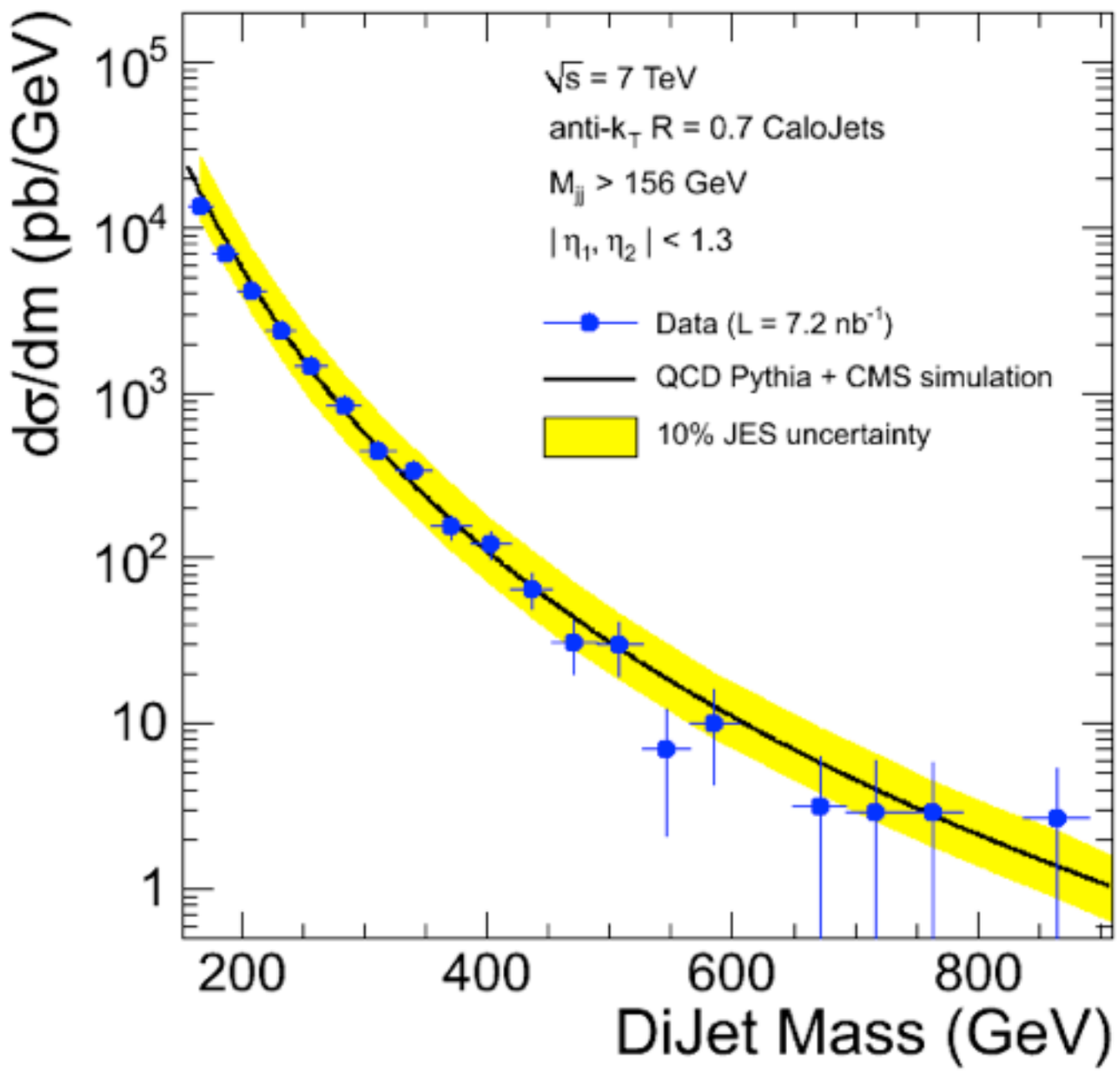
Dijet Mass and QCD

- The data is in good agreement with the full CMS simulation of QCD from PYTHIA.



