Reinterpretations and Recommendations Discussion

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Outline

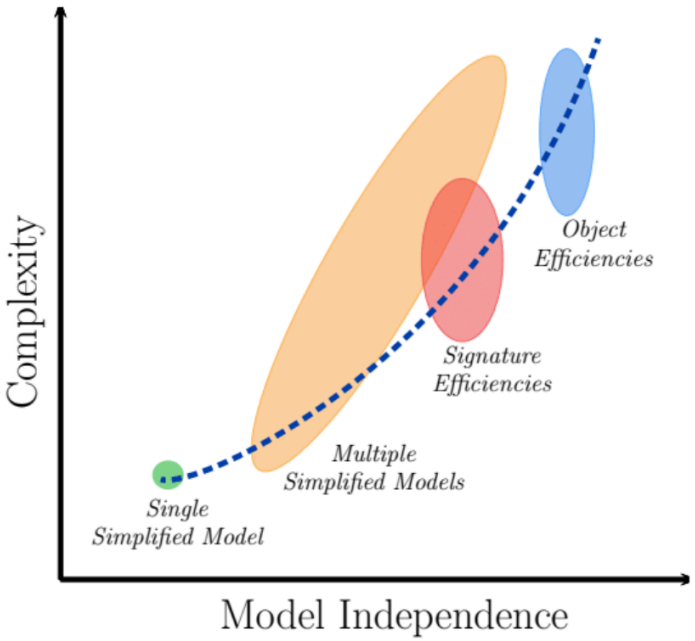
- Reinterpretations chapter highlights
- Topics for today's discussion

Reinterpretations Chapter, Section 1

Section 1: Possibilities for Presentation of Results

- Some possibilities of how we can present the search results:
  1. Signal efficiencies for a single simplified model
  2. Efficiencies for several simplified models
  3. Signature efficiencies
  4. Object efficiencies

- **We describe the advantages and disadvantages of presenting the results for each of the four ways above**



Reinterpretations Chapter, Section 2

Section 2: Recasting Examples for Specific Searches

1. Displaced Leptons
2. Displaced Jets
3. Displaced Vertices
4. Disappearing Tracks
5. Heavy Stable Charged Particles
6. Non-pointing Photons
7. Displaced Lepton-Jets

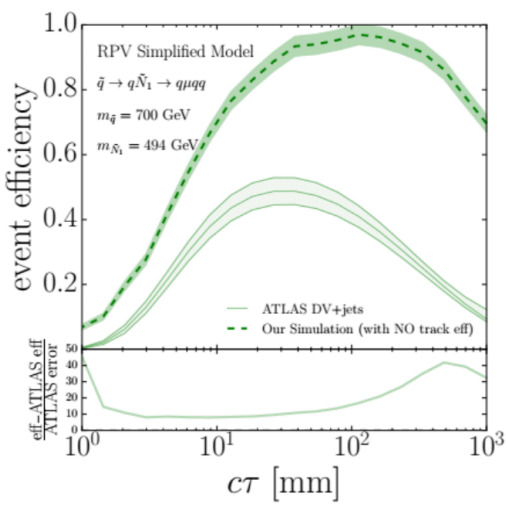
- **Present lessons learned and recommendations for each search**

Reinterpretations Chapter, Section 2

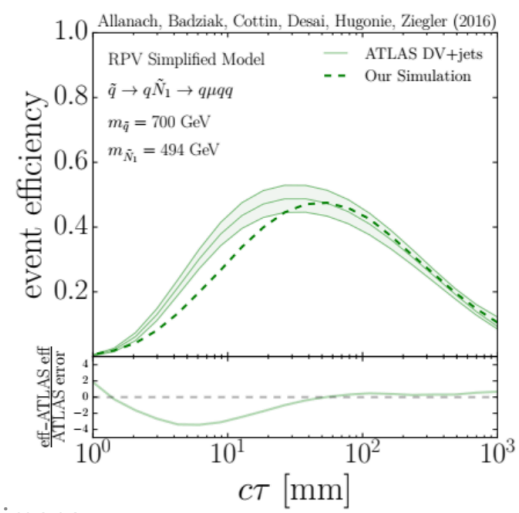
Example: Section 2.3

- ATLAS 8 TeV displaced vertex or displaced lepton pairs search (arXiv:1504.05162)
- Search reinterpretation:
  - Chose a parameterization of the tracking efficiency that had a fair fit across the 3 benchmark models tested

