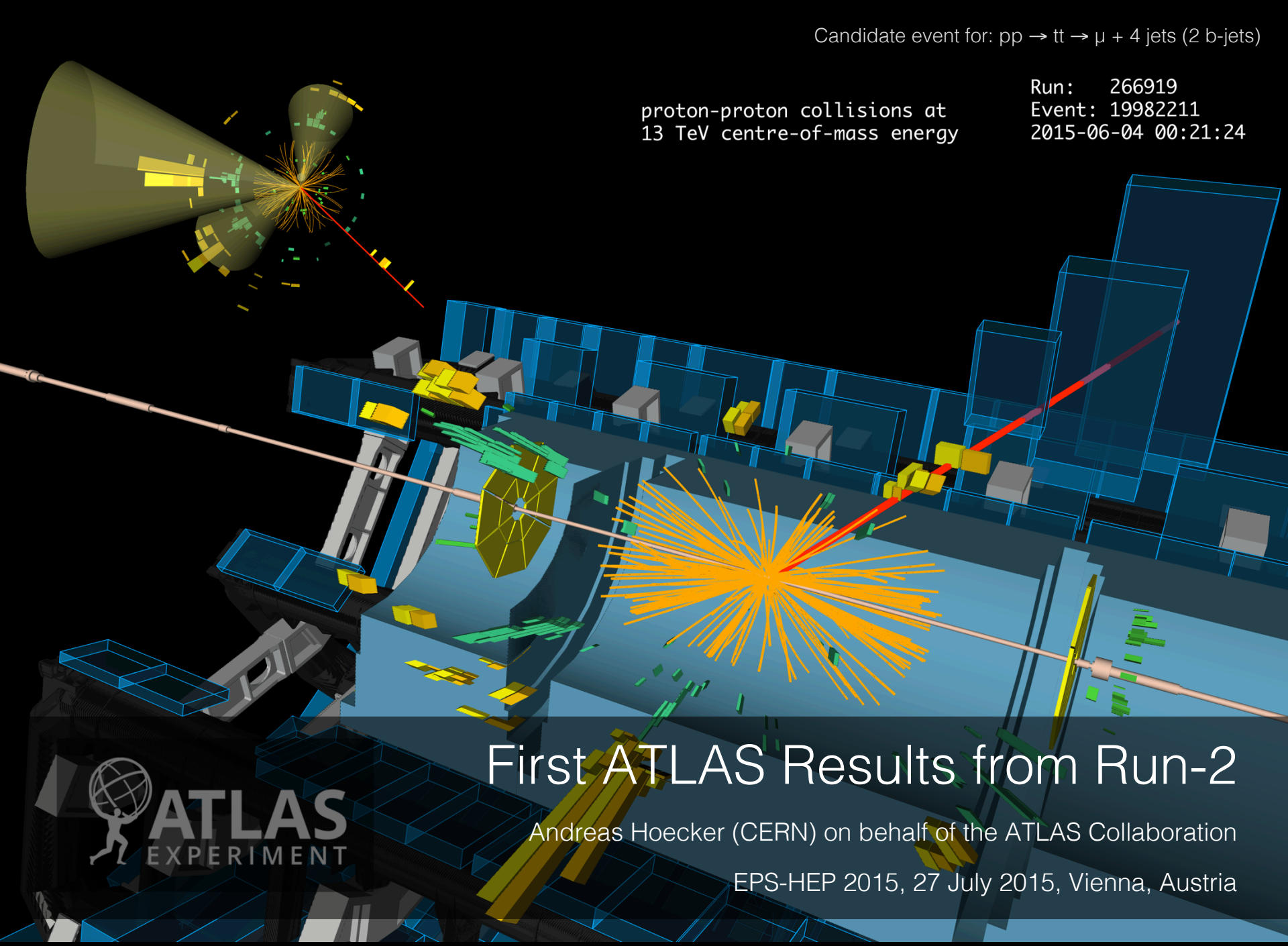


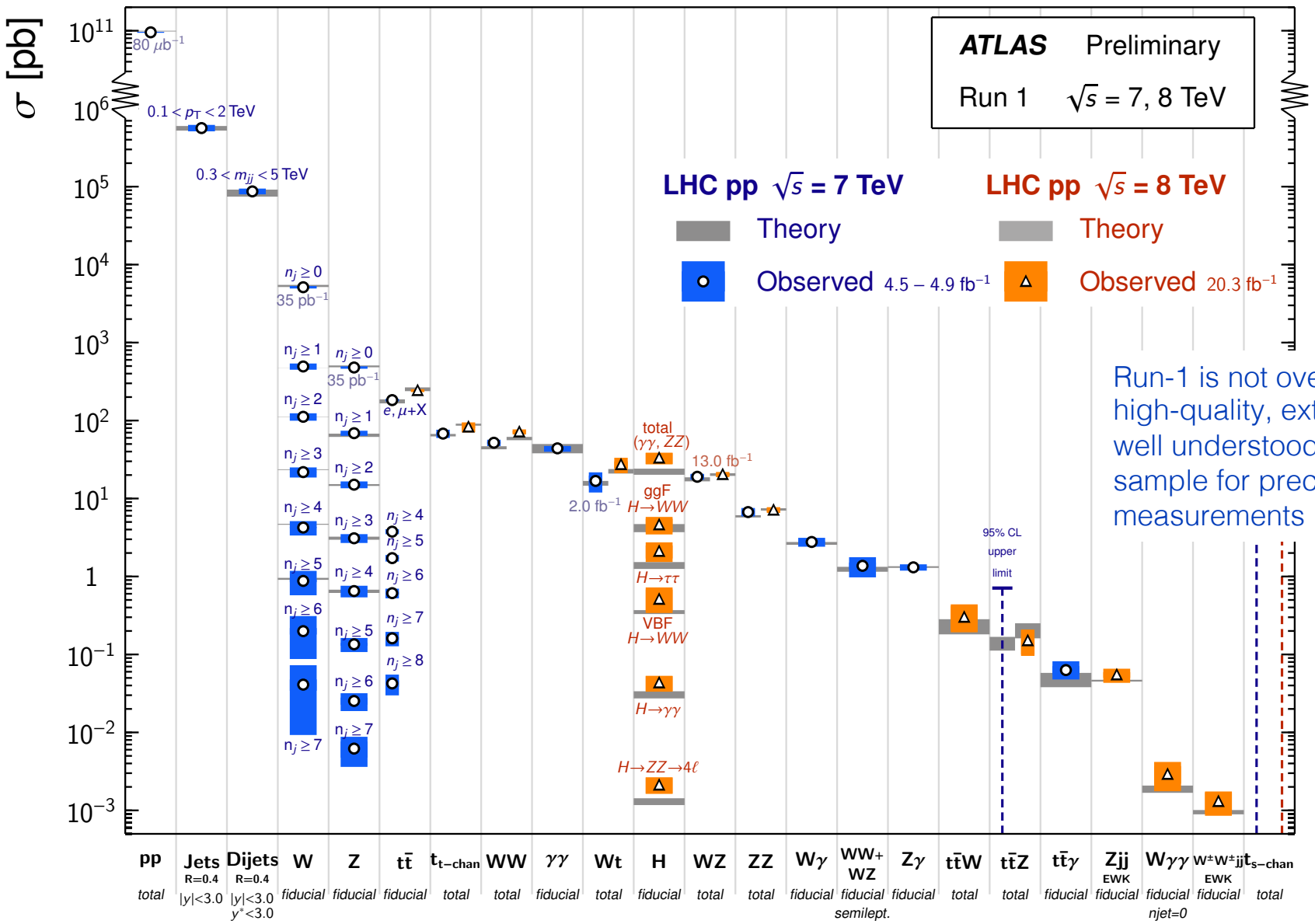
First ATLAS Results from Run-2

Andreas Hoecker (CERN) on behalf of the ATLAS Collaboration

EPS-HEP 2015, 27 July 2015, Vienna, Austria

Harvest of results from Run-1 (447 papers to date) confirming predictive power of SM

→ Covered by plenary speakers: Maxime Gouzevitch, Nicholas Hadley, Pierre Savard, Alessandro Tricoli

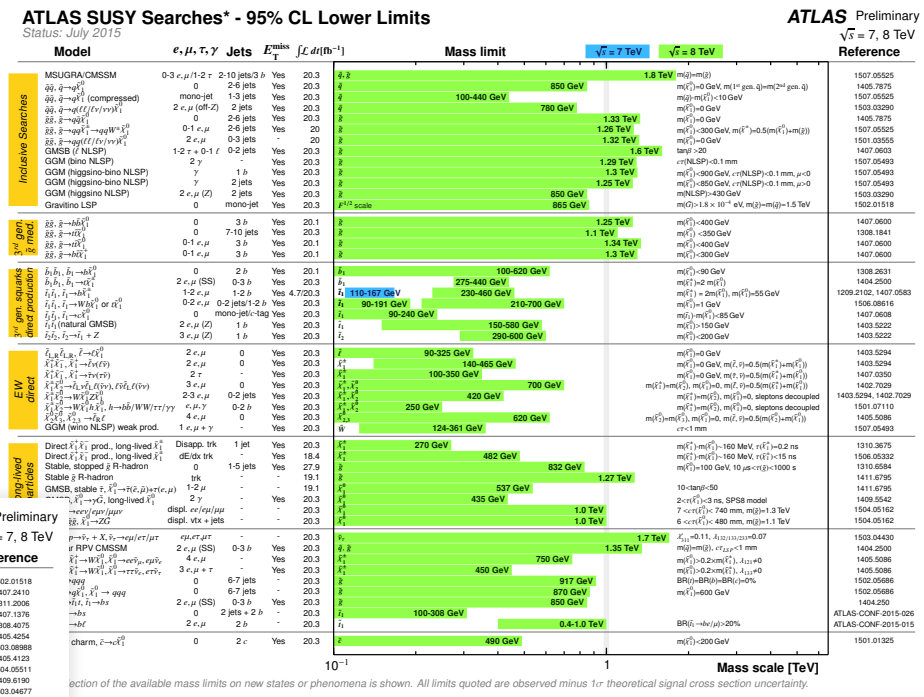


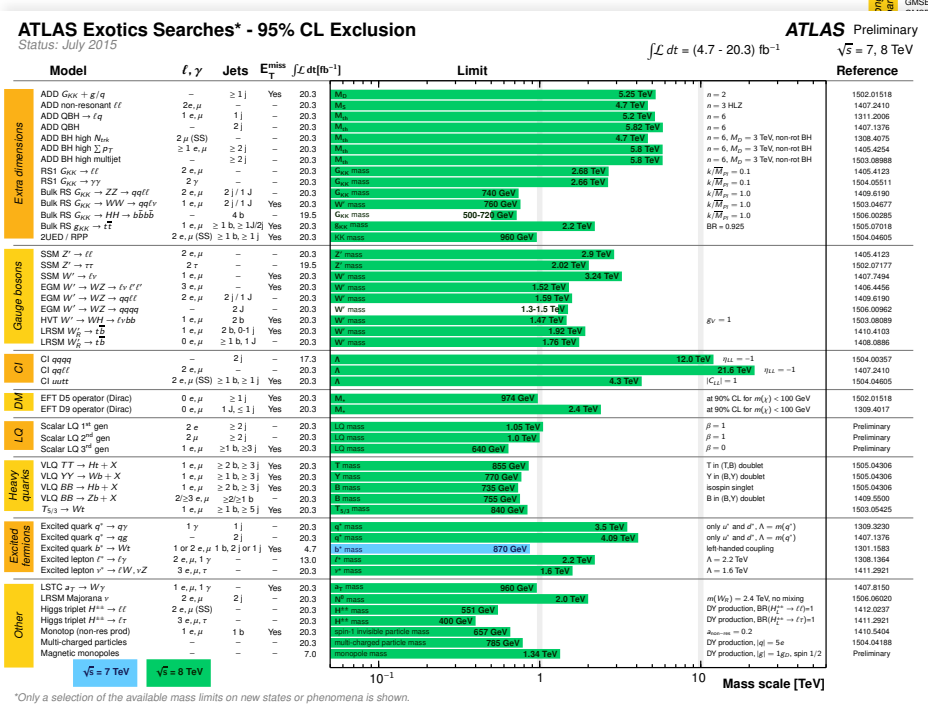
Run-1 is not over yet: high-quality, extremely well understood data sample for precision measurements

We also did a vast amount of BSM searches — with no significant anomaly seen so far

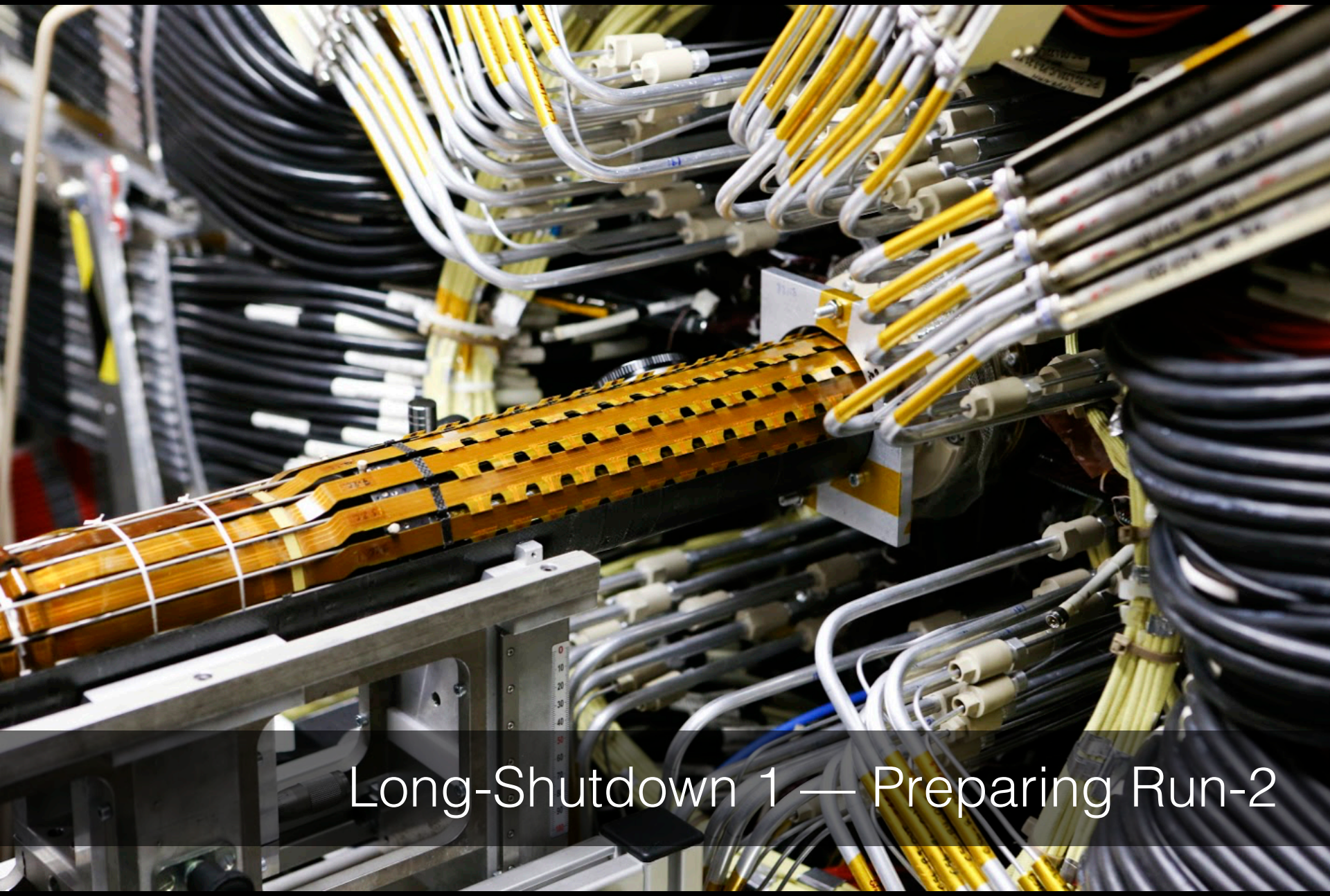
Theory-agnostic, signature based searches, as well as highly targeted model-dependent ones

→ Covered by plenary speakers: Ivan Mikulec, Anna Sfyrla



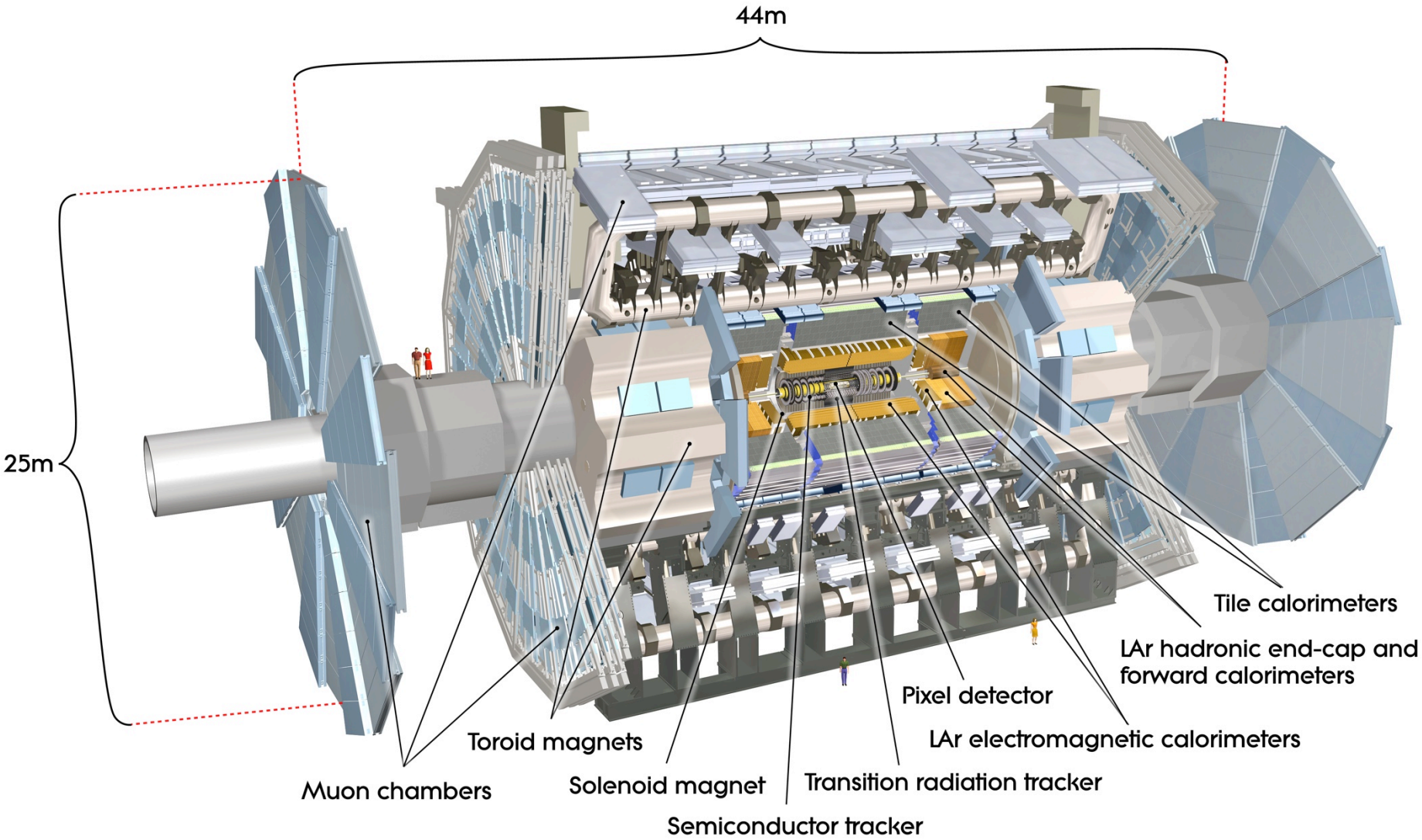


Not unexpectedly, a few of these searches ended up showing some anomaly, a legacy to check in Run-2



Long-Shutdown 1 — Preparing Run-2

The (Run-1) ATLAS Detector



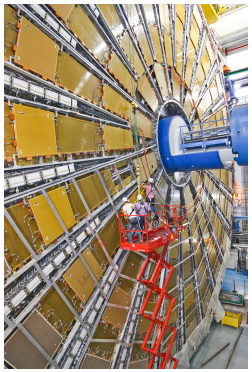
ATLAS went through important upgrades during LS1

In all areas: detector, online, offline, computing

Infrastructure upgrades: magnet & cryogenic systems, additional muon chamber shielding, new beam pipes

Detector consolidation: muon chamber completion ($1.0 < |\eta| < 1.3$) & replacements, calorimeter electronics repairs, improved inner detector read-out capability to cope with 100 kHz L1 trigger rate, new pixel detector services and module repairs

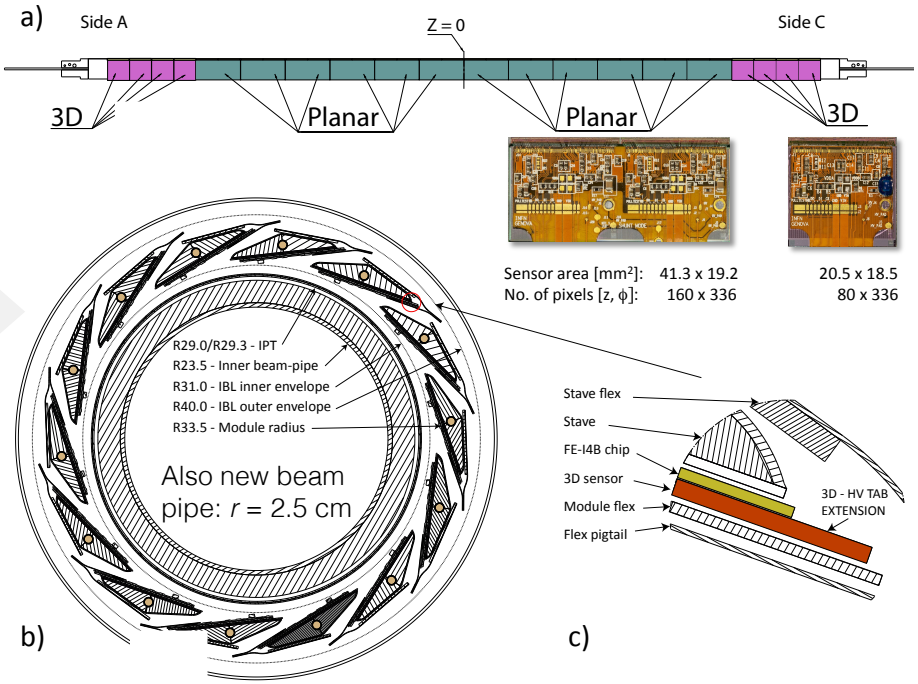
Replacement of TGC chambers



New topological L1 trigger and new central trigger processor, restructured high-level trigger

