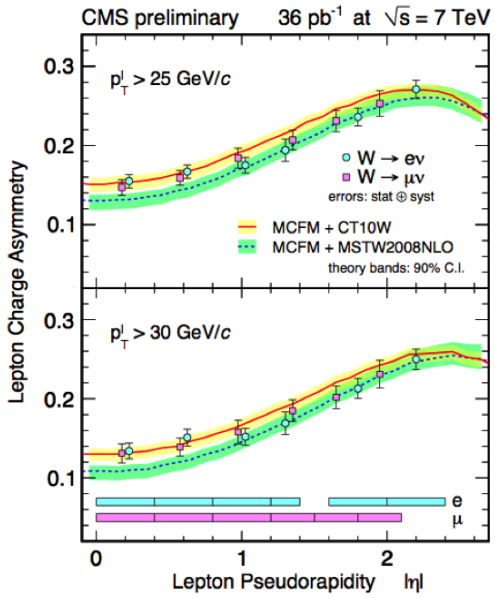
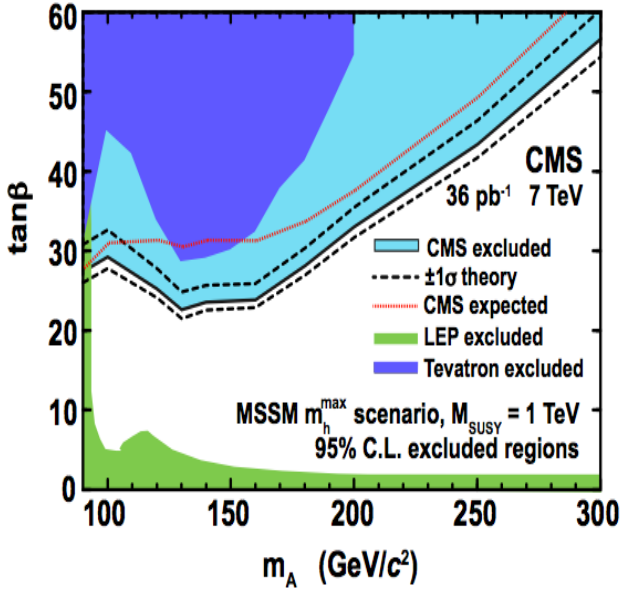
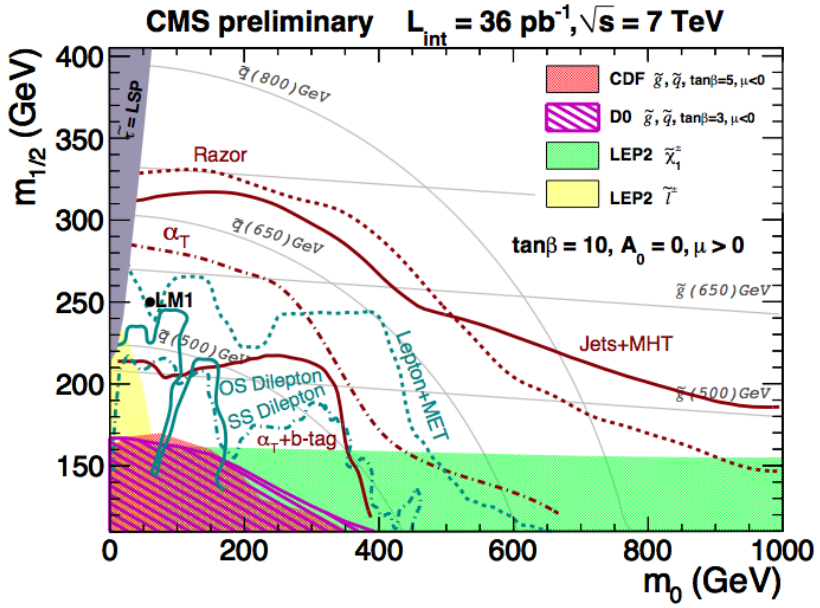
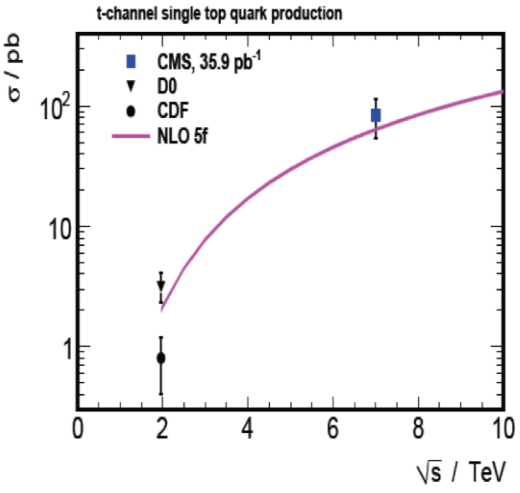
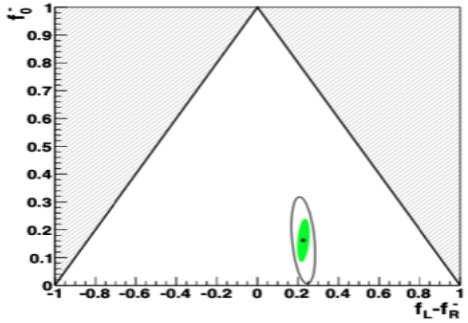
CMS Status Report @ P-LHC

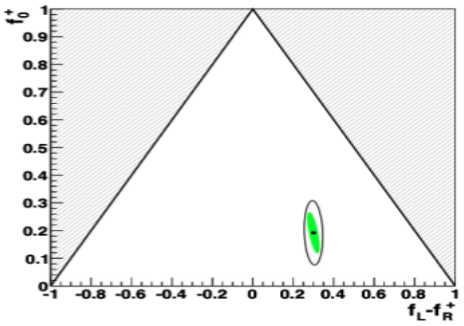


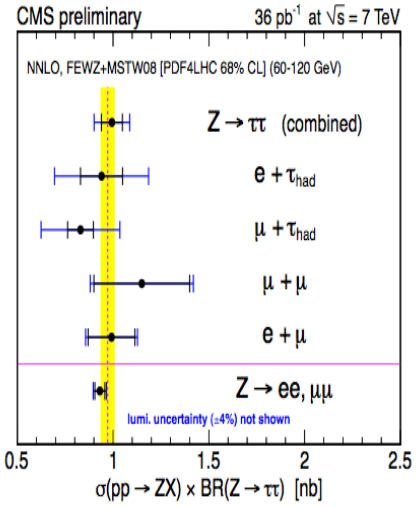








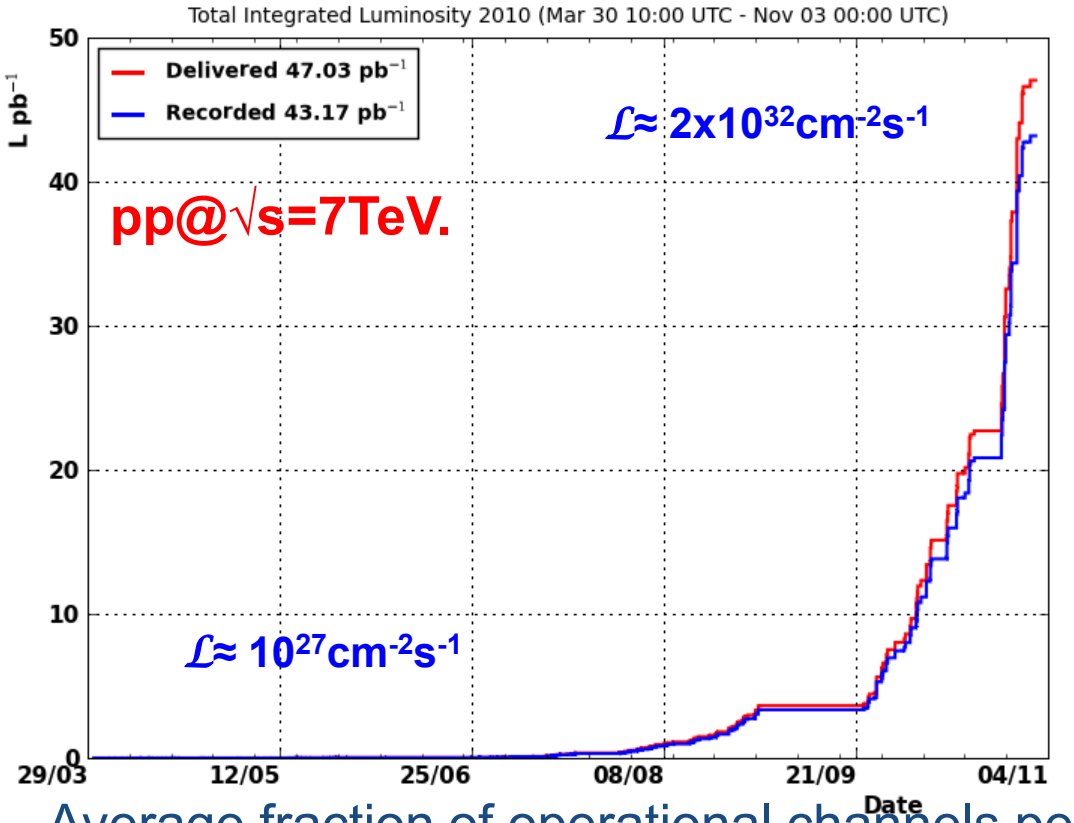


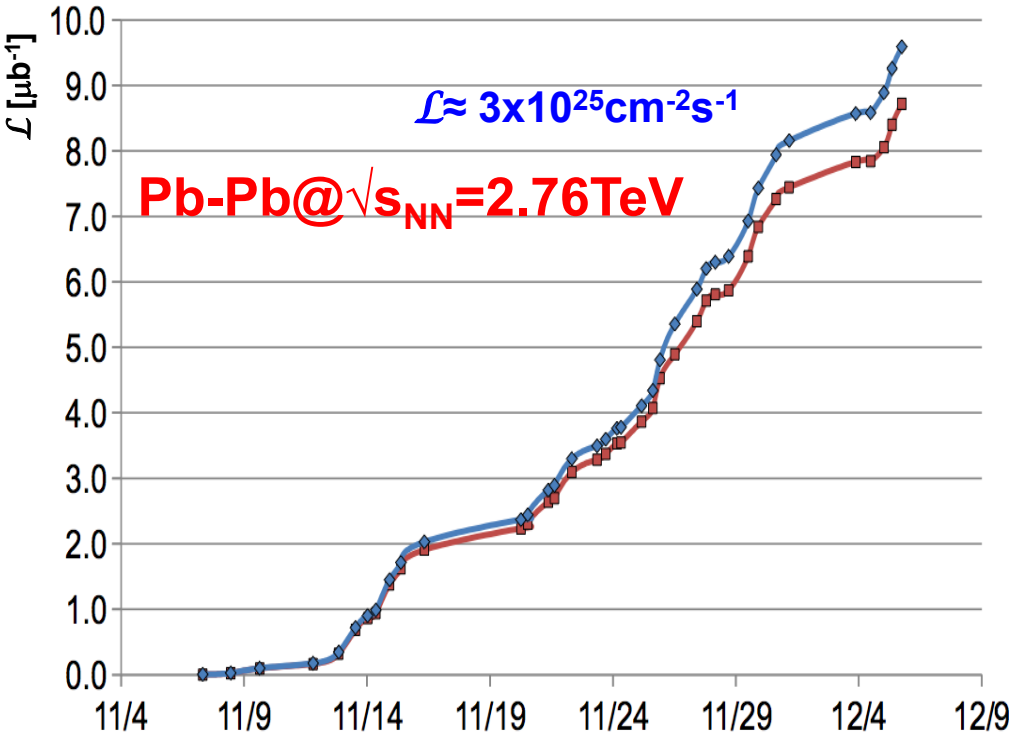


Guido Tonelli
CERN/INFN&University of Pisa

LHC/CMS operations: p-p and Pb-Pb collisions

pp: **~47pb^{-1}** delivered by LHC and **~43pb^{-1}** collected by CMS.
Pb-Pb: ~9.5μb^{-1} delivered and **~8.7μb^{-1}** recorded.
Overall data taking efficiency **~92%.**





Average fraction of operational channels per CMS sub-system **>99%.** Quality of the data for physics (any analysis)**~85%** of recorded data.

CMS papers on Collision Data… so far

1. Measurement of the Inclusive Jet Cross Section in pp Collisions at 7 TeV
2. Measurement of the $t\bar{t}$ production cross section and the top quark mass in the dilepton channel in pp collisions at $\sqrt{s}$=7
3. Search for First Generation Scalar Leptoquarks in the e*vjj* Channel in pp Collisions at $\sqrt{s}$= 7 TeV
4. Suppression of excited Y states in PbPb collisions at $\sqrt{s_{NN}}$= 2.76 TeV
5. Measurement of W*γ* and *Zγ* production in pp collisions at $\sqrt{s}$=7 TeV
6. Long-range and short-range di hadron angular correlations in central PbPb collisions at $\sqrt{s_{NN}}$= 2.76 TeV
7. Search for supersymmetry in events with a lepton, a photon, and large missing transverse energy in pp collisions at $\sqrt{s}$= 7 TeV
8. Measurement of the Polarization of W Bosons with Large Transverse Momenta in W+Jets Events at the LHC
9. Charged particle transverse momentum spectra in pp collisions at $\sqrt{s}$= 0.9 and 7 Te
10. Search for new physics with same-sign isolated dilepton events with jets and missing transverse energy at the LHC
11. Measurement of the B0Production Cross Section in pp Collisions at $\sqrt{s}$= 7 TeV / CMS Collaboration
12. Measurement of the differential dijet production cross section in proton-proton collisions at sqrt(s)=7 TeV
13. Search for Neutral MSSM Higgs Bosons Decaying to Tau Pairs in pp Collisions at sqrt(s)=7 TeV
14. Measurement of the Inclusive Z Cross Section via Decays to Tau Pairs in pp Collisions at sqrt(s) = 7 TeV
15. Search for Large Extra Dimensions in the Diphoton Final State at the Large Hadron Collider
16. Measurement of the Lepton Charge Asymmetry in Inclusive W Production in pp Collisions at sqrt(s) = 7 TeV
17. Search for Physics Beyond the Standard Model in Opposite-sign Dilepton Events in pp Collisions at $\sqrt{s}$= 7 TeV
18. Search for Resonances in the Dilepton Mass Distribution in pp Collisions at $\sqrt{s}$= 7 TeV
19. Search for Supersymmetry in pp Collisions at $\sqrt{s}$= 7 TeV in Events with Two Photons and Missing Transverse Energy
20. Search for a W' boson decaying to a muon and a neutrino in pp collisions at $\sqrt{s}$= 7 TeV
21. Study of Z boson production in PbPb collisions at $\sqrt{sNN}$= 2.76 TeV
22. Measurement of W+W−Production and Search for the Higgs Boson in pp Collisions at $\sqrt{s}$= 7 TeV
23. Search for Heavy Bottom-like Fourth Generation Quark in tW Final State at CMS in pp Collisions at $\sqrt{s}$=7TeV.
24. Strange Particle Production in pp collisions at $\sqrt{s}$= 0.9 and 7 TeV
25. Measurement of BB Angular Correlations based on Secondary Vertex Reconstruction at $\sqrt{s}$=7TeV in CMS
26. Measurement of Dijet Angular Distributions and Search for Quark Compositeness in pp collisions at $\sqrt{s}$=7TeV
27. Observation and studies of jet quenching in PbPb collisions $\sqrt{S_{NN}}$= 2.76 TeV
28. First Measurement of Hadronic Event Shapes in pp collisions at $\sqrt{s}$=7TeV
29. Dijet Azimuthal Decorrelations in pp Collisions at $\sqrt{s}$=7TeV
30. Measurement of Bose–Einstein Correlations in pp Collisions

CMS papers on Collision Data… so far

31. Inclusive b-hadron production cross section with muons in pp collisions
32. Search for Heavy Stable Charged Particles in pp collisions
33. Search for Supersymmetry in pp Collisions at 7 TeV in Events with Jets and Missing Transverse Energy
34. Measurement of the B+ Production Cross Section in pp Collisions at √s = 7TeV
35. Search for a heavy gauge boson W' in final states with electrons and large missing ET in pp collisions
36. Upsilon production cross section in pp collisions at √s = 7TeV
37. Search for Pair Production of Second-Generation Scalar Leptoquarks in pp Collisions at √s= *7TeV*
38. Search for Pair Production of First-Generation Scalar Leptoquarks in pp Collisions at √s= *7TeV*
39. Search for Microscopic Black Hole Signatures at the Large Hadron
40. Measurements of Inclusive W and Z Cross Sections in pp Collisions at √s = *7TeV*
41. Measurement of the Isolated Prompt Photon Production Cross Section in pp Collisions at √s= 7TeV
42. Search for Stopped Gluinos in pp collisions at √s= *7TeV*
43. Charged particle multiplicities in pp interactions at √s= 0.9, 2.36, and 7 TeV
44. Prompt and non-prompt J/ production in pp collisions at √s= 7TeV
45. First Measurement of the Cross Section for Top-Quark Pair Production in Proton-Proton Collisions
46. Search for Quark Compositeness with the Dijet Centrality Ratio in pp Collisions at √s= *7 TeV*
47. Search for Dijet Resonances in 7 TeV pp Collisions at √s=7TeV
48. Observation of Long-Range, Near-Side Angular Correlations in Proton-Proton Collisions at the LHC.
49. CMS Tracking Performance Results from Early LHC Operation.
50. First Measurement of the Underlying Event Activity at the LHC with √s = *0.9 TeV*
51. Transverse-momentum and pseudorapidity distributions of charged hadrons inppcollisions ats√= 7 TeV
52. First Measurement of Bose-Einstein Correlations in pp collisions at √s=0.9 and 2.36 TeV at the LHC
53. Transverse momentum and pseudorapidity distributions of charged hadrons at √s=0.9 and 2.36 TeV

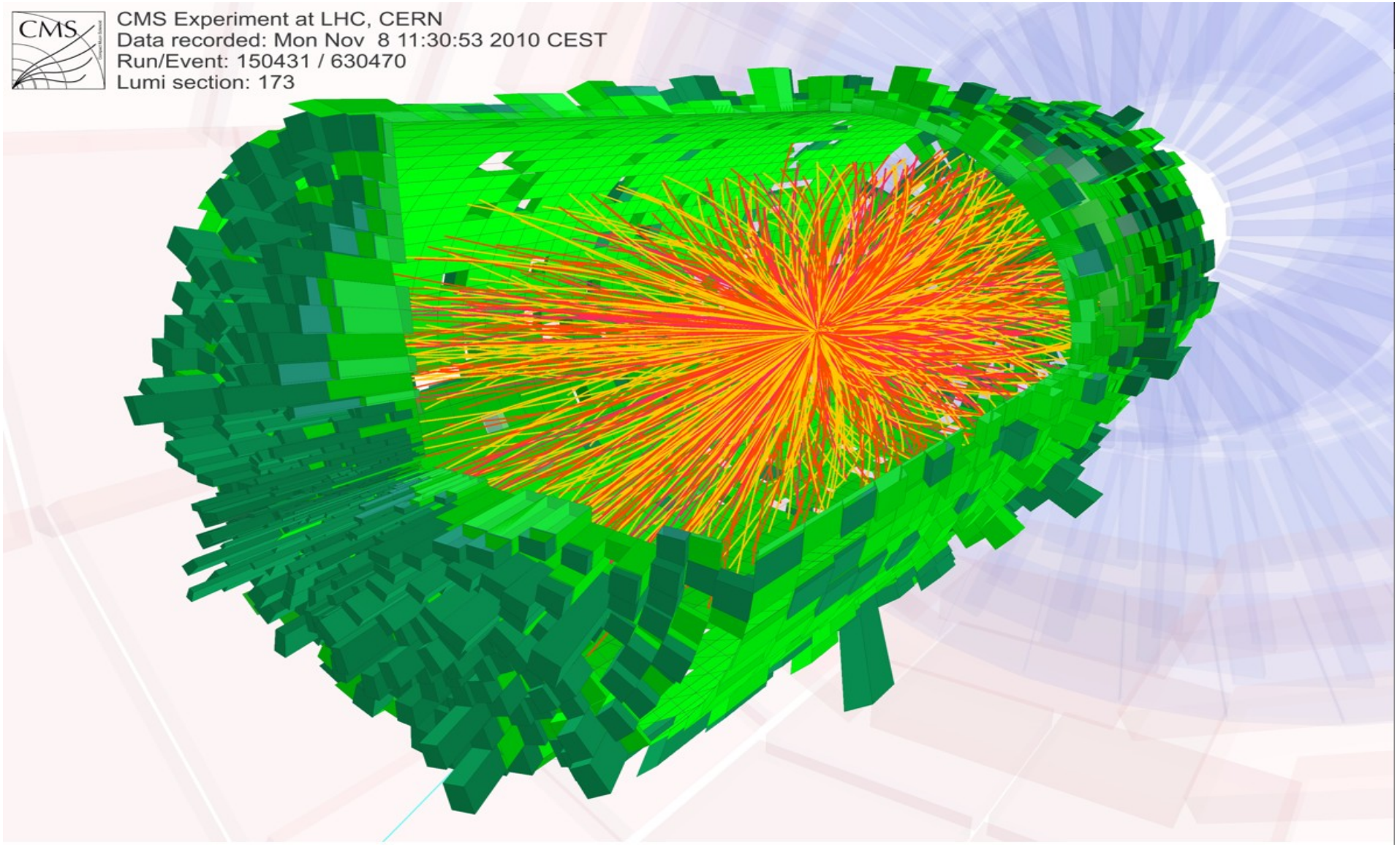
+20 currently in CWR + others in preparation on results presented at the Winter Conferences and at Quark Matter 2011.

Current estimate of the CMS Scientific Production of the first year of LHC running > 80 papers.

