

NLO MC

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conveners: Frixione, Krauss, Maltoni, P.N.

- Support group; some assistance provided to other groups
- No meetings yet
- Here I report on individual progress in Higgs generators since the Yellow Report:
 - Higgs line-shape in pole mass scheme (Passarino's line shape)
 - $H + \text{up to 2 jets}$ available at NLO in the POWHEG BOX

Higgs line-shape

$$\frac{M\Gamma(M)}{(M^2 - \mu_{\text{H}}^2)^2 + \mu_{\text{H}}^2\gamma_{\text{H}}^2}$$

M : Higgs virtuality, $\Gamma(M)$: width at virtuality M , $\mu_{\text{H}} + i\gamma_{\text{H}}$: complex pole location. A code provided by Passarino gives μ_{H} and γ_{H} given the Higgs mass, and he also provides a program to interpolate a $\Gamma(M)$ value.

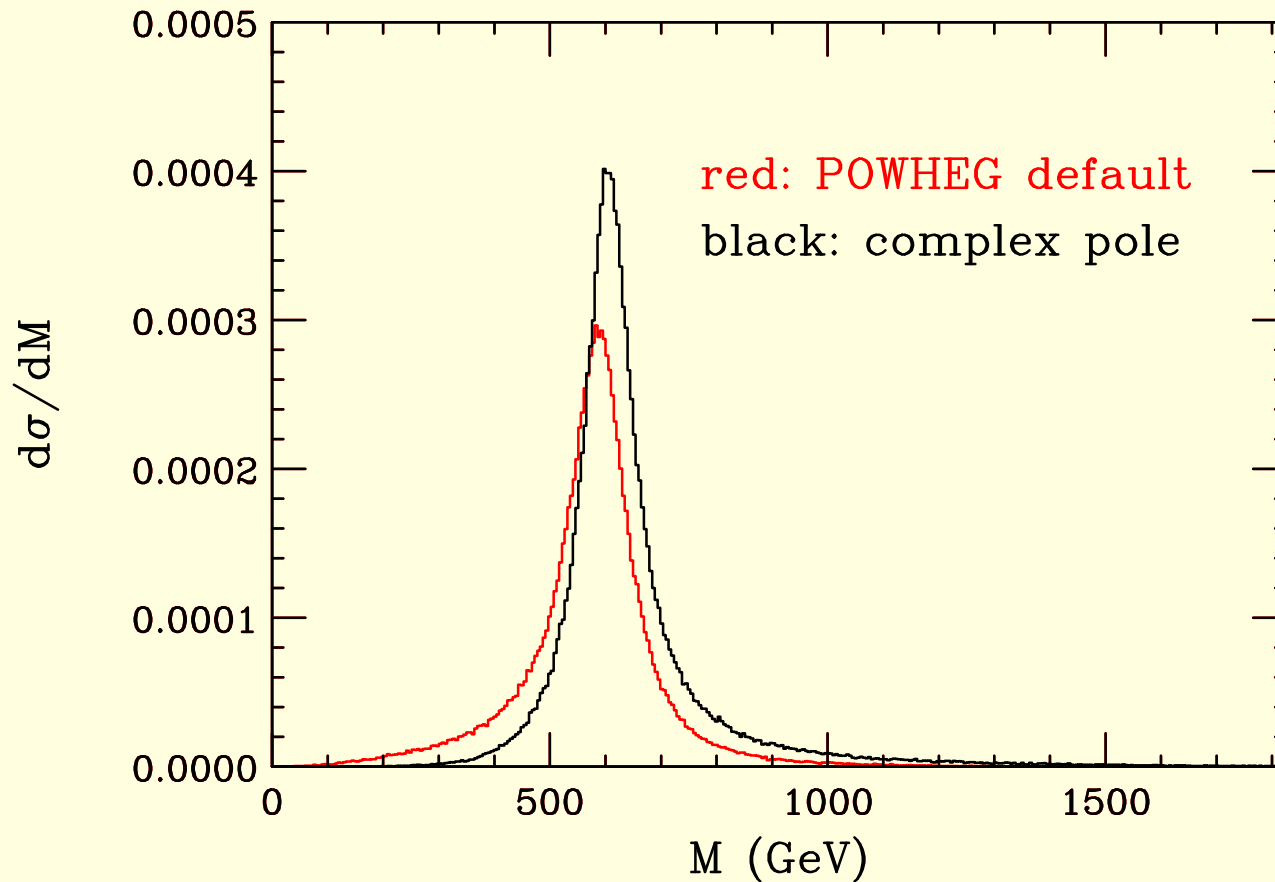
Notice: in narrow width limit

$$\frac{\mu_{\text{H}}\gamma_{\text{H}}}{(M^2 - \mu_{\text{H}}^2)^2 + \mu_{\text{H}}^2\gamma_{\text{H}}^2} \implies \pi\delta(M^2 - \mu_{\text{H}}^2)$$

