Higgs & New Physics in ATLAS

Eilam Gross

מכון ויצמן למדע
WEIZMANN INSTITUTE OF SCIENCE

Outline

- ATLAS and the LHC
- Higgs search
  - H→WW→lνlν
- Exotics
  - Search for Physics in Dijet Mass and angular correlations
  - W'
  - Z'
  - Di-phton+E_T^{miss}, UED, Long lived highly ionizing particles NOT IN THIS TALK
- SUSY search
  - Final States with 1 Lepton, Jets and E_T^{miss}
  - Final States with 0 Lepton, Jets and E_T^{miss}
- Summary (the new PDG…..)

LHC and ATLAS operation

In 2010:

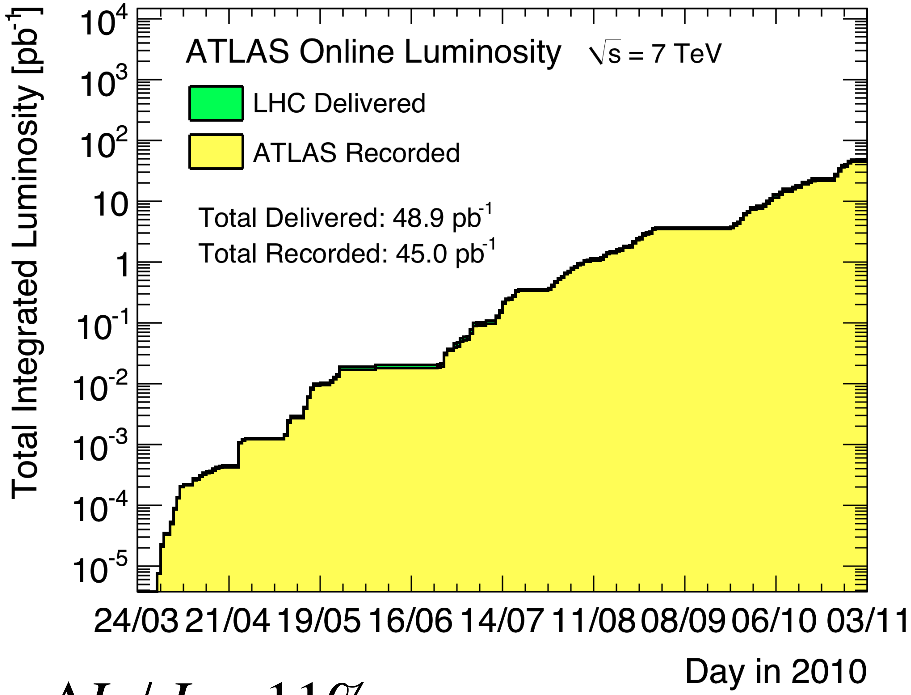
- Proton-proton collisions.
- The physics results shown in this talk are based on ~36 pb^{-1} integrated luminosity at $\sqrt{s} = 7$ TeV.

For 2011:

- Startup planned for March with $\sqrt{s} = 7$ TeV.
- Base aim: ~1 fb^{-1} of integrated luminosity during 2011

Beyond:

- LHC will run in 2012
- Then long shutdown and run at higher energy.



$$\Delta L / L = 11\%$$

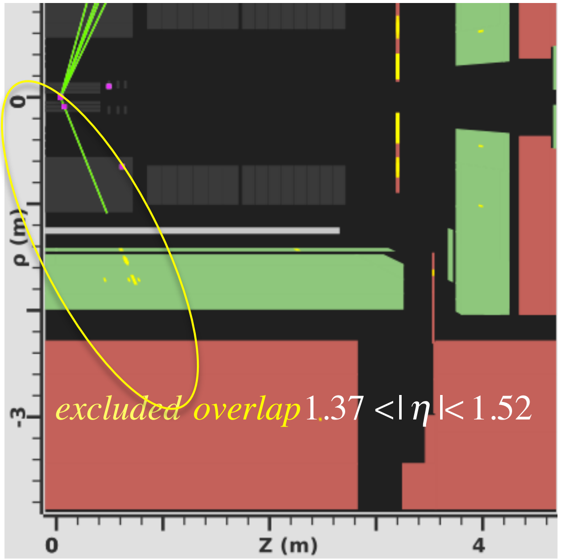
new luminosity calibration data,
improved determinations of the LHC bunch currents,
and revised estimates of systematic uncertainties

$$\Delta L / L = 3.2\%$$

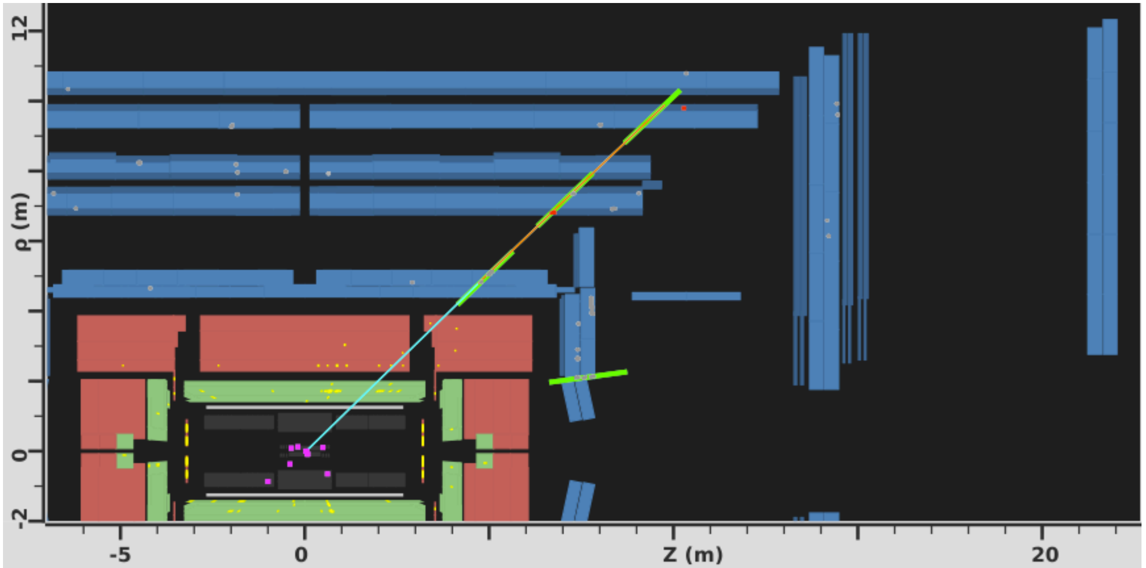
Frequently Used Objects

These are the objects used in H→WW analysis, details might be analysis dependent

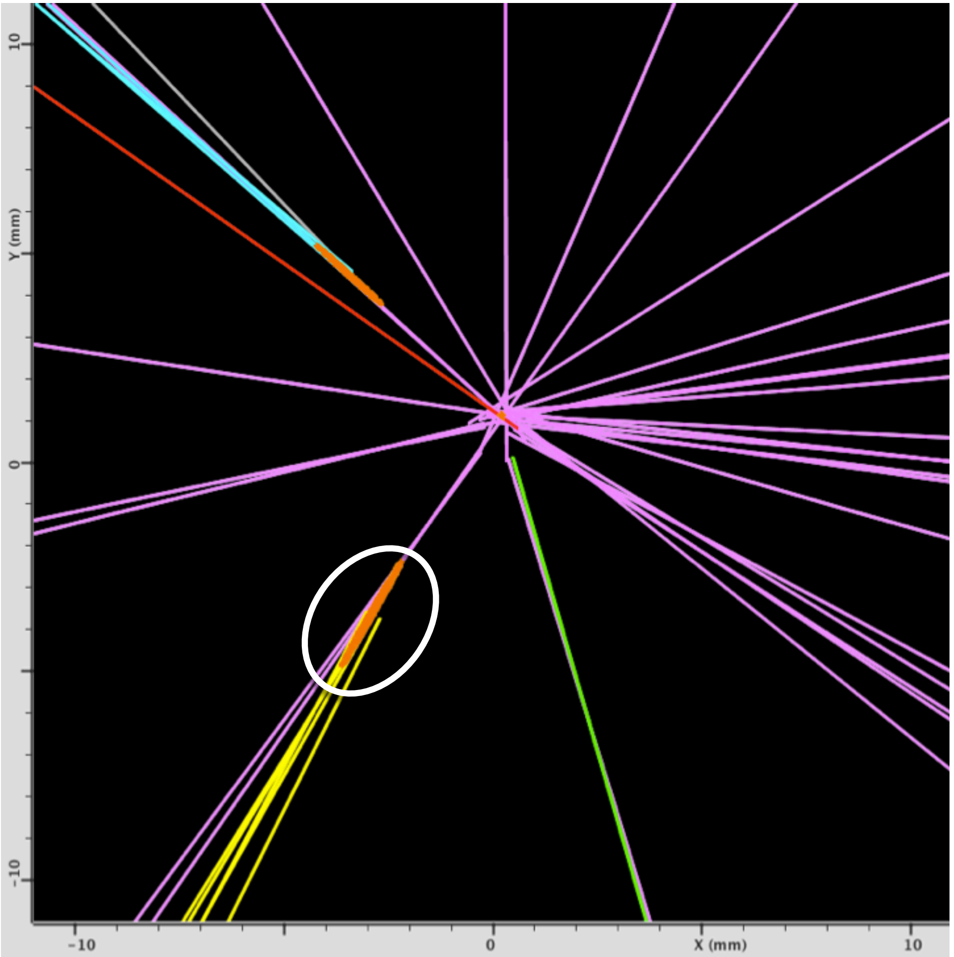
- Electrons: Energy from calorimeter cluster, η ,ϕ from track $|\eta|< 2.4$
  Isolation within a cone $\Delta R=\sqrt{\Delta\phi^2+\Delta\eta^2}=0.3$
  excluding barrel end-cap overlap region



- Muons: Combined Inner Detector tracks +Muon Spectrometer , Same isolation criteria

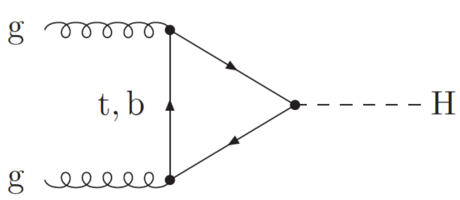


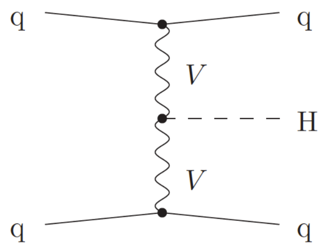
Frequently Used Objects

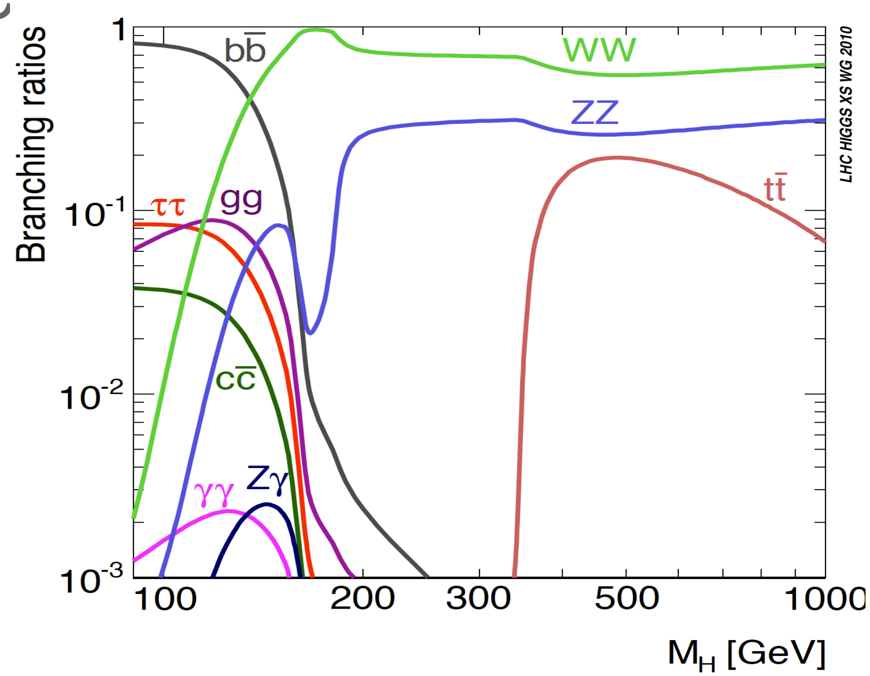


- **b-jets:** Displaced secondary vertex with a b-tag weight $L/\sigma(L) > 5.7$ which gives ~50% eff for b-jets from t-quarks (mistag ~0.1-1% depending on jets p_T)
- **Jets:** Reconstructed from topological clusters using IR-safe anti-kT algorithm with size parameter D=0.4; $|\eta| < 4.5$ $p_T^{jet} > 25$ GeV
- **E_T^{miss}:** Reconstructed from topological energy clusters in calorimeters, with corrections for Muons

Higgs Production and Decay





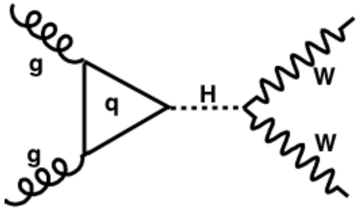


- Gluon fusion dominates by a factor O(10)
- INTERESTING REGION: $114.4 < m_H < 185$ GeV
  - LEP $m_H > 114.4$ GeV
  - TEVATRON $158 < m_H < 175$ GeV @ 95% CL
  - Theory (precision measurements) $m_H < 185$ GeV (taking LEP observation into account)

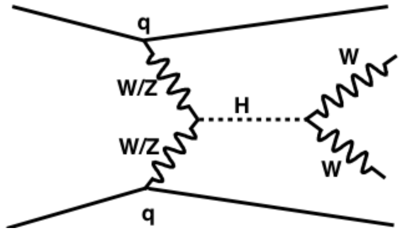
- H→WW, dominant decay channel in the intermediate and high mass region

