VBF Higgs Production at the HL-/HE-LHC

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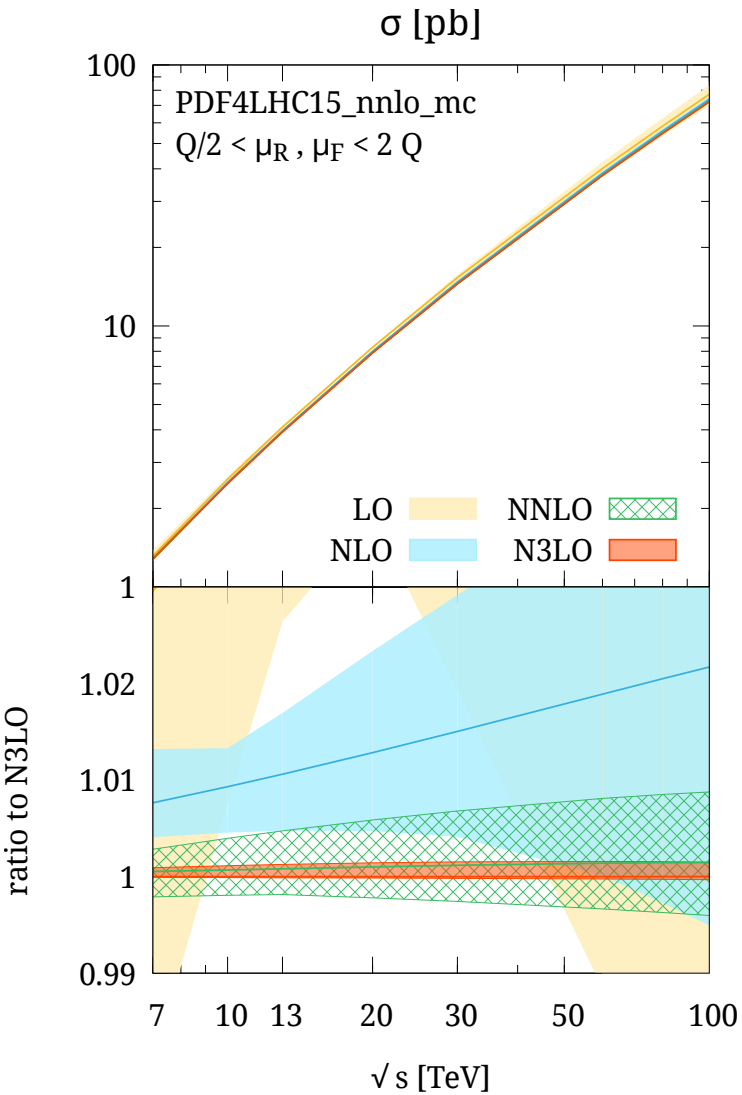
CERN

This talk

- Status on ongoing work
  - First inclusive N3LO results at 27 TeV
  - Differential results under "typical" tight/loose VBF cuts at LO and NLO
  - Initial study of tag jet rapidities
- Setup
  - PDG values for EW parameters (M_W, M_Z, G_F)
  - PDF: PDF4LHC_nnlo
  - $\sqrt{s} = 27$ TeV
  - Pure VBF approximation as implemented in PROVBFH and NNLOJET

Still very preliminary!

Inclusive N3LO results



$\sqrt{s}$	$\sigma^{(\text{incl})}_{\text{N3LO}}$ [pb]
13 TeV	3.928
20 TeV	7.890
27 TeV	12.41
30 TeV	14.50
100 TeV	72.33

Scale uncertainty of N3LO result is at the permille level. This clearly underestimates the theoretical uncertainty.

Fiducial setup

Define two anti-k_t tag jets with $p_t > 30$ GeV and $R = 0.4$ and always require

$$y_{j_1} y_{j_2} < 0.$$

We define a "loose" set of VBF cuts (upper frame in the following)

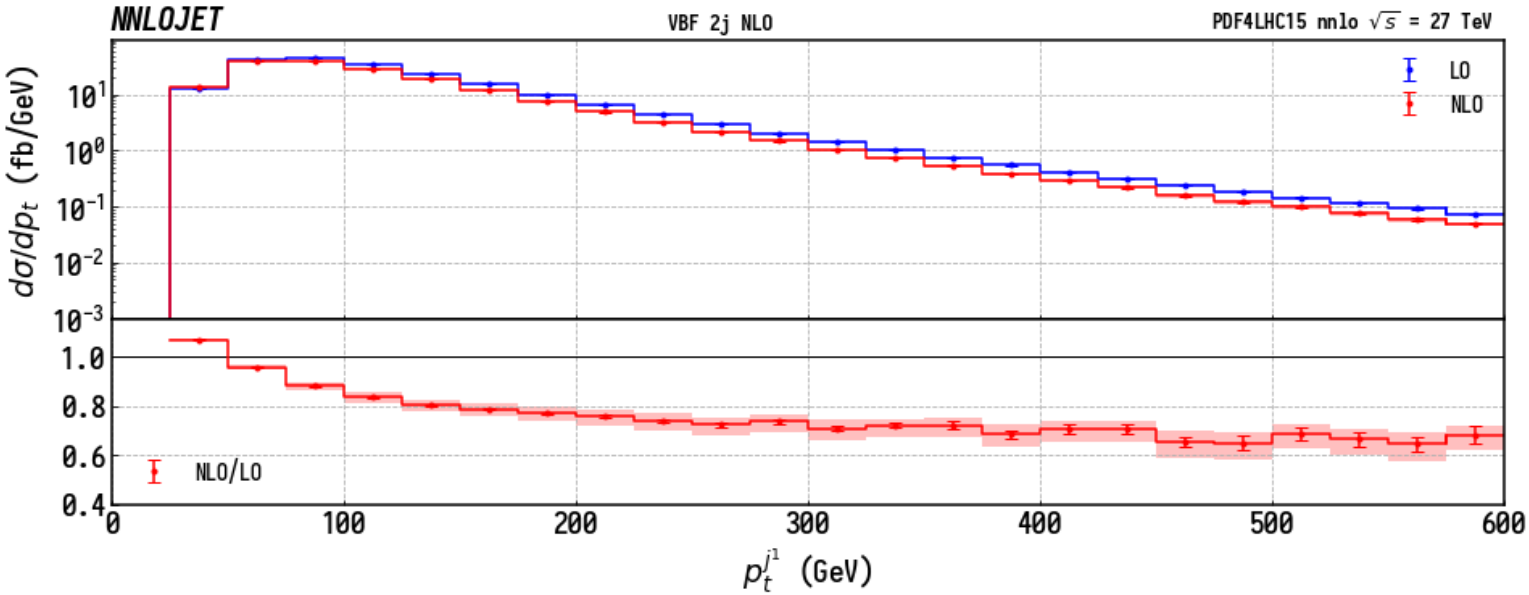
$$M_{jj} > 500 \text{ GeV}, \qquad |\Delta y_{jj}| > 3,$$

