5th International workshop on heavy quark production in heavy-ion collisions

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Book of Abstracts

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Welcome

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Welcome and announcements

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Coherence effects and broadening in medium-induced QCD radiation off a massive $q\bar{q}$ antenna

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Studies of medium-induced QCD radiation usually rely on the calculation of single-gluon radiation spectrum off an energetic parton traversing an extended colored medium. Recently, the importance of interference effects between emitters in the medium has been explored. In this work we extend previous studies by calculating the single-gluon coherent spectrum off an antenna consisting of a massive quark-antiquark pair. Interferences dominate the spectrum of soft gluons, which are mainly emitted outside of the cone made by the antenna opening angle, while the antenna results in a superposition of independent emitters above a critical gluon energy scale. We study the interplay between the dead-cone effect and medium-induced jet broadening in both cases of soft and hard gluons and present results on energy loss distributions.

Lattice QCD / **6**

Effects of momentum dependent drag and equation of state on the heavy flavour suppression

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The momentum dependence of the drag and diffusion coefficients of heavy quarks propagating through a quark gluon plasma (QGP) have been evaluated. The effects of the equation of state and momentum dependence of transport coefficients on the suppression of heavy flavours in QGP have been studied. We observe that the momentum dependence of the transport coefficients plays crucial role in the suppression of the heavy quarks and, consequently, in discerning the properties of the QGP using heavy flavors as a probe. We use the experimental data on nuclear suppression of heavy flavours and hadronic multiplicity from RHIC and LHC to constrain the initial condition of the QGP

expected to be formed at nuclear collision at RHIC energies.
Again, we have calculated drag and diffusion coefficients using Hard Thermal Loop(HTL) approximations. In this case we have shielded the infra-red divergence by the effective gluon propagator dictated by HTL perturbation theory.

Summary:

We have found out quantitatively that radiative energy loss plays more dominant role in the nuclear modification factor than the collisional loss.
We have obtained the value of the initial entropy density, which varies from 20 to 59/fmˆ3 depending on the value of the velocity of sound suggested by lattice QCD. Our investigation leads to a conservative value of the initial entropy density of ~20/fmˆ3 with a corresponding initial temperature of ~210 MeV, which is well above the value of the transition temperature predicted by lattice QCD.
As for the HTL approximated transport coefficients, we have found that there are considerable differences between drag and diffusion obtained using Debye mass as the infra-red shield and that calculated using HTL approximated gluon self energy as the shield.

HQ prod in jets and b-tag / **8**

b-Jet tagging in proton-(anti)proton collisions

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A large part of the high-pt physics programme at the Tevatron and LHC colliders relies on the identification of jets originating from the fragmentation of b quarks. In my presentation I will discuss the salient features of the b-jet tagging algorithms developed to achieve this goal, and also discuss the methods that have been developed to calibrate the performance of these algorithms.

Lattice QCD / **9**

Recent developments in lattice studies for quarkonia

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I will give a review on recent developments in lattice QCD studies for quarkonia in the quark gluon plasma medium. I will discuss recent progress in the extraction of spectral properties from lattice QCD calculations of hadronic correlation functions. Besides medium modifications of bound states and their dissociation in the plasma I will focus on transport coefficients, like heavy quark diffusion constants, extracted from different correlation functions on the lattice. Present limitations and future perspectives for studies of quarkonia and related transport coefficients on the lattice will be discussed.

Open charm / **10**

Suppression and elliptic flow of open charmed mesons

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For the first time in ultra-relativistic heavy ion collisions it is possible at the LHC and also at RHIC to measure the suppression and flow of D mesons directly without any contribution from B mesons, giving direct and unbiased insight to the charm quark interactions with the quark gluon plasma. Model calculations and predictions for the nuclear modification factor and elliptic flow of D mesons in ultra-relativistic heavy ion collisions are reviewed and compared to experimental data. Furthermore, the D meson results are put into context with other heavy flavor observables.

Quarkonia / **11**

Bottomonium Suppression in Heavy Ion Collisions

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The thermal suppression of heavy quark bound states represents an ideal observable for determining if one has produced a quark gluon plasma in ultrarelativistic heavy-ion collisions. In recent years, however, a paradigm shift has taken place in the theory of quarkonium suppression due to new first principles calculations of the thermal widths of these states. These thermal widths are large, eg O(20-100 MeV) for the Upsilon, and cause in-medium suppression of the states at temperatures below their traditionally defined disassociation temperatures. In order to apply the newly developed understanding to phenomenology, however, one must make detailed space-time models of the plasma including the effects of finite shear viscosity. These effects include not only the modification of the time evolution of the temperature of the system, flow, etc., but also the emergence of potentially large local momentum-space anisotropies which can affect the in-medium properties of the states. I will present comparisons of theory with data from RHIC 200 GeV/nucleon Au-Au collisions and LHC 2.76 TeV/nucleon Pb-Pb collisions as a function of number of participants, rapidity, and transverse momentum.

Summary / **12**

Recent results on heavy flavour production from LHCb

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During 2011, the LHCb experiment accumulated ˜1 fb−1 of data in proton-proton collisions data at 7 TeV, collecting a sample rich in B mesons and baryons. The data provide a wealth of new measurements as well as probes of QCD theory predictions. We present recent results in quarkonium and b and c hadron production, as well as studies of these states' properties such as masses and decay asymmetries.

Future experiments and upgrades / **13**

The STAR Heavy Flavor Upgrades

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The STAR have already reported on results in pp and AA on heavy flavor production. In order to perform high precision measurements of heavy flavor STAR has embarked on an upgrade program. The primary motivation for the Heavy Flavor Tracker (HFT) is perform measurements of heavy quark collectivity and to separate bottom and charm quark energy loss in the QCD medium. This will be achieved by the HFT by extending the capabilities of STAR by measurements of displaced vertices and direct topological identification of open charm. The motivation for the Muon Telescope Detector (MTD) is to provide muon identification at mid-rapidity for measurements of J/psi and Upsilon.
These detectors will greatly enhance the STAR physics capability to measure heavy quark collectivity and correlations using topologically reconstructed charmed hadrons and heavy quark decay electron-muon correlations and bottom quark production In addition, measurements of the quarkonium muon decay channels will enable us to separate Upsilon 1S from 2S and 3S states in p+p and A+A collisions. An overview of the upgrades, their expected performance and current status will also be presented. The STAR Collaboration should complete the Heavy Flavor Tracker (HFT) and the Muon Telescope Detector (MTD) upgrades by 2014.

