Recent Physics and Performance Highlights from ATLAS

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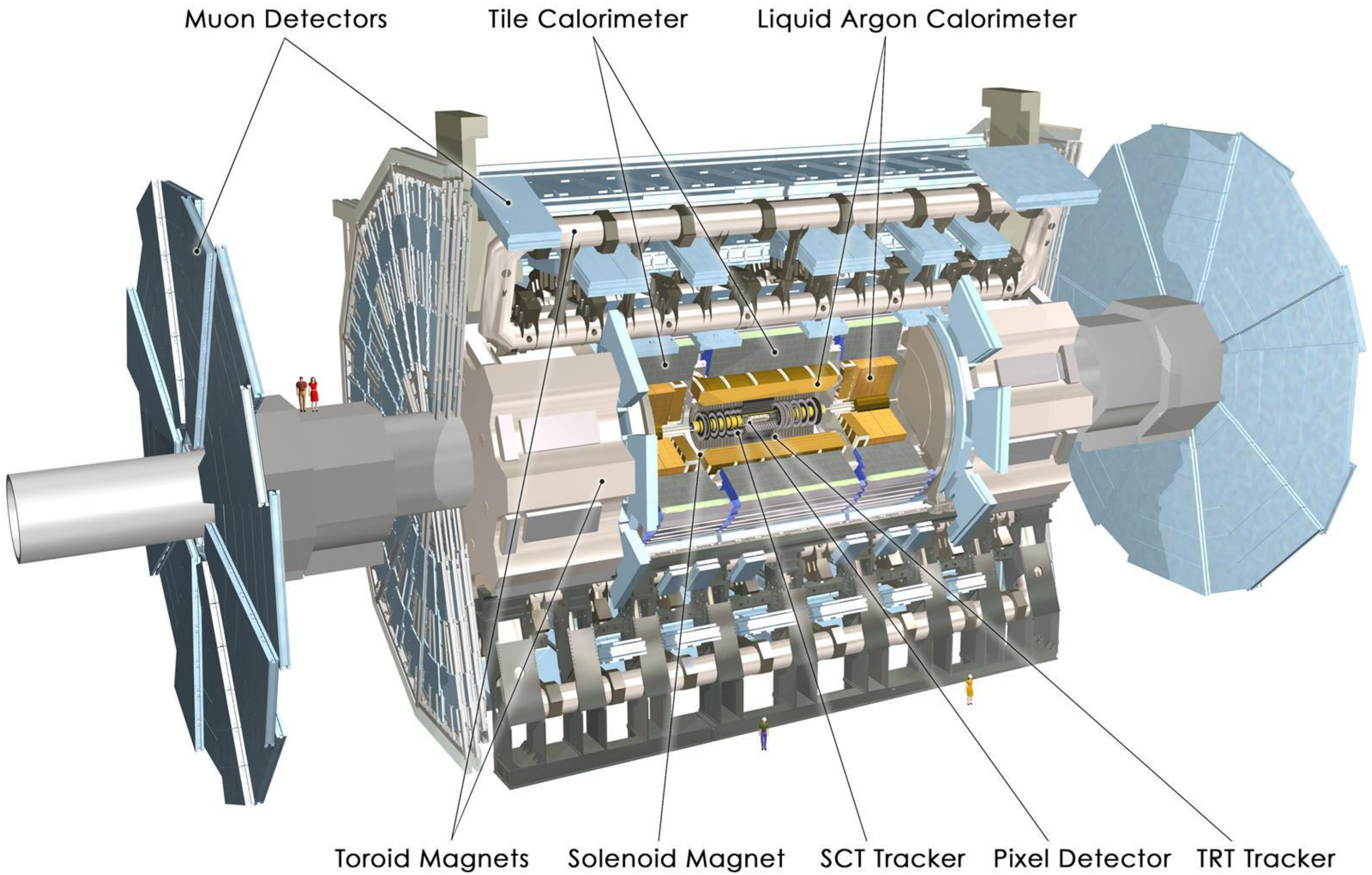
on behalf of the ATLAS Collaboration

TOP2017, September 17-22, 2017, Braga, Portugal

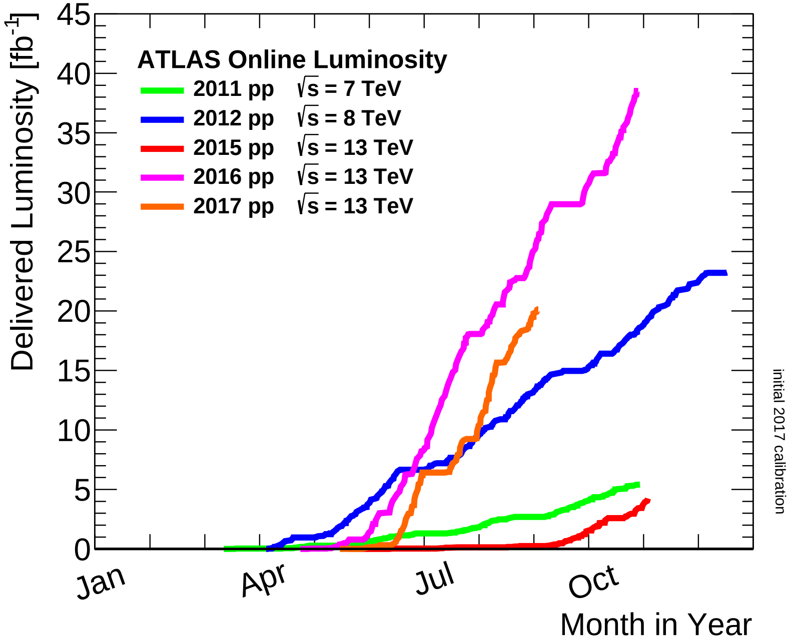
ATLAS Detector

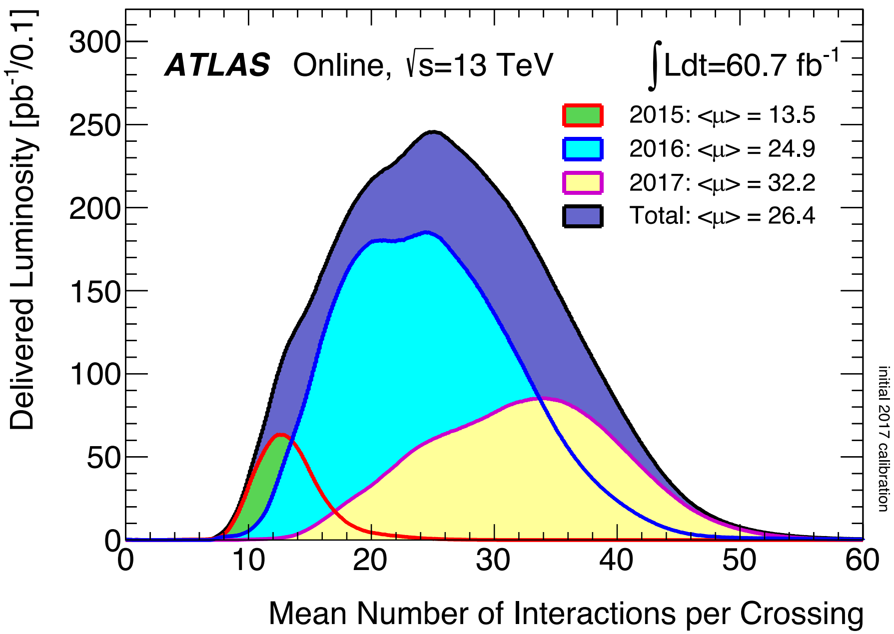


Outline

- ATLAS detector performance
- ATLAS recent physics results
  - Higgs analyses
  - BSM (SUSY and exotics) searches
  - Standard Model analyses
- Summary

ATLAS Operation





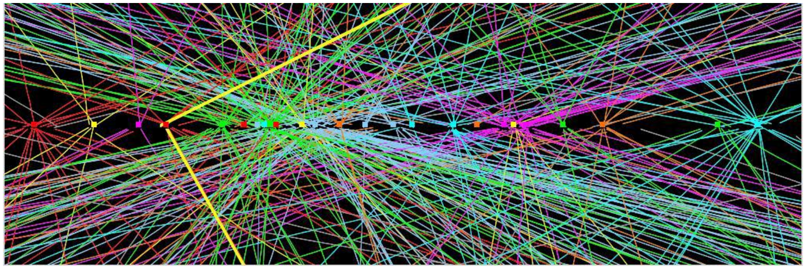
ATLAS performing well at high pileup

2016 Peak luminosity of 1.4 $\times 10^{34}$ cm^{-2} s^{-1}

- **Max pileup ~44**
- **Integrated luminosity of 38.5 fb^{-1} @ 13 TeV**
- **ATLAS recorded 35.6 fb^{-1}**

2017 Peak luminosity of 1.7 $\times 10^{34}$ cm^{-2} s^{-1}

- **Max pileup ~50**
- **Integrated luminosity of 19.9 fb^{-1} @ 13 TeV (09/01)**
- **ATLAS recorded 18.4 fb^{-1}**



$Z\rightarrow\mu\mu$ with 25 pileups)

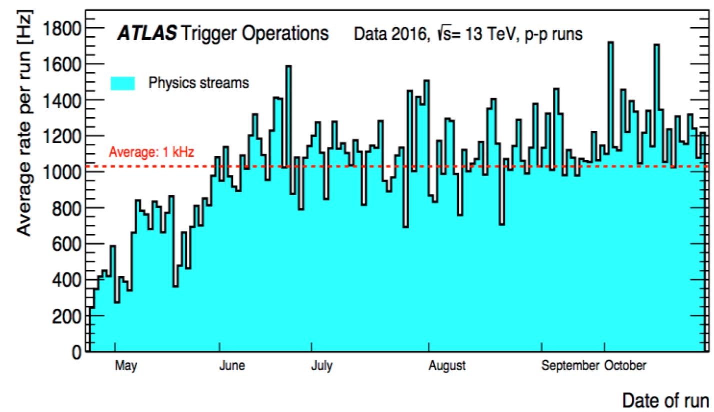
ATLAS Detector Status

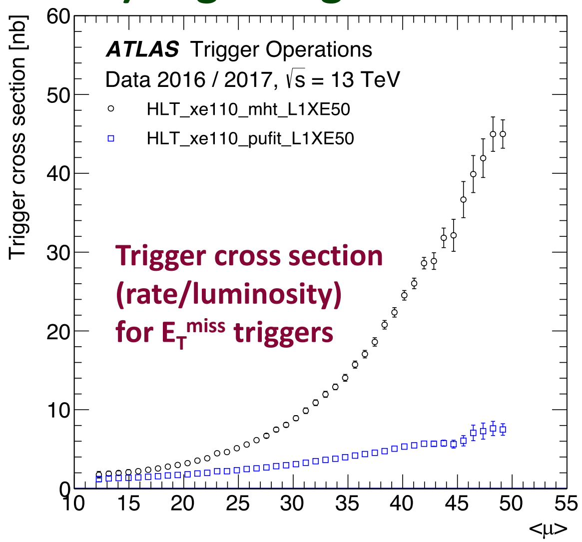
(From July 2017)

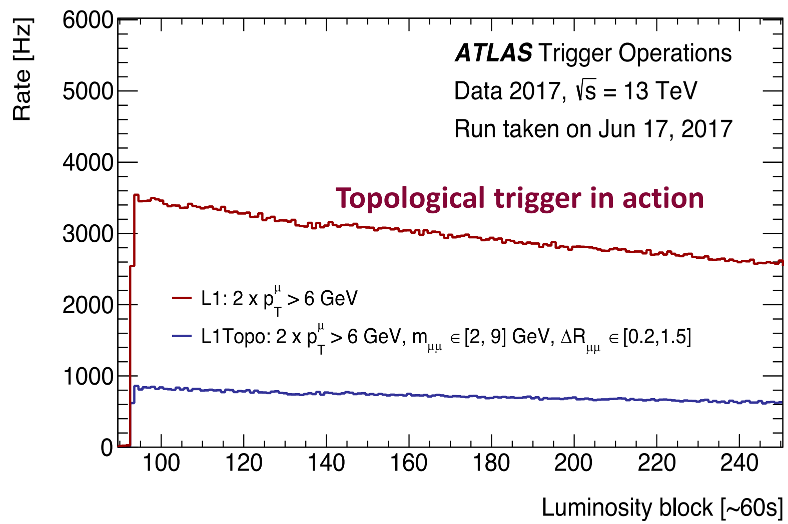
Subdetector	Number of Channels	Approximate Operational Fraction
Pixels	92 M	97.8%
SCT Silicon Strips	6.3 M	98.7%
TRT Transition Radiation Tracker	350 k	97.2%
LAr EM Calorimeter	170 k	100 %
Tile Calorimeter	5200	99.2%
Hadronic End-Cap LAr Calorimeter	5600	99.5%
Forward LAr Calorimeter	3500	99.7%
LVL1 Calo Trigger	7160	99.9%
LVL1 Muon RPC Trigger	383 k	99.8%
LVL1 Muon TGC Trigger	320 k	99.9%
MDT Muon Drift Tubes	357 k	99.7%
CSC Cathode Strip Chambers	31 k	95.3%
RPC Barrel Muon Chambers	383 k	94.4%
TGC End-Cap Muon Chambers	320 k	99.5%
ALFA	10 k	99.9%
AFP	430 k	93.8%

Trigger Performance

- Complex trigger menu to meet physics, monitoring and calibration requirements
  - ~2000 active menu items
  - Level-1 rate up to 100 kHz and output rate ~1kHz to permanent storage
- Challenges at high pileup, may require threshold increase and advanced algorithms
  - Non-linear rate growth
  - Performance (efficiency, resolution, etc) degrading

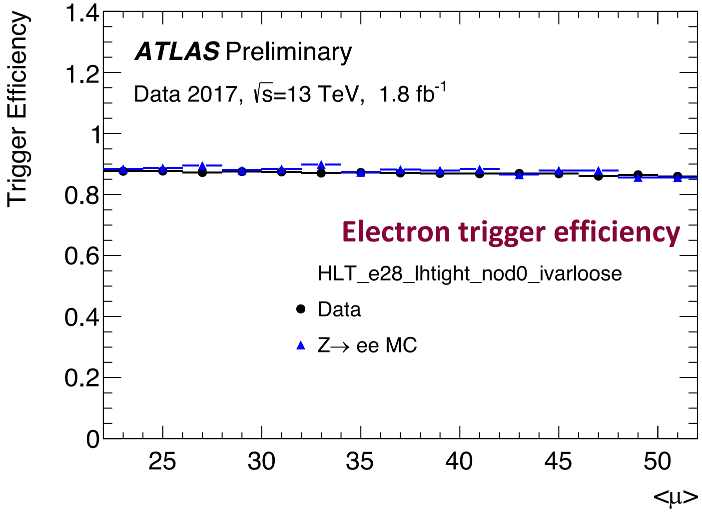


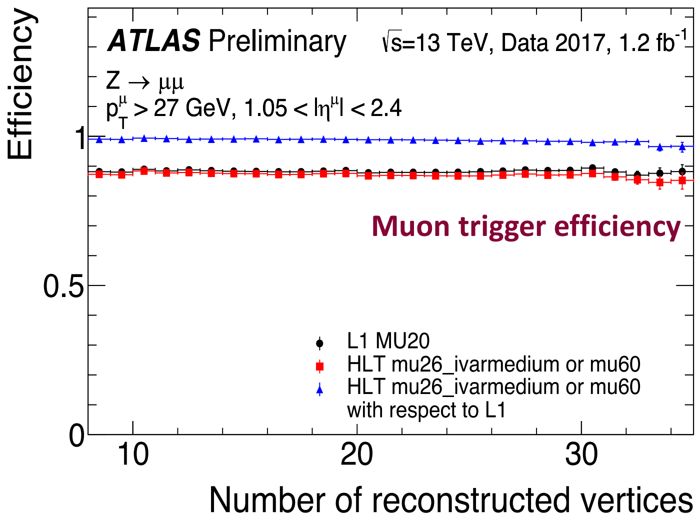


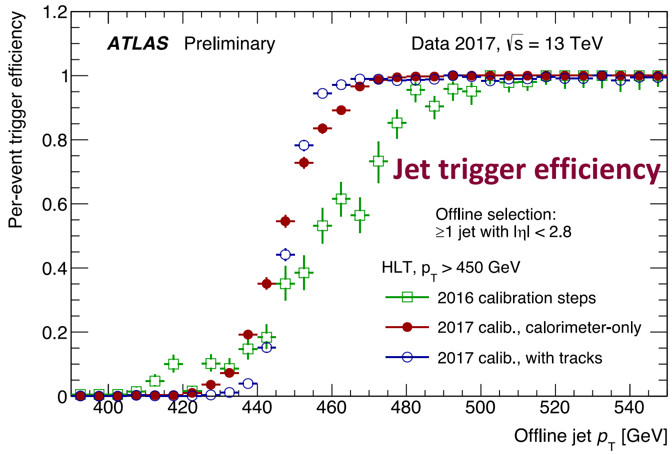


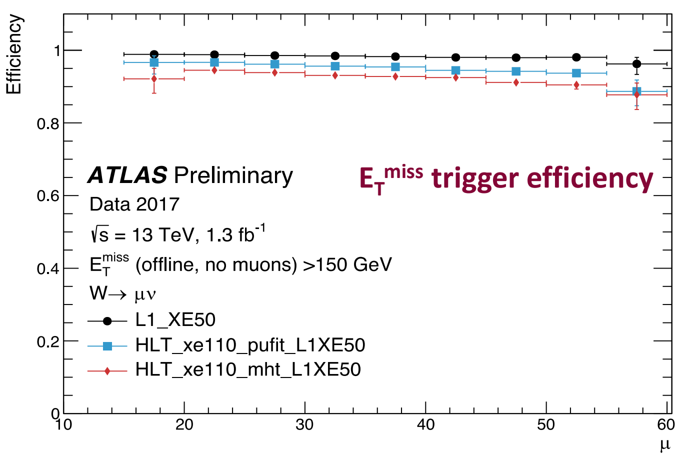
Trigger Performance (cont'd)