New *Insertable B-layer*: fourth pixel layer at 3.3 cm from beam, consisting of planar & 3D (forward) silicon sensors, smaller pixels

New software, new production system, new analysis model, …



At 10^{34} cm^{-2} s^{-1} @ 13 TeV pp the LHC produces:

- 200 Hz $W \rightarrow l\nu$
- 19 Hz $Z \rightarrow ll$
- 8 Hz top pair
- 0.5 Hz Higgs

ATLAS EXPERIMENT

Run Number: 266904, Event Number: 25884805

Date: 2015-06-03 13:41:54 CEST

Run-2 Physics & Performance

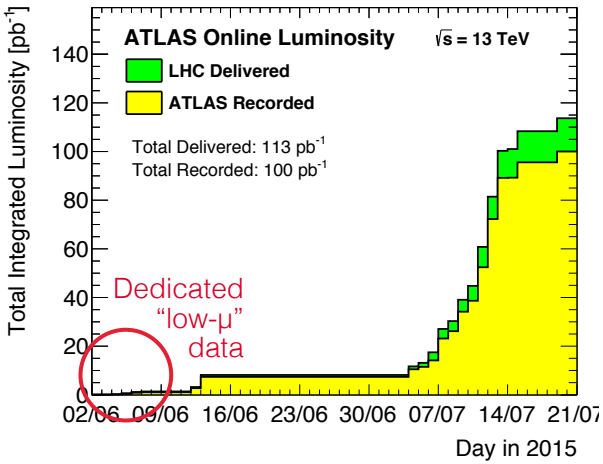
13 TeV data summaries

I will show results between 170 μb^{-1} and 85 pb^{-1} today

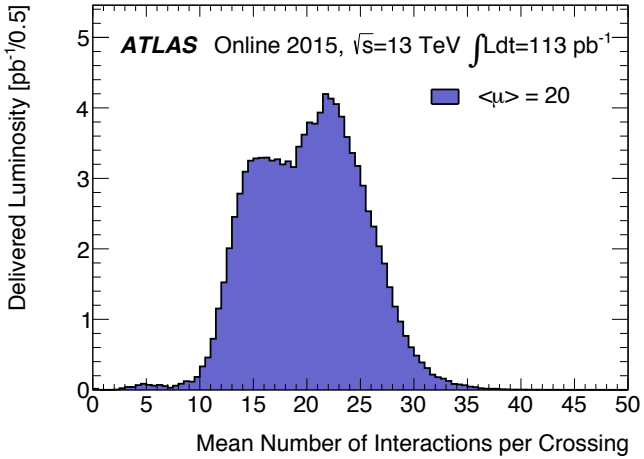
Luminosity

Measured with forward detectors, calibrated with "mini van-der-Meer" scan during low-μ run to 9% precision

Maximum peak: L = 1.6 10^{33} cm^{-2} s^{-1}



Pileup interactions profile



Data quality

All good for physics: 93.3%

An additional set of data recorded in special conditions for detector calibration purposes is not included in physics analysis

ATLAS pp run: June-July 2015										
Inner Tracker			Calorimeters		Muon Spectrometer				Magnets	
Pixel	SCT	TRT	LAr	Tile	MDT	RPC	CSC	TGC	Solenoid	Toroid
97.3	99.6	100	98.4	100	100	100	100	100	100	99.3
All good for physics: 93.3%										

Luminosity weighted relative detector uptime (in percent) and good quality data delivery during 2015 stable beams in pp collisions at √s = 13 TeV between 3 June and 16 July – corresponding to 91 pb^{-1} of recorded data.

Soft physics with tracks at 13 TeV

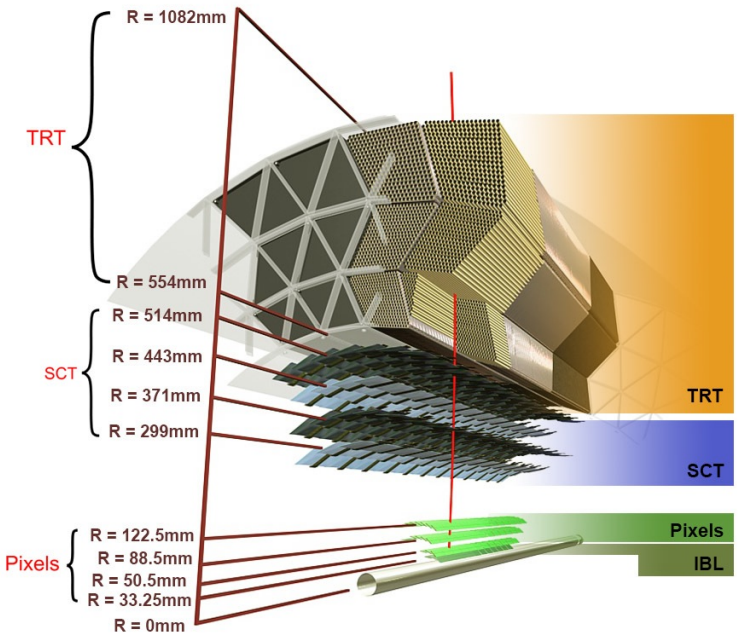
One of the very first proton–proton collisions recorded by ATLAS in “quiet beam” conditions in May 2015

Inner tracking performance

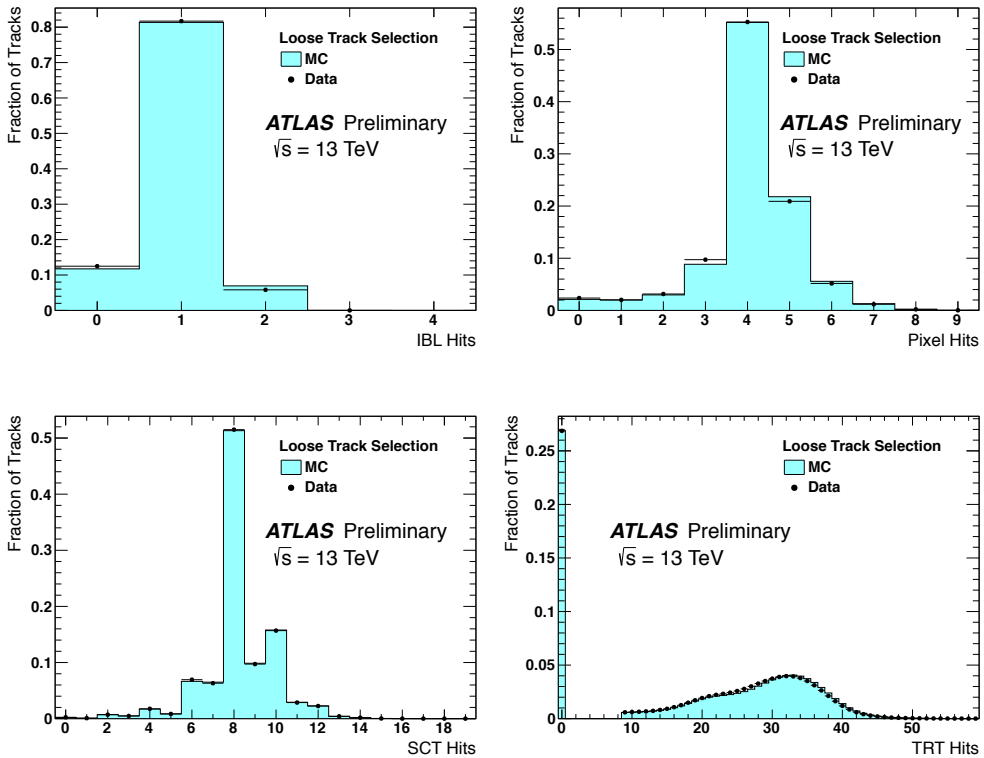
[ATL-PHYS-PUB-2015-018]
→ Karolos Potamianos's talk at EPS

ATLAS tracking in Run-2 features the new IBL, reduced material within acceptance, and algorithmic improvements (eg, huge speed-up, *tracking in dense environment* [ATL-PHYS-PUB-2015-006])

Sketch of ATLAS inner tracking detectors



Hit reconstruction in data and MC



Inner tracking performance with IBL

[IDTR-2015-003, IDTR-2015-006, IDTR-2015-007] → Karolos Potamianos

Detector alignment and material studies crucial for new detectors and services

Material studies

Based on:

- Hadronic interactions
- Photon conversions
- “SCT extension”

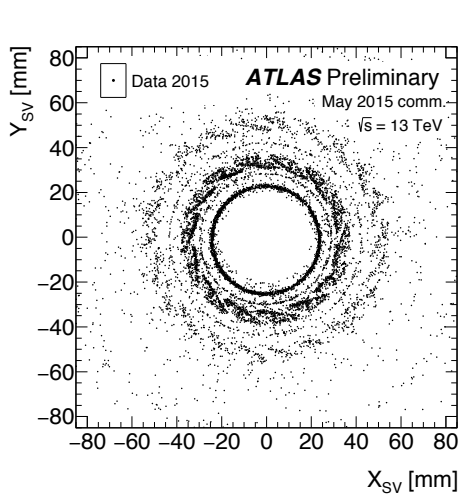
Material uncertainty dominates tracking systematics

“Radiography” pictures used to validate material description in simulation

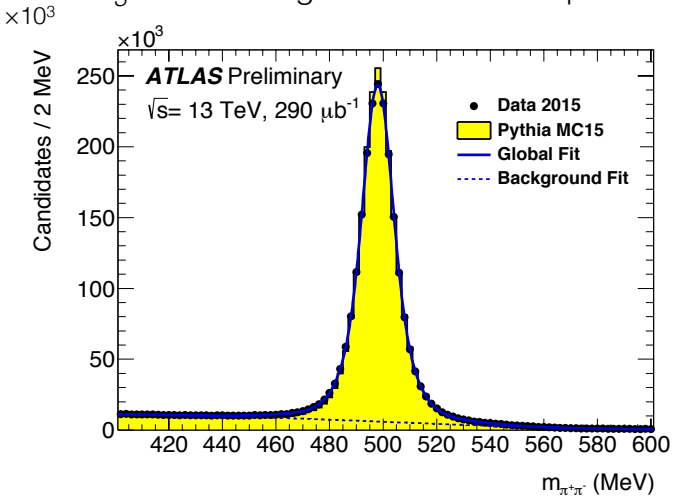
Impact parameter resolution improvement from IBL

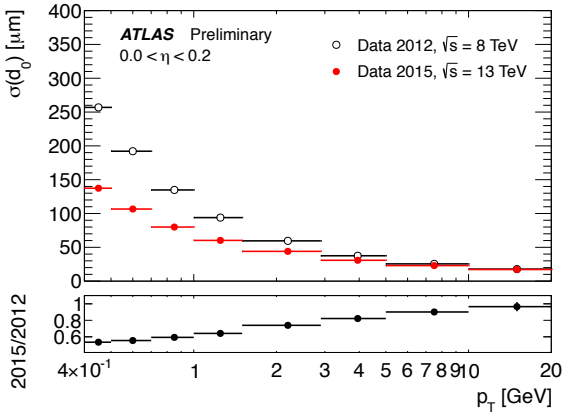
Measured improvement of impact parameter resolution with IBL depending on track p_T

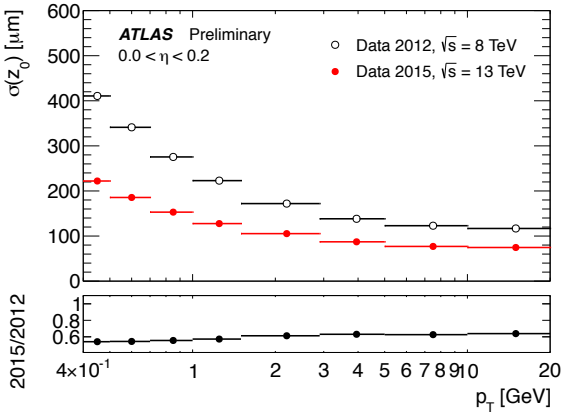
Hadronic interaction vertices



K_S mass as alignment & material probe







Properties of inelastic pp collisions at 13 TeV

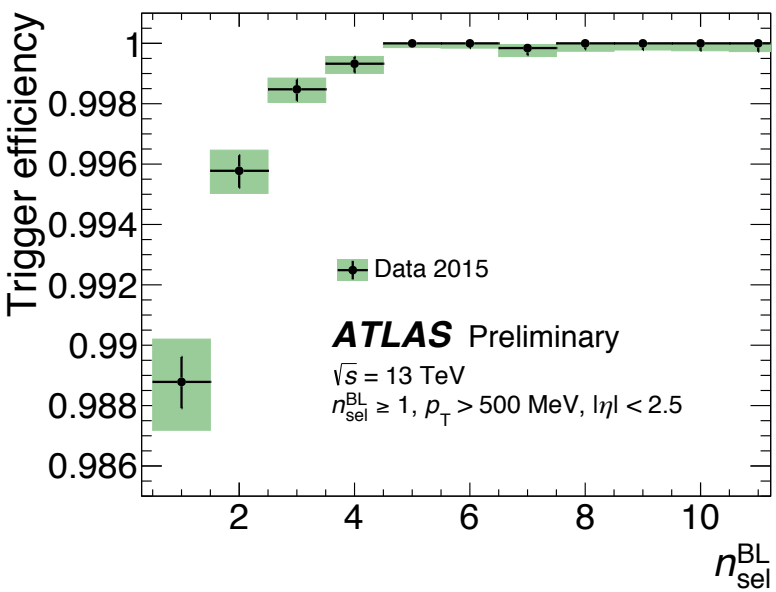
Key input to pileup and underlying event modelling, uses low-μ data

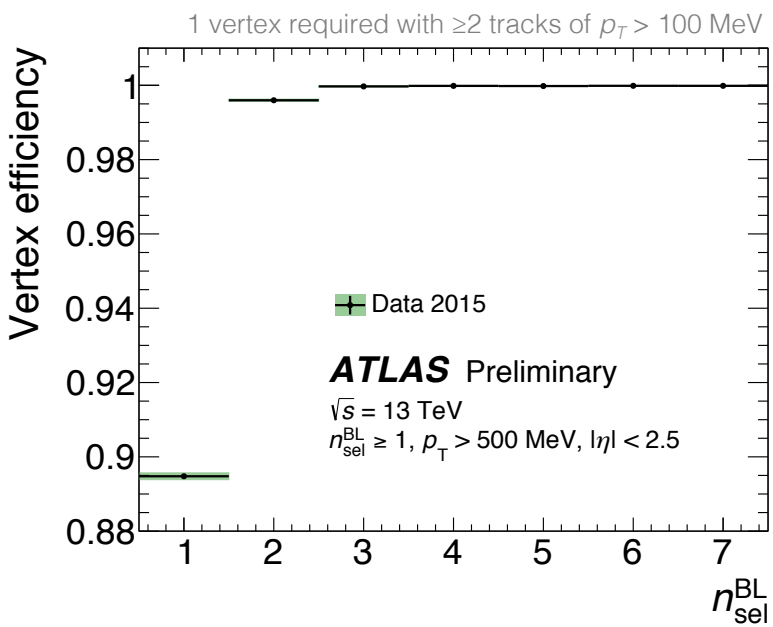
[ATLAS-CONF-2015-028]
→ Anthony Morley

Measurement of primary charged particle production: $dN_{ch}/d\eta$, $d^2N_{ch}/d\eta dp_T$, N_{ch}, $\langle p_T \rangle / N_{ch}$

Fiducial cuts: $p_T > 0.5$ GeV, $|\eta| < 2.5$, $N_{ch} \geq 1$

- Trigger events with as little "bias" as possible: ≥1 hit in forward scintillators (MBTS, $2.07 < |\eta| < 3.86$)
- Measure trigger and vertexing efficiencies from data
- Measure and subtract secondary interactions and fake tracks
- Correct for tracking inefficiency
- Unfold measured spectra from detector effects





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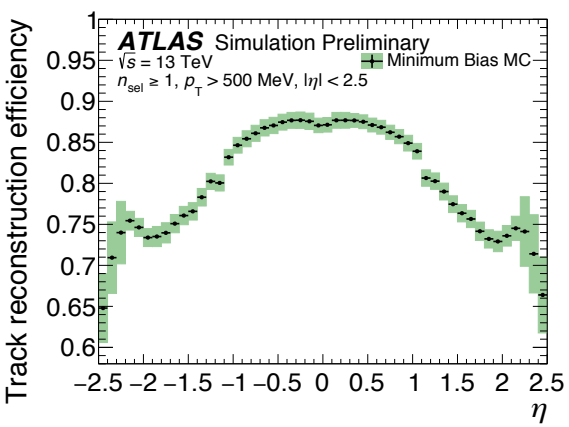
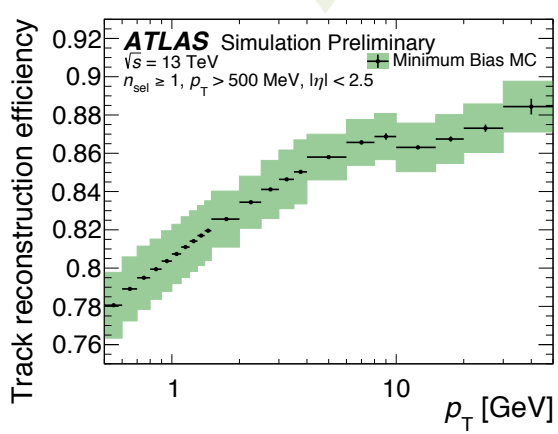
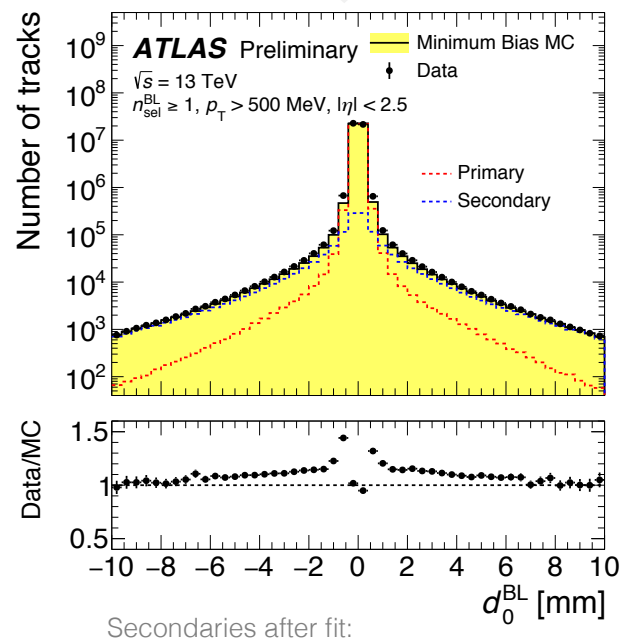
Fiducial cuts: $p_T > 0.5$ GeV, $|\eta| < 2.5$, $N_{ch} \geq 1$

- Primary particles have τ > 300 ps (9 cm)
- Secondaries are produced after τ > 30 ps (9 mm)
- Strange baryons with 30 < τ < 300 ps are excluded

- Trigger events with as little "bias" as possible
- Measure trigger and vertexing efficiencies from data
- Measure and subtract secondary interactions and fake tracks
- Correct for tracking inefficiency
- Unfold measured spectra from detector effects







Tracking efficiency dominant uncertainty:
1.1% central, 6.5% forward

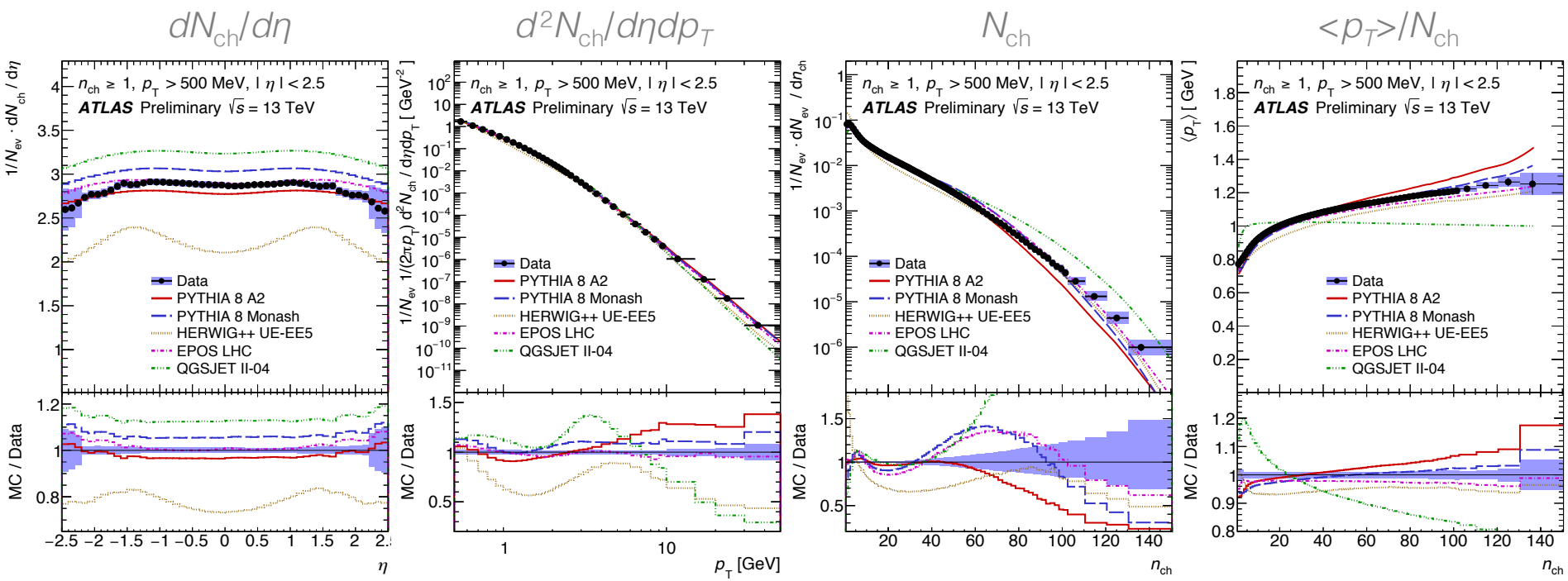
Secondaries after fit:
2.6 ± 0.6% of tracks in SR

