Jet Energy Resolution for the Dijet Balance Method

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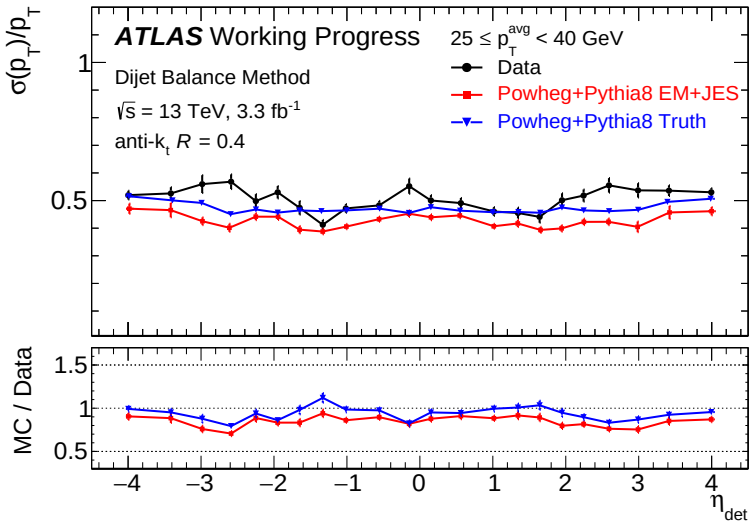
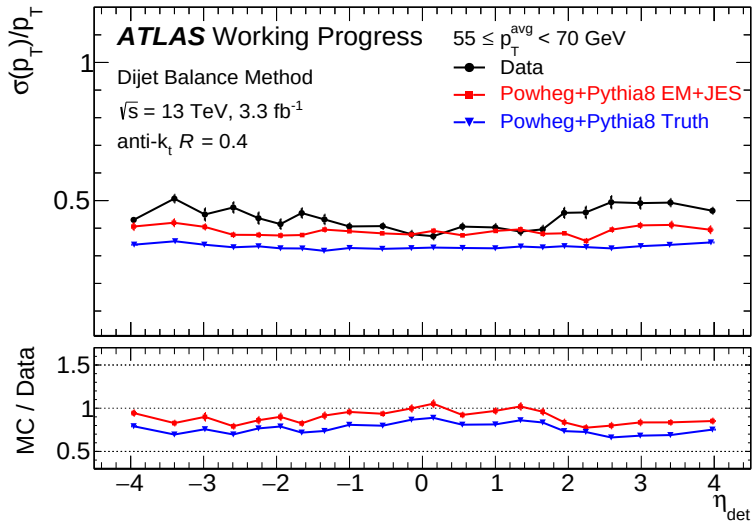
February 16, 2016

