HK 22: Schwerionenkollisionen und QCD Phasen IV

Time: Tuesday 16:30–19:00 Location: HS AP

Group Report HK 22.1 Tue 16:30 HS AP

Suppression of Charged Particle Production at Large Transverse Momentum in Central $Pb-Pb$ Collisions at $\sqrt{s_{NN}} = 2.76$ TeV — •Jacek Otwinowski for the ALICE-Collaboration — GSI, Planckstr. 1, 64291 Darmstadt

Inclusive transverse momentum spectra of primary charged particles in Pb-Pb collisions at $\sqrt{s_{NN}} = 2.76$ TeV have been measured by the ALICE Collaboration at the LHC. The data are presented for central and peripheral collisions, corresponding to $0-5\%$ and $70-80\%$ of the hadronic Pb-Pb cross section. The measured charged particle spectra in $|\eta| < 0.8$ and $0.3 < p_T < 20$ GeV/c are compared to the expectation in p-p collisions at the same $\sqrt{s_{NN}}$, scaled by the number of underlying nucleon-nucleon collisions. The comparison is expressed in terms of the nuclear modification factor R_{AA}. The result indicates only weak medium effects ($R_{AA} \simeq 0.7$) in peripheral collisions. In central collisions, R_{AA} reaches a minimum of about 0.14 at $p_T = 6-7$ GeV/c and increases significantly at larger p_T. The measured suppression of high-p_T particles is stronger than that observed at lower collision energies, indicating that a very dense medium is formed in central Pb-Pb collisions at the LHC.

HK 22.2 Tue 17:00 HS AP

Rekonstruktion von π^0 und η Mesonen mittels Photon Konversionen in ALICE in Proton Proton Kollisionen am CERN LHC — •Friederike Bock — Physikalisches Institut Heidelberg, Heidelberg, Germany

Der LHC am CERN lieferte in 2010 *pp*-Kollisionen bei Schwerpunktsenergien von $\sqrt{s} = 900$ GeV und $\sqrt{s} = 7$ TeV. Die präzise Messung der Transversalimpulsspektren von π^0 -und η-Mesonen bei diesen Energien ist von besonderer Wichtigkeit für die Ermittlung des Produktionswirkungsquerschnitts dieser Teilchen zur Überprüfung von pQCD -Berechnungen. Diese Spektren sind essentiell für die Extraktion des Spektrums direkter Photonen, da sie die Hauptquellen des Untergrunds bilden. Desweiteren stellen sie Referenzdaten für die Ermittlung der Unterdrückung der Produktion neutraler Mesonen in Schwerionenkollisionen (R_{AA}) bereit.

In ALICE ist die Messung von $\pi^0(\eta)$-Mesonen auf zwei unterschiedlichen Wegen möglich, über Kalorimeter und über die Messung konvertierter Photonen im Zentralen Spurerkennungssystem. Letzteres ermöglicht die Bestimmung des p_T-Spektrums bis hin zu kleinen Transversalimpulsen mit sehr guter Aufösung und hoher Signifikanz. Durch eine präzise Gamma-Ray Tomographie des Detektors ist es zusätzlich möglich die Dicke des Detektormaterials auf 0.11 X/X_0 auf ± 6% zu ermitteln.

In dieser Präsentation werden die Rekonstruktions-Methode erläutert und die Resultate für die π^0- und η-Mesonen gezeigt werden.

HK 22.3 Tue 17:15 HS AP

Rekonstruktion von π^0-Mesonen mittels Photon-Konversionen mit ALICE in PbPb-Kollisionen am CERN LHC — •Radoslav Rusanov für die ALICE-Kollaboration — Physikalisches Institut Heidelberg, Germany

Im späten Herbst 2010 wurde die Umstellung des CERN LHC auf Schwerionenbetrieb erfolgreich vollzogen. Einen Monat lang lieferte der Beschleuniger Blei-Blei-Kollisionen bei einer Schwerpunktsenergie von $\sqrt{s} = 2.76$ TeV pro Nukleonenpaar. Für die Bestimmung der Produktionsrate von π^0-Mesonen in *PbPb*-Kollisionen bei dieser Energie ist die Messung des π^0-Transversalimpulsspektrums für verschiedene Zentralitäten von großer Bedeutung. Der Vergleich dieses Spektrums in zentralen *PbPb*-Kollisionen mit *pp*-Kollisionen (R_{AA}) sowie peripheren *PbPb*-Kollisionen (R_{CP}) erlaubt dabei eine Charakterisierung des erzeugten Mediums.

