

**Basic electron cuts**

**Deuterium run 015053**

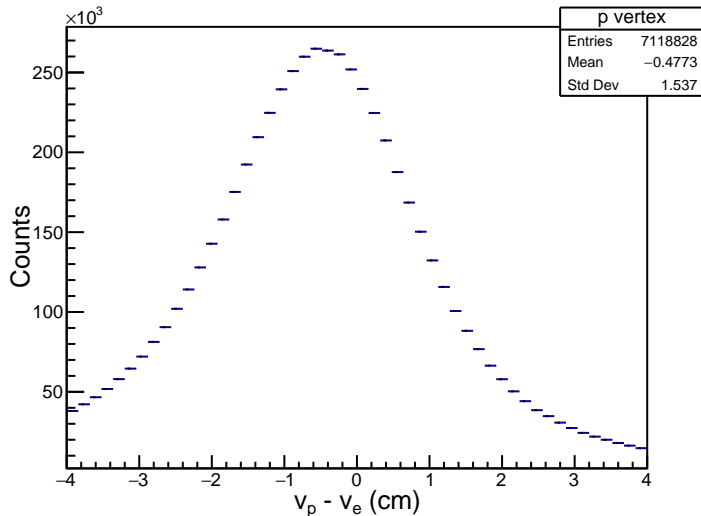
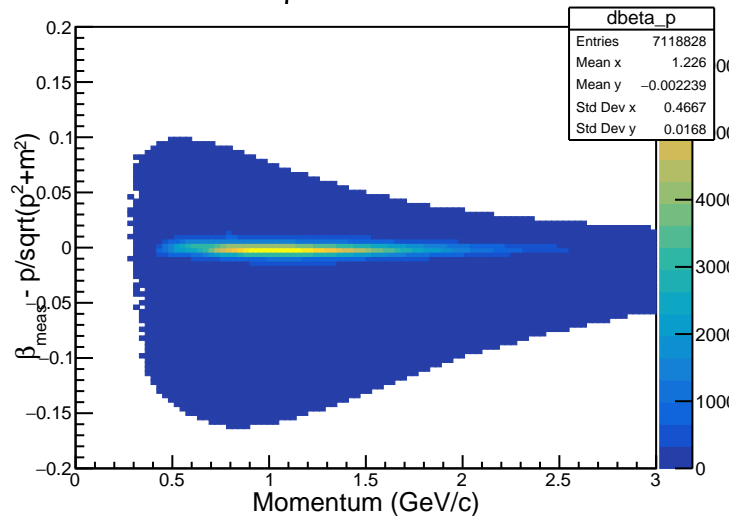
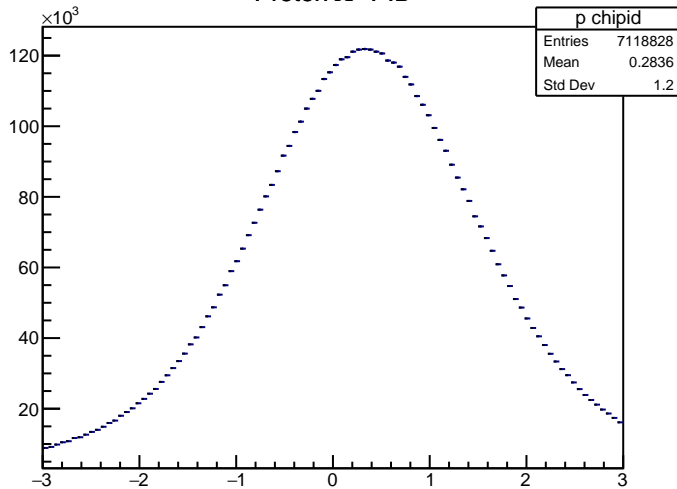
**$d(e,e'p)n$**

**allow only PID=0,11,22,2212,2112**

**exactly 1p, 1e**

**proton in FD**

Proton vertex - electron vertex

 $\Delta \beta$  vs MomentumProton  $X^2$  PID

# Basic electron cuts

Deuterium run 015053

$d(e,e'p)n$

Require proton in FTOF

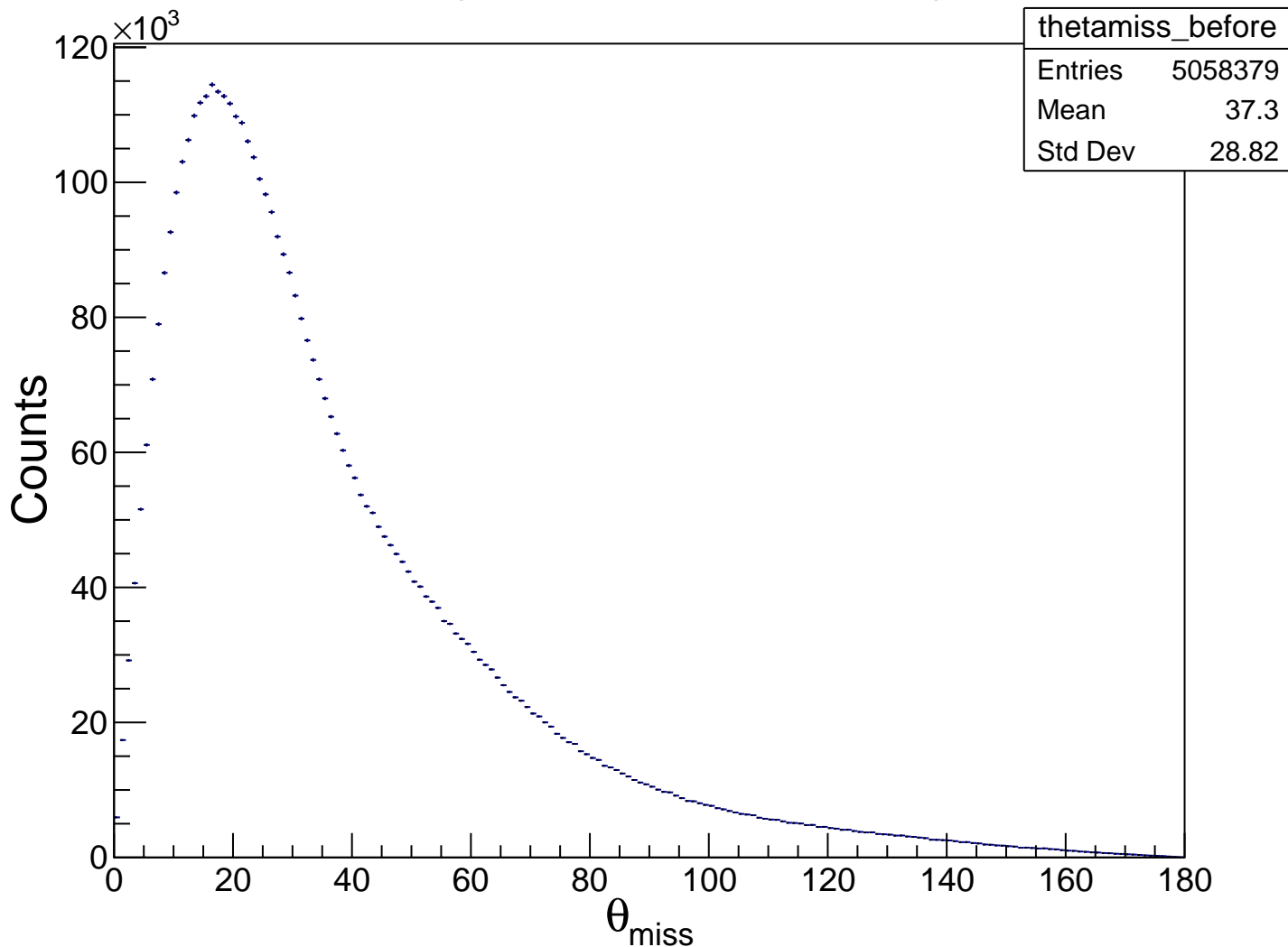
$$-4 \text{ cm} < v_p - v_e < 2 \text{ cm}$$

