

Reinterpretation of LLP searches

Eighth LLP Workshop

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Universidade Federal do ABC

with contributions from: G. Cottin, N. Desai, B. Fuks, J. Heisig, S. Kulkarni and M. Selvaggi

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Recasting increases the physics impact of the experimental results

Recasting/Reinterpreting LLP searches

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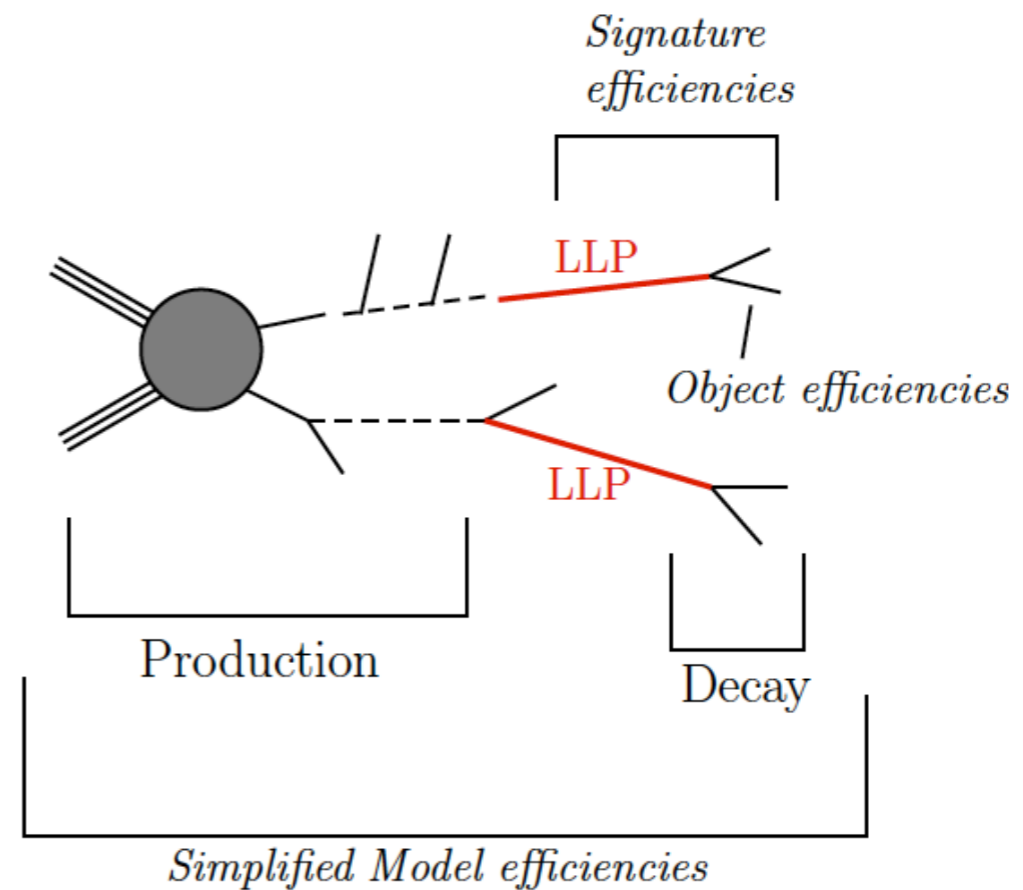
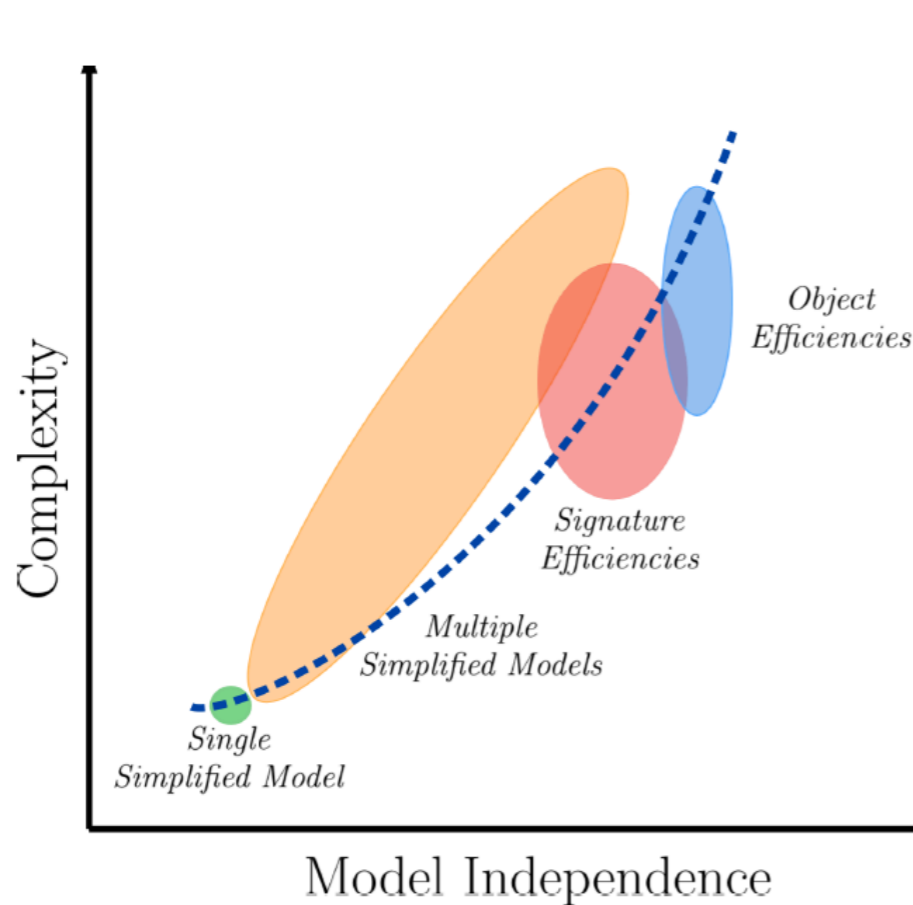
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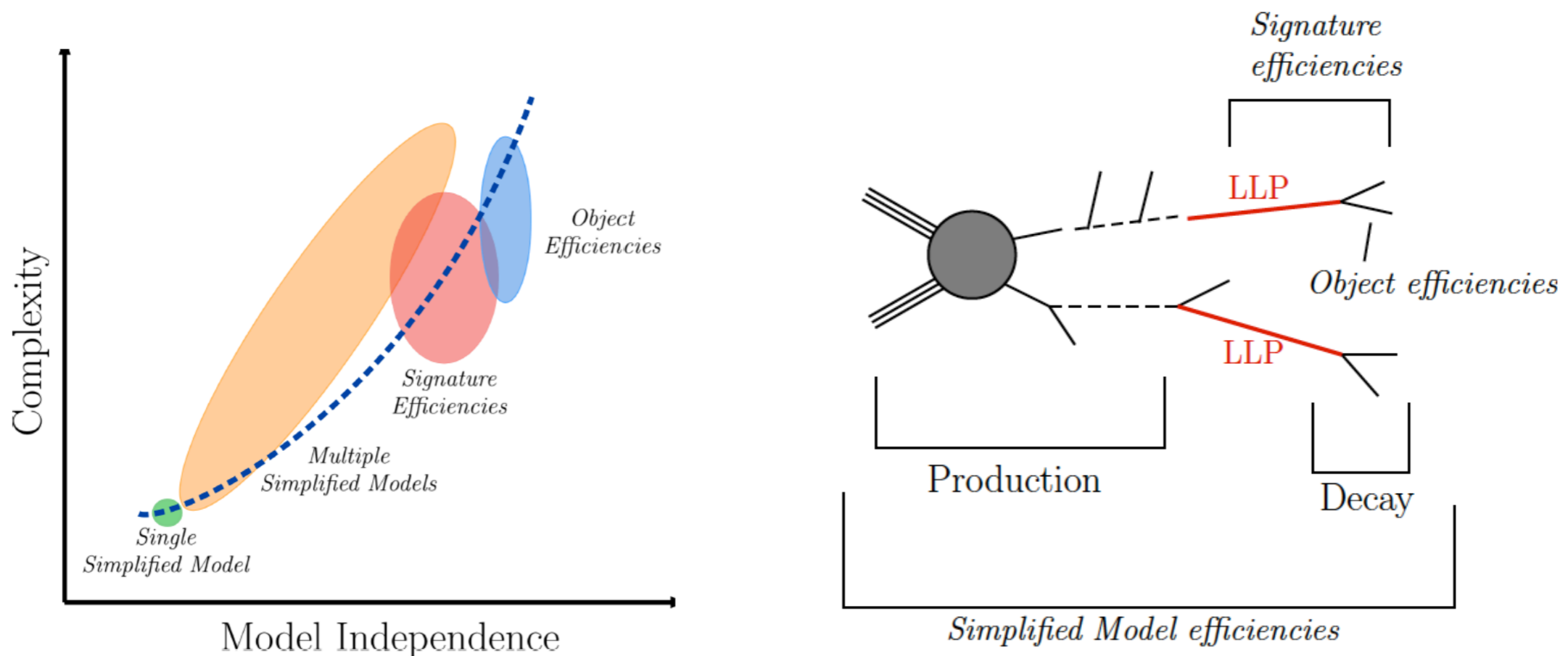
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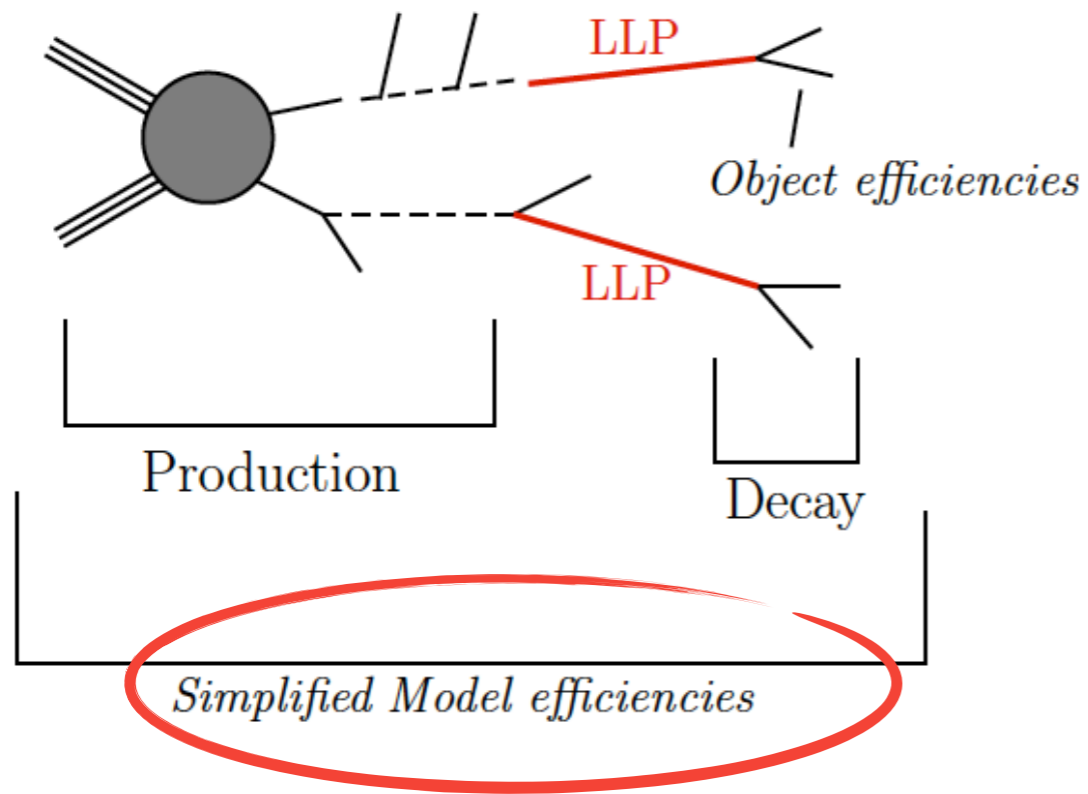
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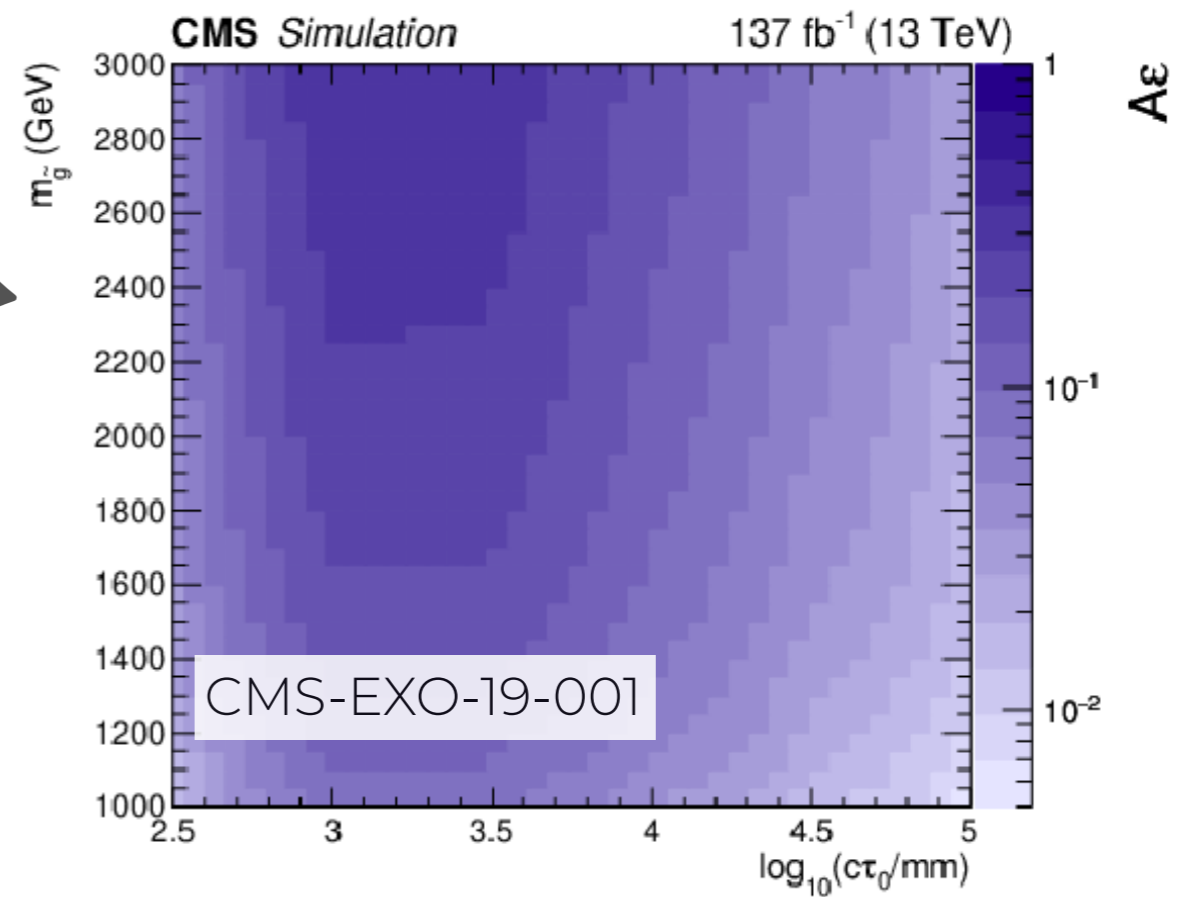
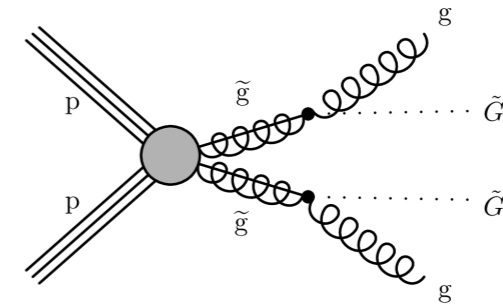
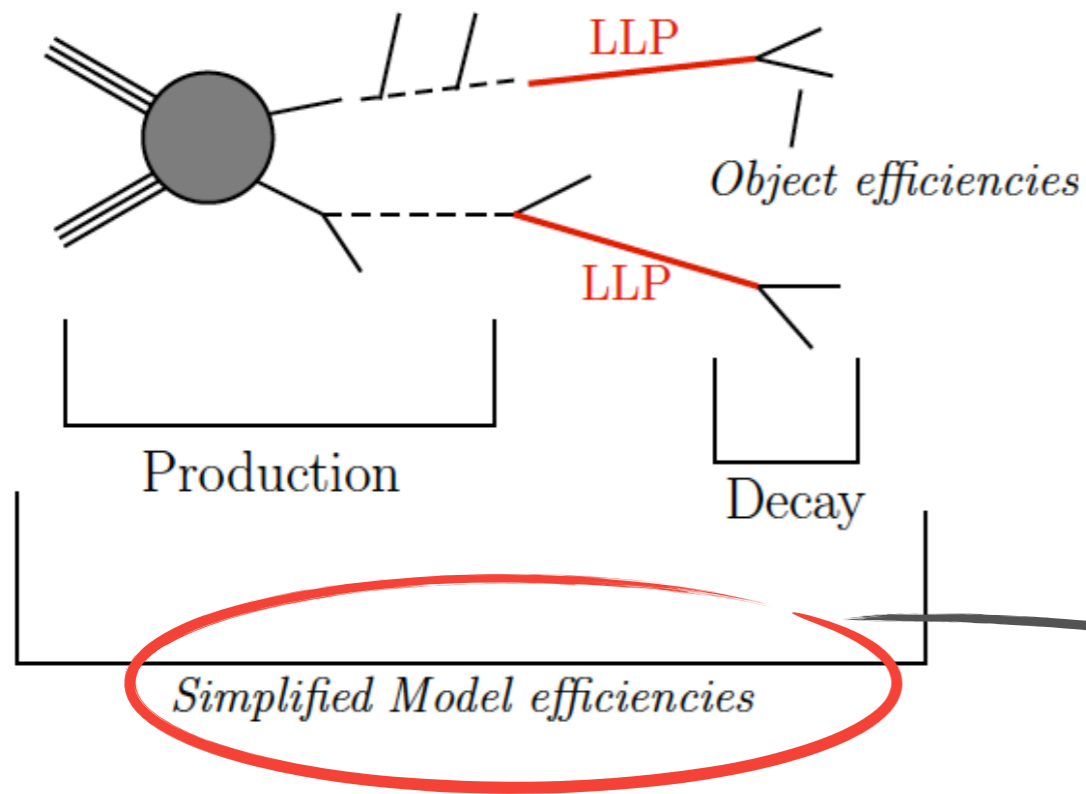