- **Excellent algorithm performance at high pileup**



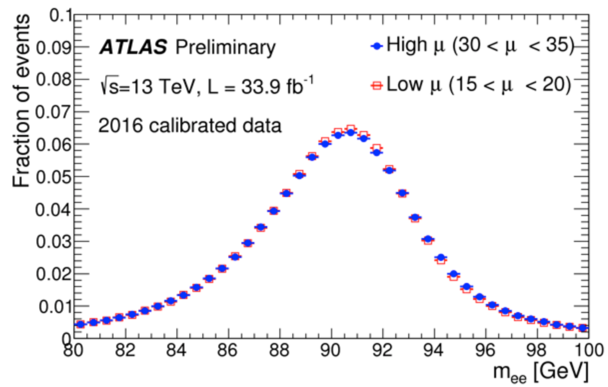




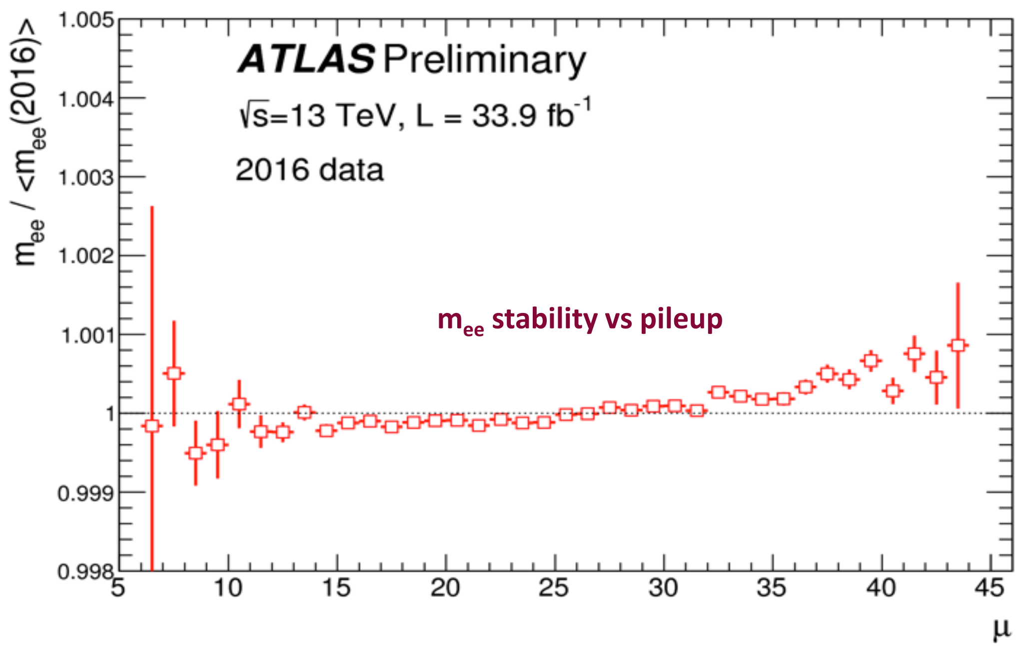


Physics Object Performance

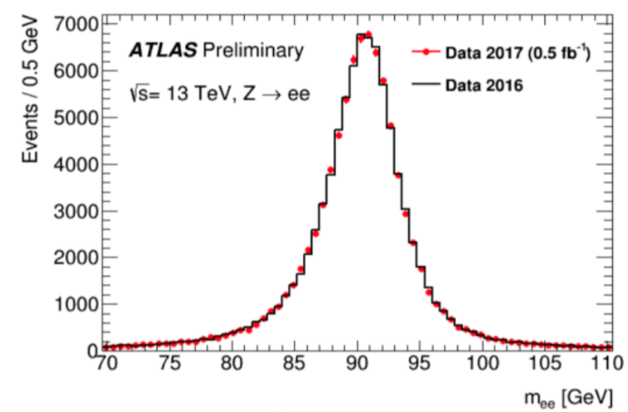
- **Physics analyses start with detector data, then physics objects**
  - **Electrons, muons, taus, jets, b-tagged jets, E_T^{miss} etc**
- **Robust algorithms and stable detector performance**
- **Good data quality and Monte Carlo agreement**



m_{ee} at low and high pileup



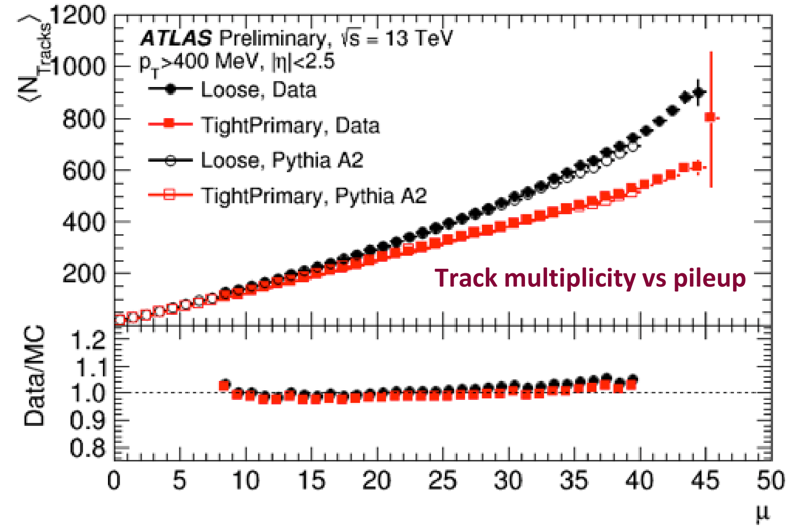
m_{ee} stability vs pileup

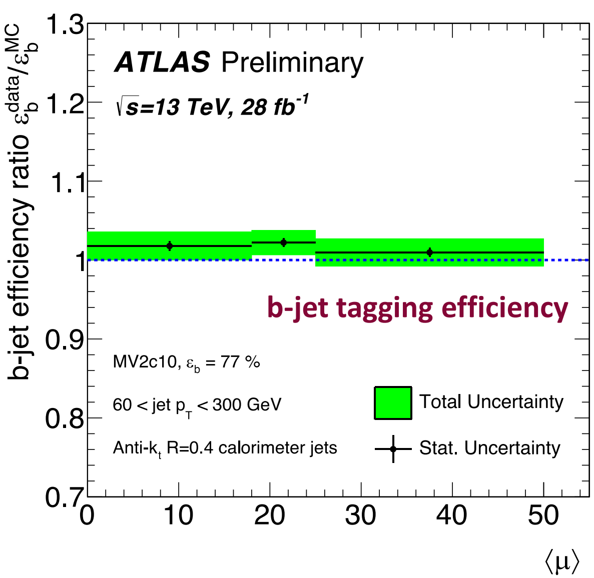


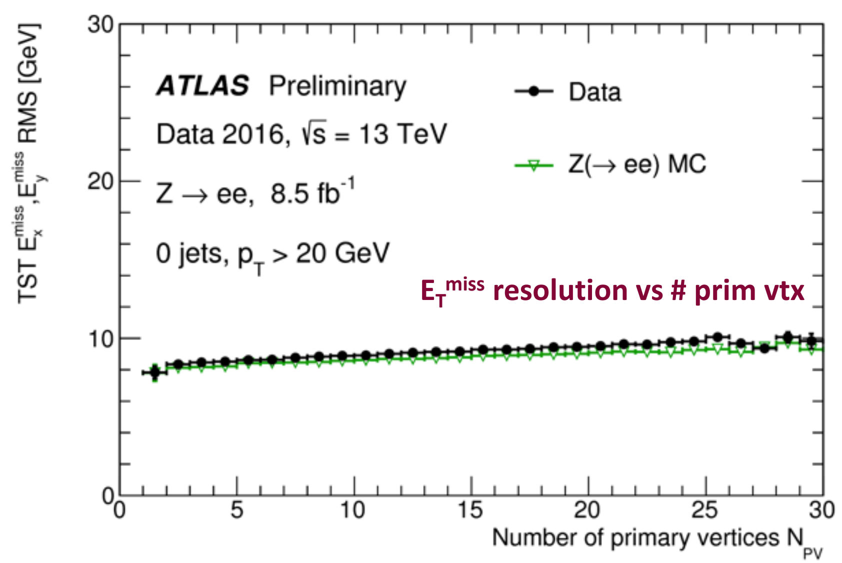
m_{ee} in 2016 and 2017

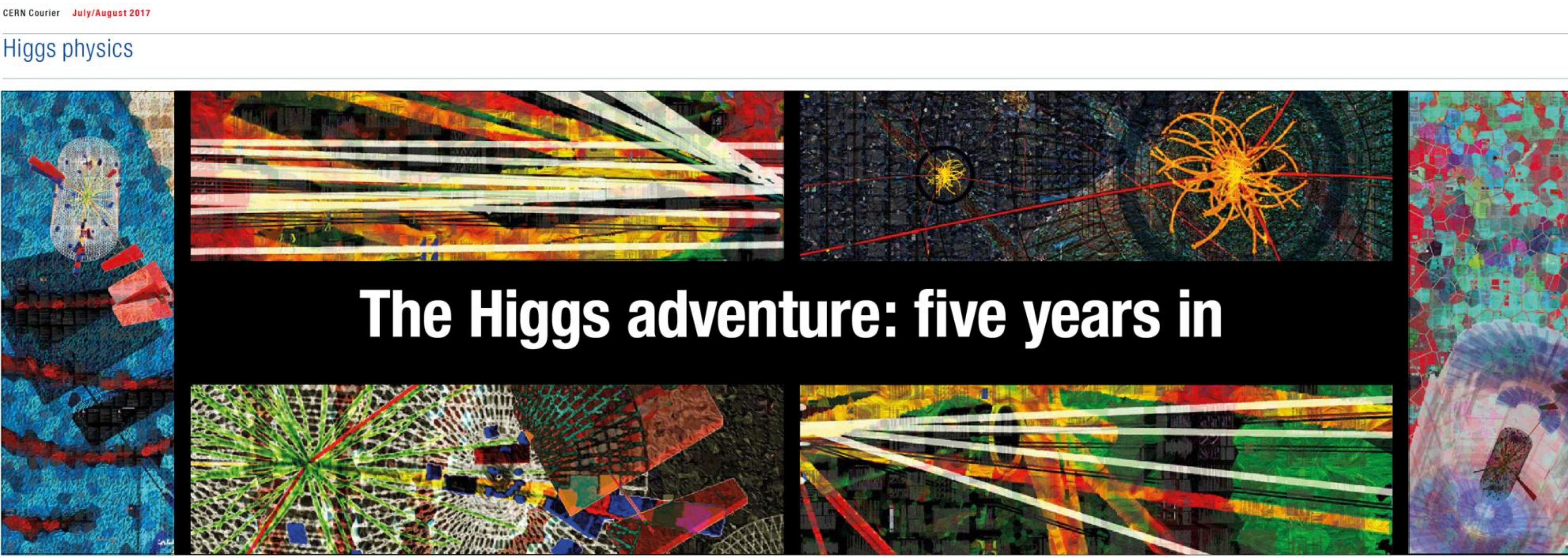
Physics Object Performance (cont'd)

- **Robust algorithms and stable detector performance**
- **Good data quality and Monte Carlo agreement**





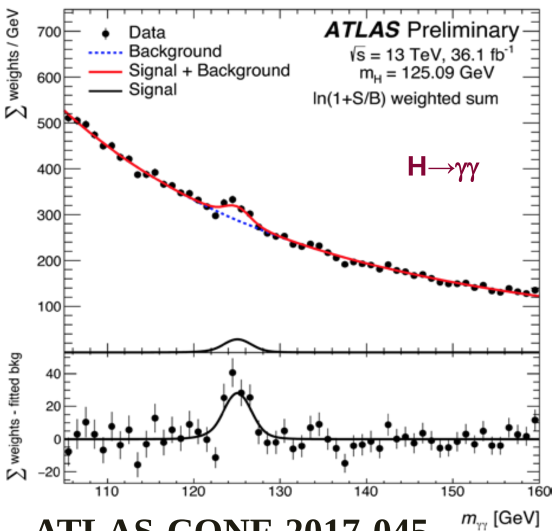



CERN Courier July/August 2017
Higgs physics
The Higgs adventure: five years in

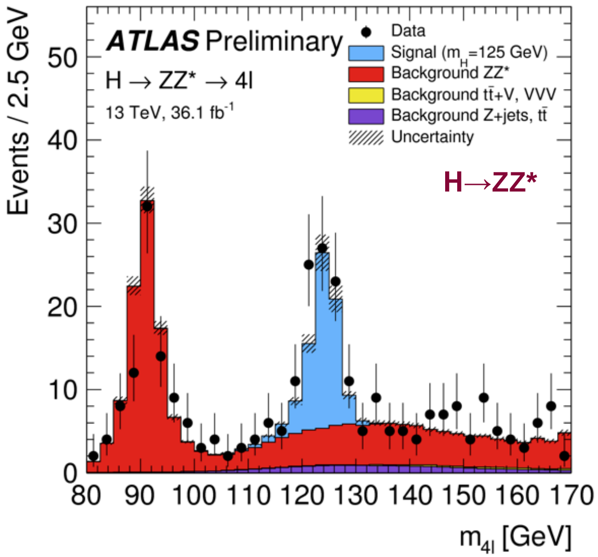
Higgs Production

arXiv:1708.02810

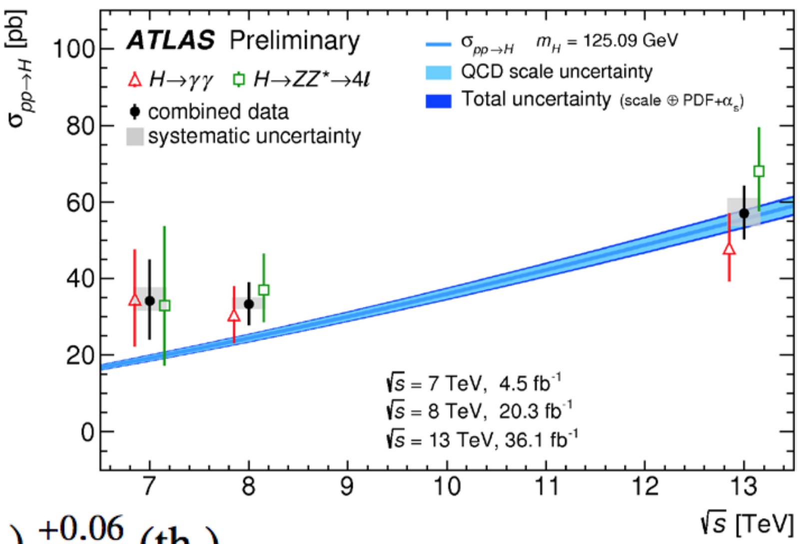
- More measurements of Higgs properties possible with higher √s & larger dataset
- Measurements with H→γγ and H→ZZ*→4l



ATLAS-CONF-2017-045



- Combined measurements of fiducial and total production cross-sections (assumes SM branching ratios)



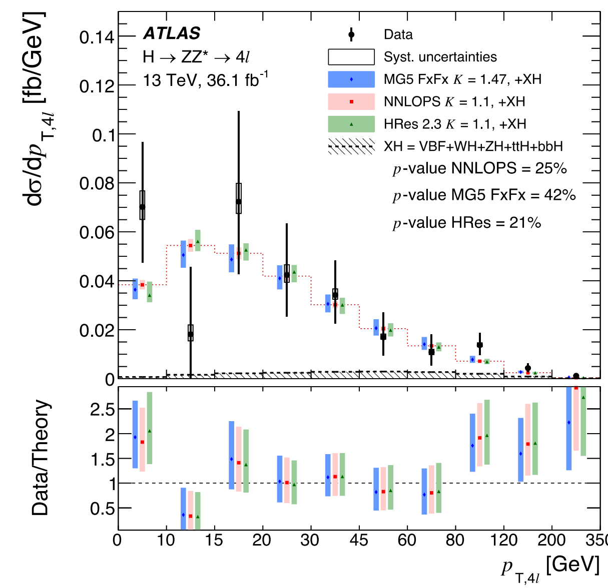
- Combined global signal strength compatible with Standard Model

$$\mu = 1.09 \pm 0.12 = 1.09 \pm 0.09\,(\text{stat.})\,^{+0.06}_{-0.05}\,(\text{exp.})\,^{+0.06}_{-0.05}\,(\text{th.})$$

