Standard Model Results from ATLAS at 13 TeV

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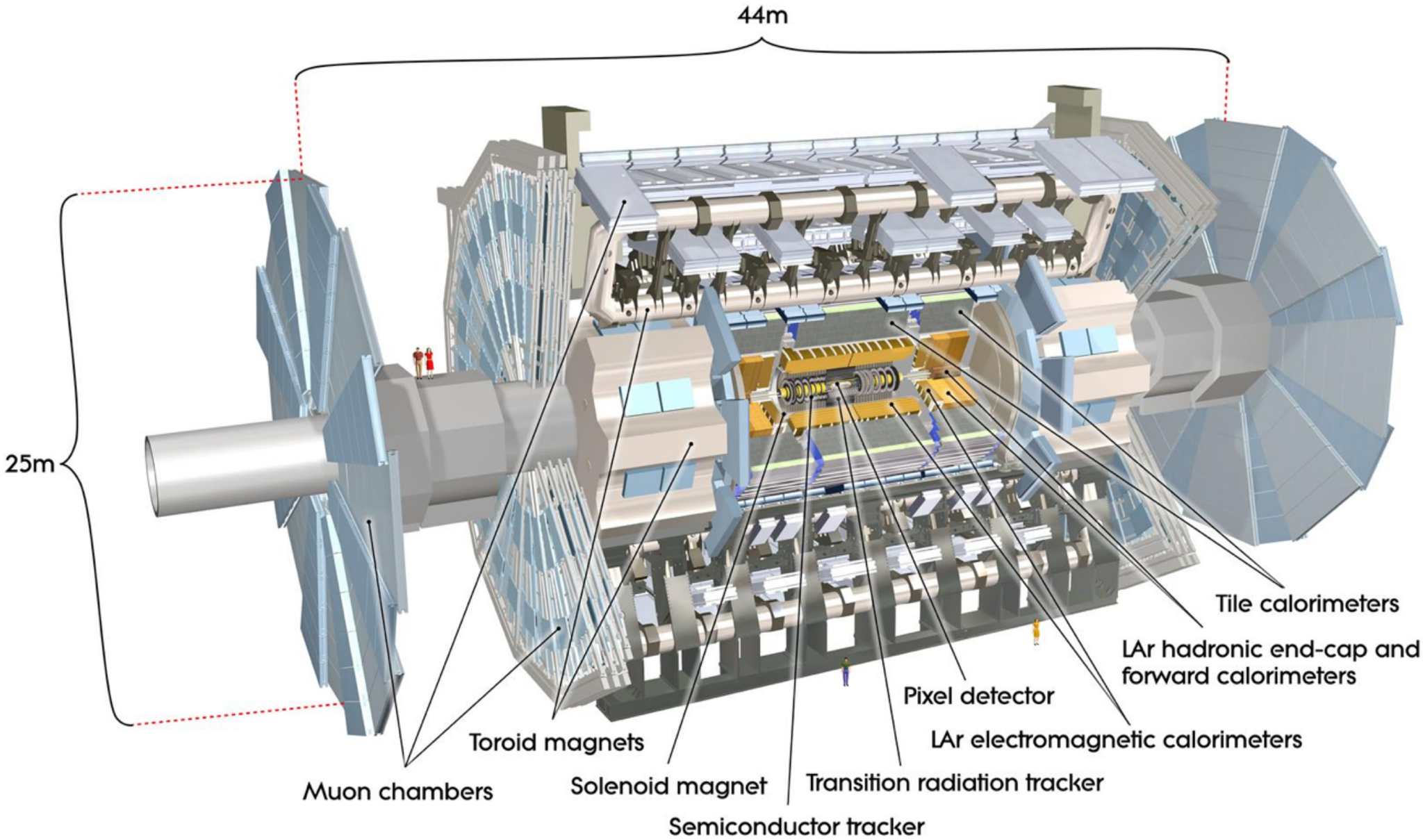
On behalf of the ATLAS Collaboration

UNIVERSITY OF LIVERPOOL

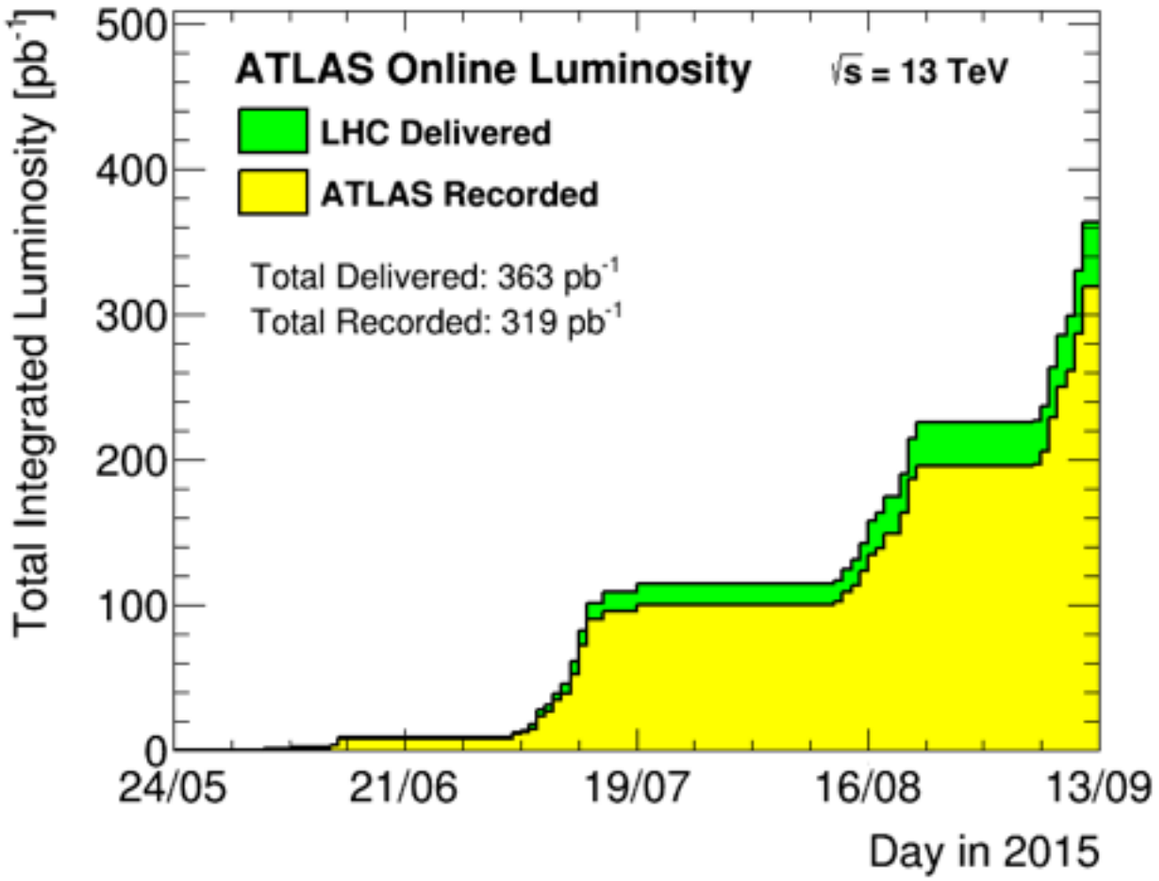
TOP2015, Ischia, 14th September 2015

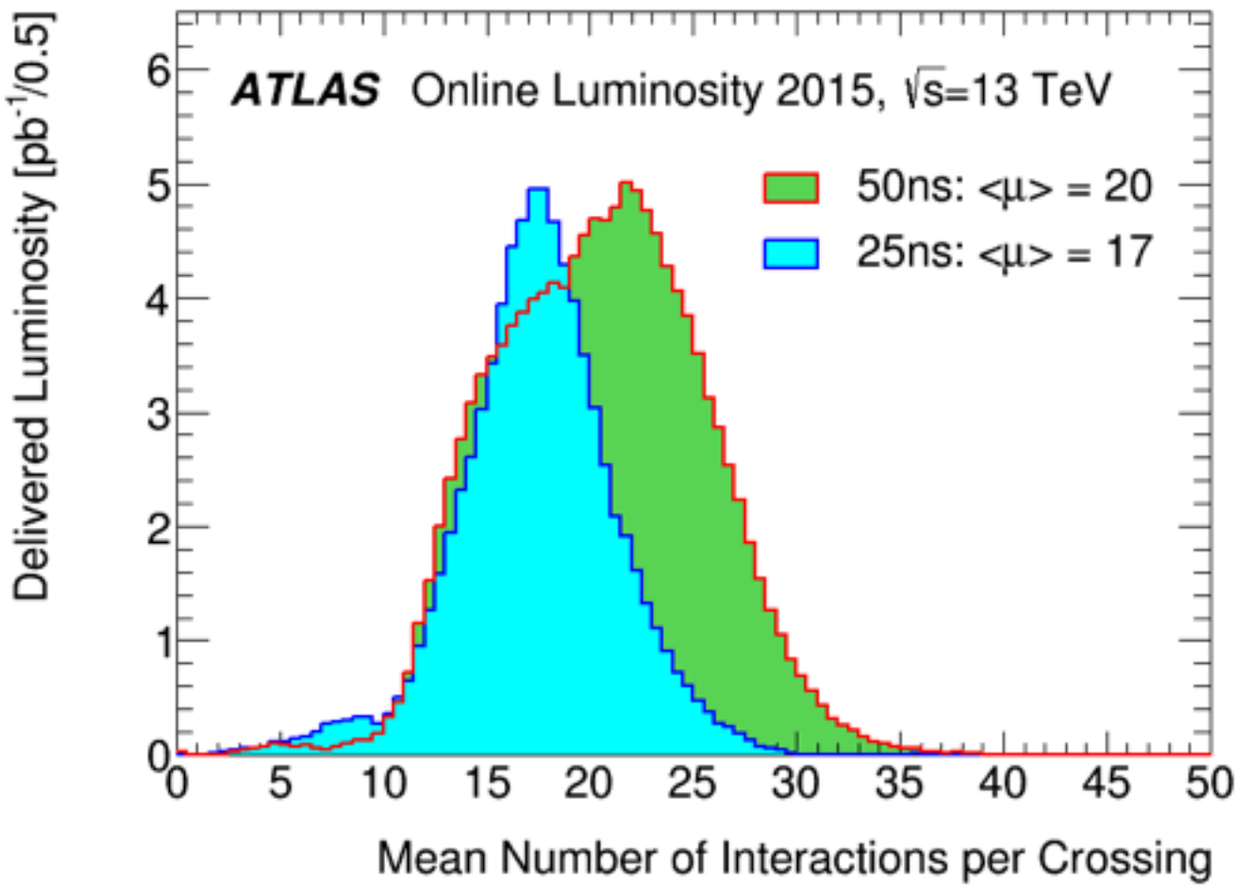
ATLAS



- Upgraded detector (see Imma's talk), upgraded DAQ, upgraded Trigger
- A new analysis model with four times faster reconstruction - all successfully commissioned

