MANCHESTER 1824

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Inclusive jet cross section: Low p_T Forward region

Gareth Brown
University of Manchester
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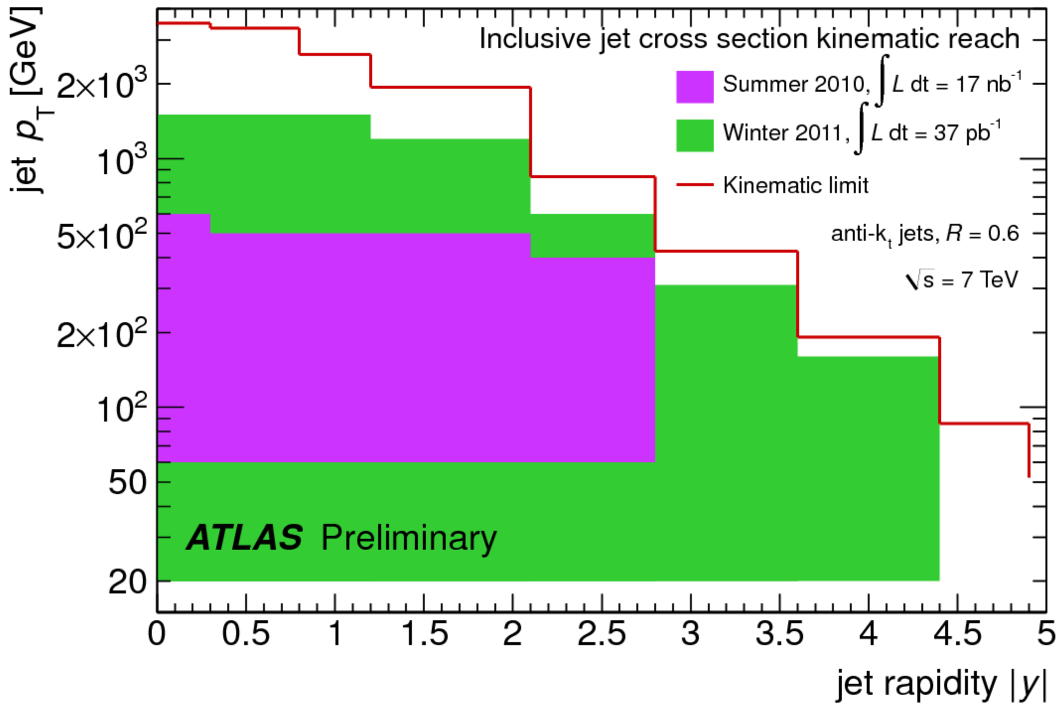
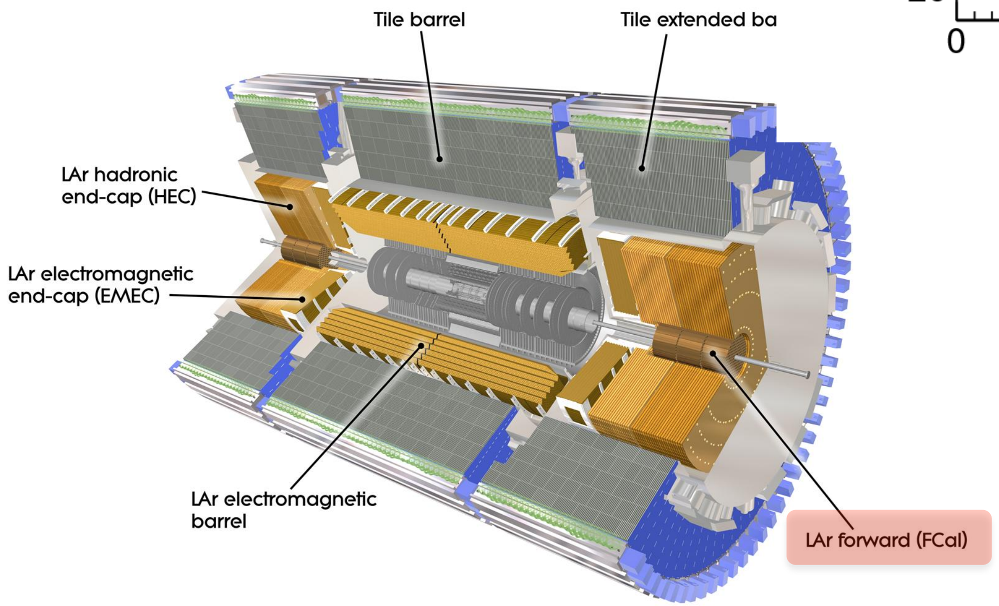
Introduction

