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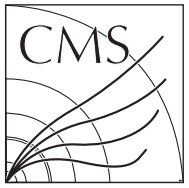

The Compact Muon Solenoid Experiment

Conference Report

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First CMS results

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Abstract

First results obtained by CMS in the 2010 LHC run are presented

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Title: First CMS Results

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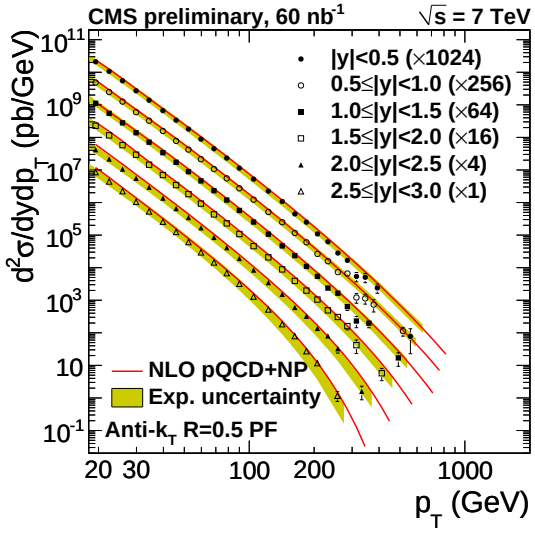
Abstract: First results obtained by CMS in the 2010 LHC run are presented

In the year 2009 the LHC collider at CERN started with proton proton collisions at a center of mass energy of 900 GeV, later the energy was increased to 2.36 TeV and in March 2010 a 7 TeV run began which ended in November 2010. The CMS experiment [1] has recorded about 40/pb of integrated luminosity at this record energy. The CMS detector performed very well and many interesting measurements were made. Lead-lead collisions at a total center of mass energy of 574 TeV at the end of 2010 brought new insights into heavy ion physics.

First of all the CMS collaboration has 're-discovered' all Standard Model particles, including W and Z bosons decaying leptonically, the heaviest quark top and the lighter quarks in form of various meson and baryon resonances. These analyses demonstrate that the detector has reached the design values for efficiency and resolution.

The inclusive jet [2] and dijet [3] production cross sections were among the first CMS measurements. The figure [2] shows that QCD calculations can reproduce the jet yields very well.



From the smooth falloff of the measured dijet cross section as a function of dijet mass one can set limits on new particles. For example excited quarks can be excluded within a contact interaction model up to a mass of 1.58 TeV at 95% confidence level [3], thus improving older Tevatron limits significantly. From more than 100'000 W decays and about 10'000 Z decays their production cross sections were measured, these results are in good agreement with NNLO QCD calculations [4]. Also a first measurement of the top cross section was made [5], confirming the expected strong rise (by a factor of about 25) with respect to proton - antiproton collisions at 2 TeV center of mass energy.

The production of charged particles in minimum bias events (more precisely: in Non Single Diffractive events) was studied in great detail, in the pseudorapidity range $|\eta| < 2.4$ and for transverse momenta as low as 30 MeV. In particular the yield as a function of η, the multiplicity distribution and the p_T distribution were determined at 0.9 TeV, 2.36 TeV and 7 TeV and compared to different model predictions and to data at other center of mass energies [6]. Furthermore the production of strange particles like the Ξ^- were measured [7]. Overall the increase of cross sections and multiplicity with center of mass energy is steeper than anticipated. The current models with parameters tuned without using LHC data do not provide a satisfactory description in all details. Also the shape of jets and the topology of hadronic events in general were analysed in detail [8, 9]. The models Pythia and Herwig provide a good description of these CMS measurements.

A very interesting new feature was discovered in p p events with a very high charged particle multiplicity ($N > 110$, $p_T = 1 - 3$ GeV). In the two particle correlation as a function of $\Delta\eta$ and $\Delta\Phi$ a 'ridge' structure, a long range correlation in $\Delta\eta$ at small values of the azimuthal distance $\Delta\Phi$ was revealed by CMS [10]. Current Monte Carlo models cannot explain this feature.

Finally already after a few days the first interesting heavy ion results were made public by CMS [11]: Z boson production in lead lead collisions and 'jet quenching', seen as dijet events with very different energies carried by the two jets.

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