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# Dijet production with a jet veto using the ATLAS detector

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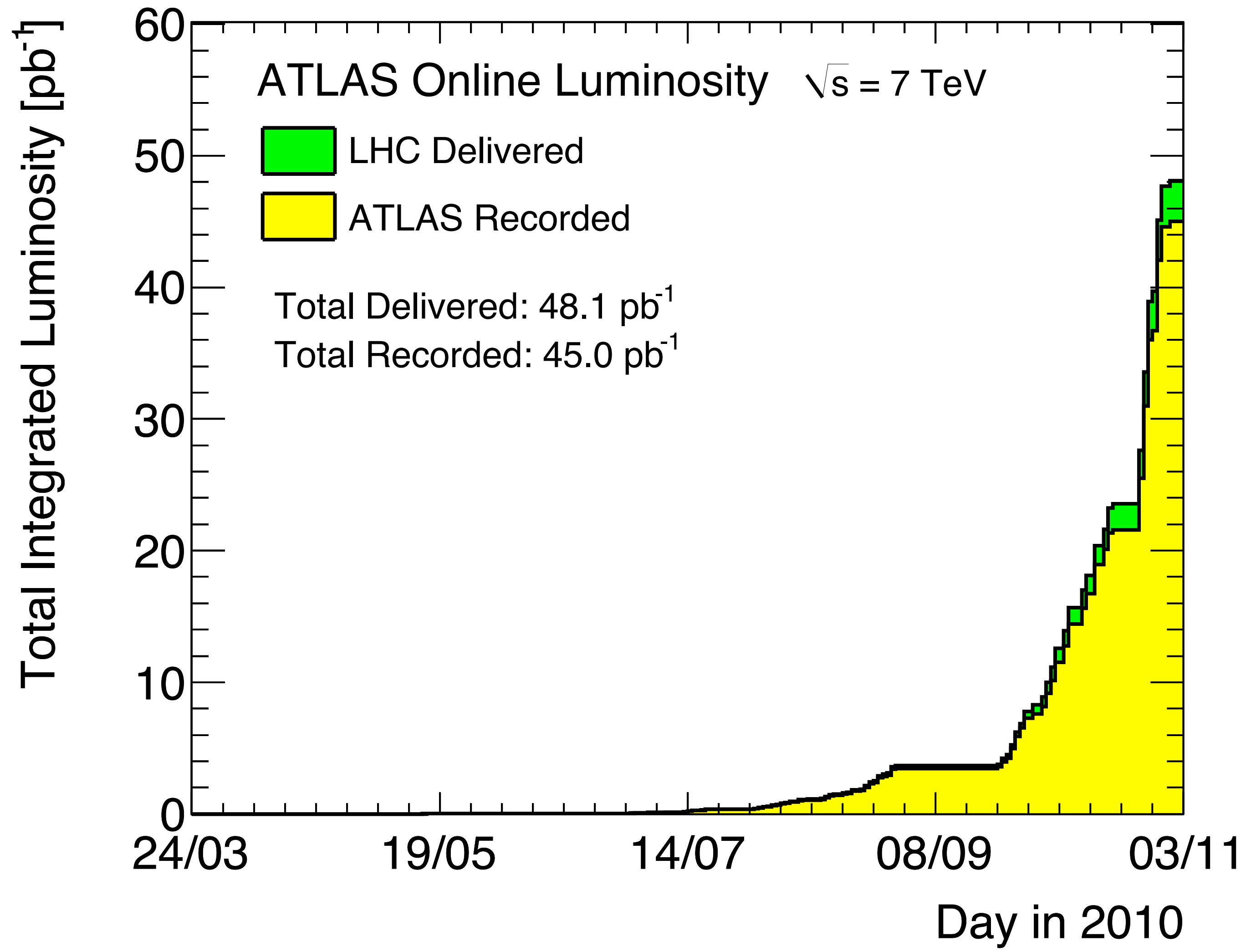
# Outline

- Introduction to measurement.
- New veto results from 2010 data.
- Comparison to latest theoretical predictions.