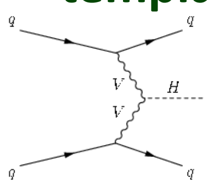
ATLAS-CONF-2017-047

Higgs Cross Section

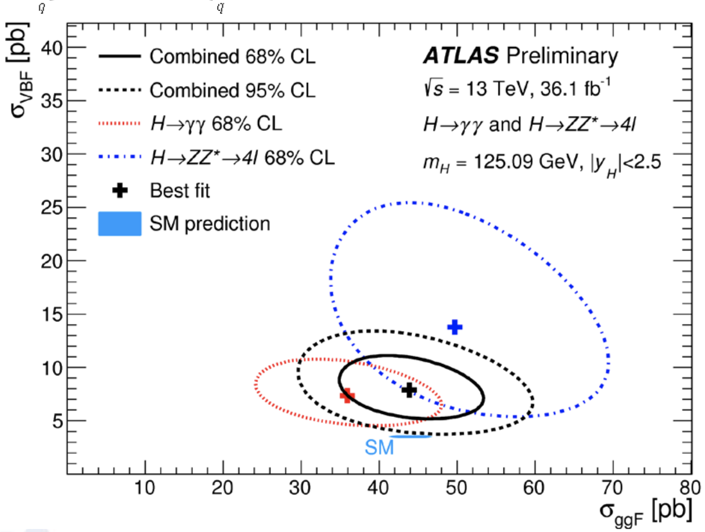
arXiv:1708.02810

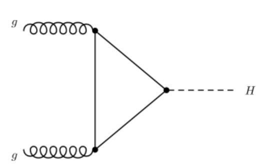


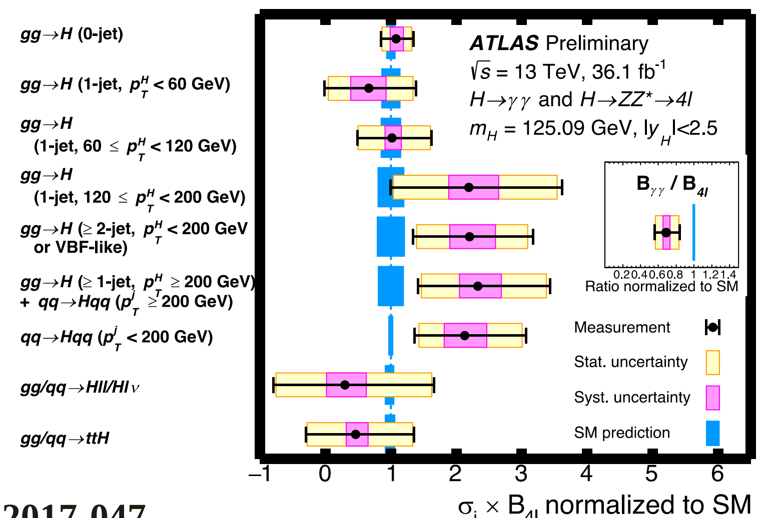
- Higgs differential cross-sections as functions of the kinematics of Higgs boson and additional jets
- Interpreting in terms of cross-sections for production processes (ggF, VBF dominate)
- Interpreting also with new simplified template cross-section (STXS) framework



enabling detailed comparison with theory [LHCXSWG]





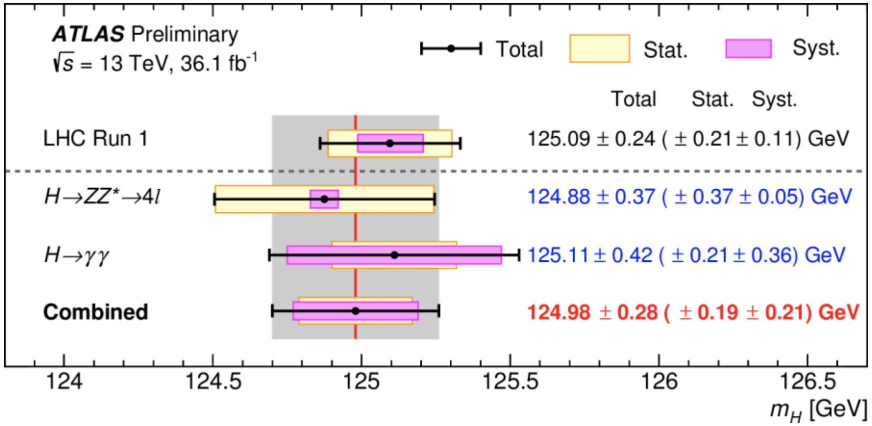


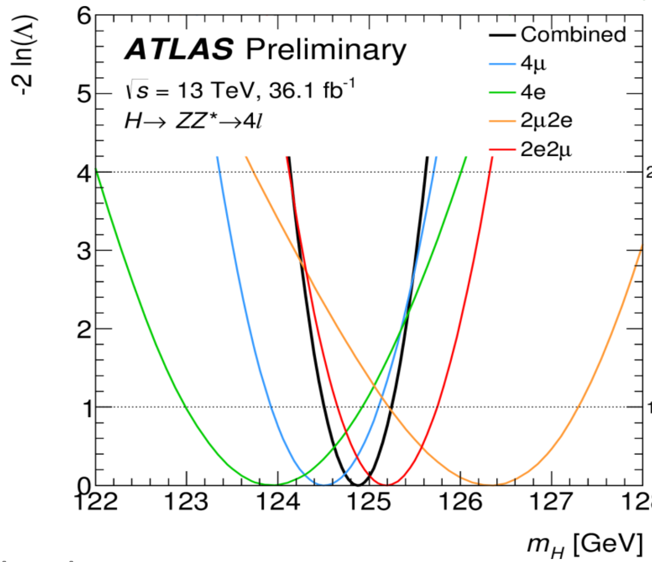
ATLAS-CONF-2017-047

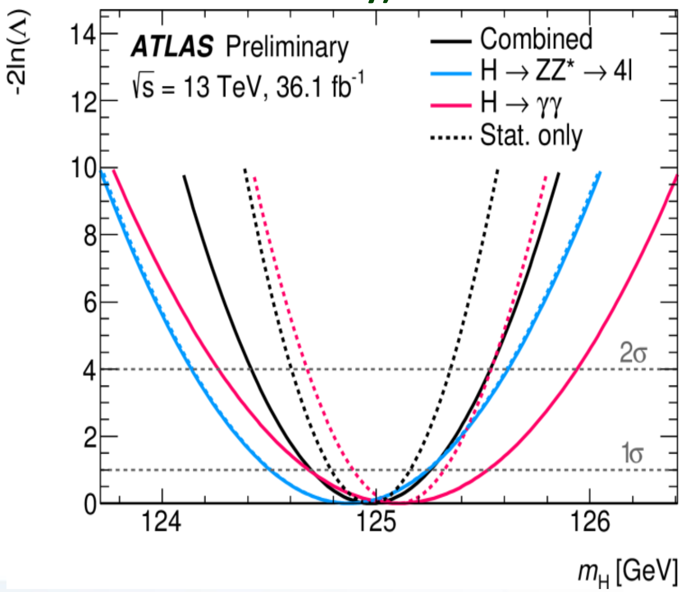
Higgs Mass

- With H→ZZ* (4l) and H→$\gamma\gamma$
- Measurements complementary
  - $\gamma\gamma$ channel systematic uncertainty dominating
  - 4l channel statistical uncertainty dominating
- 4l channel results consistent between electron and muon channels
- 4l and $\gamma\gamma$ results consistent
- Combined result consistent with Run-1
  - This ATLAS-only, preliminary Run 2 result having already an uncertainty similar to the ATLAS+CMS final Run 1 value (and already a lower stat. uncertainty)

ATLAS-CONF-2017-046

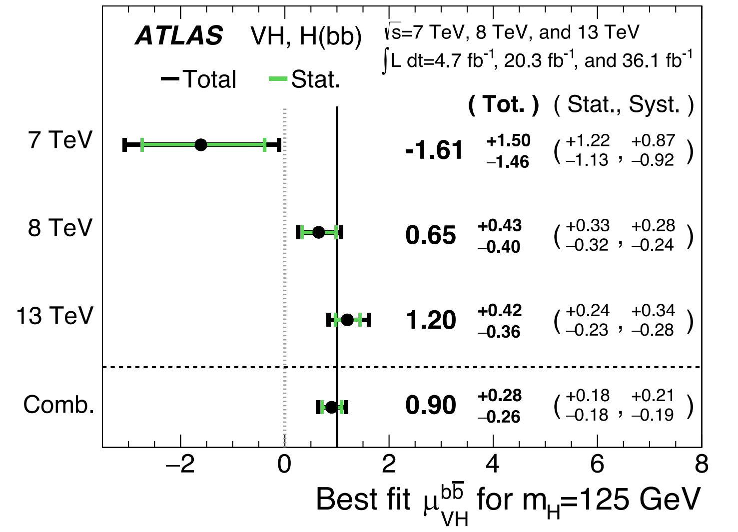


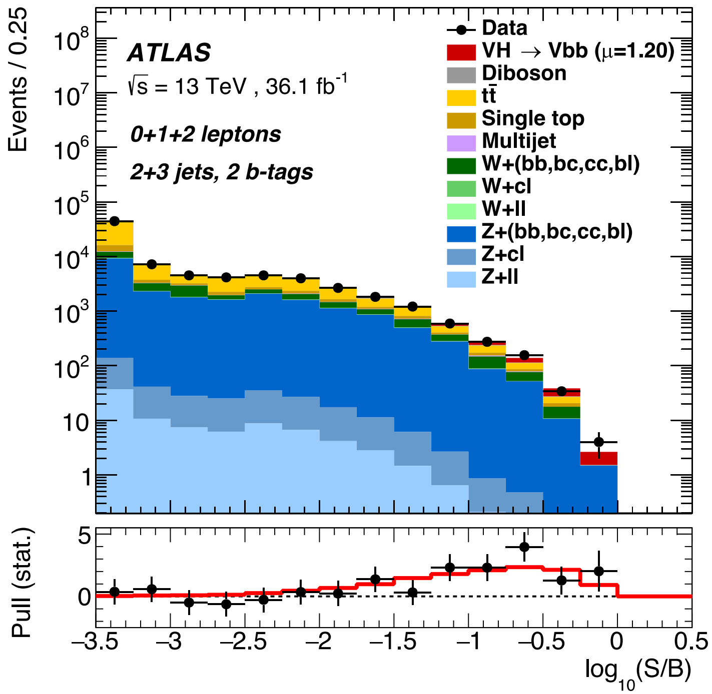


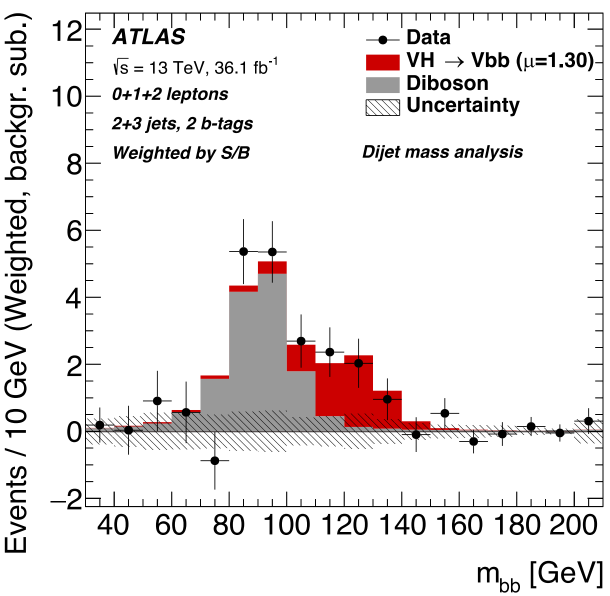


H→bb Evidence

- VH search of Run 2 with V(W/Z), H→bb
- Observed significance 3.5σ (3.0σ expected)
  - BDT analysis for VH(bb)
  - Cross check with cut-based analysis(3.5σ observed, 2.8σ expected)
- Combination of MVA result with ATLAS Run-1 giving 3.6σ observed, 4.0σ expected
- Observed signal strength consistent with SM

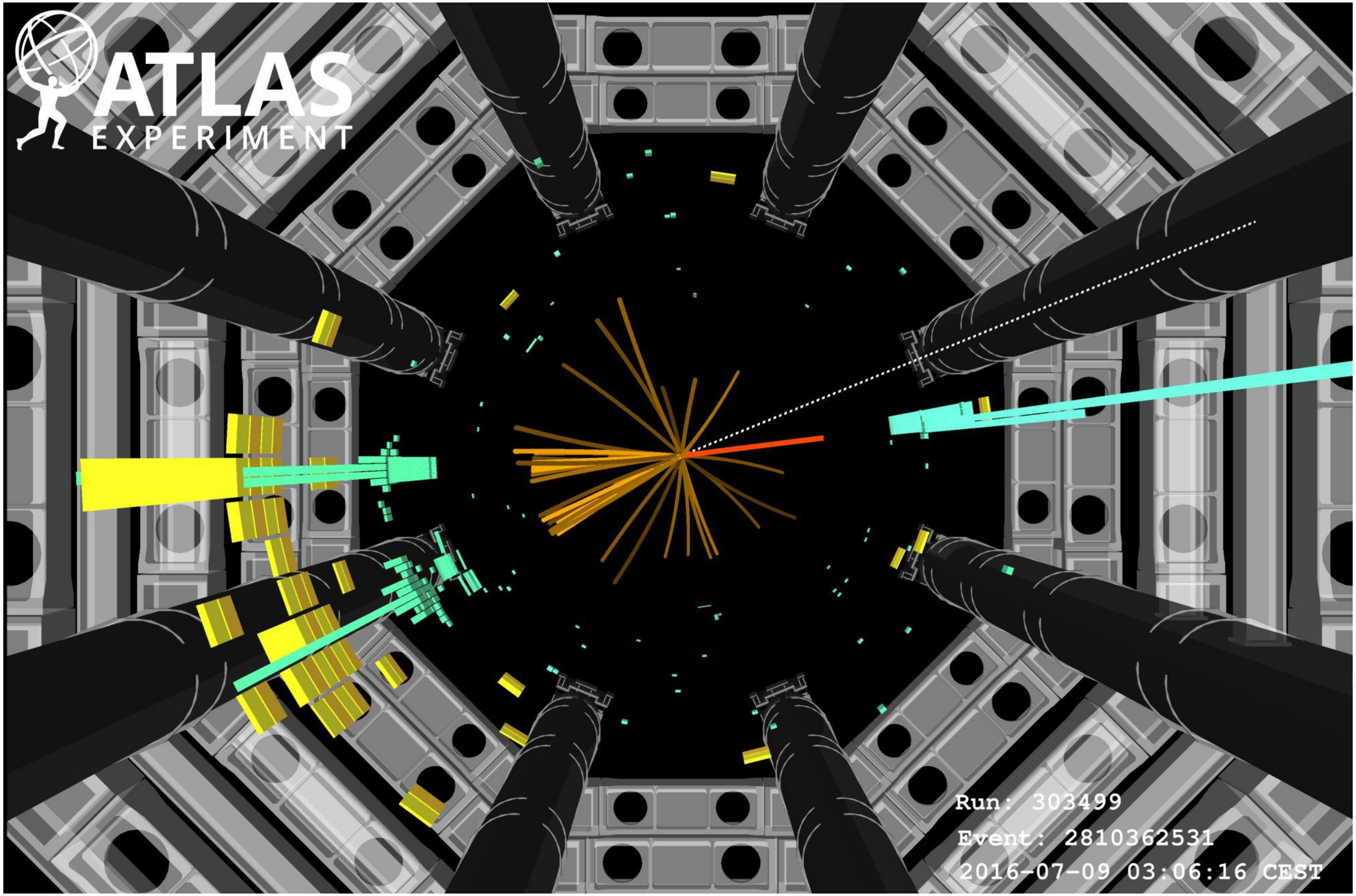




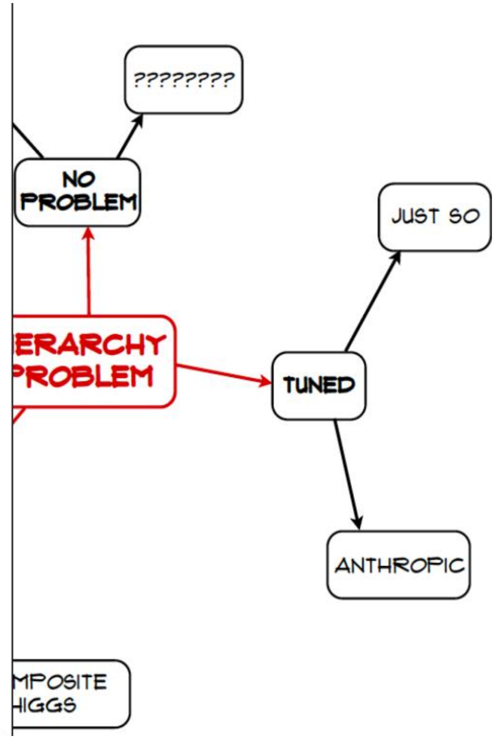


arXiv:1708.03299

W(eν)H(bb) Candidate

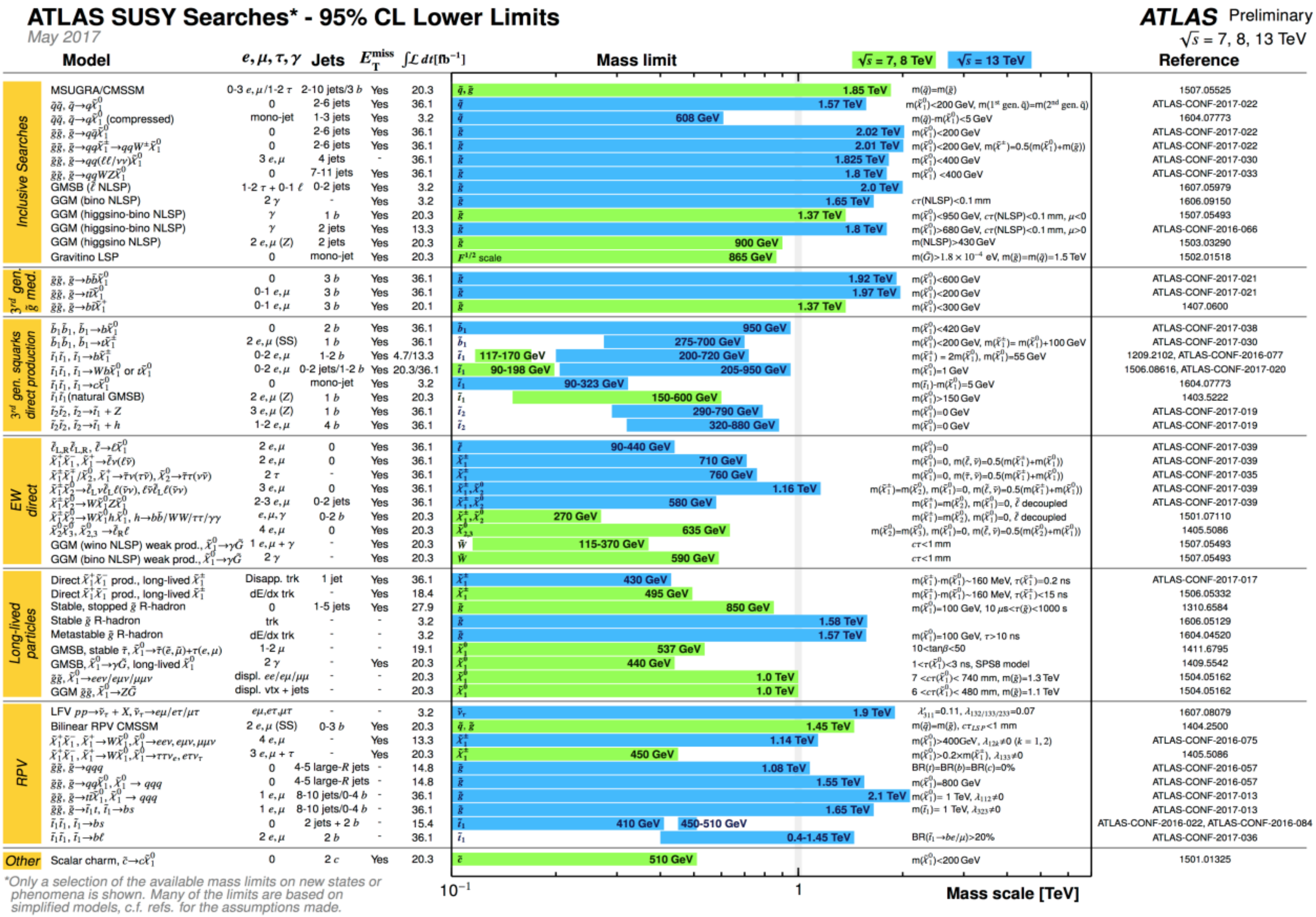


If you know of a better hole, go to it



John Ellis on SUSY,
HKUST IAS High Energy Physics Conference, Hong Kong, 01/23/2017