$$\frac{M\Gamma(M)}{(M^2 - \mu_{\text{H}}^2)^2 + \mu_{\text{H}}^2\gamma_{\text{H}}^2} \implies \pi\delta(M^2 - \mu_{\text{H}}^2) \frac{\Gamma(\mu_{\text{H}})}{\gamma_{\text{H}}}$$

So, going from the Breit Wigner formula to Passarino's, the cross section is affected.

Straightforward implementation in the POWHEG BOX gg_H generator.
Samples generated with traditional Breit Wigner can be easily reweighted to get Passarino's line shape (fully equivalent to the updated gg_H generator).

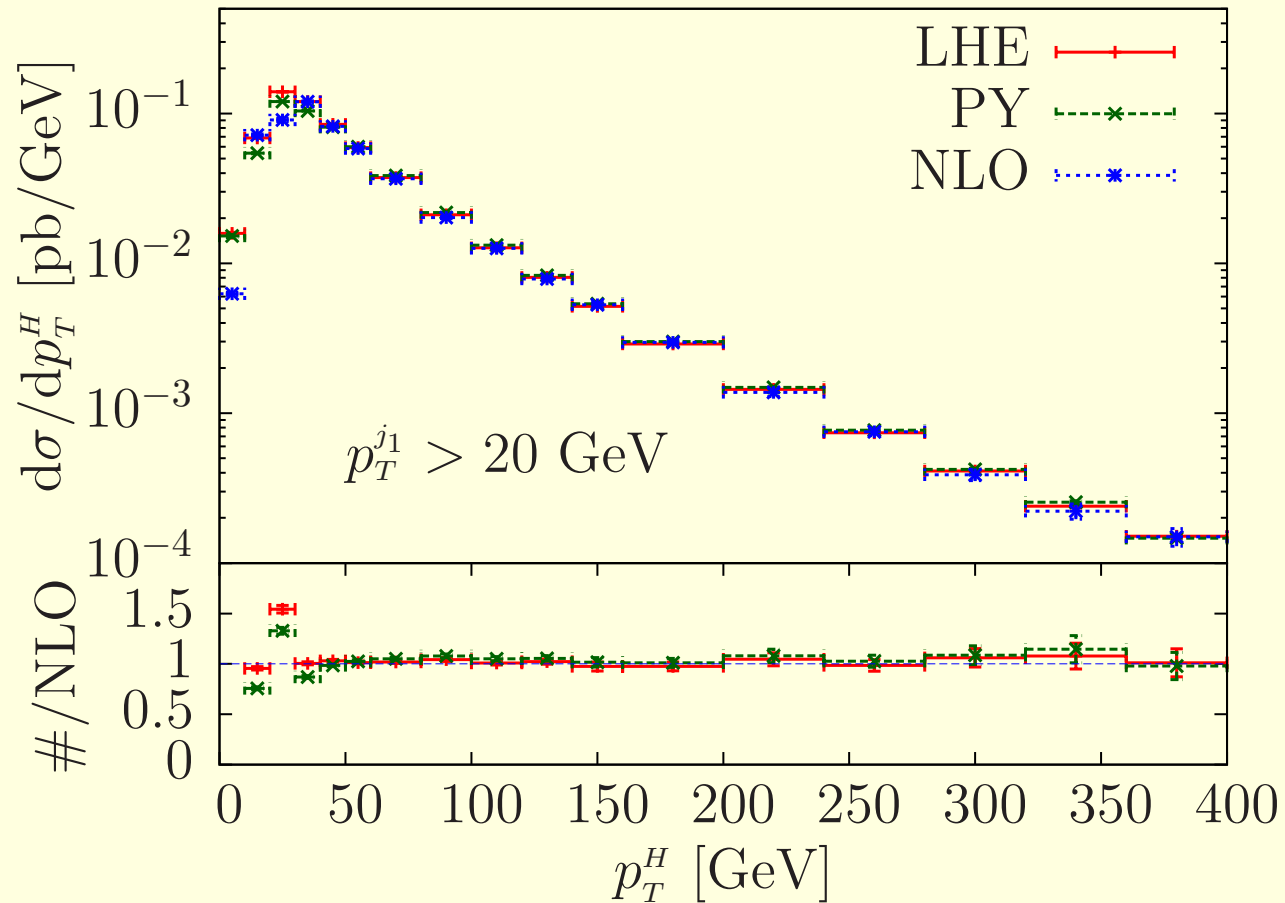


Higgs plus up to 2 jets

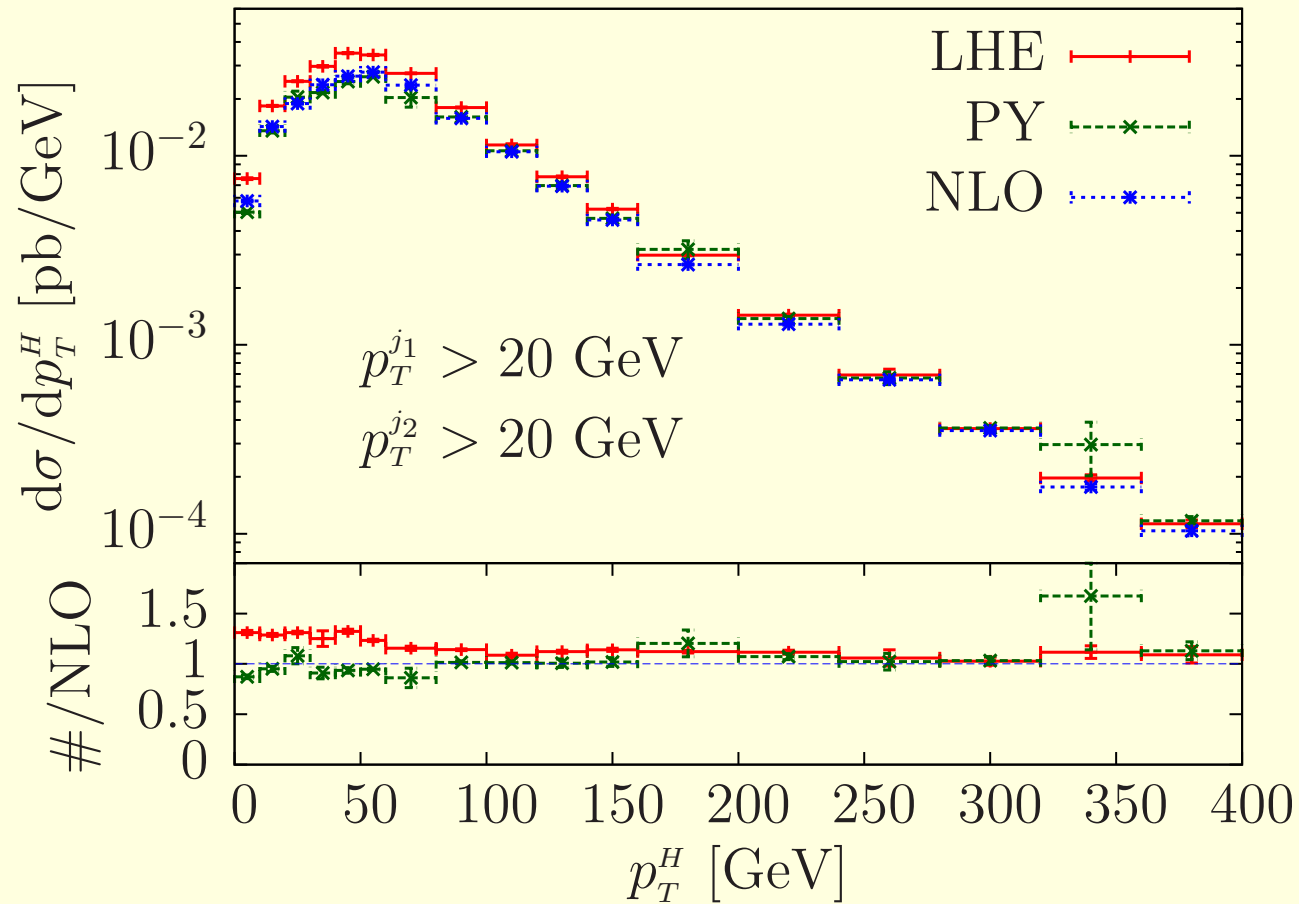
(Campbell, Ellis, Oleari, Frederix, Williams, P.N. 2012)

