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TOPICAL VOLUME

International Europhysics Conference on High Energy Physics

Aachen (Germany) – July 17–23, 2003

Editors: M. Beneke, C. Berger, W. Braunschweig, Y. Kiyo, D. Haidt

The High Energy Physics (HEP) conference of the European Physical Society (EPS) is one of the two most important international conferences of this research field. It is organized every second year in alternation with the International Conference on High Energy and Particle Physics (ICHEP) of the International Union for Pure and Applied Physics (IUPAP). In 2003 the conference (International Europhysics Conference on High Energy PHysics, HEP 2003) was held in Aachen, Germany on July 17–23. The two most recent previous conferences of this series were held in Budapest 2001 and in Tampere 1999. The conference consisted of poster sessions, parallel sessions and plenary sessions. The first three days (starting Thursday) were reserved for the parallel sessions on 15 different topics with more than 300 invited contributions. After a break reserved for excursions three days of plenary talks followed where the status and the recent progress of elementary particle physics was reviewed by 18 invited speakers. The conference is traditionally also used as a forum for the presentation of the prizes sponsored by the European Physical society. During the opening ceremony the 2003 High Energy Particle Physics Prize of the EPS was awarded to David Gross (UC Santa Barbara), David Politzer (Caltech) and Frank Wilczek (MIT). In addition the prize for Young Particle Physicists was given to Guillaume Unal (LAL Orsay), the Gribov Medal to Nima Arkani-Hamed (Harvard) and the Outreach Prize to Rolf Landua (CERN) and Nicholas Tracas (Athens).

The conference was organized by the High Energy and Particle Physics Divison of the European Physical Society and it was supported by the Human Potential Programme of the European Commission, the University of Aachen (RWTH Aachen, where "RWTH" stands for Rheinisch Westfälische Technische Hochschule), the Friends of the University (Pro RWTH) and the Department of Physics at the University of Aachen.

The EPS Conference at Aachen received more than 1400 abstracts. After a severe selection a small number was accepted for a direct presentation during the parallel sessions. In many cases the convenors asked for a mini review covering several abstracts. This procedure ended up in about 320 contributions to the parallel sessions. The write-ups of these contributions are published in this Topical Volume. In addition it contains also the 20 reports given by the plenary speakers, which reviewed their field including the achievements of the parallel sessions.

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The road ahead

S. Willenbrock

PACS: 13.85.-t

Abstract. I describe the surrounding landscape on the road to the CERN Large Hadron Collider. I revisit the milestones of hadron-collider physics, and from them draw lessons for the future. I recall the primary motivation for the journey – understanding the mechanism of electroweak symmetry breaking – and speculate that even greater discoveries may await us. I review the physics that we know beyond the standard model – dark matter, dark energy, and neutrino masses – and discuss the status of grand-unified theories. I list the reasons why the Higgs boson is central to the standard model as well as to physics beyond the standard model.

Eur Phys J C 34, s01, s11–s15 (2004)
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Status of the Large Hadron Collider (LHC)

Lyndon R. Evans

Abstract. The Large Hadron Collider (LHC), due to be commissioned in 2007, will provide particle physics with the first laboratory tool to access the energy frontier above 1 TeV. In order to achieve this, protons must be accelerated and stored at 7 TeV, colliding with an unprecedented luminosity of 10^{34} cm^{-2} s^{-1} The 8.3 Tesla guide field is obtained using conventional NbTi technology cooled to below the lambda point of helium. The machine is now well into its installation phase, with first beam injection foreseen for spring 2007. A brief status report is given and future prospects are discussed.

Index Terms: accelerators, cryogenics, superconductors.

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CMS Status

M. Della Negra
(As spokesperson of the CMS Collaboration)

Abstract. The status of the construction and installation of CMS is reviewed. All big mechanical pieces have been assembled in the surface hall SX5 (except the 2^{nd} hadronic endcap calorimeter, HE+1, to be assembled this autumn). Full test of the magnet on the surface will start in March 2005. Waiting for the underground caverns to be ready, installation and commissioning of the hadron calorimeter and of the muon system has started in SX5. The assembly sequence followed by CMS (v33) is based on the completion of the full CMS detector, minus the staged items (ME4/1 and ME4/2, some RPC chambers at low angles, 50% DAQ online farm, 3^{rd} forward pixel disks), in time for physics in mid-2007.

