HEPP Workshop 2019

Report of Contributions

Contribution ID: **1**   Type: **not specified**

Measurement of heavy-flavour production via leptonic decays in proton-proton collisions at LHC energies with ALICE.

Wednesday, 30 January 2019 14:40 (20 minutes)

The measurements of heavy-flavour production via leptonic decays in proton-proton (pp) collisions with ALICE at Large Hadron Collider (LHC) energies are described. Heavy flavour (charm and beauty) are produced at an early stage of the collision via hard scatterings. In ALICE, heavy-flavour measurements are measured in the central barrel ($|\eta|<0.9$) via the semi-electronic decay channel and at forward rapidity ($-4<\eta<-2.5$) via the single muonic decay channel.
These measurements provide a testing ground for quantum chromodynamics (QCD) theoretical models.
These collisions also serve as a baseline for heavy-ion collisions. Results obtained by the ALICE Collaboration will be described and, where available, compared to model calculations

Author: MONTEVERDI, Christine Marie (iThemba LABS, National Research Foundation (ZA))

Co-authors: BUTHELEZI, Edith Zinhle (iThemba LABS, National Research Foundation (ZA)); Prof. PAPKA, Paul (iThemba Labs, National Research Foundation (ZA)); FOERTSCH, Siegfried (iThemba LABS, National Research Foundation (ZA))

Presenter: MONTEVERDI, Christine Marie (iThemba LABS, National Research Foundation (ZA))

Session Classification: Session II

Contribution ID: **2**   Type: **not specified**

Strangeness production in different colliding systems measured with the ALICE experiment

Wednesday, 30 January 2019 15:00 (20 minutes)

In heavy ion collisions, strangeness enhancement had been proposed as a signature of the QGP formation. Surprisingly, more recent observations have shown an enhanced production of (multi-)strange hadrons in high-multiplicity pp and p-Pb collisions at the LHC. The multiplicity dependence of strangeness production measured with the ALICE experiment will be discussed in pp, p-Pb, Xe-Xe and Pb-Pb collisions in order to highlight similarities across different colliding systems. Data will also be compared to models such as PYTHIA, DIPSY, EPOS and statistical hadronization models.

Author: DELSANTO, Silvia (University of the Witwatersrand (ZA))

Co-author: BIANCHI, Livio (Universita e INFN Torino (IT))

Presenter: DELSANTO, Silvia (University of the Witwatersrand (ZA))

Session Classification: Session II

Contribution ID: **3**　　　　　　　　　　　　　　　　　　Type: **not specified**

Top-quark background estimation for BSM search $H \to Sh \to 2\ell+ >= 2$ jets with the ATLAS detector

Thursday, 31 January 2019 14:40 (20 minutes)

This proceeding presents the top-quark background estimation for the $H \to Sh$ search. The final state for this search is characterized by two leptons (electron and muon) and at least two jets. The top-quark is the dominant background contribution for this analysis. The analysis strategy defines the Signal, Control and Validation Regions which are in the phase space of 0 b-jet,1 b-jet and 2 b-jets respectively. The top-quark Validation Region is built to correct the Monte Carlo mismodeling observed in the leptonic kinematics. Finally, the normalization factor is obtained in the top-quark Control Region to be applied to the top-quark background in the 1 b-jet and 0 b-jet phase space

Authors: MONNAKGOTLA, Jeremiah Kgomotso (University of the Witwatersrand (ZA)); HERNANDEZ JIMENEZ, Yesenia (University of the Witwatersrand (ZA))

Presenter: MONNAKGOTLA, Jeremiah Kgomotso (University of the Witwatersrand (ZA))

Session Classification: Session IV

Contribution ID: **4**   Type: **not specified**

An Application of Rubi: Series Expansion of the Quark Mass Renormalization Group Equation

Wednesday, 30 January 2019 12:00 (20 minutes)

We highlight how Rule-based Integration (Rubi) is an enhanced method of symbolic integration which allows for the integration of many difficult integrals not accomplished by other computer algebra systems. Using Rubi, many integration techniques become tractable. Integrals are approached using step-wise simplification, hence distilling an integral (if the solution is unknown) into composite integrals which highlight yet undiscovered integration rules.

The motivating example we use is the derivation of the updated series expansion of the quark mass renormalization group equation (RGE) to five-loop order. This series provides the relation between a light quark mass in the modified minimal subtraction ($\overline{\text{MS}}$) scheme defined at some given scale, e.g. at the tau-lepton mass scale, and another chosen energy scale, s. This relation explicitly depicts the renormalization scheme dependence of the running quark mass on the scale parameter, s, and is important in accurately determining a light quark mass at a chosen scale. The five-loop QCD $\beta(a_s)$ and $\gamma(a_s)$ functions are used in this determination.

