Recent Run 1 Results

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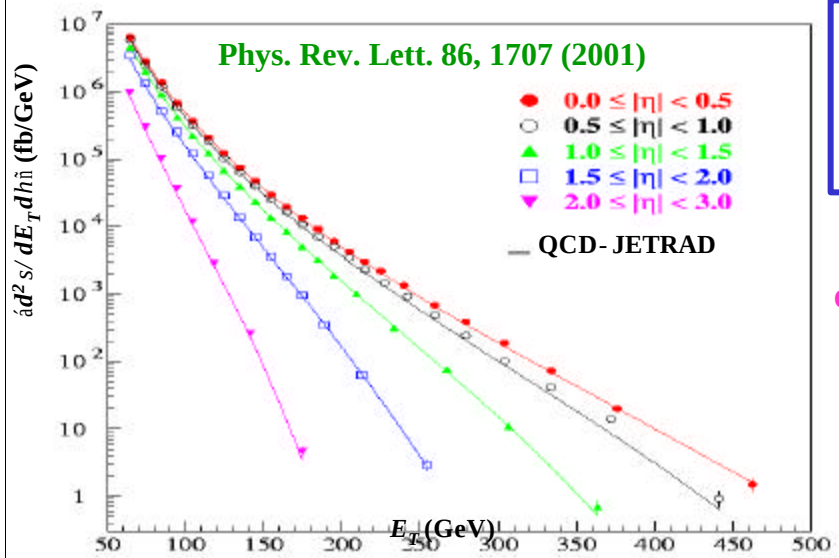
Recent QCD Results

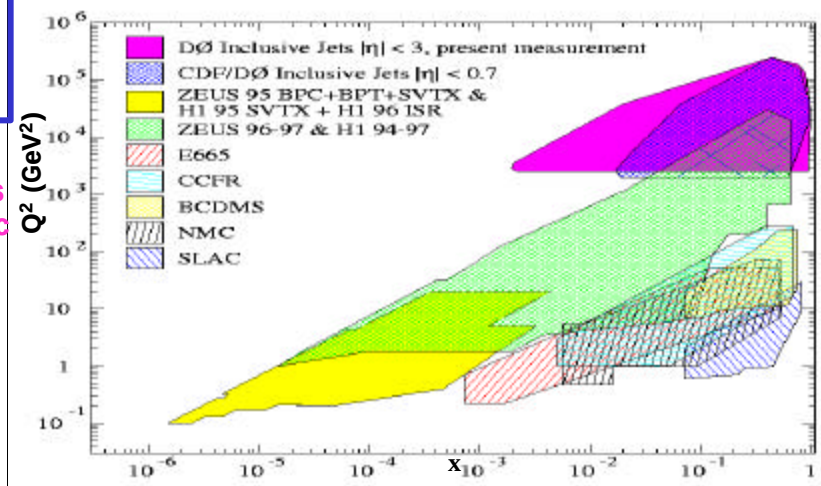


Inclusive jets
$p\bar{p}$ ® *jet* + *X*
@
$\sqrt{s}$ = 1.8 TeV

Consistent with pQCD calculations over large dynamic range |h|<3, and indicates preference of CTEQ4HJ, MRSTg- and CTEQ4M PDFs

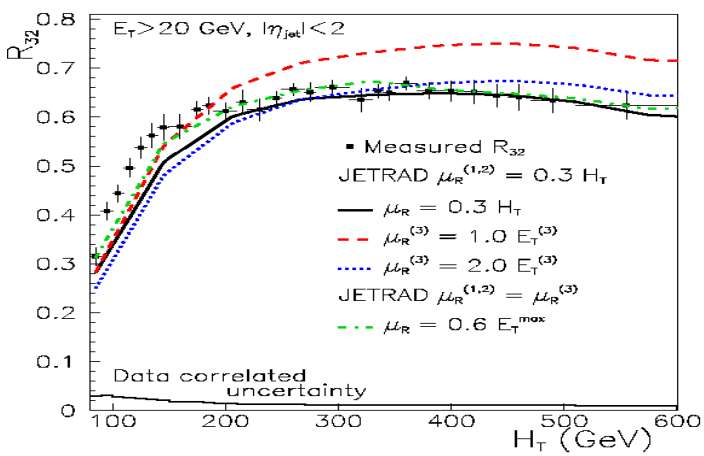
Currently being used in new global PDF fits by MRST group

