The Inclusive Jet Cross Section

at $\sqrt{s} = 630$ GeV

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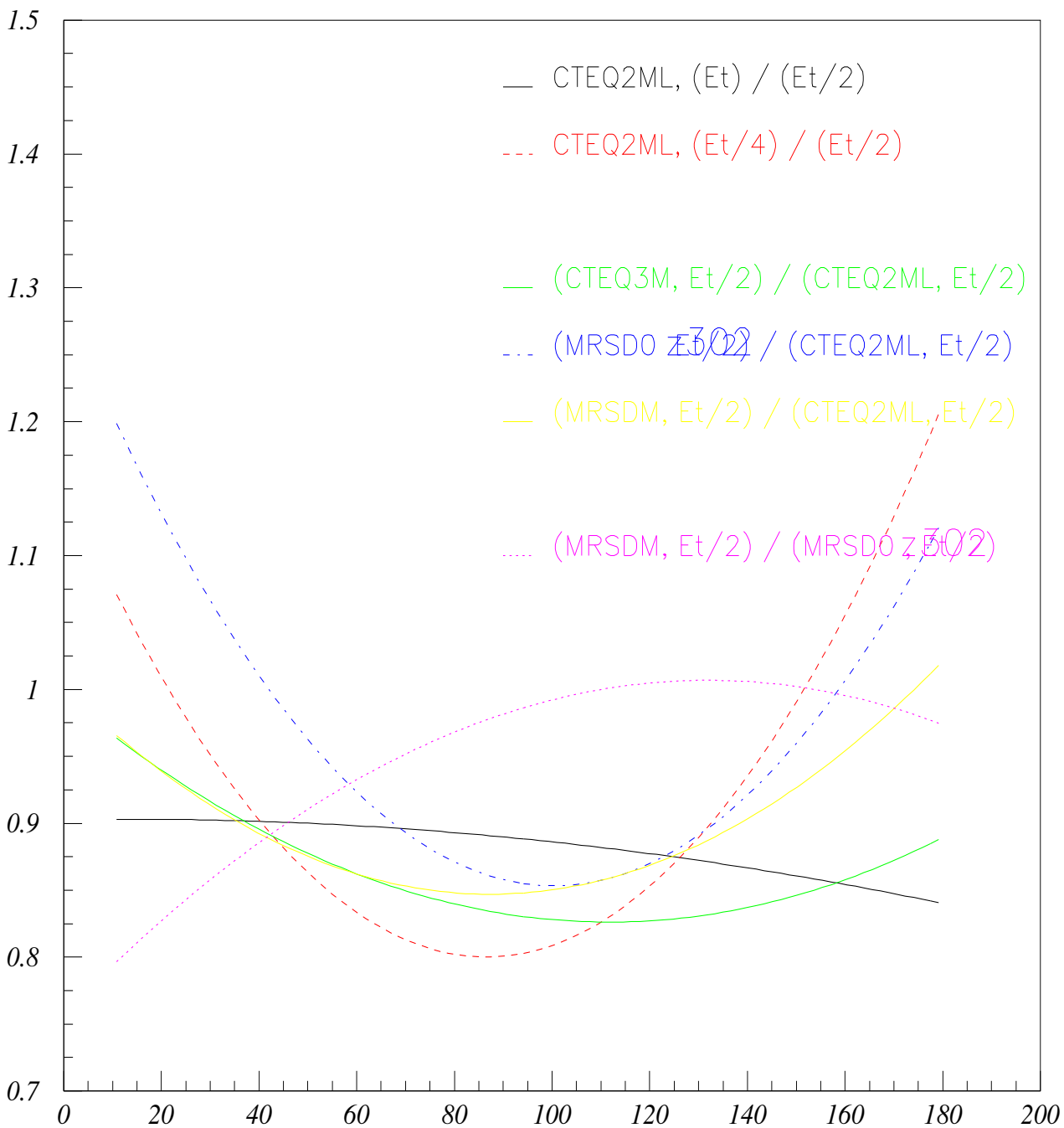
for the DZero Experiment

Motivation

- Previous measurements at this energy were compared to leading order…theoretical uncertainty ~ 30%
- Next-to-leading order QCD is consistent to within ~20% when comparing PDFs and renormalization scales to one another

Comparison of available PDFs



Jet Triggers

	Energy Threshold	Integrated Luminosity
Jet 12	12 GeV	3.56 nb-1
Jet 12b	12 GeV	20.7 nb-1
Jet 30	30 GeV	398 nb-1

Low threshold triggers are ‘prescaled’ to limit their exposure...conserves bandwidth

Determination of Cross Section

Jet Cuts and **Event Cuts**

remove ‘fake’ jets caused by cosmic rays, poor beam conditions, electrical surges.

Calculation:

$$\frac{d^2\sigma}{dE_T\, d\eta} = \frac{\Delta N}{\int \mathscr{L}\, dt \times \varepsilon \times \Delta E_T \times \Delta\eta}$$

ΔN = Jet population per bin

ε = efficiencies / acceptances

$\Delta\eta = 1.0$ since $-0.5 < \eta < 0.5$

ΔE_T varies with E_T (statistics)

Major Sources of Uncertainty

Energy Scale Uncertainty

This constitutes the majority of the systematic error

Luminosity Uncertainty

Currently, this is comparable to the Energy Scale uncertainty

Studies in progress!

