Update on Dijet Resonances in Dijet Mass at 7 TeV

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Outline

- Dijet Mass Distribution and QCD
- Dijet Mass Distribution and Fit
- Trigger Efficiency
- Limits on Dijet Resonances
  - ✓ Statistical Error Only
- Conclusion

Event Selection

- Dataset

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    (135059-135735) /MinimumBias/Commissioning10-SD_JetMETTau-
Jun14thSkim_v1/RECO
     (136066-137028) /JetMETTau/Run2010A-Jun14thReReco_v2/RECO
     (137437-139558) /JetMETTau/Run2010A-PromptReco-v4/RECO
     (139779-140159) /JetMETTau/Run2010A-Jul16thReReco-v1/RECO
     (140160-141961) /JetMETTau/Run2010A-PromptReco-v4/RECO
     (141962-142558) /JetMET/Run2010A-PromptReco-v4/RECO
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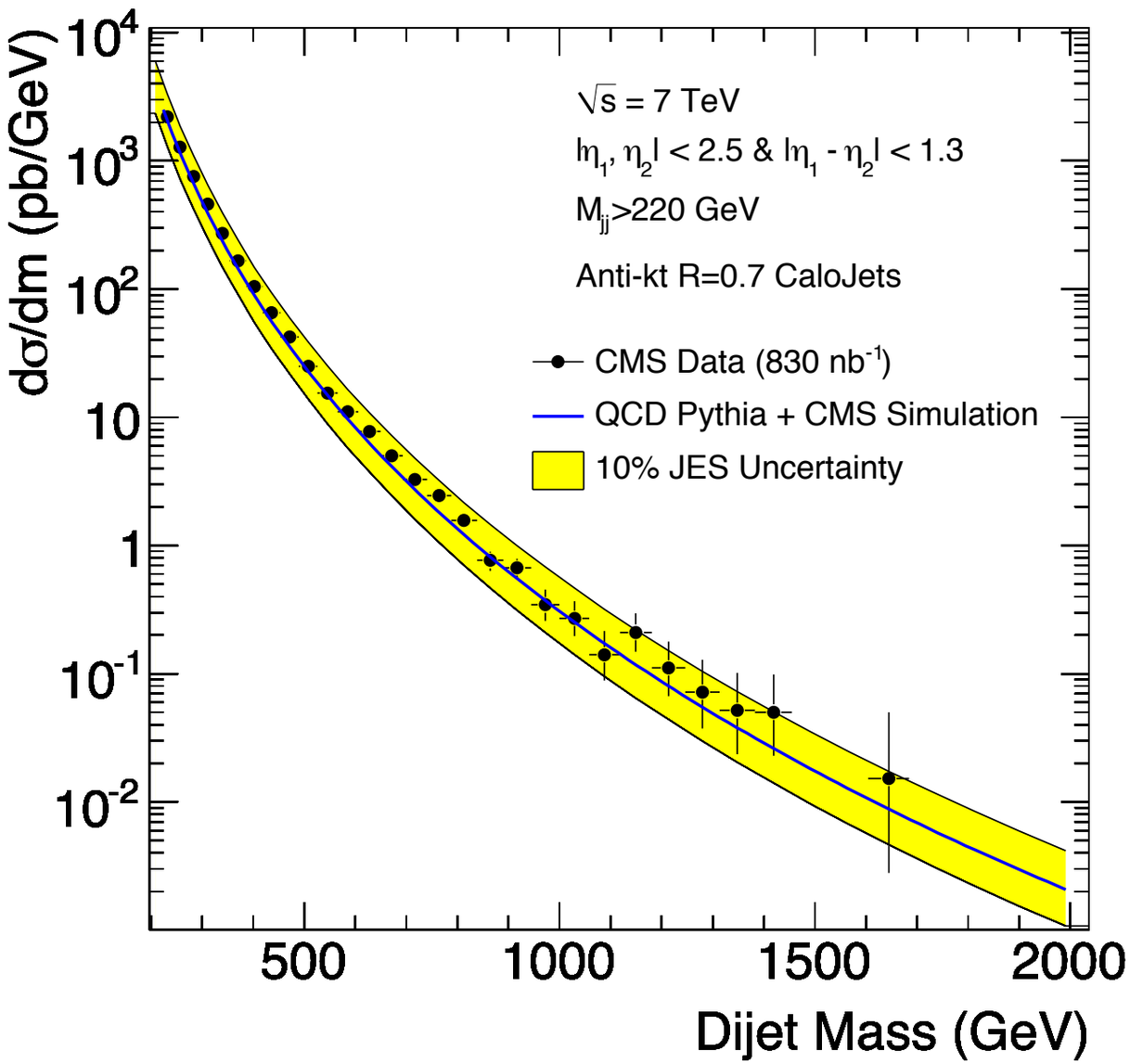
  - ✓ Jason files daily with DCS
  - ✓ Scraping event removal
  - ✓ Estimated Luminosity: 0.83 pb-1
- Event Selection
  - ✓ HLT_Jet50U & Trigger bits: "0"
  - ✓ AK7caloJets
  - ✓ JEC: L2+L3, "Summer10" + Residual from data (to be applied for only data)
  - ✓ |PVz| < 15 cm && PVndof >= 4
  - ✓ Both |Jet η|< 2.5 and |Δη|<1.3
  - ✓ Both leading jets passing the "loose" jet id & Mjj > 220 GeV (corrected)
- Total: 118601 Dijet Events