Extends significantly the kinematic reach of previous studies



$$R_{32} \circ \frac{s(p\bar{p} \text{ ® } 3 + \text{jets})}{s(p\bar{p} \text{ ® } 2 + \text{jets})} \text{ ® vs. } H_T \text{ @ } \sqrt{s} = 1.8 \text{ TeV}$$

Well described by pQCD and permits evaluation of the sensitivity of the calculations to m_R-scale; Preference at a_s^3 for a single hard scale

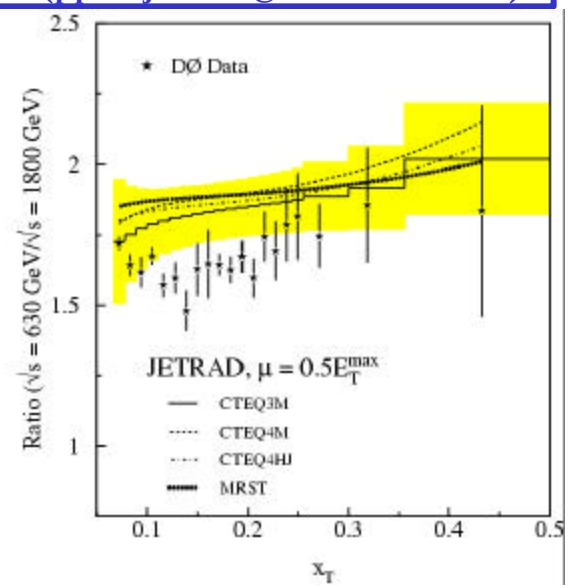


PRL in print
Phys. Rev. Lett. 86, 1955 (2001)

$$R_{630/1800} \circ \frac{s(p\bar{p} \text{ ® jet} + X \text{ @ } \sqrt{s} = 630 \text{ GeV})}{s(p\bar{p} \text{ ® jet} + X \text{ @ } \sqrt{s} = 1800 \text{ GeV})}$$

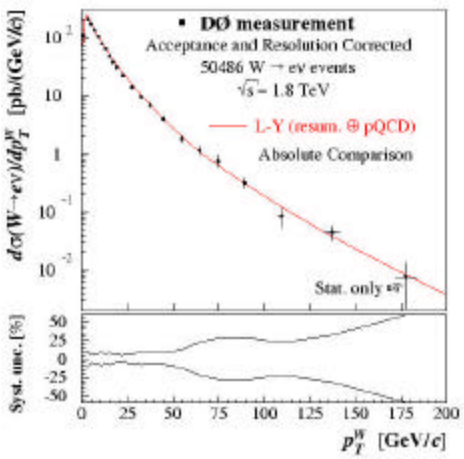
Good agreement with predictions in shape but not in normalization

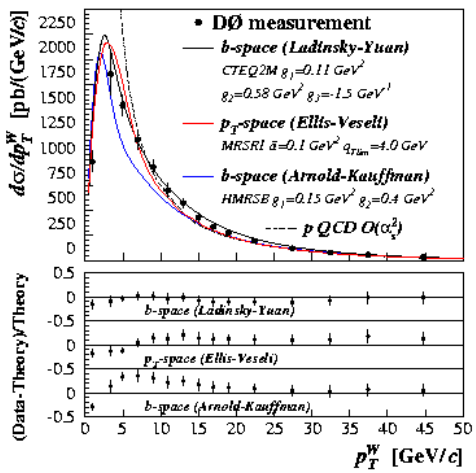
PRL in Print
Phys.Rev.Lett.86, 2523 (2001);