- The inclusive jet double differential cross section is measured as a function of p_T for various rapidity ranges.
- This updated analysis has extended the data used from 17 nb^{-1} to 37 pb^{-1} allowing jets with:
  - Low p_T jets (20 GeV)
  - High rapidity ($|\eta|<4.4$)





The extension into the forward region results in two new rapidity, η, bins.

1. **Transition** from the HCAL endcap to FCAL ($2.8<|\eta|<3.6$)
2. **FCAL** region ($3.6<|\eta|<4.4$)

Event Selection (Forward)

•Jet quality cleaning cuts

•Require ≥1 vertex (vertex required to have ≥ 5 associated charge tracks)

Check that forward Jets have vertices as outside ATLAS tracking.

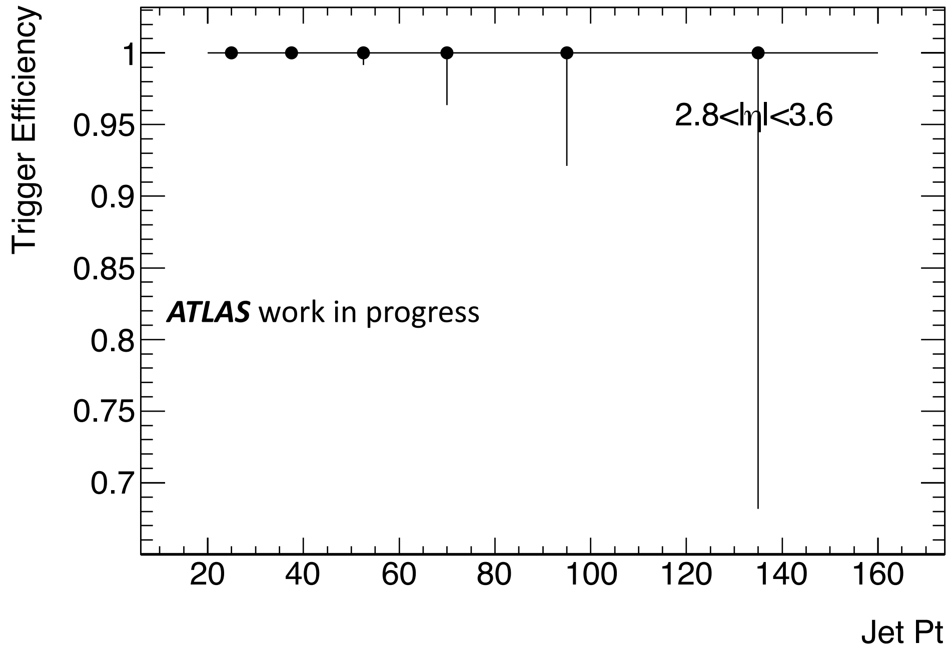
•Fully efficient trigger for jets p_T and η range

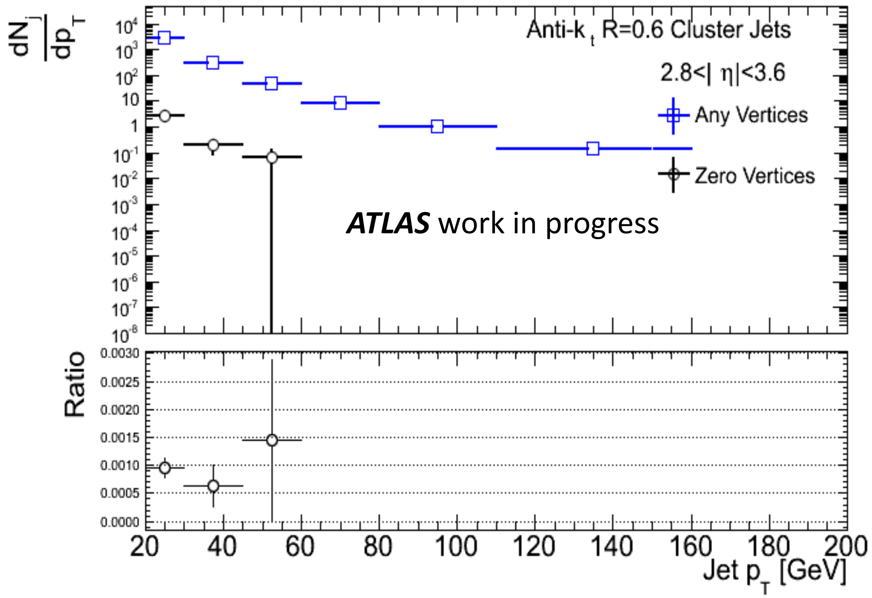
Check that the minimum bias trigger fully efficient for the low p_T forward Jets.