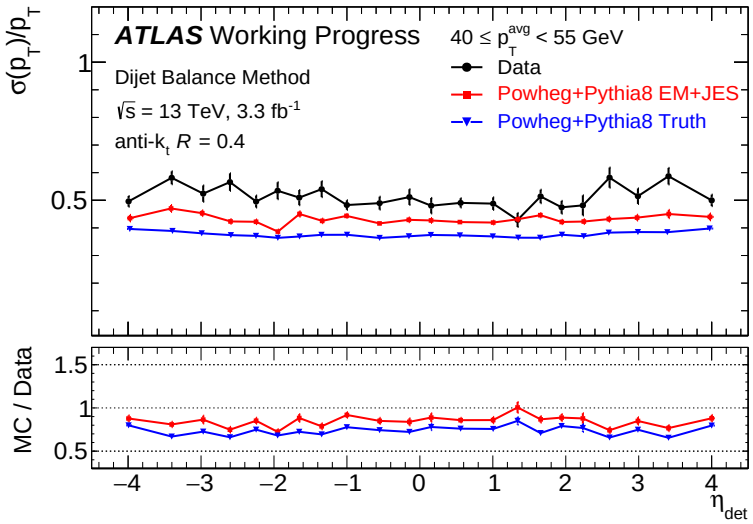
Status

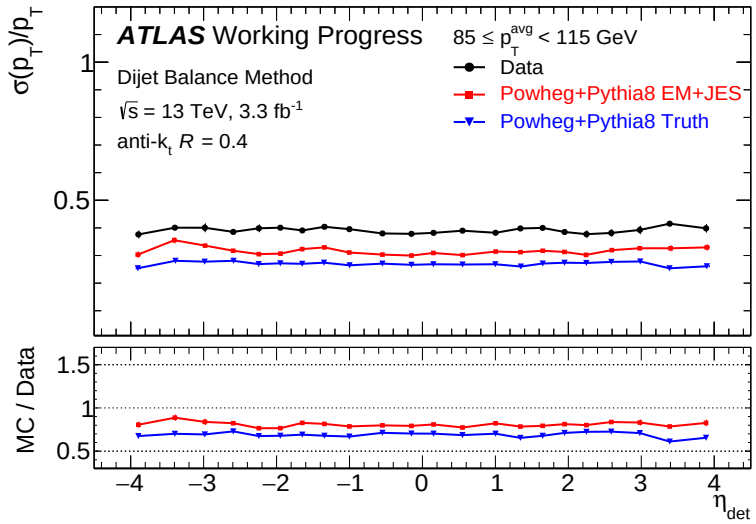
- Produced plots of the fractional jet pT resolutions vs average pT and vs eta for:
  - Data $\sqrt{s} = 13$ TeV (EM+JES)
  - Powheg+Pythia8 MC Reco (EM+JES)
  - Powheg+Pythia8 MC Truth
- Subtracted the MC Truth (Powheg+Pythia8) resolution from the MC Reco and Data

JER vs Eta



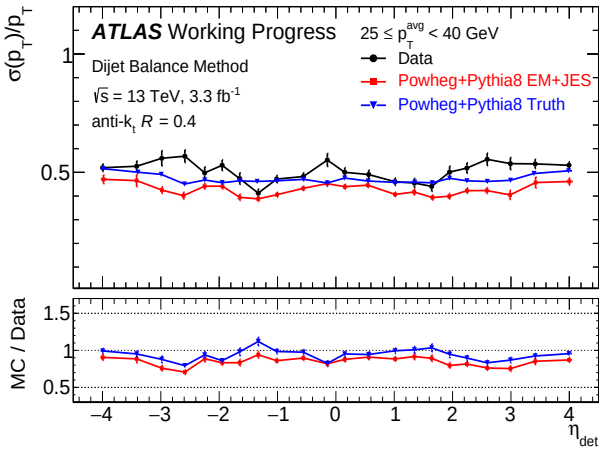




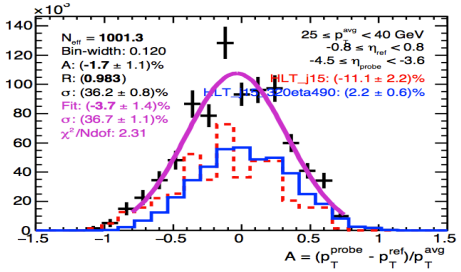


- Problem with $25 <$ pTavg < 40 bin: Truth MC has a higher resolution than Reco MC.

