ELECTRON ENERGY CORRECTIONS

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WORKFLOW

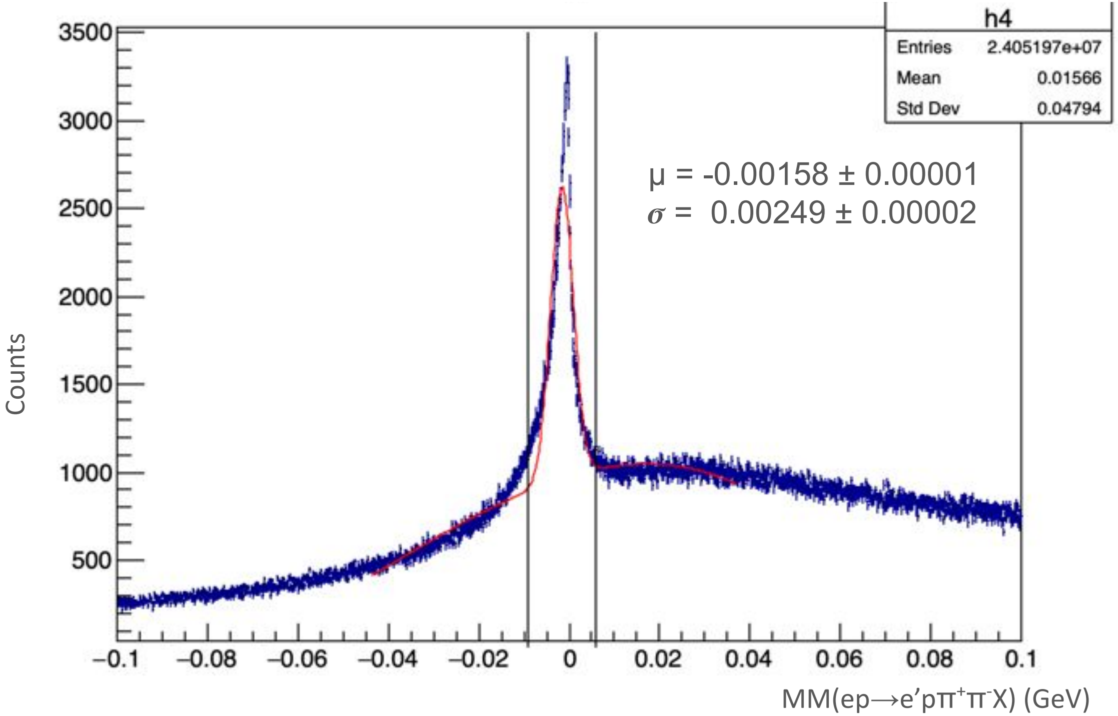
1. Select exclusive $ep \rightarrow e'p\pi^+\pi^-$ events (electron in FT all charged in FD)
2. Reduce background contributions by selecting proton events in $ep \rightarrow e'\pi^+\pi^-X$ and by selecting pion events in $ep \rightarrow e'p\pi^+X$.
3. Obtain electron Energy difference $\Delta E = E_{reconstructed} - E_{detected}$ as a function of $E_{detected}$
4. Obtain correction function by fitting the energy dependence of ΔE

WORKFLOW

For comparison, histograms for both Fall 2018 (Outbending) and Spring 2019 (Inbending) are included. As a reminder, the beam energy for Fall 2018 is 10.6 GeV, while for Spring 2019 it is 10.2 GeV.

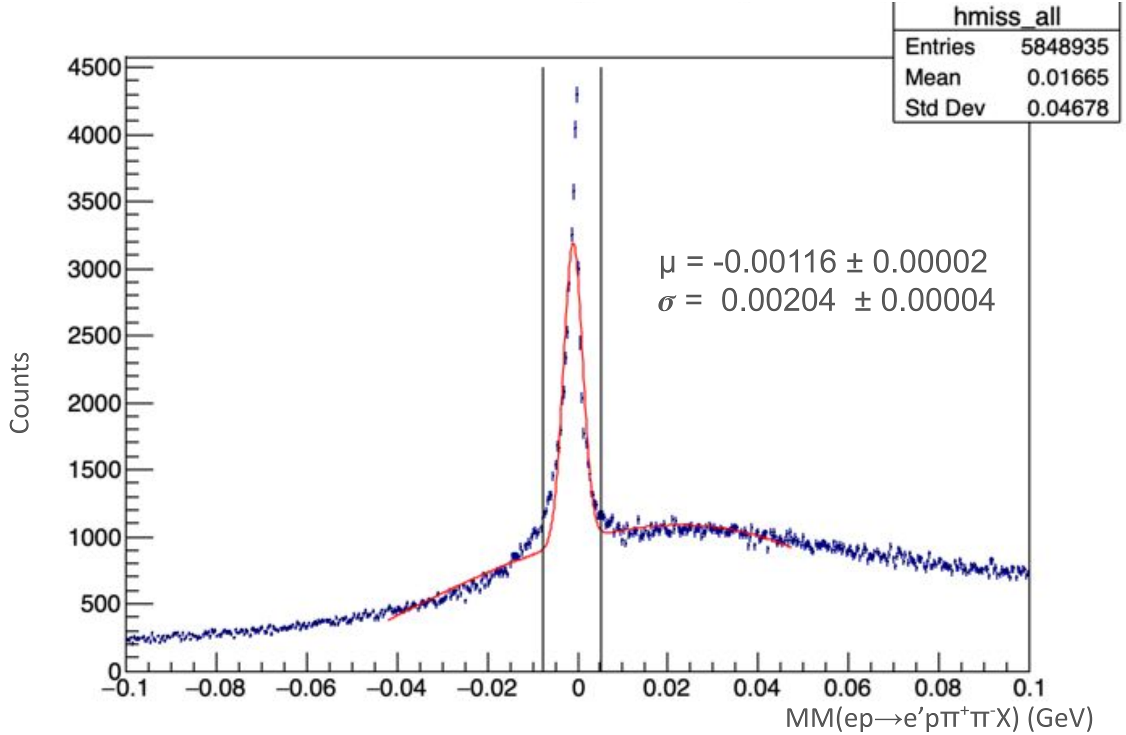
EXCLUSIVE EVENTS: SPRING 2019

Missing mass squared of $ep \rightarrow e'p\pi^+\pi^-X$, fitted with a gaussian + polynomial background. The cut on the missing mass squared was calculated as $\mu \pm 3\sigma$ (indicated with vertical lines in the histogram).



