11th Beam Telescopes and Test Beams Workshop

Report of Contributions

Contribution ID: **1** Type: **Talk**

MONOLITH - picosecond time stamping capabilities in fully monolithic highly granular silicon pixel detectors.

Thursday, 20 April 2023 10:00 (20 minutes)

The MONOLITH ERC Advanced project aims at producing a monolithic silicon pixel ASIC with 50 μm pixel pitch and picosecond-level time stamping. The two main ingredients are low noise, fast SiGe BiCMOS electronics and a novel sensor concept, the Picosecond Avalanche Detector (PicoAD). The PicoAD uses a patented multi-PN junction to engineer the electric field and produce continuous gain layer deep in the sensor volume. The result is an ultra-fast current signal with low intrinsic jitter in a full fill factor and highly granular monolithic detector. Proof-of-concept prototype with gain layer has already shown full efficiency with 17ps time resolution. Latest test-beam measurement of a second prototype without gain layer but improved front-end electronics have also shown full efficiency and a time resolution of 20ps averaged on the pixel surface.

Primary author: Mr MORETTI, Théo (University of Geneva (CH))

Presenter: Mr MORETTI, Théo (University of Geneva (CH))

Session Classification: Sensors

Contribution ID: **2** Type: **Talk**

The monolithic ASIC for the high precision preshower detector of the FASER experiment at the LHC

Monday, 17 April 2023 17:00 (20 minutes)

The FASER experiment at the LHC will be instrumented with a high precision W-Si preshower to identify and reconstruct electromagnetic showers produced by two O(TeV) photons at distances down to 200μm.
The new detector features a monolithic silicon ASIC with hexagonal pixels of 100 μm pitch, extended dynamic range for the charge measurement and capability to store the charge information for thousands of pixels per event. The ASIC integrates SiGe HBT-based fast front-end electronics with O(100) ps time resolution. Analog memories inside the pixel area are employed to allow for a frame-based event readout with minimum dead area.
A description of the pre-shower and its expected performance will be presented together with the design of the monolithic ASIC and the lab and testbeam (August 2022, H2 beamline) results of the pre-production ASIC.

Primary authors: PICARDI, Antonio (Universite de Geneve (CH)); FENOGLIO, Carlo Alberto; MAGLIOCCA, Chiara (Universite de Geneve (CH)); FERRERE, Didier (Universite de Geneve (CH)); MARTINELLI, Fulvio (Universite de Geneve (CH)); IACOBUCCI, Giuseppe (Universite de Geneve (CH)); SAIDI, Jihad (Universite de Geneve (CH)); SABATER IGLESIAS, Jorge Andres (Universite de Geneve (CH)); PAOLOZZI, Lorenzo (CERN); IODICE, Luca (Universita degli Studi di Napoli Federico II (IT)); VICENTE BARRETO PINTO, Mateus (Universite de Geneve (CH)); Mr MILANESIO, Matteo (Universite de Geneve (CH)); KOTITSA, Rafaella Eleni (Universite de Geneve (CH)); Dr CARDELLA, Roberto (Universite de Geneve (CH)); GONZALEZ SEVILLA, Sergio (Universite de Geneve (CH)); ZAMBITO, Stefano (University of Geneva); KUGATHASAN, Thanushan (CERN); Mr MORETTI, Théo (Universite de Geneve (CH))

Presenter: SABATER IGLESIAS, Jorge Andres (Universite de Geneve (CH))

Session Classification: Experiments - LHC

Contribution ID: **3** Type: **Talk**

Future Continuation of Test Beams at SLAC's End Station A

Monday, 17 April 2023 15:50 (20 minutes)

Until end of 2018 SLAC's End Station Test Beam (ESTB) provided 2 - 15 GeV electrons for over seven years to 58 experiments with 701 users. Operation was suspended with the start of LCLS-II construction. We have designed and are installing a new beam line which will connect the LCLS-II 4 GeV CW superconducting RF Linac to End Station A (ESA). In some respects, beam conditions will be similar but also distinctively different compared to the past. Maximum beam energy will be lower at 4 GeV and the maximum beam current will be a few nA, but the beam rate will increase from 5 Hz to 40 - 186 MHz with a 50 % duty cycle. Due to the low current, the bunch charge, or number of electrons per bunch will be drastically reduced since no primary beam will be brought into ESA. For tracking experiments which use one to a few electrons per bunch, the new beam will be a vast improvement due to its high repetition rate. The high repetition rate and short bunch length also enable test beam studies of fast timing detectors and high-rate performance, or pile-up studies. The experimental infrastructure remains unchanged with the Caladium Telescope from Carlton University still available. The beam line should be operational by the end of 2024.

Primary author: HAST, CARSTEN

Presenter: HAST, CARSTEN

Session Classification: Facilities

Contribution ID: **4** Type: **Talk**

The DESY II Test Beam Facility

Monday, 17 April 2023 14:30 (20 minutes)

In 2022, the DESY II Test Beam Facility was in operation from February to December offering 111 weeks of beam time. After 2020 and 2021, the first year again without extraordinary shutdowns. In this contribution, a review is given over the test beam period in 2022 and the current status of the facility. This includes an update on the tests for a potential new beam line using the direct electron beam. Furthermore, an outlook on the season 2023 and the current planning for the future of the facility will be presented.

Primary authors: STANITZKI, Marcel (Deutsches Elektronen-Synchrotron (DE)); MEYNERS, Norbert (Deutsches Elektronen-Synchrotron (DE)); DIENER, Ralf

Presenter: DIENER, Ralf

Session Classification: Facilities

Contribution ID: **6** Type: **Talk**

Irradiation and test beam facility PARTREC in Groningen, NL

Friday, 21 April 2023 11:40 (20 minutes)

After 25 years of successful research in the nuclear and radiation physics domain, the KVI-CART research center in Groningen is upgraded and re-established as the PARticle Therapy REsearch Center (PARTREC). Using the superconducting cyclotron AGOR and being embedded within the University Medical Center Groningen, providing proton beams of up to 190 MeV and ion beams (up to Pb) with energies up to 90 MeV/nucleon. The intensity of the continuous beam can be varied between several hundreds of particles per second to about 1 microAmp. A number of further upgrades, scheduled for completion in 2023, will establish a wide range of irradiation modalities, such as pencil beam scanning, shoot-through with high energy protons and SOBP for protons, helium and carbon ions. PARTREC delivers a variety of proton and ion beams and infrastructure for detector tests and radiation hardness experiments conducted by scientific and commercial communities, and nuclear science research in collaboration with the Faculty of Science and Engineering of the University of Groningen.

Primary author: GERBERSHAGEN, Alexander (PARTREC, UMCG, University of Groningen (NL))

Co-authors: Dr JONES, Brian; VAN DER GRAAF, Emiel (PARTREC, UMCG, University of Groningen (NL)); Dr VAN GOETHEM, Marc-Jan (PARTREC, UMCG, University of Groningen (NL)); Prof. SCHIPPERS, Marco (PARTREC, UMCG, University of Groningen (NL)); Dr DENDOOVEN, Peter (PARTREC, UMCG, University of Groningen (NL)); Prof. BOTH, Stefan (PARTREC, UMCG, University of Groningen (NL)); Prof. BRANDENBURG, Sytze (PARTREC, UMCG, University of Groningen (NL))

Presenter: GERBERSHAGEN, Alexander (PARTREC, UMCG, University of Groningen (NL))

Session Classification: Facilities

Contribution ID: **8** Type: **Talk**

Reconstruction of high track density beams in beam tests

Friday, 21 April 2023 10:30 (20 minutes)

The Inner Tracker of the ATLAS experiment requires the optimal performance of its pixel sensors. To test their efficiency, a reliable track reconstruction and analysis for testbeam data is necessary to ensure the precise detection of particles. The quality of data from testbeam campaigns are influenced by many factors, including high beam densities, which can impair the track reconstruction.
To analyse and evaluate the data taken at beam tests, the track reconstruction software Corryvreckan is used. It is now the predominant reconstruction framework for beam tests and was developed with the intention to reduce external dependencies without reducing the quality and versatility of track reconstruction in complex environments.
The reconstruction of particle tracks with too many hits becomes increasingly difficult due to the ambiguity of track fits. In order to differentiate between false and true reconstructed tracks, a machine learner is implemented, which is trained on simulated testbeam data, generated by the Allpix Squared software.
This talk presents results of the track reconstruction of high track density using Corryvreckan and the performance of a machine learner for true track tagging. Both simulated data and real testbeam data is investigated.

Primary author: KRAUSE, Christopher (Technische Universitaet Dortmund (DE))

Co-authors: WEINGARTEN, Jens (Technische Universitaet Dortmund (DE)); KROENINGER, Kevin Alexander (Technische Universitaet Dortmund (DE))

Presenter: KRAUSE, Christopher (Technische Universitaet Dortmund (DE))

Session Classification: Testbeam Software

Contribution ID: **9** Type: **Talk**

The ATLAS High-Granularity Timing Detector: test beam campaigns and results

Wednesday, 19 April 2023 12:20 (20 minutes)

The expected increase of the particle flux at the high luminosity phase of the LHC (HL-LHC) with instantaneous luminosities up to L ⍰ 7.5×1034 cm−2 s-1 will have a severe impact on the ATLAS detector performance. The pile-up is expected to increase on average to 200 interactions per bunch crossing. The reconstruction and trigger performance for electrons, photons as well as jets and transverse missing energy will be severely degraded in the end-cap and forward region, where the liquid Argon based electromagnetic calorimeter has coarser granularity and the inner tracker has poorer momentum resolution compared to the central region.
The High Granularity Timing Detector (HGTD), a new timing detector for ATLAS, will be installed in front of the liquid Argon end-cap calorimeters for pile-up mitigation and for bunch per bunch luminosity measurements. This detector will cover the pseudo-rapidity range from 2.4 to about 4.0. Two silicon sensors double sided layers will provide a precision timing information for minimum ionizing particles with a time resolution better than 50-70 ps per hit (i.e 30-50 ps per track) in order to assign the particle to the correct vertex. Each readout cell has a transverse size of 1.3×1.3 mm2 leading to a highly granular detector with about 3 millions of readout electronics channels. Low Gain Avalanche Detectors (LGAD) technology was chosen as it provides an internal gain good enough to reach large signal over noise ratio needed for excellent time resolution. A dedicated ASIC for the HGTD detector, ALTIROC, is being developed in several phases producing prototype versions of 2×2, 5×5 and 15×15 channels. HGTD modules are hybrids of the LGAD and ALTIROC connected through flip-chip bump bonding process.
Several test beam campaigns have been conducted at DESY and CERN SPS H6 beamline in 2022. The performance of irradiated Carbon-enriched LGAD sensors has been studied. First module prototypes of 15×15 arrays with a pad size of 1.3×1.3 mm2 for the HGTD project have been tested from different manufacturers. Their performance with charged-particle beams before irradiation is evaluated. A summary of the results from LGAD-only and hybrids will be presented.

