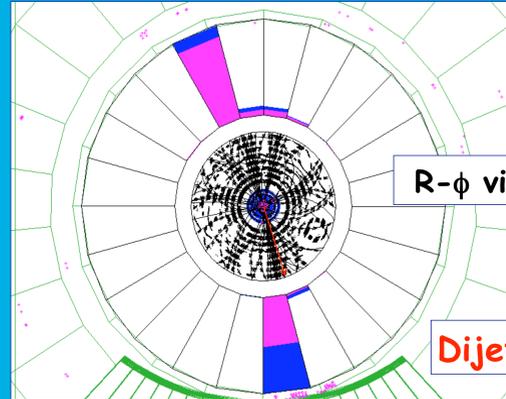




Testing QCD: Jet Production at CDF

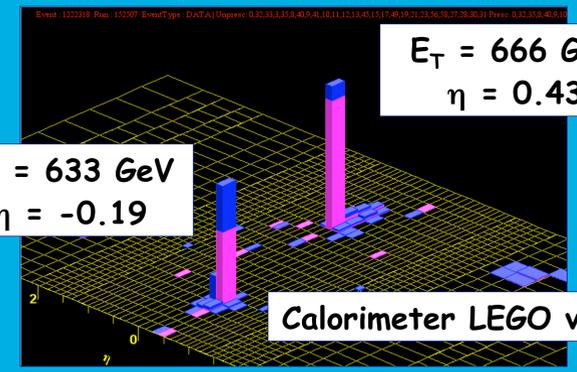
Motivation

New level of precision
in the knowledge of QCD processes
in hadron collisions



R- ϕ view

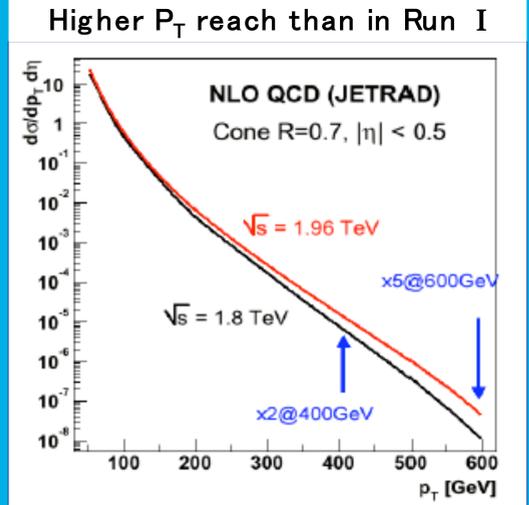
Dijet Mass = 1374 GeV/c²



E_T = 633 GeV
 η = -0.19

E_T = 666 GeV
 η = 0.43

Calorimeter LEGO view



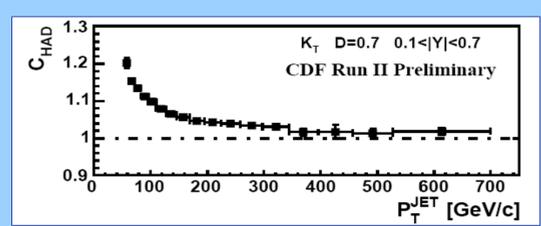
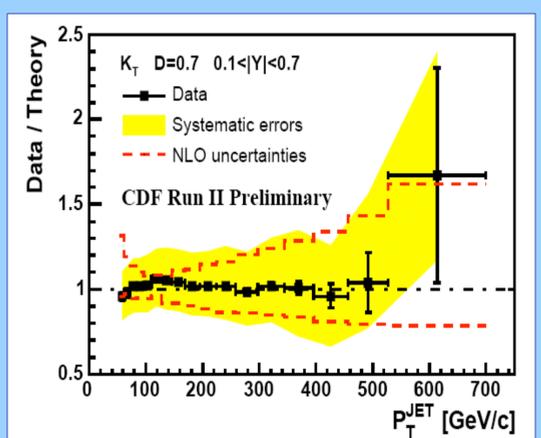
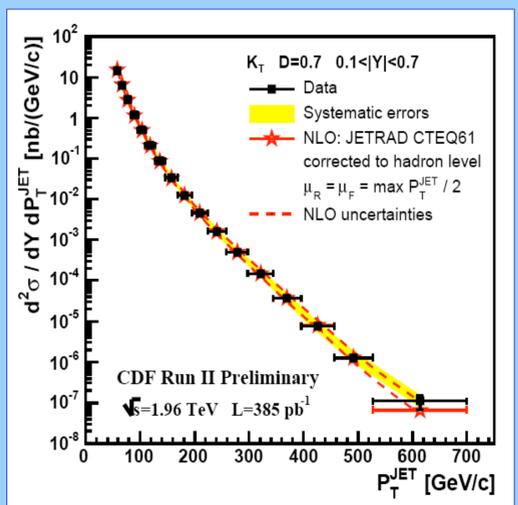
Jet production results are stringent tests of QCD

- ✓ Perturbative QCD
- ✓ Parton Distribution Functions (PDFs)

High transverse momentum (P_T) tail sensitive to **New Physics**

Inclusive Jet Cross Section

- ✓ Use K_T algorithm: preferred by theory
- ✓ Infrared/collinear safe to all orders in pQCD
- ✓ No merging/splitting issue



8 orders of magnitude!