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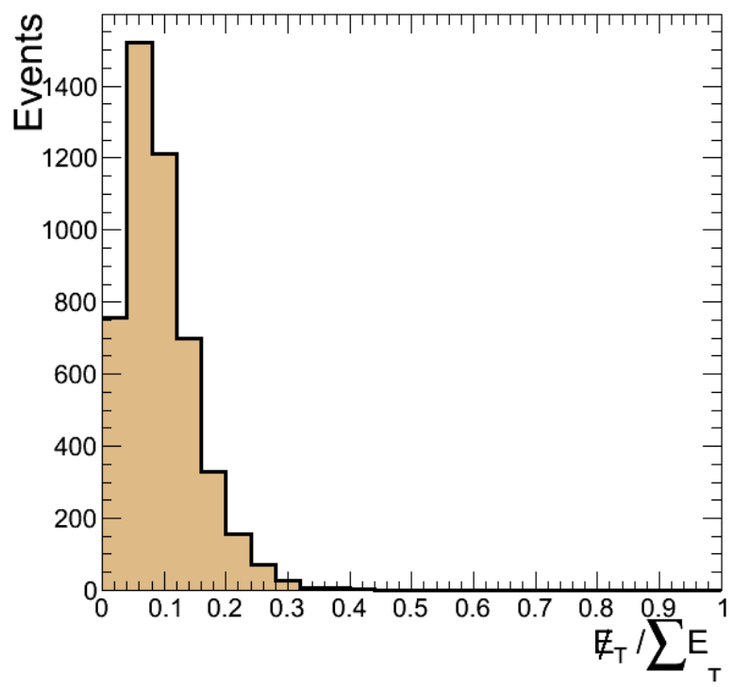
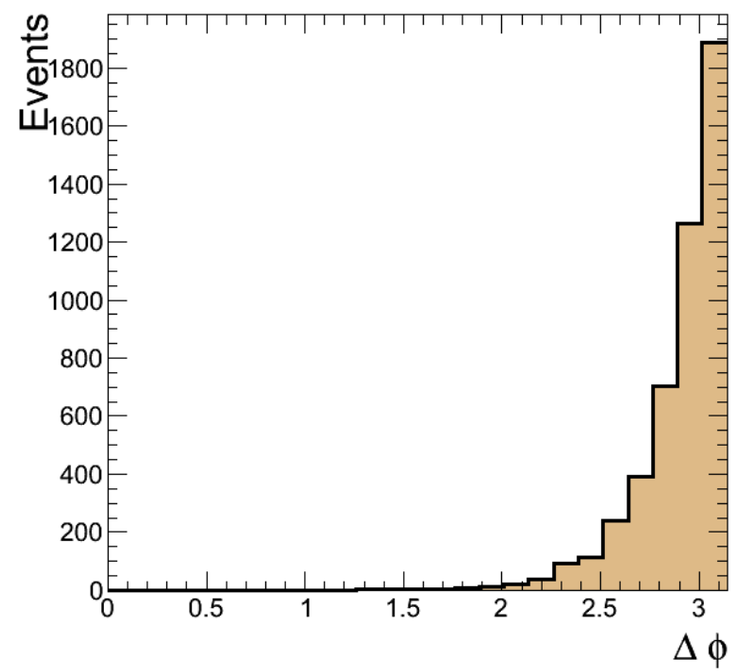
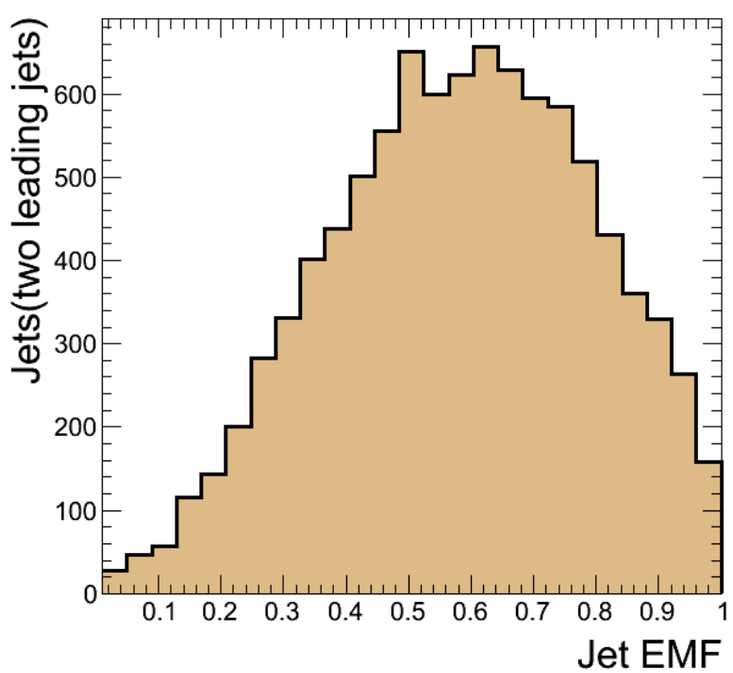
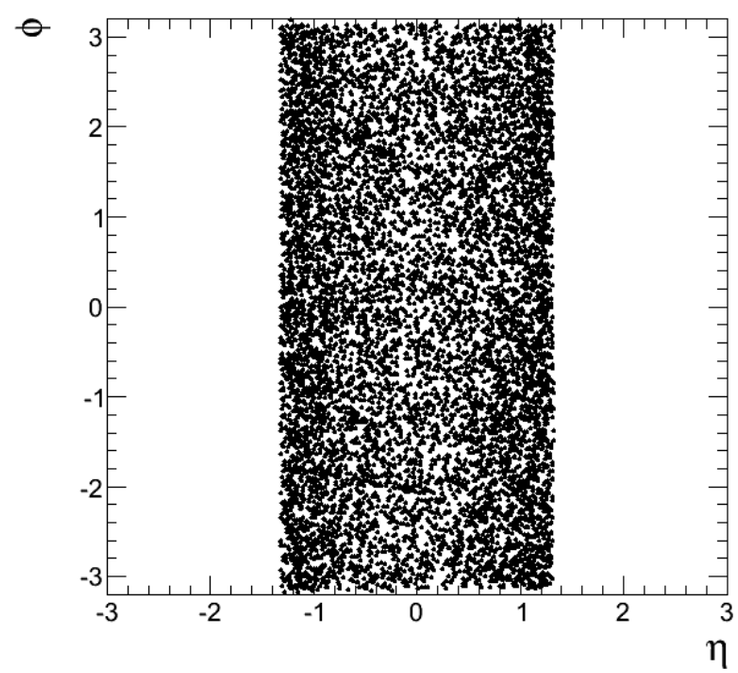
Basic Jet Distributions





