Gluon Fusion Contribution to HJJ as seen from High Energy Jets

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Outline

- High Energy Jets:
  Why do something different?
  What is done?

- Requested results for H+Dijets (the gluon fusion contribution)

- Some additional quantities, to help illuminate the difference between the
  weak boson fusion and gluon fusion contribution

High Energy Jets – the basics

In the limit of small invariant mass between particles, the collinear limit is good.

In the limit of large invariant mass between particles, the High Energy Limit is good.

HEJ deals systematically with the perturbative effects of requiring a large centre of mass energy while looking at jets of standard pt: Think WBF cuts: mjj>400GeV, pt-jet>25GeV.

High Energy Jets

Gives a partonic cross section, resumming to all orders the dominant real and virtual corrections for hard wide-angle emissions (and also soft emissions).

Merging with a parton shower is possible – but will here describe pure partonic results:

- Quick, and partonic results already compared to ATLAS,CMS,D0 data
- Effects of the shower on the requested quantities relatively small (within scale variation)
- No underlying event, MPI,...

The perturbative challenge of WBF cuts

- Within the WBF cuts of a large invariant mass (or a large rapidity difference) between two hard jets, there is little kinematical suppression for additional radiation (com E dominated by the two jets).

- The WBF process (no colour exchange) will radiate predominantly colinearly around quark jets

- The GF contribution has colour exchange between the jets – radiation into rapidity span between jets. Effect of high multiplicity (3j, 4j, ...) events important!

Perturbative effects already verified

- ATLAS studied avg. number of jets>20GeV vs. rapidity span of dijet system

Zoom:
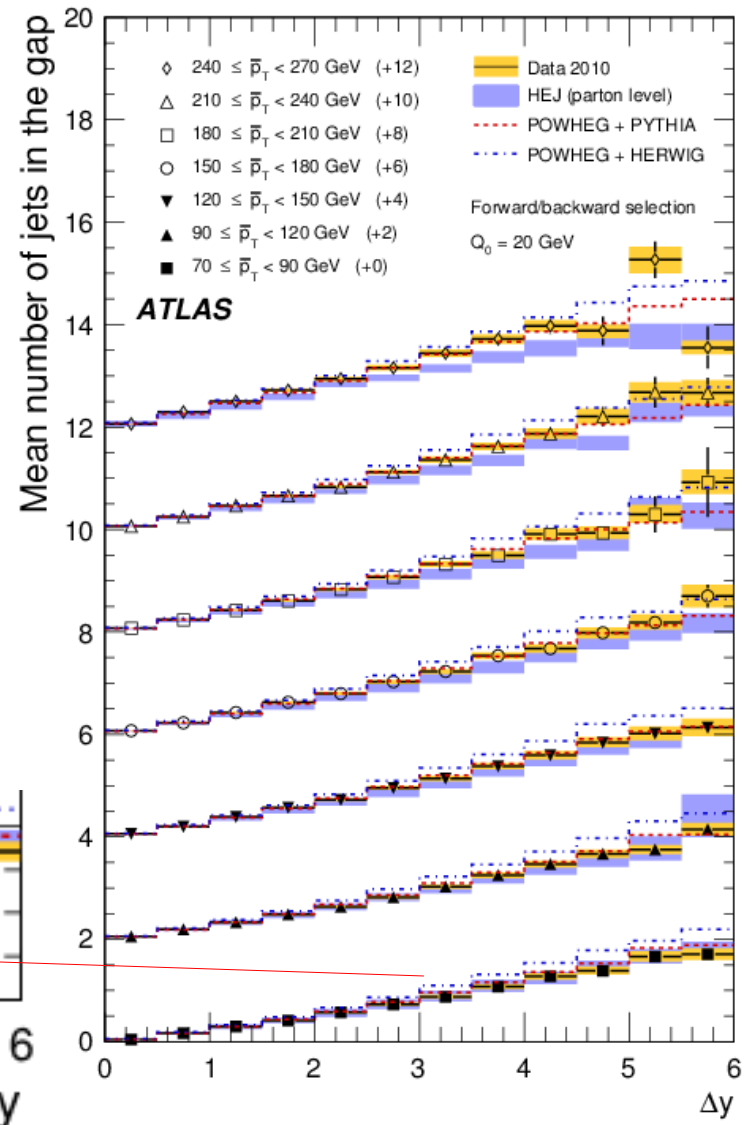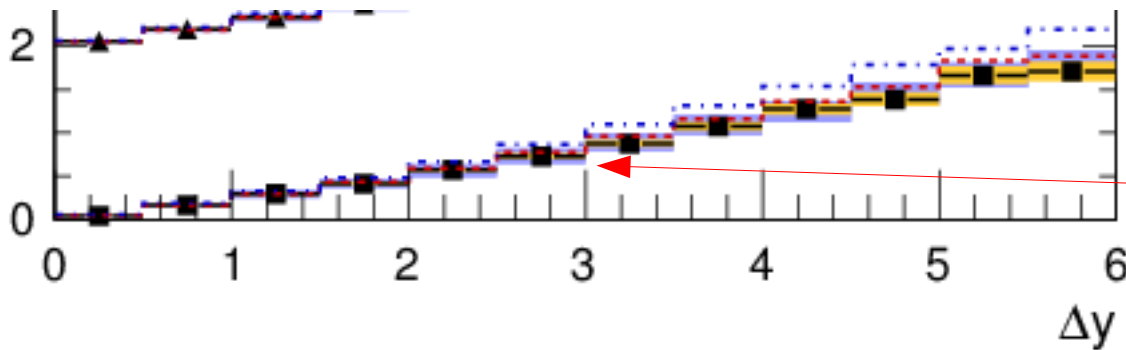
ATLAS JHEP 1109 (2011) 053

High Energy Jets - W+jets
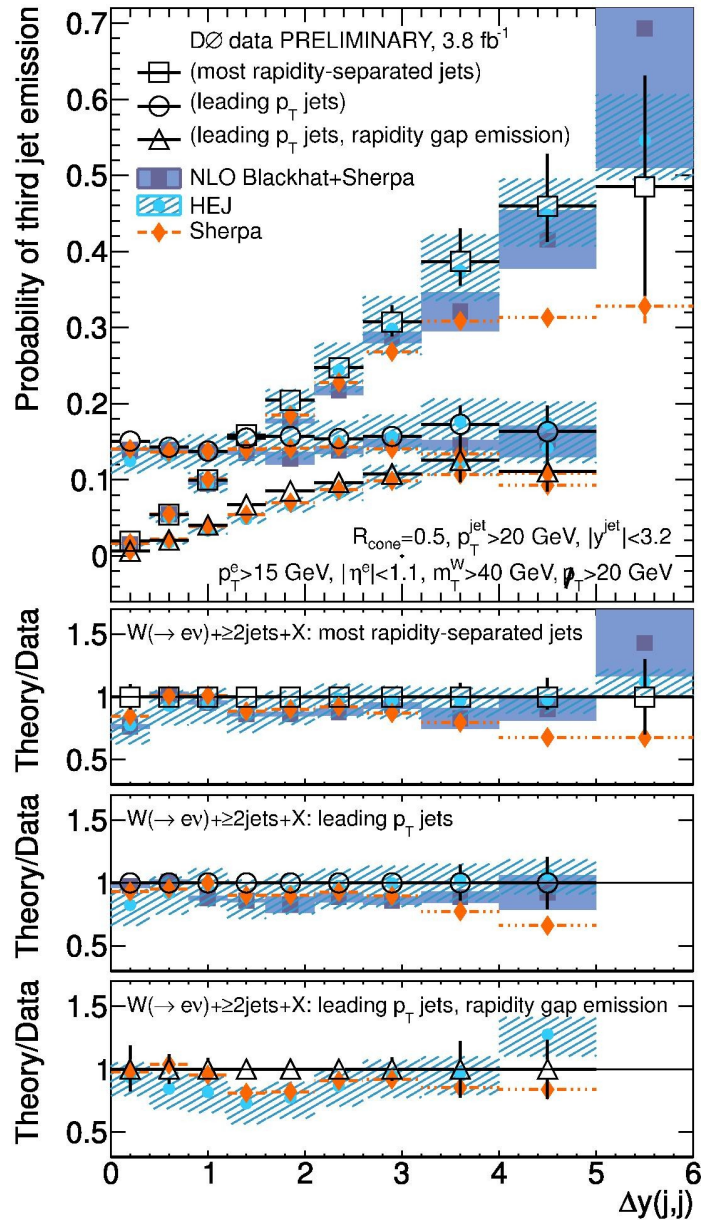
D0 Note 6339-CONF Investigates jet activity in W+jets as a function of the rapidity between the two hardest jets, and of the maximum rapidity difference between hard jets in the event.