ATLAS Luminosity





- Over 300 pb^{-1} recorded by ATLAS - measurements shown here based on up to 85pb^{-1} first data
- Luminosity uncertainty of 9% based on a preliminary calibration of the luminosity scale using a pair of x-y beam-separation scans performed in June
- Full van der Meer scans now being studied

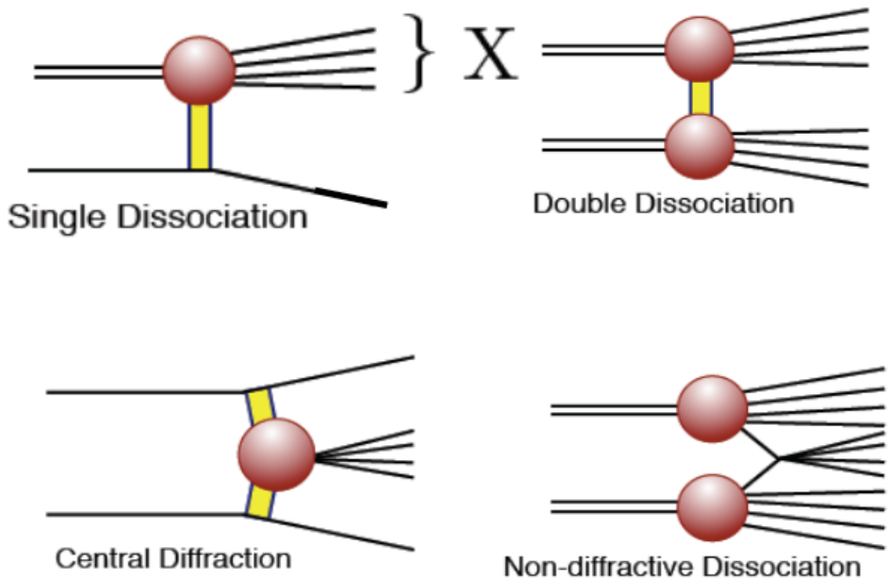
First Stable Beams

ATLAS EXPERIMENT

proton-proton collisions at 13 TeV

Run: 266904
Event: 9393006
2015-06-03 10:40:31 CEST

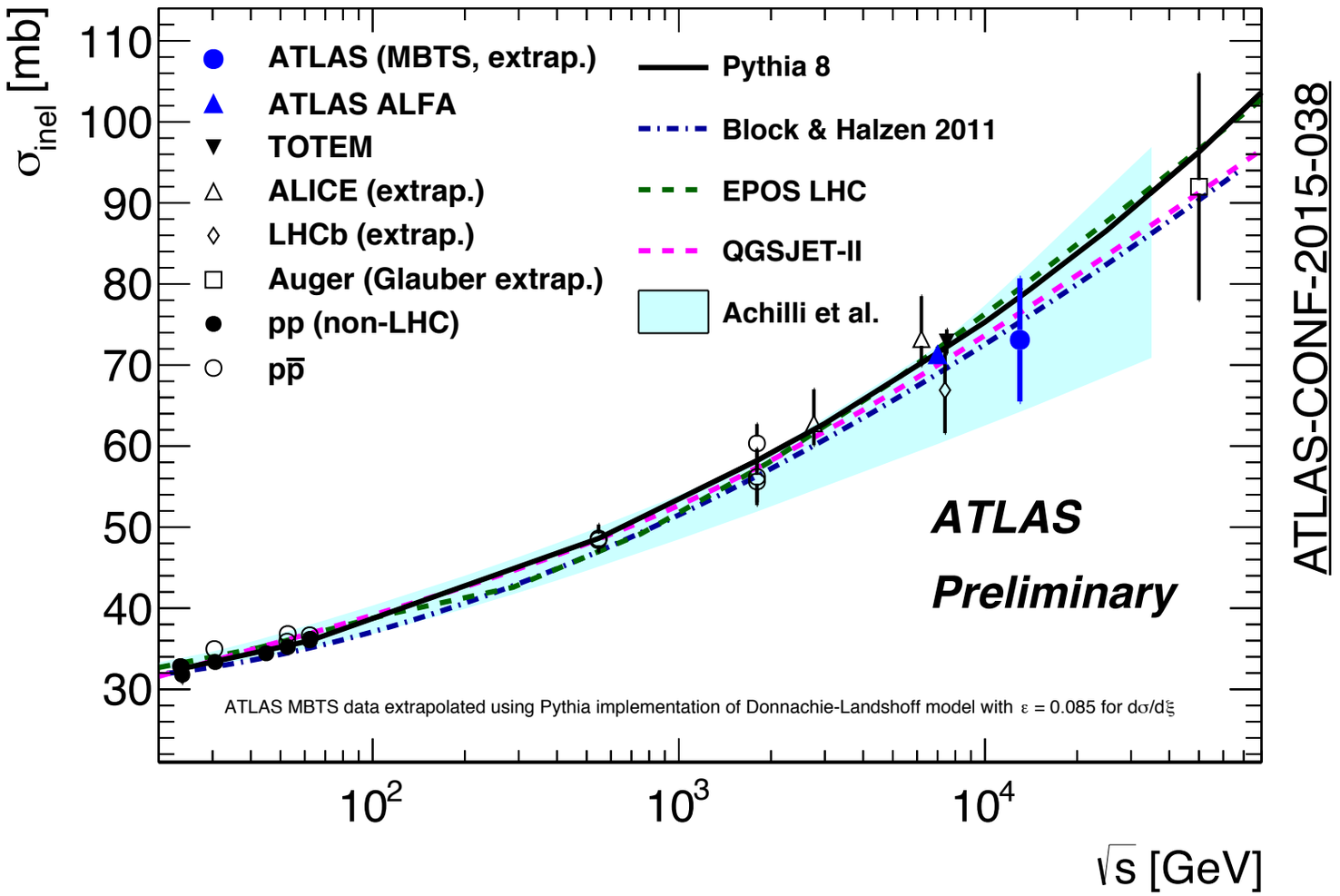
Inelastic cross section



- Simple counting experiment with very efficient trigger
- MinBias Trigger Scintillator (MBTS) defines the fiducial measurement
  - $2.08 < |\eta| < 3.86$
  - $M_X > 13$ GeV
- Measurement extrapolated to M_X=Mp
- Diffractive component effects selection efficiency, estimated using single-sided trigger

$$\sigma_{\text{inel}}(\tilde{\xi} > 10^{-6}) = \frac{N - N_{\text{BG}}}{\epsilon_{\text{trig}} \times L} \times \frac{1 - f_{\tilde{\xi}<10^{-6}}}{\epsilon_{\text{sel}}}$$

