

# **IOP HEPP Particle Physics 2009**

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University of Oxford

## **Book of Abstracts**



# Contents

TeVatron . . . . .	1
HERA and Deep Inelastic Scattering . . . . .	1
Highlights From The B Factories . . . . .	1
Welcome and administrative issues . . . . .	1
Machine Status . . . . .	1
Detector Status . . . . .	1
Phenomenology Status . . . . .	2
Neutrino Long & Short baseline . . . . .	2
Double Beta Decay . . . . .	2
Dark Matter . . . . .	2
Theory . . . . .	2
Future Facilities . . . . .	3
Finale . . . . .	3
DIS Charged Current Interactions in e+p data At ZEUS . . . . .	3
Anti neutrinos at MINOS . . . . .	3
Particle Flow at CMS . . . . .	4
Measuring Higgs boson branching fraction to cc-bar at the ILC . . . . .	4
SUSY Gauge Singlets and Dualities . . . . .	4
ZEPLIN-III: The future . . . . .	4
Measurement of Z boson transverse momentum at CDF . . . . .	5
ATLAS SCT Endcap Module Efficiency Measurement . . . . .	5
L2 tracking robustness and trigger study for semileptonic ttH channel . . . . .	5
B->K*mu+mu-: Symmetries and Asymmetries in the SM and Beyond . . . . .	6

Search Strategies for SUSY in Tri-lepton Final States . . . . .	6
Measurement of semileptonic asymmetry in Bs decays at D0 . . . . .	6
Two-Body Charmless Hadronic B decays at LHCb . . . . .	7
Particle Identification in the ND280 Electromagnetic Calorimeter . . . . .	7
Fast simulation and the Higgs with ATLAS . . . . .	7
Search for the Standard Model Higgs boson produced in vector boson fusion and decaying into a tau pair in CMS with $1\text{fb}^{-1}$ . . . . .	7
Construction of an Electromagnetic Calorimeter for ND280 and the T2K collaboration .	8
Highly Boosted HW/HZ Production . . . . .	8
Event by Event alignment studies using B physics observables in the ATLAS experiment	8
Data driven methods of a W/Z cross section measurement in ATLAS . . . . .	9
The Z boson $a_T$ distribution . . . . .	9
Crosstalk in the LHCb Vertex Locator modules . . . . .	9
Results from the first science run of ZEPLIN-III . . . . .	10
Measuring $Z \rightarrow e\bar{e}$ with ATLAS . . . . .	10
Precise Predictions for Higgs Production in Neutralino Decays . . . . .	10
Phenomenology of Rotating Extra-Dimensional Black Holes at Hadron Colliders . . . . .	11
The Physics and Analysis of Cosmic Muons in the Downstream Ecal of T2K . . . . .	11
Lifetime measurements at LHCb . . . . .	11
Testing and simulation of Multi-Pixel Photon Counter devices . . . . .	12
Spin correlation in top quark pair production at ATLAS . . . . .	12
Time dependent Dalitz plot analysis of $B^0 \rightarrow K_S \pi^+ \pi^-$ at BaBar . . . . .	12
Black hole event generation with BlackMax . . . . .	13
SuperNEMO sensitivity to neutrinoless double beta decay via the mass mechanism and right handed currents . . . . .	13
Double Beta Decay of Zr96 using NEMO-3 and Calorimeter R&D for SuperNEMO . . . . .	13
Super-leading Logarithms in QCD . . . . .	14
Performance of HPDs in the LHCb RICH Detectors . . . . .	14
Exploring the physics reach of a low-energy neutrino factory . . . . .	14
Top Quark Mass Measurement using Matrix Element Analysis Technique and Lepton + Jets Channel . . . . .	15

Lepton Asymmetries and their Evolution in the E6SSM . . . . .	15
Gaps between jets . . . . .	15
High Mass Standard Model Higgs Searches at D Zero . . . . .	16
Optimising selections for the potential discovery of inclusive Supersymmetry . . . . .	16
Recent results in rare charmless three-body hadronic B decays . . . . .	16
Performing a full angular analysis of $B_d \rightarrow K^* \mu \mu$ at LHCb . . . . .	17
Software buildup to LHC switch-on . . . . .	17
A CLIC Post-Collision Extraction Line Photon Background Study . . . . .	17
QCD matrix elements and truncated showers . . . . .	17
Determination of $ V_{ub} $ using the endpoint of the lepton spectrum . . . . .	18
Charm triggering and physics at LHCb . . . . .	18
Production of direct photons at ATLAS . . . . .	18
ATLAS Electron Trigger efficiency determination for BSM channels . . . . .	19
CP Violation in the MSSM at the LHC . . . . .	19
Computation of Resistive Wakefields . . . . .	19
Calculations of background from radioactivity in dark matter detectors . . . . .	19
Statistical Combination of Low-Mass Higgs Channels . . . . .	20
LHCb's potential in $D^0$ mixing and CP violation . . . . .	20
Chargino/ Neutralino Mass . . . . .	20
Inelastic Dark Matter and Non-Standard Halos . . . . .	21
Luminosity Performance Studies of Linear Colliders with Intra-train Feedback Systems: Simulations and Experimental Plans . . . . .	21
A study of low pt electron reconstruction efficiencies in ATLAS . . . . .	21
Constraining PDFs at the LHC: The W asymmetry . . . . .	22
PPAN and Grant Panels, including Project Approvals and Progress on Advisory Panels . . . . .	22
Science Board View of Programme and Priorities –Big Issues, Opportunities, Accelerator Vision . . . . .	22
STFC Update, including Financial Situation . . . . .	22
IoP PAB gp . . . . .	22
PPAP Role, Constitution and Plans . . . . .	23

Economic Impact . . . . .	23
Selling Particle Physics to the Treasury . . . . .	23
Commisioning the LHCb Vertex Detector . . . . .	23
Closing Remarks . . . . .	23

**Plenary I: Collider Physics / 3**

## **TeVatron**

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**Plenary I: Collider Physics / 4**

