

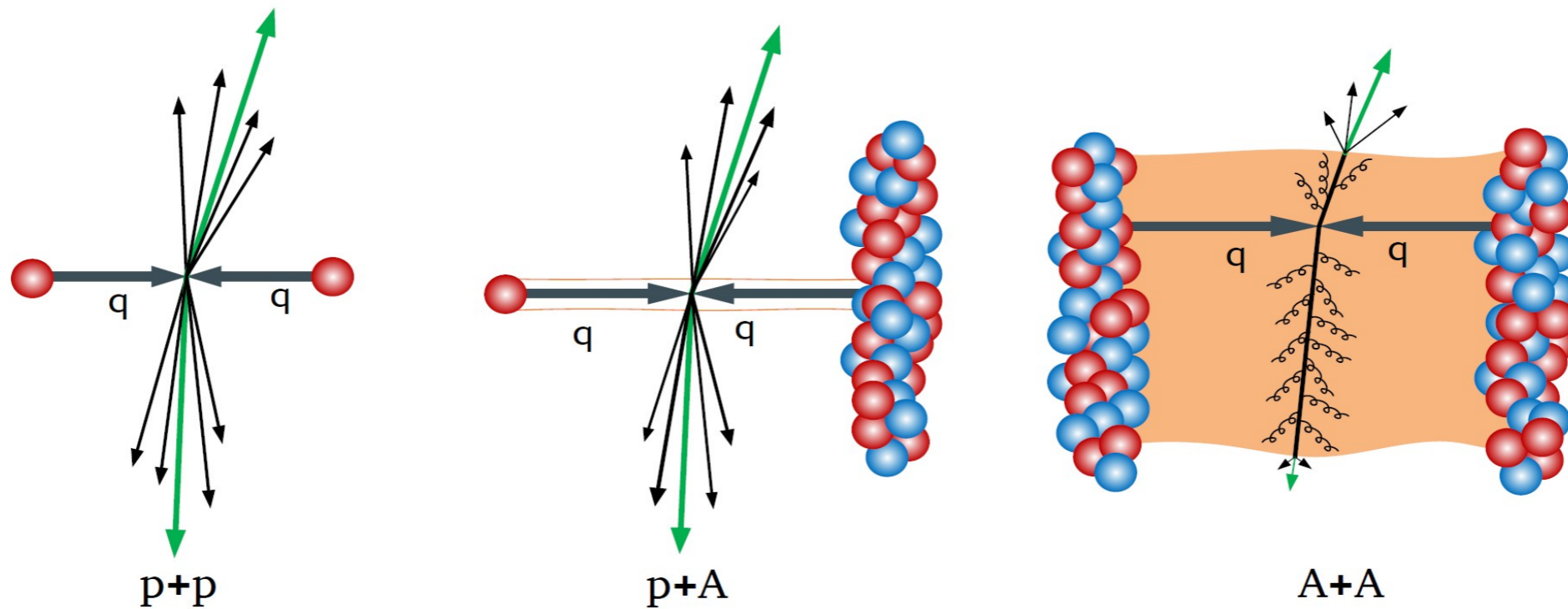


# New Results on Jets in Heavy Ion Collisions with the ATLAS Experiment

Run: 286665  
Event: 419161  
2015-11-25 11:12:50 CEST

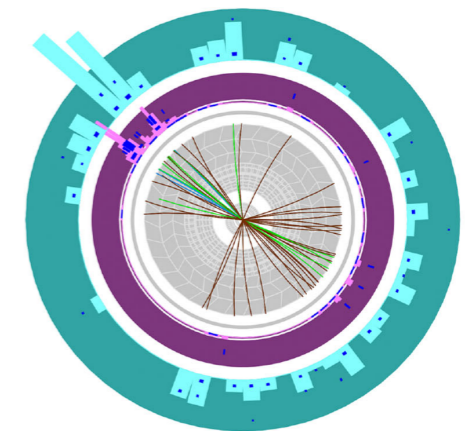
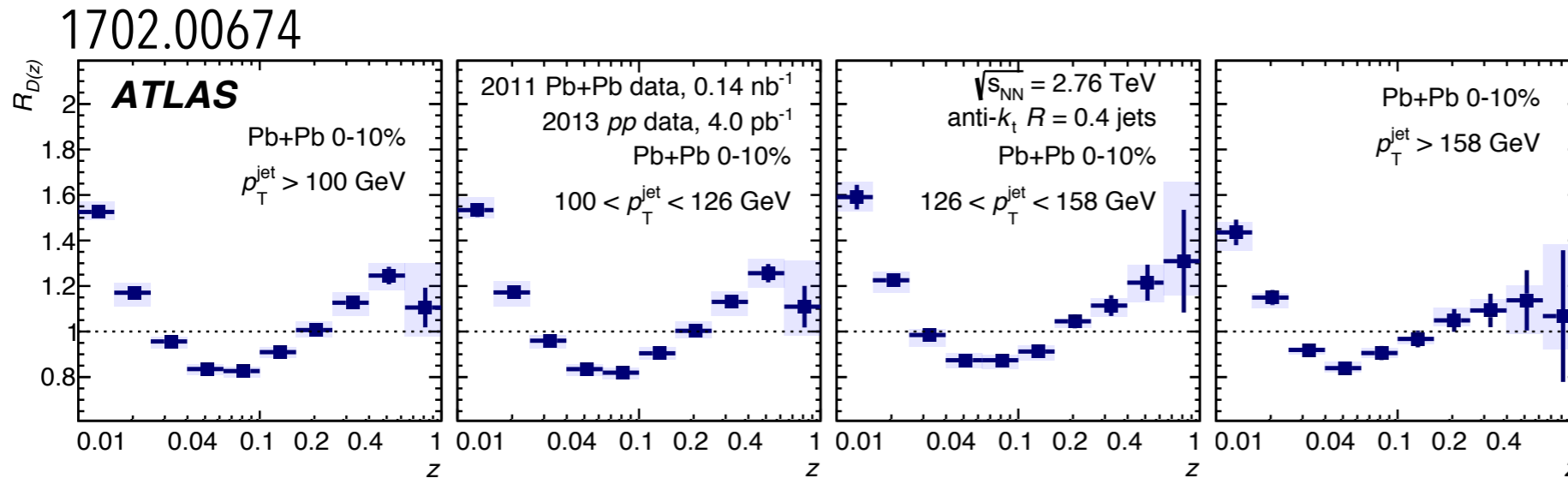
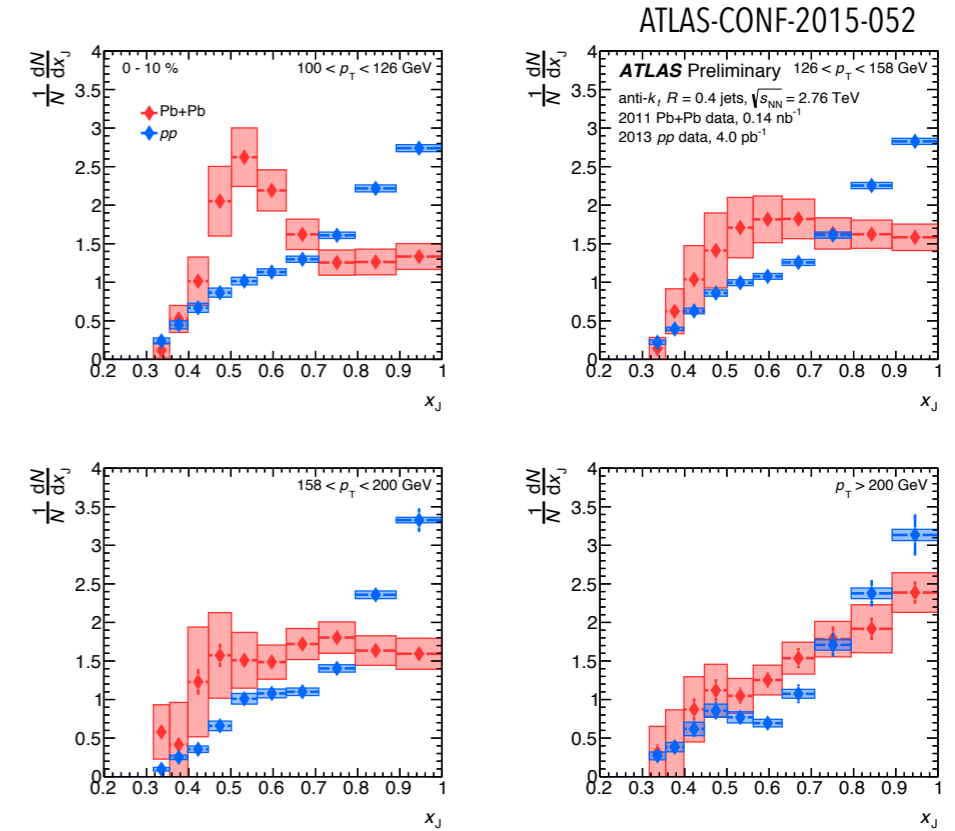
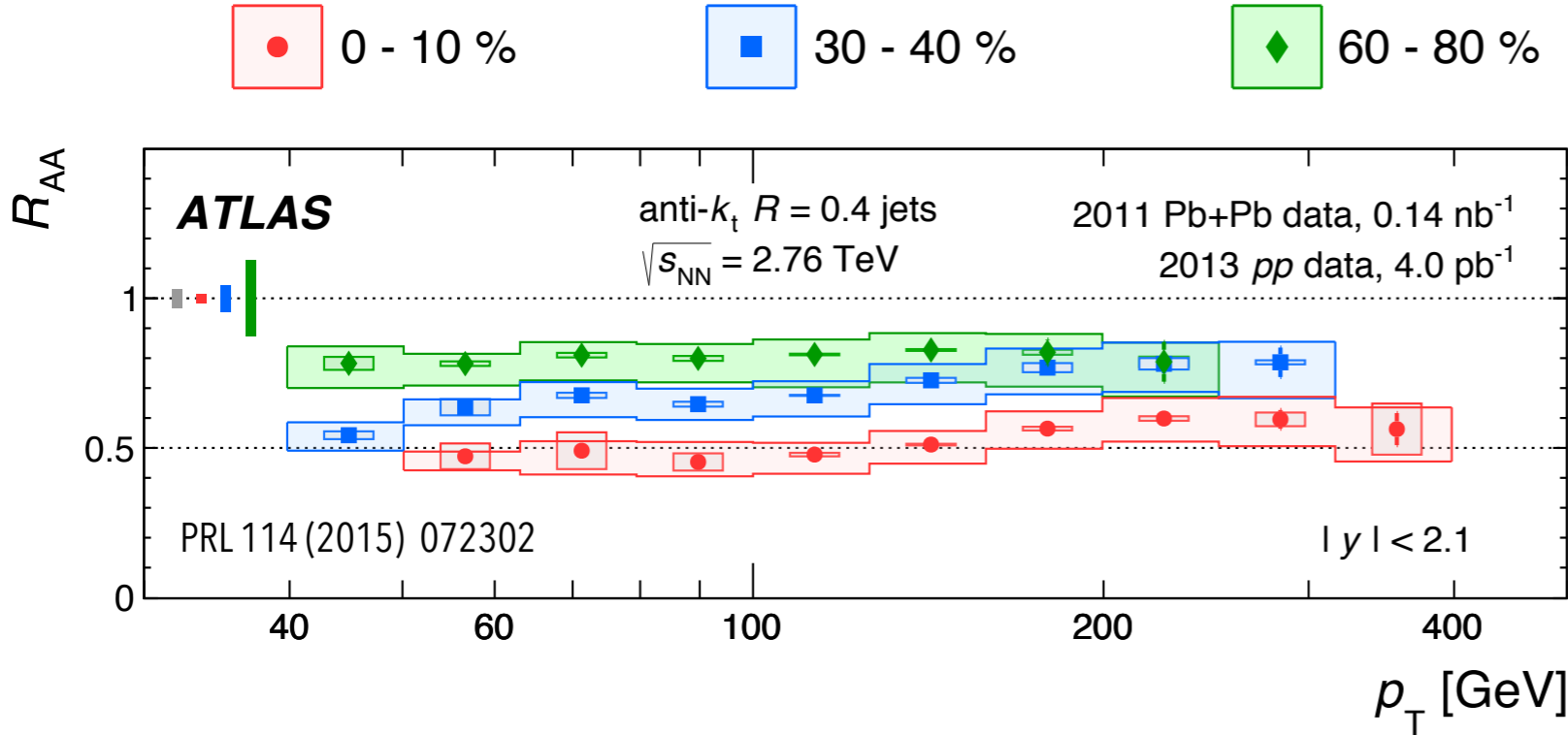
first stable beams heavy-ion collisions

