An Examination of the Current Energy Loss Package Using the Pi0 Spectrum

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Current Testing Conditions:

Vertex Cuts:

Butanol Low: -2.6 cm
Butanol High: +2.6 cm

Carbon Low: 6.0 cm
Carbon High: 8.0 cm

CH2 Low: 14 cm
Ch2 High: 17 cm

Selection Criteria:

- Each event must contain a Proton
- NGRF must be equal to one
- Mass_ref must be equal to zero

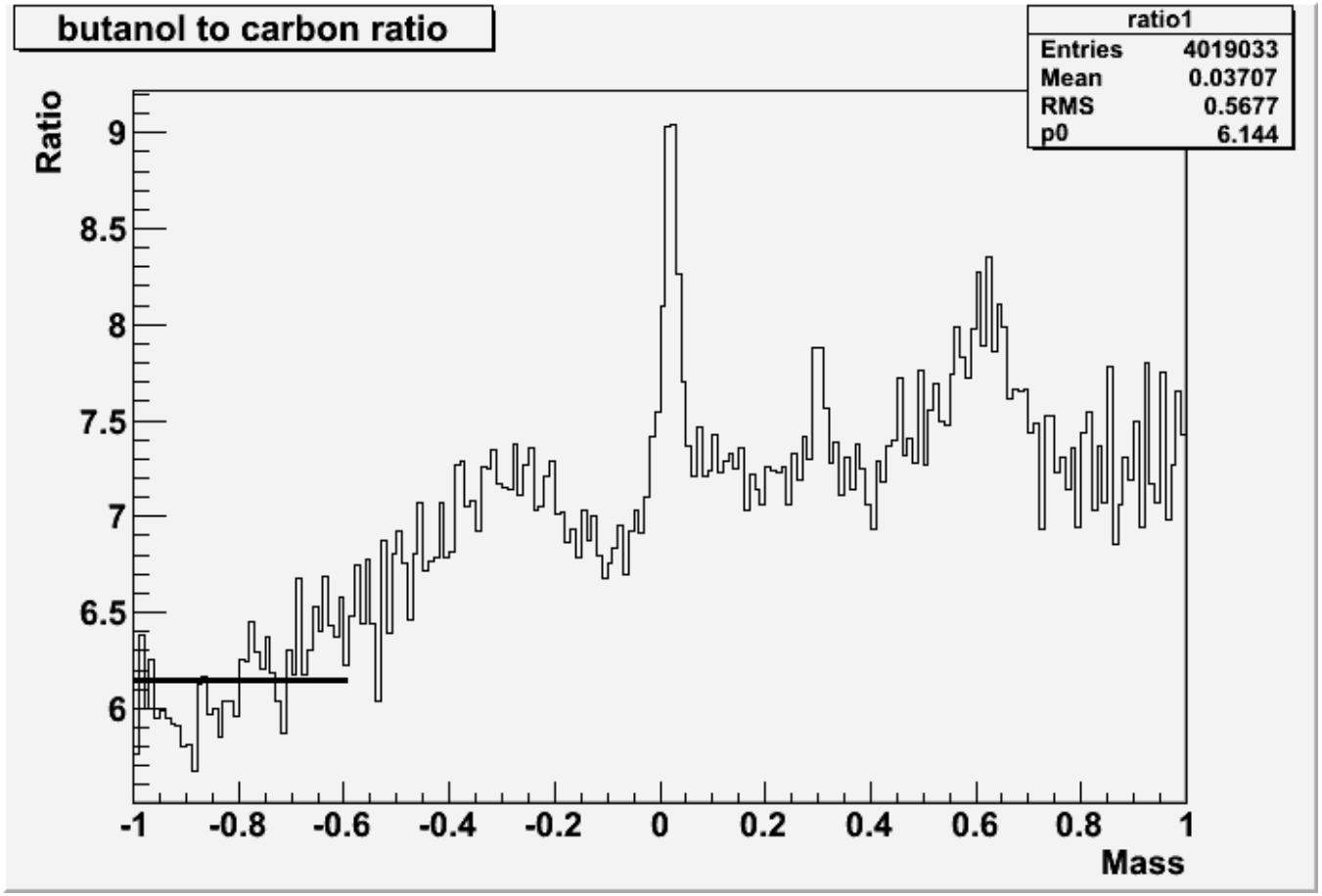
Runs Used:

(All are from running period 4)