# ATLAS



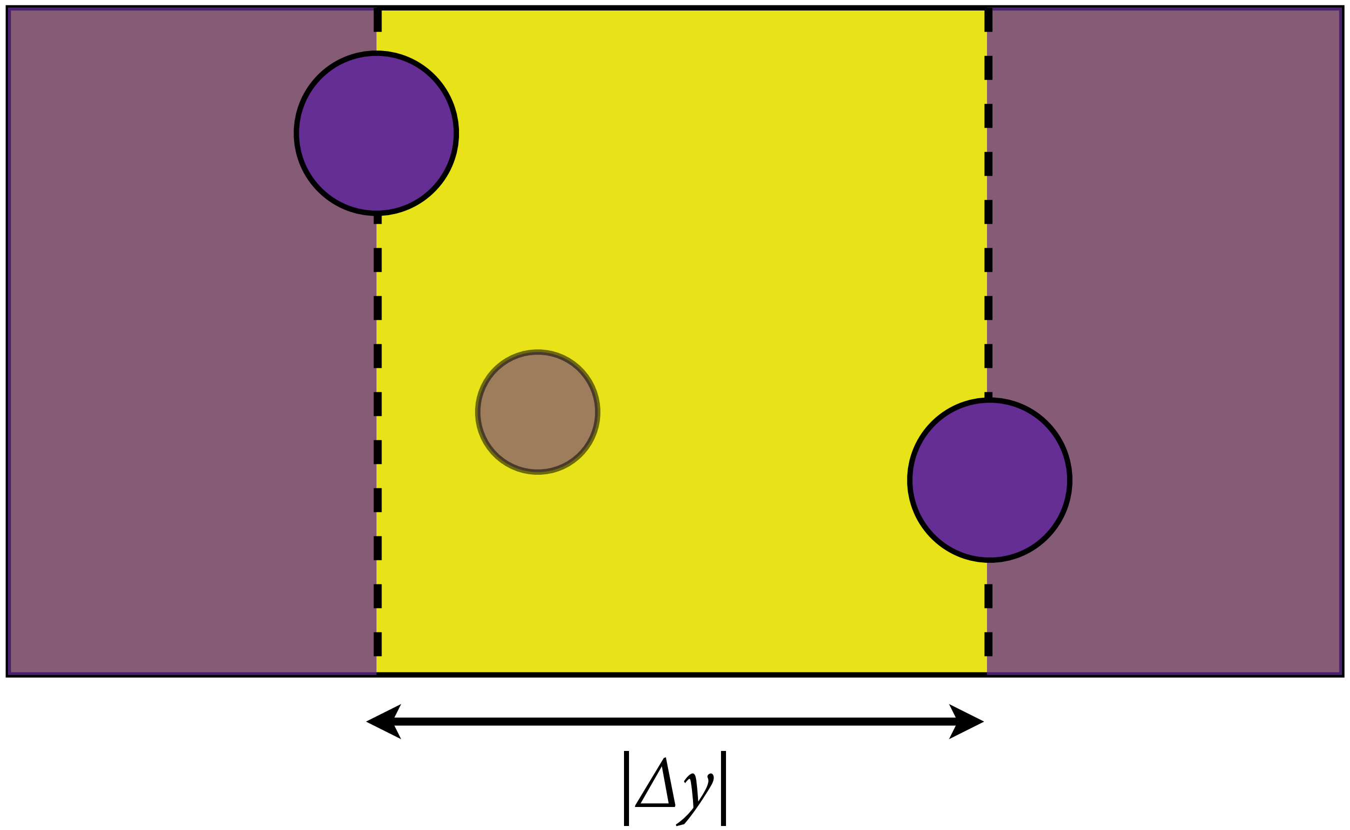

2010 was a good start for data taking at the LHC.

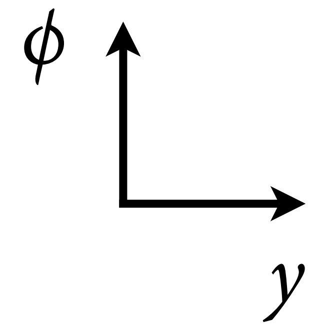
With an almost hermetic calorimeter ATLAS is able to well measure jets up to $|y| \approx 4.5$

The central jet triggers provide efficient recovery of events with average $P_T$ down to 50GeV within $|\eta|=3.2$.

Events with $N_{vertex} > 1$ can be removed to avoid pileup problems.

# The measurement




An interval between two boundary jets is defined in the rapidity-phi plane.

Observable of primary interest is the gap fraction.

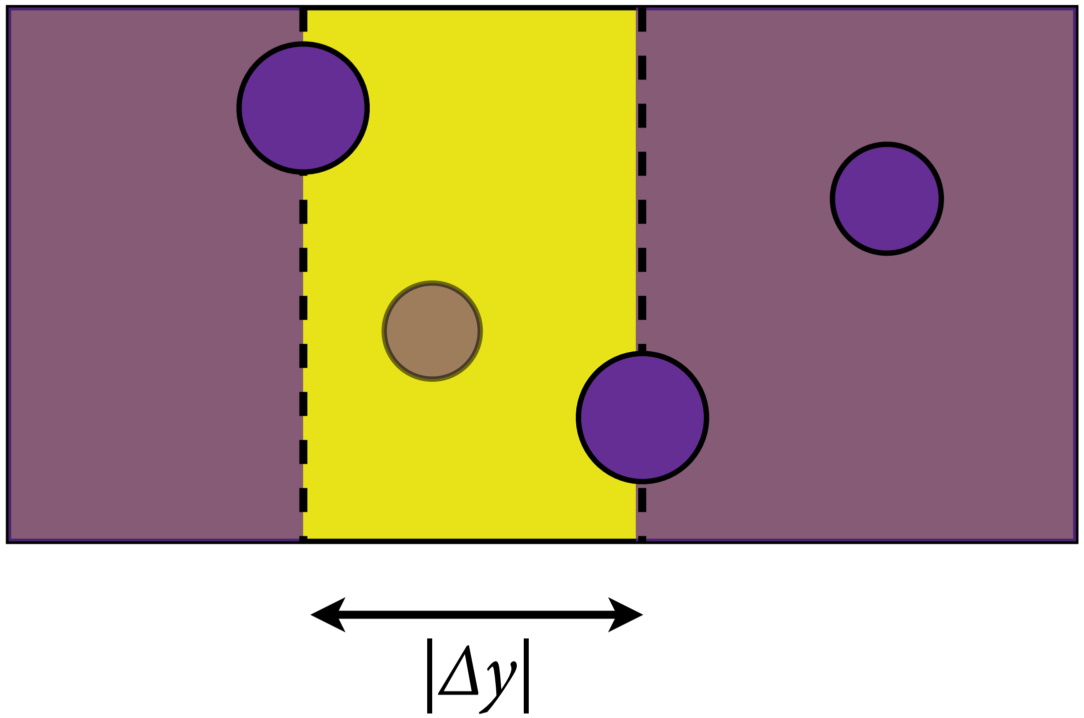
$$f_r = \frac{\sum \text{empty intervals}}{\sum \text{all events}}$$

Where the transverse momentum of the jet, if any, present in the interval determines if the event is considered empty.