# jets as a probe of hot nuclear matter



- use jets to probe the hot nuclear matter created in heavy ion collisions
- study jets, their correlations, and their structure in Pb+Pb collisions
- requires precision measurements in p+p and p+Pb collisions to establish a baseline and benchmark calculations: extensive measurements, not discussed here

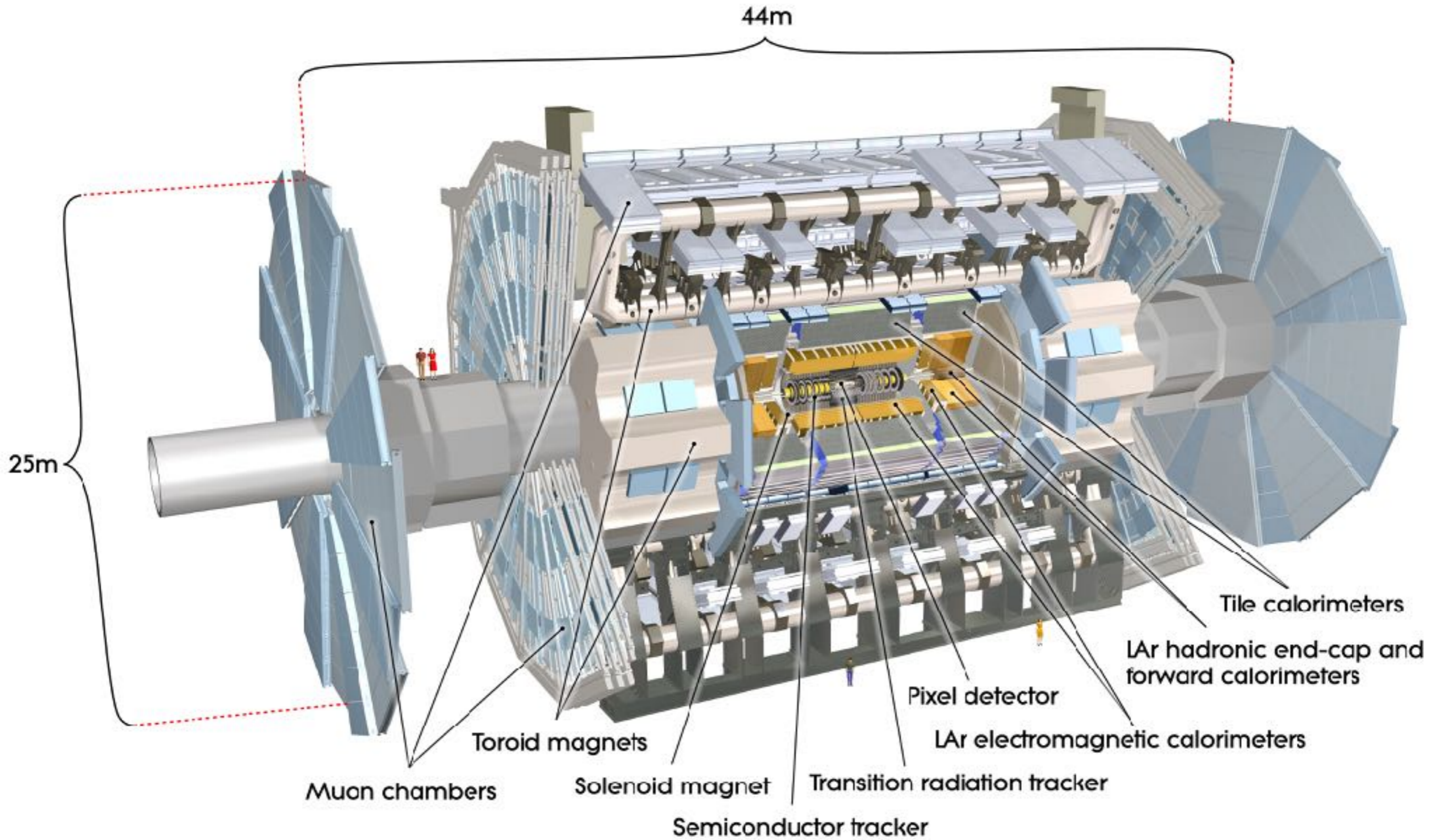
# Run 1 Results



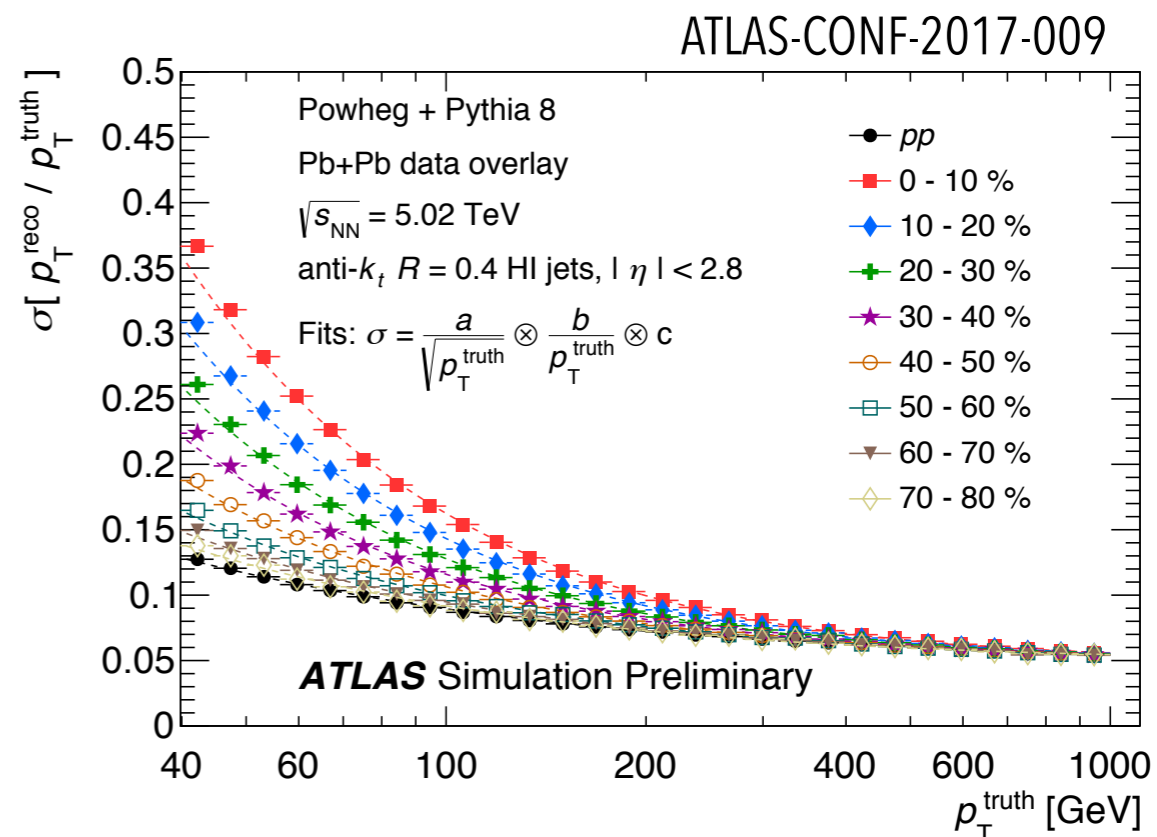
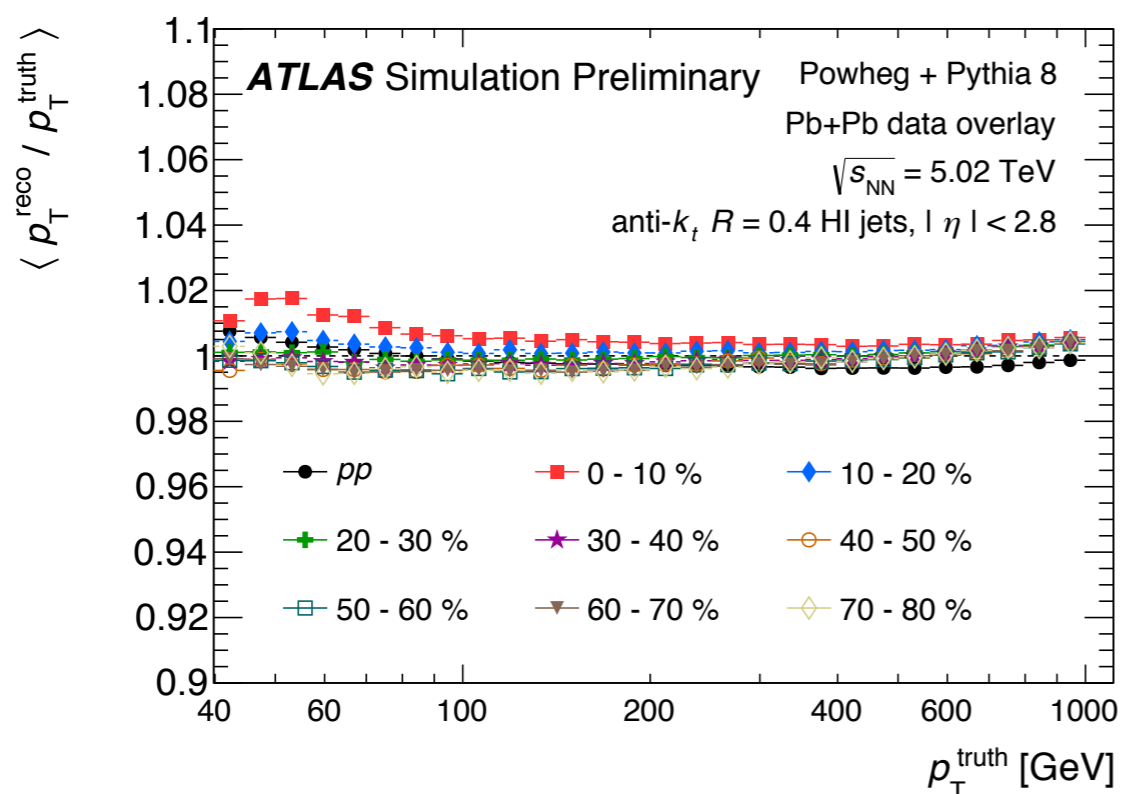
PRL 105 (2010) 252303

