Nuclear, Particle and Astrophysics (TASK)

This session has been organised in collaboration with CHIPP.

Tuesday, 10.09.2024, Room ETA F 5

Time	ID	TASK I: Detector and Performance I *Chair: Ben Kilminster, Universität Zürich*
14:00	301	**Tests and results of the power components of the ATLAS Inner Tracker detector readout system.** *Lucas Mollier, Universität Bern* The LHC at CERN will undergo significant upgrades to enhance the collision rate in the High Luminosity LHC (HL-LHC), necessitating improvement of the ATLAS detector regarding higher resolution and efficiency. The Inner Detector will be replaced by the Inner Tracker. The transmission of the data signal will be handled by the Optosystem, managing the data and responsible for the opto-electrical conversion to send the data efficiently from the ATLAS high radiation area. The Powerboard was designed to power the Optosystem by converting the provided voltage to lower levels, suitable for other Optosystem's components. Tests performed on the Powerboard to ensure its good functionality during the HL-LHC runs will be presented.
14:15	302	**Performance tests of the ATLAS Inner Tracker Pixel detector opto-electrical conversion system** *Marianna Glazewska, Universität Bern* The High Luminosity LHC will commence operation in 2029. A projected pileup of around 200 will result in consequences for data analysis complexity and radiation environment severity. The latter necessitates the replacement of the ATLAS Inner Detector with the all-silicon Inner Tracker (ITk). The Optosystem is a crucial part of the ITk readout system, performing data serialization, equalization and opto-electrical conversion with dedicated ASICs mounted on Optoboards, which are housed in Optopanels. This talk will summarize work carried out at CERN and the University of Bern, including: the final Optoboard version irradiation campaign, the development of a setup for methodical Optoboard testing, and Optopanel mechanical tests.
14:30	303	**Data transmission tests of the ATLAS Inner Tracker Detector opto-electrical conversion system.** *Una Helena Alberti, Universität Bern* Following Run III of the LHC, the ATLAS Inner Detector will undergo a series of upgrades to cope with the high radiation environment of the High Luminosity LHC. The Optosystem is the opto-electrical conversion system dedicated to the readout of the ATLAS Inner Tracker (ITk) Pixel detector that will replace the pixel detector of the Inner Detector. The testing of electrical characteristics of the components of the Optosystem and the full data transmission chain is crucial. In this talk, I will present results of the data transmission and time-domain reflectometer measurements of the Optosystem as well as the current status of Optosystem tests at Bern.
14:45	304	**Timing measurement ASIC using LGAD for possible HL-LHC upgrade** *Abderrahmane Ghimouz, Paul Scherrer Institut* The Compact Muon Solenoid (CMS) experiment at CERN will undergo a major upgrade for the high-luminosity phase of the LHC (HL-LHC) starting in 2029. In addition to improving the detector rate capabilities and performance at higher luminosities, precision timing measurements are added to mitigate pile-up effects. We plan the extension of the timing capabilities to cover the full tracker acceptance up to $\eta = 4$ using Low Gain Avalanche Detectors (LGAD). Here, we present the design efforts towards a readout Application-specific integrated circuit (ASIC) capable of operating with LGAD pixel detectors. It is designed in a 28 nm CMOS technology, to process efficiently the signals from the LGADs.

15:00	**305**	**Radiation hardness and annealing, strategies for space application of silicon photomultiplier technologies on a quasi-polar LEO orbit** *Shideh Davarpanah, DPNC, Université de Genève* While silicon photomultipliers (SiPMs) offer advantages over traditional photomultipliers, their adoption into space missions undergo challenges due to induced degradation by cosmic radiation. The University of Geneva, GSSI and FBK Research Foundation collaborate to define SiPMs for Terzina Cherenkov telescope by studying radiation hardness and light noise in situ. Using 50 MeV proton-beam and beta-radioactive source, we estimate radiation damage on SiPMs and compare results with simulated ionizing and non-ionizing effects via SPENVIS-Geant4. We developed an annealing approach suitable for a space-based middle-size satellite to limit effect of radiation damage while efficiently lowering SiPM's energy detection threshold. We will describe the mission and focus on this aspects critical for its success.
15:15	**306**	**CMS ECAL on-detector readout electronics radiation tests** *Nico Härringer [1], Günther Dissertori [1], Tomasz Gadek [1], Christian Haller [1], Nikitas Loukas [2], Werner Lustermann [1], Alexander Singovski [2], Krzysztof Stachon [1]* *[1] ETH Zürich, [2] University of Notre Dame (US)* In preparation of the operation of the CMS electromagnetic calorimeter (ECAL) barrel at the High Luminosity Large Hadron Collider (HL-LHC) the entire on-detector electronics will be replaced. The new readout electronic comprises 12240 very front end (VFE), 2448 front end (FE) and low voltage regulator (LVR) cards arranged into readout towers (RTs) of five VFE, one FE and one LVR cards. The results of testing one RT of final prototype cards at CERN's CHARM mixed field facility and PSI's proton irradiation facilities are presented. They demonstrate the proper functioning of the new electronics in the expected radiation conditions.
15:30	**307**	**TEPX Detector for the CMS Inner Tracker Upgrade: Module Production Status and Plans** *Amrutha Samalan, Paul Scherrer Institute* As part of the Phase-2 upgrade of the Compact Muon Solenoid (CMS) experiment for the upcoming High Luminosity phase of LHC (HL-LHC), the Inner Tracker (IT) of CMS will be replaced with a new detector featuring increased rate capability, higher granularity, and improved radiation hardness. Furthermore the tracking coverage is extended up to $\lvert\eta\rvert \approx 4$ by the Tracker Extended PiXel (TEPX) system consisting of four large double disks on each end. The status of the production of the TEPX sensor modules at the assembly sites, results of module testing, and the roadmap toward installation in 2028 will be presented.
15:45	**308**	**MONOLITH - picosecond capability in a high granularity monolithic silicon pixel detector** *Matteo Milanesio, Giuseppe Iacobucci, Lorenzo Paolozzi, Université de Genève* The MONOLITH H2020 ERC Advanced project aims at producing a high-granularity monolithic silicon pixel detector with picosecond-level time stamping. To obtain such extreme timing the project exploits: i) a fast and low-noise SiGe BiCMOS electronics; ii) a novel sensor concept, the Picosecond Avalanche Detector (PicoAD), that uses a patented multi-PN junction to engineer the electric field and produce a continuous gain layer deep in the sensor volume. The proof-of-concept monolithic PicoAD demonstrator provided full efficiency and 13 ps at the center of the pixel. A batch of PicoAD prototypes with different geometries and gain-layer implant doses was delivered in January 2024; testbeam results will be shown.
16:00		***Coffee Break***