Choices

- Scales: Two powers of alphas at mH.
  Fac and ren scale at max(pt_jet)
  Scale variance band: */2
  mH=126GeV (width of H included too)

- For this study: Include all decay channels of the Higgs boson

- Cuts as agreed
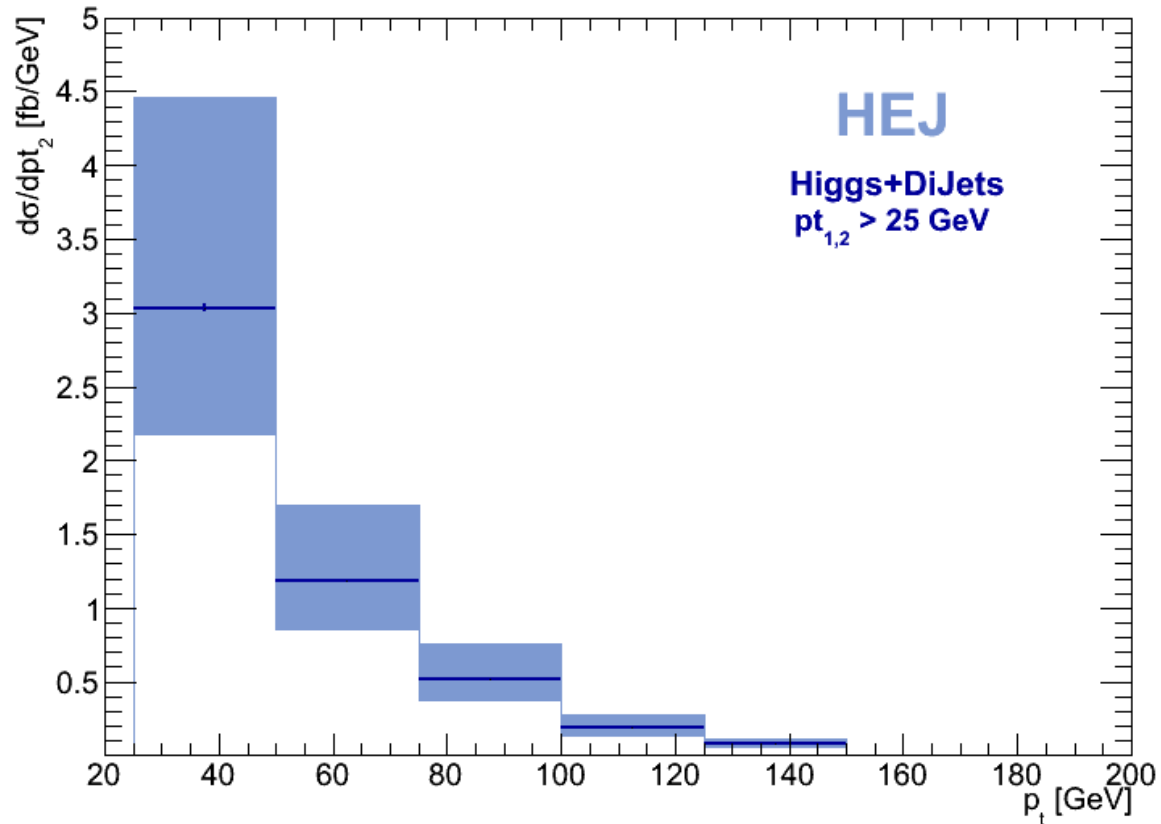
pt1
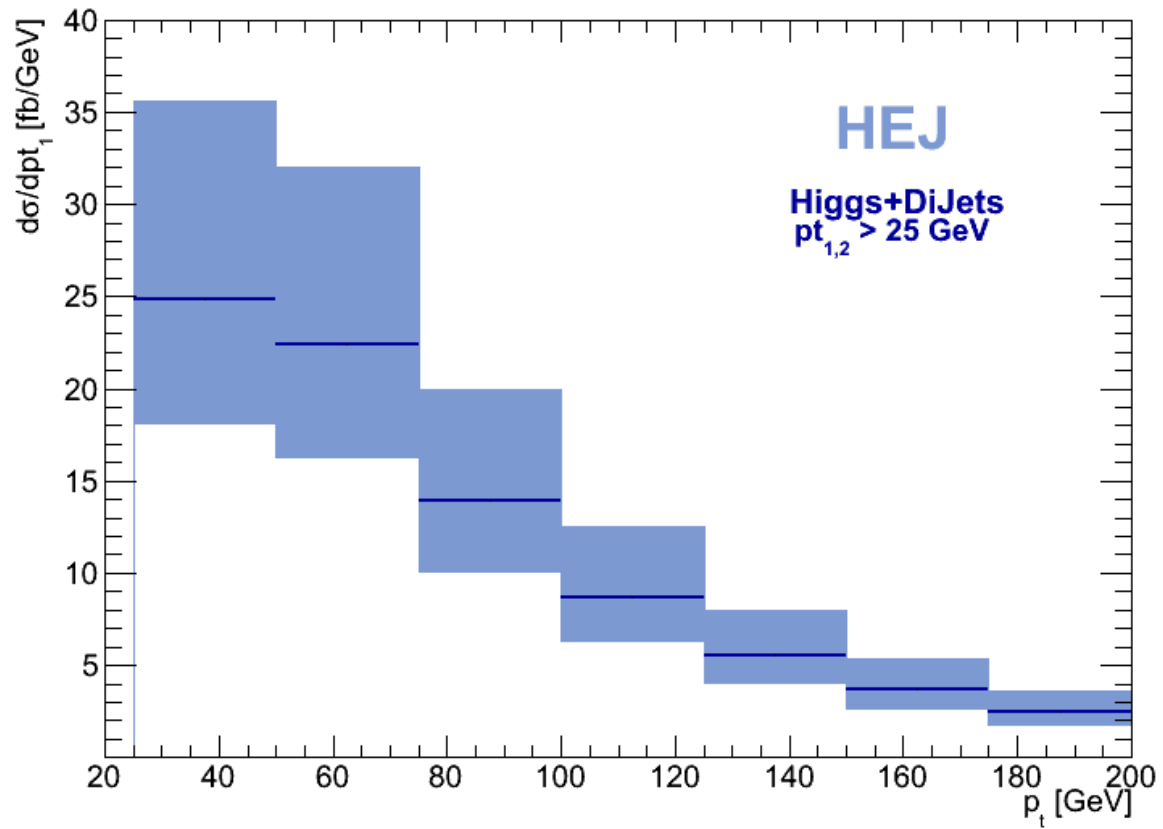
pt2
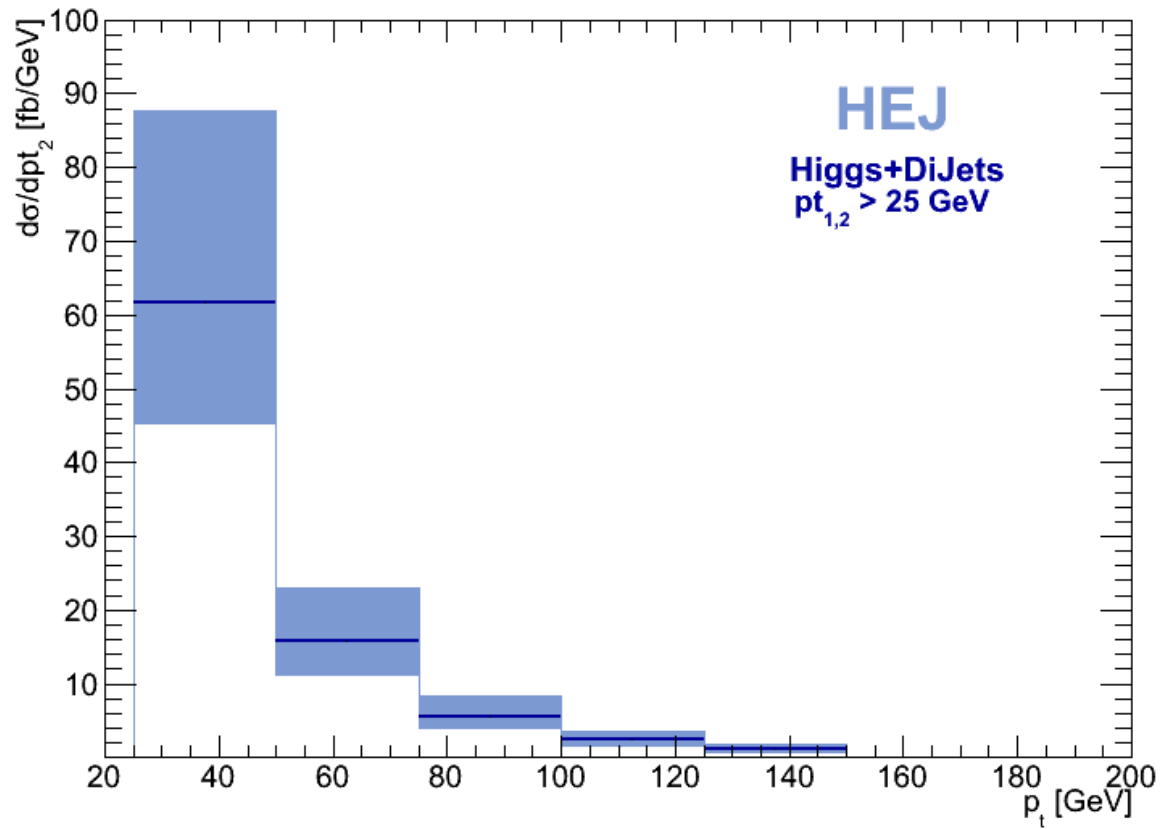
pt3
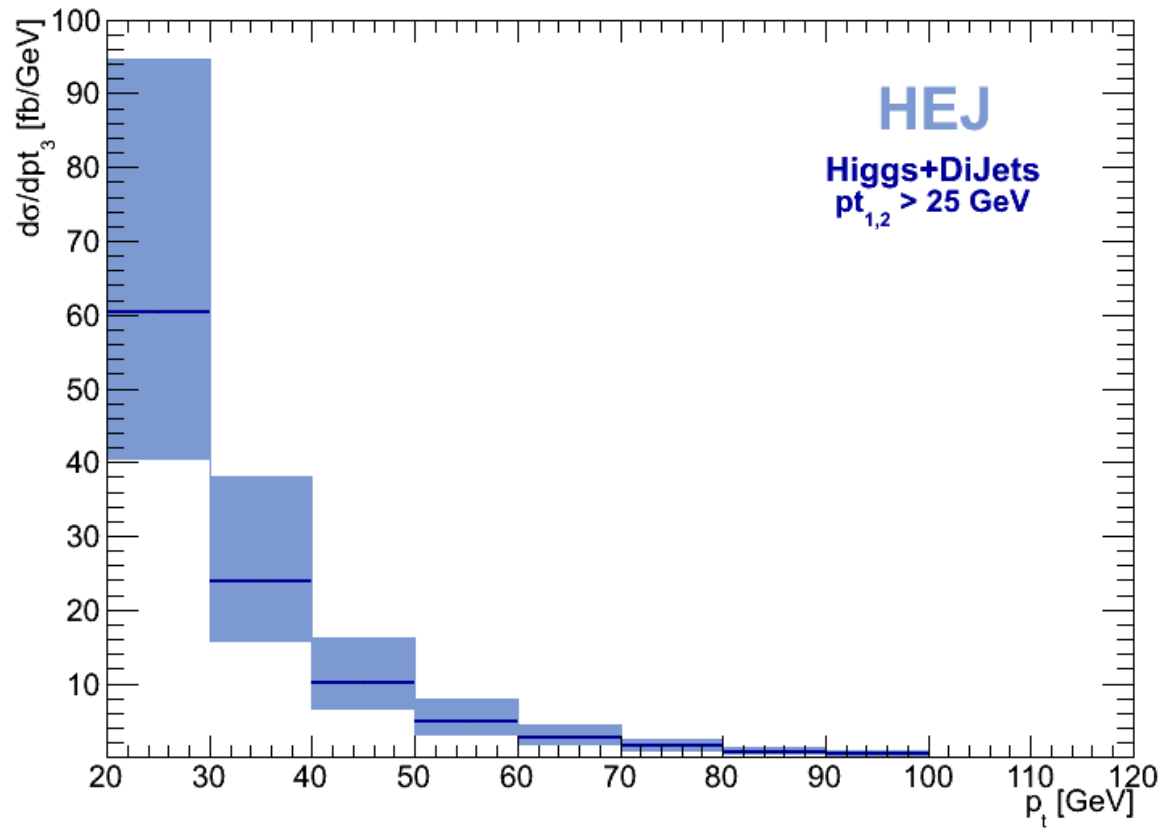
