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May 23 2003

Inclusive Jet Cross Section Update

Work being done in the Jet SubGroup:

A. Bhatti, F. Chlebana, J Dittmann, R. Field, G. Flanagan, R. Harris, J. Huston, G. Latino, M. Martinez-Perez, R. Snihur, *and others...*

Results based on 85 pb^{-1} were presented at Spring Conferences

Details written up in CDF6898

Blessed plots available at:
http://www-cdf.fnal.gov/physics/new/qcd/qcd_plots/run2/inclusive_jets/winter03/

Now have 45% more data ($85 \rightarrow 123 pb^{-1}$)!

About $10 pb^{-1}$ of data not yet processed and more coming...

Event Selection and Reconstruction

Redid Calorimetry, version 4.10.0 (reredoing 4.10.4)

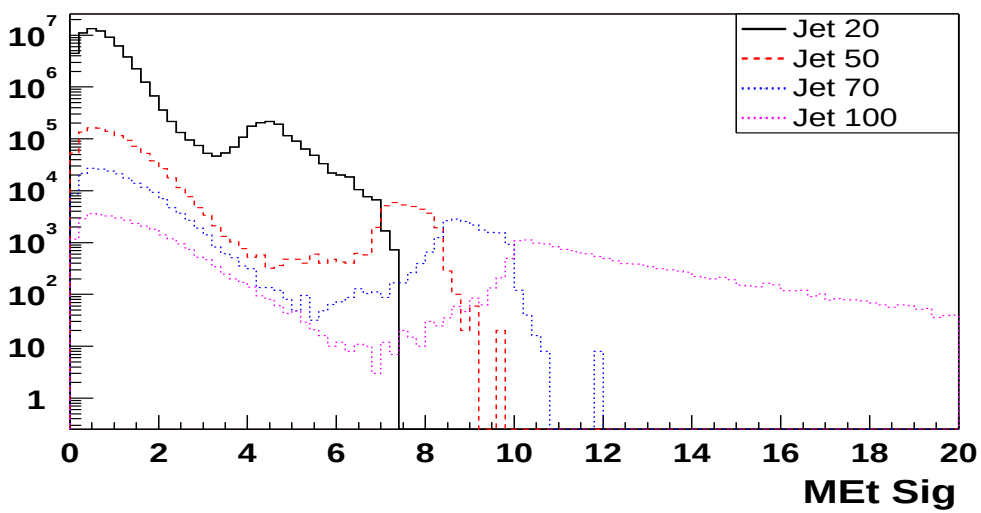
Using DataAccess to produce ntuples
→ fcdfsgi2:/cdf/data40b/s0/qcd/chlebana/jets_4.10.0

Central region: $0.1 < |\eta_{Det}| < 0.7$

Vertex cut: $|z| \leq 60$ cm, *Apply a 5% acceptance correction*

Cut on total energy: $E_{tot} \leq 1500$ GeV

Cut on Missing E_T Significance:

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J20:  MEtSig > 3.5
J50:  MEtSig > 5
J70:  MEtSig > 6
J100: MEtSig > 7
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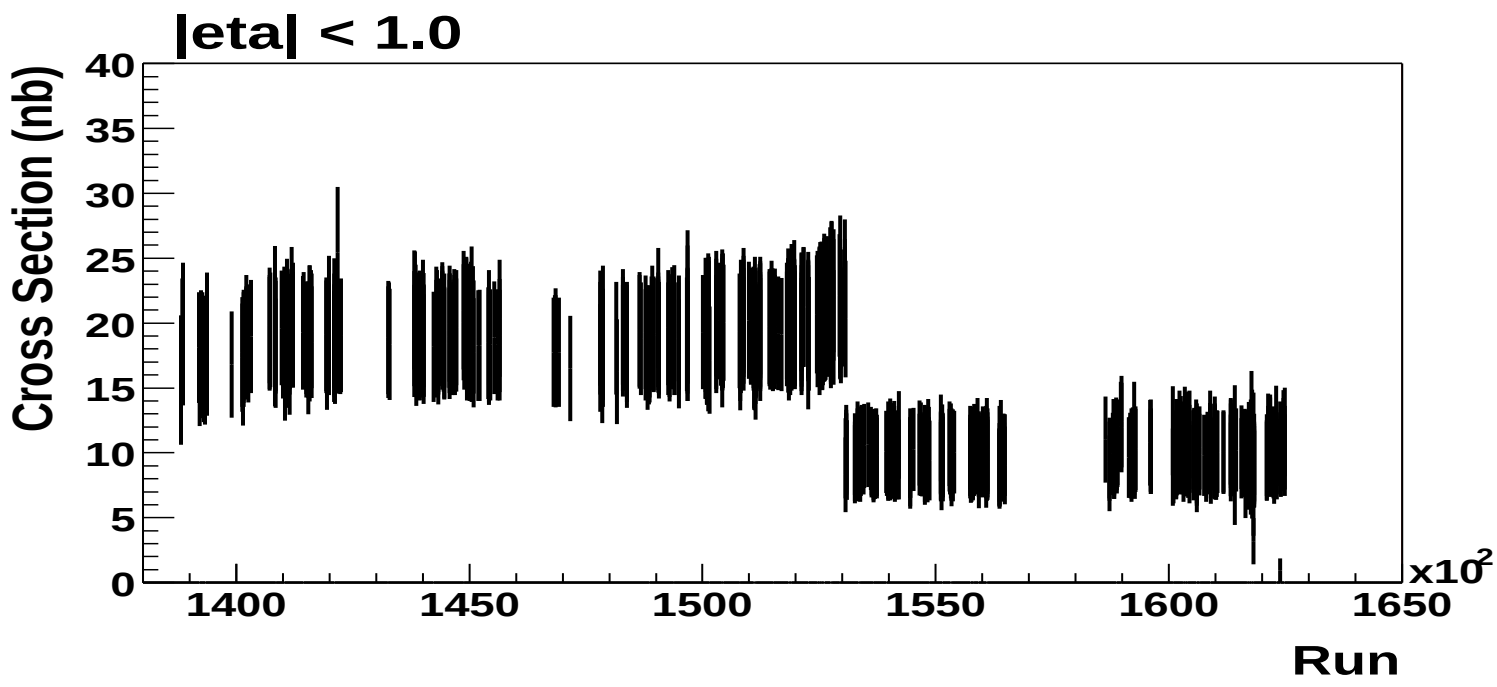
Additional sanity checks...

→ Two independent analyses

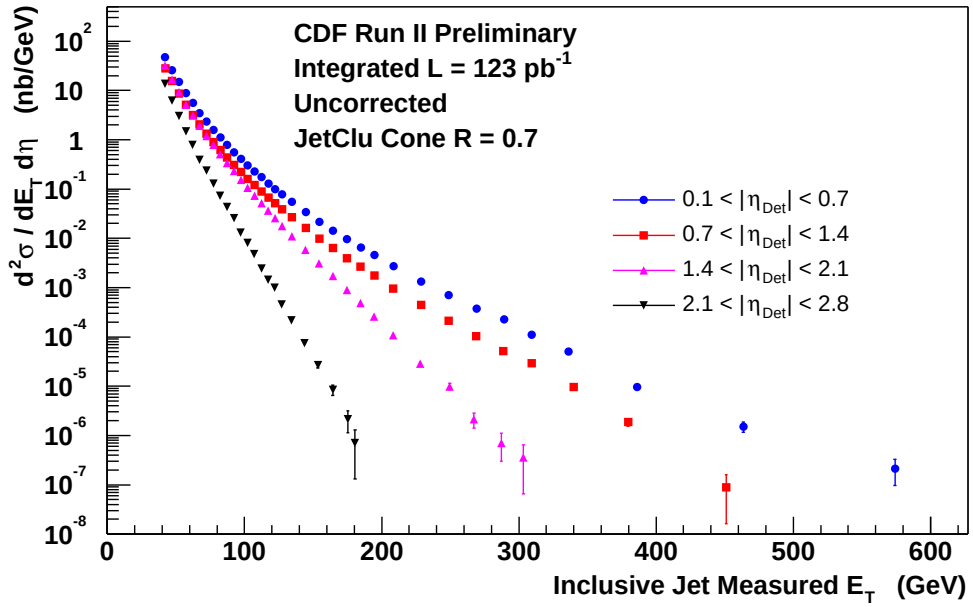
→ Checked events in ntuples match event counts from database

→ Cross section in the central region looks stable



See the change in the prescale

Measured data - input to unsmearing...



