Kinematically Weighted Event Generation for Compressed Spectra

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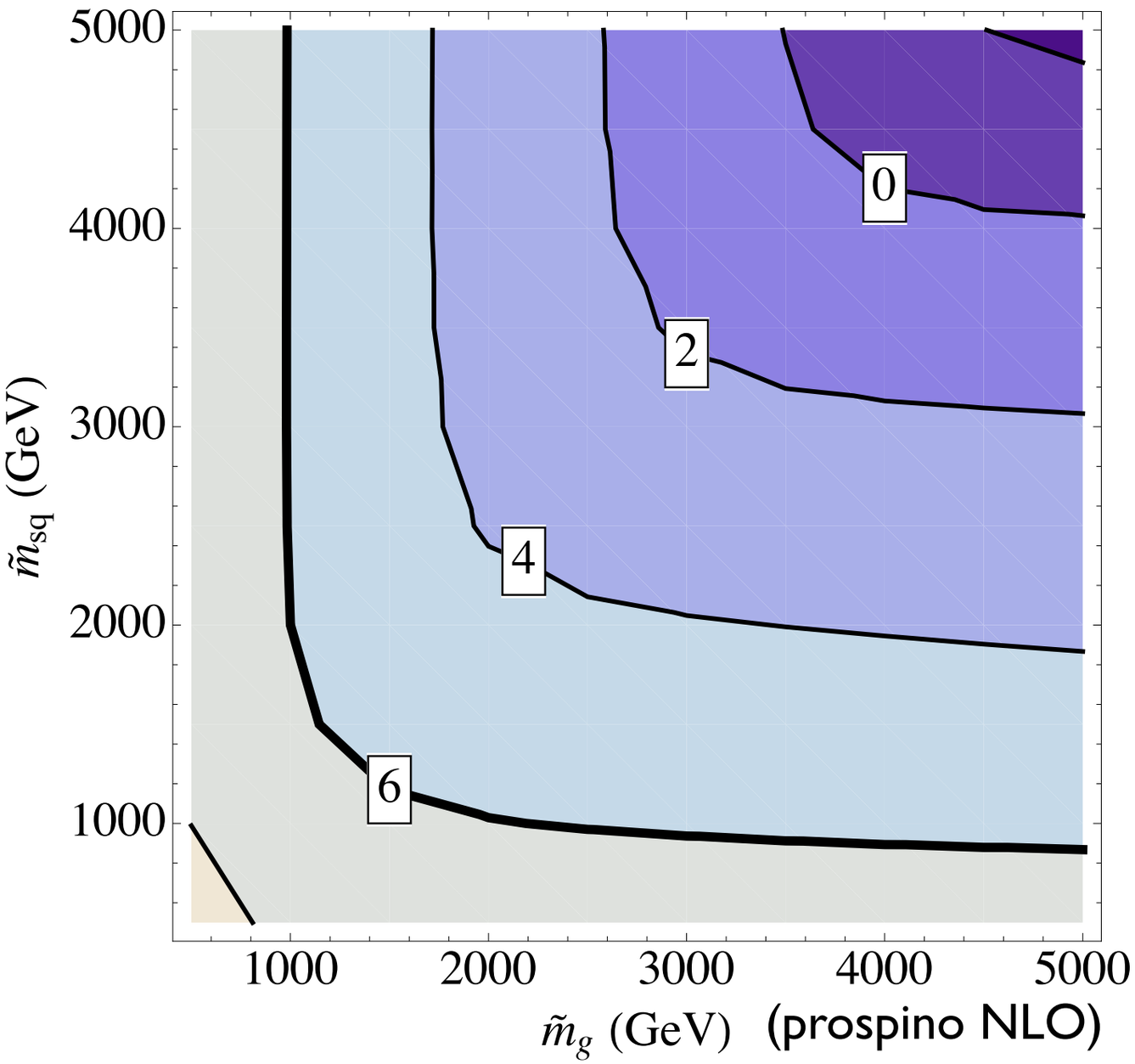
Snowmass 2013 - Brookhaven Energy Frontier Workshop

w/Jay Wacker (SLAC) and Timothy Cohen (SLAC)

MC and Luminosity

LHC 13 TeV, 3000 fb^{-1}

$$pp \to \tilde{q}\tilde{q},\ \tilde{q}\tilde{q}^*,\ \tilde{g}\tilde{q}^{(*)},\ \tilde{g}\tilde{g}$$



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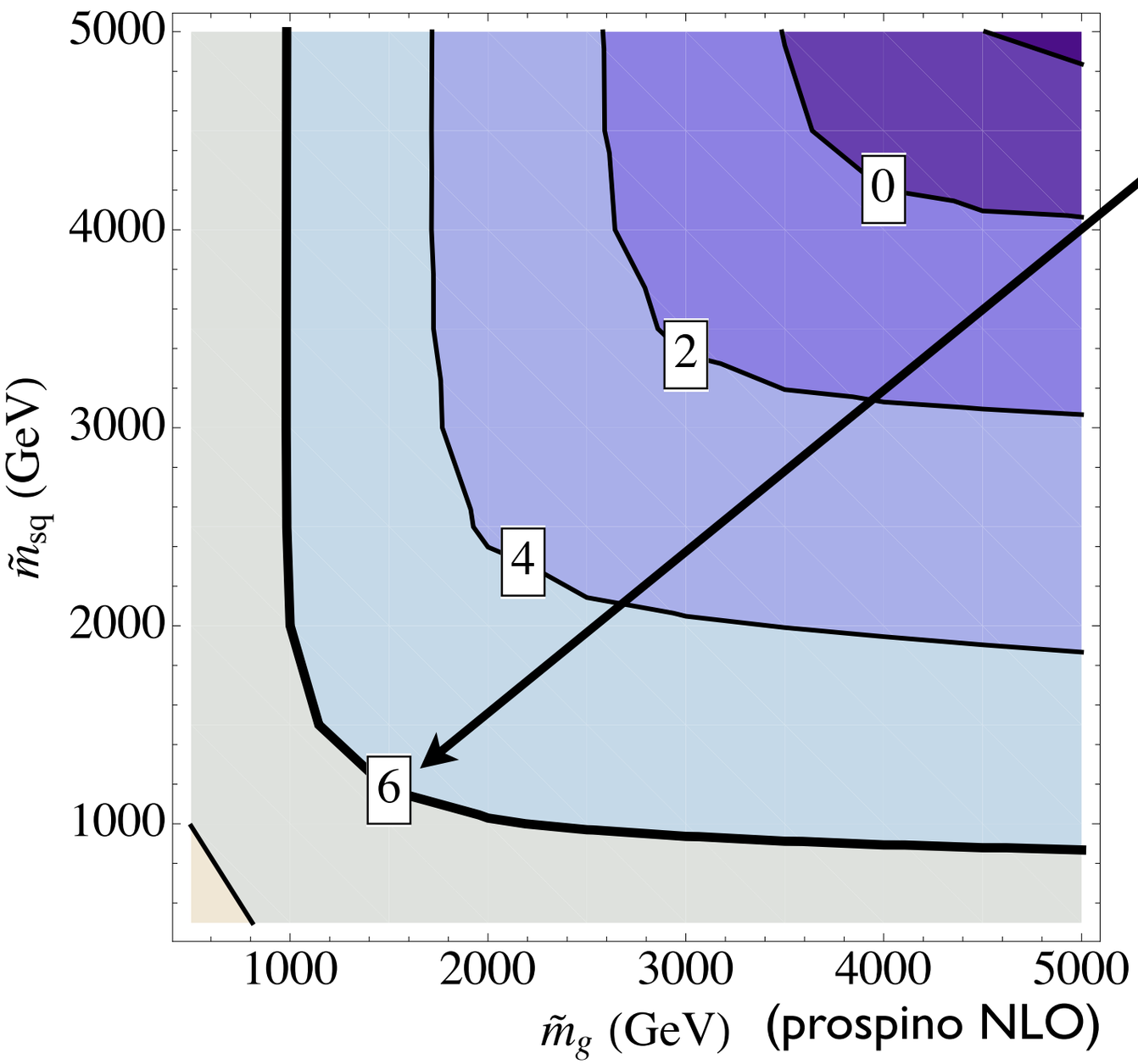

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1 million events per point!

$$\tilde{m}_g \sim \tilde{m}_q \sim 1.5 \text{ TeV}$$

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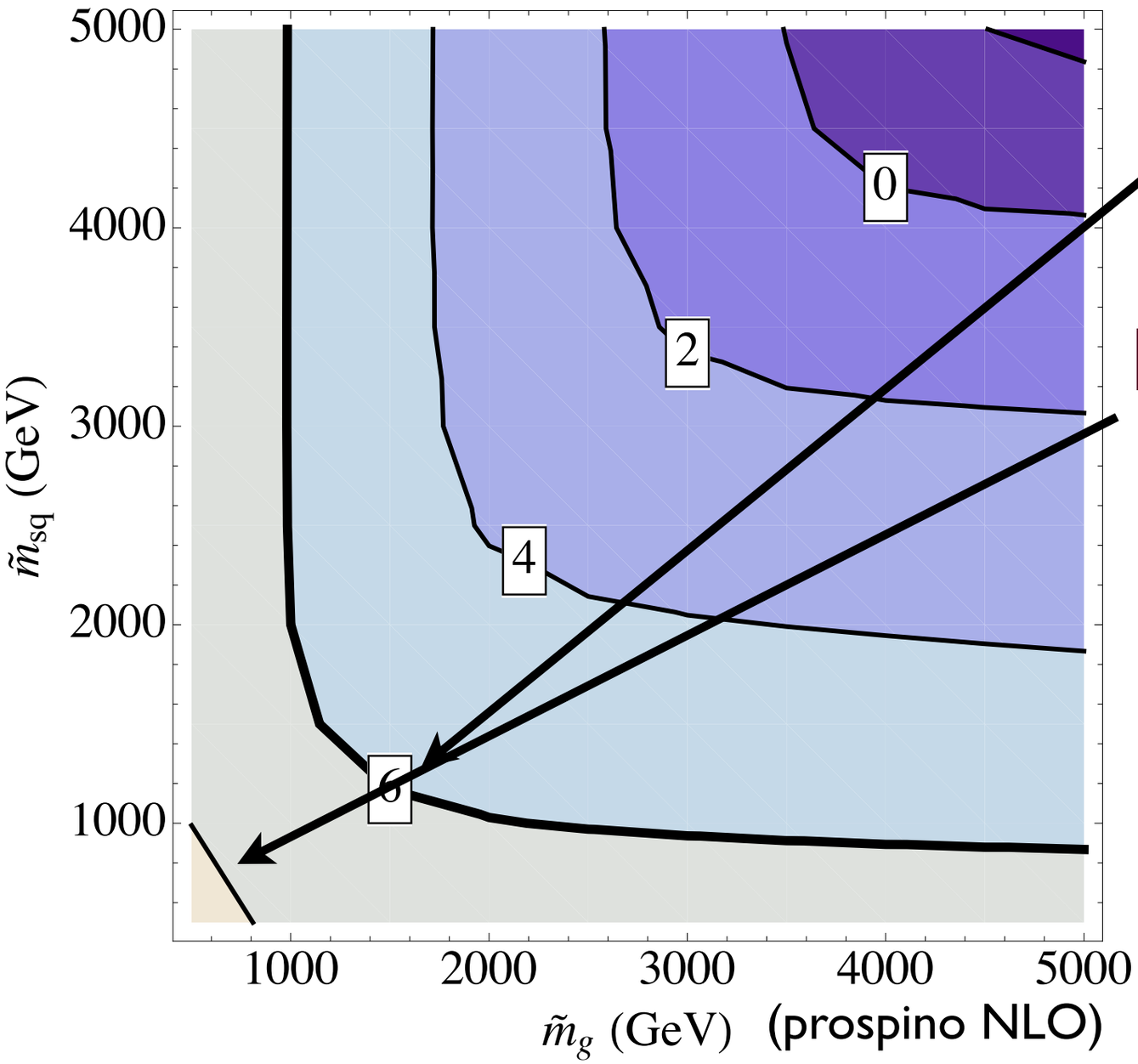