W pt and W/Z pt ratio

W transverse momentum



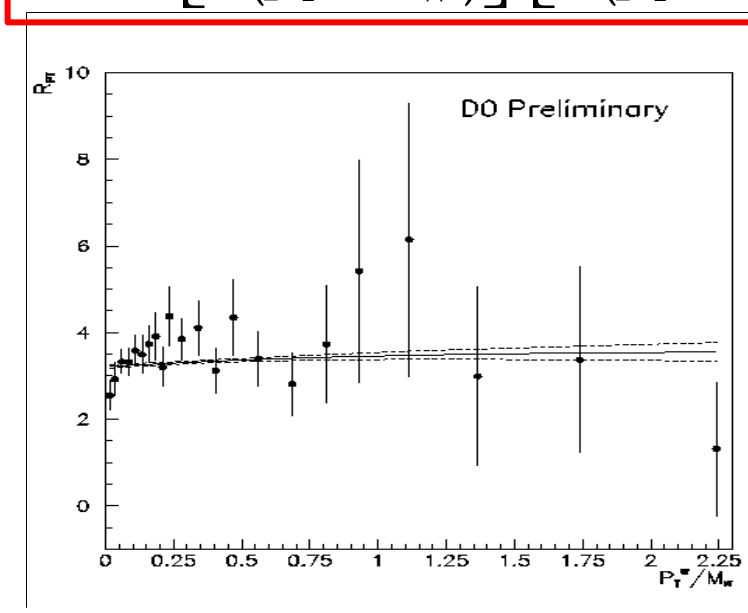


Test of perturbative and non-perturbative QCD over a large range of pt.

Data and theory show good agreement. At low pt, the perturbative calculation clearly breaks down and a combined resummed calculation and non-perturbative parametrization is needed.

W/Z differential cross section

$$R_{p_T} = \left[\frac{ds^W}{d(p_T^W/M_W)}\right] / \left[\frac{ds^Z}{d(p_T^Z/M_Z)}\right]$$



Submitted to PLB

Theory is Giele/Keller PRD57, 4433

Method can be used to predict W observables using purely pQCD theoretical prediction and measured properties from Z

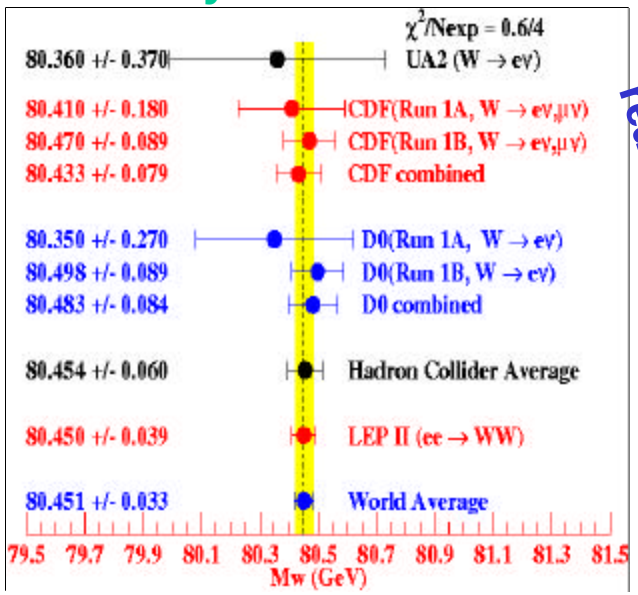
W mass and W width

Improved W mass measurement

- Include previously unused events with electrons close to the boundaries between calorimeter modules. "Edge electrons"

