Simulating MET variable for QCD Dijet and Multijets

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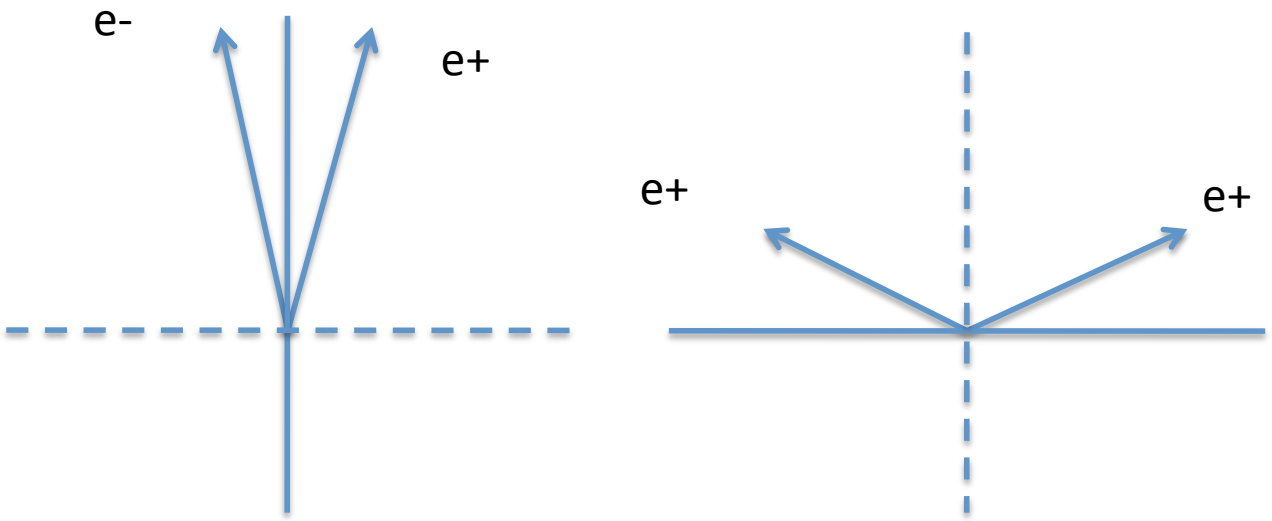
Motivations

- Idea is to use data to predict the MET background for a SUSY analysis
- Building on a study by Ellie Dobson
- Use easily identifiable channel with little real MET (Z->e+e- +jets) to find how resolution relates to hadronic energy
- Use above relationship to predict MET due to resolution effects

Find Axis about which electron resolution is a minimum

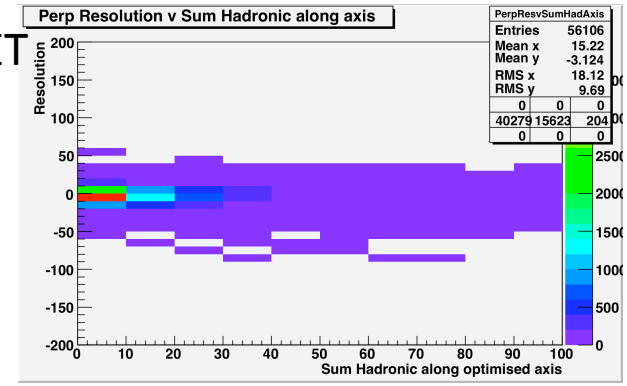
ZJETS



MET in sample is due to mis-measurement. We resolve the MET onto axis to give a component which is the resolution

