Kruger2014: The International Workshop on Discovery Physics at the LHC

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Book of Abstracts

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Parallel Session / 0

The Upgrade of the LHCb trigger system

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The current LHCb trigger system consists of a hardware level, which reduces the LHC inelastic collision rate of 30 MHz to 1 MHz, at which the entire detector is read out. In a second level, implemented in a farm of 20k parallel-processing CPUs, the event rate is reduced to about 5 kHz. The major bottleneck in LHCb's trigger efficiencies for hadronic heavy flavour decays is the hardware trigger. The LHCb experiment plans a major upgrade of the detector and DAQ system in the LHC shutdown of 2018. In this upgrade, a purely software based trigger system is being developed, which will have to process the full 30 MHz of inelastic collisions delivered by the LHC. We demonstrate that the planned architecture will be able to meet this challenge, particularly in the context of running stability and long term reproducibility of the trigger decisions. We discuss the use of disk space in the trigger farm to buffer events while performing run-by-run detector calibrations, and the way this real time calibration and subsequent full event reconstruction will allow LHCb to deploy offline quality multivariate selections from the earliest stages of the trigger system. We discuss the cost-effectiveness of such a software-based approach with respect to alternatives relying on custom electronics. We discuss the particular importance of multivariate selections in the context of a signal-dominated production environment, and report the expected efficiencies and signal yields per unit luminosity in several key physics benchmarks the LHCb upgrade.

Parallel Session / 1

Two-loop renormalisation in UED models

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Two-loop renormalization is introduced and discussed within the context of the Universal Extra-dimension (UED) models. Various issues will be discussed, in the minimal UED model, and its possible extensions to higher numbers of extra-dimensions and supersymmetry. An attempt will be made to define the running of the coupling constants at the two-loop level.

Parallel Session / 3

Vector-like multiplets, mixings and the LHC

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We consider a model-independent and general framework to study the LHC phenomenology of vector-like quarks, including particles with different electro-magnetic charge. We consider vector-like quarks embedded in general representations of the weak SU(2)L, coupling to all Standard Model quarks via Yukawa mixing. We show that, with very minimal and quite general assumptions, they can be studied in terms of few parameters in an effective Lagrangian description with a clear and simple connection with experimental observables. We also demonstrate that the parametrisation can be applied as well to cases with many vector-like multiplets, thus covering most realistic models of New Physics.

Plenary Session / **4**

The physics of heavy-ion collisions - recent insights and open questions

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This talk will give an update of our understanding of the physics of the "Little Bang" – the explosive evolution of the hot and dense QCD matter created in heavy-ion collisions. Its collective flow, color opacity and brilliance in the electromagnetic spectrum will be discussed. Special emphasis will be given to new insights arising from the recent proton-lead run at the LHC and the Beam Energy Scan and U+U runs at RHIC. A list of important questions to be addressed by theory and additional heavy-ion measurements at RHIC and LHC will be formulated and explicated.

Parallel Session / **6**

The dynamics of Composite Higgses

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The nature of the 126 GeV Higgs recently discovered at CERN has not been established yet. One intriguing possibility is that it may arise as a light composite state from a confining dynamics at the TeV scale. I will review the recent progress in understanding the dynamics that may be behind this mechanism, focusing on what we can learn by knowing its details. The masses of the spin-1 resonances can in fact be extracted from lattice calculations thus providing an estimate of the mass scale of new states. Furthermore, a lot can be learned about the physics of eventual top partners.

Student Session / **7**

Large A_t without the Desert

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Even if the unification and supersymmetry breaking scales are around 10^6 to 10^9 TeV, a large A_t coupling may be entirely generated at low energies through RGE evolution in the 5D MSSM. Independent of the precise details of supersymmetry breaking, we take advantage of power law running in five dimensions and a compactification scale in the 10 – 10^3 TeV range to show how the gluino mass may drive a large enough A_t to achieve the required 125.5 GeV Higgs mass. This also allows for sub-TeV stops, possibly observable at the LHC, and preserving GUT unification, thereby resulting in improved naturalness properties with respect to the four dimensional MSSM. The results apply also to models of "split families" in which the first and second generation matter fields are in the bulk and the third is on the boundary, which may assist in the generation of light stops whilst satisfying collider constraints on the first two generations of squarks.