## **HERA and Deep Inelastic Scattering**

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**Plenary I: Collider Physics / 5**

## **Highlights From The B Factories**

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**Plenary I: Collider Physics / 6**

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**Plenary II: LHC / 7**

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**Plenary II: LHC / 8**

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**Plenary II: LHC / 9**

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**Plenary III: Neutrinos and Dark Matter / 10**

## Neutrino Long & Short baseline

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**Plenary III: Neutrinos and Dark Matter / 11**

## Double Beta Decay

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**Plenary III: Neutrinos and Dark Matter / 12**

## Dark Matter

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**Plenary III: Neutrinos and Dark Matter / 13**

## Theory

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**Plenary IV: Final / 14**

## Future Facilities

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**Plenary IV: Final / 15**

## Finale

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**Parallel Session 1 A - QCD and Electroweak / 16**

## DIS Charged Current Interactions in e+p data At ZEUS

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ZEUS is a multi-purpose detector located on the electron-proton HERA collider. Since an upgrade to HERA in 2000, the lepton beams may be longitudinally polarised. This allows tests of the chiral nature of the Standard Model to be undertaken. Of particular interest is the charged current cross-section, which the Standard Model tells us depends on the polarisation of the incoming lepton. Results will be shown for positron-proton collisions at a centre-of-mass energy of 318 GeV, based on an data sample with total integrated luminosity of 133.6 pb<sup>-1</sup>

**Parallel Session 3 C - Neutrinos and Double Beta Decay / 17**

## Anti neutrinos at MINOS

**Author:** David Auty<sup>1</sup>

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The NuMI beam used by the MINOS experiment has a 6% component of anti neutrinos. This coupled with the magnetised MINOS experiment allows us to measure  $\overline{dm}^2$  and  $\sin^2 \theta_{\text{bar}}$  directly. If CPT is conserved these should be the same as  $dm^2$  and  $\sin^2 \theta$ .

**Parallel Session 1 C - Detectors and Future Facilities / 18****Particle Flow at CMS**

**Author:** Jamie Ballin<sup>1</sup>

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Information from the tracking, calorimetry and muon detection systems of the CMS detector at the Large Hadron Collider at CERN, can be combined to give a holistic description of a proton-proton collision in terms of photons, electrons, muons and hadrons. A 'particle flow' technique is presented which seeks to determine the energy and momenta of these particles. By decomposing events in this way we may expect superior efficiencies and energy resolution for jets, missing transverse energy and tau reconstruction compared to conventional reconstruction techniques used at hadron colliders. The application of particle flow to CMS testbeam data is presented.

**Parallel Session 3 B - Higgs / 20****Measuring Higgs boson branching fraction to  $c\bar{c}$  at the ILC**

**Author:** Yambazi Banda<sup>1</sup>

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The precise measurements of the Higgs boson properties will be very key to further understanding fundamental particle interaction. In particular, the study of the Higgs boson branching ratios is important in determining the Higgs couplings and nature of the Higgs boson. Here we look at the tools used for the measurement of  $H \rightarrow c\bar{c}$  branching ratio and the precision for such a measurement.

**Parallel Session 3 A - Beyond the Standard Model / 21****SUSY Gauge Singlets and Dualities**

**Author:** James Barnard<sup>1</sup>

<sup>1</sup> *University of Durham*

By including gauge singlets in supersymmetric gauge theories, we have been able to construct and test new types of Seiberg duality which may help in finding dual theories for supersymmetric GUTs.

**Parallel Session 2 C - Detectors and Future Facilities / Neutrinos and Dark Matter / 22****ZEPLIN-III: The future**

**Author:** Emma Barnes<sup>1</sup>

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ZEPLIN-III aims to be the world's leading detector of weakly interacting massive particles, the favored explanation of Galactic dark matter. Identification is based on extraction of scintillation and electroluminescence signals from a two-phase xenon target. A successful first science run has demonstrated the benefits of ZEPLIN-III's unique high-field operation, open-plan geometry and use of radiologically clean materials. An increased sensitivity is to be achieved by the retrofitting of custom-made ultra-low background photomultiplier tubes and a high efficiency veto detector. This talk will present the requirements, design and simulation of ZEPLIN-III in its upgraded configuration, illustrating its potential for the future and first direct detection of dark matter.

23

## Measurement of Z boson transverse momentum at CDF

**Author:** Daniel Beecher<sup>1</sup>

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The measurement of the transverse momentum of Z boson is a test of perturbative QCD and in the limit of low momentum probes into the non-perturbative regime.

**Parallel Session 2 C - Detectors and Future Facilities / Neutrinos and Dark Matter / 24**

## ATLAS SCT Endcap Module Efficiency Measurement

**Author:** Nicholas Austin<sup>1</sup>

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A description of my work on the measurement of efficiencies of modules in the SCT endcap using cosmic data taken in SR1 during the cosmic tests.

**Parallel Session 3 B - Higgs / 25**

## L2 tracking robustness and trigger study for semileptonic ttH channel

**Author:** Catrin Bernius<sup>1</sup>

<sup>1</sup> *University College London*

The ATLAS trigger is made up of three levels. The second level is software based and the earliest stage where data is available from the tracking detectors. Tracking is needed to verify several signatures with different requirements. IDScan is an algorithm which reconstructs tracks from hits in the Pixel and SCT detector. The robustness of this algorithm against missing layers of the detector is crucial and the results of this study are shown in this talk. A promising but also very challenging channel

for a Higgs discovery in the low mass region is the  $t\bar{t}H$  associated production, where the Higgs decays to a  $b\bar{b}$  pair. Due to the complex final state of jets, lepton and missing energy it is possible to trigger on many different signatures. In this talk, the efficiencies of the various trigger signatures and their combination are presented.

