Quark Matter 2008, Feb. 4-10, 2008 - Jaipur - India
Proposed for oral presentation
Session : Future Physics Prospects and Detectors

Quarkonia Studies in PbPb Collisions by the ATLAS Experiment at LHC

A. Lebedev[a] for the ATLAS Collaboration

[a]Department of Physics and Astronomy, Iowa State University
Ames, IA 50010, USA, *lebedev@iastate.edu*

The measurement of quarkonia production in heavy ion collisions provides a powerful tool for studying the properties of hot and dense matter created in such collisions. Especially important is simultaneous measurement of different quarkonia states, since they are predicted to dissociate at different temperatures, and thus provide valuable information about deconfinement.
We studied the possibility to measure Upsilon and J/ψ quarkonia families via di-muon decays in heavy ion collisions in the ATLAS experiment at LHC. We present the simulation results for expected acceptance, reconstruction efficiency, mass resolution, rates and background estimates for Upsilon and J/ψ states in PbPb collisions at LHC.

First commissioning results of ALICE–TOF SuperModules

A. Alici

University of Bologna and INFN,
Bologna, Italy, *alici@bo.infn.it*

The ALICE TOF is a large array based on 1638 Multigap Resistive Plate Chambers (MRPCs) arranged in 90 modules. The whole system is divided in 18 sectors called SuperModules (SM); five modules are grouped in a line to form one SM. Two SMs were installed in the ALICE experiment in autumn 2006 and before the end of 2007 many others will follow; the completion of the TOF is expected in the first months of 2008.
A set of quality tests has been so far developed in order to take under control the several phases of the assembly operation and to verify the proper working of each SM component, including the front-end and the readout electronics. In the meantime a set of tools to check and debug the quality of the data stream created by a SM has been developed as well. These tools should be able to discover faulty conditions or bad detector configurations during data taking in order to restore as quickly as possible the quality of the data. Most of these checks are beeing repeated with the installed SMs as a part of the commissioning procedures. Results concerning all these tests on the installed SMs are presented.

The ALICE Trigger

A. Bhasin[a], **D. Evans**[a], **G.T. Jones**[a], **P. Jovanović**[a],
A. Jusko[a], **I. Králik**[b],**M. Krivda**[a], **C. Lazzeroni**[a],
R. Lietava[a],**H. Scott**[a],**L. Šándor**[b],**J. Urbán**[c]
and O. Villalobos Baillie[a]
for the ALICE collaboration.

[a]School of Physics and Astronomy, The University of Birmingham, UK
[b] Institute of Experimental Physics, Košice, Slovakia
[c]P.J. Šaf'arik University, Faculty of Science, Košice, Slovakia

The ALICE experiment aims to take data both in pp and in ion-ion collisions, running in pp mode simultaneously with the other LHC experiments ATLAS, CMS and LHCb. Although a reduction in luminosity at the ALICE collision point will be employed, the resulting pp luminosity (about $\mathcal{L} = 10^{30} cm^{-2}\mathrm{s}^{-1}$) gives a collision rate of around 100 kHz, over an order of magnitude higher than in Pb-Pb collisions. The trigger system must perform efficiently in both environments, allowing the same functionality.
The ALICE trigger system is unusual, in that it allows dynamic partitioning during normal data taking. This technique has been developed because some sub-systems in the detector, notably the muon arm, are designed to run faster than the large detectors in the central barrel, which are designed to operate with the Time Projection Chamber (TPC), a device with a drift time of 88 μs. This is necessary as the muon arm must accumulate events at a faster rate than the TPC in order to reach the required levels of statistics. In addition, a sophisticated system of past-future protection controls the number and type of superimposed overlapping events recorded with each trigger, in order to ensure that recorded events are reconstructable.
In this presentation the principles of the ALICE trigger will be presented. The trigger system is now complete and has been installed. Preliminary performance data, based on trigger integration tests and data taking with cosmic rays, will be presented.

Three body reconstruction of charmed mesons in ALICE

E. Bruna[a] (for the ALICE Collaboration)

[a]University of Torino
Via P. Giuria 1, 10125 Torino, Italy, *elena.bruna@to.infn.it*

Charm quarks are expected to be produced via hard processes in the early stage of heavy ion collisions at relativistic energies. This makes open charmed mesons a powerful tool to investigate nuclear effects on charm production, propagation and hadronization in the medium produced in heavy-ion collisions. Very interesting results have been obtained from RHIC experiments via the measurement of non-photonic electrons. The measurement of as many charmed hadrons as possible is required to reduce the systematic error on the charm cross section and to improve the measurements of the main experimental observables used to study medium effects: D-meson quenching and azimuthal anisotropy. The ratio D_s^+/D^+ is expected to provide information on the hadronization mechanisms. In addition, measurements of mesons with open charm offer a natural normalization for charmonia production at the LHC.

One of the ongoing studies related to the heavy-flavour physics in ALICE at the LHC is the exclusive reconstruction of D^+ and D_s^+ mesons via their charged three-body decays in Pb-Pb ($\sqrt{s} = 5.5$ TeV) and p-p ($\sqrt{s} = 14$ TeV) collisions. The selection strategies for these analyses and the results of the feasibility studies on Monte Carlo events are presented.

Vacuum Engineering and it's test in ALICE

Chuncheng Xu[a] and **Johanna Stachel**[b]

[a]Institute of Partice Physics, Centre China Normal University,
Wuhan, Hubei, 430079, P. R. China, *xucc@iopp.ccnu.edu.cn*

[b] Physikalisches Institute Der Universitaet Heidelberg,
Philosophenweg 12, D 69120 Heidelberg, Germany,*stachel@physi.uni-heidelberg.de*

T.D.Lee's idea about vacumm engineering is explained. Some hints of vacumm phase transition of already existed experiments are recalled. Measurement of Z0 production in ALICE experiment is proposed to test these ideas. Simulations on the reconstruction of Z0 in pp and in AA is done. The low level triggering of Z0 with TRD and MUON is suggested.

References

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Data analysis in ALICE

F. Carminati[a]
On behalf of the ALICE Offline Project

[a]CERN-PH
1211 Geneva 23, Switzerland, *federico.carminati@cern.ch*

Since 1998 the ALICE Offline Project has developed an integrated offline framework (AliRoot) and a distributed computing environment (AliEn) to process the data of the ALICE experiment. The latest development of the framework has been centered on analysis, which is the most important activity in view of harnessing the physics content of the data. Todays computing environment offers great opportunities in terms of computing power and flexibility of usage. However this comes at the price of being able to exploit a complicated

and relatively immature infrastructure composed of heterogeneous parallel and distributed computing resources. The ALICE Offline project has developed an infrastructure based on the ROOT system and the WLCG Grid middleware, which have been integrated via original solutions, and developed to face the challenges specific to the ALICE experiment. This talk will review the development and current status of the ALICE Offline with particular attention to the analysis tools and strategy. The presentation will describe how this environment has been tested during a series of exercises of increasing complexity carried on over the years. The status of readiness of the systems will be described, as well as the major challenges facing it on the eve of data taking. The lessons learned during this development will be described and analysed, and the future roadmap will be presented and discussed.

Benchmarking ALICE TPC Simulations with Test Data

P. Christiansen[a] and **P. Gros**[a] for the ALICE TPC Collaboration

[a]Div. of Experimental High-Energy Physics, Lund University,
Lund, SE-221 00 Lund, Sweden,
peter.christiansen@hep.lu.se and *philippe.gros@hep.lu.se*

The TPC is the main tracking detector in the central barrel ($|\eta| \leq 1$) of the ALICE experiment. The tracking in the TPC provides the seeds for global tracking in the other detectors such as ITS and TRD, and is thus of great importance for the whole detector performance. Simulations of all physical processes in the TPC provide important information to optimize reconstruction algorithms, and will be the basis for obtaining detector response corrections for the determination of acceptance, momentum resolution, and tracking efficiency.
It is therefore important to validate the ALICE TPC simulation with test data. We present a comparison of TPC simulated data, based on the ALICE tuned GEANT3 and FLUKA codes, to test beam and cosmic commissioning data results on position resolution and energy loss resolution and discuss the implications for how well momentum resolution and energy loss resolution can be determined from the TPC simulations.
We also show results from a stand alone simulation which only takes the ionization energy loss into account, but is simpler, faster and more flexible, to better understand which detector effects determine the performance.