Summary:

In the MSSM there are two ways of reaching the experimental value of
the Higgs mass.
1- By a superheavy stop sector (m_t ~ 10 TeV)
2- Or by a large mixing in the stop sector A_t ~$\sqrt{6}m_t$.
The first option is disfavored by fine-tuning arguments while the second
one allows for lighter stops m_t 1 TeV and it is thus prefered by
naturalness arguments. The solution advocated in this work is to resolve the previous issue by introducing an extra (fifth) dimension and taking advantage of the power low running to generate a sizable value of A_t starting from a very small value to achieve the required 125.5 GeV Higgs mass.

Plenary Session / **8**

The Tsallis Distribution in High Energy Physics

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The use of Tsallis distributions in the analysis of High Energy Physics data has increased in recent years. These distributions are related on a Thermodynamics description of the hot hadronic-system produced at ultra-relativistic collisions, proposed by Hagedorn several years ago.
In this talk a brief review on the Thermodynamics description of HEP data and on the role that Tsallis distributions plays in the field will be presented. Some consequences of the application of these concepts in hadronic systems will be discussed. In particular, it will be shown that one can give a complete thermodynamics description of hot hadronic matter through the analysis of experimental data from HEP and/or from the analysis of the known hadron mass spectrum.
An extension of this Thermodynamics description for finite chemical potential was recently obtained, and will be discussed in this talk. Finally, some applications of the obtained Thermodynamics for studies of neutron stars and cosmology will be shown.

Summary:

1) The Hagedorn's theory and Frautisch's description of hadrons.
2) Introduction of Tsallis theory in HEP.
3) The self-consistency principle in nonextensive statistics.
4) Hadron Thermodynamics and LQCD.
5) Hadron Thermodynamics for finite chemical potential.
6) Applications for neutrons stars and in Big-Bang nucleosysnthesys.
7) Conclusions.

Plenary Session / **9**

Dynamics of strongly interacting parton-hadron matter

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We study the non-equilibrium dynamics of heavy-ion collisions from SIS to LHC energies within the Parton-Hadron-String Dynamics (PHSD) transport approach, which incorporates explicit partonic degrees of freedom in terms of strongly interacting quasiparticles (quarks and gluons) in line with an equation of state from lattice QCD as well as the dynamical hadronization and hadronic collision dynamics in the final reaction phase.

We investigate the equilibrium properties of strongly-interacting infinite parton-hadron matter in terms of transport coefficients, such as shear and bulk viscosity, electric and heat conductivity at finate temperature and quark chemical potential.
Furthermore, the 'highlights' of the latest results on electromagnetic probes (photons and dileptons), heavy quarks and 'bulk' collective flow observables from heavy-ion collisions will be presented.

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Neutrino Mass Models at Three-Loop and their Phenomenology

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We consider classes of standard model (SM) extensions with a scalar representation (charged singlets and/or triplet) and three generation fermionic representations (right handed neutrinos or triplets). In these models, the neutrino masses are generated at three loops, which provide an explanation for their smallness, and the lightest neutral fermion, is a dark matter candidate. We find that for three generations of RH neutrinos, the model can be consistent with the neutrino oscillation data, lepton flavor violating processes, give a relic density in agreement with the recent Planck data, and the electroweak phase transition can be strongly rst order. We also show that the charged scalars may enhance the branching ratio h-> gamma gamma , where as h-> gamma Z get can get few percent suppression. We also discuss the phenomenological implications of the RH neutrinos at both LHC and future electron positron colliders.

Parallel Session / **12**

Double Higgs boson production at FCC-he and prospects for measurements of the Higgs boson self-coupling

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The measurement of the triple Higgs boson coupling is one of the most important goals of Higgs physics in the present and future collider experiments, which provide the first direct information on the Higgs potential that is responsible for EWSB.

In this talk we present double-higgs production scenario at the LHeC/FCC-he through $e^{-}p$ collision which will provide information about trilinear coupling (λ_{HHH}) and possibility of new physics. The LHeC will provide e- to collide head on with protons at the LHC. The LHC will be replaced with the FCC (future circular collider) with proton beams of up to 50 TeV and e- energy will be varied from 60-250 GeV. Due to more involved experimental and theoretical constraints it is difficult to measure (λ_{HHH}) precisely at the LHC. The relevant dimension six operators are studied involved in this process.

Plenary Session / **15**

Heavy-flavor physics with ALICE at the LHC

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Charm and beauty quarks are important probes to study the characteristics and the evolution of the strongly interacting, deconfined matter produced in relativistic heavy-ion collisions. ALICE at the LHC is well equipped to reconstruct heavy-flavor hadrons and many measurements were performed since the LHC startup in proton-proton, proton-lead and lead-lead collisions. Hadronic and semileptonic decays are detected at mid and at forward rapidity to study heavy-flavor hadron production and its modification by initial- and final-state effects in heavy-ion collisions.

