Kruger 2022: Discovery Physics at the LHC

Report of Contributions

https://indico.tlabs.ac.za/e/113

Contribution ID: **1** Type: **Oral**

Recent searches for new phenomena with the ATLAS detector

Many theories beyond the Standard Model (BSM) have been proposed to address several of the Standard Model shortcomings, such as the origin of dark matter and neutrino masses, the fine-tuning of the Higgs Boson mass, or the observed pattern of masses and mixing angles in the quark and lepton sectors. Many of these BSM extensions predict new particles or interactions directly accessible at the LHC. This talk will present some highlights on recent searches based on the the full Run 2 data collected by the ATLAS detector at the LHC with a centre-of-mass energy of 13 TeV. These include searches for leptoquarks and vector-like fermions, new high mass resonances and lepton flavour violating decays, dark matter searches in final states with large missing transverse momentum, as well as dark-sector searches using unconventional and long-lived particle signatures.

Primary authors: ATLAS SPEAKER TO BE SELECTED; ZAAZOUA, Mohamed (Mohammed V University in Rabat (MA))

Presenter: ZAAZOUA, Mohamed (Mohammed V University in Rabat (MA))

Contribution ID: **2** Type: **Oral**

Recent results on Standard Model with the ATLAS detector

The high energy and diverse running operations at the LHC allow the ATLAS detector to probe the Standard Model in extreme phase spaces and environments. This talk will highlight recent results for the ATLAS experiment. In particular, we will focus on probes of QCD from high energy jet production to measurements of the strong coupling. Additionally, this talk will also highlight recent measurements of multiboson production including a first measurement of simultaneous pair production of longitudinally polarised vector bosons at the LHC. This talk also presents a review of the latest measurements of the Higgs boson properties, including its mass, CP, differential cross-sections, and couplings including self-coupling measurement. Specific results on production mode cross sections, Simplified Template Cross Sections are presented. These precise boson, diboson and Higgs differential cross-section measurements are interpreted in a combined Effective Field Theory analysis, allowing to systematically probe gauge boson self-interactions. Finally, in this talk an overview is given of the top quark physics program of the ATLAS experiment, with emphasis on recent searches and measurements with a pronounced sensitivity to new phenomena. First run 3 results are included, as well as an outlook to the broader run 3 and HL-LHC program.

Primary authors: ATLAS SPEAKER TO BE SELECTED; YOUNG, Christopher (University of Freiburg)

Presenter: YOUNG, Christopher (University of Freiburg)

Contribution ID: **3** Type: **Oral**

Recent results from heavy ion collisions with ATLAS

This talk presents an overview of recent ATLAS measurements in heavy ion collision systems. These include multiple measurements of jet production and structure, which probe the dynamics of the hot, dense Quark-Gluon Plasma formed in relativistic nucleus-nucleus collisions, and measurements of quarkonia and heavy flavor production to probe the QGP medium properties. UPC results include comprehensive studies of exclusive dilepton production (electron, muon, and tau pairs), providing detailed constraints on the nuclear photon flux and its dependence on the impact parameter and photon energy. Further, measurements of the tau-lepton anomalous magnetic moment and studies of light-by-light scattering will be discussed as well.

Primary authors: ATLAS SPEAKER TO BE SELECTED; SANTOS, Helena (LIP)

Presenter: SANTOS, Helena (LIP)

Contribution ID: **4** Type: **Oral**

Higgs boson property measurements at the ATLAS experiment

Very detailed measurements of Higgs boson properties can be performed with the Run 2 13 TeV pp collision dataset collected by the ATLAS experiment. This talk presents a review of the latest measurements of the Higgs boson properties, including its mass, CP, differential cross-sections . Furthermore, couplings, including self-coupling measurement using Higgs pair production, combining measurement targeting various production modes and decay channels is reported. Specific results on production mode cross sections, Simplified Template Cross Sections, and their interpretations are presented. These measurements are used to test specific scenarios of physics beyond the Standard Model, as well as its extension in the framework of Effective Field Theories.

Primary authors: ATLAS SPEAKER TO BE SELECTED; IAKOVIDIS, George (BNL)

Presenter: IAKOVIDIS, George (BNL)

Contribution ID: **5** Type: **Oral**

Probing the SM and beyond with top quarks, jets and photons in the ATLAS experiment

In this contribution, recent results of the ATLAS experiment are presented in pp collisions at sqrt(s) = 13 TeV that test the predictions of the Standard Model in production of jets and top quarks in association with energetic photons. We present the latest measurements on production of jets with new event-shape jet observables defined in terms of reference geometries with cylindrical and circular symmetries using the energy mover's distance. In addition, prompt inclusive photon production is measured for two distinct photon isolation cones, R=0.2 and 0.4, as well as for their ratio. Results are furthermore presented of searches in several associated top quark production processes with Standard Model gauge bosons, among which the recent observation of associated production of a single top quark with a photon. Finally bounds are presented on flavour-changing-neutral-current (FCNC) interactions, derived from searches of rare and suppressed top quark decay and production mechanisms.

Primary authors: ATLAS SPEAKER TO BE SELECTED; SIMPSON, Ethan

Presenter: SIMPSON, Ethan

Contribution ID: **6** Type: **Oral**

Searches for BSM physics using challenging and long-lived signatures with the ATLAS detector

Various theories beyond the Standard Model predict new, long-lived particles with unique signatures which are difficult to reconstruct and for which estimating the background rates is also a challenge. Signatures from displaced and/or delayed decays anywhere from the inner detector to the muon spectrometer, as well as those of new particles with fractional or multiple values of the charge of the electron or high mass stable charged particles are all examples of experimentally demanding signatures. The talk will focus on the most recent results using 13 TeV pp collision data collected by the ATLAS detector.