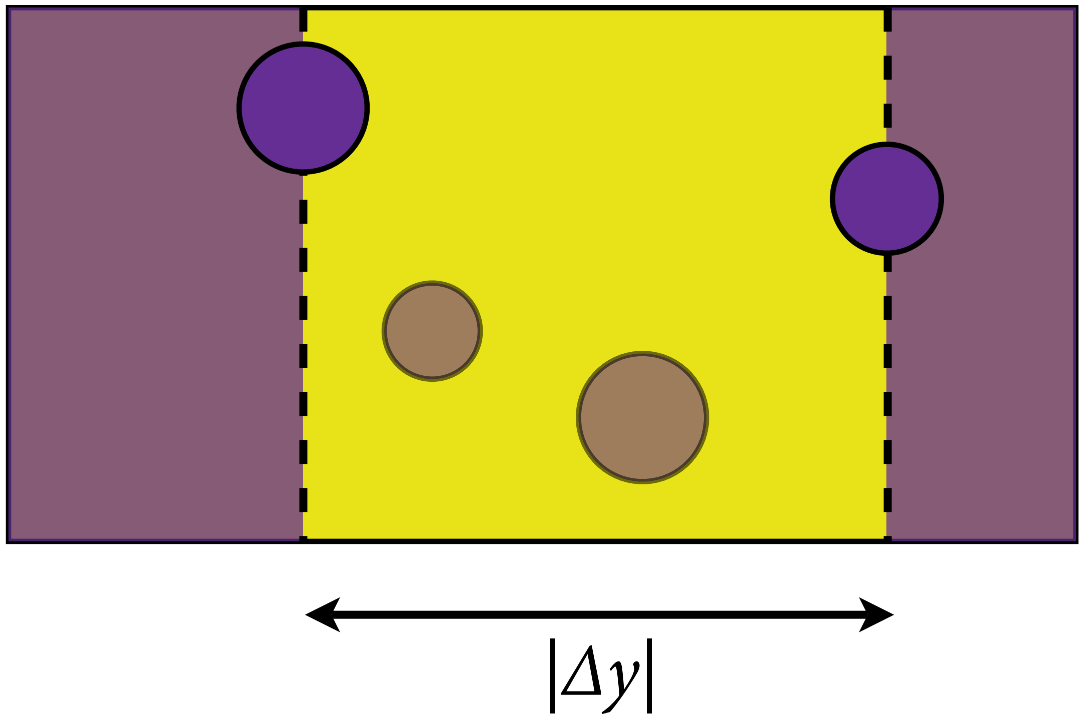
It's sensitive to some interesting physics and allows the study of jet vetoes with early data.

# Interval choices

**Selection A**




**Selection B**




Where we considered the boundary jets to be those with the highest transverse momentum.

The most forward and backward jets (with $P_T$ > 20GeV) can also be taken to be the boundary jets.

# Physics motivation

Why measure events with jet vetoes?

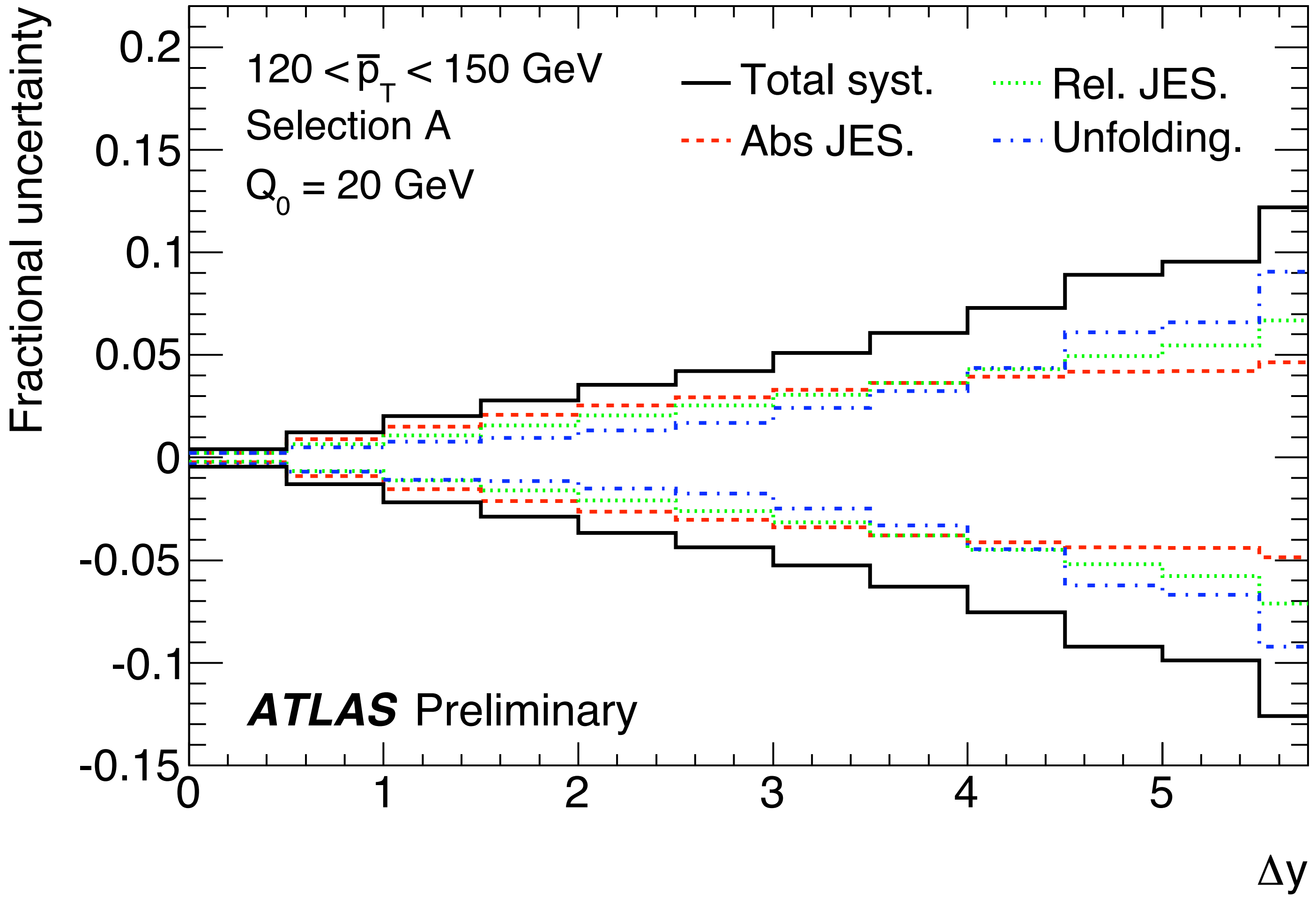
- QCD process with high cross section.
- In different limits the jet veto requirement probes different physics.