Primary author: CASTILLO GARCIA, Lucia (IFAE - Barcelona (ES))

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Presenter: KURDYSH, Oleksii (Université Paris-Saclay (FR))

Session Classification: Timing

Contribution ID: **10** Type: **Tutorial**

The Corryvreckan Test-Beam Reconstruction Framework — Hands-on

Tuesday, 18 April 2023 14:30 (2 hours)

Corryvreckan is a software framework dedicated to the analysis of test-beam data. It employs a modular concept, providing algorithms for typical analysis steps like pixel masking, clustering, tracking, alignment and for the reconstruction of commonly investigated observables like detection efficiency, spatial and temporal resolution or material budget. This approach allows for a flexible configuration and adaption to a broad range of setups and devices, and explicitly includes the EUDAQ2 framework and the AIDA TLU.

This tutorial provides an introduction to the Corryvreckan framework, the use of different analysis modules and their configuration. A key point of Corryvreckan — the flexible event building mechanism — will be covered for a typical setup, making use of EUDAQ2 and the AIDA TLU. Finally, the use of Corryvreckan as a tool for online monitoring will be covered.

Primary author: FEINDT, Finn (Deutsches Elektronen-Synchrotron (DE))

Co-authors: SIMANCAS, Adriana (Deutsches Elektronen-Synchrotron (DE)); VIGNOLA, Gianpiero (Deutsches Elektronen-Synchrotron (DE))

Presenters: SIMANCAS, Adriana (Deutsches Elektronen-Synchrotron (DE)); FEINDT, Finn (Deutsches Elektronen-Synchrotron (DE)); VIGNOLA, Gianpiero (Deutsches Elektronen-Synchrotron (DE))

Session Classification: Hands-On Tutorial

Contribution ID: **11** Type: **Talk**

Longevity studies for the CMS Drift Tube System towards HL-LHC

Monday, 17 April 2023 18:40 (20 minutes)

The various CMS detector parts will face significant challenges as a result of the High Luminosity LHC (HL-LHC) program. While some of them will be replaced by more sophisticated systems, others, like the Drift Tube chambers, will need to function at 5 times the instantaneous luminosity that they were designed for and maintain roughly 10 times the anticipated LHC integrated luminosity. To meet these challenges and investigate their influence on detector performance, a series of accelerated irradiation tests were carried out at the CERN Gamma Irradiation Facility. The studies on the longevity of the Drift Tube system after integrating approximately 45 mC/cm of charge, as predicted at 3 $\times$ HL-LHC integrated luminosity, have been performed and reported in this talk. The approach used to reduce the impact of the high integrated charge is addressed.

Primary author: SARKISOVI, Valentina (Rheinisch Westfaelische Tech. Hoch. (DE))

Presenter: SARKISOVI, Valentina (Rheinisch Westfaelische Tech. Hoch. (DE))

Session Classification: Experiments - LHC

Contribution ID: **12** Type: **Talk**

Testbeam results for the ATLAS ITk Strip upgrade

Monday, 17 April 2023 17:40 (20 minutes)

In order to cope with the occupancy and radiation doses expected at the High-Luminosity LHC, the ATLAS experiment will replace its Inner Detector with an all-silicon Inner Tracker (ITk), containing pixel and strip subsystems. The strip subsystem will be built from modules, consisting of one or two n+-in-p silicon sensors, one or two PCB hybrids containing the front-end electronics, and one powerboard with high voltage, low voltage, and monitoring electronics. The sensors in the central region of the detector will use a simple rectangular geometry, while those in the forward region will use a radial geometry with built-in stereo angle.
To validate the expected performance of the ITk strip detector, a series of testbeam campaigns has been performed over several years at the DESY-II testbeam facility. Tracking was provided by EUDET telescopes, consisting of six Mimosa26 pixel planes. An additional pixel layer was used to improve the timing resolution of the telescope. Tracks are reconstructed using the General Broken Lines algorithm, resulting in a spatial resolution of several microns. In recent years the focus has been on assessing the module performance post-irradiation. Modules from different regions of the detector were built using sensors and/or front-end electronics irradiated to the maximum expectation from the HL-LHC, including a 50% safety factor. Measurements were performed of the charge collection, signal efficiency, and noise occupancy of the modules, as well as tracking performance in various sensor regions. The results give confidence in the operability of the detector across its lifetime.

Primary author: JAIN, Geetika (TRIUMF (CA))

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Presenter: JAIN, Geetika (TRIUMF (CA))

Session Classification: Experiments - LHC

Contribution ID: **13** Type: **Talk**

Test-Beam Instrumentation and Results of the RD50-MPW3 HV-CMOS Detector

Thursday, 20 April 2023 10:20 (20 minutes)

The CERN RD50 collaboration developed several radiation-hard monolithic silicon particle detectors (DMAPS) to study their usability for tracking and vertexing. The most recent development is the so-called *RD50-MPW3*.
This sensor was fabricated in a 150nm High Voltage CMOS process by *LFoundry* and consists of 64 × 64 pixel with a pitch of 62µm. Besides an analog front end, the chip comprises a full digital readout and control unit. The detector was delivered in Sep. 2022 and has been under evaluation since then.
To study the performance of this detector in terms of spatial resolution, cluster-size distribution, efficiency, and general tracking capabilities, beam tests (at *CERN-SPS* and the Austrian medical facility *MedAustron*) have been performed.
For these tests, the chip utilized the *Caribou*-DAQ system and got integrated into the well-established frameworks *Peary* and *EUDAQ*. The test beam analysis is performed with the *Corryvreckan* framework. The DAQ system uses the *AIDA-TLU* for synchronization purposes with a beam telescope.
In this talk, I will present some of the implementation details of the DAQ system, like the (timestamped) synchronization concept and the 1GBit/s UDP data collector. Furthermore, I will discuss several encountered problems and present the gathered test-beam results.

Primary author: PILSL, Bernhard (Austrian Academy of Sciences (AT))

Presenter: PILSL, Bernhard (Austrian Academy of Sciences (AT))

Session Classification: Sensors

Contribution ID: **14** Type: **Talk**

Tests of Resistive Plate Chambers with ecological gas mixture at GIF++ facility

Tuesday, 18 April 2023 12:20 (20 minutes)

A strong effort is ongoing to find ecological alternative gas mixtures to be used for Resistive Plate Chambers (RPCs). RPCs are widely used in present LHC experiments and in other applications. Main gases used for proper RPC operations in avalanche mode are Tetrafluorethane (usually called R134a) and SF6. Both these gases have high Global Warming Potential and the community is starting studying possible ecological replacements.
A collaboration among different experiment and laboratories (ATLAS, CMS, ALICE, LHCb/SHiP and CERN-EPDT group) is using the GIF++ facility to test long term performance of RPC under irradiation using ecological mixtures.
The experimental setup, the tools to monitor the system and the results from latest test beams together with long term plans will be presented.

Primary author: GALATI, Giuliana (Universita e INFN, Bari (IT))

Presenter: GALATI, Giuliana (Universita e INFN, Bari (IT))

Session Classification: Experiments - Non-LHC

Contribution ID: **15** Type: **Talk**

Beam test of a 180 nm CMOS Pixel Sensor for the CEPC vertex detector

Tuesday, 18 April 2023 11:20 (20 minutes)

The proposed Circular Electron Positron Collider (CEPC) imposes new challenges for the vertex detector in terms of pixel size and material budget. A Monolithic Active Pixel Sensor (MAPS) prototype, TaichuPix, based on a data-driven structure and a column drain readout architecture, has been implemented to achieve high spatial resolution and fast readout. In order to verify the spatial resolution of the baseline vertex detector, a detector system consists of telescope and 2 DUTs with different process was setup based on TaichuPix-3 chips and tested at DESY TB21 beamline in December 2022. This talk will presents the characterization of TaichuPix-3 chip, which include the experimental setup, cluster size, spatial resolution, detection efficiency and the corresponding results in different threshold. The offline analysis results indicates the spatial resolution better than 5μm and the detection efficiency better than 98%.

Primary authors: LI, Shuqi (Chinese Academy of Sciences (CN)); Mr WU, Tianya (Chinese Academy of Sciences (CN)); LIANG, Zhijun (Chinese Academy of Sciences (CN))

Presenter: LI, Shuqi (Chinese Academy of Sciences (CN))

Session Classification: Experiments - Non-LHC

Contribution ID: **16** Type: **Talk**

Online Track-finding and Event Selection in Hardware at 40 MHz

Friday, 21 April 2023 10:50 (20 minutes)

High intensity beams, such as the M2 muon beam at CERN, provide a significant challenge to DAQ systems, in particular when reading out many sensors. For example, beam tests conducted by the MUonE experiment used silicon strip sensors with a bandwidth of 5 Gb/s per module.

Future beam tests will incorporate up to 18 of these modules connected to a triggerless readout system. Limits on processing and data storage will necessitate online event selection to be implemented on state-of-the-art AMD-Xilinx UltraScale+ FPGAs.

This talk will present a general purpose platform for online event selection, from simple occupancy cuts, to track reconstruction, vertexing and particle identification using low-latency machine learning.

Primary author: MONK, David Gabriel (Northwestern University (US))

Presenter: MONK, David Gabriel (Northwestern University (US))

Session Classification: Testbeam Software

Contribution ID: **17** Type: **Talk**

CERN Secondary Beam lines and Test Beam facilities overview

Monday, 17 April 2023 14:50 (20 minutes)

CERN offers a diverse set of test beam facilities that offer many different particle types over a large momentum range. These secondary and tertiary beams are produced from primary proton and ion beams of the PS and SPS accelerators and serve fixed-target experiments as well as dedicated experimental areas for test beam users. The available beams range from below 1 GeV/c up to 400 GeV/c and a selectable flux from a few particles up to 10^9 particles per extraction. This talk presents a general overview of all beamlines and available experimental areas, including beam properties, and available infrastructure for tests, such as beam telescopes and other beam instrumentation. Finally, a brief overview of the beam control software is given.