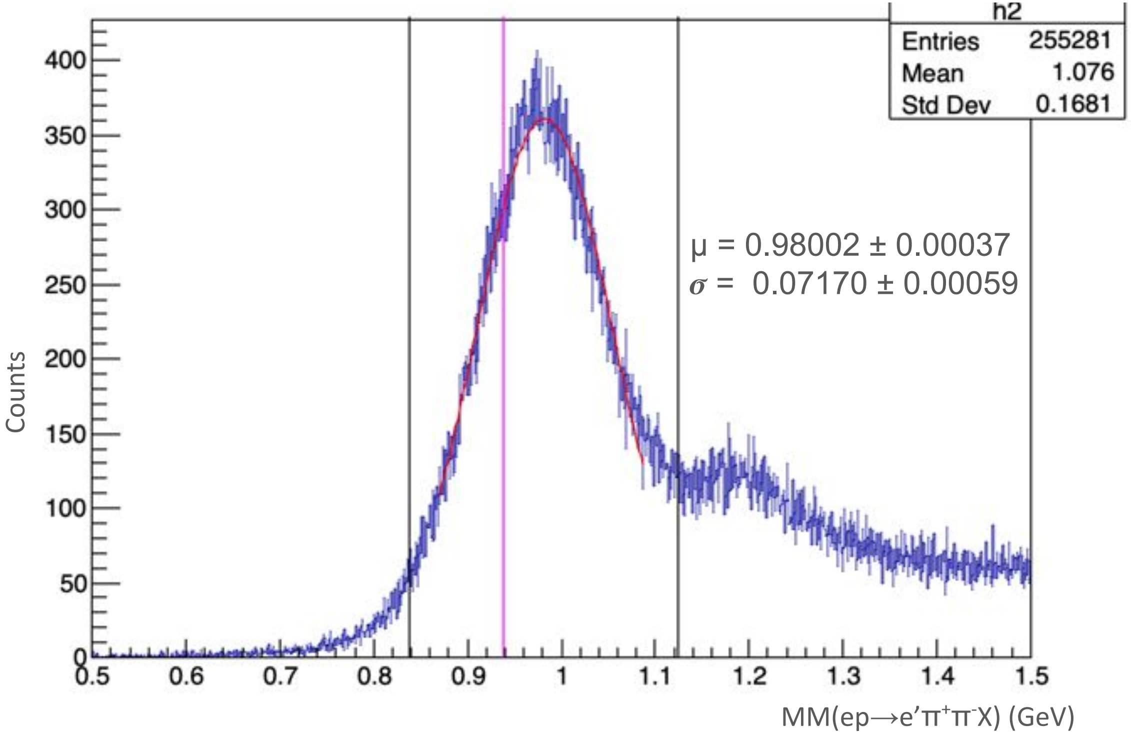
EXCLUSIVE EVENTS:: FALL 2018

This is the same histogram as the previous slide obtained from Fall 2018 data.



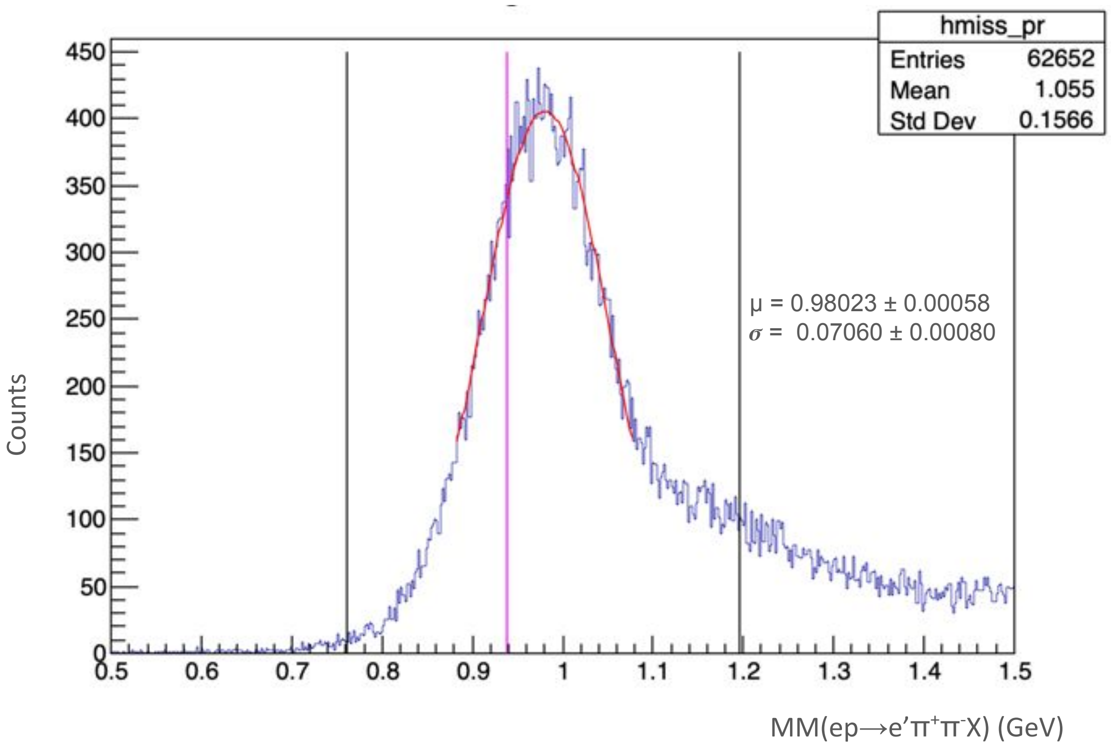
SELECTING PROTON: SPRING 2019

Missing mass of proton, fitted with a gaussian + polynomial background. The cut on the missing mass was calculated as $\mu \pm 2\sigma$. The magenta line is the literature value of the mass of proton, and the two grey lines are the selection interval.



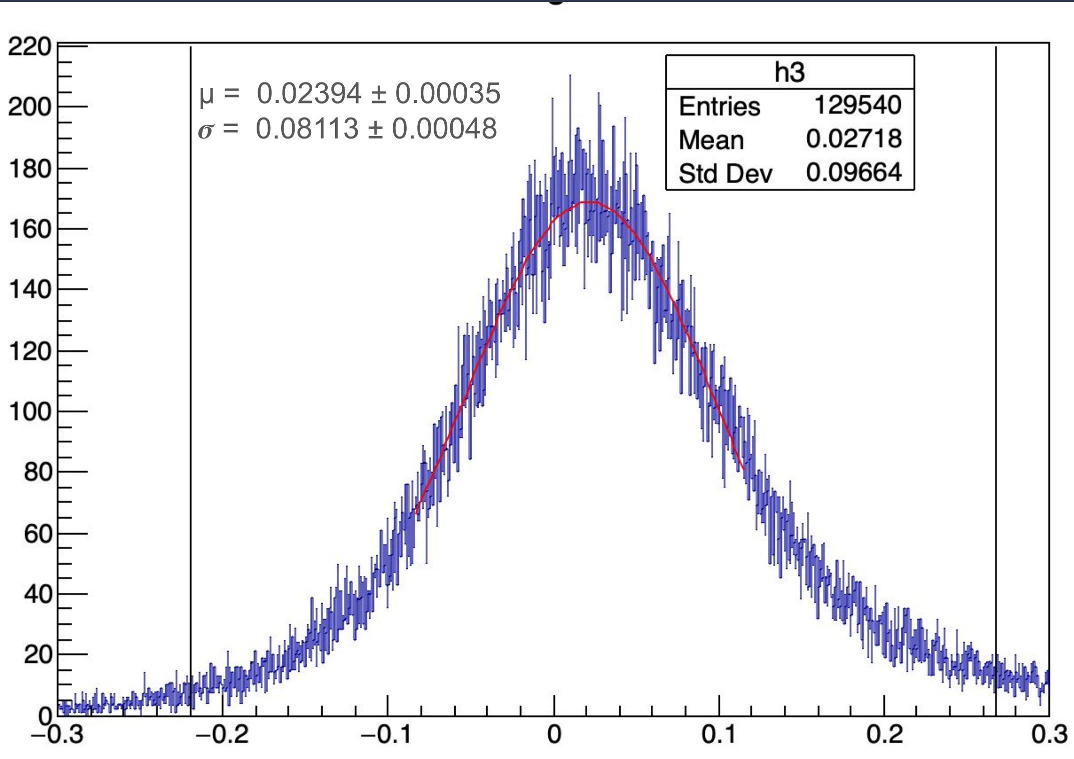
SELECTING PROTON: FALL 2018

The Fall 2018 equivalent of the previous slide. The interval was selected as $\mu \pm 3\sigma$.



