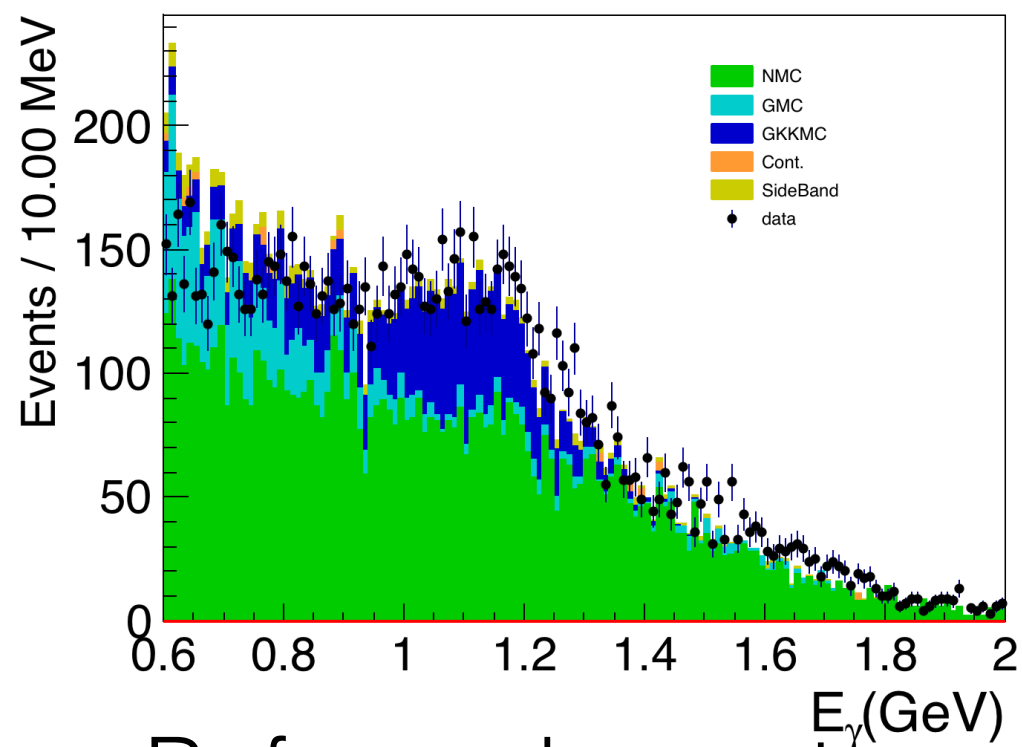


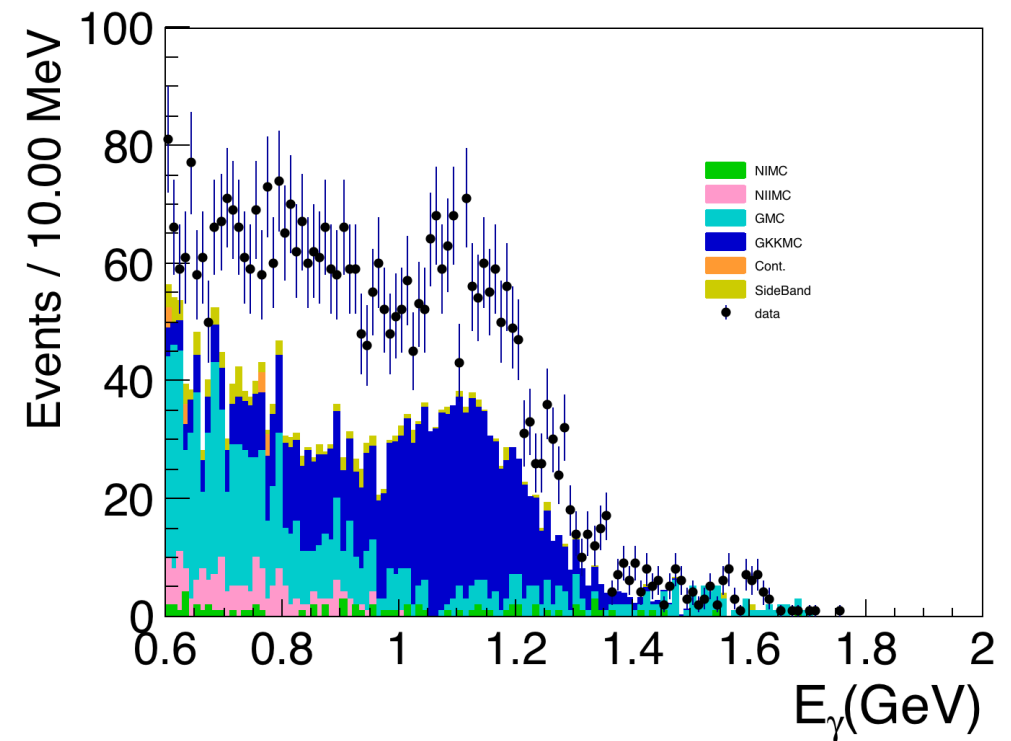
# Status of Finding the $J/\psi \rightarrow \gamma + \text{invisible}$

Shi Xiaodong, Peng Haiping  
State Key Laboratory of Particle Detection and Electronics  
USTC

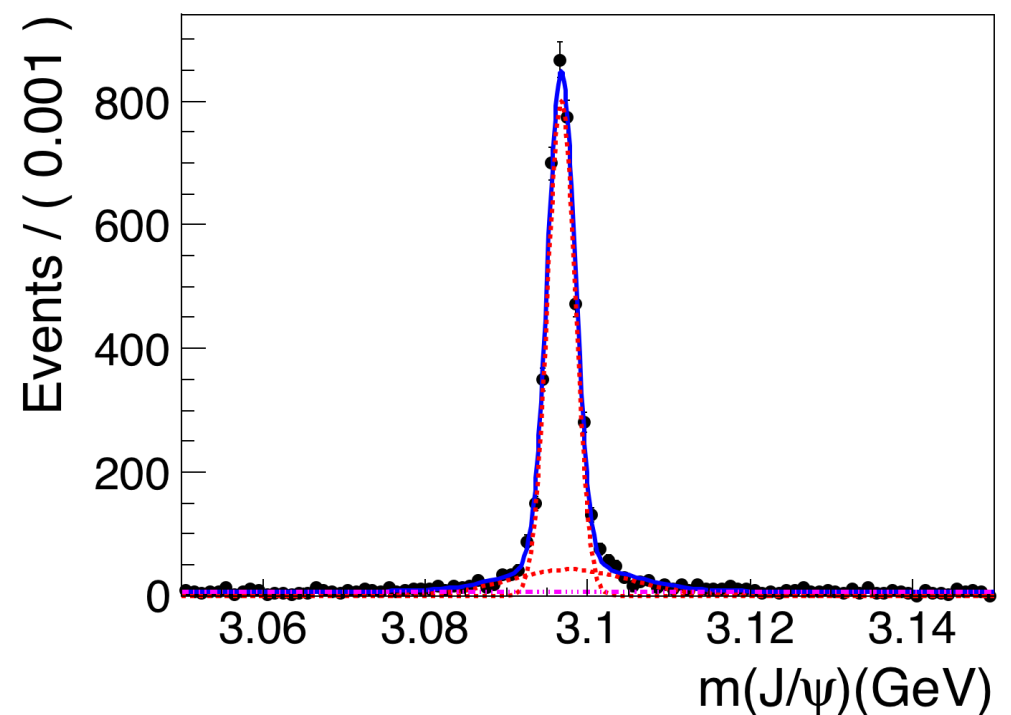
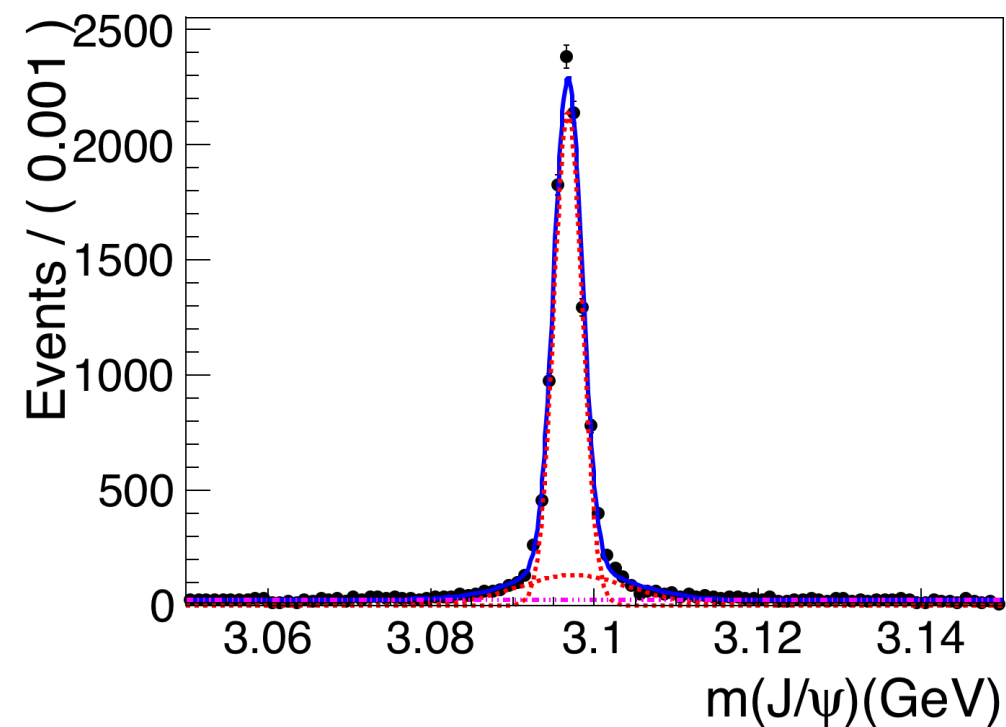
# Problem