Primary authors: ATLAS SPEAKER TO BE SELECTED; COCCARO, Andrea (INFN)

Presenter: COCCARO, Andrea (INFN)

Contribution ID: **7** Type: **Oral**

Searches for new heavy particles using the ATLAS detector

Many theories beyond the Standard Model predict new phenomena, such as Zprime, Wprime bosons, scalars, KK gravitons, heavy leptons, supersymmetry, in final states with high-pT objects such as leptons, photons and jets. Searches for new physics with such signatures are performed using the ATLAS experiment at the LHC. The most recent 13 TeV pp results with the full LHC Run 2 dataset will be reported.

Primary authors: ATLAS SPEAKER TO BE SELECTED; PORTILLO QUINTERO, Dilia María (TRIUMF (CA))

Presenter: PORTILLO QUINTERO, Dilia María (TRIUMF (CA))

Contribution ID: **9** Type: **Oral**

Upgrade of ATLAS Hadronic Tile Calorimeter for the High Luminosity LHC

The Tile Calorimeter (TileCal) is a sampling hadronic calorimeter covering the central region of the ATLAS experiment, with steel as absorber and plastic scintillators as active medium. The High-Luminosity phase of LHC, delivering five times the LHC nominal instantaneous luminosity, is expected to begin in 2029. TileCal will require new electronics to meet the requirements of a 1 MHz trigger, higher ambient radiation, and to ensure better performance under high pile-up conditions. Both the on- and off-detector TileCal electronics will be replaced during the shutdown of 2026-2028. PMT signals from every TileCal cell will be digitized and sent directly to the back-end electronics, where the signals are reconstructed, stored, and sent to the first level of trigger at a rate of 40 MHz. This will provide better precision of the calorimeter signals used by the trigger system and will allow the development of more complex trigger algorithms. The modular front-end electronics feature radiation-tolerant commercial off-the-shelf components and redundant design to minimise single points of failure. The timing, control and communication interface with the off-detector electronics is implemented with modern Field Programmable Gate Arrays (FPGAs) and high speed fibre optic links running up to 9.6 Gb/s. The TileCal upgrade program has included extensive R&D and test beam studies. A Demonstrator module with reverse compatibility with the existing system was inserted in ATLAS in August 2019 for testing in actual detector conditions. The ongoing developments for on- and off-detector systems, together with expected performance characteristics and results of test-beam campaigns with the electronics prototypes will be discussed.

Primary authors: Dr KUMAR, Mukesh (University of the Witwatersrand); WILKENS, Henric (CERN)

Presenter: WILKENS, Henric (CERN)

Contribution ID: **10** Type: **Oral**

Performance and calibration of the ATLAS Tile Calorimeter

The Tile Calorimeter (TileCal) is a sampling hadronic calorimeter covering the central region of the ATLAS experiment, with steel as absorber and plastic scintillators as active medium. The scintillators are read-out by the wavelength shifting fibres coupled to the photomultiplier tubes (PMTs). The analogue signals from the PMTs are amplified, shaped, digitized by sampling the signal every 25 ns and stored on detector until a trigger decision is received. The TileCal front-end electronics reads out the signals produced by about 10000 channels measuring energies ranging from about 30 MeV to about 2 TeV. Each stage of the signal production from scintillation light to the signal reconstruction is monitored and calibrated. During LHC Run-2, high-momentum isolated muons have been used to study and validate the electromagnetic scale, while hadronic response has been probed with isolated hadrons. The calorimeter time resolution has been studied with multi-jet events. First results using early LHC Run-3 data will be shown. A summary of the performance results, including the calibration, stability, absolute energy scale, uniformity and time resolution, will be presented.

Primary authors: Dr KUMAR, Mukesh (University of the Witwatersrand); MLYNARIKOVA, Michaela (CERN)

Presenter: MLYNARIKOVA, Michaela (CERN)

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

Spin Physics Detector at NICA

The SPD (Spin Physics Detector) is a planned spin physics experiment in the second interaction point of the NICA collider that is under construction at JINR. The main goal of the experiment is the test basics of the QCD via the study of the polarized structure of the nucleon and spin-related phenomena in the collision of longitudinally and transversely polarized protons and deuterons at the center-of-mass energy up to 27 GeV and luminosity up to 10^32 1/(cm^2 s). Detector design, physics research program, and the current status of the SPD project will be presented. Special attention will be paid to the DAQ, computing system, and offline software, capable to deal with the high data rate, reaching 0.2 Tbit/s at the maximum design luminosity

Primary author: ZHEMCHUGOV, Alexey (JINR)

Presenter: ZHEMCHUGOV, Alexey (JINR)

Contribution ID: **17** Type: **Oral**

Role of rapidity choice for the Balitsky-Kovchegov equation

Reaching higher energies of electron-ion collisions with facilities like EIC is expected to provide a probe of a kinematic region where the divergent parton densities should start to exhibit signs of saturation.
This phenomenon is theoretically implemented by the Balitsky-Kovchegov (BK) equation, which, within the colour dipole picture, describes the evolution of the dipole scattering amplitude with respect to rapidity. There are two possible formulations of the BK equation based on which rapidity, projectile or target, is considered. Besides this variable, there are four more degrees of freedom, two of which have been so far incorporated into the numerical solutions.
We present a comparative solution of the two-dimensional BK equation formulated in both projectile and target rapidity together with their impact on quantities to be observed at EIC such as proton structure functions or vector meson production cross sections.

Primary author: VACULČIAK, Matěj

Presenter: VACULČIAK, Matěj

Contribution ID: **18** Type: **Oral**

Characterization of particle production through UE and very forward energy in hadronic collisions with ALICE at the LHC

Effects that were expected to occur only in the hot and dense medium formed in heavy-ion collisions, such as collective fluid-like behaviour and strangeness enhan- cement, were observed in high multiplicity proton–proton (pp) and proton–nucleus (pA) collisions. The strength of these effects increases steadily with the final sta- te multiplicity going from pp to p–Pb up to peripheral Pb–Pb collisions. These results triggered extensive studies of bulk properties in small collision systems, focusing on the dependence of experimental observables on the charged-particle multiplicity measured at midrapidity.
Collisions can be characterized through the Underlying Event (UE), consi- sting of products from soft processes like Multiparton Interactions (MPI) and beam remnants. In particular, particle production can be studied in terms of the charged-particle density produced in the transverse region and a self-normalized observable based on multiplicity in the transverse region, RT . Results about the charged particle production as a function of RT in pp, p–Pb and Pb–Pb collisions at √sNN = 5.02 TeV will be presented, together with final results about identified particle production in pp collisions at √s = 13 TeV. The study of the fragmenta- tion of the projectile and the target can also provide direct insights into the initial stages and can be studied measuring the very forward energy. Results about the correlation between the very forward energy and particle production at midrapi- dity in pp collisions at √s = 13 TeV and in p–Pb collisions at √sNN = 8.16 TeV will be presented. Finally, the results will be compared with with general purpose event generators, such as PYTHIA and EPOS, to test if these models can describe both the MPI-dependent UE and the forward fragmentation, observables mainly driven by non-perturbative QCD physics.

