Comments on the TMT analysis

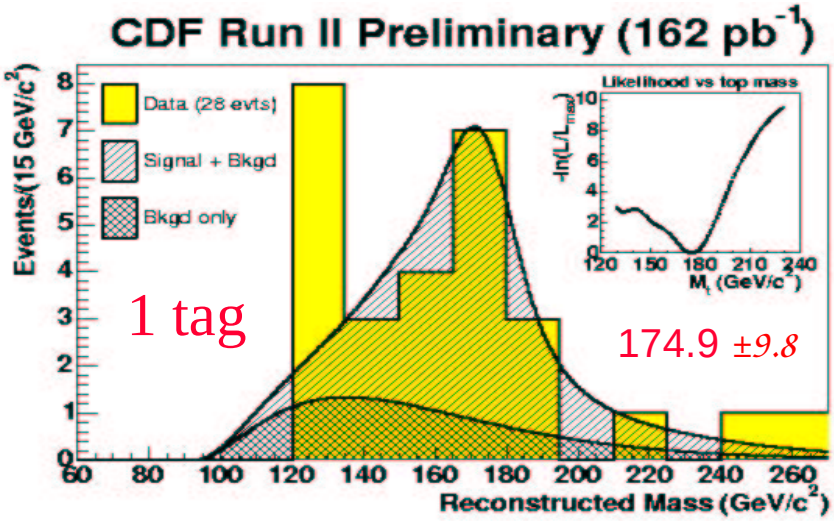
The Top mass has shifted by about 4 GeV.

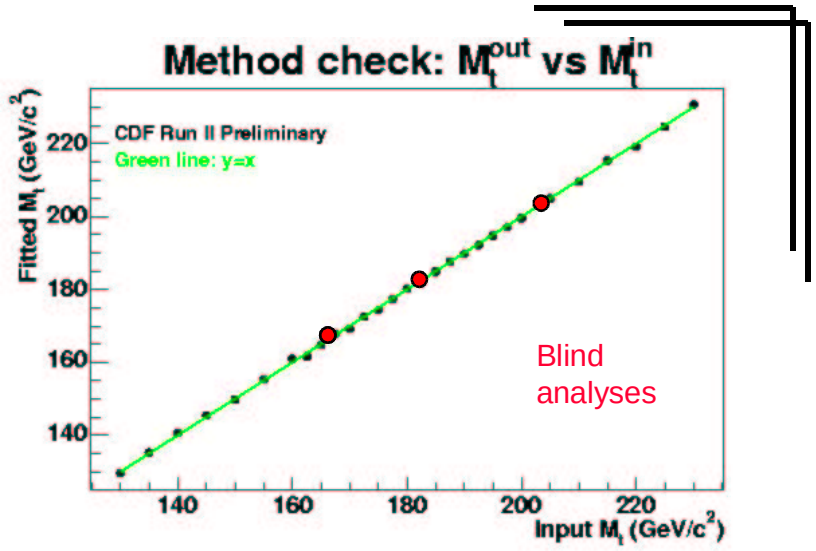
- Are the Gen5 events compatible with the Gen4 events
- Do the jet energy scale changes justify this shift?

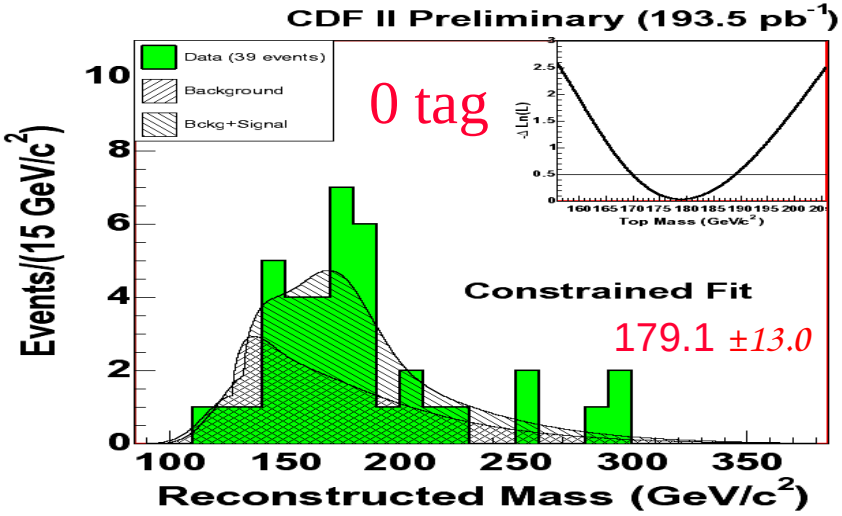
Revised April 8/05

CDF: Template method – 0 & 1 b tag (Velev (Lathuille), summer 04 results)

- Selection criteria
  - one e or μ with p_T > 20 GeV/c
  - 3 jets with E_T > 15 GeV, 4th jet with E_T > 8 GeV
  - missing E_T > 20 GeV
- 1 SVX tag
  - 28 SVX-tagged *tt* candidates
  - 6.8 ±1.2 estimated background
- 0 tag
  - extra cut - $E_T^{4th\ jet}$ > 21 GeV/c²– increases s/b ratio (s/b ~ 1.)
  - 39 events selected



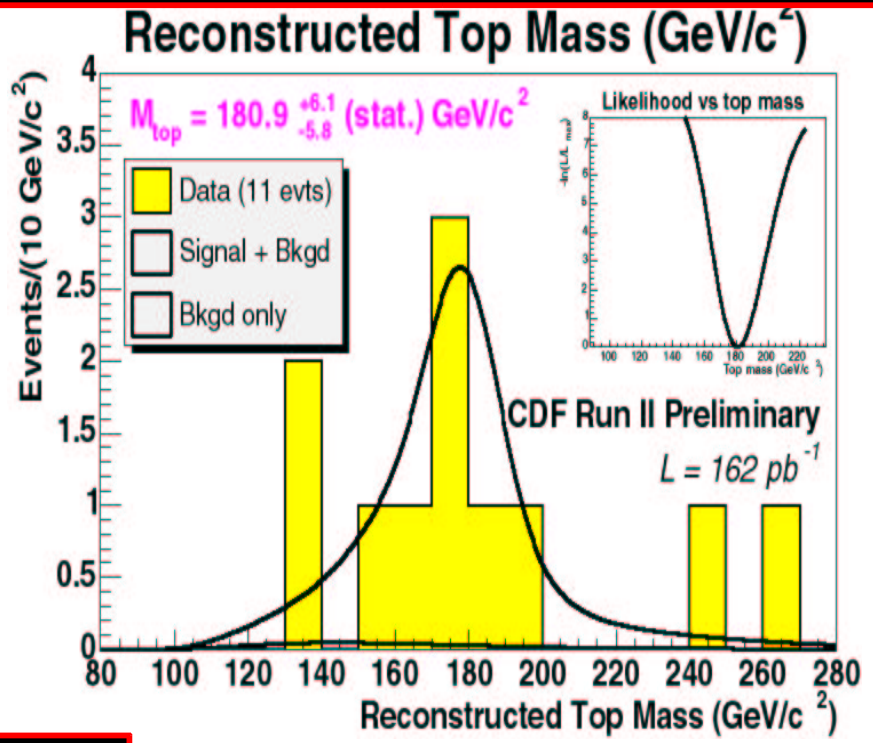




CDF: Template method – 2b tags

- SVX and Jet Probability algorithms are utilized to select two b-jets candidates
- Non-tagged jets, cut on W mass
  - $60 < M_W < 100$ GeV/c^2
- 11 events were selected with expected background of 0.3 ±0.2
- Results from double, single tagged and non-tagged samples are statistically independent and can be combined