Time	ID	**TASK II: Detector and Performance II** *Chair: Marcelle Soares-Santos, Universität Zürich*
16:30	**311**	**Production and Qualification of the Vertex Detector for the Mu3e Detector** *Thomas Christian Senger, University of Zurich* The Mu3e experiment aims to detect charged lepton flavor violation through the decay chain $\mu^+ \rightarrow e^+ e^- e^+$. With sensitivities of 10^{-15} in its initial phase and 10^{-16} in the final phase, it improves upon prior experiments by four orders of magnitude. The innovative experimental concept is based on a tracking detector built from novel ultra-thin silicon pixel sensors and scintillating fibres and tiles. The upcoming discussion will spotlight the production of the Vertex detector and the qualification of Mupix 11 pixel sensor modules. It will delve into the challenges associated with data transmission, particularly concerning connections via micro-twisted pair cables.
16:45	**312**	**Construction and Commissioning Status Report on Mu3e Experiment** *Yifeng Wang, ETH Zurich* Mu3e is an experiment under construction at the Paul Scherrer Institute dedicated to the search for the charged lepton flavor violating muon decay, $\mu \rightarrow eee$, at branching fractions of 10^{-16}, extending the results from SINDRUM by four orders of magnitude. To track low momentum particles while maintaining good vertex and timing resolution, a combined 4D tracking system integrating HV-MAPS, scintillating fiber and tile technology is employed. Furthermore, to tackle the high data rate of 100 Gbits/s the DAQ chain uses FPGA boards and a farm equipped with GPUs for track reconstruction and rate reduction. Construction and commissioning status of the scintillating fiber detector will be reported.
17:00	**313**	**Cryogenic Characterization of Neutron-Irradiated SiPMs** *Esteban Curras Rivera, Guido Haefeli, EPFL* The current tracker detector of the LHCb experiment, based on Scintillating Fibres (SciFi) coupled to silicon photomultipliers (SiPMs), will be upgraded for the HL-LHC operations. The SiPMs will be exposed to a radiation environment, mainly dominated by fast neutrons, that will reach 3×10^{12} neq/cm^2 at the end of their lifetime. This will degrade their performance and compromise the overall efficiency of the whole experiment. To cope with this problem, cryogenic cooling with liquid Nitrogen is being investigated as a possible solution to mitigate the performance degradation of the SiPMs induced by radiation damage. The effect of the cryogenic operation on key parameters of neutron-irradiated SiPMs is going to be presented.
17:15	**314**	**The Outer Detector of the LUX ZEPLIN dark matter direct detection experiment** *Harvey Birch, University of Zurich* LUX-ZEPLIN (LZ) is centered on a liquid xenon time projection chamber (LXe-TPC) searching for nuclear recoils induced by Weakly Interacting Massive Particles. One of the backgrounds for LZ are neutrons, as they result in nuclear recoils in the TPC. Surrounding the TPC is an Outer Detector which is used to veto neutron events in the TPC. The Outer Detector consists of 17 t of gadolinium-loaded liquid scintillator confined in acrylic tanks surrounding the TPC and 238 t of high purity water as the outermost layer. This volume is monitored by 120 PMTs to detect light from particle interactions. I will present an overview of the LZ Outer Detector and its performance.
17:30	**315**	**Outer Detector Energy Calibration of the LUX-ZEPLIN Experiment** *Miguel Hernandez, Universität Zürich* The LUX-ZEPLIN (LZ) experiment is a dual-phase liquid xenon time projection chamber aiming to make direct observation of weakly interacting massive particles (WIMPs). LZ published first results of data taken from December 2021 to May 2022, finding it consistent with background only, no WIMP hypothesis. Ensuring the accuracy of detector response with calibrations is vital. In the case of the neutron veto, the Outer Detector (OD), three calibration source deployment tubes are employed to ensure sufficient spatial calibration. I will present an overview of the OD energy calibration, with gamma sources ranging from 122 keV to 4.44 MeV, used to ensure the accuracy of the gadolinium neutron capture response.

17:45	**316**	**Results from low temperature wafer-wafer bonded pad-diodes for particle detection** *Johannes Martin Wüthrich, André Rubbia, ETH Zurich* Low-temperature covalent wafer-wafer bonding enables the creation of novel types of semiconductor particle detectors, including the monolithic integration of high-Z materials with conventional CMOS sensors. To investigate the influence of the bonding interface on the signal formation within such structures simple bonded pad diodes have been fabricated. We present results from two different fabrication runs. Initial results showed that these types of structures are very sensitive to trace contaminations which can distort their depletion behaviour. But we show that even under non-ideal bonding conditions, the resulting signals can be fully predicted from first principles based on the extended Shockley-Ramo theorem.
18:00		
18:30		***CERN 70***
19:45		***Postersession with Apéro***

Wednesday, 11.09.2024, Room ETA F 5

Time	ID	**TASK III: Low energy I** *Chair: Luis Miguel Garcia Martin, EPF Lausanne*
14:30	**321**	**The n2EDM experiment - A search for new physics at the precision frontier** *Wenting Chen, PSI Villigen, on behalf of the nEDM Collaboration* The permanent neutron electric dipole moment (nEDM) is a very sensitive probe for exploring physics beyond the standard model at the low energy frontier, particularly regarding charge-parity (CP) violation. With the ultracold neutron (UCN) source at the Paul Scherrer Institut providing high neutron statistics and the new apparatus, the n2EDM experiment aims to measure the nEDM with a sensitivity an order of magnitude higher than the current best measured limit of 1.8×10^{-26} e·cm. This talk will present an overview of the experiment and preliminary results from the first commissioning measurements. Supported by SNF #204118
14:45	**322**	**An Active Magnetic Shield for the n2EDM Experiment - Simulation and Optimization** *Sergey Ermakov [1], Vira Bondar [1], Klaus Stefan Kirch [1,2], Patrick Mullan [1], Nathalie Ziehl [1]* *[1] ETH Zürich, [2] PSI Villigen* The n2EDM experiment at PSI aims to improve upon the best sensitivity measurements of the neutron electric dipole moment. This requires a stable and uniform magnetic field environment. To achieve this, a large system of coils surrounding the experimental area is implemented, called the Active Magnetic Shield (AMS). The AMS is engineered to counteract magnetic disturbances via a feedback loop mechanism. This system effectively compensates static and variable fields up to the sub-hertz frequency range, with magnitudes of up to 50 μT. This talk introduces the operational principle of the AMS and discusses simulations and optimizations via genetic algorithms to enhance the system's performance. Research supported by SNSF grant: 200441.

