ATLAS and DPNC

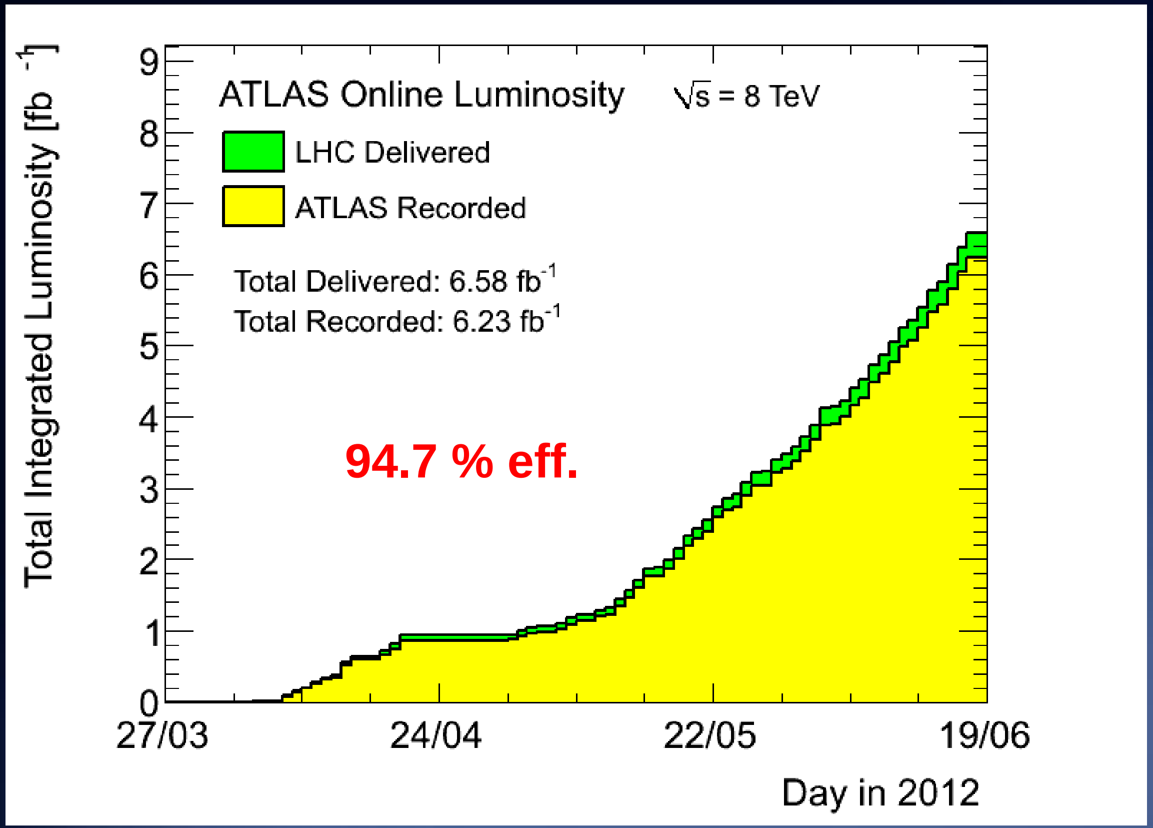
18 June 2012

Marzio Nessi

23 years of dreams …. starting in 1989 …

2012 promises to be a decisive discovery year !!!

Detector and trigger in excellent shape !



ATLAS 2012 p-p run										
Inner Tracker			Calorimeters		Muon Spectrometer				Magnets	
Pixel	SCT	TRT	LAr	Tile	MDT	RPC	CSC	TGC	Solenoid	Toroid
100	99.4	100	95.0	98.7	100	99.2	100	99.9	100	100

Luminosity weighted relative detector uptime and good quality data delivery during 2012 stable beams in pp collisions at √s=8 TeV between April 4th and May 31st (in %) – corresponding to 3.5 fb^{-1} of recorded data. The inefficiencies in the LAr calorimeter will partially be recovered in the future.

L1			HLT						
Muon	Calo	CTP	electron	photon	muon	tau	jet	b-jet	missing E_T
99.0	100	99.8	99.3	99.3	100	99.9	98.6	99.9	99.3

Luminosity weighted relative trigger quality delivery during 2011 stable beams in pp collisions at √s=7 TeV between 13 March and 31 October (in %).

Recorded:

2010 @ 7 TeV : 0.05 fb^{-1}
2011 @ 7 TeV : 5.25 fb^{-1}
2012 @ 8 TeV : 6.23 fb^{-1}

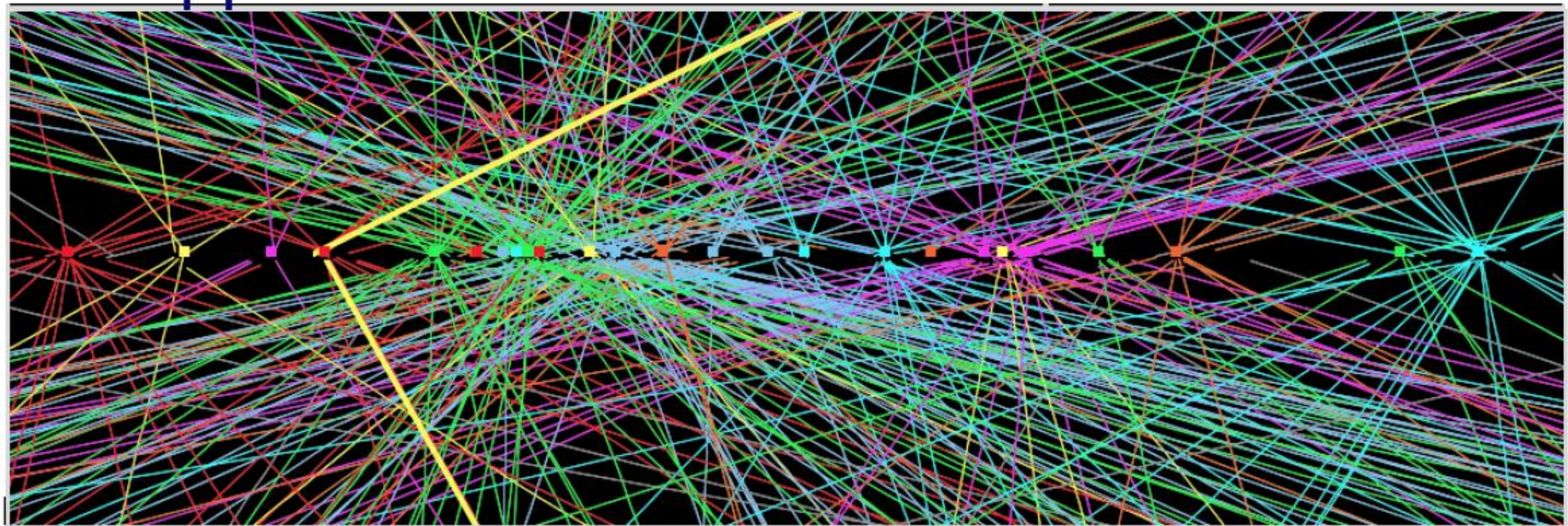
11.53 fb^{-1} in proton runs
166. μb^{-1} in HI runs

More then 91% of all data good for any type of analysis

ATLAS EXPERIMENT

Detector performing already above design specifications

Z→μμ event from 2012 data with 25 vertices



Lpeak ~ $7 \cdot 10^{33}$ cm^{-2} sec^{-1}

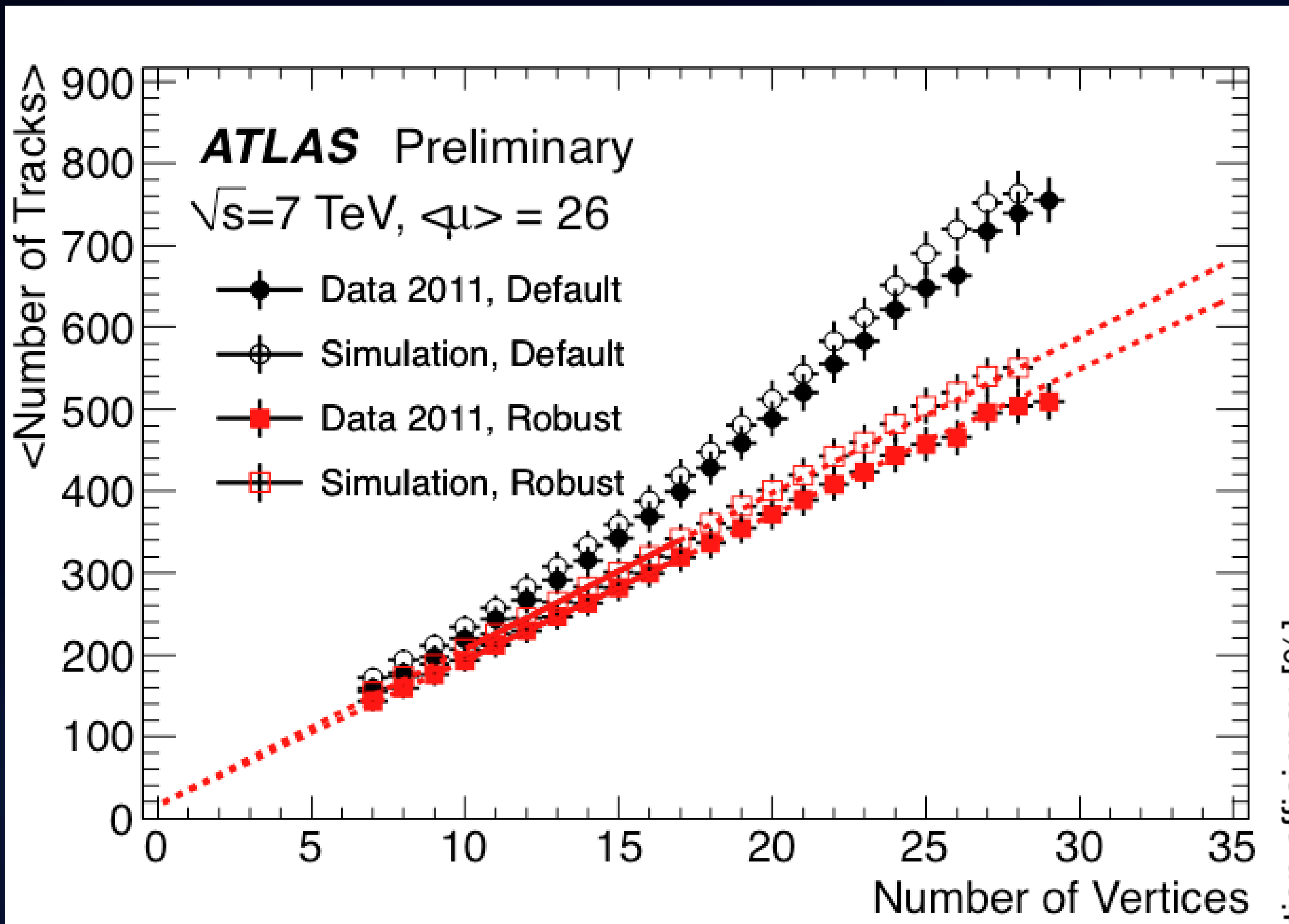
@ 50 ns bunch spacing

~ 32 event/bncx at the beginning of the fill, with fluctuations up to 41

We designed ATLAS for 25 pile up events (average)

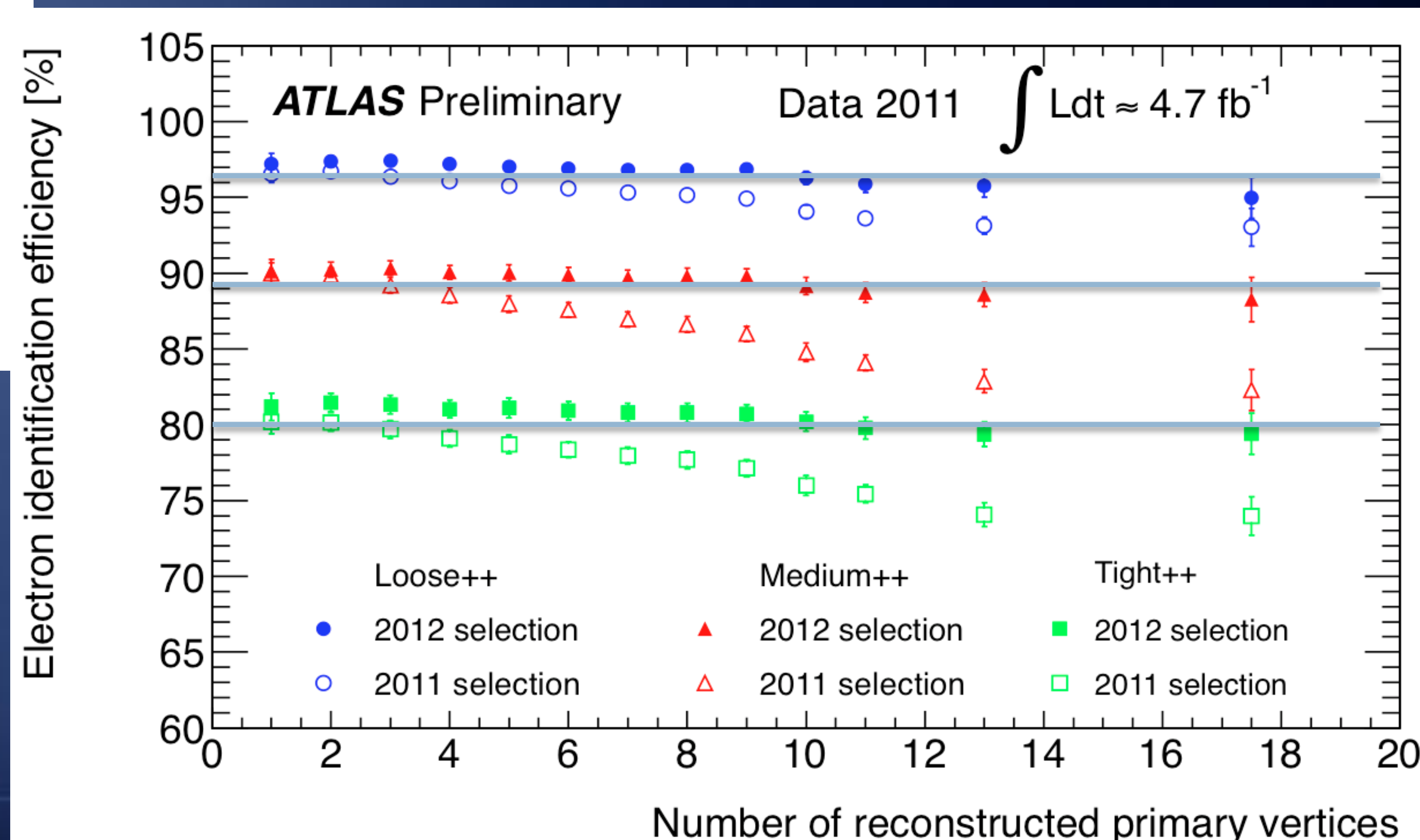
@ 14 TeV, 25 ns we will be for sure ok up to Lpeak ~ $1.3 \cdot 10^{34}$ cm^{-2} sec^{-1}

Does the detector really work on such extreme conditions? (1)



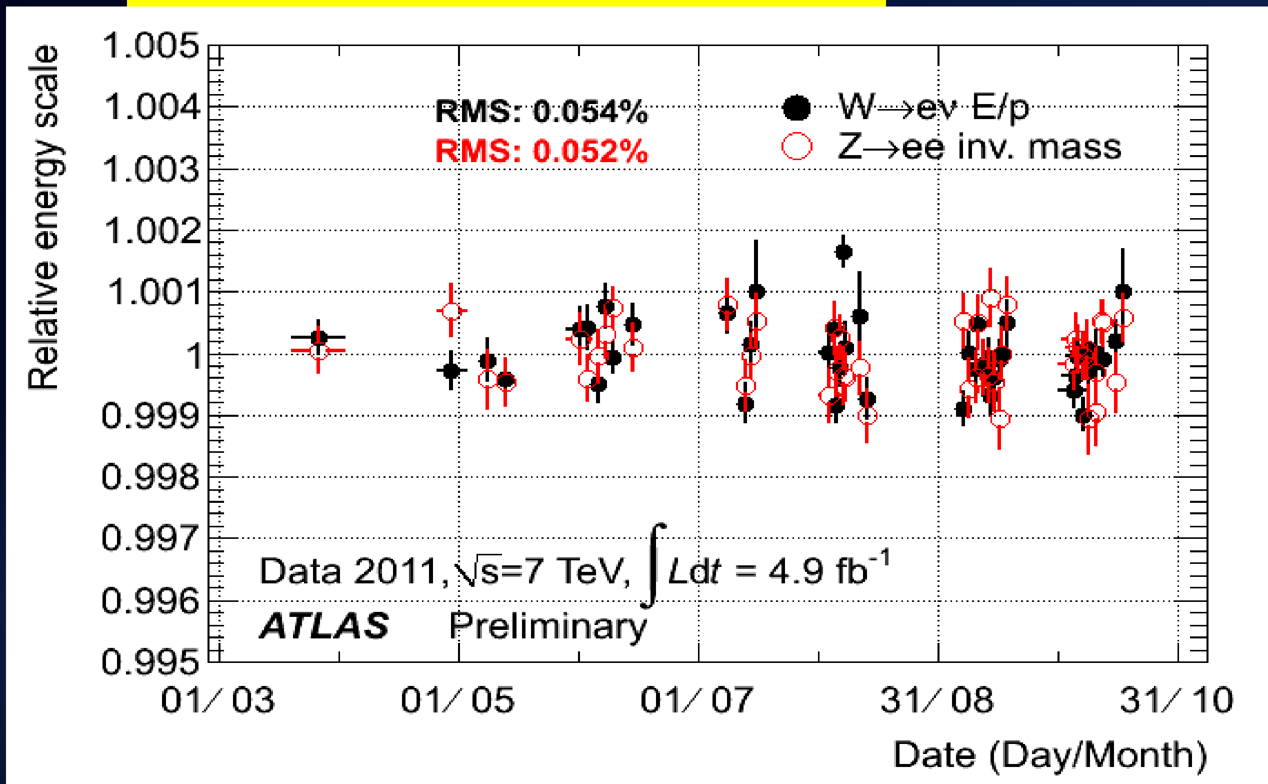
Number of tracks scales linearly with pileup
Fakes increase but can be recovered with "robust" cuts

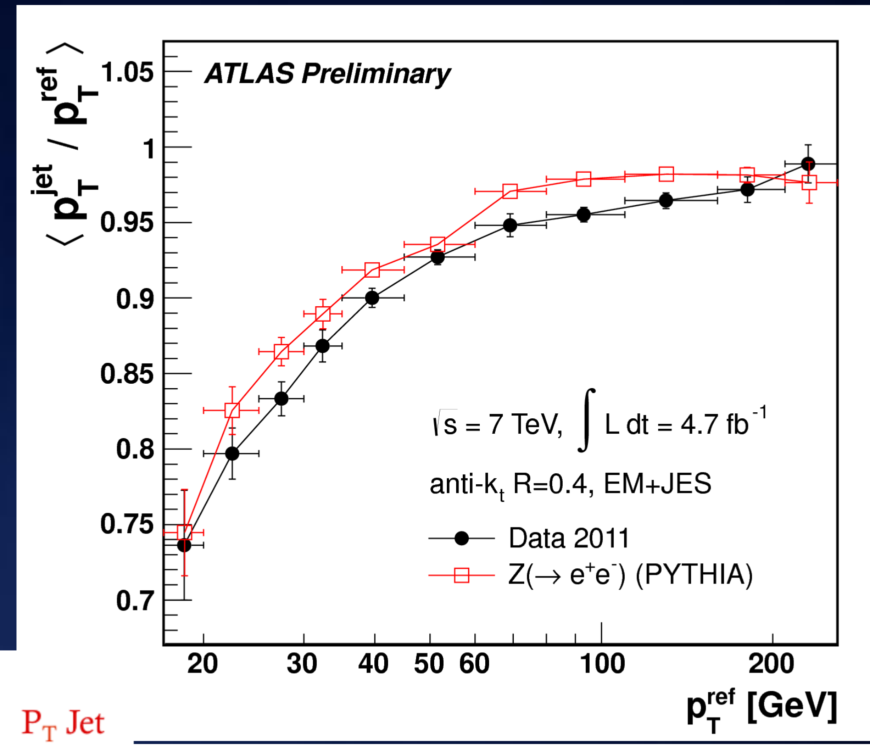
Electron identification efficiency before and after retuning the reconstruction algorithms (cuts in particular)

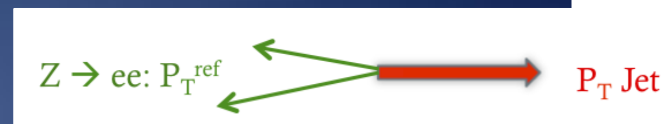


Does the detector really work on such extreme conditions? (2)

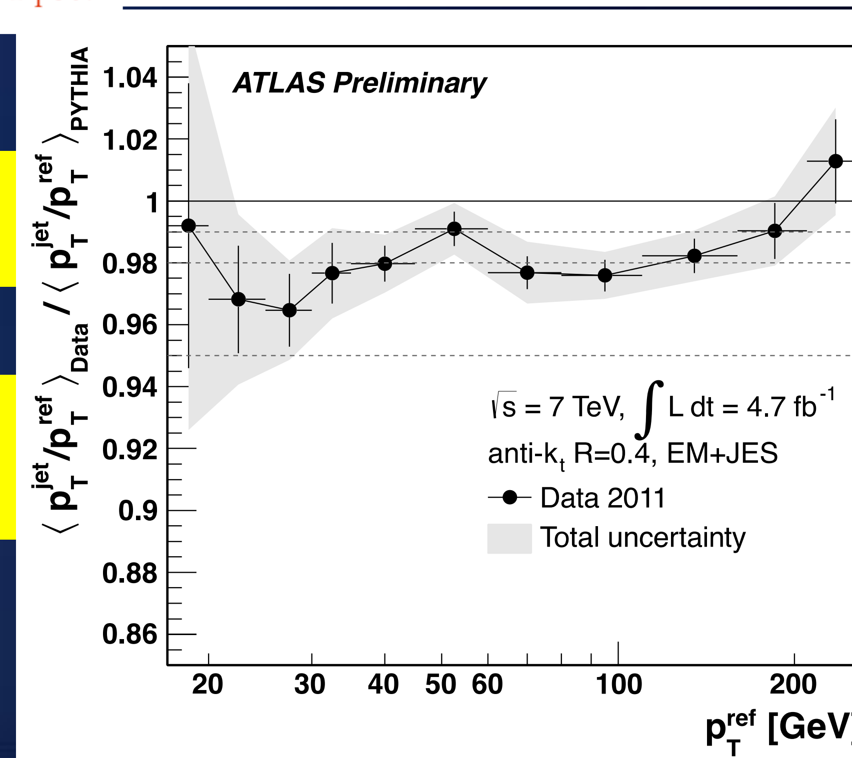
Stability of the EM calorimeter E-scale vs time during the run (pile up changes)







Uncertainty less than 2% for p_t > 25 GeV



Jet E-scale calibration with Z+jet events (jet E-scale known to better than ~1% in some p_T/η ranges)

η coverage	2011 resolution (GeV)	2010 resolution (GeV)
|η| < 2.47	1.76 ± 0.01	1.88 ± 0.08
|η| < 1.37	1.60 ± 0.01	1.62 ± 0.09
2.47 < |η| < 1.37	1.99 ± 0.02	1.99 ±0.22

Z->ee mass resolution stable as a function of pile up

ATLAS EXPERIMENT

Does the detector really work on such extreme conditions? (3)

	Offline Selection	**Trigger Selection**		**L1 Peak (kHz)** **L_{peak}= 7e33**	**EF Ave (Hz)** **L_{ave}= 5e33**
		L1	EF		
Single leptons	Single muon > 25GeV	15 GeV	24 GeV	8	45
	Single electron > 25GeV	18 GeV	24 GeV	17	60
Two leptons	2 muons >15 2 muons > 20,10 GeV	2x10 GeV 15GeV	2 x 13 GeV 18,8 GeV	1 8	5 8
	2 electrons, each > 15GeV	2x10 GeV	2x12 GeV	6	8
	2 taus > 45, 30GeV	15,11 GeV	29,20 GeV	12	12
Two photons	2 photons, each > 25GeV 2 loose photons, > 40,30	2 x10 GeV 12,16 GeV	2 x 20 GeV 35, 25 GeV	6 6	10 7
Single jet	Jet pT > 360 GeV	75 GeV	360 GeV	2	5
MET	MET > 120 GeV	**40 GeV**	80GeV	2	17
Multi-jets	5 jets, each pT > 55 GeV	4x15GeV	5x55GeV	1	8
b-jets	b + 3 other jets pT>45 GeV	4x15GeV	4x45GeV+btag	1	4
TOTAL				**<75**	**~400 (mean)**

- Tracking based isolation applied to single leptons at EF to limit rate
- Above triggers are used by most analyses, currently 564 items in the menu
- Many Specialized triggers, e.g. J/ψ -> e^+e^- for efficiency studies.