H→WW→ll+E_T^{miss}, the Higgs flag analysis (so far)-I

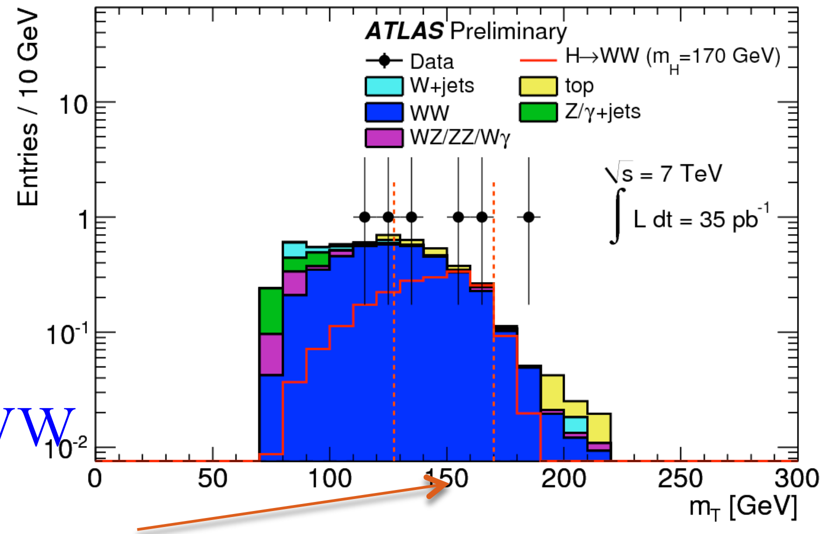
- H+0j,H+1j



- H+2j



- Preselection
  - Trigger and event cleaning (→L=35 pb-1)
  - 2 opposite sign high p_T isolated leptons (ee, $\mu\mu$,eμ)
  - Veto against same flavour di-lepton resonances based on m_{ll}
  - Large E_T^{miss}>30 GeV (against QCD)
- Topological Cut
  - Spin correlations discriminate H vs WW



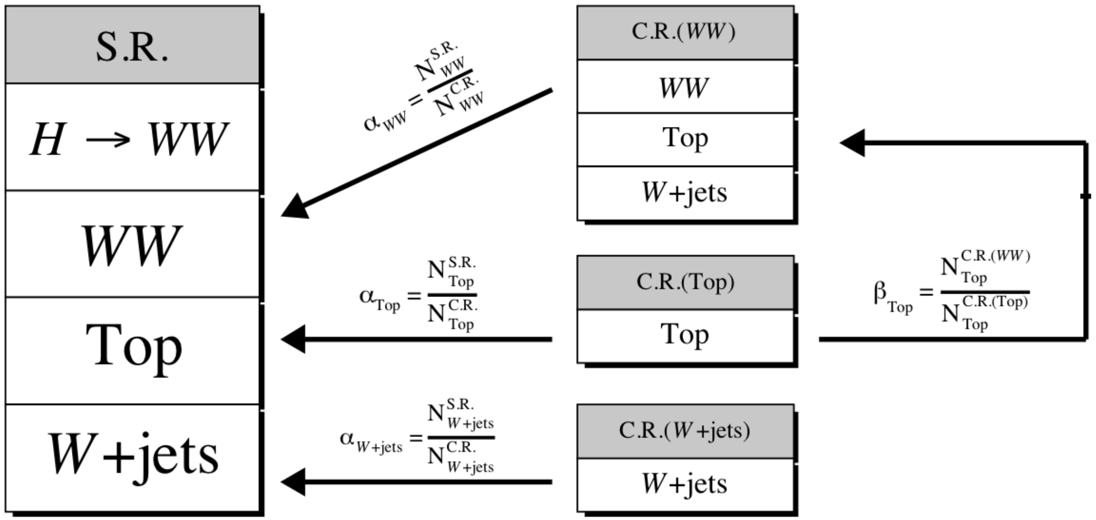
$$\Delta\phi_{ll} < 1.3\ (m_H < 170),\ \Delta\phi_{ll} < 1.8\,(m_H \geq 170)$$

  - Transverse mass $0.75 \times m_H < m_T < m_H$ $\quad m_T = \sqrt{(E_T^{ll} + E_T^{miss})^2 - (\vec{p}_T^{\,ll} + \vec{p}_T^{\,miss})^2}$

Data Driven Backgrounds

- Identify a set of cuts (defines a Control Region) that select events enriched in a particular background (Control Sample)
- Subtract the contaminations of other backgrounds in control sample (usually by MC or data driven as well).
- Extrapolate (data driven or MC) into the Signal Region (defined by analysis cuts) to estimate the background in the signal region

$$N_{WW}^{SR} = \alpha_{WW} \times (N_{WW}^{CR} - \beta_{top} \cdot N_{top}^{CR} - ...)$$

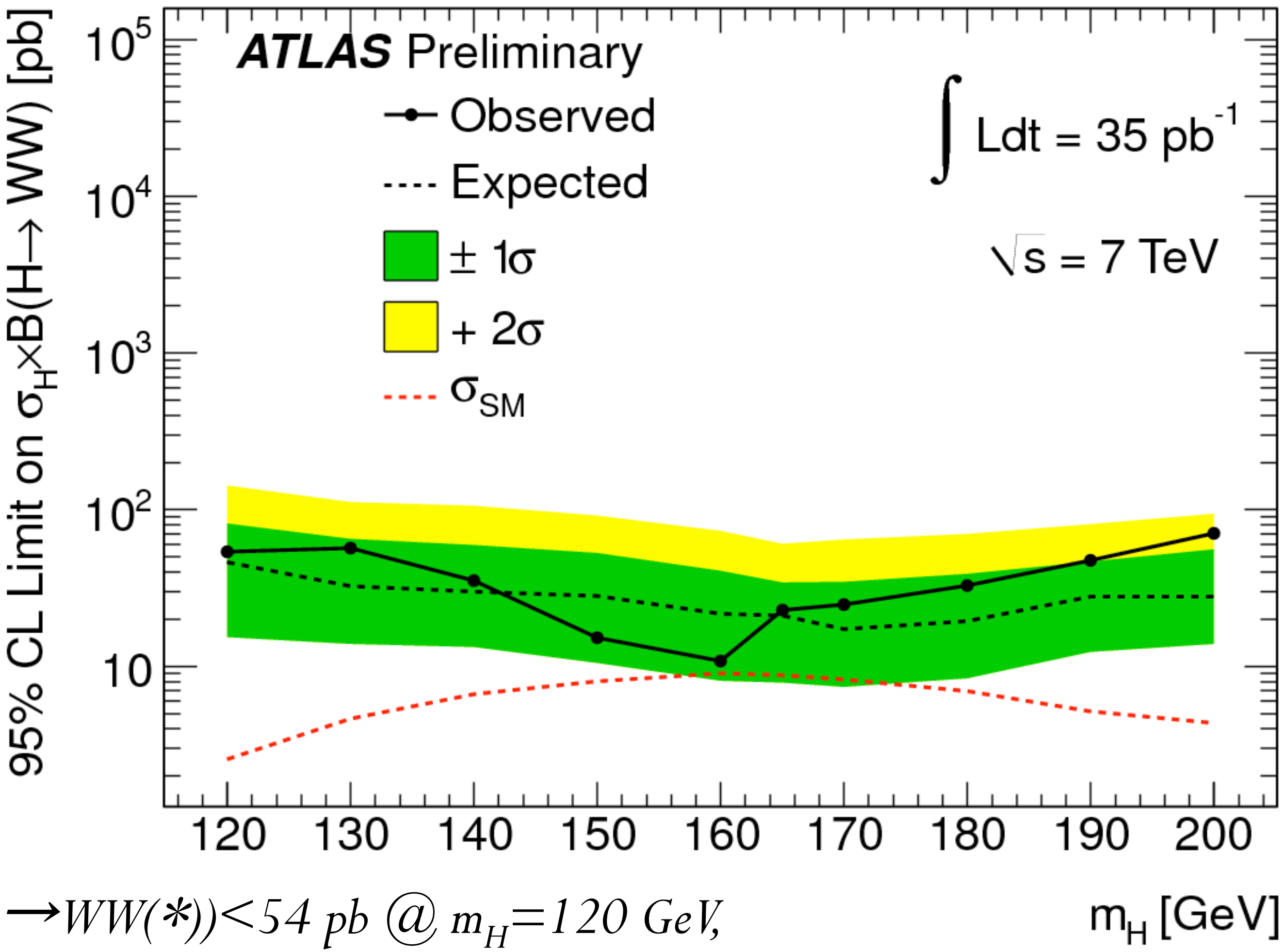


The uncertainties on the extrapolation factors (α , β) from the control samples are O(40%,20%)

Deriving Limits

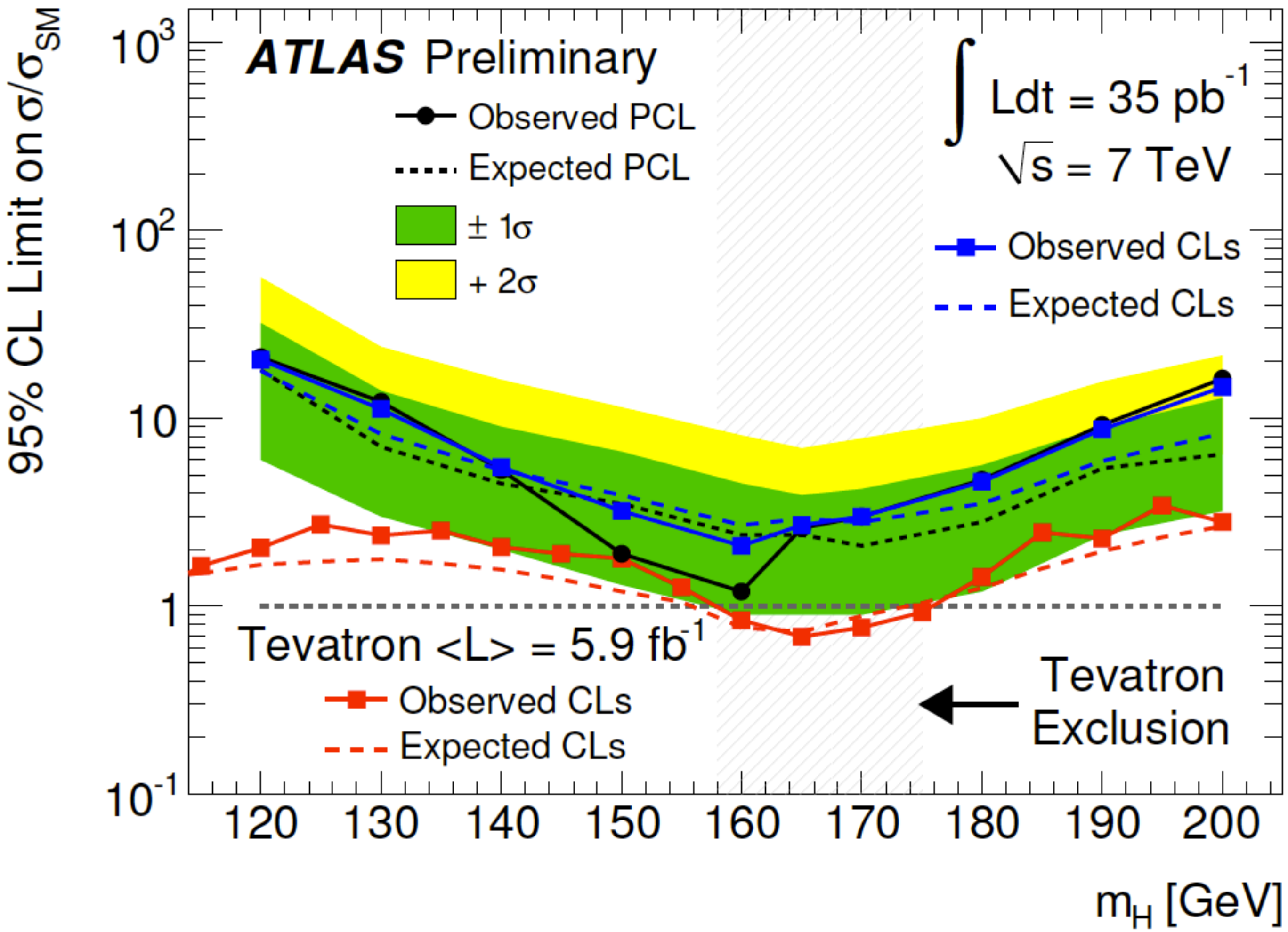
- Various methods have been used to derive limits taking into account the systematic uncertainties;
  correlations when channels are combined were taken as 100%(e.g. Luminosity for MC driven BGs) or 0% (e.g. MC statistics or theory)
- Some analyses used Bayesian inference
- Most common method used in ATLAS is the frequentist Profiled LR in which the systematics are profiled $L(H_s)/L(_{best})$
- The basis of all methods is to construct the Likelhood for the signal hypothesis under test
- A limit was obtained by rejecting the signal hypothesis at the 95% Confidence Level
- Find the minimum $\sigma \times BR$ for which $Prob(observation|H_s) < 5\%$
- To protect against downward fluctuations of BG, Power Constrained Limit (*PCL*) and the LEP inherited *CLs* were used.

H→WW, the Higgs flagship analysis (so far)-II



- $\sigma \times BR(H \rightarrow WW(*)) < 54\ pb$ @ $m_H = 120$ GeV,
- $\sigma \times BR(H \rightarrow WW(*)) < 11\ pb$ @ $m_H = 160$ GeV
- $\sigma \times BR(H \rightarrow WW(*)) < 71\ pb$ @ $m_H = 200$ GeV.

