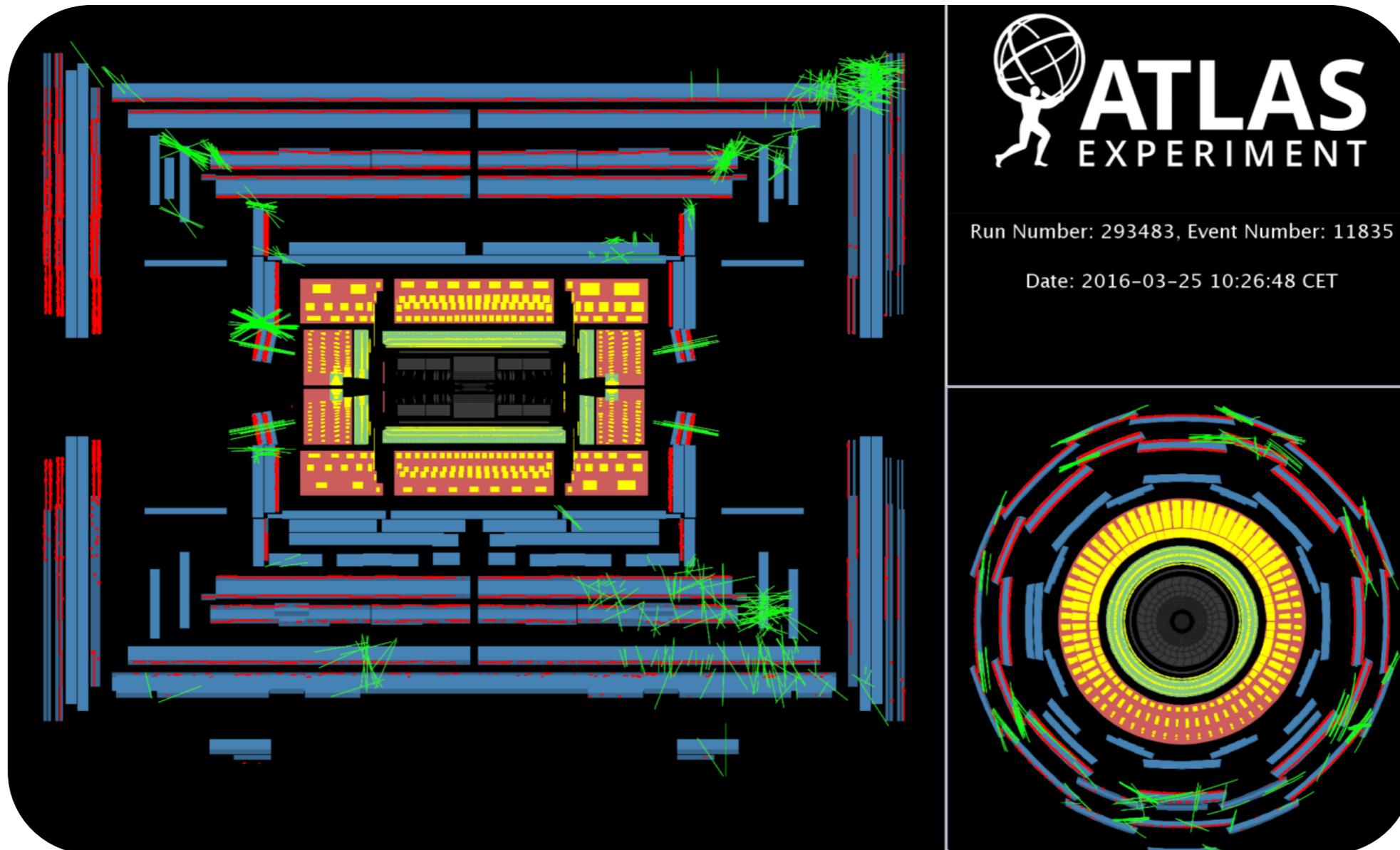


# ATLAS

## DETECTOR STATUS AND PHYSICS HIGHLIGHTS

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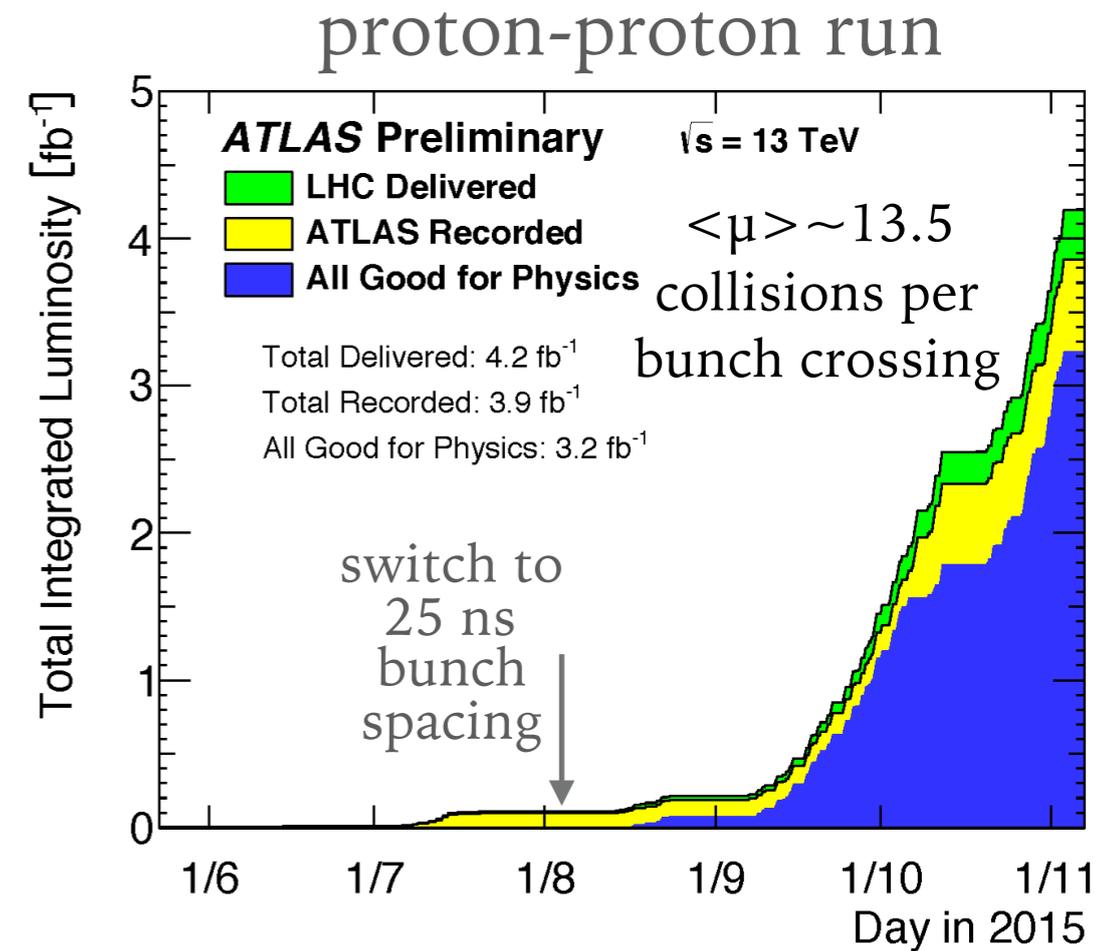
*Stephanie Majewski,  
University of Oregon*

*HEPAP Meeting,  
Mar 31 - Apr 1, 2016*

# 2015 DATA-TAKING



- ▶ Compared to 2012...
  - $\sqrt{s}$ : 8  $\rightarrow$  13 TeV
  - bunch spacing: 50  $\rightarrow$  25 ns
- ▶ 3.2 fb<sup>-1</sup> of 25 ns data good for physics (including new innermost pixel layer)
- ▶ Data-taking efficiency: 92%  
Data good for physics: 87%
- ▶ Excellent trigger performance and stability
- ▶ Successful heavy ion run as well!  
0.67 nb<sup>-1</sup> @  $\sqrt{s_{NN}} = 5.02$  TeV



Peak luminosity:  
 $5.0 \times 10^{33} \text{ cm}^{-2} \text{ s}^{-1}$

# NEW ATLAS RESULTS FOR WINTER CONFERENCES

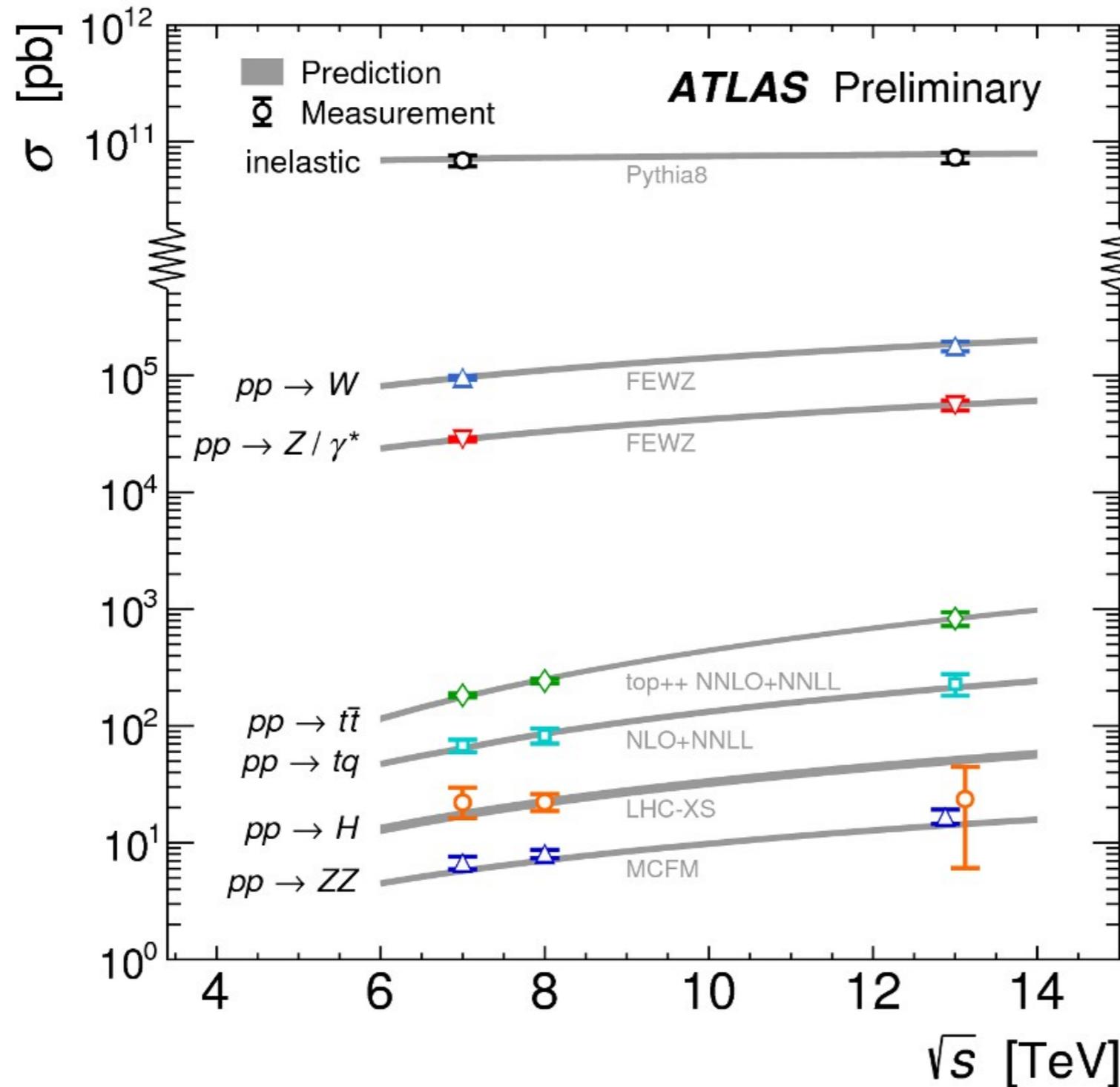


Topic	Document type	Short title	Reference and Link	Release conference
Top physics	Conference Note	ttV cross section at 13 TeV	<a href="#">ATLAS-CONF-2016-003</a>	Moriond EW
Top physics	Conference Note	ttbar cross section in the e+mu channel at 13 TeV	<a href="#">ATLAS-CONF-2016-005</a>	Moriond EW
Higgs physics	Conference Note	HH to bb+2-photons	<a href="#">ATLAS-CONF-2016-004</a>	Moriond EW
Higgs physics	Conference Note	Search for 2-photons + MET	<a href="#">ATLAS-CONF-2016-011</a>	Moriond EW
Higgs physics	Conference Note	Search for H->ZZ->llnn	<a href="#">ATLAS-CONF-2016-012</a>	Moriond EW
Higgs physics	Conference Note	Search for A->Zh	<a href="#">ATLAS-CONF-2016-015</a>	Moriond EW
Higgs physics	Conference Note	Search for H->ZZ->llqq	<a href="#">ATLAS-CONF-2016-016</a>	Moriond EW
SUSY	Conference Note	Direct stop production in the 1-lepton channel	<a href="#">ATLAS-CONF-2016-007</a>	Moriond EW
SUSY	Conference Note	Direct stop production in the 2-lepton channel	<a href="#">ATLAS-CONF-2016-009</a>	Moriond EW
SUSY	Paper	Search for SUSY in the 2 same-sign lepton and 3 lepton channels	<a href="#">arXiv:1602.09058</a>	Moriond EW
SUSY	Paper	Search for SUSY with large jet multiplicities and MET	<a href="#">arXiv:1602.06194</a>	Moriond EW
Exotics	Conference Note	lepton+jets TeV-gravity	<a href="#">ATLAS-CONF-2016-006</a>	Moriond EW
Exotics	Conference Note	Z+gamma resonances	<a href="#">ATLAS-CONF-2016-010</a>	Moriond EW
Exotics	Conference Note	Search for vector like quarks in lepton+jets	<a href="#">ATLAS-CONF-2016-013</a>	Moriond EW
Exotics	Conference Note	Search for high mass ttbar resonances	<a href="#">ATLAS-CONF-2016-014</a>	Moriond EW
Exotics	Conference Note	HH->4b search	<a href="#">ATLAS-CONF-2016-017</a>	Moriond EW
Exotics	Conference Note	Search for resonances in diphoton events	<a href="#">ATLAS-CONF-2016-018</a>	Moriond EW
Standard Model physics	Paper	Measurement of charged particle multiplicities	<a href="#">arXiv:1602.01633</a>	Moriond EW

<http://twiki.cern.ch/twiki/bin/view/AtlasPublic/Winter2016-13TeV>



# PHYSICS HIGHLIGHTS: INCLUSIVE CROSS-SECTIONS



- inelastic  
 7 TeV,  $20 \mu\text{b}^{-1}$ , Nat. Commun. 2, 463 (2011)  
 13 TeV,  $63 \mu\text{b}^{-1}$ , ATLAS-CONF-2015-038
- △  $pp \rightarrow W$   
 7 TeV,  $36 \text{pb}^{-1}$ , PRD 85, 072004 (2012)  
 13 TeV,  $85 \text{pb}^{-1}$ , ATLAS-CONF-2015-039
- ▽  $pp \rightarrow Z/\gamma^*$   
 7 TeV,  $36 \text{pb}^{-1}$ , PRD 85, 072004 (2012)  
 13 TeV,  $85 \text{pb}^{-1}$ , ATLAS-CONF-2015-039
- ◇  $pp \rightarrow t\bar{t}$   
 7 TeV,  $4.6 \text{fb}^{-1}$ , Eur. Phys. J. C 74:3109 (2014)  
 8 TeV,  $20.3 \text{fb}^{-1}$ , Eur. Phys. J. C 74:3109 (2014)  
 13 TeV,  $78 \text{pb}^{-1}$ , ATLAS-CONF-2015-049
- $pp \rightarrow tq$   
 7 TeV,  $4.6 \text{fb}^{-1}$ , PRD 90, 112006 (2014)  
 8 TeV,  $20.3 \text{fb}^{-1}$ , ATLAS-CONF-2014-007  
 13 TeV,  $3.2 \text{fb}^{-1}$ , ATLAS-CONF-2015-079
- $pp \rightarrow H$   
 7 TeV,  $4.5 \text{fb}^{-1}$ , arXiv:1507.04548  
 8 TeV,  $20.3 \text{fb}^{-1}$ , arXiv:1507.04548  
 13 TeV,  $3.2 \text{fb}^{-1}$ , ATLAS-CONF-2015-069
- △  $pp \rightarrow ZZ$   
 7 TeV,  $4.6 \text{fb}^{-1}$ , JHEP 03, 128 (2013)  
 8 TeV,  $20.3 \text{fb}^{-1}$ , ATLAS-CONF-2013-020  
 13 TeV,  $3.2 \text{fb}^{-1}$ , arXiv:1512.05314