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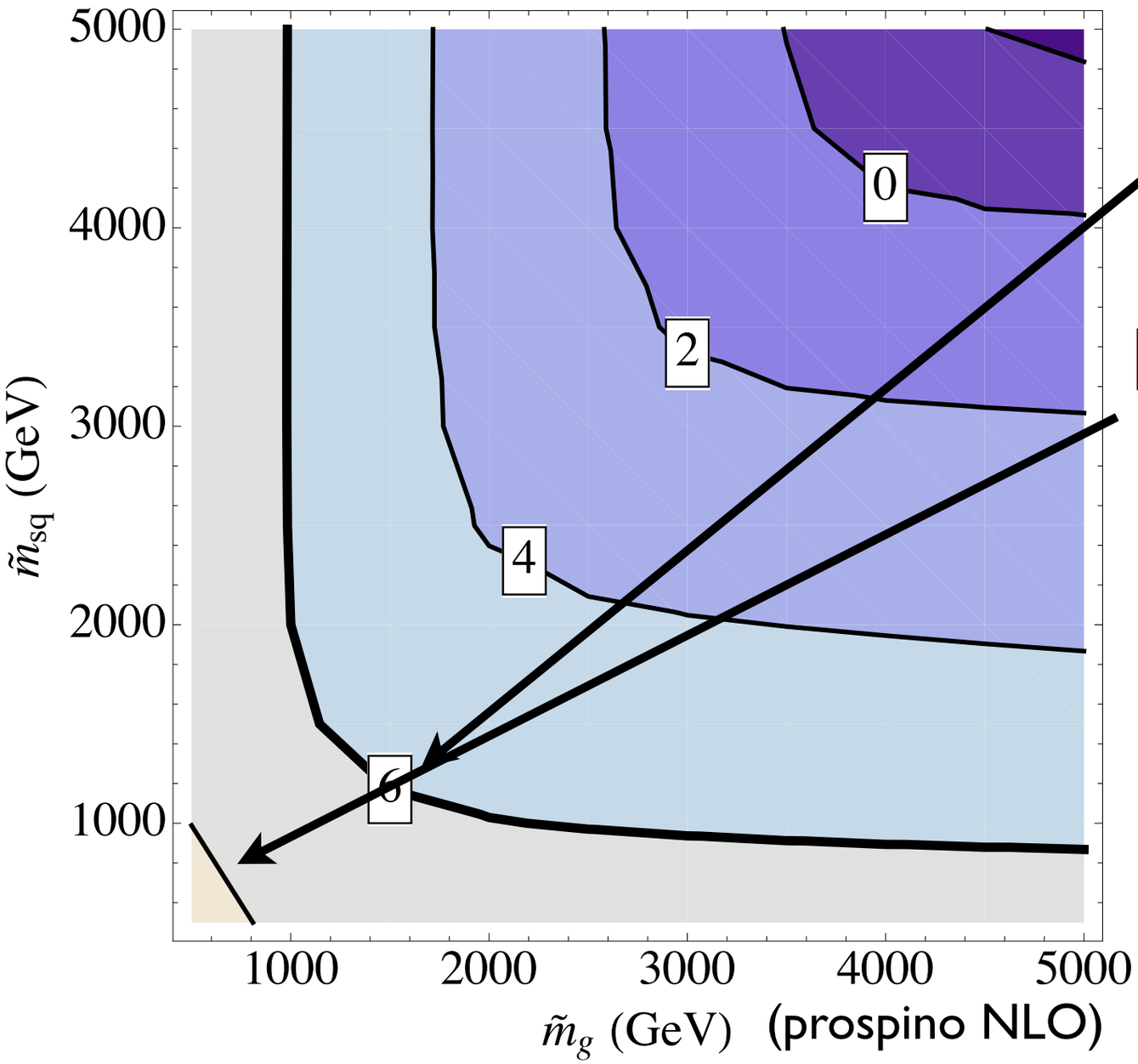

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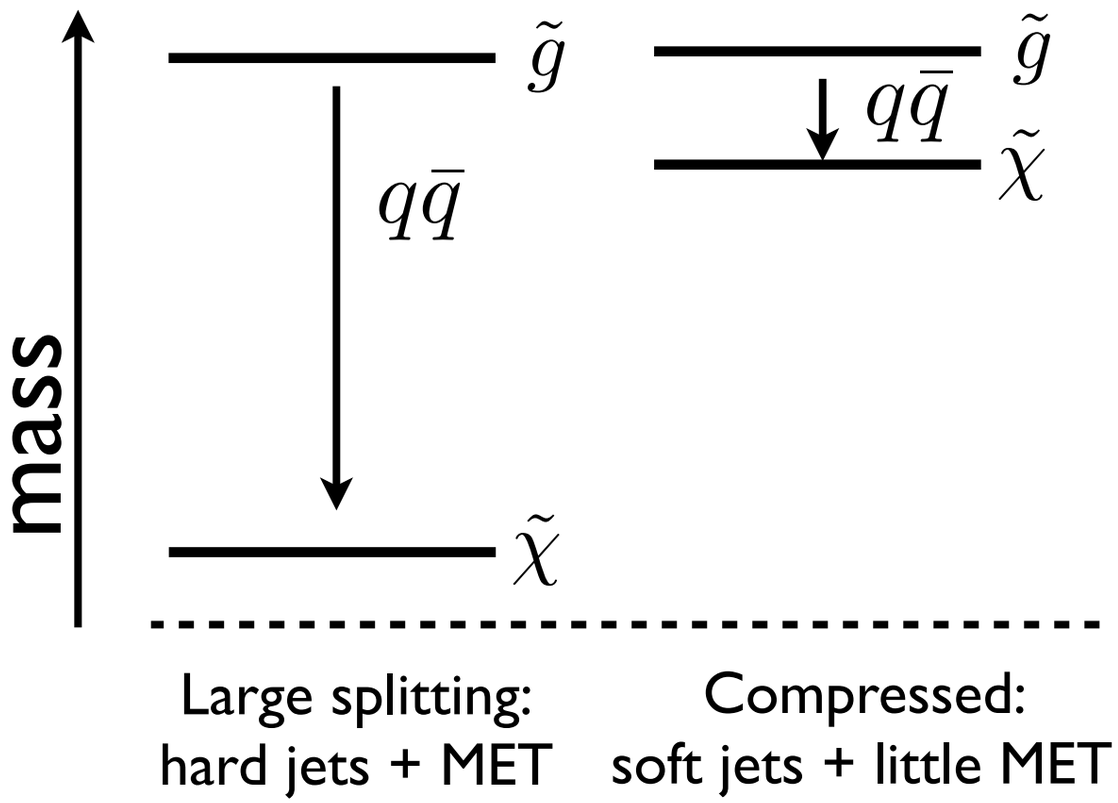
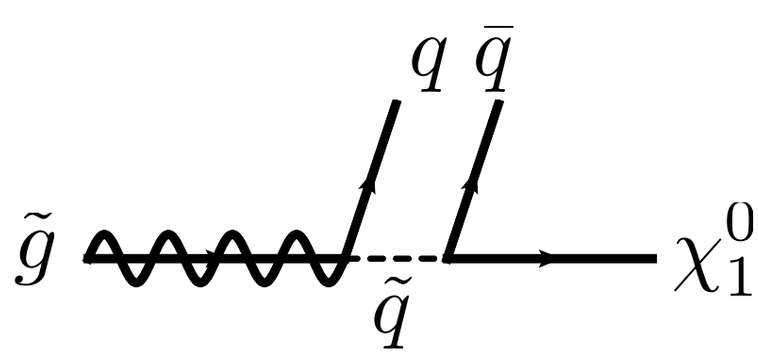
High luminosity