$$-0.02 < \Delta \beta < 0.02$$

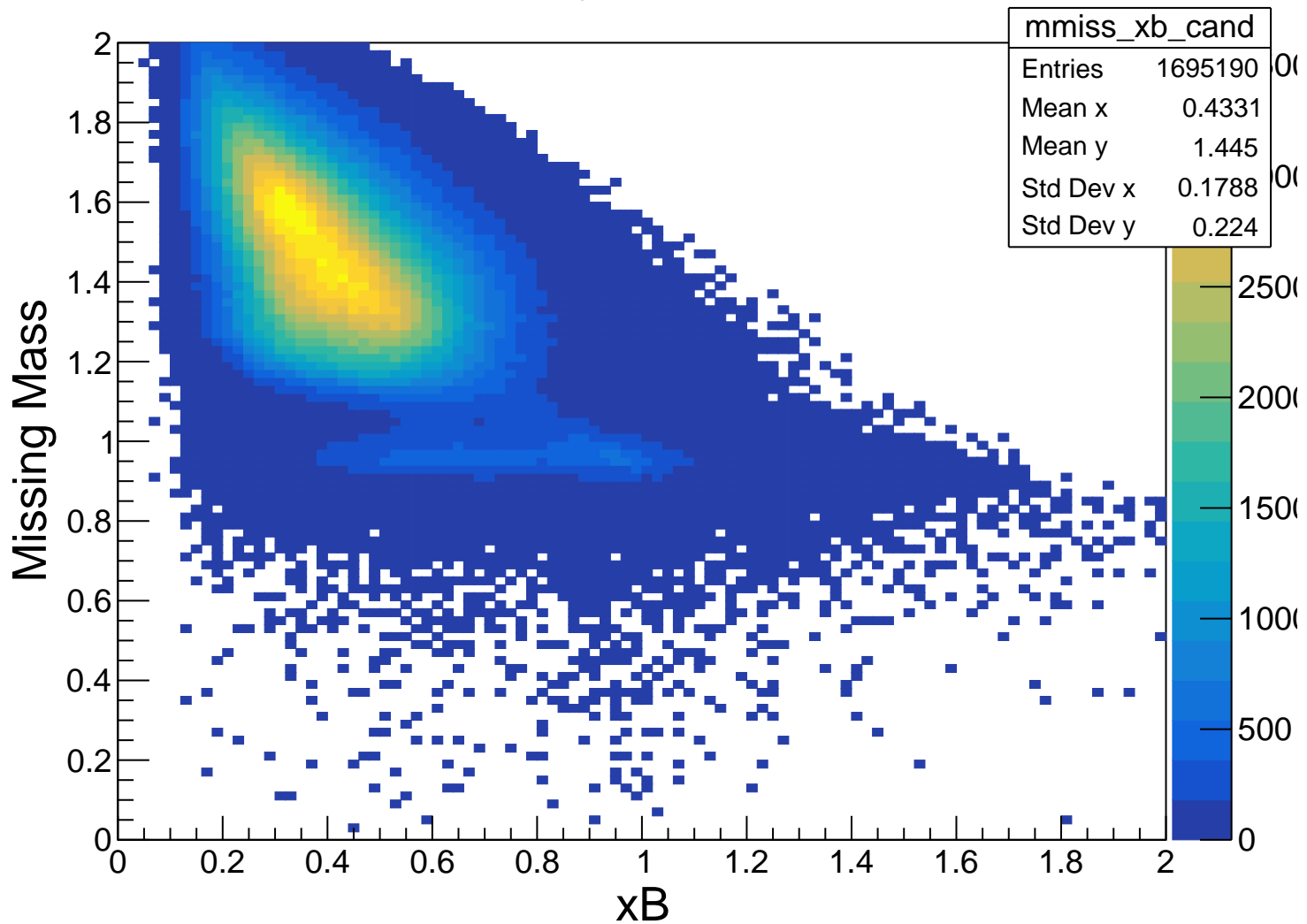
$$p_p > 0.3 \text{ GeV}/c$$

$$-3 < \text{proton } \chi^2_{\text{PID}} < 3$$

# Missing Momentum Polar Angle



# Missing Mass vs xB



**Basic electron cuts**

**Deuterium run 015053**

**d(e,e'pn)**

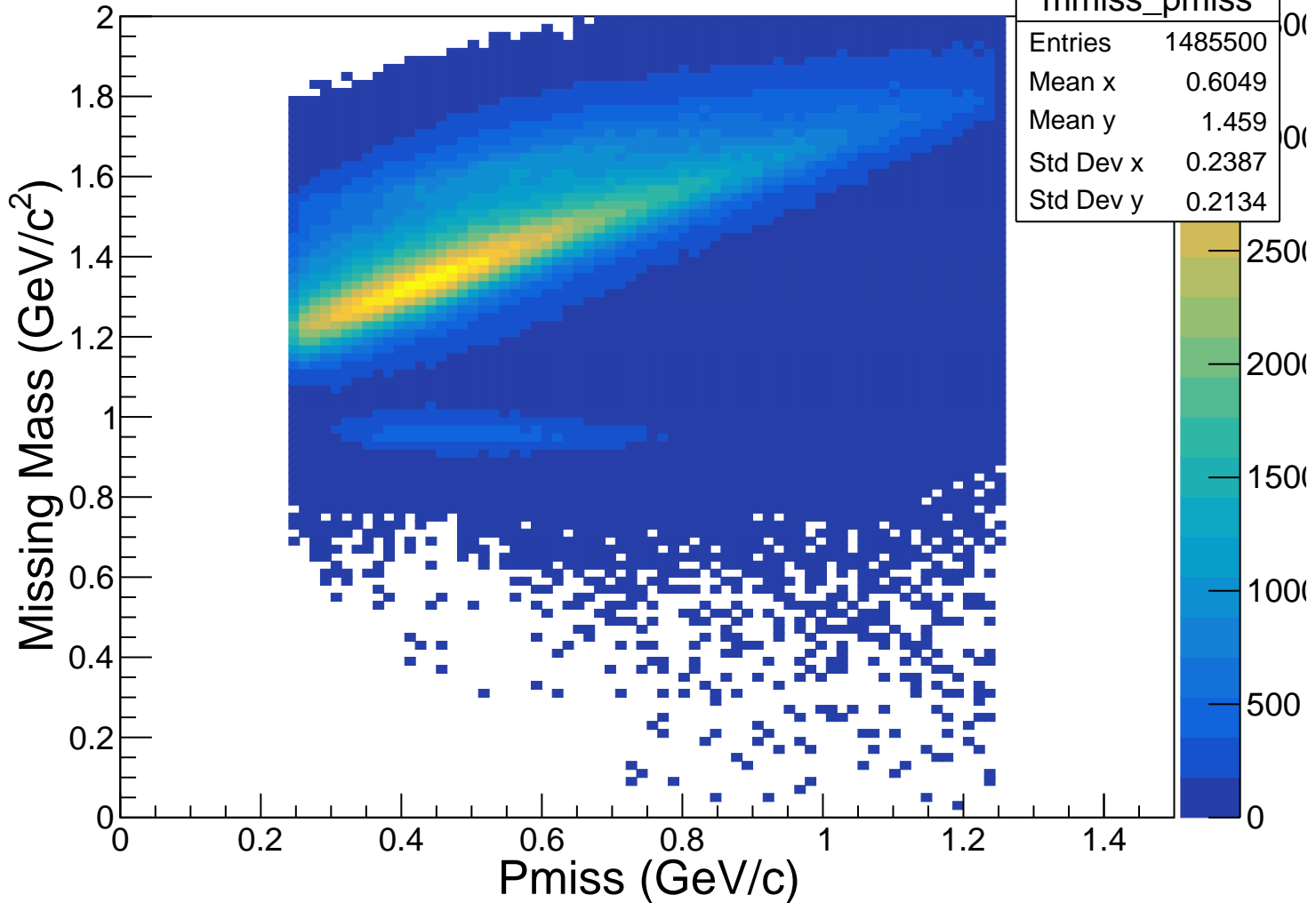
**proton cuts**

**$40 \text{ deg} < \theta_{\text{miss}} < 140 \text{ deg}$**

**$0.24 \text{ GeV}/c < p_{\text{miss}} < 1.25 \text{ GeV}/c$**

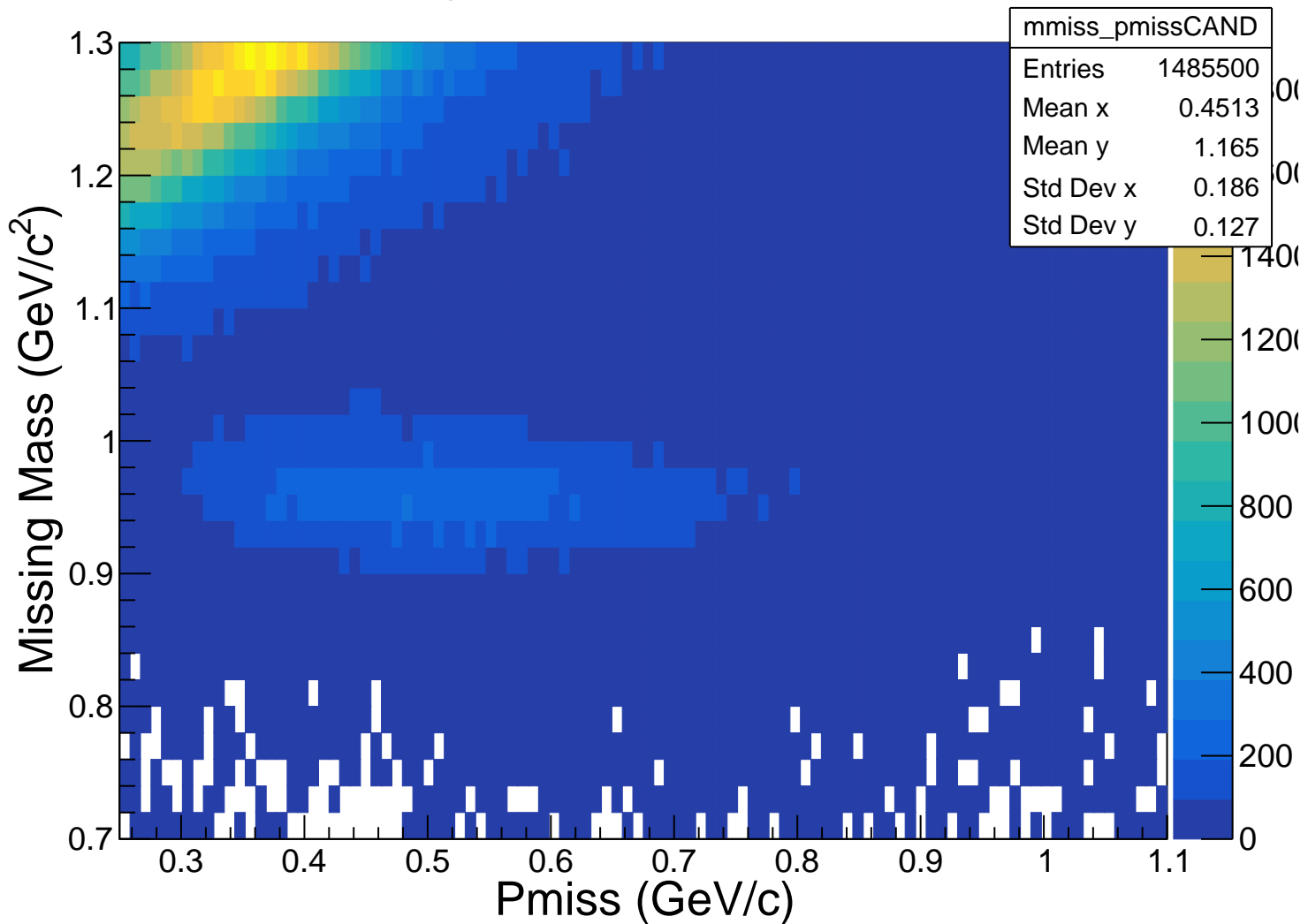
## **EFFICIENCY BY MOMENTUM - CANDIDATES**

# Missing Mass vs Pmiss d(e,e'p)n

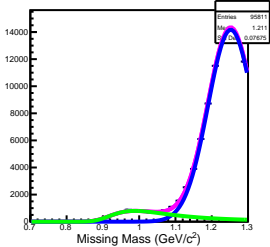




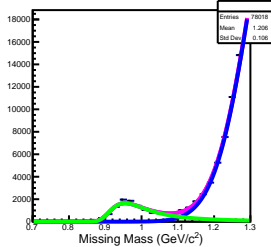
# Missing Mass vs Pmiss d(e,e'p)n



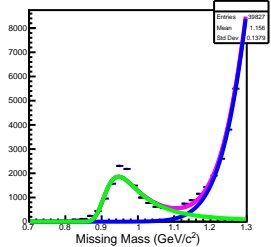
Missing Mass vs Pmiss d(e,e'p)n



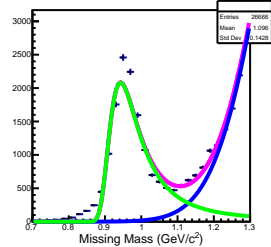
Missing Mass vs Pmiss d(e,e'p)n



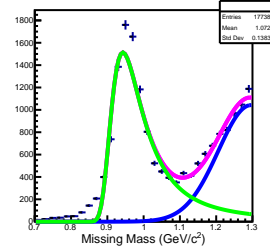
Missing Mass vs Pmiss d(e,e'p)n



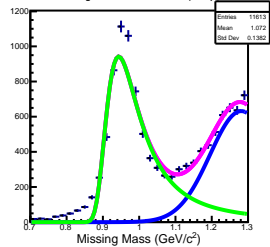
Missing Mass vs Pmiss d(e,e'p)n



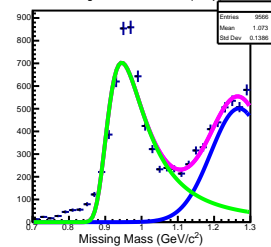
Missing Mass vs Pmiss d(e,e'p)n



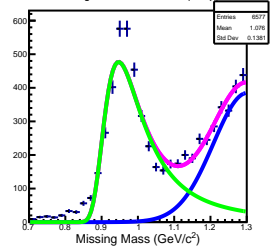
Missing Mass vs Pmiss d(e,e'p)n



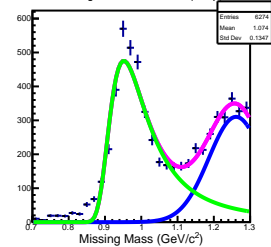
Missing Mass vs Pmiss d(e,e'p)n



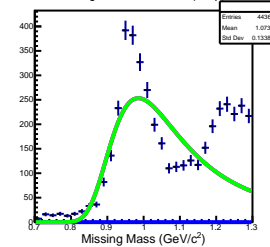
Missing Mass vs Pmiss d(e,e'p)n



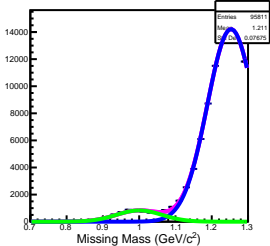
Missing Mass vs Pmiss d(e,e'p)n



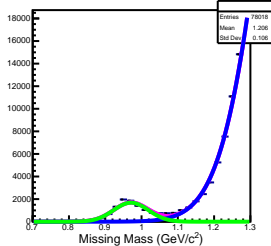
Missing Mass vs Pmiss d(e,e'p)n



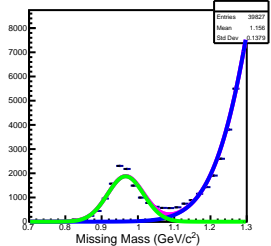
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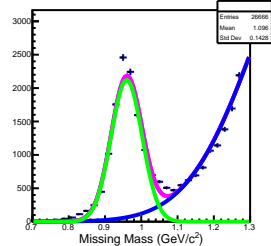
Missing Mass vs Pmiss d(e,e'p)n



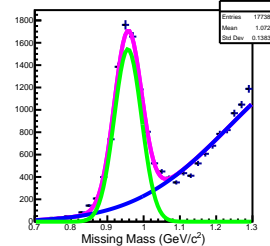
Missing Mass vs Pmiss d(e,e'p)n



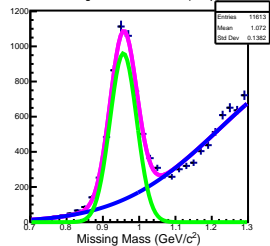
Missing Mass vs Pmiss d(e,e'p)n



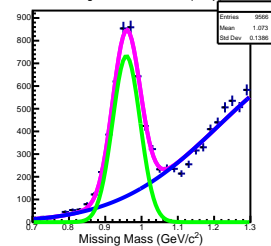
Missing Mass vs Pmiss d(e,e'p)n



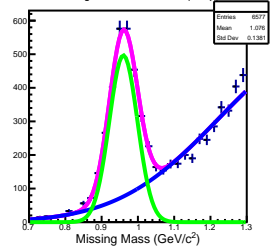
Missing Mass vs Pmiss d(e,e'p)n



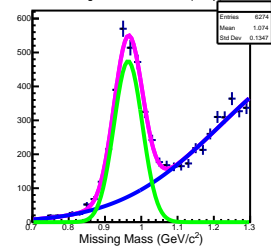
Missing Mass vs Pmiss d(e,e'p)n



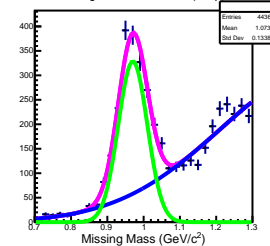
Missing Mass vs Pmiss d(e,e'p)n



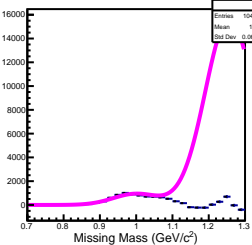
Missing Mass vs Pmiss d(e,e'p)n



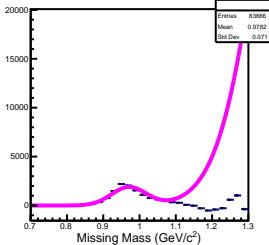
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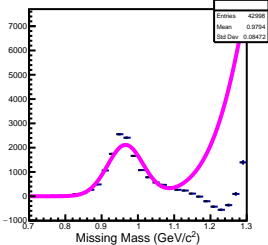
Missing Mass vs Pmiss d(e,e')n



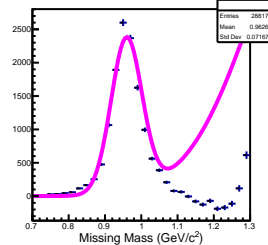
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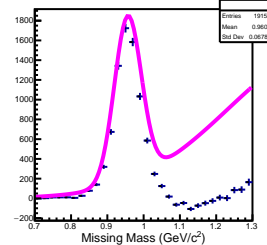
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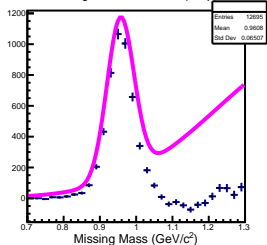
Missing Mass vs Pmiss d(e,e')n



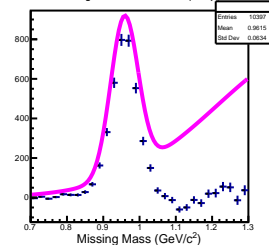
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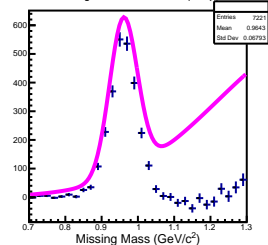
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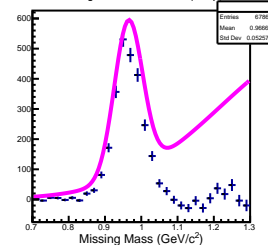
Missing Mass vs Pmiss d(e,e')n