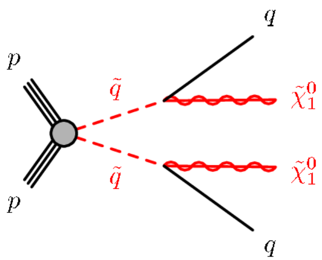
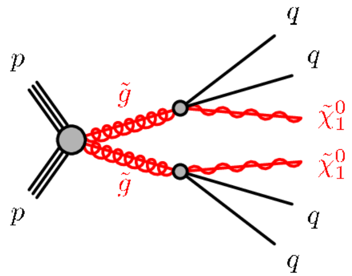
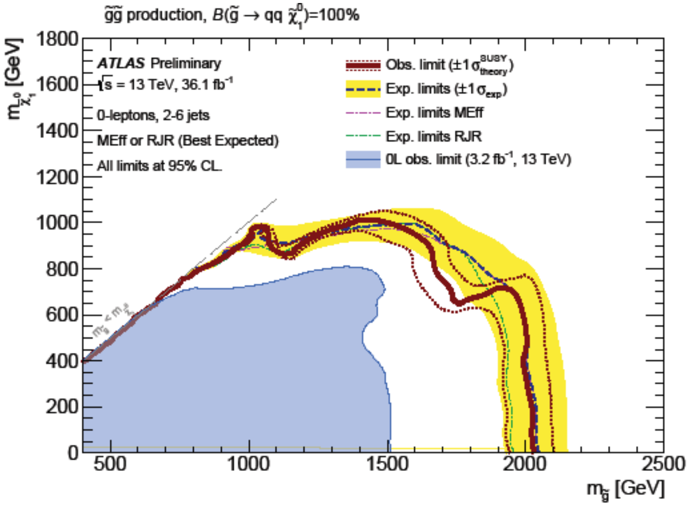
SUSY

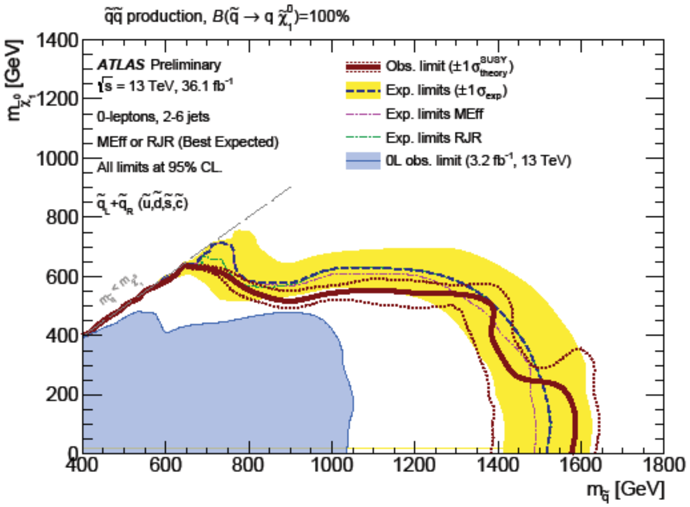


ATLAS SUSY Searches* - 95% CL Lower Limits
May 2017
ATLAS Preliminary
$\sqrt{s}$ = 7, 8, 13 TeV
Model | e, μ, τ, γ | Jets | E_T^{miss} | ∫L dt[fb⁻¹] | Mass limit | $\sqrt{s}$ = 7, 8 TeV | $\sqrt{s}$ = 13 TeV | Reference
Inclusive Searches
MSUGRA/CMSSM | 0-3 e,μ/1-2 τ | 2-10 jets/3 b | Yes | 20.3 | q̃, g̃ 1.85 TeV | m(q̃)=m(g̃) | 1507.05525
q̃q̃, q̃→qχ̃⁰₁ | 0 | 2-6 jets | Yes | 36.1 | q̃ 1.57 TeV | m(χ̃⁰₁)<200 GeV, m(1st gen. q̃)=m(2nd gen. q̃) | ATLAS-CONF-2017-022
q̃q̃, q̃→qχ̃⁰₁ (compressed) | mono-jet | 1-3 jets | Yes | 3.2 | q̃ 608 GeV | m(q̃)-m(χ̃⁰₁)<5 GeV | 1604.07773
g̃g̃, g̃→qq̄χ̃⁰₁ | 0 | 2-6 jets | Yes | 36.1 | g̃ 2.02 TeV | m(χ̃⁰₁)<200 GeV | ATLAS-CONF-2017-022
g̃g̃, g̃→qqχ̃±₁→qqW±χ̃⁰₁ | 0 | 2-6 jets | Yes | 36.1 | g̃ 2.01 TeV | m(χ̃⁰₁)<200 GeV, m(χ̃±)=0.5(m(χ̃⁰₁)+m(g̃)) | ATLAS-CONF-2017-022
g̃g̃, g̃→qq(ℓℓ/νν)χ̃⁰₁ | 3 e,μ | 4 jets | - | 36.1 | g̃ 1.825 TeV | m(χ̃⁰₁)<400 GeV | ATLAS-CONF-2017-030
g̃g̃, g̃→qqWZχ̃⁰₁ | 0 | 7-11 jets | Yes | 36.1 | g̃ 1.8 TeV | m(χ̃⁰₁) <400 GeV | ATLAS-CONF-2017-033
GMSB (ℓ̃ NLSP) | 1-2 τ + 0-1 ℓ | 0-2 jets | Yes | 3.2 | g̃ 2.0 TeV | | 1607.05979
GGM (bino NLSP) | 2 γ | - | Yes | 3.2 | g̃ 1.65 TeV | cτ(NLSP)<0.1 mm | 1606.09150
GGM (higgsino-bino NLSP) | γ | 1 b | Yes | 20.3 | g̃ 1.37 TeV | m(χ̃⁰₁)<950 GeV, cτ(NLSP)<0.1 mm, μ<0 | 1507.05493
GGM (higgsino-bino NLSP) | γ | 2 jets | Yes | 13.3 | g̃ 1.8 TeV | m(χ̃⁰₁)>680 GeV, cτ(NLSP)<0.1 mm, μ>0 | ATLAS-CONF-2016-066
GGM (higgsino NLSP) | 2 e,μ (Z) | 2 jets | Yes | 20.3 | g̃ 900 GeV | m(NLSP)>430 GeV | 1503.03290
Gravitino LSP | 0 | mono-jet | Yes | 20.3 | F^{1/2} scale 865 GeV | m(G̃)>1.8 × 10⁻⁴ eV, m(g̃)=m(q̃)=1.5 TeV | 1502.01518
3rd gen. g̃ med.
g̃g̃, g̃→bb̄χ̃⁰₁ | 0 | 3 b | Yes | 36.1 | g̃ 1.92 TeV | m(χ̃⁰₁)<600 GeV | ATLAS-CONF-2017-021
g̃g̃, g̃→tt̄χ̃⁰₁ | 0-1 e,μ | 3 b | Yes | 36.1 | g̃ 1.97 TeV | m(χ̃⁰₁)<200 GeV | ATLAS-CONF-2017-021
g̃g̃, g̃→bt̄χ̃⁺₁ | 0-1 e,μ | 3 b | Yes | 20.1 | g̃ 1.37 TeV | m(χ̃⁰₁)<300 GeV | 1407.0600
3rd gen. squarks direct production
b̃₁b̃₁, b̃₁→bχ̃⁰₁ | 0 | 2 b | Yes | 36.1 | b̃₁ 950 GeV | m(χ̃⁰₁)<420 GeV | ATLAS-CONF-2017-038
b̃₁b̃₁, b̃₁→tχ̃±₁ | 2 e,μ (SS) | 1 b | Yes | 36.1 | b̃₁ 275-700 GeV | m(χ̃⁰₁)<200 GeV, m(χ̃±₁)= m(χ̃⁰₁)+100 GeV | ATLAS-CONF-2017-030
t̃₁t̃₁, t̃₁→bχ̃±₁ | 0-2 e,μ | 1-2 b | Yes | 4.7/13.3 | t̃₁ 117-170 GeV 200-720 GeV | m(χ̃±₁) = 2m(χ̃⁰₁), m(χ̃⁰₁)=55 GeV | 1209.2102, ATLAS-CONF-2016-077
t̃₁t̃₁, t̃₁→Wbχ̃⁰₁ or tχ̃⁰₁ | 0-2 e,μ | 0-2 jets/1-2 b | Yes | 20.3/36.1 | t̃₁ 90-198 GeV 205-950 GeV | m(χ̃⁰₁)=1 GeV | 1506.08616, ATLAS-CONF-2017-020
t̃₁t̃₁, t̃₁→cχ̃⁰₁ | 0 | mono-jet | Yes | 3.2 | t̃₁ 90-323 GeV | m(t̃₁)-m(χ̃⁰₁)=5 GeV | 1604.07773
t̃₁t̃₁(natural GMSB) | 2 e,μ (Z) | 1 b | Yes | 20.3 | t̃₁ 150-600 GeV | m(χ̃⁰₁)>150 GeV | 1403.5222
t̃₂t̃₂, t̃₂→t̃₁ + Z | 3 e,μ (Z) | 1 b | Yes | 36.1 | t̃₂ 290-790 GeV | m(χ̃⁰₁)=0 GeV | ATLAS-CONF-2017-019
t̃₂t̃₂, t̃₂→t̃₁ + h | 1-2 e,μ | 4 b | Yes | 36.1 | t̃₂ 320-880 GeV | m(χ̃⁰₁)=0 GeV | ATLAS-CONF-2017-019
EW direct
ℓ̃L,Rℓ̃L,R, ℓ̃→ℓχ̃⁰₁ | 2 e,μ | 0 | Yes | 36.1 | ℓ̃ 90-440 GeV | m(χ̃⁰₁)=0 | ATLAS-CONF-2017-039
χ̃⁺₁χ̃⁻₁, χ̃⁺₁→ℓ̃ν(ℓν̃) | 2 e,μ | 0 | Yes | 36.1 | χ̃±₁ 710 GeV | m(χ̃⁰₁)=0, m(ℓ̃, ν̃)=0.5(m(χ̃±₁)+m(χ̃⁰₁)) | ATLAS-CONF-2017-039
χ̃±₁χ̃∓₁/χ̃⁰₂, χ̃⁺₁→τ̃ν(τν̃), χ̃⁰₂→τ̃τ(ντ̃) | 2 τ | - | Yes | 36.1 | χ̃±₁ 760 GeV | m(χ̃⁰₁)=0, m(τ̃, ν̃)=0.5(m(χ̃±₁)+m(χ̃⁰₁)) | ATLAS-CONF-2017-035
χ̃±₁χ̃⁰₂→ℓ̃Lνℓ̃Lℓ(ν̃ν), ℓν̃ℓ̃Lℓ(ν̃ν) | 3 e,μ | 0 | Yes | 36.1 | χ̃±₁, χ̃⁰₂ 1.16 TeV | m(χ̃±₁)=m(χ̃⁰₂), m(χ̃⁰₁)=0, m(ℓ̃, ν̃)=0.5(m(χ̃±₁)+m(χ̃⁰₁)) | ATLAS-CONF-2017-039
χ̃±₁χ̃⁰₂→Wχ̃⁰₁Zχ̃⁰₁ | 2-3 e,μ | 0-2 jets | Yes | 36.1 | χ̃±₁, χ̃⁰₂ 580 GeV | m(χ̃±₁)=m(χ̃⁰₂), m(χ̃⁰₁)=0, ℓ̃ decoupled | ATLAS-CONF-2017-039
χ̃±₁χ̃⁰₂→Wχ̃⁰₁hχ̃⁰₁, h→bb̄/WW/ττ/γγ | e,μ,γ | 0-2 b | Yes | 20.3 | χ̃±₁, χ̃⁰₂ 270 GeV | m(χ̃±₁)=m(χ̃⁰₂), m(χ̃⁰₁)=0, ℓ̃ decoupled | 1501.07110
χ̃⁰₂χ̃⁰₃, χ̃⁰₂,₃→ℓ̃Rℓ | 4 e,μ | 0 | Yes | 20.3 | χ̃⁰₂,₃ 635 GeV | m(χ̃⁰₂)=m(χ̃⁰₃), m(χ̃⁰₁)=0, m(ℓ̃, ν̃)=0.5(m(χ̃⁰₂)+m(χ̃⁰₁)) | 1405.5086
GGM (wino NLSP) weak prod., χ̃⁰₁→γG̃ | 1 e,μ + γ | - | Yes | 20.3 | W̃ 115-370 GeV | cτ<1 mm | 1507.05493
GGM (bino NLSP) weak prod., χ̃⁰₁→γG̃ | 2 γ | - | Yes | 20.3 | W̃ 590 GeV | cτ<1 mm | 1507.05493
Long-lived particles
Direct χ̃⁺₁χ̃⁻₁ prod., long-lived χ̃±₁ | Disapp. trk | 1 jet | Yes | 36.1 | χ̃±₁ 430 GeV | m(χ̃±₁)-m(χ̃⁰₁)~160 MeV, τ(χ̃±₁)=0.2 ns | ATLAS-CONF-2017-017
Direct χ̃⁺₁χ̃⁻₁ prod., long-lived χ̃±₁ | dE/dx trk | - | Yes | 18.4 | χ̃±₁ 495 GeV | m(χ̃±₁)-m(χ̃⁰₁)~160 MeV, τ(χ̃±₁)<15 ns | 1506.05332
Stable, stopped g̃ R-hadron | 0 | 1-5 jets | Yes | 27.9 | g̃ 850 GeV | m(χ̃⁰₁)=100 GeV, 10 μs<τ(g̃)<1000 s | 1310.6584
Stable g̃ R-hadron | trk | - | - | 3.2 | g̃ 1.58 TeV | | 1606.05129
Metastable g̃ R-hadron | dE/dx trk | - | - | 3.2 | g̃ 1.57 TeV | m(χ̃⁰₁)=100 GeV, τ>10 ns | 1604.04520
GMSB, stable τ̃, χ̃⁰₁→τ̃(ẽ, μ̃)+τ(e, μ) | 1-2 μ | - | - | 19.1 | χ̃⁰₁ 537 GeV | 10<tanβ<50 | 1411.6795
GMSB, χ̃⁰₁→γG̃, long-lived χ̃⁰₁ | 2 γ | - | Yes | 20.3 | χ̃⁰₁ 440 GeV | 1<τ(χ̃⁰₁)<3 ns, SPS8 model | 1409.5542
g̃g̃, χ̃⁰₁→eeν/eμν/μμν | displ. ee/eμ/μμ | - | - | 20.3 | χ̃⁰₁ 1.0 TeV | 7 <cτ(χ̃⁰₁)< 740 mm, m(g̃)=1.3 TeV | 1504.05162
GGM g̃g̃, χ̃⁰₁→ZG̃ | displ. vtx + jets | - | - | 20.3 | χ̃⁰₁ 1.0 TeV | 6 <cτ(χ̃⁰₁)< 480 mm, m(g̃)=1.1 TeV | 1504.05162
RPV
LFV pp→ν̃τ + X, ν̃τ→eμ/eτ/μτ | eμ,eτ,μτ | - | - | 3.2 | ν̃τ 1.9 TeV | λ′311=0.11, λ132/133/233=0.07 | 1607.08079
Bilinear RPV CMSSM | 2 e,μ (SS) | 0-3 b | Yes | 20.3 | q̃, g̃ 1.45 TeV | m(q̃)=m(g̃), cτLSP<1 mm | 1404.2500
χ̃⁺₁χ̃⁻₁, χ̃⁺₁→Wχ̃⁰₁, χ̃⁰₁→eeν, eμν, μμν | 4 e,μ | - | Yes | 13.3 | χ̃±₁ 1.14 TeV | m(χ̃⁰₁)>400GeV, λ12k≠0 (k = 1, 2) | ATLAS-CONF-2016-075
χ̃⁺₁χ̃⁻₁, χ̃⁺₁→Wχ̃⁰₁, χ̃⁰₁→ττνe, eτντ | 3 e,μ + τ | - | Yes | 20.3 | χ̃±₁ 450 GeV | m(χ̃⁰₁)>0.2×m(χ̃±₁), λ133≠0 | 1405.5086
g̃g̃, g̃→qqq | 0 | 4-5 large-R jets | - | 14.8 | g̃ 1.08 TeV | BR(t)=BR(b)=BR(c)=0% | ATLAS-CONF-2016-057
g̃g̃, g̃→qqχ̃⁰₁, χ̃⁰₁ → qqq | 0 | 4-5 large-R jets | - | 14.8 | g̃ 1.55 TeV | m(χ̃⁰₁)=800 GeV | ATLAS-CONF-2016-057
g̃g̃, g̃→tt̄χ̃⁰₁, χ̃⁰₁ → qqq | 1 e,μ | 8-10 jets/0-4 b | - | 36.1 | g̃ 2.1 TeV | m(χ̃⁰₁)= 1 TeV, λ112≠0 | ATLAS-CONF-2017-013
g̃g̃, g̃→t̃₁t, t̃₁→bs | 1 e,μ | 8-10 jets/0-4 b | - | 36.1 | g̃ 1.65 TeV | m(t̃₁)= 1 TeV, λ323≠0 | ATLAS-CONF-2017-013
t̃₁t̃₁, t̃₁→bs | 0 | 2 jets + 2 b | - | 15.4 | t̃₁ 410 GeV 450-510 GeV | | ATLAS-CONF-2016-022, ATLAS-CONF-2016-084
t̃₁t̃₁, t̃₁→bℓ | 2 e,μ | 2 b | - | 36.1 | t̃₁ 0.4-1.45 TeV | BR(t̃₁→be/μ)>20% | ATLAS-CONF-2017-036
Other
Scalar charm, c̃→cχ̃⁰₁ | 0 | 2 c | Yes | 20.3 | c̃ 510 GeV | m(χ̃⁰₁)<200 GeV | 1501.01325
10⁻¹
1
Mass scale [TeV]
*Only a selection of the available mass limits on new states or phenomena is shown. Many of the limits are based on simplified models, c.f. refs. for the assumptions made.

