Top Quark Mass at CDF

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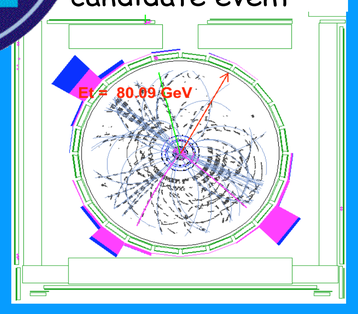
candidate event



Why measure the top quark mass?

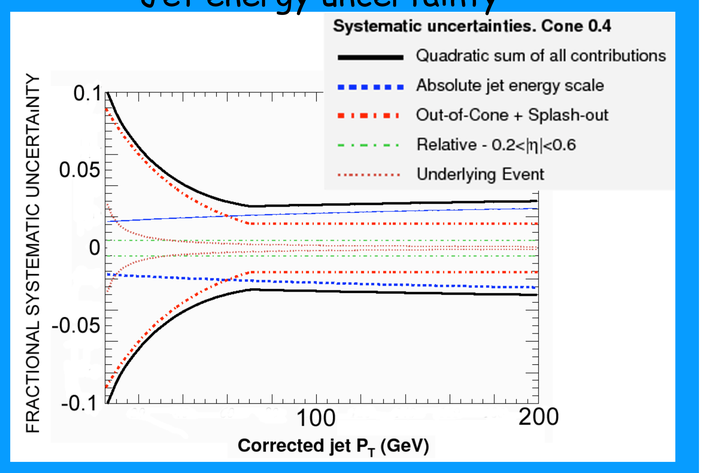
Top quark mass constrains Standard Model Higgs mass

Probes physics beyond the Standard Model via strong Yukawa coupling

Important but difficult measurement:
- Complicated events
- Many measured objects to figure out with correct assignments
- Different backgrounds

Attack the problem from all angles:
- Different decay channels
- Multiple methods developed

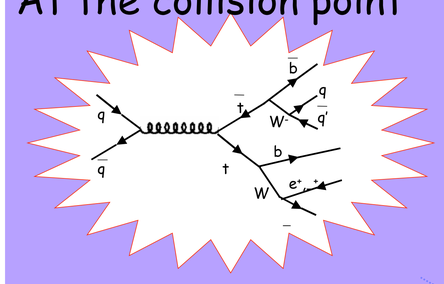
Jet energy uncertainty



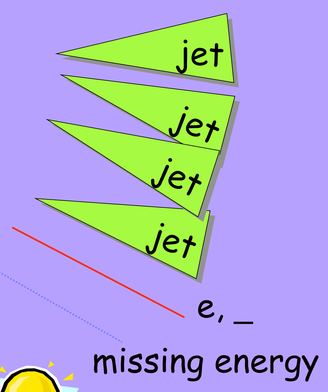
Jet Energy Scale is one of the main challenges

Lepton + Jets channel:

At the collision point



In the detector

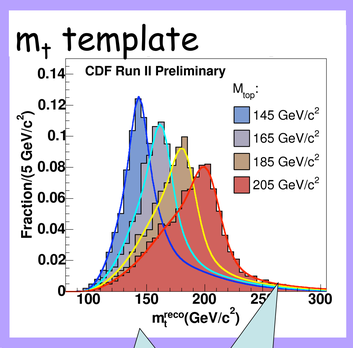


- Good signal to background ratio
- One fully reconstructed top (Golden Channel)

We can calibrate jet energy shifts *in-situ* using hadronic W peak

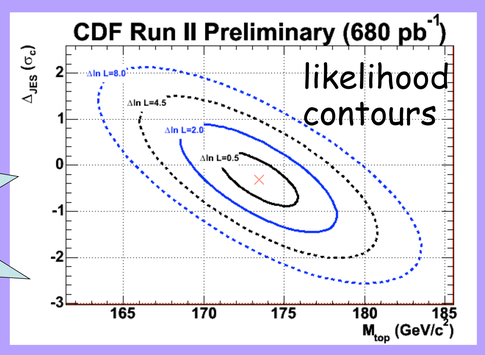
The single best top quark mass measurement in the world!