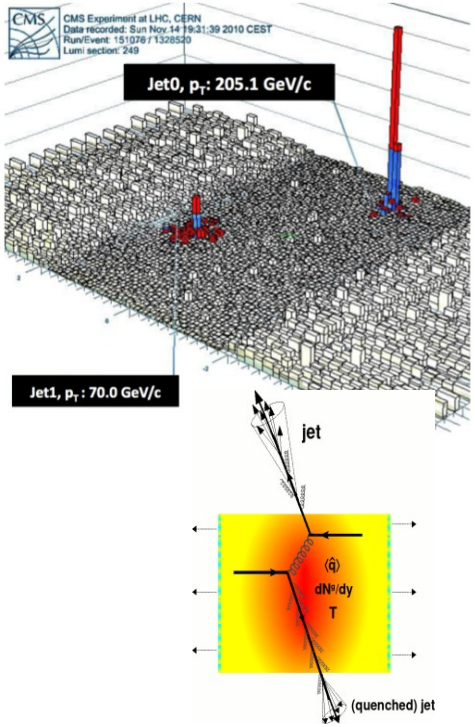
CMS speakers at P-LHC

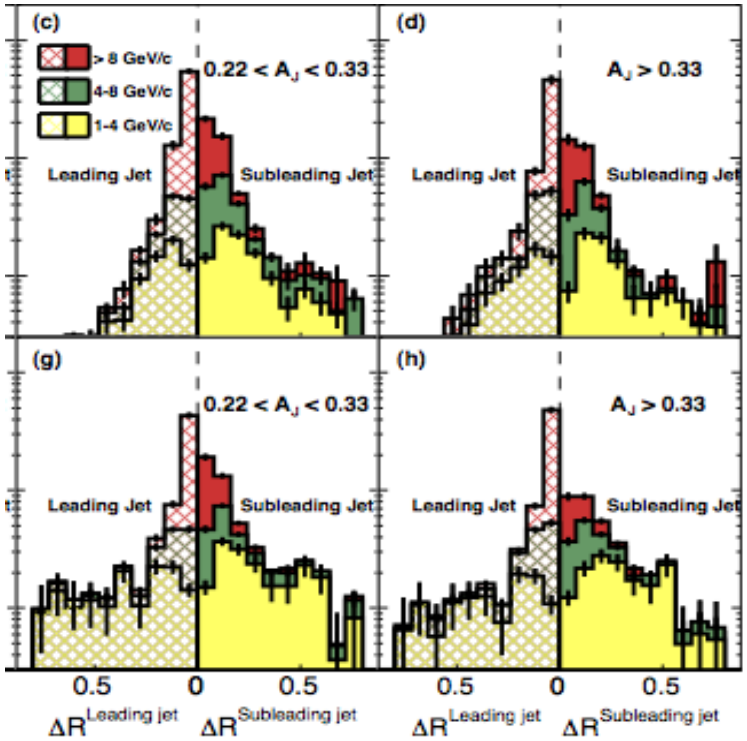
1.	Luca Lista (INFN di Napoli)	EWK Results from CMS
2.	Alicia Calderon Tazon (Universidad de Cantabria)	Top results from CMS
3.	Lars Sonnenschein (RWTH, III. Physik. Inst.)	Searches in CMS
4.	Konstantinos Kousouris (Fermi National Accelerator Lab.)	Hard QCD results from CMS
5.	Marcello Mannelli (CERN)	Higgs results from CMS
6.	Suharyo Sumowidagdo (UC Riverside)	Top quark cross section measurements with CMS
7.	Thomas Speer (Brown Univ.)	Top quark mass and other properties measurements with CMS
8.	Mara Senghi Soares (CIEMAT)	Single top quark production with CMS
9.	Didar Dobur (Univ. of Florida)	Search for SUSY at CMS in leptonic final states
10.	Piet Verwilligen (Ghent Univ.)	Search for SUSY at CMS in all-hadronic final states
11.	Krzysztof Piotrzkowski (Univ. Catholique de Louvain)	Exclusive measurements (di-leptons and vector mesons) at CMS
12.	Raphael Granier De Cassagnac (LLR, Ec. Poly., IN2P3-CNRS)	Heavy-ion results from the CMS experiment
13.	Hermine Woehri (CERN)	Measurements of quarkonia production and polarization with the CMS experiment
14.	Polina Otiougova (Univ. Zürich)	Measurements of B production with the CMS experiment
15.	Paolo Bartalini (National Taiwan University (NTU))	Underlying event studies at CMS
16.	Philippe Gras (DSM/DAPNIA, CEA/Saclay)	QCD studies with photons in CMS
17.	Ashok Kumar (Univ. of Delhi)	Higgs Searches at CMS
18.	Alexander Flossdorf (DESY)	Measurements of forward energy flow and forward jet production with CMS
19.	Will Reece (CERN)	W, Z + jets production with CMS detector
20.	Hwi Dong Yoo (Purdue Univ.)	Study of W and Z production, lepton charge asymmetry and Z differential cross sections at CMS
21.	Armando Lanaro (Univ. of Wisconsin)	Measurements of WW, Wγ and Zγ production cross sections at CMS
22.	Carmen Diez Pardos (CIEMAT)	Search for leptonic resonances at CMS
23.	Sertac Ozturk (Cukurova Univ.)	Search for hadronic resonances at CMS
24.	Ka Vang Tsang (Brown Univ.)	Search for Large Extra Dimensions at CMS
25.	Anne-Fleur Barfuss (Kansas State Univ.)	Search for leptoquarks and heavy quarks at CMS
26.	Ann-Karin Sanchez (ETH Zürich)	Soft and hard diffraction at CMS
27.	Monika Jindal (Panjab Univ.)	Measurement of Underlying Events using Drell-Yan Process
28.	Leonardo Benucci (Universiteit Antwerpen)	Search for New Physics with Mono-jet and MET in pp collisions at sqrt(s)=7 TeV
29.	Silvia Taroni (Univ. di Perugia e Sez. dell'INFN)	Measurement of the lepton charge asymmetry in inclusive pp to WX production at sqrt(s)= 7 TeV at CMS
30.	Piet Verwilligen (Ghent Univ.)	Search for new physics at CMS with jets and missing momentum
31.	Cesare Calabria (Univ. di Bari e Sez. dell'INFN)	Physics with taus at CMS
32.	Marc Dunser (HEPHY)	Search for Supersymmetry in the single-lepton channel at CMS
33.	Valentin Knunz (HEPHY)	Measurement of J/psi production at CMS
34.	Stefan Antonius Schmitz (RWTH, III. Physik. Inst. A)	Search for Large Extra Dimensions in Dimuon Events at CMS
35.	Ronald Charles Remington (Univ. of Florida)	Search for new physics in the same-sign di-lepton channel at CMS
36.	Marco Meneghelli (Univ. di Bologna e Sez. dell'INFN)	Heavy stable particles in CMS
37.	Xianyou Wang (Inst. of High Energy Physics)	Observation of the X(3872) state with the CMS experiment
38.	Ferdinando Giordano (UC Riverside)	Performance of the CMS Pixel detector for the Phase I upgrade at HL-LH

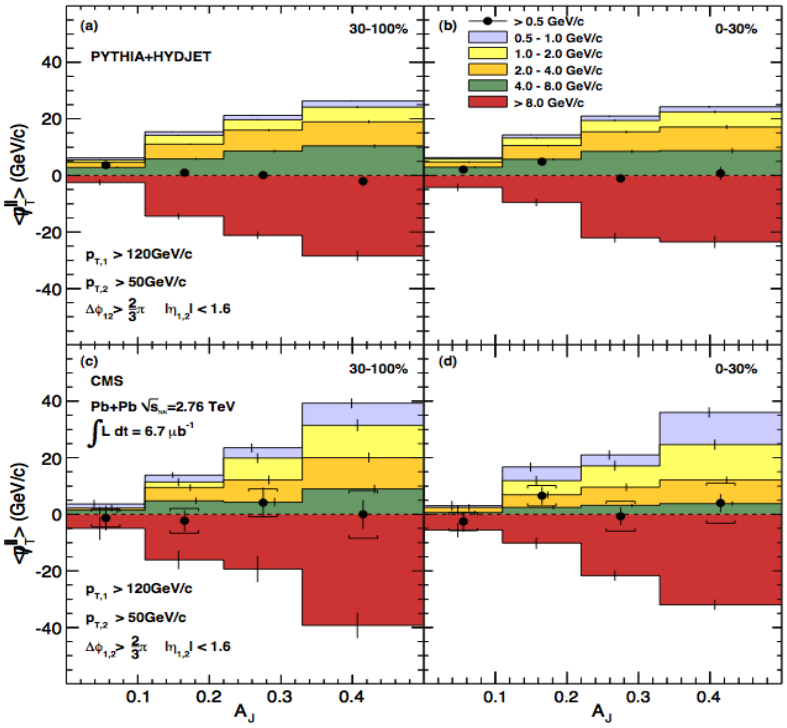
Pb-Pb collisions in CMS



Jet quenching: direct observation and detailed understanding





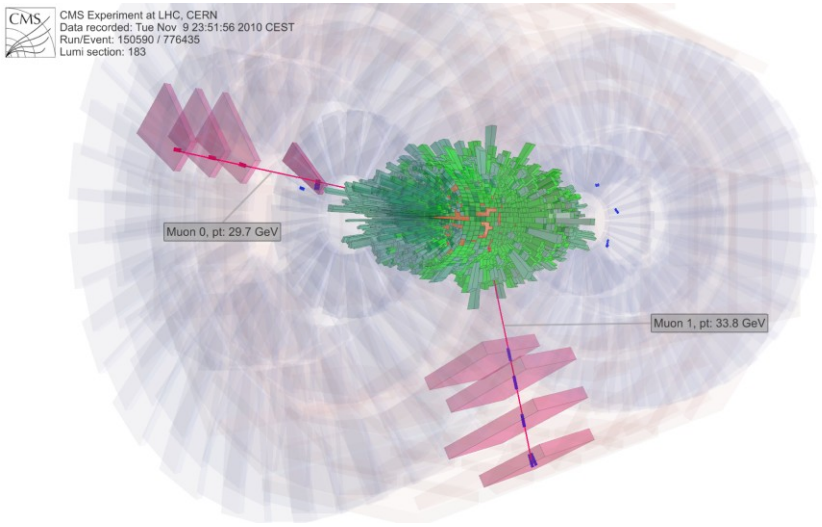


The phenomenon of jet quenching in Heavy-Ion collisions is now described in detail and fully understood.

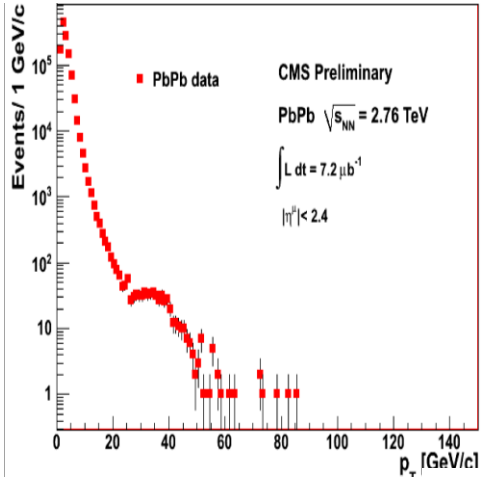
The di-jet momentum balance is fully recovered if we consider the low p_T tracks distributed over a wider angular range wrt the jet axis.

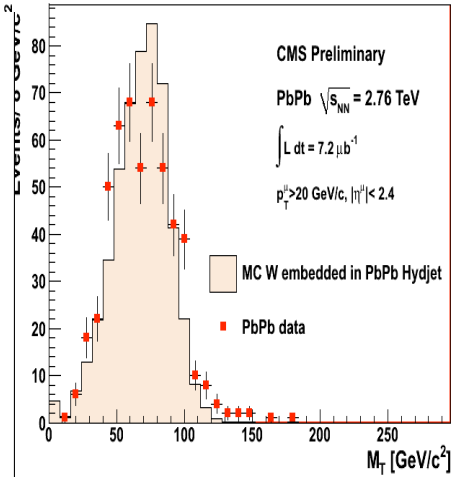
arXiv:1102.1957; Submitted to Physical Review C

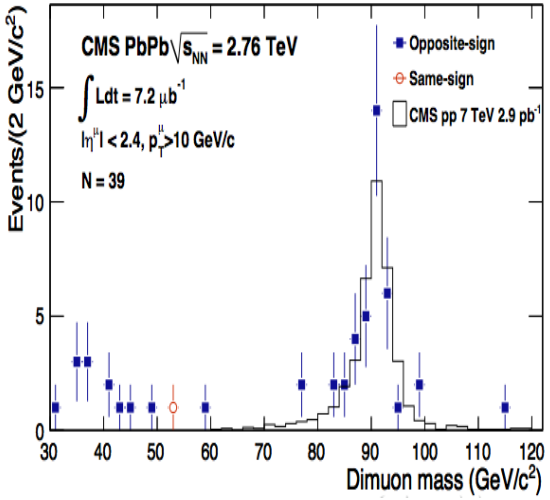
Observation of Z and W produced in HI collisions

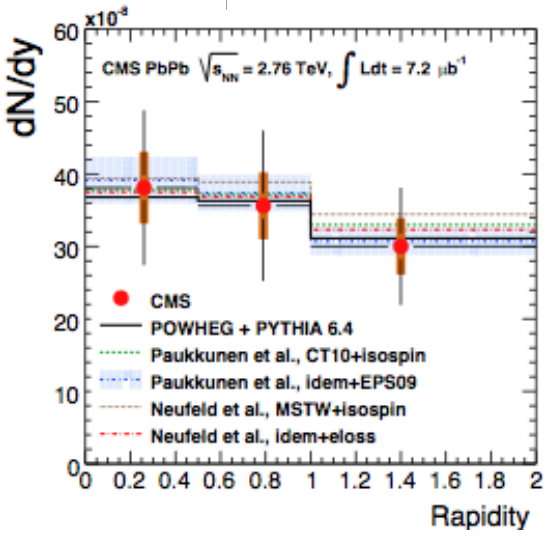


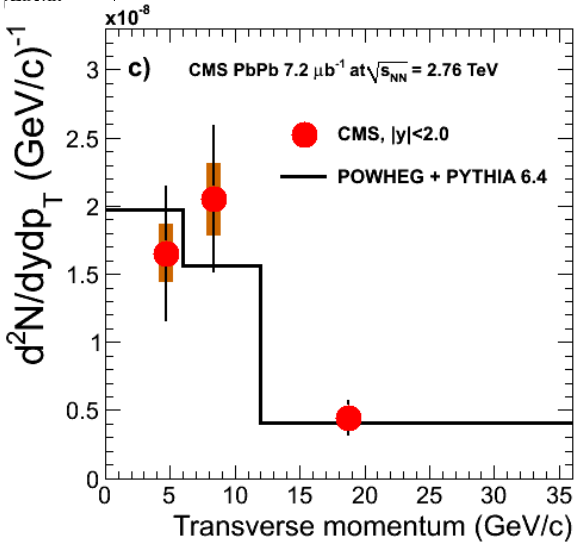
For the first time Electroweak probes accessible in HI collisions.







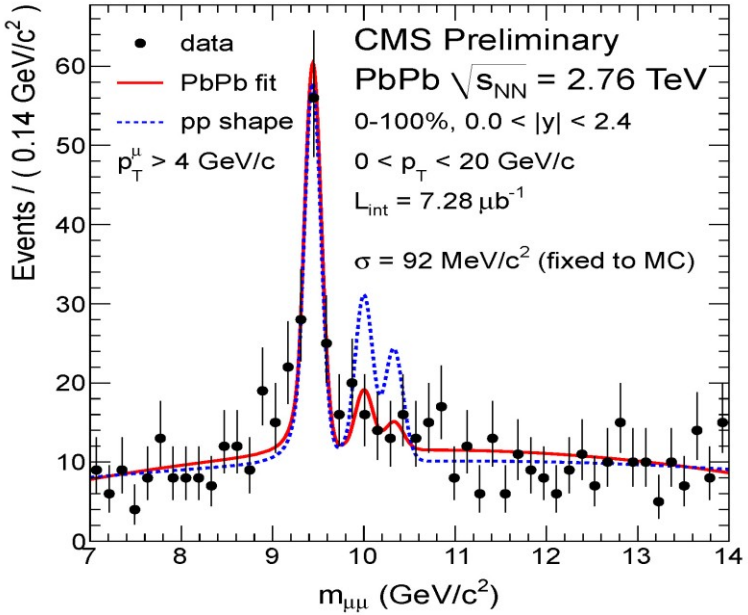




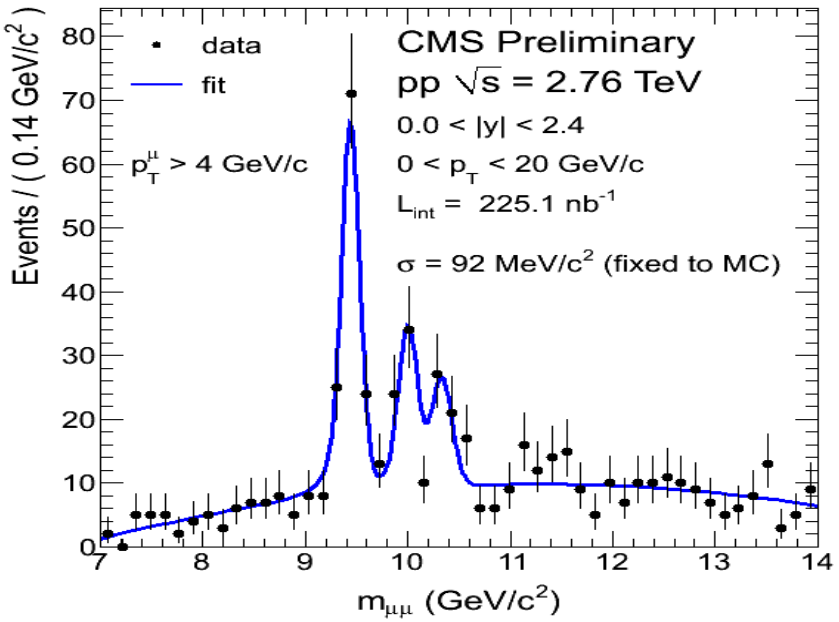
arXiv:1102.5435; *PRL 106*, 212301 (2011)

New CMS Result in HI

PbPb @ 2.76 TeV



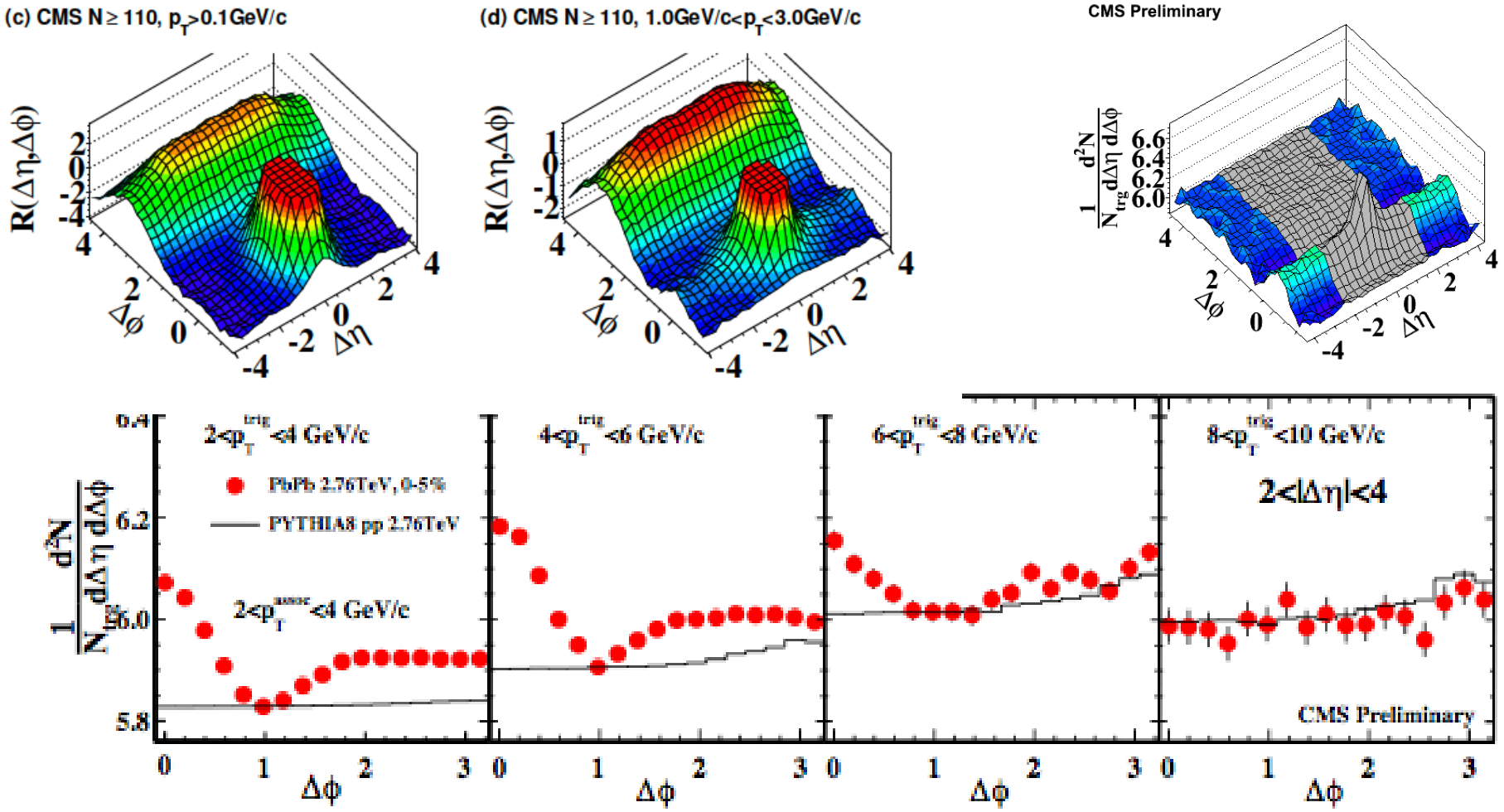
pp @ 2.76 TeV



Suppression of the weakly bound excited ϒ states

arXiv:1105.4894 ; CMS-HIN-11-007 ; CERN-PH-EP-2011-074

Long range correlations in pp and ion data

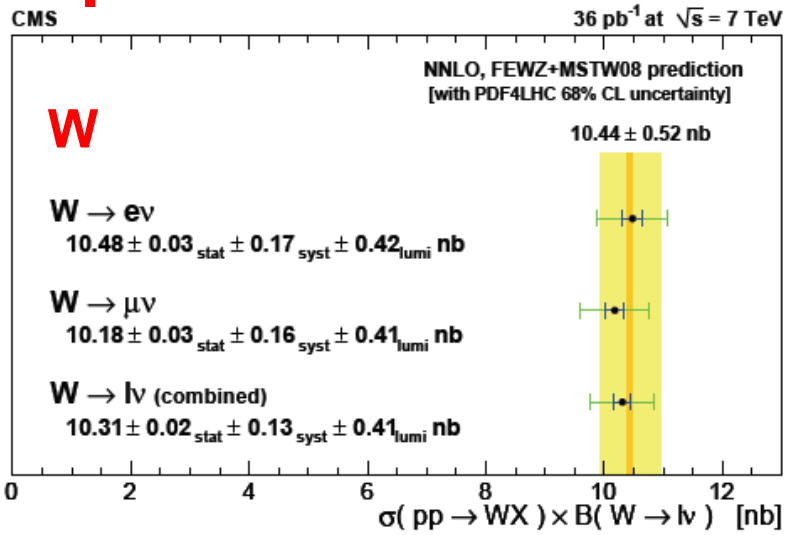


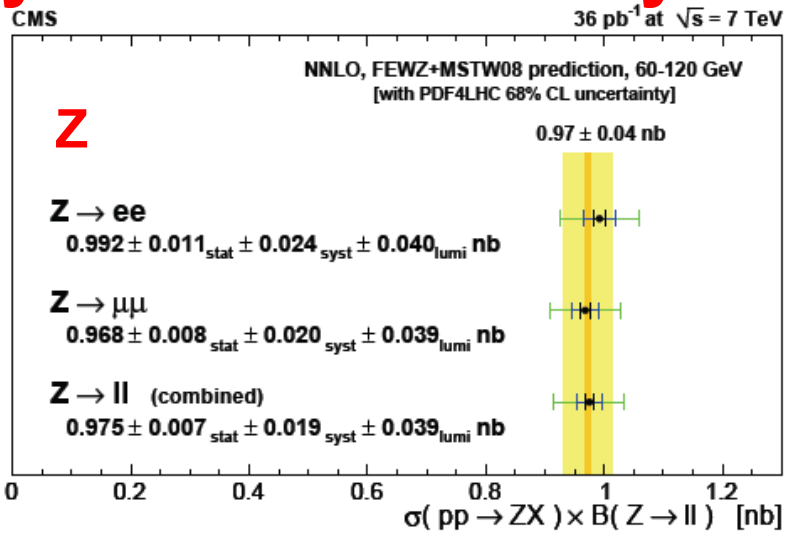
Ridge most evident for 2 GeV < p_T^{trig} < 6 GeV; it disappears at high p_T

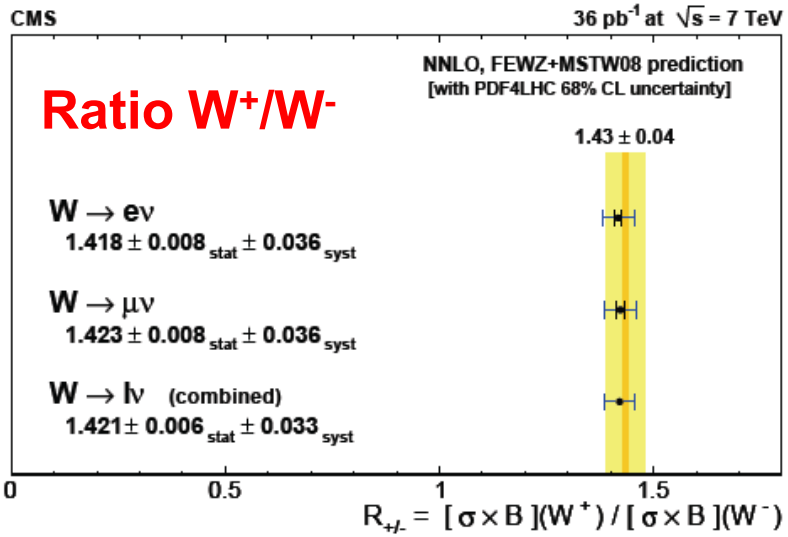
arXiv:1105.2438 ; CMS-HIN-11-001 ; CERN-PH-EP-2011-056.

