

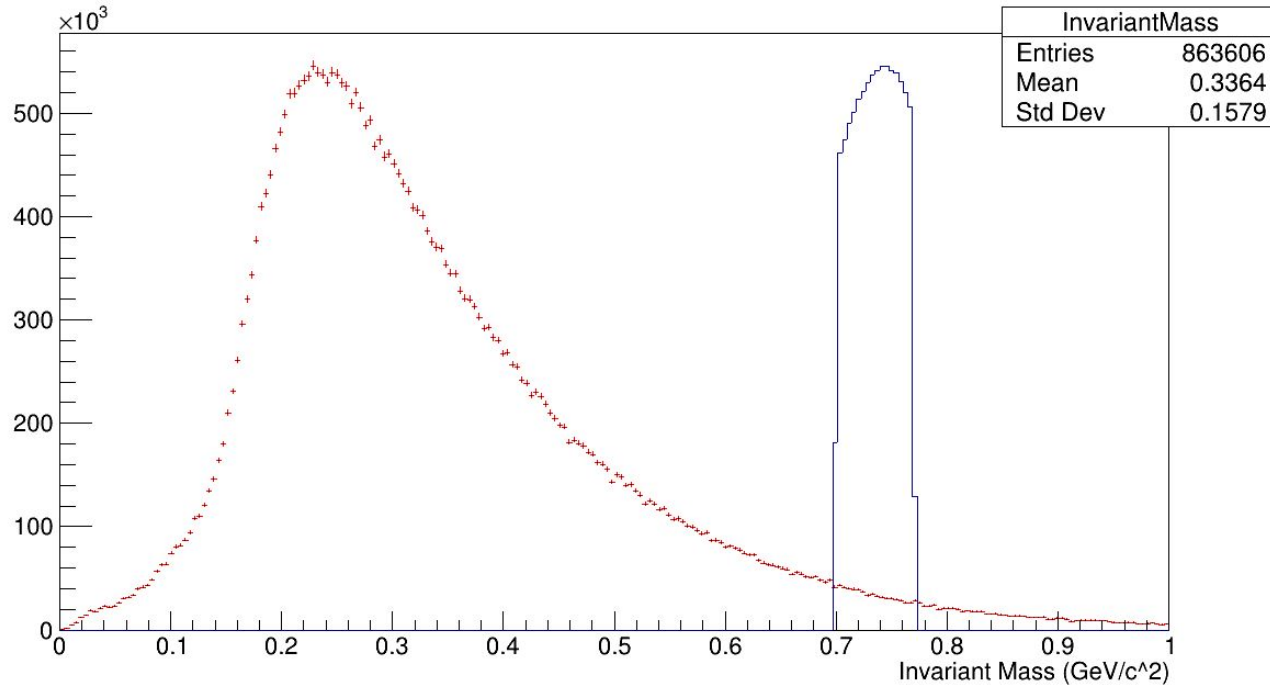
# Analyzing Training Variables for Neural Network

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# Motivation

- Andrew is training me to use the neural nets he has developed
- The current system uses two separate NNs
  - A NN to classify negative tracks as either electron or  $\pi^-$
  - A NN to classify positive tracks as either positron or  $\pi^+$
  - Selects good events by making specified cuts on the NN responses
- The current NN can only train one track at a time
  - Training variables cannot be fed into the NN that are a composite of separate tracks
  - It would be ideal to figure out a new NN system to train on both tracks
  - Analyzing the training variables for differences to see if a NN of this type is viable
- $e^\pm$  trained on Bethe-Heitler  $\gamma p \rightarrow e^+e^-$  simulation
- $\pi^\pm$  trained on gluex  $\gamma p \rightarrow \rho^0 \rightarrow \pi^+\pi^-$