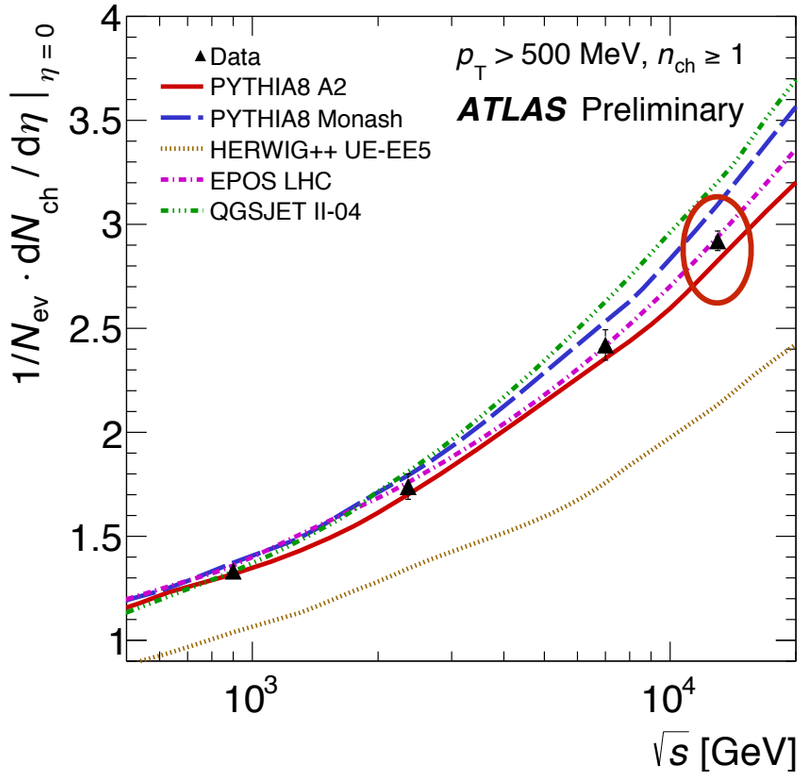
Inelastic cross section results

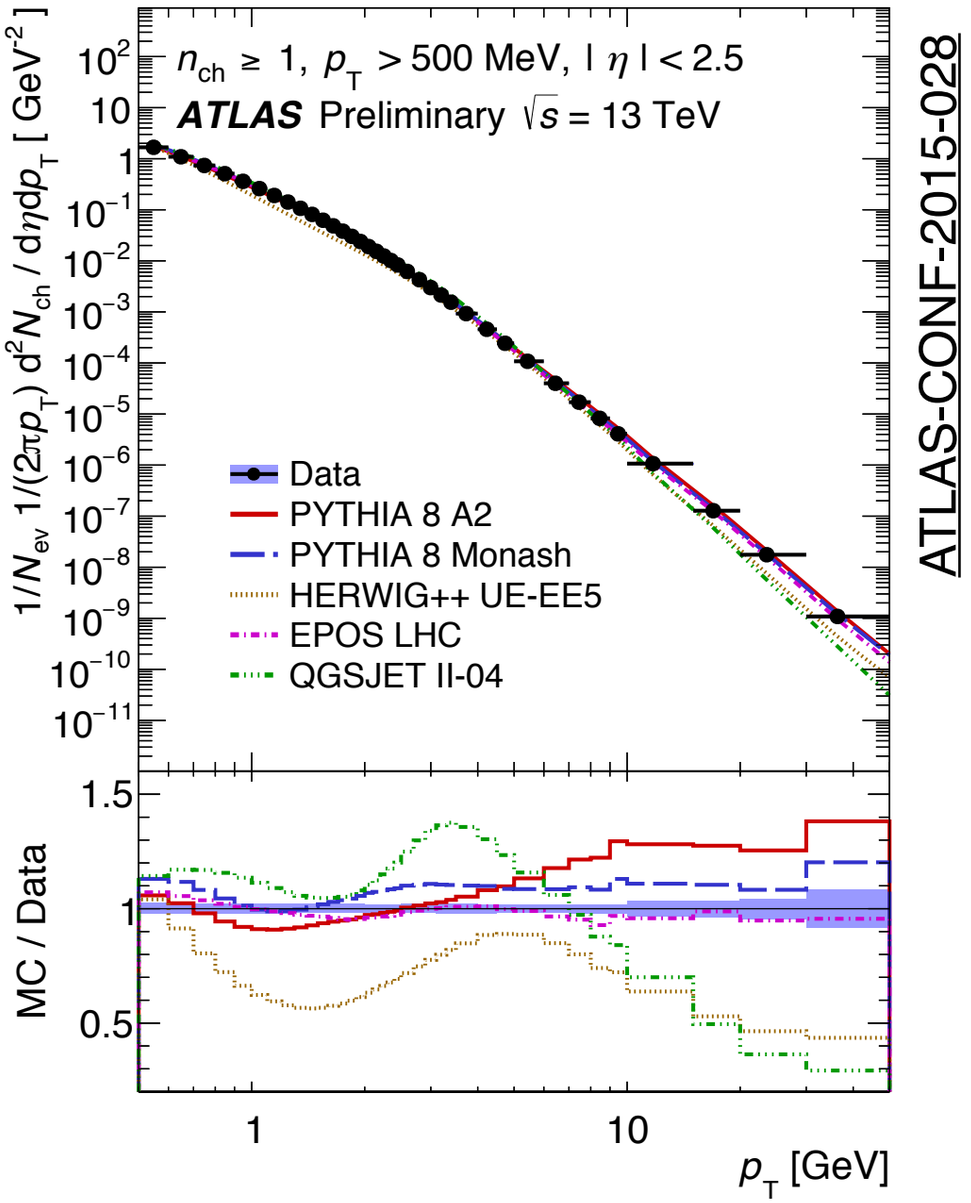


σ_{fid}=65.2±0.8 (exp.)±5.9 (lum.) mb

σ_{inel}=73.1±0.9(exp.)±6.6(lum.)±3.8(extr.) mb

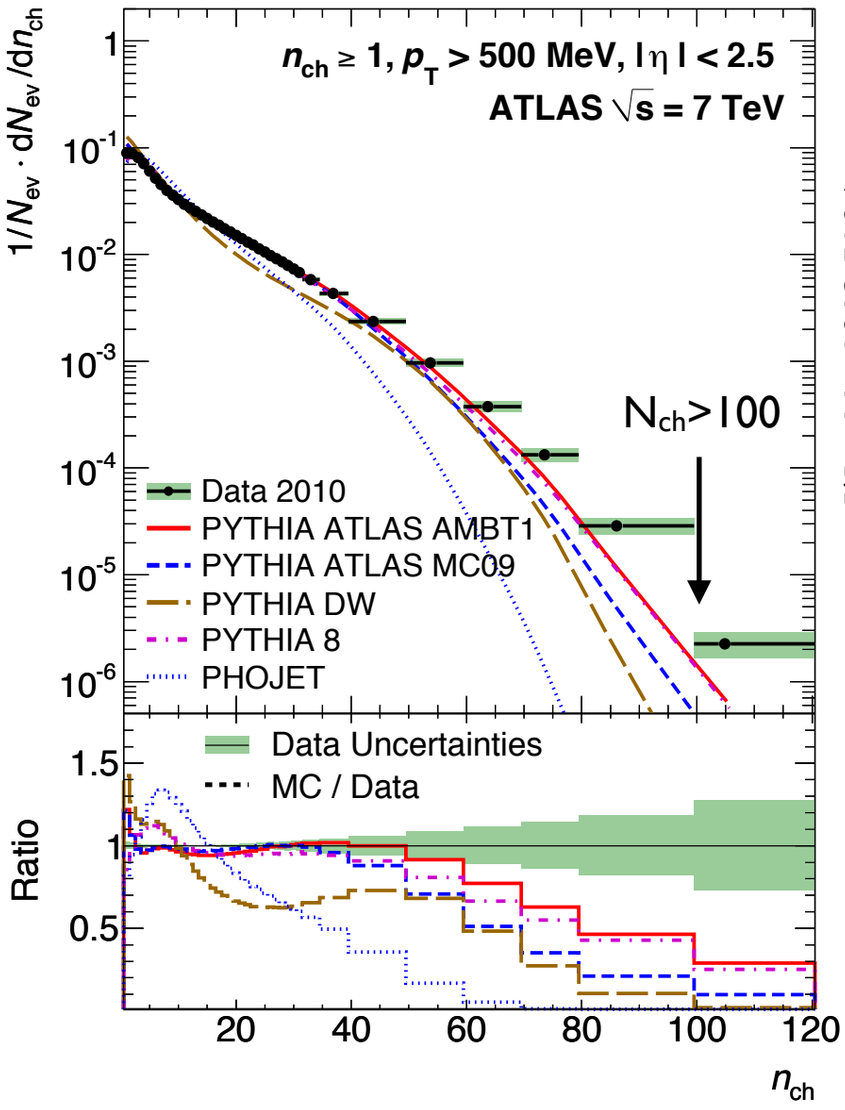
MinBias measurements



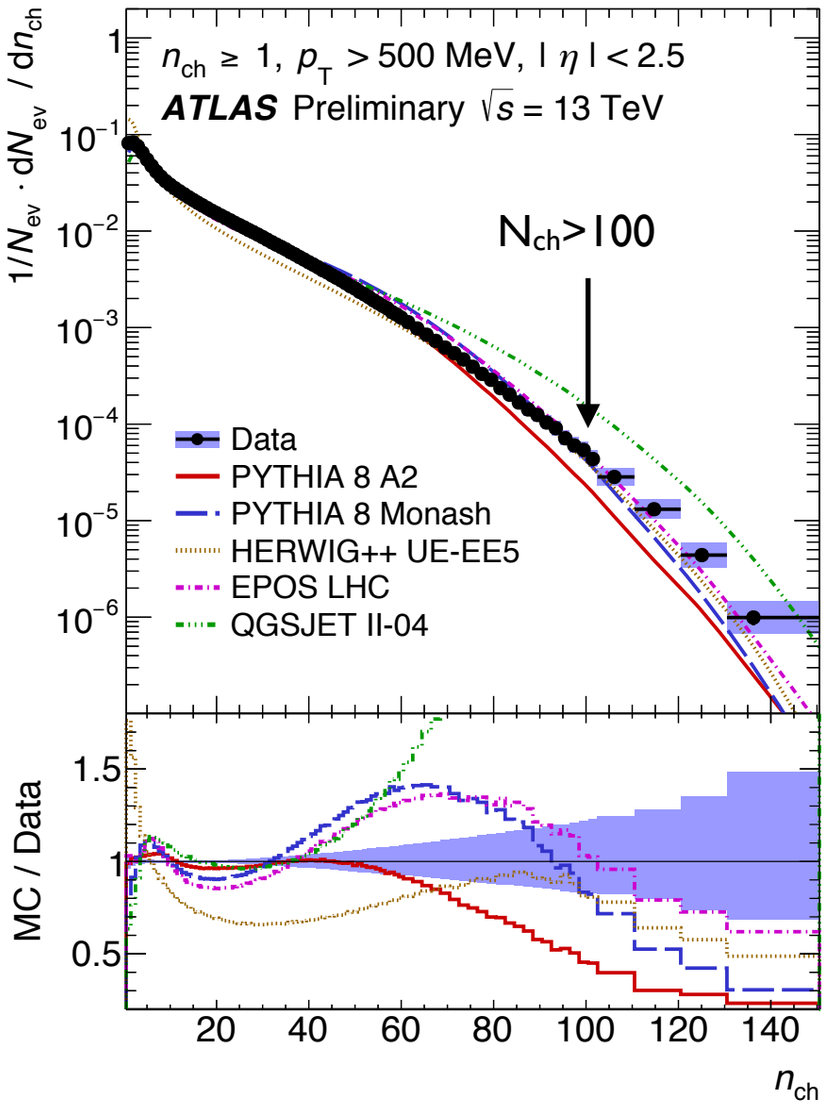


- Tracking requirements similar to Run 1:
  - At least one track with $p_T > 500$ MeV
  - Exactly one vertex with 2 tracks having $p_T > 100$ MeV
- Data described by EPOS and Pythia8 with both A2 and MONASH tunes