Properties of inelastic pp collisions at 13 TeV

Key input to pileup and underlying event modelling, uses low-μ data

[ATLAS-CONF-2015-028]
→ Anthony Morley

Resulting spectra from 9M data events & comparison to hadronic physics models



Difficult to provide one universal tune that describe MB and UE data equally well (→ next slides)

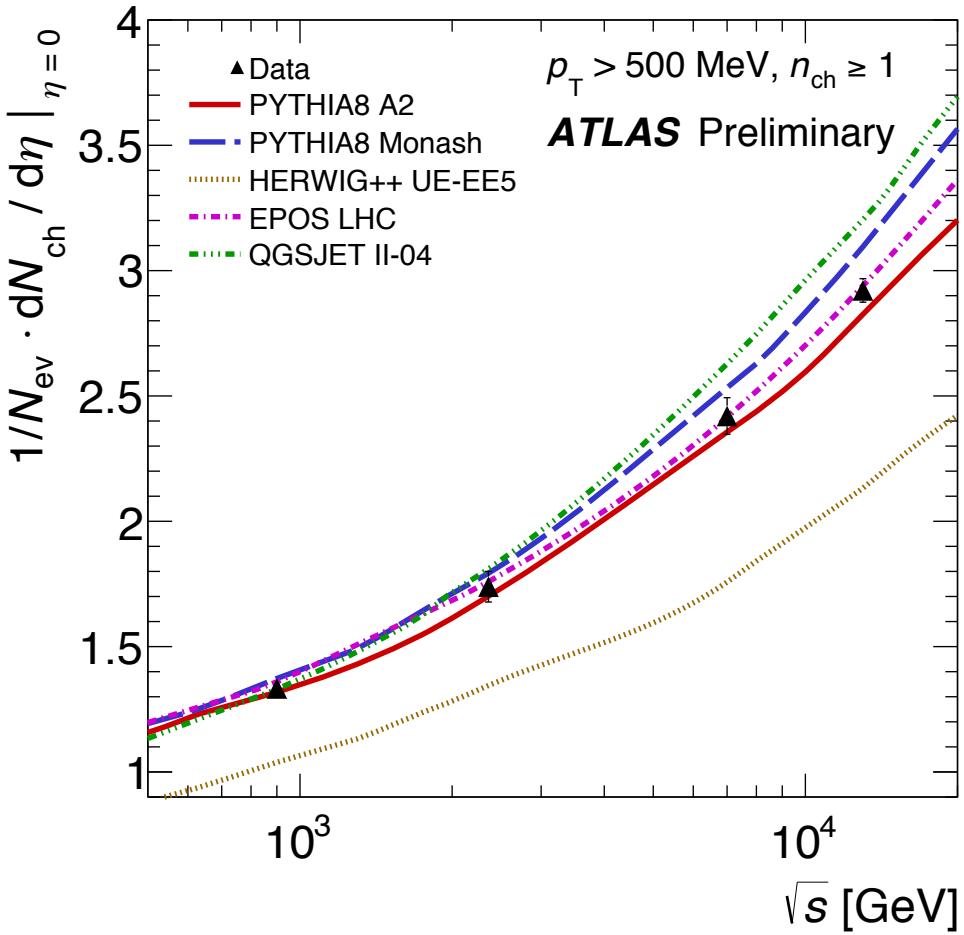
Overall, the EPOS and PYTHIA 8 tunes describe the data most accurately
EPOS best in η, p_T, and $<p_T>$, while PYTHIA 8 (A2 – ATLAS MB default) best in N_{ch}

Properties of inelastic pp collisions at 13 TeV

Key input to pileup and underlying event modelling, uses low-μ data

[ATLAS-CONF-2015-028]
→ Anthony Morley

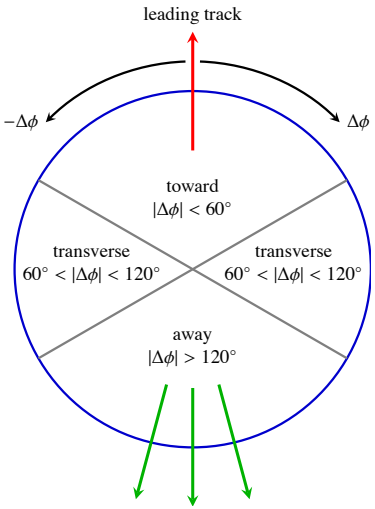
Average charged-particle multiplicity per unit of rapidity for $\eta = 0$ vs CM energy



For comparison, the strange baryon contribution is included at 13 TeV (1.5% correction factor)

Properties of inelastic pp coll. at 13 TeV

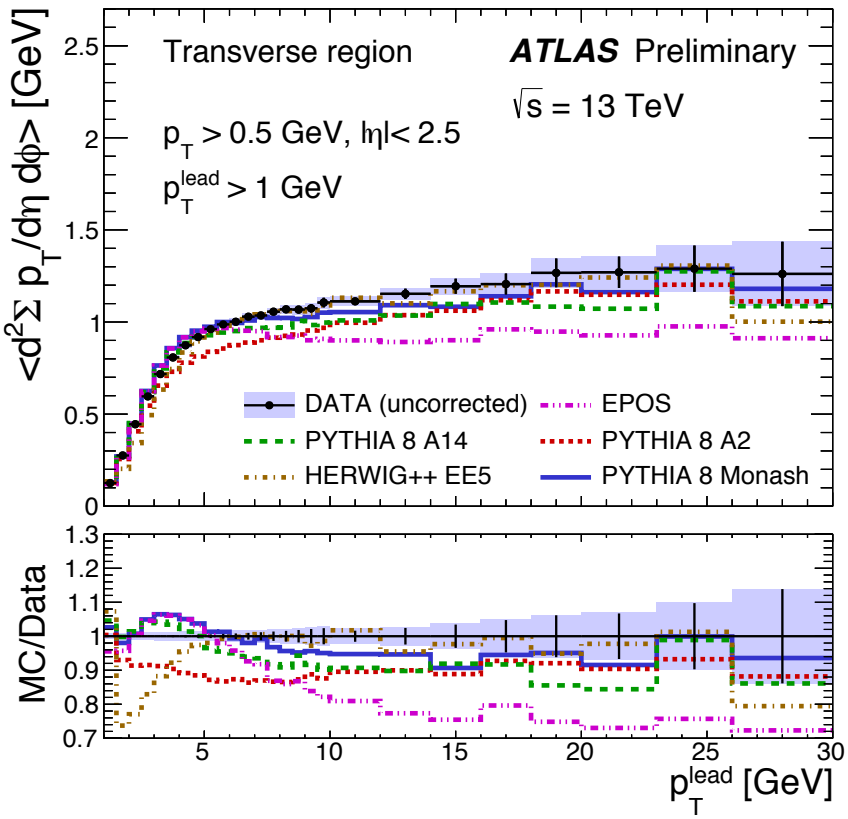
Key input to pileup and underlying event modelling, uses low-μ data

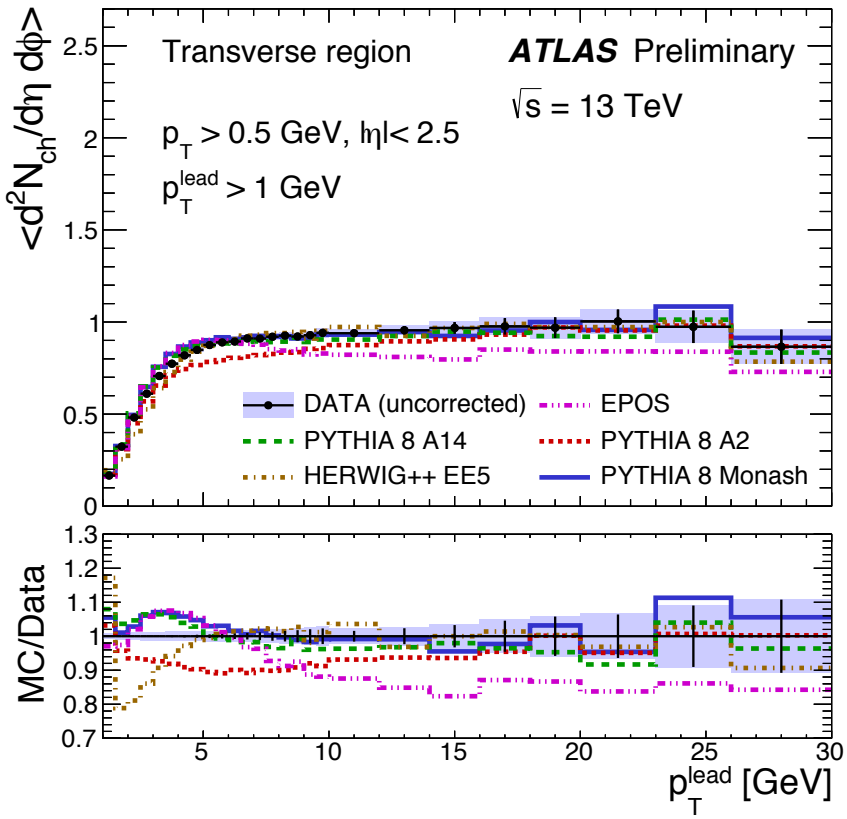


We also studied underlying event (UE) spectra to further validate the energy extrapolation of the MC modelling

[ATL-PHYS-PUB-2015-019]
→ Thorsten Kuhl

Uncorrected detector level quantities





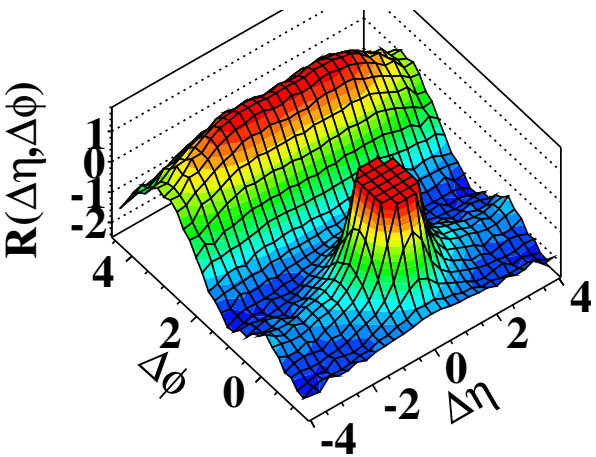
Long-range two-charged-particle angular correlations

In high-multiplicity pp collisions using low-μ data

Near-side ($\Delta\phi \sim 0$) "ridge" shape along $\Delta\eta$ seen in pp, pPb and PbPb collisions

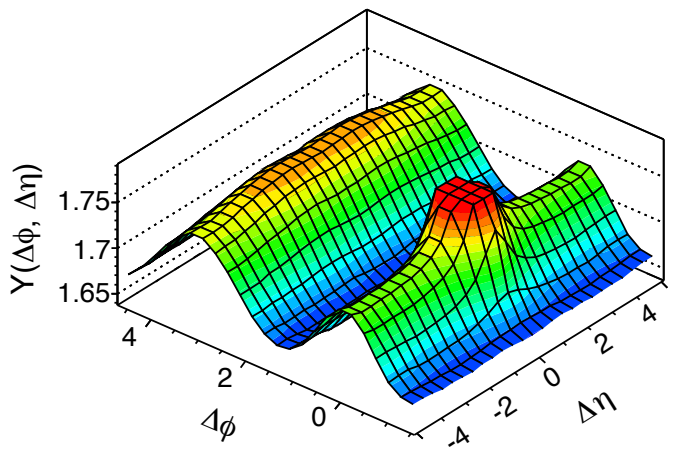
Effect increases with particle multiplicity and moderate p_T

CMS, pp at 7 TeV:
$N_{ch} > 110$, $1.0 < p_T < 3.0$ GeV



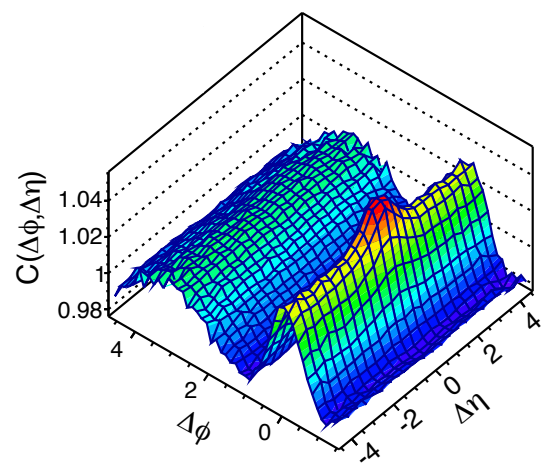
[CMS, 1009.4122]

ATLAS, pPb at 5.02 TeV:
$N_{ch} > 220$, $1.0 < p_T < 3.0$ GeV



[ATLAS, 1212.5198]

ATLAS, PbPb at 2.76 TeV:
Centrality 0–5%



[ATLAS, 1504.01289]

[Enhancement found to be also present at $\Delta\phi \sim \pi$, when subtracting hard scattering contributions]

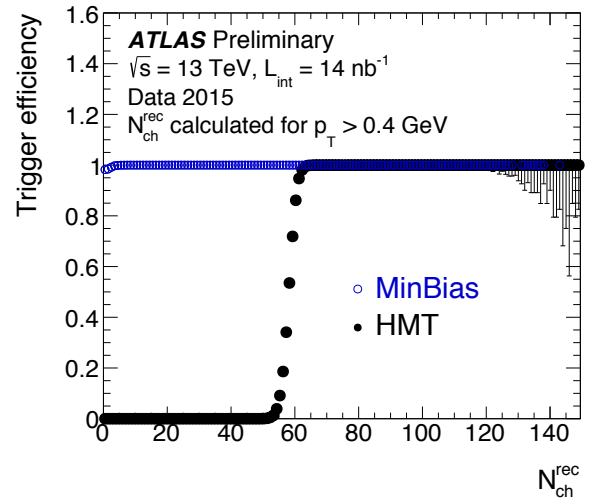
Two-charged-particle angular correlations at 13 TeV

In high-multiplicity pp collisions using low-μ data

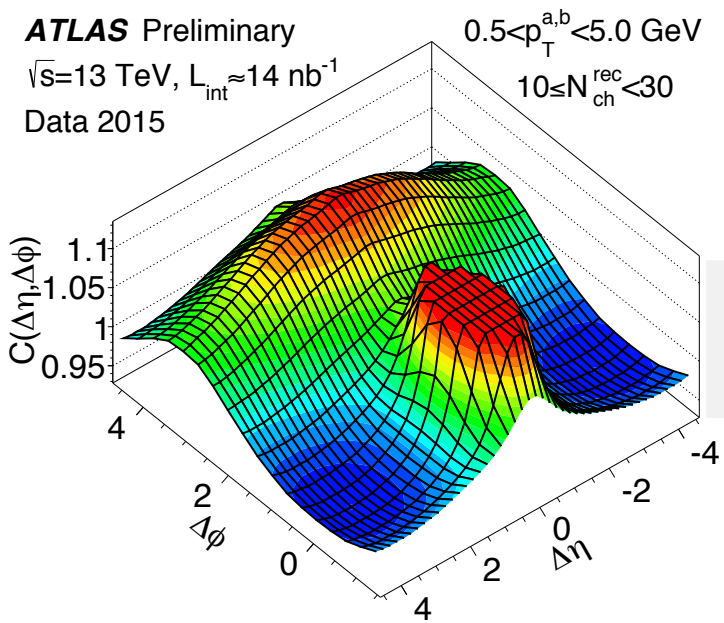
[ATLAS-CONF-2015-027]
→ Miguel Arratia

How does the pp ridge evolve with CM energy ?

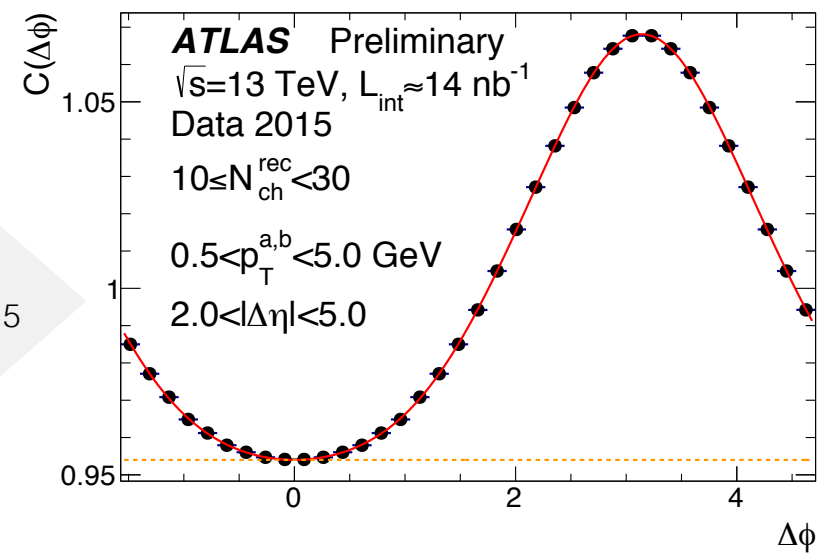
- Trigger on MBTS (97M events) & high charged multiplicity (9.5M)
- Exploit work on tracking corrections from minimum bias analysis
- Extract two-particle correlation function → $C(\Delta\eta, \Delta\phi) = \frac{S(\Delta\phi, \Delta\eta)}{B(\Delta\phi, \Delta\eta)}$
  (background from mixed events)



Low charged multiplicity



Integrate:
$2 < |\Delta\eta| < 5$



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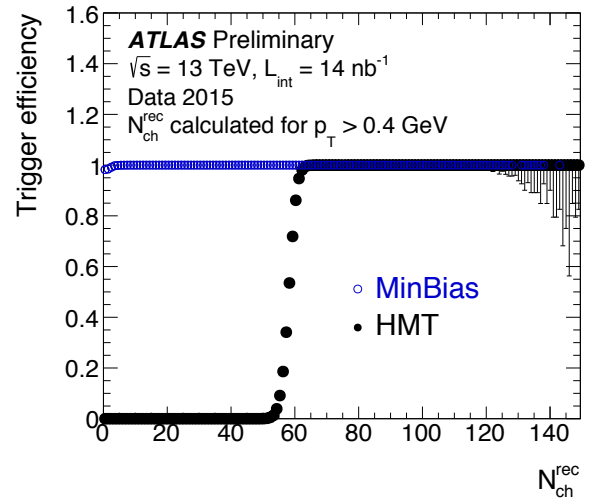
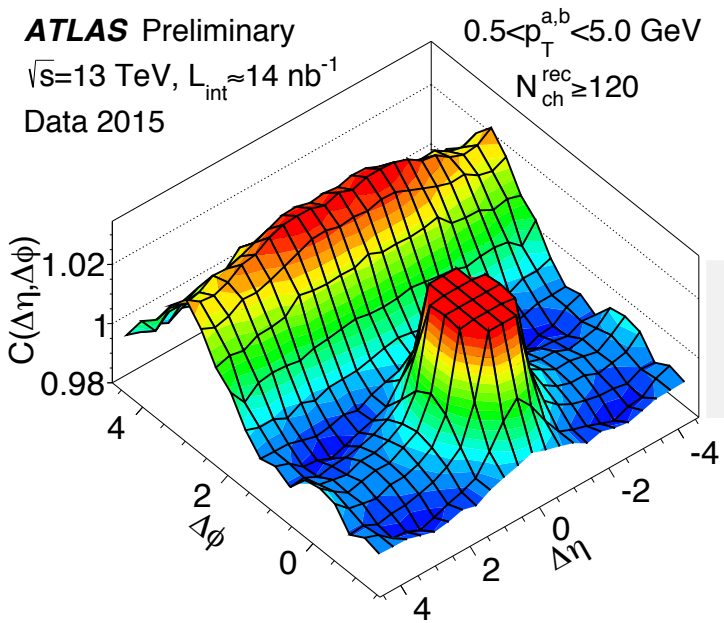
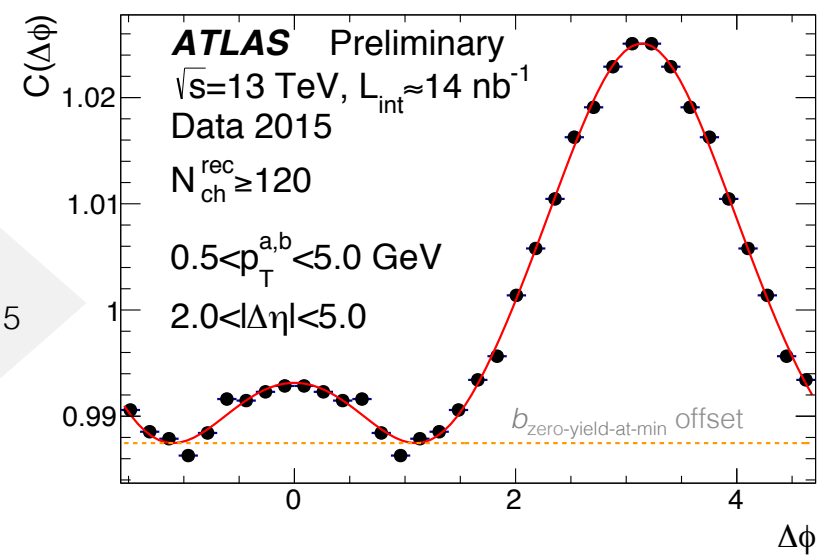