# Invariant Mass



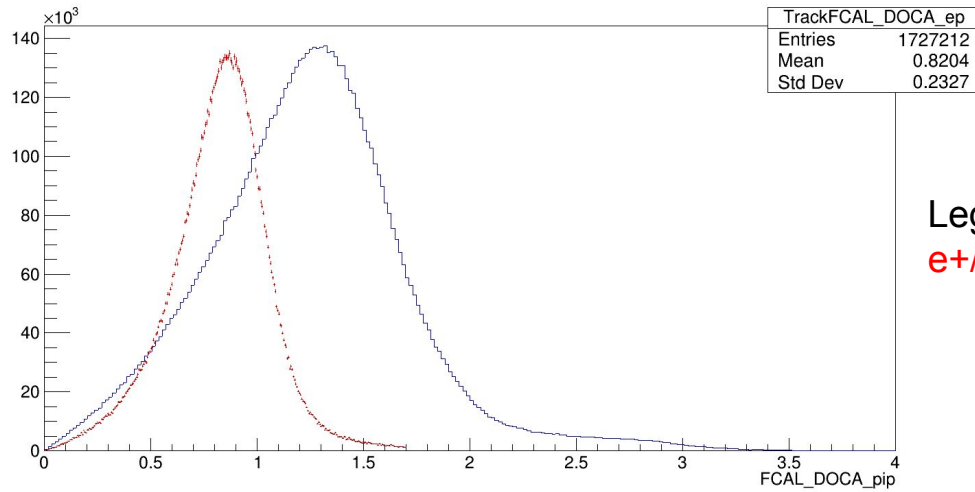
Total mass of the system

Legend

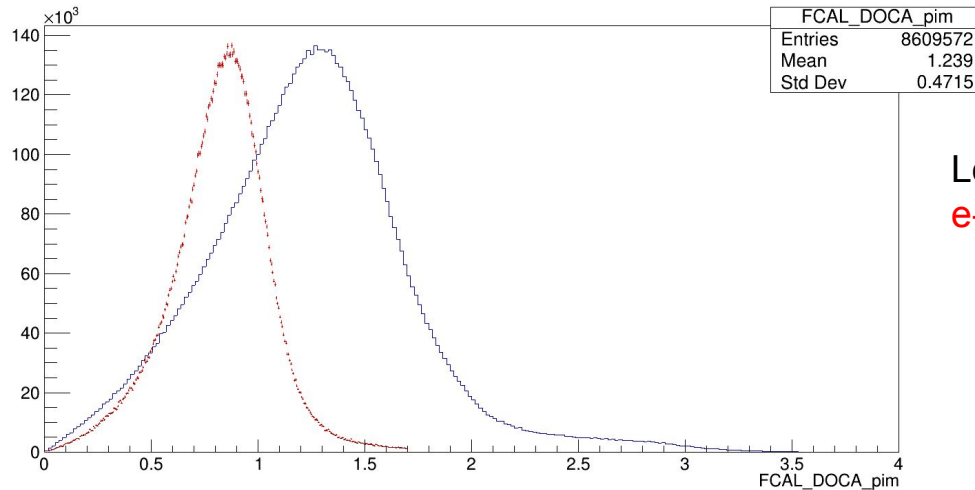
e+/e- simulation

π+π- gluex data

# FCAL DOCA - Positron/Pi+



# FCAL DOCA - Electron/Pi-



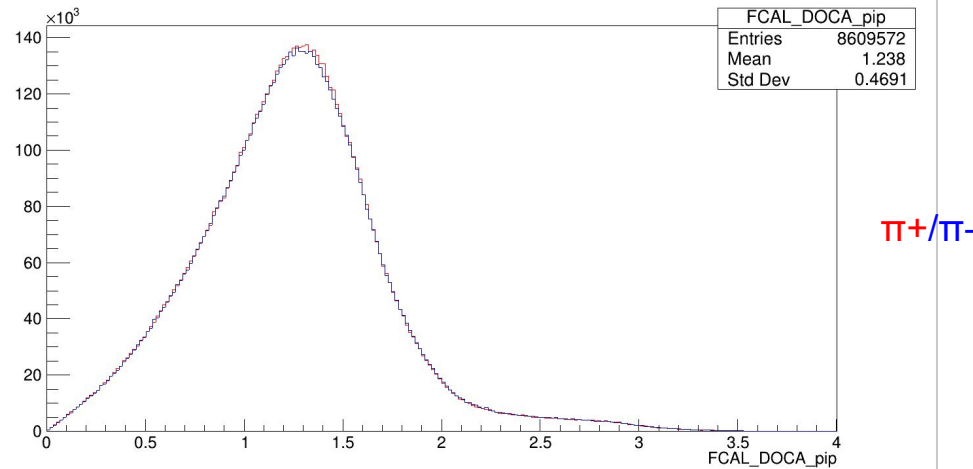
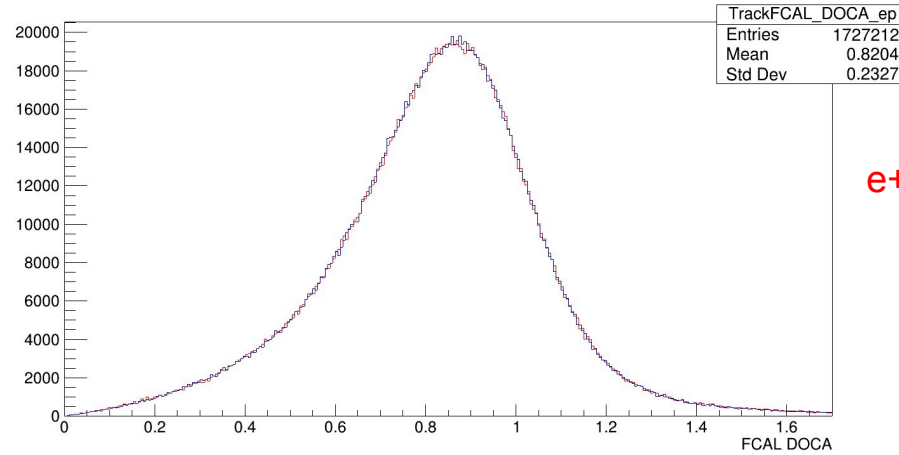