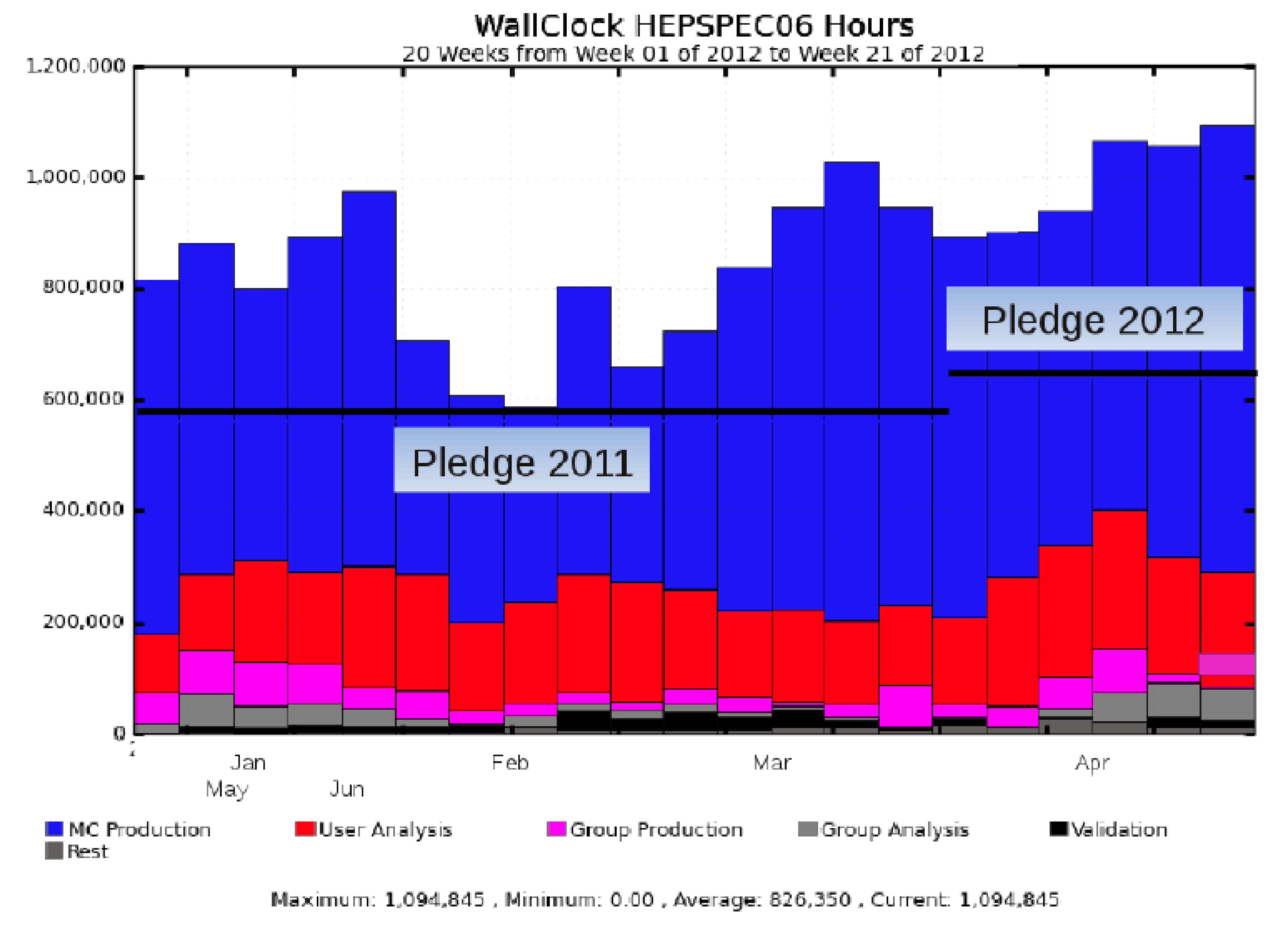
ATLAS EXPERIMENT

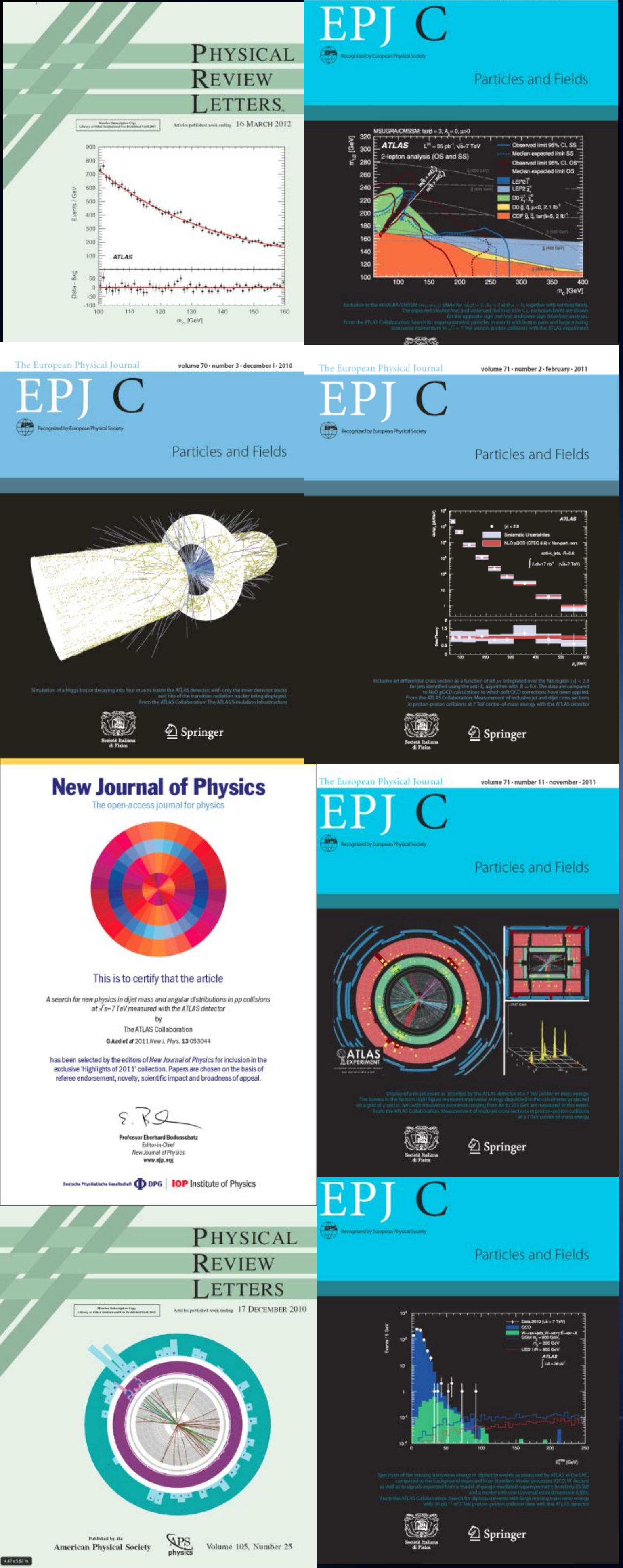
And computing follows

Number of concurrent jobs at all ATLAS Tiers: CERN, 10 Tier1-s,~ 70 Tier2 federations → > 80 sites

Available resources fully used (stressed ...)

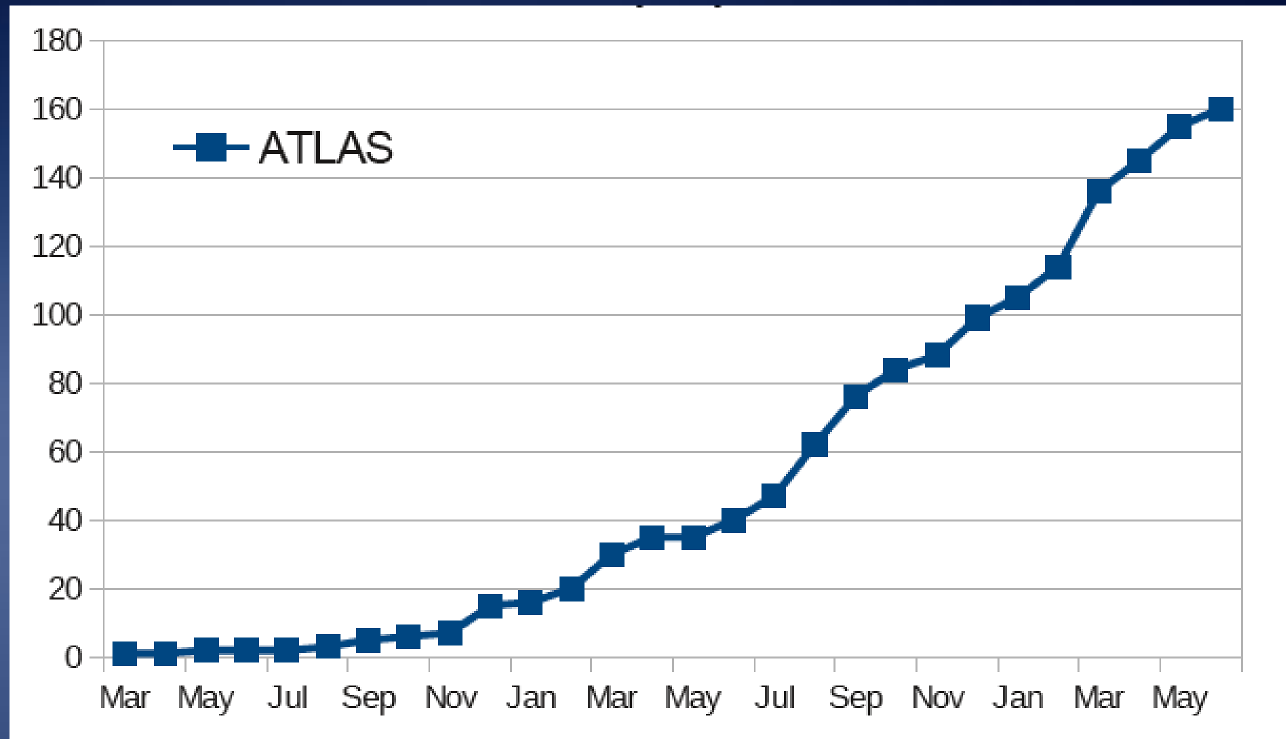
ATLAS Computing Model has proven to be very flexible, adapting to data-taking and analysis demands (e.g. dynamic data placement, less reprocessing than foreseen, very intense simulation)

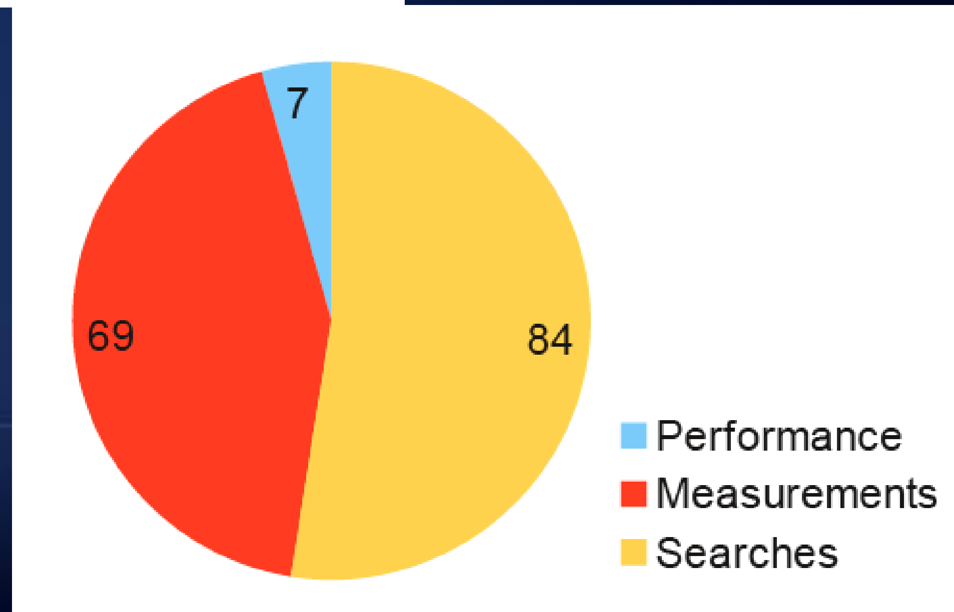




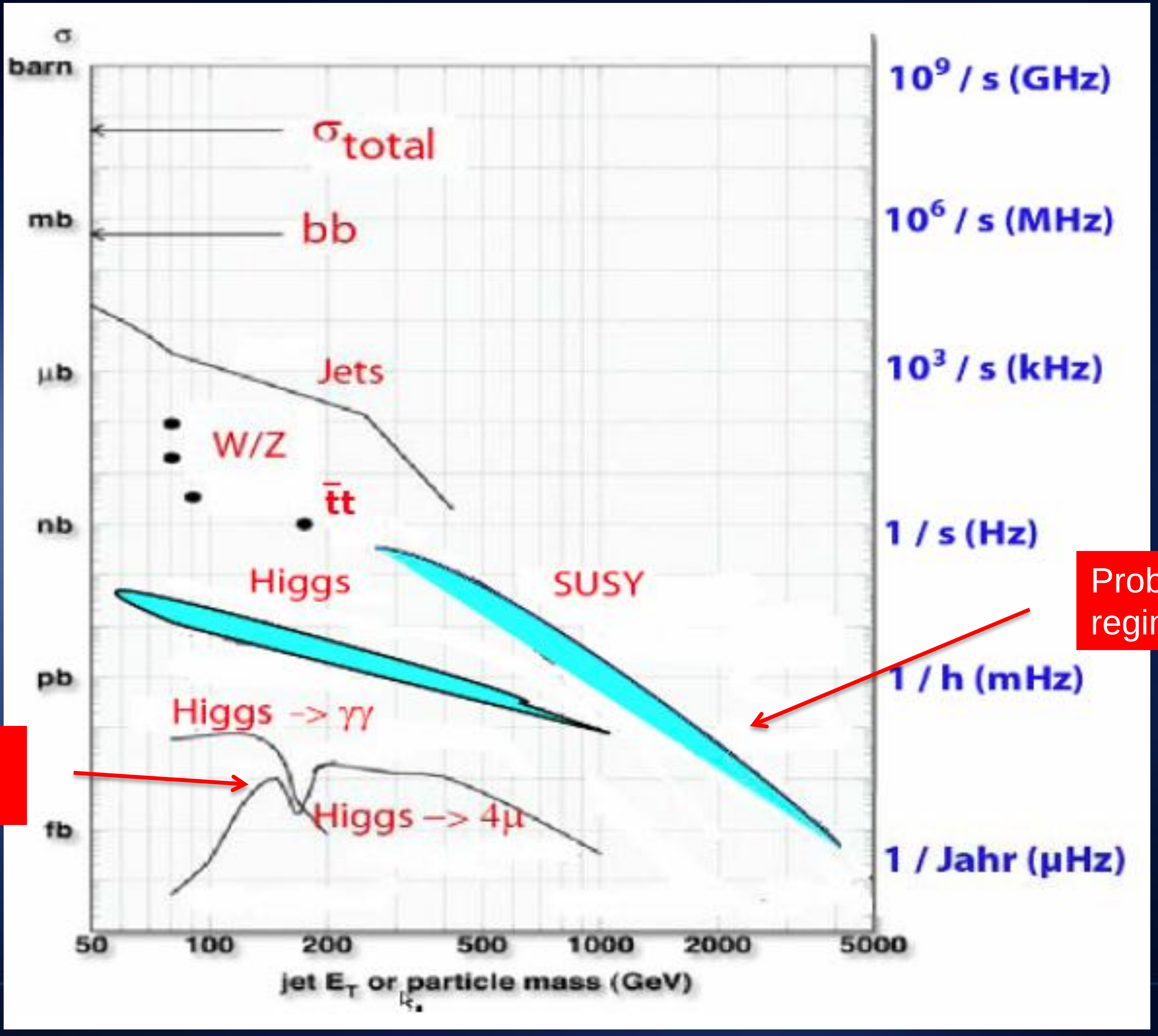
And publications

160 papers on collision data
325 conference notes, 60 in 2012
~2 papers/week in the last months





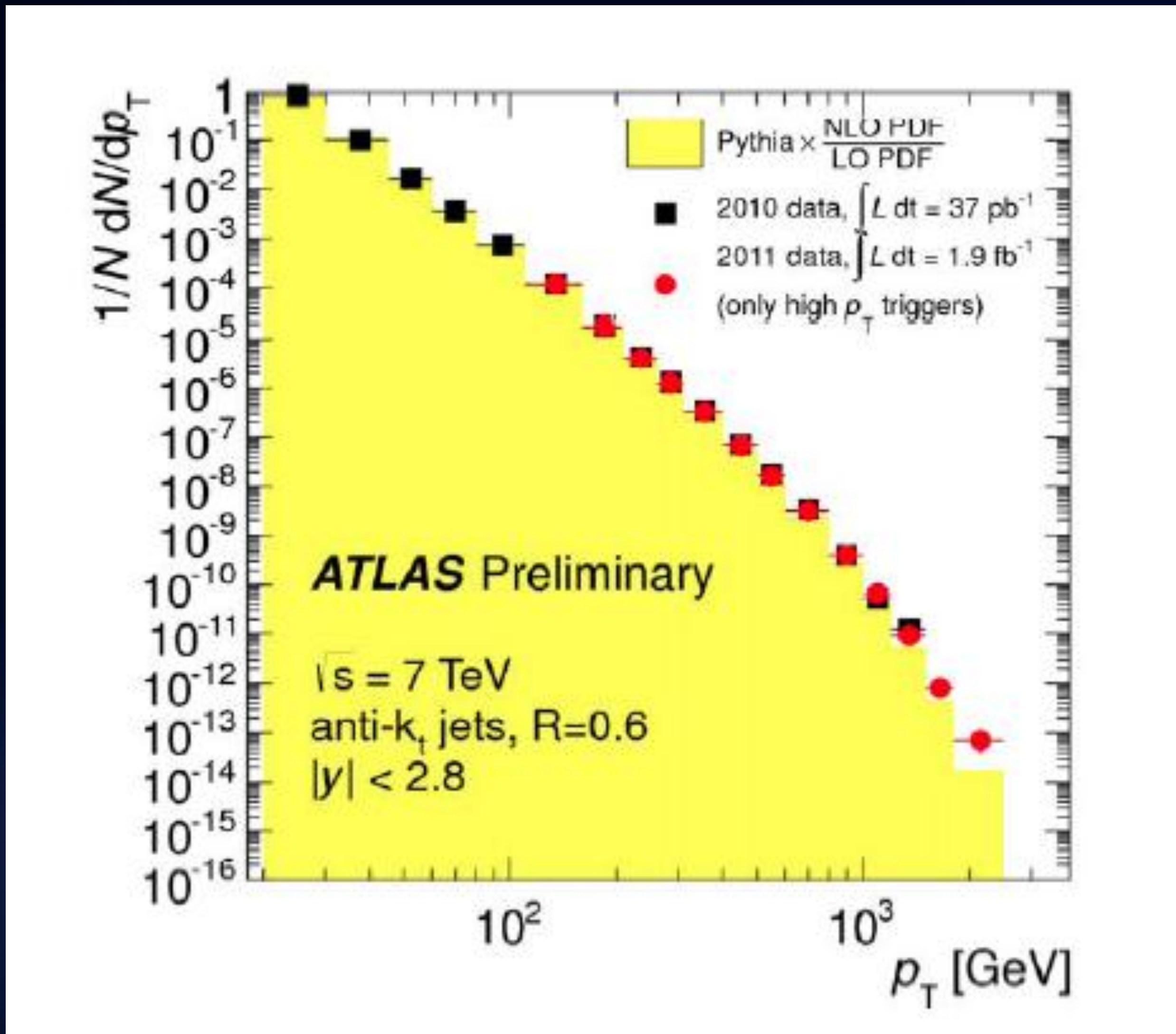
Great sensitivity to physics

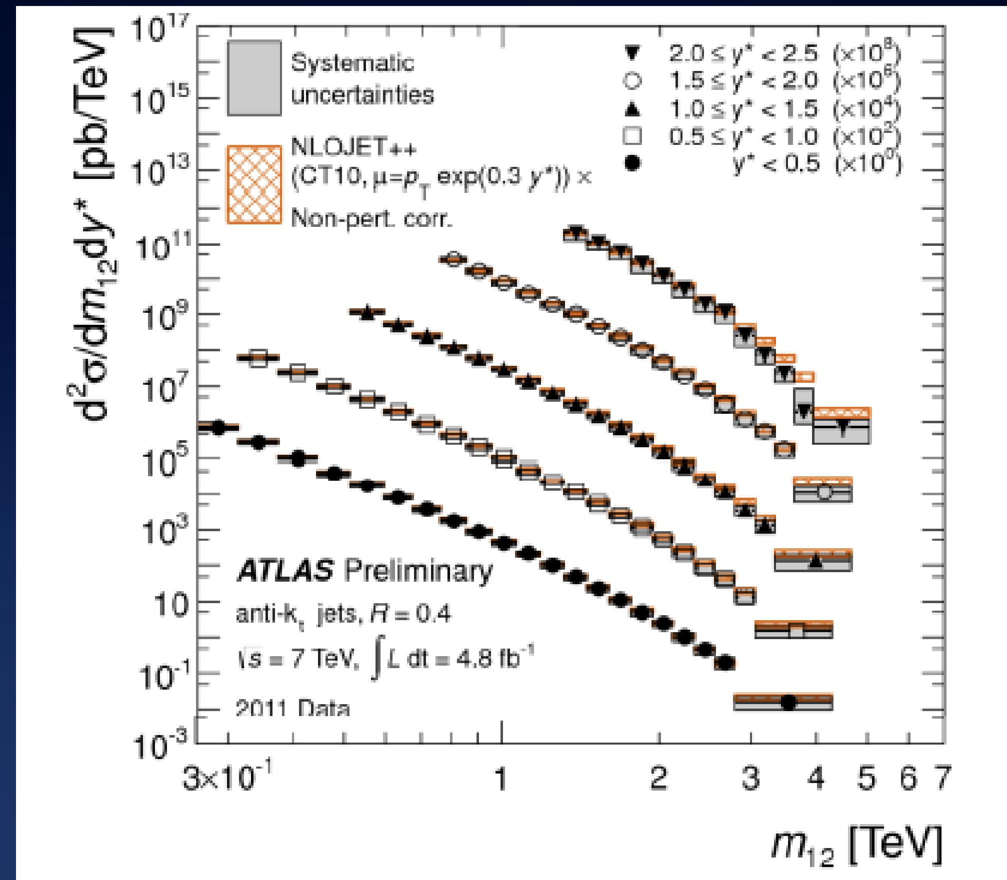


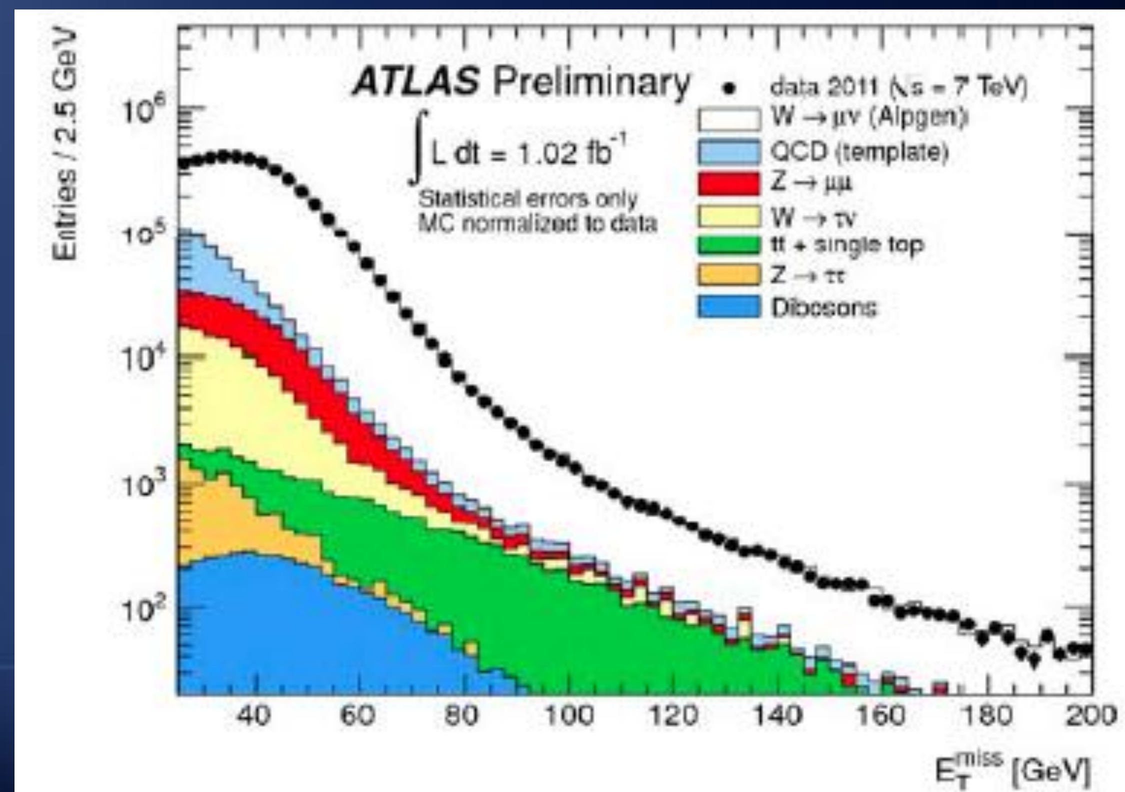
Probing the few TeV mass regime

Measuring cross-sections down to few fb

First on QCD



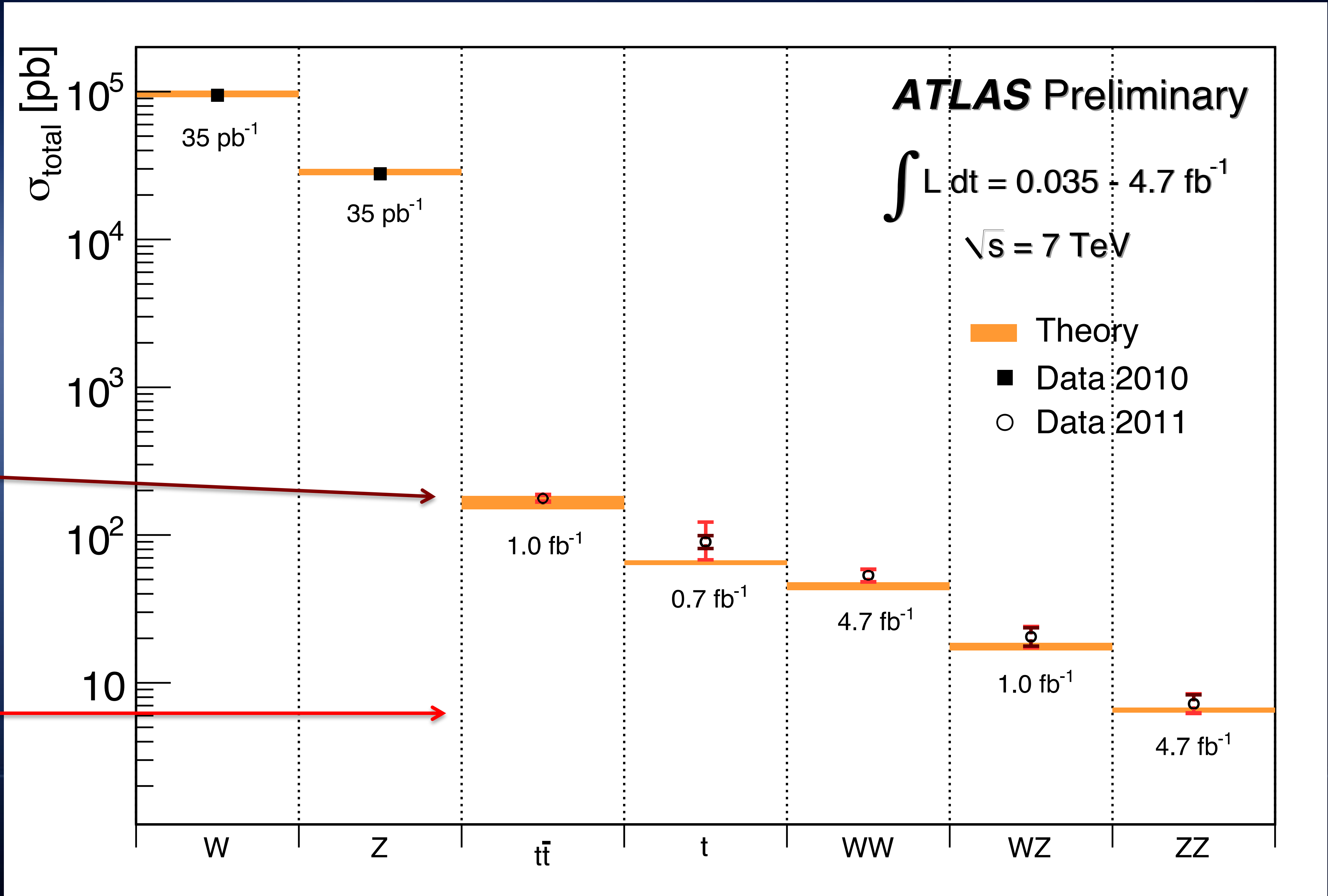




p_T, E_T^{miss}, di-jet masses, ….
understood over many orders of magnitude

Summary of main electroweak and top cross-section measurements

SM expectations agree with measurements (within present uncertainties)