High charged multiplicity



Integrate:
$2 < |\Delta\eta| < 5$



Two-charged-particle angular correlations at 13 TeV

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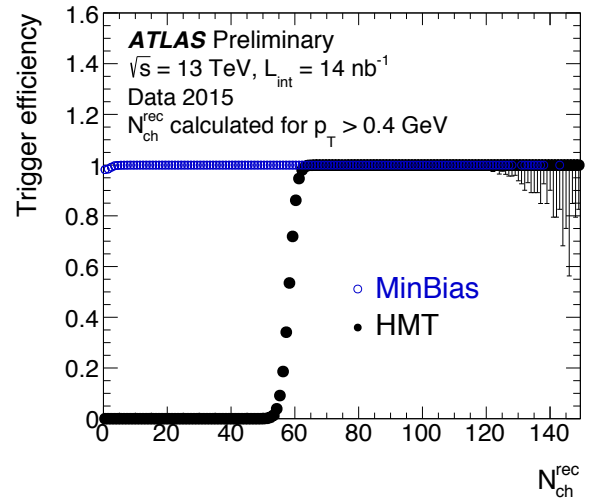
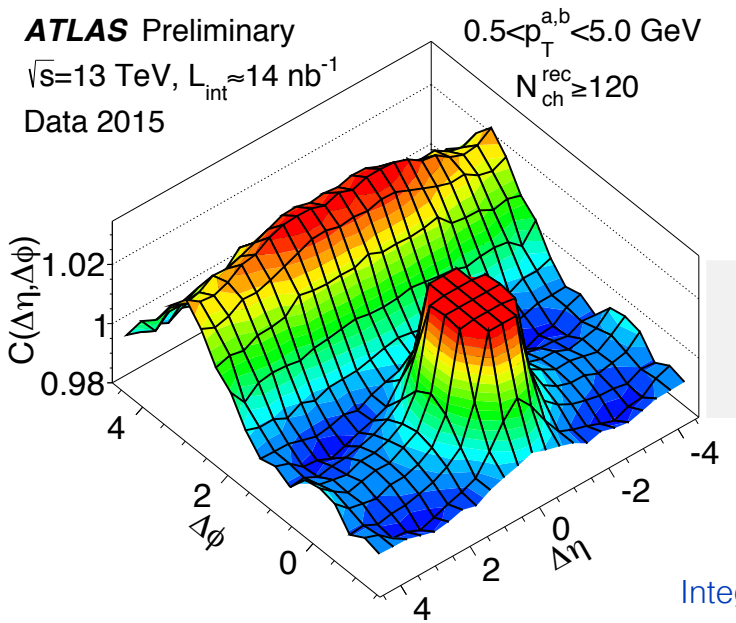
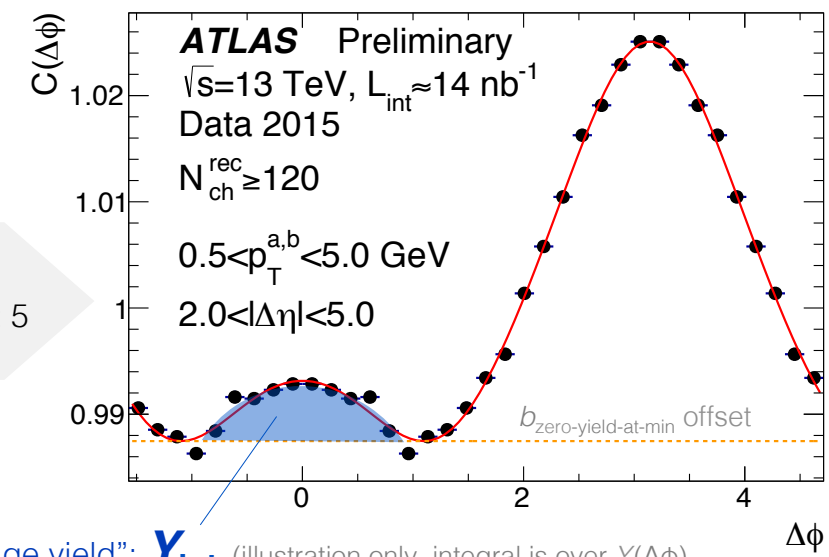


High charged multiplicity



Integrate:
$2 < |\Delta\eta| < 5$



Integrated "ridge yield": Y_{int} (illustration only, integral is over $Y(\Delta\phi)$)

Two-charged-particle angular correlations at 13 TeV

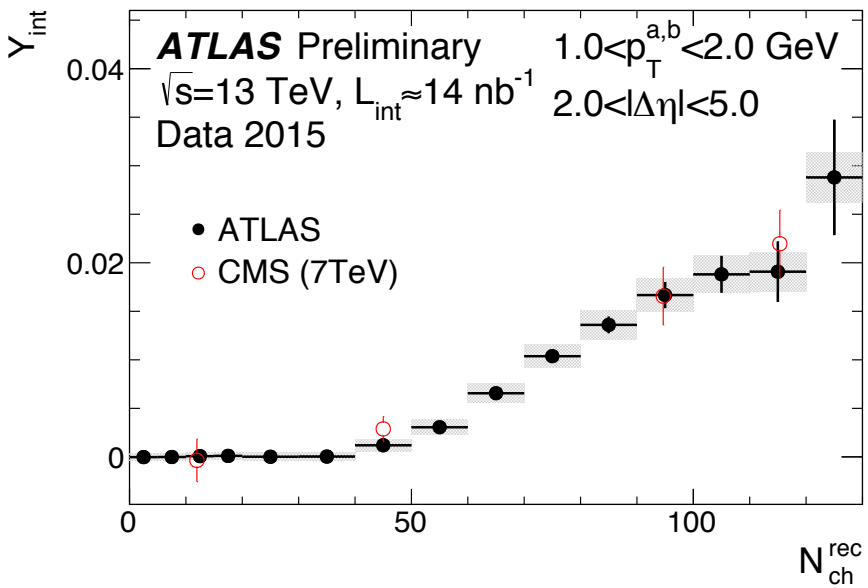
In high-multiplicity pp collisions using low-μ data

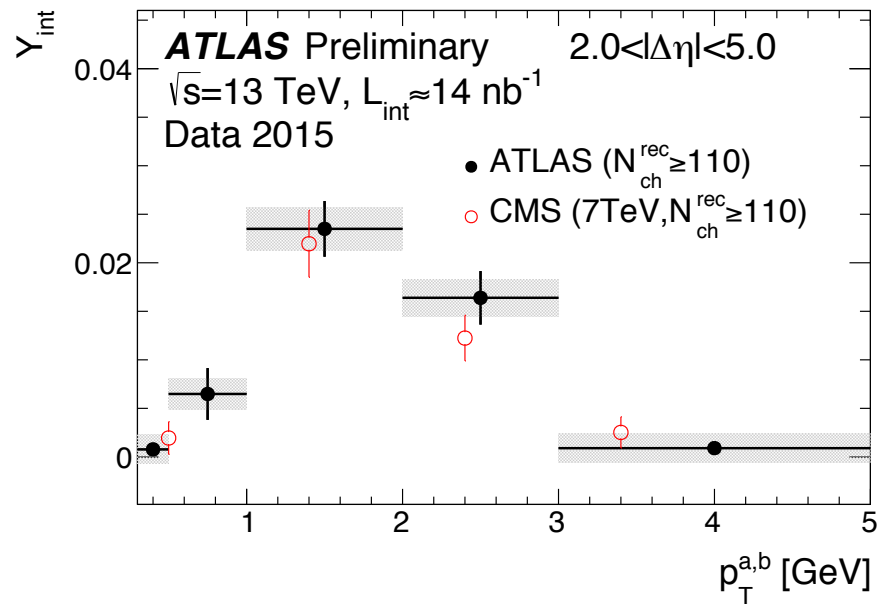
[ATLAS-CONF-2015-027]
→ Miguel Arratia

Integrated "ridge yield" versus charged multiplicity and p_T range

$\boldsymbol{Y_{int}}$ = integral of $Y(\Delta\phi) - b_{ZYAM}$ between ridge minima in $\Delta\phi$ (b_{ZYAM} is simple Y offset correction at minima)

Systematic effects dominated by tracking efficiency, ZYAM procedure, MC closure



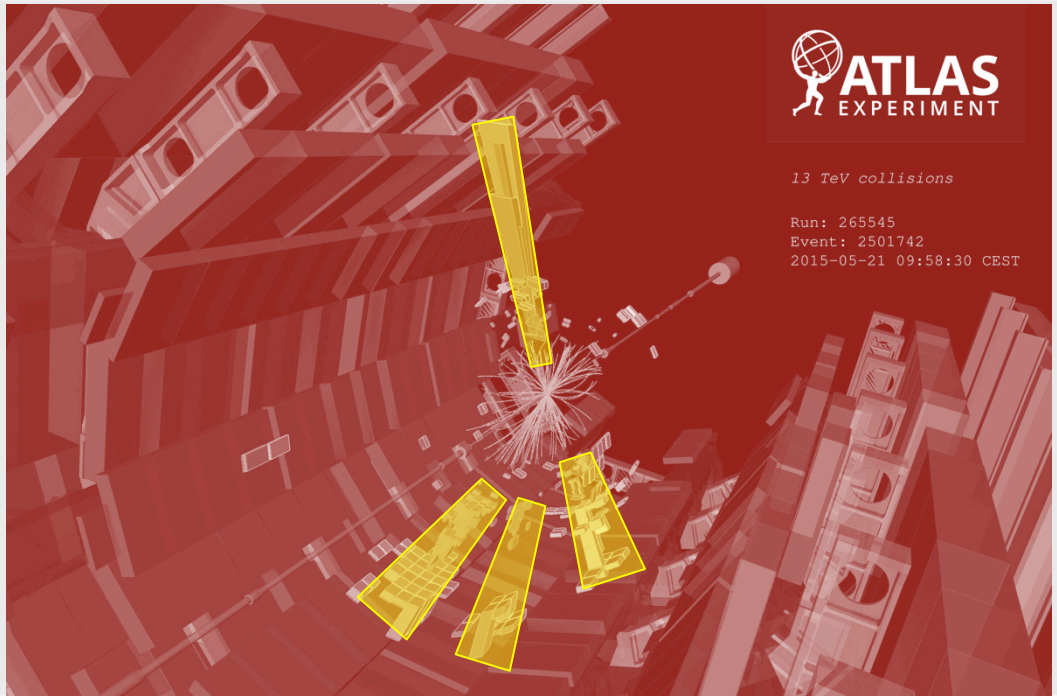


→ Compatible yield at different CM energies

CMS uses 2 < |Δη| < 4.0. The yields from 1210.5482 were multiplied by 3.6 in above plots (see ATLAS-CONF-2015-027)

Now moving to higher luminosity and p_T

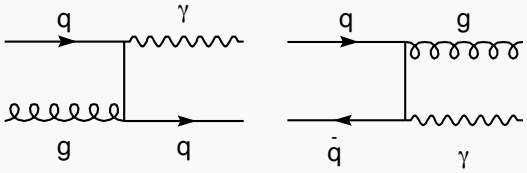
Physics with photons and jets at 13 TeV



One of the very first jetty (4 jets) events recorded by ATLAS in “quiet beam” conditions in May 2015

Photon production at 13 TeV

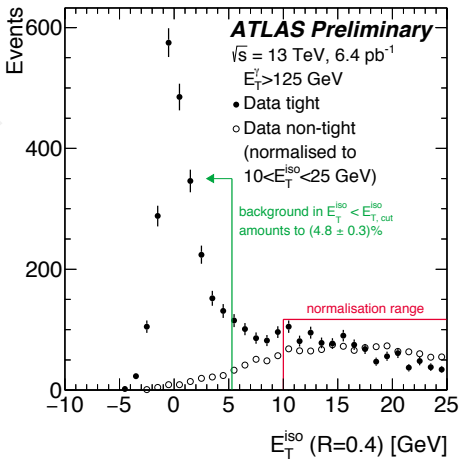
Test perturbative QCD in cleaner environment than jets



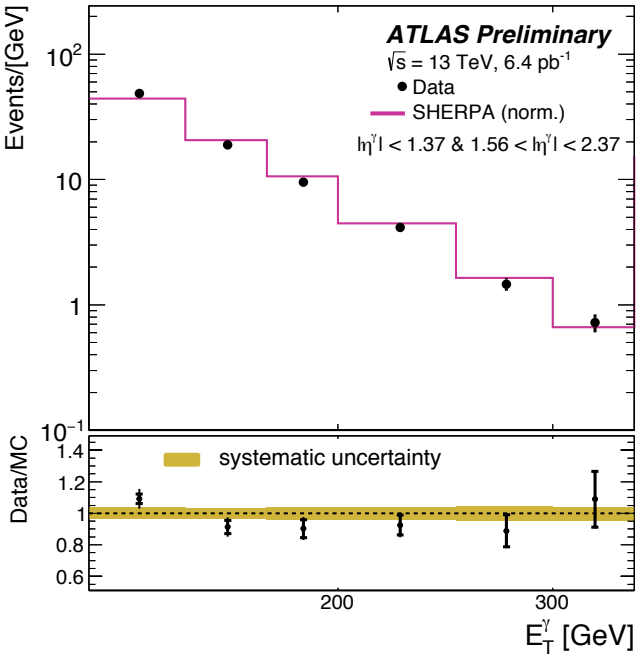
[ATL-PHYS-PUB-2015-016] → Martine Bessner

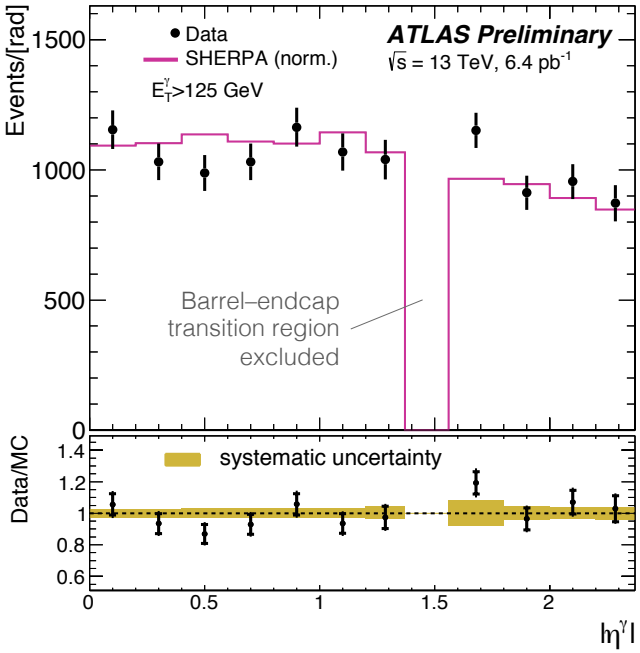
Measurement of isolated photon yield

Subtract mis-identification background from data



Photon production vs. $E_{T,\gamma}$ and $|\eta_\gamma|$ (detector level, MC normalised to data)





Systematics dominated by photon energy scale, resolution and efficiency

Good agreement of shape with SHERPA 2.1 (LO + ≤3 partons)

Systematic uncertainties dominated by: photon energy scale, photon ID, background subtraction

Jet production at 13 TeV

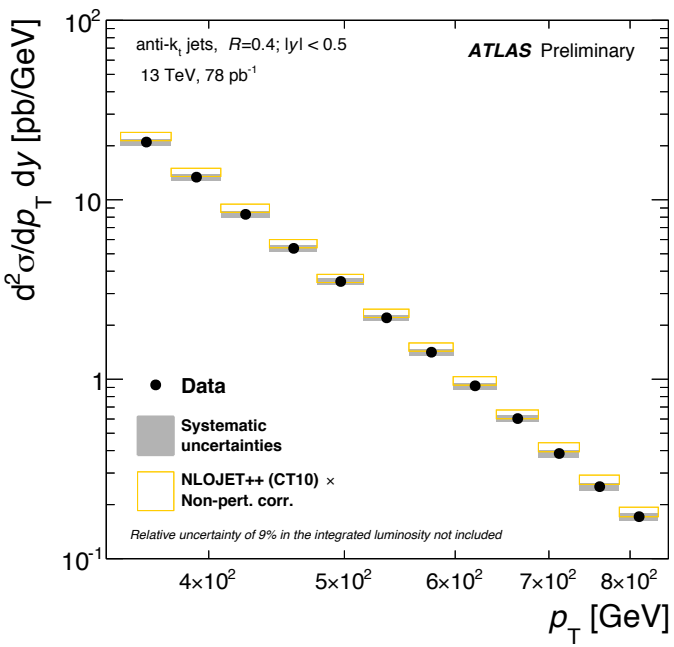
Early central-jet cross-section measurement at 13 TeV

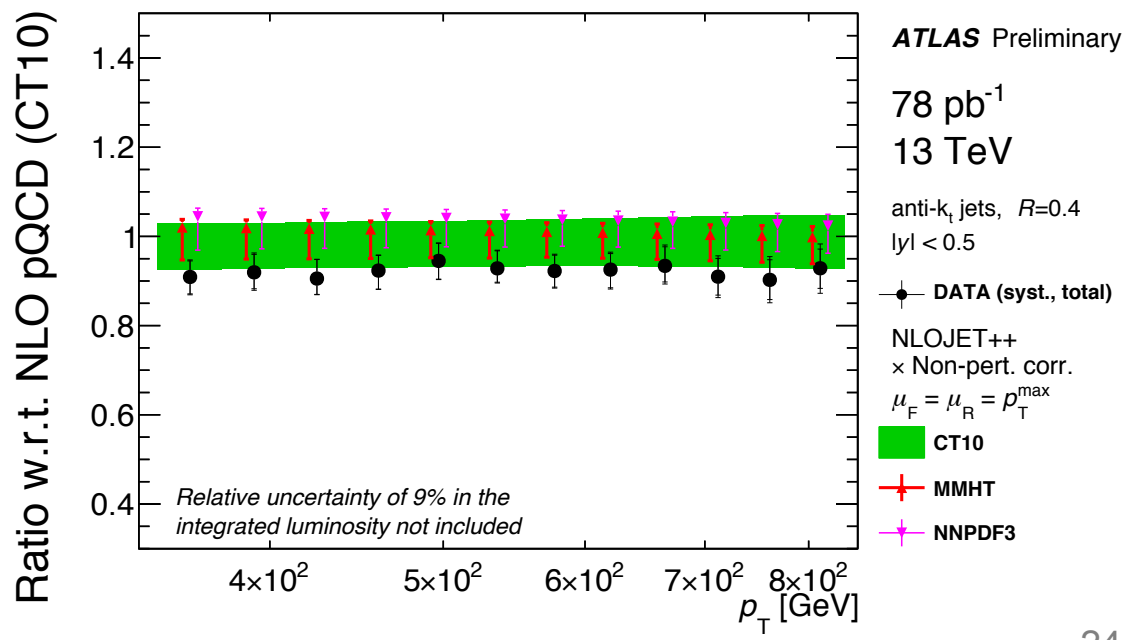
[ATLAS-CONF-2015-034] → Pavel Starovoitov

Measurement performed within fiducial region 350 < p_T < 840 GeV and $|y_{jet}|$ < 0.5:

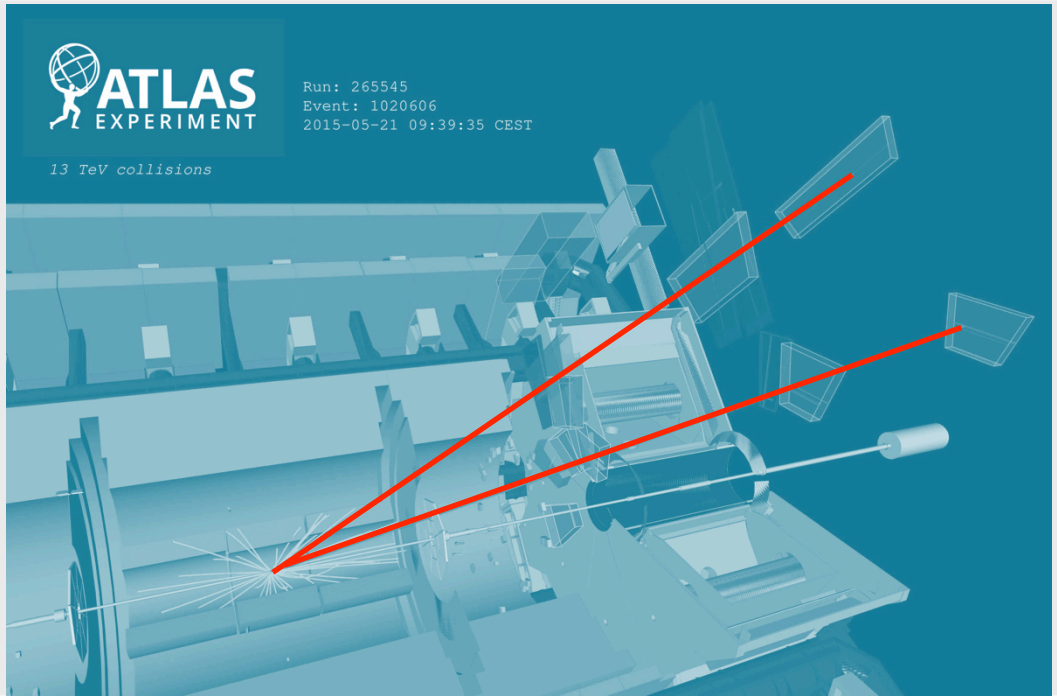
- Single jet trigger, fully efficient above 300 GeV jet p_T
- Reconstruct anti-k_t $R = 0.4$ jets, calibrated using MC and Run-1 data, validated in Run-2 data
- Unfold to particle level
- Dominant systematic uncertainty: jet energy scale and resolution

Compare with NLO theory (incl. PS+UE corrections) of measured diff. cross sections vs. p_T