m_t template



Template Method

- Compare reconstructed top mass and W mass shapes from Monte Carlo to shapes in data



M_{top} = 173.4 ± 2.8 GeV

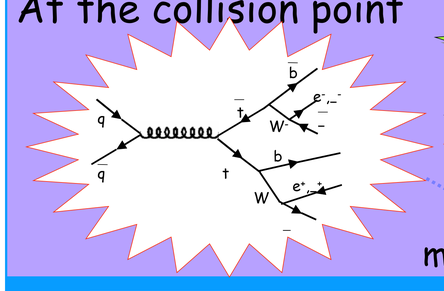
Matrix Element Method

- Use the Standard Model (matrix element) for each event to determine the most likely values of M_{top} and the jet energy scale.
- All combinations are used.

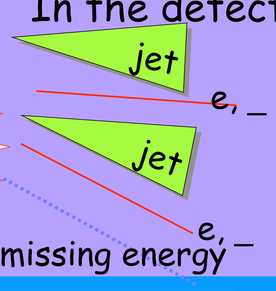
M_{top} = 174.1 ± 2.9 GeV

Dilepton channel:

At the collision point



In the detector

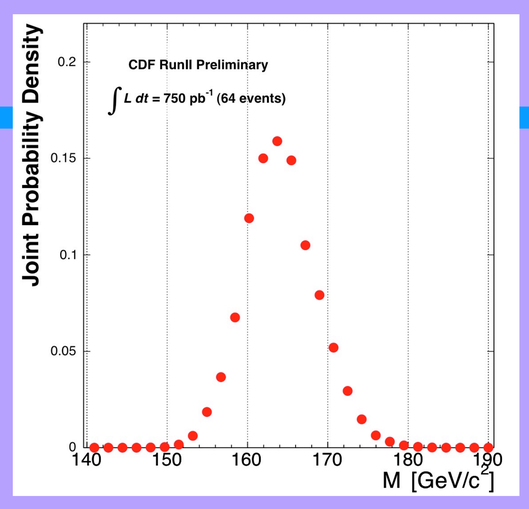


- Excellent purity
- Poor statistics
- Only one missing energy for two neutrinos

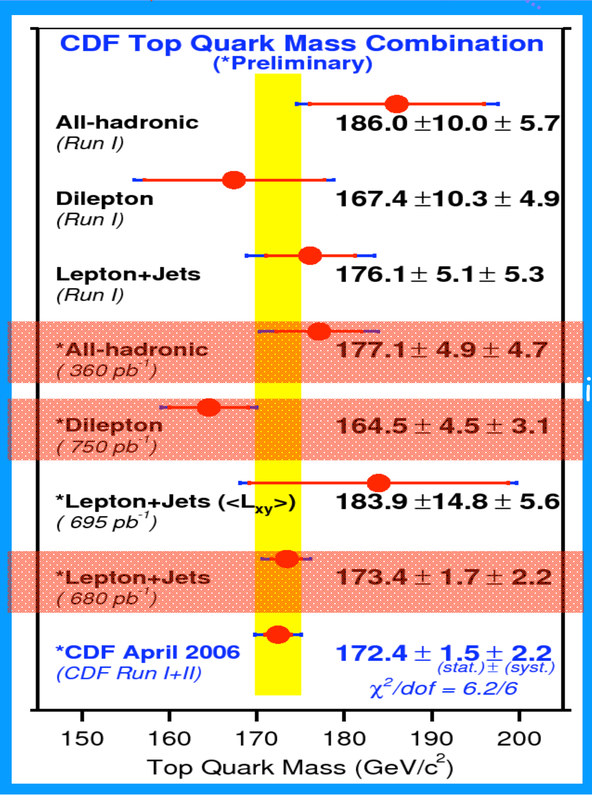
Matrix Element Method

- Determine the most likely value of top mass weighted by the matrix element for given measured quantities

M_{top} = 164.5 ± 5.5 GeV



Impact of CDF measurements



First Run II in All Hadronic !

Single Best !!

M_{top}^{CDF} = 172.4 ± 2.6 GeV
M_{top}^{World} = 172.5 ± 2.3 GeV

Dramatic improvement to the constraint on the Higgs mass