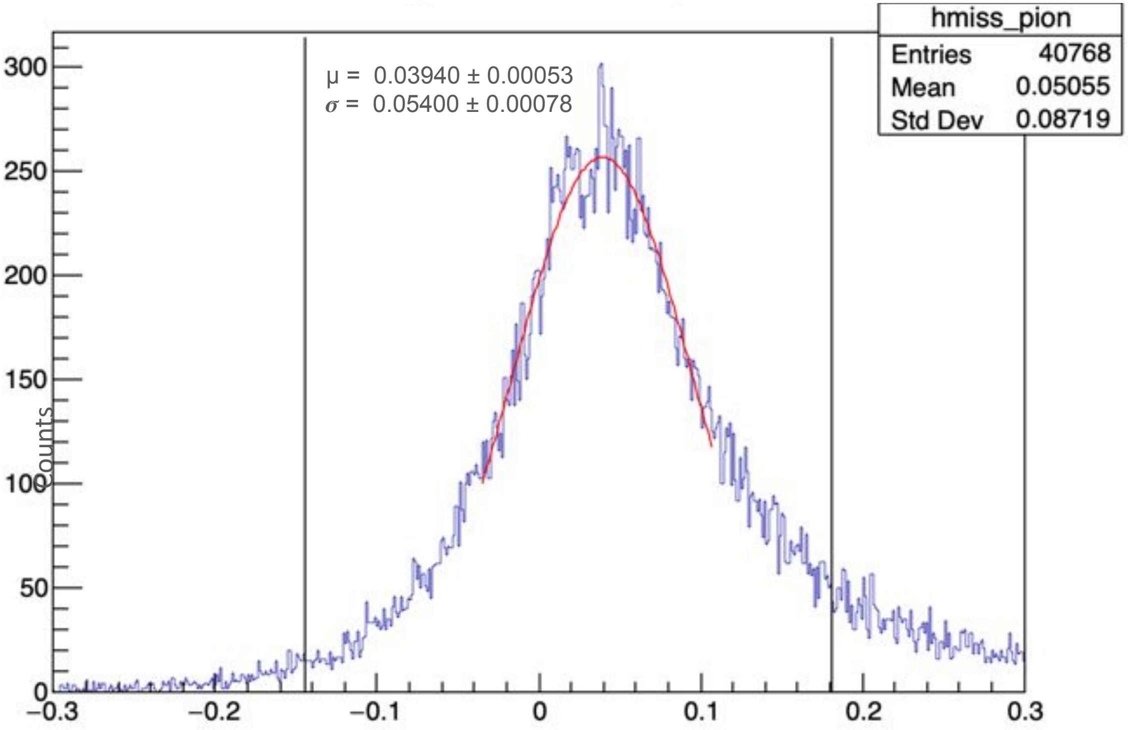
SELECTING PION MINUS: SPRING 2019

Missing mass squared of π^-, fitted with a gaussian + polynomial background. The cut on the missing mass squared was calculated as $\mu \pm 3\sigma$.



SELECTING PION MINUS: FALL 2018

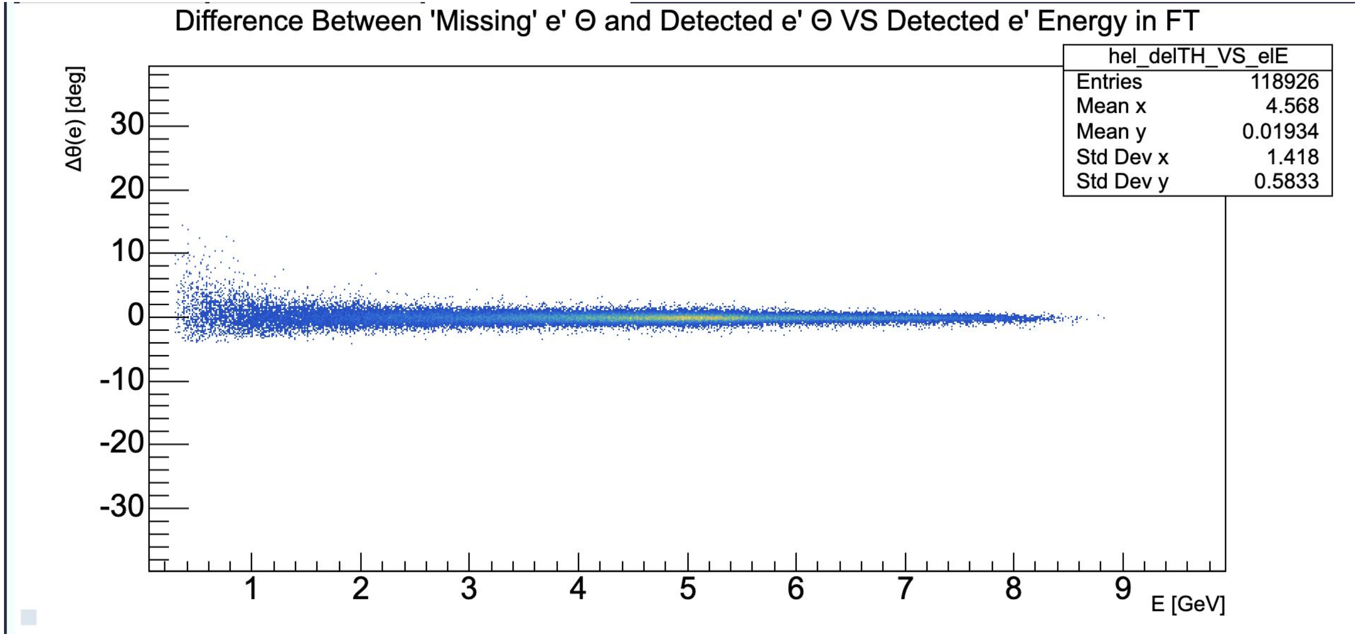
This is the same histogram as the previous slide obtained from Fall 2018 data.



MM(ep→e'π⁺pX) (GeV)

