



Search for LLPs with Displaced Hadronic Jets in ATLAS

1

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Benchmark Models

- ▶ Hidden Valley
 - ▶ Higgs portal – scalar pairs
 - ▶ Z' (Run 1 only)
- ▶ Stealth SUSY
- ▶ WIMP Baryogenesis

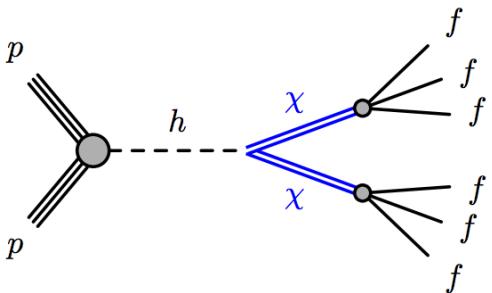


Figure 3: Feynman diagrams for the Higgs portal Baryogenesis model.

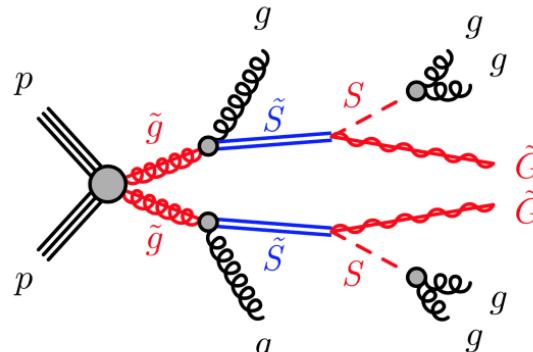


Figure 2: Feynman diagrams for the Stealth SUSY model.

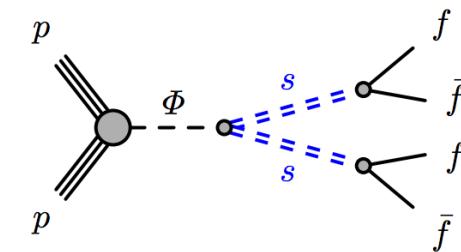
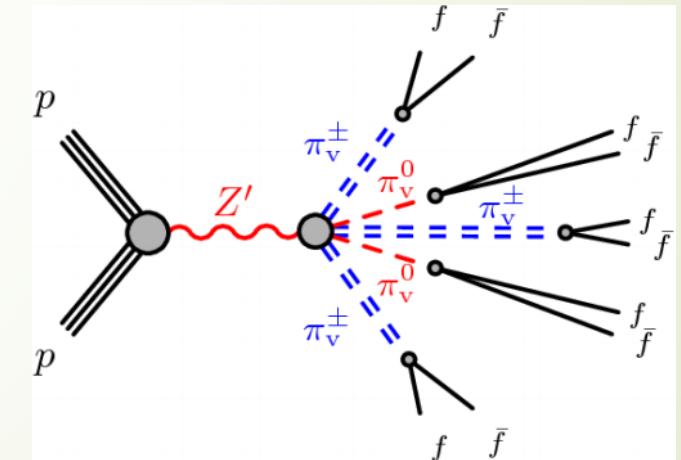
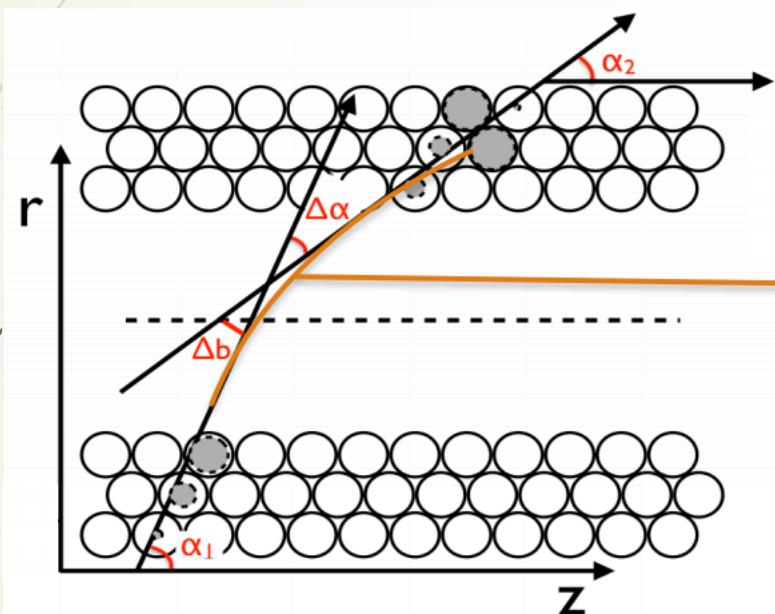


Figure 1: Feynman diagrams for the Higgs decaying into displaced hadronic jets.