MinBias measurements



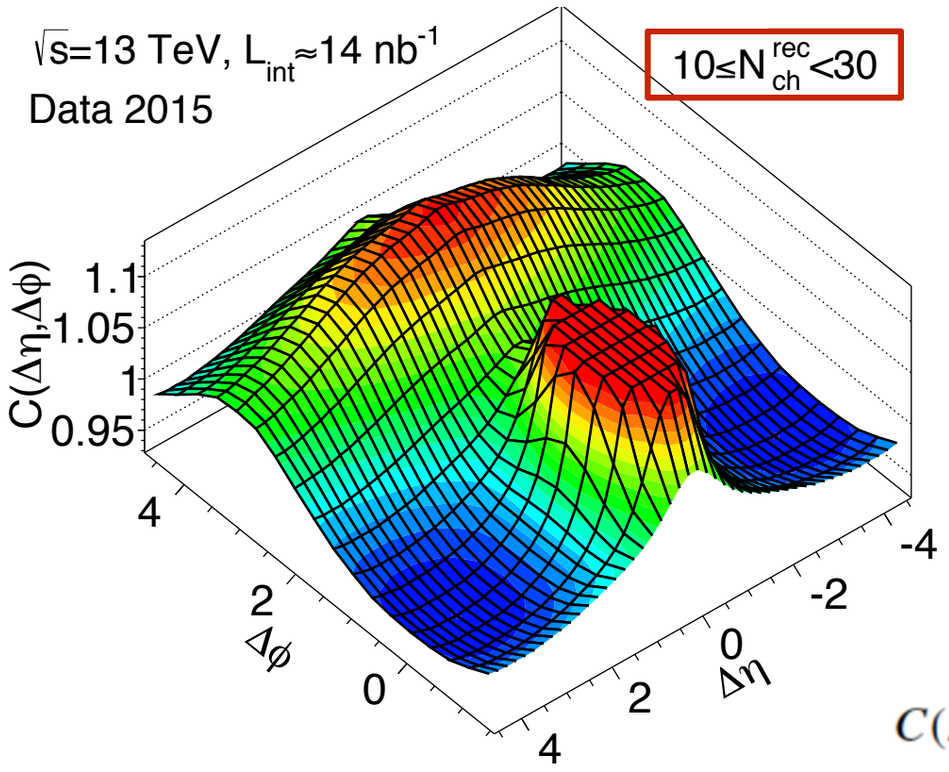
[*] arXiv:1012.5104

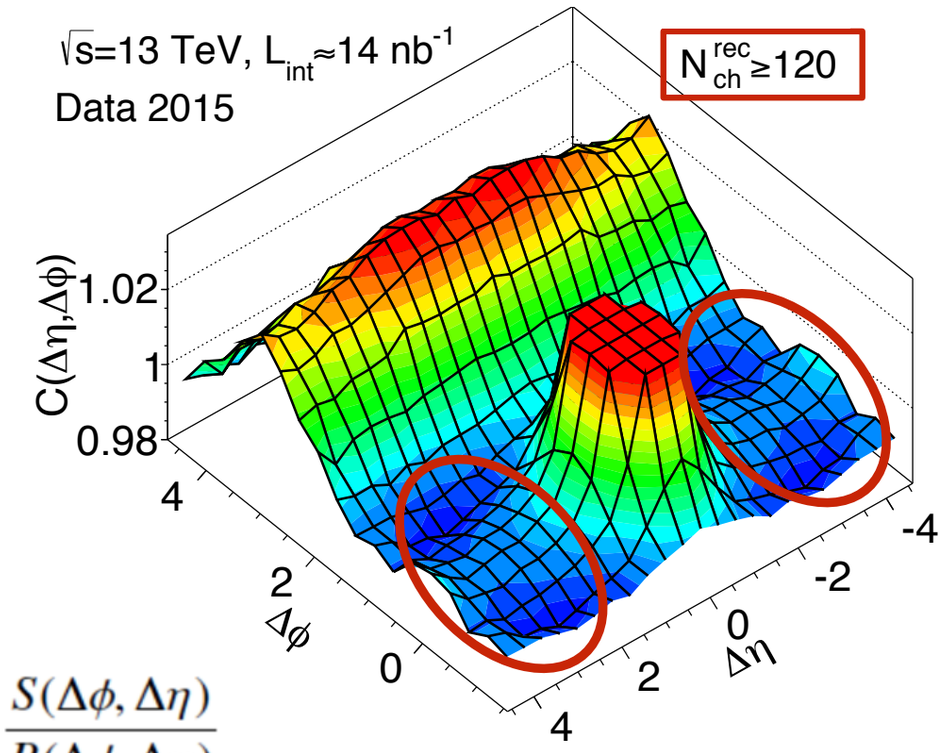


ATLAS-CONF-2015-028

- Increased particle production compared to 7 TeV
- Data reasonably well described by Pythia8 A2 tune up to N_{ch} of 60

The Ridge





ATLAS-CONF-2015-027

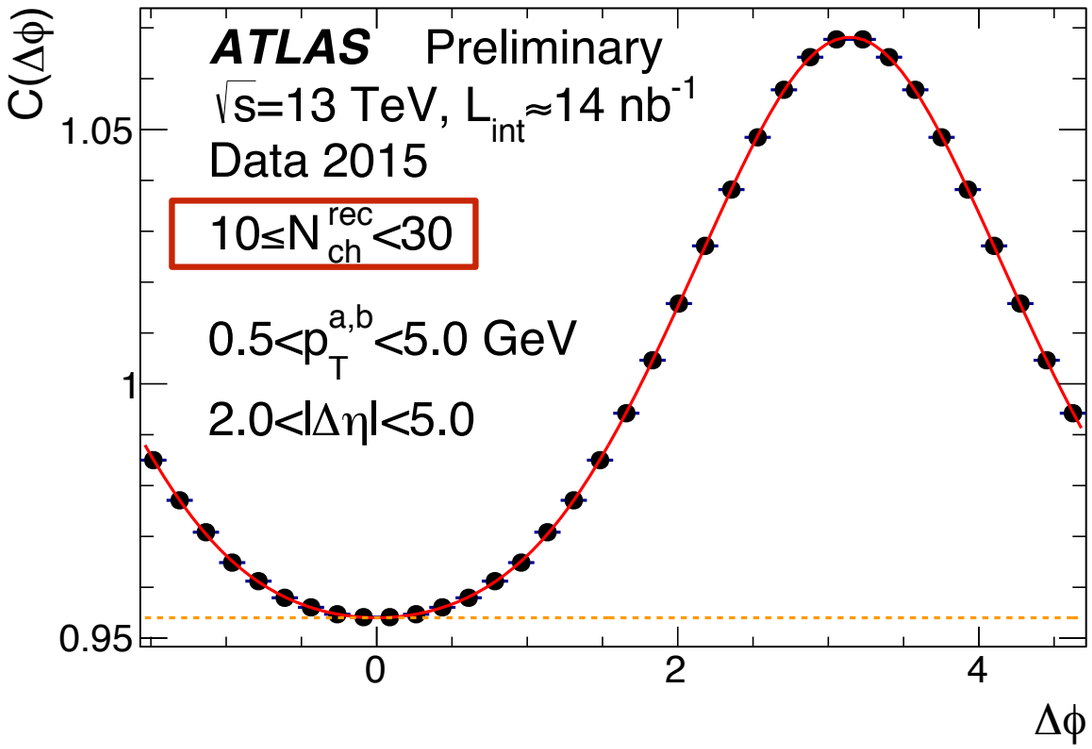
$$C(\Delta\eta, \Delta\phi) = \frac{S(\Delta\phi, \Delta\eta)}{B(\Delta\phi, \Delta\eta)}$$

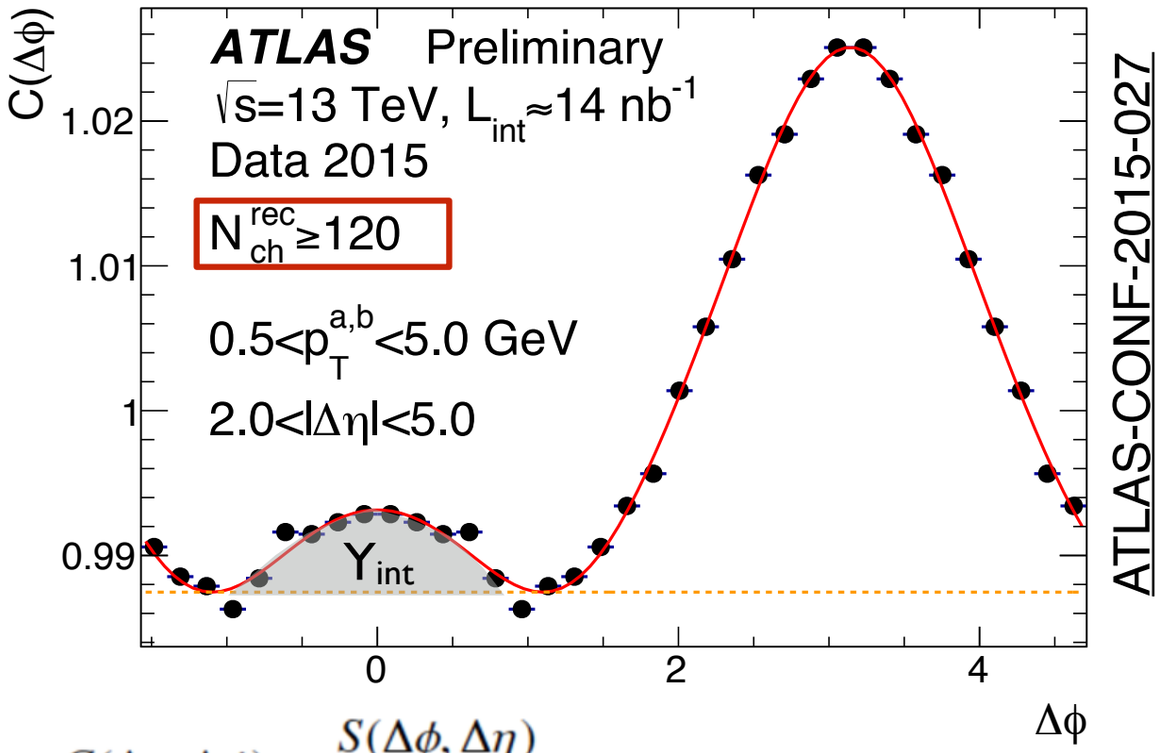
S=same event
B=mixed event (proxy for no correlation)

- Events with large N_{ch} show correlations at large $\Delta\eta$ and $\Delta\phi = 0$

