Résumé des conférences de l'été 2011: collisionneurs

Fabrice Couderc

Overview

- b-physics
- top phyiscs
- Higgs searches
- BSM searches
- a few words on EW & QCD measurements

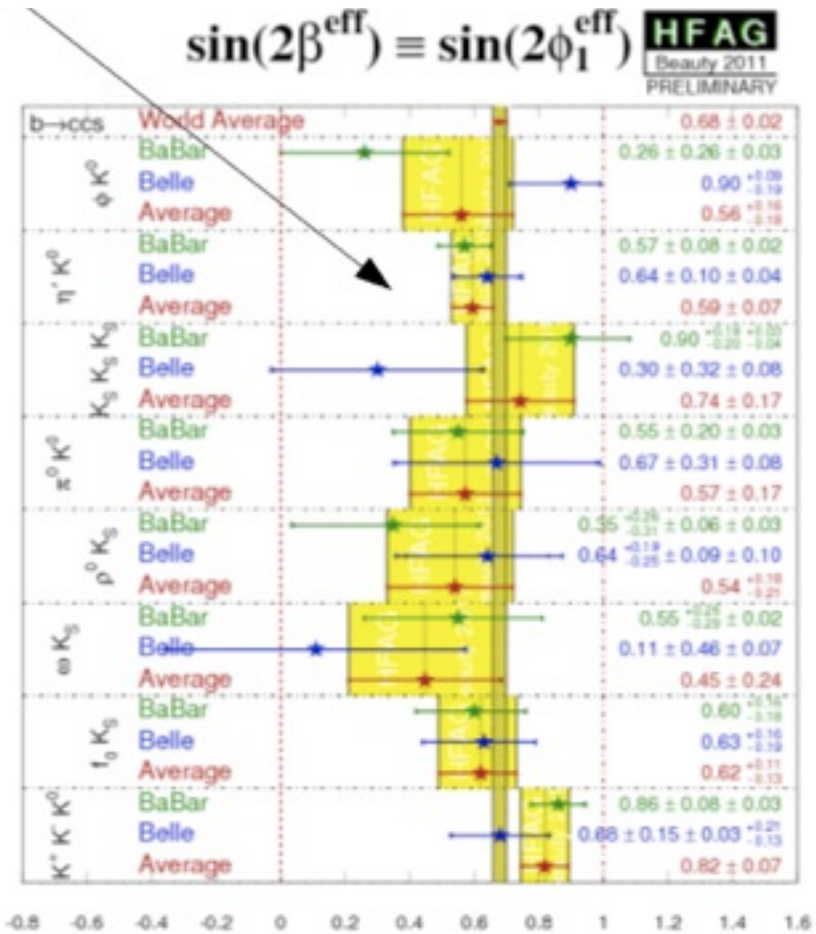
With the help from worldwide best experts on:

top :slides from Frederic Deliot
BSM :slides Henri Bachacou

b-physics

CKM in B_d sector amasingly well understood by B factories

Some old tensions resolved...

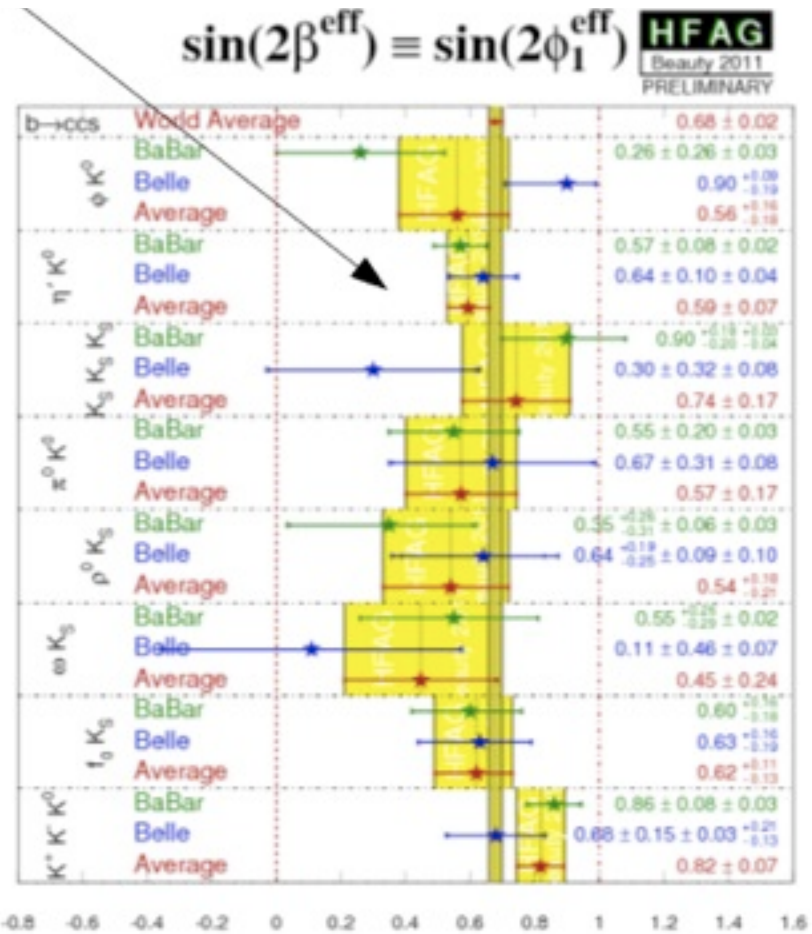


Compare sin2β measured in clean b→ccs with measurements of "sin2β" in:

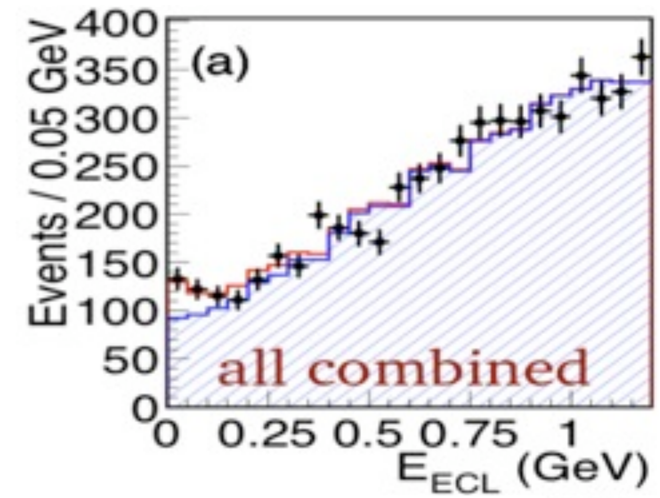
- b→sss (used to be 2.X σ away)
- b→ccd, b→cud

CKM in B_d sector amasingly well understood by B factories

Some old tensions resolved... but other tensions appeared recently



Belle: B→τν



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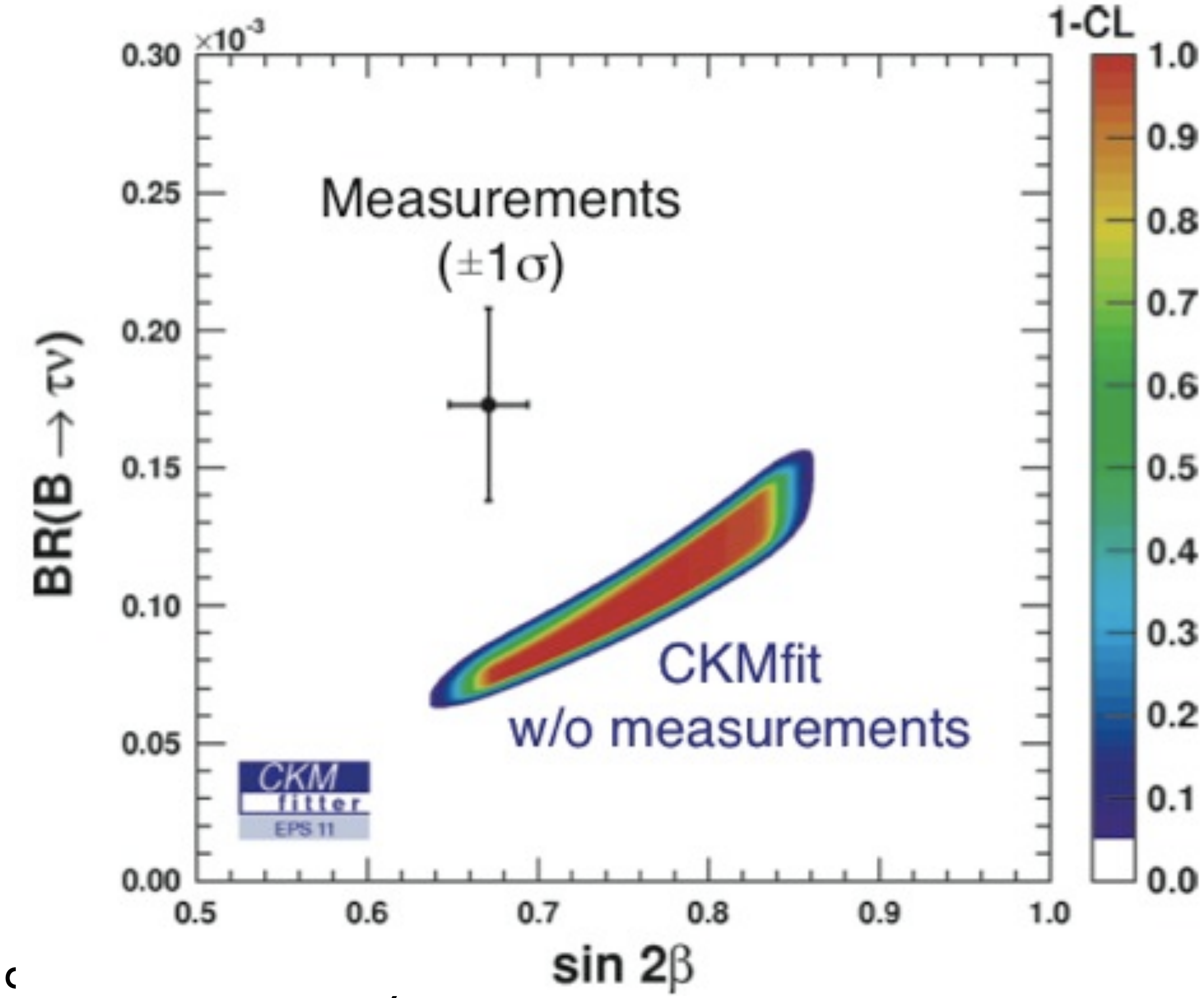
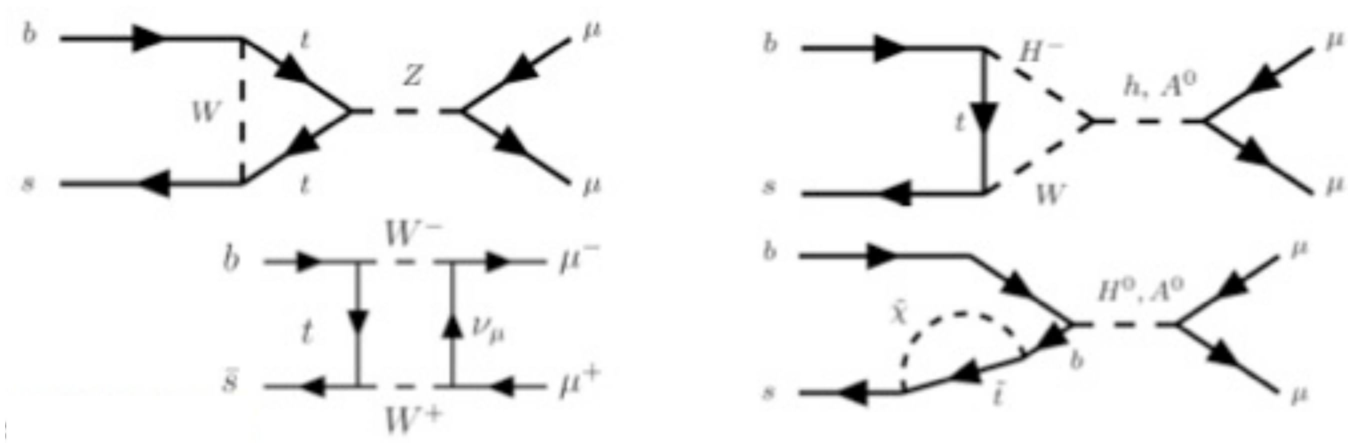


Search for $B_s \rightarrow \mu\ \mu$

Buras et al: arXiv 1007.5291

- Predicted to be very rare in the SM due to GIM & helicity suppression:
  - $Br_{SM}(B_s \rightarrow \mu\mu) = (3.2\pm0.2) \times 10^{-9}$
- Large sensitivity to NP, eg SUSY:
  - $$\mathrm{Br}_{\mathrm{MSSM}}(B_q \to \ell^+\ell^-) \propto \frac{M_b^2 M_\ell^2 \tan^6\beta}{M_A^4}$$

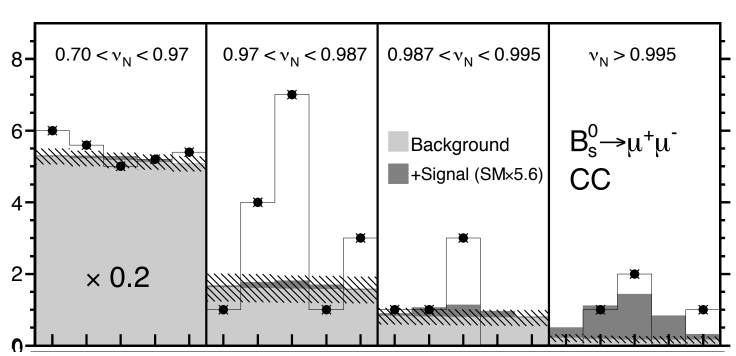


One of the golden channel

New result from CDF: positive!

A search has been performed for $B_s^0 \to \mu^+\mu^-$ and $B^0 \to \mu^+\mu^-$ decays using 7 fb^{-1} of integrated luminosity collected by the CDF II detector at the Fermilab Tevatron collider. The observed number of B^0 candidates is consistent with background-only expectations and yields an upper limit on the branching fraction of $\mathcal{B}(B^0 \to \mu^+\mu^-) < 6.0 \times 10^{-9}$ at 95% confidence level. We observe an excess of B_s^0 candidates. The probability that the background processes alone could produce such an excess or larger is 0.27%. The probability that the combination of background and the expected standard model rate of $B_s^0 \to \mu^+\mu^-$ could produce such an excess or larger is 1.9%. These data are used to determine $\mathcal{B}(B_s^0 \to \mu^+\mu^-) = (1.8^{+1.1}_{-0.9}) \times 10^{-8}$ and provide an upper limit of $\mathcal{B}(B_s^0 \to \mu^+\mu^-) < 4.0 \times 10^{-8}$ at 95% confidence level.

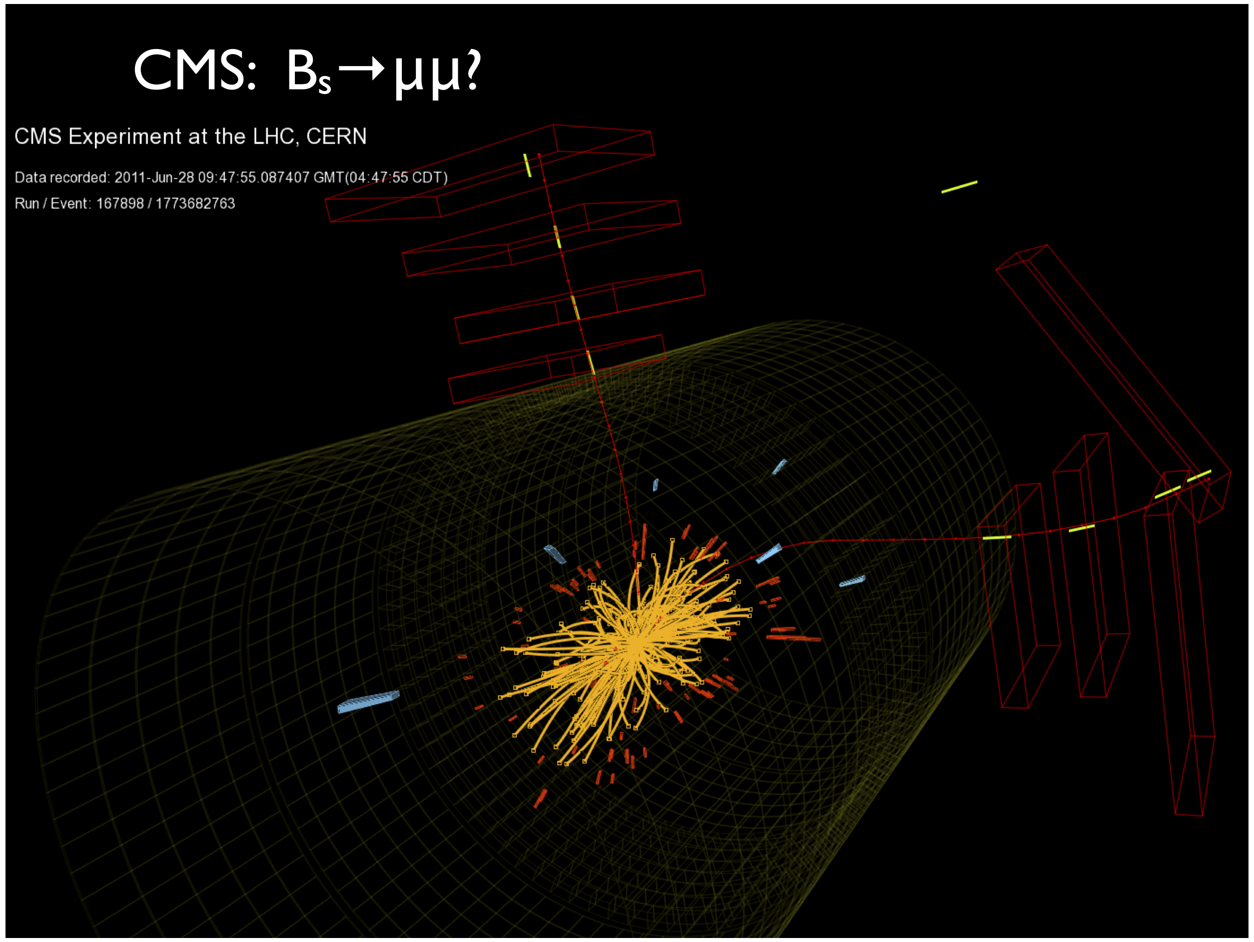
$$\mathcal{B}(B_s \rightarrow \mu\mu) = 1.8^{+1.1}_{-0.9} \times 10^{-8}$$

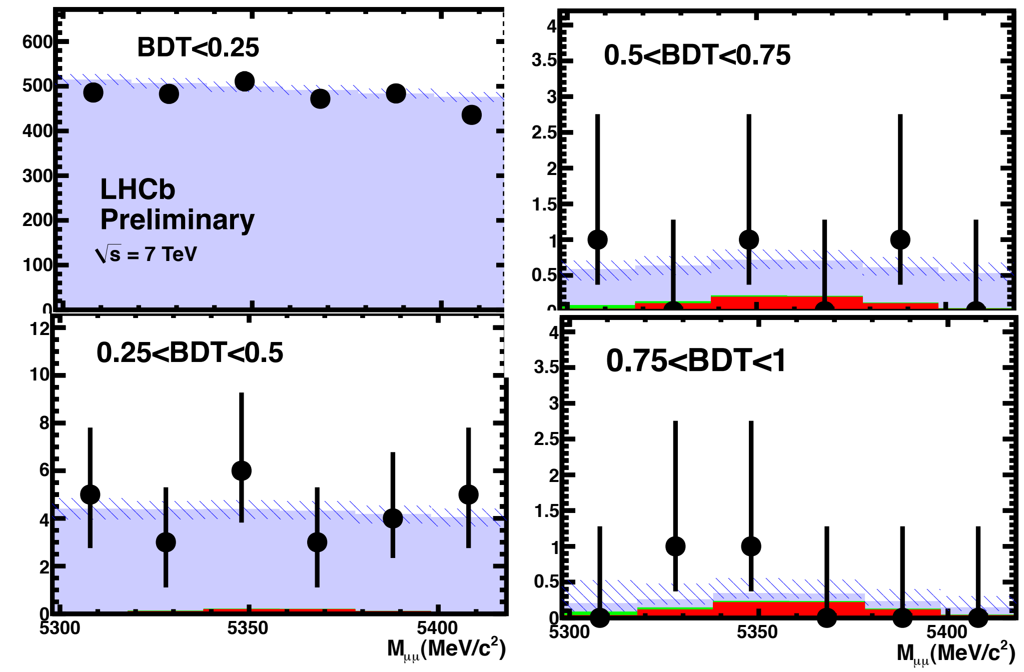


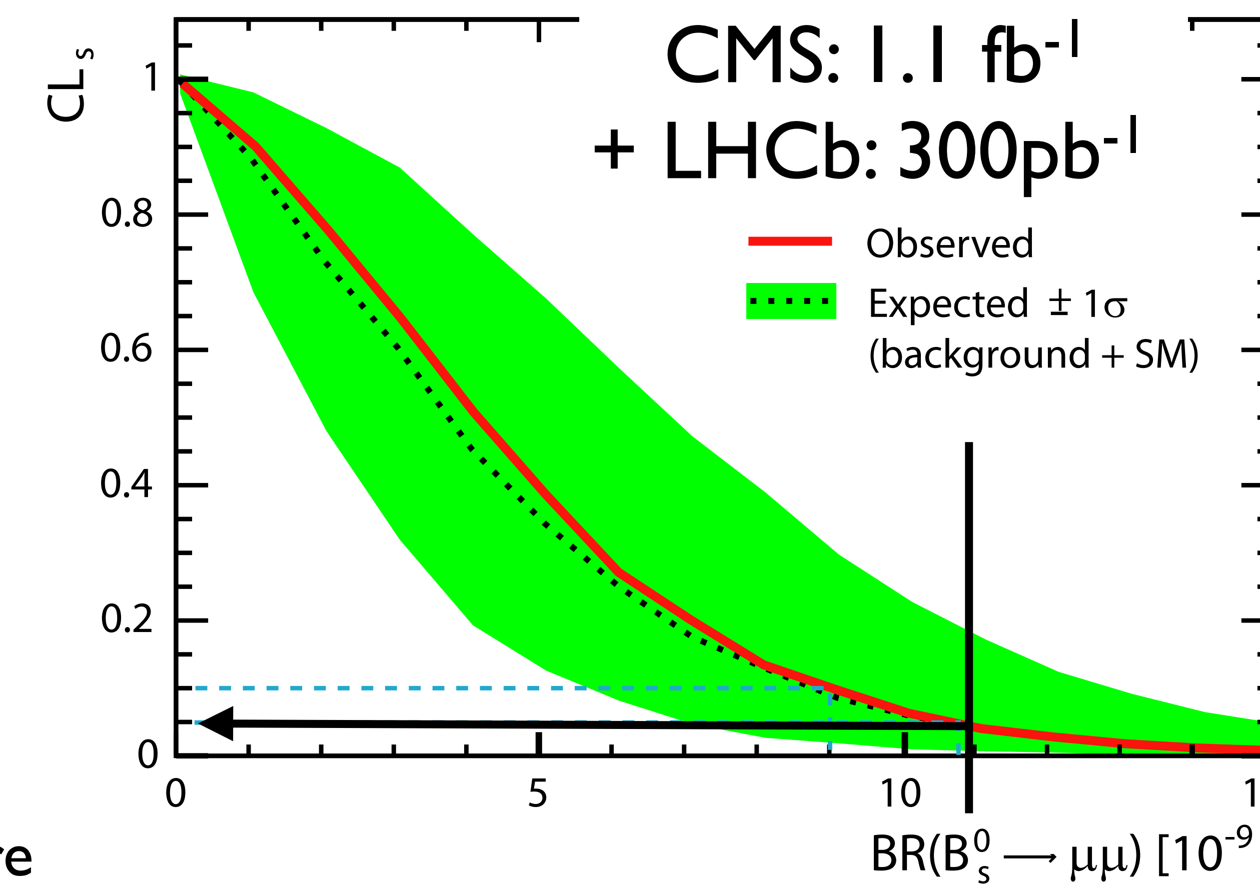
Studies of flavor-changing neutral current (FCNC) decays have played an important role in formulating the theoretical description of particle physics known as the standard model (SM). In the SM all neutral currents conserve flavor so that FCNC decays do not occur at lowest order. The decays of B_s^0 mesons (with a quark content of $\bar{b}s$) and B^0 mesons ($\bar{b}d$) into a dimuon pair ($\mu^+\mu^-$) [1] are examples of FCNC processes that can occur in the SM through higher order loop diagrams. Their branching fractions are predicted in the SM to be $(3.2\pm0.2)\times10^{-9}$

p-value bkg: 0.27% (3σ)
p-value bkg+SM sig: 1.9% (2.3σ)

CMS+LHC*b*: Combined $B_s \to \mu\mu$ Limit







< 11×10^{-9} @ 95% CL

- p-value background only: 8%
- p-value background + SM BR: 55%

  CDF: $18^{-0.9} \times 10^{-9}$
- $Br(B_s \to \mu\mu) < 11 \times 10^{-9}$ @ 95% CL
- Given that the 95% CL is still 3.4 x SM, there remains plenty of room for NP, keep an eye in the near future!

LHCb-CONF-2011-047= CMS-PAS-BPH-11-019

Dimuon Charge Asymmetry

$$a^b_{sl} = \frac{\Gamma(\overline{B} \to \mu^+ X) - \Gamma(B \to \mu^- X)}{\Gamma(\overline{B} \to \mu^+ X) + \Gamma(B \to \mu^- X)}$$

Direct semileptonic decay

Neutral *B* meson oscillation and then semileptonic decay

- Measure *CP* violation in mixing via
$$A^b_{sl} = \frac{N_b(\mu^+\mu^+) - N_b(\mu^-\mu^-)}{N_b(\mu^+\mu^+) + N_b(\mu^-\mu^-)}$$

- DØ: Evidence for anomalous dimuon charge asymmetry, (6 fb^{-1},PRL **105**, 081801 (2010))
  3.2σ deviation from $A^b_{sl}(SM) = (-0.023^{+0.005}_{-0.006})\%$

DØ Update 9.0 fb^{-1} arXiv:1106.6308, sub. to PRD

$$A^b_{sl} = (-0.787 \pm 0.172 \pm 0.093)\%$$

Now a 3.9σ deviation from SM prediction

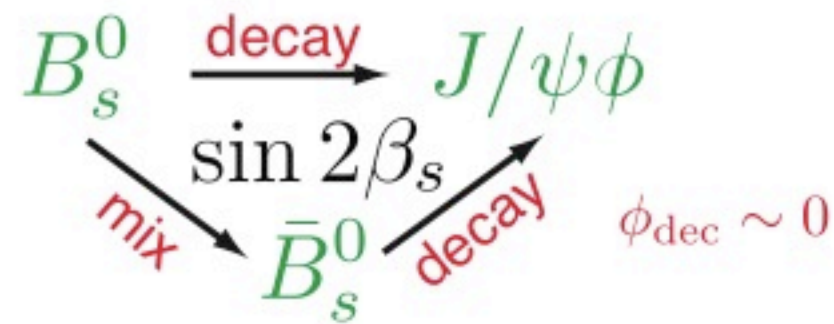
2 same sign muons: one B meson has necessarily oscillated.
Combination of B_d and B_s asymmetry:
B_d asymmetry is zero (B factories) ⇒ hint for new physics in B_s

Link with CP violation in B_s

Golden mode,
Hadron Colliders

$$\phi_s^{J/\psi\phi} \approx -2\beta_s = -2\beta_s^{SM} + \phi_s^{NP}$$

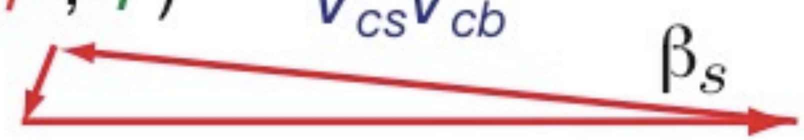
$-2\beta_s^{SM}$: $-(0.038 \pm 0.002)$



"Squashed" Triangle

(ρ, η)

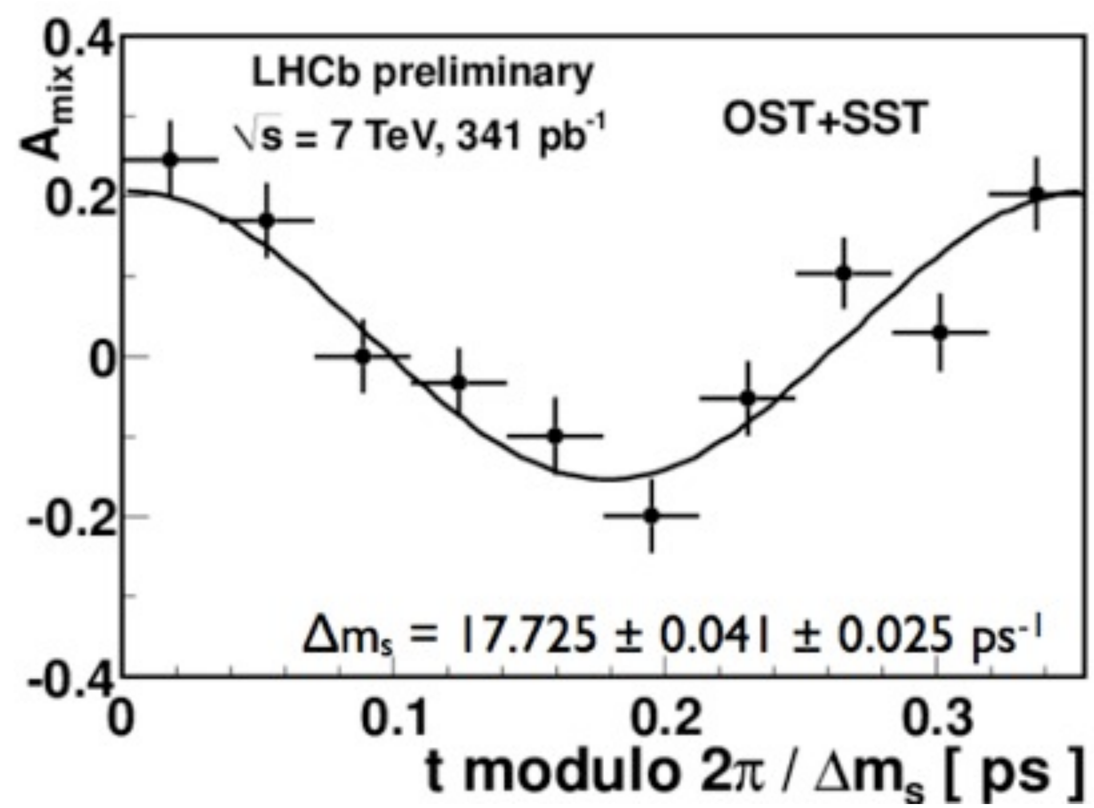
$$\frac{V_{ts}V_{tb}^*}{V_{cs}V_{cb}^*}$$



CP violation through interference of diagrams with and w/o mixing

Link with dimuon asymmetry:

$$a_{sl}^s = \frac{|\Gamma_s^{12}|}{|M_s^{12}|} \sin\phi_s = \frac{\Delta\Gamma_s}{\Delta M_s} \tan\phi_s$$



