Search for New Physics In Multijets in CMS

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For the CMS Collaboration

With
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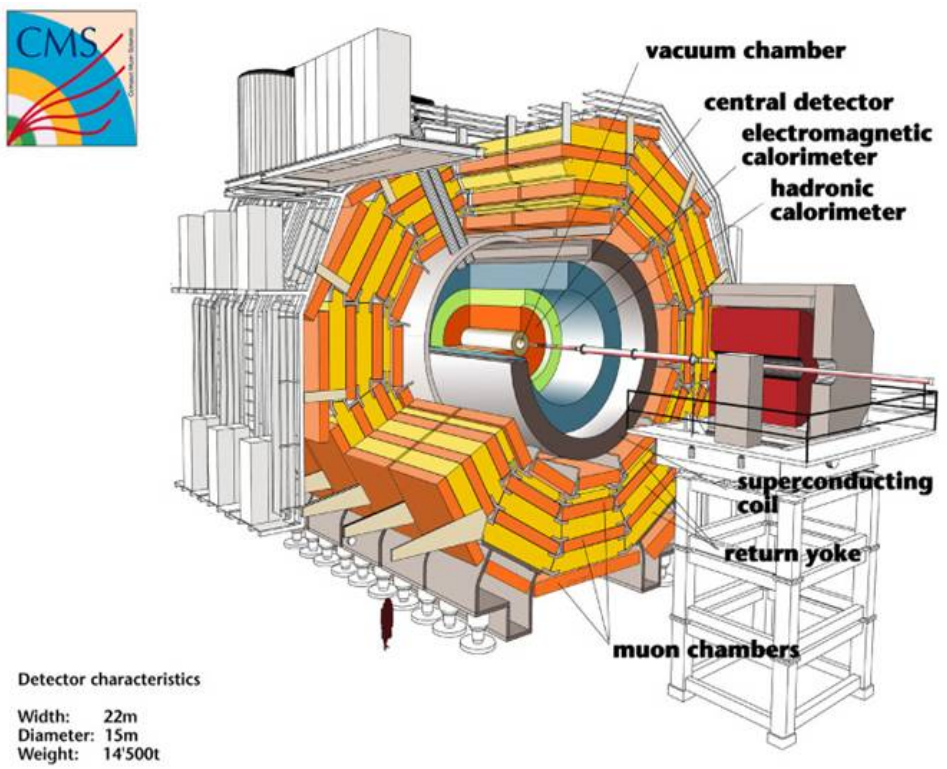
The CMS Detector

- What are the differences between CMS and CDF for this analysis?
- Tracking down to $|\eta| < 2.4$
- Hadron calorimeter granularity of 0.087x 0.087 in $\eta - \phi$
- Anti-kt (!) cone 0.5
- Trigger is HT (150 GeV)
- Event selection (>= 6 jets)