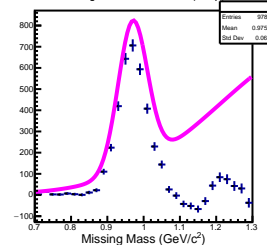
Missing Mass vs Pmiss d(e,e')n



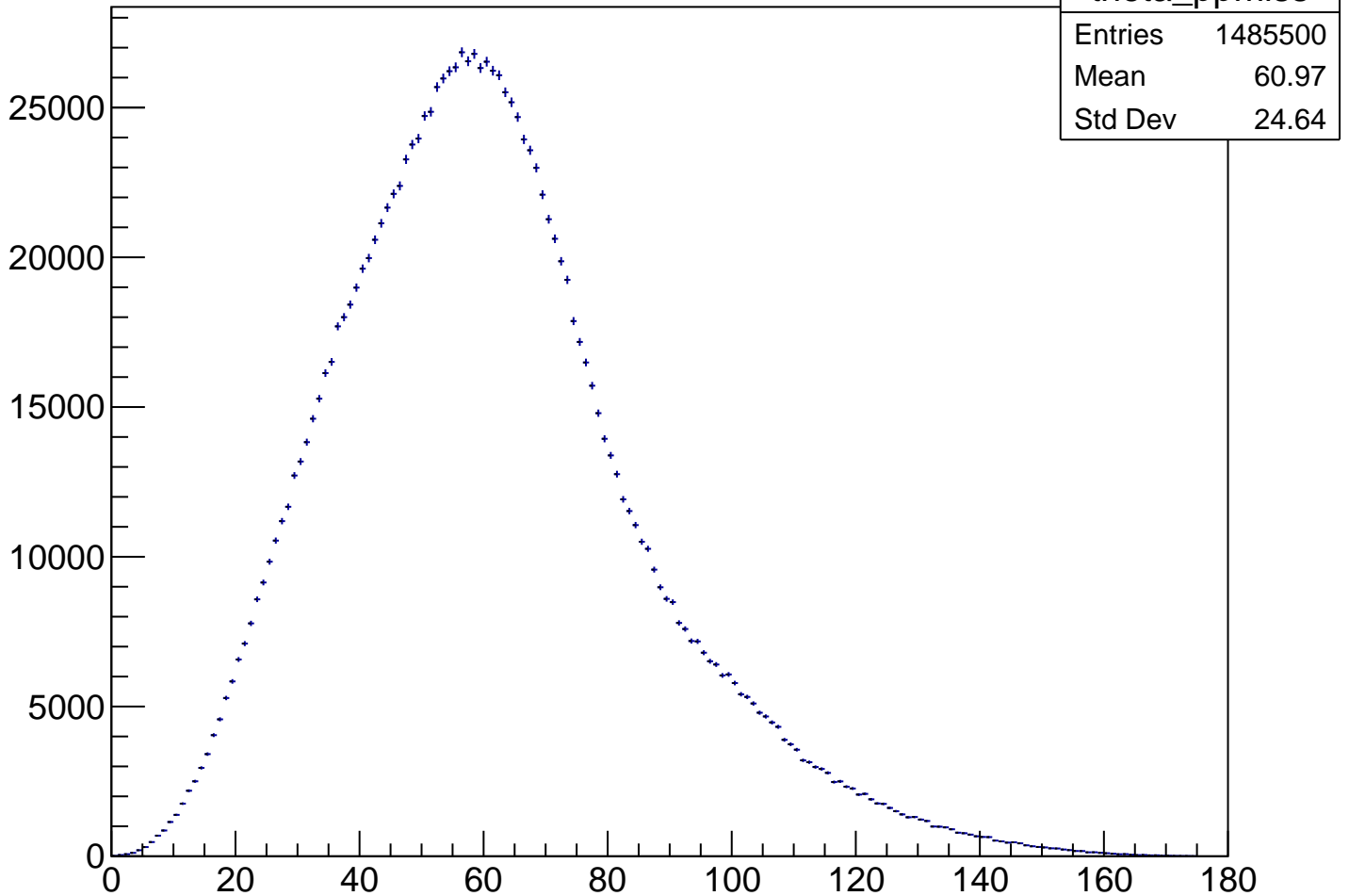
Missing Mass vs Pmiss d(e,e')n



Missing Mass vs Pmiss d(e,e')n

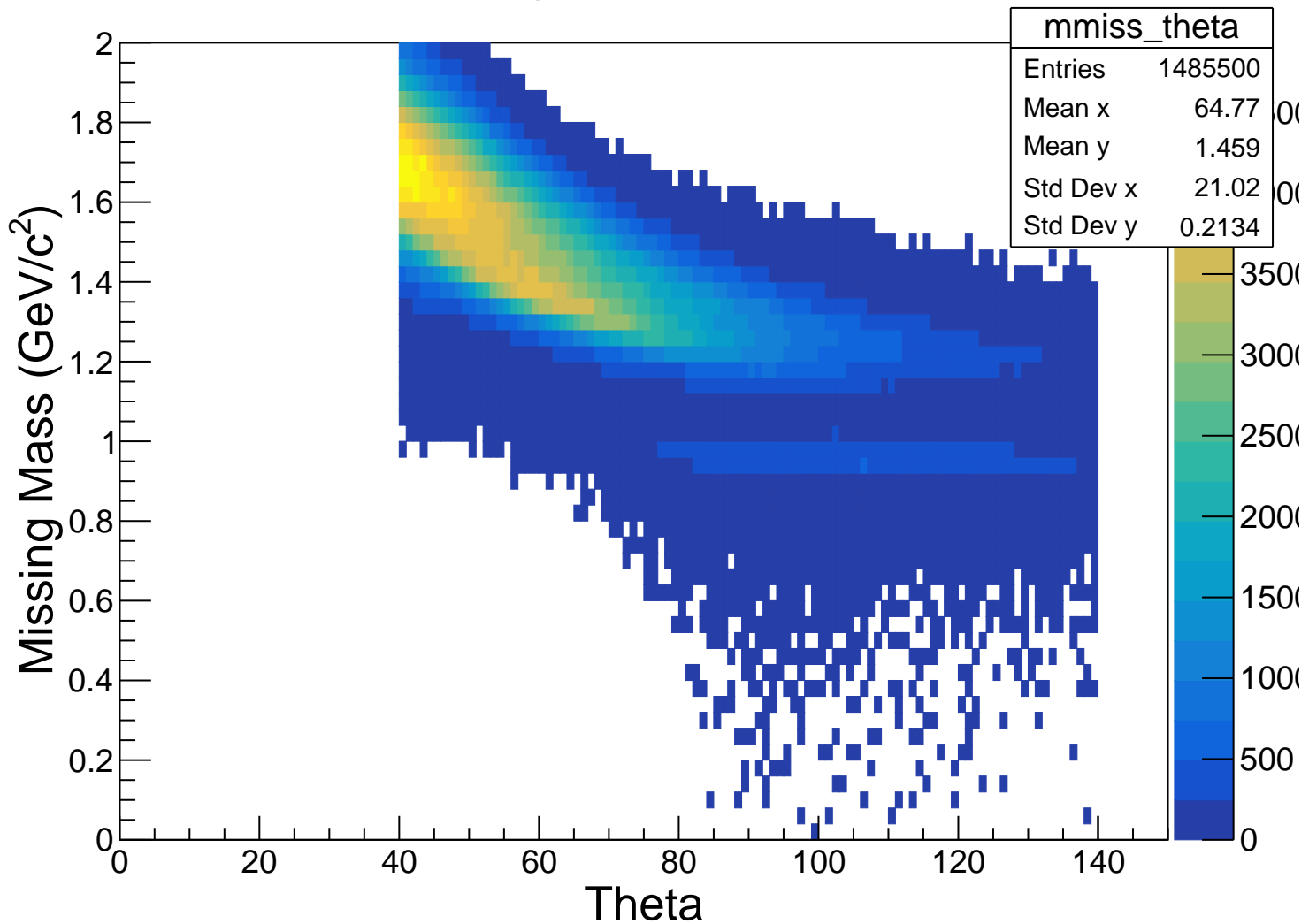


# Angle between $p_p$ and $p_{miss}$

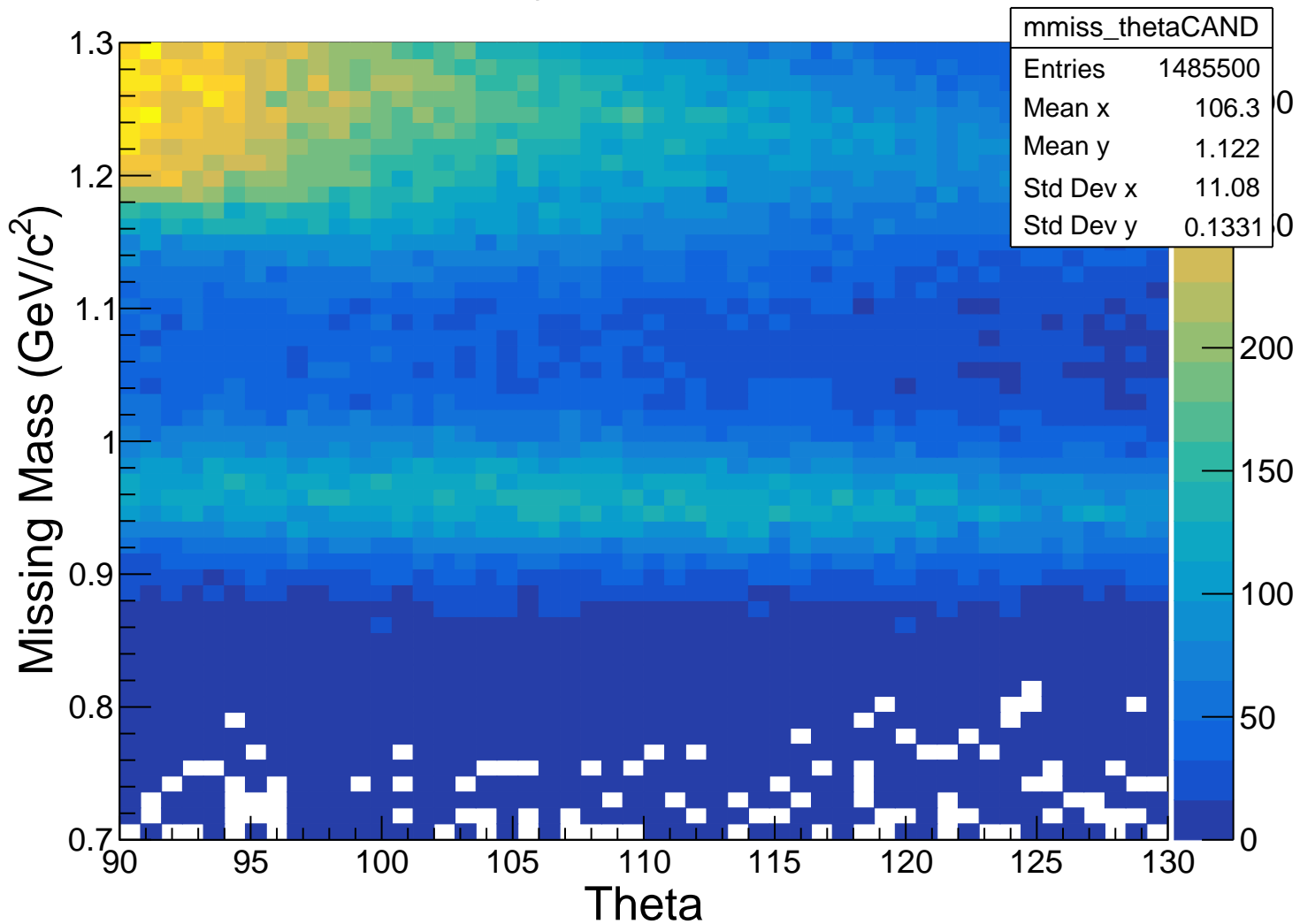


## **EFFICIENCY BY THETA - CANDIDATES**

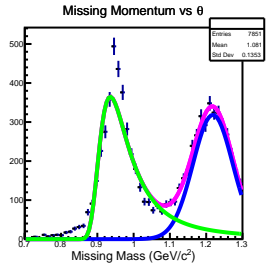
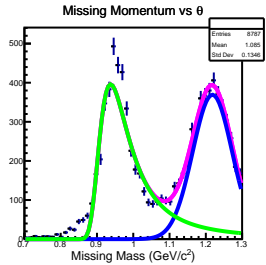
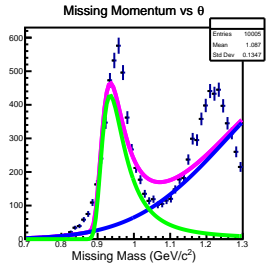
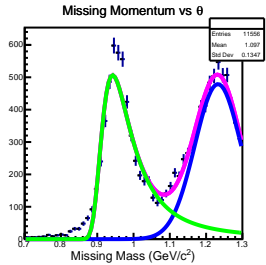
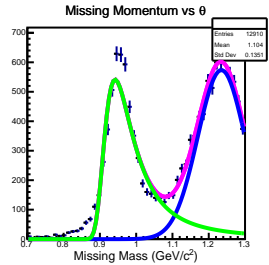
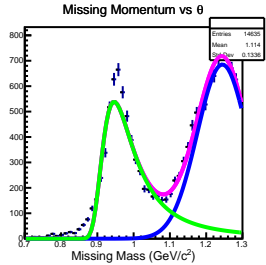
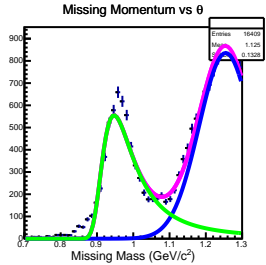
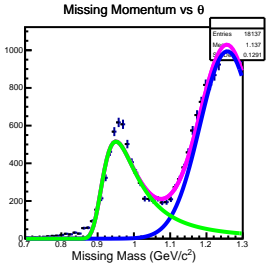
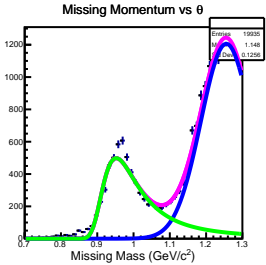
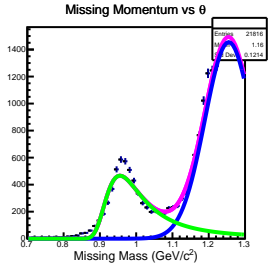
# Missing Momentum vs $\theta$

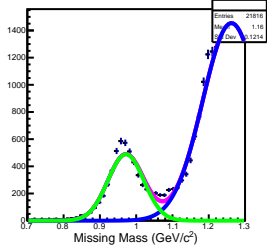
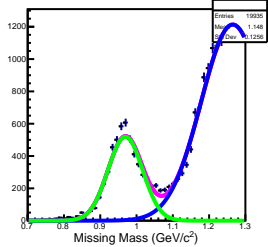
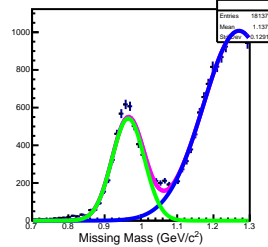
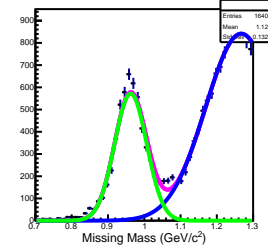
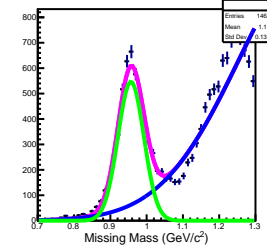
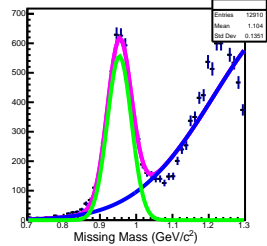
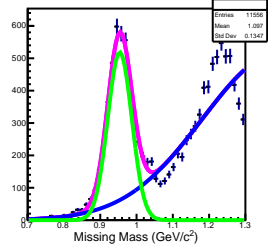
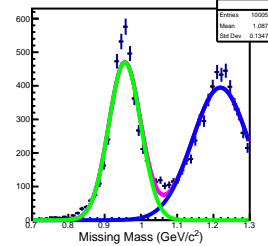
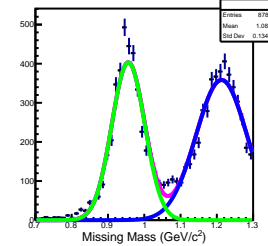
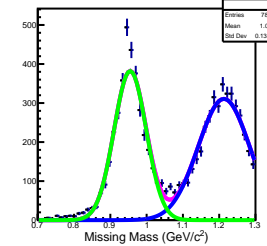