Z^0 Reconstruction in Heavy Ion Collision with CMS at LHC

Dipanwita Dutta
on behalf of the CMS collaboration
ddutta@barc.gov.in

Nuclear Physics Division,
Bhabha Atomic Research Centre,Trombay, Mumbai, India 400085.

Z^0 boson is an important probe to study the Nuclear Shadowing of Parton Distribution Function in the Heavy Ion Collision at LHC at $\sqrt{s} = 5.5 TeV$. The factor 30 increase in energy between RHIC and LHC dcrease the x values from 0.02 to 6.7×10^{-4}. Since the dominant contribution of Z^0 production is through quark antiquark fusion, it is an unique probe to study the nuclear effect of quark PDF at very low x upto very high Q^2. The Compact Muon Solinoid (CMS) detector with its excellent muon detection capability for a wide range of energy and rapidity, is absolutely suitable to study the Z^0 bosons through the deacy muons. Being a very clean signal $Z^0 \rightarrow \mu^+\mu^-$ is also considered to be the alternative baseline for quarkonium supression.

In this work we will report the reconstruction capability of the $Z^0 \rightarrow \mu^+\mu^-$ signal in the Heavy Ion Collision for CMS detector using CMSSW software framework. Accoridng to the estimation by PYTHIA, around 19000 Z^0 is expected for one month of LHC run with Pb+Pb beam at $\sqrt{s}$ 5.5 TeV with integrated luminosity $L_{int} = 0.5nb^{-1}$. The possible pQCD backgrounds are muons from open beauty, charm and Drell-Yan. The Heavy ion background is mostly decay muons from π and K mesons. HYDJET event geneator is used for Heavy Ion background study. Signal to background ratio for $Z^0 \rightarrow \mu^+\mu^-$ within CMS detector acceptace will be reported. Reconstruction efiiciency, invariant mass, p_T, η and rapidity distribution of Z^0 signal for different centrality of Pb-Pb Collision will be estimated.

The ALICE Muon Spectrometer and related Physics

B. Espagnon[a]

[a]ALICE Collaboration, Université Paris-Sud, Institut de Physique Nucléaire d'Orsay, Orsay, 91406 , France, *espagnon@cern.ch*

The LHC heavy ion physics program aims at investigating the properties of strongly interacting matter at extreme energy density where the formation of the Quark Gluon Plasma is expected. Among the most promising observables, open heavy flavours and heavy quarkonium states are especially relevant since, on the one hand, they are copiously produced and, on the other hand, they provide sensitive information on the collision at both short timescale (production mechanisms) and long timescale (medium effects). In ALICE, they will be measured through the hadronic channel as well as from (di)electrons and (di)muons. Particular emphasis will be put in this talk on their measurement in the (di)muon decay channel. The ALICE muon spectrometer will be described as well as its construction and installation status. A few selected topics concerning muon physics in heavy ion collisions at LHC will be addressed and the expected performances of the ALICE muon spectrometer will be shown.

Day 1 at LHC: Zero Degree Calorimeters for Beam Optimization and Physics Measurements

Edmundo Garcia
on behalf of the CMS collaboration

University of Illinois at Chicago
845 W. Taylor St. MC273, Chicago, IL, USA 60607

The CMS Zero Degree Calorimeters (ZDCs) will make significant contributions to the start up and early physics at the Large Hadron Collider (LHC). The ZDCs sit 140 m away from

the interaction point, 60 m after the first beam separator dipole magnets. Each calorimeter consists of an electromagnetic section divided into 5 vertical strips and a hadronic section with four divisions in depth, each division based on a compact quartz fiber/tungsten matrix. The calorimeters are designed to measure and trigger on photons and neutrons with $\eta > 8.2$. In CMS the LHC beams will cross in the horizontal plane. The ZDCs can measure the average x position and the crossing angle, vital parameters for beam tuning. The length of the interaction zone can also be measured by looking at the time differences between the two calorimeters. The calorimeters can also make a measurement of the absolute luminosity via Van der Meer scans. We will present test beam data which show our ability to measure these parameters and describe the scheme for transmitting the information in real time to the LHC control group. We will also discuss the potential of the ZDCs for physics measurements at CMS, related to diffraction, forward physics, and ultra-peripheral collisions, with special emphasis on what can be learnt about QCD from the first proton-proton run.

STATUS OF THE PHOTON SPECTROMETER (PHOS) OF THE ALICE EXPERIMENT

P. T. Hille[a]
For the ALICE PHOS Collaboration

[a]Department of Physics, University of Oslo, Norway

PHOS is the electromagnetic spectrometer of the ALICE experiment at CERN and will consist of 17920 detection channels of lead tungstate ($PbWO_4$) crystals segmented in 5 modules of 56*64 crystals covering $-0.12 < \eta < 0.12$ in pseudo rapidity and an azimuthal angel of 100%.
The first PHOS module has been assembled and tested at CERN and is scheduled to be installed in ALICE at November 5, 2007 while the next two modules are currently being assembled.
Parts of the first module were calibrated with electron beam during July - August 2006. Preliminary analysis results of the beamt-test data collected in 2006 were presented at QM 2006. Further calibration with cosmic muons is currently ongoing at CERN.
The status of the PHOS detector, final analysis results for the 2006 beam test data and preliminary results of calibration with cosmics of the first PHOS module will be presented.

The PHENIX Hadron Blind Detector

T. K. Hemmick[a] for the PHENIX Collaboration

[a]Stony Brook University
Stony Brook, New York, USA *Thomas.Hemmick@stonybrook.edu*

As our understanding of the new states of matter created in RHIC collisions increases, so too does the need for a look “inside” the medium through the use of color-neutral or so-called penetrating probes. Among these are electrons, photons, and muons. Electron measurements

in the PHENIX central arm are hampered by the large combinatorial background resulting from random combinations of positrons and electrons that were not created as a pair. These random combinations are dominated by the principal sources of electrons; π^0 Dalitz decays and photon conversions. Each of these sources leaves the unique signature of a small opening angle and can be identified by a detector placed immediately following the beam pipe.
The PHENIX hadron blind detector (HBD) was built expressly for this purpose and was used for the first time in Run 7. Each half of the detector consists of twelve triple-GEM stacks whose top most GEM is coated with CsI, making the device photo-sensitive in the deep ultraviolet. Cherenkov light from relativistic electrons forms unfocused blob patterns in the cathode. Electron pairs are identified both by pulse height (in the case of complete overlap) and by blob size/shape. Results from the HBD in Run 7 and its overall performance will be discussed.

Challenges with micro-vertex detection and silicon tracking in the CBM experiment at FAIR

Johann M. Heuser[a] for the CBM Collaboration

[a]Gesellschaft für Schwerionenforschung mbH,
D-64291 Darmstadt, Germany, *J.Heuser@gsi.de*

The Compressed Baryonic Matter (CBM) experiment at the future Facility for Antiproton and Ion Research (FAIR) in Darmstadt is being designed for systematic investigations of heavy-ion collisions in fixed-target mode at beam energies from 10 to 45 GeV/nucleon. The goal of the research program is to explore the QCD phase diagram in the region of highest baryon densities. The detector has to measure hadronic, leptonic and photonic observables with large acceptance. The interaction rates will be as high as 10 MHz in order to measure extremely rare probes like charm near threshold. The experimental challenge is to accomplish in particular the decay vertex reconstruction of D mesons and Λ_c baryons in the high-multiplicity, high-rate collision environment. Prerequisit is an ultra-low mass, fast and radiation tolerant instrumentation of the interaction region, involving new and innovative technologies.
Efficient track reconstruction of the hundreds of charged particles per central collision, and their high-resolution momentum determination shall be achieved with a thin, large-area silicon tracking detector system, the central component of the CBM experiment. Low-mass silicon microstrip detector modules are being developed that keep the power consuming self-triggered front-end electronics with its support and cooling infrastructure outside of the aperture of the tracking system. Thin hybrid pixel detector tracking stations, possibly realized in 3D-integration technologies, are considered in the upstream section of the silicon tracker where the track densities are highest. The decay vertex detection shall be achieved with further ultra-thin stations of monolithic active pixel sensors mounted on diamond support structures with integraded electrical busses and thermal management. They refine the track measurement very close to the target with extremely high spatial resolution. Fast and efficient track reconstruction algorithms are being developed that fully exploit the projective and true space point measurements of the highly granular silicon detectors.
The concept of the CBM silicon detector system, results of feasibility studies on heavy flavor measurements, and an overview of the detector R&D activities will be presented.