Dijet Mass and QCD

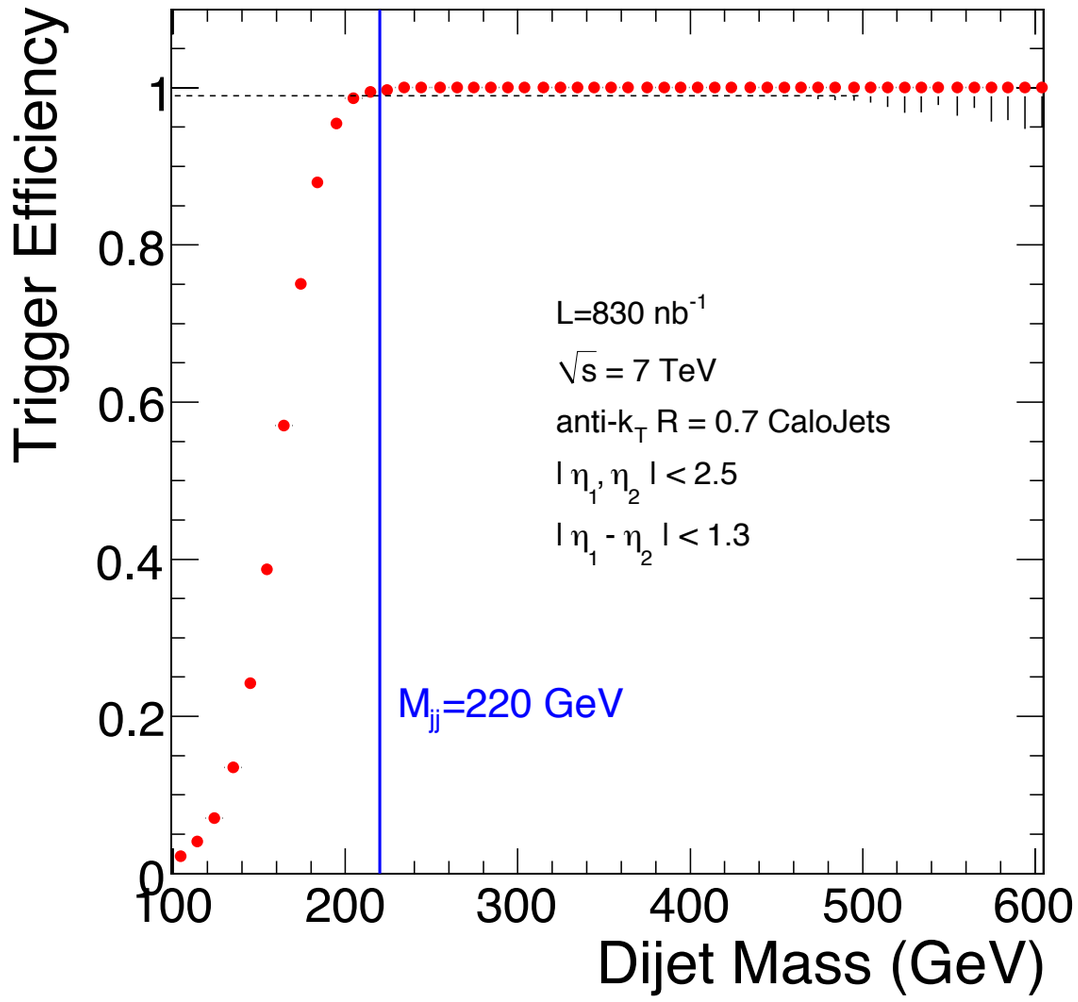
- The data is in good agreement with full CMS simulation of QCD from PYTHIA.