➔ For a detailed discussion see the Reinterpretation and LLP White Papers (2003.07868 and 1903.04497)

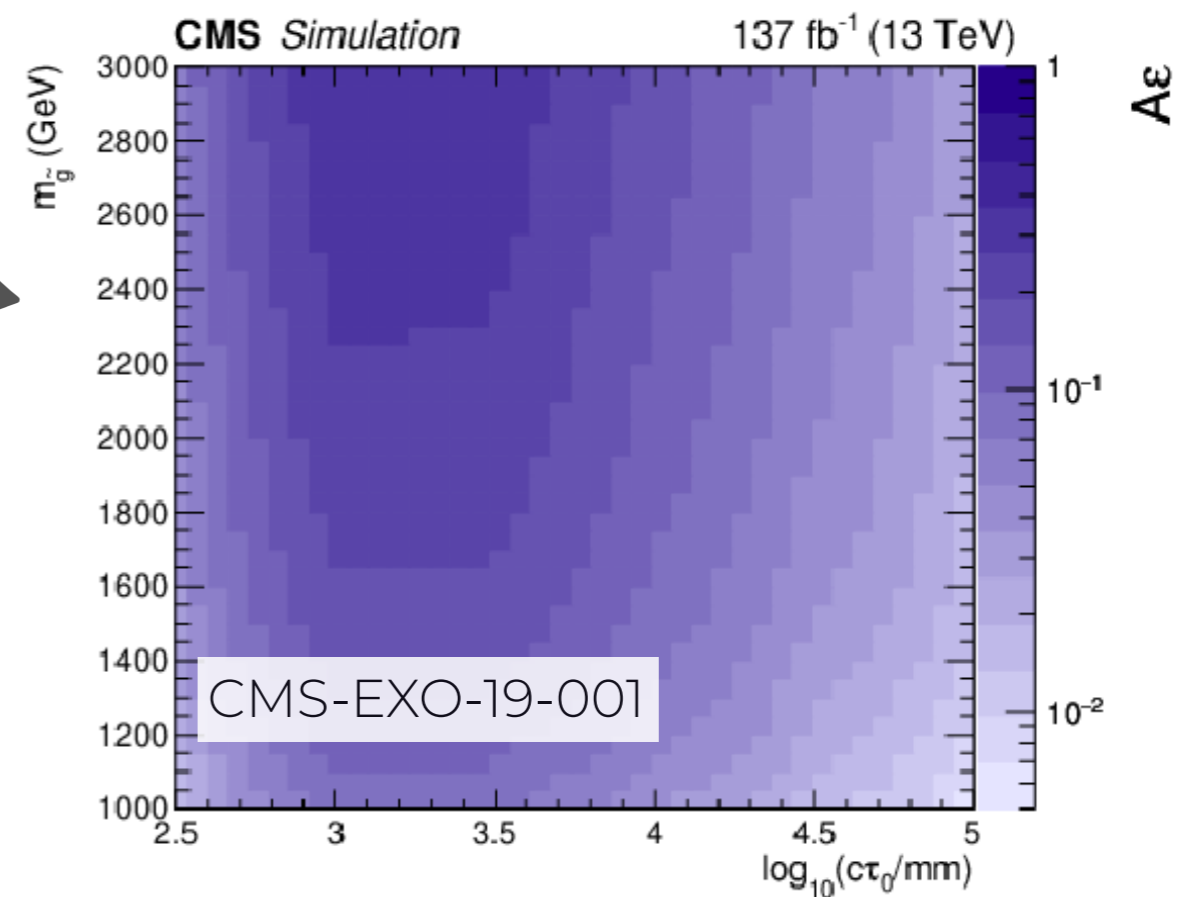
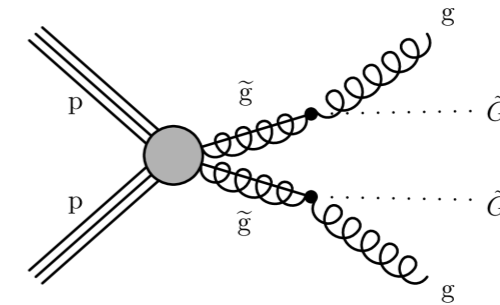
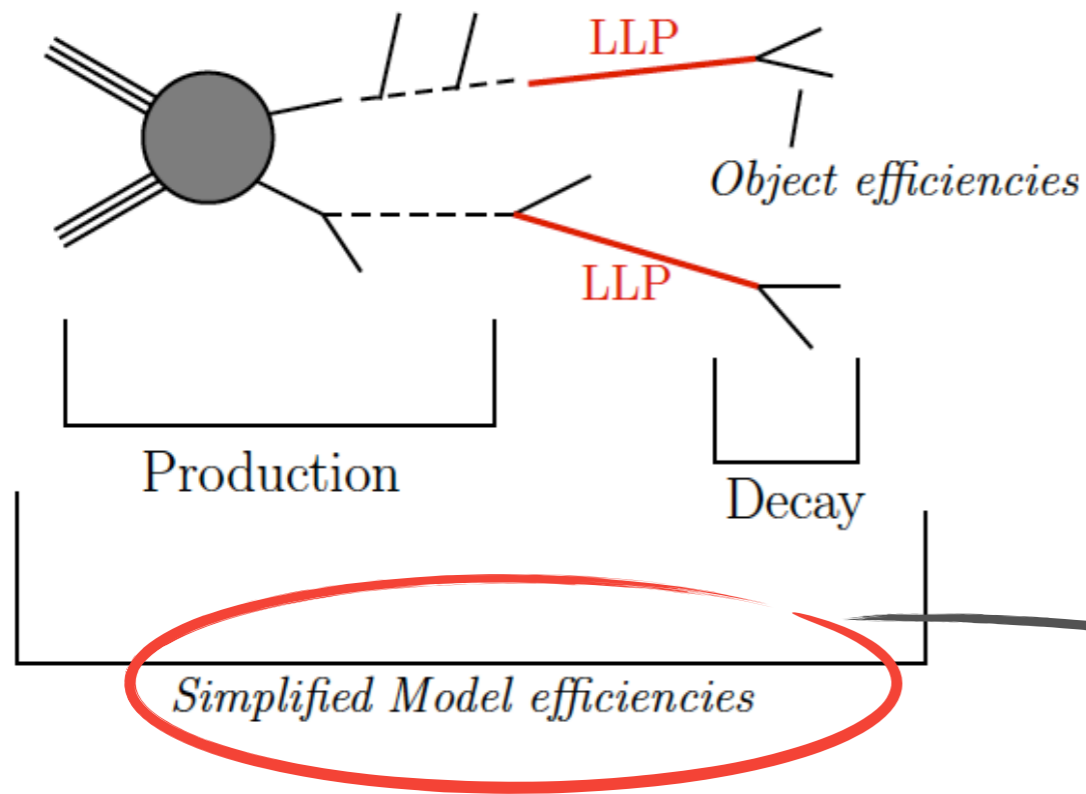
Simplified Model Results



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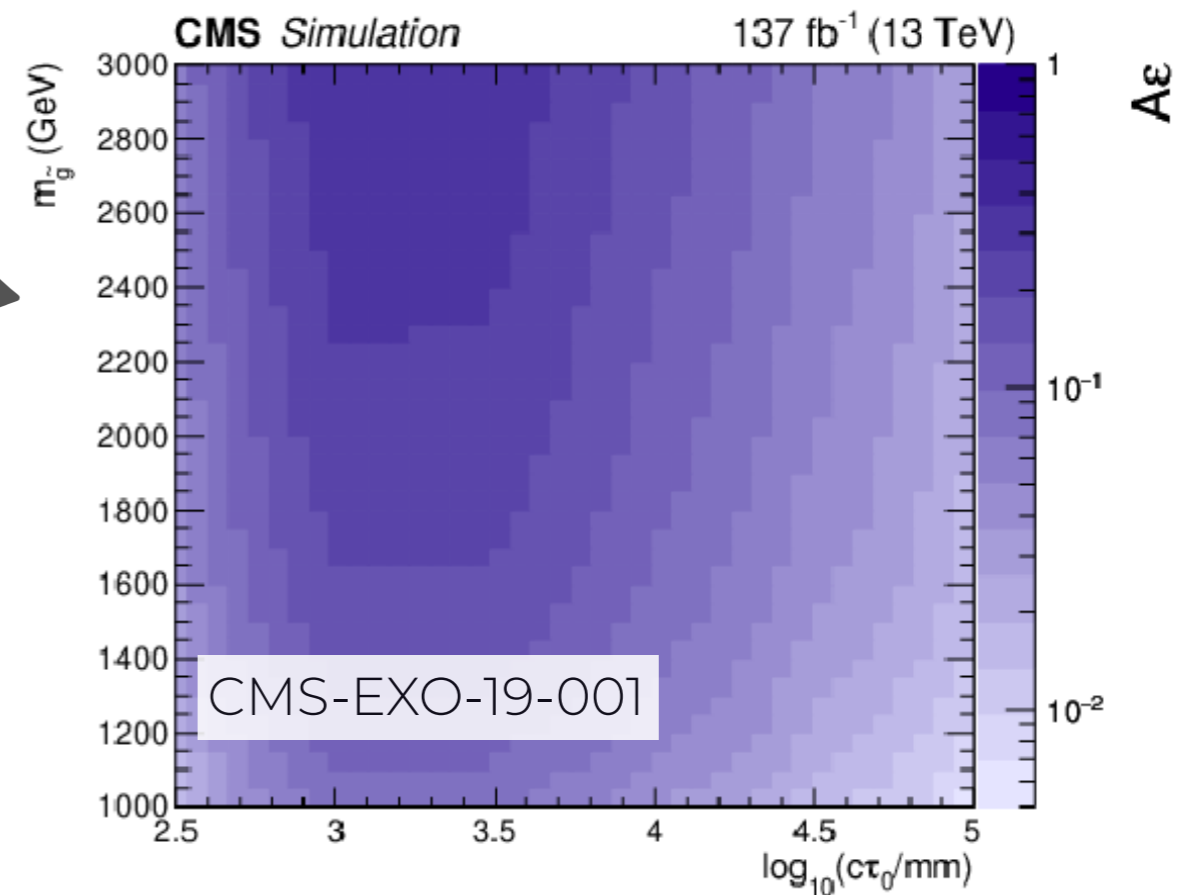
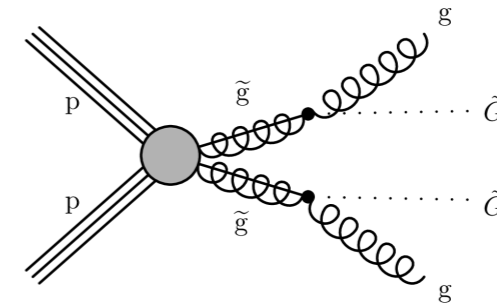
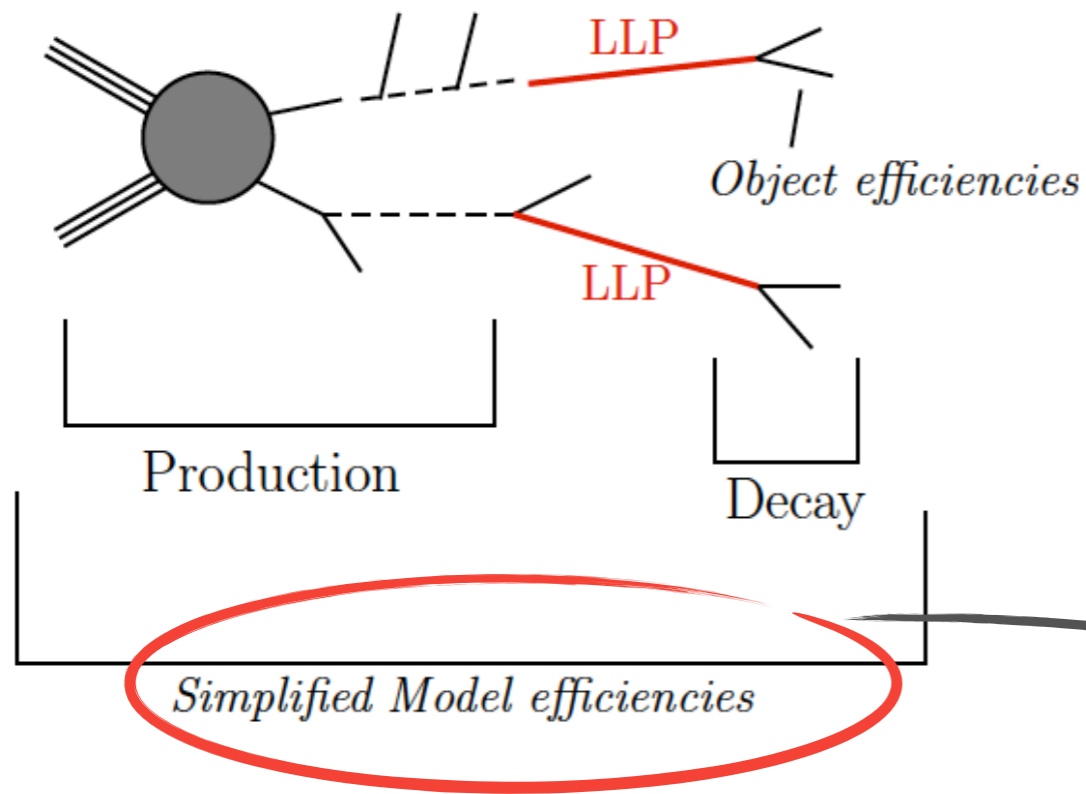