Physics with leptons at 13 TeV



One of the very first J/Ψ → μμ candidates recorded by ATLAS in “quiet beam” conditions in May 2015

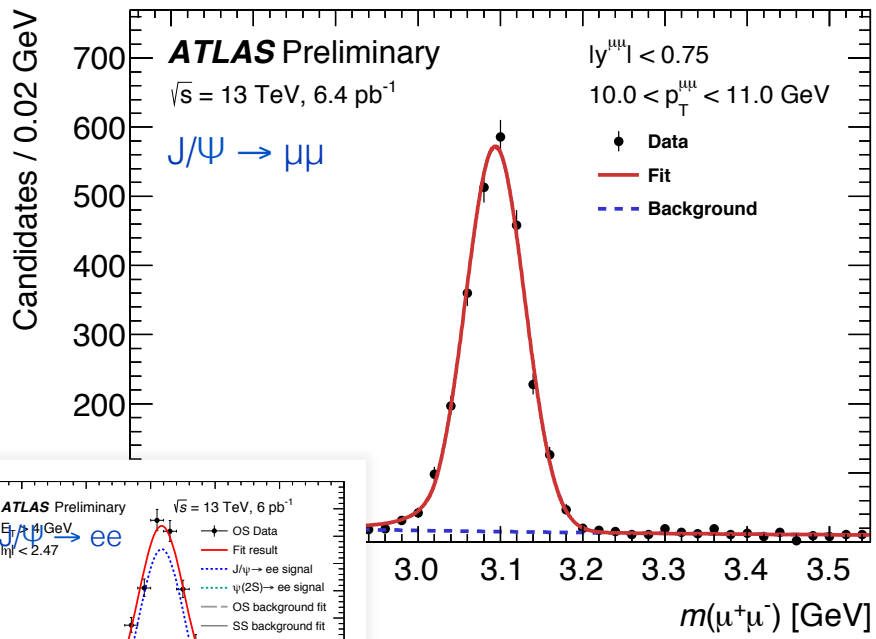
J/Ψ production at 13 TeV

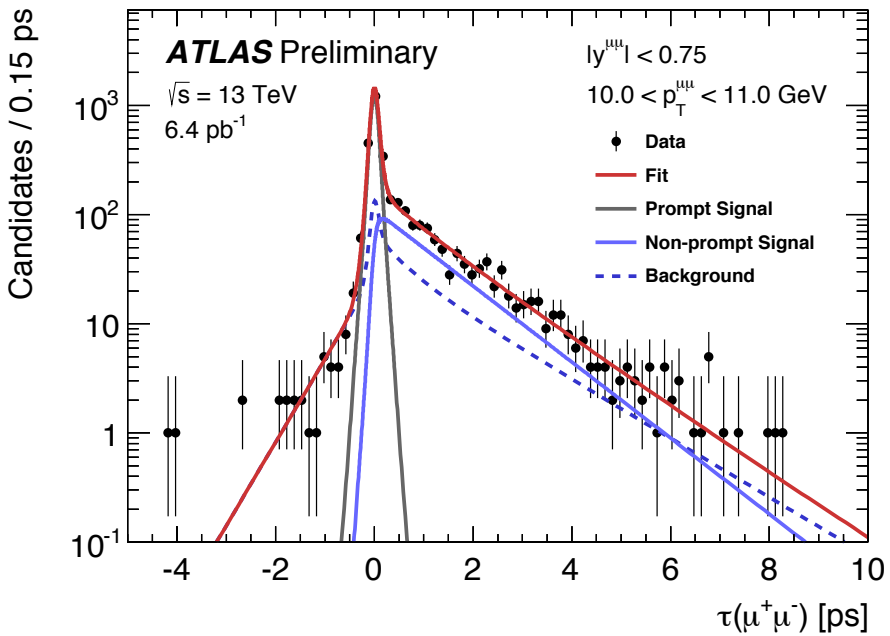
Good environment in early data with low trigger thresholds

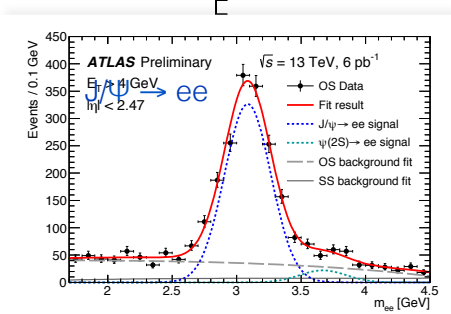
[ATLAS-CONF-2015-030
See also: ATLAS-CONF-2015-024]
→ Stefanos Leontsinis

J/Ψ are produced promptly and via weak decays of b-hadrons

Use the initial 6.4 pb^{-1} data to measure non-prompt J/Ψ fraction via 2D fit to $m_{\mu\mu}$ and proper decay time distribution: $\tau = L_{xy}\, m_{J/\Psi} / p_{T,\mu\mu}$







J/Ψ production at 13 TeV

Good environment in early data with low trigger thresholds

[ATLAS-CONF-2015-030
See also: ATLAS-CONF-2015-024]
→ Stefanos Leontsinis

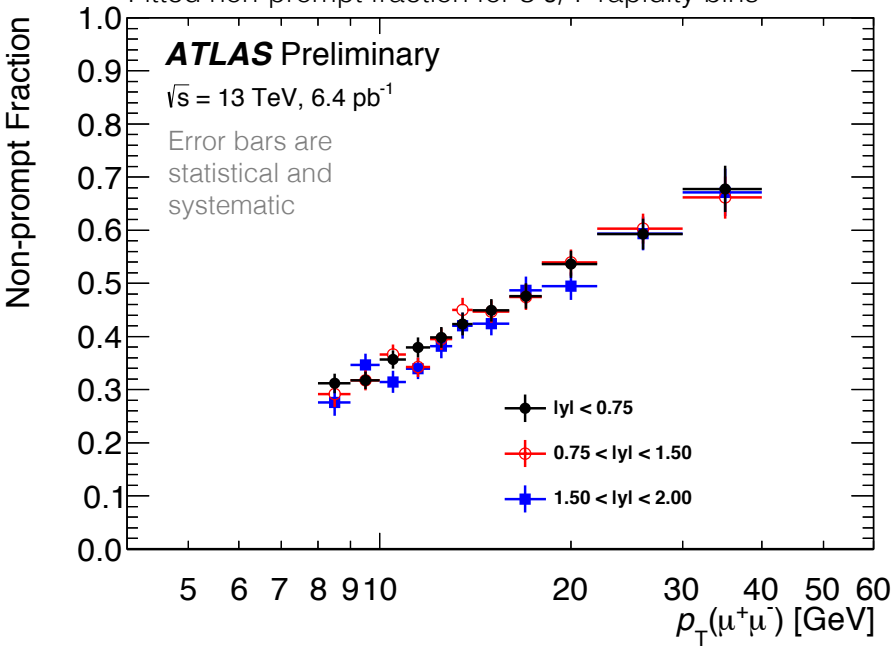
Selection:

$p_{T,\mu} > 4$ GeV, $|\eta_\mu| < 2.3$, $p_{T,\mu\mu} > 8$ GeV, $|y_{\mu\mu}| < 2$,
70k candidates, fully data-driven analysis

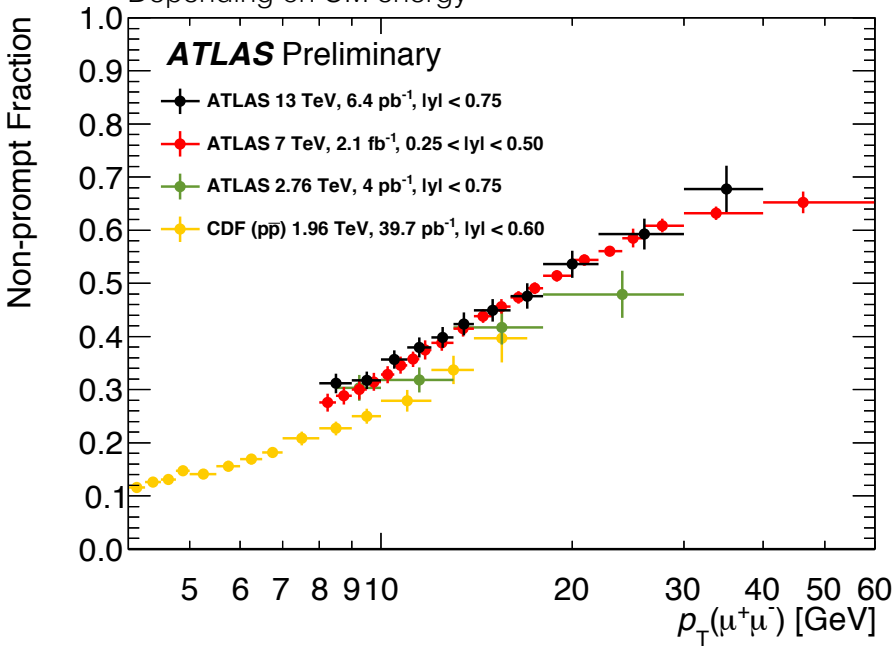
Non-prompt J/Ψ fraction:

$$f_b^{J/\psi} \equiv \frac{pp \to b + X \to J/\psi + X'}{pp \xrightarrow{\text{Inclusive}} J/\psi + X'}$$

Fitted non-prompt fraction for 3 J/Ψ rapidity bins

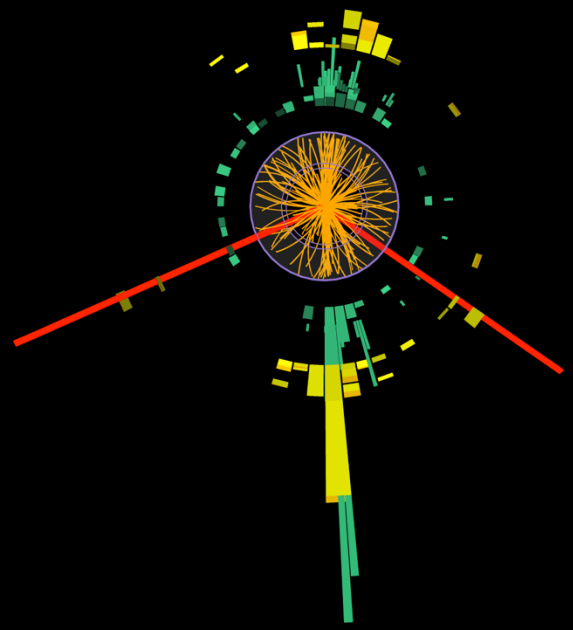


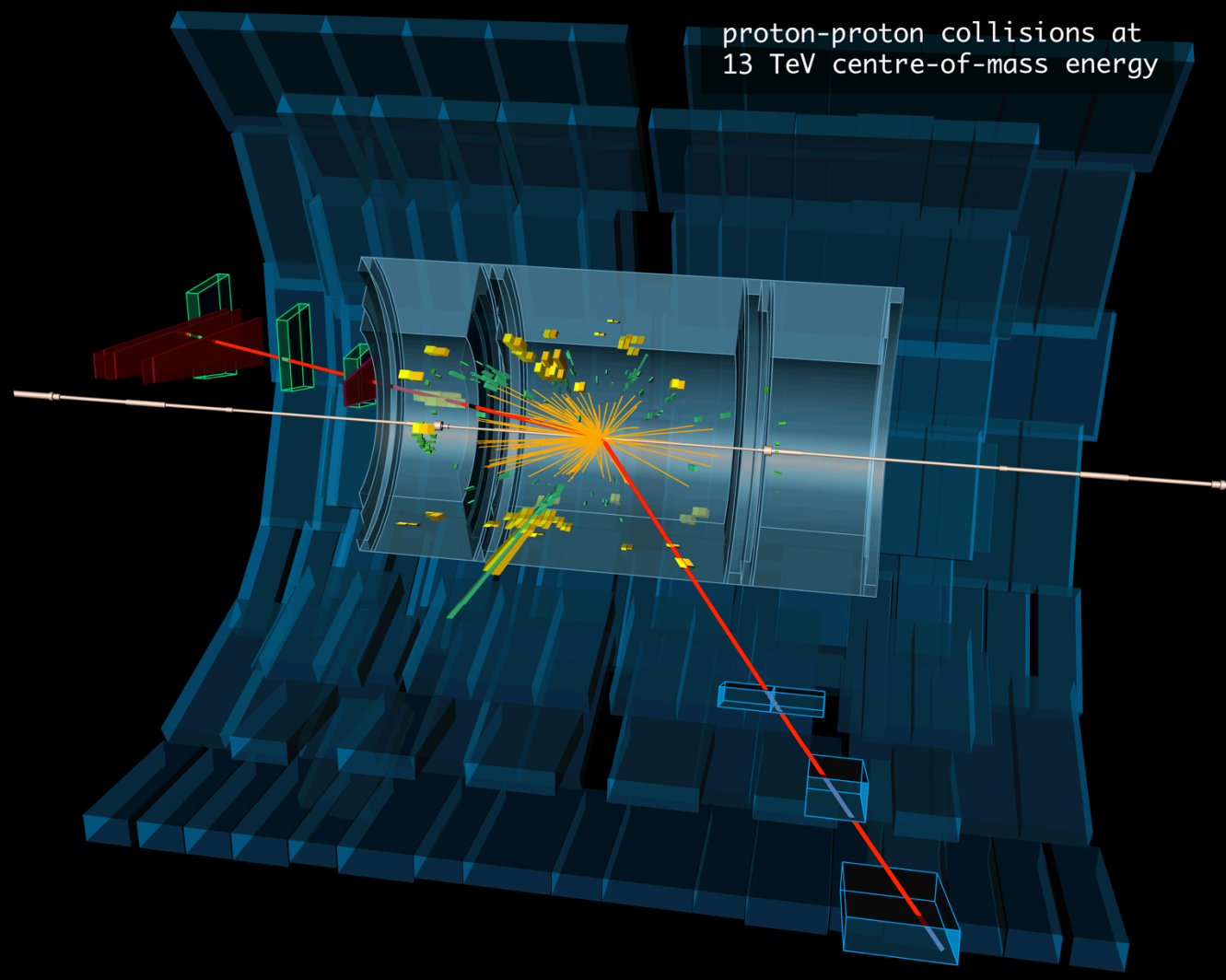
Depending on CM energy



Non-prompt contribution to total rate rises rise from approximately 25% at $p_{T,\mu\mu}$ of 8 GeV to 65% at 40 GeV

W and Z boson production at 13 TeV





ATLAS EXPERIMENT

Run: 267639
Event: 82839370
2015-06-14 11:20:48

Displays of one Z(→ μμ) + jets candidate event

Z and W production at 13 TeV

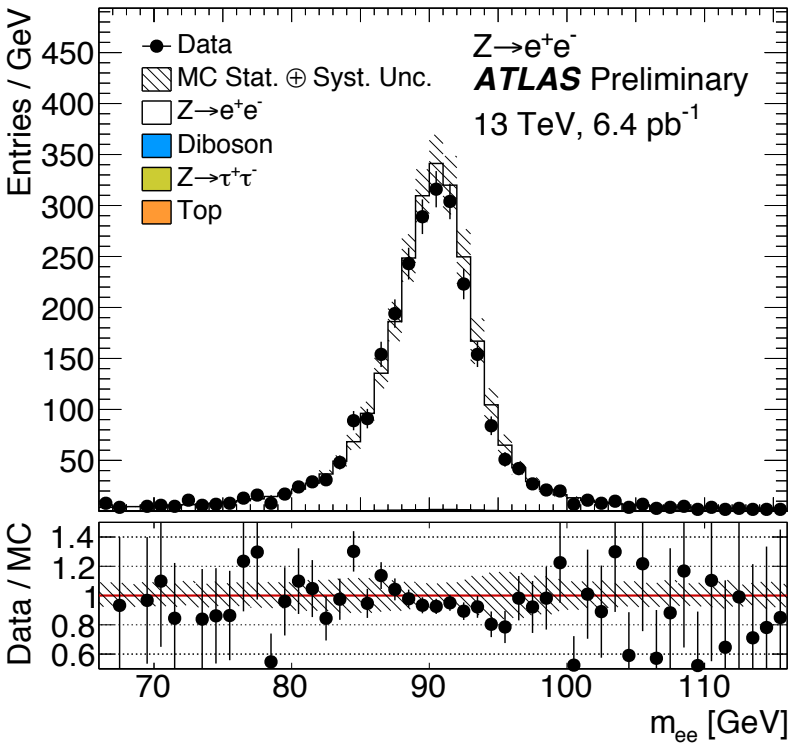
Expect increase of cross section by factors of 1.7 and 1.6, respectively

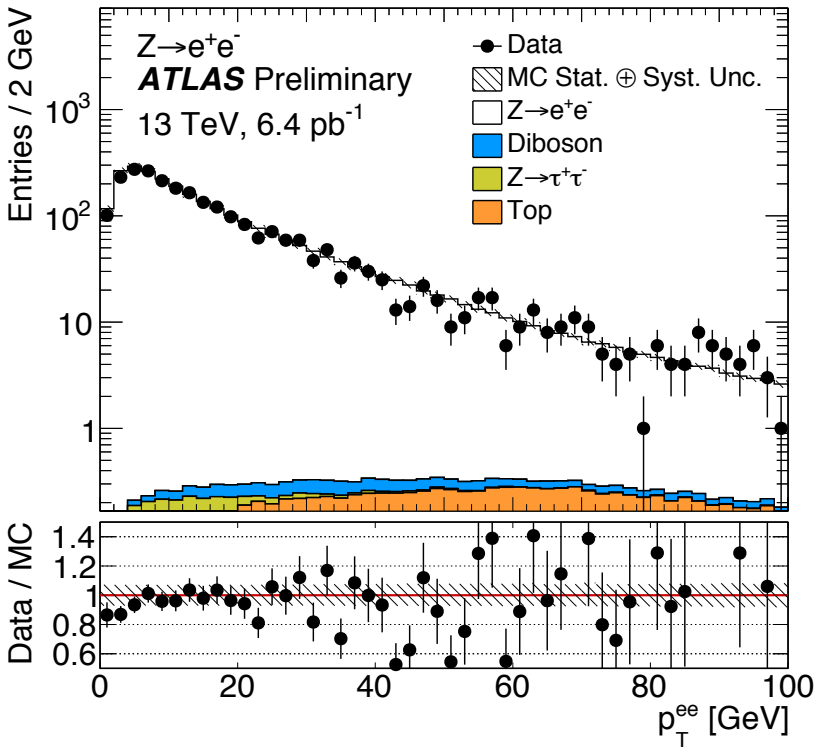
[ATL-PHYS-PUB-2015-021]
→ Markus Zinser

Leptonic decays are important standard candles to verify and calibrate e/μ performance

Following plots are normalised to NNLO QCD and to luminosity. Observed Z and W yields agree with SM expectations within uncertainty. Error bands in plots do not include 9% luminosity uncertainty

Electron identification scale factors from 8 TeV data and MC





Z and W production at 13 TeV

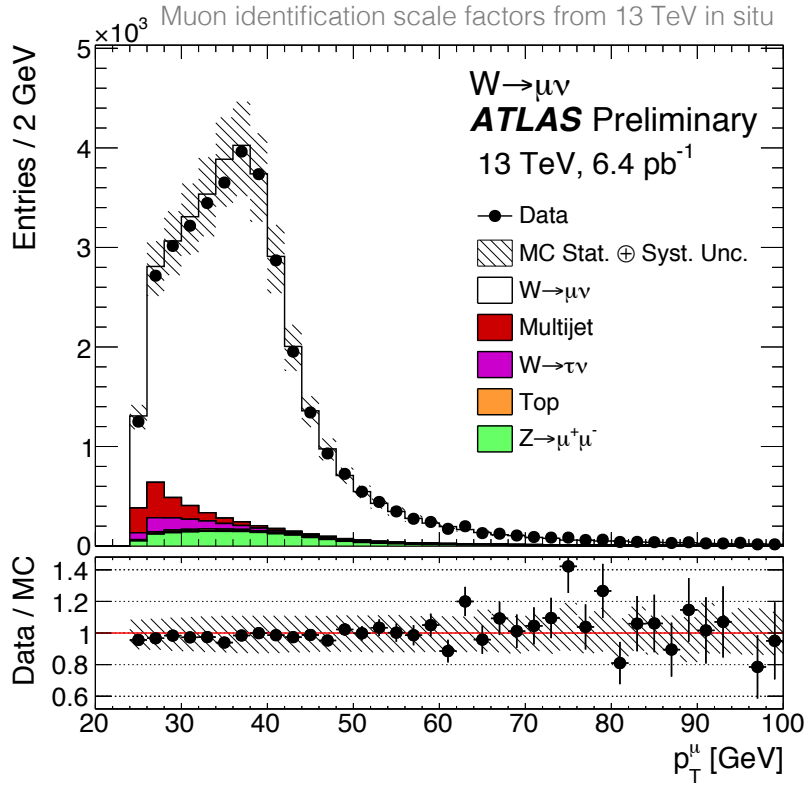
Expect increase of cross section by factors of 1.7 and 1.6, respectively

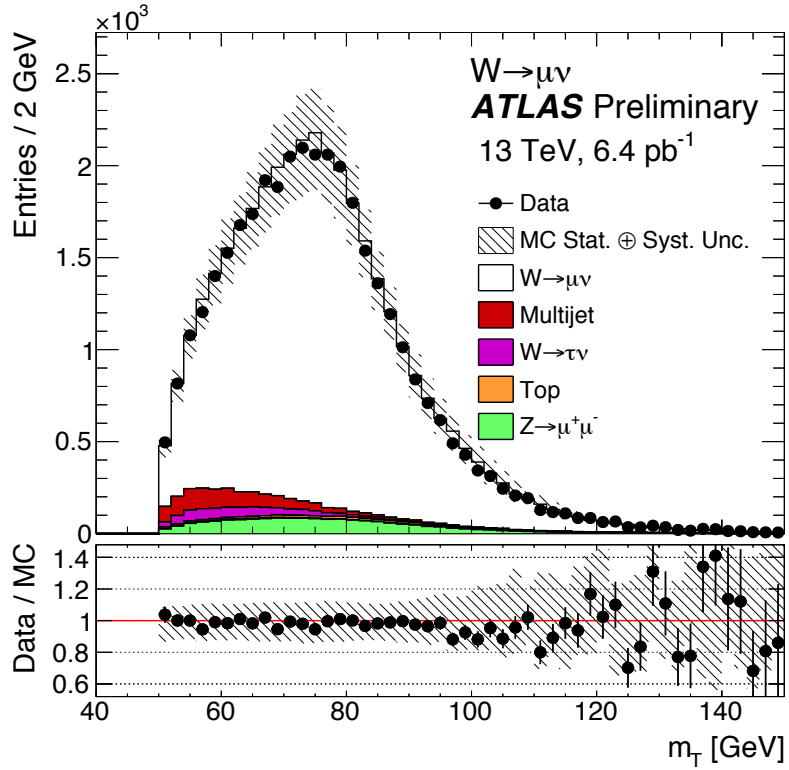
[ATL-PHYS-PUB-2015-021]
→ Markus Zinser

Leptonic decays are important standard candles to verify and calibrate e/μ performance