goal: use the high statistics Run2 data to make precise, differential measurements of jets in PbPb collisions

# ATLAS



# jet reconstruction performance



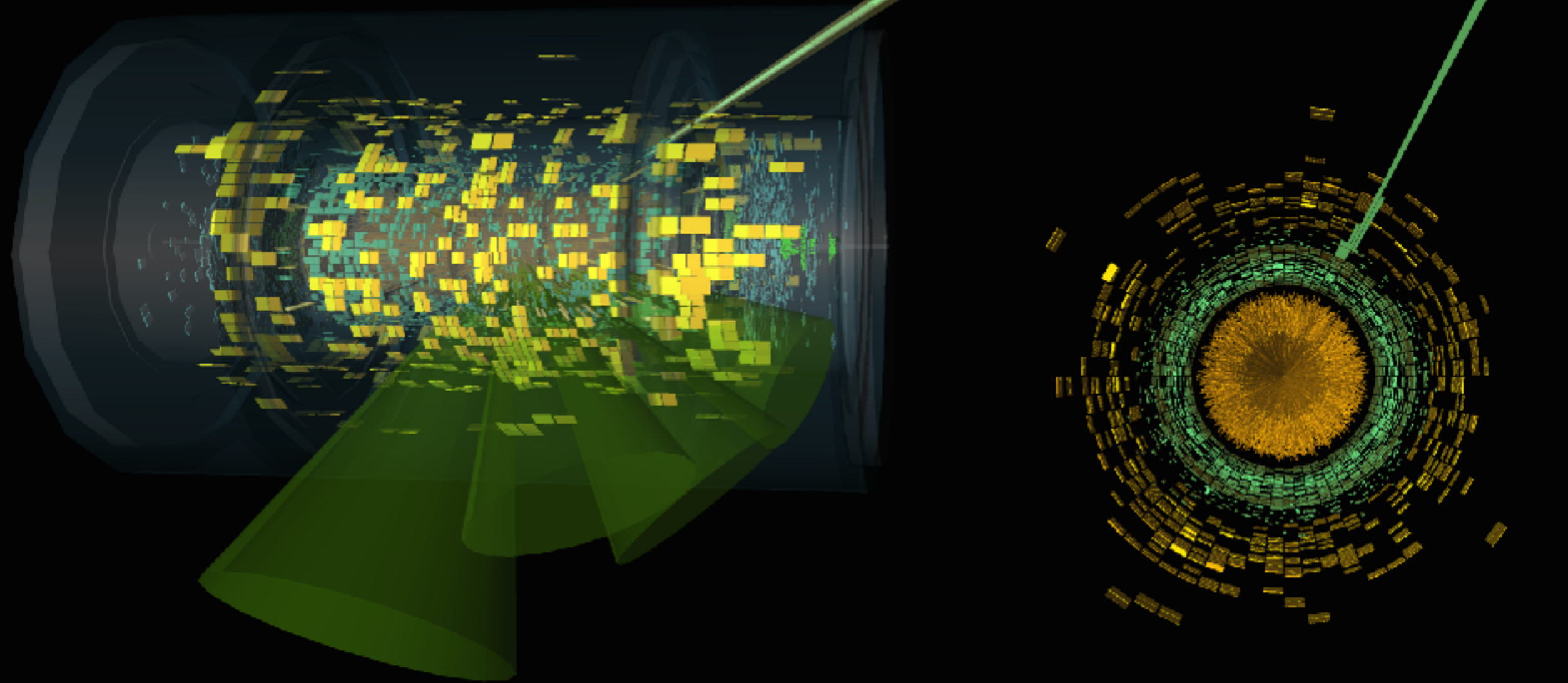
- **Jet Energy Scale:**  $\sim 1\%$  centrality dependence
- **Jet Energy Resolution:** increased underlying event fluctuations lead to larger resolution in central collisions

excellent jet reconstruction performance key to precision measurements



Pb+Pb,  $\sqrt{s_{NN}} = 5.02$  TeV  
photon + multijet event  
 $\Sigma E_T^{FCal} = 4.06$  TeV