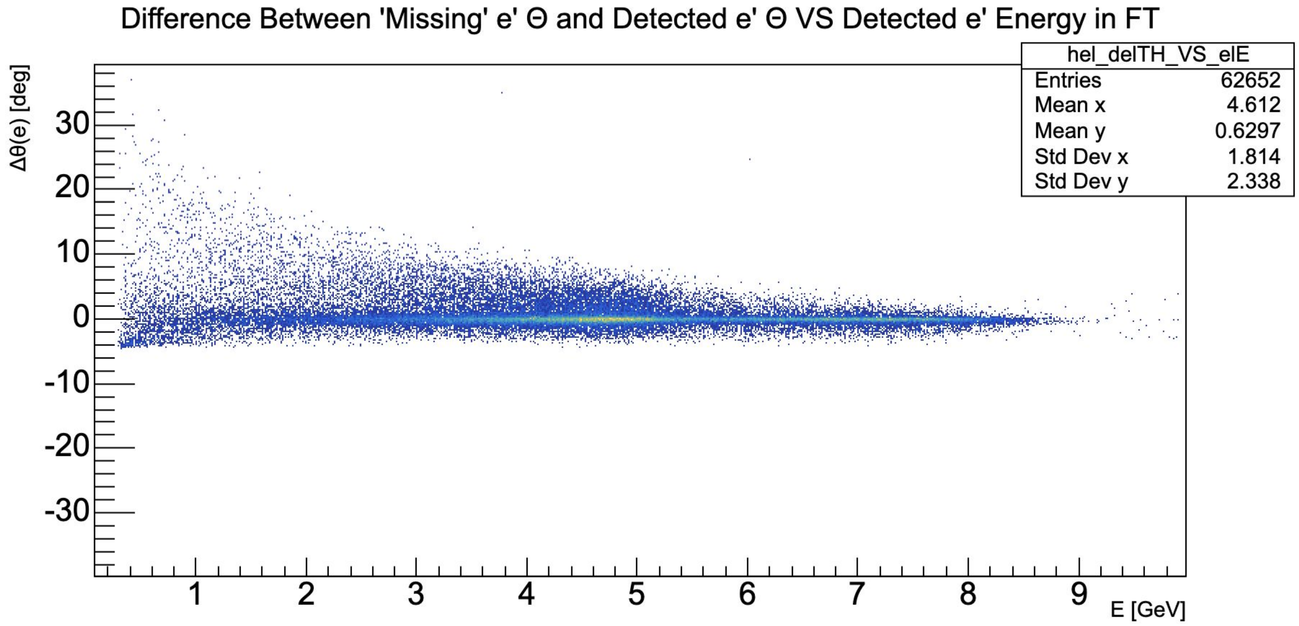
DELTA THETA: SPRING 2019

Histogram of $E_{reconstructed}$ vs $\Delta\theta$, where $\Delta\theta = \theta_{reconstructed} - \theta_{detected}$



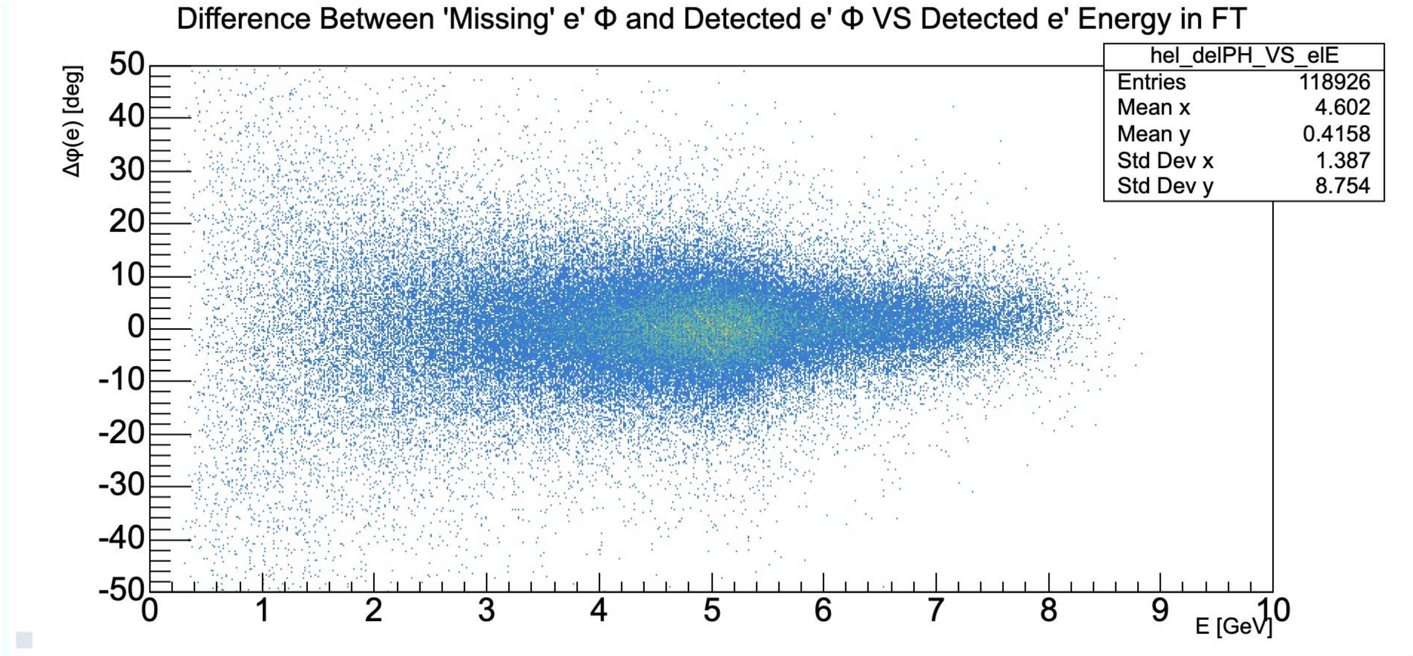
DELTA THETA: FALL 2018

Histogram of $E_{reconstructed}$ vs $\Delta\theta$, where $\Delta\theta = \theta_{reconstructed} - \theta_{detected}$



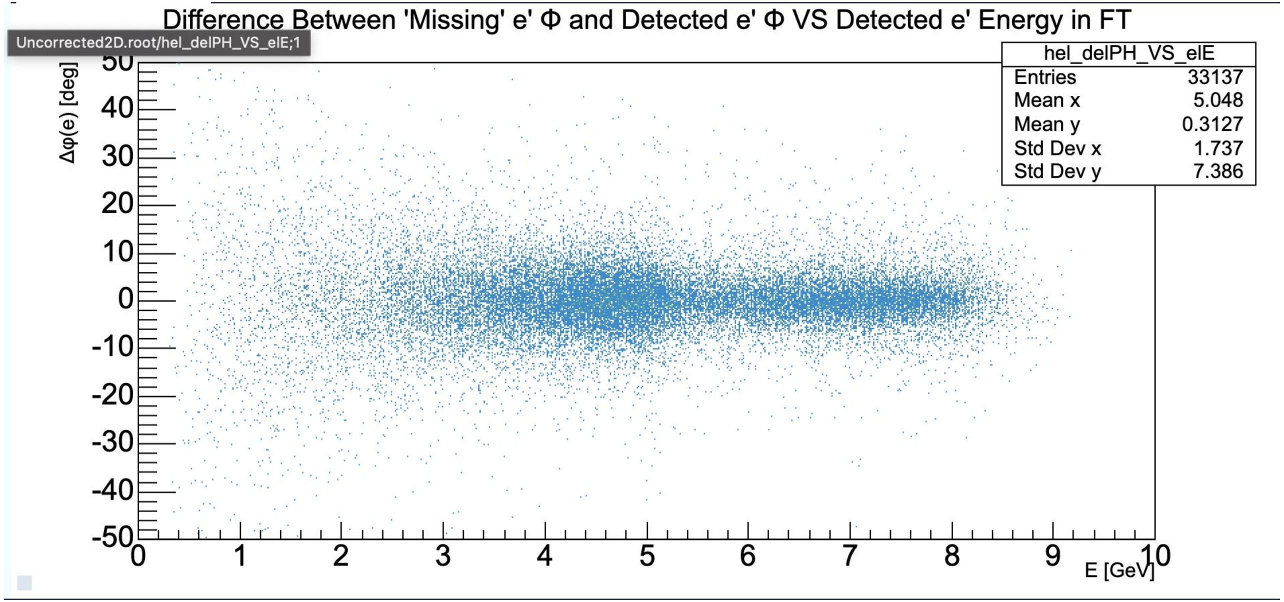
DELTA PHI: SPRING 2019

Histogram of $E_{reconstructed}$ vs $\Delta\phi$, where $\Delta\phi = \phi_{reconstructed} - \phi_{detected}$