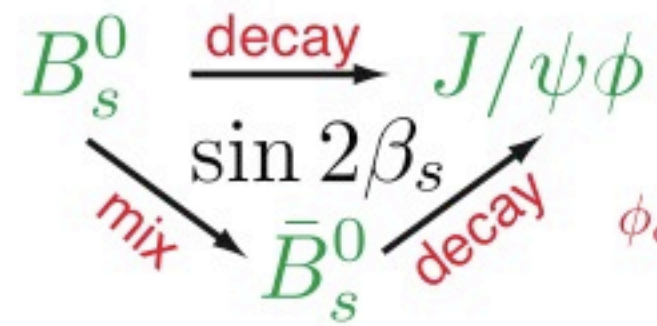
NB: $\Delta m_d \sim 0.5\ ps^{-1}$

Link with CP violation in B_s

$$\phi_s^{J/\psi\phi} \approx -2\beta_s = -2\beta_s^{SM} + \phi_s^{NP}$$

$-(0.038 \pm 0.002)$

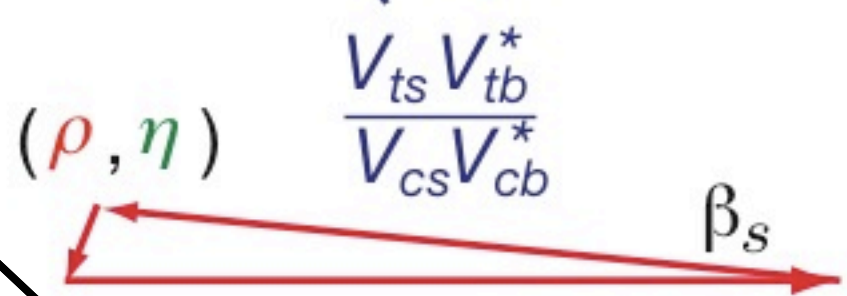
Golden mode,
Hadron Colliders



$\phi_{\text{dec}} \sim 0$

CP violation through interference of diagrams with and w/o mixing

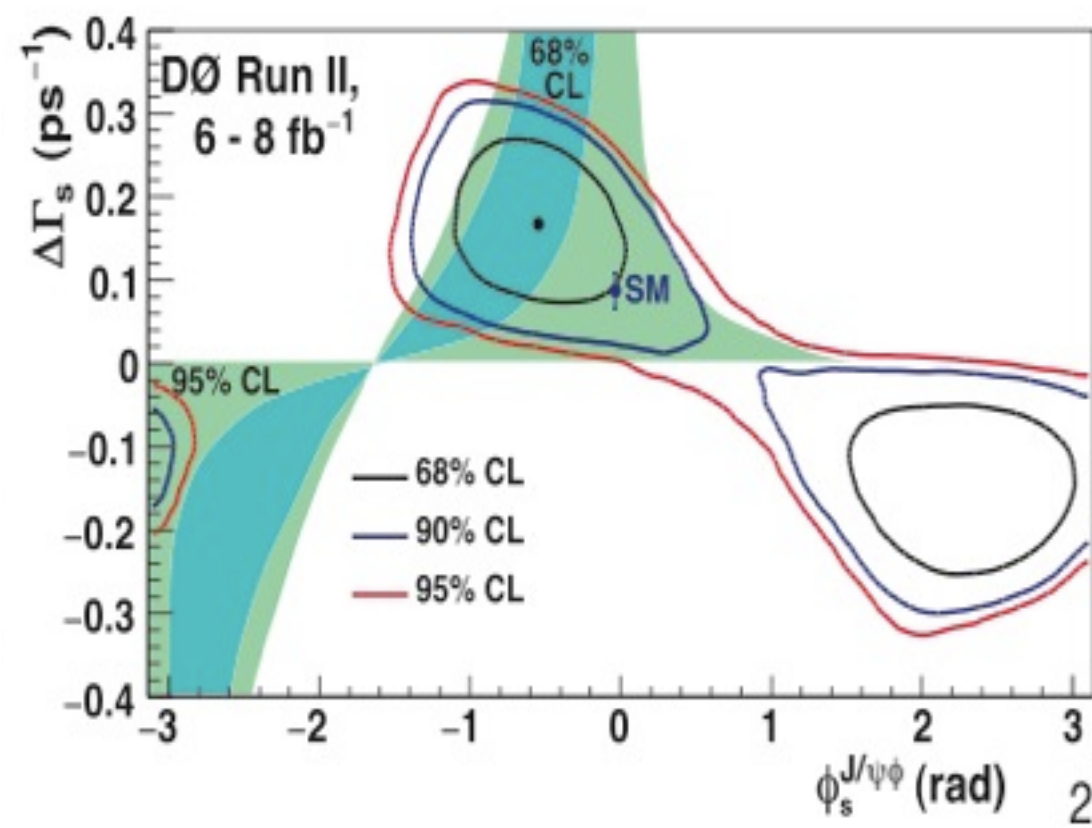
"Squashed" Triangle



same Φ_s

Link with dimuon asymmetry:

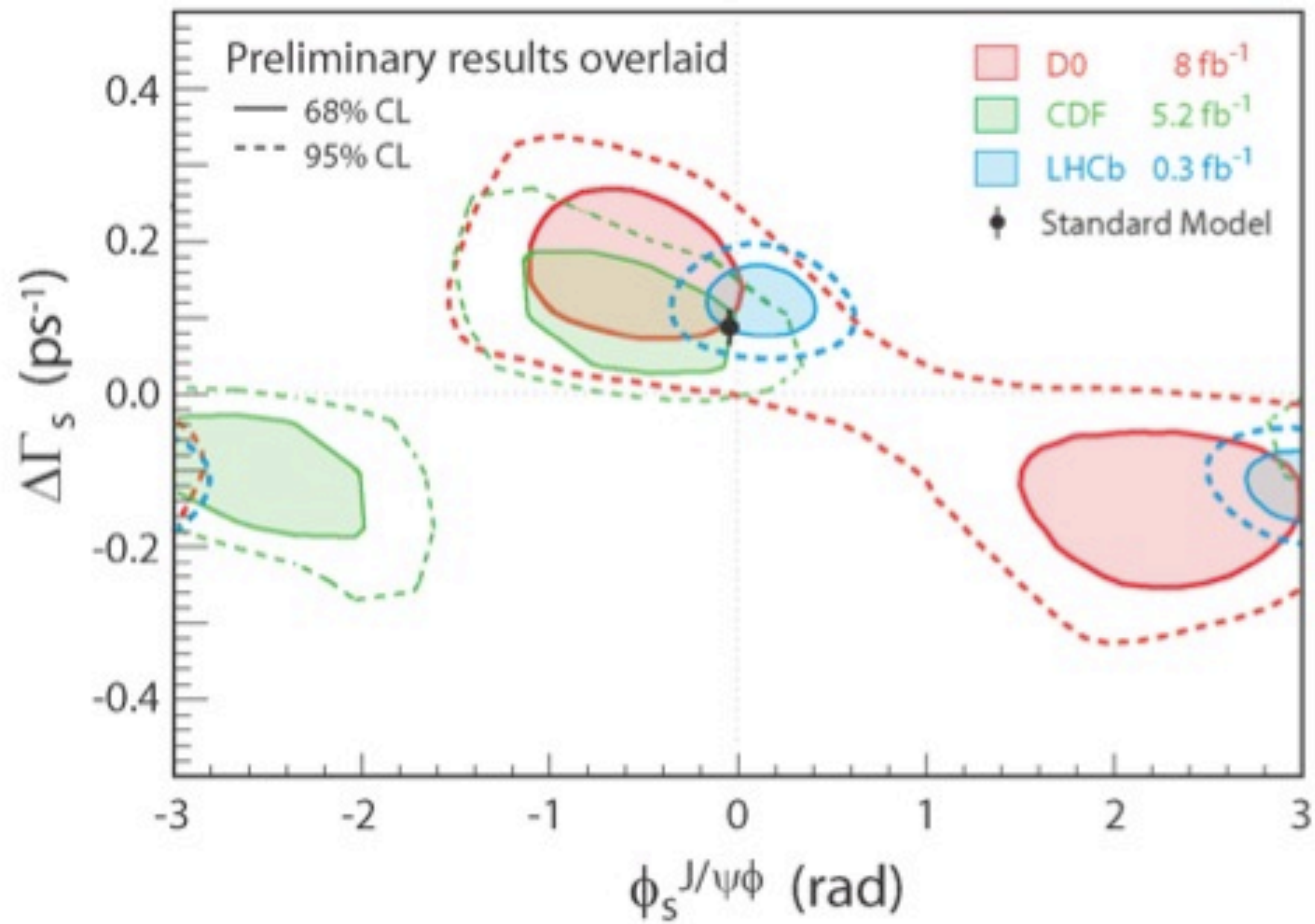
$$a_{\text{sl}}^s = \frac{|\Gamma_s^{12}|}{|M_s^{12}|}\sin\phi_s = \frac{\Delta\Gamma_s}{\Delta M_s}\tan\phi_s$$



Two completely different measurements at the Tevatron deviates and point to the same corner. But here comes LHCb....

LHCb: $B_s \to \Psi\,\Phi$

New result from LHCb with 300 pb^{-1}
much more compatible with SM than current Tevatron measurements

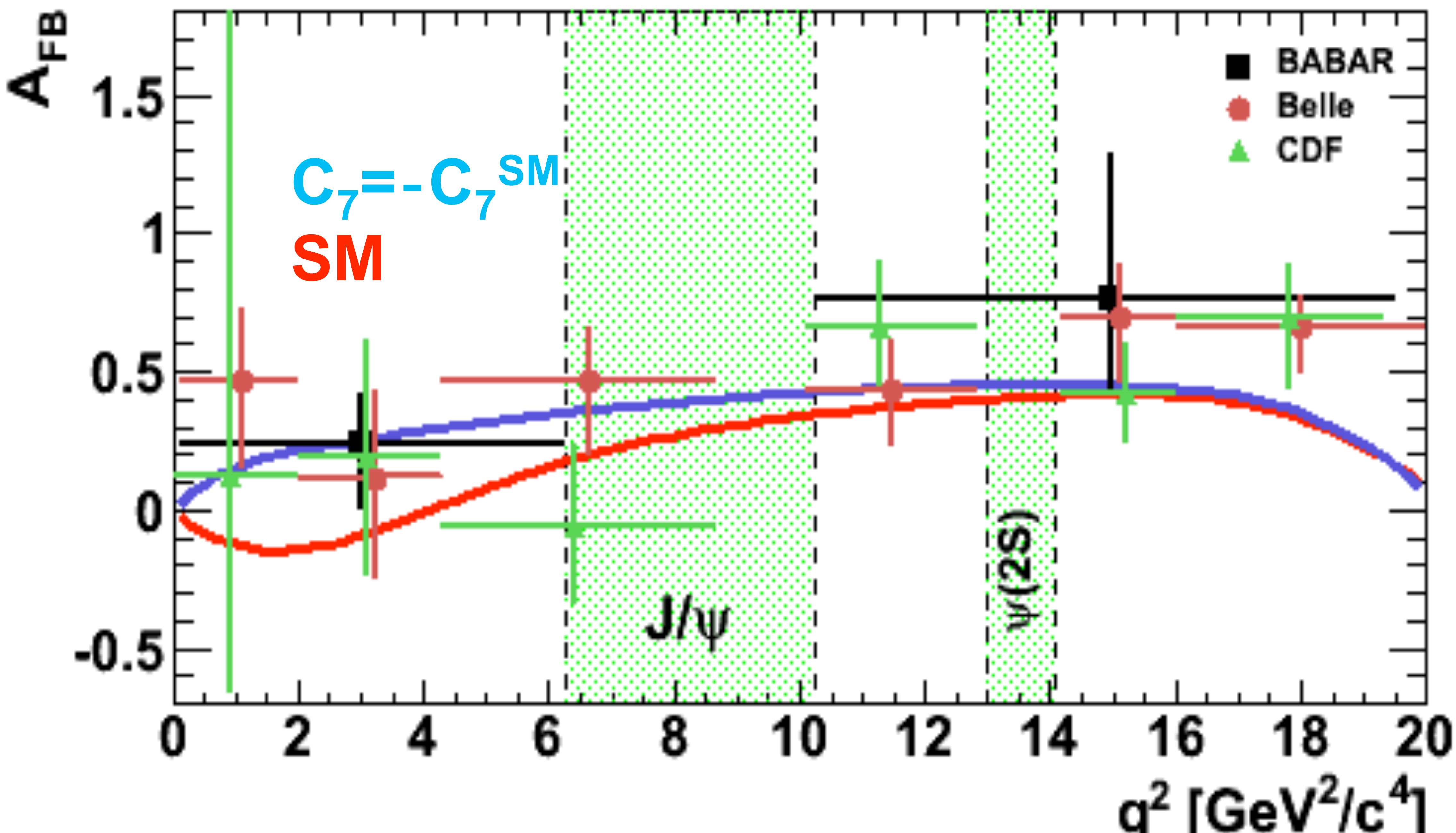


This is NOT an official accurate overlay!! – only an “artist's view”

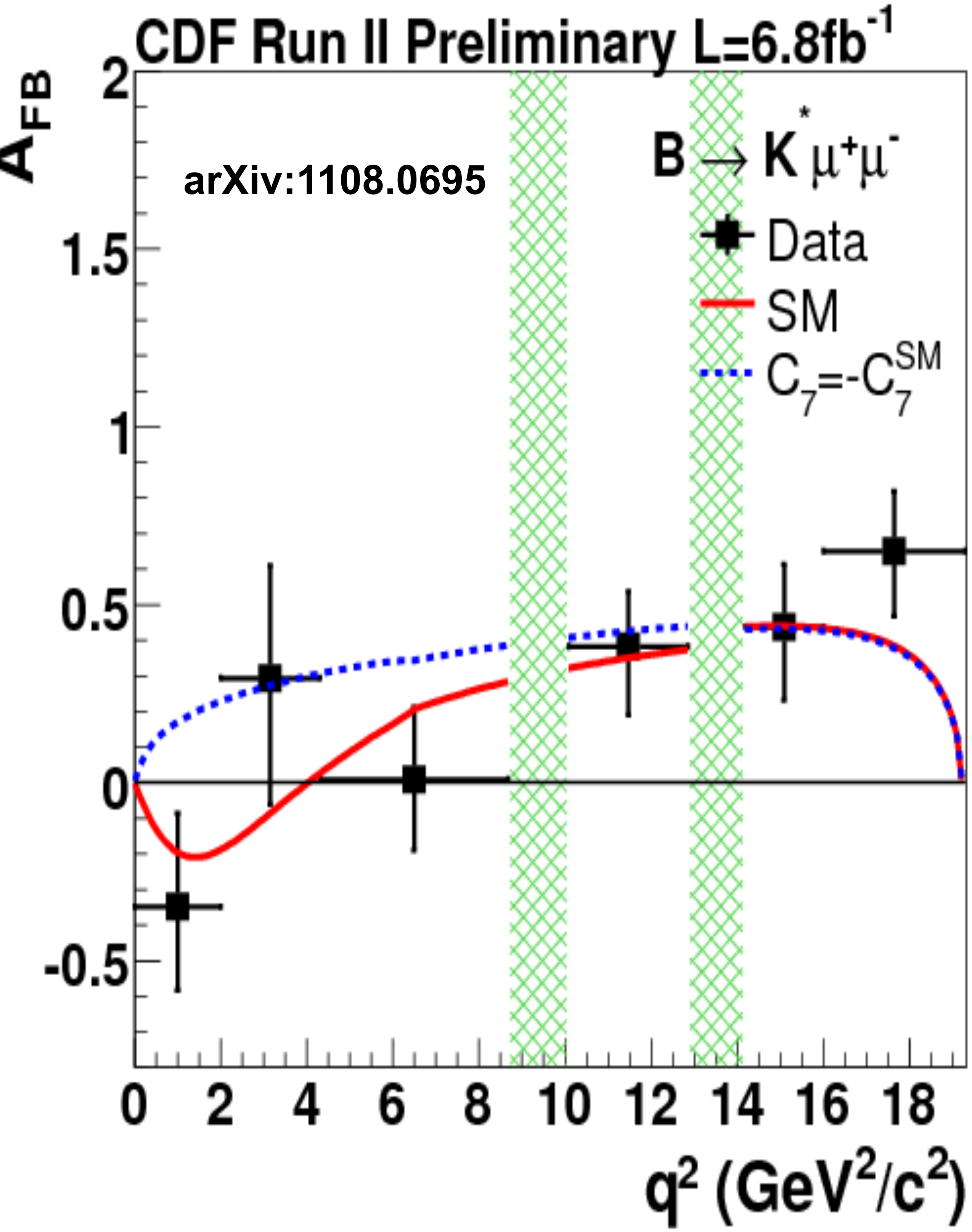
Context

Asymmetry FB of the lepton system vs its q^2 is very sensitive to new physics.

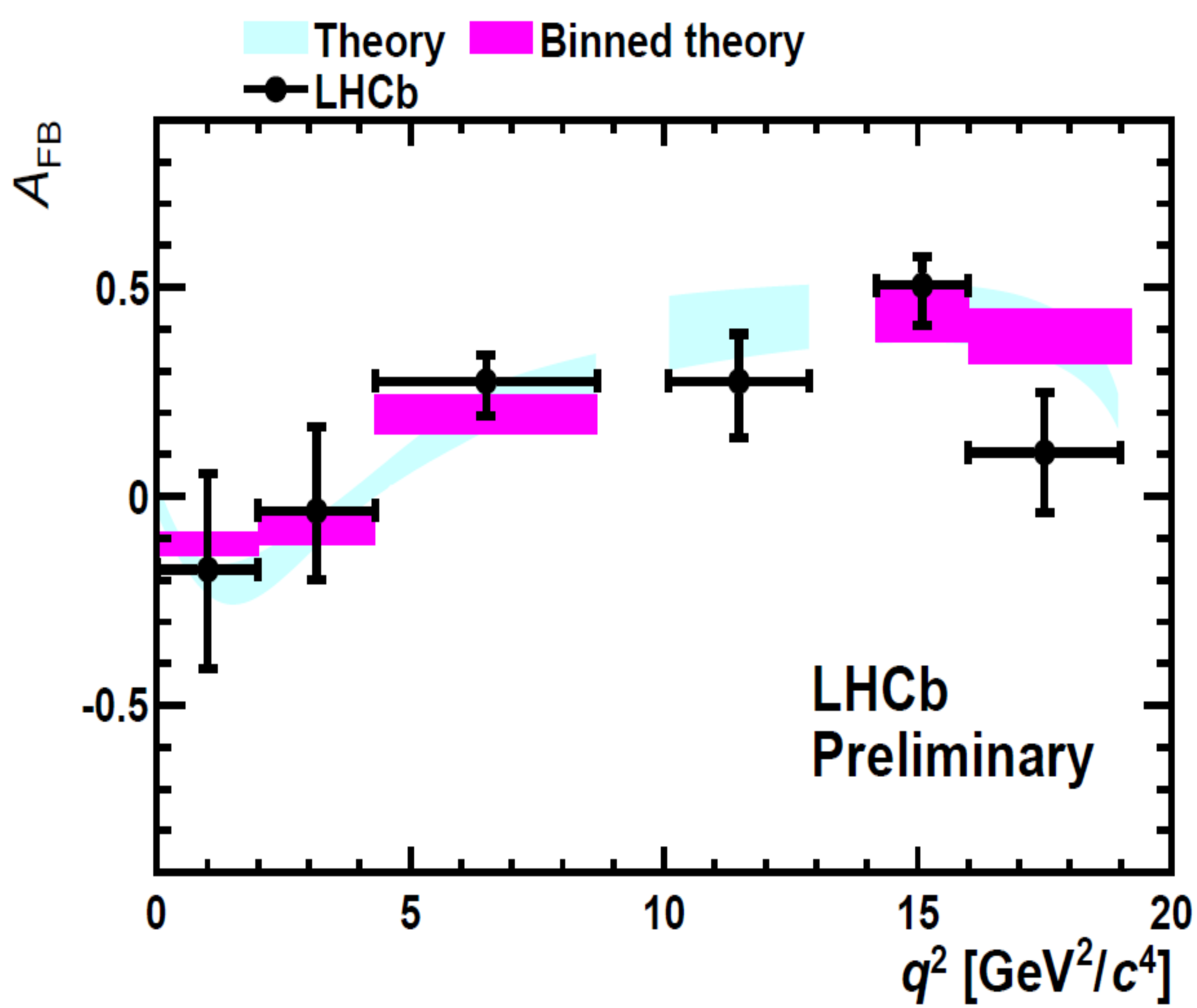
Some hints of deviations from B-factories and CDF



A_{FB} in $B_d \to K^*ll$



LHCb-CONF-2011-039

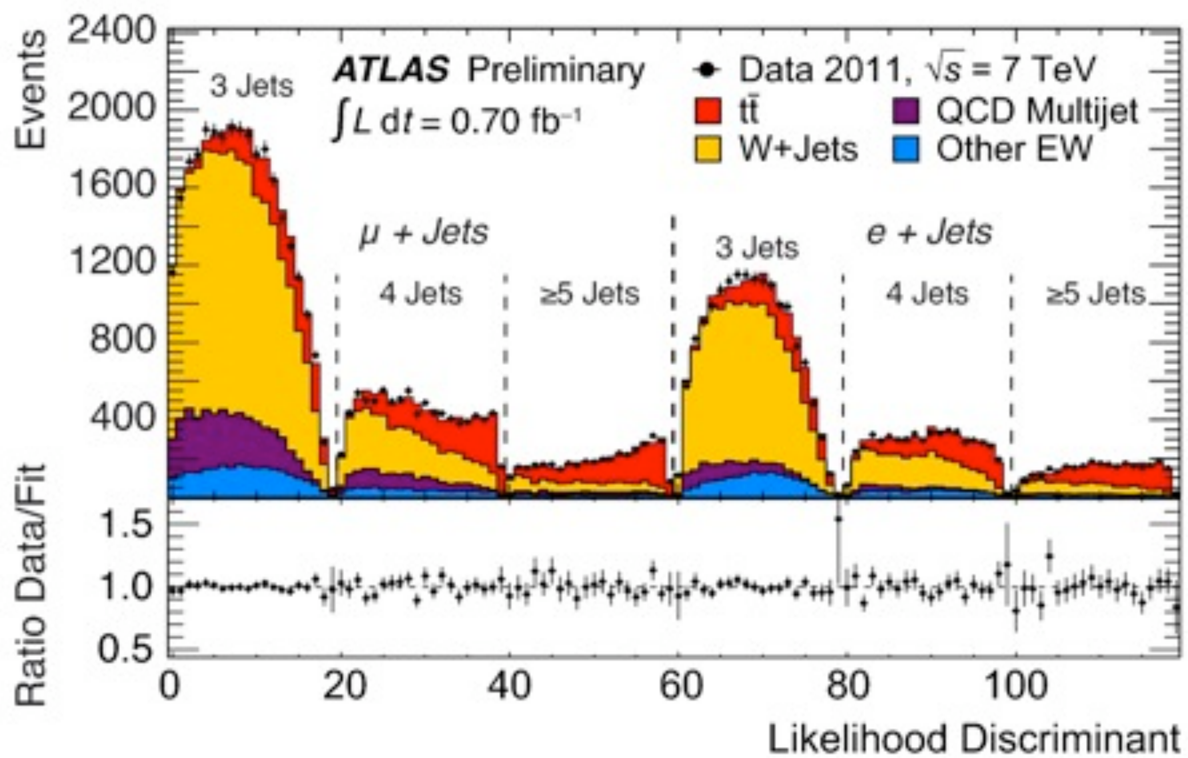


top physics

ttbar Cross Section

- most precise measurement: in the ljets channel
  - fit the number of W+jets together with the number of ttbar
  - fit the systematic uncertainties to reduce them

Altas new result
w/o b-tagging
w/ profiling

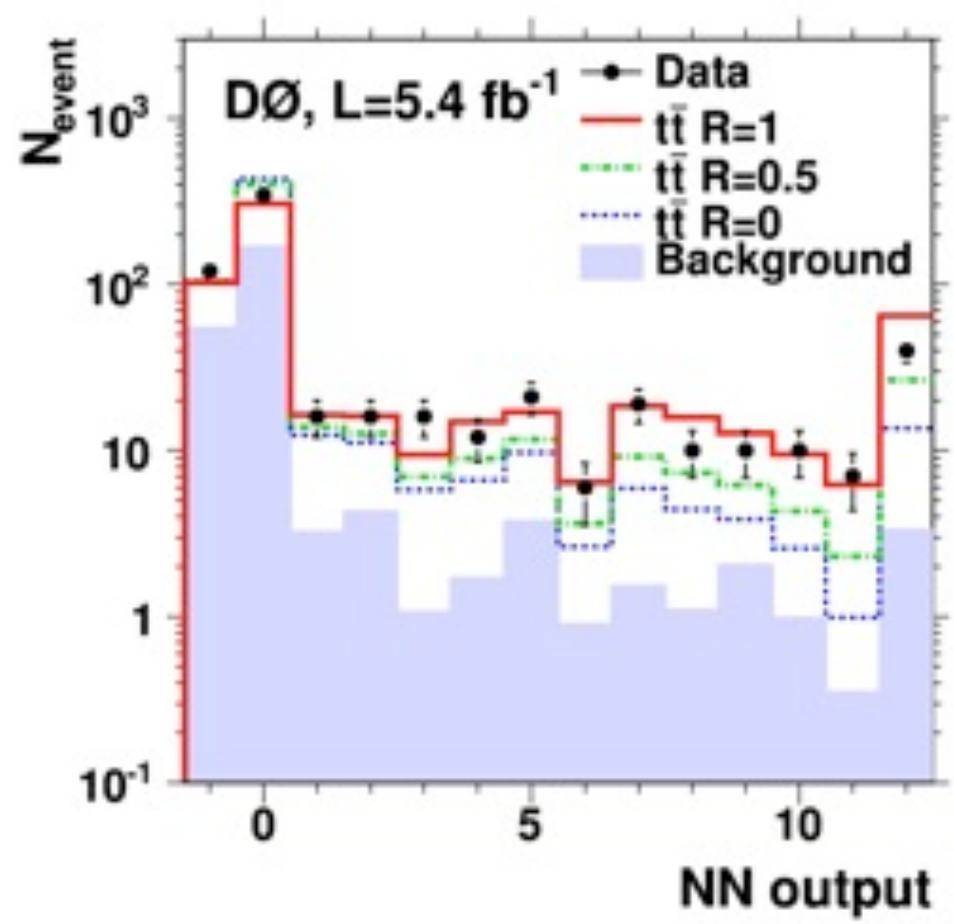


- cross section in different final states (consistency of the SM)
  - Tevatron: in almost all the channels
  - LHC: apart from ljets and dilepton, now measurements in alljets and μτ
  - agreements between the different channels
- in addition to the cross section, fit R

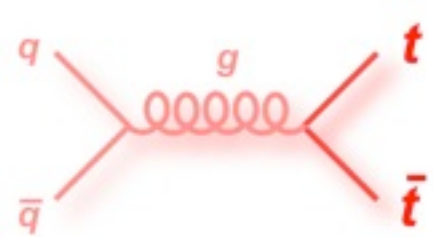
$$R = \frac{\mathcal{B}(t \to Wb)}{\mathcal{B}(t \to Wq)} = \frac{|V_{tb}|^2}{|V_{tb}|^2 + |V_{ts}|^2 + |V_{td}|^2}$$

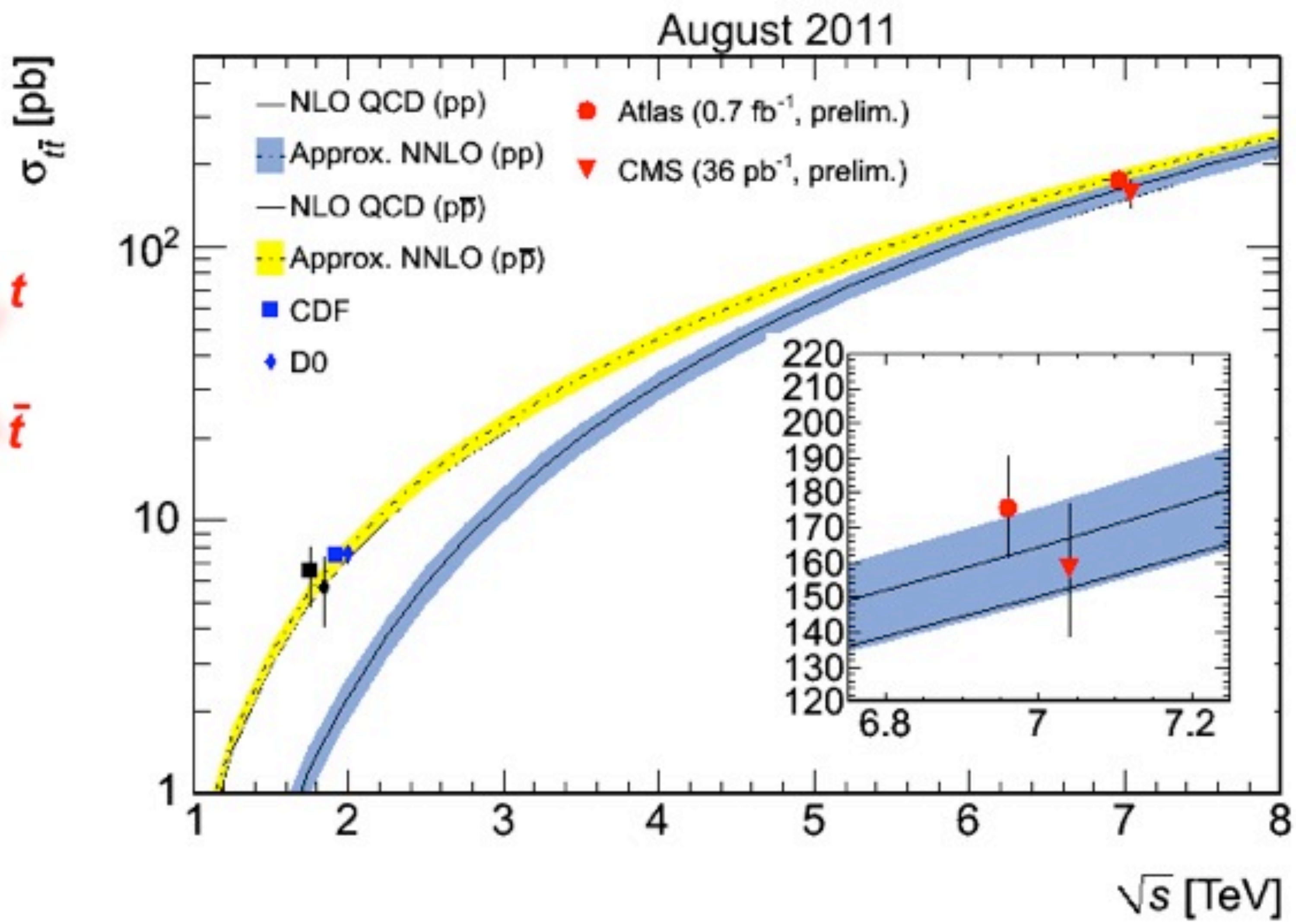
ljets+dilepton: $|V_{tb}| = 0.95 \pm 0.02$ assuming CKM unitarity

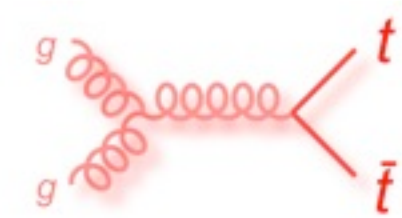
(agreement with the SM: 1.6 %)

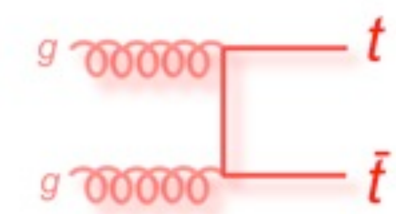


ttbar Cross Section Summary









decay channel combined
for $m_t = 172.5$ GeV:

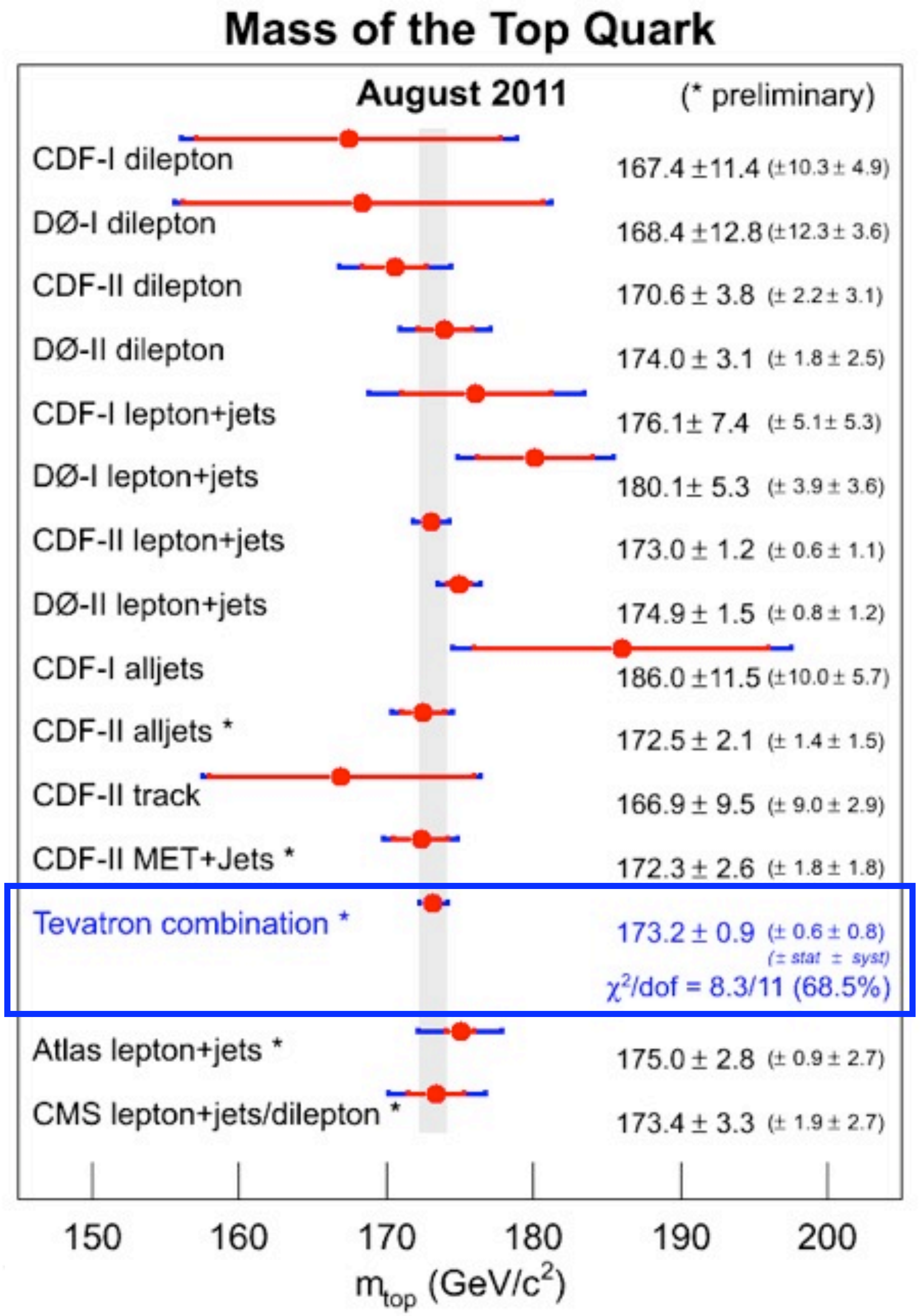
CDF (up to 4.6 fb^{-1})	$\sigma(p\bar{p} \to t\bar{t}) =$	$7.5 \pm 0.31(\text{stat}) \pm 0.34(\text{syst}) \pm 0.15(\text{theory})$ pb	~ 6.5 %
D0 (5.6 fb^{-1}, arXiv:1105.5384)	$\sigma(p\bar{p} \to t\bar{t}) =$	$7.56^{+0.63}_{-0.56}$ (stat + syst + lumi) pb	
Atlas (0.7 fb^{-1})	$\sigma(pp \to t\bar{t}) =$	$179.0 \pm 9.8(\text{stat} + \text{syst}) \pm 6.6(\text{lumi})$ pb	~ 6.6 %
CMS (36 pb^{-1})	$\sigma(pp \to t\bar{t}) =$	$158 \pm 10(\text{uncor.}) \pm 15(\text{cor.}) \pm 6(\text{lumi})$ pb	

Measurements agree with the QCD predictions

Future measurements will focus on differential cross sections

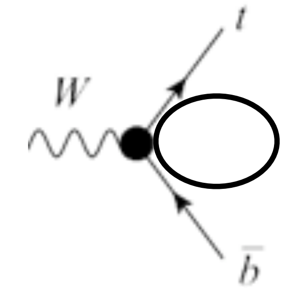
Top Quark Mass

- why measuring the top mass precisely ?
  - predict the Higgs boson mass together with the W boson mass
  - consistency of the SM and possibly with the direct Higgs measurements
- Tevatron:
  - most precise measurements using the matrix element method
  - new channel : CDF MET+jets
- new Tevatron combination
  - uncertainty below 1 GeV for the first time
  - all channels give consistent results
  - still working on decreasing the systematic uncertainties
- LHC in the ljets channel:
  - CMS: ideogram method
  - Altas: 2D template fit (Mtop,JES)
- mass difference: Mt-Mtbar
  - CMS: $\Delta m_t = -1.2 \pm 1.2\,(\text{stat.}) \pm 0.5\,(\text{syst.})\ \text{GeV}$
  - CDF: $\Delta M_{top} = -3.3 \pm 1.4\,(\text{stat.}) \pm 1.0\,(\text{syst.})\ \text{GeV}/c^2$

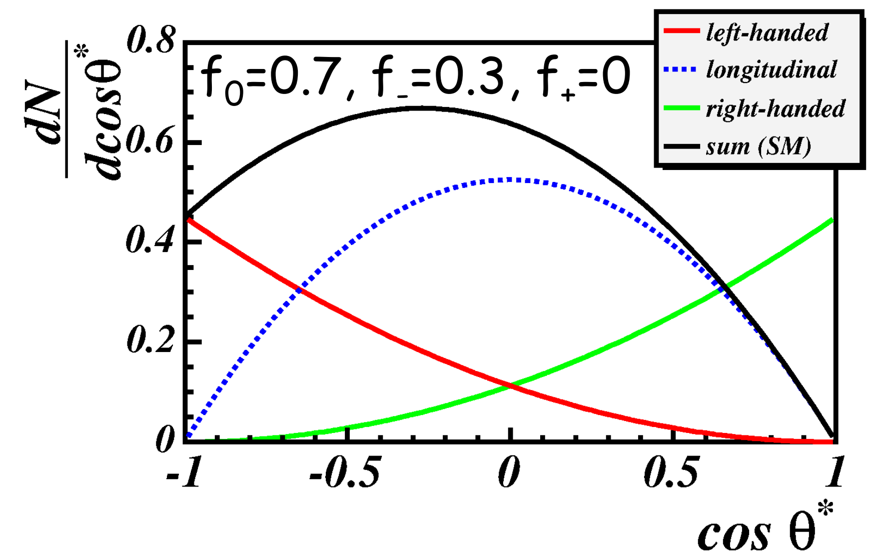


W Boson Helicity In Top Decays

- motivation:
  - test the SM at the electroweak scale
  - new physics could affect the helicity, **no right-handed W in the SM**



- measurement methods:
  - template fit of the cosθ* distribution
    (angle between the lepton from the W boson and the top direction in W boson rest frame)
  - matrix element (ME)

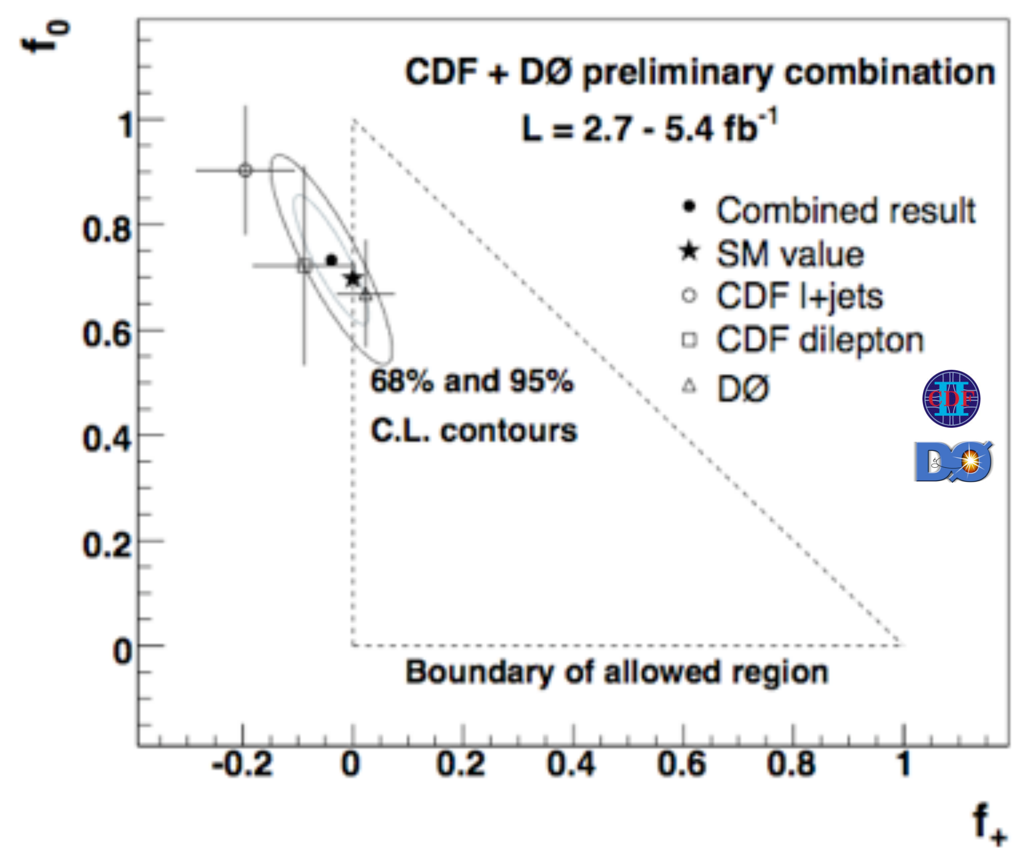


- combination of the latest Tevatron results:
  - taken correlation into account
    both when f_0 and f_+ are floating or only one of them

$$f_0 = 0.732 \pm 0.063(\mathrm{stat}) \pm 0.052(\mathrm{syst})$$
$$f_+ = -0.039 \pm 0.034(\mathrm{stat}) \pm 0.030(\mathrm{syst})$$
(2D)

- Atlas result:
  - dilepton/lepton+jets template (0.7 fb^{-1})
    already the same precision as the Tevatron combination:

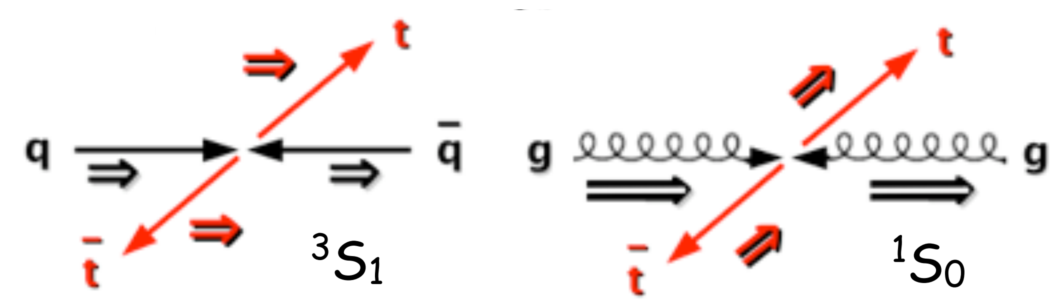
$$f_0 = 0.75 \pm 0.08(\mathrm{stat+syst})$$
(1D)



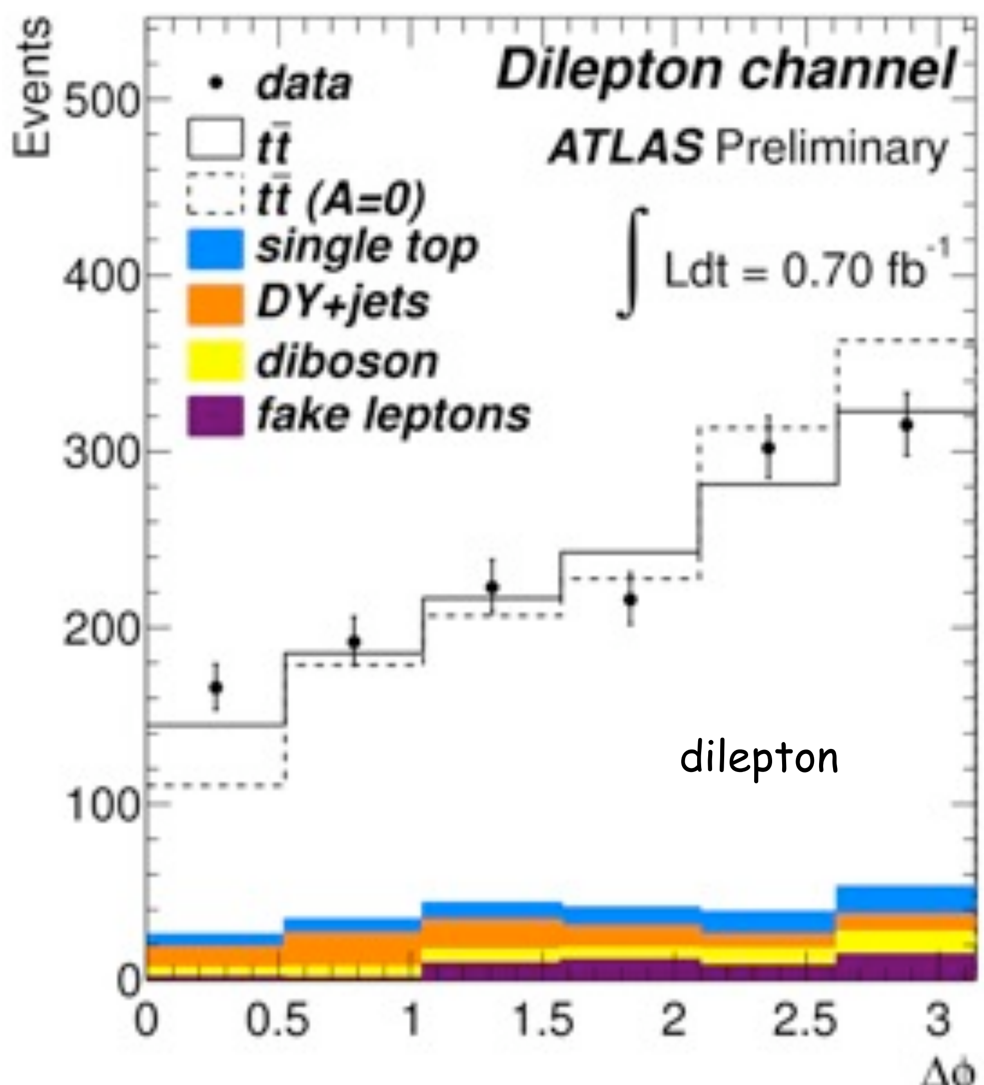
Measurements agree with the SM predictions

Top Pair Spin Correlations

- in the SM, the spin of the top and of the antitop are produced correlated
  - correlation preserved in the decay products
  - can be affected by new physics



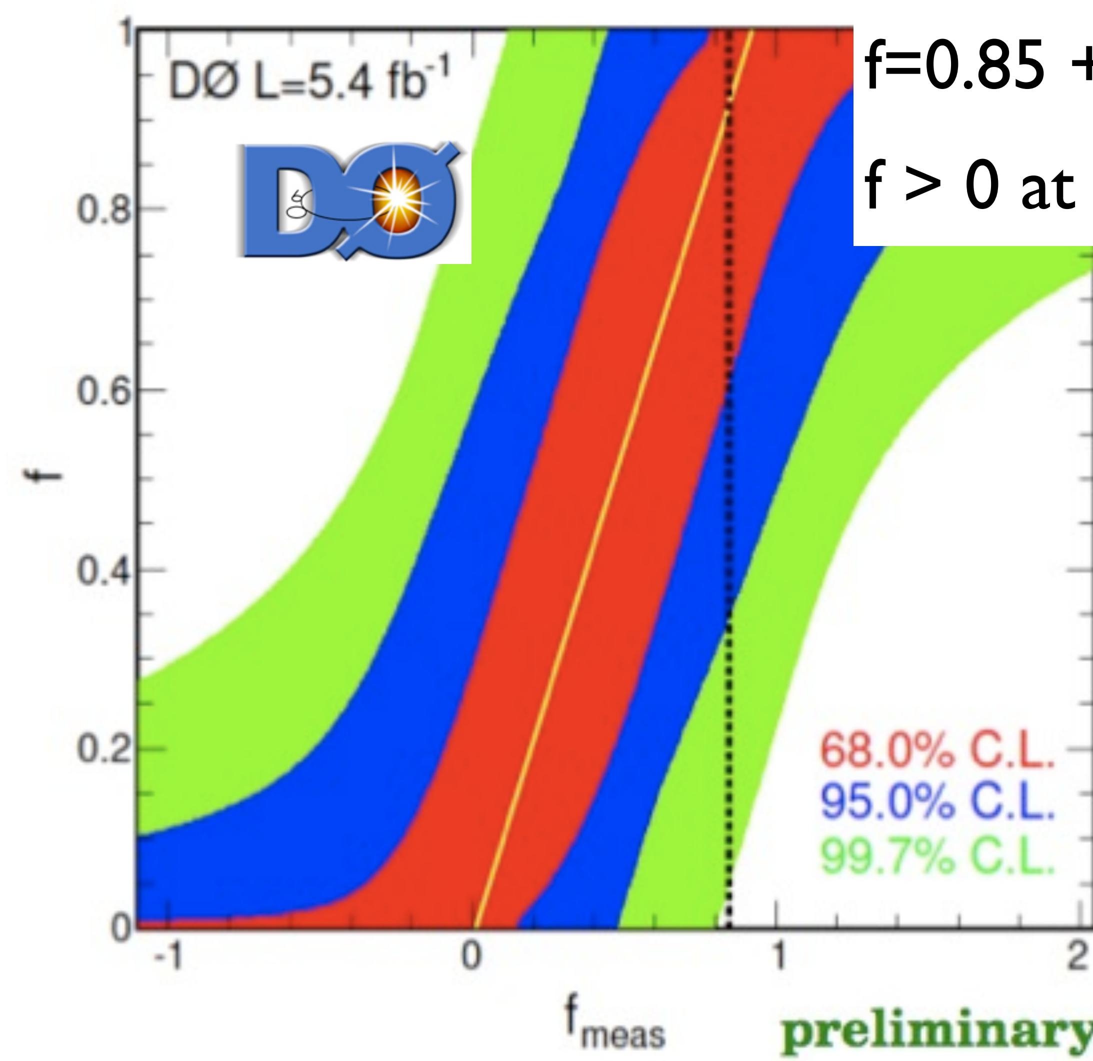
- measurement methods:
  - template fit of the $\cos\theta_1 \cos\theta_2$ distribution
  (θ: angle from the down-type fermion wrt spin basis in the top/antitop rest frame) or $\Delta\Phi = |\Phi_{l+} - \Phi_{l-}|$ (in the lab frame)



helicity basis, $A=0.34^{+0.15}_{-0.11}$

$A_{SM}=0.32$

- matrix element: measure f: fraction of events with spin correlation using a template fit of R

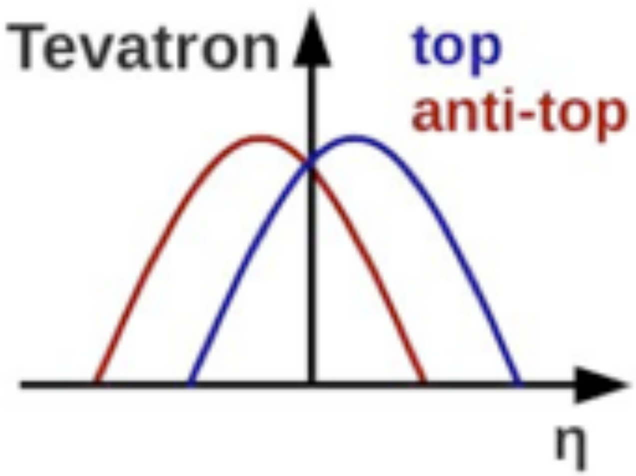


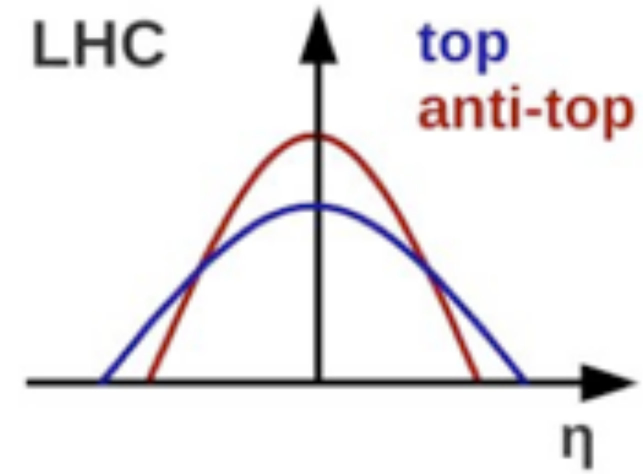
f=0.85 +/- 0.29

f > 0 at 3.1 σ

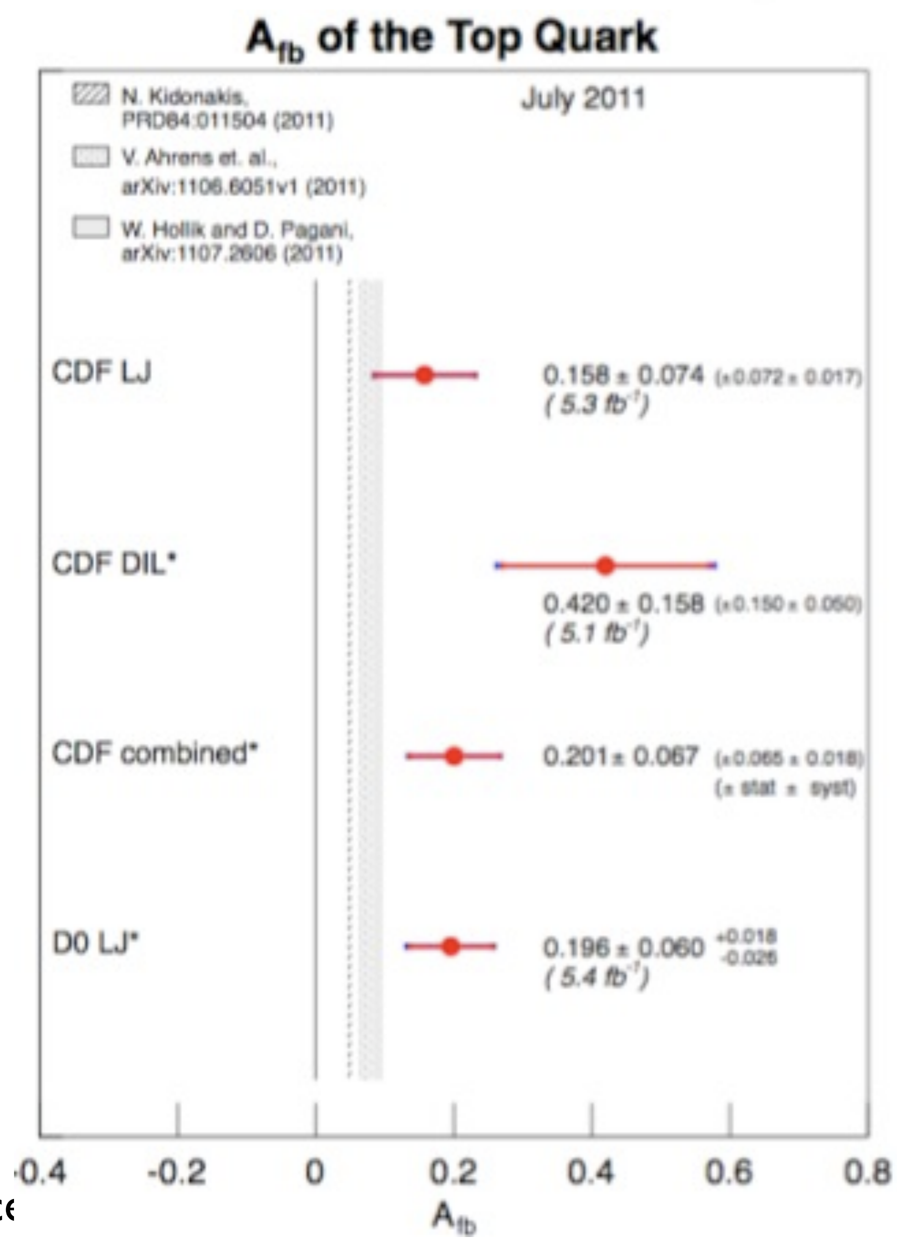
Top-Antitop Charge Asymmetry

- At NLO, QCD predicts an asymmetry for $t\bar{t}$ produced via $q\bar{q}$ initial state

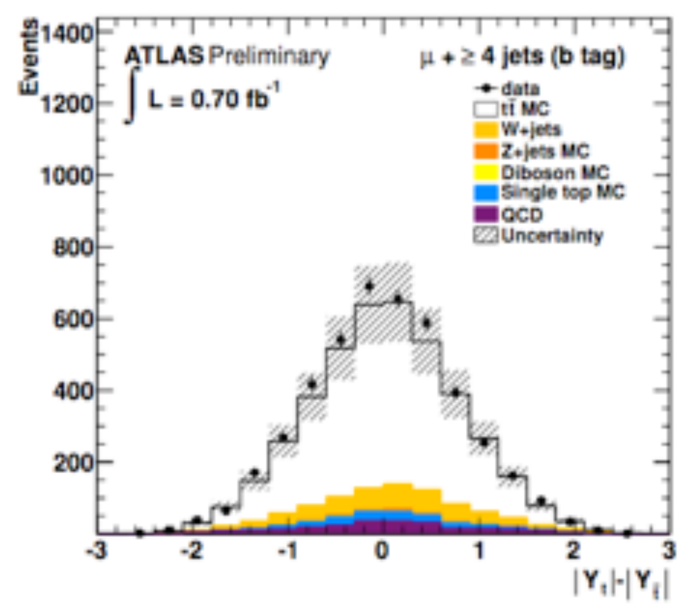


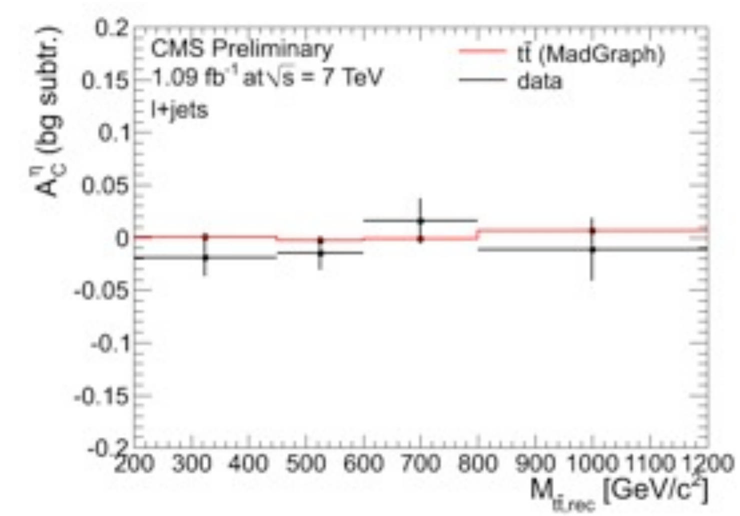


smaller at LHC since low $q\bar{q}$ fraction



$$A_C = \frac{N(\Delta|Y| > 0) - N(\Delta|Y| < 0)}{N(\Delta|Y| > 0) + N(\Delta|Y| < 0)} \qquad \Delta|Y| = |Y_t| - |Y_{\bar{t}}|$$

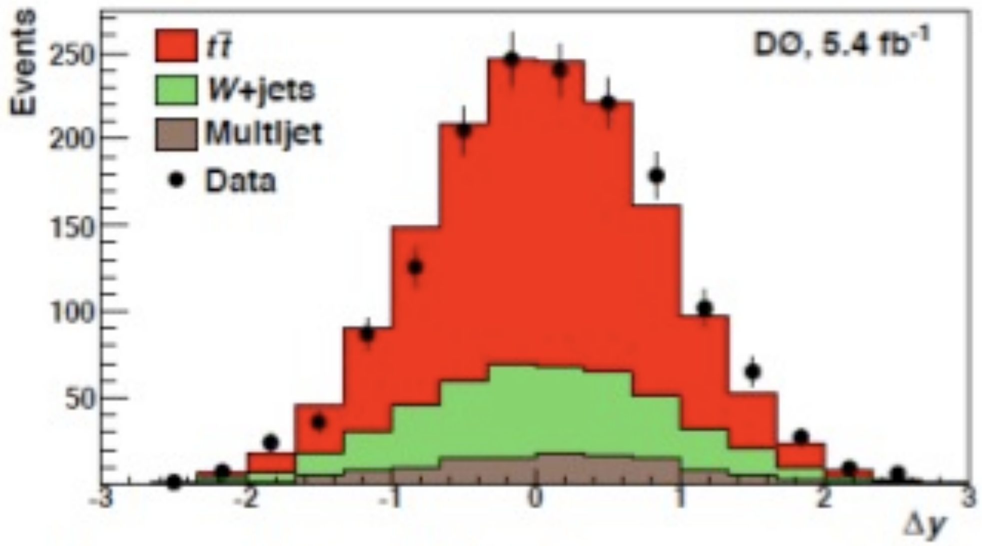




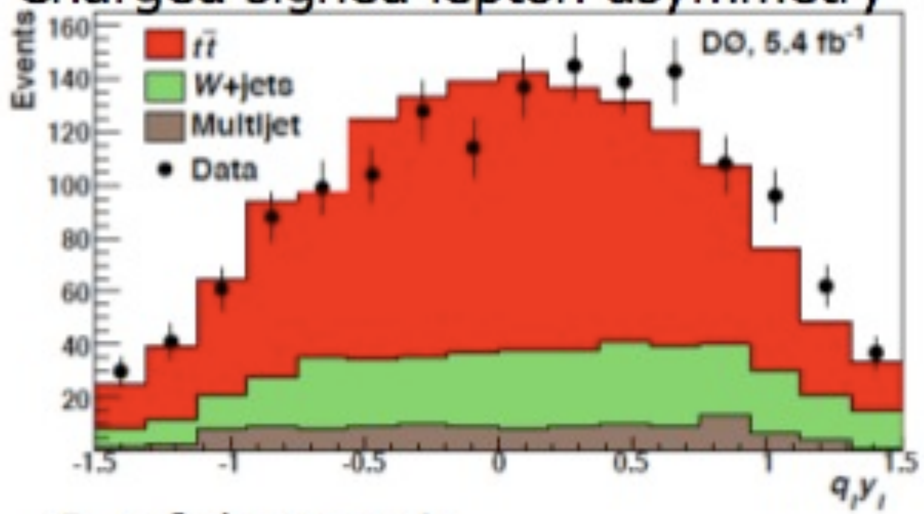
	unfolded data	SM prediction
Altas: A_C^y (0.7 fb^{-1})	-0.024 ± 0.016 (stat) ± 0.023 (syst)	0.006 (MC@NLO)
CMS: A_C^η (1.1 fb^{-1})	-0.016 ± 0.030 (stat)$^{+0.010}_{-0.019}$ (syst)	0.0130

Currently no deviation from the predictions at the LHC

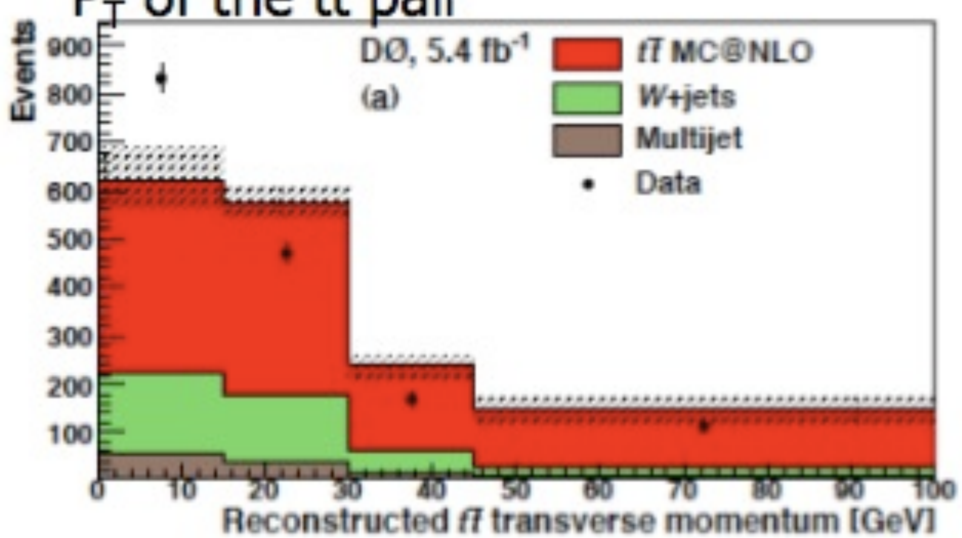
Top-Antitop Charge Asymmetry



Charged signed lepton asymmetry

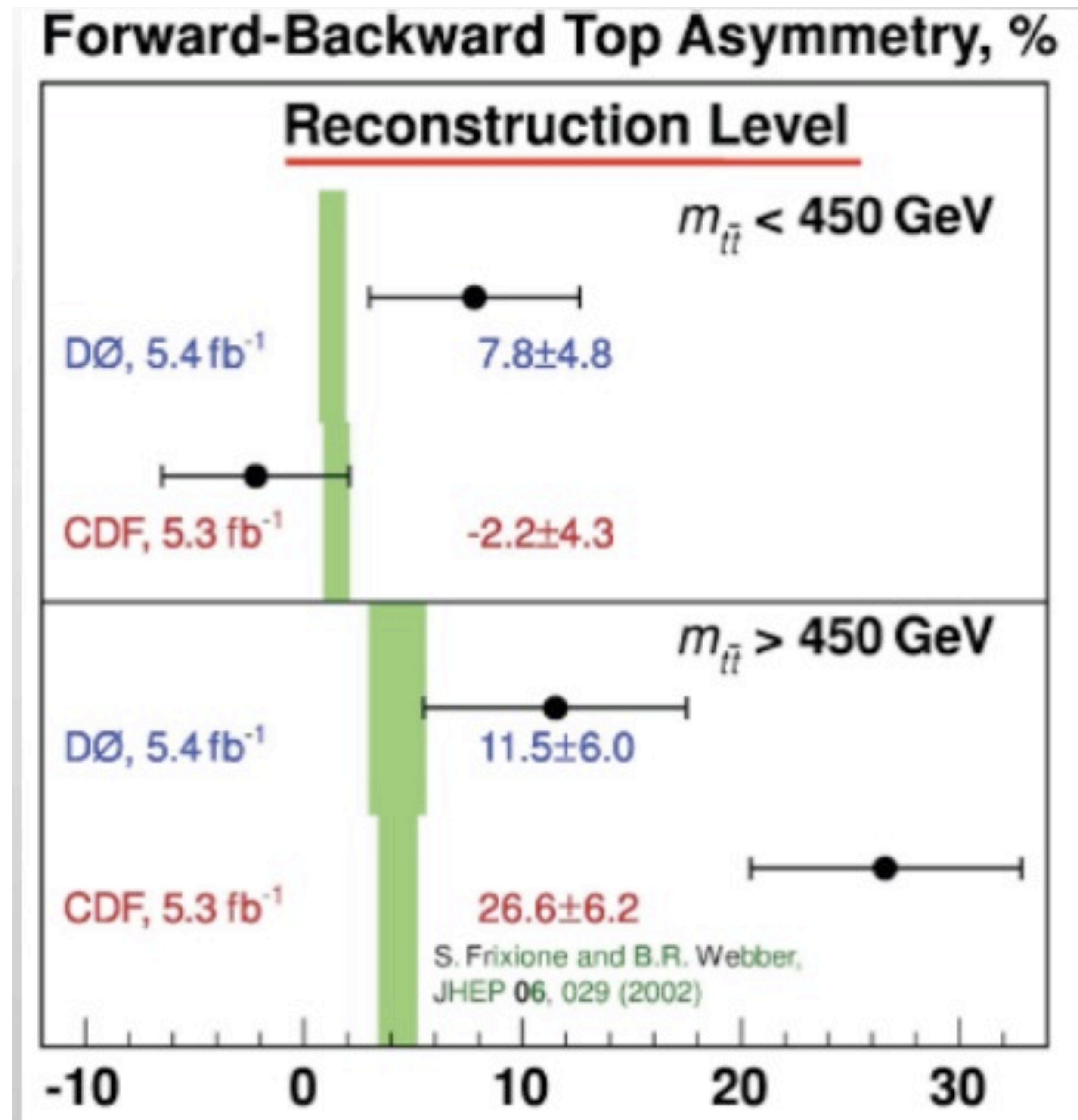


P_T of the tt pair



$$A^{t\bar{t}} = \frac{N(\Delta y > 0) - N(\Delta y < 0)}{N(\Delta y > 0) + N(\Delta y < 0)}$$

$$\Delta y = y_t - y_{\bar{t}}$$



Inclusive asymmetry consistent at D0 and CDF, but not dependence on Mtt not so much

top in a nutshell

we know already a lot about the top quark

Tevatron: focusing on the legacy measurements

LHC top physics is only warming up !