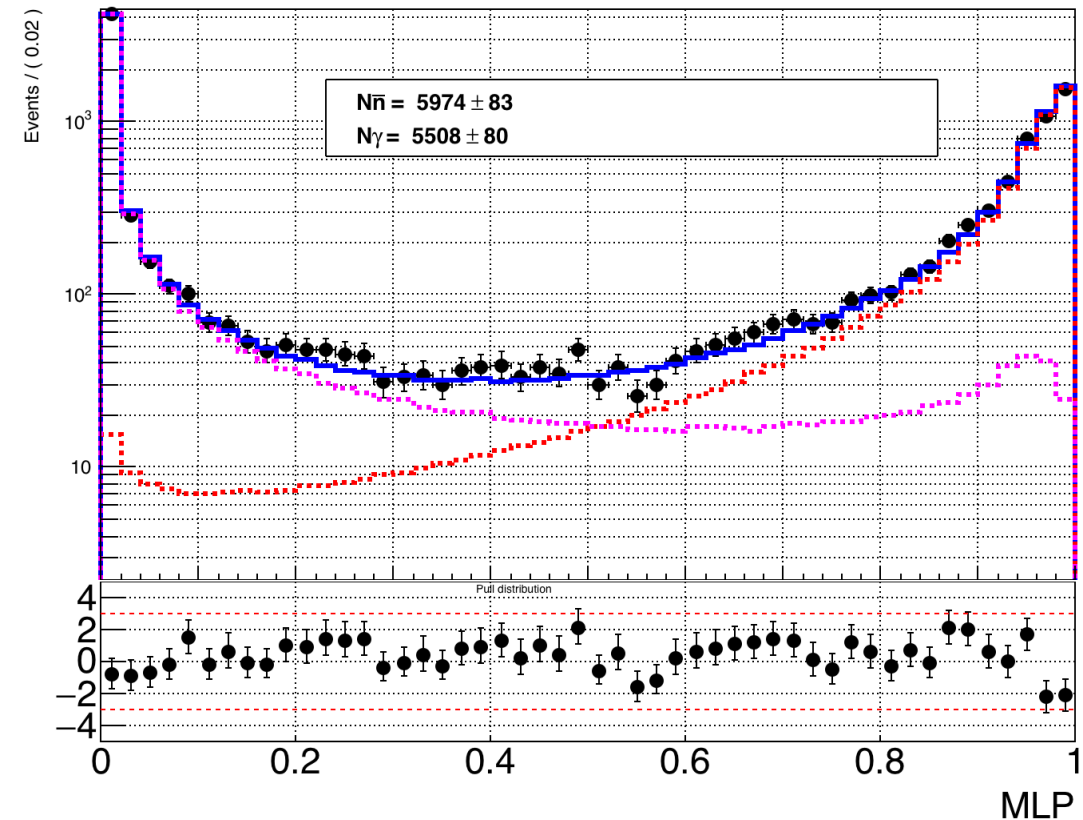
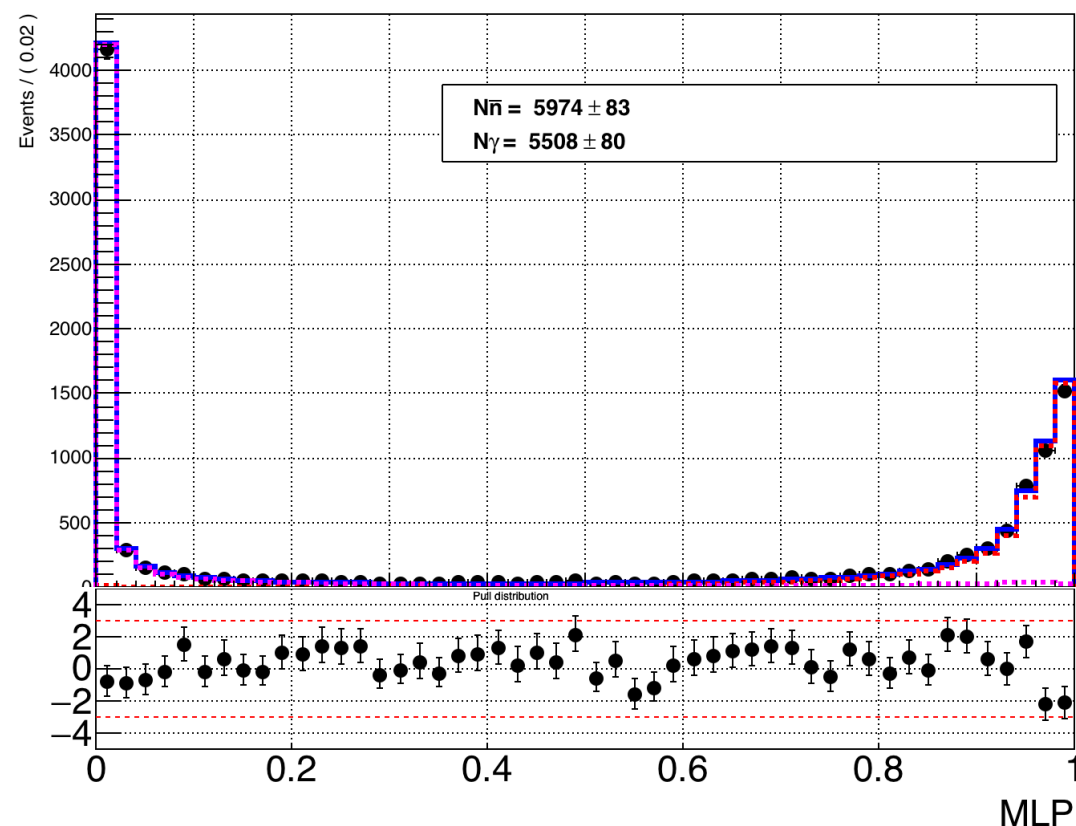
Before  $n\text{-}\bar{n}$  veto



After  $n\text{-}\bar{n}$  veto



# Try to get the ratio of gamma to nbar



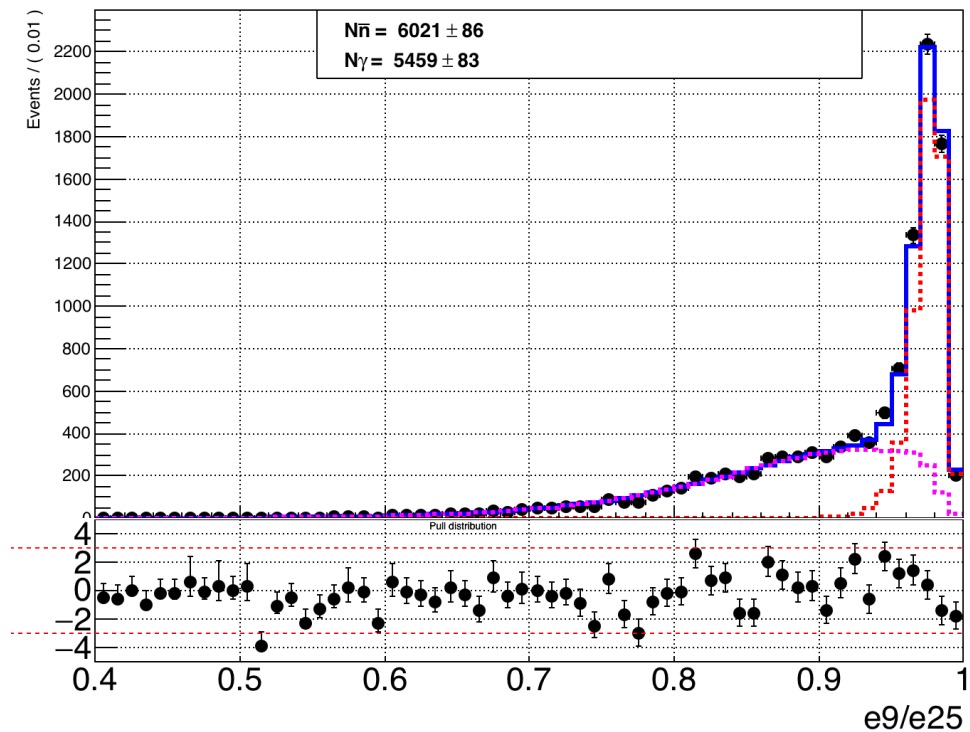
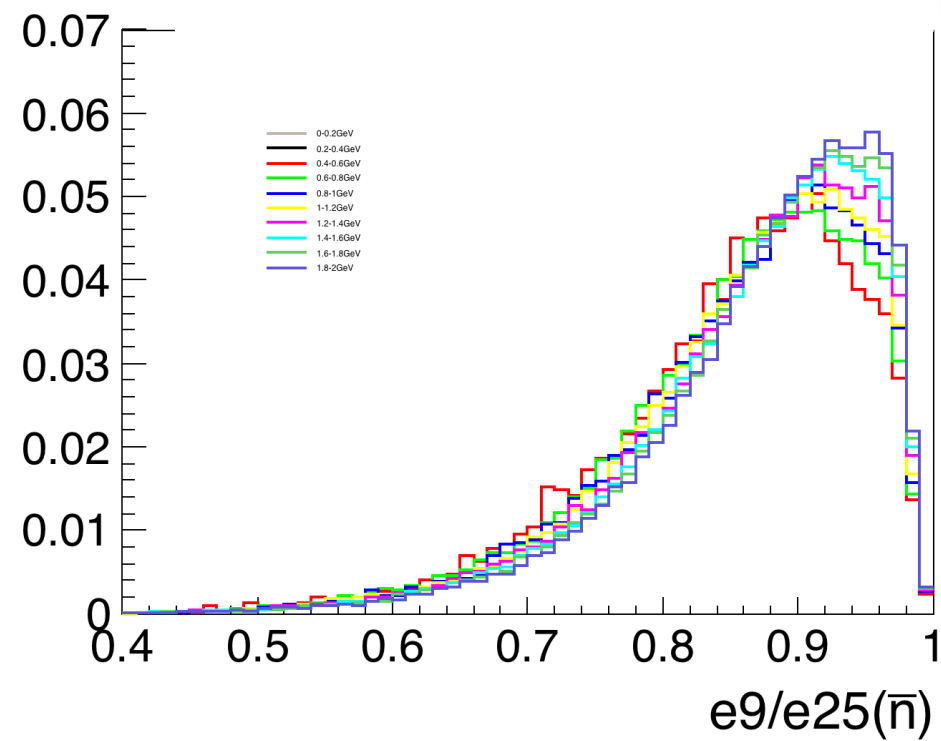
Before n-bar veto