An overview of the LHC Run1 results will be given. The variety and the precision of the available measurements of the nuclear modification factor, the elliptic flow and correlations with hadrons, suggest first constraints to theoretical models. A summary of what we learned so far at the LHC energies will be presented.

Parallel Session / **16**

Collectivity phenomena search in pp, p-Pb and Pb-Pb collisions with ALICE at the LHC

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One of the main design goals of the ALICE experiment is hadron identification at mid-rapidity over a wide range of transverse momenta. Thanks to its excellent PID capabilities and pT coverage, ALICE

offers an ideal test-bench for the measurement of transverse momentum distributions, dN/dy and <pT> of identified light flavor hadrons. In the present contribution those measurements are reported for pp, p-Pb and Pb-Pb collisions at the LHC energies.
A particle mass dependent hardening of the spectral shapes is observed in Pb-Pb collisions and can be interpreted as due to hydrodynamical flow and may be quantitatively parameterized with Boltzmann-Gibbs Blast Wave fits. The study of the possible existence of collective phenomena in small systems such as pp, p-Pb and peripheral Pb-Pb is also presented showing that similar trends are observed for those systems in multiplicity dependent studies.

Parallel Session / 17

D meson reconstruction with ALICE: present results and future perspectives

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A hot and dense medium, made of deconfined quarks and gluons, the Quark Gluon Plasma (QGP), can be created in ultra relativistic heavy-ion collisions. Charm and beauty quarks are excellent probes to investigate its properties and its evolution, since they are mainly produced at the early stages of the collisions in hard partonic scattering processes. Hot and dense nuclear matter effects can be studied by comparing heavy flavour production in Pb-Pb, pp and p-Pb collisions. Proton- proton collisions are used as a reference, while p-Pb collisions provide a way to assess cold nuclear matter effects. The ALICE detector, thanks to its excellent tracking and vertexing capabilities, allows the full reconstruction of two and three body hadronic decays of D0, D+, D*+ and Ds+ mesons in the central rapidity region.
A major upgrade of the ALICE experiment is scheduled for the second long shutdown (LS2) of the LHC (2018-19). The upgrade of the readout of most of the detectors will allow to fully exploit the increase of Pb-Pb luminosity expected for the LHC Run 3: the goal of the Collaboration is to collect a sample of minimum-bias collisions 100 times larger than the sample expected before LS2. The installation of a new Inner Tracking System, composed of seven layers of pixel detectors, will provide an increase of the tracking spatial precision by a factor of about three and will allow for a substantial improvement of the current performances for what concerns the heavy flavour reconstruction capabilities, especially at low momenta. Furthermore, new observables will be accessible, like, for example, the full kinematic reconstruction of beauty hadrons ($B+ \longrightarrow D0\pi +$ with $D0 \longrightarrow K+\pi -$) and heavy flavour baryons ($\Lambda+c$ and also Λb)
In this talk the current results concerning open charm reconstruction will be presented and the expected perspectives for the future LHC Run 3 will be discussed.

Plenary Session / 18

Review of Strange Particle Production up to LHC Energies

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The production of hadrons, mainly of strange particles, has been studied intensively over the last decades as they are very powerful probes to study the dynamics of the high-density state created in heavy-ion collisions. With the new results from the LHC the energy range has been further extended and allows for a study of the various observables in a large energy range. Emphasis is put in this talk on the comparison between pp and heavy-ion collisions. The recent results from the p-Pb

experiment at the LHC complete this comparison and it remains to be seen whether these results are a bridge between pp and Pb-Pb or whether distinct features are seen. New results on heavier particles and on strange resonances complete the picture on the evolution of the high-temperature, high-density state created in heavy-ion collisions.

Parallel Session / **19**

Low mass dilepton measurements with ALICE at the LHC

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Low mass dileptons are powerful tools to study the evolution of the system created in relativistic heavy ion collisions because (i) they are produced in all stages the collision, and (ii) they do not interact strongly thus leave the collision area unaffected by the final state interactions. Low mass dileptons provide also an ideal way to access the thermal photon radiation from the hot and dense medium in heavy ion collisions, which is a key measurement to characterise the medium directly.

The current status of the low mass dilepton measurements (dielectron at mid-rapidity and dimuon at forward rapidity) in pp, p-Pb and Pb-Pb collisions with the ALICE experiment at LHC will be presented. The perspective of dilepton observables in heavy ion runs in RUN2 phase with higher data taking rate, as well as in RUN3 phase after major upgrades of the ALICE sub-detectors will be discussed.

