6. miniworkshop difrakce a ultraperiferních srážek

Wednesday, 13 September 2023 - Friday, 15 September 2023

ČVUT Děčín

Programme

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Wednesday, 13 September 2023

Beyond ALICE (16:30 - 18:00)

-Conveners: Matěj Vaculčiak

[28] Welcome (16:30)

Presenter: VACULČIAK, Matěj

Practical information on the workshop, recent achievemts of the group and goals of the worshop are presented.

[29] Introduction to the group (16:45)

Presenter: CONTRERAS, Jesus Guillermo

A brief summary is given of the composition of the group and the general research topics that it covers. The spirit and goals of the meeting as well as its evolution in the last few years are presented.

[30] Introduction to phonons (17:00)

Presenter: MATAS, Marek

Phonons are the quasi-particles representing lattice vibrations of condensed matter. Why is it convenient to talk about vibrational quanta as particles? And why do we want to study them anyway? Phonons are some of the most promising low-energy excitations (O(meV)) that can be used in the detectors of tomorrow for capturing the feeblest interactions that lurk beyond the boundaries of the Standard Model. This talk will introduce the phenomenon and its current and future use in experimental particle physics.

[31] Some notes on writing papers (17:30)

Presenter: CONTRERAS, Jesus Guillermo

Writing papers is one of the fundamental activities of any scientist. In this talk, a few basic concepts on writing papers are provided. The general components and potential structure of scientific papers are presented. The different typical journals and their style as well as restrictions on length, number of figures and so on are discussed. Particulars of some published papers are shown.

Dinner (19:00 - 21:00)

Thursday, 14 September 2023

Breakfast (08:00 - 09:00)

Detectors (09:00 - 12:00)

-Conveners: David Grund

[32] Status of the MFT (09:00)

Presenter: KRUPOVÁ, Diana

The MFT is a silicon tracking detector consisting of 10 layers of ALPIDE silicon sensors using CMOS technology. It extends the ALICE physics program by adding vertexing capabilities at forward rapidities and provides valuable track information thanks to its position in front of the absorber of the Muon Spectrometer. This talk will provide an overview of detector performance in 2022 and 2023 data taking, with a focus on new features implemented in detector operation in preparation for the upcoming heavy-ion period.

[33] Status of FDD (09:20)

Presenter: TORRES ROJAS, Solangel

The Forward Diffractive Detector (FDD) is a sub-detector of the Fast Interaction Trigger (FIT) of the ALICE experiment consisting of two scintillator arrays installed, each array on one side with respect to the ALICE interaction point (IP) at very forward rapidity, at around 20 meters from the IP. The FDD has been running since 2022, collecting data from pp collision and is being tuned to run in the upcoming Pb-Pb period in October 2023. This talk will review the performance of the FDD during the data-taking period of 2022 and 2023 and the preparation status for the upcoming Pb-Pb collisions.

[34] Characterisation of home-made plastics (09:40)

Presenter: ZABLOUDIL, Vojtěch

Plastic scintillators are widely used in high-energy physics for particle detection. One example is the Forward Diffractive Detector (FDD), a sub-system of the newly-added trigger detector Fast Interaction Trigger (FIT), which was incorporated to the ALICE apparatus during a major upgrade for Runs 3 and 4. In order to fulfil the increasing requirements on future scintillators such as ultrafast time response, low cost and good radiation hardness, novel materials and technologies need to be developed. To this end, the production of custom-made scintillators with inorganic CsPbBr3 nanocrystals embedded in organic polystyrene and silicone matrices is discussed. As a part of this work, a test bench was set up to use cosmic-ray muons to characterise the samples and study their performance.

[35] My ITS3 work at CERN (10:00)

Presenter: SZOLLOSOVA, Timea

ALPIDE3 are monolithic silicon sensors under development within the upgrade program of the ALICE ITS (ITS3). During upcoming irradiation tests during fall 2023, the effects of Single Event Upset and Latch-ups are to be observed. SEUs are events of bit-flip in memory caused by energy deposited by radiation and latch-ups manifest by sudden increased power consumption. This talk will overview the hardware and software work for the chip tests.