Jets in highest E_T bins

Bin	85 pb^{-1}	123 pb^{-1}
320-360	165	281
360-440	68	109
440-520	4	17
520-620	3	3

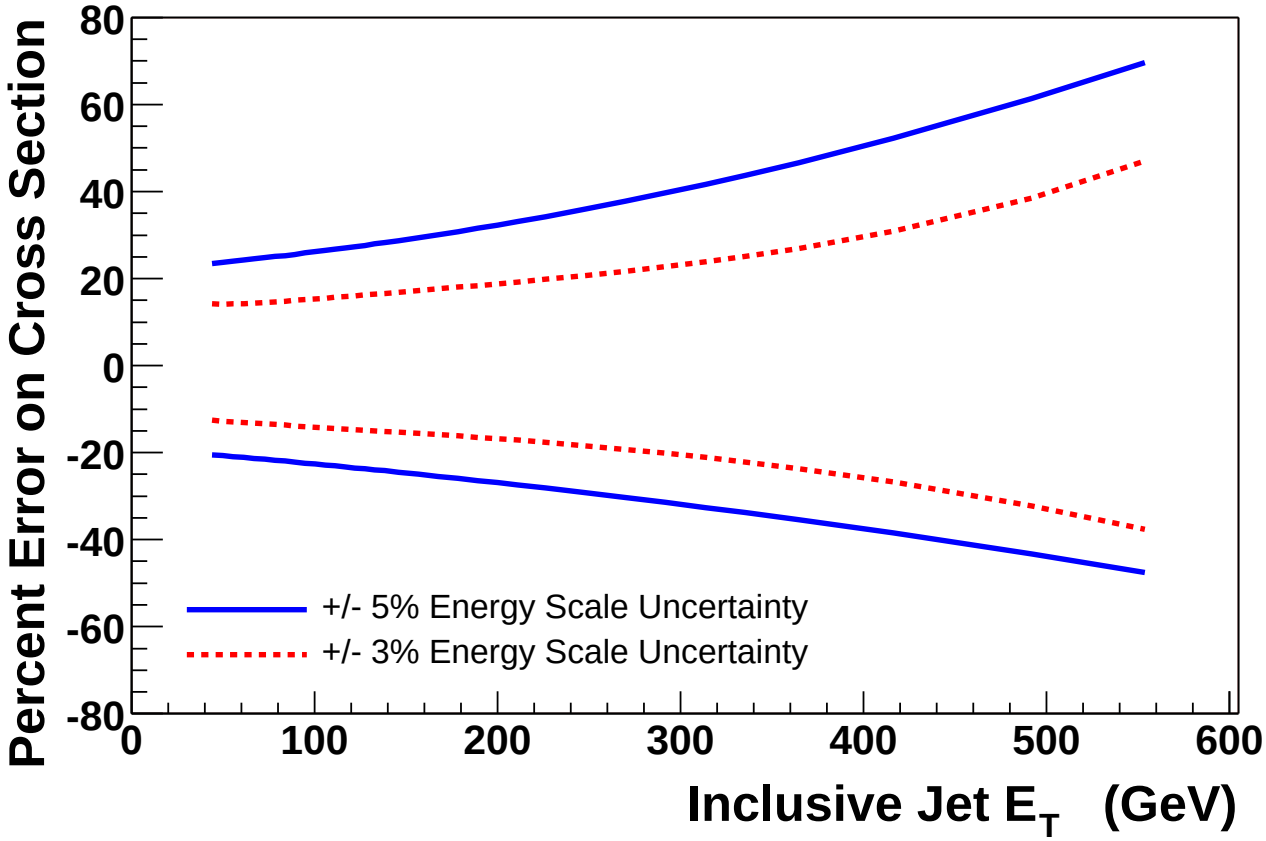
Statistical fluctuations are smoothing out, added another point in the second η bin

Run II results extend Run I ($\sim$400 GeV) by about 150 GeV

As new data becomes available it is easy to rerun the code to produce updated results

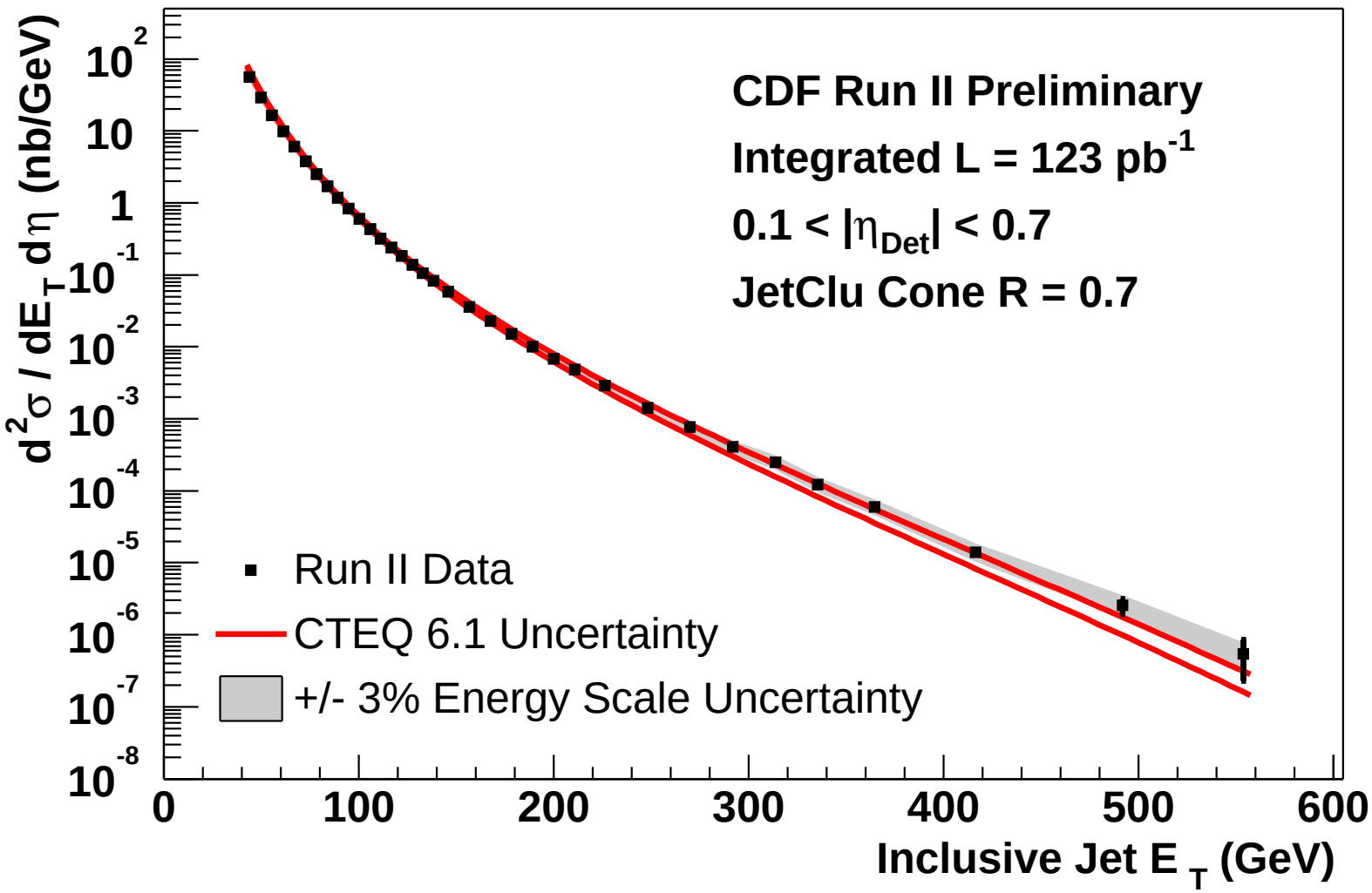
Energy scale uncertainly is the dominant systematic error

