T 33: Detektorsysteme I

Zeit: Montag 16:45–19:05 Raum: VMP8 SR 205

Gruppenbericht T 33.1 Mo 16:45 VMP8 SR 205

Run II Performance of Luminosity and Beam Condition Monitors at CMS — •Jessica Lynn Leonard — DESY, Hamburg, Germany

The BRIL (Beam Radiation Instrumentation and Luminosity) system of CMS consists of instrumentation to measure the luminosity online and offline, and to monitor the LHC beam conditions inside CMS. An accurate luminosity measurement is essential to the CMS physics program, and measurement of the beam background is necessary to ensure safe operation of CMS. Many of the BRIL subsystems have been upgraded and others have been added for LHC Run II to complement the existing measurements.

The beam condition monitor (BCM) consists of several sets of diamond sensors used to measure online luminosity and beam background with a single-bunch-crossing resolution. The BCM also detects when beam conditions become unfavorable for CMS running and may trigger a beam abort to protect the detector. The beam halo monitor (BHM) uses quartz bars to measure the background of the incoming beams at larger radii. The pixel luminosity telescope (PLT) consists of telescopes of silicon sensors designed to provide a CMS online and offline luminosity measurement. In addition, the forward hadronic calorimeter (HF) delivers an independent luminosity measurement, making the whole system robust and allowing for cross-checks of the systematics.

An overview of the performance during 2015 LHC running for the new/updated BRIL subsystems will be given, including the uncertainties of the luminosity measurements.

T 33.2 Mo 17:05 VMP8 SR 205

Analyse von Teststrahldaten von ATLAS DBM pCVD-Modulen — Fabian Hügging, •Jens Janssen und Norbert Wermes — Physikalisches Institut, Universität Bonn

Der Diamond Beam Monitor (DBM) ist ein Luminositäsmonitor für den ATLAS Detektor, der im Zuge eines Upgrades des ATLAS Pixeldetektors im Jahr 2013 eingebaut wurde. Hauptbestandteil des DBM ist der FE-I4B Pixel-Auslesechip, dessen strahlenharte Ausleseelektronik für die B-Lage des ATLAS Pixeldetektors entwickelt worden ist. Der Auslesechip ist für hohe Ausleseraten bei gleichzeitig hohen Teilchenspurdichten geeignet. 18 der 24 Auslesechips des DBM wurden mit etwa 21 mm×18 mm großen und 500 μm dicken polykristallinen Diamant-Sensoren (pCVD) bestückt. Die Module wurden in etwa 1 m Entfernung vom Wechselwirkungspunkt als 3-lagige Strahlenteleskope um das Strahlrohr angeordnet. Der DBM soll als Ergänzung bestehender Luminositätsmonitore dienen und findet zusätzlich Verwendung als Tracker für die Untersuchung von Halo- und Kollisionspartikeln. In dem Vortrag werden Teststrahldaten, die am SPS aufgenommen worden sind und mehrere pCVD-Module umfassen, vorgestellt.

T 33.3 Mo 17:20 VMP8 SR 205

Testbeam Results of the Upgraded Fast Beam Condition Monitor at CMS — •Maria Hempel[1,2], Konstantin Afanaciev[7], Piotr Burtowy[4], Hans Henschel[2], Olena Karacheban[1,2], Wolfgang Lange[2], Jessica Lynn Leonard[2], Itamar Levy[5], Wolfgang Lohmann[1,2], Dominik Przyborowksi[6], Vladimir Ryjov[4], Sergey Schuwalow[3], Roberval Walsh[3], and Agnieszka Zagozdzinska[4] — [1]BTU, Cottbus, Germany — [2]DESY, Zeuthen, Germany — [3]DESY, Hamburg, Germany — [4]CERN, Geneva, Switzerland — [5]Tel Aviv University,Tel Aviv, Israel — [6]AGH-UST, Cracow, Poland — [7]NCPHEP, Minsk, Belarus

The Fast Beam Condition Monitor BCM1F at CMS is based on single-crystal diamond sensor with nanosecond time resolution. BCM1F delivered luminosity and machine induced background information to the CMS and LHC control room during the first running period of the LHC. A major upgrade to BCM1F was developed and built during the long shutdown of the LHC in 2014. The increased rate and the 25ns spacing should be handled with sensors subdivided by a double pad metallization and a faster new front-end ASIC. A prototype with these new components was investigated in the testbeam at DESY-II. The results are presented and also verified by Superfish simulations.