+ colored production

High statistics samples

Compressed Spectra Example - gluino 3-body





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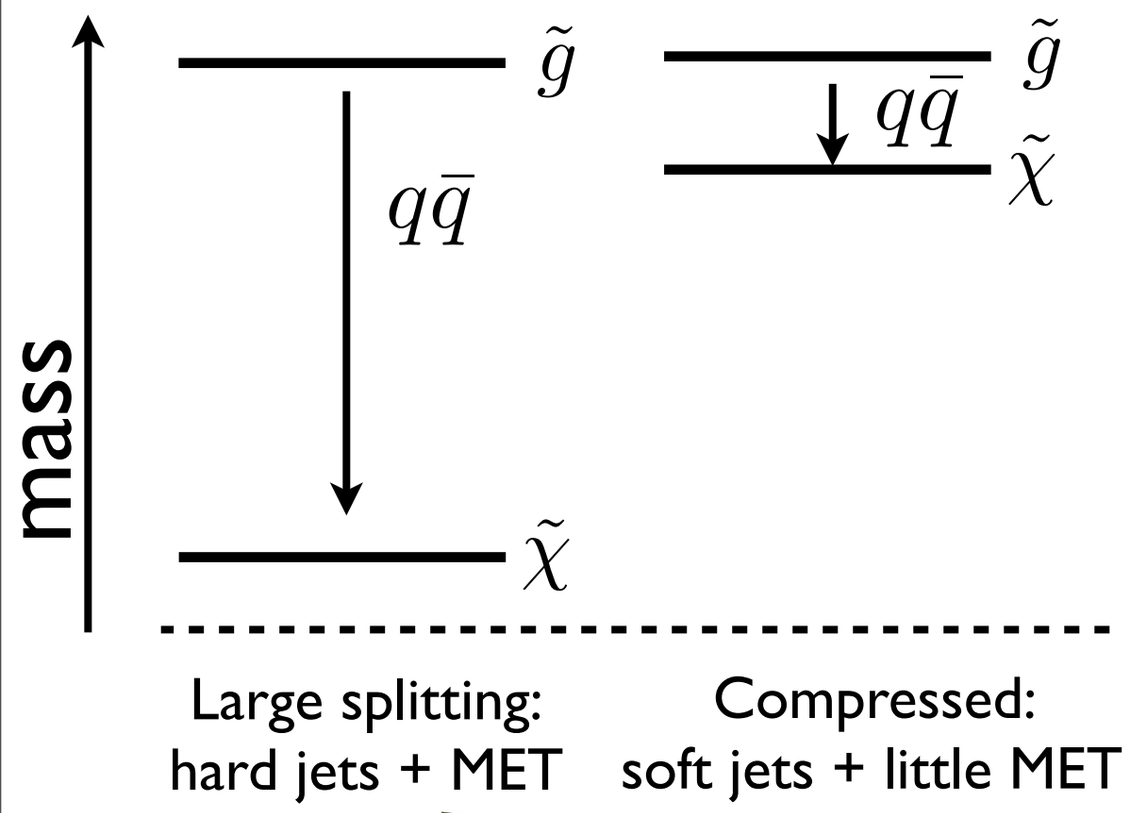
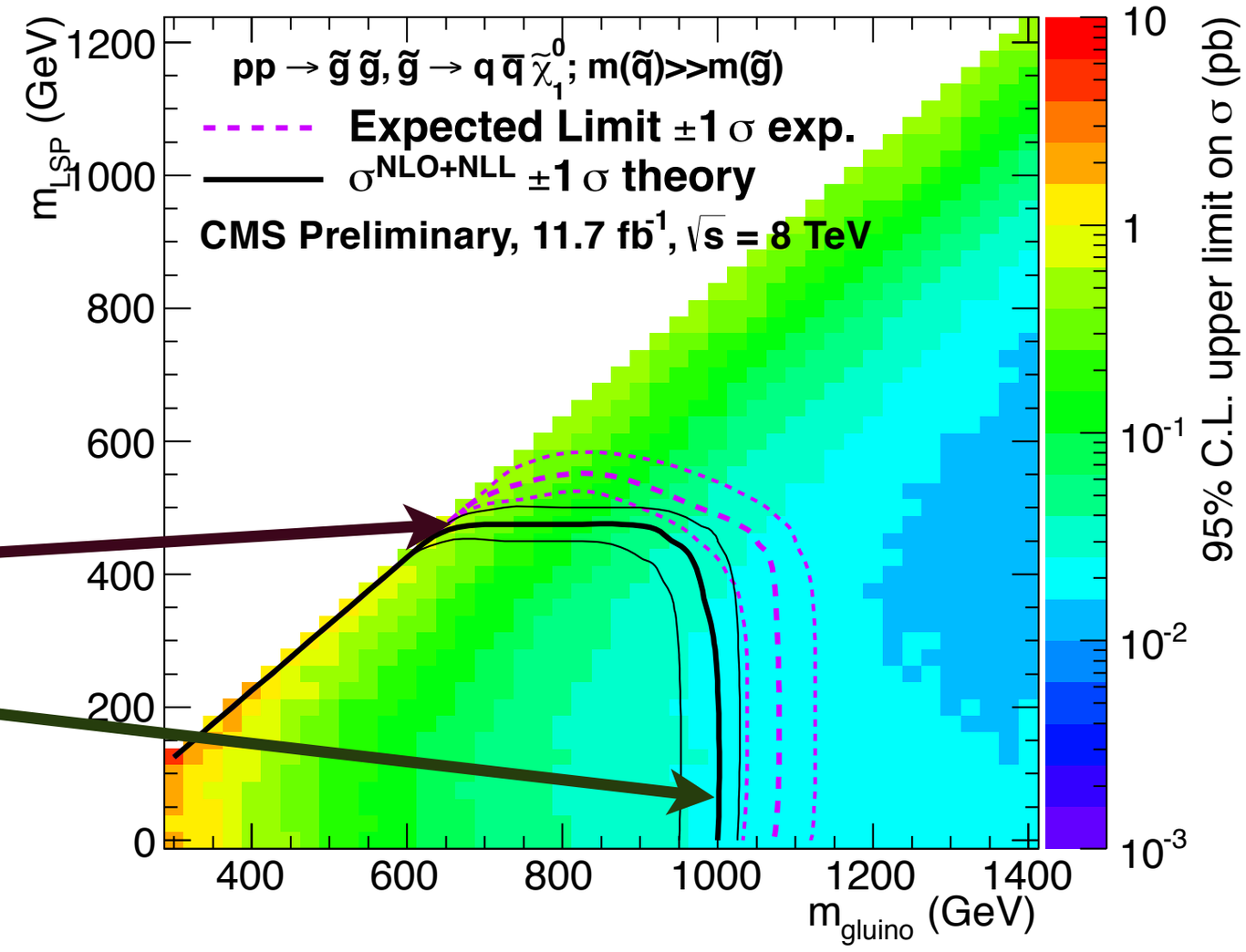
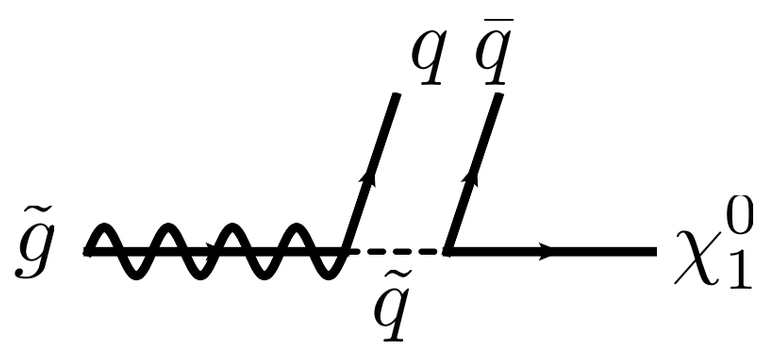


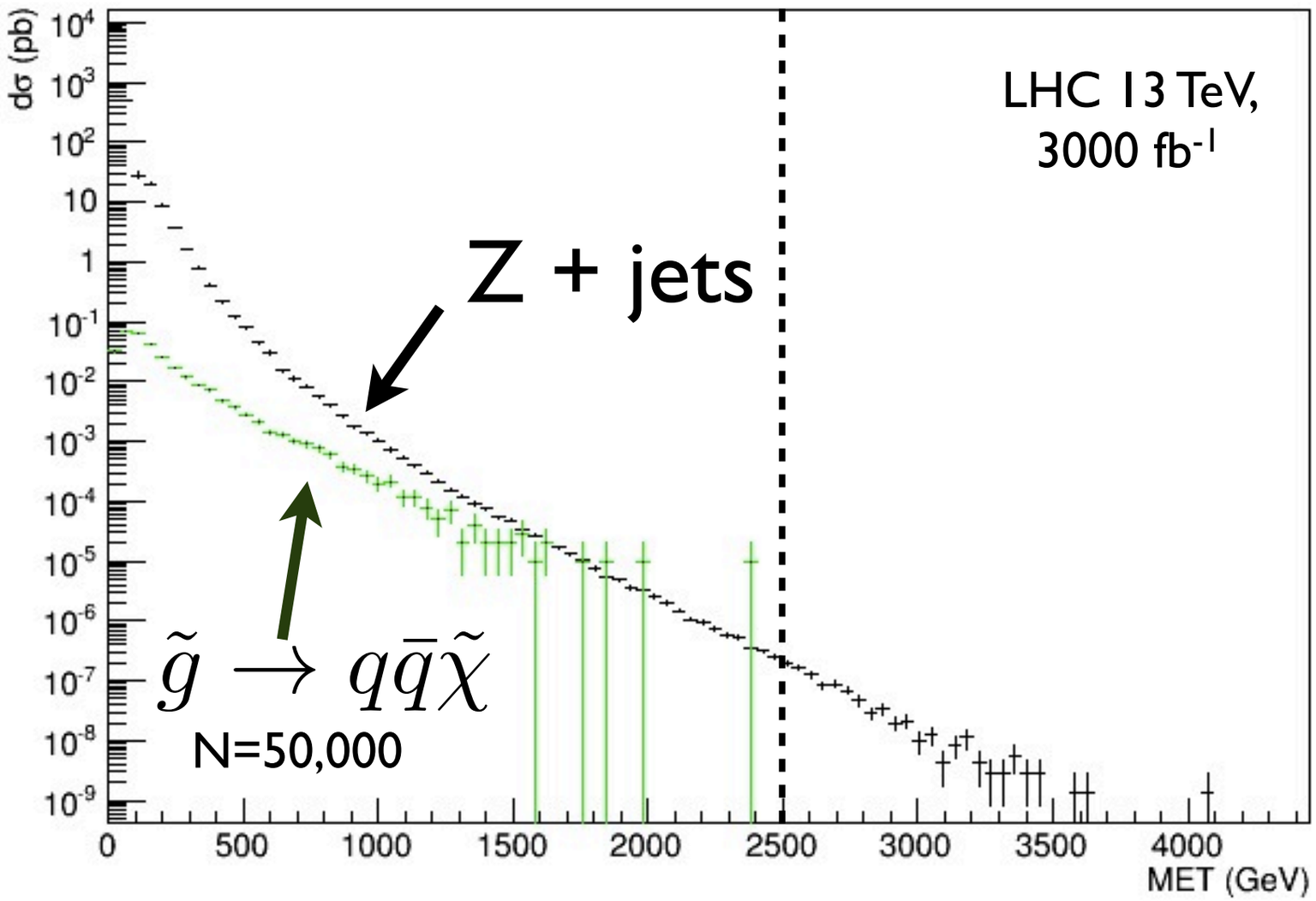




- CMS-PAS-SUS-12-028

Signal vs. Background

$\tilde{m}_g = 1000\ \mathrm{GeV}, \tilde{m}_\chi = 900\ \mathrm{GeV} \quad (\sigma = 0.3\ \mathrm{pb})$



How to get MC statistics at high luminosity?

Generate more events?

10 models

X 10 kinematic points

X 10^7 events

= 1 billion events

Weighted events!