Energy Resolution

This correction is very large at low Et and thus has a large uncertainty

Jet Energy Scale

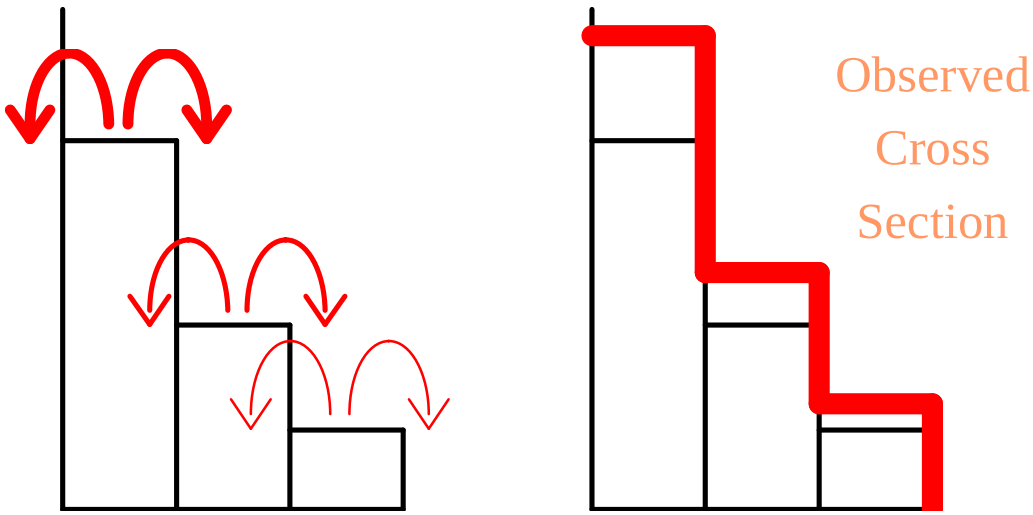
$$E_{Jet} = \frac{(E_{measured} - O)}{(1 - S)\, R_{Hadron}}$$

O = Offset corrects for underlying event (spectator partons) and noise from uranium absorber plates. Determined with minbias studies.

S = Showering correction recovers energy that escapes the cone *after* the particles hit the calorimeter. Determined by simulation and test beam data.

R = hadronic **Response** of the calorimeter. Calibrated with jet+photon events and Dijets.

Jet Resolution and smearing effects



Finite jet energy resolution has the effect of inflating the cross section, especially where the cross section is steepest.

The correction (‘unsmearing’) is determined with dijet asymmetry measurements.

Unsmearing Procedure

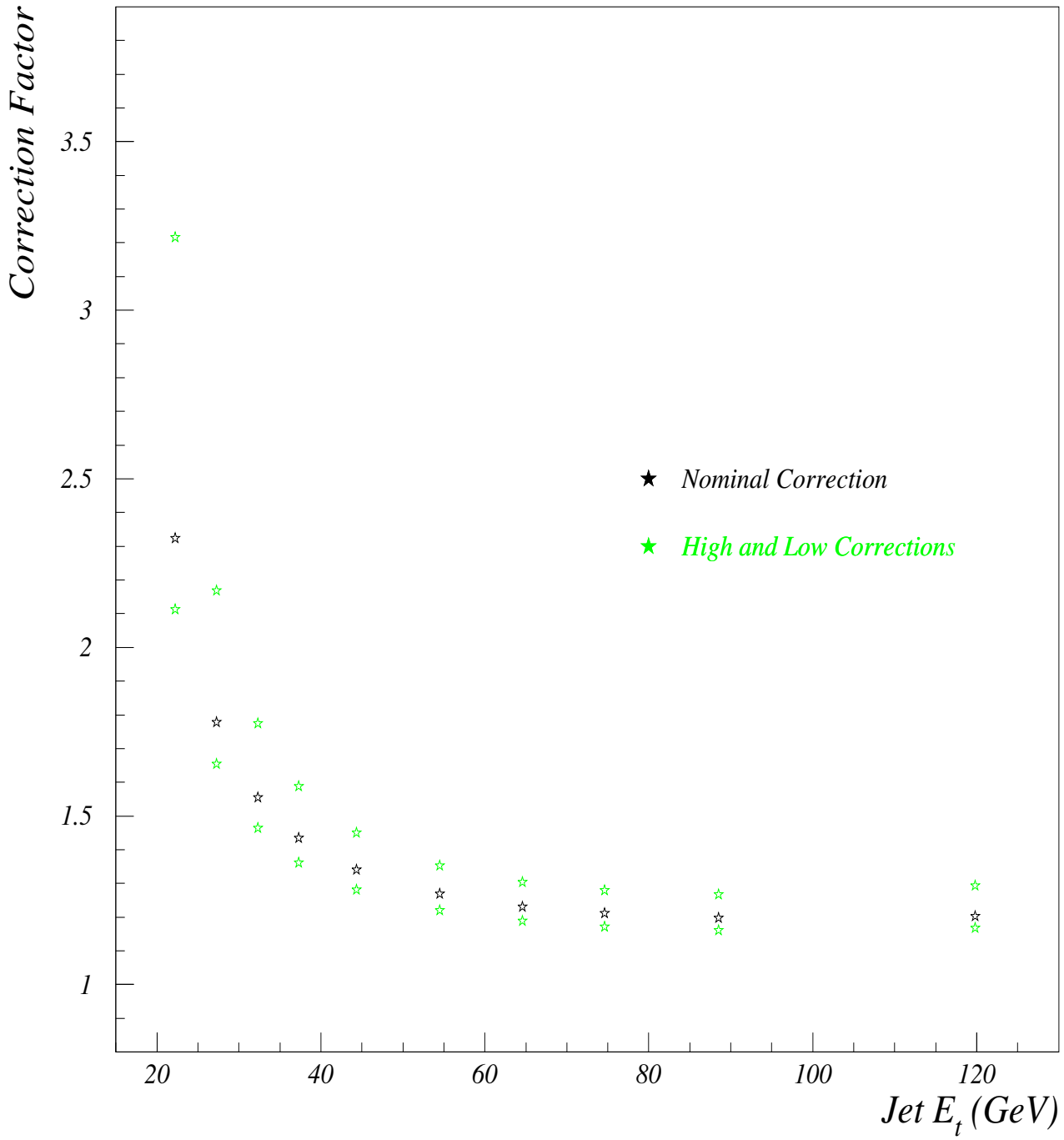
$$f(x) = \int \frac{1}{\sqrt{2\pi}\sigma} e^{\frac{-(x-y)^2}{\sigma^2}} \cdot [Ay^{-B}(1-\frac{2y}{\sqrt{s}})^{C}] \; dy$$