•Check the effect of Pile-up on forward low p_T jets.

Trigger + Vertices

- For the low p_T region we use a minimum bias trigger (MBTS) that selects events with energy deposited in scintillators in the region (2.1<|η|<3.8)
- A complementary trigger used for efficiency.
- MBTS fully efficient (100%) for jets in the FCAL and transition regions.

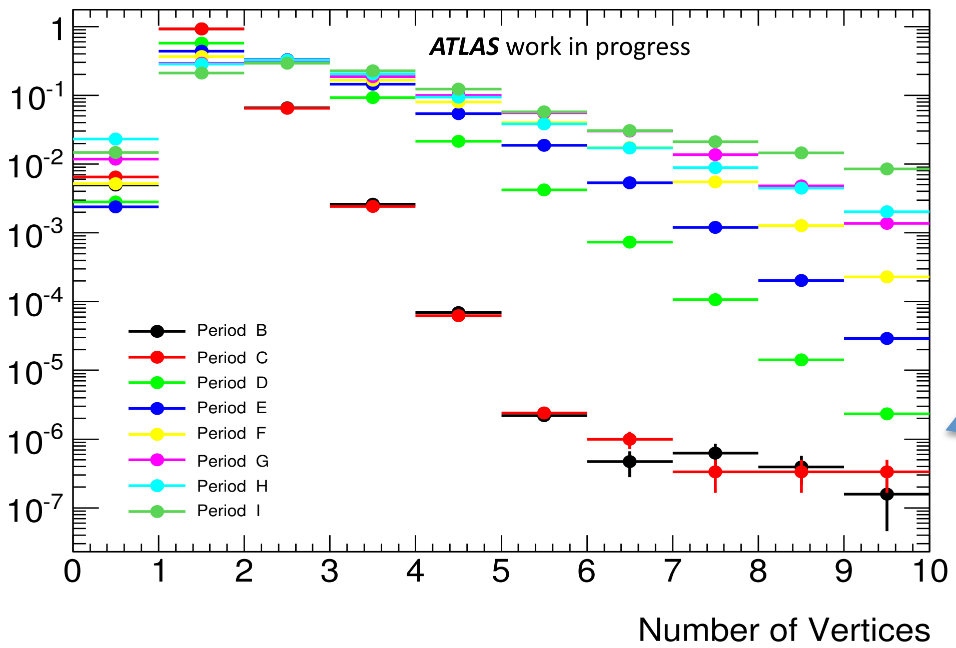




- Forward jets can be outside the tracking region of ATLAS.
- Very low number of events have no vertex (similar to central region).
- No bias from vertex selection for forward jets.