Calorimeter task force working on understanding the energy scale



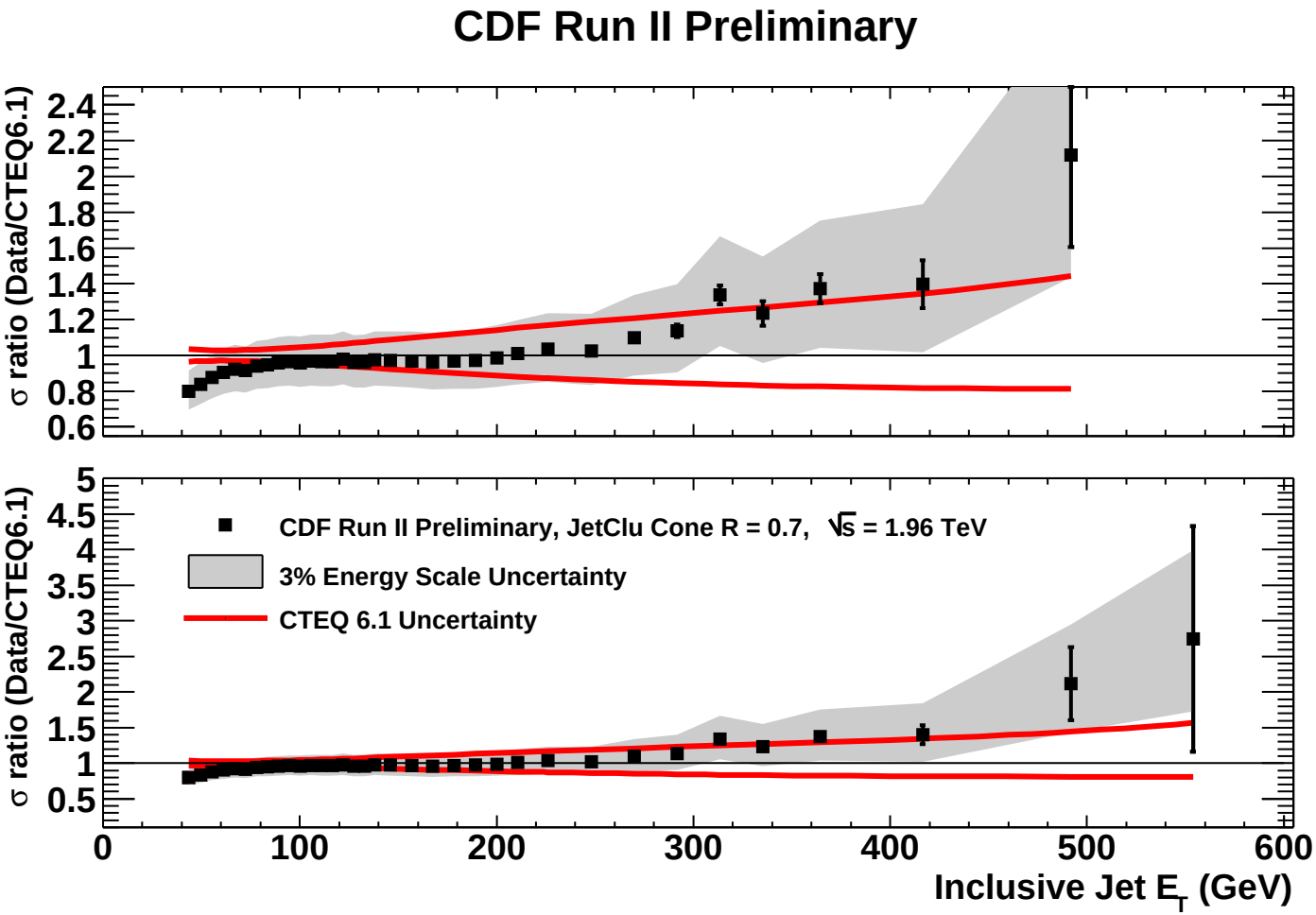
Expect to have a better understanding of the energy scale
$\rightarrow$ reduce the uncertainty from 5% to 3% (or 1%?)

Corrected Cross Section



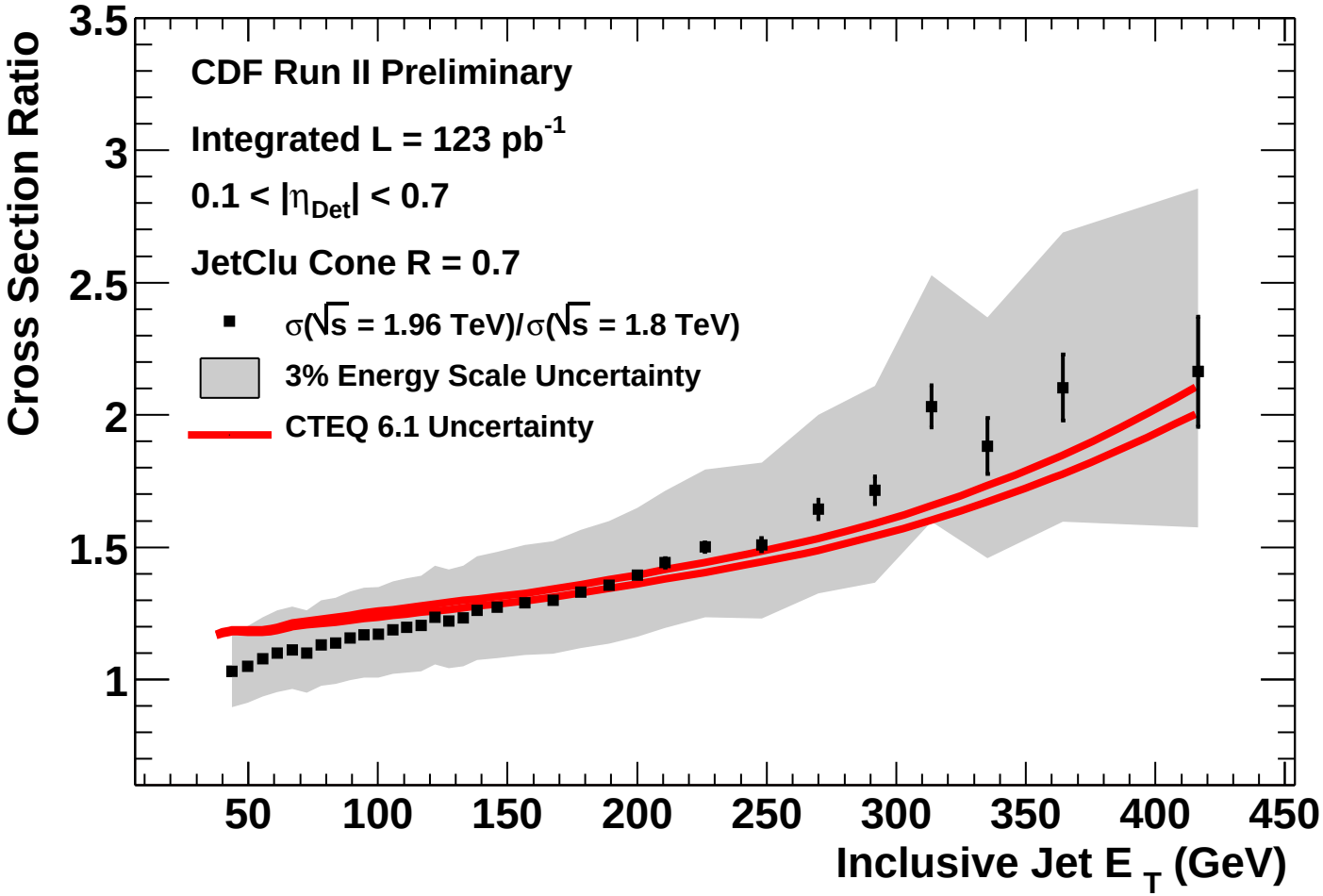
Already starting to see some systematic deviation at high E_T