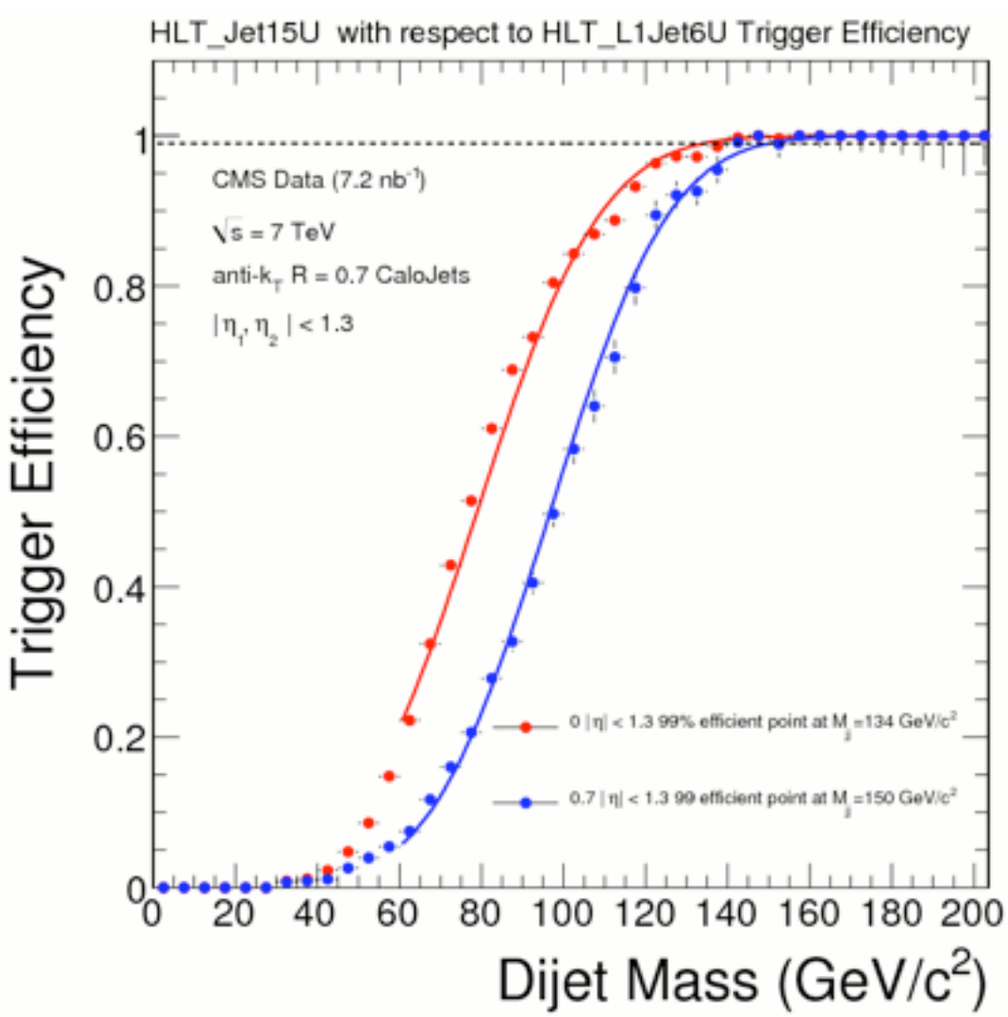


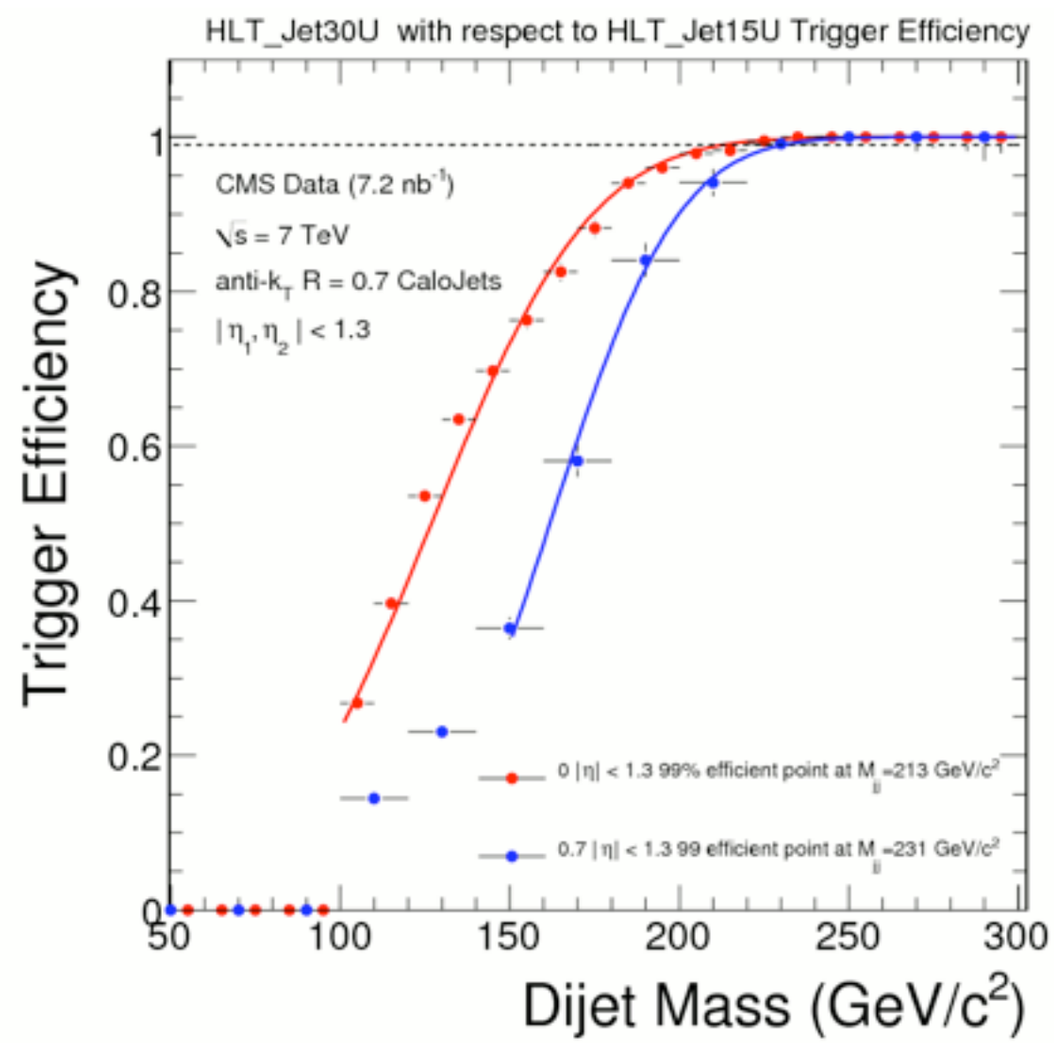


- Basic jet distributions look good.
  - ✓ Low MET
  - ✓ Back-to-Back in phi
  - ✓ No peaks near 0 or 1 in jets EMF distribution
  - ✓ η-ϕ is uniform

Trigger Efficiencies

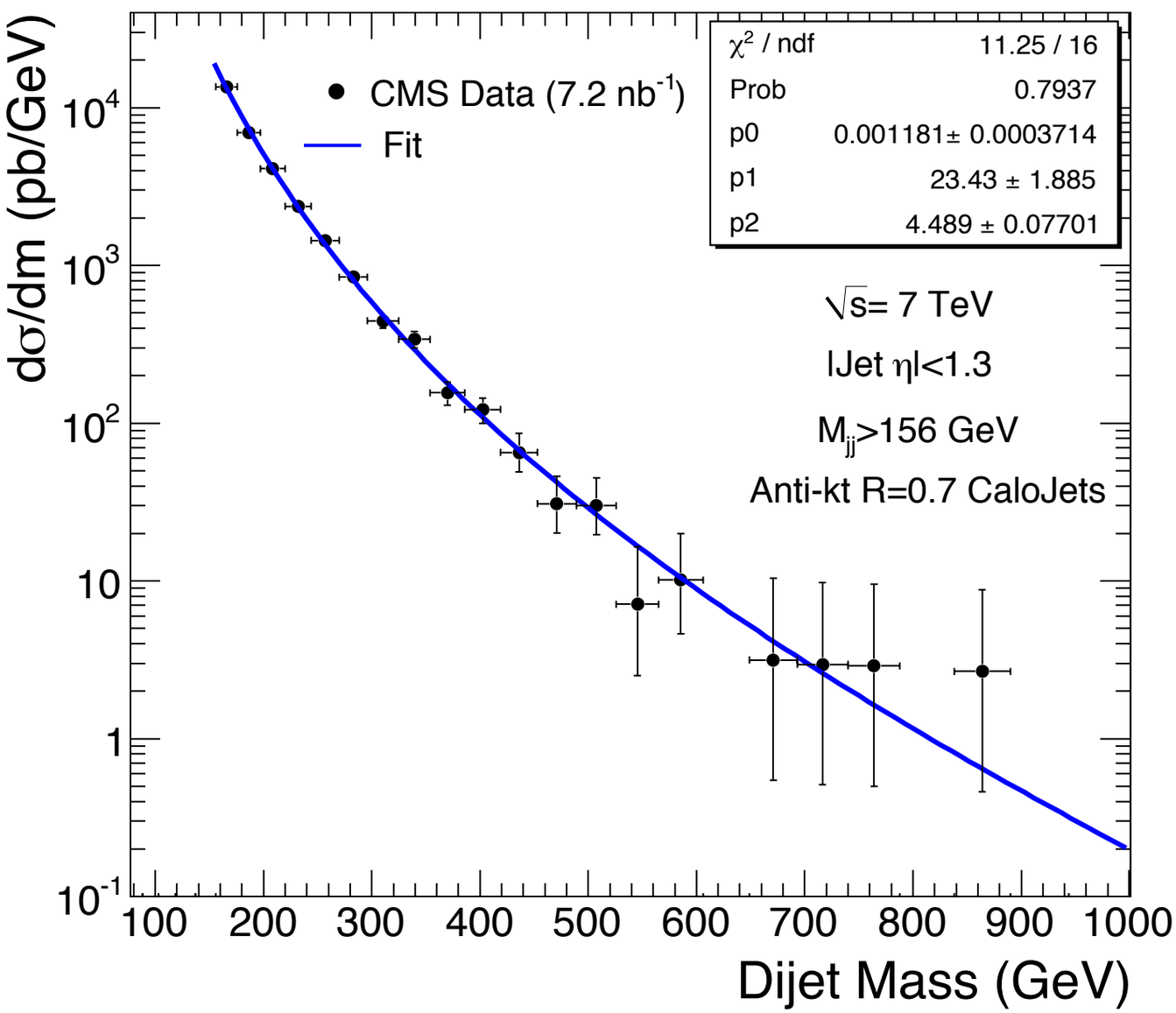
- The HLT_Jet15U unprescaled jet trigger we are using is 99% efficient
  - ✓ at M_{jj}=134 GeV for $|\eta|<1.3$
- The HLT_Jet30U unprescaled jet trigger we are using is 99% efficient
  - ✓ at M_{jj}=213 GeV for $\eta|<1.3$