Eur Phys J C 34, s01, s29–s37 (2004)
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ATLAS overview

Marzio Nessi (On behalf of the ATLAS Collaboration)

Abstract. ATLAS STATUS REPORT of the construction work, including for the first time a report on the ongoing underground installation work. The status of all major subsystems is being presented. Particular emphasis is given to ongoing work for final assembly and integration ready for installation in the cavern.

Eur Phys J C 34, s01, s39–s48 (2004)
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The startup of Run II: Status of Tevatron, CDF, and DØ

Jianming Qian (For the CDF and DØ Collaborations)

PACS: 13.85.Lg – 14.54.Ha – 14.70.-e – 14.80.-j

Abstract. I briefly summarize the current status of Tevatron Run II, and highlight a few preliminary results from the CDF and DØ experiments.

Eur Phys J C 34, s01, s49–s53 (2004)
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Status of the LHCb experiment

T. Nakada (On behalf of the LHCb collaboration)

PACS: 25.70.Ef – 21.60.Gx – 27.30.+t

Abstract. LHCb is a dedicated experiment to study CP violation and other rare processes in the B meson system at LHC. It is designed to exploit the large sample of B_d and B_s mesons available at LHC by having a trigger system efficient for both leptonic and hadronic final states, particle identification capability over large momentum range and excellent decay time resolution. Recently, the detector has been reoptimized in order to reduce the material budget and to improve the trigger performance. Construction of various detector components is well advancing and the experiment is expected to be ready for data taking from the beginning of the LHC operation.

Eur Phys J C 34, s01, s55–s62 (2004)
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Status of the ALICE experiment

Yves Schutz

PACS: 25.70.Ef – 21.60.Gx – 27.30.+t

Abstract. A status of the ALICE experiment is given. Details on the advancement of the major projects, together with results of recent performance tests are presented.

Eur Phys J C 34, s01, s63–s74 (2004)
Digital Object Identifier (DOI):
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CMS inner tracking

M. Mannelli

Abstract. The CMS Tracker consists of three layers of silicon pixel detectors, surrounded by some 220m^2 of silicon strip sensors. It is designed to operate reliably in a harsh radiation environment for at least a decade, and to provide accurate and robust tracking in a high occupancy situation. We briefly discuss the layout of the CMS Tracker, and the basic design considerations from which it was derived. We then review the status of the project, with a focus on module assembly. Finally, we highlight a few aspects of the expected tracking performance.

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The CMS muon system: Physics performance

S. Lacaprara (On behalf of the CMS Collaboration)

PACS: 25.70.Ef – 21.60.Gx – 27.30.+t

Abstract. The CMS experiment will take data at the CERN LHC starting from 2007. The CMS muon system has been designed to identify, reconstruct and measure muons with high efficiency and accuracy. In this paper the layout of the system and the key features of the detectors are presented. The reconstruction algorithms, in the context of the High Level Trigger, and their performance in terms of resolution, rate reduction and trigger efficiency are also discussed.

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Electromagnetic calorimetry and e/γ performance in CMS

G. Dissertori (On behalf of the CMS ECAL Collaboration)

PACS: CMS ECAL electromagnetic calorimetry crystals

Abstract. The electromagnetic calorimeter of the CMS experiment at LHC will consist of about 76000 Lead Tungstate crystals. Its main purpose is the very precise energy measurement of electrons and photons produced in proton–proton collisions at 14 TeV centre-of-mass energy. A review is given of its main building blocks and its construction status. Then the results of the testbeam campaign in 2002 are discussed. Finally, the overall calibration and reconstruction strategy is outlined.

Eur Phys J C 34, s01, s99–s108 (2004)
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CMS: Hadronic calorimetry, jets, and $\not\!\!E_T$ performance

V. Daniel Elvira, for the CMS Collaboration

PACS: 29.40.Vj – 29.40.Mc – 29.40.Ka

Abstract. The CMS experiment [1] uses a general purpose detector designed for detecting the diverse signatures associated with Higgs production and new physics beyond the Standard Model. These processes are typically associated with final states containing a large missing transverse energy and several high energy jets. Here, we present a description and status report of the construction and testing of the CMS hadronic calorimeter system, as well as its ability to measure jets and $\not\!\!E_T$.