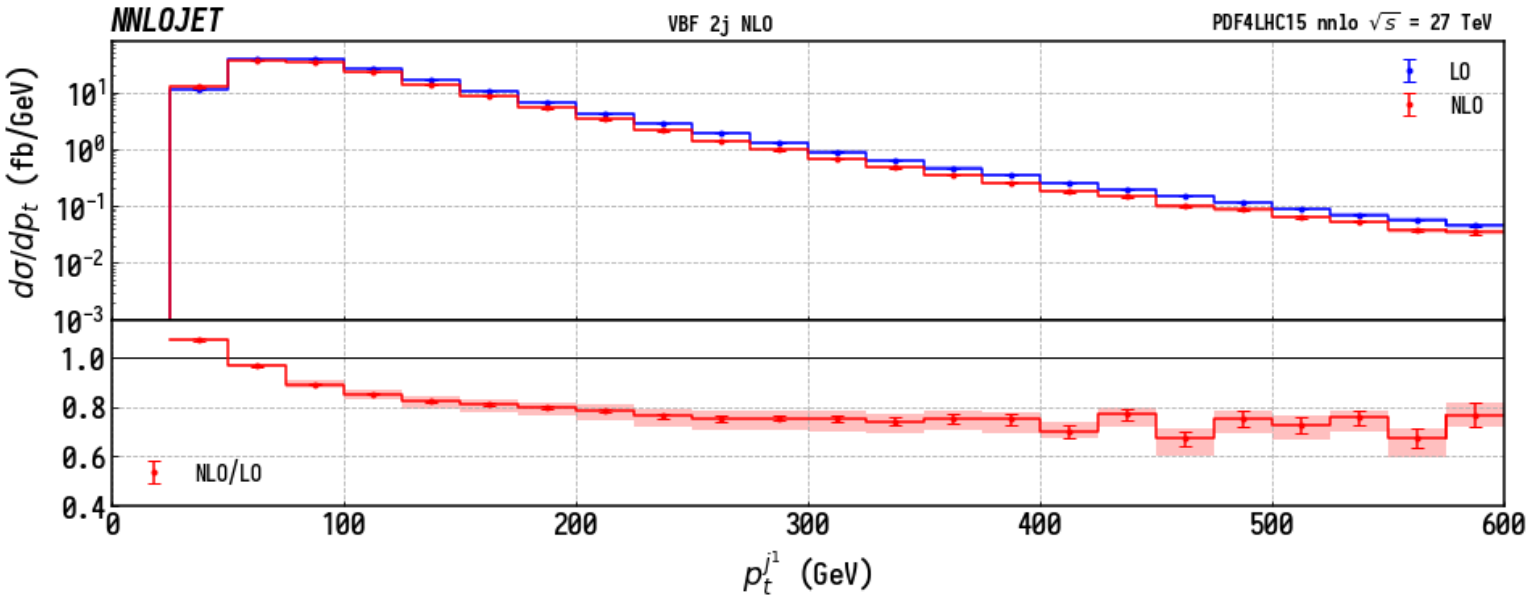
and a "tight" set with (lower frame in the following)

$$M_{jj} > 600 \text{ GeV}, \qquad |\Delta y_{jj}| > 4.5.$$

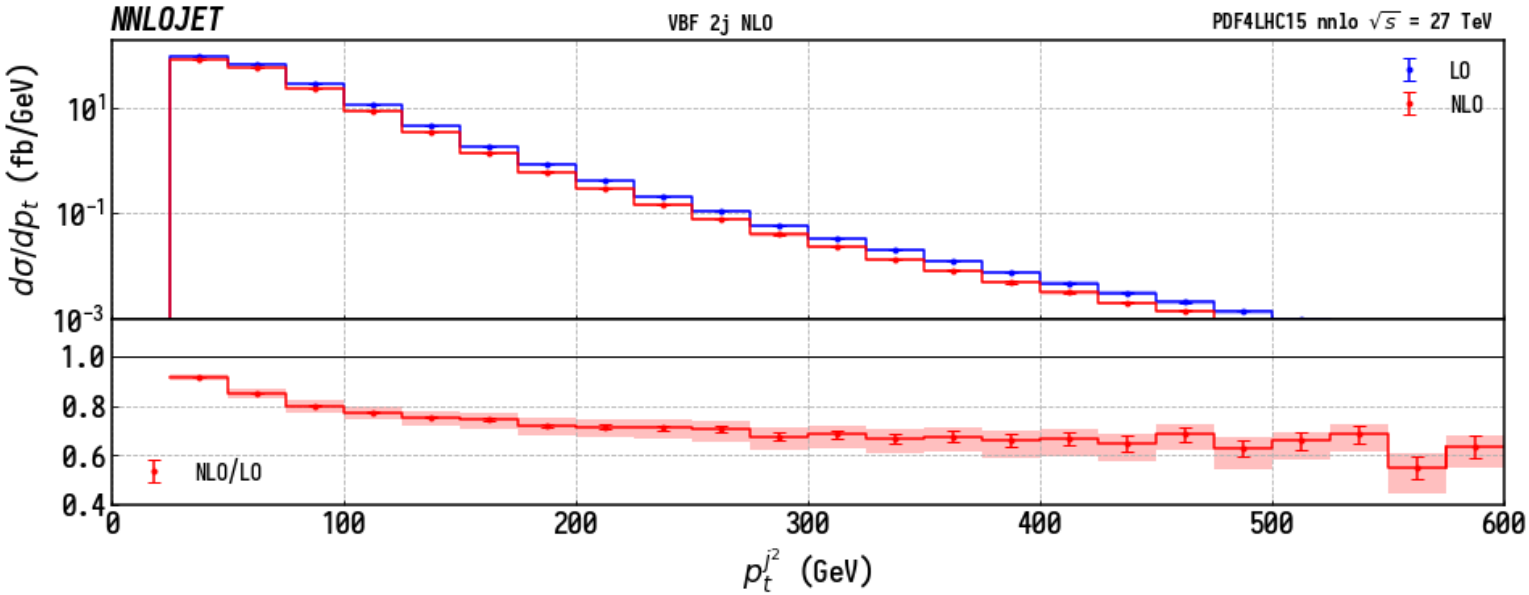
These cuts will we updated and changed after we perform a scan in M_{jj} and $|\Delta y_{jj}|$.