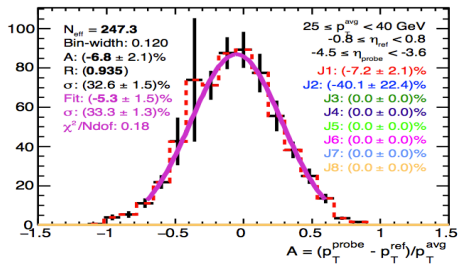
JER vs Eta: 25 < pTavg < 40



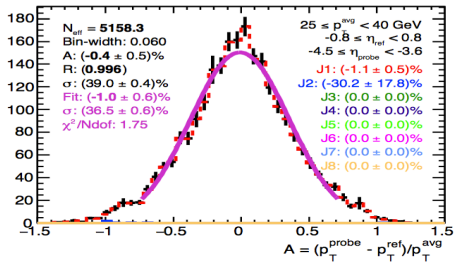
Data



MC EMTopo

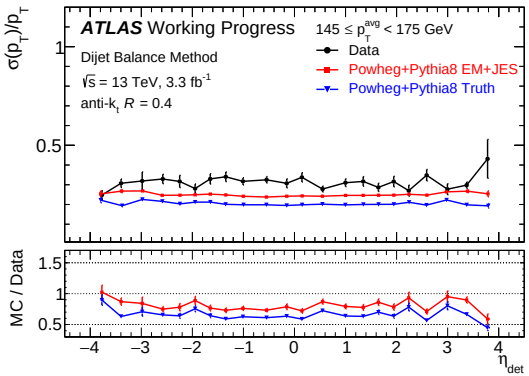


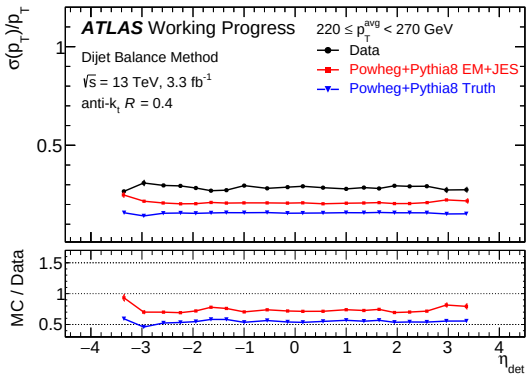
MC Truth

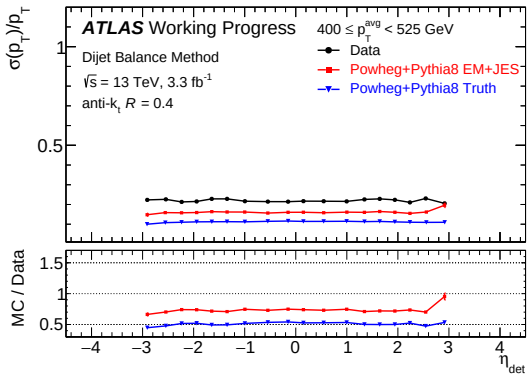


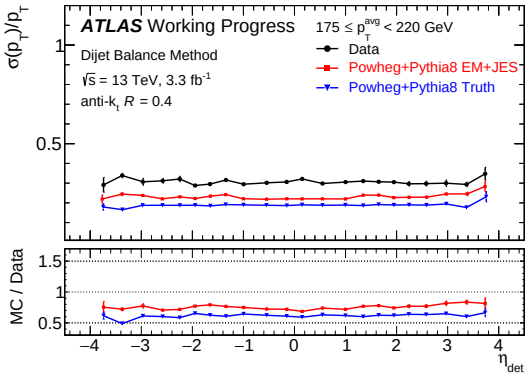
- The fit doesn't take into account the possibility of a double gaussian.
- Going to try narrowing this bin range that the fit runs over to see if this affects this plot.