where

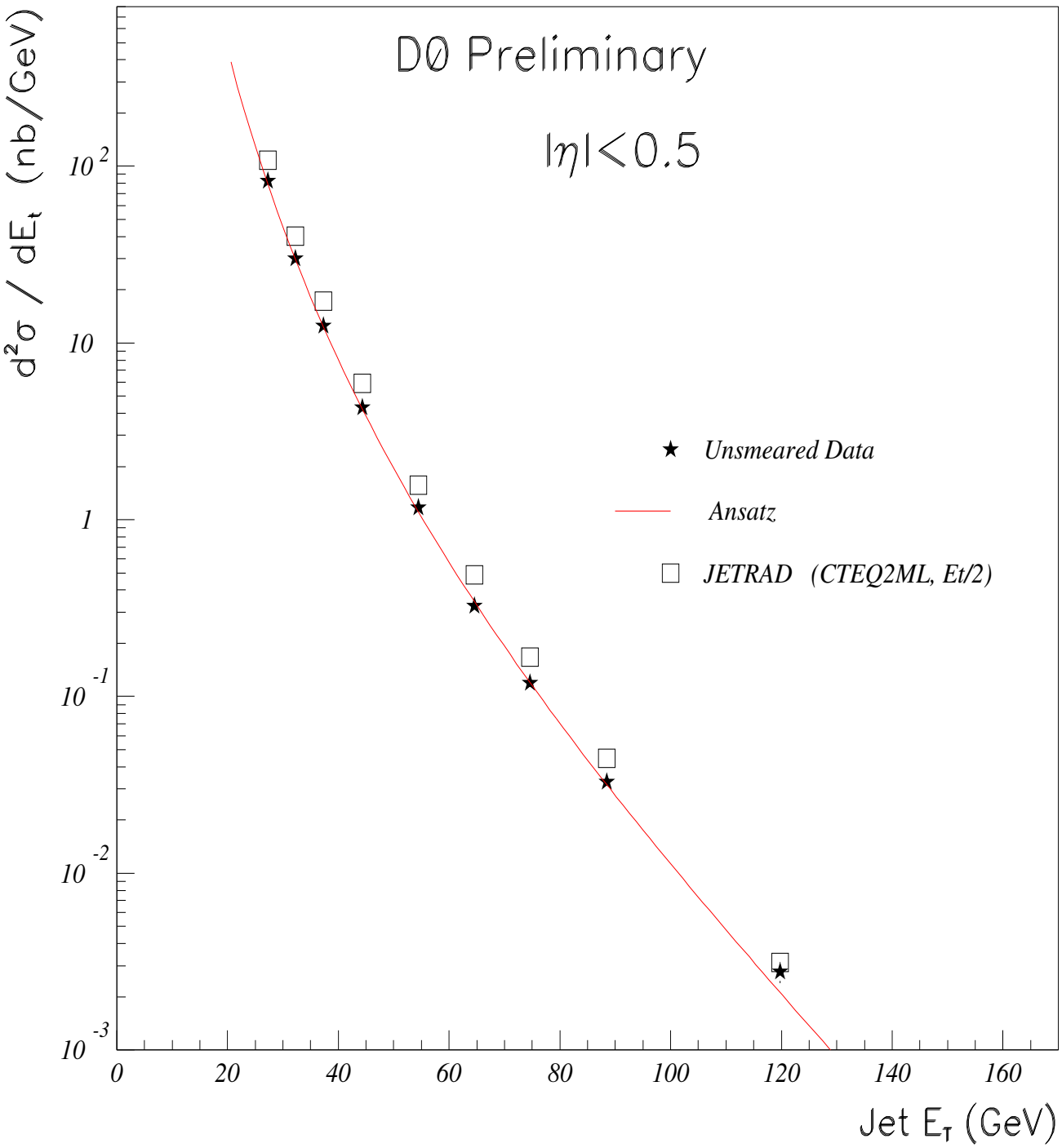
$$(\frac{\sigma_{E_T}}{E_T})^2 = \frac{N^2}{E_T^{\,2}} + \frac{S^2}{E_T} + C^2$$

We postulate that the observed cross section is a convolution of some ‘true cross section’ and a gaussian. We fit the convolution of an ansatz and a measesured resolution gaussian to the cross section to infer the correction factor.