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The ATLAS inner detector and flavour tagging performance

R. Hawkings (On behalf of the ATLAS Collaboration)

Abstract. The design of the ATLAS inner detector is described, paying particular attention to recent design changes and their impact on performance. The status of construction is briefly discussed, followed by calibration and alignment issues and a summary of current flavour tagging studies.

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The ATLAS muon spectrometer

L. Pontecorvo (On behalf of the ATLAS Collaboration)

Abstract. This paper presents the Muon Spectrometer of the ATLAS detector. The general characteristics of this system as acceptance, resolution and trigger capabilities are discussed together with the main physics goals and the background conditions. Four different detector technologies are used for triggering and precise tracking in the spectrometer; in the following, a description of the main characteristics of each of them, focusing on test beam results, is presented.

Eur Phys J C 34, s01, s129–s137 (2004)
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ATLAS electromagnetic calorimetry and performance of electron/photon detection

P. Schwemling (On behalf of the ATLAS Collaboration)

Abstract. The design constraints and the target physics performance of the ATLAS Electromagnetic Calorimeter are reviewed, and the construction status is summarized. Test-beam data, covering a large part of the final detector, have been analysed and measurements of several important detector performance estimators are presented. Finally, some aspects of the electron and photon reconstruction and the expected performance of the detector are reviewed.

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Hadronic calorimetry and jet/τ/$\mathbf{E}_T^{miss}$ performance studies in ATLAS

B. Caron (On behalf of the ATLAS Collaboration)

Abstract. Jets, τ jets, and missing transverse energy are important components of the physics expected at the LHC. The accurate measurement of the direction and energy of jets, along with missing energy, impose strong requirements upon the performance of the ATLAS detector system. These requirements and the ATLAS Hadronic Calorimetry system are reviewed. A brief discussion of the jet reconstruction algorithms, jet energy scale calibration, and forward jet tagging is also included. The methods and expected accuracy by which τ jets are reconstructed and identified is covered. The expected E_T^{miss} resolution and minimization of fake high E_T^{miss} tails is presented.

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The CMS trigger system

C. Seez (On behalf of the CMS collaboration)

Abstract. The CMS trigger system must reduce an input data rate from the LHC bunch-crossing frequency of 40 MHz to a rate which will be written to permanent storage. A detailed study has recently been made of the performance of this system. This paper presents key elements of the results obtained and gives details of a draft "trigger table" for the Level-1 Trigger and the High-Level Trigger selection at a "start-up" luminosity of 2×10^{33} cm^{-2}s^{-1}. High efficiencies for most physics objects are attainable with a selection that remains inclusive and avoids detailed topological or other requirements on the event.

Eur Phys J C 34, s01, s161–s172 (2004)
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Early physics reach of CMS

K. Hoepfner (On behalf of the CMS collaboration)

PACS: CMS – Higgs boson – Supersymmetry – 10fb−1 physics

Abstract. When the LHC turns on, CMS will have most of the detector ready, except some (minor) staged items.

The commissioning of the detector and the impact of stageing is discussed. The physics potential of the first physics run, anticipated to provide an integrated luminosity of up to 10fb^{-1}, is demonstrated using examples on Higgs boson and Supersymmetry particle searches.

Eur Phys J C 34, s01, s173–s183 (2004)
Digital Object Identifier (DOI): 10.1140/epjcd/s2004-04-018-6

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The ATLAS trigger system

R. Hauser (On behalf of the ATLAS Collaboration)

PACS: 25.70.Ef – 21.60.Gx – 27.30.+t

Abstract. ATLAS is one of two general-purpose detectors at the next-generation proton–proton collider, the LHC. The high rate of interactions and the large number of read-out channels make the trigger system for ATLAS a challenging task. The initial bunch-crossing rate of 40 MHz has to be reduced to about 200 Hz while preserving the physics signals against a large background. ATLAS uses a three level trigger system, with the first level implemented in custom hardware, while the high level trigger systems are implemented in software on commodity hardware. This note describes the physics motivation, the various selection strategies for different channel and the physical implementation of the trigger system.