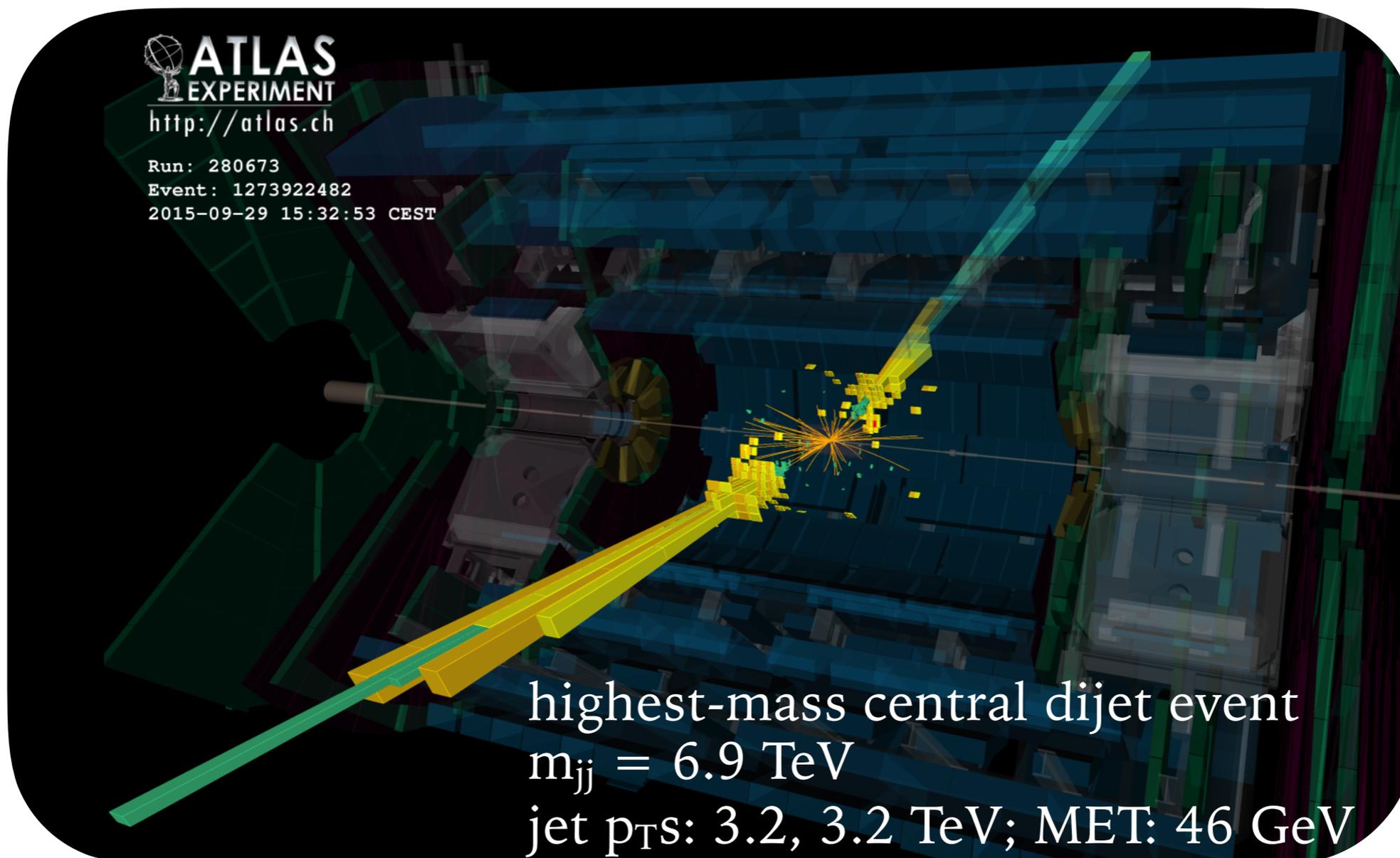
December 2015



# PHYSICS HIGHLIGHTS: SEARCHES



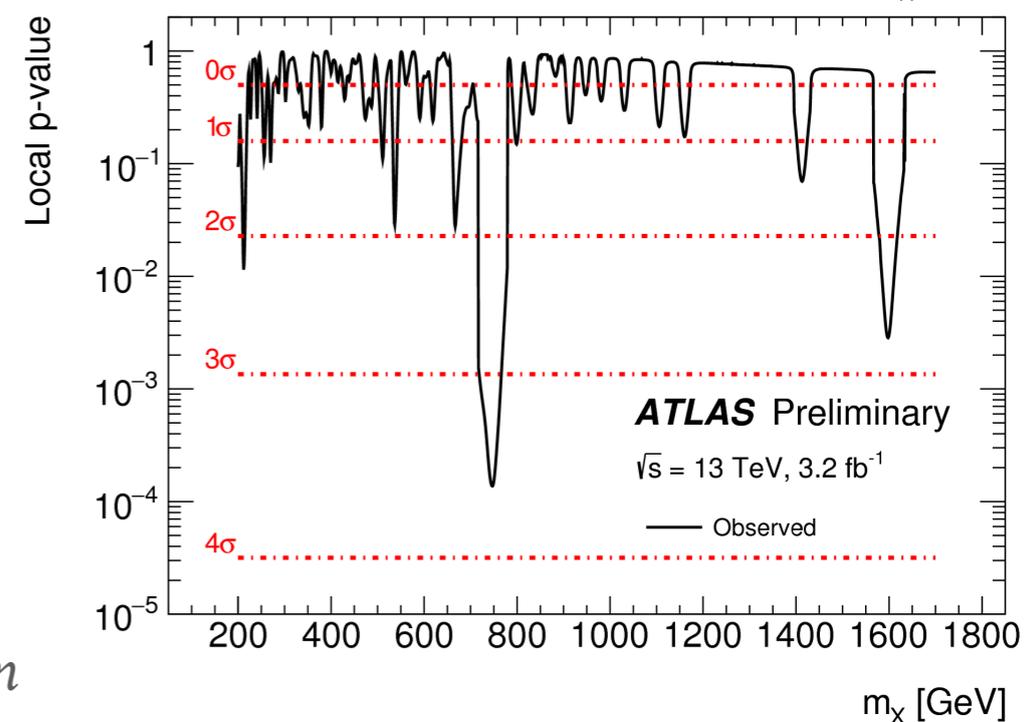
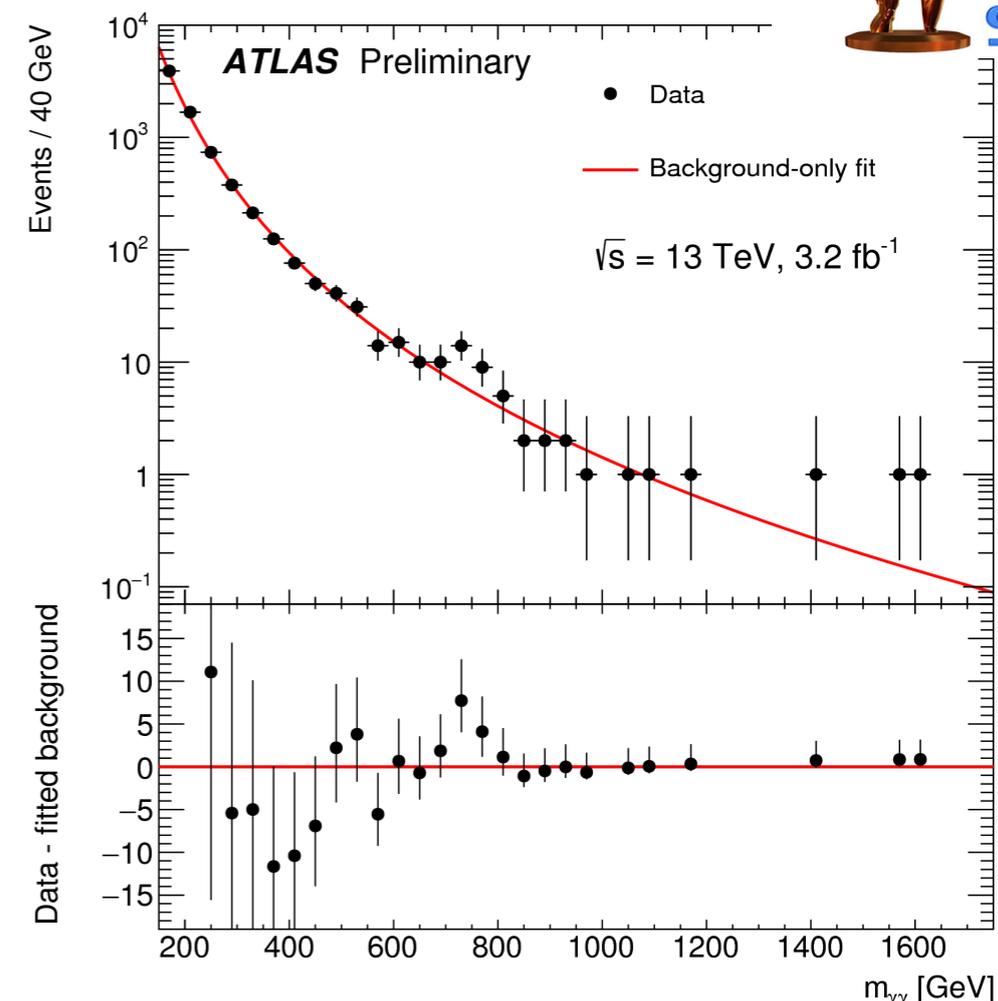
- ▶ 13 TeV proton-proton CM energy → large cross-section increase for high-mass states!



# PHYSICS HIGHLIGHTS: DIPHOTON RESONANCE SEARCH



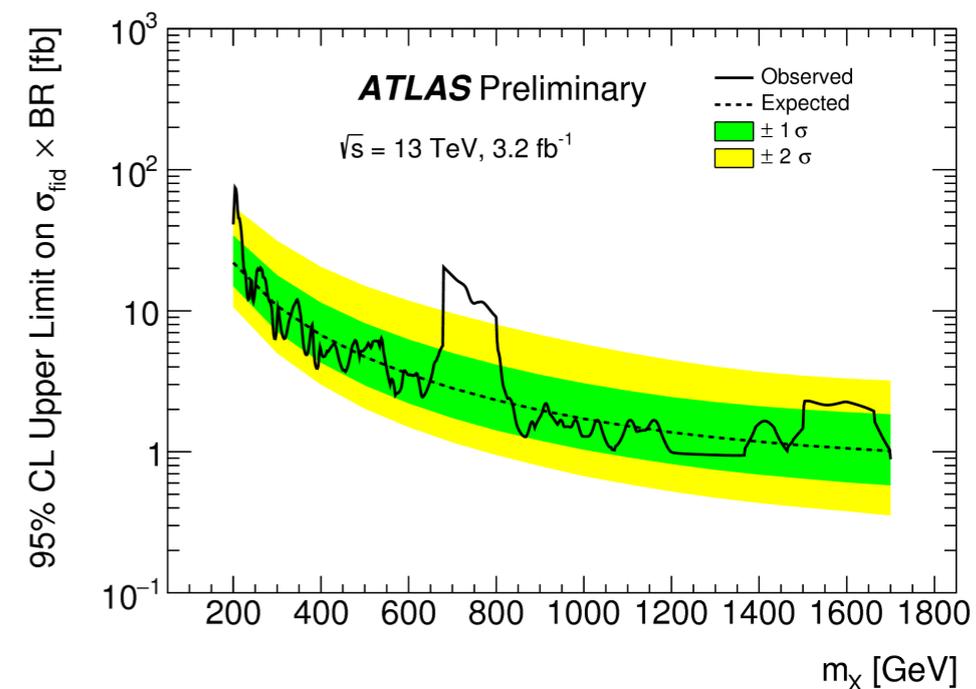
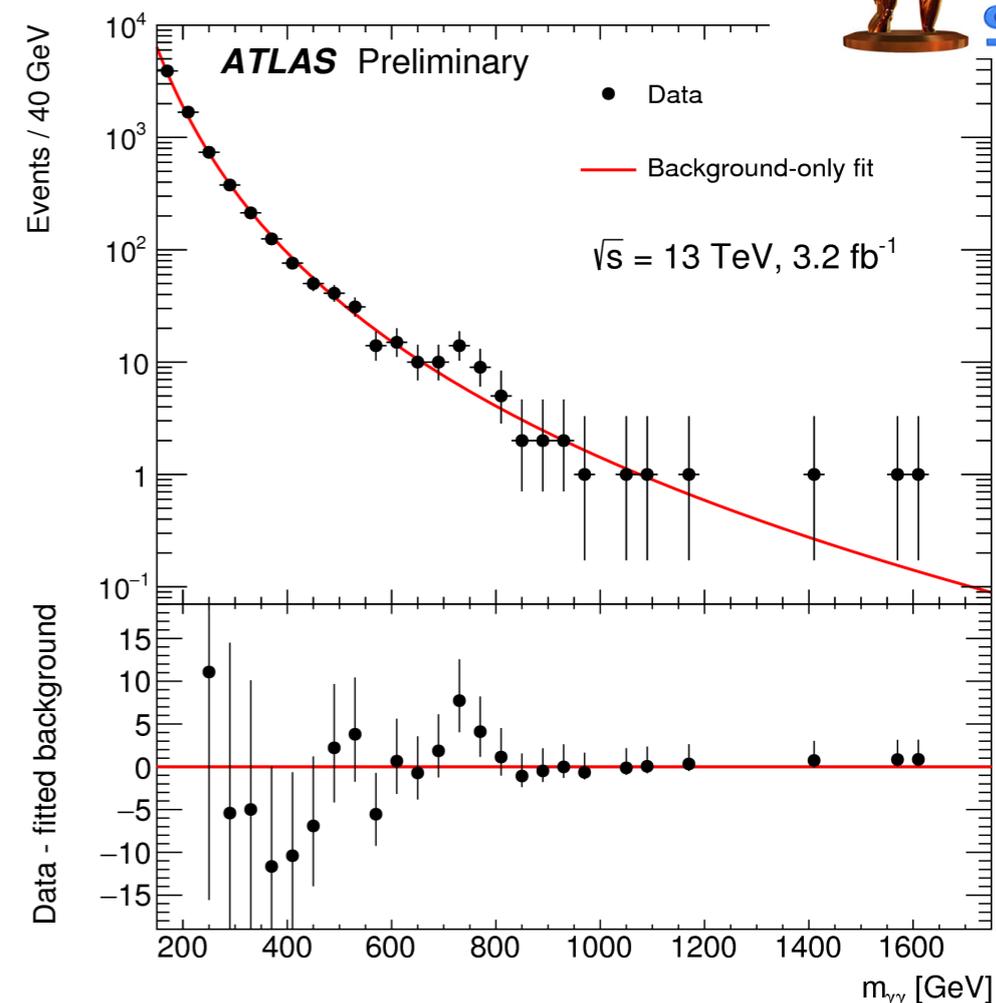
- Presented in December, event selection similar to SM Higgs:
  - 2 photons,  $E_T/m_{\gamma\gamma} > 0.4, 0.3$
  - $p_T$ -dependent isolation, purity  $\sim 90\%$
- Bkg fit: simplest functional form chosen that minimizes spurious signal in bkg-only simulation
- Excess found in diphoton mass spectrum (search optimized for scalar resonance)
  - local significance  $3.6\sigma$  ( $3.9\sigma$ ) for narrow 4 MeV (45 GeV) width
  - **Global significance  $2.0\sigma$  ( $2.3\sigma$ )**



# PHYSICS HIGHLIGHTS: DIPHOTON RESONANCE SEARCH



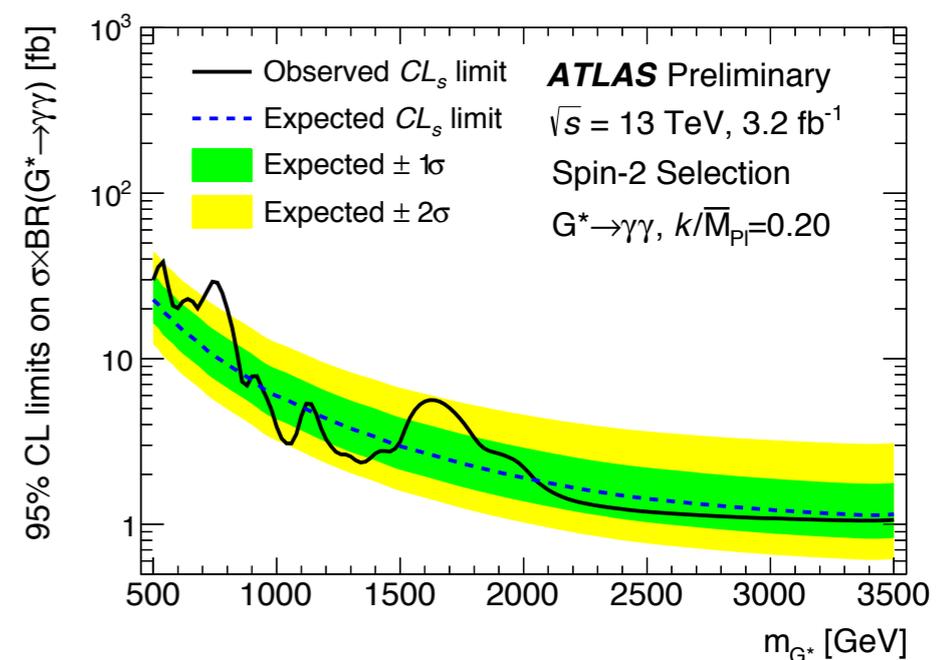
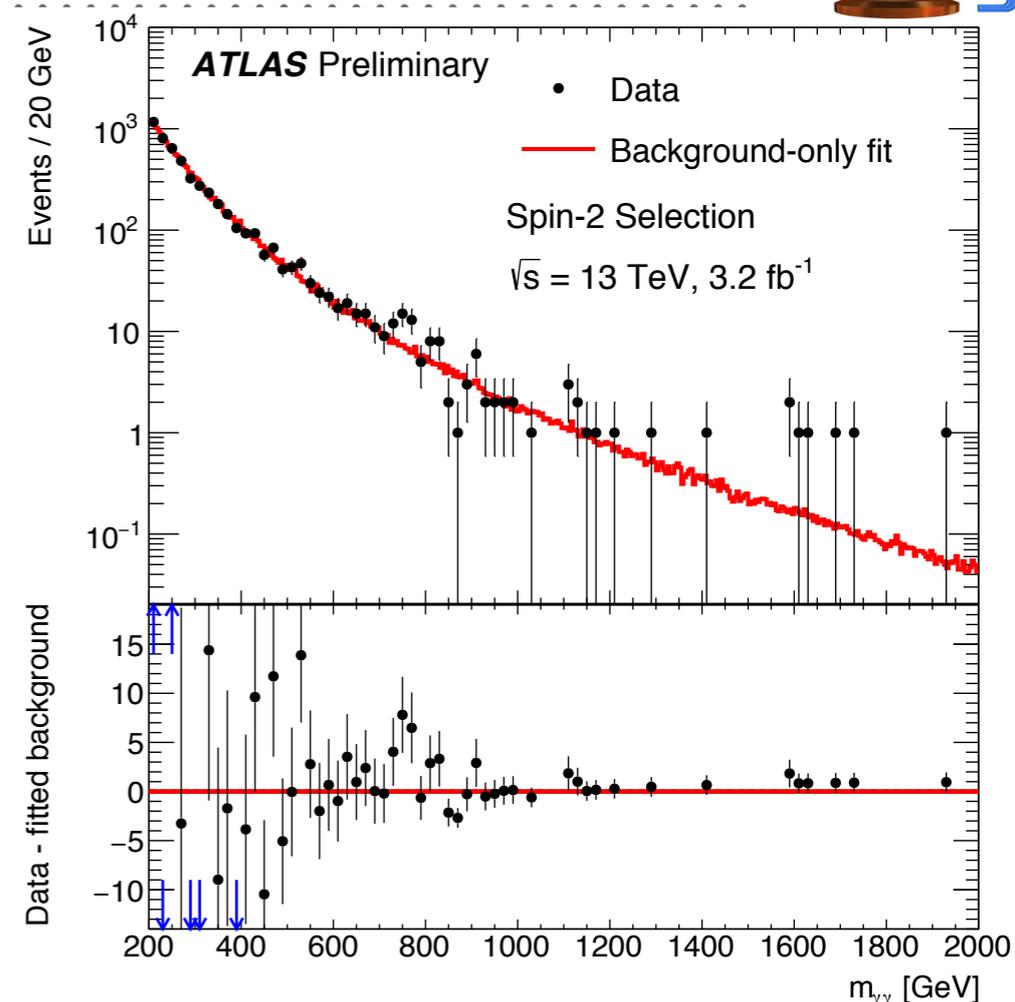
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  - **Global significance  $2.0\sigma$  ( $2.3\sigma$ )**





# PHYSICS HIGHLIGHTS: DIPHOTON RESONANCE SEARCH

- (new!) spin-2 analysis w/ looser selection:
  - 2 photons, each with  $E_T > 55$  GeV
  - uses Randall-Sundrum graviton as kinematic benchmark
  - dimensionless coupling  $k/\overline{M}_{\text{pl}}$ : 0.01-0.3  
 $k$  = curvature scale of extra dimension
- Most significant excess in diphoton mass spectrum at  $k/\overline{M}_{\text{pl}} = 0.2$ ,  $\Gamma = 48$  GeV
- local significance  $3.6\sigma$
- **Global significance  $1.8\sigma$**



# PHYSICS HIGHLIGHTS: A ROADMAP...

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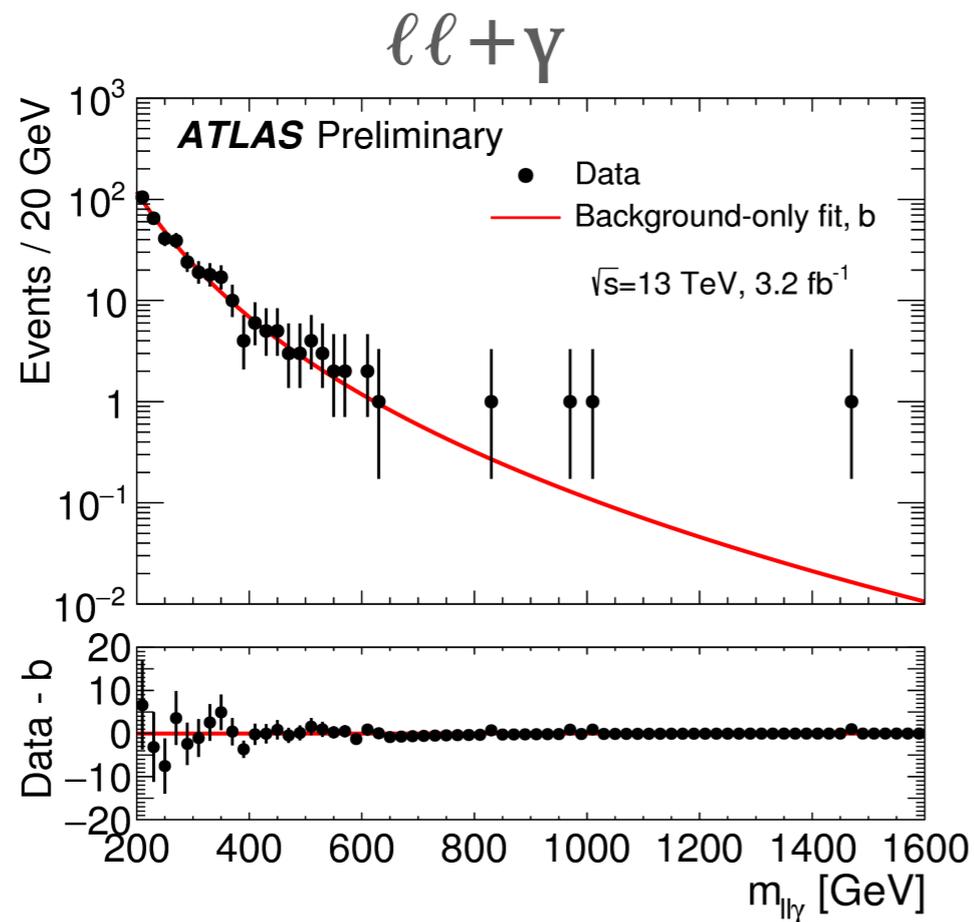
► If the bump is a resonance, what can other channels tell us?

1.  $S \rightarrow ZZ, \gamma Z$ : a must implied by  $S \rightarrow \gamma\gamma$ .
2.  $S \rightarrow W^+W^-$  (or correlations of 1) would tell that  $SU(2)_L$  is involved.
3.  $S \rightarrow hh$  (or correlations of 1,2) would tell that  $H$  is involved.
4.  $S \rightarrow t\bar{t}, b\bar{b}, \dots$  DM, ? would point to different directions.

