

# sQCD corrections to Z + jet production

Ryan Gavin  
University of Wisconsin Madison

with F Petriello, M Trenkel  
in progress

Pheno II  
May 10, 2011

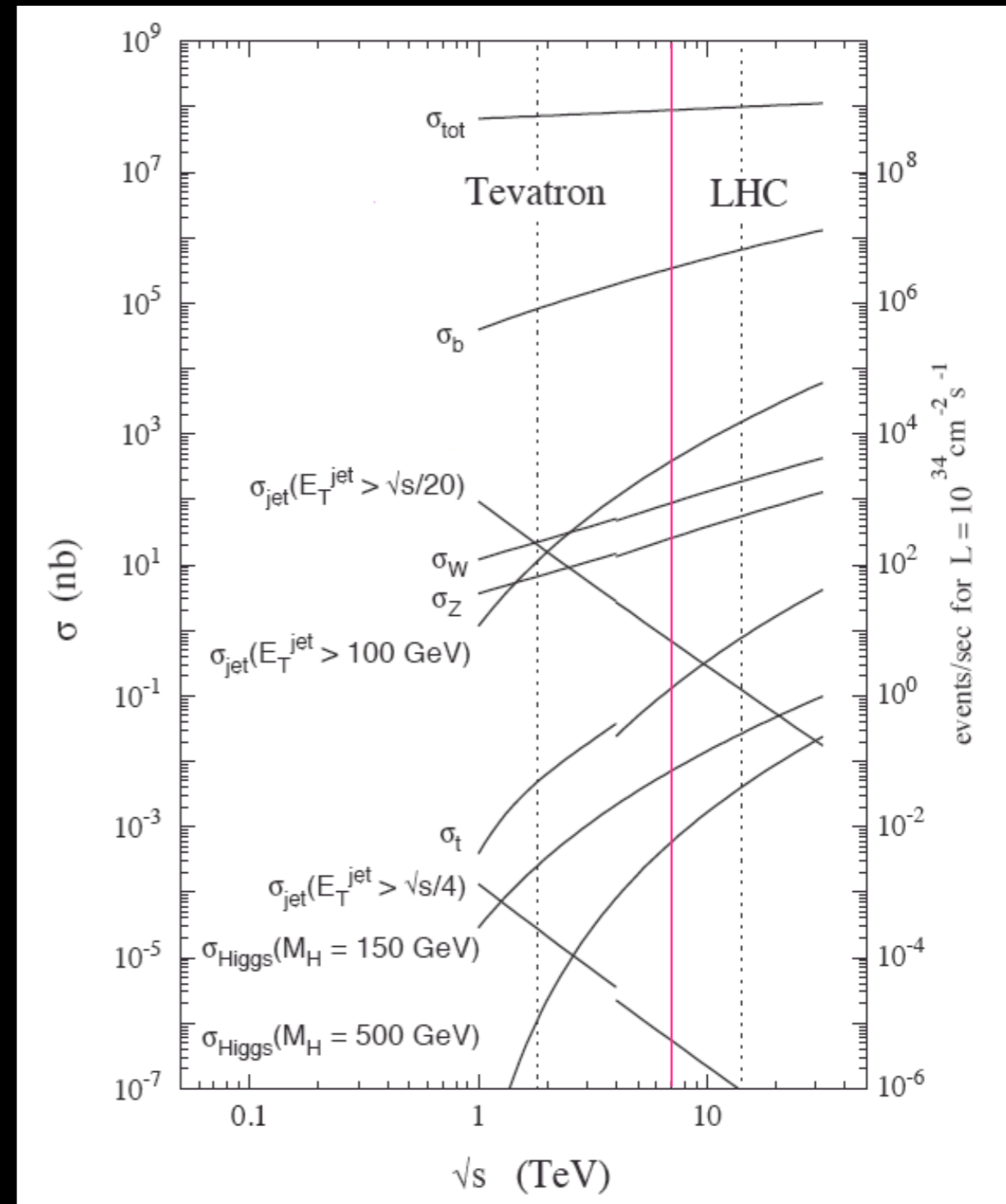
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- $\sigma_Z, \sigma_W$ 
  - large production cross sections
  - 1 to 10's of nbs



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- Constraint on some BSM physics



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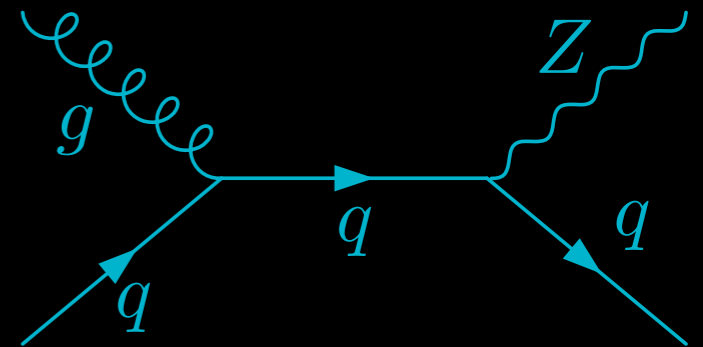
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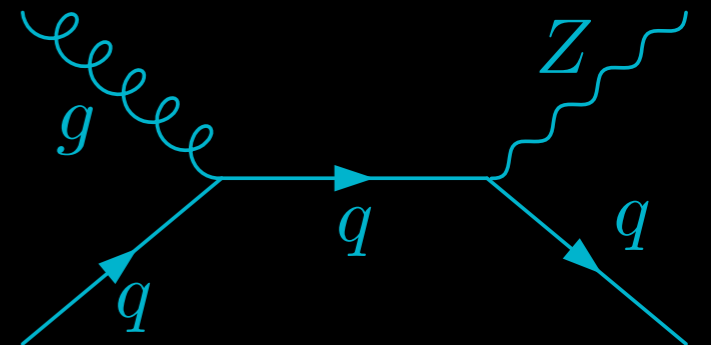
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- Z/W + 1 jet helps constrain gluon PDF
- Background to new physics searches