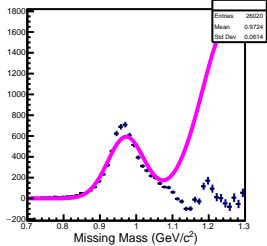
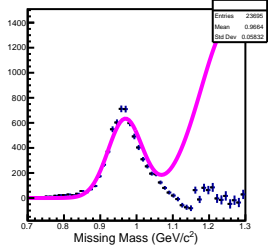
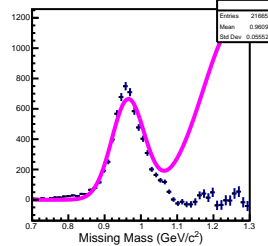
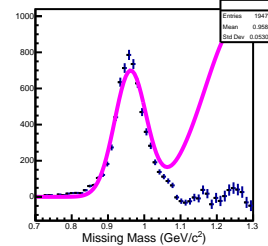
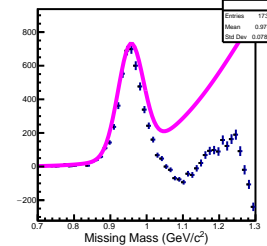
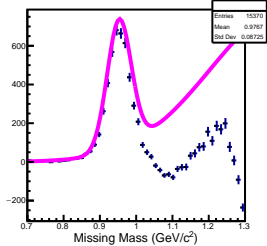
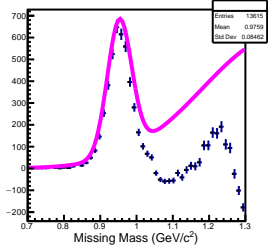
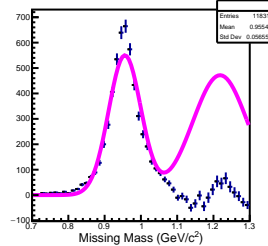
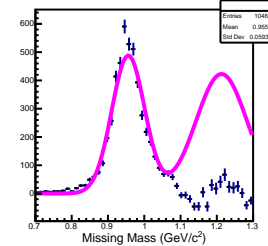
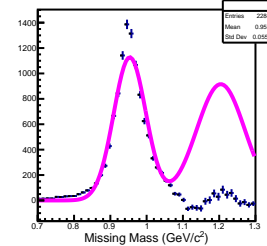
# Missing Momentum vs $\theta$







Missing Momentum vs  $\theta$ Missing Momentum vs  $\theta$ Missing Momentum vs  $\theta$ Missing Momentum vs  $\theta$ Missing Momentum vs  $\theta$ Missing Momentum vs  $\theta$ Missing Momentum vs  $\theta$ Missing Momentum vs  $\theta$ Missing Momentum vs  $\theta$ Missing Momentum vs  $\theta$ 

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**Basic electron cuts**

**Deuterium run 015053**

**$d(e,e'pn)$**

**proton cuts**

**$p_{\text{miss}}$  cuts**

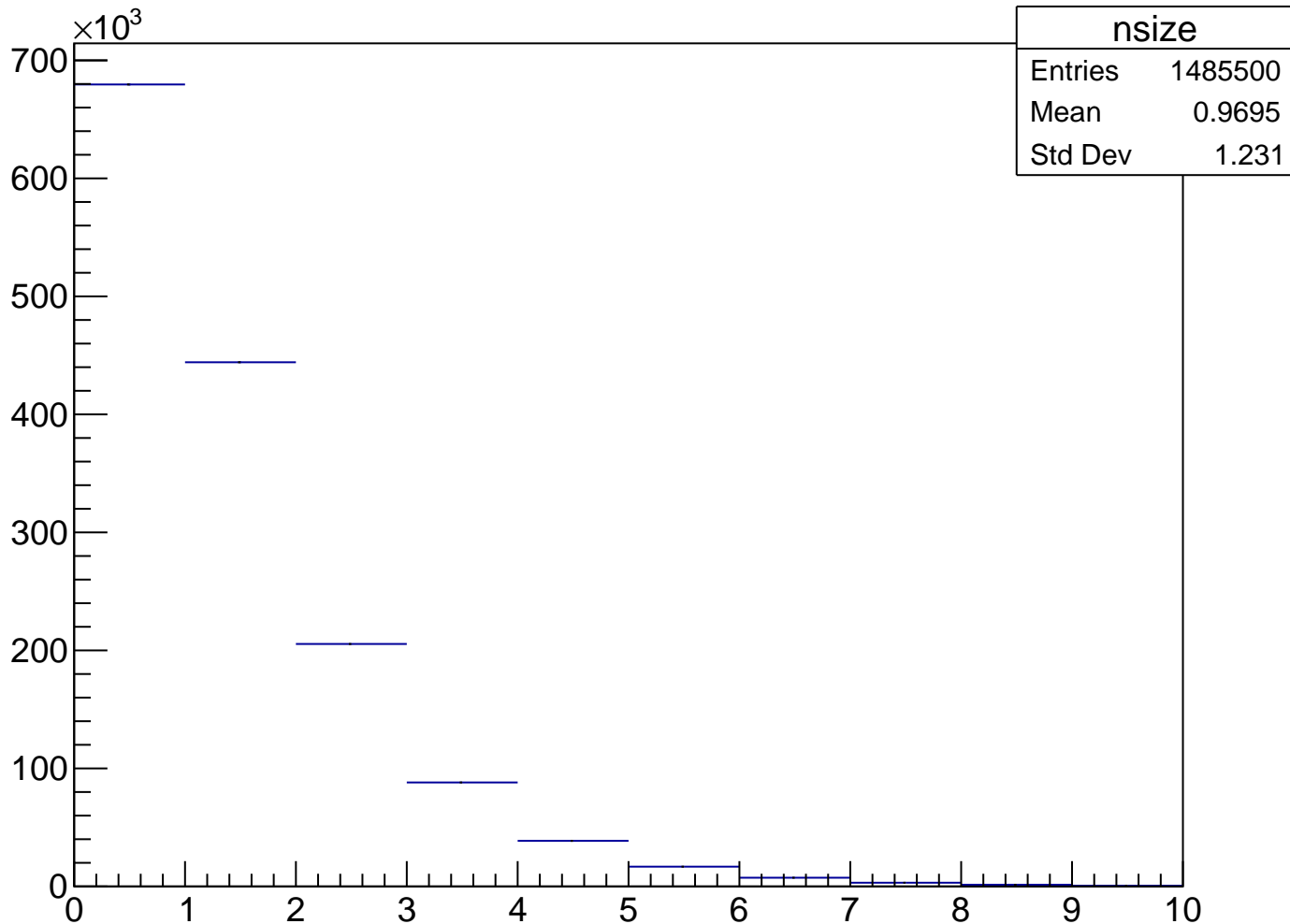
**Require neutron in CND**

**exclude  $\theta_n=0$ ,  $\phi_n=0$**

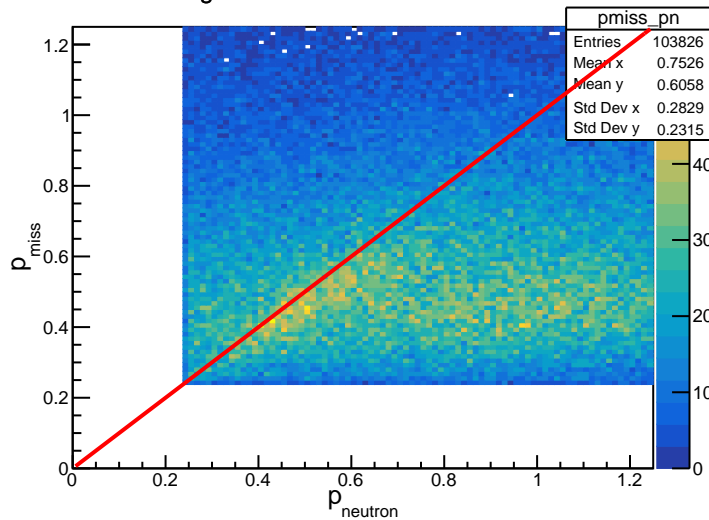
**$40 \text{ deg} < \theta_n < 140 \text{ deg}$**

**$0.25 < \beta_n < 0.8$**

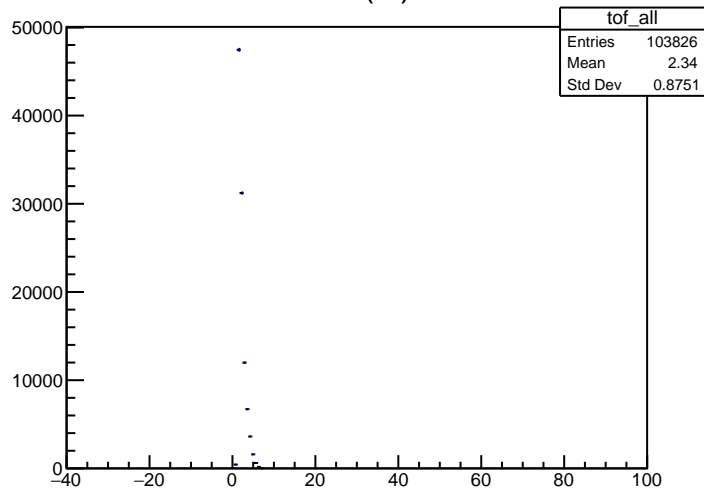
# Number of reconstructed neutrons



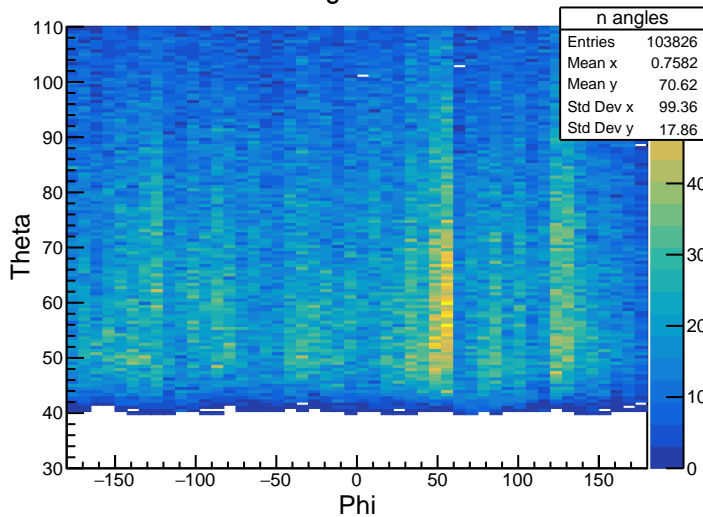
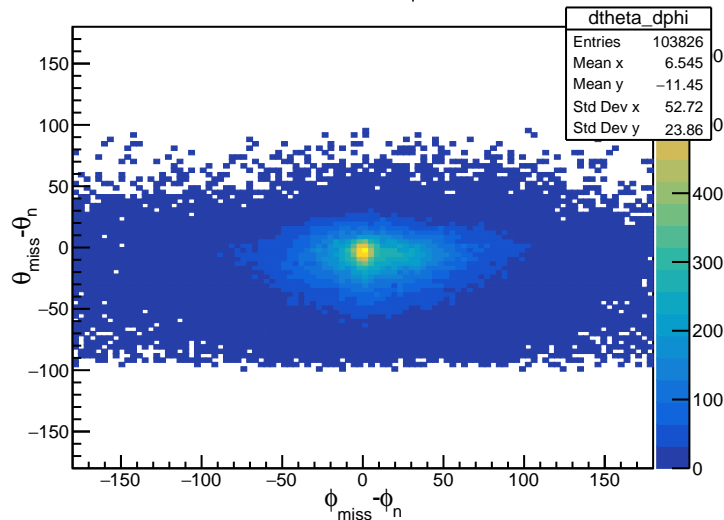
Missing Momentum vs Neutron Momentum



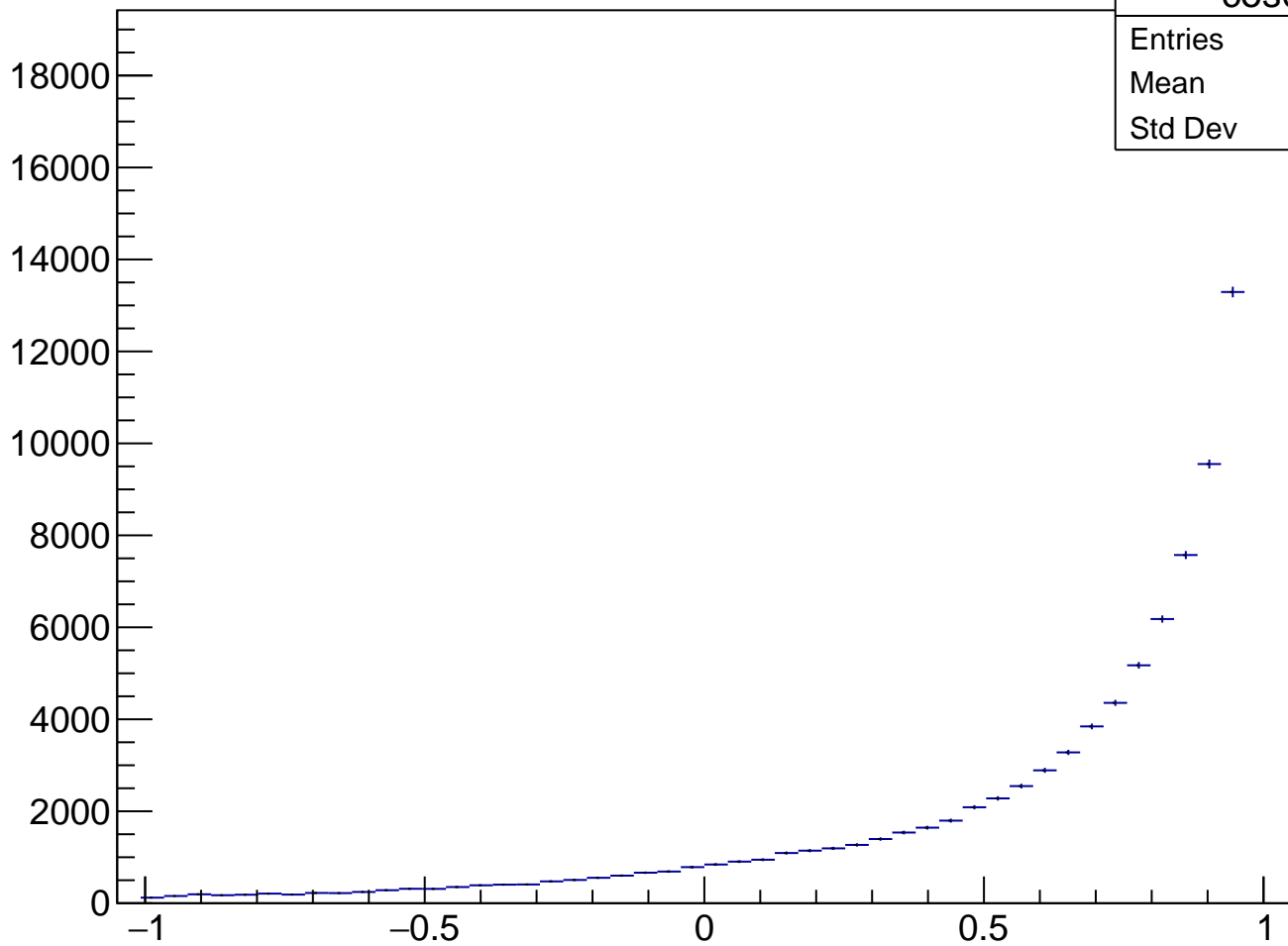
TOF (ns)