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ON-LINE ANALYSIS OF ALICE PHOTON SPECTROMETER DATA IN THE HIGH LEVEL TRIGGER (HLT) SYSTEM

P. T. Hille[a]

For the ALICE/PHOS and the ALICE/HLT Collaboration

[a]Department of Physics, University of Oslo, Norway
Norway

This paper describes the ALICE HLT with an emphasis on Photon Spectrometer (PHOS) data processing.
PHOS consists of 17920 detection channels of lead tungstate ($PbWO_4$). Each detection channel is amplified with two different gains giving 35840 readout channels.
The ALICE trigger system comprises the L0, L1, L2 Hardware triggers and the HLT which is a software trigger running on 900 PCs.
The ALICE trigger system selects data to be read out at an anticipated data rate of 25 GByte/s whereas the bandwidth of the Data acquisition and storage is 1.25 GByte/s [1].
The HLT compresses the input data to be compatible with the provided bandwidth by a combination of compression algorithms and on-line selection of the most interesting physics events.
For PHOS, semi Gaussian detector signals are oversampled at 10 MHz giving ∼64 samples per channel. By estimating the amplitude and the peak position in the HLT the data can be compressed by a factor 20.
A different approach based on[2][3] to parameter estimation, the "PeakFinder" algorithm, will be presented. The amplitude and the peak position are evaluated as a statistically optimum weighted sum of the samples. The output of the algorithm converges to optimum estimates several order of magnitudes faster than fitting techniques. Benchmark results using calibration data from PHOS will be presented.

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Minimum bias triggering in CMS for 14 TeV p+p and 5.5 TeV Pb+Pb collisions at the LHC

Richard Hollis[1]

on behalf of the CMS collaboration

[1]*University of Illinois at Chicago*
845 W. Taylor St. MC273, Chicago, IL, USA 60607

The start of LHC running and the corresponding initial low luminosities during ramp-up to full luminosity in p+p collisions represent a unique, and possibly one-time, opportunity to obtain a significant amount of ideal minimum bias data without the added complications and potential biases associated with data containing multiple collisions per bunch crossing. A significant minimum bias sample of p+p data will provide valuable physics datasets with which to characterise the global properties of proton collisions and to aid in establishing a solid experimental foundation for the heavy-ion physics program at LHC energies.
Important considerations need to be taken into account in the selection of a trigger to enable the effective recording of relevant minimum bias events in both proton and heavy-ion collisions. This work provides a description of possible triggering schemes for minimum bias collisions in the CMS detector for both 14 TeV p+p collisions as well as 5.5 TeV Pb+Pb collisions. A discussion of possible biases imposed on the data at the triggering level and ways to reject (or accept) beam-gas collisions will be included.

Open charm measurement with HFT at STAR

J. Kapitan[a] for the STAR Collaboration

[a]Nuclear Physics Institute, ASCR,
Rez near Prague, 25068, Czech Republic, *kapitan@rcf.rhic.bnl.gov*

Anisotropic flow measurements have demonstrated development of partonic collectivity in 200 GeV Au-Au collisions at RHIC. To understand the partonic EOS, one must address thermalization in these collisions. Given their large masses, collective motion of heavy-flavor (c,b) quarks could be used to indicate the degree of thermalization of the light-flavor quarks (u,d,s). To investigate heavy-quark energy loss and medium properties, it is essential to measure with good precision open-charm spectra at high p_{T}. This will resolve the ambiguity of non-photonic electrons from open-charm and open-beauty semileptonic decays currently measured at RHIC. Both v_2 and spectra measurements require direct reconstruction of hadronic decays of open-charm hadrons.
The Heavy Flavor Tracker (HFT), a proposed upgrade to the STAR experiment at midrapidity, will measure v_2 of open-charm hadrons to very low p_{T} by reconstructing their displaced decay vertices. The HFT consists of two fast strip detector layers - the Intermediate Silicon Tracker (IST) and the Pixel detector, which is made of two low mass monolithic active pixel sensor (MAPS) layers. The IST is essential to improve hit identification at the Pixel detector when running at full RHIC-II luminosity, while the Pixel detector enables a high precision position measurement close to the collision vertex.
MAPS are fabricated using a standard CMOS technology and feature high detection efficiency and low noise with low power dissipation. The selection of a thin-oxide diode layout results in better radiation tolerance. A prototype small-size three-chip telescope with a readout system has recently been tested in STAR. We report on results from these measurements. Using the full Geant simulation of the STAR tracking system with the HFT, we will show that the HFT can directly reconstruct open-charm hadrons on event-by-event basis with high signal to background ratio, and thus can measure v_2 and spectra with a large p_{T} coverage

at midrapidity.

Performance studies of the final prototype of the CASTOR Calorimeter with electrons, muons and pions

P. Katsas[1], **N. Bakirci**[2], **S. Cerci**[2] et al.

[1] *University of Athens, Nuclear & Particle Physics Section, GR-157 71 Athens*
[2] *Cukurova University, Adana, Turkey*

We will present beam test results for the final prototype of the CASTOR Čerenkov calorimeter, to be installed in the very forward region ($5.1 < \eta < 6.6$) of the CMS experiment at the LHC. The beam test was carried out in the H2 line at the CERN/SPS in 2007 using beams of electrons, pions and muons of various energies. The CASTOR calorimeter consists of an electromagnetic and a hadronic section, with successive layers of tungsten plates as absorber and fused silica quartz plates as active material. The Čerenkov light produced by the incoming charged particles is collected in reading units along the depth of the calorimeter and transported onto PMTs by light-guides. We will present results on the energy linearity and resolution of the calorimeter, as well as the spatial resolution of the hadronic showers, e/pi ratio and leakage, and will compare the performances to GEANT4 simulations.

Direct photon physics with ALICE PHOS

Yu.Kharlov
for the ALICE/PHOS collaboration

IHEP Protvino, Russia, *Yuri.Kharlov@cern.ch*

Direct photons are produced during the entire evolution of nucleus-nucleus collisions. Since the photons interact only electromagnetically with the hot nuclear matter, they carry undistorted information about its properties. At low and medium transverse momenta, the direct photon spectrum is dominated by thermal photons and those from jet-medium interactions. These photons can be used to estimate the temperature and the energy density of the hot matter. At high transverse momenta, prompt photons make a dominant contribution to direct photon spectrum, providing a possibility to study the initial state of the collision and a nuclear modification of structure functions.
The Photon Spectrometer, PHOS is a high-resolution electromagnetic calorimeter of the ALICE experiment dedicated for precise measurement of direct photon yield in pp and AA collisions in a wide p_T range. Experimentally, the direct photons are measured as an excess of the photon spectrum over the decay photon one. Based on the experience of the PHENIX (RHIC) experiment and detailed Monte Carlo simulation of the ALICE setup, we study the feasibility of the direct photon measurement in PHOS and make an estimation of the systematic errors in π^0 spectrum and γ/π^0 ratio measurements with PHOS. We concentrate on

the soft region of the direct photon spectrum, which is the most sensitive to the experimental uncertainties.
In this talk, we also review recent predictions of the direct photon production at LHC energies. The sources of theoretical uncertainties and expected values of the all-to-decay photon ratio is discussed in the talk. The theoretical predictions of direct photon excess over background are compared with expected systematic errors in PHOS.