$M_{top} = 180.9^{+6.4}_{-6.0}$ (stat) ± 5.8 (sys) GeV/c^2



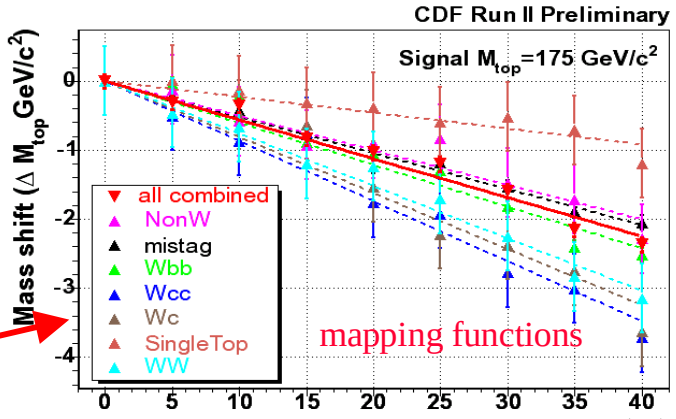
Combined New Result

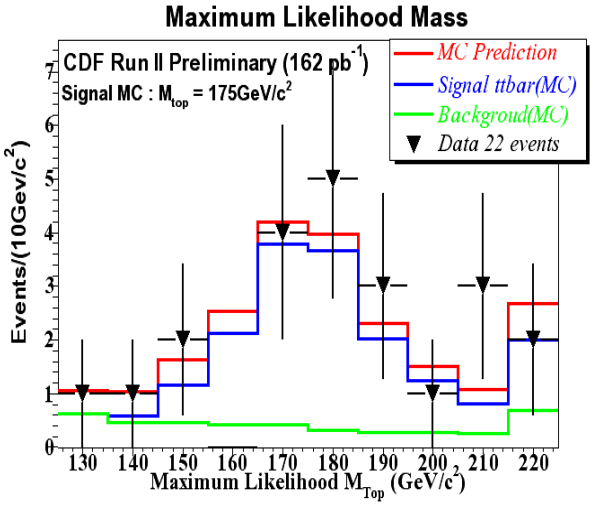
$M_{top} = 177.2^{+4.9}_{-4.7}$ (stat) ± 6.6 (sys) GeV/c^2

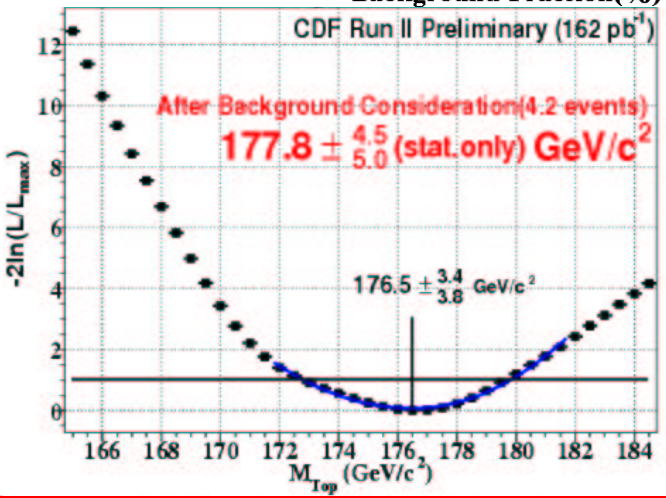
~ 85% of the systematic error comes from jet energy scale error

CDF: Lepton + jets - DLM

- Lepton + jets channel
  - 1 e or μ with p_T > 20 GeV/c
  - Exactly 4 jets with E_T > 15 GeV – LO ME
  - missing E_T > 20 GeV
  - ≥ 1 b-tag
- 19% background fraction (mapping





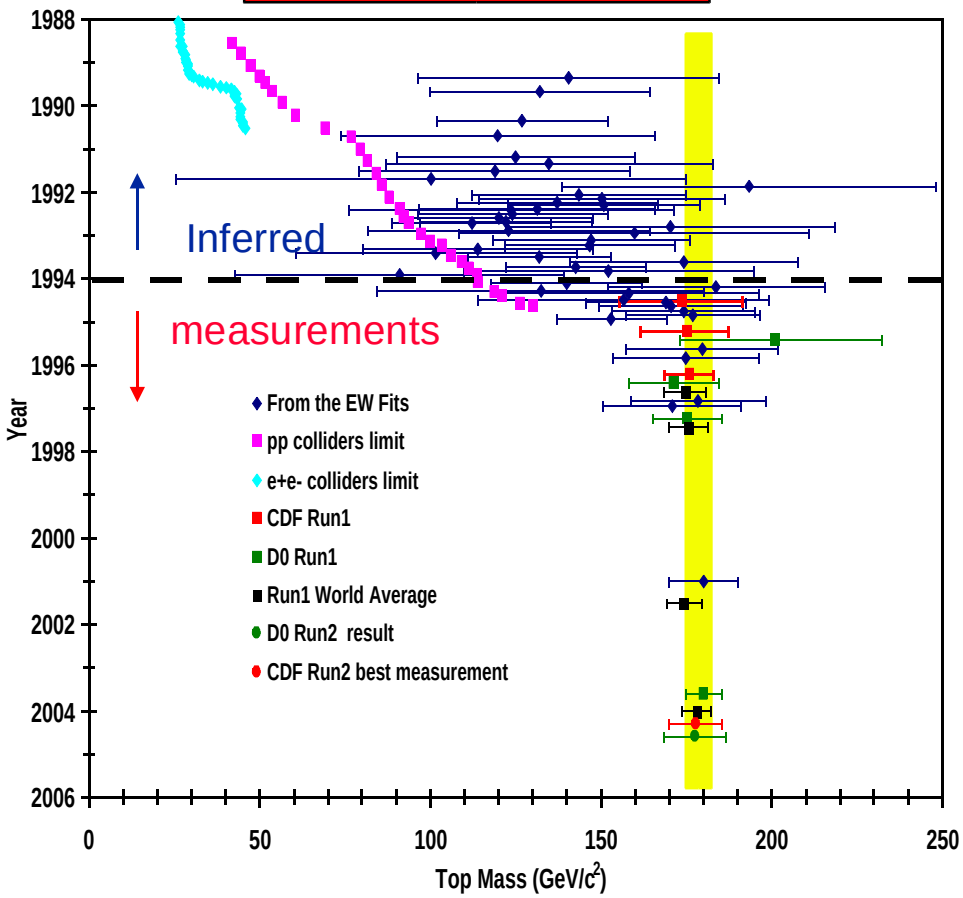


Systematic Uncertainties	ΔM_{top} (GeV/c^2)
Jet Energy Scale	5.3
Transfer function	2.0
ISR	0.5
FSR	0.5
PDF	2.0
Generator	0.6
Spin correlation	0.4
NLO effect	0.4
Bkg fraction	0.5
Bkg Modeling	0.5
MC Modeling	0.5
Total	**6.2**

$$m_{top} = 177.8^{+4.5}_{-5.0} \text{ (stat)} \pm 6.2 \text{ (sys) GeV}/c^2$$

Top mass measurements (Velev)