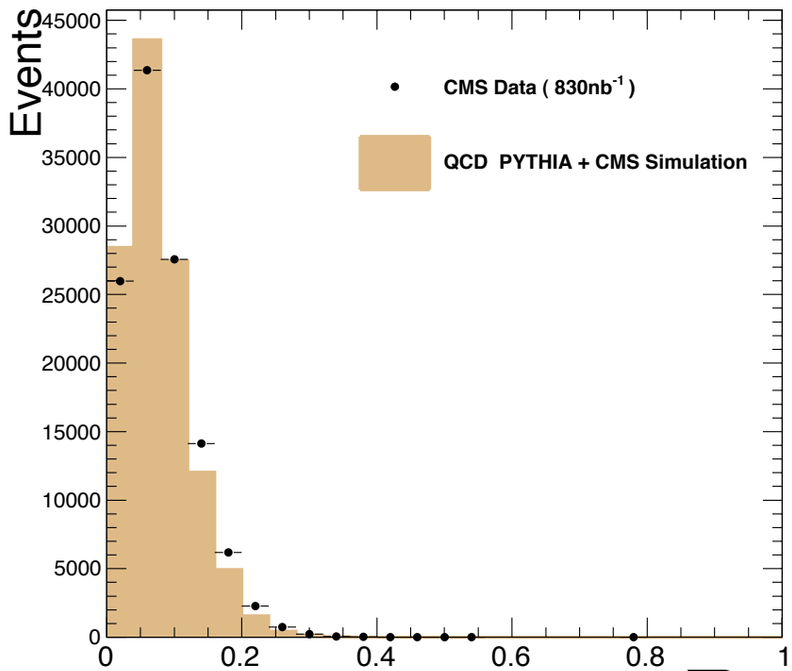
Trigger and JetID Efficiencies

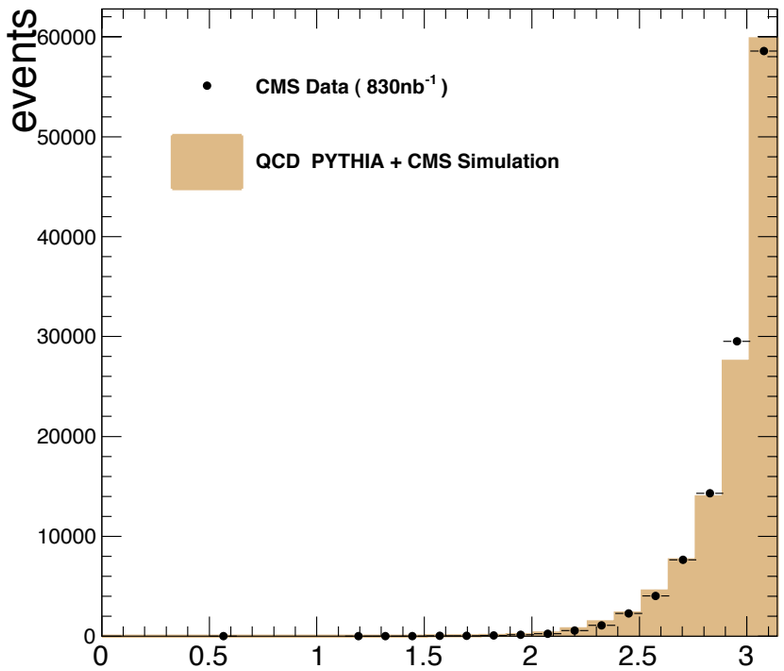
- HLT_Jet50 trigger is full efficient

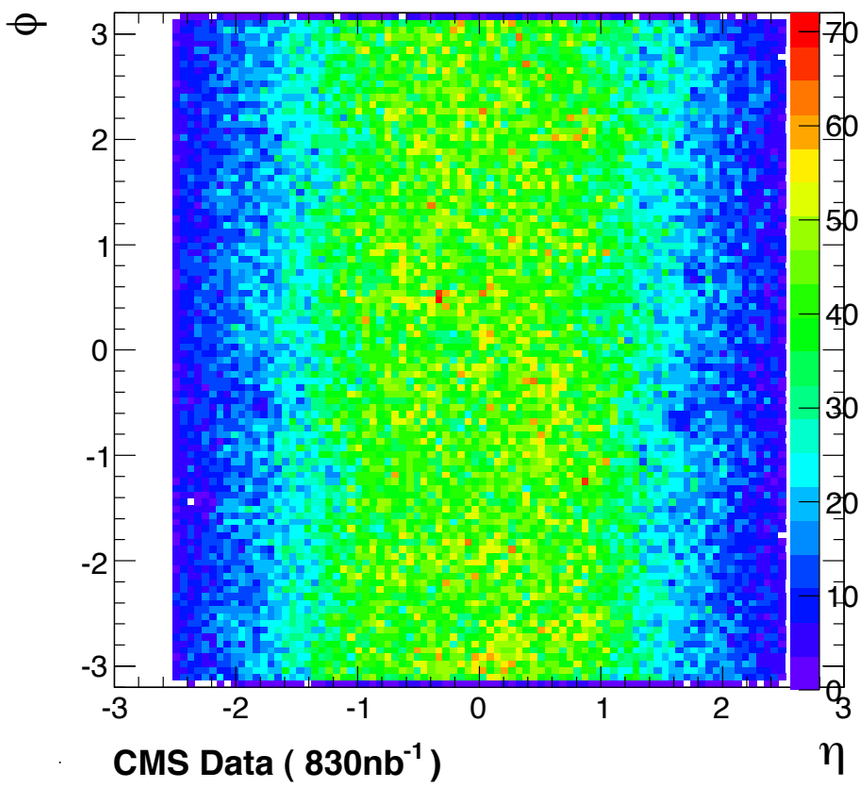
✓ at M_{jj}=220 GeV for $|\eta|<2.5$ and $|\Delta\eta|<1.3$