T 33.4 Mo 17:35 VMP8 SR 205

A new luminometer and beam conditions monitor for the CMS experiment. — •Olena Karacheban[1,2], Anne Dabrowski[3], Hans Henschel[2], Maria Hempel[1,2], Wolfgang Lange[2], Jessica Leonard[4], Itamar Levy[5], Wolfgang Lohmann[1,6], Dominik Przyborowski[7], Vladimir Ryjov[3], Sergej Schuwalow[2,4], David Stickland[3], Roberval Walsh[4], and Agnieszka Zagozdzinska[3] — [1]Brandenburg University of Technology, Cottbus — [2]DESY-Zeuthen, Germany — [3]CERN, Geneva, Switzerland — [4]DESY-Hamburg, Germany — [5]Tel Aviv University, Tel Aviv, Israel — [6]RWTH Aachen University, Aachen, Germany — [7]AGH-UST University, Cracow, Poland

The luminosity is a key quantity of any collider, which allows for the determination of the absolute cross sections from the observed rate in a detector. The Fast Beam Conditions Monitor (BCM1F) was upgraded in the last LHC long technical stop (LS1) to 24 diamond sensors read out by a dedicated fast ASIC in 130 nm CMOS technology. The backend comprises a deadtime-less histogramming unit, with a 6.25 ns bin width, in VME standard. A microTCA system with better time resolution is in development. BCM1F is used for luminosity and machine induced background measurements at the CMS experiment. The performance of the detector in the first running period, as well as results on the calibration (Van-der-Meer scan) and the measurements of the luminosity will be presented.

T 33.5 Mo 17:50 VMP8 SR 205

MPX Detectors as LHC Luminosity Monitor — •Andre Sopczak[1], Babar Ali[1], Nedaa Ashba[2], Benedikt Bergmann[1], Khaled Bekhouche[3], Davide Caforio[1], Michael Campbell[4], Erik Heijne[1], Claude Leroy[2], Anna Lipniacka[5], Marzio Nessi[4], Stanislav Pospisil[1], Frank Seifert[1], Jaroslav Solc[1], Paul Soueid[2], Michal Suk[1], and Daniel Turecek[1] — [1]IEAP CTU in Prague — [2]University of Montreal — [3]Biskra University — [4]CERN — [5]Bergen University

A network of 16 Medipix-2 (MPX) silicon pixel devices was installed in the ATLAS detector cavern at CERN. It was designed to measure the composition and spectral characteristics of the radiation field in the ATLAS experiment and its surroundings. This study demonstrates that the MPX network can also be used as a self-sufficient luminosity monitoring system. The MPX detectors collect data independently of the ATLAS data-recording chain, and thus they provide independent measurements of the bunch-integrated ATLAS/LHC luminosity. In particular, the MPX detectors located close enough to the primary interaction point are used to perform van der Meer calibration scans with high precision. Results from the luminosity monitoring are presented for 2012 data taken at $\sqrt{s} = 8$ TeV proton-proton collisions. The characteristics of the LHC luminosity reduction rate are studied and the effects of beam-beam (burn-off) and beam-gas (single bunch) interactions are evaluated. The systematic variations observed in the MPX luminosity measurements are below 0.3% for one minute intervals.

T 33.6 Mo 18:05 VMP8 SR 205

Electric field deformation in diamond sensors induced by radiation defects — •Florian Kassel[1], Wim de Boer[1], Felix Bögelspacher[1], Anne Dabrowski[2], Alexander Dierlamm[1], Moritz Guthoff[2], Thomas Müller[1], and Pia Steck[1] — [1]Institut für Experimentelle Kernphysik (IEKP), Karlsruher Institut für Technologie (KIT) — [2]CERN

The BCML system is a beam monitoring device in the CMS experiment at the LHC. As detectors 32 poly-crystalline CVD diamond sensors are positioned in a ring around the beam pipe at a distance of +-1.8 m and +-14.4 m from the interaction point. The radiation hardness of the diamond sensors in terms of measured signal during operation was significantly lower than expected from laboratory measurements. At high particle rates, such as those occurring during the operation of the LHC, a significant fraction of the defects act as traps for charge carriers. This space charge modifies the electrical field in the sensor bulk leading to a reduction of the charge collection efficiency (CCE).