Top mass history

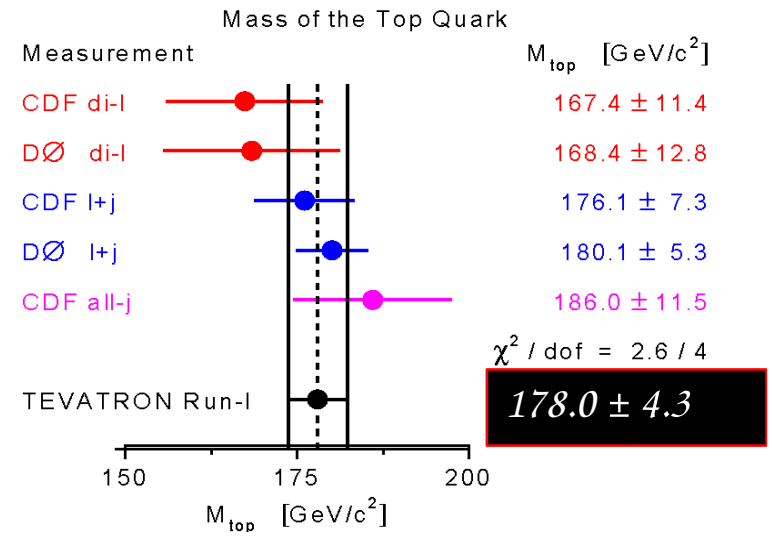


The summary of EW fits (up to 1995) is from: hep-ph/9704332

- New Run1 analysis on the sample of ~125 pb^{-1} collected by DØ in 1994 - 1996
  - Lepton + jets data
  - Matrix Element type analysis technique

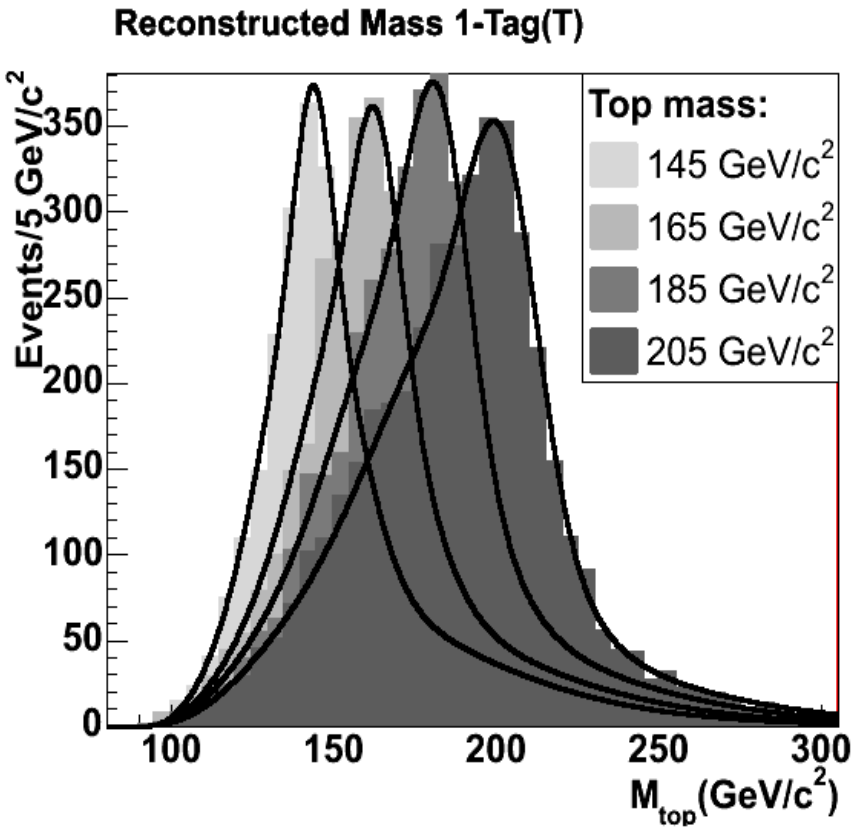
Nature 429, 638-642 (2004)

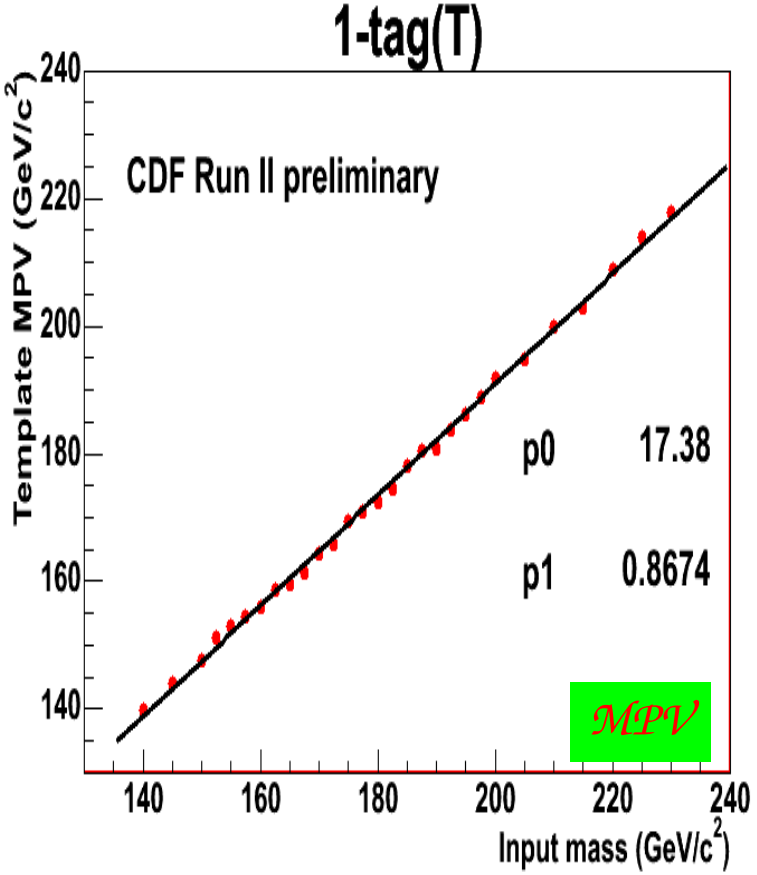
M_{top} = 180.1 ± 3.6 (stat) ± 3.9 (sys)



