IoP Joint HEPP and APP Annual Conference 2019

Report of Contributions

https://indico.cern.ch/e/797094

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

Welcome

Monday 8 April 2019 11:00 (10 minutes)

Session Classification: Plenary

Track Classification: Plenary

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

Colliders

Monday 8 April 2019 11:10 (40 minutes)

Presenter: VIRDEE, Jim (Imperial College (GB))

Session Classification: Plenary

Track Classification: Plenary

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

Neutrinos

Monday 8 April 2019 11:50 (40 minutes)

Presenter: WARK, Dave (RAL / Imperial College London)

Session Classification: Plenary

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

Cosmology

Tuesday 9 April 2019 15:00 (30 minutes)

Presenter: DI VALENTINO, Eleonora (Institut d'Astrophysique de Paris)

Session Classification: Plenary

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

Theory

Monday 8 April 2019 17:00 (30 minutes)

Presenter: BAUER, Martin (Heidelberg University)

Session Classification: Plenary

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

g-2/LFV

Monday 8 April 2019 17:30 (30 minutes)

Presenter: HESKETH, Gavin (University College London (UK))

Session Classification: Plenary

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

CTA

Monday 8 April 2019 18:00 (30 minutes)

Presenter: Dr LEACH, Steven (University of Leicester)

Session Classification: Plenary

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

LHC - Standard Model

Tuesday 9 April 2019 09:00 (30 minutes)

Presenter: PETERS, Yvonne

Session Classification: Plenary

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

LHC Searches

Tuesday 9 April 2019 09:30 (30 minutes)

Presenter: LEONIDOPOULOS, Christos (The University of Edinburgh (GB))

Session Classification: Plenary

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

Gravitational Waves

Tuesday 9 April 2019 10:00 (30 minutes)

Presenter: Dr DOOLEY, Katherine (Cardiff University)

Session Classification: Plenary

Contribution ID: **11** Type: **not specified**

Short baseline neutrinos

Tuesday 9 April 2019 14:00 (30 minutes)

Presenter: BLAKE, ANDY (Lancaster University)

Session Classification: Plenary

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

Detector technology

Tuesday 9 April 2019 14:30 (30 minutes)

Presenter: COLEMAN, Jon (University of Liverpool)

Session Classification: Plenary

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

Electronics

Monday 8 April 2019 12:30 (30 minutes)

Presenter: ROSE, Andrew William (Imperial College (GB))

Session Classification: Plenary

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

LHC Higgs

Wednesday 10 April 2019 09:00 (30 minutes)

Presenter: VICKEY, Trevor (University of Sheffield (GB))

Session Classification: Plenary

Contribution ID: **15** Type: **not specified**

HEPP Prize

Wednesday 10 April 2019 09:30 (30 minutes)

Presenter: KABOTH, Asher (University of London (GB))

Session Classification: Plenary

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

Dark Matter

Wednesday 10 April 2019 10:00 (30 minutes)

Presenter: Dr MCCABE, Christopher (King's College London)

Session Classification: Plenary

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

Outreach

Wednesday 10 April 2019 14:00 (30 minutes)

Presenter: CREMONESI, Linda (University of London (GB))

Session Classification: Plenary

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

Double Beta Decay

Wednesday 10 April 2019 14:30 (30 minutes)

Presenter: Dr PATRICK, Cheryl (University College London)

Session Classification: Plenary

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

LHC - Flavour

Wednesday 10 April 2019 15:00 (30 minutes)

Presenter: MALDE, Sneha Sirirshkumar (University of Oxford (GB))

Session Classification: Plenary

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

LHC - Upgrades

Wednesday 10 April 2019 15:30 (45 minutes)

Presenter: EKLUND, Lars (University of Glasgow (GB))

Session Classification: Plenary

Track Classification: Plenary

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

Measurement of the CP nature of the Htt Yukawa coupling using gluon fusion production in association with two jets with a Higgs boson decay to a tau lepton pair

Monday 8 April 2019 14:00 (15 minutes)

Since the discovery of the Higgs boson with a mass near 125 GeV, much effort has been dedicated to studying its properties. This talk presents one such study, which investigates the CP structure of the Higgs boson by exploiting the gluon fusion production process in association with two jets. Analysis of the azimuthal angle correlations of the jets provides an insight into the CP nature of the Htt Yukawa coupling. Higgs bosons decaying into a pair of tau leptons are considered, and the full 2016 and 2017 datasets collected at the CMS experiment are used.

Presenter: DOW, Albert Kenneth (Imperial College (GB))

Session Classification: Parallel stream 1

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

Measuring the top higgs couplings CP-nature in ttH(->bb) dilepton events.

Monday 8 April 2019 14:15 (15 minutes)

The coupling strength of the higgs boson to fermions is predicted to be proportional to the fermions mass, making the higgs top coupling the strongest in the SM.
This coupling strength can be directly measured in the production of a higgs boson in combination with two top quarks, which was observed in 2018. In the SM, the higgs top coupling is predicted to be a CP-even coupling but measuring a CP-odd component would suggest physics beyond the SM.
I will present how the current data collected with the ATLAS experiment can be used for a measurement on the top higgs coupling.
I will concentrate on the case where both two top quarks decay leptonically and the higgs decays into a bbbar pair. In this decay channel, there are many challenges such as the two neutrinos and high multiplicity of jets in the final state. This talk will demonstrate the full event reconstruction including reconstruction of the top quarks using neutrino weighting. I will also present how kinematic variables in the event may be combined in MVA techniques to optimise the sensitivity of this measurement and allow us to set limits on the coupling parameters with existing and upcoming LHC data.

Presenter: SCHARMBERG, Nicolas (University of Manchester (GB))

Session Classification: Parallel stream 1

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

Background Modelling in the ttH(H→γγ) Channel

Monday 8 April 2019 14:30 (15 minutes)

The discovery of the Higgs boson in 2012 by the ALTAS and CMS experiments at CERN was only the beginning, the properties of this particle still need to be measured and compared with theoretical predictions. The ttH production channel allows a direct measurement of the Higgs coupling to top quarks, the heaviest particle in the Standard Model, while the H→γγ decay channel gives a narrow peak in the mγγ spectrum that is easily distinguished from background.
The shape of this background model needs to be as accurate as possible in order to minimise uncertainty on measurements. With the models being created from analytical functions fitted to simulated Monte Carlo background samples, a method for estimating how much the resulting model differs from the true distribution is required. For H→γγ analyses this is carried out using the spurious signal method which quantifies how much background could falsely be interpreted as signal and assigns it as the systematic error on the model.
However, the spurious signal method is highly dependent on the statistical fluctuations of the Monte Carlo sample, making it difficult for the production of simulated events to keep up with the rising luminosity of data-sets. This has resulted in the background systematics becoming dominant in several measurement channels. A study to quantify the effects of Monte Carlo sample statistics on the systematic error on the background model has been undertaken to provide estimates to help decide which channels are not feasible for producing enough Monte Carlo events for the spurious signal test or for which channels need an increase in production. This talk will address the spurious signal problem and present the results of this study.

Presenter: HEATH, Matthew Peter (The University of Edinburgh (GB))

Session Classification: Parallel stream 1

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

Prospects for top-Yukawa coupling and Higgs boson CP at the CLIC e+e- collider

Monday 8 April 2019 14:45 (15 minutes)

The compact linear collider - or CLIC - is a proposed electron-positron collider and is currently the only mature option for a multi-TeV linear collider. The CLIC accelerator is based on a novel two-beam acceleration technique at an acceleration gradient of 100 MV/m. It would be built in stages, with three centre-of-mass energies of 380 GeV, 1.5 GeV and 3 TeV. CLIC will make precise measurements of Standard Model processes, including the Higgs boson, and study any new physics processes. In this talk, I will present my studies of ttH production at 1.5 GeV, using polarised beams and an integrated luminosity of 2.5/ab. This can be used to measure the precision of the top-Yukawa coupling in the Standard Model to be 2.7% and to investigate the CP properties of the top-Higgs coupling.

Presenter: ZHANG, Yixuan (The University of Edinburgh (GB))

Session Classification: Parallel stream 1

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

Constraining Systematics at T2K with Near-Detector Fits

Monday 8 April 2019 14:45 (15 minutes)

T2K is a long baseline neutrino oscillation experiment designed to make precise measurements of the parameters governing neutrino oscillations. A muon (anti-)neutrino beam is produced at the Japan Proton Accelerator Research Complex (J-PARC) on the east coast of Japan, and is aimed towards the Super-Kamiokande (SK) detector 295km away near the west coast. In this analysis, Markov Chain Monte Carlo is used to fit the Monte Carlo prediction to data from the near detectors, ND280 and INGRID, which measure the neutrino flux and interaction cross-sections before oscillation. The flux and interaction models are parameterised using external data and T2K beam line monitoring measurements to set the prior values and uncertainties. The fit to ND280 data incorporates the prior knowledge, further constraining the uncertainties and adjusting the parameters. Several updates have been made to the data samples and cross-section model used for the 2019 oscillation analysis to maximise the constraint on these systematics, and reduce the impact they have on oscillation results. After the near detector fit, the central values and uncertainties of the parameters are used in the prediction of SK data for the full oscillation fit. Typically the near detector fitting process reduces systematic uncertainties from 12-14% to 2-4%, allowing world-leading oscillation parameter measurements to be made at T2K.

Presenter: PARKER, William Charles (University of London (GB))

Session Classification: Parallel stream 4

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

The High Pressure gas Time Projection Chamber: a Future Neutrino Detector

Monday 8 April 2019 15:00 (15 minutes)

Understanding neutrino-nucleus interaction cross-sections at the 1-2 percent level will be crucial for the next generation of long baseline neutrino experiments. Due to its low hadron momentum detection threshold, a High Pressure gas Time Projection Chamber (HPTPC) is a strong candidate for achieving a significant reduction in uncertainties on these cross-sections . An HPTPC is part of the baseline design of DUNE and a candidate for use in Hyper-Kamiokande.
An optically read out prototype HPTPC, rated to 5 bar of pressure, was built at Royal Holloway, University of London. The detector was used to make proton scattering measurements on at the CERN East Area T10 beamline from August to September 2018.
In order to improve experimental uncertainties on neutrino-nucleus cross-sections, it is important to improve the models that we use to describe them. HPTPC data will be used to tune the final state interaction parameters in NEUT, the primary neutrino Monte Carlo generator used by the T2K experiment. This tuning will enable a reduction in the systematic uncertainty of neutrino oscillation measurements made by T2K and future experiments.