15:00	**323**	**An efficient spin transport system for ultracold neutrons in the n2EDM experiment** *Gian Luca Caratsch, PSI Villigen, for the n2EDM collaboration* The n2EDM experiment at the Paul Scherrer Institut (PSI) aims to improve the sensitivity of the measurement of the neutron electric dipole moment by a factor of ten. The neutron polarization must be conserved all along their path in the apparatus. To rotate the spin of the ultracold neutrons adiabatically with the magnetic field vector, spin transport coils (STC) are installed. We present the characterization of the magnetic fields produced by these coils, and the determination of the spin transport efficiency. To compensate background fields, the STC will be extended with additional coils. The research is funded by SNF 200021_212754.
15:15	**324**	**A high-sensitivity Cesium magnetometer array for the n2EDM experiment** *Victoria Kletzl, Paul Scherrer Institut, on behalf of the NEDM Collaboration* To increase the sensitivity of the neutron electric dipole moment (nEDM) by at least a factor of 10, next generation experiments will require corresponding improvements in statistics and systematics. The n2EDM experiment, currently being commissioned at the Paul Scherrer Institut, will employ an array of 112 optically pumped Cesium vapor magnetometers, measuring the magnetic field map with pT sensitivity. This will help to characterize and reduce field gradients in the central apparatus up to seventh order, largely improving systematics. This talk will give an introduction to the systematic effects induced by magnetic field inhomogeneities, as well as an overview and status report on the Cesium magnetometer array. Supported by SNF#188700.
15:30	**325**	**The muEDM experiment at PSI** *David Höhl, Philipp Schmidt-Wellenburg, Paul Scherrer Institut* At PSI a high precision experiment is being set up to search for the muon electric dipole moment (muEDM) employing the frozen-spin technique. A muEDM larger than the Standard-Model prediction would be a sign for new physics. The search is conducted in two phases with a final precision of $6 \cdot 10^{-23}$ e·cm. Eventually, this will improve the current best limit by three orders of magnitude. The EDM signal is measured by detecting an emission asymmetry of decay positrons from stored muons in a solenoid. This talk covers the basic principles of the experiment, the experimental setup and its development, test measurements towards the final experiment, and gives an outlook onto the experiment.
15:45	**326**	**Preliminary Results for the Injection Studies at Low Magnetic Fields for the muEDM Experiment** *Diego A. Sanz-Becerra, Paul Scherrer Institut, on behalf of the muEDM collaboration* The muEDM experiment at PSI aims to directly measure the electric dipole moment (EDM) of antimuons. In December 2023, a test beam was conducted to test the injection of muons at low magnetic fields for the muEDM experiment. The focus was to validate detector prototypes for use in the experiment and to assess changes in the momentum of the injected muons after altering the magnetic conditions, which are crucial for the muEDM experiment. Preliminary results confirm the performance of the detector prototypes and the control of the momentum of the injected muons within the systematic limits needed for the experiment. This presentation will outline the experimental approach, data analysis, and the implications of the preliminary results of the test beam.

16:00	**327**	**Muonic Atom Spectroscopy of ^{238}U** *Anastasia Doinaki, Paul Scherrer Institut, for the MuX collaboration* Muonic atom spectroscopy can be used to determine nuclear charge radii as muons orbit close to the nucleus, making them highly sensitive to nuclear properties. The muX experiment aims to determine the nuclear charge radius of Radium-226. However, radioactive isotopes are available only in microscopic quantities. To address this, the muX collaboration developed a novel technique based on transfer reactions in a high pressure hydrogen/deuterium gas mixture. Once captured, the muons cascade down to their ground state, emitting characteristic X-rays whose energy provides insights into nuclear properties. In the case of Uranium-238, the muonic spectrum has been analyzed, studying the cascade behaviors associated with direct and transfer muon capture.
16:15		
16:30		***Coffee Break***
		TASK IV: Low energy II *Chair: Klaus Kirch, PSI Villigen & ETH Zürich*
17:00	**331**	**Measurement of the X17 anomaly with the MEG II detector** *Giovanni Dal Maso, Paul Scherrer Institut, for the MEG II Collaboration* In 2016 the ATOMKI collaboration measured an anomaly in the angular distribution of the pair produced by the M1 transition of the isoscalar 1+ state on ^{8}Be, which might be explained by creation and decay of a boson, the X17, with mass 17.0 MeV/c^{2}. The result was later confirmed in the 0-/0+ transition in Helium. The apparatus of the MEG II experiment has been employed at the beginning of 2023 to measure such anomaly with a LiPON target and a different detection technique based on the COBRA spectrometer and the Cylindrical Drift Chamber. We present the status of the measurement.
17:15	**332**	**Results of the neutron to mirror-neutron oscillations at PSI** *Nathalie Ziehl, ETH Zürich, on behalf of the nn' collaboration* Mirror-particles as hidden-sector copies of standard model particles could provide answers for several standing issues in particle physics. Mirror neutrons, for instance, could provide baryon number violation and be viable candidates for dark matter. The mirror-neutron experiment at PSI was designed to search for anomalous disappearances of ultracold neutrons in the presence of varying non-zero magnetic field. It completed operation in 2021, testing a mirror magnetic field from 5 μT to 109 μT, and found no evidence for anomalous neutron losses. We provide an in-depth look at the data analysis based on Monte Carlo simulations and precise magnetic field maps and present new limits on the oscillation time.
17:30	**333**	**High-Resolution Spectroscopy of Muonic Lithium - First Steps and Prospects of the QUARTET Experiment** *Katharina von Schoeler [1], Andreas Abeln [2], Thomas Elias Cocolios [3], Marie Deseyn [3], Ofir Eizenberg [4], Andreas Fleischmann [2], Loredana Gastaldo [2], Cesar Godinho [5], Michael Heines [3], Paul Indelicato [6], Klaus Stefan Kirch [1,7], Andreas Knecht [7], Daniel Kreuzberger [2], Jorge Machado [5], Ben Ohayon [4], Nancy Paul [8], Randolf Pohl [9], Daniel Unger [2], Stergiani Marina Vogiatzi, Frederik Wauters [9], Aziza Zendour [7] [1] ETH Zürich, [2] Heidelberg University, [3] KU Leuven, [4] Technion IIT, [5] NOVA, [6] CNRS, [7] Paul Scherrer Institut, [8] Laboratoire Kastler Brossel, [9] Johannes Gutenberg University Mainz* Accurate measurements of nuclear charge radii are essential for QED tests and benchmarking nuclear structure theory. Muonic atom spectroscopy is a particularly suited tool for measuring the RMS radii of nuclear charge distributions and has successfully provided data for very light and heavier nuclei. However, the energy range (~ 20 - 200 keV) for elements from lithium to neon remains poorly studied, due to technological limitations in conventional spectroscopy methods. Addressing this, the QUARTET collaboration uses cryogenic metallic magnetic calorimeters (MMCs) for high-resolution spectroscopy of light muonic atoms. A pivotal test beam in October 2023 at the Paul Scherrer Institute demonstrated the potential of MMCs, showcasing the first high-resolution spectra of muonic lithium.