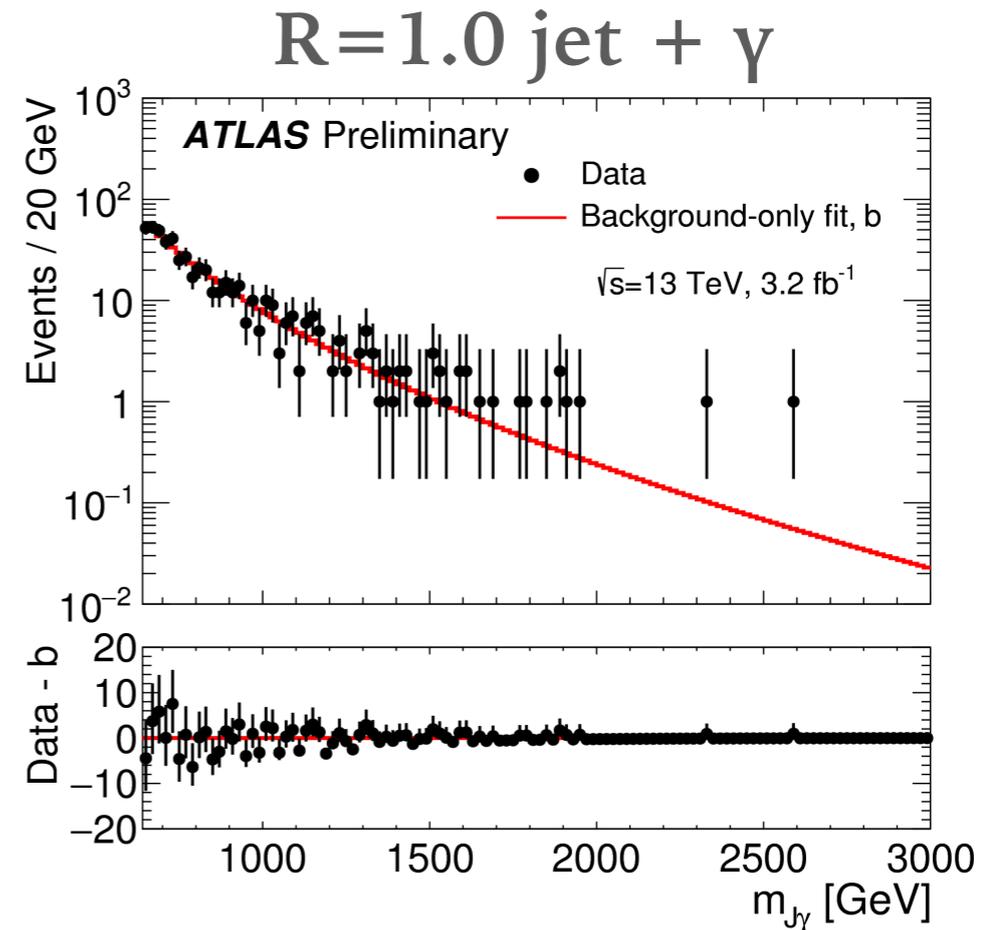
*A. Strumia, Moriond EW 2016*

(also an outline for the flurry of searches I will present next)

# PHYSICS HIGHLIGHTS: $Z\gamma$ RESONANCE SEARCH

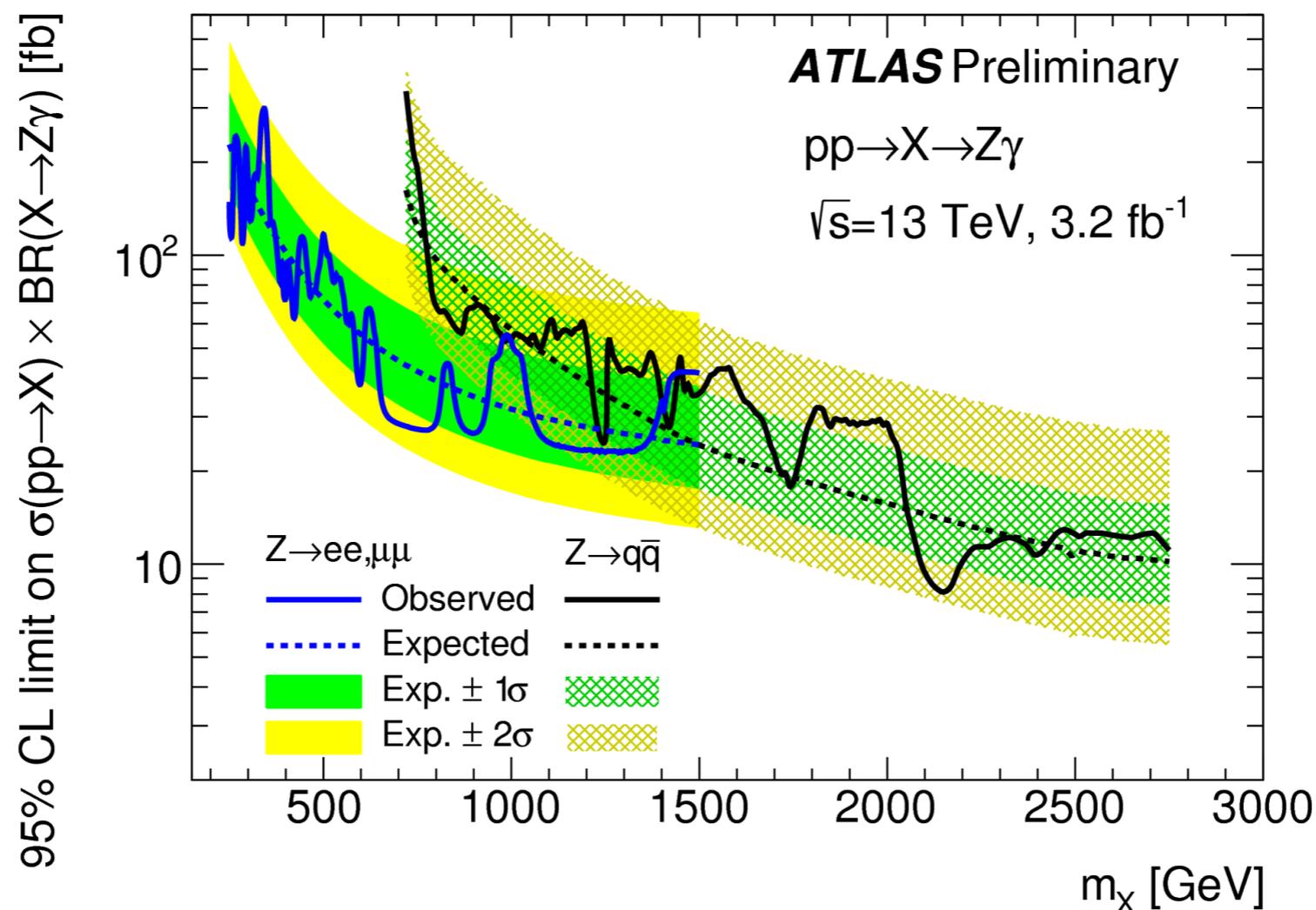


- 2 same-flavor, opposite sign electrons or muons consistent with  $Z$  ( $\pm 15$  GeV)
- $\varepsilon(pp \rightarrow X \rightarrow Z\gamma)$ : 1.9-2.9%



- 1 trimmed, large-R jet with  $p_T > 200$  GeV and within  $\pm 15$  GeV of  $Z$  boson mass
- $\varepsilon(pp \rightarrow X \rightarrow Z\gamma)$ : 7.7-11%

# PHYSICS HIGHLIGHTS: $Z\gamma$ RESONANCE SEARCH

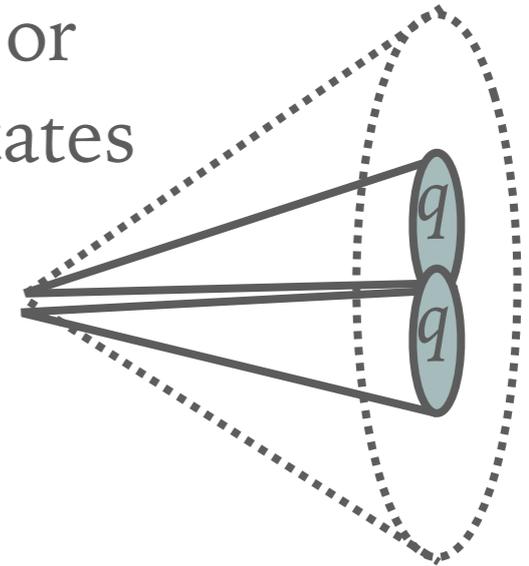


- largest deviation from background:  $2\sigma$  @ 350 GeV
- observed limits range from 295 fb @  $m_X = 340$  GeV to 10 fb @  $m_X = 2.15$  TeV

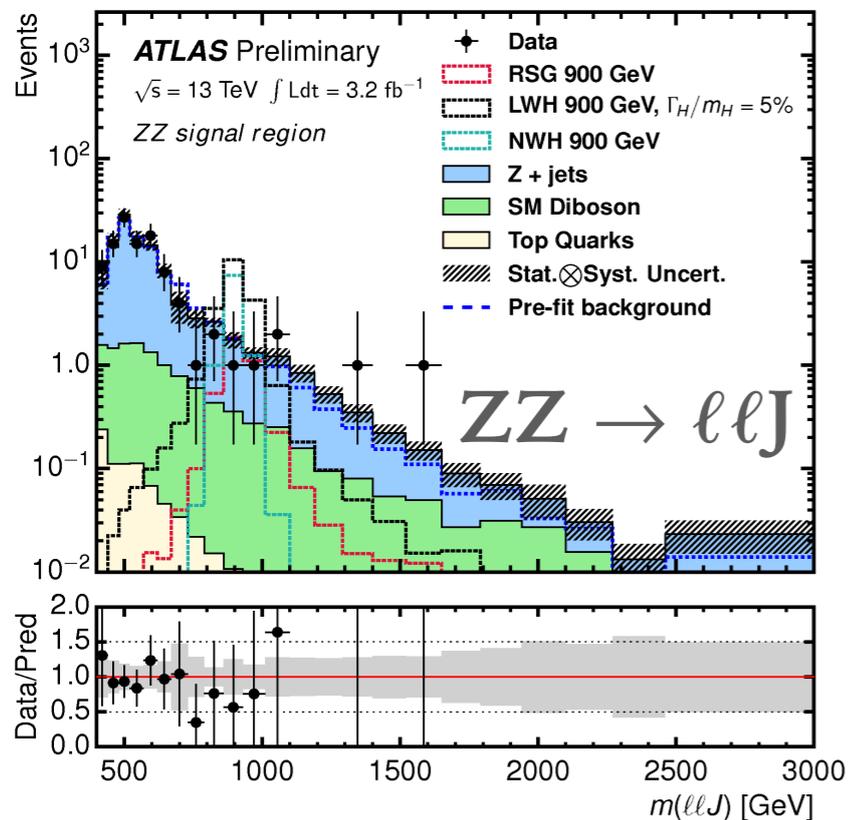
# PHYSICS HIGHLIGHTS: ZZ RESONANCE SEARCHES



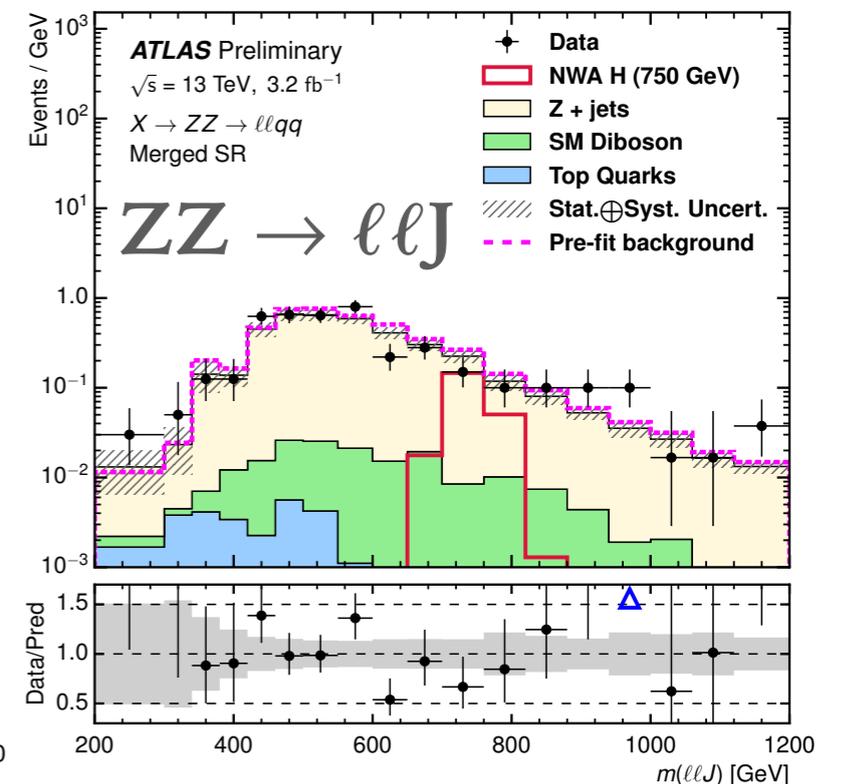
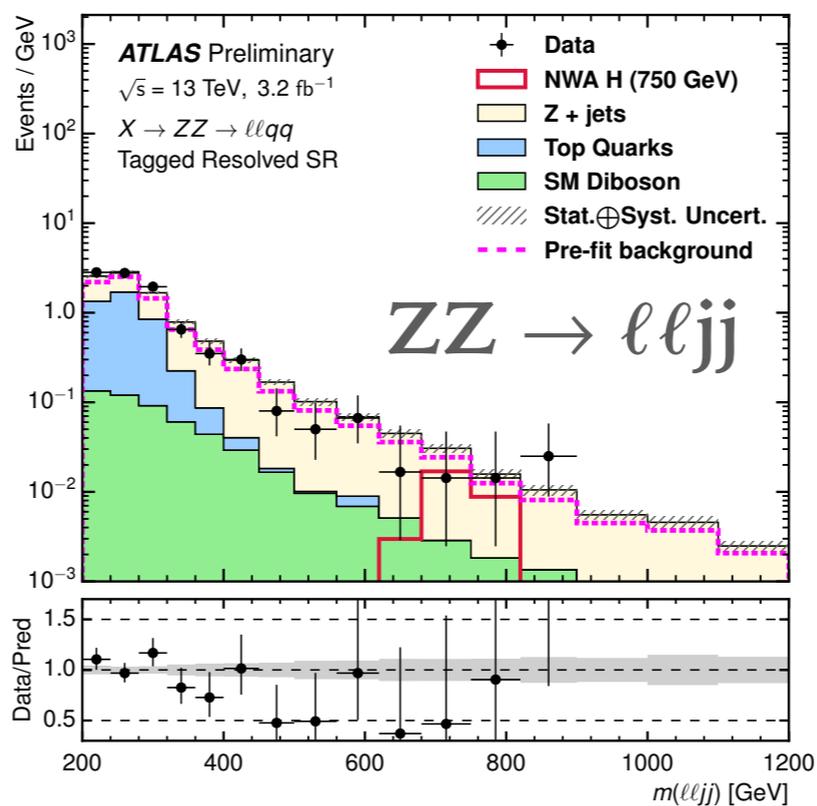
- searches for heavy Higgs-like boson (or RS graviton, or heavy vector triplet) in  $ZZ \rightarrow \ell\ell\ell\ell, \ell\ell qq, \ell\ell\nu\nu$  final states
- high-mass signal regions include merged jets
- (new!): intermediate mass range analysis includes merged and resolved signal regions



ATLAS-CONF-2015-071



ATLAS-CONF-2016-016

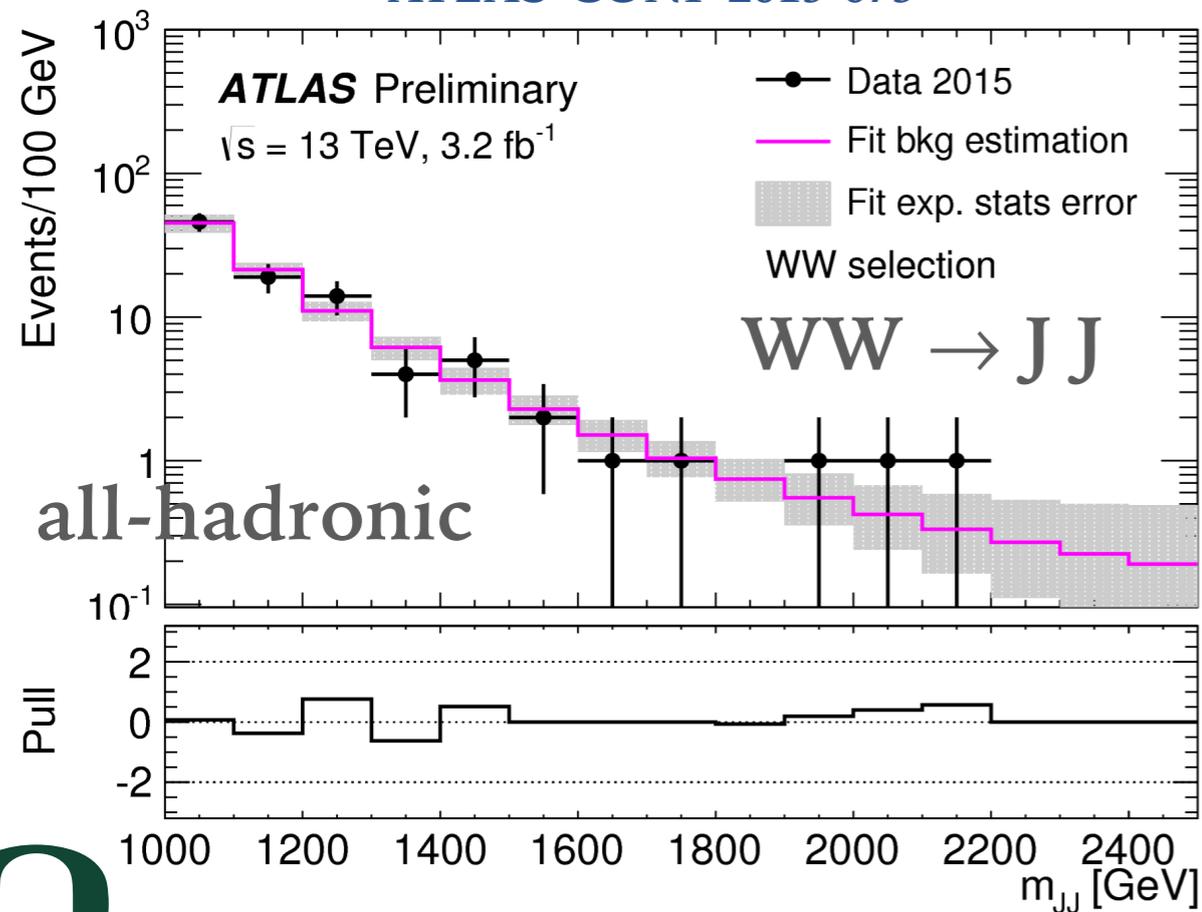


# PHYSICS HIGHLIGHTS: WZ/WW RESONANCE SEARCHES

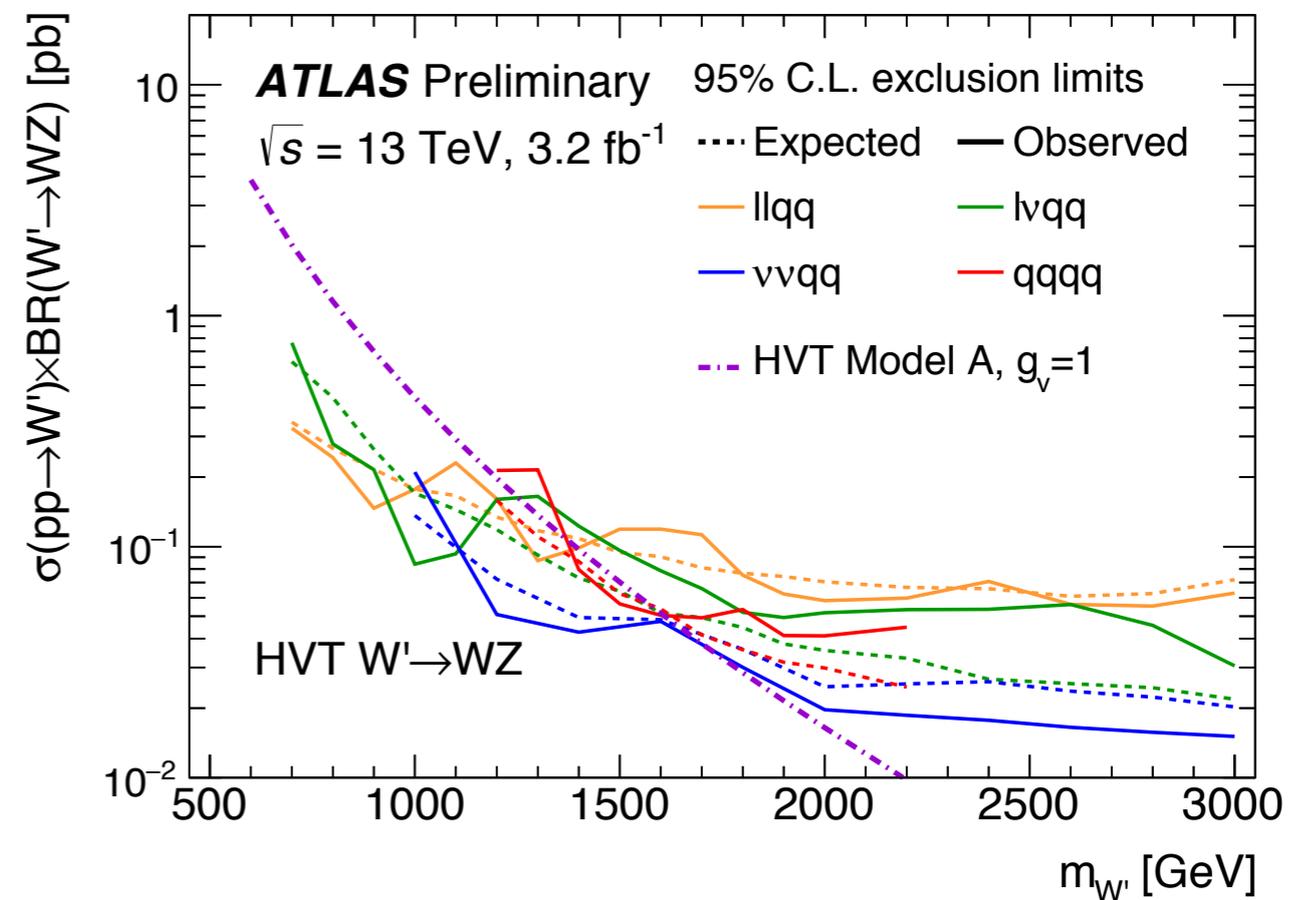


- $WZ/WW \rightarrow \ell\ell qq, \ell\nu qq, \nu\nu qq, qqqq$
- Results interpreted in terms of heavy vector triplet model (8 TeV signal: extended gauge model, excluded 1.3-1.5 TeV)
- Data excesses ( $2-2.5\sigma$ ) at  $\sim 2$  TeV in Run 1 not confirmed, more data needed to (dis-)prove them