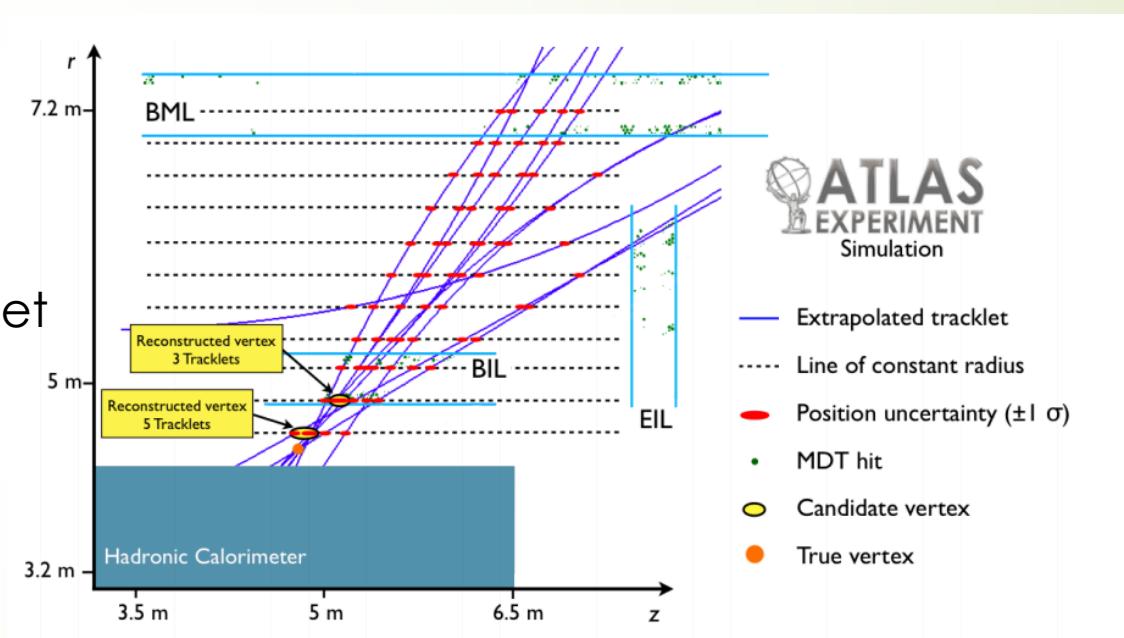


ATLAS Displaced Vertex Reconstruction