# FCAL DOCA

Positive and negative tracks overlaid on each other to measure differences between tracks

Legend

$e^+/e^-$  simulation

$\pi^+/\pi^-$  gluex data



# FCAL E9/E25 - Electron/Pi minus

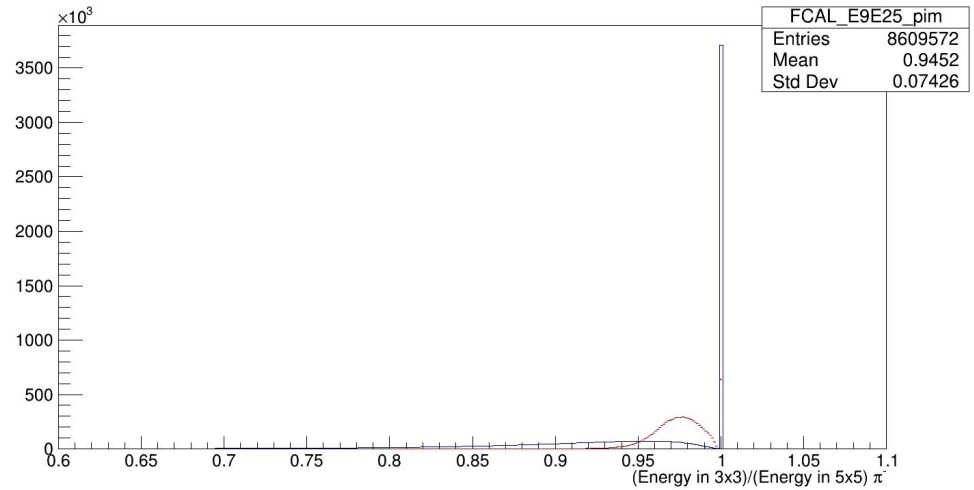
E9/E25 shower ratio - summed energy in a 3x3 and 5x5 array of Pb-glass centered on the shower

