 \times 10^{34}\text{cm}^{-2}\text{s}^{-1}$. In order to enable fast and precise tracking in this environment, it is planned to upgrade the entire LHCb tracking system. The downstream tracking system, known as the Mighty Tracker, has to withstand the increased radiation and occupancy at a similar or lower material budget than the current detector. Thus, a hybrid solution consisting of silicon pixels, called MightyPix, with a size of 55x165μm in the inner and scintillating fibres in the outer region is under development. In order to fulfill the conditions beyond Run4, the pixels are based on the technology of HV-CMOS MAPS.
To characterize the MightyPix, a new readout system is currently developed in Bonn. Further, first characterization studies are ongoing and development chips as the ATLASPix3.1 have been characterized at testbeams.
This presentation covers an introduction into the newly developed readout system for the MightyPix, latest testbeam results and an overview of the current developments regarding the Mighty Tracker with focus on the MightyPix.

T 44.2 Tue 17:15 WIL/A317

Characterization of HV-CMOS sensors for the Mighty Tracker at LHCb — •Can-Deniz Arslan, Klaas Padeken, Hannah Schmitz, Niclas Sommerfeld, and Sebastian Neubert — Helmholtz-Institut für Strahlen- und Kernphysik, Bonn, Germany

From Run 5 of the HL-LHC onwards the LHCb detector expects an instantaneous luminosity of $1.5 \cdot 10^{-34}\text{cm}^{-2}\text{s}^{-1}$.
The upgraded downstream tracker will be called the Mighty Tracker and it will be equipped with HV-CMOS sensors around the beamline and scintillating fibres in the outer regions. A development version of the MightyPix is currently characterized. For this purpose a newly developed readout system is used and commissioned.
A first characterization of the development chip will be shown. The status of further plans including an irradiation campaign at the isochronous cyclotron in Bonn will be reported.

T 44.3 Tue 17:30 WIL/A317

Development of a setup to measure the timing resolution of the upcoming Mighty Tracker — •Niclas Sommerfeld, Can-Deniz Arslan, Klaas Padeken, Hannah Schmitz, and Sebastian Neubert — Helmholtz-Institut für Strahlen- und Kernphysik Bonn

With the upgrade during LS4, the instantaneous luminosity at the LHCb experiment will increase by almost one order of magnitude to $1.5 \times 10^{34}\,\text{cm}^{-2}\text{s}^{-1}$. With this increased data rate the untriggered readout of the LHCb detector provides changeless for the tracking detectors. The downsteam tracker (Mighty Tracker) will be instrumented with HV-CMOS pixel sensors in the central part. To assign each hit to the correct bunchcrossing, a timing resolution of 3 ns is needed to contain 3 sigma of the hits in a 25 ns window.

To measure the timing resolution of the MightyPix in the lab, a timing setup is required. This ongoing development of a generalized timing layer will be presented within this talk. The setup will consist of fast plastic scintillators with SIPM readouts and configurable, standardized outputs. The modular design allows to use this setup in a variety of applications.

T 44.4 Tue 17:45 WIL/A317

High rate measurements of HV-MAPS for a future main tracker — Sebastian Bachmann, •Lucas Dittmann, Maja Lecher, and Ulrich Uwer — Physikalisches Institut, Heidelberg, Germany

The LHCb experiment plans to upgrade its detector during the long shutdown 4 of the LHC to cope with a further luminosity increase at LHCb's interaction point during Run 5. For this upgrade, the currently installed scintillating fiber tracker will be replaced by the MightyTracker. The MightyTracker consists of an inner part made from silicon pixels sensors and an outer part made from scintillating fibers.

For the silicon sensor part of the MightyTracker, dedicated High-Voltage Monolithic Active Pixels Sensors (HV-MAPS), which are called MightyPix, are proposed. HV-MAPS are produced in commercial High-Voltage CMOS technology, which allows the design of low cost, thin and radiation hard sensors.

The MightyPix sensors in the hottest regions of the MightyTracker will experience a mean particle rate of 125 kHz/mm^2. To determine possible hit rate limitations of existing HV-MAPS experimentally, rate measurements with ATLASPix3.1 sensors have been performed. The results are compared to theoretical expectations. The ATLASPix3.1 sensor is used as a proxy for the MightyPix sensor, since the pixel readout of both sensors will be structured similarly.

T 44.5 Tue 18:00 WIL/A317

Series Production of 2S Modules for the Phase-2 Upgrade of the CMS Detector in Aachen — Max Beckers[1], Christian Dziwok[1], Lutz Feld[2], Katja Klein[2], Martin Lipinski[2], Vanessa Oppenländer[2], Alexander Pauls[2], Oliver Pooth[1], Nicolas Röwert[2], Felix Thurn[2], and •Tim Ziemons[1] — [1]III. Physikalisches Institut B, RWTH Aachen University — [2]I. Physikalisches Institut B, RWTH Aachen University, D-52056 Aachen

The CMS detector will be upgraded in the Phase-2 Upgrade for the operation at the HL-LHC. Among others, the silicon tracking system will be completely replaced by a new system providing an extended acceptance, an improved granularity and the feature to include tracking information into the first level hardware trigger. The new Outer Tracker will consist of 2S modules with two strip sensors and PS modules with a macro-pixel sensor and a strip sensor, specialized detector modules with onboard p_T discrimination.

Up to 1000 2S modules will be assembled and tested at RWTH Aachen University. In this talk, the module assembly process is summarized and the preparation of the series production is presented.

T 44.6 Tue 18:15 WIL/A317

Development of a database and web applications for the production of CMS 2S modules — •Max Beckers[2], Christian Dziwok[2], Lutz Feld[1], Katja Klein[1], Alexander Pauls[1], Oliver Pooth[2], Nicolas Röwert[1], Martin Lipinski[1], Vanessa Oppenländer[1], Felix Thurn[1], and Tim Ziemons[2] — [1]I. Physikalisches Institut B, RWTH Aachen University, D-52056 Aachen — [2]III. Physikalisches Institut B, RWTH Aachen University

For the CMS Phase-2 Outer Tracker upgrade, new silicon strip detector modules consisting of two silicon strip sensors, so-called 2S modules, are developed and produced. This process is distributed along multiple assembly centers worldwide. To ensure consistent module quality, many specifications need to be respected. This includes different kinds of tests and measurement results.

RWTH Aachen University will build around 1000 2S modules. The production requires well-organized procedures. To guarantee the transparency and traceability of the production conditions and module quality many data are recorded and analyzed.

This talk presents how production and testing are organized in Aachen with a focus on the processing of the acquired data during module assembly. This includes multiple web applications based on a central database. This database is compatible with the central CMS construction database. Exemplary measurements are shown.