Abstracts

Alekseev, Igor: for the EPECUR Collaboration ***``High Precision Measurements of the Pion Proton Differential Cross Section"***

Study of the elastic scattering can produce a rich information on the dynamics of the strong interaction. The EPECUR collaboration is aimed at the research of baryon resonaces in the second resonance region via pion-proton elastic scattering and kaon-lambda production. The experiment features high statistics and better than 1 MeV resolution in the invariant mass thus allowing searches for narrow resonances with the coupling to the πp channel as low as 5%. The experiment is of "formation" type, i.e. the resonances are produced in s-channel and the scan over the invariant mass is done by the variation of the incident pion momentum which is measured with the accuracy of 0.1% with a set of 1 mm pitch proportional chambers located in the first focus of the beam line. The reaction is identified by a magnetless spectrometer based on wire drift chambers with a hexagonal structure. Background suppression in this case depends on the angular resolution, so the amount of matter in the chambers and the setup was minimized to reduce multiple scattering. The measurements started in 2009 with the setup optimized for elastic pion proton scattering. With 3 billions of triggers already recorded the differential cross section of the elastic πp-scattering on a liquid hydrogen target in the region of the diffractive minimum is measured with statistical accuracy about 1% in 1 MeV steps in terms of the invariant mass. The talk covers the experimental setup, current status and some preliminary results.

Andersen, Jeppe: ***``Jets at LHC"***

I will review recent progress in several directions of the perturbative description of processes with several hard jets. In particular, I will focus on processes where analyses of LHC data have already shed light on the perturbative mechanisms behind hard jet production. I will furthermore suggest directions for further studies.

Arleo, Francois: ***``Photon + Heavy-Quark Production in p-A and A-A Collisions"***

A detailed phenomenological study of direct photon + heavy-quark jet production in p-A and A-A collisions at next-to-leading order in QCD is presented. The dominant contribution to the cross-section comes from the gluon-heavy-quark (gQ) initiated subprocess, making this process very sensitive to both the gluon and the heavy-quark nuclear parton densities. This process is also used in order to probe the energy loss of heavy-quarks in quark-gluon plasma produced in heavy-ion collisions at RHIC and LHC.

Bianchi, Nicola: ***``Hadron Multiplicities in DIS off Nucleons and Nuclei Measured at HERMES"***

HERMES has measured the multiplicities of different hadrons in the semi-inclusive deep-inelastic scattering as function of several kinematical variables: z, p_T, x_B, Q^2. The results on hydrogen and deuterium targets give information on the fragmentation of quarks into different final state hadrons and provide an important input for the extraction of the fragmentation functions using QCD fits. The results on nuclear targets clearly show a nuclear medium modification of the vacuum fragmentation function suggesting a large effect of the partonic energy loss in the cold nuclear matter. These results are important for

the understanding of the hadron and jet quenching in the present high energy heavy ion experiments.

Bindi, Marcello: ***``Inelastic Cross Section Measurements at LHC".***

Blaizot, Jean-Paul: ***``Extreme States of Matter and Ultra-Relativistic Heavy Ion Collisions"***

This talk will present selected topics in the theoretical study of dense and hot QCD matter, in the light of the ongoing experiments at the LHC.

Brook, Nicholas: ***``Particle Production and Minimum Bias Distributions at LHC"***

The latest results on Particle Production and Minimum Bias event at Large Hadron Collider (LHC) are discussed. The results are compared to various QCD models incorporated in Monte Carlo event generators and with other phenomenological models.

Bruni, Alessia*: ``Atlas Results on Diffraction"*

The diffractive physics program and results for the ATLAS experiment are discussed.

Chattopadhyay, Sukalyan: ***``Results from the ALICE Experiment on Heavy-ions and Low-x QCD Physics"***

ALICE is a multipurpose detector for high-energy nucleus-nucleus physics at the CERN Large Hadron Collider. It focuses on the study of strong interaction under extreme conditions of temperature and density and at small parton momentum fraction. The talk will present an overview of the experimental results obtained from lead-lead collisions at 2.76 TeV per nucleon. Low-x pQCD results in pp collisions will be highlighted as well.

Das, Sumit: ***``Quantum Quench Across Holographic Phase Transitions"***

The holographic correspondence can be used to study non-equilibrium behavior of strongly coupled quantum field theories. One such phenomenon is that of quantum quench, where a coupling of the field theory is time dependent and typically asymptotes to constants at early and late times. In the gravity dual this can describe, under suitable circumstances, either black hole formation, or passage through a spacelike region of high curvature similar to a cosmological singularity. In particular in recent work holography has been used to study situations where quantum quench happens across a critical point, and has revealed interesting scaling properties.