$e^+/\pi^+$

Legend

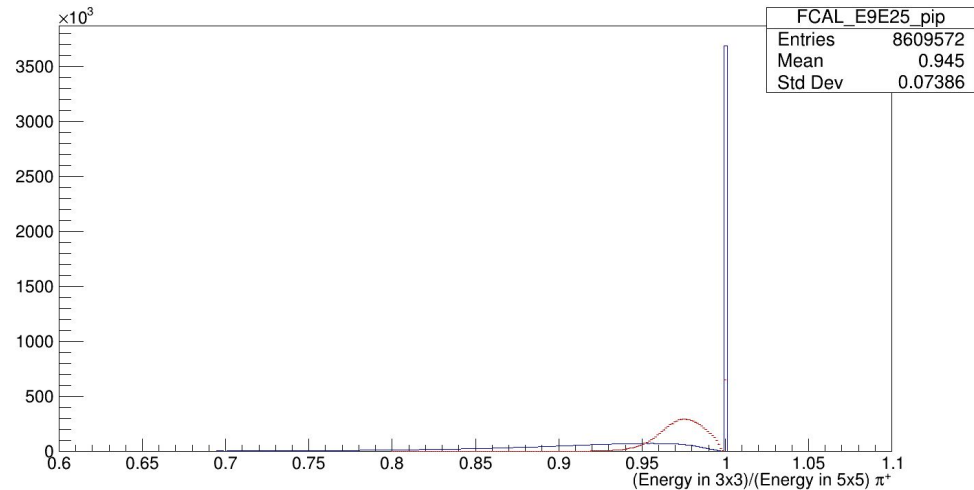
$e^+/\pi^-$  simulation

$\pi^+/\pi^-$  gluex data



# FCAL E9/E25 - Positron/Pi plus

$e^-/\pi^-$



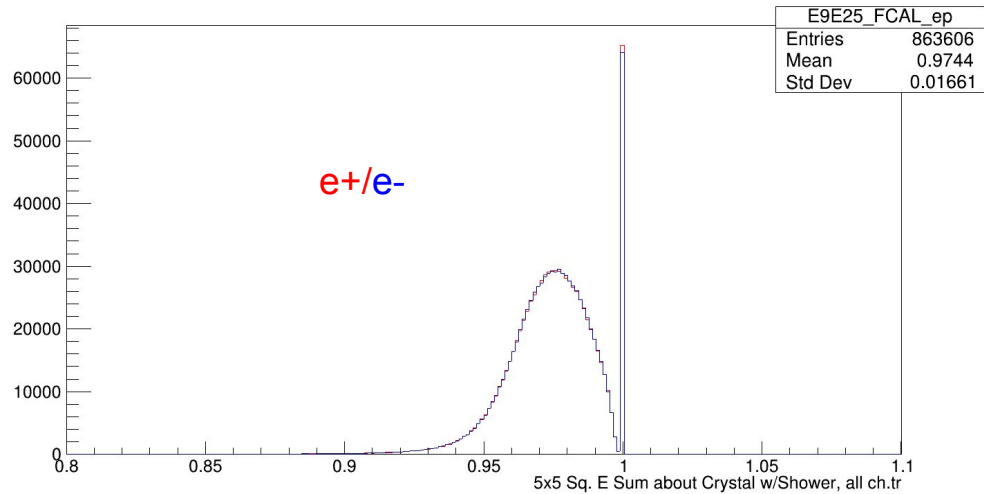
# FCAL E9E25 electron/positron

Positive and negative tracks overlaid  
to see if there is any major differences  
between tracks