Data compared to QCD NLO predictions using CTEQ 6.1



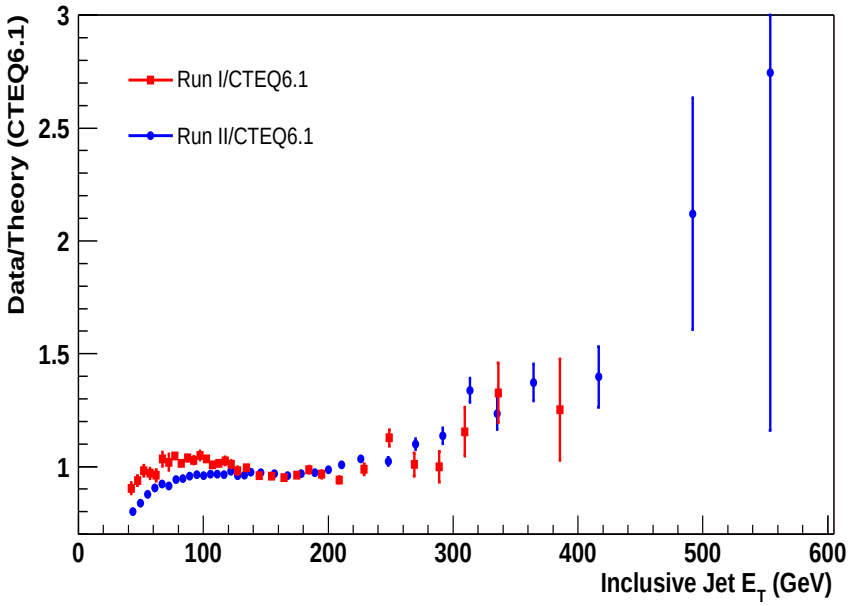
Final Luminosity not yet determined

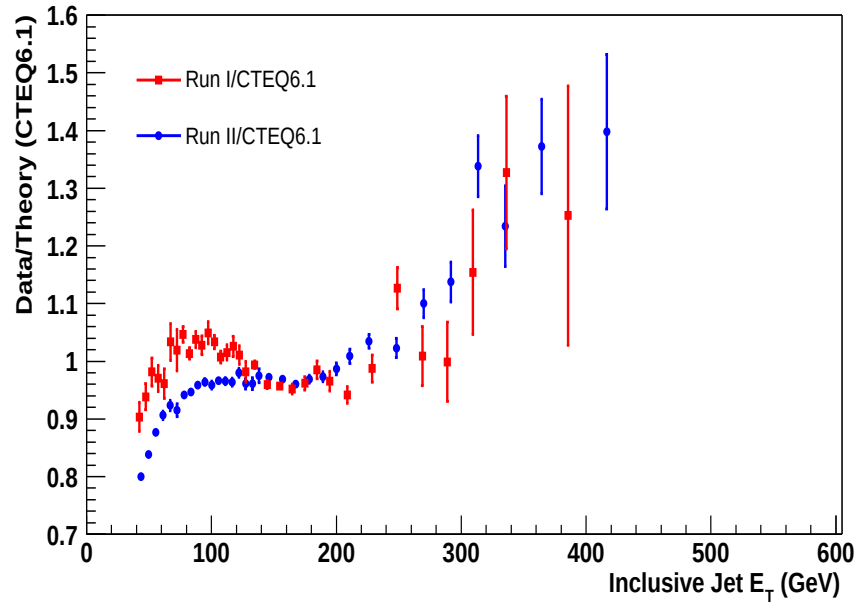
Ratio of the Run II/Run I cross section



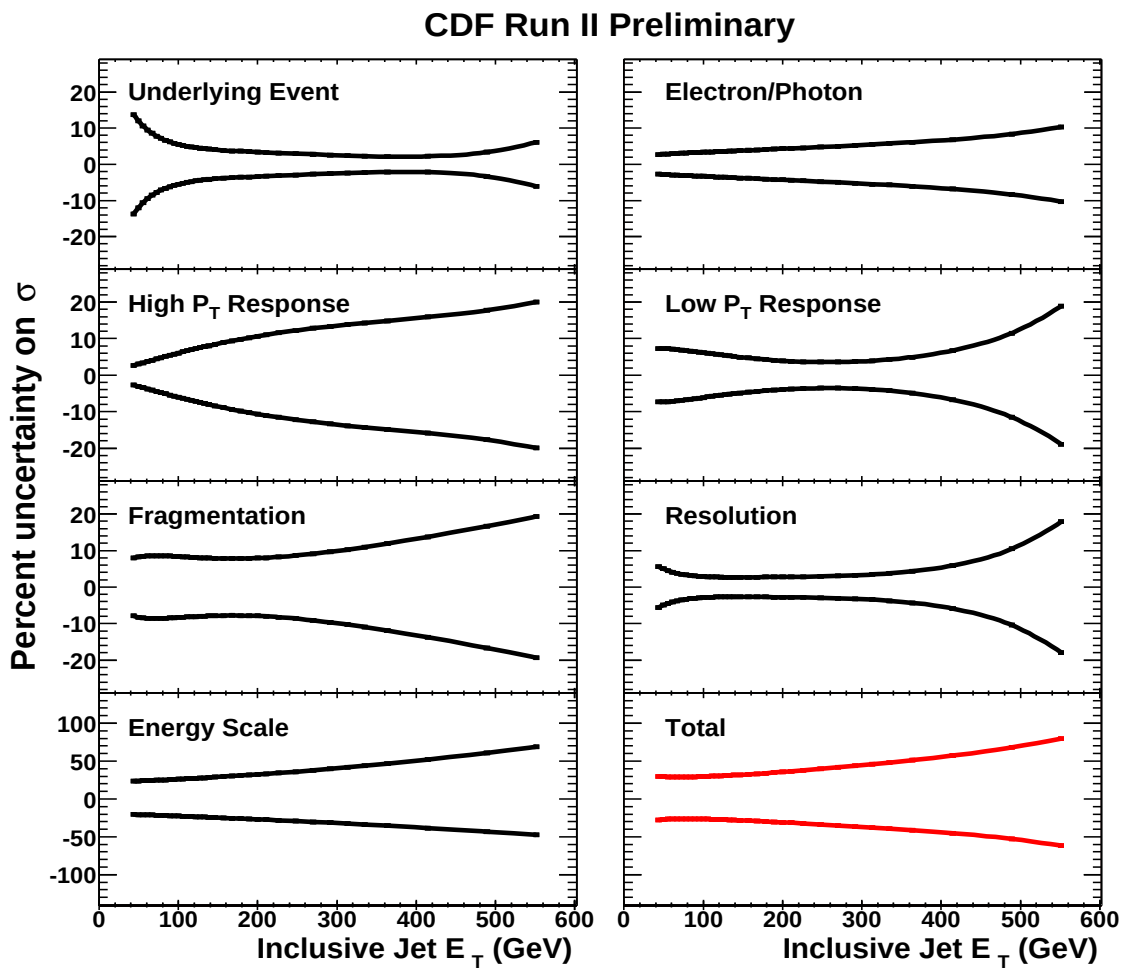
Final Luminosity not yet determined

In Run I, the larger statistical error at low E_T allowed for a good fit. With increased statistics we can better resolve the shape.