Eur Phys J C 34, s01, s185–s195 (2004)
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Early physics reach of the ATLAS detector

Ivor Fleck (On behalf of the ATLAS Collaboration)

PACS: 25.70.Ef – 21.60.Gx – 27.30.+t

Abstract. The first year of data taking at ATLAS should be a very challenging and rewarding time. It will include commissioning of the detector and many interesting physics results. The commissioning of the detector components will mainly rely on physics signals. The staging of some subdetectors will influence the B physics program and result in slightly reduced significances in most physics analyses. The searches for Higgs bosons and supersymmetric particles have been studied in great detail. If a Higgs boson from the Standard Model exists, it will be discovered within the first year. If supersymmetry exists the discovery of at least one light Higgs boson as well as some supersymmetric particles is very probable within the first year of the LHC.

Eur Phys J C 34, s01, s197–s208 (2004)
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Recent results and prospects for high p_T physics at DØ

Cecilia E. Gerber (For the DØ Collaboration)

PACS: 13.85.Lg – 14.54.Ha – 14.70.-e – 14.80.-j

Abstract. I present recent results from the DØ experiment using ≈ 50 pb^{-1} of data recorded at the center of mass energy of 1.96 TeV at the Fermilab Tevatron. In addition, I summarize prospects for high p_T physics at the Tevatron as a function of integrated luminosity.

Eur Phys J C 34, s01, s209–s220 (2004)
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Recent results in high p_T physics from CDF

Gregory F. Veramendi (For the CDF Collaboration)

Abstract. We present the most recent high p_T results from the CDF experiment using $p\overline{p}$ collisions at $\sqrt{s}$ = 1.96 TeV produced at the Tevatron Collider at Fermilab. We will summarize results in electroweak physics, top physics and searches for physics beyond the Standard Model. Many of the measurements of important signals like W boson, Z boson, and the top quark have been reestablished. Taking advantage of the increase in energy and detector upgrades, these measurements are already beginning to be competitive with previous results.

Eur Phys J C 34, s01, s221–s239 (2004)
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Physics reach with CMS at high and super-high luminosities

James W. Rohlf

PACS: 11.30.Pb – 12.38.Qk; 12.60.Fr – 12.60.Fr – 12.60.Jv – 12.60.Rc – 14.60.Cd – 14.60.Ef – 14.60.Fg – 14.65.Fy – 14.65.Ha – 14.80.Bn – 14.80.Cp – 14.80.Ly – 14.70.Fm – 14.70.Hp – 14.70.Pw

Abstract. The physics reach of the Compact Muon Solenoid, under construction to study proton-proton collisions at a centre-of-mass energy of 14 TeV, is presented at design luminosity of 10^{34}cm^{-2}s^{-1} and beyond (10^{35}cm^{-2}s^{-1}). The sensitivity for detection of the standard-model Higgs boson in the channels qqH (W fusion), WH, and tH is discussed with the result that the Higgs boson is observable in multiple decay modes over entire mass range, 0.1-1 TeV/c^2. Higgs boson searches for decays involving taus in the context of the Minimal Supersymmetric Standard Model result in a limit of about 0.6 TeV/c^2 at tanβ=25. Sparticle reconstruction for decays containing leptons and jets results in a squark/gluino mass reach in the range 2.5-3 TeV/c^2. Limits on Kaluza-Klein excitations of the graviton or a new heavy vector boson are in the 5-6 TeV/c^2 range. The scattering of vector bosons at high energy and discovery potential for compositeness is described.

Eur Phys J C 34, s01, s241–s254 (2004)
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Physics potential of ATLAS detector with high luminosity

Bing Zhou (On behalf of the ATLAS Collaboration)

Abstract. The ATLAS detector is designed to exploit the full physics potential in the TeV energy region opened up by the Large Hadron Collider at a center of mass energy of 14 TeV with very high luminosities. The physics performance of the ATLAS detector on Higgs, extra-dimension and strong symmetry breaking scenario is summarized in this note. ATLAS experiment has great discovery potential for these new phenomena with high luminosity. Triple gauge couplings are very sensitive for probing new physics at TeV scale. We show that ATLAS can measure these couplings very precisely with high luminosity.

