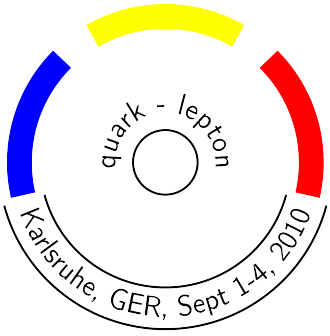
XXX. Symposium on Physics in Collision

Book of Abstracts



Contents

The solar neutrino results of Borexino

Primary Authors: Michael Wurm (TU München)
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Speaker: Michael Wurm (TU München)
on behalf of the Borexino Collaboration

Borexino is the first experiment succeeding in a real-time measurement of solar neutrinos in the sub-MeV energy region. Based on the unprecedented radiopurity of the 300-ton liquid-scintillator target and the surrounding detector materials, and due to the extensive rock shielding provided in the Gran Sasso National Laboratory (LNGS), Borexino has allowed to study neutrinos from various sources during its three-year running time: The present contribution reviews the results on the solar Berillium-7 and Boron-8 neutrino flux measurements along with their impact on neutrino oscillation parameters and the standard solar model. The prospects of a future measurement of CNO/pep neutrinos will be outlined.

The Infrared Behavior of QCD Running Coupling and Hadron Spectrum

Primary Author: Gurjav Ganbold (JINR, Dubna)

Speaker: Gurjav Ganbold (JINR, Dubna)

References: G.Ganbold, Phys. Rev. D79, 034034 (2009)
G.Ganbold, Phys. Rev. D81, 094008 (2010)

The behavior of QCD effective coupling is studied in the low-energy region within a relativistic quantum-field model based on analytical confinement. The spectra of two-quark and two-gluon bound states are defined by using the Bethe-Salpeter equation and compared with conventional meson masses. A new, independent and specific infrared-finite behavior of QCD coupling is revealed below energy scale $\sim 1\,\mathrm{GeV}$. Particularly, an infrared-fixed point is extracted at $\alpha_s(0)/\pi \simeq 0.241$. We provide a new analytic estimate of the lowest-state glueball mass and, as an application, calculate masses of some intermediate and heavy mesons. The model may serve a reasonable framework to describe simultaneously different sectors in low-energy particle physics.

Search for CP-violating charge asymmetry in $B^+ \to J/\psi K^+$ decays

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Speaker: Kazuyuki Sakai (Niigata University, Japan)
on behalf of the Belle Collaboration

We present a result of search for CP-violating charge asymmetry in $B^+ \to J/\psi K^+$ decays using 772×10^6 B anti-B meson pairs collected with the Belle detector at the KEKB asymmetric energy e^+e^- collider.

The result supersedes our previous measurement and represents the most sensitive measurement up to date.

Measurement of the branching fraction of $B^0 \to D^+D^-$ decays

Primary Author: Markus Röhrken (KIT, Karlsruhe)

Speaker: Markus Röhrken (KIT, Karlsruhe)
on behalf of the Belle Collaboration

We report a measurement of the branching fraction of $B^0 \to D^+D^-$ decays. The result is based on a data sample that contains 535×10^6 $B\bar{B}$ pairs collected on the $\Upsilon(4S)$ resonance with the Belle detector at the asymmetric-energy KEKB e^+e^- collider. We obtain $(2.32 \pm 0.25 \pm 0.29) \times 10^{-4}$ for the branching fraction of $B^0 \to D^+D^-$ decays, which is in agreement with previous measurements.

An improved full reconstruction tool utilizing NeuroBayes

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on behalf of the Belle Collaboration

The full reconstruction is an important tool for particle physics at the B factories. By fully reconstructing one of the two B mesons coming from the $\Upsilon(4S)$ resonance (tag side), the 4-momentum of the other B meson (signal side) is immediately known and all remaining tracks in the detector can be associated with this other B meson. The full reconstruction is therefore an important tool for the analysis of semileptonic and other rare B decays including neutrinos, while it can also be used for measuring inclusive branching ratios.

