HK 44: Schwerionenkollisionen und QCD Phasen

Zeit: Donnerstag 16:30–19:00 Raum: P 5

Gruppenbericht HK 44.1 Do 16:30 P 5

Jet Reconstruction in Pb-Pb Collisions at $\sqrt{s_{\rm NN}}$ = 2.76 TeV with ALICE — •Bastian Bathen[1], Christian Klein-Bösing[1,2], and Markus Zimmermann[1] for the ALICE-Collaboration — [1]Institut für Kernphysik, WWU Münster — [2]ExtreMe Matter Institute EMMI, GSI, Darmstadt

The Large Hadron Collider (LHC) at CERN delivered in 2010 and 2011 heavy-ion collisions (Pb-Pb) with collision energies per nucleon pair of $\sqrt{s_{\rm NN}}$ = 2.76 TeV. The ALICE experiment studies those collisions to explore the quark-gluon plasma (QGP), a state of matter where the color confinement of the quarks and gluons, which constrains them in hadrons, does not exist anymore.

Initial, hard scattered partons, with large momentum transfer in transverse direction, can be used as probes to study properties of the QGP since they traverse the medium before they fragment into a spray of hadrons ("jets"). Thereby the partons strongly interact with the medium and exchange momentum. That results in a modified fragmentation pattern compared to jets in proton-proton collisions.

The aim of jet measurements is an unbiased reconstruction of the parton properties and jet structure. The main issue in central heavy-ion collisions is the large amount of soft background from subleading processes. We present the current status of jet reconstruction based on charged particles with the ALICE experiment and we discuss the impact of the underlying event for the jet reconstruction.

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HK 44.2 Do 17:00 P 5

A study of jet fragmentation properties in proton-proton collisions at $\sqrt{s}$ = 7 TeV with ALICE at the LHC — •Hermes Leon Vargas and Christoph Blume for the ALICE-Collaboration — Institut für Kernphysik, Goethe-Universität Frankfurt am Main

The excellent tracking capabilities of the ALICE experiment provide an ideal tool to study the properties of charged jets. These are characterized in this study via two observables: $NT90$ and the second moment of the jet profile. $NT90$ is defined as the minimum number of tracks inside the jet cone that are necessary to recover 90% of the jet transverse momentum. The second moment of the jet profile quantifies the spatial distribution of the tracks around the jet axis, weighted by their transverse momentum. The jet properties are presented as a function of the jet transverse momentum and as a function of the underlying charged particle multiplicity. The latter is measured by the detectors in the central barrel of the experiment, selecting a subset of the total event multiplicity. This subset is chosen such that any bias due to the hard scattering that initiated the jets is minimized. The selection is based on track transverse momentum cuts and event geometry. A comparison with Monte Carlo generators is presented.

HK 44.3 Do 17:15 P 5

Separation of decay photons and prompt photons in ALICE using a neural network — •Thomas Keuter for the ALICE-Collaboration — Institut für Kernphysik, WWU Münster, Deutschland

In this talk, the separation of decay photons and prompt photons in simulated proton-proton collisions at $\sqrt{s}$ = 7 TeV in the ALICE experiment will be presented. The ALICE experiment investigates the quark-gluon plasma (QGP), created in central Pb-Pb-collisions at the LHC. Prompt photons are an ideal probe to investigate the QGP, since they do not interact strongly and are therefore mostly unaffected by a strongly interacting medium. They can be used as a reference for single particle spectra, because their R_{AA} should be equal to one. Moreover, the fragmentation function of hadrons can be calculated in γ-jet events if prompt photons can be identified and also jet-quenching in Pb-Pb collisions can be investigated. Photons from particle decays (mainly π^0 and η) form a large background and these decay photons have to be separated from the prompt photons. In this talk, a neural network is used to distinguish between the photons on an event-by-event basis. The network can be trained with decay photons which are identified using an invariant mass analysis and with prompt photons using so-called random cones in minimum bias events.