Calorimetry in PHENIX: today and in future

E. Kistenev [a)] for the PHENIX Upgrade Collaboration

[a]Department of Physics, Brookhaven National Laboratory
Upton, NY, 11933, USA, *kistenev@bnl.gov*

PHENIX relies on calorimetry at midrapidities for triggering on the remnants of hard scattering in Heavy Ion and Nucleon-Nucleon collisions, for identification of charged and neutral leptons and hadrons produced in those collisions and measuring their energies. Calorimetry was essential for early discovery of suppression of particle production at large transverse momenta in central heavy ion collisions, it is a main instrument used to study direct lepton production and to measure spin dependent asymmetries. The advent of high luminosity RHIC running will allow PHENIX to extend its kinematical reach and to study the nuclear effects on parton distribution functions leading to QGP production. Addressing challenges of high luminosity running require substantial enhancement to existing PHENIX particle spectrometers including calorimetry. The intent is to increase acceptance for calorimetry measurements from currently available $\delta\eta \times \delta\phi \sim 0.35$ to $\delta\eta \times \delta\phi \sim 20$ with two new calorimeters (Nose Cone in the rapidity range between 1 and 3 units and Muon Piston in the rapidity range 3 to 4 units) in each of the forward muon spectrometers.
The MPCs built of PbWO4 scintillating crystals were recently installed into PHENIX and already accumulated data during last PHENIX data taking period.
The Tungsten-Silicon Nose Cone tracking calorimeters are currently in the final stage of intensive R&D program with system prototype fully implementing readout of the future detector recently tested in the particle beams at CERN.
This talk will briefly review the basic design ideas of the PHENIX multicomponent calorimetry system and present available performance data collected in the test beam and during PHENIX running. The priority will be given to new ideas developed and implemented in the PHENIX upgrade phase.

Detailed studies of Quarkonium production in heavy-ion collisions with CMS at the LHC

Olga Kodolova[1]
on behalf of the CMS collaboration

[1] *Moscow State University,119992 Moscow, Russia*

The measurement of the charmonium (J/ψ, ψ') and bottomonium (Υ, Υ', Υ'') resonances in nucleus-nucleus collisions provides crucial information on high-density QCD matter. First, the suppression of quarkonia production is generally agreed to be one of the most direct probes of quark-gluon plasma formation. The observation of anomalous J/ψ suppression at the CERN-SPS and at RHIC is well established but the clarification of some important remaining questions (role of hadronic absorption, feed-down contributions, and extra production via recombination) requires equivalent studies of the Υ family, only possible at the LHC energies. Second, the production of heavy-quarks proceeds mainly via gluon-gluon fusion processes and, as such, is sensitive to saturation of the gluon density at low-x in the nucleus ("Color Glass Condensate"). Measured departures from the expected "vacuum" quarkonia cross-sections in Pb-Pb collisions at the LHC will thus provide valuable information not only on the thermodynamical state of the produced partonic medium, but also on the initial-state modifications of the nuclear parton distribution functions. We report the capabilities of the CMS detector to study quarkonia production in Pb-Pb collisions at 5.5 TeV through the dimuon decay channel. The CMS muon acceptance is very large in the central region, $|\eta| < 2.4$, and, thanks to the powerful tracking system and the 4 Tesla magnetic field, the dimuon mass resolution is about 54 (90) MeV at the Υ mass as measured in the barrel (barrel+endcap), the best of all LHC experiments. The performance of the several level dimuon triggers of CMS in heavy-ion collisions will be presented. Using fast MC simulations with the most recent cross-section estimates of the signal (quarkonia) and backgrounds (heavy-flavour and light mesons), we present the reconstructed mass, dN/dy, dN/dp_T spectra, signal/background ratios, and the expected statistics estimated in different centrality bins for the J/ψ and Υ families. After one month of Pb-Pb running at the nominal luminosity (0.5 nb^{-1}) – and assuming no quarkonia suppression – CMS will reconstruct 180 000 J/ψ and 25 000 Υ dimuons, enough to compare central and peripheral Pb-Pb collisions, and to carry out differential studies (as a function of y, etc.) which will contribute significantly to clarify the physics mechanisms behind the production (and destruction) of quarkonia states in high-energy nucleus-nucleus collisions.

Luminosity Determination in ALICE with T0 and V0 detectors

T. Malkiewicz[a*], **F. Nendaz**[b], **A. Bogdanov**[c], **B. Cheynis**[b], **L. Ducroux**[b], **V. Grigoriev**[c], **J.-Y. Grossiord**[b], **T. Karavicheva**[d], **A.B. Kurepin**[d], **A. Kurepin**[d], **A. Mayevskaya**[d], **T. Nayak**[e], **M. Oledzki**[a], **R. Tieulent**[b] and **W.H. Trzaska**[a], on behalf of ALICE T0 and V0 collaboration

[a] Department of Physics, University of Jyväskylä, Finland
* *tomatkie@jyu.fi*

[b] IPNL, Universit de Lyon, CNRS/IN2P3, Villeurbanne, France

[c] Moscow Engineering Physics Institute (MePhI), Moscow, Russia

[d] Academy of Science, Institute of Nuclear Research (INR), Moscow, Russia

[e] Variable Energy Cyclotron Centre (VECC), Department of Atomic Energy (DAE), India

Two of ALICE forward detectors, V0 and T0[1,2], will play an important role in extracting the first physics results and the beam diagnostics during the startup of LHC. Already the runs during the LHC commissioning period should provide sufficient data for luminosity and multiplicity determination and for establishing the position of the interaction point along longitudinal and transverse axis. Precise determination of the relative luminosity and its monitoring is required as it enters cross section calculations of all physics processes. The goal is to keep the systematic error of relative luminosity in ALICE within 5%.

The V0 detector covers the pseudo-rapidity range of $-3.7 < \eta < -1.7$ and $2.8 < \eta < 5.1$. It is made of two arrays of plastic scintillators placed on the opposite sides of the interaction point (IP). Each array is made of 4 concentric rings subdivided into 8 sectors making 32 cells. The light from each cell is collected by a grid of wavelength shifting fibers and directed to a photomultiplier tube (one tube per cell). The overall time resolution is below 1 ns which is adequate for suppression of beam-gas events. The acceptance of V0 is sufficient to assure 98% trigger efficiency also for pp collisions. The T0 detector consists of two arrays of Cherenkov counters, 12 counters per array, covering the pseudo-rapidity range of $-3.28 < \eta < -2.97$ and $4.61 < \eta < 4.92$, and is located in the immediate proximity of V0 arrays. The size of quartz radiators is matched to the diameter of photocathode yielding excellent time (below 40 ps) and amplitude (below 1 MIP) resolution[3].
Extensive calculations for the response of the V0 and T0 detectors have been performed within the ALICE simulation framework for pp collisions at 900GeV and 14TeV using Pythia event generator, and for PbPb collisions at 5.5 TeV using HIJING. It is seen that the detectors can be used for online determination of the longitudinal and transverse vertex positions with good accuracy. The efficiency for minimum bias events has been calculated to be about 80% and 40% for V0 and T0 detectors, respectively with maximum systematic uncertainty of 3%. Expected uncertainty in the luminosity is about 10% for initial running period of LHC and ultimately with known cross sections this number is expected to go down to 5%.

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REACTION PLANE DETERMINATION BY MEANS OF THE ALICE ZERO DEGREE CALORIMETERS

N. De Marco (for the ALICE Collaboration)

INFN - Sezione di Torino,
Torino, 10125, Italy, *demarco@to.infn.it*

A possible way to estimate the reaction plane of the ion-ion collision is to measure the sideward deflection of the spectator neutrons. In the ALICE experiment this kind of measurement can be performed by means of the two neutron zero degree calorimeters (ZN), which are located at opposite sides with respect to the beam intersection point (I.P.). In fact the ZN calorimeters, thanks to their segmentation in four towers, are position sensitive devices. Concerning their localizing capability, a spatial resolution of 3mm has been measured for a 100 GeV/c hadron beam. This performance will be used to reconstruct, event by event, the centroid coordinate of the spectator neutron spot on the ZN front-face, which is sensitive to the directed flow ("bounce off") of spectator neutrons. The measurement of the centroid will therefore allow to reconstruct the 1st-order event plane azimuth. A simulation has been performed in order to estimate the dependence of the event plane resolution on the magnitude of the directed flow v1 of the spectator neutrons and on the neutron multiplicity. In particular, it will be shown that the event plane resolution is not dominated by the smearing on the centroid measurement, but by the smearing due to the transverse lead beam divergence at the I.P.. Finally a possible tool to select events with small lead beam divergence at I.P. is discussed, using the information coming from both the ZN calorimeters.