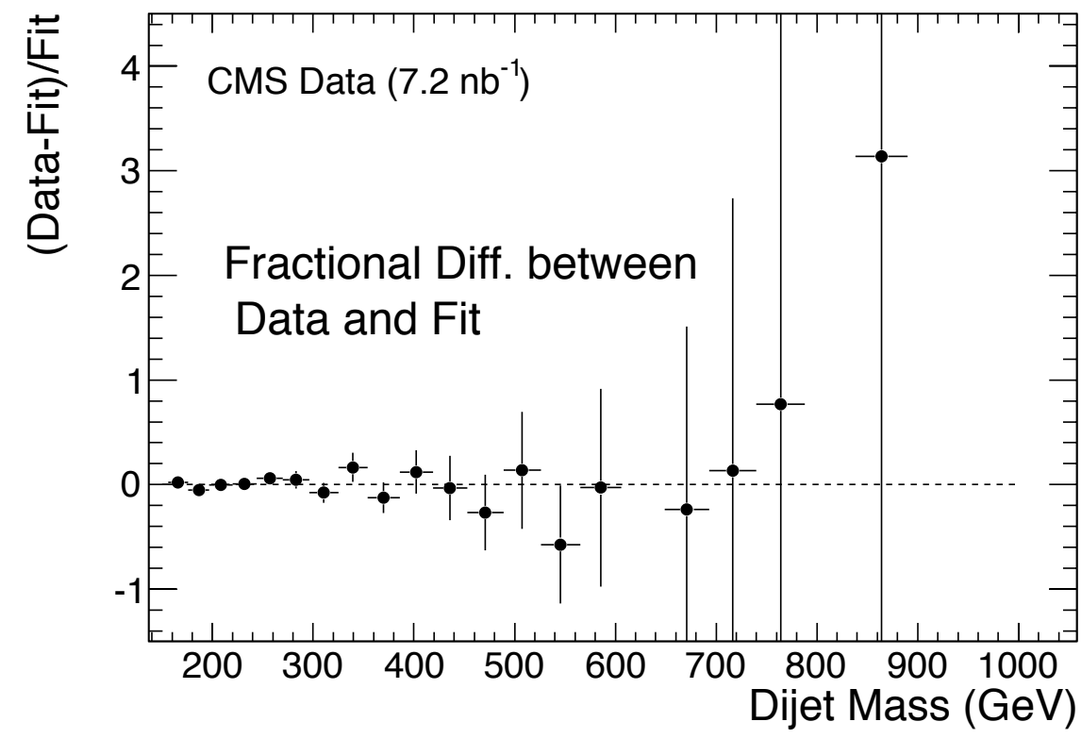


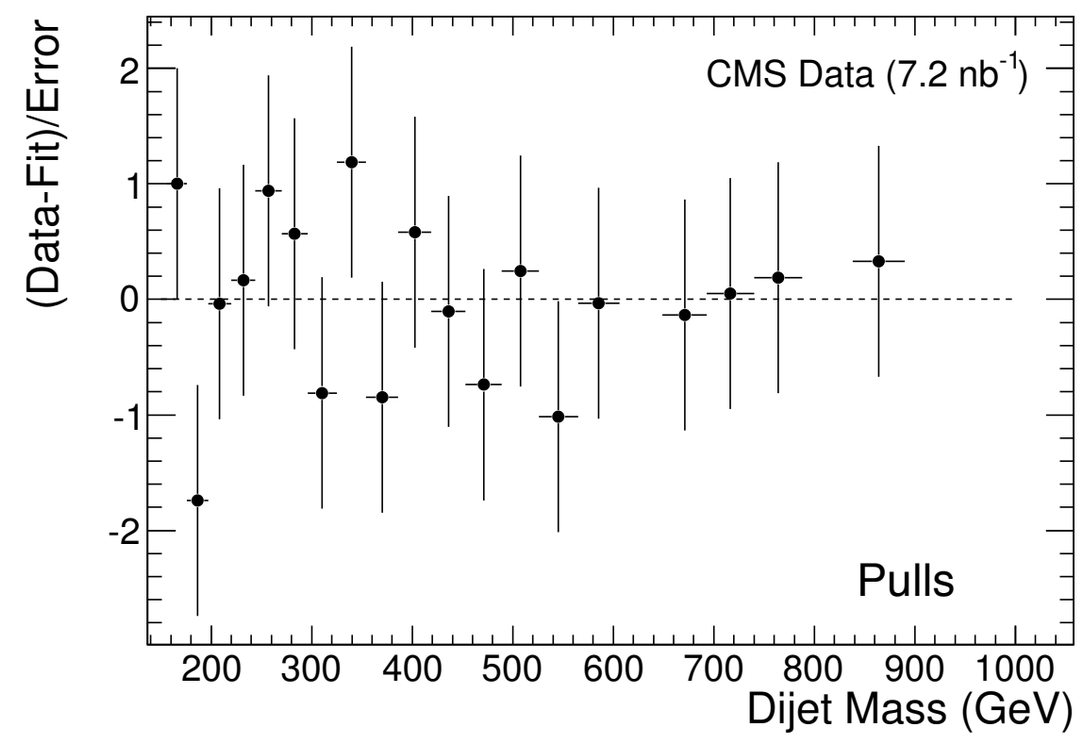


Dijet Mass and Fit

- We fit the data with the function
- We get a good fit.