Plenary Session / **20**

Light Flavour Production in the ALICE Experiment

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The ALICE Experiment at CERN has excellent capabilities for the measurement of light-flavour hadrons, thanks to its extensive particle identification and the very good tracking. In this talk, after briefly reviewing the most relevant features of the ALICE detector, we will summarise results on identified light-flavour hadron production. The measurements cover a large number of hadron species (from pions to multi-strange baryons and light nuclei) and extend over a very large transverse momentum region (from ~ 100 MeV/c to ~ 20 GeV/c, depending on the species). The measurements in pp collisions at √s = 900 GeV, 2.76 TeV and 7 TeV provide important constraints for QCD-inspired Monte Carlo models and serve as a baseline for measurements in nuclear collisions. The results in Pb-Pb collisions at √s_{NN} = 2.76 TeV allow the measurement of the expansion properties of the fireball, the study of parton energy loss in the hot QCD medium and of the hadronization mechanisms (such as recombination or statistical hadronization). Finally, the measurements in p-Pb collisions at at √s_{NN} = 5.02 TeV play a crucial role, as they allow investigation of the effects of ordinary nuclear matter and bridge pp and Pb-Pb results in terms of multiplicity of produced particles.

Plenary Session / **22**

Review of (anti-)(hyper-)Nuclei Production and Search for Exotic Baryon States with ALICE at the LHC

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In ultra-relativistic collisions at the Large Hadron Collider (LHC) light (anti-)(hyper-)nuclei are produced with significant yields, especially in collisions between lead nuclei. In addition, these collisions give the possibility to search for light exotic bound states of baryons. Light nuclei are identified using the excellent particle identification capabilities of the Time Projection Chamber (TPC) and the Time-Of-Flight (TOF) detector of the ALICE experiment.

Transverse-momentum spectra and production yields of light composite objects such as (anti-)nuclei and the (anti-)(hyper)triton will be presented. To understand their production mechanism the comparison of the results obtained for the three collision systems, pp, p-Pb and Pb-Pb and at different energies will be discussed. They are then compared with predictions from thermal and coalescence models. In addition, we will present results from searches for weakly-decaying light exotic states, such as the Lambda-Lambda (H-dibaryon) and the Lambda-neutron bound states.

Parallel Session / 23

Charmonium production in Pb-Pb and p-Pb collisions with ALICE at the LHC

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The hot and dense nuclear matter created in heavy ion collisions at relativistic energies consists in its early stage
of a plasma of deconfined quarks and gluons (QGP).
Charmonium production is a very sensitive probe to both the conditions of the QGP medium, such as energy density and temperature,
and to non-medium conditions like total charm cross-section production and cold nuclear matter (CNM) effects.
The strong J/psi suppression observed in central
nucleus-nucleus collisions at RHIC and SPS has been
proposed as evidence for the QCD analogue of the Debye screening effect. At the LHC, the wealth of results available for Pb-Pb collisions
at 2.76 TeV per nucleon suggests that the formation of charmonium via quark (re)combination in medium or at the
chemical freeze-out gives a significant contribution to the total yields. The recent p-Pb results on charmonium production allows
for an estimation of the CNM effects which strenghtens the support for models including the (re)combination effect
in Pb-Pb collisions.
Covering a large rapidity range ($|y|<0.9$ and $2.5<y<4.0$) down to zero transverse momentum, ALICE is capable to provide
both differential and total cross-section measurements for J/psi, which are crucial for disentangling the various

contributions to the observed results. We will present an overview of the ALICE data on J/psi production in Pb-Pb collisions at mid- and forward-rapidity and the latest measurements on J/psi and psi(2S)
production in p-Pb collisions at 5.02 TeV. The current theoretical understanding of these data will be discussed
using comparisons to model calculations.

Plenary Session / **24**

Direct Photon and high-pT Particle Production with ALICE

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Direct-photons produced in the hot fireball of a heavy-ion collision leave the medium unscathed. They are therefore believed to provide information about the very early stage of the collisions. In particular, the direct photon pT spectrum at low pT (1 < pT < 4 GeV/c) might contain information about the initial temperature of the quark-gluon plasma. A further diagnostic tool is the azimuthal anisotropy of direct photons. A large azimuthal anisotropy of low-pT direct-photons similar in magnitude to the pion anisotropy would suggest that direct-photon mostly come from the late stage of the collision. This would be at variance with current hydrodynamic models and therefore constitute a puzzle. Another way to study properties of the hot medium is the measurement of jet and high-pT particle production in pp and A-A collisions. Results from p-A collisions play an important in differentiating between effects from hot and cold nuclear matter. The ALICE experiment at the LHC is ideally suited to measure photon production, especially at low pT. In the study of jet and high-pT particle production ALICE profits from its excellent particle identifications capabilities. The current status of results on direct photon and high-pT particle production from ALICE will be presented in this talk.