**Wide-angle soft radiation** | Mueller-Navelet jets | Mueller-Tang jets

BFKL terms are expected to be important for evaluation of the gap cross section

$$\sim \alpha_s^n Y^m \ln\left(\frac{Q^2}{Q_0^2}\right)^n \text{ for } m \leq n$$

# Uncertainties




The main sources of uncertainty for this measurement arise from the **jet energy scale** and the **unfolding** procedure.

Event selection and observable choice conspire to minimize effect of jet energy scale.

Ratios!

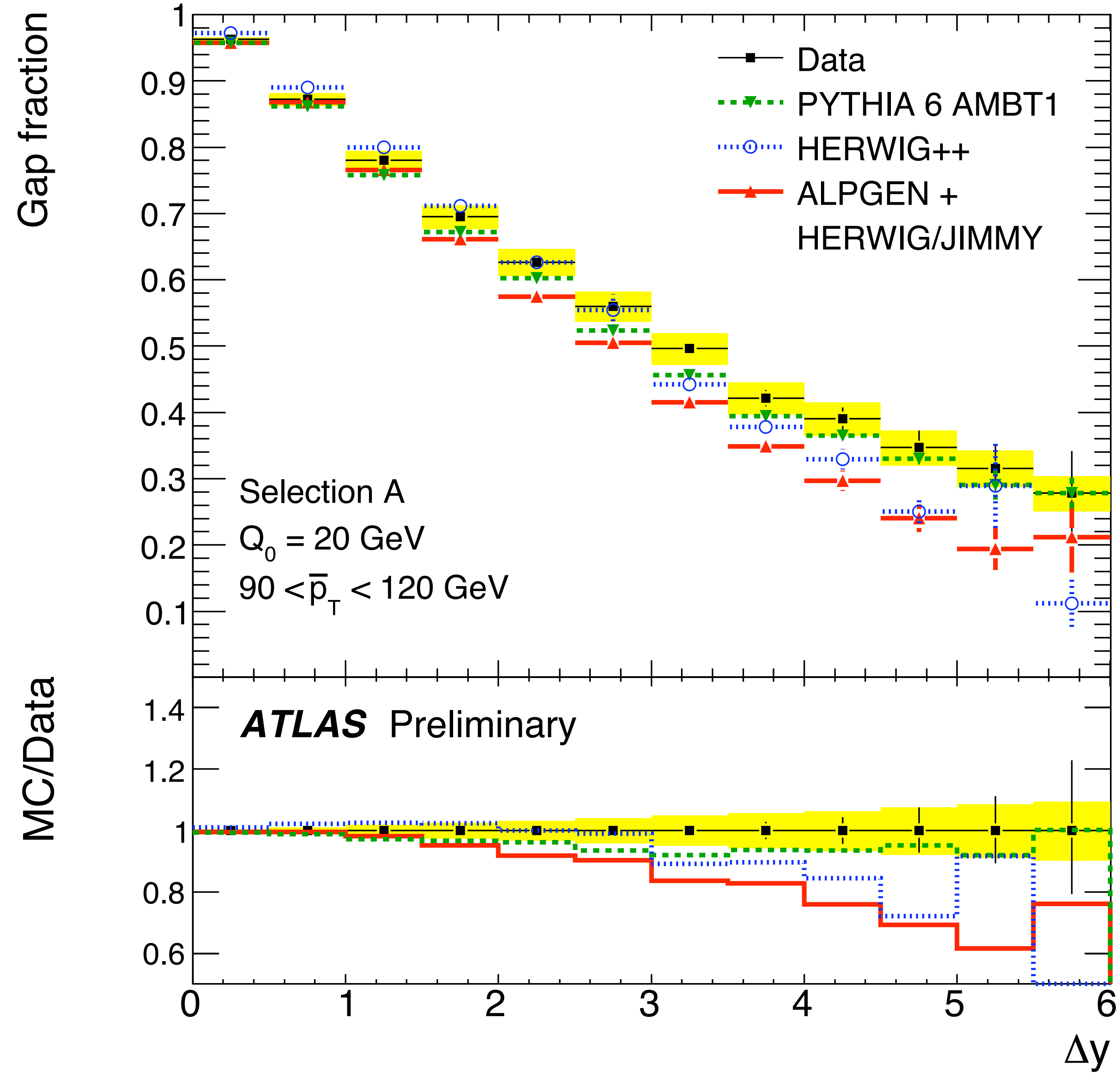
Other possible sources such as pile-up, trigger and jet cleaning were all found to have negligible impact on the measurement.

# Gap fractions

Comparison to a number of standard monte carlo generators.

Alpgen+Herwig/Jimmy and Herwig++ add too much extra energy into the interval.