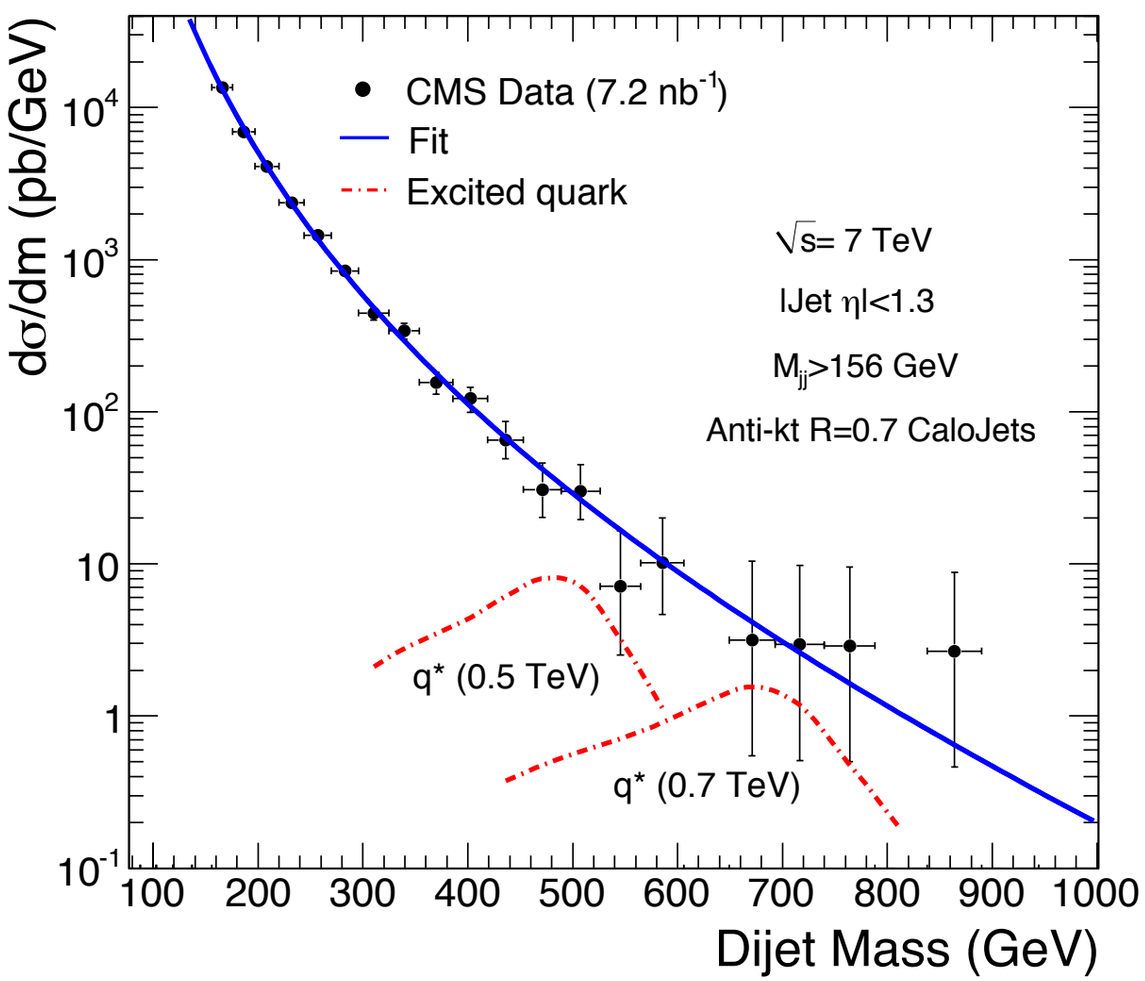


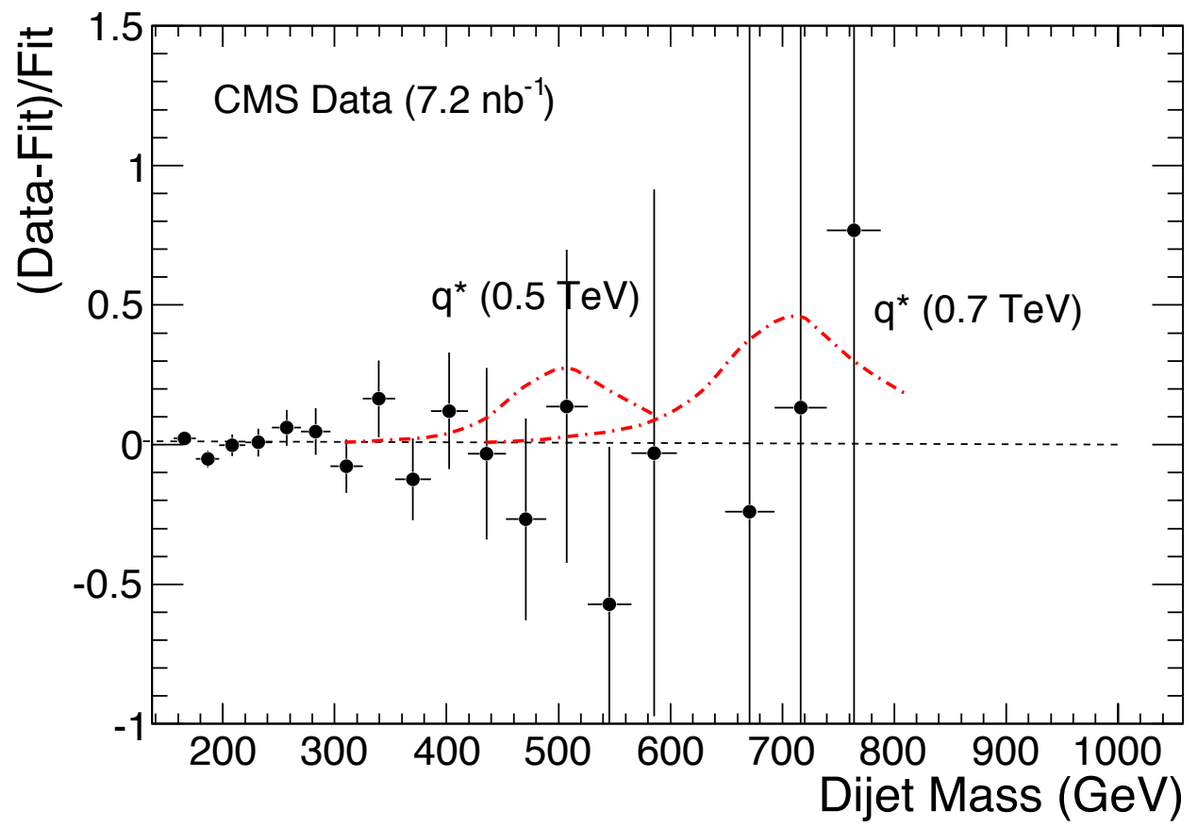




Fit and Signal

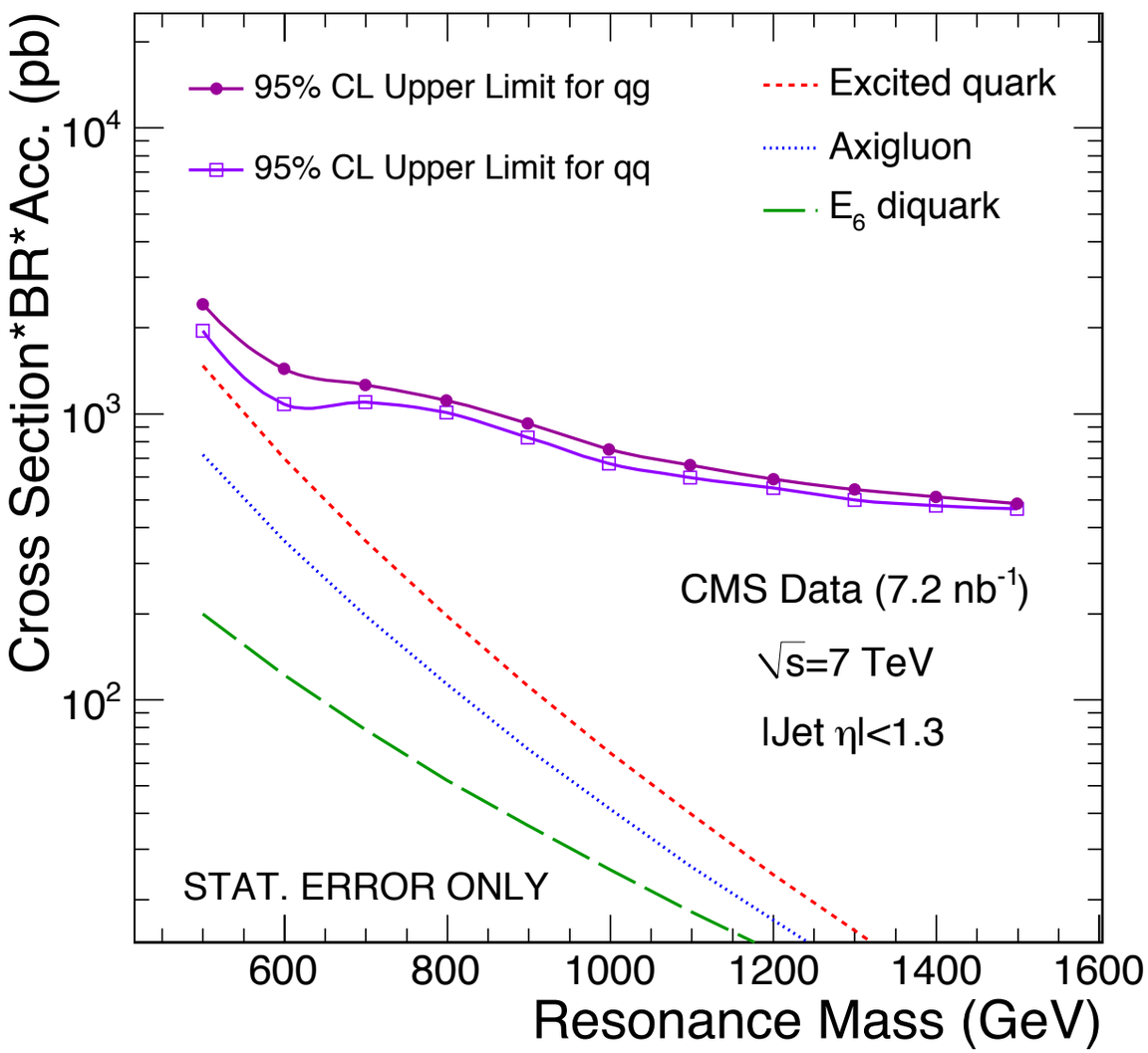
- We search for excited quark signal in our data.
- Simulation of Excited quark signals are shown at 0.5 TeV and 0.7 TeV.