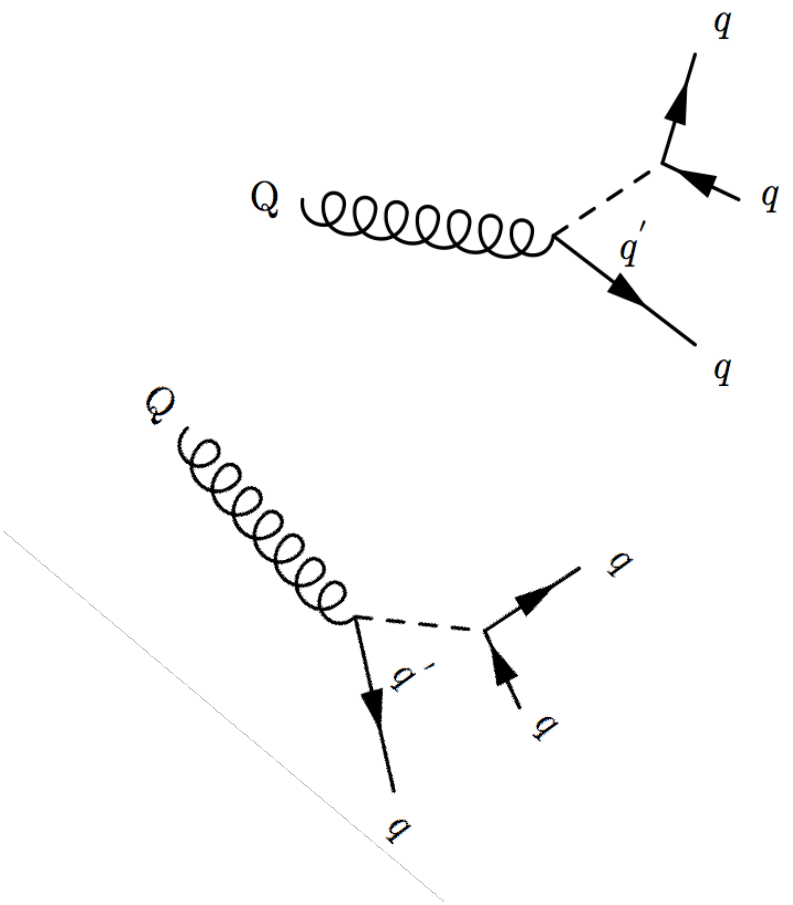
  Jet Pt > 45 GeV

  SumPt_6 > 425 GeV



A bump hunt with >= 6 jets

- Model this using RPV gluino pair production → 6 jets
- Cross sections are high, ~325 pb at m=200, to ~1pb at m=500.
- Note: If you look at the top ~8 jets in Pt, you rarely capture the 6 “signal” jets.
  - ISR/FSR are often 2nd, 3rd in the list.
- We only look for *one* of the signal triplets.



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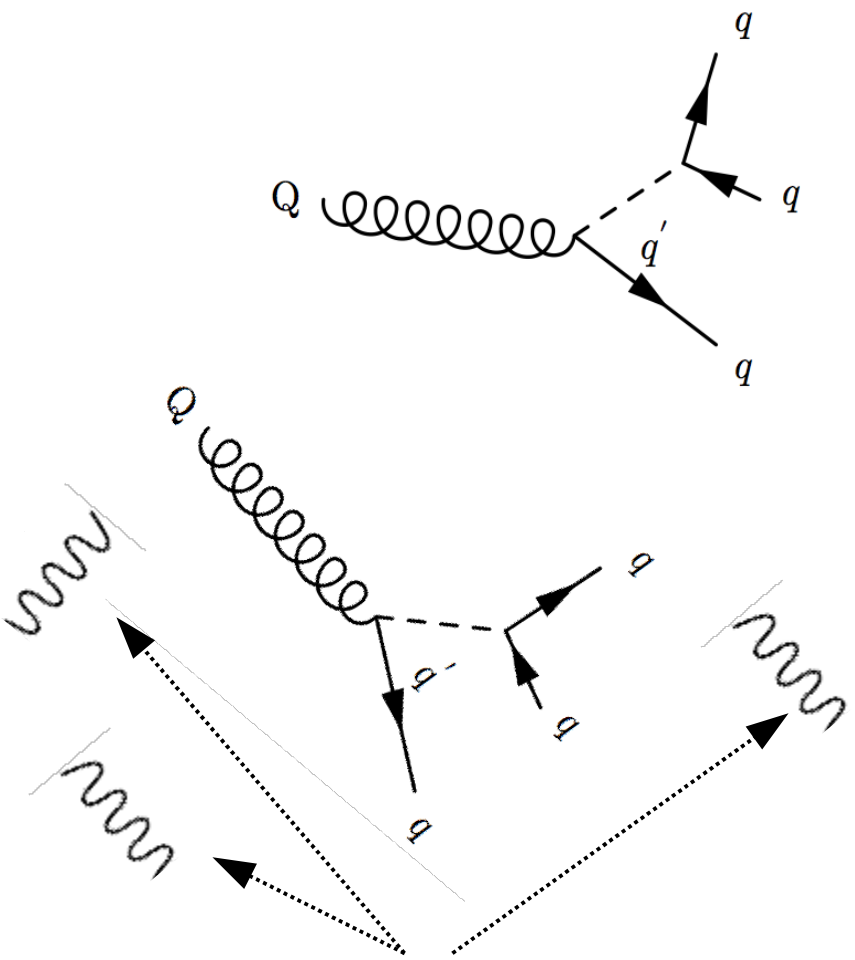
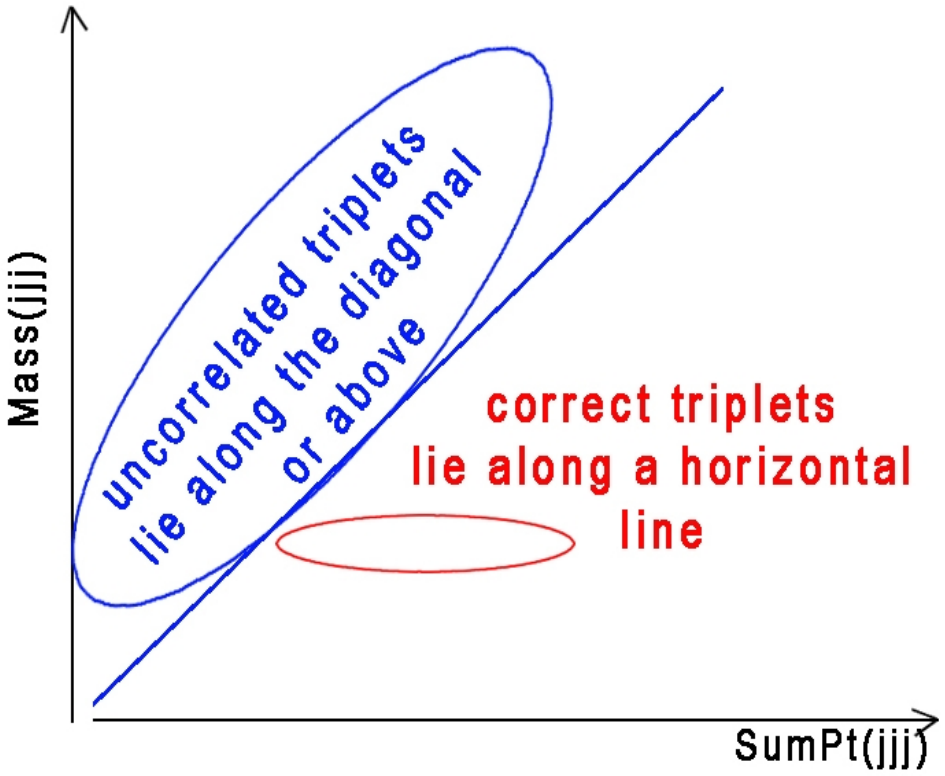