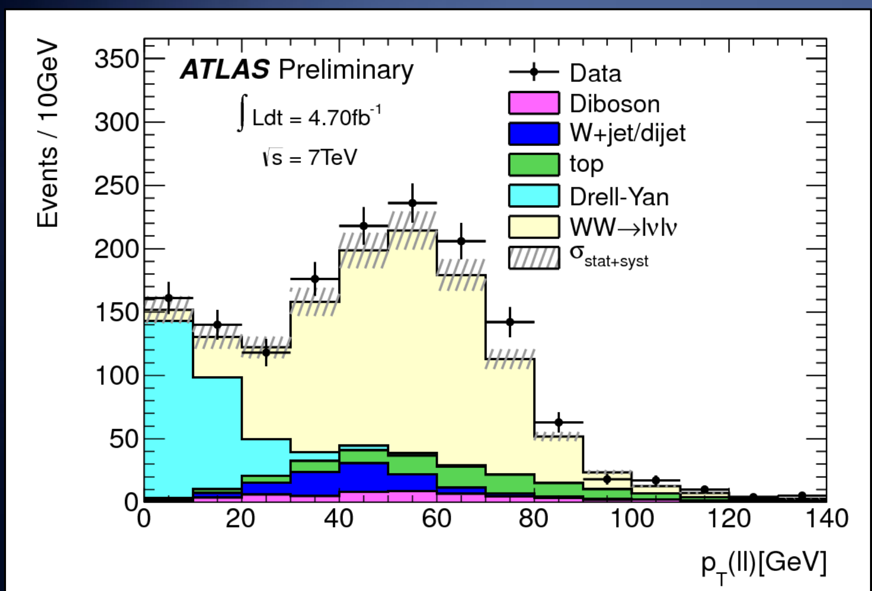
Experimental precision (~6%) starts to challenge theory for e.g. tt (background to most searches)

Measuring cross-sections down to few fb (including leptonic branching ratios)

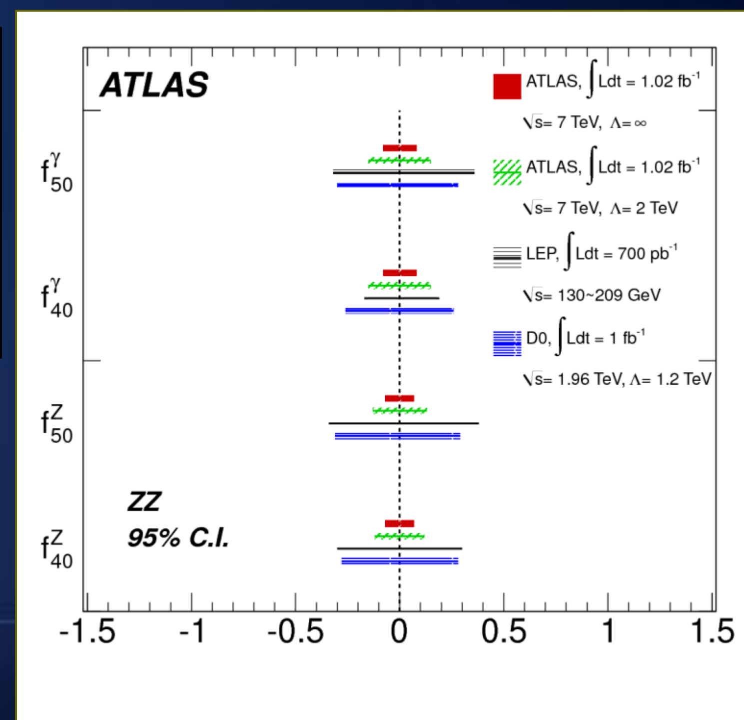
σxBR(ZZ→ 4l) ~ 40 fb

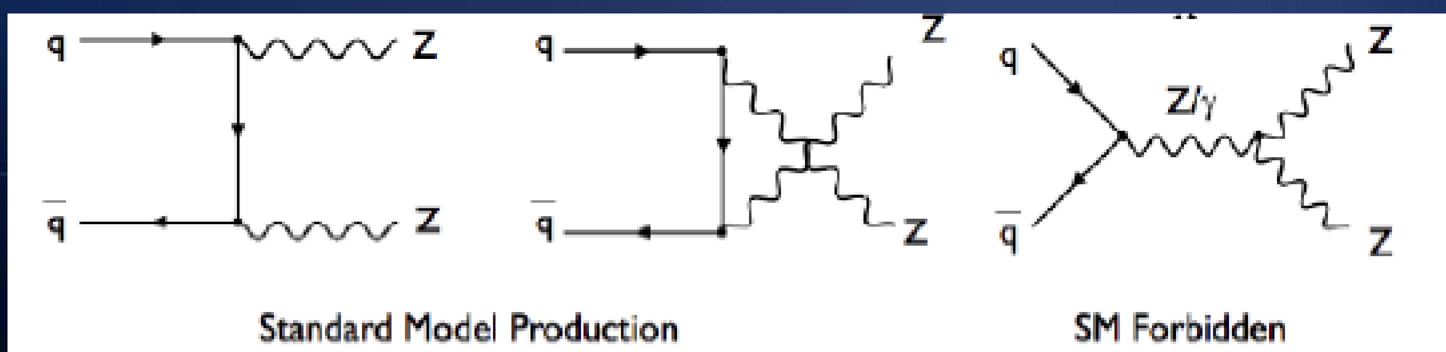
Diboson production : WW, WZ, ZZ

Process	Final state	Measured total cross-section	Theory (NLO SM)
WW	lvlv	$\sigma^{tot}_{W^+W^-} = 53.4 \pm 2.1(\text{stat}) \pm 4.5(\text{syst}) \pm 2.1(\text{lumi})$ pb	45.1 ± 2.8 pb
ZZ	4l	$\sigma^{tot}_{ZZ} = 7.2^{+1.1}_{-0.9}$ (stat) $^{+0.4}_{-0.3}$ (syst) ± 0.3 (lumi) pb	$6.5^{+0.3}_{-0.2}$ pb
ZZ	llvv	$\sigma^{tot}_{ZZ} = 5.4^{+1.3}_{-1.2}(\text{stat.})^{+1.4}_{-1.0}(\text{syst.}) \pm 0.2(\text{lumi.})$ pb	$6.5^{+0.3}_{-0.2}$ pb



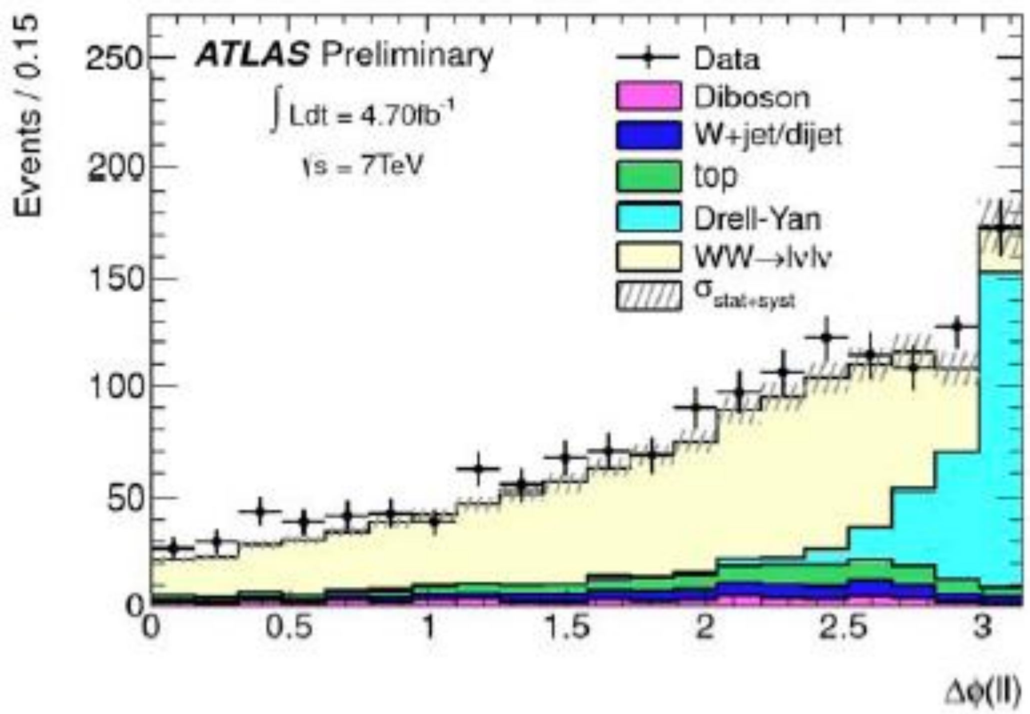
- Backgrounds to Higgs searches
- Give access to triple gauge couplings and New Physics



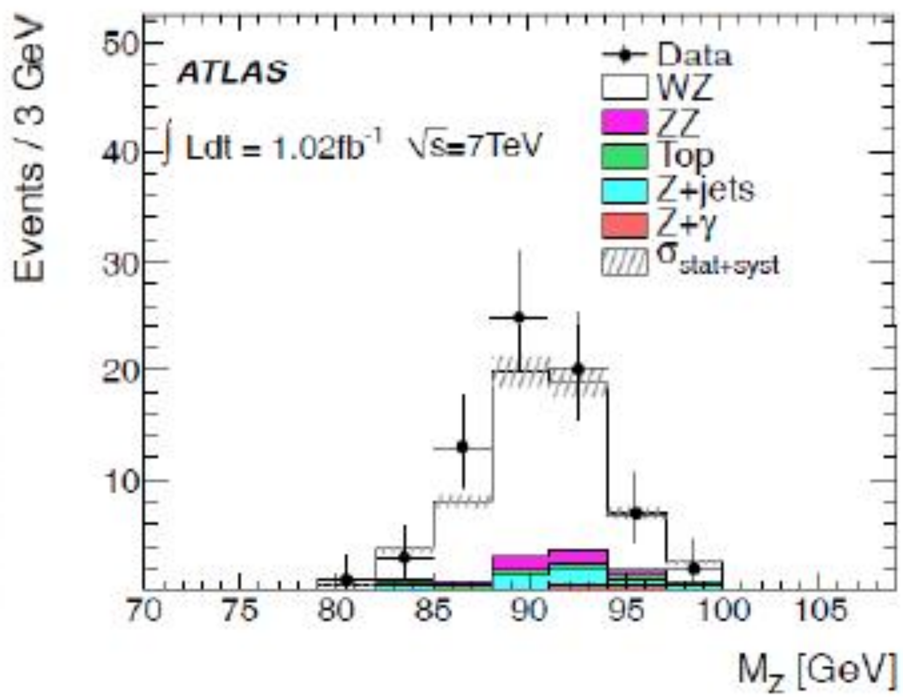


Diboson production : WW, WZ, ZZ

WW

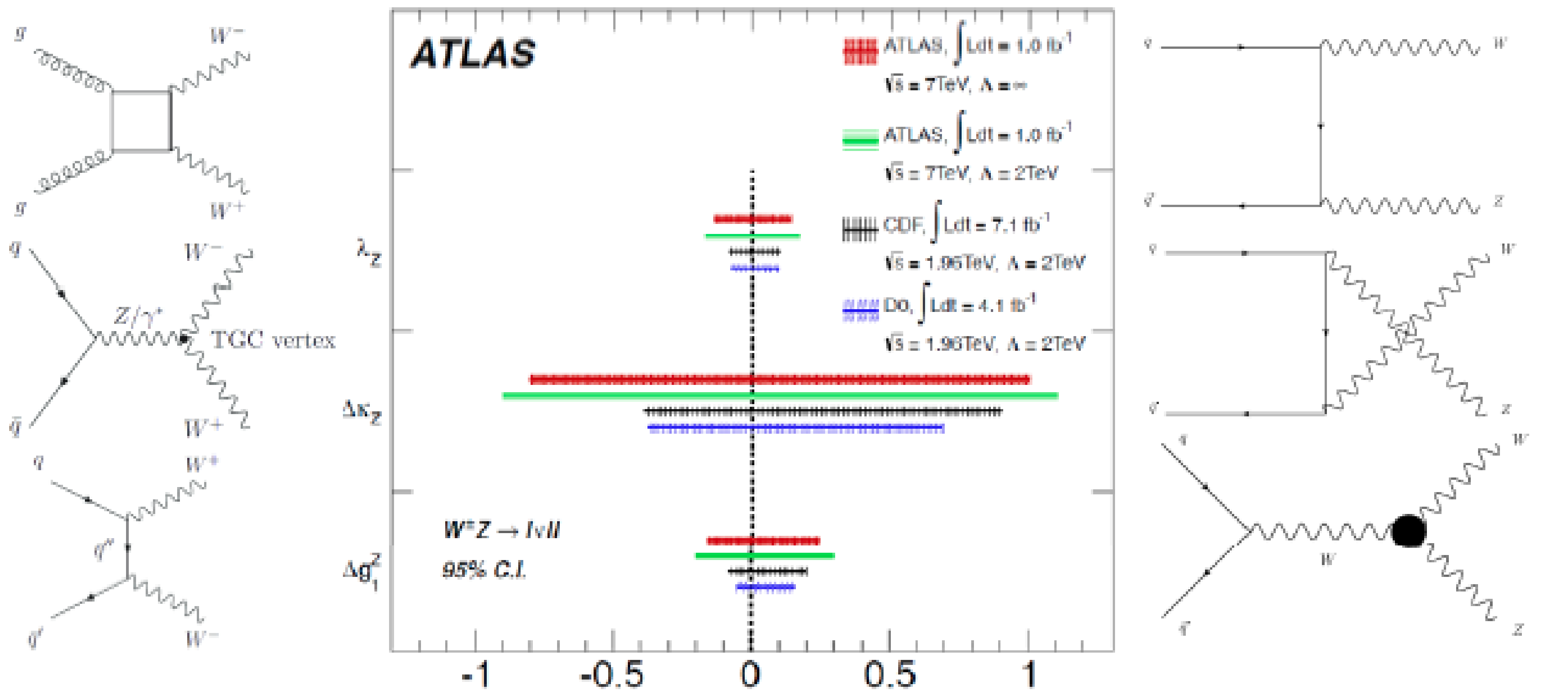


WZ



- WZ (SM: 17±1 pb)

$$20.5^{+3.1}_{-2.8}(\text{stat.})^{+1.4}_{-1.3}(\text{syst.})^{+0.9}_{-0.8}(\text{lumi.})\text{ pb.}$$



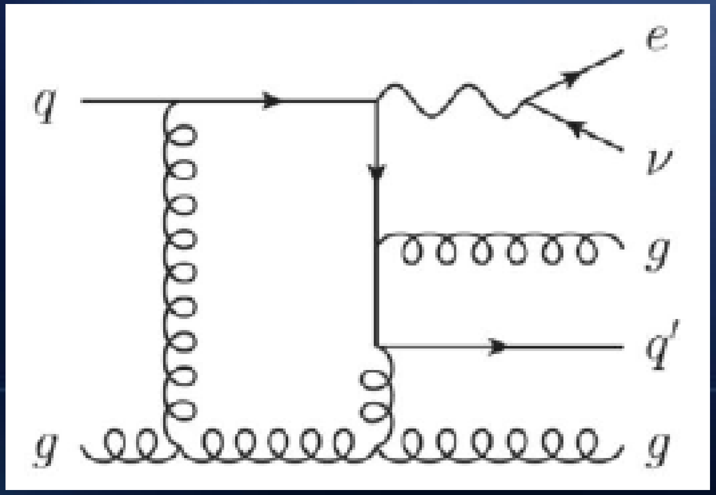
Understanding Z/W+Jets

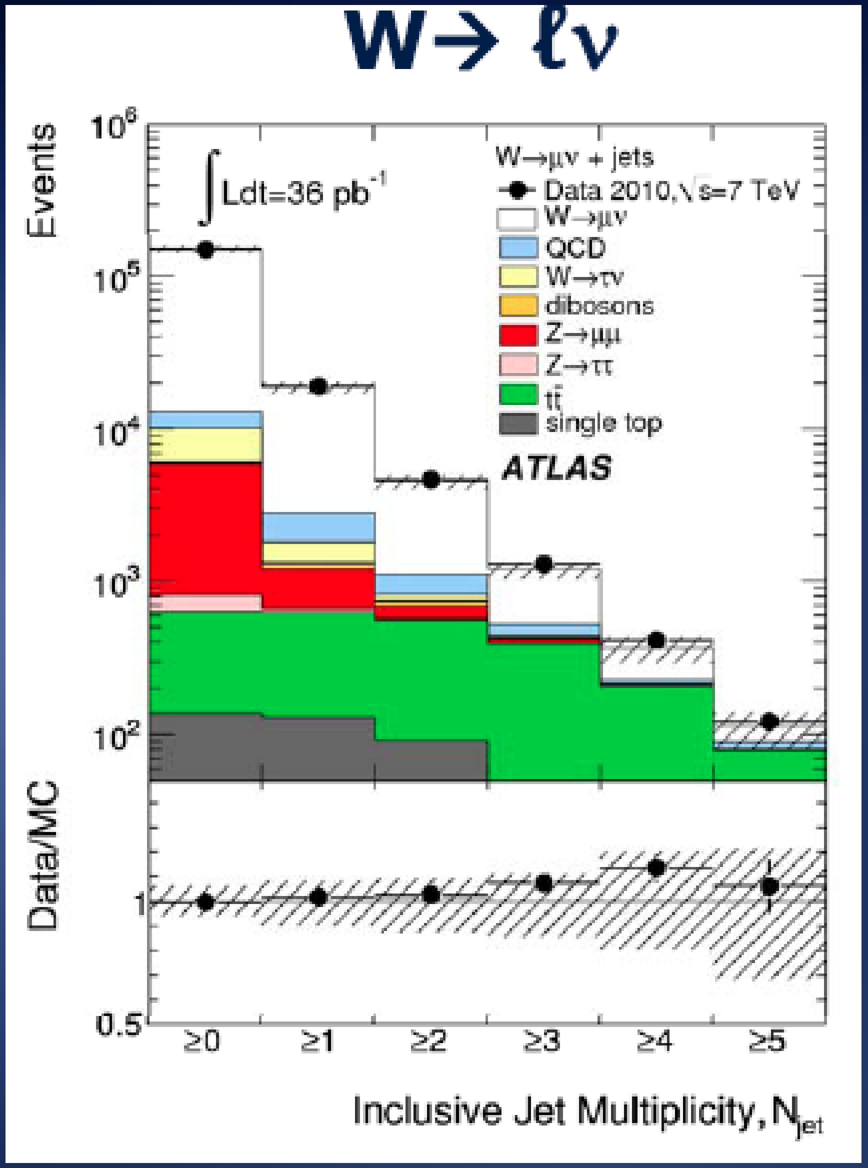
Pushes limits on W and Z total cross-sections

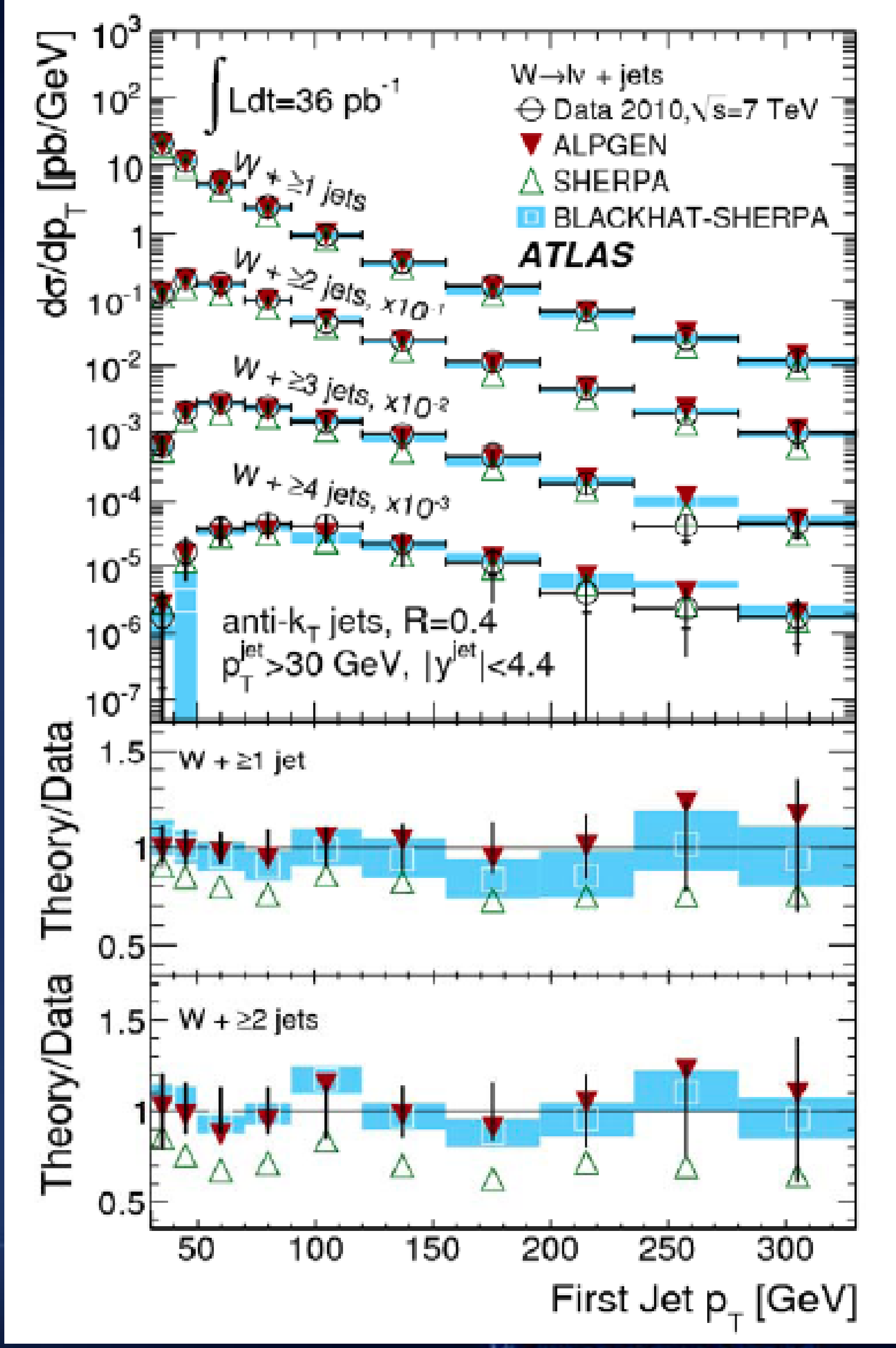
W/Z, W+/W- ratios, or extra jets (up to 5)