Primary author: PAROZZI, Elisabetta Giulia (Università degli Studi e INFN Milano (IT), CERN)

Presenter: PAROZZI, Elisabetta Giulia (Università degli Studi e INFN Milano (IT), CERN)

Session Classification: Facilities

Contribution ID: **19** Type: **Talk**

Simulation of Radial Strips for Comic Ray Studies

Wednesday, 19 April 2023 14:40 (20 minutes)

Context of the Talk

The ATLAS Inner Detector (ID) will be replaced with a new all-silicon tracker (ITk) for LHCs high luminosity phase. ITk will consist of a pixel and a strip subdetector, both of which subdivide into barrel and endcap sections. The endcap strip modules use a radial strip geometry that resembles a polar coordinate system. Groups of these modules are then placed on a common support structure (petals) which are arranged in discs to form two endcaps of the detector. Additionally, an 1/8 slice of one endcap (called "System Test") is being commissioned at DESY. Among many characterisation measurements, it is also planned to take cosmic ray data with this setup to verify tracking and overall detector performance.

Scope of the talk

A new implementation of both the radial strips geometry and cosmic rays was developed for the simulation framework Allpix². Additionally, an effort to implement this geometry also in the Corryvreckan framework to allow for tracking is currently ongoing. This talk will cover the simulation of the radial strips geometry used in the ALTAS ITk Strips Endcap modules R0 - R5 in the context of Cosmic Ray studies to be performed with the Endcap System Test.

Outline

- Cosmic rays in Allpix²
- Studies performed with barrel - type sensors
- Analysis options for cosmic ray detectors
- The radial strip geometry
- A tracking telescope build from radial sensors
- Building the petal + System Test
- System Test Simulation

Primary author: Mr CASPAR, Maximilian (DESY)

Co-author: PRIVARA, Radek (Palacky University (CZ))

Presenter: Mr CASPAR, Maximilian (DESY)

Session Classification: Simulation

Contribution ID: **20** Type: **Talk**

Test Beam Facilities at Fermilab

Monday, 17 April 2023 15:30 (20 minutes)

Fermilab plays host to the Fermilab Test Beam Facility(FTBF) and the Irradiation Test Area (ITA). The FTBF is one of the highest energy facilities in the world which is dedicated to helping experimenters develop, test, and calibrate particle detectors. The Fermilab accelerator complex delivers a 120 GeV primary proton beam and secondary/tertiary beams of varying momenta and particle content. The ITA provides access to high intensity (up to 2.7e15/hr) 400 MeV protons directly from the FNAL linac. In addition, FTBF and ITA provide beamline instrumentation, sources, ancillary equipment, and technical support needed to run successful experiments. The facility hosts over 200 users a year from all over the world including collider physics (CMS, ATLAS, Electron-Ion Collider), neutrino physics (DUNE), cosmic experiments, pure R&D, and NASA experiments. Facility capabilities, scheduling, and plans will be discussed in this talk.

Primary author: PASTIKA, Nathaniel Joseph (Fermi National Accelerator Lab. (US))

Presenter: PASTIKA, Nathaniel Joseph (Fermi National Accelerator Lab. (US))

Session Classification: Facilities

Contribution ID: **21** Type: **Talk**

Monte Carlo simulations of a beam telescope setup based on a 65 nm CMOS Imaging Technology

Wednesday, 19 April 2023 15:40 (20 minutes)

Monolithic CMOS sensors enable the development of detectors with low material budget and a low fabrication cost. Besides, using a small collection electrode results in a small sensor capacitance, a low analogue power consumption, and a large signal-to-noise ratio. TCAD Device simulations are used to model the highly non-linear electric field inside this type of sensor. These electric fields can be imported into the Allpix Squared framework, which simulates the full response of the sensor under particle interaction, accounting for the effects like Landau fluctuations in the energy deposition stage, formation of delta electrons, and propagation of charges via drift and diffusion. Thus, the combination of TCAD and Allpix Squared allows for precise and high statistics simulations needed for sensor characterization.

One of the goals of the Tangerine Project is to develop a test beam telescope setup consisting of detector prototypes designed in a novel 65nm CMOS imaging process. This contribution describes the first steps and results in the design of such a telescope using the Allpix Squared and Corryvreckan frameworks for simulation and analysis.

Primary author: RUIZ DAZA, Sara (Deutsches Elektronen-Synchrotron (DE))

Co-authors: WENNLÖF, Håkan (Deutsches Elektronen-Synchrotron (DE)); SPANNAGEL, Simon (Deutsches Elektronen-Synchrotron (DE))

Presenter: RUIZ DAZA, Sara (Deutsches Elektronen-Synchrotron (DE))

Session Classification: Simulation

Contribution ID: **22** Type: **Talk**

The Years 2022 and 2023 in the CERN SPS and PS Physics Coordination and Irradiation Facilities

Monday, 17 April 2023 15:10 (20 minutes)

CERN offers a range of beamlines for fixed target physics and test beam studies in its PS East Area (EA) and SPS North Area (NA) accelerator complex. Additionally, CERN also supports a diverse range of activities via its irradiation facilities, including the PS EA based IRRAD, CHARM, CHIMERA and the SPS NA based GIF++ installations.
The year 2022 was the first year of full physics operation at CERN after the extended Long Shutdown 2 (LS2). We will present an overview about the test and physics program at our facilities and report about developments and challenges during this intensive year. We will also discuss the ongoing service and user improvements under the recently started EU funded EURO-LABS project. Finally, we will discuss the upcoming 2023 program and provide an outlook about the expected developments over the course of this year.

Primary authors: GKOTSE, Blerina (CERN); HOLZER, Eva Barbara (CERN); RAVOTTI, Federico (CERN); JAEKEL, Martin R. (CERN); SCHWINZERL, Martin (CERN)

Presenter: HOLZER, Eva Barbara (CERN)

Session Classification: Facilities

Contribution ID: **23** Type: **Talk**

Results of the ETROC1 Performance and Advancements towards the Next Generation Chip

Wednesday, 19 April 2023 12:40 (20 minutes)

The MIP Timing Detector (MTD) will be installed as a part of the CMS Phase-2 Upgrade to sustain track reconstruction and particle identification by incorporating Time-of-Flight information in the High Luminosity LHC (HL-LHC) era. The Endcap Timing Layer (ETL) of the MTD makes use of Low-Gain Avalanche Diode (LGAD) sensors read out with frontend ASICs referred to as the Endcap Timing Read-Out Chip (ETROC). The design of the ETROC enables effective processing of LGAD signals with a time resolution of 50 ps per hit. By employing two detector layers, this configuration can achieve a time resolution of 35 ps per track.

During the year 2022, a telescope made of three layers of bump-bonded LGAD sensors and ETROC prototypes (ETROC1) were installed at the Fermilab Test Beam Facility. Using a 120 GeV proton beam the time resolution of a single hit was determined to be in the range of 42-45 ps, which is comparable to the results obtained in 2021 based on collected data over a few months of operation. We're setting up a new telescope to test the next version of ETROC, ETROC2, which includes 256 channels, a factor of 16 more than ETROC1, and has new features such as automatic calibration of discriminator threshold, a waveform sampler in one channel to monitor the waveform from the LGAD sensor, and ability to perform self-tests. In this talk, I will present the ETROC telescope setup and time resolution studies with beam, and discuss ongoing works for the future generations of ETROC.

Primary author: LEE, Jongho (University of Illinois Chicago)

Presenter: LEE, Jongho (University of Illinois Chicago)

Session Classification: Timing

Contribution ID: **24** Type: **Talk**

Towards a time-resolved LHCb-RICH detector

Wednesday, 19 April 2023 12:00 (20 minutes)

Thanks to the properties of the LHCb-RICH optical system, the time of arrival of the Cherenkov photons emitted by the charged particles passing through the detector can be predicted very precisely. This timing information can be
used to significantly improve both the PID performance and the signal to noise ratio for
the detector and will ultimately allow the system to withstand luminosities
in excess of 10^{34} cm^2s^{-1}, foreseen after the long shutdown 3 phase (2026-2028).
In this talk I will show the preliminary results of a test beam campaign carried out at CERN between 2021 and 2022 where a small detector prototype equipped with a new front-end ASIC and a custom FPGA designed to timestamp the time of arrival of each photon was tested for the first time. Different types of photosensors were coupled to this new electronics and their timing performances evaluated.

Primary author: Dr BARTOLINI, Matteo (University of Cambridge (GB))

Presenter: Dr BARTOLINI, Matteo (University of Cambridge (GB))

Session Classification: Timing

Contribution ID: **25** Type: **Talk**

Test Beam Characterization of a digital SiPM in 150 nm CMOS Imaging Technology

Wednesday, 19 April 2023 11:40 (20 minutes)

Silicon photomultipliers (SiPMs) are solid-state light detectors capable of detecting single photons with high quantum efficiency in the ultraviolet to visible energy range with excellent time resolution. Due to their unique characteristics, these devices are increasingly used in high-energy physics, medical and commercial applications. Most SiPMs are implemented as large arrays of single-photon avalanche diodes (SPADs) in a parallel circuit, serving as analog photon counters.

Recently, SPADs have been integrated into standard high-volume CMOS processes. This not only allows the production of large volumes of SiPMs at a relatively low cost, but also offers the possibility of combining SPAD peculiarities with the flexibility and possibilities offered by CMOS imaging technology. The implementation of CMOS circuitry extends the properties of standard SiPMs with features such as in-pixel digitization, full Hitmap readout, masking of noisy SPADs, implementation of trigger logic, on-chip Time to Digital Converter. These features allow exploring new fields of applications for SPAD arrays such as Minimum Ionizing Particle detection with excellent spatial and temporal resolutions (4D-Tracking)

A prototype digital SiPM (dSiPM) with per-pixel CMOS circuits was developed at DESY in a 150-nm CMOS technology offered by LFoundry. The chip consists of a 32 x 32-pixel main dSiPM and test structures. Several characterizations were performed in the laboratory on the prototypes and three Test Beam campaigns were carried out at DESY-II Testbeam facility investigating the 4D-Traking performance of the dSiPM.

In this contribution, the results of the characterizations performed on the Chip will be reported. In particular, the Test Beam setups and techniques used for data taking and Corryvreckan analysis will be presented, along with an overview of planned future studies.