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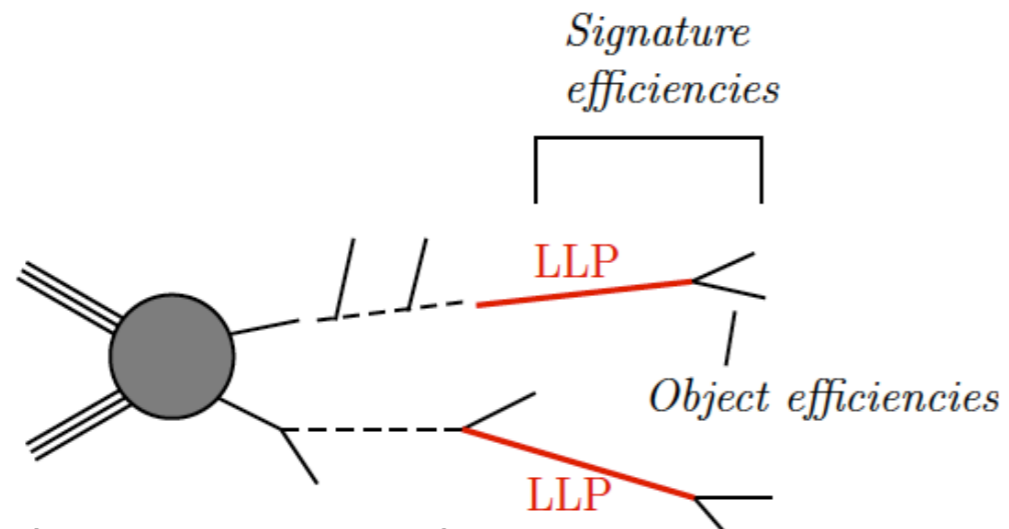
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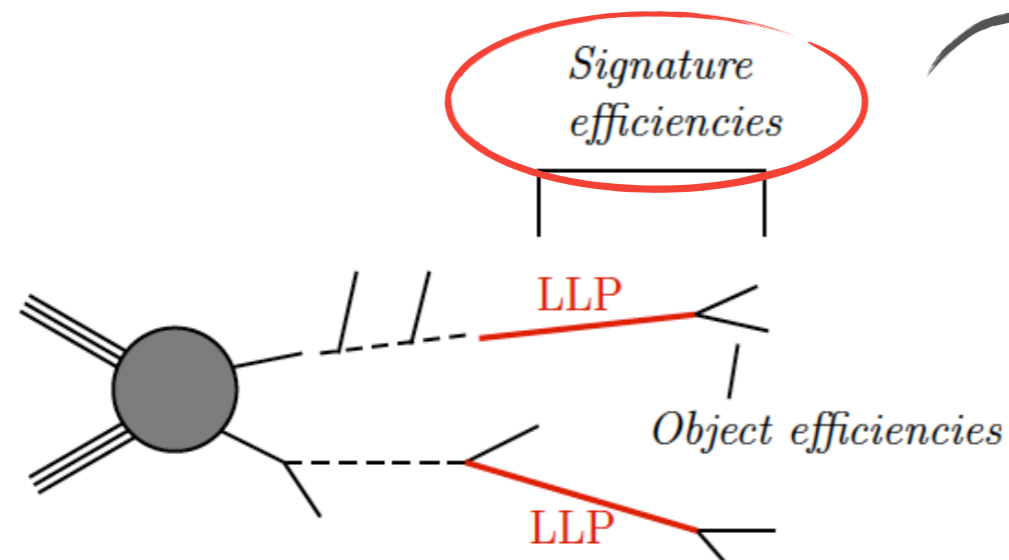


- Present in almost all analyses
- Avoids simulating the event selection
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- But it should provide:
 - a good coverage of all relevant SMS parameters (masses and lifetimes)
 - efficiencies for individual production/decay modes
 - data in digital format!

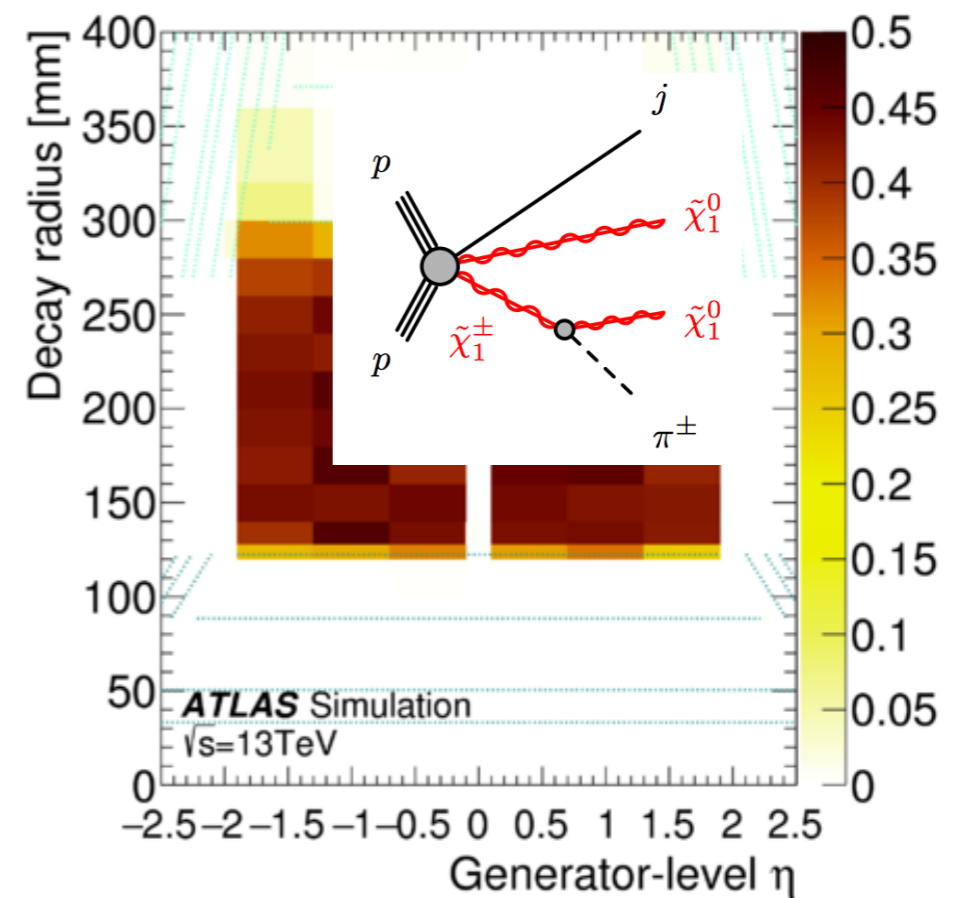
Object/Signature Efficiencies



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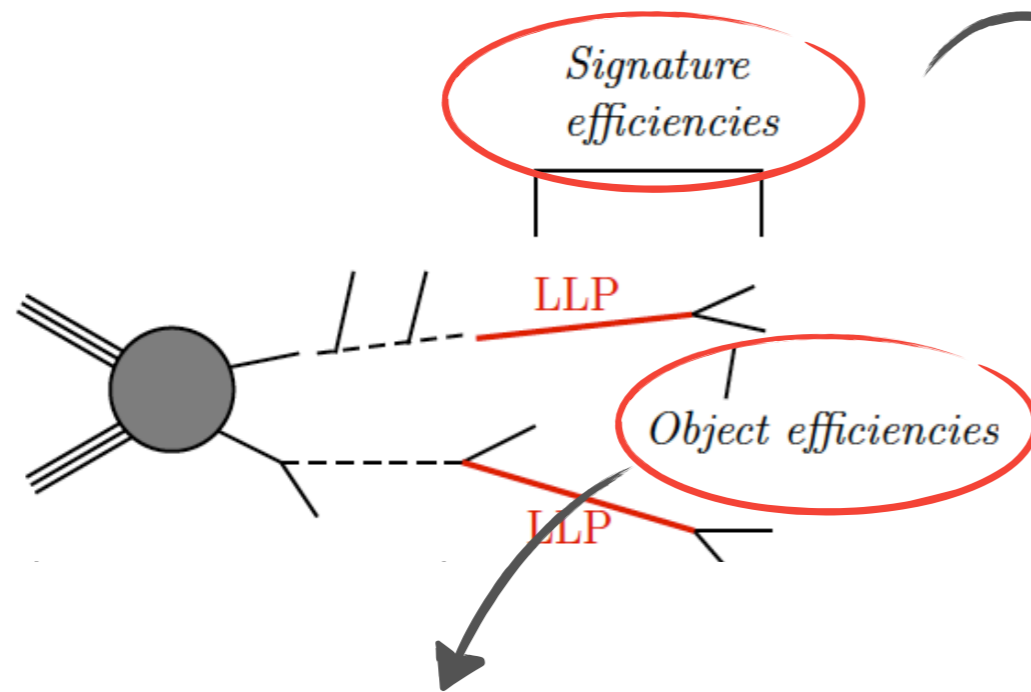


- Assumptions about the decay and/or production mode are folded in (some model bias)



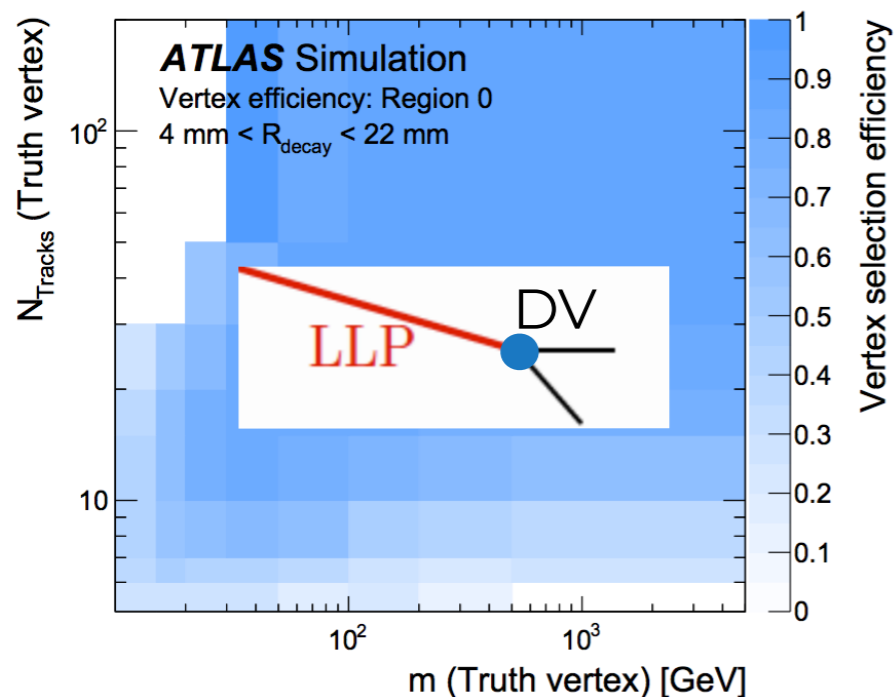
- The reco efficiency has the LLP p_T distribution folded in.
- Could it be applied to events with a different p_T distribution?