[36] Single photon detection with SiPMs (10:40)

Presenters: TORRES ROJAS, Solangel, ZABLOUDIL, Vojtěch

The silicon photomultipliers are becoming a very commonly used sensor devised to measure very low levels of light (in the order of single photons) from scintillator materials, Cherenkov radiators and other light sources. Good calibration of these devices is a very useful test to adjust a proper voltage level to work in a specific experiment. In this hands-on session, the participants will set up a test bench to measure the single photon distribution of a SiPM and estimate the charge produced by a single photo-electron.

time	[id] title	presenter
10:20	Coffe break	

Lunch (12:00 - 14:00)

Phenomenology (14:00 - 15:40)

-Conveners: Dagmar Bendová

[38] Recent hot-spot model results (14:00)

Presenter: RIDZIKOVÁ, Alexandra

The Hot-spot model, based on color dipole approach, provides a description of the proton structure in the transverse plane by hot spots. Hot spots are localized regions of higher partonic densities, whose positions change event-by-event. The number of hot spots increases with decreasing Bjorken-x. Moreover, the effects of making the radius of the proton and radius of hot spots energy dependent are studied.

[39] Recent BK results (14:20)

Presenter: VACULČIAK, Matěj

The structure of hadrons is a complex open question in modern physics. The inner working of quantum chromodynamics allows for a dynamical evolution of the structure and a fast growth of the densities of hadron constituents with respect to their fractional momentum. At some point, this unlimited growth needs to be curbed and saturation is expected to occur. The Balitsky-Kovchegov (BK) equation introduces such a saturation mechanism in the description of gluon evolution. Its complexity, however, requires a numerical solution as presented in this talk together with an introductory derivation of the BK equation.

[40] Fitting with correlated uncertainties (14:40)

Presenter: CONTRERAS, Jesus Guillermo

One of the main motivations of the meeting is to share the different techniques that one member of the team uses so that the rest of the team can profit from this knowledge. A case in point is the estimation of model parameters using data that has correlated uncertainties. A method based on Lagrange multipliers, used by the H1 and ALICE Collaboration, is presented. An example of its application, to extract the slope of the energy dependence of coherent j/psi production, is presented along with the relevant code.

[44] Introduction to decision trees (15:00)

Presenter: BENDOVÁ, Dagmar

Prepare to delve into the fascinating intersection of particle physics and machine learning. Our mission is to demystify the intricate landscape of decision trees while maintaining a conversational and accessible tone. We'll navigate beyond theory, delving into the practical implications of decision trees. These powerful algorithms play a central role in deciphering complex datasets by discerning patterns that evade human eyes. Taking it up a notch, we'll venture into the realm of advanced techniques: random forests and boosted decision trees. However, what truly sets this workshop apart is its focus on real-world applicability. We'll showcase instances where decision trees and their counterparts have tried to revolutionize data interpretation in particle physics experiments. Brace yourself to unravel the potential of decision trees!

time	[id] title	presenter
15:20	Coffee break	

Analysis (15:40 - 17:00)

-Conveners: Diana Krupová

[41] Measurement of charm mesons in ALICE (15:40)

Presenter: ŽERTOVÁ, Karla

Strong interaction between quarks and gluons in the standard model is described by Quantum Chromodynamics (QCD). The investigation of the phase diagram of QCD has been an active subject for many years. Especially, this research focuses on the transition between hadrons at low temperatures and the quark-gluon plasma (QGP) at high temperatures. For the study of the quark-gluon plasma, hard probes, such as the charm quark, which are produced in the QGP and carry information about this environment, are suitable. Charm quarks hadronize into D mesons, whose products can be detected and reconstructed. The ALICE experiment, located on LHC at CERN, has introduced a new software called O2, designed to more effectively analyse data from Run 3. With new maximum energy of 13,6 TeV, the results from this run should bring new interesting findings regarding QCD.