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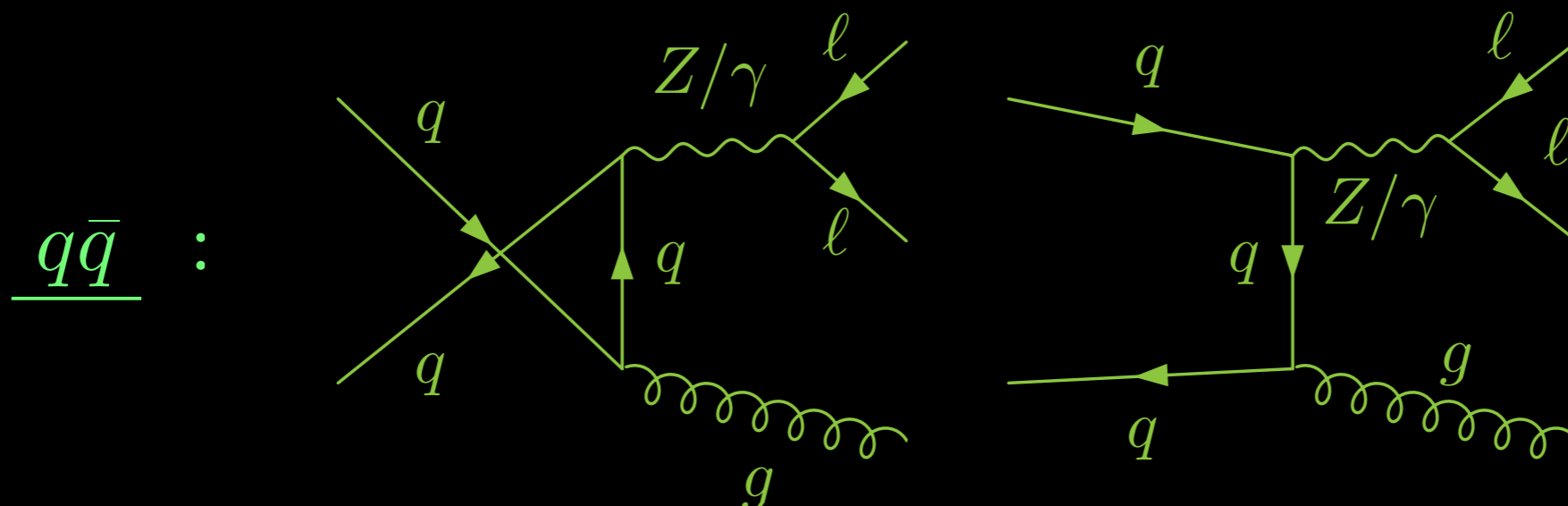
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diagrams obtained by quark and antiquark crossing with gluon



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- Studies in EW NLO & QCD NLO corrections to Z+jet
  - QCD:  $\sigma_{\text{int}} \sim 35\%$
  - EW:  $\sigma_{\text{int}} \sim -3 \text{ to } -5\%$

} variation in differential distributions

Denner, Dittmaier, Kasprzik,  
Muck - arXiv:1103.0914

# New Physics Contributions

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- Consider Z+jet in the supersymmetric framework
  - calculate supersymmetric QCD corrections to Z+jet

# sQCD NLO Calculation

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- supersymmetric QCD corrections
  - squarks,  $\tilde{q}_i$  & gluinos,  $\tilde{g}$
- Loop diagrams
  - self-energy insertion
  - Z vertex corrections
  - Gluon vertex corrections
  - Boxes

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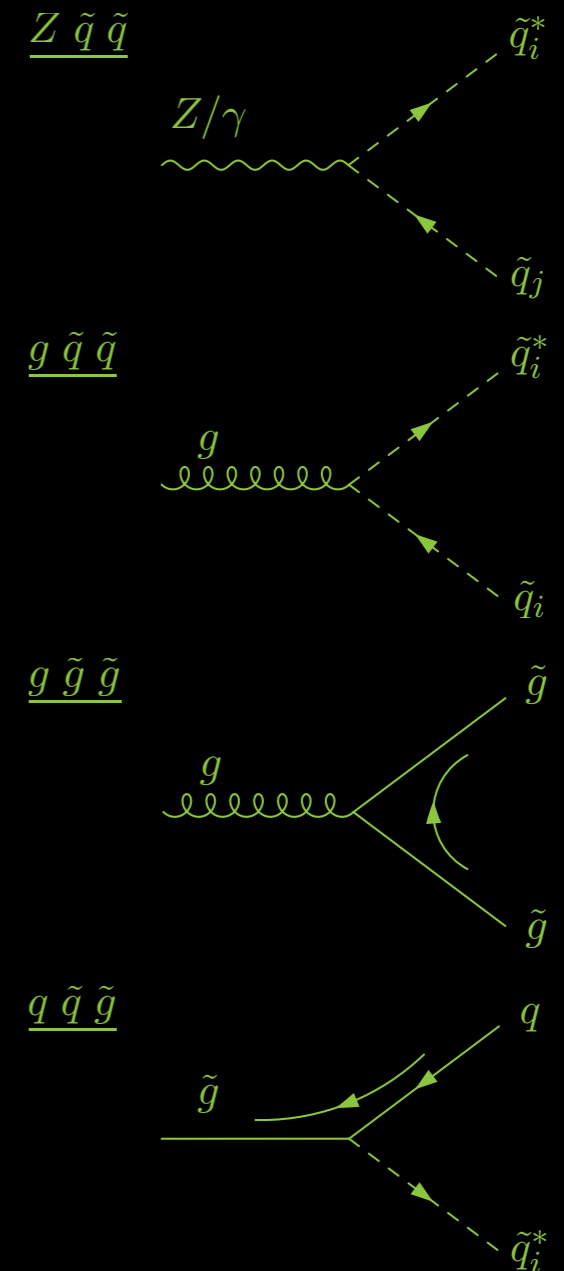
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## SM / SUSY interactions