Der ALICE-Detektor bietet neben der konventionellen Methode mit Kalorimetern eine Alternative zur Messung von π^0-Mesonen mittels Rekonstruktion konvertierter Photonen im zentralen Spurerkennungssystem. Die π^0-Messung mit dieser alternativen Methode erlaubt die Bestimmung des p_T-Spektrums bis hin zu sehr kleinen Transversalimpulsen von etwa 0.4 GeV mit hoher Auflösung.

In diesem Vortrag wird der aktuelle Stand der π^0-Analyse in *PbPb*-Kollisionen präsentiert.

HK 22.4 Tue 17:30 HS AP

Jet and High-p_T Measurments with the ALICE Experiment at the LHC — •Bastian Bathen[1], Tom Dietel[1], and Christian Klein-Bösing[1,2] for the ALICE-Collaboration — [1]Institut für Kernphysik, WWU Münster — [2]ExtreMe Matter Institute, GSI Darmstadt

Jet and high-p_T measurements provide a detailed insight of the strongly interacting matter, called Quark-Gluon Plasma (QGP), which is expected to be produced in heavy-ion collisions. Jets, as a spray of high-p_T particles, are produced from the fragmentation of hard scattered partons and can be used as a hard probe of the QGP formed in later stages of a heavy-ion collision. Before looking into heavy-ion collisions we study proton-proton collisions where the partons evolve in a QCD-vacuum. These measurements are essential in order to understand the jet production and detector response to jets in a clean environment.

With the first year data-taking of the ALICE experiment at the LHC (CERN) in 2010 we studied p+p collisions and Pb+Pb collision at the highest energy ever provided by any collider. We present results from the first period of p+p collisions up to $\sqrt{s} = 7$ TeV and show first studies of Pb+Pb collisions at $\sqrt{s_{NN}} = 2.76$ TeV. These include raw jet-production rates and a more specifically momentum distributions of tracks within jets and the single track correlation to jets which is sensitive to medium effects of the QGP.

HK 22.5 Tue 17:45 HS AP

Quark and gluon composition of jets in proton-proton collisions at $\sqrt{s} = 7$ TeV with ALICE at the LHC — •Hermes Leon Vargas for the ALICE-Collaboration — Institut für Kernphysik, Goethe-Universität Frankfurt am Main

The ALICE experiment at the LHC has excellent tracking capabilities, which makes it an ideal tool to study the properties of charged jets, such as the particle distribution inside the jets. Based on the different fragmentation properties of the jets initiated by quarks or gluons, a method to estimate the ratio of the number of quark over gluon jets as a function of the transverse momentum of the jet is presented. The method is based on the discriminating variable $NT90$ that allows to statistically differentiate quark and gluon jets. $NT90$ is defined as the minimum number of tracks, inside the jet cone, necessary to recover 90 % of the jet transverse momentum. A comparison between the predictions of $NT90$ from the Monte Carlo generators Pythia and Phojet with the measurements performed by ALICE during the recent proton-proton run at $\sqrt{s}$=7 TeV is presented.

HK 22.6 Tue 18:00 HS AP

Two- and Three-Particle Jet-Like Correlations in the ALICE Experiment at the LHC — •Jason Glyndwr Ulery for the ALICE-Collaboration — Institut für Kernphysik, Goethe Universität, Frankfurt am Main

The Large Hadron Collider has collided protons at energies of $\sqrt{s} = 0.9$ and 7 TeV and lead ions at $\sqrt{s_{NN}} = 2.76$ TeV. Jet-like correlations can be used to study these collisions. In *pp* collisions, these correlations provide information about the fragmentation of a high momentum parton into a jet of hadrons. The correlations in *pp* collisions also provide a baseline for heavy-ion collisions. A medium is formed in central heavy-ion collisions which is theoretically expected to be a deconfined start of quarks and gluons, referred to as the Quark-Gluon Plasma. Jets can be used to probe this medium. The study of the interaction of the jet and the medium in jet-like correlations can provide information on how energy is deposited into the medium by the jet and how the jet and medium modify each other. We will present the status of a 2- and 3-particle jet-like correlation analysis of charged particles measured in the ALICE Time Projection Chamber and Inner Tracking System in *pp* and Pb+Pb collisions.