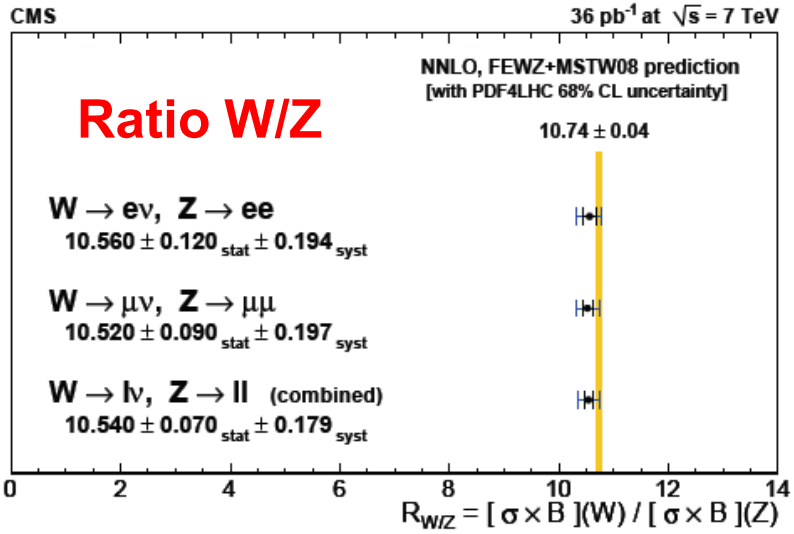
7TeV pp collisions: new EWK measurements

36pb^{-1} and 4% uncertainty on the luminosity



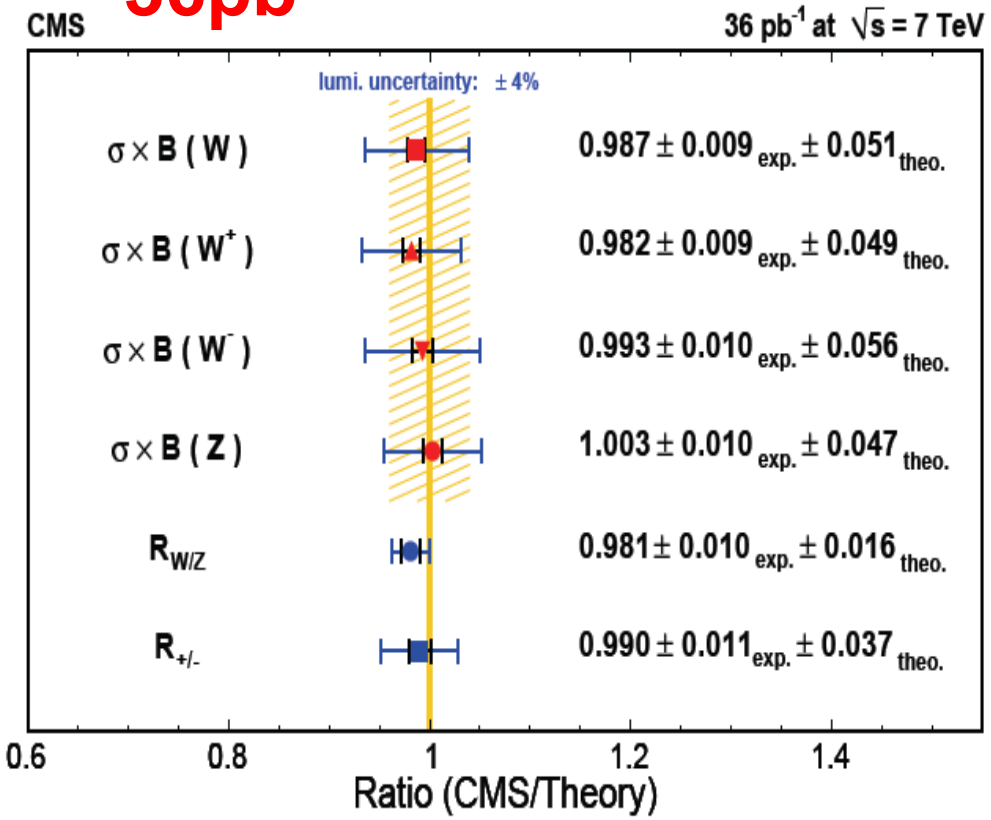


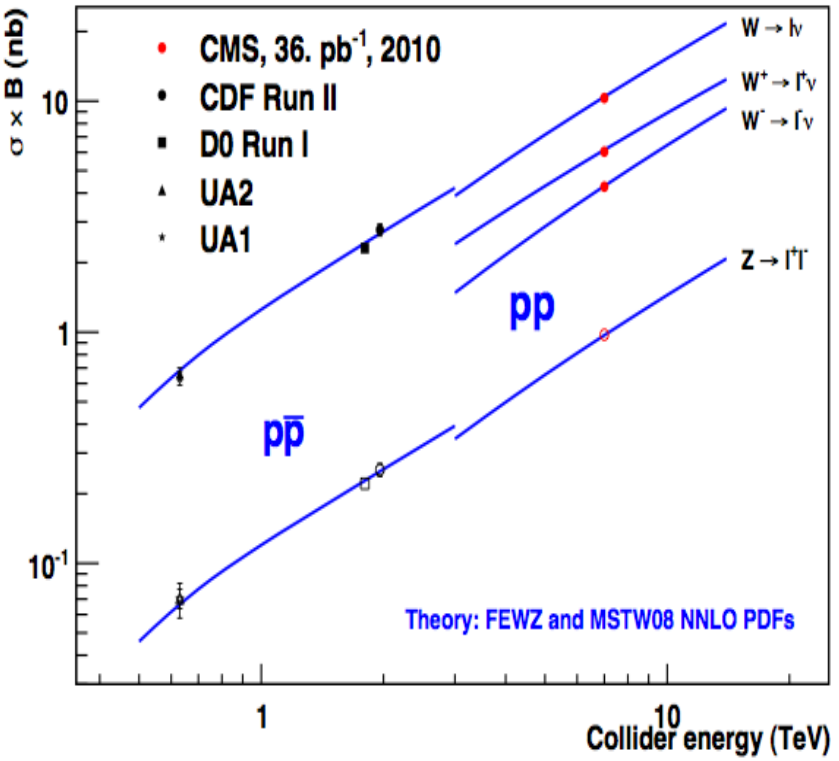




W and Z production cross sections

36pb^{-1}





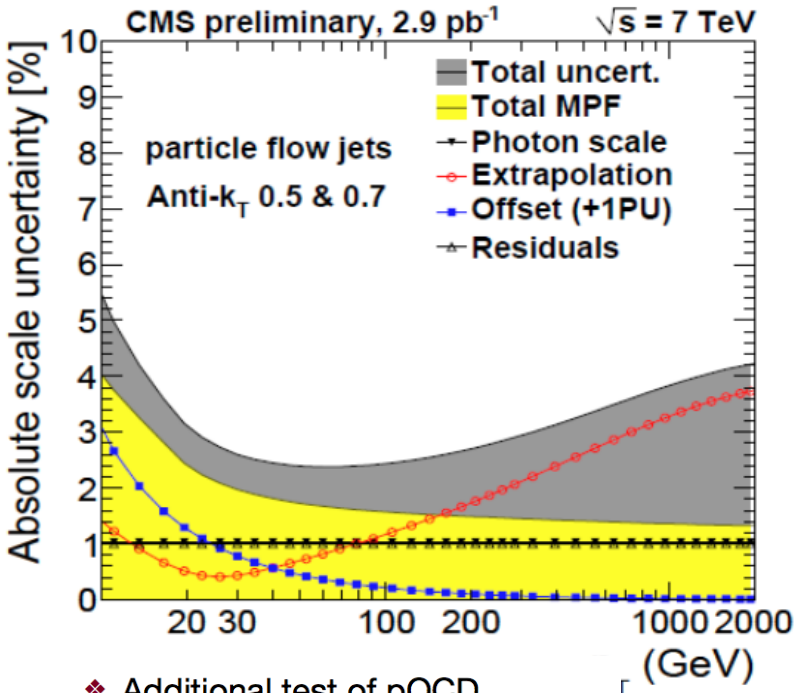
Notice: all major components of the measurements (efficiency, background, systematic errors etc) are carefully evaluated using data driven methods.

1) CMS PAS EWK-10-005

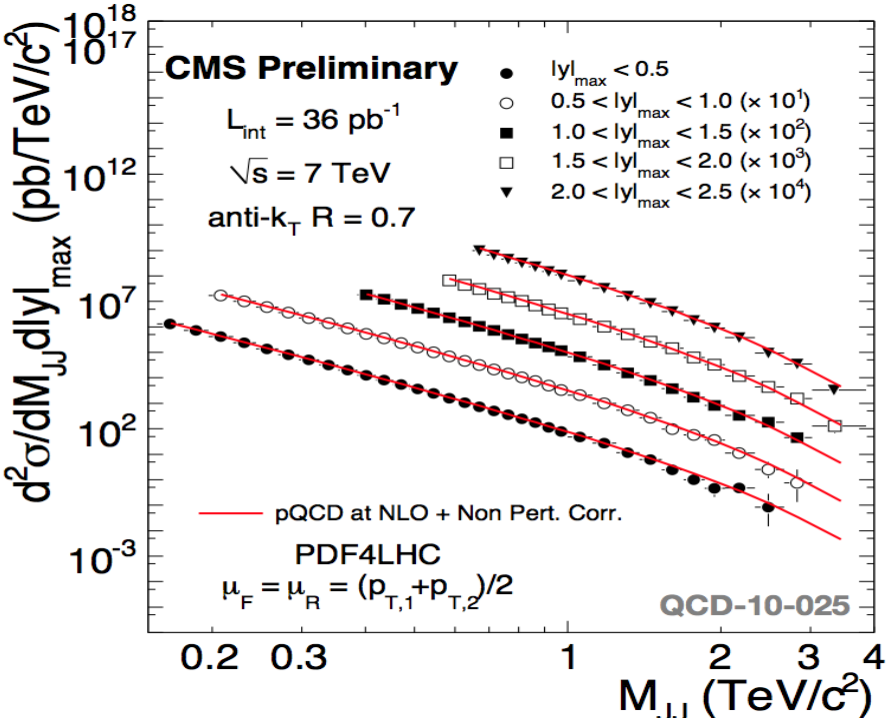
2) arXiv:1012.2466 ; *J. High Energy Phys. 01 (2011) 080*

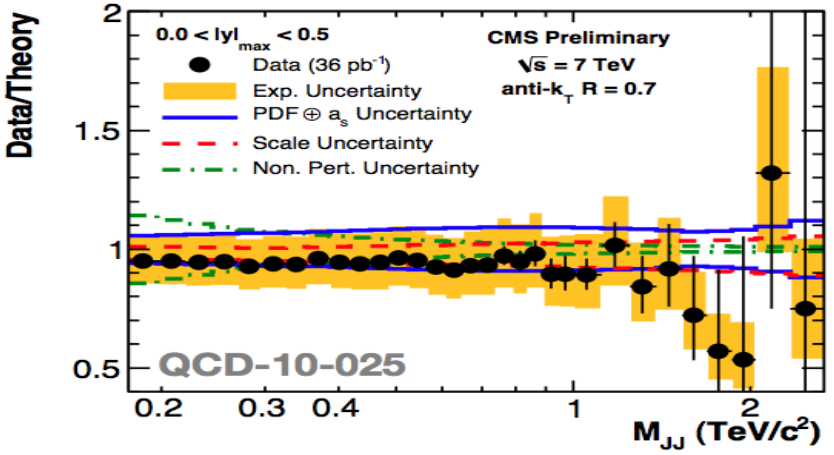
JEC; Di-jet Cross Section vs Mass.

Uncertainty on the energy scale depending on p_T and η: 3-5%

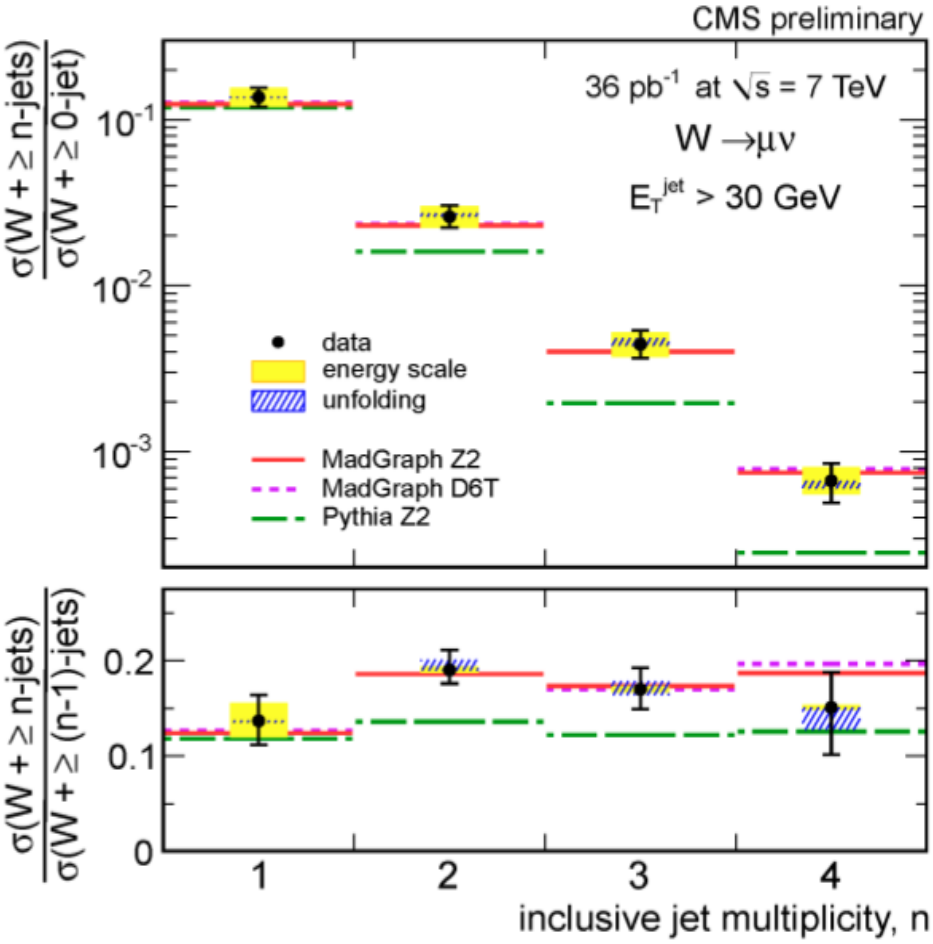


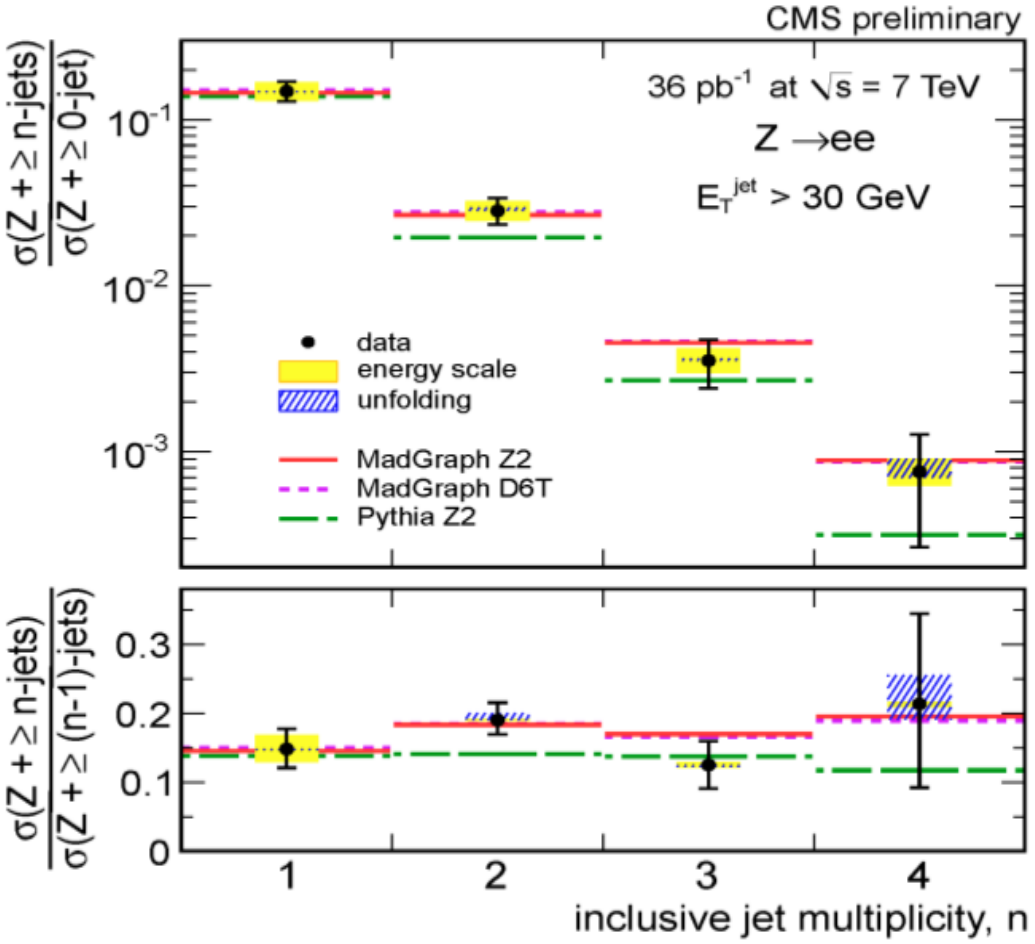
- Additional test of pQCD
- Background for 'bump hunting'
- Up to M_{JJ} = 3.5 TeV/c^2
- Data/theory compatible with inclusive jet measurement





W, Z +jets: the challenge of understanding very complex backgrounds



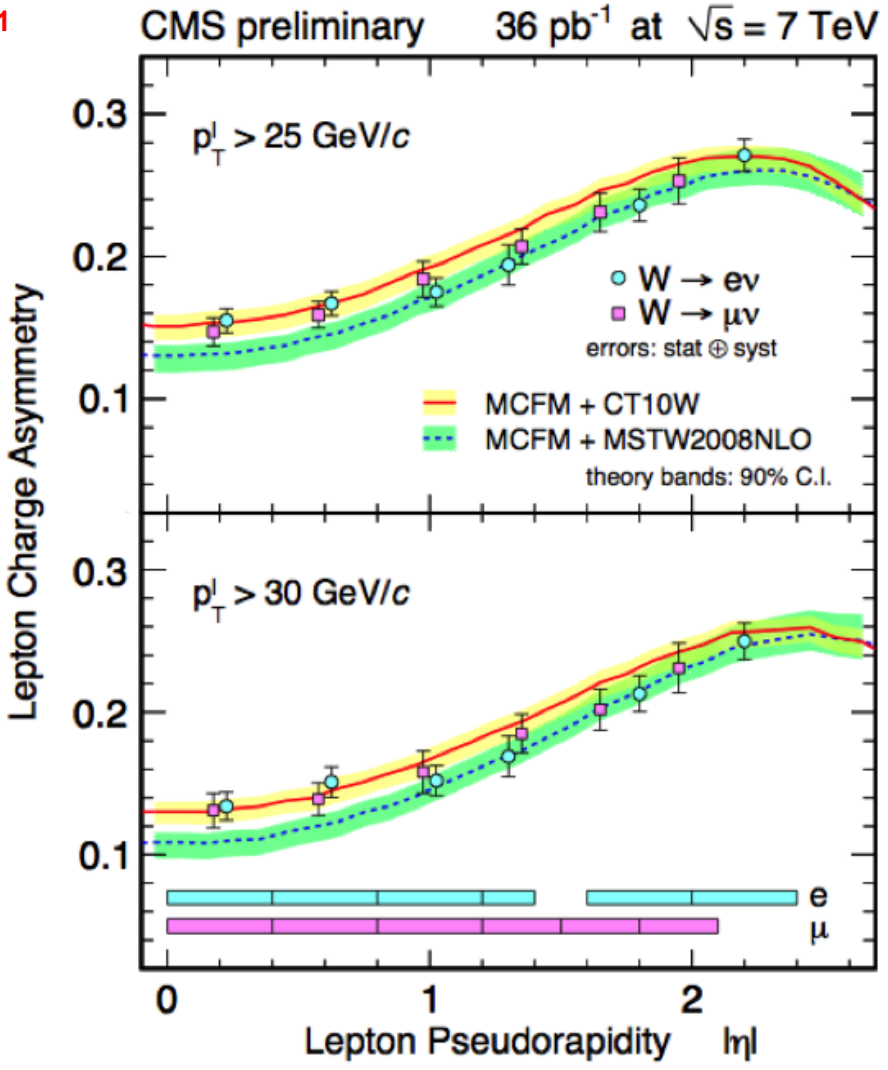


Results agree reasonably well with MADGRAPH
PYTHIA, as expected not describing well data when more than 1 jet is present.