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The TOTEM experiment

V. Avati, V. Bergholm, V. Boccone, M. Bozzo, M. Buenerd, A. Buzzo, R. Cereseto, S. Cuneo, C. Da Viá, M. Deile, K. Eggert, F. Ferro, J.P. Guillaud, J. Hasi , F. Haug, R. Herzog, P. Jarron, J. Kalliopuska, A. Kiiskinen, K. Kurvinen, A. Kok, W. Kundrat, R. Lauhakangas, M. Lokajichek, D. Macina, M. Macrí, T. Mäki, S. Minutoli, A. Morelli, P. Musico, M. Negri, E. Noschis, F. Oljemark, R. Orava, M. Oriunno, K. Österberg, V.G. Palmieri, K. Protasov, R. Puppo, D. Rebreyend, R. Rudischer, G. Ruggiero, H. Saarikko, A. Santroni, G. Sanguinetti, G. Sette, W. Snoeys, S. Tapprogge, A. Toppinen, A. Verdier, S. Watts, E. Wobst

PACS: 25.70.Ef – 21.60.Gx – 27.30.+t

Abstract. TOTEM will measure the total *pp* cross-section at LHC by using a luminosity independent method based on simultaneous evaluation of the total elastic and inelastic rates. For an extended coverage of the inelastic and diffractive events, two forward tracking telescope are employed. The elastically or diffractively scattered protons are measured by a set of special detectors, which can be moved close to the circulating protons beams. The paper describes the physics reach of the experiment and the detectors which are being considered.

Eur Phys J C 34, s01, s269–s277 (2004)
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Heavy-ion collisions at RHIC

G. Roland

PACS: 24.85.+p – 25.75.Nq

Abstract. In the first three years of running, the four RHIC experiments have collected a rich set of high quality data on nuclear collisions over a wide range in collision energy and system size. The data allow a systematic study of the evolution of the collision system from the initial state to the final freeze-out of hadrons. The measurements show convincingly that in Au+Au collisions at the highest RHIC energies, a dense, interacting medium is formed early on. In this paper, some of the key measurements are described that have revealed the unique and sometimes unexpected properties of this medium.

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Heavy ions at LHC: Theoretical issues

R.J. Fries, B. Müller

PACS: 24.85.+p – 25.75.Nq – 13.85.-t

Abstract. We give a brief overview of our current theoretical understanding of ultra-relativistic heavy ion collision and the properties of super-hot nuclear matter. We focus on several issues that have been discussed in connection with experimental results from the CERN SPS and from the Relativistic Heavy Ion Collider RHIC. We give an extrapolation of our current knowledge to LHC energies and ask which physics questions can be addressed at the LHC.

Eur Phys J C 34, s01, s287–s298 (2004)
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ALICE physics reach

C. Blume (For the ALICE collaboration)

PACS: 12.38.Mh – 25.75.Nq

Abstract. The ALICE experiment at the CERN LHC will be dedicated to the investigation of heavy ion reactions at the highest energies. The main objective is the study of strongly interacting matter under extreme conditions. The performance of the ALICE detector for a variety of observables are discussed. A special emphasis is put on the measurement of hard probes, which will be of high relevance at LHC energies. For all these observables p+p reactions will provide an important baseline measurement, so therefore p+p physics will be an integral part of the ALICE programme.

Eur Phys J C 34, s01, s299–s305 (2004)
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Heavy ion physics with CMS

R.R. Betts

PACS: 25.70.Ef – 21.60.Gx – 27.30.+t

Abstract. The study of ultra-relativistic nuclear collisions with CMS is reviewed. The ability of the detector to function in the resulting high multiplicity environment is demonstrated. Simulated results for some physics signals are presented.