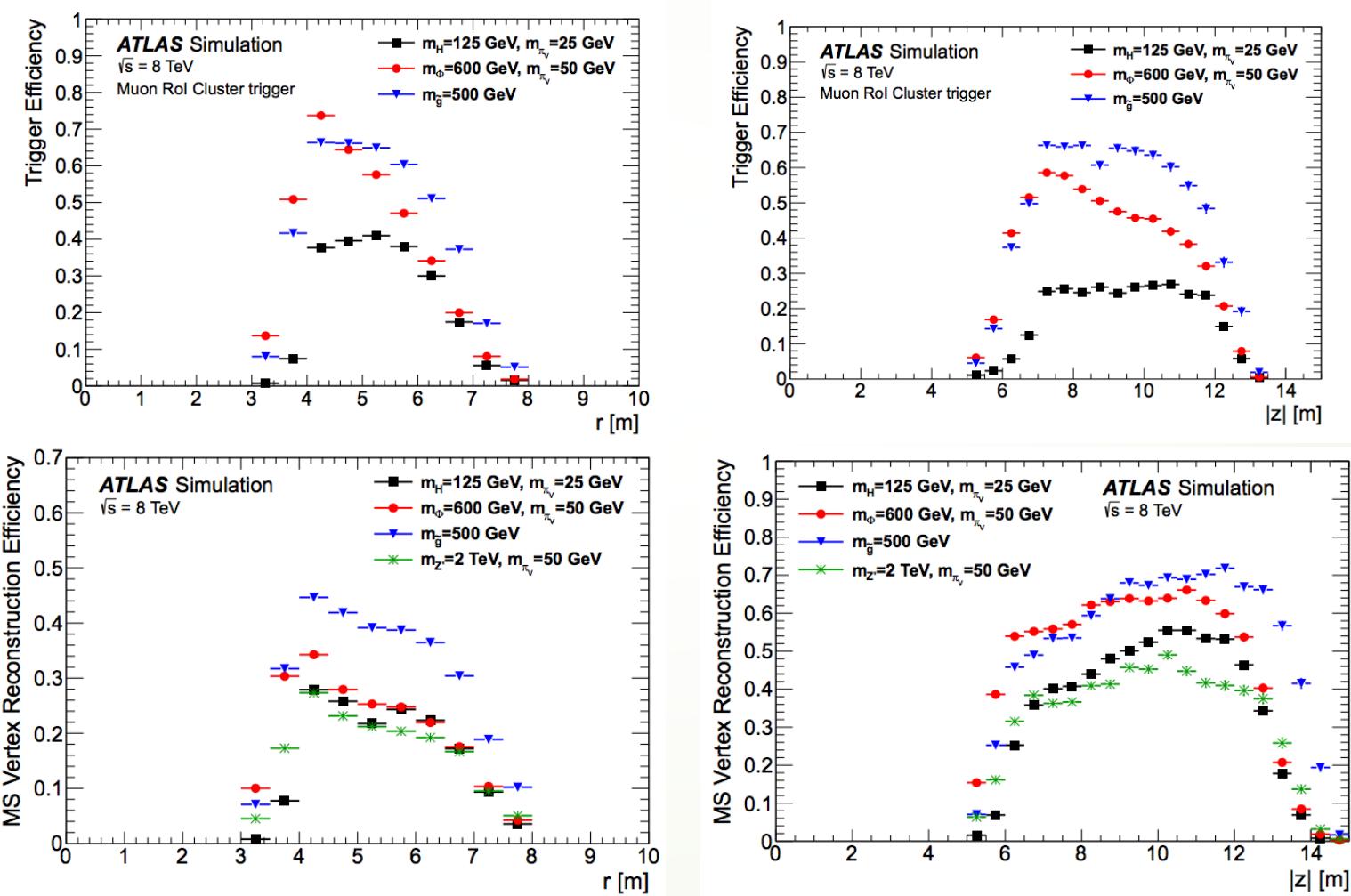
MS stand-alone vertex reconstruction (arXiv:1311.7070)