- Weaker version of effect seen in p-A and A-A collisions

The Ridge





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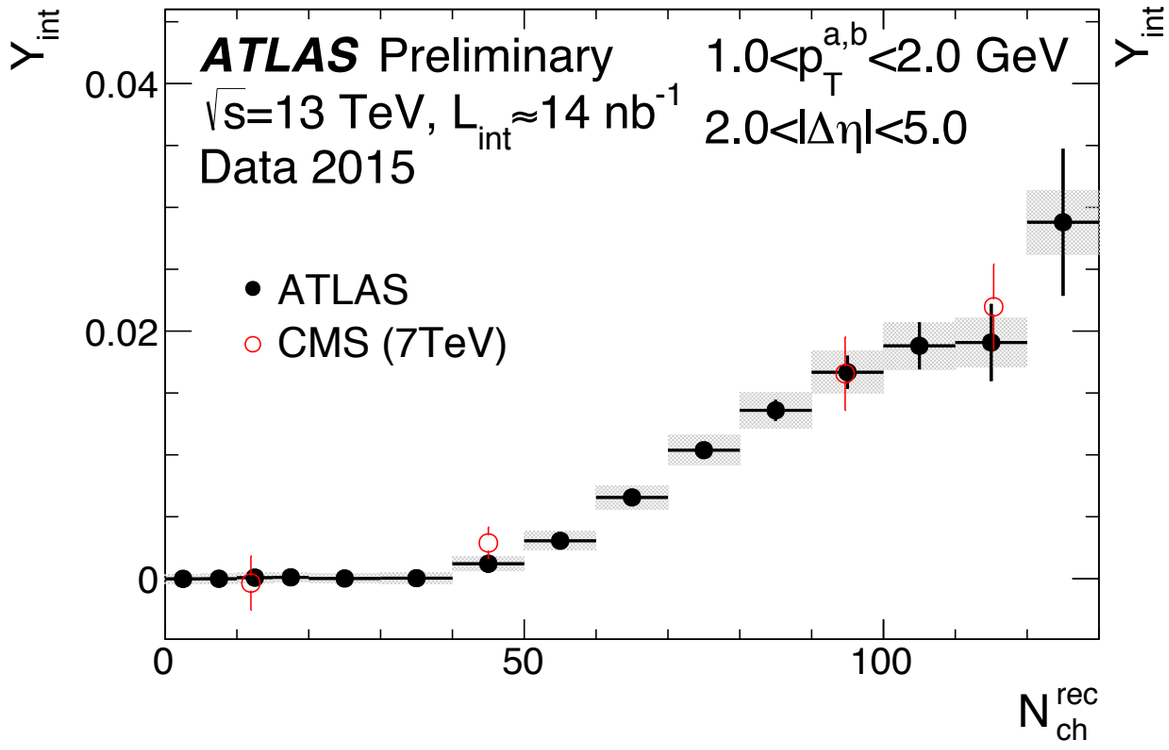
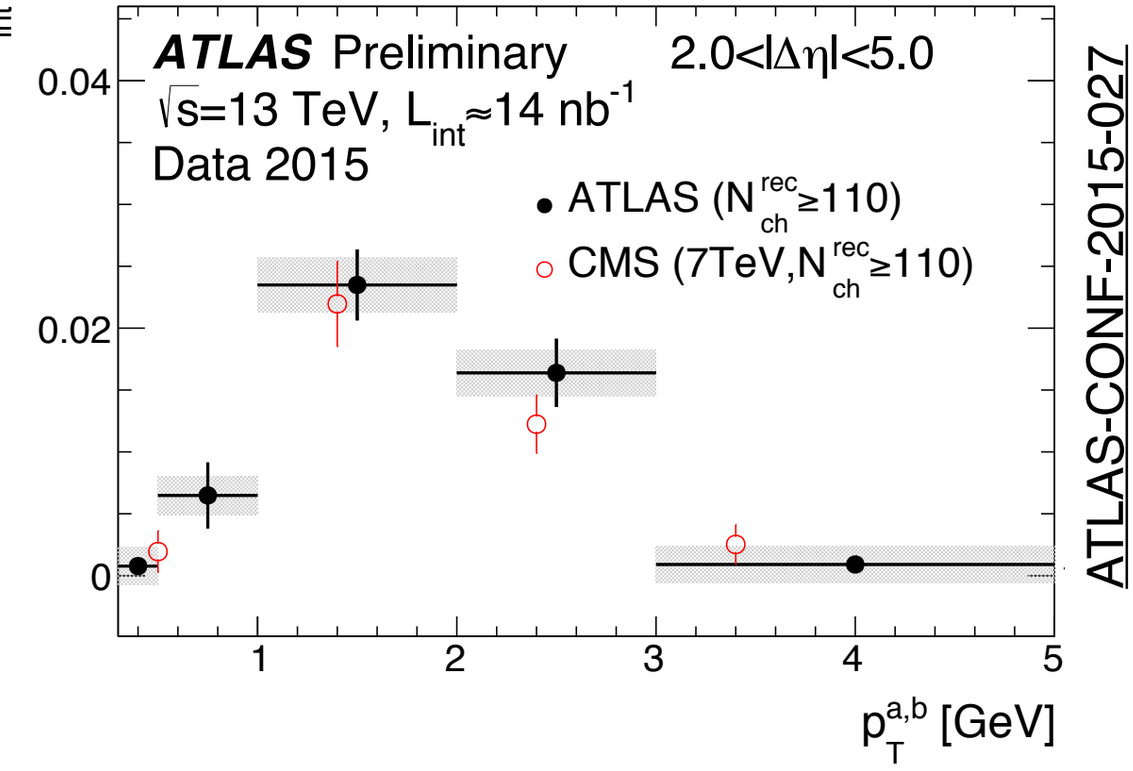
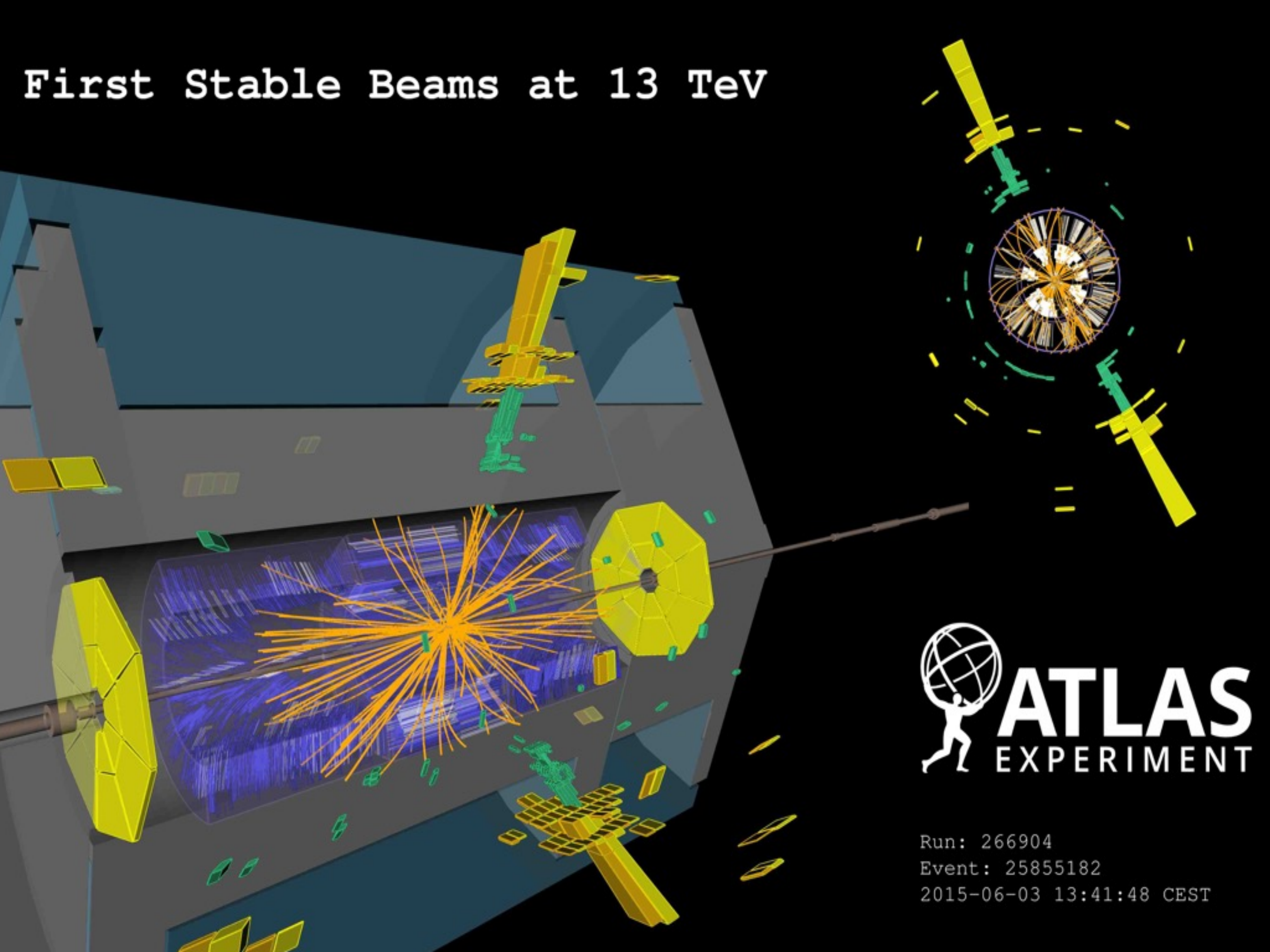