Presenter: NONNENMACHER, Toby Sean (Imperial College (GB))

Session Classification: Parallel stream 4

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

DQM4HEP: a generic online monitor for particle physics experiments

Monday 8 April 2019 15:30 (15 minutes)

Currently there is a lot of activity in R&D for future colliders. Multiple detector prototypes are being tested, each with different requirements for data acquisition and monitoring, which has generated different ad hoc software solutions. We present DQM4hep, a generic C++11 framework for online monitoring for particle physics experiments, and results obtained at several testbeams with detector prototypes using the framework as it was developed. The work on DQM4hep forms part of AIDA-2020, a collaboration for establishing common tools and infrastructures for particle physics experiments.

Presenter: COATES, Tom (University of Sussex (GB))

Session Classification: Parallel stream 1

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

Integration-by-parts identities and multi-loop QCD amplitudes

Monday 8 April 2019 15:45 (15 minutes)

As the LHC gathers ever more data and makes measurements with increasingly high precision, it is essential for theorists to match this precision when making predictions for cross-sections. In QCD and other gauge theories, this high precision is achieved by including multi-loop Feynman diagrams when calculating scattering amplitudes. Integration-by-parts identities (IBPs) are widely used when computing the associated multi-loop integrals. The solution of large systems of IBPs is a major bottleneck in the computation of high-precision QCD amplitudes for processes observed at the LHC, such as 3-jet production.
In this talk, I will discuss my work on IBPs, first presented in arXiv:1805.09182, where we introduce a new strategy for solving systems of IBPs, which we believe to be especially applicable to problems with many kinematic scales and/or many master integrals. Using this strategy, we have solved the IBPs needed for the computation of any planar 2-loop 5-point massless amplitude in QCD. We have also derived some new results for the associated non-planar integrals. Ultimately, we expect that the remaining non-planar contributions will be computable in analytic form, which would allow cross-sections for processes such as 3-jet production to be predicted at Next-to-next-to-leading order in QCD, reducing theoretical uncertainties down to a few percent.

Presenter: CHAWDHRY, Herschel (University of Cambridge)

Session Classification: Parallel stream 1

Contribution ID: **29** Type: **not specified**

Search for long-lived neutral particles that decay into displaced jets in the ATLAS detector

Monday 8 April 2019 14:00 (15 minutes)

Long-lived particles feature in many extensions to the Standard Model that have been proposed to address some of its open questions. Decays of long-lived particles created in collider experiments would produce unique signatures that may have been overlooked by previous searches for promptly decaying particles.

A search for pairs of neutral long-lived particles (LLPs) decaying in the volume of the ATLAS detector (mainly in the hadronic calorimeter) is presented, which probes LLP decay lengths ranging between a few centimetres and a few tens of metres. The analysis uses a simplified Hidden Sector model as a benchmark, where scalar LLPs are pair-produced from decays of heavy bosons, and eventually decay to SM fermions (mainly b-quarks). If this decay occurs in the calorimeters, the two resulting fermions are reconstructed as a single displaced jet with unusual features compared to jets from SM processes. A series of machine learning techniques were employed to identify the displaced jets and reduce the contamination from background in the search region. A data-driven estimate of the remaining background was performed and limits were set on the production cross section times branching ratio, extrapolated as a function of the decay length of the LLPs. These are presented combined with limits from a search which looks for displaced jets in the ATLAS muon spectrometer.

Presenter: Ms MORRIS, Alice (University College London (GB))

Session Classification: Parallel stream 2

Contribution ID: **30** Type: **not specified**

Search for the Higgs boson decay to a pair of muons with the ATLAS detector at the LHC

Monday 8 April 2019 14:15 (15 minutes)

Higgs decay to a muon pair is the most promising way to probe Yukawa couplings to the second generation fermions at the LHC. Experimentally the analysis is challenging due to a small branching ratio (2.2*10ˆ-4) and proceeds as a search for an excess at the Higgs mass in the dimuon invariant mass spectrum dominated by the irreducible Drell-Yan background. This talk presents the search with 79.8 fb-1 of data collected with the ATLAS detector at sqrt(s)=13 TeV, and prospects for the High Luminosity LHC.

Presenter: ZGUBIC, Miha (University of Oxford (GB))

Session Classification: Parallel stream 2

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

Search for H->ee using 140/fb of 13 TeV pp collision data with ATLAS experiment

Monday 8 April 2019 14:30 (15 minutes)

Since the discovery of the Higgs boson in 2012, the observed production and decay modes have all been related to its coupling to gauge bosons and to third generation fermions. The focus is now shifting towards the Higgs boson couplings to the second generation fermions, in particular to muons, but the first generation is much less explored. This talk will present the ongoing efforts within the ATLAS collaboration to search for the rare Higgs boson decay to an electron and a positron using complete Run 2 integrated luminsoity. The search itself uses a similar method to previous searches at ATLAS for the di-muon decay of the Higgs, as the two decay channels have similar backgrounds and signal efficiencies. This talk will cover, in more detail, the motivations for and methods used in the search, as well as the expected results.

Presenter: TURNER, Russell James (University of Birmingham (GB))

Session Classification: Parallel stream 2

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

IceCube astrophysical neutrino 7.5-year data

Monday 8 April 2019 14:45 (15 minutes)

The IceCube Neutrino Observatory detects astrophysical neutrinos with energies above TeV scales which provides the first solid evidence for astrophysical neutrinos from cosmological accelerators. Here we describe The High Energy Starting Event (HESE) selection and why it is useful for probing the high energy astrophysical landscape. With higher statistics taken over 7.5 years, we have been able to test the diffuse astrophysical flux whilst amplifying our rejection of atmospheric backgrounds using our neutrino veto region method. By doing so, the chance of understanding the characteristics of cosmic sources is also improved. With improved systematics and calibration, we aim to analyze rare topologies in the IceCube detector such as tau candidates, as well as Glashow neutrinos.

Presenter: KATORI, Teppei (Queen Mary University of London)

Session Classification: Parallel stream 2

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

Noise Rejection Method Using Spherical Harmonic Decomposition

Monday 8 April 2019 15:00 (15 minutes)

The rapid analysis of gravitational-wave data for burst-like signals is not trivial for many reasons, such as the non-Gaussian non-stationary nature of the background noise in the detectors and the lack of information about potential sources such as exhaustive waveform models or sky position. One active research area is based on the use of X-SphRad (X-Pipeline Spherical Radiometer), a software package designed for performing autonomous searches for un-modeled gravitational-wave bursts. X-SphRad has an approach based on spherical radiometry, that transforms time series data streams into the spherical harmonic domain. We will describe the harmonic coefficients potential in discriminating gravitational wave candidates from background noise, and overview a noise rejection method. We are testing this method on the data given by the LIGO-VIRGO collaboration.

Presenter: MASSERA, Elena

Session Classification: Parallel stream 2

Contribution ID: **34** Type: **not specified**

Status of the LUX-ZEPLIN (LZ) dark matter experiment

Monday 8 April 2019 15:15 (15 minutes)

LUX-ZEPLIN (LZ) is a dark matter direct detection experiment under construction at the Sanford Underground Research Facility in Lead, South Dakota. The dual-phase TPC at its core will contain seven tonnes of active liquid xenon to search for Weakly Interacting Massive Particles (WIMPs). Fabrication and assembly operations are on track to start a 1000-day science run in 2020 with a fiducial volume of 5.6 tonnes. In this talk I will present an overview of the current status of the experiment and its timeline.

Presenter: LOPEZ PAREDES, Brais (University of Sheffield (GB))

Session Classification: Parallel stream 2

Contribution ID: **35** Type: **not specified**

Radon Backgrounds in LZ

Monday 8 April 2019 15:30 (15 minutes)

LUX-ZEPLIN (LZ) is a next-generation two-phase xenon TPC detector operating at 4850 feet below ground with an active mass of 7 tonnes. The primary goal of LZ is to search for low-energy interactions from the dark matter halo in our galaxy —hypothesised to be in the form of Weakly Interacting Massive Particles (WIMPs). Operating for 1000 days and using a 5.6-tonne fiducial mass, LZ is projected to exclude at a 90% confidence level, spin-independent WIMP-nucleon cross-sections above 1.6x10-48 cm2 for a 40 GeV/c2 mass WIMP. Radon presents the largest contribution to the background model in achieving this sensitivity. In this talk, I will present the comprehensive radon screening programme in LZ that informs material selection and construction; contributions from various radon-related backgrounds, including emanation, plate-out and mis-reconstruction effects; and finally, the implications of radon levels in LZ for both the experiment's sensitivity and the spin-independent WIMP discovery potential of LZ.

Presenter: Mr UTKU, Umit (University College London)

Session Classification: Parallel stream 2

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

Top-Antitop Charge Asymmetry with Fully Bayesian Unfolding

Monday 8 April 2019 14:00 (15 minutes)

A measurement of the top-antitop charge asymmetry is underway at the ATLAS experiment at the LHC. This is being being performed at 13 TeV with 80 fb-1 of proton-proton collision data, with the eventual aim to use the full 140 fb-1 Run 2 dataset. The method of Fully Bayesian Unfolding (FBU) is employed to determine the parton-level charge asymmetry. This technique generates a posterior probability distribution for the asymmetry which we compare with the expectation from Monte-Carlo simulation. The method also helps to reduce the systematic uncertainties and will allow the combination of three ttbar decay channels: dilepton, lepton+jets with resolved jets and lepton+jets with boosted (collimated) jets. The asymmetry is expected to be small, though effects beyond the Standard Model can change this. It is being determined inclusively and also in bins of top-antitop transverse momentum, mass and velocity. In addition to the asymmetry for the top-antitop pair, a measurement is made in the dilepton channel of the asymmetry between the two leptons. This has reduced uncertainties but the predicted asymmetry is smaller.

Presenter: VALLANCE, Robert Adam (University of Birmingham (GB))

Session Classification: Parallel stream 3

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

Single dissociative diffraction at √s=13 TeV with the ATLAS detector

Monday 8 April 2019 14:15 (15 minutes)

I will be presenting an overview of the ATLAS analysis of the single dissociative diffraction cross-section in p-p collisions at 13 TeV. I am the main analyser for this measurement and it will be the topic of my PhD thesis.

Single dissociative diffraction (pp->pX) occurs when there is a t-channel exchange with the quantum numbers of the vacuum with one proton remaining intact and the other dissociating into a diffractive system 'X'. It's cross-section is approximately 10-20% of the total p-p cross-section at √s=13 TeV but this is not well constrained.

The aim of the analysis is to measure the differential cross-section as a function of the squared four-momentum exchanged in the t-channel and the fractional energy loss of the intact proton. This will enable tests of models based on different approaches to soft strong interactions and the calculation of parameters that are important in the tuning of MC models.

The analysis has several novel components. The data are from a low pile-up, high β* optics run of the LHC. The ALFA roman pot detectors, situated ˜240m away from the interaction point, are used to provide tagging and kinematic reconstruction of intact protons. At the time of writing there are no public LHC diffractive results that use proton tagging.

