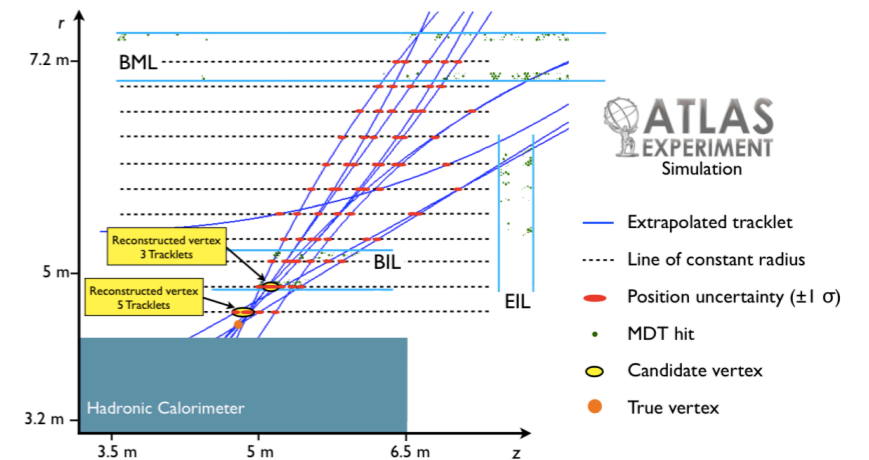


# Discussion: Displaced Vertices & Exotic Higgs Decays



Zhen Liu

University of Pittsburgh/Fermilab

Henry Lubatti, Heather Russell

University of Washington

Brian Shuve

Perimeter Institute for Theoretical Physics

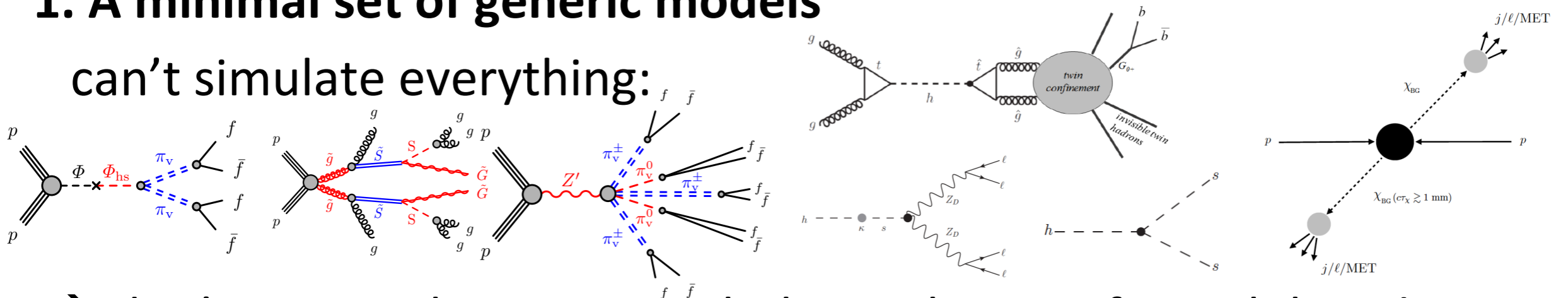
# An experimentalist's wishlist for models with long-lived particles