H→WW, the Higgs flagship analysis (so far)-III

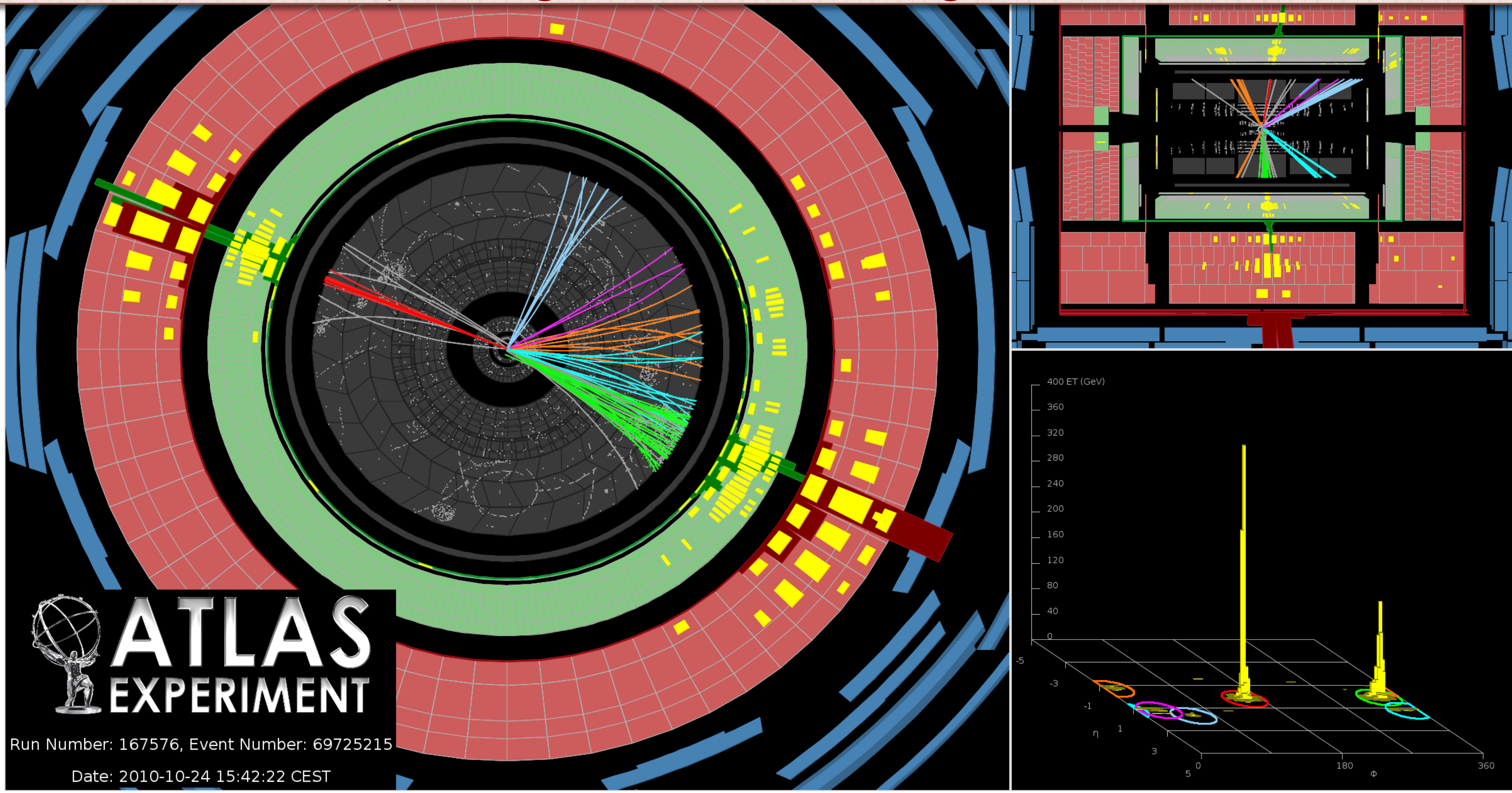


ATLAS excludes SM Higgs $\sigma < 1.2\times\sigma_{SM}$ Expected $\sigma < 2.5\times\sigma_{SM}$

(CMS ~ $\sigma <\sim 3\times\sigma_{SM}$ this conf)

Exotic in Di Jets m_{jj}=2.6 TeV

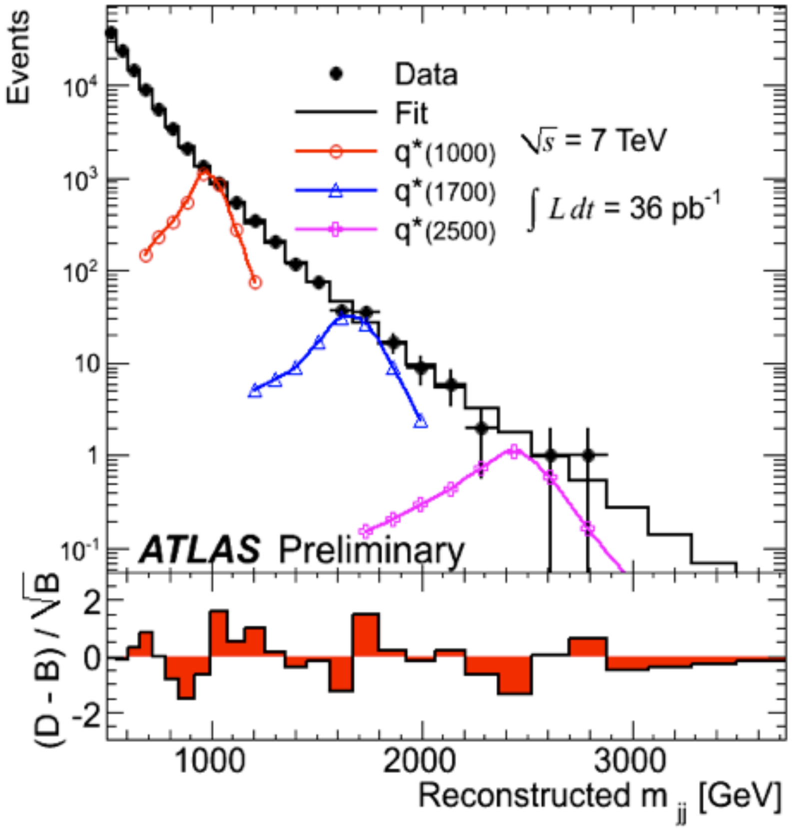
Look for two very energetic jets with large (p_T) transfer.



- The highest mass central dijet event and the highest-p_T jet collected by the end of October 2010: two central high-p_T jets have an invariant mass of 2.6 TeV and the highest p_T jet has p_T of 1.3 TeV.1st jet (ordered by p_T): p_T = 1.3 TeV, η = 0.2, ϕ = 2.82nd jet: p_T = 1.2 TeV, η = 0.0, ϕ = -0.5Missing E_T = 42 GeV, ϕ = 1.5 Sum E_T = 2.2 TeV

Search for Physics is Dijet Mass

- These are 2→2 scattering well understood in the SM framework (QCD)
- Benchmark signal: BSM resonant processes such as qg→q*
- Observable m_{jj}
- A bump hunter is constructed to look for a peak anywhere, taking into account the look elsewhere effect
- The lowest *p-value* in trying to reject the background-only hypothesis and observe a signal, occur at *995-1253* GeV, with *p-value=0.39*→ *No Evidence*



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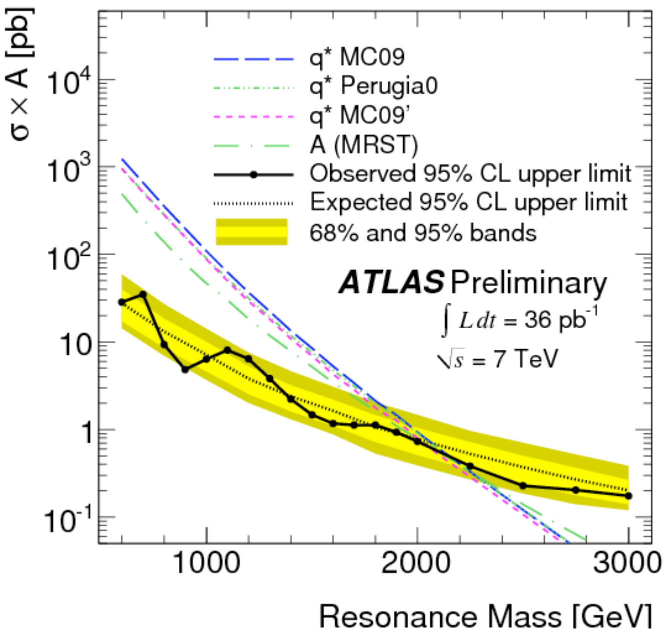
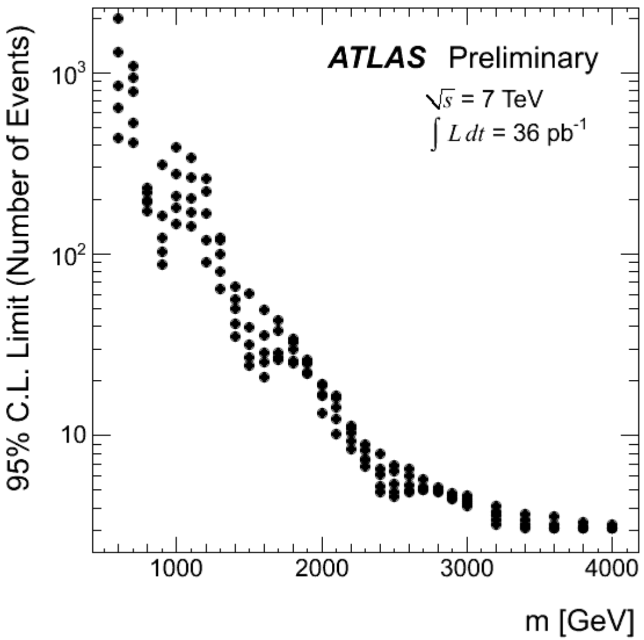
Search for Physics is Dijet Mass



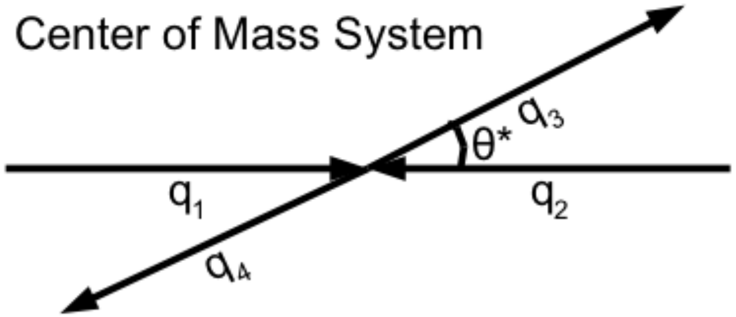


- Lower bounds are set on
- m_{q*}>2.15 TeV (exp 2.07)
  (CMS 1.58 TeV @ 2.9pb^{-1})
  TEVATRON 0.87 TeV @1130 pb^{-1}
  - Axigluon 2.10 TeV,
  - QBH 3.67 TeV (exp 3.64) for n=6 extra dimensions.
- Model independent limits on the number of observed events for Gaussian signals of various widths as a function of the mean Gaussian profile

Search for Physics in Angular Correlations

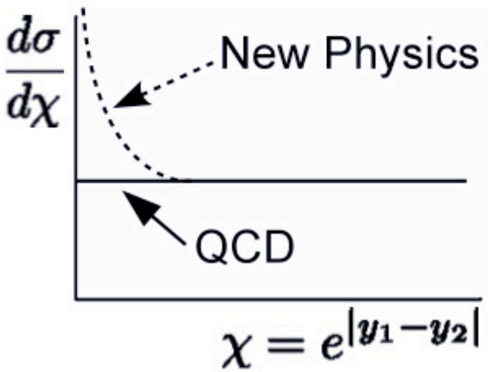
- Observables: rapidity in the CM frame $y^* = \frac{1}{2}\ln\left(\frac{1+|\cos\theta^*|}{1-|\cos\theta^*|}\right)$

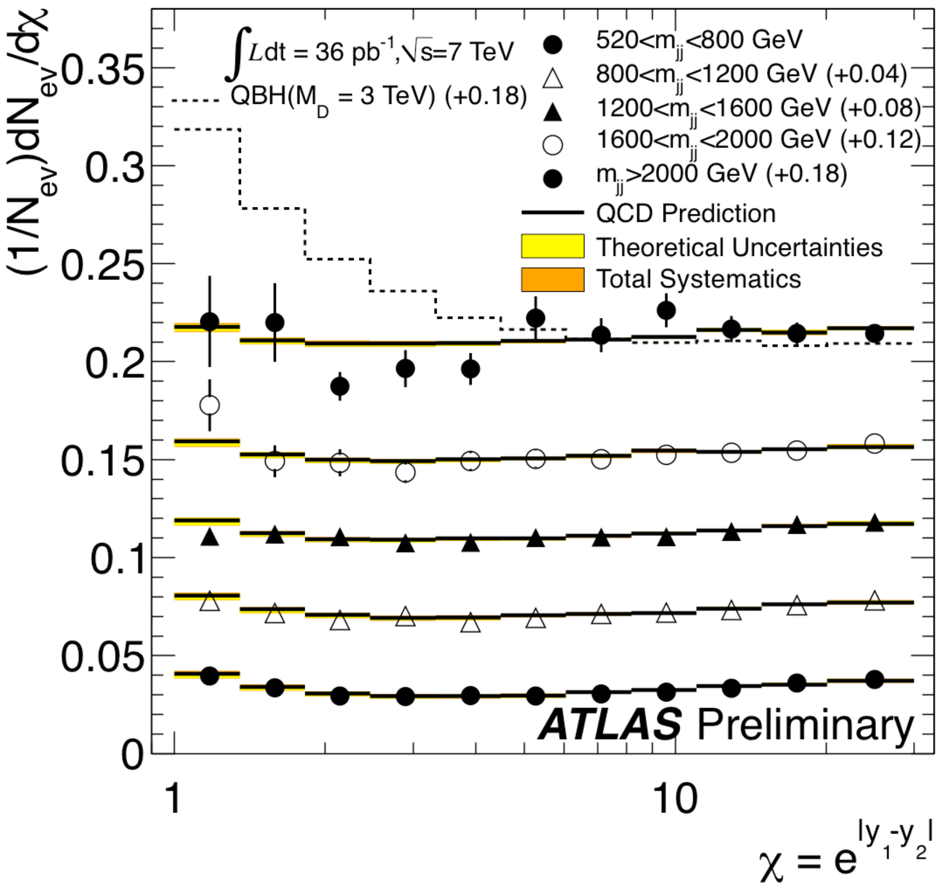
$$y^* = \frac{1}{2}(y_1 - y_2)$$



- → the di jet angular variable

$$\chi \equiv \exp(|y_1 - y_2|) \doteq \exp(2|y^*|)$$





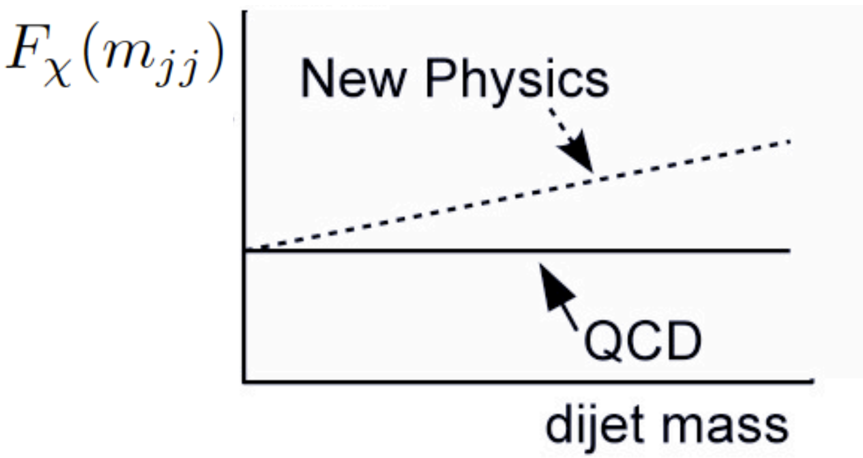
Search for Physics in Angular Correlations