The new full reconstruction tool was developed for the Belle experiment at the KEK-B collider. The program was written from scratch, heavily utilizing the mulitvariate analysis software package NeuroBayes. With the addition of this more sophisticated analysis technique and the addition of several reconstruction channels for the tag side, an improvement in efficiency of more than 100 % could be achieved. Thus, the new full reconstruction enables many analyses to achieve an increase of a factor 2 in their signal sample.

Measurement of W and Z boson production in pp at $\sqrt{s} = 7\,\mathrm{TeV}$ with the ATLAS detector

Primary Authors: Verena Martinez Outschoorn (Harvard University)

Speaker: Verena Martinez Outschoorn (Harvard University)
on behalf of the ATLAS Collaboration

The first measurement of the production cross-sections for W and Z bosons in proton proton interactions at $\sqrt{s} = 7\,\mathrm{TeV}$ are reported from the ATLAS experiment. Based on its excellent capability for reconstructing both high pT electrons and muons, the electron and the muon decay modes of the W/Z bosons are compared. First results for the ratio of W/Z production and of W^+/W^- production will also be described.

Jet production cross-section and jet properties in pp at $\sqrt{s} = 7\,\mathrm{TeV}$ with the ATLAS detector

Primary Authors: Francesc Vives (Universitat Autonoma de Barcelona)

Speaker: Francesc Vives (Universitat Autonoma de Barcelona)
on behalf of the ATLAS Collaboration

Making use of the excellent calorimetry of the ATLAS experiment, measurements of the cross-section for jet production and of jet properties in proton-proton interactions at $\sqrt{s} = 7\,\mathrm{TeV}$ will be presented. The corrected and unfolded inclusive cross-section for high-p_T jets will be described, together with the cross-section as a function of the invariant di-jet mass. Special emphasis will be given to the discussion of the initial understanding of the jet energy scale. Furthermore, the corrected distribution of the angular difference between the two leading jets will be shown, both for the azimuthal as well as for the polar angle. Also studies of the shape of the observed jets will be presented. All results will be compared to theoretical predictions.

Data Driven W^+-jets background estimation for $H \to WW \to ll\nu\nu$ (Higgs)

Primary Authors: Ruslan Asfandiyarov (University of Wisconsin)

Speaker: Ruslan Asfandiyarov (University of Wisconsin)
on behalf of the ATLAS Collaboration

Higgs decay to WW leading to a final state of 2 leptons and missing energy constitutes one of the main Higgs search channels at the LHC. A major background to the signal comes from W^+-jets events with a leptonic decay of the W and a jet faking a lepton. We discuss methods to estimate such a background shape and normalization from real data, with little reliance on Monte Carlo. The rate of the W^+-jets background in the 7 TeV real data is compared with expectations from simulation.

Performance of the ATLAS Trigger Reconstruction for Minimum Bias Events, Jets, and Missing Transverse Energy in pp-collisions at $\sqrt{s} = 7\,\mathrm{TeV}$

Primary Author: Regina Kwee (CERN/HU Berlin)

Speaker: Regina Kwee (CERN/HU Berlin)
on behalf of the ATLAS Collaboration

Since the restart of the LHC, ATLAS has successfully recorded data at $\sqrt{s} = 0.9$ and 7 TeV. The ATLAS trigger strategy realised a step-wise activation of the three level trigger system, starting with hardware-based first-level (L1) triggers and moving with increasing luminosities to the deployment of the software-based high-level triggers (HLT). We will present L1 and HLT triggers and their performance on 7 TeV collision data, whose use case range from the measuremens of inelastic charged particle spectra to new physics searches. We will focus on triggers selecting inelastic *pp*-collsions (minimum bias), missing transverse energies (missing E_T), jets and bjets. Different minimum bias triggers based of central tracking and forward detector components, their efficiencies as well as possible biases are presented. We highlight missing E_T triggers, which require the magnitude of the vector sum of all transverse energies to exceed some threshold. While look-up-tables allow fast trigger decisions at L1, the full calorimeter signal is accessed at HLT to make a more precise estimate on missing E_T. We also outline the performance of various jet triggers, showing results for inclusive, dijet, and multijet efficiencies at L1 and HLT. Furthermore, results on the performance of bjet trigger algorithms are presented, allowing for B-meson identification at HLT.