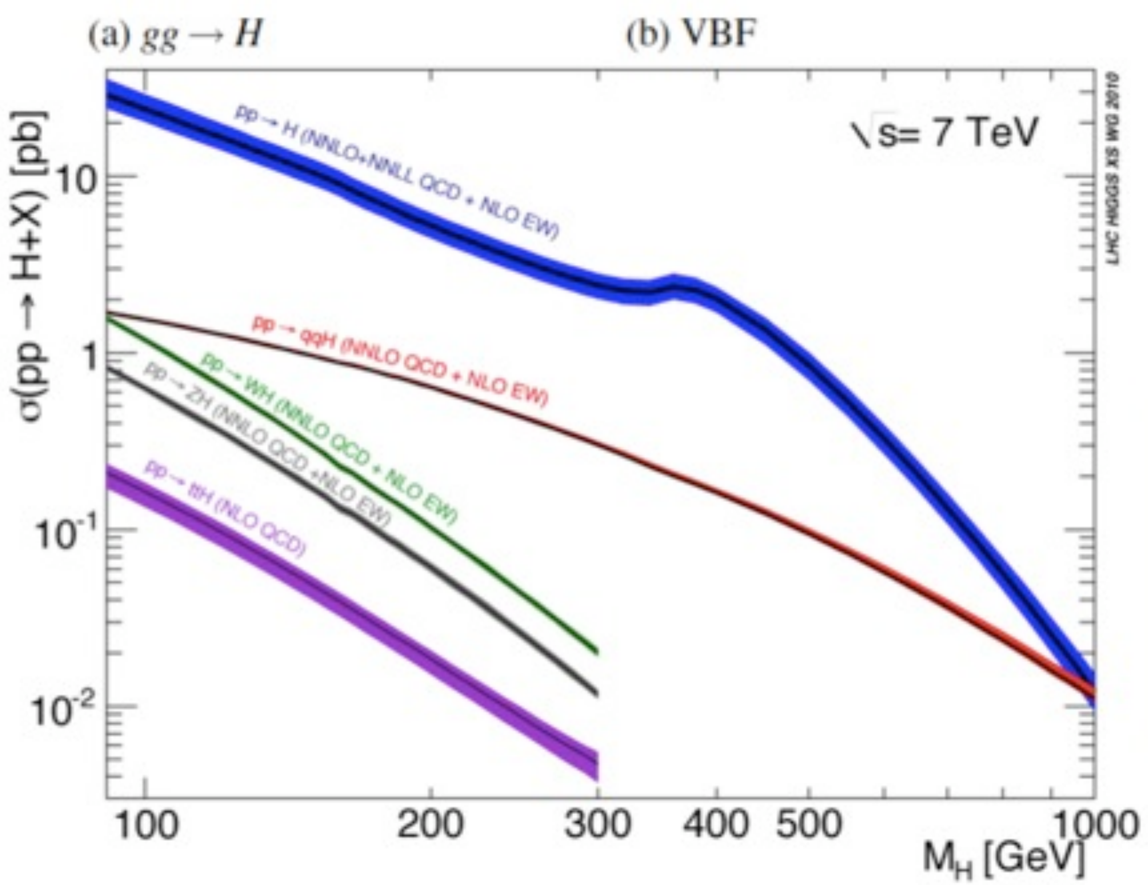
Property	Measurement		SM Prediction	Luminosity (fb^{-1})
$\sigma_{t\bar{t}}$ (for $M_t = 172.5$ GeV)	$p\bar{p} \to t\bar{t}$	CDF: $7.5 \pm 0.31(\text{stat}) \pm 0.34(\text{syst}) \pm 0.15(\text{theory})$ pb	$7.46^{+0.48}_{-0.67}$ pb	up to 4.6
		D0: $7.56^{+0.63}_{-0.56}$ (stat + syst + lumi) pb		5.6
	$pp \to t\bar{t}$	Atlas: $179.0 \pm 9.8(\text{stat + syst}) \pm 6.6(\text{lumi})$ pb	$164.6^{+11.4}_{-15.7}$ pb	0.7
		CMS: $158 \pm 10(\text{uncor.}) \pm 15(\text{cor.}) \pm 6(\text{lumi})$ pb		0.036
σ_{tbq} (for $M_t = 172.5$ GeV)	$p\bar{p} \to t\bar{t}$	CDF: 0.8 ± 0.4 pb ($M_t = 175$ GeV)	2.26 ± 0.12 pb	3.2
		D0: 2.90 ± 0.59 pb		5.4
	$pp \to t\bar{t}$	Atlas: 90^{+32}_{-22} pb	$64.6^{+3.3}_{-2.6}$ pb	0.7
		CMS: $83.6 \pm 29.8(\text{stat + syst}) \pm 3.3(\text{lumi})$ pb		0.035
σ_{tb} (for $M_t = 172.5$ GeV)	$p\bar{p} \to tb$	CDF: $1.8^{+0.7}_{-0.5}$ pb ($M_t = 175$ GeV)	1.04 ± 0.04 pb	3.2
		D0: $0.68^{+0.38}_{-0.35}$ pb		5.4
	$pp \to tb$	Atlas: < 26.5 pb		0.7
σ_{Wt} (for $M_t = 172.5$ GeV)	$pp \to Wt$	Atlas: < 39.1 pb	15.7 ± 1.4 pb	0.7
$\lvert V_{tb} \rvert$		CDF: $\lvert V_{tb} \rvert = 0.91 \pm 0.11(\text{stat + sys}) \pm 0.07(\text{theory})$	1	3.2
		D0: $\lvert V_{tb} \rvert = 1.02^{+0.10}_{-0.11}$		5.4
$R = B(t \to Wb)/B(t \to Wq)$		CDF: > 0.61 @ 95% CL	1	0.2
		D0: 0.90 ± 0.04		5.4
$\sigma(gg \to t\bar{t})/\sigma(p\bar{p} \to t\bar{t})$	$p\bar{p} \to t\bar{t}$	CDF: $0.07^{+0.15}_{-0.07}$	0.18	1
M_t		Tev: 173.2 ± 0.9 GeV	-	up to 5.8
		Atlas: 175.9 ± 2.8 GeV	-	0.7
		CMS: 173.4 ± 3.3 GeV	-	0.036
$M_t - M_{\bar{t}}$		CDF: $-3.3 \pm 1.4(\text{stat}) \pm 1.0(\text{syst})$ GeV	0	5.6
		D0: $0.8 \pm 1.8(\text{stat}) \pm 0.5(\text{syst})$ GeV		3.6
		CMS: $-1.2 \pm 1.2(\text{stat}) \pm 0.5(\text{syst})$ GeV		1.1
W helicity fraction		Tev: $f_0 = 0.732 \pm 0.063(\text{stat}) \pm 0.052(\text{syst})$	0.7	up to 5.4
		Atlas: $f_0 = 0.75 \pm 0.08(\text{stat + syst})$	0.7	0.7
Charge		CDF: -4/3 excluded @ 95% CL	2/3	5.6
		D0: 4/3 excluded @ 92% CL		0.37
Γ_t		CDF: < 7.6 GeV @ 95% CL	1.26 GeV	4.3
		D0: $1.99^{+0.69}_{-0.55}$ GeV		up to 2.3
spin correlation	$p\bar{p} \to t\bar{t}$, beam	CDF: $0.72 \pm 0.64(\text{stat}) \pm 0.26(\text{syst})$	$0.777^{+0.027}_{-0.042}$	5.3
		D0: $0.66 \pm 0.23(\text{stat + sys})$		5.4
	$pp \to t\bar{t}$, helicity	Atlas: $0.34^{+0.15}_{-0.11}$	0.32	0.7
Charge asymmetry	$p\bar{p} \to t\bar{t}$	CDF: 0.158 ± 0.074	0.06	5.3
		D0: 0.196 ± 0.065		5.4
	$pp \to t\bar{t}$	Atlas: $A_C^y = -0.024 \pm 0.016(\text{stat}) \pm 0.023(\text{syst})$	0.006	0.7
		CMS: $A_C^\eta = -0.016 \pm 0.030(\text{stat})^{+0.010}_{-0.019}(\text{syst})$	0.013	1.1

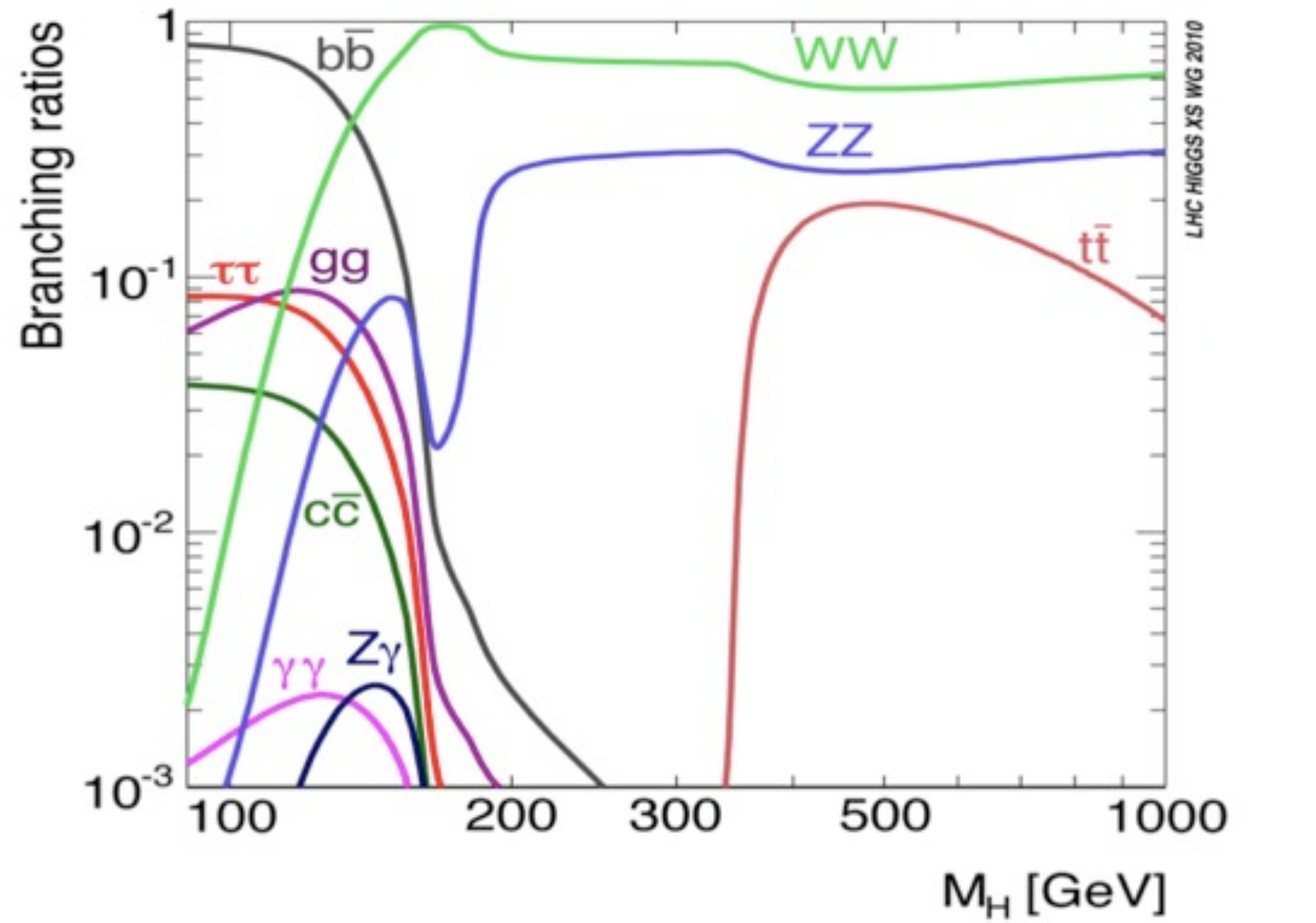
Higgs boson(s) searches

NB: Journée Higgs SPP le 2 novembre 2011.
Présentations détaillées de tous les résultats de l'été.

Higgs searches

Impressive showing from LHC. This summer saw the really transition from Tevatron to LHC





Strategy is mass dependent, because the Higgs boson branching ratio changes a lot with the m_H:

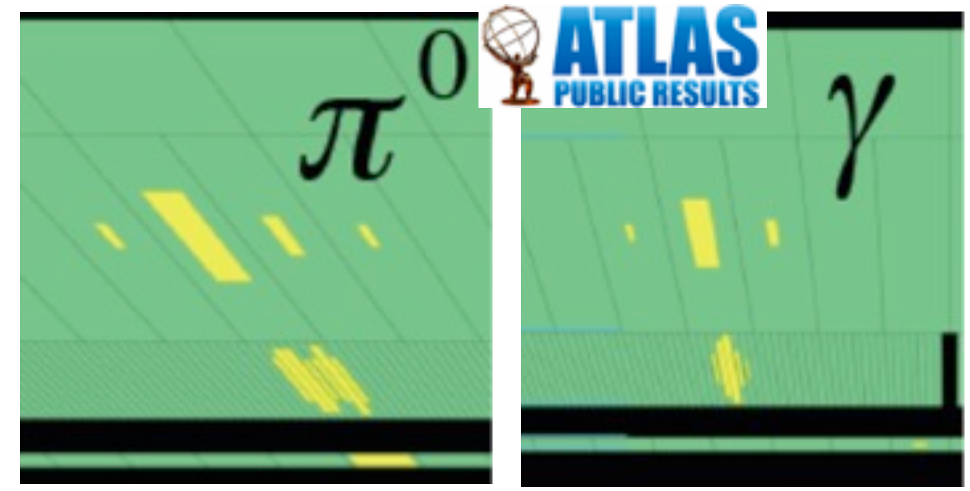
- at low mass inclusive H→bb with H channel can not be used (mostly H→γγ is left at LHC).
- background, hence sensitivity, very much depends on the final state
- Combine a lot of different channels, both at LHC and Tevatron

Golden channels at LHC

Low mass (m_H<140 GeV): $H \rightarrow \gamma\gamma$

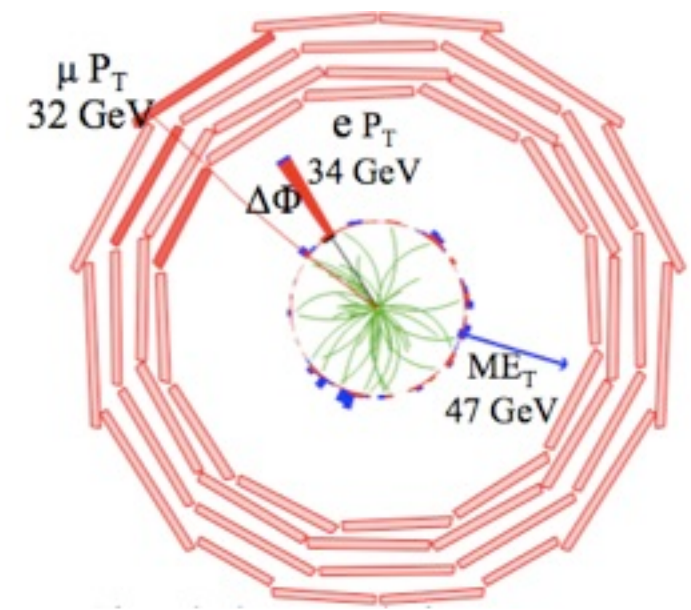
very good mass resolution (~1.5%),
very low BR (~0.001)
quite a lot of background

Dominate search for m_H < 120 GeV



Intermediate mass (m_H>120 GeV):
$H \rightarrow WW \rightarrow 2\ell 2\nu$

very poor mass resolution (~10s GeV), higher BR,
low background (diboson)



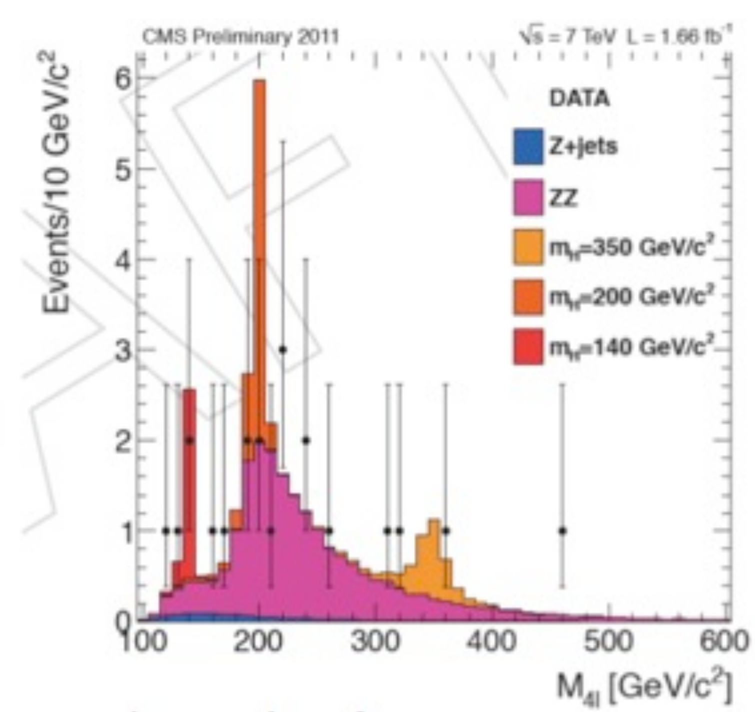
Intermediate - high mass:
$H \rightarrow ZZ \rightarrow 4\ell$

cleanest mode

very good mass resolution, small BR, low background

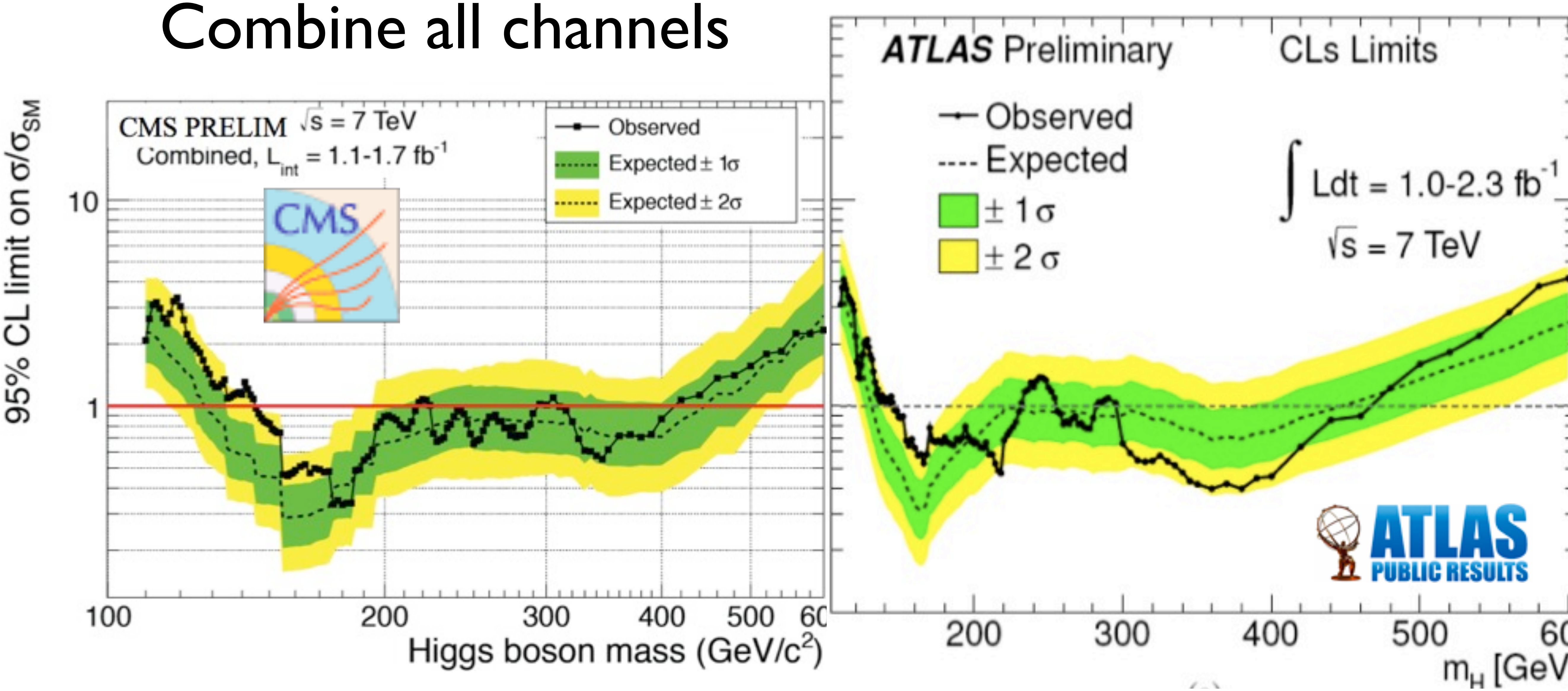
High mass only (m_H>200 GeV):
$H \rightarrow ZZ \rightarrow 2\ell 2q$ / $2\ell 2\nu$

quite good / poor mass resolution, good BR,
small background at high mass.



SM Higgs results (1)

Combine all channels



CMS Exclusion @ 95% CL

145 < mH < 216 GeV
226 < mH < 288 GeV
310 < mH < 400 GeV

Atlas Exclusion @ 95% CL

146 < mH < 232 GeV
256 < mH < 282 GeV
296 < mH < 466 GeV

SM Higgs results (2)

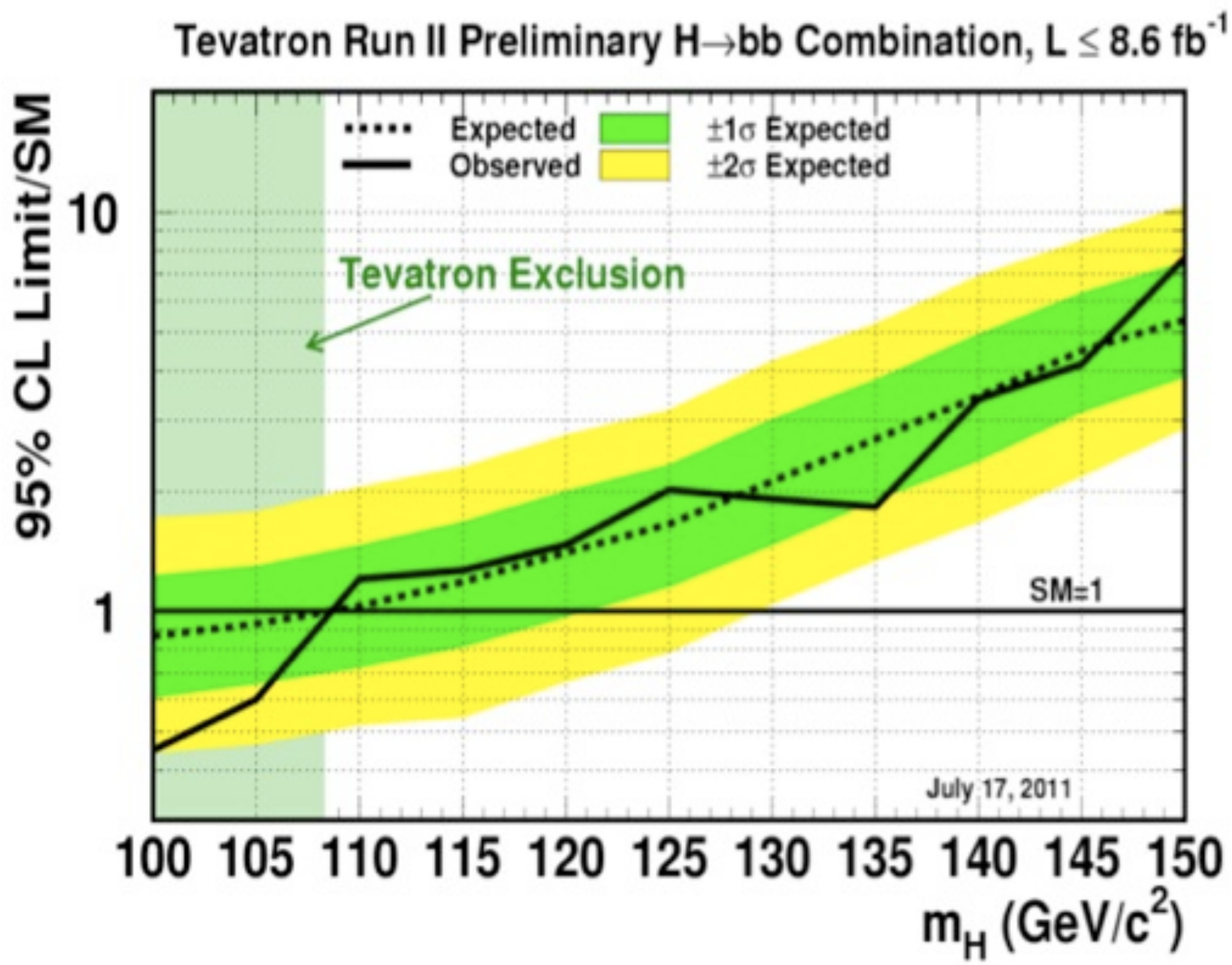
- Overall broad 2σ excess in the region 130-150GeV for both experiments, this is due to WW.
- Fluctuations in the observed curves are due to a superposition of three different sources: high frequency for good mass resolution modes (short correlation length), low frequency for WW mode (long correlation length), low frequency at high mass because Higgs natural width is large. Look elsewhere effect (LEE) factors are not straightforward.
- Low mass caveats (m_H < 125 GeV):
  - sensitivity is not yet very good (will need statistics)
  - for now poor sensitivity to $H \rightarrow bb$ which is important to test the EWSB.
  - $H \rightarrow bb$ still the domain of the Tevatron
  - A new hope: $H \rightarrow bb$ tagging @ LHC

Tevatron exclusion @ 95% CL

m_H < 109 GeV

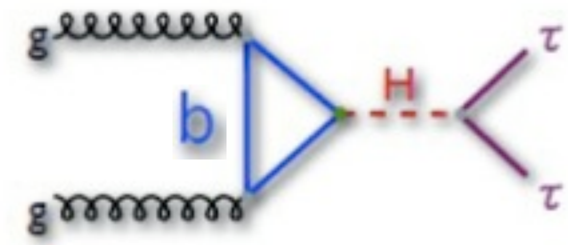
156 < m_H < 177 GeV

From associated W/Z+H prod.