Summary:

Overview of ALICE results on direct photon and high-pT particle production

Parallel Session / **25**

Jet Nuclear Modification Factor from the AdS/CFT Correspondence

Author: Razieh Morad[1]

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We define a novel definition of the holographic light hadron jet by a separation of scales from plasma to jet, which leads to the re-emergence of the late-time Bragg peak in the instantaneous jet energy loss rate. We use the holographic energy loss of light quark and our new jet prescription in AdS/CFT to calculate the nuclear modification factor of jet for a brick of plasma (both static and expanding plasma) and compare the AdS/CFT results with the experimental data for most central Pb-Pb collision at LHC at 2.76 TeV center-of-mass energy. Defining a “renormalized” AdS/CFT jets that we argue better reflect QCD physics, we find a surprisingly good agreement between our toy model which

is the first fully strongly coupled calculations, and preliminary jet suppression data from heavy ion collisions at LHC.

Student Session / **26**

Energy momentum tensor associated with hard parton production in finite time

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Particle physics has had remarkable success in describing collider data using usual Feynman diagram techniques, but little is understood regarding particles during the time of interaction. We use the Schwinger-Keldysh finite-time formalism applied to an interacting scalar field theory to derive a perturbative expression for the energy momentum tensor associated with hard particle production. This is used as a foundational model to study jet production in the QGP.

Possible applications include perturbative calculations of dispersion relations for interacting non-linear field theories, insight into the flow of momentum for off-shell particles, and the creation of a hybrid early-time pQCD/late-time AdS/CFT energy loss model to describe high momentum observables in heavy-ion collisions.

Student Session / **27**

Measurements of W+- boson production in p-Pb collisions at the LHC with ALICE

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ALICE (A Large Ion Collider Experiment) is designed and optimized to
study ultra-relativistic heavy-ion collisions, where a hot and dense strongly-interacting medium is created. W± bosons are produced in hard scattering
processes occurring at the early stage of the collision and, not being affected by
the strong interaction, they can be used as a benchmark for medium induced
effects. In proton-nucleus collisions the production of W± bosons can be used
to test the validity of the binary collision scaling and to study the nuclear
modification of Parton Distribution Functions. In ALICE, the production of
W± bosons is measured via the contribution of their decays to the inclusive
pT-differential yield reconstructed with the muon spectrometer at forward and
backward rapidity. This measurement is done separately for μ+ ⟵ +W and μ− ⟵ −W. The recent results in p−Pb collisions at √s_{NN} = 5.02 TeV will be
presented and the measured cross sections will be compared to pQCD at NLO
calculations.

Plenary Session / **28**

Results from the p-Pb Run at the LHC

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The LHC has run p-Pb collisions at √s_{NN} = 5.02 TeV in addition to √s_{NN} = 2.76 TeV Pb-Pb and the pp physics program. The p-Pb program was conceived originally to investigate initial-state effects in the collisions of nuclei. The p-Pb results appear to exhibit a lack of strong initial-state effects, but are surprising in that they reveal a strong similarity to the final-state hydrodynamic effects observed in Pb-Pb collisions. In this presentation, I will summarize the p-Pb results from the LHC and place them in perspective with what is observed in pp and Pb-Pb. This will include results on particle production, identified particle spectra, correlation measurements, large transverse momentum jets and hadrons, and other measurements.