17:45	**334**	**Radiative corrections and Monte Carlo tools for low-energy $e^+ e^-$ experiments** *Sophie Kollatzsch, Paul Scherrer Institut* The development of radiative corrections and Monte Carlo tools for low-energy e^+e^- experiments is relevant for high-precision tests of the Standard Model, such as the determination of the leading hadronic contribution to the muon (g – 2) or the electroweak precision fits. Recently, there has been a renewed initiative to compare Monte Carlo tools. The main aim is to compare the available codes for benchmark scenarios relevant to both scan experiments (such as CMD) and radiative return experiments (such as KLOE). These codes include QED corrections at fixed order and/or resummation effects for $e^+e^- \to X^+X^-(\gamma)$ for $X \in \{e, \mu, \pi\}$. We will present their findings.
18:00	**335**	**Probing neutrinoless double beta decay with LEGEND** *Aravind Remesan Sreekala, Matteo Agostini, Abigail M. Alexander, Gabriela Rodrigues Araujo, University of Zurich* The dominance of matter over antimatter is one of the most puzzling questions in particle physics and cosmology. Since the Standard Model prohibits reactions violating the lepton number, the answer may lie in Beyond SM processes. The LEGEND experiment is designed to probe one such reaction: the neutrinoless double beta ($0\nu\beta\beta$) of ^{76}Ge. Observing this decay would shed light on the matter-antimatter asymmetry, the absolute neutrino mass scale and order, and definitively prove the Majorana nature of neutrinos. Since 2023, LEGEND has been operating 142 kg of ^{76}Ge detectors placed in an active LAr shield, aiming to achieve a half-life sensitivity exceeding 10^{27} years after an exposure of 1 tonne-year.
18:15		

Wednesday, 11.09.2024, Room ETZ E 7

Time	**ID**	**TASK V: Physics at LHCb** *Chair: Paolo Crivelli, ETH Zürich*
17:00	**341**	**Heavy flavour spectroscopy at LHCb** *Daniel Charles Craik, University of Zurich* Spectroscopy of hadrons containing heavy-flavour quarks provides essential inputs to test models of quantum chromodynamics. I will present some of the latest spectroscopy results from LHCb, covering both conventional and exotic hadrons.
17:15	**342**	**Measurement of the branching ratio of $B^+ \to K^+\pi^+\pi^-\mu^+\mu^-$ at LHCb** *Anni Kauniskangas, EPFL* Precision measurements of rare particle decays have gained significant interest as a way of indirectly searching for new physics. In these indirect searches, the properties of the rare decays are measured to a high precision in order to look for discrepancies between the experiment and the SM predictions that could be caused by new particles intervening with the decay. This contribution describes an ongoing measurement of the branching ratio of the rare decay $B^+ \to K^+\pi^+\pi^-\mu^+\mu^-$ using data from the LHCb experiment at CERN.

17:30	343	**Search for the $B_s^0 \to \mu^+\mu^-\gamma$ decay with photon conversions** *Raphael van Laak, EPFL* Flavor-changing neutral currents, forbidden at tree level in the Standard Model, serve as sensitive indicators of new physics. A particularly promising channel is the decay $B_s^0 \to \mu^+\mu^-\gamma$, which is unaffected by chiral suppression, unlike its nonradiative counterpart. Leveraging recent studies at LHCb, we introduce a novel detection technique that employs photon conversion in the VELO detector to analyze proton-proton collision data, corresponding to an integrated luminosity of 5.4 fb^{-1} at $\sqrt{s}$ = 13 TeV. This method aims to refine and extend the existing limits on the branching fraction, enhancing our understanding of the underlying physics.
17:45	344	**Measurement of BR($B_s \to K_S K_S$) with Run 2 LHCb data** *Kerim Guseinov, Luis Miguel Garcia Martin, Radoslav Marchevski, EPFL* The decays $B_{(s)}^0 \to K_S^0 K_S^0$ proceed via flavor-changing neutral currents that are suppressed in the Standard Model and therefore provide greater sensitivity to new physics. And the latest measurements of their branching fractions exhibit some tension with the SM. Since the time of the existing measurement, the LHCb experiment has collected a large amount of data and had several improvements to its online selection. This allows one to significantly improve the precision using Run 2 data. The current work presents a status report on the ongoing measurement of the $B_S^0 \to K_S^0 K_S^0$ and $B^0 \to K_S^0 K_S^0$ branching fractions.
18:00	345	**Search for $K^0 \to \pi^+\pi^-\mu^+\mu^-$ decays with the Run II LHCb data** *Luis Miguel Garcia Martin, EPFL* Rare Kaon meson decays serve as highly sensitive probes for both heavy and light New Physics. Notably, the $K_S \to \pi^+\pi^-\mu^+\mu^-$ process, which is of order 10^{-14} in the Standard Model (SM), holds the potential to be enhanced by up to a factor of 100 in exotic Beyond the Standard Model (BSM) scenarios. The analysis of the $K_S \to \pi^+\pi^-\mu^+\mu^-$ decay is anticipated to exhibit high cleanliness owing to the exceptional performance of the LHCb experiment in pion and muon reconstruction. Results for $K_L \to \pi^+\pi^-\mu^+\mu^-$ will also be provided, for which there are no SM predictions. Herein, we present the current progress on the exploration of the $K_S \to \pi^+\pi^-\mu^+\mu^-$ decay utilizing data from 2016-2018 of the LHCb experiment.
18:15	346	**Search for violation of leptonic universality in Semileptonic Hyperon Decays in LHCb** *Alexandre Brea Rodriguez, EPFL - LPHE* Theoretical studies have demonstrated that Semileptonic Hyperon Decays (SHD) can be sensitive to BSM dynamics that break lepton flavour universality (LFU). The LFU test observable, defined as the ratio between muon and electron modes, is sensitive to non standard contributions. This talk will present the current status of the $\Lambda \to p\mu^-\bar{\nu}_\mu$ branching ratio measurement using Run 2 LHCb data. Additionally, prospects for other SHD measurements will be discussed.
18:30	347	**Search for the $B_{(c)}^+ \to \tau^+\nu_\tau$ decay at LHCb** *Rita de Sousa Ataide da Silva, Fred Blanc, Alexandre Brea Rodriguez, EPFL - LPHE* The decay process $B_{(c)}^+ \to \tau^+\nu_\tau$ offers a direct experimental determination of the CKM element V_{ub} (V_{cb}), contributing to precision tests of the Standard Model. Additionally, the observation of this decay holds potential for probing extensions of the Standard Model, e.g. the two-Higgs doublet model and supersymmetry. We aim to measure the $B_{(c)}^+ \to \tau^+\nu_\tau$ branching fraction using the decay mode $\tau^+ \to \pi^+\pi^-\pi^+\bar{\nu}_\tau$ at LHCb, which poses a significant challenge due to the presence of two neutrinos in the final state. In this presentation we introduce novel techniques designed for the study of this decay in the challenging hadronic environment of the LHCb experiment.