Without Tracking Efficiency



With Tracking Efficiency



Reinterpretations Chapter, Section 2

Example: Section 2.3

- **Lessons learned:**
  - Vertex efficiency only given by search authors for DV+μ channel for a single benchmark, not clear how it translates to other channels
  - Fitting an efficiency for a single benchmark does not necessarily give good results for other benchmarks
- **Recommendations:**
  - Provide vertex efficiency as a function of r_{DV} and z_{DV} for at least two different masses
  - Provide a simplified material map
  - Provide 3D interpolated efficiencies for tracks for different types of particles, possibly with an additional efficiency factor for the vertex depending upon the numbers and types of particles coming from it

Reinterpretations Chapter, Section 3

Section 3: Recasting Inside the Experimental Collaborations

1. The RECAST Framework
   - RECAST is a tool that allows us to reinterpret a given analysis under a different model
   - Provides a **statistical analysis** of a **new signal** with respect to the **same data and background estimates** as the original analysis and derive **new limits**
   - Steps:
     - Contain analysis workflows in REANA, preserve analysis methods
     - Then RECAST analysis and derive new limits
   - RECAST framework well-established with ATLAS analyses
   - Starting to develop RECAST with CMS analysis preservation and REANA

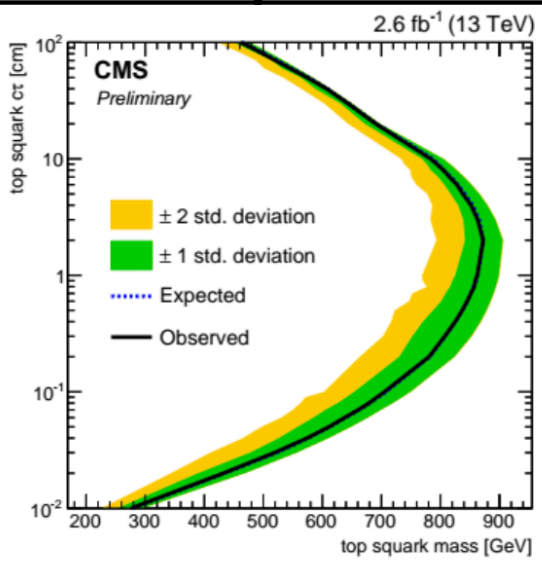
Reinterpretations Chapter, Section 4

Section 4: Reinterpretation with Prompt Analysis

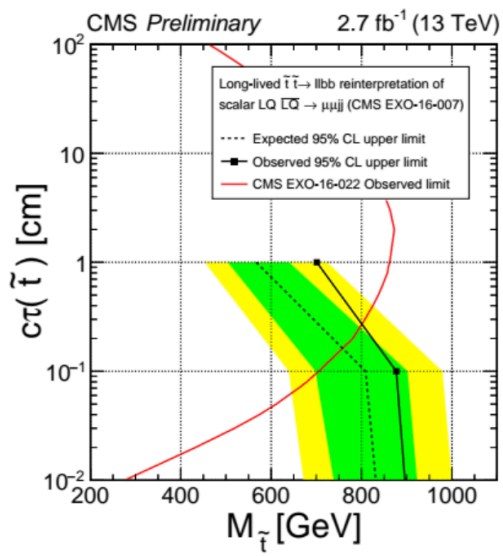
1. An Experiment-Internal Example

- **We describe the CMS search for second generation leptoquarks, which was reinterpreted using a long-lived RPV SUSY model**

Displaced Lepton Search



Prompt Reinterpretation



Reinterpretations Chapter, Section 5

Section 5: Our Proposals for the Presentations of Results

- **Main recommendation: experiments provide as detailed efficiency information as possible**
  - Ideally including LLP reconstruction efficiency as a function of p_T, boost, and position
- **When complete efficiency maps are not possible:**
  - Provide efficiencies and limits on a large, diverse array of simplified models
    - Different multiplicities of final state particles, boosts, LLP masses, decay positions, etc.
  - Provide per-object efficiencies

For Discussion

- Comments on the chapter content?
- How realistic are the recommendations/requests that we are making?
- Are our conclusions appropriate?
- Please give us your feedback!
- Current chapter 5 draft: https://www.dropbox.com/s/7ezy4luendxmsi2/LLP_chap_5.pdf?dl=0