Unsmearing Correction



Data (630 GeV CM Energy) and NLO QCD



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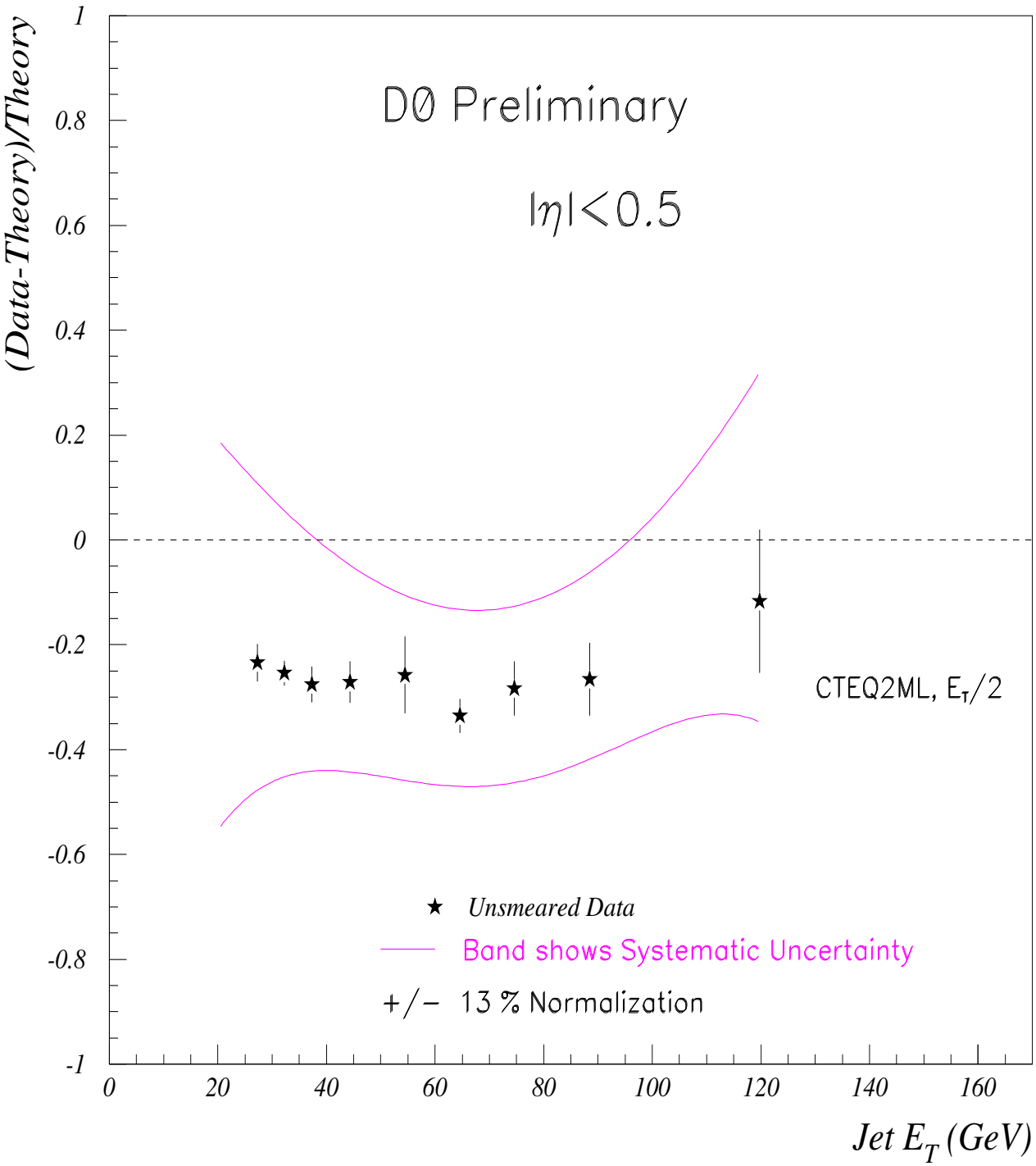

