WG1 discussion summary:
PS uncertainties

- … a lot of discussion, clearly not a topic you solve in one morning
- key points / possible future directions

''We hold these truths to be self-evident''

… or the new LH manifesto

We should expect no large PS effects if

- ✳ no harsh cuts on phase space
- ✳ simple enough processes (low mult., no scale hierarchies)
- ✳ no large dependence on jet shape
- ✳ away region sensitive to soft physics (high p_t…)
- ✳ ``inclusive enough quantities''

- However, in practice we may
  - ✳ have to deal with ``problematic'' region/observables *(limited statistics, efficiencies…)*
  - ✳ ``inclusive enough quantity'' can be quite challenging to define. Case-by-case study often required. Detailed comparison against f.o./resummation can help highlighting the critical regions *[see e.g. Stefano's talk on Monday]*

~~One size fits all~~

A pragmatic approach: PS UNCERTAINTY ≡ | PYTHIA-HERWIG |
``The experimental equivalent would be: *SYSTEMATIC UNCERTAINTY* ≡ | *ATLAS-CMS* | ``

- Above procedure ``non ideal'' *[see e.g. top analysis]*
- Different assumptions / approximation within same generator can lead to sizeable differences *[powheg vs MC@NLO, recoil scheme, starting scale… see e.g. VBF]*
- Much more complicated patterns, one-size-fits-all does not work

The ideal world: PS as prediction tool → each prediction comes with associated (reliable) uncertainty. Compare within quoted uncertainties, use most precise result available. *Still very far from having something like that.*

Moving forward

The precision approach: can we quantify the effect of higher order QCD effects, in a reliable way? PS authors/theorists naturally suited, but need guidance

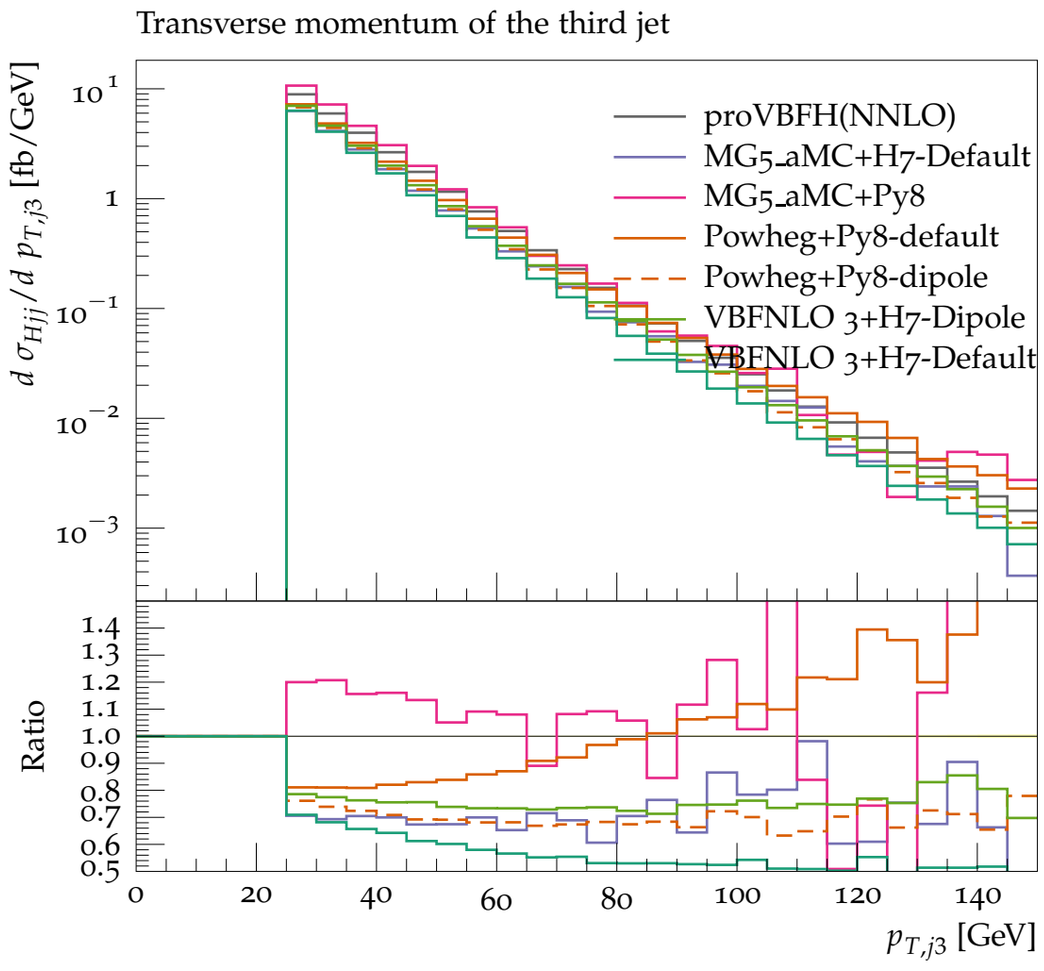
- FO/PS, PSvPS comparisons good starting points to highlight where the problems may be. Then case-by-case analysis
- For a given (set of) analysis, which are the most relevant regions/distributions? Need non-trivial shape information…
- Difficult with BDT/MVA. Can we find a ``toy model'' of most important distribution from MVAs, and work from there?
- Can we work it background? Identify ``key'' observable, have a prediction+error estimate, feed back to MVA. How do things change?
- E.g. STXS, well-defined regions that can be explored