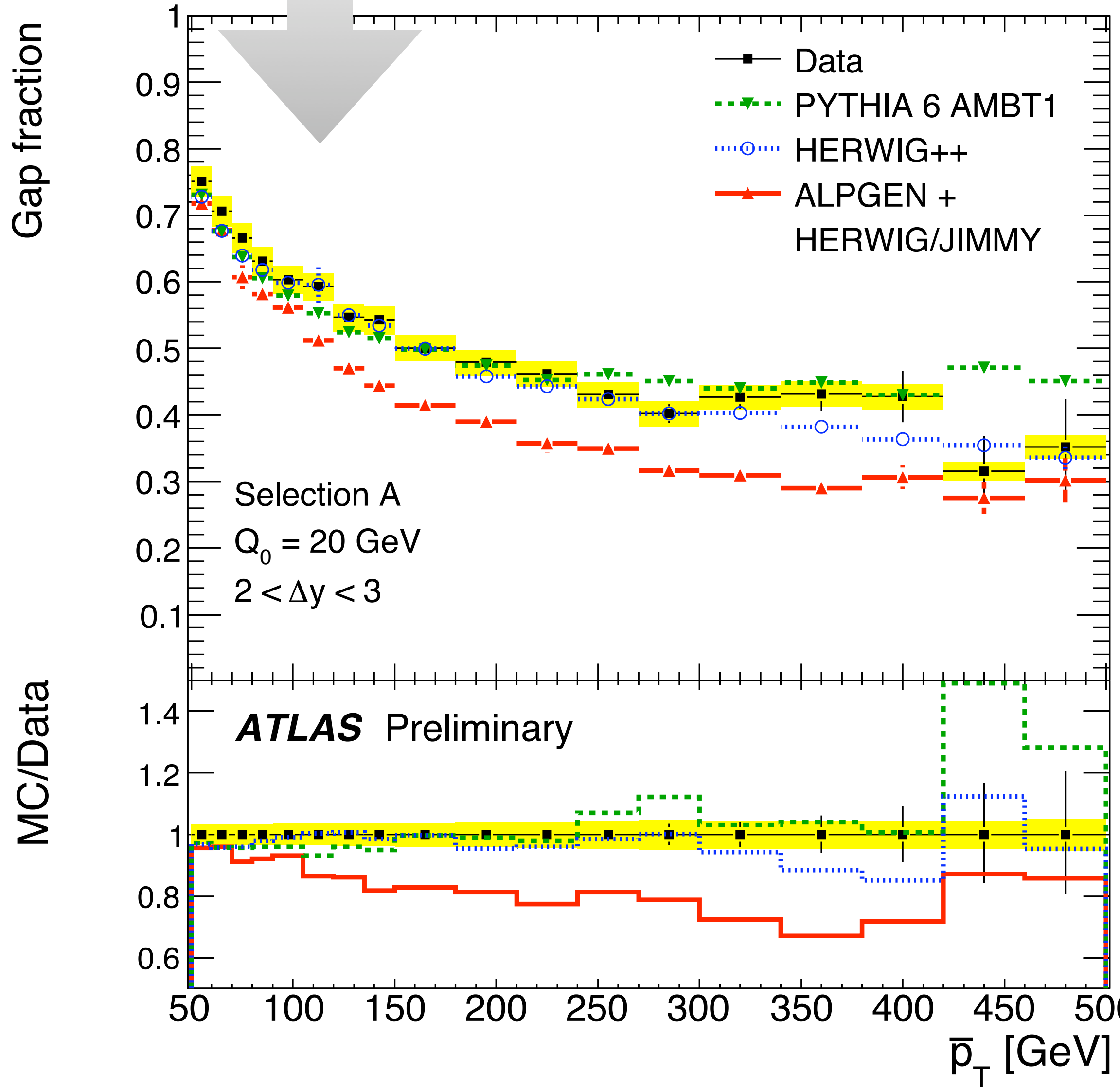
The disagreement **grows** with the size of the interval.