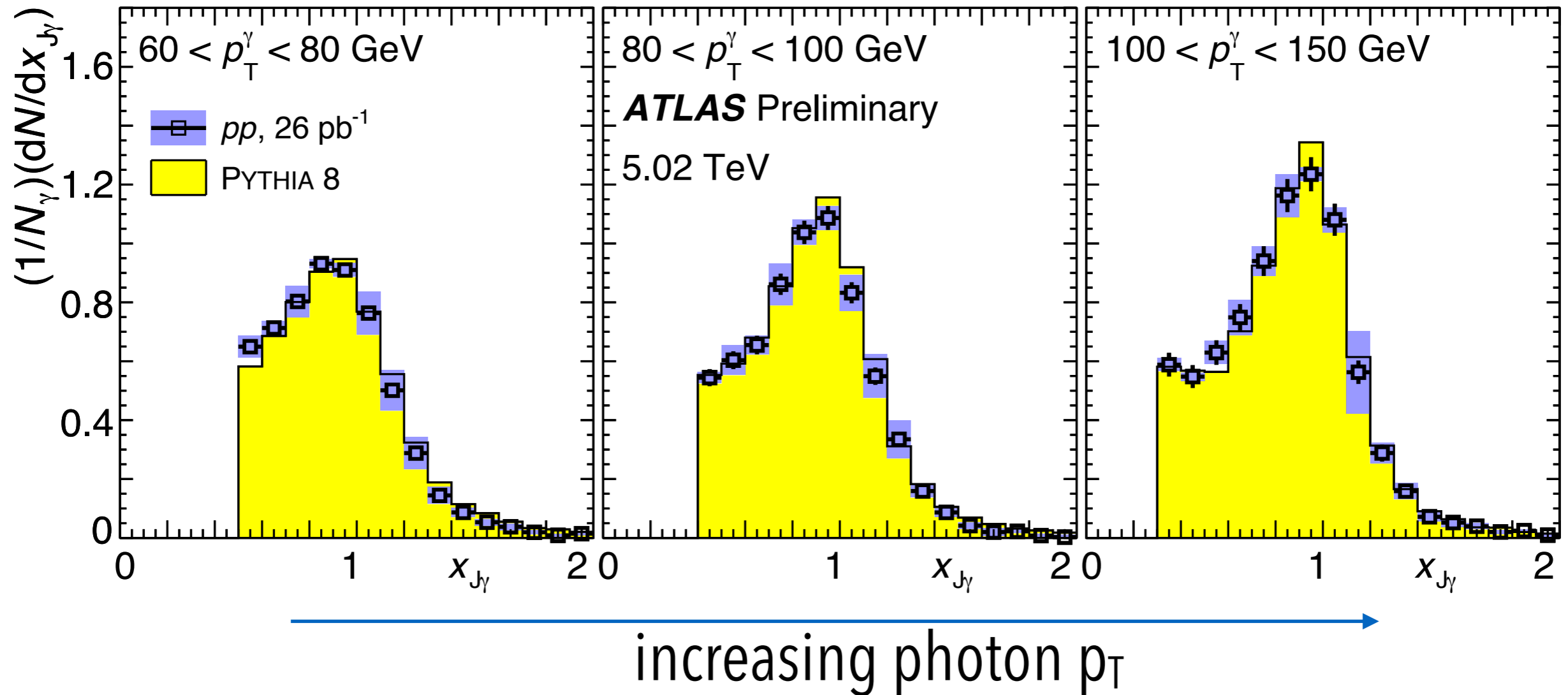
Run: 286834  
Event: 124877733  
2015-11-28 01:15:42 CEST



# photon-jet correlations in pp

$$x_{J\gamma} = p_{T,\text{jet}} / p_{T,\gamma}$$

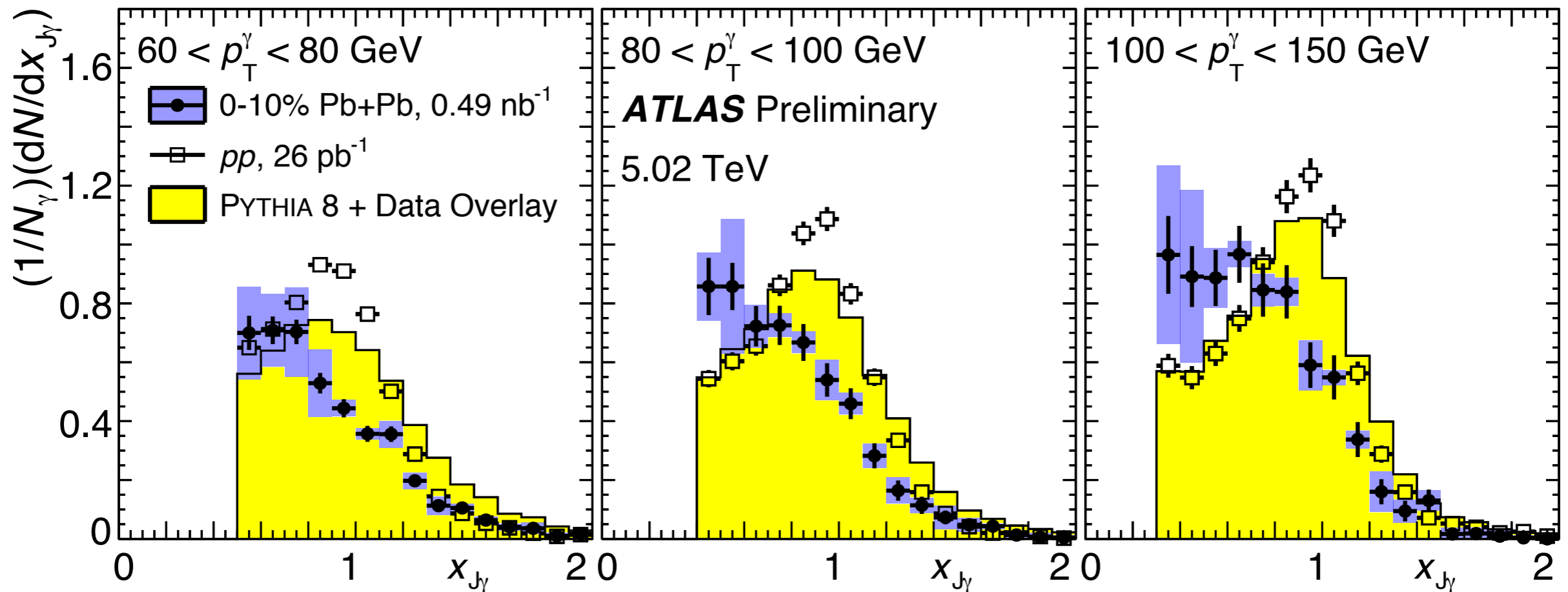
**photons:**  $p_T > 60$  GeV; **jets:**  $R = 0.4$  anti- $k_T$ ,  $p_T > 30$  GeV



corrected for backgrounds and jet energy scale, but not for jet energy resolution, which is present in data and MC

# photon-jet correlations in PbPb

$$x_{J\gamma} = p_{T,\text{jet}} / p_{T,\gamma}$$

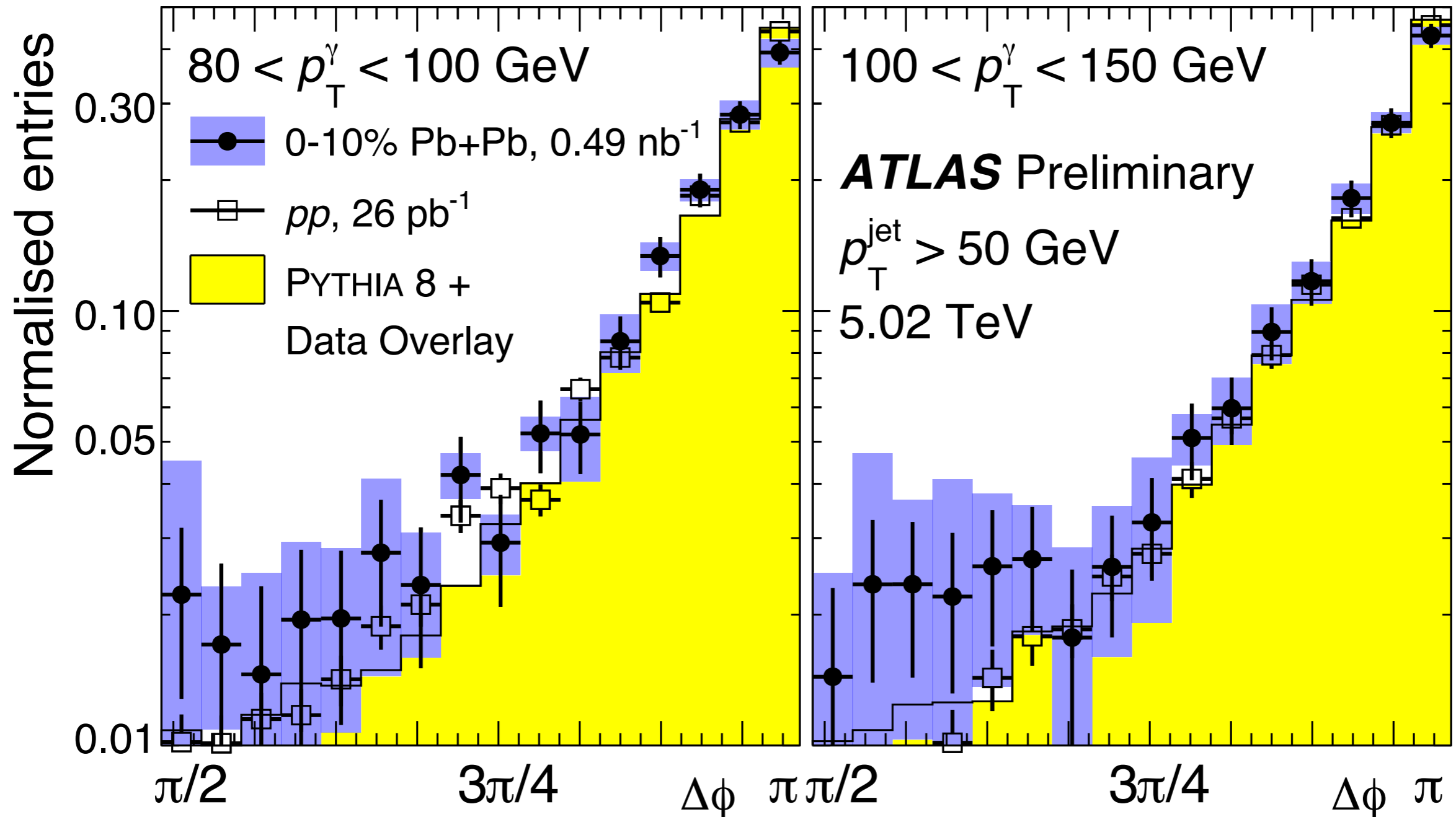


increasing photon  $p_T$

**PbPb result:** reduction in balanced photon-jet pairs; increase in unbalanced photon-jet pairs compared to pp and Pythia8 overlaid with data