Eur Phys J C 34, s01, s307–s315 (2004)
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Heavy ion physics with the ATLAS detector

H. Takai

PACS: 25.70.Ef – 21.60.Gx – 27.30.+t

Abstract. Recent results from RHIC experiments suggest that a hot and dense QCD matter, which maybe the quark gluon plasma (QGP), is formed in Gold+Gold collisions at a center mass energy of 200 GeV per colliding nucleon pair. The LHC is planning to accelerate heavy nuclei such as Lead at energies of 2.75 TeV/nucleon. At these energies it will be possible to produce a even higher temperature QCD matter. In addition, hard scattering cross sections will increase significantly and they could be used as probes of the QCD matter. RHIC experiments suggest that hard scattered quarks inside the QGP radiate gluons and therefore modify the jet properties such as energy angular distribution. The ATLAS detector with its large acceptance is ideally suited to detect and study jets from nucleus-nucleus collisions. Initial simulation studies show most of the ATLAS detector will perform well in a high multiplicity environment, including inner detector tracking. Jet reconstruction is possible with an energy resolution close to the high luminosity proton-proton run. In this paper we present a summary of our initial round of simulations studies of the ATLAS detector in the heavy ion environment.

Eur Phys J C 34, s01, s317–s323 (2004)
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The ALICE dimuon spectrometer

A. Morsch (On behalf of the ALICE Collaboration)

Abstract. The ALICE forward muon spectrometer has been designed to measure the complete spectrum of heavy quark vector mesons via their muonic decays in pp, proton–nucleus (pA) and nucleus–nucleus (A–A) collisions. Here we present the main design criteria, an overview of the spectrometer and the status and plans of the project.

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Space charge limited avalanche growth in multigap resistive plate chambers

A.N. Akindinov, A. Alici, F. Anselmo, P. Antonioli, Y. Baek, M. Basile, G. Cara Romeo, L. Cifarelli, F. Cindolo, F. Cosenza, A. De Caro, S. De Pasquale, A. Di Bartolomeo, M. Fusco Girard, M. Guida, D. Hatzifotiadou, A.B. Kaidalov, D.W. Kim, D.H. Kim, S.M. Kisselev, G. Laurenti, K. Lee, S.C. Lee, E. Lioublev, M.L. Luvisetto, A. Margotti, A.N. Martemiyanov, R. Nania, F. Noferini, P. Otiougova, F. Pierella, P.A. Polozov, E. Scapparone, G. Scioli, S.B. Sellitto, A.V. Smirnitski, M.M. Tchoumakov, G. Valenti, D. Vicinanza, K.G. Voloshin, M.C.S. Williams, B.V. Zagreev, C. Zampolli, A. Zichichi

PACS: 29.40.Cs – 7.77.-n – 52.80.Dy

Abstract. The ALICE TOF array will be built using the Multigap Resistive Plate Chamber(MRPC) configured as a double stack. Each stack contains 5 gas gaps with width of 250 μm. There has been an intense R&D effort to optimise this new detector to withstand the problems connected with the high level of radiation at the LHC. One

clear outcome of the R&D is that the growth of the gas avalanche is strongly affected by space charge. The effect of the space charge is a decrease in the rate of change in gain with electric field; this allows more stable operation of this detector. We have measured the gain as a function of the electric field and also measured the ratio of the fast charge to the total charge produced in the gas gap. It is well established that RPCs built with 250 μm gas gap have a much superior performance than 2 mm gaps; we discuss and compare the performance of 250 μm gap MRPCs with 2 mm gap RPCs to show the importance of space-charge limitation of avalanche growth.

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Jet physics in ALICE with a proposed electromagnetic calorimeter

T.M. Cormier (On behalf of the ALICE – USA Collaboration: Creighton University, Kent State University, Lawrence Berkeley National Laboratory, Michigan State University, Oak Ridge National Laboratory, Purdue University, The Ohio State University, University of California, Berkeley, University of California, Davis, University of California, Los Angeles, University of Houston, University of Tennessee, Wayne State University)

PACS: 25.75.Dw – 25.75.Gz

Abstract. The high P_T capabilities of the ALICE experiment provided by an additional electromagnetic calorimeter are discussed in light of recent results from RHIC.

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Beauty and charm physics at CDF Run II

M. Bishai (For the CDF II collaboration)

PACS: 13.85.Ni – 13.85.Lg – 13.25.Hw – 12.38.Qk – 13.30.Eg – 12.15.Ff – 12.15.Mm

Abstract. Using the data samples collected with the CDF Run II detector during the year 2002 and early 2003, new measurements of the production cross-sections and the masses, lifetimes and branching fractions of beauty and charm hadrons are presented. New measurements of the Λ_b mass, lifetime, and branching fractions have greatly improved the current knowledge of bottom baryon properties and decay dynamics. The large charm signals made available by the silicon vertex track trigger have enabled the establishment of key measurements using rare charm decays that are sensitive to new physics beyond the Standard Model. The decay signals $B_s \to D_s\pi$ and the two body charmless decays of B^0 and B_s have been established. These decay channels are important milestones towards the measurement of B_s mixing and direct CP violation in the B system.