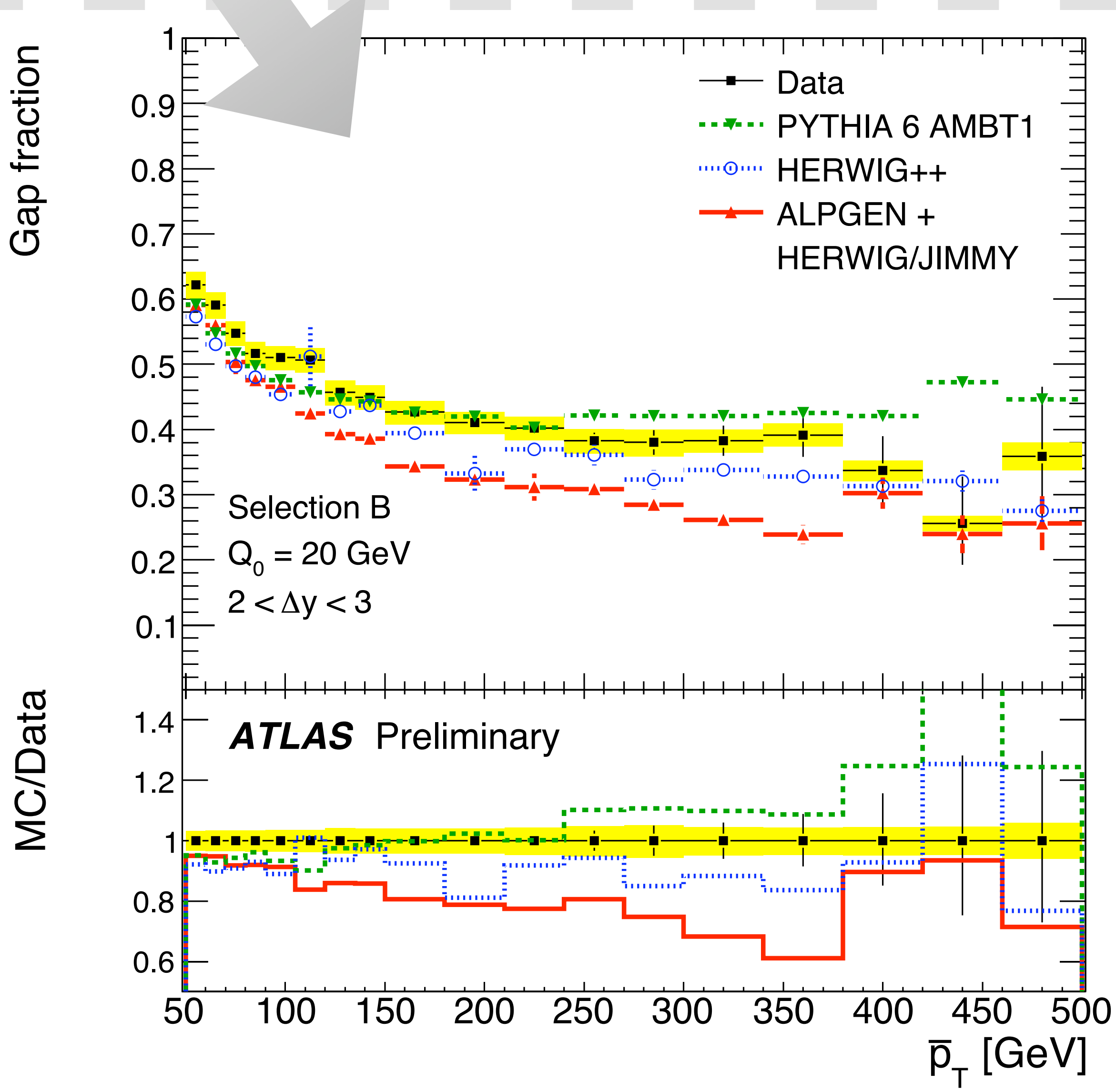


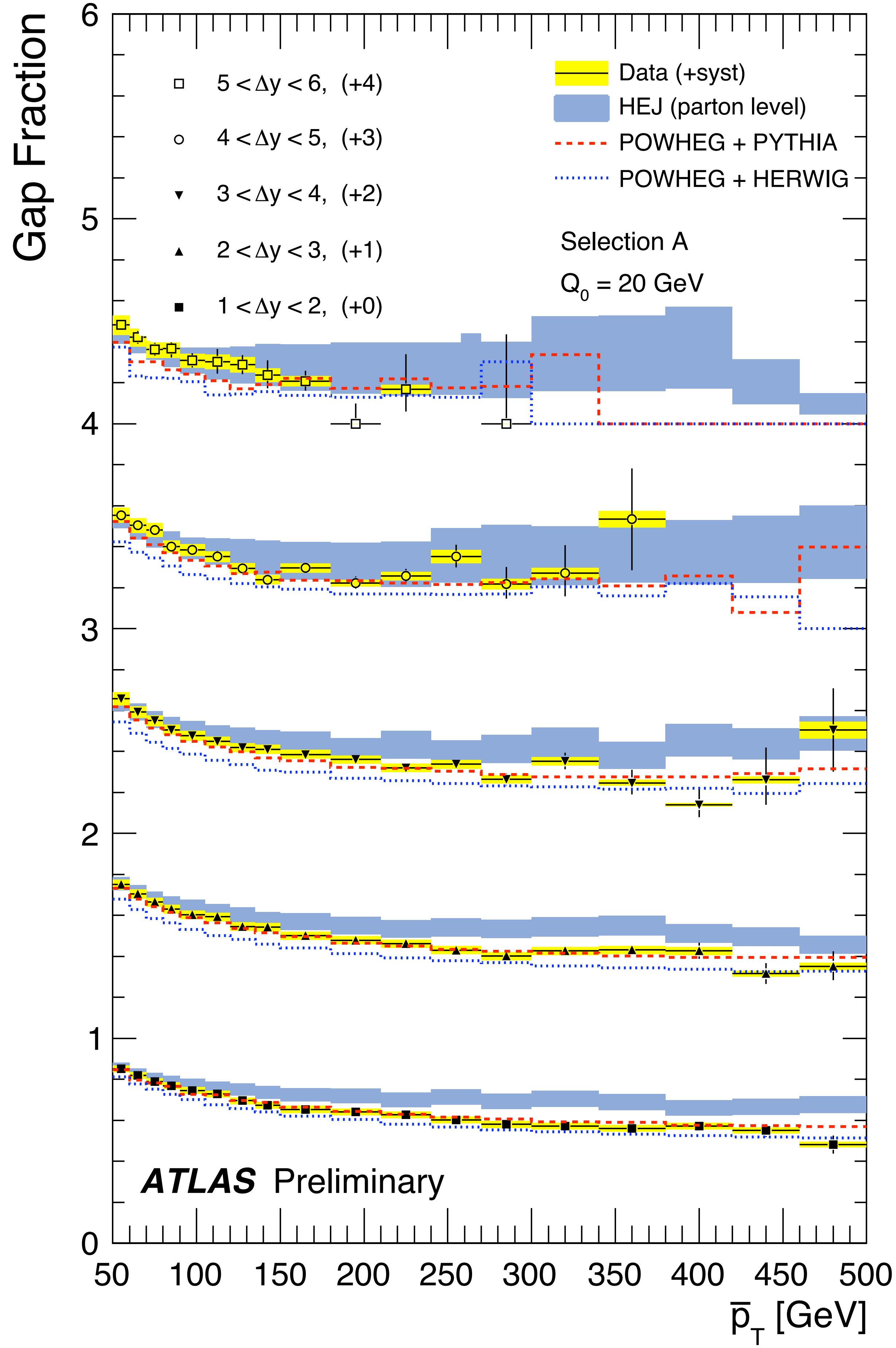

→ Large |Δy| data provides model constraints

There is similar levels of disagreement seen when considering the gap fraction as a function of average $P_T$.