ATLAS-CONF-2015-073



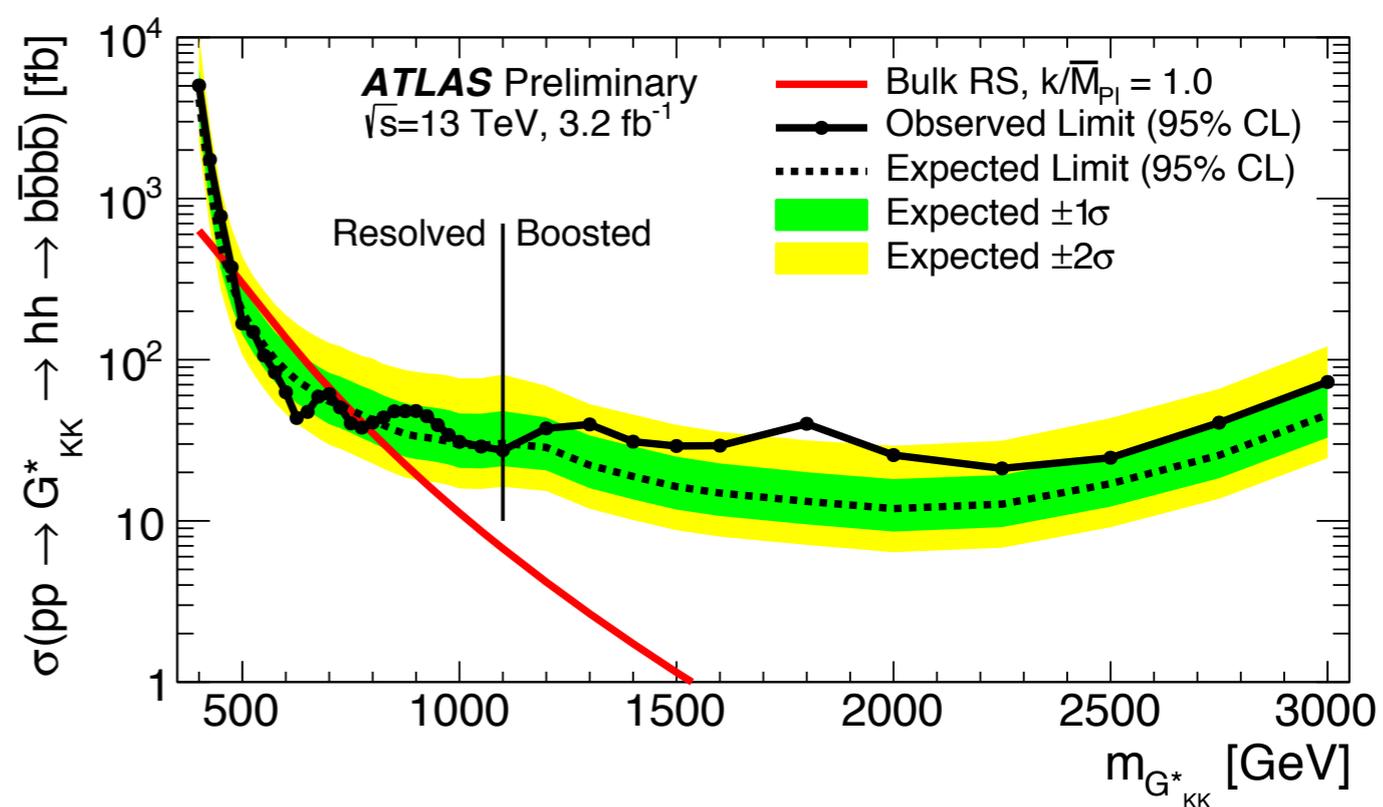
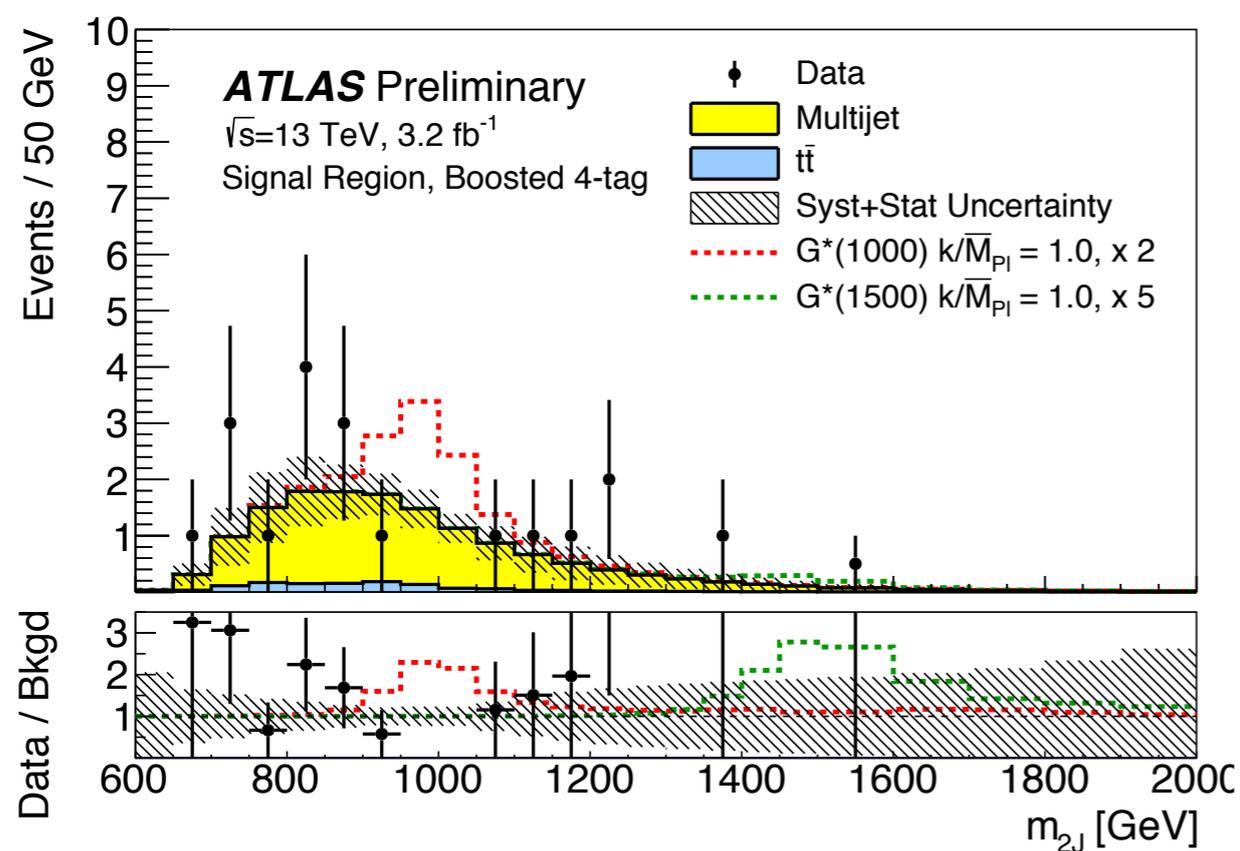
WZ Summary plot





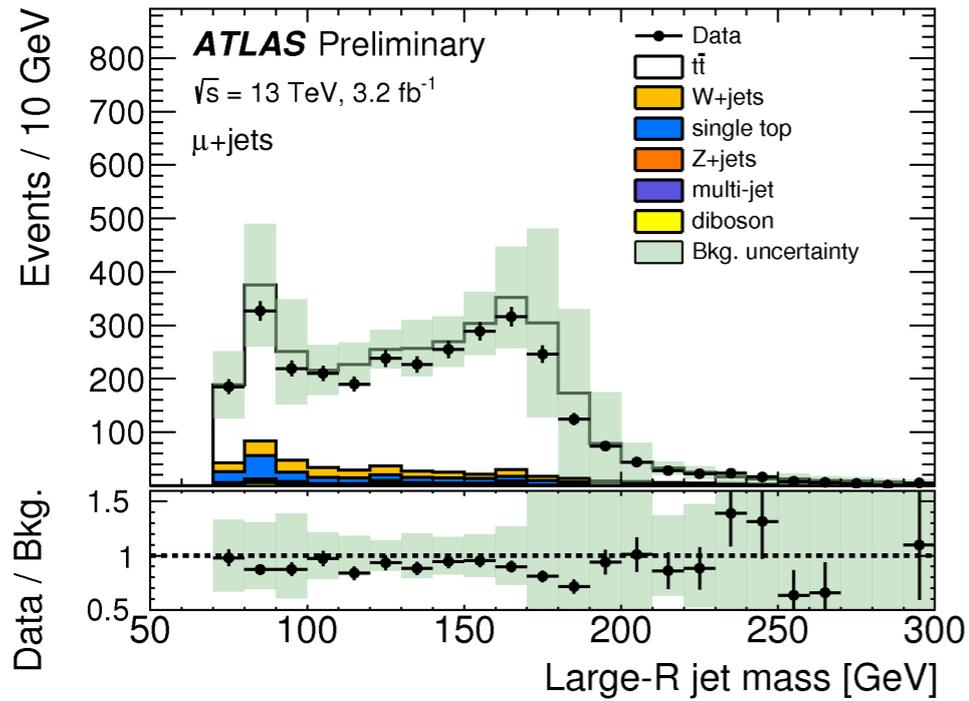
# PHYSICS HIGHLIGHTS: HH RESONANCE SEARCHES

- decay channel:  $hh \rightarrow bbbb$ , data interpreted in RS Graviton model  
→ already similar sensitivity to Run 1 (excluded 500-720 GeV)
- Events selected with 3 or 4 b-tagged track-jets matched to  $R=1.0$  jets; Higgs-tagging based on  $m_J \sim m_h$

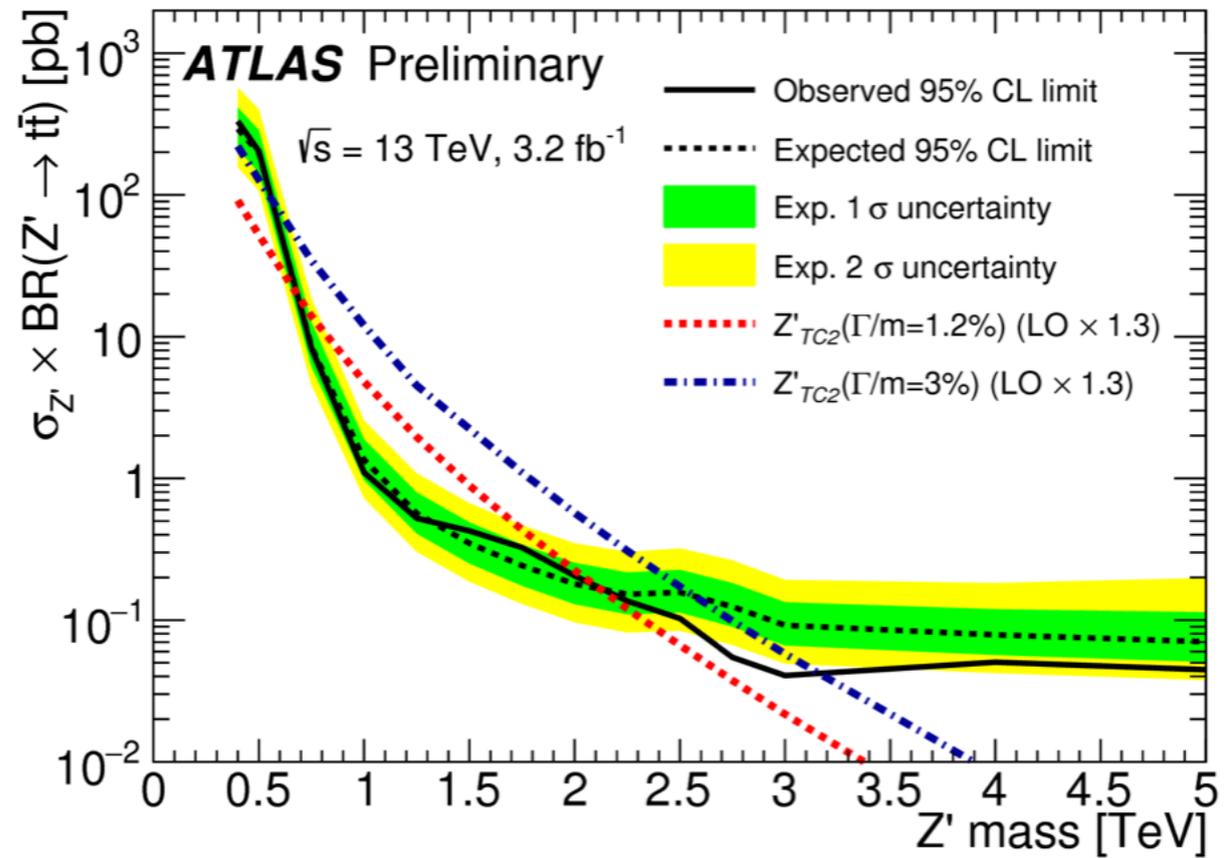
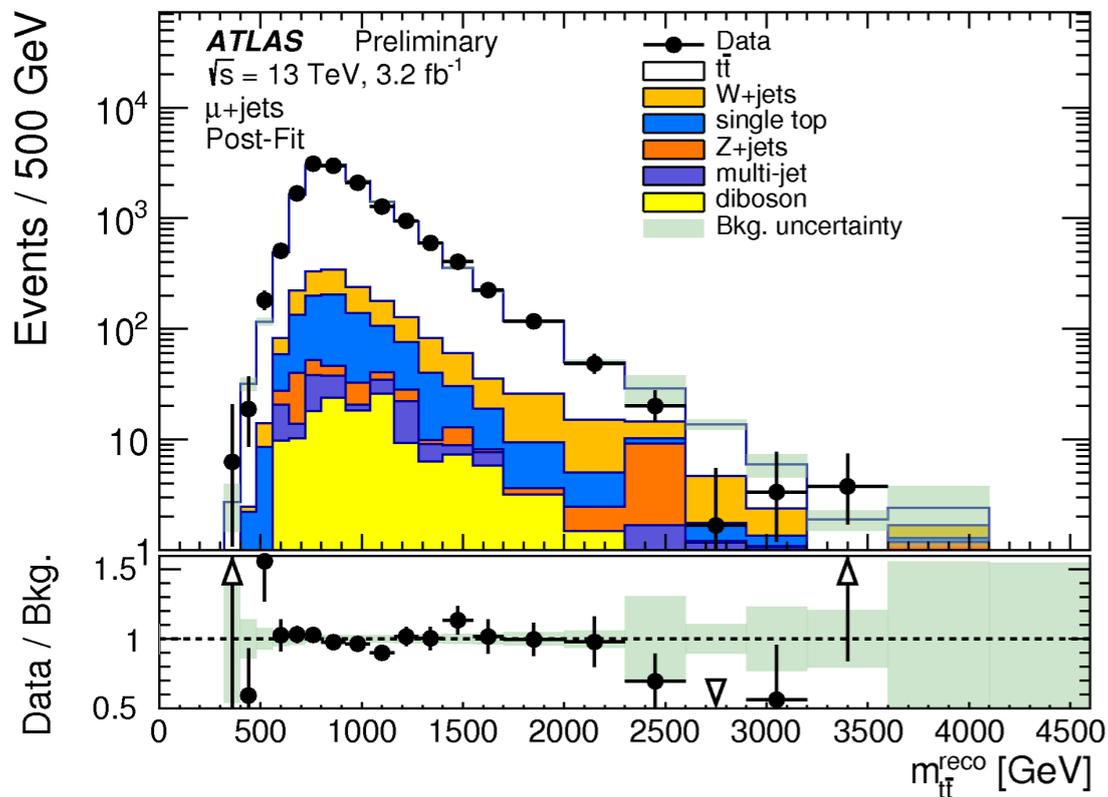




# PHYSICS HIGHLIGHTS: $T\bar{T}$ RESONANCE SEARCHES



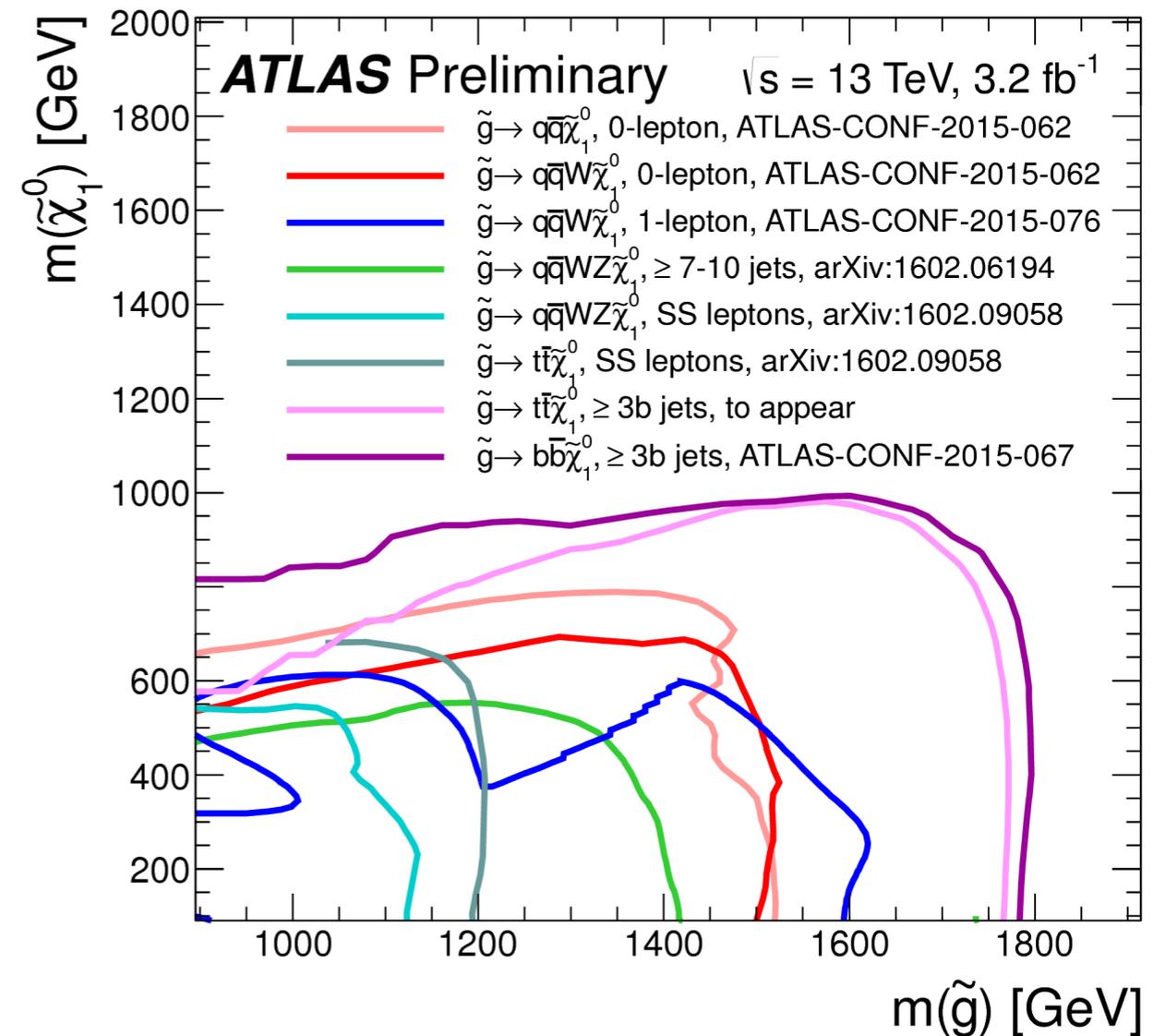
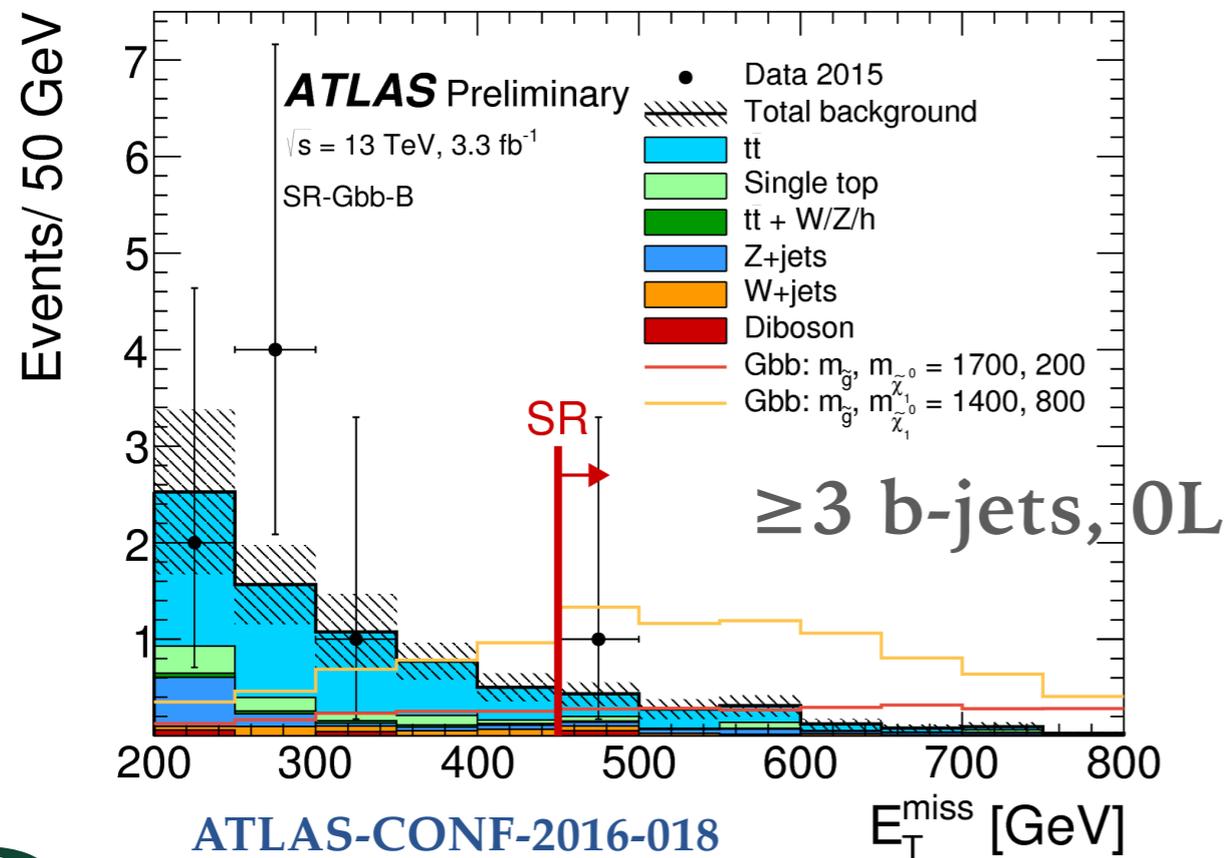
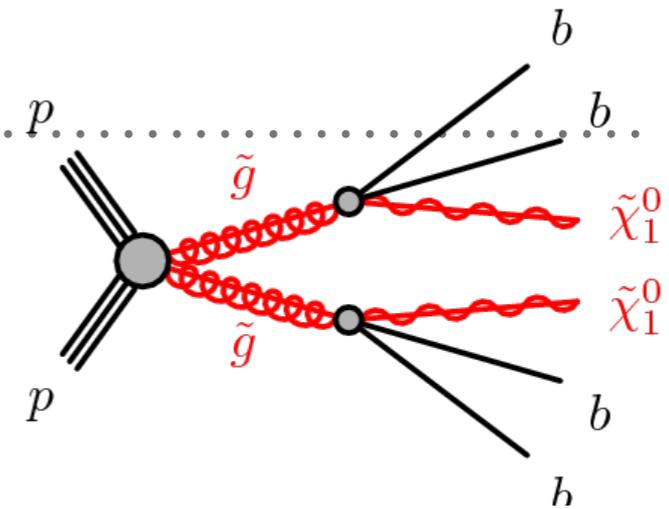
- $e/\mu$ +jets, dedicated isolation variables, large-R jet for top tagging
- narrow-width top-color  $Z'$ ,  $\Gamma/m=1.2\%$
- not yet stronger than full combination of 0L, 1L, 2L channels from 8 TeV