Authors: MES, Alexes (University of Cape Town);   Mr STEPHENS, Jed (University of Cape Town)

Presenter: MES, Alexes (University of Cape Town)

Session Classification: Session I

Contribution ID: **5**   Type: **not specified**

Probing colour reconnection in ttbar events

Thursday, 31 January 2019 12:10 (20 minutes)

Improvement in the modelling of color reconnection (CR) is critical for precise measurements in $t\bar{t}$ events at the Large Hadron Collider. Modelling of CR is one of the main sources of uncertainty in top quark measurements. Different experimental observables have been studied, but due to lack of sensitivity they don't provide convenient input to constrain the modelling of CR. In this study, the activity of charged particles between subjets of a large-radius jet induced by a t ($\bar{t}$) decaying hadronically, is probed if sensitive to CR. A Rivet based study shows differences in the distribution of the sum of the transverse momentum and the multiplicity of charged particles for color-connected and non color-connected subjets.

Authors: RAFANOHARANA, Dimbiniaina (University of the Witwatersrand (ZA)); KAR, Deepak (University of the Witwatersrand (ZA))

Presenter: RAFANOHARANA, Dimbiniaina (University of the Witwatersrand (ZA))

Session Classification: Session III

Contribution ID: **6**   Type: **not specified**

ALICE Muon Identifier User Logic for Common Readout Unit

Friday, 1 February 2019 09:00 (20 minutes)

This project concerns the development of the Common Readout Unit (CRU) user logic for the Muon Identifier (MID) of the ALICE detector. In light of the upgrades to the Large Hadron Collider (LHC) resulting in increased data throughput the ALICE MID requires an upgrade of its Data Acquisition chain, most notably a move from the legacy triggered readout method to a continuous readout method. The data production in continuous readout mode is several orders of magnitude higher than that of triggered readout. As such, real-time data conditioning is required to meet storage constraints. The ALICE MID user logic will perform this function by extracting the data, reformatting, arranging and transmitting it in packets according to the requirements of the computing system. The user logic is a separate component that interfaces to the Core CRU firmware and is implemented in an FPGA using a hardware description language.

Author: Mr BOYLES, Nathan (University o Cape Town)

Presenter: Mr BOYLES, Nathan (University o Cape Town)

Session Classification: Session V

Contribution ID: **7**   Type: **not specified**

Search for a heavier Higgs like boson and a dark force boson using ATLAS experiment results

Thursday, 31 January 2019 11:30 (20 minutes)

A search for boson that lies beyond the standard model is conducted where the progenitor 125 Gev Higgs Boson decays ultimately to four leptons (electrons or muons). The Higgs boson provides a portal into the hidden sector which contains dark particles. The processes under consideration include $H \rightarrow ZX \rightarrow 4l$ and $H \rightarrow XX \rightarrow 4l$ where X is the dark vector boson Zd or the pseudoscalar boson a, which are part of the two models used in the analysis. The mass range under consideration for the dark vector boson or the pseudoscalar boson are $1 < X < 60$GeV. The data under analysis is collected from p-p collisions at the LHC from the ATLAS detector using a centre of mass energy of $\sqrt{s}=14$ TeV with an integrated luminosity of 36-1 fb. Upper limits at the 95% confidence level are imposed on the fiducial cross sections for the processes under consideration. The subsequent work considers relaxing the Higgs Boson mass constraint upwards and also improvements in the background estimation

Authors: MAPEKULA, Xola (University of Johannesburg (ZA)); CONNELL, Simon (University of Johannesburg (ZA)); BOYE, Diallo (University of Johannesburg (ZA)); TRUONG, Thi Ngoc Loan (University of Johannesburg (ZA)); Dr ASSAMAGAN, Ketevi Adikle (Brookhaven National Laboratory (US))

Presenter: MAPEKULA, Xola (University of Johannesburg (ZA))

Session Classification: Session III

Contribution ID: **8**   Type: **not specified**

The Explanation of the Muon g - 2 Anomaly using the Madala Hypothesis

Wednesday, 30 January 2019 16:40 (20 minutes)

The muon anomalous magnetic moment (muon -2) is among the most precisely measured quantities in particle physics. The latest measurement is discrepant from the predictions of the Standard Model –the difference between the experimental and theoretical values is in the range of three to four standard deviations. One possible explanation for this is the interaction of the muon with particles from beyond the Standard Model. It is shown that the discrepancy in the muon -2 can be explained by mixing of the muon with an extra heavy lepton in the mass range 100 GeV –1000 GeV, along with the coupling of the muon to a scalar boson ⬚ with mass 150 GeV introduced through the Madala hypothesis.