Lepton charge asymmetry in inclusive W

36pb^{-1}

	$p_T^\ell > 25$ GeV		$p_T^\ell > 30$ GeV	
$\|\eta^e\|$	$\mathcal{A}(e)$ ($\pm$stat $\pm$ sys)	Prediction	$\mathcal{A}(e)$ ($\pm$stat $\pm$ sys)	Prediction
[0.0 - 0.4]	$0.155 \pm 0.006 \pm 0.007$	$0.157^{+0.010}_{-0.010}$	$0.134 \pm 0.007 \pm 0.007$	$0.134^{+0.009}_{-0.009}$
[0.4 - 0.8]	$0.167 \pm 0.006 \pm 0.007$	$0.169^{+0.010}_{-0.011}$	$0.151 \pm 0.007 \pm 0.008$	$0.146^{+0.009}_{-0.010}$
[0.8 - 1.2]	$0.175 \pm 0.007 \pm 0.008$	$0.193^{+0.009}_{-0.011}$	$0.152 \pm 0.007 \pm 0.008$	$0.169^{+0.009}_{-0.011}$
[1.2 - 1.4]	$0.194 \pm 0.010 \pm 0.009$	$0.216^{+0.010}_{-0.012}$	$0.169 \pm 0.011 \pm 0.009$	$0.191^{+0.010}_{-0.012}$
[1.6 - 2.0]	$0.236 \pm 0.008 \pm 0.009$	$0.256^{+0.010}_{-0.014}$	$0.213 \pm 0.009 \pm 0.009$	$0.234^{+0.011}_{-0.015}$
[2.0 - 2.4]	$0.271 \pm 0.008 \pm 0.009$	$0.271^{+0.012}_{-0.017}$	$0.250 \pm 0.009 \pm 0.009$	$0.257^{+0.013}_{-0.018}$
$\|\eta^\mu\|$	$\mathcal{A}(\mu)$ ($\pm$stat $\pm$ sys)	Prediction	$\mathcal{A}(\mu)$ ($\pm$stat $\pm$ sys)	Prediction
[0.0 - 0.4]	$0.147 \pm 0.006 \pm 0.008$	$0.157^{+0.010}_{-0.010}$	$0.131 \pm 0.007 \pm 0.010$	$0.134^{+0.009}_{-0.009}$
[0.4 - 0.8]	$0.159 \pm 0.006 \pm 0.007$	$0.169^{+0.010}_{-0.011}$	$0.139 \pm 0.007 \pm 0.009$	$0.146^{+0.009}_{-0.010}$
[0.8 - 1.2]	$0.184 \pm 0.006 \pm 0.011$	$0.193^{+0.009}_{-0.011}$	$0.158 \pm 0.007 \pm 0.013$	$0.169^{+0.009}_{-0.011}$
[1.2 - 1.5]	$0.207 \pm 0.007 \pm 0.010$	$0.220^{+0.009}_{-0.012}$	$0.185 \pm 0.008 \pm 0.011$	$0.196^{+0.010}_{-0.012}$
[1.5 - 1.8]	$0.231 \pm 0.008 \pm 0.011$	$0.246^{+0.010}_{-0.014}$	$0.202 \pm 0.008 \pm 0.012$	$0.222^{+0.011}_{-0.014}$
[1.8 - 2.1]	$0.253 \pm 0.008 \pm 0.014$	$0.265^{+0.010}_{-0.015}$	$0.231 \pm 0.009 \pm 0.015$	$0.245^{+0.011}_{-0.016}$



Precision EWK measurements are already being produced at LHC.

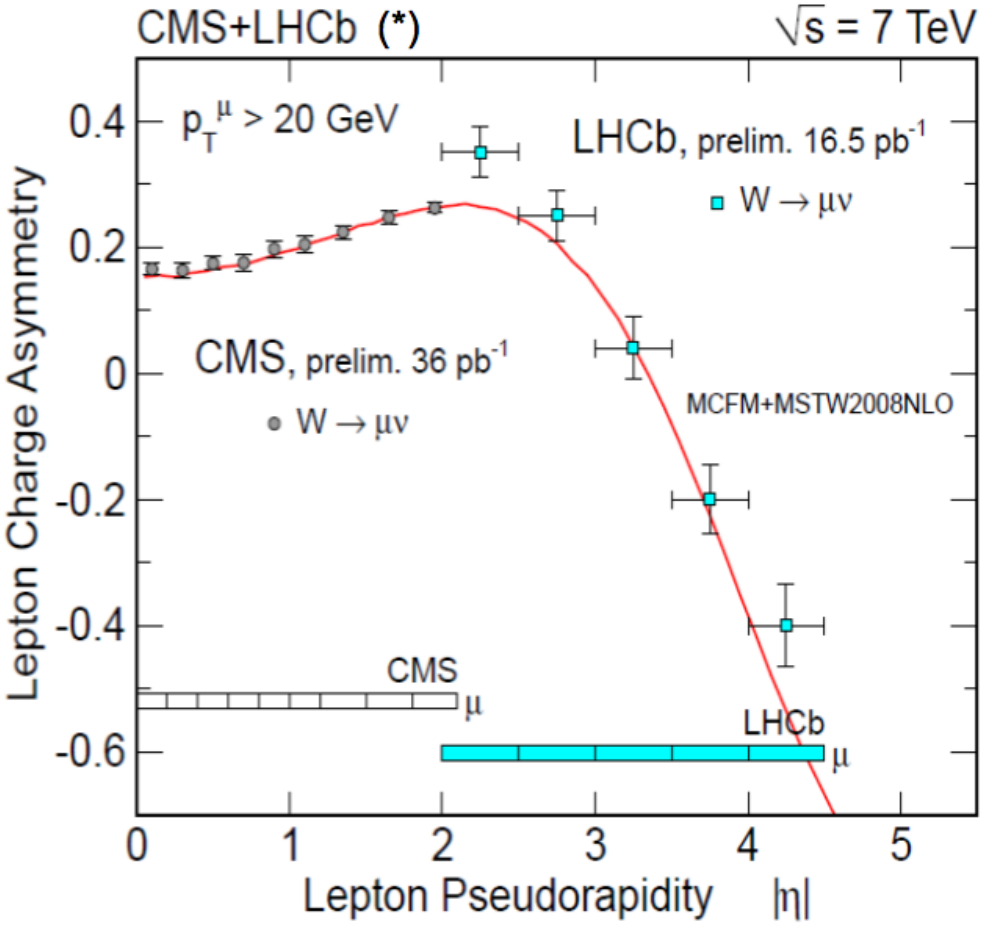
The values of the charge asymmetry between electrons and muons are in good agreement with each other.

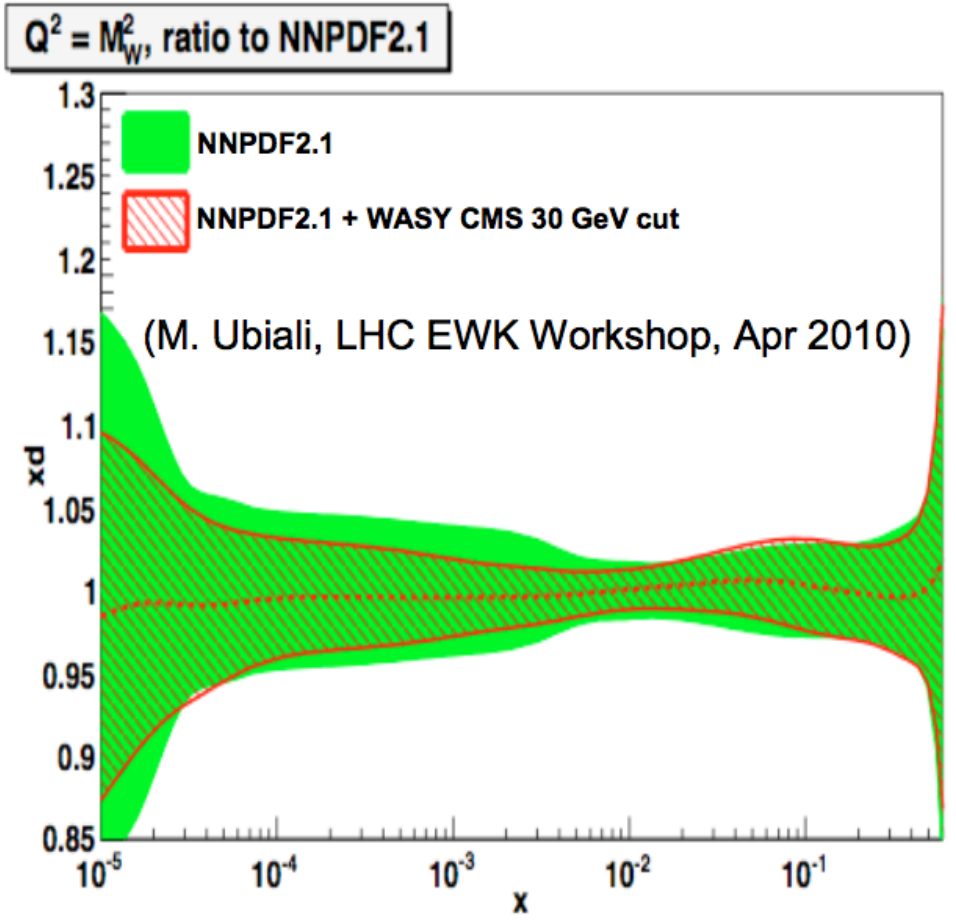
The precision of the measurement is good enough to provide new inputs to the PDF global fits.

arXiv:1103.3470 *Submitted to the Journal of High Energy Physics*

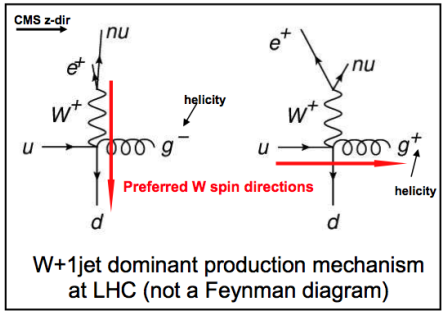
Lepton charge asymmetry in inclusive W

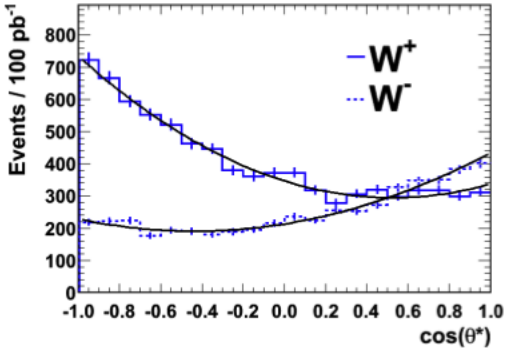
We are able to produce precision EWK measurements good enough to constrain significantly the PDF global fits.



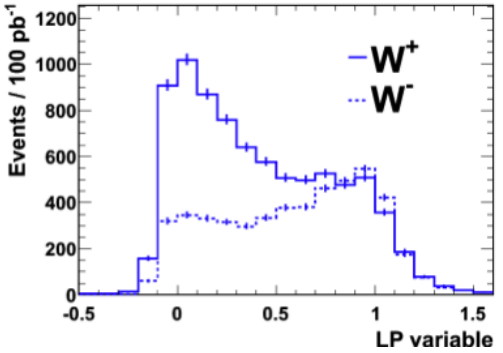


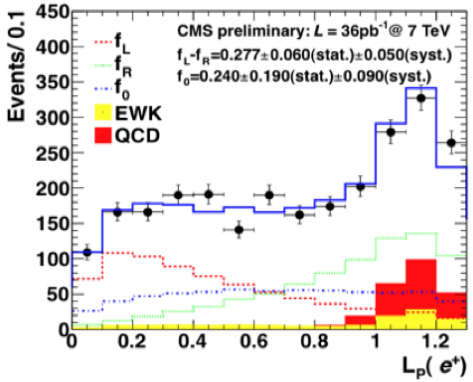
First measurement of W polarization at a pp Collider

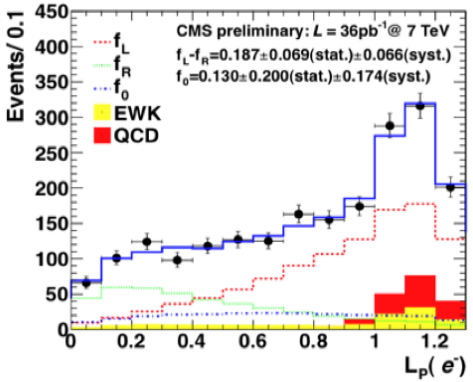


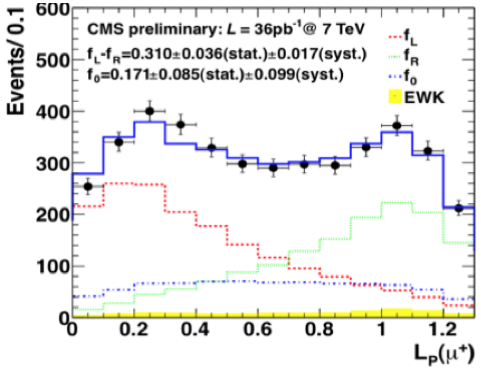


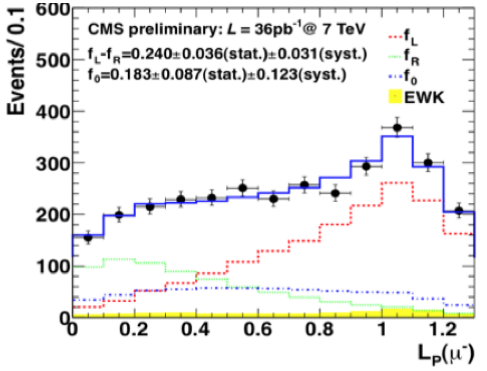
$$LP = \frac{\vec{P}_T(\ell)\cdot\vec{P}_T(W)}{\left|\vec{P}_T(W)\right|^2}$$



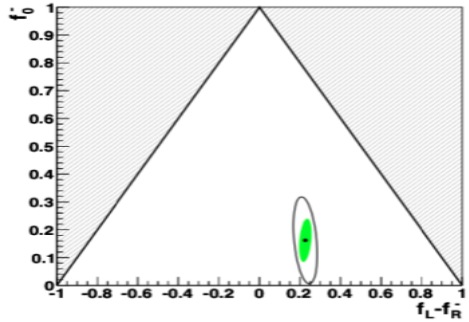


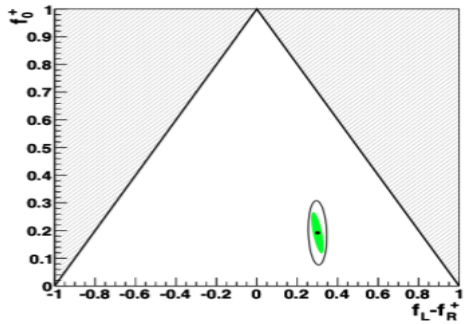






comb: $(f_L - f_R)^-$	0.226 ± 0.031 (stat.) ± 0.050 (syst.)	***MC: 0.242***
comb: f_0^-	0.162 ± 0.078 (stat.) ± 0.136 (syst.)	***MC: 0.215***
Correlation (stat)	0.304 (stat.)	
comb: $(f_L - f_R)^+$	0.300 ± 0.031 (stat.) ± 0.034 (syst.)	***MC: 0.322***
comb: f_0^+	0.192 ± 0.075 (stat.) ± 0.089 (syst.)	***MC: 0.225***
Correlation (stat)	-0.660 (stat.)	



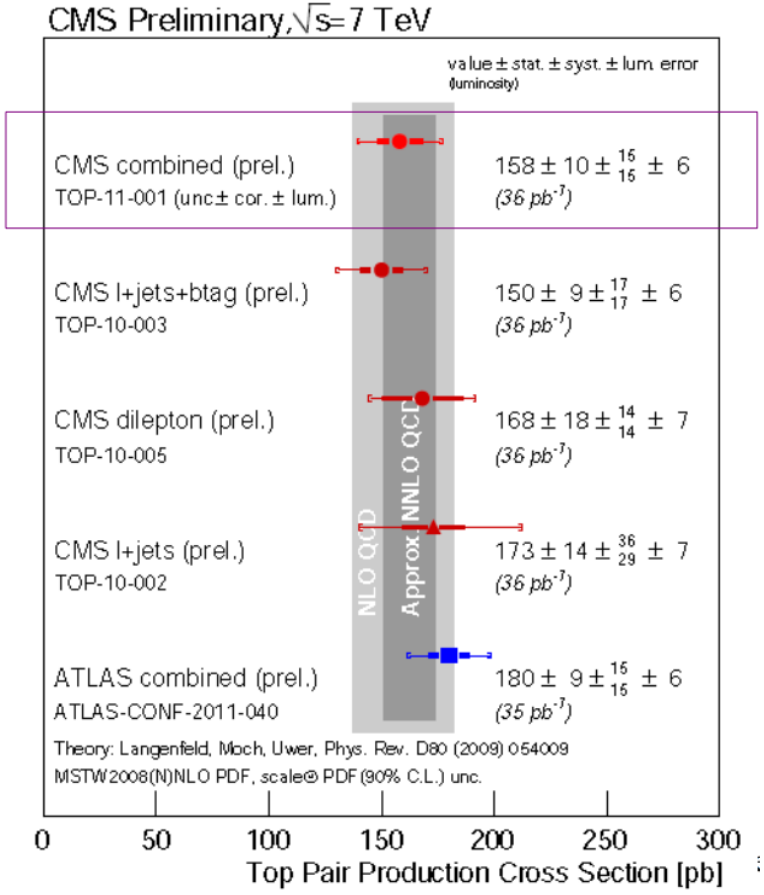


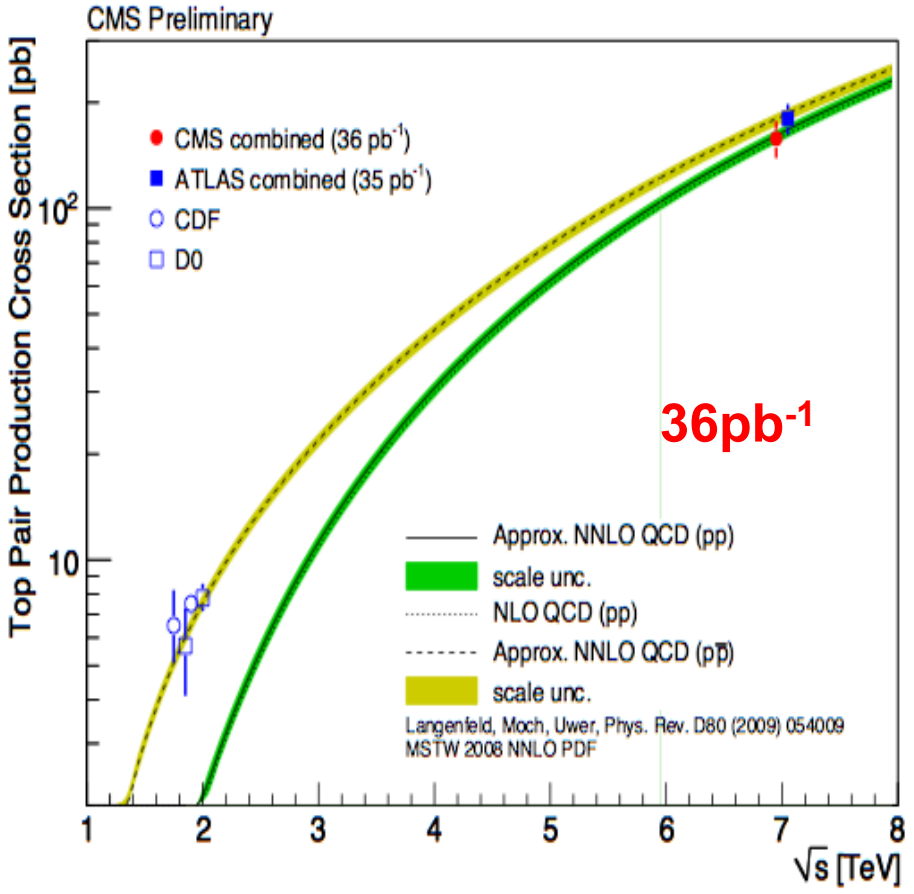
arXiv:1103.3470 submitted to the Journal of High Energy Physics

Top cross section combined result

New measurements of the top cross section (leptons+jets with and without btag)

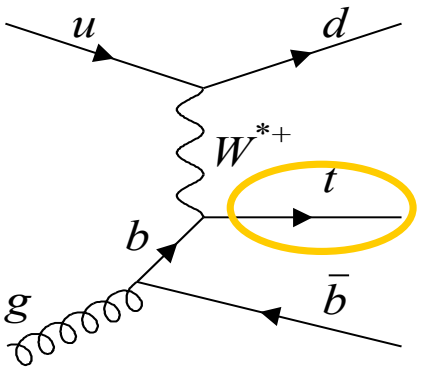
$$\sigma = 158 \pm 10 \pm 16 \pm 6(\text{lumi})\text{pb}$$