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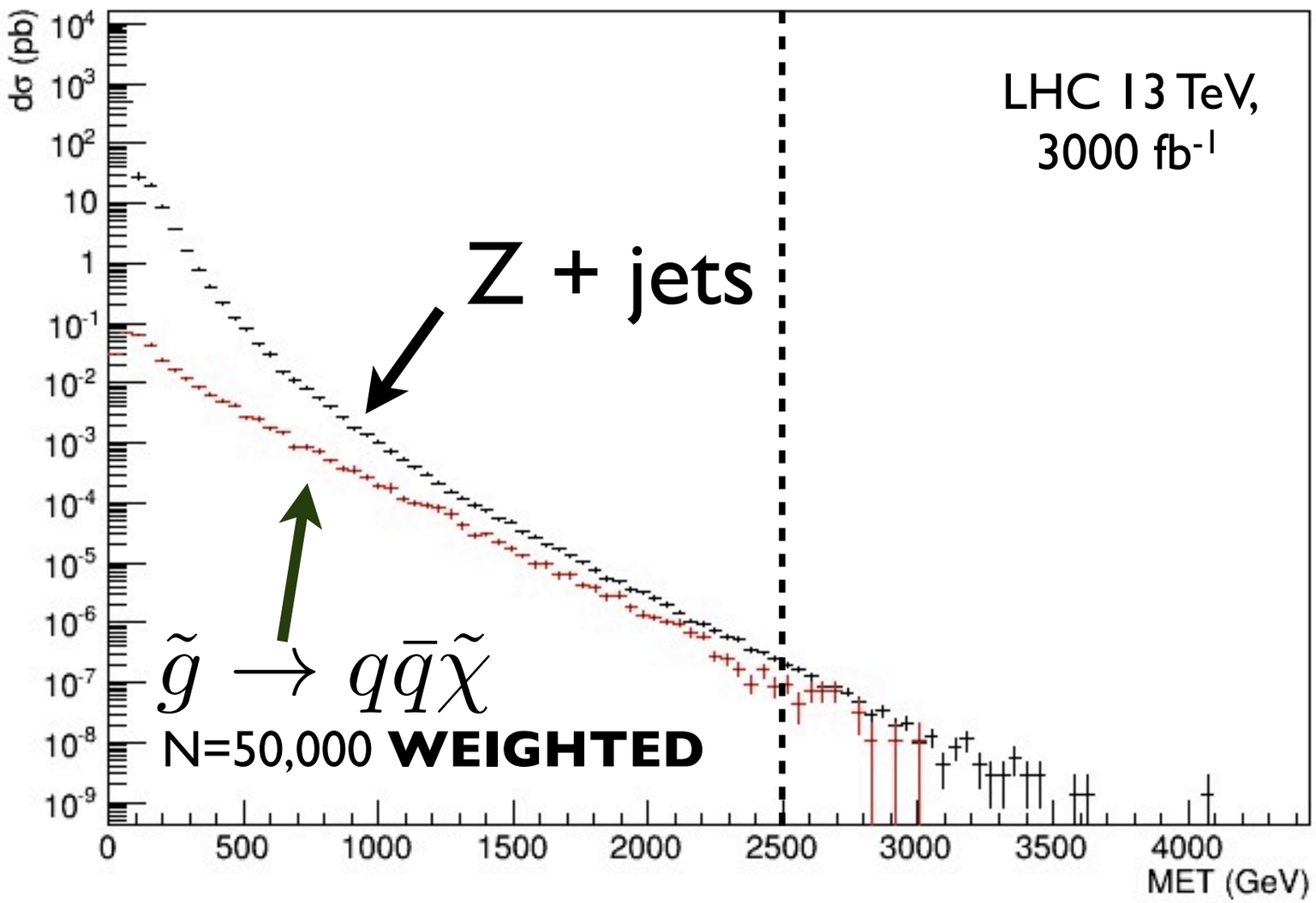

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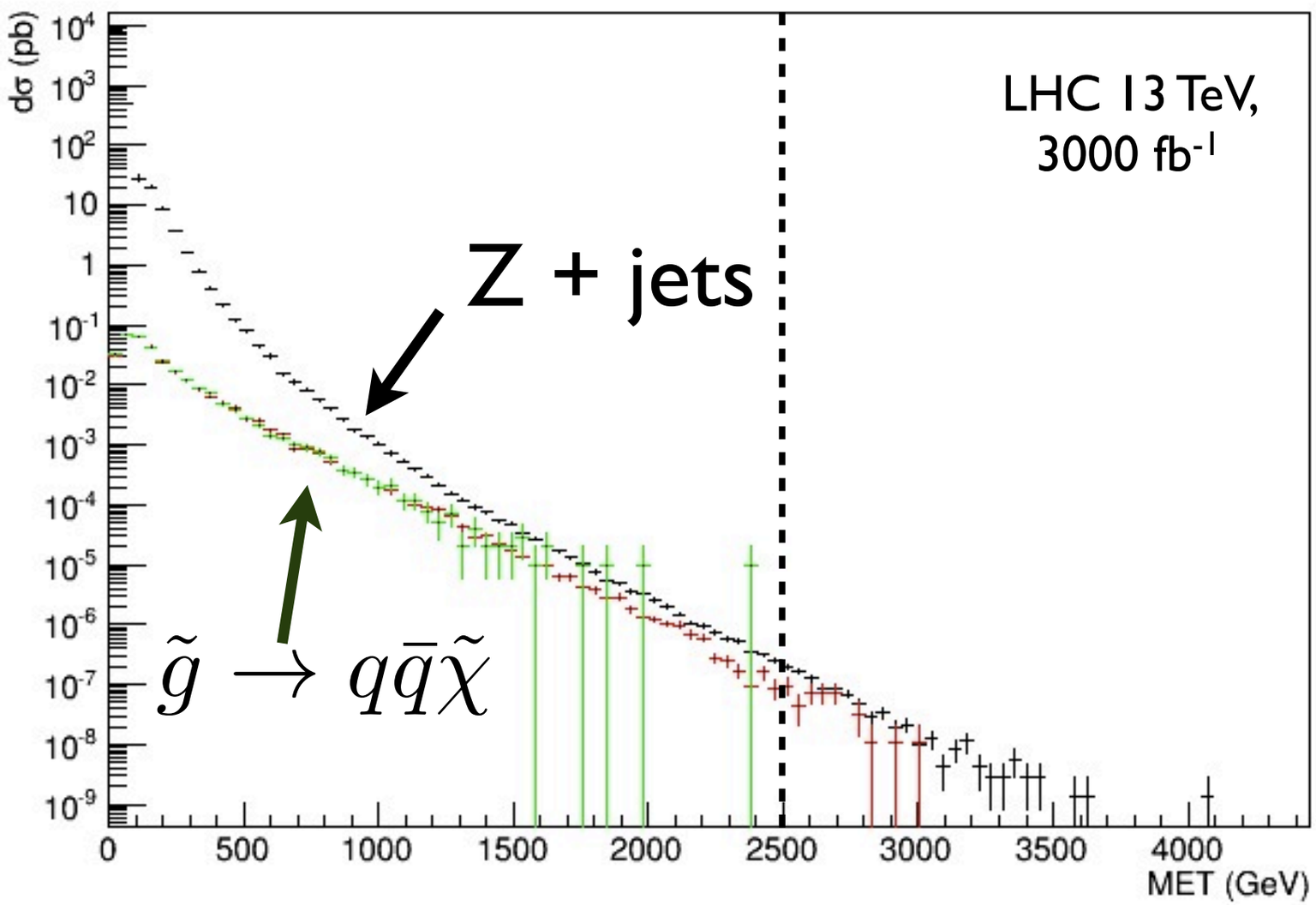

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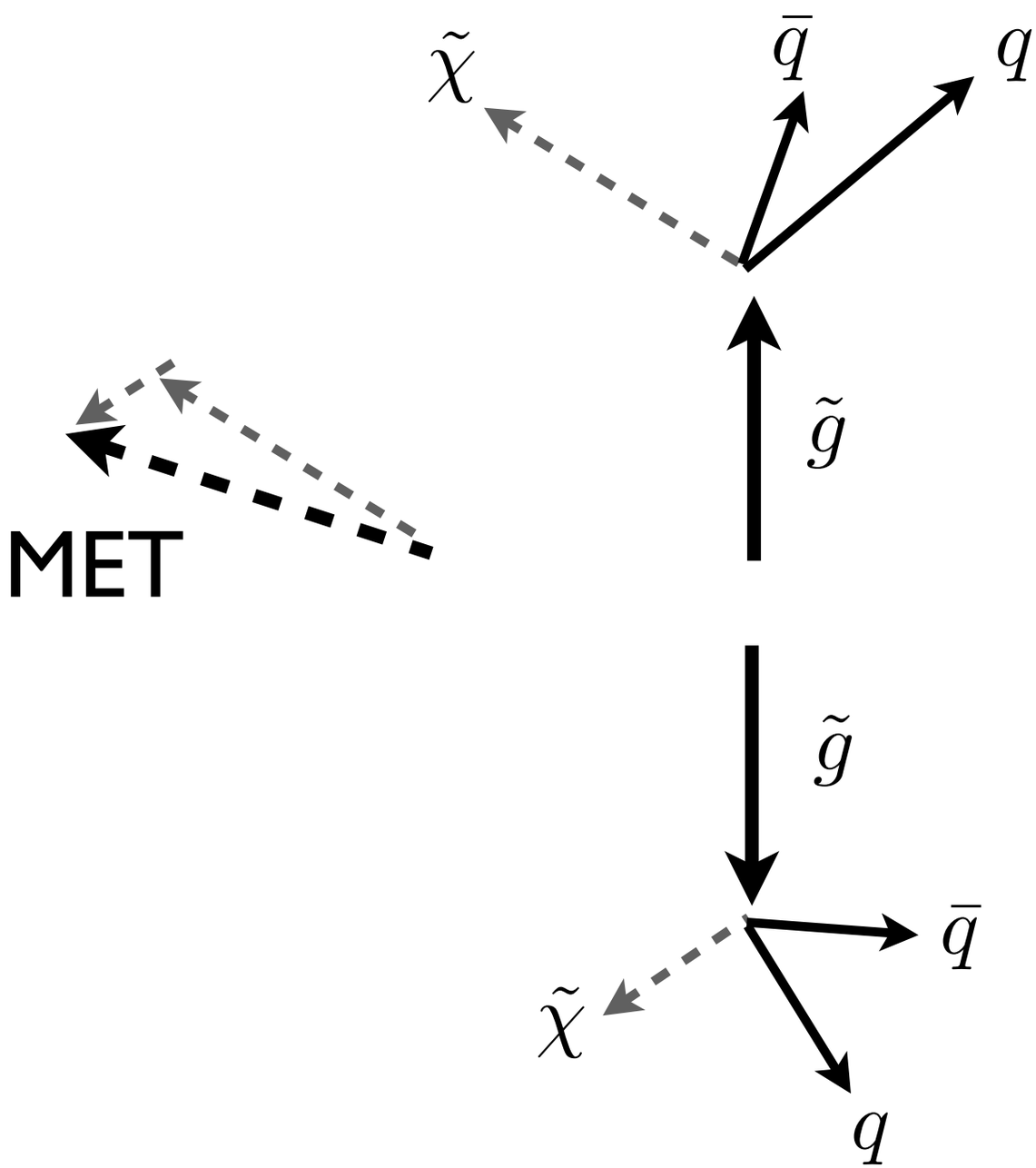
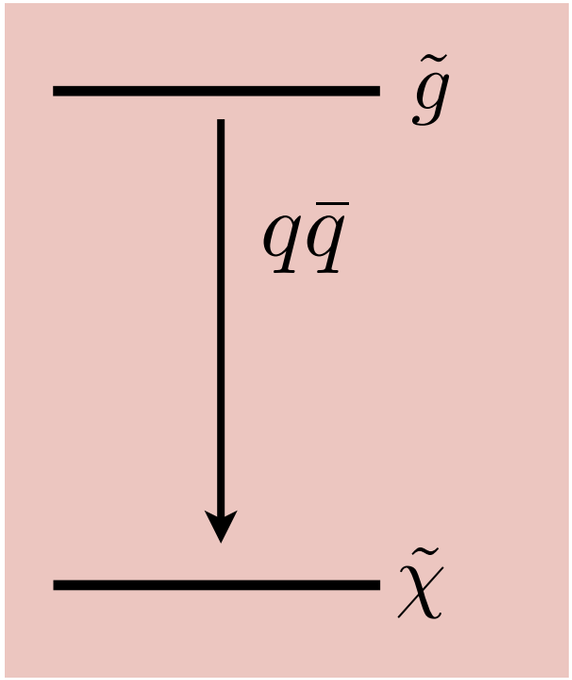