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B physics at the DØ experiment

G. Borisov

Abstract. First results reveal good capabilities of DØ experiment to study B physics. A new tracking system, high reconstruction rate and efficient trigger allow the selection of many interesting B-hadron decay modes such as semileptonic decays and final states involving J/ψ. This talk presents preliminary measurements of B-hadron properties in these modes, together with future plans and perspectives of B physics in DØ.

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Theoretical issues in *b* physics

J.L. Rosner

PACS: 11.30.Er – 11.30.Hv – 13.25.Hw – 14.40.Nd

Abstract. Examples are given of some current questions in b physics to which LHC experiments may provide answers. These include (i) the precise determination of parameters of the Cabibbo-Kobayashi-Maskawa (CKM) matrix; (ii) measurements of CKM phases using B decays to CP eigenstates; (iii) the search for direct CP asymmetries in B decays; (iv) rare radiative B decays; (v) the study of B_s properties and decays, (vi) excited states of B and B_s mesons, and (vii) the search for heavier quarks which could mix with the b quark.

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The BTeV experiment: Physics and detector

K. Honscheid

Abstract. Exploring the large number of heavy quarks produced at Fermilab's Tevatron collider, the BTeV experiment is designed to make precision measurements of Standard Model parameters and to perform an exhaustive search for physics beyond the Standard Model. In my presentation at LHC2003 I presented some highlights of the BTeV physics program and discussed a few of the many technological challenges the BTeV collaboration faces designing and building the detector

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CMS B physics reach

V. Ciulli (On behalf of CMS Collaboration)

Abstract. At the design luminosity of 10^{34} cm^{-2} s^{-1}, about 10^6 $b\bar{b}$ pairs are expected to be produced every second at the Large Hadron Collider. With such huge statistics and the precise tracking of the CMS detector B mesons can be investigated for CP violation, B_s^0-$\bar{B}_s^0$ mixing and rare decays. The trigger, however, cannot retain all $b\bar{b}$ events for a later selection of exclusive B decays. A dedicated trigger strategy, which uses tracking immediately after the first trigger stage, is presented and results on few important benchmark channels are given.

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ATLAS: B physics reach

M. Smizanska (On behalf of the ATLAS collaboration)

PACS: 25.70.Ef – 21.60.Gx – 27.30.+t

Abstract. The current scope and status of the ATLAS B-physics trigger and of off-line performance studies are presented. From the initial running at low-luminosity at LHC, high-statistics B analyses will allow sensitive tests of possible new physics contributions by searching for additional CP violating effects and for anomalous rates of rare B-decay channels. In the physics of the B_s^0 meson system there is sensitivity to mass and width differences and to a weak mixing phase beyond the Standard Model expectation. ATLAS will also be able to access rare B decays using the high-luminosity running. Measurements of beauty production sensitive to higher order QCD terms will also be made, providing new data to investigate present inconsistencies between theory and experiment.

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Physics reach of the LHCb experiment

M. Musy (On behalf of the LHCb collaboration)

Abstract. The physics prospects of the LHCb experiment are presented here for precision CP violation measurements and rare decays.

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Tracking performance in LHCb

J. van Tilburg (On behalf of the LHCb collaboration)

PACS: 07.05.Kf – 13.25.Hw – 29.40.-n

Abstract. The tracking system of the LHCb detector has been re-optimised to reduce the amount of material which particles traverse. The different subcomponents involved in tracking are described. The track reconstruction algorithms are shown to have a good efficiency for finding tracks with the re-optimised setup. The tracking system is capable of providing the excellent spatial and momentum resolutions which are required for the challenging physics program of LHCb.

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Particle identification with the LHCb experiment

C. Jones

Abstract. The status of the design and construction of the LHCb detector components associated with particle identification is presented in relation to the current re-optimisation of the overall experiment. The methods used to perform particle identification are briefly described and the overall performance is discussed with reference to example decay channels.