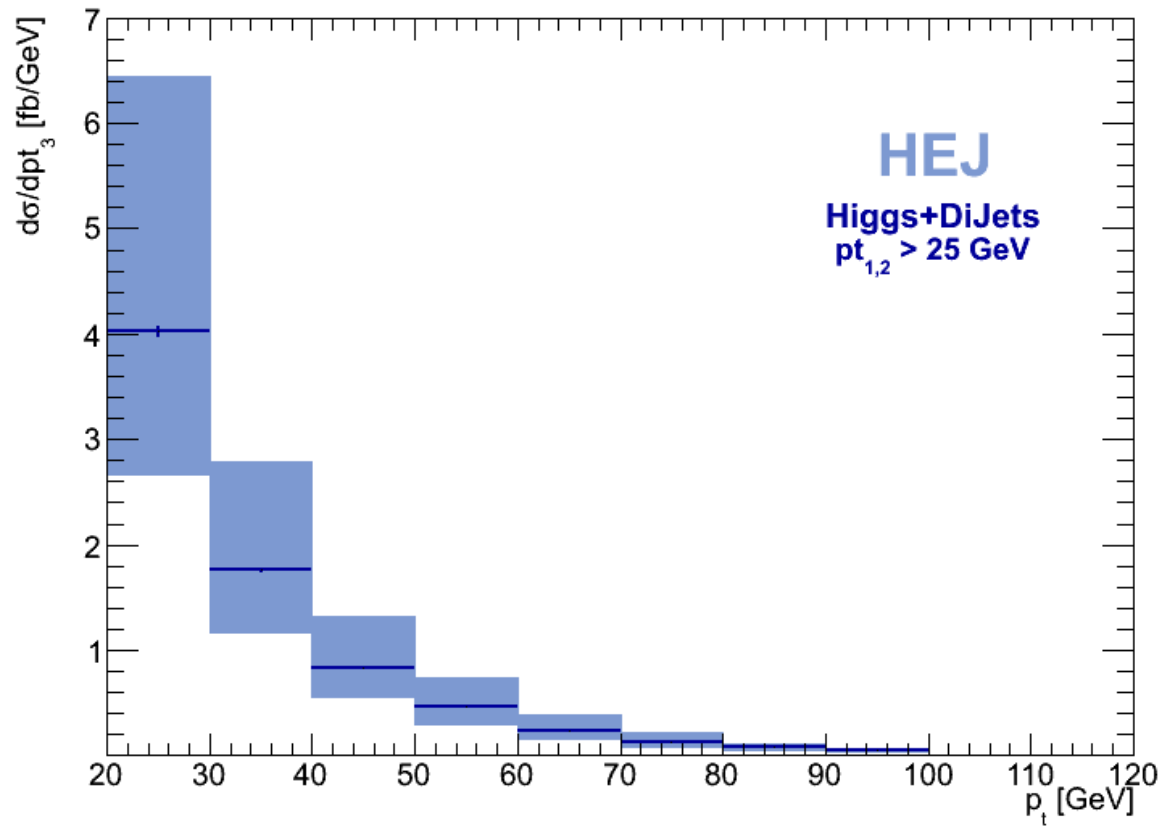# y1
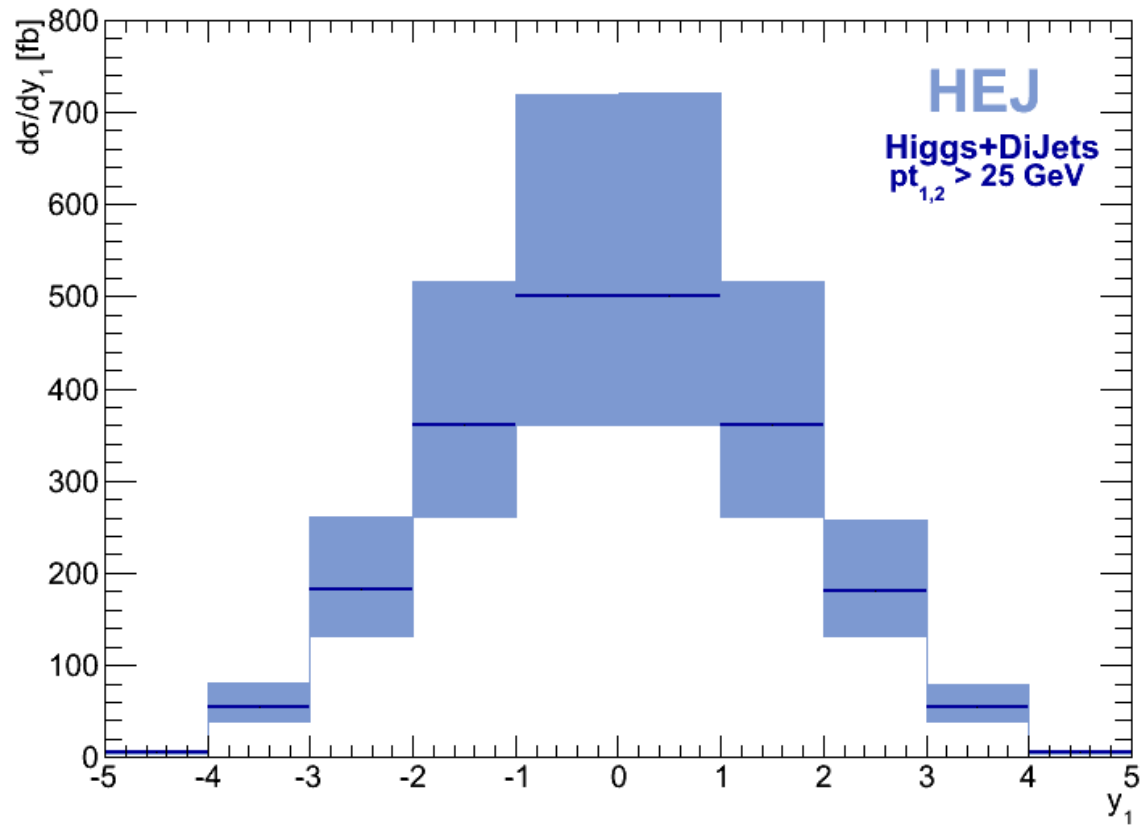
y2
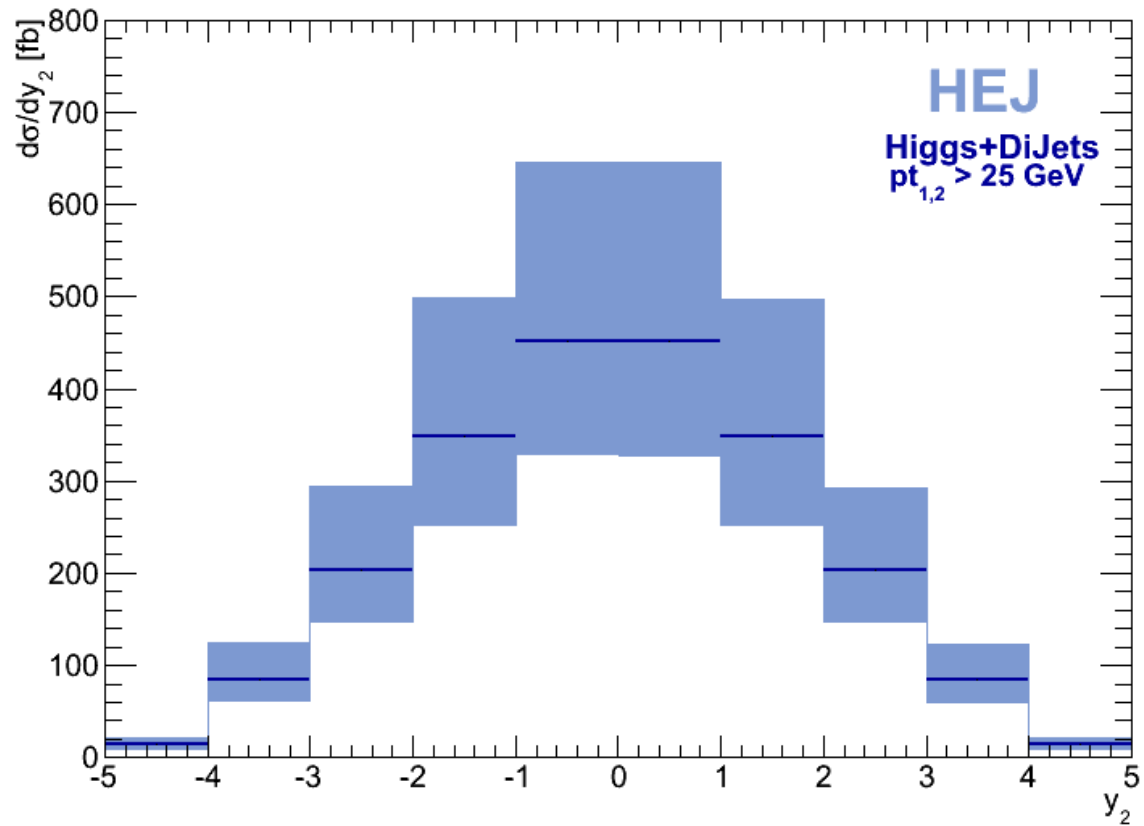
y3
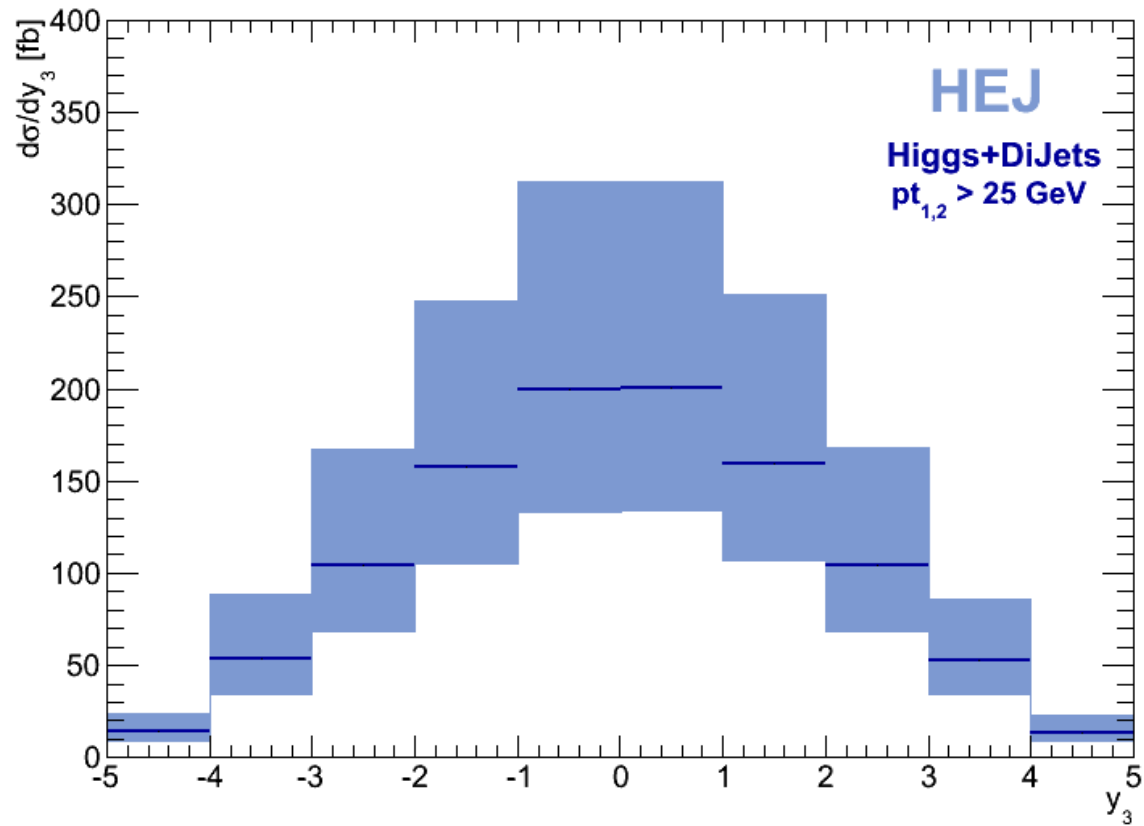
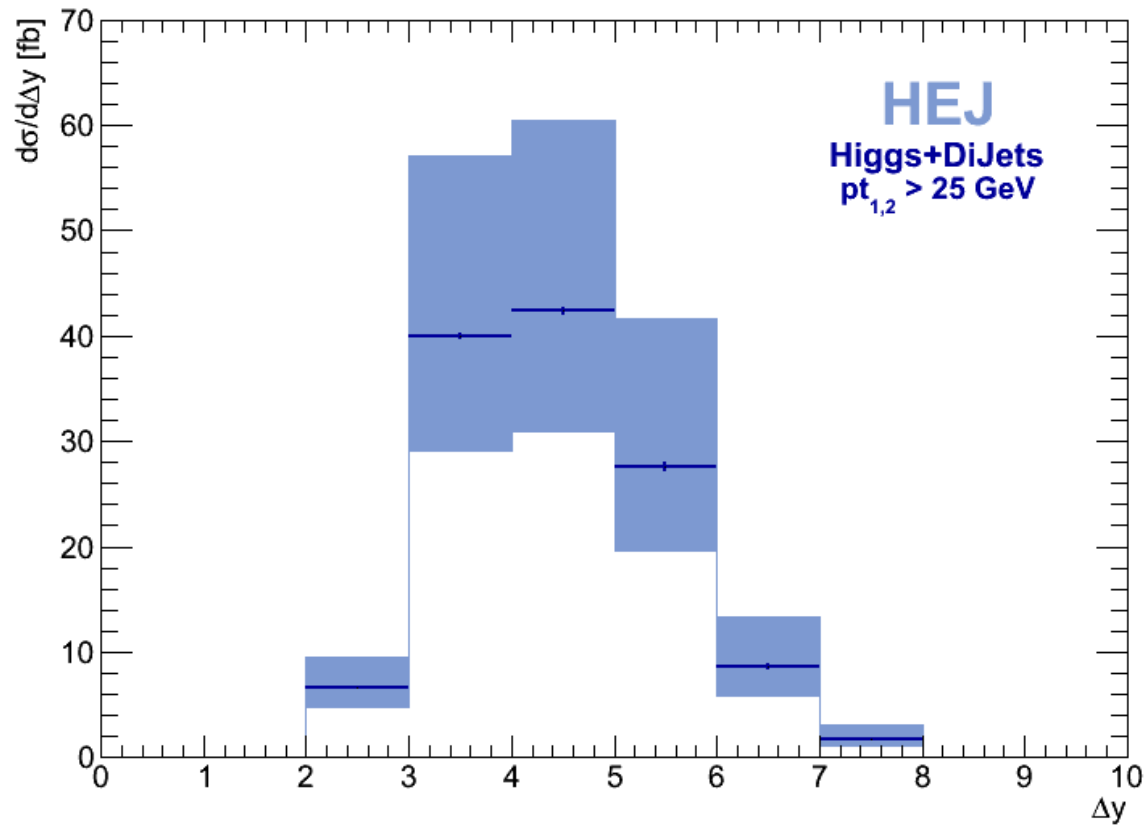# Rap diff between two hardest jets