Neutron Angular Distribution

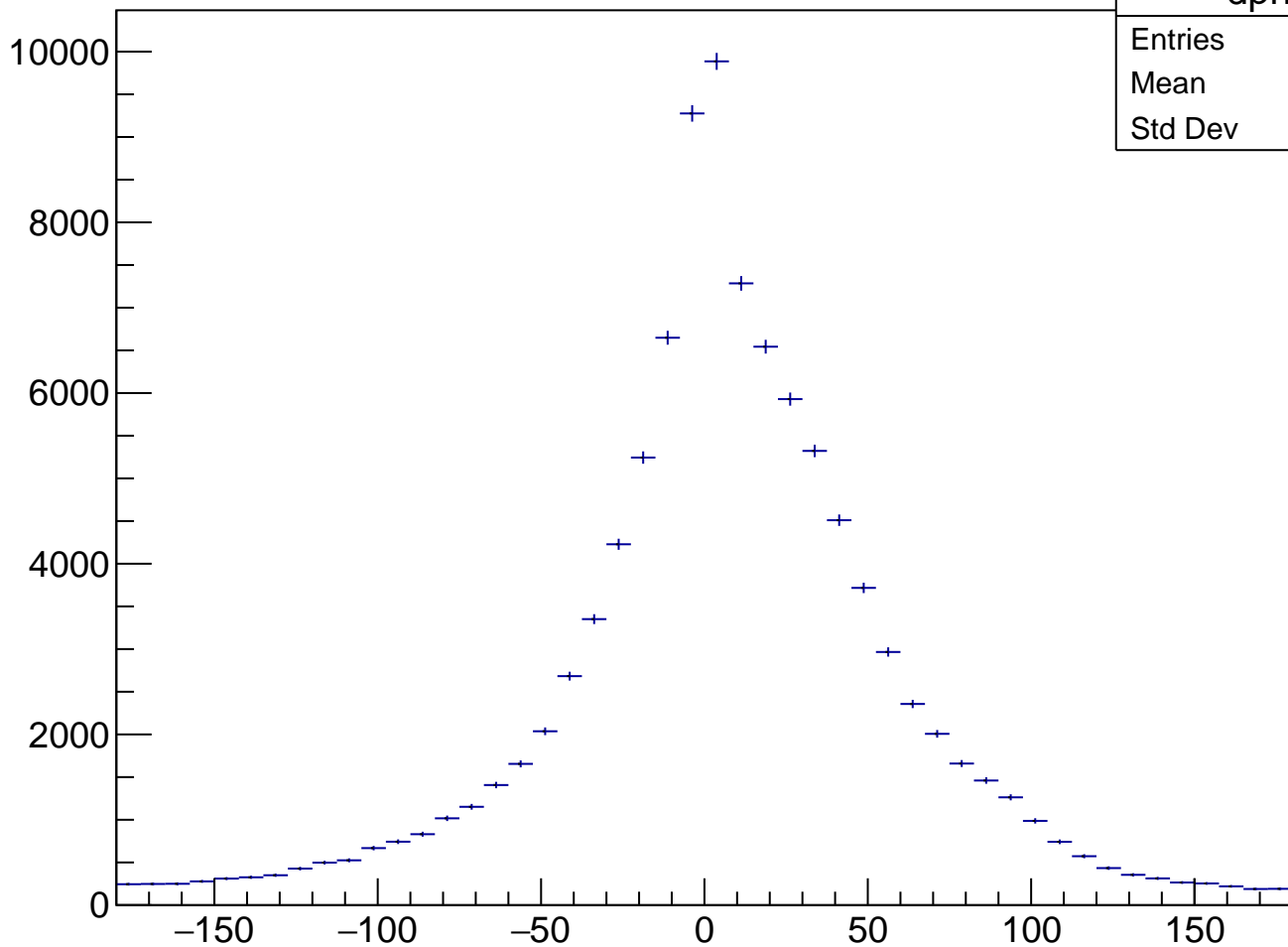
 $\Delta \theta$  vs  $\Delta \phi$ 

$\cos \theta_{\text{pmiss,pneutron}}$



cos0	
Entries	103826
Mean	0.663
Std Dev	0.3972

$$\Delta \phi = \phi_{\text{pmiss}} - \phi_n$$





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Deuterium run 015053

$d(e,e'pn)$

proton cuts

$p_{\text{miss}}$  cuts

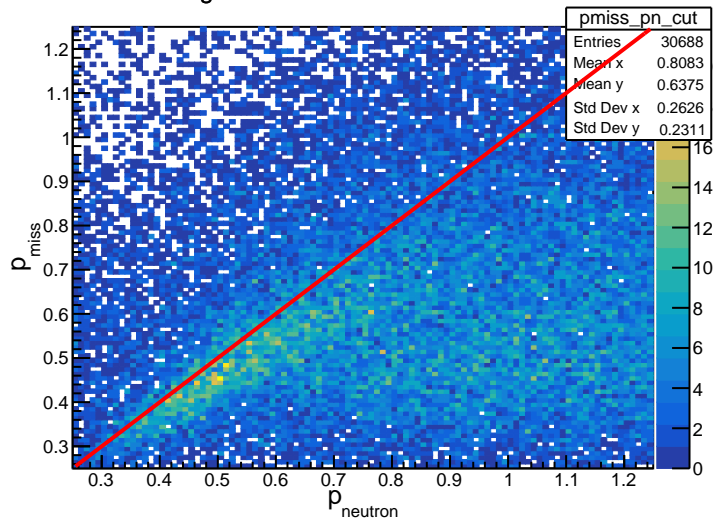
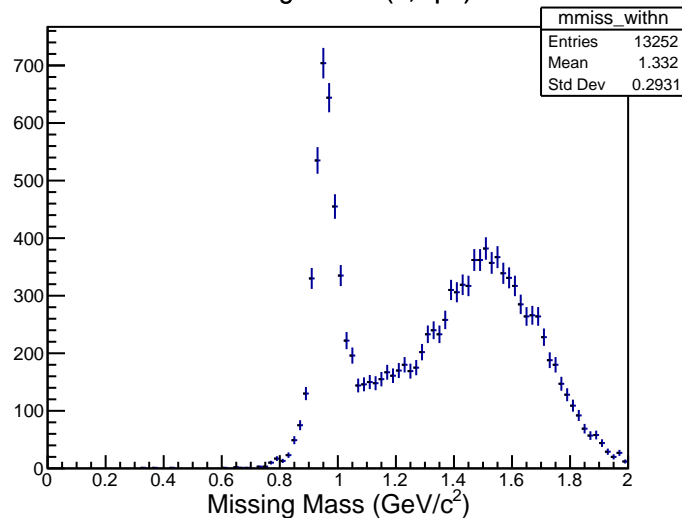
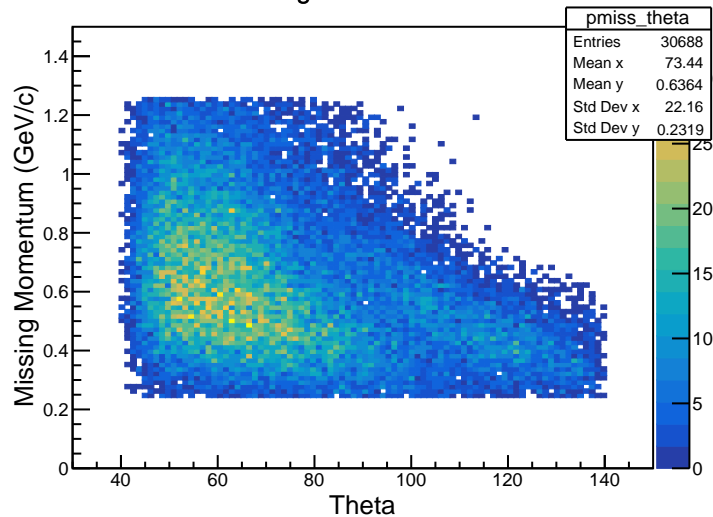
exclude  $\theta_n=0$ ,  $\phi_n=0$

$40 \text{ deg} < \theta_n < 140 \text{ deg}$

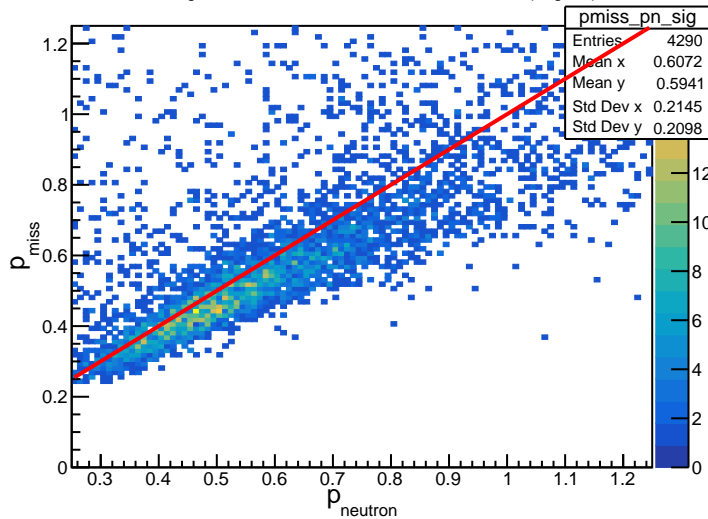
$0.25 < \beta_n < 0.8$

$\cos \theta_{p\text{miss},pn} > 0.9$ ,  $-20 < \Delta \phi < 20$

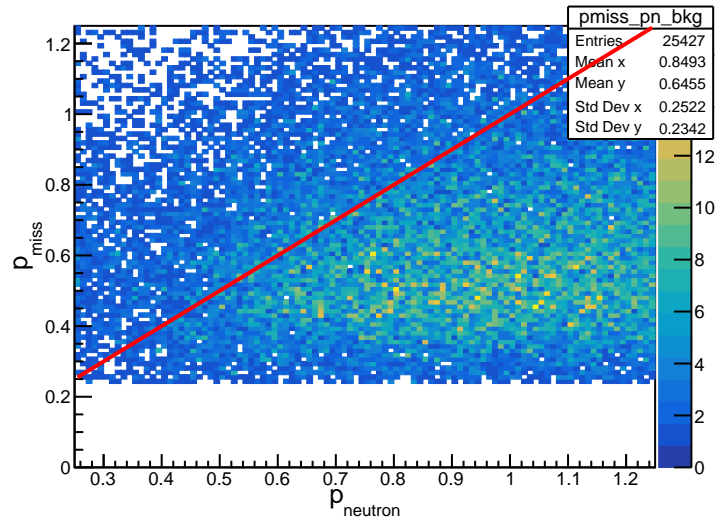
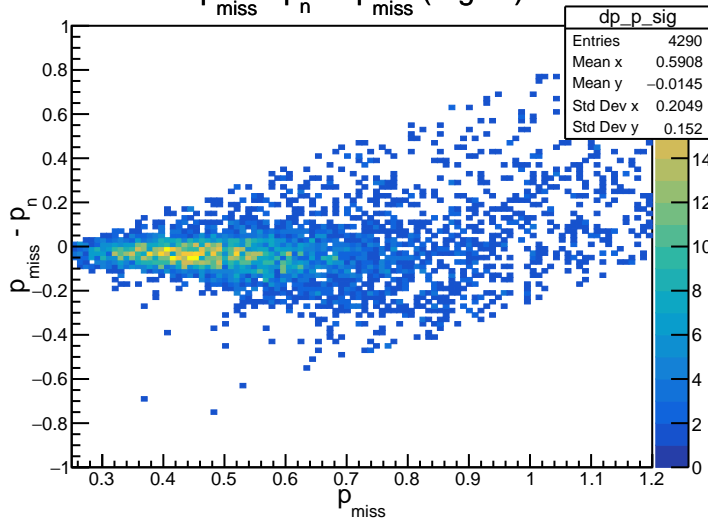
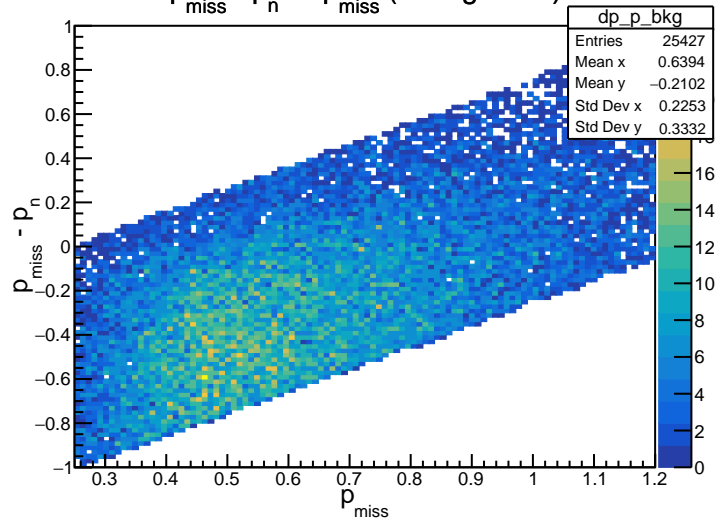
Missing Momentum vs Neutron Momentum