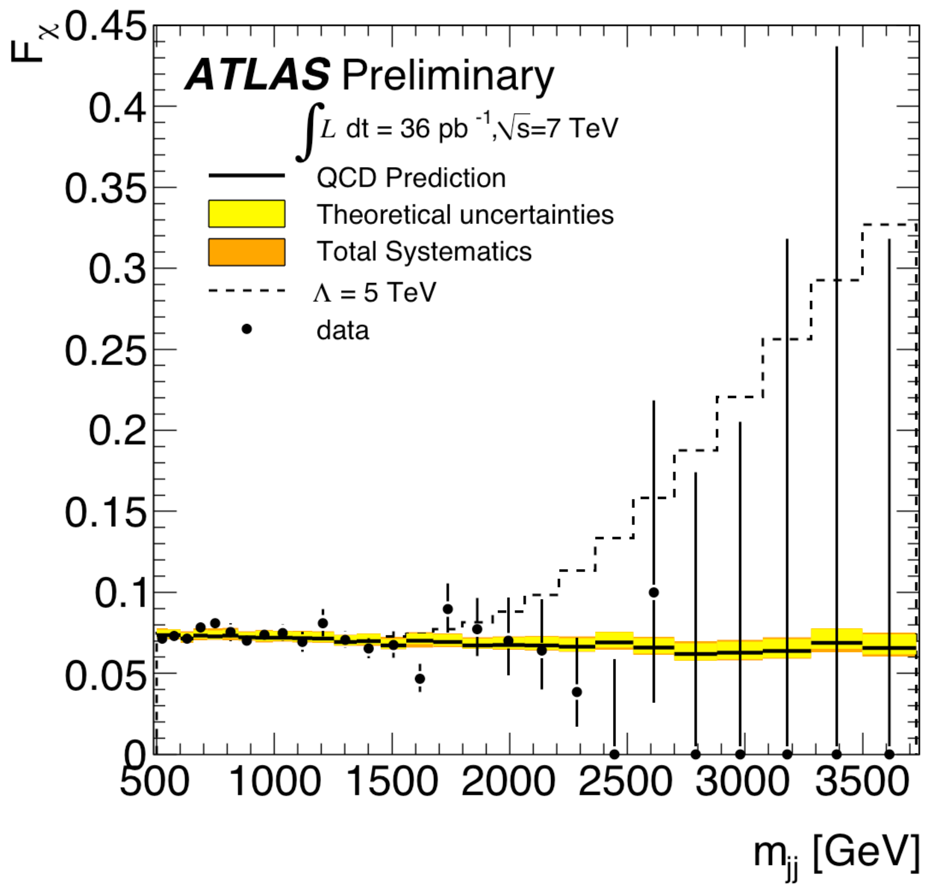
- Observables: centrality
  the fraction of jets produced centrally

$$F_\chi(m_{jj}) = \frac{N_{events}(|y^*| < 0.6)}{N_{events}(|y^*| < 1.7)}$$

$$y^* = \frac{1}{2}(y_1 - y_2)$$

-





Exotic: Search for New Physics in Di Jet Mass and Angular Correlations

Model and Analysis Strategy	95% C.L. Limits (TeV)	
	Expected	Observed
Excited Quark q^*		
Resonance in m_{jj}	2.07	2.15
$F_\chi(m_{jj})$	2.08	2.60
Randall-Meade Quantum Black Hole for $n = 6$		
Resonance in m_{jj}	3.64	3.67
$F_\chi(m_{jj})$	3.50	3.84
$dN/d\chi$ for $m_{jj} > 2$ TeV	3.37	3.69
Axigluon		
Resonance in m_{jj}	2.01	2.10

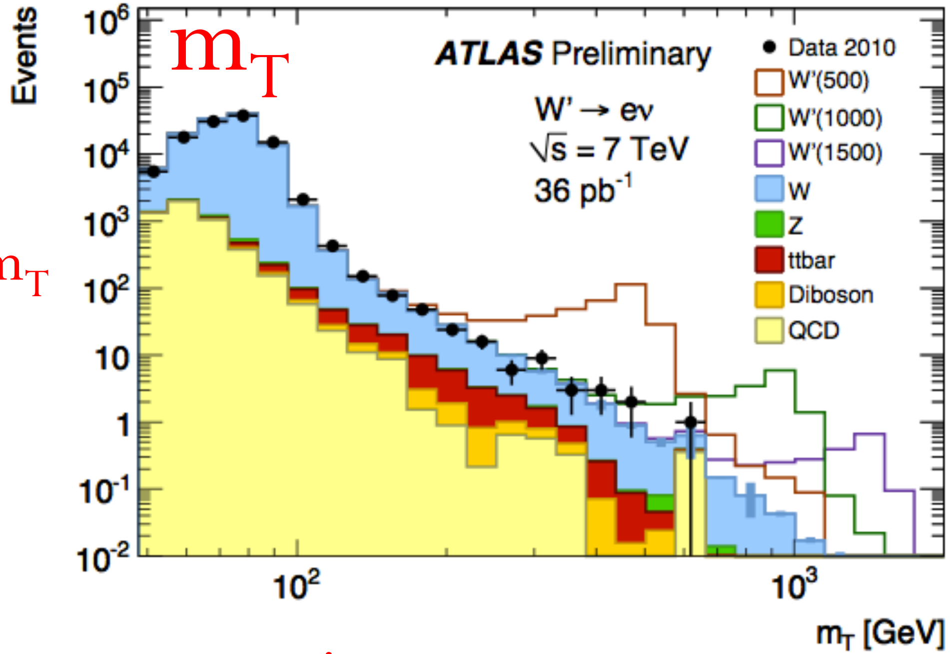
Search for W' (lepton + missing E_T)

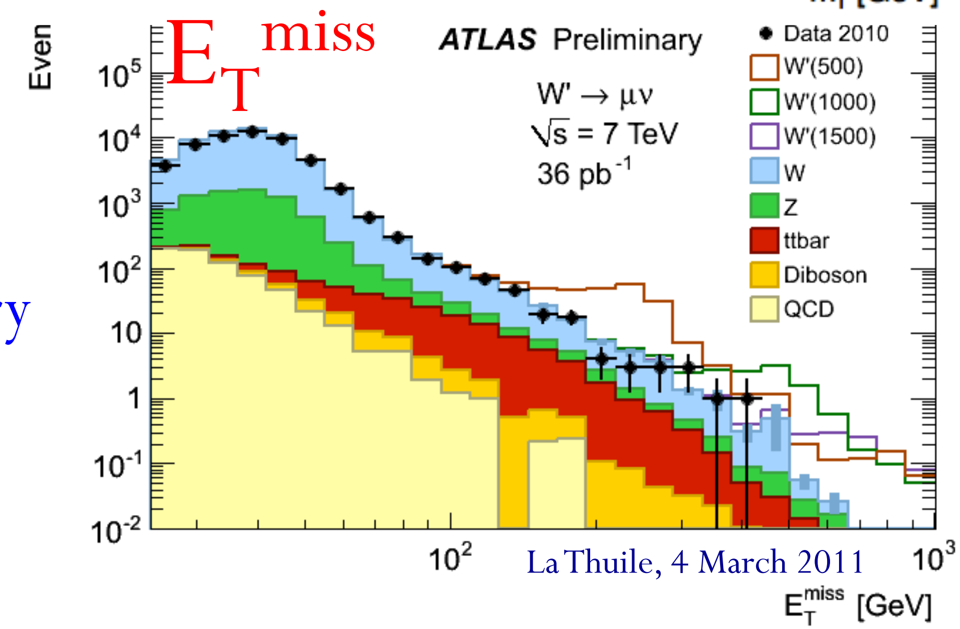
- Standard Sequential Model (SSM) contains W', Z' with a SM coupling and width linearly increasing with mass (another benchmark is chiral W^*)
- ATLAS finds no evidence neither for this nor for this…
- Yet the search is challenging because it requires the understanding of the tail of the Standard Model W m_T distribution, which requires an understanding of the detector $m_T = \sqrt{2 p_T^{\ell} E_T^{miss} (1 - \cos\varphi_{\ell\nu})}$
- Extrapolation of knowledge from the Z scale to the TeV scale is not trivial, e.g. understanding tracking efficiencies and resolution for 300 GeV Muon

Search for W' (lepton + missing E_T)

$$m_T = \sqrt{2 p_T^{\ell} E_T^{miss}(1-\cos\varphi_{\ell\nu})}$$

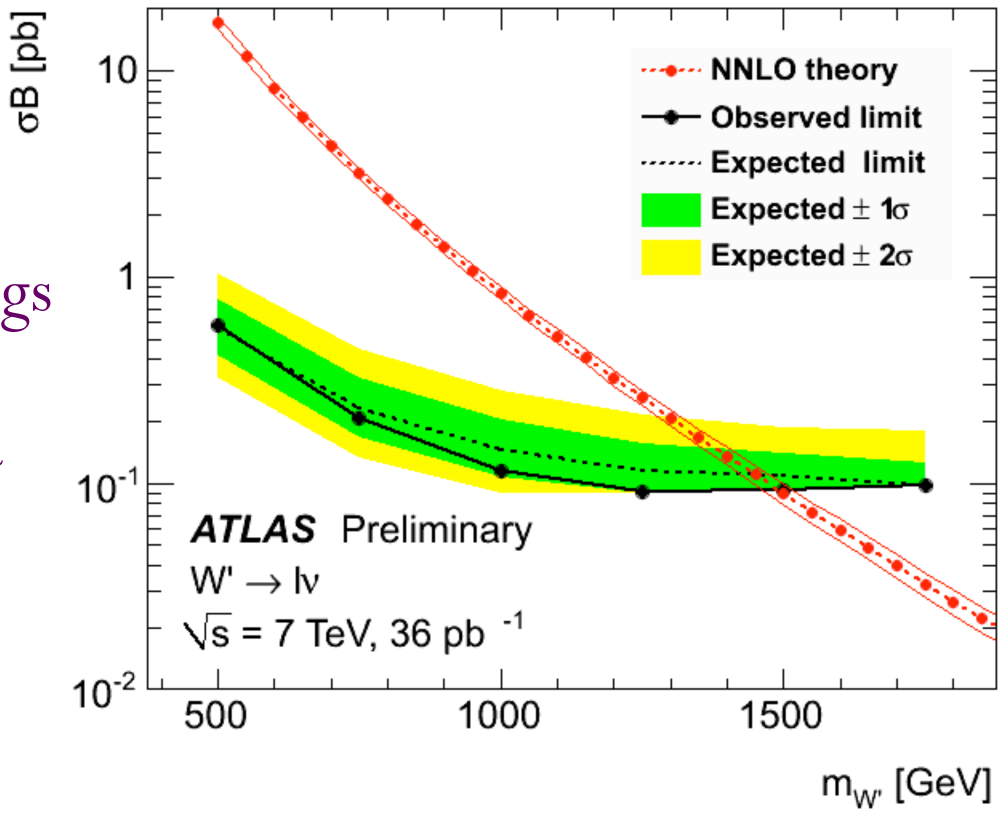
- Signal characterized by ONE isolated lepton with high p_T, high E_T^{miss} and high m_T.
- The signal is located at the tail of the m_T distribution
- Understanding the m_T distribution requires high resolution measurement of lepton momentum and missing transverse energy.
- BG from EW processes: W, Z, top
- BG from QCD estimated with auxiliary measurements (control regions), data driven.