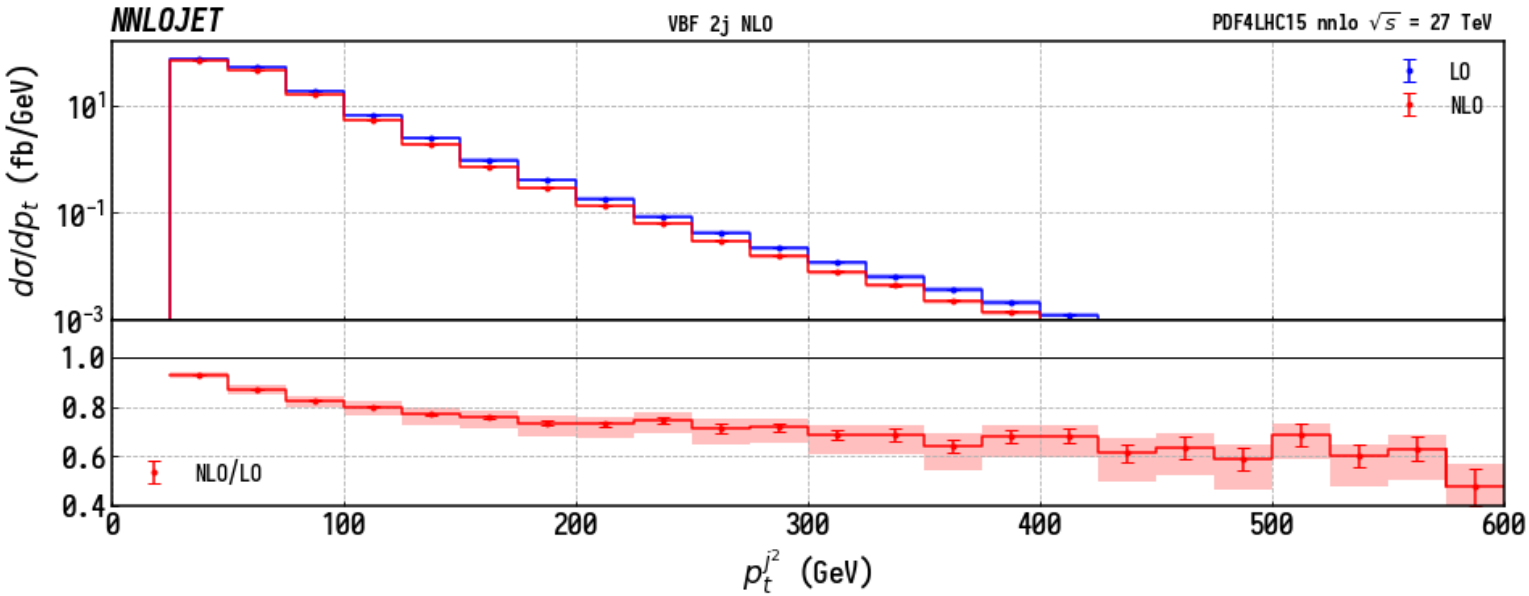
Distributions - p_{t,j_1}



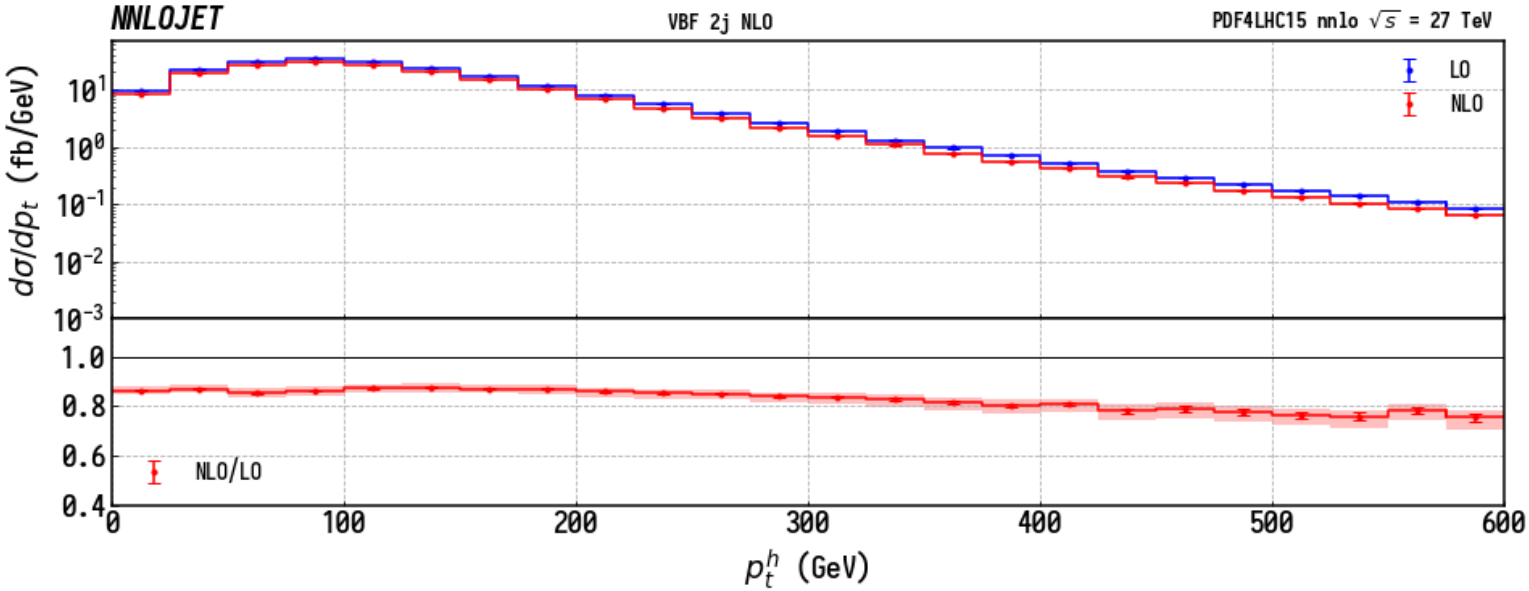


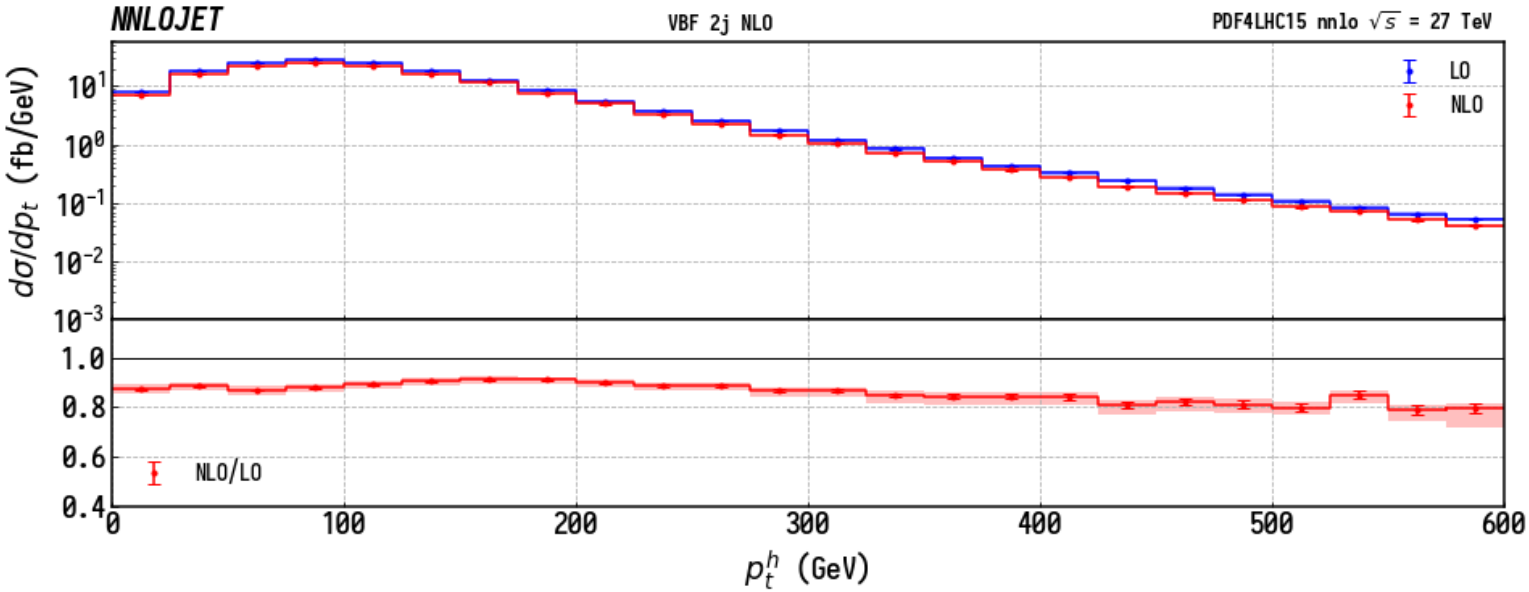
Distributions - p_{t,j_2}



