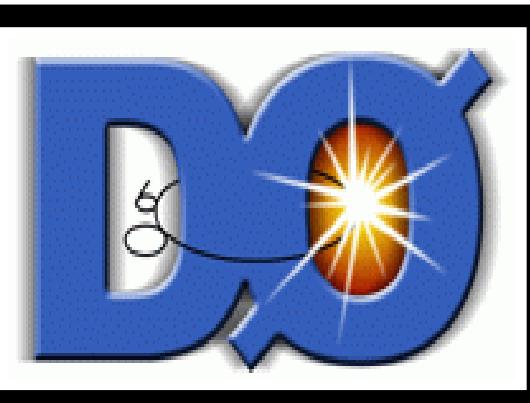
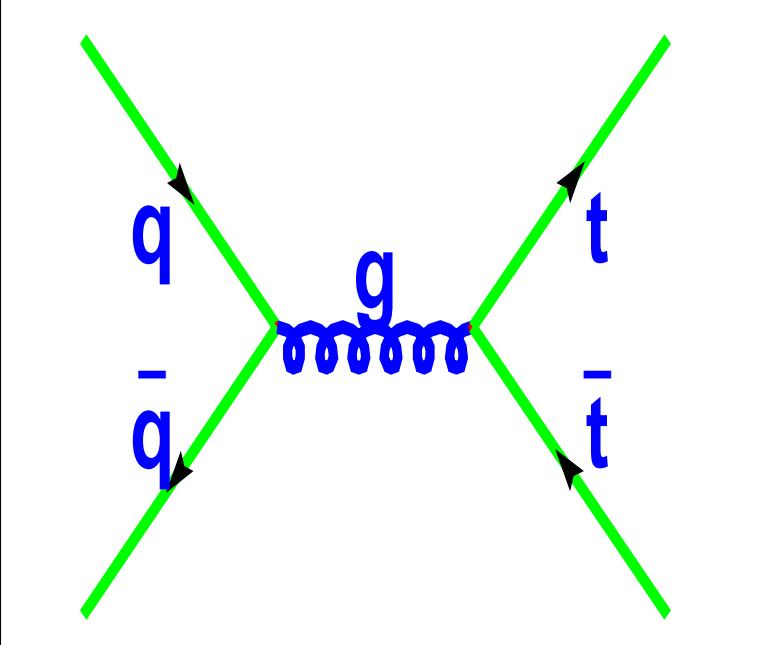