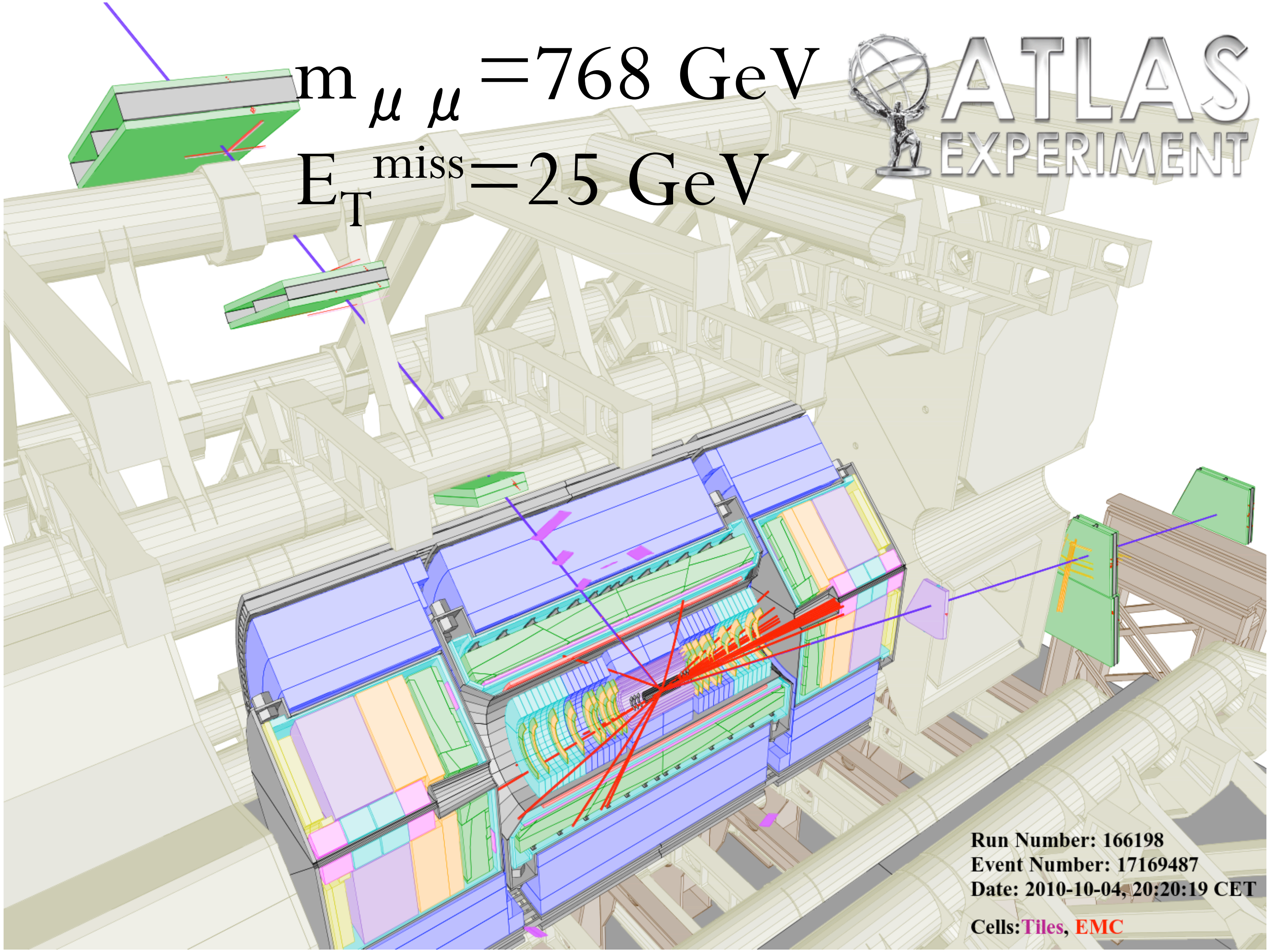


Search for W' (lepton + missing E_T): Limits

- Limits are obtained by a single counting CLs statistical procedure.
- The final one bin is defined by $m_T > 0.5 m_{W'/W*}$
- Assuming W' has SSM couplings we set an upper limit on its $\sigma \times$BR wrt SM couplings as a function of its mass
- Exclude
  $m_{W'} < 1.49$ TeV @ 95% CL
  (exp 1.45 TeV)
  CMS 1.58 TeV this conf
  (exp similar to ATLAS)

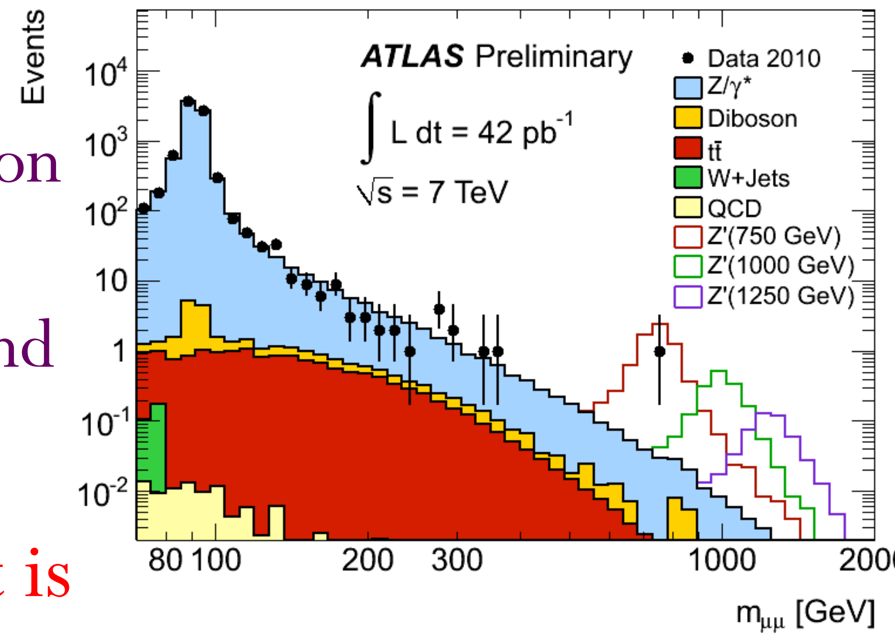


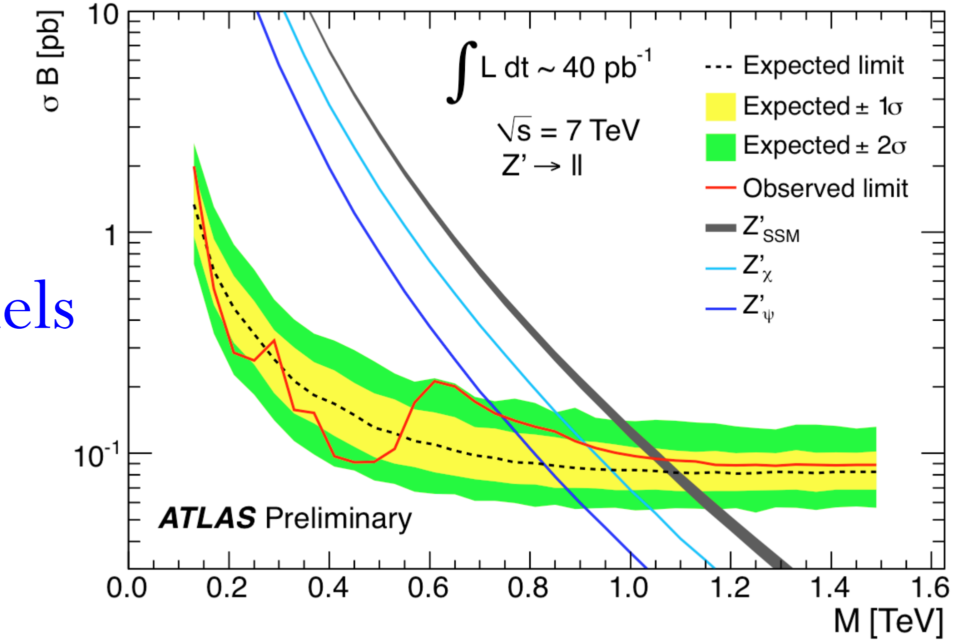
The highest dilepton event ever recorded



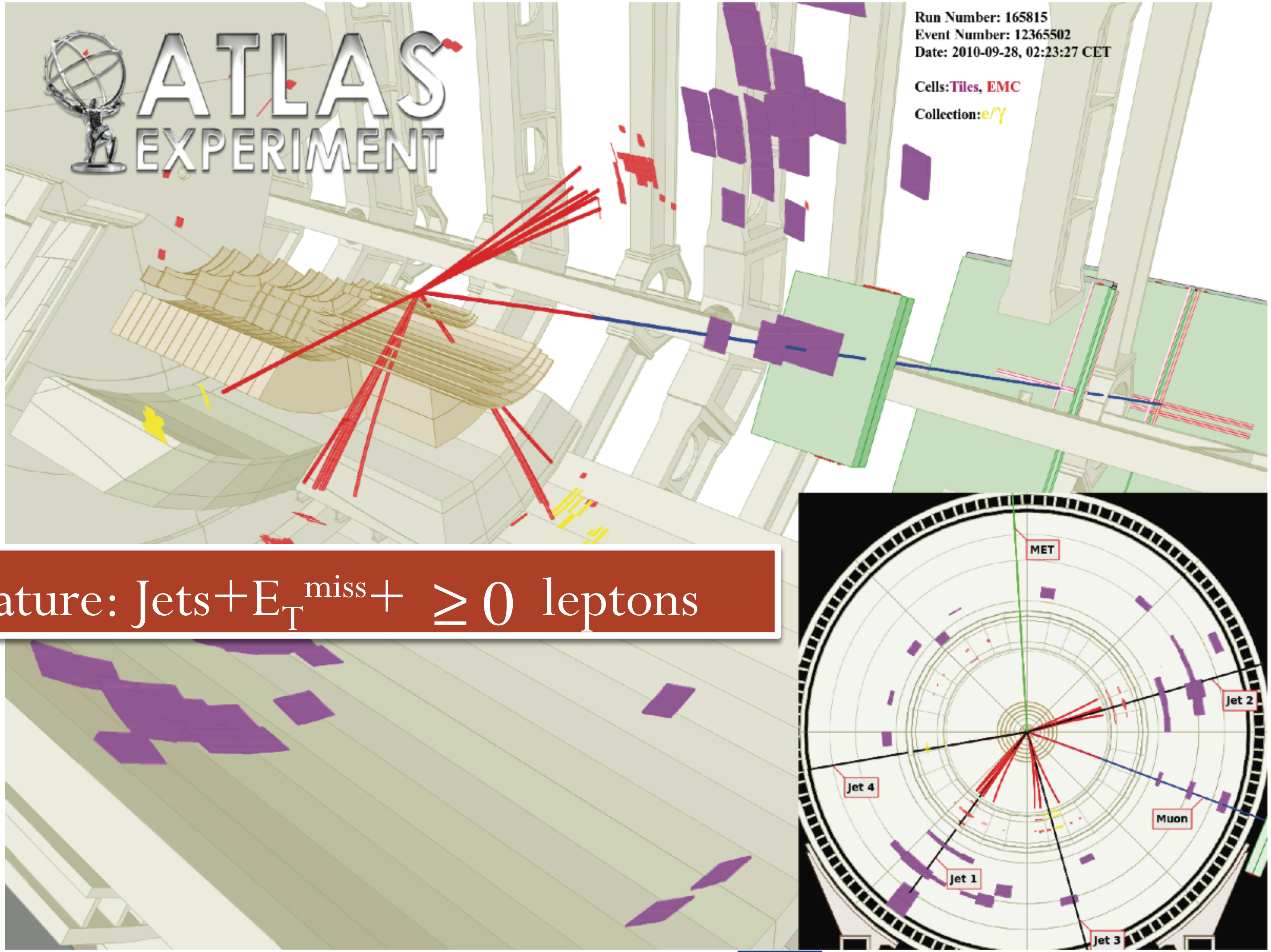
Search for Z'→ee,μμ

- Search for di-muons or di-electron resonances on top of a continuous falling background
- Given the absence of a signal ….
- SSM Z' combined mass limit is
  1.048 TeV (obs)
  1.084 TeV (expected)
  CMS 1.140 this conf
- Limits on E6-motivated Z' models
  e.g. $m_{Z'_\psi} > 727\ GeV$,
  $m_{z'_\chi} > 892\ GeV$