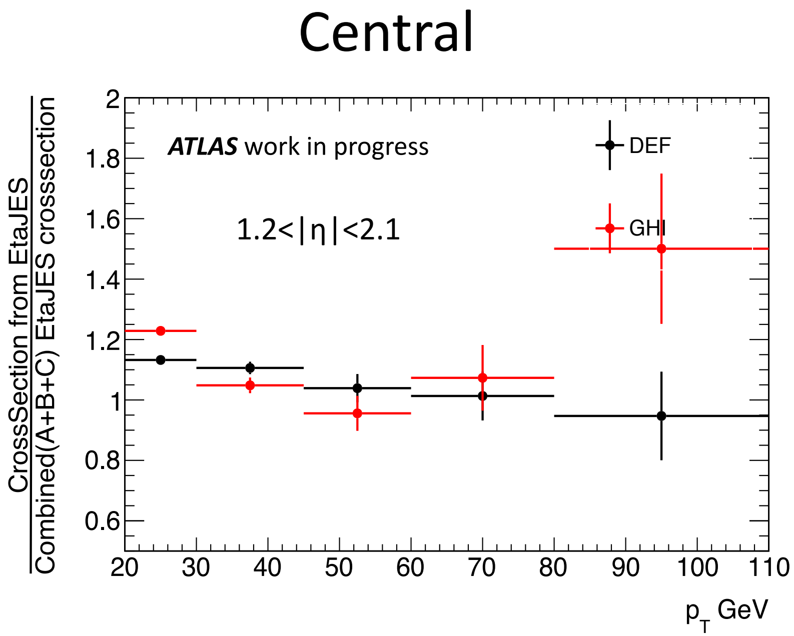
Pileup

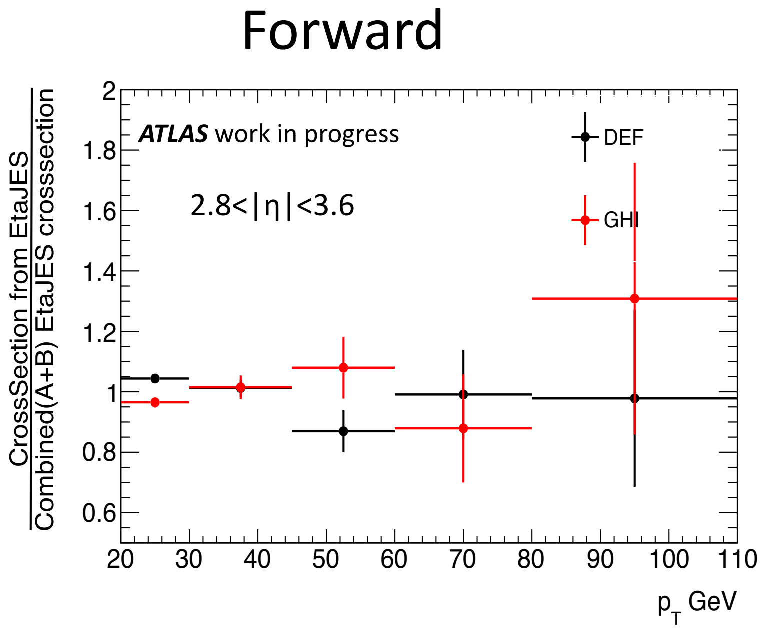
- Pileup is multiple proton proton interaction
- The pileup interactions leads to low energy deposits throughout the calorimeter.
- Low p_T jets are most affected.
- During 2010 the amount of pileup increased significantly.



Period	Mean Nº Vertices	Instantaneous Luminosity
A	1.0	
B	1.1	Low
C	1.1	
D	1.6	
E	1.9	Medium
F	2.2	
G	2.5	
H	2.3	High
I	2.8	

Pileup effect on cross section





- To check the effect of pileup we use Periods A,B and C as a base as they have very low levels of pileup.
- Looking at the ratio of DEF and GHI to ABC we can see the effect of the pileup
- The central region is affected more by the pileup than the forward region.
- As Period A-C has 2/3 of the MBTS data, we only use these periods for low p_T jets.

Theoretical Predictions

Data (corrected for detector effects) is compared to fixed order NLO calculations. Two approaches to NLO predictions, both estimate the affect due to missing higher order terms and non-perturbative QCD.

NLOJet

•Used NLOJet++ generator with CTEQ6.6 NLO pdf for perturbative part.

•Uncertainty from higher order terms are estimated by scale variation.

