Introduction

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Dark shower meeting - 12 / 05 / 22

LPSC GRENOBLE | MODANE
cnrs IN2P3 Les deux infinis

White paper: towards v2

- Work ongoing on the white paper since the submission to the arXiv (https://arxiv.org/abs/2203.09503)
  - You can check out the differences here

- Once v2 is ready -> replace on the arXiv and submit to journal (suggestions welcome)

- Work on the text:
  - Some redundant text removed in the first section between theory and benchmarks, typos, …
  - Uniform choice for some wording, such as “semi-visible jets”
  - Uniform notation now applied throughout the paper – centrally defined in workshopsymbols.tex
  - Feynman diagrams and other plots remade with new notation
  - For ‘external’ plots – no change, but different notation explicitly explained in the caption

White paper: towards v2

- Work on the physics:
  - In Section 3.1 (SUEP), added:
    - Distributions of event isotropy for a few benchmark signal points (See below)
    - A distribution showing how event isotropy degrades with increasing HT trigger thresholds (see below)
    - Two paragraphs summarizing a few further possible L1 strategies

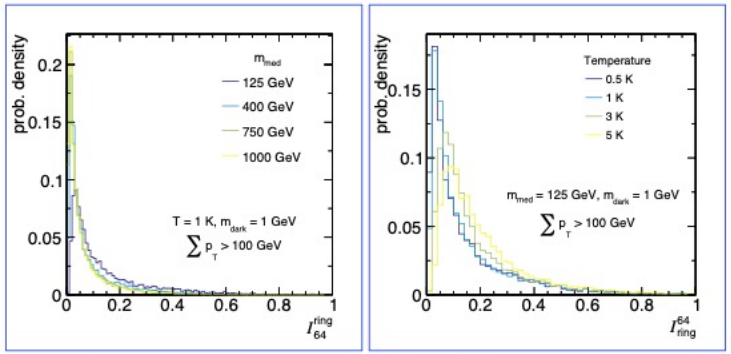

Figure 16: Isotropy distributions are shown for different SUEP mediator masses on the left and for different temperatures on the right. The isotropy is calculated for ring geometry with segmentation 64 for generator level tracks. Tracks are defined as status = 1 charged particles with $p_T > 0.1$ GeV and $|\eta| < 2.4$. Only events that pass the requirement $\sum p_T > 100$ GeV are kept. The production mode is Gluon Fusion (GF) with a dark photon branching fraction of $BR(A'_v \to e\bar{e}, \mu\bar{\mu}, \pi\bar{\pi}) = (40, 40, 20)\%$.

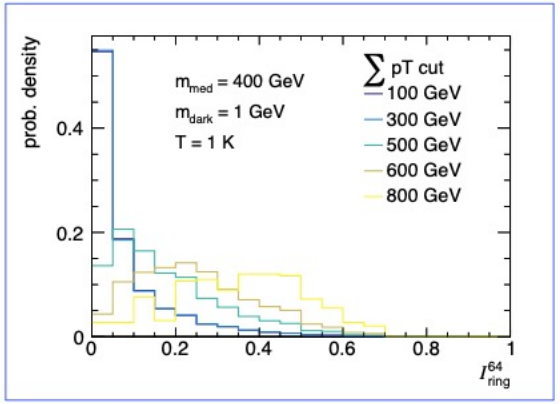

Figure 20: Isotropy distributions are shown for different values of the $\sum p_T$ event selection. The $\sum p_T$ is calculated for generator level tracks that are defined as status = 1 charged particles with $p_T > 0.1$ GeV and $|\eta| < 2.4$. The production mode is Gluon Fusion (GF) with a dark photon branching fraction of $BR(A'_v \to e\bar{e}, \mu\bar{\mu}, \pi\bar{\pi}) = (40, 40, 20)\%$.

  - In Section 4.2 (new pythia module validation), plots remade with corrected benchmarks (rho mass slightly corrected – no big change)
  - In Section 4.3 (jet substructure pheno studies), plots being made for large-R jets (0.8) as well, high-stat samples needed to be made for these – if they look sane, to go in soon

Outcome of the project

- v1 report online and almost done with the report v2 thanks to a strong th / ph / exp community working on these topics (also including a strong community on SUEPs!) - the collaboration should be further continued through dedicated workshops, LHC WGs, …

- Improved theory understanding of SU(N) theories, including predictions for mass spectra as well as low energy behaviour depending on flavour breaking patterns

- New version of pythia with improved handling of dark sector scenarios which is at least partially validated

- Several new and ambitious efforts to identify experimental SM - DS discriminants using e.g. machine learning