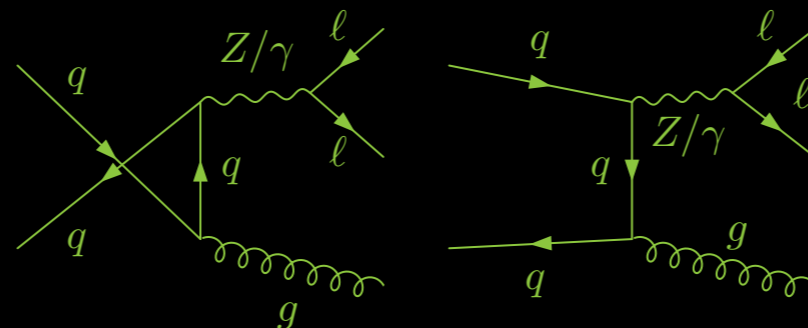
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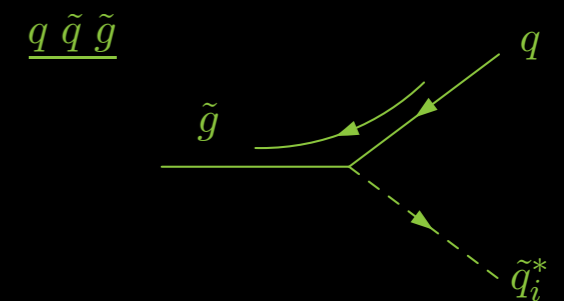
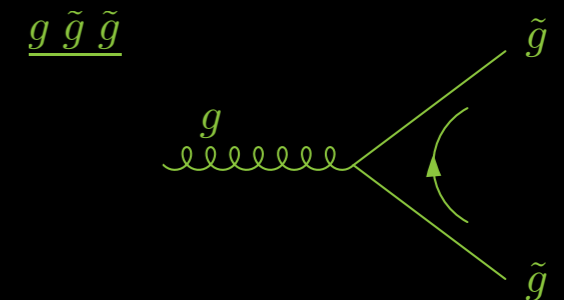
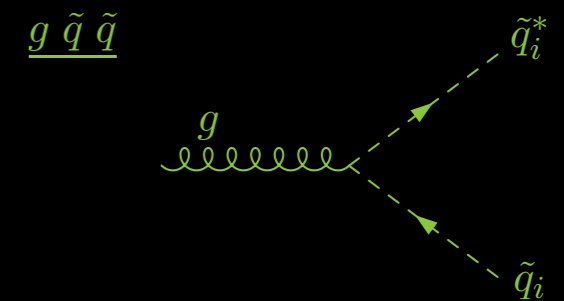
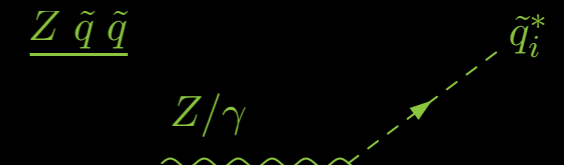
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- QCDloop used in numerical evaluation of scalar loop integrals [arXiv:0712.1851](https://arxiv.org/abs/0712.1851)

# Numerical Results

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- $p_{T,\text{jet}} > 20 \text{ GeV}$
- $M_{l^+l^-} > 50 \text{ GeV}, |\eta_{\text{jet}}| < 2.5$
- CTEQ6M PDF set
- $\mu_R = \mu_F = M_Z$
- $\alpha_s(M_Z) = 0.118$
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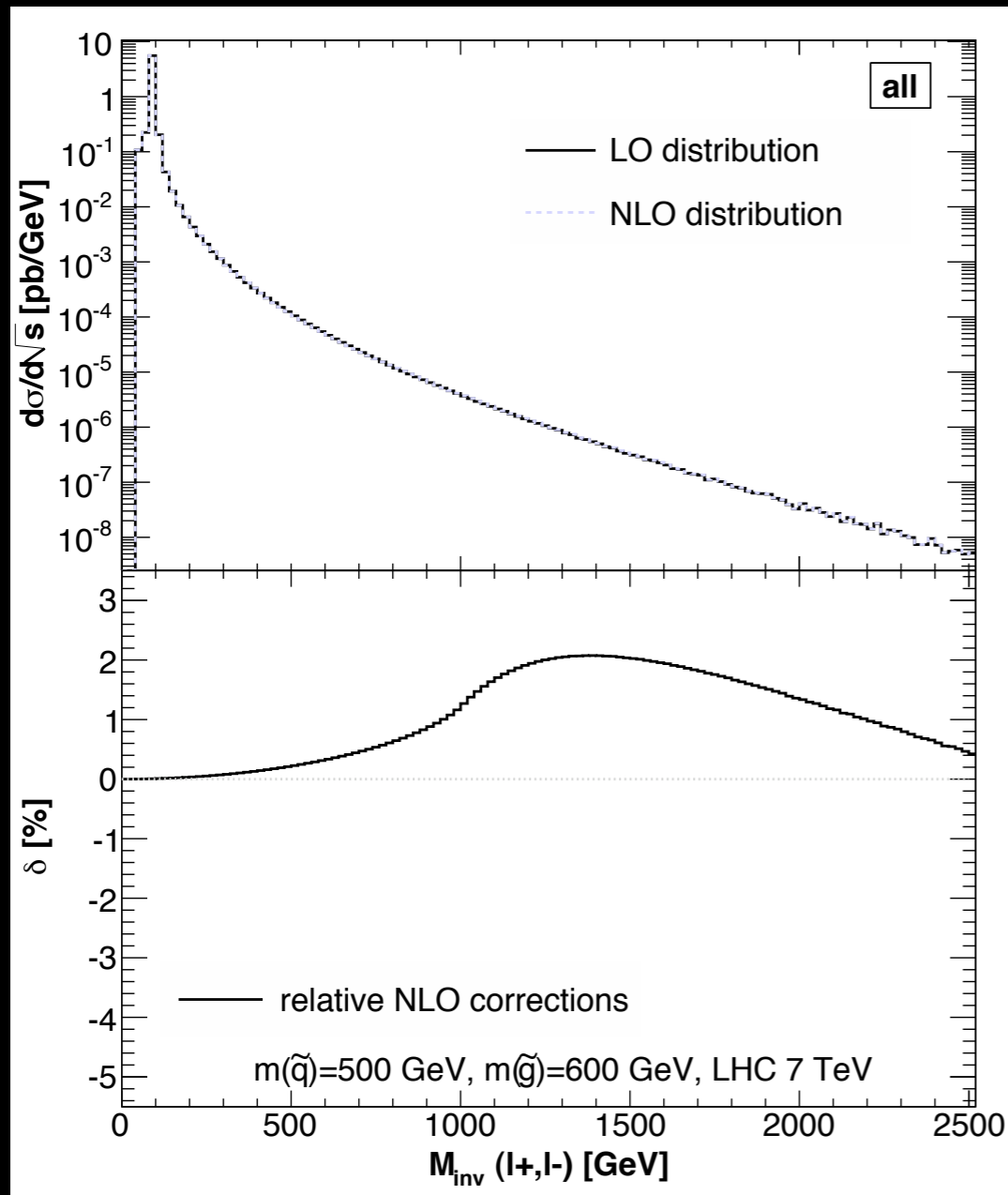
$$m_{sg} = 600 \text{ GeV}$$