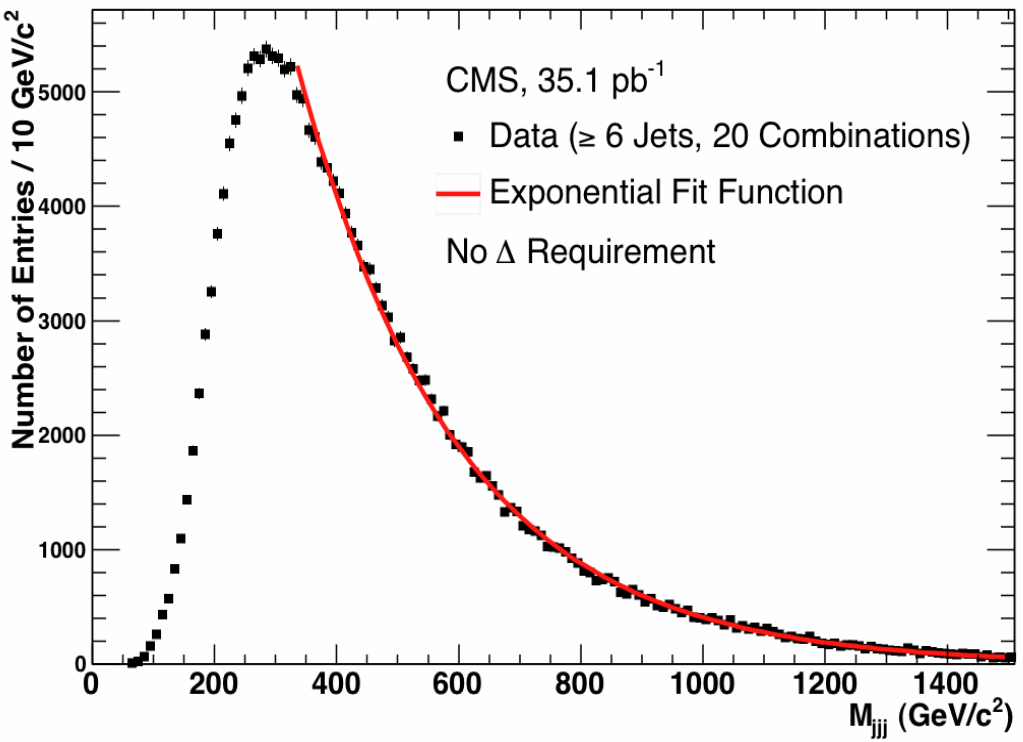
Real events have lots of activity not connected to the hard interaction. It's not necessarily soft...

Jet Ensemble



- Basic idea is the same as CDF:
  - Look at all possible combinations of 3 jets.
- 6 jet event → 20 triplets...
- Make the same distribution as we did for CDF
  - Mjjj vs Ptjjj

CMS Data, No diagonal offset cut



- QCD and wrong signal combinatorics have similar mass shapes.
- We parametrize the background by weighting in SumPt bins and plotting mass
  - We scale Njet=4 and fit, and it describes Njet=5 well.
  - Wethen scale the Njet=5 to describe the Njet>6 sample