In inclusive MC,  $n(\text{gamma})=3532, n(\text{anti-bar})=7855$

From data,  $n(\text{gamma})=5508, n(\text{anti-bar})=5974$

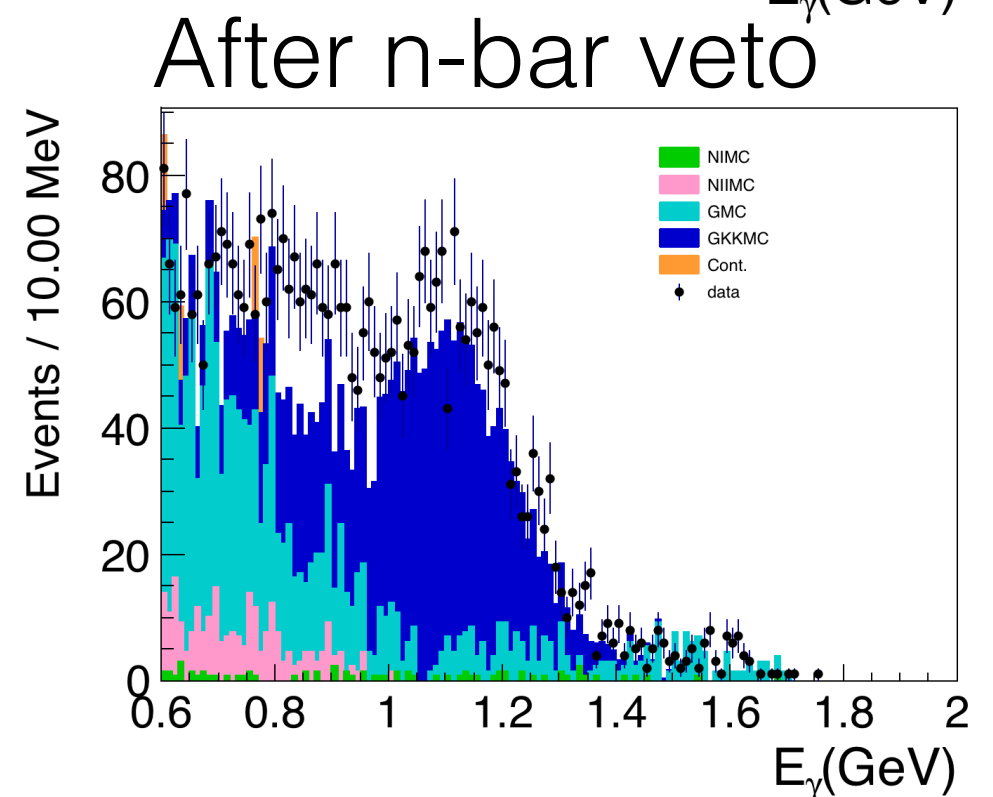
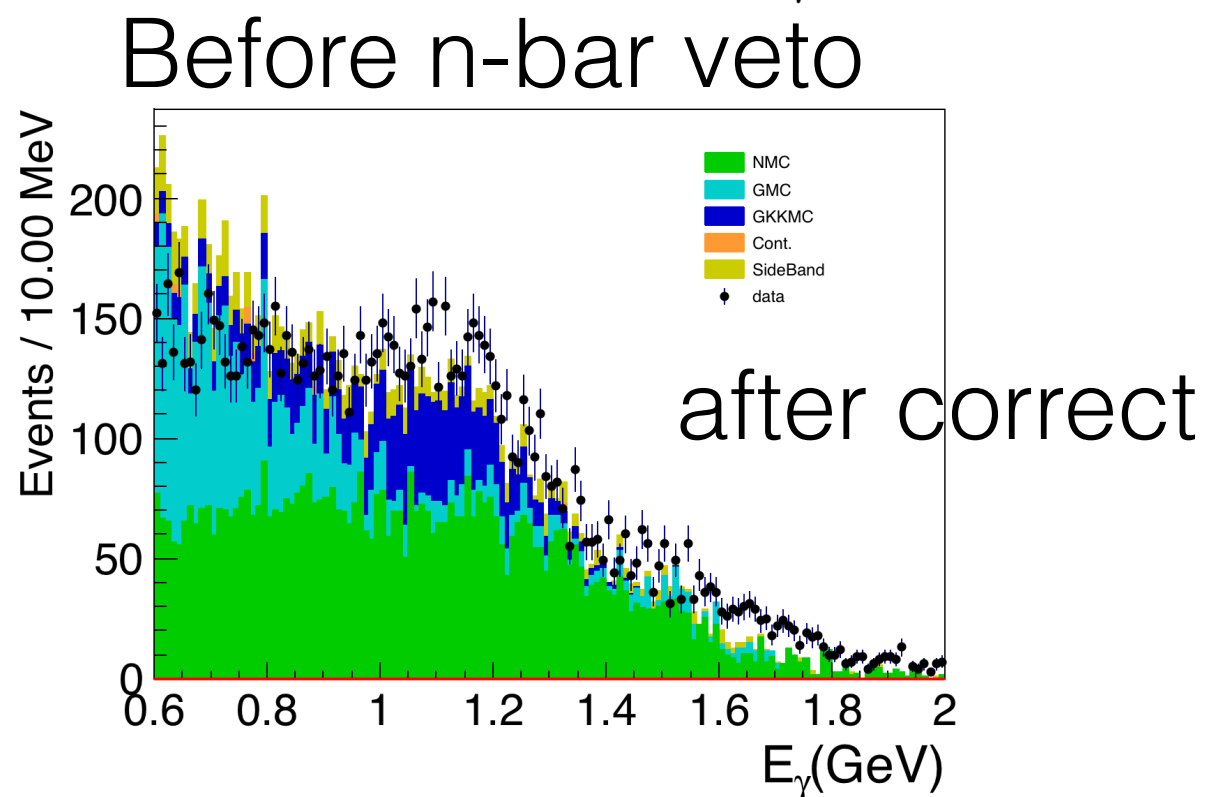
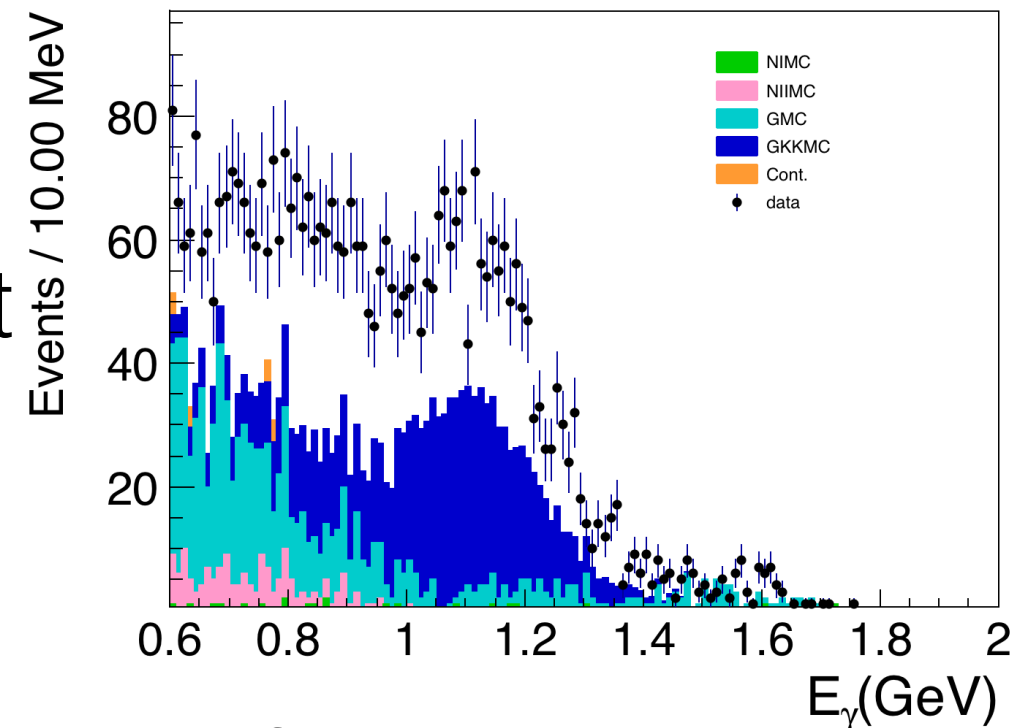
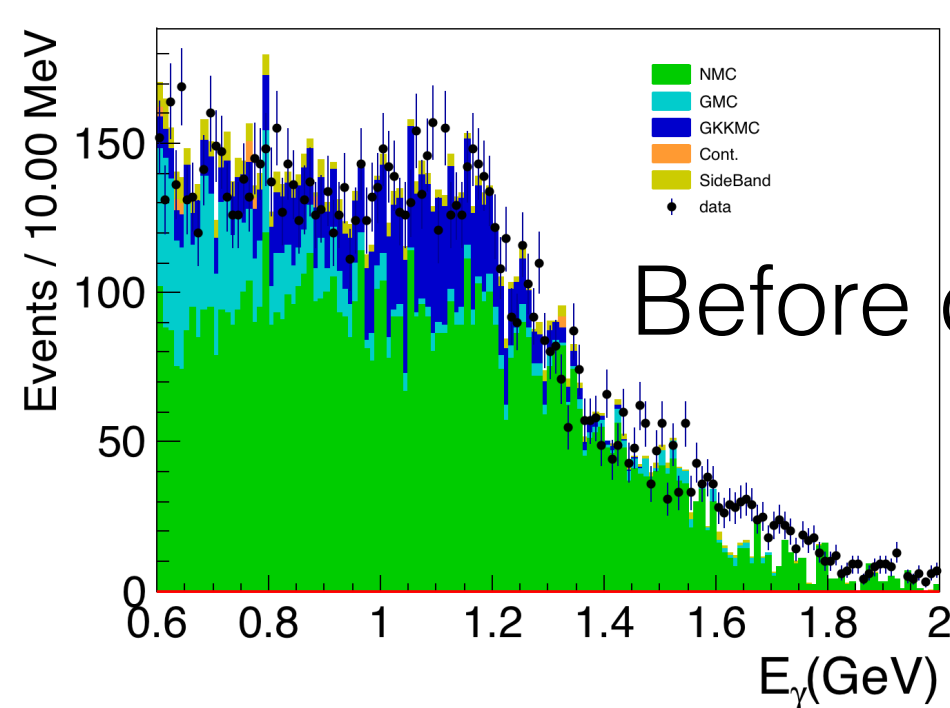
Need to correct the ratio of gamma in inclusive MC