Primary author: VIGNOLA, Gianpiero (Deutsches Elektronen-Synchrotron (DE))

Co-authors: RASTORGUEV, Daniil (Deutsches Elektronen-Synchrotron (DE)); FEINDT, Finn (Deutsches Elektronen-Synchrotron (DE)); POBLOTZKI, Frauke (Deutsches Elektronen-Synchrotron (DE)); DIEHL, Inge; GREGOR, Ingrid-Maria (DESY & Bonn University); HANSEN, Karsten (DESY); SPANNAGEL, Simon (Deutsches Elektronen-Synchrotron (DE)); LACHNIT, Stephan (Deutsches Elektronen-Synchrotron (DE)); VANAT, Tomas (Deutsches Elektronen-Synchrotron (DE))

Presenter: VIGNOLA, Gianpiero (Deutsches Elektronen-Synchrotron (DE))

Session Classification: Timing

Contribution ID: **26** Type: **Talk**

4D Trackers Based on AC-LGAD with Long Strip Readout Electrodes

Thursday, 20 April 2023 12:00 (20 minutes)

Silicon-based sensors that can deliver a timing resolution of a few tens of ps along with a significantly better spatial resolution (O(few μm)) have been studied extensively in recent years. In an AC-coupled Low-Gain Avalanche Diode (LGAD), a highly-doped p+ gain layer is implanted between a continuous n+ layer and p-type bulk to form a high-field multiplication region. Electrical signals in the n+ layer are AC-coupled to metal electrodes that are separated from the n+ layer by a thin insulator layer. Signal sharing among the adjacent electrodes in AC-LGAD sensors enables a significantly better spatial resolution while maintaining the excellent fast-timing resolution offered by the conventional LGAD sensors. The AC-LGAD technology has been suggested to use for particle identification (PID), tracking, and far-forward detectors at Electron-Ion Collider (EIC). Precision timing detectors in EIC will provide PID capabilities below the threshold of Cherenkov PID detectors. We demonstrated for the first time the performance of large-area AC-LGAD sensors produced by Brookhaven National Laboratory (BNL) [1]. The data was collected at the Fermilab 120 GeV proton test beam facility using the LGAD characterization setup comprised of a silicon tracking telescope to measure the impact position of each proton, and a fast micro-channel plate detector (MCP-PMT). The waveforms from AC-LGAD and MCP-PMT were recorded using an eight-channel Lecroy Waverunner 8208HD oscilloscope. Sensors were aligned by considering the variations in the sensor position along the beamline and the rotation around the beam axis. These large-area AC-LGAD sensors achieved an excellent spatial resolution of around 10 – 80 μm, and a timing resolution of around 30 – 50 ps depending on the length of the strip. Despite the excellent performance of AC-LGADs in this prototyping run, we observed a significant non-uniformity of the gain layer [1]. A follow-up production was performed at BNL in order to improve the gain layer uniformity. In this presentation, we will present the signal characteristics and charge sharing of AC-LGADs from the latest production batch with Fermilab test beam measurement.

References:
[1] Madrid, Christopher, et al. "First survey of centimeter-scale AC-LGAD strip sensors with a 120 GeV proton beam."arXiv preprint arXiv:2211.09698 (2022).

Primary author: NANDA, Shirsendu (University of Illinois at Chicago (US))

Presenter: NANDA, Shirsendu (University of Illinois at Chicago (US))

Session Classification: Sensors

Contribution ID: **27** Type: **Talk**

KEK PF-AR Test Beamline

Monday, 17 April 2023 16:10 (20 minutes)

In this presentation, I will report/introduce newly constructed KEK PF-AR Test Beamline.
The beamline is based on KEK PF-AR 6.5 GeV electron storage ring for photon source. The beamline provide continuous 1 kHz electron beam up to 5 GeV.
The beamline is now in commissioning phase and will be open for user from JFY2023.

Primary author: NAKAMURA, isamu (KEK)

Presenter: NAKAMURA, isamu (KEK)

Session Classification: Facilities

Contribution ID: **29** Type: **Talk**

Beam-test Evaluation of Single-die Bonded Hybrid Assemblies and Timepix3-iLGAD Devices

Thursday, 20 April 2023 10:40 (20 minutes)

Single die-bonding enables prototyping of new devices produced in Multi-Project-Wafer submissions. This contribution will introduce two alternative interconnect approaches developed within the scope of the CERN EP-R&D and AIDAinnova projects: single-die bump-bonding and in-house anisotropic conductive adhesive bonding. Focus will be on the interconnect characterisation of the CLICpix2 and Timepix3 hybrid assemblies with planar silicon sensors. Furthermore, the first results of large-area inverse Low-Gain Avalanche Detectors with 55 um pixel pitch bonded to a Timepix3 readout-chip will be discussed. Noteworthy aspects of the device performance include gain uniformity and timing performance.
The analysed data are obtained from a 120GeV/c pion beam provided at the CERN SPS North Area. Tracking and time-stamping is achieved by the CLICdp Timepix3-based beam telescope setup. Efforts into future-proofing the setup with picosecond track-time resolution, environmental and data-quality monitoring will also be presented.

Primary authors: DANNHEIM, Dominik (CERN); BUSCHMANN, Eric (CERN); SCHMIDT, Janis Viktor (KIT - Karlsruhe Institute of Technology (DE)); BRAACH, Justus (CERN, Hamburg University (DE)); VICENTE BARRETO PINTO, Mateus (Universite de Geneve (CH)); NOVOTNY, Patrik (Czech Academy of Sciences (CZ)); SVIHRA, Peter (CERN)

Presenter: SVIHRA, Peter (CERN)

Session Classification: Sensors

Contribution ID: **30** Type: **Talk**

In-beam Analogue Pixel Test Structure characterization with the ALPIDE telescope

Thursday, 20 April 2023 11:20 (20 minutes)

The ALICE experiment is preparing the ITS3, an upgrade of its Inner Tracking System for LHC Run 4.
The technology proposed for this upgrade is Monolithic Active Pixel Sensor (MAPS) produced in the 65 nm CMOS imaging process by TPSCo. Different pixel test structures have been developed to validate this technology. One of these is the Analogue Pixel Test Structure (APTS) which features an analogue readout of a matrix 4 x 4 pixels, available with different process modifications and pixel pitches: 10, 15, 20, and 25 um.
The performance of different APTS types, pixel pitches, and irradiation levels has been studied at the CERN PS and SPS with hadron beams of respectively 10-12 GeV/c and 120 GeV/c using ALPIDE telescopes for tracking.
In this talk, the analysis and the results of these test beam measurements will be presented.

Primary author: ALOCCO, Giacomo (Universita e INFN, Cagliari (IT))

Presenter: ALOCCO, Giacomo (Universita e INFN, Cagliari (IT))

Session Classification: Sensors

Contribution ID: **31** Type: **Talk**

Evolution and applications of the RD51 VMM3a/SRS gaseous beam telescope

Tuesday, 18 April 2023 10:40 (20 minutes)

The RD51 collaboration at CERN focuses on the R&D of Micro-Pattern Gaseous Detectors (MPGDs). Included in this work are joint test beam campaigns at a semi-permanent facility at the H4 beam line of CERN's Super Proton Synchrotron (SPS). As part of the test beam infrastructure, two beam telescopes with 10 x 10 cm² active area are provided. Both of them are read out with the RD51 Scalable Readout System (SRS), covering up to 5k readout channels (typically around 500 per detector).

In one of the telescopes, making use of Gas Electron Multiplier (GEM) detectors, the SRS is used with the ATLAS/BNL VMM3a front-end ASIC, which was successfully integrated into the SRS over the past years. The interaction points of the interacting particles are obtained with 50 µm resolution and the interaction time with nanosecond resolution. The front-end electronics provides also the charge information, allowing a detector characterisation in energy, space and time. Due to the front-end's self-triggered continuous readout, particle interactions up to the MHz regime can be recorded.

Having commissioned the electronics in various test beam campaigns, this presentation gives a deeper insight into the telescope's performance. In particular, the many different detectors that have been successfully characterised are presented, showing the suitability of the electronics for R&D purposes. One detector type, the µRWELL, is especially highlighted as it is intended to be used as a technology for a third beam telescope in the future. In addition, a pattern injection technology is reviewed that allowed the operation of the self-triggered beam telescope as added beam detectors of the NA61/SHINE experiment, which was operated in event-matching mode.

Primary author: SCHARENBERG, Lucian (CERN, University of Bonn (DE))

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Presenter: SCHARENBERG, Lucian (CERN, University of Bonn (DE))

Session Classification: Beam Telescopes

Contribution ID: **32** Type: **Talk**

Testbeam Analysis for the LHCb Upgrade-II Mighty Tracker

Monday, 17 April 2023 18:20 (20 minutes)

LHCb is expected to see an increase in integrated luminosity from 50 fb^{-1} to as much as 300 fb^{-1} by the end of Run 5-6. Such an increase prompts an upgrade to the LHCb tracking system: to deal with higher occupancy, more interactions per bunch-crossing, and harsher radiation conditions - to name a few key challenges.
For Upgrade-II of the LHCb detector (expected $\geq$ 2030), the proposed Mighty Tracker aims to address these challenges by incorporating monolithic HV-CMOS sensors into the design for the innermost region of the downstream tracking detector, whilst retaining the current Scintillating Fibre-based approach for the outer region. The HV-CMOS sensor for the Mighty Tracker, the MightyPix, is being developed to have sufficient radiation-hardness, and a time resolution of approximately 3 ns to deal with the high occupancy expected in the inner region.
This talk will cover the analysis and experience gained from Testbeam data obtained at DESY with the AtlasPix3.1 (a predecessor to the upcoming MightyPix1) at varying irradiation levels, with the Corryvreckan analysis software and snakemake workflow automation.

Primary author: O'NEIL, Ryunosuke (The University of Edinburgh (GB))

Presenter: O'NEIL, Ryunosuke (The University of Edinburgh (GB))

Session Classification: Experiments - LHC

Contribution ID: **33** Type: **Talk**

Implementation of bent pixel sensors analysis in the Corryvreckan framework

Thursday, 20 April 2023 12:20 (20 minutes)

The excellent performance of bent ALPIDE sensors has been demonstrated within the ALICE ITS3 R&D. In the corresponding analysis effort a need for simulation and reconstruction software capable of accurately handling bent sensors emerged. The Corryvreckan framework is being updated to include the ability to model bent sensor geometries, providing an important tool for bent pixel sensor beam data analysis.

