Jet energy corrections

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Final presentation

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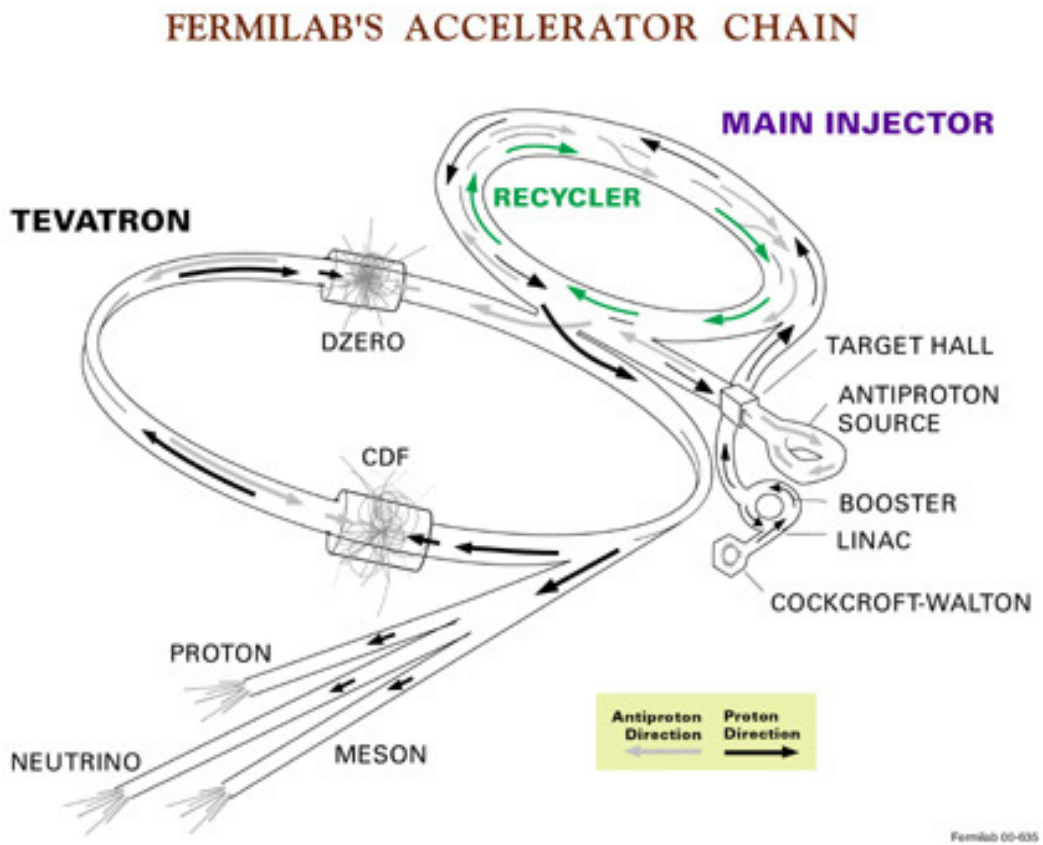
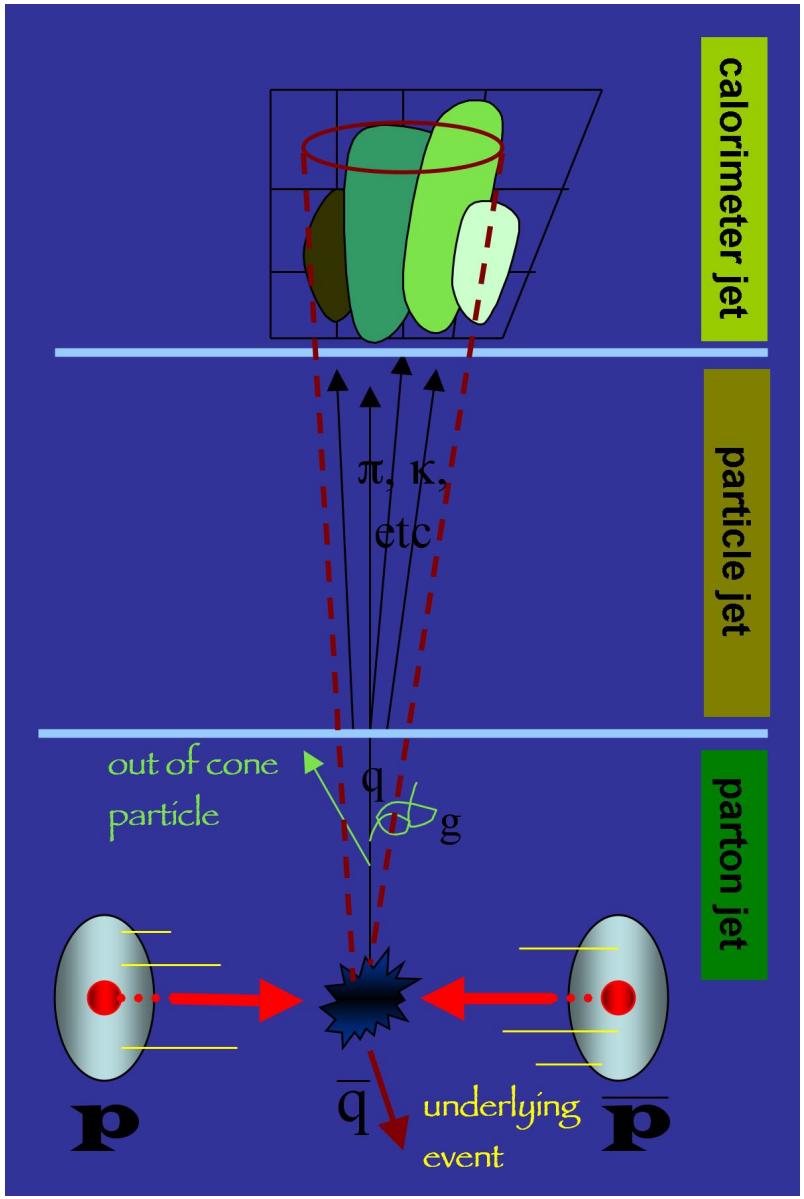
Experimental environment