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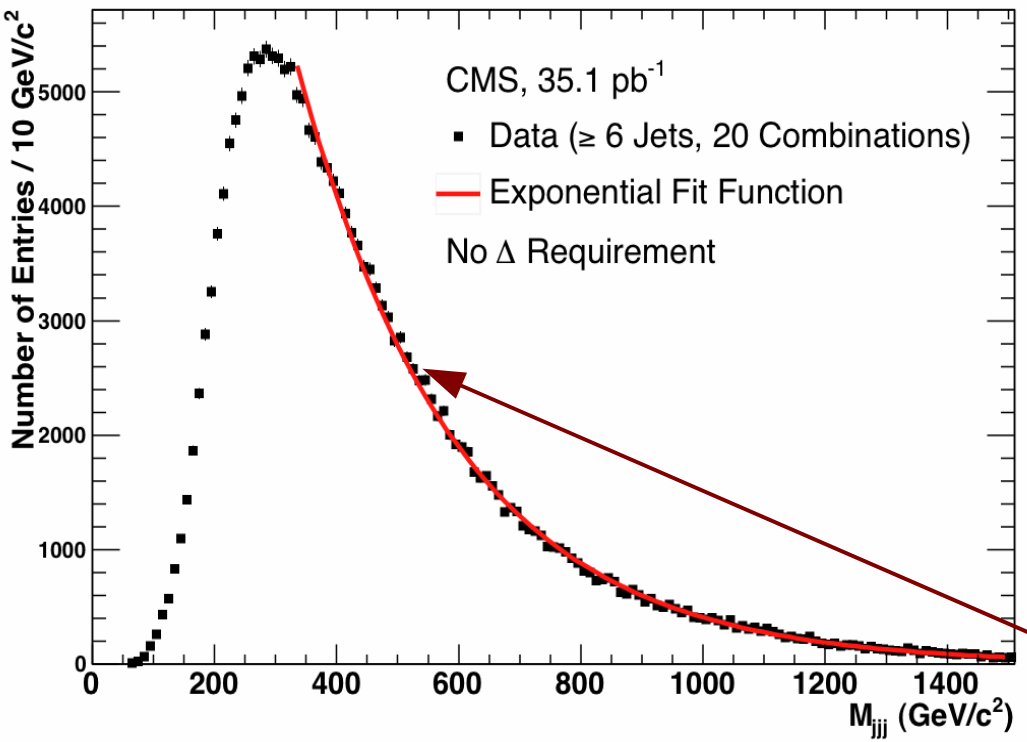

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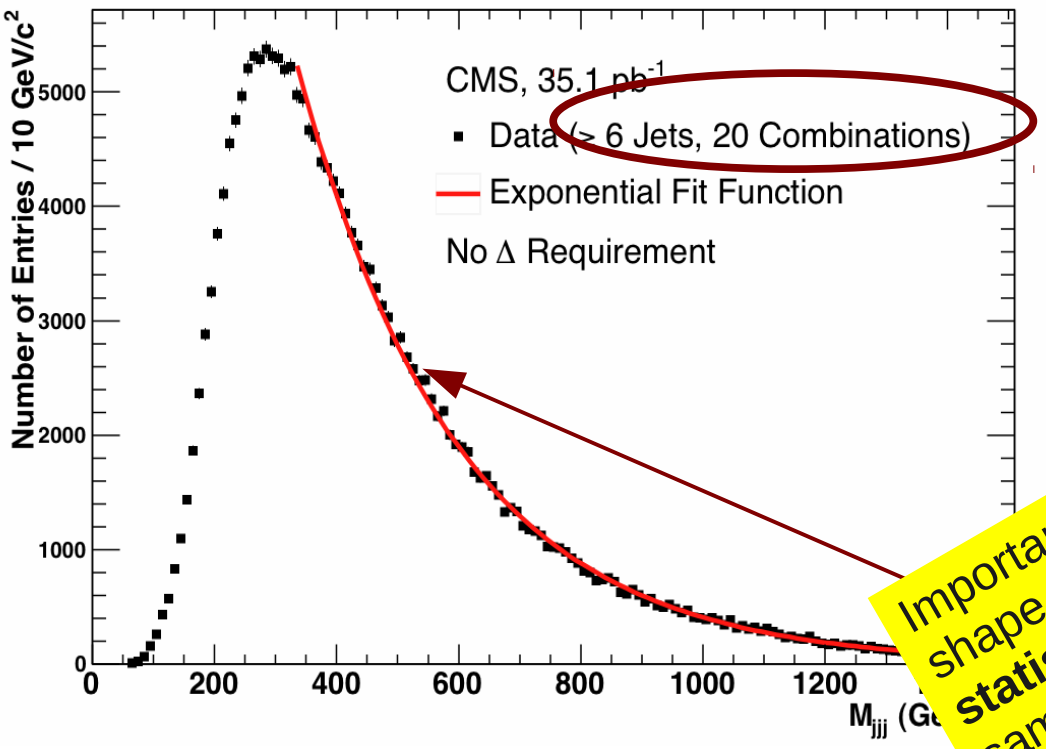

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Important note: Background shape is parametrized using **statistically independent** data sample that is reasonably free of signal.