- 55604
- 55605
- 55606
- 55610
- 55611

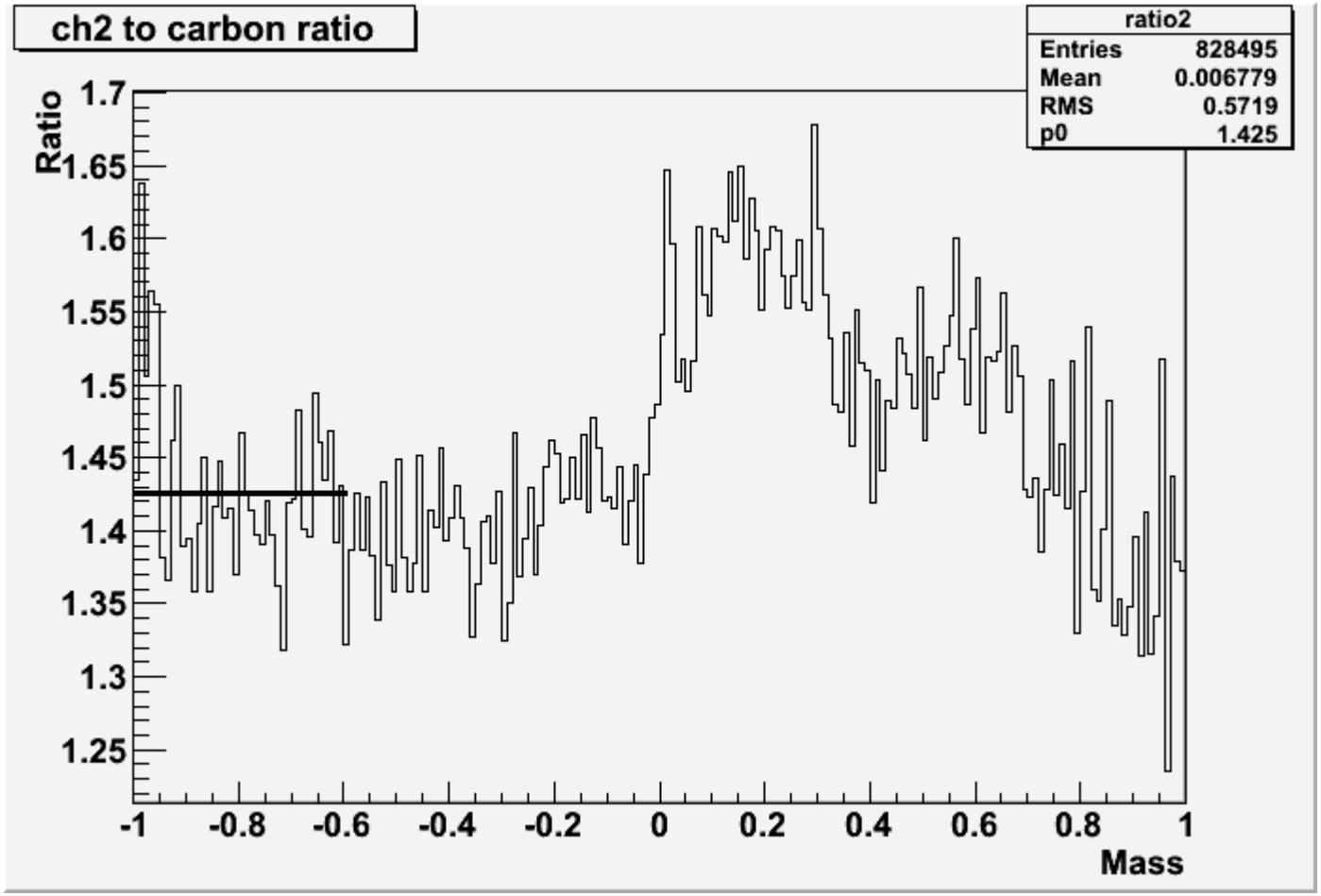
Finding the Scaling Factor for Butanol:

This is obtained from plotting the ratio of the unscaled mass squared spectrum for butanol to the unscaled mass squared spectrum for carbon and then applying a line-fit to the resulting spectrum in the range from -1.0 to -0.6. The result, as can be seen below, is a scaling factor of 6.144.