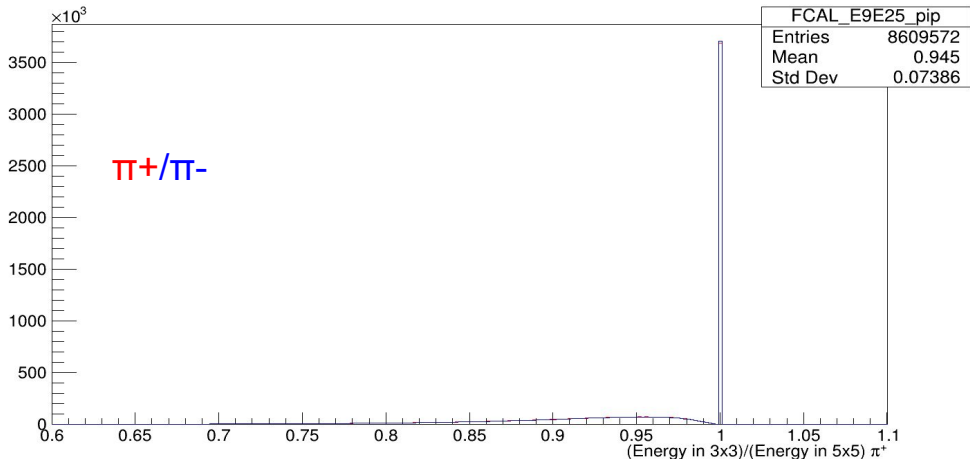
Legend

$e^+/e^-$  simulation

$\pi^+\pi^-$  gluex data



# FCAL E9E25 pion +/ pion -



# FCAL E/p kinfite positron/pion plus

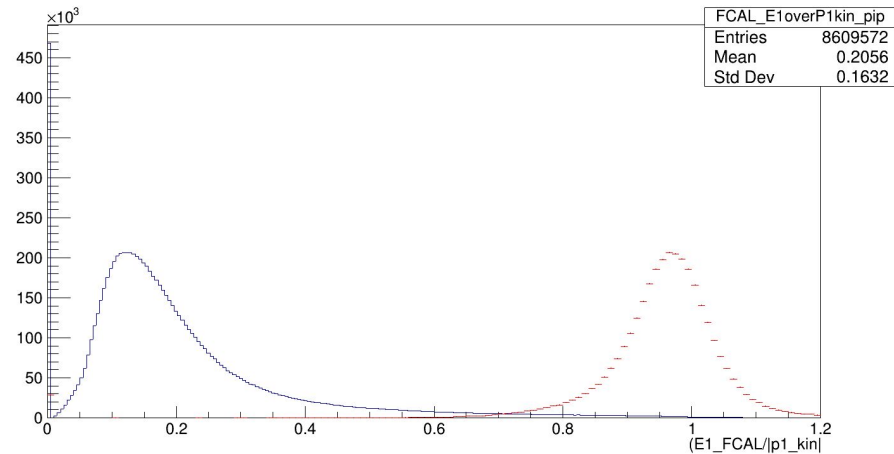
FCAL energy over the kinematic fit of  
the momentum