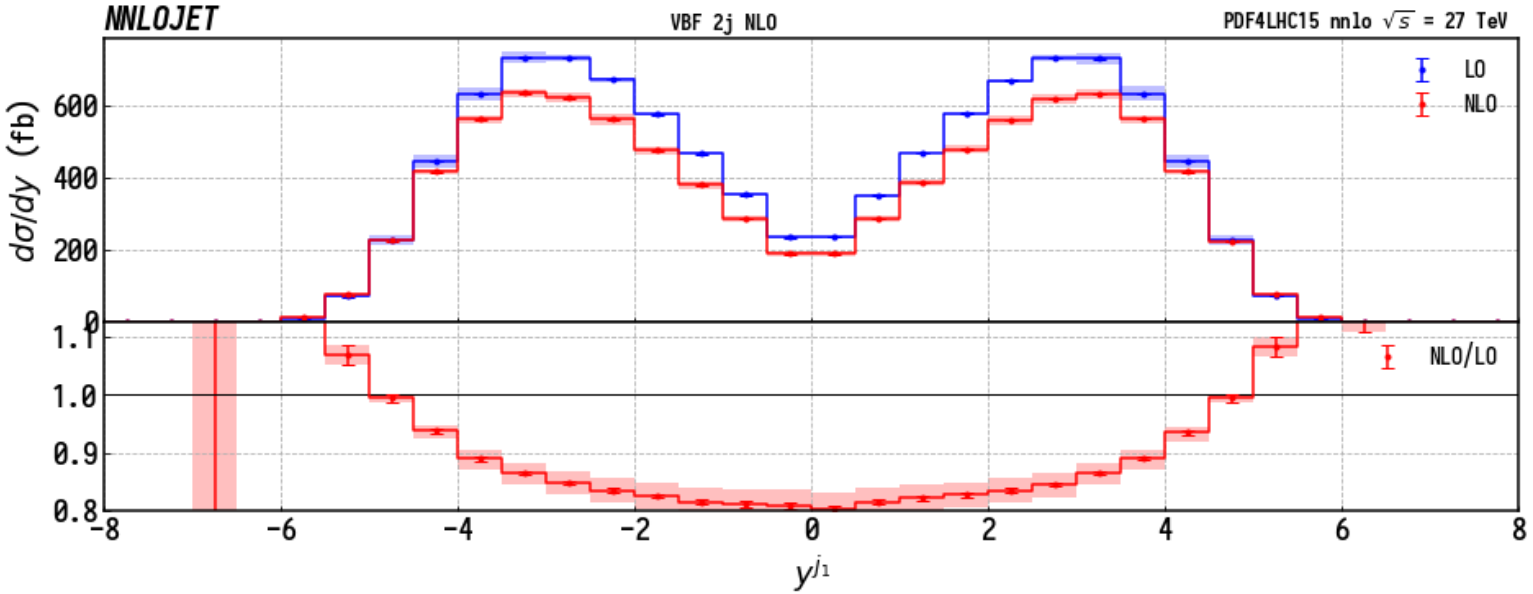


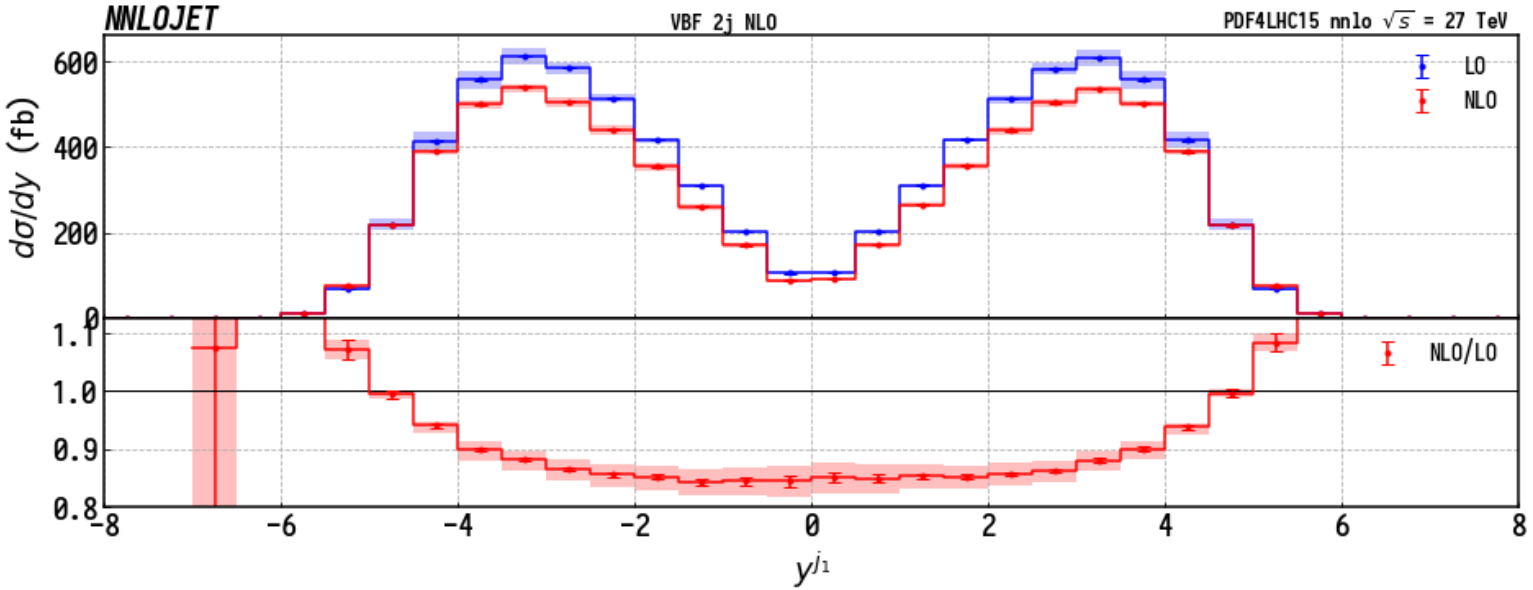
Distributions - $p_{t,H}$



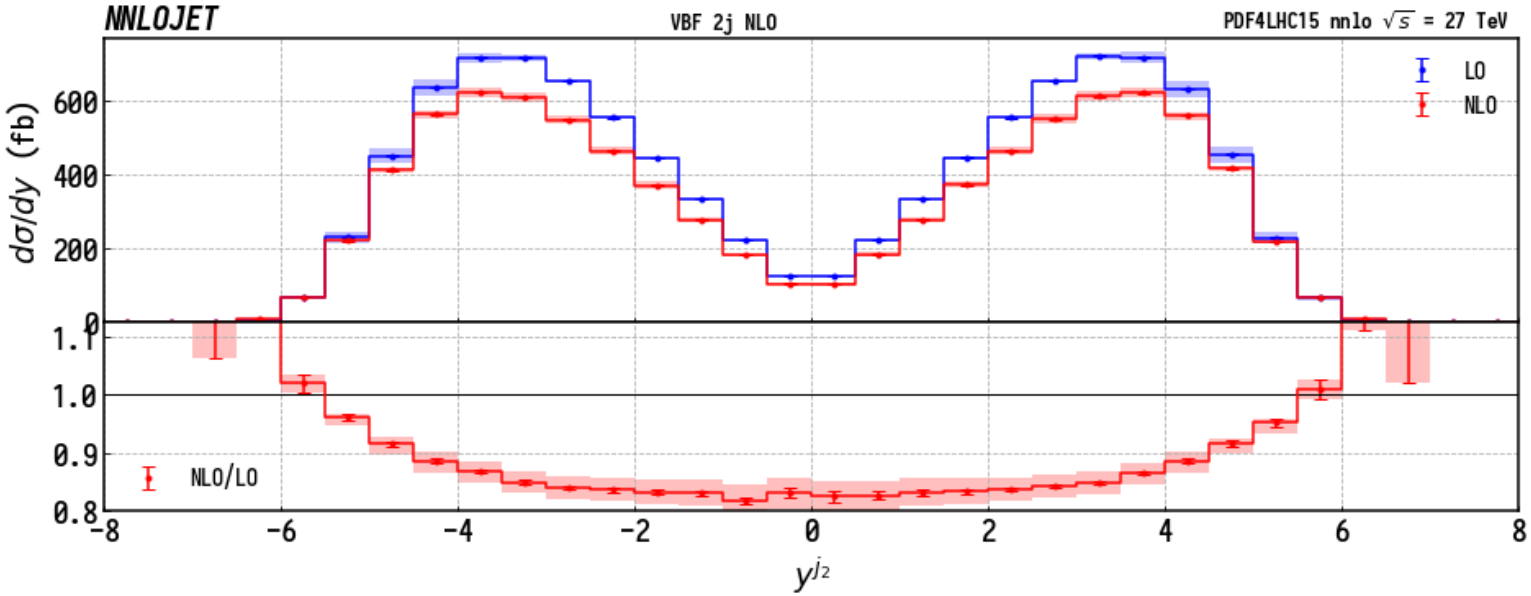


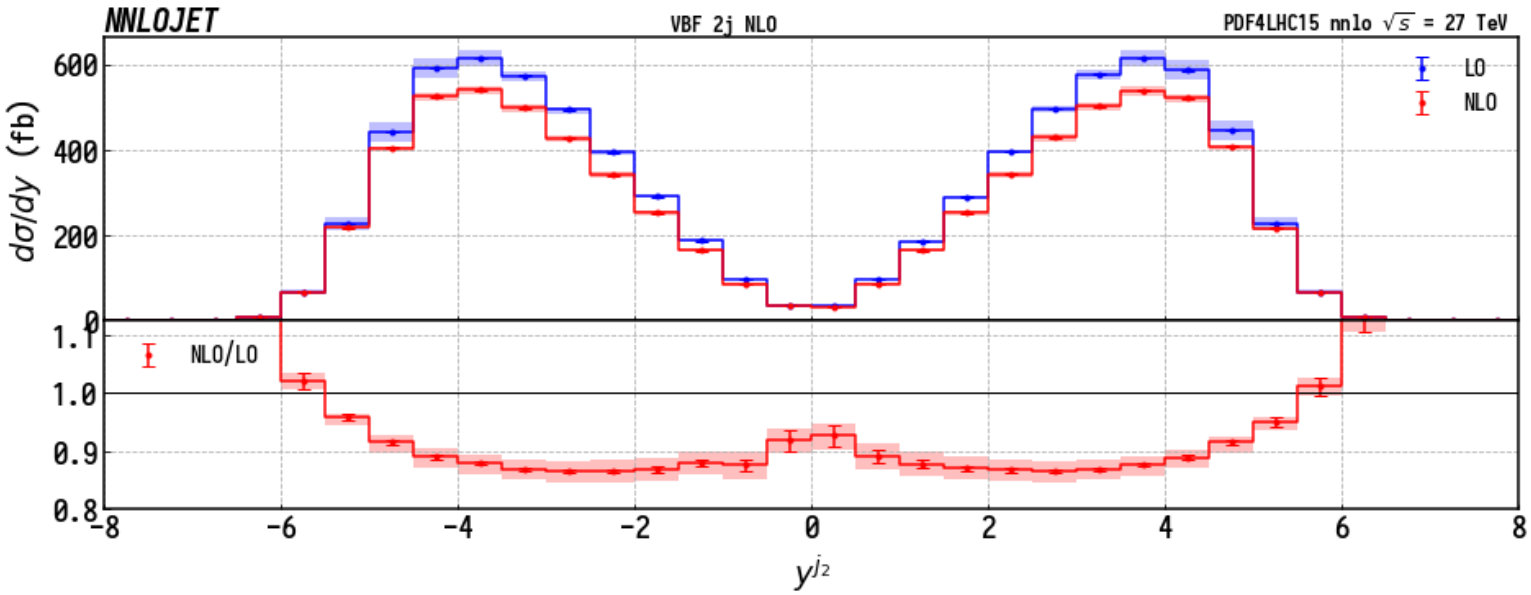