[42] Strange particles in jets in Pb-Pb collisions (16:00)

Presenter: EREMENKO, Ekaterina

An enhancement of the baryon-to-meson ratio has been observed for the inclusive production of light-flavour particles at intermediate transverse momenta (2 GeV/c < pT < 6 GeV/c) in heavy-ion collisions when compared to the ratio measured in proton-proton (pp) collisions at both RHIC and LHC collision energies. This enhancement is commonly attributed to parton coalescence and recombination in a hot and dense medium. Measurements of pT spectra of identified baryons and mesons in jets represent an important tool for understanding the interplay of various hadronization mechanisms that contribute to particle production in the hot and dense medium created in heavy-ion collisions. This talk presents the analysis of strange particle production in jets and bulk using Pb+Pb data at √s = 5.02 TeV from the ALICE experiment.

[43] Measurement of multiplicity in heavy-ion collisions with ALICE during the LHC Run 3 (16:20)

Presenter: HESOUNOVÁ, Helena

During the Long Shutdown 2, ALICE group developed a new analysis software capable to handle data from the newly designed detectors with continuous readout. The whole structure of an analysis software had to be changed to fit the requirements of the Run 3. The presentation is focused on the structure of O2 and the multiplicity analysis of Pb-Pb Run3 data.

[37] Modeling nuclear trasverse profile using Woods-Saxon distributions (16:40)

Presenter: ČEPILA, Jan

Models for deuteron, light nuclei, distorted nuclei and heavy nuclei are presented using potentials suggested by Woods-Saxon and the fitting of analytic functions to the resulting thickness functions.

Dinner (19:00 - 21:00)

Friday, 15 September 2023

Breakfast (08:00 - 09:00)

Analysis (09:00 - 12:00)

-Conveners: Marek Matas

[45] Quantum tomography (09:00)

Presenter: BROZ, Michal

Quantum tomography is a method to experimentally extract all that is observable about a quantum mechanical system. The tomographic method bypasses much of the field-theoretic formalism to concentrate on what can be observed with experimental data, and how to characterize the data. The method of quantum tomography uses a known “probe” to explore an unknown system. Data is related directly to matrix elements, with minimal model dependence and optimal efficiency. In this contribution we introduce quantum tomography to collider physics with the illustration of the angular distribution of lepton pairs.

[46] Quantum tomography of the two-lepton system with ALICE (09:20)

Presenter: HAIDLOVÁ, Sára

Probing of hadron structure and their properties is of great interest in studies of heavy-ion physics. One of the tools for said study is analysis of exclusive photoproduction of J/psi in ultra-peripheral collisions. Presented analysis shows a new perspective on studies of heavy-ion collisions using quantum tomography, a procedure independent of models focusing solely on measured observables. This approach uses basic properties of quantum mechanics to determine quantum states of studied particles from their final state angular distribution. The analysis not only presents the methods of quantum tomography and their utilization for studies of two-lepton systems on an idealized data sample generated using Monte Carlo simulation, but also analysis of real data measured in 2018 on ALICE during Pb-Pb run at 5.02 TeV, and determination of polarization states of vector meson.

[47] Azimuthal anisotropies in coherent rho0 production (09:40)

Presenter: CONTRERAS, Jesus Guillermo

Interference effects on the diffractive coherent photoproduction of the rho0 vector meson are studied at midrapidity with the ALICE detector. Interference comes about because there are two potential photon sources in Pb+Pb ultraperipheral collisions. The interference effects are expected to be more important at midrapidity, where both amplitudes are similar and at small impact parameters. In this contribution, the first measurement of the impact parameter dependence of interference effects is presented. The interference is studied via anisotropies in an azimuthal distribution of the decay products of the rho meson.