Parametrising the resolution

MET

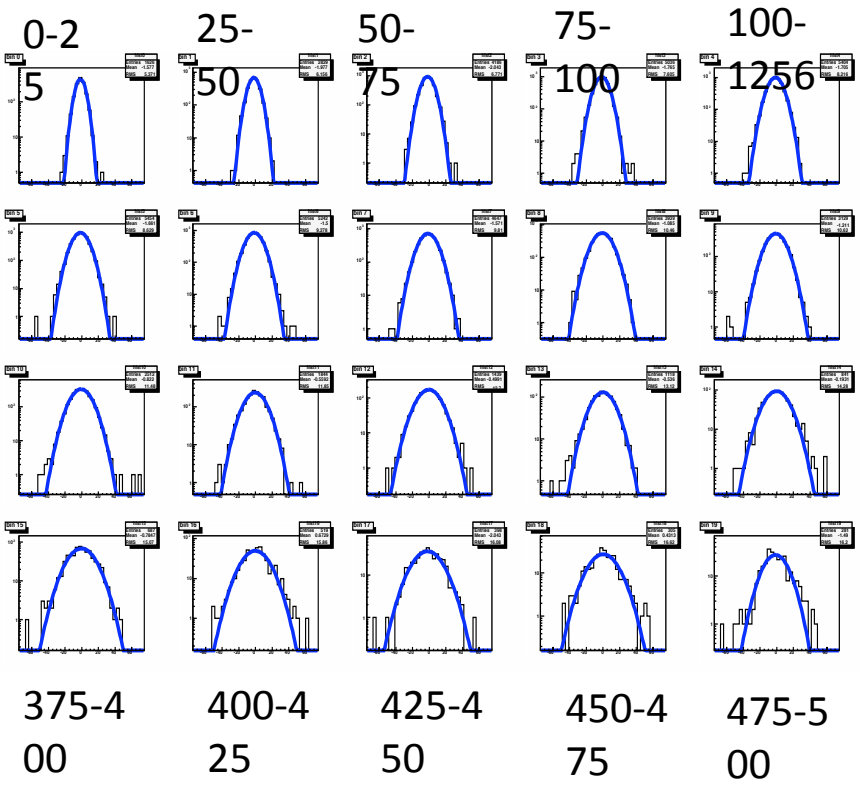


Hadronic component

- A modification to Ellie's work is that I am taking the hadronic energy component along the direction of the axis and using this as a parameter for MET

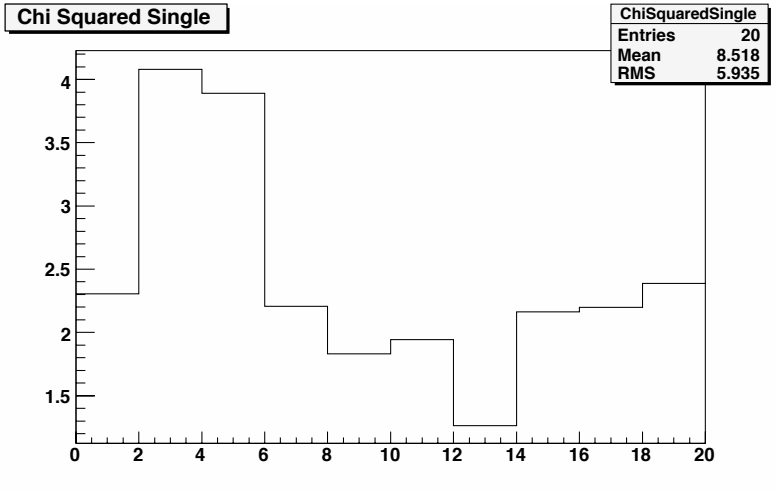
$$AOD\_value\_Sum\_scalar\_hadronic \times \frac{\sum Jets(resolved\_onto\_optimised)}{\sum Jets(global)}$$