Deile, Mario: ***``First Measurements of Proton-Proton Elastic Scattering and Total Cross-Section at the LHC by TOTEM"***

The TOTEM experiment at the LHC has measured the differential cross-section for elastic proton-proton scattering at the energy of ps = 7TeV in several dedicated runs, partly with a special high-¯°Ë beam optics. The data published until now and presented here were collected with Roman Pot detectors placed as close as 7 times the transverse beam size from the outgoing beams at the interaction point 5. These data sets cover a range of squared four-momentum transfer |t| from 0.02 to 2.5GeV2, exhibiting an approximately exponential behavior for $|t| < 0.33\text{GeV}^2$ with a slope $B = (20.1 \pm 0.2\text{stat} \pm 0.3\text{syst})\text{GeV}^{-2}$, followed by a

significant diffractive minimum at |t| = (0.53 ± 0.01stat ± 0.01syst)GeV2. For |t| > 1.5GeV^2, a power-law decrease with an exponent of −7.8±0.3stat±0.1syst was observed. By extrapolation of the exponential part at low |t| to t = 0, a total elastic cross-section of (24.8 ± 0.2stat ± 1.2syst)mb was obtained. Applying the optical theorem and using the luminosity measurement from CMS, a total cross-section of (98.3 ± 0.2stat ± 2.8syst)mb was deduced. From the total and elastic cross-section measurements, an inelastic pp cross-section of (73.5±0.6stat +1.8 −1.3 syst)mb was inferred.

DelDuca, Vittorio: ***``Amplitudes and Wilson Loops in N=4 SYM"***

In the planar N=4 supersymmetric Yang-Mills theory, we discuss two-loop amplitudes and Wilson loops, and the use of symbols in their evaluation

Dembinski, Hans: ***``Recent Measurements of Ultra-high Energy Cosmic Rays and their Impact on Hadronic Interaction Modeling"***

The advent of large hybrid detectors like the Pierre Auger Observatory and Telescope array provided a significant step forward in understanding the nature and origin of ultra-high energy cosmic rays. The purpose of these instruments is to measure the flux of cosmic rays, search for their sources, and to derive their mass composition. The interpretation of the observational data in term of mass relies on hadronic interactions models at center-of-mass energies from 10 to 1000 TeV. However, the available models only give a partly consistent picture and are challenged by simultaneous observations of the longitudinal profile an air shower and the lateral ground profile. The talk will summarize recent measurements in the field and point out their relation to hadronic interaction modeling.

D'Enterria, David: ***``Frontiers of QCD: From Puzzles to Discoveries. Experimental Summary and Perspectives"***

The main experimental highlights of EDS'11 will be summarized and future perspectives in the experimental study of the QCD frontier will be discussed.

Dremin, Igor: ***``Parton Content of Hadronic Interactions"***

Comparison of the independent pair parton interaction model with experimental data on multiplicity distribution in 7 TeV pp-collisions leads to conclusion that the number of active parton pairs involved increases with multiplicity reaching the values as high as 7-8. This reflects the parton density increase with energy. Meanwhile, we are working on explanation of the dip structure in elastic pp seen recently by TOTEM.

Favart, Laurent*: ``Exclusive Electroproduction of Vector Mesons"*

Worldwide results on electroproduction of vector mesons will be reviewed and discussed.

Gay Ducati, Beatriz: ***``Estimations for the Higgs Boson Production with QCD and EW Corrections in Exclusive Events at the LHC"***

The Higgs boson production is investigated in proton-proton collisions at next-to-leading order accuracy in central exclusive diffractive processes at the LHC. The production process by the double Pomeron exchange is analyzed in the diffractive factorization through the Ingelman-Schlein approach, taking into account the parton content of the Pomeron by the

diffractive partonic distribution function provided by the H1 Collaboration. Hence, we estimate the production cross section of the Higgs boson, as well as its rapidity distribution for distinct energies of the LHC. Also, we include the gap survival probability in our calculation, which is studied in recent works and expected to lie in the range between 1% and 5% for the energy regime of 14 TeV. As a result, we found a production cross section of about 0.3–0.8 (1.2–3.7) fb at 7 (14) TeV, being of the same order as predicted by the two-photon and the Balitsky-Fadin-Kuraev-Lipatov Pomeron mechanisms. Therefore, assuming the selection rules of spin parity properties, the exclusive production is a promising channel for the Higgs boson detection in the LHC

Godizov, Anton: ***``Models of Elastic High-Energy Scattering to Falsify at the LHC"***

Various phenomenological models of diffractive elastic scattering are considered in comparison with the recent TOTEM data on the total and differential cross-sections. Physical implications for the theory of strong interaction are discussed.