The ALICE Silicon Strip Detector performances during the first LHC data taking

Primary Author: Giacomo Contin (Univ. Trieste/INFN Trieste)

Speaker: Giacomo Contin (Univ. Trieste/INFN Trieste)
on behalf of the ALICE Collaboration

The Silicon Strip Detector (SSD) is a fundamental part of the Inner Tracking System (ITS) for the ALICE experiment. Since the early phase of p-p collisions at LHC, the SSD is fully operational and participating in the charged particle detection and identification carried out by ALICE. The performance of the SSD during the 900 GeV and 7 TeV collision data taking is presented here.

The stability of the system is monitored through the time evolution of its calibration parameters and their correlation with the environmental conditions. The intrinsic noise of the 2.6 million channels composing the SSD is used to assess the detector efficiency.

Finally the performances in terms of hit reconstruction and energy-loss measurement are discussed with reference to the global tracking and the ITS-standalone particle identification carried out in the first collision events.

Alignment of the ATLAS Inner Detector tracking system

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Salvador Marti I Garcia (IFIC-Valencia)
Daniel Kollar (CERN)

Speakers: John Alison (University of Pennsylvania)
on behalf of the ATLAS Collaboration

ATLAS is a multipurpose experiment that records the products of the LHC proton-proton collisions. In order to reconstruct the trajectories of charged particles, ATLAS is equipped with an inner tracking system built on silicon planar sensors (pixel and microstrips) plus drift-tube based detectors, all embedded in a 2 T solenoidal field.

In order to achieve its scientific goals, the alignment of the ATLAS tracking system requires the accurate determination of its almost 36000 degrees of freedom (DoF). Thus the physics goals of the experiment demand an alignment precision of the silicon sensors below 10 micrometers.

The implementation of the track based alignment within the ATLAS software framework unifies different alignment approaches and allows the alignment of all tracking subsystems together. The use of the assembly survey data as well as the primary vertex and beam spot constraints have been implemented in the alignment software. As alignment algorithms are based on minimization of the track-hit residuals, one needs to solve a linear system with a large number of DoF, which poses a numerical challenge. The alignment jobs can be executed at the CERN Analysis Facility or using the GRID infrastructure. The event processing is run in parallel in many jobs. The output matrices from all parallel jobs are added in a single one before solving.

We will present the results of the alignment of the ATLAS detector using many millions of real data high p_T tracks recorded from the 7 TeV LHC collisions of the 2010 run. The alignment validation is performed with measurements of the alignment observables as well as many other physics observables, notably resonance invariant masses (in the following channels: $K_s \to \pi^+\phi^-$, $J/\psi \to \mu^+\mu^-$ and $Z \to \mu^+\mu^-$), the E/p ratio for electrons, the decay length of long lived particles, plus the impressive results on material studies from γ conversions and hadronic interactions. The results of the alignment with real data reveal that the current precision of the alignment constants is about 10 microns.

Simulation study of the n^+-n^- Si sensors having p-spray/p-stop implant for the SiD detector

Primary Author: Pooja Saxena (Delhi University)

Speaker: Pooja Saxena (Delhi University)

Silicon Detector (SiD) is one of the proposed detector for future e^+-e^- Linear colliders, like International Linear Collider (ILC). The estimated neutron background for ILC is around $1 - 1.6 \times 10^{10}$ $^1/_{\text{MeV}}$ equivalent neutrons cm^{-2} year^{-1} for the Si micro strip sensors to be used in the innermost vertex detector. The $p^+n^-n^+$ double-sided Si strip sensors are supposed to be used as position sensitive sensors for SiD. On the n^+n^- side of these sensors, shorting due to electron accumulation leads to uniform spreading of signal over all the n^+ strips. Hence inter-strip isolation becomes one of the major technological challenges. One of the attractive methods to achieve the inter-strip isolation is the use of uniform p-type implant on the silicon surface (p-spray). Another alternative is the use of floating p-type implants that surround the n-strips (p-stops). However, the high electric fields at the edge of the p-spray/p-stop have been shown to induce pre-breakdown micro-discharge. An optimization of the implant dose profile of the p-spray and p-stop is required to achieve good electrical isolation while ensuring satisfactory breakdown performance of the Si sensors. In the present work, we report the preliminary results of simulation study performed on the n^+n^- Si sensors, equipped with p-spray and p-stops, using SILVACO tools.