- Automatic MadGraph4 - POWHEG BOX interface.
Sets up all tree level amplitudes needed by the POWHEG BOX. The process is entered via a MadGraph4 process card, the interface does all the rest. Only the virtual corrections are missing.
- Fast code for the virtual corrections to Higgs plus 1 and 2 jets are available in MCFM

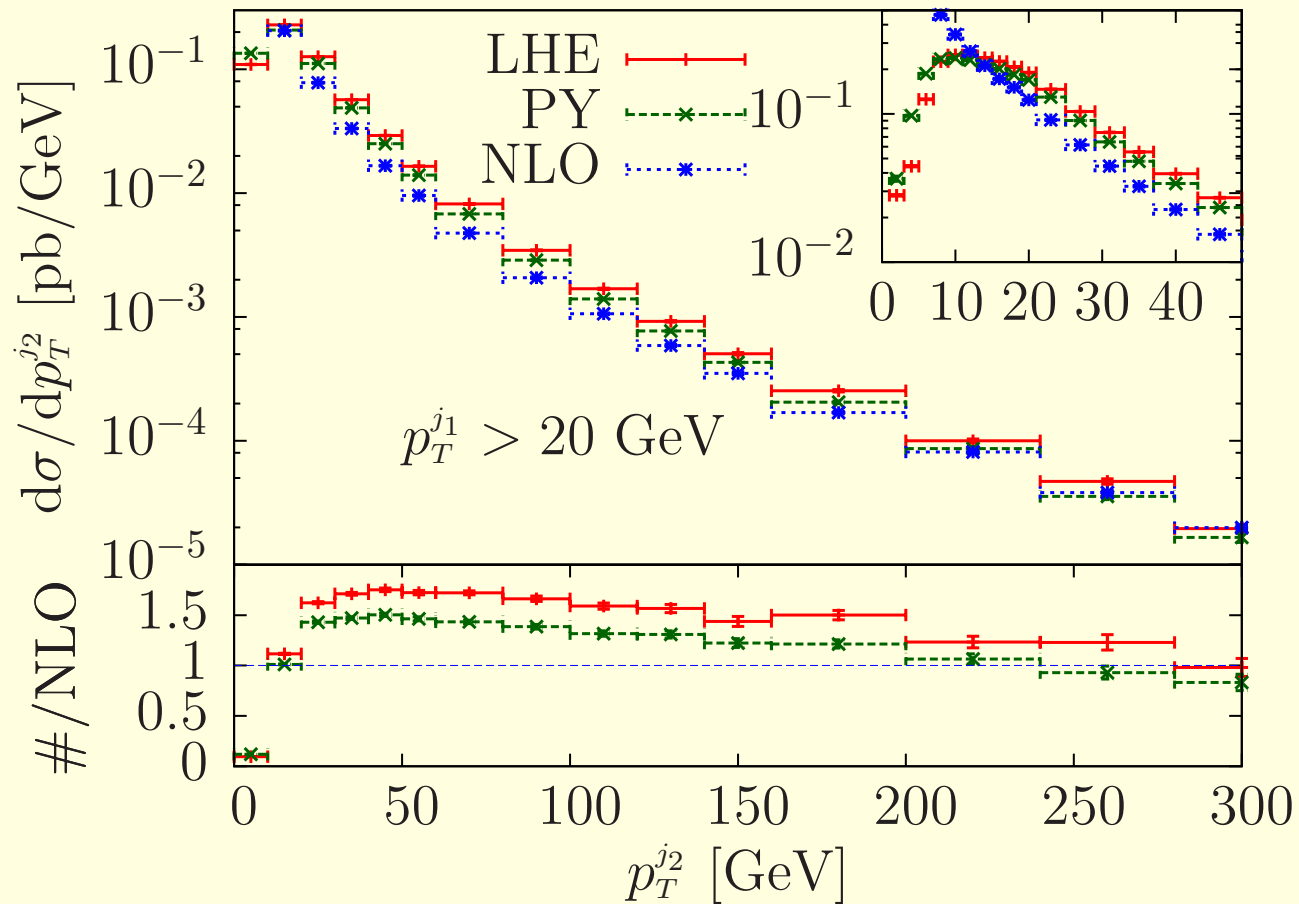
These two ingredients have allowed the fast construction of a generator for Higgs plus up to two jets in gluon fusion.