Enable test of

- MC generators
- proton pdfs



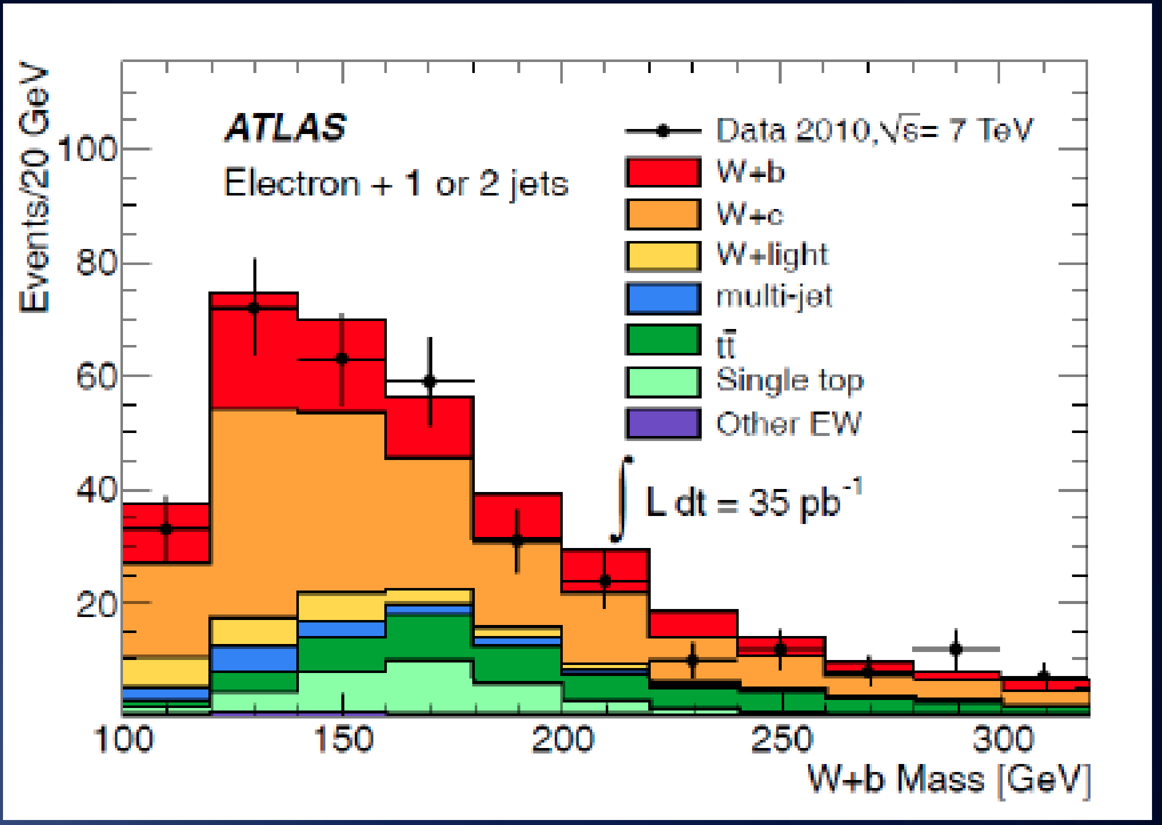


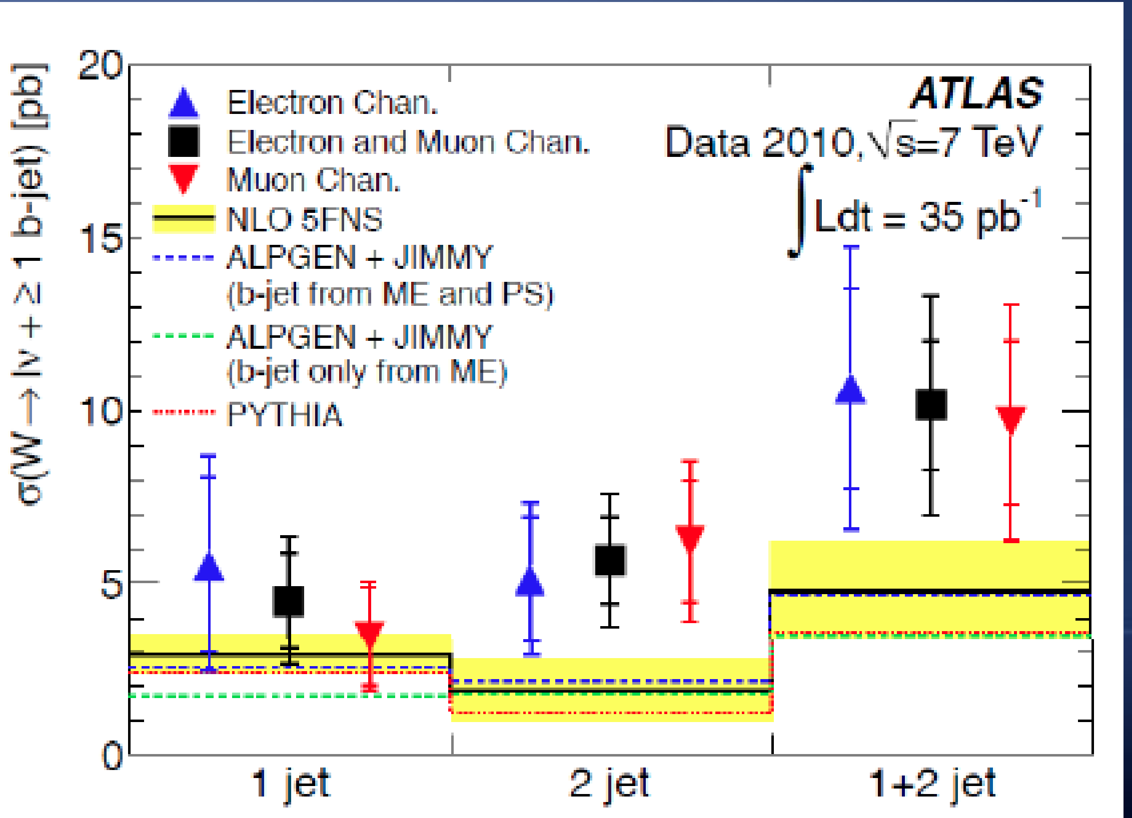


W+b and Z+b cross-sections

~ 1/100 of all jets expected to be b-jets

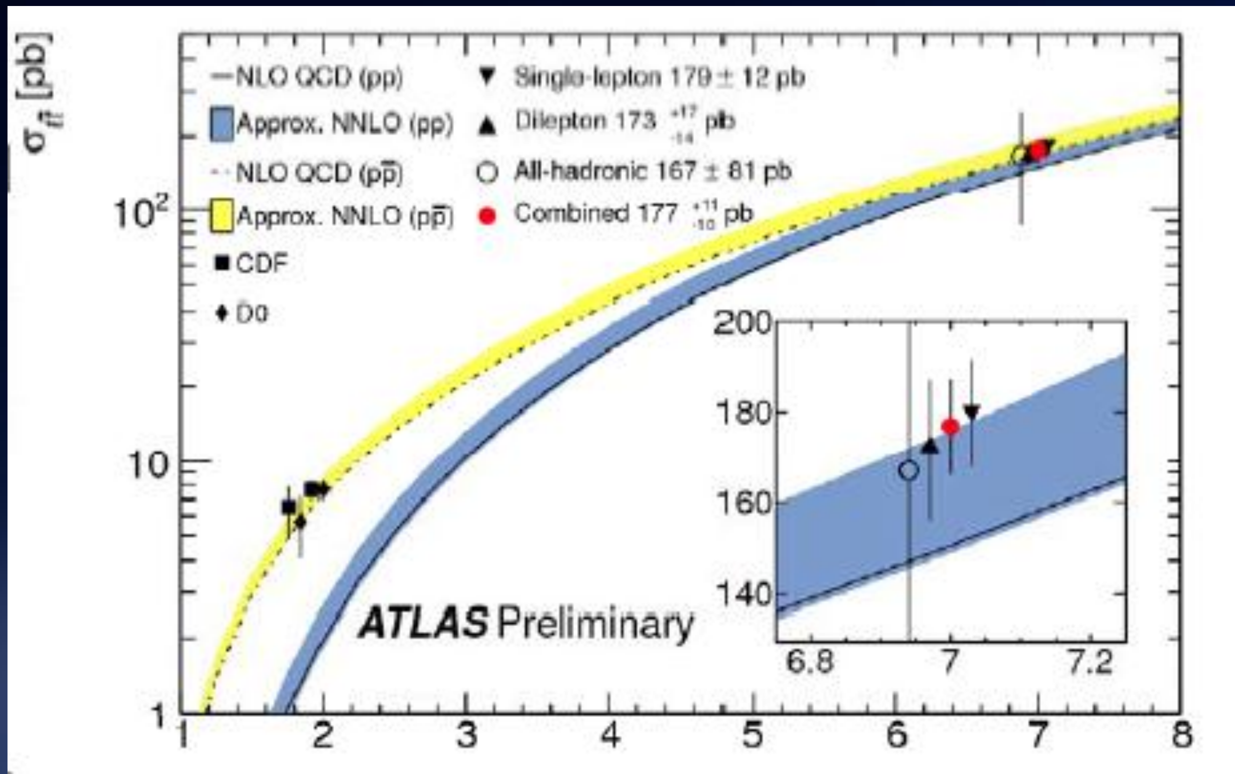
crucial for b-pdfs
background to many searches

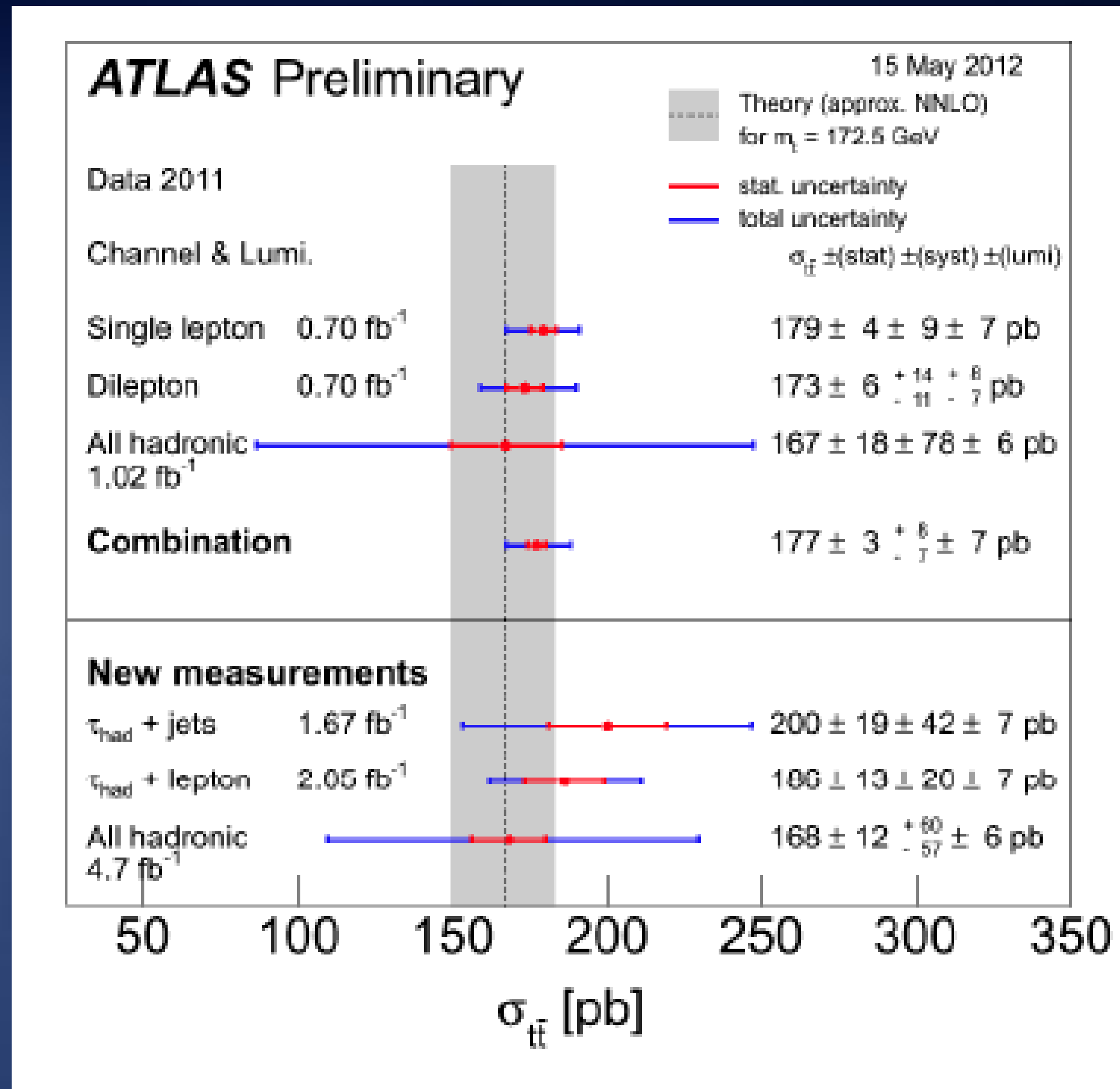




W+b somewhat larger than expected

TOP physics

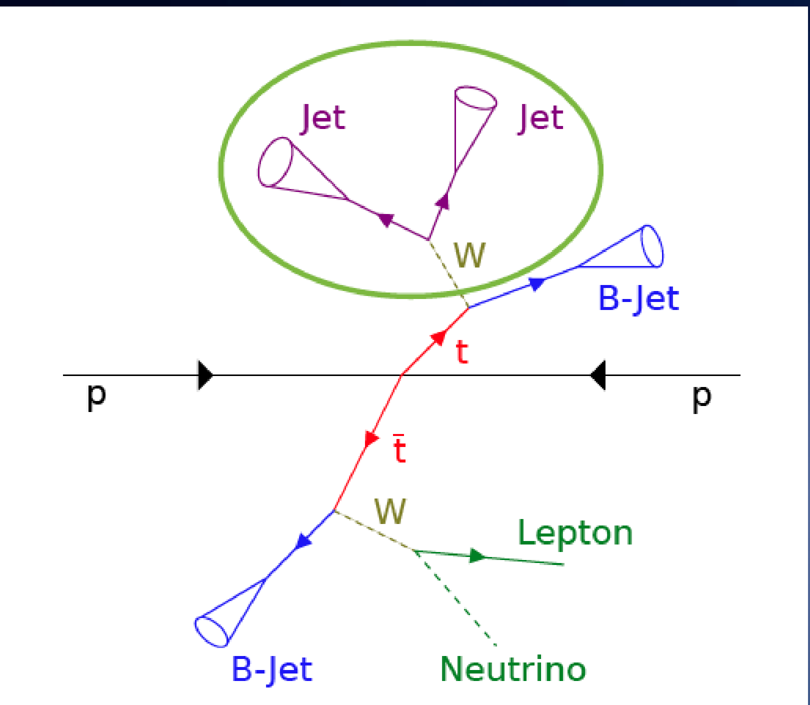




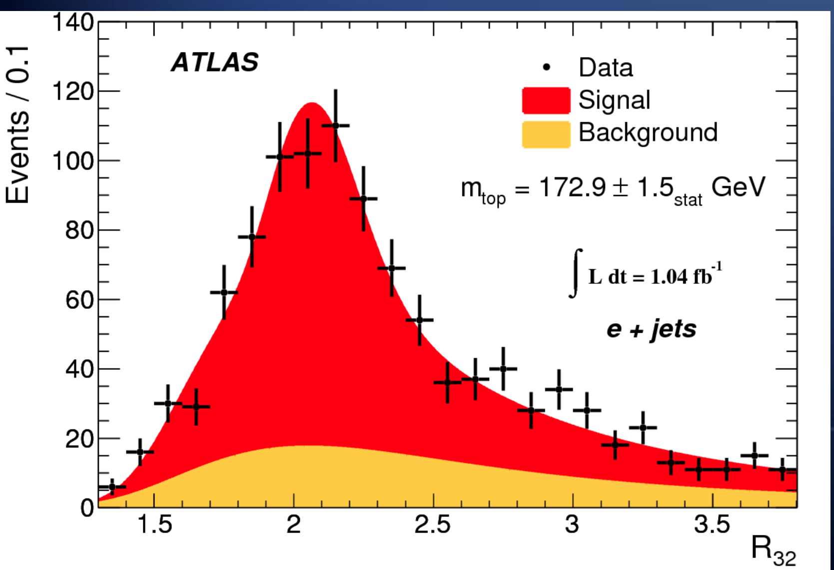
Measurement more precise than theory:

ATLAS: $\square_{tt}$ (7 TeV) = 177^{+11}_{-10} pb
Theory: $\square_{tt}$ (7 TeV) = 165^{+11}_{-16} pb

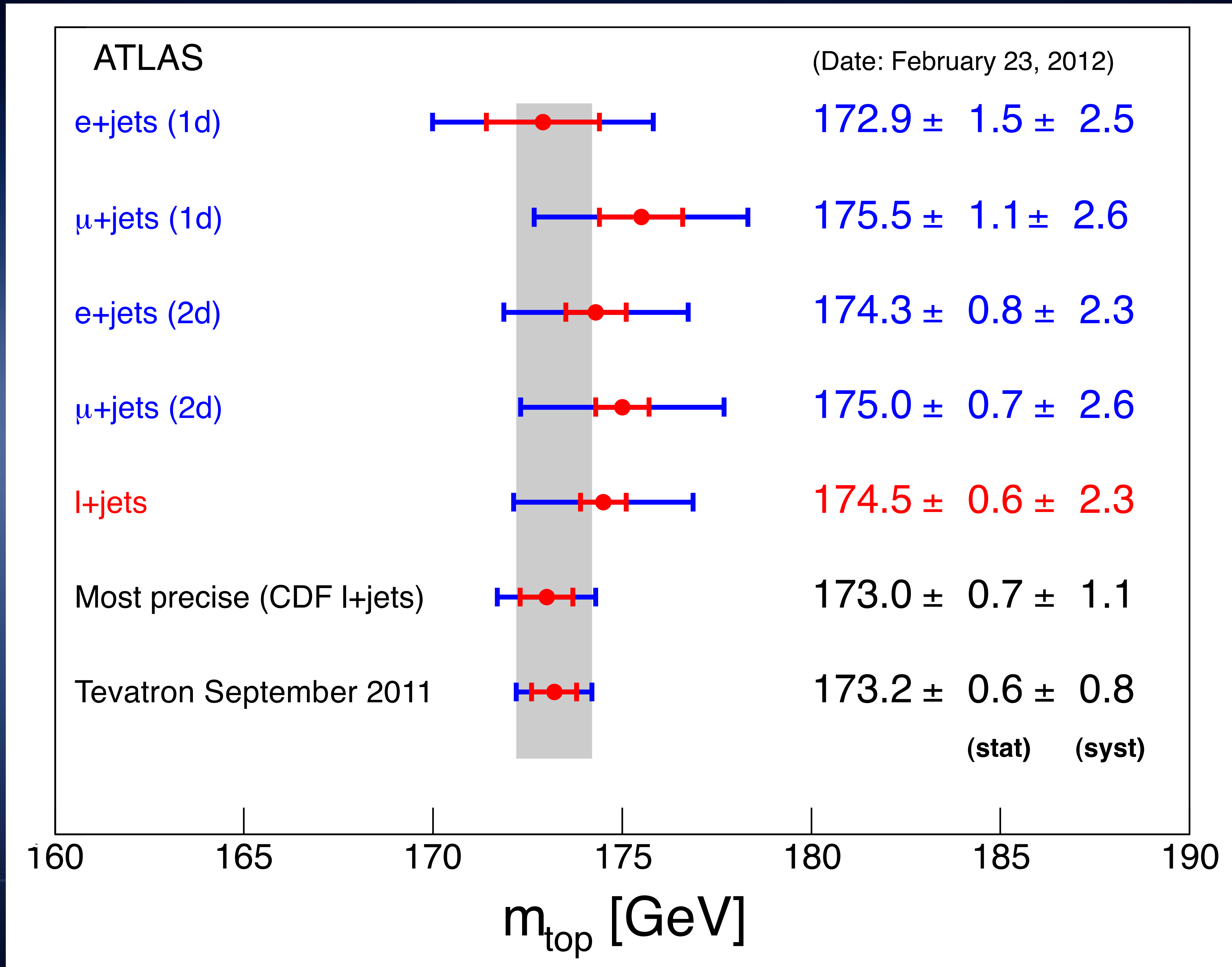
TOP mass



Jet
Jet
W
B-Jet
t
p
p
t̄
W
Lepton
B-Jet
Neutrino



ATLAS
Data
Signal
Background
m_{top} = 172.9 ± 1.5_{stat} GeV
$\int L\,dt = 1.04\ fb^{-1}$
e + jets
Events / 0.1
R_{32}
140
120
100
80
60
40
20
0
1.5
2
2.5
3
3.5

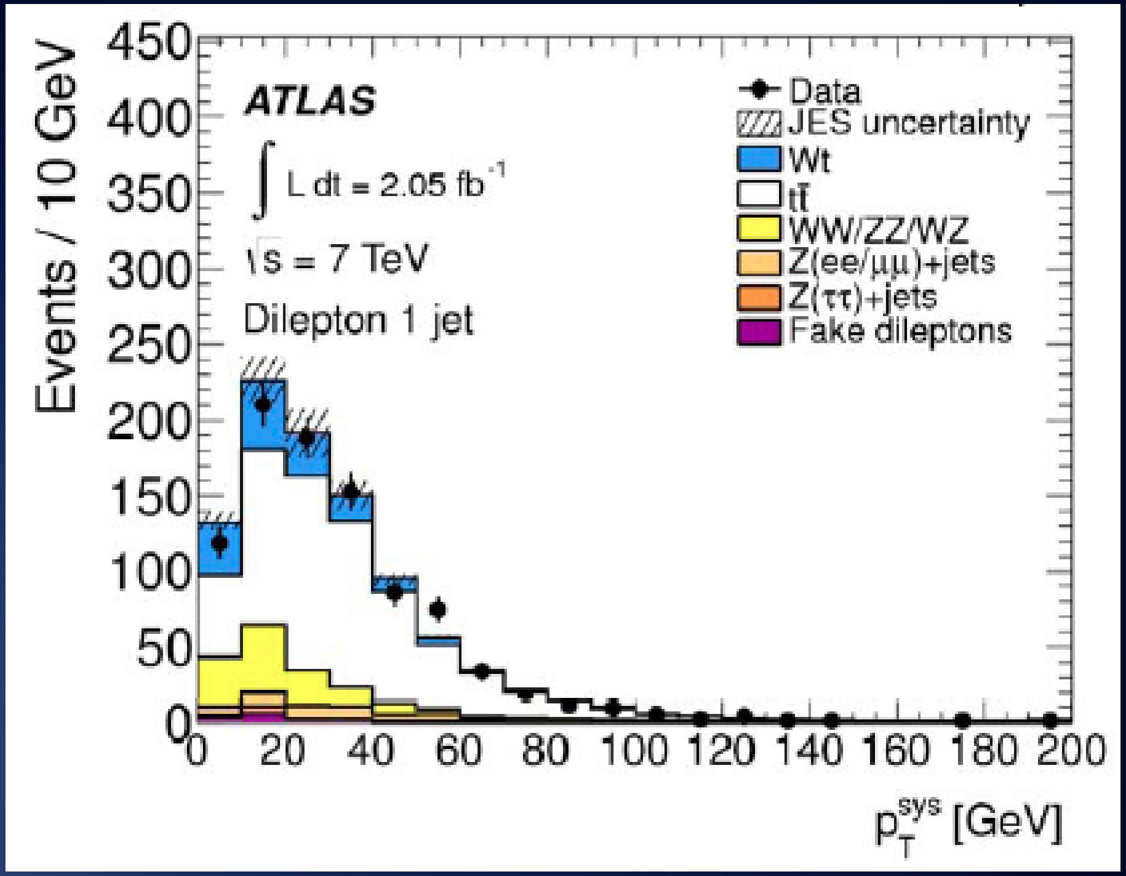


ATLAS
(Date: February 23, 2012)
e+jets (1d) 172.9 ± 1.5 ± 2.5
μ+jets (1d) 175.5 ± 1.1 ± 2.6
e+jets (2d) 174.3 ± 0.8 ± 2.3
μ+jets (2d) 175.0 ± 0.7 ± 2.6
l+jets 174.5 ± 0.6 ± 2.3
Most precise (CDF l+jets) 173.0 ± 0.7 ± 1.1
Tevatron September 2011 173.2 ± 0.6 ± 0.8
(stat)
(syst)
160
165
170
175
180
185
190
m_{top} [GeV]

Single top measurements

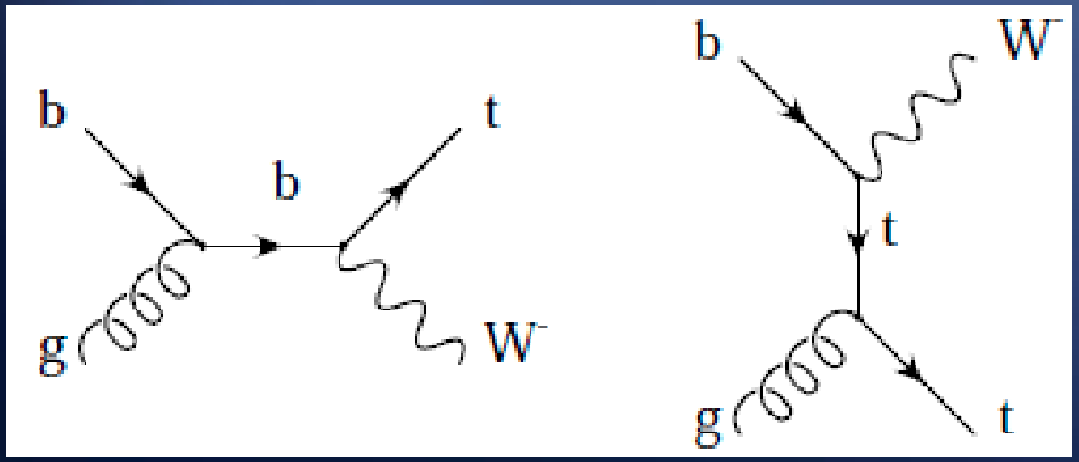
- ✓ ATLAS sees evidence for single top in Wt-channel (3.3σ, V_{tb}=1.03+0.16-0.19)

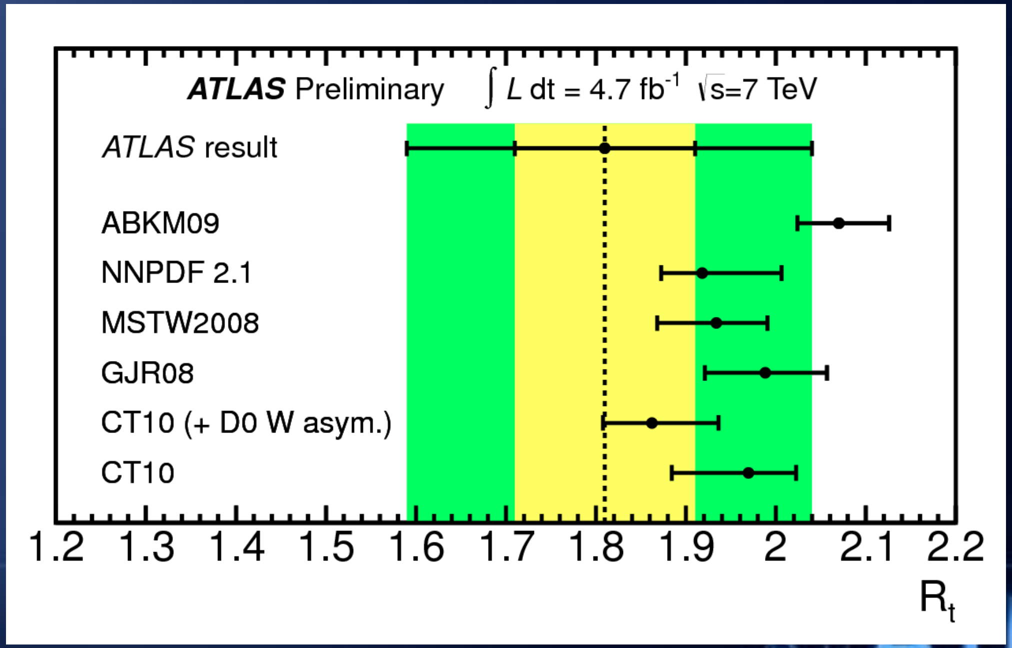
Measured cross-section
$\sigma_{Wt} = 16.8 \pm 2.9\ (\text{stat}) \pm 4.9\ (\text{syst})$ pb
Extracted
$\sigma_{Wt}^{theory} = 15.7 \times |V_{tb}|^2$ pb $\rightarrow$ $|V_{tb}| = 1.03^{+0.16}_{-0.19}$