->More W->en events

->More Z->ee events lead to additionally constraint calibration

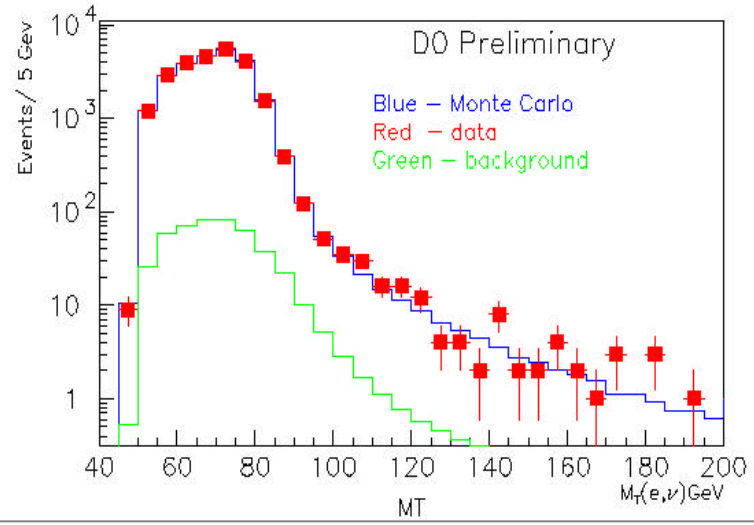


D0's error on W mass reduced by 8%

New World Average direct measurements: 80.451 ± 0.033 GeV

Direct measurement of the W width

- **The tail region of $M_T(W)$ is sensitive to $\Gamma(W)$ and can be used to extract $\Gamma(W)$.**



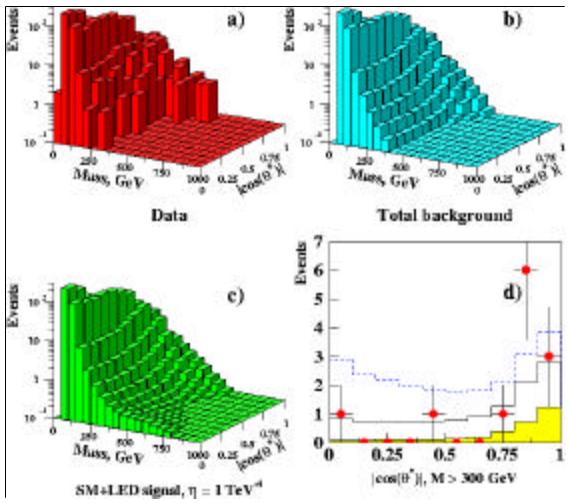
- Avoids using theoretical inputs.
- Explores the region above W pole where new physics could appear

$\Gamma(W) = 2.231^{+0.145}_{-0.138}$ (stat) ± 0.092 (syst) GeV

SM prediction: $\Gamma(W)$=2.0937 ± 0.0025 GeV

Extra Dimensions and Technicolor

Extra Dimensions

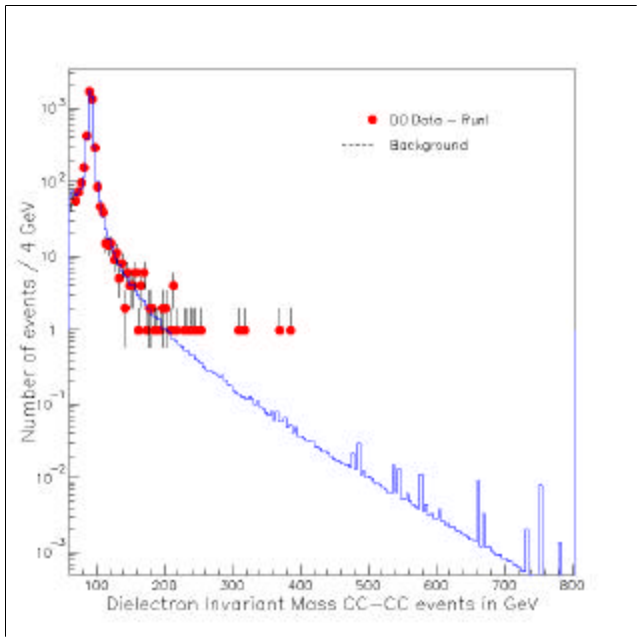


We search for Graviton exchange in the e^+e^- and $\gamma\gamma$ M_{inv} vs. $\cos\theta^*$ distributions