Presenter: Mr KENDRICK, James (University of Birmingham (GB))

Session Classification: Parallel stream 3

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

Top quark charge asymmetry at LHCb

Monday 8 April 2019 14:30 (15 minutes)

The LHCb experiment provides unique detector coverage, $2 < \eta < 5$, of high energy proton-proton interactions produced at the Large Hadron Collider. Designed to study b- & c-hadron physics, LHCb is fully instrumented in the forward region with excellent tracking and vertex resolution.
The top quark is the heaviest fundamental particle and is expected to play a special role in new physics scenarios. Higher order interference mechanisms, sensitive to physics beyond the reach of current colliders, result in a charge asymmetry, Att , in the angular distributions of top pairs. LHCb' s acceptance offers greater sensitivity to Att due to reduced dilution from gluon-gluon fusion.
Top quarks are identified through the presence of a high pT muon and b-jet in the final state. Forward production was first observed with Run I data at LHCb in this channel. The increase in available statistics with Run II, as well as improved signal to background ratio, will allow the first measurement of the top charge asymmetry in the forward region.

Presenter: MEAD, James (University of Liverpool (GB))

Session Classification: Parallel stream 3

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

CP violation measurements in B decays with final state neutral kaons: how precise can we get?

Monday 8 April 2019 14:45 (15 minutes)

Measurements of CP violation in B decays are entering a high precision era, and with the increasing precision comes a need for an equally precise understanding of limiting uncertainties. I will present a recent, world-leading precision measurement of the CP-violating CKM phase gamma, using data from the LHCb experiment. The measurement used B -> DK decays, where the D meson decays to a neutral kaon and two pions. Sensitivity to the CP violating phase gamma is obtained via interplay between gamma and the phase of the D decay over the decay phase space.
The expected precision within the next five years requires the study of second-order physics effects. I will focus on phenomenological work on a potentially limiting systematic uncertainty due to the inherent CP violation in the neutral kaon system, as well as material dependent kaon regeneration effects that can mimic CP violation signatures. Earlier estimates have put the relative bias due to these effects as high as 4 %, which would soon limit the obtainable precision. Therefore, a detailed understanding of the effects is crucial. I will present arguments for why the effect on measurements in the LHCb Upgrade and Belle 2 is expected to be at the sub-percent level.

Presenter: BJORN, Mikkel (University of Oxford)

Session Classification: Parallel stream 3

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

A scintillator-based range telescope for quality assurance in proton therapy

Monday 8 April 2019 15:00 (15 minutes)

In particle therapy, range measurements are an integral part of the daily quality assurance (QA) process. Most treatment centres use water phantoms or Multi-Layer Ionisation Chambers for the range QA. A system is under development at University College London to provide fast, robust and cost-effective range QA measurements based on a plastic scintillator range telescope. This detector would be easy to set up and allow the verification of all range steps of a typical particle therapy centre within the time of delivery.
The results of proof-of-principle experiments with clinical particle beams are presented. A prototype was built at UCL and tested in multiple treatment centres across Europe with protons, Helium and Carbon ions. The range reconstruction of protons has an uncertainty of 0.15 mm, complying with clinical standards for quality assurance detectors. During a radiation damage assessment a dose of 6,000 Gray was delivered to the range telescope, corresponding to approximately a year' s worth of integrated dose. Although a reduction in the scintillator light output of a few percent was observed, there was no quantifiable impact on the range measurement itself.

Presenter: KELLETER, Laurent (UCL)

Session Classification: Parallel stream 3

Contribution ID: **41** Type: **not specified**

Neutrinoless Double Beta Decay in the SNO+ Experiment

Monday 8 April 2019 15:15 (15 minutes)

SNO+ is a multipurpose neutrino detector located in 2km underground in Sudbury, Canada. The main physics goal of the project is to search for neutrinoless double beta decay in Tellurium-130. For phase I, SNO+ will deploy 4t of natural Tellurium inside the detector volume in the form of Tellurium-loaded liquid scintillator. The detector is currently filled water and taking data. The Tellurium loading is expected to start later this year. I will discuss the requirements for the SNO+ scintillator along with the loading technique. The nature of the signal extraction and the projected sensitivity to neutrinoless double beta decay in SNO+ will also be presented.

Presenter: KROUPOVA, Tereza (CERN)

Session Classification: Parallel stream 3

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

First physics results from the SNO+ experiment

Monday 8 April 2019 15:30 (15 minutes)

Various theories beyond the Standard Model propose baryon number violating processes in order to explain the matter-antimatter asymmetry in the universe, many of which result in some form of nucleon decay. Some modes of nucleon decay are invisible, in the sense that the final state particles remain undetected. Following the disappearance of one or two nucleons in such a nucleus, the subsequent de-excitation of the remaining daughter nucleus may yet be observed via gamma-ray emission. Understanding the corresponding branching ratios for the population of various energy states in the daughter nuclei is crucial for setting lifetime limits on these decays.
The SNO+ experiment has been taking data for the past two years, during which the detector was filled with ultrapure water for commissioning and calibration purposes. Due to the 2 km rock overburden (6000 m.w.e.) and the high target purity, it was possible to conduct low background measurements as well as new physics searches in the 5-10 MeV energy range. In particular, a search for invisible nucleon and dinucleon decay modes in 16O was conducted. Additionally, the 8B solar neutrino flux was measured with an exceptionally low background rate. Results from these analyses are discussed here.

Presenter: Dr NIRKKO, Martti (University of Sussex (UK))

Session Classification: Parallel stream 3

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

A search for light Higgs bosons in supersymmetric decay cascades at CMS.

Tuesday 9 April 2019 11:45 (15 minutes)

This talk presents a search for pairs of light Higgs bosons produced in NMSSM decay cascades using the CMS detector. The analysis uses data sets corresponding to the 2016 and 2017 proton-proton collisions at a centre-of-mass energy of 13 TeV. The final state targeted is that where both Higgs bosons decay into bbbar pairs.
The signal model is of interest because, under certain mass configurations, the missing transverse energy in the events can be highly suppressed. This produces an all jet final state that typical supersymmetry searches would not be sensitive to. In suppressing the missing transverse energy, the Higgs bosons become highly boosted objects, leading to a small angular separation between the b-quarks. Consequently, each bbbar pair is reconstructed in a single AK8 jet. Substructure techniques are applied to the AK8 jets to measure the mass of the reconstructed object, and to determine how likely it is that the AK8 jet originates from two b-quarks.

Presenter: TAYLOR, Joseph (University of Bristol (GB) / Rutherford Appleton Lab (GB))

Session Classification: Parallel stream 3

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

Prospects for ttZ measurements at ATLAS with the full 140 fb-¹ Run 2 dataset

Monday 8 April 2019 14:00 (15 minutes)

We review the recent measurement of the inclusive ttZ cross-section with 36 fb-1 of data at 13 TeV at the ATLAS experiment, using EFT considerations and background modelling for generic SUSY/DM searches as motivation for continuing to improve the precision of this result. We then present plans for a differential ttZ measurement in the 3 and 4 lepton channels with the full 140 fb-1 Run 2 dataset, and highlight a number of promising research directions, such as a re-interpretation in terms of ttZ spin correlation observables, or the possibility to unfold SUSY/DM validation regions (or even null-result signal regions) to constrain the ttZ(vv) process. Particular attention is also given to the topic of semi-leptonic top reconstruction, necessary to match the performance of the dileptonic decay channels.

Presenter: RAVINA, Baptiste (University of Sheffield (GB))

Session Classification: Parallel stream 4

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

Search for the supersymmetric partner to the top quark in the all-hadronic channel with the ATLAS Detector.

Monday 8 April 2019 14:30 (15 minutes)

The author/presenter will outline the status of the search for Supersymmetry (SUSY) in the 3rd generation sector, particularly the SUSY partner of the top quark, using the 140.5 ifb dataset collected from the ATLAS detector from LHC Run 2 (2015-2018).
This analysis is searching in the all-hadronic channel for a reconstructed final state of top-antitop pairs and Missing Energy, looking to observe R-Parity Conserving (RPC) SUSY. LHC Run 2 has profited from both increased statistics and improved understanding of the underlying objects of each collision event, and we will present the benefits this has offered for our search.
We will cover the search strategy, namely the definition of signal, control and validation regions for our background processes, the ATLAS detector configuration, key backgrounds and (if possible) new search results. The author will outline their work in particular into the study of constraining the all hadronic ttbar+ Z(-> 2 neutrinos) background in an all hadronic channel using the semi-leptonic ttbar+Z (->2 leptons) in a trilepton channel, a significant new component to the search strategy.

Presenter: ANTHONY, Matthew Thomas (University of Sheffield (GB))

Session Classification: Parallel stream 4

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

A preliminary charged-current muon neutrino inclusive selection in SBND.

Monday 8 April 2019 15:00 (15 minutes)

SBND, a 112 ton liquid argon time projection chamber, is the near detector of the short-baseline neutrino program at Fermilab. Once data taking begins in 2020, it will provide flux constraints for sterile neutrino searches and produce world leading neutrino-argon cross-sections with seven million neutrino events in 3 years. This talk will demonstrate the capability of SBND's time projection chamber and cosmic ray tagger system to select charged-current muon neutrino interactions above the largest source of background, cosmic ray muons.

Presenter: BROOKS, Tom (University of Sheffield)

Session Classification: Parallel stream 1

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

An electron neutrino event selection procedure in the Short-Baseline Near Detector

Monday 8 April 2019 15:15 (15 minutes)

The Short Baseline Neutrino (SBN) programme at Fermilab consists of three Liquid Argon Time Projection Chambers (LArTPCs) on the Booster Neutrino Beam. The key goal of the SBN programme is to perform the most sensitive search to date for sterile neutrinos in the eV-mass scale through appearance and disappearance oscillation channels. In order to achieve the sensitivities capable to the SBN programme, sophisticated reconstruction algorithms are being developed to identify the flavour and energy of neutrino events. An electron neutrino event selection procedure is being developed to evaluate the proposed sensitivities for electron neutrino appearance and cross-section measurement in the closest detector, at 110 m from the neutrino source, the Short Baseline Near Detector (SBND). The current effectiveness of the selection process will be presented.