# Standard Model Physics for Run II

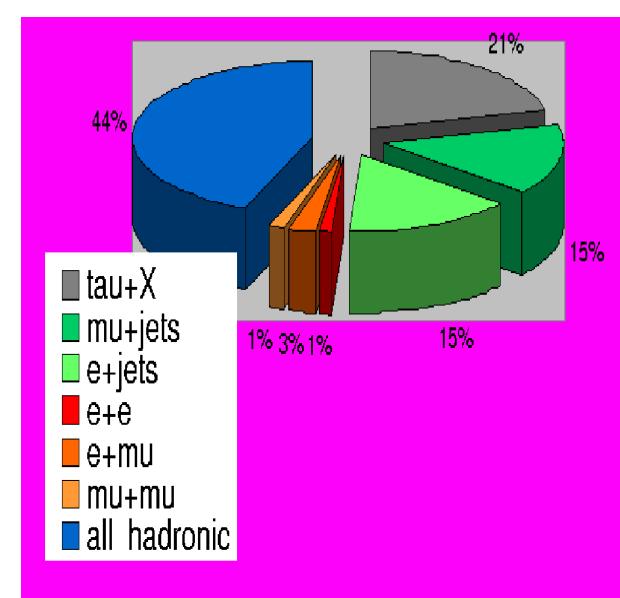


## Top Physics

The top quark is the heaviest of all quarks  
Discovered at Fermilab in Run I

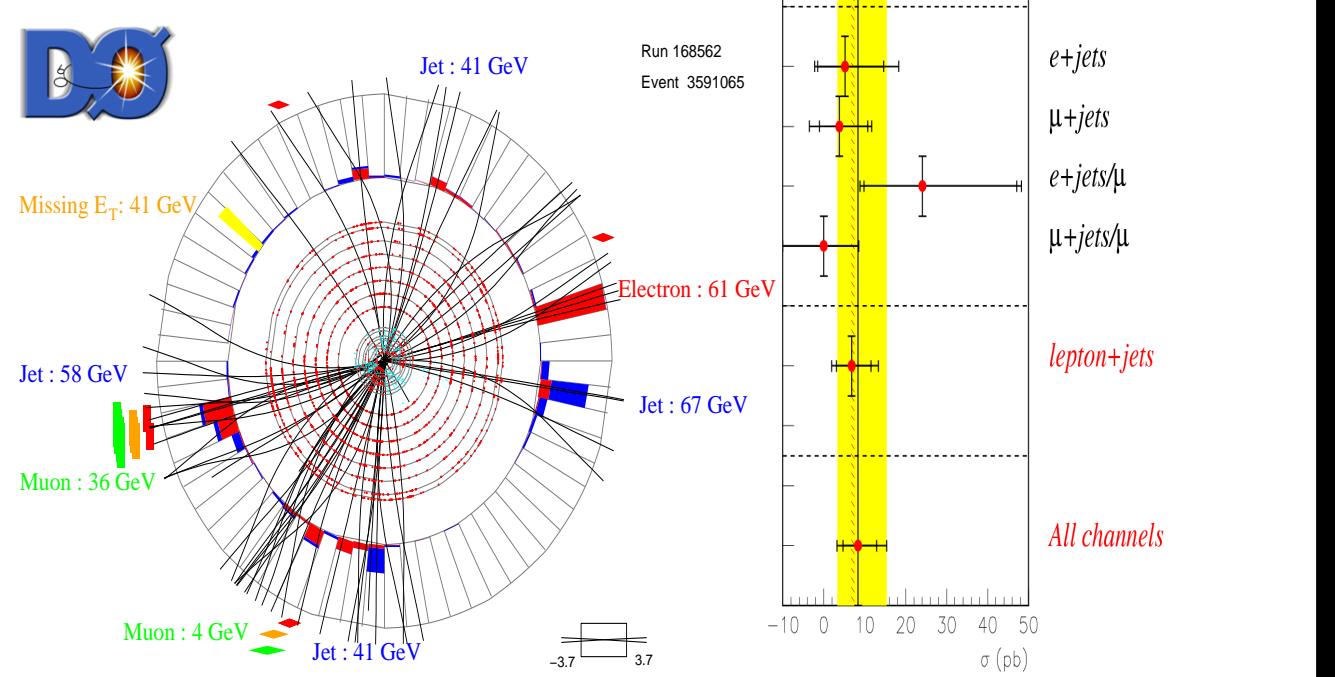


Feynman diagram for top production  
The dominant production channel at the Tevatron

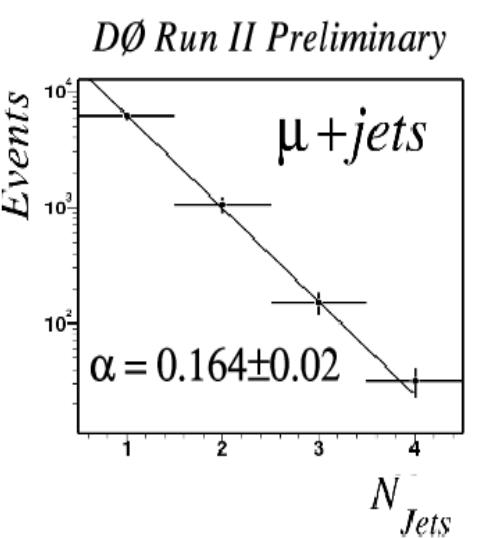


Top quark decay modes  
Most tops decay to all jet  
few decay to two lepton

Top to  $e + jets$  candidate event  
Electron plus four jets with two jets having a soft muon tag



Berends scale  
Measuring the number of  $W + jet$  events subtracting off QCD background