In this contribution, the implementation of bent sensor geometries in Corryvreckan is discussed, which will allow the alignment of telescope-like setups and reconstruction of particle trajectories. Technical aspects related to the change of coordinate systems, correct handling of uncertainties in a cylindrical geometry and tracking with both straight lines and general broken line fits will be addressed, alongside the need for accurate geometric representations and material properties. Moreover, mechanical aspects, measurement issues and interpretation of data that stem from test-beam campaigns with bent ALPIDEs are discussed.

Primary author: BLIDARU, Mihail Bogdan (Heidelberg University (DE))

Presenter: BLIDARU, Mihail Bogdan (Heidelberg University (DE))

Session Classification: Sensors

Contribution ID: **34** Type: **Talk**

Time resolved RICH testbeam simulation

Wednesday, 19 April 2023 14:00 (20 minutes)

The Ring Imaging Cherenkov (RICH) detectors at LHCb play an integral role in particle identification. However, with the fivefold increase in luminosity resulting from LHCb upgrade II and the high luminosity LHC, the RICH detectors will have to introduce timing resolution on the order of 100 ps to retain performance. This time resolved upgrade is the focus of current RICH testbeam campaigns, the most recent being carried out in October 2022. The goal is to evaluate the performances of MaPMTs and SiPMs as photodetectors, and the readout electronics.

In order to characterise the detector performance and identify causes of timing jitter, an accurate GEANT4 simulation of the testbeam setup is required. This simulation covers the beam effects, the production of Cherenkov photons, their path to the photodetectors, the detection mechanisms, and the detector effects that follow. Timing information is tracked throughout the simulation, allowing for picosecond time resolution studies. This talk will cover both the simulation setup and mechanics, before making comparisons between experiment and simulation, and finally reporting the time resolution achieved.

Primary authors: FOULDS-HOLT, Daniel (University of Cambridge (GB)); BARTOLINI, Matteo (University of Cambridge (GB)); EASO, Sajan (Science and Technology Facilities Council STFC (GB)); WOTTON, Stephen (University of Cambridge (GB))

Presenter: FOULDS-HOLT, Daniel (University of Cambridge (GB))

Session Classification: Simulation

Contribution ID: **35** Type: **Talk**

TANGERINE Project: Transient Studies using a Technology Computer-Aided Design and Allpix Squared combination approach

Wednesday, 19 April 2023 15:20 (20 minutes)

The goal of the TANGERINE project is to develop the next generation of monolithic silicon pixel detectors using a 65 nm CMOS imaging process, which offers a higher logic density and overall lower power consumption compared to previously used processes. In order to understand the processes that are involved in the development in the new 65 nm technology, a combination of Technology Computer-Aided Design (TCAD) and Monte Carlo (MC) simulations are used.

Transient simulations allow for studying the response of the sensor over time, such as the signal produced after a particle passes through the sensor. The study of these signals is important to understand the magnitude and timing of the response from the sensors and improve upon them. While TCAD simulations are accurate, the time required to produce a single pulse is large compared to an MC and TCAD combination approach, which reduces the simulation time and allows for studies that are not possible with TCAD alone such as Landau fluctuations or secondary production. In this approach, electrostatic fields from TCAD are imported into the Allpix Squared framework, a simulation framework for semiconductor radiation detectors, and through the use of the Shockley-Ramo Theorem, the pulses induced from charges moving through the sensor are calculated.

In this contribution, the advantages of this approach and the resulting pulses obtained from the MC and TCAD simulations used as validation between the two methods will be presented.

Primary author: DEL RIO VIERA, Manuel Alejandro (Deutsches Elektronen-Synchrotron (DE))

Presenter: DEL RIO VIERA, Manuel Alejandro (Deutsches Elektronen-Synchrotron (DE))

Session Classification: Simulation

Contribution ID: **36** Type: **Talk**

Performance of the MIMOSIS - Monolithic Active Pixel Sensor for CBM MVD and beyond

Tuesday, 18 April 2023 12:00 (20 minutes)

MIMOSIS is a Monolithic Active Pixel Sensor (MAPS) designed in CIS Tower Jazz 180 nm technology for the Micro Vertex Detector (MVD) of the CBM heavy ion experiment at FAIR/GSI. In addition, its characteristics pave the road toward sensors equipping future Higgs factories. It is also anticipated to equip beam telescopes and various devices developed in the framework of the HORIZON 2020 large scale infrastructure project EURIZON.
The sensor will host 1024 columns of 504 digital pixels with $27 \times 30\ \mu m^2$ pixel dimensions. The analog pixel front-end was inspired by the ALPIDE sensor equipping the ALICE-ITS2 but introduces AC-coupled sensing elements, which allow for applying a top depletion voltage of exceeding 20V and thus for fully depleting the pixel. The sensor is read with a time stamping of 5 μs in continuous mode. The internal multi-stage buffering is designed for a hit rate of up to 20 MHz and may buffer peak rates of 80 MHz for up to 50 μs.This talk introduces the first full size prototype MIMOSIS-1, which hosts a total of four different pixel front ends each combined with three different sensing nodes. We discuss the test-beam results obtained with sensors irradiated with radiation loads of up to 3×10^{14} n_{eq}/cm^2 and 5 MRad ionizing dose. Preliminary results indicate a spatial resolution of about 5.5 μm with more than 99% detector efficiency, even after combined irradiation, thereby complying with the CBM requirements. Finally, an outlook on the MIMOSIS-2 prototype, which was submitted in for fabrication early 2023, is provided.

Primary author: BUGIEL, Roma (Centre National de la Recherche Scientifique (FR))

Presenter: BUGIEL, Roma (Centre National de la Recherche Scientifique (FR))

Session Classification: Experiments - Non-LHC

Contribution ID: **37** Type: **Talk**

Simulations and Test Beam Characterization of a MAPS in 65 nm CMOS Imaging Technology

Wednesday, 19 April 2023 15:00 (20 minutes)

Monolithic CMOS sensors produced in a 65 nm imaging technology are being investigated for an application in particle physics for the first time. Their main characteristic is the integration of an active sensor and readout circuit in the same silicon wafer, which provides a reduction in material budget. Compared to the previously investigated 180 nm process, the 65 nm technology offers a significant improvement in the logic density of the pixels. The small collection electrode sensor is characterized by a low input capacitance, granting a high signal to noise ratio (S/N) and a low power consumption. The Tangerine project aims to develop the next generation of silicon pixel sensors intended as vertex detectors for future lepton colliders and as reference detectors in test beam measurements. The first sensor is envisioned to potentially be used as a telescope in the DESY-II test beam facility. TCAD Device and Monte Carlo simulations are used to develop an understanding of the sensor technology and provide important insight into performance parameters of the sensor. Prototypes are characterized in laboratory and test beam facilities by studying their charge collection, spatial resolution and efficiency. Combining results from all these studies it is possible to optimize the sensor layout. This contribution will present the first comparison of simulation results to test beam data of a 65 nm CMOS sensor with a small collection electrode.

Primary author: SIMANCAS, Adriana (Deutsches Elektronen-Synchrotron (DE))

Co-authors: VELYKA, Anastasiia; FEINDT, Finn (Deutsches Elektronen-Synchrotron (DE)); VIGNOLA, Gianpiero (Deutsches Elektronen-Synchrotron (DE)); WENNLÖF, Håkan (Deutsches Elektronen-Synchrotron (DE)); SPANNAGEL, Simon (Deutsches Elektronen-Synchrotron (DE))

Presenter: SIMANCAS, Adriana (Deutsches Elektronen-Synchrotron (DE))

Session Classification: Simulation

Contribution ID: **38** Type: **Talk**

Test-beam qualification of a Pixel-Strip module for the CMS Outer Tracker Phase II Upgrade

Monday, 17 April 2023 18:00 (20 minutes)

The Large Hadron Collider (LHC) will undergo a major "High Luminosity"upgrade with the goal of delivering a peak instantaneous luminosity of about $5 - 7.5 \times 10^{34}\mathrm{cm}^{-2}\mathrm{s}^{-1}$ by 2029. In order for the CMS experiment to cope with the higher radiation levels and data rates, the current CMS Silicon Tracker will be replaced. The upgraded Outer Tracker will introduce a new module concept, made of two vertically stacked silicon sensors, which will exploit the strong magnetic field inside the CMS detector to perform an on-board $\mathrm{p_T}$ discrimination, selecting high $\mathrm{p_T}$ particles locally and sending the corresponding information to the CMS Level-1 triggering system.

This talk will focus on one of the two foreseen designs, namely the silicon Pixel-Strip (PS) module. The module is made of a $10 \times 5\mathrm{cm}^2$ strip sensor, with $2.5\mathrm{cm}$ long strips and 100μm pitch, stacked on top of a macro pixel sensor with $1400 \times 100\mu\mathrm{m}$ macro pixels bump-bonded to dedicated macro pixel ASICs. The latter are of particular importance as they implement the logic of on-board $\mathrm{p_T}$ discrimination. The sensor stack is surrounded by peripheral front-end, readout and power hybrids. The front-end hybrids are in charge of strip sensor readout and data concentration. The readout hybrid handles the control of the front-end ASICs and the bi-directional optical data communication with the back-end system. Finally, the power hybrid ensures power distribution to all the front-end electronic components.

After an introduction to the concept of $\mathrm{p_T}$ discrimination and to the design of the PS module, the talk will mainly focus on qualification studies performed at the DESY II Test Beam Facility. The presented results will cover cluster size and resolution studies, detection efficiencies and most importantly the on-board $\mathrm{p_T}$ discrimination performance.

Primary author: OTARID, Younes (DESY)

Co-author: NÜRNBERG, Andreas (Deutsches Elektronen-Synchrotron (DE))

Presenter: OTARID, Younes (DESY)

Session Classification: Experiments - LHC

Contribution ID: **39** Type: **Talk**

Test Beam Characterisation of passive CMOS Strip Sensors

Tuesday, 18 April 2023 11:40 (20 minutes)

In high-energy physics, upgrades for particle detectors and studies on future particle detectors are largely based on silicon sensors as tracking devices. The surface that needs to be covered by silicon sensors is constantly increasing so that they become an immense cost driver in particle physics experiments.
Consequently, there is a need to investigate new silicon sensor concepts that can realise large-area coverage and cost-efficiency.
A promising technology is found in passive CMOS sensors, based on CMOS imaging technology. They provide a lowered sensor cost by being produced in commercial chip processing lines. Since passive CMOS sensors do not contain any active elements they also allow for a large choice of possible vendors.