Legend

$e^+/e^-$  simulation

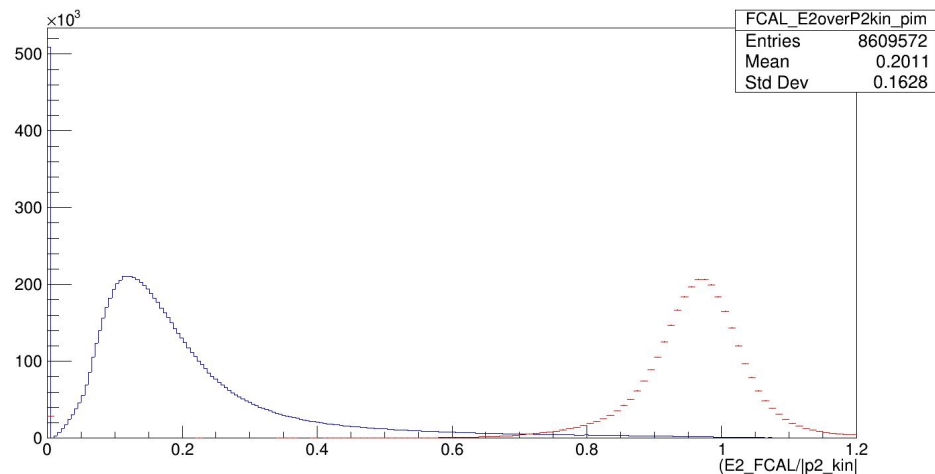
$\pi^+\pi^-$  gluex data

$e^+/\pi^+$



# FCAL E/p kinfite electron/pion minus

$e^-/\pi^-$



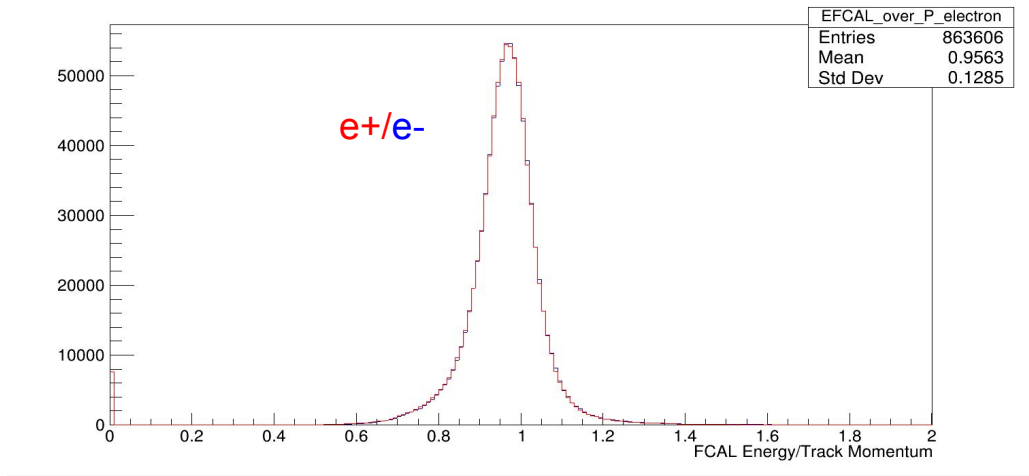


# E/p electron/positron

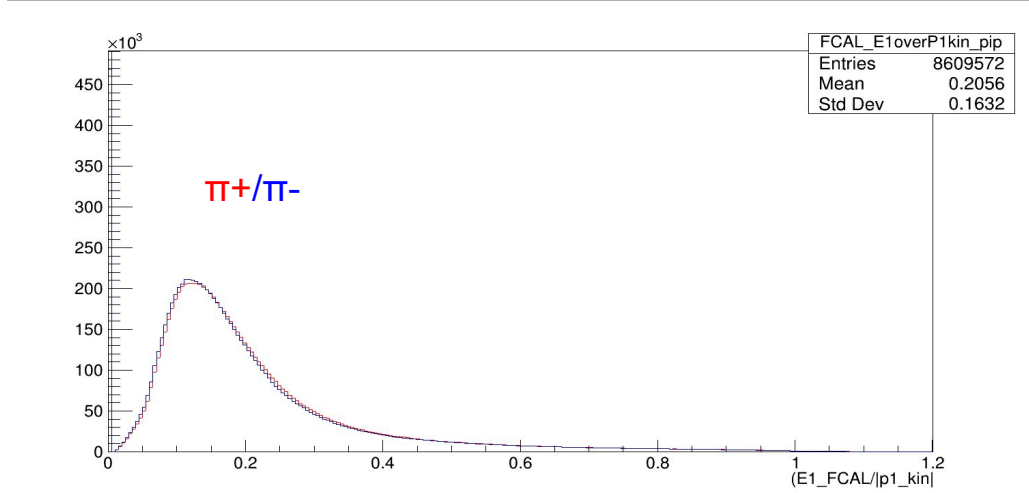
Positive and negative tracks plotted over each other to determine if there are major differences