# Another variable (not MVA)

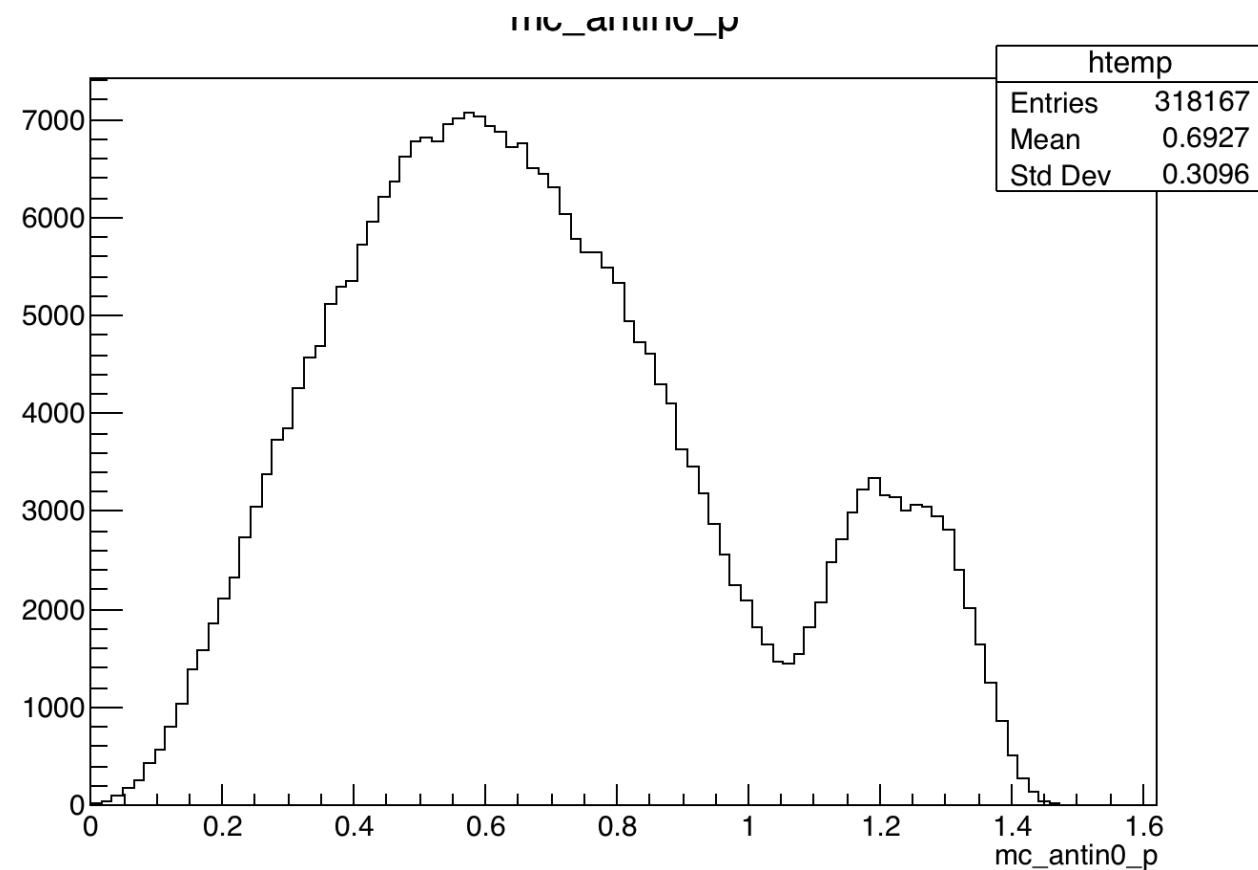


consistent with MLP fit result

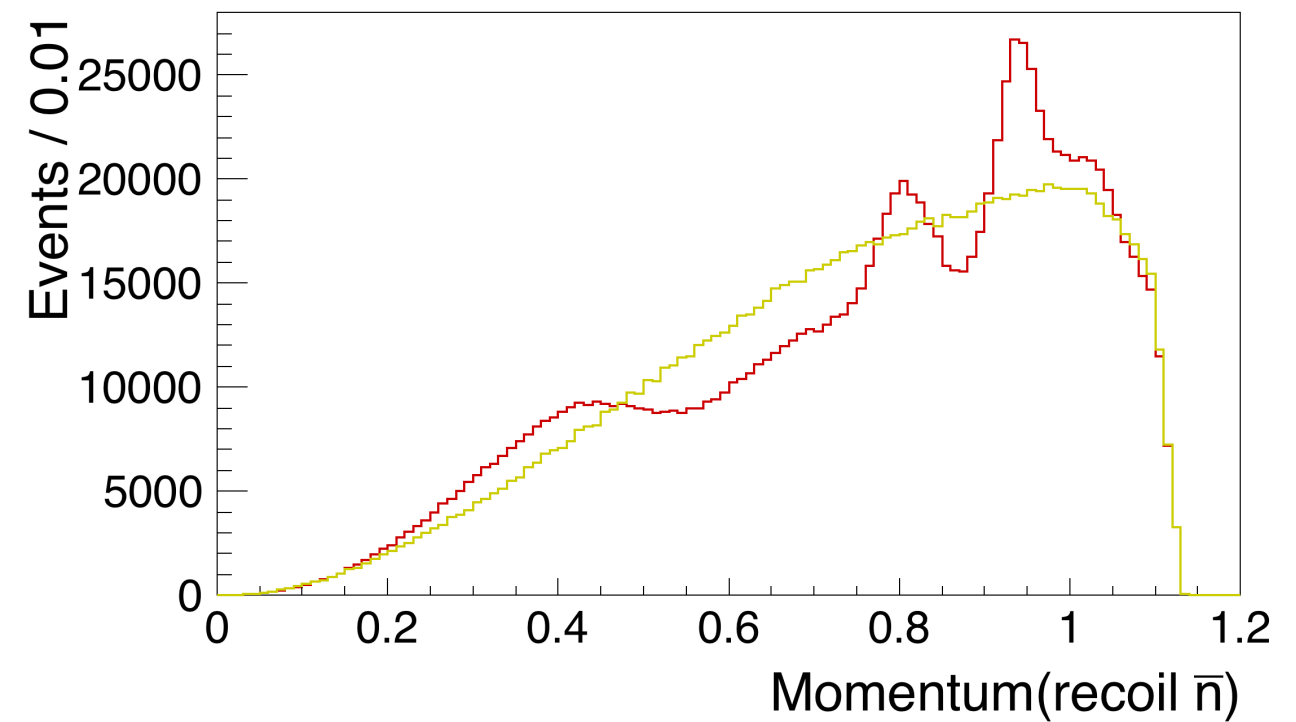
# correct result



# anti-n still not perfect

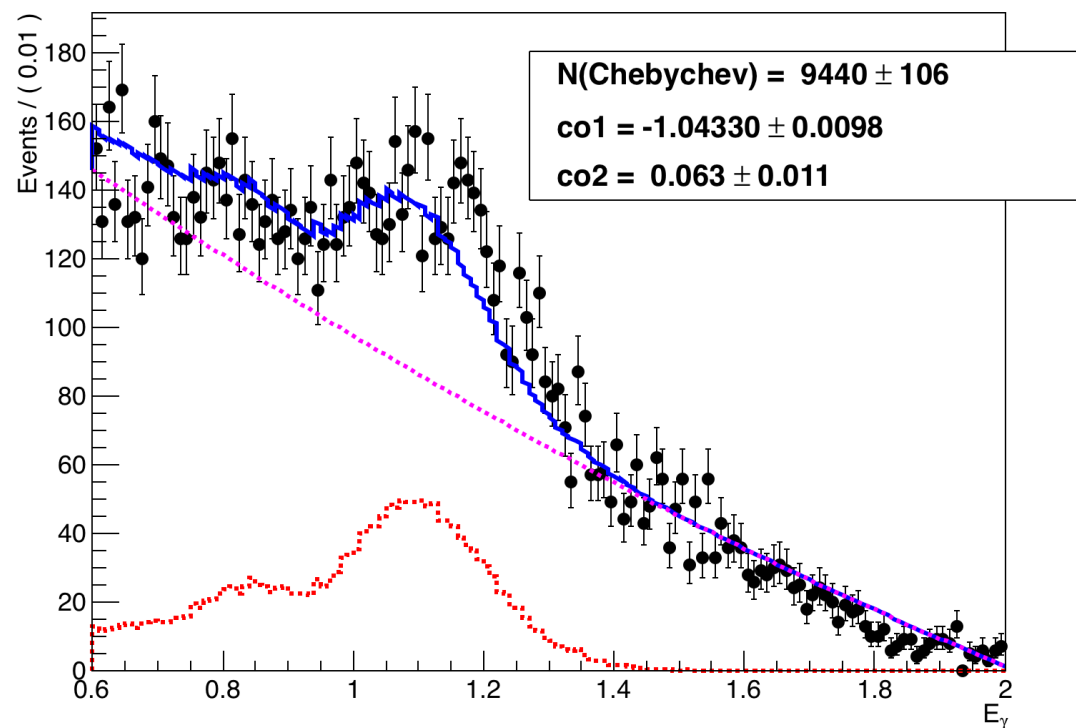


$p(n)$

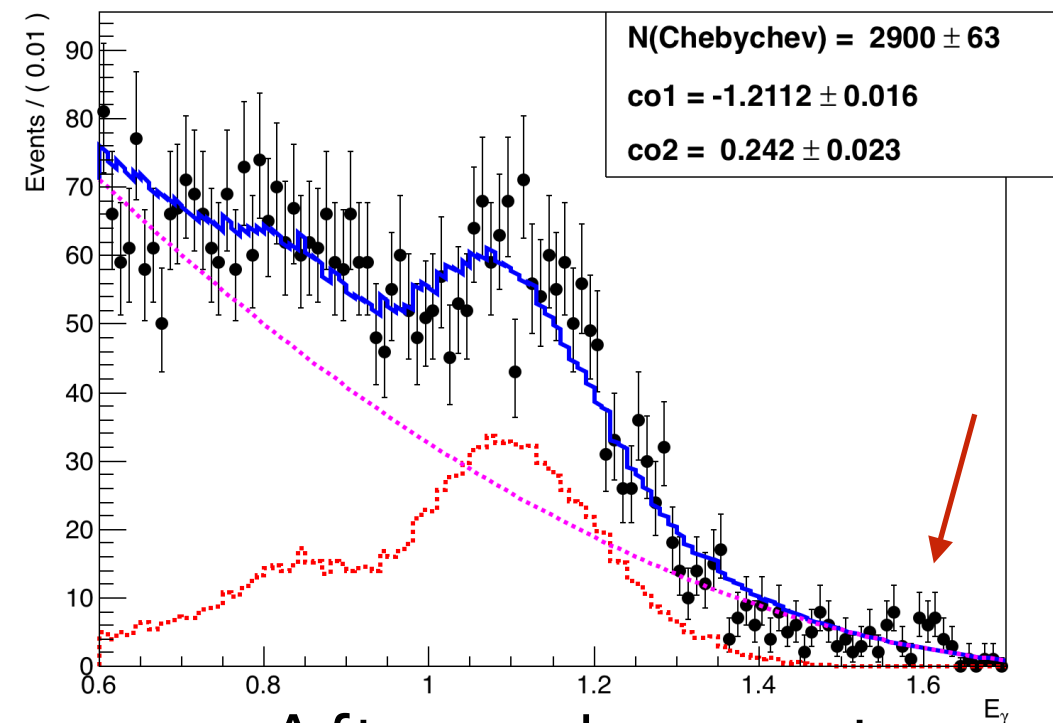


$p\ n\ \pi i$