large splitting



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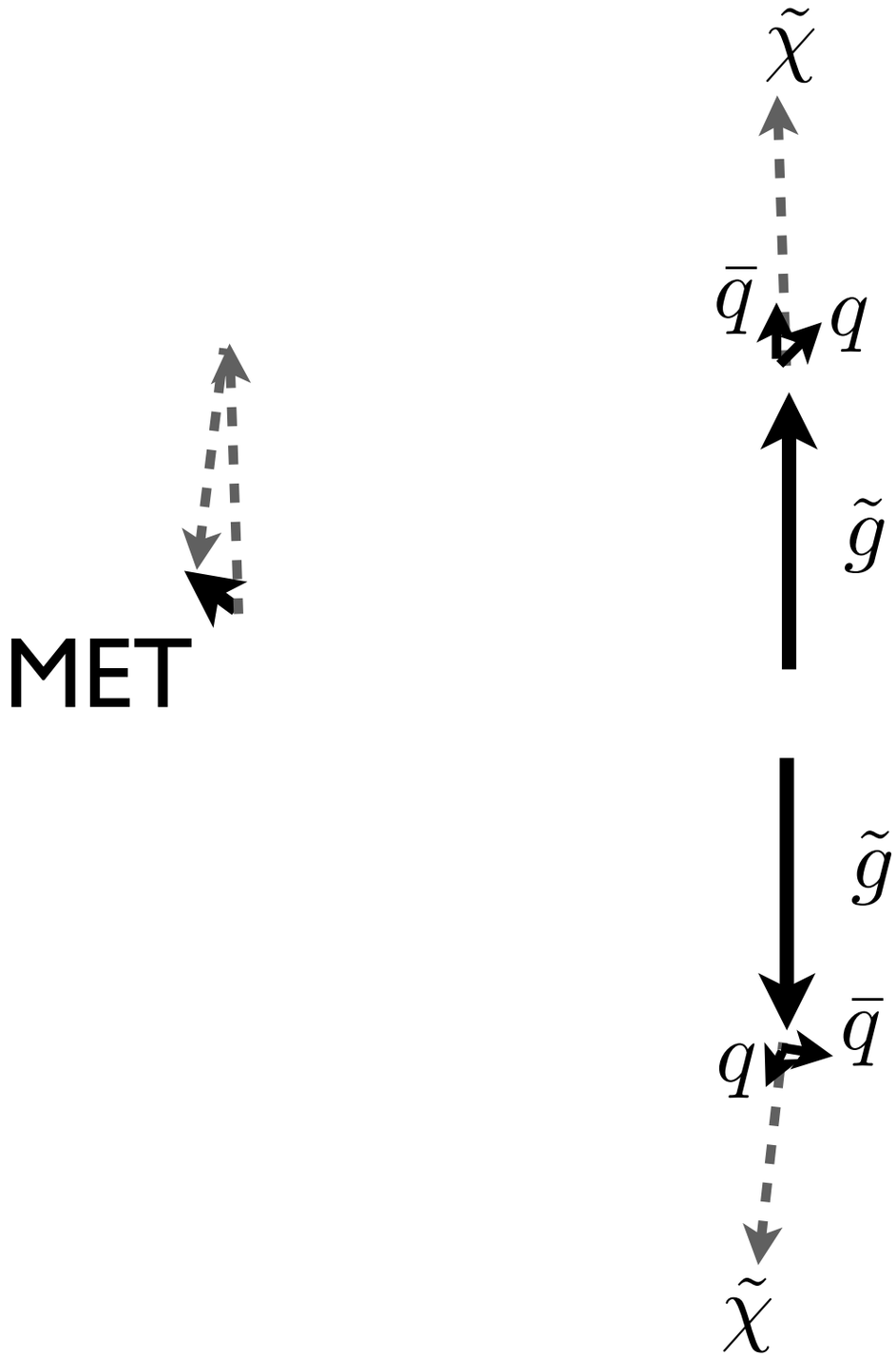

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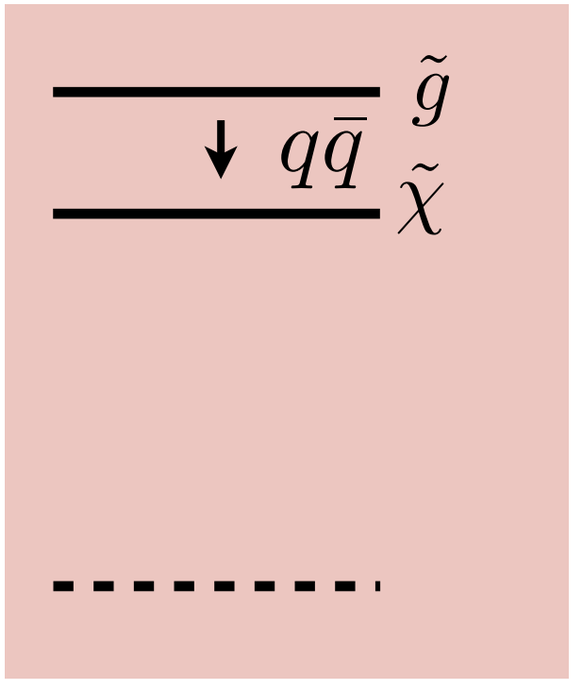

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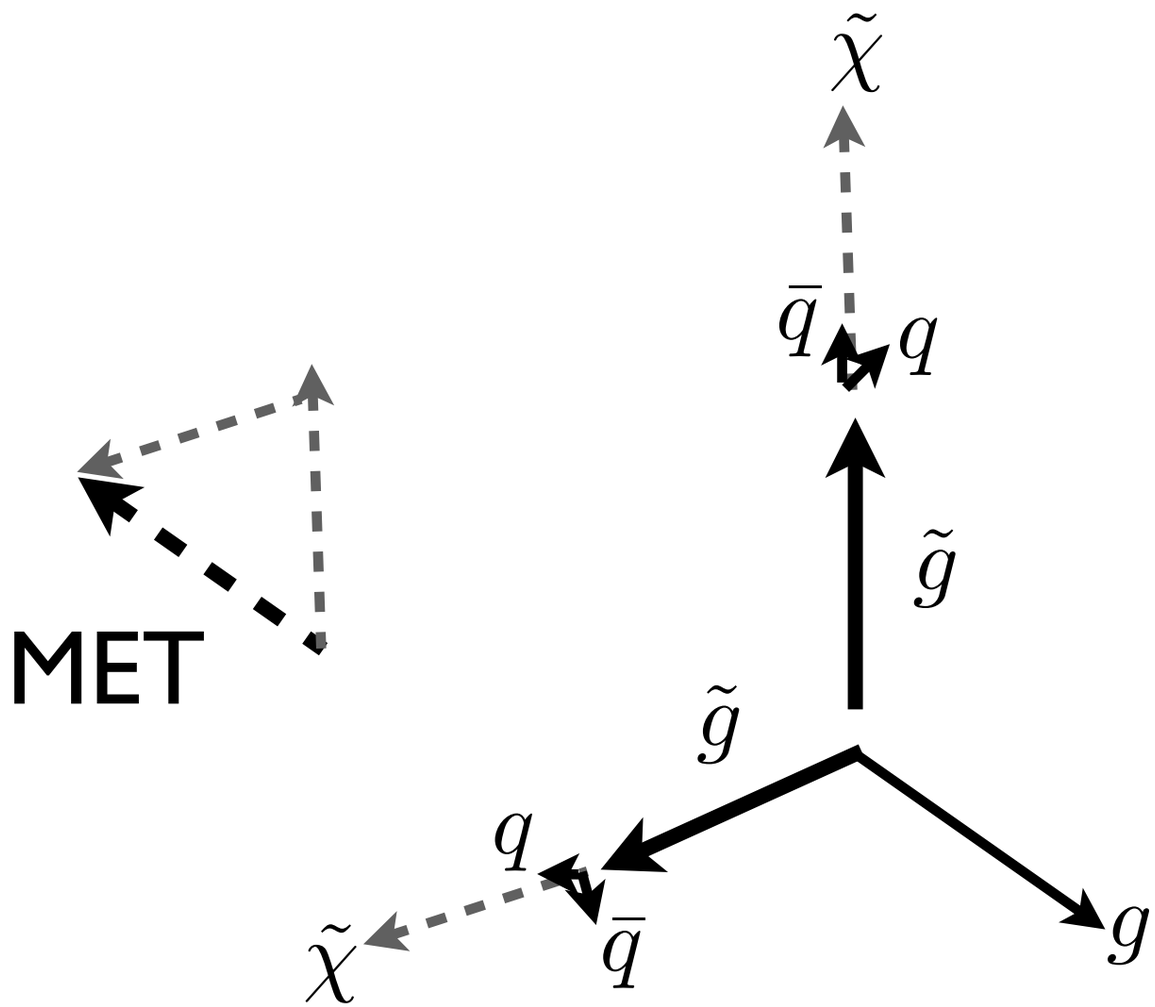

