Discussion:
searches for decays with MET, showering, and/or displaced objects

LHC HXSWG WG3: May Meeting

[these slides by J. Shelton for the conveners (Bressler, Gori, Mohammadi), May 21, 2015]

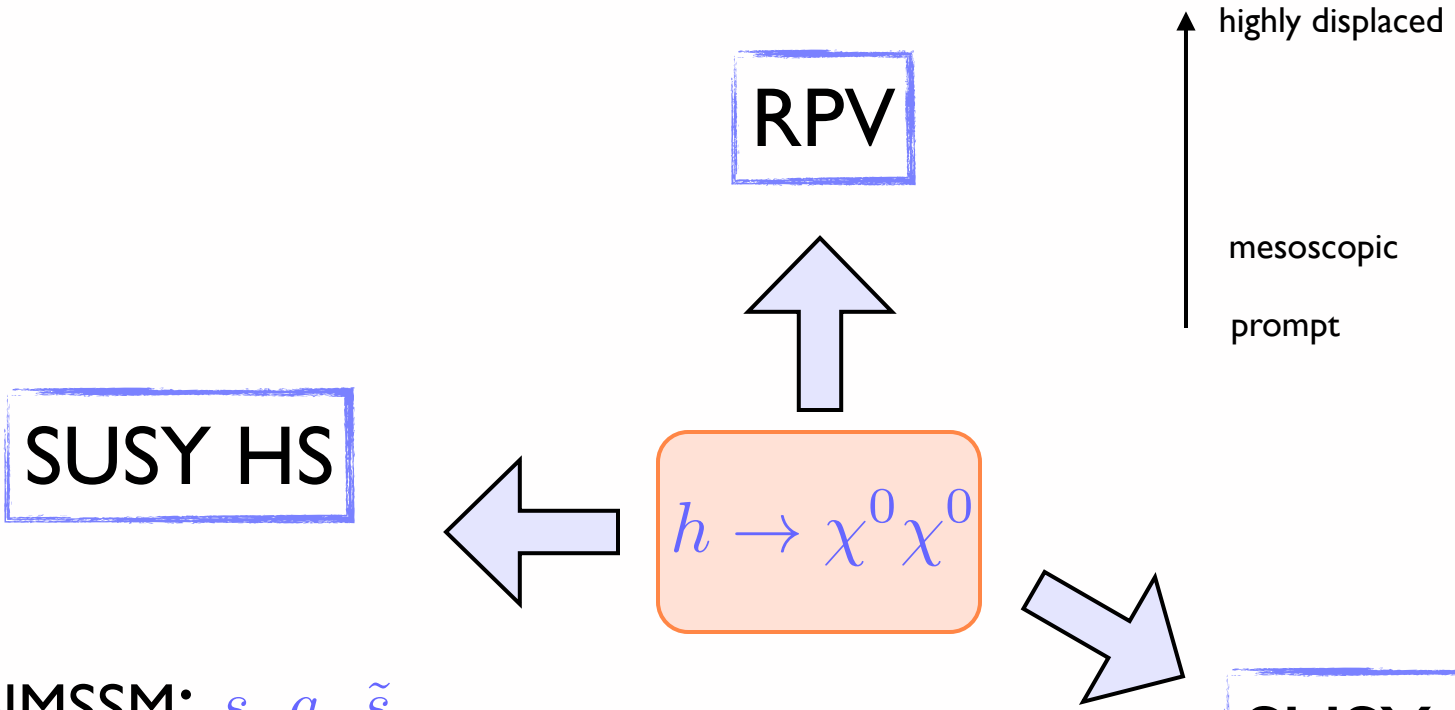
Searches with MET

- Fixed number of partons:
  - SUSY, neutrino models, DM
- Relatively few experimental searches:
  - Well-studied h $\longrightarrow$ MET; challenging; innovative searches
  - h $\longrightarrow$ 1, 2 photons + MET [ATLAS-CONF-2015-001]
  - h $\longrightarrow$ SUSY "lepton jets" [CMS-PAS-HIG-13-010, ATLAS 1409.0746, ...]
  - recasts [arXiv:1312.4992] show untapped potential for leptonic/photonic + MET; what about hadronic?

Searches with MET

- Fixed number of partons:
  - Unique experimental challenges:
    low mass scales, poor mass resolution
  - What are the major obstacles to performing these searches / broadening existing program?
  - ...
- h -> SUSY lepton jets (refs)