Goulianos, Konstantin: ***``CDF Results on Diffraction and Exclusive Production"***

Recent CDF results on diffractive and exclusive production are presented and compared with theoretical expectations.

Grabas, Herve: ``Study of the Anomalous Coupling Between Photon and W/Z bosons and the AFP project"

We study the *W/Z* pair production via two-photon exchange at the LHC and give the sensitivities on quartic gauge anomalous couplings between photons and *W/Z* bosons for an integrated luminosity of 30 and 200 fb^{-1}. Only the leptonic and semi-leptonic decays of the electroweak bosons are considered. The AFP (ATLAS Forward Physics) project will allow to detect the intact protons in the final state scattered at small angles and produced in the photon exchange. We describe the main detectors involved in the project stressing in particular the design of the timing detector and its electronics.

Harland-Lang, Lucian: ***``Latest Results on Standard Candle Central Exclusive Production within the Durham Model"***

I will discuss work performed as part of the KRYSTHAL collaboration on standard candle central exclusive production (CEP) processes within the pQCD-based Durham model, which involve the production of systems with sufficiently low masses that observation of these processes is already possible at the Tevatron and in the early LHC low luminosity runs. These processes allow us to test the overall theoretical formalism as well as being of interest in their own right. I will in particular concentrate on the CEP of light meson pairs (pi+pi-, K+K-, eta eta...), but will also discuss diphoton and χ_c CEP, in particular in relation to the recent experimental data from both the Tevatron and the LHC.

Hashimoto, Koji: ***``Holographic Nucleus"***

Using a new holographic description of multi-baryon system derived in string theory, we show the formation of atomic heavy nuclei, with nuclear radius analytically calculated.

Heinrich, Michael*: ``Underlying Event Results for LHC"*

The potential discovery of new, yet undetected particles and phenomena at hadron colliders requires a highly sophisticated modeling of background processes in Monte Carlo event generators in order to maximize significances and signal over background ratios. The Underlying Event (UE) is a non-reducible background to all processes at the LHC and arises from soft scatterings which overlay the hard partonic interaction which have to be included in the event simulation. As the UE happens in the regime of soft quantum chromo-dynamics, the perturbative calculation breaks down and phenomenological, highly tunable models have to be employed. The transition from previous collider experiments to the LHC was performed by extrapolating the predictions of these models to the new energy domain. It is thus vital to test and improve Monte Carlo generators at every newly accessible center-of-mass energy to provide the best description possible to the physics community. In this presentation, an overview of recent results by both the CMS and ATLAS collaborations are given, shedding light on different approaches to measuring the UE and the most up-to-date Monte Carlo descriptions of these phenomena.

Honda, Morihiro: ``Study of the Interaction Model Using Atmospheric Muons for the Calculation of Atmospheric Neutrino Flux"

We have calculated the atmospheric neutrino flux with the interaction model selected and modified by the study of atmospheric muons. Recently there are reported new observations of the primary cosmic rays. We have updated the study of atmospheric muons and interaction model with the newly observed primary cosmic ray data.

Hreus, Tomas: *``MPI Results from the LHC"*

The aim of the talk is to summarize recent studies on the Multiple Partonic Interactions at the LHC, with the emphasis on the on high pT parton MPIs (such as the double parton scattering). Along with the experimental results from LHC, an overview of theoretical MPI highlights will be given, together with the feasibility studies at generator level.

Igi, Keiji: *``Universal Rise of Total Hadronic Cross Sections and Predictions at LHC"*

We show that the data on $\bar{p}(p)p$, $\pi^{\mp}p$, and $K^{\mp}p$ forward scatterings support the expectation that the asymptotic behavior of all cross sections is flavor independent. By using the most recent measurements from ATLAS, CMS, and Auger, we predict σpp tot($\sqrt{s}$ = 7 TeV) =96.1±1.1 mb . We also use our results to predict the total $\pi^{\mp}\pi$+ cross sections as a function of $\sqrt{s}$. After completing the manuscript [1], we found that the TOTEM has measured a total pp cross section at $\sqrt{s}$ = 7 TeV, 98.3±0.2(*stat.*)± 2.8(*syst.*) mb, which is a somewhat large value but consistent with our prediction within the errors.