# A naive fit



Before n-bar veto



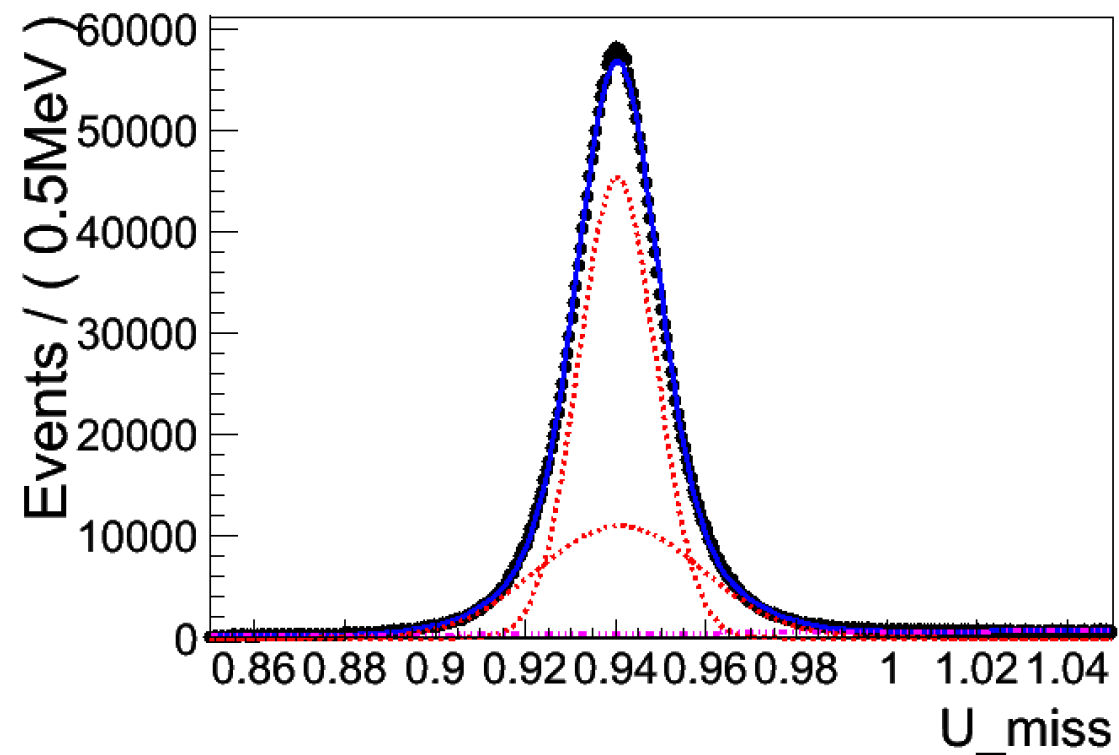
After n-bar veto

Next to do:  
Use other exclusive MC to  
describe other peak

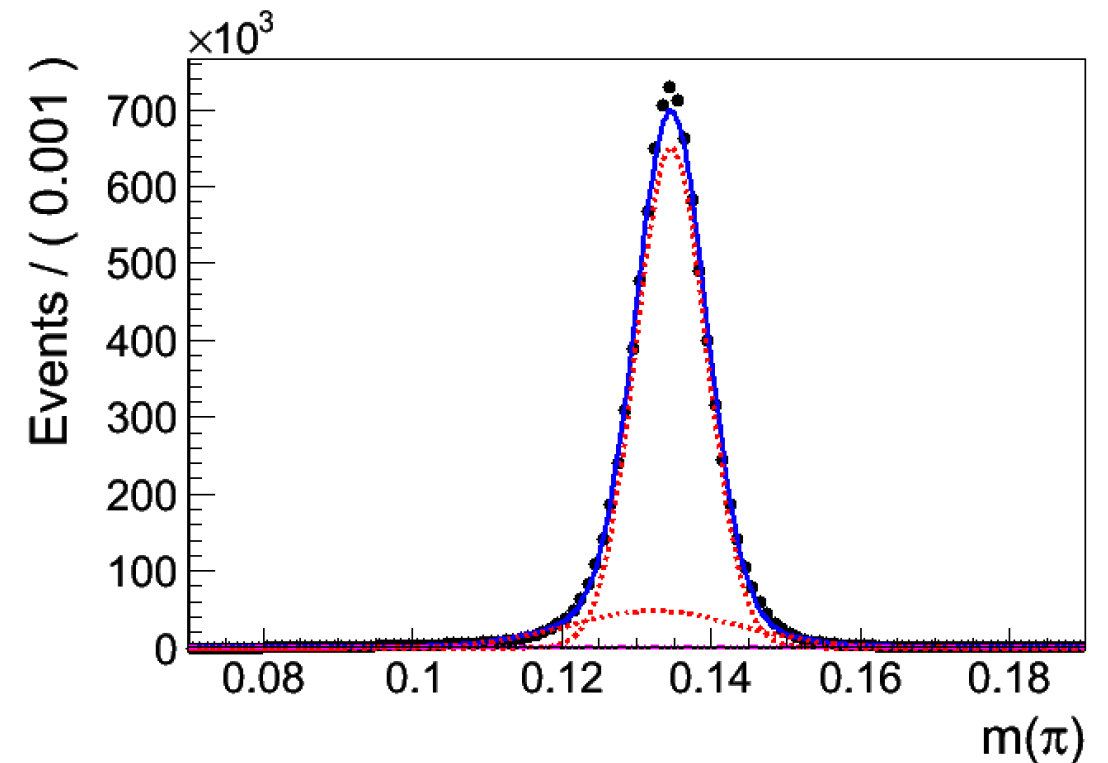
**Back-up**



# anti-n BKG study

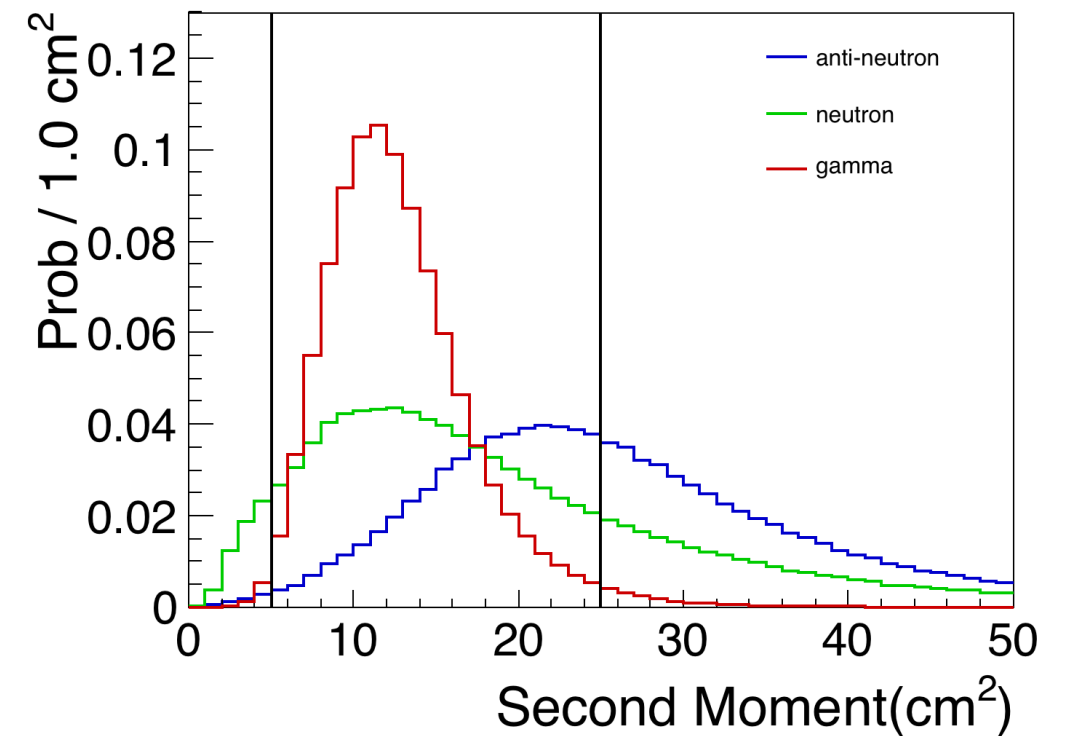
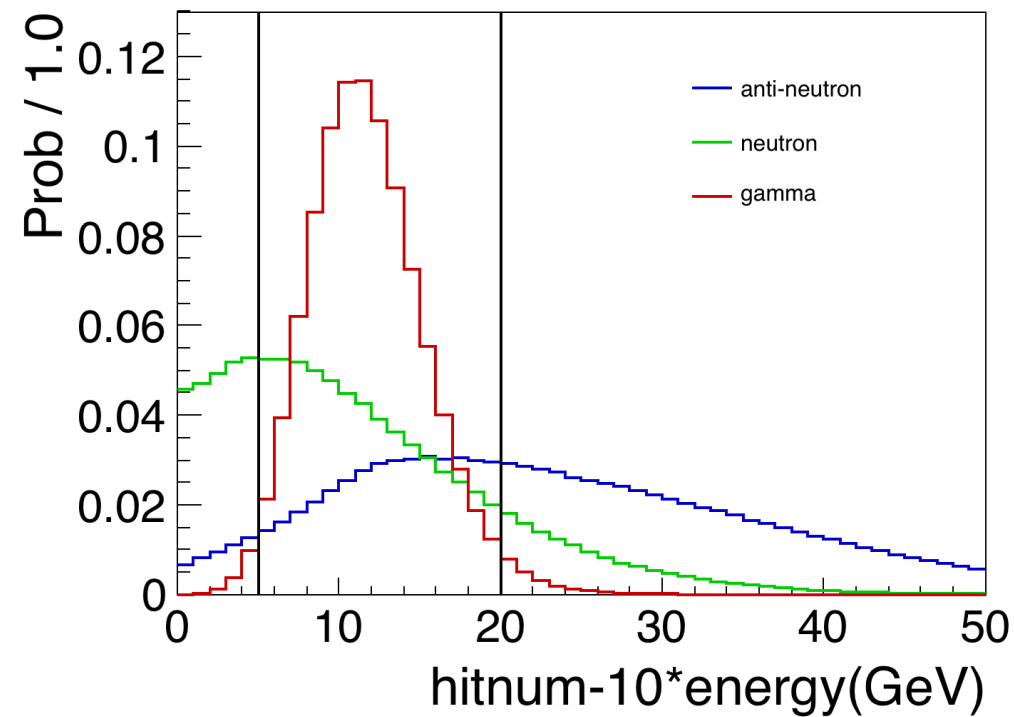


