LHC on the March

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IHEP, Protvino

Book of Abstracts

Contents

Morning Session / **15**

Opening address

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Morning Session / **19**

Status of the CMS detector and upgrade plans

Author: Luigi Guiducci[1]

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The CMS experiment at the LHC collected 5.55 /fb of proton proton collisions data at a center of mass energy of 7 TeV in 2011 and almost 20 /fb at 8 TeV energy in 2012, while the LHC run is still ongoing. The CMS detector has shown excellent performance and very good data taking efficiency. The operational experience will be discussed focusing on relevant technical aspects. The performance of CMS subdetectors will be illustrated. Emphasis will be put on the solutions adopted during 2012 run to adapt to the increase in luminosity of the LHC while mantaining the high quality of the physics objects delivered to offline analysis. New challenges, dictated by future LHC luminosity scenarios, are ahead of CMS: an overview of the detector upgrade plans, both on medium and long term range, will be given.

Morning Session / **10**

ALICE status and plans

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The ALICE experiment has been running successfully since 2010 and made an impressive progress towards understanding of hot and dense QCD matter produced in heavy-ion collisions at LHC energies. Recent results on identified particle spectra, azimuthal anisotropy, particle correlations, heavy flavour and quarkonia production in PbPb collisions at sqrt(sNN) = 2.76 TeV will be presented. Future physics challenges and the ALICE upgrade perspectives will be briefly reviewed at the end.

Morning Session / **0**

Development of detector control system software simulator for electromagnetic calorimeter PHOS

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We report on the development of a software simulator of the detector control system for the ALICE Photon Spectrometer (PHOS). PHOS is an electromagnetic calorimeter, part of the ALICE experiment installed at the CERN Large Hadron Collider (LHC). The simulator was design and developed based on the experience acquired during the first years of operation of the detector, from 2009 to 2012. It simulates the behavior of all detector subsystems and auxiliary services: cooling and thermal stabilization of the crystal matrix, low-and high-voltage power supplies, LED monitoring system, gas supply, water cooling and front-end electronics. The simulator is written in ETM PVSS II SCADA environment C-like programming language CONTROL based Microsoft Windows XP platform. It allows to autonomously develop alarm and software protections, remotely train the ALICE shifters and to fine-tune, commission and configure the software updates before deployment in the experiment.

Morning Session / **32**

LHCb status and overview

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The LHCb experiment is purposed to study the properties of the beauty and charmed particles decays. In such decays the search for the physics beyond the Standard Model is performed in an indirect way, as one expects contribution from non-standard particles and forces to become visible through the branching fractions of the rare decays, CP-asymmetries and many other observables. The LHCb detector provides a high efficiency for detection and reconstruction of the decays of the beauty particles produced in the proton-proton collisions. Exploiting the power of the LHC machine during the past two years LHCb has recorded ˜3fbˆ-1 of data, which allowed to observe a number of new decays and increase the accuracy in measuring the effects, which have already been seen before. As the long technical stop is upcoming, an upgrade of both detector subsystems and trigger is planned for the LHCb, before the LHC will start working at its nominal energy and bunch crossing frequency. The talk will include an overview of the LHCb detector, its current status and performance. The main highlights of the recent physics results and the plans for the upgrade will also be shown.

Morning Session / **17**

Status of the ATLAS detector

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After the successful data taking year of 2011 at 7 TeV, since March of 2012 the ATLAS experiment at LHC is collecting data with colliding proton beams at the previously unparalleled centre of mass energy of 8 TeV. A challenging task was to cope with the augmented event rates due to the increased luminosity delivered by the collider and large pileup conditions. A status of the ATLAS detector is presented as of November 2012. Individual sub-detector systems and their operation status will be presented in this talk, together with the main physics results that demonstrate the performance of the detector.