- ✓ t-channel has been measured separately for top and anti-top

- ✓ Individual channels agree with SM, ratio starts to be sensitive to u/d ratio



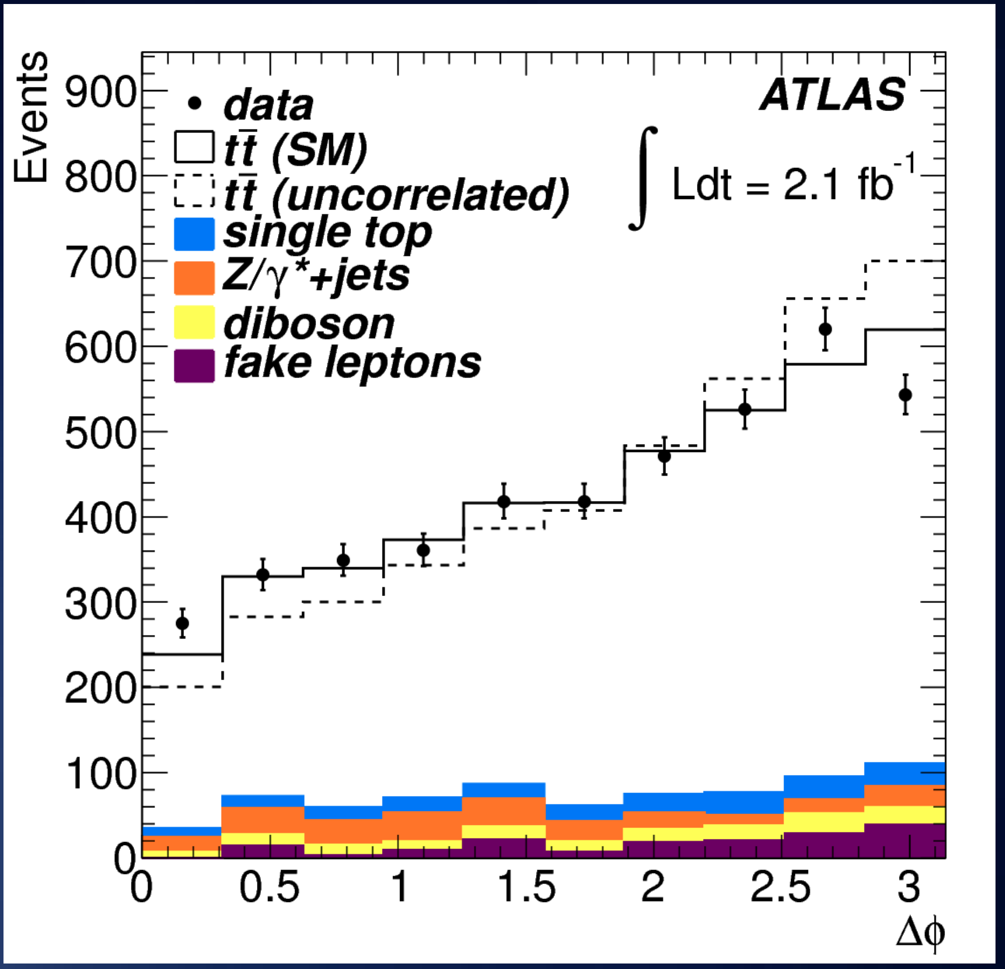


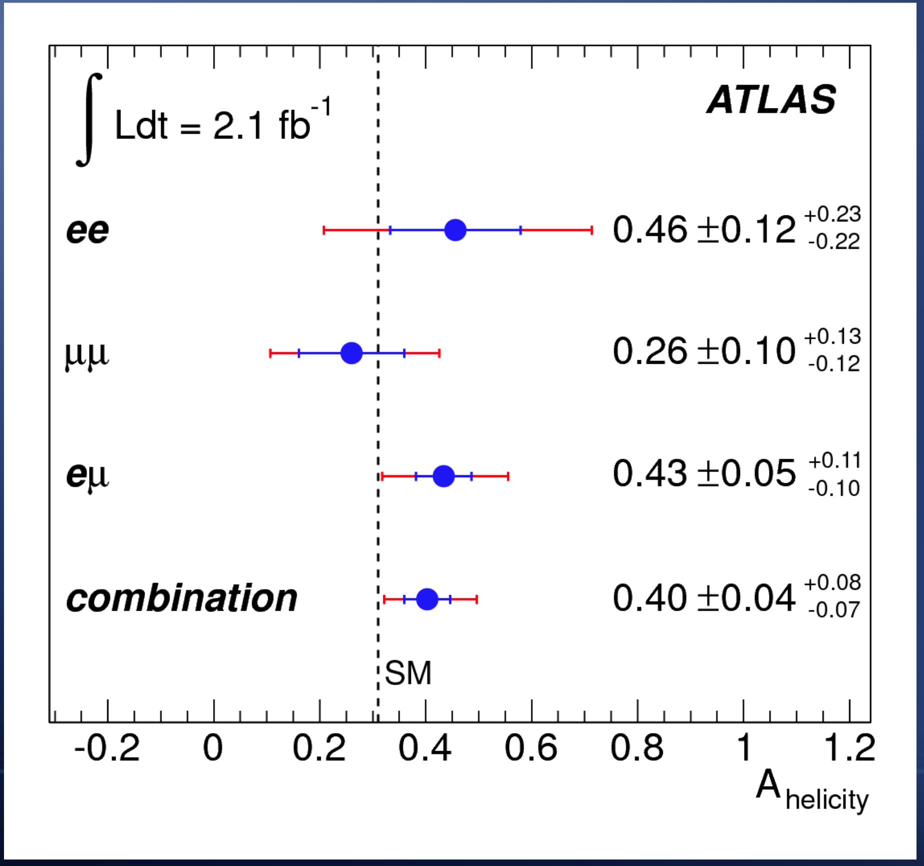
Measurement of $t\bar{t}$ spin correlations

In strong production the tops are unpolarised

However the tt spins are correlated due to the production process

ATLAS measurement establishes spin correlation to 5.1σ (4.2σ expected)

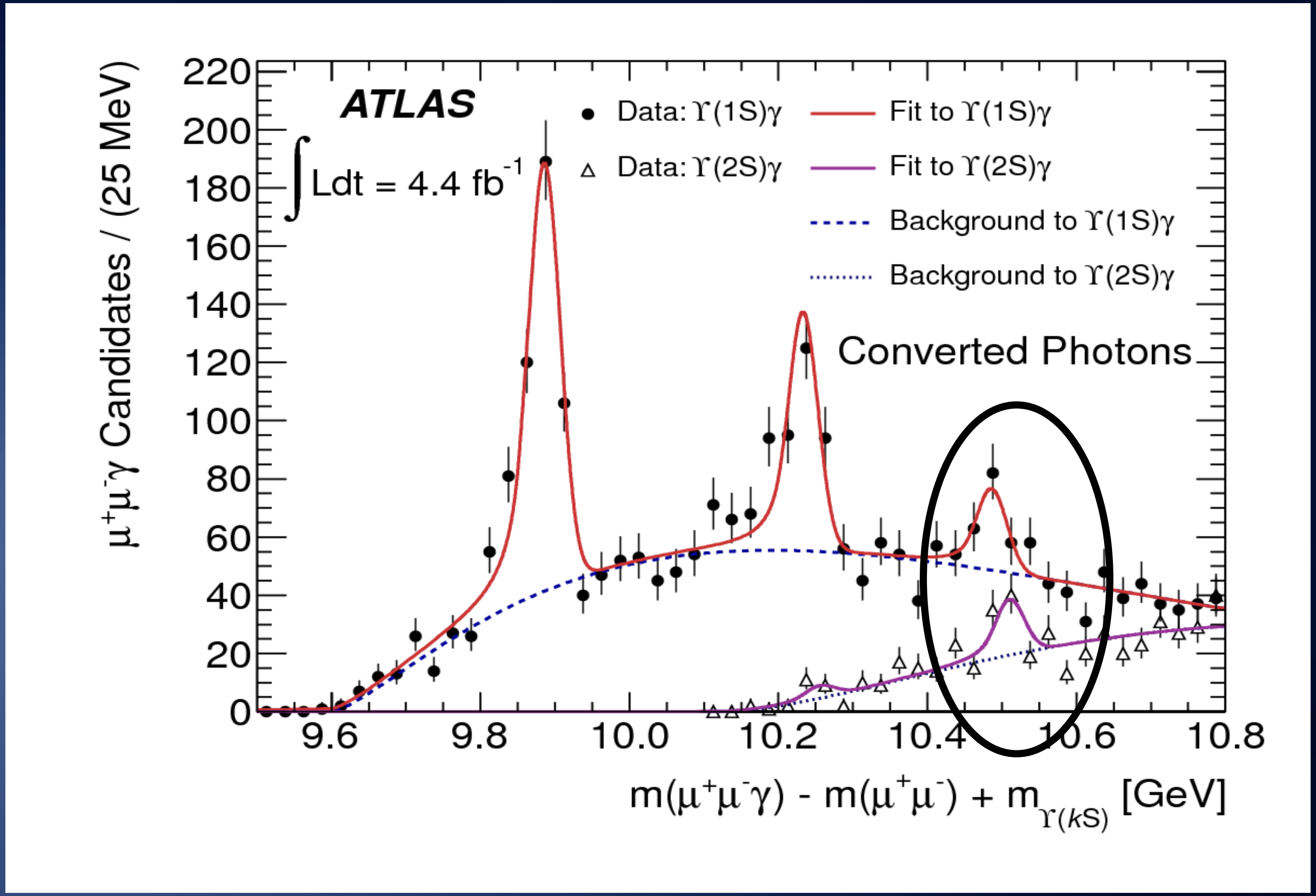




A new particle state discovered

$X_b(3P) \rightarrow Y(1s,2s)\ \gamma$

- $\chi_b(nP) \rightarrow Y(1s,2s)\ \gamma \rightarrow \mu\mu\ \gamma$
- $X_b(1P)$ m= 9.9 GeV and $X_b(2P)$ m= 10.2 GeV states clearly visible
- New structure at 10.5 GeV observed
  → $X_b(3P)$
- Confirmed with Y(2s) data and with converted photons
- Significance > 6 σ



M $[\chi_b(3P)]$ =10.539 ± 0.004 (stat) ± 0.008 (syst) GeV

$\chi_b(3P)$ interpretation consistent with theoretical predictions

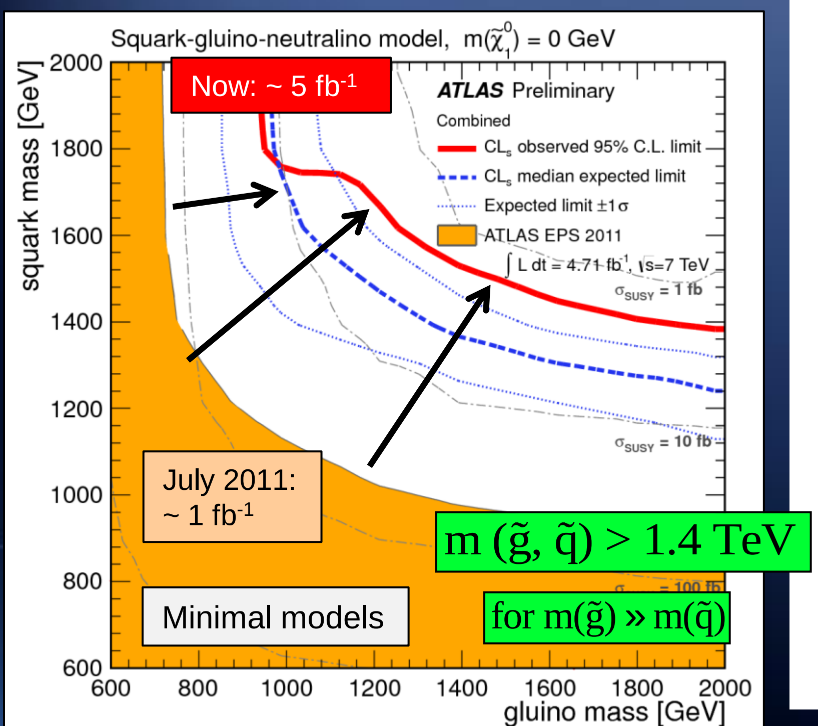
SUSY

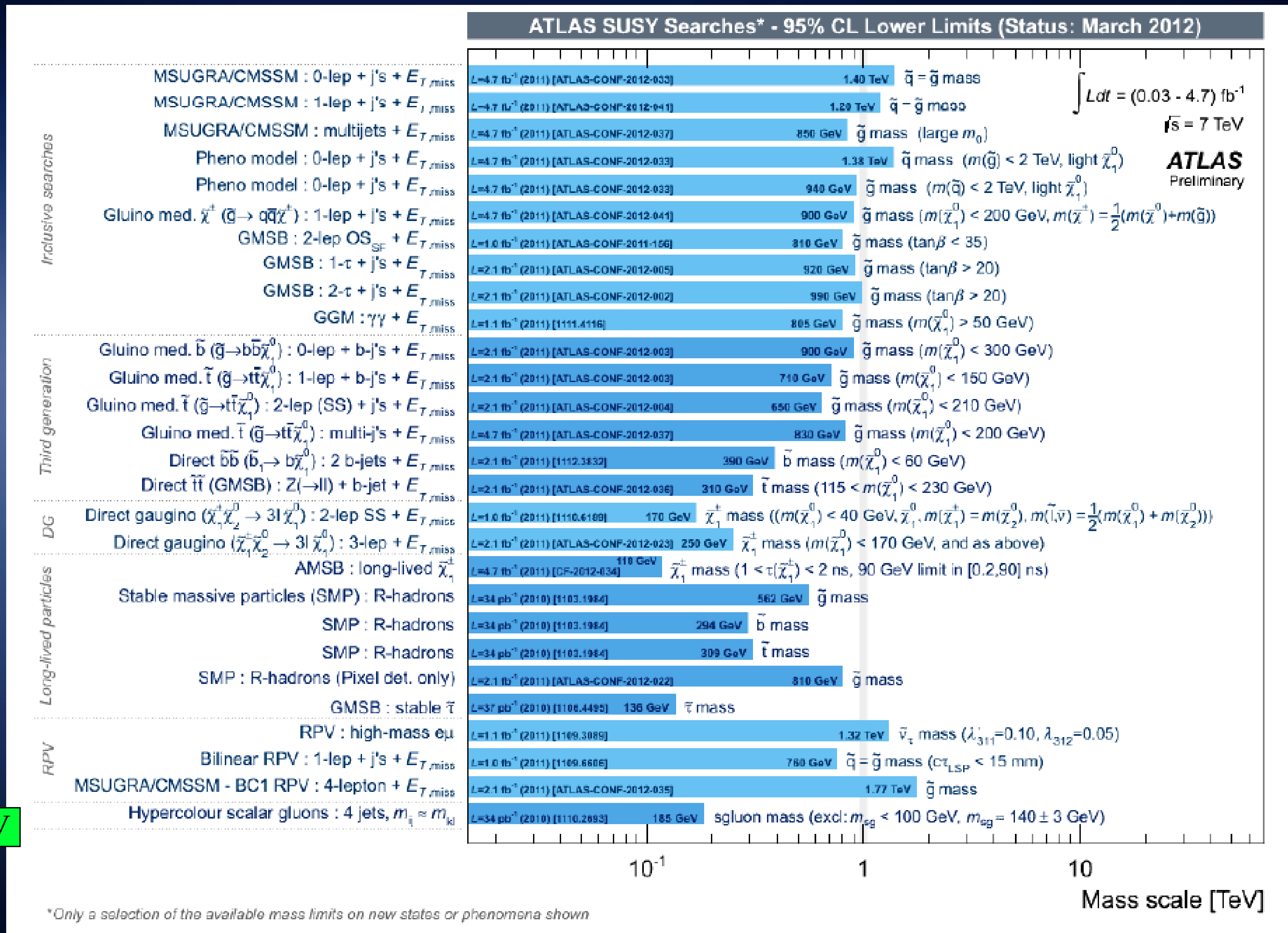
Larger luminosity allows searches for : ***Higher masses,*** >1TeV covered for “standard” scenarios

Rarer processes

Search for rarer Processes cover scenarios with larger mass splitting

- ✓ inclusive searches
- ✓ third generation
- ✓ direct gaugino
- ✓ long-lived particles
- ✓ ….



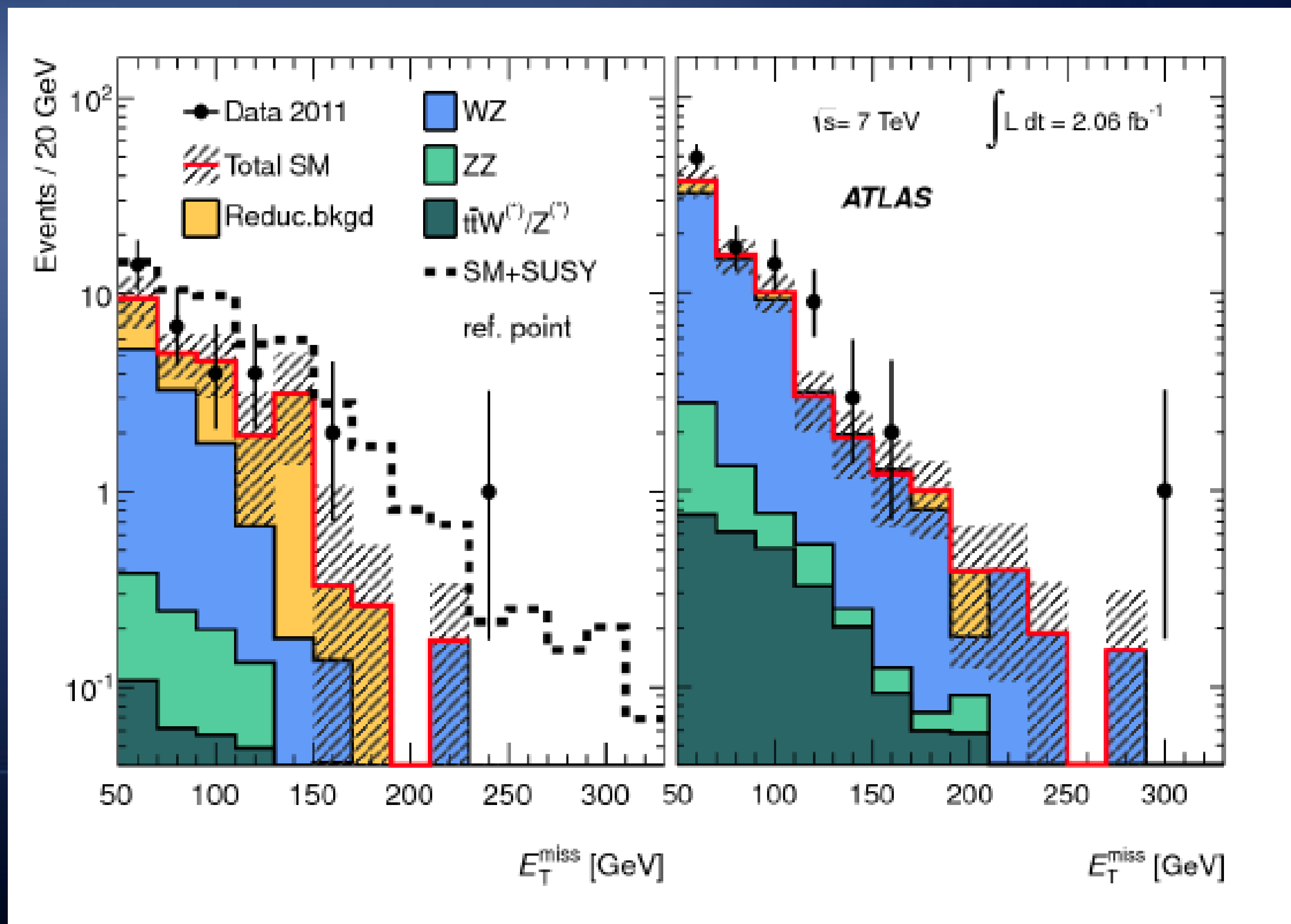


Searches for charginos/neutralinos

Direct chargino/neutralino production has cross-section in the pb range

ATLAS has searched for this in 3-lepton final state

Limits in the m($\chi^{\pm}_1$, χ^0_2) ~ 150GeV region have been set



Searches for 3rd generation squarks

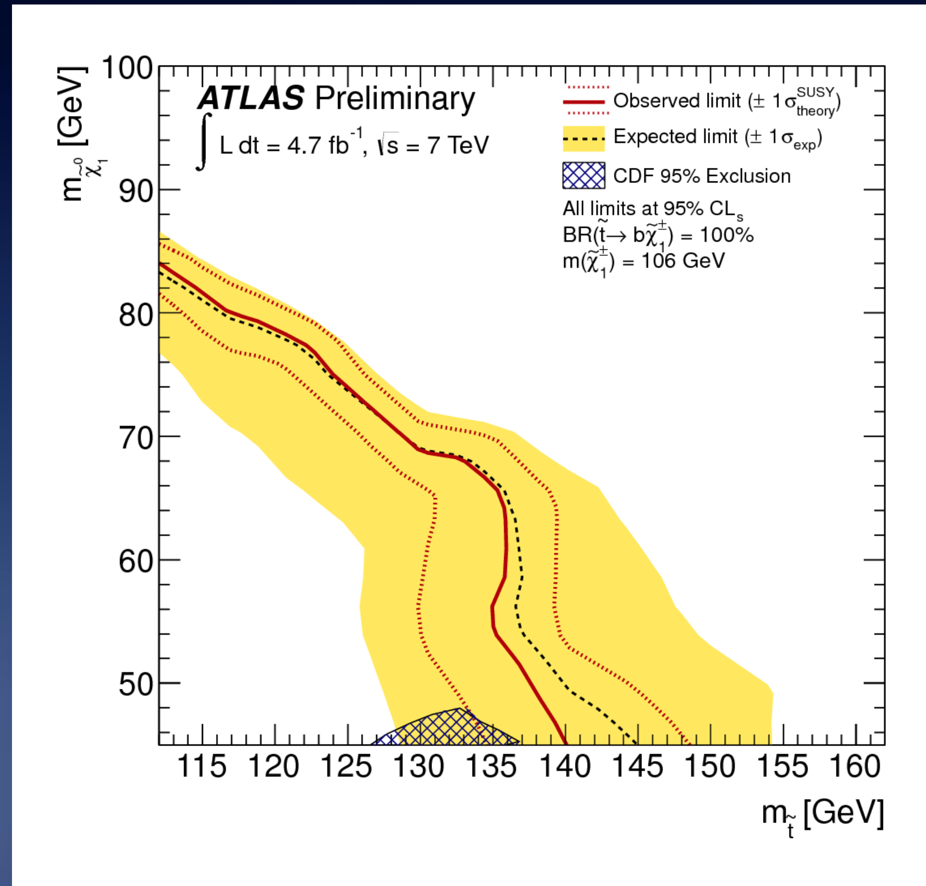
ATLAS has searched for very light stops in direct production using

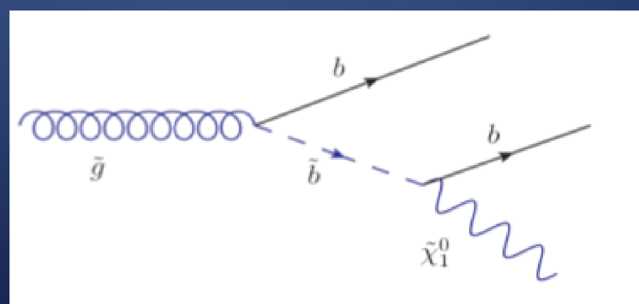
2 leptons+MET

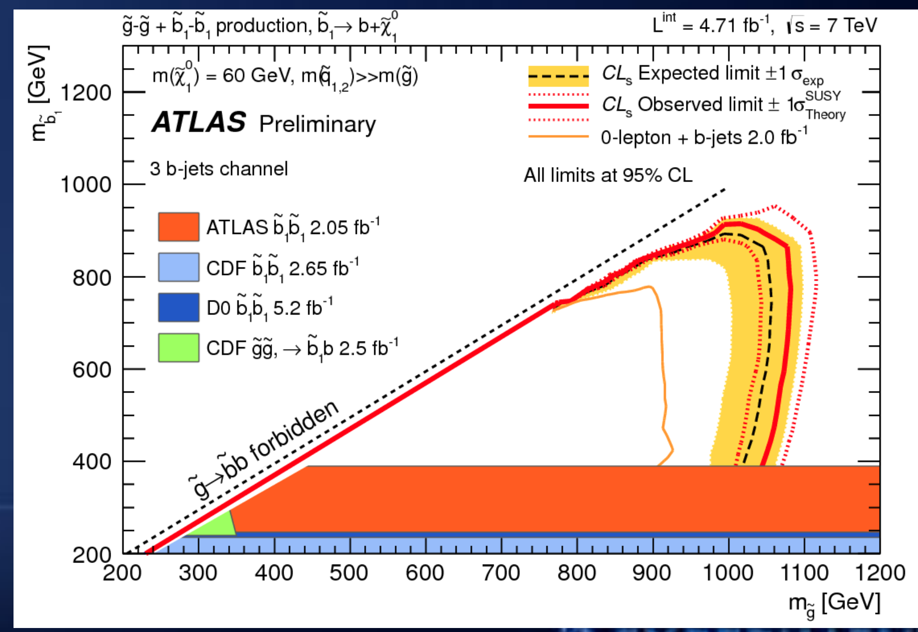
and

In gluino mediated production for stops and sbottom using events with ≥3 b-jets+MET