Following plots are normalised to NNLO QCD and to luminosity. Observed Z and W yields agree with SM expectations within uncertainty. Error bands in plots do not include 9% luminosity uncertainty

Muon identification scale factors from 13 TeV in situ





Large number of additional kinematic distributions in ATL-PHYS-PUB-2015-021

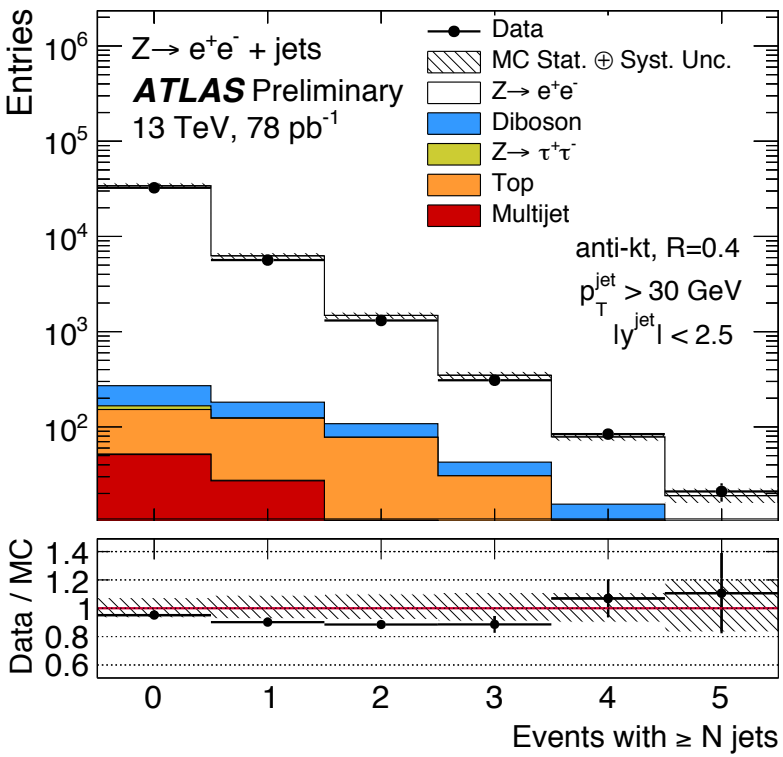
Z and W production at 13 TeV

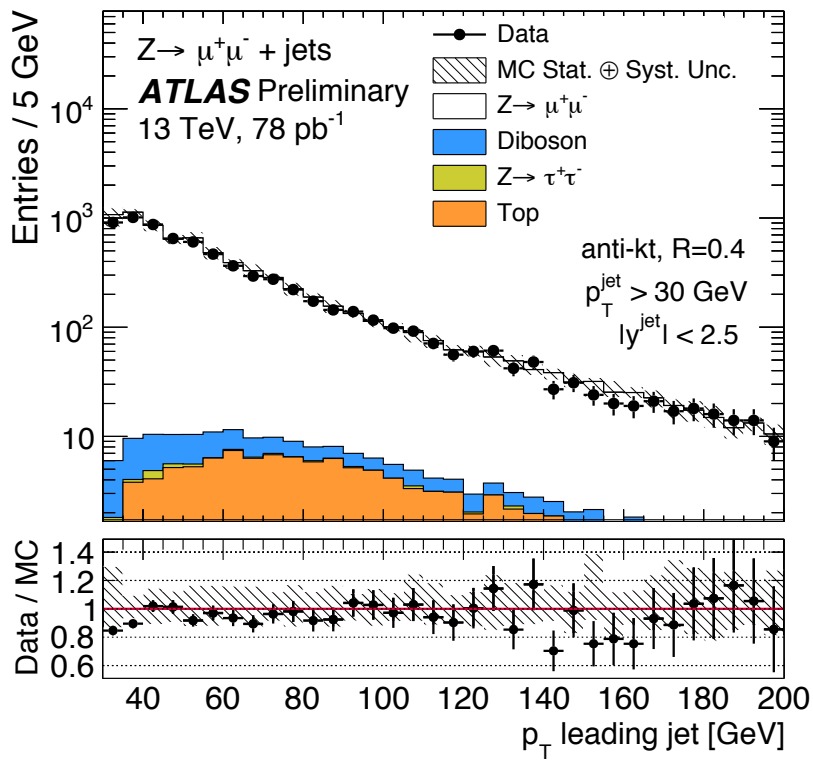
Expect increase of cross section by factors of 1.7 and 1.6, respectively

[ATL-PHYS-PUB-2015-021]
→ Markus Zinser

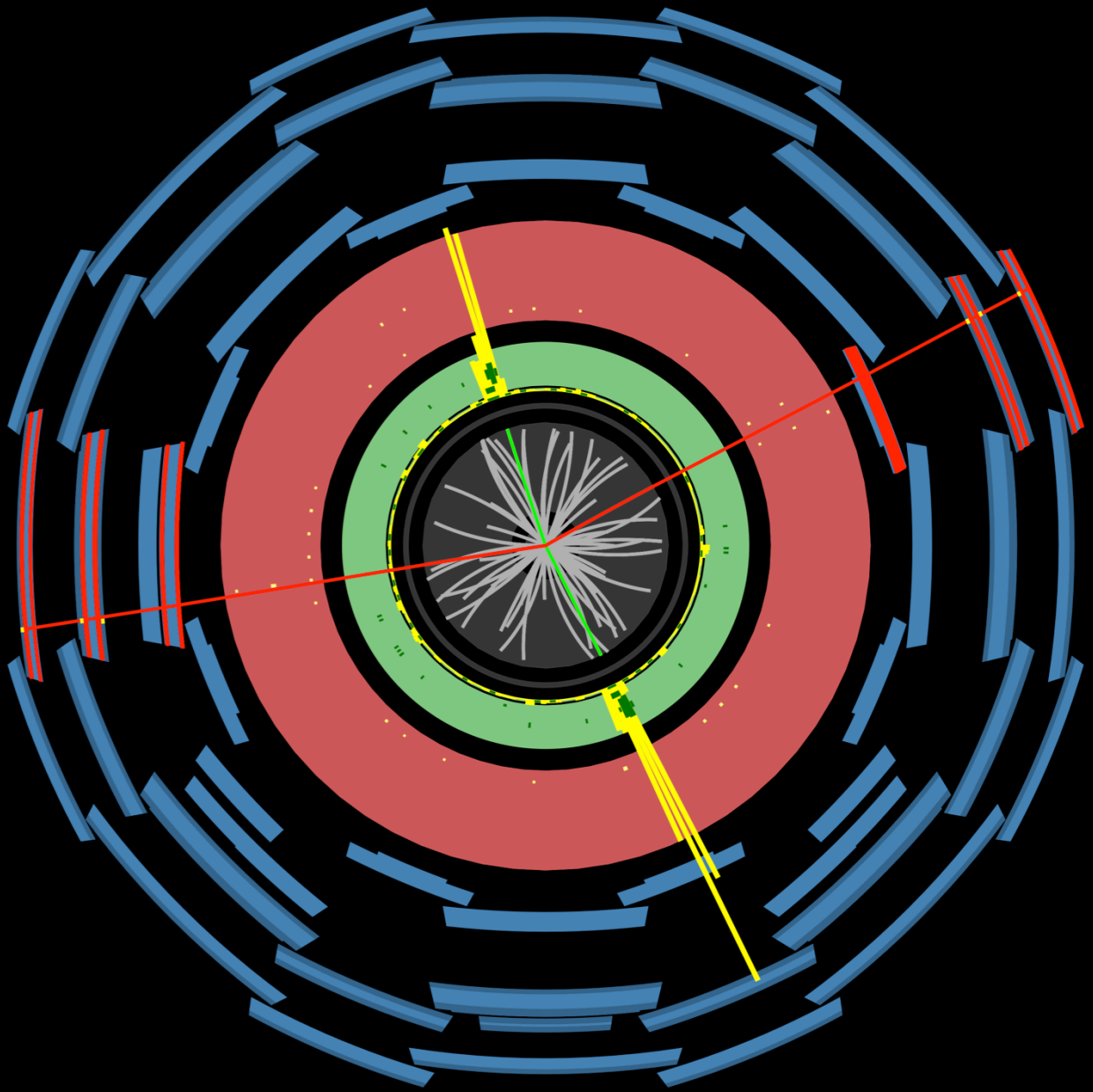
We also looked into Z production in association with jets

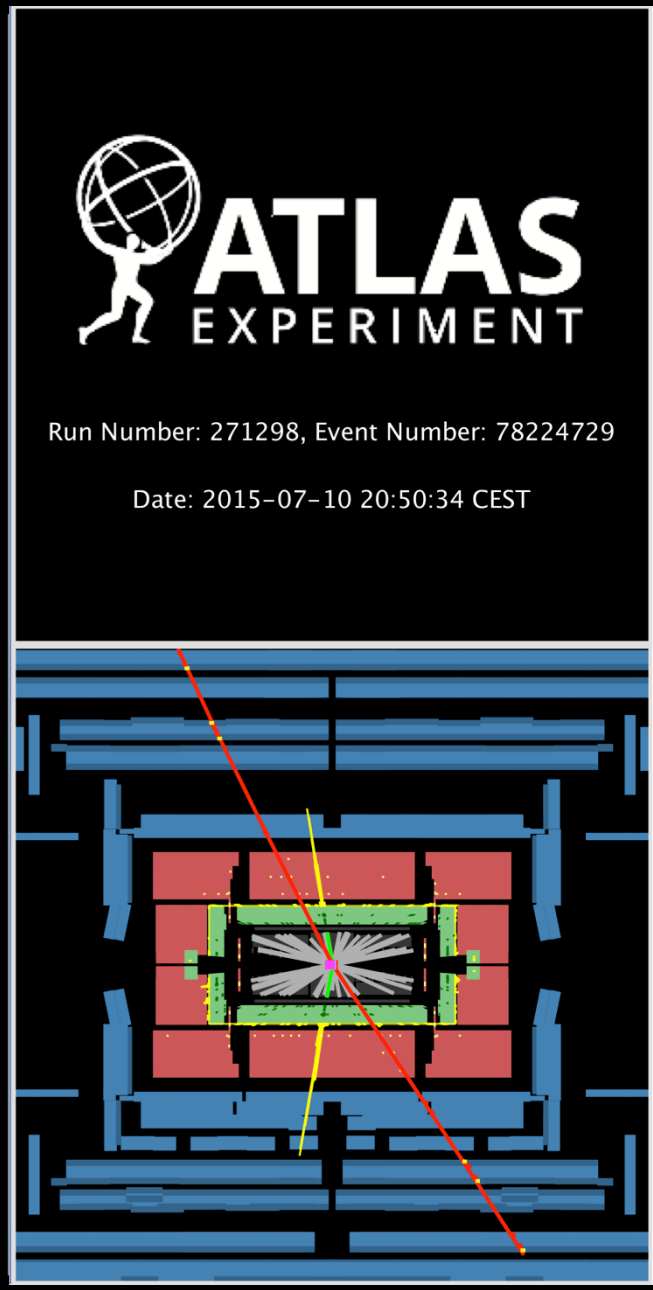
Important channel for QCD studies and background to new physics searches.
Good description by SHERPA 2.1 generator (up to 2 partons at NLO, 4 partons at LO ME)
(note: detector level plots)



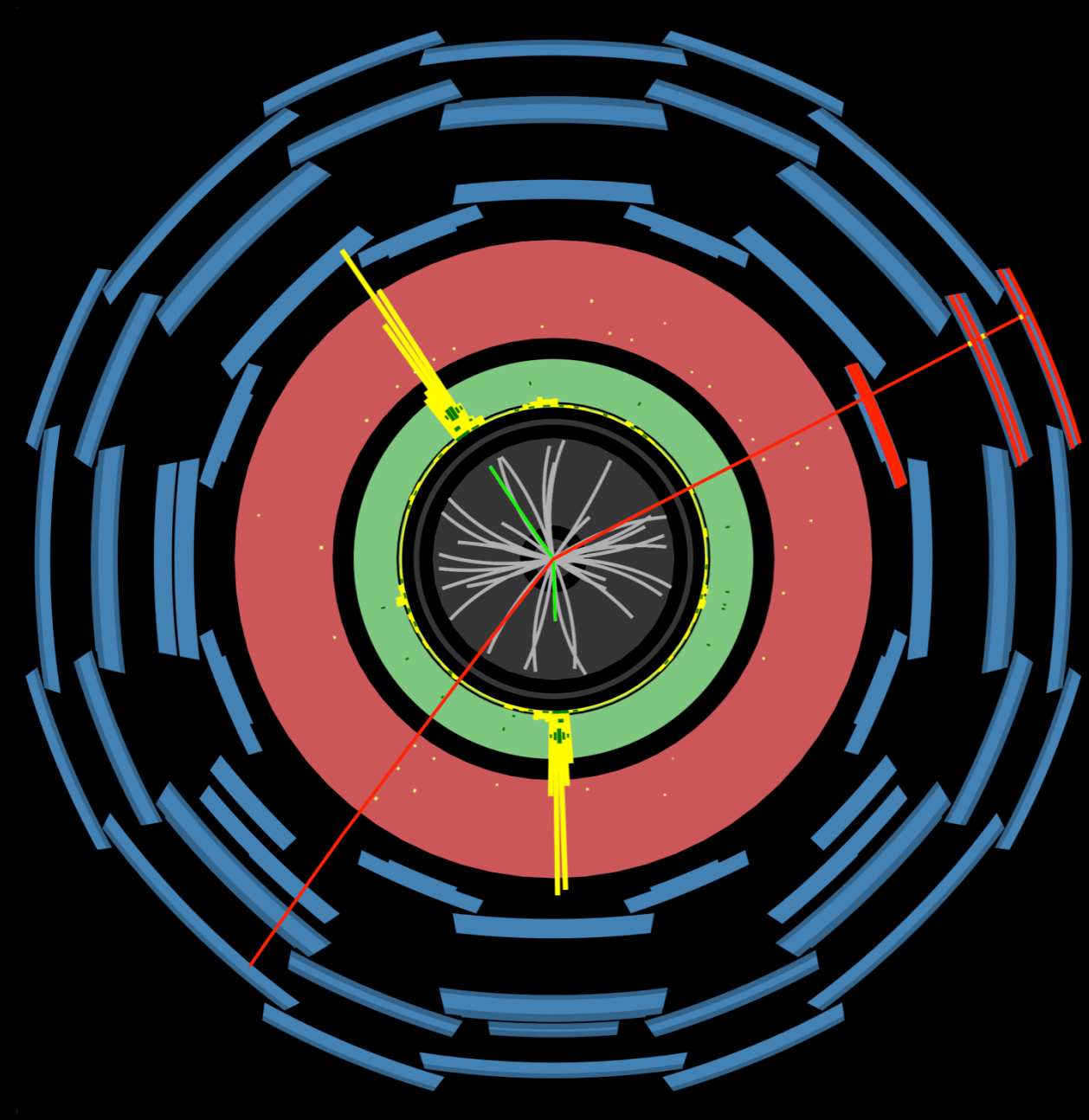


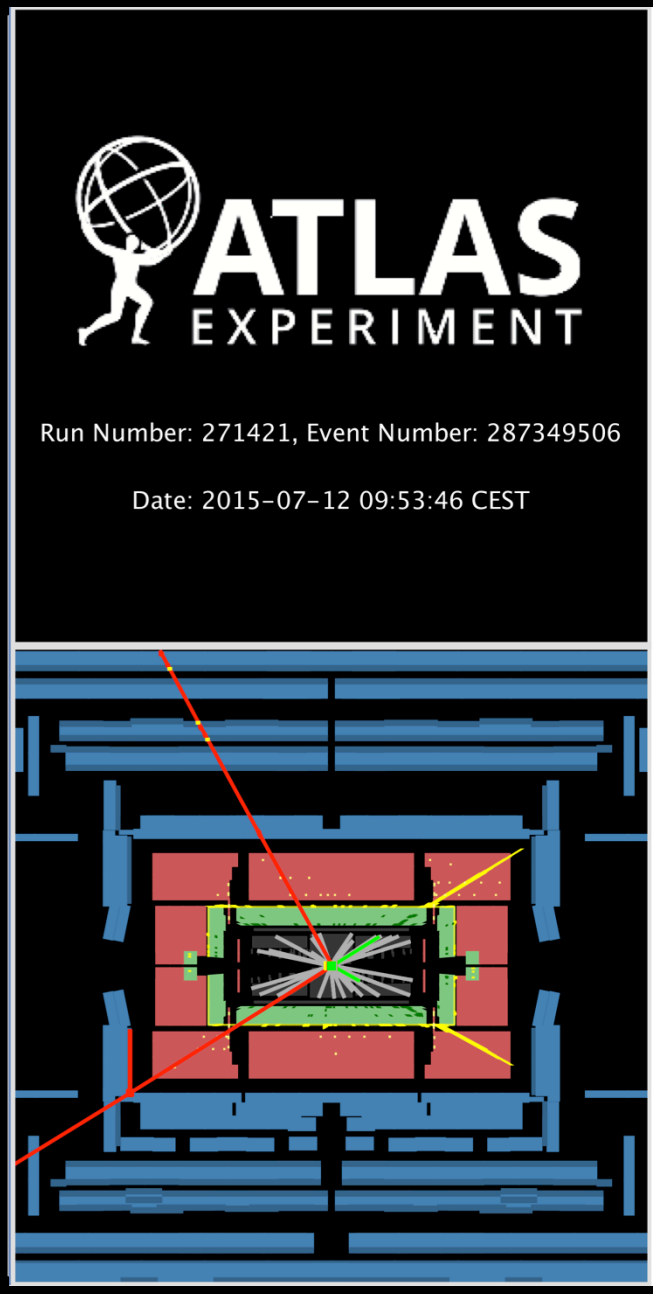
Display of $ZZ \rightarrow \mu^+\mu^- + e^+e^-$ candidate event ($m_{\mu\mu\,/\,ee}$ = 94 / 86 GeV, $m_{\mu\mu ee}$ = 191 GeV)



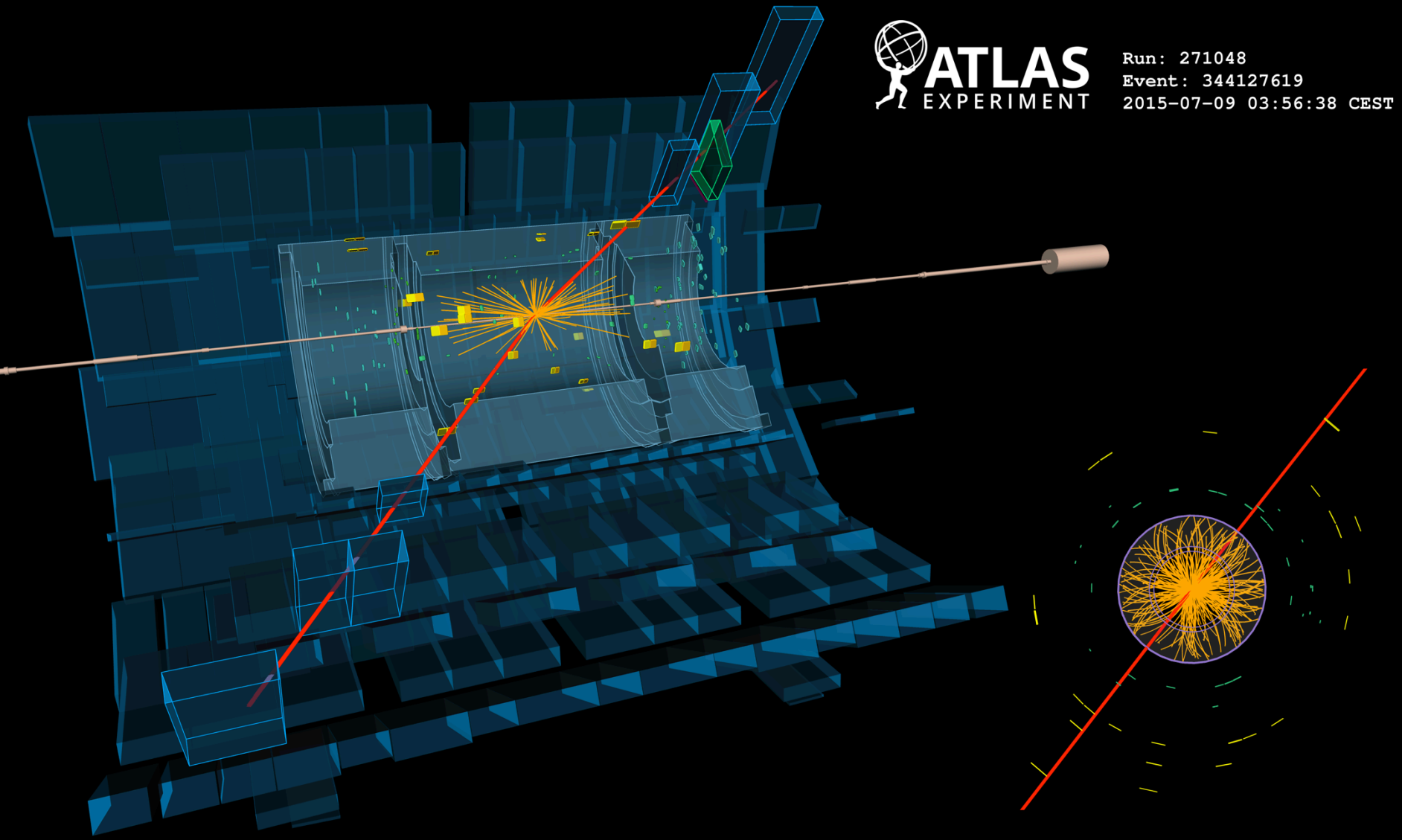


Display of ZZ → $\mu^+\mu^-$ + e^+e^- candidate event ($m_{\mu\mu\,/\,ee}$ = 90 / 92 GeV, $m_{\mu\mu ee}$ = 305 GeV)