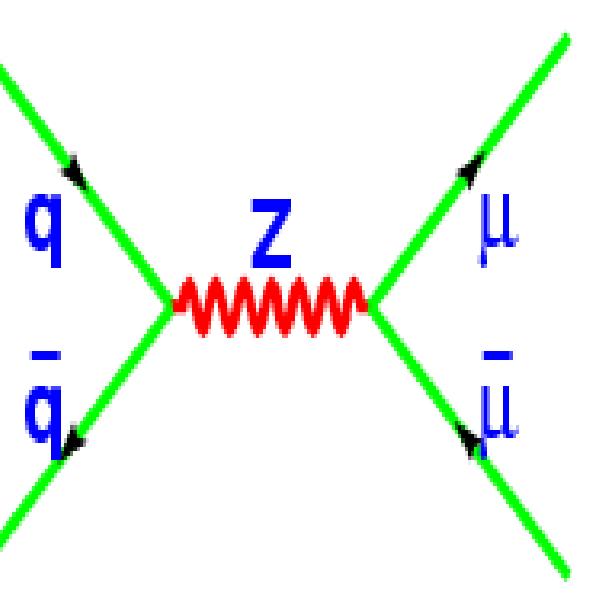
D $\bar{0}$  Run II Preliminary  
 $\mu + jets$   
 $\alpha = 0.164 \pm 0.02$   
D $\bar{0}$  Run II Preliminary  
 $e + jets$   
 $\alpha = 0.145 \pm 0.02$

Top cross section  
Combining all channels  
an excess of 3  $\sigma$  is observed

D $\bar{0}$  Preliminary

Run 168562 Event 3591065  
Jet : 41 GeV  
Missing  $E_T$ : 41 GeV  
Electron : 61 GeV  
Jet : 58 GeV  
Muon : 36 GeV  
Muon : 4 GeV  
Jet : 41 GeV  
Jet : 67 GeV  
lepton+jets  
All channels

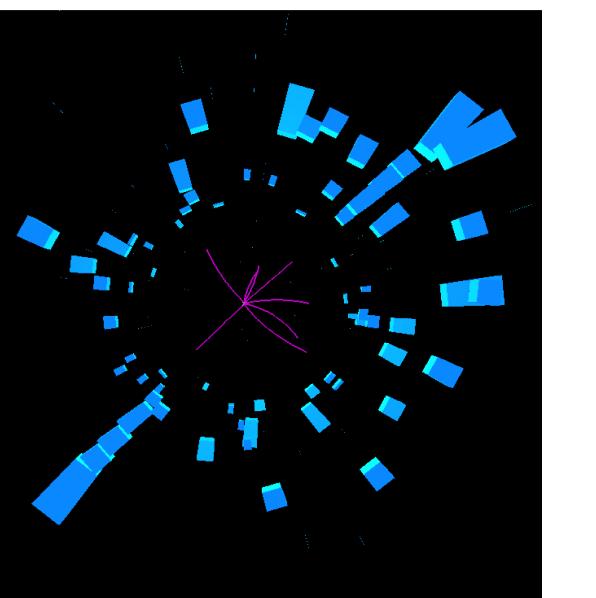
dileptons  
 $e + jets$   
 $\mu + jets$   
 $e + jets + \mu$   
 $\mu + jets + \mu$   
lepton+jets



Feynman diagram for Z

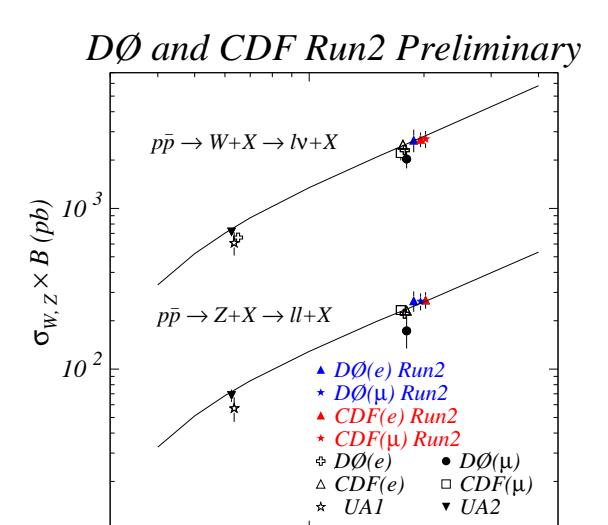
W and Z bosons mediate the electroweak force