- Measured results/theory not treated the same? *(see J Huston's talk at May 16, 2003 QCD meeting)*.
- Parameterization of Jet response used in unsmearing not correct?
- Non-linear calorimeter response at high and low E_T?

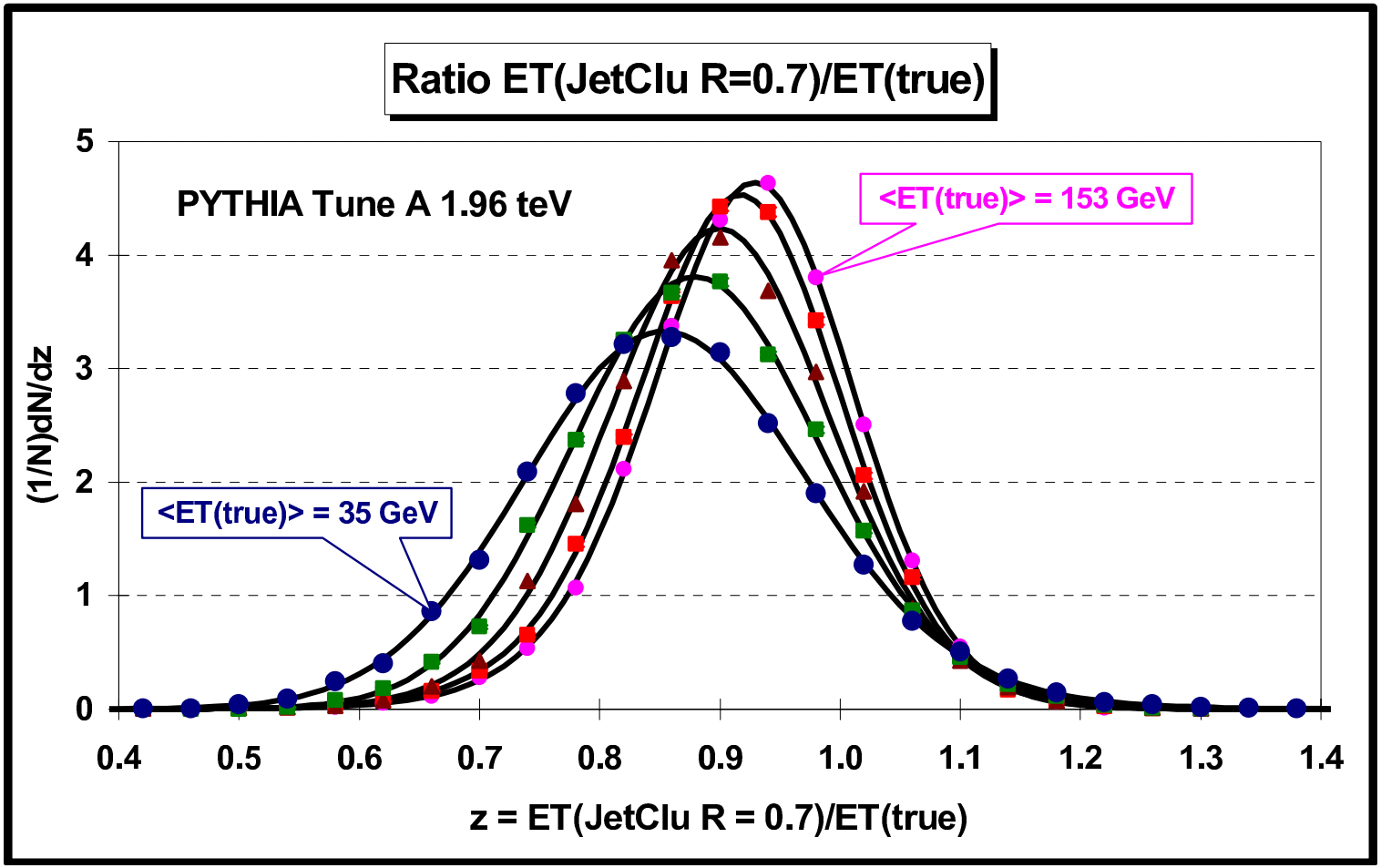


The underlying event systematic has a shape at low E_T that can lead to the observed deficiency.

But we believe we have a good understanding of the underlying event...

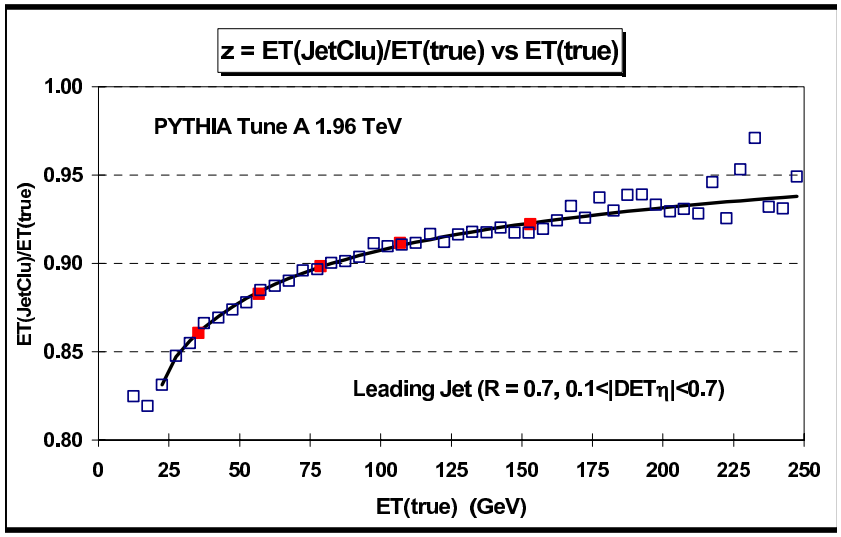
Redoing/checking response functions used in the unsmearing

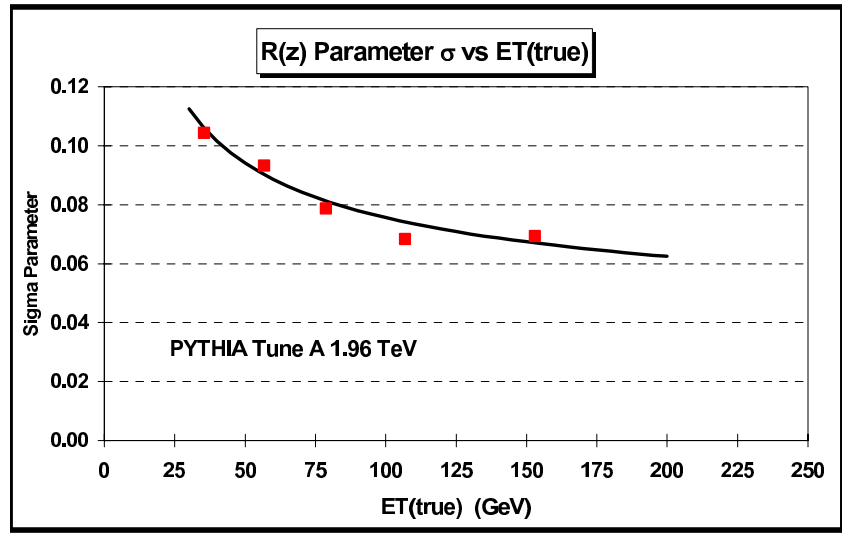
(R. Field)