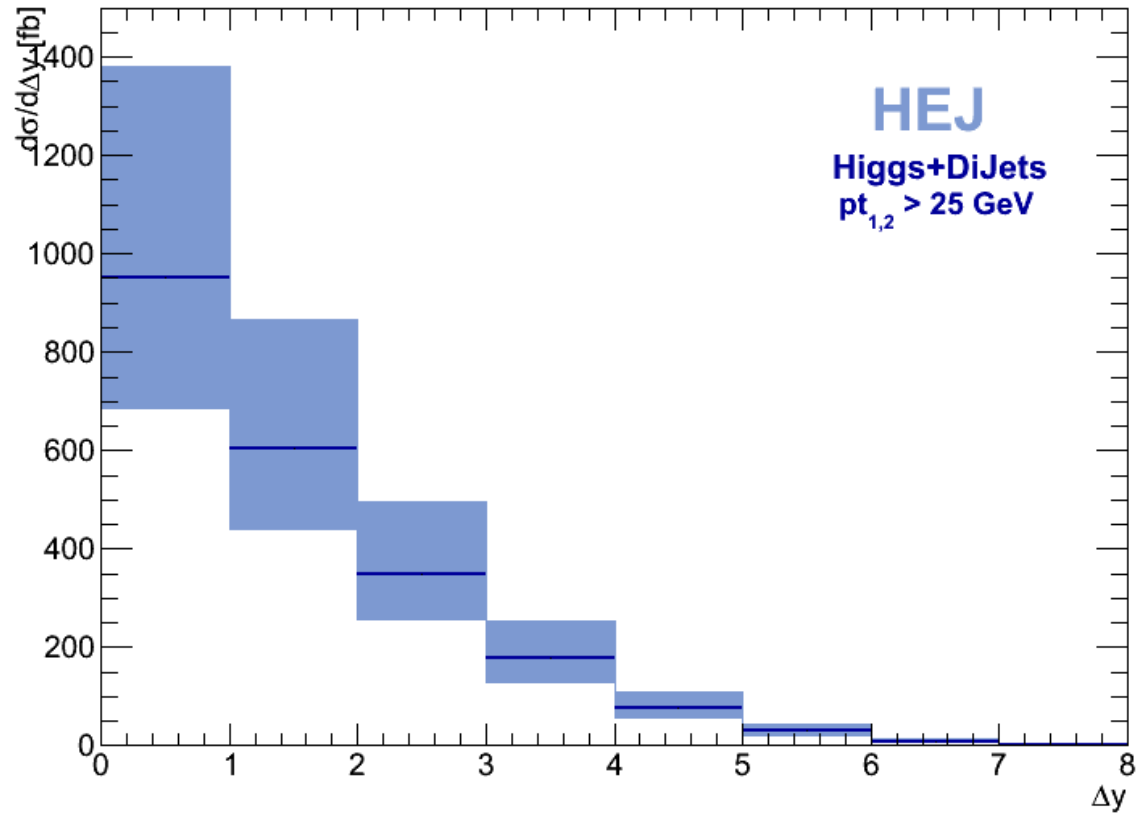
Pt1 (wbf cuts)
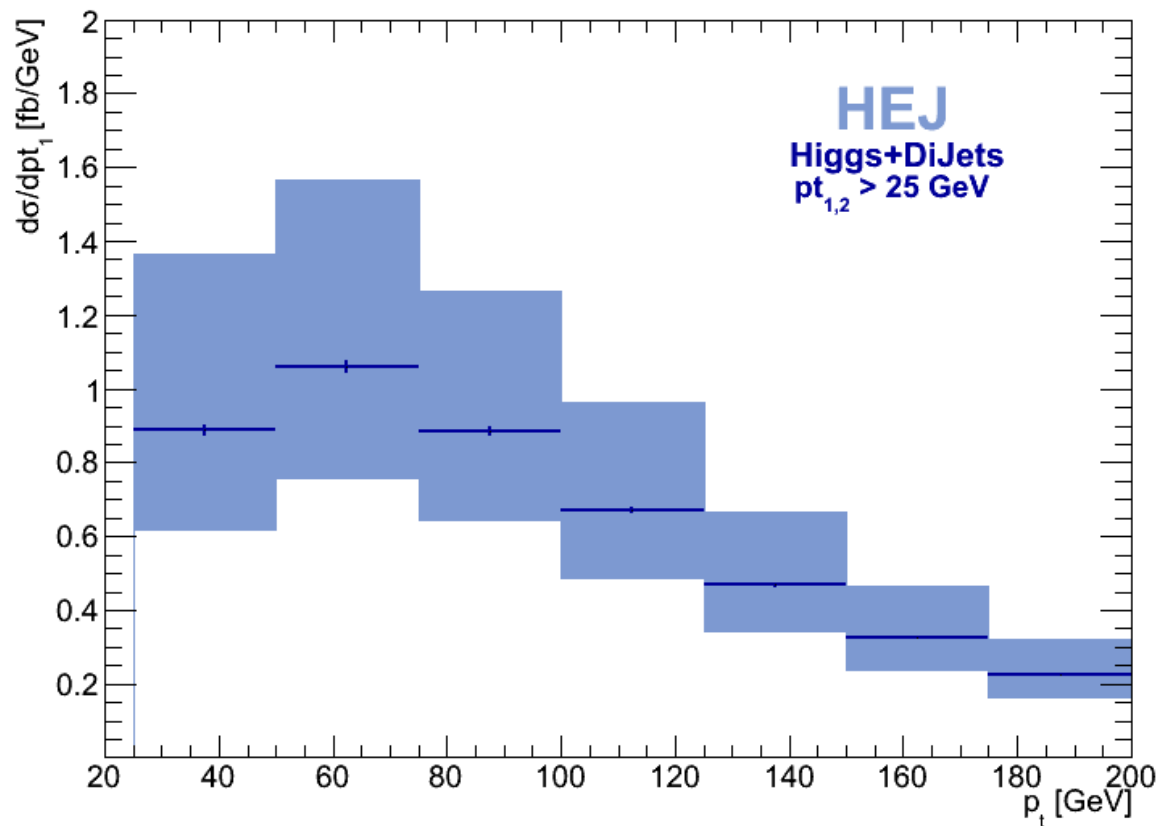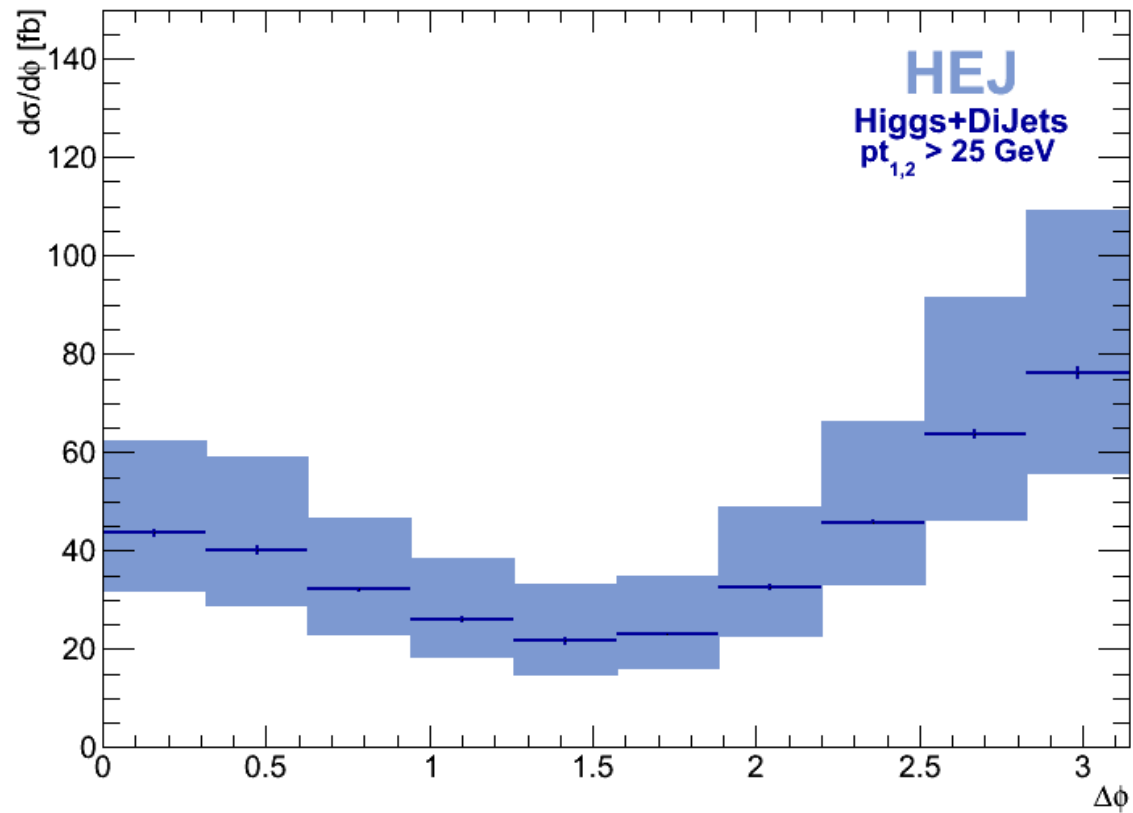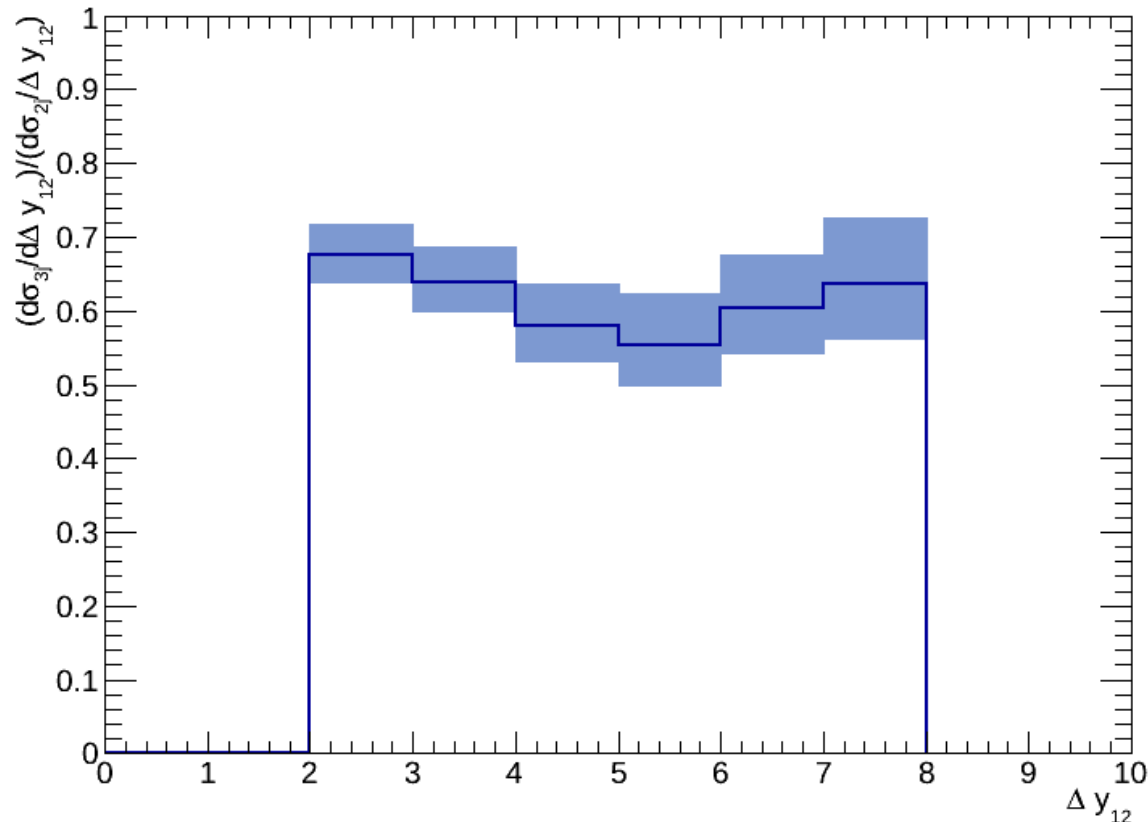
Pt2 (wbf cuts)