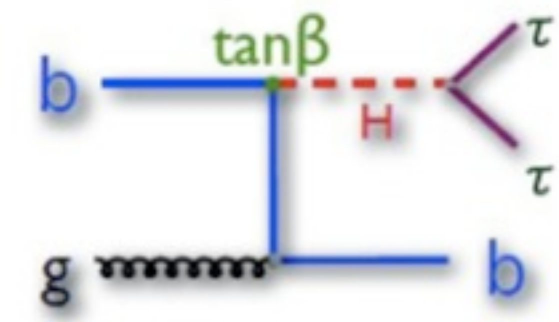


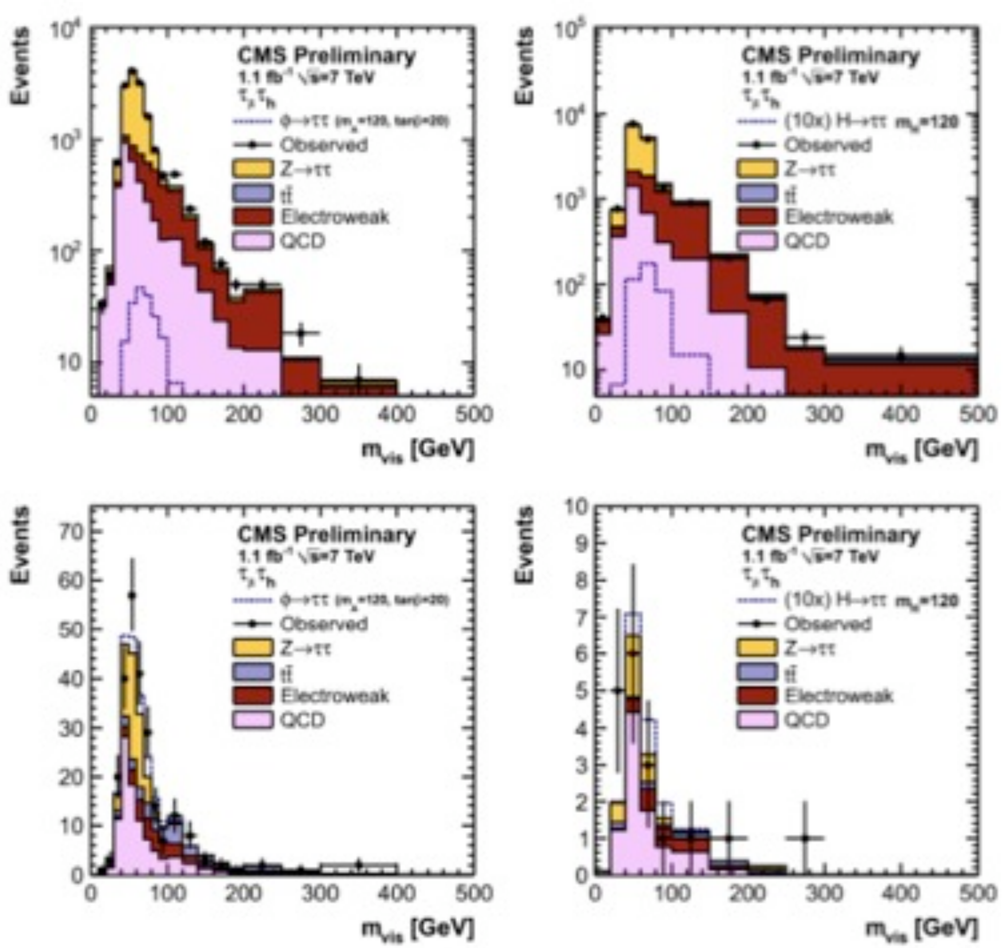
MSSM Higgs searches

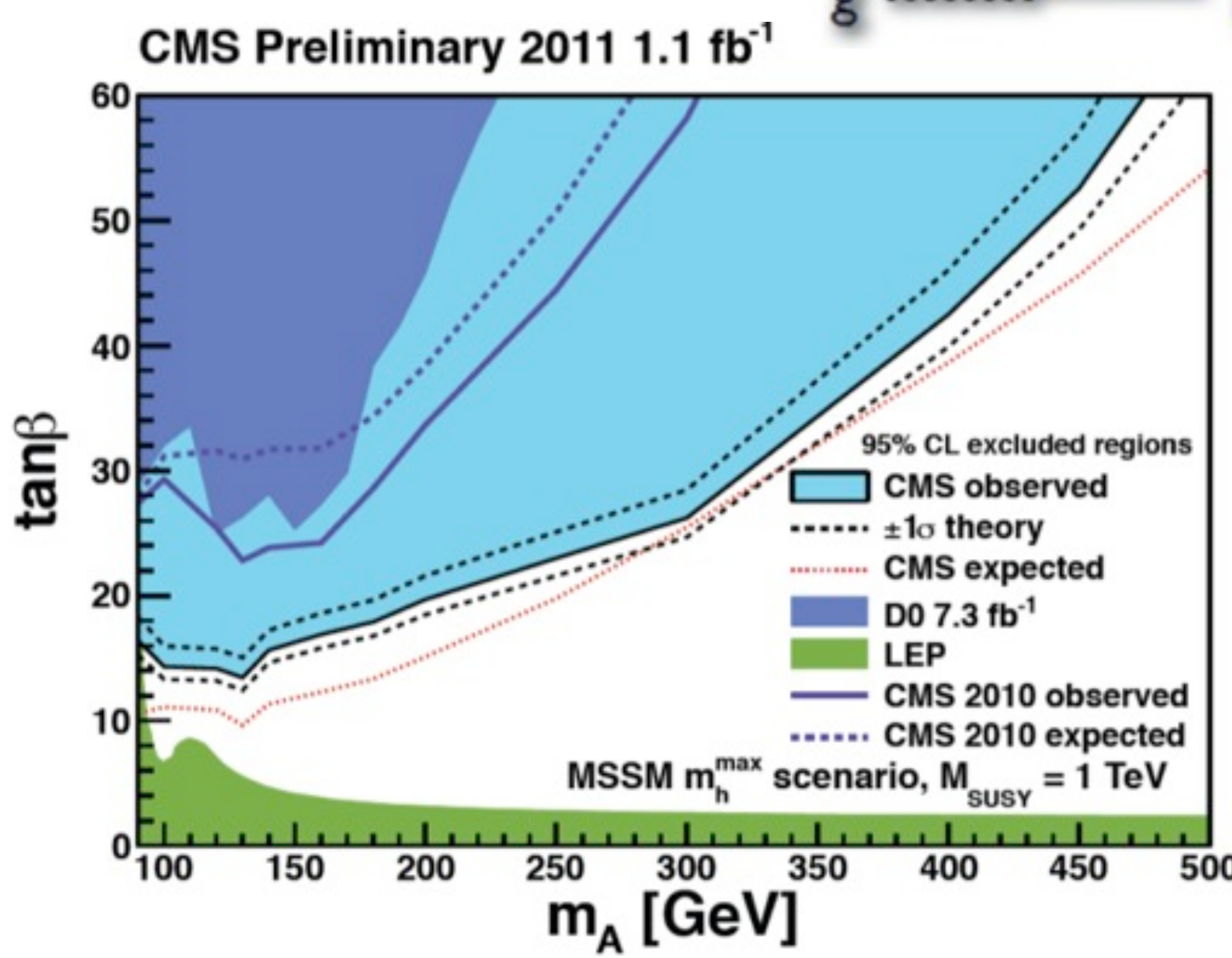
- MSSM is a two Higgs doublet model ⇒ 5 physical Higgs boson: 3 neutral (h/H/A), 2 charged ($H^{+/-}$)



- coupling to down-type fermions proportional to tanβ.
- tanβ > 10: $H \to \tau\tau$ / $H \to bb$: 10%/90%
- produced via b-quarks
- can only exploit $\tau\tau$ channel (bbb only done at Tevatron)
- tanβ ~ 40 theoretically interesting (m_{top} / m_b ~ 40)



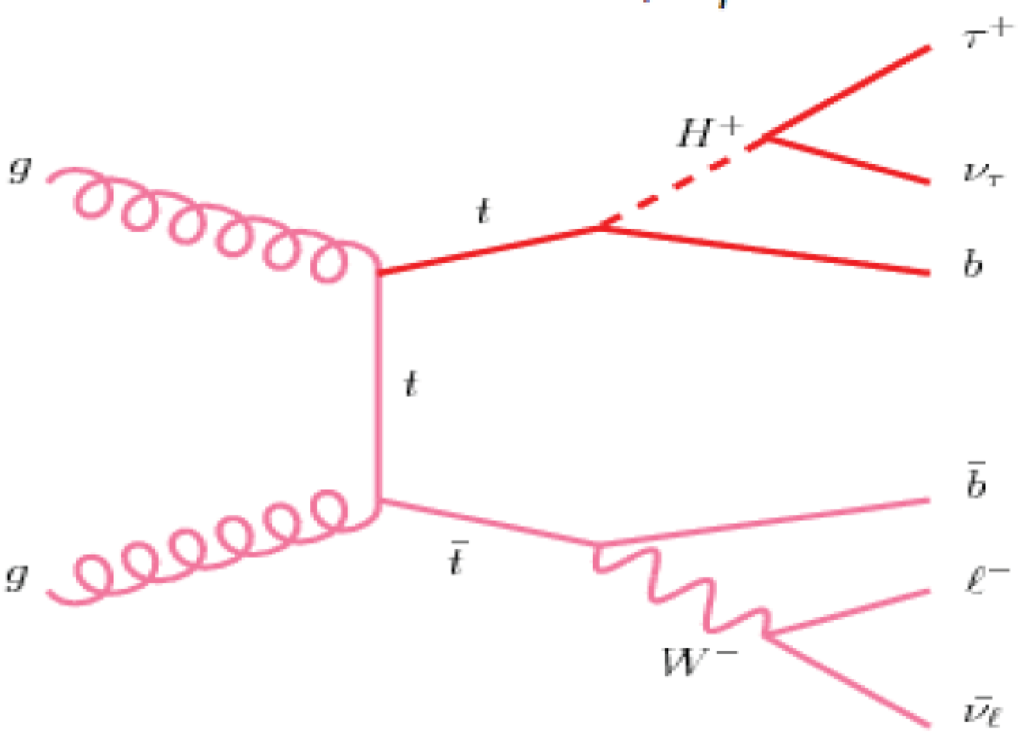


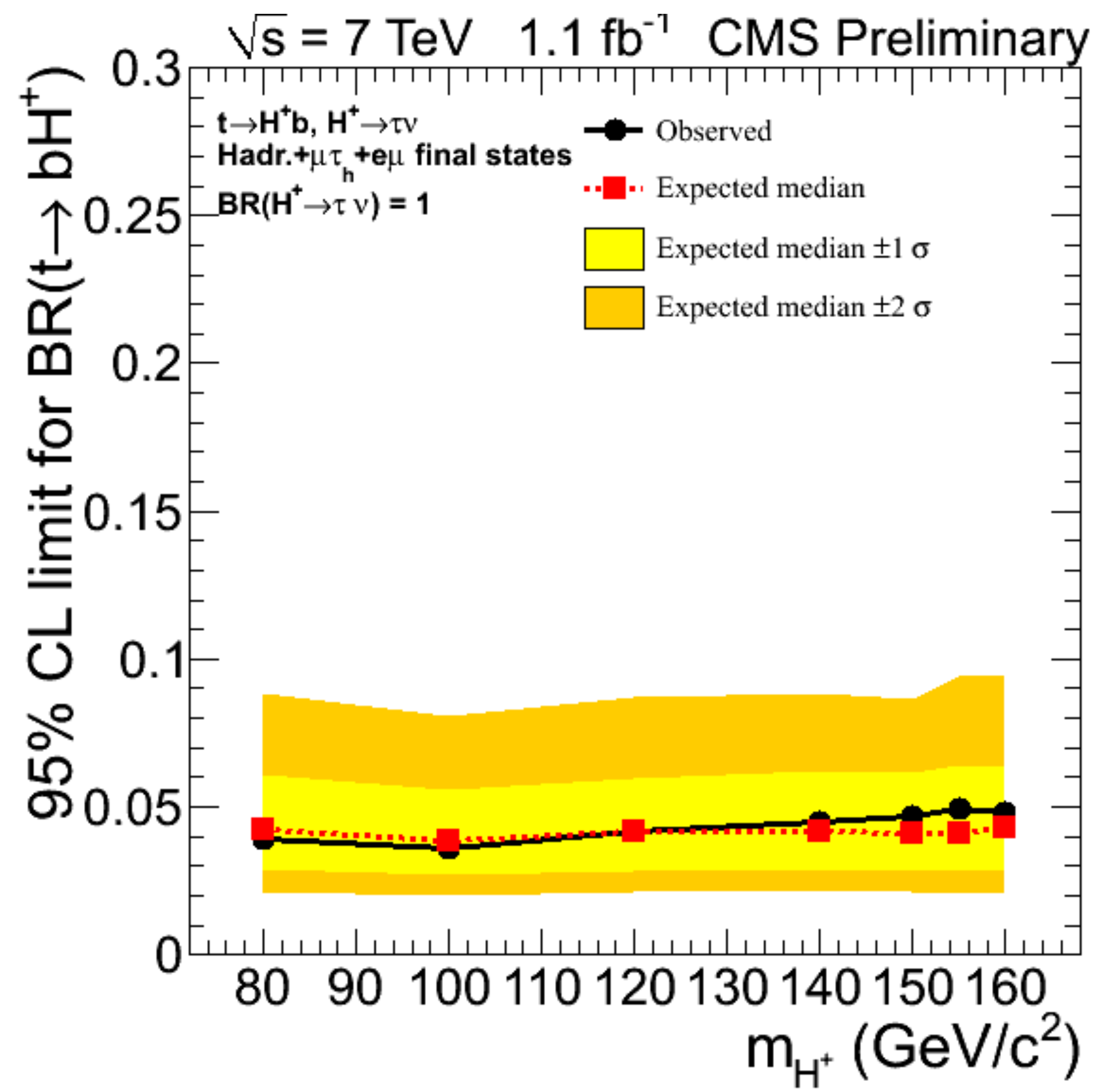


Charged Higgs In pp → ttbar Decays: EPS Results

$H^+ \rightarrow \tau^+ \upsilon$
in ttbar decays

$t\bar{t} \rightarrow H^+ W^- b\bar{b} \rightarrow \tau \nu_\tau l \nu_l b\bar{b}$



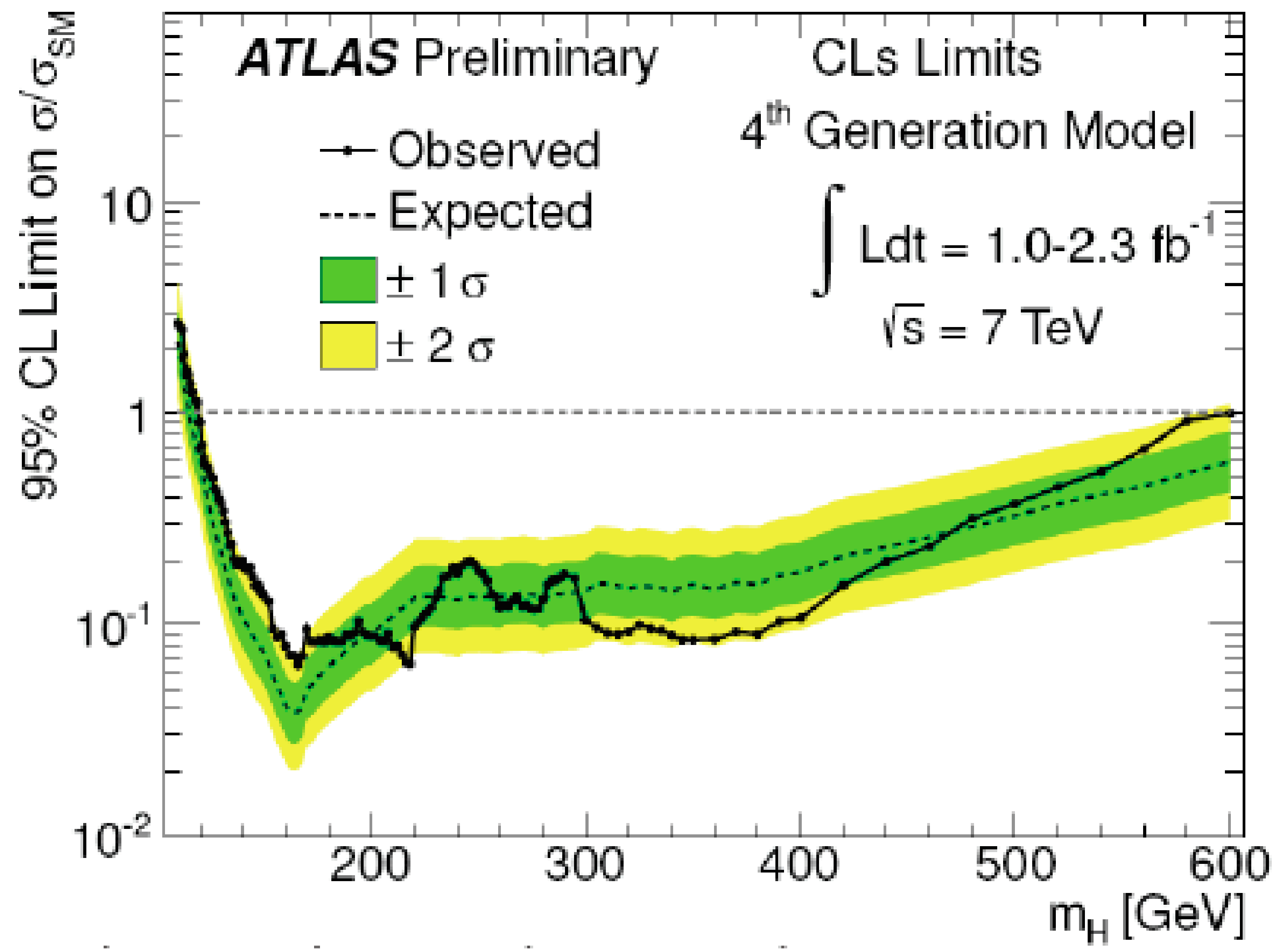


Tevatron limit : 0.15 – 0.2

4th generation of quarks

4th generation relaxed the tension in the EWfit and allows for a higher mass Higgs boson. It enhances the Higgs boson production by ~9.

Higgs limits assuming a 4th generation of quarks and leptons:

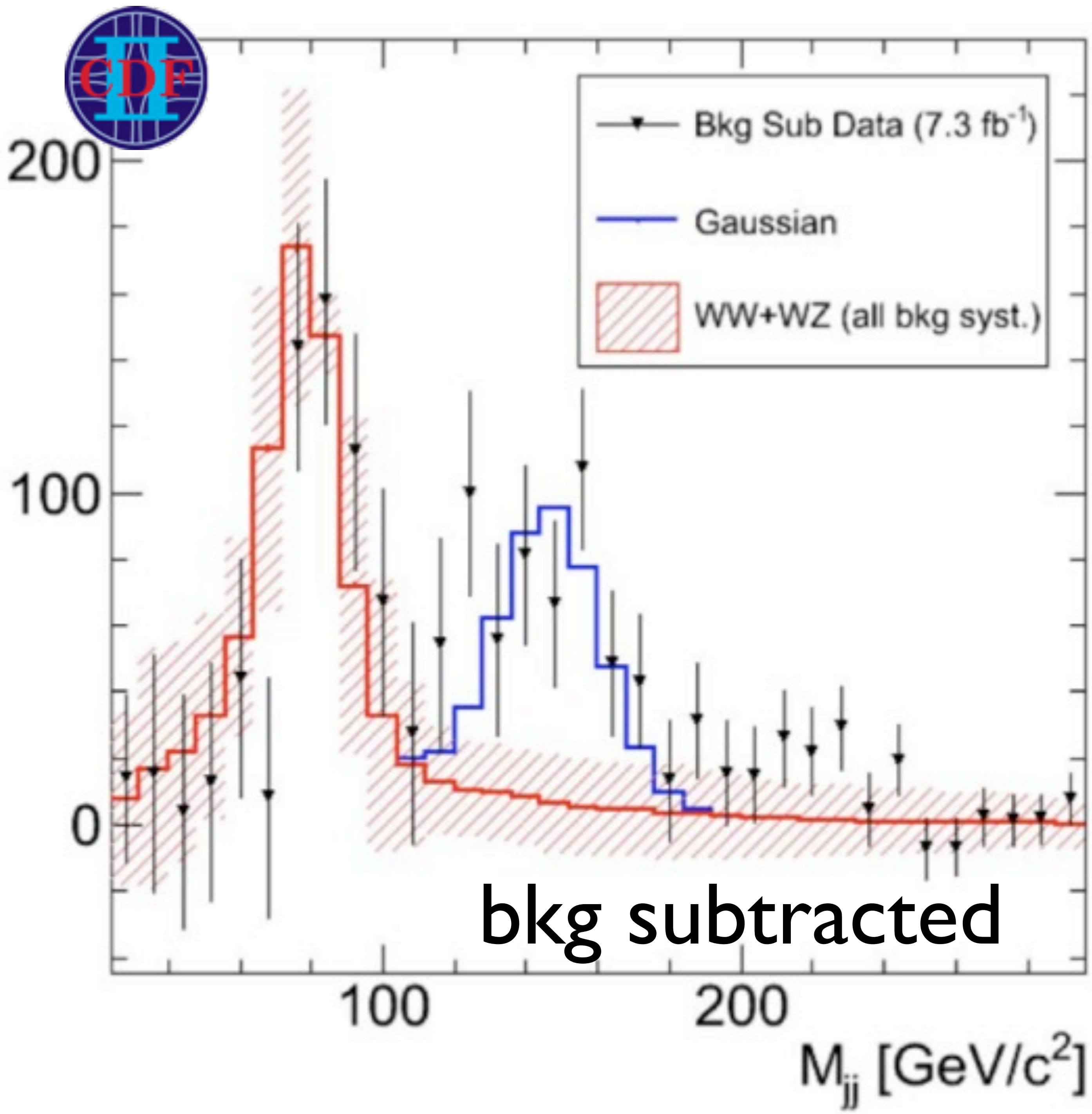


Other exotic fermions are still alive and interesting, but the sequential 4th generation is in deep troupble!

BSM searches

CDF W+2jets saga

Bump confirmed by CDF at EPS11 and LP11 (~4σ)
In the meanwhile at Higgs Hunting: CDF speaker was much less aggressive (potential very nice and clever experimental reason)
Not much in D0 data and not clear what to expect at LHC



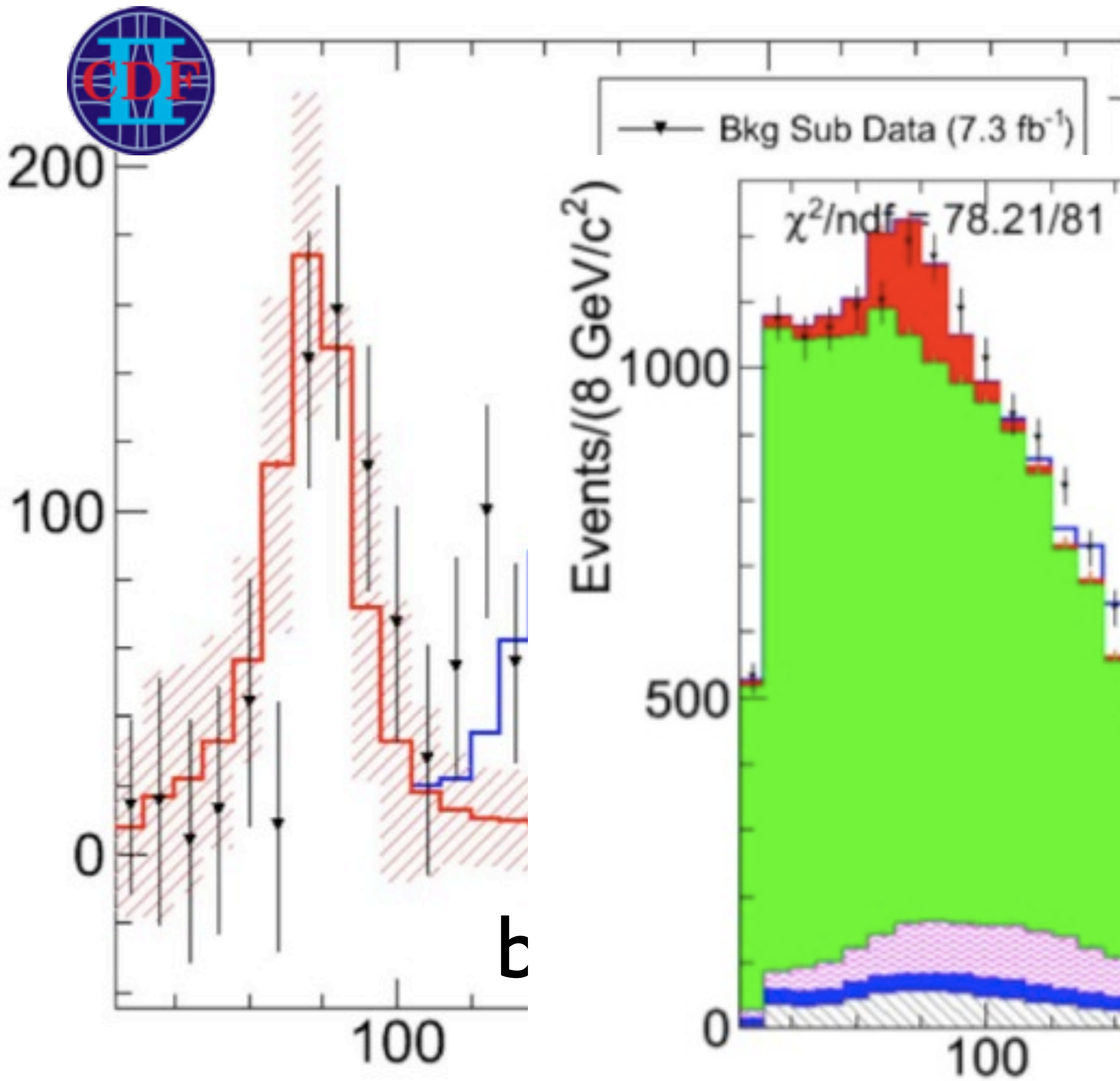
Check:
$W(\rightarrow e\nu)$+2j vs $W(\rightarrow \mu\nu)$+2j there is really something in the di-jet mass spectrum. LP11 speaker presented a full battery of tests but one, shown at Higgs Hunting Workshop (also by CDF speaker)

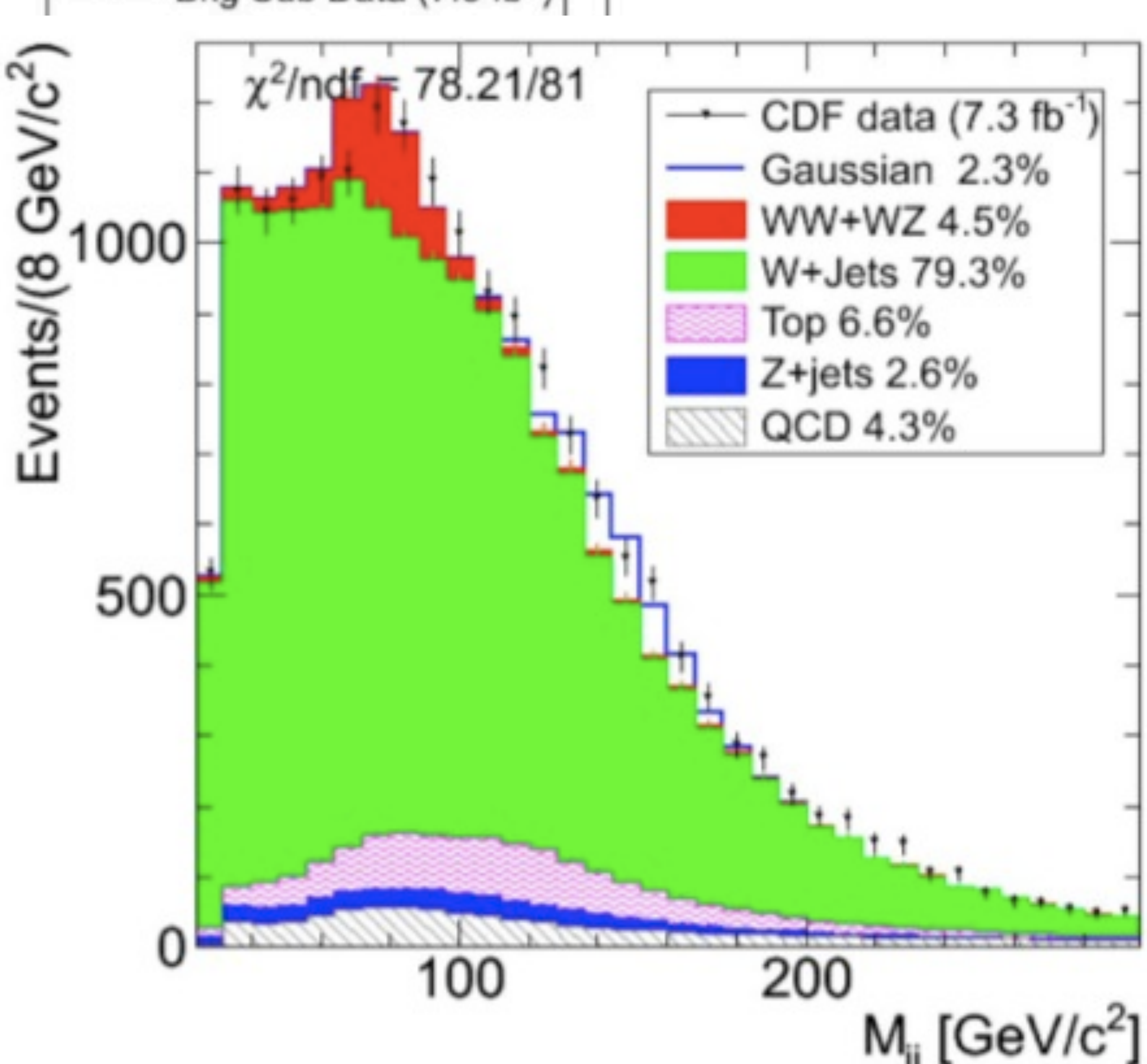
CDF W+2jets saga

Bump confirmed by CDF at EPS11 and LP11 (~4σ)

In the meanwhile at Higgs Hunting: CDF speaker was much less aggressive (potential very nice and clever experimental reason)

Not much in D0 data and not clear what to expect at LHC

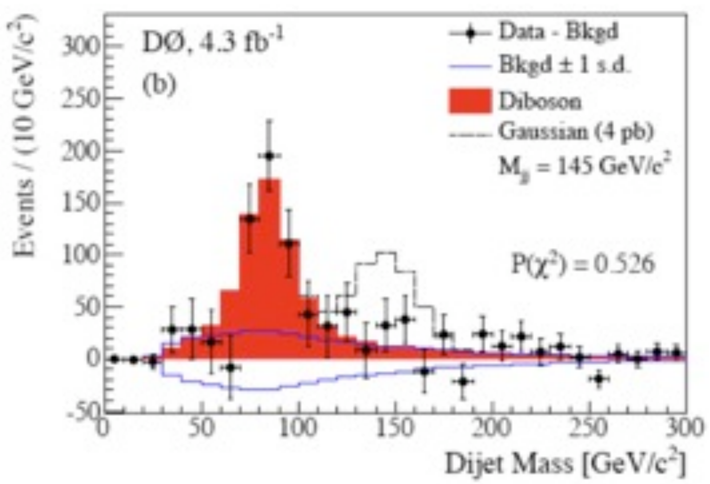


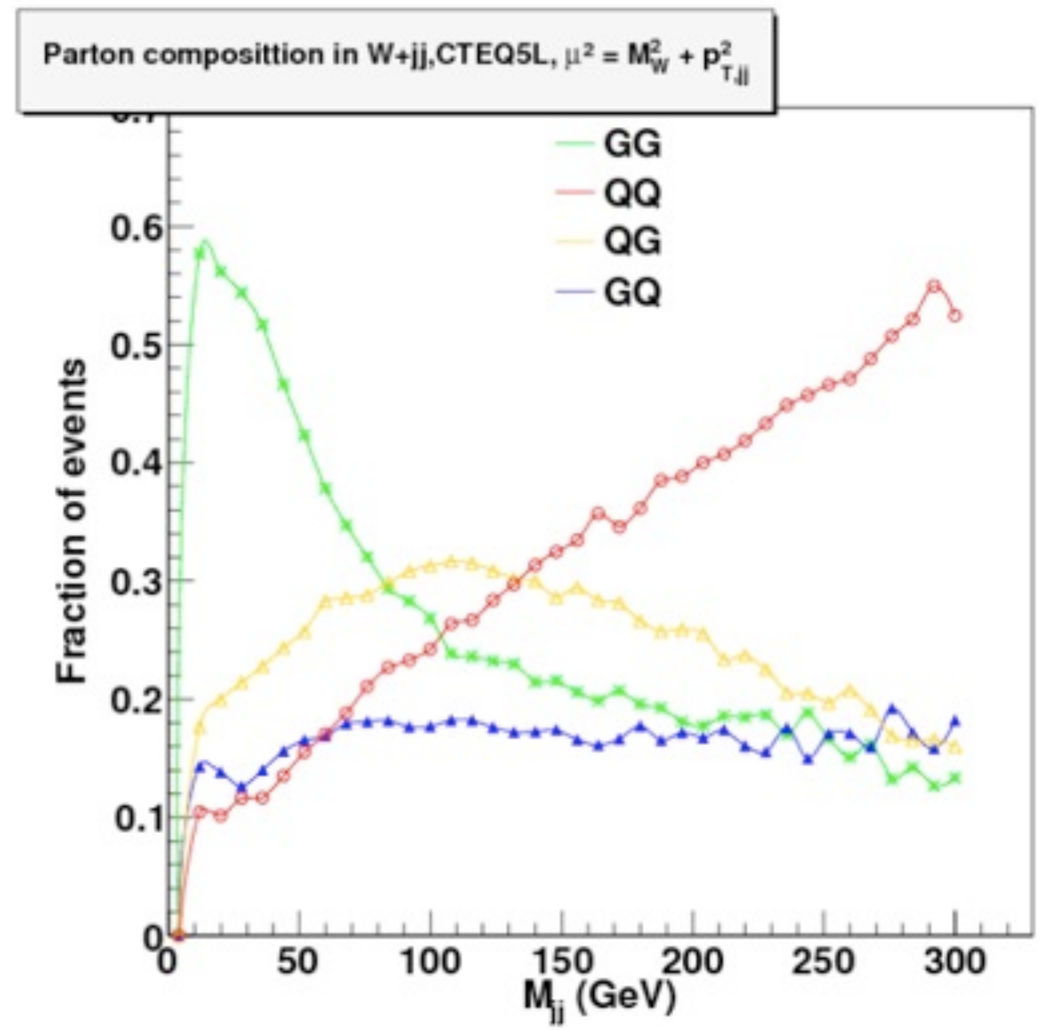


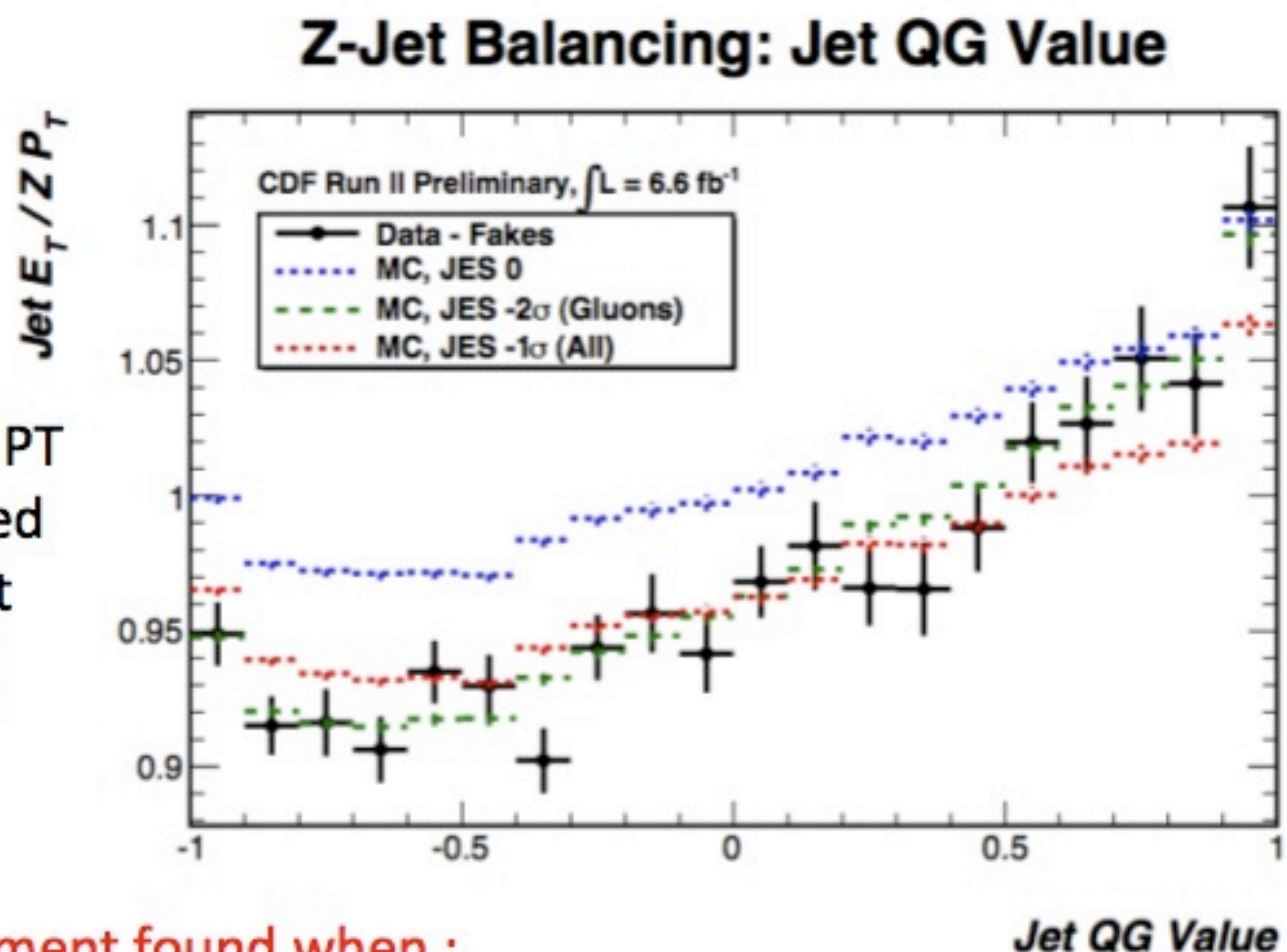
Check:

's W(→μν)+2j
something in
s spectrum.
presented a
tests but one,
gs Hunting
so by CDF

CDF W+2jets saga







"true" jet PT determined from Z+jet balancing

Also, explains why W+jets and Z+jets do not have mis-modeling when b-tag is applied (due to quark enhancement)

Best agreement found when :
- Quark jet energy scale left alone
- Gluon jet energy scale shifted down in MC by 2 Sigma

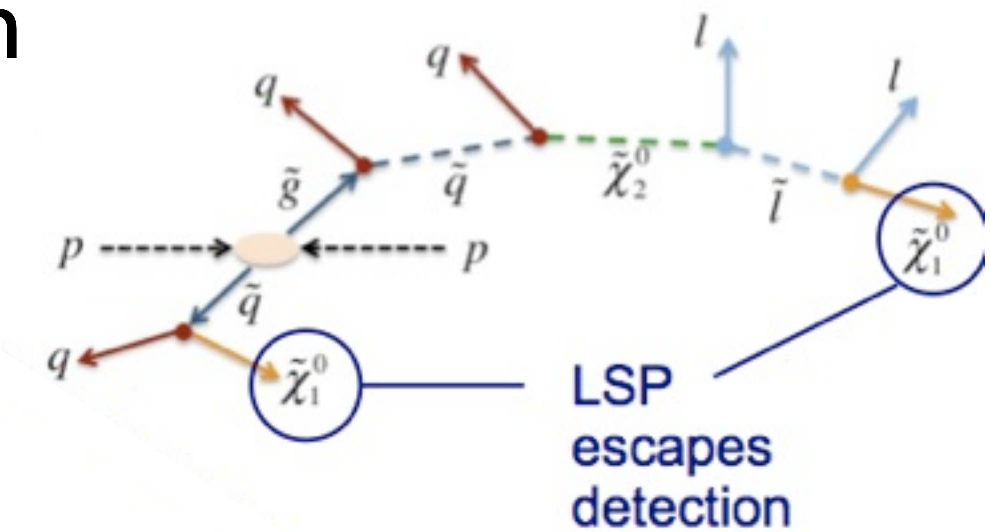
SUSY: Jets + Missing E_T

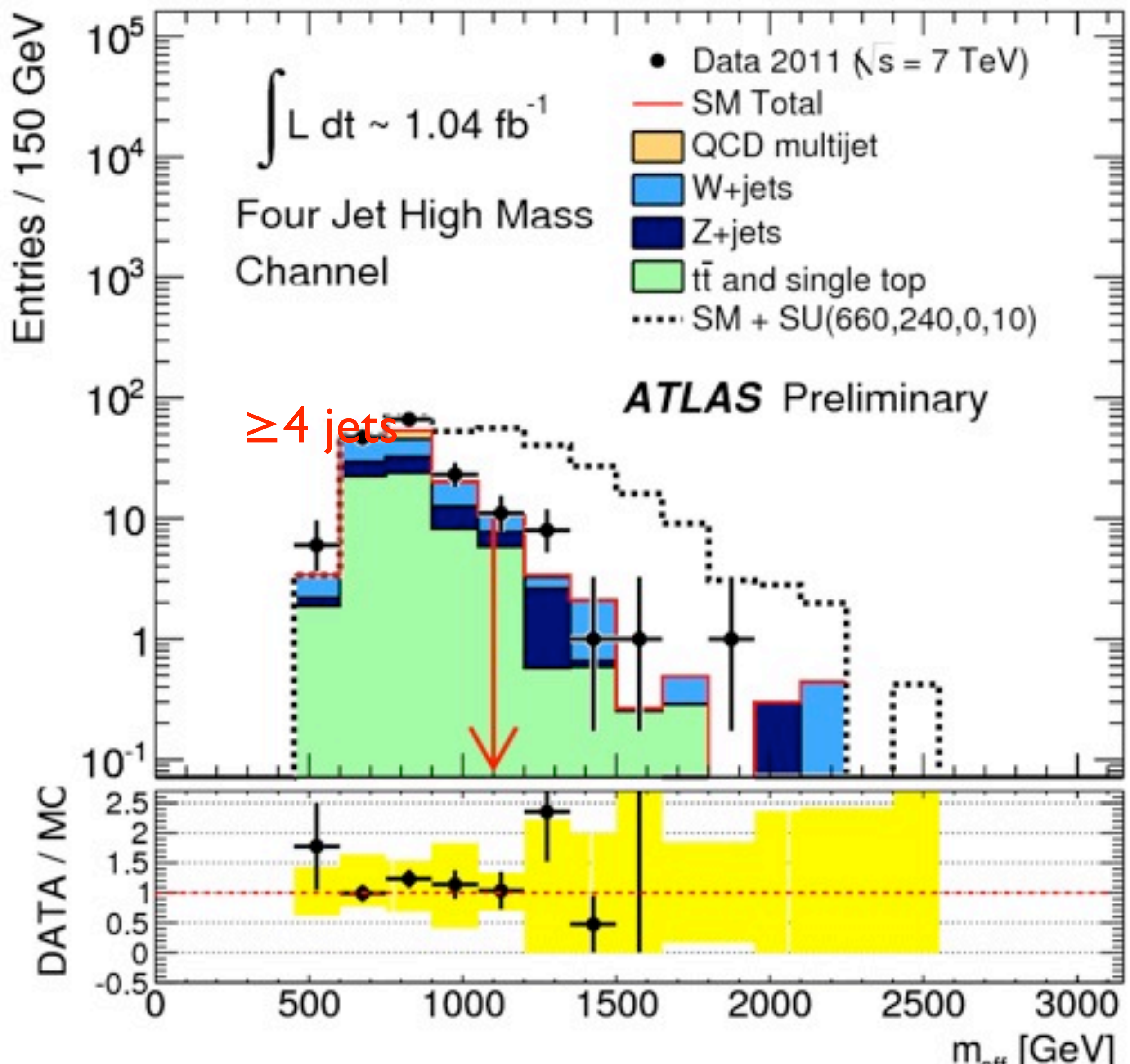
$\tilde{q} \rightarrow q\tilde{\chi}_1^0$

$\tilde{g} \rightarrow qq\tilde{\chi}_1^0$

- "Workhorse" of SUSY search
- ATLAS:
  - →Cut on MET and m_{eff}

H_T = scalar sum of all jet E_T

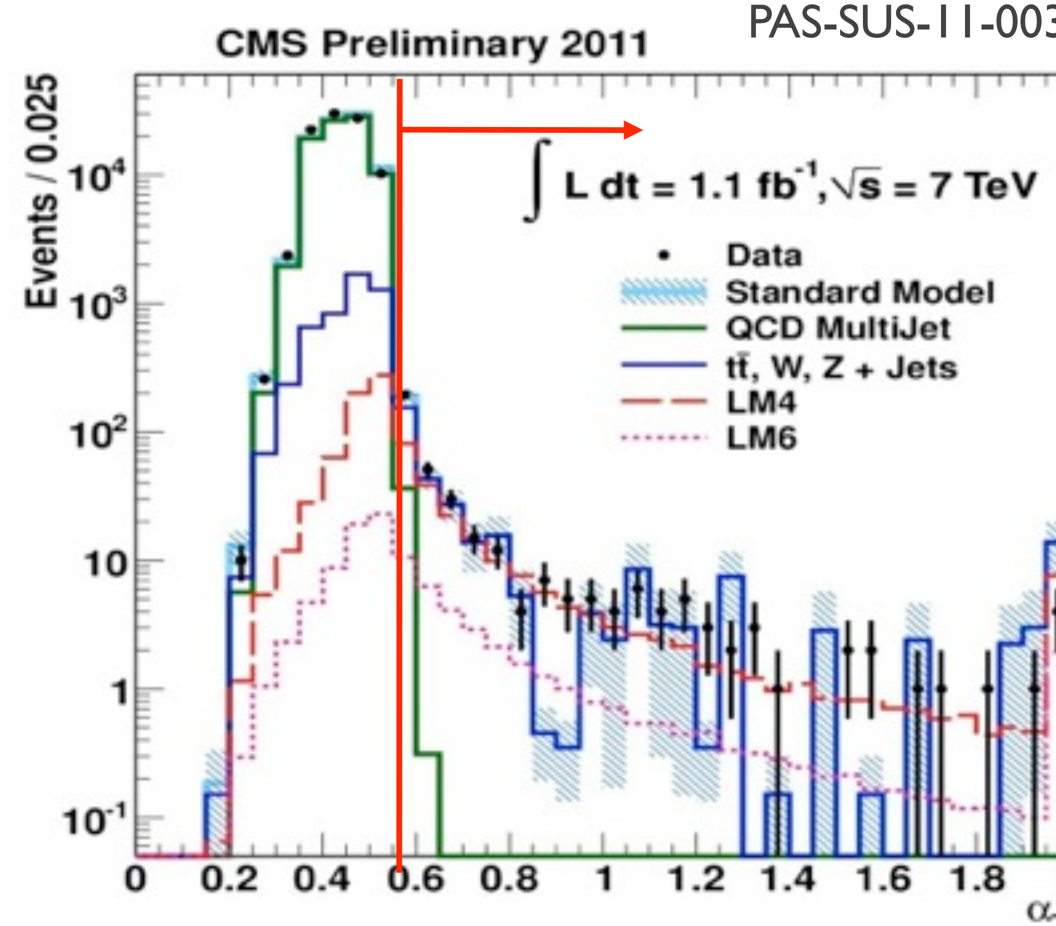




m_{eff} = H_T + Missing E_T [GeV]

- CMS explores various techniques:
  - → α_T = 2nd jet E_T / Trans. Mass

PAS-SUS-11-003



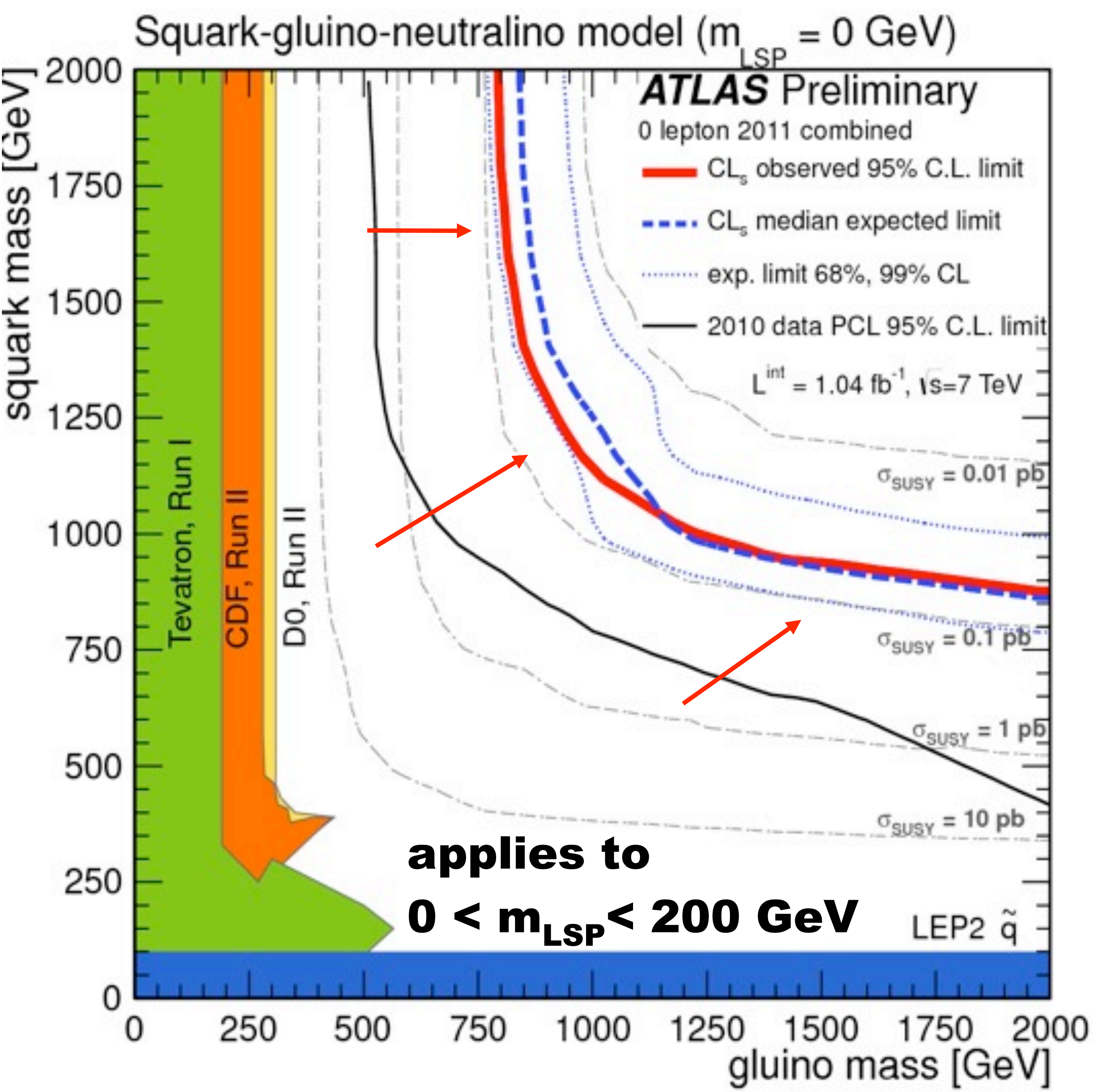
SUSY: Jets + Missing E_T

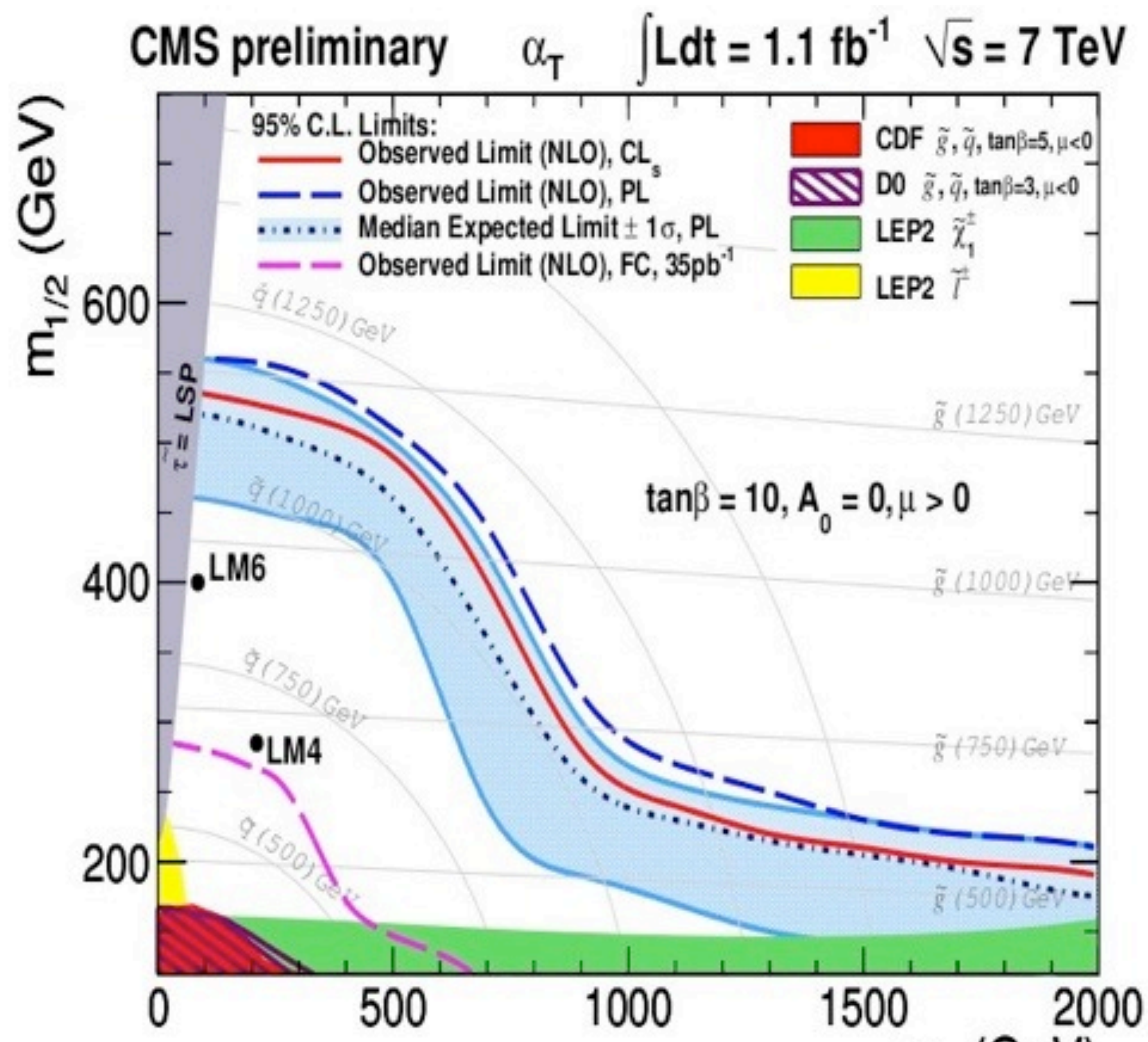
$\tilde{q} \rightarrow q\tilde{\chi}_1^0$

$\tilde{g} \rightarrow qq\tilde{\chi}_1^0$

- Exclude up to ~ 1 TeV for m(squark)=m(gluino)

cMSSM basically ruled out, will need to look for more evolved models (NMSSM, gMSSM...)

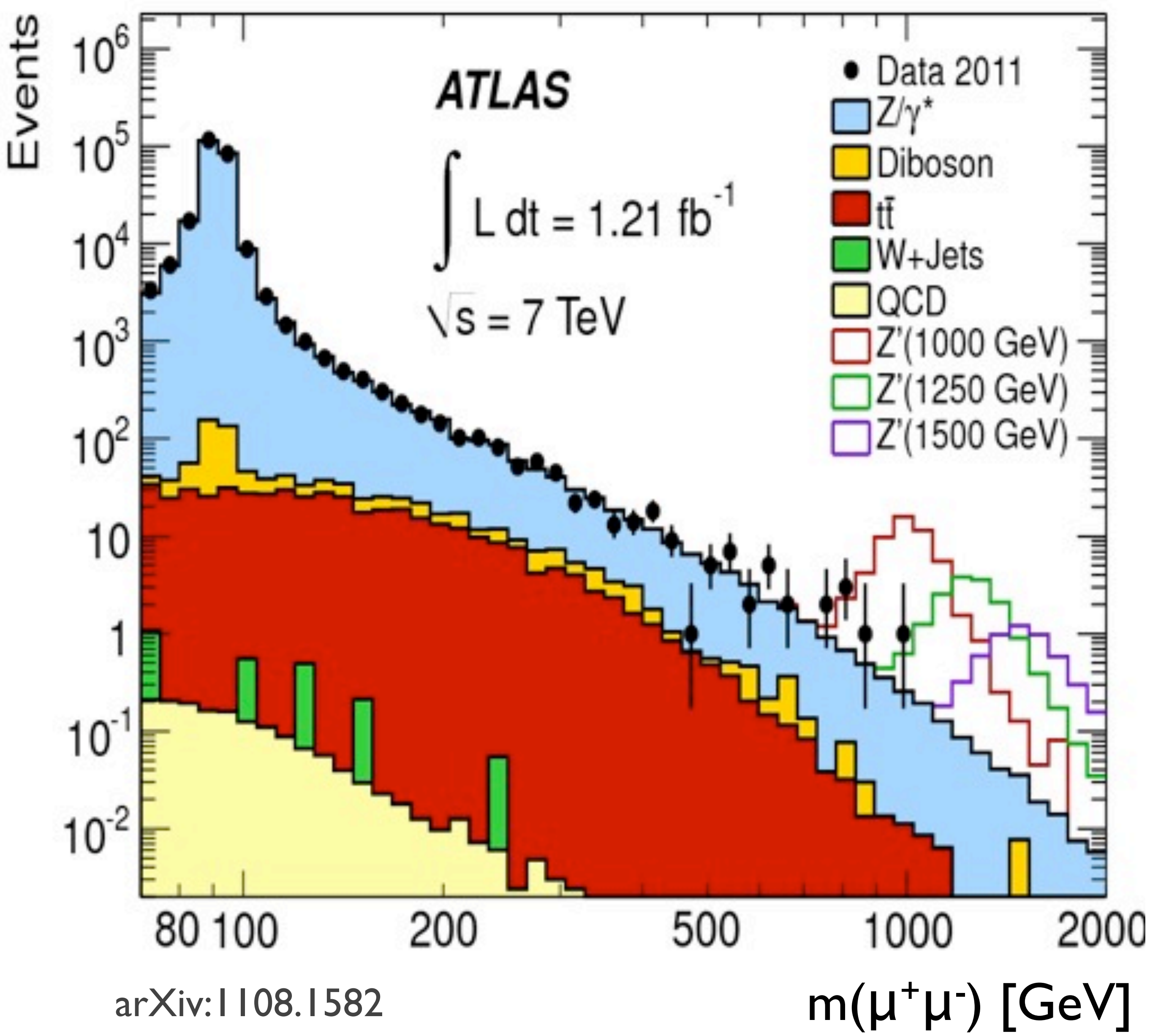




CMS-SUS-11-003

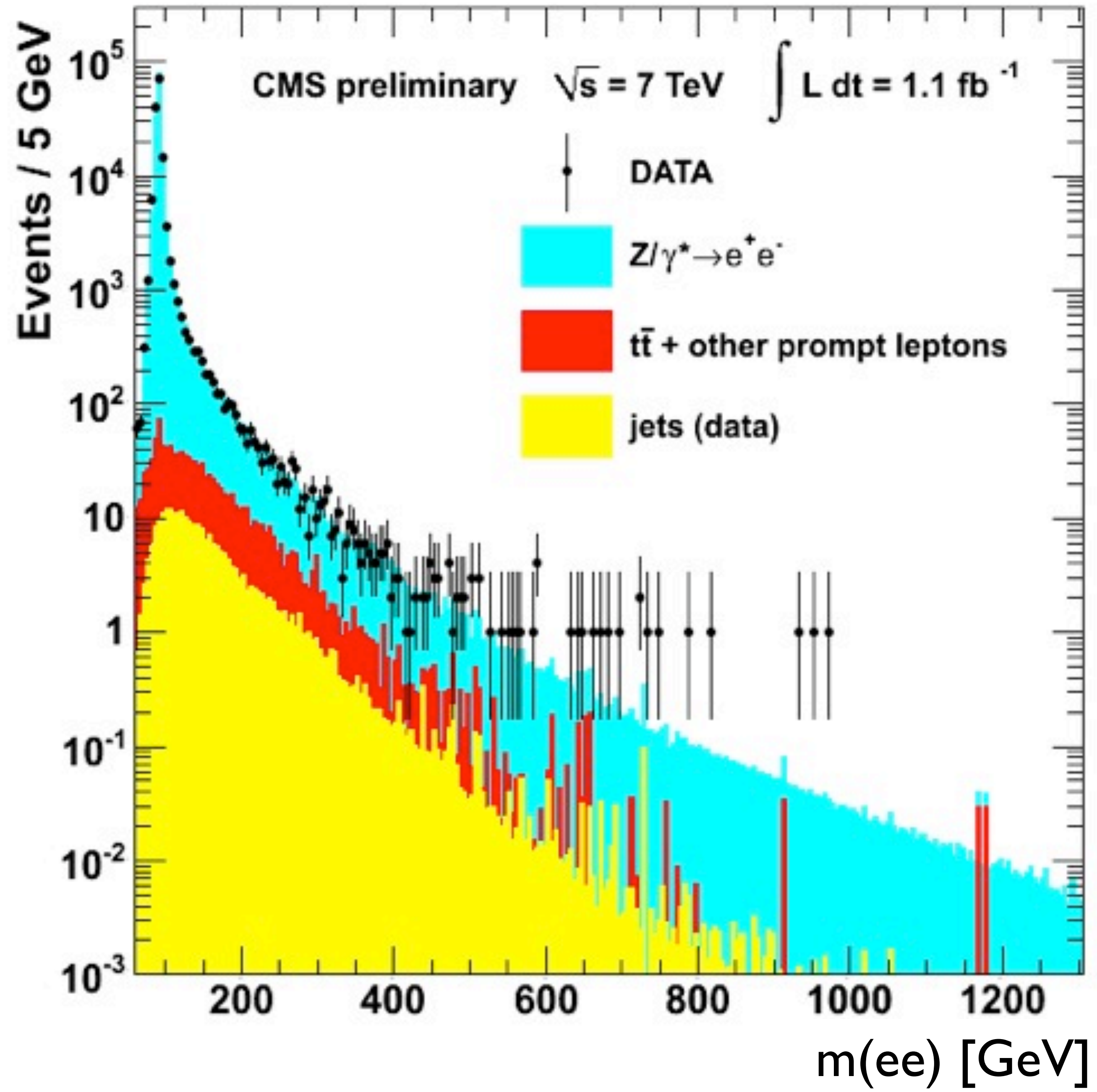
Search for Heavy Resonance: dilepton channel

- Randall-Sundrum KK graviton excitation
- Neutral heavy gauge boson
- Technihadron



arXiv:1108.1582

CMS-EXO-11-019



Search for Heavy Resonance: dilepton channel

Randall-Sundrum KK graviton excitation

Neutral heavy gauge boson

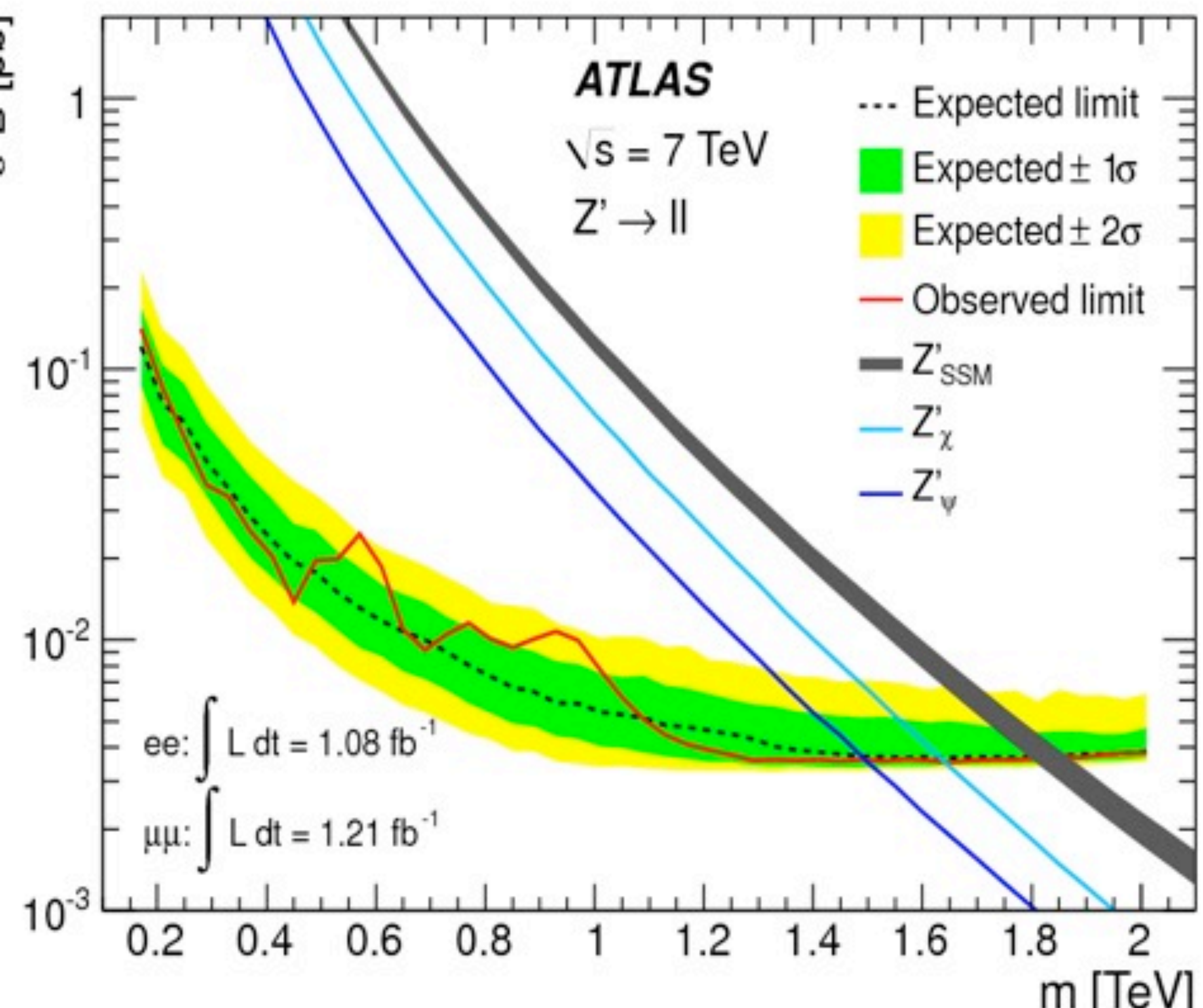
Technihadron

Sequential SM:

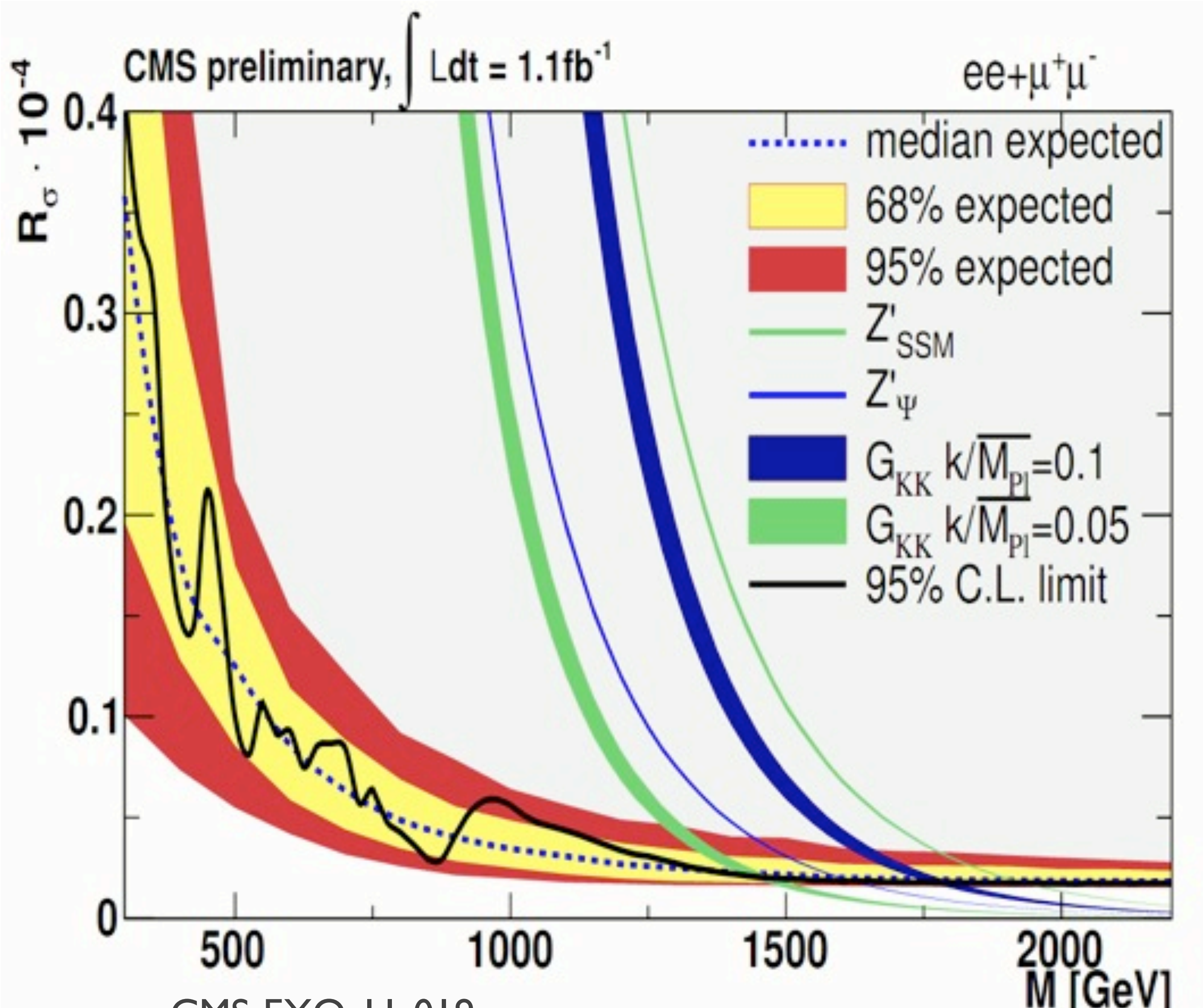
$m(Z') > 1.9$ TeV at 95% C.L.