Author: SABATTA, Danielle Dorinda (University of the Witwatersrand (ZA))

Presenter: SABATTA, Danielle Dorinda (University of the Witwatersrand (ZA))

Session Classification: Session II

Contribution ID: **9**   Type: **not specified**

Effects of Nuclear Deformations on Particle Production in Relativistic Heavy Ion Collisions

Wednesday, 30 January 2019 11:30 (30 minutes)

We have implemented spherical harmonics for intrinsically deformed nuclei collisions (U+U) at RHIC and (Xe+Xe) at LHC, in HIJING and AMPT models and calculated various physical observables. The study of intrinsic deformation in nucleus is important because it may cause asymmetry in the initial configuration of interacting particles and thus affect the final observables. It is also important to study deformed system for deeper understanding of properties of hot and dense system formed in relativistic heavy ion collisions through final asymmetry in final particle production and its abundances. Such asymmetries may also occur in core of dense or compact systems such as neutron stars etc. Our present calculations were done taking different collision angles of Uranium nuclei. We call such collision configurations as tip, body, side and random. The results show different yields in particle production from different collision angles. However, particles ratios seem to be unaffected by our choices of the collision configurations.

Authors: Dr YOUNUS, Mohammed (Nelson Mandela University); Mr TRIPATHY, Sushanta (Indian Institute of Technology Indore, India); Mr TRIPATHY, Shreekant (Institute of Physics, Bhubaneswar, India); Prof. SAHOO, Raghunath (Indian Institute of Technology Indore, India); Prof. SAHU, Pradip (Institute of Physics, Bhubaneswar, India); Dr DE, Sudipan (NISER, Jatni, Khurda, India)

Presenter: Dr YOUNUS, Mohammed (Nelson Mandela University)

Session Classification: Session I

Contribution ID: **10** Type: **not specified**

ALICE Muon Tracking Chambers low-voltage system upgrade

Friday, 1 February 2019 09:20 (20 minutes)

The low-voltage power supply system upgrade project primarily focuses on the requirements of the new Front-end Electronics (FEE) along with vital power distribution considerations to achieve a robust and effective low-voltage power supply system for the new FEE. The new FEE (Dual-SAMPA and SOLAR) are designed to have a much higher power consumption compared to the present FEE. For this purpose, the present low-voltage power system needed to be re-evaluated and thereby undergo an upgrade to meet the power needs for the smooth operation of the ALICE MCH electronics. The DualSAMPA itself requires close to double the power at a much lower voltage of 1.25V while the SOLAR will require additional low-voltage power supplies (LVPS) to meet the new capacity. Various solutions for the low-voltage system upgrade were investigated –DCDC converters that would sustain in the high magnetic field and radiation environment, modification of the current LVPS from Wiener, splitting of low-voltage lines to the FEE into smaller factions and a combination of these solutions. In order to meet the time-frames for the Long Shutdown 2 (LS2), the most efficient and effective solution was to have the present LVPS modified along with notable power distribution considerations and this will be presented in detail.

Author: Mr KURIAKOSE, Rony (iThemba LABS, National Research Foundation)

Presenter: Mr KURIAKOSE, Rony (iThemba LABS, National Research Foundation)

Session Classification: Session V

Contribution ID: **11**

Type: **not specified**

Improving the top-quark reconstruction on the W′ search in the hadronic channel.

Thursday, 31 January 2019 11:50 (20 minutes)

The search for W′ $\rightarrow tb$ decays in the hadronic final states using the full run 2 data, which was collected by the ATLAS detector at the Large Hadron Collider (LHC), is on going. Reconstruction of the top-quark is one of the crucial steps in this search. To conduct the study of improving the top-quark reconstruction, two signal samples, which had 2 and 3.5 TeV W′ masses were studied. These signal samples enabled us to study methods that are used to choose the large-Radius jet (large-R jet) to be our top-quark candidate in the detector level, then compare it to the same large-R jet of the top-quark in the particle level if they match. This helps us to better estimate the top-quark selection efficiency in this search. There are two methods of choosing the large-R jet top-quark candidate that were studied. These methods both yielded approximately 82 \% match to the large-R jet of the top-quark in the particle level.

Author: MHLANGA, Fortune Nhlanhla (University of the Witwatersrand (ZA))

Presenter: MHLANGA, Fortune Nhlanhla (University of the Witwatersrand (ZA))

Session Classification: Session III

Contribution ID: **12**
Type: **not specified**

Phenomenology of new scalar boson productions in the e-p collider: Challenges and Prospects

Wednesday, 30 January 2019 16:20 (20 minutes)

In this talk we discuss a model consisting of Two-Higgs Doublet Model (2HDM) along with a CP even scalar singlet with different global $\mathbb{Z}_2$ symmetry. Let us call this new model "2HDM+S". We discuss the constraints on its parameters emanating from our phenomenological studies. We use it further to explain the possibility of producing new scalars in the electron-proton collider environment and its implications in the future collider searches.