n/nbar from  $J/\psi \rightarrow p n \pi$   
purity in  $3\sigma$  region: 97.9%

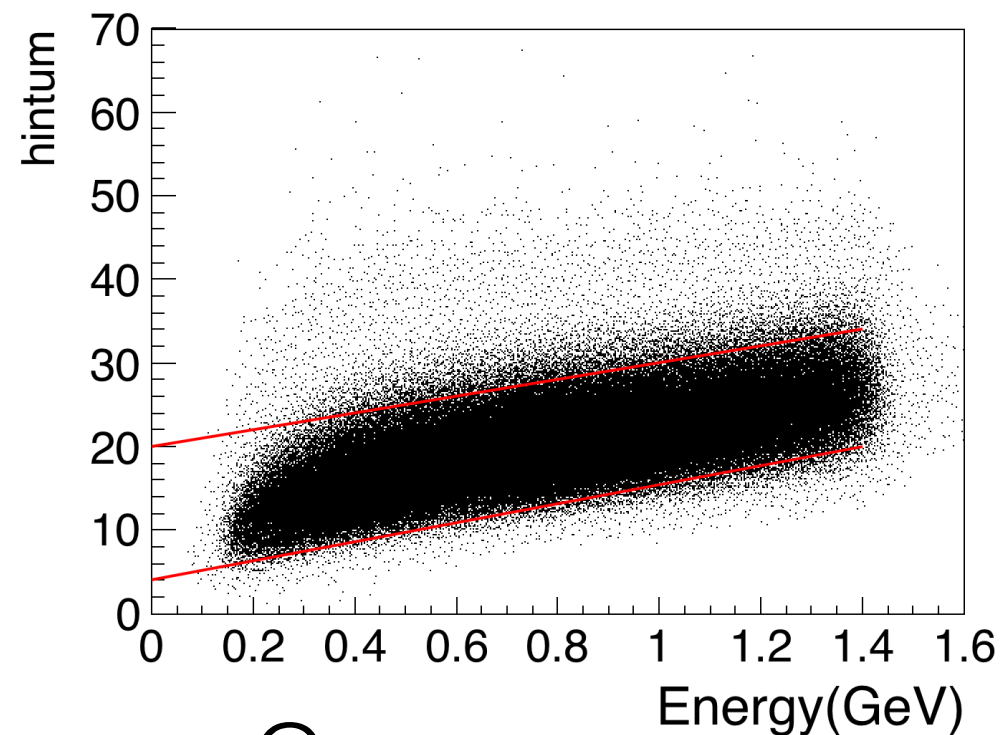


gamma from  $J/\psi \rightarrow \rho \pi$   
purity in  $3\sigma$  region: 99.6%

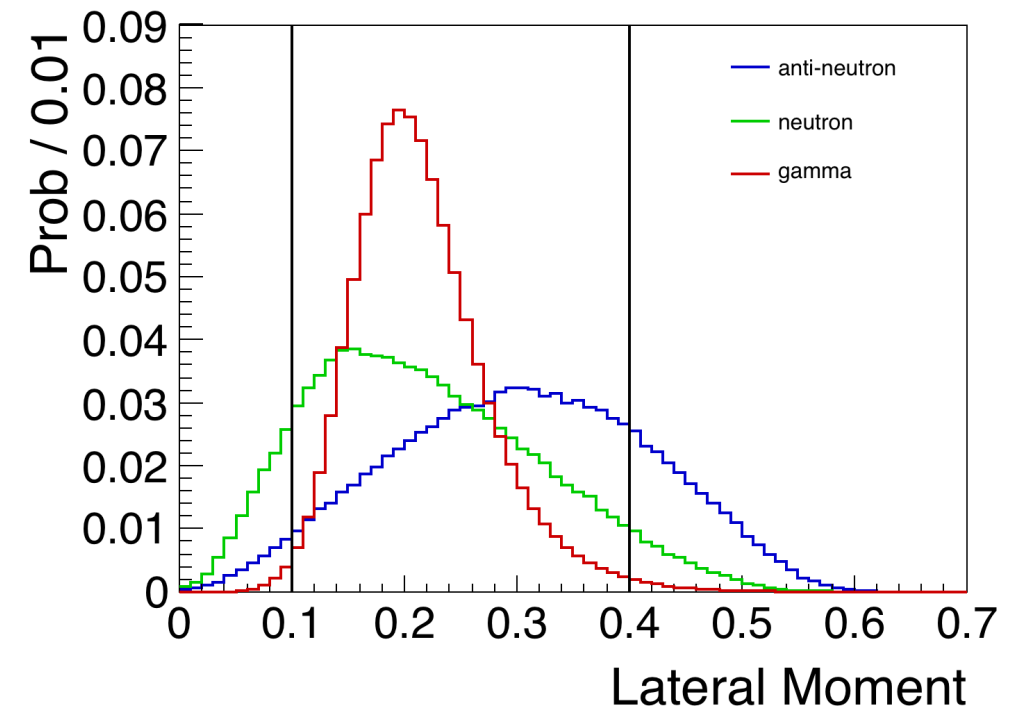
# anti-n veto



$4 < \text{hits number} - 10 \times \text{Energy(GeV)} < 20$