•Get non-perturbative corrections by comparing PYTHIA after parton showering to full generation of PYTHIA (with hadronization and MPI)

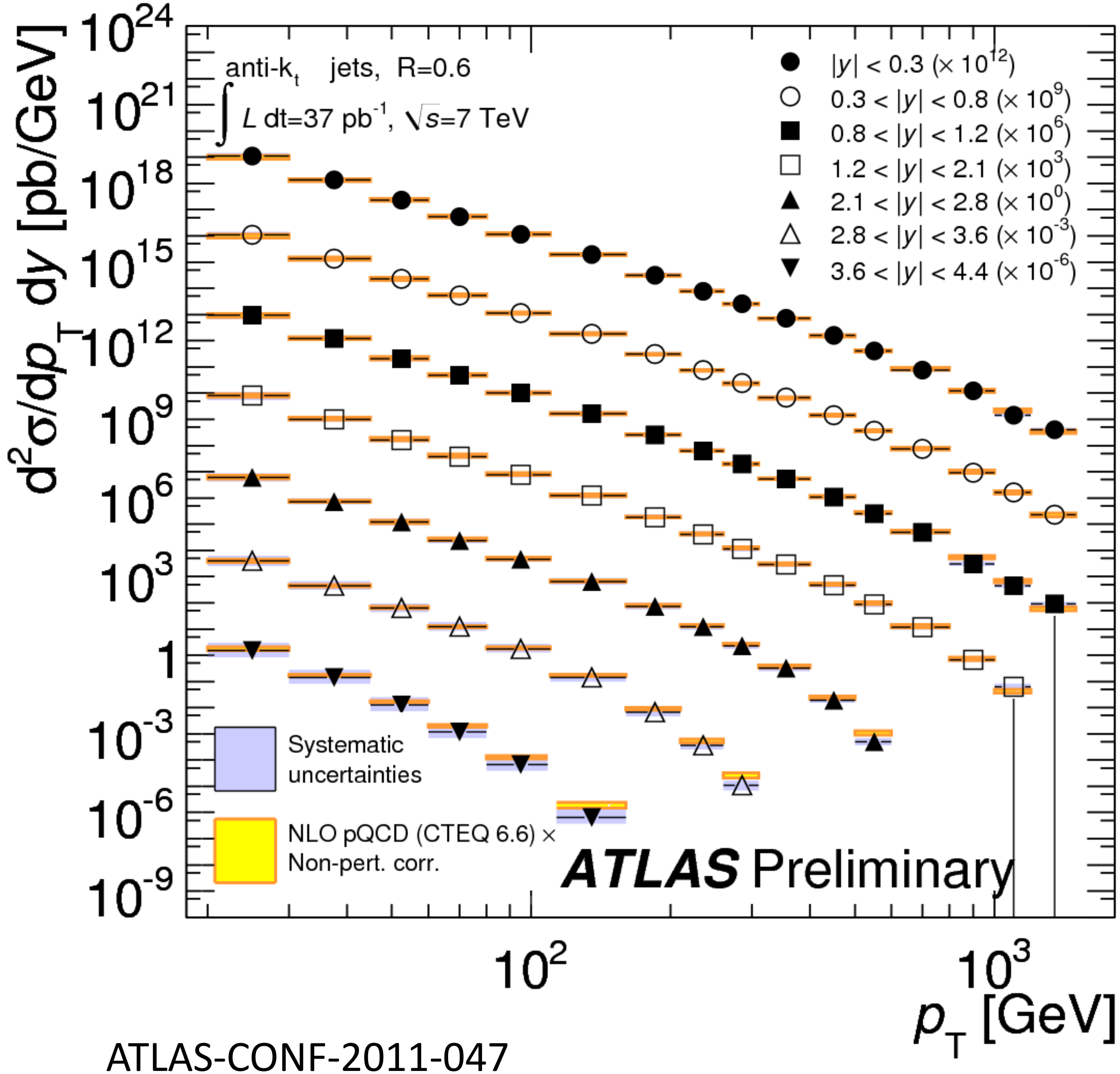
POWHEG

•POWHEG generates the NLO parton distribution.

•The higher order effects (and uncertainty) are estimated from the parton showering from PYTHIA and HERWIG.