Display of $\mu^+\mu^-$ event with 881 GeV invariant mass



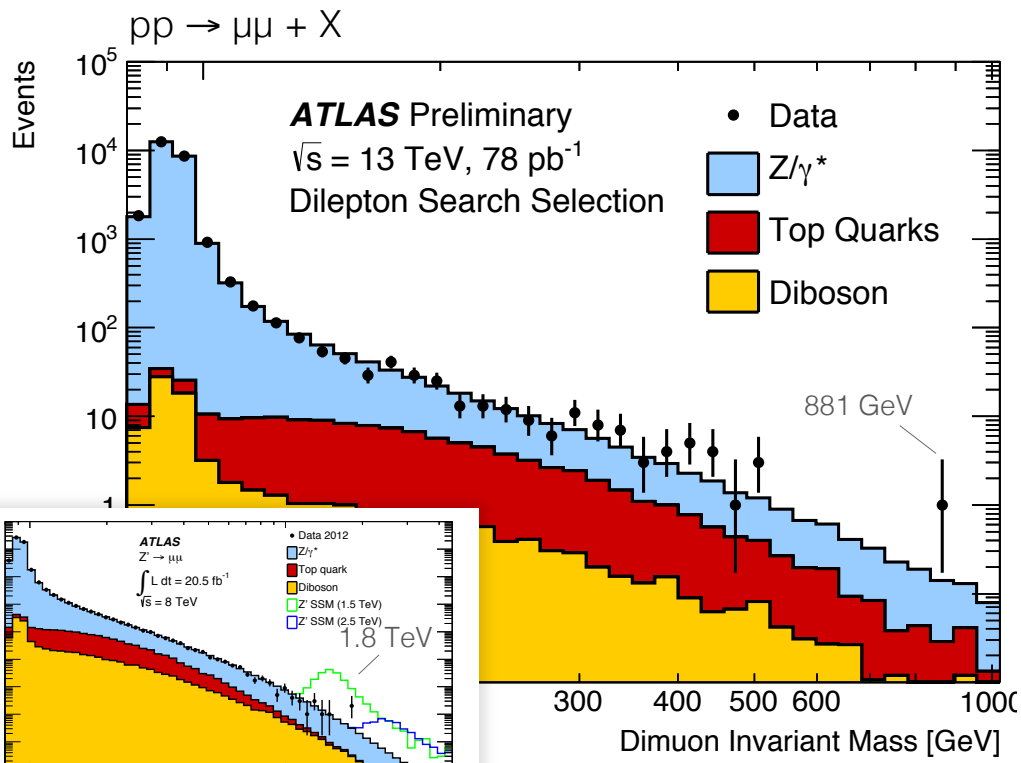
High-mass dilepton production

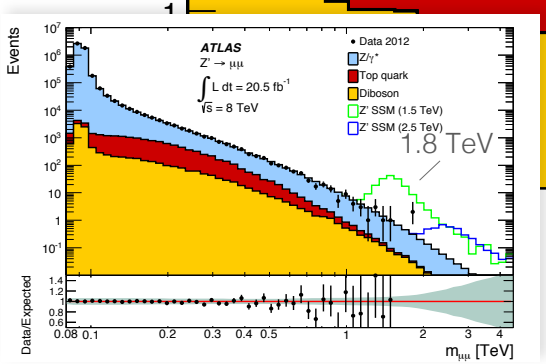
Insufficient luminosity yet to challenge Run-1 sensitivity to new physics

[EXOT-2015-001, EXOT-2015-004]
→ Woiciech Fedorko

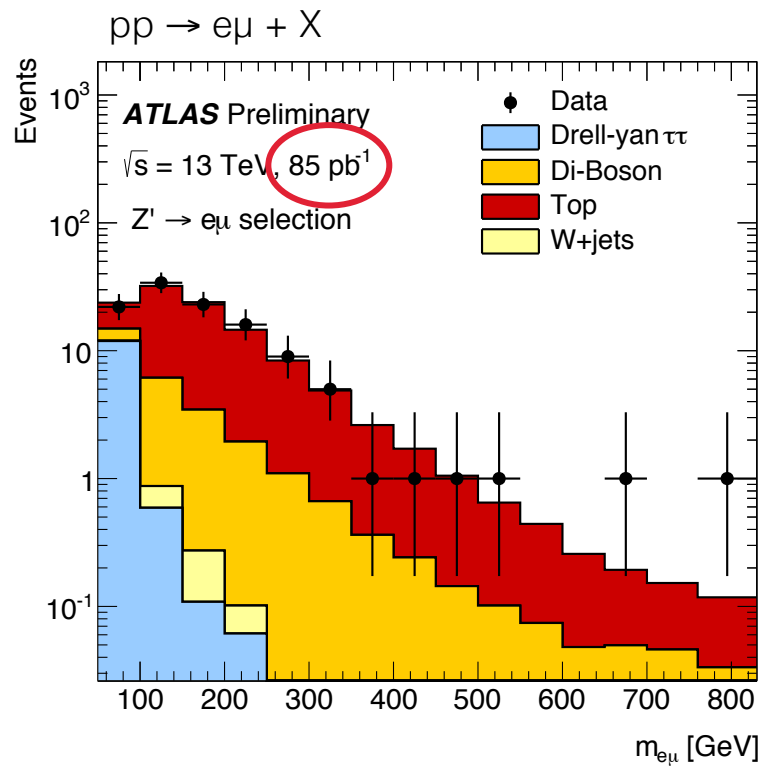
Drell-Yan production at high q^2

Dominant irreducible backgrounds taken from MC simulation, DY normalised to Z peak



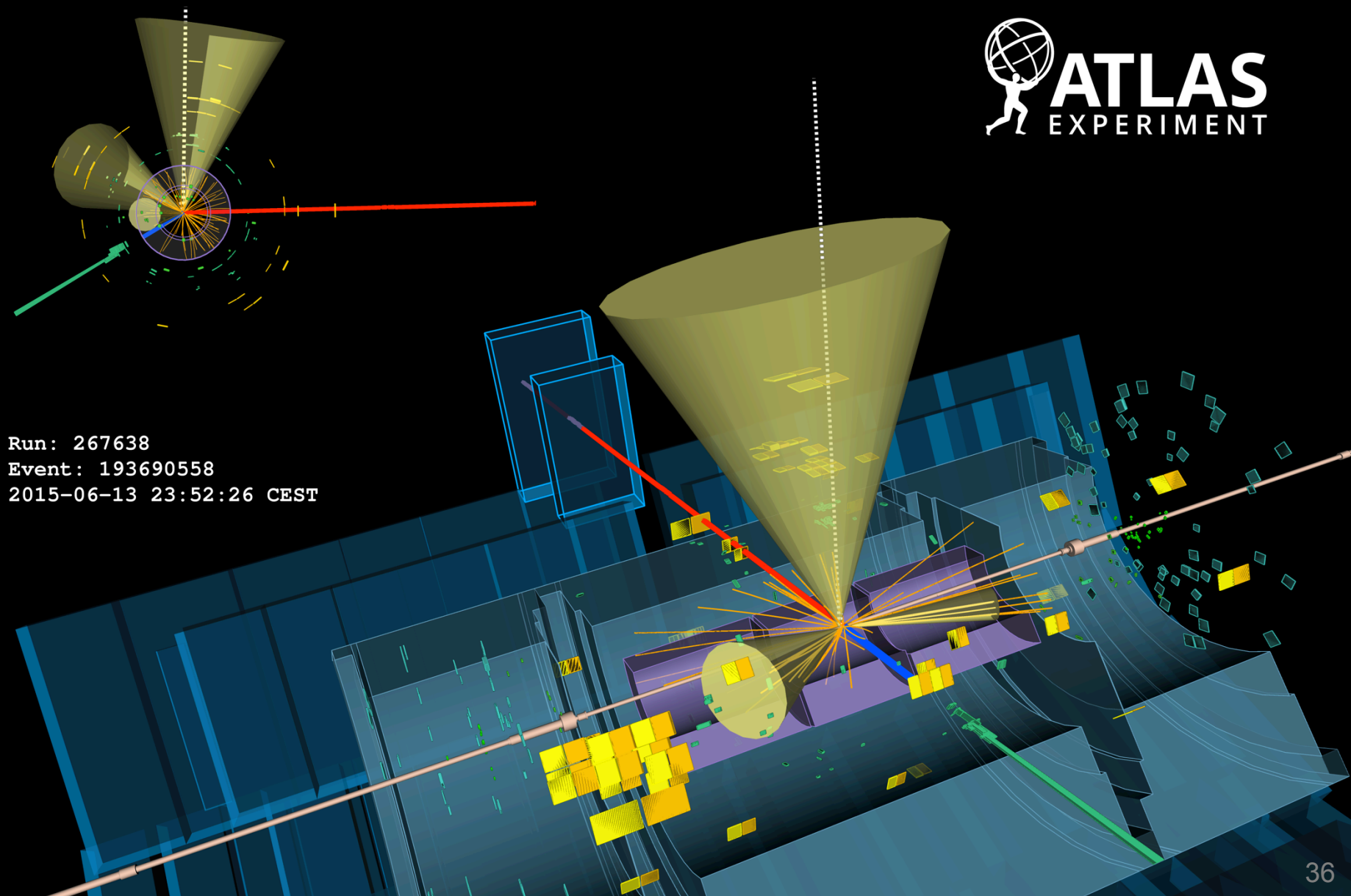


[20.3 fb^{-1}, 8 TeV, arXiv:1405.4123]



Display of tt → eμ + 2 b-jets candidate event

Top-quark production at 13 TeV



Top-antitop production at 13 TeV

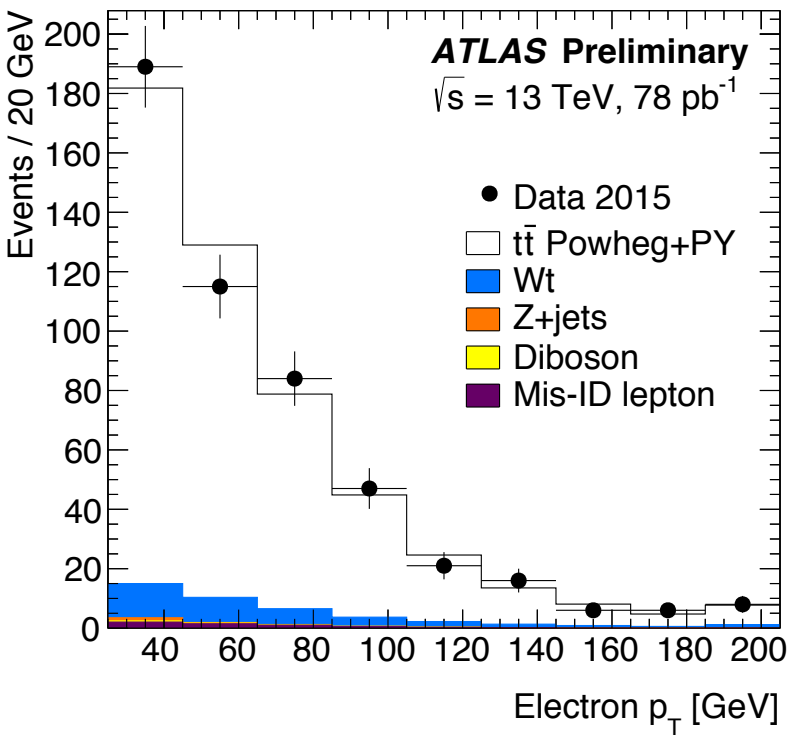
Expect increase of 8 TeV cross section by a **factor of 3.3**

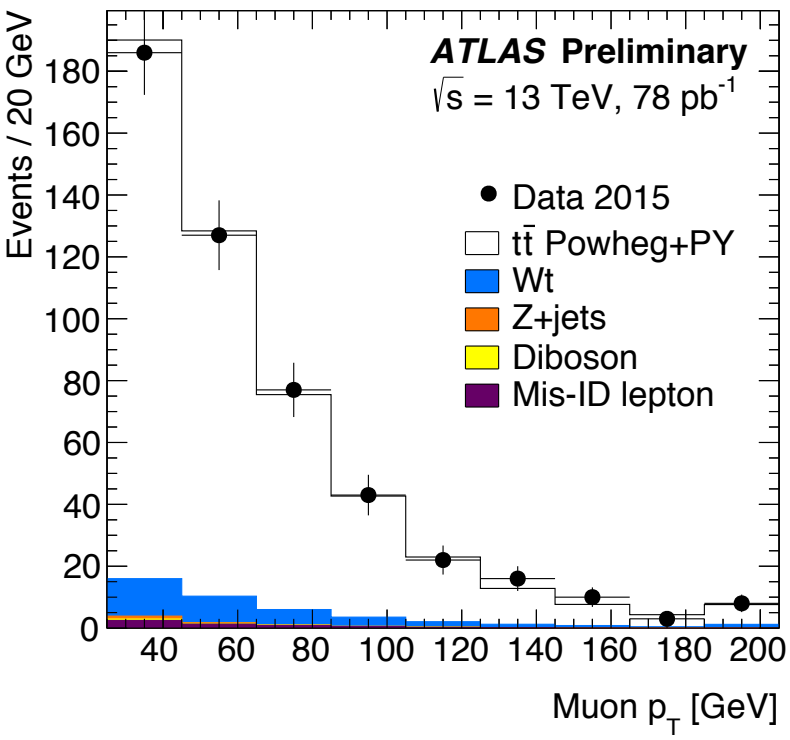
[ATLAS-CONF-2015-033]

Cleanest channel: tt → (e + ν + b-jet) + (μ + ν + b-jet) = eμ + 2 b-jets + $E_{T,\mathrm{miss}}$

Select: OS electrons & muons with p_T > 25 GeV, at least one b-tagged jet with p_T > 25 GeV
(clean channel, no $E_{T,\mathrm{miss}}$ requirement needed → reduce systematics)

Shape comparison only. MC normalised to data





Top-antitop production at 13 TeV

Extraction of top-pair cross section

[ATLAS-CONF-2015-033]

Apply robust data-driven method that provided most precise Run-1 measurements (7, 8 TeV)

Following relation allows to simultaneously determine σ_{tt} and ε_b from data

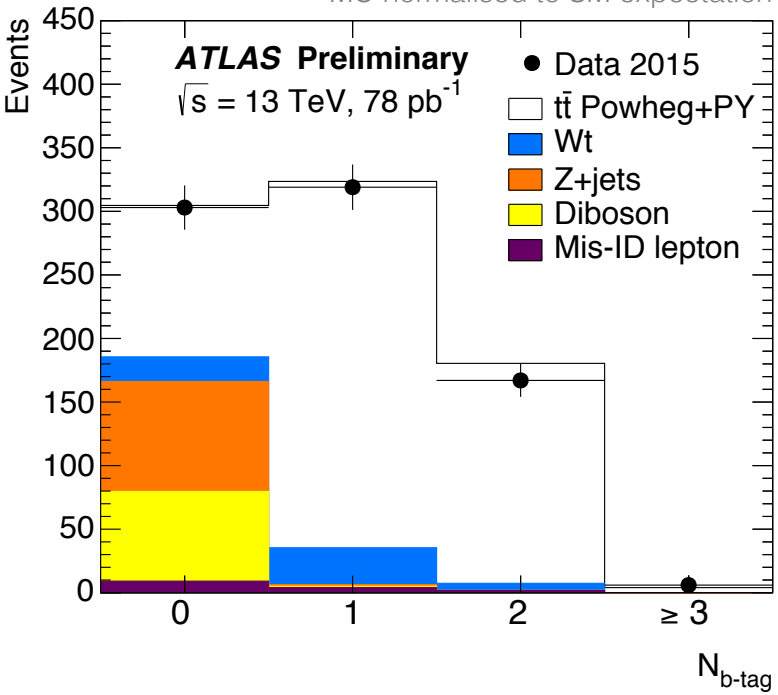
$$N_1 = L \cdot \sigma_{t\bar{t}} \cdot \varepsilon_{e\mu} \cdot 2\varepsilon_b \cdot \left(1 - C_b \varepsilon_b\right) + N_1^{bkg}$$

$$N_2 = L \cdot \sigma_{t\bar{t}} \cdot \varepsilon_{e\mu} \cdot C_b \varepsilon_b^2 + N_2^{bkg}$$

Where:

- $N_{1(2)}$ – number of selected events with 1(2) b-tags
- $N_{1(2)}^{bkg}$ – number of background events with 1(2) b-tags
- L – luminosity of data sample
- $\varepsilon_{e\mu}$ – (tt →) eμ selection eff & acc (~0.9%) incl. BR
- ε_b – probability to b-tag q from t → Wq
- $C_b = \varepsilon_{bb} / \varepsilon_b$ is non-factorisation correction (1.005 ± 0.006 from MC)

MC normalised to SM expectation



Observe: $N_1 = 319$, $N_2 = 167$

Expect: $N_1^{bkg} = 37.3 \pm 5.5$, $N_2^{bkg} = 8.5 \pm 3.5$,
dominated by Wt (MC, approx. NNLO), then mis-id. e/μ (MC & data)

Top-antitop production at 13 TeV

Extraction of top-pair cross section

[ATLAS-CONF-2015-033]

Solving the equation gives the following 13 TeV pp → tt + X cross section

$$\sigma_{tt}\ (13\ \text{TeV}) = 825 \pm 49\ (\text{stat}) \pm 60\ (\text{syst}) \pm 83\ (\text{lumi})\ \text{pb}$$

Total relative uncertainty of 14% (4.3% at 8 TeV)

$\sigma_{tt}[\text{SM}]\ (13\ \text{TeV}) = 832^{+40}_{-46}$ pb (at NNLO + NNLL accuracy, m_t = 172.5 GeV, Top++ 2.0)

Systematic uncertainty (7.3%) dominated by

- tt hadronisation (4.5%) → large Pythia8 / Herwig++ parton shower effect, to be further studied
- tt NLO modelling, ISR/FSR radiation & PDF (2.9%)
- Electron ID + isolation (4.2%)
- Muon ID + isolation (1.6%)
- Lepton mis-identification (1.3%)
- Lepton triggers (1.3%)

→ will improve with more data

Overall uncertainty dominated by luminosity (9%) → will improve with full van-der-Meer luminosity scan

We also measure: $\varepsilon_b = 0.527 \pm 0.026 \pm 0.006$, in good agreement with simulation: 0.543

