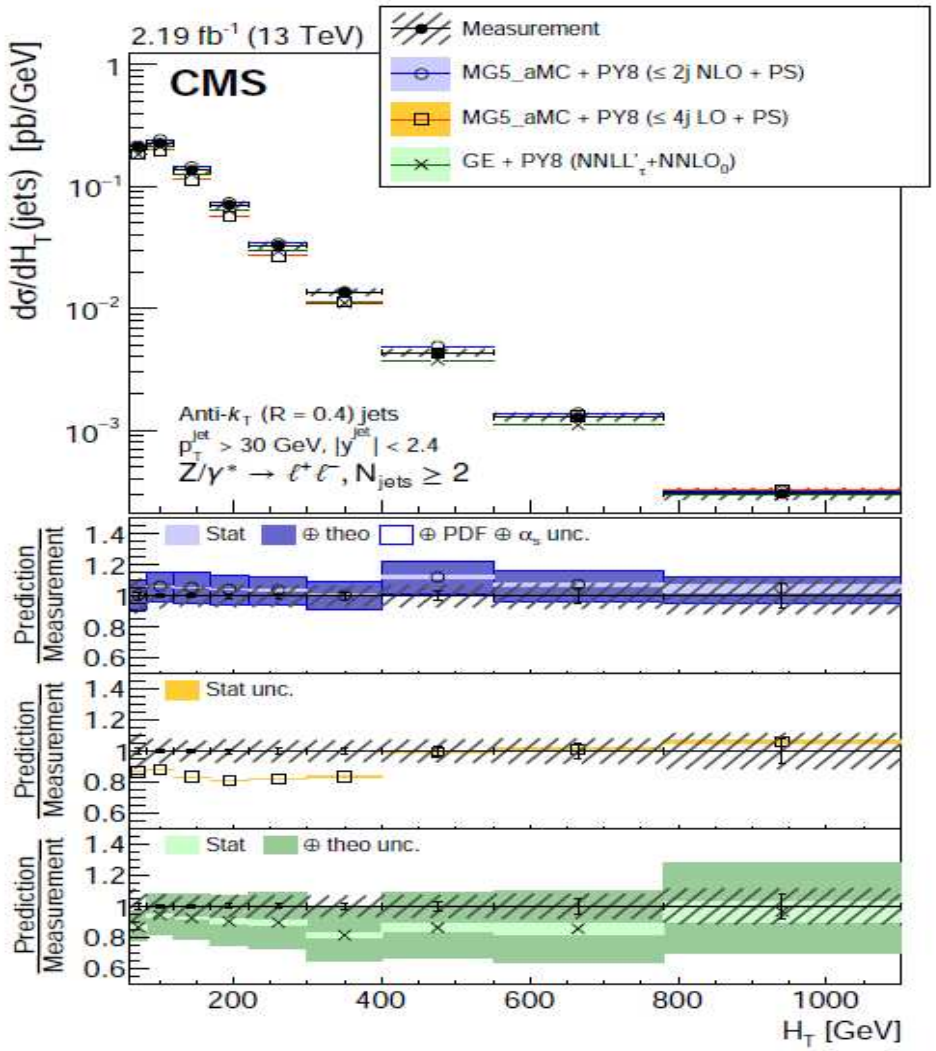
Stefano Frixione

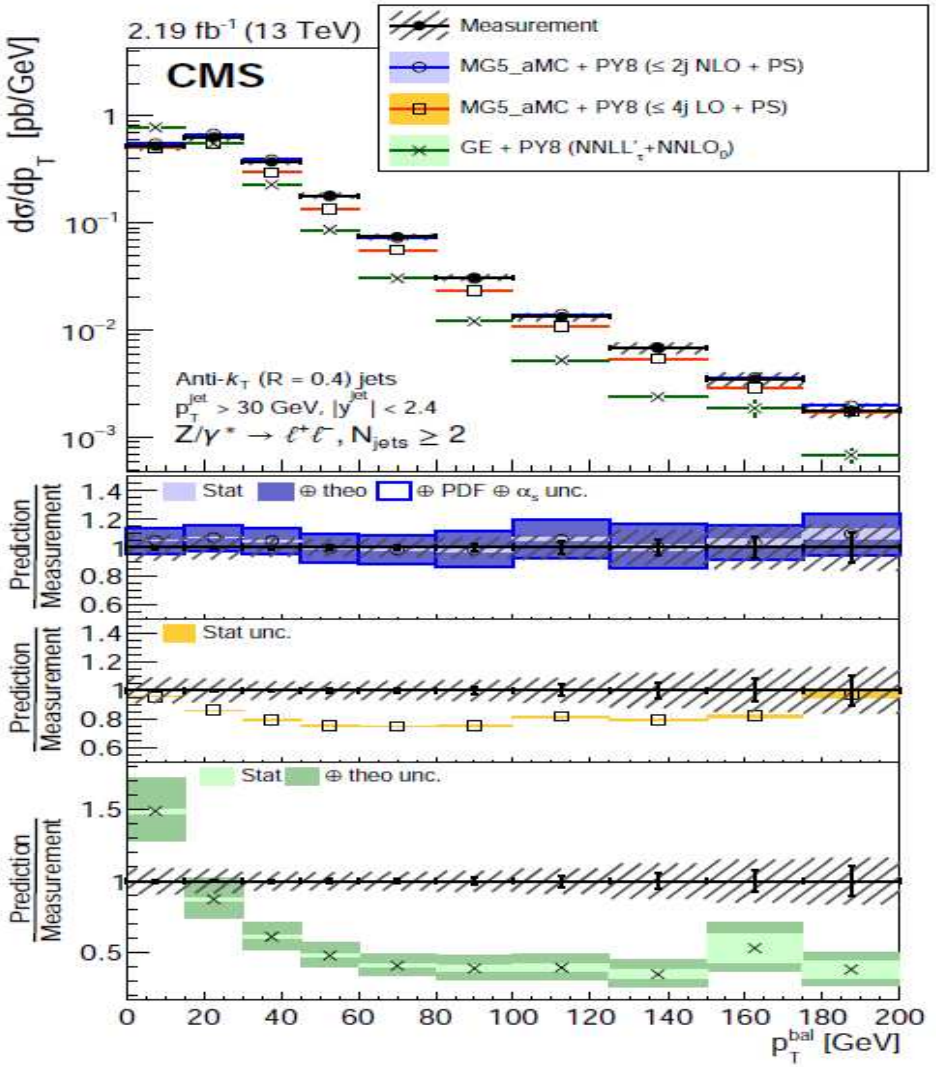
For the record

HSF meeting, CERN, 27/11/2018

What follows is trivial, but needs to be kept in mind

- Better be right than fast
- (N)NLO simulations allow one to treat theoretical systematics seriously. This has a very direct impact on both SM and BSM physics
- There is no way to guess the local (in phase-space) behaviour of systematics without performing simulations
- One typical example: merging scale variations for a given $p_T(j)$ analysis cut. NLO and LO have typically different behaviours
- Unweighting events means spending time earlier, but saving it (plus disk space) later