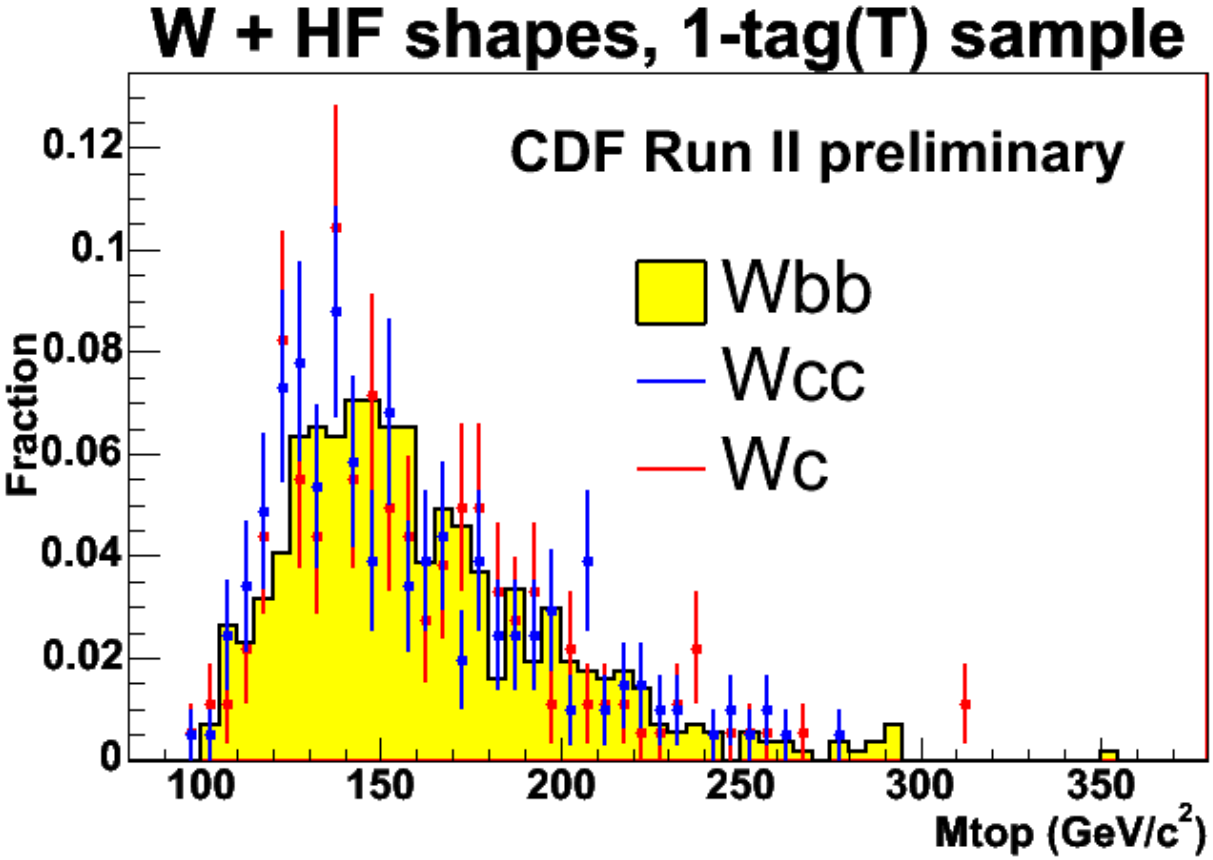
New Run I D0 measurement: 180.2 ± 5.3 GeV

Signal templates (Un-Ki)

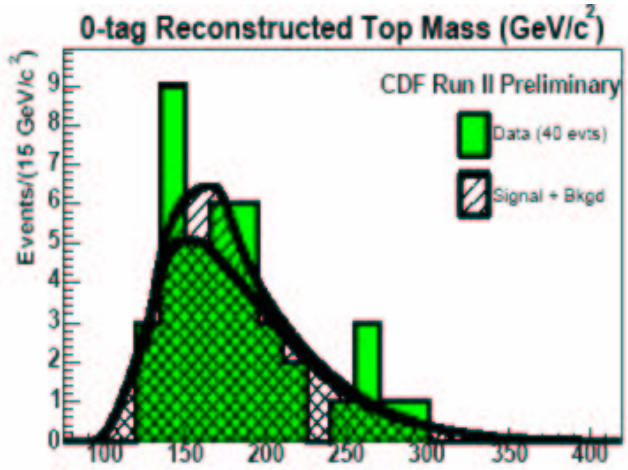


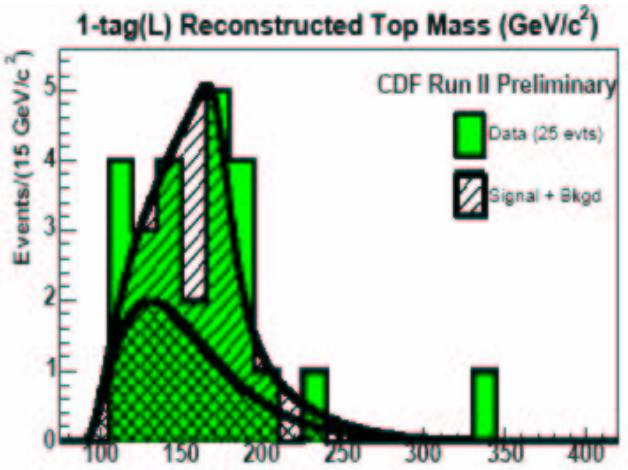


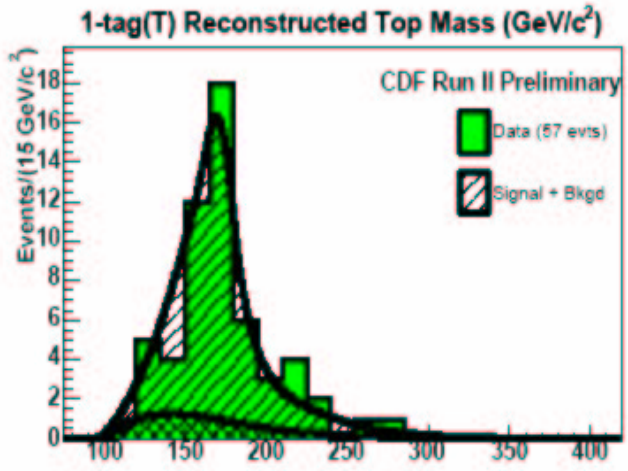
Bkgd templates (Wbb/cc/c)