Open charm / **14**

Radiative Contributions to Heavy Quark Energy Loss in a Langevin Approach

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Over the past year our group has studied heavy quark energy loss in the context of a Langevin approach. Main emphasis of our study was the question of heavy quark thermalization in a QGP medium as well as the dependence of the most common observables associated with heavy quark energy loss (R_AA and v_2) on various parameters of the medium evolution, to which our Langevin approach is coupled.

Here, in addition to reviewing the results of the aforementioned studies, we will introduce an algorithm that incorporates the radiative energy loss of heavy quarks in a QGP medium into the current Langevin framework by treating gluon radiation as an additional force to the heavy quarks traversing the medium. We examine the corresponding effects on observables such as the elliptic flow and the nuclear modification factor, and compare our simulations to the experimental results at the LHC. Our study constitutes an essential contribution to a more quantitative understanding of the energy loss of heavy quarks propagating through hot and dense nuclear medium.

New ideas from theory / **15**

Precision quarkonium studies using multi-purpose fixed-target experiments

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I will briefly review the most important quarkonium-production results at fixed-target experiments (NA50, NA60, Hera-B, E866, ...) reported in the last decade. Then I will move onto the discussion of the many quarkonium-physics opportunities offered by A multi-purpose Fixed-Target ExpeRiment (AFTER) using the proton and lead Large Hadron Collider (LHC) beams extracted by a bent crystal. With a foreseen integrated luminosity of 0.5 fb−1 per year on a typical 1 cm-long target, AFTER would provide a quarkonium observatory, where their production can be analysed in great details in pp, pd and pA collisions at sqrt(sNN)= 115 GeV and at sqrt(sNN)= 72 GeV in PbA collisions. By instrumenting the target-rapidity region, the large negative-xF domain can be accessed for the first time, greatly extending previous measurements by Hera-B and E866. Such analyses should help resolving the quarkonium-production controversies and clear the way for gluon PDF extraction via quarkonium studies. The nuclear target-species versatility provides a unique opportunity to study nuclear matter and the features of the hot and dense matter formed in PbA collisions.

Quarkonia / **16**

Measurement of the J/ψ elliptic flow at forward rapidity in Pb-Pb collisions at $\sqrt{s_{NN}}$ = 2.76 TeV with the ALICE experiment

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Heavy quark resonances, produced in high energy heavy-ion collisions, are important observables for the study of Quantum Chromodynamics (QCD) interactions at extreme energy-densities. Lattice QCD calculations predict a phase transition of the nuclear matter to Quark Gluon Plasma (QGP). The suppression (due to color screening mechanism) or enhancement (due to regeneration mechanism) of charmonium resonances (J/ψ) have been proposed as a signature of QGP. ALICE has measured the J/ψ in the forward rapidity region via the dimuon ($\mu^+\mu^-$) decay channel in Pb-Pb collisions at $\sqrt{s_{NN}}$ = 2.76˜TeV, the result shows less suppression with respect to that measured at lower energies of SPS and RHIC. The elliptic flow measurement of J/ψ provides an important observation to test the degree of thermalization of J/ψ in heavy-ion collisions.

In this talk, the elliptic flow of J/ψ measured in the forward rapidity (-4.0<y<-2.5) of ALICE via $\mu^+\mu^-$ decay channel will be discussed for Pb-Pb collisions at $\sqrt{s_{NN}}$ = 2.76 TeV. The recent analysis of the p_T integrated flow for different centrality bin will be presented. We will also discuss differential flow as function of transverse momentum. The results will be compared with the previous measurements at RHIC and theoretical calculations.

Quarkonia / **17**

Quarkonium production measurements in Pb-Pb collisions with the ALICE experiment at the LHC

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ALICE (A Large Ion Collider Experiment), one of the four main experiments at the Large Hadron Collider (LHC), was designed and built to perform dedicated research on heavy ion collisions to study the Quark Gluon Plasma (QGP), a deconfined state of strongly interacting QCD matter.

As heavy flavours are produced on a very short time-scale in the initial hard scattering processes, they can be used to characterize the hot and dense medium formed in high-energy heavy-ion collisions through their modified yield as compared to pp collisions.

In ALICE, quarkonium production is measured via the dielectron and dimuon decay channels at central (|y| < 0.9) and forward (2.5 < y < 4) rapidity, respectively.

In this talk the latest results on quarkonium production by the ALICE experiment in Pb-Pb collisions at sqrt{s_{NN}} = 2.76 TeV will be presented.

HF particle correlations / **18**

Exclusive coherent production of heavy vector mesons in nucleus-nucleus collisions

Author: Wolfgang Schaefer[1]

Co-authors: Anna Cisek [1]; Antoni Szczurek [1]

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High energy heavy ions are the source of a
flux of Weizs\"acker-Williams photons, which can be
utilized to study the photoproduction of vector mesons
on nuclear targets.
We discuss how information on the small-x gluon
distribution in the nucleus can be obtained.

We present our calculations based on a $k_\perp$-factorization
approach which allows us to construct the unintegrated glue
of a nucleus from the free-nucleon one.

Saturation effects are incorporate by an explicit treatment of the
$q\bar{q}g$-Fock state. If time permits, we also briefly discuss the role of the latter in incoherent diffraction on nuclei.

The presentation will be based on our recent publication

"Exclusive coherent production of heavy vector mesons in nucleus-nucleus collisions at LHC."
A. Cisek, W. Schafer (Cracow, INP), A. Szczurek (Cracow, INP & Rzeszow U.), Phys.Rev. C86 (2012) 014905.