Morning Session / **21**

ATLAS Upgrades Towards the High Luminosity LHC

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After successful LHC operation at the center-of-mass energy of 7 TeV in 2011, the LHC is scheduled to deliver even more data in 2012 at 8 TeV. Meanwhile, plans are actively advancing for a series of upgrades, culminating roughly 10 years from now in the high luminosity LHC (HL-LHC) project, delivering of order five times the LHC nominal instantaneous luminosity along with luminosity levelling. The final goal is to extend the data set from about 300fb-1 expected for LHC running to 3000 fb-1 by around 2030. Current planning in ATLAS also has significant upgrades to the detector during the consolidation of the LHC to reach full LHC energy and further upgrades to accommodate running already beyond nominal luminosity this decade. The challenge of coping with HL-LHC instantaneous and integrated luminosity, along with the associated radiation levels, requires further major changes to the ATLAS detector. The designs are developing rapidly for an all-new inner-tracker, significant upgrades in the calorimeter and muon systems, as well as improved triggers and data acquisition. This presentation summarises the various improvements to the ATLAS detector required to cope with the anticipated evolution of the LHC instantaneous luminosity during this decade and the next.

Evening Session / **18**

B-physics at ATLAS

Author: Vladimir Nikolaenko[1]

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Status of B-physics studies in ATLAS is reviewed, starting from Onia results based on dimuon channel. J/psi->mu+mu- decay also serves as a basis for identification of B-mesons and Lambda_b baryons. Results on cross section and lifetime measurements, CP-violation parameters and rare decay searches are also presented.

Evening Session / **14**

CMS results on B-Physics

Author: Bora Akgun[1]

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The recent results of the CMS experiment in the field of b-quark production, B hadron spectroscopy and decays are reviewed. The B_{s} lifetime difference is measured and the first observation of a new baryon with beauty, the Xi(b)*0 is presented.

Evening Session / **3**

ALICE results on heavy-flavour production at the LHC

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In ultra-relativistic heavy-ion collisions, heavy quarks, i.e. charm and beauty, are of particular interest, since they are produced in the early stage of the reaction and coexist with the surrounding medium. Therefore the measurement of open heavy-flavour production in Pb-Pb collisions at the LHC gives access to the mechanisms of heavy-quark transport and energy loss in hot and dense QCD matter. The ALICE apparatus allows us to measure heavy-flavour particles down to low transverse momentum, using hadronic and electronic final states at central rapidity and muonic final states at forward rapidity. We first present results in pp collisions at centre-of-mass energies of 2.76 and 7 TeV. These measurements provide information on heavy-quark production at LHC energies and constitute the reference for heavy-ion studies. We focus then on the observation of the suppression and azimuthal anisotropy of heavy-flavour production in Pb-Pb collisions at 2.76 TeV.

Evening Session / **29**

Charm and Charmonia production at LHCb

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Studies of charm and charmonia production provide important tests of QCD. During 2010 and 2011 the LHCb experiment collected a dataset corresponding to about 1/fb of integrated luminosity in proton-proton collisions at sqrt(s) = 7 TeV. We present measurements of the production of J/psi, psi(2S), chi_c1 and chi_c2 as well as their cross-section ratio, and a cross-section ratio of chi_c to J/psi. We also present measurements of double charm production which is the first observation at hadronic collisions. The results are compared to theoretical predictions.

Evening Session / **4**

Charmed penguin versus BAU

Author: Mikhail Vysotsky[1]

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Since most probably Standard Model cannot explain large value of CP asymmetries recently observed in D-meson decays we propose the fourth quark-lepton generation explanation of it. As a byproduct weakly mixed leptons of the fourth generation enable to save the baryon number of the Universe from erasure by sphalerons.

Evening Session / **1**

Rare decays at LHCb

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In this presentation, rare decays of B and D mesons are discussed. Such decays are sensitive to the presence of physics beyond the Standard Model as they are mediated by loop diagrams. New physics can be probed by measuring unexpectedly high branching ratios, CP, isospin and forward backward asymmetries and other angular observables. The last results of LHCb experiment in this field are presented.

Evening Session / **2**

CMS results on Quarkonium production

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Using large data samples of di-muon events, CMS has performed detailed measurements in the field of quarkonium production. Differential cross-sections of (prompt) J/psi, psi(2S) and Y(nS) states in pT and rapidity will be presented, as well as studies of P-wave charmonia (chi_c), using the decay mode J/psi + gamma where the photon converts in an e+e- pair inside the detector. All our measurements will be compared to several theoretical predictions, including NLO nonrelativistic QCD.
We, will in particular, present for the first time results on double-J/psi production, as well very recent results on two exotic quarkonium states.

