T 88: Detector Systems III

Time: Thursday 16:00–18:15 Location: Tm

T 88.1 Thu 16:00 Tm

A Scintillator Based Background and Beam Abort System for SuperKEKB — •Ivan Popov, Hendrik Windel, Thomas Kraetzschmar, and Frank Simon — Max Planck Institute for Physics

The asymmetric-energy collider SuperKEKB started its physics operation in March 2019. The usage of a nano-beam scheme will enable collisions of electrons and positrons at record-breaking luminosities, but requires continuous particle injections at a rate of 50 Hz. These injections result in periods of high backgrounds, which can negatively affect the operation of Belle II subdetectors. In order to monitor and mitigate such backgrounds, the CLAWS detector system, consisting of scintillator tiles read out by silicon photomultipliers, is in operation in various forms since 2016. Beginning with the first physics run in 2019, 32 sensor modules have been distributed along the final focusing magnets. Over the course of SuperKEKB's run time in 2020 the sensors have been proven to reliably and consistently observe disturbances in the particle beam which can result in catastrophically high backgrounds and quenches of the final focusing magnets. An upgrade of the electronics and the DAQ together with the implementation of a smart trigger logic enables the generation of a beam abort trigger within 400 ns after the occurrence of excessive background, thus ensuring the safe operation of the experiment. The CLAWS system is currently undergoing the necessary upgrades, which will enable its use as a beam abort system and will be operational in time for SuperKEKB's 2021 run time. In this report, the development and early results of the CLAWS system upgrade are discussed.

T 88.2 Thu 16:15 Tm

Open-source tools for a robust and versatile slow control system — •Jaron Grigat — Albert-Ludwigs-Universität Freiburg

Most experiments are equipped with a number of auxiliary sensors to keep track of the experiment's conditions and ensure a secure and stable operation. The slow control system monitors these parameters; the name refers to the relatively low rate at which the values have to be tracked. We present a slow control system developed as an open-source solution for small- to medium-size experiments. Based on the successful operation of the system in three different experiments in the field of direct Dark Matter search, we show how the modular design of the software allows an easy adaptation of the system to new experimental setups.

T 88.3 Thu 16:30 Tm

The LumiTracker detector — Johannes Albrecht, •Elena Dall'Occo, David Rolf, and Dirk Wiedner — Experimentelle Physik 5, TU Dortmund

The LumiTracker is a newly proposed detector upstream of the LHCb interaction point. It consists of a mini telescope based on silicon pixel detectors with the main goals of providing a real-time estimate of luminosity and contributing to its offline measurement. The luminosity measurement is based on reconstructing and counting tracks, exploiting the linearity with luminosity. Simulation studies show that a precision of 1% is achievable over an integration time of 5 seconds for an average number of *pp* interactions per bunch crossing of 7.6. In addition, such a solution would allow to measure the longitudinal profile of the luminous region with an expected resolution per track of a few millimetres.

In this talk, the feasibility studies, the LumiTracker projected performance and the detector specifications within the global framework of the LHCb detector are presented.

T 88.4 Thu 16:45 Tm

Upgrade of the LHCb Beam Condition Monitor — •Martin Bieker, Holger Stevens, and Dirk Wiedner — Experimentelle Physik 5, TU Dortmund

The LHCb experiment is a single-arm forward spectrometer at the LHC and it focuses on measurements in the *b* and *c* quark sector. Due to its unique geometry, featuring a sensitive tracking system located as close as 3.5 mm to the LHC beams, the detector is at risk of damage from adverse beam conditions. For this reason, the particle flux is monitored near the beampipe by 8 diamond sensors in a circular arrangement at either side of and close to the interaction point.

This so-called Beam Conditions Monitor (BCM) successfully protected the LHCb detector during Run I and Run II of the LHC. However, at the end of Run II in 2018 indications of possible ageing effects in the diamond sensors were observed. The system is being overhauled and will receive new diamond sensors and a new back-end electronics matching the LHCb upgrade standards.

This talk will give an overview of the activities linked to the development of the new BCM system. Both the status of the readout architecture and the characterisation of diamond sensors for use in the upgrade BCM system will be covered.

T 88.5 Thu 17:00 Tm

Techniques and challenges for aligning LHCb's Scintillating Fibre Tracker — •Sophie Hollitt — Experimentelle Physik 5, TU Dortmund, Dortmund, Germany

LHCb's new Scintillating Fibre Tracker (SciFi) is currently being commissioned for the next LHC data run beginning later this year. Correctly calibrating the existing LHCb alignment algorithms with respect to the SciFi's geometry will be crucial for the SciFi to reach its full potential during operation.