Event display for Z candidate  
two back to back muons with low missing energy



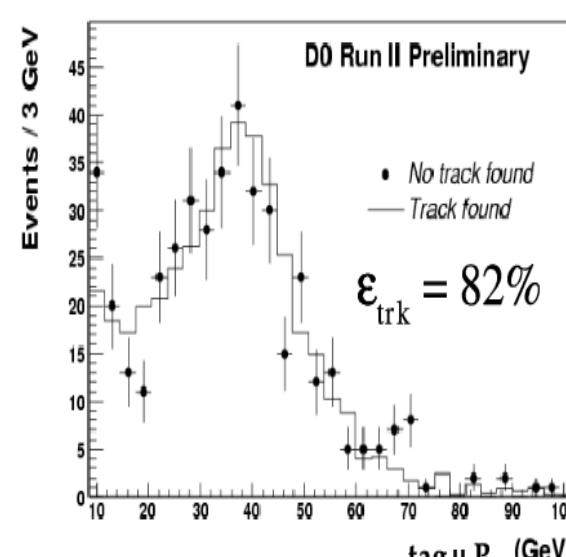
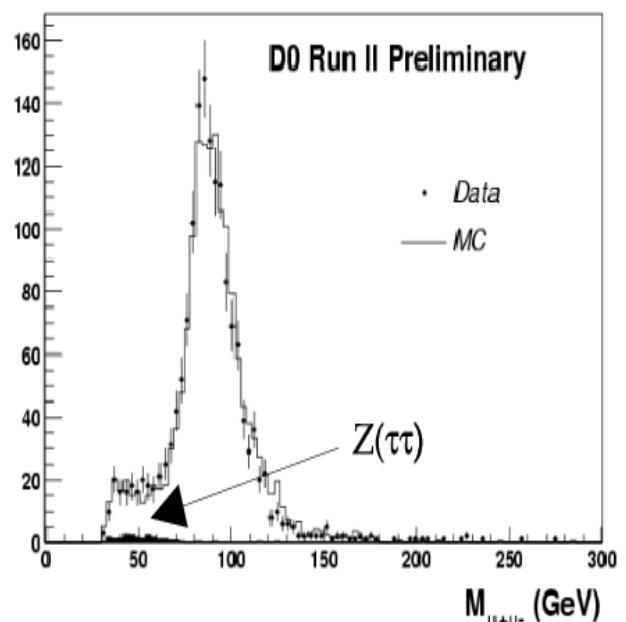
## W/Z

Studying W and Z bosons help us test the consistency of standard model couplings



W/Z cross sections  
1585 candidates in 32 pb of data

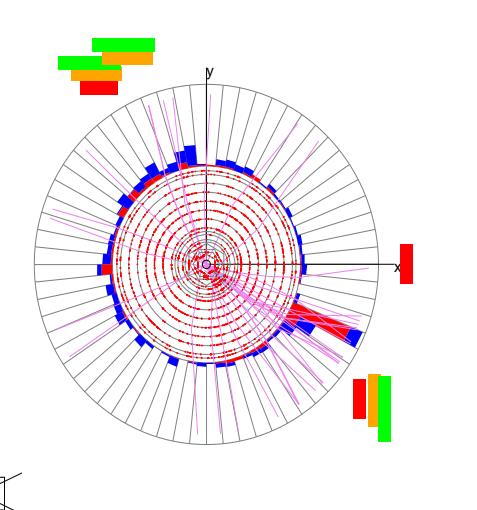
Z invariant mass  
Comparing data plus background to MC



Tracking efficiency  
Comparing events with tracks found to events without tracks to determine efficiency

