

Dark Shower Simulation

Marat Freytsis

Rutgers, The State University of New Jersey

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Dark simulation landscape

- The workhorse: Pythia8 hidden valley module

- ▶ stripped down version of QCD p_T -ordered dipole shower
- ▶ provides basic treatment of parton shower + hadronization
- ▶ basic hard processes provided, integration with MG, etc.
- ▶ decays to SM must be added by hand
- ▶ suitable for SM-like shower dynamics

Emerging jets: Schwaller, Stolarski, Weiler [1502.05409]

Semi-Visible Jets: Cohen, Lisanti, Lou, Mishra-Sharma [1503.00009, 1707.05326]

- Ad hoc and one-off approaches

- ▶ Generate soft events via parametrized model

Knapen, Pagan Griso, Papucci, Robinson [1612.00850]

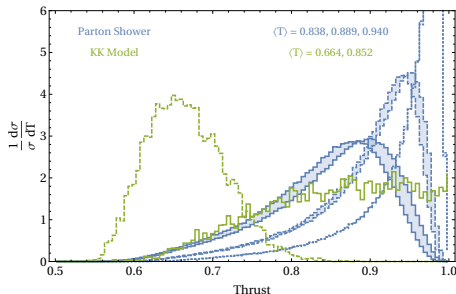
Pythia8 plugin at https://gitlab.com/simonknapen/suep_generator

- ▶ Extra-dimensional simplified models

Cesarotti, Reece, Strassler [2009.08981]

Bridging the divide

- Parton showers
 - ▶ Resum large logs *but*
 - ▶ Require perturbative couplings
- Strongly coupled analogs
 - ▶ “Expansion” around infinite coupling
 - ▶ Can sometimes approach jetty events in an uncontrolled approximation
- Not aware of obvious way to probe intermediate regime



Quantifying our unknowns

- Pythia module currently limited in scope
 - ▶ One showering scheme
 - ▶ Few hadronization parameters
 - ▶ Simple, highly degenerate dark hadron spectrum
- QCD/QED showers much more developed (for obvious reasons)
 - ▶ This flexibility is a necessity to fit data
 - ▶ Can also be a handle to study modeling uncertainties
 - ▶ Latter is also a topic of active discussion in the SM community
- Do we have any good approaches to “theory uncertainties” in holographic models?

Other questions going forward

- How much flexibility do we need?

Doubt anyone needs full QCD-like spectra for hidden valleys

- Are there dark shower scenarios with large sensitivities to currently less-understood aspects of PS/hadronization MCs?

- ▶ Color reconnection
- ▶ Multi-particle spin correlations

- Can SM/dark shower interference effects ever be important?

- Standard scheme(s) for quantifying theory/modeling errors?

I'm doubtful. Don't even have widely-agreed upon schemes for QCD