HK 44.4 Do 17:30 P 5

Anisotropy of Neutral Pion production in Pb-Pb collisions at $\sqrt{s_{NN}}$ = 2.76TeV measured by ALICE — •Daniel Lohner for the ALICE-Collaboration — Physikalisches Institut, Universitaet Heidelberg

The ALICE PbPb research program focusses on the quark-gluon plasma, a state of matter in which quarks and gluons are no longer confined in hadrons. The in-medium energy loss of partons is referred to as jet quenching and can be observed in experiments as a suppression of the particle production (R_{AA}). Furthermore, the asymmetric shape of the reaction plane in non-central collisions leads to an azimuthal anisotropy of the particle production. The neutral pion dominantly decays into two photons. Those are measured via their conversion in the detector material using the ALICE Inner Tracking System and Time Projection Chamber or by the ALICE calorimeters, PHOS and EMCAL. The neutral pion yield is studied as a function of the emission angle with respect to the reaction plane. The anisotropy is measured by the second harmonic Fourier component v_2. At low transverse momentum, v_2 can be described by collective expansion of the medium (elliptic flow), at high transverse momentum v_2 provides insights into the path-length dependence of QCD energy loss.

HK 44.5 Do 17:45 P 5

Messung von π^0 und η Mesonen in ALICE in pp und Pb–Pb-Kollisionen am CERN LHC — •Friederike Bock für die ALICE-Kollaboration — Physikalisches Institut, Heidelberg, Deutschland

Der Large Hadron Collider (LHC) am CERN lieferte bis Ende 2011 pp-Kollisionen bei Schwerpunktsenergien von $\sqrt{s}$ = 0.9, 2.76 und 7 TeV, darüber hinaus Pb–Pb-Kollisionen bei einer Energie von $\sqrt{s_{NN}}$ = 2.76 TeV. Die präzise Messung der Transversalimpulsspektren von π^0 und η-Mesonen ist von besonderer Wichtigkeit für die Ermittlung des Wirkungsquerschnitts dieser Teilchen im jeweiligen Kollisionssystem. Diese Messung erlaubt eine Überprüfung der pQCD -Berechnungen in pp-Kollisionen bei verschiedenen Energien. Der nukleare Formveränderungsfaktor R_{AA} in Pb–Pb-Kollisionen repräsentiert die Unterdrückung der Teilchenproduktion bei hohem transversalem Impuls und trägt somit zur Charakterisierung des erzeugten Mediums bei.
In ALICE ist die Messung von π^0 (η)-Mesonen auf zwei unterschiedlichen Wegen möglich, über Kalorimeter und über die Messung konvertierter Photonen in den Spurdetektoren. Die kombinierten Ergebnisse sollen in diesem Vortrag gezeigt werden. Mit der Konversions Methode wird eine sehr gute Auflösung bei sehr kleinen p_t (0.3 GeV/c) erreicht, während die Kalorimeter bei höheren Energien eine bessere Auflösung haben. Desweiteren können die mit Konversionen gemessenen π^0 Mesonen auf Grund ihren guten räumlichen Auflösung mit Jets korreliert werden, was die Messung von Fragmentationsfunktionen erlaubt, auch hierzu werden erste Ergebnisse präsentiert.

HK 44.6 Do 18:00 P 5

Measurement of the J/ψ inclusive production cross section in pp collisions with ALICE at the LHC — •Jens Wiechula for the ALICE-Collaboration — Physikalisches Institut, Universität Tübingen

The measurement of the J/ψ production cross section in pp collisions is crucial for testing pQCD models of quarkonium production in the new energy regime provided by the LHC. In addition, the cross section in pp is important as reference for the heavy-ion program, for which J/ψ is an essential observable for the deconfined matter.

ALICE measures the J/ψ production at midrapidity ($|y| < 0.9$) in the di-electron channel as well as at forward rapidity ($2.5 < y < 4.0$) with a dedicated muon spectrometer. In both channels J/ψ mesons are reconstructed down to zero transverse momentum. This kinematical reach is unique among the LHC experiments.

We will present the rapidity dependence of the inclusive J/ψ production cross section and transverse momentum spectra at a centre of mass energy of $\sqrt{s}$ = 7 TeV as well as at $\sqrt{s}$ = 2.76 TeV. In addition, polarisation measurements and the contribution of decays from B-hadrons will be addressed.