Primary author: OPPEDISANO, Chiara (INFN Sezione di Torino)

Presenter: OPPEDISANO, Chiara (INFN Sezione di Torino)

Contribution ID: **19** Type: **Oral**

Cooperation between DLNP JINR and Wits University: results and prospects

The groups of DLNP JINR and Wits University (Johannesburg) have been successfully cooperating for several years in the study of radiation hard detectors and new materials. Materials were irradiated with neutron beams from the IBR-2M reactor (JINR) and samples were studied at JINR and Wits University.
This report presents the results of the joint work of our groups, as well as plans for further joint research within the JINR-South Africa cooperation.

Primary author: Dr DAVYDOV, Yuri (JINR)

Presenter: Dr DAVYDOV, Yuri (JINR)

Contribution ID: **20** Type: **Oral**

B-Physics Highlights

Plenary talk on CMS B-physics results.

Primary author: Prof. SWAIN, Sanjay

Presenter: Prof. SWAIN, Sanjay

Contribution ID: **21** Type: **Oral**

FIrst Data with FASER: A new LHC experiment for long lived particle searches

FASER, the ForwArd Search ExpeRiment, is an experiment dedicated to searching for light, extremely weakly-interacting particles at CERN's Large Hadron Collider (LHC). Such particles may be produced in the very forward direction of the LHC's high-energy collisions and then decay to visible particles inside the FASER detector, which is placed 480 m downstream of the ATLAS interaction point, aligned with the beam collisions axis. FASER also includes a sub-detector, FASERν, designed to detect neutrinos produced in the LHC collisions and to study their properties. FASER was designed, constructed, installed and commissioned during 2019-2022 and has been taking physics data since the start of LHC Run 3 in July 2022. This talk will present the status of the experiment, including the detector design, the physics sensitivity and the detector performance with first collision data.

Primary author: ANTEL, Claire (Universite de Geneve (CH))

Presenter: ANTEL, Claire (Universite de Geneve (CH))

Contribution ID: **22** Type: **Oral**

Photoproduction results from ALICE in ultra-peripheral collisions at the LHC

Vector meson photoproduction is studied at the LHC with the ALICE detector in pA and AA ultra-peripheral collisions (UPCs), where the ions act as powerful sources of quasi-real photons. Measurements of vector meson photoproduction off hadrons shed light on the initial state of QCD matter inside the targets and provides important constraints to the initial conditions used in models of heavy ion collisions.

The first measurement at the LHC of dissociative photoproduction of J/ψ off protons is presented. This process is sensitive to quantum fluctuations of the structure of the target at the subnucleon level. In addition, cross sections for the exclusive channel and continuum dimuon production at small masses were obtained. This latter process probes our understanding of the photon flux coming off protons and off lead ions in a new kinematic region. The transverse momentum dependence of J/ψ photoproduction on lead targets in Pb–Pb collisions, which is sensitive to the gluonic structure of Pb in the impact-parameter plane, is also presented.

Primary author: HERMAN, Tomas (Czech Technical University in Prague (CZ))

Presenter: HERMAN, Tomas (Czech Technical University in Prague (CZ))

Contribution ID: **24** Type: **Oral**

Extra-dimensional theory and phenomenology in the era of gravitational waves

Now that we find ourselves in the epoch of gravitational-wave (GW) astronomy, we can explore new avenues by which to test general relativity (GR) and search for extra dimensions. As a first step, we consider the quasinormal mode (QNM) spectrum of a 4D Schwarzschild black hole embedded in a 7D partially-compactified space-time of mixed scalar curvature. This allows us also to explore the properties of a space-time under-represented in the Beyond the Standard Model literature whose higher-dimensional part is a nilmanifold (twisted torus) characterised by negative Ricci curvature. We compute the QNM frequencies in this setup using three numerical techniques and import constraints from the LIGO-Virgo-KAGRA collaboration to place bounds on a possible observable from extra dimensions. Our next step is to study the finite temperature effective potential of a simplified 5D model to determine if a first-order phase transition is possible, as well as strong enough to generate a detectable GW signature.

Primary authors: CHRYSOSTOMOU, Anna (UJ / IP2I - University Lyon 1); Prof. CORNELL, Alan (University of Johannesburg); DEANDREA, Aldo (IP2I - University Lyon 1); LIGOUT, Etienne (ENS-Lyon); TSIMPIS, Dimitrios (IP2I - University Lyon 1)

Presenter: CHRYSOSTOMOU, Anna (UJ / IP2I - University Lyon 1)

Contribution ID: **25** Type: **Oral**

Operation and performance of the ATLAS TileCal ALTI system and test-beam results

The Timing, Trigger and Control (TTC) system of the ATLAS Tile Calorimeter has be replaced for the Run 3 data-taking period. A new TTC interface module, the ATLAS Local Trigger Interface (ALTI) has been integrated and commissioned as part of the Phase-I upgrades. The ALTI module participated in the first Run 3 stable beam collisions (July 2022), recording events at $\sqrt{s}$ = 13.6 TeV. The TileCal test-beam TTC system is also being upgraded to use the ALTI module. The test-beam setup is equipped with upgraded electronics for the High Luminosity LHC. The ALTI module will be used for data-taking during the November 2022 test-beam campaign. We present the current status and the first test-beam results with the ALTI module.