Islam, Munir: *``Proton Structure from High Energy Proton-Proton and Antiproton-Proton Elastic Scattering"*

Our phenomenological investigation of high energy pp and $\bar{p}p$ elastic scattering and study of the gauged Gell-Mann-Levy linear σ-model using path-integral formulation have led us

to a physical picture of the proton structure. Namely, proton is a Condensate Enclosed Chiral Bag. Based on this picture, our prediction of pp elastic scattering at c.m. energy 7 TeV is discussed against the backdrop of recent measurements of elastic pp $d\sigma/dt$ at LHC by the TOTEM Collaboration at $\sqrt{s} = 7$ TeV.

Itakura, Kazunori: ***``Forward Hadron Production at Collider Energies and its Possible Application to Cosmic Ray Physics"***

Recent theoretical progress towards accurate description of hadron production in forward rapidities at collider energies is presented. In particular, we discuss "hard contributions" to the inclusive hadron spectra, and how the effects of gluon saturation in the target is important. We also discuss possible application of this framework to the collision of a primary cosmic ray with the atomic nucleus in atmosphere whose collision energy could be much higher than the collider energies even at the LHC.

Jenkovszky, Laszlo: ***``Lessons from the First Results on Elastic pp Scattering at the LHC"***

The fist results on proton-proton elastic scattering and total cross section by the TOTEM Collaboration are analyzed in the framework of various models, with special emphasis on the dip-bump structure in the differential cross section.

Jenkovszky, Laszlo: ***``Exclusive Diffractive Production of Real Photons and Mesons at HERA***

A simple and efficient model applicable both to exclusive diffractive deeply virtual Compton scattering (DVCS) and vector meson production (VMP) is presented. The model is fitted to the HERA data from the H1 and ZEUS Collaborations. It may be useful in extracting general parton distributions (GPD).

Jevicki, Antal: ***``The AdS Avatars of Large N QCD Dipoles"***

High energy QCD scattering at Large N is known to be dominated by a collection of dipoles. We discuss the manifestation of such "collective dipoles" as Higher Spin states in a one higher dimensional Anti de Sitter space.

Knutsson, Albert: ***``CMS Results on Diffraction"***

The talk gives an overview of measurements on diffraction performed with the CMS detector at LHC. The results include the first observations of diffraction in pp collisions at 0.9, 2.36 and 7 TeV centre-of-mass energies. A study of forward energy flow, central charged-particle multiplicity and rapidity gaps in events with W and Z bosons, as well as the forward energy flow in minimum-bias and di-jet events, are shown. Cross-sections for dijet production in events with a large rapidity gap are also presented.

Kurihara, Yoshimasa*: ``QCD Event-Generator GR@PPA2.8 and its Applications"*

GR@PPA2.8 is an event generator for proton-proton and proton-antiproton scattering processes. It includes initial-state jet matching for weak boson production processes. I will

give recent developments of GR@PPA2.8 and its application to TEVATRON and LHC. Especially I will present an application to CDF dijet anomaly process.

Li, Hsiang-nan: ***``QCD Resummation for Jet Substructures"***

We provide a novel development in jet physics by predicting the energy profiles of light-quark and gluon jets in the framework of perturbative QCD. Resuming large logarithmic contributions to all orders in the coupling constant, our predictions are shown to agree well with Tevatron CDF and Large-Hadron-Collider CMS data. We also extend our resummation formalism to the invariant simplified model of this extra-dimension approach, it is found that electron and neutrino can be the GSLT partners. In particular, neutrino mass, charge and intrinsic momentum are estimated and compared with the data of parity non-conservation (PNC) experiments, neutrino oscillations, SN1987A observation and the recent claim of neutrino faster-than-light evidence at OPERA.