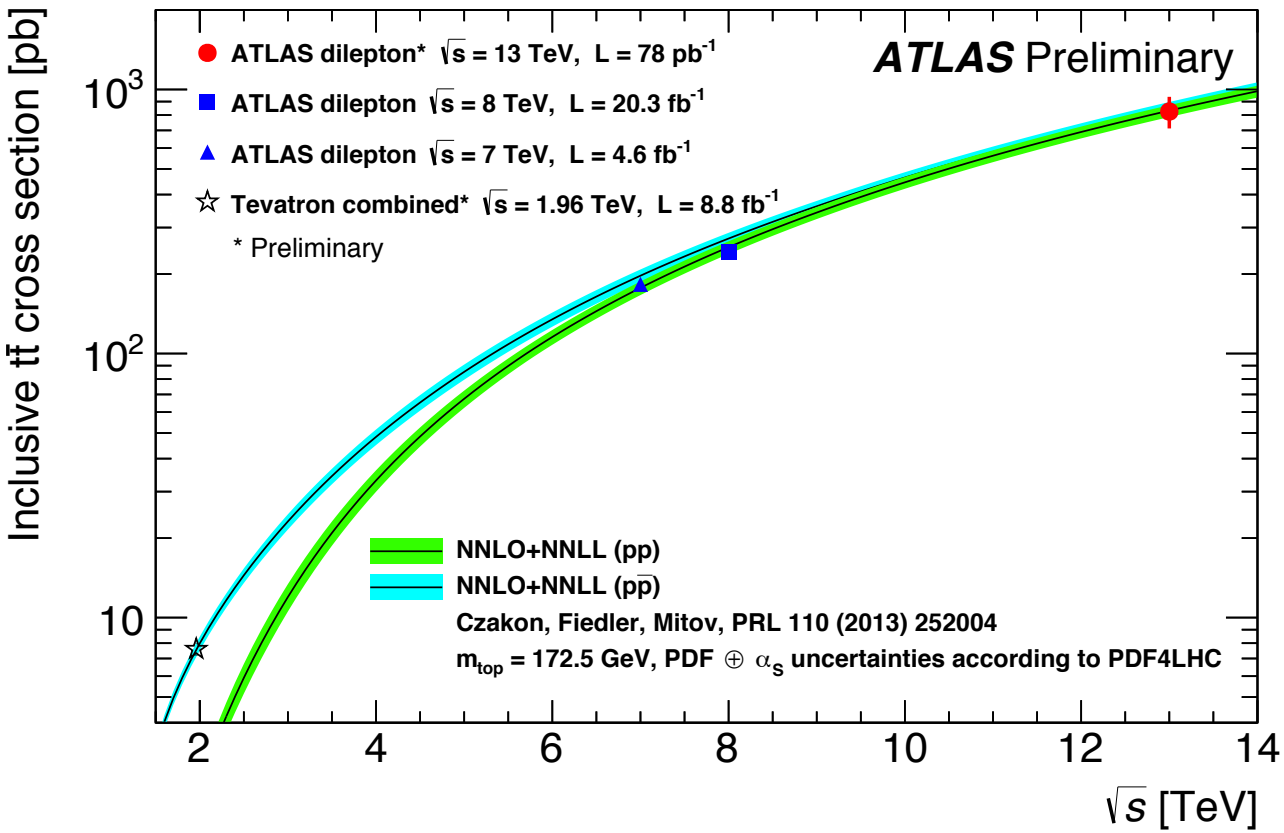
Top-antitop production at 13 TeV

Extraction of top-pair cross section

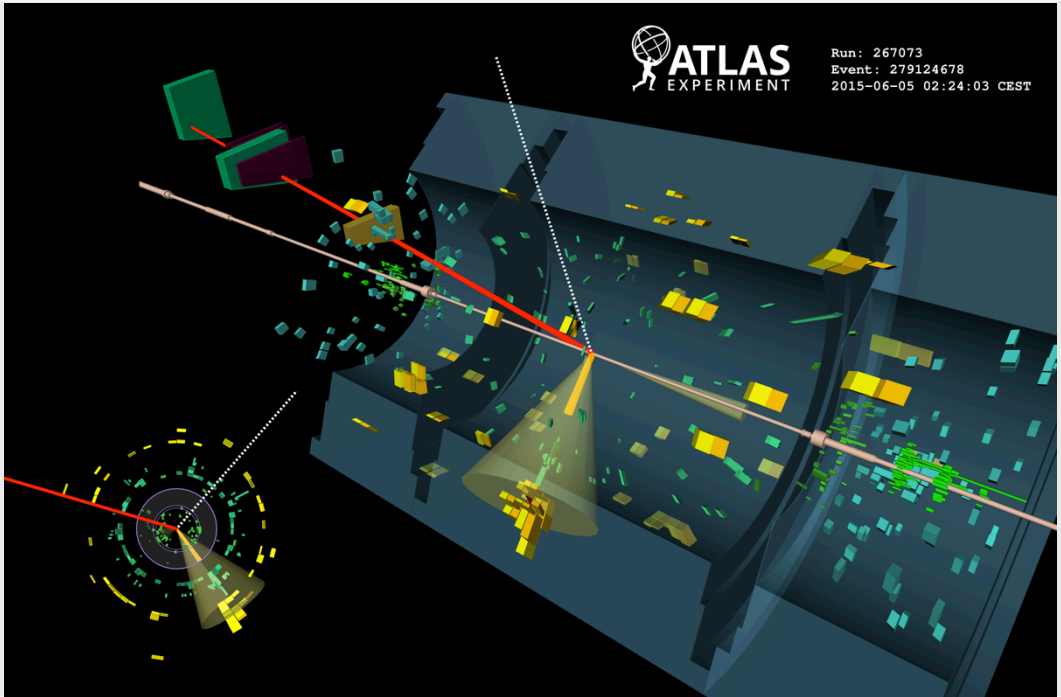
[ATLAS-CONF-2015-033]

Solving the equation gives the following 13 TeV pp → tt + X cross section

σ_{tt} (13 TeV) = 825 ± 49 (stat) ± 60 (syst) ± 83 (lumi) pb



Conclusions



Display of t-channel single-top candidate event: muon with p_T of 30 GeV, central b-tagged jet of 50 GeV, forward jet 30 GeV, $E_{T,\mathrm{miss}}$ of 40 GeV

Conclusions

The LHC is back again — great data for physics collected: thanks to the CERN accelerator teams for tireless efforts

ATLAS is fully engaged into analysis of 13 TeV data, only a fraction of work shown today

New detector systems, software & analysis model successfully integrated & commissioned

Remarkable understanding of new 13 TeV data after only a few weeks of running

Performed soft physics measurements including verification of “Ridge” at 13 TeV
Minimum bias and underlying event studies show good extrapolation from Run-1 tunes

Measurement of differential 13 TeV central jet cross section and photon studies

Early measurements of J/Ψ, W and Z production in agreement with expectations

Measurement of top-pair production cross section: heaviest particle known at highest collider energies ever reached — consistently predicted by the Standard Model

See next pages for a full list of ATLAS references to 13 TeV physics & performance analysis documents

List of 13 TeV ATLAS references for EPS-HEP 2015

PHYSICS OBJECT & TRIGGER PERFORMANCE

Tracking
https://twiki.cern.ch/twiki/bin/view/AtlasPublic/InDetTrackingPerformanceApprovedPlots

Tracking Performance	ATL-PHYS-PUB-2015-018
Vertexing Performance	ATL-PHYS-PUB-2015-026
Inner detector Alignment	ATL-PHYS-PUB-2015-031
Hadronic resonances	IDTR-2015-006
IP resolution Run 1 vs Run 2	IDTR-2015-007

Jet and missing transverse momentum
https://twiki.cern.ch/twiki/bin/view/AtlasPublic/JetEtMissPublicCollisionResults

Jet cleaning	ATLAS-CONF-2015-029
Early MET studies	ATL-PHYS-PUB-2015-027
MET performance for 13 TeV	ATL-PHYS-PUB-2015-023
Jet performance for 13 TeV	ATL-PHYS-PUB-2015-031
Uncertainty treatment	ATL-PHYS-PUB-2015-014

Electron and photon
https://twiki.cern.ch/twiki/bin/view/AtlasPublic/ElectronGammaPublicCollisionResults

Electron ID in Z / $J/\psi \rightarrow ee$	EGAM-2015-003
Photon reconstruction	EGAM-2015-004
Photon ID efficiencies	EGAM-2015-002

Muon
https://twiki.cern.ch/twiki/bin/view/AtlasPublic/MuonPerformancePublicPlots

ID and reconstruction	MUON-2015-002
Early reconstruction plots	MUON-2015-001

Tau
https://twiki.cern.ch/twiki/bin/view/AtlasPublic/MuonPerformancePublicPlots

Early 13 TeV commissioning	ATL-PHYS-PUB-2015-025

Trigger
https://twiki.cern.ch/twiki/bin/view/AtlasPublic/TriggerPublicResults#Public_results_from_signature_gr

The above link points to results from all trigger signatures

Use CDS to find 'PUB' and 'CONF' notes: https://cds.cern.ch

Performance plots (eg, IDTR-2015-007, that is not 'CONF' or 'PUB')
can be directly accessed via the following bulk address: https://atlas.web.cern.ch/Atlas/GROUPS/PHYSICS/PLOTS

For example, for 'IDTR-2015-007', the link is:
https://atlas.web.cern.ch/Atlas/GROUPS/PHYSICS/PLOTS/IDTR-2015-007

List of 13 TeV ATLAS references for EPS-HEP 2015

PHYSICS ANALYSIS

Standard Model
https://twiki.cern.ch/twiki/bin/view/AtlasPublic/StandardModelPublicResults

Charged particle spectra	ATLAS-CONF-2015-028
Underlying event study	ATL-PHYS-PUB-2015-019
Jet cross section	ATLAS-CONF-2015-034
Inclusive photon study	ATL-PHYS-PUB-2015-016
Diphoton study	ATL-PHYS-PUB-2015-020
W and Z production study	ATL-PHYS-PUB-2015-021

Heavy ions
https://twiki.cern.ch/twiki/bin/view/AtlasPublic/HeavyIonsPublicResults

Two-particle correlations	ATLAS-CONF-2015-027

B-physics and quarkonia
https://twiki.cern.ch/twiki/bin/view/AtlasPublic/BPhysPublicResults

Non-prompt J/Ψ production	ATLAS-CONF-2015-030

Top
https://twiki.cern.ch/twiki/bin/view/AtlasPublic/TopPublicResults

Top-antitop cross section	ATLAS-CONF-2015-033
Top kinematic distributions	ATL-PHYS-PUB-2015-017

SUSY performance studies
https://twiki.cern.ch/twiki/bin/view/AtlasPublic/SupersymmetryPublicResults

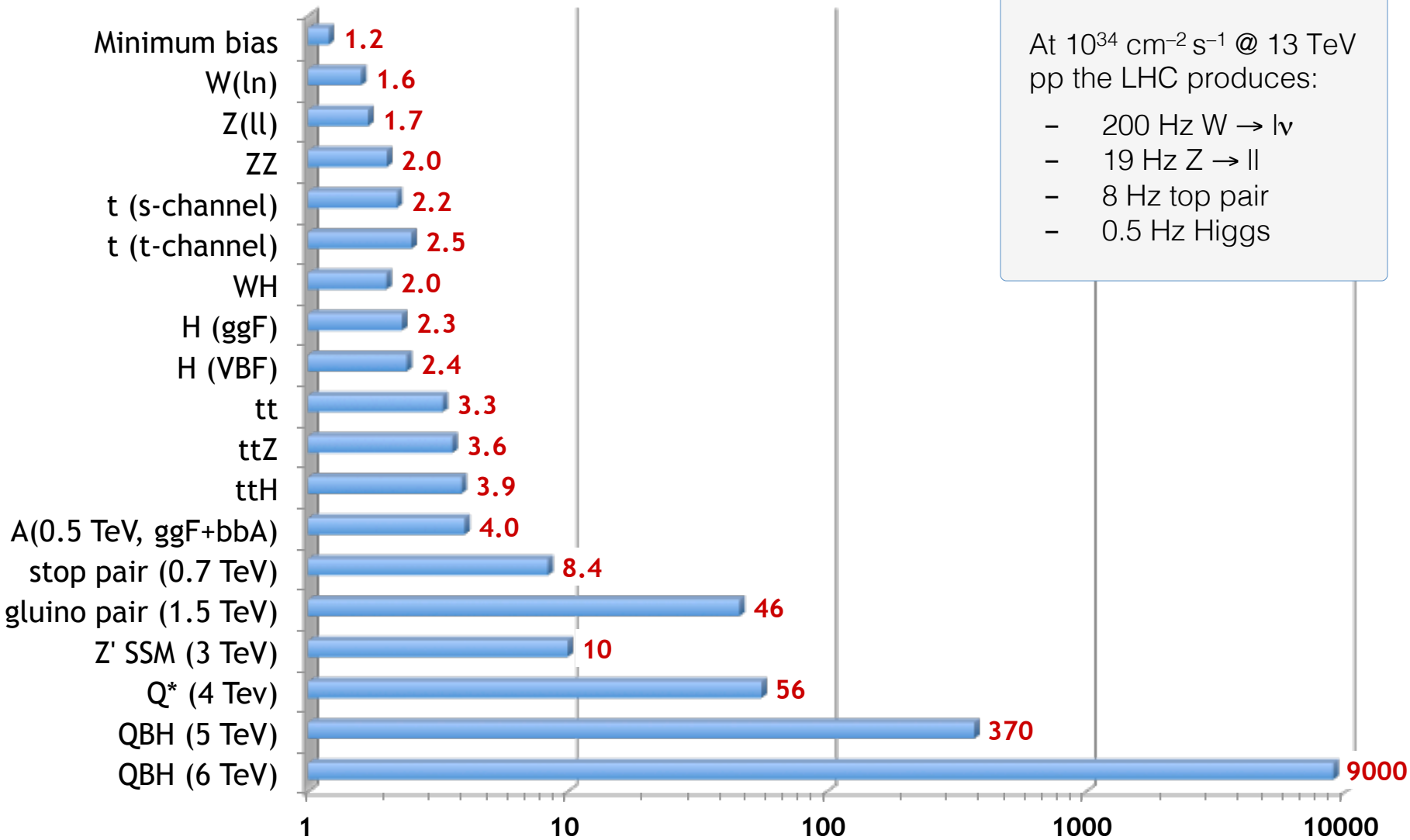
0-lepton + 2–6 jets + MET	ATL-PHYS-PUB-2015-028
1-lepton + 2–6 jets + MET	ATL-PHYS-PUB-2015-029
0-lepton + 6–7 jets + MET	ATL-PHYS-PUB-2015-030

Exotics performance studies
https://twiki.cern.ch/twiki/bin/view/AtlasPublic/ExoticsPublicResults

Z' → ll selection plots	EXOT-2015-001
Z' → eμ selection plots	EXOT-2015-004
W' → lν selection plots	EXOT-2015-002
Diphoton selection plots	EXOT-2015-003
Monojet selection plots	EXOT-2015-005
Mono-b-jet selection plots	EXOT-2015-007
Photon + MET trigger plot	EXOT-2015-006
Long-lived muon vertex plot	EXOT-2015-008

A few extra slides…

13 TeV / 8 TeV inclusive pp cross-section ratio

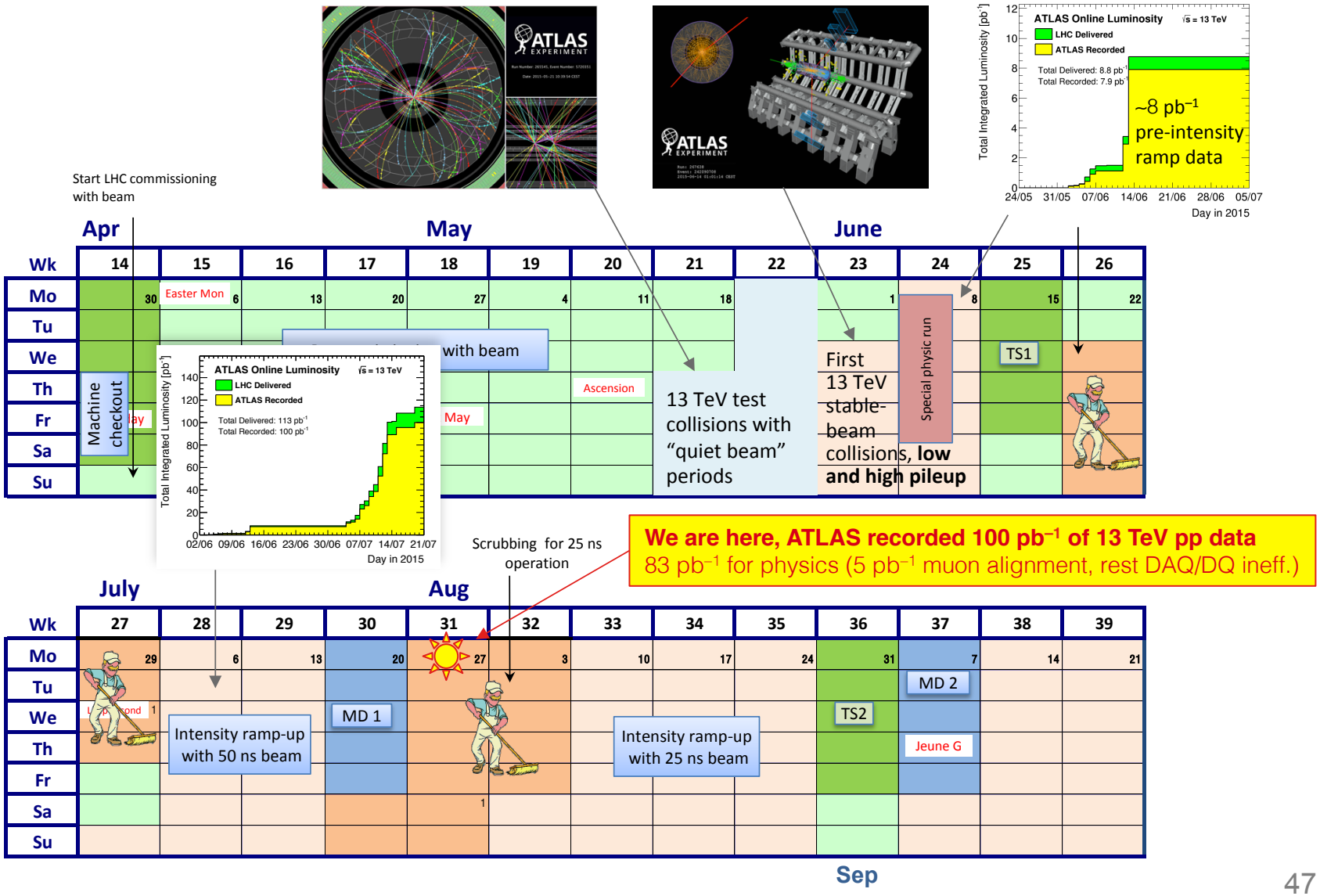


At 10^{34} cm^{-2} s^{-1} @ 13 TeV pp the LHC produces:

- 200 Hz W → lν
- 19 Hz Z → ll
- 8 Hz top pair
- 0.5 Hz Higgs

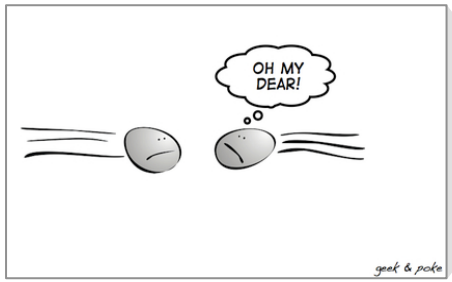
13 TeV data taking history

LHC schedule: https://espace.cern.ch/be-dep/BEDepartmentalDocuments/BE/LHC_Schedule_2015.pdf



The ATLAS data path in a nutshell

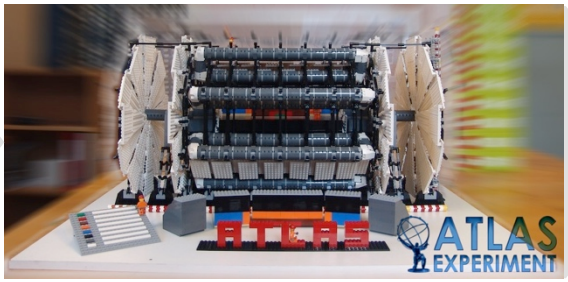
Large Hadron Collider



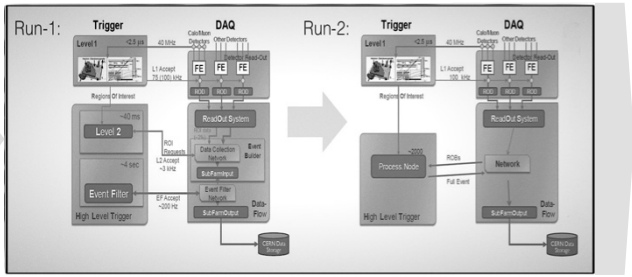
50 ns bunch distance

L_{max} ~ 1.7 $\times 10^{33}$ cm^{-2} s^{-1}

ATLAS Detector



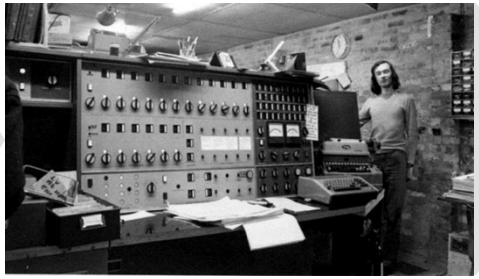
Trigger & Online monitoring



L1 (HW, up to 100 kHz) + HLT (SW, 1 kHz)

Low-threshold single lepton triggers, single MET and jet triggers, and low-threshold di-object & topological triggers

Calibration & Reconstruction



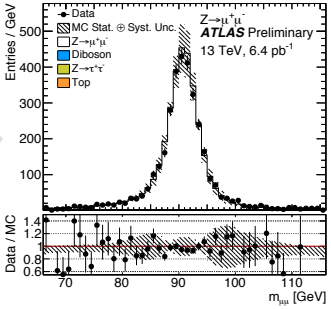
48h calibration & data quality processing, then prompt reconstruction of data in Tier-0

Distributed computing

Production of standardised derived datasets for physics and performance analysis

Also: MC production — 1.8 billion 13 TeV events

Analysis

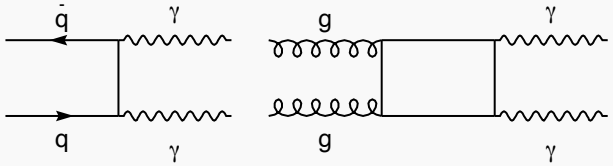


Performance groups provide standard physics objects with calibrations and uncertainties, unified in analysis release

Analysis groups build physics analyses upon this ground work

Diphoton production at 13 TeV

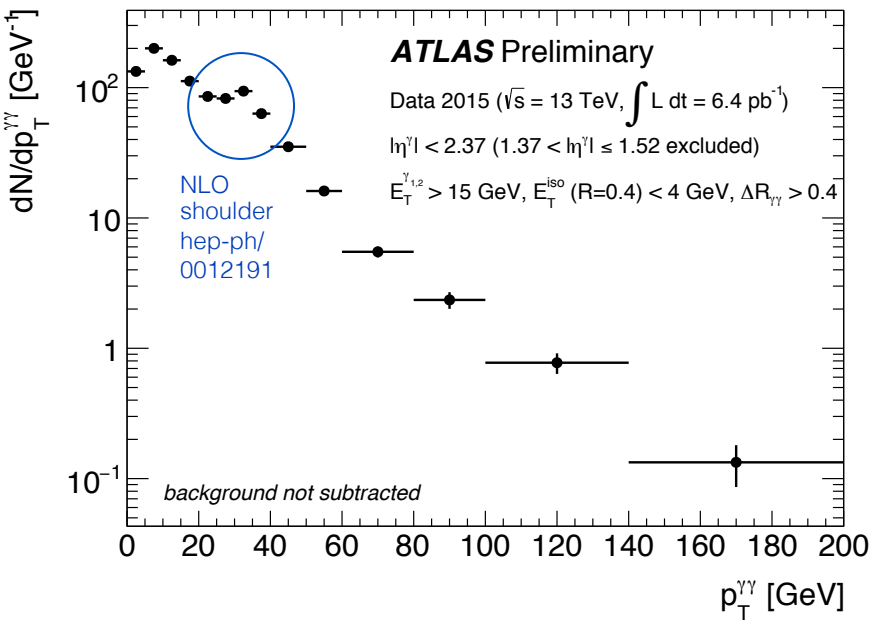
Irreducible background to Higgs, new physics sensitivity



[ATL-PHYS-PUB-2015-020, EXOT-2015-003]

Isolated diphoton yield

Raw diphoton p_T spectrum (not background subtracted)



Diphoton mass, compared to SM prediction