The passive CMOS project at DESY is investigating passive CMOS strip sensors fabricated at LFoundry in a 150 nm technology.
The process of stitching achieves two different strip formats of the n-in-p sensor. Furthermore, the strip design varies in doping concentration and width of the n-well to study various depletion concepts.
The sensor performance is evaluated based on test beam measurements conducted at the DESY II test beam facility at DESY Hamburg.
In order to process the strip sensor data the ALiBaVa (Analogue Liverpool, Barcelona, Valencia) readout system is used.
This presentation will provide results of the test beam data analysis with the Corryvreckan software, as well as comparisons between irradiated and unirradiated strip sensors, concerning their hit detection efficiency.

Primary author: DAVIS, Naomi Afiriyie (Deutsches Elektronen-Synchrotron (DE))

Presenter: DAVIS, Naomi Afiriyie (Deutsches Elektronen-Synchrotron (DE))

Session Classification: Experiments - Non-LHC

Contribution ID: **40** Type: **Talk**

Beam Telescopes at the DESY II Test Beam Facility

Tuesday, 18 April 2023 10:00 (20 minutes)

Test beam measurements often rely on a precise reconstruction of the tracks of beam particles. For this purpose, the DESY II Test Beam facility provides one beam telescope at each of its three beam lines. This includes two copies of the well established and widely used EUDET-type telescope, which has become an integral part of the test beam infrastructure over the last decade, but is also approaching its end-of-life by now. The third beam telescope is a novel prototype that offers the same flexibility for integrating devices under test as the EUDET-type telescope but uses a more recent pixel sensor, ALPIDE, with improved noise and timing performance.
This talk will give an overview of the telescope systems currently used at the DESY II Test Beam facility and present the status and plans for future upgrades.

Primary authors: HERKERT, Adrian (Deutsches Elektronen-Synchrotron (DE)); HUTH, Lennart (Deutsches Elektronen-Synchrotron (DE)); STANITZKI, Marcel (Deutsches Elektronen-Synchrotron (DE))

Presenter: HERKERT, Adrian (Deutsches Elektronen-Synchrotron (DE))

Session Classification: Beam Telescopes

Contribution ID: **42** Type: **Talk**

Testing of Pre-Series Tile Modules at DESY II for the CMS HGCAL Upgrade

Wednesday, 19 April 2023 10:20 (20 minutes)

For the HL-LHC phase, the calorimeter endcap of the CMS detector will be upgraded with a High Granularity Calorimeter (HGCAL), a sampling calorimeter that will use silicon sensors as well as scintillator tiles read out by silicon photomultipliers (SiPMs) as active material (SiPM-on-tile). The design of the SiPM-on-tile section was inspired by the CALICE AHCAL. The complete HGCAL will be operated at $-30°C$. The basic detector unit in the SiPM-on-tile section is the tile module, consisting of a PCB with one or two HGCROC ASICs, reading out up to 96 SiPM-on-tiles. About 50 tile modules will be produced at DESY and at Fermilab in 2023, in an effort to validate all production and quality control steps, and to construct a small stack as well as two active layer cassette prototypes. Two such tile boards were produced and were tested with electron beams at DESY II. These tile modules contain the latest readout chip (HGCROCv3) and SiPMs with custom made radiation hard packaging produced specifically for the CMS HGCAL. The progress of these beam tests will be presented.

Primary author: LI, Jia-Hao (Deutsches Elektronen-Synchrotron DESY)

Presenter: LI, Jia-Hao (Deutsches Elektronen-Synchrotron DESY)

Session Classification: Calorimetry

Contribution ID: **43** Type: **Talk**

Geant4 validation on test-beam calorimetry data

Wednesday, 19 April 2023 10:00 (20 minutes)

The Geant4 simulation toolkit is used by several experimental groups for detector design studies and detector beam test assessments. In the present era of increasingly detailed detectors, Geant4 plays a key role. It is required to undergo major improvements in both physics accuracy and computational performance. Calorimeter beam tests involve various particles at different energy scales and represent ideal benchmarks for the physics validation of Monte Carlo tools for radiation–matter simulation. The Geant4 Collaboration developed and maintains a validation and testing suite, geant-val, to house test-beam results and their comparison with simulations. We will report our findings from a broad validation campaign on test beam data. In particular, we investigate the Geant4 capability to model the calorimeter response, energy fluctuations, and shower shapes using data from the ATLAS experiment and experimental groups targeting future lepton colliders. Geant-val is an open project to which anyone is invited to contribute; this Workshop will give the possibility to show the Geant4 validation status, as well as to chart the next validation studies in collaboration with experimental groups running new beam tests.

Primary authors: RIBON, Alberto (CERN); KONSTANTINOV, Dmitri (Institute for High Energy Physics of NRC Kurchatov Institute (RU)); PEZZOTTI, Lorenzo (CERN)

Presenter: PEZZOTTI, Lorenzo (CERN)

Session Classification: Calorimetry

Contribution ID: **44** Type: **Talk**

Characterisation of a novel trigger and timing plane for the EUDET Telescopes

Tuesday, 18 April 2023 10:20 (20 minutes)

The DESY Test Beam facility provides 1-6 GeV electron beams for users and precise reference tracking systems, the EUDET-type telescopes. The telescope readout is triggered externally and up to 10 particles are recorded in one readout cycle, causing ambiguities as no time-stamping is provided.

TelePix is a 180 nm HV-CMOS sensor foreseen to be used in upgrades of the EUDET-style pixel beam telescopes allowing for fast timing and triggering on a region of interest. Test beam characterisations of TelePix1 have shown an efficiency of above 99% and a time resolution of 2.4 ns. Here, characterisation results of TelePix1 are presented using the latest test beam results.

TelePix2, the larger version of the TelePix1 sensor, is now in the commissioning phase. The first sensors have arrived and are now wire bonded onto custom developed PCBs. The initial progress made towards this effort is also presented.

Primary authors: WINTLE, Arianna; SEFKOW, Felix (Deutsches Elektronen-Synchrotron (DE)); AUGUSTIN, Heiko Christian (Heidelberg University (DE)); Prof. PERIC, Ivan (Karlsruhe Institute of Technology KIT); HUTH, Lennart (Deutsches Elektronen-Synchrotron (DE)); STANITZKI, Marcel (Deutsches Elektronen-Synchrotron (DE))

Presenter: WINTLE, Arianna

Session Classification: Beam Telescopes

Contribution ID: **45** Type: **Talk**

Beam tests of sensors for a compact electromagnetic calorimeter

Thursday, 20 April 2023 11:40 (20 minutes)

Sensor samples for a future compact electromagnetic sampling calorimeter were tested in DESY-II electron beam in 2021 and 2022. The sensors are made of silicon and GaAs with the size of 5×8 cm^2. They are 320 μm and 500 μm for the silicon and GaAs sensors in thickness, respectively, and the pad size is 5×5 mm^2. The compactness of the sampling calorimeter requires the readout through traces connected to the pads and to bond pads at the edges of the sensors. For the silicon sensors, copper traces on a Kapton foil are used, connected to the sensor pads with conducting glue. The pads of the GaAs sensors are connected to the bond pads via aluminium traces on the sensor substrate. The whole data readout system is orchestrated by a trigger logic unit (TLU). With the telescope, the effects of the traces and the bond pads are studied. We will show the preliminary results for the homogeneity of the response, edge effects at pads and sensors, and cross talk due to the readout traces.

Primary authors: LOHMANN, Wolfgang Friedrich (Deutsches Elektronen-Synchrotron (DE)); HUANG, Shan (Tel Aviv University)

Presenter: HUANG, Shan (Tel Aviv University)

Session Classification: Sensors

Contribution ID: **46** Type: **Talk**

Timing Characterization of a digital SiPM

Wednesday, 19 April 2023 11:20 (20 minutes)

Silicon Photo-Multipliers (SiPMs) are pixelated semiconductor detectors consisting of Single-Photon Avalanche Diodes (SPADs). These single-photon sensitive detectors are often analog devices that require separate digitization. Combining SiPMs with digital readout known from modern pixel sensors offers new possibilities like full hitmap readout, pixel masking or fast timestamping.
Such a digital SiPM was developed and tested at DESY. It is a monolithic chip manufactured in a 150nm CMOS process from LFoundry. The chip has a 32x32 pixel matrix and TDC (time-to-digital converter) that allows for timestamps with a resolution of less than 100ps.
Two testbeam campaigns were carried out at the DESY-II testbeam facility to investigate the timing resolution of this chip. In this contribution, an overview of the analysis procedure will be given and first preliminary results presented.

Primary author: LACHNIT, Stephan (Deutsches Elektronen-Synchrotron (DE))

Presenter: LACHNIT, Stephan (Deutsches Elektronen-Synchrotron (DE))

Session Classification: Timing

Contribution ID: **47** Type: **Lecture**

Experiments and detectors in photon science

Wednesday, 19 April 2023 09:00 (45 minutes)

Synchrotron and Free Electron Laser facilities produce highly intense, focused X-ray beams suitable for a wide range of experiments studying the structure of objects down to the atomic scale, for example in molecular biology and materials science. Rapid improvements in beam brilliance at new facilities have enabled new experiments, but also placed high demands on detector performance. In particular, X-ray diffraction experiments have required pixel detectors with increasing speed, noise performance and dynamic range, with an evolution from pioneering hybrid pixel detectors such as Pilatus to newer projects such as AGIPD for FELs and CoRDIA for future light sources. In addition, there are some experiments where features of particle trackers, such as precision timestamping and triggering, are needed in photon science.

Primary author: PENNICARD, David

Presenter: PENNICARD, David

Session Classification: Overview Lectures

Contribution ID: **48** Type: **Lecture**

From Sensor to Detector - with some Obstacles

Tuesday, 18 April 2023 09:00 (45 minutes)

Silicon tracking detectors are very large and complex system - and each of the are unique. In the history of these detectors many different geometries and designs were built. However, some steps are always the same during the development and construction of the detector.
In this presentation the way from the bare sensor to a full detector will be described including an overview of most important milestones. A few example will be added to show what can go wrong and what to learn from this.

Primary author: GREGOR, Ingrid-Maria (DESY & Bonn University)

Presenter: GREGOR, Ingrid-Maria (DESY & Bonn University)

Session Classification: Overview Lectures

Contribution ID: **49** Type: **Lecture**

Silicon sensor technologies for vertex and tracking detectors at future e+e- colliders

Monday, 17 April 2023 13:30 (45 minutes)

Several proposals for future e+e- colliders are currently under study, such as CLIC, ILC, FCC-ee or CEPC. The physics goals and experimental conditions at these 'Higgs Factories' pose challenging demands on the performance of the detector systems. For the silicon-based vertex and tracking layers, a single-plane spatial resolution of a few microns is needed, combined with very thin sensors (<100 microns). Moreover, hit-time tagging with a few nanosecond resolution is required to reject beam-induced background events for some of the collider options. An even better track-timing precision well below 100 ps opens up the possibility of particle identification by time-of-flight measurements.