HEAVY FLAVOUR PHYSICS IN ALICE

M. Masera[a] for the **ALICE Collaboration**[b]

[a]Dipartimento di Fisica Sperimentale, University of Torino and I.N.F.N.,
Via P. Giuria, 1 – 10125 Torino, Italy, *masera@to.infn.it*

[b] *http://aliceinfo.cern.ch/Collaboration/index.html*

With a centre of mass energy of $5.5\,TeV$ per nucleon, Pb–Pb collisions at the CERN Large Hadron Collider (LHC) are expected to provide a copious yield of heavy quarks. Charm and beauty are produced at the early stages of nucleus–nucleus interactions therefore, thanks to their long lifetime on the collision timescale, they are sensitive and powerful probes of the medium formed in the collision.
The barrel tracking detectors of the ALICE apparatus will measure the momentum of the charged particles in the central rapidity range ($\eta < 0.9$) down to low p_T and will provide hadron and electron identification and an accurate measurement of the primary and secondary vertex positions. Muons will be detected by a dedicated spectrometer in the pseudorapidity region $-4 < \eta < -2.5$. With this combination of detection techniques, the ALICE experiment will study quarkonia both in the e^+e^- and in the $\mu^+\mu^-$ decay channels. Open heavy flavoured hadrons will be studied in the semileptonic decay channels both at central and forward rapidities. In addition, exclusive reconstruction of selected hadronic decay modes in the barrel acceptance will be feasible for charmed mesons.
After a general overview of the ALICE perspectives for heavy flavour physics, this talk will present some of the several physics analyses which have been developed and tested on data coming from detailed simulations of the apparatus.

Identified particle spectra from HMPID: probing the intermediate momentum region

Levente Molnar for the ALICE-HMPID Collaboration

Istituto Nazionale di Fisica Nucleare, Sezione di Bari, Italy
Res. Inst. Particle & Nucl. Phys., Hungarian Academy of Sciences, Hungary
Levente.Molnar@ba.infn.it

The High-Momentum Particle Identification Detector (HMPID), situated at mid-rapidity in ALICE, is designed to identify $\pi^{\pm}$, $K^{\pm}$, p and $\overline{p}$ in the intermediate momentum region on track-by-track basis. The layout of the HMPID chambers is optimized to study momentum correlations at high momenta. Three sigma separation of $\pi^{\pm}$ and $K^{\pm}$ is achievable up to p $\sim$ 3 GeV/c and for p, $\overline{p}$ up to p $\sim$ 5 GeV/c. The HMPID particle identification can be extended to resonance particles in the hadronic channels, such as $\phi \rightarrow K^+K^-$ or even to nuclei: d, t, He^3 and α via charge-mass separation. Jet quenching, observed in heavy-ion collisions at RHIC, suppresses the high-p_T particle yield and enhances particle production in the $p_T \sim 1-4$ GeV/c window. Furthermore, measured difference in pion and proton production made this region very interesting. Track-by-track particle identification performed by HMPID becomes essential to investigate this momentum region on event-by-event basis. In this talk we present selected physics topics and results on the HMPID performance and capabilities.

Preparation for the alignment of the ALICE Inner Tracking System

S. Moretto[a], **A. Dainese**[b], **A. Jacholkowski**[c], **M. Lunardon**[a], and **A. Rossi**[d]

[a] Università di Padova, Padova, Italy, *moretto@pd.infn.it*

[b] INFN - Laboratori Nazionali di Legnaro, Legnaro (Padova), Italy

[c] Università di Catania, Italy

[d] Università di Trieste, Italy

The ALICE experiment [1] at the LHC is dedicated to the study of the state of strongly-interacting matter at high energy density, which is expected to be produced in Pb–Pb collisions at $\sqrt{s_{\rm NN}} = 5.5$ TeV. The main track reconstruction devices in the ALICE central barrel are the large Time Projection Chamber (TPC) and the Inner Tracking System (ITS). The latter provides the high-precision vertexing capabilities that will allow ALICE to carry out a rich heavy-flavour physics program [2]. The ITS consists of six cylindrical layers of silicon detectors with three different technologies: pixels in the two innermost layers (SPD), drift detectors in the two intermediate layers (SDD), and strips in the two outer ones (SSD). Any electronic/silicon tracking system can be considered as an assembly of several separate modules, whose positions are displaced, with respect to the ideal case, during the assembly and the integration of the different detector components [3-4]. These displacements, if not known, will degrade the tracking performance of the detector, thus the physics performance. Therefore, it is mandatory to "align" the detector, that is, to measure the displacements and deformations, so that they can be properly taken into account during track reconstruction. In this contribution we present the status of the preparation for the ITS alignment using measured charged tracks. The target precision for the alignment procedures are set by asking that the overall effect of residual unknown misalignments should not significantly degrade the resolutions. As an example, for the pixel detectors, whose position resolution is about 12 μm in the most precise direction, a residual misalignment not larger than 10 μm can be tolerated. The task of aligning the ALICE ITS is particularly challenging also due to the very large number of degrees of freedom, which are almost 13,000. The ITS alignment procedure will use tracks from cosmic-ray muons (data taking will start in February 2008), and tracks from pp collisions that will be collected later in the year. Two independent methods, based on tracks-to-measured-points residuals minimization, are being prepared. The first method uses the Millepede approach [5], where a global fit to all residuals is performed, extracting all the misalignment parameters simultaneously. The second method performs a (local) minimization for each single module and accounts for module correlations by iterating the procedure until convergence is reached. An overview of the application of these two methods will be presented, along with the results obtained from simulation studies.

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CBM at FAIR - Self-Triggered Front-End Electronics and Challenges for Data Acquisition and Event Selection Systems

Walter F.J. Müller[a] for the CBM Collaboration

[a]Gesellschaft für Schwerionenforschung mbH,
D-64291 Darmstadt, Germany, *W.F.J.Mueller@gsi.de*

The 'Compressed Baryonic Matter' (CBM) experiment at the new 'Facility for Antiproton and Ion Research' (FAIR) in Darmstadt is designed to study the properties of highly compressed baryonic matter produced in nucleus-nucleus collisions in the 10 to 45 A GeV energy range. One of the key observables is hidden (J/Ψ) and open (D^0, $D^{\pm}$) charm production. To achieve an adequate sensitivity interaction rates of up to 10^7 events/second are required, resulting in major technological challenges for the detectors, front-end electronics and data processing.
The selection of open charm candidate events is based on the detection of displaced vertices. This requires a track reconstruction of the full event already in the first event selection stage, which is not feasible within the typical first level trigger latency requirements of conventional triggered data acquisition systems. CBM is therefore based on self-triggered front-end electronics, which autonomously detects all particle hits and sends the hit parameters together with a precise absolute time-stamp to a network of feature extraction and event selection stages.
The CBM FEE, DAQ and event selection concept and recent progress in the development of self-triggered front-end electronics, high-bandwidth data acquisition and event building systems as well as fast track reconstruction algorithms will be presented.

Results of the commissioning of the SSD of ALICE

G.J.L. Nooren[a] and **M. Bregant**[b] for the ALICE collaboration

[a]Department of Physics, Utrecht University
P.O.B 80000 3508 TA Utrecht, the Netherlands, *nooren@nikhef.nl*

[b] Dipartimento di Fisica, Università di Trieste, and INFN Trieste
Trieste, 34127, Italy, *marco.bregant@ts.infn.it*

The Silicon Strip Detector (SSD) forms the two outermost layers of the ALICE Inner Tracking System (ITS), connecting the TPC with the inner layers of the ITS. The SSD consists of 1698 double-sided silicon microstrip modules, 96 μm pitch, distributed in two cylindrical barrels, whose radii are 38 cm and 43 cm, respectively. With 4.8 square meters this is today's largest installed double-sided stripdetector. The SSD is presently being commissioned. The first commissioning results will be presented. All the SSD channels have been characterised based on their noise. Although the overall noise increased a bit at each assembly step, the biascurrents of the installed sensors are not significantly different from the bare sensors. The stability over several weeks of the most important parameters has been studied on prototypes and parts of the assembled detector. Preliminary results coming from the first cosmics run, which allows a reliable assessment of the gain and signal-to-noise ratio of the detector will be presented. The occurrence of the different kind of defects (dead channels) and their effects on the detector performance will be discussed.