Presenter: BARKER, Dominic (University of Sheffield)

Session Classification: Parallel stream 1

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

Measurement of CP violation parameters in $B^0 \to DK^{*}0$ decays

Wednesday 10 April 2019 11:00 (15 minutes)

The CP-violating angle γ is the only angle of the unitarity triangle which can be measured via tree-level processes. γ can also be measured indirectly using loop-level processes, which are susceptible to the effects of new physics. An observed discrepancy between the direct and indirect measurements of γ would be evidence for new physics. Reducing the experimental uncertainty on the direct γ measurement is therefore of great interest.
To measure γ, we exploit interference between decays with b → u and b → c quark transitions. One such decay is B0 → DK*0, where D is a superposition of D0 and anti-D0 mesons. An analysis of this mode is presented with D reconstructed in the two-body final states K-π+, K+π-, K+K- and π+π-, and the four-body final states K-π+π-π+, K+π-π+π- and π+π-π+π-. The data sample used corresponds to 5 fb-1 of proton-proton collisions collected by the LHCb experiment. Several observables are measured, including CP asymmetries. These provide constraints on γ as well the amplitude ratio rB and strong phase difference δB between the interfering decays.

Presenter: PULLEN, Hannah (University of Oxford (GB))

Session Classification: Parallel stream 1

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

Angular analysis of B+⟶ K+ee at the LHCb experiment

Monday 8 April 2019 15:30 (15 minutes)

Numerous recent anomalies in the b⟶sll flavour sector give indication of potential lepton flavour universality (LFU) violation in (axial-)vector couplings.
To probe these anomalies and further assumptions about LFU in other couplings, now more than ever, precise measurements of the SM properties are needed.
This talk presents one arm of these investigations using B+ ⟶ K+ee decays, with proton-proton collision data at LHCb collected in run 1 and run 2, to conduct the first angular analysis of this mode.
An angular analysis provides a way to measure non-trivial parameters using kinematic information from the decay, and in this mode has access to the coefficients for scalar, pseudo-scalar and tensor couplings.
This angular analysis will provide the most stringent constraint on the NP contributions through scalar, pseudo-scalar and tensor, couplings as the decay is independent of (axial-)vector couplings, and additionally provide vital understanding on the electron reconstruction efficiency in b⟶sll transitions.

Presenter: MADDRELL-MANDER, Samuel William (University of Bristol (GB))

Session Classification: Parallel stream 4

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

Branching fraction measurement of $B^0 \to \pi^+\pi^-\mu^+\mu^-$ using Run 1 and Run 2 LHCb data

Monday 8 April 2019 15:45 (15 minutes)

Flavour Changing Neutral Current processes are heavily suppressed in the Standard Model of particle physics and are potentially sensitive to contributions from as yet undiscovered particles. Recent measurements of b⟶s transitions by the LHCb collaboration show interesting tensions with Standard Model predictions.
The large LHC data set enables measurements of decays involving b⟶d transitions to be made for the first time. In combination with the b⟶s processes, these measurements will provide insights into the flavour structure of potential extensions to the Standard Model. The decay B0⟶ρ0μ+μ- is a particularly interesting b⟶d process, which was first probed using LHCb's Run 1 dataset. Progress towards an updated branching fraction measurement, using both Run 1 and Run 2 data, will be presented. In addition, the prospects for an angular analysis of the decay are discussed.

Presenter: MILLARD, Edward James (University of Warwick (GB))

Session Classification: Parallel stream 4

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

Extending dark matter searches in liquid xenon to single scintillation photons

Tuesday 9 April 2019 11:00 (15 minutes)

Dark matter experiments searching for weakly interacting massive particles (WIMPs) probe a variety of rare processes leading to O(keV) energy transfers to ordinary matter. Two-phase xenon detectors record two different signals per interaction: a prompt scintillation response (S1) and a delayed signal from ionisation (S2), with the energy threshold of standard analyses (S1+S2) largely determined by the S1 signal. We present a novel WIMP search analysis of LUX data from 2013, using a class of events with an S1 consisting of a single detected scintillation photon. This exploits a feature in the response of photomultiplier tubes to vacuum ultraviolet light which brings additional sensitivity for light WIMP interactions. We present also a projected WIMP sensitivity for the forthcoming LUX-ZEPLIN (LZ) experiment, with a lower S1 threshold achieved through the same analysis technique.

Presenter: MARANGOU, Nellie (Imperial College London)

Session Classification: Parallel stream 1

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

Background model for the LUX experiment

Tuesday 9 April 2019 11:15 (15 minutes)

The Large Underground Xenon (LUX) experiment is a retired dual phase Liquid Xenon Time Projection Chamber (LXe TPC), designed for the direct detection of dark matter. In 2016, LUX published its final limit on the spin independent nuclear cross-section for the scattering of WIMPs with nucleons. Subsequently the collaboration's focus has shifted to exploring new physics beyond this energy range. Due to the possible complexity of such signals, additional attention has been given to the radiogenic backgrounds seen in dual phase TPCs. This presentation will focus on beta, gamma, and neutron backgrounds intrinsic to LUX, with a particular emphasis on electron recoil background events which can mimic nuclear recoil signals.

Presenter: ROSSITER, Peter (University of Sheffield)

Session Classification: Parallel stream 1

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

Latest B ⟶ μ+ μ- results with the ATLAS detector

Tuesday 9 April 2019 11:30 (15 minutes)

The decay of B mesons into a pair of oppositely charged muons is extremely rare in the Standard Model, due to the suppression of Flavour-Changing-Neutral-Current (FCNC). Their Standard Model prediction is accurate and the experimental signature is very clean, therefore these decays are considered one of the golden channels to test the Standard Model and to look for deviations from its predictions due to New Physics phenomena. The latest analysis performed by the ATLAS collaboration on the dataset collected at center-of-mass energies of 13 TeV in 2015 and 2016 is presented, together with the extrapolation of the sensitivity of the analysis to the full 2015-2018 period as well as the future High Luminosity upgrade of the Large Hadron Collider.

Presenter: TRESOLDI, Fabio (University of Sussex (GB))

Session Classification: Parallel stream 1

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

Searching for new physics with emu asymmetry at the ATLAS detector

Tuesday 9 April 2019 11:45 (15 minutes)

The ATLAS experiment has never before measured the ratio of e+mu- to e-mu+ events in its data. Such a ratio is not expected to exceed one in the Standard Model in the LHC's proton-proton collisions. However, it could exceed one for some Beyond the Standard Model (BSM) scenarios like R-Parity violating supersymmetry or scalar leptoquarks. This talk presents a general search for new physics through the measurement of this ratio, that will also provide world-leading limits on these two BSM models which have not been probed with ATLAS before. This ratio measurement is highly unusual for an ATLAS BSM search, requiring little use of Monte Carlo simulation as well as allowing many systematic uncertainties to cancel out. The result will use the full 140.3fbˆ-1 of luminosity from the full run-2 dataset, taken in 2015-2018, and is aiming for publication in summer 2019.

Presenter: PACEY, Holly Ann (University of Cambridge (GB))

Session Classification: Parallel stream 1

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

Measuring Muon Induced Neutrons in the Water Phase of the SNO+ Experiment

Tuesday 9 April 2019 12:00 (15 minutes)

When a muon passes through a matter it can liberate neutrons and produce radioactively unstable isotopes. These neutrons and cosmogenic radioisotopes form a background to deep underground low-background experiments.
With a 2 km overburden, SNO+ sees approximately 3 muons per hour passing through the detector. The water phase of the experiment has just completed, and the detector is currently being loaded with scintillator. The low energy threshold and low backgrounds of SNO+ during the water phase allow the detection of neutrons via the capture of the neutron on a free proton releasing a signature 2.2 MeV gamma ray. The deployment of an AmBe source in the centre of the detector produced a tagging efficiency of 46.5⊠0.4%. This is the highest tagging efficiency achieved of any undoped water Cherenkov detector to date.
By searching for neutron captures following a muon passing through the detector the number of neutrons produced can be estimated. An analysis procedure is presented to determine the distribution of the number of neutrons generated per meter of muon track length within the detector. A measurement of the muon induced neutrons will allow an improved estimate of the backgrounds to the various dark matter experiments which are also hosted by the SNOLAB facility.

Presenter: STRINGER, Mark (University of Sussex)

Session Classification: Parallel stream 1

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

The Water Cherenkov Monitor for Anti-Neutrinos (WATCHMAN) at the Advanced Instrumentation Testbed.

Tuesday 9 April 2019 12:15 (15 minutes)

The WATer CHerenkov Monitor for Anti-Neutrinos (WATCHMAN) is the flagship project of the Advanced Instrumentation Testbed (AIT), a new US-UK collaboration in fundamental and applied science.
WATCHMAN will contain gadolinium-loaded water to allow it to detect the unique signature produced by an antineutrino interaction. With a total target mass of about 6000 tonnes, it will attempt to demonstrate that this new and scalable technology can be used for the remote monitoring of nuclear reactors. From its location in the STFC Boulby Underground Laboratory in North Yorkshire, WATCHMAN aims to observe the cycles of the Hartlepool dual-core nuclear power plant at a standoff distance of 25 kilometers.
The AIT will also enable testing of new technologies, including fast photosensors (such as Large Area Picosecond Photo-Detectors, or LAPPDs) and novel detection materials (such as water-based liquid scintillator, or WbLS).

Presenter: MALEK, Matthew (I)

Session Classification: Parallel stream 1

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

Modelling Backgrounds and Searching for WIMPs in DEAP-3600

Tuesday 9 April 2019 11:00 (15 minutes)

DEAP-3600 is single-phase liquid argon (LAr) direct-detection dark matter experiment, operating 2 km underground at SNOLAB, Sudbury, Canada. The detector consists of 3279 kg of LAr contained in a spherical acrylic vessel.
In this talk, a summary of the second dark matter search analysis of a 758 tonne-day exposure will be presented with emphasis given to modelling the detector backgrounds.

Presenter: WALDING, Joseph (University of London (GB))

Session Classification: Parallel stream 2

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

Differential measurement of the Z/γ ratio with the CMS experiment in pp collisions at 13 TeV

Tuesday 9 April 2019 11:15 (15 minutes)

The large amount of data collected at the Large Hadron Collider in its second phase of running, colliding protons at an unprecedented center of mass energy of 13 TeV, gives us the tremendous opportunity to conduct measurements of vector boson plus jets (V+jets) processes in regions of phase space that were previously limited.
This kind of processes play a key role in precision tests of the Standard Model and also the search for a wide variety of phenomena beyond the Standard Model. They are valuable probes of perturbative QCD and validate fundamental aspects of theoretical calculations, also providing crucial inputs in the determination of Parton Distribution Functions. Moreover, thanks to the high center of mass energy, V+jets processes are sensitive to effects from higher order electroweak (EWK) corrections. In parallel, developments in theoretical calculations have led to improved predictions and state of the art event generators becoming available, with the near term prospect of having automated Next-to-Leading-Order QCD and EWK corrections.The availability of such predictions, together with the large amount of data, add interest in studying particular phase space corners where EWK corrections are enhanced, such as collinear vector boson emission from a jet, and ratio of V+jets production cross sections, characterized by small systematic uncertainty on the measurement.
In my talk, I will present a precision measurement of the differential cross-sections of Z+jets and photon+jets production as a function of the boson transverse momentum and their ratio. The data was taken during 2016 by the CMS experiment and corresponds to an integrated luminosity of 35.9 fb−1, and are compared with several theoretical predictions.