- Proton-antiproton collisions at $\sqrt{s} = 1.96$ TeV
- Delivered ~ 9 inverse fb for data analysis



What is a jet?

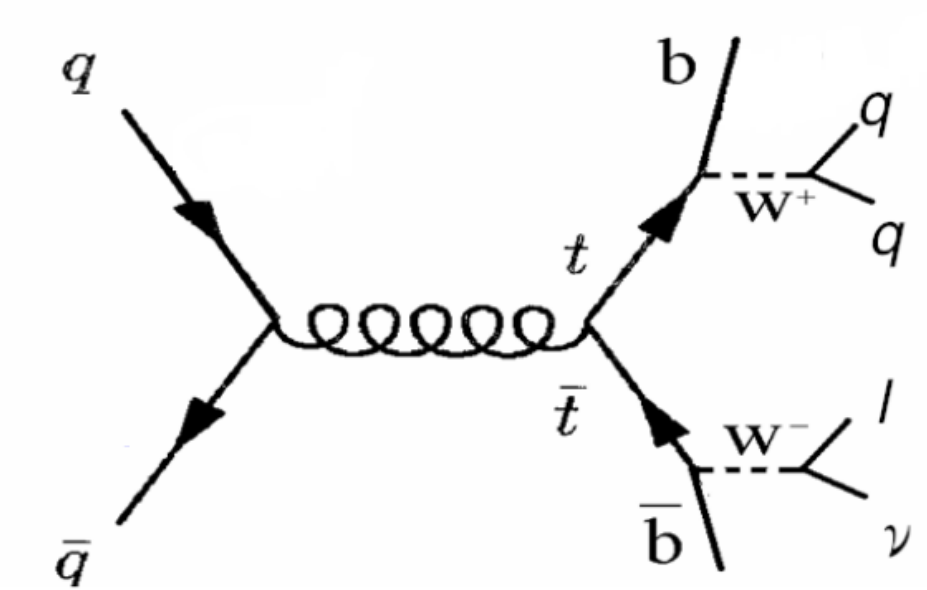


- Narrow cone of particles produced by the hadronization of a quark or gluon
- Jets are observed as clustered energy
- Reconstruct the jet in order to measure the energy of the parent quark or gluon

