T 20: Detektorsysteme I

Zeit: Montag 16:00–18:30 Raum: ST 4

T 20.1 Mo 16:00 ST 4

FANGS: Beam background monitoring during the commissioning phase of the Belle II detector — •Patrick Ahlburg, Jochen Dingfelder, Jens Janssen, Hans Krüger, Carlos Marinas, David-Leon Pohl, and Norbert Wermes — University of Bonn

The FANGS (FE-I4 ATLAS Near Gamma Sensors) detector is one of the components of the BEAST II (Beam Exorcisms for A Stable Experiment) experiment, a pre-experiment of Belle II at the SuperKEKB accelerator in Japan. BEAST II was a dedicated detector system used to study the machine-induced background during the commissioning phase of the SuperKEKB accelerator before the installation of the Belle II inner detector (silicon vertex detectors). The FANGS detector is based on hybrid pixel detector modules used in the ATLAS IBL pixel detector (FE-I4) which are sensitive to low-keV X-rays and can cope with high particle rates. In this presentation, the development and construction of the FANGS detector, the installation in BEAST II at the end of 2017 and the first results from background studies, such as energy distributions of the background, are presented.

T 20.2 Mo 16:15 ST 4

CLAWS: Monitoring Injection Backgrounds at SuperKEKB — •Hendrik Windel for the Belle 2-Collaboration — Max-Planck-Institut für Physik, München

The electron-positron collider SuperKEKB uses continuous injections at a rate of 50 Hz to achieve the highest possible luminosities. These injections result in periods of higher beam backgrounds which may impose constraints on the operation of the Belle II detector. To monitor the level and time structure of the injection backgrounds, CLAWS, an array of plastic scintillator tiles read out with silicon photomultipliers connected to a readout system providing continuous readout over several thousand revolutions of the accelerator with sub-nanosecond time resolution, was installed as part of the inner commissioning detector of Belle II for the second phase of commissioning from February to July 2018. A modified version of the CLAWS detector system is now becoming a permanent part of the beam background monitoring for the Belle II experiment, scheduled to begin regular physics operation in March 2019. This contribution will discuss results from background measurements during the second phase of commissioning, and present the technological evolution of the CLAWS system towards a permanent background monitoring detector.

T 20.3 Mo 16:30 ST 4

Belle II Pixel Detector - Performance of Final Modules — Jochen Dingfelder, Tomasz Hemperek, Hans Krüger, Florian Lütticke, Carlos Marinas, •Botho Paschen, and Norbert Wermes for the Belle 2-Collaboration — University of Bonn, Germany

In spring 2018 the SuperKEKB accelerator in Tsukuba, Japan, provided first e^+e^--collisions to the upgraded Belle II experiment. During this commissioning phase the volume of the innermost vertex detector was equipped with dedicated detectors for measuring the radiation environment as well as one sector of the final Belle II silicon strip (SVD) and pixel (PXD) detectors.

The PXD is the sub-detector closest to the interaction point. It is made from all-silicon modules integrating support structure and sensor. The sensors are pixel matrices of DEpleted P-channel Field Effect Transistors (DEPFET) which are steered and read out by 14 ASICs bump-bonded to each module.

Four of the first available PXD modules of the final iteration were set up in the commissioning PXD detector. They were operated with close-to-final services and their data used to help evaluate accelerator operation. Final PXD modules were also characterized in the laboratory and at beam tests at DESY. This talk will present results of these performance measurements and the long term tests during accelerator commissioning.

T 20.4 Mo 16:45 ST 4

Production tests and commissioning of the Pixel Vertex Detector for Belle II — •Philipp Leitl[1], Hans-Günther Moser[1], Felix Müller[1], Markus Reif[1], Oskar Tittel[1], Florian Lütticke[2], Botho Paschen[2], Harrison Schreeck[3], Philipp Wieduwilt[3], Varghese Babu[4], Felix Müller[4], and Hua Ye[4] — [1]Max Planck Institute for Physics — [2]University Bonn — [3]Georg-August-University Göttingen — [4]DESY

The Pixel Vertex Detector (PXD) is the inner most tracking detector of the Belle II experiment at the electron positron collider SuperKEKB in Tsukuba, Japan. It was designed to consist out of 40 monolithic Depleted P-channel Field Effect Transistor (DEPFET) modules arranged in two layers around the interaction point.

During 2018 the production of the PXD modules was completed. In a collaborative effort all modules went to a standardized testing procedure for optimization and characterization. As a last mechanical step the modules were glued to ladders. The used procedure turned out to be unsuited for the sensitive detector modules and had to be modified.

Finally, the inner layer was completed and integrated into the inner tracking system together with the Silicon Vertex Detector (SVD). The PXD was commissioned in Japan and cosmic ray measurements were taken before and after the insertion into the Belle II detector.

An overview of the results from the module characterization, from the inspection after module gluing and from the commissioning will be presented.

T 20.5 Mo 17:00 ST 4

Performance studies of Belle II DEPFET Pixel Half-Ladders in Test Beams — •Julian Soltau, Philipp Wieduwilt, Harrison Schreeck, Benjamin Schwenker, and Ariane Frey — Georg-August-Universität Göttingen

In the momentary ongoing upgrade of the Japanese Flavor Factory (KEKB) to SuperKEKB for the Belle II experiment the luminosity targets a luminosity increase to $8 \cdot 10^{35}$ cm^{-2} s^{-1}, which is 40 times higher than the previous luminosity of the Belle experiment. In order to handle the increased data rate, a new detector design is mandatory. This was realized by adding an additional pixel detector to the vertex detector, based on DEPFET technology. The DEPFET pixels have a completely depleted silicon bulk and combine signal detection and amplification in a single chip. As part of a beam test campaign at DESY the influence on the the efficiency of different bulk bisasing settings was tested on different half-ladders. The half-ladders used were final PXD modules with pixel sizes in the range of $(55-85) \times 55 \mu\text{m}^2$. The results from the beam test will be presented in this talk.