#### Parallel Session 1 B - Flavour Physics / 26

### **$B \rightarrow K^* \mu^+ \mu^-$ : Symmetries and Asymmetries in the SM and Beyond**

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The rare decay  $B \rightarrow K^* (\rightarrow K \pi) \mu^+ \mu^-$  is regarded as one of the crucial channels for  $B$  physics as the polarization of the  $K$  allows a precise angular reconstruction resulting in many observables. We investigate all observables in the context of the Standard Model and various New Physics models, in particular the Littlest Higgs model with T-parity and various MSSM scenarios, identifying those observables with small to moderate dependence on hadronic quantities and large impact of New Physics. We also identify a number of correlations between various observables which will allow a clear distinction between different New Physics scenarios.

#### Parallel Session 3 A - Beyond the Standard Model / 27

### **Search Strategies for SUSY in Tri-lepton Final States**

**Author:** Oleg Brandt<sup>1</sup>

<sup>1</sup> *University of Oxford*

The Large Hadron Collider with its unprecedented centre-of-mass energy will provide a unique opportunity to search for new physics Beyond the Standard Model. In this talk, I will describe search strategies for Supersymmetry in tri-lepton final states with early data of up to 10 inverse femtobarn. Using Monte Carlo simulations and a full ATLAS detector simulation I investigate the discovery potential with this final state for several benchmark points in the minimal Supergravity parameter space. A particular focus will be placed on the difficult scenario where strong interacting supersymmetric particles are very heavy ( $\sim 3$  TeV), as in such case the tri-lepton final states are likely to provide the best discovery potential. I will also address possible strategies to determine background contributions relevant for this final state from data.

#### Parallel Session 2 B - Flavour Physics / Beyond the Standard Model / 28

### **Measurement of semileptonic asymmetry in $B_s$ decays at D0**

**Author:** Sergey Burdin<sup>1</sup>

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Recent results from D0 on the semileptonic asymmetry in Bs decays will be presented and prospects will be discussed.

#### Parallel Session 1 B - Flavour Physics / 29

### Two-Body Charmless Hadronic B decays at LHCb

**Author:** Laurence Carson<sup>1</sup>

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Studies related to two-body charmless hadronic decays of B mesons ( $B \rightarrow hh$  decays) at LHCb are presented. Application of an incorrect proper time resolution model in the analysis to measure the CKM angle  $\gamma$  may bias the fitted values of  $\gamma$  and other parameters. A Monte Carlo-independent method to extract the resolution model from data is described. Also a selection for the rare decays  $B_{\{d/s\}} \rightarrow p \bar{p}$  is presented. LHCb expects to make an observation of  $B_{\{d\}} \rightarrow p \bar{p}$  with as little as  $250 \text{ pb}^{-1}$  of data, depending on its branching ratio.

#### Parallel Session 3 C - Neutrinos and Double Beta Decay / 30

### Particle Identification in the ND280 Electromagnetic Calorimeter

**Author:** Antony Carver<sup>1</sup>

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The ND280 calorimeter is a coarsely grained lead/scintillator detector. The coarse granularity presents challenges for particle identification. Progress in using an artificial neural network to separate MIP, electromagnetic showers and hadronic showers is presented.

#### Parallel Session 2 A - QCD and Electroweak / Higgs / 31

### Fast simulation and the Higgs with ATLAS

**Author:** Neil Cooper-Smith<sup>1</sup>

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Presented is an outline of the current simulation options available for use in the ATLAS collaboration. Particular attention is given to the ATLAS fast simulation, ATLFAST. By default, ATLFAST does not account for particle losses due to the reconstruction process. Therefore, a set of parametrisations of the photon reconstruction efficiency, as seen in full simulation, have been incorporated into ATLFAST, and the results are demonstrated with  $H \rightarrow \gamma \gamma$  events.

**Parallel Session 3 B - Higgs / 32****Search for the Standard Model Higgs boson produced in vector boson fusion and decaying into a tau pair in CMS with  $1\text{fb}^{-1}$** **Author:** Nicholas Cripps<sup>1</sup><sup>1</sup> *Imperial College London***Corresponding Author:** nicholas.cripps@cern.ch

The Standard Model Higgs boson, produced by vector boson fusion and decaying to a pair of tau leptons, is an important channel in the search for the Higgs in the mass range between 115 and 145 GeV/c<sup>2</sup>. A prospective analysis is presented on the observability of the Higgs boson with this channel, in the final state where one tau decays leptonically and the other hadronically, with CMS. An estimate of the expected upper limit which could be set on the signal cross-section times branching ratio, with  $1\text{fb}^{-1}$  of integrated luminosity, is given for Higgs masses in the above range.

**Parallel Session 2 C - Detectors and Future Facilities / Neutrinos and Dark Matter / 33****Construction of an Electromagnetic Calorimeter for ND280 and the T2K collaboration****Author:** Gavin Davies<sup>1</sup><sup>1</sup> *University of Lancaster***Corresponding Author:** g.davies4@lancaster.ac.uk

T2K (Tokai to Kamioka) is a 295km long-baseline experiment in Japan, due to start taking commissioning data late this year. It is designed to measure muon-neutrino oscillations to other flavours. In particular, it has the primary goal of measuring the mixing angle  $\theta_{13}$ . One of the UK's contributions is the construction and calibration of an Electromagnetic Calorimeter (ECal) for the near detector, ND280, situated 280m downstream from the neutrino production target. This talk will present an update on the construction of one module of ND280, the Downstream ECal. It will summarise results from the quality assurance of the materials, and the work involved in creating the module. The module is now complete and currently collecting cosmic ray data at RAL. It is due to be shipped to CERN for testbeam studies in April.

**Parallel Session 3 B - Higgs / 34****Highly Boosted HW/HZ Production****Author:** Adam Davison<sup>1</sup><sup>1</sup> *University College London***Corresponding Authors:** adam.robert.davison@cern.ch, adamdavison@gmail.com

Until recently extraction of the processes  $\text{HW} \rightarrow \text{bbl}\nu$  and  $\text{HZ} \rightarrow \text{bbl}$  was considered impossible at the LHC. However, recent work has shown that by studying the high  $p_T$  case, the signals can be recovered as a promising discovery channel by ATLAS.