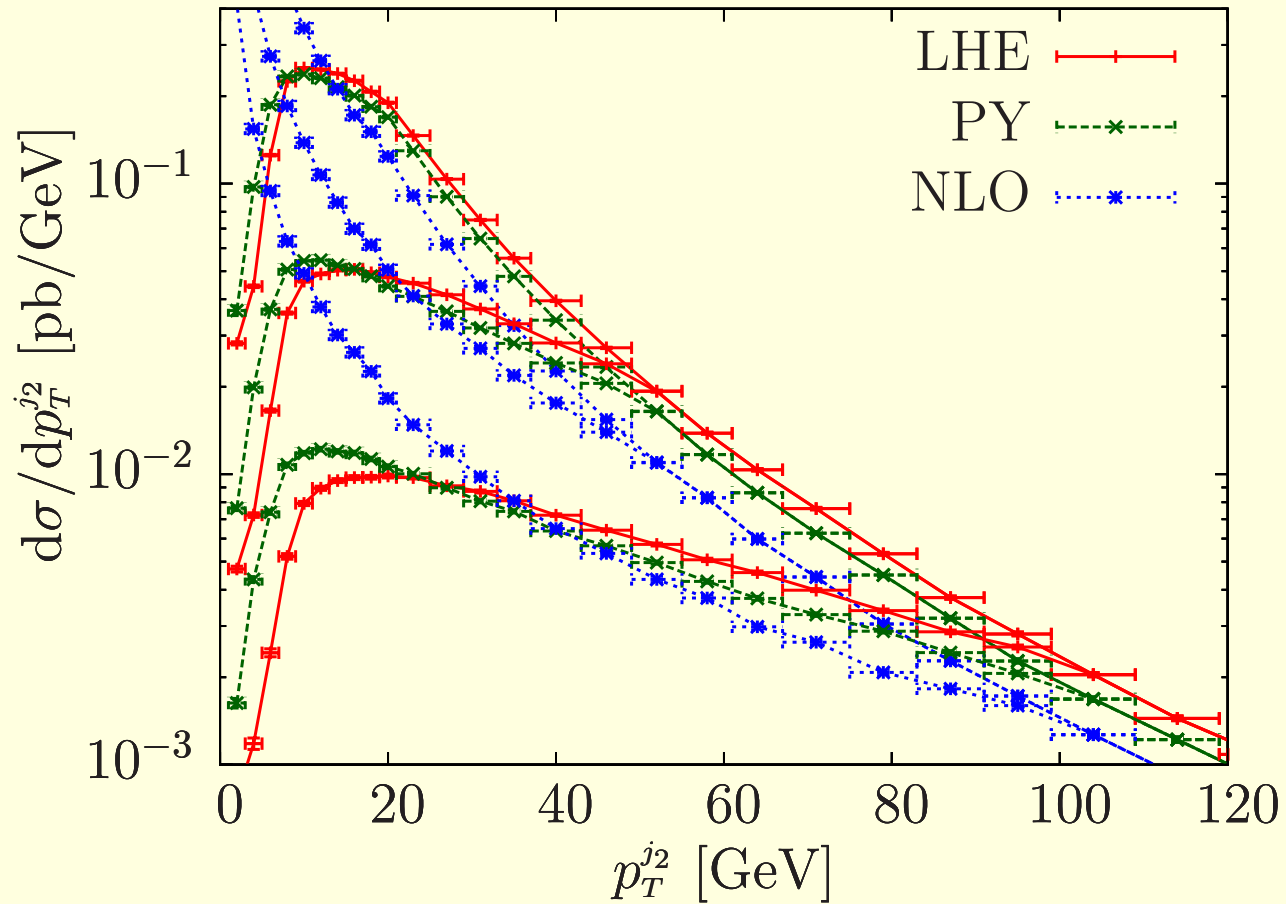
Good agreement of NLO with HJ at the level of Les Houches event and after shower for inclusive cross sections.