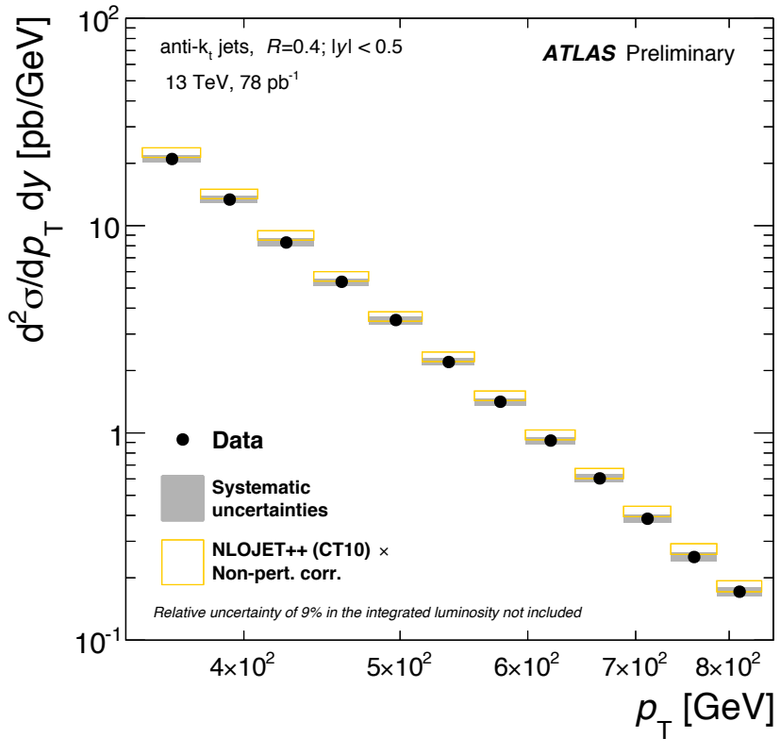


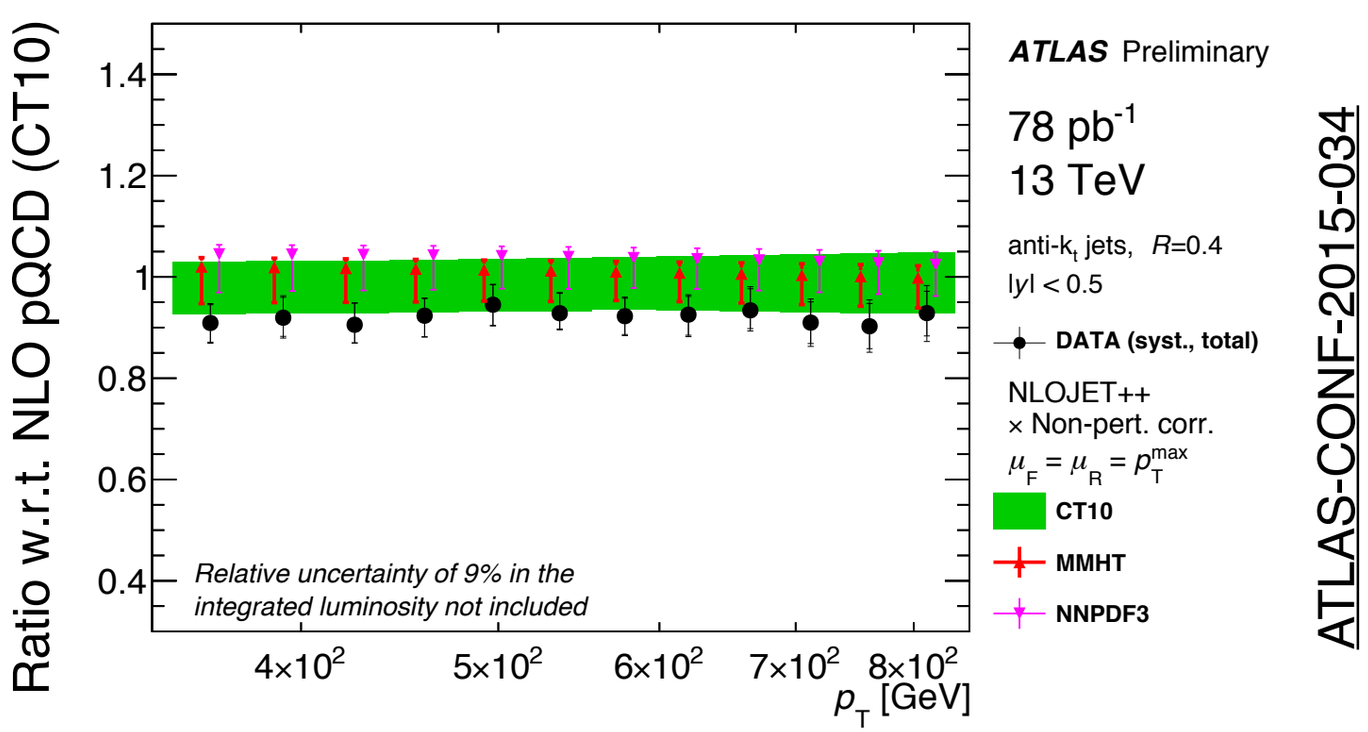
- Compare to CMS results at 7 TeV
- Larger statistics
- Size of ridge independent of centre of mass energy, depends on N_{ch}

First Stable Beams at 13 TeV

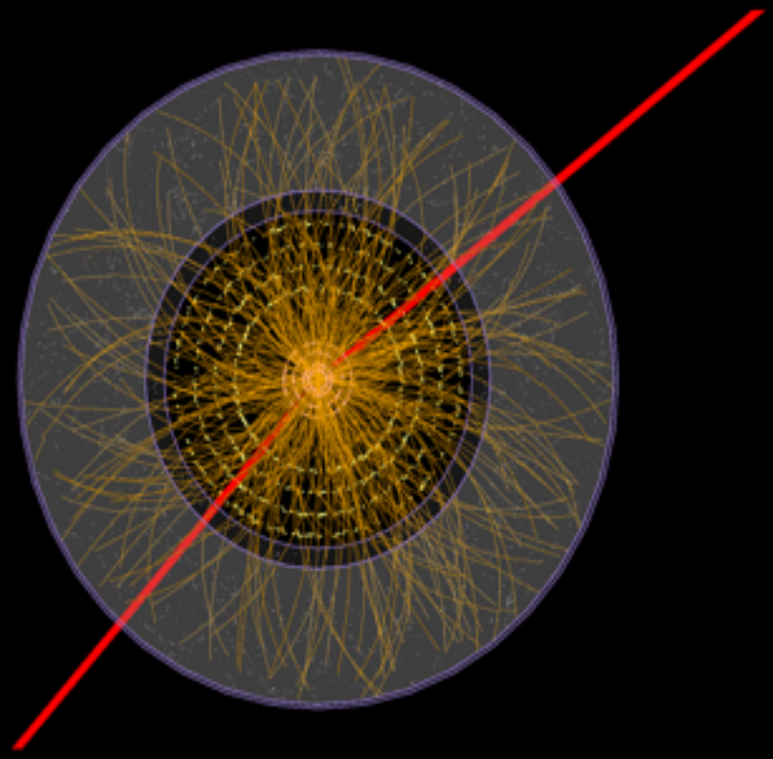


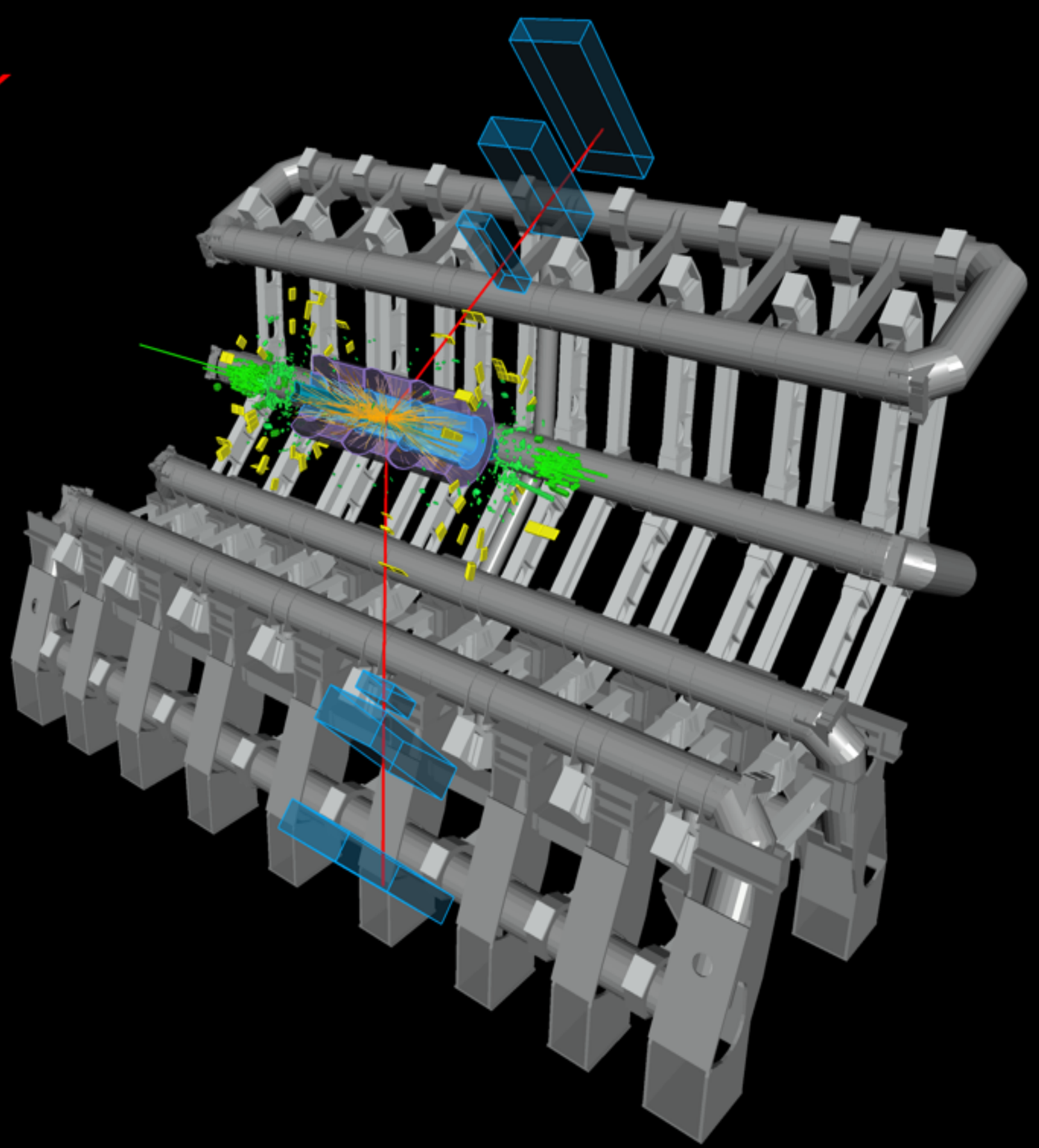
Inclusive jets





- Good agreement with fixed-order NLO calculations using several PDFs
- Systematic uncertainties dominated by luminosity (9%), comparable to uncertainty on fixed-order calculation
- Isolated photon production also being studied (ATL-PHYS-PUB-2015-016)