Evening Session / **20**

Bottomonia and Bc Production at LHCb

Author: Yiming Li[1]

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With large production cross-section and its unique rapidity coverage, the LHCb detector brings opportunity for $b\bar{b}$ bottomonia studies, hence tests for QCD models. We present here the results of Υ and $\chi_b(1P)$ production at $\sqrt{s}$ = 7 TeV. Also discussed here are studies on the B_c meson, including its production and mass measurement using $B_c^+ \to J/\psi\pi^+$ channel, and the decay of $B_c^+ \to J/\psi\pi^+\pi^+\pi^-$, both with data obtained from 2011 running of LHC.

Evening Session / **12**

B decays to charmonia at LHCb

Author: Ivan Polyakov[1]

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The LHCb experiment is a forward arm spectrometer designed to make high precision measurements of b hadron decays at the LHC. During 2011 a total luminosity of 1.0 fb-1 of data was collected at sqrt(s)=7 TeV. LHCb's efficient dimuon trigger allows to perform studies of B mesons decaying to charmonia with high precision. We will present results on B decays into J/psi and light hadrons, together with measurements of the relative branching ratios of exclusive b decays to final states involving J/psi and psi(2S) mesons.

Morning Session / **30**

Limitation on the luminosity of e+e- storage rings due to beamstrahlung.

Author: Valery Telnov[1]

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Particle loss due to the emission of single energetic beamstrahlung photons is shown to impose a fundamental limit on storage ring luminosities at energies more than 2E˜140 GeV for head-on collisions and 2E˜40 GeV for crab-waist collisions. Above these thresholds the suppression factor due to beamstrahlung scales as 1/Eˆ4/3 and for a fixed power of synchrotron radiation L \propto R/Eˆ13/3. For 2E>150 GeV both collisions schemes have a similar limits on the luminosity. The attainable luminosities at the Higgs factory energy 2E=240 GeV at storage rings and linear colliders (LC) are comparable and LC is preferable for higher energy.

Morning Session / **16**

LEP3: a possible low-cost high-luminosity Higgs factory

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The discovery of X(125) at CERN, which looks increasingly likely to be the long-awaited Higgs boson, opens the debate of which type of machine would serve best as a Higgs factory. LEP3 is a low-cost, high-luminosity circular e+e- collider operating near the Higgs production optimal centre-of-mass energy of 240GeV. We will briefly discuss what accuracies on Higgs observables are necessary to probe physics beyond the standard model and what is achievable at the LHC. We will argue that a future e+e- collider can provide much needed supplementary information and we will briefly compare circular and linear e+e- machines. In the few months following the discovery of the Higgs boson, an impressive amount of work has been done to assess the feasibility of LEP3, with very encouraging results. The most obvious choice for the location of such a machine is in the LHC tunnel, but other possibilities, notably the utilization of the UNK tunnel, will also be briefly discussed.

Morning Session / **31**

Higgs factories

Author: Valery Telnov[1]

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Various approaches to Higgs factories are discussed: LC, storage ring, muon collider, photon collider, etc, incl. news from the HF2012, FNAL, Nov. 14-16, 2012.

Evening Session / 40

J/Psi photo-production in ultra-peripheral Pb-Pb collisions

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The strong electro-magnetic fields produced by ultra-relativistic heavy ions allow for the study of gamma-gamma and gamma-nucleus processes at the CERN Large Hadron Collider. Here, we report first results obtained by ALICE on the J/psi photo-production cross section in Pb-Pb collisions at sqrt(sNN) = 2.76 TeV, both at forward rapidities (-3.6 < y < -2.6) in the mu+mu- channel, and at central rapidities (-0.9 < y < 0.9) in e+e- and mu+mu- channels. The obtained cross sections are compared with predictions from several models.
In addition, we have measured the cross section of the process gamma-gamma -> e+e- in central rapidity and compared it to the STARLIGHT Monte-Carlo prediction.