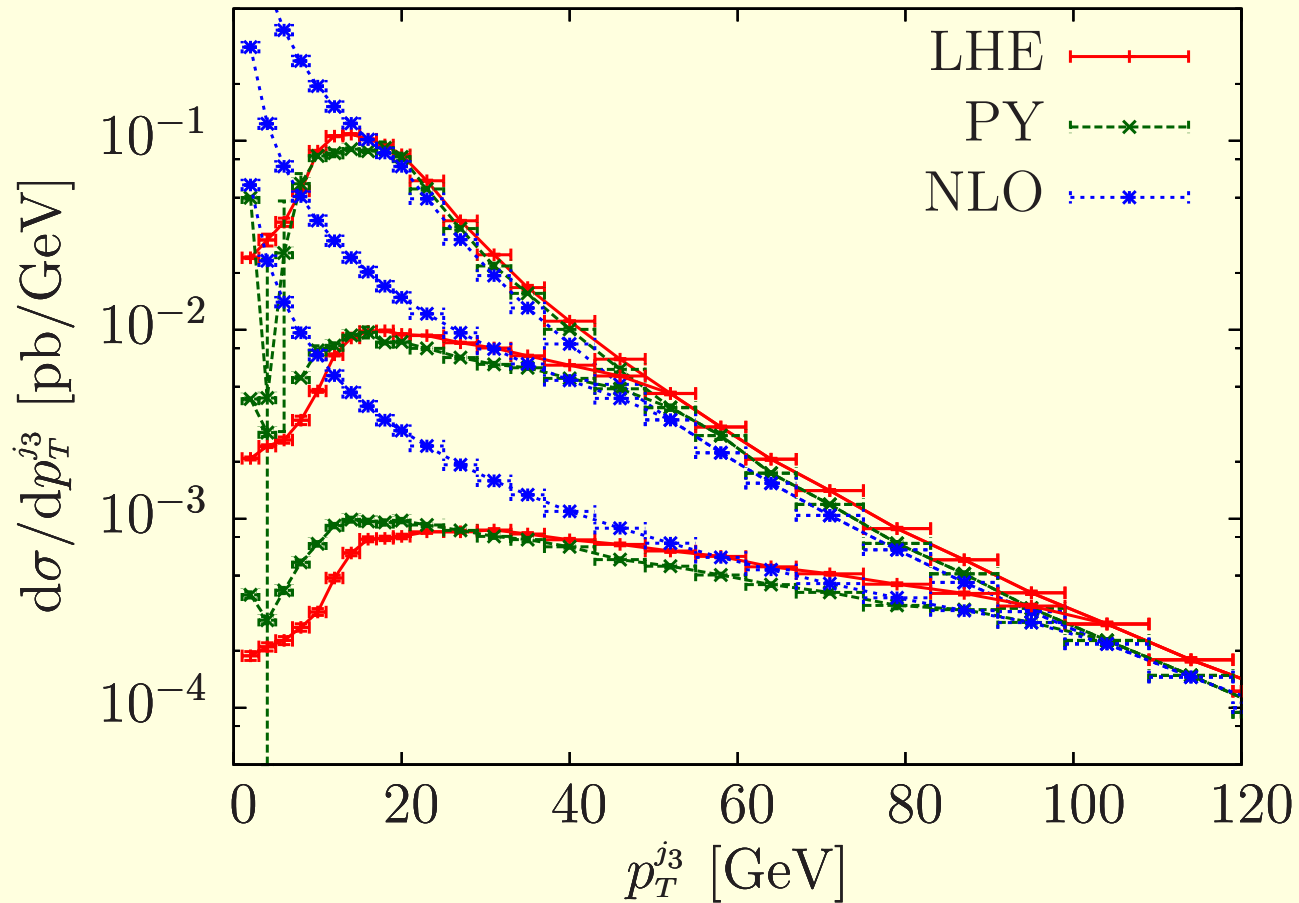
same for HJJ;