# PHYSICS HIGHLIGHTS: GLUINO SEARCHES

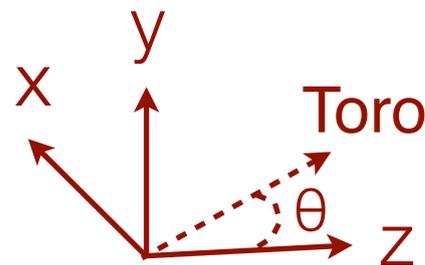
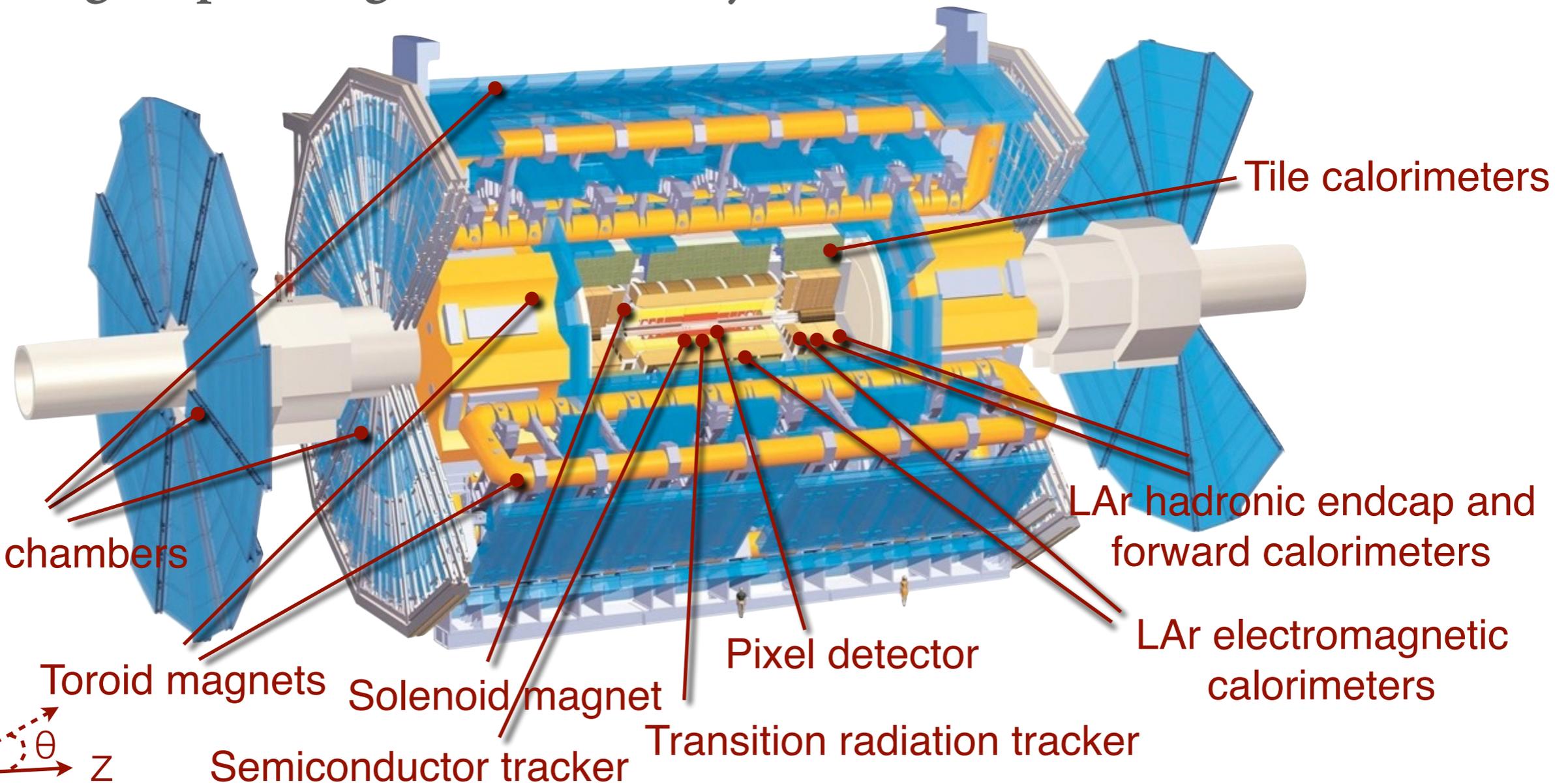


- For  $m_{\tilde{g}} \sim 1.5$  TeV, the production cross-section increase from 8 to 13 TeV is 35!
- Many signal regions depending on jet multiplicity (2-10) and #b-tagged jets
  - sensitivity also to squark production



# DETECTOR PREPARATIONS FOR 2016 RUN

- ▶ Year-end technical stop: ATLAS subsystems performed repairs and upgrades, both sides of the detector were opened
- ▶ U.S. groups integral to all subsystems

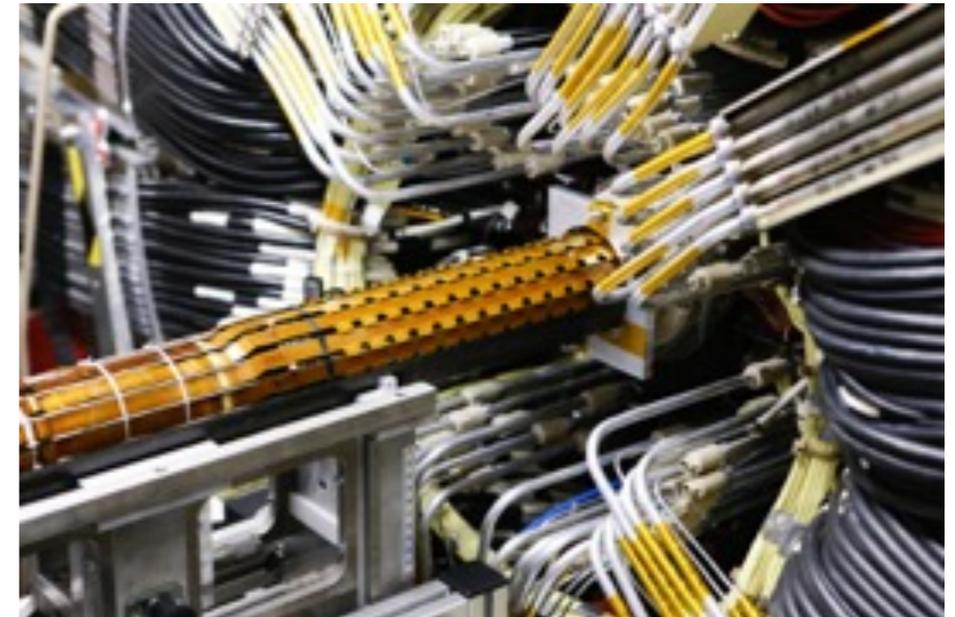


$$\eta = -\ln(\tan \theta/2)$$

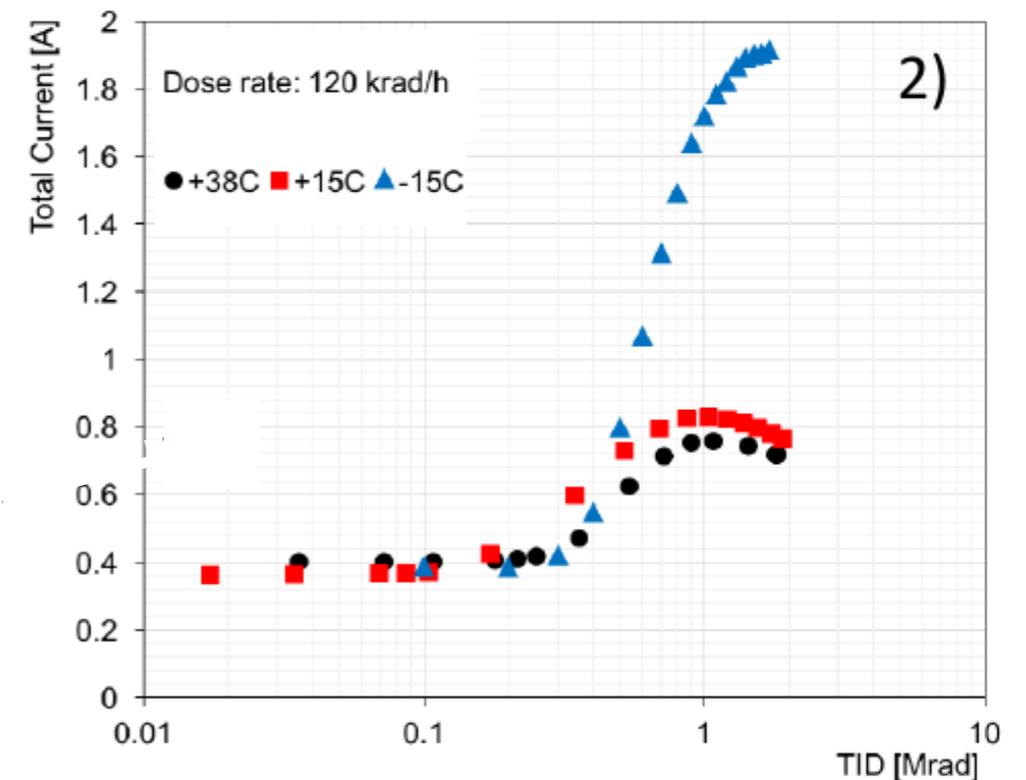
# YEAR-END TECHNICAL STOP ACTIVITIES



- Inner Detector
  - successful first year for IBL, new innermost pixel layer installed at  $R = 3.3$  cm from beam
  - low-voltage current increase due to irradiation, close to safety limit; will run at  $15^{\circ}\text{C}$  at start of 2016 run
- transition radiation tracker (TRT) gas leaks require calibration and tuning of gas system, configuration of xenon + argon finalized



IBL insertion May 2014

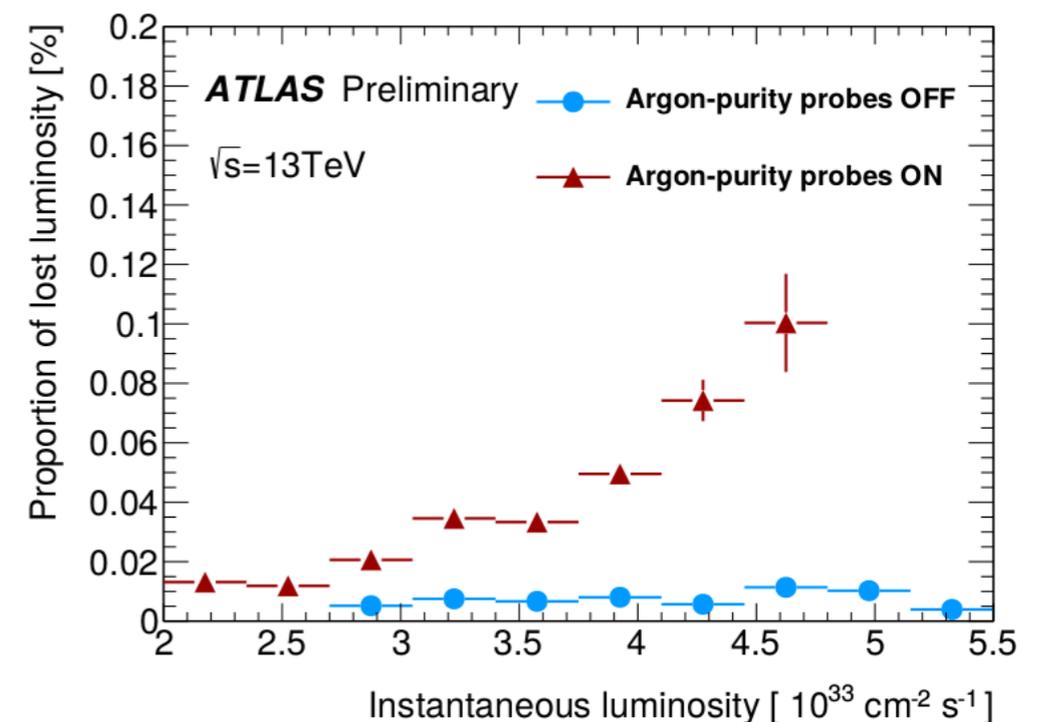
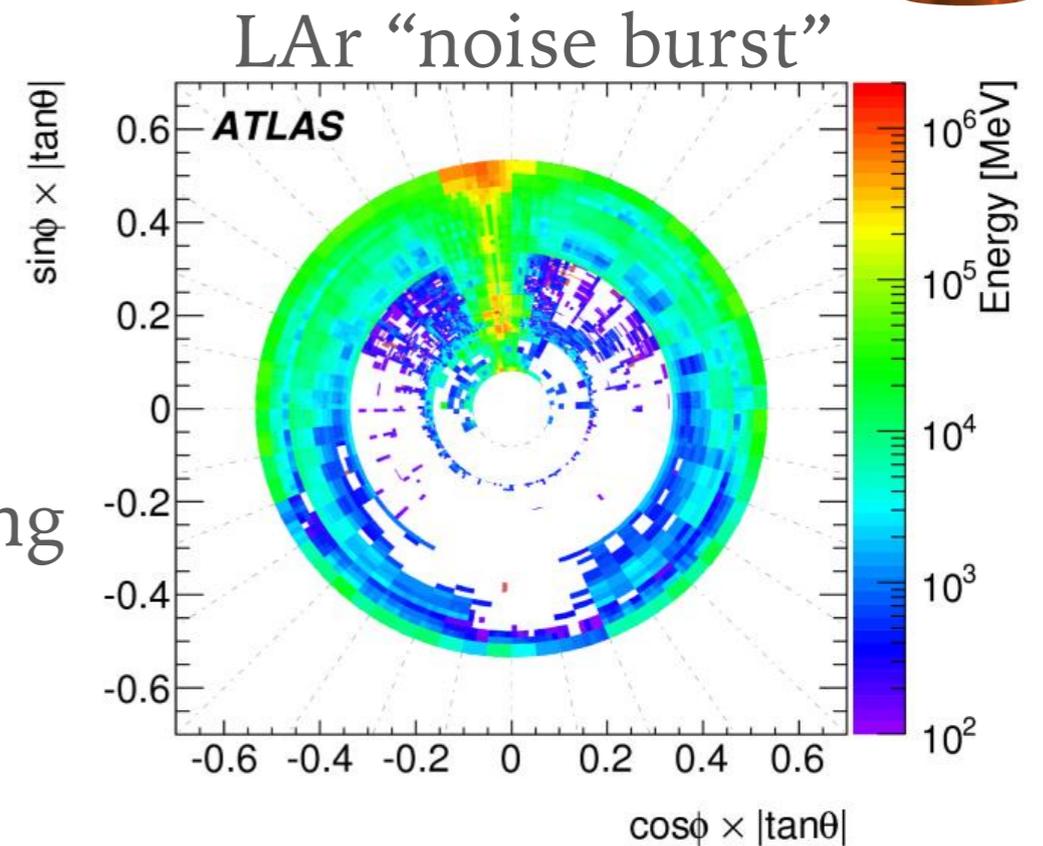


# YEAR-END TECHNICAL STOP ACTIVITIES



## ➤ Calorimeters

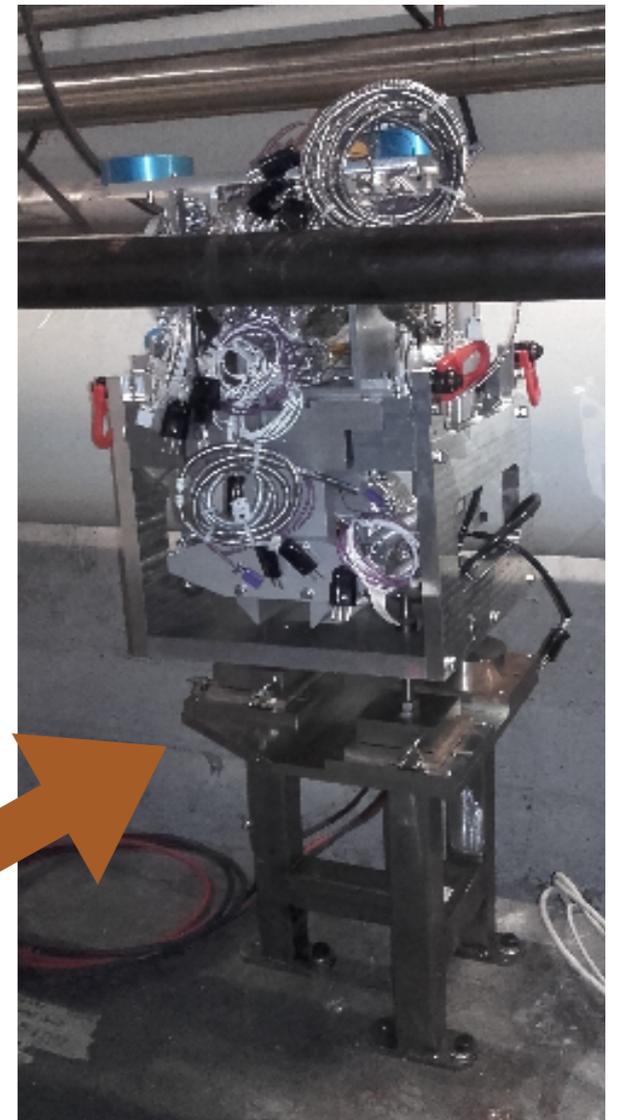
- Tile (hadronic) fixed 2 dead modules, now 100% operational
- Liquid Argon: fixes for smoother running
  - completed installation of current-controlled high voltage modules in hadronic end cap
  - LAr purity monitoring found to be correlated with “noise bursts” in the detector; plan to only run purity monitoring outside of physics data-taking



# YEAR-END TECHNICAL STOP ACTIVITIES

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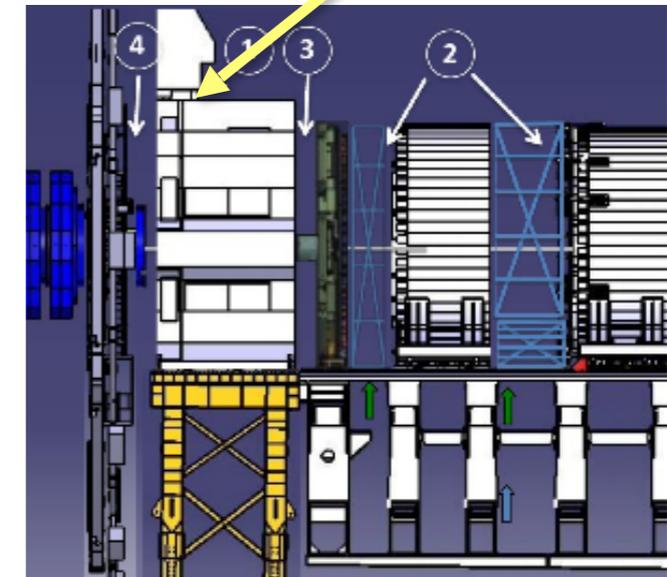
- Muon systems: mostly standard maintenance
  - Thin-gap chamber replacement
  - improvements to cathode strip chamber readout system firmware
  - fixes of gas leaks, front-end electronics, and alignment sensors for monitored drift tubes
  - repairs of leaks in resistive-plate chamber gas inlets
- Forward detectors
  - **New ATLAS Forward Proton detector** (1 arm) installed @ 220 m from interaction point to study diffractive processes



# YEAR-END TECHNICAL STOP ACTIVITIES

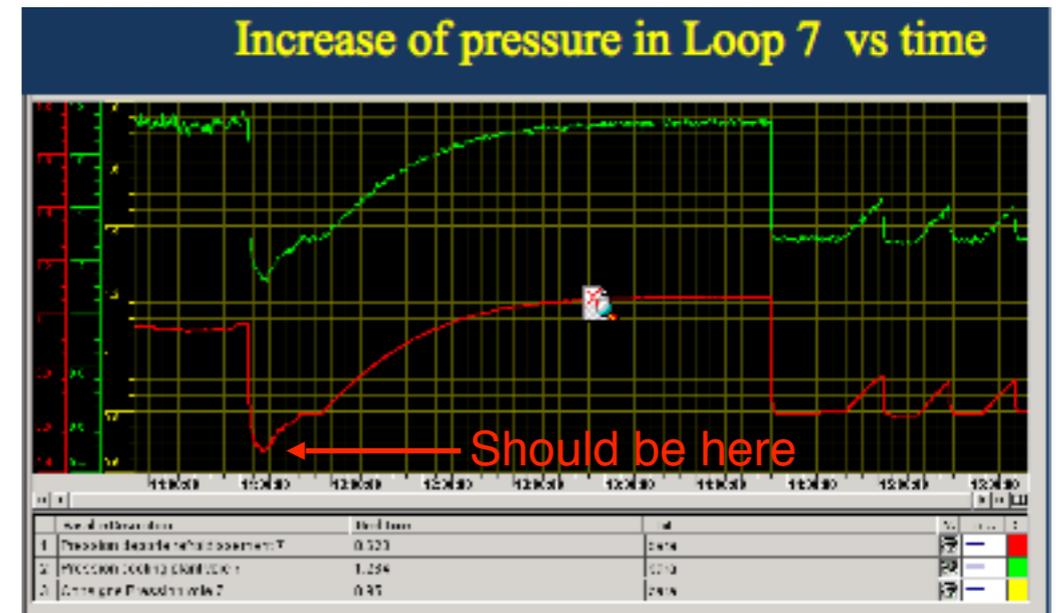
- C-side opening: endcap toroid magnet bellows for current feedthrough
  - likely happened in 2013
  - current leads not damaged
  - original bellows covered to mitigate failure risk

Location at top of ECT-C



# YEAR-END TECHNICAL STOP ACTIVITIES

- A-side opening (unplanned):  
Tile calorimeter cooling system leak started Feb 8th, impacting 12 sectors
- system runs at negative pressure; leak caused air to enter circuit and increase pressure to 1 Bar