Missing Mass  $d(e,e'pn)$ Missing Momentum vs  $\theta$ 

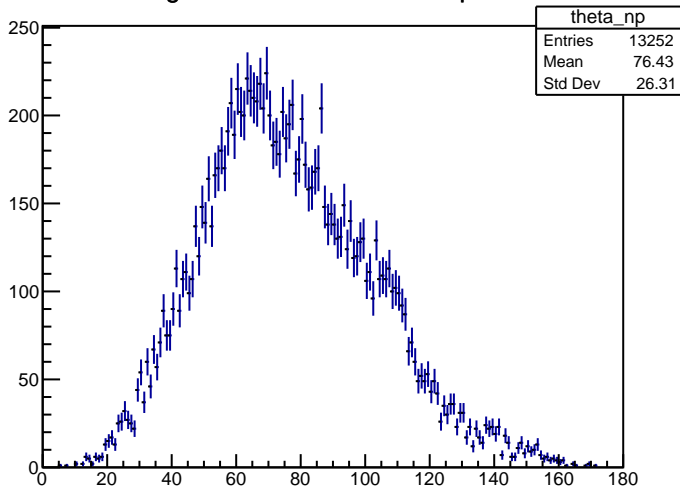
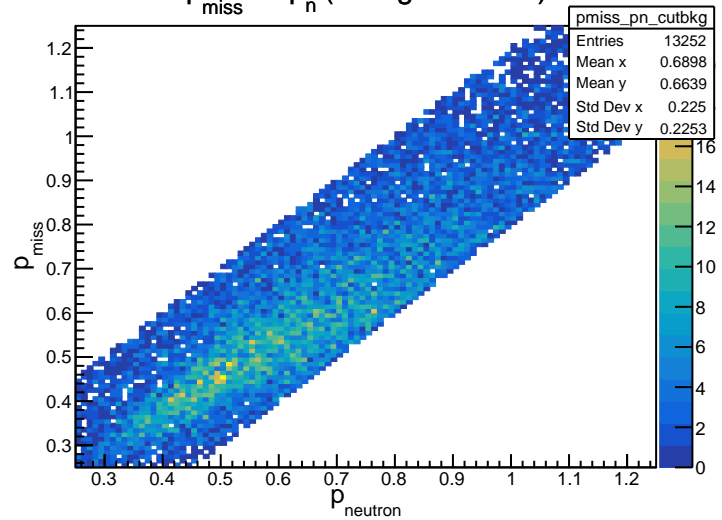
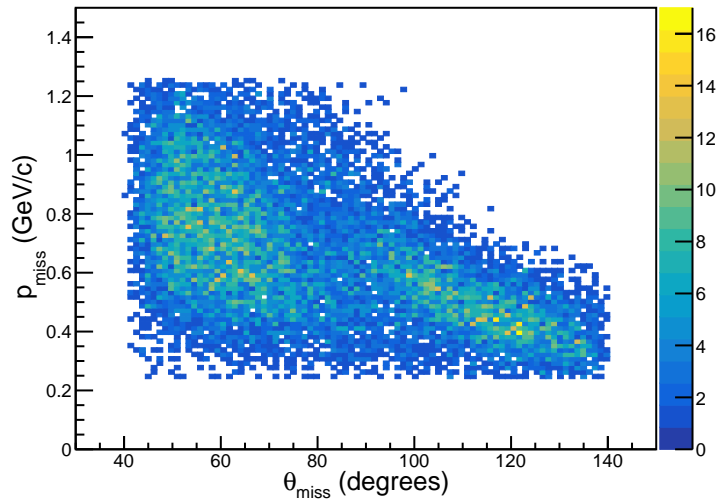
Missing Momentum vs Neutron Momentum (Signal)



Missing Momentum vs Neutron Momentum (Background)

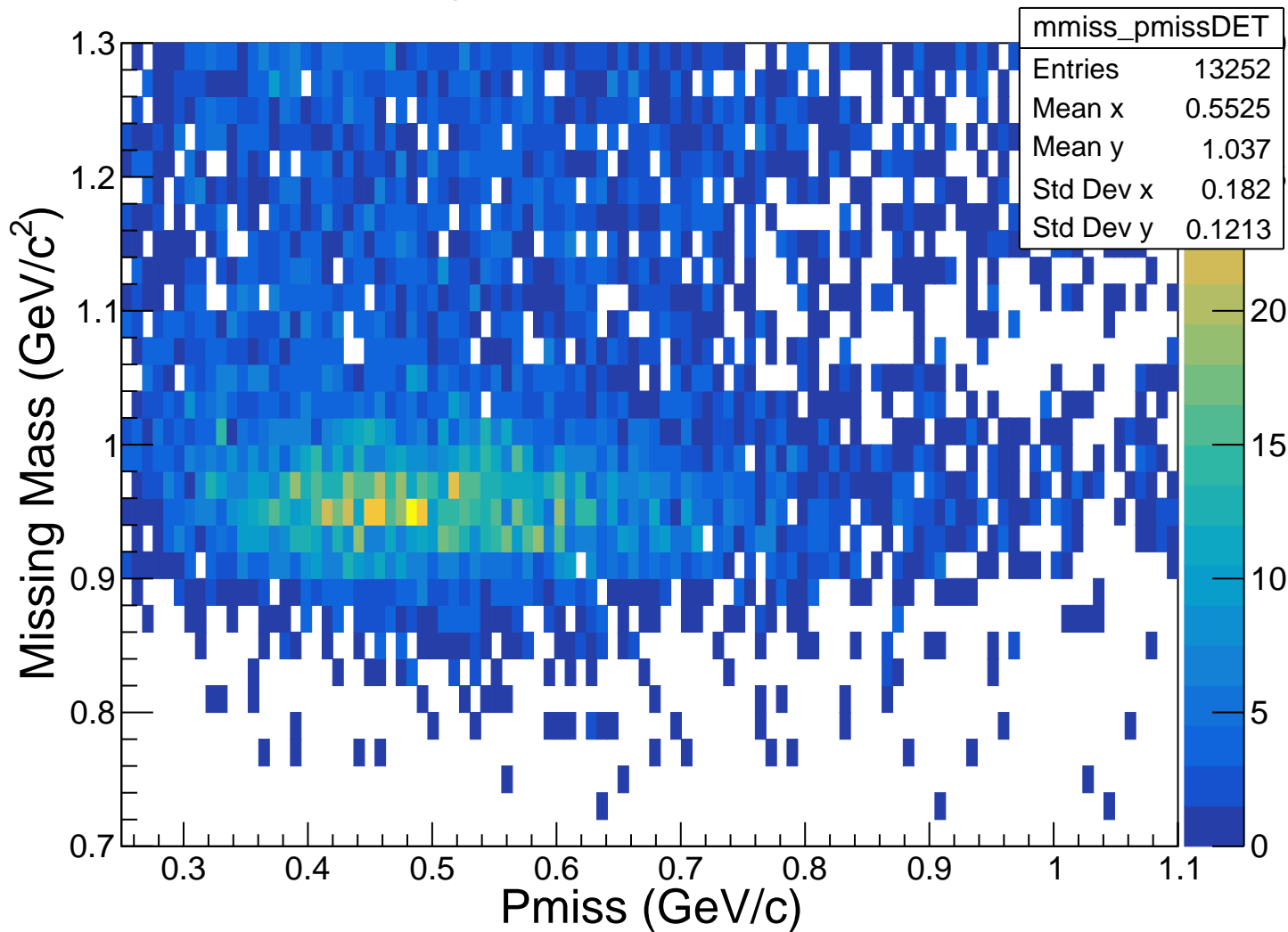
 $p_{\text{miss}} - p_n$  vs  $p_{\text{miss}}$  (Signal) $p_{\text{miss}} - p_n$  vs  $p_{\text{miss}}$  (Background)

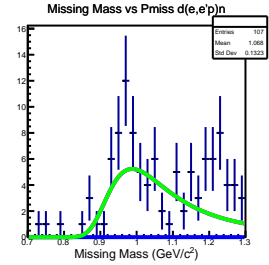
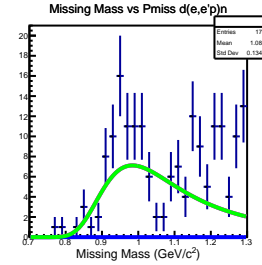
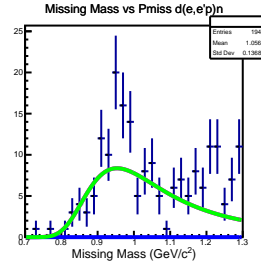
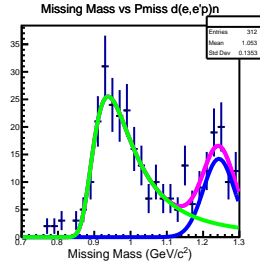
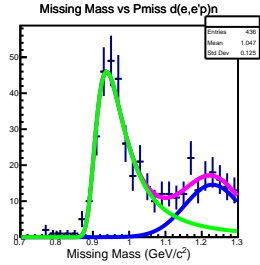
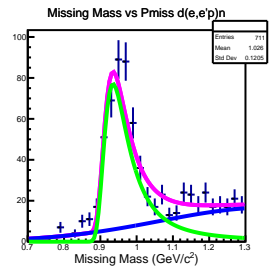
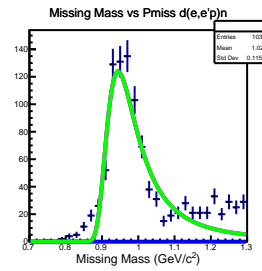
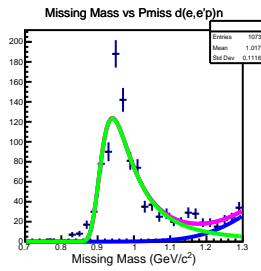
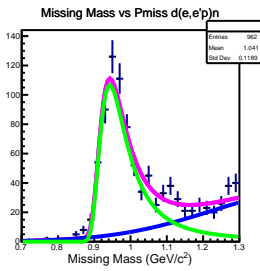
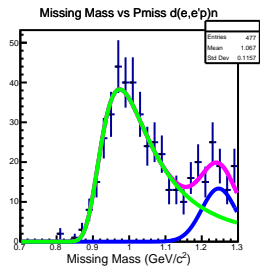
Angle between neutron and proton

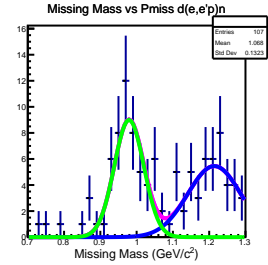
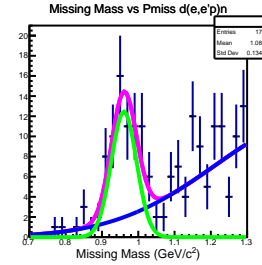
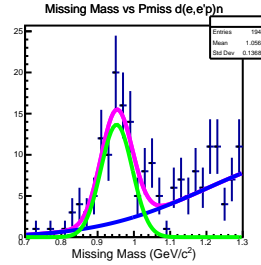
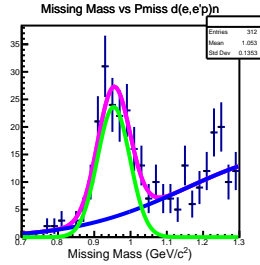
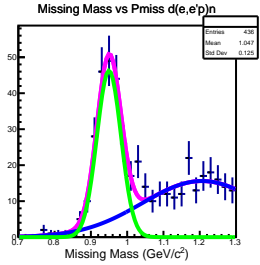
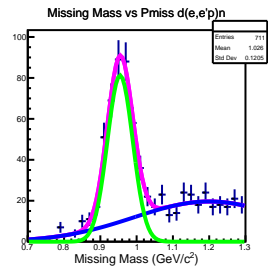
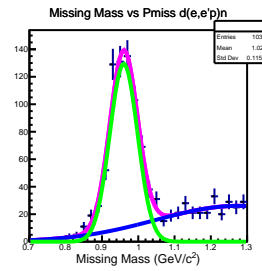
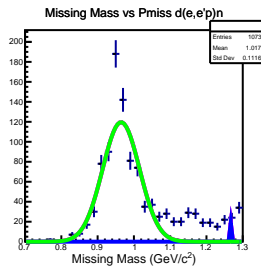
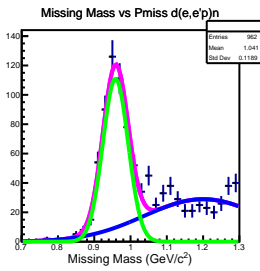
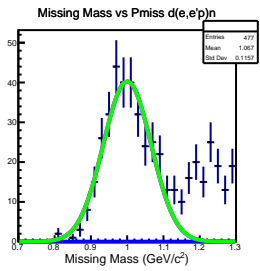
 $p_{\text{miss}}$  vs  $p_n$  (background cut)Missing Momentum vs  $p_{\text{miss}}$  Polar Angle

**EFFICIENCY BY MOMENTUM - DETECTED**

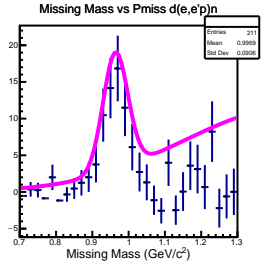
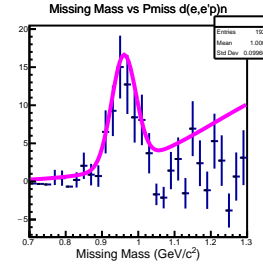
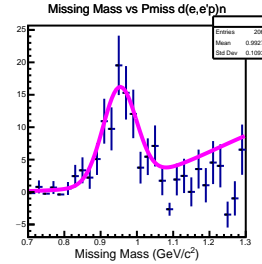
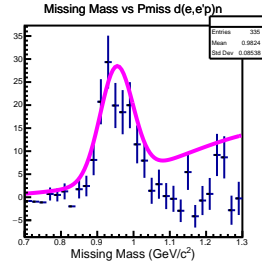
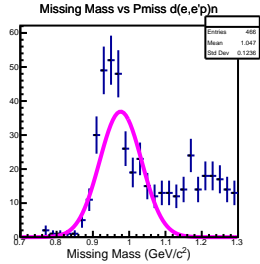
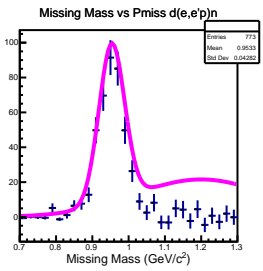
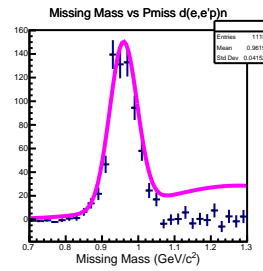
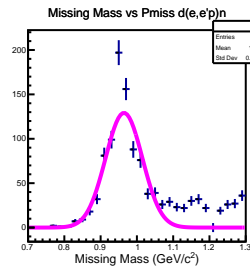
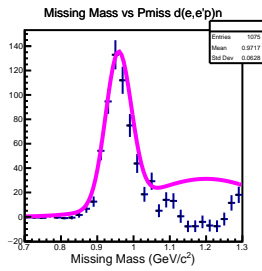
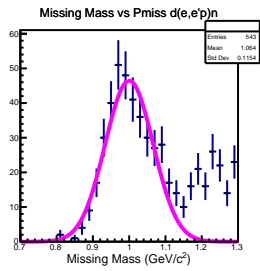
# Missing Mass vs Pmiss d(e,e'p)n