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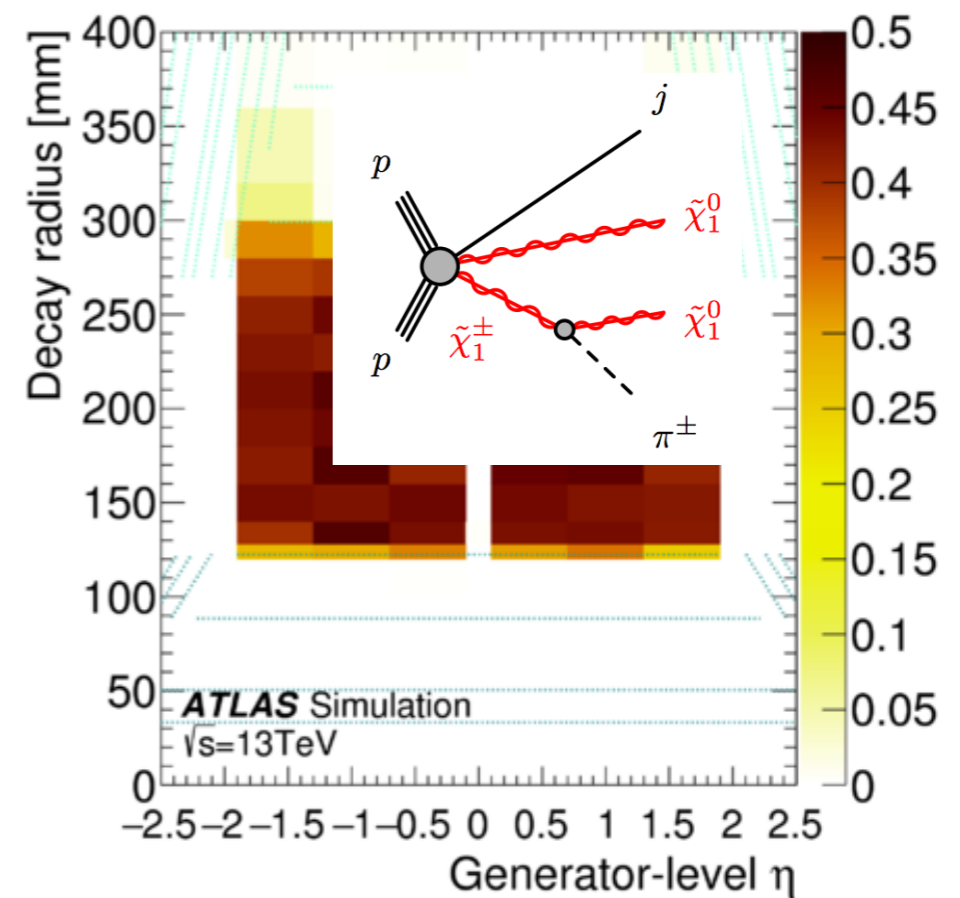


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- Functions of all the relevant (observable) parameters



“minimal model bias”



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Reinterpretation WG

- How the information provided is being used by the LLP recasting community?
- What are the issues?
- How can we move forward?

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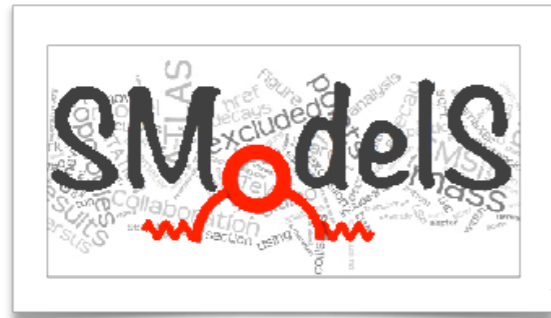
→ Concrete examples

"Real Life" Examples: SMS

- Simplified model results:

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HSCPs (CMS)

HSCPs (ATLAS)

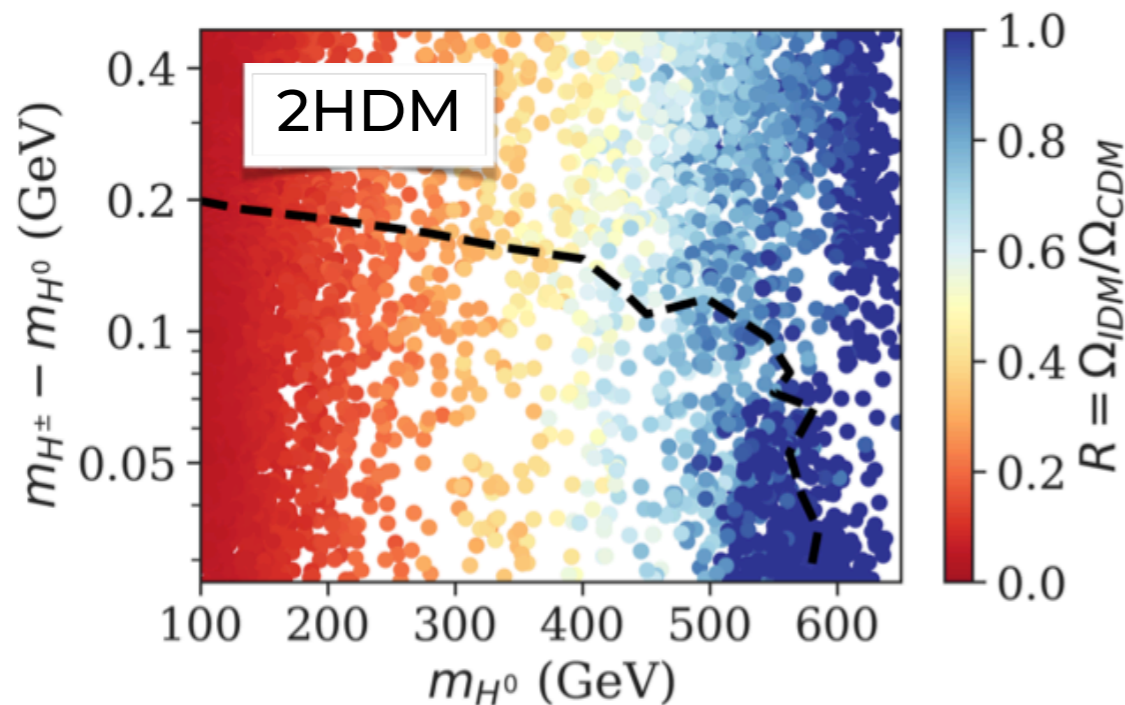
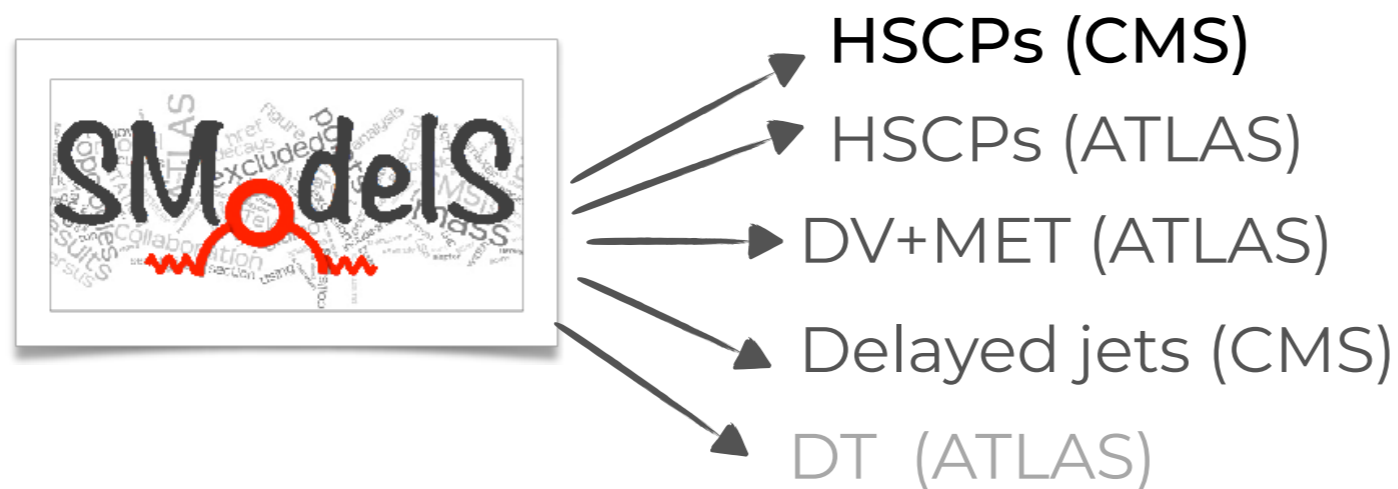
DV+MET (ATLAS)

Delayed jets (CMS)

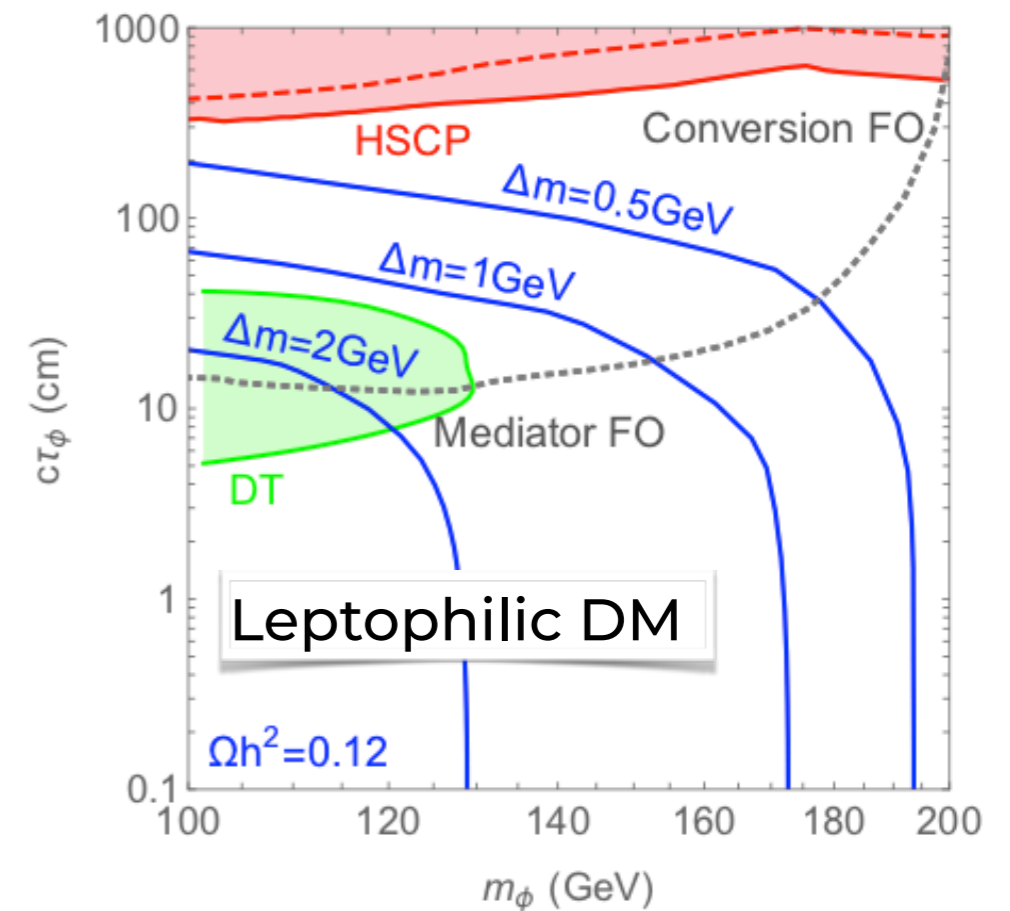
DT (ATLAS)

"Real Life" Examples: SMS

- Simplified model results:



J. Heisig, S. Kraml, AL, Phys.Lett. B788 (2019)

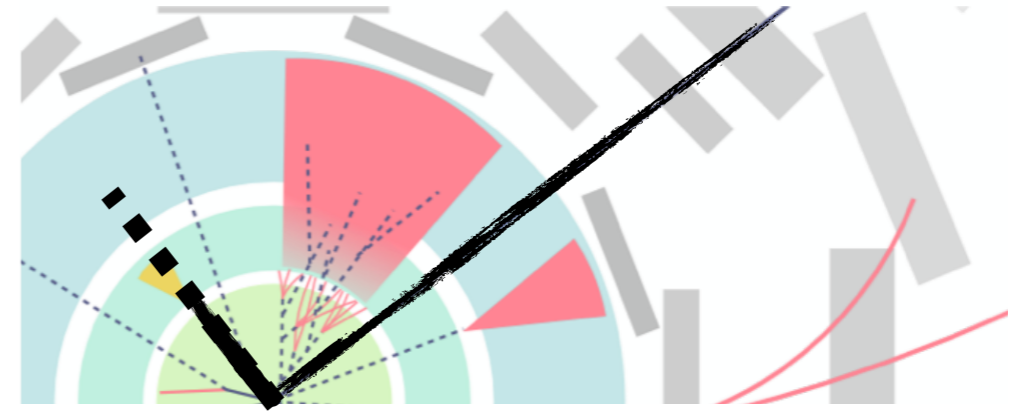


(a) $\lambda_H = 0.01$

S. Junius, L. Lopez-Honorez, A. Mariotti, arXiv:1904.07513

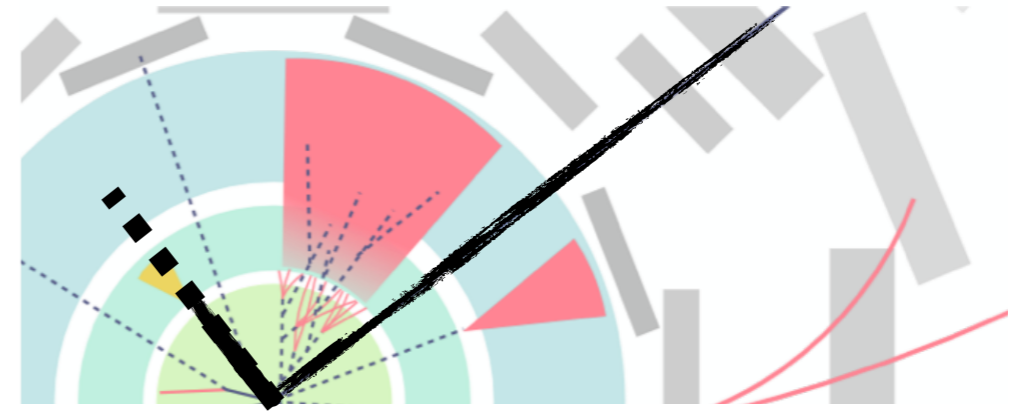
"Real Life" Examples: HSCPs

- HSCPs (plus R-hadrons):
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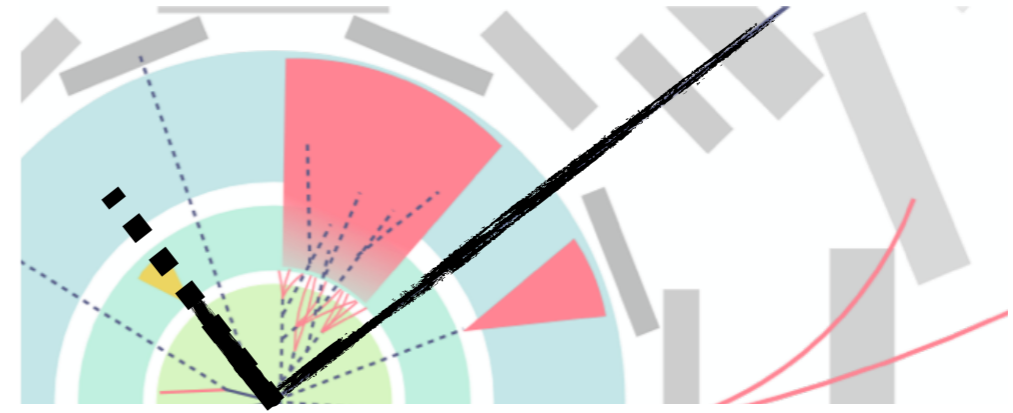
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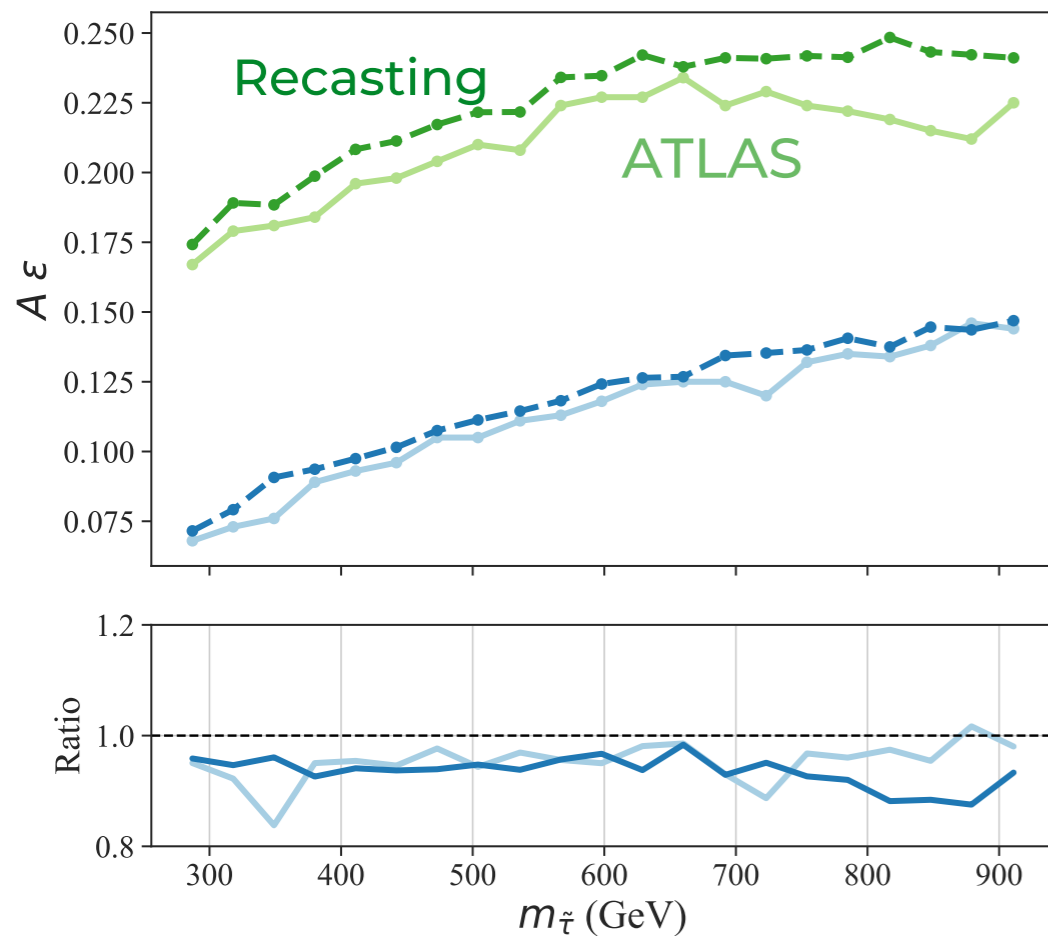


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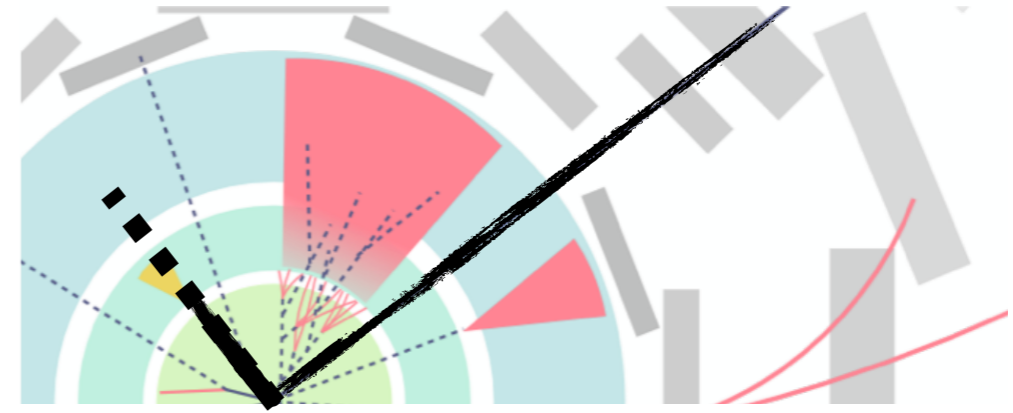


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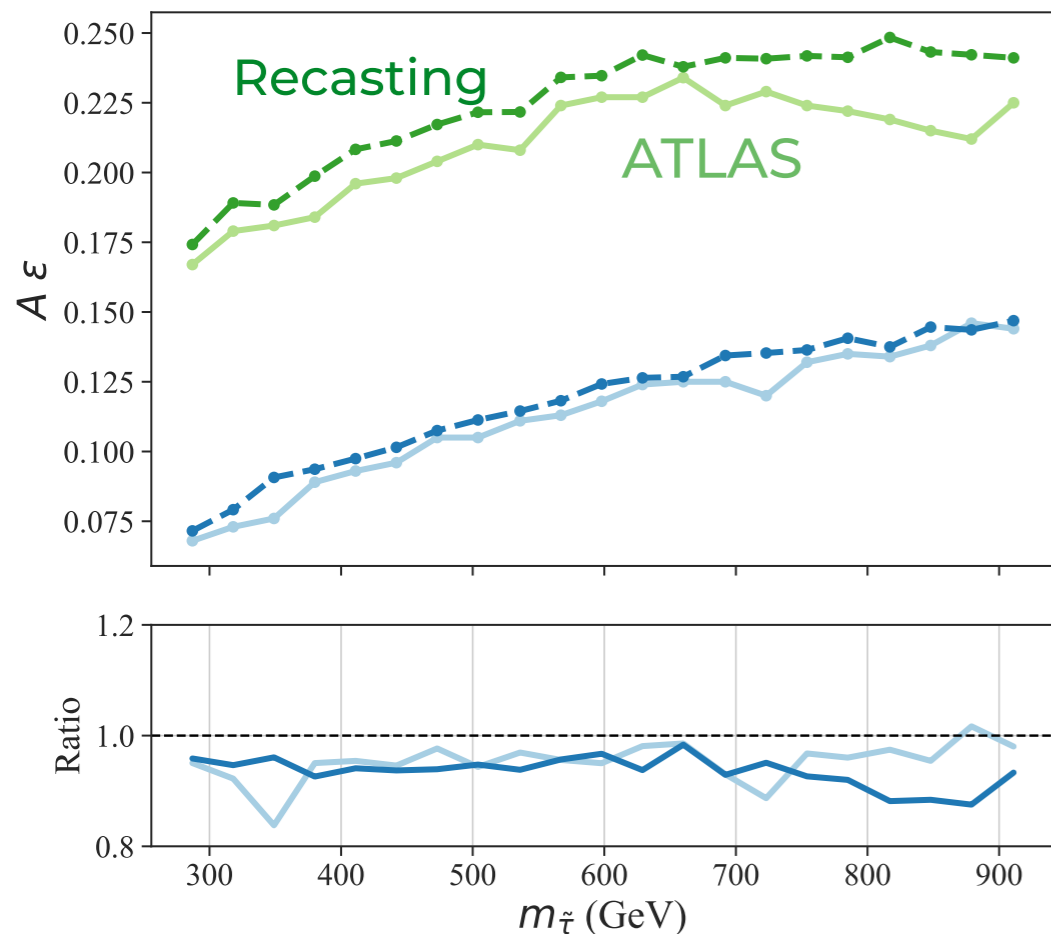


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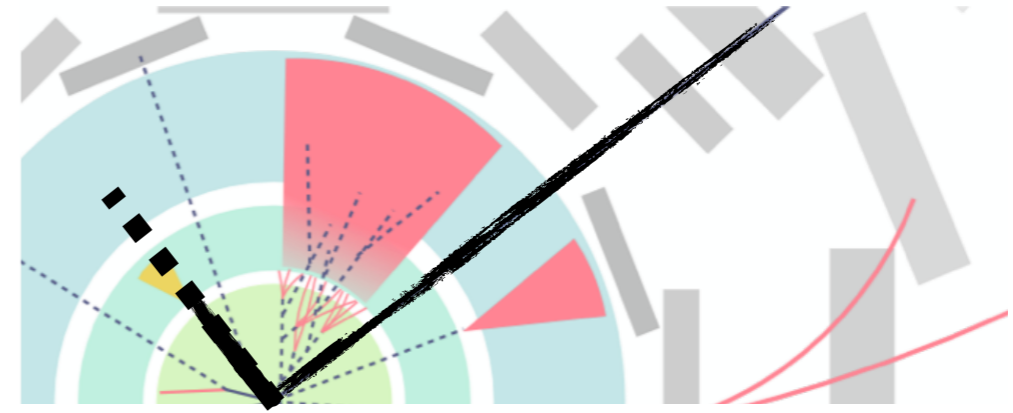


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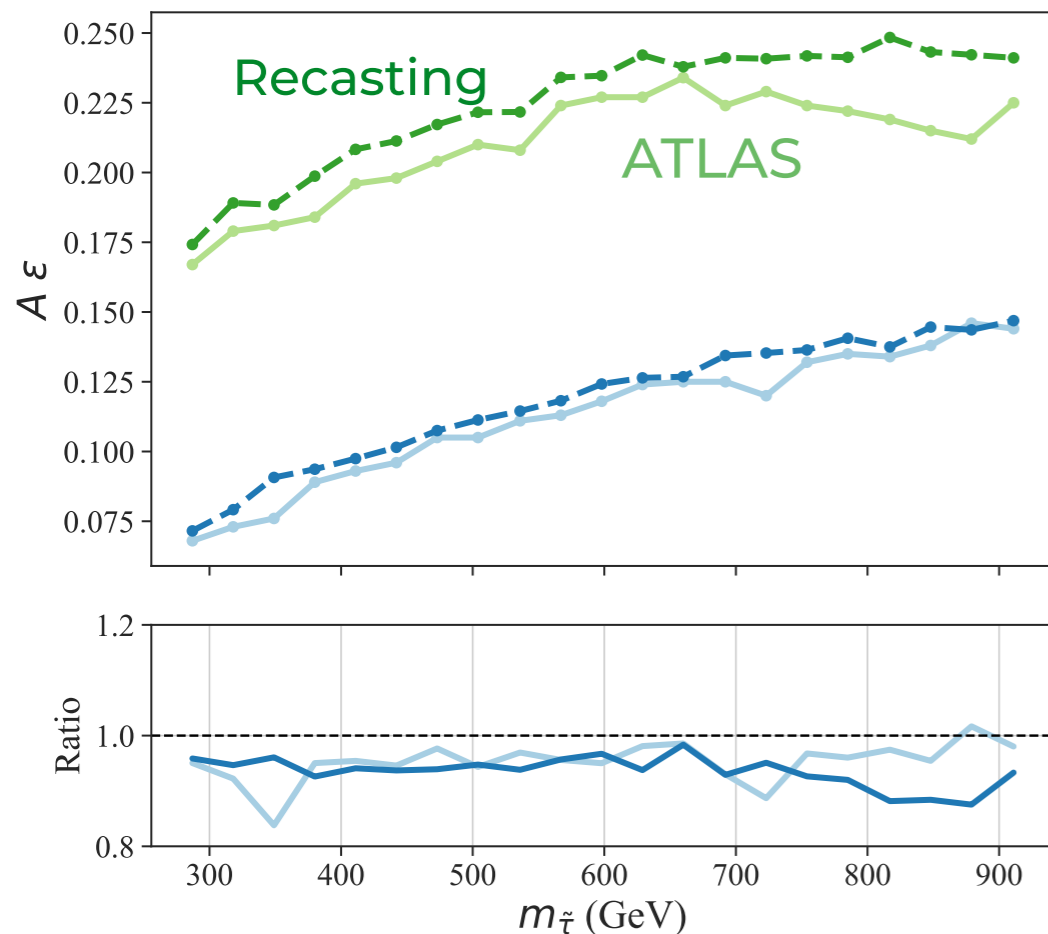
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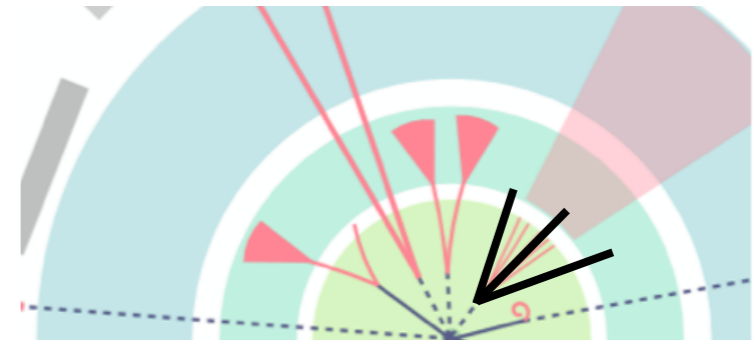
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- Not enough information from the analysis for short lifetimes (p_T spectrum, cut-flows...)
- Hadronization model?
- ME/PS matching?