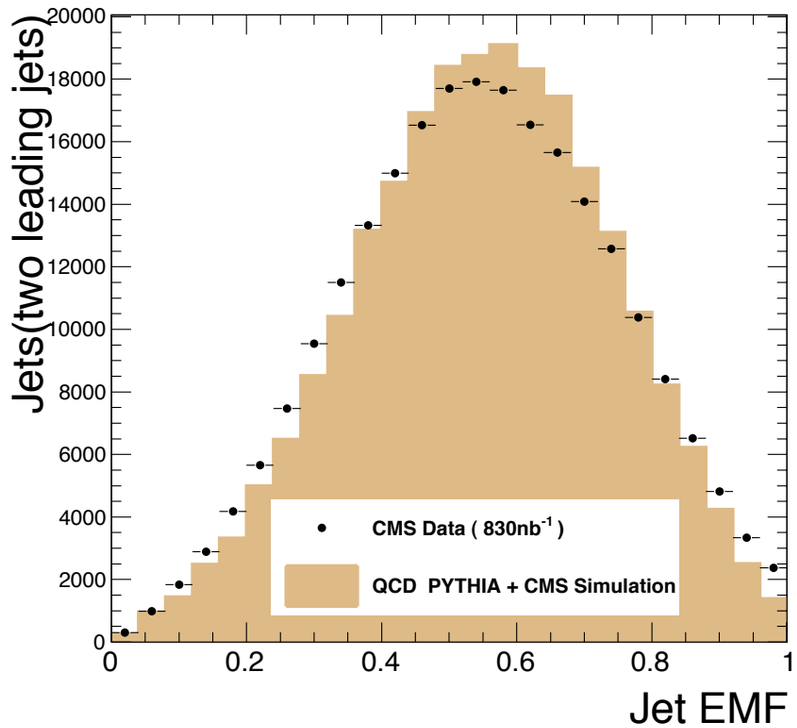


Basic Quality Plots



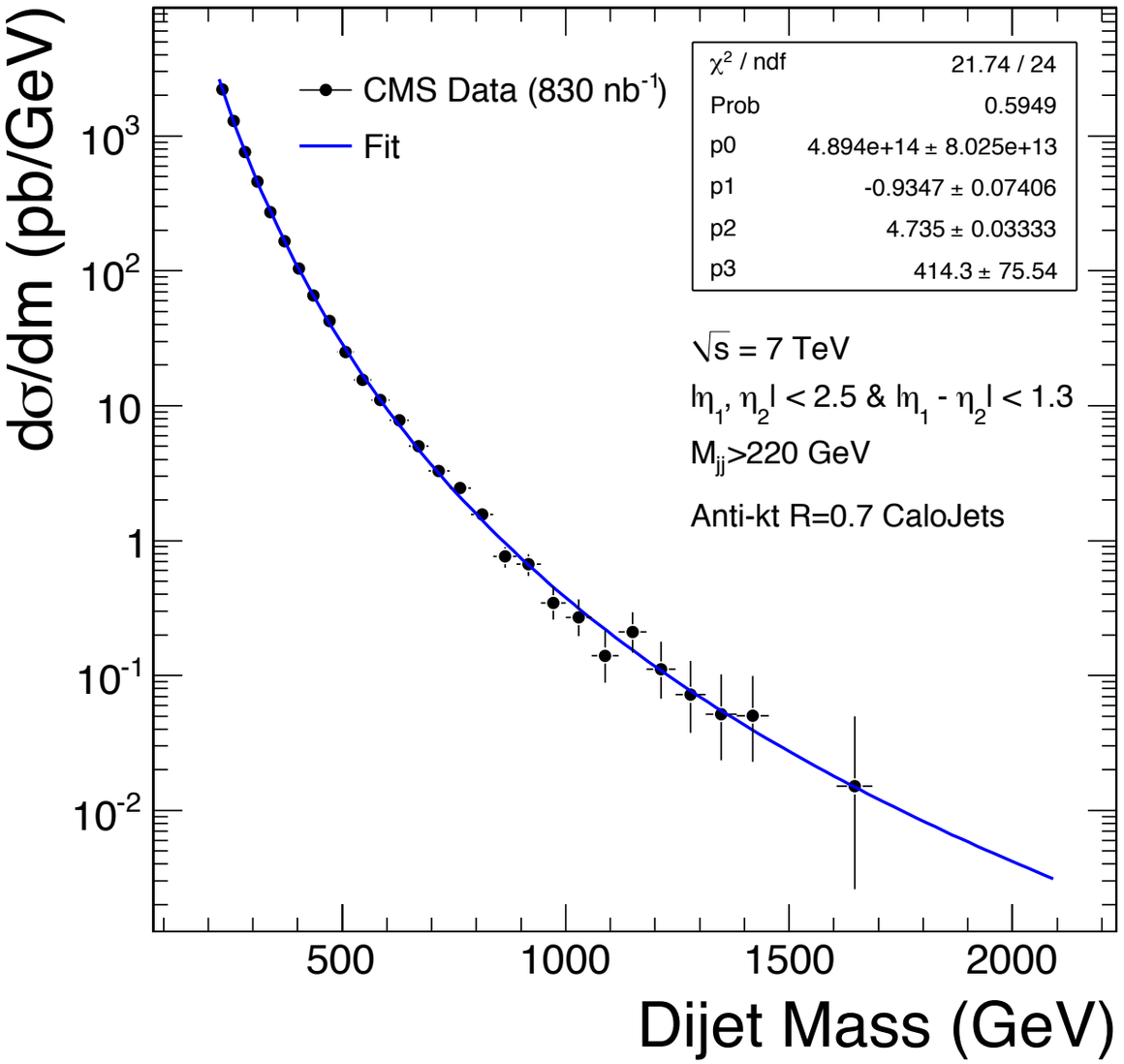






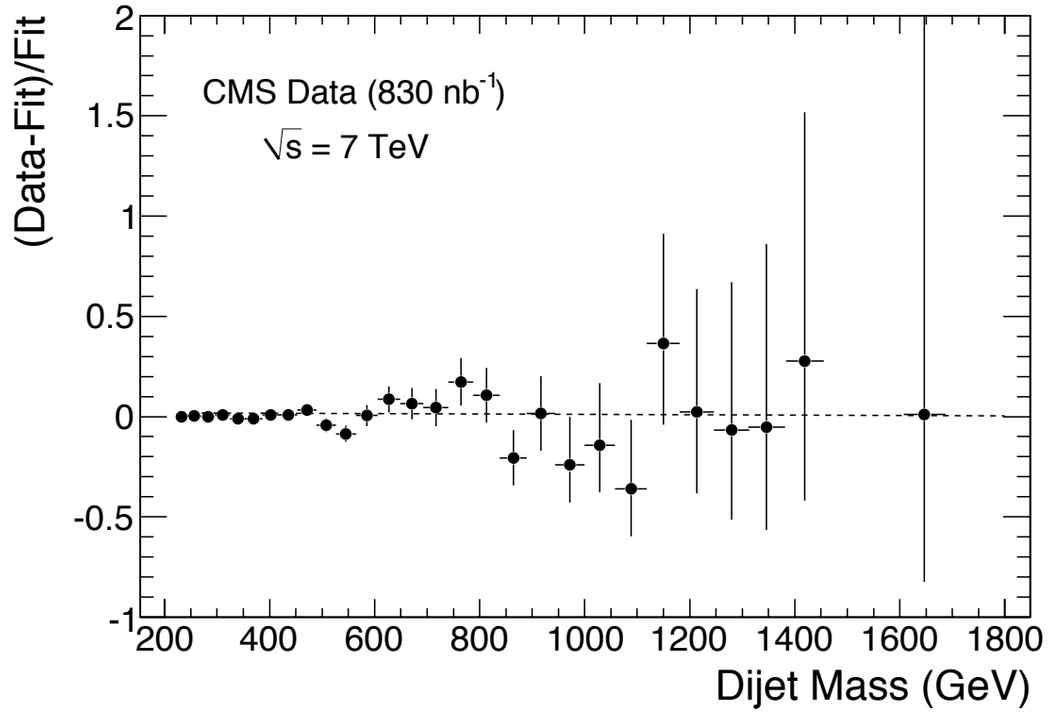
Dijet Mass and Fit

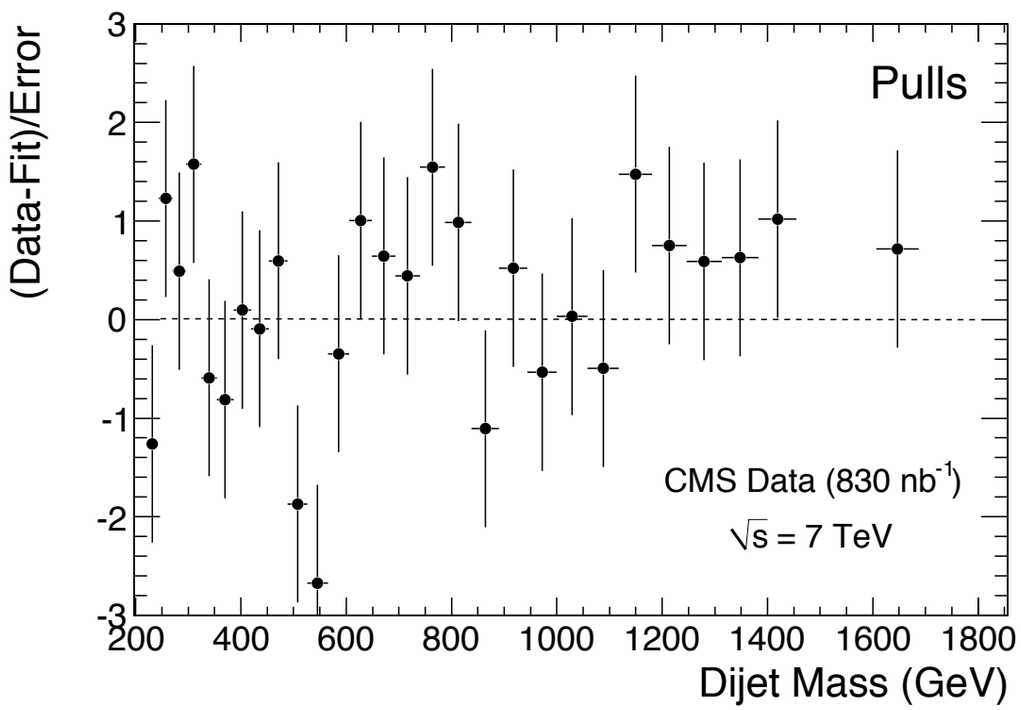
- We fit the data a function containing 4 parameters.
- We get a good fit.