**Parallel Session 2 B - Flavour Physics / Beyond the Standard Model / 35****Event by Event alignment studies using B physics observables in the ATLAS experiment****Author:** Lee De Mora<sup>1</sup><sup>1</sup> *University of Lancaster***Corresponding Author:** lee.demora@gmail.com

Event by Event alignment studies using B physics observables in the ATLAS experiment

**Parallel Session 2 A - QCD and Electroweak / Higgs / 36****Data driven methods of a W/Z cross section measurement in ATLAS****Author:** Eleanor Dobson<sup>1</sup><sup>1</sup> *University of Oxford***Corresponding Author:** e.dobson1@physics.ox.ac.uk

An important aim of the LHC is the precise measurement of W and Z boson production cross sections. It is important to make a data driven measurement of the cross sections and, whenever possible, not to rely on Monte Carlo simulation. Such a method of determining these cross sections in the ATLAS detector is outlined for the electron channel.

**Parallel Session 2 A - QCD and Electroweak / Higgs / 37****The Z boson  $a_T$  distribution****Author:** Rosa María Durán Delgado<sup>1</sup><sup>1</sup> *University of Manchester***Corresponding Author:** rositaduran@yahoo.es

We present theoretical predictions for a novel variable to study low transverse momentum vector boson production at hadron colliders. The new variable referred to as  $a_T$  has been pointed out to have experimental advantages over the usual  $p_t$  distribution and our study in conjunction with forthcoming accurate experimental data can help to shed light on perturbative radiation as well as constrain non-perturbative effects better than traditional studies of the  $p_T$  distribution.

**Parallel Session 1 C - Detectors and Future Facilities / 38****Crosstalk in the LHCb Vertex Locator modules****Author:** Lisa Dwyer<sup>1</sup><sup>1</sup> *University of Liverpool*

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The Vertex Locator (VeLo) is a silicon based particle detector in the LHCb experiment. The testbeam data taken with 10 final production VeLo modules exhibited the effects of crosstalk. A method has been developed to correct the data for this effect. A large amount of crosstalk is seen in the data, suggesting that its cause is a combination of charge sharing in the readout cables and an offset in the sampling time of the readout cables.

**Parallel Session 2 C - Detectors and Future Facilities / Neutrinos and Dark Matter / 39**

## Results from the first science run of ZEPLIN-III

**Author:** Blair Edwards<sup>1</sup>

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We present the results from the first science run of the ZEPLIN-III WIMP dark matter search. ZEPLIN-III utilises two-phase xenon, measuring both scintillation and ionisation produced by interactions in the liquid to differentiate between the nuclear recoils expected from WIMPs and the electron recoil background signals down to  $\sim 10$  keV nuclear recoil energy. The higher-field operation of the instrument provides enhanced discrimination over previous two-phase xenon experiments. The first science run of ZEPLIN-III at the Palmer Underground Laboratory (Boulby mine, UK), acquired 847 kg.days of background data, with a final fiducial exposure of 266 kg.days, placing a 90% confidence upper limit on the WIMP-nucleon spin-independent scattering cross-section with a minimum at  $7.7\text{E-}08$  pb at a WIMP mass of 55 GeV/c<sup>2</sup>.

**Parallel Session 2 A - QCD and Electroweak / Higgs / 40**

## Measuring $Z \rightarrow ee$ with ATLAS

**Author:** Michael Flowerdew<sup>1</sup>

<sup>1</sup> *University of Liverpool*

Some of the earliest measurements to be made with the ATLAS detector are of the rate and properties of Z boson production. Intense theoretical attention in recent years has culminated in next-to-next-to-leading order calculations of the production cross section of this channel, with just a few percent uncertainty. Confirmation of these predictions with LHC data, as soon as possible after collisions begin, will improve confidence in the accuracy of predictions of the rates of various backgrounds critical for Higgs and other new physics searches. Predictions relating to Z boson production, and prospects for the measurement of the total  $Z \rightarrow ee$  cross section in ATLAS, will be discussed. This channel also acts as a source of electrons which will be used to calibrate and test the performance of ATLAS with early data. Performance studies measurements will be presented, with an emphasis on measurements of electron trigger efficiencies.

**Parallel Session 2 B - Flavour Physics / Beyond the Standard Model / 41**

## Precise Predictions for Higgs Production in Neutralino Decays

**Author:** Alison Fowler<sup>1</sup>

<sup>1</sup> *Durham IPPP***Corresponding Author:** a.c.fowler@durham.ac.uk

Complete one-loop results are presented for the class of processes  $\tilde{\chi}^0_i \rightarrow \tilde{\chi}^0_j h_a$  in the MSSM with CP-violating phases beyond the lowest order. We combine the genuine vertex contributions with two-loop Higgs propagator-type corrections, thus obtaining the currently most precise prediction for this class of processes. The numerical impact of the genuine vertex corrections is studied in several examples of CP-conserving and CP-violating scenarios. The corrections to the decay width can be particularly large in the CP-violating CPX benchmark scenario, where a very light Higgs boson is unexcluded by present data. We find that in this parameter region, which will be difficult to cover by standard Higgs search channels at the LHC, the branching ratio for the decay  $\tilde{\chi}^0_2 \rightarrow \tilde{\chi}^0_1 h_1$  is large. This may offer good prospects to detect such a light Higgs boson in cascade decays of supersymmetric particles.

### Parallel Session 3 A - Beyond the Standard Model / 42

## Phenomenology of Rotating Extra-Dimensional Black Holes at Hadron Colliders

**Author:** James Frost<sup>1</sup><sup>1</sup> *University of Cambridge***Corresponding Author:** frost@hep.phy.cam.ac.uk

We present results of a new simulation of black hole production and decay at hadron colliders in theories with large extra dimensions and TeV-scale gravity. The main new feature is a full treatment of the spin-down phase of the decay process and the distributions of the associated Hawking radiation. Also included are improved modelling of the loss of angular momentum and energy in the production process and a wider range of options for the Planck-scale termination of the decay. We present results from these simulations, with emphasis on the consequences and experimental signatures of black hole rotation at the LHC.