HF decays leptons / **19**

Production of two $c\bar{c}$ pairs and two identical D mesons - evidence for double parton scattering mechanism.

Author: Antoni Szczurek[1]

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We discuss charm production at LHC. The production of single $c\bar{c}$ pairs
is calculated in the k_t-factorization approach. We use several
unintegrated gluon distributions from the literature. Some of them
include effect of small-x staturation and fullfil Balitsky-Kovchegov
evolution equation. The hadronization is included with the help of
fragmentation functions found for the production of c ($\bar{c}$) in e^+e^- collisions. Differential distributions for several
charmed mesons will be presented and compared to recent results of the ALICE
and LHCb collaborations. Some missing strength is identified.
Different schemes of fragmentation are discussed.

We concentrate on production of two pairs of $c\bar{c}$ within a simple
formalism of double-parton scattering (DPS). We perform calculation both
in collinear and k_t-factorization approaches. Surprisingly large
cross sections, comparable to single-parton scattering (SPS)
contribution, are predicted for LHC energies.
Both total inclusive cross section as a function of energy and
differential distributions are shown.
We include recently discussed evolution of double partons in the case
of two scales.
We discuss perspectives how to identify the double scattering
contribution. We find much larger cross section for large rapidity distance
between charm quarks from different hard parton scatterings
compared to single scattering.
Predictions for two $c\bar{c}$ pair production in single-parton
scattering will be presented.
We present also first results for the $c\bar{c}c\bar{c}$ production
in the k_t-factorization approach. The results are compared with
those for the collinear approach.

Predictions for the production of different pairs of charm mesons
(D^0D^0, $D^0\bar{D}^0$, etc.) are presented for the kinematics of
ATLAC, CMS, ALICE and LHCb experiment. Differential distributions of single meson
provided that both mesons are measured by the detector, distribution in azimuthal angle
between two mesons and in dimeson invariant mass are calculated and will be compared
with recent experimental data. Predictions for future measurements are given.

LITERATURE:

\item M. {\L}uszczak, R. Maciu{\l}a and A. Szczurek,
"Production of two $c\bar{c}$ pairs in double-parton scattering",
Phys. Rev. {\bf D85} (2012) 094034.

\item W. Sch\"afer and A. Szczurek,
"Production of two $c\bar{c}$ pairs in gluon-gluon scattering
in high energy proton-proton scattering",
Phys. Rev. {\bf D85} (2012) 094029.

\item R. Maciu{\l}a and A. Szczurek, a paper in preparation.

HF decays leptons / **20**

Radiative energy loss and damping effects

Author: Thierry Gousset[1]

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The effect of the damping of radiation in an absorptive medium on radiative energy loss is considered. First, the radiation spectrum for a fast parton going through a dense medium is estimated from considerations on the formation time in the QCD context. In a second stage, such a derivation is connected to a full calculation carried out in electrodynamics.

Open charm / **21**

Open charmed mesons at LHC

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I will discuss production of open charmed mesons in proton-proton collisions at the LHC. The cross section for inclusive production of $c\bar{c}$ pairs is calculated in the framework of the $k_\perp$-factorization approach. Taking wide range of x values necessary for the calculation we use and test several unintegrated gluon distributions from the literature. Some of them include effect of small-x saturation and fullfil Balitsky-Kovchegov evolution equation. Theoretical uncertainties of the model related to the choice of renormalization and factorization scales as well as due to the quark mass are also discussed. Results from the $k_\perp$-factorization approach are compared to NLO parton model and FONLL predictions. The hadronization of charm quarks is included with the help of different fragmentation functions found for the production of charm in e^+e^- collisions. Sensitivity of our predictions to the choice of the model of fragmentation is also shown. Inclusive differential distributions in transverse momentum and (pseudo)rapidity of several charmed mesons (D^0, $D^\pm$,$D^{*\pm}$,$D_S^\pm$) will be presented and compared to recent results of the ALICE, ATLAS and LHCb collaborations. Furthermore, I will also consider production of different pairs of charmed mesons ($D^0\bar{D}^0$, D^0D^-, $D^+D_S^-$ etc.) in the unique kinematics of forward rapidities in the LHCb experiment. Kinematical correlations in azimuthal angle $\varphi_{D\bar{D}}$ and invariant mass $M_{D\bar{D}}$ distributions will be presented and compared to LHCb data.

HF decays leptons / **22**

Measurement of heavy-flavour decay muon production at forward rapidity in Pb-Pb collisions at sqrt(sNN) = 2.76 TeV with ALICE

Author: Philippe Pillot[1]

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Heavy flavours (charm and beauty) are expected to provide essential information on the properties of the high-density strongly-interacting system formed in the early stages of high-energy heavy-ion collisions. In particular, the investigation of modifications of heavy-flavour transverse momentum yield will shed light on the nature of the parton-medium interactions, while the measurement of their collective flow provides insights on the possible thermalization of heavy quarks in the medium.

ALICE is the experiment at the LHC mainly dedicated to the study of nucleus-nucleus collisions. At forward rapidity (2.5 < y < 4), the production of open heavy flavours is measured via their semi-muonic decay channels in the Forward Muon Spectrometer. After a short description of the apparatus, the latest results on the pT-differential nuclear modification factor RAA and elliptic flow of muons from heavy-flavour decays in Pb-Pb collisions at sqrt(sNN) = 2.76 TeV will be presented.