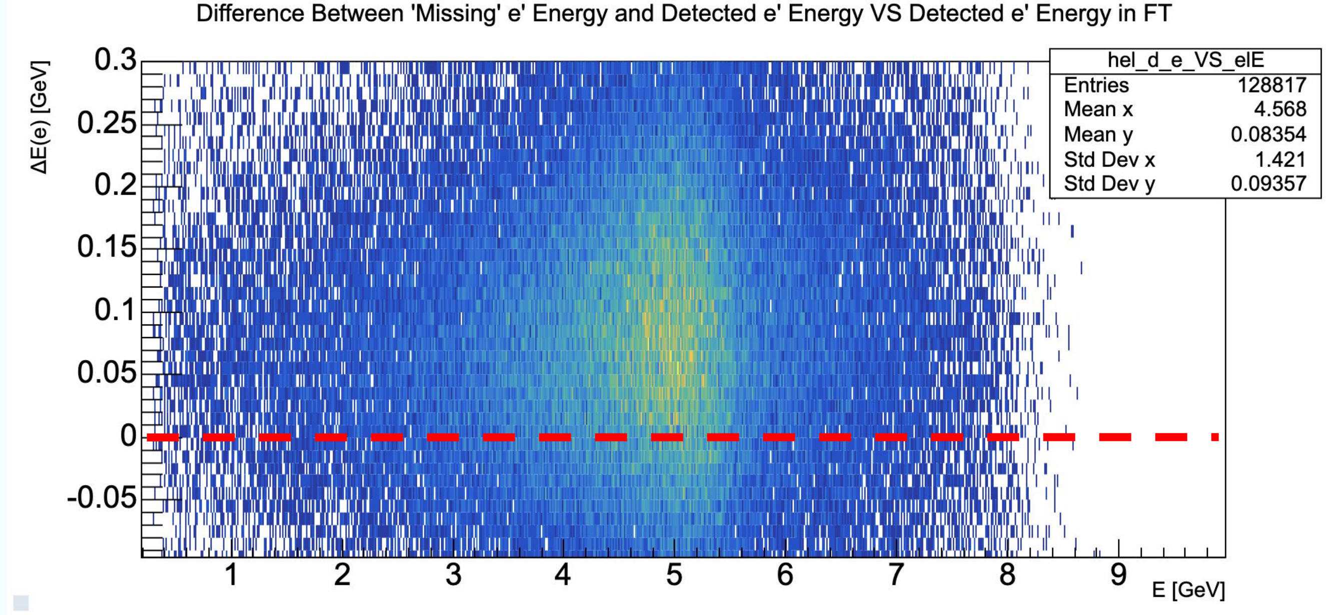
DELTA PHI: FALL 2018

Histogram of $E_{reconstructed}$ vs $\Delta\phi$, where $\Delta\phi = \phi_{reconstructed} - \phi_{detected}$



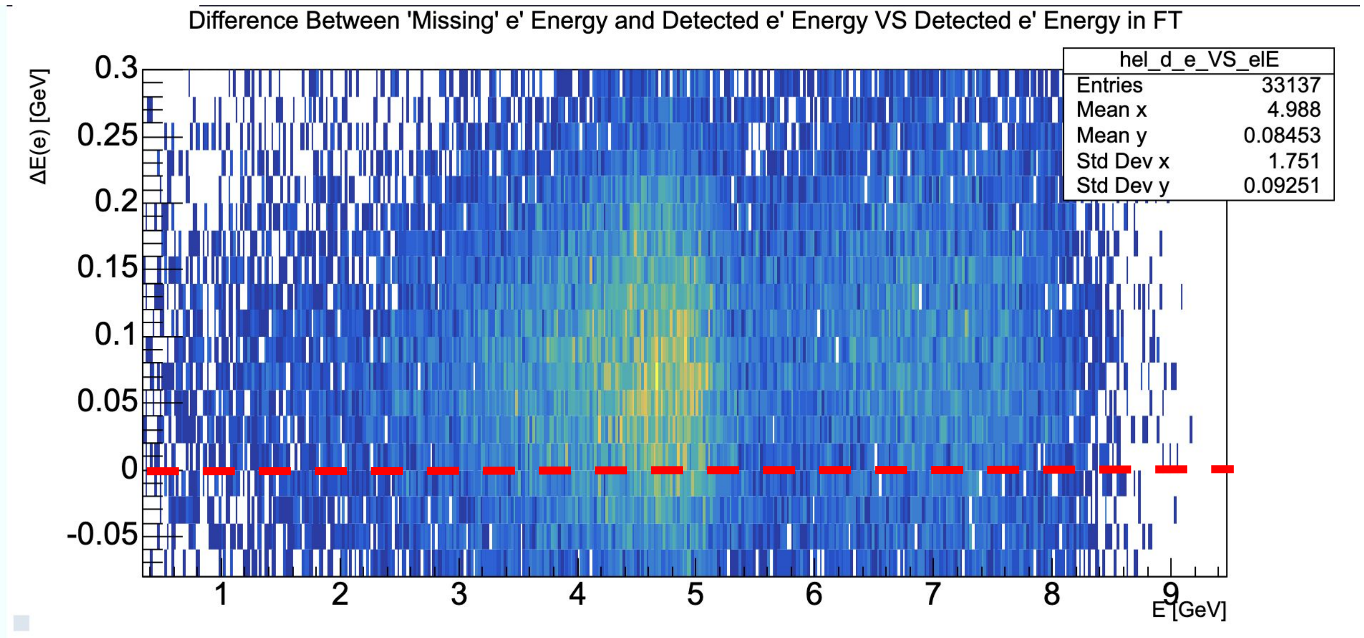
DELTA E: SPRING 2019

Before the energy correction:



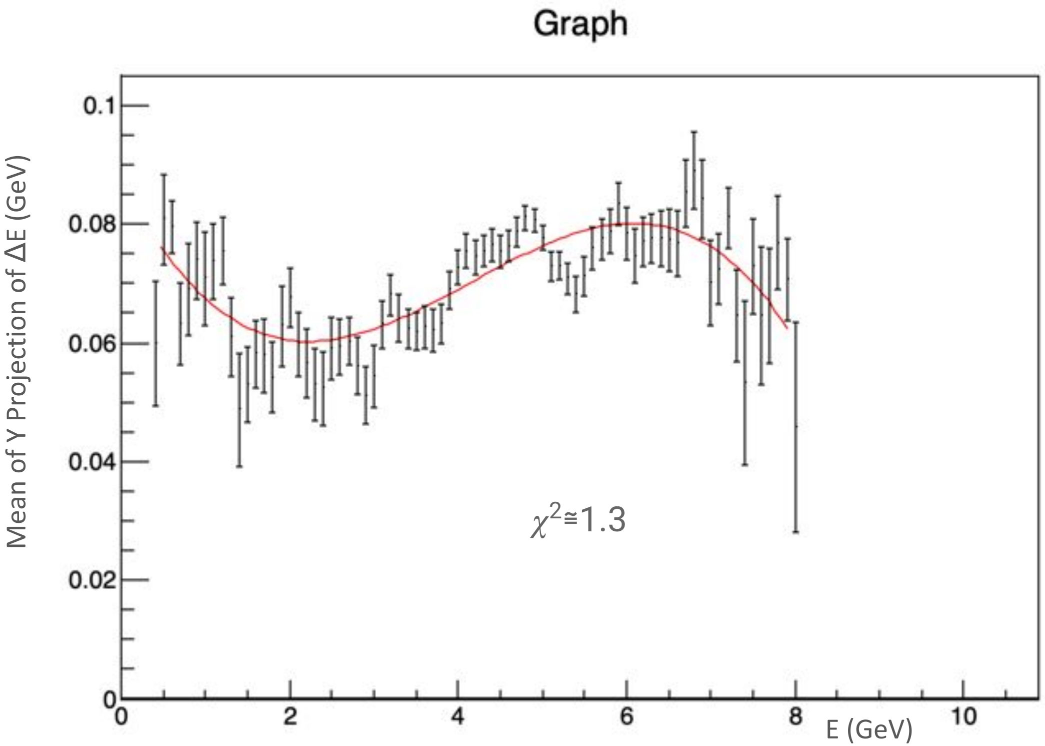
DELTA E: FALL 2018

Before the energy correction:



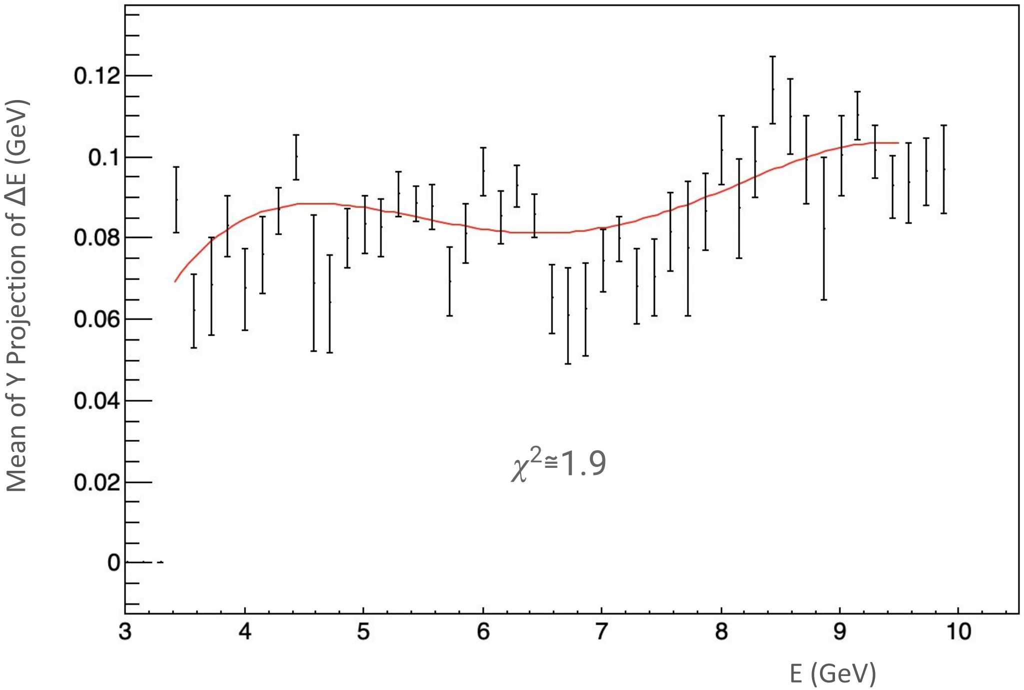
FITTING THE FUNCTION: SPRING 2019

Extracting the mean and standard deviation of the projected slices and plotting to a 3rd degree polynomial fit to find a correction function for the electron.



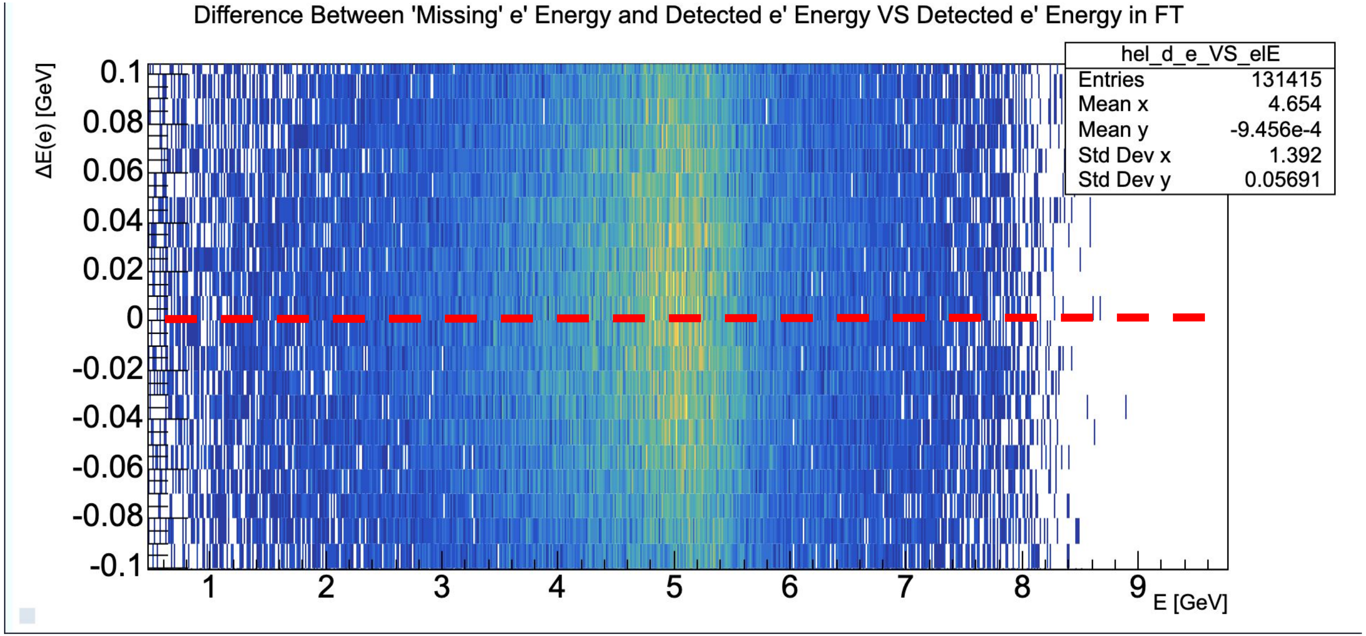
FITTING THE FUNCTION: FALL 2018

Extracting the mean and standard deviation of the projected slices and plotting to a 4th degree polynomial fit to find a correction function for the electron.