18:45	**348**	**Search for axion-like particles at LHCb** *Pasquale Andreola, University of Zurich* Axion-like particles (ALPs) are hypothetical particles predicted in many extensions of the Standard Model (SM). ALPs can mediate the interactions between dark and ordinary matter, coupling to the different SM bosons. Thanks to its full software trigger and excellent vertex resolution, the LHCb experiment has excellent sensitivity for different ALPs, even at low masses, thus playing a unique role in the search for ALPs at LHC. Some results from searches for ALPs will be presented. An outlook on searches for ALPs coupling to gluons, such as axion-like particles decaying into pions, will be discussed.
19:00	**349**	**BDF/SHiP at the SPS ECN3 high-intensity beam facility** *Martina Ferrillo, University of Zurich* The SHiP experiment is a pioneering initiative proposed at the CERN ECN3 to establish a general-purpose fixed target facility. Its primary objective is to explore the Hidden Sector portals domain and the potential discovery of novel particles envisaged in extensions of the Standard Model with unprecedented sensitivity. The central aim of the SHiP experiment is to unveil the existence of Feebly Interacting Particles (FIP) within the mass spectrum below 10 GeV, by directing a high-intensity 400 GeV/c proton beam onto a hybrid thick target to probe elusive particles. In this talk I will discuss the experimental proposal and detector layout.
19:15		

Thursday, 12.09.2024, Room ETA F 5

Time	ID	TASK VI: Machine Learning *Chair: Alexandre Brea Rodriguez, EPFL*
14:00	**351**	**Machine Learning Methods for Top Reconstruction using the ATLAS Experiment** *Daniele Dal Santo, Universität Bern* The application of state-of-the-art machine learning (ML) techniques based on graph or transformer architectures for LHC collision event reconstruction and classification will be presented. A focus is put on the application of ML methods to events which feature 2 top quarks and a large missing transverse momentum. Those events are especially interesting for searches beyond the standard model. ML helps to overcome the combinatorial challenge of matching each top decay product with the correct parent particle. As a benchmark, these techniques are applied to the search for a scalar partner of the top quark in all-hadronic tt-MET final states with data collected during Run-2 and Run-3 with the ATLAS detector.
14:15	**352**	**Anomaly detection techniques for ATLAS calorimeter data quality monitoring** *Vilius Čepaitis, Steven Schramm, Université de Genève* The ATLAS detector at the LHC records vast amounts of data. To ensure excellent detector performance, a number of checks are performed both during and after data-taking. This study introduces a prototype algorithm designed to automatically identify detector anomalies in ATLAS liquid argon calorimeter data. The data is represented as a multi-channel time series, corresponding to average calorimeter energy cluster properties. In this work, we investigate the capability of unsupervised machine learning techniques, such as autoencoders, to detect transient detector issues. Such tools are planned to be implemented to identify previously-unknown detector issues and significantly facilitate data quality shifter work.

14:30	**353**	**Pileup for physics: building a novel hadronic physics dataset** *Carlos Moreno Martinez, Mario Alves Cardoso, Antti Pirttikoski, Steven Schramm, Vilius Čepaitis, Université de Genève* Pileup, or the presence of multiple independent proton-proton collisions within the same bunch-crossing, is critical to the production of enormous datasets at the LHC. However, the typical LHC physics analysis only considers a single collision in each bunch crossing; the pileup collisions are viewed as an annoyance to be rejected. By reconstructing these pileup collisions, it is possible to access an enormous dataset of hadronic physics processes. In this contribution, we motivate this new approach, and describe the procedure used to reconstruct pileup collisions. We then use data recorded by the ATLAS Detector during Run 2 of the LHC to demonstrate the validity of this approach to traditional datasets.
14:45	**354**	**Mitigating experimental challenges in using pileup for physics** *Mario Alves Cardoso, Carlos Moreno Martinez, Antti Pirttikoski, Steven Schramm, Vilius Čepaitis, Université de Genève* Pileup, or the presence of multiple independent proton-proton collisions within the same bunch-crossing, is critical to the production of enormous datasets at the LHC. However, the typical LHC physics analysis only considers a single collision in each bunch crossing; the pileup collisions are viewed as an annoyance to be rejected. By reconstructing these pileup collisions, it is possible to access an enormous dataset of hadronic physics processes. In this contribution, we detail some experimental challenges associated with the pileup dataset as recorded by the ATLAS Detector. Examples include selection biases and the treatment of physics objects that overlap in the detector, but which originate from different proton-proton collisions.
15:00	**355**	**Extracting the jet energy resolution from pileup collisions** *Antti Pirttikoski, Mario Alves Cardoso, Carlos Moreno Martinez, Steven Schramm, Vilius Čepaitis, Université de Genève* Pileup, or the presence of multiple independent proton-proton collisions within the same bunch-crossing, is critical to the production of enormous datasets at the LHC. However, the typical LHC physics analysis only considers a single collision in each bunch crossing; the pileup collisions are viewed as an annoyance to be rejected. By reconstructing these pileup collisions, it is possible to access an enormous dataset of hadronic physics processes. In this contribution, we demonstrate the extraction of a physical quantity, the jet energy resolution, using data recorded by the ATLAS Detector during Run 2 of the LHC. Comparisons of results using pileup collisions with those from the traditional dataset are presented.
15:15	**356**	**Machine Learning in b → s ll** *Jason Aebischer, University of Zurich* Short-distance (SD) effects in b → s ll transitions can give large corrections to the SM prediction. They can however not be computed from first principles. In my talk I will present a neural network, that takes such SD effects into account, when inferring the Wilson coefficients C9 and C10 from b → s ll angular observables. The model is based on likelihood-free inference and allows to put stronger bounds on new phyiscs scenarios than conventional global fits.
15:30	**357**	**Leveraging transformers and RL to identify key b-hadron backgrounds** *Guillermo Hijano Mendizabal, William Sutcliffe, University of Zurich* Experimental measurements of b-hadron decays encounter a broad spectrum of backgrounds due to the numerous possible decay channels with similar final states. Additionally, computational limitations necessitate simulating only the most significant backgrounds. Identifying the leading backgrounds requires a careful analysis of the final state particles, potential misidentifications and kinematic overlaps. This talk introduces an innovative approach utilizing transformer networks and reinforcement learning to determine the critical backgrounds impacting measurements of b- hadron decays.