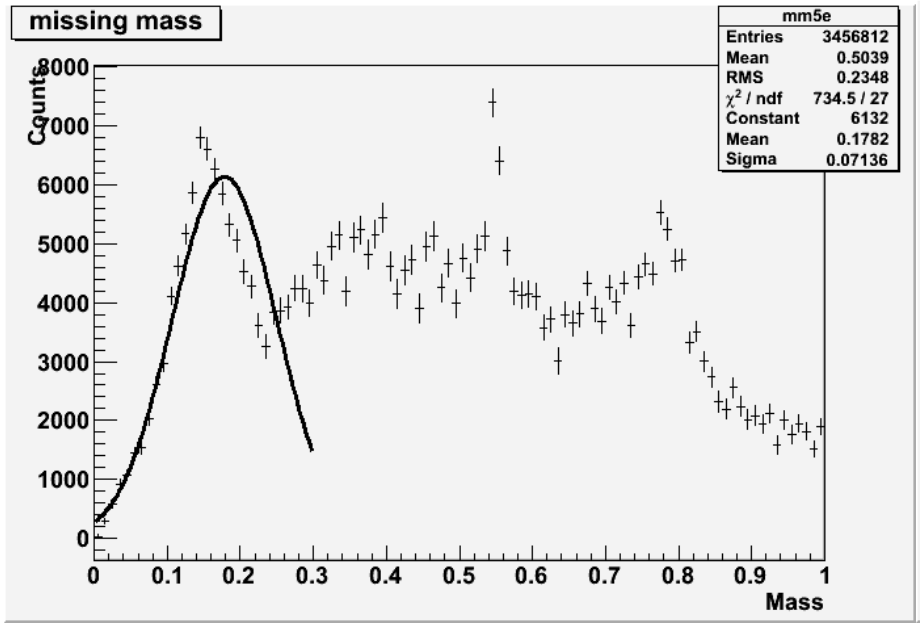
Finding the Scaling Factor for CH2:

This is obtained using the exact same method for the butanol scaling factor. As we can see from below we get a factor of 1.425 for the CH2 target.

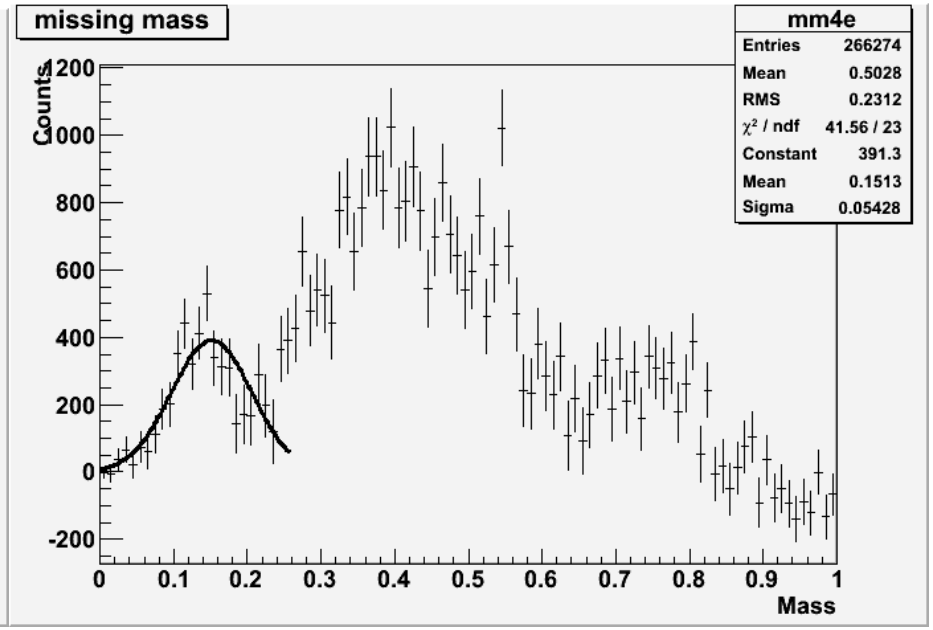


Using the Scaling Factors and Applying Initial Fits:

Now that we have the scaling factors at our disposal we apply them, Individually, to the carbon spectrum (the mass spectrum, not the mass squared spectrum)and then subtract the scaled carbon from either butanol or CH2 depending on the factor used. With this plot in hand we can then attempt an initial Gaussian fit:



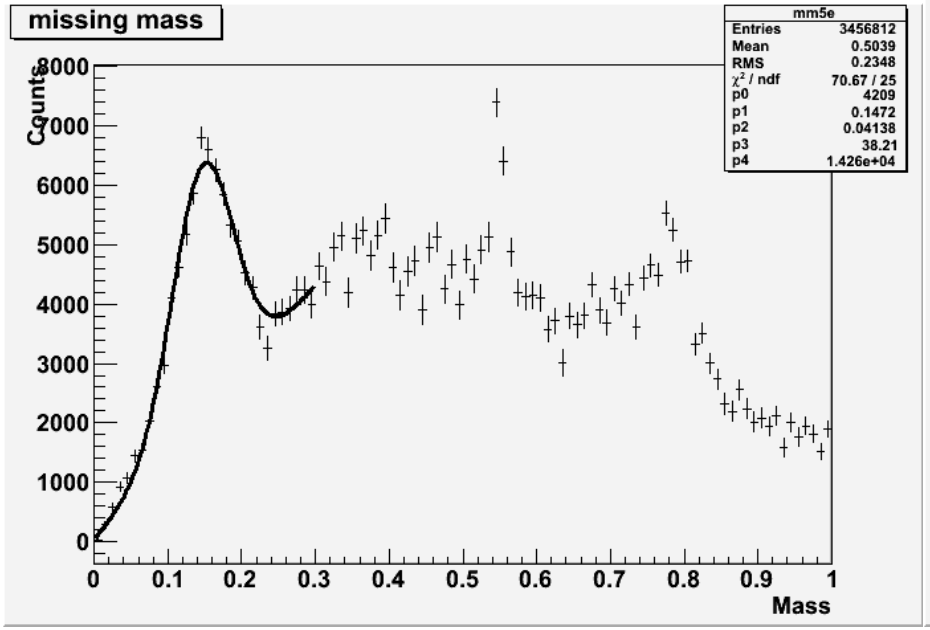
(Butanol)



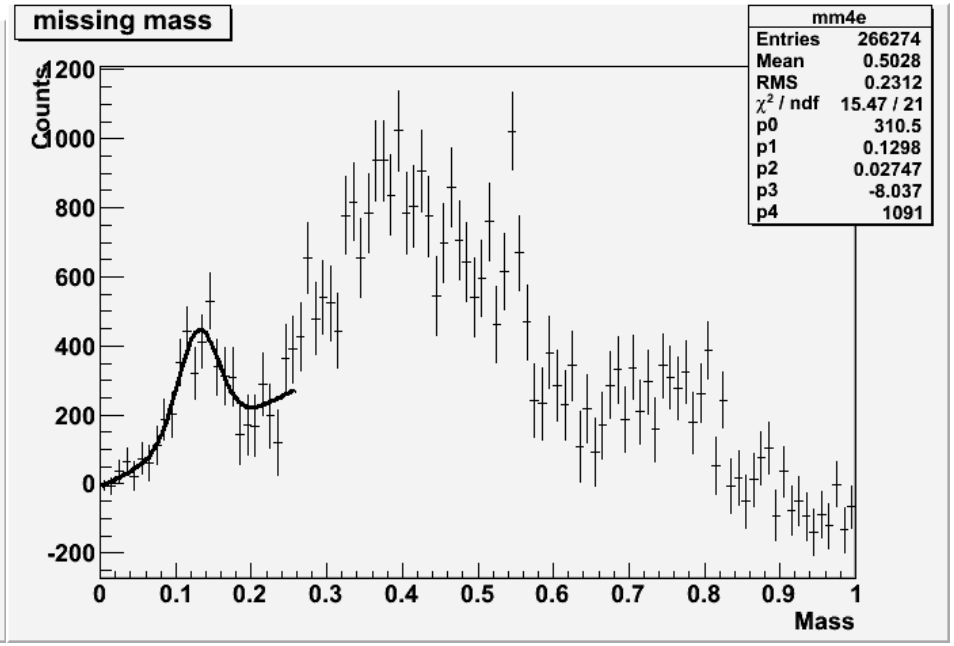
(CH2)

Using the Scaling Factors and Applying Initial Fits:

As we can see from the previous slide, the Gaussian fits horribly so lets try fitting with a Gaussian and a first order polynomial:



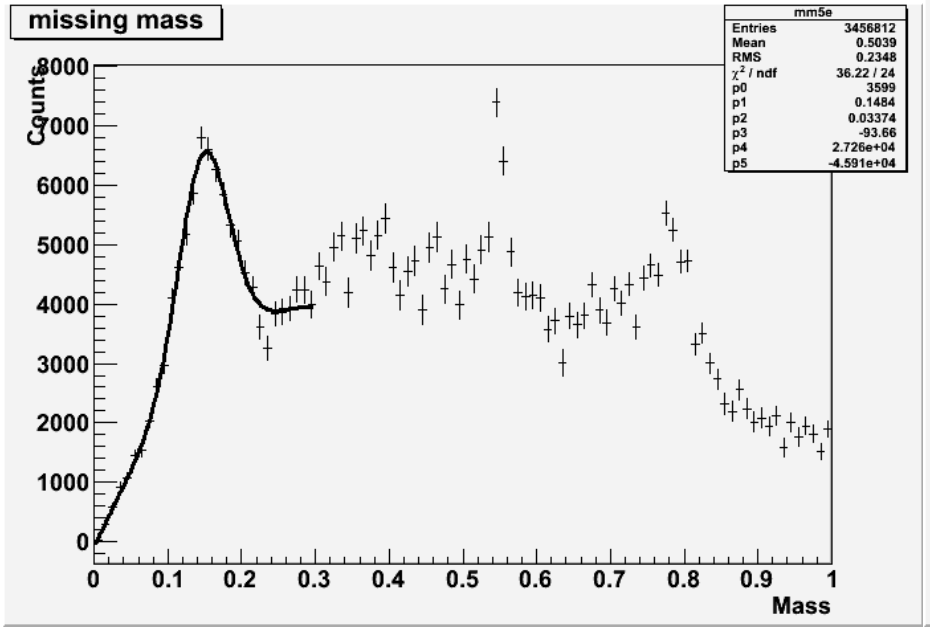
(Butanol)



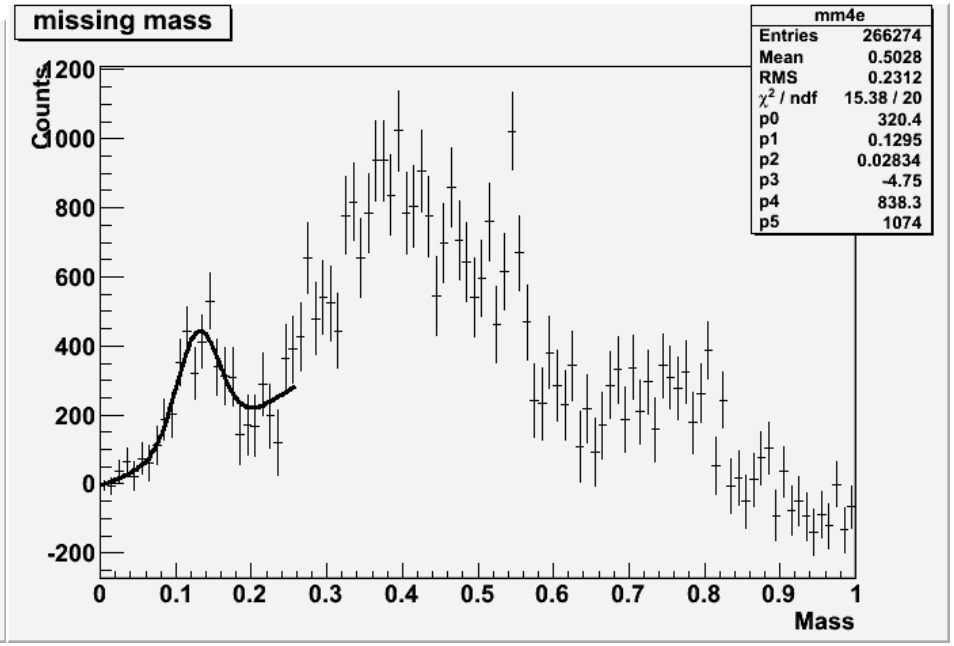
(CH2)

Using the Scaling Factors and Applying Initial Fits:

The first order polynomial cleaned up the fits a lot, but it may be possible to obtain a better fit using a second order polynomial so here we give it a try:



(Butanol)



(CH2)

Results:

Target:	Fit:	Mass:	Chi Squared:
Butanol	Single Gaussian	178.2 MeV	734.5/27
Butanol	Gaussian + Pol1	147.2 MeV	70.67/25
Butanol	Gaussian + Pol2	148.4 MeV	36.22/24
CH2	Single Gaussian	151.3 MeV	41.56/23
CH2	Gaussian + Pol1	129.8 MeV	15.47/21
CH2	Gaussian + Pol2	129.5 MeV	15.38/20

Conclusions:

Overall we see a very good agreement between what Michael has found and what I have found using the same requirements for our tests (Michael found a pi0 mass of 128 MeV for the CH2 target and 149 MeV for the butanol target). We are confident in our methodology now and feel that further testing of the positions and sizes of the cuts will be in order to better determine the validity of the current energy loss package.