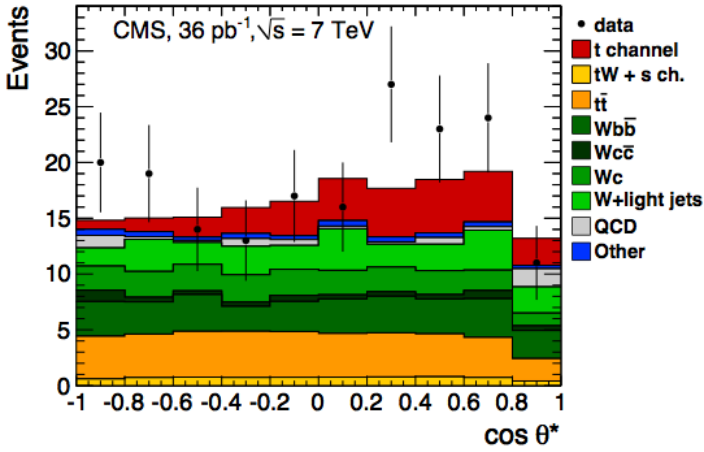


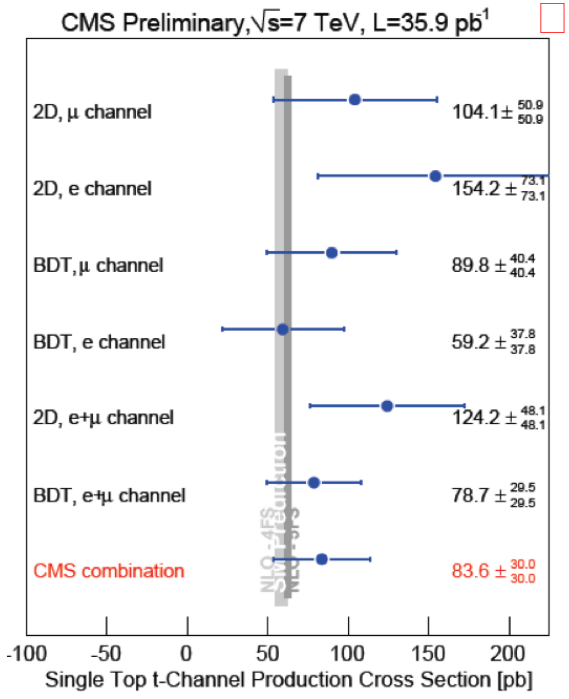
CMS-TOP-10-003-001; CERN-PH-EP-2011-085; CMS-TOP-10-002-002; CERN-PH-EP-2011-060
arXiv:1105.5661 ; CMS-TOP-11-002 ; CERN-PH-EP-2011-055

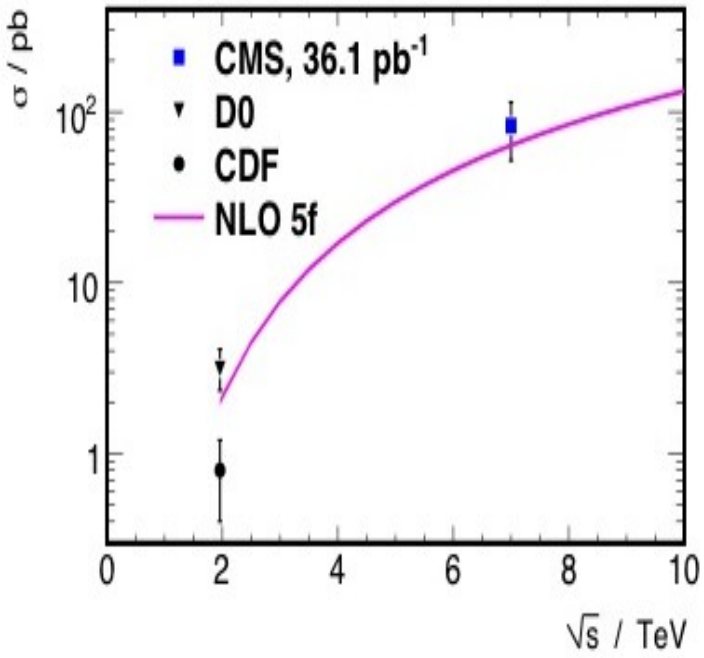
Single top @LHC: the challenge of tiny cross section over tough background.

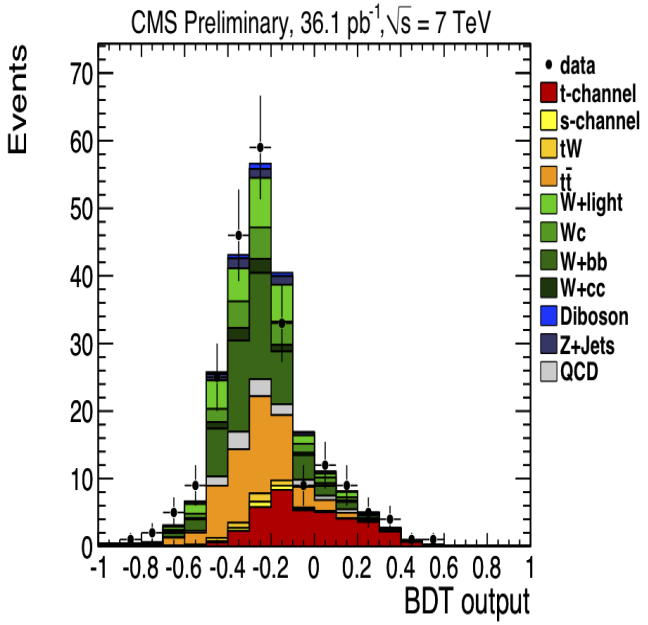


- Example of finding tiny signals with lepton, MET, b-tag and jets
- Two different analyses (cut based and BDT): three different channels.
- **Very challenging analysis.**
- **$\sigma = 83.0 \pm 29.8 \pm 3.3(\text{lumi})$pb**



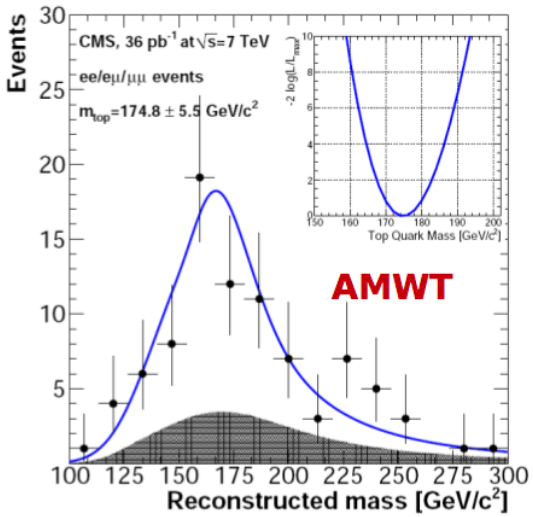






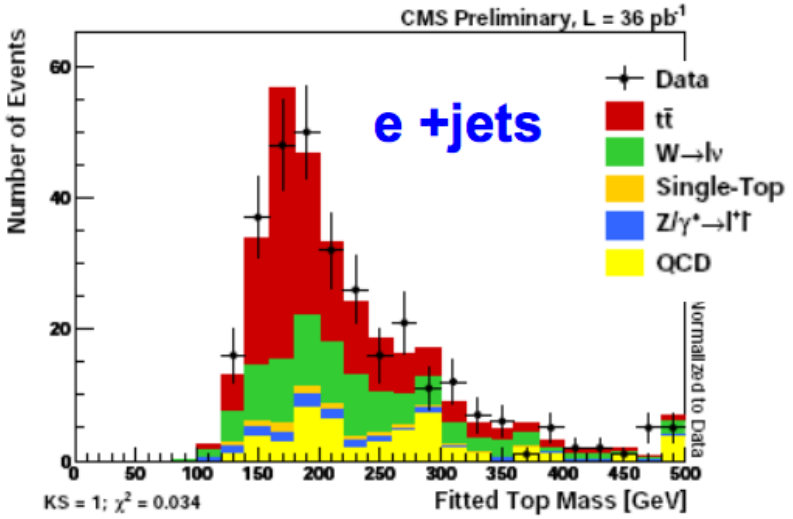
CMS PAS TOP-10-008-002; CERN-PH-EP-2011-066

Top mass

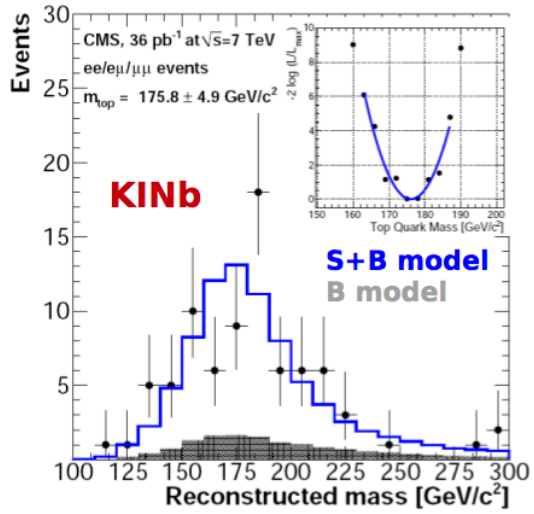


Dilepton channel
M_{top}=175.5±4.6±4.6 GeV/c^2

Lepton+jets channel
M_{top}=173.1±2.1±2.8 GeV/c^2

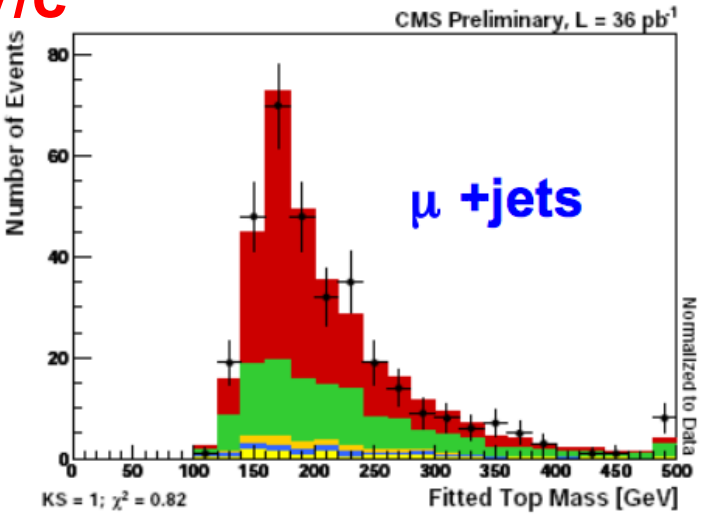


CMS combination
M_{top}=173.4±1.9±2.7GeV/c^2



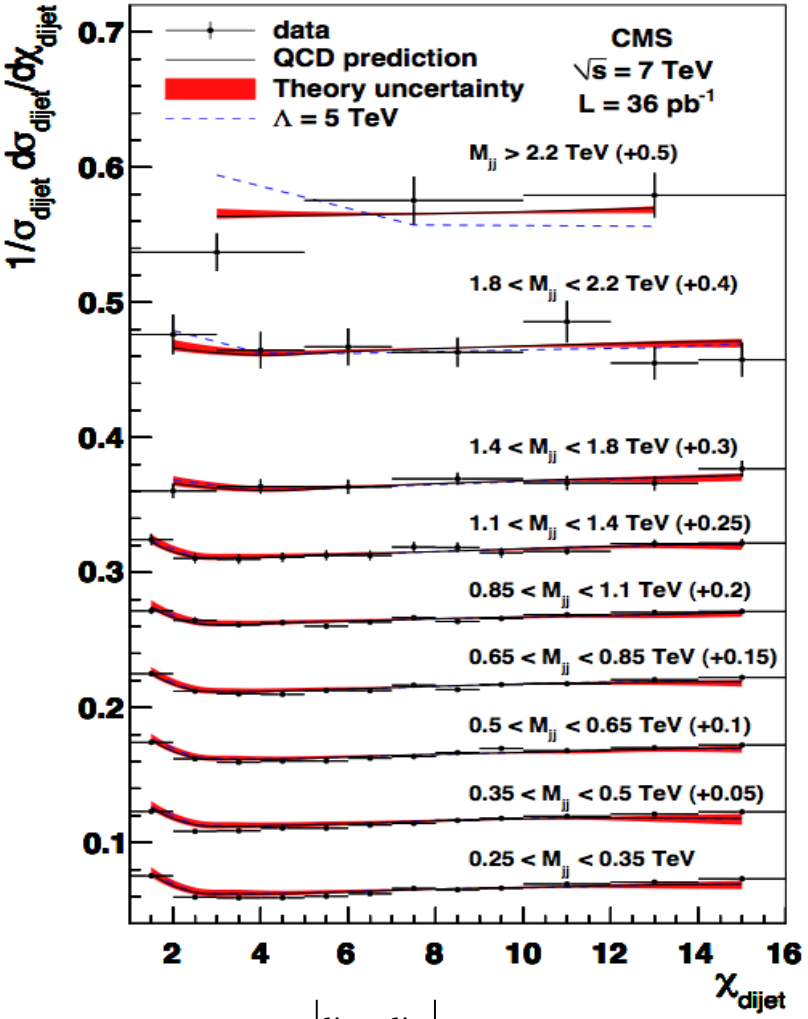
2% precision

LHC is now a top factory and will allow soon detailed studies of top properties.

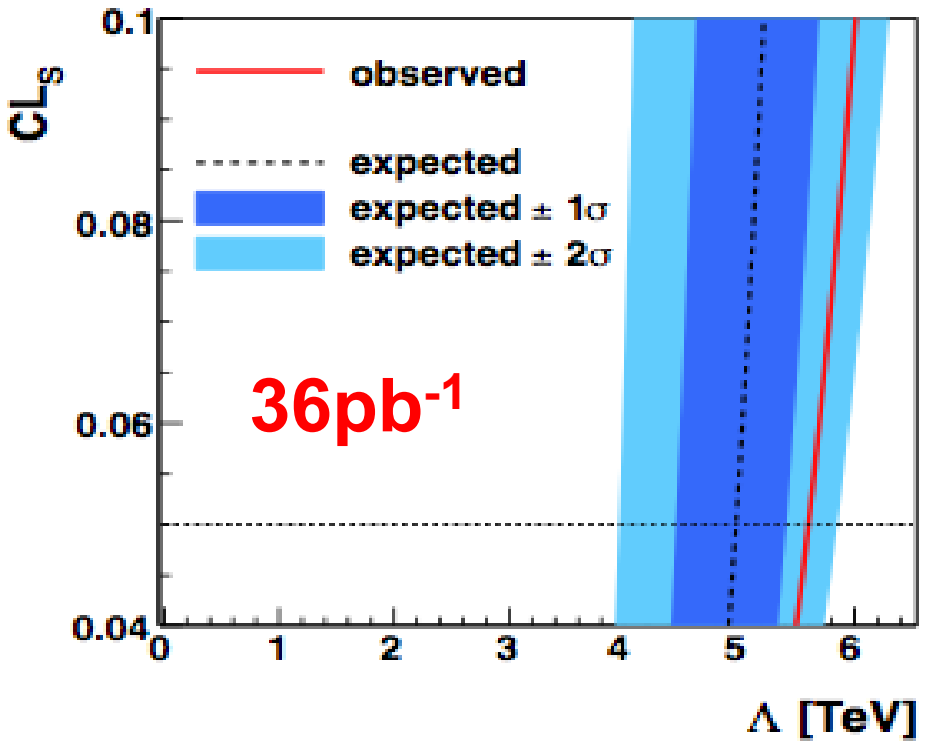


arXiv:1105.5661 ; CMS-TOP-11-002 ; CERN-PH-EP-2011-055

Search for quark compositeness



$$\chi = e^{|y_1 - y_2|}$$

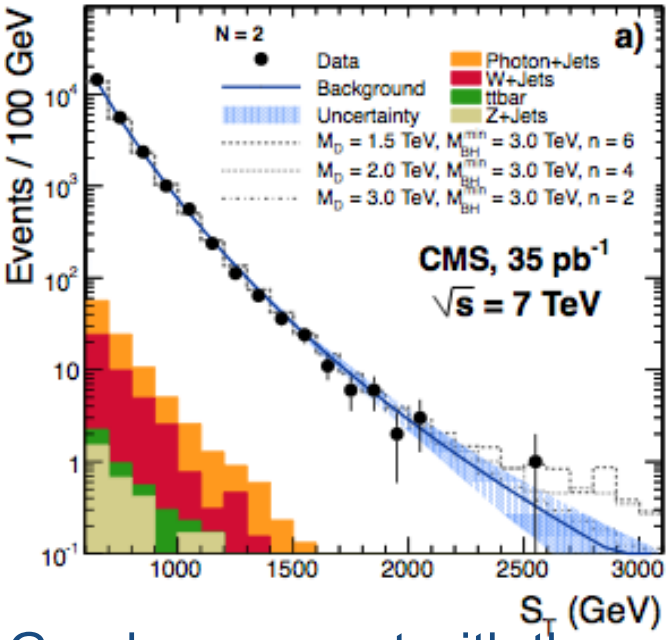


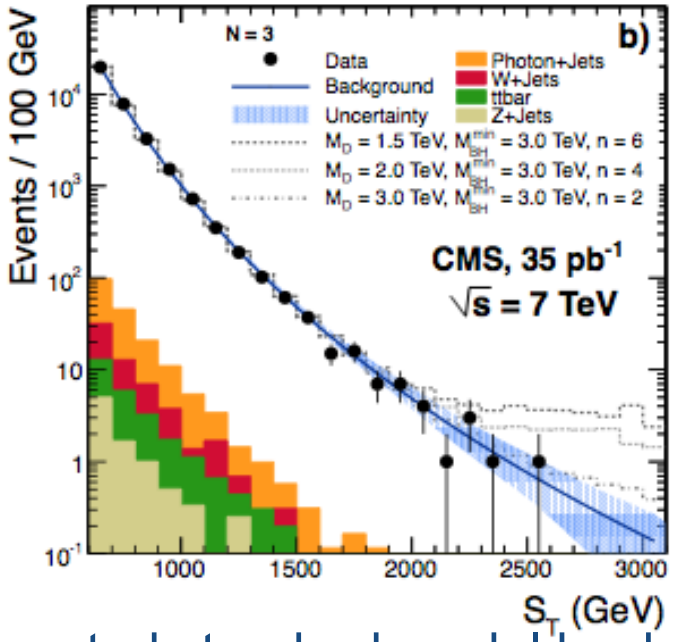
The dijet angular distributions are compatible with pQCD predictions for dijet invariant mass of 250GeV up to>2.2TeV. We put a lower limit on the contact interaction scale of **Λ=5.6 TeV** at 95% CL.

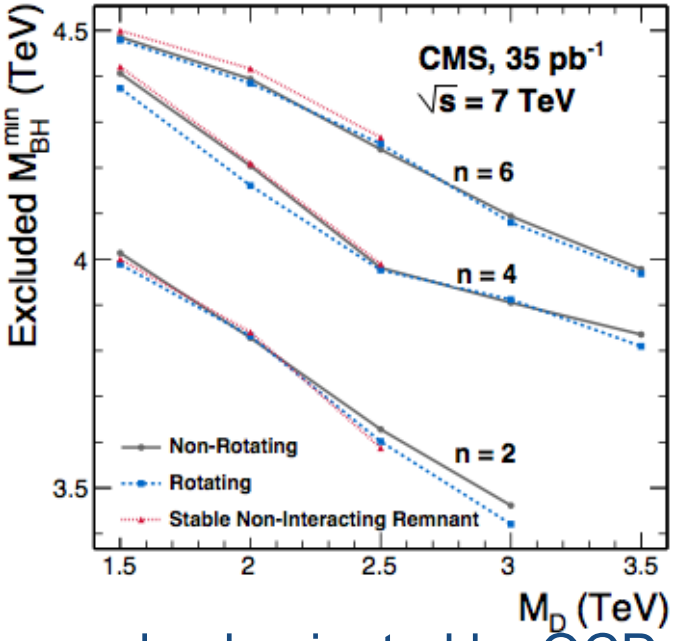
arXiv:1102.2020; Submitted to Physical Review Letters

First direct search of microscopic black holes signatures at a particle collider.

Events with large total transverse energy are analyzed for the presence of multiple high-energy jets, leptons, and photons, typical signal expected from a microscopic black hole.