Authors: Dr KUMAR, Mukesh (University of the Witwatersrand (ZA)); Dr ISLAM, Rashidul (Indian Institute of Technology Guwahati); Prof. MELLADO GARCIA, Bruce (University of the Witwatersrand); TOMIWA, Kehinde Gbenga (University of the Witwatersrand (ZA))

Presenter: Dr KUMAR, Mukesh (University of the Witwatersrand (ZA))

Session Classification: Session II

Contribution ID: **13**   Type: **not specified**

Metrics in infinite derivative gravity theory

Wednesday, 30 January 2019 12:20 (20 minutes)

Infinite derivative gravity is a theory which extends on general relativity by modifying the Einstein-Hilbert action. Where the hope is that we are able to remove the pathologies found in the UV region of general relativity. In this talk I will present various linearised metrics in the theory of infinite derivative gravity and will show that we indeed are able to remove the singularities that are usually found in general relativity without having to introduce ghosts to the theory. I will also show that these new metrics reproduce general relativistic metric in the infrared region.

Author: HARMSEN, Gerhard (University of the Witwatersrand)

Presenter: HARMSEN, Gerhard (University of the Witwatersrand)

Session Classification: Session I

Contribution ID: **14**   Type: **not specified**

Bottomonia Suppression in Heavy-Ion Collisions from AdS/CFT

Wednesday, 30 January 2019 14:00 (20 minutes)

In a novel investigation into the physics of a strongly coupled quark gluon plasma, we compute for the first time the suppression of $\Upsilon(1S)$ in a strongly coupled QGP and compare the results to those from a weakly coupled QGP. The complex binding energies which inform the thermal width and hence the R_{AA} of the bottomonia in $\sqrt{s}_{NN} = 2.76$ TeV Pb+Pb collisions are determined using imaginary time techniques. Further, we probe the validity of using complex heavy quark potentials from AdS/CFT for all quark separation r in the calculation of the aforementioned binding energies by independently computing the meson spectrum in vacuum using semiclassical, rotating open strings attached to the D7-brane.

Author: BARNARD, Nadia (University of Cape Town)

Co-author: HOROWITZ, William (University of Cape Town)

Presenter: BARNARD, Nadia (University of Cape Town)

Session Classification: Session II

Contribution ID: **16**   Type: **not specified**

H4l lepton isolation studies for the $H \rightarrow ZZ \rightarrow 4\ell$ channel

Thursday, 31 January 2019 14:00 (20 minutes)

Most of the interesting physics signatures at the LHC require the identification of prompt non-fake leptons or photons. Non-fake leptons are usually isolated and have no activity around them hence it is important to define an "isolation energy" around leptons to reduce any contamination from non-prompt and fake objects. In this proceeding, reoptimization studies have been performed to decrease the pileup dependence of the lepton isolation variables for the High Higgs ($m_{4l} \geq 200$ GeV) Mass and Low Higgs ($115 \leq m_{4l} \leq 130$ GeV) Mass.

Authors: MTINTSILANA, Onesimo (University of the Witwatersrand (ZA));   LAGOURI, Theodota (University of the Witwatersrand (ZA))

Presenter: MTINTSILANA, Onesimo (University of the Witwatersrand (ZA))

Session Classification: Session IV

Contribution ID: **17**　　　　　　　　　　　　　　　　　　Type: **not specified**

Search for a new resonance in the diphoton decay in association with E_T^{miss} with the ATLAS detector

Thursday, 31 January 2019 14:20 (20 minutes)

A search for a new resonance motivated by strong deviations in the production of multiple leptons at the EW scale is conducted. The analysis is part and parcel of the Madala hypothesis whereby a heavy-scalar 'H' decays to two photons, which is necessary to study a resonance diphoton mass peak of this scale. The analysis final state is therefore characterized by two photons and E_T^{miss} and the analysis categories are extrapolated to the $Z\gamma + E_T^{miss}$ search. A good measurement of E_T^{miss} is important for numerous searches for new physics at the Large Hadron Collider. The performance of E_T^{miss} for this high mass search is presented.

Author: LIAO, Shell-May (University of the Witwatersrand (ZA))

Co-authors: RUAN, Xifeng (University of the Witwatersrand (ZA)); MELLADO GARCIA, Bruce (University of the Witwatersrand)

Presenter: LIAO, Shell-May (University of the Witwatersrand (ZA))

Session Classification: Session IV

Contribution ID: **18**   Type: **not specified**

Application of Boosted Decision Trees in the search for a new boson decaying into $Z + \gamma$ final state

Friday, 1 February 2019 11:30 (20 minutes)

Motivated by strong deviations in the production of multiple leptons at the Electroweak (EW) scale we attempt a search for a resonance, which could provide a direct evidence for new physics Beyond the Standard Model (BSM). Here we attempt a search for a resonance in the Z and photon system in association with jets and missing transverse energy. For BSM studies missing transverse energy is a key ingredient, in this study a multivariate technique is employed to suppress fake missing energy signal and the results are compared to those obtained using paper-based cuts. The study is performed at different central jet multiplicities.