$$m_{sq} = 500 \text{ GeV}$$

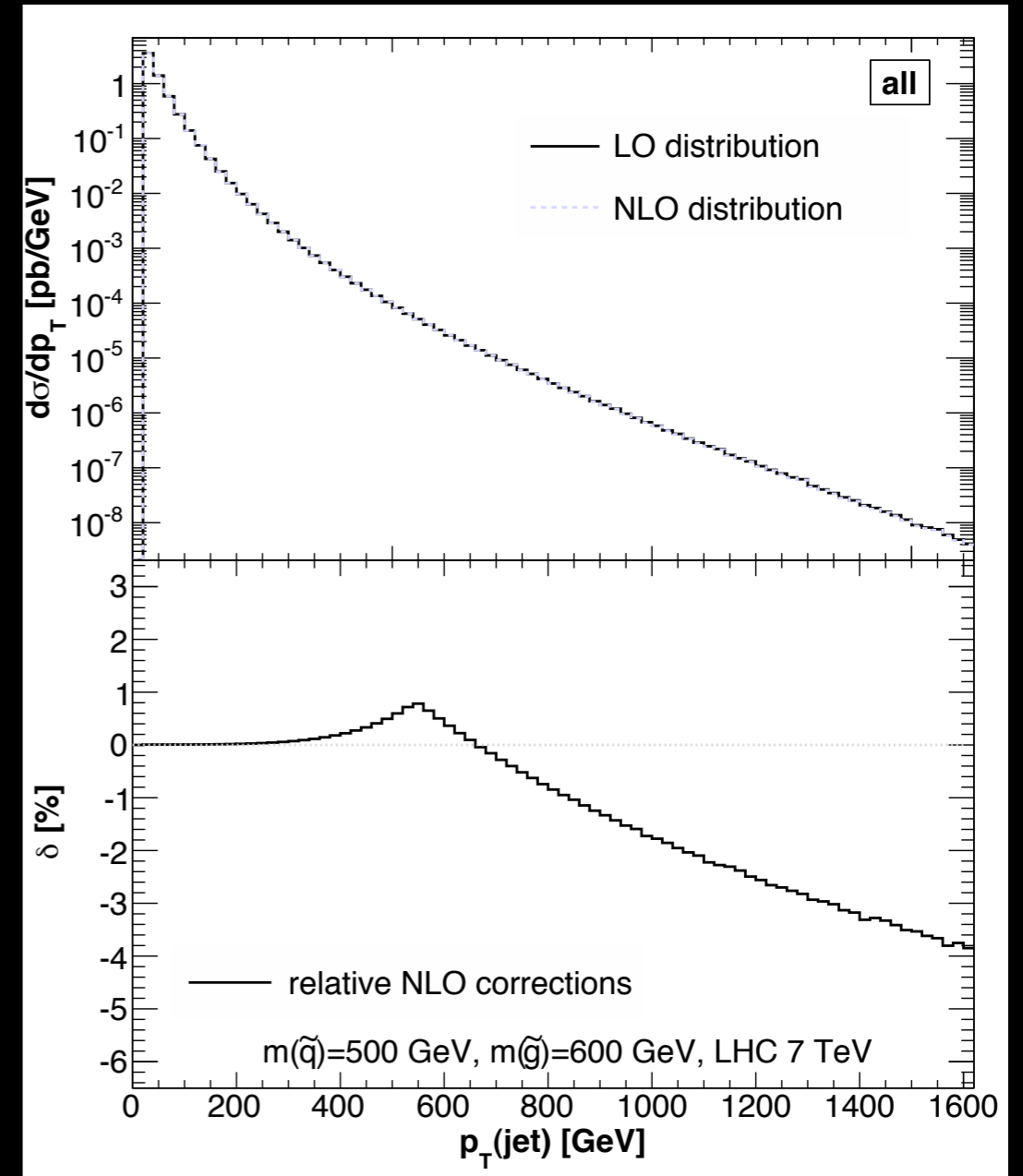
all squark masses equal  
no L-R squark mixing