Pt3 (wbf cuts)

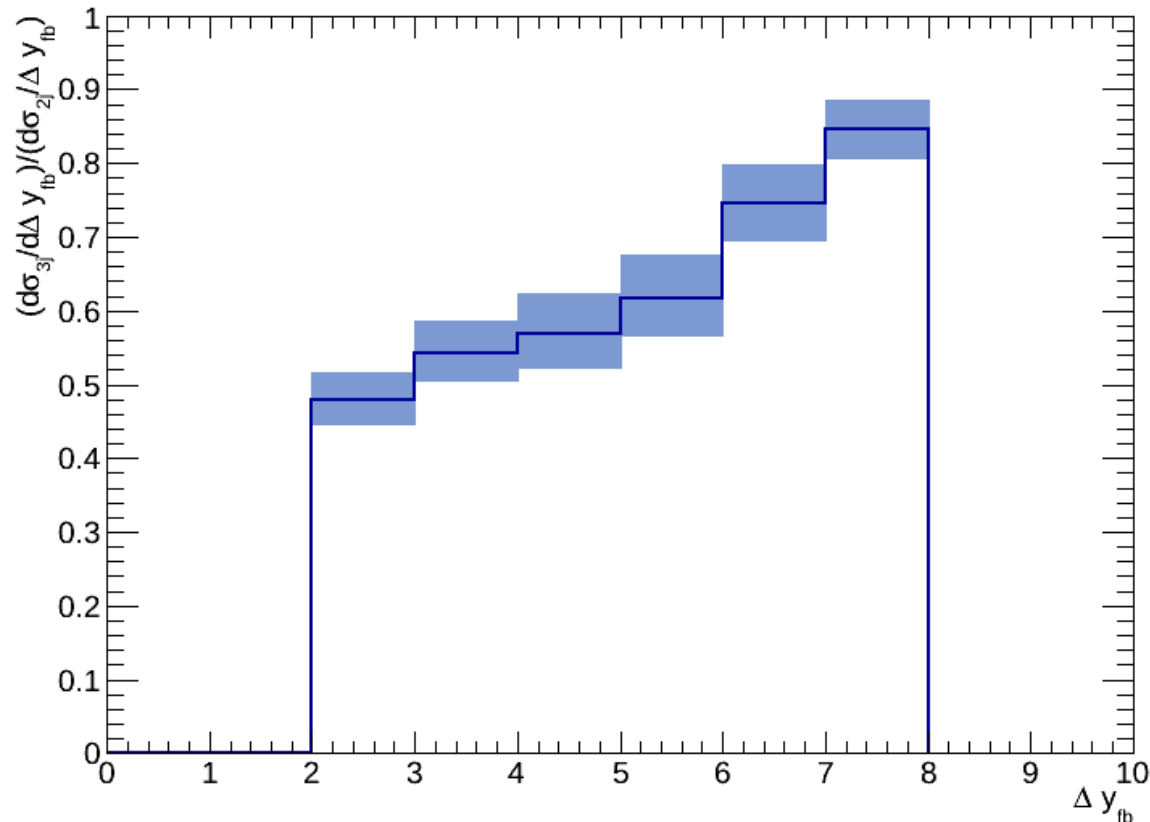# Rap between hardest jets (wbf cuts)