Open charm / **23**

D meson nuclear modification factors and D meson elliptic flow in Pb–Pb collisions at √s_{NN} = 2.76 TeV with the ALICE detector

Author: Alessandro Grelli[1]

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The properties of the hot and dense QCD medium formed in ultra-relativistic heavy-ion collisions, as well as the mechanism of in-medium partonic energy loss, can be accessed via the measurement of the nuclear modification factor of particle production. The measurement of D meson production provides key tests of parton energy-loss models, which predict that charm quarks should experience less in-medium energy loss than light quarks and gluons. Moreover if in-medium hadronization is the dominant mechanism of charm hadron formation at low p_{T} then the production of charm strange hadrons, like D_{s}ˆ{+}, is expected to be largely enhanced. Finally the elliptic flow v2 of D meson compared to that of light hadrons is expected to bring insights into the degree of thermalization of charm quarks within the quark gluon plasma.
The ALICE experiment has measured the production of prompt Dˆ{0}, Dˆ{+} and Dˆ{*+} and Dˆ{+}*{s} mesons in pp and Pb-Pb collisions at the LHC at √s = 7 and 2.76 TeV and at √s*{NN} = 2.76 TeV, respectively, via the exclusive reconstruction of their hadronic decay. The p_{T}-differential production yields in the range 1 < p_{T} < 36 GeV/c (4<pT<12 GeV/c in the case of Dˆ{+}*{s}) at central rapidity, |y| < 0.5, were used to calculate the nuclear modification factor. A suppression of a factor 4-5 for p*{T} ≥ 10 GeV/c in the 7.5% most central collisions was observed. The measurement of the D meson elliptic flow in semi-central (30-50%) Pb-Pb collisions will be presented.

Cold nuclear matter / **24**

Feasibility of the detection of D0 mesons in the NA61/SHINE experiment at the CERN SPS

Author: Yasir Ali[1]

Co-author: Pawel Staszel [1]

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A feasibility study of D0 meson (Open charm) measurements by its decay into two daughter particles, D0 ⟶ K+ π−, in central Pb+Pb collisions at the CERN SPS energies will be presented.
The study for the NA61/SHINE experimental setup supplemented
with a future vertex detector that will allow for a precise track and vertex reconstruction at the target proximity. In order to generate the physical input we use the AMPT (A MultiPhase Transport model) event generator with multiplicities of D0 and D0bar mesons scaled to the multiplicities predicted by the HSD model. We employed the GEANT4
application to describe particle transport through the experimental setup.
The presentation will discuss obtained results focusing on the predicted experimental yields of D0 mesons and comparing different analysis strategies. It will also address the issue of the vertex detector optimization regarding its geometry and applied detection
technologies.

Quarkonia / **25**

Open and hidden charm dynamics

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Based on the Parton-Hadron-String Dynamics (PHSD) transport approach
we study the suppression pattern of charmonia at SPS and RHIC with
respect to centrality and rapidity employing various model concepts
such as variants of the comover absorption' model or thecharmonium melting' scenario. A detailed comparison to the RHIC experimental data demonstrates that non-hadronic interactions are mandatory to describe the narrowing of the J/Ψ rapidity distribution from pp to central Au+Au collisions. The Ψ' to J/Ψ ratio is found to be crucial in disentangling the different charmonium absorption scenarios especially in the RHIC energy range.
Also we investigate the contribution from open and hidden charm and bottom to the dilepton production from SPS to LHC energies.

Lattice QCD / **26**

The chiral transition and equation of state

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I present various bulk observables from lattice QCD
that characterize the chiral and deconfinement aspects
of the transition at finite temperature. I discuss the
efforts towards a mapping of the QCD phase diagram at small
chemical potentials, and present preliminary results on the
effect of the dynamical charm quark.

Future experiments and upgrades / **27**

Heavy flavour measurements with ALICE in view of the inner tracker upgrade

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The ALICE experiment at the LHC studies Pb-Pb and pp collisions with the aim of investigating the properties of the high-density state of strongly-interacting matter, expected to be produced in Pb-Pb collisions.
Heavy quarks are sensitive probes to test the medium properties, since they are formed at shorter time scale with respect to the deconfined state.
The present measurements of the nuclear modification factor (R_AA) and azimuthal anisotropy of heavy flavour mesons are limited by the large combinatorial background, in the low pt region.
The measurements of heavy-flavour baryons, interesting to assess the thermalization of heavy quarks in the medium and discriminate among thermal and coalescence models, is difficult to be achieved with the current tracking and impact parameter resolution due to the small displacement (tens of microns for the case of the Lambda_c) of the decay tracks from the primary vertex.
The Upgraded Inner Tracking System will have greatly improved features in terms of: determination of the distance of closest approach (dca) to the primary vertex, standalone tracking efficiency at low pt, momentum resolution and readout capabilities. The large benefit of the upgraded detector on the heavy-flavour physics performance will be presented in this talk.

HQ prod in jets and b-tag / **28**

b-jet Identification in PbPb Collisions with CMS

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The flavor dependence of jet quenching is a powerful handle to discriminate models of parton energy loss in heavy ion collisions. While there is evidence for a strong energy loss of heavy quarks from single particle measurements, heavy flavor tagging of fully reconstructed jets has thus far not been achieved in heavy ion collisions. In this talk we demonstrate the capacity of CMS to identify jets initiated by bottom quarks using displaced vertices reconstructed in the silicon tracking system. Identification of b-jets is shown to be feasible even in the dense environment of PbPb collisions. We discuss the status and prospects for measurements of identified b-jets in PbPb collisions with CMS.

HF decays leptons / **29**

Measurement of the nuclear modification factor and the elliptic flow of electrons from heavy flavour decays in Pb-Pb collisions at 2.76 TeV with ALICE

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Theodor Rascanu for the ALICE collaboration

In heavy-ion collisions, charm and beauty quarks are produced in
the initial hard scattering processes. They propagate then through the created Quark Gluon Plasma. Therefore they are a sensitive tool to probe the medium's properties.

One way to measure heavy-quarks is via electrons from the semileptonic decay channels of open charm and beauty hadrons. The suppression of heavy flavour electrons, quantified by the nuclear modification factor R_{AA},carries information about the heavy quark energy loss mechanism in the medium.
At low transverse momentum, the level of thermalization of heavy quarks can be studied via the azimuthal anisotropy of the heavy flavour electron emission in the transverse plane, the elliptic flow v_{2}. At high pt, v_{2} provides insight on the path length dependence of parton energy-loss.

In this talk we present R_{AA} and v_{2} measurements of electrons from heavy flavour decays at central rapidity with ALICE in central (0-10%) and semi-central (20-40%) Pb-Pb collisions at $\sqrt{s_{NN}}$ = 2.76 TeV, respectively. The electrons are identified using the Time Of Flight detector and Time Projection Chamber at low momenta, as well as the Electromagnetic Calorimeter at higher momenta. The latest detector also provides the possibility to trigger on electrons in the collision.
We compare the results to different theoretical models.