HK 22.7 Tue 18:15 HS AP

Charged Particle Momentum Distribution in Jets in ALICE — Bastian Bathen[1], •Oliver Busch[2], and Christian Klein-Bösing[1,3] for the ALICE-Collaboration — [1]Institut fuer Kernphysik, Westfälische Willhelms-Universität Münster — [2]Physikalisches Institut, Ruprecht-Karls-Universität Heidelberg — [3]ExtreMe Matter Institut EMMI, GSI Helmholtzzentrum fuer Schwerionenforschung, Darmstadt

Jets are defined in QCD as cascades of consecutive emission of partons

from an initial hard scattering. The process of parton showering and subsequent hadronisation is broadly known as fragmentation. They can be studied via the momentum distribution of hadrons in jets. High energy nucleus-nucleus collisions allow us to study parton fragmentation within a QCD medium, and the properties of this medium via the modification of the jet structure.

The ALICE experiment at CERN LHC is a general-purpose heavy ion experiment designed to study the physics of stronlgy interacting matter and the Quark-Gluon-Plasma, with excellent charged particle reconstuction and identification capabilities over a wide momentum range. We present measurements of fragmentation functions for jets reconstructed from charged particles in the ALICE central barrel. First results for proton-proton collisions are discussed and the status of the corresponding analysis for heavy ion collisions is presented. We give an outlook on identified particle fragmentation functions.

HK 22.8 Tue 18:30 HS AP

ALICE TRD GTU Online Tracking and Trigger Performance in pp and PbPb Collisions — •Felix Rettig, Stefan Kirsch, and Volker Lindenstruth for the ALICE-Collaboration — Frankfurt Institute for Advanced Studies, University of Frankfurt

The ALICE Transition Radiation Detector is designed to provide fast trigger contributions for several signature classes. A total of 1.2 million analog channels is preprocessed massively parallel by more than 65000 custom quad-processor multi-chip modules. By means of pattern matching algorithms, short stiff track segments are identified and parametrized. Within 3μs up to several thousand track segments per event are then transferred to a second stage, the Global Tracking Unit.

The GTU consists of 109 FPGA-based processing nodes arranged in a three-level hierarchy, where 90 nodes receive track segment data at an aggregate bandwidth of up to 2.16 TBit/s and perform an online 3D reconstruction and momentum calculation for high-momentum tracks within 1.2μs. Track information is forwarded to 18 Supermodule Units running local trigger algorithms, i.e. a single high-momentum electron trigger and a jet trigger. The top-level Trigger Generation Unit provides the TRD global trigger contributions to the central ALICE trigger system within 6μs after the collision.

Presented here is the performance of the online tracking and selected triggers based on the first year of LHC operation with pp collisions at $\sqrt{s} \leq 7$ TeV as well as PbPb collisions at $\sqrt{s_{NN}} = 2.76$ TeV.

HK 22.9 Tue 18:45 HS AP

Beauty and beauty-jet measurement via displaced vertices with ALICE in p+p collisions at $\sqrt{s} = 7$ TeV — •MinJung Kweon for the ALICE-Collaboration — Universitaet Heidelberg Physikalisches Institut, Heidelberg, Germany

The measurement of single electrons from heavy flavor hadron decays at RHIC indicates strong coupling of heavy quarks to the medium produced in ultra relativistic heavy-ion collisions. The LHC extends greatly the kinematic range to high transverse momentum which enables new tests of heavy quark jet dynamics. The beauty hadrons and jets containing beauty hadrons have distinctive properties, which allow for their clear identification. We introduce methods to preferentially select electrons from beauty hadron decays by minimum distance of closest approach cuts and by reconstructing secondary vertices. The first analysis applying these techniques in the ALICE experiment for p+p collisions at $\sqrt{s} = 7$ TeV is presented. The analysis status of the data from Pb+Pb collisions, which will allow us to understand beauty quark energy loss in the medium, is also reported.