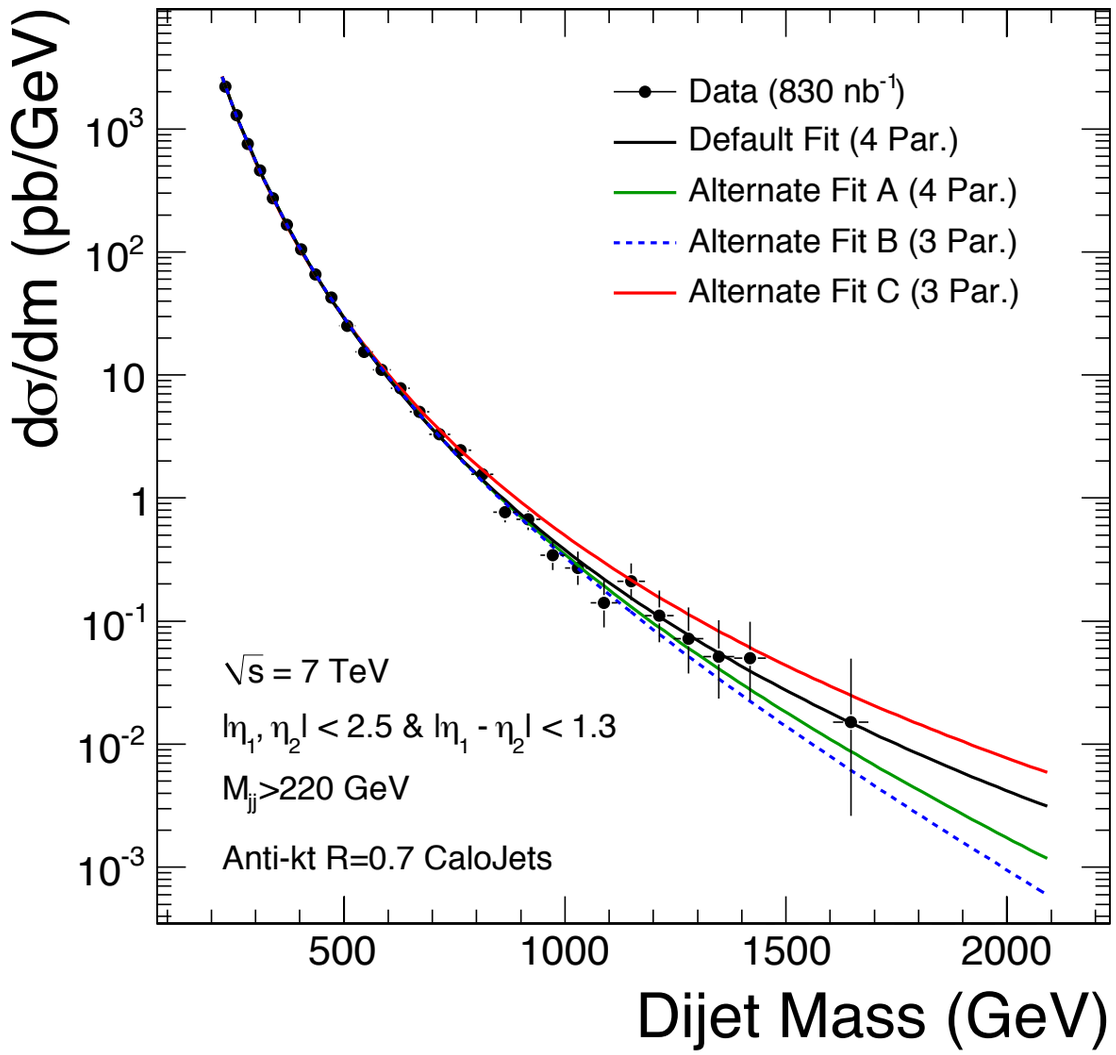
$$\frac{P_0 \cdot \left(1 - m/\sqrt{s} + P_3 \cdot (m/\sqrt{s})^2\right)^{P_1}}{m^{P_2}}$$

Fractional Diff. between Data and Fit





Another Fit Parametrization



- In addition to the default fit, 3 alternate functional forms are considered.
- Default 4 parameters fit gives best result.