Jet energy corrections

- Correct the measured jet energy in order to estimate the "true" energy
- Jet energy corrections are divided into different levels to accommodate different effects:
  - response of the calorimeter to different particles, un-instrumented regions of the detector, multiple interactions, underlying events, energy radiated outside the jet, ...
- To calibrate the corrections we need a clean signal with known energy

Previous work



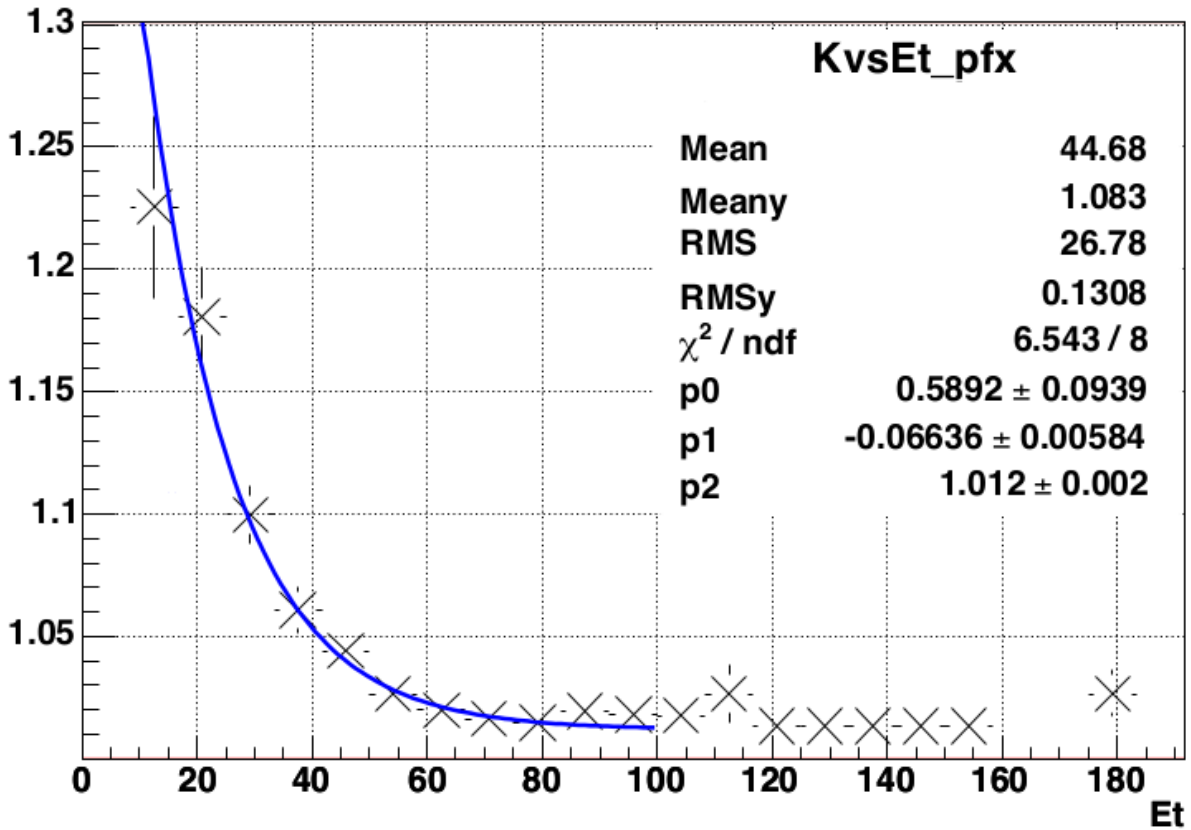
$t\bar{t} \rightarrow jjl\nu b\bar{b}$

Find the jet energy corrections $k1$,$k2$ that best approximate the W mass:

$$\chi^2(k_1, k_2) = \frac{(E_{j1} - k_1 E_{j1})^2}{\Delta E_{j1}^2} + \frac{(E_{j2} - k_1 E_{j2})^2}{\Delta E_{j2}^2} + \frac{(M(k_1, k_2) - M_W)^2}{\sigma_{jj}^2}$$

Previous result

Fit the correction with a continuous function of Et: $[0] \cdot e^{[1] \cdot Et} + [2]$