Relic density determination at the LHC

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The neutralino is the lightest supersymmetric particle in many SUSY models. Thus in R parity conserving models it provides a perfect dark matter candidate by being electromagnetically neutral, weakly interacting and stable. Following cosmological models, at the freeze-out time most neutralinos should have been transformed into standard model particles by annihilation. The annihilation cross section is inversely proportional to the observed dark matter density and thus precisely known.

In case SUSY will be discovered at the LHC, it is not a proof that the neutralino is the dark matter existing in the universe. But to get a hint one can try to determine the neutralino annihilation cross section from LHC data and see if it is consistent with the annihihilation cross section corresponding to the relic density, as discussed above. It is shown that in a large region of parameter space this cross section is dominated by pseudoscalar Higgs exchange and the correct value can only be obtained for values of $\tan\beta$ around 50. This would lead o a large cross section for pseudoscalar Higgs production, which is proportional to $\tan\beta$ squared.

This cross section or the width of the pseudoscalar Higgs can be exploited to determine $\tan\beta$ and thus determine the annihilation cross section in the regions without co-annihilation or very light squarks and sleptons. In the latter case the t-channel would dominate, but this region is already excluded by the Higgs limits and other electroweak constraints.

Top quark pair production in ATLAS

Primary Authors: Maria Moreno (Universitat de Valencia)

Speaker: Maria Moreno (Universitat de Valencia)
on behalf of the ATLAS Collaboration

Top-quark pairs are expected to be produced copiously at the LHC, even at the lower beam energy and luminosity expected in the first years of running. Establishing the top-pair signal and measuring the production cross-section are important benchmarks for ATLAS, and will help understand the detector performance for events with high-p_T leptons, high jet multiplicity, missing transverse energy and b-jets. The status and prospects for these early top physics measurements will be shown, with a particular emphasis on the progress achieved with data so far.

Measurement of the cross section for open-beauty production with muons and jets in pp Collisions at center-of-mass energy of 7 TeV

Primary Author: Daniel Cedric Troendle (CMS)

Speaker: Daniel Cedric Troendle (CMS)
on behalf of the CMS Collaboration

A measurement of the open beauty production cross section in proton-proton collisions at center-of-mass-energy of 7 TeV is presented. The dataset was recorded with the CMS Experiment at the Large Hadron Collider(CERN). Events are selected by the presence of one muon. The transverse momentum of the muon with respect to the closest track jet discriminates b events from background. The open beauty production cross section is presented as a function of muon transverse momentum and pseudorapidity. The data are compared with QCD Monte Carlo predictions.

Search for the lepton-number-violating decay $B \to Dl^+l^+$ at Belle

Primary Author: Oksu Seon (Nagoya University)

Speaker: Oksu Seon (Nagoya University)
on behalf of the Belle Collaboration

In the Standard Model, lepton-number-violating decays such as $B^+ \to D^-l^+l^+$ is strictly forbidden, but they are allowed if there exist Majorana-type neutrinos. In this poster, we report a first search for $B^+ \to D^-l^+l^+$ ($l = e$ or μ) decays with 772×10^{-6} $B\bar{B}$ pairs produced by energy-asymmetric e^+e^- collision at KEKB accelerator and recorded by the Belle detector. We measure no events in signal region and obtain upper limits of branching fraction in the order of 10^{-6} at the 90 % C.L..

Borexino beyond solar neutrinos: Analysis of geo-neutrinos, Pauli exluded transitions of C^{12} and cosmogenic backgrounds

Primary Authors: Michael Wurm (TU München)
Jürgen Winter (TU München)

Speaker: Jürgen Winter (TU München)
on behalf of the Borexino Collaboration

The 100 t fiducial volume liquid-scintillator experiment Borexino, located at the Laboratori Nazionali del Gran Sasso, is far more than an observatory for solar neutrinos. Its extremely low energy threshold of about 50 keV due to its unprecedented radiopurity also enable to conduct other analyses, i.e. the search for geo-neutrinos, the investigation of the Pauli exclusion principle in C^{12} and cosmogenic backgrounds.

