Low-x 2019

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Book of Abstracts
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UPC results from ALICE

V+jets production and Jet cross sections at CMS and tests of QCD

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Vertices of three reggeized gluons and the unitarity corrections to the propagator of reggeized gluons

Welcome

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Anomalous coupling studies and the pomeron structure at the LHC

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Axion-like particles in light-by-light scattering in pp, pPb, and Ar-Ar collisions

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BFKL Resummation in the inclusive Higgs Boson Plus Jet production at the LHC

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The inclusive production of a Higgs boson and of a jet at the LHC, featuring a wide separation in rapidity, is an interesting probe process for the investigation of the BFKL mechanism of resummation of energy logarithms in the QCD perturbative series. Here, we present for the first time a partial next-to-leading order BFKL analysis for cross sections and azimuthal correlations.

BFKL resummation in inclusive processes

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Closing items

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Correlations at unequal rapidity in the dilute limit of JIMWLK

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Unequal rapidity correlations can be studied within the stochastic Langevin picture of JIMWLK evolution in the Colour Glass Condensate effective field theory. By evolving the classical field in the direct and complex conjugate amplitudes, the Langevin formalism can be used to study two-particle production at large rapidity separations. The evolution between the rapidities of the two produced particles can be expressed as a linear equation, even in the full nonlinear limit. In addition, the Langevin formalism for two-particle correlations reduces to a BFKL picture in the dilute limit and in momentum space, providing an interpretation of BFKL evolution as a stochastic process for colour charges.

Determination of proton parton distribution functions using ATLAS data

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Diffractive PDF determination from HERA inclusive and jet data at NNLO QCD

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Discussion session: DPS, saturation

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Discussion session: PDFs, DGLAP...
Discussion session: Soft and hard diffraction

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Forward jet cross sections: from trijet to NLO dijet

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Using the formalism of the light-cone wave function in pQCD together with the hybrid factorization, we compute the cross-section for two and three particle production at forward rapidities in proton-nucleus collisions. We focus on the quark channel, in which the three produced partons — a quark accompanied by a gluon pair, or two quarks plus one antiquark — are all generated via two successive splittings starting with a quark that was originally collinear with the proton. The produced partons are put on-shell by their scattering off the nuclear target, described as a Lorentz-contracted “shock-wave”. By using the three-parton component of the quark light-cone wave function, together with the virtual corrections, we can then present our progress on the computation of the next-to-leading order correction to the cross-section for the production of a pair of jets.

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Forward photon measurements with ALICE at the LHC as a probe for low-x gluons

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Impact parameter dependence of colinearly improved Balitsky-Kovchegov evolution
Initial-state fluctuations and anisotropies in heavy-ion collisions

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Introduction to XFitter

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J/ψ production in hadron scattering: two parton showers contribution

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LHCf forward physics results

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The main aim of the LHC forward (LHCf) experiment is to provide precise measurements of the particles production spectra in the forward region of the hadronic collisions. These high energy calibration data are very important for the tuning of hadronic interaction models used by ground-based cosmic rays experiments. LHC is the best place where we can perform these measurements,
because proton-proton collisions at $\sqrt{s} = 14$ TeV is equivalent to the interaction of a $10^{17}$ eV cosmic ray with the atmosphere.

LHCf makes use of two small sampling calorimeters installed at ±140 m from LHC IP1, so that it can detect neutral particles produced by p-p and p-ion collisions with pseudo-rapidity $\eta > 8.4$.

In the past years, LHCf acquired data in p-p and p-ion collisions at different energies (p-p at $\sqrt{s} = 0.9$, 2.76, 7 and 13 TeV; p-Pb at $\sqrt{s_{NN}} = 5.02$ and 8.1 TeV). In this talk, we will present the analysis results published by the collaboration, relative to neutrons, photons and $\pi^0$ production spectra, compared with models predictions.

We will also present some preliminary results relative to the ATLAS-LHCf common analysis, from which we expect to significantly increase the impact of LHCf measurements, discriminating between diffractive and non-diffractive events by the use of ATLAS information in the central region.

A short overview of the future activities foreseen at the LHC-Run3 (14 TeV p-p and p-O runs) will also be given.

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**Latest results on double parton scattering and MC tuning from CMS**

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**Low $x$ physics and saturation in terms of TMD distributions**

**Authors:** Tolga Altinoluk$^1$; Piotr Kotko$^2$; Renaud Boussarie$^3$

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One of the main difficulties to understand the continuity between low $x$ physics and more standard QCD factorization frameworks which apply for more moderate energies is the very nature of the parton distributions involved. I will argue that low $x$ physics can be understood as the eikonal limit of an infinite twist TMD distribution framework, and discuss the consequences of this observation for saturation and for gluon polarizations at small $x$. 
Measurements of event properties, correlations in multi jet events and jet gap jet events in CMS

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Measurements of event properties, correlations in multi jet events and jet gap jet events in CMS are reviewed.

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Measurements of multi-parton interactions at ATLAS

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Measurements of single diffraction using forward proton tagging at ATLAS

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Mueller Tang cross sectiona at NLL

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NNLO QCD fits to jets and extraction of alpha_s

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Photon-induced processes in production of heavy particle pairs at the LHC

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Prospects for measurements of H/Z production cross section ratios using CMS Run II data.