Luszcak, Marta: ***``Diffractive Production of cbar-c Pair"***

At high-energies the gluon-gluon fusion is the dominant mechanism $\bar{c}$c of c production. This process was calculated in the NLO collinear as well as in the kt-factorization approaches in the past. We show that the present knowledge of gluon distributions does not allow to make a precise predictions for $\bar{c}$c production at LHC, in particular at forward rapidities. In this analysis we have discussed single and central diffractive production of c $\bar{c}\,\bar{c}$ c pairs in the Ingelman-Schlein model. In these calculations we have included diffractive parton distributions obtained by the H1 collaboration at HERA and absorption effects neglected in some early calculations in the literature. The absorption effects which are responsible for the naive Regge factorization breaking cause that the cross section for diffractive processes is much smaller than that for the fully inclusive case, but could be measured at RHIC and LHC by imposing special condition on rapidity gaps. We discuss also a fully exclusive diffractive production of $\bar{c}$c. It was advocated recently that the cross section for this mechanism may be substantial. We have found here that both at RHIC and LHC its contribution is smaller than that for single diffractive one. In our opinion it is very timely to analyze if this contribution could be measured. This requires an analysis of the final state. We expect that the final state in single and exclusive production are different enough to set criteria to pin down the fully exclusive component. It is, however, not obvious if the central diffractive and purely exclusive mechanisms could be differentiated experimentally. They may look similar as far as rapidity gap structure is considered. We predict that the total contribution of central diffractive mechanism is similar to that for the exclusive one. In contrast the final state multiplicity can be expected to be different. A better analysis requires a Monte Carlo studies.

Maor, Uri: ***``Is the Pomeron Necessary and if so Why is is so Complicated"***

A formulation of the soft Pomeron, compatible with s and t channel unitarity is presented. It is based on the observation that elastic and diffractive scattering are strongly coupled through the Good-Walker mechanism and multi Pomeron interactions. The implication of the above for LHC and AUGER recent cross section data are presented and compared with recent mini jets models. I shall comment on the approach of the elastic scattering amplitude to the black disc bound and discuss what can and can not be learned from the

Froissart-Martin bound. If time permits I shall add a few comments on soft and hard Pomerons and compatibility with AdS/CFT correspondence.

Mesropian, Christina: ***``Hard QCD Results with Jets"***

A comprehensive overview of the latest aspects of hard QCD physics in proton-anti-proton collisions at $\sqrt{s}$ =1.96 TeV is presented. In particular, measurements of the inclusive jet and dijet production, jet substructure studies, the production of vector bosons in association with energetic jets are discussed.

Milhano, Jose Guilherme: ***``From Theory to Phenomenology in the CGC"***

I will review the CGC formulation and its current phenomenological application.

Mitsuka, Gaku: ***``High Energy Hadronic Interactions and Cosmic Ray Physics"***

The interpretation of observations of ultra-high energy cosmic rays rely the knowledge about forward particle production in hadronic interaction. Especially the choice of the hadronic interaction model in the Monte Carlo simulations of air shower development significantly affects the simulated results, and accelerator data on the production of very forward emitted particles are indispensable for constraining the hadronic interaction models. In this talk, recent progress in understanding high energy hadronic interaction is discussed from the viewpoint of the cosmic ray observations.

Miyachi, Yoshiyuki: ***``Spin Structure of the Nucleon Studied at HERMES"***

HERMES has studied the spin structure of the nucleon with the polarized 26.7 GeV electron or positron beam from HERA at DESY together with various nucleon targets. Inclusive and semi-inclusive measurements of deep-inelastic scattering with the polarized nucleon targets were carried out. Especially measurements with the transversely polarized target provided rich information for understanding the internal structure in terms of transverse-momentum dependent quark distributions. Measurements of hard exclusive production of real photons or mesons, which allow us to access generalized parton distributions, were also carried out. Selected results from these measurements at HERMES and the impact on the research of the nucleon spin structure will be presented and discussed.

Nguyen, Matthew: ***``CMS Results on Heavy Ion and Low-x QCD Physics"***

We present results of the CMS experiment from PbPb collisions at $\sqrt{s_{NN}}$ = 2.76 TeV, probing quark and gluon matter at unprecedented values of energy density. In particular, we will focus on studies of jet quenching. As a function of centrality, dijet events with a high pT leading jet were found to have an increasing momentum imbalance that was significantly larger than those predicted by simulations. Using charged tracks, both the fragmentation pattern of jets as well as the missing transverse momentum with respect to the jet axis were measured. The studies demonstrate the a large fraction parton momentum is carried by soft particles at large angle with respect to the jet. Using the reconstructed jet as a reference, high transverse momentum fragments close to the jet axis demonstrate a similar fragmentation pattern to jets in pp collisions.