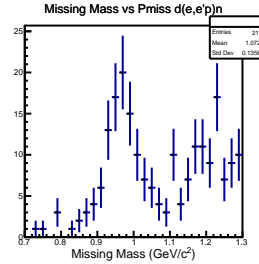
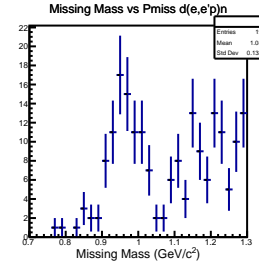
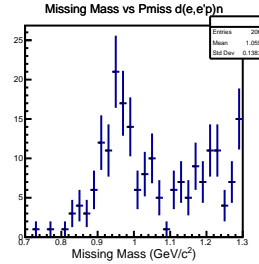
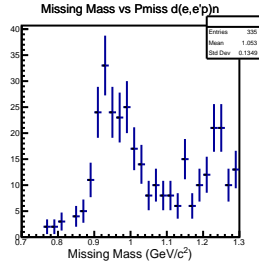
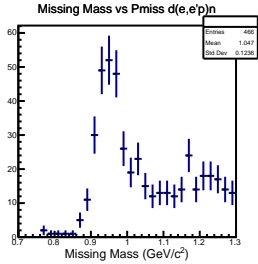
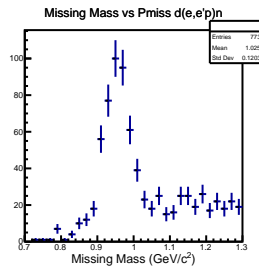
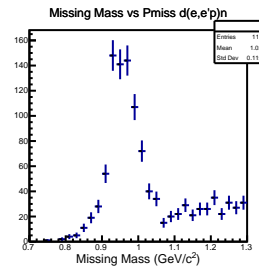
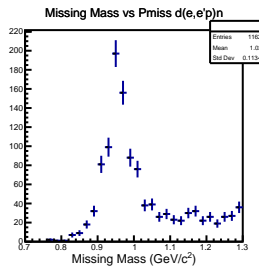
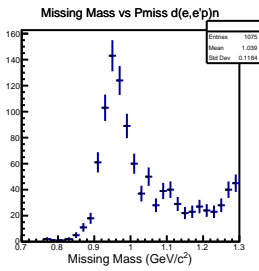
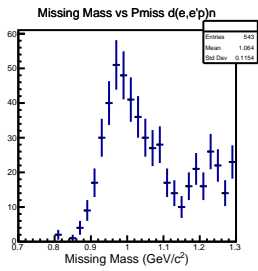






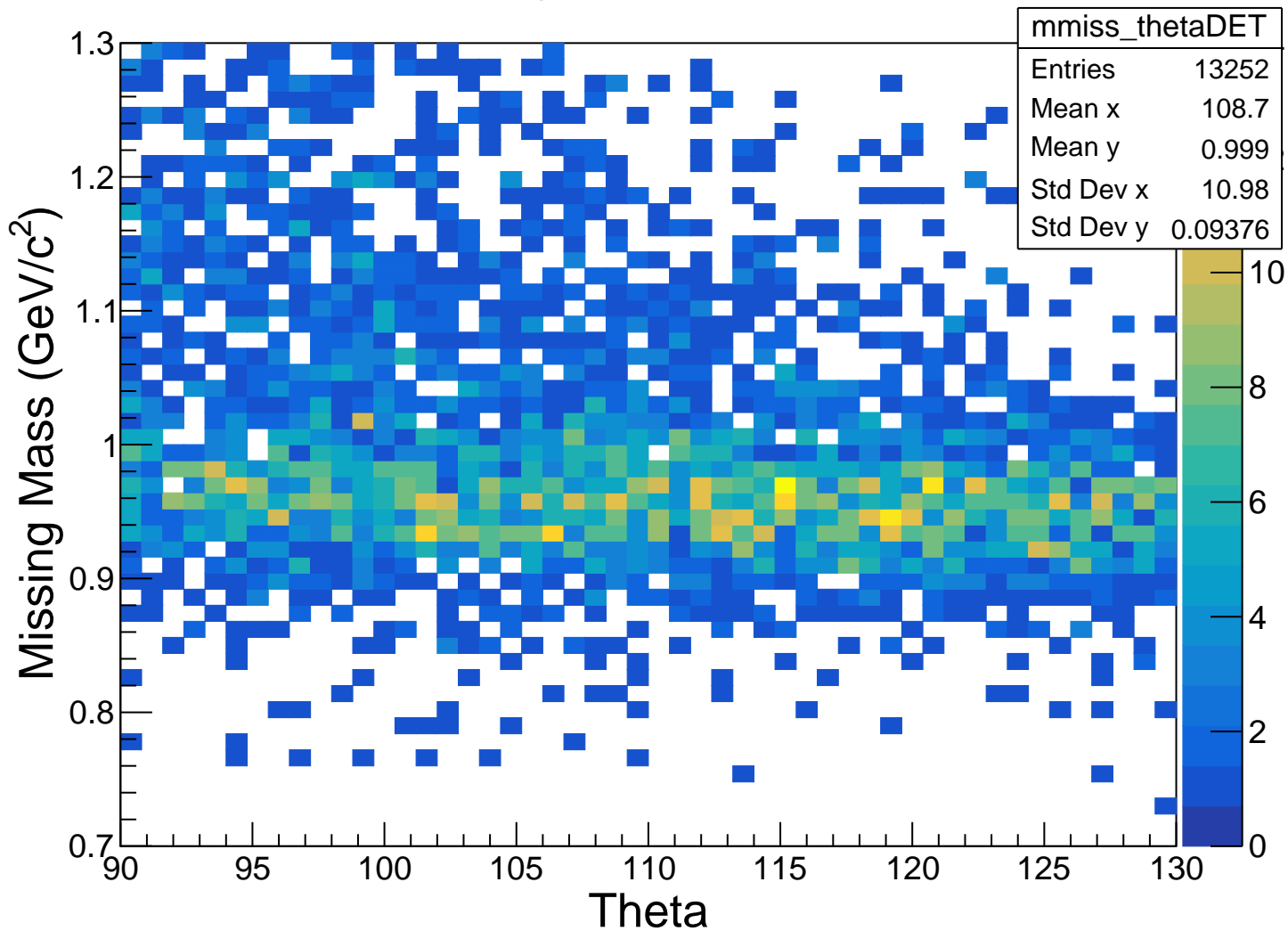


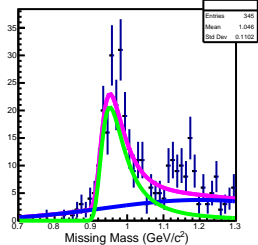
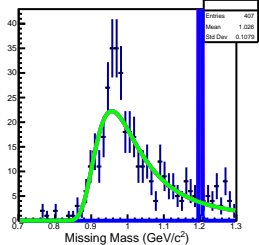
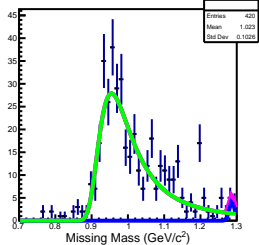
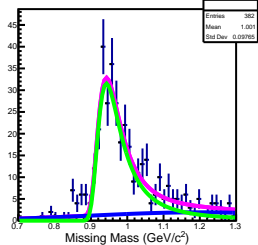
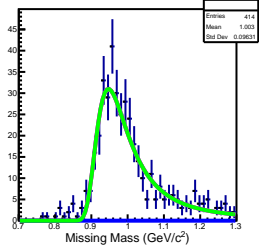
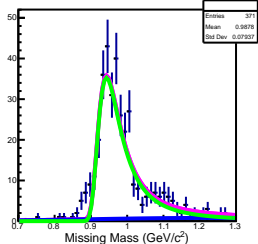
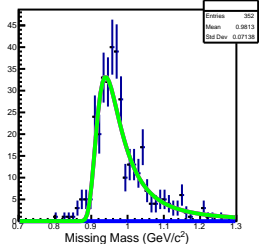
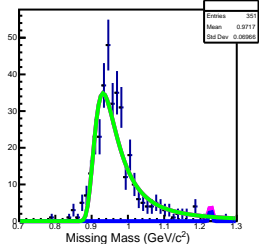
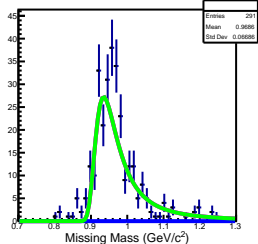
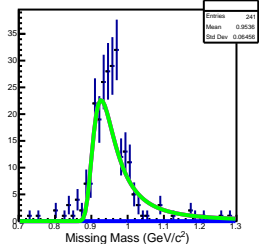


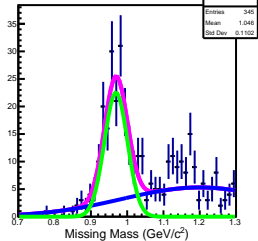
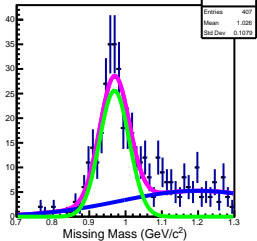
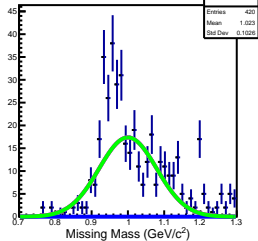
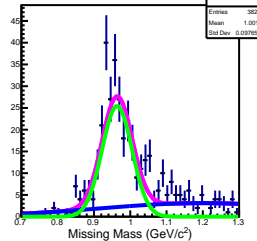
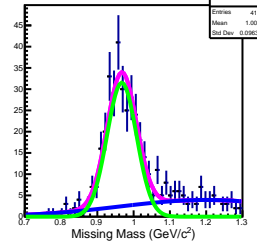
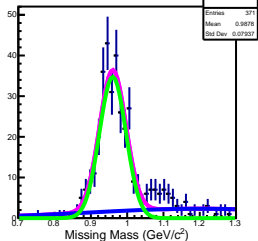
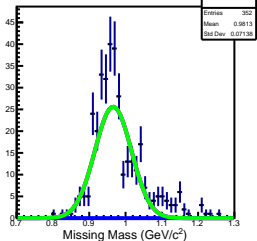
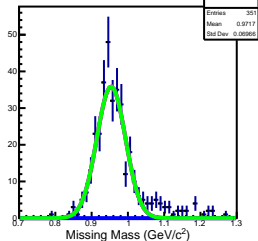
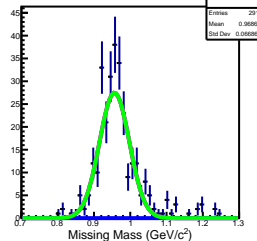
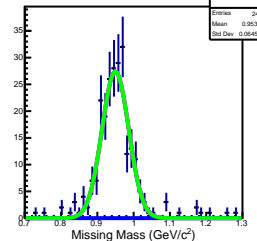


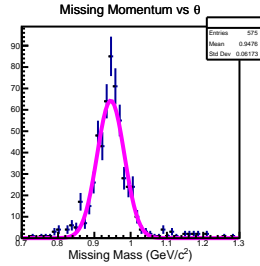
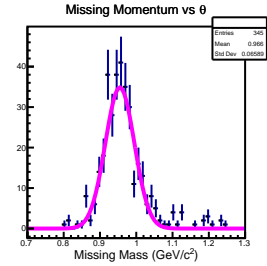
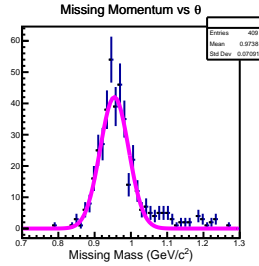
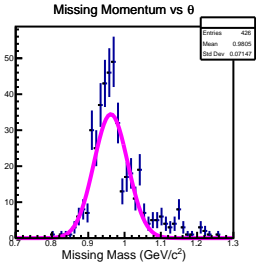
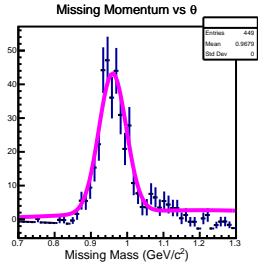
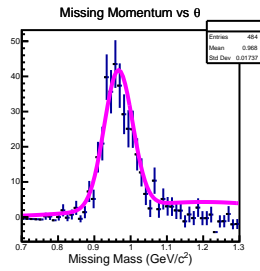
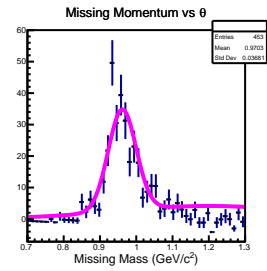
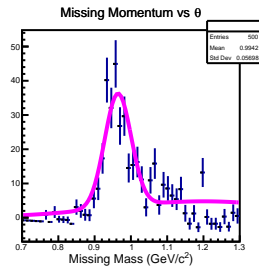
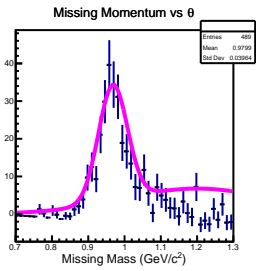
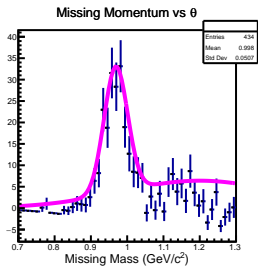
**EFFICIENCY BY THETA - DETECTED**

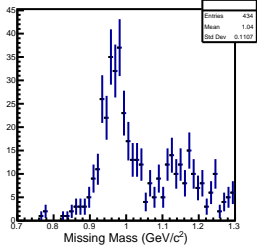
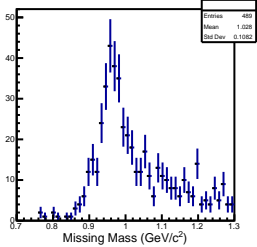
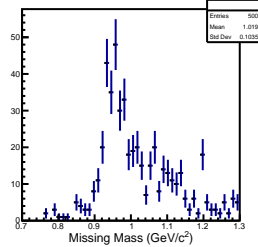
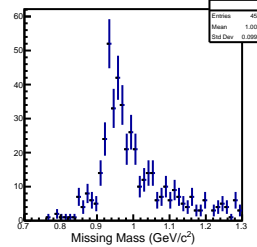
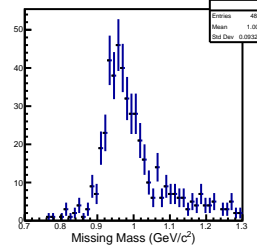
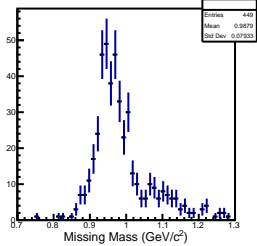
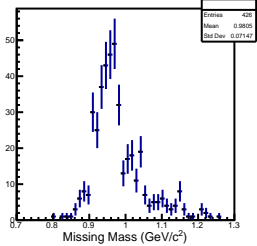
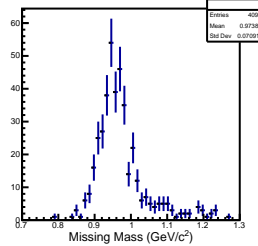
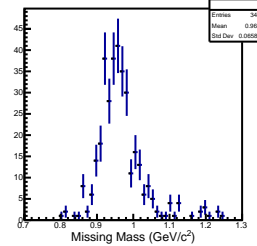
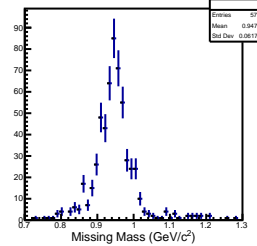
# Missing Momentum vs $\theta$