Presenter: ZECCHINELLI, Giacomo (Imperial College (GB))

Session Classification: Parallel stream 2

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

Search for dark matter produced in association with bottom or top quarks with the ATLAS detector

Tuesday 9 April 2019 11:30 (15 minutes)

If dark matter interacts weakly with standard model particles it could be produced at the LHC and therefore could be observed with the ATLAS detector. WIMP dark matter would not interact with the detector and therefore would leave a signature involving large amounts of missing transverse momentum. There are a number of models assume a mediator which couples to both dark matter and the standard model. We will present a summary of searches for fermionic dark matter, produced through the exchange of a spin-0 mediator, in association with heavy flavour (bottom and top) quarks.

Presenter: THORPE, Edward James (University of London (GB))

Session Classification: Parallel stream 2

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

Associated production of a J/psi + photon at ATLAS

Tuesday 9 April 2019 11:45 (15 minutes)

The aim of this analysis is to study the process pp-> J/psi + photon + X, in order to understand the production mechanisms of this final state, and possibly to assess some information on the spin structure of the gluon distribution inside the proton. Analysing the subprocess g+g->J/psi + photon there is the prospect of seeing azimuthal modulations in the Collins-Soper frame, induced by the polarization of the gluons. The analysis is using the data collected during Run2 by the ATLAS experiment at CERN.

Presenter: TEE, Amy (Lancaster University (GB))

Session Classification: Parallel stream 2

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

Search for a heavy Higgs boson decaying into a Z boson and another heavy Higgs boson in the llbb final state in 13 TeV pp collision with ATLAS detector

Tuesday 9 April 2019 12:00 (15 minutes)

In this talk a search for a Higgs boson cascade in the context of the two-Higgs-Doublet Model is presented. In this cascade, a heavy Higgs boson A decays to ZH, where H is another heavy Higgs boson with mass > 125 GeV. Subsequently, the Z boson decay leptonically and the H boson into a bb pair. The search is motivated by the mechanism which generates the matter-antimatter asymmetry in the context of extended Higgs sectors, known as electroweak baryogenesis. In the context of 2HDM, this mechanism requires large mass splitting between the two heavier Higgs bosons. The search uses a data sample corresponding to an integrated luminosity 36.5 fb-1 from proton-proton collision data at a center-of-mass of 13 TeV recorded in 2015 and 2016 by the ATLAS detector at the LHC.

The A boson is assumed to be produced via gluon-fusion and b-associated production in the mass range 230-800 GeV and to decay to the H boson in the mass range 130-700 GeV, which is prefered by electroweak baryogenesis models. The dominant backgrounds of this analysis are expected to be Standard Model Z + heavy flavour jets and top-pair production. Monte Carlo samples are data driven method are used to develop methods to estimate the backgrounds and improve the sensitivity of the analysis.

The result of the search has been published in 2018 [Phys. Lett. B 783(2018)392]. No evidence for the production of an A boson is found. Considering each production process separately, 95% confidence-level upper limits on the pp->A->ZH production cross-section times the branching ratio H->bb are reported to be in the range 14-830 fb-1 for the gluon-gluon fusion process and 26-570 fb-1 for the b-associated production process for the corresponding mass ranges of A and H bosons. The results are also interpreted in the context of two-Higgs-doublet models.

Presenter: CHAN, Wai Yuen (University of Liverpool (GB))

Session Classification: Parallel stream 2

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

Searching for dark matter in DEAP-3600 in a 758 tonne-day data set.

Tuesday 9 April 2019 12:15 (15 minutes)

The DEAP-3600 detector, based 2km underground at SNOLAB (Sudbury, Canada) is a dark matter direct detection experiment. The detector is a single phase liquid argon (LAr) target, of 3279 kg mass. In this talk, the results of a dark matter search analysis of 758 tonne-days will be presented. No candidate signal events were observed in the WIMP region of interest, resulting in the leading limit on the WIMP-nucleon spin-independent cross section measured on a LAr target. The world-leading pulse shape discrimination result will be discussed, together with the plans to move towards a profile-likelihood statistical approach to perform the dark matter search analysis.

Presenter: KEMP, Ashlea (Royal Holloway, University of London)

Session Classification: Parallel stream 2

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

Beam test studies of a prototype TORCH detector

Tuesday 9 April 2019 11:15 (15 minutes)

TORCH is a time-of-flight detector designed to provide particle identification over the 2-10 GeV/c momentum range. Consisting of 18 large quartz plates, TORCH measures the time of arrival of charged particles through prompt Cherenkov light which is trapped by total-internal reflection. At the top of the plate the light is focused onto a row of micro-channel plate (MCP) detectors which measure the photon arrival time and position.
Designed for the LHCb detector, TORCH aims for a 15 ps track time resolution over a 10 m flight path. This translates into a 3 standard deviation separation between pions and kaons with momenta of 10 GeV/c. To achieve such a track resolution requires a time resolution of 70 ps per photon for 30 detected photons per track.
In the latter half of 2018 both a small-scale (120 x 350 x 10 mm3) and a half-scale (660 x 1250 x 10 mm3) prototype were tested in a 5 GeV/c mixed proton-pion beam at the CERN PS. Employing data-driven calibrations, the single photon timing performance has been measured, providing proof of principle for the TORCH concept. The projected performance of a full-scale TORCH detector instrumented in the LHCb experiment, determined through simulation studies, will also be presented.

Presenter: HANCOCK, Thomas Henry (University of Oxford (GB))

Session Classification: Parallel stream 3

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

Photon yield and MCP-PMTs in a prototype TORCH detector.

Tuesday 9 April 2019 11:00 (15 minutes)

TORCH (Time Of Internally Reflected CHerenkov light) is a novel concept of a Ring Imaging Cherenkov time-of-flight detector, which is being developed with a possible application in an upgrade of the LHCb experiment in 2030. Currently it is still in the Research and Development (R&D) phase. It utilises Cherenkov radiation to identify particles at low momenta. It would be located at 10m from the proton-proton interaction point, and consist of a 30 mˆ2 by 10 mm quartz plate which propagates emitted photons to Micro-Channel Plate Photomultiplier tubes (MCP-PMTs) where they can be captured. Total internal reflection in the detector propagates the photons onto the MCP-PMTs. To achieve a 3-sigma separation between kaons and pions up to 10 GeV/c, a timing resolution of 15 ps per photon is required. This provides the greatest challenge in this project and requires careful testing, performed during the so-called beam tests.

Presenter: GABRIEL, Emmy Pauline Maria (The University of Edinburgh (GB))

Session Classification: Parallel stream 3

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

Search for chargino and neutralino production in final state with three leptons and missing transverse momentum, via WH intermediate decays

Tuesday 9 April 2019 11:30 (15 minutes)

The direct production of chargino-neutralino, pp⟶$\tilde{\chi}$±1$\tilde{\chi}$02, followed by their decays via intermediate WH states ($\tilde{\chi}$±1$\tilde{\chi}$02⟶W±H$\tilde{\chi}$01$\tilde{\chi}$01), where H is the 125-GeV Standard Model Higgs boson, is a very important channel for the search for electroweak supersymmetry at the Large Hadron Collider. Amongst others, the search can be performed in the channel where both the W and the H decay fully leptonically ($\tilde{\chi}$±1⟶$\tilde{\chi}$01(W±⟶ℓ±ν) and $\tilde{\chi}$02⟶$\tilde{\chi}$01(H⟶ℓℓ)), yielding three leptons in final state. Results are presented from this search using 36.1 fb−1 of √s=13 TeV proton-proton collision data recorded with the ATLAS detector, together with an outlook for the full Run-2 analysis.

Presenter: TROVATO, Fabrizio (University of Sussex (GB))

Session Classification: Parallel stream 3

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

Searches for NMSSM Signatures with low Missing Transverse Energy at the CMS detector at the LHC

Tuesday 9 April 2019 12:00 (15 minutes)

We examine scenarios in the Next-to-Minimal Supersymmetric Standard Model (NMSSM) whereby two Standard Model-like Higgs bosons are produced via squark and gluino decay cascades along with two light, low-momentum neutrino Lightest Supersymmetric Particles (LSPs), resulting in very little Missing Transverse Energy (MET). Firstly, by recasting a general-purpose Jets+MET αT-based analysis we demonstrate how the sensitivity of current SUSY search efforts decreases in certain regions of parameter space within these scenarios. Finally we develop a novel search technique utilising machine learning-driven double-b-tagging variables for the case where each Higgs boson decays to a boosted bb pair.

Presenter: TITTERTON, Alexander (University of Bristol (GB))

Session Classification: Parallel stream 3

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

Search for decays of the Higgs Boson to bottom quarks via Associated Vector Boson production at the ATLAS experiment

Wednesday 10 April 2019 12:00 (15 minutes)

To demonstrate whether the particle discovered in 2012 is the Standard Model (SM) Higgs boson, all of its couplings to other SM particles have to be measured. In the SM, the coupling of the Higgs boson to fermions has a strength proportional to the mass of the fermion. Since the b-quark is the heaviest particle that the Higgs can kinematically decay into, it has the largest branching ratio. The measurement of this branching ratio is key for testing the SM and for constraining models of physics beyond the SM.
This talk will present the efforts of the ATLAS experiment to measure the Higgs decay to b quarks via associated Vector Boson production (VHbb). We make use of 79.8 fb-1 of proton-proton collision data at the centre-of-mass energy of √s = 13 TeV, collected by the ATLAS detector between 2015 and 2018. An excess of events was found over the expected background from other SM processes with an observed (expected) significance of 4.9 (4.3) standard deviations. Combination with data taken in 2011 and 2012 yielded an observed (expected) significance of 5.4 (5.5) standard deviations, providing observation of the Higgs decay into b-quarks.

Presenter: SPITERI, Dwayne (University of Glasgow)

Session Classification: Parallel stream 4

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

Approaching the neutrino mass problem with a beam dump experiment.

Tuesday 9 April 2019 12:15 (15 minutes)

The origin of the neutrino mass is still an open problem in physics and many efforts are being made to solve it.
Among the possible solutions, the simplest ones involve an extension of the Standard Model, where new singlet fermions are added. The most famous of this mechanism is the Type I seesaw, but the new particles introduced are usually at a scale not accessible by current and future experiments and therefore this model is not appealing for phenomenology studies.
However, symmetry-protected variants of the seesaw mechanism, like the Inverse Seesaw, could explain the existence of light-neutrino masses while also providing observable signatures of Heavy Neutral Leptons (HNLs) in a range of upcoming neutrino beam experiments.
In this talk, I will discuss the phenomenology of sterile neutrinos arising from low-scale neutrino mass models and the implications of a realistic mass model on the search for HNL. I will focus in particular on the impact on the signal of the strong polarisation effects in the beam for Majorana and (pseudo-)Dirac states, providing formulae to incorporate these in both production and decay. I will then talk about signatures for discovery of HNL and signatures of lepton number violation that could be searched for in beam dump experiment, taking the DUNE experiment as a case study.