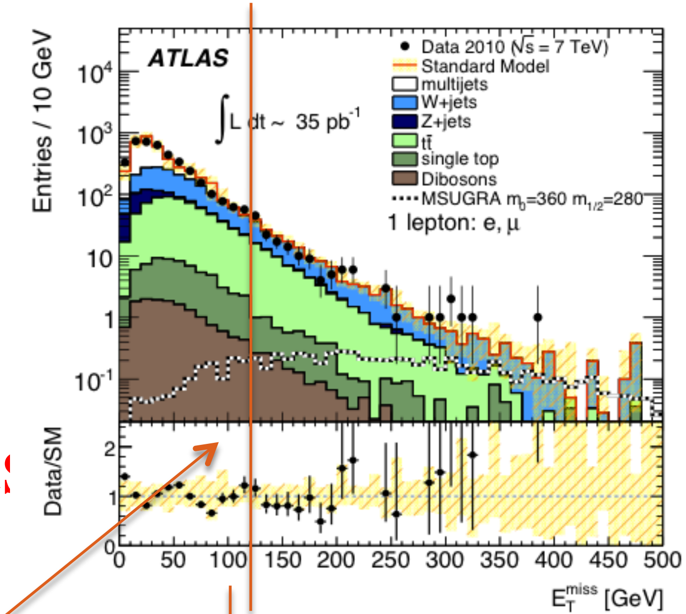
Supersymmetry Searches

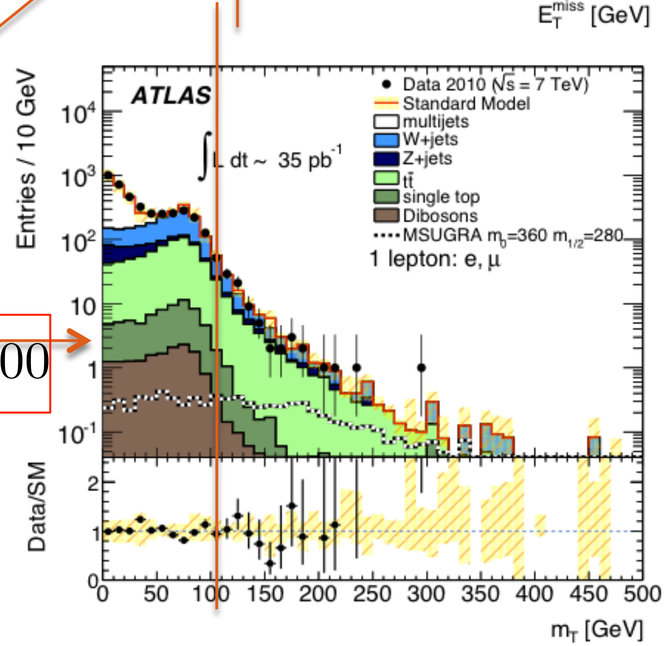


Signature: Jets+E_T^{miss}+ ≥ 0 leptons

SUSY: Final States with 1 Lepton,Jets and E_T^{miss}

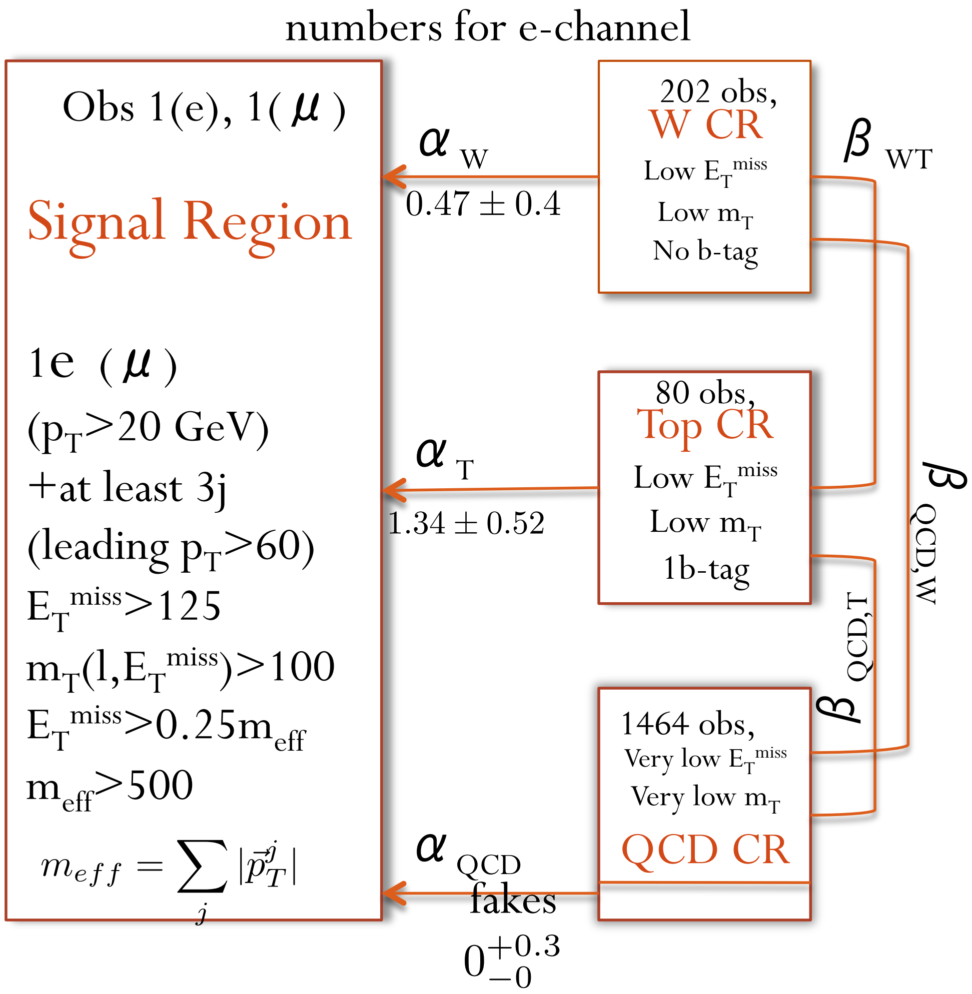
- The signature:
  - Exactly one isolated lepton with p_T>20 GeV
    - suppresses QCD multijet
  - At least three high-p_T jets with p_T>30, (leading with p_T>60 GeV)
  - Significant missing transverse energy
  - $m_T = \sqrt{2p_T^l E_T^{miss}(1 - cos\phi_{l,E_T^{miss}})} > 100$
- Main BG sources: W+jets, TOP and QCD (fakes)





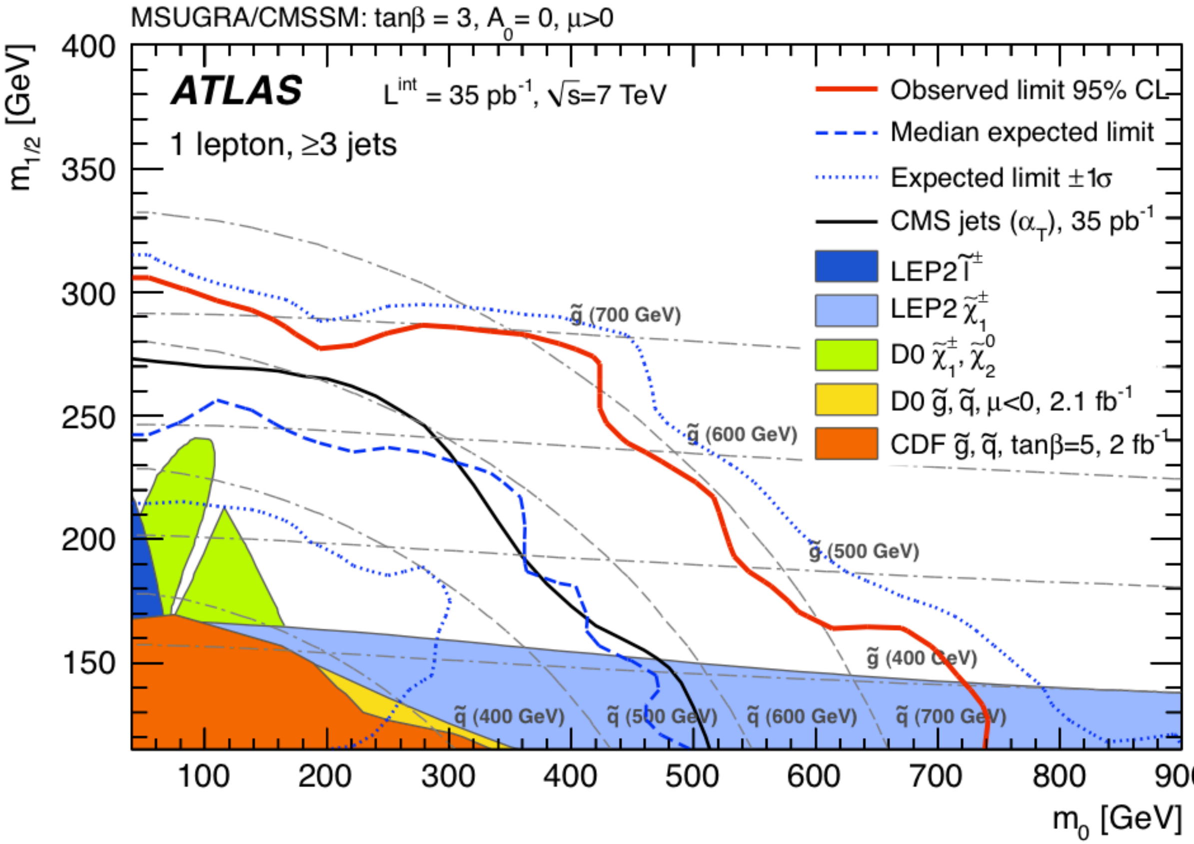
SUSY: Final States with 1 Lepton,Jets and E_T^{miss}

- Signal region + 3 Control regions for main BG sources.
- $L(n|s,b,\theta) = P_S \times P_W \times \times P_{Top} \times P_{QCD} \times C_{syst}$
- θ represents the systematic uncertainties
- C_{syst} represents the constraints on systematic uncertainties, including correlations.
- Use Profile Likelihood to set limits on contributions to new physics



SUSY: Final States with 1 Lepton,Jets and E_T^{miss}

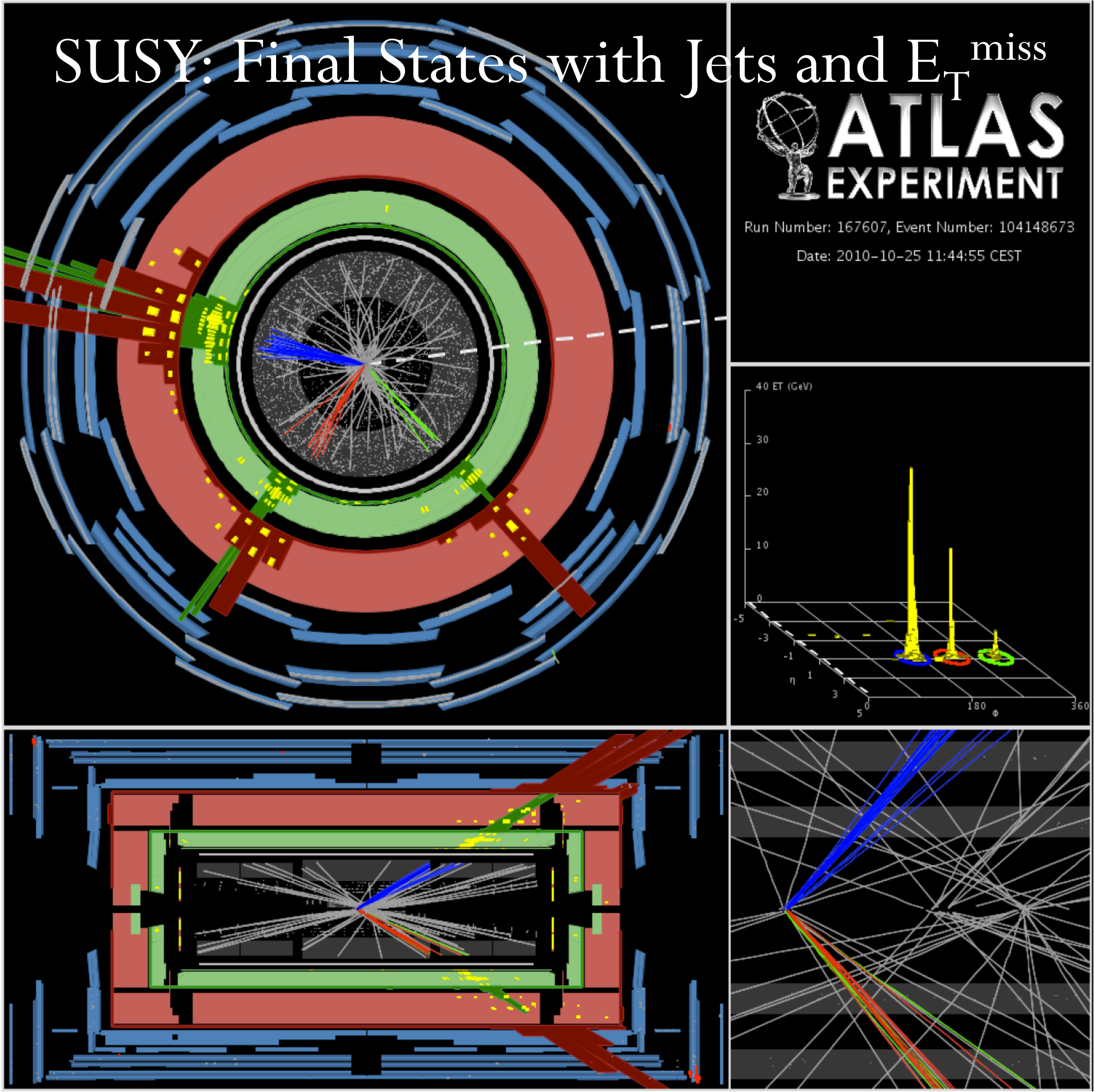
- The results are interpreted within the mSUGRA benchmark, as limits in the $(m_0, m_{1/2})$ plane
- limits depend only moderately on tan β
- For the model considered and for $m_{\tilde{q}} = m_{\tilde{g}}$, $m_{\tilde{g}} > 700\ GeV\ @95\%\ CL$



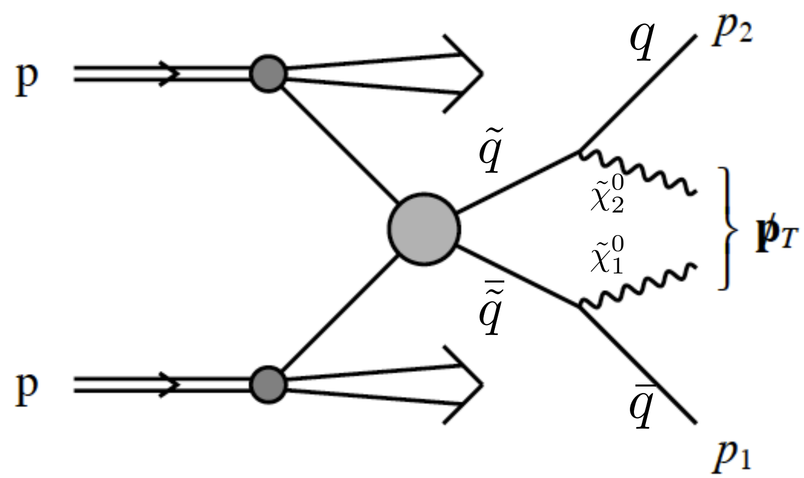
model ind 95% CL upper limit	e channel	μ channel
events	2.2	2.5
σ (pb)	0.065	0.073

3jets $+E_T^{miss}$

- This is a signal candidate event found in the light $\tilde{q}\bar{\tilde{q}}, \tilde{g}\tilde{g}, \tilde{g}\tilde{q}$ signal regions



SUSY: Final States with Jets and E_T^{miss}



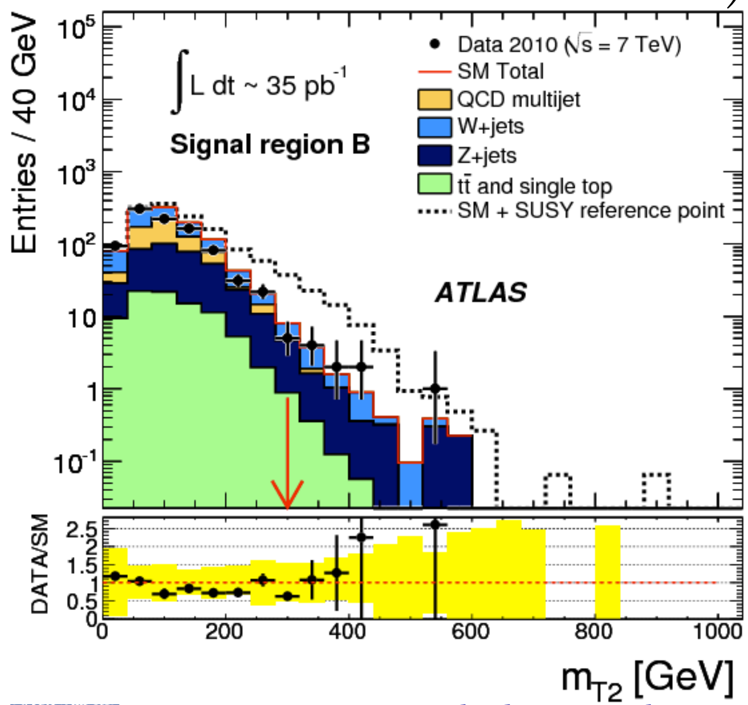
- Large $E_T^{miss} > 100$
- Use mass variables

$$m_{eff} = E_T^{miss} + p_T^{jet1} + p_T^{jet2}$$

$$m_{T2} = \sqrt{min[max\{m_T^2(q_1, p_1^{miss}), m_T^2(q_2, p_2^{miss})\}]}$$

$$p_{T,1}^{miss} + p_{T,2}^{miss} = p_T^{miss}$$

mass variables >300-500 Ge)