Open charm / **30**

Open charmed mesons production at STAR

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The properties of the hot and dense nuclear matter produced at RHIC in heavy ion collisions can be investigated in multiple ways by heavy flavor production.
In this talk, we will present the STAR results of open charm hadron production at mid-rapidity in $p+p$ and Au+Au collisions at
$\sqrt{s_{NN}}$ = 200 GeV. Open charm mesons were reconstructed
directly via hadronic decay channels with daughter particles
identified by TPC and TOF detectors. With abundant statistics of
Au+Au collisions collected by STAR in the year 2010 and 2011, the
D-meson is measured at p_T from 0 to 8 GeV in minimum bias Au+Au
collisions. The centrality dependence of D-meson p_T spectra as well as the nuclear modification factor will be presented. The measurement of the D^0 elliptic flow in 200 GeV Au+Au collisions will be reported. Finally, we will discuss the open charm hadron
measurement in $\sqrt{s} = 500$ GeV $p+p$ collisions to study the energy dependence of charm production.

HF decays leptons / **33**

Heavy quark quenching from RHIC to LHC

Author: Pol Gossiaux[1]

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Recently, we have proposed a microscopic approach for the quenching and thermalisation of heavy quarks (HQ) in URHIC \cite{Gossiaux:2008,Gossiaux:2009,Gossiaux:2010}, assuming that they interact with light partons through both elastic and radiative processes evaluated by resorting to some parameterization of the running coupling constant, while those partons are spatially distributed along hydrodynamical evolution of the hot medium. This approach is able to explain successfully several observables measured at RHIC, such as a) the nuclear modification factor and the elliptic flow of non-photonic single electrons and b) the nuclear modification factor of D mesons presented by STAR at QM 2012. We will discuss the predictions of our model for D and B mesons production in URHIC at LHC energies and confront them with experimental results obtained so far by ALICE and CMS collaborations for Pb-Pb collisions at $\sqrt{s} = 2.76$ TeV.

Since \cite{Bluhm:2011}, our interest has been triggered on the effect of an absorptive medium on radiative energy loss and more specifically on its implications on the standard LPM \cite{LPM} effect. We have advocated that the large time needed for the photon formation in Bremsstrahlung from ultrarelativistic charges is not affordable if damping is taken into account. Similar effect manifests itself in QCD, as we have recently advocated in \cite{Bluhm_2012}. It has possible implications on the quenching of D mesons in URHIC that will be discussed in this talk, focusing on observables such as nuclear modification factor and correlations.

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\begin{thebibliography}{9}

\bibitem{Gossiaux:2008}
P.B. Gossiaux, J. Aichelin, Phys. Rev. C{\bf 78}, 014904 (2008), [hep-ph/0802.2525].

\bibitem{Gossiaux:2009}
P.B. Gossiaux, R. Bierkandt, J. Aichelin, Physical Review C{\bf 79} (2009) 044906

\bibitem{Gossiaux:2010}
P.B. Gossiaux, V. Guiho, J. Aichelin, J. Phys. G: Nucl. Part. Phys. {\bf 37} (2010) 094019

\bibitem{Gossiaux:2011}
P.B. Gossiaux et al., arXiv:1102.1114

\bibitem{Bluhm:2011}
M. Bluhm, P.B. Gossiaux, and J. Aichelin, arXiv:1106.2856, PRL {\bf 107} (2011) 265004

\bibitem{LPM}
L.D. Landau and I. Ya. Pomeranchuk, Dokl. Akad. Nauk SSSR {\bf 92} (1953) 535; ibid. {\bf 92} (1953) 735.

\bibitem{Bluhm_2012}
M. Bluhm, P. B. Gossiaux, T. Gousset, J. Aichelin,[arXiv:1204.2469v1]

\end{thebibliography}

Quarkonia / **34**

J/ψ production in STAR

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The suppression of charmonia production in high energy nuclear collisions relative to proton-proton collisions due to the color screening was proposed as a signature of the formation of Quark-Gluon Plasma. However, there are other effects that may affect the observed charmonia production, such as cold nuclear matter effects, final state nuclear absorption, statistical coalescence of $c\bar{c}$ pairs. Studies of J/ψ production and J/ψ elliptic flow (v_2) in heavy-ion collisions can provide insight into the properties of the hot and dense medium created in relativistic heavy-ion collisions at RHIC. Moreover, measurements of the J/ψ production for different colliding systems, centralities and collision energies may help to understand J/ψ production mechanisms as well as the medium properties.
The J/ψ production in p+p collisions is equally important, as the J/ψ production mechanism in elementary collisions is not yet known. Of particular interest in p+p collisions is the J/ψ cross-section and spin alignment (J/ψ polarization). At high-p_T, this can provide discrimination power between different J/ψ production models.

In this talk results on J/ψ production via the dielectron decay channel in Au+Au, d+Au and $p + p$ collisions at midrapidity at $\sqrt{s_{NN}}$ = 200 GeV in STAR experiment in broad p_T range, $0 < p_T < 14$ GeV/c, will be presented. The J/ψ nuclear modification factor in Au+Au and d+Au collisions as a function of centrality and p_T, and the J/ψ v_2 in Au+Au collisions will be shown. The J/ψ polarization measurement will be presented in p+p collisions for J/ψ p_T from 2 to 6 GeV/c.