Inclusive Searches

- Inclusive searches with 0 lepton, 2-6 jets and large E_T^{miss}
- Targeting high-mass gluinos and squarks
- Exclusion limit of 2.0 TeV for gluinos and 1.6 TeV for squarks
- Searches also with leptons for long chains

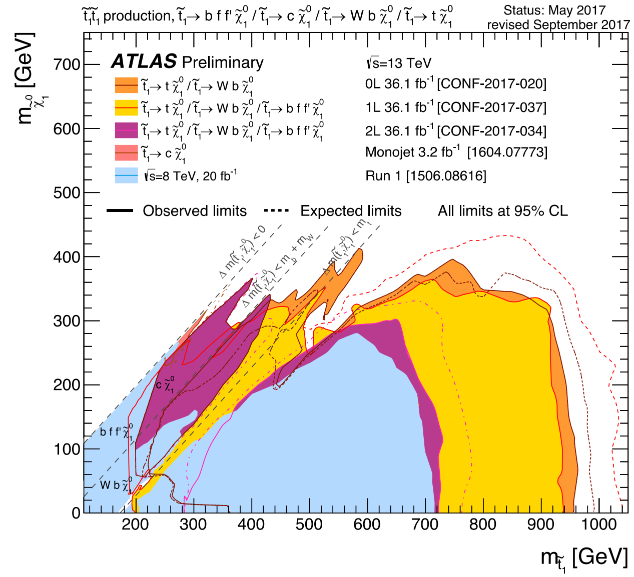




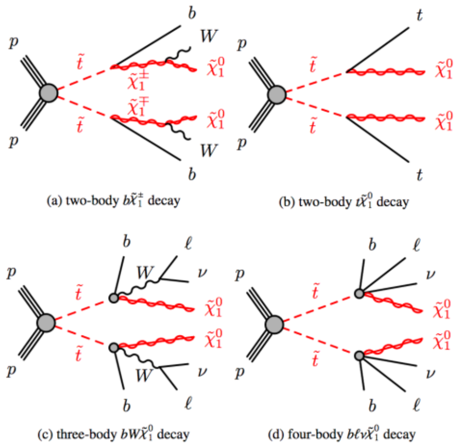


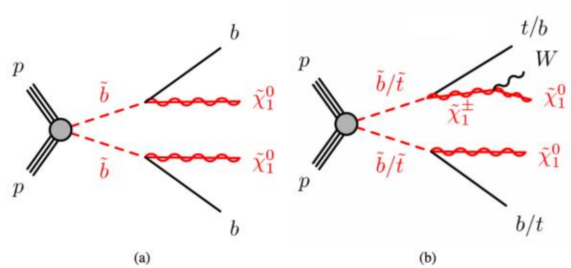
Daniel Guest's talk

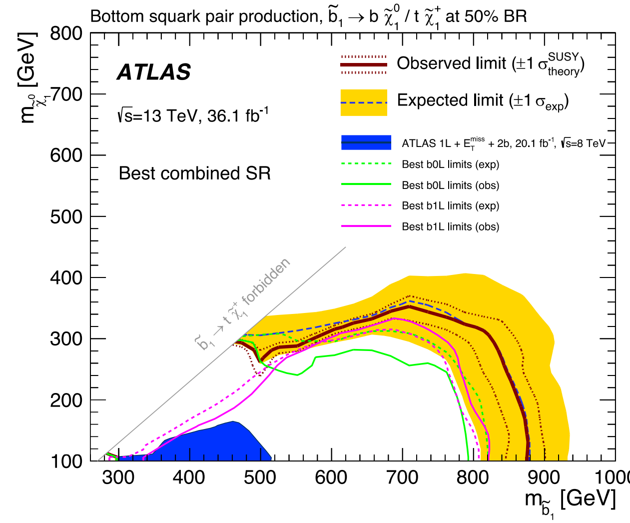
3rd Generation SUSY

- Signatures of 3rd generation squarks important (theoretical role in loop corrections to Higgs mass, Natural SUSY)
- Low cross section and complex final states
  - Searches for direct stop (t_1) production in the 0/1/2-lepton channels targeting 2/3/4-body decay modes
  - Searches for direct sbottom(b_1) production with b-jets + E_T^{miss}
- No significant excesses over SM expectation
  - Almost no gap left for stop search
  - Other more realistic models also studied





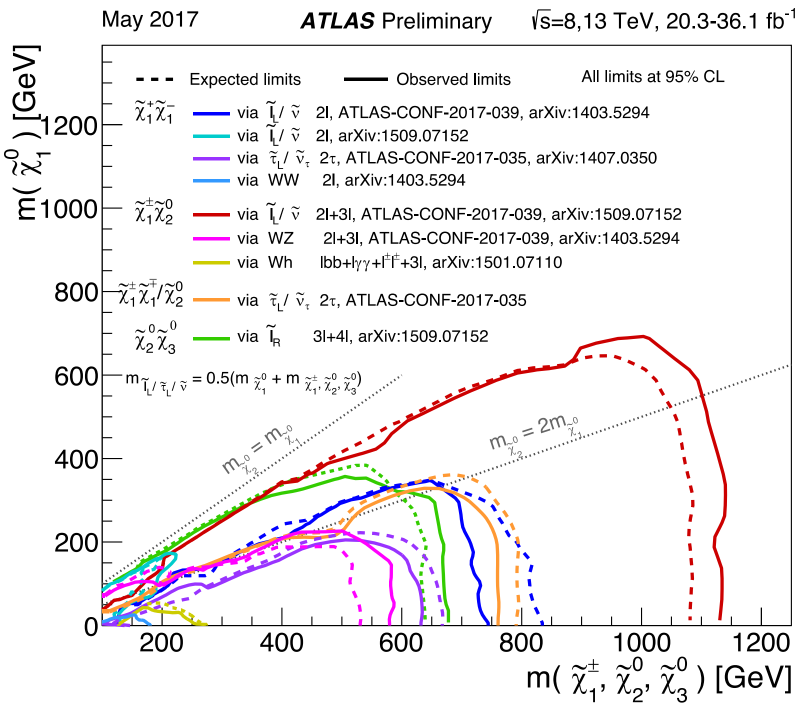


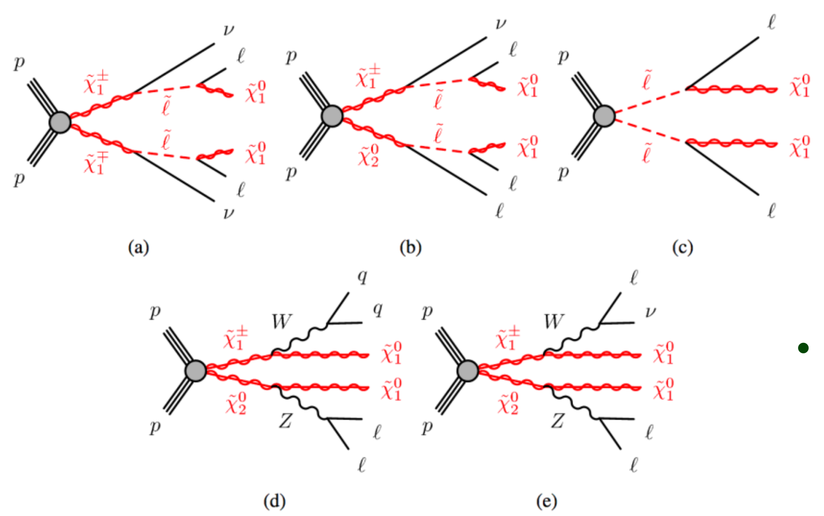


Daniel Guest's talk

Electroweak SUSY

- Electroweak sector be the only accessible at LHC if colored sparticles mass above 3-4 TeV
- Lower cross section
- Direct production of charginos, neutralinos, sleptons
  - Searches for direct production of charginos and neutralinos with 2 or 3 leptons + E_T^{miss}
- No significant excesses over SM expectation

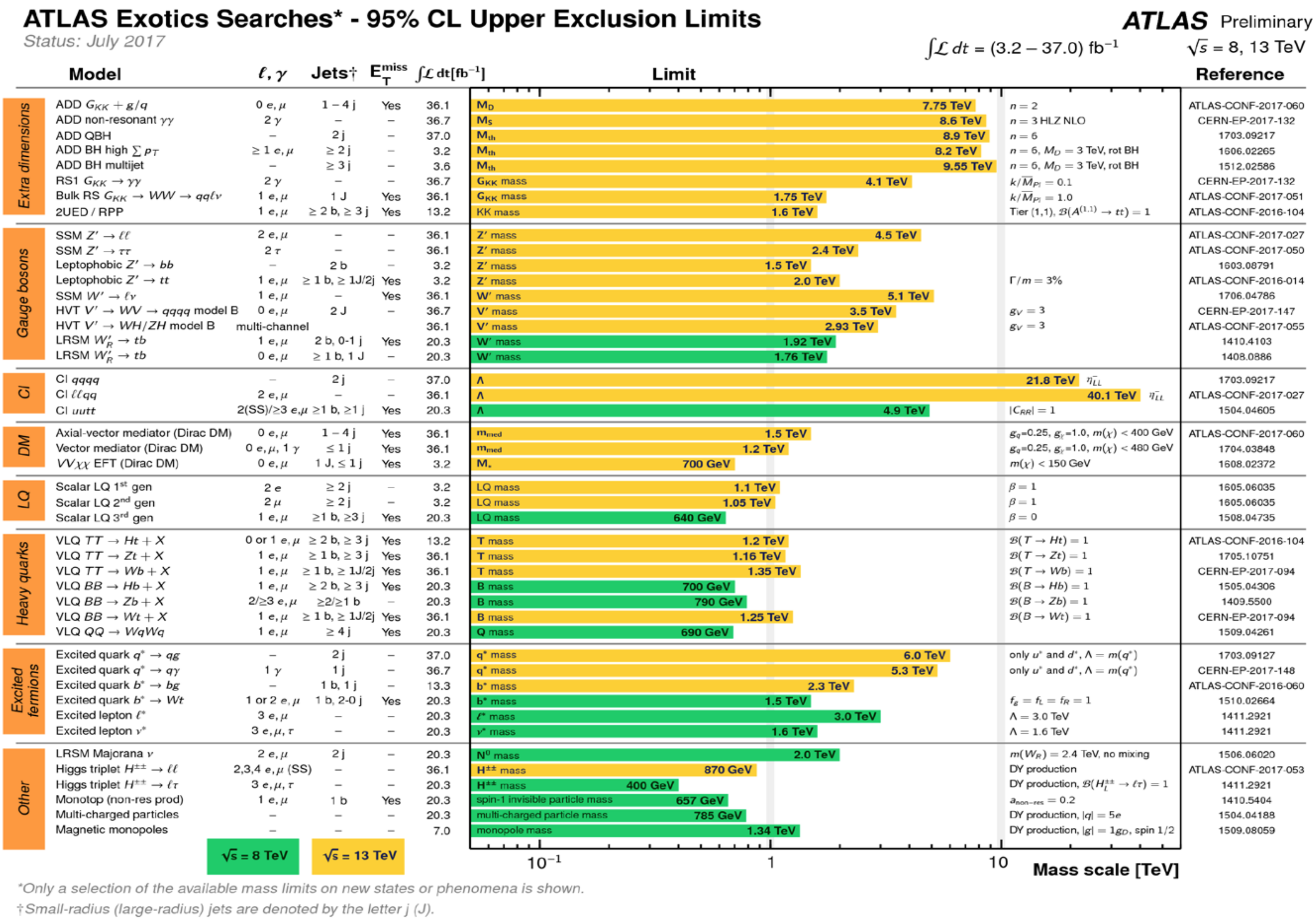




Also

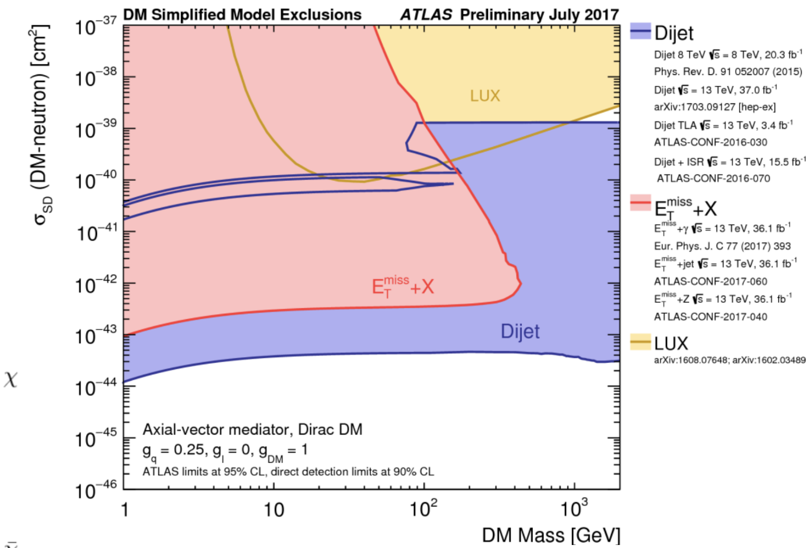
- Signatures allowing low mass SUSY to escape detection
  - Searches for R-Parity violating models (lacking E_T^{miss})
  - Searches for long-lived signatures (mass degenerate SUSY states)