Early Limits with Stat. Error Only

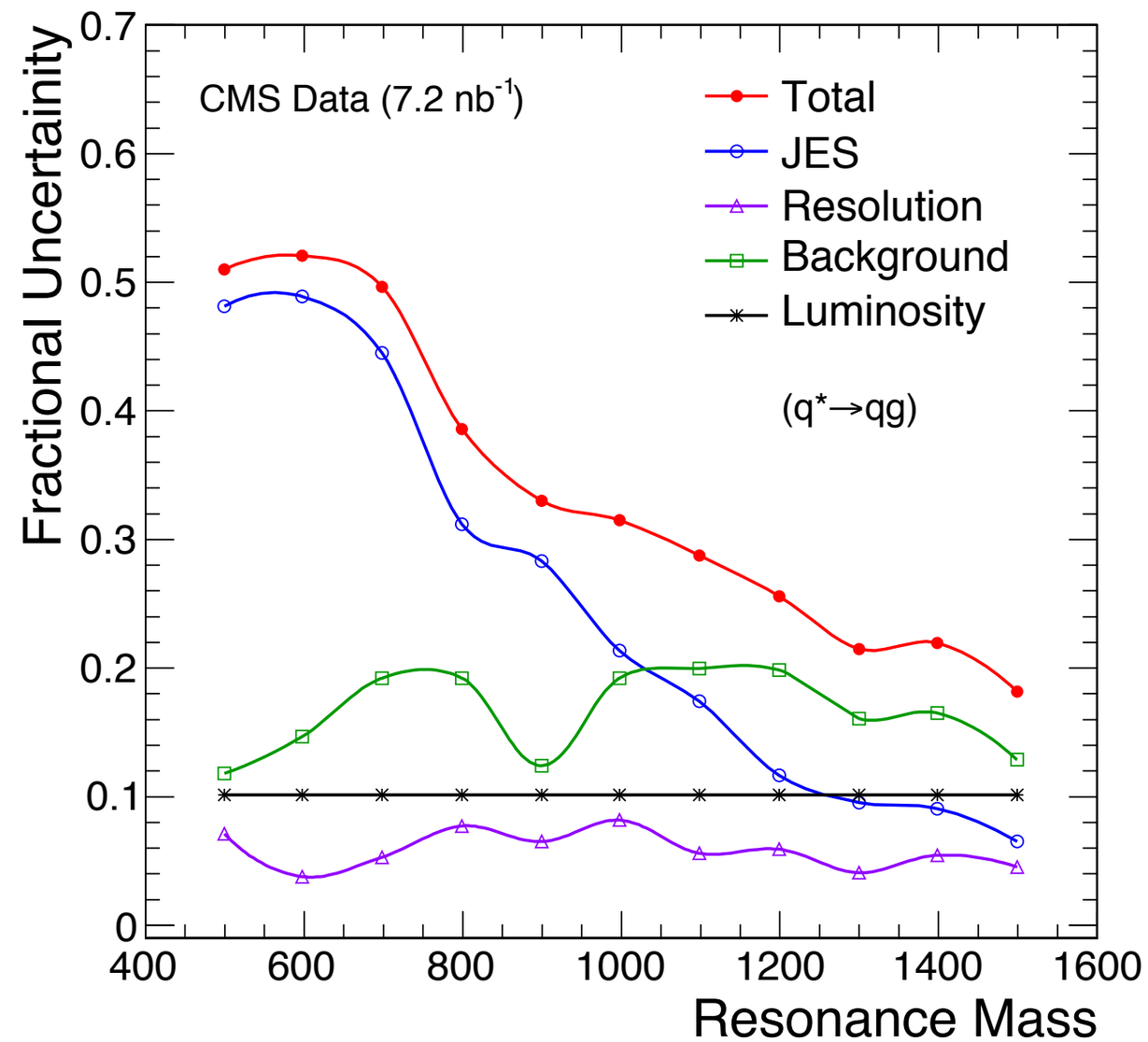
- To calculate limit on new particle cross section we use a binned likelihood by the Bayesian approach.
- 95% CL Upper limit with Stat. Error. Only compared to cross section for various model.
  - ✓ Show quark-gluon and quark-quark resonances separately. Difference is small.



	95% CL Upper Limit (pb)	
Mass (TeV)	quark-gluon	quark-quark
0.5	2402	1942
0.6	1416	1077
0.7	1254	1084
0.8	1101	1008
0.9	923	817
1.0	746	663
1.1	654	591
1.2	584	545
1.3	542	496
1.4	507	475
1.5	481	461