Geo-neutrinos, i.e. electron anti-neutrinos, are produced in beta-decay chains of U and Th, and in the beta-decay of K^{40} abundant in Earth's mantle and crust. They are a unique probe for the interior of the Earth and allow to check geological models. Borexino is the first experiment to observe geo-neutrinos at more than 3 sigma C.L. at a rate of $3.9^{+1.6}_{-1.3}(^{+5.8}_{-3.2})$ events/(100 ton yr) [1].

Moreover, the Pauli exclusion principle (PEP) has been tested for nucleons in C^{12} [2]. Namely, the non-Paulian transition of ${}^1P^{3/2}$-shell nucleons to the filled ${}^1S^{1/2}$ shell, emitting γ, n, p, or $\beta^{\pm}$, has been investigated. Due to the extremely low background and the large mass of the Borexino detector, most stringent up-to-date experimental bounds on PEP violating transitions of nucleons could be established.

Despite a shielding of about 3800 m.w.e., the residual cosmic muon flux still is a major issue for low background experiments. In fact, these muons can produce neutrons and radionuclides in the detector, forming the so-called cosmogenic background. Both rates and lateral distribution around the muon track can be analysed in Borexino.

[1] G. Bellini et al.,Physics Letters B 687 (2010) 299–304
[2] G. Bellini et al.,Phys. Rev.C 81, 034317 (2010)

Measurement of the inclusive Z production cross section with the CMS detector

Primary Author: Manuel Zeise (KIT, Karlsruhe)

Speaker: Manuel Zeise (KIT, Karlsruhe)
on behalf of the CMS Collaboration

First measurements of inclusive Z production cross sections in muon and electron decay channels at 7 TeV are presented for proton-proton collisions in the Compact Muon Solenoid (CMS) detector at the Large Hadron Collider (LHC). The comparison of the kinematic quantities as well as the studies of selection efficiencies demonstrate a good agreement between simulated events and current data. The measured inclusive cross section for $Z(\gamma*)$ production agrees with NNLO QCD cross section calculations and current parton distribution functions.

Inclusive b-jet production measurement on early CMS data

Primary Author: Daniel Martschei (KIT, Karlsruhe)

Co-Author: Simon Honc (KIT, Karlsruhe)

Speaker: Daniel Martschei (KIT, Karlsruhe)
on behalf of the CMS Collaboration

We describe a measurement of the inclusive b-jet production in pp collisions at $\sqrt{s} = 7\,\mathrm{TeV}$. The analysis has been done on the first physics data collected by the CMS experiment at the Large Hadron Collider at CERN. To improve the low p_T measurement, the jets are reconstructed with the Particle Flow algorithm. The experimental uncertainties from jet energy corrections, jet energy resolutions and luminosity are reduced by taking a ratio to the inclusive jet production cross section. We're using a simple secondary vertex high purity tagger, which is one of the most reliable b-taggers for this early measurement, for selecting a jet sample with high b-jet purity. To measure the b fractions in the tagged jet data sample, we made a template fit to the secondary vertex mass. Our estimation of the b-tagging efficiency is taken from Monte Carlo simulation. Thus our studies on LO+NLO contributions from flavor creation, flavor excitation and gluon splitting are shown as well.

The Underlying Event with the Jet Area/Median approach in CMS

Primary Author: Michael Heinrich (KIT, Karlsruhe)

Co-Author: Danilo Piparo (KIT, Karlsruhe)

Speaker: Michael Heinrich (KIT, Karlsruhe)
on behalf of the CMS Collaboration

The first measurement of the charged component of the Underlying Event using the recently proposed jet area/median approach is presented for proton-proton collisions. The sensitivity to different generator tunes is demonstrated for charged particle jets after applying detector specific selection criteria and thresholds. The subsequent comparison of uncorrected CMS data with predictions of different Underlying Event models after detector simulation reveals significant discrepancies indicating the need for improved tunes of the Monte Carlo event generators.