Dsigma/dphi (wbf cuts)

3j/2j rates (wbf cuts)

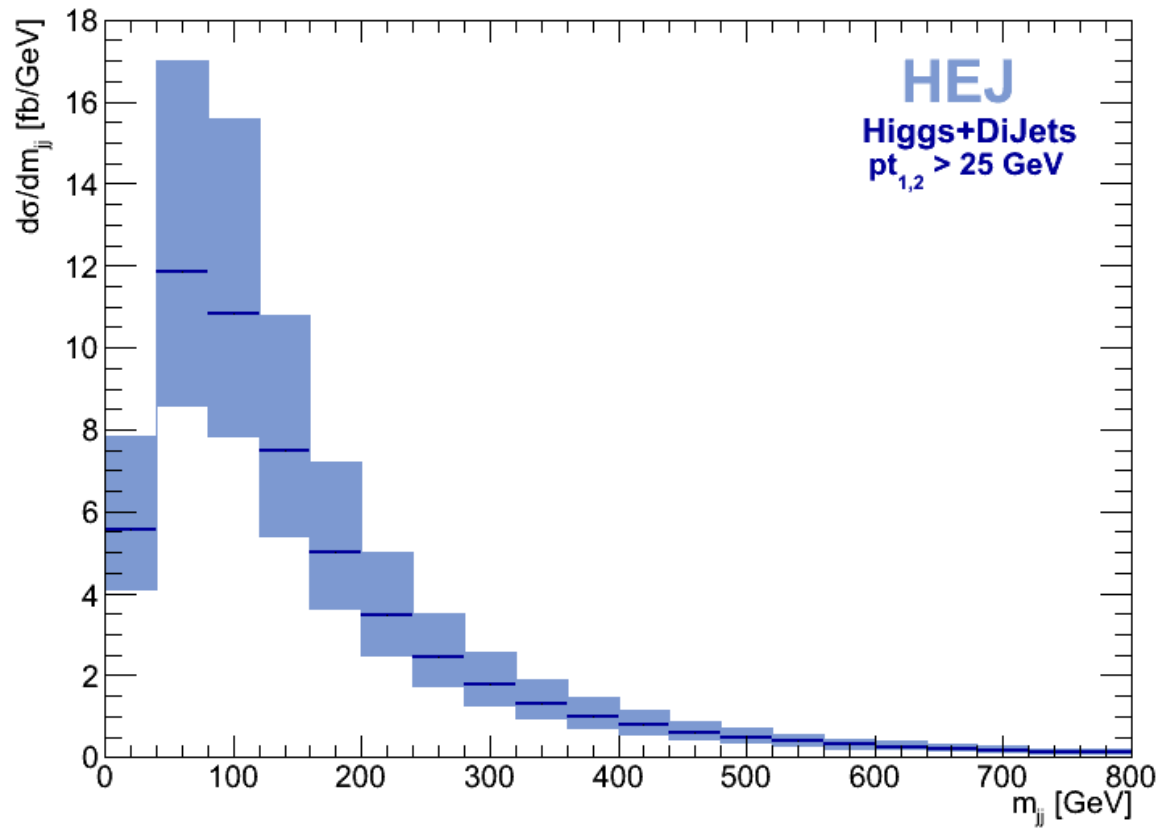Exclusive 2j rate less than half the cross section for all delta y_12