A diamond irradiation campaign was started to investigate the rate dependent electrical field deformation with respect to the radiation damage. Besides the electrical field measurements via the Transient Current Technique, the CCE was measured. The experimental results were used to create an effective trap model that takes the radiation damage into account. Using this trap model the rate dependent electrical field deformation and the CCE were simulated with the software "SILVACO TCAD". This talk will compare the experimental measurement results with the simulations.

T 33.7 Mo 18:20 VMP8 SR 205

Messungen zur Ladungssammlung an pCVD Diamant mit der *transient-current-technique* (TCT) — •Helge Christoph Beck, Lars Graber, Arnulf Quadt und Jens Weingarten — II. Physikalische Institut, Georg-August-Universität Göttingen

Für zukünftige Hochenergieteilchenexperimente mit höherer Luminosität werden strahlenharte Detektormaterialien für Spurdetektoren benötigt. Industriell mit dem *chemical vapour deposition* (CVD) Verfahren hergestellte Diamanten könnten dafür in Frage kommen. Diese werden je nach Wachstumsverfahren in einkristalline (scCVD) oder polykristalline (pCVD) Diamanten unterschieden. Bei der Herstellung entstehen besonders bei pCVD Diamanten viele Korngrenzen, an denen driftende Ladungen eingefangen werden können. Um die Eignung als Sensormaterial bestimmen zu können, muss daher das Ladungssammlungsverhalten studiert werden, z.B. mit TCT Messungen: Mit einer α-Quelle werden dazu Elektron-Loch Paare nahe einer Elektrode im Material erzeugt. Durch die Nähe zur Elektrode wird eine Sorte Ladungsträger beinahe sofort gesammelt, sodass mit einem angelegten elektrischen Feld der durch die andere Ladungsträgersorte induzierte Strom gemessen werden kann. Aus der Form des Signals kann auf viele Eigenschaften des Materials, z.B. auf die Mobilität der Ladungsträger und die *charge collection distance* (mittlere Strecke, die von Ladungsträgern zurück gelegt wird, bevor sie eingefangen werden), geschlossen werden.

In diesem Vortrag werden Ergebnisse von TCT Messungen an einem pCVD Diamanten präsentiert.

T 33.8 Mo 18:35 VMP8 SR 205

Full simulation of the beam-related backgrounds at the ILC — •Anne Schütz — DESY/KIT

The ILC has been proposed as the next machine at the energy frontier and a Technical Design Report was presented in 2012. As part of the site-specific studies to prepare the hosting of the ILC in Japan, the final focus region of the ILC had to be adapted. In this contribution, updated results for the beam-related background as well as new results for the backgrounds originating from the beam dump are presented. The beam-related backgrounds are simulated using GuineaPig and are then propagated through the full simulation of the SiD detector. The impact of various modifications in the final-focus region on the detector occupancies are then evaluated. For the neutron background from the beam dump, the FLUKA simulation suite is used, which is well established for dosimetry and shielding studies. With this program, the effect of the neutrons from the ILC beam dumps on the ILC detectors are studied.

T 33.9 Mo 18:50 VMP8 SR 205

CLAWS: Beam background monitoring in the commissioning of SuperKEKB — •Miroslav Gabriel, Hendrik Windel, Naomi van der Kolk, and Frank Simon — Max Planck Institute for Physics

The background levels, in particular those originating from the continuous injection to maximize luminosity, are a concern for the inner vertex detector of Belle-II at the SuperKEKB accelerator. To better understand this background, and in particular its time dependence, dedicated measurements will be made during the commissioning phase of the accelerator, scheduled to begin in February 2016. One of the detectors for these measurements, CLAWS, is based on scintillators coupled to SiPMs which were originally developed for timing measurements of hadronic showers in the CALICE calorimeters. The data acquisition is based on digitizers with very deep buffers allowing the continuous recording of more than 1000 revolutions of the accelerator to provide a detailed analysis of the evolution of the background levels after injection. In this contribution, we will present the overall CLAWS setup, the technical solutions adopted for the data acquisition and analysis, and discuss the performance of the detector elements.