STAR Physics Program and Technical Challenges with the RHIC Energy Scan with Au+Au Collisions

G. Odyniec[a] for the STAR Collaboration

[a]Lawrence Berkeley National Laboratory,
Berkeley, California, 94720, USA, *G_Odyniec@lbl.gov*

The future STAR physics program includes a Au+Au energy scan extending to low $\sqrt{s_{NN}}$. Among other things, this energy scan will provide a unique opportunity to search for the QCD phase boundary and a key landmark, a possible critical point, in the phase diagram. Due to its large uniform acceptance and (with the addition of the TOF barrel) excellent PID, by the time of Run 10 (in 2010) STAR will be uniquely positioned to cover this physics in unprecedented depth and detail, as well as other novel physics possibilities. Running at very low energies poses major new challenges for accelerator experts at RHIC and for physicists preparing for data taking. We report on the status of work to address challenges faced by STAR collaboration (e.g. triggering and beam rejection capabilities, reaction plane determination, effects of PID contamination on physics observables), including selected results from tests of low energy RHIC runs with Au (in 2001 and 2007) and Cu (in 2004).

Determination of Pb-Pb Event Centrality Using the CASTOR and HF Calorimeters in CMS

Sertac Ozturk[1]
on behalf of the CMS collaboration

[1] *Cukurova University, Physics Department, Adana, 01330, Turkey*

The Compact Muon Solenoid (CMS) experiment at the LHC is a general purpose detector designed to investigate the physics at the TeV scale. Although the main goal of the CMS experiment is the search of "new physics" phenomena (Higgs boson, beyond Standard Model signals, etc), the HF and CASTOR calorimeters provide CMS with a large calorimetric

coverage in the forward direction, which provides excellent detector capabilities for heavy-ion studies. The measurement of the impact parameter, b, or centrality of a heavy ion collision is essential to characterize the events, because many phenomena in heavy-ion collisions depend crucially on the amount of overlap between the colliding ions. The monotonic correlation between the transverse energy deposited in the forward detectors and b makes possible a measurement of the impact parameter with a resolution of about 1 fm. We will present generator-level studies of the capabilities of the HF and CASTOR calorimeters to determine the centrality of the events in Pb-Pb collisions at $\sqrt{s} = 5.5$ TeV collisions, in CMS.

The ALICE Electromagnetic Calorimeter

Peter Jacobs[a] for the **ALICE Collaboration**

[a]Lawrence Berkeley National Laboratory
Berkeley, California, USA 94720
pmjacobs@lbl.gov

A large electromagnetic calorimeter (EMCal) is under construction as an upgrade to the ALICE experiment at the LHC. The EMCal will extend the photon, electron, and jet measurement capabilities of ALICE by providing electromagnetic calorimetry over 110 degrees of azimuth and $|\eta| < 0.7$. The EMCal is a Shashlik-type lead/scintillator sampling calorimeter with 12672 projective towers, read out via avalanche photodiodes. The readout electronics provide 14-bit effective dynamic range, with the capability to trigger rapidly on both individual showers and large jet-like regions of energy deposition. The physics scope and capabilities of the EMCal will be discussed, together with performance results obtained in test beam measurements.

Measurement of Photon Multiplicity at Forward Rapidity in ALICE

M.M. Aggarwal[1], Z. Ahammed[2], S.K.Badyal[3], R. Bala[3], A. Bhasin[3], P. Bhaskar[2], A. Bhati[1], S. Chattopadhyay[2], T.K. Das[2], A.K. Dash[4], A.K. Dubey[2], M.R. Dutta Majumdar[2], M.S. Ganti[2], P. Ghosh[2], A. Gupta[3], R. Gupta[3], C. Jena[4], L. Kumar[1], A. Mahajan[3], S. Mahajan[3], D.P. Mahapatra[4], L.K. Mangotra[3], B. Mohanty[2], M.M. Mondal[2], N. Mondal[2], B.K. Nandi[5], S.K.Nayak[3], T.K. Nayak[2], S.K. Pal[2], S.C. Phatak[4], B.V.K.S. Potukuchi[3], S.K. Prasad[2], P. Pujahari[5], R. Raniwala[6], S. Raniwala[6], P.K. Sahu[4], J. Saini[2], S. Sambyal[3], S. Sharma[3], R.N. Singaraju[2], V. Singhal[2], B. Sinha[2], M.D. Trivedi[2], R. Varma[5], Y.P. Viyogi[4]
1. Panjab University, Chandigarh, 2. Variable Energy Cyclotron Centre, Kolkata, 3. Jammu University, Jammu, 4. Institute of Physics Bhubaneswar, 5. IIT-Bombay, Mumbai, 6. University of Rajasthan, Jaipur.

(For the ALICE Collaboration)

The ALICE experiment is designed for the dedicated study of the physics of strongly interacting matter and quark-gluon plasma at LHC energies. The experiment consists of several detector systems to achieve specific physics goals [1]. The multiplicity and spatial distribution of photons in the forward region ($2.3 \leq \eta \leq 3.7$) will be measured by the Photon Multiplicity Detector (PMD). The photon measurements along with those of charged particles from the Forward Multiplicity Detector will provide vital information on limiting fragmentation, the equation of state of matter from the determination of elliptic flow, order of phase transition and the formation of disoriented chiral condensates using multiplicity fluctuations.

The PMD [2] is a preshower detector, where a three radiation length thick lead converter is sandwiched between two planes of highly granular gas proportional counters. The information from the detector plane, placed towards the interaction point is used to veto the charged particles, whereas the preshower data from the other plane is used for photon identification. The PMD consists of 221184 honeycomb shaped proportional counters, each of 0.25cm^2 area. The front-end electronics consists of MANAS (Multiplexed ANAlog Signal) chips [3] for anode signal processing and the Cluster Read Out Concentrator Unit System (CROCUS) [3]. The PMD modules have been tested using the pion and electron beams from 1 GeV to 6 GeV. A conversion relation of the calculated energy loss and corresponding measured values has been obtained for calibrating the response of the detector.
The performance of the PMD has been studied extensively using event generators and GEANT simulation package. Major steps in the simulation process consist of generation of hits, clustering and discrimination of charged particles to photons. The output of reconstruction is written as the Event Summary Data (ESD). The ESD consists of details of the constructed hits in both planes of the PMD. The efficiency and purity of photon counting in the PMD have been found be around 54% and 65%, respectively.
Detailed physics simulations are in progress using the photon and charged particle information in the forward rapidity regions for both p-p and heavy-ion collisions. Readiness of the PMD for the day-1 physics at the LHC and results of physics simulations will be presented.

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Very high momentum particle identification at the LHC

Guy Paić[1] for the VHMPID Collaboration
Instituto de Ciencias Nucleares, Universidad Nacional Autónoma de México
Guy.Paic@cern.ch

A. Agócs[3], R. Alfaro[4], G. Barnaföldi[3], L. Boldizsár[3], E. Cuautle[1], G. De Cataldo[2], D. Di Bari[2], A. Di Mauro[6], Z. Fodor[3], E. Futó[3], E. Garcia[5,1], G. Hamar[3], P. Lévai[3], P. Martinengo[6], A. Mastroserio[2], L. Molnár[2,3], E. Nappi[2],A. Ortiz[1], C. Pastore[2], D. Perrino[2], V. Peskov[1], F. Piuz[6], P. Podesta[1], L. Serkin[1], I. Sgura[2], N. Smirnov[7], D. Varga[3], G. Volpe[2]

[1]Instituto de Ciencias Nucleares, Universidad Nacional Autónoma de México
[2]Dipartimento di Fisica dell'Universit and Sezione INFN
[3]MTA KFKI RMKI Research Institute for Particle and Nuclear Physics
[4]Instituto de Física, Universidad Nacional Autónoma de México
[5]University of Illinois, Chicago
[6]CERN
[7]Yale University

The anomalies observed at RHIC for the baryon meson ratios have prompted a number of theoretical works on the nature of the hadrochemistry in the hadronisation stage of the pp collisions and in the evolution of the dense system formed in heavy ion collisions. Although the predictions differ in the theoretical approach, generally a substantial increase in the baryon production is predicted in the range 10-30 GeV/c [1] and [2]. This raises the problem of baryon identification to much higher momenta than originally planned in the LHC experiments. After a review of the present status of theoretical predictions we will present the possibilities of a gas ring imaging Cherenkov detector of limited acceptance which would be able to identify track-by-track protons until 30 GeV/c. The physics capabilities of such a detector in conjunction with the ALICE experiment will be contemplated as well as the triggering options to enrich the sample of interesting events with a dedicated trigger or/and using the planned Electromagnetic Calorimeter (EMCAL). The use of the EMCAL opens interesting possibility to distinguish quark and gluon jets in gamma - jet events and subsequently the study of the probability of fragmentation in pion, kaon or proton or triggering on jets in the EMCAL. The possibilities of such detector would be detection of pions until 16 GeV/c kaons from 9 till 16 GeV/c and protons from 15 till 30 GeV/c in a positive way. Additionally identification of protons by absence of signal is possible from 9-15 GeV/c. The various alternatives for the photon detectors and radiator gases will be discussed.