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We present prospects for the direct measurement of ratios of differential cross sections for the production of Z and Higgs bosons in proton-proton collisions, using data taken by CMS during the LHC Run II. The aim of the measurement is to study soft and hard gluon emission in the initial state for Higgs and Z production mechanisms. Hence, we focus on variables known to be sensitive to the production mechanisms of heavy bosons: jet multiplicity, transverse momenta of the boson and leading jet, and momentum balance in the transverse plane. We use Monte-Carlo samples to study the feasibility of the measurement and estimate the expected precision.

Recent PDF results from top physics and heavy flavour results at CMS

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Recent results CMS and TOTEM on exclusive production, light by light scattering and diffraction

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Recent results from PPS and PPS status and prospects

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Recent results from PPS and PPS status and prospects

Author: CMS Collaboration

Recent results from PPS and PPS status and prospects
This talk describes the present PPS status concerning the detector itself and data taking, as well as future prospects including high lumi.

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Recent results on central exclusive production within the tensor-pomeron and vector-oddron approach

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Recent results on photon-photon, photo-nuclear, and heavy-ion collisions from ATLAS at the LHC

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Recent results on soft and forward physics from CMS

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Recent results on soft and forward physics from CMS are reviewed.

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Regge cuts in the Reggeized gluon channel

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Review of TOTEM results

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Roman pots and the impact parameter for ion-ion

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Scaling properties of elastic pp and ppbar scattering at LHC energies

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Searches for Dark Matter at the LHC in forward proton mode

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Studies of Central Exclusive Production and Soft QCD phenomena at LHCb

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The LHCb detector at the LHC offers unique coverage of forward rapidities. This enables complementary measurements of soft QCD phenomena to those at the other LHC detectors. Measurements of the inelastic cross-section and of particle production will be presented. Measurements of Central Exclusive Production (CEP) at LHCb will also be presented. These measurements probe QCD, allowing investigation of the nature of pomerons, and provide constraints on low-x gluon phenomenology, probing potential saturation effects. CEP measurements at LHCb in the most recent LHC run have significantly benefited from the installation of new high rapidity shower counters (the "HeR-SCHel" subdetector). The performance and use of this new detector for CEP studies will also be discussed.
Studies of Jet Fragmentation and Hadronisation at LHCb

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Studies of Jet Fragmentation and Hadronisation at LHCb

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Sudakov resummation in the CGC framework

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Sudakov resummation in the CGC framework

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In this talk we would like to present our recent works on how to incorporate Sudakov resummation into the dilute-dense factorization framework.

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The NL BFKL vertex for Mueller-Tang jets in the soft-gluon approximation

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The TOTEM data at roots = 13 TeV and the enigma of the odderon

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We demonstrate that a model based on CGC/saturation approach, successfully describes soft interaction collisions for a wide energy range of W = 30 GeV to 13 TeV, including the new TOTEM data at 13 TeV. Incorporating the secondary Reggeons in our approach enables us to describe the complete set of soft data, including the energy behaviour of $\rho$, the ratio of the real to the imaginary parts of the elastic scattering amplitude. We argue that it is premature to claim that an odderon contribution is necessary, and estimate its possible contribution as 1 mb to the real part of the amplitude at W =
13 TeV. We show that the odderon contribution depends on the value of the energy, leading to \( \text{Re} A(s,t=0) = 8 \text{ mb} \) at \( W = 21.3 \text{ GeV} \). Bearing this in mind, we do not believe that \( p \) at high energy is the appropriate observable for detecting the odderon contribution.

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**Thermal radiation and inclusive production in the CGC/saturation approach at high energies for hadron-hadron and ion-ion collision**

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**UPC results from ALICE**

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**V+jets production and Jet cross sections at CMS and tests of QCD**

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**V+jets production and Jet cross sections at CMS and tests of QCD**

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V+jets production and Jet cross sections at CMS and tests of QCD are reviewed.

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**Vertices of three reggeized gluons and the unitarity corrections to the propagator of reggeized gluons**

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High energy QCD hadronic interactions in the Regge kinematics, when the transferred transverse momenta are much smaller than an energies of colliding particles, can be described by the interaction
of gluons with reggeized ones ("reggeized gluons", reggeons). The description of these processes was firstly introduced in series of L.N. Lipatov’s papers. Calculations of the amplitudes of different scattering processes in this approach reveal also a so-called multi-Regge structure of the amplitudes. Therefore, in order to analyze different scattering processes with multi-Regge kinematics, L.Lipatov proposed an effective action based on QCD properties at high energy.

We develop the effective action formalism, see\cite{1,2,3,4,5,6}, based on the reggeized gluons as the main degrees of freedom, which can be considered as a reformulation of the RFT (Regge field theory) calculus for the case of high-energy QCD. The perturbation theory is based on the knowledge of the classical solutions of equations of motion and loops contributions to effective action.

Our main goal in this study is to obtain unitarity corrections to amplitudes. The unitarity corrections to the propagator of reggeized gluons calculated in the framework of QCD RFT require a knowledge of the expressions for reggeon propagator and vertices of the interaction of three reggeons to one QCD loop precision. In the last paper\cite{6}, we calculated the vertex of interactions of $A_+, A_+, A_-$ Reggeon fields to this precision. We demonstrated, that all loop leading logarithmic order contributions to the vertex can be summed through the integro-differential equation similar to the BFKL one.

\renewcommand\bibsection{References}
\begin{thebibliography}{4}
\end{thebibliography}

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