Primary author: TLOU, Humphry (University of the Witwatersrand)

Co-author: MELLADO, Bruce (University of the Witwatersrand and iThemba LABS)

Presenter: TLOU, Humphry (University of the Witwatersrand)

Contribution ID: **26** Type: **Oral**

An alternative explanation of the multi-lepton anomalies at the LHC

In recent years, hints for multi-lepton anomalies have been accumulated by the analysis of Large Hadron Collider (LHC) data, pointing towards the existence of beyond the Standard Model (SM) Higgs bosons. In this study, we further investigate these multi-lepton anomalies by considering the Higgs Triplet Model with a hyper-charge of zero (HTM0). It consists of a neutral scalar H^0 that stems from the CP-even component of the Higgs triplet and also the two charged scalars $h^{\pm}$ which stem from the charged component of the Higgs triplet. These components come from the mixing between the nonphysical fields of the Higgs doublet and the Higgs triplet.

Primary author: Mr MULAUDZI, Anza-Tshilidzi

Co-authors: MELLADO, Bruce (University of the Witwatersrand and iThemba LABS); CRIVELLIN, Andreas (UZH & PSI); Mr COLORETTI, Guglielmo (Paul Scherrer Institute)

Presenter: MELLADO, Bruce (University of the Witwatersrand and iThemba LABS)

Contribution ID: **28** Type: **Oral**

Two same sign and there lepton final states in four top production at the LHC

The limitations of the standard model (SM) have led the community of particle physics to search for different physics models beyond the SM (BSM). With the discovery of the Higgs boson at the LHC completing the SM of particle physics and its measured properties are compatible with the one predicted by the SM, this does not exclude the possible existence of additional scalar bosons provided their mixing with SM Higgs is small. It has been found that the extension of the 2HDM model with a singlet scalar well describes the multi-lepton anomalies at the LHC, where the mass of heavy scalar $m_H \approx 270$ GeV, the mass of singlet scalar $m_S \approx 150$ GeV. One of those anomalies is the excess production of two same-sign leptons and three isolated leptons in association with b-jets. Both the ATLAS and CMS experiments have reported sustained excesses in these final states. Here, we focus on the CP-odd scalar of the 2HDM+S model which is the heavy pseudoscalar(A) in the mass range 400-600 GeV. The leading decays of the heavy pseudoscalar are $A \rightarrow t\bar{t}, ZH$ producing four top quarks and four lepton final states. We investigate the production of two same-sign and three leptons from the production of four top quark final states. We discuss the differences between the SM and BSM production mechanisms of four top quarks from $t\bar{t}A$ ($A \rightarrow t\bar{t}, ZH$).

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Co-authors: KUMAR, Mukesh (University of the Witwatersrand); MELLADO, Bruce (University of the Witwatersrand and iThemba LABS)

Presenter: MATHAHA, Thuso (University of the Witwatersrand)

Contribution ID: **30** Type: **Poster**

Use of kernel density estimation in searches for new resonances at the LHC

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Abstract: A machine learning generative model based on kernel density estimation was used to reproduce the Monte Carlo (MC) datasets. This method estimates the kernel density of the data using the Gaussian kernel and then generates additional samples from the distribution. We demonstrate the ability of this approach to reproduce a set of kinematic features, that are used for the search of new resonances decaying to Zɣ, final states at the LHC. A weak supervision learning classification based on deep neural implementation was used to compare the performance of generated datasets with MC datasets. In this approach, the model is trained on partially labelled datasets. The primary results show that our model generates synthetic data reasonably well. The purpose of the research is to establish the search for heavy resonances beyond the Standard Model (SM) with topological requirements using machine learning techniques.

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Primary authors: TRIPATHI, Nidhi; MELLADO, Bruce (University of the Witwatersrand); DAHBI, Salah-Eddine (University of the Witwatersrand (ZA))

Presenter: TRIPATHI, Nidhi

Contribution ID: **31** Type: **Oral**

The Assessment of Different VAE derivatives for Data Generation and Event Classification in Zγ Final State Background Data

Data generation and event classification are crucial and resource-intensive processes in high energy physics searches at the LHC. Deep learning methodologies are being increasingly adopted as alternative methodologies to traditional data generation and event classification mechanisms to increase efficiency, accuracy and resource demand. In this work, a Variational Auto-encoder (VAE) and derivatives; Variational Auto-encoder plus Discriminator (VAE+D), Variational Auto-encoder plus Normalising Flows plus Discriminator (VAE+NF+D), Copula Variational Auto-encoder (CVAE) and Copula Variational Auto-encoder plus Discriminator (CVAE+D) are assessed as both data generators and event (signal) classifiers for use with Zγ final state background data. These VAE derivatives are trained on Monte Carlo simulated Zγ final state background data to be able to generate new data and classify data which is not recognised as training data.

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Co-author: MELLADO, Bruce (University of the Witwatersrand and iThemba LABS)

Presenter: STEVENSON, Finn (University of the Witwatersrand, CERN)

Contribution ID: **32** Type: **Oral**

Heat dissipation Improvement of ATLAS (Detector) Electronics by Thermal Interface Materials based on Carbon Nanomaterials

Over the past decades, carbon nanomaterials were widely used in the main stream applications due to their expectional electrical, mechanical and magnetic properties. In addition to the mentioned properties, carbon nanomaterials are characterised by high thermal conductivity, with values as high as 6000 W/mK. In this presentation, we report on the incorporation of carbon nanomaterials in a commercial thermal interface material, in order to enhance the thermal transfer. The new developped thermal interface material based on carbon nanomaterials is intended to improve the heat dissipation in electronic parts of the ATLAS detector at CERN. The mixture of epoxy/carbon nanomaterials was achieved by following a precised protocol based on sonication. The thermal transmission measurements of the developed thermal interface materials were carried by an appartus built in house. Based on the recorded results, the highest heat dissipation is achieved by thermal interface materials fabricated with 1% of carbon nanomaterials. These results were supported by measuring the thermal resistance of these fabricated thermal interface materials by the ASTM D5470 approach and it revealed a decrease of 50%. Also, The thermal interface material showing the highest thermal transfer was tested on the low voltage power supply which was running on a test bench developed by the Wits team.