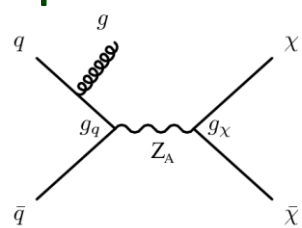
Exotics


ATLAS Exotics Searches* - 95% CL Upper Exclusion Limits
Status: July 2017
ATLAS Preliminary
$\int \mathcal{L}\, dt = (3.2 - 37.0)\ \mathrm{fb}^{-1}$
$\sqrt{s}$ = 8, 13 TeV
Model | ℓ, γ | Jets† | E_T^{miss} | $\int \mathcal{L}\, dt[\mathrm{fb}^{-1}]$ | Limit | Reference
Extra dimensions
ADD $G_{KK} + g/q$ | 0 e, μ | 1 − 4 j | Yes | 36.1 | M_D 7.75 TeV | n = 2 | ATLAS-CONF-2017-060
ADD non-resonant γγ | 2 γ | – | – | 36.7 | M_S 8.6 TeV | n = 3 HLZ NLO | CERN-EP-2017-132
ADD QBH | – | 2 j | – | 37.0 | M_{th} 8.9 TeV | n = 6 | 1703.09217
ADD BH high $\sum p_T$ | ≥ 1 e, μ | ≥ 2 j | – | 3.2 | M_{th} 8.2 TeV | n = 6, M_D = 3 TeV, rot BH | 1606.02265
ADD BH multijet | – | ≥ 3 j | – | 3.6 | M_{th} 9.55 TeV | n = 6, M_D = 3 TeV, rot BH | 1512.02586
RS1 $G_{KK} \to \gamma\gamma$ | 2 γ | – | – | 36.7 | G_{KK} mass 4.1 TeV | $k/\overline{M}_{Pl}$ = 0.1 | CERN-EP-2017-132
Bulk RS $G_{KK} \to WW \to qq\ell\nu$ | 1 e, μ | 1 J | Yes | 36.1 | G_{KK} mass 1.75 TeV | $k/\overline{M}_{Pl}$ = 1.0 | ATLAS-CONF-2017-051
2UED / RPP | 1 e, μ | ≥ 2 b, ≥ 3 j | Yes | 13.2 | KK mass 1.6 TeV | Tier (1,1), $\mathcal{B}(A^{(1,1)} \to tt) = 1$ | ATLAS-CONF-2016-104
Gauge bosons
SSM $Z' \to \ell\ell$ | 2 e, μ | – | – | 36.1 | Z′ mass 4.5 TeV | | ATLAS-CONF-2017-027
SSM $Z' \to \tau\tau$ | 2 τ | – | – | 36.1 | Z′ mass 2.4 TeV | | ATLAS-CONF-2017-050
Leptophobic $Z' \to bb$ | – | 2 b | – | 3.2 | Z′ mass 1.5 TeV | | 1603.08791
Leptophobic $Z' \to tt$ | 1 e, μ | ≥ 1 b, ≥ 1J/2j | Yes | 3.2 | Z′ mass 2.0 TeV | Γ/m = 3% | ATLAS-CONF-2016-014
SSM $W' \to \ell\nu$ | 1 e, μ | – | Yes | 36.1 | W′ mass 5.1 TeV | | 1706.04786
HVT $V' \to WV \to qqqq$ model B | 0 e, μ | 2 J | – | 36.7 | V′ mass 3.5 TeV | g_V = 3 | CERN-EP-2017-147
HVT $V' \to WH/ZH$ model B | multi-channel | | | 36.1 | V′ mass 2.93 TeV | g_V = 3 | ATLAS-CONF-2017-055
LRSM $W'_R \to tb$ | 1 e, μ | 2 b, 0-1 j | Yes | 20.3 | W′ mass 1.92 TeV | | 1410.4103
LRSM $W'_R \to tb$ | 0 e, μ | ≥ 1 b, 1 J | – | 20.3 | W′ mass 1.76 TeV | | 1408.0886
CI
CI qqqq | – | 2 j | – | 37.0 | Λ 21.8 TeV η_{LL}^- | | 1703.09217
CI ℓℓqq | 2 e, μ | – | – | 36.1 | Λ 40.1 TeV η_{LL}^- | | ATLAS-CONF-2017-027
CI uutt | 2(SS)/≥3 e,μ | ≥1 b, ≥1 j | Yes | 20.3 | Λ 4.9 TeV | $|C_{RR}| = 1$ | 1504.04605
DM
Axial-vector mediator (Dirac DM) | 0 e, μ | 1 − 4 j | Yes | 36.1 | m_{med} 1.5 TeV | g_q=0.25, g_χ=1.0, $m(\chi)$ < 400 GeV | ATLAS-CONF-2017-060
Vector mediator (Dirac DM) | 0 e, μ, 1 γ | ≤ 1 j | Yes | 36.1 | m_{med} 1.2 TeV | g_q=0.25, g_χ=1.0, $m(\chi)$ < 480 GeV | 1704.03848
$VV\chi\chi$ EFT (Dirac DM) | 0 e, μ | 1 J, ≤ 1 j | Yes | 3.2 | M_* 700 GeV | $m(\chi)$ < 150 GeV | 1608.02372
LQ
Scalar LQ 1st gen | 2 e | ≥ 2 j | – | 3.2 | LQ mass 1.1 TeV | β = 1 | 1605.06035
Scalar LQ 2nd gen | 2 μ | ≥ 2 j | – | 3.2 | LQ mass 1.05 TeV | β = 1 | 1605.06035
Scalar LQ 3rd gen | 1 e, μ | ≥1 b, ≥3 j | Yes | 20.3 | LQ mass 640 GeV | β = 0 | 1508.04735
Heavy quarks
VLQ $TT \to Ht + X$ | 0 or 1 e, μ | ≥ 2 b, ≥ 3 j | Yes | 13.2 | T mass 1.2 TeV | $\mathcal{B}(T \to Ht) = 1$ | ATLAS-CONF-2016-104
VLQ $TT \to Zt + X$ | 1 e, μ | ≥ 1 b, ≥ 3 j | Yes | 36.1 | T mass 1.16 TeV | $\mathcal{B}(T \to Zt) = 1$ | 1705.10751
VLQ $TT \to Wb + X$ | 1 e, μ | ≥ 1 b, ≥ 1J/2j | Yes | 36.1 | T mass 1.35 TeV | $\mathcal{B}(T \to Wb) = 1$ | CERN-EP-2017-094
VLQ $BB \to Hb + X$ | 1 e, μ | ≥ 2 b, ≥ 3 j | Yes | 20.3 | B mass 700 GeV | $\mathcal{B}(B \to Hb) = 1$ | 1505.04306
VLQ $BB \to Zb + X$ | 2/≥3 e, μ | ≥2/≥1 b | – | 20.3 | B mass 790 GeV | $\mathcal{B}(B \to Zb) = 1$ | 1409.5500
VLQ $BB \to Wt + X$ | 1 e, μ | ≥ 1 b, ≥ 1J/2j | Yes | 36.1 | B mass 1.25 TeV | $\mathcal{B}(B \to Wt) = 1$ | CERN-EP-2017-094
VLQ $QQ \to WqWq$ | 1 e, μ | ≥ 4 j | Yes | 20.3 | Q mass 690 GeV | | 1509.04261
Excited fermions
Excited quark $q^* \to qg$ | – | 2 j | – | 37.0 | q* mass 6.0 TeV | only u^* and d^*, $\Lambda = m(q^*)$ | 1703.09127
Excited quark $q^* \to q\gamma$ | 1 γ | 1 j | – | 36.7 | q* mass 5.3 TeV | only u^* and d^*, $\Lambda = m(q^*)$ | CERN-EP-2017-148
Excited quark $b^* \to bg$ | – | 1 b, 1 j | – | 13.3 | b* mass 2.3 TeV | | ATLAS-CONF-2016-060
Excited quark $b^* \to Wt$ | 1 or 2 e, μ | 1 b, 2-0 j | Yes | 20.3 | b* mass 1.5 TeV | $f_g = f_L = f_R = 1$ | 1510.02664
Excited lepton ℓ^* | 3 e, μ | – | – | 20.3 | ℓ* mass 3.0 TeV | Λ = 3.0 TeV | 1411.2921
Excited lepton ν^* | 3 e, μ, τ | – | – | 20.3 | ν* mass 1.6 TeV | Λ = 1.6 TeV | 1411.2921
Other
LRSM Majorana ν | 2 e, μ | 2 j | – | 20.3 | N^0 mass 2.0 TeV | $m(W_R)$ = 2.4 TeV, no mixing | 1506.06020
Higgs triplet $H^{\pm\pm} \to \ell\ell$ | 2,3,4 e, μ (SS) | – | – | 36.1 | $H^{\pm\pm}$ mass 870 GeV | DY production | ATLAS-CONF-2017-053
Higgs triplet $H^{\pm\pm} \to \ell\tau$ | 3 e, μ, τ | – | – | 20.3 | $H^{\pm\pm}$ mass 400 GeV | DY production, $\mathcal{B}(H_L^{\pm\pm} \to \ell\tau) = 1$ | 1411.2921
Monotop (non-res prod) | 1 e, μ | 1 b | Yes | 20.3 | spin-1 invisible particle mass 657 GeV | $a_{non-res}$ = 0.2 | 1410.5404
Multi-charged particles | – | – | – | 20.3 | multi-charged particle mass 785 GeV | DY production, $|q| = 5e$ | 1504.04188
Magnetic monopoles | – | – | – | 7.0 | monopole mass 1.34 TeV | DY production, $|g| = 1g_D$, spin 1/2 | 1509.08059
$\sqrt{s}$ = 8 TeV
$\sqrt{s}$ = 13 TeV
10^{-1}
1
10
Mass scale [TeV]
*Only a selection of the available mass limits on new states or phenomena is shown.
†Small-radius (large-radius) jets are denoted by the letter j (J).

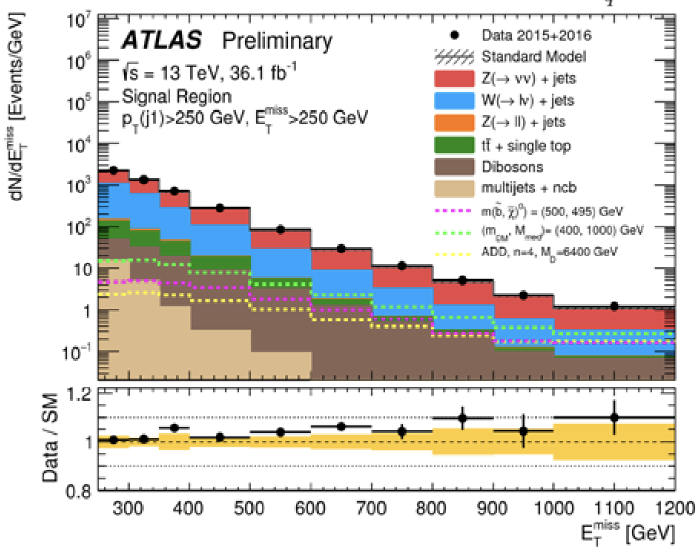
Searches for Dark Matter

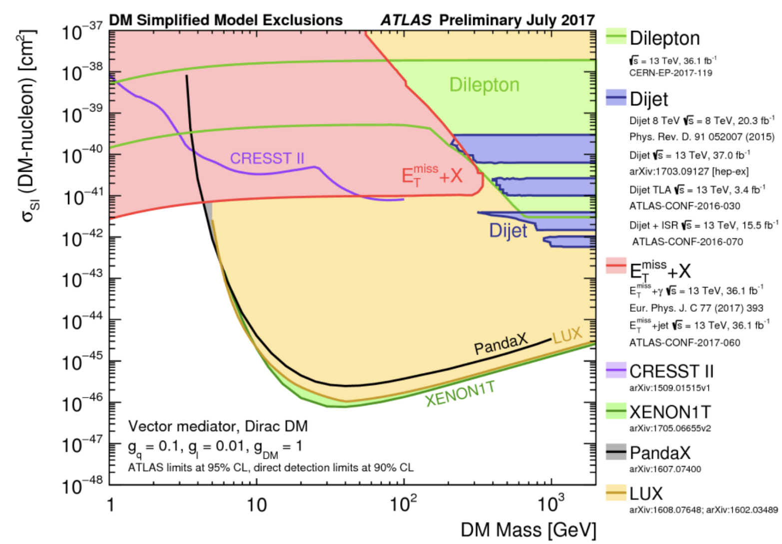
- Mono-object (jet(s)/γ/Z(ll)/H(γγ/bb)) + E_T^{miss} for DM searches
- Complementary to direct dark matter searches
- Using simplified models to guide analyses and interpret results
- No significant excesses over SM expectation





ATLAS-CONF-2017-060

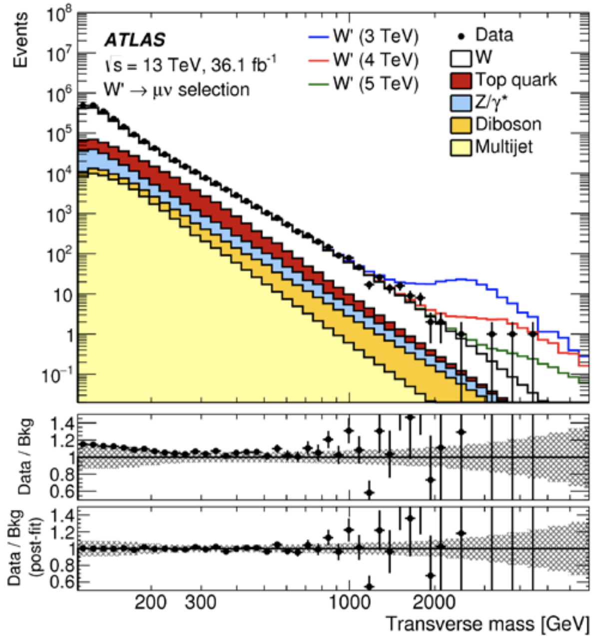


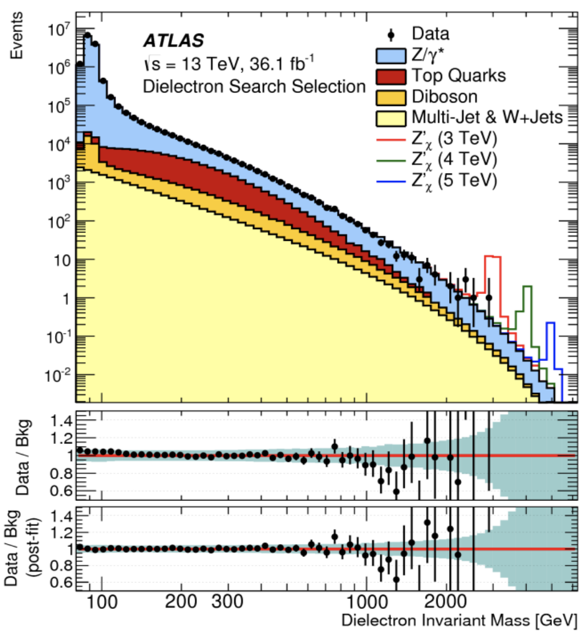


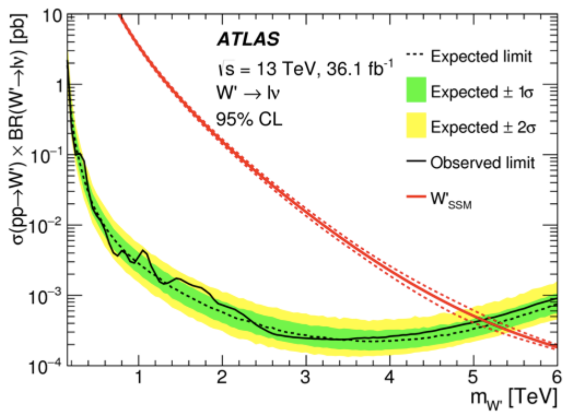
Daniel Guest's talk

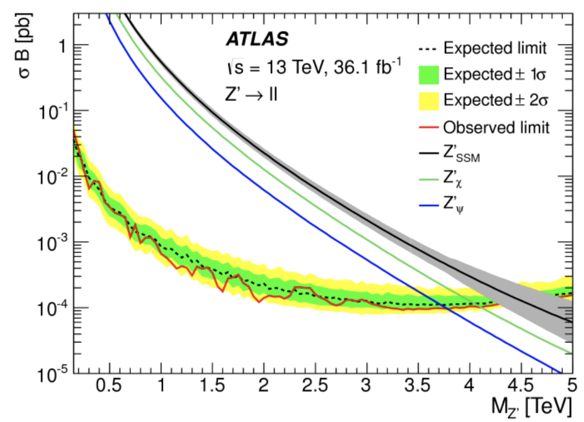
Searches with Dilepton, Lepton+E_T^{miss}

- Resonance searches $Z' \rightarrow l^+l^-$, $W' \rightarrow l^\pm + E_T^{miss}$
- No significant excess over SM expectation
- 95% CL exclusion limits in various new physics scenarios





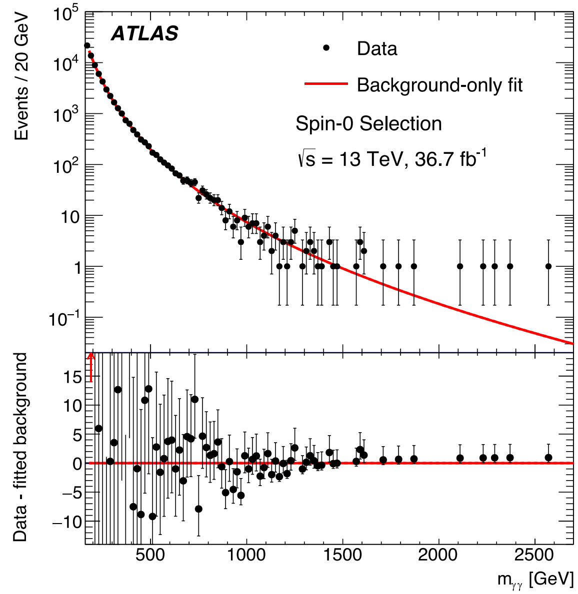


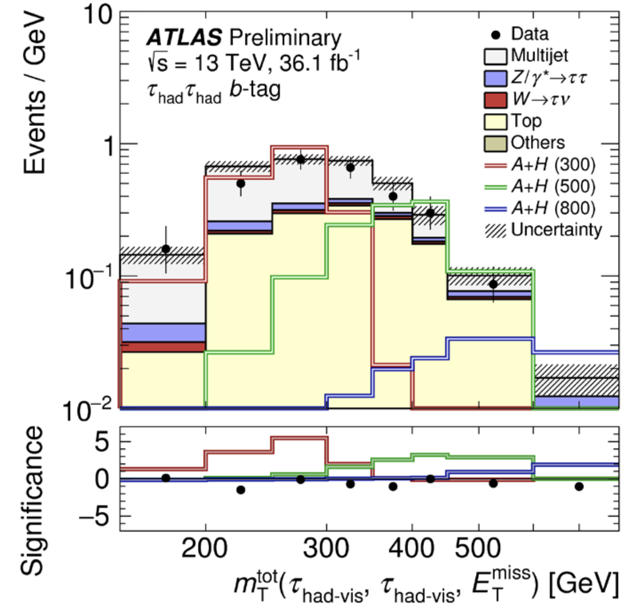


arXiv:1706.04786 arXiv:1707.02424

Searches with γγ, τ⁺τ⁻

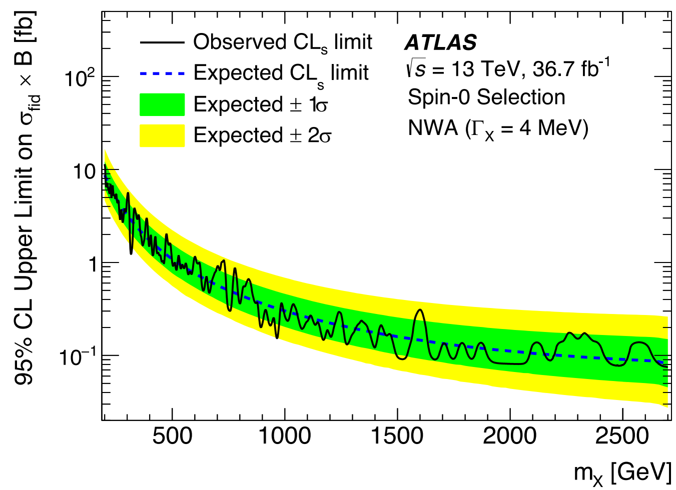
- Heavy scalar searches with γγ, τ⁺τ⁻
- γγ search also for spin-2 graviton
- τ⁺τ⁻ search sensitive to SUSY Higgs (H/A) models
- No significant excesses over SM expectation