Take slices in Sum component hadronic energy

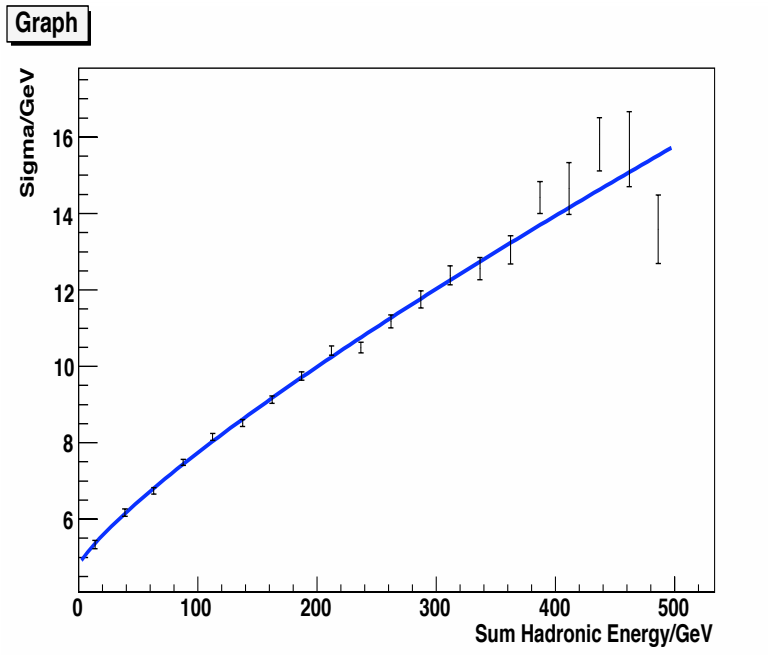


- Slices were taken of resolution plotted in bins of hadronic component from 0 to 500GeV

- Gaussian fits were made to the slices



Plot sigma of slices as a function of sum hadronic component energy

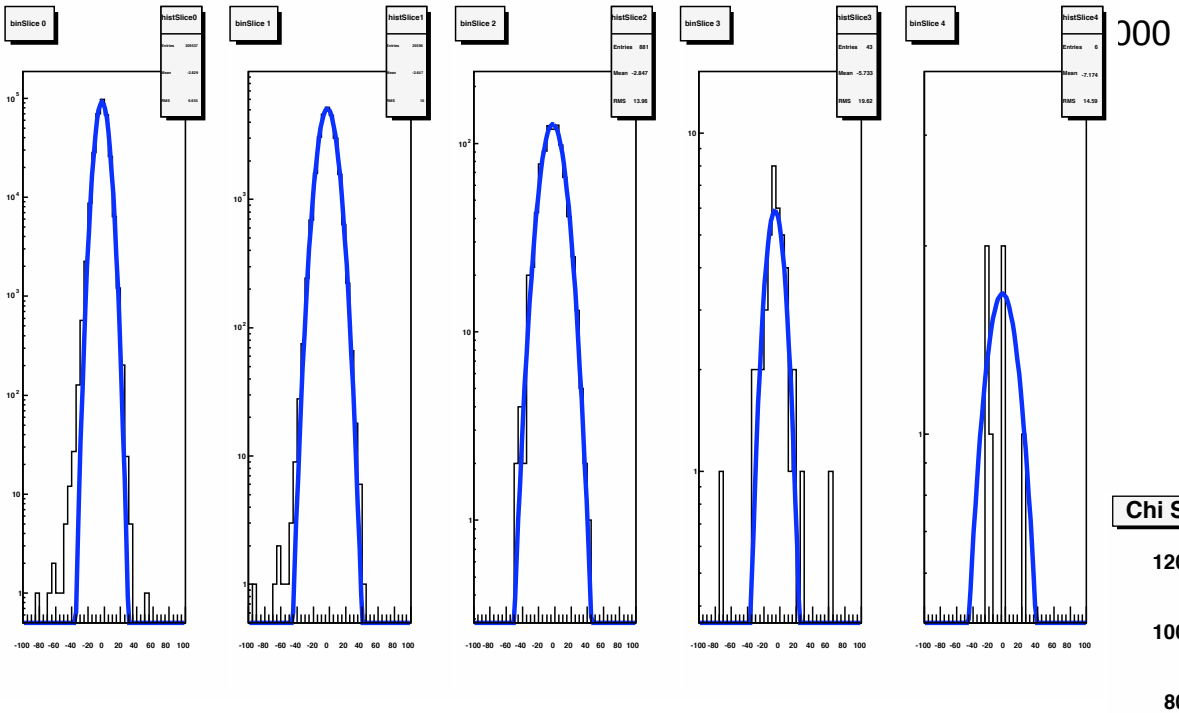


$$a \times x^{b} + c$$

- The sigmas of the slices were plotted as a function of hadronic component
- For each bin the data point was plotted on the horizontal axis at the mean value of entries for that slice
- A fit was made to allow for extrapolation

Proof of Concept. Repeat method with Dijets

DIJETS



Dijet have no events outside of 1 TeV Sum hadronic. Therefore only shown from 0-1TeV