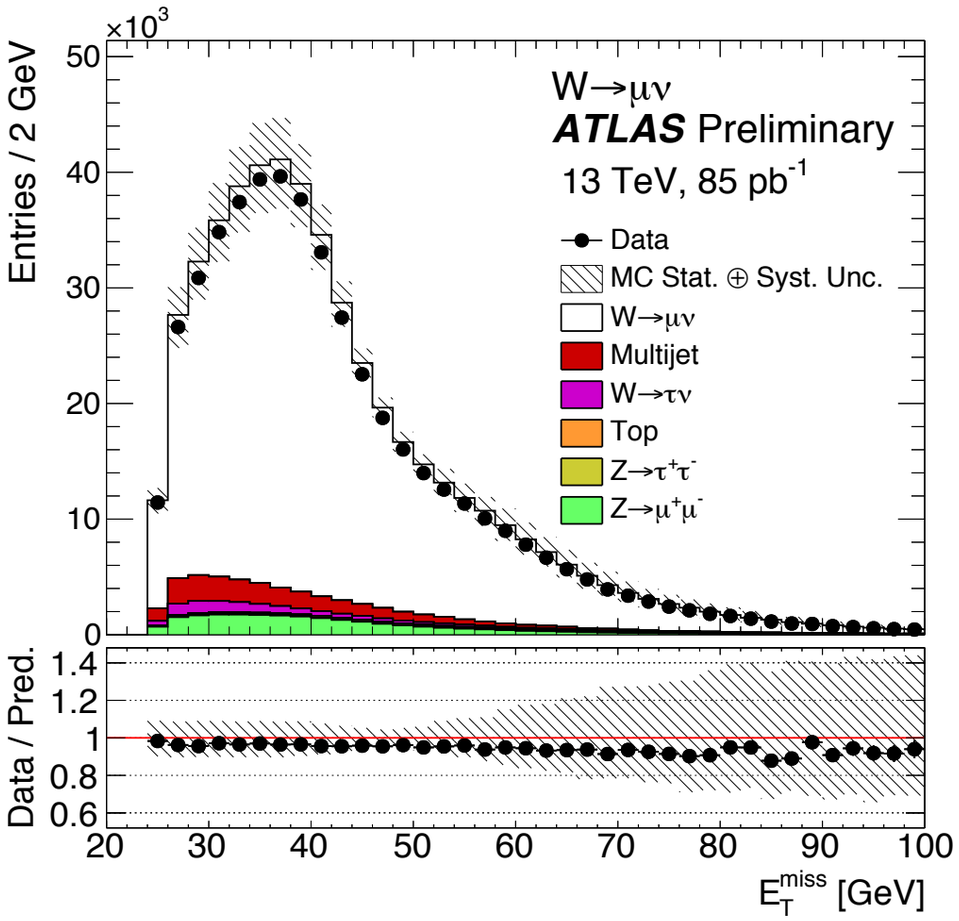


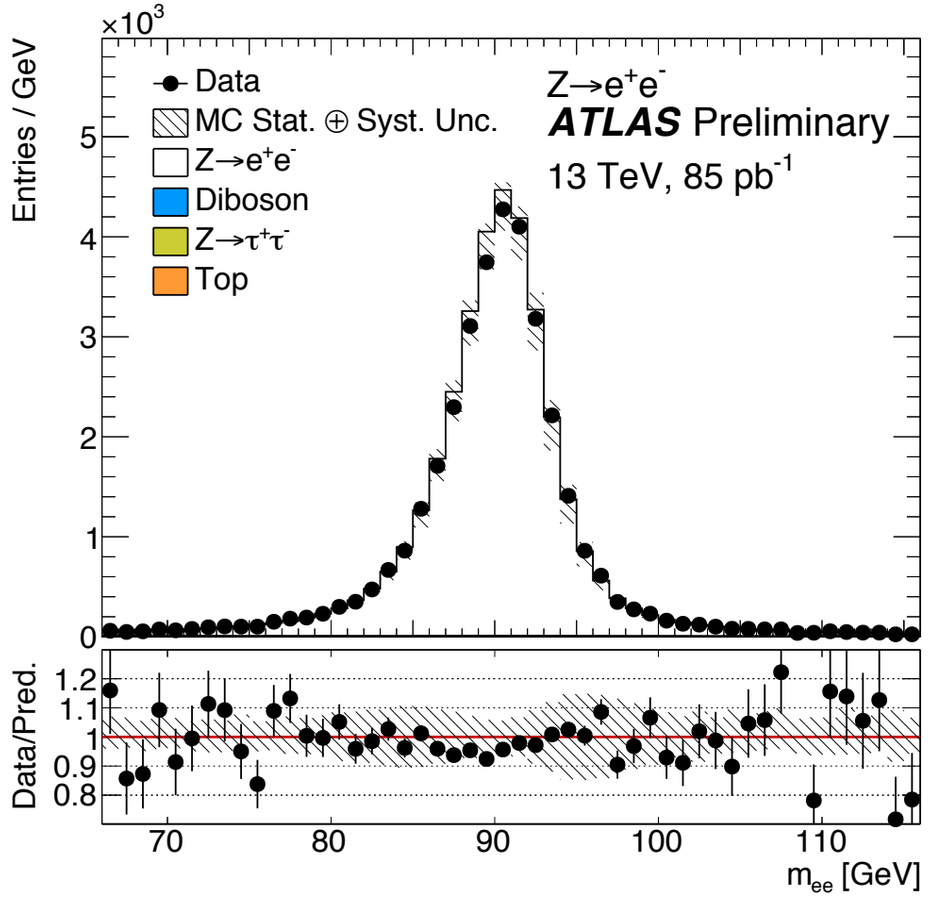


ATLAS
EXPERIMENT

Run: 267638
Event: 242090708
2015-06-14 01:01:14 CEST

W and Z

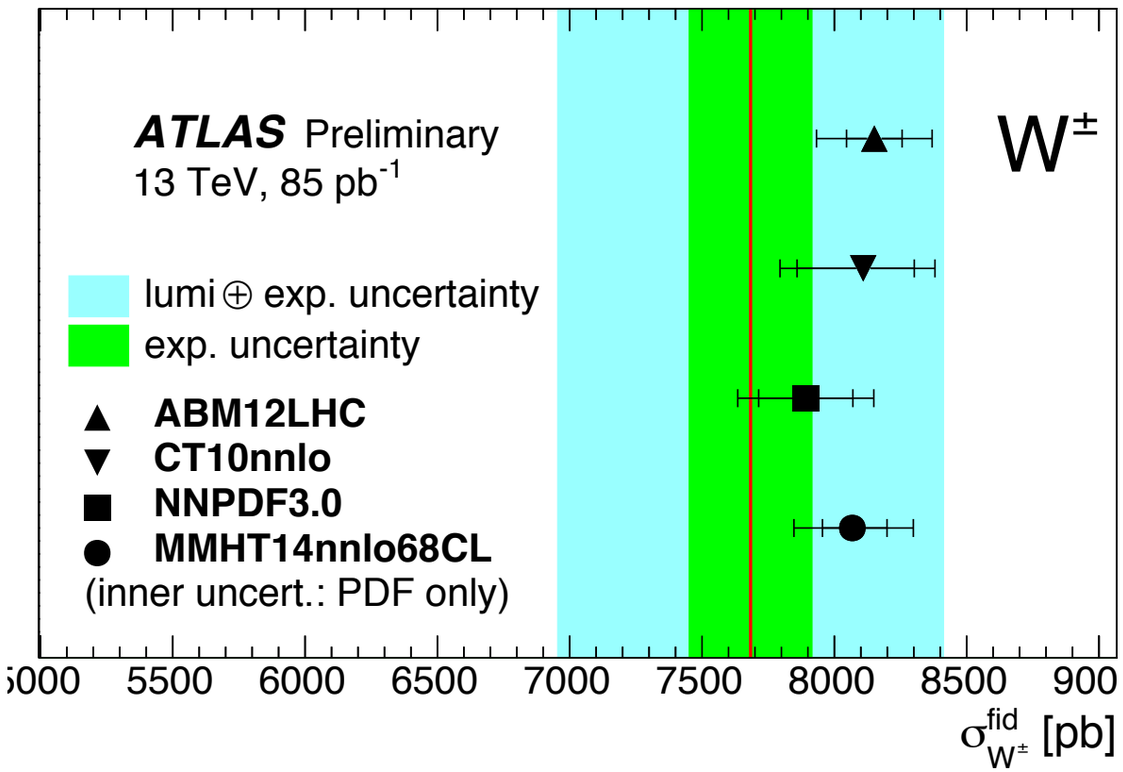


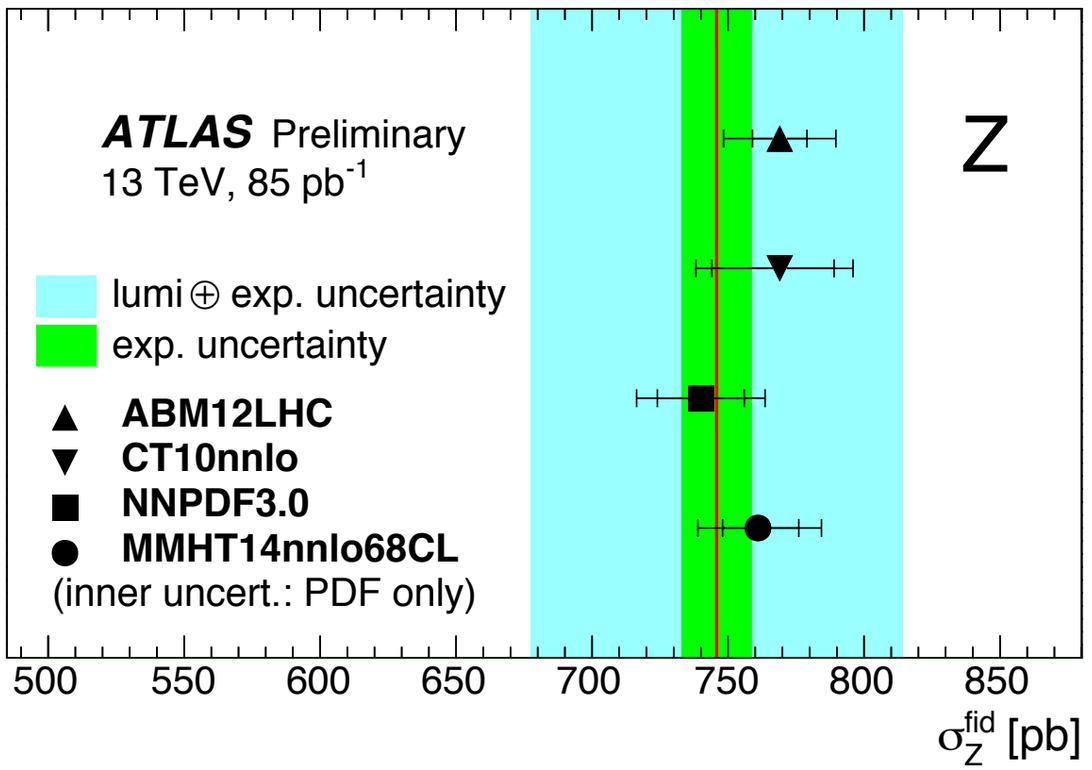


ATLAS-CONF-2015-039

- Collected approximately 1 million W candidates and 100k Z
- Measured fiducial and total cross sections
- Systematic uncertainties dominated by luminosity, followed by lepton efficiencies