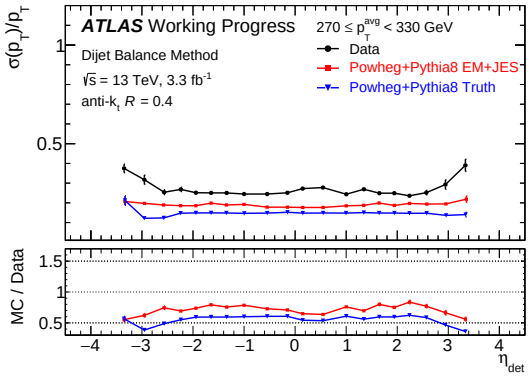
JER vs Eta

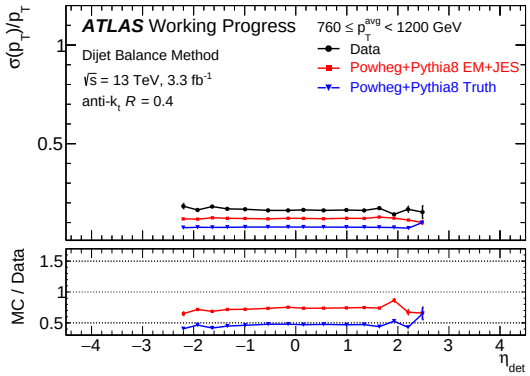






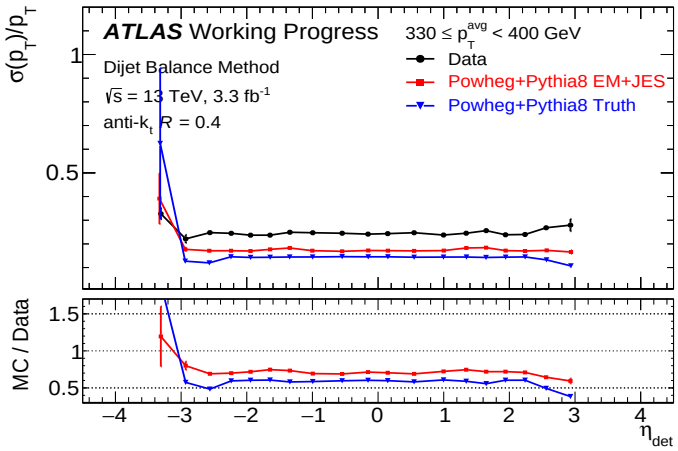


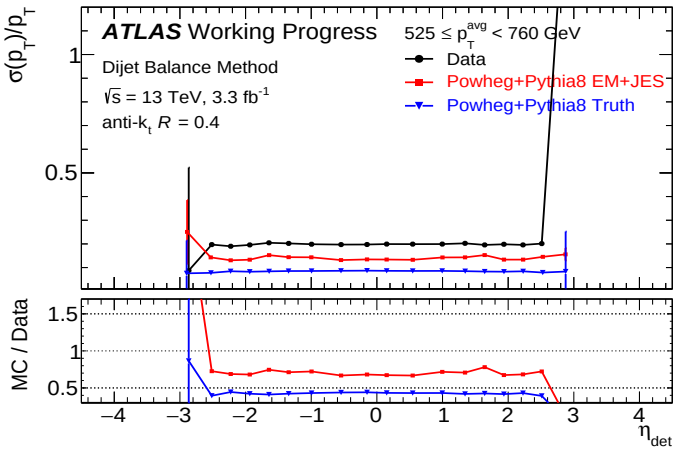


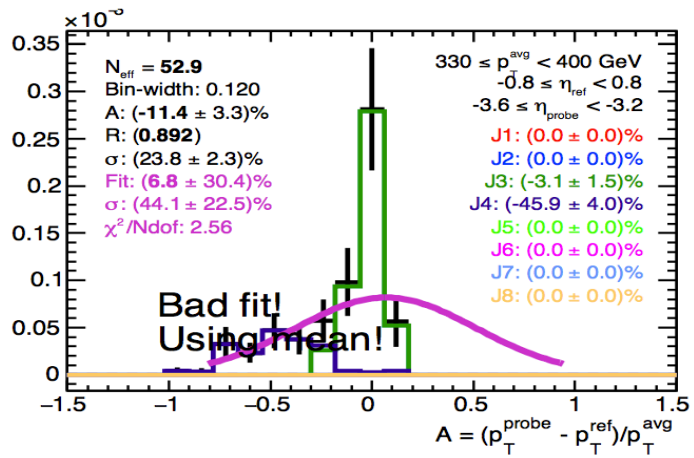


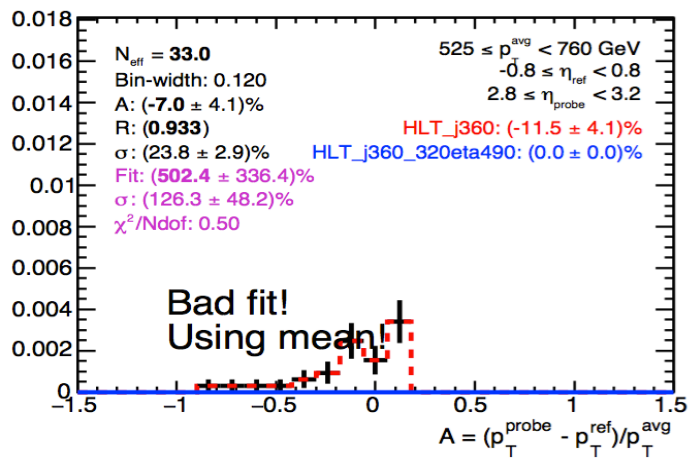
- The other pT ranges are mostly as would be expected.
- However, there are a few issues with a lack of statistics in some of the fits that affects two pT ranges: $330 < \text{pTavg} < 400$ and $525 < \text{pTavg} < 760$.