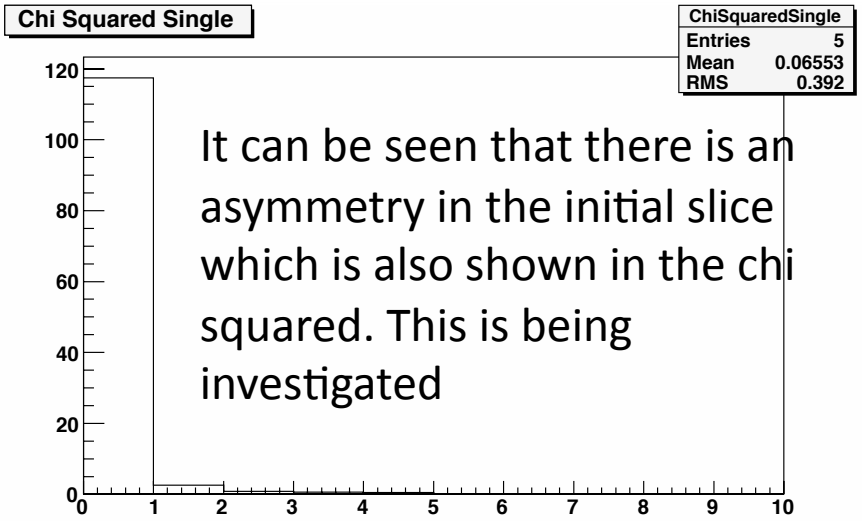
SLICES

Axis was chosen to be the lead jet axis

Little real MET so resolve MET onto axis to give resolution

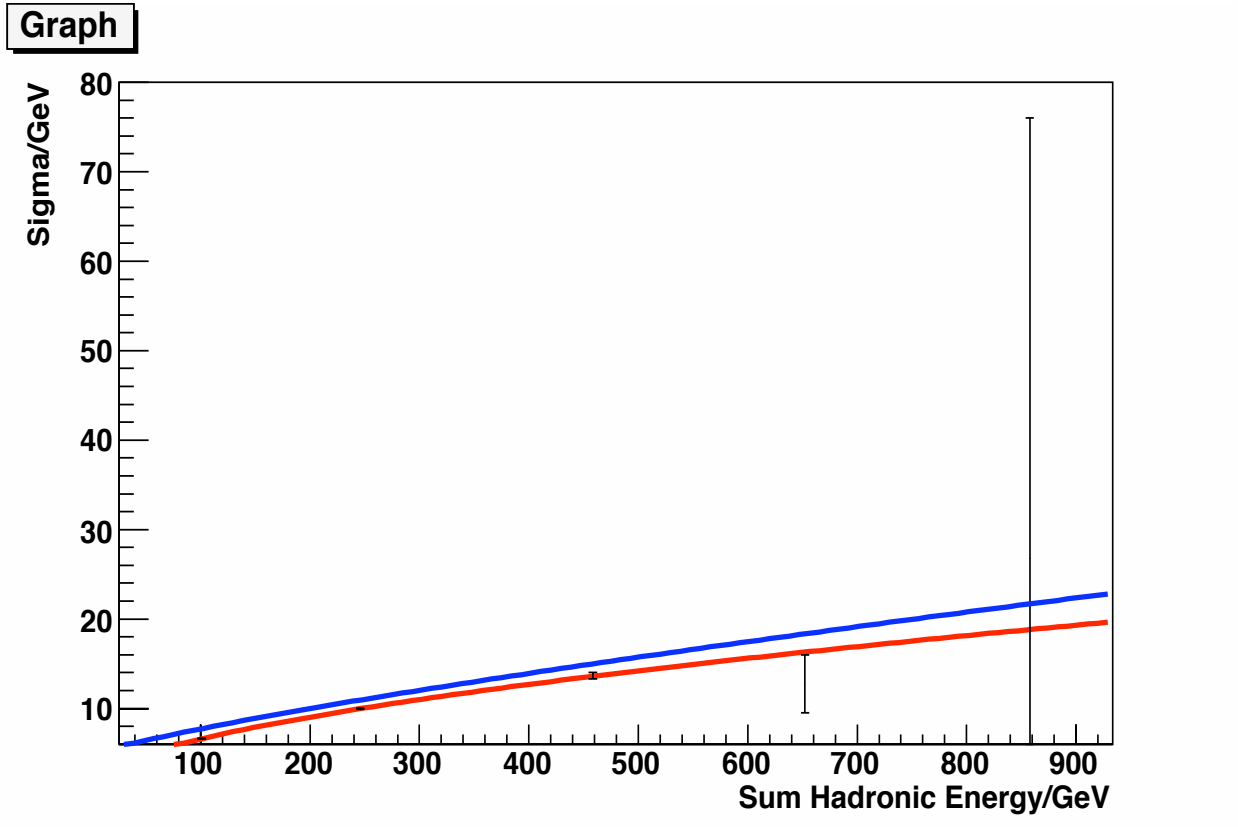
Parameterize with hadronic component along axis