•Non-perturbative effects estimated from hadronization and MPI algorithms

Results: $d^2\sigma/dp_T dy$



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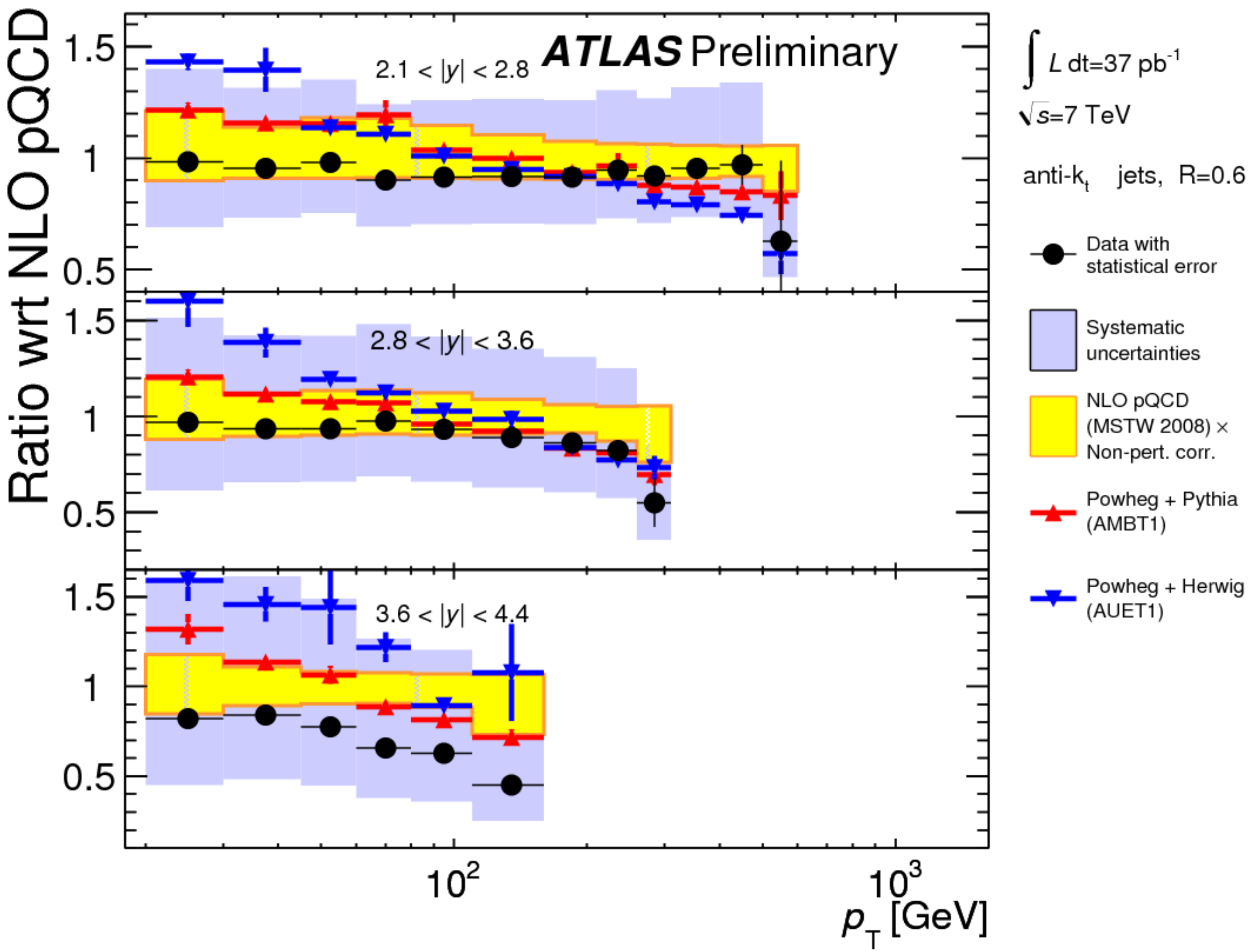
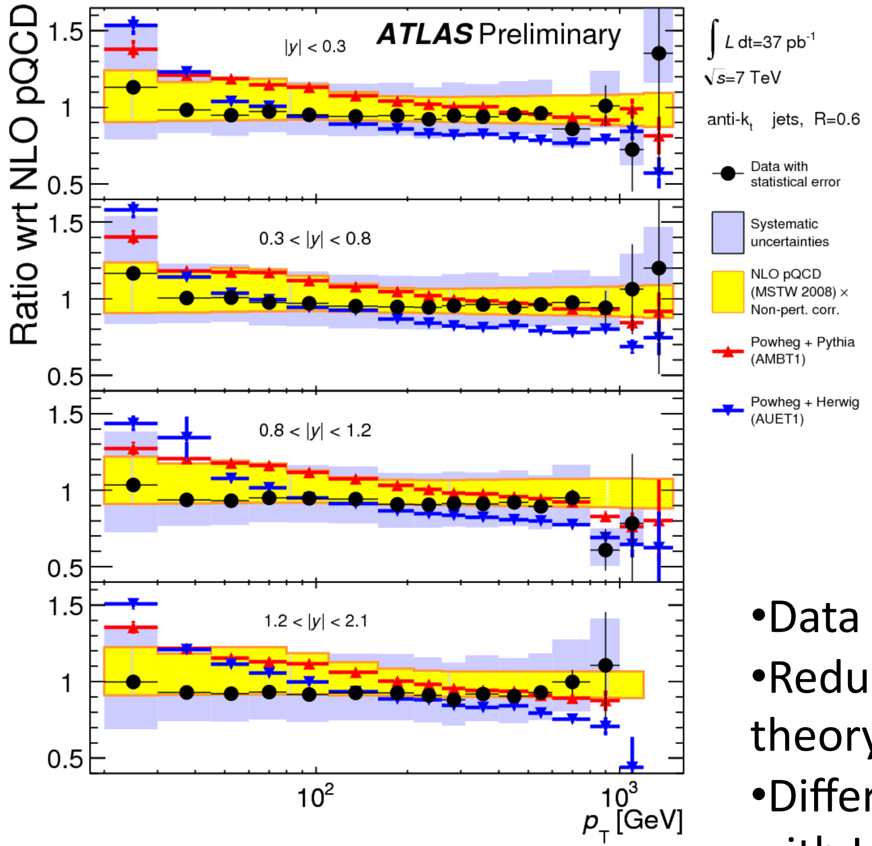
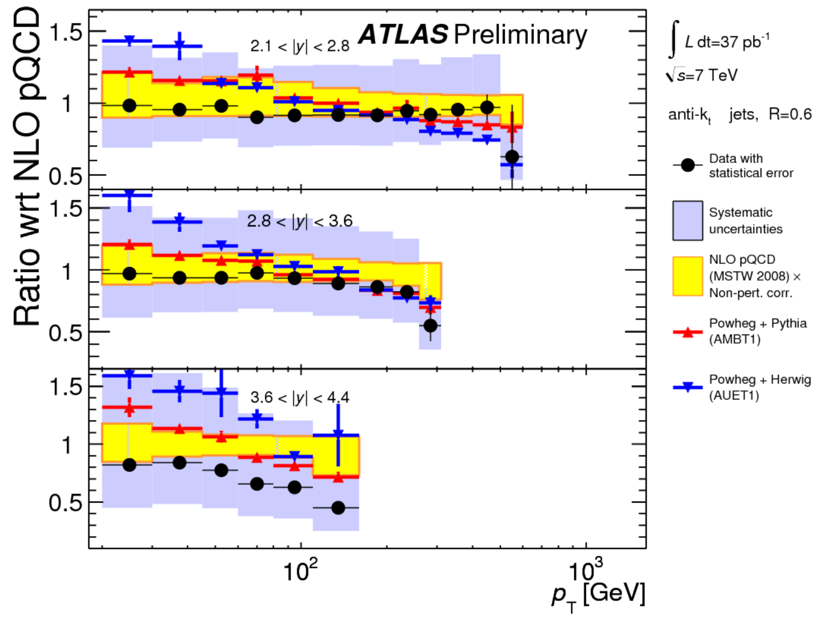
Results: Ratio wrt NLO pQCD



Dominant systematic is JES and Unfolding

Results: Ratio wrt NLO pQCD





- Data encompasses all three theoretical predictions.
- Reducing the uncertainty on the data could constrain the theory.
- Differences between POWHEG with PYTHIA and POWHEG with HERWIG due to the different parton showering implementation.
- Differences between the NLO pQCD and the POWHEG +HERWIG at the low p_T region.

Conclusions

- The inclusive jet cross section measurement has been extended to cover the forward region ($|\eta|<4.4$) and to a p_T of 20 GeV
- The data has been increased from 17 nb^{-1} to 37 pb^{-1}.
- Event selection does not cause bias for low p_T jets in the forward region.
- Two different approaches to NLO predictions were considered, NLO pQCD and POWHEG
- The results show the data is consistent with all theory curves shown.
- Some tension between the different theory calculations that lower systematic errors on the data could help resolve.