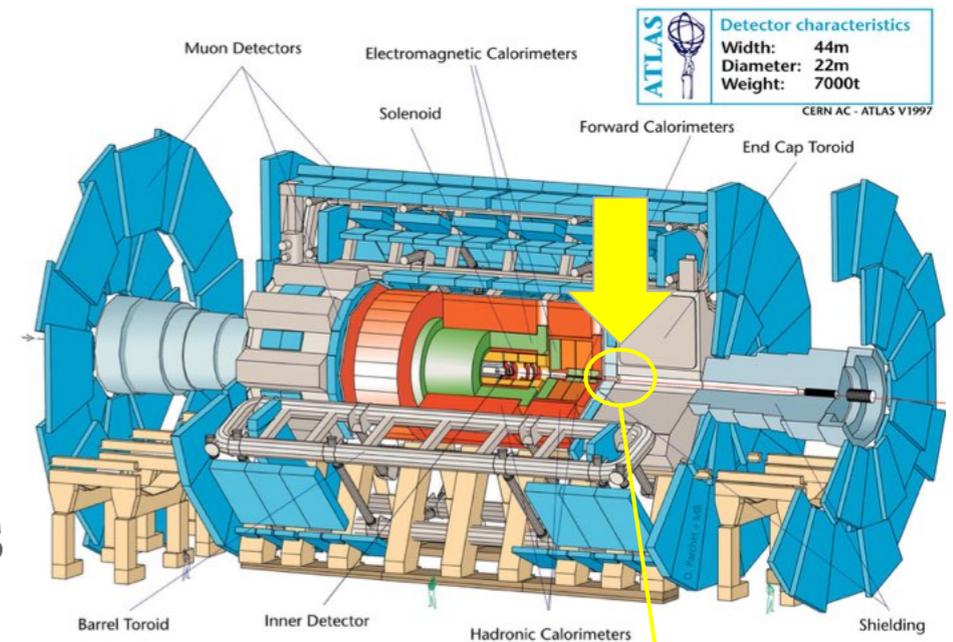


- problem (wrong connector) quickly found and fixed after opening on Feb 15th
- parasitically, other Tile channels fixed and LAr front-end board replaced (optical transmitter)
- crane error (by 19 mm) caused some cable damage upon opening; repaired within one day

# YEAR-END TECHNICAL STOP ACTIVITIES



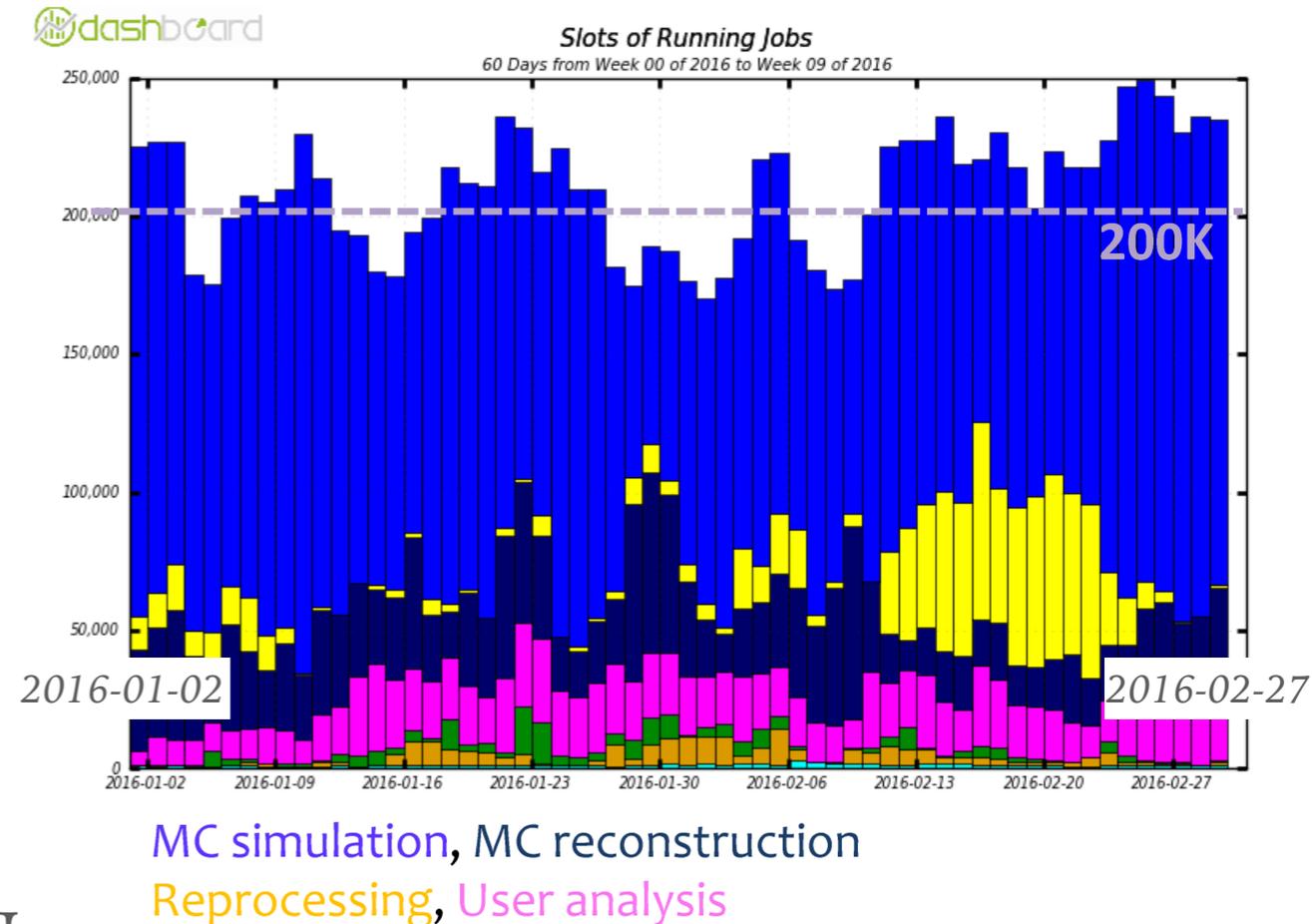
- After A-side opening issue, CERN vacuum group inspected both A & C sides
- Discovered small dimple and scratches on C-side beam pipe bellows; suspect incorrect tooling used to compress bellows
- initial tests found no leak, but to be safe, collar/clamp installed



# PREPARING FOR 2016...



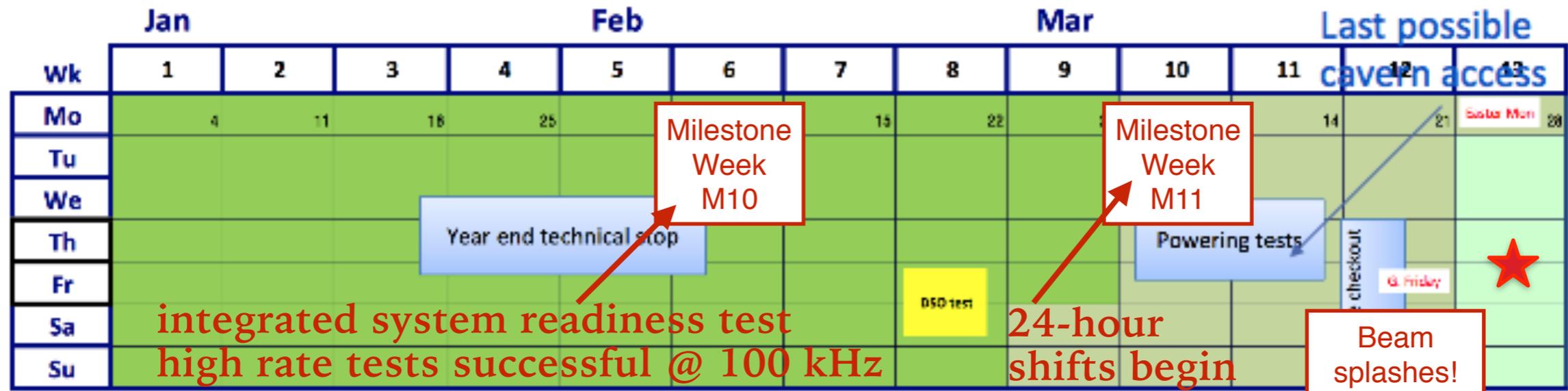
- Trigger/DAQ:
  - trigger menu optimized for 2016 high pileup running conditions
  - FTK (full-scan tracking at 100 kHz) to be commissioned for the barrel in 2016; 65nm CMOS chip delivered to CERN
- Reprocessed 2015 data (2 billion events) w/ same reconstruction as 2016 data within 2 weeks



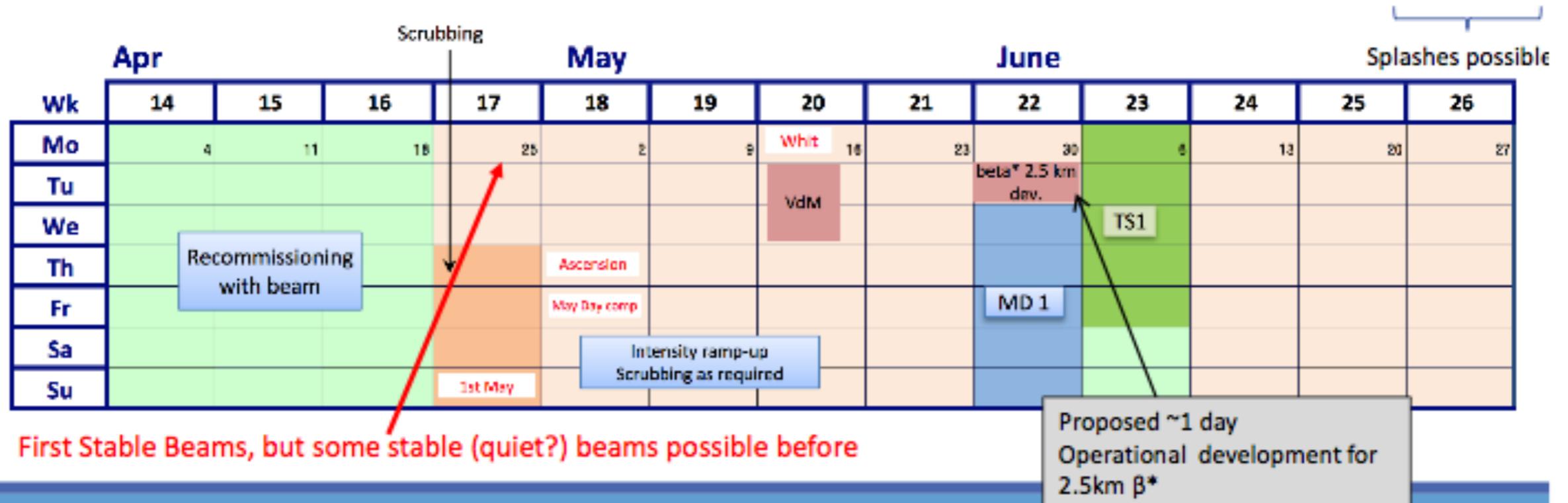
## reconstruction improvements:

- lumiblock IBL/pixel alignment
- local occupancy measurement using TRT
- improved tau ID & flavor-tagging

# PREPARING FOR 2016...



**Side C opening for beampipe safety → ~1 week behind (previous version of) schedule**



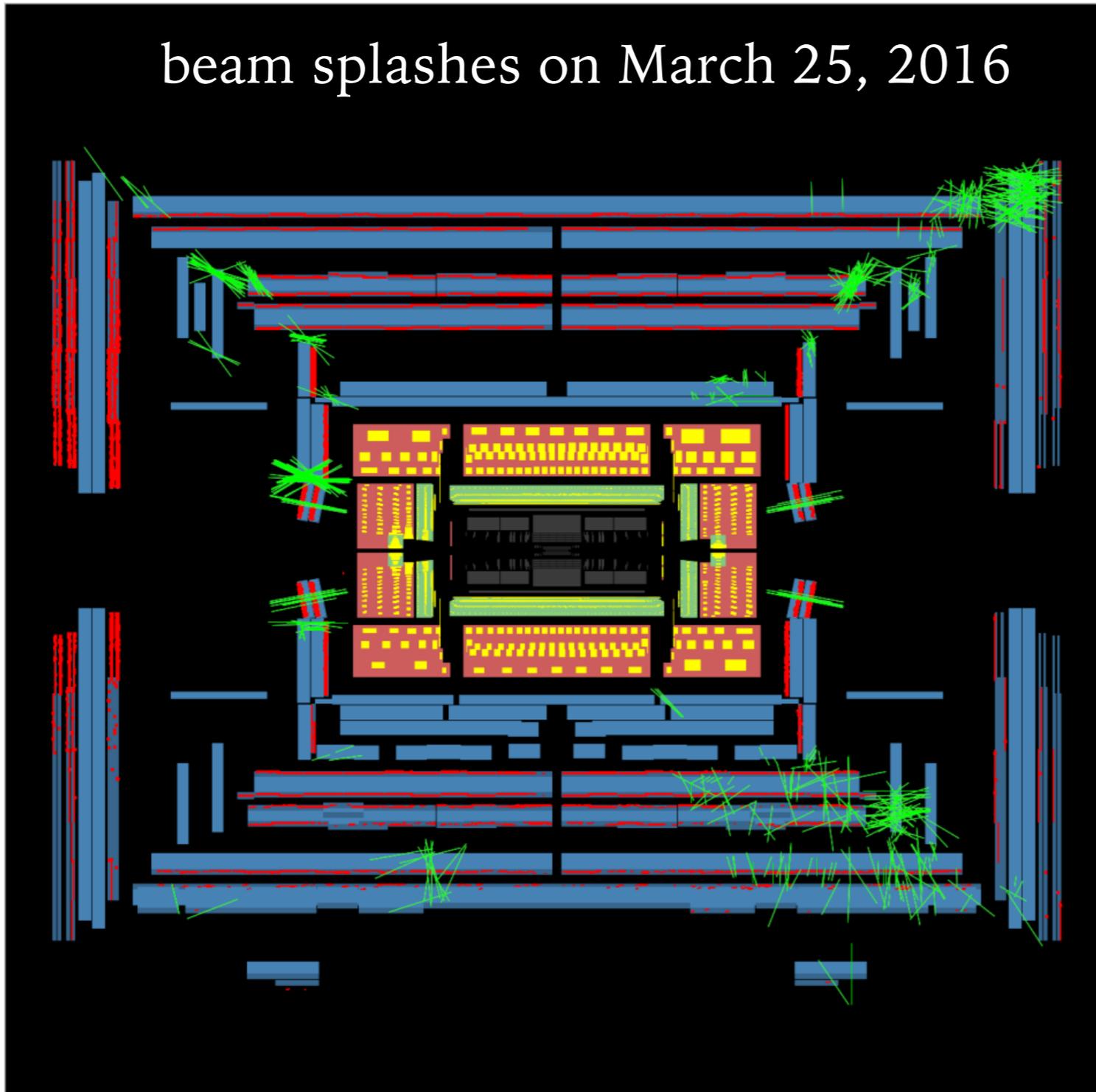
**First Stable Beams, but some stable (quiet?) beams possible before**



# PREPARING FOR 2016...

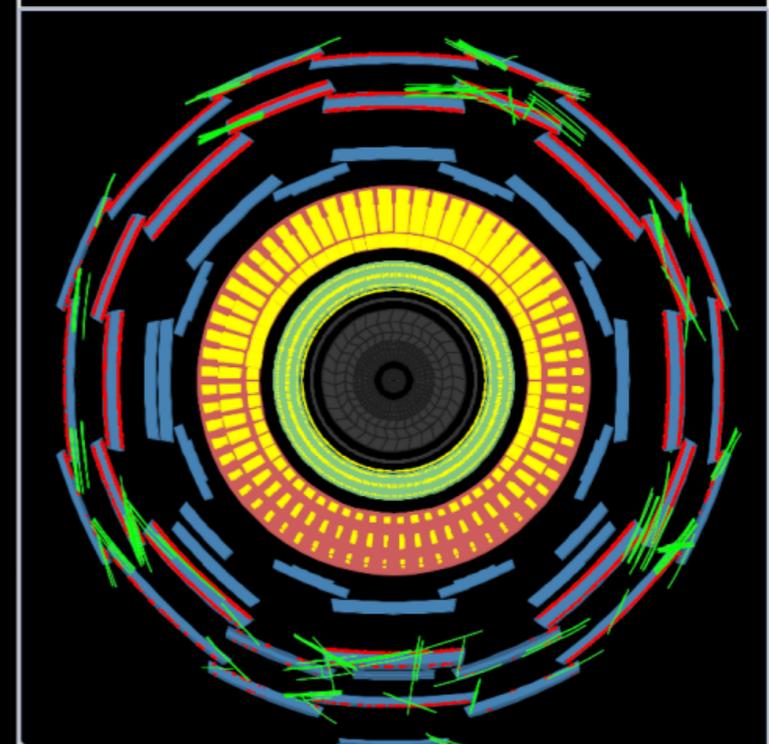


beam splashes on March 25, 2016



Run Number: 293483, Event Number: 11835

Date: 2016-03-25 10:26:48 CET



# SUMMARY & OUTLOOK

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- Impressive suite of searches and measurements based on 2015 dataset
  - **ATLAS has submitted >500 papers on collision data to peer-reviewed journals**
- Year-end technical stop activities complete, ATLAS data-taking restarted, switched to 24-hour operation (beam splashes on 25 March!)
- Stable beams expected end of April
- LHC outlook for 2016:  
peak luminosity  $1 \times 10^{34} \text{ cm}^{-2} \text{ s}^{-1}$ , 25  $\text{fb}^{-1}$  delivered



# ADDITIONAL SLIDES



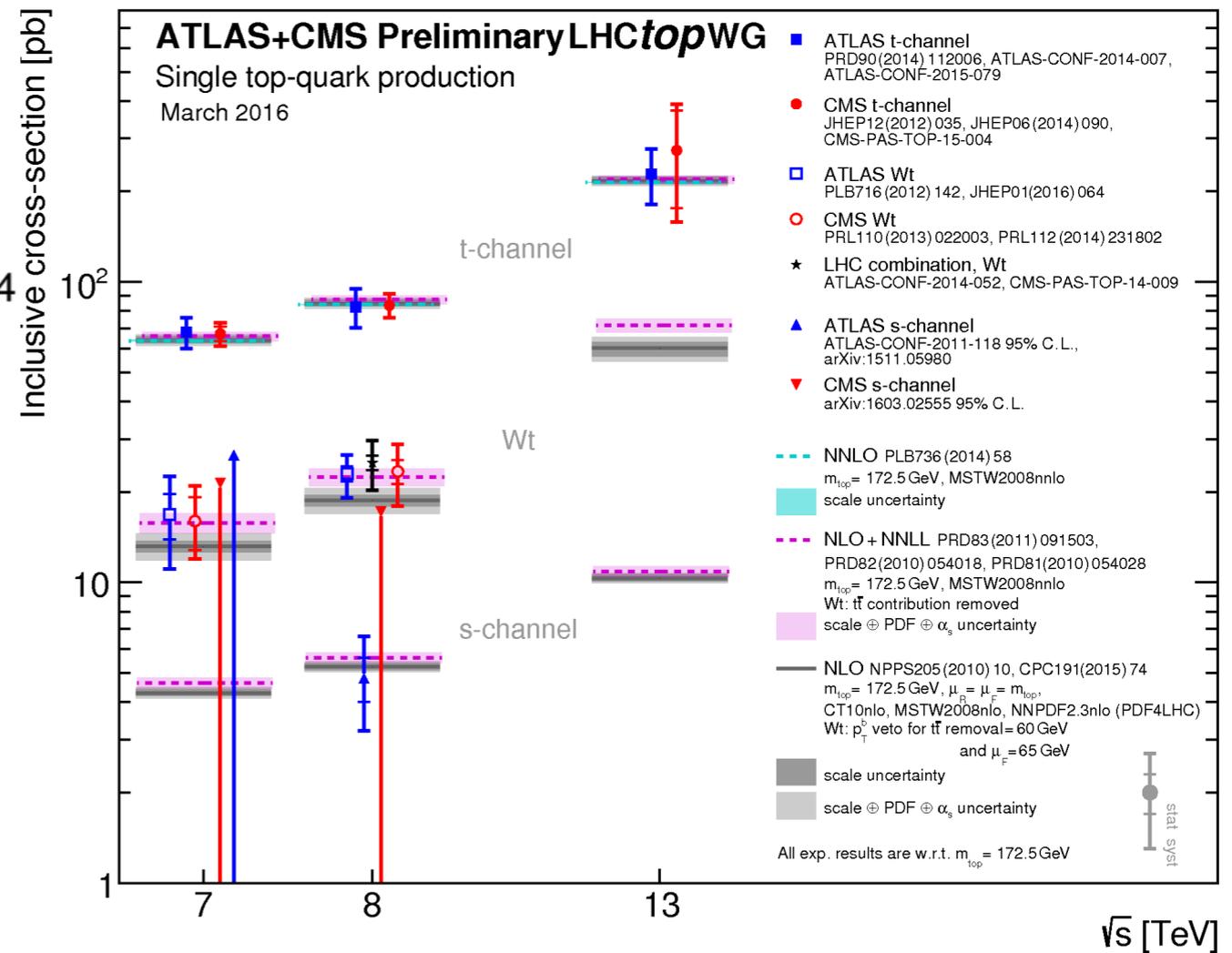
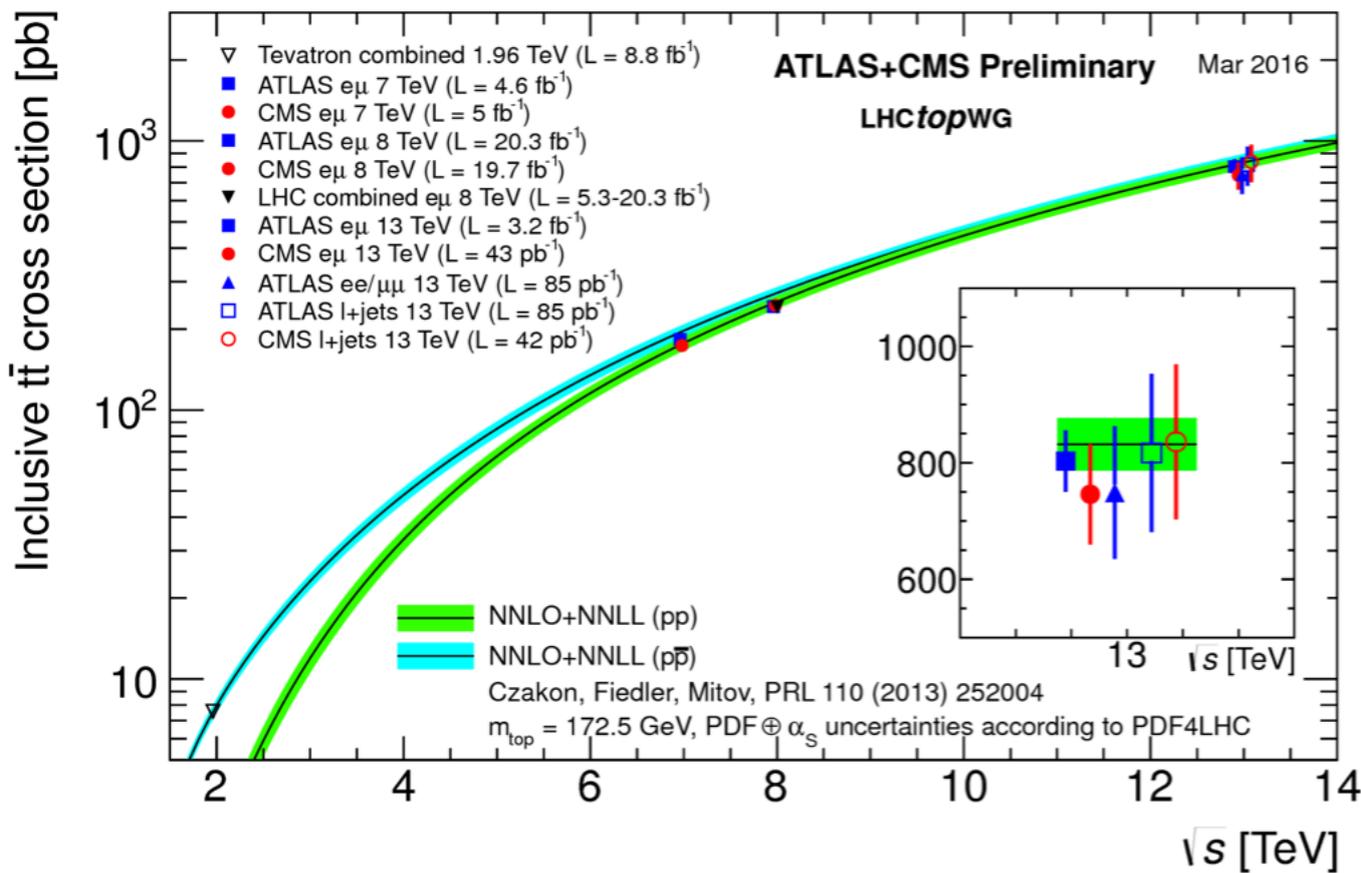