Take slices (as shown above and fit Gaussian)



It can be seen that there is an asymmetry in the initial slice which is also shown in the chi squared. This is being investigated

Comparison of sigmas from slices from z->e+e- and from Dijets



Blue:- Calculated from Z+Jets over a range of 0-500GeV

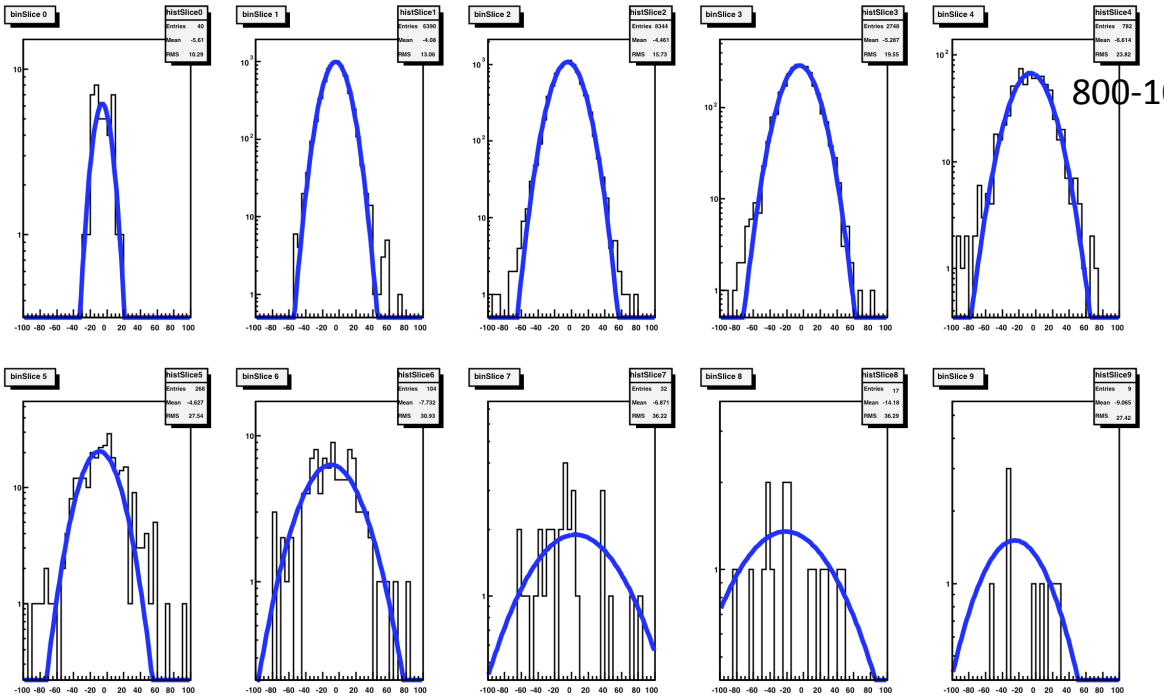
Red:- Fit through the sigmas for the Dijets. Data goes up to 1 TeV

The entries were placed at the mean value on the horizontal axis for each slice

Proof of concept repeat method with MULTIJETS

Multijets

0-200 200-400 400-600 600-800 800-1000



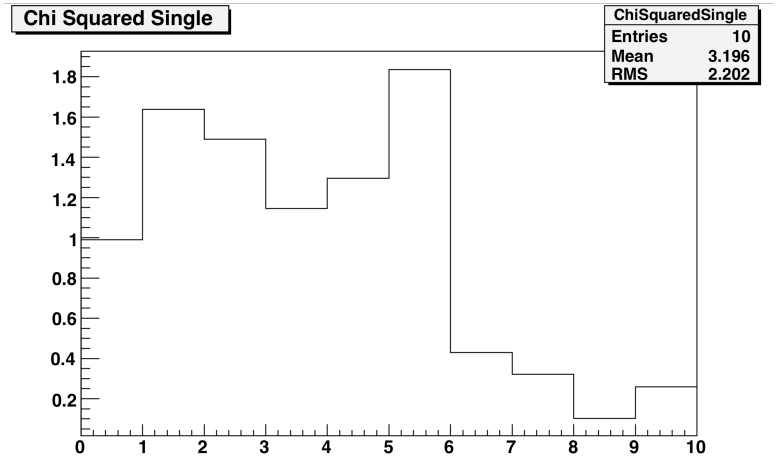
1000-1200 1200-1400 1400-1600 1600-1800 1800-2000