Problems with the fit



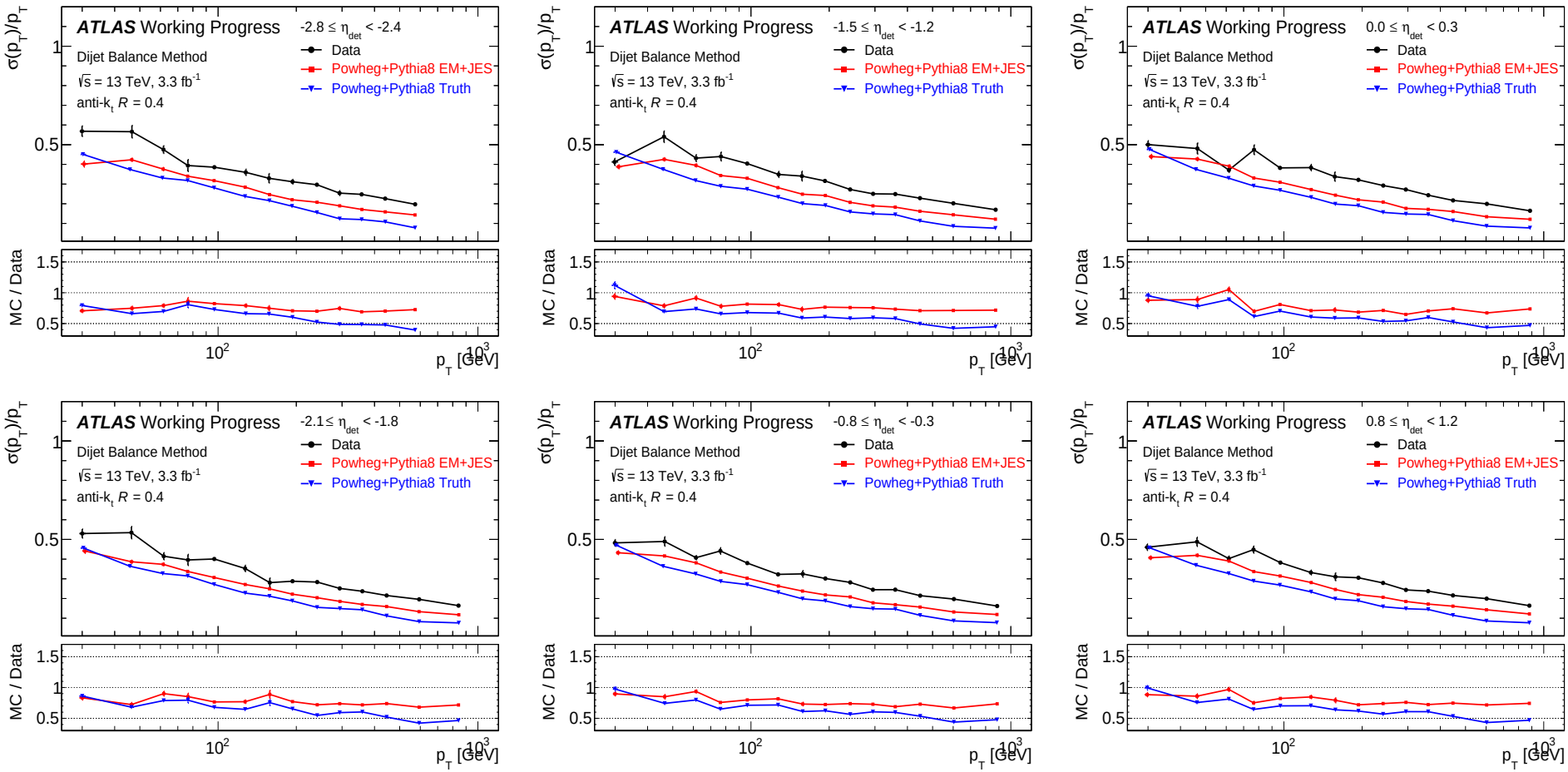






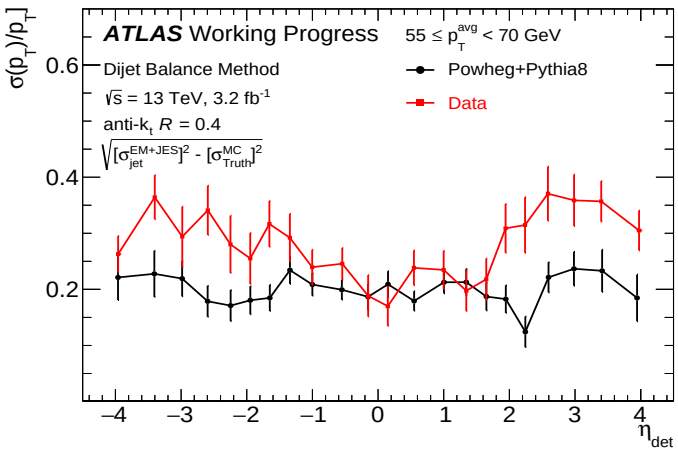
- Both cases have bad fits due to low statistics in these bins. The mean is used - doesn't always work due to weighting problems.
- Going to look into changing the bin sizes and restricting the rms value when the fit fails.