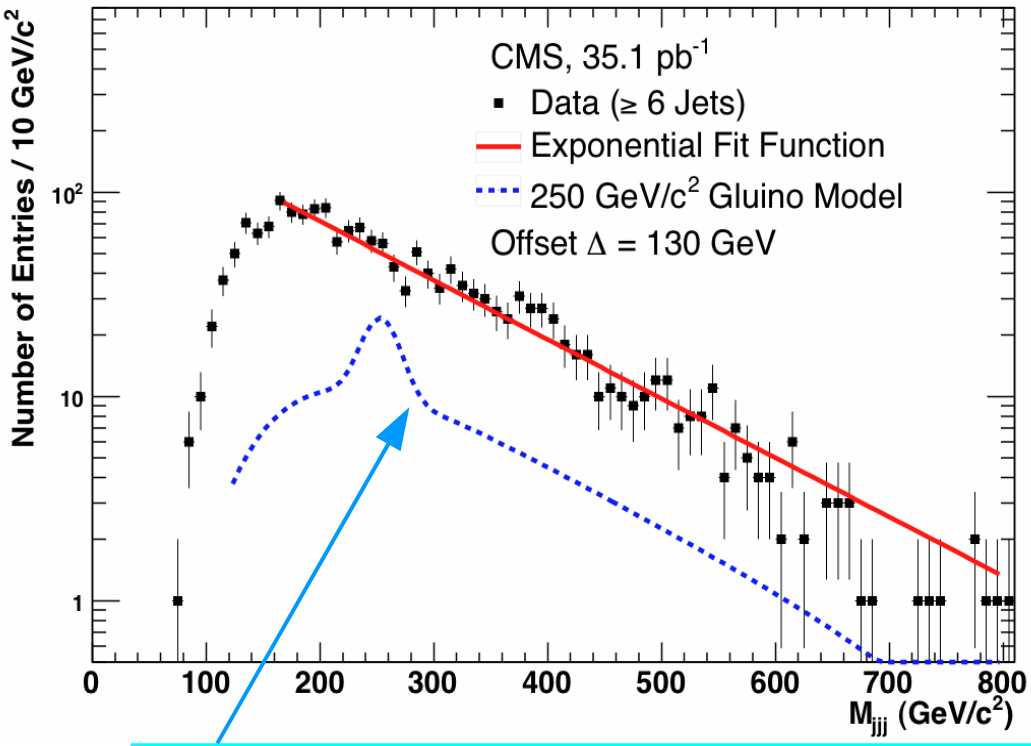
Diagonal cut optimization.

- In CMS we find that diagonal offset of 130 GeV/c is optimal for the range of gluino masses we are sensitive to.
- We fit masses in the range 170 – 800 GeV/c^2.

  Acceptance ranges from 0.4% to 5%.