Author: RAPHEEHA, Ntsoko Phuti (University of the Witwatersrand (ZA))

Co-authors: RUAN, Xifeng (University of the Witwatersrand (ZA)); MELLADO GARCIA, Bruce (University of the Witwatersrand)

Presenter: RAPHEEHA, Ntsoko Phuti (University of the Witwatersrand (ZA))

Session Classification: Session V

Contribution ID: **19**   Type: **not specified**

The ATLAS Tile Calorimeter LVPS hardware upgrade and testing

Friday, 1 February 2019 10:00 (20 minutes)

This proceeding presents the design and production of the testing stations to examine the reliability and quality of the Tile Calorimeter LVPS (Low Voltage Power Supplies), which will power the next generation of upgraded hardware in the TileCal (Tile Calorimeter) system of ATLAS at CERN. A LVPS brick is subjected to a stressed environment where the load and temperature are both elevated. In this environment the expected operational life of the brick is reduced, which serves as an indicator of how long the bricks will last under the normal environment in the detector. Two new types of testing stations, which build upon the previous generation of testing stations would be used in the initial production of the TileCal system. Full information and undertaken tasks will be presented.

Author: NKADIMENG, Edward Khomotso (University of the Witwatersrand (ZA))

Co-author: MELLADO GARCIA, Bruce (University of the Witwatersrand)

Presenter: NKADIMENG, Edward Khomotso (University of the Witwatersrand (ZA))

Session Classification: Session V

Contribution ID: **20**   Type: **not specified**

Applications of Machine Learning techniques in mono-higgs searches

Friday, 1 February 2019 12:30 (20 minutes)

A search for the Dark Matter (DM) in association with the Standard Model like Higgs boson was performed during the 2015 and 2016 data. In this analysis we use Multivariate Analysis (MVA) methods to suppress the fake missing transverse energy, using the Boosted Decision Tree (BDT) we are able to enhance the regression performance of typically weak MVA methods for the DM search. We scan the results on the cut of MET and METSig to find the best MVA training and how much we can gain and which variable is the best.

Author: Mr MDLULI, Moratwe (University of the Witwatersrand (ZA))

Presenter: Mr MDLULI, Moratwe (University of the Witwatersrand (ZA))

Session Classification: Session V

Contribution ID: **21**   Type: **not specified**

Search for dark matter with machine learning with the ATLAS detector

Friday, 1 February 2019 12:10 (20 minutes)

High-energy particle physics experiments usually involve retrieving useful and interesting event data out of extremely large data sets where in most cases there is less signal and more background. To produce the best possible experimental results it is desirable to optimally discriminate between signal and background. The Toolkit for Multivariate Analysis (TMVA) within ROOT provides many different algorithms for the classification of signal and background events. ATLAS pile-up suppression techniques can impose fake missing transverse energy in the analysis of E_T^{miss}. In this study, two Multivariate classification techniques were trained to discriminate between signal of real missing transverse energy over background of fake missing transverse energy. The Multivariate techniques used are boosted decision trees (BDTs) and Multilayer perceptron (MLP). The performance of the two classifiers were compared and the BDTs performed better than the MLP classifier.

Author: Mr MAGABE, Audrey Thabang (University of the Witwatersrand (ZA))

Presenter: Mr MAGABE, Audrey Thabang (University of the Witwatersrand (ZA))

Session Classification: Session V

Contribution ID: **22**　　　　　　　　　　　　　　　　　　　Type: **not specified**

Machine Learning in the search for new heavy resonances decaying to $Z\gamma$ with the ATLAS detector

Friday, 1 February 2019 11:10 (20 minutes)

The search for new physics beyond the standard model is vital for ATLAS experiments to answer fundamental questions concerning laws of interactions and forces. This study searches for heavy resonances decaying to $Z\gamma$ in association with missing energy using data of the LHC proton-proton collisions at a centre of mass of 13 TeV collected by the ATLAS experiment. Using the multivariate analysis boosted decision tree, the signal and background data sample was split into 50:50 training and testing. The results obtained shows that the classifier performs well in discriminating the signal and background, and it can be used to improve the quality of the signal data sample in the search for new physics.