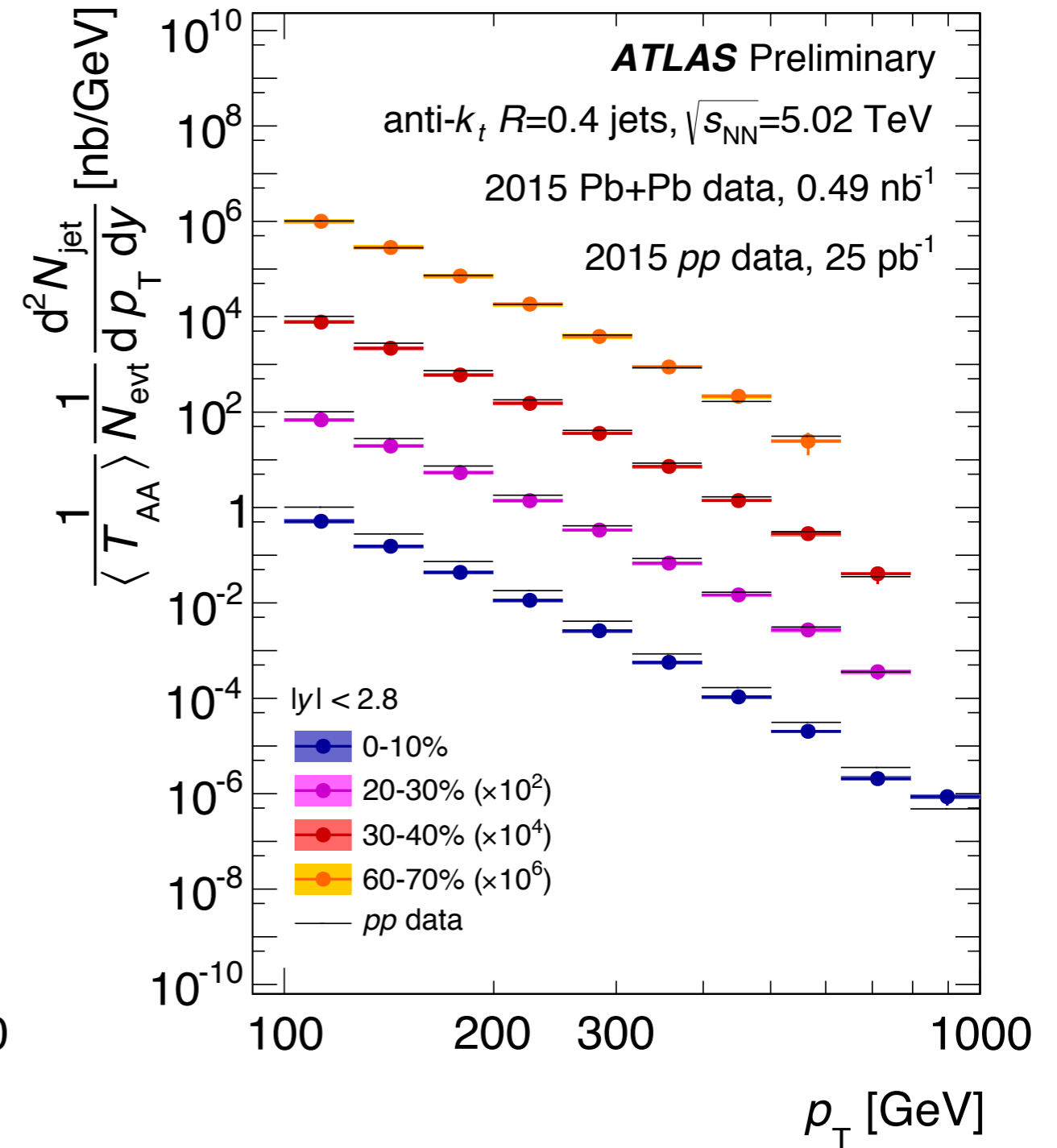
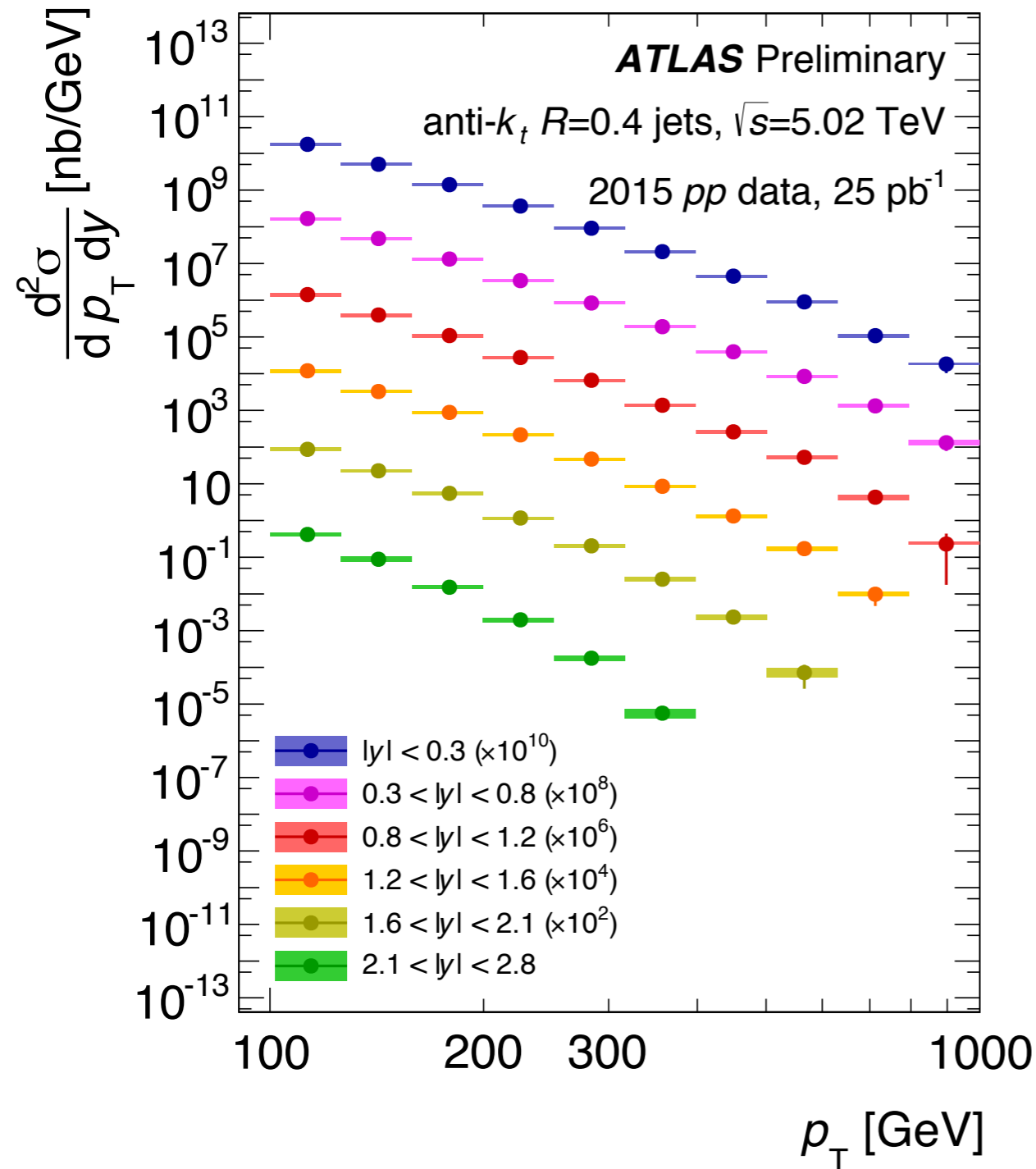
# photon-jet angular distributions