The selection of alignment constraints and degrees of freedom for the different parts of the SciFi at different scales provides a particular challenge. In this talk, the current status of the alignment will be discussed in relation to this challenge.

T 88.6 Thu 17:15 Tm

Commissioning of the LHCb Scintillating Fibre Tracker — Sebastian Bachmann, Daniel Berninghoff, Xiaoxue Han, Blake Leverington, Ulrich Uwer, and •Lukas Witola — Universität Heidelberg, Heidelberg, Deutschland

The LHCb detector is currently undergoing a major upgrade. The modifications will enable the detector to operate at an increased instantaneous luminosity and to read out data at the LHC bunch crossing rate of 40 MHz. The new operating conditions require the replacement of the complete tracking system. The main tracking stations will be replaced by the SciFi Tracker, a large high granular scintillating fibre tracker readout by arrays of silicon photomultipliers (SiPMs). A custom ASIC is used to digitise the SiPM signals at 40 MHz. Further digital electronics perform clustering and data-compression before the data is sent via optical links to the DAQ system.
The detector modules together with the readout electronics and all services are mounted on so-called C-Frames. The serial assembly and commissioning of frames is currently ongoing at the LHCb CERN site. The talk will give an overview of the detector and present experiences from the serial production and the latest commissioning results.

T 88.7 Thu 17:30 Tm

The SHiP Experiment - Surround Background Tagger (SBT) — •Patrick Deucher for the SHiP-SBT-Collaboration — Johannes Gutenberg Universität, Mainz, Germany

SHiP is a proposed, general-purpose fixed target experiment at the SPS accelerator of the CERN Facility. Data collection is aimed to start in 2027 focusing on the identification of Hidden Sector Particles, such as Heavy Neutral Leptons and light dark matter, and further investigation concerning tau neutrinos. When the high-intensity 400 GeV/c proton beam impinges on the hybrid target, heavy mesons and other weakly interacting particles of masses below 10 GeV/c* are created which can potentially decay into the particles of interest. After a hadron absorber and an active muon shield, the beam traverses through a vacuum vessel, where the particles are expected to decay. The products are then detected by a magnetic spectrometer and a calorimeter. To discriminate against external particle interactions, the vessel is enveloped by the Surround Background Tagger (SBT). The SBT is divided into segments and utilizes liquid scintillator and Wavelength Shifting Optical Modules (WOM) connected to SiPMs to identify throughgoing particles. In 2018/19, we have performed test beam measurements with a prototype detector cell at CERN PS and DESY. This contribution gives a general overview on the SBT and results from the past test beams.

T 88.8 Thu 17:45 Tm

Rekonstruktionsfähigkeit von Orts-/Richtungsinformation in einem Flüssigszintillatordetektor mit Hilfe von SiPM-

Ringarray-Auslese wellenlängenschiebender Module — •Joscha Hanel für die SHiP-SBT-Kollaboration — Humboldt-Universität zu Berlin

SHiP ist ein vorgeschlagenes Beam-Dump-Experiment in der CERN SPS North Area mit dem Ziel, nach sogenannten Hidden Particles (Search for Hidden Particles, SHiP) zu suchen. Proton-Proton-Kollisionen mit dem 400GeV-SPS-Protonenstrahl auf ein fixiertes Target könnten schwach wechselwirkende neue Teilchen mit einer Masse zwischen 0,1 und 10GeV erzeugen. Hadronen aus diesen Kollisionen werden absorbiert, Myonen durch ein Magnetsystem abgelenkt. Dadurch bleiben nur Neutrinos und andere neutrale Teilchen übrig, um im 50m langen Zerfallsvolumen zu zerfallen. Dieses Volumen wird von Szintillationsflüssigkeit (Surround Background Tagger, SBT) umgeben, um Untergrundereignisse, die durch Myonen und Neutrinowechselwirkungen erzeugt werden, zu identifizieren. Die Szintillationsphotonen können durch wellenlängenschiebende optische Module detektiert werden, die an ringförmige Arrays von Silizium-Photomultipliern (SiPMs) gekoppelt sind. Dieser Vortrag zeigt Ergebnisse einer Testbeam-Messung, die mit einem Prototyp einer SBT-Zelle in der DESY electron test-beam facility durchgeführt wurde. Der Fokus bei der Analyse liegt auf der Frage, ob es möglich ist, Informationen zur Trajektorie durchquerender Teilchen aus Mustern der SiPM-Antwort über das ringförmige Array zu rekonstruieren.

T 88.9 Thu 18:00 Tm

Verbesserung der Lichtausbeute durch Verwendung eines transparenzverbesserten Flüssigszintillators für den SHiP-SBT — •Max Zacharias für die SHiP-SBT-Kollaboration — Humboldt-Universität zu Berlin, Berlin, Germany

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