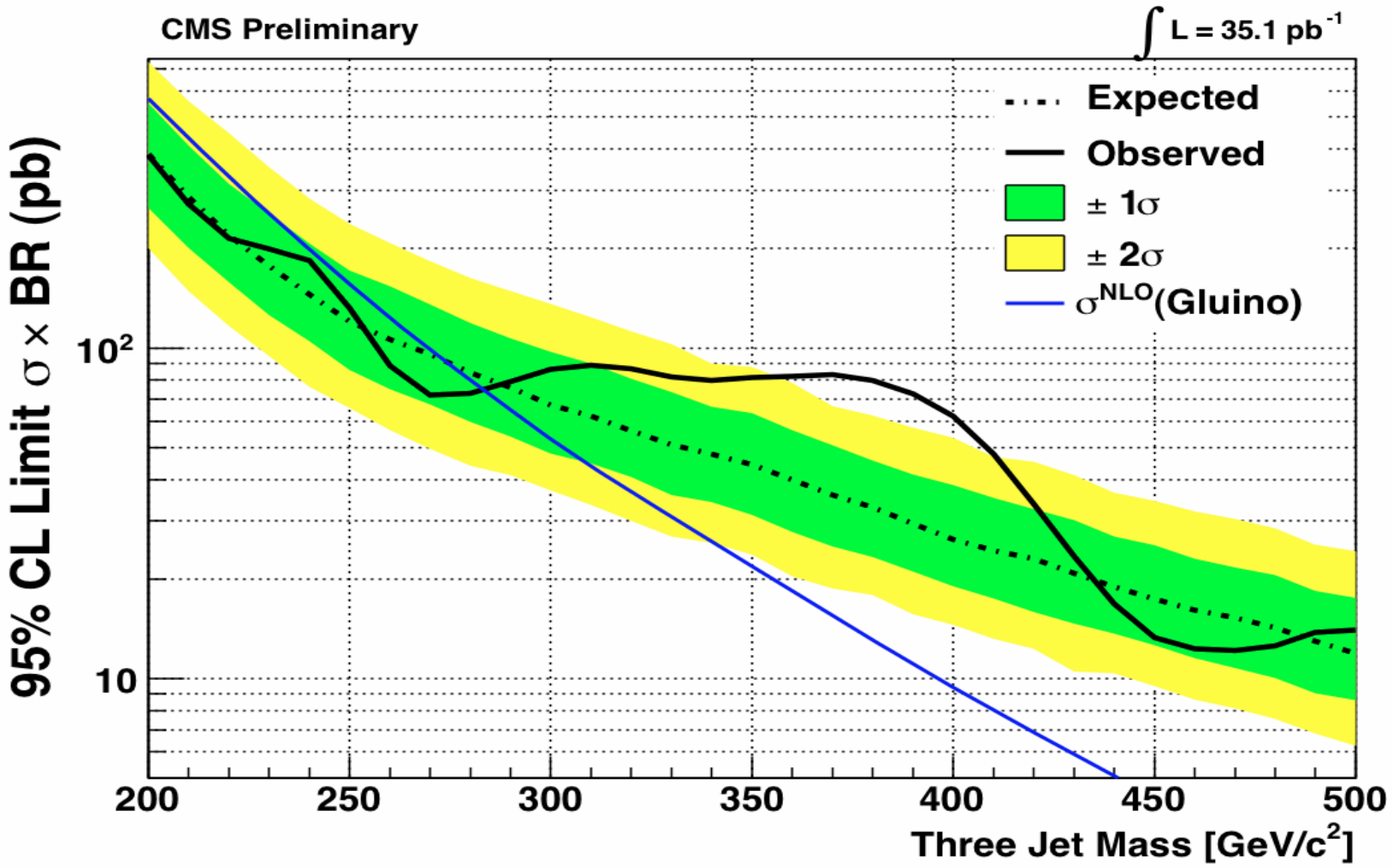
  Sys. Unc. from 10% to 19%

  Jet energy biggest contribution
- Not sensitive to ttbar.
  - Jet pt too high.



m=250 gluino cross-section from Pythia (LO) corrected by Prospino (NLO) normalized to data luninosity.