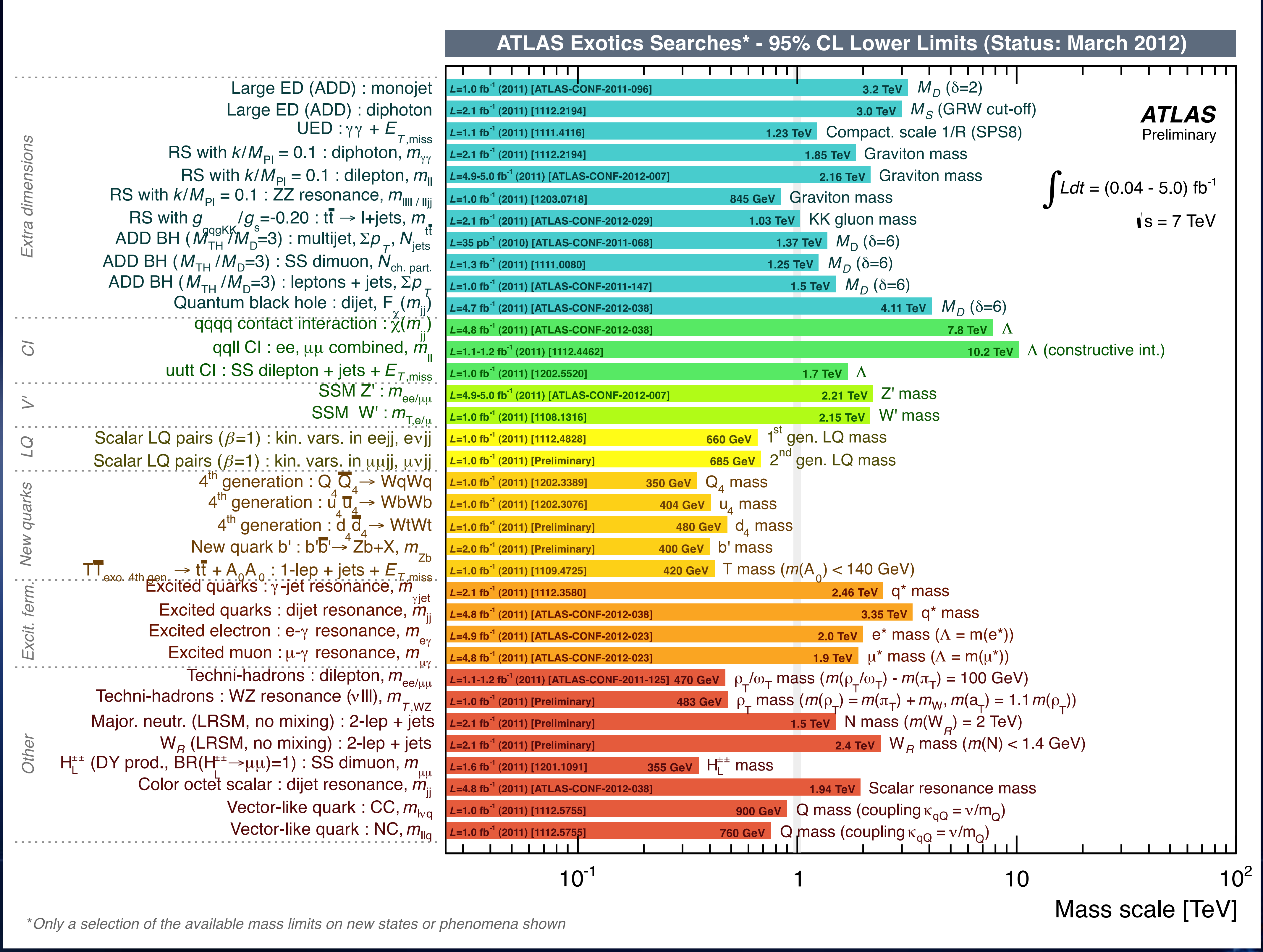
No signal found





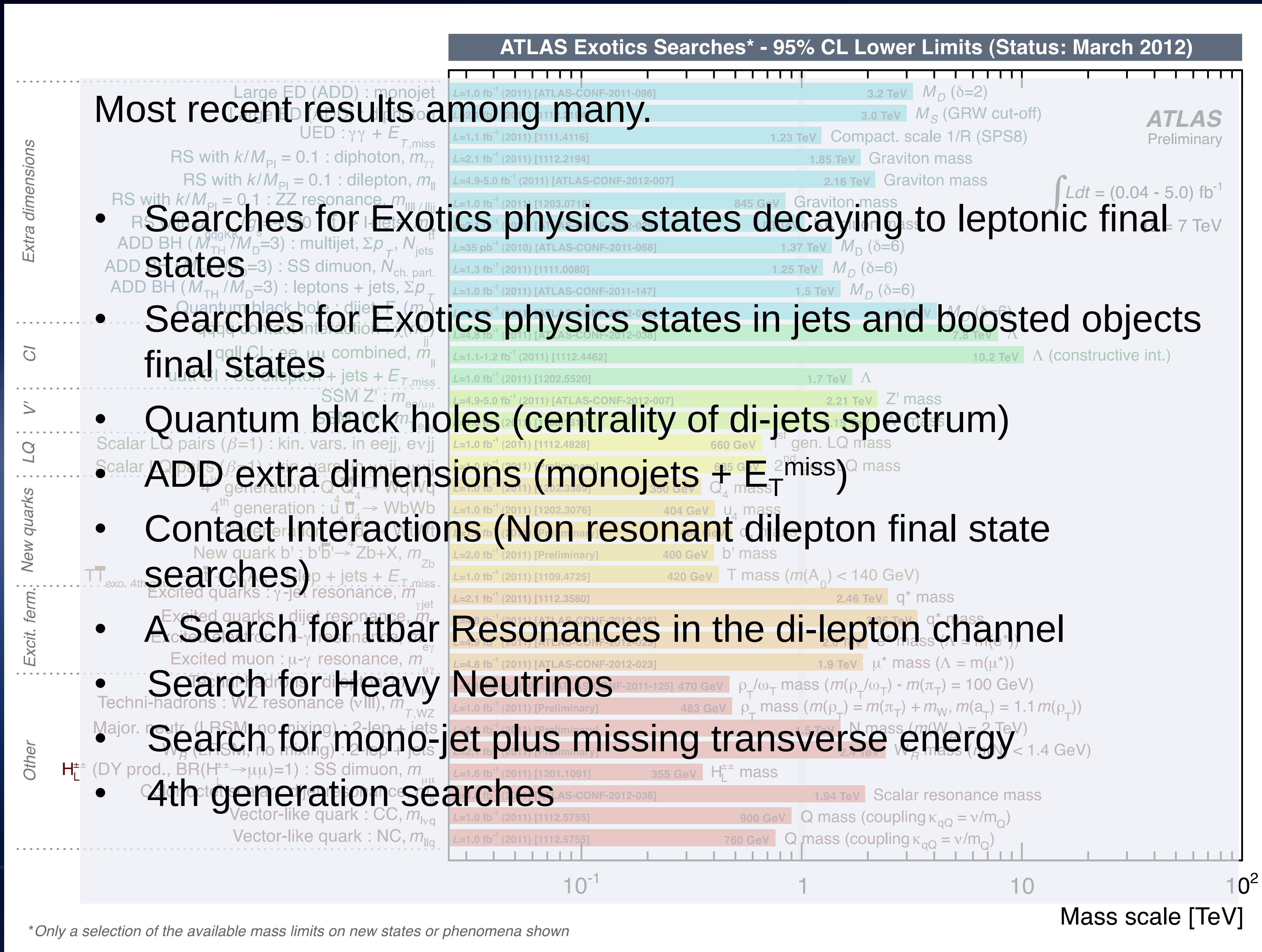


Exotics



ATLAS Exotics Searches* - 95% CL Lower Limits (Status: March 2012)
ATLAS
Preliminary
∫Ldt = (0.04 - 5.0) fb^-1
√s = 7 TeV
Extra dimensions
Large ED (ADD) : monojet — L=1.0 fb^-1 (2011) [ATLAS-CONF-2011-096] — 3.2 TeV — M_D (δ=2)
Large ED (ADD) : diphoton — L=2.1 fb^-1 (2011) [1112.2194] — 3.0 TeV — M_S (GRW cut-off)
UED : γγ + E_T,miss — L=1.1 fb^-1 (2011) [1111.4116] — 1.23 TeV — Compact. scale 1/R (SPS8)
RS with k/M_Pl = 0.1 : diphoton, m_γγ — L=2.1 fb^-1 (2011) [1112.2194] — 1.85 TeV — Graviton mass
RS with k/M_Pl = 0.1 : dilepton, m_ll — L=4.9-5.0 fb^-1 (2011) [ATLAS-CONF-2012-007] — 2.16 TeV — Graviton mass
RS with k/M_Pl = 0.1 : ZZ resonance, m_llll / lljj — L=1.0 fb^-1 (2011) [1203.0718] — 845 GeV — Graviton mass
RS with g_qqgKK/g_s=-0.20 : tt̄ → l+jets, m_tt̄ — L=2.1 fb^-1 (2011) [ATLAS-CONF-2012-029] — 1.03 TeV — KK gluon mass
ADD BH (M_TH /M_D=3) : multijet, Σp_T, N_jets — L=35 pb^-1 (2010) [ATLAS-CONF-2011-068] — 1.37 TeV — M_D (δ=6)
ADD BH (M_TH /M_D=3) : SS dimuon, N_ch. part. — L=1.3 fb^-1 (2011) [1111.0080] — 1.25 TeV — M_D (δ=6)
ADD BH (M_TH /M_D=3) : leptons + jets, Σp_T — L=1.0 fb^-1 (2011) [ATLAS-CONF-2011-147] — 1.5 TeV — M_D (δ=6)
Quantum black hole : dijet, F_χ(m_jj) — L=4.7 fb^-1 (2011) [ATLAS-CONF-2012-038] — 4.11 TeV — M_D (δ=6)
CI
qqqq contact interaction : χ(m_jj) — L=4.8 fb^-1 (2011) [ATLAS-CONF-2012-038] — 7.8 TeV — Λ
qqll CI : ee, μμ combined, m_ll — L=1.1-1.2 fb^-1 (2011) [1112.4462] — 10.2 TeV — Λ (constructive int.)
uutt CI : SS dilepton + jets + E_T,miss — L=1.0 fb^-1 (2011) [1202.5520] — 1.7 TeV — Λ
V'
SSM Z' : m_ee/μμ — L=4.9-5.0 fb^-1 (2011) [ATLAS-CONF-2012-007] — 2.21 TeV — Z' mass
SSM W' : m_T,e/μ — L=1.0 fb^-1 (2011) [1108.1316] — 2.15 TeV — W' mass
LQ
Scalar LQ pairs (β=1) : kin. vars. in eejj, eνjj — L=1.0 fb^-1 (2011) [1112.4828] — 660 GeV — 1st gen. LQ mass
Scalar LQ pairs (β=1) : kin. vars. in μμjj, μνjj — L=1.0 fb^-1 (2011) [Preliminary] — 685 GeV — 2nd gen. LQ mass
New quarks
4th generation : Q_4 Q̄_4 → WqWq — L=1.0 fb^-1 (2011) [1202.3389] — 350 GeV — Q_4 mass
4th generation : u_4 ū_4 → WbWb — L=1.0 fb^-1 (2011) [1202.3076] — 404 GeV — u_4 mass
4th generation : d_4 d̄_4 → WtWt — L=1.0 fb^-1 (2011) [Preliminary] — 480 GeV — d_4 mass
New quark b' : b'b̄' → Zb+X, m_Zb — L=2.0 fb^-1 (2011) [Preliminary] — 400 GeV — b' mass
TT̄_exo. 4th gen. → tt̄ + A_0A_0 : 1-lep + jets + E_T,miss — L=1.0 fb^-1 (2011) [1109.4725] — 420 GeV — T mass (m(A_0) < 140 GeV)
Excit. ferm.
Excited quarks : γ-jet resonance, m_γjet — L=2.1 fb^-1 (2011) [1112.3580] — 2.46 TeV — q* mass
Excited quarks : dijet resonance, m_jj — L=4.8 fb^-1 (2011) [ATLAS-CONF-2012-038] — 3.35 TeV — q* mass
Excited electron : e-γ resonance, m_eγ — L=4.9 fb^-1 (2011) [ATLAS-CONF-2012-023] — 2.0 TeV — e* mass (Λ = m(e*))
Excited muon : μ-γ resonance, m_μγ — L=4.8 fb^-1 (2011) [ATLAS-CONF-2012-023] — 1.9 TeV — μ* mass (Λ = m(μ*))
Other
Techni-hadrons : dilepton, m_ee/μμ — L=1.1-1.2 fb^-1 (2011) [ATLAS-CONF-2011-125] — 470 GeV — ρ_T/ω_T mass (m(ρ_T/ω_T) - m(π_T) = 100 GeV)
Techni-hadrons : WZ resonance (νlll), m_T,WZ — L=1.0 fb^-1 (2011) [Preliminary] — 483 GeV — ρ_T mass (m(ρ_T) = m(π_T) + m_W, m(a_T) = 1.1 m(ρ_T))
Major. neutr. (LRSM, no mixing) : 2-lep + jets — L=2.1 fb^-1 (2011) [Preliminary] — 1.5 TeV — N mass (m(W_R) = 2 TeV)
W_R (LRSM, no mixing) : 2-lep + jets — L=2.1 fb^-1 (2011) [Preliminary] — 2.4 TeV — W_R mass (m(N) < 1.4 GeV)
H_L^±± (DY prod., BR(H_L^±±→μμ)=1) : SS dimuon, m_μμ — L=1.6 fb^-1 (2011) [1201.1091] — 355 GeV — H_L^±± mass
Color octet scalar : dijet resonance, m_jj — L=4.8 fb^-1 (2011) [ATLAS-CONF-2012-038] — 1.94 TeV — Scalar resonance mass
Vector-like quark : CC, m_lνq — L=1.0 fb^-1 (2011) [1112.5755] — 900 GeV — Q mass (coupling κ_qQ = v/m_Q)
Vector-like quark : NC, m_llq — L=1.0 fb^-1 (2011) [1112.5755] — 760 GeV — Q mass (coupling κ_qQ = v/m_Q)
10^-1
1
10
10^2
Mass scale [TeV]
*Only a selection of the available mass limits on new states or phenomena shown

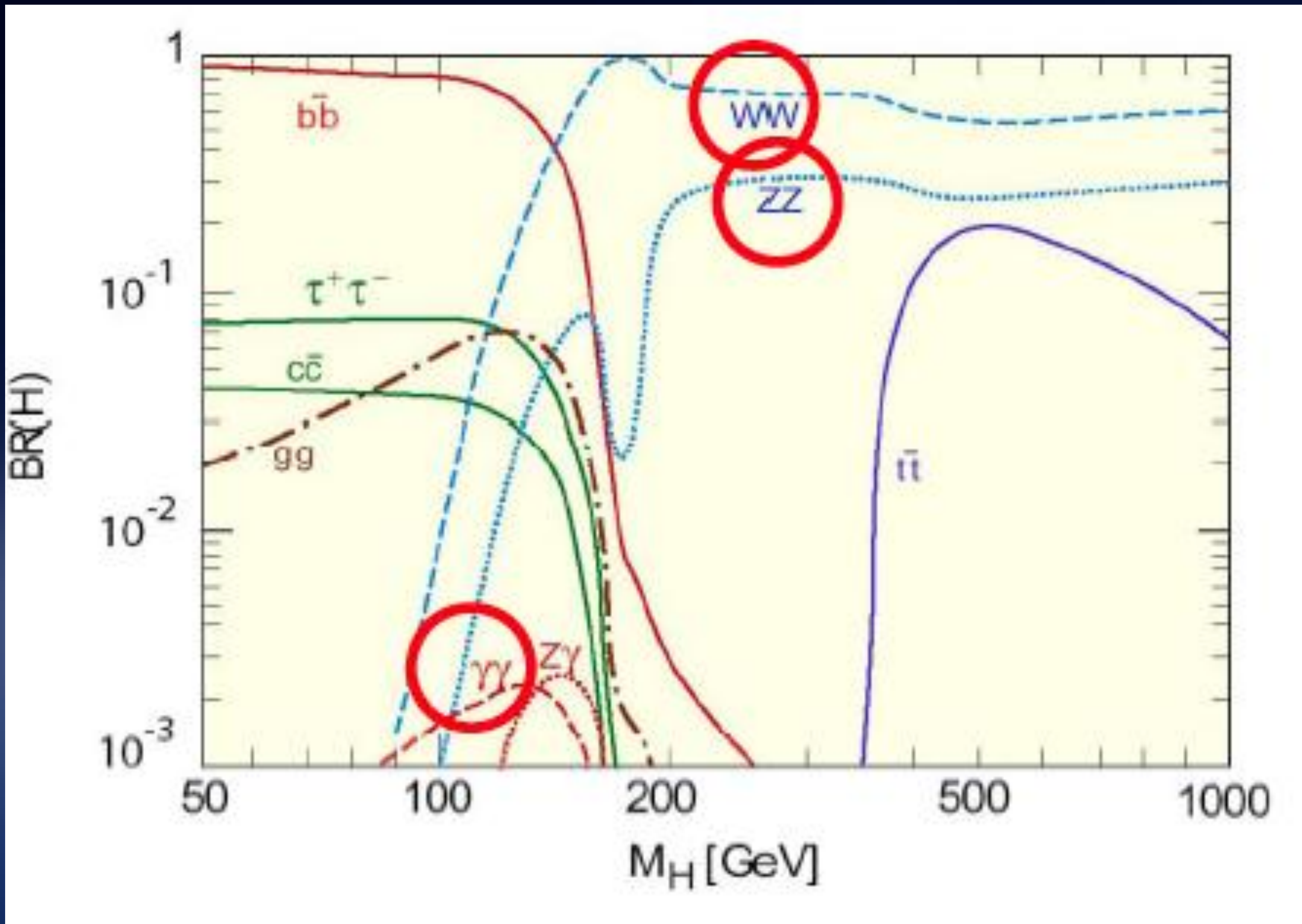
Exotics

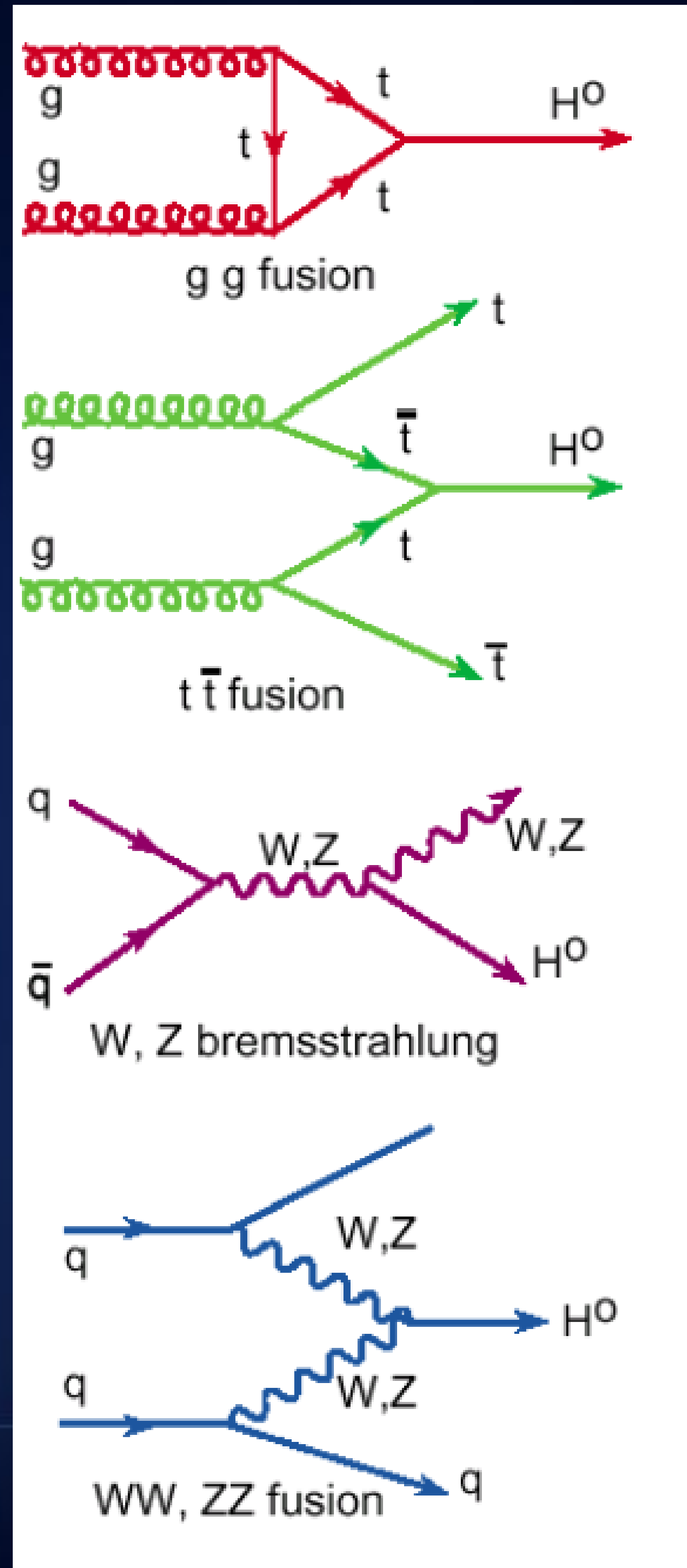


Most recent results among many.

- Searches for Exotics physics states decaying to leptonic final states
- Searches for Exotics physics states in jets and boosted objects final states
- Quantum black holes (centrality of di-jets spectrum)
- ADD extra dimensions (monojets + E_T^{miss})
- Contact Interactions (Non resonant dilepton final state searches)
- A Search for ttbar Resonances in the di-lepton channel
- Search for Heavy Neutrinos
- Search for mono-jet plus missing transverse energy
- 4th generation searches

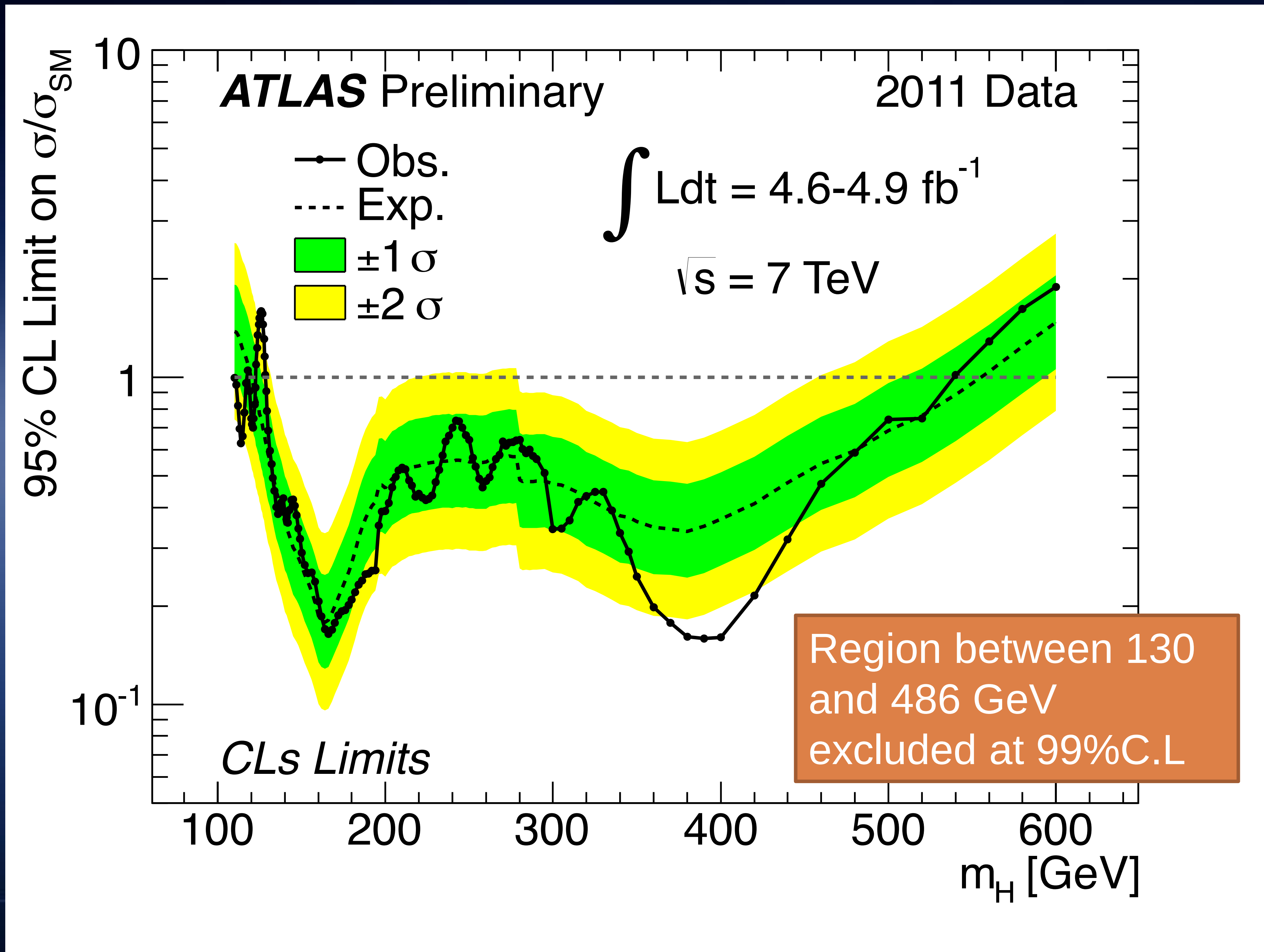
SM HIGGS search



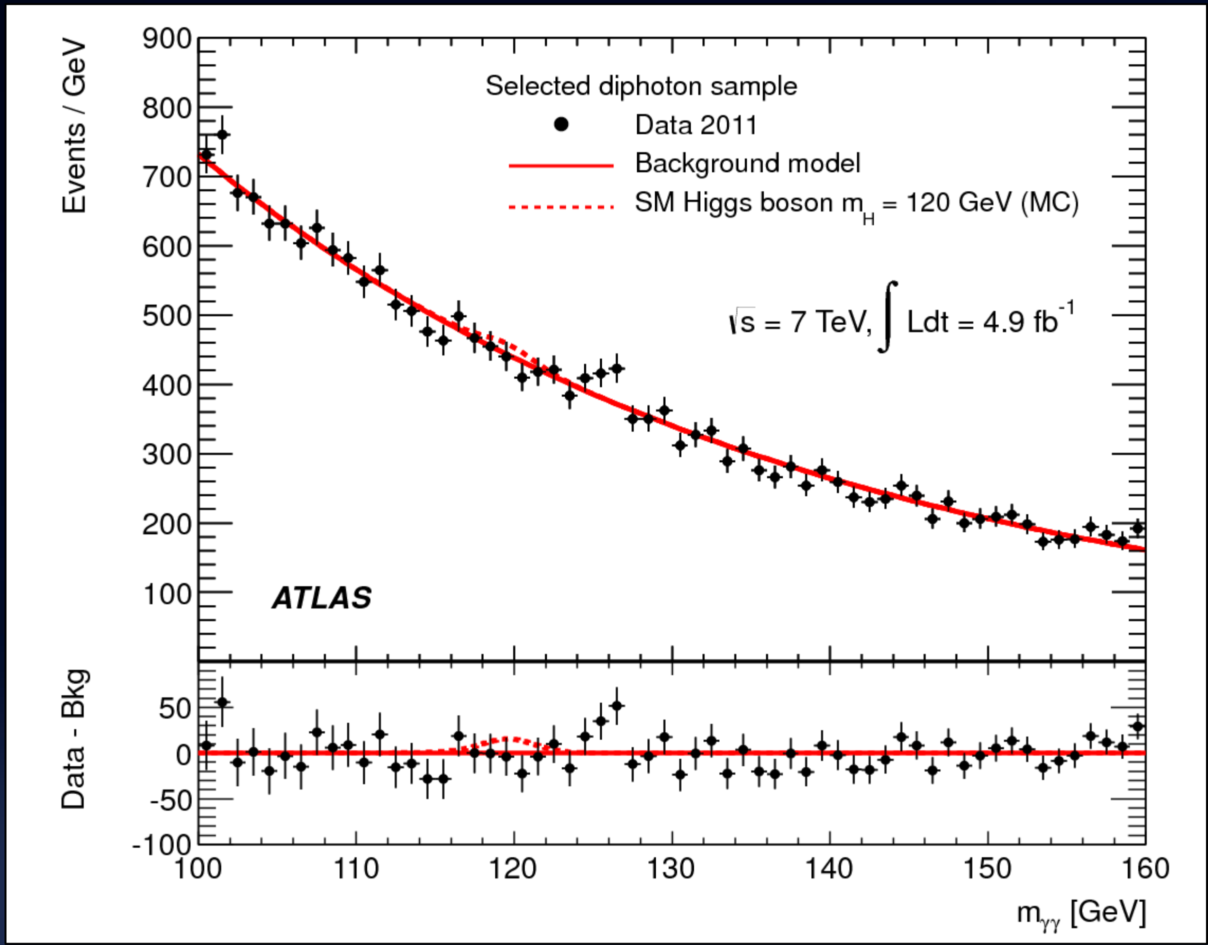


At the moment just these 3 channels have enough sensitivity !!