Distributions - y_{j_1}



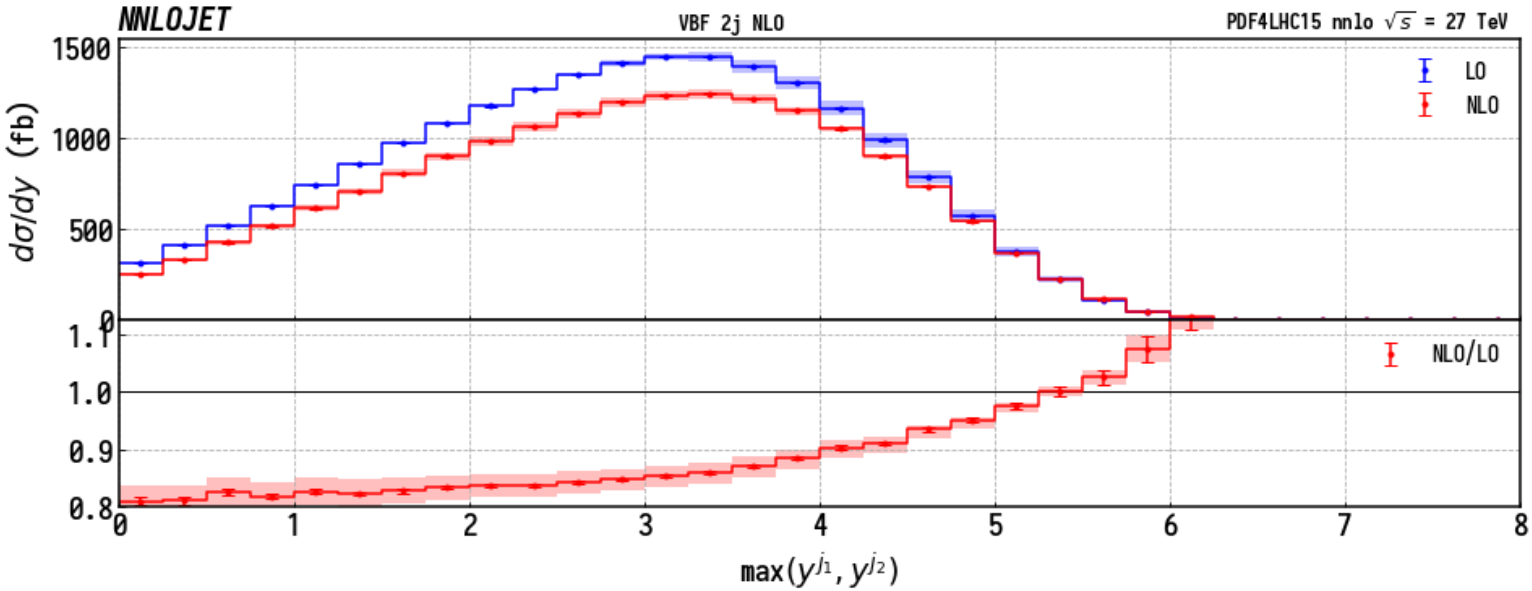


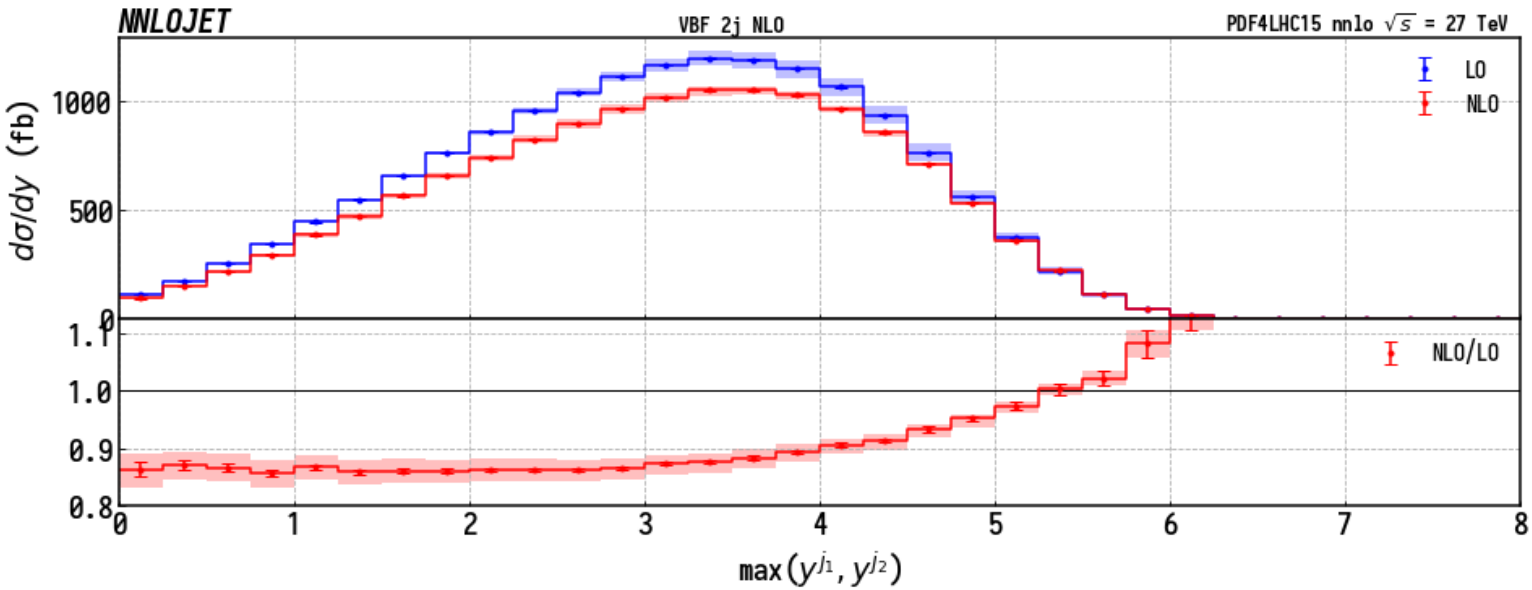
Distributions - y_{j_2}



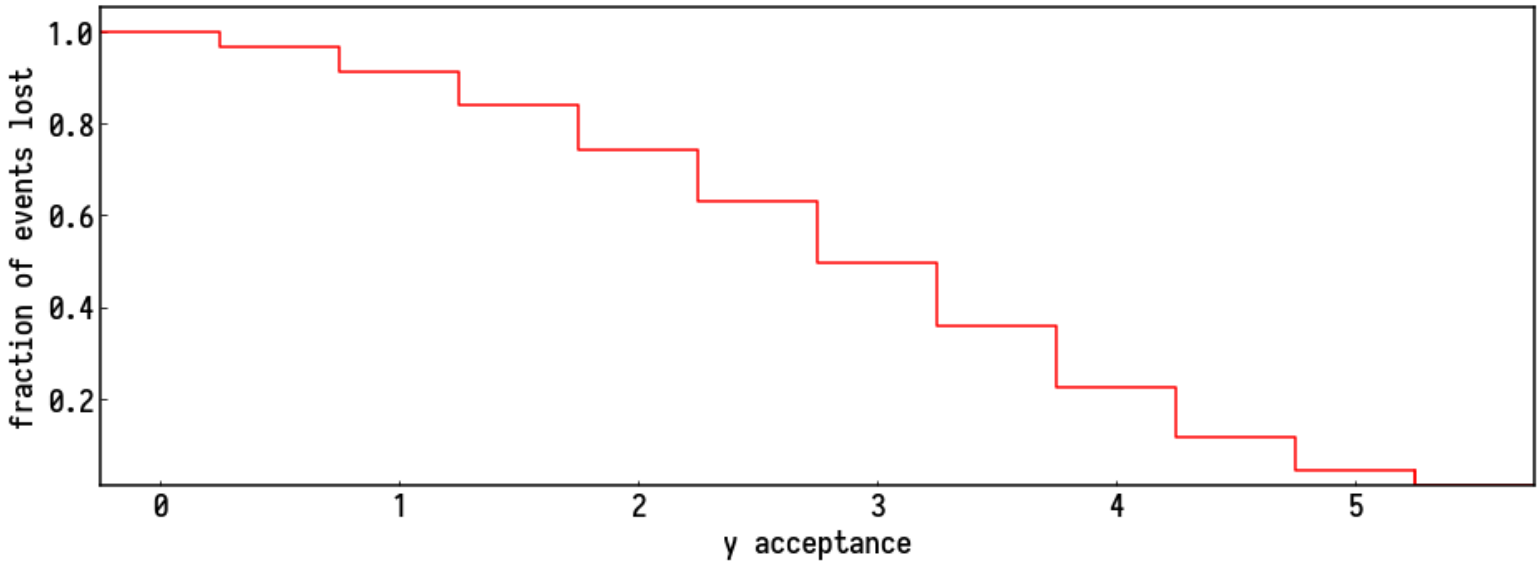