Nystrand, Joakim: ***``Photonuclear Interactions in Heavy-ion Collisions at the LHC"***

The strong electromagnetic fields associated with relativistic heavy-ions lead to very large cross sections for photon-induced processes in heavy-ion collisions at the CERN Large Hadron Collider. In fact, the photonuclear cross sections for certain processes in Pb+Pb collisions far exceed the total hadronic cross section of about 8 b. The photonuclear interactions can be divided into those there the target nucleus remains intact (exclusive production) and those there the target nucleus disintegrates. In both cases, the hadronic interaction of the photon can understood from Vector Meson Dominance.
It has been found from the first run with heavy-ions at the LHC that photonuclear reactions provide a significant background to hadronic interactions with centralities between 80 - 100%. Having good models for the photonuclear particle production is thus essential[1,2]. Exclusive photoproduction of heavy vector mesons (J/Psi, Upsilon) has been proposed as sensitive probes of the nuclear gluon distributions. The STARLIGHT Monte Carlo[3] has been shown to describe many features of exclusive vector meson production at the Brookhaven Relativistic Heavy-Ion Collider. I will give an overview of photonuclear interactions at the LHC and discuss the physics opportunities they provide as well as the problem of them being a background to hadronic processes.

Pierog, Tanguy: ***``Comparison of Hadronic Interaction Models with LHC Data"***

The main observables of high energy air showers initiated by high energy cosmic rays depend on the nature and energy of the primary particles. As a result, simulation of showers initiated by hadronic particles will have a strong dependence on the physics of hadronic interactions at energies well above even the LHC. In particular the uncertainty in the prediction of shower observables for different primary particles and energies is currently dominated by differences between hadronic interaction models. Since the end of 2009, LHC data has become available for proton-proton scattering at different energies, extending to the reach of collider data. On the one hand. the LHC data on minimum bias measurements can be used to test Monte Carlo generators and these new constrains will help to reduce the uncertainties in air shower predictions. On the other hand, the constraints given by the air shower measurement help to improve hadronic interaction model as well and can be used to understand underlying events at LHC. In this contribution, we will show the results of the comparison between the currently used high energy hadronic interaction models and LHC data. Implications for both air shower simulations and LHC will be discussed.

Poghosyan, Martin*: ``Diffractive and Inelastic Cross-Sections in Proton-Proton Collisions at $\sqrt{s}$ = 0.9 TeV, 1.76 TeV and 7 TeV with ALICE at the LHC"*

The relative rates of single- and double- diffractive processes were measured with the ALICE detector by studying properties of gaps in the pseudorapidity distribution of particles produced in proton-proton collisions at $\sqrt{s}$ = 0.9 TeV, 2.76 TeV and 7 TeV. ALICE triggering efficiencies are determined for various classes of events, using a detector simulation validated with data on inclusive particle production. Cross-sections are determined using van der Meer scans to measure beam properties and obtain a measurement of the luminosity.

Royon, Christophe: ***``D0 Results on Diffraction"***

We will describe the results from the D0 experiment at the Tevatron, namely the measurement of the elastic differential cross section and the search for exclusive diffractive

events in the jet channel.

Schicker, Reiner: ***``Central Diffraction in ALICE"***

The ALICE experiment at the Large Hadron Collider (LHC) at CERN consists of a central barrel covering the pseudorapidity range −0.9 < _ < 0.9 and of additional detectors which can be used to define pseudorapidity gaps −3.7 < _ < −0.9 and 0.9 < _ < 5.1. The low pT threshold of the central barrel gives ALICE a unique opportunity to study the low mass sector of central production at the LHC. I will summarize the status of analyzing events with a double gap topology from minimum bias data, and will present the prospects of a dedicated double gap trigger for data taking of central diffractive events in proton-proton collisions at ps = 7 TeV.

Shibata, Makio: ***``Cosmic-ray Energy Spectrum Around the Knee"***

Characteristics of cosmic-ray energy spectrum are discussed using results of recent direct observations and air shower experiments, in which interesting global and fine structures are reported. Possibilities of interpreting these structures in terms of nearby source or nonlinear effect in cosmic-ray acceleration are presented in this report focusing on the chemical composition measurement by CREAM, Tibet and KASCADE experiments. Interaction model dependence involved in the air-shower analysis is also discussed referring to LHCf data.

Snellings, Raimond: ***``Angular Correlations of Hadrons Measured at the Large Hadron Collider"***

The measured two and multi-particle angular correlations allow us to constrain the dynamics of the collisions at LHC energies. In this talk I will present the recent results from ALICE, ATLAS and CMS measured in collisions of protons and in heavy-ions.