SLICES

Axis was chosen to be the lead jet axis

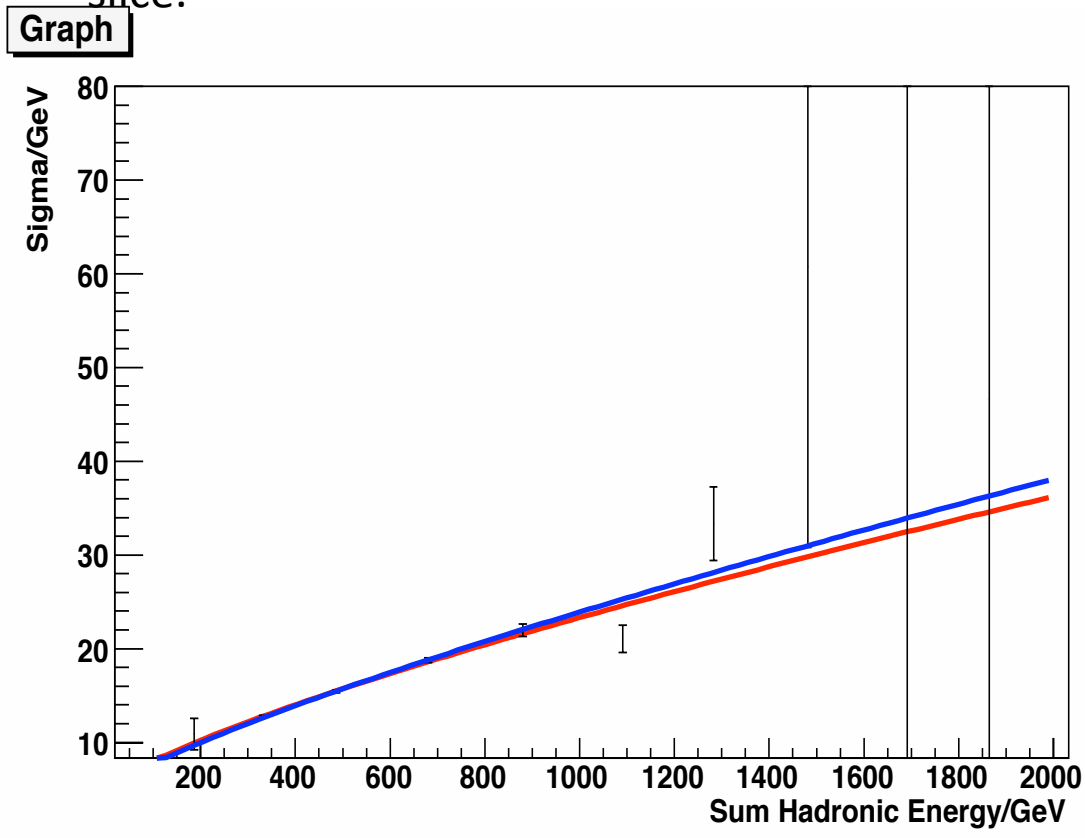
Slices taken in range from 0GeV to 2TeV

Much higher energy range than with ZJets



Comparison of the Sigmas z->e+e- and multijets

The entries were placed at the average horizontal position of all of the entries in each slice.