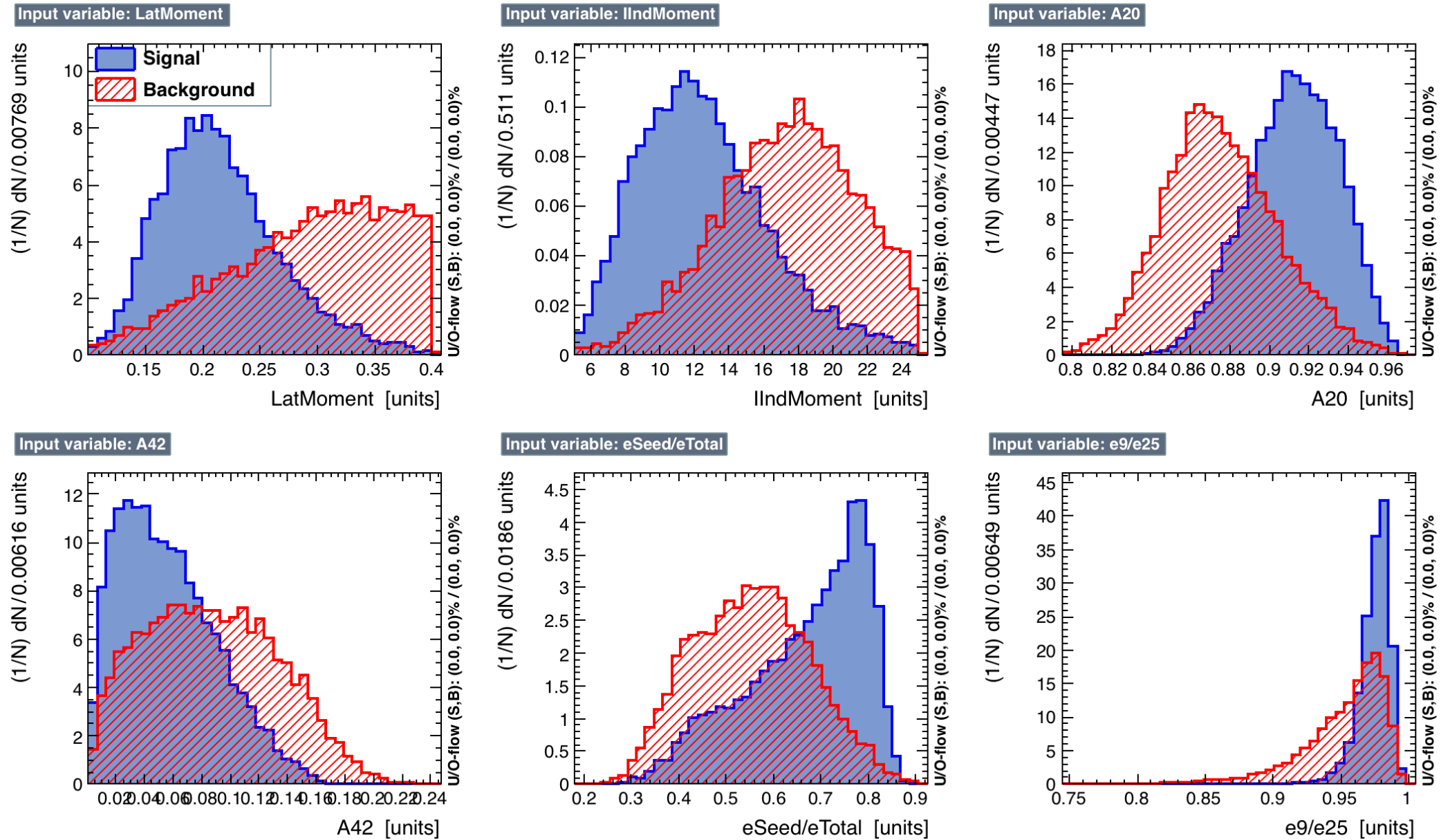


$5 < \text{Second Moment} < 25$



$0.1 < \text{Lateral Moment} < 0.4$

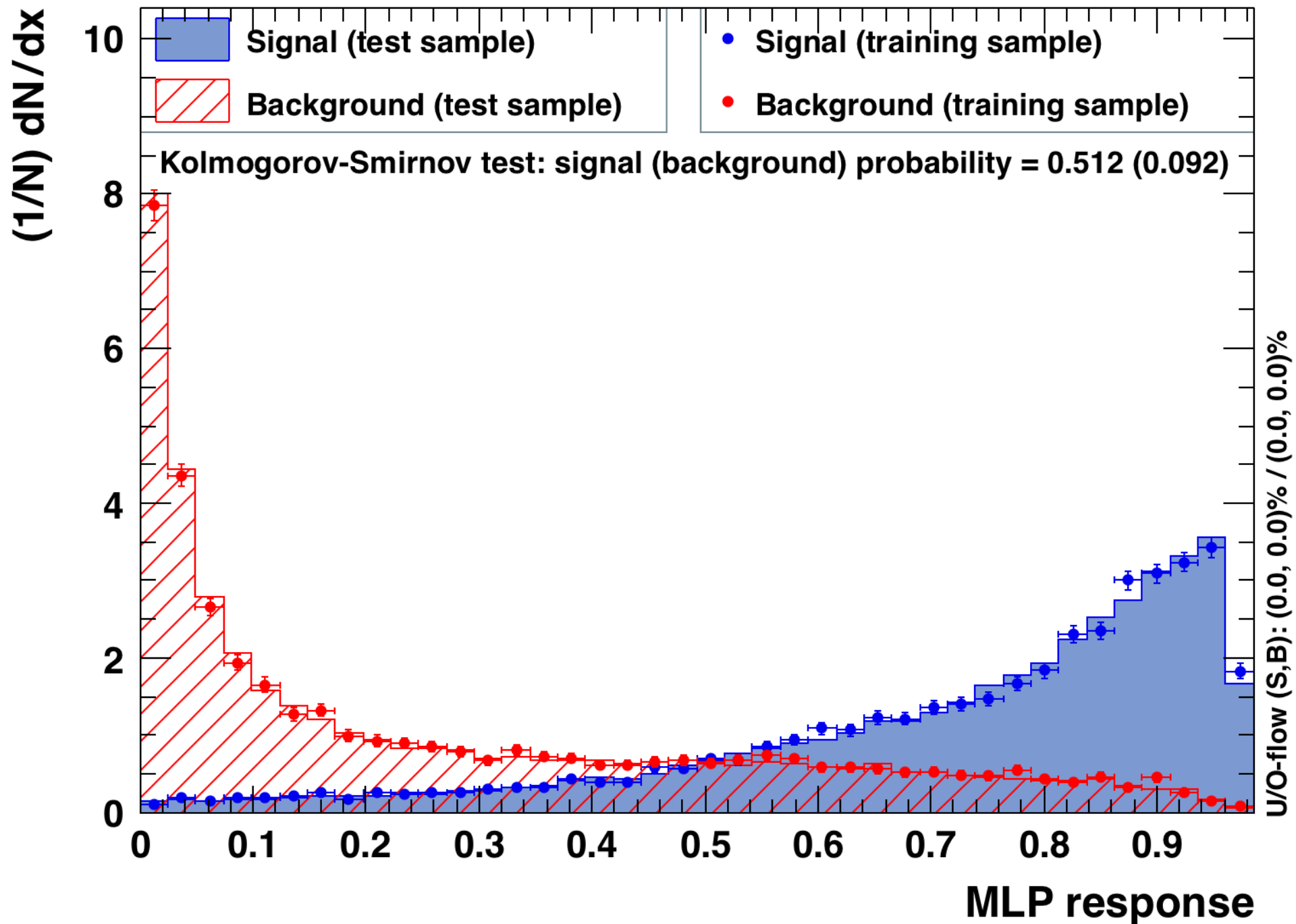
# MVA's input variables



All input variables are from RecEmcShower

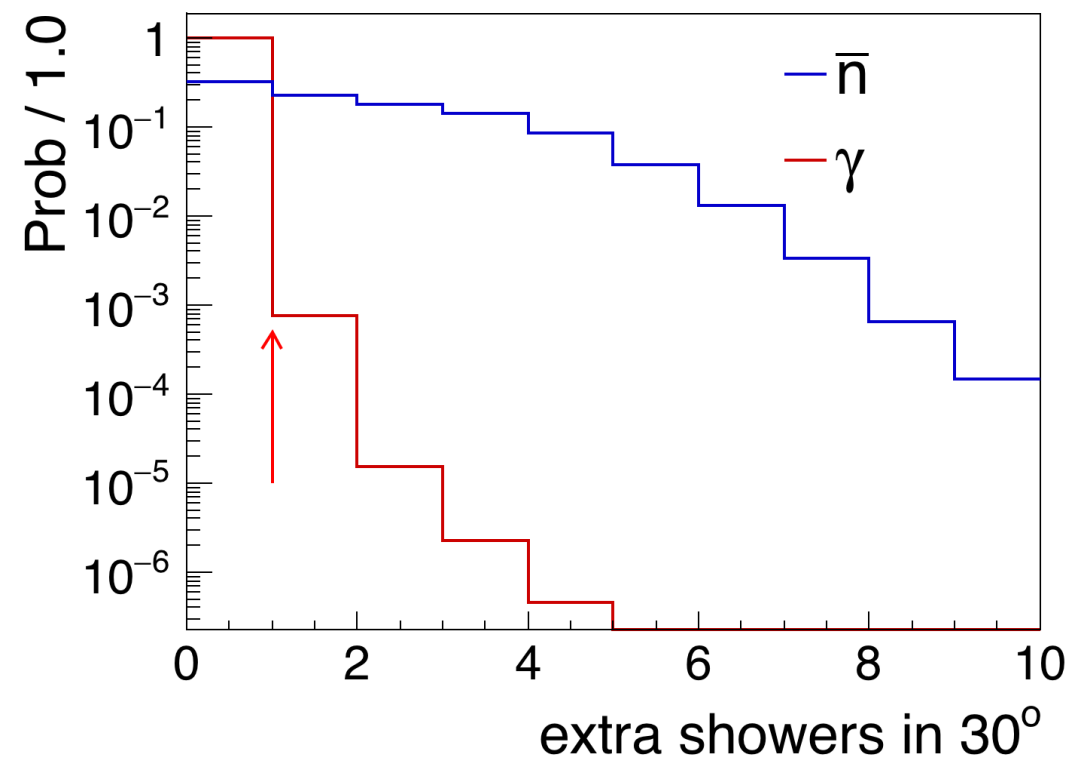
# MVA's Output

TMVA overtraining check for classifier: MLP