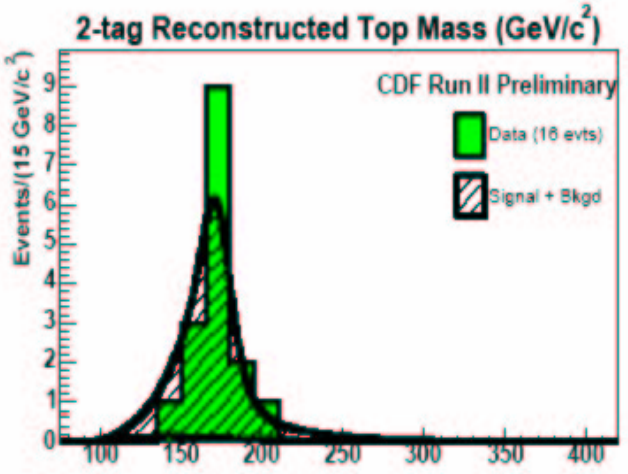


Reconstructed top mass with the fitted top mass =173.2 GeV





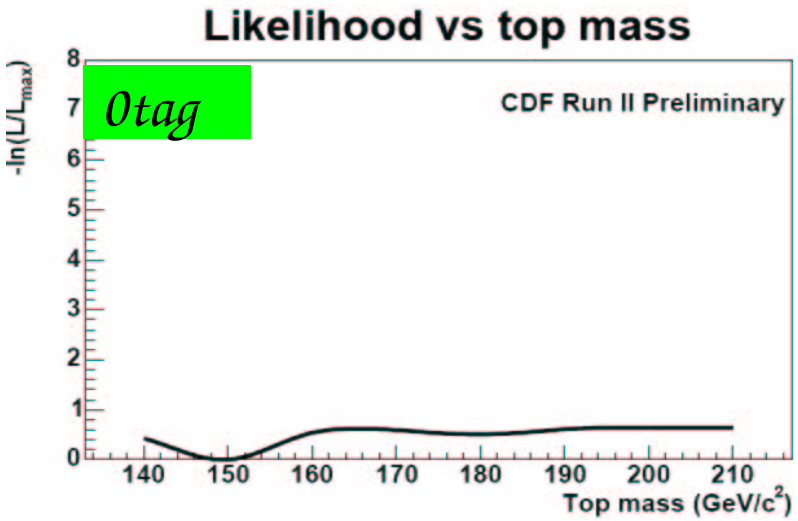


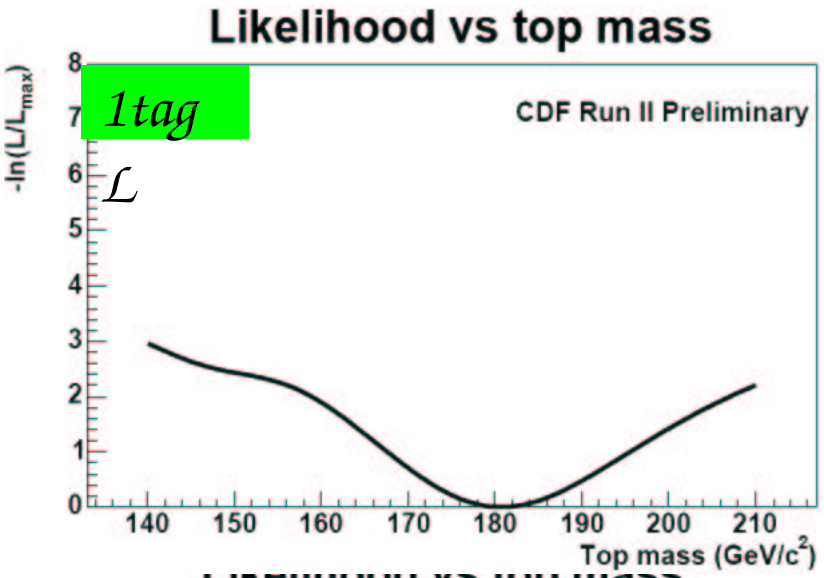


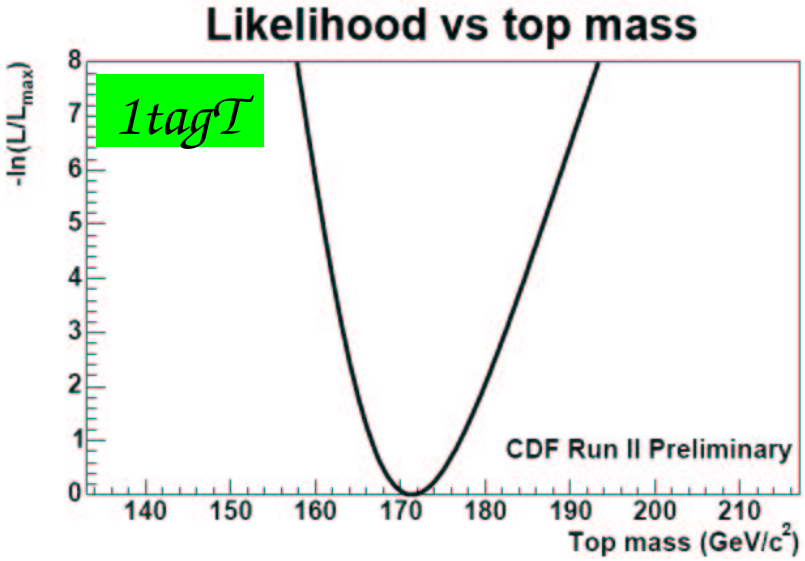
$M=173.2^{+2.9}_{-2.8}(\text{stat}) \pm 3.4(\text{sys})$ Old $M=177.8\ ^{+4.5}_{-5.0}$ **$\pm$ 6.2**

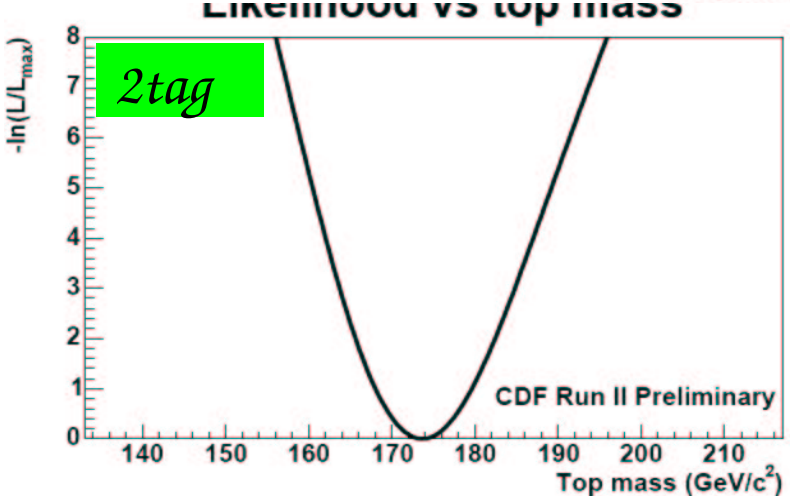
$M=173.2^{+4.7}_{-4.0}$ **GeV** $M= 177.8_{-8.}\ ^{+7.7}$ GeV

Likelihood vs top mass









Gen4-vs-Gen5: data sample

Mass has shifted by 5.6 GeV. What is different?

- Gen4-vs-Gen5 reconstruction
- New jet corrections

Gen4-vs-Gen5 for first 162 pb-1

Do we get the same events?