Evening Session / 41

Neutral meson production in pp and Pb-Pb collisions at the LHC measured with ALICE

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Identified hadron spectra are considered to be sensitive to transport properties of strongly interacting matter produced in high-energy nucleus-nucleus collisions.
We present measurements of π^0 and η mesons at mid-rapidity in a wide transverse momentum range in pp and Pb-Pb collisions at LHC energies measured with the ALICE detector. The mesons are reconstructed via their two-photon decays by two complementary methods, using the electromagnetic calorimeters and the central tracking system for photons converted to electron-positron pairs on the material of the inner ALICE barrel tracking detectors.
Comparison of the ALICE results on neutral mesons with those of lower-energy experiments is discussed.

Evening Session / 36

Review of recent results on jet physics in Heavy Ion from LHC

Author: Alexandre Shabetai[1]

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A cross-over between ordinary nuclear matter and a state of deconfined quarks and gluons, the Quark Gluon Plasma (QGP) is predicted by lattice QCD calculations. Experimentally, ultra-relativistic heavy ion collisions are used to study such a hot and dense medium.
Jets are sensitive to early stage of heavy ion collisions. This property allows to probe the QGP. Their strong interaction with the medium leads to a modification of their structure and to a re-distribution of their energy. Experimentally, this can be seen as a marked reduction of their measured energy in a given reconstruction cone. Their fragmentation pattern is also modified. This phenomenon is called “jet-quenching”.
Many experimental observations such as the suppression of back-to-back azimuthal correlations, the suppression of inclusive hadrons - or even jet - spectra or measurements of modified jet fragmentation functions, can all be used in order to learn about in-medium energy loss. Comparing those to theoretical calculations provide hints about the density of the QGP.
Moreover, measurements of jets in proton-proton collisions provide a baseline needed for heavy ion studies . They are also useful to test pQCD.
An overview of recent results on jet physics from LHC experiments (ALICE, CMS ans ATLAS) will be presented. We will discuss and compare them to some RHIC results (from STAR and PHENIX).

Evening Session / **11**

Jet measurements in proton-proton and PbPb collisions with the ALICE experiment at LHC

Author: Rishat Sultanov[1]

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Jets are an important tool in testing QCD and probing the hot and dense nuclear matter created in high energy heavy-ion collisions. They can be used to study hard scatterings, fragmentation and hadronisation and how this processes differ from baseline vacuum measurements in case of presence of a partonic medium. Vacuum measurements are obtained from proton-proton collisions.
Data taken by the ALICE detector system in proton-proton collisions at sqrt(s) = 7 TeV and in heavy ion collisions at sqrt(s) = 2.76 have been analysed and results for jet pT spectra, R_AA, cross section and inclusive structure are presented. The procedures used to reconstruct jets and to extract them from a background will be discussed.

Morning Session / **28**

Status of U70

Author: Sergey Ivanov[1]

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The report overviews present status of the Accelerator Complex U70 of IHEP-Protvino comprising four machines (2 linear accelerators and 2 synchrotrons). Particular emphasis is put on the recent upgrades aimed at improving quality of proton beam and implementing program to accelerate light ions (carbon).

Morning Session / **35**

LHC status & plans (including upgrade)

Author: Mirko Pojer[1]

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In three years of operation, the LHC has delivered a total of more than 25 fb-1 of integrated luminosity, providing collisions at 7 and 8 TeV c.o.m. The reasons for this tremendous success will be underlined.
At the beginning of next year, the machine will be stopped for about 20 months, at the end of which the energy, and therefore the potential for discoveries, will be increased. The details of this "upgrade" will be shown, as well as the strategy for future performance improvements.

Morning Session / **33**

Consequences for LHC from cosmic ray experiments

Author: Anatoly Petrukhin[1]

[1] *Moscow State Engineering Physics Institute (RU)*

In cosmic ray experiments, the particles with energies (10ˆ15 −10ˆ19) eV are investigated. This interval corresponds to (1.4 −140) TeV in the center-of-mass system, which is 10 times higher than maximum LHC energy. Many unusual results in cosmic ray experiments in this energy interval were observed, which cannot be explained in frame of existing theoretical models and approaches. For their explanation from a single point of view, the production of new massive state of matter (with mass ˜ 1 TeV) with large orbital momentum is required. The most suitable version is the production of QGP blobs, the decay of which into light quarks is suppressed by large orbital momentum. Possible decay into heavy-quarks (top-antitop) changes the picture of hadron interaction. In this talk, possible approaches to investigations of new QGP state in cosmic rays and LHC experiments are considered, taking into account that threshold energy is considerably lower for nuclei-nuclei interactions and corresponds to LHC energies. For pp-interactions, energy of 14 TeV is insufficient for production of a new state of matter.