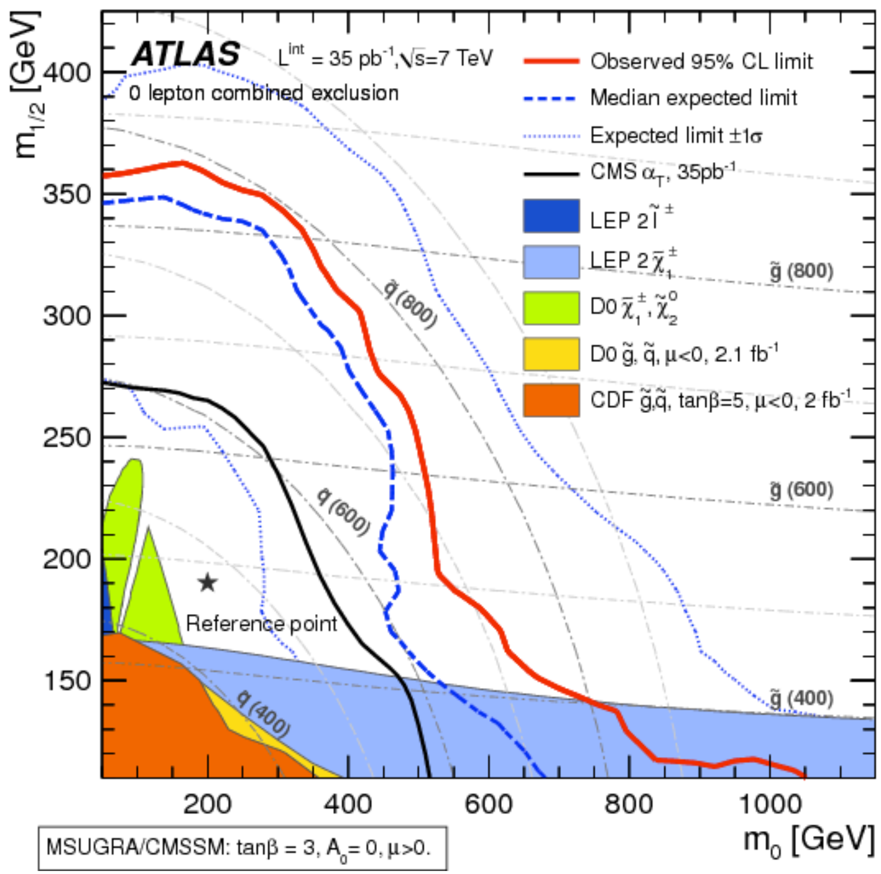
$ref / m_{1/2} = 190, m_0 = 200, A_0 = 0, tg\beta = 3, \mu > 0$

- lepton veto
- BG from W+j, Z+j, Top
- Optimize to maximal acceptance in the $(m_{\tilde{g}}, m_{\tilde{q}})$ plane for models where all other SUSY particles beyond the reach of LHC

SUSY: Final States with Jets and E_T^{miss}

- Limits obtained with the PL method
- Good agreement with SM
- Gluino masses below 500 GeV are excluded in simple model containing only squarks, a gluino octet and a massless neutralino
- Exclusion increases to 870 GeV for $m_{\tilde{g}} = m_{\tilde{q}}$
- In mSUGRA same mass squarks and gluinos are excluded below 775 GeV

(parameters indicated in the plot)



Summary

- Higgs: will soon catch up with TEVATRON sensitivity
- Exotics:
  - m_{q*}>2.6 TeV (exp 2.08)
    TEVATRON 0.87 TeV @1130 pb^{-1}
  - Axigluon 2.10 TeV,
  - QBH 3.67 TeV (exp 3.64) for n=6 extra dimensions
  - $m_{W'}$>1.49 TeV (exp 1.45)
  - $m_{Z'}$>1.048 TeV (exp 1.084)
- SUSY:
  - Model dependent, yet lower limits on $m_{\tilde{g}}, m_{\tilde{q}}$ >500-800 GeV
    large improvement over previous bounds
- IN SHORT:

We have only just began and already rewriting the pdg

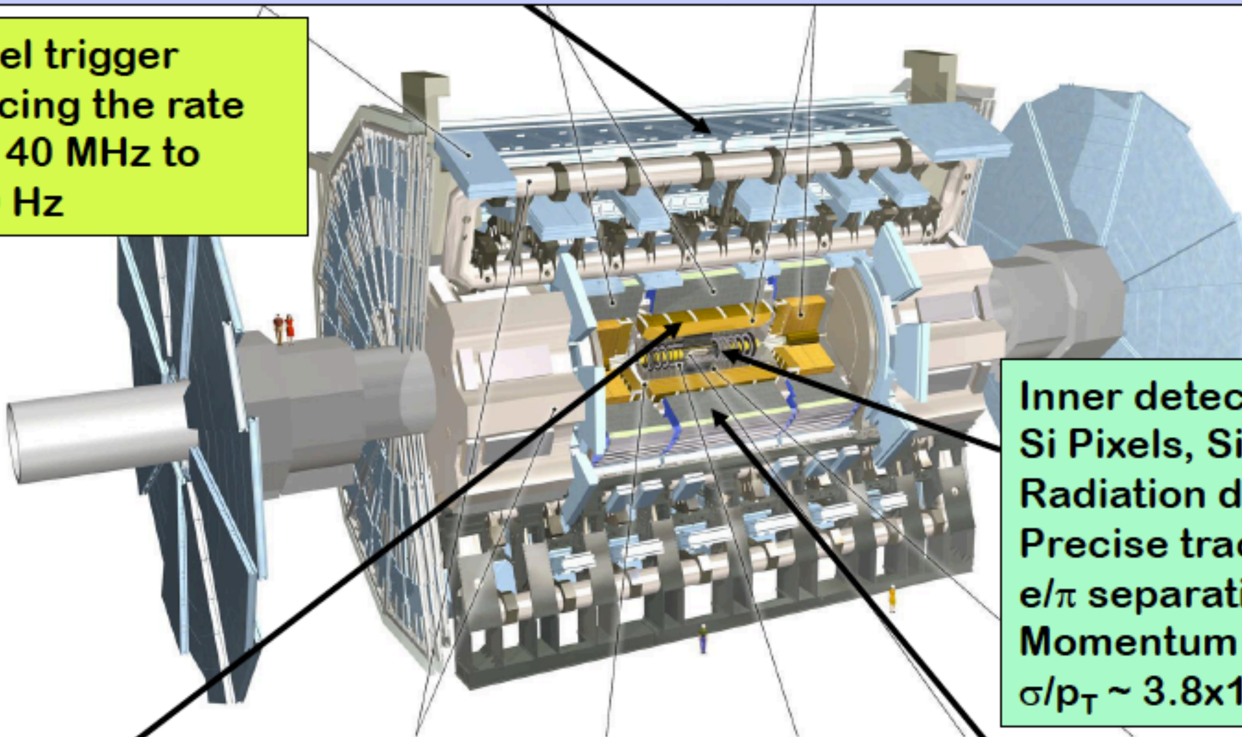
BACKUP

The ATLAS detector

Muon spectrometer ($|\eta|<2.7$): air-core toroids with gas-based muon chambers
Muon trigger and measurement with momentum resolution < 10% up to $p_\mu \sim 1$ TeV

3-level trigger reducing the rate from 40 MHz to ~200 Hz

Length: ~ 46 m
Radius: ~ 12 m
Weight: ~ 7000 tons
~10^8 electronic channels
3000 km of cables



Inner detector ($|\eta|<2.5$, B=2 T):
Si Pixels, Si strips, Transition Radiation detector (straws)
Precise tracking and vertexing, e/π separation
Momentum resolution:
$\sigma/p_T \sim 3.8\times10^{-4}\, p_T(\text{GeV}) \oplus 0.015$

EM calorimeter: Pb-LAr accordion
e/γ trigger, identification and measurement
Energy resolution: $\sigma/E \sim 10\%/\sqrt{E} \oplus 0.7\%$

HAD calorimeter ($|\eta|<5$): segmentation, hermeticity
Fe/scintillator Tiles (central), Cu/W-LAr (forward)
Trigger and measurement of jets and missing E_T
Energy resolution: $\sigma/E \sim 50\%/\sqrt{E} \oplus 0.03$

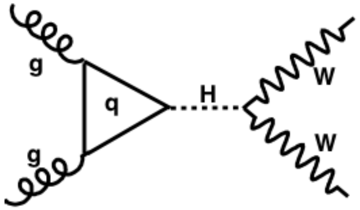
Frequently Used Objects

These are the objects used in H→WW analysis, details might be analysis dependent

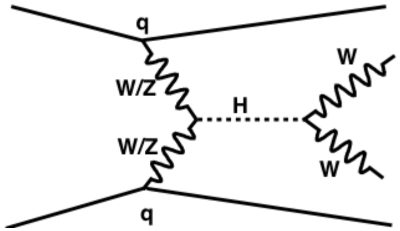
- Electrons: Energy from calorimeter cluster, η, ϕ from track
  Isolation within $\Delta R = \sqrt{\Delta\phi^2 + \Delta\eta^2} = 0.3$ $|\eta| < 2.47, excludec\ crack\ 1.37 < |\eta| < 1.52$
- Muons: Combined ID tracks +Muon Spectrometer , $|\eta| < 2.4$
  Same isolation criteria
- Jets: Reconstructed from topological clusters using IR-safe anti kT algorithm with size parameter D=0.4;
  $p_T$jet>25 GeV $|\eta| < 4.5$
- b-jets: Displaced secondary vertex with a weight SV0>5.72 which gives 50% eff for b-jets from t-quarks
- $E_t$miss: Reconstructed from topological energy clusters in calorimeters, with corrections for Muons

H→WW→ll+E_T^{miss}, the Higgs flag analysis (so far)-I

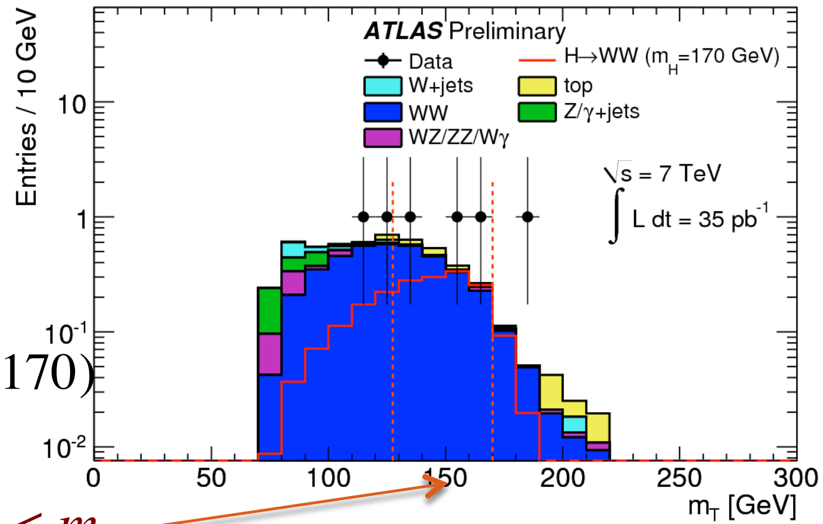
- H+0j,H+1j



- H+2j



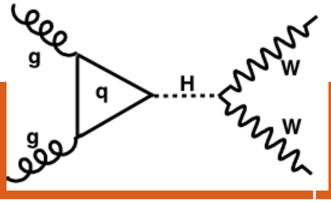
- Preselection
  - Trigger and event cleaning (→L=35 pb-1)
  - 2 opposite sign isolated leptons (ee, $\mu\mu$, eμ) with p_T>20,15 GeV
  - Veto against same flavour di-lepton resonances
    m_{ll} > 15 GeV, $|m_{ll}-m_Z|$ > 10 GeV
  - E_T^{miss}>30 GeV (against QCD)
- Topological Cuts
  - Spin correlations discriminate H vs WW
    $$\Delta\phi_{ll} < 1.3\ (m_H < 170),\ \Delta\phi_{ll} < 1.8\ (m_H \geq 170)$$
  - Transverse mass

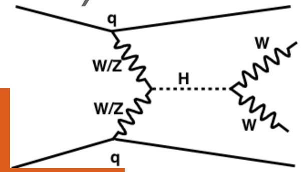


$$m_T = \sqrt{(E_T^{ll} + E_T^{miss})^2 - (\vec{p}_T^{\,ll} + \vec{p}_T^{\,miss})^2} \qquad 0.75 \times m_H < m_T < m_H$$

  - m_{ll}<50 (65) GeV for $m_H < 170\ (m_H \geq 170)$ mass (H+0,1 Jets), <80 (H+2jets)