	2-tag	1-tag	0-tag	total	overlap	
Gen 4	2	26	40	68	52	-23%
Gen5	12	42	22	76	52	+32%

Of the 68 events: 31 have the same N-tag

21 moved from one tag to another

16 have disappeared all together (20 if no χ^2 cut)

lost: 5 tracking or b-tag algo

9 due to new jet corrections

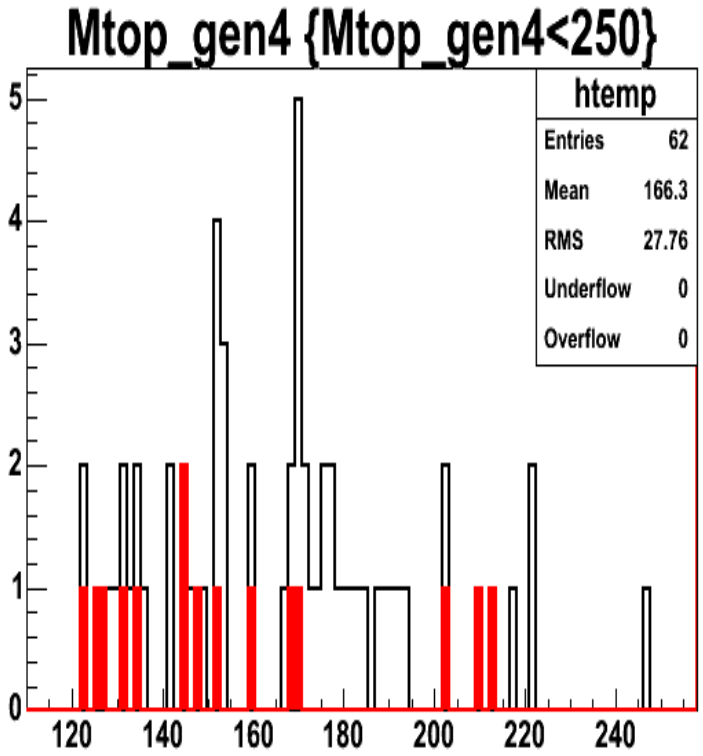
4 no tight lepton

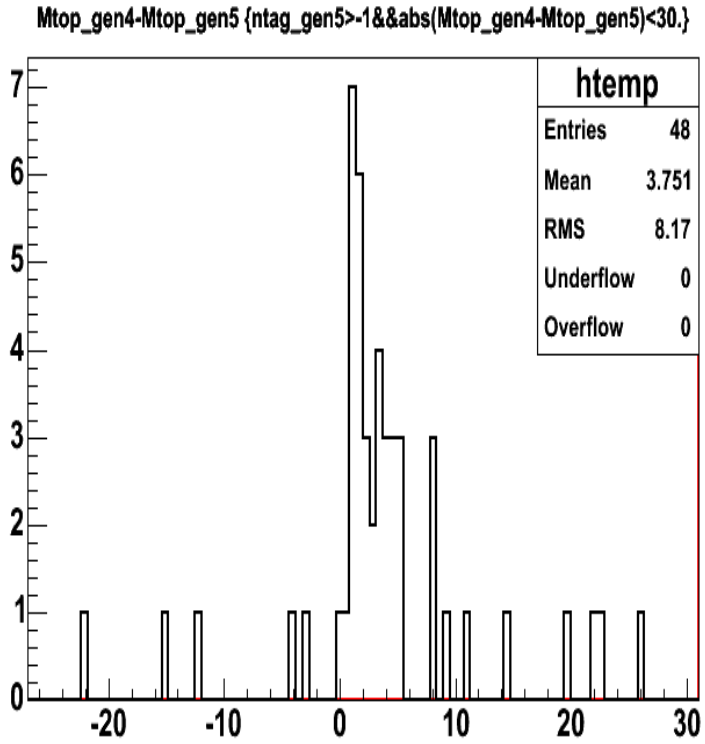
2 others not traced

A variety of reasons, may code changes. It seems plausible

Gen4 vs Gen5 (mass shift)

Do the events give the same mass?





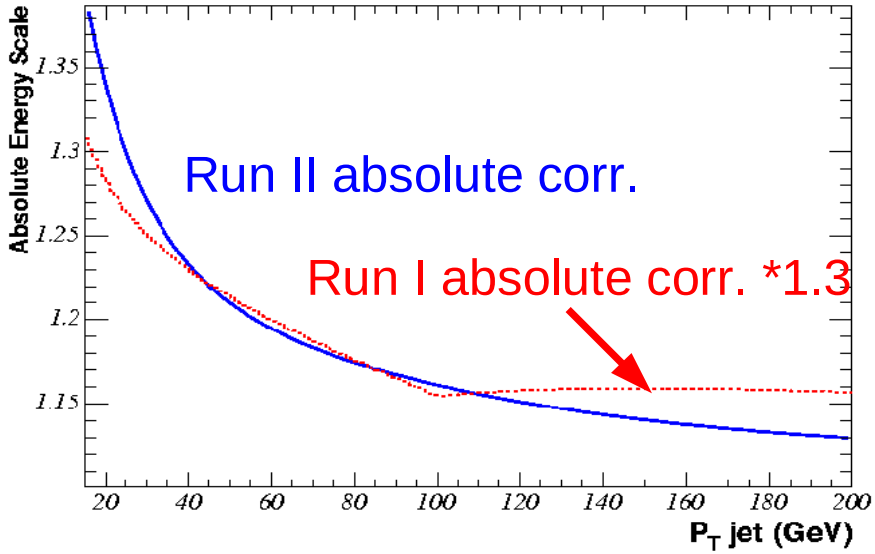
Red: lost events

DM = 3.75 GeV

Jet corrections Gen4-vs-Gen5

What changed?

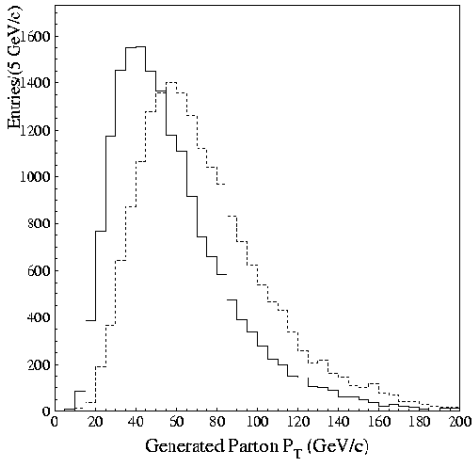
- Relative corrections
- Absolute corrections



Run I needed a CEM correction of about 2%

1% in E-scale--> 1.2 Gev in DM

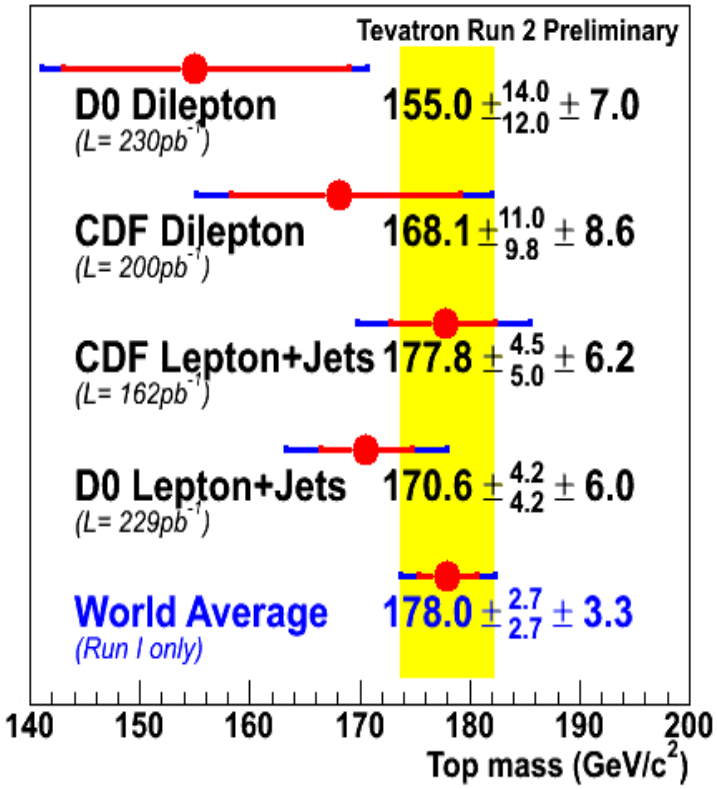
I do not completely understand the 3.7 GeV shift. Gen4 used Run I abs. *1.065, from runI-runII comparison in gam-jet balance. If this was the whole story, it would be OK, but CEM and CHA changes come in as well.