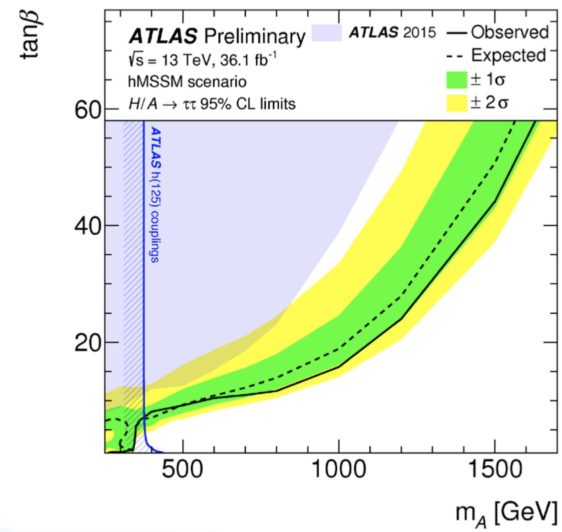




arXiv:1707.04147

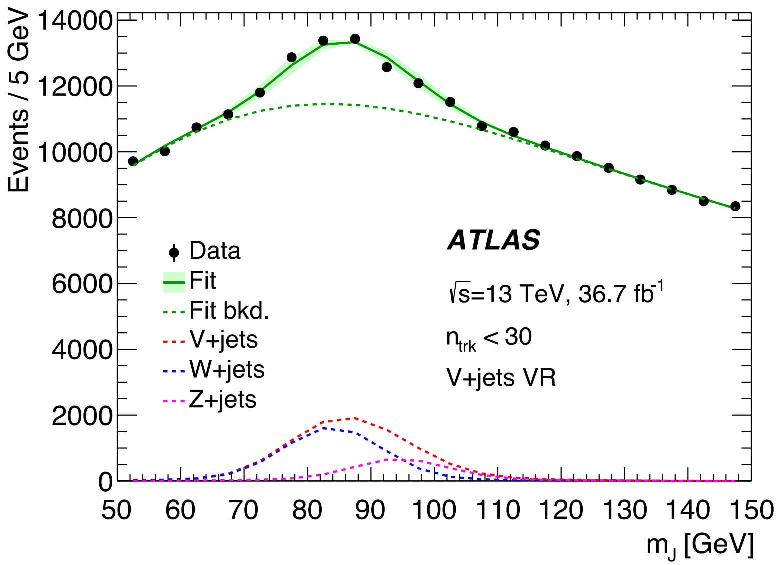
ATLAS-CONF-2017-050



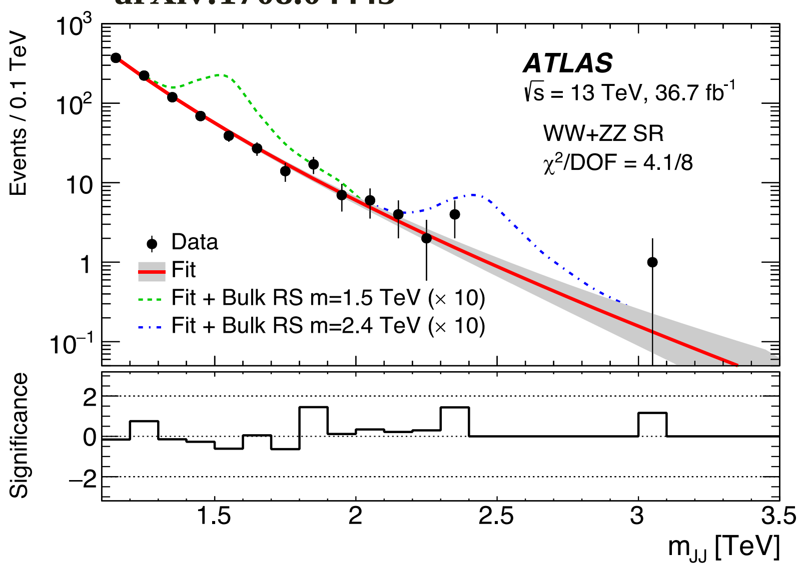


Searches with Di-bosons: VV

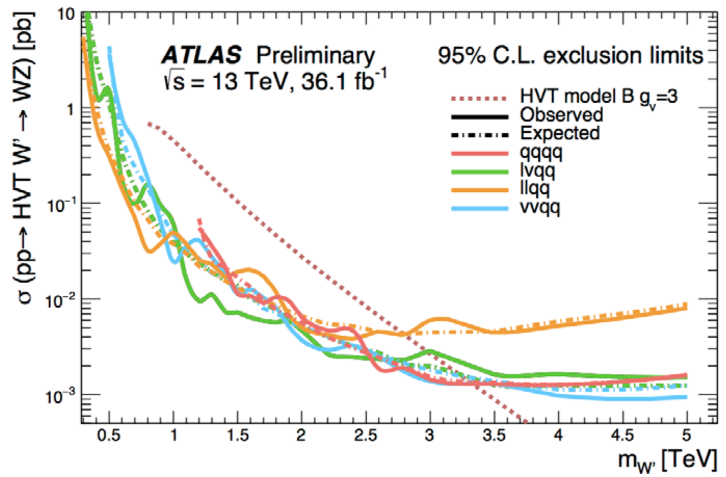
- Resonance searches for X → VV (V=W/Z)
  - VV → qqqq/qqlν/qqll/qqνν
- Merged jets at high p_T using substructure techniques (boson-tagging)
- No significant excesses over SM expectation
- Limit setting in the framework of Heavy Vector Triplet model (HVT)



arXiv:1708.04445

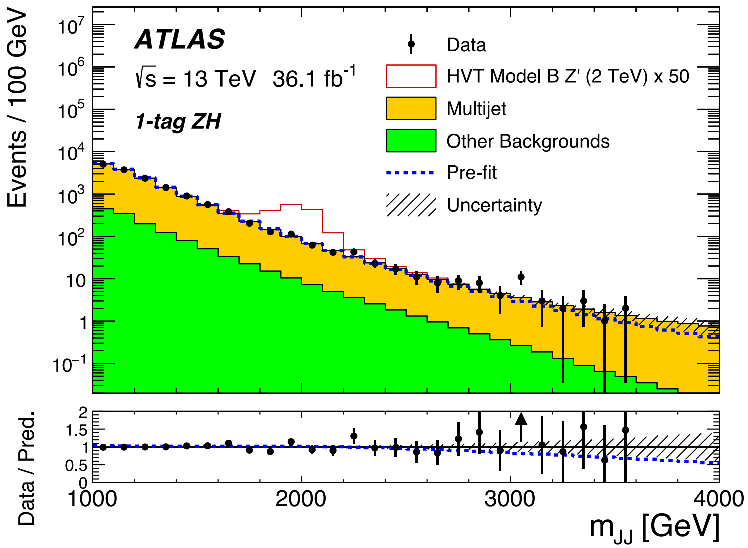


ATLAS-CONF-2017-018/051/055, EXOT-2016-019/029

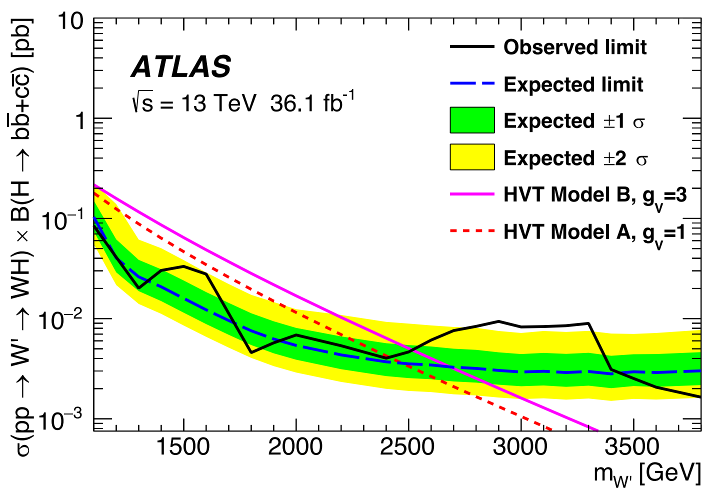


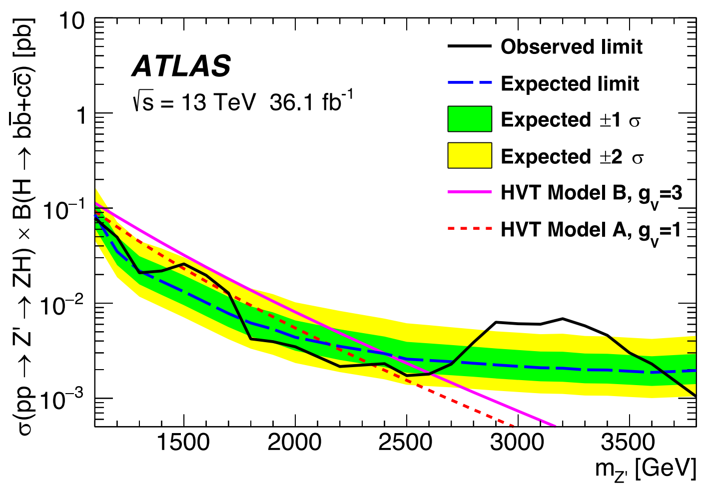
Searches with Di-bosons: VH

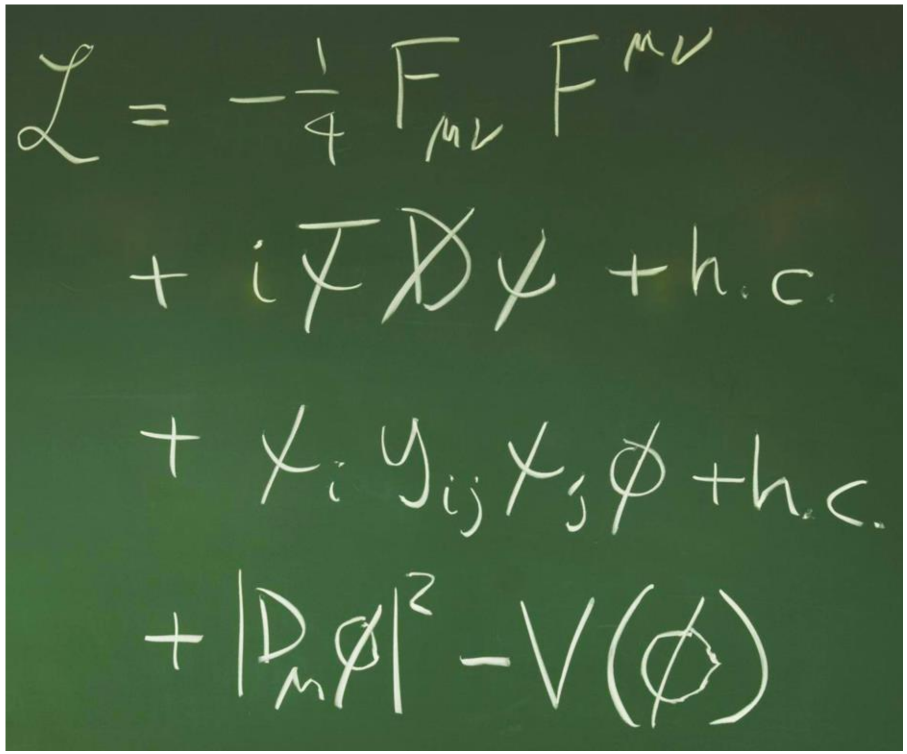
- Resonance searches for X → VH (V=W/Z)
  - VH → qqbb/lνbb/llbb/ννbb
- Merged jets at high p_T using substructure techniques (boson-tagging)
- Limit setting in the framework of Heavy Vector Triplet model (HVT)
- Excess in qqbb channel around 3 TeV (ZH with 3.3σ local, 2.1σ global significance), but not seen in lepton channels



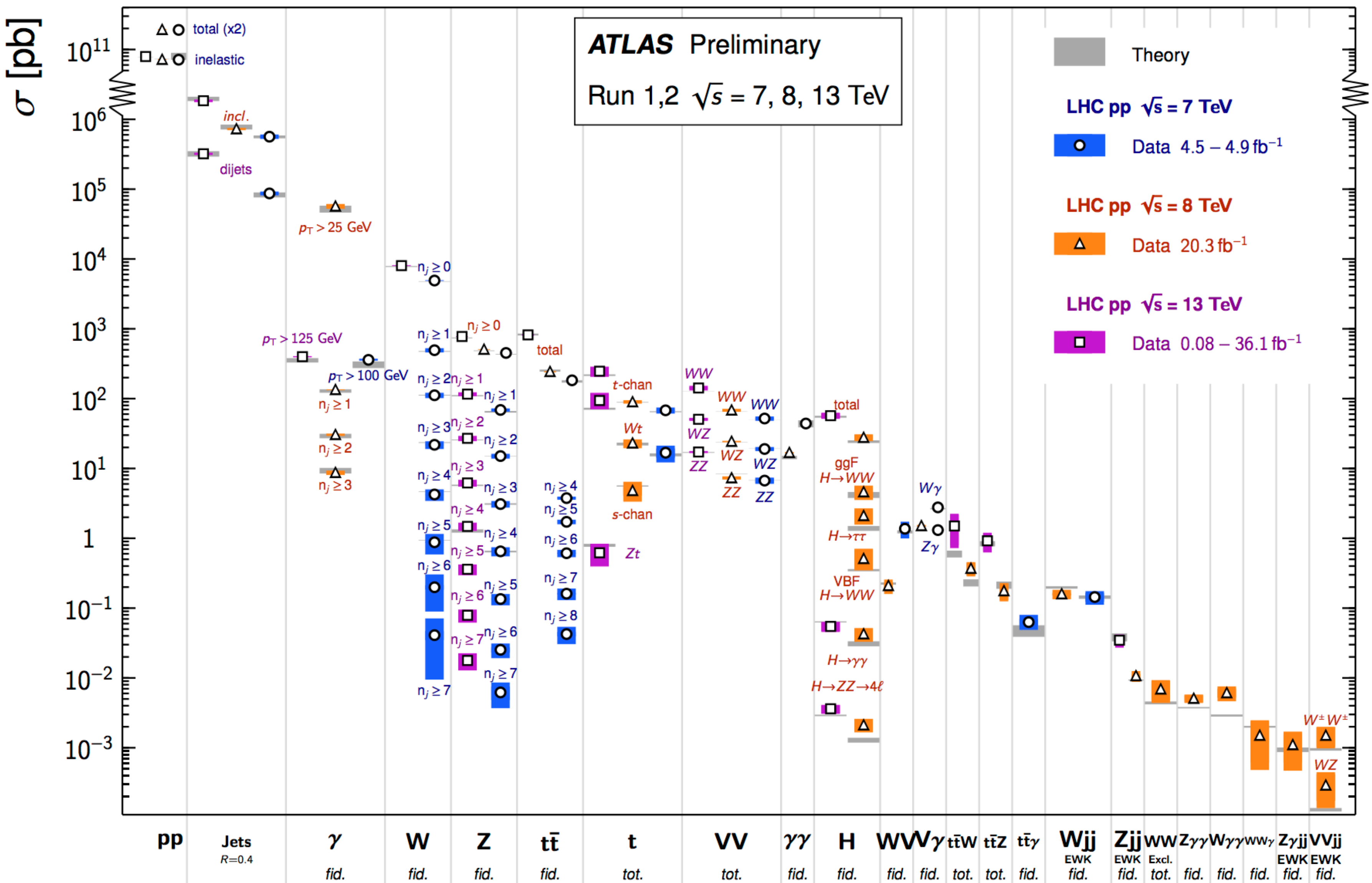
arXiv:1707.06958






$\mathcal{L} = -\frac{1}{4} F_{\mu\nu} F^{\mu\nu}$
$+ i \bar{\psi} \not{D} \psi + h.c.$
$+ \psi_i y_{ij} \psi_j \phi + h.c.$
$+ |D_\mu \phi|^2 - V(\phi)$