Primary author: MOUANE, Othmane (Ithemba labs)

Co-authors: Mr NKADIMENG, Edward (University of the Witwatersrand); SIDERAS-HADDAD, ELIAS (WITS UNIVERSITY); MELLADO, Bruce (University of the Witwatersrand and iThemba LABS)

Presenter: MOUANE, Othmane (Ithemba labs)

Contribution ID: **33** Type: **Oral**

The response of gap and crack scintillators of the Tile Calorimeter of the ATLAS detector to isolated muons from proton-proton collisions.

The Tile calorimeter of the ATLAS experiment at the Large Hadron Collider is a hadronic sampling calorimeter that is designed for the reconstruction of hadrons, jets, tau-particles and missing transverse energy. In this study, the performance of gap and crack scintillators cells of the Tile calorimeter is studied by their response to muons originating from $W \to \mu\nu$ events. The response is quantified by measuring the amount of energy deposited per unit length in each cell to evaluate the performance of all the modules of the Tile calorimeter and the time stability of the response over the entire Run 2 data taking period.

Primary authors: RAPHEEHA, Phuti (Wits University); MELLADO, Bruce (University of the Witwatersrand and iThemba LABS)

Presenter: RAPHEEHA, Phuti (Wits University)

Contribution ID: **34** Type: **Oral**

Heavy-flavour production measurements in ALICE

Open heavy-flavour hadrons are one of the the key diagnostic tools available to study the dense, hot strongly interacting matter formed in relativistic collisions. The charm and beauty quarks are produced at the early stages of the collision via hard scattering due to their large bare masses, which exceed the QCD scale parameter ($\lambda_{\rm QCD}$) significantly. Consequently in pp collisions, where the hot and strongly interacting medium is not expected to be formed, the measurement of heavy-flavour production serves as a reference for heavy-ion collisions, provides a crucial testing ground for pQCD models, as well as helps to understand hadronization mechanisms in vacuum. Multiplicity dependent measurements in pp collisions, are also valuable tools to investigate the hadronization mechanisms and characterize multiparton interactions; and helps to search for possible connections between small and extended interacting systems.\par
In this presentation, an overview of the latest results on the production measurements of heavy-flavour hadrons in pp and Pb–Pb of the ALICE collaboration will be presented. Charm and beauty fragmentation results will be discussed via the measurements of the yield ratios of different heavy-flavour hadron species, including studies as a function of multiplicity. In particular, the baryon-over-meson production ratio will be presented in both pp and Pb–Pb collisions. The multiplicity dependent self-normalised yields of heavy-flavour particles in pp collisions at $\sqrt{s}$ = 13 TeV will also be shown.

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Presenter: ACHARYA, Shreyasi (Université Clermont Auvergne (FR))

Contribution ID: **35** Type: **Oral**

Development of TiO-0016, a web tool for ATLAS Tile Calorimeter

TiO-0016 is part of the Tile-in-One Platform (TiO), a collection of independent web applications called plugins. It is designed to provide temperature and voltage data assessment from the Front End (FE) Electronics of the Tile Calorimeter. Since instrumentation and its interfaces are a very important aspect of any experiment, automatic control procedures, efficient error recognition and managing communication with external systems is crucial to perfect collected data from the ATLAS experiment. The Detector Control System (DCS) of the ATLAS Experiment at CERN enables equipment supervision of all the twelve different ATLAS sub-detectors. Most of the offline analysis software were usually created by different collaborators and a variety of different technologies were used in their development. Maintenance and usage were cumbersome and most times, original developers were not available to support. A report on a single plugin developed to access, present and analyse data on voltage and temperature from the Front-end power supplies is given. This is geared towards a contribution to the Tile-in One Calorimeter Platform (TiO). The aim is to achieve ease of maintenance and ease of usage of the web interface tools.

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Presenter: KIBIRIGE, Betty (University of Zululand)

Contribution ID: **36** Type: **Oral**

Evaluation of the impact on measurements precision in search for resonances at ATLAS Experiment

Motivated by the recent emergence of multi-lepton anomalies as deviations from Standard Model (SM) predictions in several ATLAS and CMS analyses of Large Hadron Collider data, it is anticipated that the production of Higgs-like scalar H and excesses in the multi-lepton final states at the Large Hadron Collider will have a significant rate. A 2HDM+S model, where S is a singlet scalar in the mass range of 130 GeV to 160 GeV, describes these anomalies reasonably well and could point to the existence of physics beyond the Standard Model (BSM). Here we search for such excesses at a mass of $m_S = 150$ GeV in the $Z\gamma$ final state, where Z boson decays leptonically to $\mu^+\mu^-$ and e^+e^-. In order to understand well the distributions of BSM signal and SM background, accurate and precise measurements are crucial. The quantification of anticipated experimental systematic uncertainties and spurious signals impacting measurement precision are the focus of this study. According to preliminary results, both systematic uncertainties and spurious signal over its background fluctuations ($S/\delta S$) are within the allowable threshold of 5% and 50%, respectively.

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Presenter: MOKGATITSWANE, Gaogalalwe (University of the Witwatersrand)

Contribution ID: **37** Type: **Oral**

A search for a heavy pseudoscalar that decays into a Z boson and another heavy scalar boson, leading to four lepton final states in pp collisions at $\sqrt{s}$ = 13~TeV.

A search for a heavy resonance pseudo-scalar, A, decaying into a Z boson and another heavy scalar boson, H, is carried out at the LHC using a data sample corresponding to an integrated luminosity of 139 fb^{-}1 from proton-proton collisions at $\sqrt{s}$= 13~TeV. In these studies, the scalars H will decay to two scalars S or an S and a Standard Model Higgs boson H via an effective model. The $A \to Z(\to \ell\ell)$ and $H(H \to SS$ or $Sh)$ production in at least four leptons final state will be examined in this search.