### Parallel Session 2 C - Detectors and Future Facilities / Neutrinos and Dark Matter / 43

## The Physics and Analysis of Cosmic Muons in the Downstream Ecal of T2K

**Author:** Melissa George<sup>1</sup><sup>1</sup> *Queen Mary, University of London***Corresponding Author:** m.a.george@qmul.ac.uk

### Parallel Session 1 B - Flavour Physics / 44

## Lifetime measurements at LHCb

**Author:** Marco Gersabeck<sup>1</sup><sup>1</sup> *University of Glasgow*

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The trigger for hadronic events at LHCb causes a lifetime bias which has to be taken into account in any time-dependent measurement. A Monte-Carlo free method for removing this bias is presented in the context of measurements of lifetimes and lifetime ratios using channels such as  $B_s \rightarrow KK$ . An overview of the wide ranging physics opportunities with these measurements will be given.

#### Parallel Session 1 C - Detectors and Future Facilities / 45

### Testing and simulation of Multi-Pixel Photon Counter devices

**Author:** Martin Haigh<sup>1</sup>

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The Multi-Pixel Photon Counter (MPPC) is an APD array operated in Geiger mode, marketed by Hamamatsu. These devices achieve comparable performance to PMTs, with the advantages of compactness and insensitivity to magnetic fields. They have great potential in HEP applications, and are being used in the ND280 near detector of the T2K long-baseline neutrino experiment. Results from the testing and simulation of the MPPCs used in ND280 will be presented.

#### Parallel Session 2 A - QCD and Electroweak / Higgs / 46

### Spin correlation in top quark pair production at ATLAS

**Author:** Simon Head<sup>1</sup>

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The high mass and large width of the top quark corresponds to a Standard Model prediction for a lifetime shorter than the timescale for strong interactions, implying that the top quark decays before hadronisation. Therefore, properties such as the spin correlation in the  $t\bar{t}$  system are transferred to the decay products. In this talk I will discuss the possibility of measuring this correlation with early ATLAS data.

#### Parallel Session 2 B - Flavour Physics / Beyond the Standard Model / 47

### Time dependent Dalitz plot analysis of $B^0 \rightarrow K\pi^+\pi^-$ at BaBar

**Author:** Jelena Ilic<sup>1</sup>

<sup>1</sup> *University of Warwick*

**Corresponding Author:** j.ilic@warwick.ac.uk

A time-dependent amplitude analysis of  $B^0 \rightarrow K\pi^+\pi^-$  decays is performed in order to extract the CP violation parameters of  $f_0(980)K_s$  and  $\rho^0(770)K_s$  and direct CP asymmetries of  $K^+(892)\pi^-$ . The

*relative phases between  $B^0 \rightarrow K^+(892)\pi^-$  and  $B^0 \rightarrow K^{*-}(892)\pi^+$ , relevant for the extraction of the unitarity triangle angle  $\gamma$ , is also measured. The results are obtained from the final BaBar data sample.*

### Parallel Session 3 A - Beyond the Standard Model / 48

## Black hole event generation with BlackMax

**Author:** Cigdem Issever<sup>1</sup>

<sup>1</sup> *University of Oxford*

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We present a comprehensive black-hole event generator, BlackMax, which simulates the experimental signatures of microscopic and Planckian black-hole production and evolution at proton-proton, proton-antiproton and electron-positron collisions in the context of brane world models with low-scale quantum gravity. The generator is based on phenomenologically realistic models free of serious problems that plague low-scale gravity, thus offering more realistic predictions. The generator includes all of the black-hole graybody factors known to date and incorporates the effects of black-hole rotation, splitting between the fermions, non-zero brane tension and black-hole recoil due to Hawking radiation (although not all simultaneously).

### Parallel Session 3 C - Neutrinos and Double Beta Decay / 49

## SuperNEMO sensitivity to neutrinoless double beta decay via the mass mechanism and right handed currents

**Author:** Christopher Jackson<sup>1</sup>

<sup>1</sup> *University of Manchester*

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SuperNEMO is a next generation neutrinoless double beta decay experiment currently in development, which will probe the inverted hierarchy neutrino mass region. The detector will consist of a double beta emitting foil of Se82 or Nd150 surrounded by a tracking chamber and calorimetry, which allows measurement of electron angular correlations and individual energies. These signatures can be used to identify the underlying mechanism of neutrinoless double beta decay. SuperNEMO sensitivity to both the mass mechanism and right handed currents are examined in the cases of limit setting or discovery.

### Parallel Session 3 C - Neutrinos and Double Beta Decay / 50

## Double Beta Decay of Zr96 using NEMO-3 and Calorimeter R&D for SuperNEMO

**Author:** Matthew Kauer<sup>1</sup>

<sup>1</sup> *University College London*

**Corresponding Author:** kauer@hep.ucl.ac.uk

Using 911 days of data from NEMO-3, a world best  $2\nu\text{BB}$  decay half-life of  $\text{Zr}96$  has been measured to be  $[2.36 \pm 0.17(\text{stat}) + 0.17 - 0.14(\text{syst})] \times 10^{19}$  yr. The obtained limit on the  $0\nu\text{BB}$  decay half-life at the 90% confidence level is  $8.5 \times 10^{21}$  yr which leads to the limit on the effective Majorana neutrino mass  $< 7.4 - 20.3$  eV, using the RQRPA and pnQRPA nuclear models. SuperNEMO is a next-generation double beta decay experiment based on the successful tracking plus calorimetry design approach of the NEMO-3. SuperNEMO can study a range of isotopes, the baseline isotopes are  $\text{Se}82$  and possibly  $\text{Nd}150$ . The total isotope mass will be 100-200 kg. A sensitivity to a  $0\nu\text{BB}$  half-life greater than  $10^{26}$  years can be reached which gives access to Majorana neutrino masses of 50-100 meV. One of the main challenges of the SuperNEMO R&D is the development of the calorimeter with an energy resolution of 4% FWHM at 3 MeV ( $Q(\text{bb})$  value of  $\text{Se}82$ ). This unprecedented milestone has been achieved using low density plastic scintillator coupled to high quantum efficiency photomultiplier tubes.