Missing Momentum vs  $\theta$ Missing Momentum vs  $\theta$ Missing Momentum vs  $\theta$ Missing Momentum vs  $\theta$ Missing Momentum vs  $\theta$ Missing Momentum vs  $\theta$ Missing Momentum vs  $\theta$ Missing Momentum vs  $\theta$ Missing Momentum vs  $\theta$ Missing Momentum vs  $\theta$ 

Missing Momentum vs  $\theta$ Missing Momentum vs  $\theta$ Missing Momentum vs  $\theta$ Missing Momentum vs  $\theta$ Missing Momentum vs  $\theta$ Missing Momentum vs  $\theta$ Missing Momentum vs  $\theta$ Missing Momentum vs  $\theta$ Missing Momentum vs  $\theta$ Missing Momentum vs  $\theta$ 

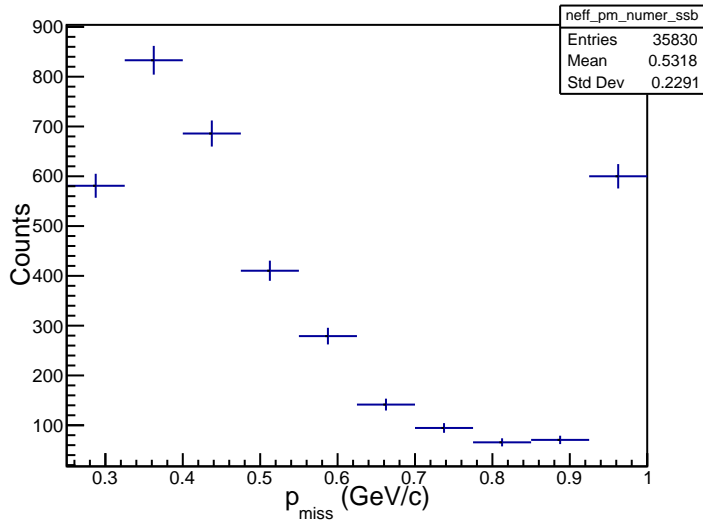


Missing Momentum vs  $\theta$ Missing Momentum vs  $\theta$ Missing Momentum vs  $\theta$ Missing Momentum vs  $\theta$ Missing Momentum vs  $\theta$ Missing Momentum vs  $\theta$ Missing Momentum vs  $\theta$ Missing Momentum vs  $\theta$ Missing Momentum vs  $\theta$ Missing Momentum vs  $\theta$ 

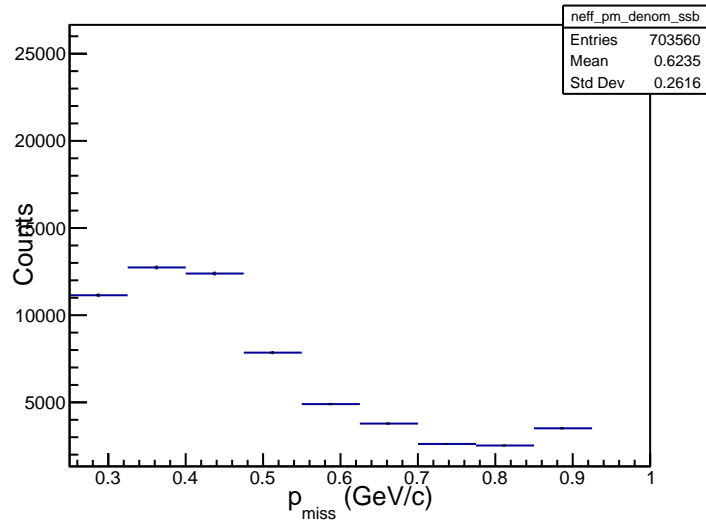


## **EFFICIENCY RESULTS**

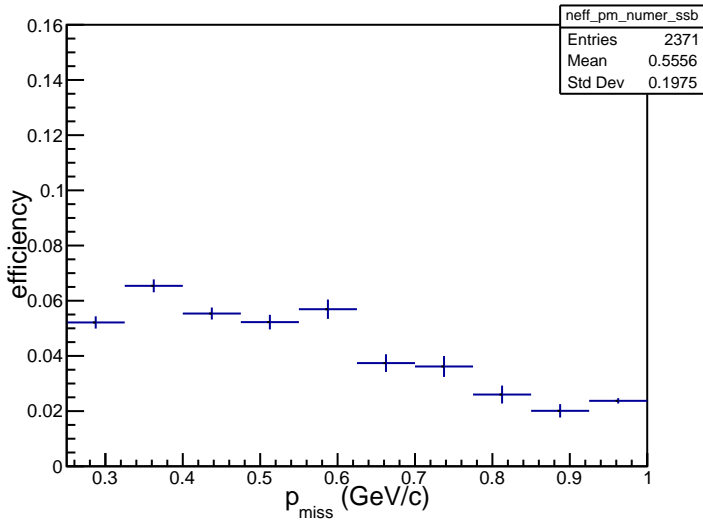
Neutrons



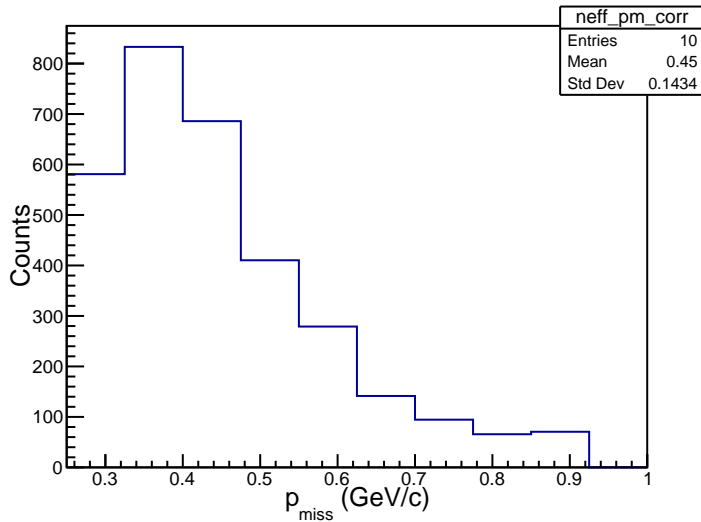
Neutron Candidates



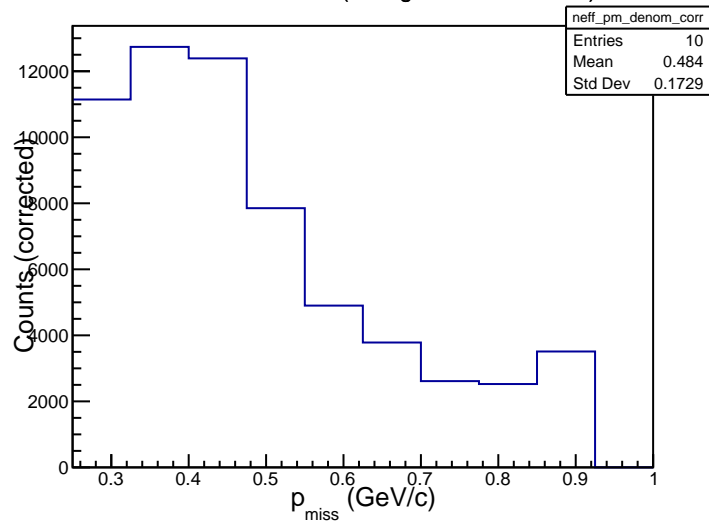
Neutrons



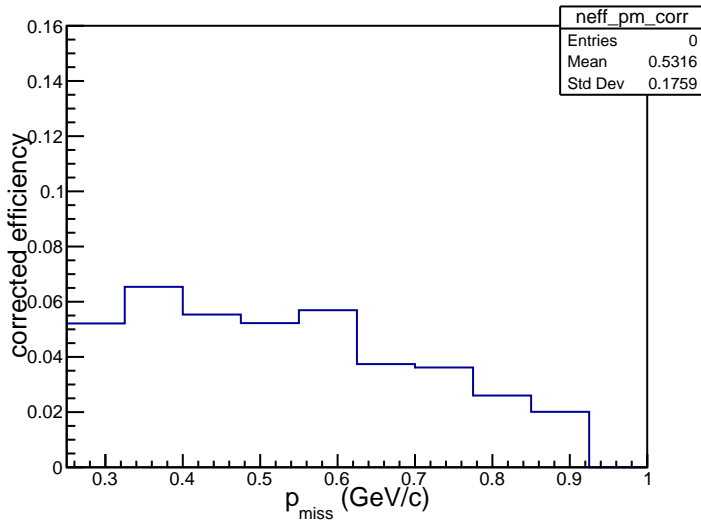
Neutrons



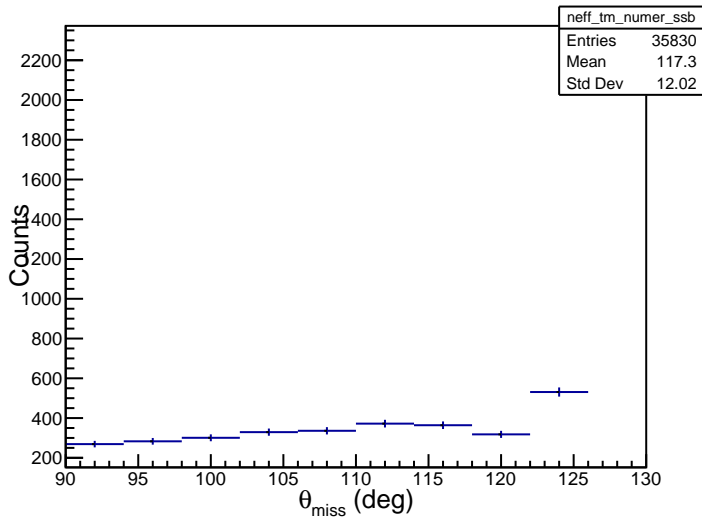
Neutron Candidates (Background Subtracted)



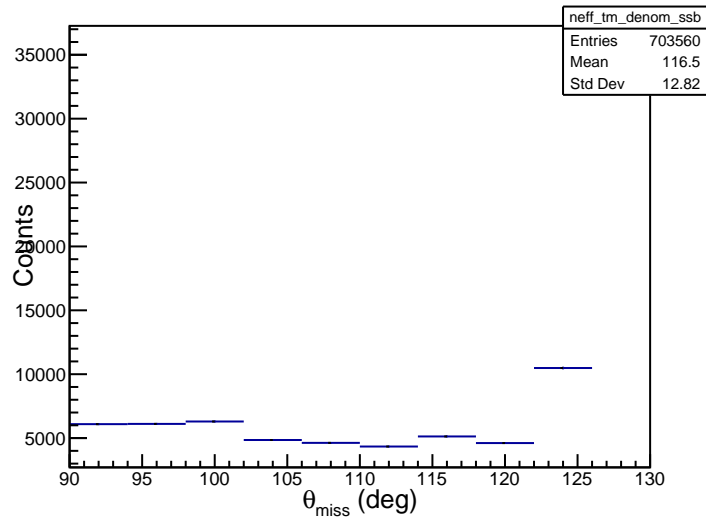
Neutrons



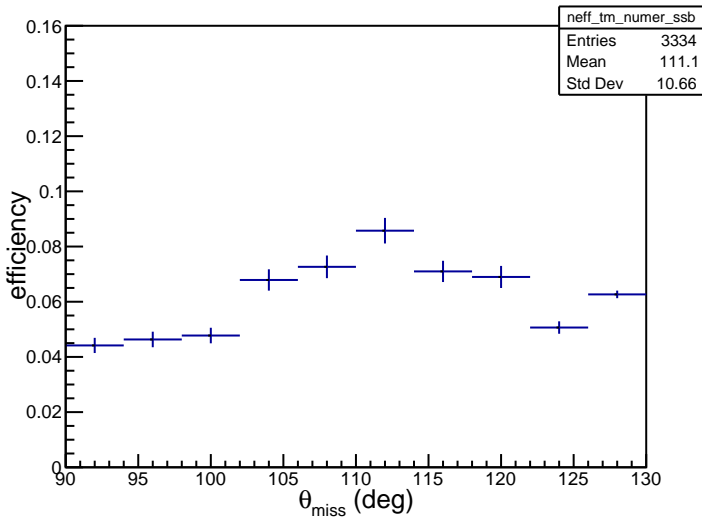
Detected Neutrons



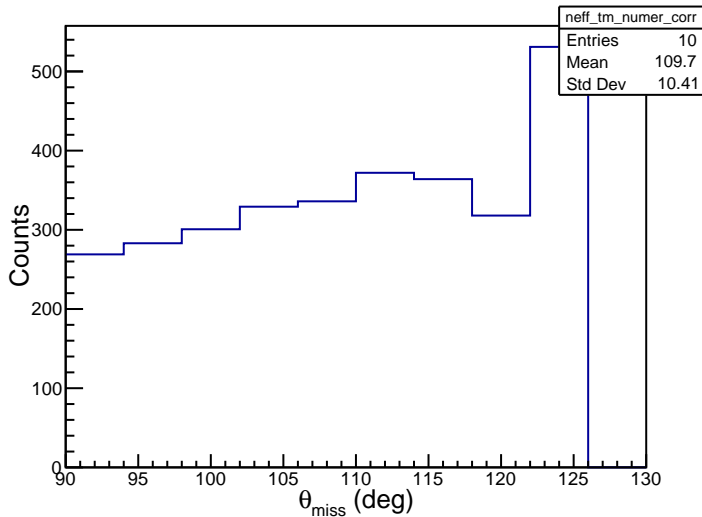
Neutron Candidates



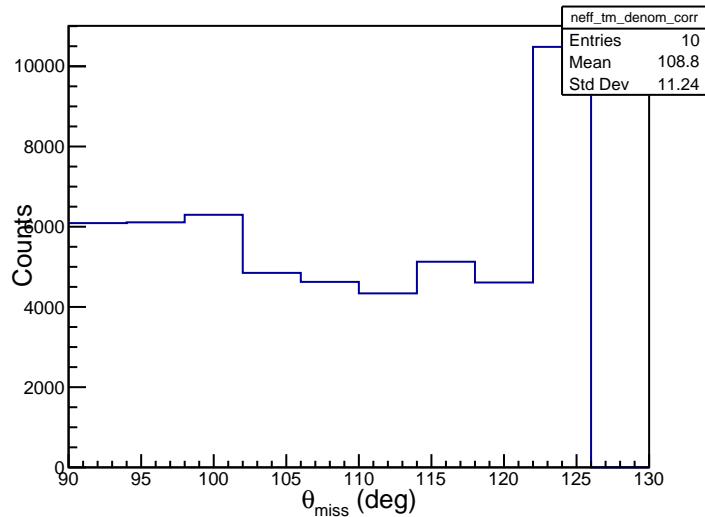
Detected Neutrons



Detected Neutrons



Neutron Candidates



Detected Neutrons