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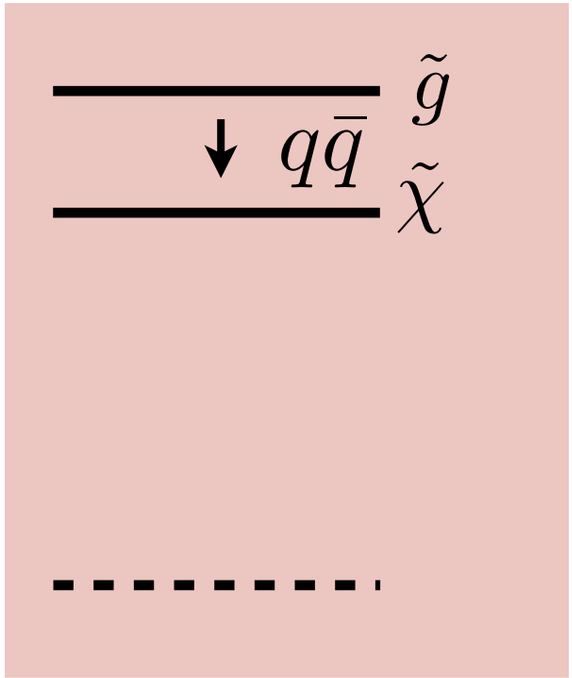

+ recoil ISR/FSR

Weighted event generation

Goal: Generate events in appropriate bins of jet recoil momentum (in practice, HTJ)

Procedure: *(see http://www.stanford.edu/~timcohen/WeightedEventsUsingMadgraph.pdf)*

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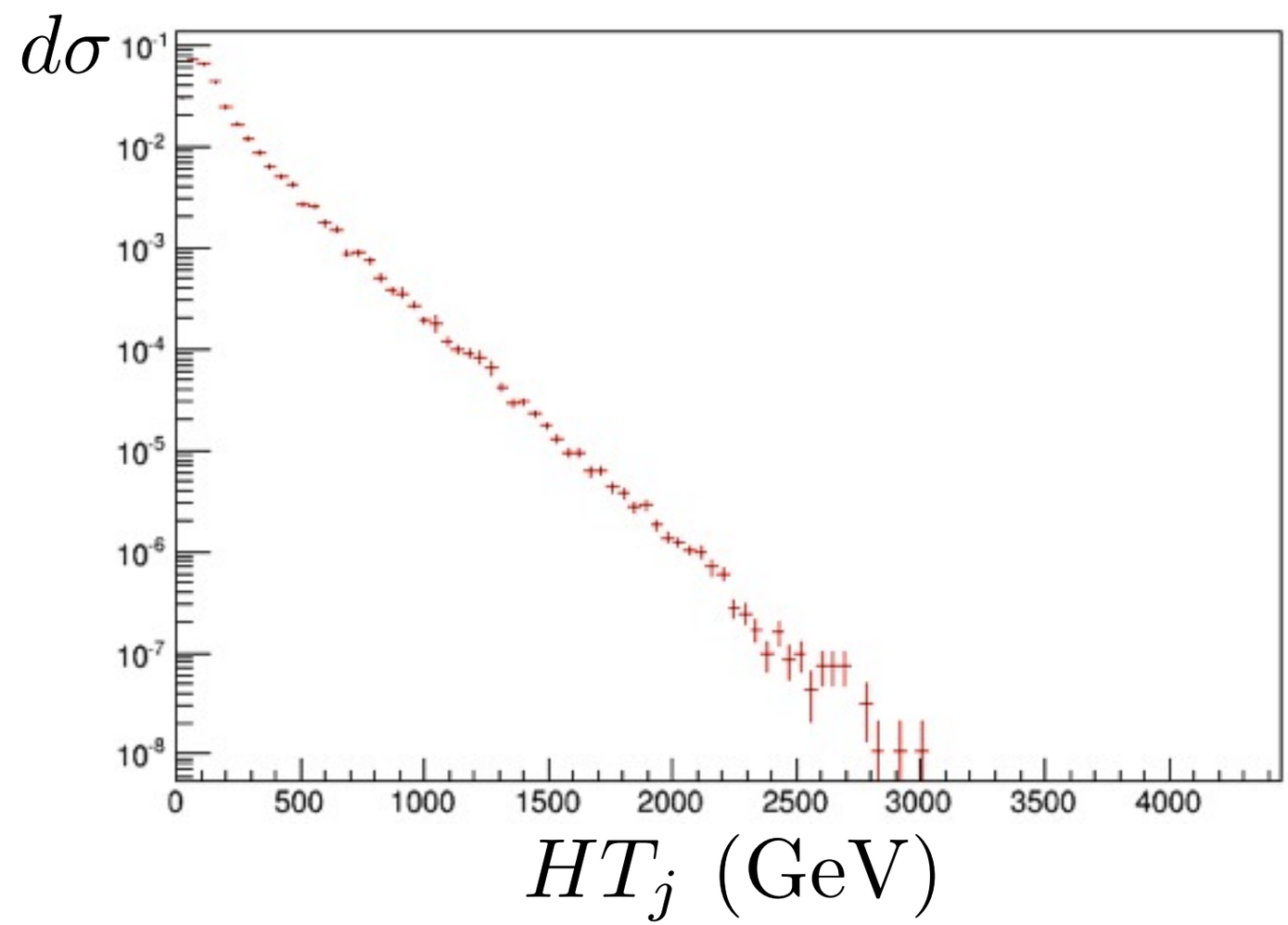

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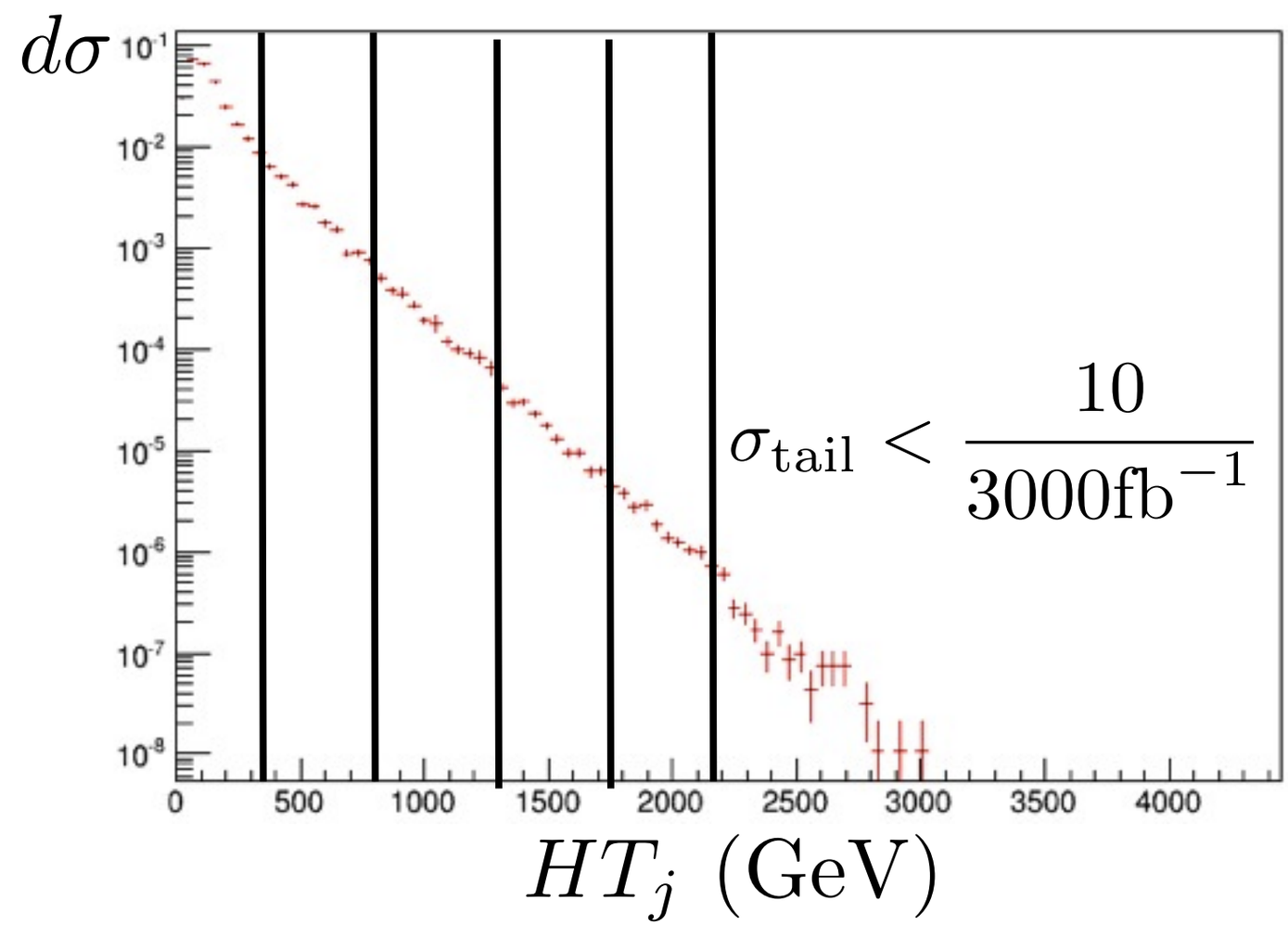