T 20.6 Mo 17:15 ST 4

Optimization of Belle II DEPFET Pixel Sensor Biasing — •Philipp Wieduwilt, Harrison Schreeck, Julian Soltau, Benjamin Schwenker, and Ariane Frey — Georg-August-Universität Göttingen

The Belle II experiment at the Japanese B-Factory SuperKEKB will start taking data in early 2019. The SuperKEKB e^+e^- collider runs at a very high peak luminosity of $8 \cdot 10^{35}\text{cm}^{-2}\text{s}^{-1}$ at the $\Upsilon(4S)$ resonance, producing B mesons. In order to reconstruct the decay vertices of the B mesons in this harsh environment, the Belle II detector will be equipped with a DEPFET based silicon pixel detector (PXD). The silicon bulk, on which the field-effect transistors form the individual pixels, is biased by different voltages enabling bulk depletion, charge collection and charge removal.

The base constituents of the PXD are half-ladders of a 768×256 sensitive DEPFET pixel matrix and front-end read-out ASICs. The PXD design consists of two layers (12 ladders in the outer layer, 8 ladders in the inner layer) with four different pixel pitches of $55 \times 50\,\mu\text{m}^2$ to $85 \times 50, \mu\text{m}^2$. This talk will present observations on characterization of the final PXD half-ladders, as well as studies for finding the optimal sensor biasing scheme.

T 20.7 Mo 17:30 ST 4

Optimization procedure of the PXD modules for Phase 3 — •Markus Reif für die Belle 2-Kollaboration — Max Planck Institute for Physics

The Pixel Vertex Detector (PXD) is part of the new Belle II detector at the electron positron collider SuperKEKB in Tsukuba, Japan. For Phase 3, 20 modules were installed, arranged cylindrically around the interaction point. Each module contains 192000 Depleted P-channel Field-Effect Transistor (DEPFET) pixels.

Phase 3 starts in the beginning of 2019. For this phase the 'full'

Belle II detector containing all subdetectors will be installed as well as the complete SuperKEKB collider. This then allows for the first time to take data with the full system.

To optimize the PXD modules for data taking, several tests are performed. The software framework had to be adapted from the lab setups, where only single modules were operated, to the final detector setup in Japan.

The tests which are performed and the results from the currently installed PXD modules are presented.

T 20.8 Mo 17:45 ST 4

Noise threshold optimization of SCT strips of the ATLAS detector — •Frank Sauerburger and Karsten Köneke — Albert-Ludwigs-Universität, Freiburg, Deutschland

An optimization study to reduce the effect of noisy strips in the Semi-Conductor Tracker (SCT) of the ATLAS detector is presented. Currently, strips are marked as “noisy” in the 48-hour calibration loop if their average occupancy is above $p = 1.5\%$. Hits in masked strips are not considered during reconstruction. The current threshold has been determined for the configuration of Run 1. Due to an increase in the number of pile-up events and a higher center-of-mass energy in Run 2, it is expected that the current masking algorithm is not optimal for Run 2. The masking criterion is studied from the point of view of tracking performance. The barrel residual and the number of tracks are used as figures of merit to assess the tracking performance. Furthermore, an alternative treatment of masked strips is tested. Instead of removing the hit information before reconstruction, the strips are marked as “dead” in order to reduce the number of holes introduced by the masking of noisy strips.

T 20.9 Mo 18:00 ST 4

The beam induced background in the ATLAS semiconductor tracker — •Edoardo Rossi[1], Christian Sander[1], and Saverio D’Auria[2] — [1]DESY — [2]University of Milan

The Beam Induced Background (BIB) is composed of particles generated by the interaction of the LHC beam with the environment, for example gas molecules in the beam pipe. Studying the characteristics of the BIB is crucial to estimate and reject this background, which plays a signicant role, for example, in mono-jet analyses and in searches for rare events, where even the smallest backgrounds needs to be estimated accurately.

In this presentation, results from the analysis of the BIB in the Semiconductor Tracker (SCT) of the ATLAS experiment are shown. To disentagle the effect of the BIB from collision fragments, events with unpaired proton bunches are exploited. A signicant signature of the BIB particles arises from the timing of their hits, which has the effect of creating an asymmetric hit distribution in the two SCT end caps. Using this signature, it is possible to further select events with a large BIB component.

In this talk, the hit density and distribution of the BIB measured in the SCT are discussed.

T 20.10 Mo 18:15 ST 4

Measurement and optimization of the soft-error-recovery rates in the phase 1 pixel detector — •Torben Lange[1], Peter Schleper[1], Benedikt Vormwald[1], Jory Sonneveld[1], Klaas Padeken[2], Abhisek Datta[3], and Atanu Modak[4] — [1]Univeristät Hamburg, Germany — [2]Vanderbilt University, US — [3]Cornell University, US — [4]Kansas State University, US

While constructed in a radiation hard way to operate in the high radiation environment at the center of the CMS experiment, single-event upsets or SEU that cause different parts of the silicon-pixel-tracking detector to stop sending data are unavoidable in a system this close to the interaction point. The soft-error recovery is an automated procedure to recover those detector parts that stop sending data after radiation induced SEUs during operation. This talk gives an overview of trigger- and recovery rates for the soft-error recovery and discusses based on this if and how the trigger thresholds for the soft-error recovery could be adjusted for the RUN-3 of LHC data taking.