Pt of jets (light and b jets

Summary (from Velev, Lathuille)

- Several new top mass measurements available in different decay channels:
  - CDF Run II preliminary results
    - DLM: most precise measurement from run II
    - CDF: best measurement
      176.7±7.8 GeV/c^2
  - Best Run II DØ results from l+jet channel:
    170.6±7.3 GeV/c^2 (from 2 days ago)
  - new techniques have being developed
- Tevatron is performing very well
  - Delivered luminosity approaches 800 pb^{-1}
  - Top mass updates from the higher statistic (~ 325 pb^{-1}) will be available soon (next months)
  - A lot of work is done to the reduce systematics –especially the jet-energy scale systematic uncertainty
  - Precision will be limited by systematic uncertainties



The CDF lepton+jets is now $M=173.2^{+4.7}_{-4.0}$GeV

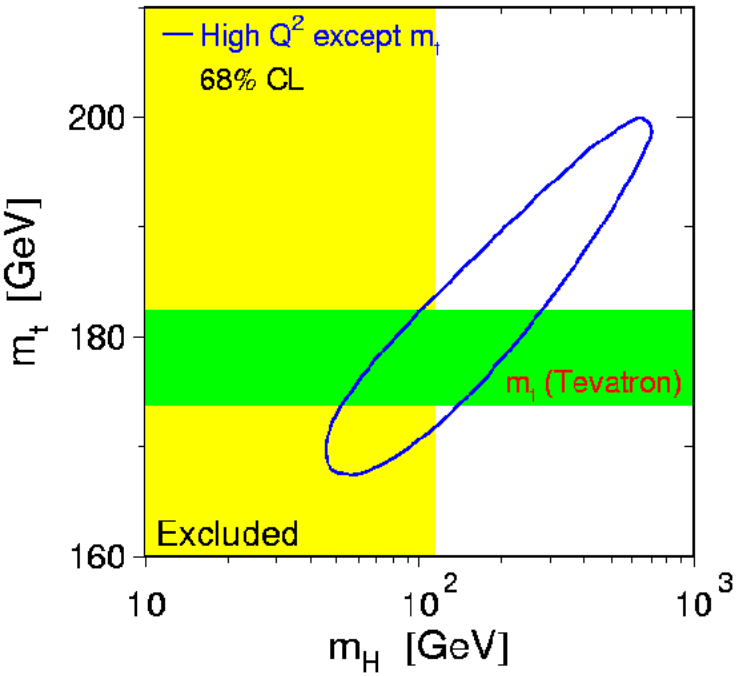
Jean-Francois is now M=173.5 ± 4.1 GeV

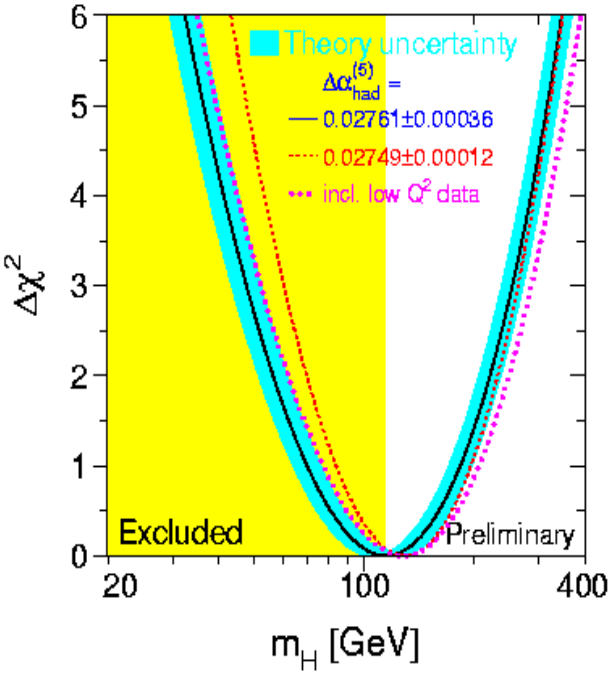
Top Quark property Measurements

Bachacou, Fernandez, Freeman, Galtieri, Gibson, Lujan, Lys, McFarlane, Nielsen, Yao

- The Standard Model predicts the Higgs mass, once the W and Top mass are measured with high precision.
- Loop corrections to MW proportional to Mt^2 and MH

Run I: M(top) = 178.0± 4.3 GeV CDF+D0 comb.





Feb. 2005 best Fit

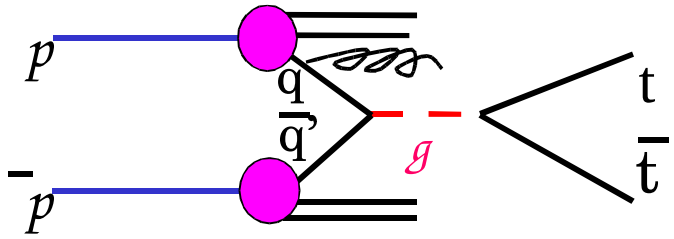
$M_H = 126\ ^{+73}\ _{-48}$ GeV

$M_H < 280$ GeV at 95% CL

Direct limit:
MH < 114 GeV

Top Physics Studies

t t Production at the TeV:



$t\,t \rightarrow W^{+}\, b\, W^{-}\, b$

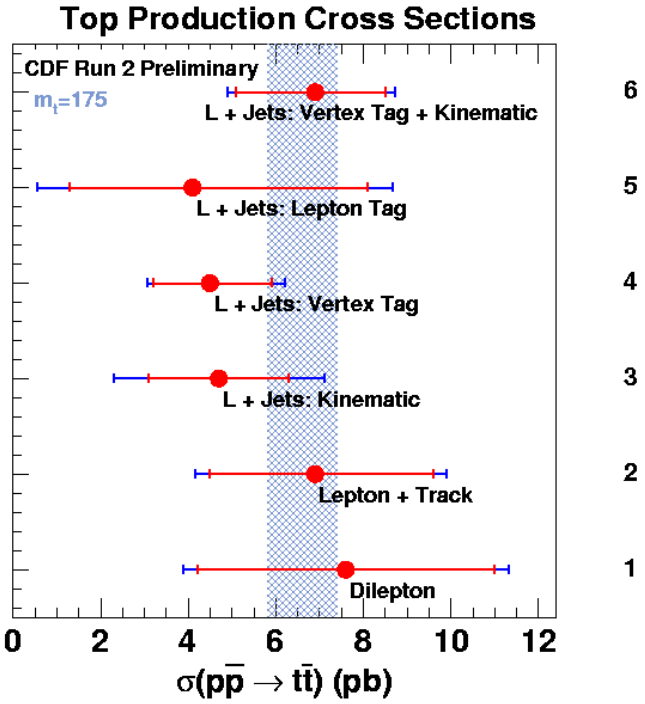
Top quark is heavy: decays very fast!