Limit on RPV gluinos



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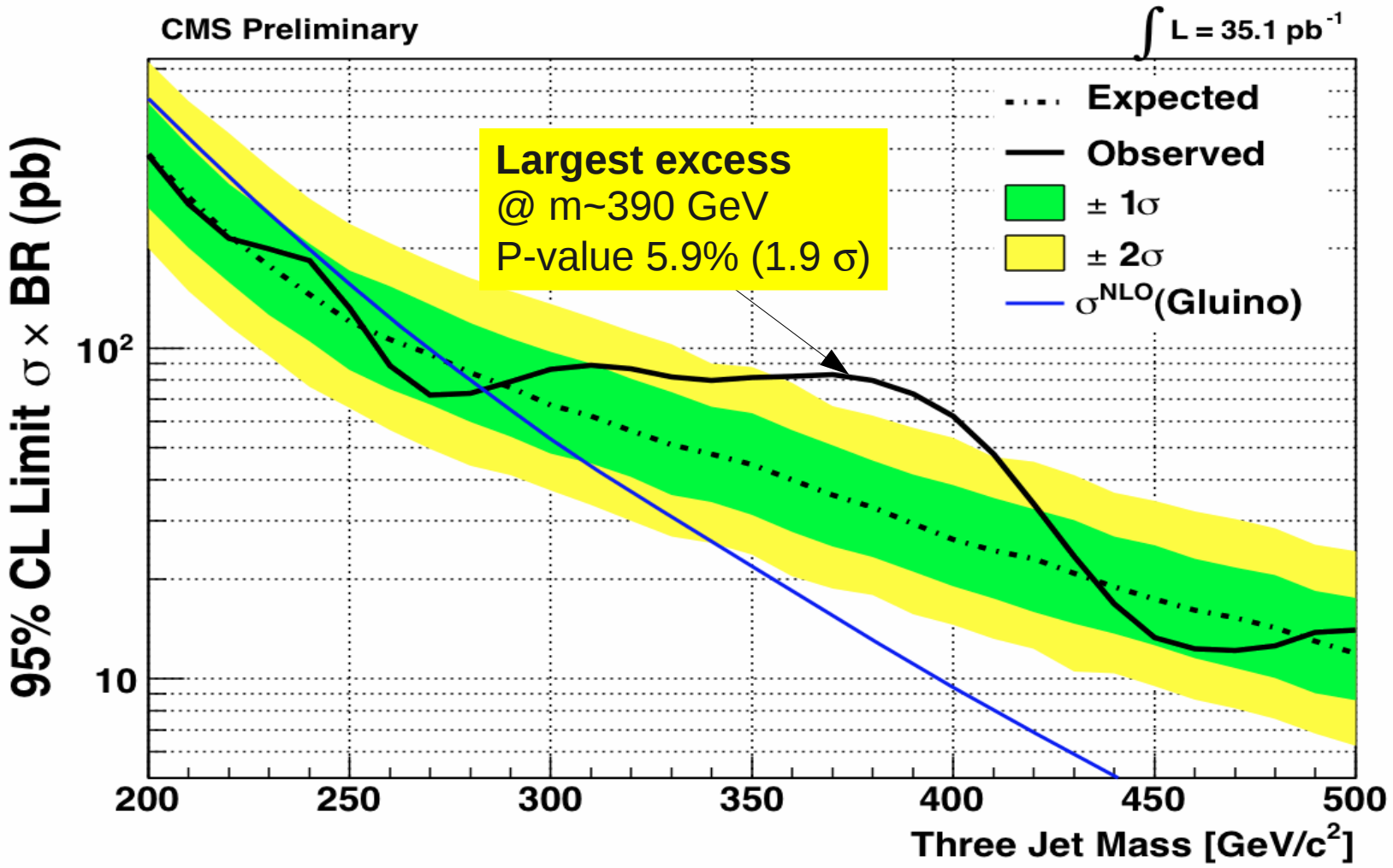
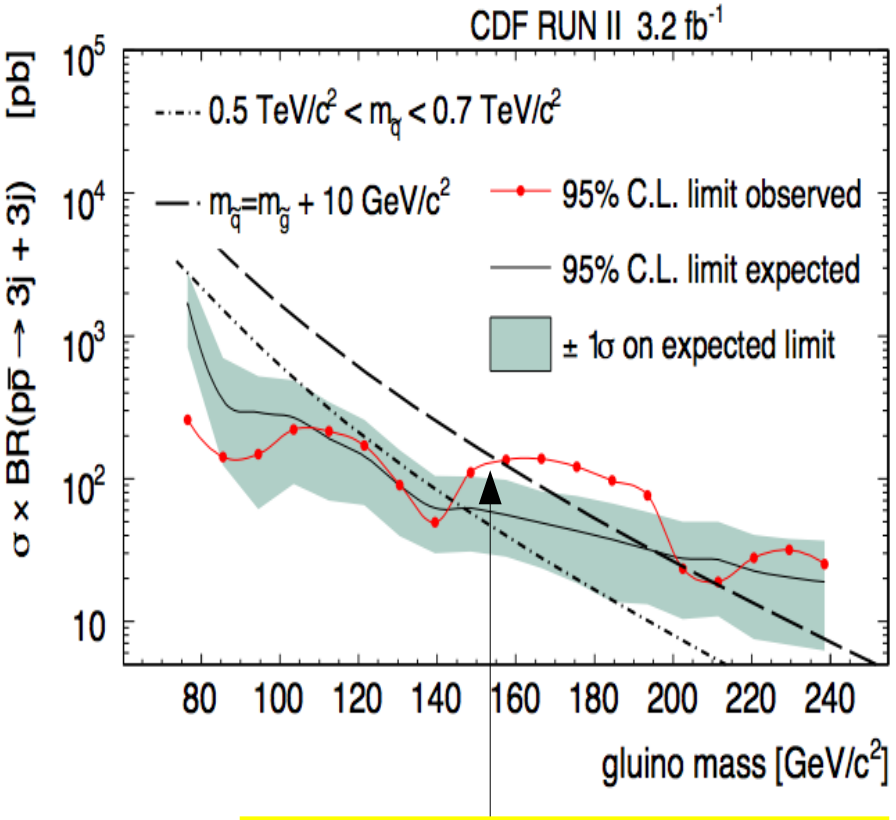
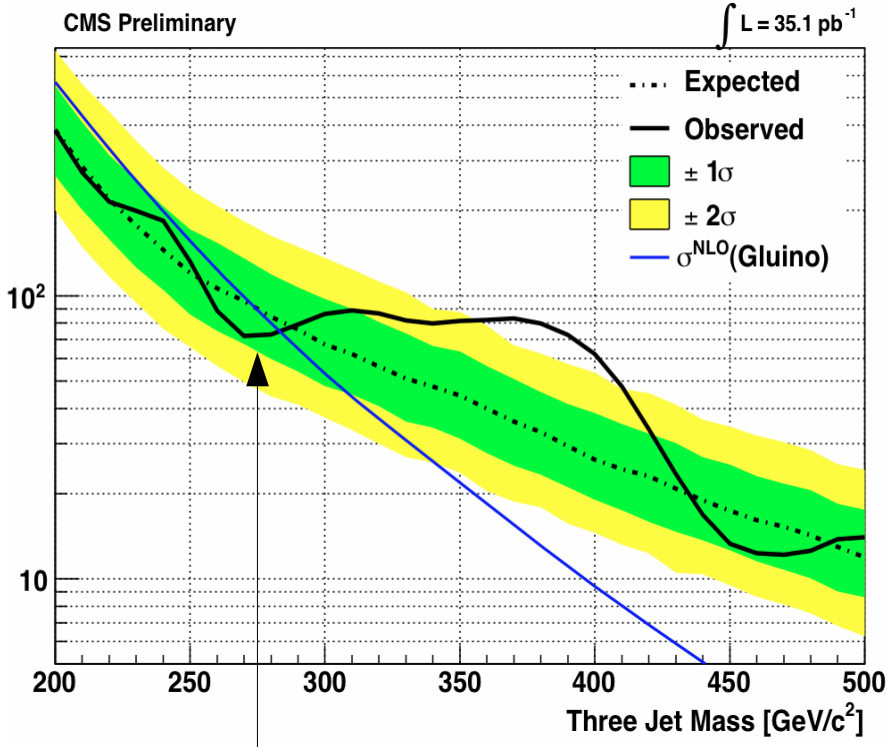