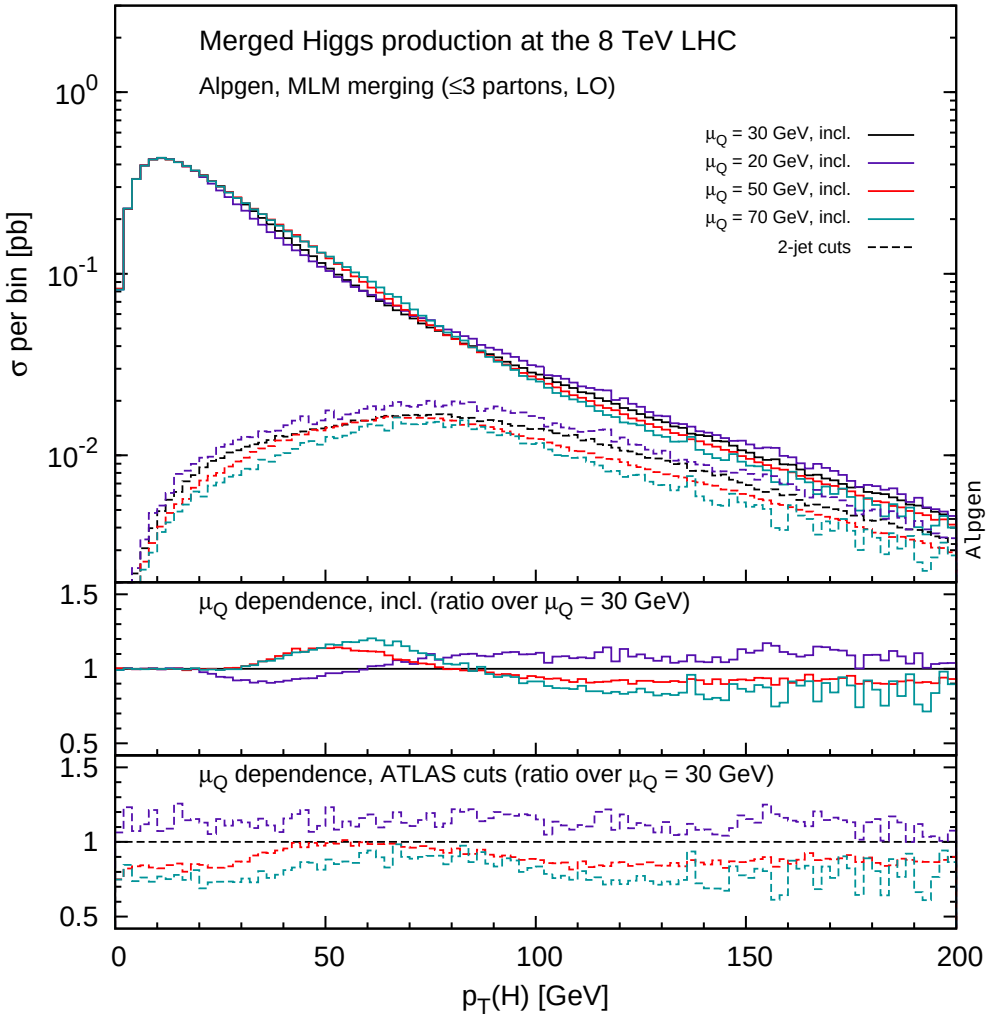
$pp \rightarrow Z$+jets, 1804.05252

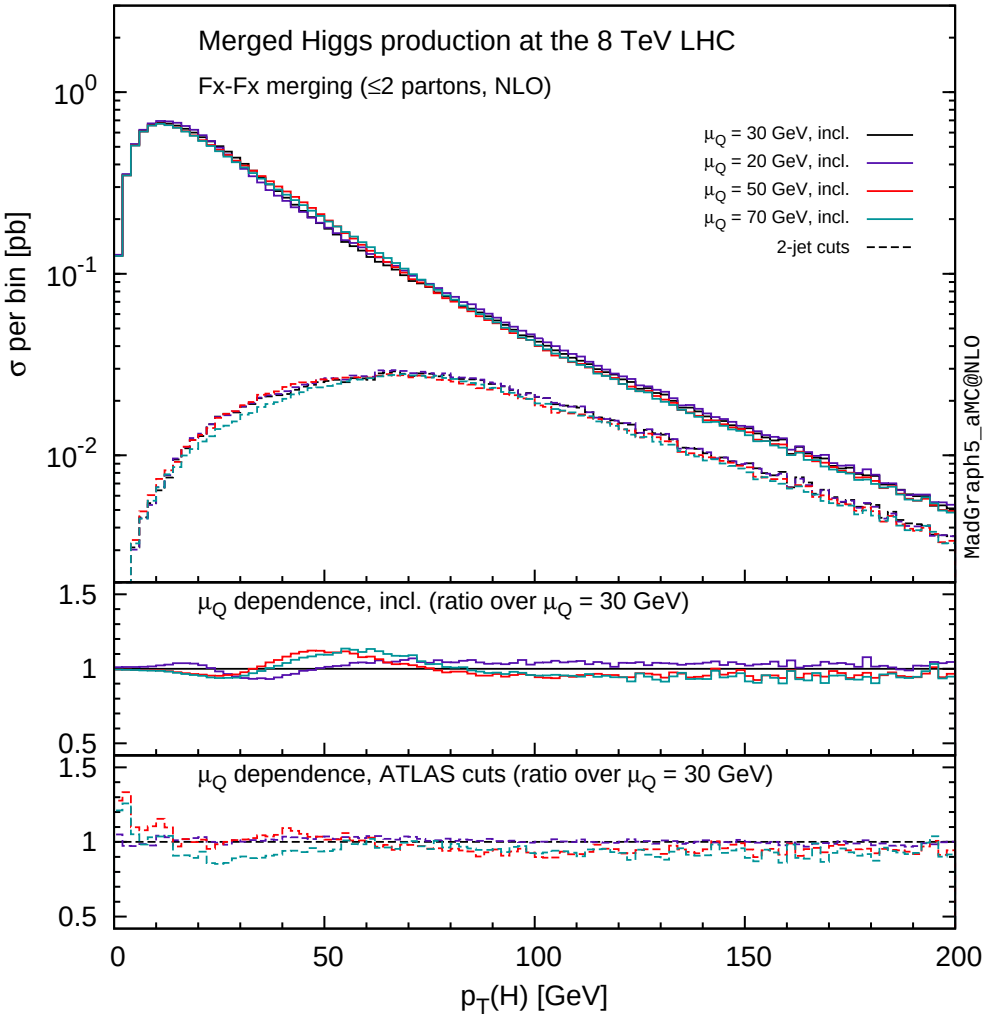
"... The measurements are in good agreement with the results of the NLO multiparton calculation. ... The multiparton LO prediction does not agree as well as the NLO multiparton one"

