HK 16: Schwerionenkollisionen und QCD Phasen

Zeit: Montag 16:45–19:15 Raum: HSZ-201

Gruppenbericht HK 16.1 Mo 16:45 HSZ-201

Jet Reconstruction in Pb-Pb and pp collisions with the ALICE experiment — •Oliver Busch for the ALICE-Collaboration — Universität Heidelberg, Physikalisches Institut

Jets are defined in QCD as cascades of consecutive emission of partons from an initial hard scattering. The process of parton showering and subsequent hadronization is broadly known as fragmentation. High energy nucleus-nucleus collisions allow us to probe parton fragmentation within a QCD medium and the properties of this medium via the modification of the jet spectrum and jet structure. Jet reconstruction in pp collisions provides an elementary baseline and allows to investigate perturbative and non-perturbative aspects of particle production.

The Large Hadron Collider (LHC) at CERN delivered in 2010 and 2011 heavy-ion collisions (Pb-Pb) with collision energy per nucleon pair of $\sqrt{s_{NN}} = 2.76$ TeV and pp collisions at $\sqrt{s} = 7$ TeV. ALICE at the LHC is a general-purpose heavy ion experiment designed to study the physics of strongly interacting matter and the Quark-Gluon-Plasma, combining excellent charged particle reconstuction over a wide momentum range with electromagnetic calorimetry. We present measurements of jet production cross sections, jet structure and jet fragmentation for charged particle jets and full jets in Pb-Pb and pp collisions. The results are confronted with theory predictions.

HK 16.2 Mo 17:15 HSZ-201

Jet fragmentation into strange hadrons in Pb-Pb collisions with ALICE at the LHC — •Alice Zimmermann for the ALICE-Collaboration — Physikalisches Institut, Universitaet Heidelberg, Germany

The ALICE experiment at the LHC aims at studying ultra-relativistic heavy-ion collisions, where quarks and gluons are expected to be deconfined and to form the so-called Quark-Gluon Plasma. The measurement of particle jets, stemming from hard-scattering of partons in the colliding nuclei, allows to study parton energy-loss in the medium and correspondingly to constrain theoretical models. Production in jets of strange particles, like K^0_s, Λ and $\overline{\Lambda}$ particles, gives insight into fragmentation mechanisms and baryon-to-meson ratio in jets. These particles are reconstructed via their V0-decay topology.

In this talk, first results on K^0_s and Λ production in jets are presented for Pb-Pb collisions at $\sqrt{s_{NN}} = 2.76$ TeV. Based on their V0-decay topology, these particles can be reconstructed within jets at mid-rapidity, over a wide range of transverse momentum (from p_T(V0)= 0.2 to 10 GeV/c).

HK 16.3 Mo 17:30 HSZ-201

Momentum asymmetry of reconstructed jets in ultra-relativistic heavy-ion collisions — •Florian Senzel[1], Jan Uphoff[1], Oliver Fochler[1], Zhe Xu[2], and Carsten Greiner[1] — [1]Institut für Theoretische Physik, Goethe-Universität Frankfurt, Max-von-Laue-Straße 1, D-60438 Frankfurt, Germany — [2]Department of Physics, Tsinghua University, Beijing, China

Recent experimental data measured in $\sqrt{s} = 2.76\,A$TeV Pb+Pb collisions by ATLAS and CMS showed a significant imbalance in the transverse momenta of the two reconstructed jets with the highest transverse momenta. This momentum imbalance is assumed to be caused by the different energy and momentum loss of the di-jets by scatterings within the created medium. To investigate this momentum loss we extended the transport model BAMPS which solves the full 3+1D Boltzmann equation for partons based on pQCD cross sections. One feature of BAMPS is the stochastic modeling of 2→2 as well as 2↔3 scattering processes. We will show our results for the momentum asymmetry A_J and have a closer look at the role of further recoil scattering processes of the initial shower partons on the momentum loss of the reconstructed jets. For this investigation it is crucial to carefully consider the subtraction of the soft underlying background medium. Therefore we use a subtraction method which is orientated on the established experimental methods.

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HK 16.4 Mo 17:45 HSZ-201

Forward Central Jets Correlations — •Pedro Cipriano, Hannes Jung, Albert Knutsson, and Thomas Schörner-Sadenius — Desy, Hamburg, Germany

The azimuthal correlation between forward and central jets has been measured in pp collisions with the CMS detector at the LHC at the centre-of-mass energy of 7 TeV. The forward jet is required to be reconstructed in the hadronic forward calorimeter, within the pseudo-rapidity $3.2 < |\eta| < 4.7$, while the central jet is limited to $|\eta| < 2.8$. Both jets are required to have transverse momentum, pt > 35 GeV. The measurement of the azimuthal angle between the jets is performed for different separations in pseudo-rapidity between the jets, with the largest separation being 7.5 units. The measurement is repeated for two subsamples of events, one in which an additional jet is required between the forward and the central jet, and one where the additional jet is vetoed. The measurement is compared to several different Monte Carlo models and tunes.