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Presenter: MTINTSILANA, Onesimo (University of Witwatersrand)

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

Hunting for the critical point — recent NA61/SHINE results

The fixed-target NA61/SHINE experiment at the CERN Super Proton Synchrotron (SPS) seeks to find the critical point (CR) of strongly interacting matter and the properties of the onset of deconfinement. The experiment provides a scan of measurements of particle spectra and fluctuations in proton-proton, proton-nucleus, and nucleus-nucleus interactions as functions of collision energy and system size, corresponding to a two-dimensional phase diagram (T-μ_B). This gives also a unique insight into the onset of deconfinement in light and medium-size systems.
New NA61/SHINE results are shown here, including transverse momentum and multiplicity fluctuations in Ar+Sc collisions compared to NA61 p+p and Be+Be data, and proton and charged hadron intermittency results in Ar+Sc and Pb+Pb collisions.
Recently, the effects of change in the system size dependence, labeled as the "onset of fireball", were observed in NA61/SHINE data - with some unexpected system size dependence, however.

Primary author: TURKO, Ludwik (University of Wroclaw)

Presenter: TURKO, Ludwik (University of Wroclaw)

Contribution ID: **39** Type: **Oral**

Frequentist approach to quantify fake signals when using semi-supervised machine learning classifiers

In searches to discover new physics, at the LHC, machine learning classifiers can be used to extract signal events from background processes. Semi-supervised machine learning classifiers can be used to extract unlabeled signals from labeled background events, reducing biases caused by preconceived understanding of the signal. When training machine learning classifiers, overfitting can cause background events to be misclassified as signals. The amount of fake signals, or error caused in over-training, must therefore be quantified before the classifier can be used to discover new physics.
The study consists of the methodology and results of a frequentist approach to quantify fake signals produced in the over-training of a semi-supervised DNN classifier. To this end, Zɣ final state background data is used to evaluate an optimized semi-supervised DNN classifier. The frequentist approach is used to account for the probability of observing local excesses, elsewhere within the mass range. This is achieved by repeating the pseudo-experiment a sufficient number of times to completely understand the significance. Each pseudo-experiment consists of an distinct Zɣ dataset, generated using a WGAN, to train the DNN and a fixed mass background rejection scan to expose fake signals from the DNN response output

Primary author: LIEBERMAN, Benjamin (University of Witwatersrand)

Presenter: LIEBERMAN, Benjamin (University of Witwatersrand)

Contribution ID: **41** Type: **Oral**

Overview and 2022 data taking the experience of ALICE online and offline processing in Run 3

ALICE has upgraded many of its detectors for LHC Run 3 to operate in continuous readout mode recording Pb-Pb collisions at 50 kHz interaction rate without trigger.
The computing infrastructure was upgraded accordingly, and new reconstruction software has been developed to process the data in real time at rates 50 times higher than during Run 2.
ALICE has put a new computing scheme in place, using the same software, and the same computing farm for synchronous online reconstruction during data taking and for asynchronous reconstruction when there is no beam in the LHC.
Th synchronous reconstruction performs mostly detector calibration, QA, and raw data compression, while the asynchronous reconstruction yields the AODs with the final reconstruction output.
To handle the large data rates of Run 3, ALICE leverages heavily the compute power of GPUs.
This synchronous processing is dominated by the TPC, which produces by far the largest data volume, and TPC reconstruction is fully running on GPUs.
When the online computing farm is not used for synchronous processing while there is no stable beam, it runs asynchronous processing jobs.
Since the majority of the compute performance of the online farm is in the GPUs, and since the asynchronous processing is not dominated by the TPC in the way the synchronous processing is, there is an ongoing effort to offload a significant amount of compute load from other detectors to the GPU as well.
The talk will give an overview of the ALICE computing scheme and the experience from 2022 data taking.
We give an overview of the current state and the plans for the asynchronous reconstruction, and the current performance of synchronous and asynchronous reconstruction with GPUs for pp and Pb-Pb data.

Primary author: Dr ROHR, David (CERN)

Presenter: Dr ROHR, David (CERN)

Contribution ID: **42** Type: **not specified**

Greetings from the National Research Foundation

Presenter: NXOMANI, Clifford (NRF)

Session Classification: Session I

Contribution ID: **43** Type: **not specified**

Subatomic physics at iThemba LABS

Presenter: AZAIEZ, Faiçal (iThemba LABS)

Session Classification: Session I

Contribution ID: **44** Type: **not specified**

Greetings from the Department of Science and Technology

Presenter: Dr ADAMS, Daniel (Department of Science and Technology)

Session Classification: Session I

Contribution ID: **45** Type: **not specified**

Structure of the workshop

Presenter: Prof. MELLADO, Bruce (University of the Witwatersrand and iThemba LABS)

Session Classification: Session I

Contribution ID: **46** Type: **not specified**

The ALICE experiment: probing QCD matter at the LHC

Presenter: ANTINORI, Federico (INFN, Padova, Italy)

Session Classification: Session I

Contribution ID: **47** Type: **not specified**

New Physics in Flavour Observables? - B anomalies in semi-leptonic penguins

Presenter: HURTH, Tobias

Session Classification: Session I

Contribution ID: **48** Type: **not specified**

Welcome from the National Research Foundation

Monday, 5 December 2022 10:00 (10 minutes)

Presenter: NXOMANI, Clifford (NRF)

Session Classification: Session I

Contribution ID: **49** Type: **not specified**

iThemba LABS: a unique subatomic physics facility in the continent and the southern hemisphere

Monday, 5 December 2022 10:10 (30 minutes)

Presenter: AZAIEZ, Faiçal (iThemba LABS)

Session Classification: Session I

Contribution ID: **50** Type: **not specified**

Welcome from the Department of Science and Innovation

Monday, 5 December 2022 10:40 (10 minutes)

Presenter: Dr ADAMS, Daniel (Department of Science and Innovation)