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Data Acquisition and Triggering in the PHENIX Experiment at RHIC

Martin L. Purschke[a], for the PHENIX Collaboration

[a]Physics Department, Brookhaven National Laboratory
Upton, NY 11973, USA, *purschke@bnl.gov*

The PHENIX trigger and data acquisition system has now been operated with several new detectors at event assembly rates above 5 KHz of minimum bias Au+Au collisions with events of about 120 Kbyte for a recording rate above 600 Mbyte/sec. This has made it possible to accumulate an integrated luminosity of about $800\mu\text{b}^{-1}$ in Run 7, with a total of about 5×10^9 events recorded with livetime above 90%. The data acquisition system will be described, with emphasis on the techniques used to achieve high event assembly rates with good livetime. Future upgrades to acquire data from several new detectors and higher luminosity will be discussed.

Prototype Performance of Novel Muon Telescope Detector at STAR

Lijuan Ruan (for the STAR Collaboration)

Physics Department, Brookhaven National Laboratory,
Upton, New York, NY 11973, USA *ruan@bnl.gov*

A large area of muon telescope detector is proposed to measure muons of momentum at a few GeV/c at mid-rapidity, allowing for the detection of di-muon pairs from QGP thermal radiation, quarkonia, light vector mesons, possible correlations of quarks and gluons as resonances in QGP, and Drell-Yan production as well as the measurement of heavy flavor hadrons through their semi-leptonic decays into single muons.
The R&D research has been carried out for this large area Muon Telescope Detector (MTD). The multi-gap resistive plate chamber technology with large module, long strips and two-end readout (Long-MRPC) was used for this research. The results from cosmic ray and beam test will be presented to address intrinsic timing and spatial resolution for Long-MRPC. Besides, a single prototype of MTD was installed in STAR during the 200 GeV Au+Au run in spring 2007. The detector consists of a long-MRPC layer between two layers of scintillator planes. They are placed outside of the magnet yoke that serves as hadron absorber. We will present results from this prototype run. Muon identification capability, timing and spatial resolution will be reported. We also discuss the implication of these tests on the physics performance and capabilities of full scale detector.

High Voltage characteristic of large area Cathode Pad Chambers for Muon Spectrometer of ALICE

M. Danish Azmi[b], **S. Bose**[a], **S. Chattopadhyay**[a], **D. Das**[a],**M. Irfan**[b] **S. Das**[a] **I.A. Khan**[b], **S. Pal**[a], **L. Das**[a], **T. Sinha**[a] and **B.C. Sinha**[a]

[a] High Energy Physics Divison, Saha Institute of Nuclear Physics, Kolkata, West Bengal, 700 064, India, *tinku.sinha@saha.ac.in*

[b] Physics Department, Aligarh Muslim University, Aligarh, Uttar Pradesh, 202002, India, *danish.azmi@saha.ac.in*

Large area Cathode Pad Chambers (CPC) with inner and outer radii of 23.7 cm and 117 cm respectively have been fabricated and tested for 2nd Tracking station of Muon Spectrometer of ALICE.

The active area of this detector has a radiation length of less than 2 % and the frames are fabricated with Peek GF-30. The anode wire plane consists of 474 anode wires of which 53 % have lengths greater than 1 meter. The separation between the wire plane and the grounded cathode plane is 2.5 mm. The high voltage behaviour of the chamber have been tested under two situations.

- With no support below the wires to reduce sagging of long wires.
- With a G10 strip-support whose dimension is 950 mm x 2 mm x 2.4 mm.

The High Voltage (HV) tests show that a better stability is achieved when the strip support is implemented. Therefore this solution has been adopted for operation in ALICE.

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STUDY OF QUARKONIUM POLARIZATION IN THE MUON CHANNEL AT ALICE

E. Scomparin[a], **for the ALICE Collaboration**

[a]INFN Torino, Italy
Via P.Giuria 1, I-10125 Torino (Italy), *scomparin@to.infn.it*

The study of quarkonium polarization at hadron colliders represents an important test of the production models. Recent results, obtained at CDF, are in striking disagreement with NRQCD predictions, although such a model correctly reproduces the production cross sections. Furthermore, in nucleus-nucleus collisions, the observed degree of polarization may be related to the characteristics of deconfined matter. Because of these interesting features, quarkonium polarization will surely represent an interesting observable at LHC energies. In ALICE, the polarization of the ψ and Υ states can be measured in the dilepton channel, both in the central barrel and in the forward ($2.5< y <4$) muon arm. In this talk, we present the results of a feasibility study, relative to the muon channel, concerning p-p and Pb-Pb collisions. In particular we will show the expected performance for the measurement of J/ψ and Υ polarization both as a function of transverse momentum and centrality.

B-meson measurement via secondary J/ψ production in Pb-Pb collisions at $\sqrt{s}_{NN} = 5.5$ TeV in CMS

Ji Hyun Kim[1] **and P. Shukla**[2]
on behalf of the CMS collaboration

[1] Department of Physics, Korea University
1, 5-Ka, Anam-dong, Sungbuk-ku, Seoul 136-701, Korea
ji.hyun.kim@cern.ch

[2] Nuclear Physics Division, Bhabha Atomic Research Centre,
Trombay, Mumbai 400 085, India
pshukla@barc.gov.in

The production of heavy quarks in heavy-ion collisions is important because they are expected to give information about high-density QCD matter. The heavy quarks lose energy in dense medium and the recent experimental data from RHIC have shown that the c quarks lose their energy as much as light quarks. Because of the unprecedented high beam energies at the LHC, the cross sections of charm and bottom production at LHC would be at least one order of magnitude larger than those at RHIC. As a result, one can expect more precise systematic studies of the energy loss phenomena of heavy flavours for the first time. One interesting aspect at LHC is secondary J/ψ coming from the decays of B-mesons with branching ratio 1.16 %. The J/ψ from B decays can be separated from the primary J/ψ (produced at collision vertex) using the secondary vertex which can be efficiently reconstructed with the CMS trackers. According to estimates by leading order pQCD calculations, about 13000 dimuons decayed from secondary J/ψ can be expected under the kinematical cuts of $p_{\mathrm{T}}^{\mu} > 5$ GeV/c and $|\eta^{\mu}| < 2.4$, in one month of PbPb run in CMS. This work presents the simula-

tions of the reconstruction of secondary J/ψ through displaced dimuons. The CMS detector acceptance, reconstruction efficiency, secondary vertex reconstruction efficiency and Level-1 and Level-2 trigger efficiencies to this process will be given. A comparison will be made to the primary J/ψ results and the effect of the CMS efficiencies on the ratio of secondary to primary J/ψ will be calculated.