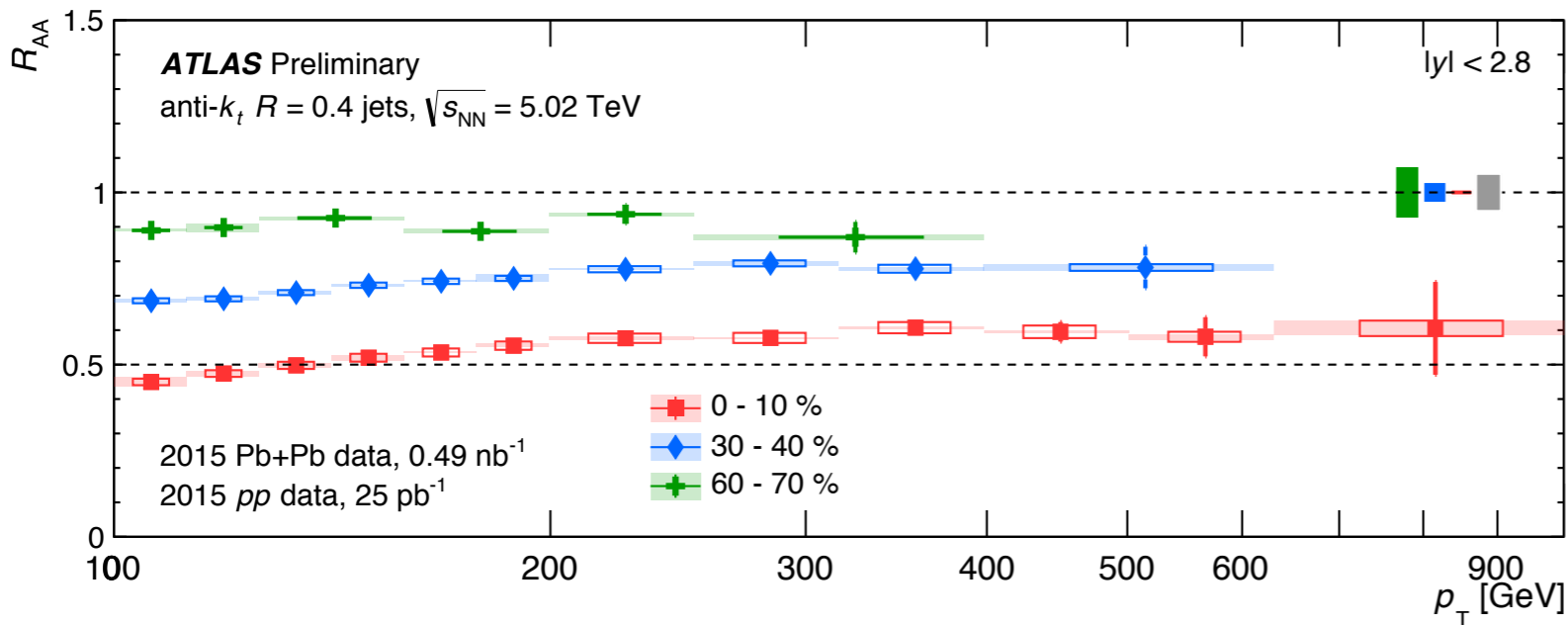
no evidence observed for additional large angle contributions in PbPb collisions

# inclusive jet spectra in PbPb & pp

ATLAS-CONF-2017-009

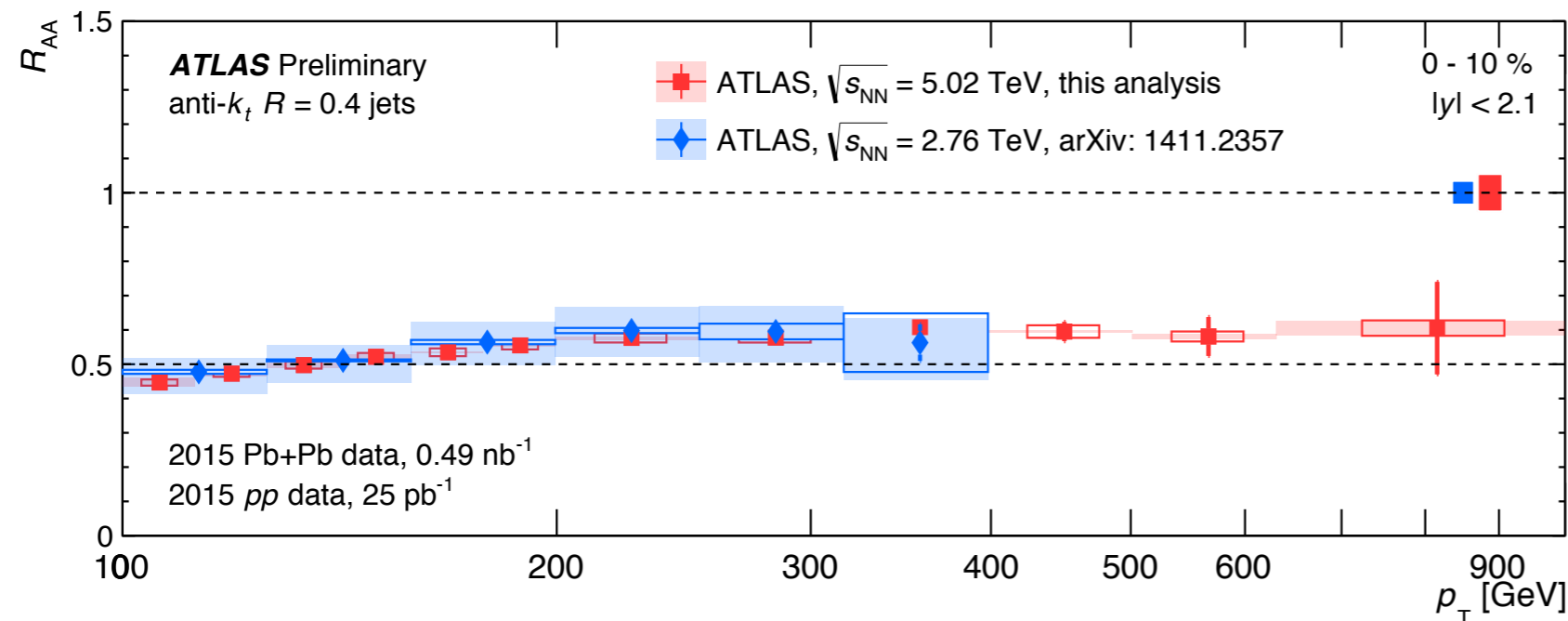


spectra out to  $\sim 1$  TeV, differential in **rapidity** and **centrality**



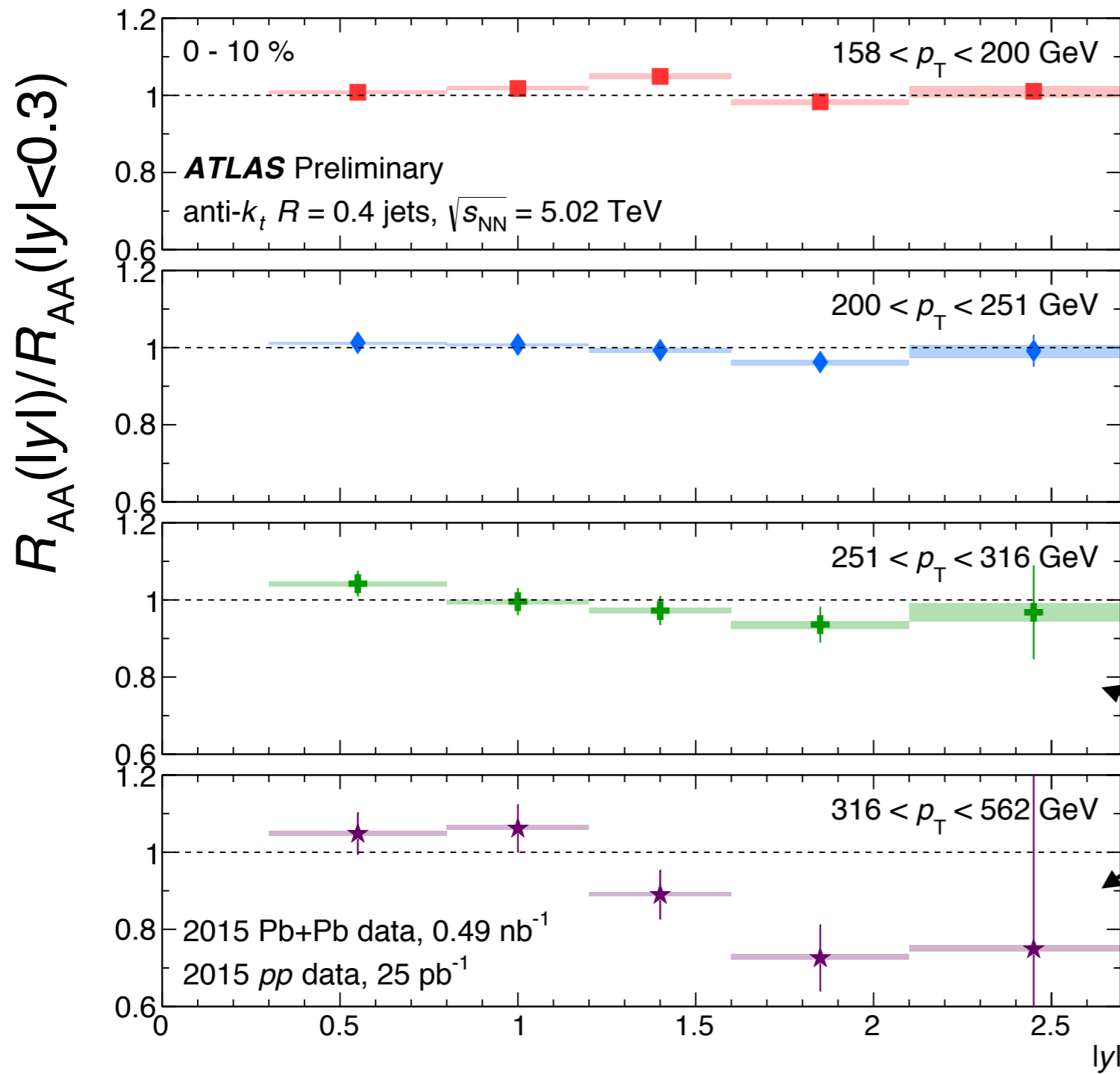
$$R_{AA} = \frac{N_{AA,jet}}{N_{AA,evt} \sigma_{pp,jet} \langle T_{AA} \rangle}$$