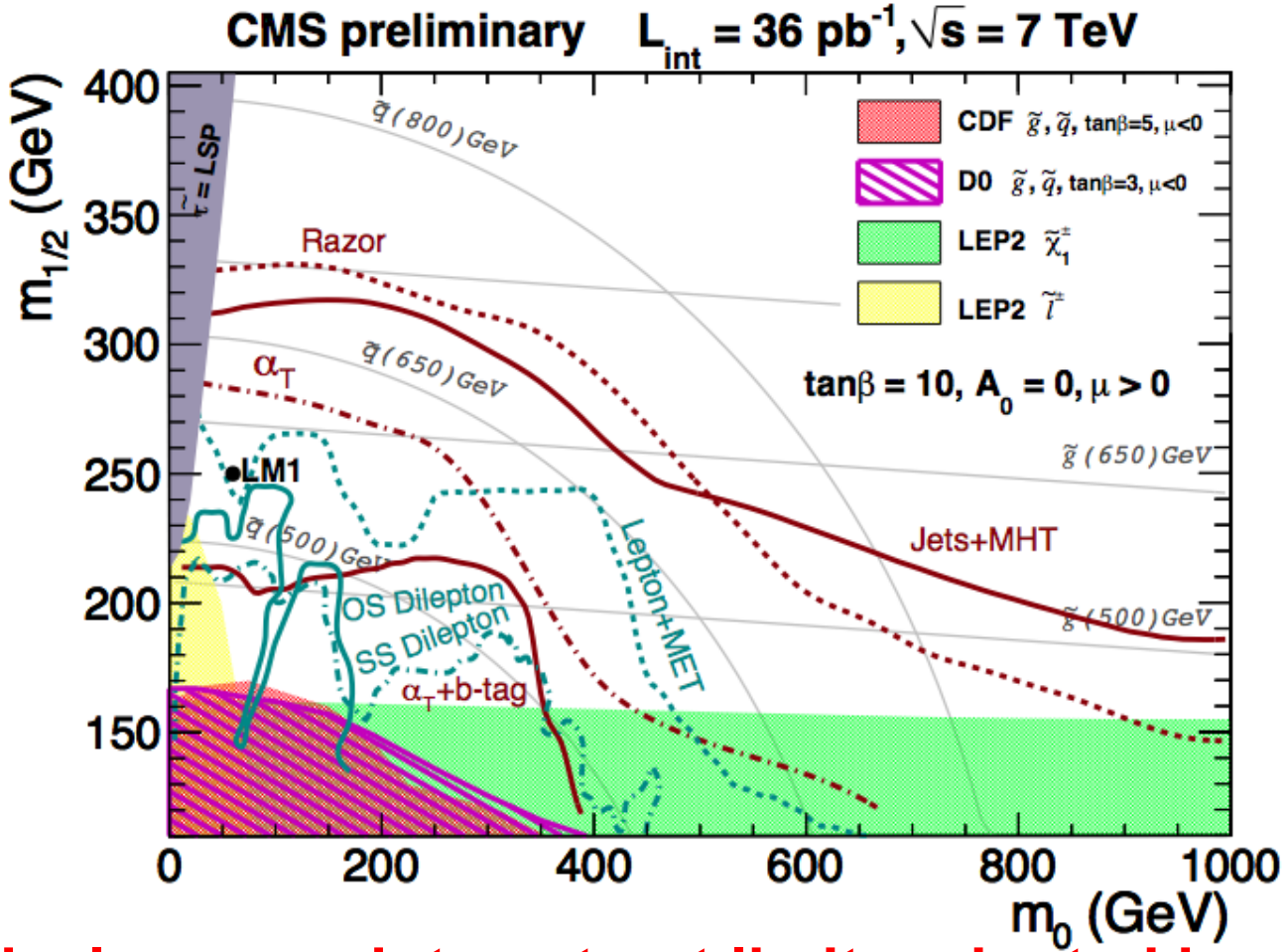


Good agreement with the expected standard model backgrounds, dominated by QCD multijet production, is observed for various final-state multiplicities. Limits on the minimum black hole mass are set, in the range **3.5–4.5 TeV**, for a variety of parameters in a model with large extra dimensions.

arXiv:1012.3375; ***Phys. Lett. B697 (2011***)

Progress on SUSY

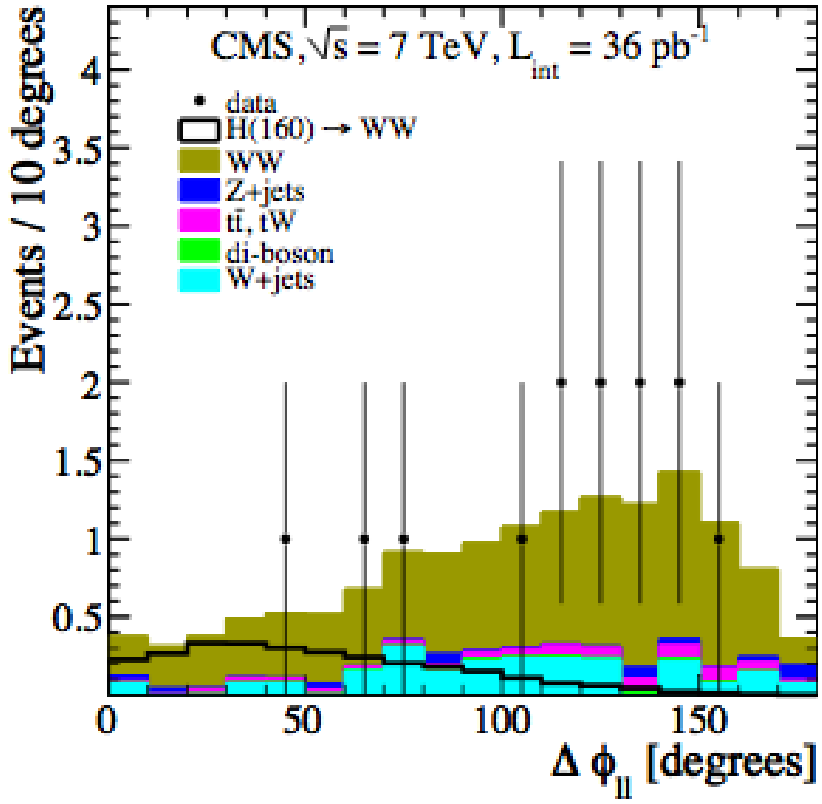
Results on several analyses on SUSY signals (α_T with and without b-tag, fully hadronic channels, di-photons, SS/OS dileptons, single leptons+MET, photons and MET, lepton spectrum and multi-leptons etc) have been produced.

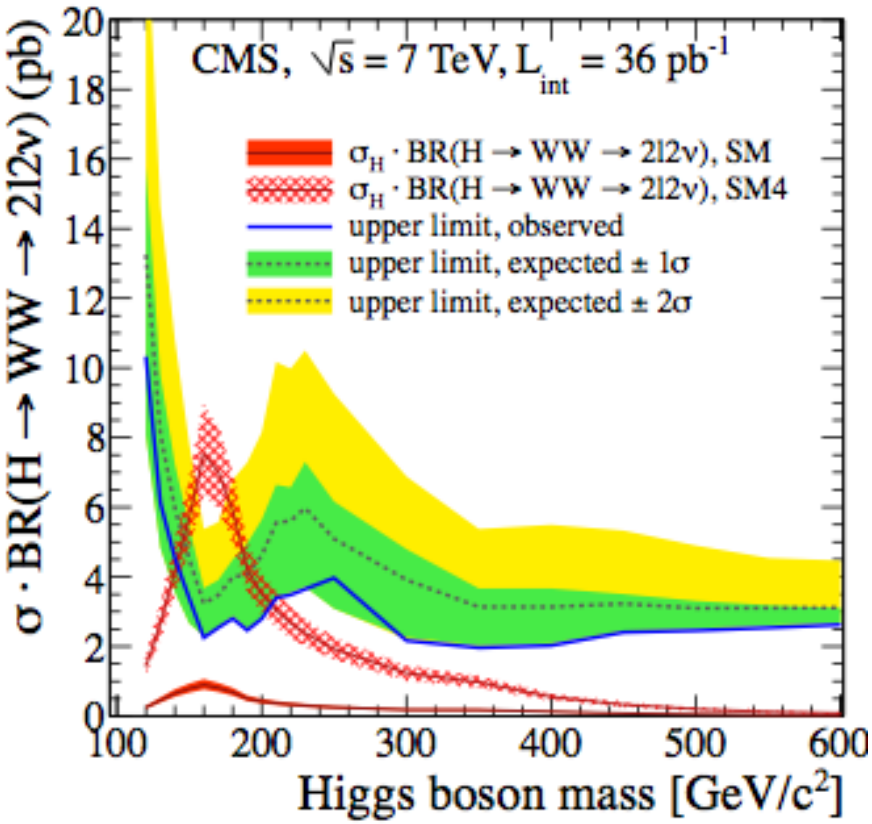


Conservative statistical approach to extract limits adopted by CMS. Prospects for 2011: discover squarks and gluinos (if SUSY is a symmetry of nature) well above 1TeV.

First CMS result on the SM Higgs: H→WW

36pb^{-1}



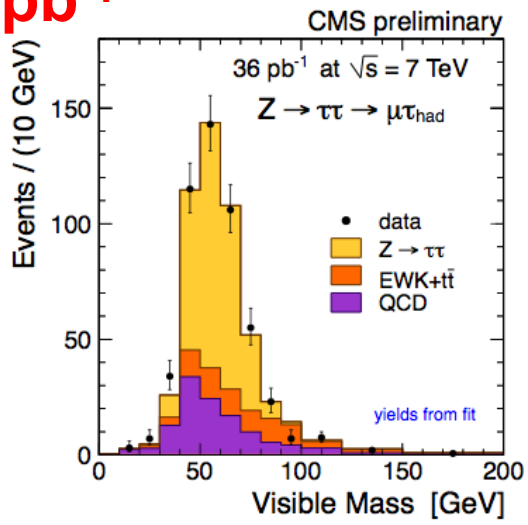


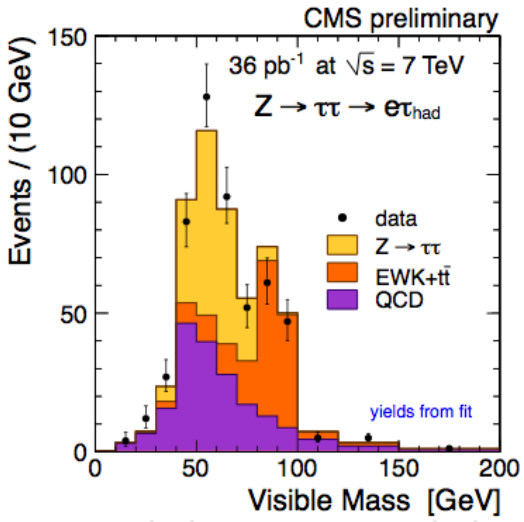
- 4th-f generation case: excluded region m_H = [144 – 207] GeV
- SM case: excluded ~× 3 SM expectation at m_H = 160 GeV

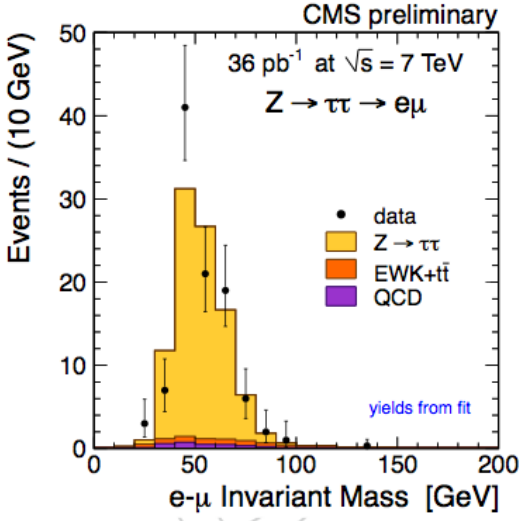
arXiv:1102.5429, *Phys. Lett. B 699 (2011) 25-47*

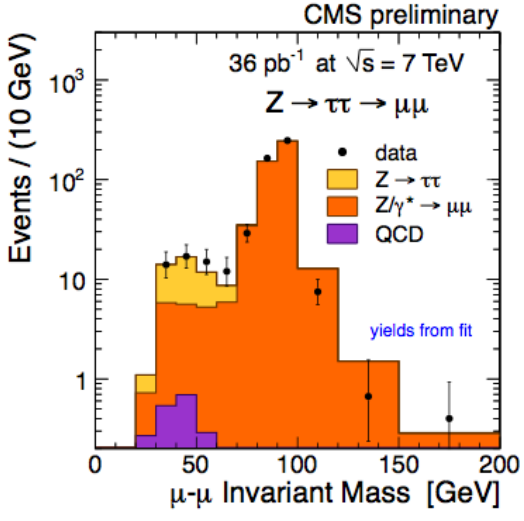
$Z \rightarrow \tau^+\tau^-$

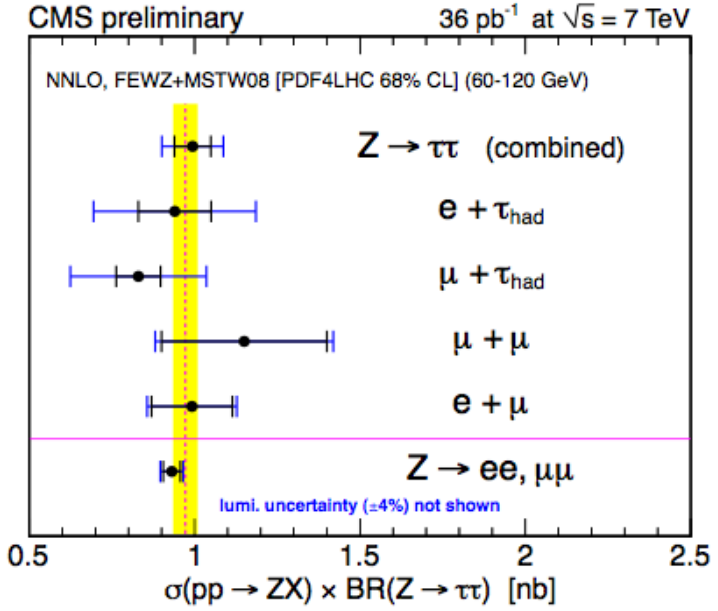
36pb^{-1}









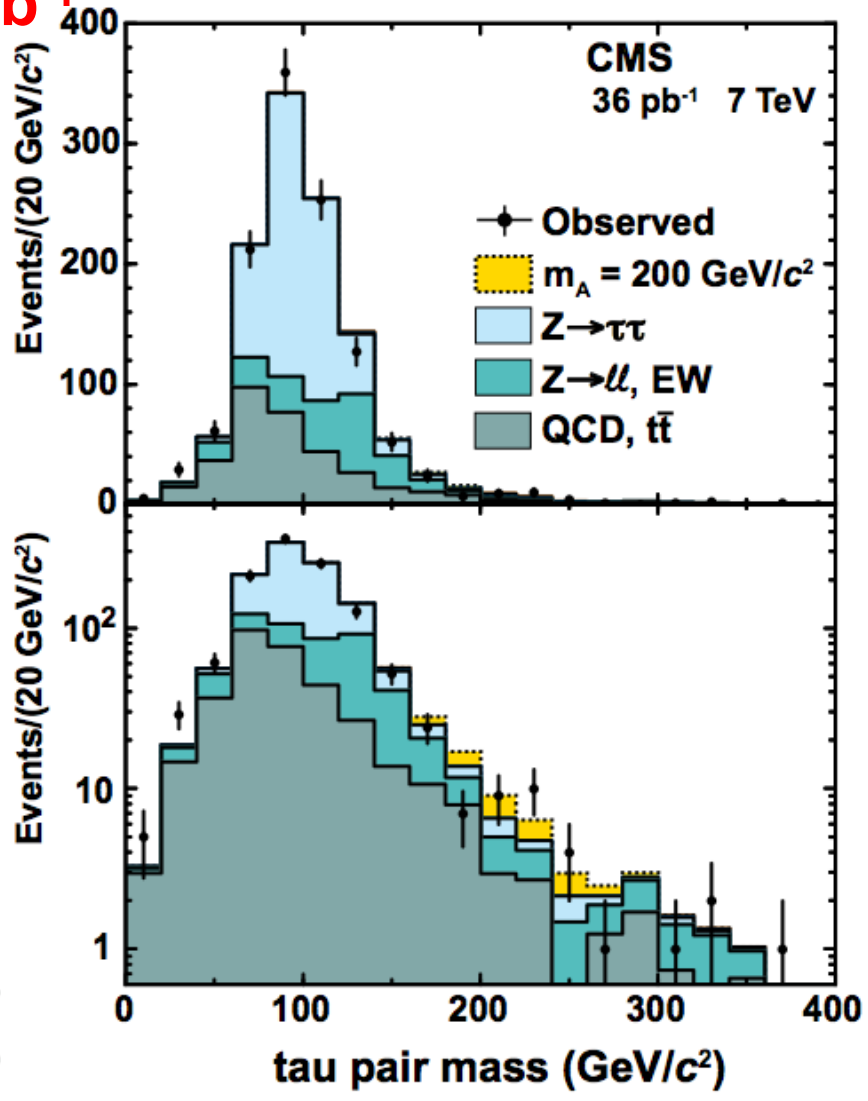


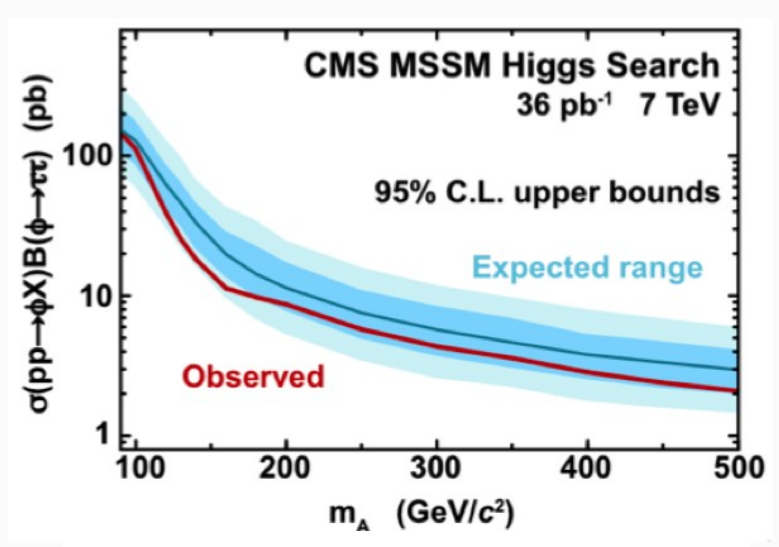
Measurement of the tau id efficiency → important to understand the tau as a discovery tool (Higgs, SUSY etc)

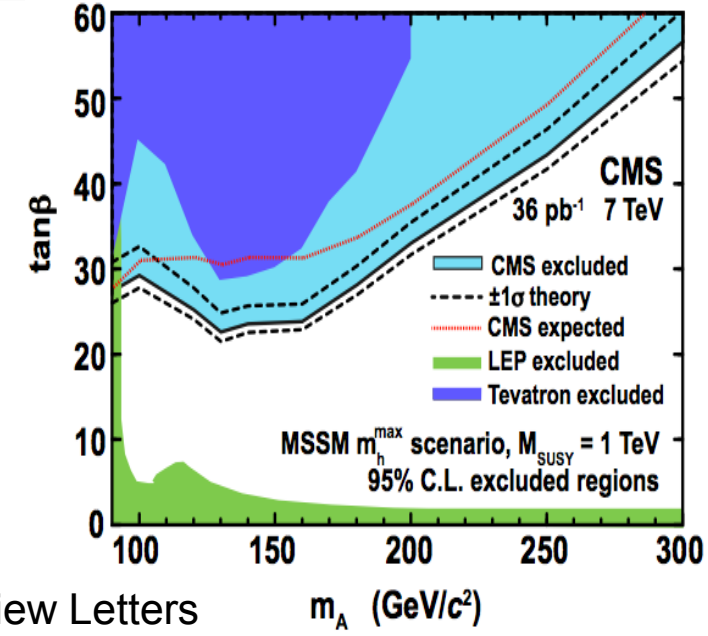
CMS-EWK-10-013; Submitted to the Journal of High Energy Physics