$\Gamma(t \rightarrow Wb) \approx 1.5$ GeV, $t = 4 \times 10^{-25}$ sec

$\Lambda_{QCD} = 100$ Mev, $\Lambda^{-1} = 10^{-23}$ sec

No hadronization: no top mesons or baryons

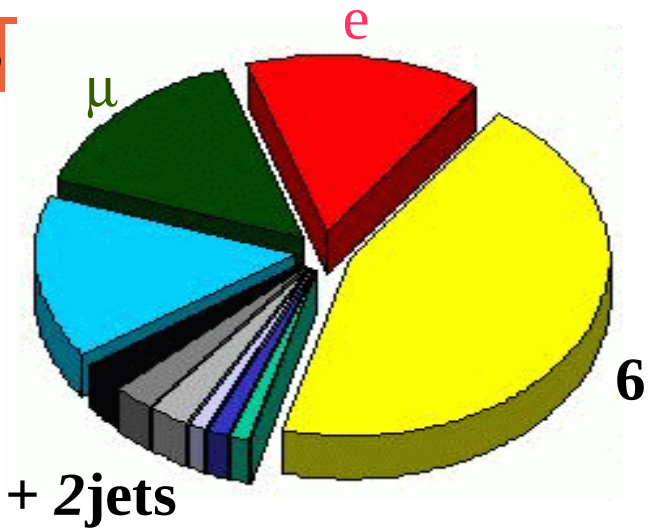
CDF σ measurements in Run II



W + JETS

***l* + 4jets**

τ



6 jets

2*l* + *2*jets

Top events are preferentially in W+? 3 jets

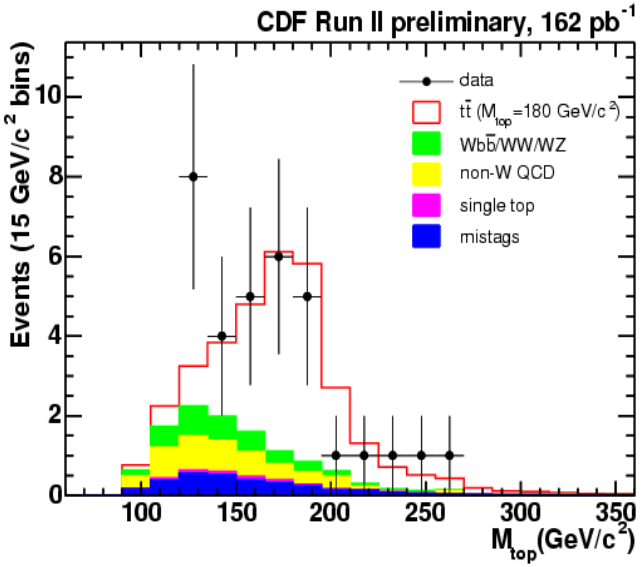
Top mass:Summer '04 LBNL method

Volobouev, Fernandez, Freeman (PHD thesis), Galtieri, Lys

Fits events to $t\,t \rightarrow W^{+}\,b\,W^{-}\,b$

- Jet E-scale (JES)allowed to vary within a gaussian shape in W mass fit
- Multivariate templates for mass fitting likelihood (fast method developed)
- Separate templates for correct and incorrect permutations.
- Probability of correct choice determined from χ^2 value of all permutations.
- Two-dimensional templates: mass and E_{T4} (sum of the 4 jets)
- Increase discrimination between background as well as other top masses.

Summer '04 result



$M = 175.1^{+6.4}_{-6.3}$ (stat) +6.8 (syst)

33 b-tagged events
34% background

Top Mass: new LBNL method

Volobouev,Bachacou, Fernandez, Freeman (thesis), Galtieri, Lujan, Lys

Major systematic uncertainty in top mass measurement comes from jet energy uncertainties. Use transfer functions rather then average corrections to improve resolution.

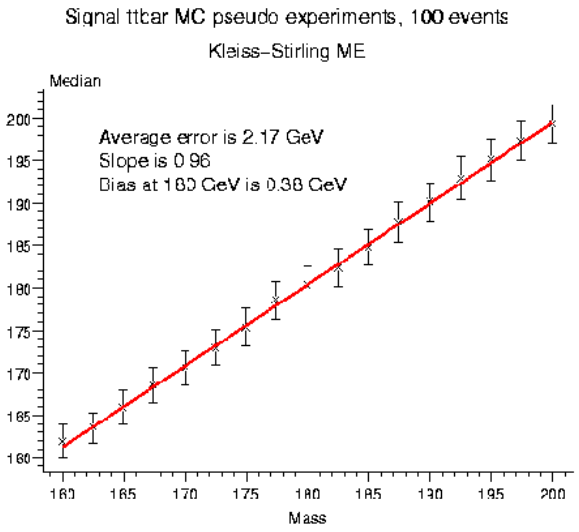
This requires integrating over phase space and Matrix Element, after a transformation into measured variables (similar to the method D0 has used for recent Run I result). See Kondo (1988), Dalitz&Goldstein(1990). Integration being done over four variables + the JES uncertainty.

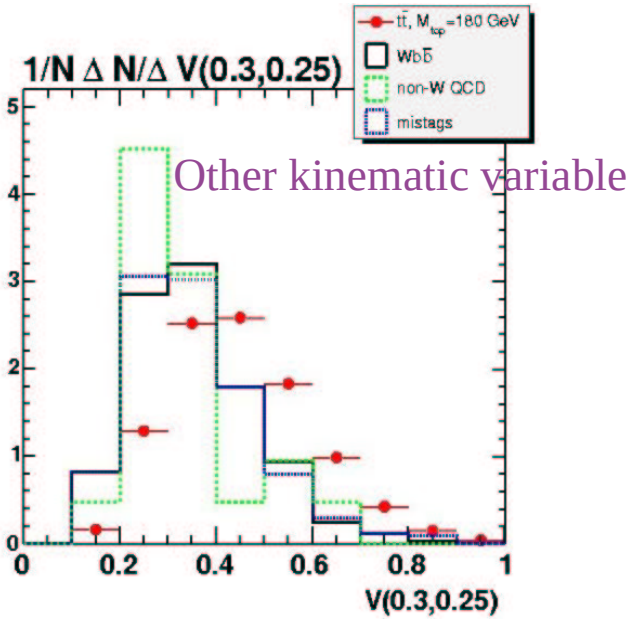
Use multivariate method for background separation.

New data sample will have about 60 tagged events

Work in progress. Method to be evaluated by the collaboration

Uses TF and full ME integration





Other kinematic variable


BERKELEY LAB