Eur Phys J C 34, s01, s411–s417 (2004)
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The LHCb L0 trigger and related detectors

A. Satta (On behalf of the LHCb Collaboration)

PACS: 25.70.Ef – 21.60.Gx – 27.30.+t

Abstract. The LHCb experiment will study CP violation and other rare phenomena using the b-hadrons produced at the LHC. A powerful trigger system is mandatory to select efficiently the b-hadron decays of interest out of the 40 MHz input rate keeping the output rate to an acceptable level for tape storage. The trigger system is divided in three levels. In this document an overview of the first trigger level, L0, and the related detectors is given.

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The LHCb Level-1 Trigger

T. Schietinger

PACS: 25.70.Ef – 21.60.Gx – 27.30.+t

Abstract. The intermediate trigger stage of the LHCb experiment, operating after the initial hardware assortment but before the selection of specific decay channels, is described. Implemented in software, the trigger uses information on track impact parameters and transverse momenta to identify b hadron events. The main components, the decision algorithm and some performance figures are presented.

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LHC physics analysis – Worldwide distribution

N.H. Brook

Abstract. The generic needs and requirements of performing analysis in the LHC era are examined. These requirements are addressed assuming a distributed computing environment such as that offered by Grid technologies. The developments and the tools being evolved in the individual LHC experiments are presented

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LHC accelerator R&D and upgrade scenarios

F. Ruggiero

Abstract. I report the results of a CERN task force set up to investigate a possible staged upgrade of the LHC and of its injectors, with a view to increasing the machine luminosity by an order of magnitude from the nominal $10^{34}\,\mathrm{cm}^{-2}\,\mathrm{s}^{-1}$ to $10^{35}\,\mathrm{cm}^{-2}\,\mathrm{s}^{-1}$. Scenarios for an LHC energy upgrade by nearly a factor two have also been considered. An interesting outcome of these discussions has been a novel approach to the optimization of the collider performance, compatible with the beam-beam limit for high intensity proton bunches or long ‘super-bunches’. I also sketch a new design of the interaction regions, including an alternative beam crossing scheme. To put things in perspective, I first address LHC commissioning scenarios and challenges associated with machine protection and electron cloud effects. Finally I discuss further studies required for an LHC performance upgrade and outline an R&D programme.

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LHC detector upgrade

Dan Green

Abstract. There has already been a study in some depth about the physics reach and the needed upgrades to the LHC experiments, ATLAS and CMS, in the recent past [1]. Subsequently, there were presentations at the CERN ICFA meeting on the accelerator upgrades [2], the detector upgrades [3] and the consequent physics reach [4].

In this note only a brief overview of the detector needs is attempted. If there is a tenfold increase in luminosity (the Super LHC or SLHC). First an example of the increased physics reach using sequential Z bosons is given. The rapidity distribution of heavy states is also illustrated. Then a simple parameterization of the inclusive inelastic, or “minbias”, events is presented.

This model is subsequently used to explore the impact of a tenfold increase in pileup on jet finding and reconstruction at the SLHC. It is also used to estimate the occupancy of tracker elements and the ionization radiation dose sustained by the tracker. Those estimates inform on the shape of possible tracker upgrades for the SLHC and the associated front-end electronics, which must also be upgraded.

The calorimetry of ATLAS and CMS must also be strengthened in order to work at the SLHC. The ATLAS liquid argon and the CMS crystal and scintillator calorimetry are briefly considered. A reduction in forward angular coverage to compensate for the increased radiation field is mentioned. For the muon system a similar reduction in angular coverage would maintain the remainder of the system in a state essentially the same as that for LHC operations. Finally, triggering and data acquisition issues are cursorily discussed.

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LHC Symposium 2003: Summary talk

J.A. Appel

Abstract. This summary talk reviews the LHC 2003 Symposium, focusing on expectations as we prepare to leap over the current energy frontier into new territory. We may learn from what happened in the two most recent examples of leaping into new energy territory. Quite different scenarios appeared in those two cases. In addition, we review the status of the machine and experiments as reported at the Symposium. Finally, I suggest an attitude which may be most appropriate as we look forward to the opportunities anticipated for the first data from the LHC.