Heather Russell

University of Washington

## 1. A minimal set of generic models

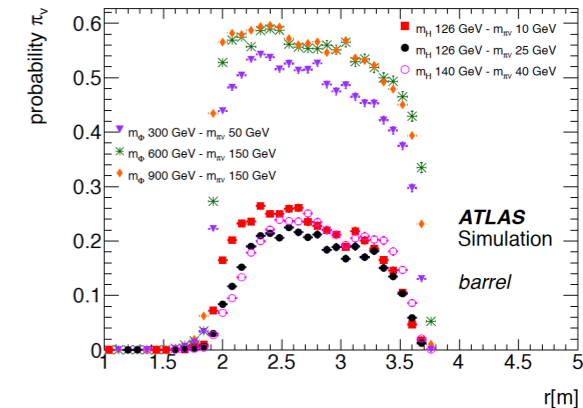
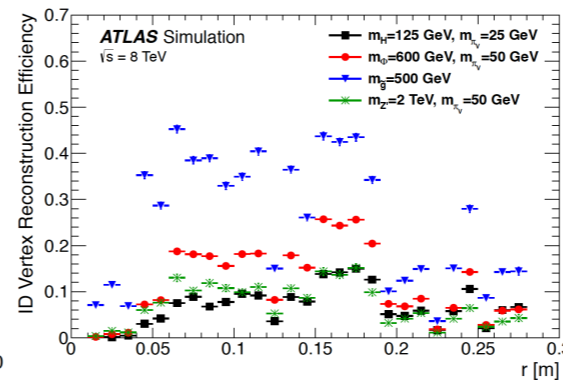
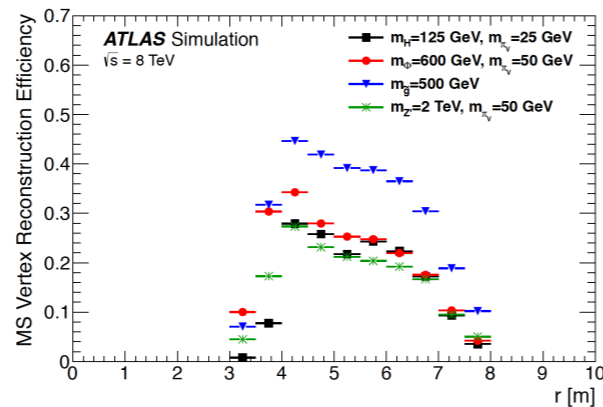
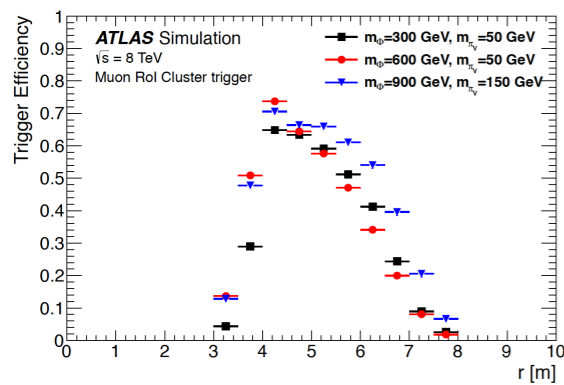
can't simulate everything:



→ don't want to leave gaping holes in the set of possibilities!

## 2. A set of parameters that are necessary to take full advantage of results from simplified models

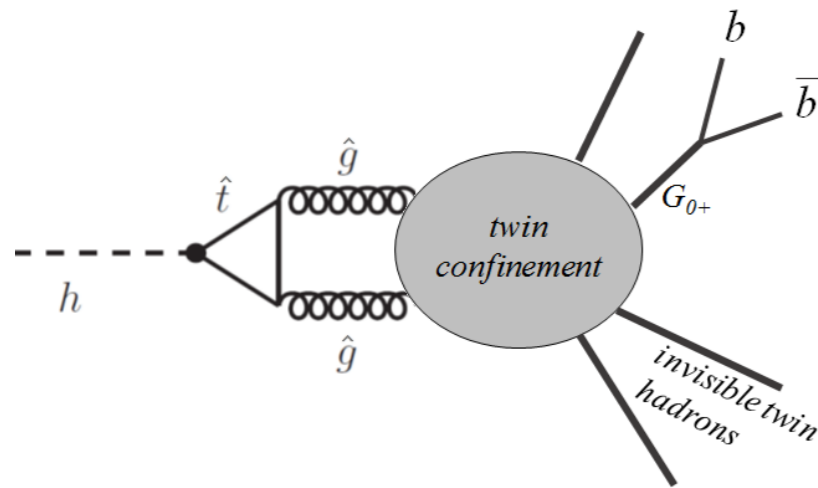
need to anticipate the scope of future models with long-lived particles



→ don't want to end up with simplified models that can't be used for their intended purpose!

# A Theorist's Wishlist for Long-Lived Analyses

Brian Shuve  
PI



Higgs decays are soft!