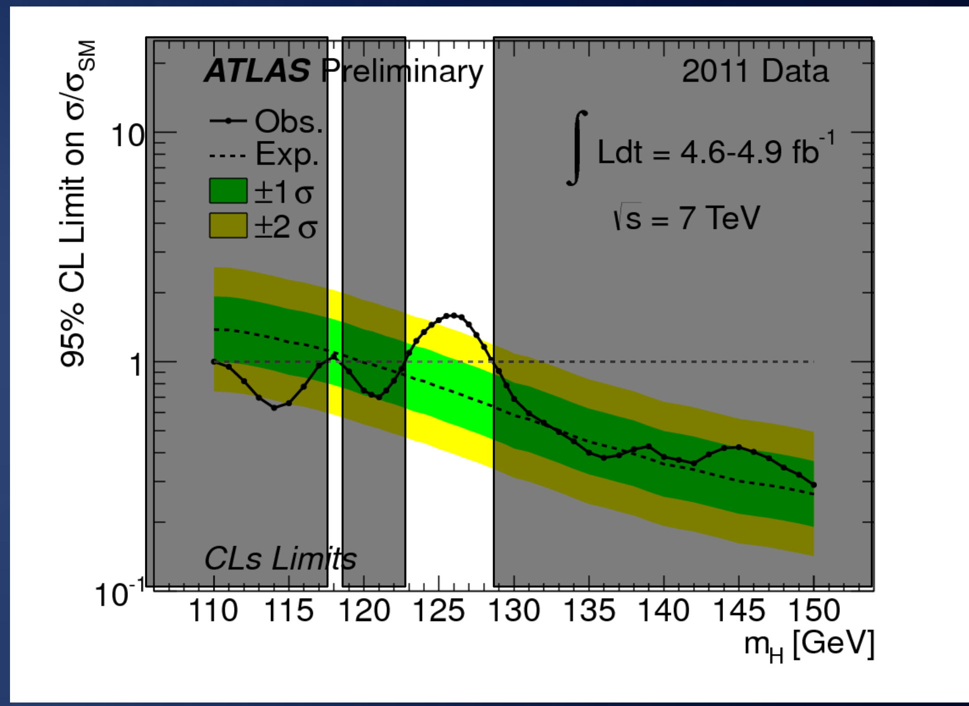
M > 130 GeV excluded

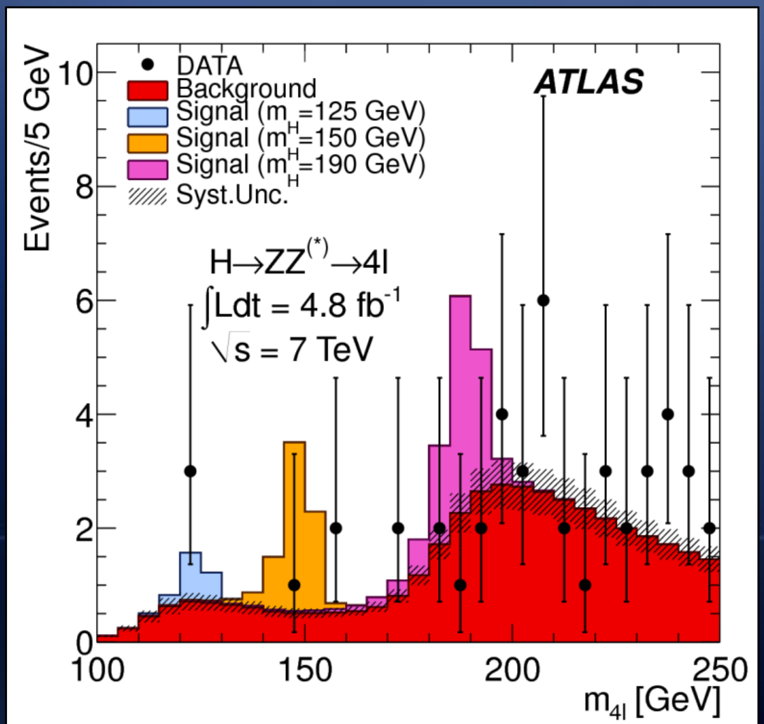


M ~125 GeV still possible !



H→ γγ:
for m_H ~ 125 GeV, ~70 signal events expected after all cuts, and ~ 3000 background events in signal mass window → S/B ~ 0.02





H→ 4l:
in the region m_H < 141 GeV (not excluded at 99% CL by ATLAS+CMS combination) 3 events are observed: two 2e2μ events (m=123.6 GeV, m=124.3 GeV) and one 4μ event (m=124.6 GeV)

What next ?

- 2012 statistics x 2
- Not all analysis un-blinded yet. First results are just discussed now in the collaboration (sorry!).
- Make sure to be ready with full statistics on

4l and gamma gamma

for ICHEP

→ ***Next 2 weeks very hot!***

Future strategy

- ✓ if m_H~ 125 GeV exists → measure properties: mass, couplings, self-couplings (!?), spin and CP; look for rare decays (e.g. H→ μμ). This will start in the coming years but higher statistics needed in some cases (e.g. rare decays)

- ✓ $V_L V_L$ scattering: if Higgs exists → confirm "regularization" of cross-section; if not → understand what keeps cross-section finite. Note: marginal with O(100 fb^{-1})

- ✓ extend mass reach for New Physics (typically by ~ 30% going to 3000 fb^{-1})

- ✓ if New Physics discovered at the LHC/HL-LHC → explore the new scenario: extend/complete spectrum; measurements (require high-statistics)

Example: SUSY: extend reach towards higher squark and gluino masses (~3 TeV); third generation; low cross-section processes (gauginos, sleptons); isolate exclusive (rare) decay chains for precision measurements

ATLAS EXPERIMENT

Future strategy

A fundamental question to be addressed: trade-off between pile-up and integrated luminosity:

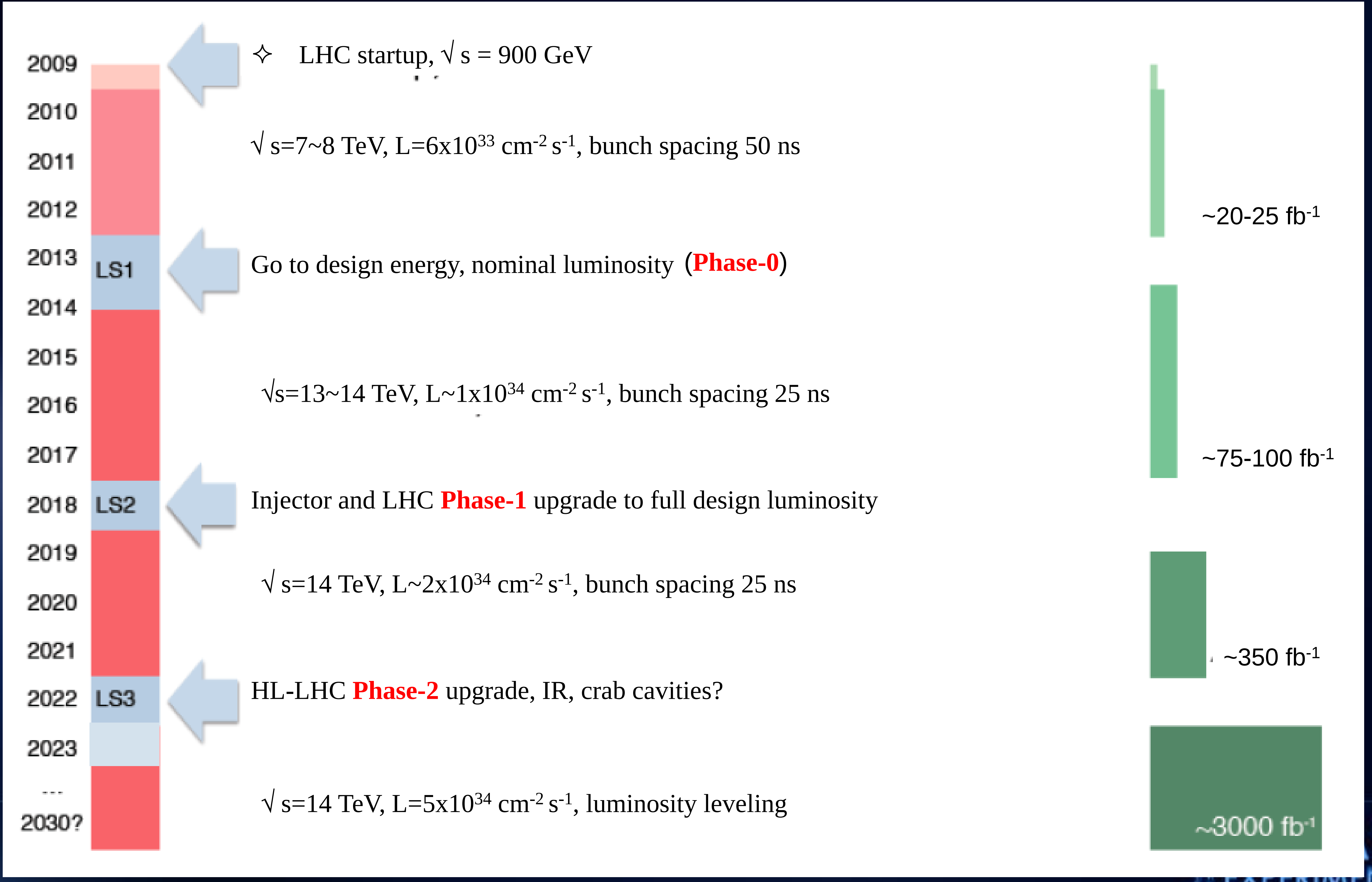
-- what physics processes are marginally affected by pile-up and benefit from as much statistics as possible ? In general, all high-mass searches …

-- what physics processes are affected by pile-up → less integrated luminosity in cleaner conditions may be a better choice (e.g. coupling measurements for VBF $H\rightarrow \tau\tau$) ?

This potential "tension" will affect the LHC / HL-LHC operation program

ATLAS EXPERIMENT

A long way in front of us !



Looking at short, medium and long term!

We have to make sure that we are able to adapt to the challenges offered by the LHC accelerator in all its phases, also because our detector technology is aging if not evolving properly (including radiation damage!)

Phase 0:	**To nominal energy and nominal peak Luminosity**
Phase 1:	**To ultimate peak Luminosity : 2 x nominal peak Luminosity**
Phase 2:	**To HL-LHC mode : 5 x nominal peak Luminosity + Luminosity leveling, to maximize the integrated Luminosity (~ 300 fb^{-1}/year)**

In addition we have to make sure we maintain the infrastructure efficient and operational over decades, minimizing single points of failure

ATLAS EXPERIMENT

PHASE 0 up to the 2013/2014 shutdown (LS1):

- Plans worked out since a few years through regular interactions within the Collaboration (CB), National Contact Physicists, RRB scrutiny group, CERN and the various service providers:
  - long list of maintenance/consolidations/repairs that we are preparing since a few years
  - Anticipate the 4th pixel layer installation (IBL)….. LS2 installation in 2018 would be too late!
  - Prepare detector for optimal data taking at nominal Luminosity !!!

Detector consolidation:

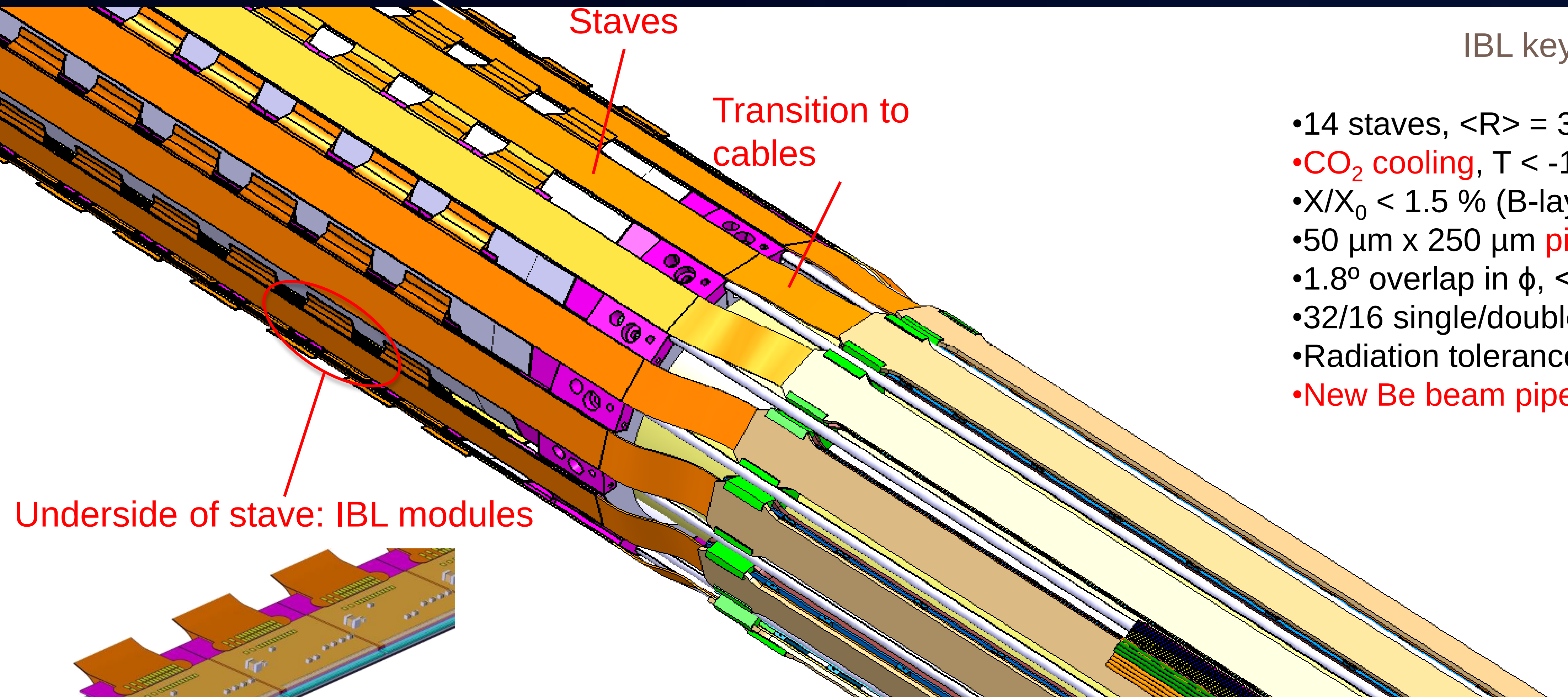
- New ID evaporative cooling plant
- New Calorimeters LV power
- Magnets cryogenics consolidation
- Muon spectrometer consolidation
- Infrastructure consolidation (electr, ventilation, radiation protection,…)
- Maintenance and repairs everywhere

Detector upgrade:

- New Aluminum beam pipes
- New small radius central Be pipe
- IBL: pixel 4th layer
- NSQP : Improved pixel services layout ? (decision during 2012)
- New chambers in the muon spectrometer to improve geometrical coverage

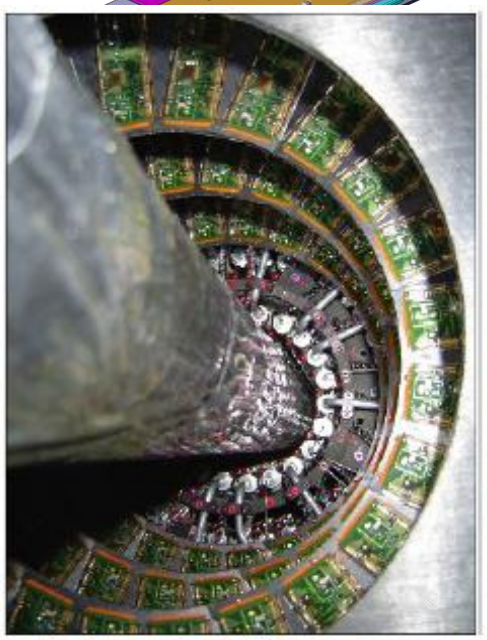
ATLAS EXPERIMENT

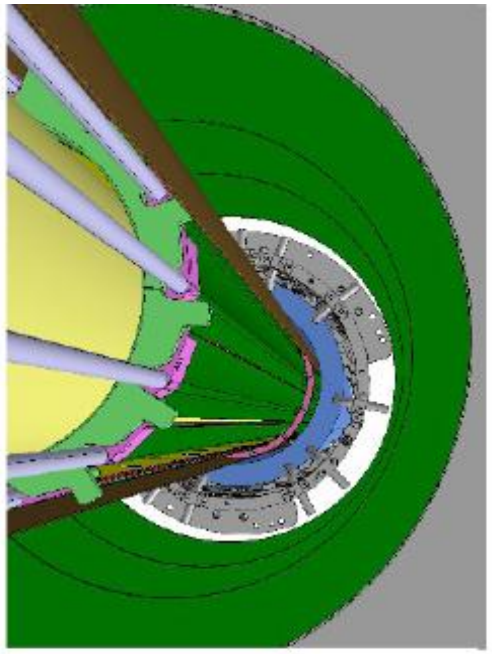
ATLAS is preparing for a 4 layer pixel in SL1 : IBL

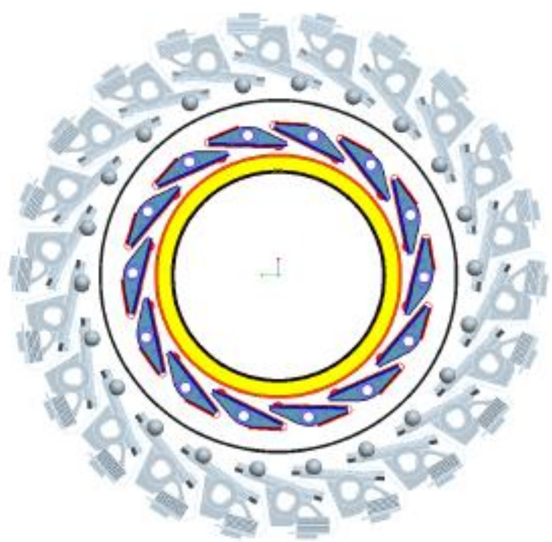


IBL key Specs / Params

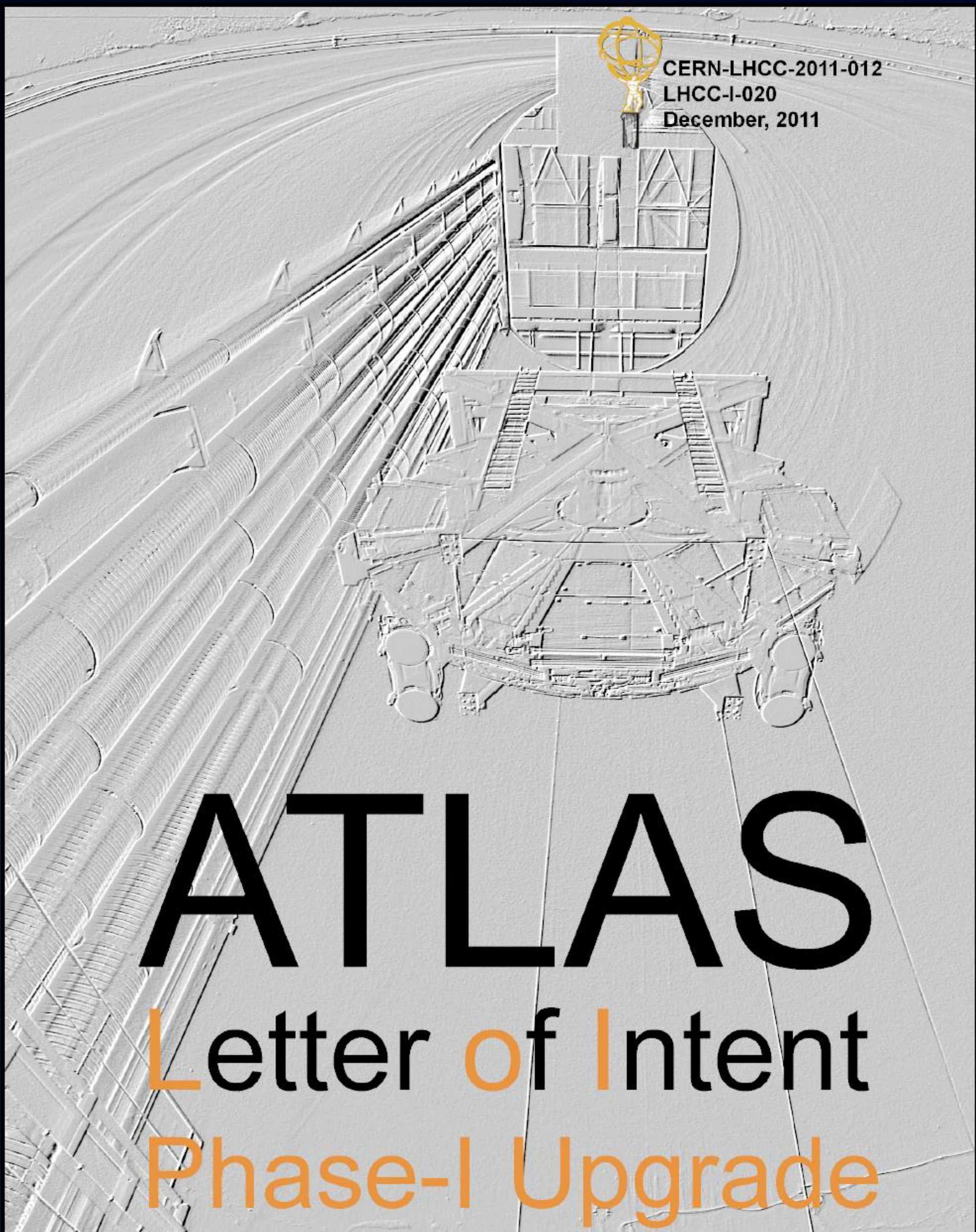
- 14 staves, <R> = 33.25 mm
- CO_2 cooling, T < -15ºC @ 0.2 W/cm^2
- X/X_0 < 1.5 % (B-layer is 2.7 %)
- 50 µm x 250 µm pixels (planar and 3D)
- 1.8º overlap in ϕ, < 2% gaps in Z
- 32/16 single/double FE-I4 modules per stave
- Radiation tolerance 5x10^{15} n_{eq}/cm^2
- New Be beam pipe of smaller radius







Phase 1 challenge:



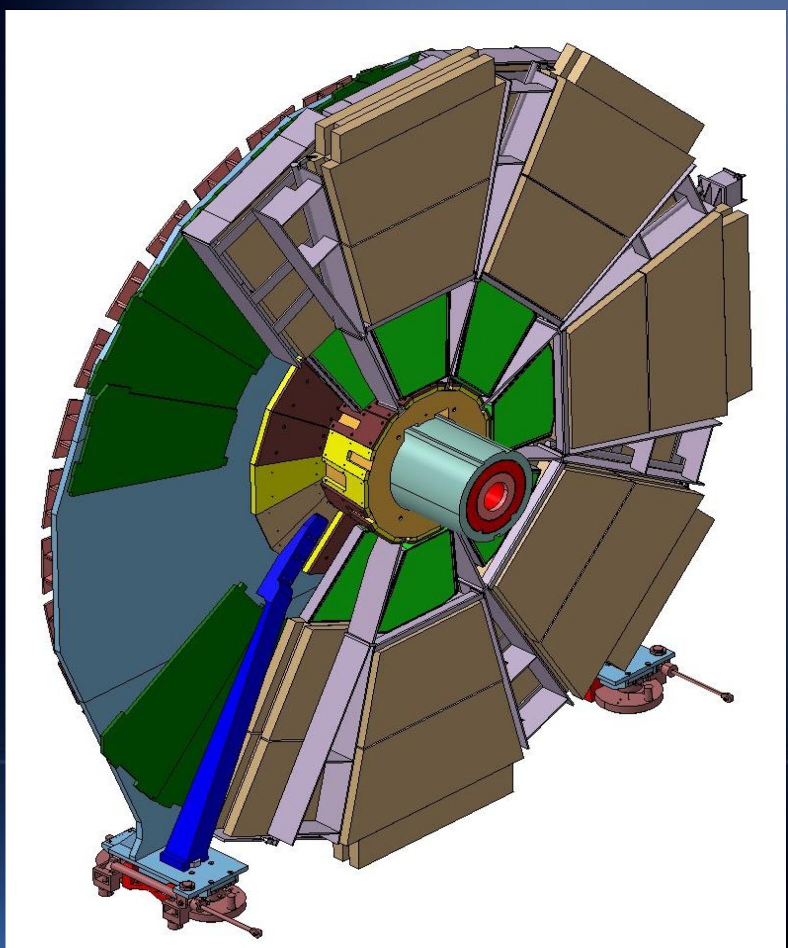
https://cdsweb.cern.ch/record/1402470/
(CERN-LHCC-2011-012)

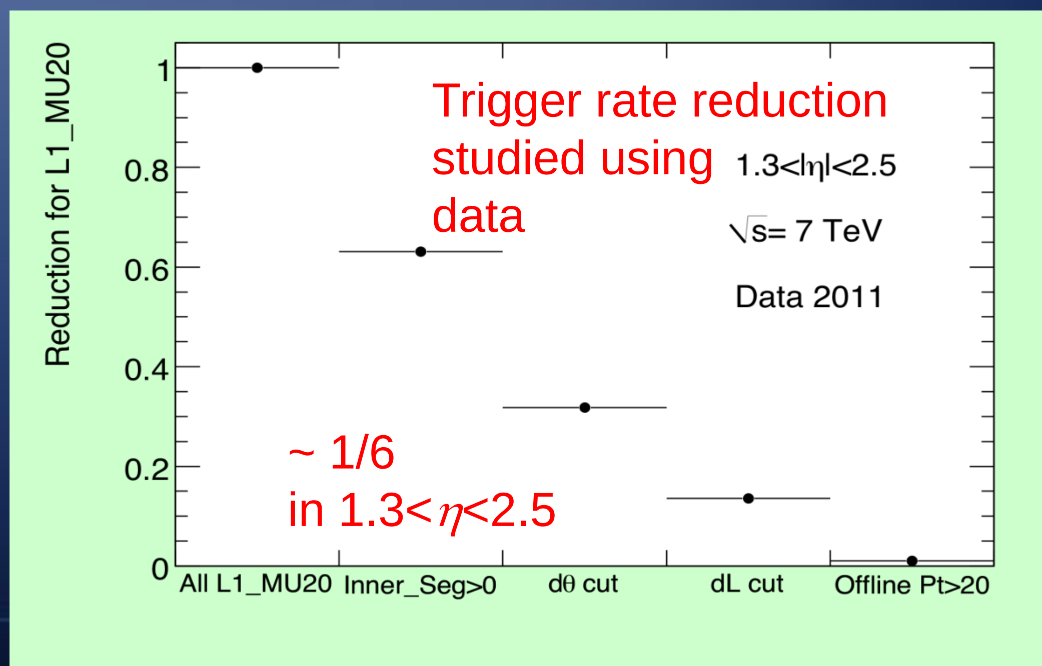
- Physics will continue to require Level-1 single lepton thresholds with p_T of order 20 GeV even with pile-up as high as ~50 (L =2 10^{34} $cm^{-2}s^{-1}$, 25ns) or even ~75 (L =3 $10^{34}cm^{-2}s^{-1}$, 25ns)
- Need to preserve nominal luminosity trigger acceptance even for L >$10^{34}cm^{-2}s^{-1}$
- Retain some "simple" triggers in the menu to avoid and/or understand physics biases
- Keep acceptances high and similar between barrel and forward
- In addition, aim at using secondary vertexing and track information to retain high purity, good efficiency samples of interesting channels at the HLT level
- Wherever feasible retain sensitivity to beyond the SM physics with as little model dependence as possible