# Kinematic Distributions

$M_{ll}$

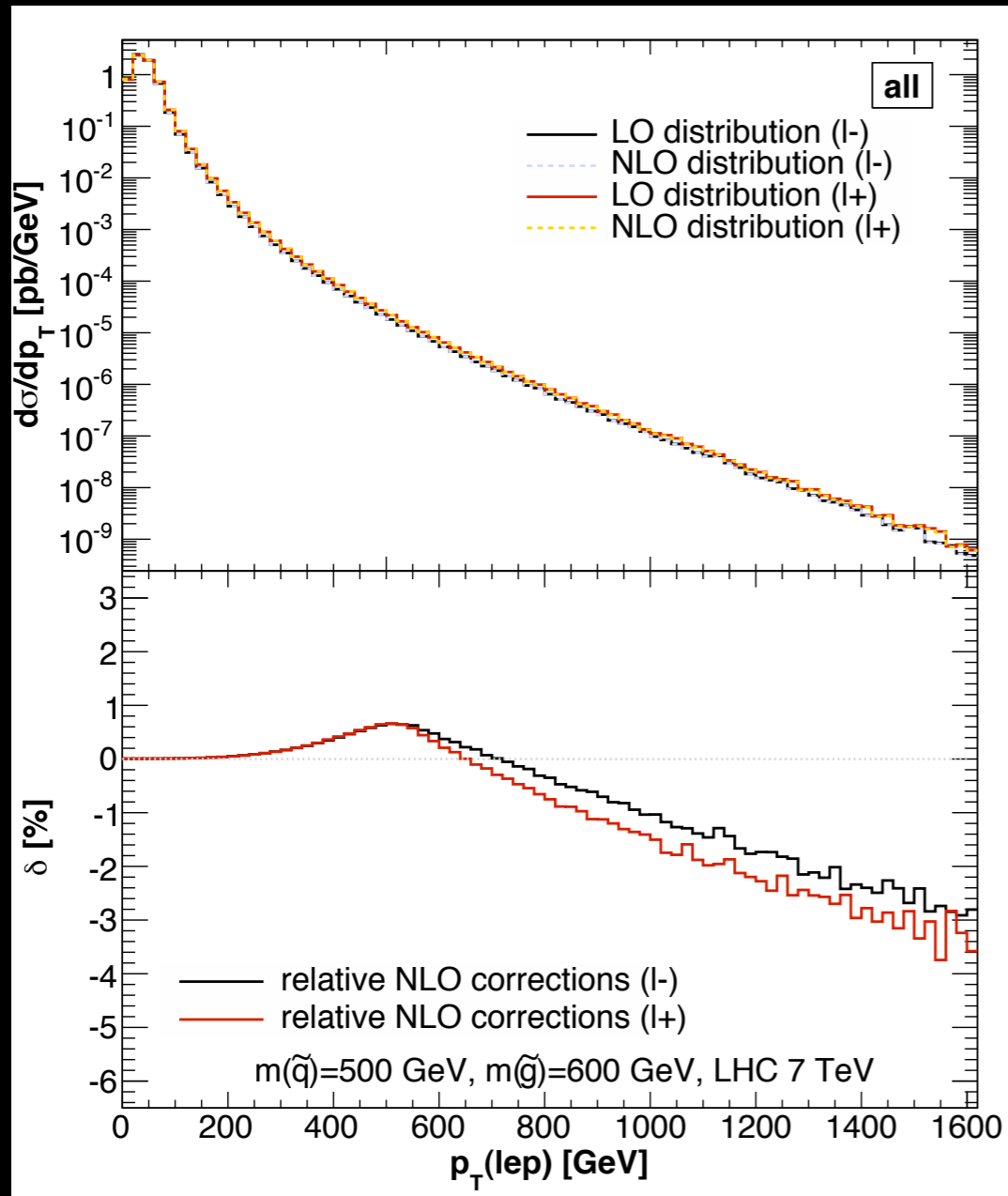


Jet  $p_T$

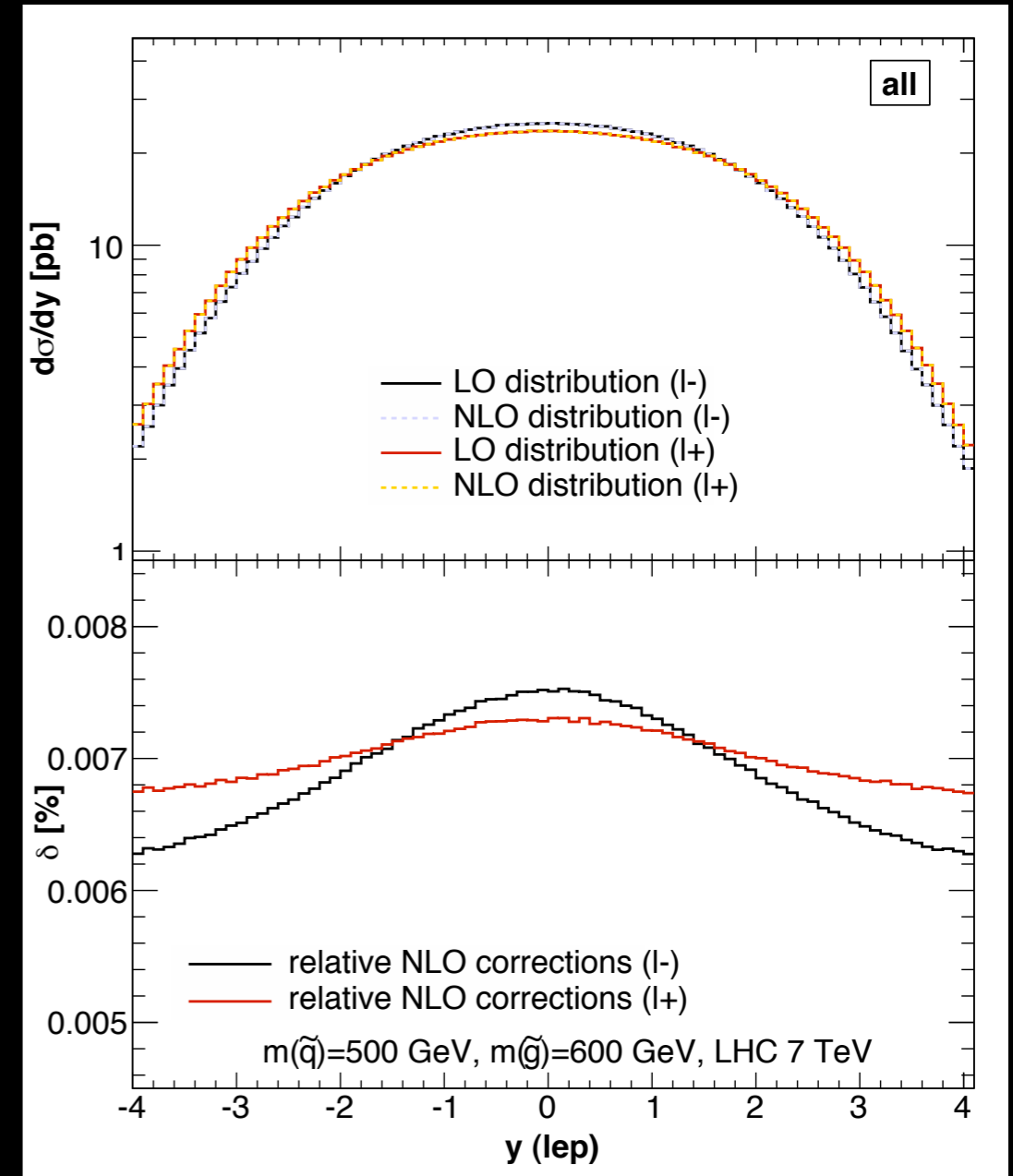


# Kinematic Distributions

lepton  $p_T$