H→WW→ll+E_T^{miss}, the Higgs flag analysis (so far)-I

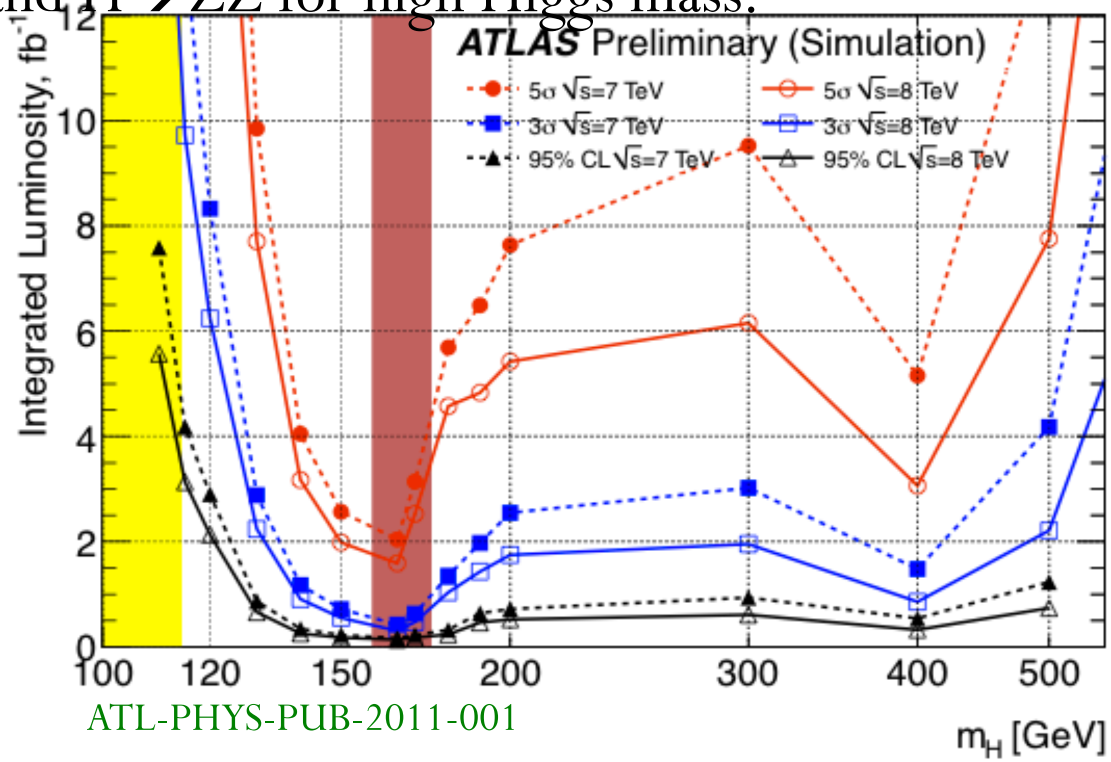




H+0jets	H+1jet	H+2jets
Jet Veto	1jet, Anti b-tag	2 forward tagged jets Anti b-tag
$\|p_T^{ll}\|>30$ GeV	$\|p_T^{tot}\|<30$ GeV to suppress soft gluons recoiling against the ll+1j	$\|p_T^{tot}\|<30$ GeV
	Use collinear mass fit to reject $Z\rightarrow\tau\tau$	Use collinear mass fit to reject $Z\rightarrow\tau\tau$
		No jet activity in central region
		2 jets in opposite hemispheres
		Tagged jets separated $\Delta\eta>3.8$
		$m_{jj}>500$ GeV

Near future of Higgs search

- H→γγ is the most sensitive channel for low Higgs mass
- H→WW for intermediate and H→ZZ for high Higgs mass.
- With $4fb^{-1}$ ATLAS can exclude a SM Higgs all the way to 500 GeV at $\sqrt{s}$=7 TeV
- Complex analyses, though, will probably do much better – (perhaps <$3fb^{-1}$ will do)



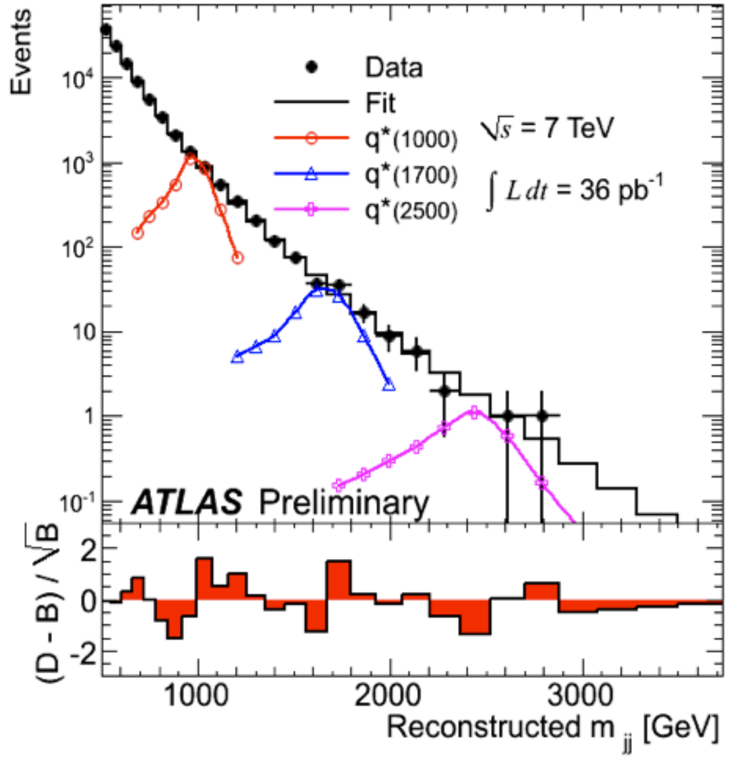
ATL-PHYS-PUB-2011-001

This rough combination with
H→γγ, ττ, VBF (H→bb),
H→WW→lνlν, H→ZZ→llνν, llbb, 4l

Bill Murray, Chamonix 2011

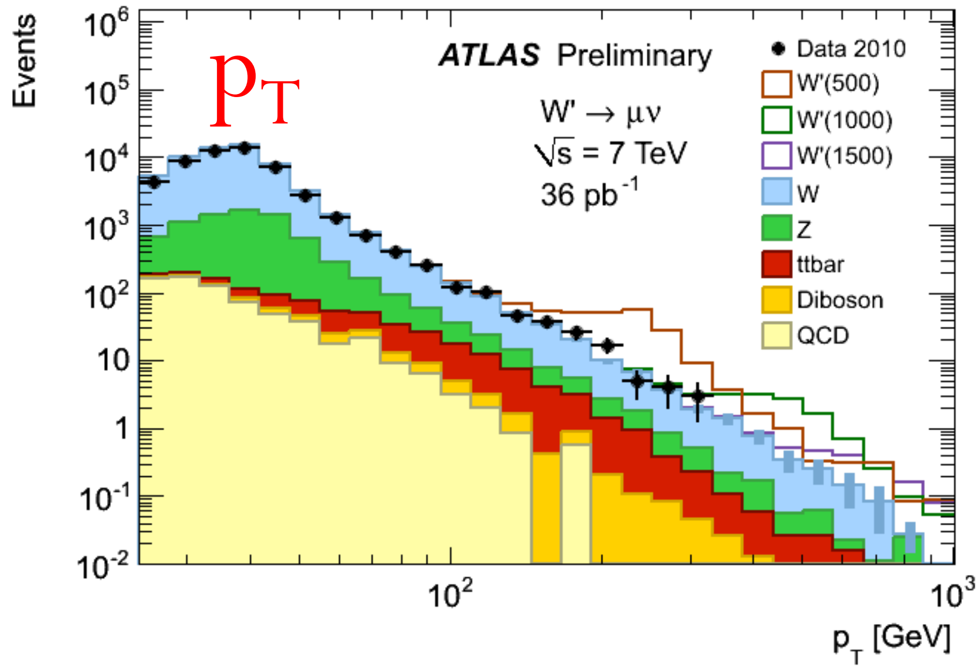
Search for Physics is Dijet Mass

- Look for final states with two very energetic jets of particles produced with large transverse momentum (p_T) transfer.
- These are 2→2 scattering well understood in the SM framework (QCD)
- Benchmark signal: BSM resonant processes such as qg→q*
  The compositeness scale M is set to m_{q*}, with f_s=1, $\mathcal{L} = \frac{g_s f_s}{4M} \bar{q}^*_R \sigma^{\mu\nu} \lambda_a G^a_{\mu\nu} q_L$
- Observable $m^{jj} = \sqrt{(E_1 + E_2)^2 + (\vec{p}_1 + \vec{p}_2)^2}$
- A bump hunter is constructed to look for a peak anywhere, taking into account the look elsewhere effect
- The lowest *p-value* in trying to reject the background-only hypothesis and observe a signal, occur at *995-1253* GeV, with *p-value=0.39*→ *No Evidence*



Search for W' (lepton + missing E_T)

- Muons are requested to have hits in three Muon stations ($|\eta|<1.05$) $p_T>25$ Ge
- Electrons are required to have $E_T>25$ GeV
- Missing E_T:
  electrons $\mathbf{E}_{\mathrm{T}}^{\mathrm{miss}} = \mathbf{E}_{\mathrm{Tcalo}}^{\mathrm{miss}} = -\sum_{\mathrm{topo}} \mathbf{E}_{\mathrm{T}}^{\mathrm{clus}}$
  muons $\mathbf{E}_{\mathrm{T}}^{\mathrm{miss}} = \mathbf{E}_{\mathrm{Tcalo}}^{\mathrm{miss}} - \mathbf{p}_{\mathrm{T}}^{\mu} + \mathbf{E}_{\mathrm{T}}^{\mu,\mathrm{loss}}$
- Missing E_T threshold is applied to suppre QCD background $E_T^{miss}>25$ GeV
- In the electron channel where QCD background at high m_T is of more concern, require $E_T^{miss}>0.6p_T$



Search for W' (lepton + missing E_T)

- Standard Sequential Model (SSM) contains W', Z' with a SM coupling and width linearly increasing with mass (also chiral W*)

- One model adds new types of spin-1 chiral bosons, which are complementary to the gauge ones. The charged partner of these chiral bosons is the W* which decays to a lepton and neutrino with completely different kinematics.

- ATLAS finds no evidence neither for this or for this…

- Yet the search is challenging because it requires the understanding of the tail of the Standard Model W m_T distribution.

$$m_T = \sqrt{2 p_T^{\ell} E_T^{miss} (1 - \cos\varphi_{\ell\nu})}$$

Supersymmetry Searches

MSSM-124

2 Higgs Doublets H_1, H_2; R_P

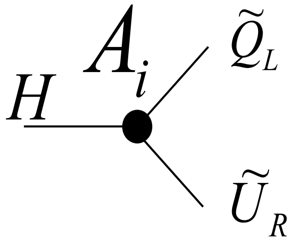
At GUT (10^{16} GeV)

$M_3 = M_2 = M_1 = m_{1/2}$ $\quad m_{\tilde{f}} = m_0$

SU(3) X SU(2) X U(1)

$A_i = A_0$

$m^2_{H_i} = m_0^2 + \mu^2$



mSUGRA GUT: $m_0, m_{1/2}, A_0, B_0, \mu_0$

$\frac{\partial V}{\partial H_i} = 0$ SSB: Low Energy

$M_1 : M_2 : M_3 = \alpha_1 : \alpha_2 : \alpha_3$

$tg\beta = \frac{\langle v_{up} \rangle}{\langle v_{down} \rangle} = \frac{\langle H_2 \rangle}{\langle H_1 \rangle}$

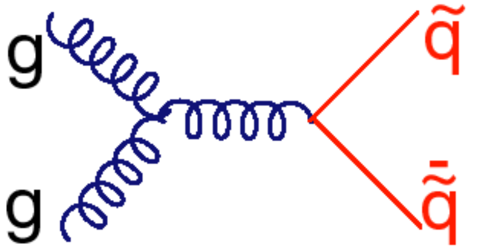
5 pars: $(m_0), (m_{1/2}), A_t, tg\beta, sign(\mu)$

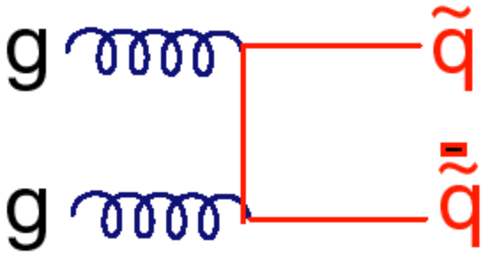
Spin	0	1/2	1
Gauge Sector	H^0, h^0, A^0	$\tilde{B}$, $\tilde{H}, \tilde{h}$, $\tilde{W}$ } $\tilde{\chi}_i^0$ neutralinos; $\tilde{\chi}_1^0$ LSP	γ, z^0
	$H^{\pm}$	$\tilde{H}^{\pm}$ $\chi^{\pm}_{1,2}$ $\tilde{W}^{\pm}$ charginos	$W^{\pm}$
		$\tilde{g}$ gluino	g
Particles Sector	sleptons, sneutrinos: $\tilde{\ell}_{R,L}, \tilde{\nu}$	ℓ, ν	
	squarks: $\tilde{q}_{R,L}$	q	

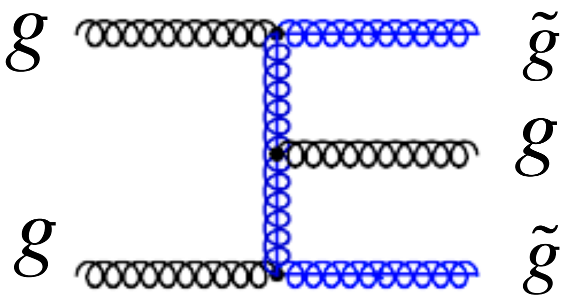
In R-parity conserving SUSY models the LSP is stable and escapes detection leading to events with large E_T^{miss}

Supersymmetry Searches

- Production







- Decay
- Typical sfermion mass hierarchy

$$m_{\tilde{q}} >> m_{\tilde{\ell}_L} \sim m_{\tilde{\upsilon}} > m_{\tilde{\ell}_R}$$

- $\tilde{q}_L \to q\tilde{\chi}^{\pm}$
- $\tilde{g} \to q\bar{q}'\tilde{\chi}^{\pm}$

- Possible chargino decays

$$\tilde{\chi}^{\pm} \to W^{\pm}\tilde{\chi}^{0} \to l\nu\tilde{\chi}^{0}$$
$$\tilde{\chi}^{\pm} \to W^{\pm}\tilde{\chi}^{0} \to q\bar{q}'\tilde{\chi}^{0}$$

Signature: Jets+E_T^{miss}+ ≥ 0 leptons

SUSY: Final States with 1 Lepton,Jets and E_T^{miss}

- The signature:
  - Exactly one isolated high-transverse momentum
    (p_T>20 GeV) electron or muon→
    - suppresses QCD multijet
    - enables trigger
  - At least three high-p_T jets
    (p_T>30, leading with p_T>60 GeV)
  - Significant missing transverse momentum (E_T^{miss}>125).
    $\Delta\Phi(jet,\vec{E}_T^{miss}) > 0.2$ against fakes
  - $m_T = \sqrt{2p_T^l E_T^{miss}(1 - cos\phi_{l,E_T^{miss}})} > 100$
- Main BG sources:
  W+jets, TOP and QCD (fakes)