Quarkonia / **35**

Coherent J/psi photoproduction in ultra-peripheral Pb-Pb collisions at ALICE

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The ALICE experiment at the CERN Large Hadron Collider allows the study of vector meson production in ultra-peripheral heavy-ion collisions (UPC). Due to the strong electromagnetic fields gamma-gamma and gamma-nucleus processes can be studied.
We report the first results obtained at ALICE on the coherent J/psi photo-production cross section, a process sensitive to the gluon distribution of the nuclei, in PbPb collisions at sqrt(s_NN) = 2.76 TeV and its rapidity dependence measured at both forward rapidities (mu+mu- channel) and central rapidities (e+e- and mu+ mu- channels)

HF decays leptons / **36**

Bottom electron production in 7 Tev pp collisions at ALICE

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Tomas Aronsson for the ALICE collaboration

High-energy heavy-ion collisions at the LHC allow for the study of the properties of the quark-gluon plasma (QGP). Heavy quarks, charm and bottom, produced in the initial hard scattering processes of the collision are excellent probes of the QGP. When heavy quarks traverse the QGP they are expected to lose energy and such energy loss is predicted to be smaller than for gluons and light quarks. Heavy-flavour production can be studied using electrons from semi-leptonic decays of D and B mesons. The separation of electrons from these two sources (charm and bottom) is of crucial importance to address the expected mass dependence of energy loss. In this talk, we present the

measurement of electrons from bottom decay in the transverse momentum range of 1-11 GeV/c in 7 TeV pp collisions at the LHC. Two methods are used to identify electrons from bottom decay; a track impact-parameter study based on the displacement of the decay vertex from the collision vertex, and a two-track secondary vertex b-tagging algorithm used to select displaced decay vertices. The cross section for bottom decay electrons is compared to FONLL pQCD predictions and it will serve as a reference for studies of B meson suppression in Pb-Pb collisions.

Summary:

Bottom electron production in 7 Tev pp collisions at ALICE, Tomas Aronsson for the ALICE collaboration

Open charm / **37**

Heavy flavor spectra in AA collision within a Langevin approach

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Co-authors: Arturo De Pace [2]; Francesco Prino [1]; Marco Monteno [1]; Marzia Nardi [3]; alfredo molinari [4]; wanda maria alberico [5]

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We present the updated outcomes of a theoretical study of heavy-flavor spectra in AA collisions. The core of the analysis is represented by the study of the propagation of heavy (c and b) quarks in the Quark Gluon Plasma: their dynamics is described through a relativistic Langevin equation, whose transport coefficients are evaluated within a thermal-field-theory approach. Results obtained with lattice-QCD transport coefficients will be also shown. Our Langevin approach, at variance with radiative energy-loss calculations, would lead (asymptotically) the heavy quarks to thermal equilibrium.
The numerical solution of the Langevin equation enters into a multi-step setup including
- Initial hard production of the q-qbar pairs, given by the POWHEG-BOX event generator (based on NLO pQCD);
- For the AA case: Langevin dynamics in the QGP background (evolving according to hydrodynamics);
- Hadronization according to the most up-to-date branching fractions and fragmentation functions;
- Decays into the experimentally accessible channels (open charm hadrons, displaced J/psi, heavy-flavor electrons).
- Evaluation of inclusive spectra (in pp and AA), R_AA and v_2 (in AA) and comparison with the most recent experimental results obtained in Pb-Pb collisions at the LHC at 2.76 TeV.
Our analysis represents an improvement of the calculation presented in Eur.Phys.J. C71 (2011) 1666. In particular measurements of exclusive open-charm spectra which became available at the LHC (at 2.76 and 7 TeV) allow now to fix the pp benchmark with tighter constraints.

Quarkonia / **38**

System Size, Energy and Rapidity Dependence of Quarkonia Production Measured by the PHENIX Detector.

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The nuclear modification of quarkonia in heavy ion collisions involves a set of physics parameters like energy density, path length and initial state effects which can be controlled experimentally with variations in the beam energy, use of different species and rapidity ranges. The PHENIX detector recently collected high statistics data using combinations of heavy ion species and beam energies in a broad rapidity range. This talk will present the most recent measurements of J/ψ, ψ', χ_c and Υ production in d+Au, Au+Au, Cu+Cu, Cu+Au collisions at $\sqrt{s_{NN}}$ =200 GeV, 62 GeV and 39 GeV in mid- ($|y|$ <0.35) and forward rapidities ($1.2 < |y| < 2.2$).

HF decays leptons / **39**

Measurement of charm and bottom contributions to electrons from heavy quark decay at RHIC-PHENIX experiment

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Heavy quark (charm and bottom) is a good probe to study the interaction between partons and quark gluon plasma (QGP). Heavy quarks are created mainly by initial hard scatterings and interaction between heavy quarks and QGP during full space-time evolution is clearly reflected in the final states.
A silicon vertex tracker (VTX) was installed at the PHENIX detector in 2011. The VTX enables us to measure charm and bottom contributions individually to electrons from heavy quark decay, and therefore to access the information of charm and bottom behavior inside QGP, which leads to greater understanding of the interaction.
In the presentation, the results of the electron measurement from charm and bottom decays for both p+p and Au+Au collisions will be presented.

HF particle correlations / **40**

Heavy flavour correlation measurements in pp and Pb-Pb collisions with ALICE

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In high energy heavy-ion collisions heavy-flavour quarks are primarily produced in the early stage of the collision, through initial hard scatterings. This makes them an important probe of the high energy density QCD matter that is formed in the collision, since they should then experience the full evolution of the system. Heavy quarks can be studied through the measurements of open heavy-flavour hadrons and single leptons from heavy-flavour decays. Azimuthal angular correlations of single electrons and charged hadrons can be utilized to estimate the relative contribution of charm and beauty hadrons to the measured heavy-flavour single electron yield. In addition, an understanding on the production and fragmentation of heavy quarks can be examined through azimuthal angular correlations of heavy-flavour hadrons.

In this talk preliminary results on the relative contribution of electrons from beauty decays to the heavy-flavour single electron yield will be shown, along with the charm and beauty production cross section in pp collisions at sqrt(s) = 2.76 TeV. These measurements will be compared to FONLL calculations. We also show results from the correlation analysis of D mesons and hadrons performed using pp collisions at sqrt(s) = 7 TeV. Finally we discuss the status of heavy-flavour electron and charged hadron correlations in Pb-Pb collisions at sqrt(s_NN) = 2.76 TeV.