Ratio of JetClu(ET)/True(ET) for different bins in E_T

Parameterization of the response and resolution *(R. Field)*





Being done for JetClu in the central η region

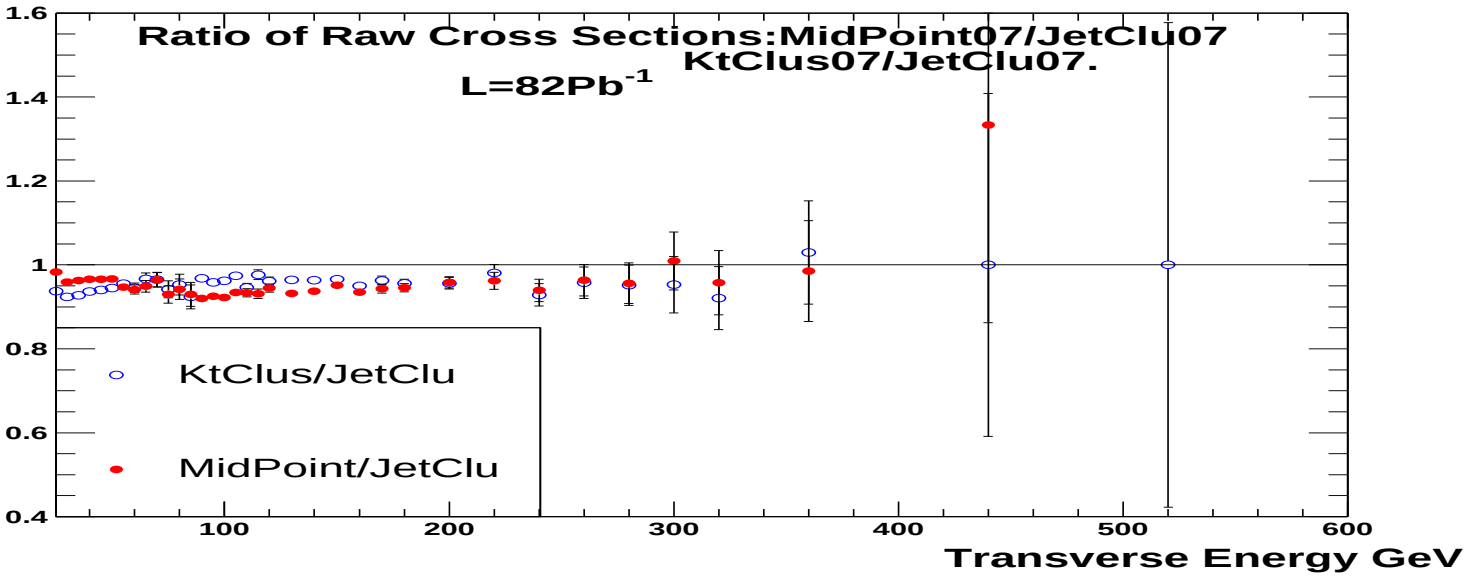
Compare to response functions that are currently being used

$\longrightarrow$ Can also determine response functions for different jet algorithms

$\longrightarrow$ Extend the inclusive jet cross section measurement to the forward η region

Looking at using different Jet Algorithms

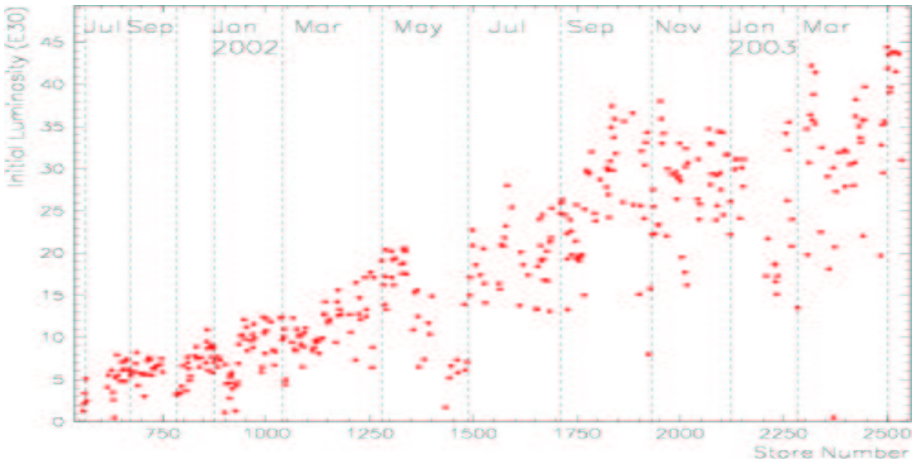
Ratio of measured E_T distribution *(G. Flanagan)*
(KtClus/JetClu and Midpoint/JetClu)



No strong shape difference but see a 5% overall shift in the cross section

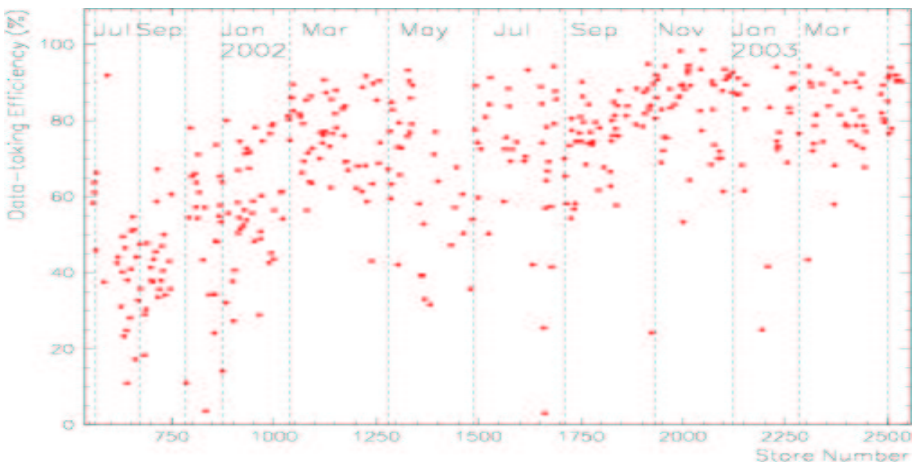
Need to have response functions determined separately for the different jet algorithms in order to correct back to the *true* cross section.

Improving Prospects...



Initial Luminosity

The Tevatron is *consistently* delivering higher luminosities



CDF Efficiency

We *routinely* achieve 90% efficiency

Have recorded 8-9pb^{-1} in one week of running...

Conclusions

- Have more data than Run I and more coming...
- Hope to have a better understanding of the energy scale $\rightarrow$ reduce the uncertainty from 5% to less than 3%
- See "interesting" features at both high and low E_T that need to be understood
- Increased statistics at lower E_T highlights trend at low E_T
- Validating/redoing response functions used in the unsmearing
- Starting to look at Run II Jet algorithms (Midpoint and Kt-Clus)

- Developing tools and an understanding that will be essential for other high profile analysis (top, higgs...)

- While waiting for more data can work on an analysis that can be presented on a shorter time scale