MEASURING CHARM AND BOTTOM USING THE PHENIX SILICON VERTEX DETECTORS

Hubert van Hecke for the PHENIX Collaboration

Los Alamos National Laboratory,
Los Alamos, NM 87454, USA, *hubert@lanl.gov*

The PHENIX experiment at RHIC has embarked on a broad range of upgrades to enhance its physics reach. One of the upgrades consists of a set of Silicon vertex trackers that combine to cover the pseudorapidity range -2.4 to 2.4. The primary physics goals of the vertex detectors are to study the properties of the QGP using heavy quarks, and to better understand the spin structure of the proton. This is accomplished by providing precision tracking and reconstruction of the primary vertex, and the recognition of secondary decay vertices, in all collision systems. This capability will enhance the heavy-quark signal and greatly reduce backgrounds. The vertex devices will consist of a 4-layer barrel section matching the acceptance of the PHENIX central rapidity detectors, and two 4-disk endcap sections matching the PHENIX muon arms. A description of the vertex detectors and some of their physics capabilities will be given, as well as technology choices and results from prototype components.

Physics Capabilities for the ATLAS Zero Degree Calorimeter

F. Videbæk [a] for the ATLAS Collaboration

[a]Brookhaven National Laboratory
Upton, NY 11973, USA *videbaek@bnl.gov*

A set of Zero Degree Calorimeters (ZDCs) are being constructed for ATLAS. They are compact calorimeters situated at zero degrees to the incident beam 140 m downstream from the central ATLAS detector capable of observing forward going neutral particles produced in heavy ion, pA, and pp collisions.
The primary role of the ZDC in Pb-Pb collisions is for the event characterization / centrality selection by determining the number of spectator neutrons, as has been demonstrated succesfully at RHIC, in establishing both a primary minimum bias trigger, and centrality determinations in connection with central rapidity measurements of particle multiplicity or transverse energy.
A secondary, but important, role is to provide a tag for a wide variety of ultra-peripheral collisons (UPC)in HI collisions such as hard photo-production and vector meson production opening a window to clean fundamental measurements.

We will present the design of the modules, the status of construction and installation, and results from test beam measurements of the modules. Examples of the physics performance in HI collisions will be shown. A discussion of the QCD regimes that can be studied in UPC HI collisions will be presented with examples of Upsilon production and coherent production of light vector mesons.

The PHENIX Fast Muon Trigger Upgrade Project

Young Jin Kim[a] for the PHENIX Collaboration

[a]University of Illinois at Urbana-Champaign,
Urbana, Illinois, 61801, United State, *yjkim97@uiuc.edu*

The origin of the proton spin is poorly understood and remains a pressing issues in Quantum Chromodynamics (QCD). The use of parity violating W-production in polarized proton-proton collisions at the Relativistic Heavy Ion Collider (RHIC) at Brookhaven National Laboratory (BNL) was proposed to measure the flavor separated quark and anti-quark helicity distributions of the proton [1]. This requires an upgrade of the first level muon trigger in PHENIX. The upgrade consists of fast dedicated trigger tracking stations using double-gap Resistive Plate Chambers (RPCs) based on the CMS end-cap RPC technology and a modification of the muon tracker Front End Electronics (FEEs) to provide fast signals for the trigger. The upgraded muon trigger will provide a first level trigger rejection factor of 10000 for high rate polarized proton-proton collisions at $\sqrt{s} = 500$ GeV sufficient for the proposed physics [2]. In this paper we summarize the physics motivation of the upgrade, review PHENIX muon trigger R&D, present the status of PHENIX fast muon trigger, and discuss simulation results.

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Z^0+jet, Reference Channel for Energy Loss in Heavy-Ions Collisions at the LHC

Camelia Mironov [1], Gerd J. Kunde [1]
on behalf of the CMS collaboration

[1] *Los Alamos National Laboratory, P.O. Box 1663, Los Alamos, NM 87545*

Abstract

The Large Hadron Collider (LHC) opens a new era for our understanding of matter under extreme conditions. In PbPb collisions at $\sqrt{s_{NN}} = 5.5$ TeV, high rates for old probes and totally new probes will become available to scan the Quark Gluon Plasma properties. We present studies of a — first time possible — tagged jet measurement in heavy-ion collisions, the leptonic decay of a high transverse momentum Z^0 in association with a hadron jet. The channel is a powerful one, in view of the fact that there is a

momentum balance between the dilepton (whose energy is not modified by the medium) and the jet (which does suffer energy loss in the medium). This makes the Z^0+jet measurement an excellent reference measurement for partonic energy loss studies.

We use the experimental technique of angular and momentum correlations to isolate the tagged jet. After extracting the jet properties and comparing the result with theoretical models, the analysis sheds light on the properties of the medium traversed (e.g. density) and parton fragmentation functions.

Fully simulated studies, for both pp and PbPb systems, will be shown to illustrate the feasibility of this measurement with the CMS detector at the LHC.

Z^0 BOSON MEASUREMENT WITH THE ALICE CENTRAL BARREL

R. Bailhache for the ALICE Collaboration

Gesellschaft fuer Schwerionenforschung, Darmstadt, 64291, Germany,*r.bailhache@gsi.de*

The ALICE experiment at the LHC will study the properties of strongly interacting matter at the highest energy densities produced in laboratory. With comprehensive measurements of all hadrons, as well as of photons, the ALICE experiment will contribute in a crucial way to the characterization of the new phase of matter, the quark-gluon plasma (QGP), expected to be produced in PbPb collisions at $\sqrt{s_{NN}}$=5.5 TeV. The study of proton-proton collisions at $\sqrt{s}$=14 TeV will address physics questions and will provide reference distributions against which the PbPb observables could be interpreted. We present a study on the detection capability of the ALICE central barrel for the Z0 boson. The measurement of Z0 carries physics potential in its own, both for pp [1] and PbPb [2] collisions. As negligible modifications of its properties are expected in QGP [2] and as it is only weakly sensitive to shadowing [3], the Z0 signal can as well serve as reference for the transverse momentum (pt) calibration and resolution, which will be crucial for many high-pt studies like jets. The study of Z0-tagged jets is in important physics topics. The Z0 signal can also be used to estimate the electron-hadron identification capability of the detector in the pt range 25-60 GeV/c. Moreover, Z0 can be an useful reference signal for the study of quarkonia production in PbPb collisions. For the present study the Z0 and W production cross sections have been extrapolated with PYTHIA from measurements at lower energies and compared with NNLO calculations [1]. For 109 minimum-bias pp collisions (σ_{mb} = 80 mb) expected to be acquired in 1 year of data taking with ALICE, the expected number of produced Z0s in the channel e^+e^- (BR=3.36%) is only about 30. The total acceptance of the signal (geometrical acceptance —η—¡0.9, tracking efficiency and PID) is about 5%. Employing in the ALICE high-level trigger system the condition pt ¿20 GeV/c would allow us to reconstruct about 300 Z0s. To evaluate the background, because of the extremely small signal, a fast simulation program is used to parametrize the response of the detectors based on complete propagation and reconstruction of particles in the ALICE central barrel [4]. The background coming from semi-electronic W decay with an additional misidentified pion is found to be negligible. However, misidentified pions produced in hard processes lead to a signal-to-background ratio of about 1/10. In central PbPb collisions, with trigger, about 15000 Z0s are expected to be detected in the central barrel in one year (2-10^8 events for 10% centrality). Assuming that the background from misidentified pions scales with the number of participants, leads to a signal-to-background ratio of about 0.6 in PbPb collisions.

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b-jet tagging in Pb-Pb collisions at 5.5 TeV

Gopika Sood[1]
on behalf of the CMS collaboration

[1] *Physics Department, Korea University, Anam-Dong, Sungbuk-Ku, Seoul, 136-701.*

Abstract

Heavy Ion Collisions at the LHC will open new perspectives in the study of the properties of the Quark Gluon Plasma in the laboratory. In particular, rare heavy quark jets (b-jets) are valuable because the radiative energy loss in a deconfined medium for heavy quarks is expected to be very different from light quarks. Therefore, the analysis of the jets initiated by a b-quark provides a crucial tool to understand "jet quenching". The CMS detector, equipped with a Silicon Pixel tracker, high granularity Electromagnetic and Hadronic calorimeters and an excellent muon system is capable of measuring heavy quark jets. In our study we have followed the standard CMS b-tagging analysis procedure, based on impact parameter vertexing information to differentiate b-jets from light flavor ones. The performance of the b-tagging algorithms is investigated for Pb-Pb events. The b-jet tagging efficiency is evaluated as a function of the mistag rate, computed from the light flavor jet efficiency. Detailed results will be presented regarding the p_t and centrality dependence of the production of the b-jets.