Morning Session / **26**

CMS results on SUSY/Beyond SM

Author: Wolfgang Waltenberger[1]

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To this date CMS has performed a wide range of searches for physics beyond the standard model. The program comprises both broad, inclusive searches as well as exclusive, specialised approaches. In this overview talk, the results with proton-proton collision data both at 7 and 8 TeV will be summarized, with a focus on presenting some highlights of the CMS search program.

Morning Session / **5**

Search for a heavy neutrino and right-handed W of the left-right symmetric model in pp collisions

Author: Mikhail Kirsanov[1]

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We describe the search for signals from the production of right-handed W bosons and heavy neutrinos $N_l (l = e, \mu)$, that arise naturally in the left-right symmetric extension to the standard model, using 5 1/fb of collision data collected by the CMS Experiment at the LHC in 2011 at $\sqrt{s} = 7$ TeV and 3.6 1/fb of 2012 collision data at $\sqrt{s} = 8$ TeV. No excess over expectations from standard model processes is observed. For models with exact left-right symmetry, and assuming either N_e or N_μ is the only right-handed neutrino accessible at LHC energies, we exclude the region in the two-dimensional parameter (M_{W_R}, M_N) space that extends beyond M_{W_R} = 2.5 TeV.

Morning Session / **27**

SUSY and Beyond SM Searches at ATLAS

Author: Nathan Edward Triplett[1]

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With the upgrade of LHC center of mass energy to 8 TeV along with high intensity beams, many regions of beyond standard model physics are able to be probed for the first time. This talk will present the current status of the ATLAS SUSY and exotic searches with a focus on the most recent 8 TeV results.

Morning Session / **8**

The LHC state at 125.7 GeV as an evidence for non-perturbative electro-weak effects

Author: Boris Arbuzov[1]

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The recently discovered resonance at $125.7\,GeV$ in invariant mass distribution of $\gamma\,\gamma$ and of $l^+\,l^+\,l^-\,l^-$ may be tentatively interpreted as a scalar bound state X consisting of two W. In the present note we

consider this option and show that this interpretation agrees existing experimental data including the last LHC discovery and the $b\bar{b}$ bump reported by CDF and D0 collaborations at TEVATRON. The application of this scheme gives satisfactory agreement with existing data without any adjusting parameter but the bound state mass $125.5\,GeV$. There are pronounced distinctions of the W-hadron option from the SM Higgs case in decay mode $X \to \gamma\, l^+ l^-$ and in the cross-section of process $p + p \to \gamma\, X$.

Evening Session / **34**

Top physics at ATLAS

Author: Saverio D'Auria[1]

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This talk will be a review of the recent Atlas experimental results on top-quark Physics.

Evening Session / **23**

CMS results on top physics

Author: Andrew Ivanov[1]

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We present CMS results on top quark production and properties measurements

Evening Session / **22**

Electroweak Physics at ATLAS

Author: Geraldine Conti[1]

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The measurement of WW, WZ, ZZ, Wγ and Zγ production cross-sections allow for precision tests of the electroweak (EW) dynamics of the Standard Model (SM). Differences between measured and predicted SM cross-sections could prove evidence for new phenomena. The diboson processes are also an important source of background to Higgs production decaying into vector boson pairs, such as H
$rightarrow WW$ and H
$rightarrow ZZ$, and also to other new physics processes. It is therefore very important to have precise measurements of their production cross-sections. The ATLAS and CMS collaborations have measured those cross-sections at 7 and 8 TeV. I will review the latest measurements of the ATLAS collaboration, as well as the limits set on the anomalous WWγ, ZZγ, Z$\gamma\gamma$ and ZZZ triple gauge-boson couplings.