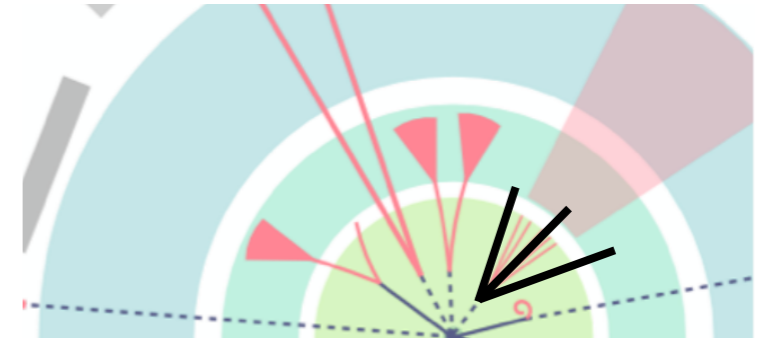
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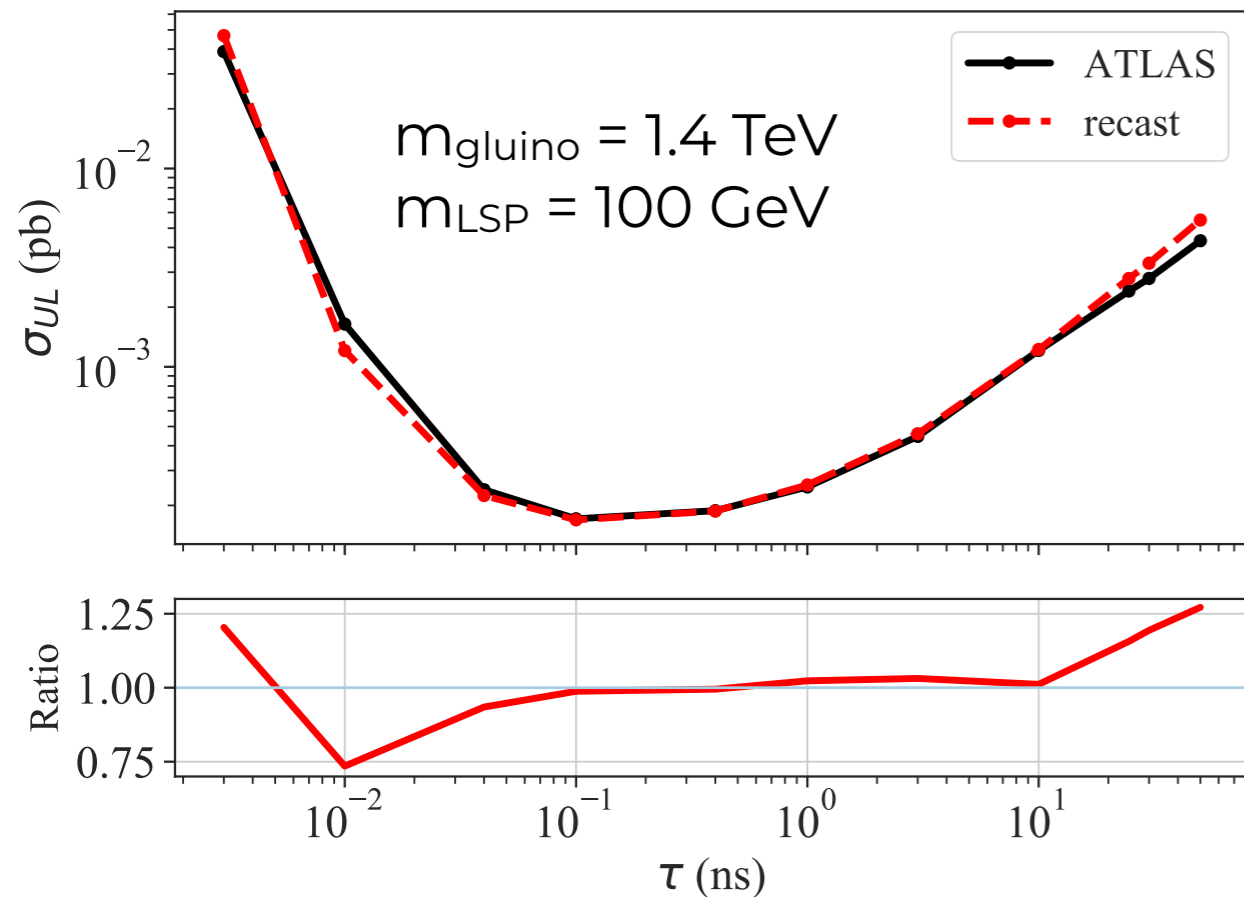
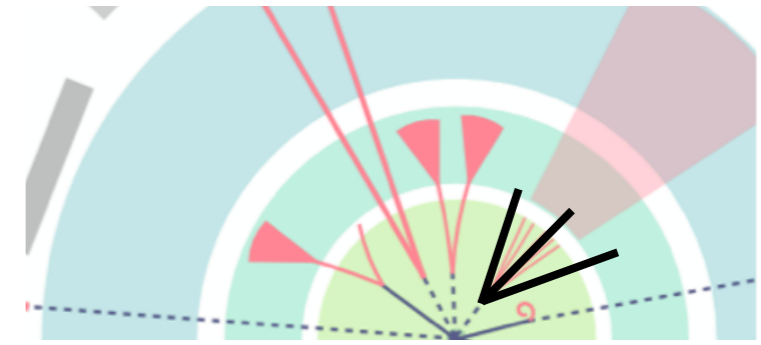
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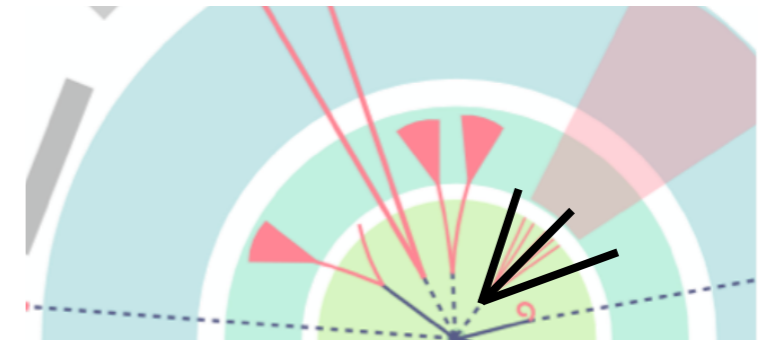
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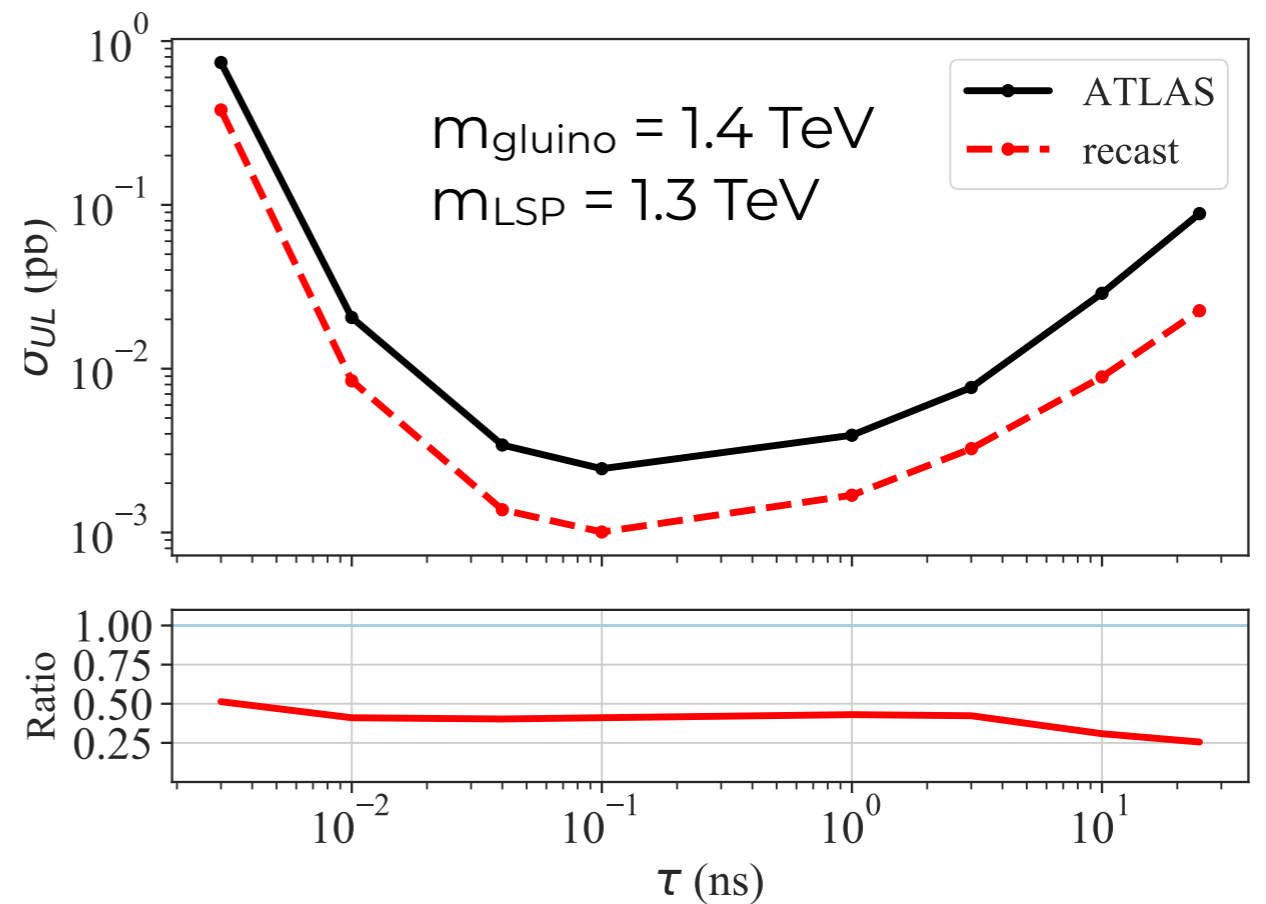
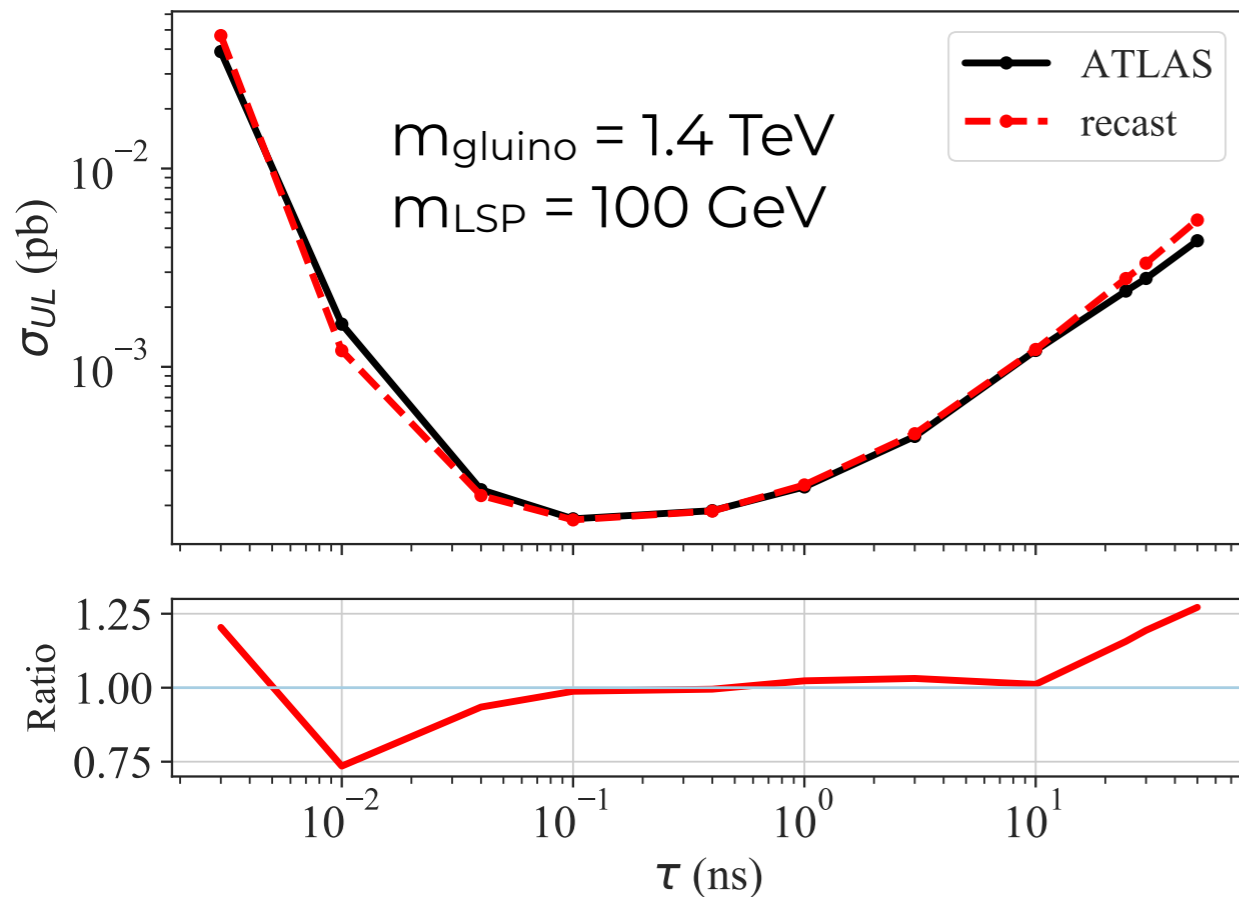