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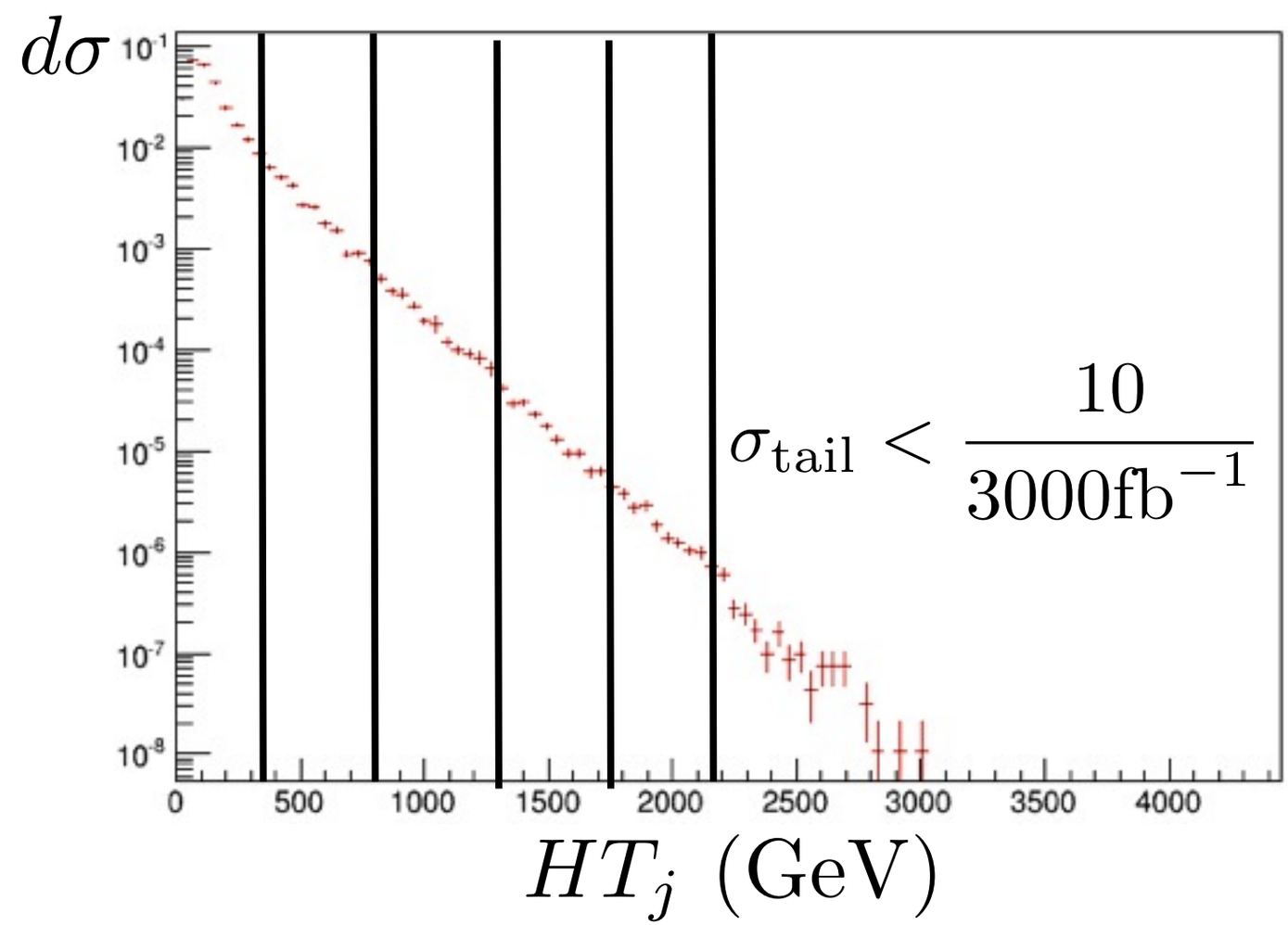

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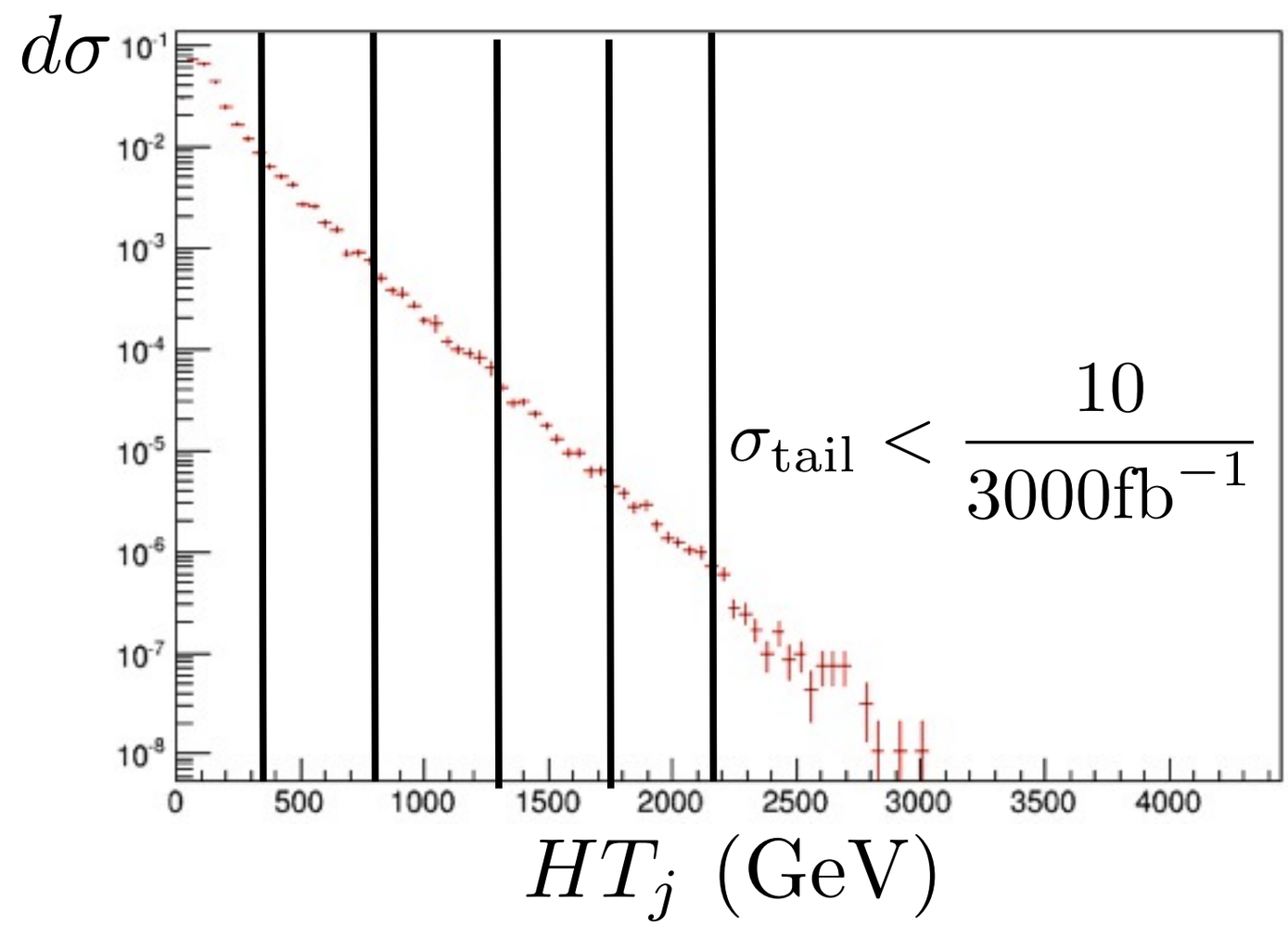
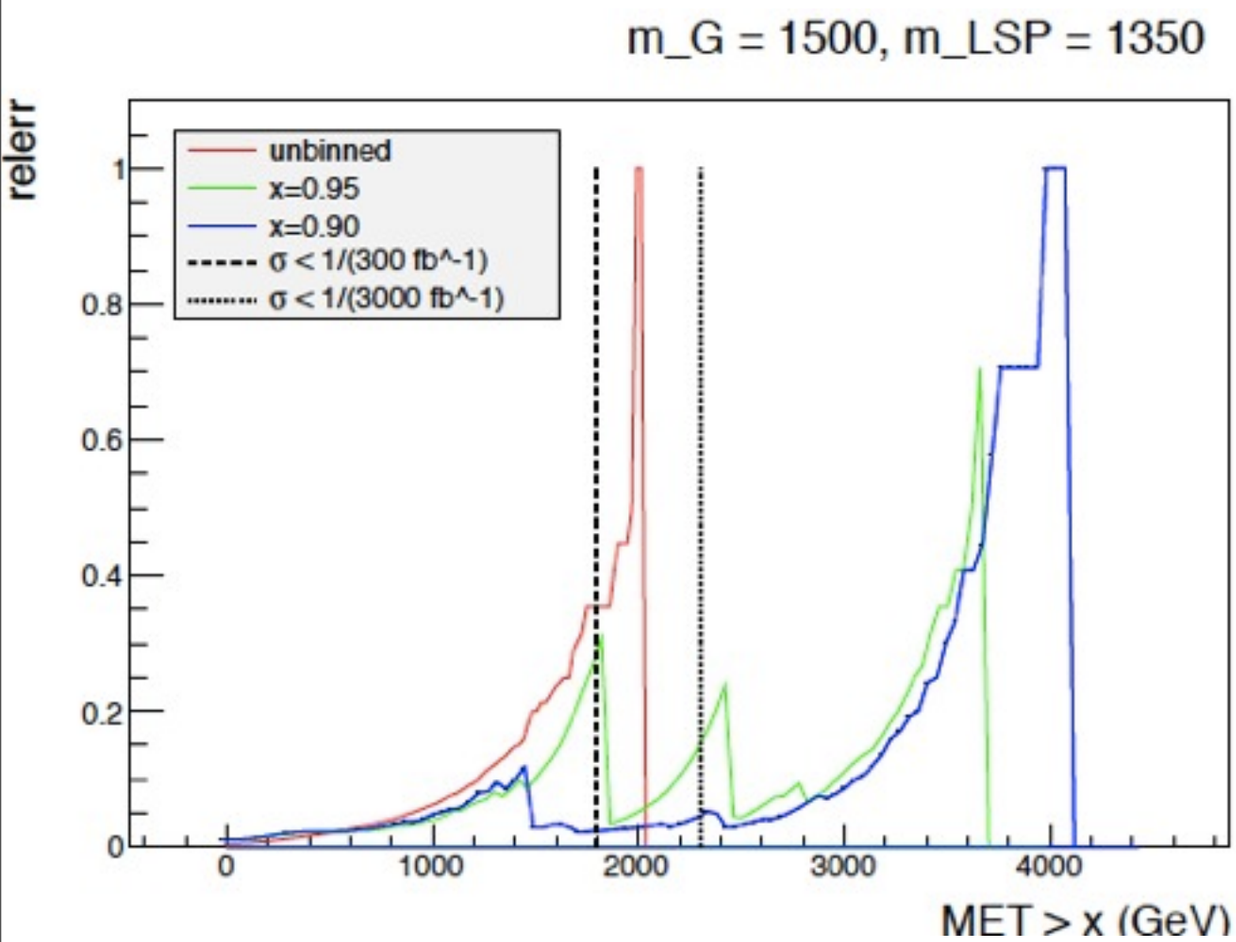
4) Reconstruction and combine with weights