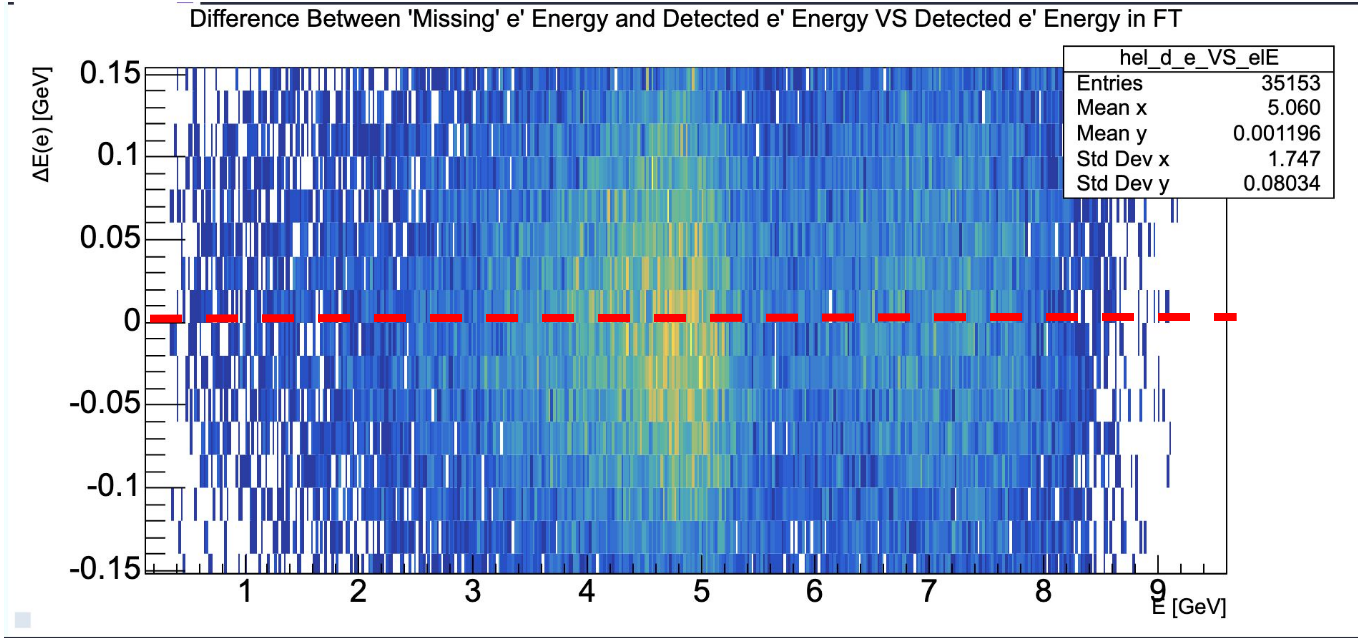
AFTER CORRECTION: SPRING 2019

After the energy correction:



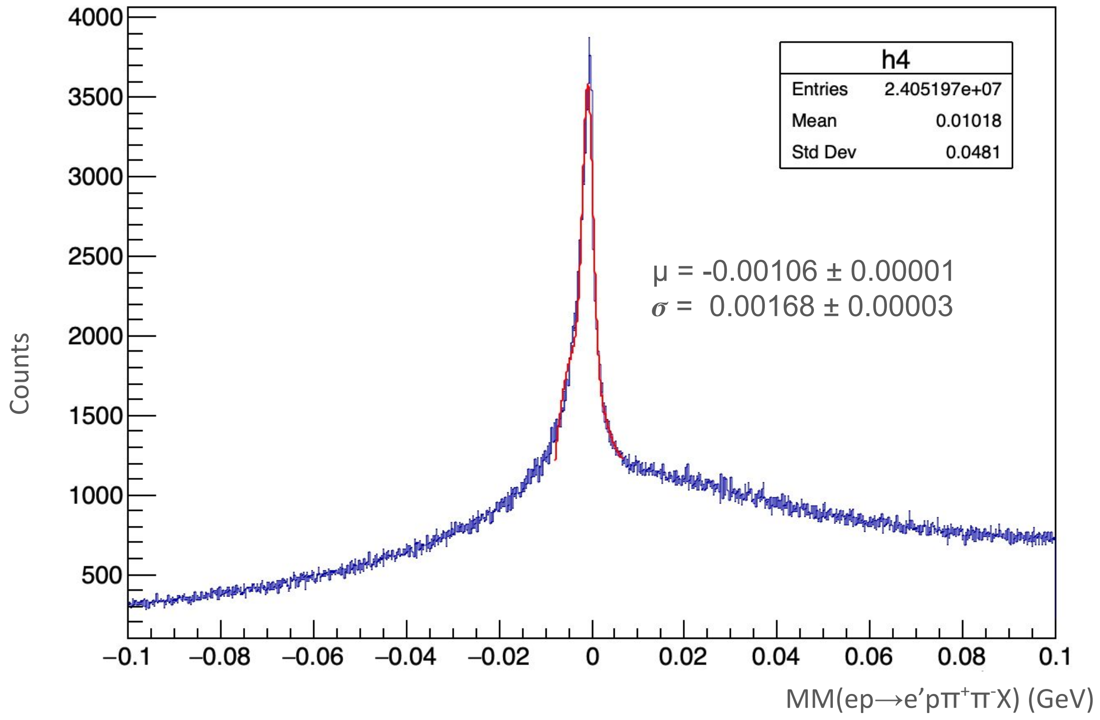
AFTER CORRECTION: FALL 2018

After the energy correction:



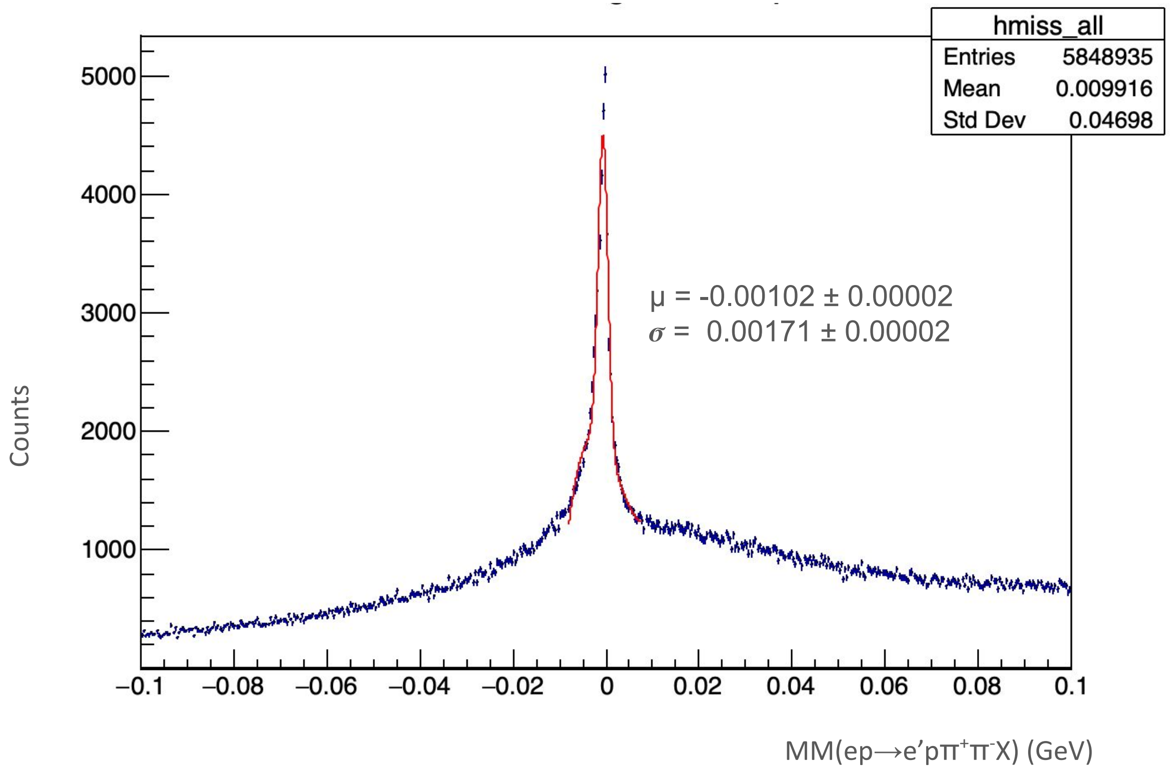
AFTER CORRECTION: SPRING 2019

Missing mass squared of $ep \to e'p\pi^+\pi^-X$, fitted with a gaussian + polynomial background, after energy correction is applied.