Pythia 6 AMBT1 does not describe selection B results as well as selection A.



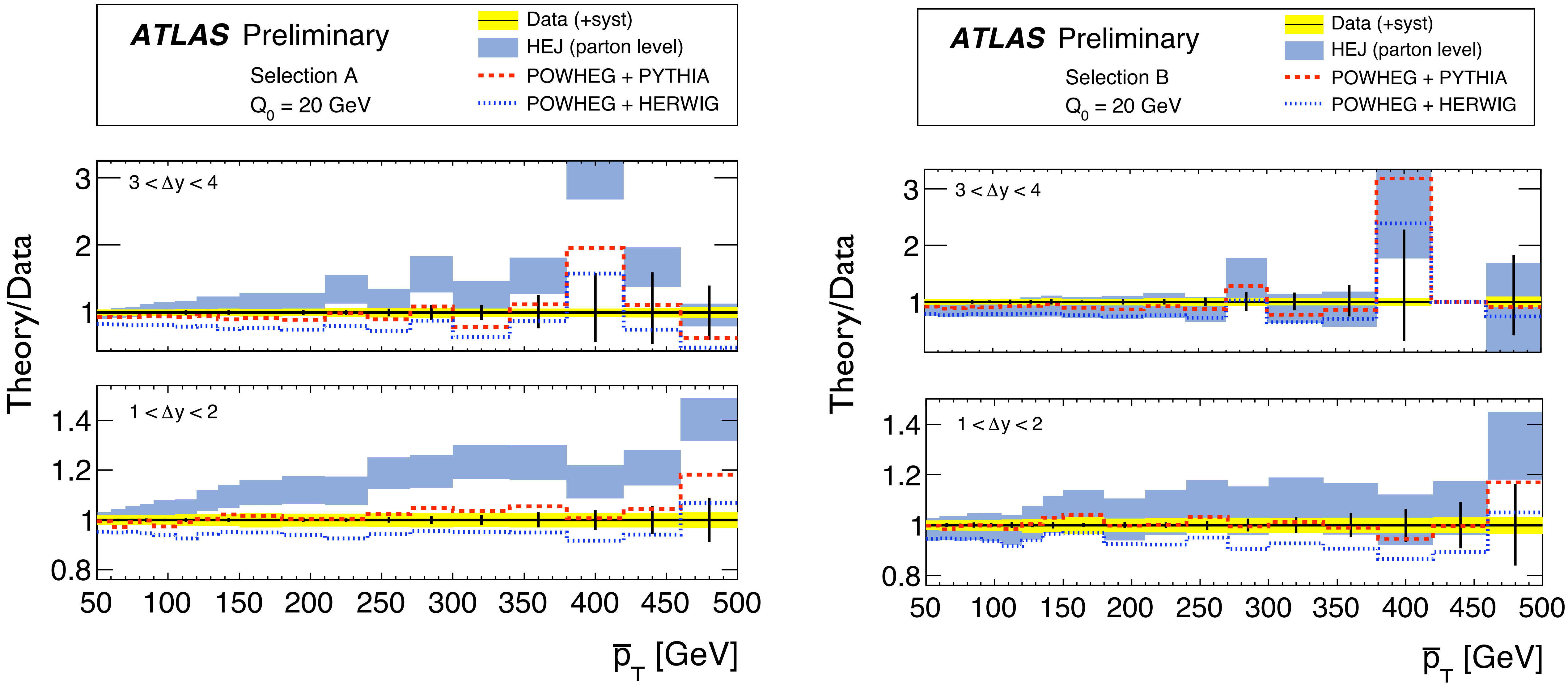






With the full 2010 data collected by ATLAS can slice data into different $|\Delta y|$ ranges.

Compare data to NLO dijet process in **Powheg** showered in both Herwig and Pythia.