First Results of Search for Stopped Gluinos in pp collisions at $\sqrt{s} = 7\,\mathrm{TeV}$ at CMS

Primary Author: Fedor Ratnikov (KIT, Karlsruhe)

Speaker: Fedor Ratnikov (KIT, Karlsruhe)
on behalf of the CMS Collaboration

We present the first results of a search for long-lived gluinos which have stopped in the Compact Muon Solenoid detector after being produced in 7 TeV pp collisions from CERN's Large Hadron Collider. We looked for the subsequent decay of these particles during time intervals where there were no pp collisions in the Compact Muon Solenoid experiment. In particular, we searched for decays during gaps between crossings in the Large Hadron Collider beam structure.

Search for Heavy Stable Charged Particles in pp collisions at $\sqrt{s} = 7\,\mathrm{TeV}$

Primary Author: Fedor Ratnikov (KIT, Karlsruhe)

Speaker: Fedor Ratnikov (KIT, Karlsruhe)
on behalf of the CMS Collaboration

A signature-based search is performed for heavy stable charged particles (HSCPs) produced in pp collisions at $\sqrt{s} = 7\,\mathrm{TeV}$, and collected with the CMS detector, using high transverse momentum muon, jet, and missing transverse energy trigger data. Momentum and ionization energy loss measurements are used to isolate candidate events with slowly moving, heavy particles. The presentation interprets result within the contexts of (quasi-)stable stau, gluino, scalar top-quark models and cross section limits.

Towards the Selection of Top-Like Events in the Lepton+Jets Channels in Early 7 TeV LHC-Data with CMS

Primary Author: Thorsten Chwalek (KIT, Karlsruhe)

Speaker: Thorsten Chwalek (KIT, Karlsruhe)
on behalf of the CMS Collaboration

The top quark is the heaviest known fermion in the standard model. Due to its large production cross section, pairs of top and antitop quarks will be copiously produced in high energy proton-proton collisions at the Large Hadron Collider (LHC). The event selection deemed for the selection of $t\bar{t}$ events is applied to an early data set of proton-proton collisions at $\sqrt{s} = 7\,\text{TeV}$. The predicted background yields are compared to the overall yield of events collected in this data set, and data-driven techniques to estimate the background contribution from QCD multijet events are evaluated in sideband regions of the phase space. Kinematic comparisons demonstrate good agreement between simulated events and current data, putting the prospect of measurements of the top-quark pair production cross section on firm ground.

Expectations for first single-top studies in CMS in pp collisions

Primary Author: Steffen Roecker (KIT, Karlsruhe)

Speaker: Steffen Roecker (KIT, Karlsruhe)
on behalf of the CMS Collaboration

The first long physics run of LHC is taking place at a center-of-mass energy of 7 TeV, and is expected to go on until an integrated luminosity of 1 fb^{-1} will have been collected. We present an analysis technique to measure the t-channel cross section for single top-quark production in CMS, that can confirm the recent observation of single-top quark production by the Tevatron experiments. Events leading to a signature of exactly one muon and two jets are selected and specific data-driven methods have been developed to reduce the sensitivity to the unknown level of background contamination.

Photon reconstruction and identification with the CMS detector in pp collisions at $\sqrt{s} = 7\,\mathrm{TeV}$

Primary Author: Sudha Ahuja (CDRST)

Speaker: Sudha Ahuja (CDRST)
on behalf of the CMS Collaboration

The performance of photon reconstruction and identification has been studied at $\sqrt{s} = 7\,\mathrm{TeV}$. Reconstruction and identification variables as well as isolation have been compared between data and Monte Carlo for signal and background. Level 1 Trigger and High Level Trigger efficiencies have been measured.

Commissioning and Performance of the CMS Electromagnetic Calorimeter

Primary Author: Eleni Petrakou (Nat. Cent. for Sci. Res. Demokritos (NRCPS))

Speaker: Eleni Petrakou (Nat. Cent. for Sci. Res. Demokritos (NRCPS))
on behalf of the CMS Collaboration

The operation and general performance of the CMS electromagnetic calorimeter at $\sqrt{s} = 7\,\text{TeV}$ are described. The first LHC beams have been used to finalize the commissioning of ECAL readout and trigger. The precision of the inter-channel synchronization and calibration has been verified and improved with collision data, exploiting decays of π^0 and η into two photons, the ϕ invariance of the energy deposition in Minimum Bias events. Di-electron and di-photon states have been also used to verify and tune the energy scale. The quality of the offline data reconstruction, from low level quantities to showers, has been investigated and improved using known physics processes. Collision data and thorough Data/MC comparisons have been used to measure and tune the detector performance. First performance results are given.