Example: $gg \to H$

- Left plots: Alpgen (LO); right plots: MadGraph5_aMC@NLO (NLO)
- Alpgen: up to 3 partons;
  MadGraph5_aMC@NLO: up to 2 partons@NLO
- Black (solid): $\mu_Q = 30$ GeV; blue (dashed): $\mu_Q = 20$ GeV;
  red (dotted): $\mu_Q = 50$ GeV; green (dot-dashed): $\mu_Q = 70$ GeV
- Some differences in the inputs to the two codes

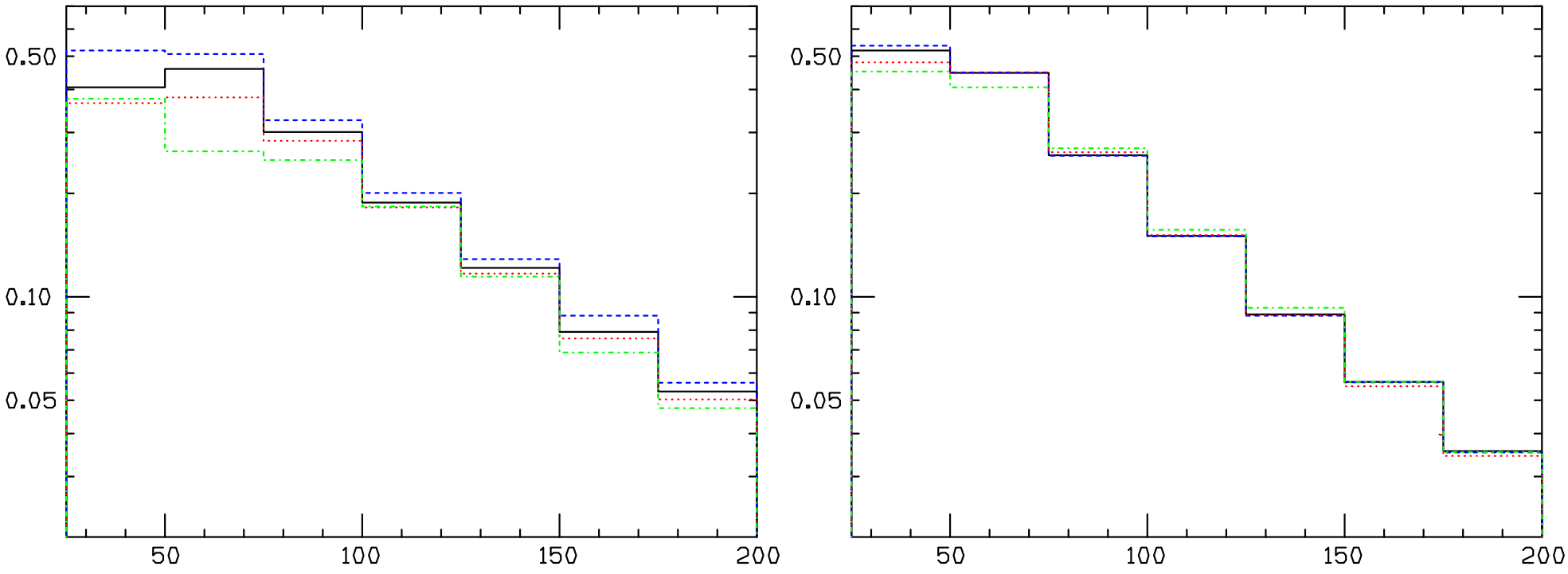
Merging: LO $\longrightarrow$ NLO



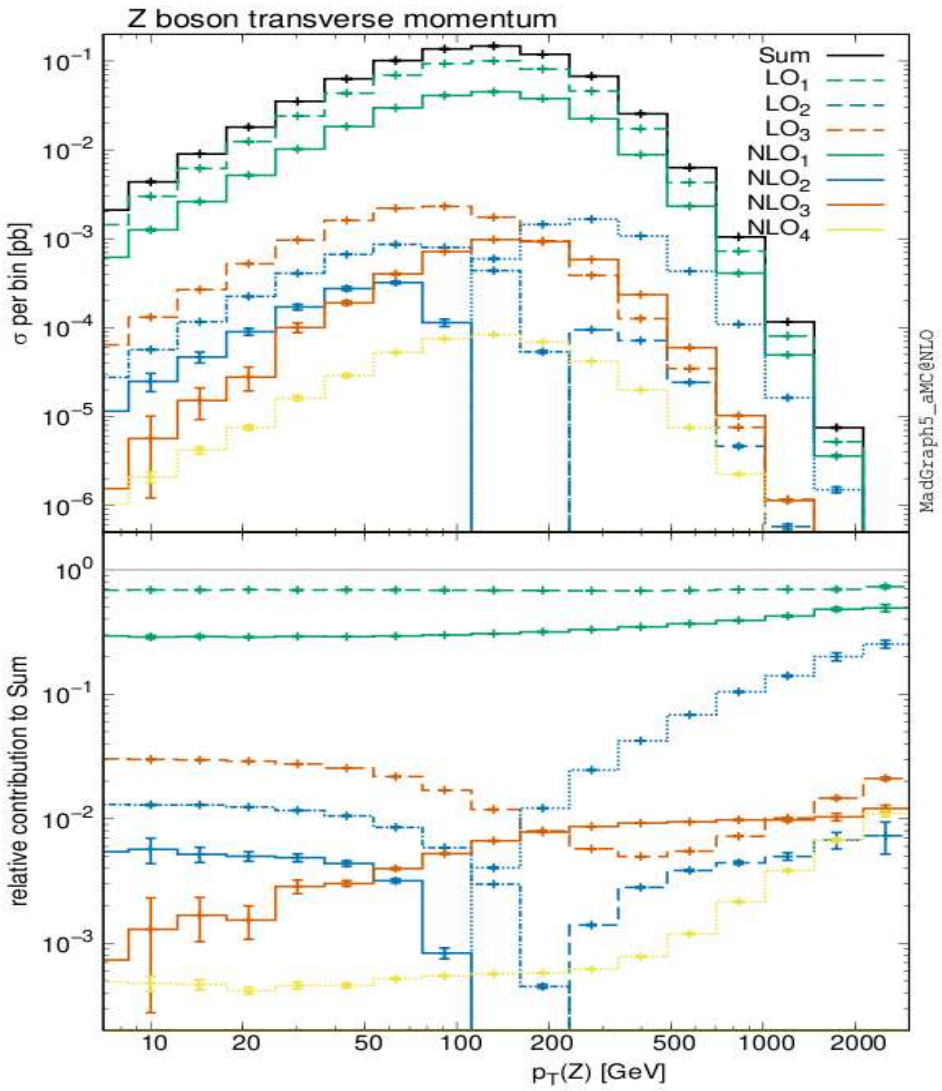


Left: LO (Alpgen). Right: FxFx (MadGraph5_aMC@NLO)