Higgs decays to neutralinos

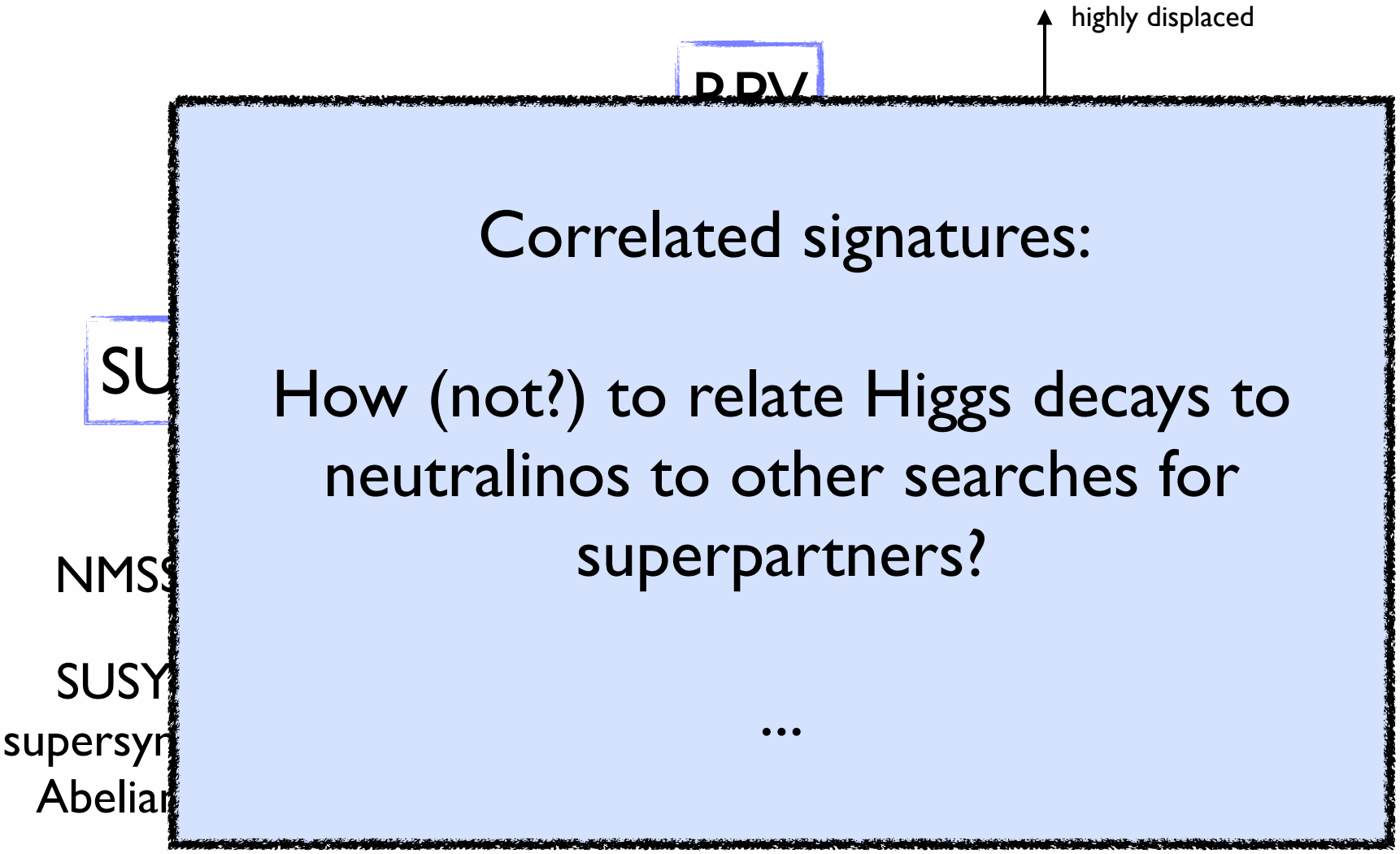


NMSSM: $s,\ a,\ \tilde{s}$

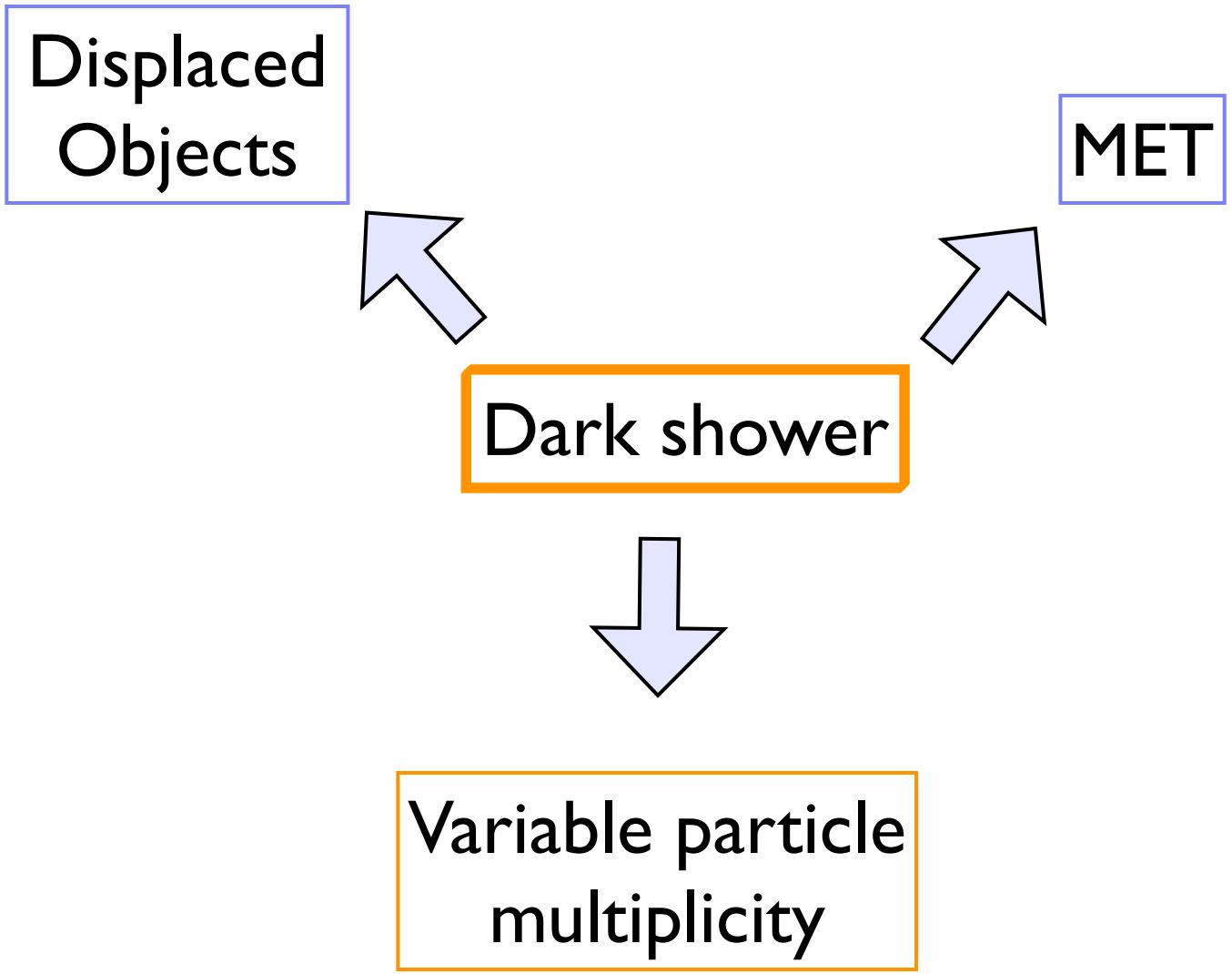
SUSY lepton jets:
supersymmetrized dark
Abelian gauge group

goldstinos
(also mesoscopic)

Higgs decays to neutralinos



Dark shower discovery program



How to estimate LHC sensitivity

Displaced Vertices (DV) are a pain. How to model simply?

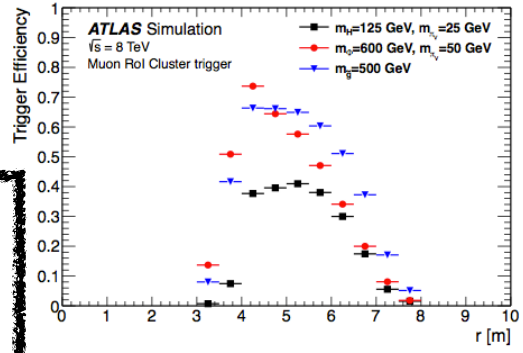
Compute number of *detected* h → 0^{++} 0^{++} → 4b (displaced) decays:

Signal Cross Section: SM higgs production, exotic decay branching ratios

Kinematics: MG + Pythia, simulate p p → h → s s → 4b