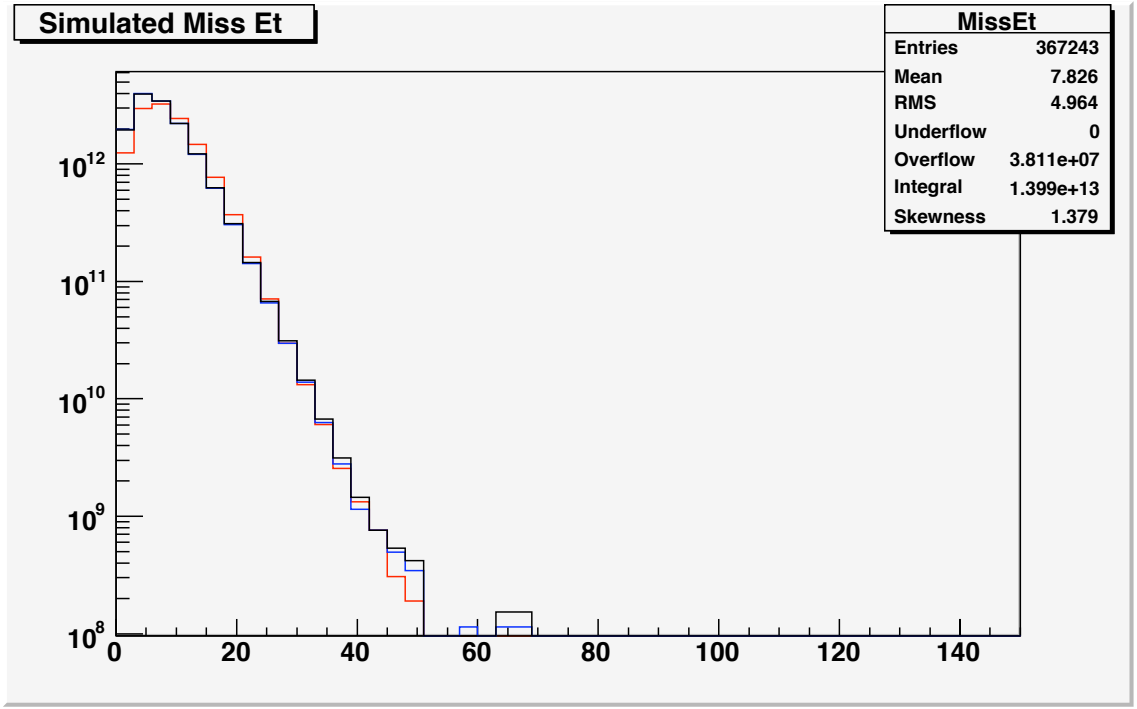
The entries were placed at the mean value on the horizontal axis for each slice

Blue:- Calculated from Z+Jets over a range of 0-500GeV

Red:- Fit through the sigmas for the Multijets. Data goes up to 2 TeV

Final Step: Simulate MET due to mis-measurement for QCD

- Define two perpendicular axis for the Dijet and multijet channels. One axis along lead jet.
- Find how much hadronic energy along each axis independently
- Use the relationship developed with Z+JETS to find a sigma for each axis
- Simulate a MET component for each axis
- Combine in quadrature to get total MET