lepton rapidity



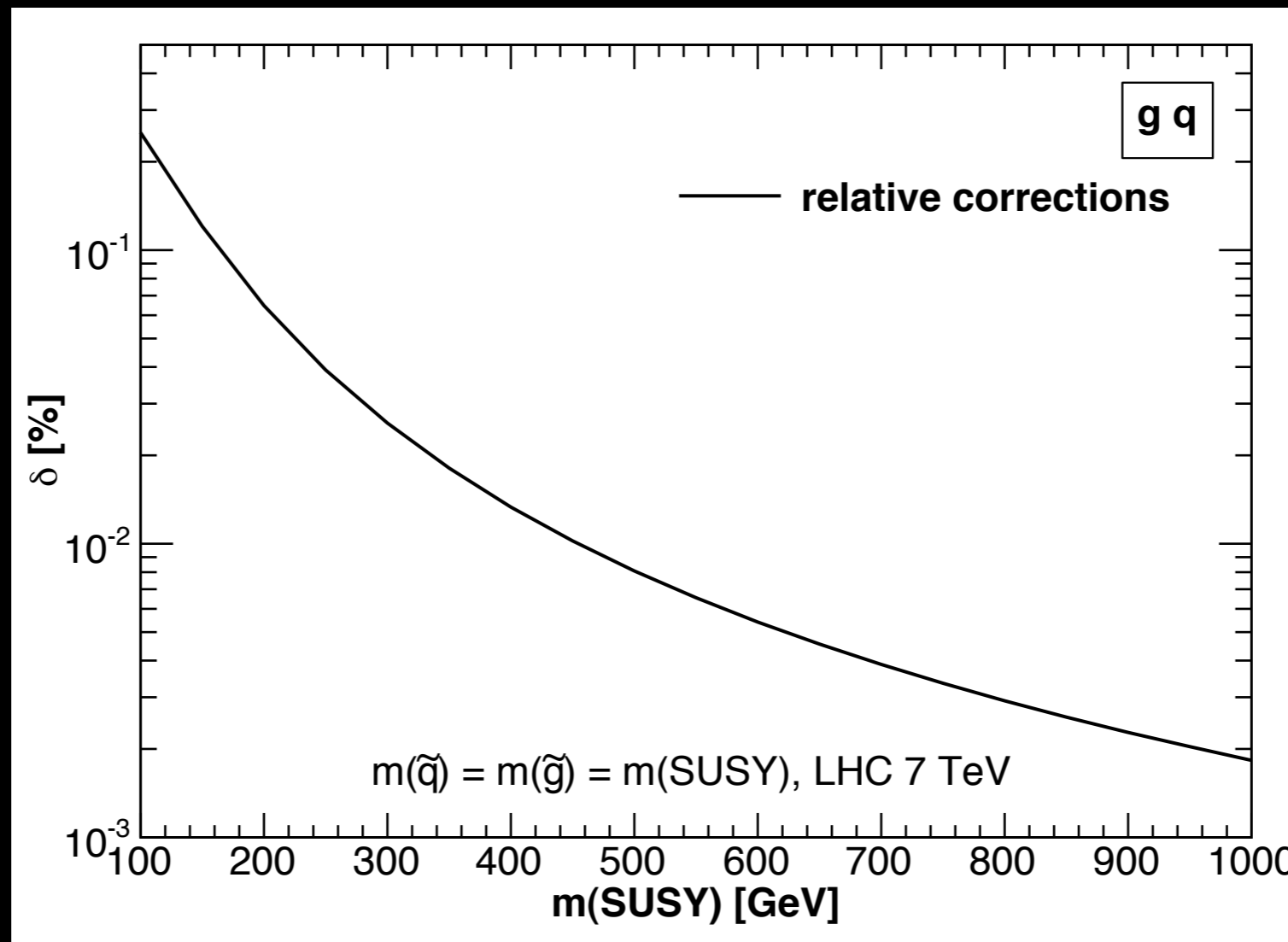
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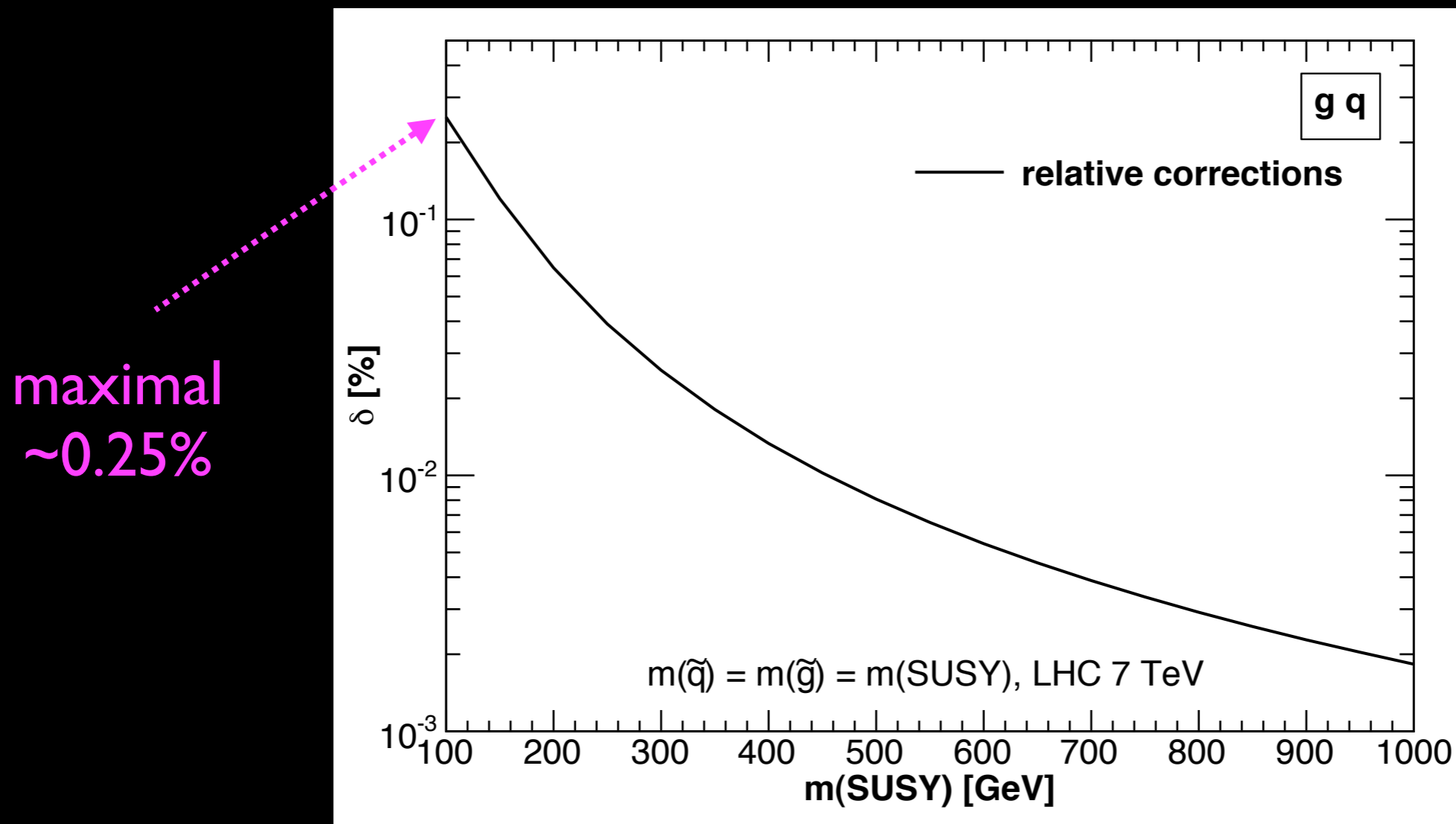