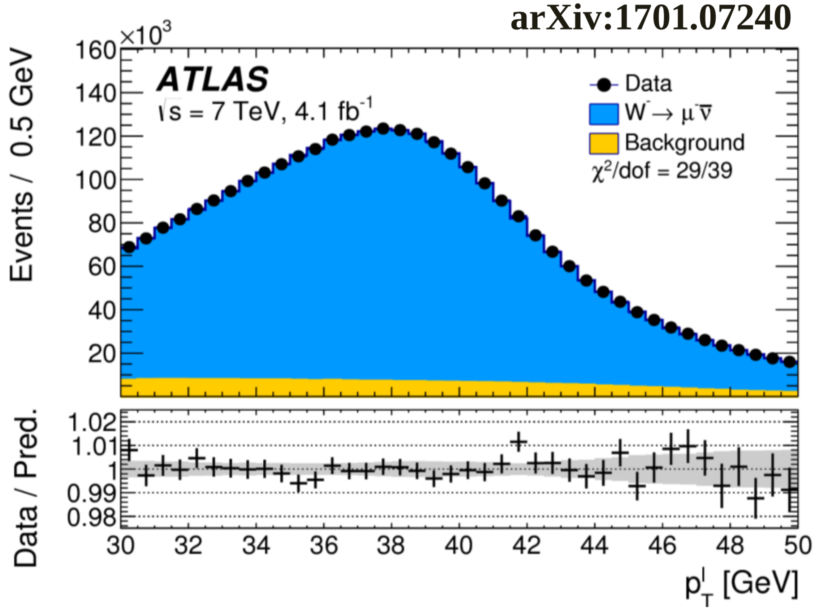
Standard Model Cross Sections

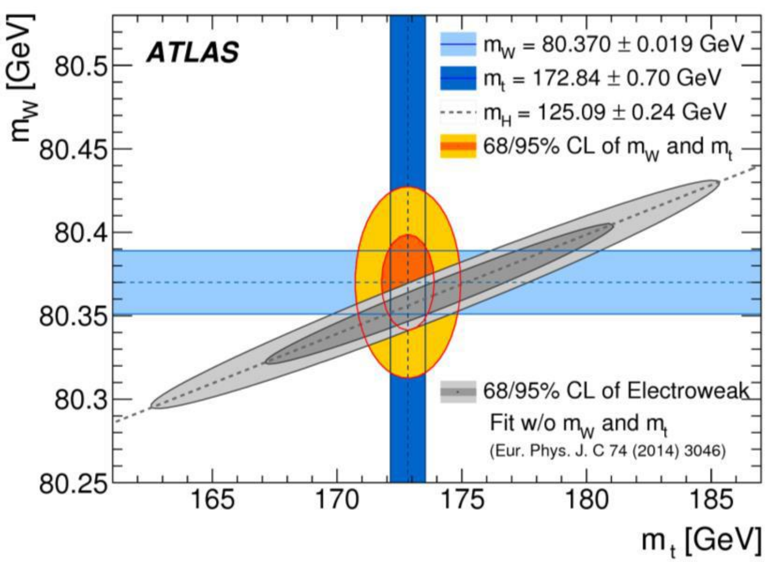


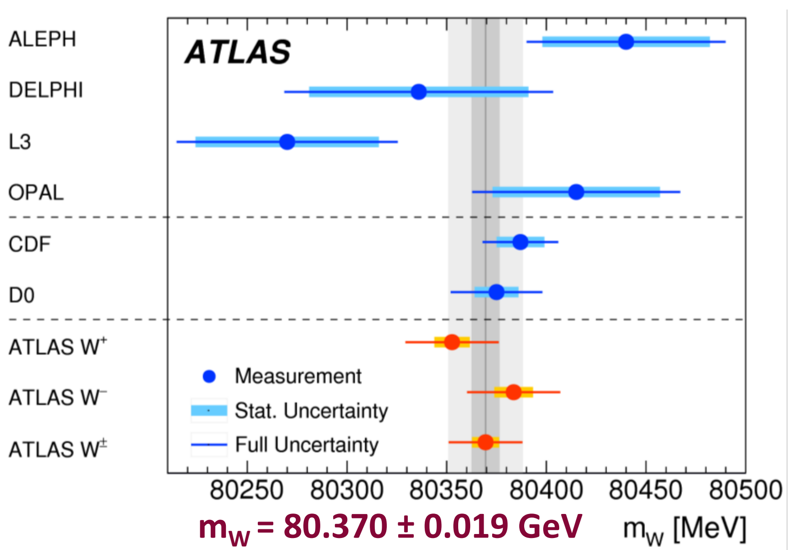
W Mass Measurement

arXiv:1701.07240

- W(eν/μν) with 4.6 fb^{-1} of data @ 7 TeV
- Understanding detector response and modelling of kinematic quantities, e.g. lepton p_T, E_T^{miss}
  - Calibration of W recoil with Z(ll) data
- Similar precision to best previous single experiment measurement from CDF
- Result consistent with SM expectation
- Further progress requires improved modelling



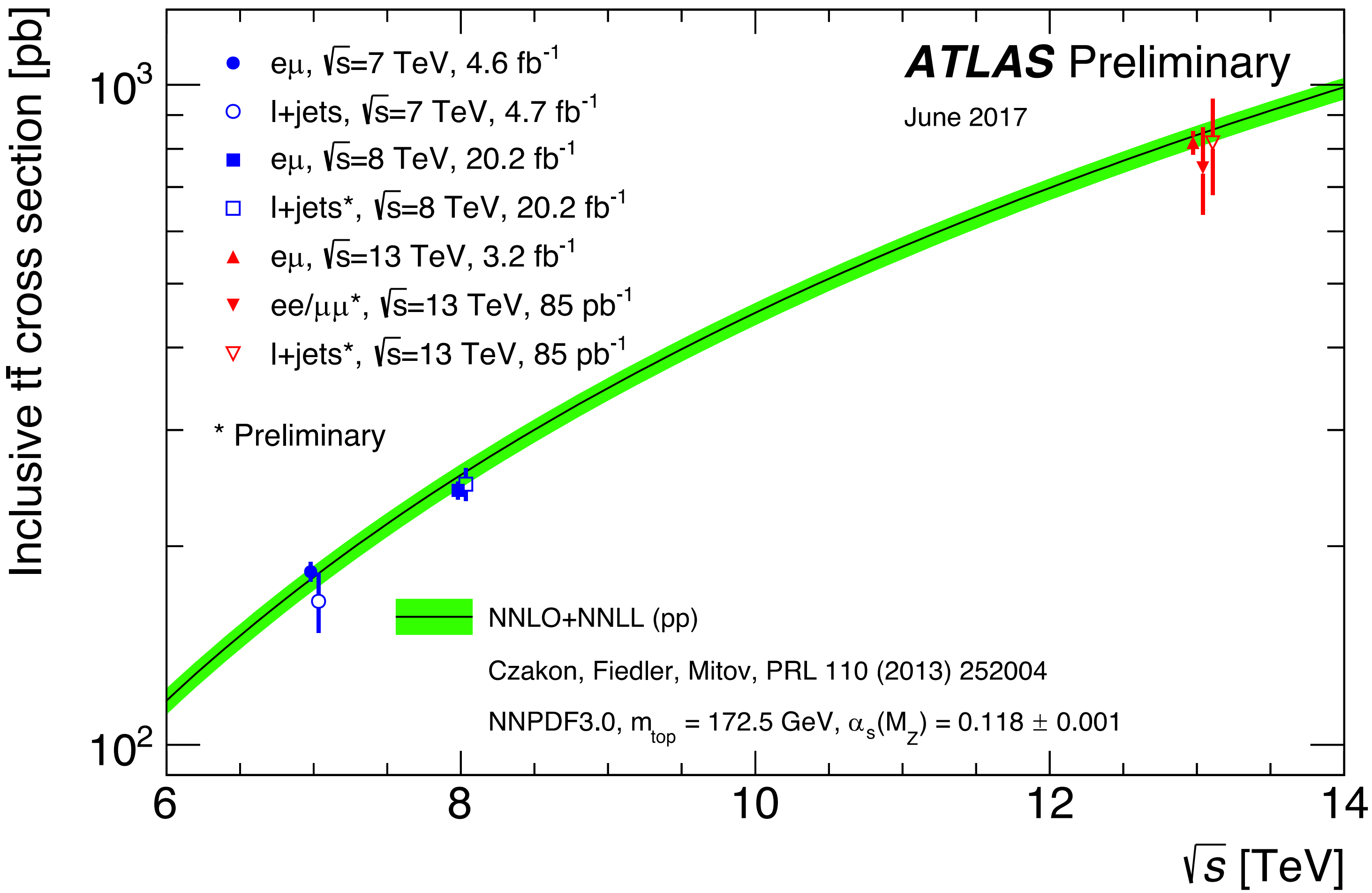




m_W = 80.370 ± 0.019 GeV

[± 7 MeV (stat.) ± 11 MeV (syst.) ± 14 MeV (modelling)]

Top Pair Production Cross Section

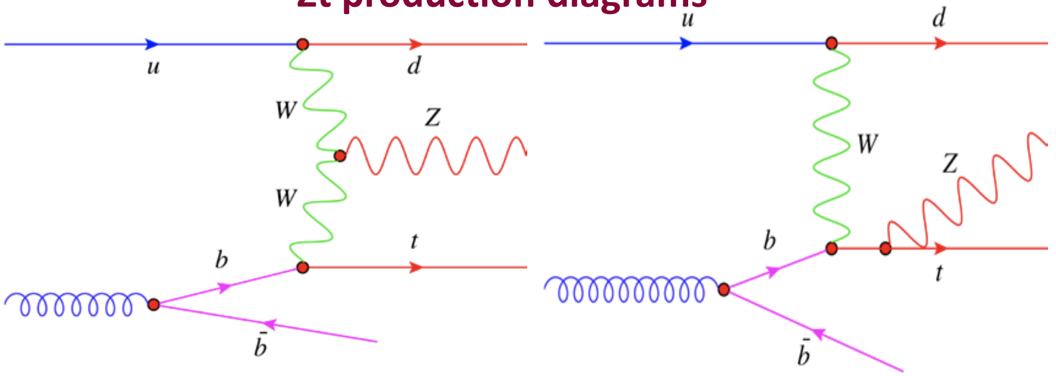


Richard Hawkings' talk
Arwa Bannoura's talk

Single Top Production: Zt

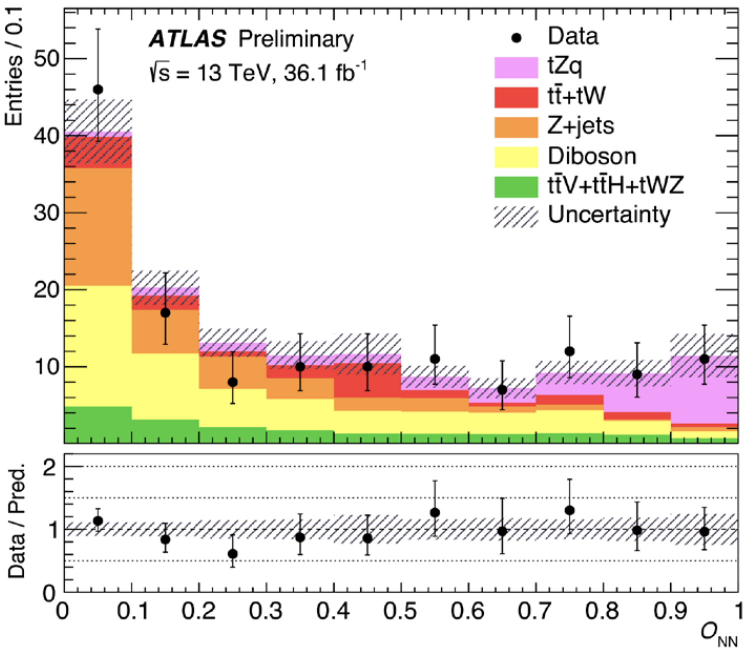
- **Previously evidences for single top quark production at LHC in s-channel, t-channel and Wt associated production**

Zt production diagrams



- **Now evidence for Zt associated production**
  - **Significance 4.2σ (5.4σ expected)**
  - **Cross-section 600 ± 170 (stat.) ± 140 (syst.) fb consistent with SM expectation**

ATLAS-CONF-2017-052



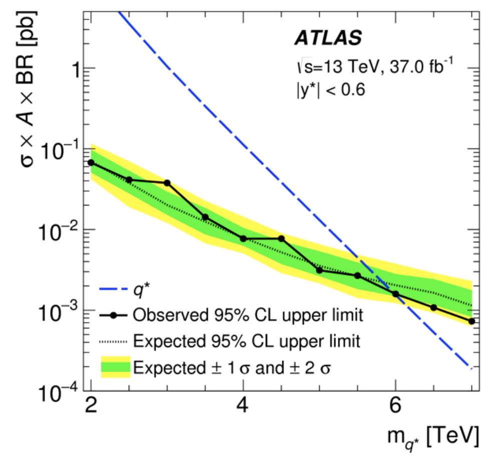
Lidia Dell'Asta's talk

Summary

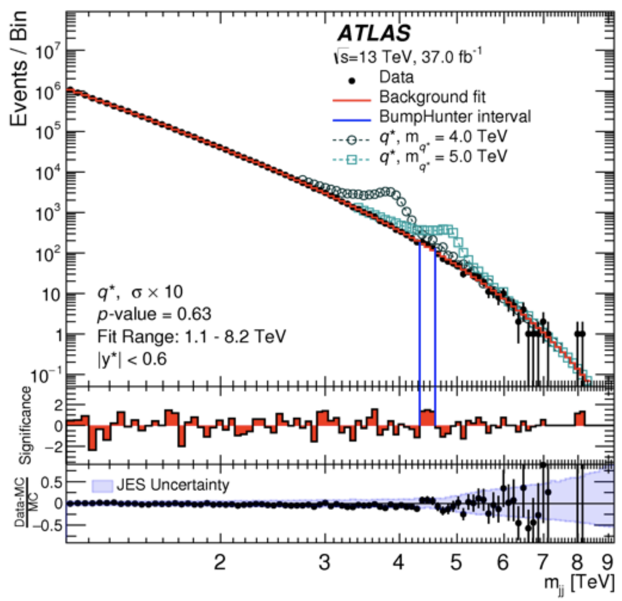
- ATLAS performing well at luminosities way beyond the LHC design
- Wide range of physics results
  - Entering precision measurement era for Higgs boson
  - No significant excesses so far from extensive searches for BSM physics
- Stay tuned
  - Ongoing 2017 another record year

Searches with Di-jets

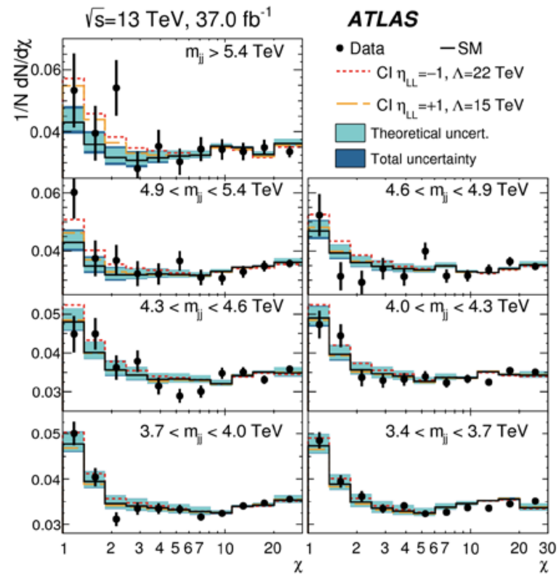
- Searches for excess in dijet mass and angular distributions
- No significant excesses over SM expectation
- New limits
  - m(q*) > 6.0 TeV (5.8 TeV exp.)
  - m(W') > 3.6 TeV (3.7 TeV exp.)
  - m(BH) > 8.9 TeV (8.9 TeV exp.)
  - Contact Interactions: $\Lambda > 13.1/21.8$ TeV (η_{LL} = +1/-1)
  - Also on generic Gaussian resonances



$$\chi = e^{y*} \sim \frac{1+\cos\theta^*}{1-\cos\theta^*}$$

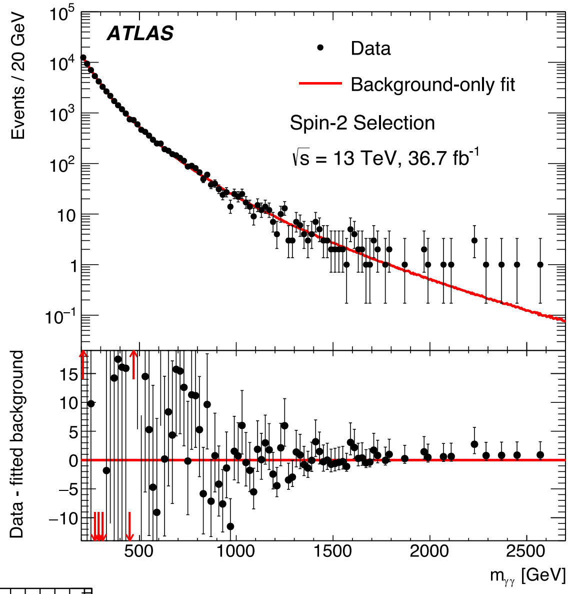


arXiv:1703.09127

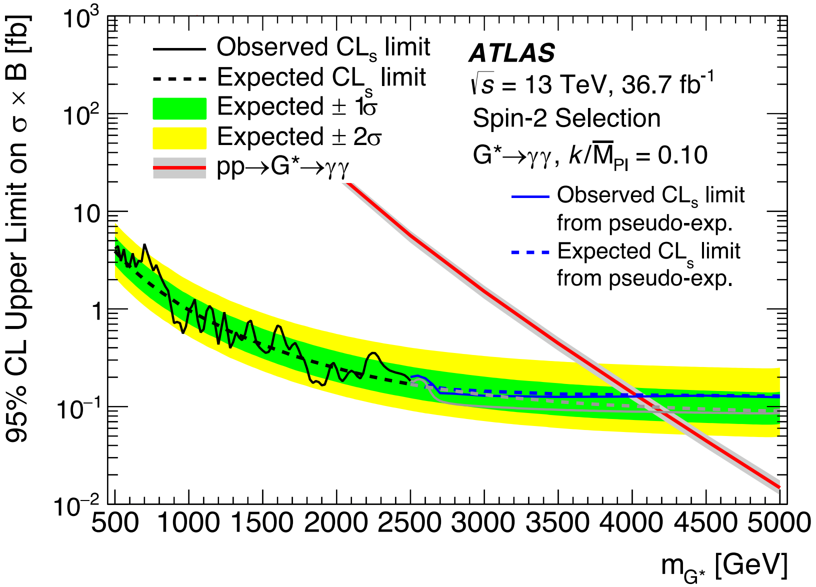


Spin-2 with $\gamma\gamma$

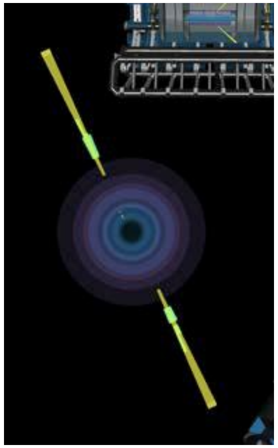
- $\gamma\gamma$ search for spin-2 graviton
- No significant excesses over SM expectation

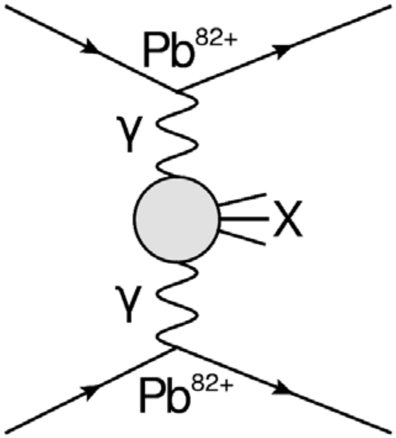


arXiv:1707.04147



Heavy Ion Physics





- **Evidence for light-by-light scattering**
  - **In 5 TeV Ultra-Peripheral Pb-Pb collisions**
- **Jet suppression up to ~1 TeV**
  - **The production of strongly interacting particles is increasingly suppressed when the density of nuclear medium increases.**

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