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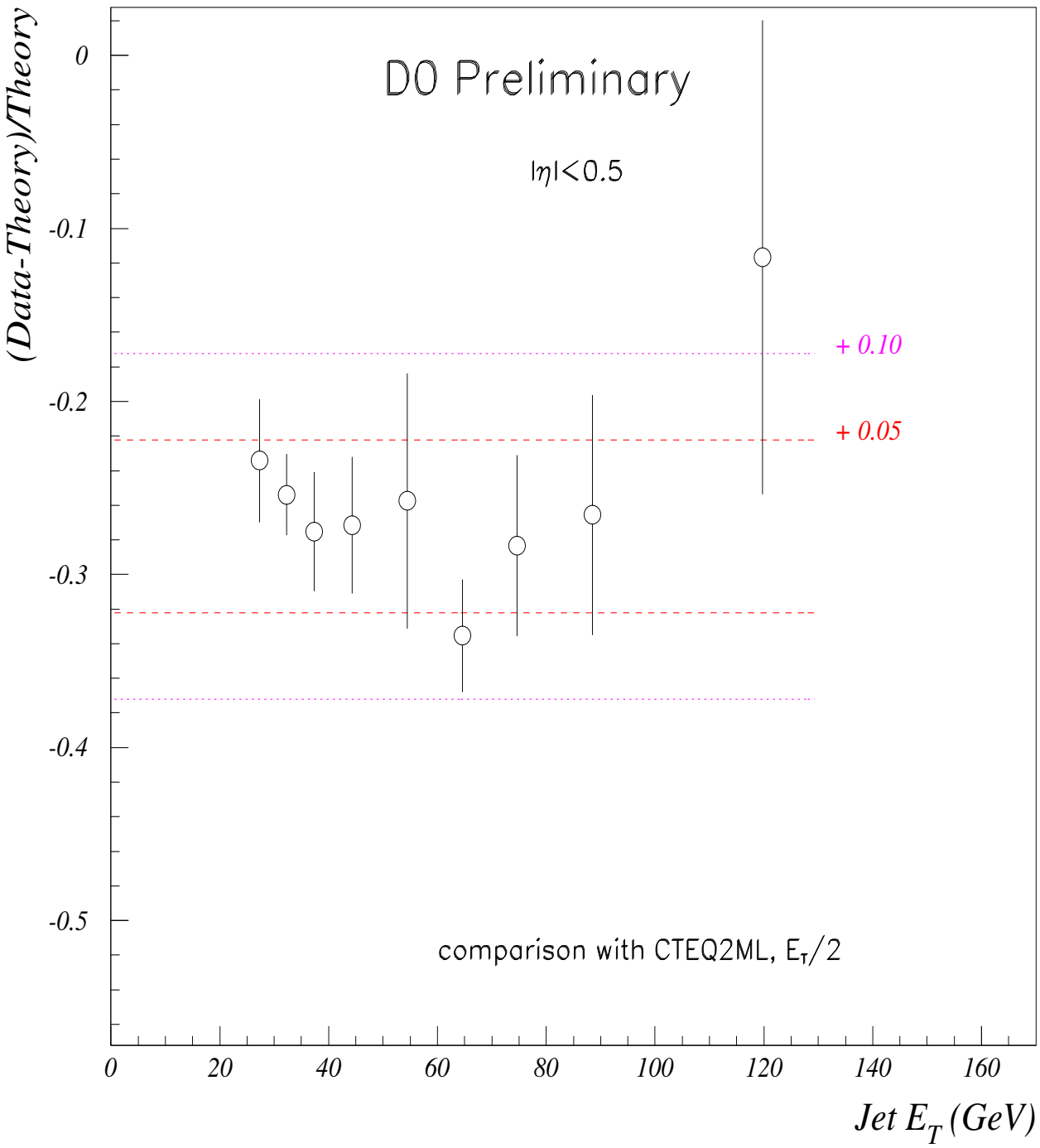