Default

$$\frac{P_0 \cdot \left(1 - m/\sqrt{s} + P_3 \cdot (m/\sqrt{s})^2\right)^{P_1}}{m^{P_2}}$$

A

$$\frac{P_0 \cdot (1 - m\sqrt{s})^{p_1}}{(m/\sqrt{s})^{p_2 + p_3 ln(m\sqrt{s})}}$$

B

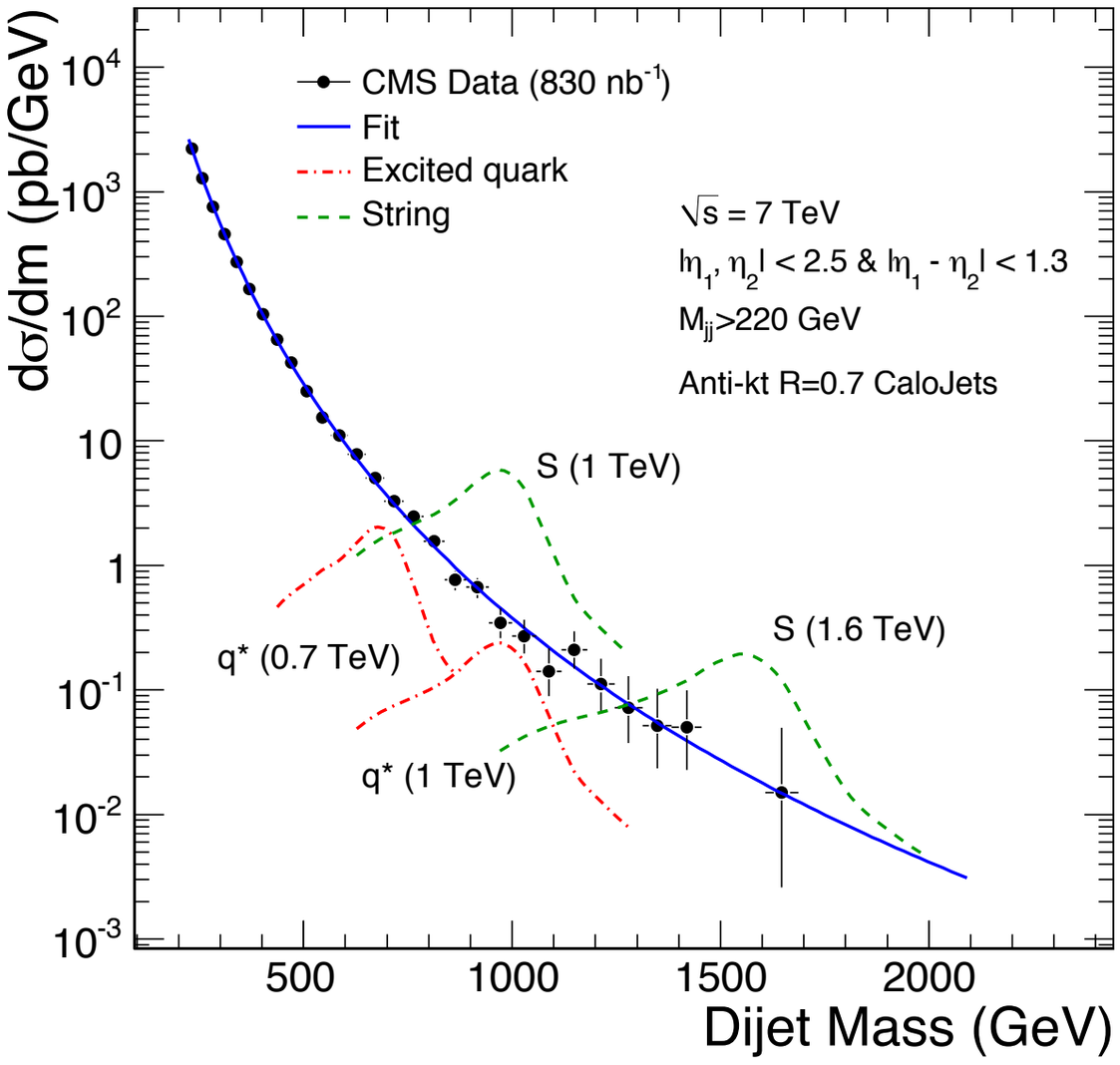
$$\frac{P_0 \cdot (1 - m/\sqrt{s})^{P_1}}{m^{P_2}},$$