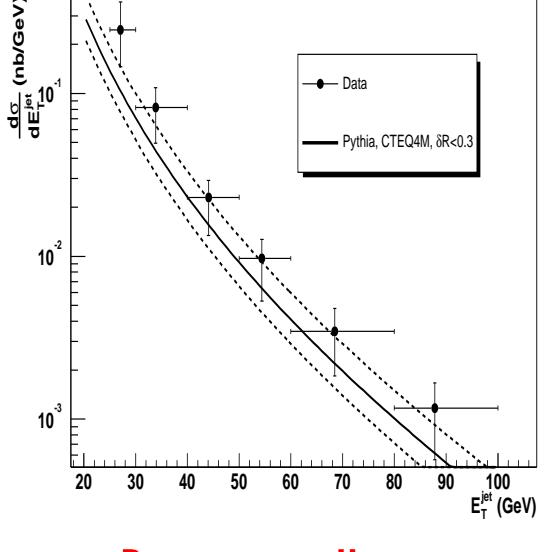
## B Physics

The b quark is the second heaviest quark and vital in CP violation



B-bar candidate event  
Two jets with two soft flavor tagging muons

D $\bar{0}$  Run 2 Preliminary



B cross section  
All species of B hadrons are produced at the Tevatron and at very high cross sections

$B_d \rightarrow J/\psi K^0$   
Needed for measurement of  $\sin(2\beta)$

D $\bar{0}$  Run II Preliminary

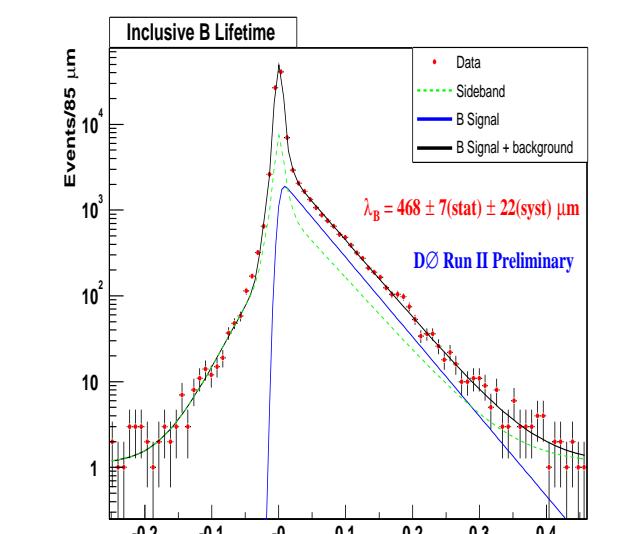


$B_d \rightarrow J/\psi K^0$   
Used for measuring flavor tagging performance

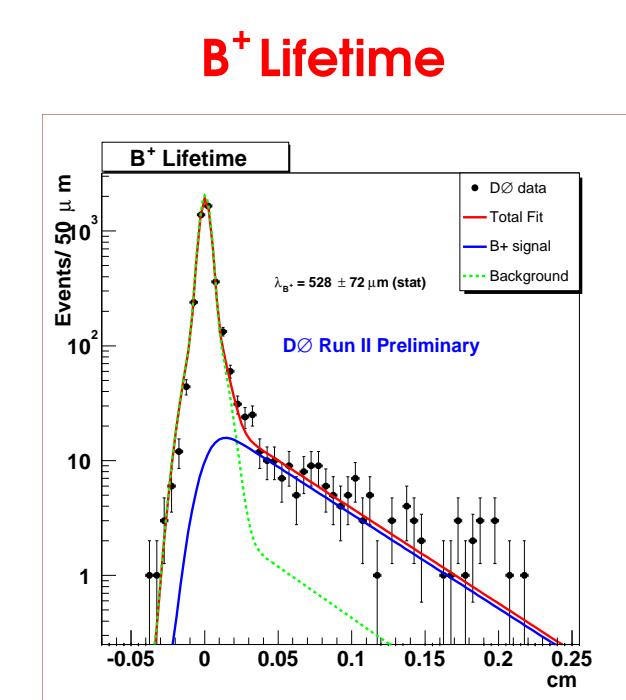
D $\bar{0}$  Run II Preliminary



$B^+ \rightarrow J/\psi K^+$   
Used for measuring flavor tagging performance



Inclusive B Lifetime  
Transverse decay length method  
Measured by the distance from B hadron production to B hadron decay