We observe no evidence for Extra Dimensions and set limits on the energy scale of extra dimensions between 1.0 and 1.3 TeV for the number of extra dimensions between 2 and 7

PRL 86 (2001) 1156

Technicolor and Z' Search



We search for technihadron and Z' production in the e^+e^- M_{inv} distribution

We observe no evidence for technicolor or Z' production and set limits of about 200 GeV for r_T and w_T, and 670 GeV for Z'

Submitted to PRL

Question: Is it possible to perform a *data*-driven search for new phenomena?

Sleuth

A quasi-model-independent new physics search strategy

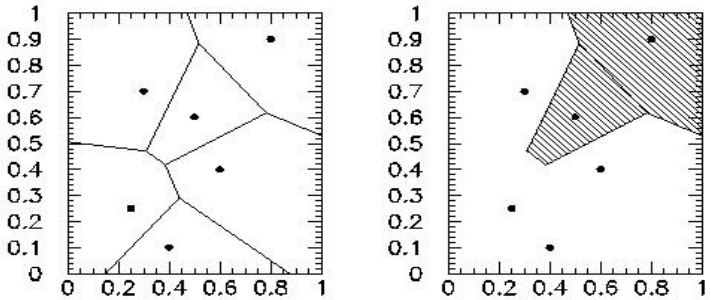
1) Define final states

2) Define variables

$$\sum p_T^{gWZ} \qquad \sum p_T^{j}$$

$$\sum p_T^{\ell} \qquad \not{p}_T$$

3) Define regions

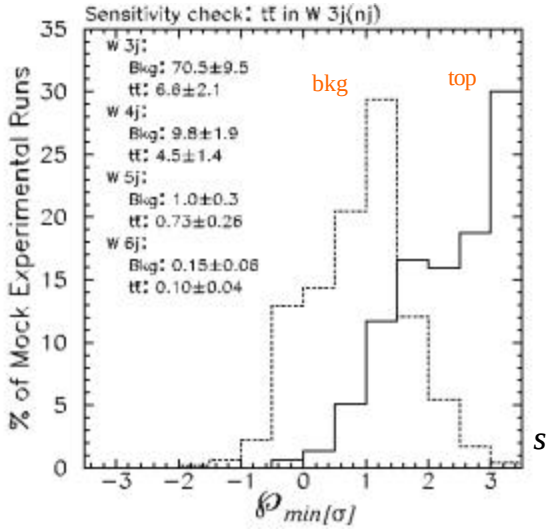


4) Define "interestingness"

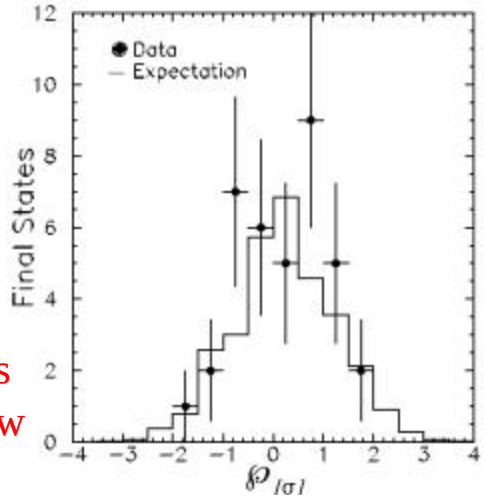
$$\sum_{i=0}^{N} \frac{e^{-b} b^{i}}{i!}$$

5) Run *hypothetical similar experiments*

6) Can Sleuth find something interesting? (yes!)



7) Does Sleuth find anything interesting in Run I data?



No. A systematic search of many final states reveals no evidence of new high p_T physics.