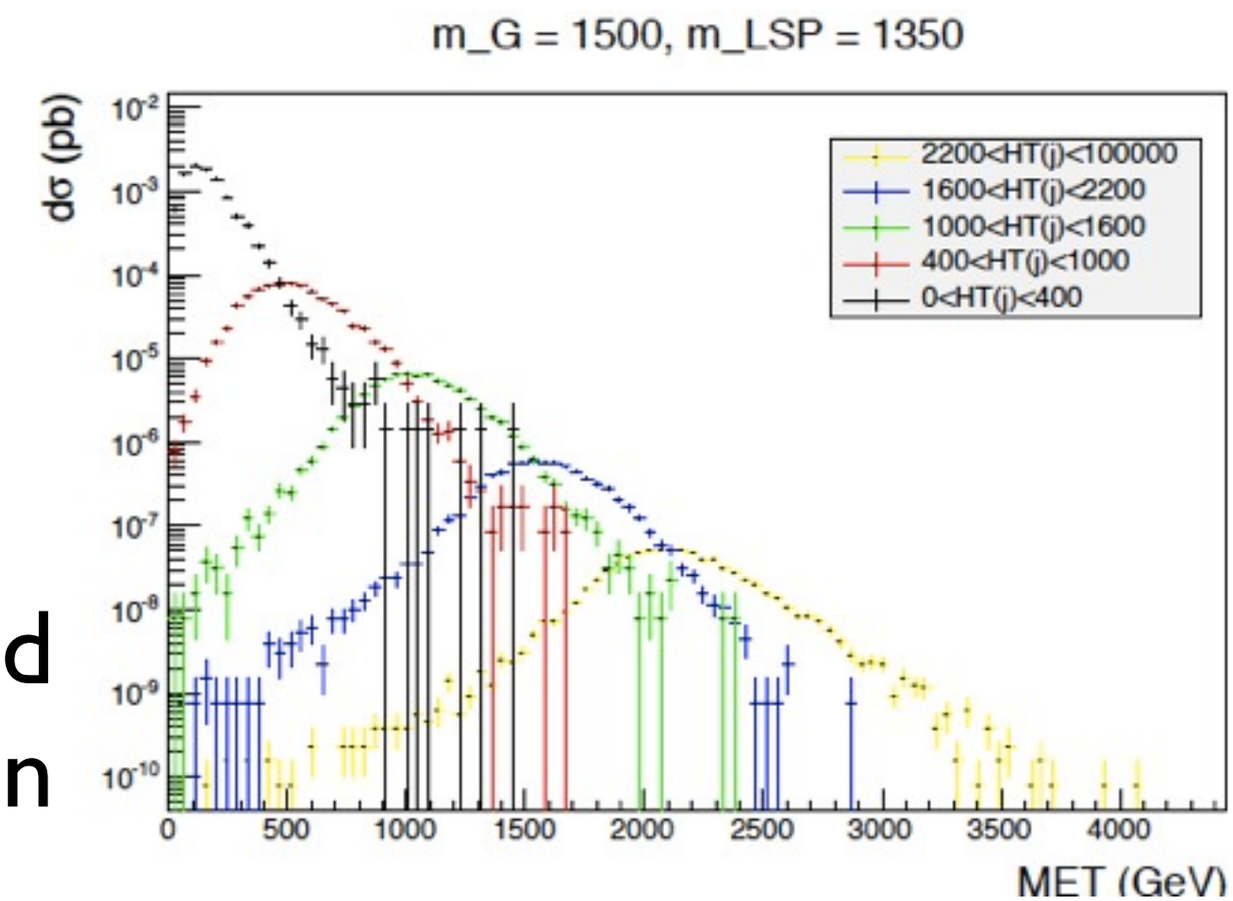


Performance - compressed



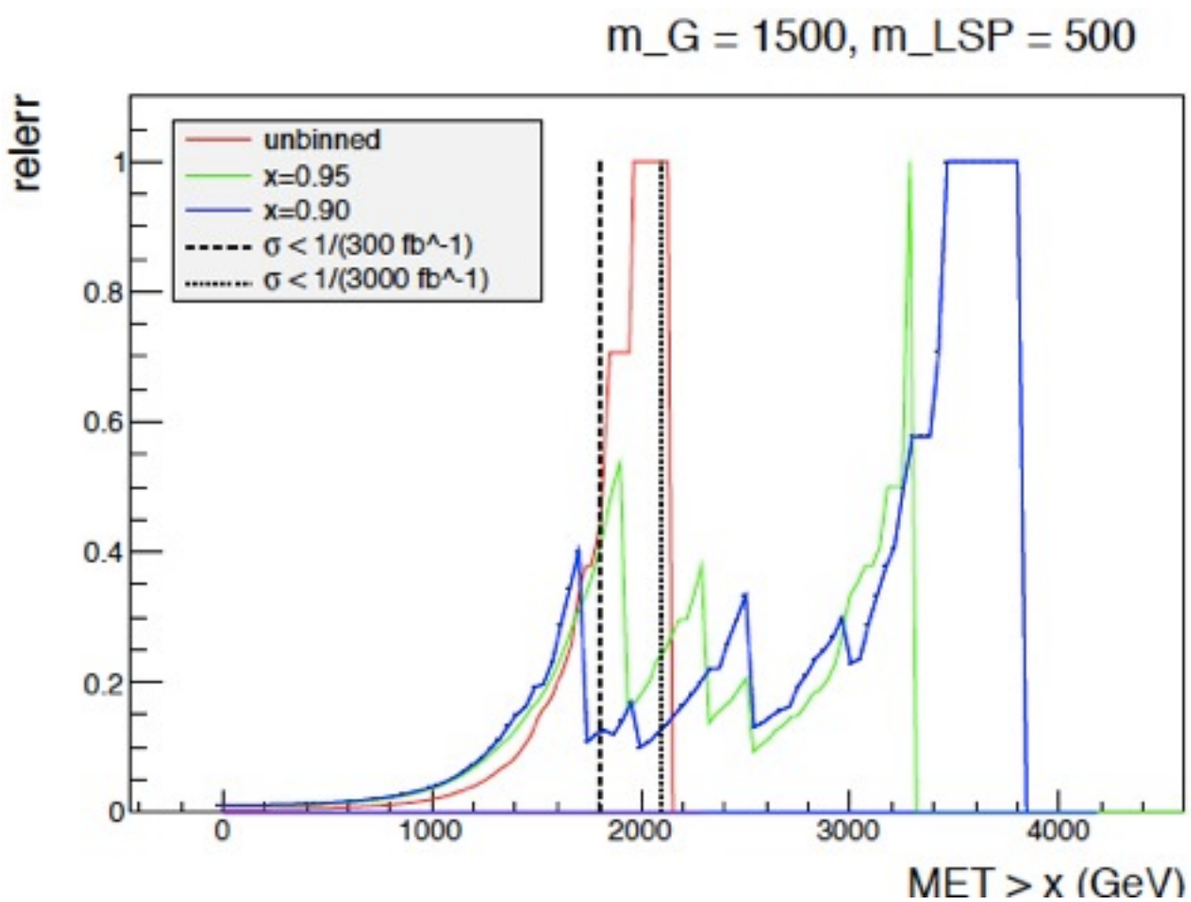
Relative error

$$\sqrt{\sum w_i^2}/(\sum w_i)$$



binned
MET distribution

Performance - large splitting



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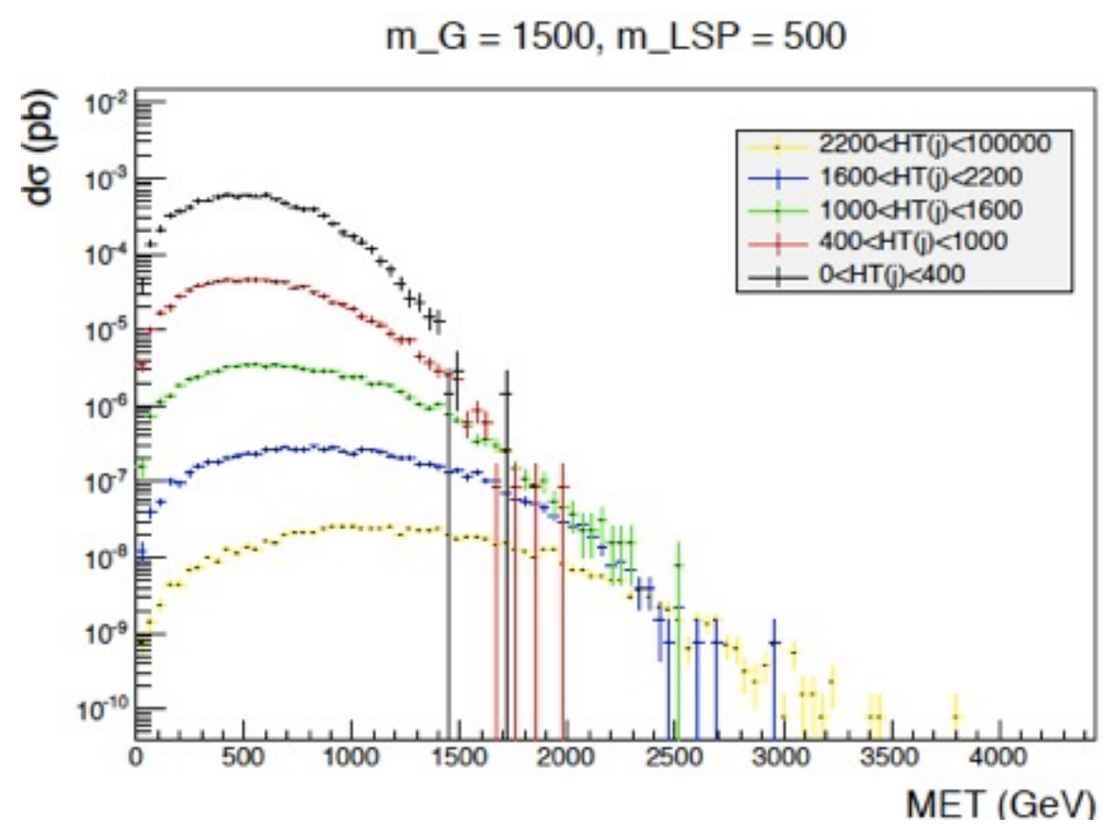

Conclusions

- Weighting used for SLAC group Snowmass Simplified model scans
  (see earlier talk and
  http://www.stanford.edu/~timcohen/SimplifiedModelsForSnowmass.pdf)
- Provides high statistics MC for interesting kinematic regimes at high luminosity upgrades
- Easily implementable with MG5/Pythia/Delphes

Questions?