Presenter: BOSCHI, Tommaso

Session Classification: Parallel stream 3

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

Matter density profile effects on neutrino oscillations at T2HK and T2HKK

Tuesday 9 April 2019 11:00 (15 minutes)

This project aims to explore the effects that changes in a matter density profile could have on neutrino oscillations, and whether these could potentially be seen by the future Hyper-Kamiokande experiment (T2HK). The analysis is extended to include the possibility of having a second detector in Korea (T2HKK).

Presenter: MOLINA SEDGWICK, Susana (Queen Mary University of London / University of Southampton)

Session Classification: Parallel stream 4

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

Optical calibration design for the Hyper-Kamiokande Outer Detector

Tuesday 9 April 2019 11:15 (15 minutes)

Hyper-Kamiokande will be the next generation water Cherenkov detector, an order of magnitude larger than Super-Kamiokande, capable of studying proton decay, atmospheric neutrinos, and detecting neutrinos from astronomical sources with far greater precision than its predecessor. It will also serve as the far detector for long baseline neutrino beams produced at J-PARC.
The detector will consist of both inner (ID) and outer (OD) detectors filled with ultrapure water. The ID will be instrumented with photomultiplier tubes (PMTs) facing inwards to detect Cherenkov light produced in neutrino interactions and potential nucleon decays, with 40% photocoverage. The OD will have PMTs on the OD inner wall facing outwards, with a photocoverage of 1%, and has the primary purpose of vetoing background events originating outside of the detector, as well as determining whether or not events occurring in the ID are fully contained.
An LED optical calibration system has been designed for the Hyper-Kamiokande ID and deployed for testing in Super-Kamiokande, incorporating narrow and diffuse beams of light. A similar system is intended for use in the OD, with light being delivered by optical fibres around the outside wall of the detector. A specific challenge of this design arises due to the geometry of the OD and sensor support structures within it, necessitating many light injection points to illuminate all PMTs to the required intensity, as well as allowing sufficient redundancy should any sources become non-functional, all while minimising the final number of injection points to mitigate costs. The initial results of simulated studies of this system using the WCSim software suite will be presented in this talk.

Presenter: PIDCOTT, Celeste

Session Classification: Parallel stream 4

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

A New Jet Pairing Method for Reconstructing HH -> bbbb Events

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Tuesday 9 April 2019 11:30 (15 minutes)

In the ATLAS HH -> bb̄bb̄ analysis, jets are paired to form Higgs boson candidates by minimizing the perpendicular distance between the pair and the line joining the point (120 GeV, 110 GeV) to the origin in the plane of leading Higgs boson candidate mass – subleading Higgs boson candidate mass. This strategy is shown to reconstruct background events such that they peak around the point (120 GeV, 110 GeV) where a signal would be expected. Here an evaluation of an alternative strategy is presented.

Presenter: STANISLAUS, Beojan (University of Oxford (GB))

Session Classification: Parallel stream 4

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

Advances and challenges in the full run 2 search of boosted di-higgs decaying to bbbb with the ATLAS detector

Tuesday 9 April 2019 11:45 (15 minutes)

After the discovery of a Standard Model like Higgs boson, new searches can now change focus towards using it as a tool to probe the Standard Model and new physics. With the largest branching fraction, the $b\bar{b}b\bar{b}$ final state is one of the leading candidates to observe this process, but the overwhelming backgrounds and the highly boosted topology reached by this process, present a challenge. This talk will outline a few of these issues and explore novel techniques to mitigate their effect.

Presenter: PAREDES SAENZ, Santiago Rafael (University of Oxford (GB))

Session Classification: Parallel stream 4

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

Angular Analysis of the B -> K* mu mu decay at the LHCb Experiment

Tuesday 9 April 2019 12:00 (15 minutes)

Recent observations of B decays hint at discrepancies with predictions of the otherwise overwhelmingly successful Standard Model of Particle Physics. These observations are extremely intriguing, as they can be interpreted in a coherent way in a number of new physics models by introducing a new vector particle such as a Z' or a leptoquark.
This talk will concentrate on one of these measurements, the angular analysis of the rare decay B->K*mumu, performed on data from the LHCb experiment. An introduction to the measurement will be given and the Run 1 results, which have a 3.4 sigma tension with the Standard Model prediction, are presented. An overview of the current status of the update of this analysis with Run 2 data collected at the LHCb detector will be given.

Presenter: KRESS, Felix Johannes (Imperial College (GB))

Session Classification: Parallel stream 4

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

Determination of hadronic resonance contributions to the B0 -> K*0μμ decay

Tuesday 9 April 2019 12:15 (15 minutes)

The angular observables of the B0 -> K*0μμ decay are showing intriguing discrepancies with Standard Model (SM) predictions [1]. The discrepancies indicate a shift of the vector coupling (C9) with a significance of about 3.4 standard deviations. This could be explained by the existence of new heavy vector particles not described by the SM. However, the discrepancies may also be explained by interference between hadronic resonance amplitudes (long distance) (e.g. B0 -> J/ΨK*0) and the SM flavour changing neutral current (short distance) amplitudes.
To solve this ambiguity, we intend to perform an unbinned fit to the decay angles and the dimuon mass of the B0 -> K*0μμ decay across the full dimuon spectrum. In the empirical model used for this fit hadronic resonances are modelled as relativistic Breit-Wigner amplitudes and the magnitudes and phases of all hadronic resonance amplitudes are defined relative to the short distance amplitudes [2]. This approach allows the simultaneous determination of the Wilson Coefficients C9 and C10 as well as the level of hadronic interference directly from data.
In the talk I will explain the model, relevant experimental effects (such as acceptance, resolution, and backgrounds), as well as the fitting procedure. Furthermore, I will discuss the expected sensitivity to the key signal parameters.
[1] LHCb collaboration, JHEP 1602 (2016) 104
[2] T. Blake et al., Eur.Phys.J. C78 (2018) no.6 453

Presenter: HECKER, Malte (Imperial College (GB))

Session Classification: Parallel stream 4

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

Update on the measurement of the Unitarity Triangle angle γ using B->D(*)K(*) decays at LHCb

Monday 8 April 2019 15:15 (15 minutes)

The measurement of the Unitarity Triangle angle γ is a cornerstone of our understanding of the CKM mechanism of quark interactions.
Due to the tiny theoretical uncertainty in self-tagging B decays to Dˆ()*K*ˆ() final states, these modes will provide a standard candle in CP-violation physics as we drive towards the ultimate precision in flavour physics.
Results in the simplest final states B->DK are well established and will be reviewed. This presentation/poster will expand on the new developments to exploit DK*a d D*K final states at LHCb.

Presenter: Ms ROLLINGS, Alexandra Paige (University of Oxford (GB))

Session Classification: Parallel stream 4

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

Measurement of the CP violating phase φs originating in $B^0s \to J/\psi\varphi$ decays using LHCb Run 2 data

Wednesday 10 April 2019 11:15 (15 minutes)

The LHCb experiment focuses on CP violation, a process that explains the abundance of matter in the Universe. The Standard Model theory prediction of CP violation is much smaller than the observed asymmetry. The 'golden decay mode' B0s→J/ψφ could easily be influenced by New Physics particles, and shift the experimentally observed amount of CP violation from the theory prediction. I will present the analysis of 2015 + 2016 3fb-1 B0s→J/ψφ data collected by the LHCb experiment at a centre-of-mass energy of 13 TeV. The talk will also cover the combination with Run 1 data, yielding the World's most precise determinations of the CP violating phase φs and of the decay width difference between the light and the heavy mass eigenstates in the B0s system.

Presenter: ZONNEVELD, Jennifer (The University of Edinburgh (GB))

Session Classification: Parallel stream 1

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

ARIADNE: A 1-ton dual-phase LArTPC with optical readout.

Wednesday 10 April 2019 11:30 (15 minutes)

ARIADNE is a 1-ton two-phase liquid argon (LAr) time projection chamber (TPC) featuring a novel optical readout method. The detector uses a Thick Gas Electron Multiplier (THGEM) in the extraction region to generate secondary scintillation light which is imaged using 4 Electron-Multiplying (EM)CCD cameras to produce high resolution images of particle interactions within the detector.

This approach has many potential improvements over current readout techniques. A combination of the high level of gain achievable in the THGEM and the single-photon sensitivity of the EMCCDs give's sensitivity at low energies.

ARIADNE underwent testing and commissioning runs in Liverpool at the end of 2017, followed by a beam line test at the CERN East Area in 2018. This was the first beam line test of an optical dual phase TPC for a detector of this scale. Initial results from these tests will be presented.

Further work has been carried out into integrating an optical Timepix3 based camera into the detector providing very fast readouts and true 3D reconstruction. These technologies have the potential to be used at future large-scale LArTPC experiments.

Presenter: VANN, Jared John (University of Liverpool (GB))

Session Classification: Parallel stream 1

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

Recent advancements on the NEWS-G spherical proportional counter sensors

Wednesday 10 April 2019 11:45 (15 minutes)

NEWS-G is an innovative experiment aiming to shine a light on the dark matter conundrum with a novel gaseous detector, the spherical proportional counter. It uses light gases, such as hydrogen, helium, and neon, as targets, to expand dark matter searches to the sub-GeV/c2 mass region. NEWS-G produced its first results with a detector -60 cm in diameter- installed at LSM (France), excluding cross-sections above 4.4 • 1037 cm2 for 0.5 GeV/c2 dark matter using neon gas. Currently, a larger -140 cm in diameter- more advanced detector is being built at LSM and a first run is under way there, before its installation at SNOLAB (Canada) at the end of the year. The detector operation will be challenging in terms of gain, electric field intensity and stability of operation, along with the demand for high radiopurity levels. In this talk, I will present new advancements in instrumentation for the spherical proportional counter relying on resistive materials, greatly limiting spark rate and intensity, permitting high gain operation in high pressure. Furthermore, I will present the recent developments on the multi-anode sensor (ACHINOS) that permits high gain operation combined with an increased electric field.

Presenter: KATSIOULAS, Ioannis (Université Paris-Saclay (FR))

Session Classification: Parallel stream 1

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

Search for single-production of vector-like B quark decaying into a bottom quark and a Higgs in the H->bb decay mode with the ATLAS experiment.