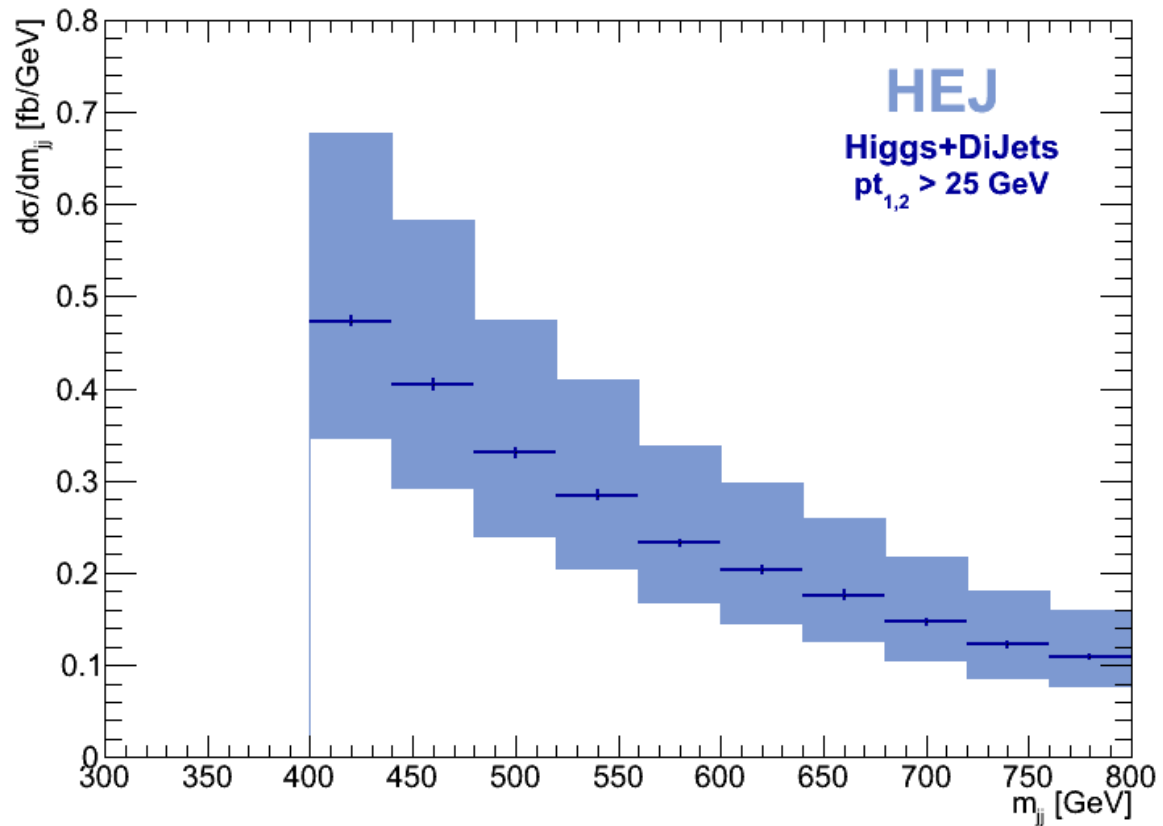Special property of gf contribution as opposed to wbf

3j/2j rates (wbf cuts)

Same data plotted against rapidity difference of the forward,backward jet
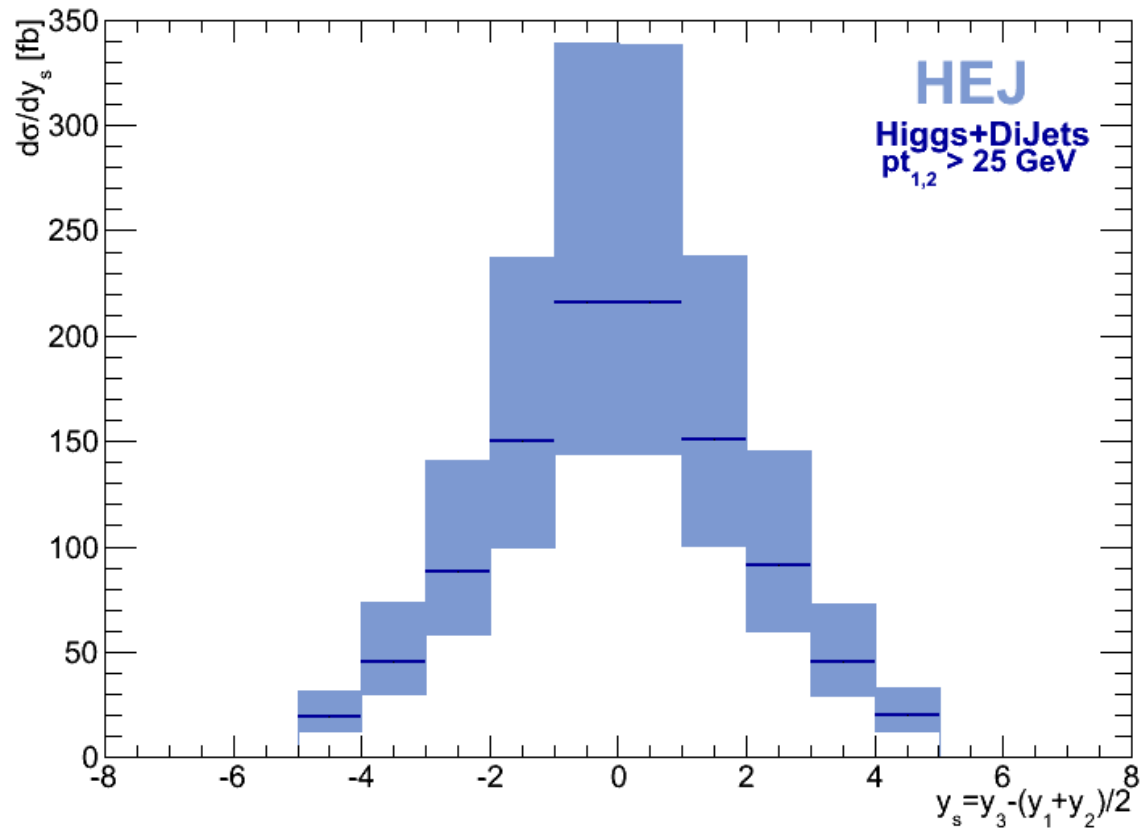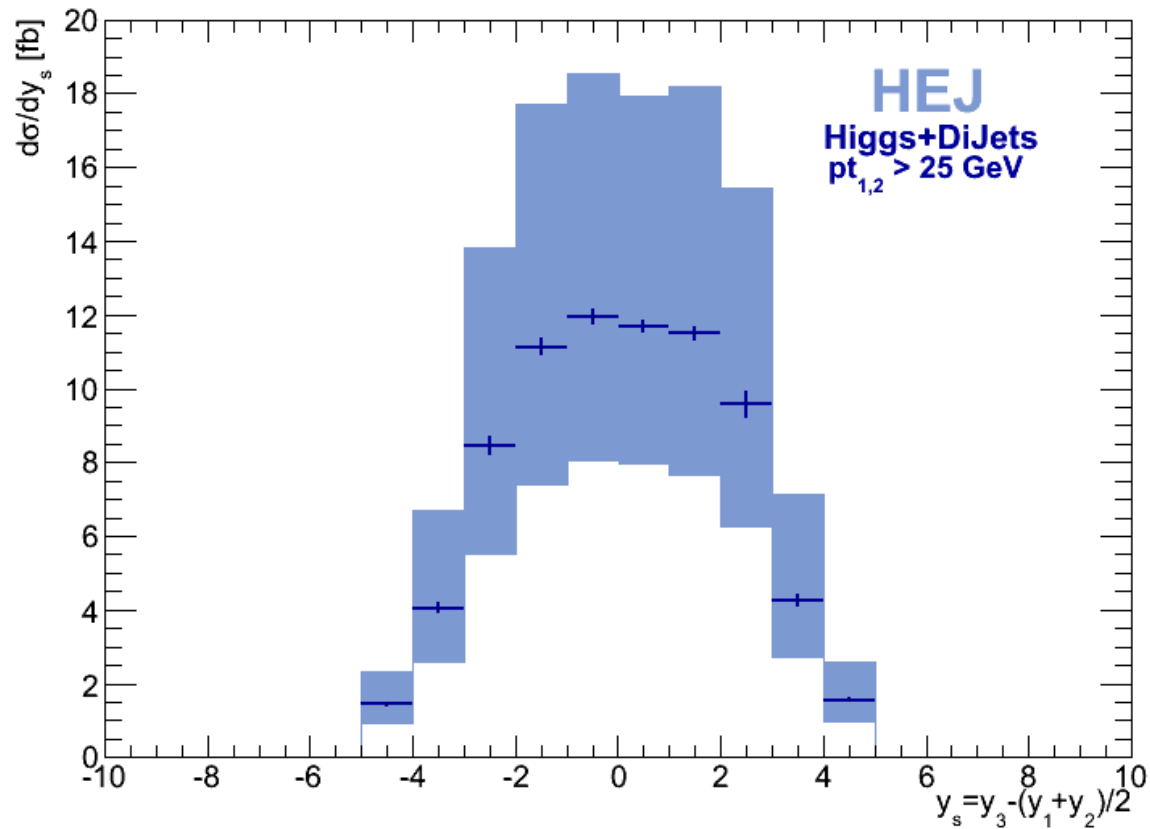Special property of gf contribution as opposed to wbf

mjj

Mjj (wbf cuts)

y3-yc

y3-yc (wbf cuts)

dsigma/dphi