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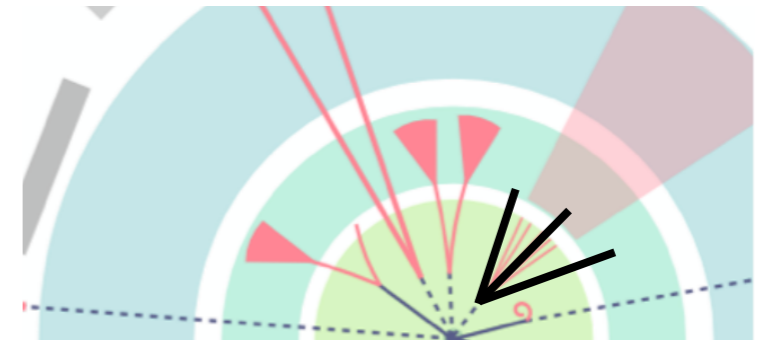
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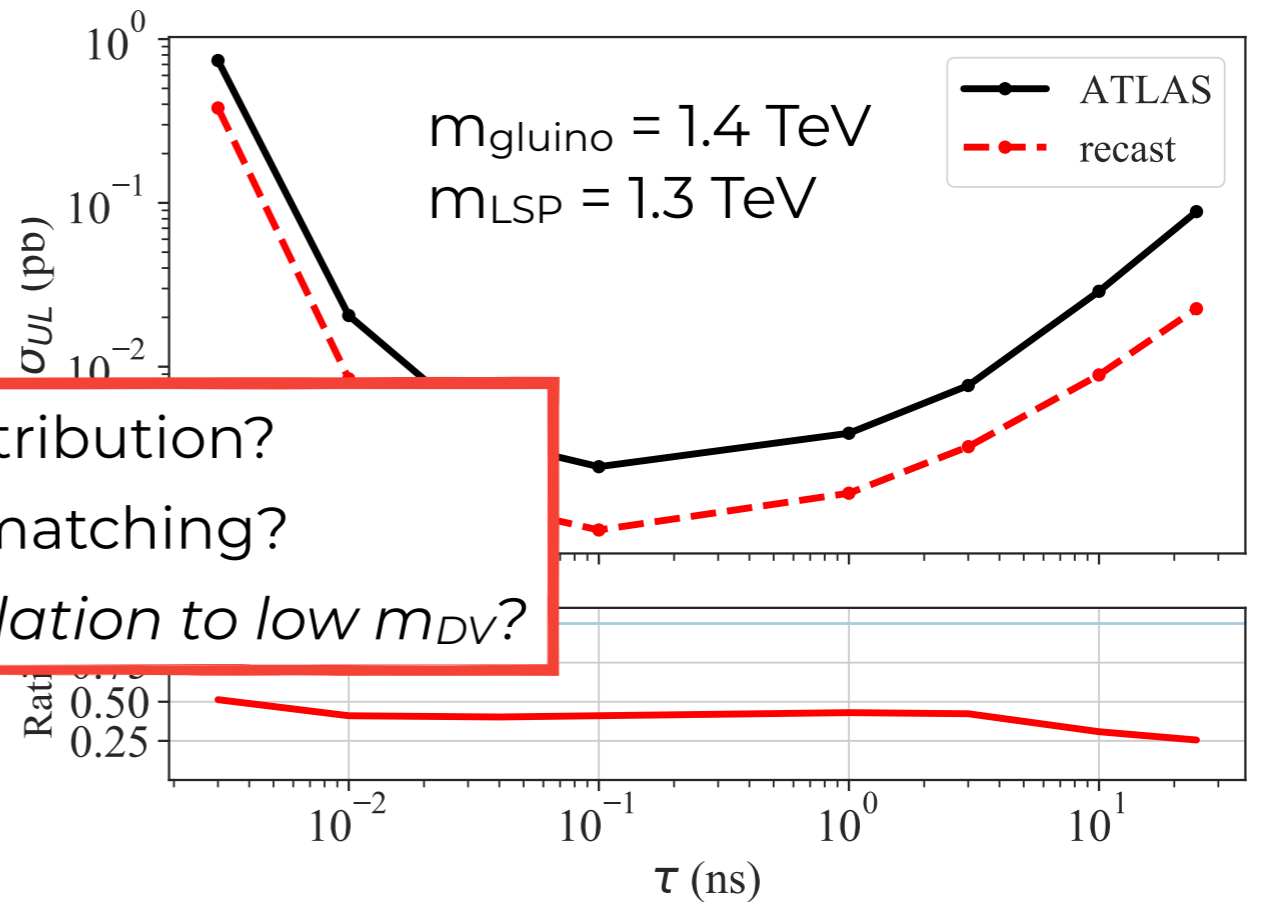
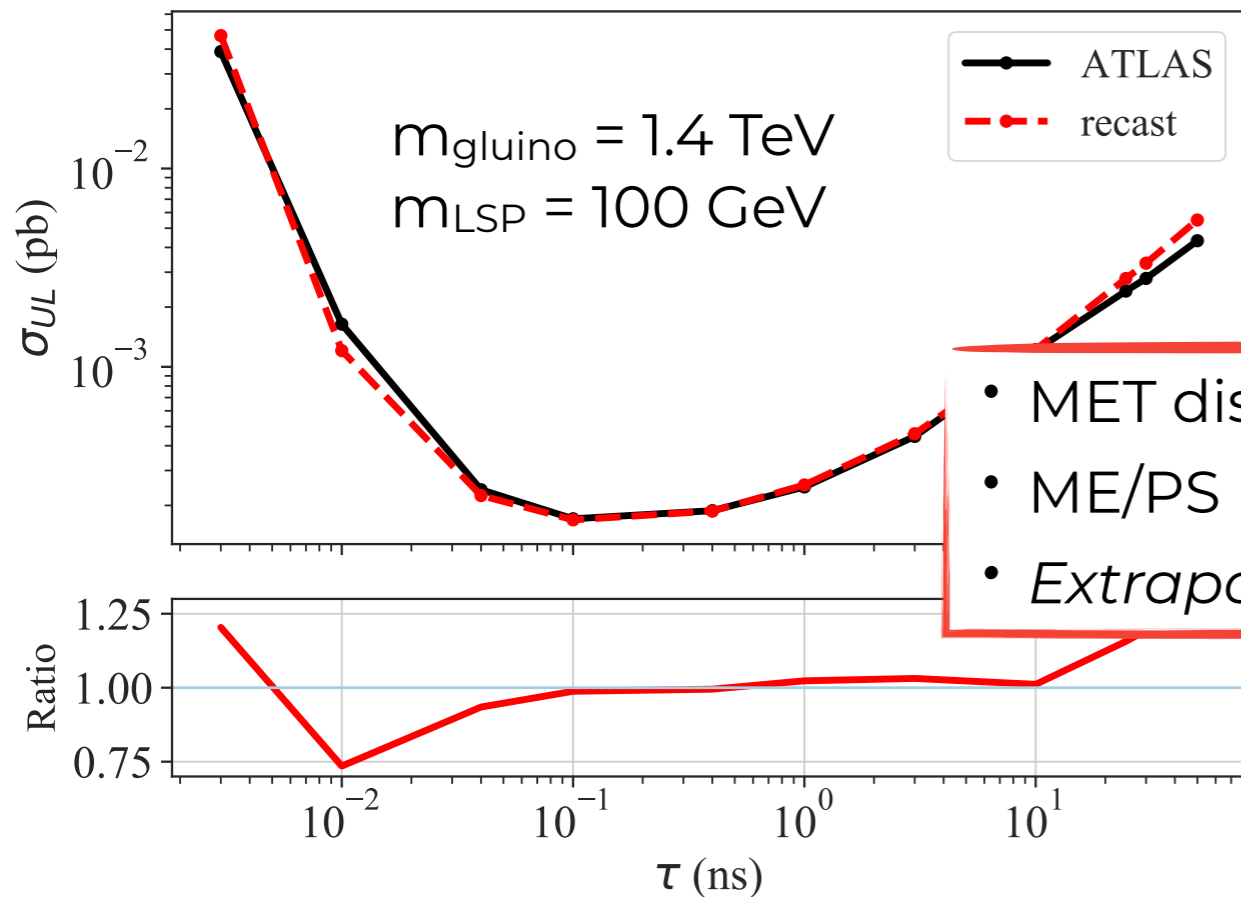
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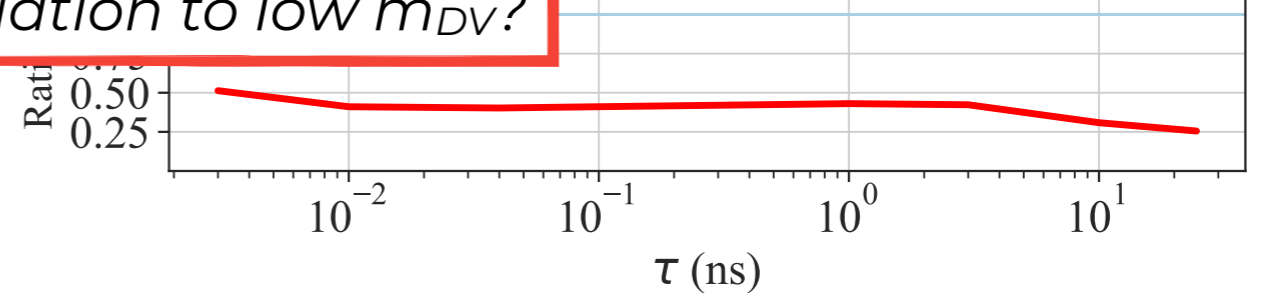
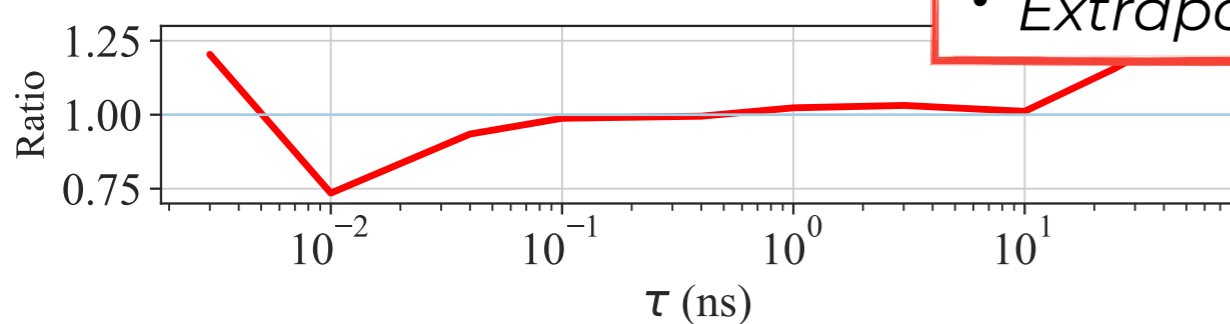
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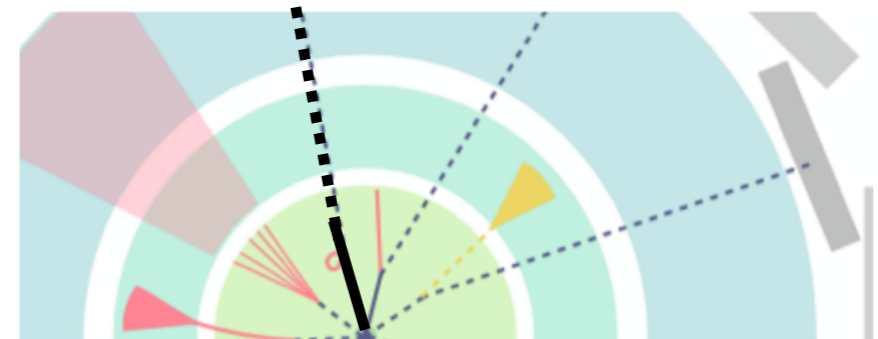


