

# A smörgåsbord of Pythia thoughts and issues!

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# Thoughts on tuning machinery

- Professor: not *really* supported! “Community maintenance mode”
  - But I’ll do my best, since there’s user demand / desire.
  - Not sure about the status of Apprentice, I wasn’t involved there. Also users
  - Active debugging, merge requests, etc. are best. We can discuss enhancement ideas
- Weighting and tunes
  - Could possibly use weighting to make a tune scan from a single run: reformat by script
  - But only for fine-tuning: big shifts of distributions will destroy the stat power of the variations... and the algorithm implicitly assumes that all MC predictions are asymptotic
  - Or you could include systematics in tuning as a regulariser, via weights: also possible, requires standard weight names for combination, add to chi2 denominator
  - Fancier use of syts with individualised nuisance params ~requires a full likelihood fit

# Issues via ATLAS

- How to treat hadrons from LHE?
  - LHE doesn't *require* on-shellness, but MG HNL model generates on-shell rhos
  - Who should generate the hadron-decay width? Doesn't experience Py hadronisation
  - Decay phase can't distribute recoils. Needs to happen in the original / LHE reading?
  - How to know that a hadron still needs width sampling, rather than just happening to still be near the pole mass *after* sampling?
- LHE processes in HI
  - MG apparently "allows" HI beams, but leaves all handling to the shower generator
  - Compatibility with Angantyr?
- Code refactoring: centralise physics logic in main progs / expt interfaces
  - Especially around different recipes for Powheg, CKKW-L, MLM, ...
  - ATLAS versions are a decade old... did we miss updates? Quite possibly! Better that the interfaces are purely technical

# One more codey thing

- EvtGen structure and Pythia decay/hadr/QED dependence
  - Making an afterburner depend on full generator(s) — cf. Sherpa YFS QED also under investigation — is the tail wagging the dog!
  - Technically, these are huge dependencies for an add-on feature. Risks of library version collision; historically of common-block clashes and maybe still some concurrency issues
  - Also physically problematic if e.g. primary hadrons made with one hadronisation model, but secondary ones made in Pythia's model via EvtGen. Also  $\Rightarrow$  tuning issues
  - Can we think about a “callback” approach for the afterburner to hand back (and iterate if needed) for the main gen to further process decays, EW corrections, etc.?
  - Might require some technical community coordination to agree cross-gen callback API