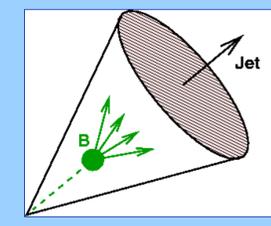
- ✓ Good agreement between Data and Theory
- ✓ Data fully corrected to the hadron level
- ✓ NLO uncertainties mainly from PDFs
 - Gluons at high x

b-jet Cross Section

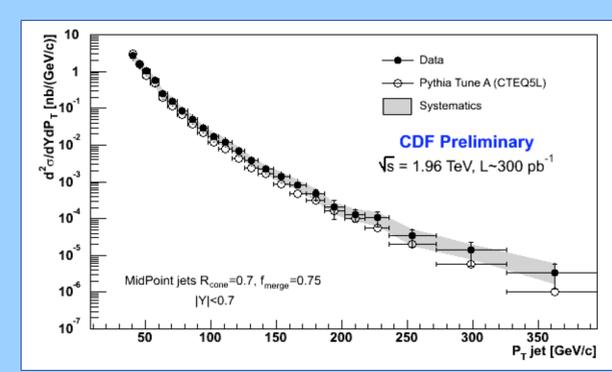
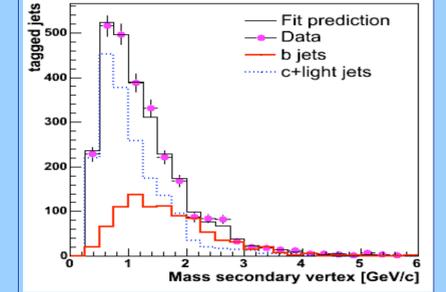
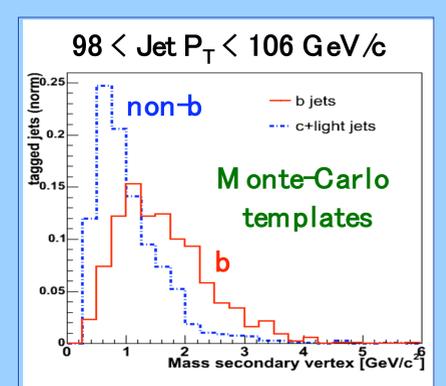
- ✓ b-jets include most of b-quark remnants
 - Small dependence on fragmentation
- ✓ b-tagging using secondary vertices

- ✓ extract b fraction by fitting templates to the data

Long lifetime of B hadrons



High masses of B hadrons



- ✓ Comparison to Pythia Tune A as expected
- ✓ Comparison to NLO will come soon



Electroweak Physics at CDF

W & Z Boson Cross Sections

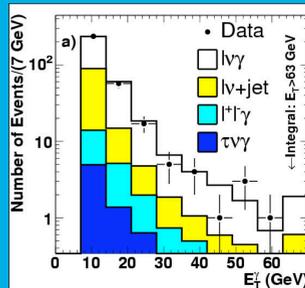
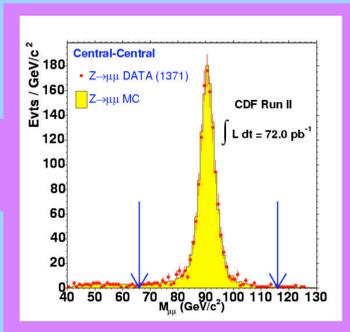
W's and Z's are the standard candles of CDF

✓ Acceptance for these events is understood to 2%.

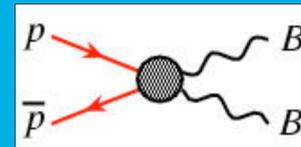
✓ Track resolution : $\delta p_T/p_T \sim 0.15\% p_T$

✓ Cross-section ratios determine fundamental parameters such as the width of the W boson :

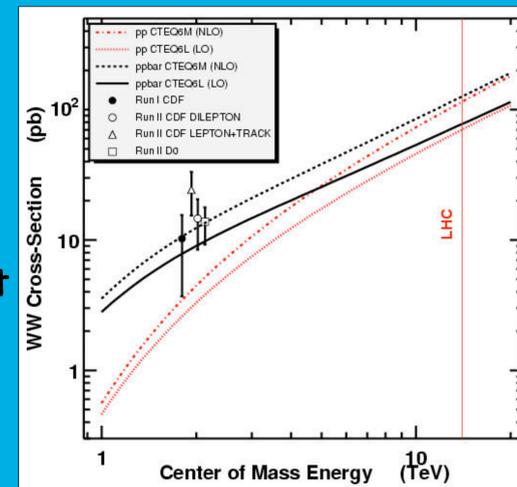
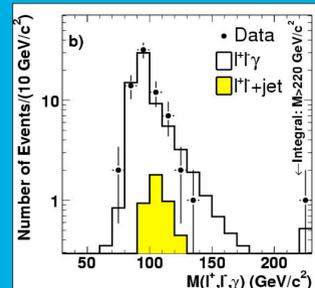
$$\Gamma_W(\text{CDF}) = 2079 \pm 41 \text{ MeV}$$