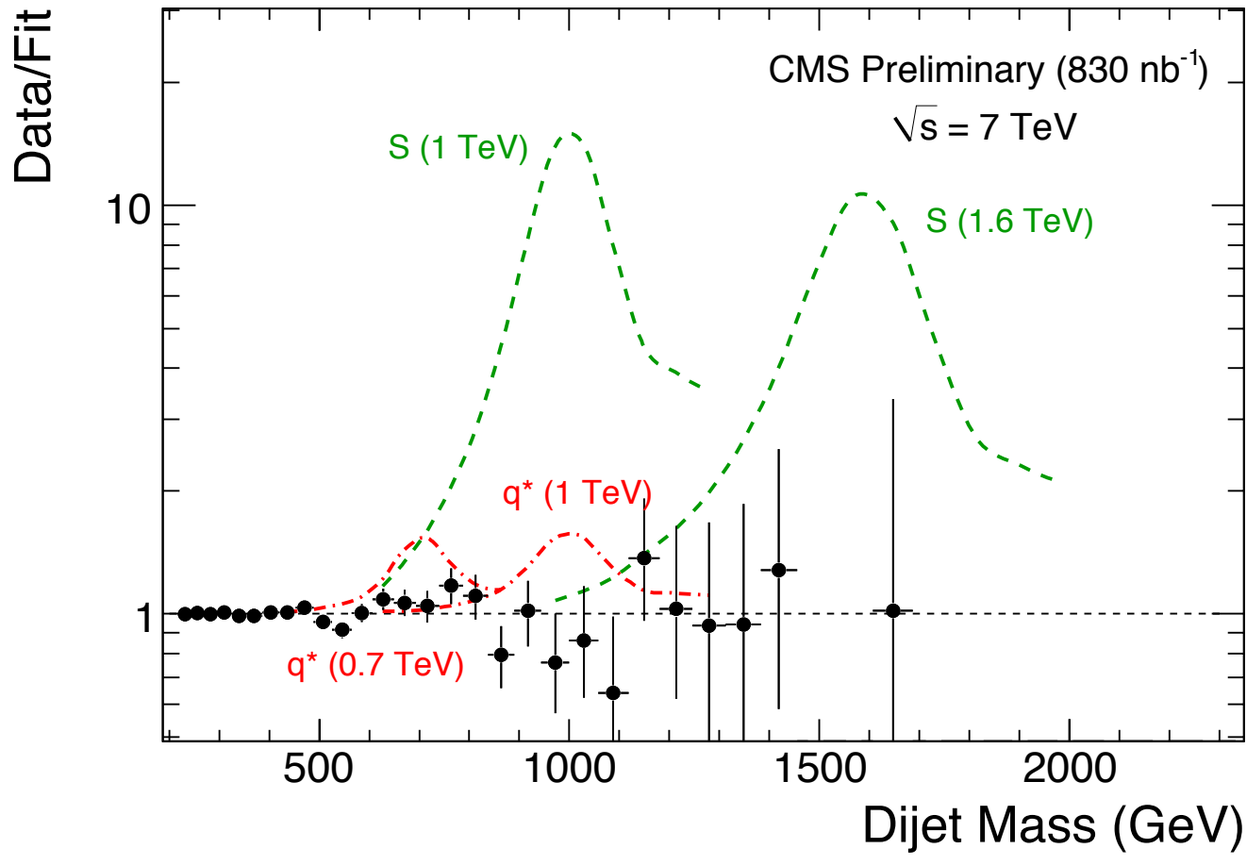
C

$$\frac{P_0}{(P_1 + m)^{P_2}},$$

Fit and Signal

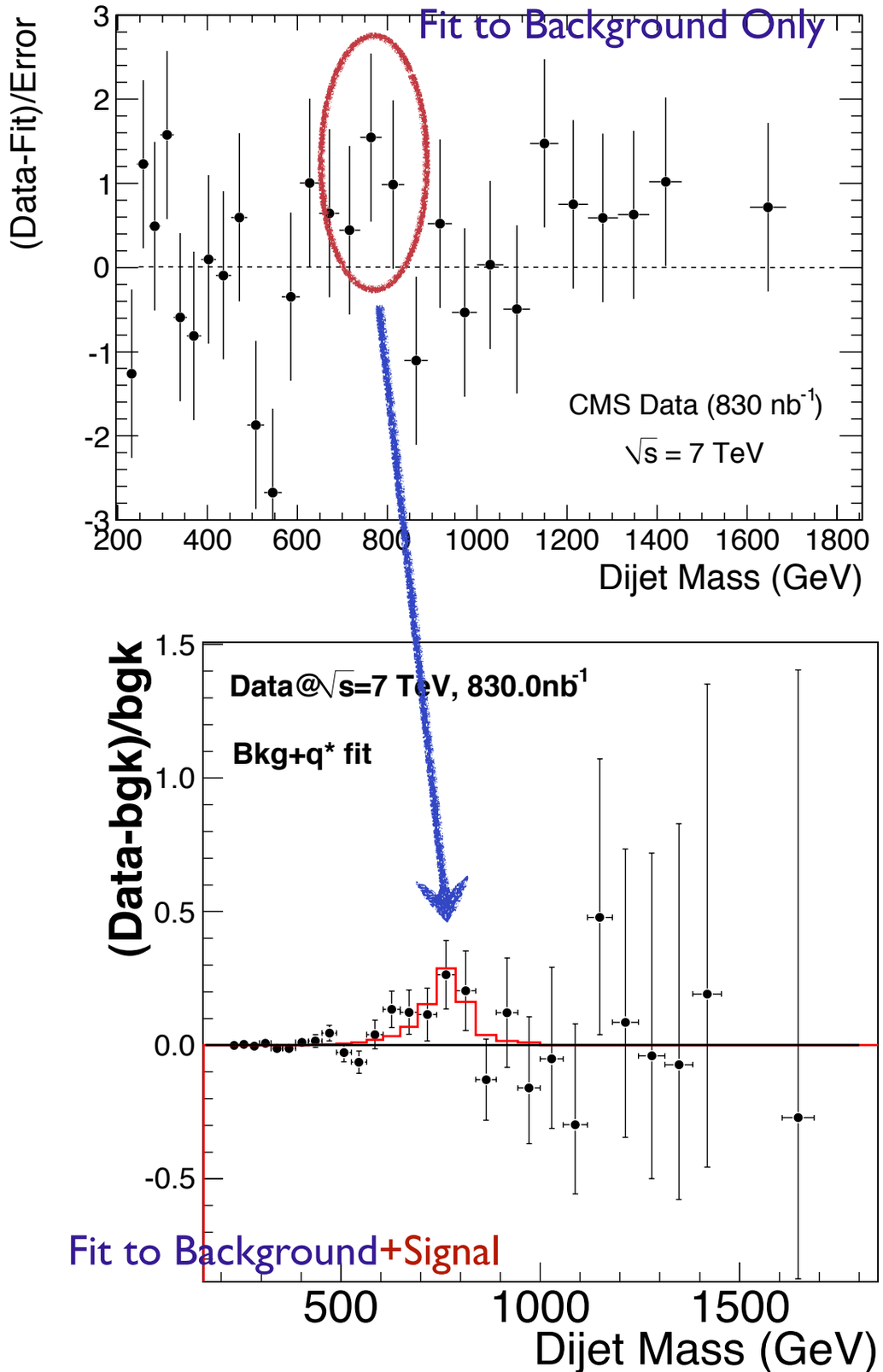
- We search for resonance signal in our data.
- Excited quark signals are shown at 0.7 TeV and 1 TeV.
- String resonance signals are shown at 0.7 TeV and 1.6 TeV.