Author: BALOYI, Nkateko (University of the Witwatersrand (ZA))

Presenter: BALOYI, Nkateko (University of the Witwatersrand (ZA))

Session Classification: Session V

Contribution ID: **23**   Type: **not specified**

The use of Machine Learning in the search for di-photons in association with missing energy

Friday, 1 February 2019 12:50 (20 minutes)

The discovery of the Higgs boson in 2012 completed the Standard Model and plays a crucial role in studies of theories beyond the Standard Model (BSM). The Madala Hypothesis is one example of BSM model and puts forward a new Heavy scalar (H) to explain anomalies observed in Run 1 and Run 2 data of the LHC. The Heavy scalar H can decay to a Higgs boson in association with jets, leptons and missing energy. This scalar boson is being searched for in the $h \rightarrow \gamma\gamma + E_T^{miss}$ decay channel. Due to the increase in pileup interactions of the LHC, this decay channel is mostly contaminated with fake missing energy. The aim of this study is to develop a Machine Learning model to discriminate between signal events with real missing transverse energy and background events with fake missing transverse energy. We train Boosted Decision Trees (BDTs) through the Toolkit for Multivariate Analysis platform to perform this discrimination while maximising signal efficiency and background rejection. Three missing energy significance categories are considered and the impact of hyperparameter tuning is investigated. Results demonstrate that BDTs perform well and lead to a 10 - 20% improvement in accuracy.

Author: GAELEJWE, Theodore Cwere (University of the Witwatersrand (ZA))

Presenter: GAELEJWE, Theodore Cwere (University of the Witwatersrand (ZA))

Session Classification: Session V

Contribution ID: **24**   Type: **not specified**

Search for physics beyond the Standard Model in events with two opposite charged leptons and jets at the LHC

Thursday, 31 January 2019 15:50 (20 minutes)

The Madala hypothesis extends the Standard Model by introducing two additional scalar bosons: the Madala particle H and the Higgs-like boson S. In this scenario physics beyond the Standard Model in the Higgs sector can be explored through the decay of the Madala particle into the S and Higgs bosons. Several of the dominant decay channels of the S and Higgs may produce a pair of opposite charged leptons accompanied by jets in the final state. The characteristics of this signature allow to isolate signal events, from other processes generated at the LHC, by comparing the kinematics of the final decay products. This work presents the studies on the signal performance using Monte Carlo simulation. These investigations are going to setup the baseline selection requirements of the search for the Madala boson at the LHC.

Author: HERNANDEZ JIMENEZ, Yesenia (University of the Witwatersrand (ZA))

Presenter: HERNANDEZ JIMENEZ, Yesenia (University of the Witwatersrand (ZA))

Session Classification: Session IV

Contribution ID: **25**　　　　　　　　　　　　　　　　Type: **not specified**

Overview of test beam campaigns for the readout electronics demonstrator of the upgrade Tile Calorimeter of the ATLAS detector

Friday, 1 February 2019 09:40 (20 minutes)

A series of Test-Beam setup campaigns took place since 2015 until 2018 where the LHC has been shut down for the next 2 years (LHC Long Shut down). During the Test-Beam campaigns the phase-II upgrade electronic prototypes have been evaluated and to help with estimate provisions for future commissioning efforts. The primary objective of the Test-Beam campaigns for ATLAS Tile Calorimeter (TileCal) is to assess the status of the Demonstrator module, TileCal drawer modules that are equipped with upgrade specific electronics, and two module that are equipped with the current legacy system electronics. The modules were exposed to muons, electrons, and hadrons at different energies to assess their performance. An overview of the Test-Beam campaigns is discussed and some results of the data collected from the modules are shown.

Authors: Mr MASUKU, Thabo (University of the Witwatersrand); LEKALAKALA, Nthabiseng Miranda (University of the Witwatersrand (ZA))

Presenters: Mr MASUKU, Thabo (University of the Witwatersrand); LEKALAKALA, Nthabiseng Miranda (University of the Witwatersrand (ZA))

Session Classification: Session V

Contribution ID: **26**   Type: **not specified**

Multi-lepton anomalies at the LHC and new physics at the EW scale

Wednesday, 30 January 2019 15:50 (30 minutes)

Based on a number of features from proton-proton collisions with Run 1 data a boson with a mass around the EW scale was postulated such that a significant fraction of its decays would entail the Standard Model (SM) Higgs boson and an additional scalar, S. One of the phenomenological implications of a simplified model, where S is treated a SM Higgs boson, is the the anomalous production of leptons. A combined study of Run 1 and Run 2 data are indicative of very significant discrepancies between data and SM Monte Carlos in a variety of final states involving multiple leptons with and without b-quarks. These discrepancies appear in corner of the phase-space where different SM processes dominate, indicating that the potential mismodeling of a particular SM process is unlikely to explain them. Systematic uncertainties from the prediction of SM processes evaluated with currently available tools seem unable to explain away these discrepancies. The internal consistency of these anomalies and their interpretation in the framework of the original hypothesis will be quantified.