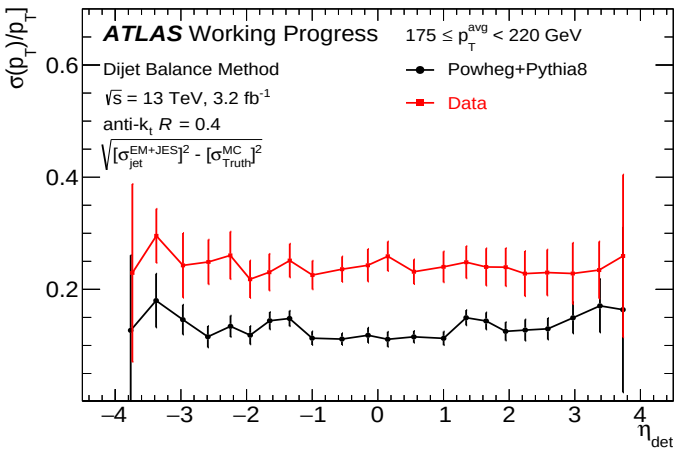
JER vs pT

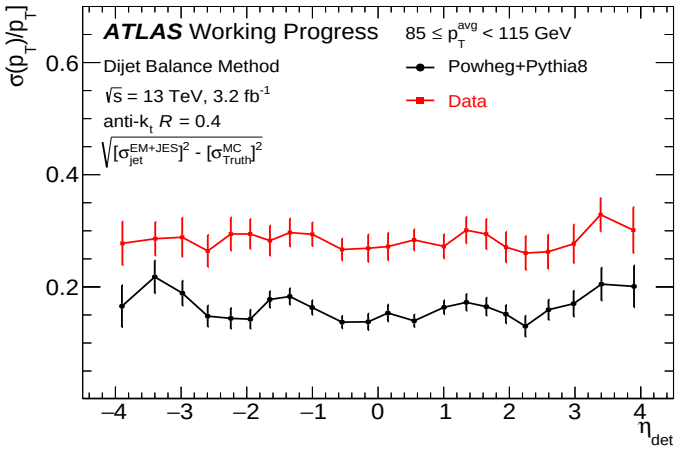


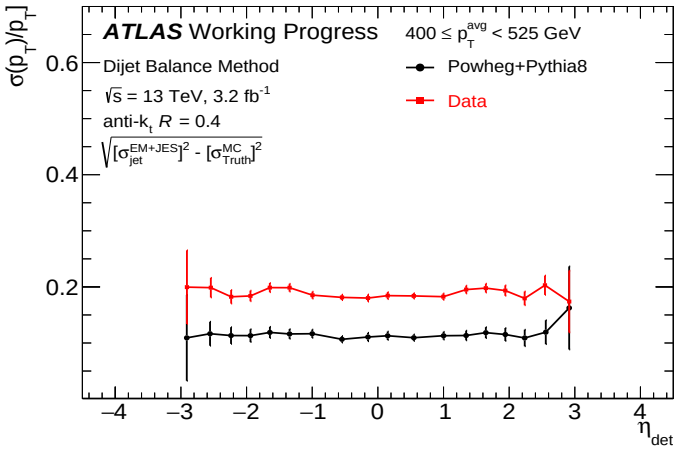
- There is turn-over behaviour in data at low pT causing crossing that isn't understood - and not consistent with MC truth.

$\sqrt{(\sigma_{jet})^2 - (\sigma^{MC}_{Truth})^2}$









- Difference plots with Powheg+Pythia8 MC Truth.

Next Steps:

- Study systematically varied MC subtractions eg. Sherpa
- Extract a mean resolution from the data and compare with the MC simulated resolution and other systematic studies
- Study the issues with the fits and bin widths, specifically looking at the lowest and highest bins. Look at merging the last bins/ dropping the bin
- Repeat with the Bisector method and compare
- Any suggestions for other studies?