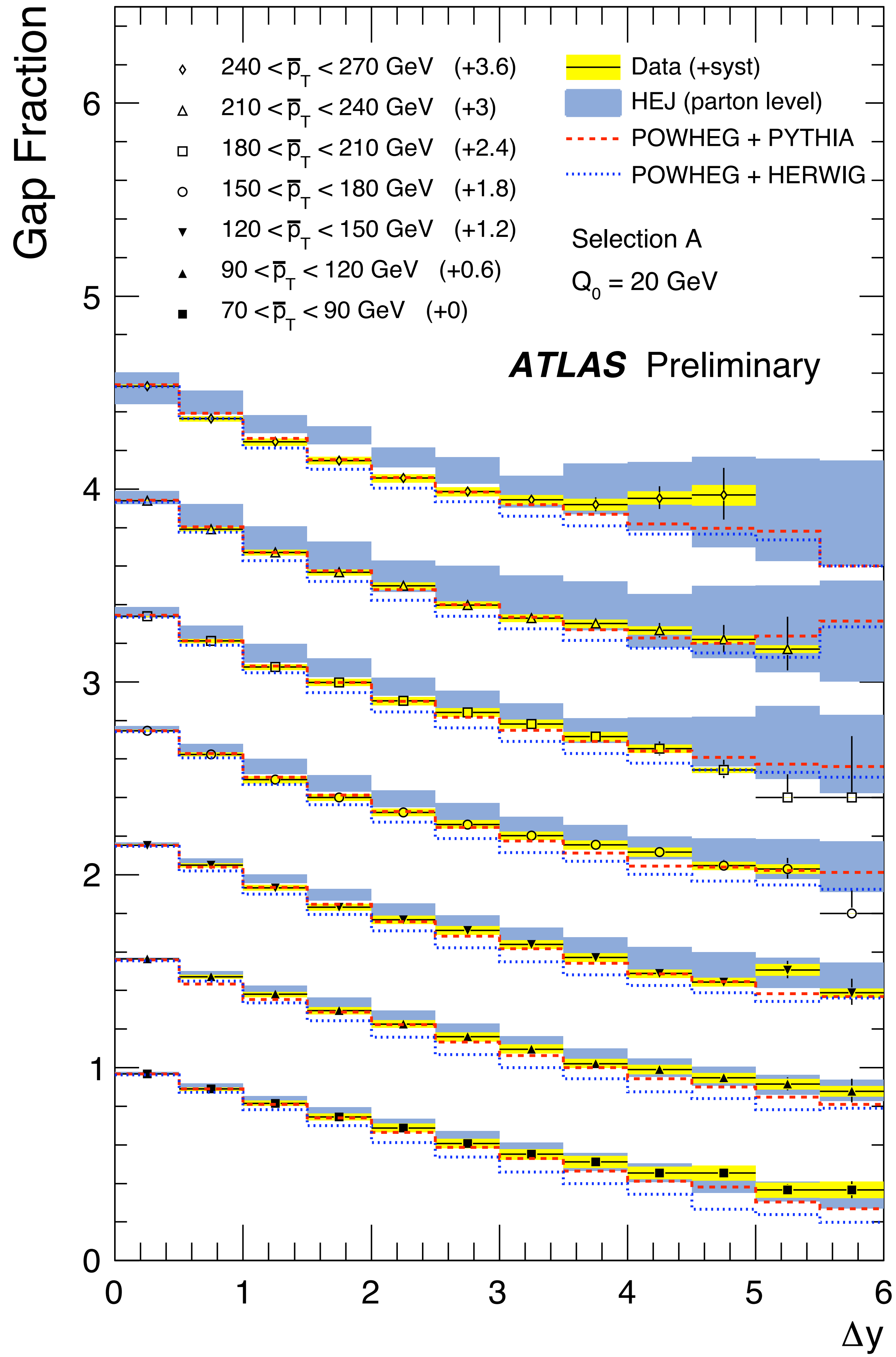
Additionally compare to **HEJ**, an all order resummation of perturbative terms for well separated multi jet events.



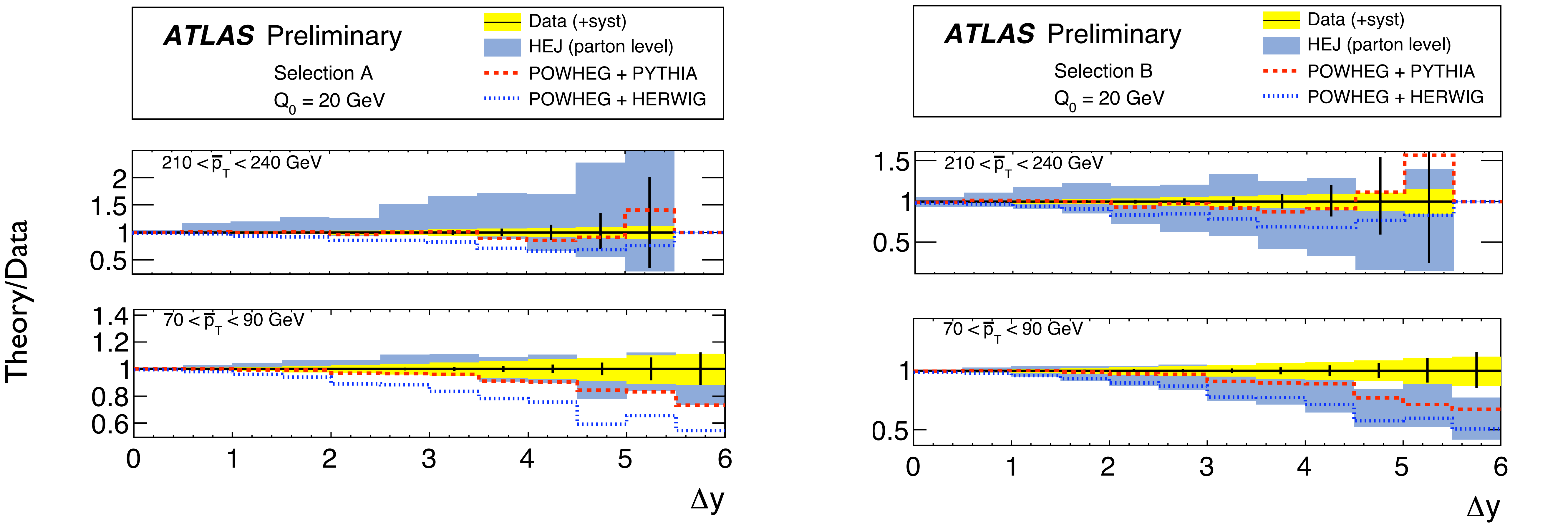

The Powheg predictions show a reasonable consistency with data.

Powheg+Herwig has a tendency to lie underneath data.

HEJ in selection A does not fit data very well at high average $P_T$.




Alternatively you can consider the gap fraction as a function of the interval size.




This time HEJ has much better agreement with data (in the low average $P_T$ slice) in selection A.

Powheg now in general undercuts the data.

# Summary

- A measurement of jet vetoes has been made across a wide region of phase space.
- Experimental uncertainties already smaller than the spread of predictions.
- Analysis will be extended into the large $|\Delta y|$ region and low $Q_0$ scale.