## Parallel Session 1 A - QCD and Electroweak / 51

### Super-leading Logarithms in QCD

**Author:** James Keates<sup>1</sup>

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Super-leading logarithmic terms have previously been observed in non-global QCD observables. This talk details a fixed order calculation of super-leading logarithms in the gaps-between-jets process. This calculation confirms previous results and extends them to  $\mathcal{O}(\alpha_s^5)$ .

## Parallel Session 1 C - Detectors and Future Facilities / 52

### Performance of HPDs in the LHCb RICH Detectors

**Author:** Young Min Kim<sup>1</sup>

<sup>1</sup> *University of Edinburgh*

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The Ring Imaging Cherenkov (RICH) detectors of the LHCb experiment, at the Large Hadron Collider (LHC), have been built to provide charged particle identification. Hybrid Photon Detectors (HPDs) are used to detect the Cherenkov photons produced in the RICH radiators. Each HPD required extensive testing and categorisation before being mounted in the RICH. A subsample of 74 HPDs underwent Quantum Efficiency measurements. Results of these tests will be presented. Afterwards, the HPDs were mounted onto columns and fitted into the RICH detectors. I developed the software for monitoring the properties of HPDs mounted into the RICH. These results will be presented alongside investigations of HPDs which had vacuum degradation. Through the RICH group's combined effort, the RICH detectors were ready for the first beams that circulated through the LHC.

## Parallel Session 3 C - Neutrinos and Double Beta Decay / 53

### Exploring the physics reach of a low-energy neutrino factory

**Author:** Tracey LI<sup>1</sup>

<sup>1</sup> *University of Durham*

A 'neutrino factory' is seen as the ideal neutrino oscillation experiment of the future. We study the physics performance of a low-energy version of this experiment, in particular its sensitivity to  $\theta_{13}$ ,  $\delta$ , the mass hierarchy and non-standard interactions, and aim to optimize its performance.

#### Parallel Session 1 A - QCD and Electroweak / 54

### Top Quark Mass Measurement using Matrix Element Analysis Technique and Lepton + Jets Channel

**Author:** Jacob Linacre<sup>1</sup>

<sup>1</sup> *University of Oxford*

**Corresponding Author:** linacre@fnal.gov

We present a top quark mass measurement using  $t\bar{t}$  candidate events for the lepton+jets decay channel from  $p\bar{p}$  collisions at 1.96 TeV at CDF. The top quark mass is extracted by employing an unbinned maximum likelihood method using per-event probability density functions calculated using signal ( $t\bar{t}$ ) and background ( $W$ +jets) matrix elements, as well as a set of parameterised jet-to-parton mapping functions. The likelihood function is maximised with respect to the top quark mass, the fraction of signal events, and the jet energy scale correction, which is constrained in-situ via the mass of the hadronic  $W$  boson.

#### Parallel Session 3 C - Neutrinos and Double Beta Decay / 55

### Lepton Asymmetries and their Evolution in the E6SSM

**Author:** Rui Luo<sup>1</sup>

<sup>1</sup> *University of Glasgow*

**Corresponding Author:** r.luo@physics.gla.ac.uk

We investigate leptogenesis in the E6 inspired Supersymmetric Standard Model. In this model, the gauge singlet right-handed neutrinos decay into ordinary leptons, exotic leptons and leptoquarks, all of which carry non-zero lepton number. Lepton asymmetries are calculated from loop diagram contributions to the right-handed neutrino decay. We find that lepton asymmetries can be enhanced drastically by extra Yukawa couplings in this model. Boltzmann Equations indicate that a successful leptogenesis can be achieved when the lightest right-handed neutrinos mass is of order  $10^6$  GeV, as required by the limit on the reheating temperature.

#### Parallel Session 1 A - QCD and Electroweak / 56

### Gaps between jets

**Author:** Simone Marzani<sup>1</sup>

<sup>1</sup> *University of Manchester*

We study the effects of QCD radiation on the cross section for the production of two jets with a cut on the transverse momentum of any radiation in the rapidity gap between them at the Large Hadron Collider. This process is of a great phenomenological interest on its own, and moreover it is closely related to Higgs production in WBF. A deep understanding of this calculation is also very important from a more theoretical point of view because of the recent discovery of “super-leading” logarithms due to non-global effects.

### **Parallel Session 3 B - Higgs / 57**

## **High Mass Standard Model Higgs Searches at D Zero**

**Author:** Nicholas Osman<sup>1</sup>

<sup>1</sup> *Imperial College London*

**Corresponding Author:** naosman@gmail.com

In this talk I will describe the current status and outlook of high mass Standard Model Higgs boson searches at D Zero, with particular emphasis on the H to WW channel. The talk will include discussion of potential methods for optimising sensitivity.

### **Parallel Session 3 A - Beyond the Standard Model / 58**

## **Optimising selections for the potential discovery of inclusive Supersymmetry**

**Author:** Paul Prichard<sup>1</sup>

<sup>1</sup> *University of Liverpool*

**Corresponding Author:** pmprichard@gmail.com

Variables are chosen and orthogonal cuts are optimised for the preferential selection of inclusive SUSY signal over standard model background. This cuts based analysis is compared with a log likelihood based analysis also selecting SUSY over backgrounds.

### **Parallel Session 2 B - Flavour Physics / Beyond the Standard Model / 59**

## **Recent results in rare charmless three-body hadronic B decays**

**Author:** Eugenia Puccio<sup>1</sup>

<sup>1</sup> *University of Warwick*

**Corresponding Author:** e.puccio@warwick.ac.uk

We report recent results from the BaBar experiment on the rare three-body charmless hadronic decays of charged and neutral B mesons. These results have been obtained using the full BaBar dataset of around 470 million BB $\bar{B}$  pairs.