Legend

- e+/e- simulation
- $\pi^+\pi^-$  gluex data

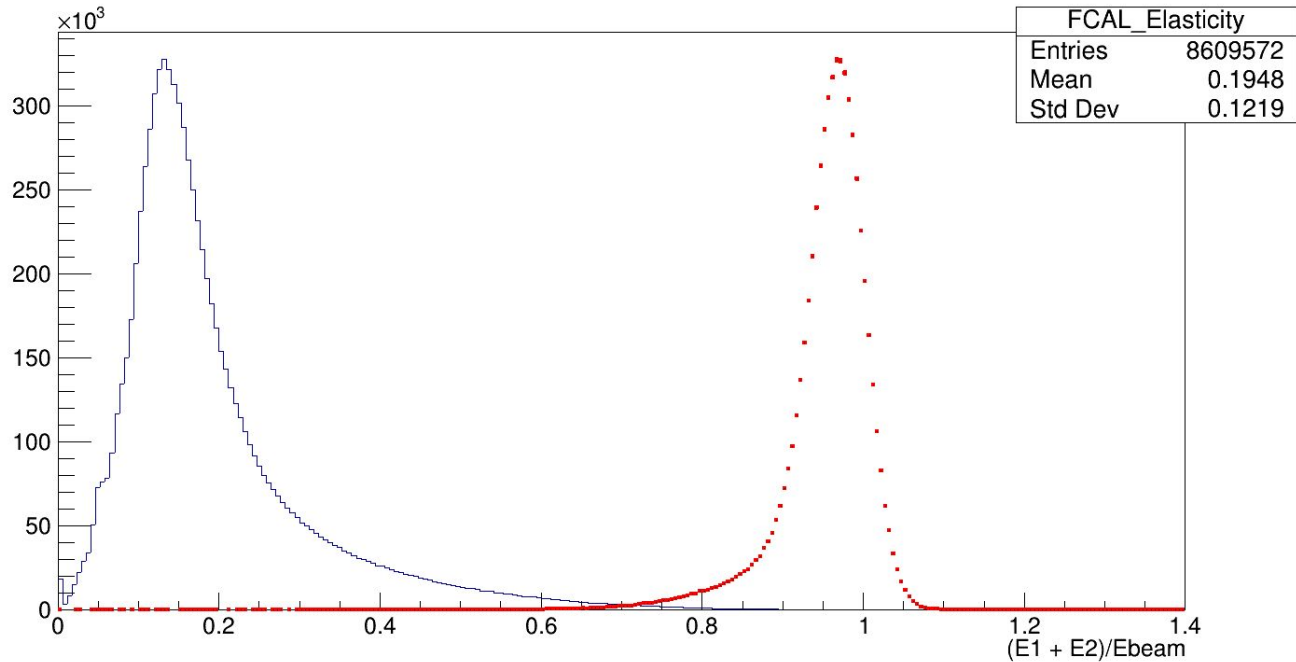


# E/p pion plus/pion minus



# Elasticity

Max Value Scaling



Calculating Elasticity requires both positive and negative tracks to be used, E1 representing negative particle's energy E2 representing the positive particle's energy

Legend

e+/e- simulation

$\pi^+\pi^-$  gluex data

# Conclusion

- The current NN system uses separate NNs for positive and negative tracks
- The comparisons of the training variables in each plot shows that there is little to no discrepancy between the the positive and negative tracks
- This should allow a new Neural Net system to be developed to allow both tracks to be measured and values like the elasticity to be calculated within the NN