integrated  
cross section

gluon-quark  
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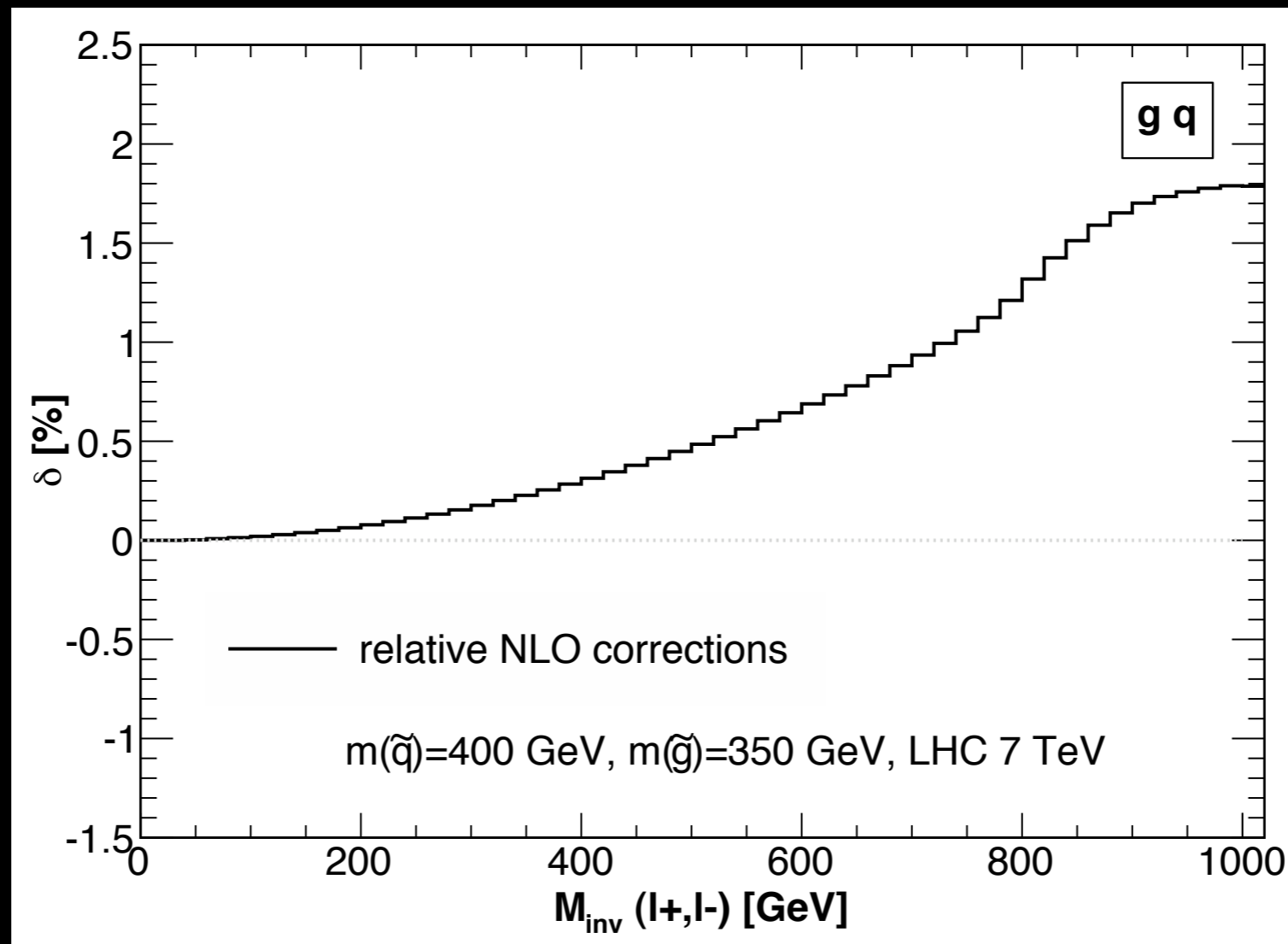
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