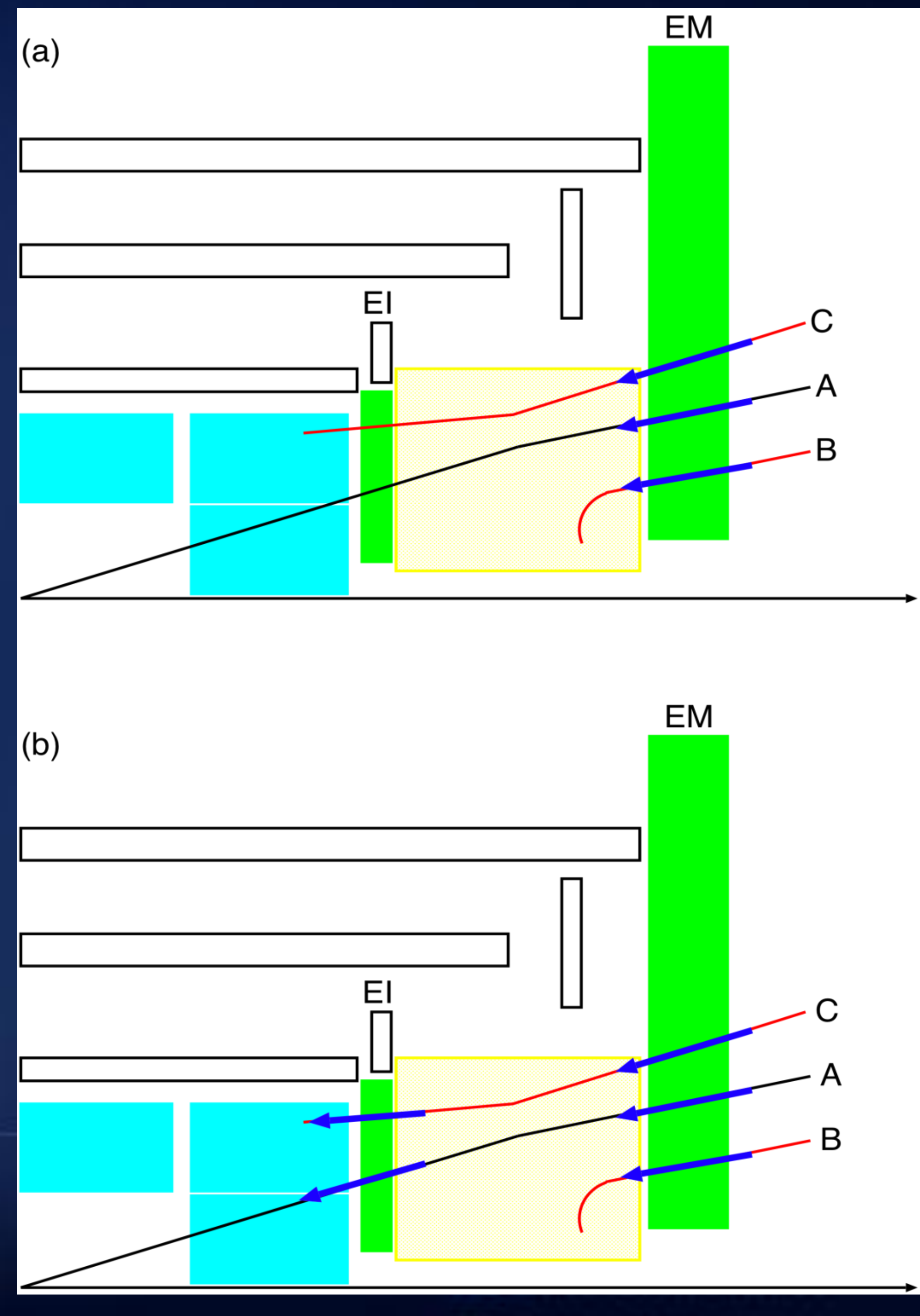
New muon small wheels (more granularity)

- Plan to replace muon small wheels with improved trigger capability: need <1mrad angular resolution and associated trigger vector capability
- Status:

- *Converging on the choice of the technology for precision tracking and trigger*
- *MicroMegas for precision coordinates and TGC for trigger the main candidates*
- *Vigorous milestone plan for 2012 to demonstrate feasibility*
- *TDR to be ready for early 2013*
- *Project being setup for ATLAS internal approval in October 2012*



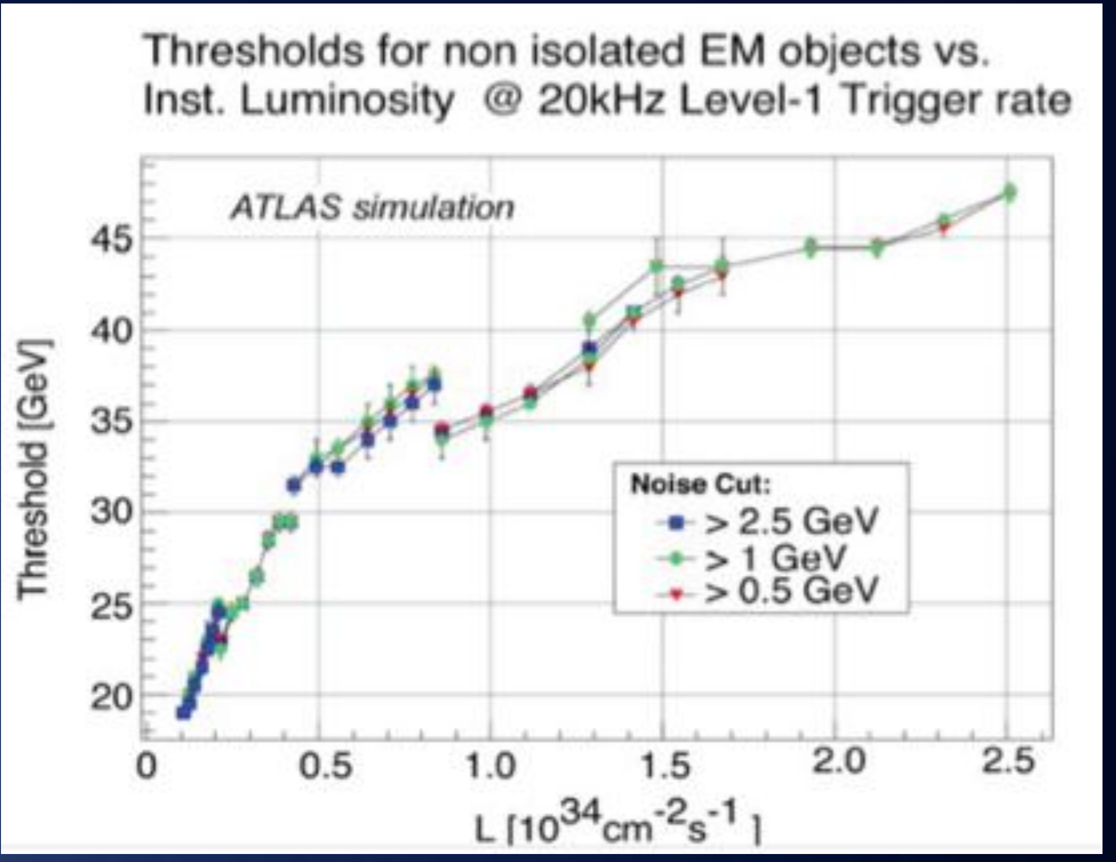


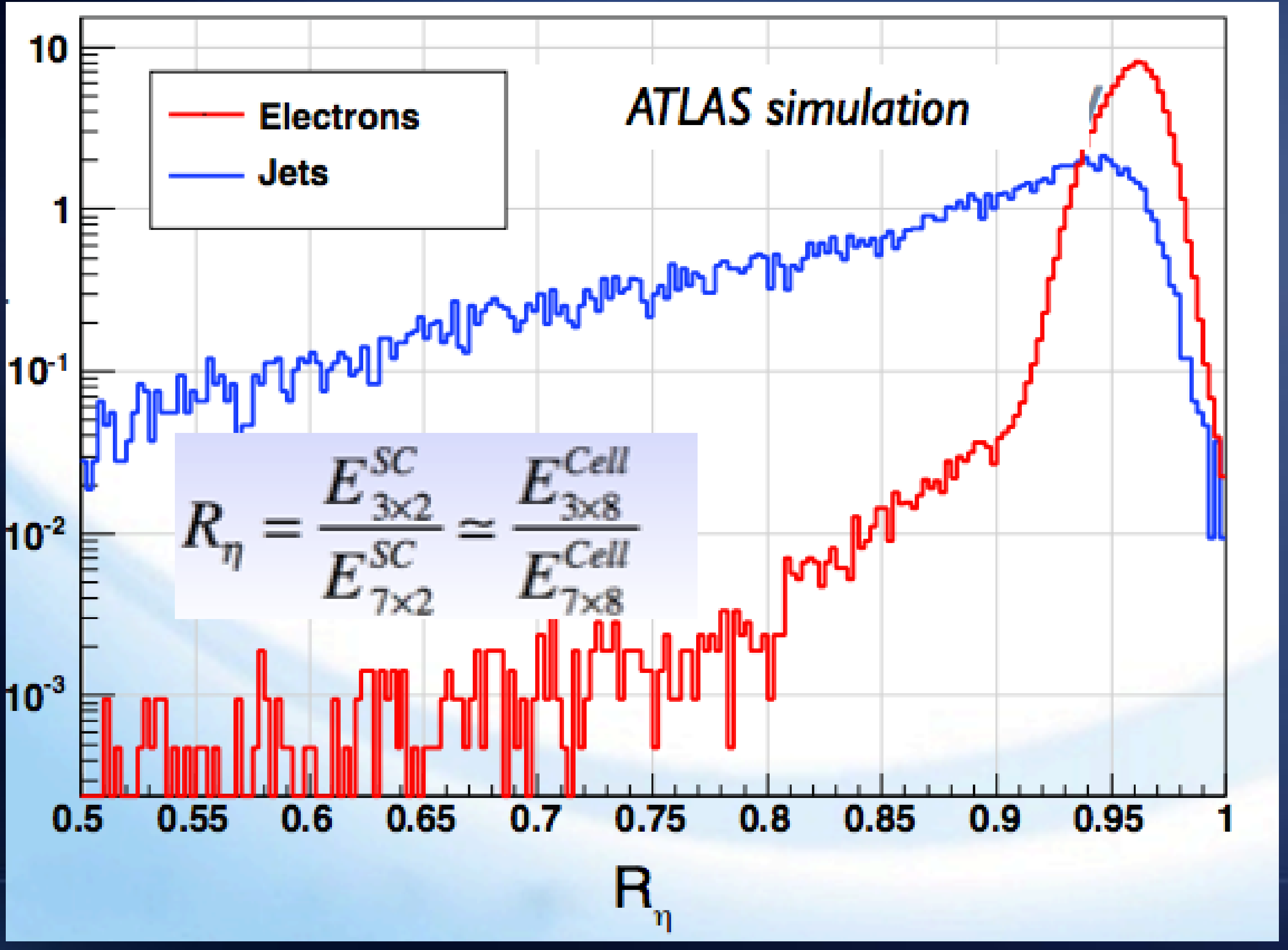


New LVL1 Calorimeter trigger (more granularity)

- Plan to better use in the LVL1 trigger the available detector granularity in the LAr Calorimeter. Develop a new front-end digital chain (trigger leg for phase I)
- GOAL:

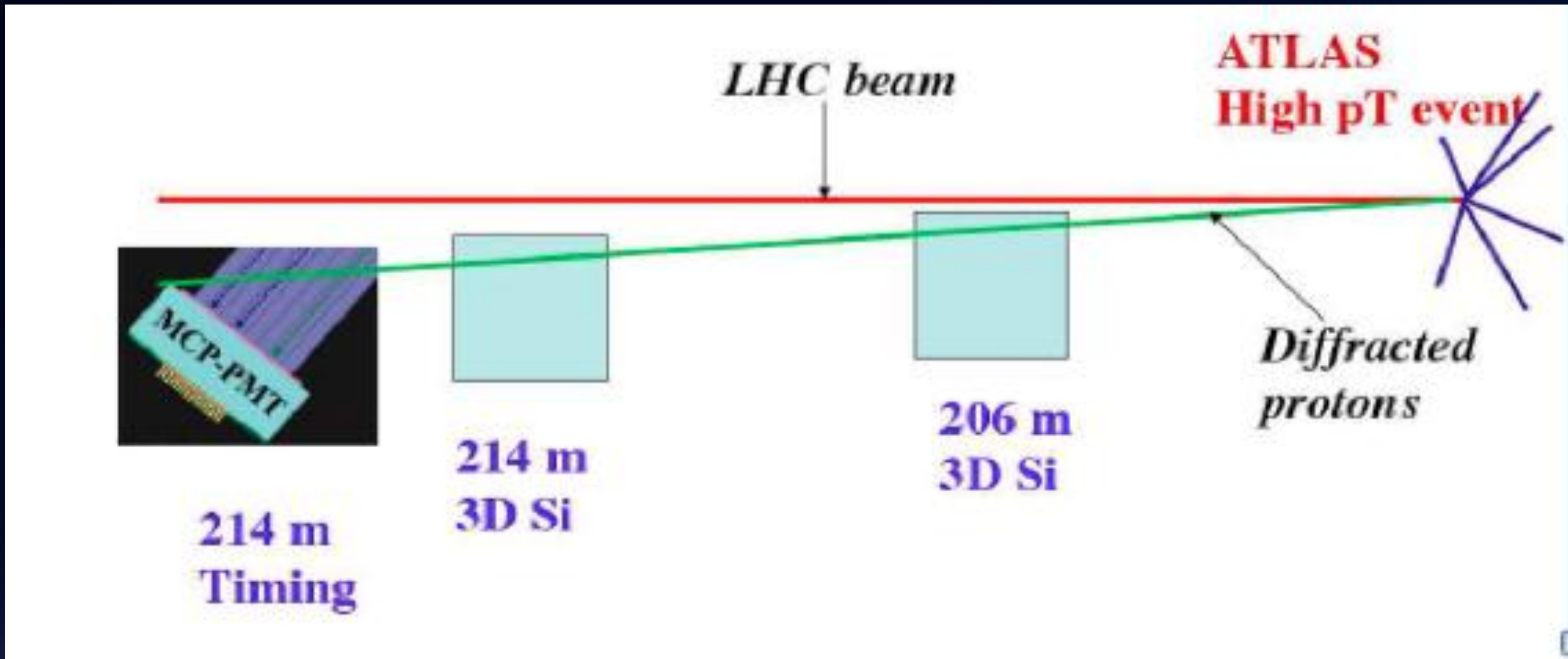
Preserve un-prescaled LVL1 theresholds for single electron trigger at PT ~ 25 GeV for LHC operation beyond the nominal design (Phase 1 LHC, HL-LHC)





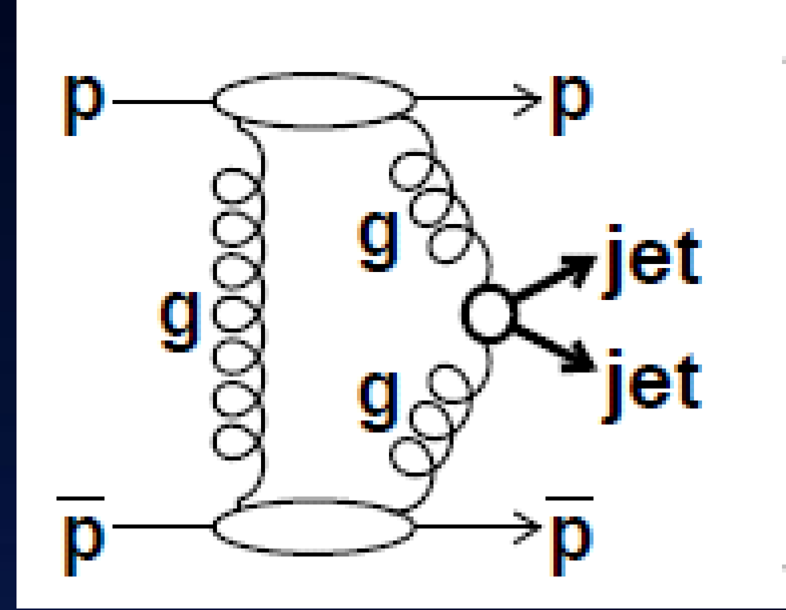
Use, at the LVL1 trigger level, a new shower shape: Ratio of energy (2nd layer of the EM calorimeter) in clusters of two sizes

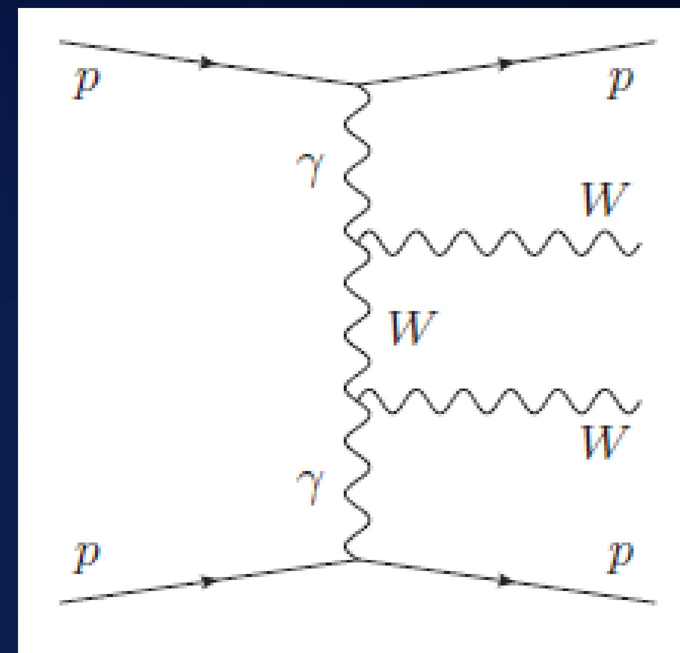
AFP : ATLAS Forward Physics

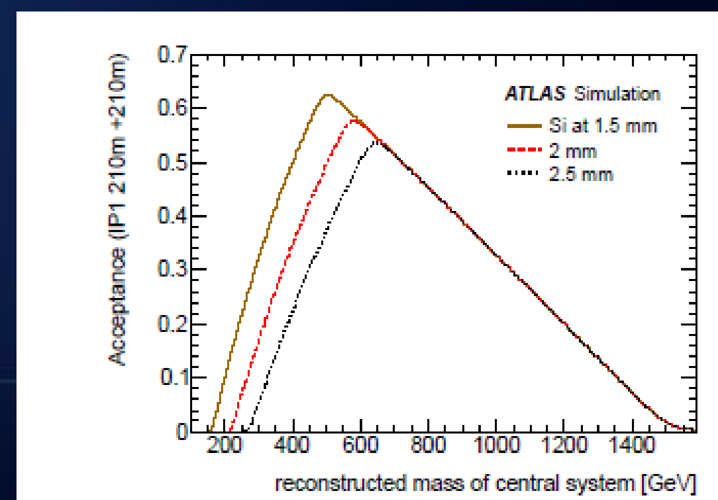


- ✓ Tag and measure protons at ± 210 m
- ✓ Trigger: rely on ATLAS high-P_T LVL1 trigger
- ✓ Detectors: radiation hard "edgeless" 3D Silicon as tracker, 10 ps timing detectors

Allows running in high pileup conditions with association with the primary vertex → **access to RARE processes**







PHASE 2: 2021/22 shutdown (LS3) or HL-LHC upgrade:

- We assume that by then the LHC will have delivered 300-350 fb^{-1}
- The LHC will be made ready to run at $L_p=5*10^{34}$ with Luminosity leveling

→ The main activity is the construction of a new inner detector for which today the collaboration is very active with R&D, prototypes and engineering work

→ *The Calorimeter readouts will need a substantial upgrade, part of it will be done in a staged way in the 2018 shutdown (digital LVL1 trigger)*

→ *If proven necessary, the end-cap LAr might need to be opened and FCAL and HEC electronics fixed. A decision will be taken in a few years from now*

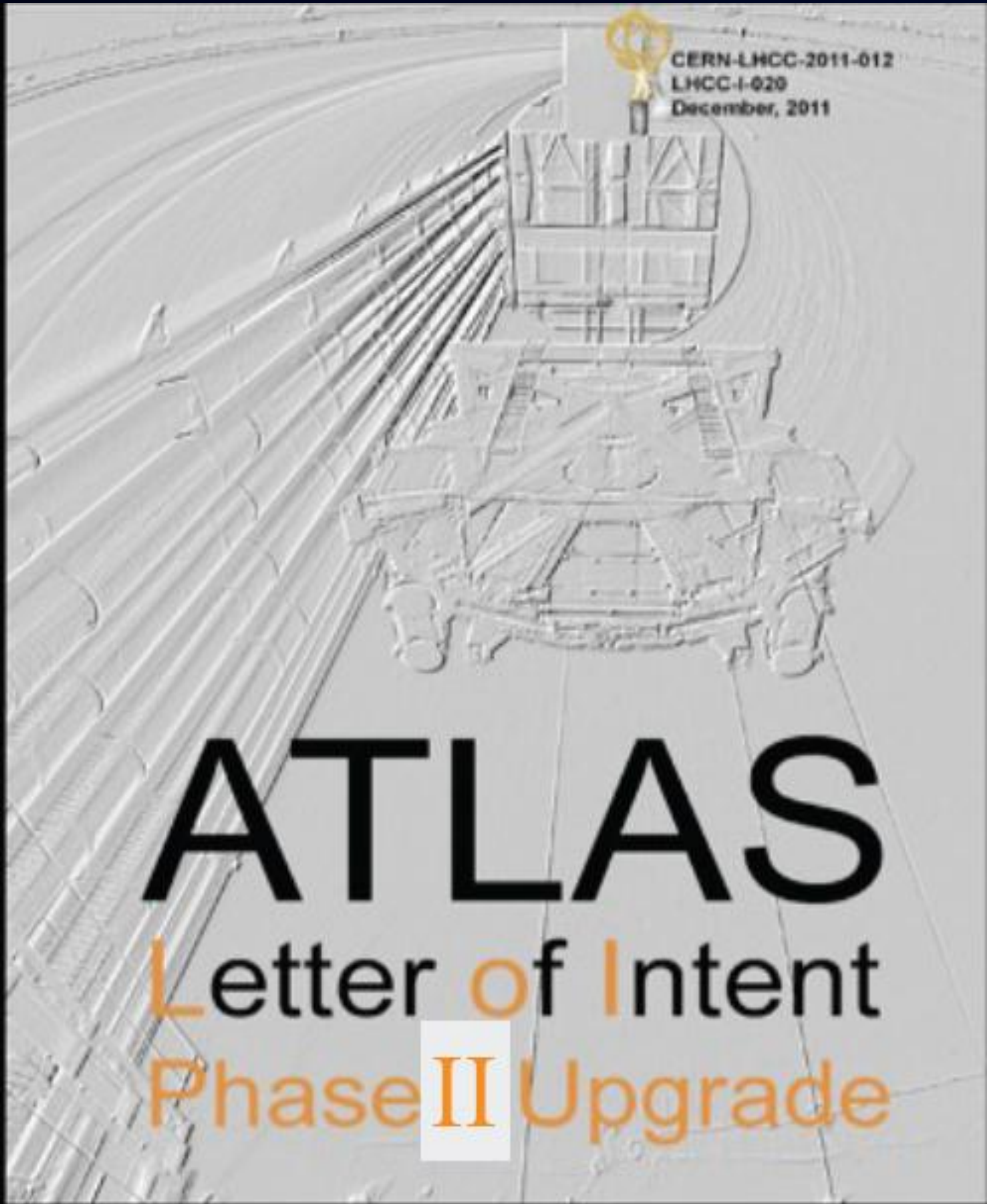
→ *The muon spectrometer will be upgraded in particular in the big wheel region*

→ *Most of the existing electronics/computing/TDAQ will need to be upgraded and modernized to face additional 8-10 years of running in extreme conditions*

ALL this will require ~2 years shutdown to prepare ATLAS for its new phase !!!

ATLAS EXPERIMENT

PHASE 2 : LOI in preparation



Today's plans :

- *Editorial board active*
- *LOI will be presented in December 2012*
- *Approved by the ATLAS CB in January 2013*
- *March 2013 looking for positive LHCC outcome*

Today's cost estimations (to be revised for the LOI) :

ATLAS PHASE II upgrade (LS3)

	it will happen [MCHF]	it might happen [MCHF]
1. New ID (strips and pixels)	*111.4*	*43.0*
2. New LAr front end and back end electronics	*32.0*	
3. New Tiles front end and back end electronics	*6.3*	
4. LAr new FCAL ?		*13.9*
5. LAr HEC cold electronics consolidation ?		*6.4*
6. Muon Barrel and Large Wheel system upgrade ?	*5.6*	*6.2*
7. TDAQ upgrade	*22.1*	*8.3*
8. L1 Track Trigger ?		*3.7*
9. TAS and shielding upgrade	*8.7*	
10. LUCID upgrade ?		*1.2*
11. Various infrastructures upgrade	*13.5*	
12. Common activities (installation, cabling, safety, ...)	*8.4*	
TOTAL	***208.0***	***82.7***

= 291 MCHF

Overall Strategy

- 2013/2014 shutdown (LS1):
  - long list of maintenance/consolidations/repairs that we are preparing since a few years
  - IBL installation, eventually entire pixel detector consolidation (nSQP project)
  - Prepare detector for optimal data taking at nominal Luminosity and Energy !!!

- 2017/18 shutdown (LS2):
  - Prepare detector for ultimate luminosity, upgrades mostly to inputs for LVL1 trigger
  - Possible additional consolidations/repairs after ~10 years of detector readiness
  - LOI presented and well received. First cost estimation included.
  - Next steps: TDRs/MOUs 2013-2014 depending on the projects(5)

- 2022/23 shutdown (LS3=HL-LHC):
  - ID aged mostly by radiation, complete construction of a new ID to be tested on surface in 2021
  - Upgrade the detector where technology will be obsolete (mostly electronics)
  - Prepare the detector for HL-LHC and 8-10 years of additional running
  - TDRs/MOUs 2014-2016 once LHC physics established and HL-CERN plans better known

How do we fit on all this as DPNC ?

ATLAS DPNC students (M=master/P=PhD, y=term)

ALEXANDRE Gauthier	(P,2012)
BACKES Moritz	(P,2013)
BARONE Gaetano	(P,2015)
BENHAR NOCCIOLI Eleonora	(P,2015)
BERNASCONI,Tancredi	(M,2012)
BILBAO DE MENDIZABAL Javier	(P,2017)
BUCCI Francesca	(P,2012)
DAO Valerio	(P,2013)
GRAMLING Johanna Lena	(P,2017)
GUESCINI Francesco	(P,2016)
KATRE Akshay	(P,2017)
MORA HERRERA Clemencia	(P,2012)
MIUCCI Antonello	(P,2016)
NEKTARIJEVIC Snezana	(P,2014)
NIKOLICS Katalin	(P,2013)
PICAZIO Attilio	(P-2016)
ROSBACH Kilian	(P,2015)
WATSON Ian	(P,2013)

Group very well integrated in ATLAS

3-4 thesis /year in the next future

ATLAS EXPERIMENT

How do we fit on all this as DPNC ?

ATLAS DPNC physicists

- BELL Paul
- BELL William
- CLARK Allan
- DOGLIONI Caterina
- FERRERE Didier
- GADOMSKI Szymon
- GONZALEZ SEVILLA Sergio
- GOULETTE Marc
- IACOBUCCI Giuseppe
- LA ROSA Alessandro
- LISTER Alison
- MARTIN dit LATOUR Bertrand
- MERMOD Philippe
- NESSI Marzio
- PASZTOR Gabriella
- POHL Martin
- WU Xin

- Bell.P. *Deputy convener of the Egamma trigger signature group*
- Doglioni.C. *Contact person for the high-mass di-jet exo analysis call energy scale*
- Gadomski.S. *Member of the ATLAS international computing board*
- Lister.A. *Top reconstruction subgroup convener*
- Mermod,Ph. *Long living particles subgroup convener*
- Clark, A. *Member of the ITK subcommittee (future inner detector)*
- Iacobucci, G. *ATLAS Swiss Contact Physicist*
- Iacobucci, G. *Convener of the physics upgrade simulation subgroup and member of the upgrade steering committee*
- Cadoux,F. *Co-convener of the IBL integration&installation w. group*
- Debieu, S. *Co-convener of the IBL off detector w.group*
- Nessi,M. *ATLAS technical coordinator*

THANK YOU!