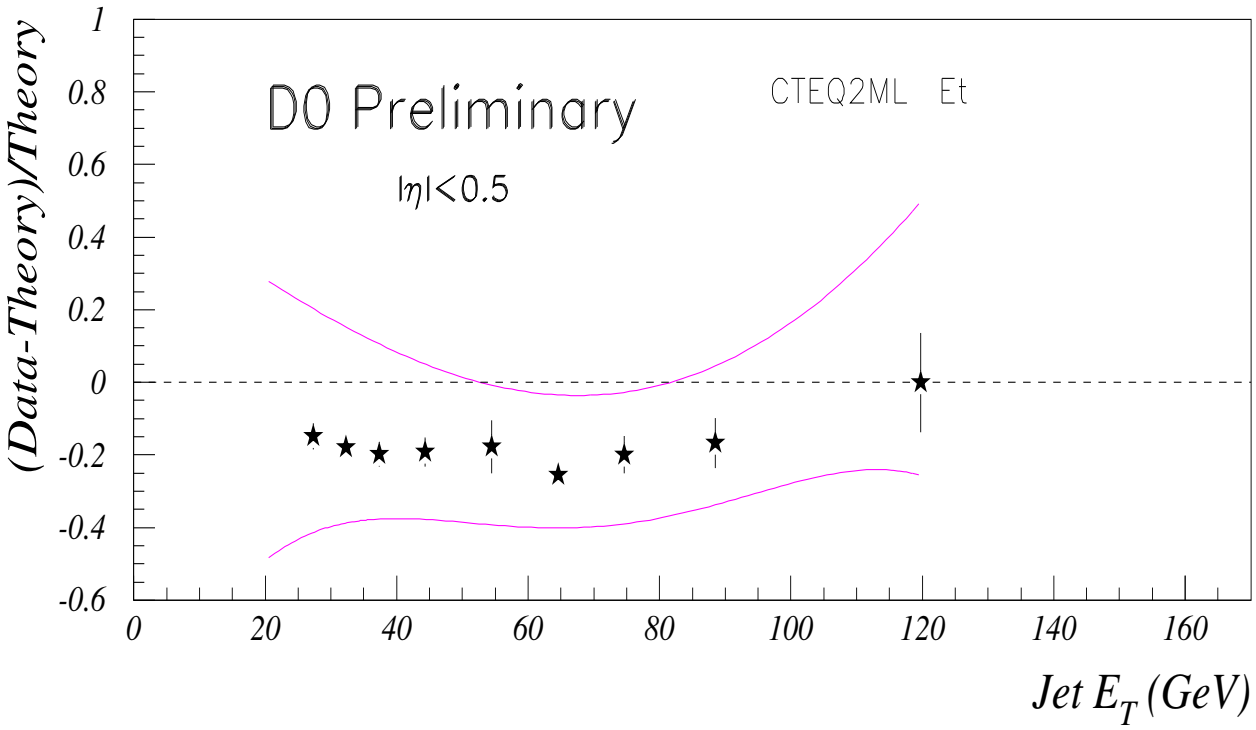
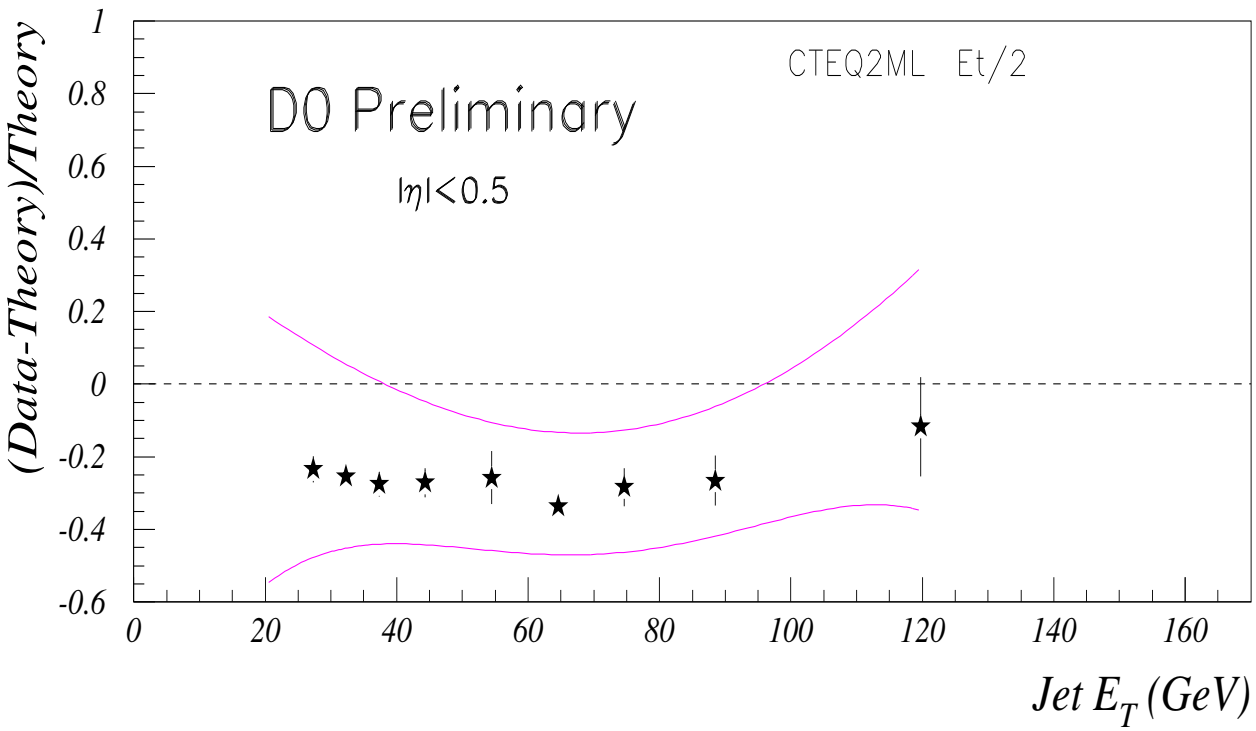
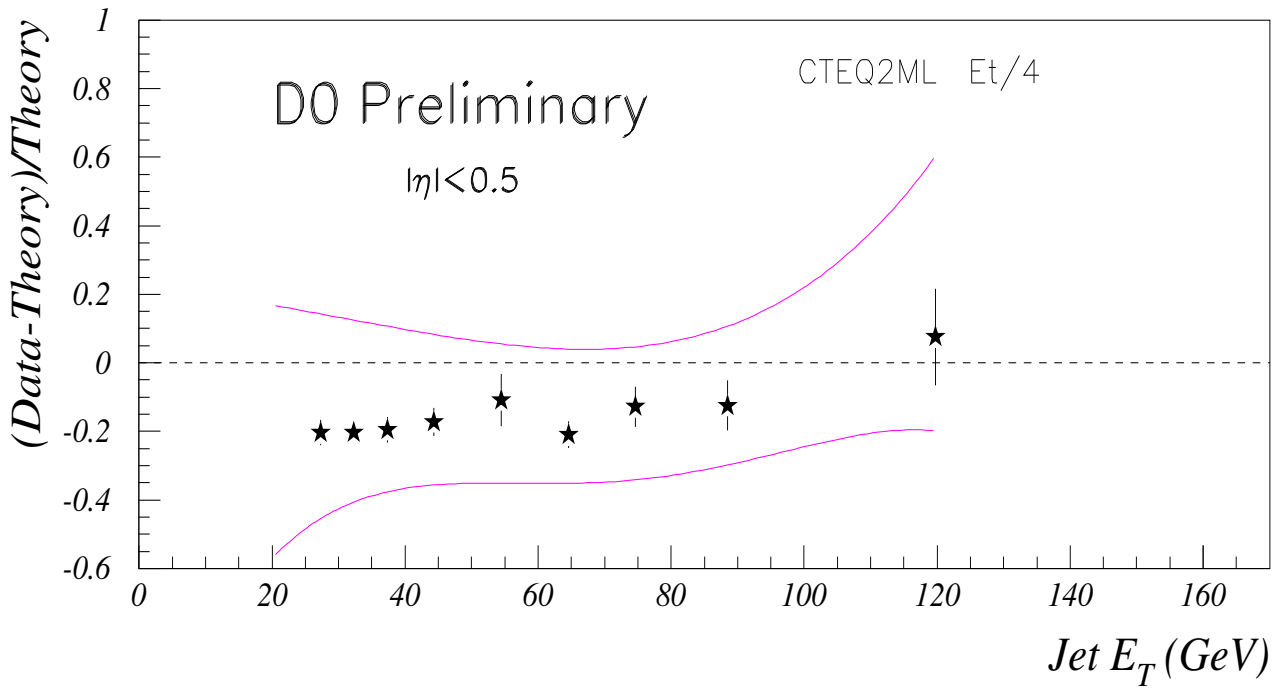