Cold nuclear matter / **41**

Cold Nuclear Matter Effects on Heavy Quarks from PHENIX

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The flexibility of the Relativistic Heavy Ion Collider has allowed the
PHENIX Collaboration to perform detailed measurements of heavy quark
production in p+p, d+Au, Cu+Cu, and Au+Au collisions at 200 GeV, probing a wide range of temperature and collision geometry.Studies of
d+Au collisions have shown significant and surprising cold nuclear
matter effects on both charmonium and open heavy flavor, which imply
that the initial state baseline for interpreting heavy quark transport
in the hot partonic medium formed in Au+Au collisions is highly modified from the elementary p+p or pQCD shape.This talk will discuss recent measurements of cold nuclear matter effects on heavy quarks, and how they may influence our understanding of the cold nuclear environment and the interpretation of Au+Au data.

HF decays leptons / **42**

Measurements of Non-photonic Electron Production and Azimuthal Anisotropy in Au+Au Collisions at STAR

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Heavy quarks are produced early in the heavy-ion collisions and are
expected to interact with the created strongly interacting partonic
medium differently from light quarks. Therefore, they can shed
new light on understanding the medium's properties. Simultaneous measurements of spectra and azimuthal anisotropy of electrons from semileptonic decays of heavy flavor hadrons provide experimental insight to distinguish different energy loss theoretical models and to characterize heavy quarks medium interaction. During RHIC 2010 run, STAR has collected a large amount of minbias, central and high tower triggered data in Au+Au collisions at $\sqrt{s_{NN}} = 39, 62.4$ and 200 GeV with detector configuration for minimum photonic conversion background. From this data we will report a new high precision measurement of non-photonic electrons mid-rapidity invariant yield, improved nuclear modification factor and v_2 in Au+Au collisions at $\sqrt{s_{NN}} = 200$ GeV. We will also report measurements of mid-rapidity invariant yield at $\sqrt{s_{NN}} = 62.4$ and v_2 at $\sqrt{s_{NN}} = 39$ and 62.4 GeV.

Open charm / **43**

D meson azimuthal anisotropy measured with ALICE experiment

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The ALICE experiment at the LHC is dedicated to the study of ultra-relativistic heavy-ion collisions, with the aim of investigating the high-density color deconned state of strongly interacting matter that is expected to be formed in these collisions.
Heavy quarks serve as a probe of the dynamics of the medium since they are produced at the early stages of the collisions and they propagate through the created matter.
The D meson azimuthal anisotropy (v2) is expected to bring insights into the degree of thermalization of charm quarks within the quark-gluon plasma.
A non-zero v2 at low transverse momentum indicates a collective motion of charm quarks with respect to the bulk of created matter, while at high transverse momentum v2 is sensitive to the path length dependence of the charm quark energy loss within the medium.
The measurement of D0, D+ and D+ elliptic
ow and D0 RAA versus event
plane in semi-central Pb{Pb collisions at
p
sNN = 2:76 TeV will be pre-
sented. D mesons have been reconstructed via their hadronic decay channels (D0 ! K⊠+, D+ ! K⊠++ and D+ ! D0+) in the central rapidity re-
gion.

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Upsilon PbPb from Alice

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CMS

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Upsilon production in STAR

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Open charm / **47**

The CBM heavy-quark program

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The Compressed Baryonic Matter (CBM) experiment at FAIR is designed to explore the QCD phase diagram in the region of high baryon densities and moderate temperatures. The key CBM observables include particles containing hidden charm – J/y and Y', open charm –D0, D+ , D* and Lc, low-mass vector mesons decaying into leptons and multi-strange hyperons. Particularly demanding is the measurement of open charm particles with very low multiplicities, which is based on the real time selection of displaced vertices with an accuracy of about 50 μm. In the talk we discuss the problems of the detection of heavy-quark particles in fixed target experiments with relativistic heavy ion collisions.

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QCD factorization theorems for production of heavy quarkonia

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PHENIX upgrades

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Heavy flavour perspectives with CBM

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Experiment summary

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Quarkonia / 58

Recent results on quarkonium and open bottom suppression in PbPb collisions at the LHC with CMS

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The Compact Muon Solenoid (CMS) has measured various quarkonium states via their decays into muon pairs in pp and PbPb collisions at sqrt(s_NN) = 2.76 TeV. Quarkonia are especially relevant for studying the quark-gluon plasma since they are produced at early times of the collision and propagate through the medium, mapping its evolution. The most recent results on the production of prompt J/psi, psi(2S) and the first three Y states will be presented. At high transverse momenta (pT>6.5 GeV) and midrapidity (|y|<1.6), psi(2S) are found to be more suppressed in PbPb collision than J/psi. Also the nuclear modification factors of the three Y states are found to decrease with decreasing binding energy, as expected in a sequential melting scenario. Furthermore, the nuclear modification factor of non-prompt J/psi from b-hadron decays gives access to study the energy loss of b-quarks in the quark-gluon plasma.

HF decays leptons / **59**

Nonperturbative Heavy-Flavor Diffusion and Hadronization in a Hydrodynamic Description of Heavy-Ion Collisions

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We compute open heavy-flavor (HF) transport in relativistic heavy-ion collisions by combining a strong-coupling treatment in both macro- and microscopic dynamics (hydro and nonperturbative diffusion interactions) [1]. The hydrodynamic bulk evolution is quantitatively constrained by bulk and multi-strange hadron spectra and elliptic flow [2]. In the Quark-Gluon Plasma (QGP) phase, heavy-quark diffusion coefficients are taken from a non-perturbative T-matrix approach. The latter leads to resonance formation close to Tc which is implemented as a hadronization (recombination) mechanism on a hydrodynamic hypersurface. In the hadronic phase, the diffusion of HF mesons is obtained from effective hadronic theory [3]. We compute observables at RHIC and LHC for both HF mesons and non-photonic electrons [4,5]. In particular, we suggest the R_AA and v_2 of the D_s mesons as a unique observable due to the coupling of charm to the strangeness enhancement in AA collisions [4], which allows to quantitatively test key components of our approach, including recombination and hadronic diffusion effects.