Author: MELLADO GARCIA, Bruce (University of the Witwatersrand)

Co-authors: VON BUDDENBROCK, Stefan (University of the Witwatersrand (ZA)); CORNELL, Alan; KUMAR, Mukesh (University of the Witwatersrand (ZA)); RUAN, Xifeng (University of the Witwatersrand (ZA))

Presenters: MELLADO GARCIA, Bruce (University of the Witwatersrand); VON BUDDENBROCK, Stefan (University of the Witwatersrand (ZA))

Session Classification: Session II

Contribution ID: **27**   Type: **not specified**

Development and data analysis of a low power radio-frequency wireless mesh network.

Friday, 1 February 2019 10:20 (20 minutes)

In this study, a wireless radio-frequency mesh network was set up in an indoor environment, namely, the School of Physics building. The purpose of the wireless mesh network (WMN) was to enable data to be communicated between the routers or nodes located within the coverage area. Data comprising of latency, outlier ratios, number of hops and packet delivery ratios was collected and analyzed using Big Data techniques developed and employed at CERN with the intention of bench-marking the performance and reliability of the mesh. It was necessary to employ these techniques since data packets exceeding 3 million in number were sent when the mesh network was up and running. Therefore, these reliable and efficient means of cleaning and analyzing the network data were used successfully.

Author: Mr SITOBOLI, Rorisang (University of the Witwatersrand)

Presenter: Mr SITOBOLI, Rorisang (University of the Witwatersrand)

Session Classification: Session V

Contribution ID: **28**   Type: **not specified**

Discriminating quark and gluon initiated jets using random forest machine learning techniques.

Friday, 1 February 2019 11:50 (20 minutes)

This project studies the use of random forest algorithm in discriminating jets initiated by quark or gluons. Jets are collimated flow of hadrons from quarks and gluons produced in collisions clustered using dedicated algorithm. The random forest which is an ensemble decision tree is discussed in detail on why it is suitable to this kind of data. Monte Carlo generated dataset is used to train the random forest algorithm and the performance is compared to the gradient boosted decision tree and multilayer perceptron neural network which are predominantly used in the previous literature. From this project, we see that the random forest performed slightly better than the other two algorithms with an accuracy of 76.66%. This may be due to it's ability to train on the whole dataset and use out-of-bag data to test performance of the algorithm.

Author: RAPETSOA, Kokotla (University of the Witwatersrand (ZA))

Presenter: RAPETSOA, Kokotla (University of the Witwatersrand (ZA))

Session Classification: Session V

Contribution ID: **29**

Type: **not specified**

W+jets fake background estimation using the fake factor method, for the BSM search $H \rightarrow Sh \rightarrow 2\ell +$ jets with the ATLAS detector

Thursday, 31 January 2019 15:00 (20 minutes)

The W+Jets(s) fake background estimation for $H \rightarrow Sh \rightarrow 2\ell +$ jets final state is presented. This paper focuses on the W+Jet(s) background estimation for the for the BSM search $H \rightarrow Sh \rightarrow 2\ell +$ >= 2 jets analysis with the ATLAS detector. Background processes that produce the same leptonic plus missing transverse energy signature in the detector, but not naturally contain two leptons from W or Z-bosons and neutrinos, are labelled as "fakes" and their presence needs to be accounted for. The process can be wrongly considered as signal when the W decays leptonically and the jet is mis-idenfied as a lepton. The number of fakes for the process is estimated from the observed yield in a set control region in the data. The calculation is carried out in a W+Jet(s) rich control region and is estimated with fake factor to the signal region. The calculation of the fake factor is done in Z+Jet(s) samples (data and MC). The results are compared to fake factor calculations in the W+Jet(s) MC samples.

Authors: MASHISHI, Lehumo (University of the Witwatersrand (ZA)); HERNANDEZ JIMENEZ, Yesenia (University of the Witwatersrand (ZA))

Presenter: MASHISHI, Lehumo (University of the Witwatersrand (ZA))

Session Classification: Session IV

Contribution ID: **31** Type: **not specified**

Opening address

Wednesday, 30 January 2019 09:00 (30 minutes)

Welcome address by the Dean of Science, Prof Muronga and Prof Andre Venter, Head of the Department of Physics followed by overview of workshop by Profs. Bruce Mellado and Alan Cornell.