RS graviton ($k/M_{Pl} = 0.1$):

$m(G) > 1.8$ TeV at 95% C.L.



arXiv:1108.1582



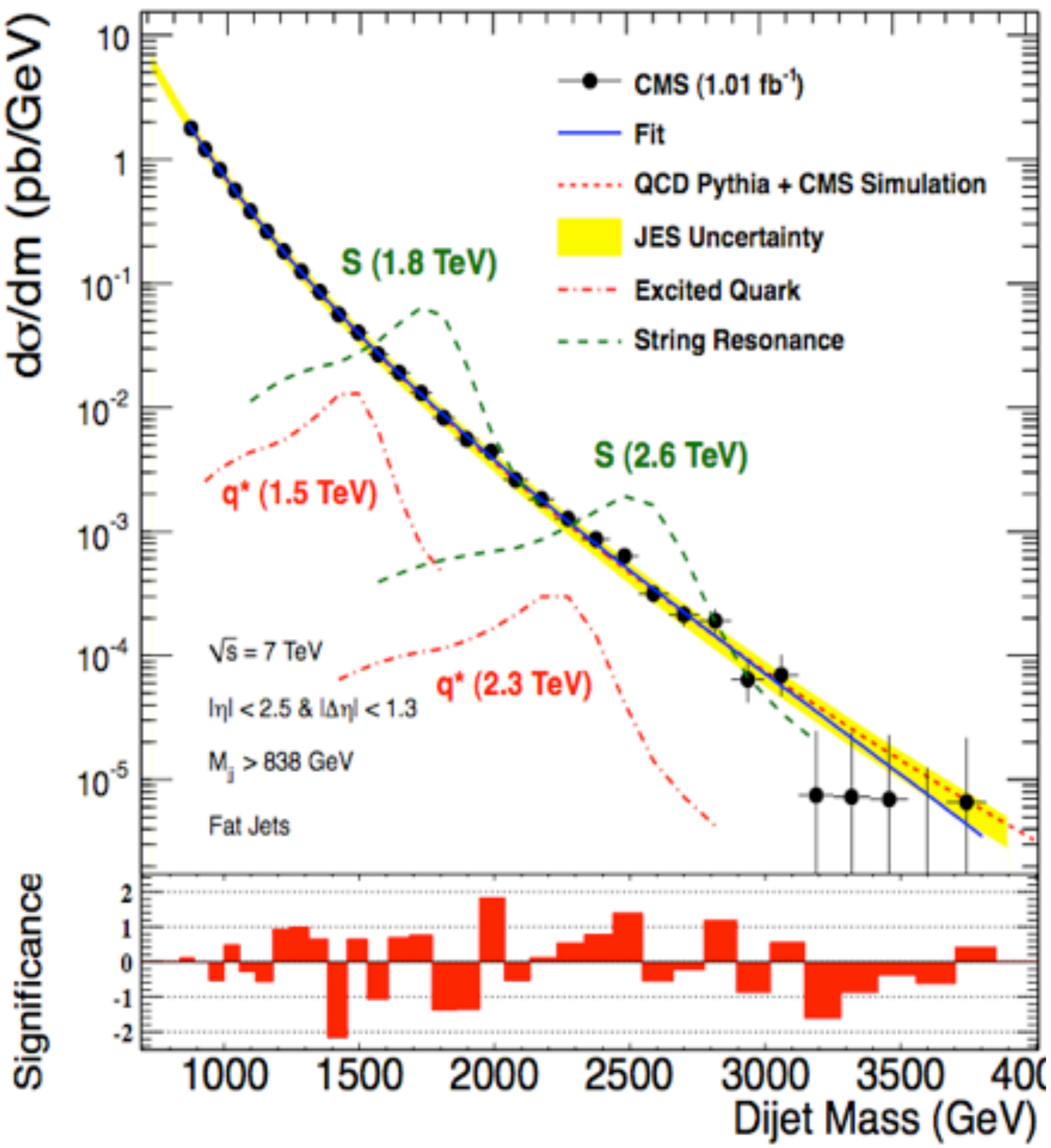
CMS-EXO-11-019

Search for Heavy Resonance: Dijet

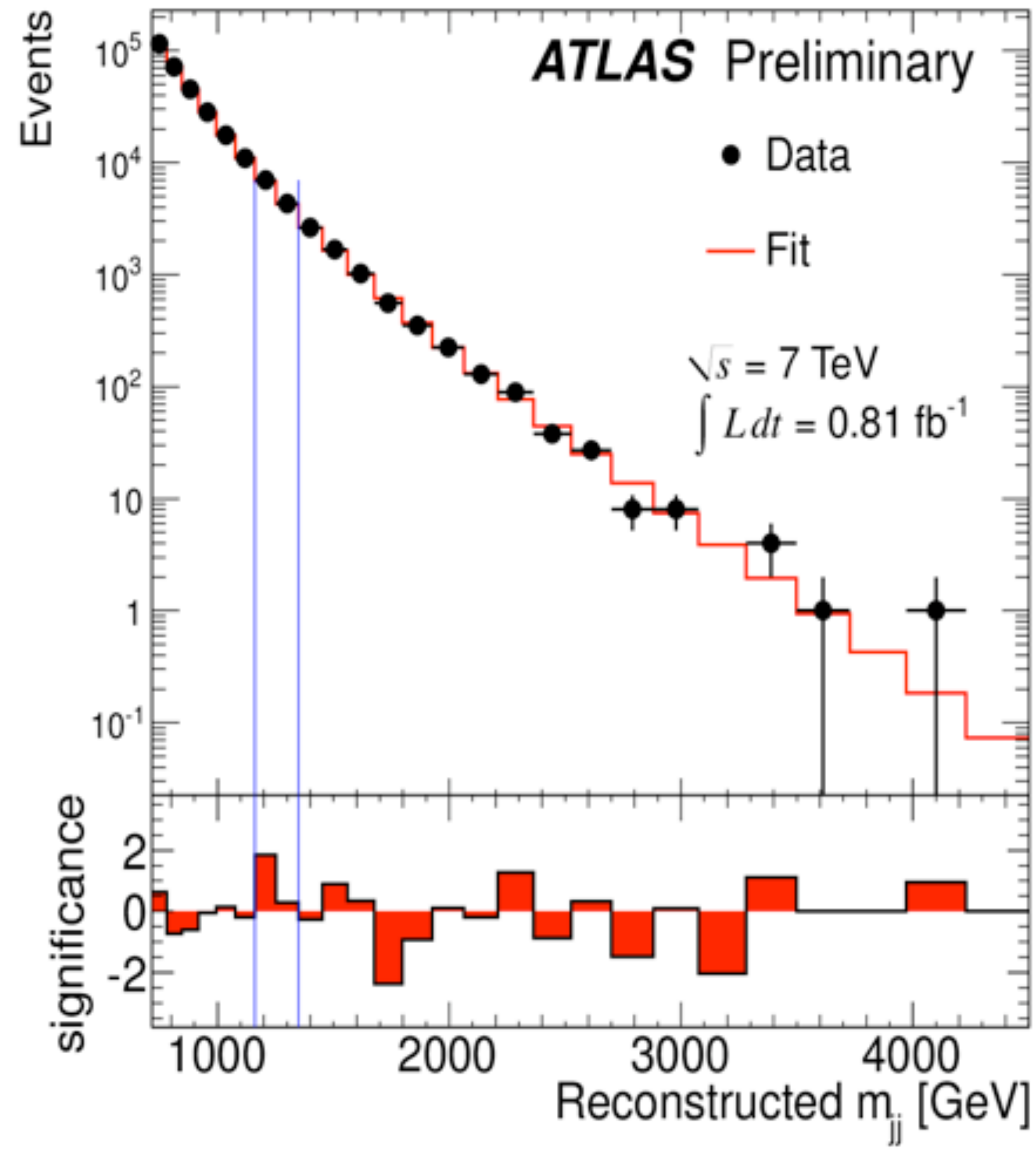
- Excited quarks, strong gravity, contact interaction
- Look for resonance above phenomenological fit of the data

Probing the quark structure beyond 4 TeV

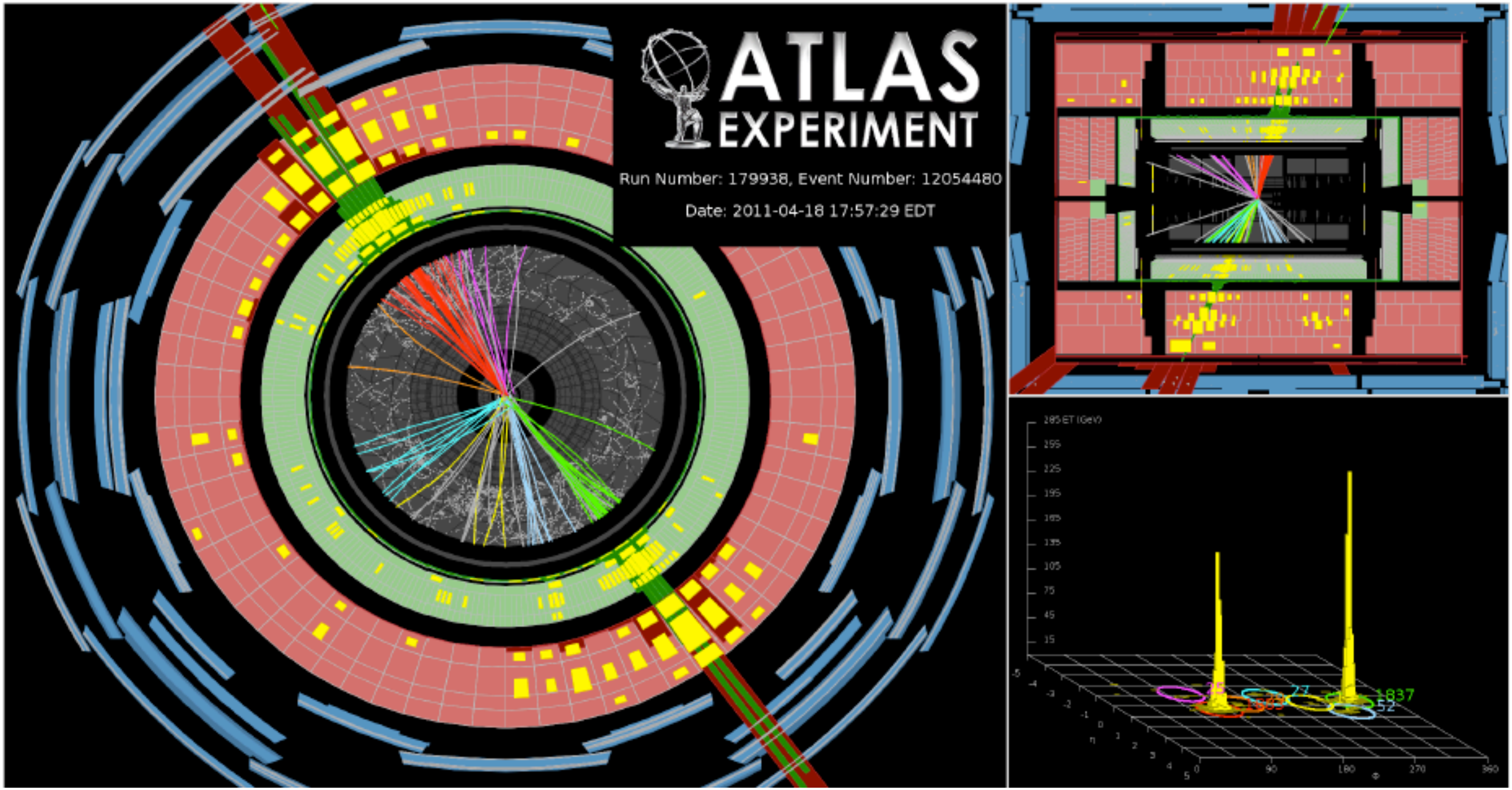
arXiv.1107.4771



ATL-CONF-2011-095



Search for Heavy Resonance: Dijet



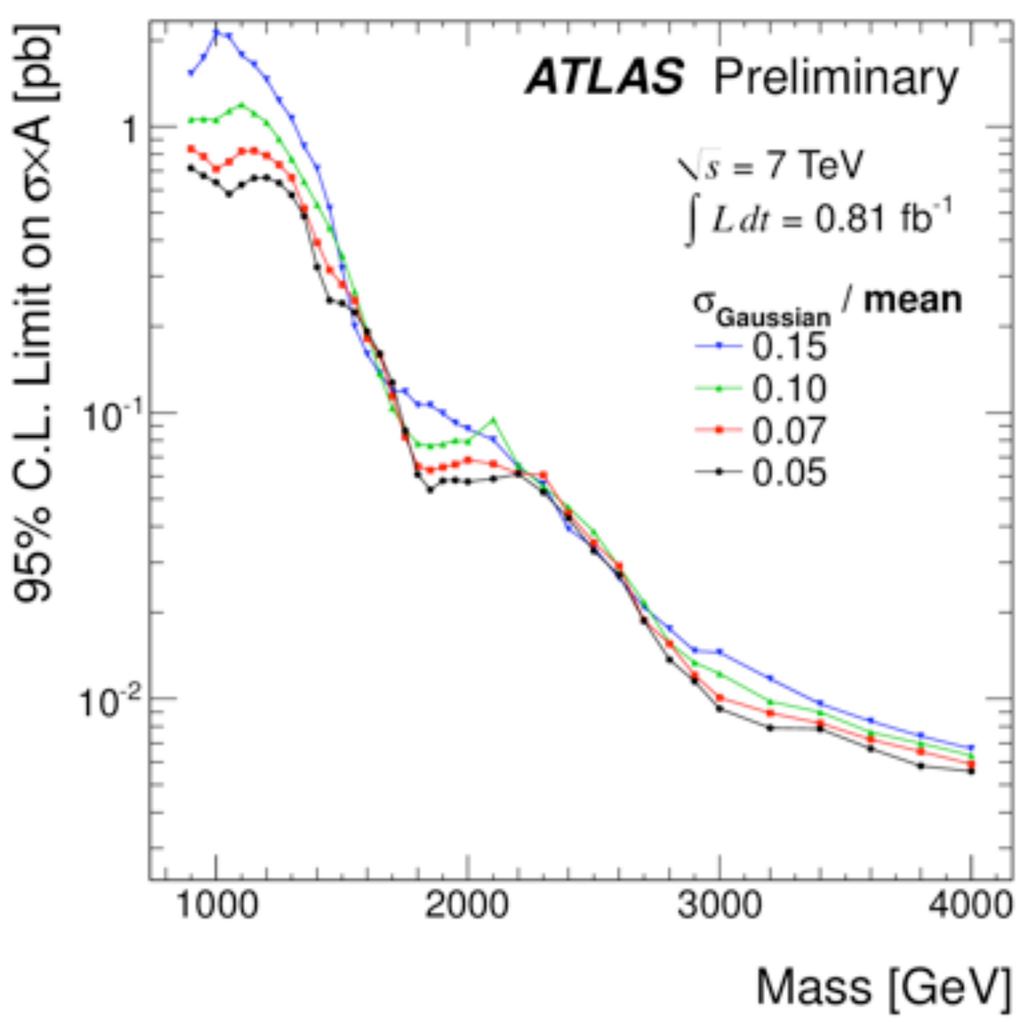
m(jet-jet) = 4.0 TeV **Missing E_T = 100 GeV**

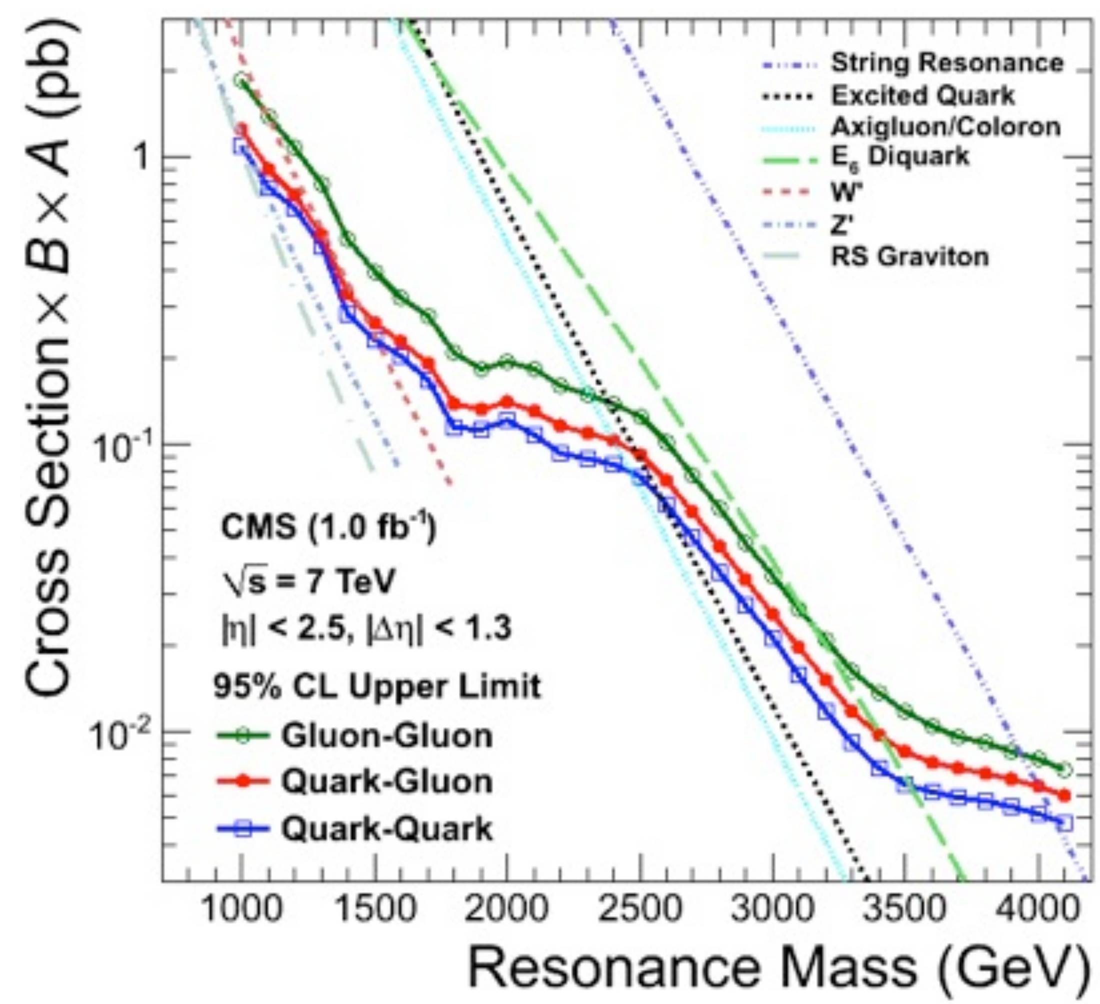
Search for Heavy Resonance: Dijet

Model ATL-CONF-2011-095	95% CL Limits (TeV) Expected	Observed
Excited Quark q^*	2.77	2.91
Axigluon	3.02	3.21
Color Octet Scalar	1.71	1.91

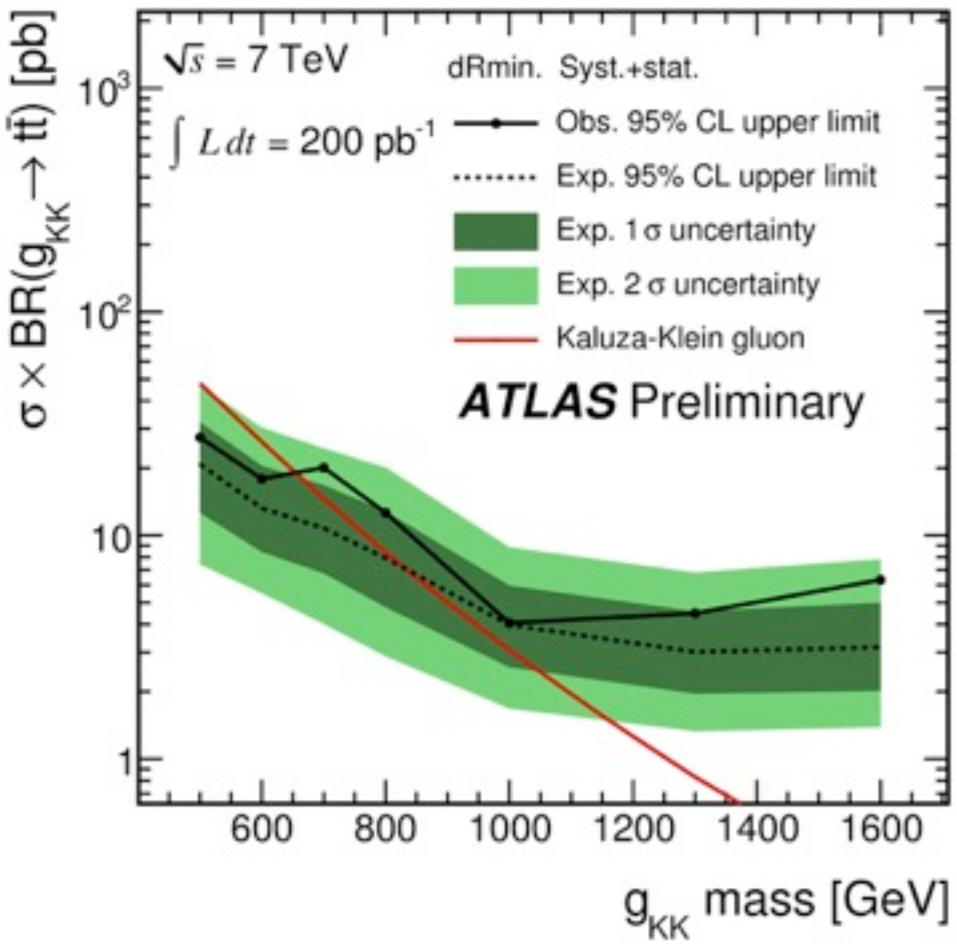
Model CMS arXiv.1107.4771	Excluded Mass (TeV) Observed	Expected
String Resonances	4.00	3.90
E_6 Diquarks	3.52	3.28
Excited Quarks	2.49	2.68
Axigluons/Colorons	2.47	2.66
W′ Bosons	1.51	1.40

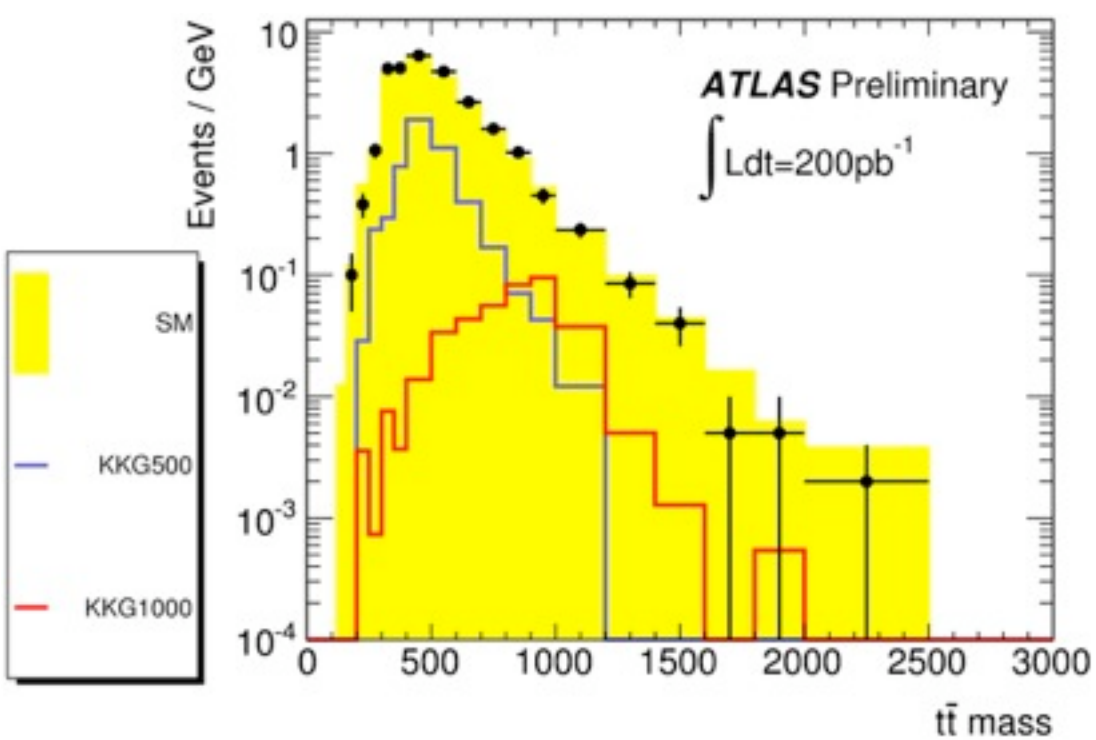
- Also providing model-independent limits:

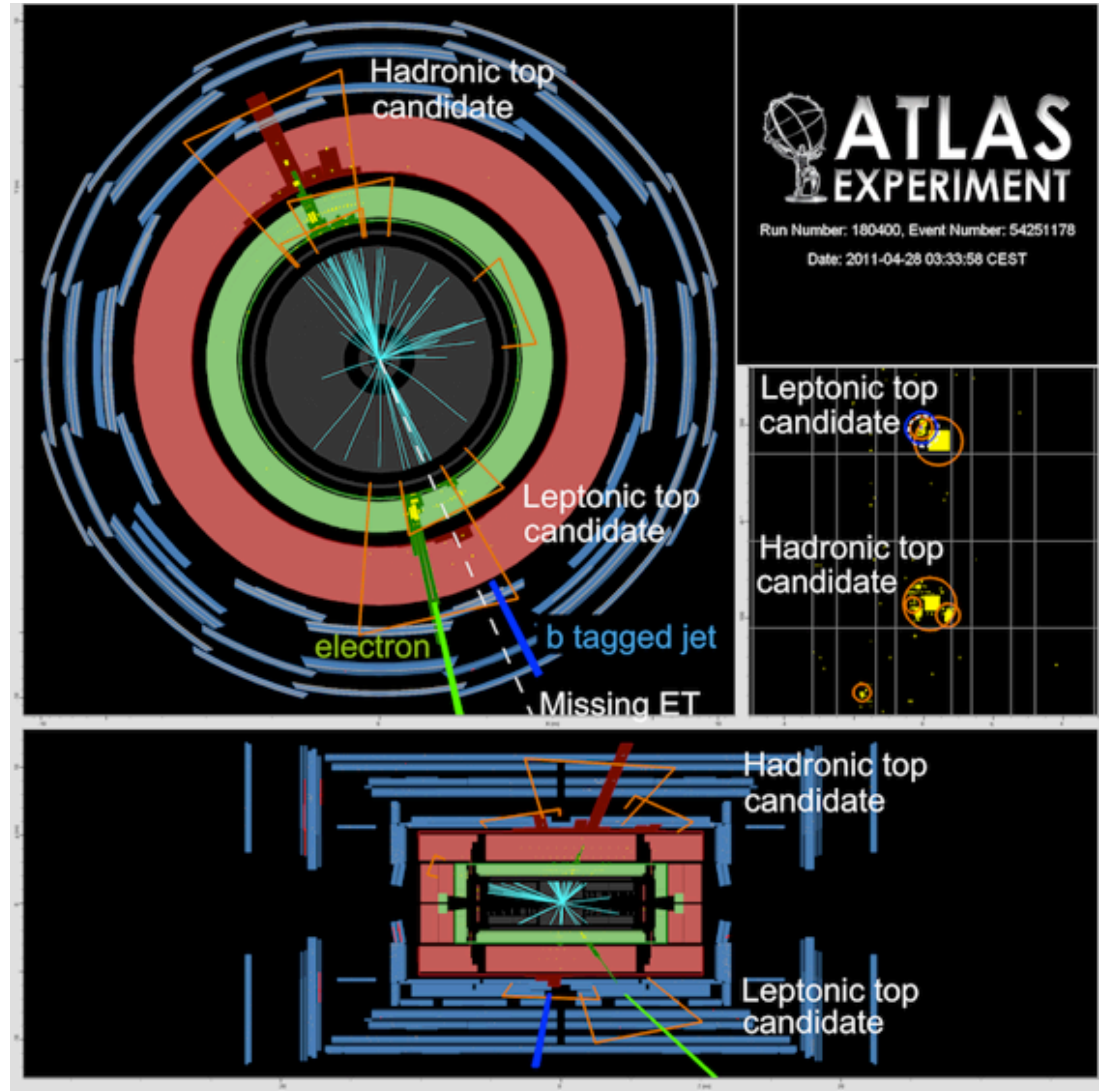




Top-antitop Resonance

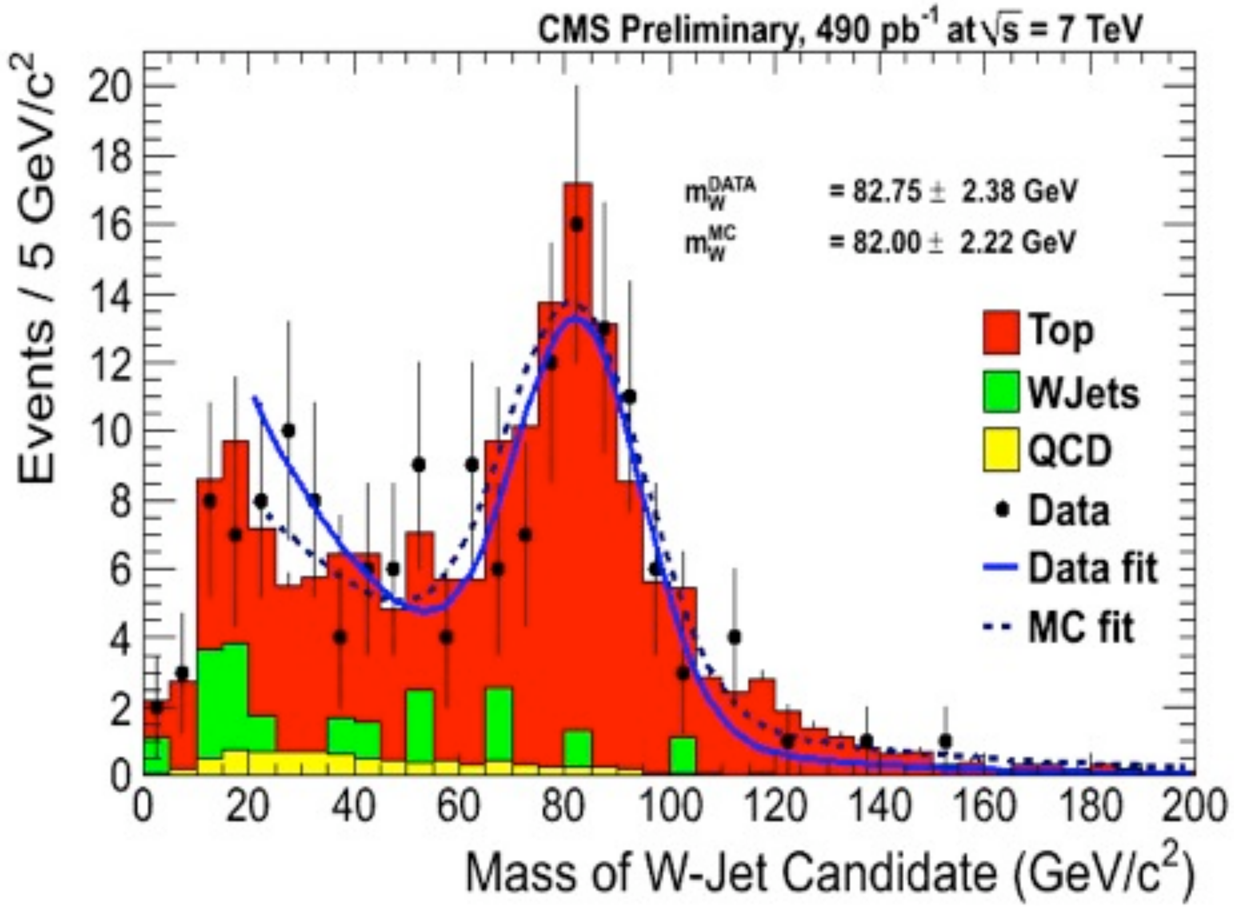


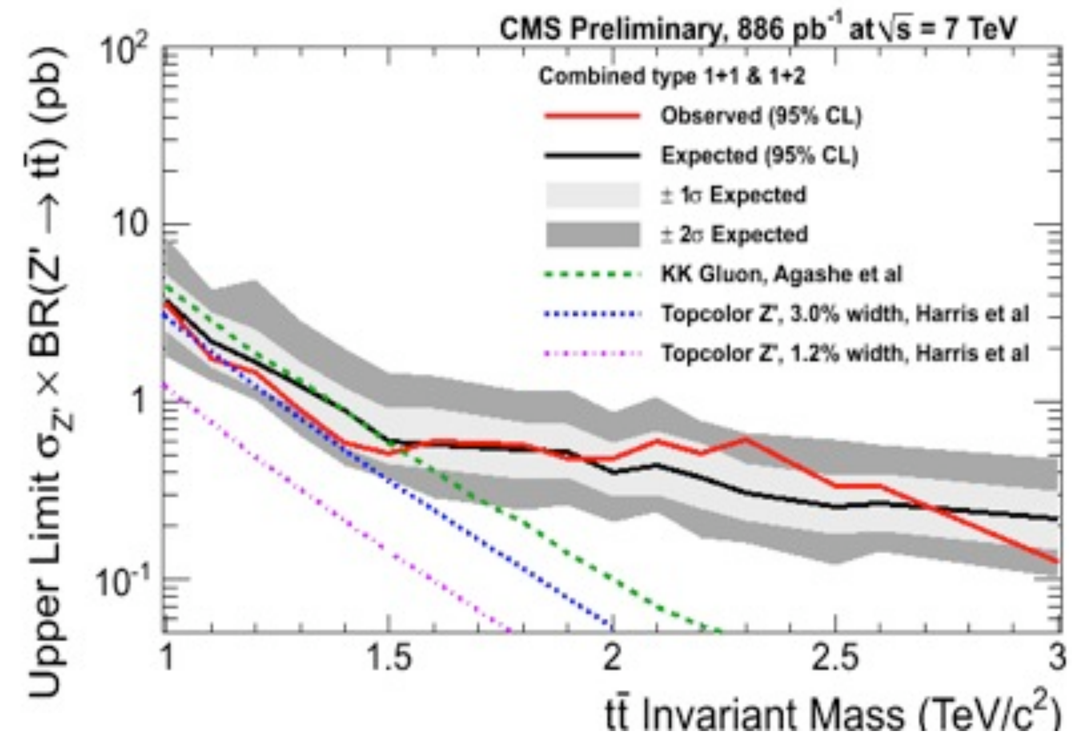


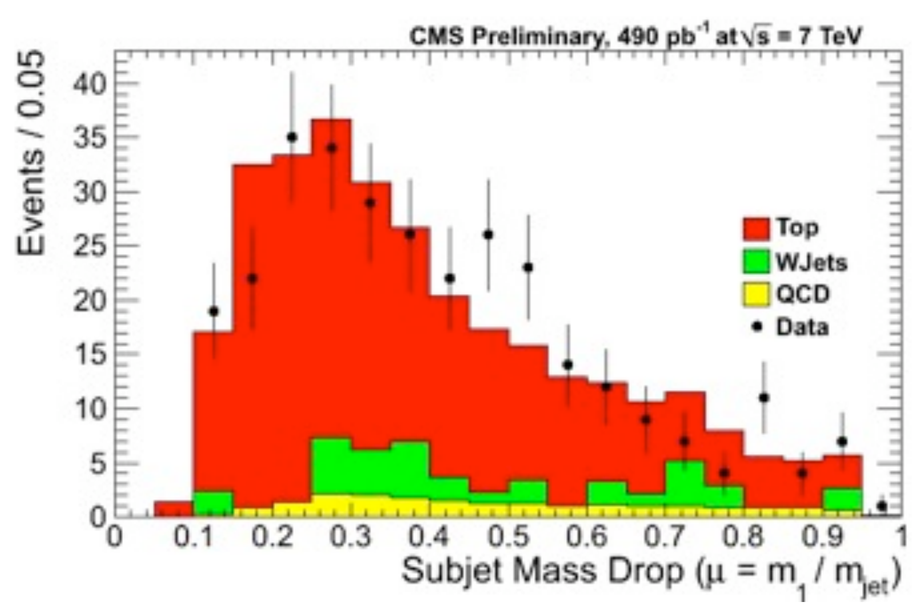


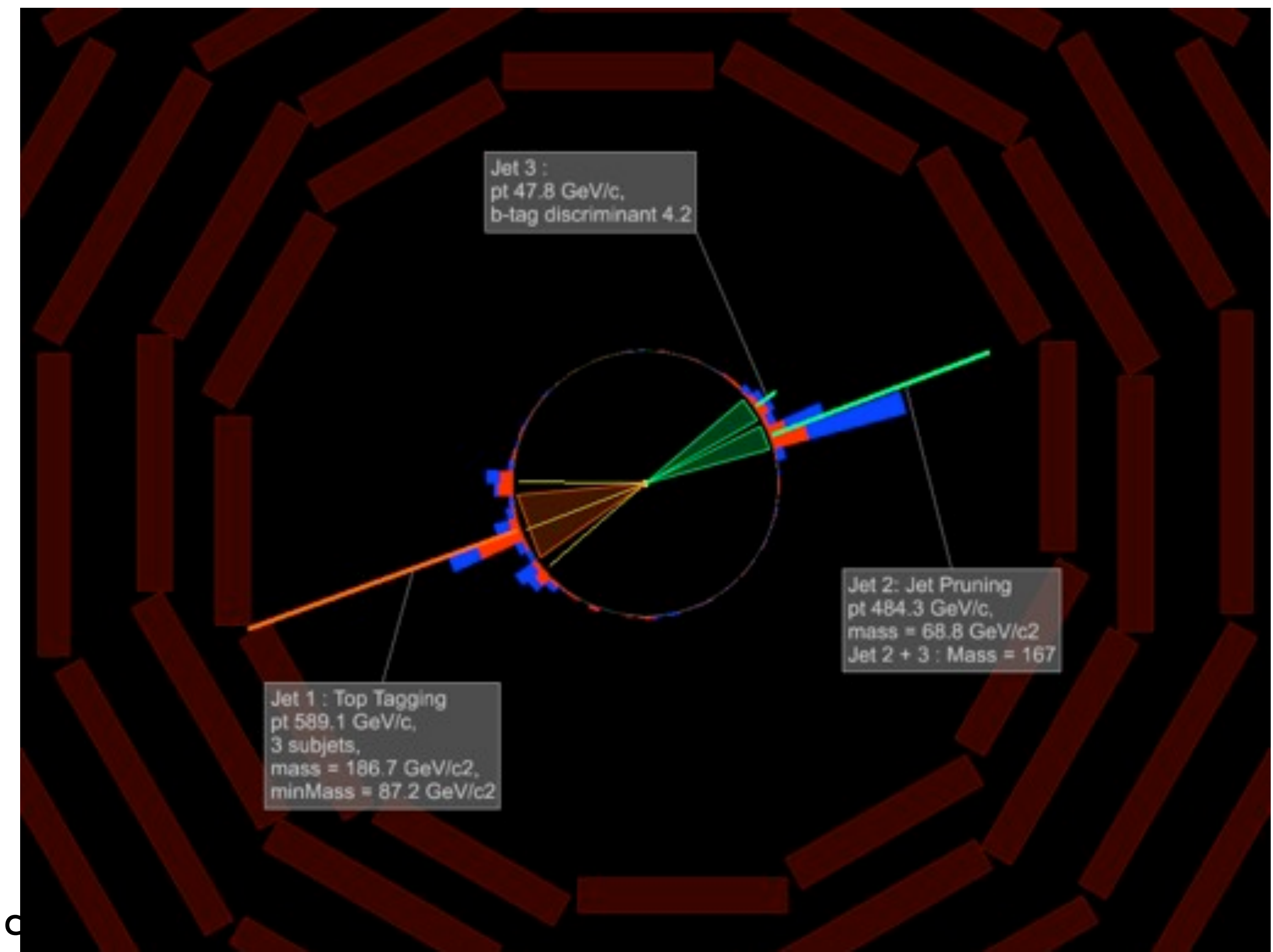
Top-antitop Resonance

- Entering the era of top-tagging!







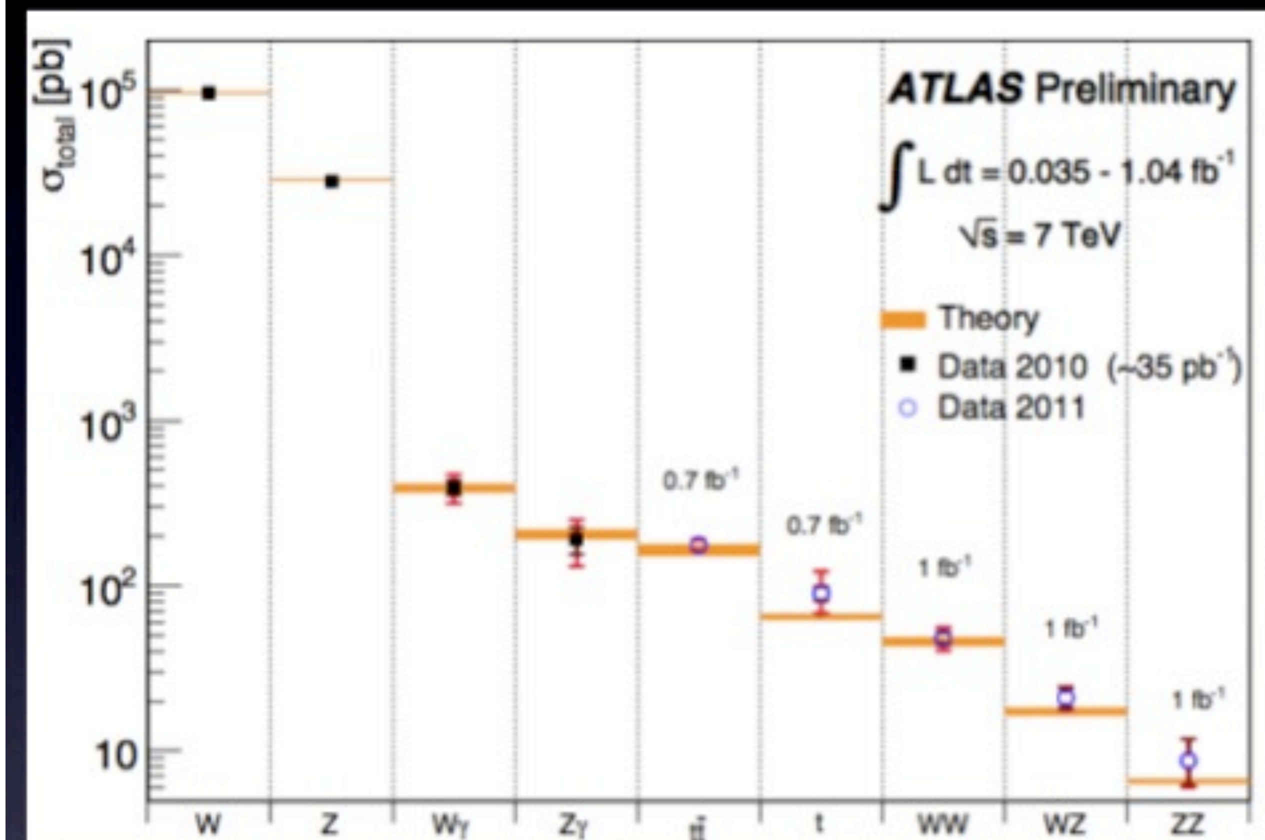


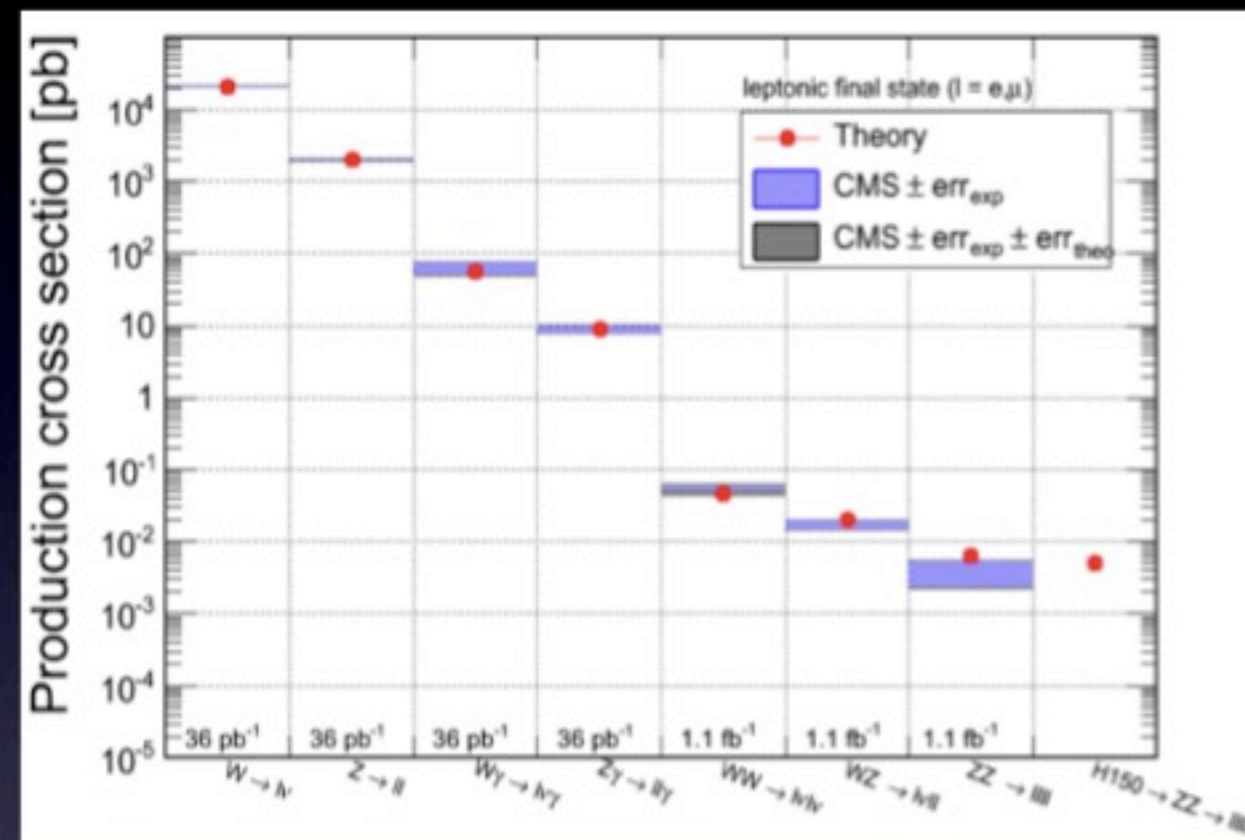
A word on EW precision measurements

EW & QCD measurements

Precision EW and QCD measurements not covered in the talk by lack of time and competence, but:

- LHC is re-establishing (quickly) the SM: measure all σ(V) and σ(VV')





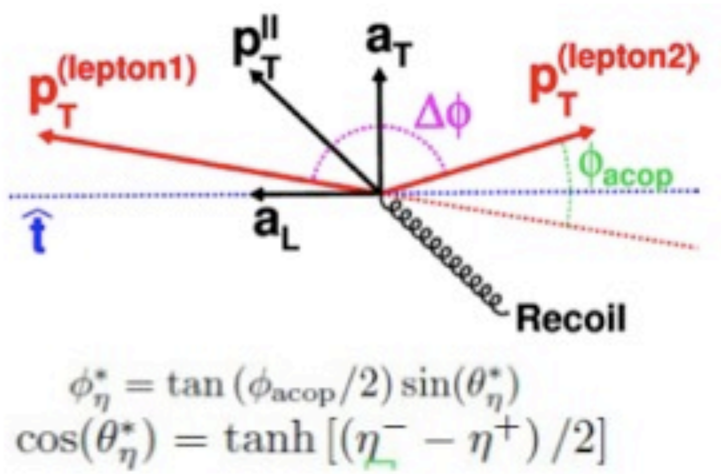
$$\sigma(W)\cdot B(W\rightarrow e\nu)\sim 10\,\mathrm{nb} \qquad \sigma(Z)\cdot B(Z\rightarrow e^+e^-)\sim 1\,\mathrm{nb}$$

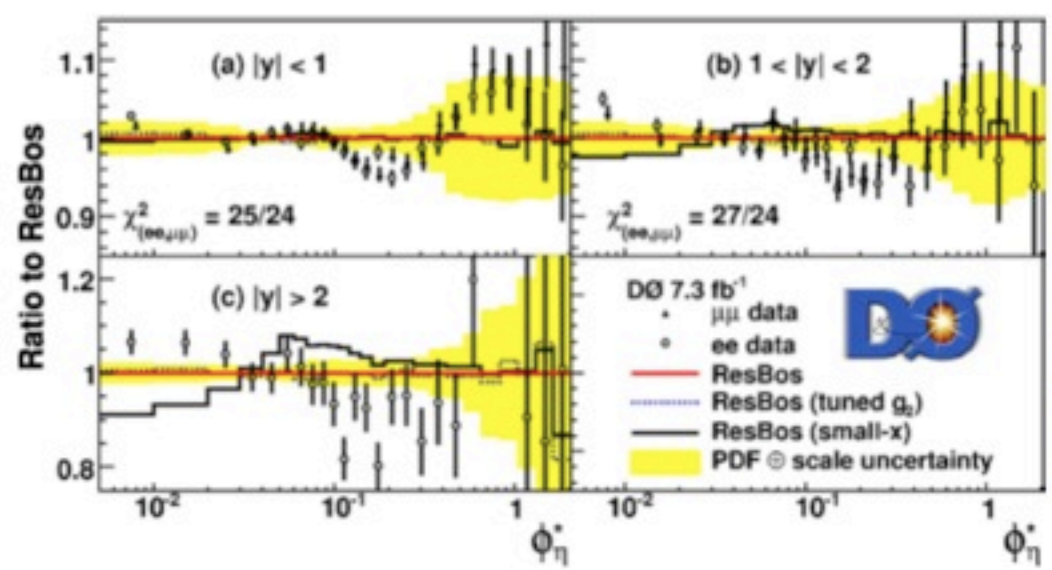
$$\sigma(WW)\cdot B(W\rightarrow l\nu)^2\sim 100\,\mathrm{fb} \qquad \sigma(ZZ)\cdot B(W\rightarrow l^+l^-)^2\sim 10\,\mathrm{fb}$$

EW & QCD measurements

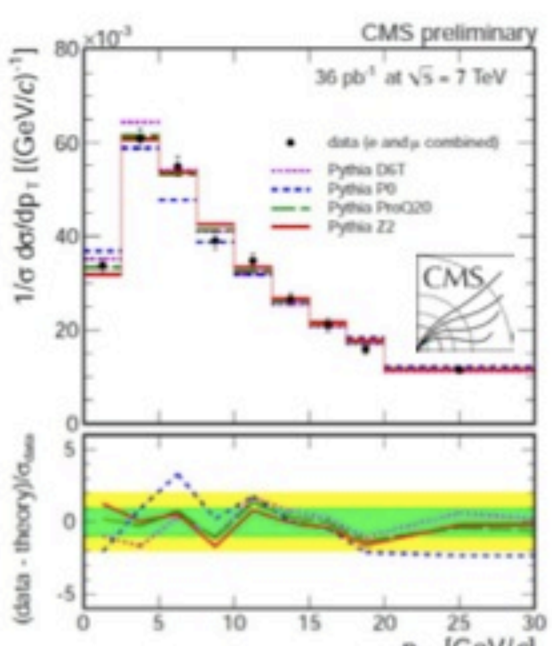
Precision EW and QCD measurements not covered in the talk by lack of time and competence, but:

- LHC is re-establishing (quickly) the SM: measure all σ(V) and σ(VV')
- Differential V Pt distributions: sensitive to PDF, high order QCD correction. Establish ground base for searches (main background).





PRL 106, 122001 (2011)



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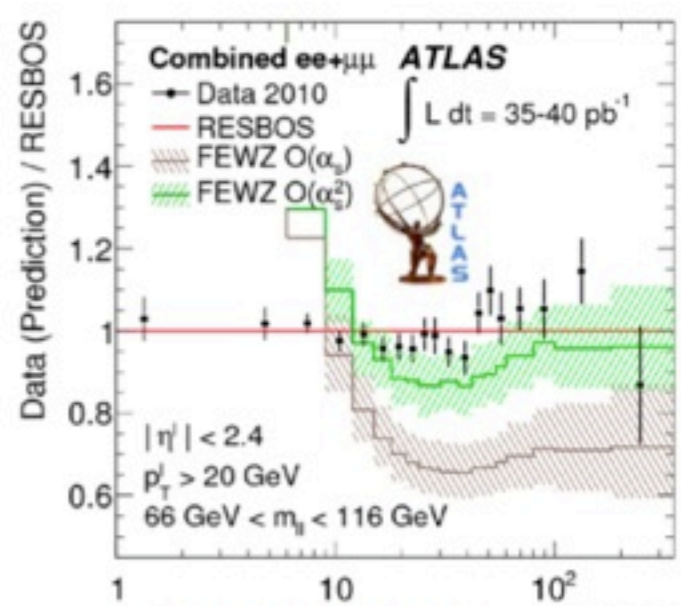
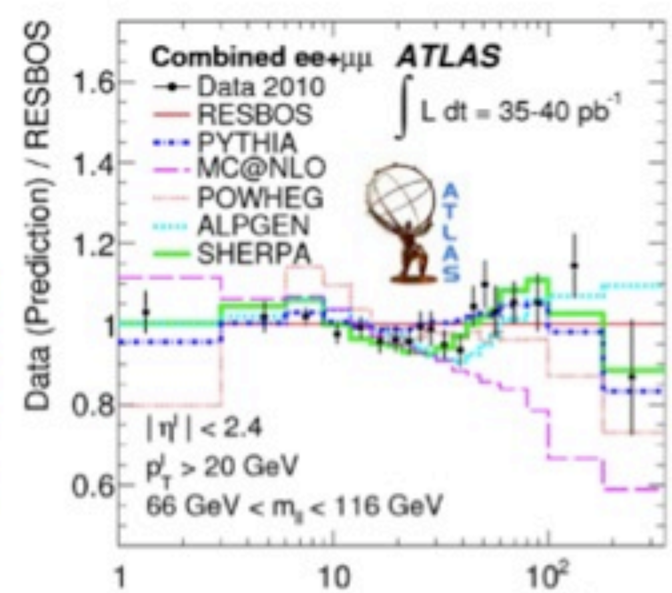


arXiv:1107.2381



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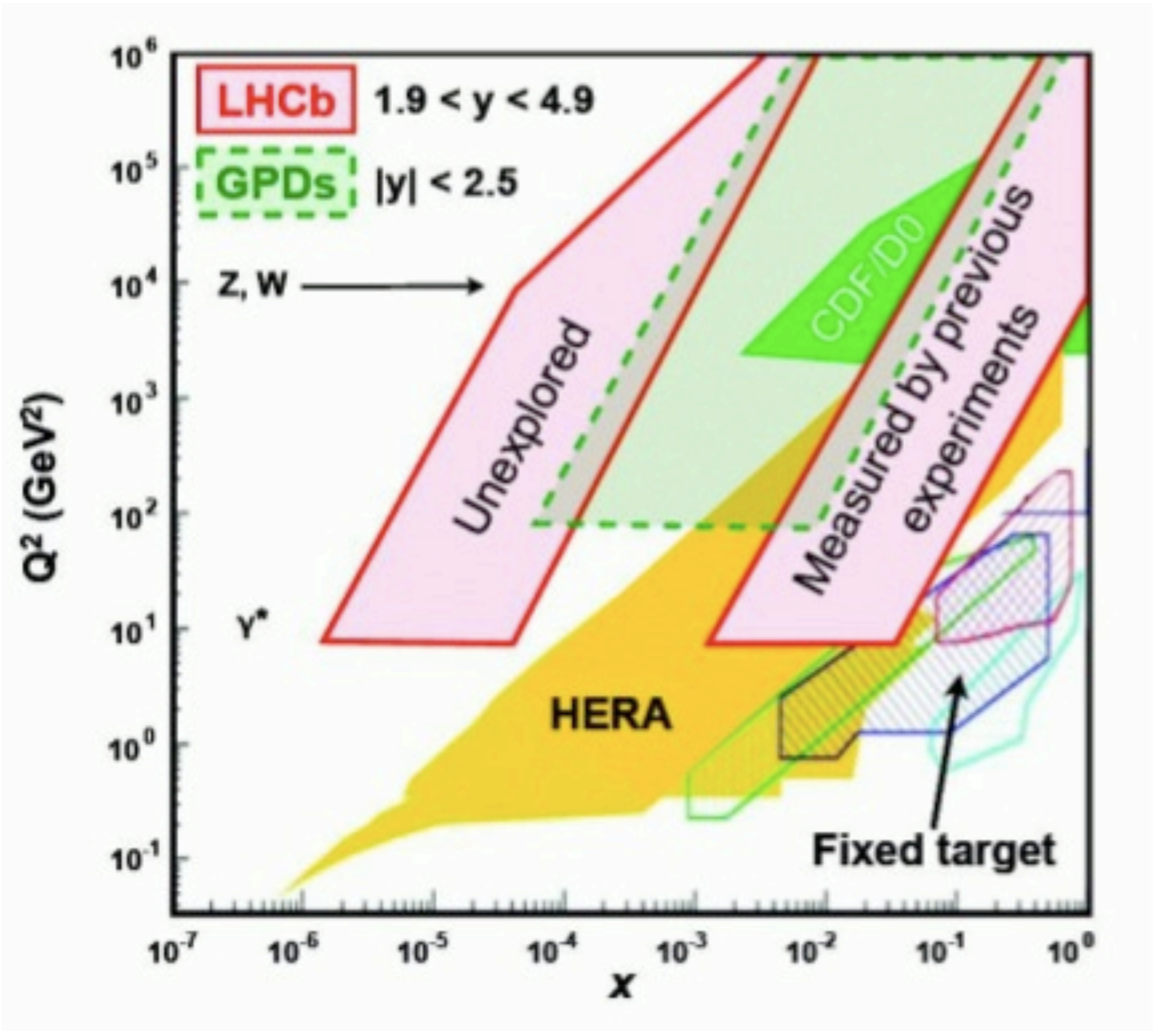

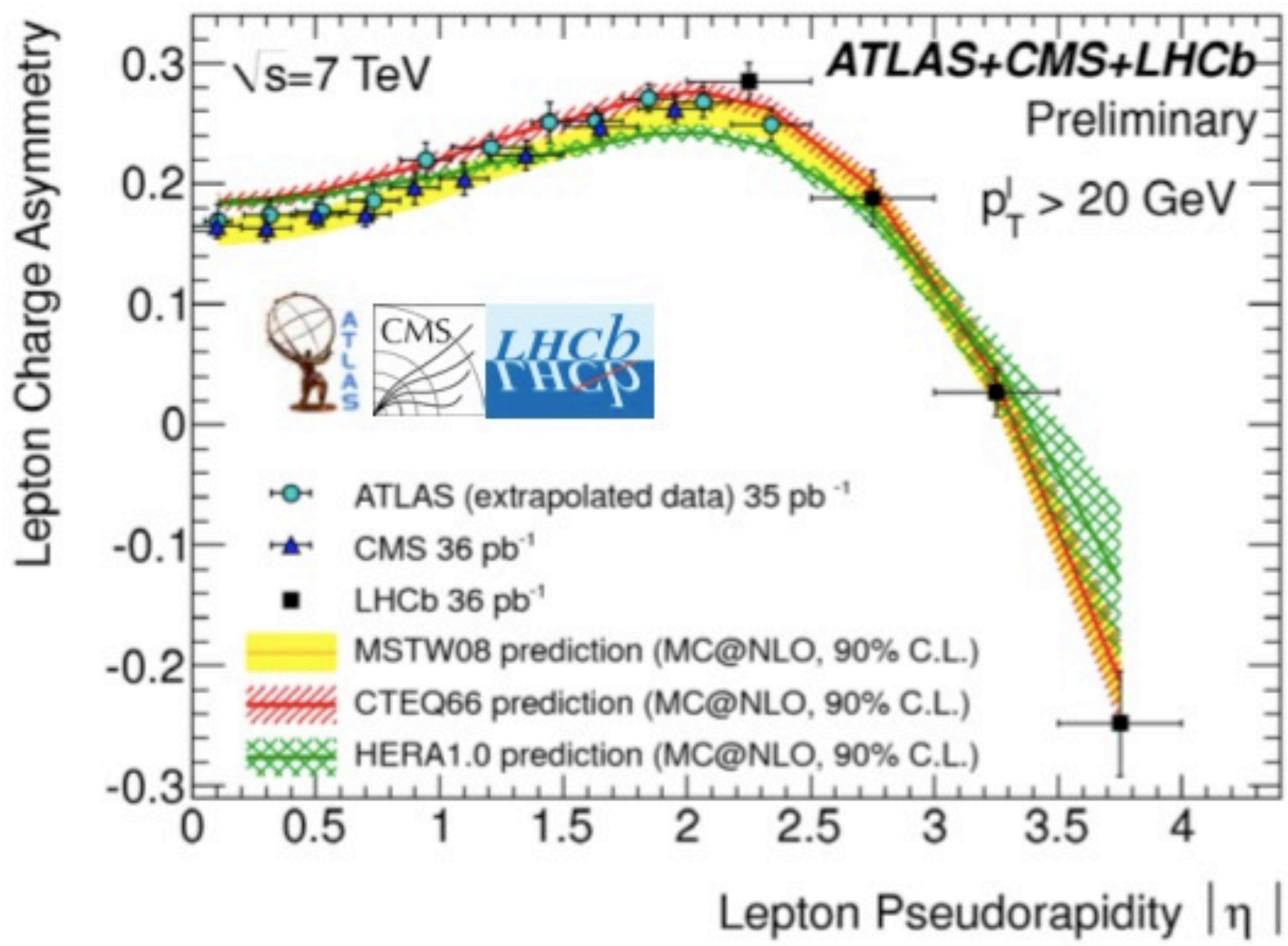

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- no new W mass measurement from Tevatron, winter conferences?
- ......

backup

Higgs results