Parallel Session / 30

Upgrade of the ATLAS Tile Calorimeter

Author: Robert Reed[1]

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The Tile Calorimeter (TileCal) is the main hadronic calorimeter covering the central region of the ATLAS experiment at LHC. TileCal readout consists of about 10000 channels. The bulk of its upgrade will occur for the High Luminosity LHC operation (Phase 2 around 2023) where the peak luminosity will increase 5x compared to the design luminosity (1034cm-2s-1) but with maintained energy (i.e. 7+7 TeV). The TileCal upgrade aims to replace the majority of the on- and off-detector electronics so that all calorimeter signals can be digitized and directly sent to the off-detector electronics in the counting room. This will reduce pile-up problems and allow more complex trigger algorithms. To achieve the required reliability, redundancy has been introduced at different levels. Three different options are presently being investigated for the front-end electronic upgrade. Extensive test beam studies will determine which option will be selected. 10 Gbps optical links are used to read out all digitized data to the counting room while 4.8 Gbps down-links are used for control, synchronization and configuration of the on-detector Field Programmable Gate Arrays (FPGAs). To provide sufficient radiation tolerance, the latter use scrubbing and partial reconfiguration. For the off-detector electronics a pre-processor (sROD) is being developed, which takes care of the initial trigger processing while temporarily storing the main data flow in pipeline and de-randomizer memories. FPGAs are extensively used for the logic functions off- and on-detector. One hybrid demonstrator prototype module with the new calorimeter module electronics, but still compatible with the present system, is planned to be inserted in ATLAS in the end of 2015.

Parallel Session / 31

Searching for P and CP odd effects in heavy ion collisions

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We investigate how local parity breaking due to fluctuations of the topological charge may affect hadron physics in heavy ion collisions. A distorted dispersion relation is derived for the lightest vector mesons ρ and ω and compared to the experimental results. The main characteristic of LPB is an invariant mass splitting that depends on the polarization. We present a detailed analysis of the invariant mass and angular distribution associated to the lepton pairs created from these mesons looking for possible LPB effects. Two angular variables are found to carry the main information related to the parity breaking effect. Possible signatures for experimental detection of LPB are discussed. We also discuss how LPB may affect other hadronic processes such as Dalitz decays

Parallel Session / **32**

Search for the critical point of strongly interacting matter at the CERN SPS NA61/SHINE experiment

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The NA61/SHINE experiment performs a detailed study of the onset of deconfinement and search for critical point of hadronic matter by colliding nuclei of different size at various beam momenta from 13A to 158A GeV/c. Experimental setup and results on the theoretically expected signatures we'll be discussed.

Parallel Session / **34**

Search for Dark Matter at CMS

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This talk reviews the latest Dark Matter (DM) results from the CMS experiment, consisting in searches for DM particles under the form of Weakly Interactive Massive Particles.

The search for directly produced DM particles exploits final states containing a high momentum object and missing transverse energy, such as monojet, monophoton, monolepton and monotop. The production of DM particles in association with top quark pairs, as well as the decay of a Higgs boson to DM particles, are is also considered.

The talk will also briefly mention prospects for LHC Run 2.

Plenary Session / **35**

SUSY Searches in the ATLAS Experiment

Author: Lawrence Lee[1]

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Despite the absence of experimental evidence, weak scale supersymmetry remains one of the best motivated and studied Standard Model extensions. This talk summarises recent ATLAS results for searches for supersymmetric (SUSY) particles. Weak and strong production in both R-Parity conserving and R-Parity violating SUSY scenarios are considered. The searches involved final states including jets, missing transverse momentum, light leptons, taus or photons, as well as long-lived particle signatures.

Plenary Session / **36**

CMS - Past, Present, and Future

Author: Greg Landsberg[1]

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I'll present the current status of CMS, with some highlights from the very successful first run of the CERN LHC, which culminated in the discovery of the Higgs boson. I'll talk about detector upgrade and commissioning work being done in preparation for Run 2 and also cover plans for long-term upgrade of the CMS detector for future high-luminosity runs.

Plenary Session / **37**

Till the supersymmetric path? To tread or not to tread?

Author: Biswarup Mukhopadhyaya[1]

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The existing status of supersymmetry (SUSY) will be surveyed, with emphasis on the LHC data. The main line of discussion will be: (a) a quick recapitulation of the desirability of SUSY, (b) The viabiliy of testable supersymmetric scenarios in view of current data, and (c) certain possibilities that are less emphasized in most discussions.

Parallel Session / **38**

NLO Heavy Quark Energy Loss in Strongly-Coupled Quark-Gluon Plasmas

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We present new predictions for the suppression of heavy quark decay products at RHIC and LHC from a NLO AdS/CFT energy loss model. Previous predictions from a tomographic model based on

only the leading order AdS/CFT contribution to energy loss and constrained by RHIC data disagreed with LHC D meson measurements. In this work we include for the first time a correct treatment of the momentum fluctuations induced in the heavy quark motion from the strongly-coupled thermal medium: we resolve the ambiguity in the evaluation of the stochastic Langevin equations using the Wong-Zakai theorem and properly take into account the fluctuations' deviations from the Einstein relations. The addition of the fluctuations leads to corrections to the suppression predictions, which are significant for charm quarks and their decay products. We demonstrate how further experimental measurements can provide insight into the dominant energy loss mechanisms in, and hence the physical properties of, the quark-gluon plasma produced in heavy ion collisions.