- *It's getting better all the time...*

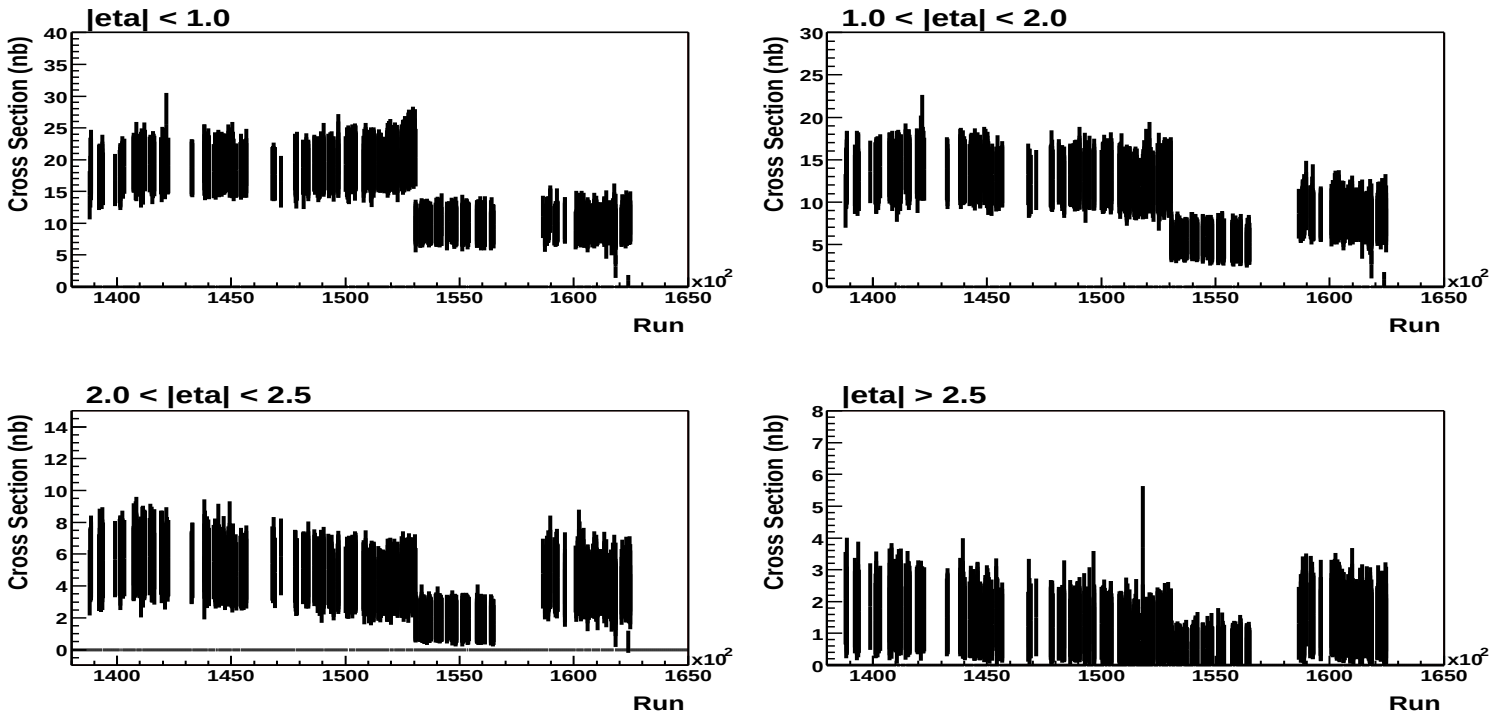
Additional Slides

Eventually want to measure the forward inclusive jet cross section

More work needed

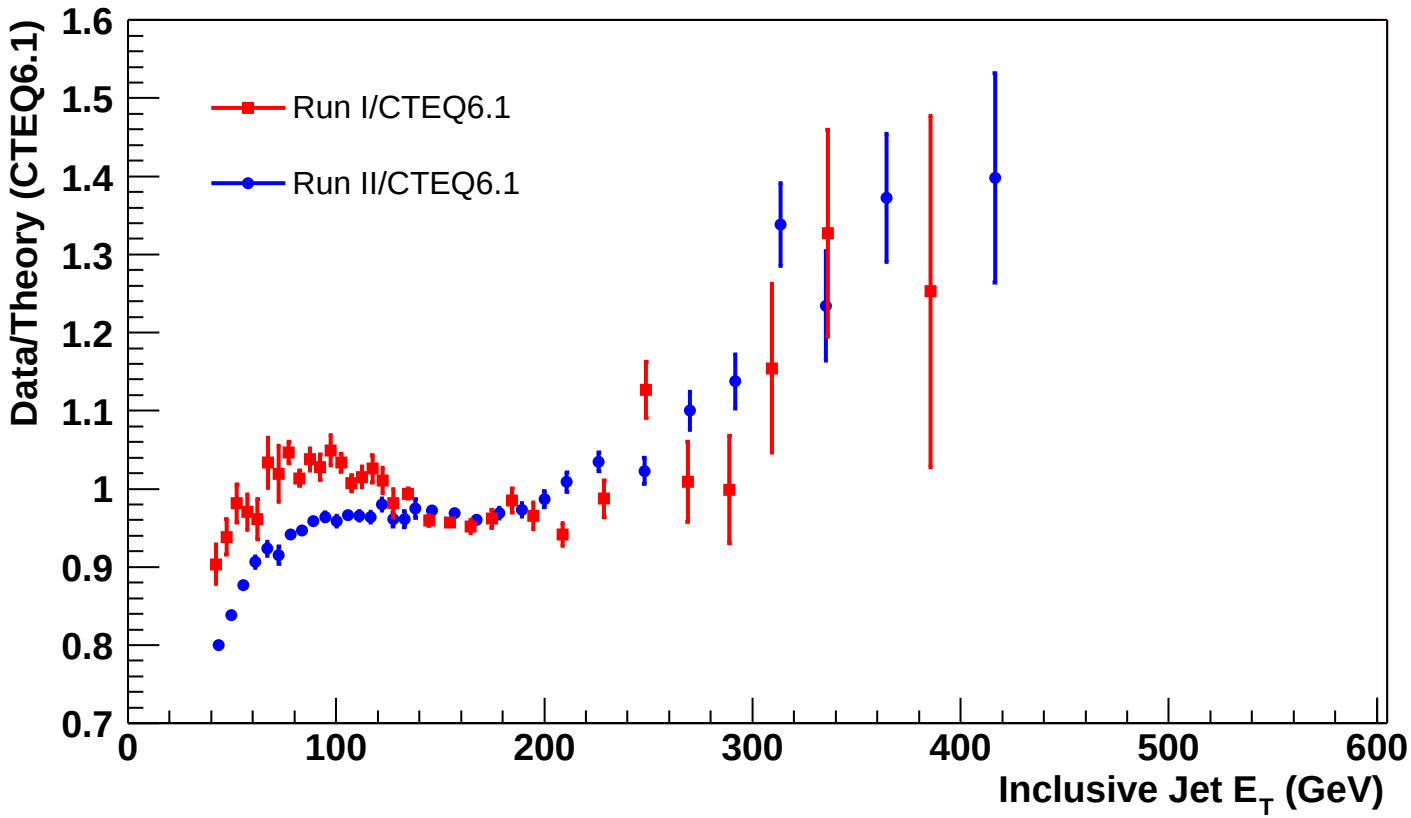
$\longrightarrow$ response dropping in the forward region

$\longrightarrow$ determine response functions in the forward region



Gain was changed after the shutdown

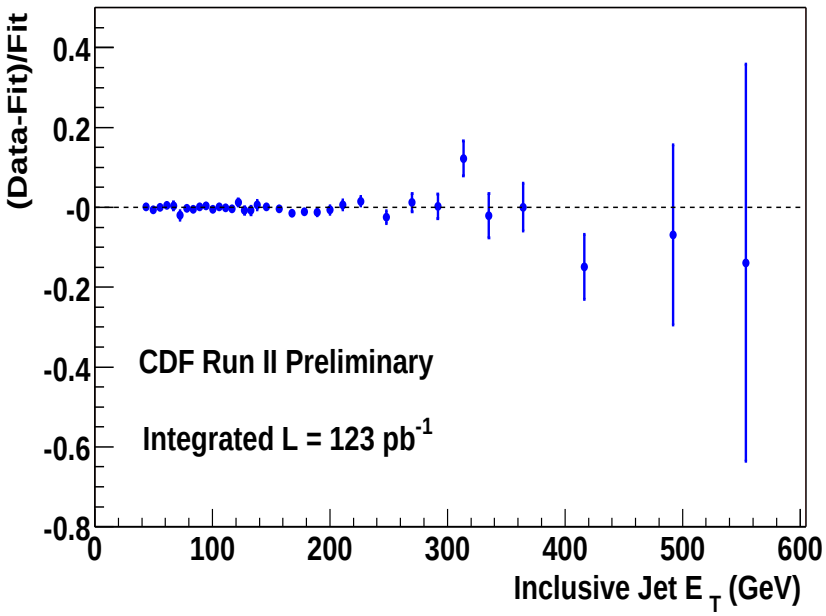
Data is rising at high E_T and there is a turn over feature at low E_T which needs to be understood.