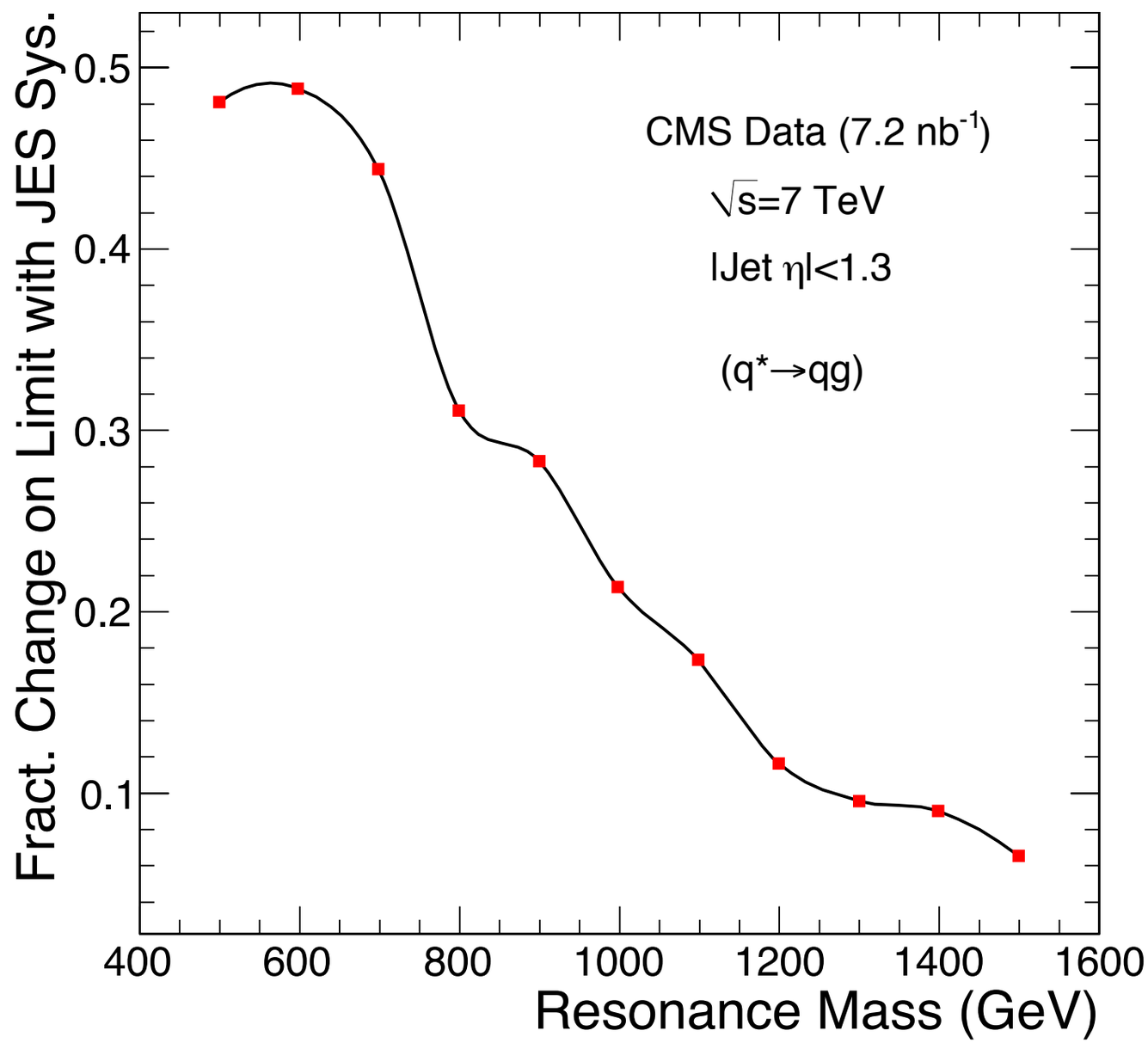
Systematic Uncertainties

- We found the uncertainty in the dijet resonance cross section from following sources
  - ✓ Jet Energy Scale (JES)
    - Uncertainty assumed to be 10% at start-up
  - ✓ Jet Energy Resolution (JER)
    - Uncertainty assumed to be 10% at start-up
  - ✓ Choice of background parametrization
    - We consider alternate parametrizations
  - ✓ Luminosity
    - Uncertainty assumed to be 10% at start-up
- We add in quadrature the individual systematic uncertainties
  - ✓ Total systematic uncertainty varies from 45% at m=0.5 TeV to 15% at m=1.5 TeV



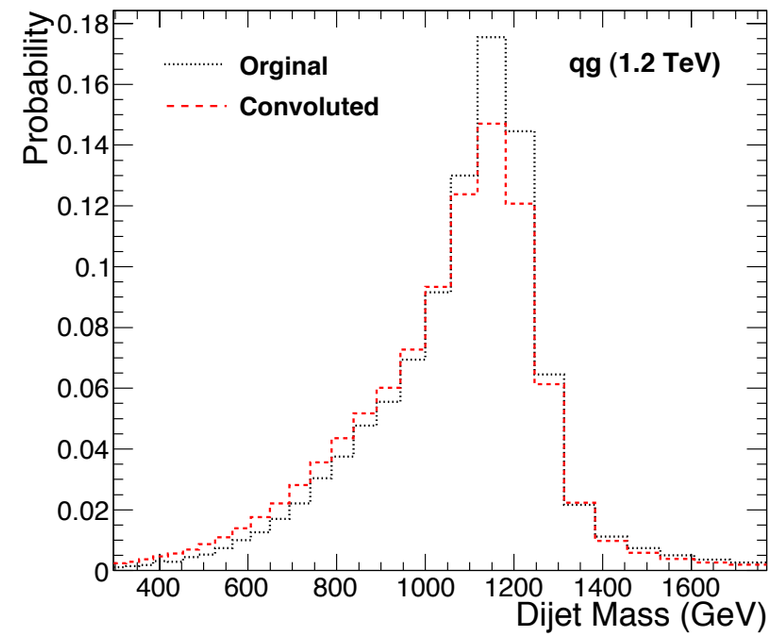
Jet Energy Scale (JES)

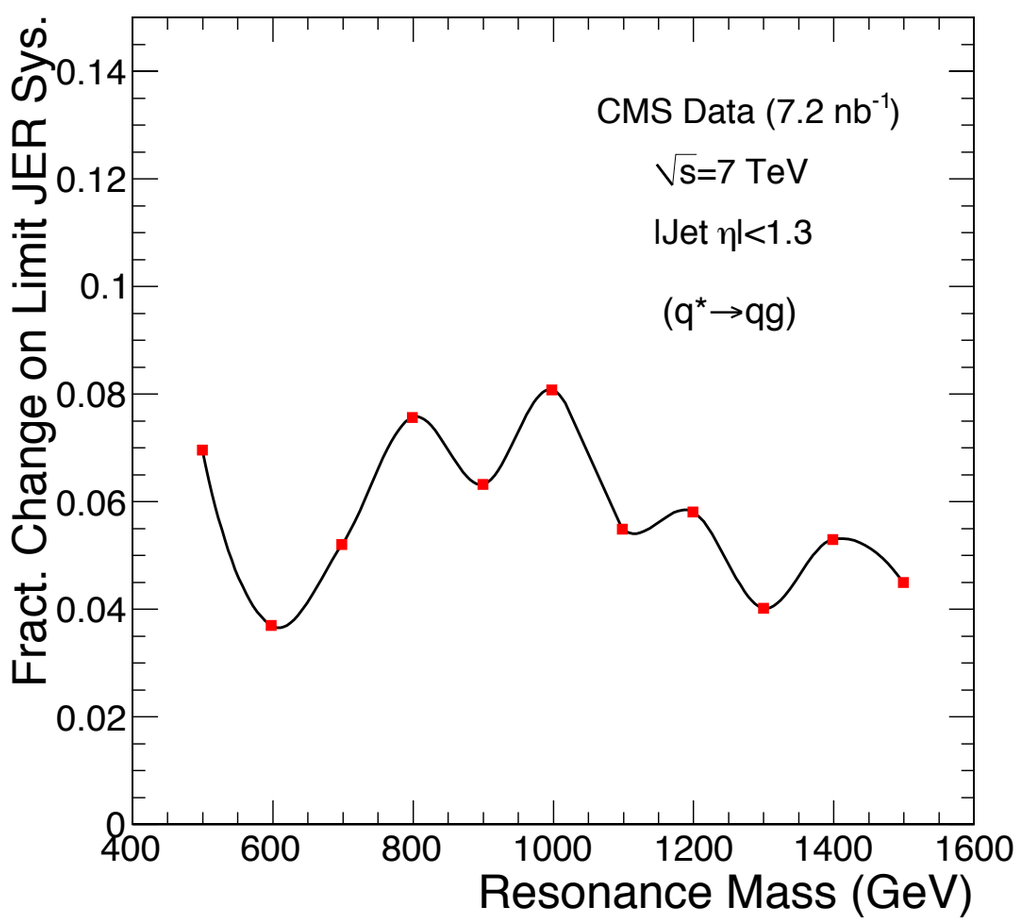
- Systematic uncertainty in jet energy is roughly 10% startup
  - ✓ We have decreased the mass of dijet resonance by 10%
  - ✓ This increases the background in the region of resonance, giving a worse limit.
  - ✓ Systematic uncertainty varies
    - from 50% at 0.5 TeV to 5% at 1.5 TeV.