Presenters: CORNELL, Alan; MURONGA, Azwinndini; MELLADO GARCIA, Bruce (University of the Witwatersrand)

Session Classification: Session I

Contribution ID: **32**   Type: **not specified**

Introduction to the SM

Wednesday, 30 January 2019 09:30 (45 minutes)

Presenter: CORNELL, Alan Stanley (University of the Witwatersrand (ZA))

Session Classification: Session I

Contribution ID: **33**   Type: **not specified**

Dark Matter Detection, Models and Constraints

Wednesday, 30 January 2019 10:45 (45 minutes)

Existence of dark matter has been inferred from its large scale gravitational interactions at various astrophysical and cosmological scales. There is no evidence as yet of non-gravitational interaction of dark matter with the SM particles. The nature of dark matter particles remains unknown. Search strategies to unravel its properties will be reviewed. The search strategies involve looking for the DM signals in 1) Direct detection of nucleon recoil in underground laboratories in DM-nucleon elastic scattering. 2) Indirect detection in pair creation and cherekov telescopes on satellites. 3) Collider searches which aim at identifying signatures of DM production at high energy accelerators such as LHC. Several dark matter models are reviewed and the constraints on the model parameters from experimental data discussed.

Author: Prof. GOYAL, Ashok (University of Delhi)

Presenter: Prof. GOYAL, Ashok (University of Delhi)

Session Classification: Session I

Contribution ID: **34**

Type: **not specified**

What can 3ℓ signatures at the LHC can tell us about additional bosons?

Thursday, 31 January 2019 16:10 (20 minutes)

As pointed out in a number of works, the LHC is displaying a number of anomalies in the production of multiple leptons in proton-proton collisions. A simplified model where a scalar, H, with a mass around the EW scale that decays predominantly to Sh, where S is a EW singlet and h is the Higgs boson in the Standard Model (SM), seems to do a reasonable job in capturing these anomalies. In this work we focus on the production of three isolated leptons (e and μ) studied by the ATLAS and CMS collaborations in the context of the production of ZW. There is it noted that the description of the transverse mass of the charged lepton and the missing transverse energy with the simplified ansatz made above is not satisfactory. In Ref. arXiv:1809.06344 the hypothesis of $A \to ZH \to ZSh$ (A is a CP-odd boson in a 2HDSM+S model) was tested and compared to the data. Similar studies are performed here using the three lepton final state.

Author: TOMIWA, Kehinde Gbenga (University of the Witwatersrand (ZA))

Co-author: Prof. MELLADO, Bruce (University of the Witwatersrand)

Presenter: TOMIWA, Kehinde Gbenga (University of the Witwatersrand (ZA))

Session Classification: Session IV

Contribution ID: **36**
Type: **not specified**

Dark Matter - continued

Thursday, 31 January 2019 09:00 (45 minutes)

Presenter: Prof. GOYAL, Ashok (University of Delhi)

Session Classification: Session III

Contribution ID: **37**   Type: **not specified**

Introduction to the SM - Continued

Thursday, 31 January 2019 09:45 (45 minutes)

Presenter: CORNELL, Alan

Session Classification: Session III

Contribution ID: **38**   Type: **not specified**

Discussion Session

Thursday, 31 January 2019 11:00 (30 minutes)

Presenters: CORNELL, Alan; Prof. GOYAL, Ashok (University of Delhi)

Session Classification: Session III

Contribution ID: **39**   Type: **not specified**

Measurement of heavy-flavours as a function of charged-particle multiplicity with ALICE at the LHC

Wednesday, 30 January 2019 14:20 (20 minutes)

Heavy flavours (charm and beauty) quarks are produced in the early stages of ultra-relativistic collisions via hard scatterings and are an important tool for studying different aspects of Quantum Chromodynamics (QCD) in hadronic collisions. Charged-particle multiplicity gives information on the global characteristics of the event and can be exploited to investigate the possible influence of the event hadronic activity on particle production. At LHC energies, the measurement of heavy-flavours as a function of charged-particle multiplicity gives insight into the mechanisms which influence their production in hadronic collisions at these energies and is a tool to test the possible role of multi-parton interactions. In ALICE, heavy-flavour production is measured at central rapidity in the hadronic and electronic decay channels as well as at forward rapidity in the muonic decay channel. Charged-particle multiplicity is measured at central and forward rapidity. We will present the results on heavy-flavour production as a function of charged-particle multiplicity in pp and p-Pb collisions.

Author: Ms MHLANGA, Sibaliso (iThemba/UCT)

Presenter: Ms MHLANGA, Sibaliso (iThemba/UCT)

Session Classification: Session II

Contribution ID: **40**   Type: **not specified**

Review of Jet Substructure and Machine Learning activies

Thursday, 31 January 2019 12:30 (20 minutes)

Several ongoing projects, involving data analysis using jet substructure and machine learning method will be summarised. ATLAS boosted heavy neutrino search and the measurement of several substructure observables in different topologies will be mentioned. The former is a precursor of several other planned searched in unusual topologies. Jet tagging using modern machine learning methods is another active area. We will also cover the analysis of medical data using machine learning methods.

Author: KAR, Deepak (University of the Witwatersrand (ZA))

Presenter: KAR, Deepak (University of the Witwatersrand (ZA))

Session Classification: Session III