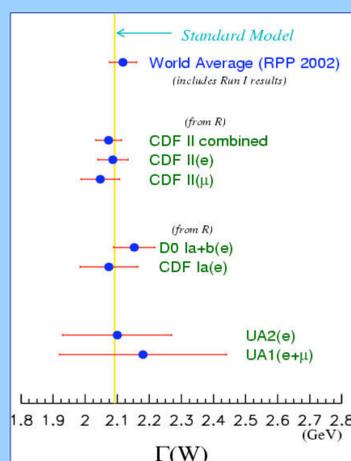
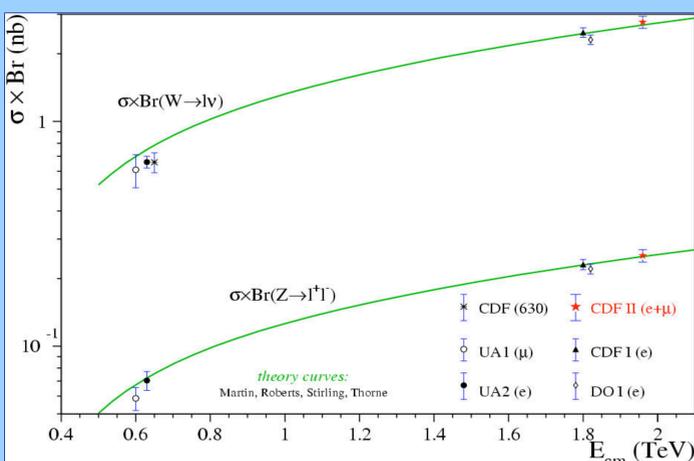
Diboson Physics



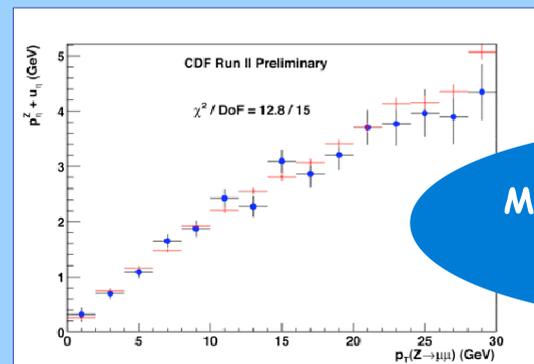
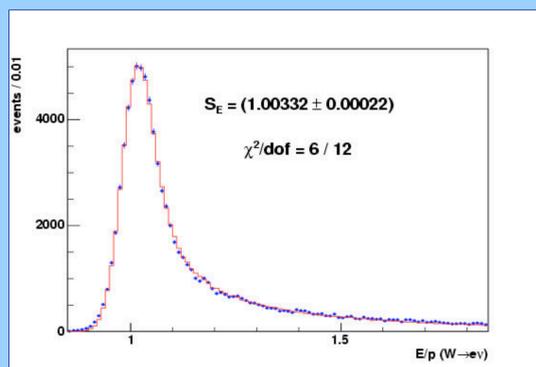
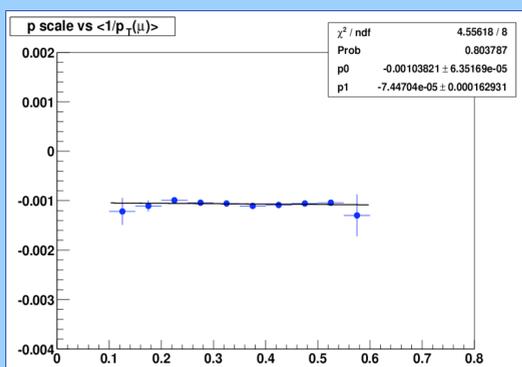
✓ $W\gamma$: photon P_T spectrum sensitive to non-SM couplings.
 ✓ $Z\gamma$: search for resonances.



✓ WW production in hadron collisions firmly established.
 ✓ Important discovery channel at the Tevatron & LHC.



W Mass Measurement



Model hadronic response Using Z -> ll events

Calibrate tracker with Muons from low-mass Resonance decays

Calibrate calorimeter with Electrons from W decays

Run II M_W measurement will significantly constrain the Higgs mass

Systematic (Run 1b)	Electrons	Muons	Common
Production and Decay Model	30(30)	30(30)	25(16)
Lepton Energy Scale and Resolution	70(80)	30(87)	25(0)
Recoil Scale and Resolution	50(37)	50(35)	50(0)
Backgrounds	20(5)	20(25)	
Statistics	45(65)	50(100)	
Total	105(110)	85(140)	60(16)

Total uncertainty 76 MeV (cf Run 1: 79 MeV)