To address these stringent detector requirements, a broad R&D program on new silicon-sensor technologies is being pursued within various collaborative frameworks. Different hybrid technologies with innovative sensor concepts, as well as advanced monolithic depleted CMOS sensors are under study.

This lecture introduces the Higgs-Factory detector requirements and gives an overview of the R&D programme for silicon-based vertex and tracking detectors.

Primary author: DANNHEIM, Dominik (CERN)

Presenter: DANNHEIM, Dominik (CERN)

Session Classification: Overview Lectures

Contribution ID: **50** Type: **Talk**

The ARES Linac as a Precision Tool for Accelerator Science, Technology and Application Developments

Friday, 21 April 2023 12:20 (20 minutes)

The generation and acceleration of ultra-short, high quality electron beams have attracted more and more interest
in accelerator science. Electron bunches with these properties are necessary to operate and test novel high-resolution diagnostics and advanced high gradient accelerating schemes.

The dedicated R&D linac ARES at DESY (Deutsches Elektronen-Synchrotron) is now fully operational and able to produce and diagnose these electron beams at the nominal energy of 155 MeV and to deliver them to users. First measurements have shown an outstanding energy stability and reproducibility with a relative energy stability of 1E-5.

ARES is also used for medical experiments in the frame of Very High Electron Energy (VHEE) treatment and FLASH radiotherapy with living cells and animal phantoms.

This contribution gives an overview of the linac, describes the three experimental stations and summarizes the beam parameter measurements. The scientific program at ARES includes accelerator R&D, medical studies and industrial applications and is outlined.

Primary author: BURKART, Florian

Presenters: BURKART, Florian; BURKART, Florian

Session Classification: Facilities

Contribution ID: **51** Type: **Tutorial**

Making the most out of your test beam time

Tuesday, 18 April 2023 14:30 (4h 30m)

The infrastructure at the DESY II test beam facility allows for highly efficient data taking if utilised correctly. The combination of the AIDA-2020 Trigger-Logic-Unit (TLU) and the beam telescopes enables highly flexible modes of data taking to easily accommodate different sensors. Data driven and triggered devices can be integrated with an minimal overhead.

We would like to take the chance of BTTB being hosted at DESY to cary out a "real testbeam campaign"condensed in a 4 hour tutorial. Starting with a brief introduction, we will quickly move to the testbeam areas and setup the telescope and the AIDA-TLU and investigate the impact different parameters on the data taking: How does triggering work? Which modes of triggering are existing? Which modes of integration do exist? How can we integrate sensors? If the time allows for it we will also study the impact of the momentum on the rate and the reconstruction/multiplicity.

Primary authors: HERKERT, Adrian (Deutsches Elektronen-Synchrotron (DE)); HUTH, Lennart (Deutsches Elektronen-Synchrotron (DE))

Presenters: HERKERT, Adrian (Deutsches Elektronen-Synchrotron (DE)); HUTH, Lennart (Deutsches Elektronen-Synchrotron (DE))

Session Classification: Hands-On Tutorial

Contribution ID: **52** Type: **Tutorial**

Hands-On: Silicon Detector Monte Carlo Simulations with Allpix Squared

Tuesday, 18 April 2023 17:00 (2 hours)

Scope of the tutorial

The goal of this interactive tutorial is to understand the usage of basic functionalities of the Allpix Squared simulation framework, and methods to extract some of the relevant quantities for sensor studies. Participants are encouraged to follow along on their own computers. A task and instructions will be provided and walked through, covering the basic concepts of configuring a simulation and a detector geometry, and extracting and interpreting histograms. We will also touch upon incorporating detailed results from TCAD into the simulations.
Some prior knowledge on the framework is helpful, but not required.

Preparation

Please install the latest release version of Allpix Squared on your computer, or make sure you have access to a working version online before the tutorial.

Detailed instructions for installation can be found in the manual or on the website (https://cern.ch/allpix-squared) and GitLab (https://gitlab.cern.ch/allpix-squared/allpix-squared)

Primary authors: WENNLÖF, Håkan (Deutsches Elektronen-Synchrotron (DE)); DEL RIO VIERA, Manuel Alejandro (Deutsches Elektronen-Synchrotron (DE)); RUIZ DAZA, Sara (Deutsches Elektronen-Synchrotron (DE)); LACHNIT, Stephan (Deutsches Elektronen-Synchrotron (DE))

Presenters: WENNLÖF, Håkan (Deutsches Elektronen-Synchrotron (DE)); DEL RIO VIERA, Manuel Alejandro (Deutsches Elektronen-Synchrotron (DE)); RUIZ DAZA, Sara (Deutsches Elektronen-Synchrotron (DE)); LACHNIT, Stephan (Deutsches Elektronen-Synchrotron (DE))

Session Classification: Hands-On Tutorial

Contribution ID: **53** Type: **Talk**

Allpix Squared - A Semiconductor Detector Simulation Framework

Wednesday, 19 April 2023 14:20 (20 minutes)

Allpix Squared, a versatile, open-source simulation framework for silicon semiconductor pixel detectors, is now around for more than five years. Since the first release, the framework has developed a lot and the range of users has grown. While originally created for silicon detectors in high-energy physics, it is capable of simulating a wide range of detector types for various application scenarios, e.g. through its interface to Geant4 to describe the interaction of particles with matter, and the different algorithms for charge transport and digitization. This makes it possible to at the same time e.g. simulate a full experimental setup with maximum computation efficiency, and to carry out detailed, time-resolved signal formation studies based on field maps imported from TCAD simulations.

Since the last edition of the BTTB workshop, two feature releases have been released, introducing new modules such as a module simulating charge deposition via a laser beam, but also the possibility to simulate other semiconductor materials than silicon.
At the same time, several new use cases are under development, widening the framework towards simulations of 3D pixel sensors, modelling impact ionisation and more.
This presentation provides an overview over the simulation framework and will highlight the recent developments and the work under development.

Primary authors: SCHÜTZE, Paul (Deutsches Elektronen-Synchrotron (DE)); SPANNAGEL, Simon (Deutsches Elektronen-Synchrotron (DE))

Presenter: SCHÜTZE, Paul (Deutsches Elektronen-Synchrotron (DE))

Session Classification: Simulation

Contribution ID: **54** Type: **Talk**

Updates, Status and Experiments of CLEAR, the CERN Linear Electron Accelerator for Research User Facility

Friday, 21 April 2023 12:00 (20 minutes)

Operating since 2017, the CERN Linear Electron Accelerator for Research (CLEAR) is a user facility providing electron beams for a large and varied range of experiments. The electron beam is produced from a Cs_2Te photocathode and is accelerated between 60 MeV and 220 MeV in a 20 m long linear accelerator (LINAC). The accelerated beam is then transported to an experimental beamline, in which experiments such as irradiation of electronics for aerospace applications, irradiation for medical applications including dosimetry and FLASH radiotherapy and beam-diagnostics development are performed. In this presentation, the current status of the beam line, the latest upgrades and the recent and future experiments are presented.

Primary author: KORYSKO, Pierre (University of Oxford (GB))

Presenter: KORYSKO, Pierre (University of Oxford (GB))

Session Classification: Facilities

Contribution ID: **55** Type: **Talk**

Latest results of the CALICE collaboration

Wednesday, 19 April 2023 10:40 (20 minutes)

TBD

Primary author: KRUGER, Katja (Deutsches Elektronen-Synchrotron (DE))

Presenter: KRUGER, Katja (Deutsches Elektronen-Synchrotron (DE))

Session Classification: Calorimetry

Contribution ID: **56** Type: **Talk**

FLASHlab@PITZ

Friday, 21 April 2023 12:40 (20 minutes)

The Photo Injector Test facility at DESY in Zeuthen (PITZ) can provide unique beam parameters regarding delivered dose and dose rate. With an average dose rate of up to 1E7 Gy/s and peak dose rates of up to 4E13 Gy/s, PITZ is fully capable of ultra-high dose rate irradiation which should allow so-called FLASH radiation therapy, a new method of cancer treatment.
A completely new beamline exclusively for FLASH RT and biology experiments was built and is constantly being improved. One goal is to develop and test detectors which cover the whole range of dose rates available at PITZ. Additionally, there is the possibility for external users to test their detectors, bring their biological samples for irradiation and do joint experiments at PITZ!
Gafchromic films were used to measure beam parameters like beam profile, dose depth profile in water, homogeneity and dark current.
First tests of active detectors will be done using silicon sensors utilized in high energy physics experiments. At low dose rates there will be a comparison with a commercially available ionization chamber.
Biological samples like DNA plasmid & cancer cells were irradiated in cooperation with TH Wildau and Charité Berlin. A possible difference between high and low dose rate irradiation will be investigated. Analysis is ongoing.

Primary author: RIEMER, Felix (Humboldt University of Berlin (DE))

Presenter: RIEMER, Felix (Humboldt University of Berlin (DE))

Session Classification: Facilities

Contribution ID: **57** Type: **Talk**

Recent test beam results of the ATLAS ITk Pixel detector

Monday, 17 April 2023 17:20 (20 minutes)

The High Luminosity program of the Large Hadron Collider (HL-LHC) will increase the beam's instantaneous luminosity up to $7.5 \cdot 10^{34} cm^{-2} s^{-1}$.
An upgrade of the ATLAS tracking detector, the Inner Tracker (ITk), is needed to cope with the resulting harsher radiation levels and number of tracks.
The outermost layers of the ITk pixel detector are designed to operate for the entire lifetime of the HL-LHC. The innermost layer, instead, will be exposed to a fluence up to almost $2 \cdot 10^{16} n_{eq}/cm^2$ (including safety factor) and is scheduled to be replaced after half of the HL-LHC program.
Planar silicon sensors will be used in most of the detector, while the innermost layer will be populated with 3D silicon sensors due to their inherent radiation hardness.
As long as pre-production sensors of different types and readout ASICs are becoming available, they are being tested in test beams both unirradiated and after irradiation.
A summary of recent results of the ATLAS ITk Pixel detector test beam campaigns will be presented.