8) Apply to Run II

Quaero – DØ Makes its Data Public!

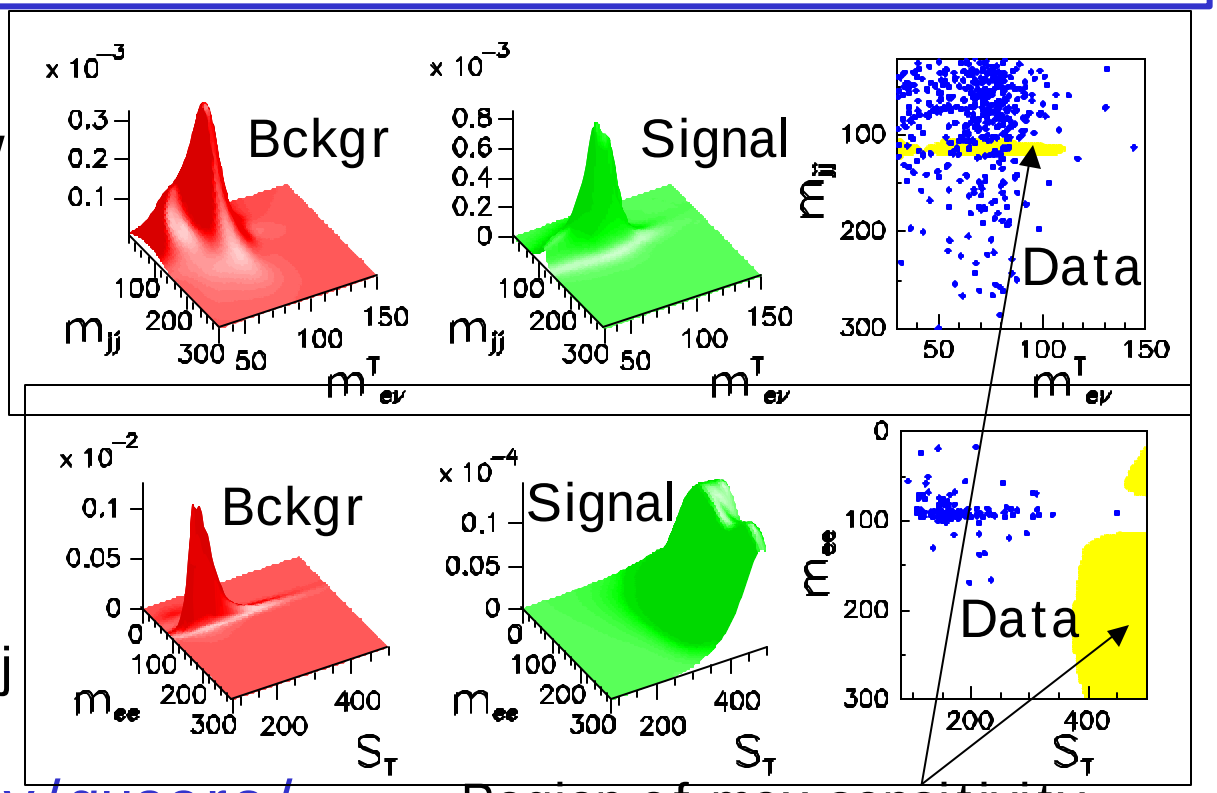
QUAERO automatically optimizes an analysis for a particular signature provided by the user, using DØ data sets and SM backgrounds. QUAERO was demonstrated in eleven separate searches: SM WW, ZZ, and tt production; resonant h→WW,ZZ; W'→WZ, and Z' → tt production; associated Higgs production; and pair production of first generation scalar leptoquarks. Search for W'→WZ is the first of its kind.

Wh →eνjj, w/ kinematic fit to W

hep-ex/0106039, submitted to PRL

Quaero: Latin for "to seek"

LQLQ →eejj



http://quaero.fnal.gov/quaero/

Region of max sensitivity