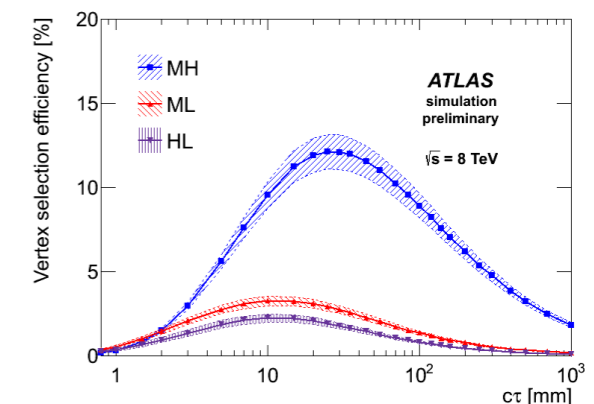
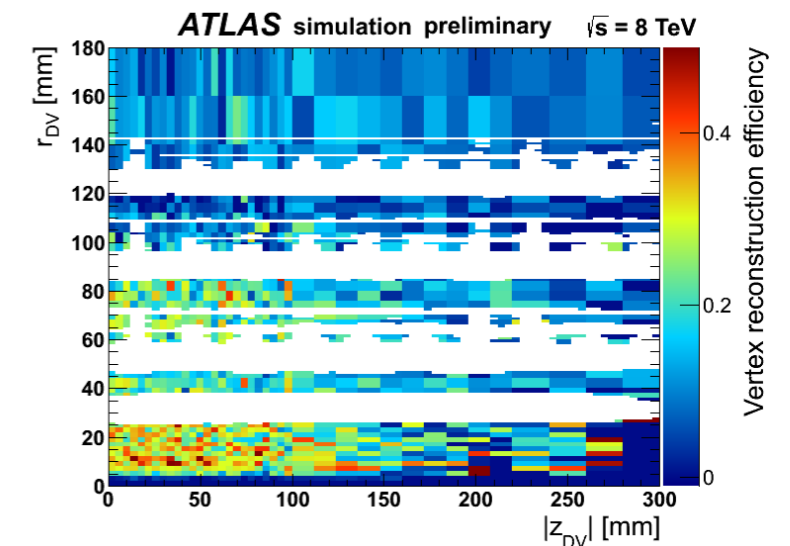
- Lower thresholds using higher multiplicity or associated prompt objects
- Use OR of many triggers/analysis pathways?
- Exploit signal characteristics of well-motivated models *in addition to* inclusive analyses (2 DV, particular kinematics, etc)

Theorists are good at inventing models = need a good way of checking broad coverage of long-lived searches

- Need efficiency maps for the *most relevant* parametric dependence
- Doesn't need to be perfect: should be close enough to establish whether a class of models is totally unconstrained/totally ruled out/in between

Helpful to have lots of info for each analysis: signal & control regions, detector performance, how selection criteria chosen

- Helps us establish what is possible & how searches could be improved to target certain scenarios



## Coverage:

What is a good balance between max. sensitivity and broad coverage?

- What are the set of interesting models with LLP (from Higgs decay)?
- Do they cover most of generic topologies?
  - Higgs decay symmetrically/asymmetrically into LLP(s)
  - LLP decays into jets, heavy flavors, leptons, MET and mixture
- Would defining a set of (topology based) simplified models be helpful?
- Are there other searches we are missing or otherwise not linking with Higgs: disappearing tracks, kinked tracks, decays in different parts of detector

## Communication:

What are the good ways to present experimental results to make is useful for theorists?

- Should results be presented in terms of full models with particular decay modes, or 'detector objects' like tracks/leptons/MET?
- Is there a lower- dimensional subset of info that is useful for theorists to get within a factor of ~few in recasting limits? Or is there a good set of benchmarks such that providing limits in terms of parameters is sufficient for setting limits?
- searches/optimizations are highly detector dependent and model dependent, generic efficiency map is hard to provide. Would high dimensional efficiency map be useful?
- Would joining prompt searches and displaced searches be helpful?