Primary author: KRAUSE, Christopher (Technische Universitaet Dortmund (DE))

Presenter: KRAUSE, Christopher (Technische Universitaet Dortmund (DE))

Session Classification: Experiments - LHC

Contribution ID: **58** Type: **Tutorial**

Hands-on: Create a Career that Suits You: Set Yourself Up for Lucky Coincidences!

Thursday, 20 April 2023 13:30 (2 hours)

Career Counselling with an expert trainer in a small group.
The aims of this hands-on tutorial are to

- Create awareness on strategic career planning
- Reflect on your own expertise and values
- Use tools to be your own advocate
- Know the power networking

We will use the methods of

- individual and group activities
- discussion and reflection

Primary author: LEEMANS, Annette (DESY)

Presenter: LEEMANS, Annette (DESY)

Session Classification: Hands-On Tutorial

Contribution ID: **60** Type: **Lecture**

Tracking in particle detectors

Thursday, 20 April 2023 09:00 (45 minutes)

The reconstruction of charged particle trajectories (often referred to as "tracking") is a critical aspect in many physics experiments and test beds. In this lecture, the key underlying concepts of tracking will be introduced, as well as common algorithmic approaches to the task, the considerations for detector design when optimising tracking performance, and dealing with experimental challenges such as detector misalignments.

Primary author: STYLES, Nicholas (Deutsches Elektronen-Synchrotron (DE))

Presenter: STYLES, Nicholas (Deutsches Elektronen-Synchrotron (DE))

Session Classification: Overview Lectures

Contribution ID: **61** Type: **Tutorial**

The Corryvreckan Test-Beam Reconstruction Framework — Hands-on

Thursday, 20 April 2023 13:30 (2 hours)

Corryvreckan is a software framework dedicated to the analysis of test-beam data. It employs a modular concept, providing algorithms for typical analysis steps like pixel masking, clustering, tracking, alignment and for the reconstruction of commonly investigated observables like detection efficiency, spatial and temporal resolution or material budget. This approach allows for a flexible configuration and adaption to a broad range of setups and devices, and explicitly includes the EUDAQ2 framework and the AIDA TLU.

This tutorial provides an introduction to the Corryvreckan framework, the use of different analysis modules and their configuration. A key point of Corryvreckan — the flexible event building mechanism — will be covered for a typical setup, making use of EUDAQ2 and the AIDA TLU. Finally, the use of Corryvreckan as a tool for online monitoring will be covered.

Primary author: FEINDT, Finn (Deutsches Elektronen-Synchrotron (DE))

Co-authors: SIMANCAS, Adriana (Deutsches Elektronen-Synchrotron (DE)); VIGNOLA, Gianpiero (Deutsches Elektronen-Synchrotron (DE))

Presenters: SIMANCAS, Adriana (Deutsches Elektronen-Synchrotron (DE)); FEINDT, Finn (Deutsches Elektronen-Synchrotron (DE)); VIGNOLA, Gianpiero (Deutsches Elektronen-Synchrotron (DE))

Session Classification: Hands-On Tutorial

Contribution ID: **62** Type: **Tutorial**

Hands-On: Silicon Detector Monte Carlo Simulations with Allpix Squared

Thursday, 20 April 2023 13:30 (2 hours)

Scope of the tutorial

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Primary authors: WENNLÖF, Håkan (Deutsches Elektronen-Synchrotron (DE)); DEL RIO VIERA, Manuel Alejandro (Deutsches Elektronen-Synchrotron (DE)); RUIZ DAZA, Sara (Deutsches Elektronen-Synchrotron (DE)); LACHNIT, Stephan (Deutsches Elektronen-Synchrotron (DE))

Presenters: WENNLÖF, Håkan (Deutsches Elektronen-Synchrotron (DE)); DEL RIO VIERA, Manuel Alejandro (Deutsches Elektronen-Synchrotron (DE)); RUIZ DAZA, Sara (Deutsches Elektronen-Synchrotron (DE)); LACHNIT, Stephan (Deutsches Elektronen-Synchrotron (DE))

Session Classification: Hands-On Tutorial

Contribution ID: **63** Type: **not specified**

Making the most out of your test beam time

Thursday, 20 April 2023 13:30 (4h 30m)

The infrastructure at the DESY II test beam facility allows for highly efficient data taking if utilised correctly. The combination of the AIDA-2020 Trigger-Logic-Unit (TLU) and the beam telescopes enables highly flexible modes of data taking to easily accommodate different sensors. Data driven and triggered devices can be integrated with an minimal overhead.

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Primary authors: HERKERT, Adrian (Deutsches Elektronen-Synchrotron (DE)); HUTH, Lennart (Deutsches Elektronen-Synchrotron (DE))

Presenters: HERKERT, Adrian (Deutsches Elektronen-Synchrotron (DE)); HUTH, Lennart (Deutsches Elektronen-Synchrotron (DE))

Session Classification: Hands-On Tutorial

Contribution ID: **64** Type: **Talk**

ElectronCT - Imaging using Low-Emittance Electron Beams

Tuesday, 18 April 2023 12:40 (20 minutes)

Recent developments in accelerator technolgies have led to an increasing interest in electron accelerators for the purpose of radiation therapy. In the context of FLASH radiotherapy, collimated electron beams with a kinetic energy in the order of 50 to 250 MeV are utilized with the prospect of reducing the damage to healthy tissue with respect to conventional electron radiotherapy.
This energy range at the same time allows for utlizing the electron beam for the purpose of imaging by exploiting the effect of multiple Coulomb scattering of charged particles in matter. The low dose deposited by such a beam renders this method a promising technique for medical imaging and could lead to synergies of therapy and diagnostics.

In this contribution, we present an imaging technique called electronCT, enabling two- and three-dimensional imaging by detecting the scattering power of electrons traversing a sample, applying silicon pixel detectors. This presentation comprises an overview over the techique and the experimental setup, simulation strategies as well as first results applying this measurement technique at the ARES linear accelerator at DESY.

Primary author: SPANNAGEL, Simon (Deutsches Elektronen-Synchrotron (DE))

Co-authors: SCHÜTZE, Paul (Deutsches Elektronen-Synchrotron (DE)); RUIZ DAZA, Sara (Deutsches Elektronen-Synchrotron (DE))

Presenter: SPANNAGEL, Simon (Deutsches Elektronen-Synchrotron (DE))

Session Classification: Experiments - Non-LHC

Contribution ID: **65** Type: **not specified**

Welcome: Beate Heinemann

DESY Director for Particle Physics

Primary author: HEINEMANN, Beate (DESY and University of Freiburg (Germany))

Presenter: HEINEMANN, Beate (DESY and University of Freiburg (Germany))

Session Classification: Welcome

Contribution ID: **66** Type: **not specified**

Welcome: Ingrid Maria Gregor

Monday, 17 April 2023 13:00 (10 minutes)

Presenter: GREGOR, Ingrid-Maria (DESY & Bonn University)

Session Classification: Welcome

Contribution ID: **67** Type: **not specified**

Welcome from IAC

Monday, 17 April 2023 13:10 (5 minutes)

Presenter: SCHÜTZE, Paul (Deutsches Elektronen-Synchrotron (DE))

Session Classification: Welcome

Contribution ID: **68** Type: **not specified**

Welcome from LOC

Monday, 17 April 2023 13:15 (10 minutes)

Presenter: SIMANCAS, Adriana (Deutsches Elektronen-Synchrotron (DE))

Session Classification: Welcome

Contribution ID: **69** Type: **not specified**

Introduction to hands-on tutorials

Monday, 17 April 2023 13:25 (5 minutes)

Primary author: SCHÜTZE, Paul (Deutsches Elektronen-Synchrotron (DE))

Co-author: ARLING, Jan-Hendrik (Deutsches Elektronen-Synchrotron (DE))

Presenters: ARLING, Jan-Hendrik (Deutsches Elektronen-Synchrotron (DE)); SCHÜTZE, Paul (Deutsches Elektronen-Synchrotron (DE))

Session Classification: Welcome

Contribution ID: **70** Type: **not specified**

Meet the industry

Thursday, 20 April 2023 16:00 (2 hours)

Companies/speakers for this session:

Nexperia - Atefeh Jafari, Hendrik Jansen, Christoph Senft, Julie Lu

Littelfuse - Alessia Renardi

Silipion IT-Solutions GmbH - Jan Eschweiler-Voecks

Session Classification: Hands-On Tutorial

Contribution ID: **71** Type: **not specified**

Announcements

Tuesday, 18 April 2023 13:00 (1 minute)

Primary authors: ARLING, Jan-Hendrik (Deutsches Elektronen-Synchrotron (DE)); ARLING, Jan-Hendrik (Deutsches Elektronen-Synchrotron (DESY))

Presenter: ARLING, Jan-Hendrik (Deutsches Elektronen-Synchrotron (DE))

Contribution ID: **72** Type: **not specified**

Announcements

Wednesday, 19 April 2023 13:00 (1 minute)

Primary authors: SIMANCAS, Adriana (Deutsches Elektronen-Synchrotron (DE)); DAVIS, Naomi Afiriyie (Deutsches Elektronen-Synchrotron (DE))

Presenters: SIMANCAS, Adriana (Deutsches Elektronen-Synchrotron (DE)); DAVIS, Naomi Afiriyie (Deutsches Elektronen-Synchrotron (DE))

Contribution ID: **73** Type: **not specified**

International Test Beam Coordinator Meeting

Thursday, 20 April 2023 12:30 (1 hour)

Remote connection also available.

Primary author: HOLZER, Eva Barbara (CERN)

Presenters: GERBERSHAGEN, Alexander (PARTREC, UMCG, University of Groningen (NL)); HAST, CARSTEN; HOLZER, Eva Barbara (CERN); NINER, Evan (Fermilab); BURKART, Florian; STEPHAN, Frank (DESY); NAKAMURA, Isamu (Department of Physics); STANITZKI, Marcel (Deutsches Elektronen-Synchrotron (DE)); SCHWINZERL, Martin (CERN); PASTIKA, Nathaniel Joseph (Fermi National Accelerator Lab. (US)); MEYNERS, Norbert (Deutsches Elektronen-Synchrotron (DE)); KORYSKO, Pierre (University of Oxford (GB)); DIENER, Ralf

Contribution ID: **74** Type: **not specified**

Announcements

Thursday, 20 April 2023 12:40 (1 minute)

Presenter: ARLING, Jan-Hendrik (Deutsches Elektronen-Synchrotron (DE))