Upgrade of this work

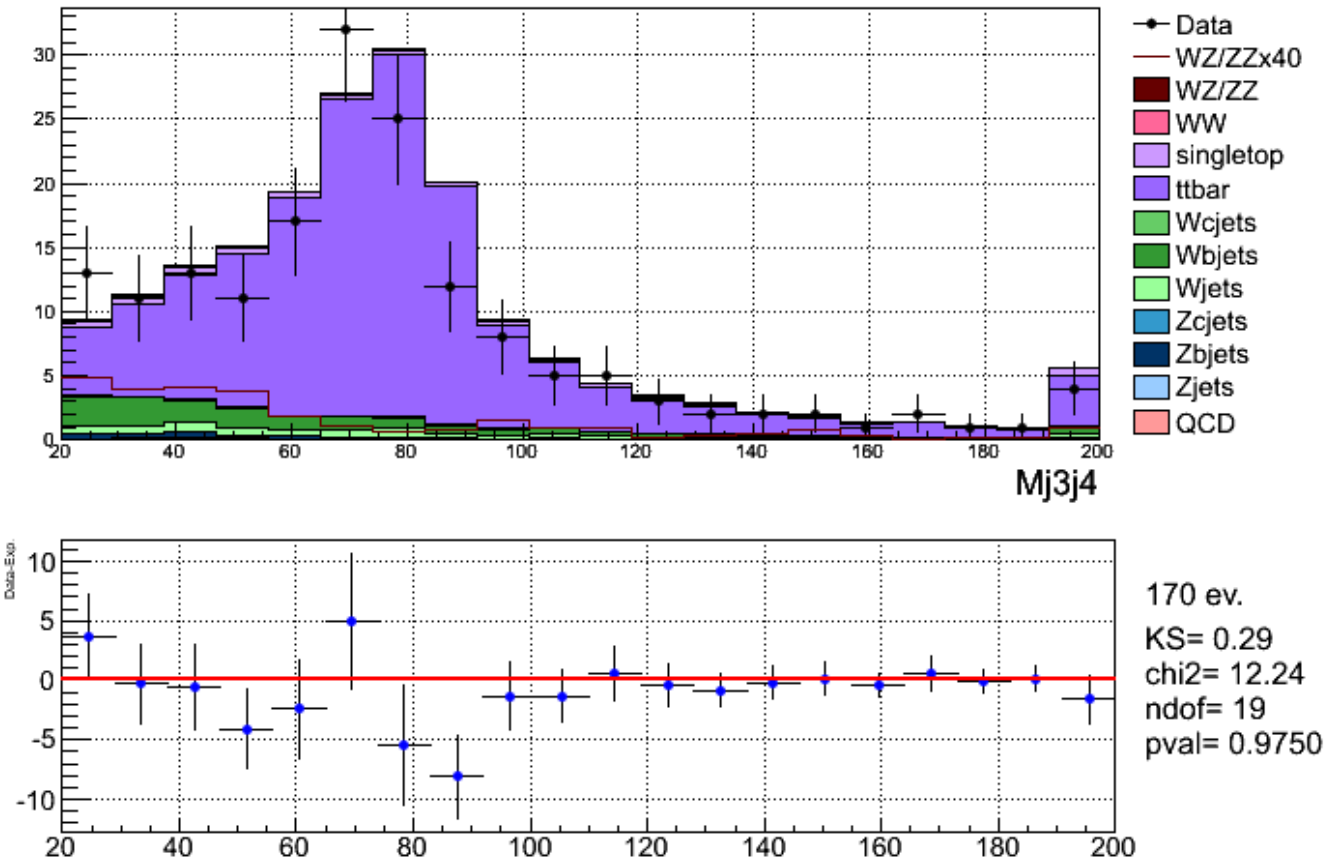
- Use the full data set ($8.7/fb$)
- Same purity of the previous sample (ttbar/data $\sim 90\%$)
- Less restrictive cuts

$\Longrightarrow$ More events in our sample

Improvement: subtract the W+jets background ($\sim 10\%$)