References:

[1] M. He, R. J. Fries and R. Rapp, Phys.Rev. C86,014903 (2012).
[2] M. He, R. J. Fries and R. Rapp, Phys. Rev. C85, 044911 (2012).
[3] M. He, R. J. Fries and R. Rapp, Phys. Lett. B701, 445 (2011).
[4] M. He, R. J. Fries and R. Rapp, arXiv:1204.4442 [nucl-th].
[5] M. He, R. J. Fries and R. Rapp, arXiv:1208.0256 [nucl-th].

Cold nuclear matter / **60**

Heavy-quarkonium suppression in p-A collisions from parton energy loss

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The effects of parton energy loss in cold nuclear matter on heavy-quarkonium suppression in p-A collisions are discussed. It is shown from first principles that at large quarkonium energy E in the nucleus rest frame, the medium-induced energy loss is proportional to E. Using this result, a phenomenological model depending on a single free parameter is able to reproduce J/psi and Upsilon suppression data in a broad xF-range and at various center-of-mass energies. These results strongly support energy loss as the dominant effect in heavy-quarkonium suppression in p–A collisions. Predictions for J/psi and Upsilon suppression in p-Pb collisions at the LHC are presented.

Welcome / **61**

Welcome, Head of the Department of Physics and Astronomy

HF decays leptons / **62**

Heavy Quark Production in Pb-Pb Collisions at the LHC with the ATLAS Detector

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Bottom quarks are important probes to study the hot, dense medium produced in the heavy ion collisions. These heavier quarks are produced at a relatively early stage of the nucleus-nucleus collisions and may have reduced gluon radiation due to the suppression of small angle gluon radiation known as the 'dead cone effect'. Because of the heavy mass of b-hadrons, muons from semi-leptonic b-hadron decays tend to have a larger angle with respect to the jet axis. This information can be used to tag b-jets. In this talk, we present the inclusive heavy flavor suppression in Pb+Pb collisions at 2.76 TeV, which was obtained by studying single muons decaying semi-leptonically from the b- and c-quark containing hadrons.

New ideas from theory / **63**

Gauge/gravity, thermalization and energy loss

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Holography provides an excellent tool to study (certain) strongly coupled gauge theories, which is especially useful if the state is very far from equilibrium. In this talk I will review current progress on thermalization, which is modelled by black hole formation, and highlight recent progress on energy loss using holography. Unfortunately I will also have to point out many caveats and uncertainties in these computations, in particular in relation to the energy loss of a energetic quark.

Quarkonia / **64**

Quarkonium at finite temperature

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I will review the effective field theory description of quarkonium interaction at finite temperature and its phenomenological implications.

Future experiments and upgrades / **65**

Future of Heavy Quark Measurement at sPHENIX

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The PHENIX Collaboration is designing a new detector configuration (sPHENIX) to continue the studies of the recent discoveries at RHIC. The new detector will be based on a strong solenoid magnet with full azimuthal calorimetry and tracking coverage as well as displaced-vertex measurement capabilities. A new landmark of sQGP interaction, color screening and initial state effect studies can be explored at RHIC with measurements like heavy flavor tagged jets, hadron(gamma)-heavy flavor correlation and identification of different quarkonia states in p+p, p+A and A+A collisions. This presentation will detail the conceptual design, the staging and the physics which can be addressed in this concept.

HF particle correlations / **66**

Heavy Flavor Dileptons at PHENIX

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Charm and bottom quarks are very effective probes of the Quark Gluon Plasma (QGP) created in heavy ion collisions as they are created in the initial hard scattering and therefore fully traverse the hot nuclear medium before fragmentation into the vacuum. Along with a well-established baseline measurement, any observed modification to heavy-ion heavy flavor spectra can yield insight into the interaction between the heavy quarks and the QGP.

Dilepton correlations provide an extremely useful window to open heavy flavor. Semi-leptonic decays of B and D mesons can be studied through both the unlike sign and like sign correlated dilepton pairs. They yield a clean signal which is largely free of contamination and provide reasonable separation of charm and bottom. Moreover, they access a region of phase space where pQCD calculations are more reliable than for single lepton observables.

The PHENIX experiment has extrapolated the charm and bottom cross sections through both leading order and next-to-leading order calculations for $sqrts = 200$˜GeV and $sqrts = 500$˜GeV. These heavy flavor results from two particle correlations have been explored in both p+p and d+Au collisions at PHENIX. Heavy flavor production determined in both the dielectron and dimuon channels will be shown.

HF particle correlations / **67**

From the RAA to azimuthal correlations: what can we learn from heavy-quark observables?

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The observation of strong jet quenching and the suppression of high-p_t hadrons in relativistic heavy-ion collisions are striking experimental signatures for the formation of a deconfined QCD plasma in which partons suffer from medium-induced energy loss. In particular, heavy quarks are considered as suitable probes for revealing the properties of the produced matter as they are created at very early stages in hard scattering processes and assumed not to thermalize completely within the medium. Typical observables for the interaction of heavy quarks with the medium constituents are the nuclear modification factor R_{AA} and the elliptic flow v_2, which we present within a combined Monte-Carlo approach and realistic fluid dynamic description of the expanding plasma for both RHIC and LHC energies. In the main part of this talk we will investigate the potential of correlations between heavy quarks and anti-quarks to reveal basic principles of energy loss scenarios at LHC. At low p_t any correlation of the initially heavy quark-antiquark pair is lost due to thermalization, at larger p_t, however, these correlations in p_t and azimuthal angle ϕ survive and show distinctive features for purely elastic and elastic plus radiative energy loss mechanisms. We discuss these results in view of the core-corona effect and the centrality dependence.

Quarkonia / **68**

Upsilon measurements in STAR

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We report on measurements of Upsilon mesons in the dielectron channel with the STAR detector at RHIC.
Upsilon mesons are expected to be sensitive to the deconfinement transition in the Quark Gluon Plasma, and
to be useful in determining the medium temperature. We compare the yield obtained in Au+Au data, separated into three centrality classes, to the measured cross section from p+p collisions. Our data are compared
to models of bottomonium dissociation.