The Largest Fluctuation in Data

- Best fit resonance at M_{jj}=780 GeV has significance 2.5 sigma from log likelihood ratio.



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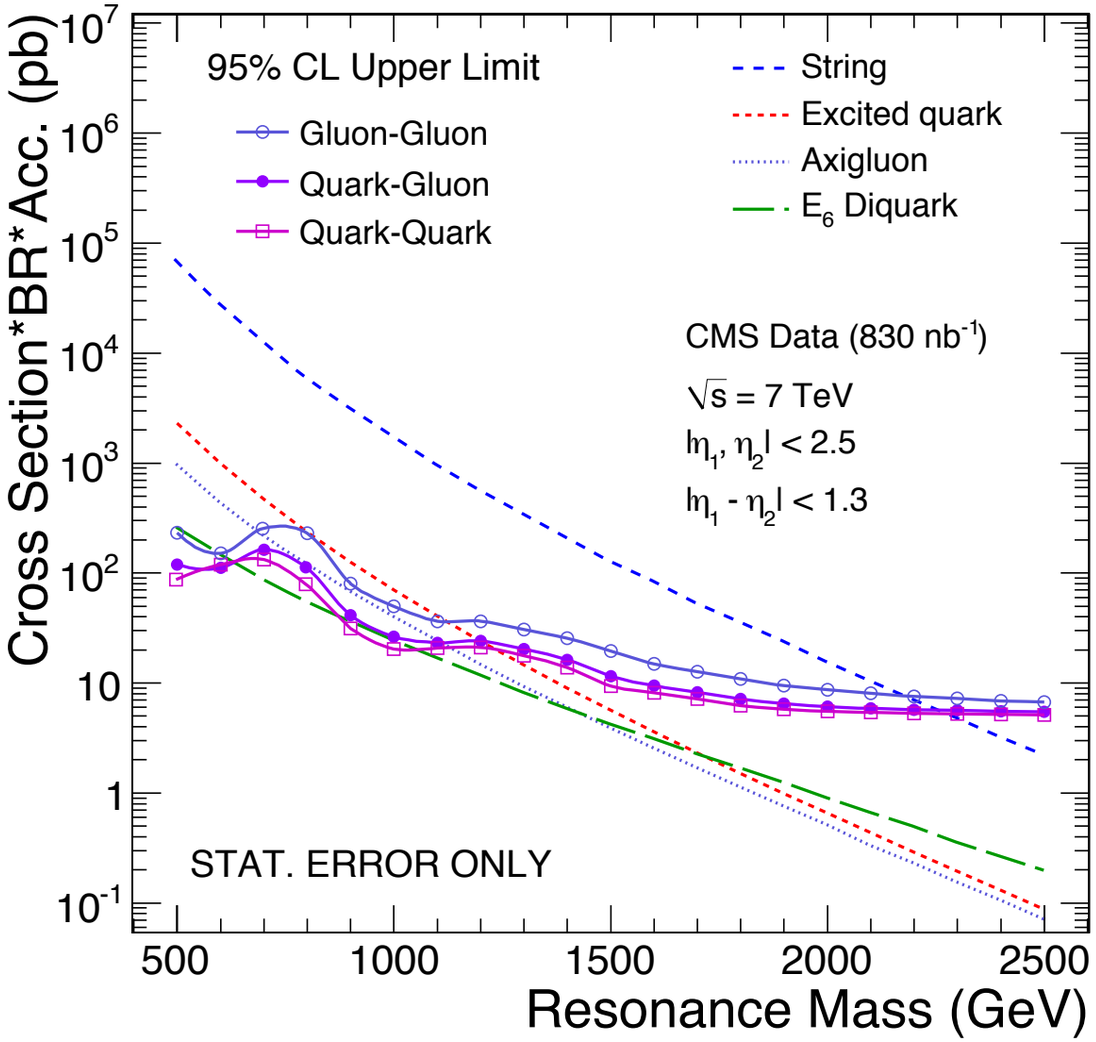
Early Limits with Stat. Error Only

- We use a flat prior to get the posterior probability density and find limit.
- We use a binned likelihood by the Bayesian approach to find limit on new particle cross section.
- 95% CL Upper limit with Stat. Error. Only compared to cross section for various model.
  - ✓ Show quark-quark and quark-gluon and gluon-gluon resonances separately.
  - ✓ gluon-gluon resonance has the lowest response and is the widest and gives worst limit.



95% C.L. Excluded Mass (TeV) (Stat. Error Only)		
Model	CMS (0.83 pb-1 @ 7 TeV)	CDF (1 fb-1 @1.96 TeV)
String	2.25	1.4
Excited quark	1.2	0.87
Axigluon/ Coloron	1.13	1.25
E6 Diquark	0.63	0.63

Conclusion

- We have a dijet mass spectrum that extends to 1.7 TeV with 830 nb^{-1} data.
- The dijet mass data spectrum is in good agreement with a full CMS simulation of QCD from PYTHIA.
- The data is well fit by a simple parametrization with four parameters.
- We observed better mass limit than Tevatron for excited quark and String Resonance with Stat. Error Only.
- CMS is very close to set better mass limit for Axigluon/Coloron and E6 Diquark.