tracklet



Run 1 RoI Cluster Trigger and MS vertex reconstruction efficiencies

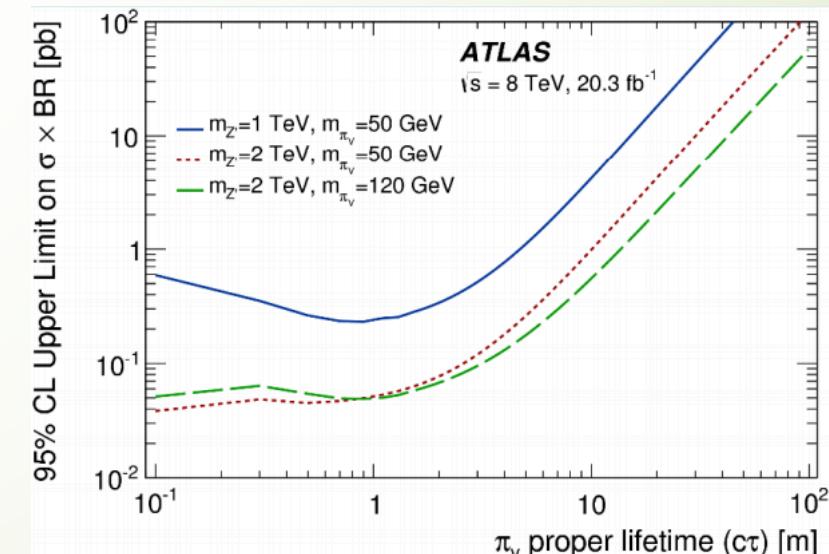
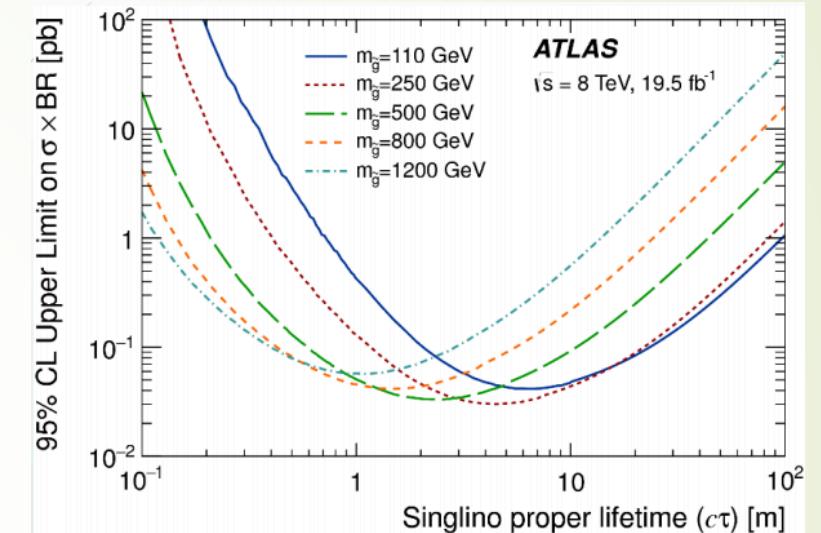


Run 1 Analysis + Results

arXiv:1504.03634v2

- ▶ Two reconstructed displaced vertices
 - ▶ 2MS vertices or MS vertex plus ID vertex
- ▶ Sensitive to Higgs decaying to long-lived scalar pairs
- ▶ No evidence for two-vertex events

Trigger	Applicable topologies	Benchmarks
Muon Roi Cluster	IDVx+MSVx, 2MSVx	Scalar boson, Stealth SUSY
Jet+ E_T^{miss}	2IDVx, IDVx+MSVx, 2MSVx	Z'



Current Searches: Two-Vertex

- ▶ Same as in Run 1
- ▶ Vertices must be separated by $\Delta R = 1.0$
- ▶ Stringent isolation criteria
 - ▶ Negligible background
- ▶ Stealth SUSY
- ▶ Bosons/Higgs → Long-lived scalars

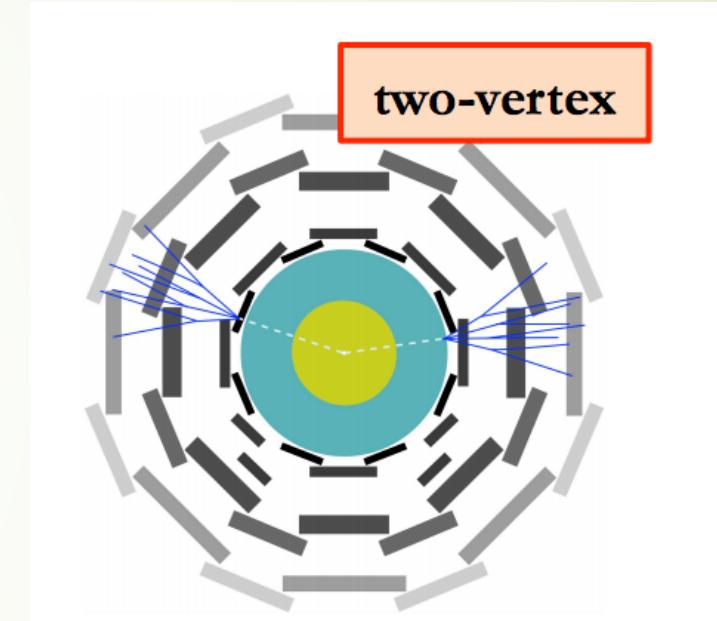
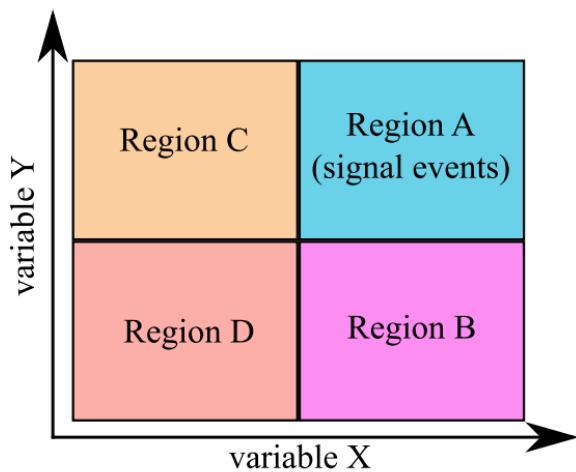