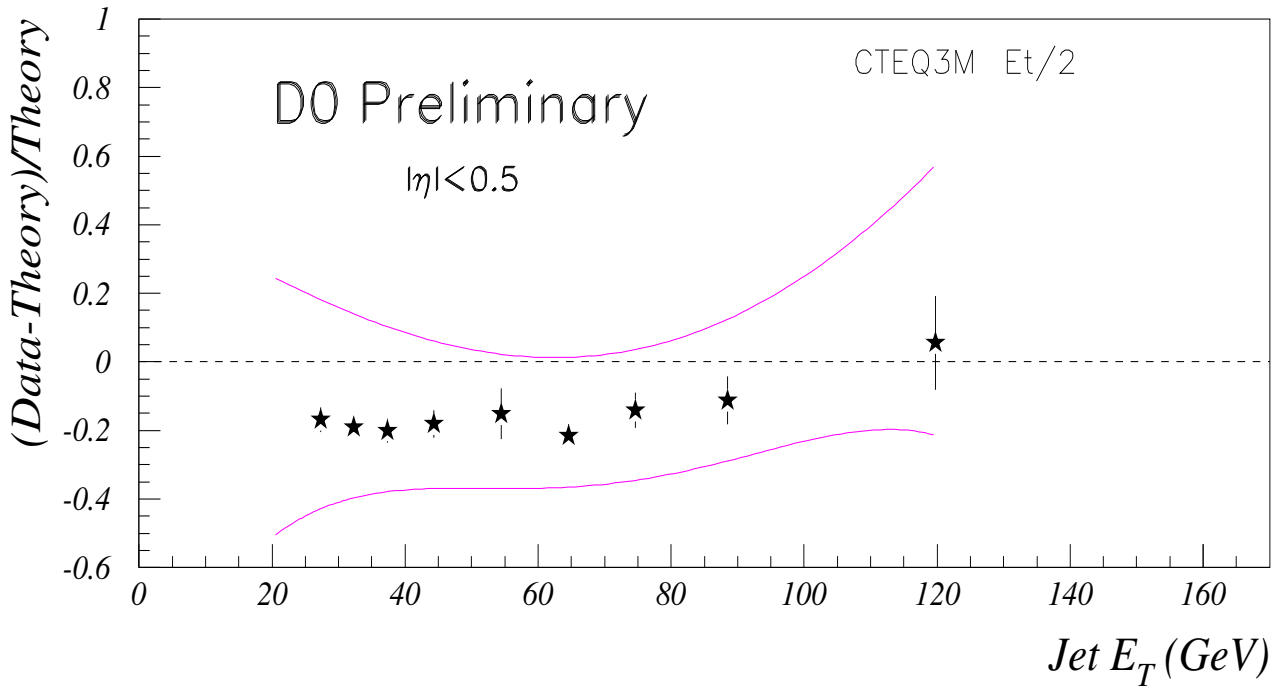
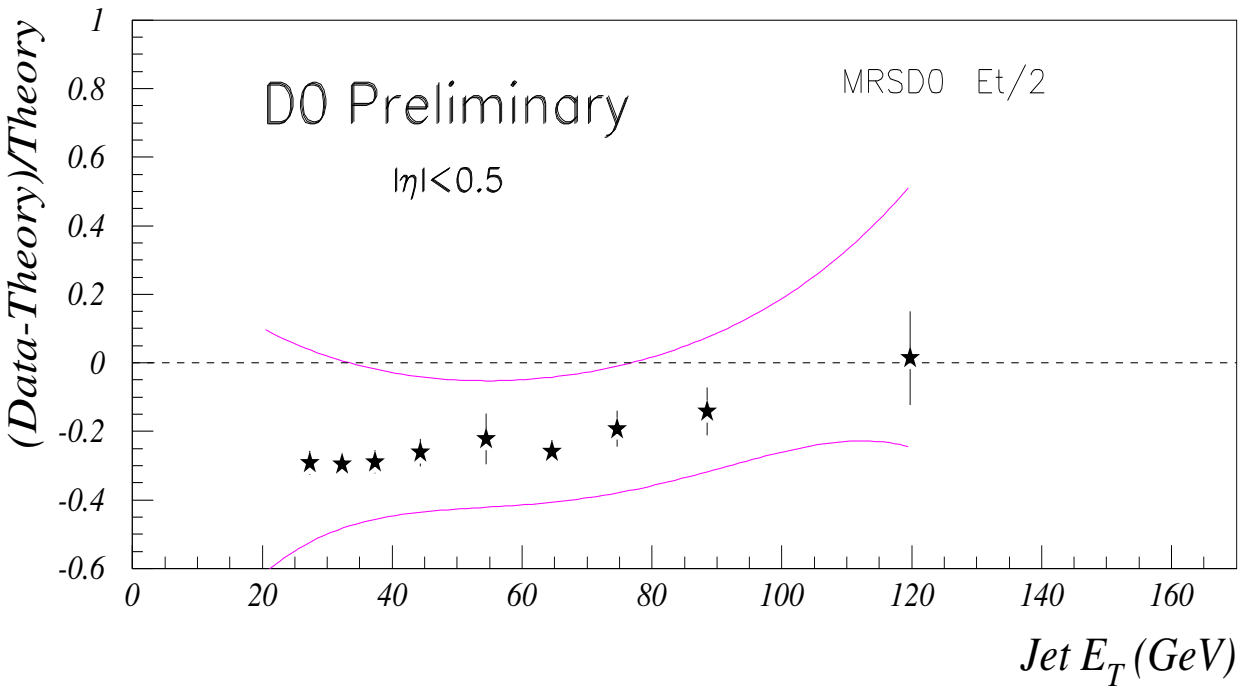