T-TBAR SAMPLE

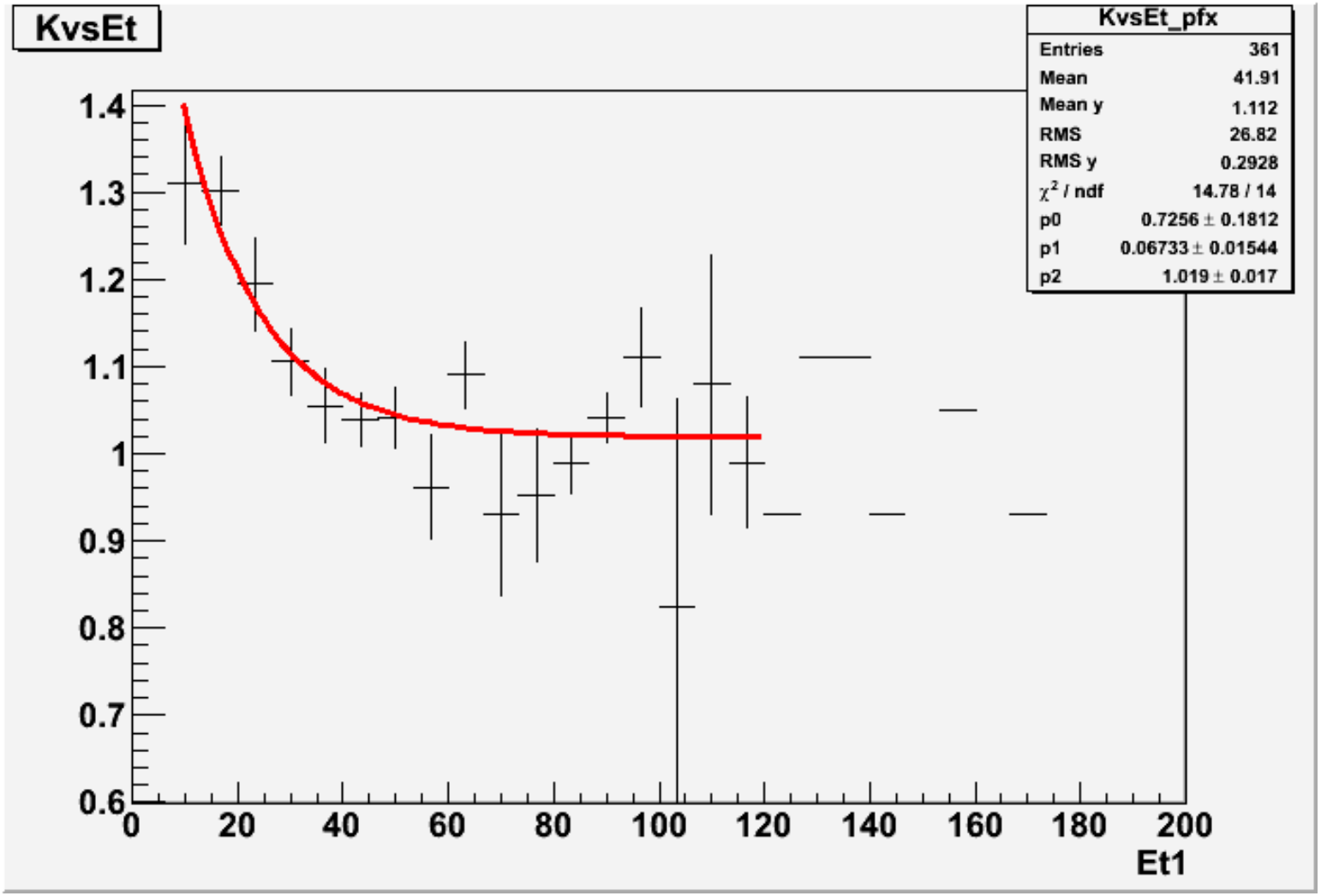
Invariant mass of the 2 untagged jets:



- b-tagging using BNess tagger
- Jets are corrected at Level 5 (absolute energy scale corrections)