HK 16.5 Mo 18:00 HSZ-201

A temperature-dependent jet-medium coupling at RHIC and LHC — •Barbara Betz — Institut für Theoretische Physik, Goethe-Universität Frankfurt, Max-von-Laue-Straße 1, D-60438 Frankfurt, Germany

The nuclear modification factor and the elliptic flow for high-p_T particles up to 300 GeV are calculated for various collision energies, ranging from the low-energy runs at the Relativistic Hadron Collider (RHIC) to the high-energy collisions at the Large Hadron Collider (LHC), considering a specific class of jet energy independent models of energy loss that feature a temperature dependent jet-medium coupling. Here, the focus is on non-perturbative models, such as the Shuryak-Liao (SL) model of magnetic monopoles, in which the jet is assumed to be strongly enhanced in the vicinity of the QCD cross-over temperature. It can be shown that an assumed factor of three enhancement of the coupling near the critical temperature is sufficient to simulateously account for the p_T, centrality, and $\sqrt{s}_{NN}$ dependence of both the elliptic flow and the nuclear modification factor.

HK 16.6 Mo 18:15 HSZ-201

Correction of detector effects with the HBOM method in event background fluctuations — •Markus Zimmermann[1,2] and Christian Klein-Bösing[1] for the ALICE-Collaboration — [1]Institut für Kernphysik, WWU Münster — [2]CERN

An important aspect of the ALICE analysis of the Quark-Gluon Plasma with hard probes are jets, which are an accumulation of particles. In heavy ion collisions, a reconstructed jet always contains particles from the background which are not generated by the initially scattered particles. The energy of this particles has to be subtracted to get the real jet energy. These background energy is different for each event and furthermore fluctuates from region to region inside each event.

Besides this, detector effects complicate the energy estimation of the jets. The used detectors only have a restricted efficiency to detect a particle and this leads to a significant amount of missing charged particles in the events. To get the real value of a measured observable it has to be corrected for these detector effects.

The background fluctuations can be corrected for the efficiency part of their detector effects with a new method, the HBOM method. In this method the detector effects are applied a few times more on the data. Than the observables are back-extrapolated to a detector effect of zero. This method does not need the knowledge about correlations in the event. Only the measured data and the detector effects which should be corrected have to be known.

HK 16.7 Mo 18:30 HSZ-201

Triggering on Jets with the ALICE TRD — •Jochen Klein for the ALICE-Collaboration — Physikalisches Institut, University of Heidelberg

The fragmentation of partons originating from hard interactions results in jets. In pp collisions jet evolution is well described by vacuum parton showers. In PbPb collisions modifications arise from the dense and strongly interacting medium. The comparison of data from PbPb, pPb, and pp data allows conclusions on medium properties.

Jets with high transverse momenta can be better separated from the high background in PbPb collisions. To collect events with such jets in pp and pPb a trigger is required. The ALICE TRD at the LHC (CERN) can provide fast hardware-based triggers about 7 μs after an

interaction. We will report on the performance of the TRD jet trigger in the pp run 2012 and show prospects for the future.

HK 16.8 Mo 18:45 HSZ-201

Zwei-Teilchen-Korrelationen und die Untersuchung des Ridge in einer partonischen Kaskade — •Benjamin Linnik und Carsten Greiner — Institut für Theoretische Physik, Goethe-Universität Frankfurt, Max-von-Laue-Straße 1, D-60438 Frankfurt, Germany

Die am RHIC und am LHC gemessenen langreichweitigen Korrelationen (ridge etc.) sind nicht hinreichend gut verstanden und weisen auf ein grundlegendes Verständnisproblem der Vorgänge in der frühen Phase einer Schwerionenkollision hin. Die experimentellen Aussagen deuten darauf hin, dass Korrelationen über grosse Rapiditätsskalen beobachtet werden und somit eine besonders starke Wechselwirkung in der frühen Phase der Kollision vorliegt. Diese frühe Phase ist besonders interessant, da dort der im frühen Universum vermutete Materiezustand des Quark-Gluon-Plasmas (QGP) erwartet wird.

Wir diskutieren die experimentellen Ergebnisse des RHIC und LHCs, erläutern unser Modell zur Simulation einer Schwerionenkollisionen, berechnen im Rahmen des Modells unter verschiedenen Anfangsbedingungen Korrelationen und vergleichen diese mit den experimentellen Daten.

Gefördert durch Land Hessen.

HK 16.9 Mo 19:00 HSZ-201

Übergang von idealen zu viskosen Machkegeln in einem kinetischen Transportmodell — •Ioannis Bouras[1], Andrej El[1], Oliver Fochler[1], Harri Niemi[2], Zhe Xu[3] und Carsten Greiner[1] — [1]Institut für Theoretische Physik, Goethe-Universität Frankfurt, Max-von-Laue-Straße 1, D-60438 Frankfurt, Germany — [2]Department of Physics, P.O. Box 35(YFL), FI-40014 University of Jyvaskyla, Finnland — [3]Department of Physics, Tsinghua University, Beijing, China

Mithilfe eines mikroskopischen Transportmodells untersuchen wir die Evolution von Kegelstrukturen, welche durch ein ultrarelativistisches Projektil erzeugt wird. Dieses durchquert die heiße und dichte Materie von Gluonen, welche in Schwerionenkollisionen erzeugt wird. Unter Zuhilfenahme verschiedener Szenarien für den Energieverlust des Projektiles im Medium und verschiedener Transporteigenschaften des Mediums selber untersuchen wir die Formation von Machkegeln. Weiterhin wird eine Winkelabhängigkeit des Machkegels beobachtet, welche von der Energiedeposition des Projektils abhängt. Die erzeugten Zweiteilchenkorrelationen werden im Detail untersucht und mit analytischen Resultaten verglichen.

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