Measurement of the Inclusive Jet Cross Section in pp Collisions at 7 TeV

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Speaker: Oliver Oberst (KIT, Karlsruhe)
on behalf of the CMS Collaboration

The measurement of the inclusive jet cross section from pp collisions at a center-of-mass energy of $\sqrt{s} = 7\,\text{TeV}$ using data collected by the CMS experiment with an integrated luminosity of about $60\,\text{nb}^{-1}$ and in the p_T range of $18 - 700\,\text{GeV}$ is presented. Several different jet reconstruction methods are investigated using an anti-k_T clustering algorithm. Studies of the systematic uncertainties in transverse momentum for each reconstruction method are presented, and the measured cross sections are found to be in agreement with next-to-leading order perturbative QCD calculations, within the experimental and theoretical uncertainties.

Searches for non-SUSY particles decaying to leptons with the CMS detector

Primary Author: Paolo Rumerio (University of Maryland)

Speaker: Paolo Rumerio (University of Maryland)
on behalf of the CMS Collaboration

The LHC has started accumulating data at a center-of-mass energy of 7 TeV. We look at the consistency of data samples containing high transverse momentum electrons and muons for their consistency with predicts for production of standard model particles. We look at the expectations for exotic new particles, such as leptoquarks, for this data.

Tevatron Combination of Single Top Quark Production

Primary Author: Jan Lueck (KIT, Karlsruhe)

Speaker: Jan Lueck (KIT, Karlsruhe)
on behalf of the CDF and D0 Collaborations

After the first observation of the inclusive single top-quark production in the s- and t-channels by both CDF and D0, the Tevatron collaborations combined their measurements using the distributions of their multivariate discriminants. A Bayesian analysis is used to extract the cross section at a center of mass energy of 1.96 TeV from 3.2 fb^{-1} (CDF) and 2.3 fb^{-1} (D0) of data, respectively. For a top quark mass of 170 GeV, a cross section of $2.76^{+0.58}_{-0.47}$ pb is extracted while the CKM matrix element $|V_{tb}|$ is measured to be 0.88 ± 0.07 with a 95 % C.L. lower limit of $|V_{tb}| > 0.77$.

PAT: the CMS Physics Analysis Toolkit

Primary Author: Yvonne Küssel (RWTH, Aachen)

Speaker: Yvonne Küssel (RWTH, Aachen)
on behalf of the CMS Collaboration

We review the options for performing user analysis at CMS. The recent work emphasized the improvement of the Physics Analysis Toolkit (PAT), a high-level analysis layer enabling the development of common analysis efforts across and within Physics Analysis Groups. PAT aims at fulfilling the needs of most CMS analyses, providing both ease-of-use for the beginner and flexibility for the advanced user. The main PAT concepts are described in detail and some examples from realistic physics analyses are given.

Measuring Muon Trigger Efficiencies in CMS with Early Data for Top Physics Analyses

Primary Author: Yvonne Küssel (RWTH, Aachen)

Speaker: Yvonne Küssel (RWTH, Aachen)
on behalf of the CMS Collaboration

With a projected design luminostity of $10^{34}\,\mathrm{cm}^{-2}\mathrm{s}^{-1}$ the LHC will provide about 10^9 proton collisions per second within the CMS detector. Thus, an efficient trigger system to select interesting events is essential. A good knowledge of these trigger efficiencies is inevitable, e.g. for cross section measurements. This study presents data-driven approaches applied to first 7 TeV data to measure the performance of the CMS muon triggers that are used for top physics analyses. The efficiency is extracted by comparing offline reconstructed muons to muon trigger objects in unbiased control samples. As alternative approach the muon trigger efficiency is measured applying tag-and-probe methods. Following both strategies the muon trigger efficiency is parameterised in different regions of transverse momentum and pseudo rapidity of the offline reconstructed muons. The results are compared with expectations obtained from simulations and their impact on physics analyses is discussed.