$B^+$  Lifetime

## QCD

QCD is the study of the strong interaction between quarks

Lego plot of a dijet event

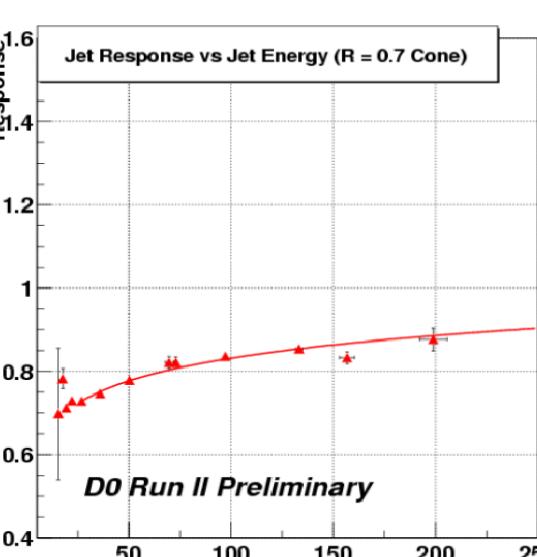
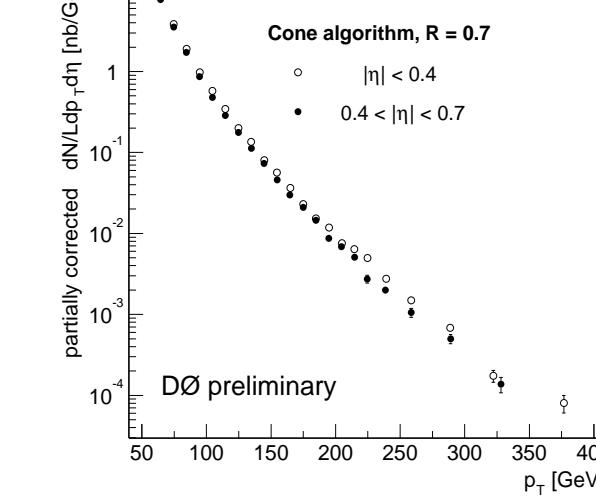
Two jet event help us study proton structure

Dijet event from the beamline

Run 101957 Event 4791549 Wed Nov 14 17:33:47 2001  
Bins: 1097 Mean: 0.405 Min: 0.388 Max: 0.424  
E\_T : 0.0062  $\mu_F$  : 1.60009g  
eta : -0.7 to 0.7  
phi : -3.7 to 3.7

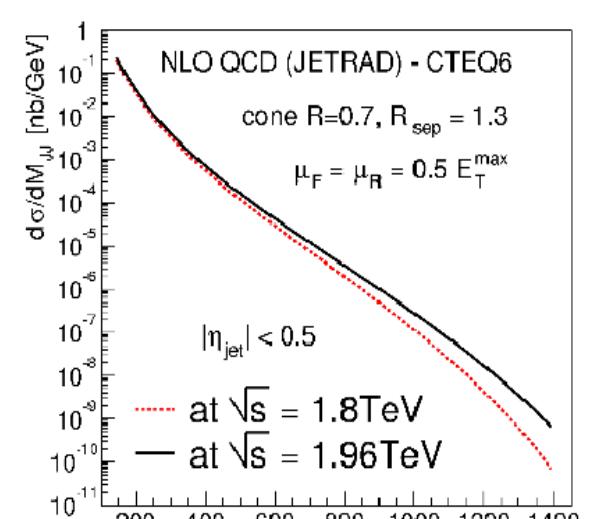
Inclusive jet pT  
Rapidity dependant cross section determines gluon pdf

D $\bar{0}$  Run II Preliminary



Jet energy scale

Detect response compared to jet energy



Dijet cross section comparing Run I to Run II  
Cross section doubles at 1.96 TeV

Observed dijet cross section  
Agrees with theory even at high mass