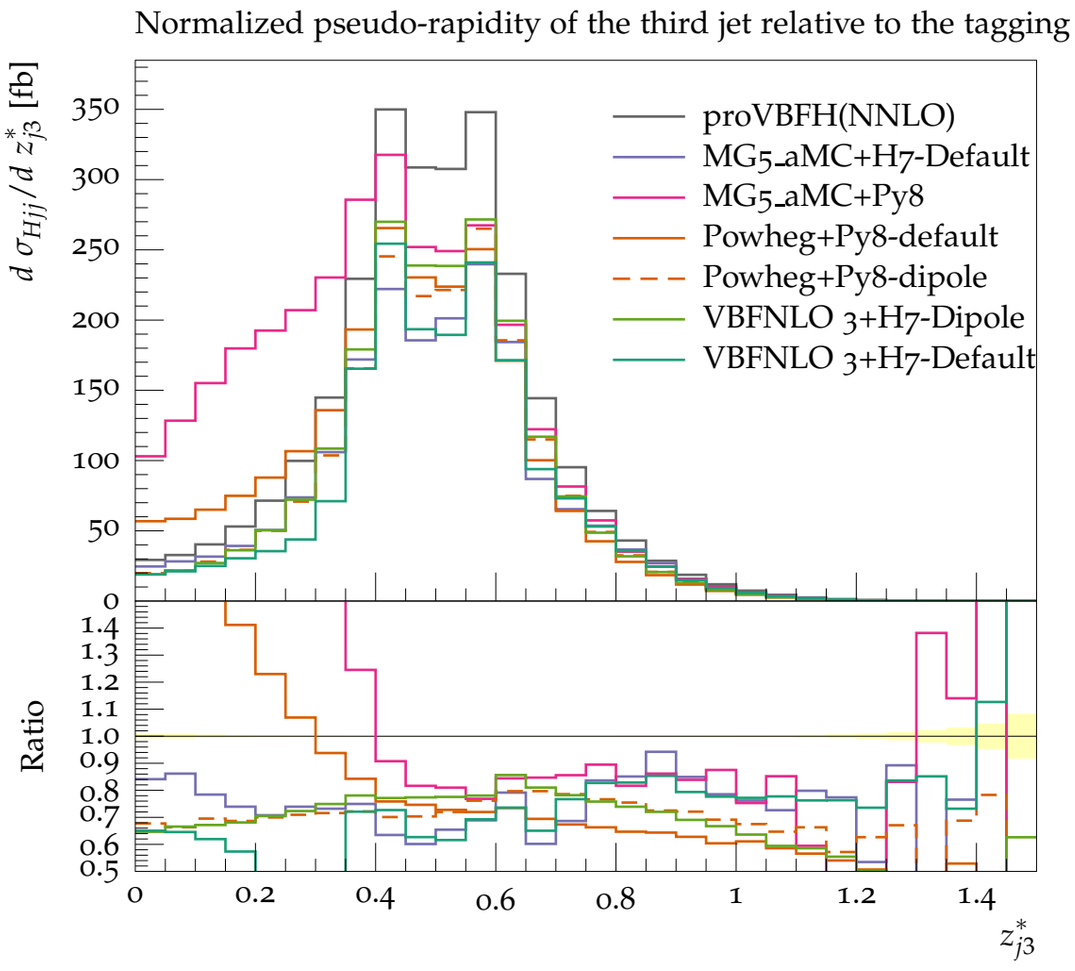
Even this baby step non trivial

- Would benefit from more streamlined interface/interaction between ATLAS/CMS/TH. *(Rivet, HEPDATA…)*
- How to correlate processes? How to change (which) parameters? (*E.g.: observables very tune-sensitive. Out of first principle control. Better stick to same tune.)*
- In several cases, different uncertainties from different underlying physical assumptions (e.g. VH→b$\bar{\text{b}}$ ATLAS vs CMS). Can we understand the differences, find common ground?

Example: VBF

$$z^*_{j_3} = \frac{y_{j_3} - \frac{y_{j_1} + y_{j_2}}{2}}{|y_{j_1} - y_{j_2}|}$$





A lot of discussion…

- Clearly impossible to find the solution in 1.5h discussion
- Even identify strategies/possible approaches highly non trivial

Will have a dedicated meeting in the (near) future

Looking forward to suggestions / contributions

General WG1 summary

- ggF/VBF: Moving forward with boosted Higgs [both exp and th]. Expect a note soon. Interesting interplay between different channels [though ggF still dominates for pt ~> 450]. Some small things yet to be understood (shower effects)

- VH: new experimental result. Theory in good shape, but gg->ZH@NLO still a key missing element. V+HF needs better modelling. Need better understanding of PS uncertainties [see previous discussion]

- ttH: interesting new studies about large PS effects. Understaning `natural' scale choice for process. Highly non trivial. Shapes under better control, still large effects on xS [maybe add plot]

- off-shell: projections for HL well under way. New results available for pp -> VV backgrounds. Still missing gg->VV@NLO [mass]. Comparison with HH can give information. Off-shell as probe of NP.

- VBF/VH: STXS well under way, see WG2