Topic	Document type	Short title	Reference and Link	Release conference
Standard Model physics	Paper	Measurement of the ZZ Production Cross Section	<a href="https://arxiv.org/abs/1512.05314">arXiv:1512.05314</a>	End of Year Event (15th Dec)
Higgs physics	Conference Note	Higgs 4-lepton cross-section measurement	<a href="https://atlas.conf.cern.ch/2015/059">ATLAS-CONF-2015-059</a>	End of Year Event (15th Dec)
Higgs physics	Conference Note	Higgs 2-photon cross-section measurement	<a href="https://atlas.conf.cern.ch/2015/060">ATLAS-CONF-2015-060</a>	End of Year Event (15th Dec)
Higgs physics	Conference Note	Search for MSSM Higgs decays to tautau	<a href="https://atlas.conf.cern.ch/2015/061">ATLAS-CONF-2015-061</a>	End of Year Event (15th Dec)
Higgs physics	Conference Note	Higgs cross-section combination	<a href="https://atlas.conf.cern.ch/2015/069">ATLAS-CONF-2015-069</a>	End of Year Event (15th Dec)
SUSY	Conference Note	Search for SUSY with events with 0-leptons, jets and MET	<a href="https://atlas.conf.cern.ch/2015/062">ATLAS-CONF-2015-062</a>	End of Year Event (15th Dec)
SUSY	Conference Note	Search for sbottom with two b-jets and MET	<a href="https://atlas.conf.cern.ch/2015/066">ATLAS-CONF-2015-066</a>	End of Year Event (15th Dec)
SUSY	Conference Note	Search for gluino-mediated stop and sbottom with events with b-jets, jets and MET	<a href="https://atlas.conf.cern.ch/2015/067">ATLAS-CONF-2015-067</a>	End of Year Event (15th Dec)
SUSY	Conference Note	Search for SUSY with events with 1-lepton, jets and MET	<a href="https://atlas.conf.cern.ch/2015/076">ATLAS-CONF-2015-076</a>	End of Year Event (15th Dec)
SUSY	Conference Note	Search for SUSY with events with 0-leptons, multijets and MET	<a href="https://atlas.conf.cern.ch/2015/077">ATLAS-CONF-2015-077</a>	End of Year Event (15th Dec)
SUSY	Conference Note	Search for SUSY with events with two same-sign leptons, jets and MET	<a href="https://atlas.conf.cern.ch/2015/078">ATLAS-CONF-2015-078</a>	End of Year Event (15th Dec)
SUSY	Conference Note	Search for SUSY with events with two opposite-sign leptons, jets and MET	<a href="https://atlas.conf.cern.ch/2015/082">ATLAS-CONF-2015-082</a>	End of Year Event (15th Dec)
B-physics and light states	Conference Note	Studies of B+ mass performance	<a href="https://atlas.conf.cern.ch/2015/064">ATLAS-CONF-2015-064</a>	End of Year Event (15th Dec)
Top physics	Conference Note	t $\bar{t}$ +jets cross-section measurement	<a href="https://atlas.conf.cern.ch/2015/065">ATLAS-CONF-2015-065</a>	End of Year Event (15th Dec)
Top physics	Conference Note	t-channel single top cross-section measurement	<a href="https://atlas.conf.cern.ch/2015/079">ATLAS-CONF-2015-079</a>	End of Year Event (15th Dec)
Exotics	Paper	Search for new phenomena with photon+jet events	<a href="https://arxiv.org/abs/1512.05910">arXiv:1512.05910</a>	End of Year Event (15th Dec)
Exotics	Conference Note	Search for new physics in the lepton+MET channel (W')	<a href="https://atlas.conf.cern.ch/2015/063">ATLAS-CONF-2015-063</a>	End of Year Event (15th Dec)
Exotics	Conference Note	Search for diboson resonances in the MET+jet channel	<a href="https://atlas.conf.cern.ch/2015/068">ATLAS-CONF-2015-068</a>	End of Year Event (15th Dec)
Exotics	Conference Note	Search for new physics in the dilepton channel (Z')	<a href="https://atlas.conf.cern.ch/2015/070">ATLAS-CONF-2015-070</a>	End of Year Event (15th Dec)
Exotics	Conference Note	Search for diboson resonances in the llqq channel	<a href="https://atlas.conf.cern.ch/2015/071">ATLAS-CONF-2015-071</a>	End of Year Event (15th Dec)
Exotics	Conference Note	Search for new physics with LFV decays to e+mu	<a href="https://atlas.conf.cern.ch/2015/072">ATLAS-CONF-2015-072</a>	End of Year Event (15th Dec)
Exotics	Conference Note	Search for diboson resonances in fully hadronic channels	<a href="https://atlas.conf.cern.ch/2015/073">ATLAS-CONF-2015-073</a>	End of Year Event (15th Dec)
Exotics	Conference Note	Search for diboson resonances in W/Z+Higgs channels	<a href="https://atlas.conf.cern.ch/2015/074">ATLAS-CONF-2015-074</a>	End of Year Event (15th Dec)
Exotics	Conference Note	Search for diboson resonances in the lnqq channel	<a href="https://atlas.conf.cern.ch/2015/075">ATLAS-CONF-2015-075</a>	End of Year Event (15th Dec)
Exotics	Conference Note	Search for dark matter in the MET+W/Z channel	<a href="https://atlas.conf.cern.ch/2015/080">ATLAS-CONF-2015-080</a>	End of Year Event (15th Dec)
Exotics	Conference Note	Search for new physics decaying to two photons	<a href="https://atlas.conf.cern.ch/2015/081">ATLAS-CONF-2015-081</a>	End of Year Event (15th Dec)
Exotics	Paper	Search for new physics with multi-jet signatures	<a href="https://arxiv.org/abs/1512.02586">arXiv:1512.02586</a>	End of Year Event (15th Dec)
Exotics	Paper	Search for new physics in dijet mass and angular distributions	<a href="https://arxiv.org/abs/1512.01530">arXiv:1512.01530</a>	End of Year Event (15th Dec)

<https://twiki.cern.ch/twiki/bin/view/AtlasPublic/December2015-13TeV>



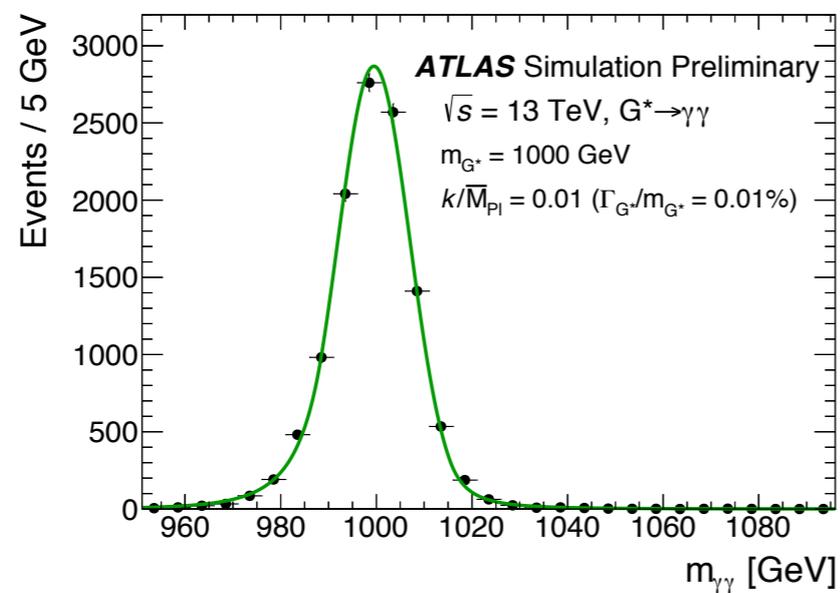
# PHYSICS HIGHLIGHTS: TOP CROSS SECTIONS



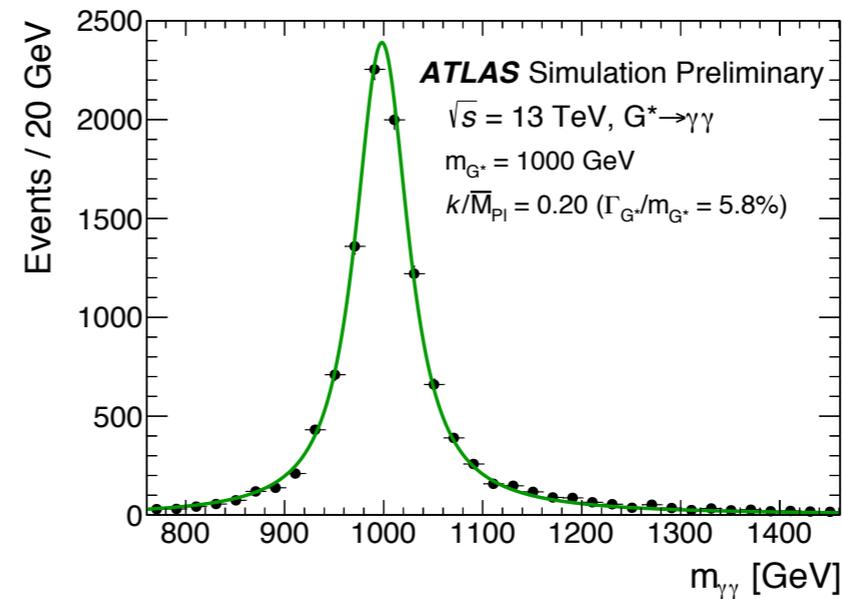


# PHYSICS HIGHLIGHTS: DIPHOTON RESONANCE SEARCH

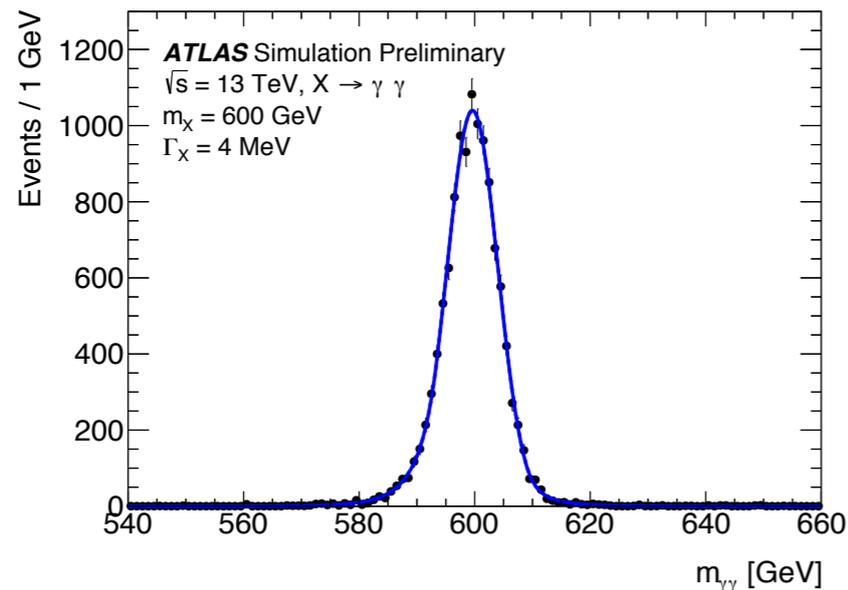
- $\gamma\gamma$  mass resolution for narrow resonance: 2 GeV - 13 GeV for masses from 200 GeV to 2 TeV



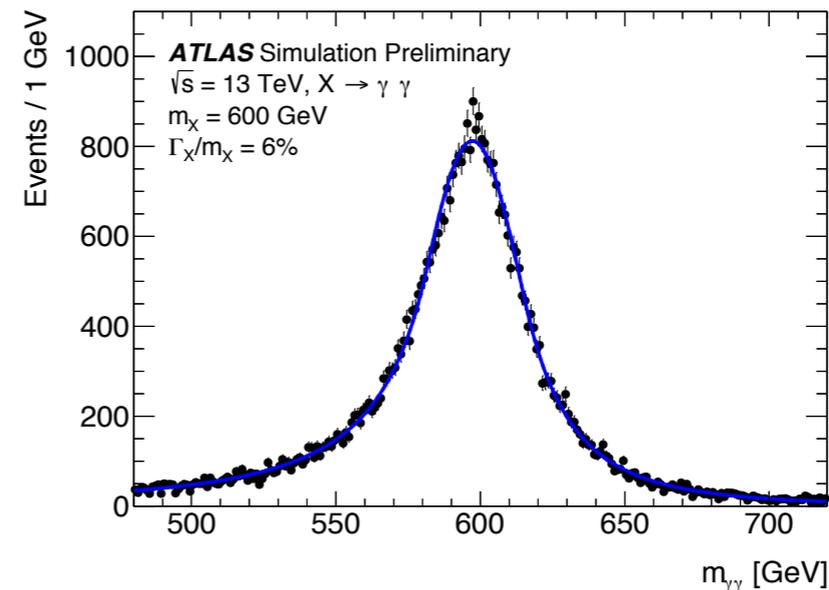
(a)



(b)



(c)



(d)

S. Majewski, Univ. of Oregon

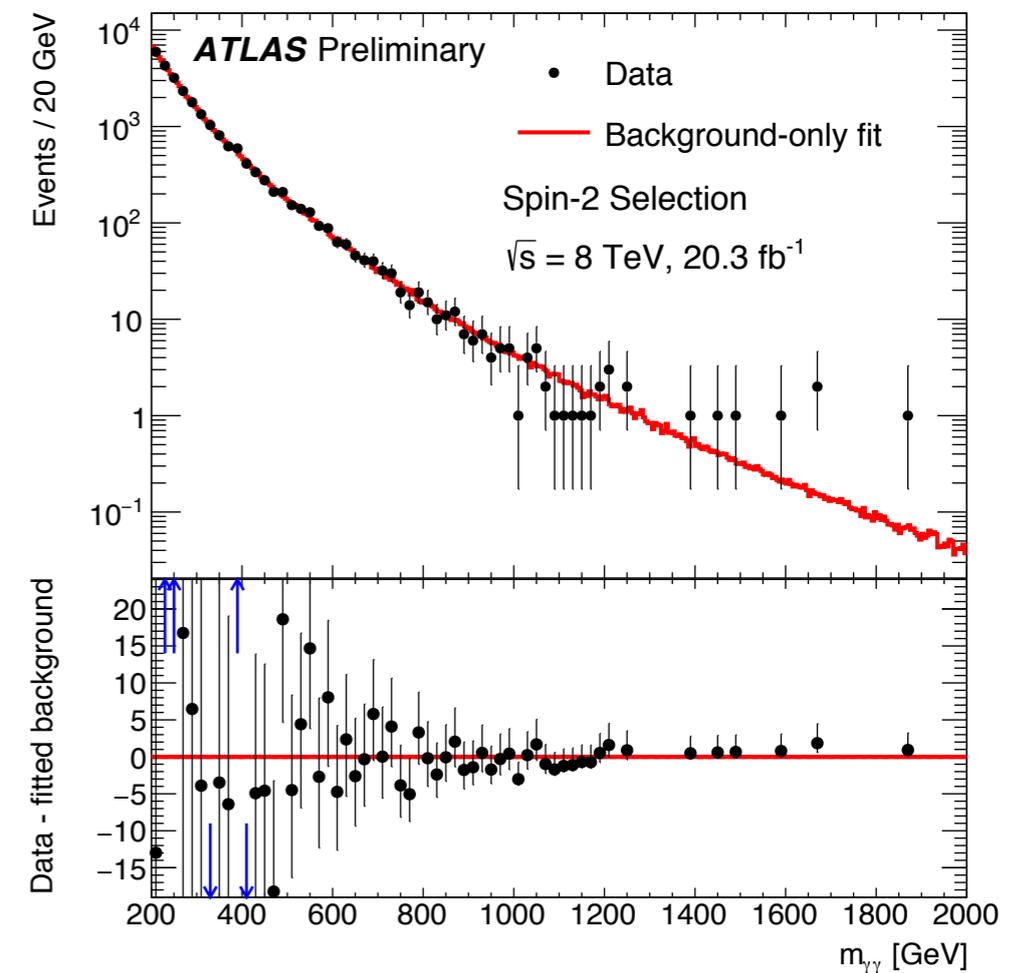
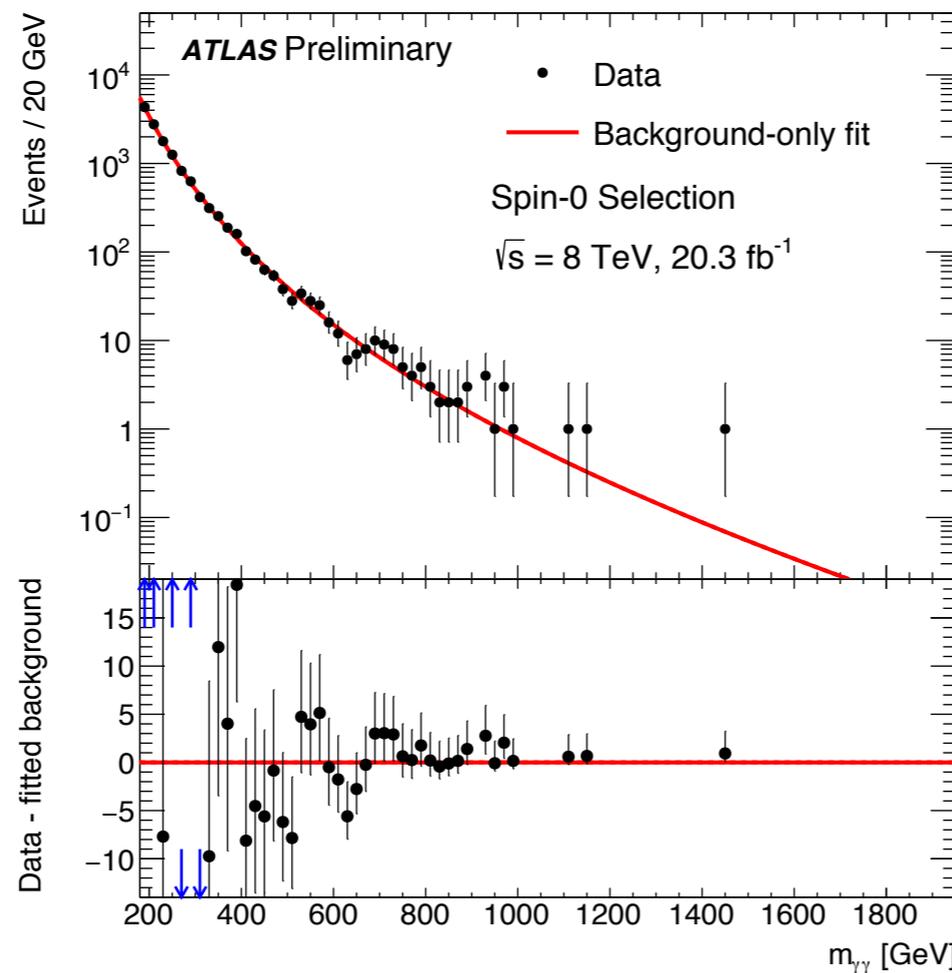




# PHYSICS HIGHLIGHTS: DIPHOTON RESONANCE SEARCH

- 8 TeV data re-analyzed with 13 TeV-style photon energy calibration, same selection
- in spin-0 analysis:  $1.9\sigma$  local @ 750 GeV for  $\Gamma/m = 6\%$  (no excess in spin-2 analysis)
- for s-channel resonance,  $\sigma_{gg}$  ( $\sigma_{qq}$ ) increases by a factor of 4.7 (2.7) @ 13 TeV