MSSM Higgs→$\tau^+\tau^-$

36pb^{-1}

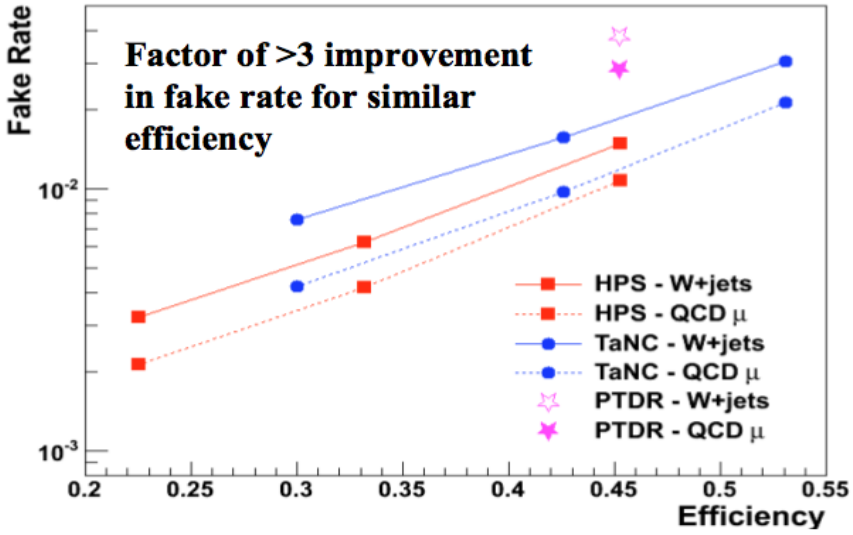


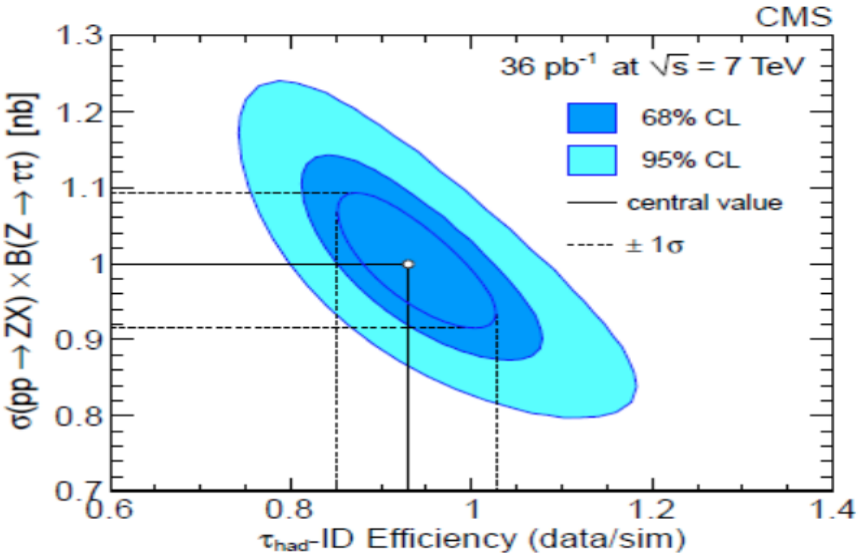


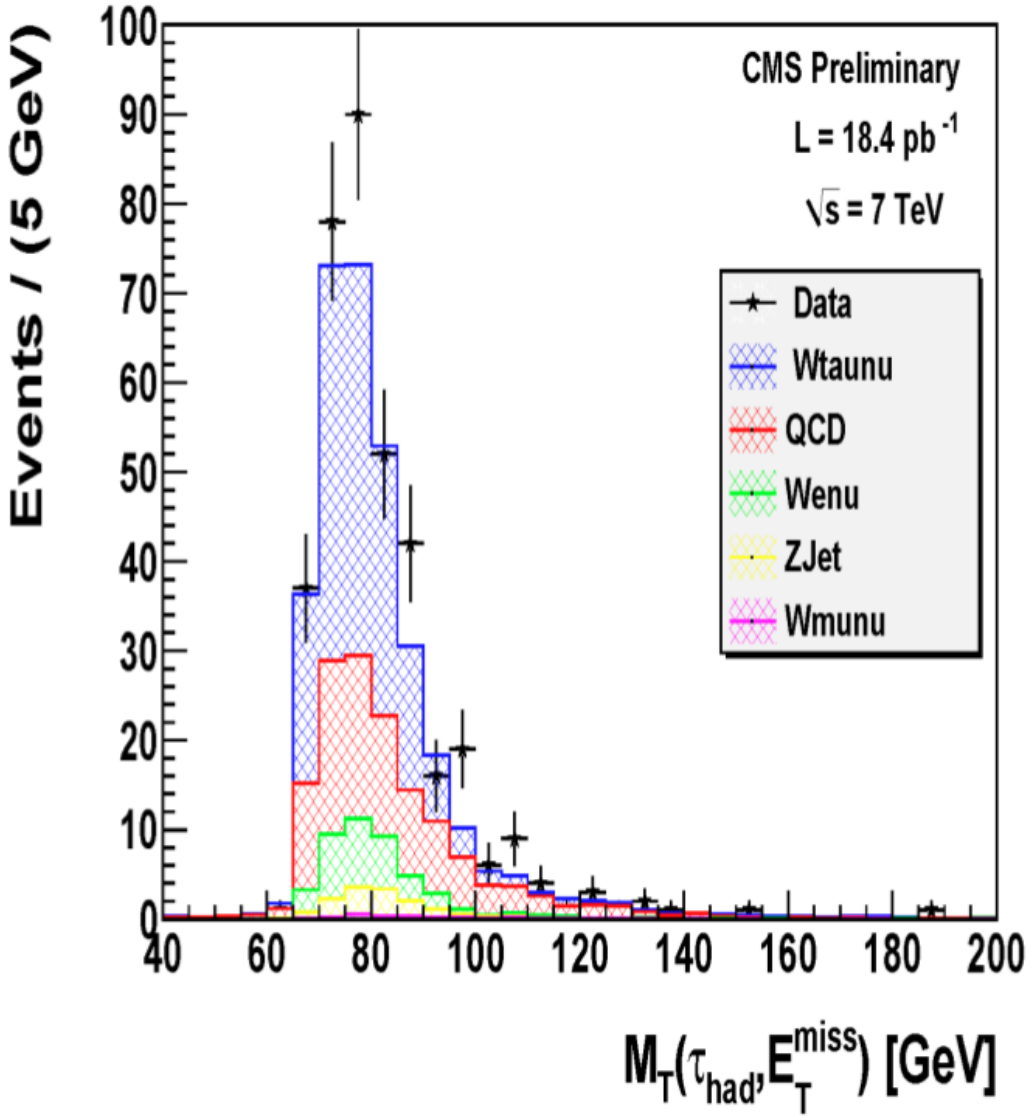


CMS-HIG-10-002-003. Submitted to Physical Review Letters

Detailed understanding of the τ lepton as a tool for discovery



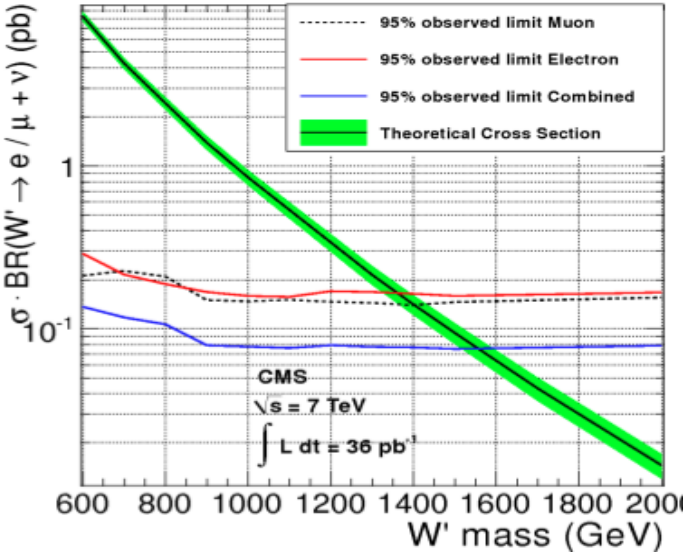


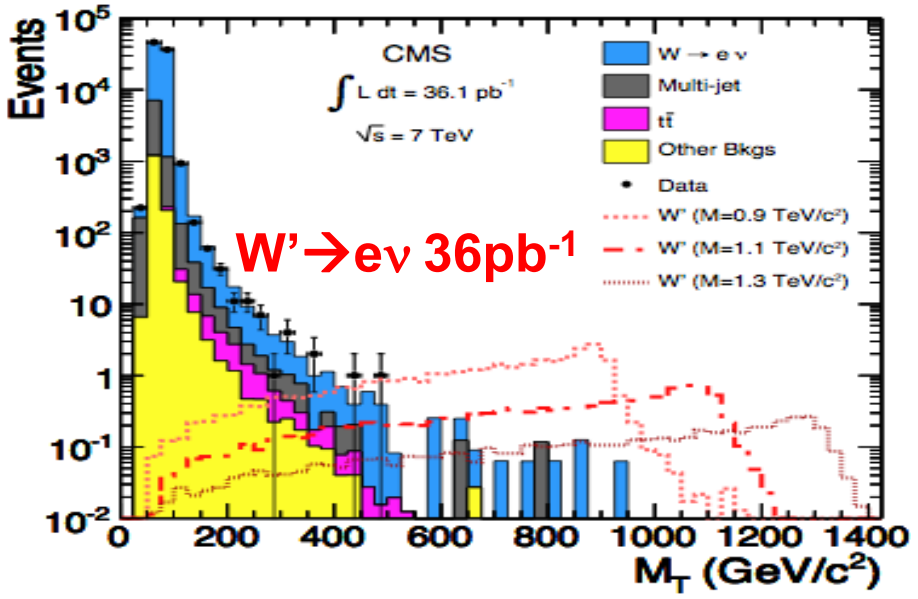


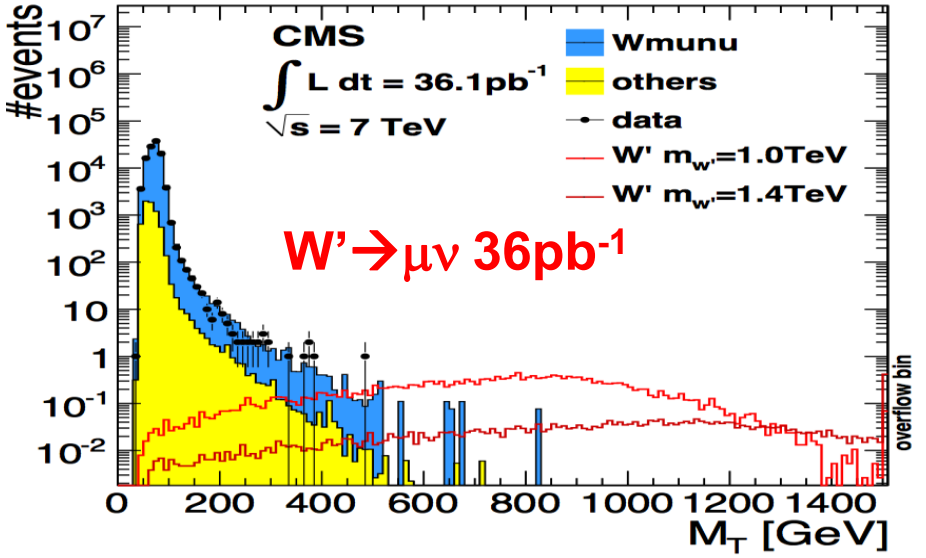
Looking for massive vector bosons

Evidence of massive extra bosons could possibly hint at new physics models.
With 2010 statistics we have been able to produce limits on W' and Z' exceeding the current limits set by the Tevatron experiments.

Assuming standard-model-like couplings and decay branching fractions we exclude a W' with mass<1.58 TeV (95%CL)



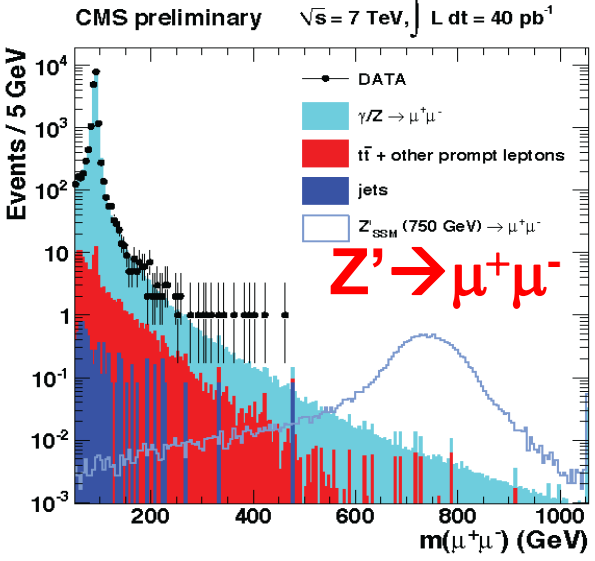


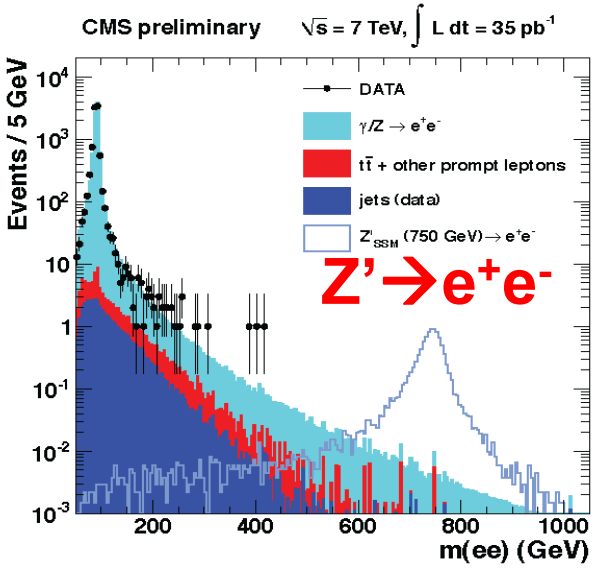


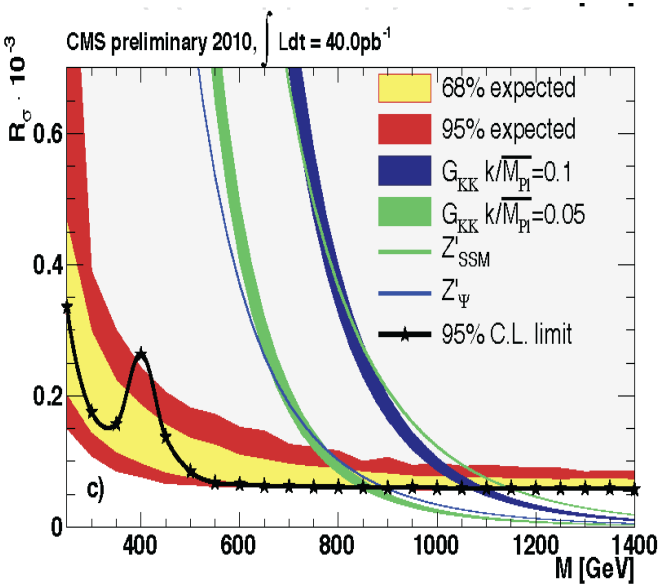
arXiv:1103.0030 Submitted to Physics Letters B.

Search for Z' in dileptons

We study in detail the high mass tail of the Z.
The spectra are consistent with known SM processes.





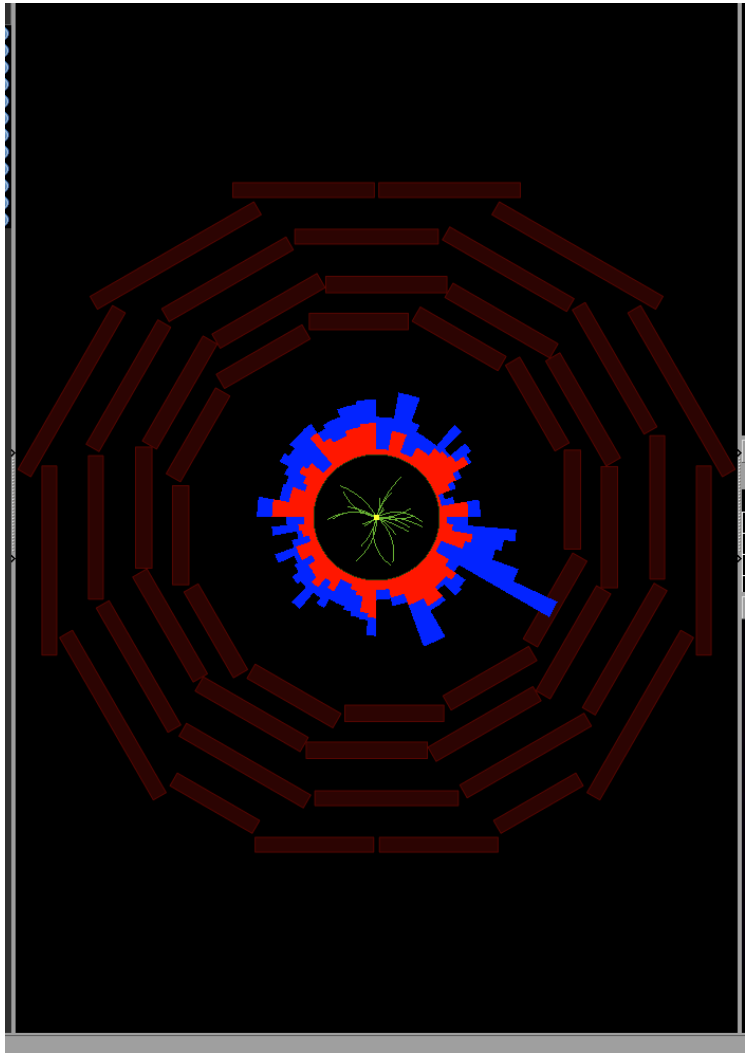


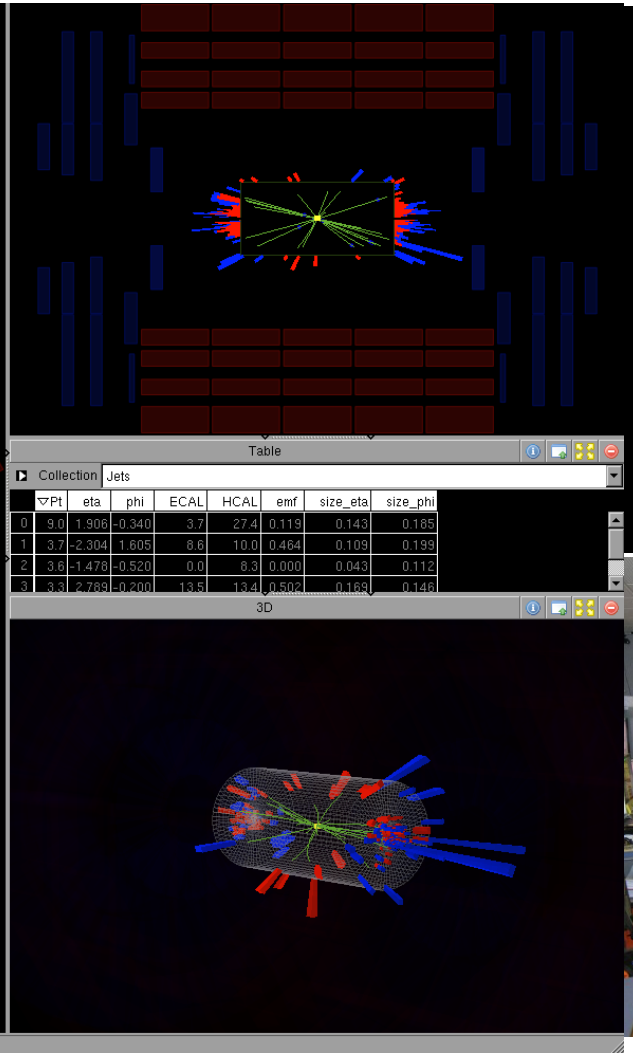
By combining the $\mu^+\mu^-$ and e^+e^- channels, the following 95% C.L. lower limits are obtained: **1140 GeV** for the Sequential Standard Model Z'_{SSM}, **887 GeV** for Super-String inspired models, Z'_ψ. RS Kaluza-Klein Gravitons are excluded below **855-1079 GeV** at 95% C.L. for values of couplings parameters (k/M_{Pl}) 0.05-0.1.

arXiv:1103.0981 ; CMS-EXO-10-013 . **In 2011-12: explore deeply the multi TeV region.**

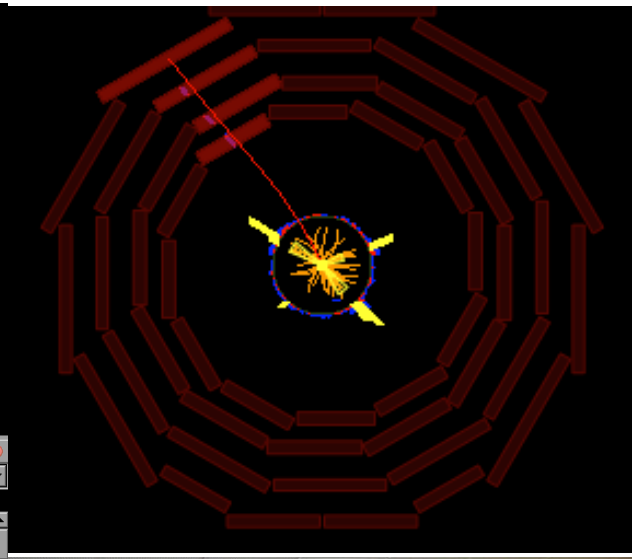
Start of 2011 pp Operation

Sunday March 13, 18:20 Stable beams in LHC and CMS taking good data.





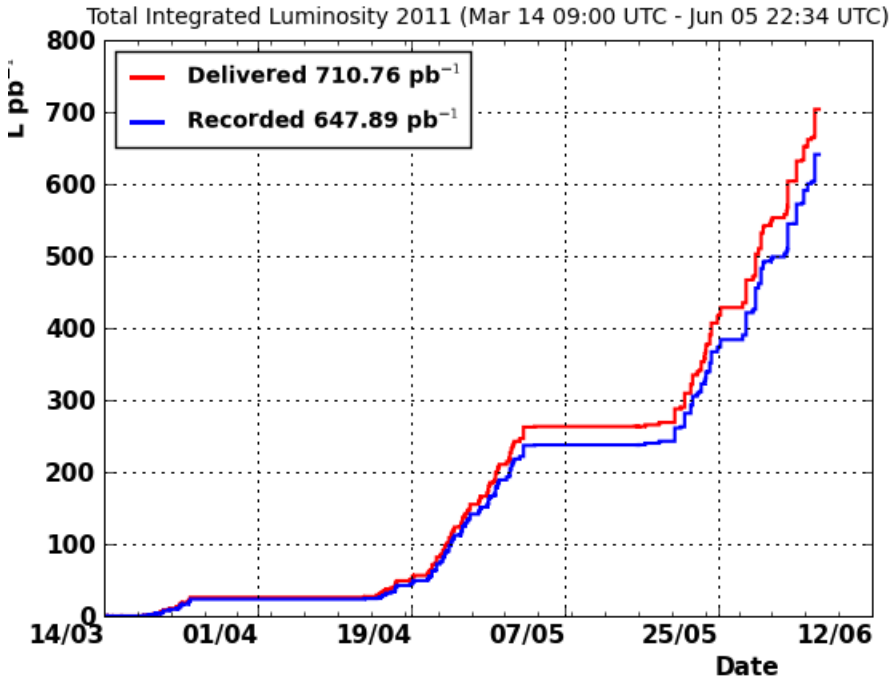
	Pt	eta	phi	ECAL	HCAL	emf	size_eta	size_phi
0	9.0	1.906	-0.340	3.7	27.4	0.119	0.143	0.185
1	3.7	-2.304	1.605	8.6	10.0	0.464	0.109	0.199
2	3.6	-1.478	-0.520	0.0	8.3	0.000	0.043	0.112
3	3.3	2.789	-0.200	13.5	13.4	0.502	0.169	0.148

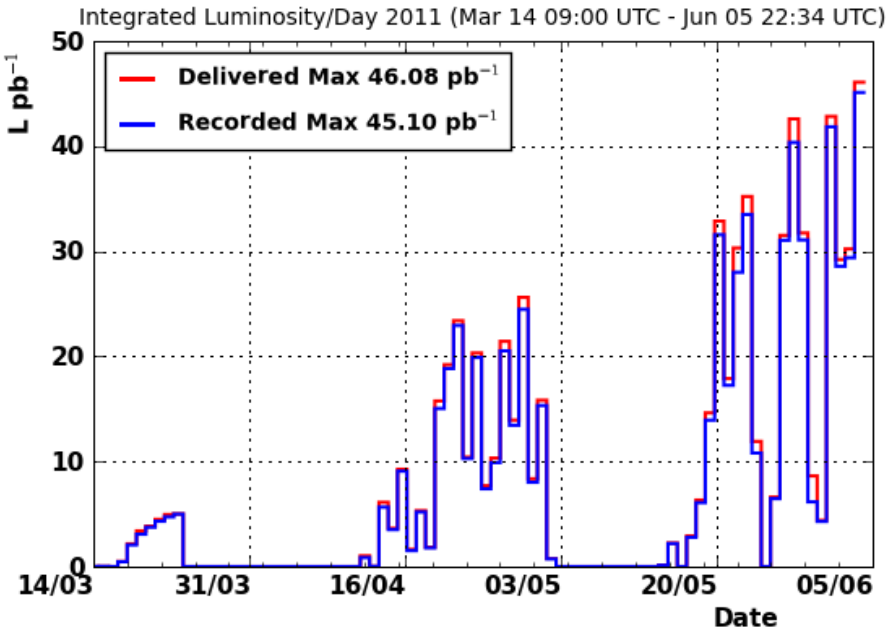


LHC and CMS operations

1092 bunches in LHC (1042 colliding in CMS); **new world record in peak luminosity** for hadron colliders **1.27e33**.