CDF + CMS Limits



Excluded:
RPV gluino mass < 144 GeV



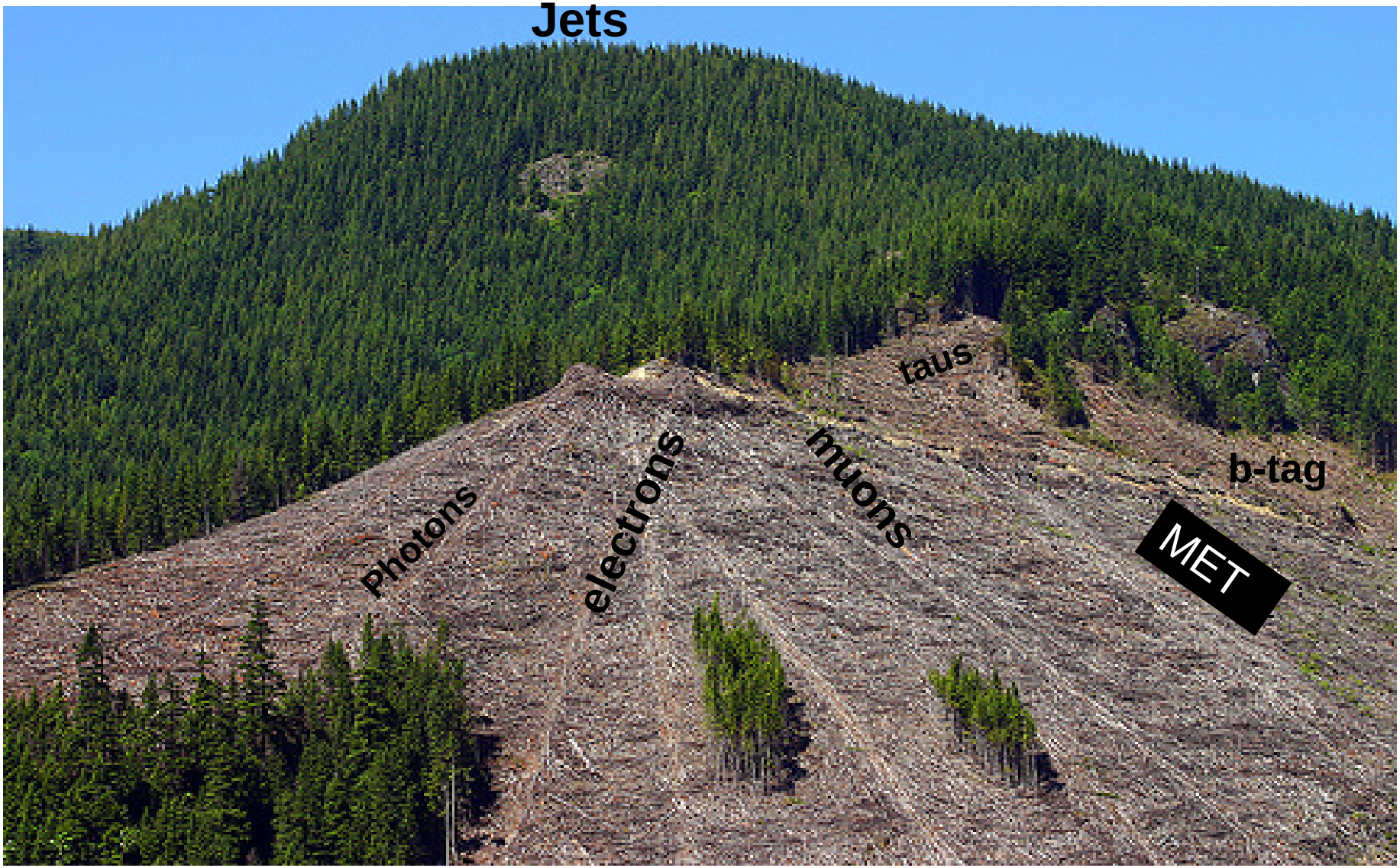
Excluded:
RPV gluino mass < 280 GeV

Summary

- These analyses came about because we asked how new physics could be hidden from “standard” BSM searches.
  - *New Physics may not have MET, leptons, b-quarks.*
  - Became part of Rouven Essig's dissertation...
- Have created a new technique (*ensemble* method).
  - Exploited it (at CDF and CMS) to look for multijet resonances.
  - Currently getting backgrounds from data, would be useful to get QCD MC.
- This technique (look at every combination) can be used for other busy signature.

New physics has not shown up in easy to harvest areas.

Need tools to get to harder to reach areas.



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