[48] Rho photoproduction (10:00)

Presenter: JURAČKA, Jakub

Ultra-peripheral collisions present an opportunity to study long-range interactions between heavy ions. A frequently studied process is vector meson photoproduction, which gives insight into low-x phenomena such as gluon shadowing or saturation. Collisions of a new ion species would improve our understanding of the nucleon number dependence of photoproduction cross sections. A short LHC oxygen run is currently proposed and scheduled for the summer of 2024. Preliminary analysis is being carried out on a small sample of MC events generated by STARlight and focuses on the calculation of acceptance times efficiency correction factors.

[49] Incoherent production of J/psi at mid rapidities (10:40)

Presenter: GRUND, David

The structure of hadrons when probed at high energies, corresponding to small values of Bjorken-x, is an open problem. This talk will present the first measurement of the dependence of the incoherent photoproduction of J/ψ off a lead ion on Mandelstam-t. The measurement was performed with the ALICE detector at midrapidity, $|y| < 0.8$, and the cross section was evaluated in five intervals in the range $0.04 < |t| < 1.0$~GeV^2; it covers the Bjorken-x range of $(0.3\mbox{--}1.4)\times 10^{-3}$. The results were compared with the predictions of three theory groups, each of which provided two models: one including and the other ignoring quantum fluctuations of the gluon density in colliding hadrons; the latter generally predict a much steeper $|t|$-dependence than observed in the data. The new ALICE results thus demonstrate, for the first time using ultra-peripheral collisions, the importance of quantum fluctuations on the sub-femtometer scale -- gluon hot spots -- for describing nuclear structure in the transverse plane.

[50] Incoherent production of J/psi at forward rapidities (11:00)

Presenter: FÍLOVÁ, Vendulka

The structure of nucleons is one of the most important topics for a complete physical description of the fundamental nature of matter. Measurements of deep-inelastic scattering (DIS) carried out at HERA provide an outstanding set of results concerning the structure of protons. The results show that the density of gluons rise steeply for low Bjorken-x values. The number of gluons grows with increasing Q^2, but it has to saturate at some point and the structure of the nucleon or a hadron reaches the saturation region. Ultra-peripheral collisions (UPCs) are a tool to help us answer and explain some of the questions and phenomena such as gluon saturation. UPCs are characterized by the impact parameter of the collision which is larger than the sum of the radii of the interacting nuclei. Hadronic interactions are strongly suppressed and photon-induced processes take place. One of many possible photonuclear interactions is incoherent photoproduction of J/Ψ meson. In such interaction a quasi-real photon interacts with a single nucleon inside the nucleus and it is characterized by the transverse momentum of the J/Ψ meson, which is larger than 300~MeV/c. The cross section for the incoherent photoproduction, in a Good-Walker approach, is proportional to the variance of the fluctuations of the gluon field. The measurement of the incoherent J/Ψ photoproduction cross section presented in this contribution is based on data collected in the year 2018 during LHC Run 2 at the center-of-mass energy of $\sqrt{s_{\rm{NN}}}=5.02$~TeV with the ALICE detector. The cross section was measured in two rapidity bins $-4.0<y<-3.25$ and $-3.25<y<-2.5$ and in transverse momentum dependence. The idea of separation in nuclear break-up classes (Xn0n) and (0nXn) is also described. Measuring the cross section in nuclear break-up classes gives us a tool to separate low and high Bjorken-x contributions to the total UPC cross section.

[51] PAG-UPC plans for Run 3 (11:20)

Presenter: LAVIČKA, Roman

The ALICE Collaboration is divided into several working groups. The group, which is focusing on physics analysis of the UPC events, is called PAG-UPC and is successfully investigating the ALICE data for over a decade. In this talk, the current plans of the group for the analyses of the newest Run 3 data will be introduced.

time	[id] title	presenter
10:20	Coffee break	

Lunch (12:00 - 14:00)