consistent with constant  $R_{AA}$  for jets from 200 GeV to 1 TeV



no significant change of  $R_{AA}$  from 2.76 TeV to 5.02 TeV

# rapidity dependence of $R_{AA}$



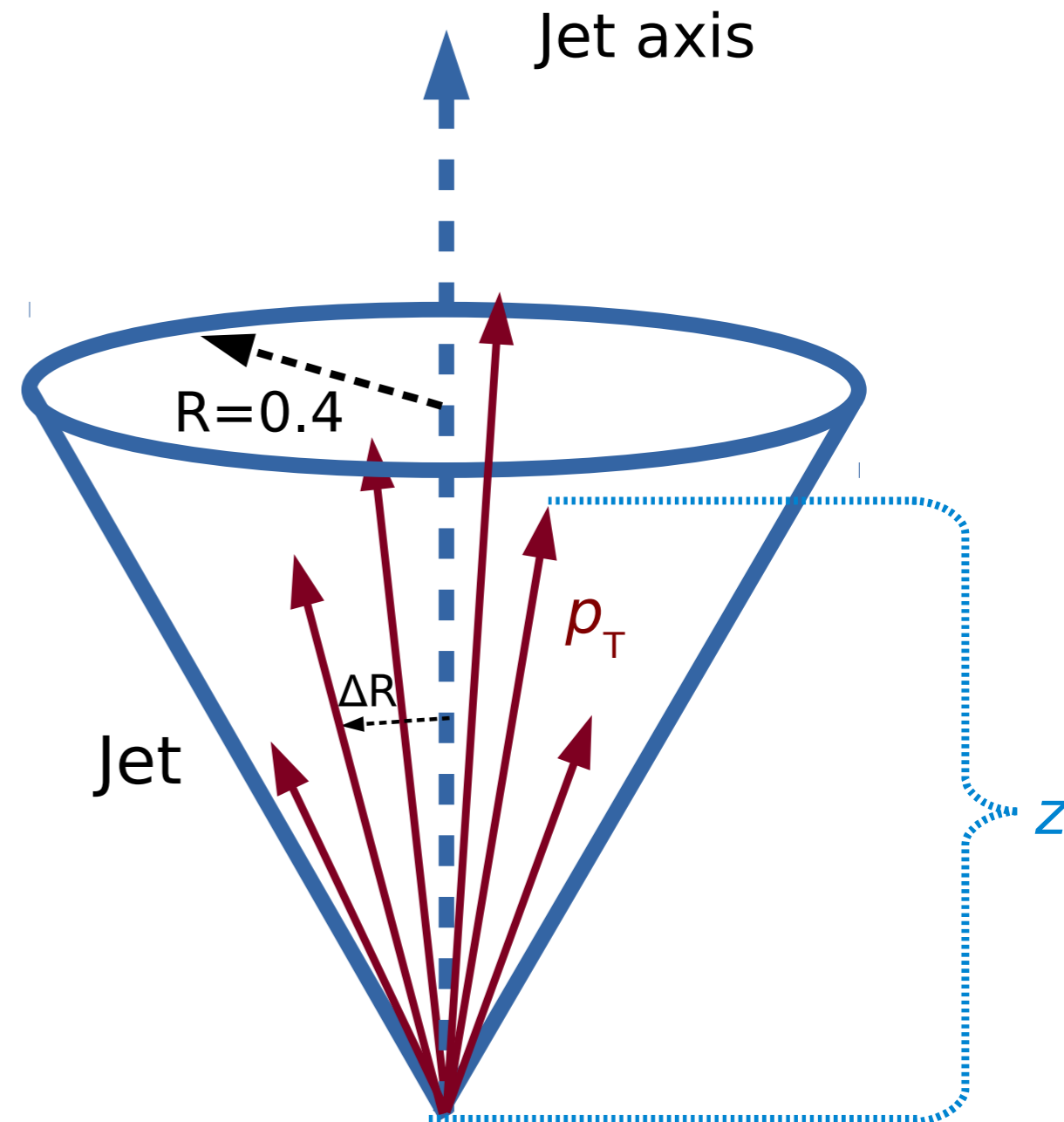
more forward

- increasing rapidity
- steeper spectra
- more quark jets
- $R_{AA}$  sensitive to both effects
- first observation of a rapidity dependence to  $R_{AA}$

how are the particles within the jet distributed?

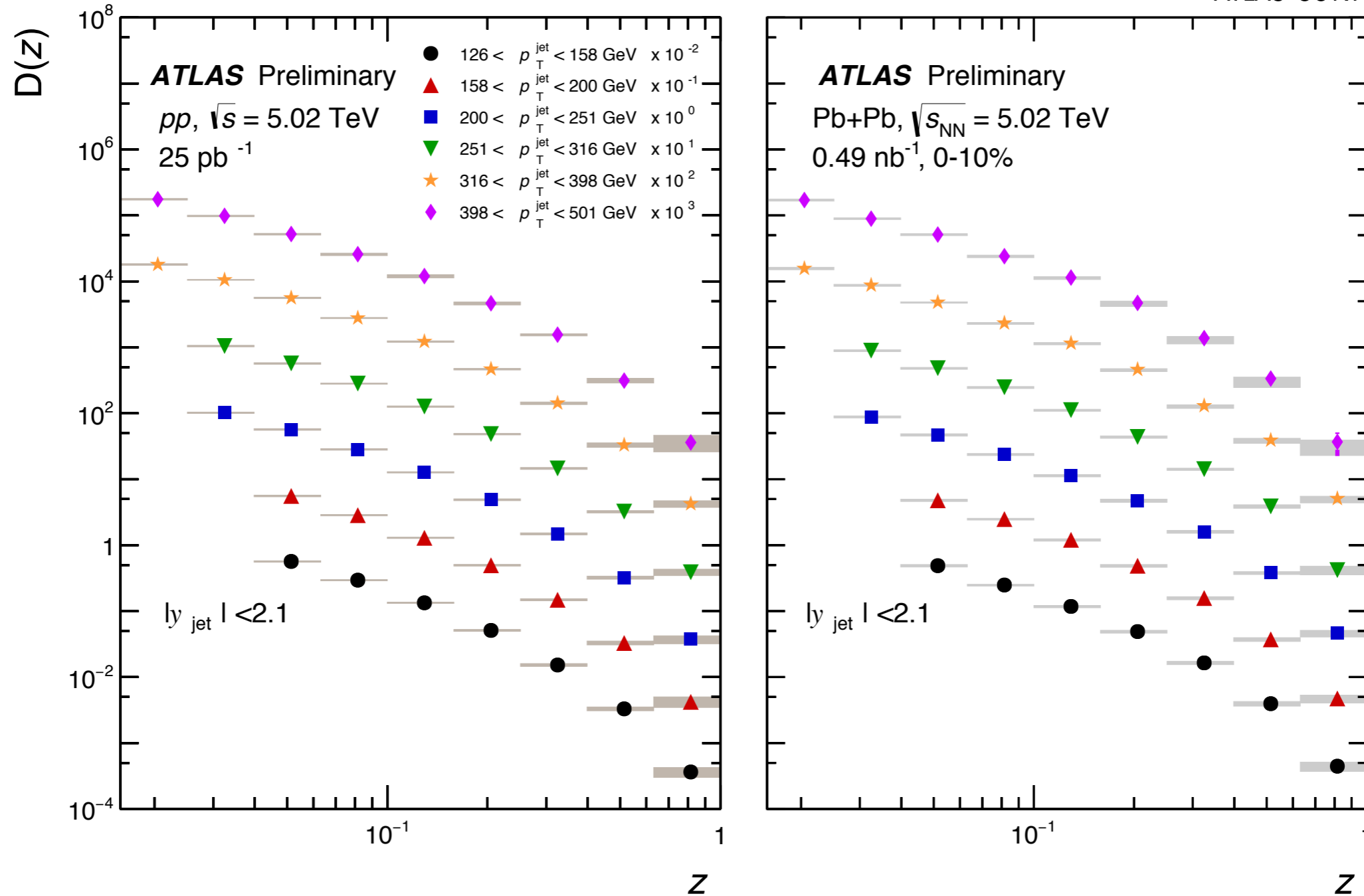
$$D(z) \equiv \frac{1}{N_{\text{jet}}} \frac{dN_{\text{ch}}}{dz}$$