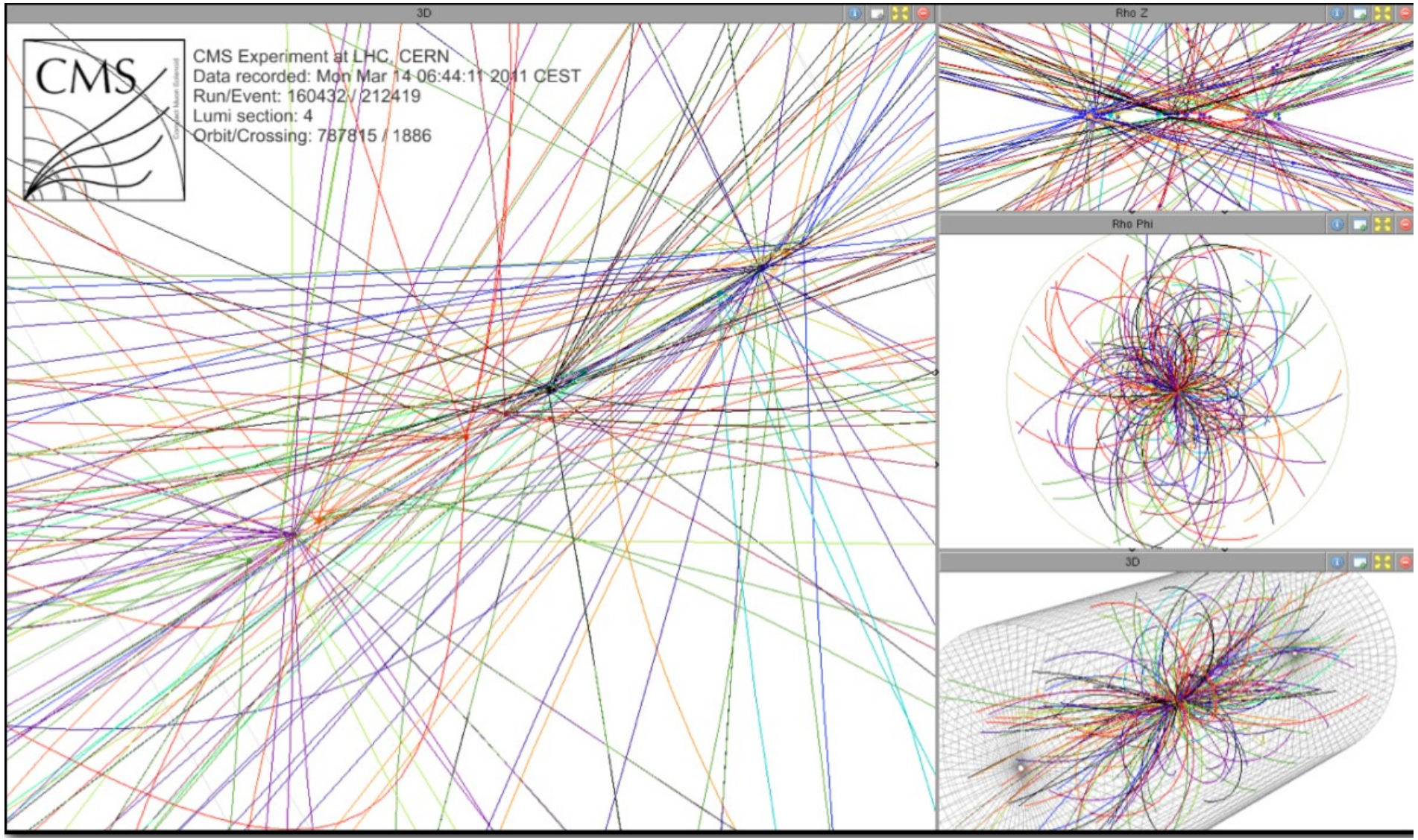
~711pb^{-1} delivered by LHC and **~648pb^{-1}** collected by CMS. **CMS data taking efficiency >91%. We can now record more than 45pb^{-1}/day.**





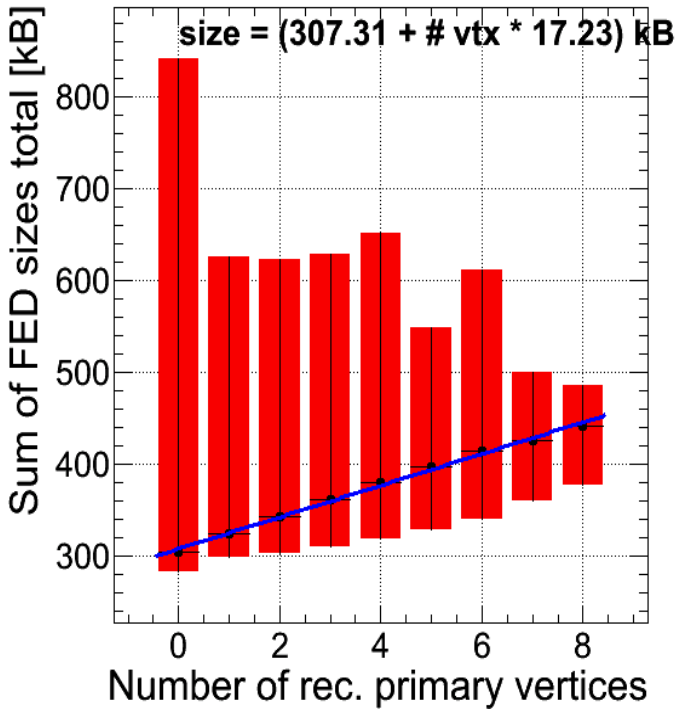
The goal of collecting 1fb^{-1} of data before the end of June is within reach.

The challenges of 2011 data taking



CMS DAQ/L1/HLT seems to be OK

The pile-up seems to behave as expected in terms of event size



DAQ Limitations

1) Total size < ~1MByte. Even with 20PU (~700 kByte) looks OK
2) No single FEDs (FRL) > 2 KB/evt @100kHz. OK tested with tracker in HI.

The Challenge for the Trigger

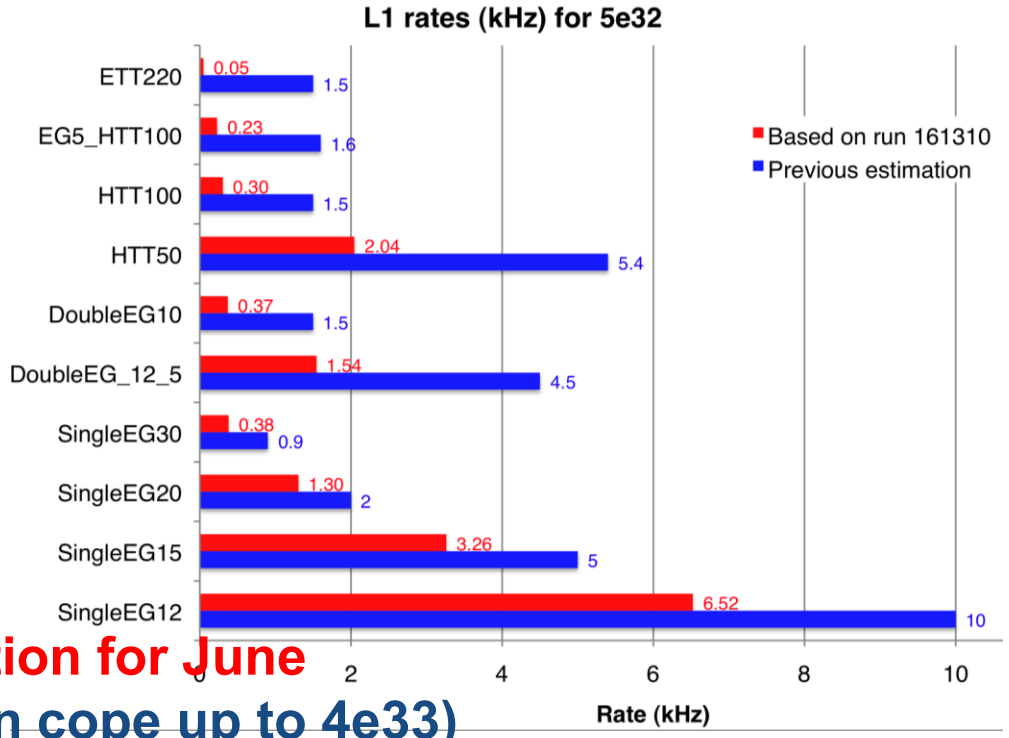
Recently deployed:

1)the new **L1 menu 1e33 (can cope up to 2e33)**

2)the second version of the **1.4e33 HLT menu(can cope up to 2.8e33)**

The new menus work well and have only very minor problems.

Despite the pile-up, the rates seem to be under control. Important work done on all critical triggers to make them less sensitive to PU conditions.



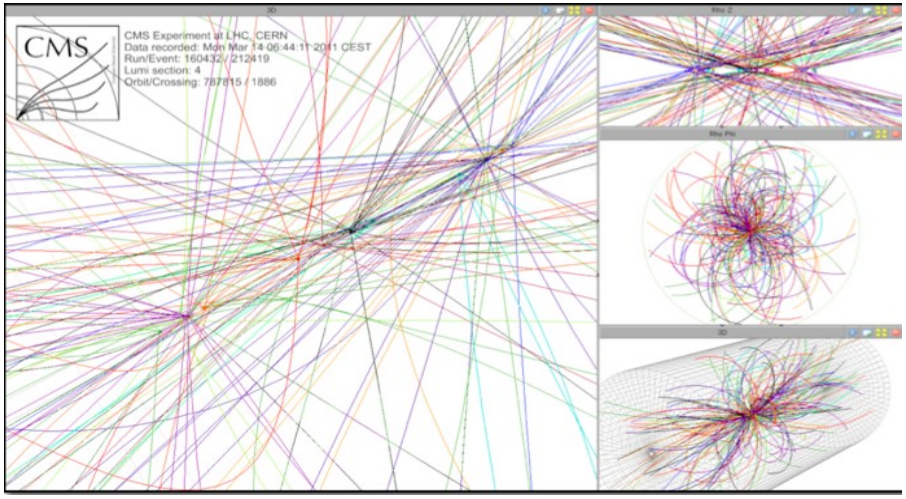
New menus in validation for June

1)the new L1 menu **2e33 (can cope up to 4e33)**

2)the second version of the **2e33** HLT menu **(can cope up to 4e33)**

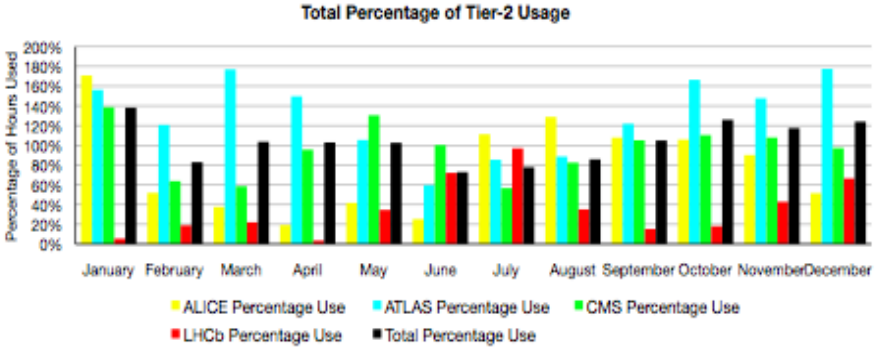
The challenge for Computing

- **Run in 2011: dataset+30%**
  - In 2010 we collected ~1.5B events. Expect more than 2B in 2011.
- **Events in 2011 are much more complicated**
  - At 10 interactions per crossing we have factors of 2-3 increase in RECO time. Factor of 2 in RECO size and AOD size
- **Resources**
  - Resource utilization for analysis was high in 2010 and increasing
  - Significant increases in Tier-1 and Tier-2 resources are available for 2011, but even with these we will have to prioritize activities



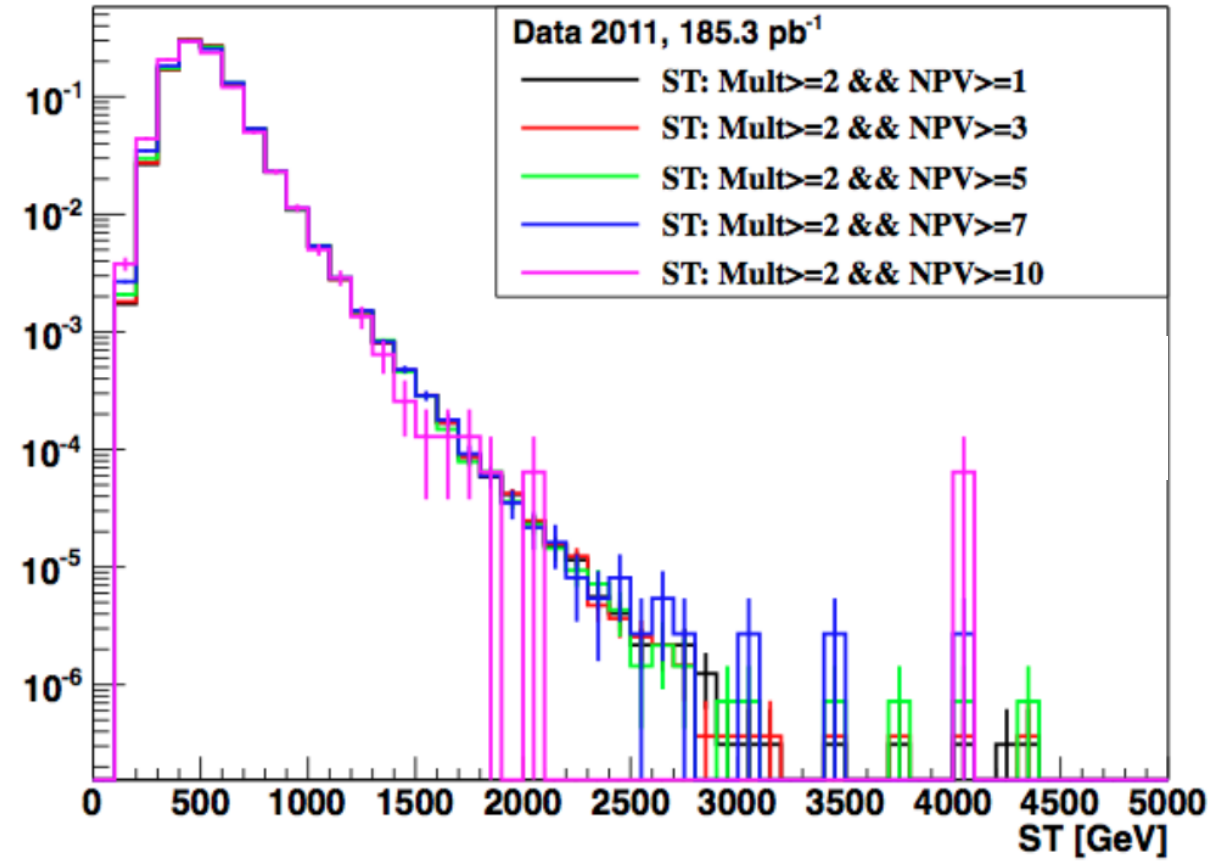
50% increase on Tier-2 resources for 2011
Larger increase in size and processing time from pile-up

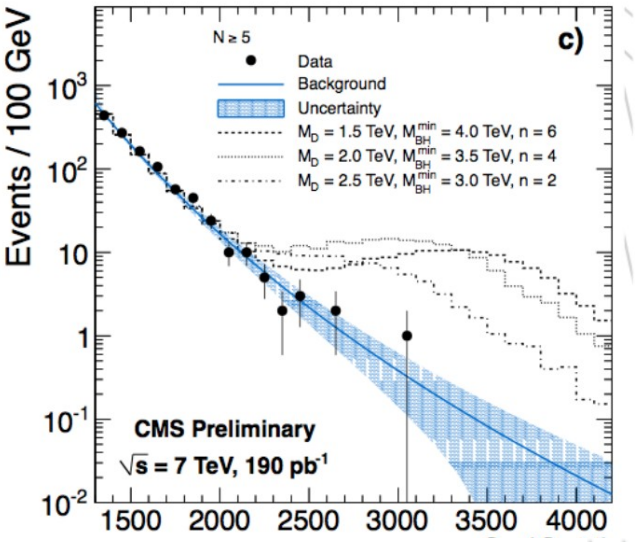
2010 T2 Usage by VO

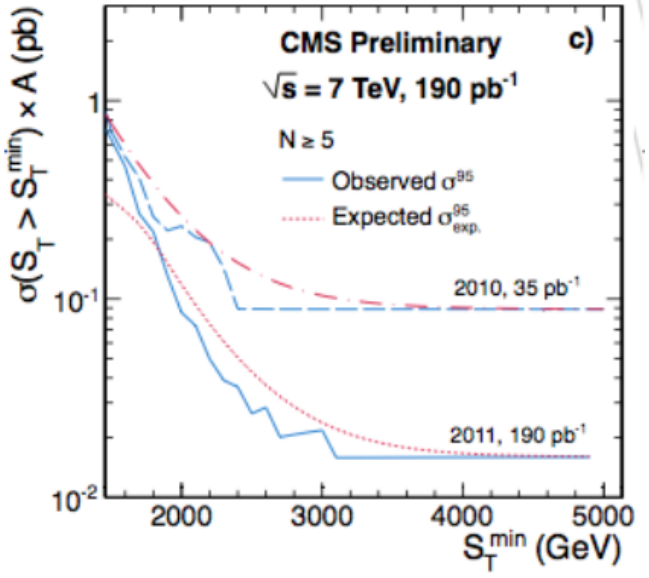


The challenge for Physics

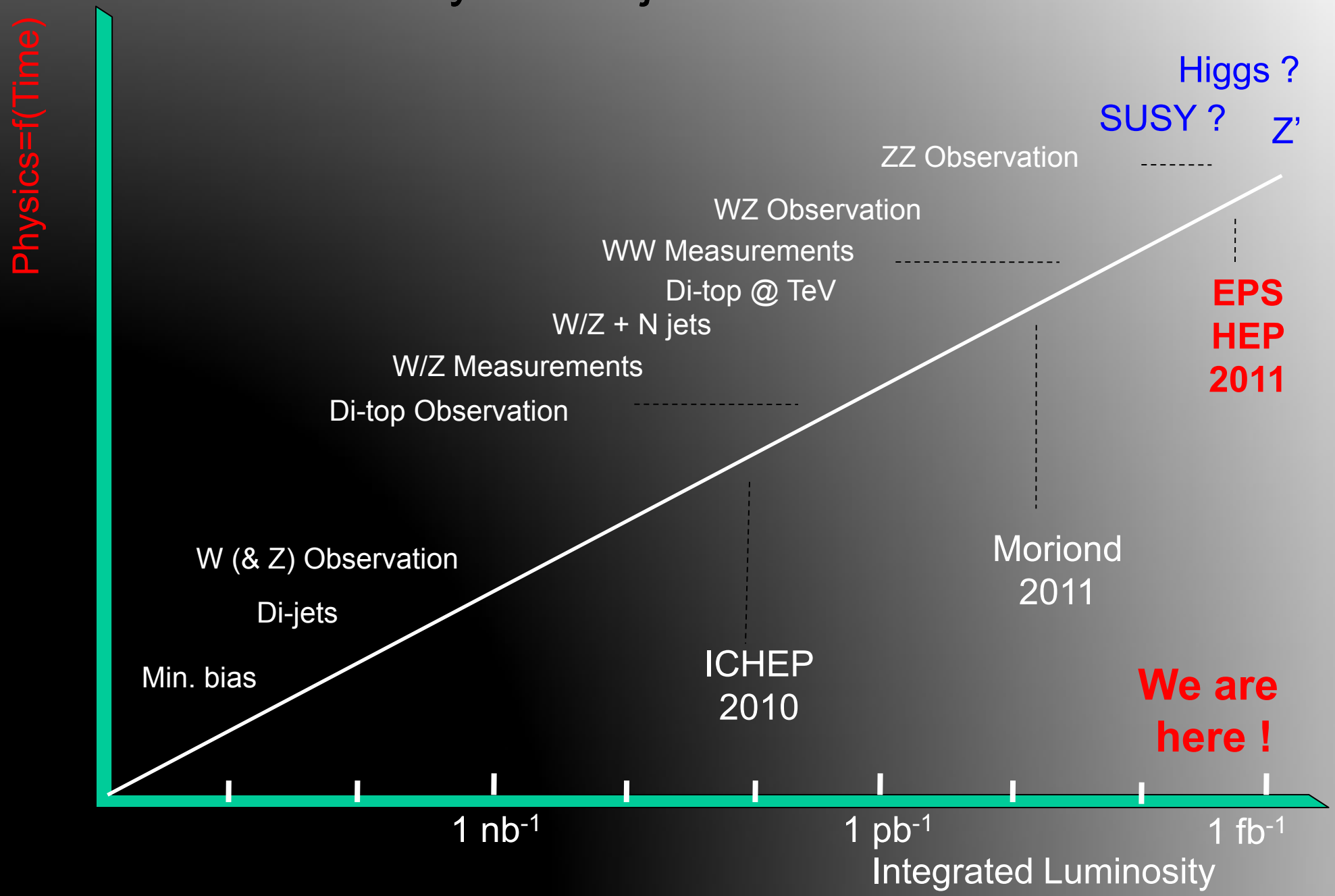
- Check carefully the effect on the pile-up on basic physics tool and selection criteria.
- An example: search for Black Holes.





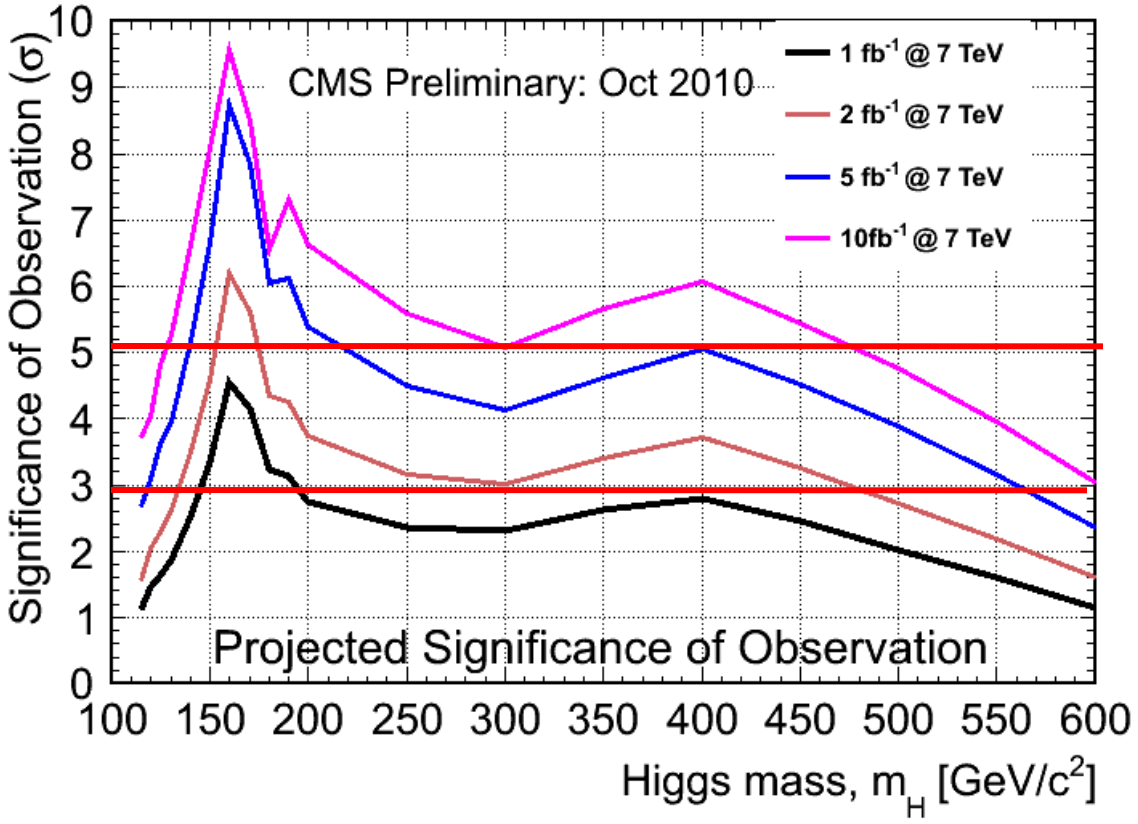


CMS Physics Objectives for LHC Run I



The reward

CMS sensitivity vs Higgs mass



From now on a Higgs Boson signal may appear any time in our data.

Conclusion

• The harvesting of results on 2010 data has been timely and extremely successful.

• So far it looks that we are able to cope with the challenges of instantaneous luminosity higher than 1E33 and <n> interactions per crossing ~10.

• Prospects for SUSY, Higgs and Exotica searches in 2011-12 appear to be very promising.

• **Signals of New Physics might appear any moment.**