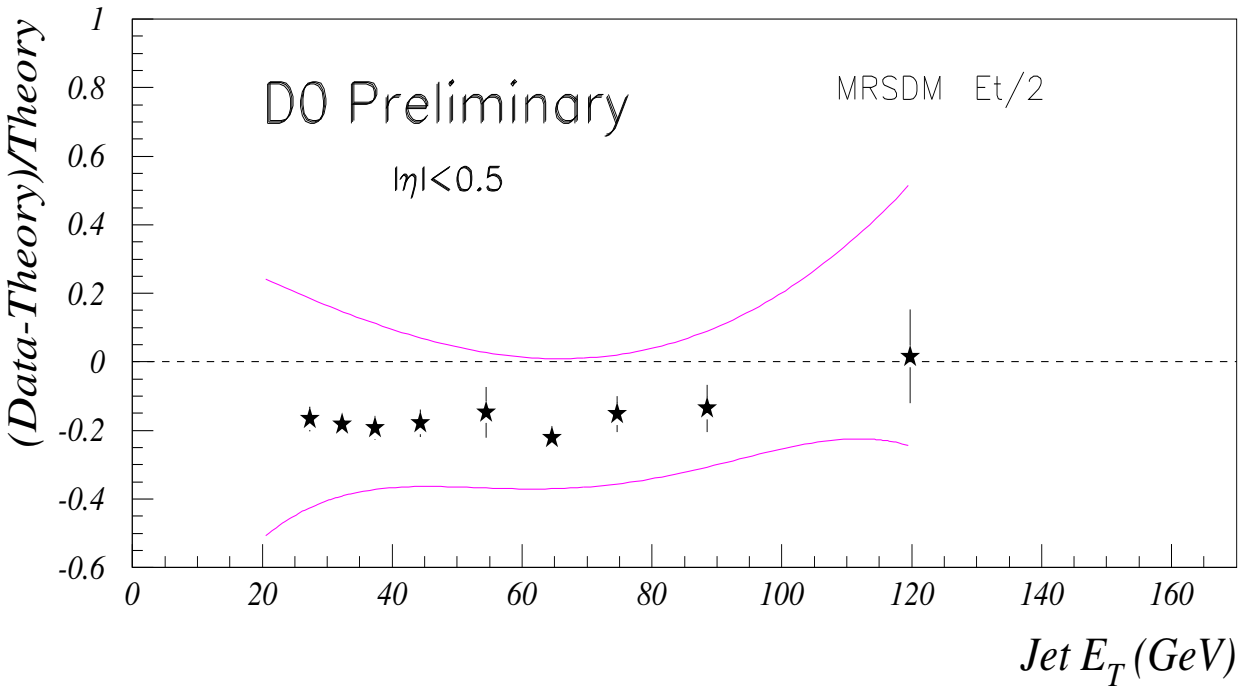

D0 Preliminary
CTEQ2ML Et
|η|<0.5
(Data-Theory)/Theory
Jet E_T (GeV)


D0 Preliminary
CTEQ2ML Et/2
|η|<0.5
(Data-Theory)/Theory
Jet E_T (GeV)


D0 Preliminary
|η|<0.5
CTEQ2ML Et/4
(Data-Theory)/Theory
Jet E_T (GeV)
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
0
20
40
60
80
100
120
140
160


D0 Preliminary
|η|<0.5
CTEQ3M Et/2
(Data-Theory)/Theory
Jet E_T (GeV)
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
0
20
40
60
80
100
120
140
160


D0 Preliminary
MRSD0 Et/2
|η|<0.5
(Data-Theory)/Theory
Jet E_T (GeV)


D0 Preliminary
MRSDM Et/2
|η|<0.5
(Data-Theory)/Theory
Jet E_T (GeV)

Summary

- A preliminary cross section at $\sqrt{s} = 630\,\mathrm{GeV}$ was presented.
- We find general agreement in the shape of the cross section with next-to-leading order predictions.
- We shall continue systematic studies to reduce the uncertainty in the measurement.
- The 1800 and 630 analyses will be combined in a study of Jet Scaling.