15:45	**358**	**Towards an AI-based trigger system for the next-generation of imaging atmospheric Cherenkov telescope cameras** *Tjark Miener, Université de Genève* Imaging atmospheric Cherenkov telescopes (IACTs) observe extended air showers (EASs) initiated by the interaction of very-high-energy gamma rays and cosmic rays with the atmosphere. Besides the Cherenkov light emitted by the EAS, the IACT cameras continuously record light from the night sky background (NSB). The trigger and data acquisition system of IACT cameras is designed to reduce the NSB and electronic noise by carrying out an on-the-fly event selection process. We present some prospective studies for an application of an Artificial-Intelligence-based trigger system for the next-generation of IACT cameras. As a high-level step of the novel trigger system, we show that gamma/hadron separation could be performed at trigger-level.
16:00	**359**	**Deep Learning-Based Data Processing in Large-Sized Telescopes of the Cherenkov Telescope Array: FPGA Implementation** *Carlos Abellan Beteta, Iaroslava Bezshyiko, University of Zurich* The Large-Sized Telescope (LST) is one of the three telescope types being built as part of the Cherenkov Telescope Array Observatory (CTAO). A next-generation camera that can be used in future LSTs is currently being developed. One of the main challenges is the 1 GHz sampling rate baseline. After filtering events, the data rate must be reduced to around 30 kHz. To achieve such a large reduction, several trigger stages will be designed and implemented in FPGA. The final trigger stage is a real-time deep learning algorithm.We will focus on porting this algorithm to FPGAs by using two different approaches: the Intel AI Suite and the hls4ml packages.
16:15	**360**	**Neutrino interaction classification in SND@LHC based on Graph Neural Network** *Zhibin Yang, EPFL* The SND@LHC is a compact experiment that aims to observe and measure high flux of energetic neutrinos of all flavours from the LHC. Identifying neutrino interaction against the large background from neutral hadrons and muons is one of the main challenges. Current identification methods are based on reconstructing muon tracks and hit multiplicity, and only consider events that are in a fiducial region of the target. We investigate the use of Graph Neural Network (GNN), where each hit is considered as a node and their relation can be learned as edge feature, to the specific use case of neutrino interaction classification with only electronic data. We evaluated our End-to-End classification method using simulated events, and the performance of identifying muon neutrinos and electron neutrinos is promising.
16:30		***Coffee Break***
		TASK VII: New physics searches at CERN *Chair: Daniel Craik, Universität Zürich*
17:00	**361**	**Search for Axion-Like Particles in Photonic Final States with the FASER Detector at the LHC** *Noshin Tarannum, Université de Genève* FASER, an experiment at the LHC, aims to search for light, weakly interacting particles produced in proton-proton collisions at the ATLAS interaction point and travel in the far-forward direction. First search of detecting a light, long-lived particle decaying into photon pairs, using 2022 and 2023 collision data will be reported. Targeting axion-like particles (ALPs) primarily coupling to weak gauge bosons, the analysis identifies one event against an expected background of 0.42 ± 0.38 events, largely due to neutrino interactions. This yields world-leading constraints on ALPs of masses up to 300 MeV and coupling strengths of around 10^{-4} GeV^{-1}, exploring previously unexplored region of parameter space.

17:15	**362**	**LHC Neutrinos at FASERν and Neutrino Energy Reconstruction Methods** *Jeremy Atkinson, Universität Bern* FASER, operating at the CERN-LHC throughout Run 3, has a dedicated high-energy neutrino physics programme using a 1.1-tonne tungsten target. The FASERν detector, composed of interleaved emulsion films and tungsten plates, is designed for neutrino interaction measurements. Using a sub-sample of 2022 data, the first electron neutrinos at the LHC have been observed, and cross-sections in the TeV regime for both electron and muon neutrinos were measured. To improve future results, incident neutrino energy must be reconstructed from topological and kinematic variables of charged final state particles. Different Machine Learning techniques are investigated for this purpose. Recent FASER results and the development of neutrino energy reconstruction methods will be presented.
17:30	**363**	**Exploring the hadronic landscapes, a novel search in multijet Events at the ATLAS Experiment** *Pantelis Kontaxakis, Stefano Franchellucci, Université de Genève* In this talk I will present a new search for Beyond Standard Model (BSM) physics at the ATLAS experiment in an all-hadronic final state. The latter poses major challenges: the QCD interactions have the highest cross-sections at LHC, and are remarkably complex to simulate. Two analysis strategies were developed to deal with this difficult background, a cut-and-count analysis approach and a search for resonances using Transformers. These methods were used to search for resonant pair production of massive particles decaying into SM quarks each. SUSY gluinos decaying via RPV couplings were considered as benchmark models. I will discuss the results obtained, showing how sensitivity was improved from previous ATLAS searches.
17:45	**364**	**Search for Top Squark Pair Production with zero Lepton Final States using ATLAS Run 3 Data** *Meinrad Moritz Schefer, Universität Bern* A search for direct top squark pair production is presented using ATLAS Run 2 and Run 3 data containing no leptons in the final state. The mass of this supersymmetric partner of the top quark is suggested to be at the TeV scale due to naturalness considerations and could therefore be produced at the LHC. Different scenarios are considered where the top squark eigenstates decay into final states with many jets and missing transverse momentum. A strict veto on any leptons together with a high missing transverse momentum and specific criteria on the various jets are strong tools to discriminate our signal against Standard Model events background.
18:00	**365**	**Growing Evidence for a Higgs Triplet at the LHC** *Sumit Banik [1,2], Saiyad Ashanujjaman [3], Guglielmo Coloretti [1,2], Andreas Crivellin [1], Bruce Mellado [4]* *[1] University of Zurich, [2] Paul Scherrer Institut, [3] SGTB Khalsa College, [4] University of Wisconsin (ATLAS)* Several LHC searches with multiple leptons in the final state point towards the existence of a new Higgs boson with a mass in the 140 - 160 GeV range, decaying mostly to a pair of W bosons. This dominant decay mode motivates a Higgs triplet with zero hypercharge, which also predicts a heavier-than-expected W-boson as indicated by the CDF-II measurement. Within this simple and predictive model, we simulate and combine channels of associated di-photon production. Considering the run-2 results of ATLAS, a significance of 4.3 sigma is obtained for a mass of 152 GeV. This is the largest statistical evidence for a new narrow resonance observed at the LHC.

18:15	**366**	**New Higgses at the Electroweak Scale** *Guglielmo Coloretti, University of Zurich (UZH) & Paul Scherrer Institute (PSI)* Many LHC measurements with multi-lepton final states and missing energy, in particular top differential distributions, show strong tensions with the SM predictions. I discuss how they can be explained by new physics within the Δ2HDMS and show the correlations to the hints for narrow resonances at the electroweak scale. Based on: 2312.17314, 2308.07953.
18:30	**367**	**Recent results from the NA62 experiment at CERN SPS** *Xiafei Chang, EPFL* The NA62 experiment, located at CERN SPS, is designed to study the ultra-rare decay $K^+ \to \pi^+ \nu \bar{\nu}$. It has collected the world larges charged koan decay sample with a decay in flight technique. In this talk, the result with the data set collected in Run 1 (2016-2018) will be presented, which is the most accurate measurement achieved so far. Updates with Run 2 (2021 onwards) data set will also be discussed. Thanks to the design of this experiment, other rare koan decays and hidden sector searches are also performed in NA62 and are introduced in this talk.
18:45	~~**368**~~	⇒ *moved to talk 349*
19:00		***Transfer to Dinner***
19:30		***Conference Dinner***