Parallel Session / 39

Single top quark production cross section using the ATLAS detector at the LHC

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Measurements of single top-quark production cross section in proton proton collisions at 7 and 8 TeV are presented. In the leading order process, a W boson is exchanged in the t-channel. For this process, for the first time a fiducial cross section measured within the detector acceptance is presented and the modelling uncertainty when extrapolating to the total inclusive cross section is assessed with a large number of different Monte Carlo generators. The result is in good agreement with the most up-to-date theory predictions. Furthermore, the single top-quark and anti-top total production cross sections, their ratio, as well as a measurement of the inclusive production cross section is presented. Differential cross sections are measured as a function of the transverse momentum and the absolute value of the rapidity of top and anti-top quarks. In addition, a measurement of the production cross section of a single top quark in association with a W boson is presented. The s-channel production is explored and limits on exotic production in single top quark processes are discussed. This includes the search for flavor changing neutral currents and the search for additional W bosons (W').

Plenary Session / 40

Heavy Ion Physics: A view from 30,000 feet

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This talk will give a brief 'high level' overview for non-experts of Ultra-relativistic Heavy Ion Physic, the study of strongly interacting matter under extreme conditions. First experiments started in the mid '80s with light ions and at low energy fixed target accelerators; with the advent of the ion colliders RHIC and LHC the available energy in the center of mass system has increased by four orders of magnitude in less than 30 years. This talk will give a concise summary of some of the main highlights from SPS to LHC, and venture an outlook on what questions to address in the next 10 to 20 years.

Parallel Session / 41

Performance of the ATLAS Tile Calorimeter

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The ATLAS Tile hadronic calorimeter (TileCal) provides highly-segmented energy measurements of incoming particles. It is a key detector for the measurement of hadrons, jets, tau leptons and missing transverse energy. It is also useful for identification and reconstruction of muons due to good signal to noise ratio. The calorimeter consists of thin steel plates and 460,000 scintillating tiles configured into 5000 cells, each viewed by two photomultipliers. The calorimeter response and its readout electronics is monitored to better than 1% using radioactive source, laser and charge injection systems. The calibration and performance of the calorimeter have been established through test beam measurements, cosmic ray muons and the large sample of proton-proton collisions acquired in 2011 and 2012. Results on the calorimeter performance are presented, including the absolute energy scale, timing, noise and associated stabilities. The results demonstrate that the Tile Calorimeter has performed well within the design requirements and it has given essential contribution to reconstructed objects and physics results. In addition, the data quality procedures used during the LHC data-taking are shown and the outcome from the detector consolidation in the maintenance period is also presented.

Plenary Session / **42**

Heavy ion physics at LHCb

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The LHCb collaboration studied the production of J/ψ and Upsilon mesons in proton-lead collisions at a proton nucleon centre-of-mass energy √sNN = 5 TeV. The measurements have been used to determine the nuclear modification factor and to compare the results with theoretical predictions. A measurement of Z boson production in proton-lead collisions is presented as well. The analyses are based on a data sample corresponding to an integrated luminosity of about 1 nb−1.

Parallel Session / **43**

Exclusive quarkonia production in the forward acceptance at the LHC

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The LHCb detector and LHC running conditions are ideally suited for measuring central exclusive production. Measurements of inclusive and differential
cross-sections of the exclusive production of J/Psi and Psi(2S), as well as double charmonium, are presented. The measurements are compared to different models as well as to photoproduction results from HERA and fixed target experiments.

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An Integration Framework Tool for ATCAs in the ATLAS Detector Control System

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ATLAS is a general purpose detector at the Large Hadron Collider at CERN,Switzerland. The current Detector Control System (DCS) consists of a highly distributed system running over many servers using the SCADA product called PVSS OA. The DCS provides multiple functionality such as automated control procedures, efficient error recognition with handling, managing communication with external systems and synchronization with the ATLAS data acquisition system. For the Phase-II upgrade in 2022 the current Versa Module Eurocards will be replaced by the new Advanced Telecommunications Computing Architecture (ATCA) chassis. This chassis provides a new protocol, of which, has not been used in ATLAS and a new strategy is required to integrate the ATCA into the DCS. This contribution describes the ATCA framework tools and how it uses a new protocol in conjunction with WinCC OA to seamlessly integrate the ATCA into the DCS.