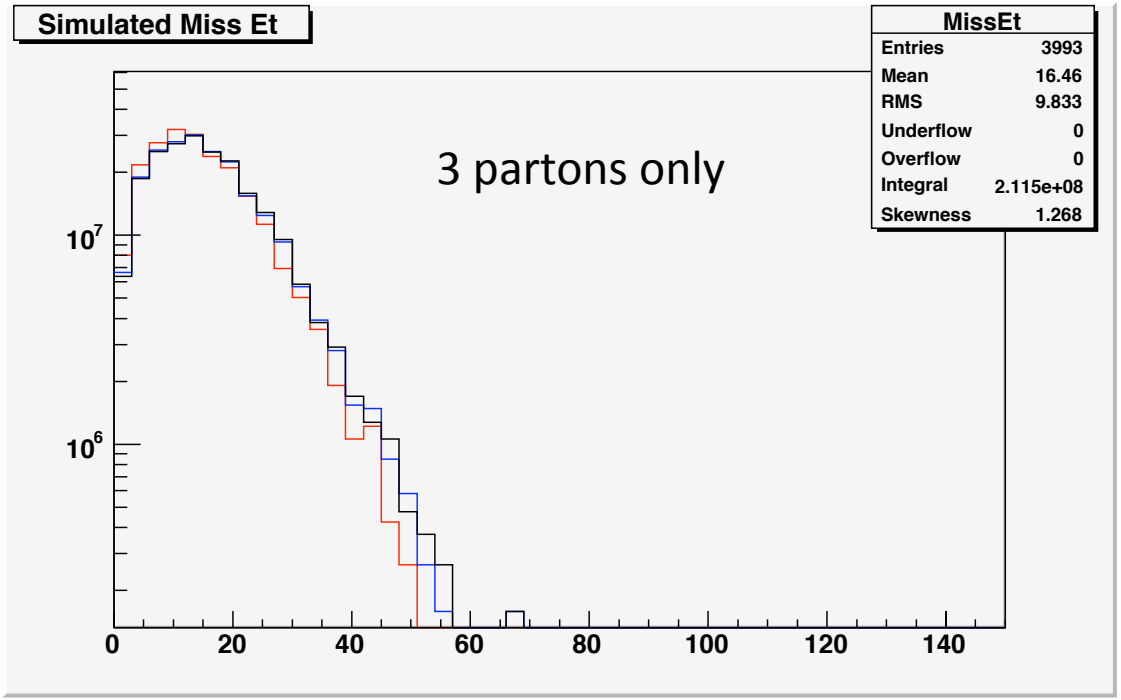
Simulated MET

Value on the AOD (black)

Generated - Measured

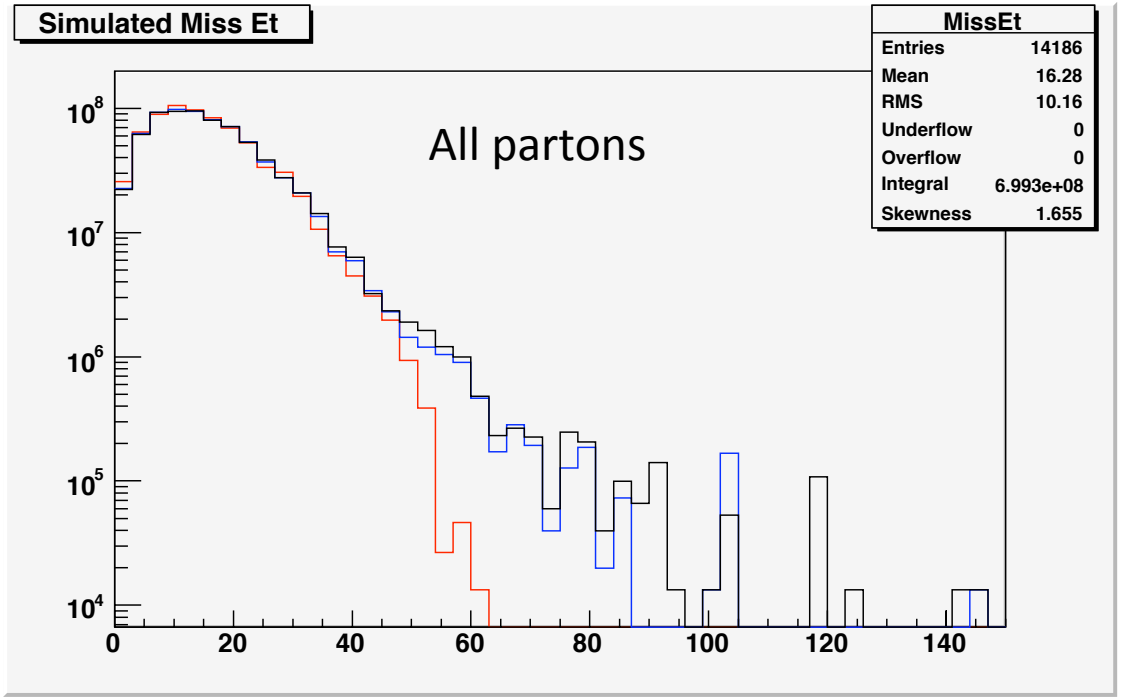
Dijet final result

See very good agreement even in the tails



Simulated MET
Value on the AOD
(black)
Generated -
Measured

Multijet final result



Conclusions

- The proof of concept shows that the method has potential
- The extrapolation for the predicted sigma's of the resolution function agrees well with the measured
- Simulating MET works well with the DIJET channel
- Simulating MET works well for 3 partons for multijet. When considering all partons tails are observed that are not fitted. This is though to be an error in the scaling factors with the Z +Jets and is being looked into
- Looking at repeating analysis with FDR 2 data