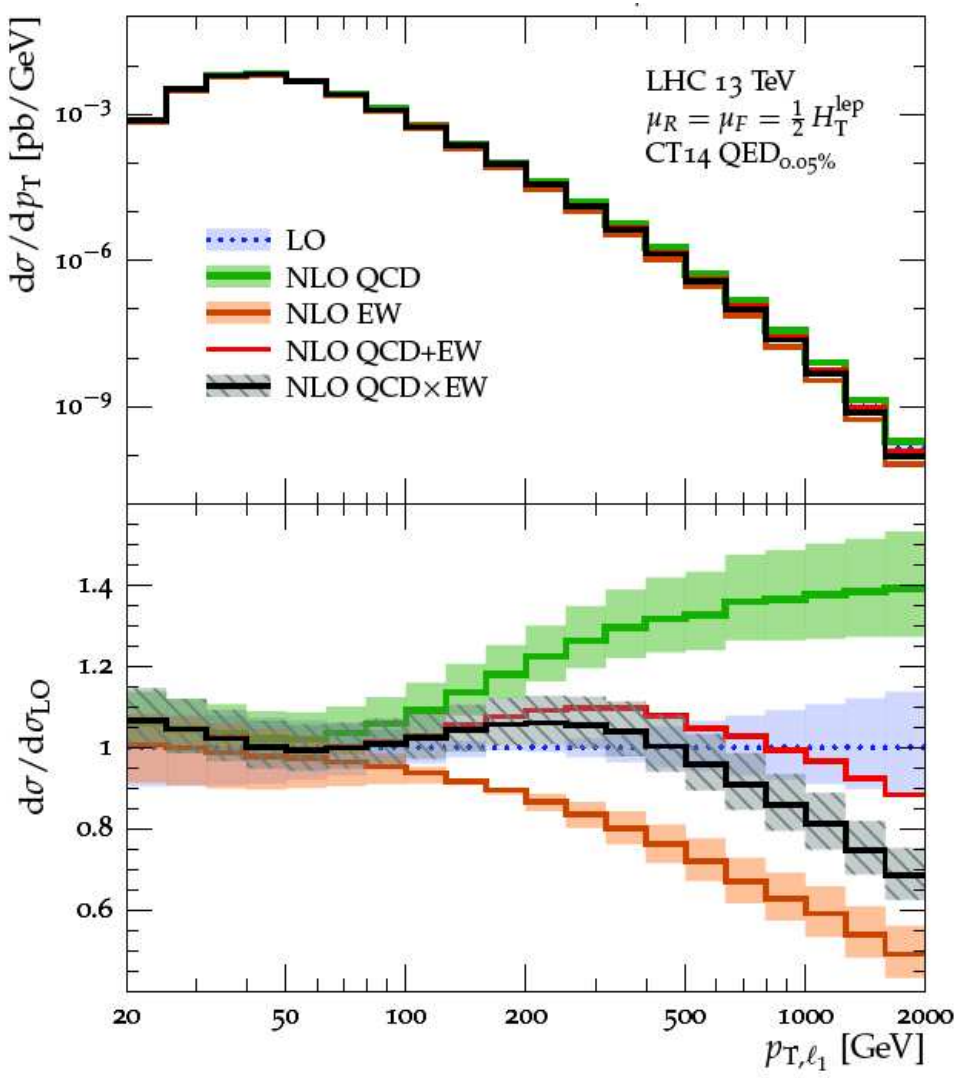
Merging: LO $\longrightarrow$ NLO



$p_T(j_1)$, at least two jets with $p_T > 25$ GeV



$pp \to t\bar{t}Z$, 1804.10017



$pp \to e^+\nu_e\mu^-\bar{\nu}_\mu$, 1705.00598

Reweighting non-QCD corrections is a tricky business