Friday, 13.09.2024, Room ETA F 5

Time	**ID**	**TASK VIII: Astroparticle physics and Dark matter** *Chair: Teresa Montaruli, Université de Genève*
13:30	**371**	**Search for gamma-ray spectral lines from dark-matter annihilation with the DAMPE satellite** *Jennifer Maria Frieden, EPFL* The annihilation of dark-matter particles may lead to the production of monochromatic gamma rays. In this contribution, the search for spectral lines in the gamma-ray spectrum using eight years of data collected with the space-borne Dark Matter Particle Explorer (DAMPE) is presented. To improve the event selection, we developed two machine-learning algorithms that outperform all the standard methods. No line signal is found between 5 GeV and 1 TeV in several regions of interest (ROI) for different dark-matter density profiles. The constraints on the velocity-averaged cross-section for the neutralino annihilation are estimated and compared with those obtained with the Fermi-LAT data.
13:45	**372**	**MiniFIT, The Small-Scale Version of the HERD Tracking System, From Design to Performance** *Chiara Perrina, EPFL* The High-Energy cosmic-Radiation Detection facility (HERD) will be the largest calorimetric experiment for the direct detection of cosmic rays. HERD aims at probing dark-matter signatures in the electron and photon spectra up to 100 TeV. It will also measure the flux of cosmic protons and heavier nuclei up to a few PeV. HERD will be equipped with a scintillating-fiber tracker (FIT) for the reconstruction of charged particle trajectories, the measurement of their absolute charge, and the enhancement of photon conversion into electron-positron pairs. A miniature version of the FIT sector, MiniFIT, was designed, built, and tested with particle beams. Its design and physics performance will be presented in this contribution.

14:00	**373**	**Terzina Telescope: Pioneering the Detection of Cherenkov Light from Extensive Air Showers in Space** *Martina D'Arco, Université de Genève* Detecting UHECRs above 100 PeV involves observing the Cherenkov light that their induced extensive air showers (EAS) produce in crossing the Earth's limb. Upping showers are caused by rare Earth-skimming neutrino-induced EAS, which are high-energy events of interest for multi-messenger astronomy. The NUSES space mission, featuring Terzina and ZIRÈ payloads, serves as a precursor. In this contribution, we describe Terzina detection goals, geometry and optical design and its photon detection camera composed of silicon photomultipliers. Moreover, we describe the work to understand the nighttime city light backgrounds. Terzina sets the stage for future missions like POEMMA, dedicated to UHECR and UHE neutrino astronomy, or a cost-effective constellation of synchronised satellites
14:15	**374**	**A comprehensive study of muons detected by the Large-Sized Telescope during its commission phase.** *Vadym Voitsekhovskyi, Université de Genève* The Large-Sized Telescope (LST) detects very high-energy gamma rays from 20 GeV to several TeV. The first prototype, LST-1, has been operational since November 2019 at La Palma's Roque de los Muchachos Observatory. Its calibration, essential for precision, utilizes the analysis of ring-shaped images from muons to determine optical throughput and point spread function. This involves reconstructing muon rings and fitting them to an analytical model to assess the mirrors' reflectivity. This work will cover an analysis of all muon data collected by LST-1, examining the physical characteristics of muon rings, the impact of quality cuts on parameter distributions, and their correlation with simulations to validate the telescope's calibration accuracy.
14:30	**375**	**The next generation cameras for the Large-Sized Telescopes of the Cherenkov Telescope Array Observatory** *Leonid Burmistrov, University of Geneva* Large-Sized Telescope target low-energy gamma rays, starting at 20 GeV. New silicon photomultiplier (SiPM) camera detect twice as much light as photomultiplier tube ones. This reduce detectable energy threshold, but separating signal from background remains a challenge. The SiPM-camera pixels are about 1/4 of the current camera allowing for higher-detail images which can be captured by AI methods. State-of-the-art SiPMs offer endless lifespan, robustness, low noise, crosstalk, and power consumption. Ideal for long-term, low-maintenance cameras. This work details telescope simulation with new camera, performance, and introduces low and high-level triggers. Early signal digitization enables sophisticated low-level trigger with density-based clustering algorithm. Convolutional neural network serves as high-level trigger and analysis.
14.45	**376**	**Testing gravity through the distortion of time** *Sveva Castello, University of Geneva* In 1998, observations of distant stellar explosions provided evidence that the expansion of the Universe is accelerating. The cosmology community has struggled to find an explanation for this ever since, postulating the existence of a form of "dark energy" driving the expansion. However, the lack of theoretical understanding of its properties motivates the search for other explanations, most notably the possibility that our theory of gravity, General Relativity, should be modified on cosmological scales. In my work, I illustrate how this hypothesis can be tested from the observed distribution of galaxies, focusing on measurements of the distortion of time that will be provided by the coming generation of galaxy surveys.

15:00	**377**	**Latest results from the XENONnT dark matter experiment** *Paloma Cimental Chávez, Universität Zürich* The XENONnT detector, hosted at the Laboratori Nazionali del Gran Sasso in Italy, is at the forefront of direct dark matter searches in the form of Weakly Interacting Massive Particles (WIMPs). Instrumented with an active target of 5.9 tonnes of liquid xenon (LXe), XENONnT employs a dual-phase time projection chamber designed to detect dark matter particles through its interactions with LXe atoms. Due to its exceptionally low background level, the physics reach of XENONnT has expanded from direct detection of dark matter to a variety of rare event searches such as solar neutrinos, bosonic dark matter, solar axions and rare nuclear decays. In this contribution, I will present an overview of the XENONnT detector and its latest scientific results.
15:15	**378**	**XLZD: The Future of Direct Dark Matter Detection** *Maximinio Adrover, Universität Zürich* Dual-phase time projection chambers (TPCs) provide the strongest constraints on the spin-independent WIMP-nucleon cross-section and great sensitivity towards other dark matter candidates. With greater exposure, this technology is expected to be able to probe dark matter cross-sections down to the neutrino fog, where coherent elastic neutrino-nucleus scattering processes pose an irreducible background. This also opens the possibility to further explore astrophysical neutrino sources. To achieve this goal, the XENON, LUX-ZEPLIN, and DARWIN (XLZD) collaborations plan to build a next-generation detector: a TPC employing about 60 t of xenon. This talk will introduce the broad physics reach of the XLZD detector and focus on the ongoing R&D needed to achieve these ambitious goals.
15:00		***END***