Session Classification: Session I

Contribution ID: **51** Type: **not specified**

Structure of the Workshop

Monday, 5 December 2022 10:50 (10 minutes)

Presenter: Prof. MELLADO, Bruce (University of the Witwatersrand and iThemba LABS)

Session Classification: Session I

Contribution ID: **52** Type: **not specified**

New Physics in Flavour Observables? - B anomalies in semi-leptonic penguins

Monday, 5 December 2022 12:30 (1 hour)

Presenter: Prof. HURTH, Tobias

Session Classification: Session I

Contribution ID: **53** Type: **not specified**

The ALICE experiment: probing QCD matter at the LHC

Monday, 5 December 2022 11:30 (1 hour)

Presenter: ANTINORI, Federico (INFN, Padova, Italy)

Session Classification: Session I

Contribution ID: **54** Type: **not specified**

Higgs measurements at CMS: Highlights and prospects

Monday, 5 December 2022 14:30 (25 minutes)

Presenter: Dr BORTIGNON, Pierluigi (University of Cagliari and INFN)

Session Classification: Session II

Contribution ID: **55** Type: **not specified**

Characterization of particle production through UE and very forward energy in hadronic collisions

Monday, 5 December 2022 14:55 (25 minutes)

Presenter: OPPEDISANO, Chiara (INFN Sezione di Torino)

Session Classification: Session II

Contribution ID: **56** Type: **not specified**

Recent results from heavy ion collisions with ATLAS

Monday, 5 December 2022 15:20 (25 minutes)

Presenter: SANTOS, Helena (LIP)

Session Classification: Session II

Contribution ID: **57** Type: **not specified**

Higgs boson property measurement at the ATLAS experiment

Monday, 5 December 2022 15:45 (25 minutes)

Presenter: IAKOVIDIS, George (BNL)

Session Classification: Session II

Contribution ID: **58** Type: **not specified**

SM measurements at CMS: Status and Highlights

Monday, 5 December 2022 16:40 (25 minutes)

Presenter: SALVATICO, Riccardo

Session Classification: Session II

Contribution ID: **59** Type: **not specified**

Performance and calibration of the ATLAS Tile Calorimeter

Monday, 5 December 2022 17:05 (25 minutes)

Presenter: MLYNARIKOVA, Michaela (CERN)

Session Classification: Session II

Contribution ID: **60** Type: **not specified**

Heavy flavour production measurements in ALICE

Monday, 5 December 2022 17:30 (25 minutes)

Presenter: ACHARYA, Shreyasi (Université Clermont Auvergne (FR))

Session Classification: Session II

Contribution ID: **61** Type: **not specified**

Radiation studies for the upgrade of the ATLAS detector

Monday, 5 December 2022 17:55 (25 minutes)

Presenter: Dr DAVYDOV, Yuri

Session Classification: Session II

Contribution ID: **62** Type: **not specified**

Searches for BSM particles including BSM Higgs

Tuesday, 6 December 2022 10:00 (1 hour)

Presenter: LANDSBERG, Greg (Brown University)

Session Classification: Session III

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

W mass measurement

Tuesday, 6 December 2022 11:00 (1 hour)

Presenter: Prof. HAYS, Chris

Session Classification: Session III

Contribution ID: **64** Type: **not specified**

ALICE upgrades and perspectives for heavy-ion physics at the LHC

Tuesday, 6 December 2022 12:30 (1 hour)

Presenter: KLEIN, Jochen (CERN)

Session Classification: Session III

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

Role of rapidity choice for the Balitsky-Kovchegov equation

Tuesday, 6 December 2022 14:30 (25 minutes)

Presenter: VACULČIAK, Matěj

Session Classification: Session IV

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

BSM searches at CMS: Highlights and prospects

Tuesday, 6 December 2022 14:55 (25 minutes)

Presenter: CHABERT, Eric (IPHC/Unistra)

Session Classification: Session IV

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

Extra-dimensional theory and phenomenology in the era of gravitational waves

Tuesday, 6 December 2022 15:20 (25 minutes)

Presenter: CHRYSOSTOUMOU, Anna (University of Johannesburg)

Session Classification: Session IV

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

Upgrade of the ATLAS Hadronic Tile Calorimeter for the High Luminosity LHC

Tuesday, 6 December 2022 15:45 (25 minutes)

Presenter: WILKENS, Henric (CERN)

Session Classification: Session IV

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

Spin Physics Detector at NICA

Tuesday, 6 December 2022 16:40 (25 minutes)

Presenter: Dr ZHEMCHUGOV, Alexey

Session Classification: Session IV

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

Heat dissipation Improvement of ATLAS Detector Electronics by Thermal Interface Materials based on Carbon Nanomaterials

Tuesday, 6 December 2022 17:05 (25 minutes)

Presenter: MOUANE, Othmane (University of Witwatersrand)

Session Classification: Session IV

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

First Data with FASER: A new LHC experiment for long lived particle searches

Tuesday, 6 December 2022 17:30 (25 minutes)

Presenter: ANTEL, Claire (Universite de Geneve (CH))

Session Classification: Session IV

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

Frequentist approach to quantify fake signals when using semi-supervised machine learning classifiers

Tuesday, 6 December 2022 17:55 (25 minutes)

Presenter: LIEBERMAN, Benjamin (University of Witwatersrand)

Session Classification: Session IV

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

B physics highlights from CMS

Wednesday, 7 December 2022 10:00 (1 hour)

Presenter: SWAIN, Sanjay (National Institute of Science Education and Research (NISER), India)

Session Classification: Session V

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

Recent searches for new phenomena with the ATLAS detector

Wednesday, 7 December 2022 11:00 (1 hour)

Presenter: ZAAZOUA, Mohamed (Mohammed V University in Rabat (MA))

Session Classification: Session V

Contribution ID: **75** Type: **not specified**

Future Colliders

Wednesday, 7 December 2022 12:30 (1 hour)

Presenter: WANG, Jin (Institute of High Energy Physics, Chinese Academy of Science)

Session Classification: Session V

Contribution ID: **76** Type: **not specified**

Probing the SM and beyond with top quarks, jets and photons in the ATLAS experiment