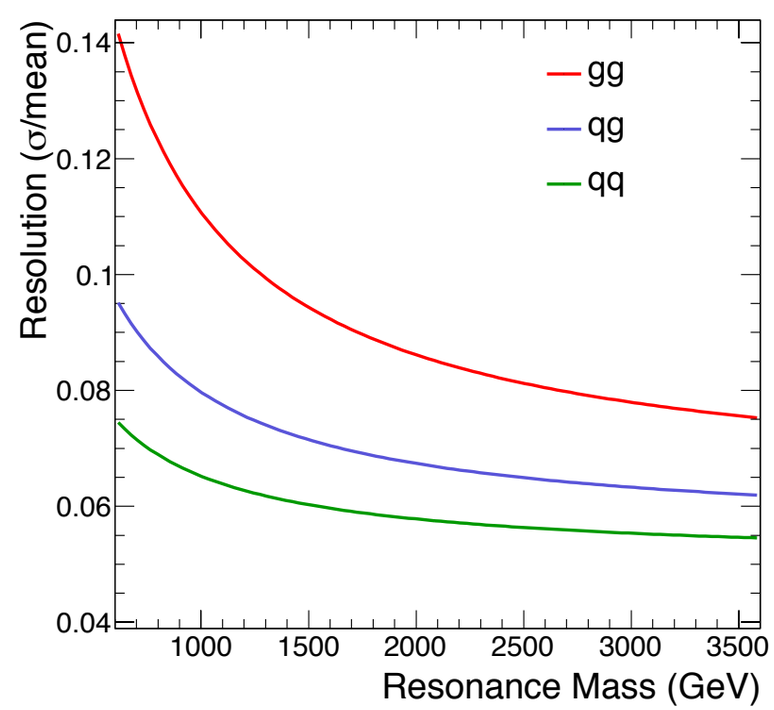


Jet Energy Resolution (JER)

- We consider uncertainty on jet energy resolution by 10%.
- Resonance shapes are convoluted with a gaussian that increasing "core" resolution by 10%
  - ✓ $\sigma_{Gaus} = \sqrt{\{(1.1)^2-1\}}\,\sigma_{Res}$
- Effect of resolution uncertainty on limit is small







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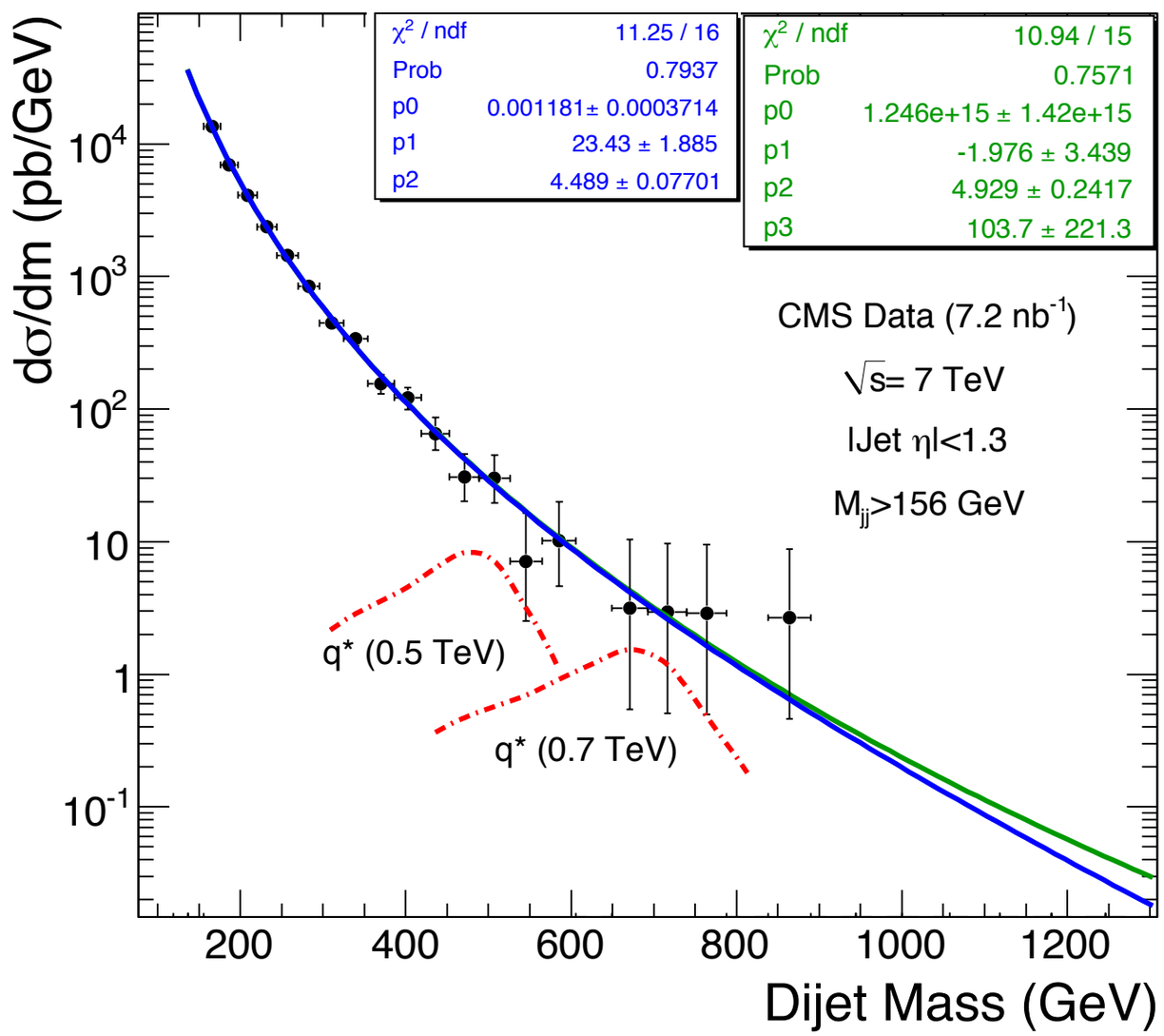
Background Parametrization Systematics

- We have varied the choice of background parametrization
  - ✓ A more complex form with 4 parameter.
- Systematic uncertainty varies from 8% to 1%.
- We expect bigger change on Back. Param. Sys. when we have more data.