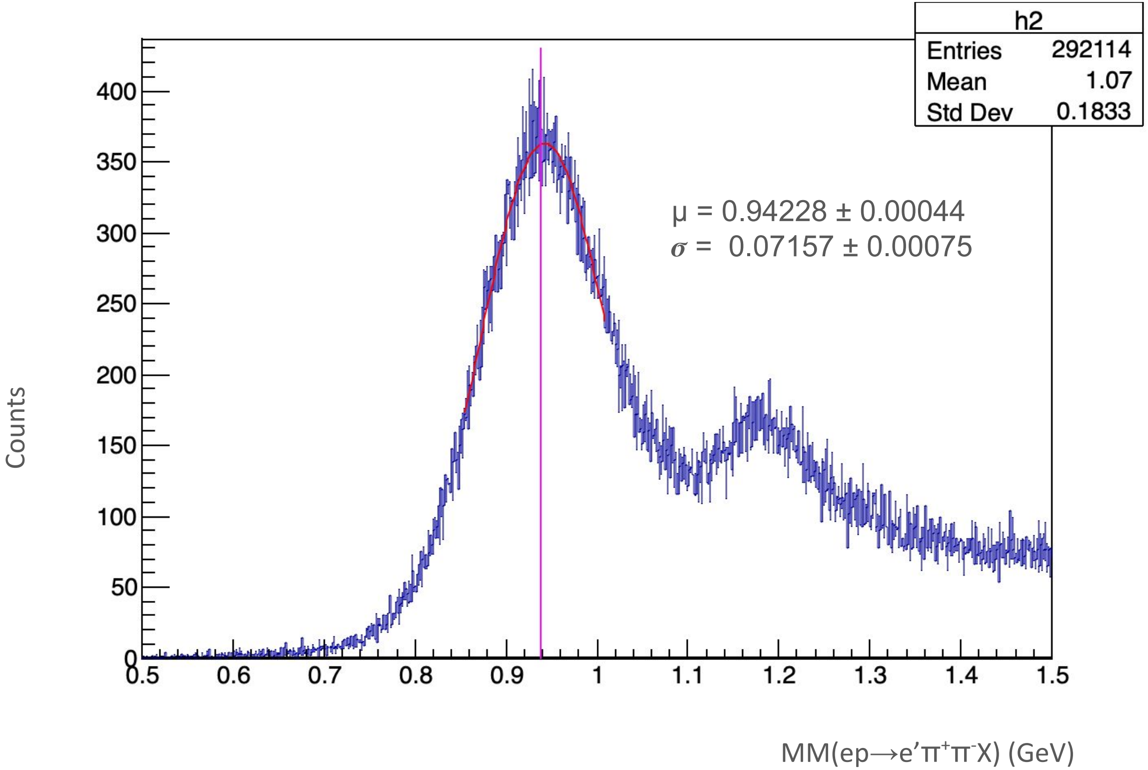
AFTER CORRECTION: FALL 2018

This is the same histogram as the previous slide obtained from Fall 2018 data.



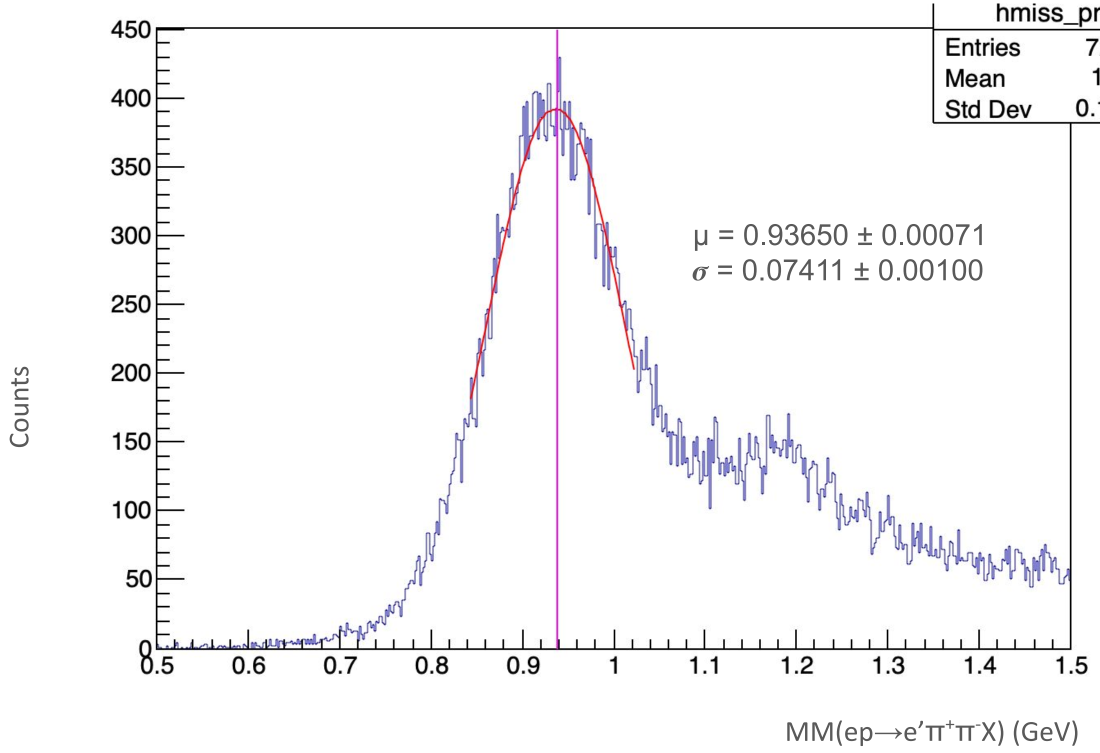
AFTER CORRECTION: SPRING 2019

Missing mass of proton, fitted with a gaussian + polynomial background, after energy correction is applied. The magenta line is the literature value of the mass of the proton.



AFTER CORRECTION: FALL 2018

This is the same histogram as the previous slide obtained from Fall 2018 data.



CORRECTION FUNCTIONS FOR RGA SO FAR

FALL 2018 (OUTBENDING)

```
TLorentzVector  Correct_Electron(TLorentzVector x){

 Double_t E_new, Px_el, Py_el, Pz_el;
 TLorentzVector el_new;
 E_new = x.E() +  0.0208922 + 0.050158*x.E() -
0.0181107*pow(x.E(),2) + 0.00305671*pow(x.E(),3) -
0.000178235*pow(x.E(),4);

 Px_el = E_new*(x.Px()/x.Rho());
 Py_el = E_new*(x.Py()/x.Rho());
 Pz_el = E_new*(x.Pz()/x.Rho());

 el_new.SetXYZM(Px_el, Py_el, Pz_el, 0.000511);

 return el_new;
}
```

SPRING 2019 (INBENDING)

```
TLorentzVector Correct_Electron(TLorentzVector x){

Double_t E_new, E_new_further_corrected, Px_el, Py_el,
Pz_el;
TLorentzVector el_new;

E_new = x.E() + 0.085643 - 0.0288063*x.E() +
0.00894691*pow(x.E(),2) - 0.000725449*pow(x.E(),3);
Px_el = E_new*(x.Px()/x.Rho());
Py_el = E_new*(x.Py()/x.Rho());
Pz_el = E_new*(x.Pz()/x.Rho());

el_new.SetXYZM(Px_el, Py_el, Pz_el, 0.000511);

return el_new;
}
```