Evening Session / **7**

Jet production in association with vector bosons at CMS

Author: Matteo Marone[1]

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The associated production of jets and vector bosons allows for stringent tests of perturbative QCD calculations and is sensitive to the possible presence of new physics beyond the Standard Model. Measurements of jet production rates in association with W, Z or photons, in proton-proton collisions at a 7 TeV center-of-mass energy is presented, using data collected with the CMS detector. In particular, we compare data to the theory predictions on jet rates, dijet invariant mass, angular correlations and event shapes distributions.

Evening Session / **9**

Higgs searches at ATLAS

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During July 2012, the ATLAS and CMS collaboration announced together the observation of a new boson in the Higgs searches, with a mass around 126 GeV.
Since then, the Large Hadron Collider has been running steadly, providing proton-proton collisions at sqrt(s)=8 TeV; both experiments have now more than doubled the amount of data available since July.
I will review the latest results of the ATLAS collaboration on Higgs searches, both in the Satandard-Model framework and beyond.
I will present the available updated results with more analyzed data and refined analysis techniques with respect to summer 2012; the first results on 2012 data of Higgs searches to b-quarks and tau leptons final states will be presented as well.

Evening Session / **24**

Combined Higgs result from ATLAS

Author: Christian Schmitt[1]

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On July 4th both ATLAS and CMS announced the observation of a new particle in the search for the Higgs boson. The required sensitivity above 5 sigma could only be achieved by combining different search channels and by analysing both the data from 2011 and 2012. Several production and decay modes can shed light on the properties of this new particle, but the full picture can only be obtained by combining all the available information.
This talk will provide an overview over the complementary measurements used as input for the latest combination at ATLAS and its results both in terms of signal strength and properties.

Evening Session / 6

SM Higgs searches by CMS at the LHC

Author: Mikhail Kirsanov[1]

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Results are presented from searches for the standard model (SM) Higgs boson in proton-proton collisions at $\sqrt{s} = 7$ and 8 TeV in five decay modes: $gamma\gamma$, bb, $\tau\tau$, WW, and ZZ. The analysed data correspond to integrated luminosities of up to 5.1 1/fb at 7 TeV and 5.3 1/fb at 8 TeV. The data exclude the existence of a SM Higgs boson in the ranges 110–122.5 and 127–600 GeV at 95\%~confidence level. An excess of events above the expected SM background is observed with a local significance of 4.9σ around 125 GeV, which we attribute to the production of a previously unobserved particle. The evidence is strongest in the two final states with the best mass resolution: the two-photon final state and the final state with two pairs of charged leptons (electrons or muons). The combined excess in these channels alone gives a local significance of 5.0σ. An unconstrained fit to the excesses in these two final states yields a mass of $125.3 \pm 0.4\,(\mathrm{stat}) \pm 0.5\,(\mathrm{syst})$ GeV. Within the statistical uncertainties, the results obtained in all search channels are consistent with the expectations for a SM Higgs boson.

Evening Session / 13

Search for MSSM Higgs with the CMS detector at LHC

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In the minimal super-symmetric extension of the Standard Model (MSSM), the Higgs sector contains two Higgs boson doublets, including, after electroweak symmetry breaking, the CP-odd neutral scalar A0, the two charged scalars H±, and the two CP-even neutral scalars h and H0.
The results in the search for neutral and charged Higgs bosons with the CMS detector at LHC are presented, based on the data samples collected at √s = 7 and 8 TeV.
The neutral Higgs boson is searched in both the μ+μ- and τ+τ- final states, whereas the charged Higgs state is searched in top quark decays with at least one τ in the final state.

Evening Session / 25

Some lessons from observed Higgs-like boson

Author: Eduard Boos[1]

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Recent discovery of new like a Higgs boson at the LHC stimulated intensive discussions of many arising questions. To which extend the observed resonance corresponds to the SM Higgs, how to extract and measure properties of the resonance such as spin, P and C parities, what are implications to various BSM scenarios assuming not a SM nature of observed boson...? Short review of results of various approaches to address such questions is presented in the talk.