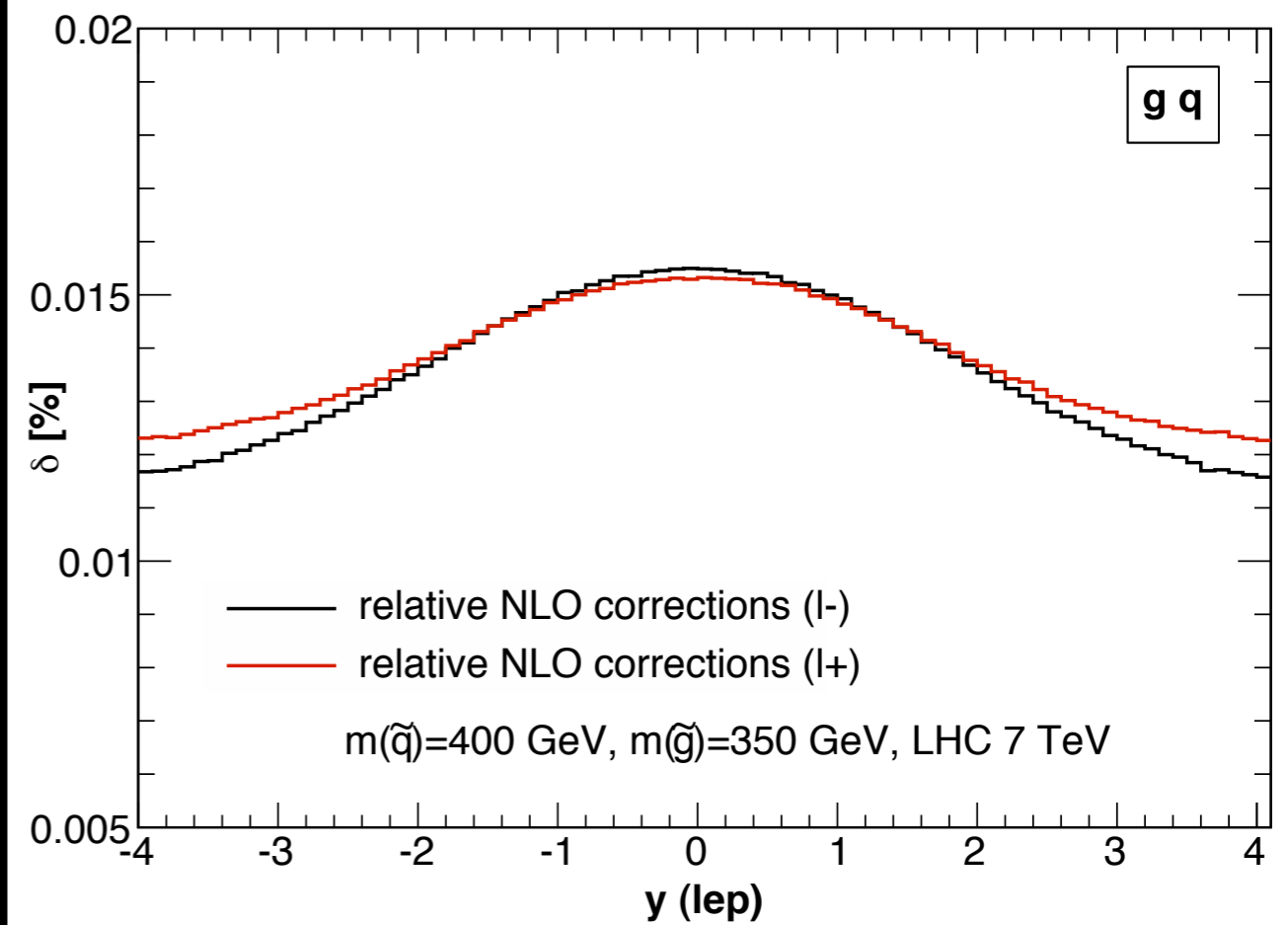
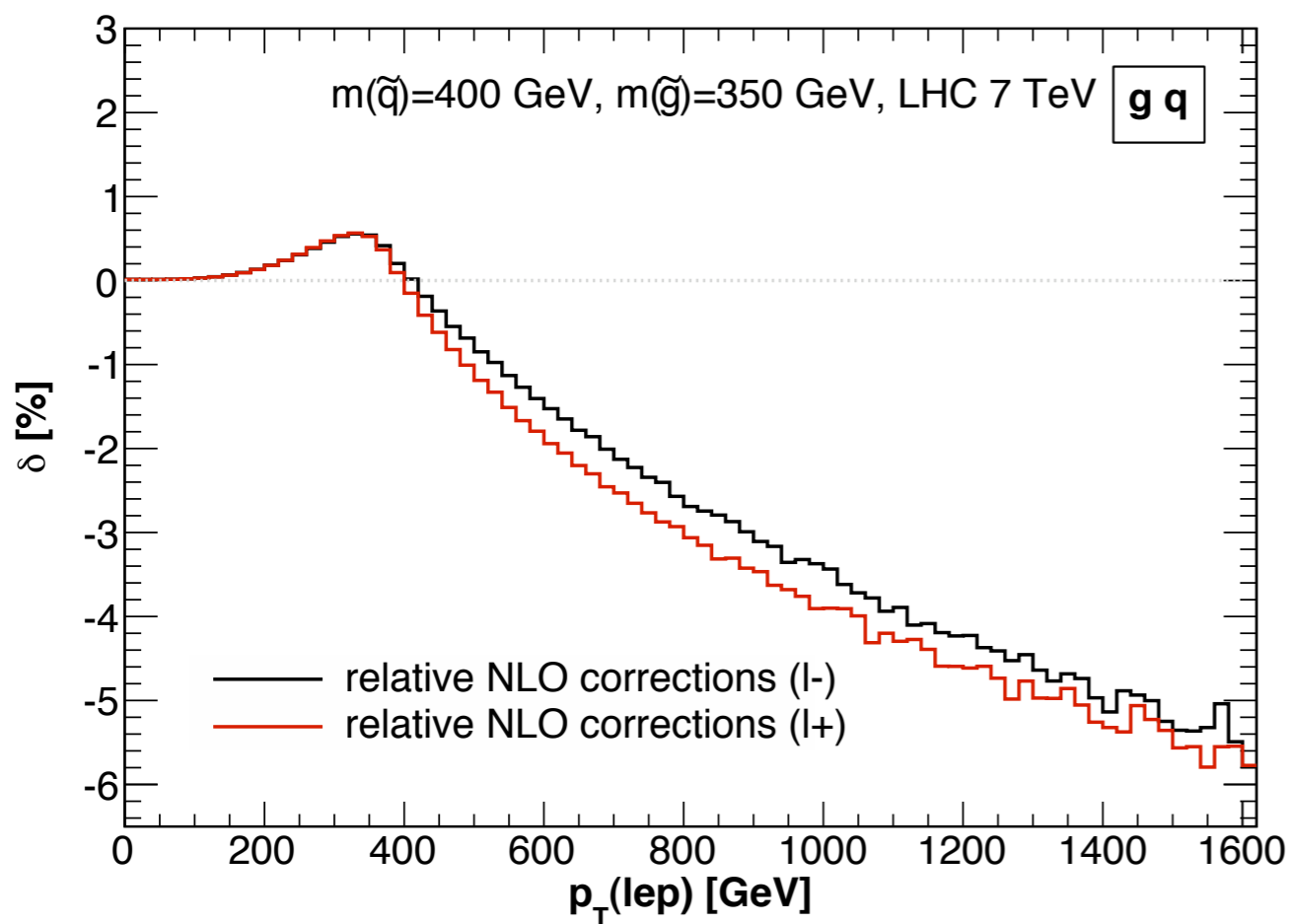




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