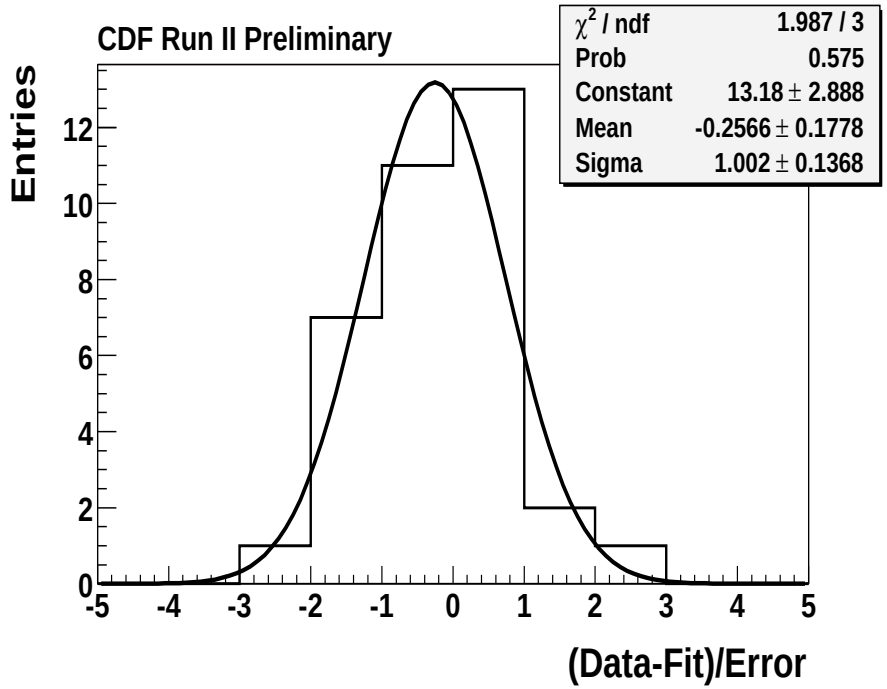


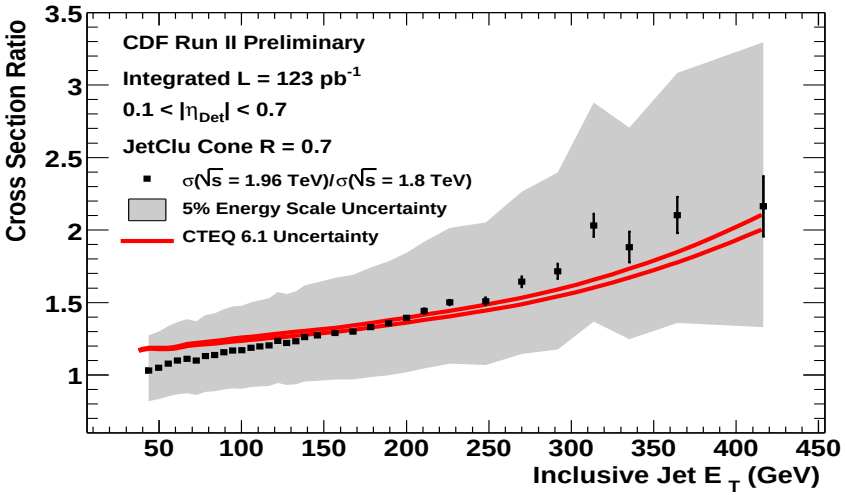
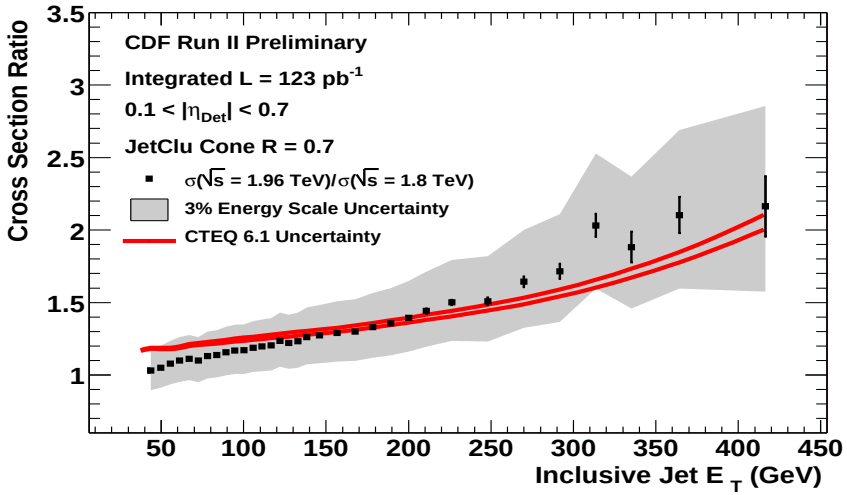
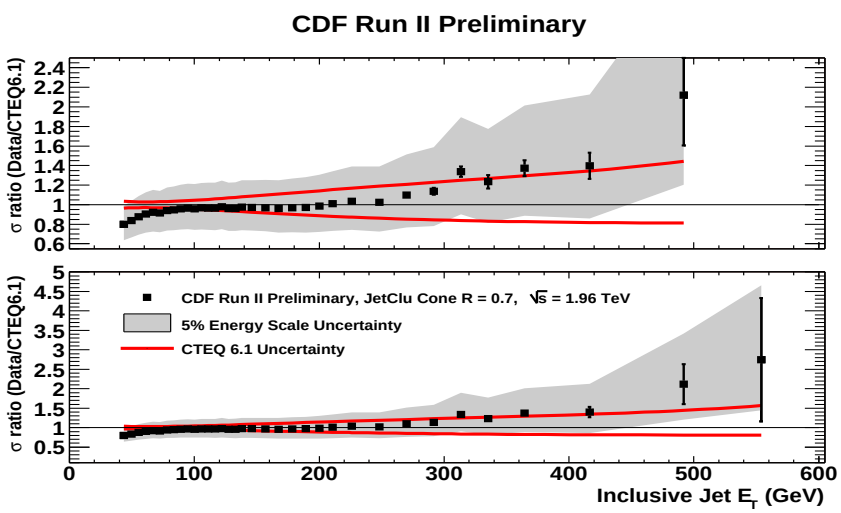
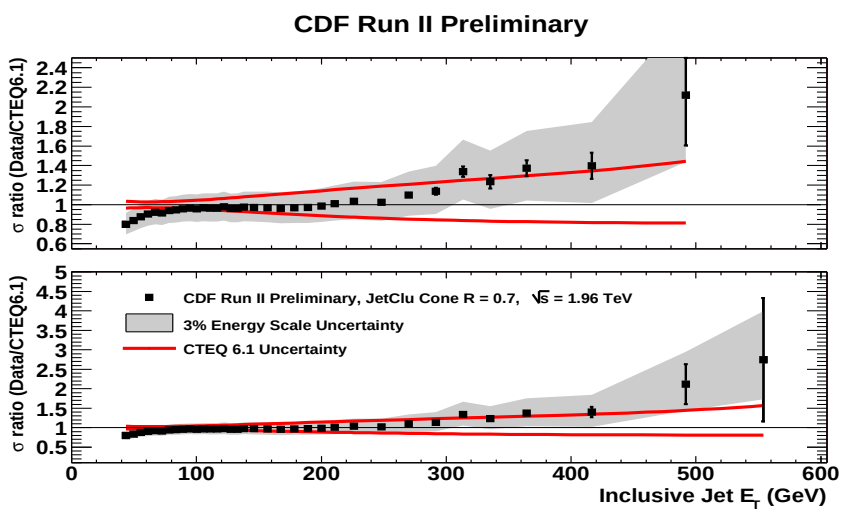
Need to verify that the detector resolution is correctly described.

Moving gluons from low x (low E_T) to high x (high E_T)

The physics function compared to the data





Statistical fluctuations are smoothing out with more data

Reduced error on the cross section 5%→3%