ID	TASK POSTER
381	**Towards Precision X-Ray Spectroscopy of Muonic low-Z Atoms Using Metallic Magnetic Calorimeters** *Aziza Zendour, PSI & ETH, for the QUARTET Collaboration* To improve existing theoretical models and obtain accurate values for fundamental constants, precise measurements of absolute nuclear charge radii are necessary. These can help in improving our knowledge of bound-state QED and aid in exploring new physics beyond the Standard Model. While muonic atom spectroscopy is known for its precision, measuring 2p–1s transition energies for low-Z nuclei of 20 – 150 keV has proven to be challenging, due to the energy resolution limitations of solid-state detectors. The QUARTET collaboration aims to improve these measurements by using a new metallic magnetic calorimeters detector to conduct high-precision X-ray spectroscopy of low-lying states in muonic atoms.
382	**Detector system to study early-to-late stability of the muEDM experiment** *Chavdar Dutsov, Paul Scherrer Institut, on behalf of the muEDM collaboration* At the Paul Scherrer Institute we are developing a high precision instrument to measure the electric dipole moment (EDM) of the muon by trapping particles in a compact storage ring. A muon EDM is a background free sign of new physics and would lead to a time-dependent directional asymmetry of decay positrons, measured by detectors close to the storage ring. The strong magnetic pulse used to trap the muons might interfere with the detectors and lead to systematic changes in their response and thus to a false EDM signal. We present a scintillation-based positron detector that is used to study early-to-late stability and control of systematic effects in the experiment.

383

Initial Results From the Michigan Xenon Experiment (MiX)

Erin Barillier [1], Wolfgang Lorenzon [2], Björn Penning [2], Greg Rischbieter [2]
[1] Universität Zürich, [2] University of Michigan

Dual-phase xenon Time Projection Chambers (TPCs) have been the leading technology in dark matter direct detection for the last several decades. Many questions remain regarding the responses from interactions within the liquid xenon (LXe). The Michigan Xenon experiment (MiX) is a 10 kg LXe TPC designed to study the microphysics of LXe, including measuring the W-value, or the mean energy required to produce observable quanta in LXe. Over the last several years, there has been tension between different W-value measurements. Here, I present the initial results of the MiX experiment in our effort to achieve a definitive measurement of the LXe W-value in order to aid dark matter detection experiments.

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Electric and magnetic field studies towards muon storage in the search for a muon electric dipole moment

Timothy Hume, Philipp Schmidt-Wellenburg, Paul Scherrer Institut

A precise configuration of electric and magnetic fields will be essential to realise the yet-undemonstrated frozen-spin technique [Farley et al. (2004), PRL:93:052001]. The apparatus under development at PSI relies on storing muons within a 3 T solenoid. The trapping scheme involves a pulsed magnetic field to kick their longitudinal momentum upon entry into a weakly-focusing magnetic field which thereafter provides longitudinal confinement. The electric field tuned to satisfy the frozen-spin condition must be highly uniform within this storage region. Simulation studies demonstrate that the proposed design suitably constrains systematic effects [Cavoto et al. (2024), EPJ.C:84:262] and permits sufficient storage efficiency to undertake a search for the muon EDM with unprecedented precision.

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Precision 3D monitoring of the LHCb SciFi tracker alignment using BCAMs

Dimitrios Kaminaris [1], Fred Blanc [1], Maria Vieites Diaz [2]
[1] EPFL, [2] CERN

A new SciFi tracker was added to the LHC during the second Long Shutdown (2019-2022). It consists of three stations, each with four detection layers of around 6 m x 5 m. Real-time 3D alignment monitoring is provided by opto-electronic BCAM sensors, which detect movements caused by magnet cycles, SciFi detector powering, or environmental changes. Triangulation provides positions for 14 points on three detection layers, monitored by 8 cameras. High-index refractive glass-balls serve as detection targets. With an intrinsic resolution of about 50 microns, preliminary results indicate enhanced sensitivity at the level of 10 - 20 microns by data averaging. Initial findings on magnetic field and operational impacts on detector alignment are presented.

386

SST-1M Telescopes, Preliminary Results and Deep Learning Event Reconstruction with CTLearn

Bastien Lacave, Université de Genève

SST-1M is a single-mirror small size Cherenkov telescope prototype developed by a consortium among institutes in Switzerland, Poland, and the Czech Republic. Currently undergoing commissioning at the Ondřejov Observatory in the Czech Republic, two SST-1M telescopes are actively collecting data of astrophysical gamma-ray sources. This poster provides an overview of the tele- scope and camera designs, and analysis pipeline, including evaluations of the instrument's responses. Preliminary results derived from ongoing observations are presented. Focus is made on the implementation of deep learning with CTLearn for event reconstruction, utilizing Convolution Neural Networks to classify gammas and hadrons primaries.

~~387~~ *cancelled*

388 An external array of remote magnetometers for the n2EDM experiment

Philipp Wagner [1], Sergey Ermakov, Klaus Stefan Kirch [1,2], Patrick Mullan [1], Nathalie Ziehl [2]
[1] ETH Zürich, [2] Paul Scherrer Institut

The n2EDM experiment aims to improve the most accurate measurement of the neutron electric dipole moment (nEDM), which requires a stable and uniform magnetic field.
Our Remote Magnetometer System (RMS) uses 14 Raspberry Pis to continuously measure the magnetic field around the n2EDM experiment. The acquired data can provide real-time information for other subsystems of the experiment. Various methods are explored to identify and interpret magnetic disturbances. To enhance the reliability of this process, we employ COMSOL simulations to examine the effect of the experiment's Active Magnetic Shielding on the measurements of the RMS.

This work is supported by SNF grant 200441.

389 Generate parton-level events from reconstructed events with Conditional Normalizing Flows

Adrian-Antonio Petre, Mauro Donega, Davide Valsecchi, Rainer Wallny, ETH Zürich

In High-Energy Physics, generating meaningful parton configurations from a collision reconstructed within a detector is a critical step for many complex tasks like the Matrix Element Method computation and Bayesian inference on parameters of interest.
We propose to tackle this problem from a new perspective by using a Transformer network to analyze the full event at the reconstruction level (including jets and leptons). This approach extracts a latent vector which is used to condition a Flow network. The full architecture generates probable sets of partons that are compatible with the observed objects.
Our strategy is applicable to events with multiple jets multiplicity and can model additional radiation at parton level.

390 Production and characterization of the Cesium magnetometer cells for the n2EDM experiment

Lea Segner, Georg Bison, Vira Bondar, Victoria Kletzl, Paul Scherrer Institut, for the nEDM collaboration

The n2EDM experiment, currently under commission at the Paul Scherrer Institute, aims to improve the sensitivity of the neutron electric dipole moment measurement by an order of magnitude. Achieving this sensitivity requires precise magnetic field measurements to control adverse systematic effects resulting from magnetic field inhomogeneities. An array of 112 optically-pumped cesium magnetometers will be used to measure the magnetic-field gradients and correct associated systematic shiPs. This contribution introduces the concept of cesium magnetometry and details the produc'on and characterization of the core component of a magnetometer: the anti-spin-relaxation-coated glass cells containing the cesium vapor.

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