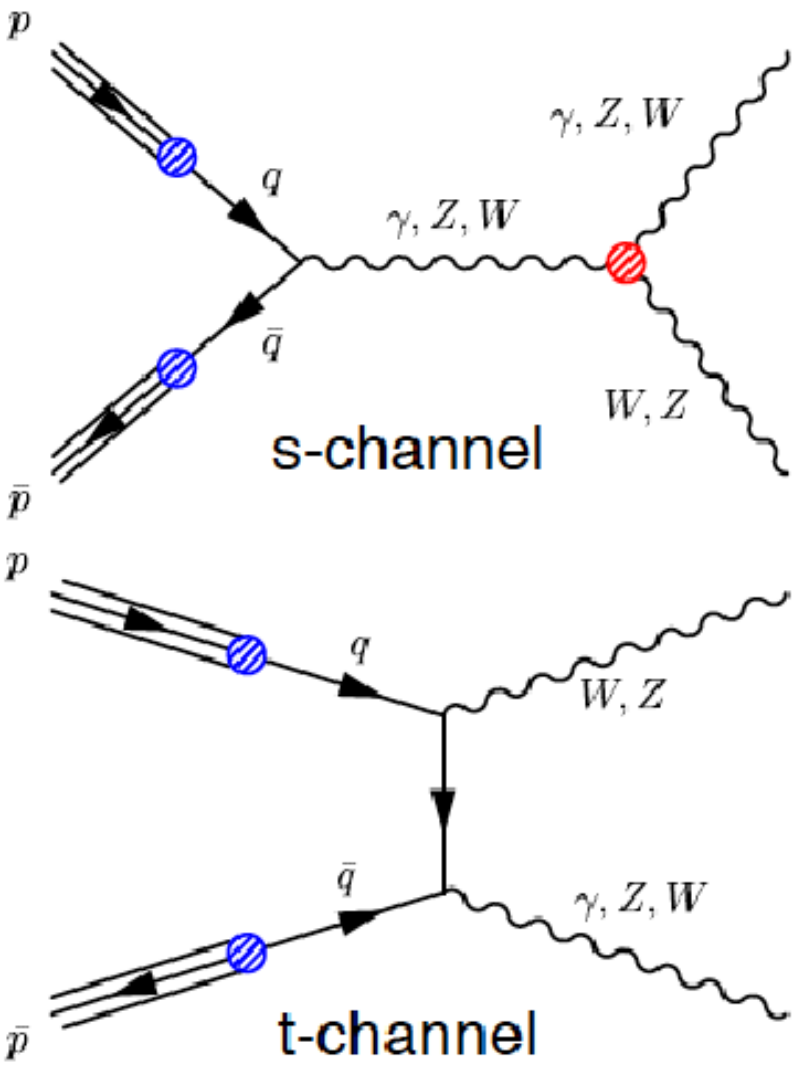
χ^2 MINIMIZATION

Fit the correction with a continuous function: $[0] \cdot e^{[1] \cdot Et} + [2]$



$\Rightarrow$ Parameter values close to the previous ones

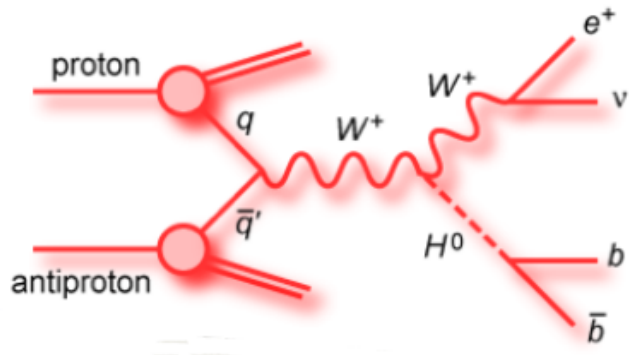
Application to diboson production

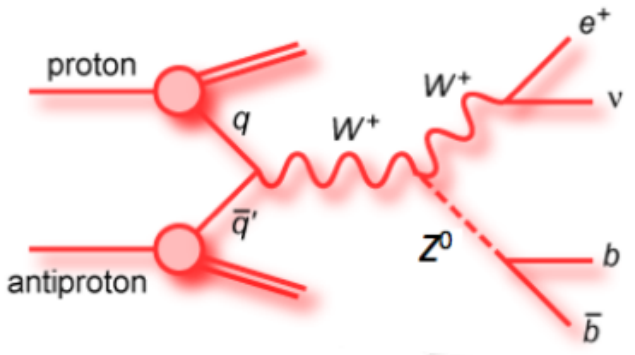


- Use this correction to improve the searches for diboson production
- Signals: WZ and ZZ production with semileptonic decays

Diboson production

Diboson searches share the same final states with the low mass Higgs analyses:





Cuts:

- number of jets=2
- $ETL5_{jet1} > 25$ Gev
- $ETL5_{jet2} > 25$ Gev
- missing $ETL5 > 20$ Gev

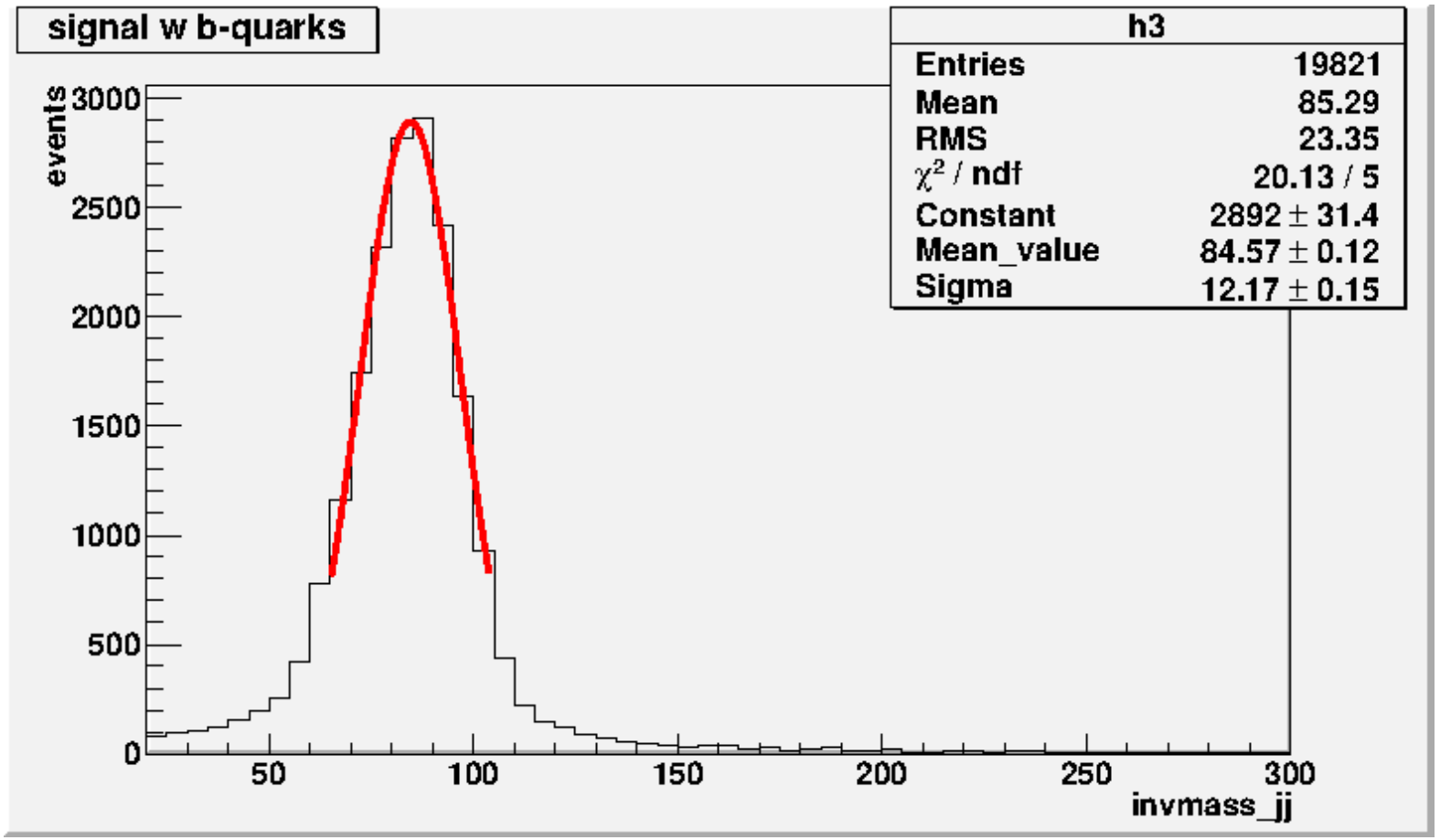
Using these corrections we hope to see an improvement in the signal-to-noise ratio

Correction procedure

Given the energy correction function:

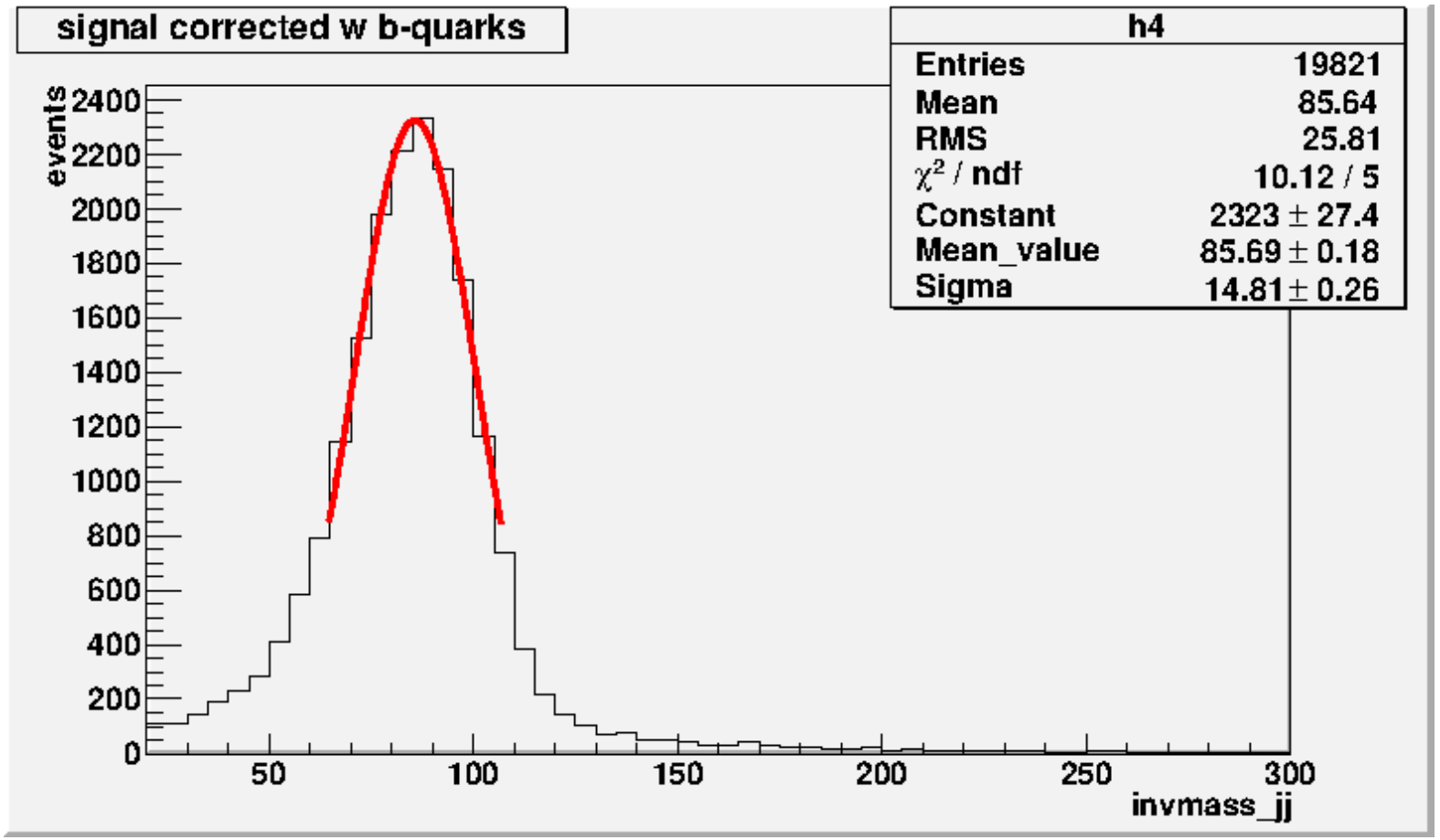
- correct Et
- correct Pt
- calculate E from Et corrected
- calculate Pz from Pt corrected
- make the invariant mass of the two jets

Signal(WZ+ZZ) w b-qrk



Signal to noise ratio: 6.95

Signal(WZ+ZZ) w b-qrk corr



Signal to noise ratio: 5.79

Next steps

- Subtract the W+jets background
- Re-derive the energy correction function