Soffer, Jacques: ***1. ``Recent Positivity Constraints for Spin Observables and Parton Distributions"***

Spin observables allow a deeper understanding of the underlying dynamics and positivity reduces substantially their allowed domains. We will present some new positivity constrains for spin observables and their implications for parton distributions. We will also make some comparisons with recent data.

Soffer, Jacques: ***2. ``Significant Issues Related to Elastic Scattering at Very High Energies"***

After giving a short review on the impact picture approach for the elastic scattering amplitude, we will discuss the importance of some issues related to its real and imaginary parts. This will be illustrated in the context of recent data from RHIC, TEVATRON AND LHC.

Son, Dam Thanh: ***1. ``Viscosity and Black Holes"***

Viscosity is a very old concept which was introduced to physics by Navier in the 19th century. However, in strongly coupled systems, viscosity is difficult to compute from first principle. In this talk I will describe some recent surprising developments in string theory

which allow one to compute the viscosity for a class of strongly interacting quantum fluids not too dissimilar to the quark gluon plasma. I will describe efforts to measure the viscosity and other physical properties of the quark gluon plasma created in relativistic heavy ion collisions.

Son, Dam Thanh: 2. ***``Anomalous Hydrodynamics and Gravity"***

By using general arguments based on symmetries and the second law of thermodynamics, we show that axial anomalies modifies hydrodynamic equations. We will see how this modification can be seen in holographic models, and discuss the implications.

Surrow, Bernd: ***``Recent results and future prospects of the polarized p+p program at RHIC"***

Svirida, Dmitry: ***``Transverse Spin Asymmetries at Small Momentum Transfered at STAR"***

Elastic scattering of polarized protons at small momentum transfer is described by interference of Coulomb and nuclear amplitudes. Presence of spin-flipping parts in hadronic amplitude may indicate contribution of exchanges other than dominating Pomeron, while the Coulomb term is well defined by QED. The talk presents preliminary results on spin asymmetries for transversely polarized proton-proton scattering at $\sqrt{s}$ = 200~GeV. About 20 millions elastic events were used to obtain the result in -t range of 0.005-0.035 ~GeV/c^2. Fit of –t dependence of A_N does not indicate any presence of single spin flipping hadronic amplitude. Values of A_{NN} and A_{SS} of the order of 10^{-3} and comparable to the systematic shifts also imply no manifestation of significant hadronic double spin flip.

Szczurek, Antoni: ***``Production of Di-gluon and Quark-antiquark Dijets in Central Exclusive Processes "***

We consider central exclusive production of gg dijets in proton-proton (proton-antiproton) collisions at LHC and Tevatron for different intermediate and final gluon polarisations. The amplitude for the process is derived within the $k_\perp$-factorization approach (with both the standard QCD and the Lipatov's effective three-gluon vertices). Compared to earlier works we include emissions of gluons from different gluonic t-channel lines as well as emission of quark-antiquark dijets. Rapidity distributions, gluon jet $p_\perp$ distributions and invariant dijet mass distributions are presented. We explore the competition of the standard diagram with both jets emitted from a single t-channel gluon and the one with the emission from both t-channel gluons. The second mechanism requires a special treatment. We propose two different approaches. Including special kinematics and using properties of off-diagonal gluons at small x and ξ we arrive to correlations in two-dimensional distributions in rapidity of one and second jet. We find that the second contribution is much smaller than that known from the literature. The digluon production constitutes an important background to exclusive Higgs production.

Takami, Hajime*: ``Propagation of Ultra-High-Energy Cosmic Rays"*

The origin of ultra-high-energy cosmic rays (UHECRs), which are believed to be extragalactic objects, has been one of the biggest mystery in high-energy astrophysics.

UHECRs interact with cosmic background photons including CMB and magnetic fields in the Universe during propagation from their sources to the Earth. Thus, in order to find UHECR sources, the understanding of the propagation process is essential. In this talk we review the propagation of UHECRs and then some recent highlights are presented.

Tan, Chung-I: ***``Holographic Central Production of Higgs and the Ads Graviton Pomeron***

The holographic approach to double diffractive Higgs production is presented for the AdS Graviton/Pomeron of Brower, Polchinski, Strassler and Tan (BPST). The goal is to provide a simple framework from the dual strong coupling point of view, which nonetheless is capable of providing phenomenologically compelling estimates of the cross sections. This is the first step in defining the building block in anticipation of experimental observations at the LHC.