Summary:

A new framework tool has been developed to assist developers in the integration of ATCA chassis into the detector control system. This framework automates data point creation and configuration.

Plenary Session / **45**

Highlights from Run-I from the CMS Experiment

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As an introduction to sessions to follow, this contribution will make a tour of a
number of selected highlights of results from the CMS experiment, from the first run of the LHC: the so called Run-I. A few outstanding Standard Model measurement results will be discussed, as well as a summary of searches for new physics. Emphasis will be given
on the present understanding of the newly found particle in 2012, a Higgs boson, with some of the latest results. While compatible with expectation, a number of 2-3 sigma deviations
are observed in the data and will be shown, and these are of course of interest to revisit with the new LHC collisions coming in spring 2015 at a higher centre of mass energy.
The talks during the rest of the week will discuss some of these results in detail.

Parallel Session / **46**

Searches for electroweak SUSY production in channels with Higgs, Z, and W bosons at CMS

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Searches for supersymmetry (SUSY) are presented based on the electroweak pair production of neutralinos and charginos, leading to decay channels with Higgs, Z, and W bosons and undetected lightest SUSY particles (LSPs) using 8 TeV collected in 2012 with the CMS detector at the LHC. Neutralino pair production leading to hh, hZ, and ZZ states with missing transverse energy (E_T^{miss}) is considered, as well as chargino-neutralino pair production, leading to hW states with E_T^{miss}. The decays of a Higgs boson to a bottom-quark pair, to a photon pair, and to final states with leptons are considered in conjunction with hadronic and leptonic decay modes of the Z and W bosons.

Plenary Session / **47**

Welcome from the Department of Science and Technology

Plenary Session / **48**

State of Physics in South Africa

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Plenary Session / **49**

CERN: A European Laboratory for a Global Project

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Plenary Session / **50**

The CERN Medium and Long Term Program towards Future Discoveries

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New Results from ALICE

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Selected Highlights from the Precision Studies in ATLAS

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Plenary Session / **53**

Physics at FAIR: Oportunities for South Africa

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Plenary Session / **54**

Physics of the Higgs Boson beyond the Standard Model

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Search for Exotics and Higgs Physics beyond the Standard Model with the ATLAS Detector

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SM Higgs Combination and Higgs Properties Measurements in ATLAS

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ATLAS Physics prospects at the high-luminosity LHC

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Plenary Session / **58**

New Heavy Flavour Results from CMS

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Plenary Session / **59**

Searches for New Physics in CP violating observables and rare heavy Quark decays at LHCb

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Searches for Supersymmetry with the CMS Detector at the LHC

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Standard Model Higgs Boson at CMS

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Parallel Session / **62**

Matrix Techniques for Higgs Studies

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Parallel Session / **63**

Recent QCD Results from ATLAS

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Searches for Dark Matter with the ATLAS Detector

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Search for the Higgs Boson in Fermionic Channels Using the ATLAS Detector

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Higgs Beyond-the-Standard Model Higgs Physics Using the ATLAS Detector

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Electroweak Results from CMS

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The LHCb Upgrade: Detector and Physics Programme

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The Physics of Heavy Quarks in Heavy-Ion Collisions

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Recent Electroweak Results from ATLAS

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Parallel Session / **72**

Search for the Higgs Boson in the ttH Production mode using the ATLAS Detector

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Parallel Session / **73**

Top-Quark Production at CMS

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Parallel Session / **74**

An Experiment to Search for Hidden Particles at the SPS (SHIP)

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Parallel Session / **75**

Quarkonium Production and Polarization in pp Collisions with the CMS Detector

Student Session / **76**

Calibration Hits in the ATLAS Calorimeter

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Student Session / **77**

Radiation hardness of plastic scintillators for the Tile Calorimeter of the ATLAS detector

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Parallel Session / **78**

Measurements of the Top-Quark Mass and Properties at CMS

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Parallel Session / **79**

Searches for Massive Top and Bottom Quarks Partners at CMS

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Parallel Session / **80**

Search for New Massive Resonances at CMS

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Plenary Session / **85**

The Future of ALICE

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The ALICE experiment at the LHC is continuing its harvet of results from RUN1, while preparing for the second LHC RUN which will start next spring. In parallel, we are preparing for the long-term future, with a major upgrade to be installed during LS2 and which will allow a rich physics program in RUN3 and RUN4 of the LHC. The main items will be reviewed.