$$z \equiv p_{\text{T}} \cos \Delta R / p_{\text{T}}^{\text{jet}}$$



# fragmentation functions in PbPb & pp

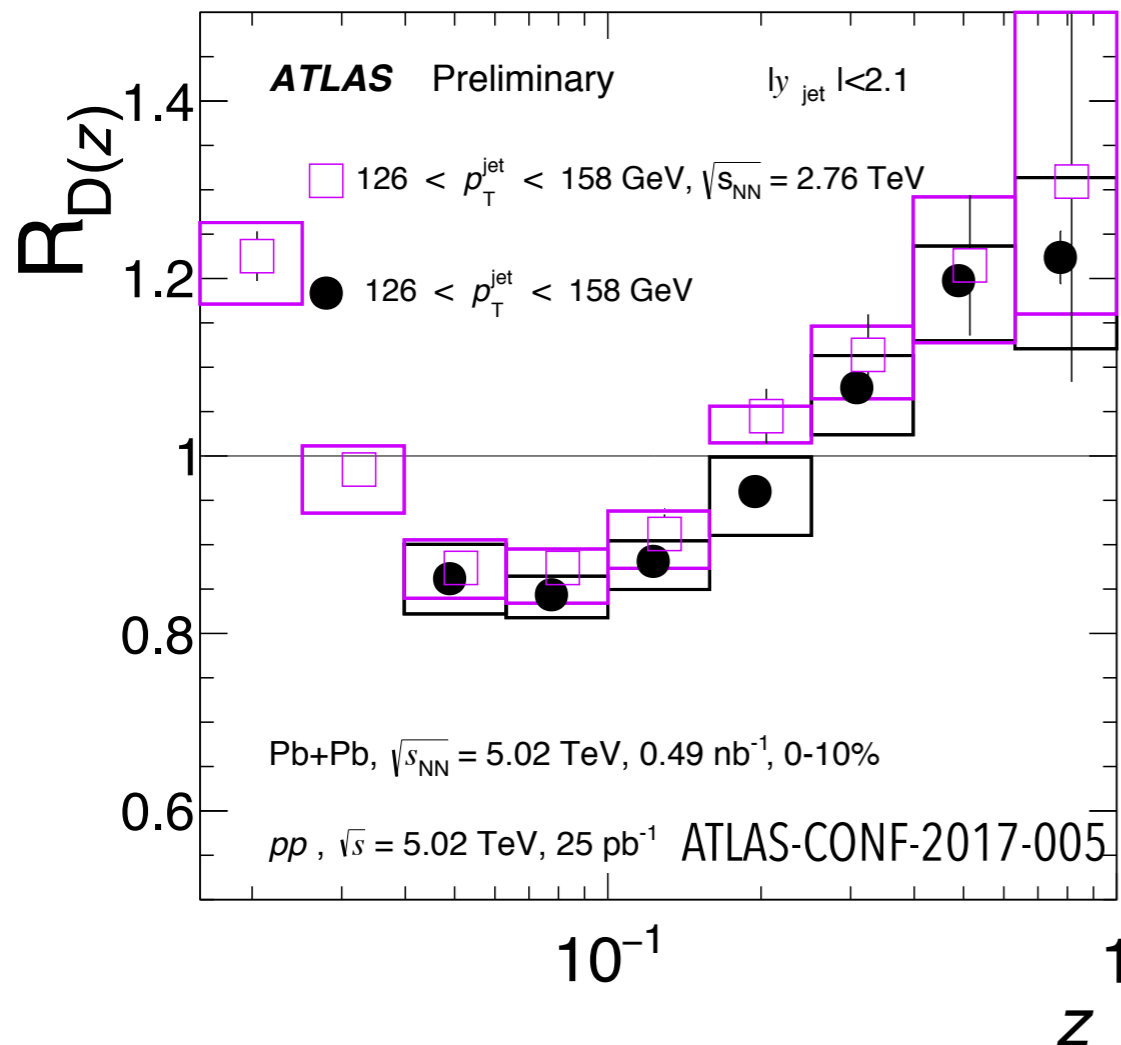
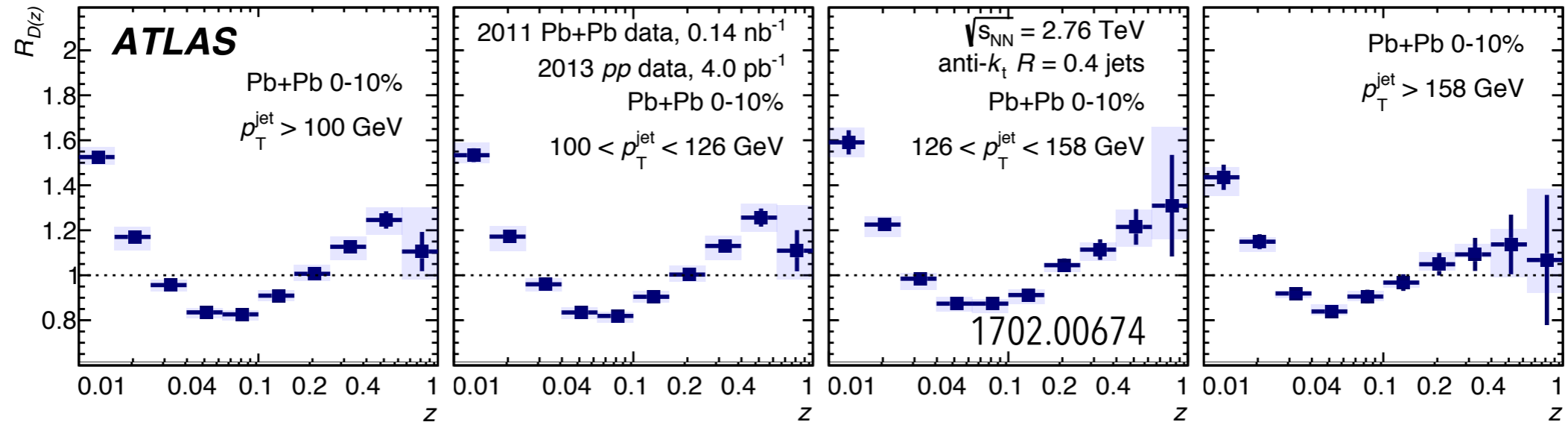
ATLAS-CONF-2017-005



- fragmentation measured differentially in jet  $p_T$  from 126 - 501 GeV
- 2D Bayesian unfolding in  $z$  & jet  $p_T$  to allow direct comparison to calculations

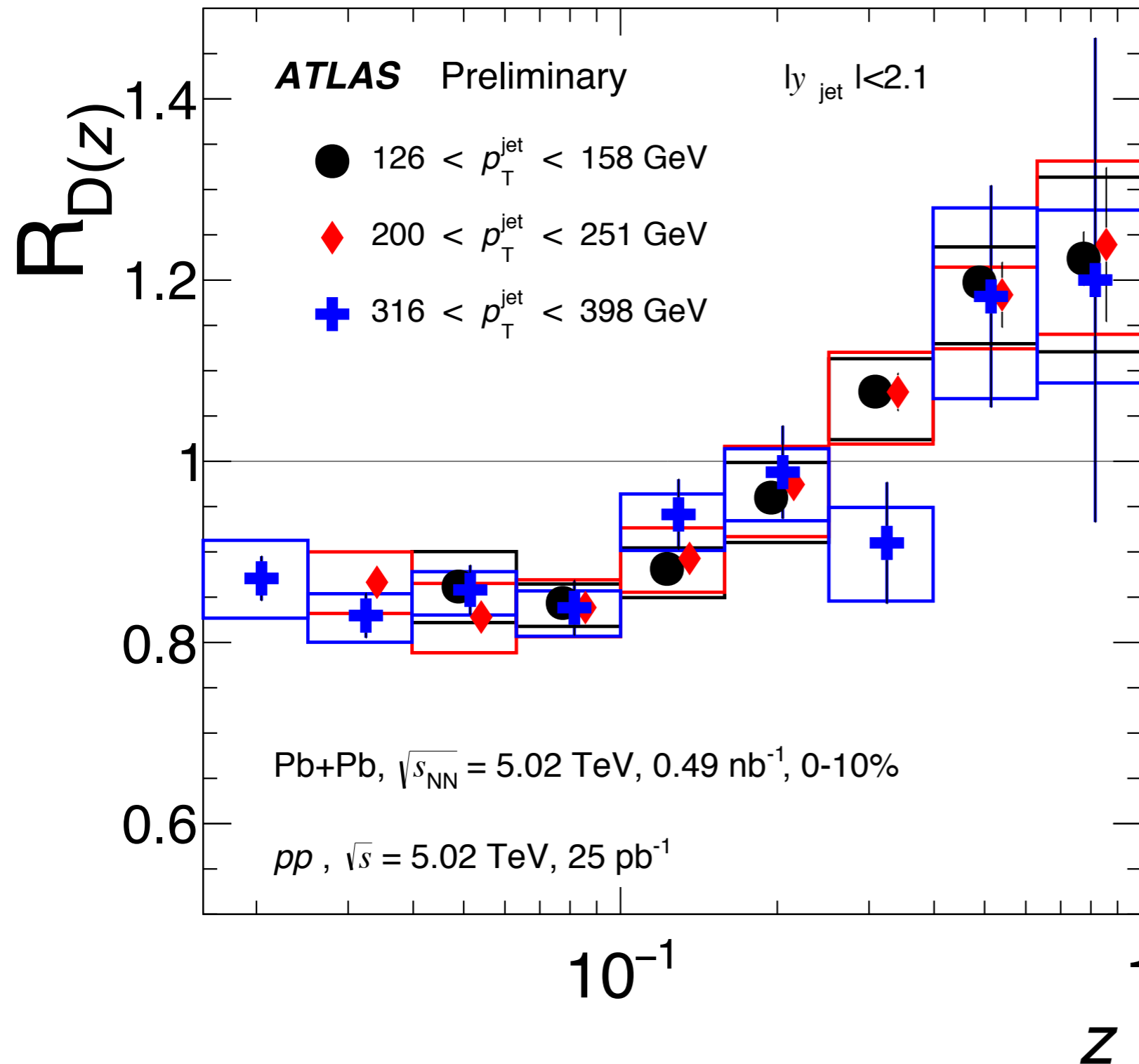
2.76 TeV

increasing jet  $p_T$  →



no difference observed between jet fragmentation in 5.02 & 2.76 TeV

# fragmentation in PbPb: 5 TeV compared to 2.76 TeV



no jet  $p_{\text{T}}$  dependence to jet fragmentation observed

high  $z$  excess  $\rightarrow$  due to different quenching of quark & gluon jets?  
 (Spousta & Cole: 1504.05169)

further work ongoing to measure the soft fragments, stay tuned!





wealth of new preliminary results  
more information available in the associated conference notes and papers

<https://twiki.cern.ch/twiki/bin/view/AtlasPublic/HeavyIonsPublicResults>

huge range in kinematics and developing a comprehensive suite of  
measurements

Run: 286665  
Event: 419161  
2015-11-25 11:12:50 CEST

first stable beams heavy-ion collisions