Commissioning and Performance of the ATLAS Muon, Electron, Tau and B physics Triggers with 7 TeV Collisions at the LHC

Primary Authors: Xabier Anduaga (UNLP)

Speaker: Xabier Anduaga (UNLP)
on behalf of the ATLAS Collaboration

In order to cope with the large rate of proton collisions at the LHC, the ATLAS experiment is equipped with a complex three level trigger system, where the first level (L1) is entirely implemented in custom built hardware and the two successive levels (referred together as High Level Triggers - HLT) are software selection algorithms running on large PC farms.

Since March 30, 2010, the LHC has been successfully providing 7 TeV proton-proton collisions, resulting in a total integrated luminosity of a few hundred inverse nanobarns. These data have been very useful to assess the performance of the ATLAS detector and trigger. In particular, the ATLAS muon, electron, tau and B physics triggers have been validated and trigger strategies have been developed to manage increasing luminosity. These triggers are very important for example for new physics discoveries at the LHC, as they allow efficient collection of the signal events while keeping the background rate within the allowed bandwidth. During 2010 they have been commissioned in various stages. Firstly, the rejection was applied only at L1 and the HLT was run online in pass-through mode. This allowed a detailed study and optimization of the HLT algorithms without interfering with the data taking. With increasing luminosity the HLT has been activated to efficiently select leptons from J/ψ, bottom, charm, W and Z decays.

This contribution focuses on the assessment of the relevant quantities in the muon, electron, tau and B physics trigger selection, emphasizing the components which are fundamental in the decision making. The different strategies for trigger efficiency measurements will be presented. In addition, the evolution of the trigger menu, which will be vital in future physics measurements, will be described.

Measurement of the top-quark mass in the lepton+jets channel using a Matrix Element Technique and the CDF Detector

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A measurement of the top-quark mass is presented, using a sample of top-antitop quark-pair candidate events for the lepton+jets decay channel. The events are selected from the Tevatron $p\bar{p}$ collision data at center-of-mass energy $\sqrt{s} = 1.96\,\mathrm{TeV}$, collected at the CDF II detector. The top-quark mass is measured by employing an unbinned maximum likelihood method where the event probability density functions are calculated using signal and background matrix elements, as well as a set of parametrized jet-to-parton transfer functions. The likelihood function is maximized with respect to the top-quark mass, the signal fraction of the sample, and a correction to the jet energy scale (JES) calibration of the calorimeter jets. The simultaneous measurement of the JES correction (Δ_{JES}) amounts to an additional *in situ* jet energy calibration based on the known mass of the hadronically decaying W boson. Using the data sample of 578 lepton+jets candidate events, corresponding to $3.2\,\mathrm{fb}^{-1}$ of integrated luminosity, the top-quark mass is measured to be $m_t = 172.4 \pm 1.4\,(stat + \Delta_{JES}) \pm 1.3\,(syst)\,\mathrm{GeV}/c^2$.

The upgrade of the CMS pixel detector for LHC Phase 1

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During the High-Luminosity upgrade of the LHC, the current CMS pixel detector will have to be replaced by a more efficient and radiation-hard device which is able to cope with the demands imposed by the improved performance of the accelerator.

The goals of the upgrade project for the pixel detector are: replacement of the current system with four barrel layers and three endcap disks, to reduce dead time in the readout, to lower the material budget and to provide four-hit pixel coverage out to pseudorapidities of 2.4. With these design modifications, the upgraded pixel detector is expected to provide improved vertex reconstruction and tracking efficiencies, as well as better impact parameter resolution, with respect to the current 3 barrel layer and 2 endcap disk system.

An overview of the envisaged design options for the upgraded CMS pixel detector is given, as well as estimates for the tracking and vertexing performance of the device. Furthermore, results from a simulation showing the improved impact parameter resolution and b-tagging capability are presented.

Measurement of J/ψ and Υ production in proton-proton collisions at $\sqrt{s} = 7\,\mathrm{TeV}$ with the CMS experiment

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The first measurements of the J/ψ and Υ production cross sections in proton-proton collisions at 7 TeV, as measured by the CMS experiment using the dimuon decay channel are presented. For the J/ψ we give the inclusive and the prompt differential cross sections versus transverse momentum. For the Υ, we present the $1S$ cross section versus transverse momentum and the $(2S + 3S)/1S$ cross-section ratio.