Non-DV Detector: PGS or Delphes is fine for trigger efficiencies.

DV: ATLAS efficiency curves for equivalent hidden valley model, convolve with decay probability event-by-event for given life-time.

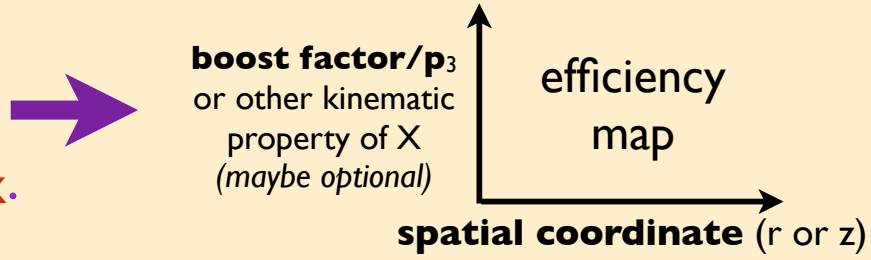


That was easy! To facilitate future DV studies, need 'standard b-tag curves' for displaced decays!

Suggested Parameterization: 2D efficiency map

For starters, assume DV are `factorizable' from rest of event (no 'fireworks').

Then, for a **given** parton-level decay **X→{y}** and mass **m_X**.



This would increase # of DV theory studies by order-of-magnitude :).