HK 44.7 Do 18:15 P 5

Centrality dependent J/ψ production in Pb-Pb collisions at $\sqrt{s_{NN}}$ =2.76 TeV with ALICE — •Ionut-Cristian Arsene — Research Division and ExtreMe Matter Institute EMMI, GSI

Helmholtzzentrum fürSchwerionenforschung, Darmstadt, Germany

The hot and dense nuclear matter formed in ultra-relativistic nuclear collisions is one of the testing grounds for the theory of strong interactions. The J/ψ meson is a very interesting probe for understanding the properties of the medium created by such collisions. It was predicted that at high temperature the J/ψ state is melting leading to the suppression of this particle with respect to pp. However it was also predicted that high production rates of charm quarks at RHIC and LHC energies will make possible (re)combination of charmonium states thus leading to J/ψ enhancement. In the ALICE detector, J/ψ is measured at mid-rapidity, $|y| < 0.9$, and forward-rapidity, $2.5 < y < 4.0$, down to zero transverse momentum. The reconstruction is done via the di-electron channel at mid-rapidity and the di-muon channel at forward-rapidity. The electron identification is done using linear energy loss in gaseous detectors, Time Projection Chamber (TPC), Transition Radiation Detector(TRD), and the time of flight method, Time Of Flight(TOF) detector. The muon identification is done using the MUON spectrometer where the tracking devices are placed behind thick hadronic absorbers. We will present J/ψ production densities as a function of rapidity and collision centrality. Furthermore, using the cross-sections measured by ALICE in pp collisions at the same energy we will show and discuss the nuclear modification factor.

HK 44.8 Do 18:30 P 5

J/ψ Production as a Function of Charged Particle Multiplicity in pp Collisions at $\sqrt{s}$ = 7 TeV — •Julian Book for the ALICE-Collaboration — Institut für Kernphysik, Goethe-Universität Frankfurt am Main

The investigation of the properties of strongly interacting matter under extreme conditions is the aim of the ALICE experiment. Quarkonia, bound states of heavy (charm or bottom) quarks such as the J/ψ, are expected to be produced in the first hard scattering. Thus they will provide insights into the earliest and hottest stages of collisions where the formation of a Quark-Gluon Plasma is expected.
The measurement of quarkonia in pp collisions will help to understand the production mechanisms of quarkonia in hadronic collisions and give the possibility to test different pQCD production models. At the new energy regime reached by the LHC, the underlying event should be affected by Multi-Parton Interactions (MPI). If the effect of MPI extends to hard processes, a non-trivial dependence of quarkonia production on the charged particle multiplicty might result.
We will present the first measurement of J/ψ production as a function of the charged particle multiplicity in pp collisions at $\sqrt{s} = 7$ TeV at the LHC.

HK 44.9 Do 18:45 P 5

J/Ψ-Hadron-Korrelationen in Proton-Proton-Kollisionen bei 7 TeV Schwerpunktenergie mit dem ALICE-Detektor — •Michael Winn für die ALICE-Kollaboration — Physikalisches Institut, Universität Heidelberg

Die Produktion von J/Ψ-Teilchen in Proton-(Anti-)Proton-Kollisionen ist Gegenstand aktueller Forschungsbemühungen auf experimenteller als auch theoretischer Seite. Insbesondere verspricht die Untersuchung von J/Ψ-Hadron-Korrelationen, ein besseres Verständnis des zu Grunde liegenden Produktionsmechanismus und der damit verknüpften Ereignistopologie zu gewinnen. Des Weiteren besteht hierdurch ein Zugang zur Abschätzung des Beitrags durch nicht prompte J/Ψ-Teilchen aus B-Zerfällen.
Im ALICE-Experiment am LHC können J/Ψ-Teilchen aus dem Dielektronenzerfallskanal im zentralen Detektorsystem rekonstruiert werden. Die im Fortschritt begriffene Analyse von Proton-Proton-Kollisionen bei 7 TeV Schwerpunktenergie umfasst Azimutal- und Pseudorapididitäts-Korrelationen zwischen J/Ψ-Kandidaten und Spuren geladener Teilchen als auch mit dem geladenen Teilchen, das den größten transversalen Impuls im jeweiligen Ereignis aufweist.