Diagram: H. Russell

Current Searches: Single-Vertex



- ▶ Single-vertex with two prompt jets
 - ▶ Higher backgrounds
 - ▶ ABCD method
 - ▶ Stealth SUSY
- ▶ Single-vertex with minimal additional requirements
 - ▶ Baryogenesis Higgs portal
 - ▶ Higgs → long-lived scalars

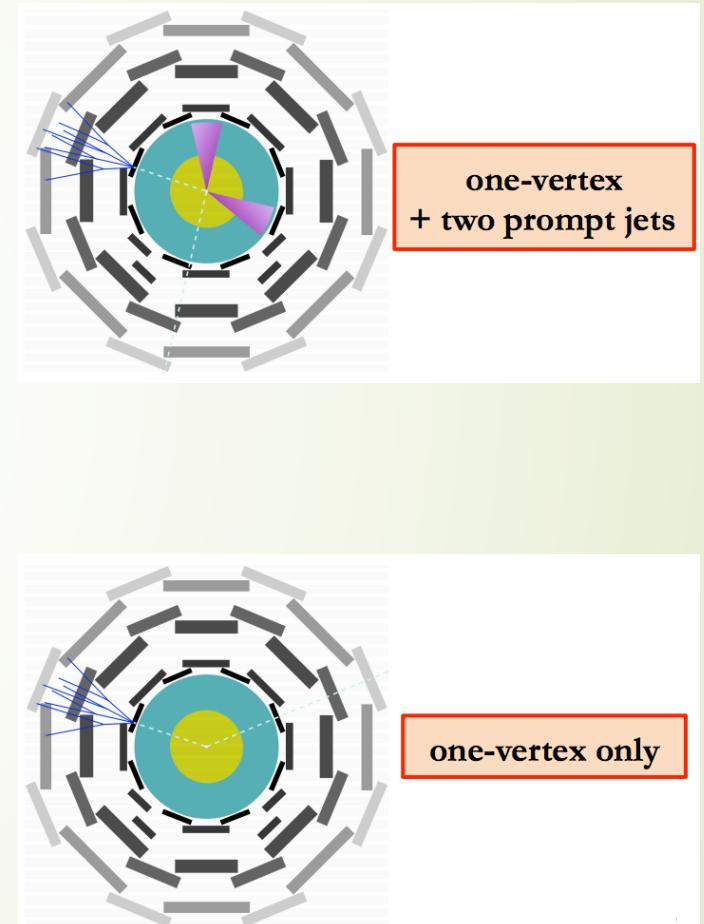


Diagram: H. Russell

The Road Ahead

- ▶ Approval set for next Wednesday
- ▶ Perform same 2 vertex and 1 vertex analysis with the rest of Run 2 data
- ▶ Add new models
- ▶ Optimize toy MC to extrapolate number of signal events vs lifetime
- ▶ MVA analysis (for ABCD plane variables)
- ▶ Further investigate noise bursts
- ▶ Re-optimize (if needed) MDT, RPC, TGC hits selection
- ▶ Studying possible event shape variables
- ▶ Thinking to other possible improvements!