**Parallel Session 1 B - Flavour Physics / 60****Performing a full angular analysis of  $B_d \rightarrow K^* \mu \mu$  at LHCb****Author:** William Reece<sup>1</sup><sup>1</sup> *Imperial College London***Corresponding Author:** w.reece06@imperial.ac.uk

The decay  $B_d \rightarrow K^* \mu \mu$  is a rare  $b \rightarrow s$  quark transition which is of great interest as a probe of beyond the Standard Model physics at the LHC. LHCb will be able to collect such large samples of these decays that a full angular analysis will be possible within a few years. Methods developed for performing this analysis will be presented, and some aspects of the related phenomenology discussed.

**Parallel Session 1 C - Detectors and Future Facilities / 61****Software buildup to LHC switch-on****Author:** Alexander Richards<sup>1</sup><sup>1</sup> *University College London***Corresponding Author:** richards@hep.ucl.ac.uk

outline of the software stability testing framework and fast ATLAS simulation with a view to getting ready for early data at the LHC

**Parallel Session 1 C - Detectors and Future Facilities / 62****A CLIC Post-Collision Extraction Line Photon Background Study****Author:** Michael Salt<sup>1</sup><sup>1</sup> *University of Manchester***Corresponding Author:** michael.salt@hep.manchester.ac.uk

In the proposed CLIC Extraction Line Design, coherently produced lepton pairs possess a significant energy distribution. In the bending region, this translates to high dispersion and possible particle loss. To prevent magnet damage, masks are positioned between the magnets to absorb these losses, of which this study analyses the effect of these lost particles. Using physics-in-matter simulation tools, these interactions are modelled and secondary particles are tracked. Photons produced in the backwards direction are identified and tracked back to the interaction point to determine the flux incident on the detectors. Of particular interest is the silicon vertex detector region since photons may trigger false signals, contributing to the backgrounds. This study will also look at the effects of detector masking, and the probability of an incident photon translating to a registered hit in the silicon.

**Parallel Session 1 A - QCD and Electroweak / 63**

## QCD matrix elements and truncated showers

**Author:** Frank Siegert<sup>1</sup>

<sup>1</sup> *University of Durham*

An improved prescription of merging matrix elements with parton showers is presented, extending the CKKW approach. This new method preserves the logarithmic accuracy of the shower.

**Parallel Session 1 B - Flavour Physics / 64**

## Determination of $|V_{ub}|$ using the endpoint of the lepton spectrum

**Author:** Michael Sigamani<sup>1</sup>

<sup>1</sup> *Queen Mary, University of London*

**Corresponding Author:** michael.sigamani@cern.ch

We present a partial branching fraction for the inclusive charmless semileptonic decay of  $b \rightarrow u l \nu$ , leading to the determination of the CKM matrix element  $|V_{ub}|$ .

**Parallel Session 1 B - Flavour Physics / 65**

## Charm triggering and physics at LHCb

**Author:** Patrick Spradlin<sup>1</sup>

<sup>1</sup> *University of Oxford*

**Corresponding Author:** patrick.spradlin@cern.ch

Copious charm hadron production at LHCb will produce physics measurements with world-leading precision, but, first, charm events must be recorded to tape. This talk will discuss triggering strategies at LHCb and some of their consequences for charm physics selection and analysis.

**Parallel Session 1 A - QCD and Electroweak / 66**

## Production of direct photons at ATLAS

**Author:** Mark Stockton<sup>1</sup>

<sup>1</sup> *University of Birmingham*

The production of direct photons at ATLAS will be an ideal test of perturbative QCD (pQCD) in a kinematic region never observed before. Gaining a deeper understanding of pQCD is essential to searches for new physics at the LHC. In addition, differential cross-section measurements of direct photon production can be used to constrain parton density functions. The plans for the first direct photon measurement with the first LHC data will be presented.

**Parallel Session 2 B - Flavour Physics / Beyond the Standard Model / 67****ATLAS Electron Trigger efficiency determination for BSM channels****Author:** Matthew Tamsett<sup>1</sup><sup>1</sup> *Royal Holloway*

This talk will present a study concerning the ATLAS electron trigger performance in a SUSY/exotic environment and the determination of this efficiency from data.

**Parallel Session 2 B - Flavour Physics / Beyond the Standard Model / 68****CP Violation in the MSSM at the LHC****Author:** Jaime Tattersall<sup>1</sup><sup>1</sup> *University of Durham***Corresponding Author:** jamie.tattersall@durham.ac.uk

The Minimal Supersymmetric Model contains many new parameters that can have CP violating phases. We investigate ways of discovering these at the LHC if the CP phases happen to be large.

**Parallel Session 1 C - Detectors and Future Facilities / 69****Computation of Resistive Wakefields****Author:** Adina Toader<sup>1</sup><sup>1</sup> *University of Manchester***Corresponding Author:** adina.toader@manchester.ac.uk**Parallel Session 2 C - Detectors and Future Facilities / Neutrinos and Dark Matter / 70****Calculations of background from radioactivity in dark matter detectors****Author:** Vito Tomasello<sup>1</sup><sup>1</sup> *University of Sheffield***Corresponding Author:** v.tomasello@sheffield.ac.uk

New generation dark matter experiments aim at exploring the  $10^{-9}$  -  $10^{-10}$  pb cross-section region for the WIMP-nucleon scalar interactions. Neutrons and gamma-rays produced in detector components are the main factors that can limit detector sensitivity. Energy spectra and production rates of neutrons coming from radioactive contamination of materials with uranium and thorium have been estimated using the code SOURCES4A. The code libraries for (alpha,n) cross-section and transition

probabilities have been updated and extended using the code EMPIRE 2.19. Radioactive background event rates from some detector components (such as copper and stainless steel), as well as from rock and concrete (lab walls), have been estimated for a hypothetical dark matter detector based on Ge crystals (for instance EURECA). Different shielding configurations (water, lead, paraffin) have been considered. Neutrons and photons have been propagated to the detector using GEANT4. Some requirements for the radiopurity of the materials have been deduced from the results of these simulations. Thickness of shielding in different configurations and required gamma discrimination factor have been investigated.