Wednesday 10 April 2019 12:00 (15 minutes)

A search is conducted for single-production of a vector-like B quark decaying into a Higgs boson and a b quark. Vector-like quarks are theorised to be highly massive colour triplet spin-1/2 fermions arising in models, such as the Little Higgs and Composite Higgs models, which tackle the hierarchy problem resulting from the measured value of the Standard Model Higgs boson mass. Vector-like quarks are predicted to mix prevalently with third generation Standard Model quarks through couplings with the weak Gauge Bosons or the Higgs Boson.
This search targets the B⟶bH decay mode in the fully hadronic channel defined by the H⟶bb secondary decay. The Standard Model background to the search, consisting mainly of continuum multi-jet production, is estimated through a fully data driven procedure. The search is carried out on the entire Run II collision data with centre-mass energy of 13 TeV, collected between 2015 and 2018, amounting to a total of 140 fb-1. Preliminary results are shown as mass-dependent 95% CL exclusion values for the production cross section of a vector-like b quark according to the benchmark model employed.

Presenter: MONTELLA, Marco (University of London (GB))

Session Classification: Parallel stream 1

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

Observation of H->bb decays in the VH production mode and first differential measurement with the ATLAS detector

Wednesday 10 April 2019 12:15 (15 minutes)

H ->bb decays allow to probe the Yukawa coupling of the Higgs boson to down type quarks. Observing these processes at the LHC is extremely challenging due to the large multi-jet background; however, this can be greatly suppressed by triggering on Missing Energy Transfer and leptons coming from the decay of a weak vector boson produced together with the Higgs.

In this talk, the latest search for H->bb decays associated with a W or Z boson with the ATLAS detector will be presented. Furthermore, the first VH->bb differential measurement in bins of transverse momentum of the vector bosons will be discussed; this type of differential measurement is particularly sensitive to Beyond Standard Model Physics in the form of Effective Field Theory models.

Presenter: AMBROZ, Luca (University of Oxford (GB))

Session Classification: Parallel stream 1

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

Searches for electroweak supersymmetry in final states containing one lepton, two b-tagged jets and missing transverse energy at the ATLAS experiment.

Wednesday 10 April 2019 11:00 (15 minutes)

Supersymmetry (SUSY) is one of numerous, and one of the most famous, theoretical extensions to the Standard Model aiming to answer open questions in particle physics, such as the nature of dark matter and the origin of the electroweak symmetry breaking. SUSY extends the particle spectrum of the SM such that each SM particle has at least one supersymmetric partner. Mixtures of the SUSY partners to the gauge bosons and Higgs can form to produce the electroweakinos; charginos and neutralinos. The lightest neutralino, often referred to as the lightest supersymmetric particle (LSP), is one of the most commonly considered WIMP dark matter candidates.

Using data collected in 2015-2016 by the ATLAS collaboration, a search for chargino-neutralino pair-production is presented. The chargino decays via a W boson and an LSP, while the neutralino decays via a Higgs boson and an LSP. The final state contains a lepton from the W decay, two b-jets from the Higgs decay, and missing transverse energy. No significant excess is observed, but exclusion limits on this process are set upto 550 GeV. A projected limit for this search channel for the HL-LHC results in an expected exclusion limit of 1280 GeV and discovery potential up to 1080 GeV. Finally, future prospects for this channel are presented, including the use of machine learning techniques to improve signal-background discrimination.

Presenter: SULLIVAN, Matthew James (University of Liverpool (GB))

Session Classification: Parallel stream 2

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

Non-parametric Bayesian event reconstruction in Super-Kamiokande detector

Wednesday 10 April 2019 11:15 (15 minutes)

We present a method for non-parametric, Bayesian neutrino event reconstruction for the Super-Kamiokande detector. Particle properties are determined in a way where the number of Cherenkov rings to be reconstructed, and therefore the number of parameters, is one of the unknowns. We discuss Bayesian model selection with Markov Chain Monte Carlo, future scalability and the issues surrounding non-parametric Bayesian reconstruction in Water Cherenkov detectors. We also briefly discuss the application of Bayesian methods in other contexts within T2K and Super-Kamiokande.

Presenter: SZTUC, Artur (Imperial College London)

Session Classification: Parallel stream 2

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

Electron neutrino selection in the MicroBooNE LArTPC using the Pandora pattern recognition reconstruction

Wednesday 10 April 2019 11:30 (15 minutes)

MicroBooNE (the Micro Booster Neutrino Experiment) is a liquid argon time-projection chamber (TPC) experiment designed for short-baseline neutrino physics, currently running at Fermilab. It aims to address the anomalous excess of low-energy events observed by the MiniBooNE experiment. In this talk the ability of the experiment to reconstruct electron neutrino-like events in the detector, using the Pandora multi-algorithm pattern recognition, will be demonstrated. In particular, we present a fully automated event selection algorithm to identify charged-current electron neutrino event candidates with no pions and at least one proton in the final state (nu_e CC0pi-Np). We discuss the combination of optical information and TPC information to reduce cosmogenic backgrounds. Additionally, we show some cuts on kinematic and geometric variables to reject background events. These cuts have been validated by analyzing two event samples orthogonal to our signal. Future improvements have been identified which will improve the reconstruction efficiency, especially at low energy. The data shown is an unblinded subsample collected by the detector between February and April 2016. It corresponds to an exposure of 4.3 × 10ˆ19 protons on target.

Presenter: VAN DE PONTSEELE, Wouter

Session Classification: Parallel stream 2

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

Applications of machine learning to the identification of particle etch pits in Moedal NTD (Nuclear Track Detector) Images.

Wednesday 10 April 2019 11:45 (15 minutes)

The Moedal Experiment uses Passive Nuclear Track Detectors (NTDs) to look for magnetic monopoles, and other heavily ionising exotic particles at the LHC. Through a process of chemical etching, the latent ionisation tracks of particles can be converted into microscopically visible known as etch-pits.
This study looks at CNN image recognition for identifying particle etch pits in an NTD foil that has been exposed to both a calibration signal (Heavy Ion Beam), and LHC background exposure.
Image data is collected with Directed-bright-field illumination, at multiple off-axis illumination angles, using a Fresnel lens. This allows the 3-d structure of the etch pits to be inferred. breaking the two dimensional visual symmetry between certain classes of object, while allowing many pits to be imaged simultaneously in the same focal plane.
Classic kernel filter methods are used in this 3d-feature space to pre-select objects of interest, which are then after labeling used to train a CNN classifier.

Presenter: MILLWARD, Lewis Richard (University of London (GB))

Session Classification: Parallel stream 2

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

Boosting the Search for New Physics in bb Events

Wednesday 10 April 2019 12:00 (15 minutes)

The observation of a new resonance would be powerful evidence for new physics beyond the Standard Model. Searching for such new resonances at the LHC via their decay to pairs of quarks is a natural and broad search for new physics. In order to reduce QCD background and enhance our sensitivity to particles which preferentially couple to mass we search for particles which decay to pairs of b-quarks. This talk will present the search for light resonances in low mass phase space which was previously unexplored by the ATLAS detector at the LHC. As well as the potential to observe new resonances this search also targets the Standard Model Higgs boson. The motivation for this analysis and the methods needed in order to access this interesting low mass region will be presented, as well as the final results which utilise 80 inverse femtobarn of 13 TeV data.

Presenter: BERESFORD, Lydia Audrey (University of Oxford (GB))

Session Classification: Parallel stream 2

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

Search for Contact Interactions using 140fb-1 of pp collision data collected at sqrt{s}=13TeV with the ATLAS detector

Wednesday 10 April 2019 12:15 (15 minutes)

A search is conducted for non-resonant high-mass phenomena in dielectron and dimuon final states. The search uses the full Run-2 proton-proton collision data collected between 2015 and 2018 at sqrt{s} = 13 TeV by the ATLAS experiment at the LHC corresponding to an integrated luminosity of 140 fb-1. A novel approach involving a functional form is fitted to the dilepton invariant mass distribution of the data in a fit region and extrapolated to high mass to model the contribution from background processes. Lower limits on the Contact Interaction energy scale are set for various models.

Presenter: ABHAYASINGHE, Deshan Kavishka (Royal Holloway, University of London (GB))

Session Classification: Parallel stream 2

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

Measurement of the CP violation parameter AΓ at LHCb with $D^0 \to \pi^-\pi^+\pi^-\pi^+$ decays.

Wednesday 10 April 2019 11:00 (15 minutes)

CP violation in the charm sector is predicted to be very small by the Standard Model and so precise measurements represent a low background environment for new physics searches. A sensitive probe is the parameter AΓ which measures time-dependent CP violation and has previously been measured with the LHCb detector in two-body D0 meson decays. D0 neutral mesons are the only ones where oscillations of an up-type quark can occur, and are sensitive to possible contributions to CP violation through mixing loops. At LHCb the cross section for charm production is very high allowing unprecedented numbers of D0 decays to be recorded.
I will present prospects of CP violation measurements in the charm sector and, using data collected by the LHCb detector at run I and run II of the LHC, a blinded preliminary result extending AΓ to four-body modes will be presented utilising the $D0 \to K^-\pi^+\pi^-\pi^+$ decay as a control channel.

Presenter: DOUGLAS, Lauren Marie (University of Glasgow (GB))

Session Classification: Parallel stream 3

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

Search for CP violation in Lb->p3pi decays

Wednesday 10 April 2019 11:15 (15 minutes)

CP violation has been established in kaon and B-meson systems, but has yet to be observed in baryonic decays. However, sizeable CP asymmetries of up to 20% are expected in certain beauty baryon decays in the Standard Model. A family of 4-body charmless baryonic decays offer a good theoretical motivation for the observation of CP violation. In this analysis a single decay channel of Lb->p3pi is used. This decay channel is of particular interest, because it propagates through tree and penguin diagrams, proportional to the same order of the Wolfenstein parameter lambda, of the CKM matrix, which suggest strong interference between these diagrams. Also this decay has a rich resonance structure that might enhance the CP violation.

Previous analysis of this channel, using a binned Triple Product Asymmetries approach, yielded the first evidence of CP violation in baryon sector with 3.3 sigma significance. An updated analysis is performed on both Run 1 and Run 2 data, collected by the LHCb detector, which corresponds to approximately 7 fbˆ-1. This constitutes an approximately sixfold increase in the yield of signal events.

A novel, model independent technique, called the Energy Test is going to be applied alongside the previously used method of Triple Product Asymmetries. This approach allows to test for both, P-even and P-odd contributions to the CP violation and is highly insensitive to detector effects. Together with an optimized binning scheme of the Triple Product Asymmetries method and the increased data sample this analysis has the potential to yield the first observation of CP violation in baryons.