• MET distribution?
 • ME/PS matching?
 • *Extrapolation to low m_{DV} ?*



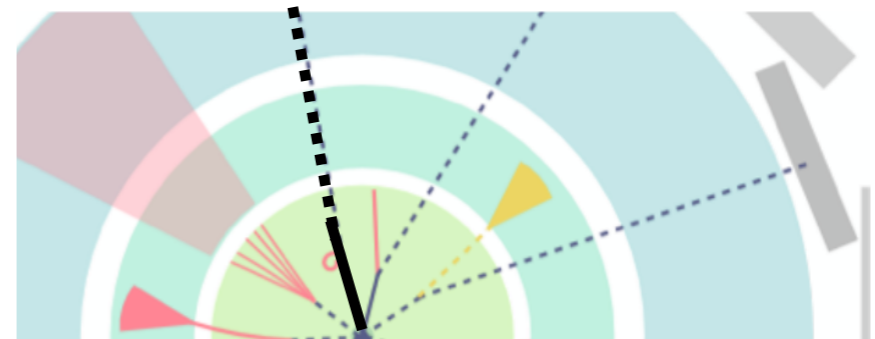
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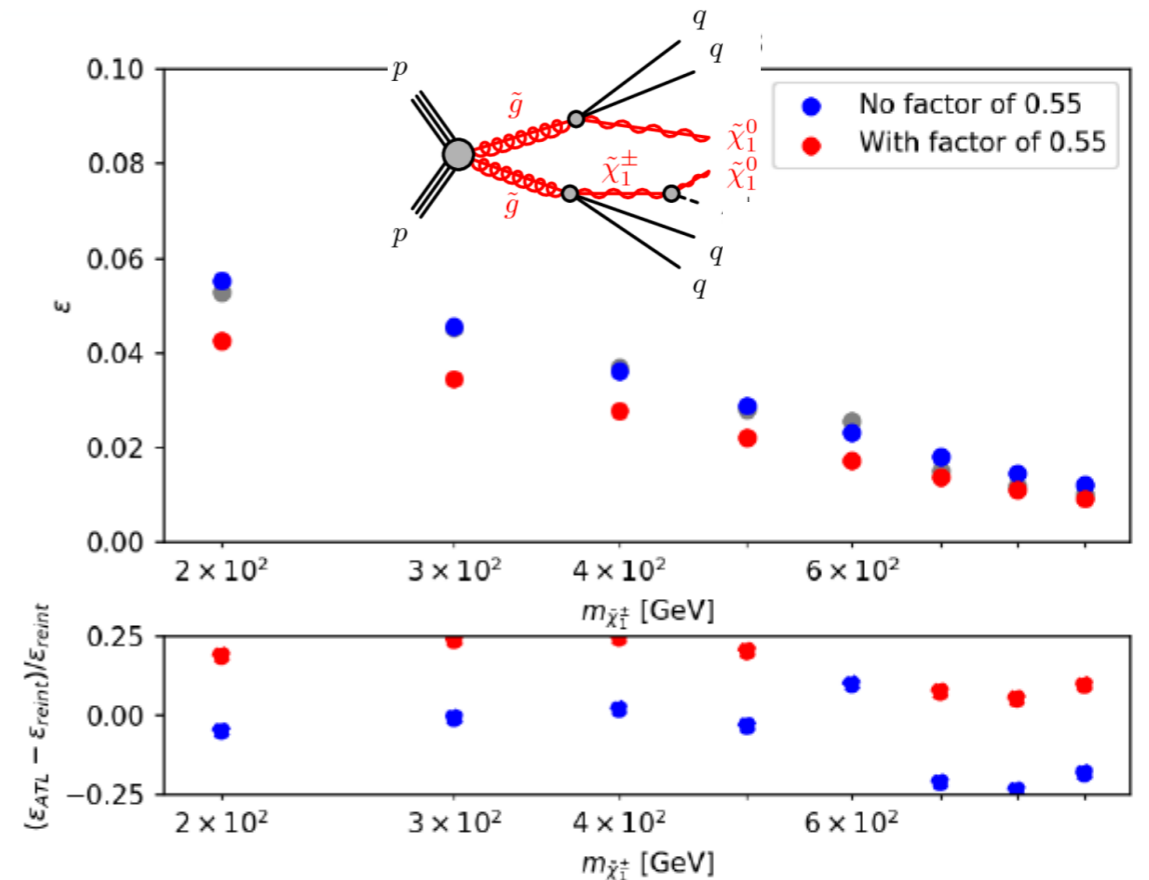
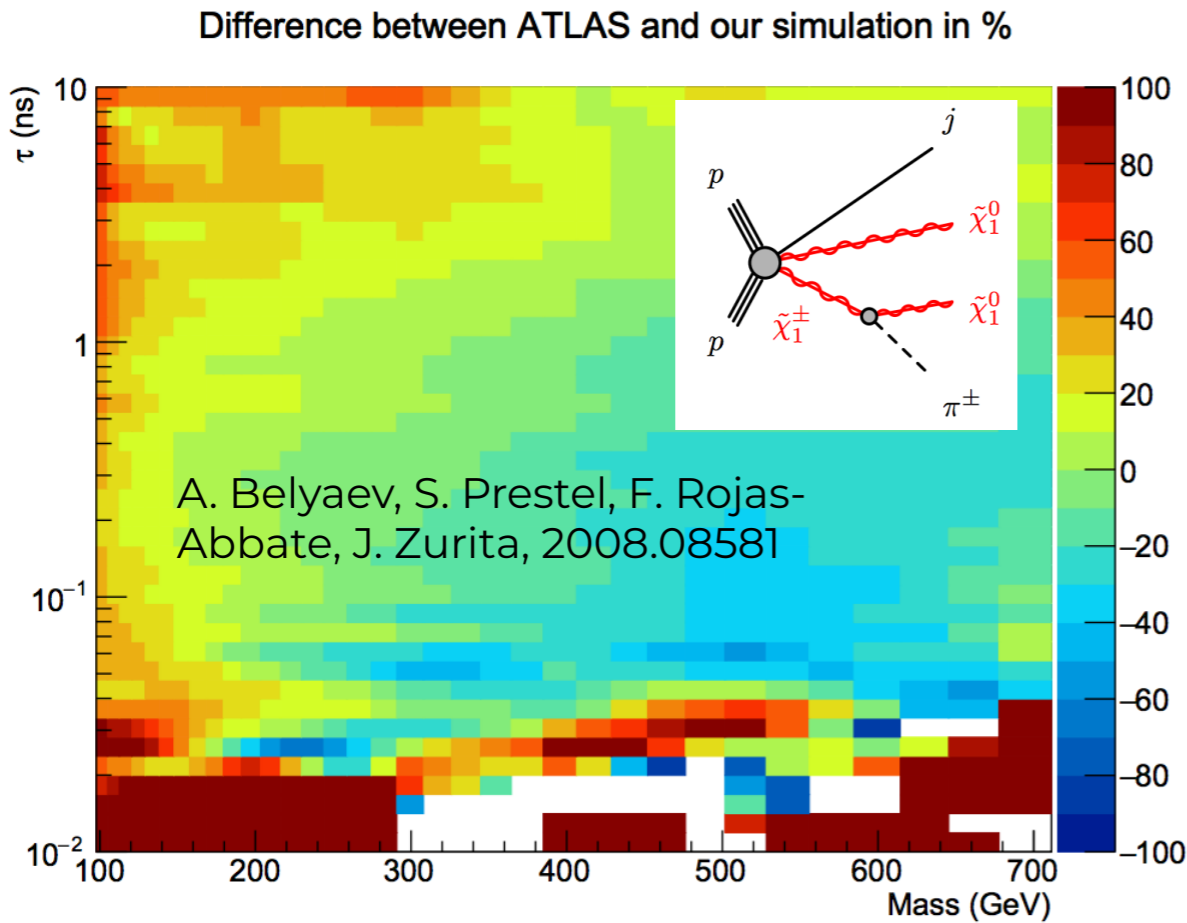
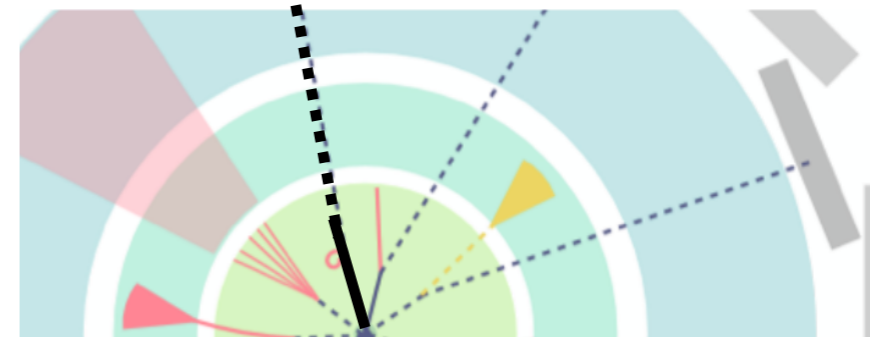
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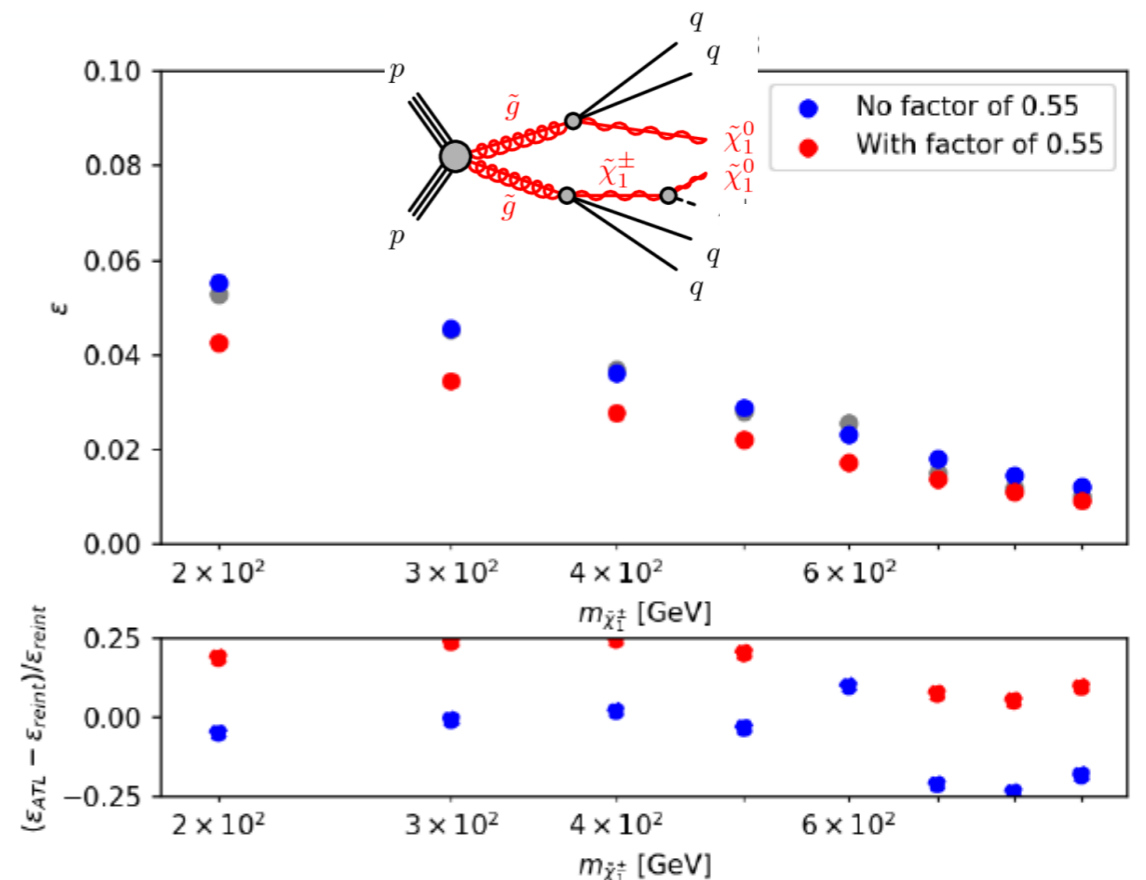
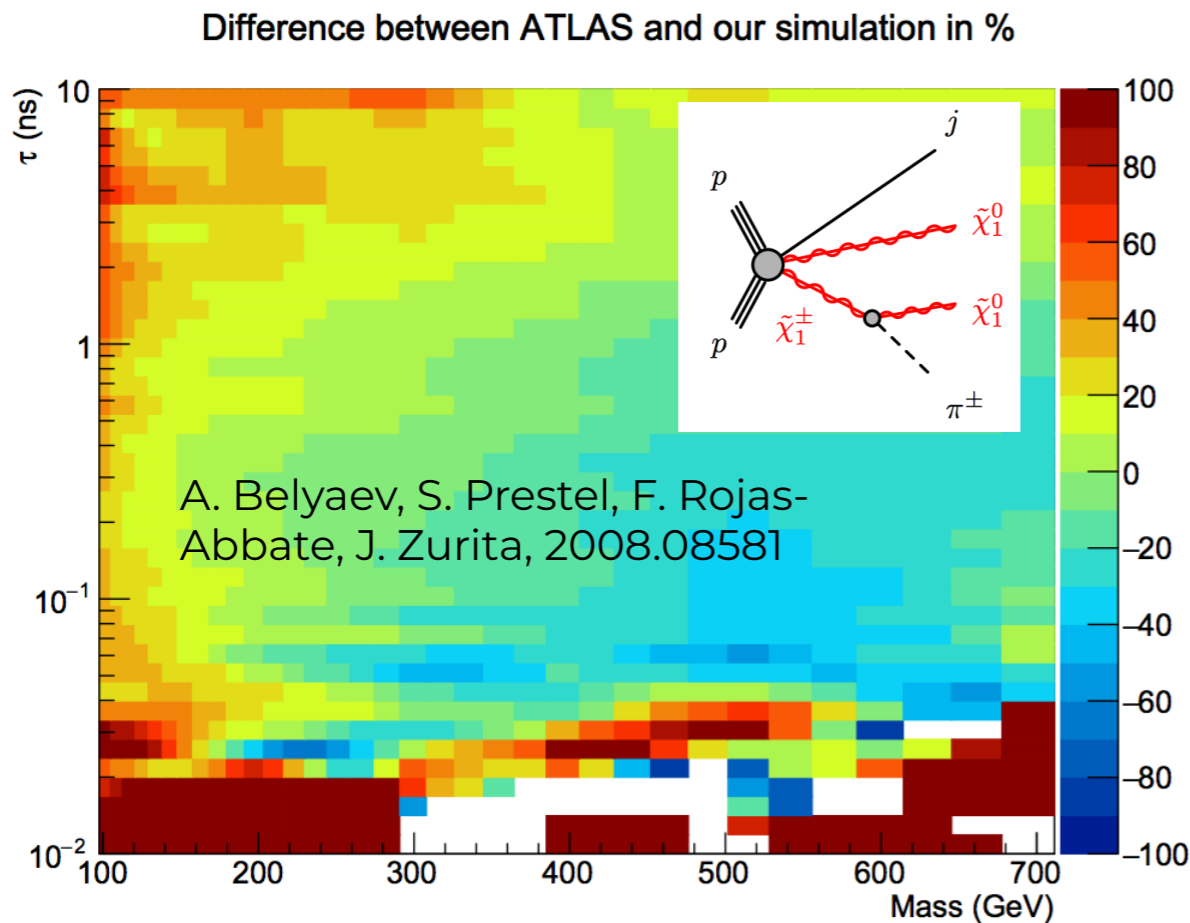
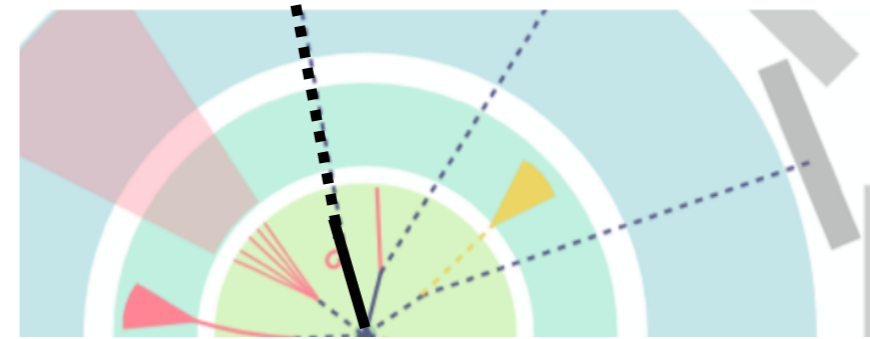
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plot provided by S. Kulkarni

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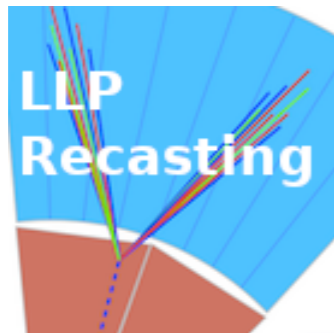
- How model independent are the efficiencies provided?
- Recasting prescriptions seem to fail for the gluino topology

Recasting Repository

- Recasting repo @ GitHub: github.com/llprecasting/recastingCodes
 - contains most of the results presented here (+ recasting code)
 - special branch for this workshop: [LLPworkshop2020](#)
 - mailing list: lp-recasting@googlegroups.com

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LLP Recasting Repository

This repository holds example codes for recasting long-lived particle (LLP) searches. The code authors and repository maintainers are not responsible for how the code is used and the user should use discretion when applying it to new models.

Adding your recasting code

This is an open repository and if you have developed a code for recasting a LLP analysis, we encourage you to include it here. Please contact lp-recasting@googlegroups.com and we will provide you with the necessary information for including your code.

Repository Structure

The repository folder structure is organized according to the type of LLP signature and the corresponding analysis and authors:

- [Displaced Vertices](#)
 - [13 TeV ATLAS Displaced Vertex plus MET by ALessa](#)
 - [13 TeV ATLAS Displaced Vertex plus MET by GCottin](#)
 - [8 TeV ATLAS Displaced Vertex plus jets by GCottin](#)
- [Heavy Stable Charged Particles](#)
 - [8 TeV CMS HSCP](#)
 - [13 TeV ATLAS HSCP](#)
- [Disappearing Tracks](#) NEW

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Many interesting studies are making use of LLP analyses!
(or urgently need to recast them!)

WG Kickoff

- Possible topics for discussion:
 - Hands-on discussion about specific analyses:
 - HSCPs, DV+MET, DT,
 - Using Delphes output for LLP recasting?
 - How to improve the communication between the pheno/experimental communities (GitHub tickets, mailing list,...)
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