### Parallel Session 3 B - Higgs / 71

## Statistical Combination of Low-Mass Higgs Channels

**Author:** Catherine Wright<sup>1</sup>

<sup>1</sup> *University of Glasgow*

**Corresponding Author:** c.wright@physics.gla.ac.uk

With the recent successes at the Tevatron, it will be more important than ever for LHC physicists hunting for the Higgs to combine their efforts. Based on current techniques, no single channel in the ATLAS repertoire will be able to discover the Higgs with less than  $\sim 5\text{fb}^{-1}$ , and as such, it will be important to combine statistically the outcomes of the individual searches. An approach is presented, based on that used at LEP and CDF, to assess the combined sensitivity of ATLAS to the Higgs Boson in mass range  $110 < 190\text{ GeV}$ .

### Parallel Session 1 B - Flavour Physics / 72

## LHCb's potential in D0 mixing and CP violation

**Author:** Funai Xing<sup>1</sup>

<sup>1</sup> *University of Oxford*

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LHCb has great potential for making important measurements in the charm sector. The core of this programme includes the precise measurements of the mixing parameters in  $D^0$ - $D^0$ bar oscillations and the search for CP-violation in D-decays. The talk will present the results of MC studies which quantify LHCb's potential sensitivity in this area. Discussion will also be given to the RICH system, whose K-Pi discrimination power is critical in the charm analysis.

### Parallel Session 3 A - Beyond the Standard Model / 73

## Chargino/ Neutralino Mass

**Author:** Yiming Li<sup>1</sup>

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The masses of chargino and neutralino are important SUSY parameters which can be measured with high precision in ILC. The chargino or neutralino pair production is one of the benchmarking processes of SiD detector concept also because the separation of chargino/neutralino events is only enabled by satisfactory performance of Particle Flow Algorithm. Here we discuss the chargino/ neutralino events selection and estimate the error of mass measurement.

#### Parallel Session 2 B - Flavour Physics / Beyond the Standard Model / 74

### Inelastic Dark Matter and Non-Standard Halos

**Author:** Matthew McCullough<sup>1</sup>

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I will discuss the compatibility of the inelastic dark matter (iDM) interpretation of the DAMA/LIBRA results with other direct detection experiments, focussing particularly on the sensitivity to the iDM velocity distribution.

#### Parallel Session 2 C - Detectors and Future Facilities / Neutrinos and Dark Matter / 76

### Luminosity Performance Studies of Linear Colliders with Intra-train Feedback Systems: Simulations and Experimental Plans

**Author:** Javier Resta Lopez<sup>1</sup>

<sup>1</sup> *Oxford university*

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The design luminosity for the future linear colliders is very demanding and challenging. Beam-based feedback systems will be required to achieve the necessary beam-beam stability and steer the two beams into collision. In particular, by means of computer simulations we study the luminosity performance improvement by intra-train beam-based feedback systems for position and angle corrections at the interaction point of linear colliders. Here results are presented for the International Linear Collider (ILC) and the Compact Linear Collider (CLIC). Moreover, we present the design of fast feedback systems to be tested at the final focus beam test facility ATF2 at KEK (Japan).

#### Parallel Session 2 A - QCD and Electroweak / Higgs / 77

### A study of low pt electron reconstruction efficiencies in ATLAS

**Author:** Susan Cheatham<sup>1</sup>

<sup>1</sup> *University of Lancaster*

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**Parallel Session 2 A - QCD and Electroweak / Higgs / 78****Constraining PDFs at the LHC: The W asymmetry****Author:** Kristin Lohwasser<sup>1</sup><sup>1</sup> *University of Oxford***Corresponding Author:** kristin.lohwasser@cern.ch

The asymmetry in the rapidity distribution of positive and negative W Bosons can help to put constraints on the parton distribution functions (PDFs). It is directly related to differences in the momentum distribution of u and d quarks and will be used to improve our knowledge on the valence quark distributions at low x. This talk will present the prospects for the W asymmetry measurement with early data at the ATLAS detector. The analysis is carried out using full detector simulation and all systematical errors on the measurement are considered.

**STFC Town Meeting (a) / 81****PPAN and Grant Panels, including Project Approvals and Progress on Advisory Panels****Author:** Jordan Nash<sup>1</sup><sup>1</sup> *CERN***STFC Town Meeting (a) / 82****Science Board View of Programme and Priorities –Big Issues, Opportunities, Accelerator Vision****Author:** Jenny Thomas<sup>1</sup><sup>1</sup> *UCL***Corresponding Author:** jthomas@hep.ucl.ac.uk**STFC Town Meeting (a) / 83****STFC Update, including Financial Situation****Author:** John Womersley<sup>1</sup><sup>1</sup> *STFC***New IOP Particle Accelerators and Beams Group / 84****IoP PAB gp**

**STFC Town Meeting (b) / 85**

## **PPAP Role, Constitution and Plans**

**Author:** Philip Burrows<sup>1</sup>

<sup>1</sup> *University of Oxford*

**STFC Town Meeting (b) / 86**

## **Economic Impact**

**Author:** Liz Towns-Andrews<sup>1</sup>

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**PP2020: Particle Physics - Fundamental Impacts / 87**

## **Selling Particle Physics to the Treasury**

**Corresponding Author:** markl@hep.ucl.ac.uk

**Parallel Session 2 C - Detectors and Future Facilities / Neutrinos and Dark Matter / 88**

## **Commisioning the LHCb Vertex Detector**

**Authors:** Abdi Noor<sup>1</sup>; Abdirizack Noor<sup>2</sup>

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**Plenary IV: Final / 89**

## **Closing Remarks**

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