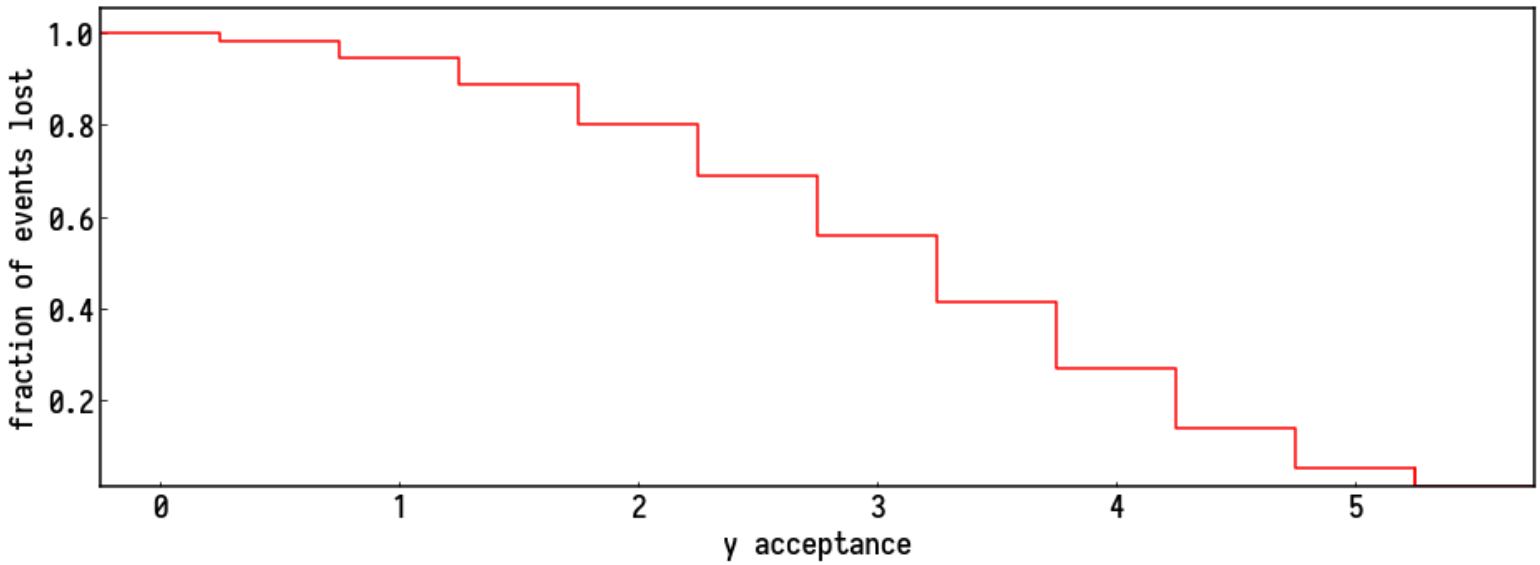
Distributions - $\max(|y_{j_1}|, |y_{j_2}|)$





Detector acceptance





Things to be done

- 2D-scan of M_{jj} and Δy_{jj} to establish VBF cuts
  - A study of ggHjj background would be valuable as well
- VBF aproximation - how well does it work at 27 TeV?
- Size of electroweak corrections
- High-$p_{t,H}$ study
- Detector reach
  - Need some input from experimentalists...
- Report at set of fiducial/inclusive cross sections based on the above
- Study M_{jj} and $p_{t,H}$ reach with full integrated luminosity