Presenter: SARPIS, Gediminas (University of Manchester (GB))

Session Classification: Parallel stream 3

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

Hunt for Hidden Photons in the LZ Experiment

Wednesday 10 April 2019 11:30 (15 minutes)

Motivated by possible theoretical extensions to the standard model, hidden photons (HP) are a suitable candidate for cold dark matter. Their possible masses cover a broad region, from 10-12 to 106 eV [1]. Large scale direct detection experiments such as LUX-ZEPLIN (LZ), built primarily to detect WIMPs, could also be sensitive to HP dark matter via the so called hidden photoelectric effect in the keV-MeV mass scale . This work presents the study of the HP sensitivity reach of the LZ experiment in the 10-40 keV mass range.

Reference :
[1] P.Arias, et al., JCAP06 (2012) 013, "WISPy cold dark matter"

Presenter: NILIMA, Athoy (University of Edinburgh)

Session Classification: Parallel stream 3

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

Neutrinoless Double Beta Decay in LZ

Wednesday 10 April 2019 11:45 (15 minutes)

Neutrinoless double beta decay (NDBD) is a hypothesised nuclear decay process that, if observed, shows that neutrinos are Majorana particles, signals the existence of lepton number violation and places constraints on the neutrino mass hierarchy. However, with T1/2 > 10ˆ25 years, searching for NDBD requires low backgrounds from intrinsic radiation and excellent energy resolution. In this talk, I will demonstrate that both of these requirements can be met by the LUX-ZEPLIN (LZ) experiment and present the estimated sensitivity of LZ to 136Xe NDBD.

Presenter: TAYLOR, Rob (Imperial College London)

Session Classification: Parallel stream 3

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

Measuring the mass of the Higgs Boson at the ATLAS detector in the H⟶ZZ*⟶4l channel using an analytic model

Wednesday 10 April 2019 12:00 (15 minutes)

Progress on the development of an analytic signal model for measuring the mass of the Higgs Boson employing the H⟶ZZ⟶*4l (l=e,mu) channel is presented. The model consists of a double-sided Crystal ball function, which is a function with a Gaussian core and power-law tails. The model is fitted to the four-lepton invariant mass distribution of H⟶ZZ⟶*4l signal Monte Carlo samples. Results from closure tests and performance of the model at expected statistics are also shown.

Presenter: POWELL, Thomas (University of Sheffield (GB))

Session Classification: Parallel stream 3

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

Search for Decays of the Higgs Boson into a Z Boson and a Light Hadronically Decaying Resonance

Wednesday 10 April 2019 12:15 (15 minutes)

A search is presented for decays of the Higgs boson to a Z boson and a hadronically decaying light resonance, h->ZX->ll+hadrons, using the Run 2 dataset of the ATLAS detector at the LHC. Due to its low mass and high boost, the resonance is reconstructed as a single jet of hadrons. A boosted decision tree is used to suppress the large multijet background. Beyond its potential for new physics, this final state is a potential probe of the charm quark Yukawa coupling and the low Qˆ2 behaviour of H->ZZ* decays.

Presenter: REYNOLDS, Elliot (University of Birmingham (GB))

Session Classification: Parallel stream 3

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

Searching for the Invisible using cross-section ratios

Wednesday 10 April 2019 11:00 (15 minutes)

With an abundance of cosmological evidence motivating the existence of dark matter, one of the topmost priorities of the High Energy Physics community is understanding its nature and integrating it into our extremely successful (yet incomplete) theory of the Standard Model. Presented here is a collider search for invisible new-physics phenomena using cross-section ratios for pp collisions at a centre of mass energy of 13 TeV at the ATLAS detector.
The production of particles invisible to the experimental apparatus can be inferred via a momentum imbalance in the detector, if produced in association with visible objects (e.g. hadronic jets). Ratios of fiducial cross-sections are then measured between the production of jets in association with missing transverse energy and the production of jets in association with either a single lepton or an opposite-sign same-flavour lepton pair, which are very similar to each other in the Standard Model, effectively leading to the cancellation of most theoretical and experimental uncertainties in the ratio.
The particle-level ratios are measured differentially with respect to a number of kinematic properties of the jet system and are readily available to be used in constraining beyond the Standard Model theories without the need of any simulation for the detector apparatus or background processes.

Presenter: KONSTANTINIDES, Vasilis (University of London (GB))

Session Classification: Parallel stream 4

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

Search for low-mass WIMPs with the DarkSide-50 experiment

Wednesday 10 April 2019 11:15 (15 minutes)

The DarkSide-50 experiment at the LNGS underground laboratory is using a dual-phase liquid argon TPC to search for particle dark matter. A recent analysis, based on the use of only the ionization signal from very low energy events, shows the potential of liquid argon to detect low-mass WIMPs (<10 GeV/cˆ2). The null result of this search is currently the world-leading exclusion limit on WIMP-nucleon cross sections for WIMPs with mass between 2 and 6 GeV/cˆ2. In this region, noble liquids experiments were expected to have only limited sensitivity due to the vanishing scintillation signal. I will discuss the details of this analysis and briefly address the requirements for a future improvement.

Presenter: AGNES, Paolo (University of Houston)

Session Classification: Parallel stream 4

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

The Darkside-20k experiment

Wednesday 10 April 2019 11:30 (15 minutes)

The DarkSide program for direct dark matter detection is a global collaboration of all the current argon-based dark matter experiments. The Darkside-20k detector will be located in the Laboratori Nazionali del Gran Sasso. It is designed to be experimental-background free and is optimized for sensitivity to high-mass WIMPs. Darkside-20k consists of an inner dual phase liquid argon (LAr) TPC detector and a surrounding argon veto detector, hosted inside a Proto-DUNE-like cryostat. The inner detector employs argon from underground sources in order to reduce the background produced by the beta-decay of the 39Ar isotope. The total mass of LAr in the inner detector is 50t. The veto detector consists of a Gadolinium-loaded plastic shell, sandwiched between two active natural LAr buffers, with total mass of 750 tonnes. The inner and veto detectors are both read out with novel, large-area silicon photo-sensors developed in a 5 year R&D programme together with Fundazione Bruno Kessler. I will present the current status of the Darkside-20k development, in particular I will focus on the performance studies of the veto system.

Presenter: SANTONE, Daria (INFN - National Institute for Nuclear Physics)

Session Classification: Parallel stream 4

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

Low Energy? Think Positive!

Monday 8 April 2019 14:15 (15 minutes)

At low energies, the world around us can be accurately described using the Standard Model. However, this is at best only an ''effective" description: valid at low energies but destined to break down as experiments probe increasingly higher energies, ultimately requiring a new (UV complete) theory to take over.
In this talk, I will demonstrate that certain constraints must be placed on such low-energy Effective Field Theories if they are to have a smooth UV completion at high energies (which is unitary, causal and local). These constraints are known as ''positivity bounds", and apply to a wide variety of Effective Field Theories in particle physics and cosmology.
As an illustrative example, I'll show how these bounds can be used to constrain Beyond the Standard Model physics (parametrized by higher derivative operators in the Standard Model Effective Field Theory), improving future fits to data by identifying a small region of parameter space for which there is a strong theoretical prior.

Presenter: MELVILLE, Scott (Imperial College, London)

Session Classification: Parallel stream 4

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

Combined Search for an Invisibly Decaying Higgs Boson in Hadronic Channels at √s = 13 TeV with CMS

Wednesday 10 April 2019 11:45 (15 minutes)

The leading upper limit on the Higgs boson to invisible state branching ratio (BR) is 24%, while the Standard Model prediction sits far below at 0.1%. The observed value was measured using pp collision data collected by the CMS experiment between 2011 and 2015. Our analysis targets a better limit by using 13 TeV data from 2016-2018 – an integrated luminosity of over 130 fb-1 – in addition to performing the combination over all Higgs production modes from the outset rather than in a posthoc fashion. The hadronic channels we include are gluon-gluon fusion, ttH, vector boson fusion (VBF) and Higgs production in association with a vector boson (VH). Analysing each production mode in an orthogonal search region gives a high degree of sensitivity compared to previous attempts. In this talk, the finalised event selection, signal categorisation, data-driven background estimation and systematic uncertainties for the non-VBF modes will be presented. A sufficiently accurate limit on the BR that is still above the Standard Model prediction may be interpreted in a beyond-Standard Model context. Constraints can be placed on theories that posit exotic particles or dark matter that couple to the Higgs, enhancing the invisible state BR.

Presenter: BHAL, Eshwen (University of Bristol (GB))

Session Classification: Parallel stream 4

Contribution ID: **98** Type: **not specified**

The search for invisibly decaying Higgs bosons at the LHC

Wednesday 10 April 2019 12:15 (15 minutes)

Progress on the search for invisibly decaying Higgs bosons at the LHC will be presented. The analysis is being performed using the CMS Run 2 data, taken in 2016-2018. Several key aspects of the analysis will be reviewed including a description of the novel analysis framework, background estimates including NLO QCD and electroweak corrections, and trigger studies. The search results will be interpreted in terms of several new Dark Matter models. Finally, future prospects for this search in the High-Luminosity LHC phase, with the upgraded CMS detector, will be discussed and simulated results presented.

Presenter: MILOSEVIC, Vukasin (Imperial College (GB))

Session Classification: Parallel stream 4

Contribution ID: **99** Type: **not specified**

An Overview of the 2019-2022 CG Round

Tuesday 9 April 2019 16:00 (15 minutes)

Presenter: MONROE, Jocelyn Rebecca (University of London (GB))

Session Classification: STFC Town Meeting

Contribution ID: **100** Type: **not specified**

STFC Update

Tuesday 9 April 2019 16:15 (30 minutes)

Presenter: BLAIR, Grahame

Session Classification: STFC Town Meeting

Contribution ID: **101** Type: **not specified**

STFC External Innovations and Global Challenges Update

Tuesday 9 April 2019 16:45 (15 minutes)

Presenter: GREEN, Jason (STFC)

Session Classification: STFC Town Meeting

Contribution ID: **102** Type: **not specified**

Science Board Update

Tuesday 9 April 2019 17:00 (10 minutes)

Presenter: SHEARS, Tara (University of Liverpool (GB))

Session Classification: STFC Town Meeting

Contribution ID: **103** Type: **not specified**

PPAP Update and PP Roadmap

Tuesday 9 April 2019 17:10 (20 minutes)

Presenter: JONES, Roger (Lancaster University (GB))

Session Classification: STFC Town Meeting

Contribution ID: **104** Type: **not specified**

PAAP Update

Tuesday 9 April 2019 17:30 (10 minutes)

Presenter: GHAG, Chamkaur (University College London)

Session Classification: STFC Town Meeting

Contribution ID: **105** Type: **not specified**

General Q&A

Tuesday 9 April 2019 17:40 (20 minutes)

Session Classification: STFC Town Meeting

Contribution ID: **106** Type: **not specified**

Giuseppe Occhialini Medal and Prize

Tuesday 9 April 2019 10:30 (5 minutes)

Session Classification: Plenary