Wednesday, 7 December 2022 14:30 (25 minutes)

Presenter: SIMPSON, Ethan

Session Classification: Session VI

Contribution ID: **77** Type: **not specified**

The response of gap and crack scintillators of the Tile Calorimeter of the ATLAS detector to isolated muons from proton-proton collisions

Wednesday, 7 December 2022 14:55 (25 minutes)

Presenter: RAPHEEHA, Phuti (Wits University)

Session Classification: Session VI

Contribution ID: **78** Type: **not specified**

Searches for BSM physics using challenging and long-lived signatures with the ATLAS detector

Wednesday, 7 December 2022 15:20 (25 minutes)

Presenter: COCCARO, Andrea (INFN)

Session Classification: Session VI

Contribution ID: **79** Type: **not specified**

An alternative explanation of the multi-lepton anomalies at the LHC

Wednesday, 7 December 2022 15:45 (25 minutes)

Presenter: MULAUDZI, Anza-Tshilidzi

Session Classification: Session VI

Contribution ID: **80** Type: **not specified**

The Assessment of Different VAE derivatives for Data Generation and Event Classification in $Z\gamma$ Final State Background Data

Wednesday, 7 December 2022 16:40 (25 minutes)

Presenter: STEVENSON, Finn (University of the Witwatersrand, CERN)

Session Classification: Session VI

Contribution ID: **81** Type: **not specified**

Photoproduction results from ALICE in ultra-peripheral collisions at the LHC

Wednesday, 7 December 2022 17:05 (25 minutes)

Presenter: HERMAN, Tomas (Czech Technical University in Prague (CZ))

Session Classification: Session VI

Contribution ID: **82** Type: **not specified**

Overview and 2022 data taking the experience of ALICE online and offline processing in Run 3

Wednesday, 7 December 2022 17:30 (25 minutes)

Presenter: ROHR, David (CERN)

Session Classification: Session VI

Contribution ID: **83** Type: **not specified**

Drell-Yan Production in Third-Generation Gauge Vector Leptoquark Models at NLO+PS in QCD

Wednesday, 7 December 2022 17:55 (25 minutes)

Presenter: SCHNELL, Luc (Max Planck Institute for Physics)

Session Classification: Session VI

Contribution ID: **84** Type: **not specified**

Recent results on Standard Model with the ATLAS detector

Thursday, 8 December 2022 10:00 (1 hour)

Presenter: YOUNG, Christopher (University of Freiburg)

Session Classification: Session VII

Contribution ID: **85** Type: **not specified**

Dynamics of Charm Production in AA and pp Collisions using Parton Cascade Model

Thursday, 8 December 2022 11:00 (1 hour)

Presenter: SRIVASTAVA, Dinesh (National Institute of Advanced Studies, Bengaluru (Formerly from Variable Energy Cyclotron Centre, Kolkata)

Session Classification: Session VII

Contribution ID: **86** Type: **not specified**

Hunting for criticalities — NA61/SHINE results

Thursday, 8 December 2022 12:30 (1 hour)

Presenter: TURKO, Ludwik (University Wroclaw)

Session Classification: Session VII

Contribution ID: **87** Type: **not specified**

Searches for new heavy particles using the ATLAS detector

Thursday, 8 December 2022 14:30 (25 minutes)

Presenter: PORTILLO QUINTERO, Dilia María (TRIUMF (CA))

Session Classification: Session VIII

Contribution ID: **88** Type: **not specified**

Development of TiO-0016, a web tool for ATLAS Tile Calorimeter

Thursday, 8 December 2022 14:55 (25 minutes)

Presenter: KIBIRIGE, Betty (University of Zululand)

Session Classification: Session VIII

Contribution ID: **89** Type: **not specified**

Two same sign and there lepton final states in four top production at the LHC

Thursday, 8 December 2022 15:20 (25 minutes)

Presenter: MATHAHA, Thuso (University of the Witwatersrand)

Session Classification: Session VIII

Contribution ID: **90** Type: **not specified**

Use of kernel density estimation in searches for new resonances at the LHC

Thursday, 8 December 2022 15:45 (25 minutes)

Presenter: TRIPATHI, Nidhi

Session Classification: Session VIII

Contribution ID: **91** Type: **not specified**

Keynote

Thursday, 8 December 2022 16:30 (40 minutes)

Presenter: VILAKAZI, Zeblon (University of the Witwatersrand)

Session Classification: Jean Cleymans Memorial

Contribution ID: **92** Type: **not specified**

Tribute

Thursday, 8 December 2022 17:10 (20 minutes)

Presenter: Dr ADAMS, Daniel (Department of Science and Technology)

Session Classification: Jean Cleymans Memorial

Contribution ID: **93** Type: **not specified**

Tribute

Thursday, 8 December 2022 17:30 (30 minutes)

Presenter: SRIVASTAVA, Dinesh (National Institute of Advanced Studies, Bengaluru (Formerly from Variable Energy Cyclotron Centre, Kolkata)

Session Classification: Jean Cleymans Memorial

Contribution ID: **94** Type: **not specified**

Tribute

Thursday, 8 December 2022 18:00 (30 minutes)

Presenter: TURKO, Ludwik (University Wroclaw)

Session Classification: Jean Cleymans Memorial

Contribution ID: **95** Type: **not specified**

Tribute

Thursday, 8 December 2022 18:30 (30 minutes)

Presenter: BRAUN-MUNZINGER, Peter (EMMI/GSI)

Session Classification: Jean Cleymans Memorial

Contribution ID: **96** Type: **not specified**

Hadronization of the QGP

Friday, 9 December 2022 10:00 (1 hour)

Presenter: BRAUN-MUNZINGER, Peter (EMMI/GSI)

Session Classification: Session IX

Contribution ID: **97** Type: **not specified**

Higgs physics 10 years after the discovery

Friday, 9 December 2022 11:00 (1 hour)

Presenter: ZANDERIGHI, Giulia (Max Planck for Physics)

Session Classification: Session IX