W and Z



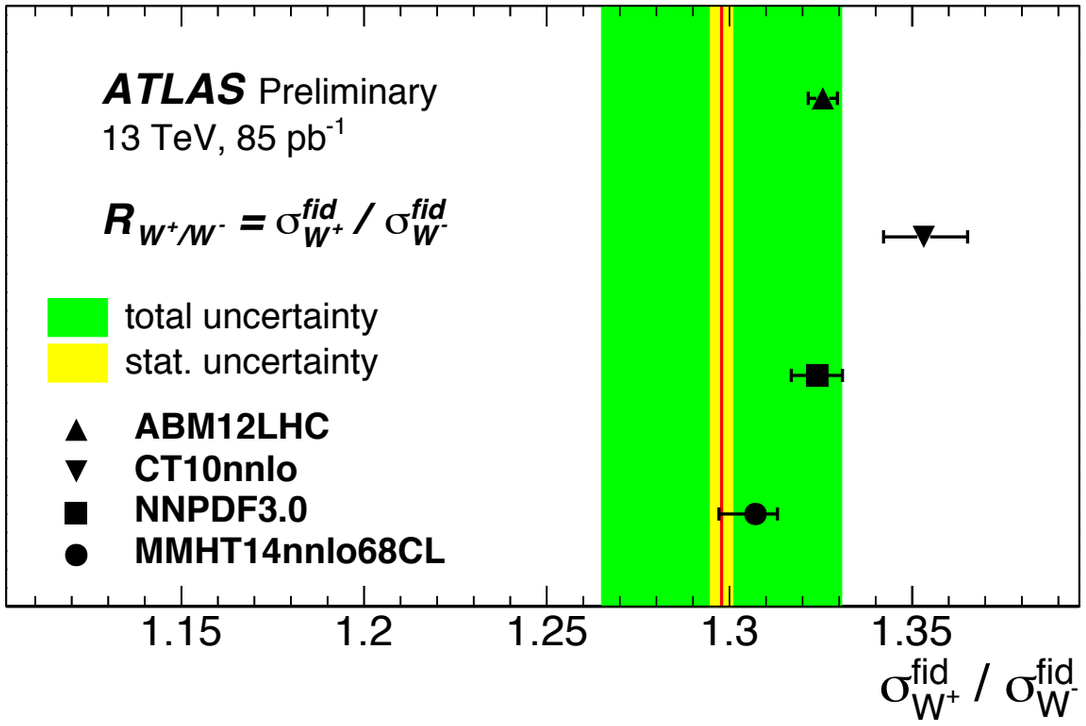


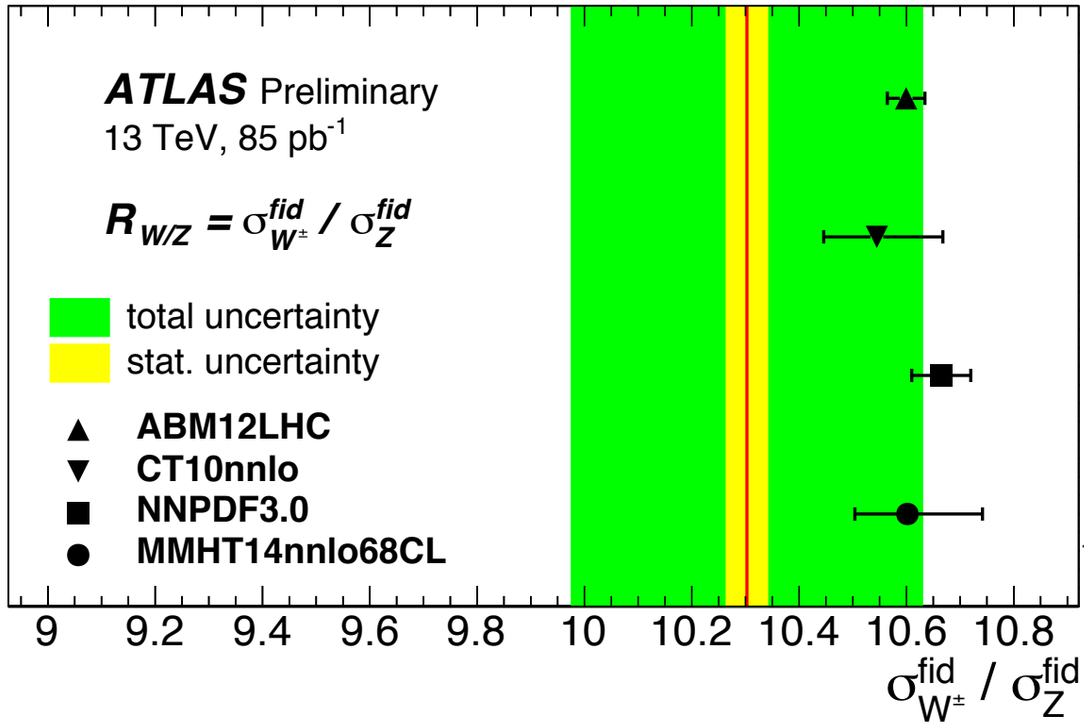
ATLAS-CONF-2015-039

- Measurements consistent with NNLO predictions using different PDFs

- Aside from the luminosity uncertainty, experimental uncertainties are similar in size to the theoretical uncertainties

W and Z ratios

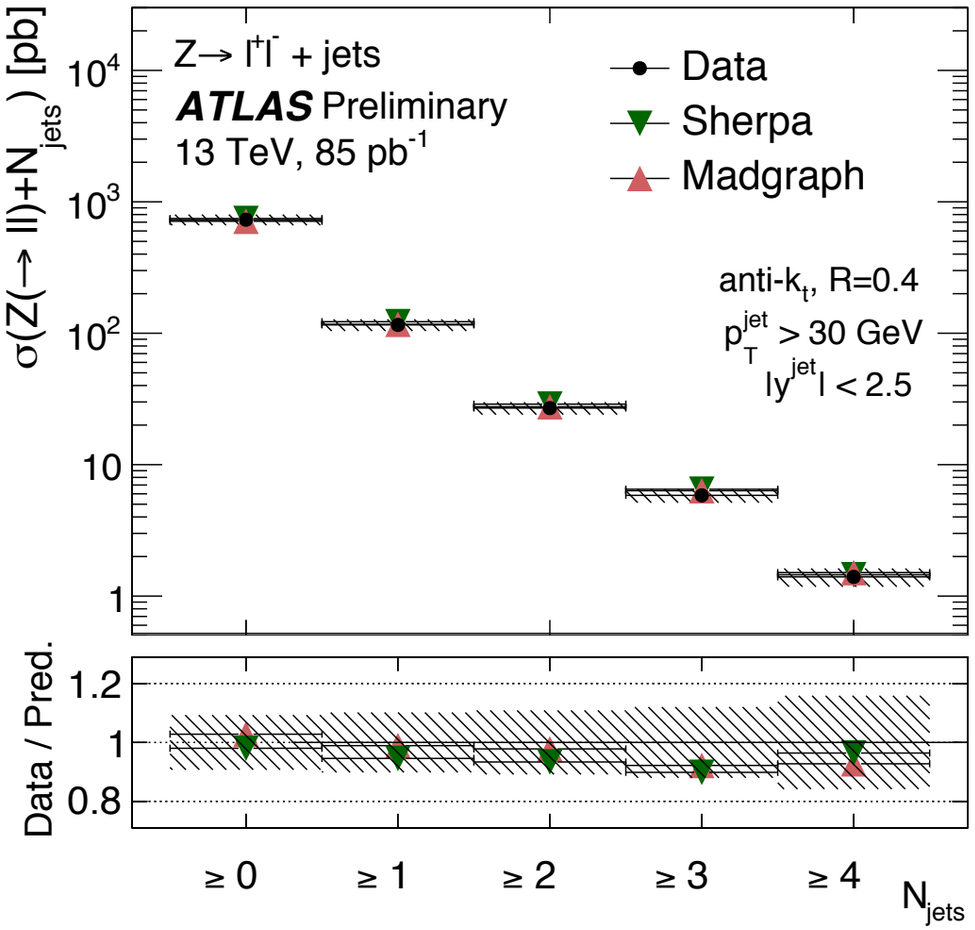


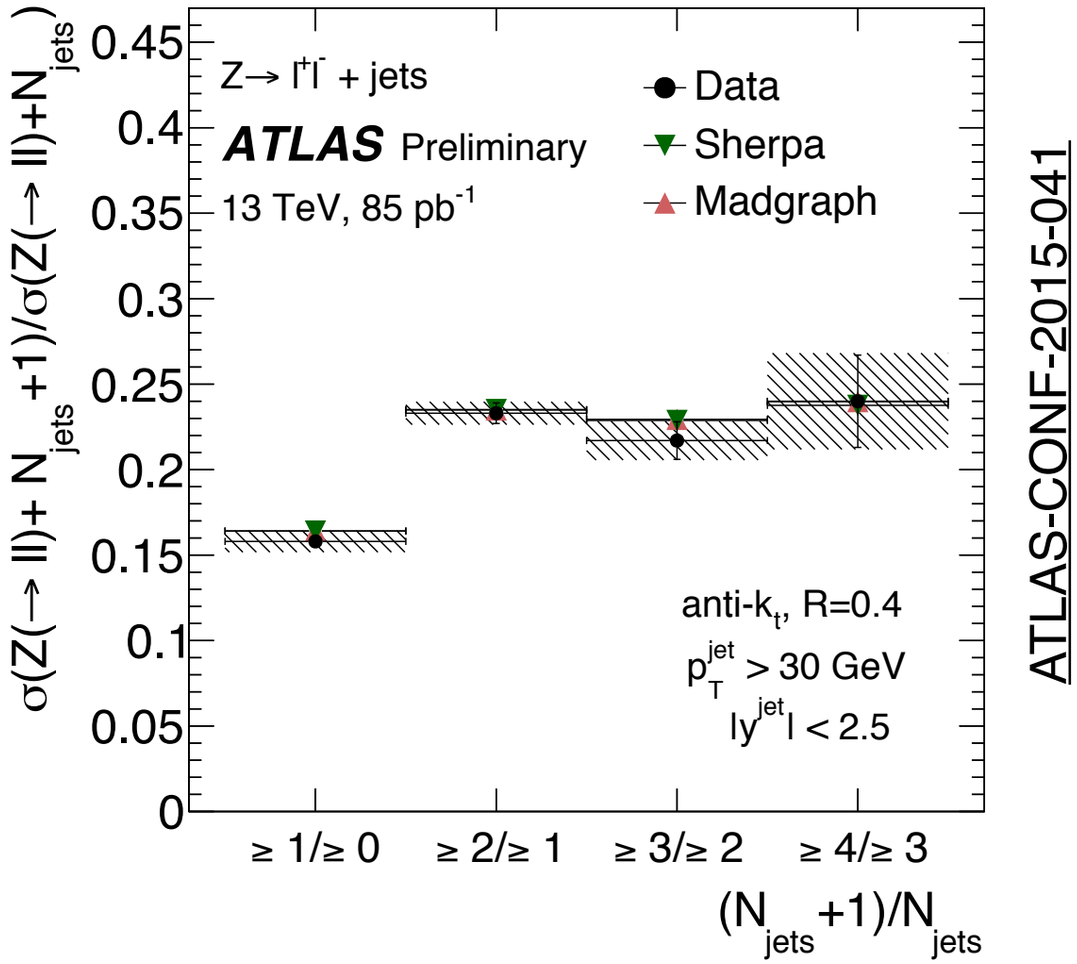


ATLAS-CONF-2015-039

- Luminosity uncertainty cancels in cross section ratios
- Statistical uncertainty negligible compared to total uncertainty of approximately 3%
- Measurements agree with several different PDFs

Z+Jets





- Cross section measurements up to N ≥ 4 jets dominated by luminosity
- Cross section ratios cancel luminosity uncertainty
- Data in good agreement with Sherpa and Madgraph

Summary and Conclusions

- First suite of measurements from ATLAS at 13 TeV
- Luminosity uncertainty of 9% is already a dominant systematic in most cases
- Inelastic cross section measurement in agreement with Pythia
- MinBias measurements agree well with Pythia and EPOS
- The Ridge is alive and well at 13 TeV, independent of centre of mass energy
- Jet cross sections agree with NLO and several PDFs
- W/Z cross sections and their ratios agree with NNLO and several PDFs
- Z+jets measurement up to N=4 also dominated by luminosity uncertainty