FEEDBACK from PWG - PWGHF

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Overview

1) How is the current MC/data ratio motivated? How would it ideally evolve for Run3/4?
Which signal biasing techniques are used and which techniques could be used:

- injected signals
- p_T hard bins
- embedding

2) Are there areas where full simulation could be replaced by fast simulation, for example parametric simulation of efficiency and resolution?

3) Do you need full simulation of the background event or could it be replaced by a simplified (effect of occupancy only)?

4)Which detectors/secondaries really need to be simulated for your analysis?
If this is unknown how could one quantify the effect of secondary interaction on the signal?

What do we use MC for in HF?

- Efficiencies
- Systematic uncertainties (cut variation, etc)
- Monte Carlo templates (signal shape for fit, prompt/non prompt shapes)

Current strategy and techniques

How is the current MC/data ratio motivated? Which signal biasing techniques are used?

- MC request was motivated by the need of having statistical uncertainties ~1/4-1/5 of the raw yield uncertainties

- **Techniques used:**
  - Injection: HF signals are currently injected. We generate pQCDall events and apply filters on the relevant signals
  - Embedding was recently introduced for several analyses. Currently used for 2018 analyses
  - Pt hard binning is currently used only for HFCJ, simplified/not used for D2H and l'HFE

Strategy for Run3

How would it ideally evolve for Run3/4? Which techniques could be used?

Strategy is going to be similar in Run3. However:

- Raw yield precisions ~% in Run3 for most of HF signals at lower p_T. So MC should scale accordingly.

- Optimization techniques will require larger number of candidate / p_T bin (as for 2018 ana

- With high statistics, data driven techniques for prompt-non prompt separation will be the main choice for prompt fraction estimation or HF tagging
  → One needs to make sure that statistics is enough even for rare displaced candidates

- In the high-precision HF era, MC/Data differences will be probably the main source of systematic uncertainties. Need for more refined MC-reweighting techniques.

Strategy for Run3

Are there areas where full simulation could be replaced by fast simulation, for example parametric simulation of efficiency and resolution?

- One can explore techniques in which only the signal component is generated and the effect of the underlying event (mostly resolution effect) is accounted with some parametrization/re-weighting on the PYTHIA signal **(~later stage embedding)**

- It could be usable for cases in which the MC is used for efficiency estimation only. Tricky for less trivial uses.

- Not explored for the moment. Similar developments are ongoing in other LHC experiments

Strategy for Run3

Do you need full simulation of the background event or could it be replaced by a simplified (effect of occupancy only)?

- In principle for most of the cases the signal component only will be needed.
- A subset of the MC production with (realistic) background could be useful to validate HF optimization and to study HF correlations and jets

Strategy for Run3

Which detectors/secondaries really need to be simulated for your analysis? If this is unknown how could one quantify the effect of secondary interaction on the signal?

- Central barrel detectors are needed (on top of what is needed for common event selection studies, global observables, etc)