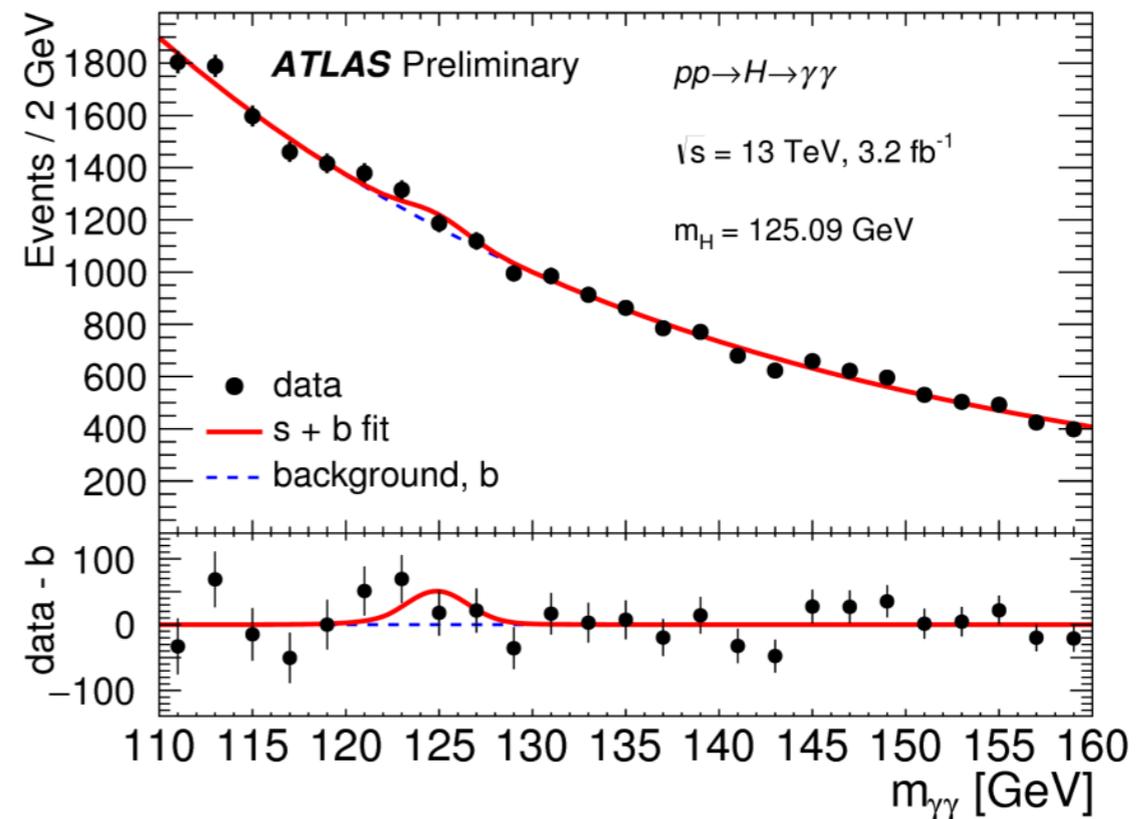
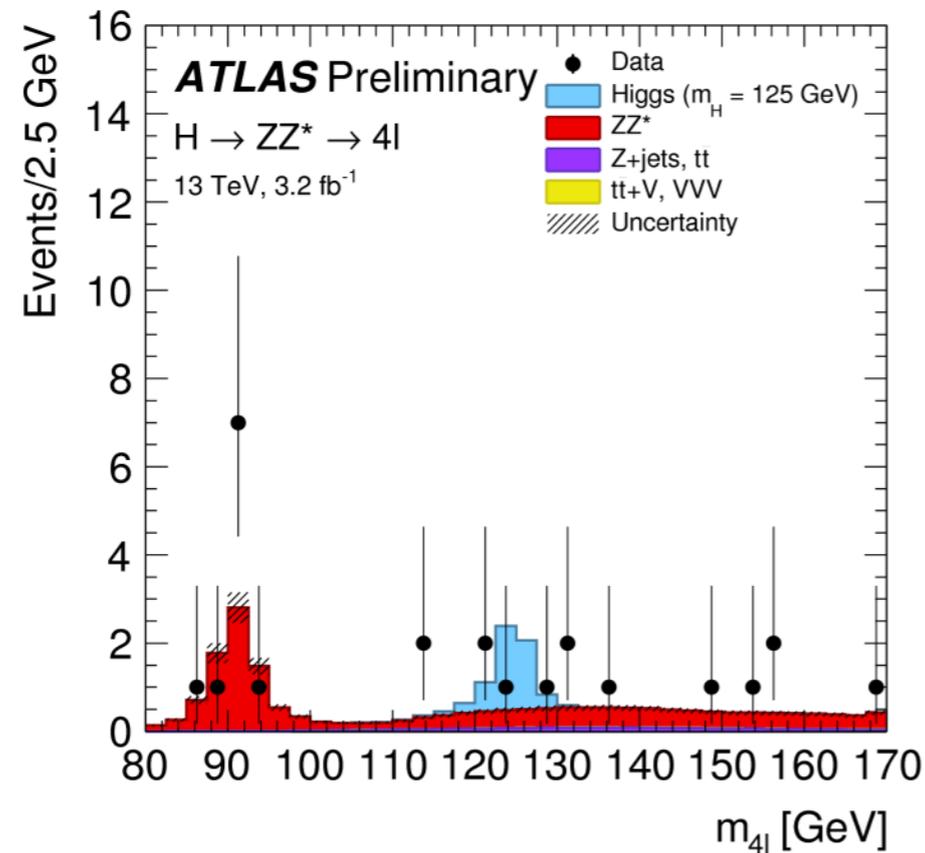
consistency  
between 8 and  
13 TeV for:  
spin-0 =  $1.2\sigma$   
spin-2 =  $2.7\sigma$   
(gg production)





# PHYSICS HIGHLIGHTS: HIGGS DISCOVERY CHANNELS

- 13 TeV data analyzed in two discovery channels:



- fully inclusive channels, still statistics-limited

$$N_{4\ell} = 1.0^{+2.3}_{-1.5}$$

$$N_{\gamma\gamma} = 113 \pm 74(\text{stat})^{+43}_{-25}(\text{sys})$$

- combined observed significance:  $1.4\sigma$  (expected:  $3.4\sigma$ )  
 compatibility with SM:  $1.3\sigma$

# DETECTOR STATUS



Oct 2015 (Oct 2012)

Subdetector	Number of Channels	Approximate Operational Fraction
Pixels	92 M	98.2% (95.0%)
SCT Silicon Strips	6.3 M	98.6%
TRT Transition Radiation Tracker	350 k	97.3%
LAr EM Calorimeter	170 k	100% (99.9%)
Tile calorimeter	4900	99.2% (98.3%) → now 100%
Hadronic endcap LAr calorimeter	5600	99.6%
Forward LAr calorimeter	3500	99.8%
LVL1 Calo trigger	7160	100%
LVL1 Muon RPC trigger	370 k	99.75%
LVL1 Muon TGC trigger	320 k	100%
MDT Muon Drift Tubes	357 k	99.7%
CSC Cathode Strip Chambers	31 k	98.4% (96.0%)
RPC Barrel Muon Chambers	370 k	96.6%
TGC Endcap Muon Chambers	320 k	99.6% (98.2%)





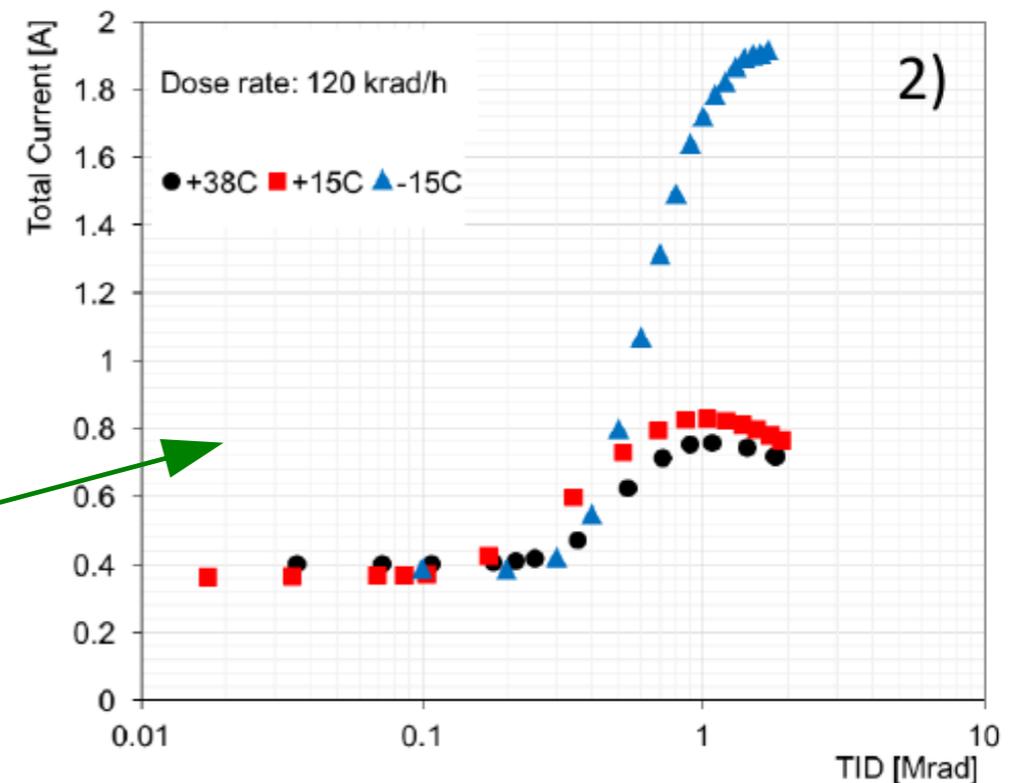
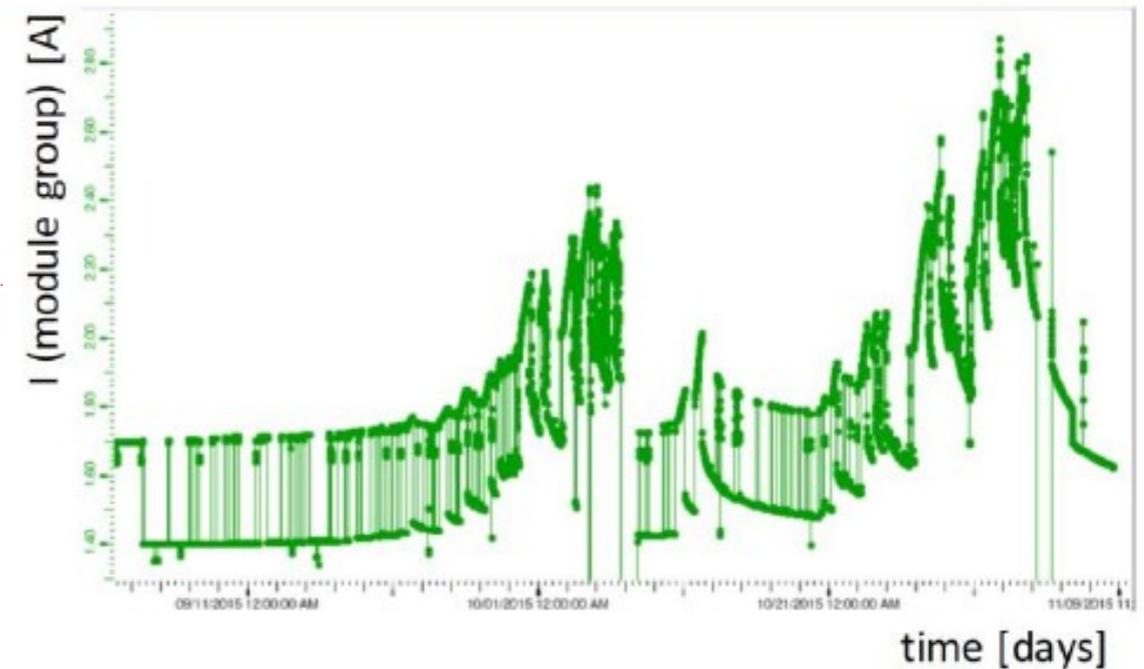
ATLAS pp 25ns run: August-November 2015										
Inner Tracker			Calorimeters		Muon Spectrometer				Magnets	
Pixel	SCT	TRT	LAr	Tile	MDT	RPC	CSC	TGC	Solenoid	Toroid
93.5	99.4	98.3	99.4	100	100	100	100	100	100	97.8
<b>All Good for physics: 87.1% (3.2 fb<sup>-1</sup>)</b>									<b>95.5% in 2012</b>	
Luminosity weighted relative detector uptime and good data quality (DQ) efficiencies (in %) during stable beam in pp collisions with 25ns bunch spacing at $\sqrt{s}=13$ TeV between August-November 2015, corresponding to an integrated luminosity of 3.7 fb <sup>-1</sup> . The lower DQ efficiency in the Pixel detector is due to the IBL being turned off for two runs, corresponding to 0.2 fb <sup>-1</sup> . Analyses that don't rely on the IBL can use those runs and thus use 3.4 fb <sup>-1</sup> with a corresponding DQ efficiency of 93.1%.										

- Some DQ issues will be recovered with reprocessing for 2015+2016 analyses (e.g., use of IBL-off data, LAr noise bursts)

# INSERTABLE B-LAYER (IBL)



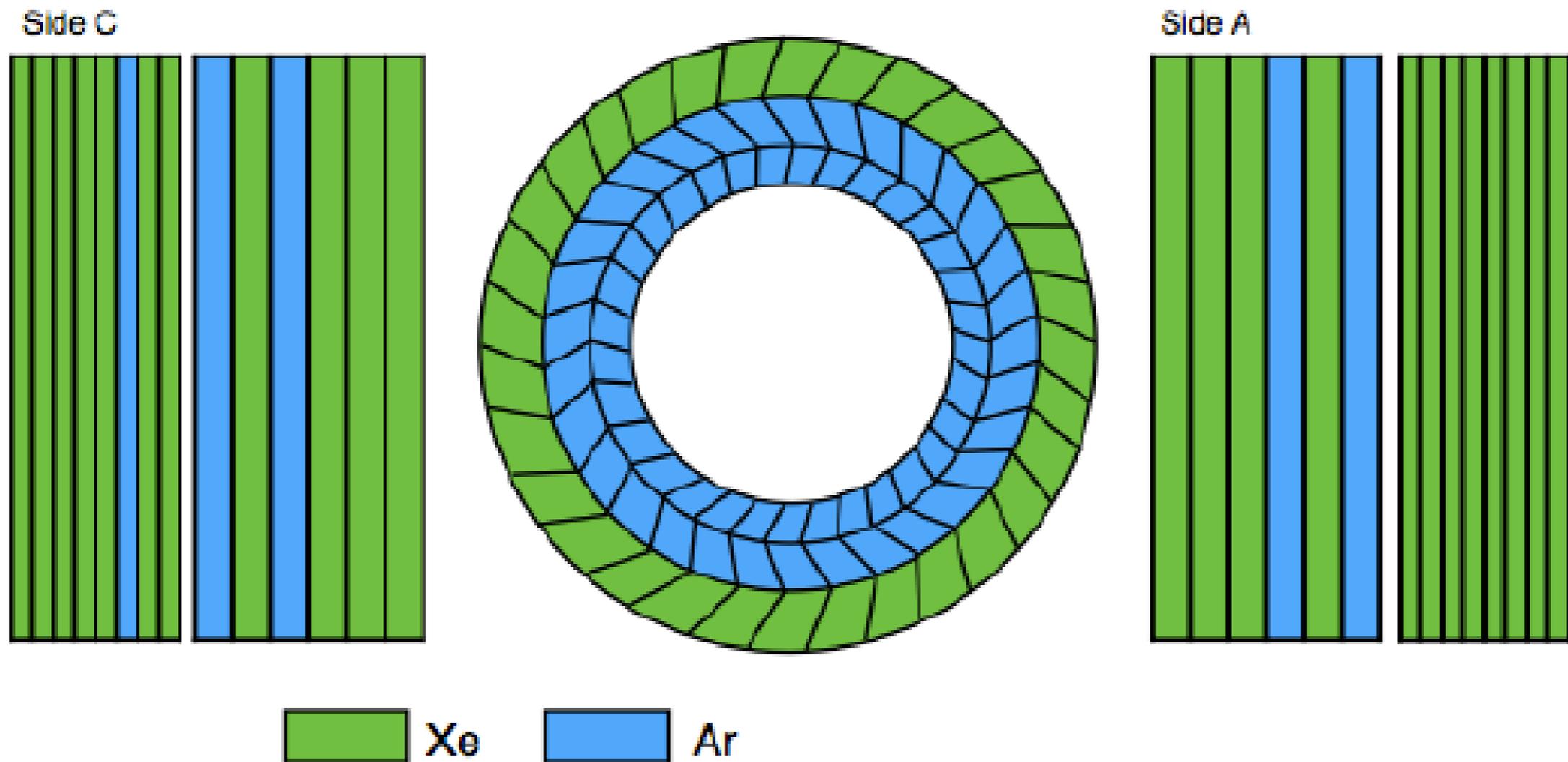
- During October 2015, observed higher than expected front-end low voltage currents
  - depends on temperature and dose rate
  - origin: NMOS transistor trap defects that are built up at the Si-SiO<sub>2</sub> interface, inducing leakage current
  - known effect, but larger than expected
- Task force launched to study, reproduce in lab
- Work done to make tracking/object ID robust against partial (or full) switch-off



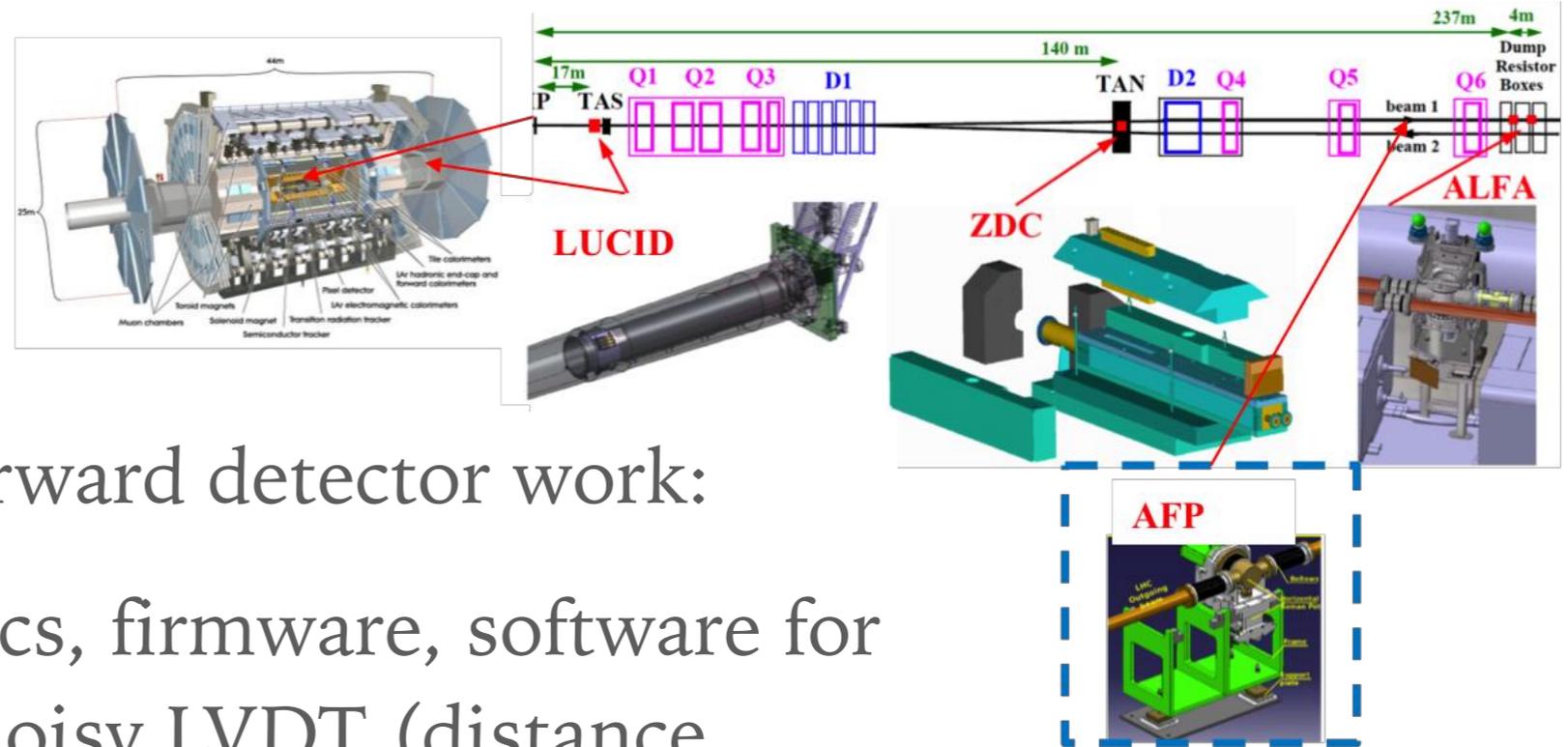
# TRANSITION RADIATION TRACKER



- Xenon vs. Argon configuration for 2016



# YEAR-END TECHNICAL STOP ACTIVITIES



- Additional details of forward detector work:
  - ALFA: new electronics, firmware, software for movement system; noisy LVDT (distance measuring device exchanged)
  - LUCID: replaced photo multiplier tubes with  $^{207}\text{Bi}$  calibrated ones
  - ZDC: taken out of the pit for refurbishments; will be back for heavy ions

# LHC EXPECTATIONS FOR 2016

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Energy	6.5 TeV
Bunch spacing	25 ns
Bunch population	~1.2e11
Max bunches/injection	288
Max. number bunches	2748
Nc GPDs	2736
Emittance exit SPS	2.7 mm.mrad
Emittance into SB	3.4 mm.mrad
Beta* GPDs	40 or 50
Crossing angle GPDs	185 or 165

- Plan to run proton-proton through Oct 2016
  - Reasonable lumi expectation:  $25 \text{ fb}^{-1}$
- Heavy ion run Nov/Dec
- Mid-Dec: start extended year-end technical stop