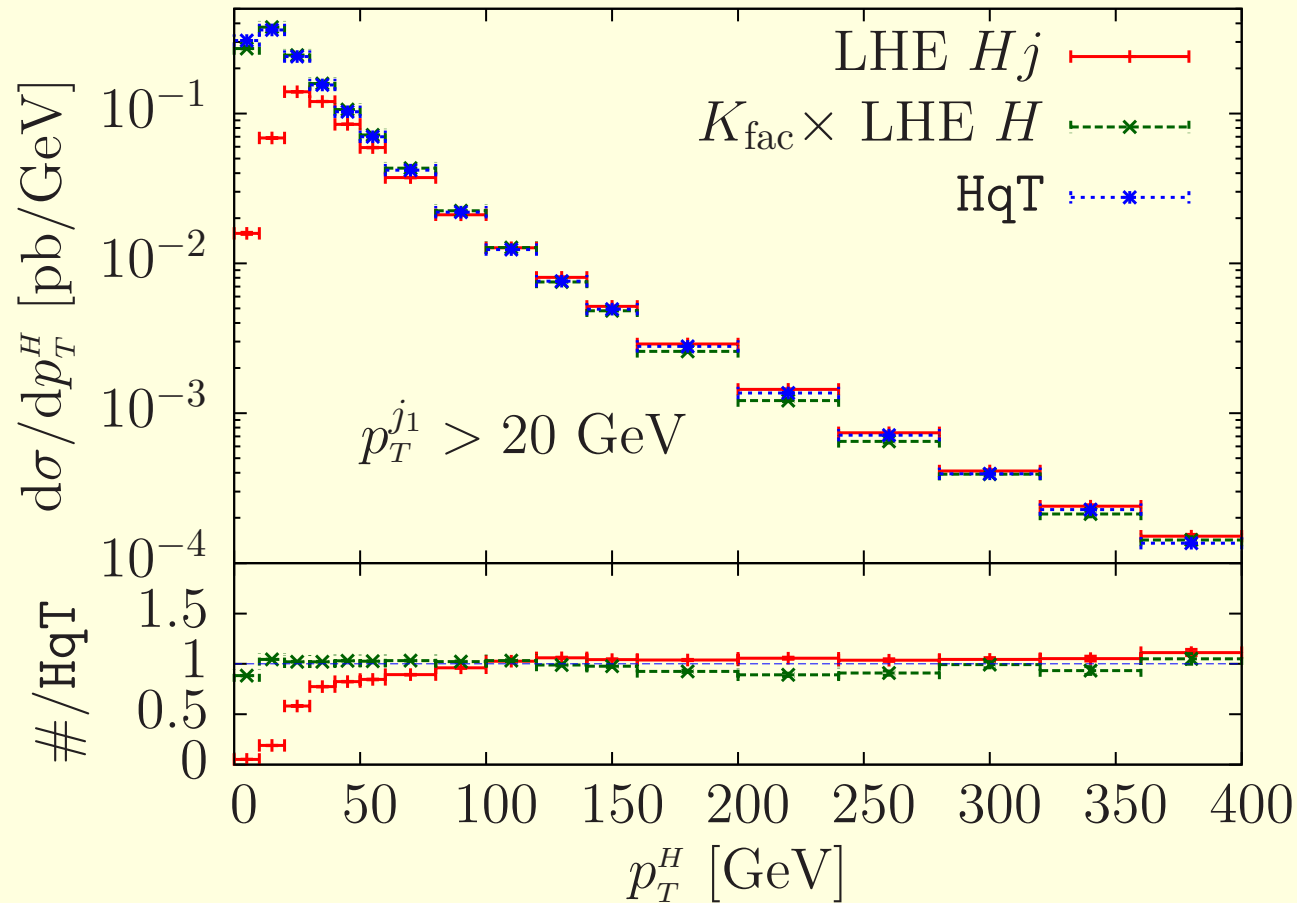
2nd jet transverse momentum in HJ (where NLO+PS makes a difference)



2nd jet p_T with a cut on the first jet p_T in HJ



Third jet in HJJ (where NLO+PS makes a difference);



p_T spectrum at high p_T in good agreement with HqT (they are the same calculation in that region). At low p_T , the lack of resummation in HJ becomes manifest.

Prospects

- $gg \rightarrow H + 2\text{jets}$ is a background to VBF Higgs production. The code is public, and can be used as is to compute this background. Current improvements under way (Hamilton, Zanderighi and P.N.). Contact us if you want to use the program.
- Since the H, HJ and HJJ generators are available, we have the opportunity of generating a sample by merging the three generators, in such a way that NLO accuracy is maintained when up to 2 hard jet are present. This work is ongoing, and it is likely that substantial progress will be made before the end of the workshop.