Tapia Takaki, Daniel: ***``For the ALICE Collaboration"***

The ALICE experiment at the CERN's Large Hadron Collider allows the study of vector meson production in ultra-peripheral heavy-ion collisions (UPC). Thanks to the large electromagnetic field of the nucleus, two-photon and photonuclear interactions can be studied in a yet unexplored kinematic regime. In 2010, ALICE recorded UPC events in Pb+Pb collisions at a centre-of-mass energy of 2.76 TeV. Dedicated triggers that make use of the Time-of-Flight, Silicon Pixel and VZERO detectors were prepared to study $\rho 0$ and J/ψ production at central rapidity; the VZERO detectors are two hodoscope arrays located at both sides of the interaction point. In addition, UPC events were also collected by requiring at least a muon candidate at forward rapidity in coincidence with VZERO-C, but having VZERO-A vetoed, which is opposite to the muon system. To ensure the exclusive process, this analysis considered the information from other sub-detectors to extend the rapidity gap up to 8 units of pseudorapidity, *i.e.* the pseudo-rapidity region where no hadrons are detected. In this way, vector mesons were measured at both central and forward rapidities. The rapidity dependence of J/ψ mesons produced in UPC reactions is particularly interesting as is expected to constrain theoretical models that differ in the relative weight attributed to the coherent and incoherent components. Furthermore, it might provide a measure of the nuclear gluon shadowing. In this talk, first results on J/ψ photoproduction using the 2010 heavy-ion data will be presented. The prospects of measuring such exclusive reactions with the data sample to be collected in 2011 will also be mentioned.

Valkarova, Alice: ***``Inclusive and Dijet Diffractive Production at HERA"***

The recent results about inclusive analyses of diffractive events as well as dijet measurements which use the forward proton spectrometers will be presented and compared with theoretical predictions.

Van Elewyck, Veronique: ***``High-energy Neutrino Astronomy: Status and Prospects"***

Neutrino astronomy has entered an exciting time with the completion of the first km^3 -scale neutrino telescope at the South Pole (IceCube) and the successful operation of the first undersea neutrino telescope in the Mediterranean (Antares). This new generation of experiments is approaching the sensitivity levels required to explore at least part of the current landscape of neutrino flux predictions from astrophysical sources, bringing

neutrino astronomy on the verge of its first discovery. Recent results from these experiments will be discussed, with a particular emphasis on the link with the phenomenology of high-energy cosmic rays and on aspects related to physics beyond the Standard Model.

Voutilainen, Mikko Antero*: ``Hard QCD Results on Jets (Including Heavy Flavors) and Photons at CMS"*

The Compact Muon Solenoid (CMS) is one of the two large multipurpose experiments at the LHC. CMS has been successfully operating since the start-up of the LHC, and has recorded in 2010 around 1 billion of the most interesting proton-proton collisions out of the approximately 3 trillion ($3x10^{12}$) provided by the LHC. The accumulated data has been used to perform stringent test of the Standard Model of particle physics, and to search for signs of new physics. Here we report on the first year (2010) jet results from the 3.5+3.5 TeV proton-proton run, with some updates from 2011, focusing on probes of hard QCD. The highlights of the first year of jet measurements in proton-proton collisions include precise determination of the jet energy scale, measurements of inclusive jet production, inclusive b-jet production and photon+jet production, hadronic event shapes, dijet azimuthal decorrelations and dijet angular distributions. These measurements have validated the experimental techniques and theoretical models used at CMS. They have also extended the energy reach beyond previous experiments, and have paved the road for discoveries of new physical phenomena.

Watari, Taizan: ``*Studying Generalized Parton Distribution in Gravity Dual*"

Generalized parton distribution (GPD) is non-perturbative information of parton contents in a hadron. While perturbative QCD can be used to study its evolution, one has to rely on experimental data and their model fitting at least in order to obtain initial profile to be fed into the evolution equation. We use a gravity dual description of strongly coupled gauge theory to study high-energy photon-hadron scattering amplitude and to extract GPD theoretically. We show i) how string theory Pomeron (BPST pomeron) determines GPD profile, ii) how saddle point value of the complex angular momentum plane amplitude controls various observables, and iii) calculation of DVCS slope parameter, which agrees qualitatively with experimental data. This presentation is based on a joint work with Ryoich Nishio.