MLP > 0.5

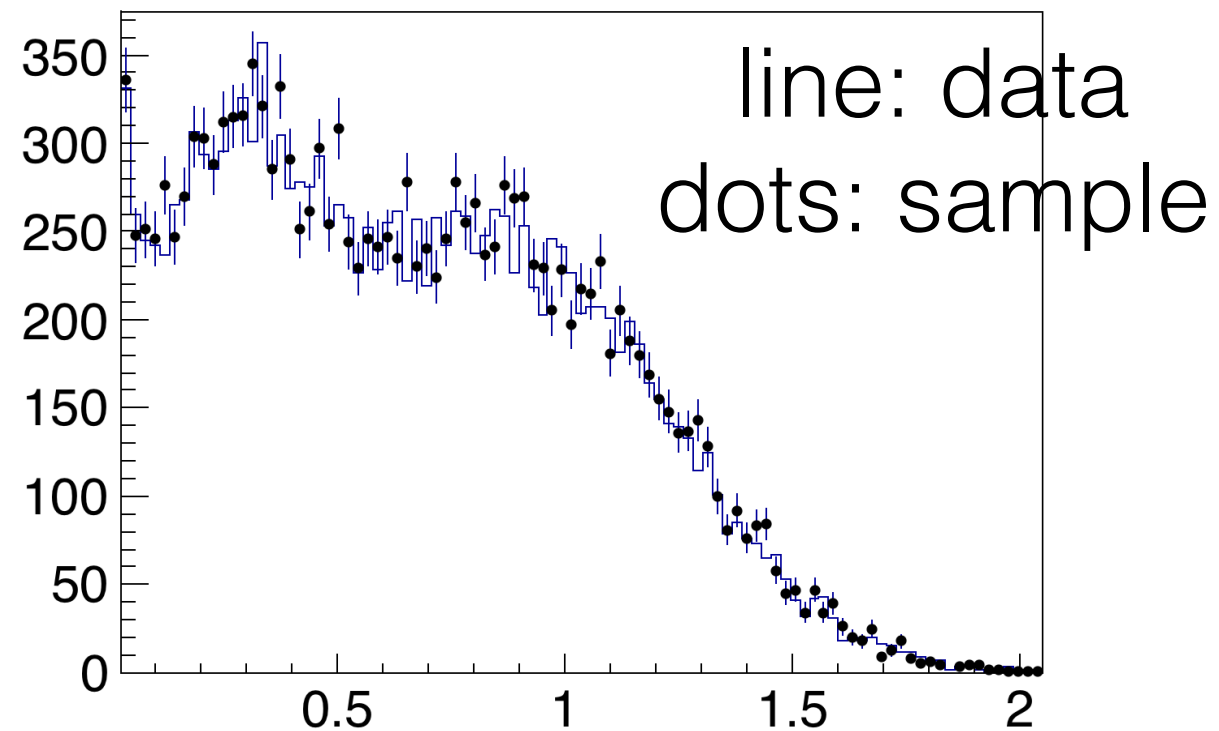
# anti-n veto



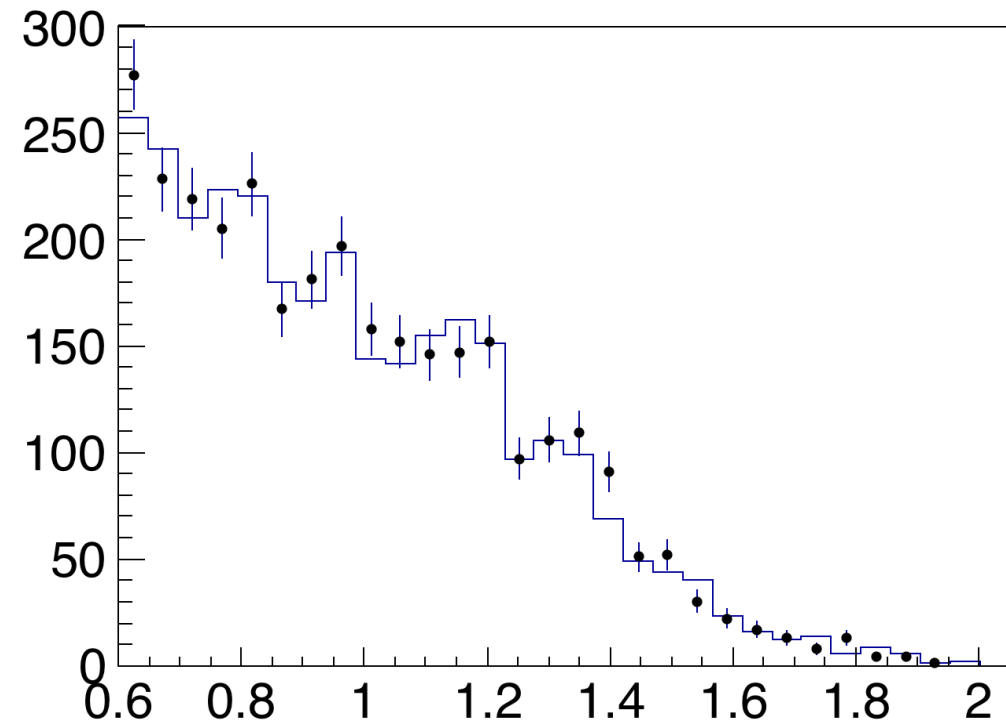
criteria:

No extra showers nearby

# check the sample code

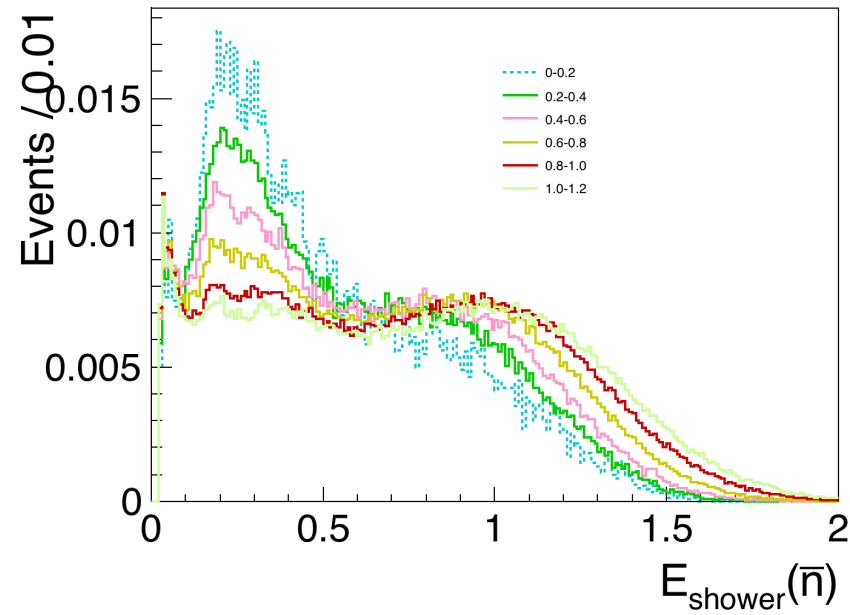
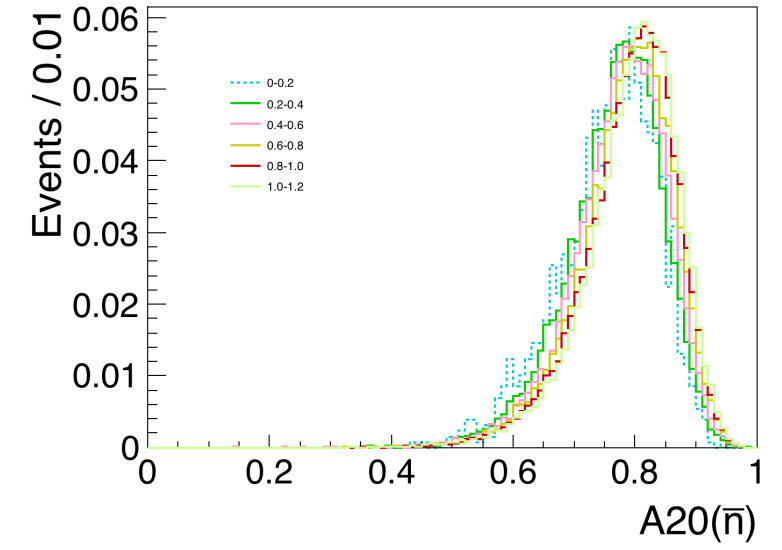
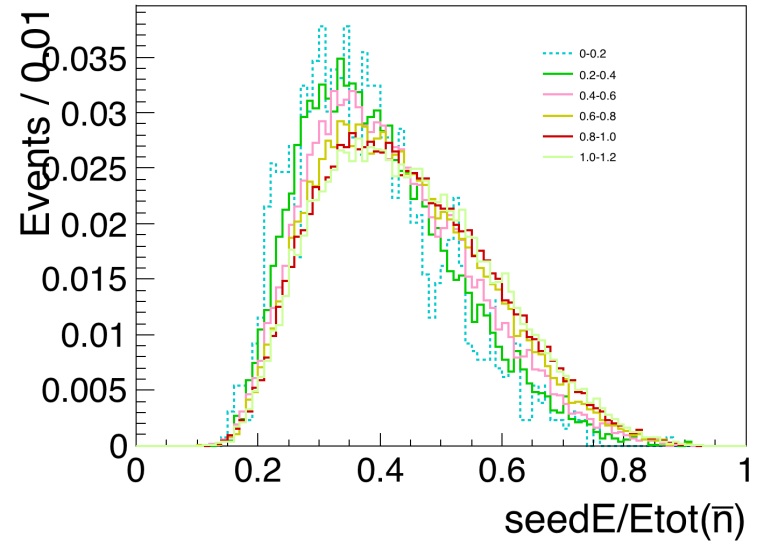
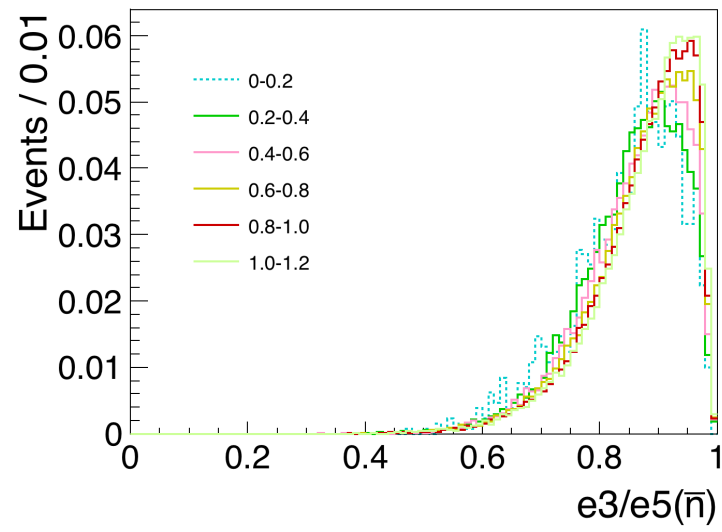
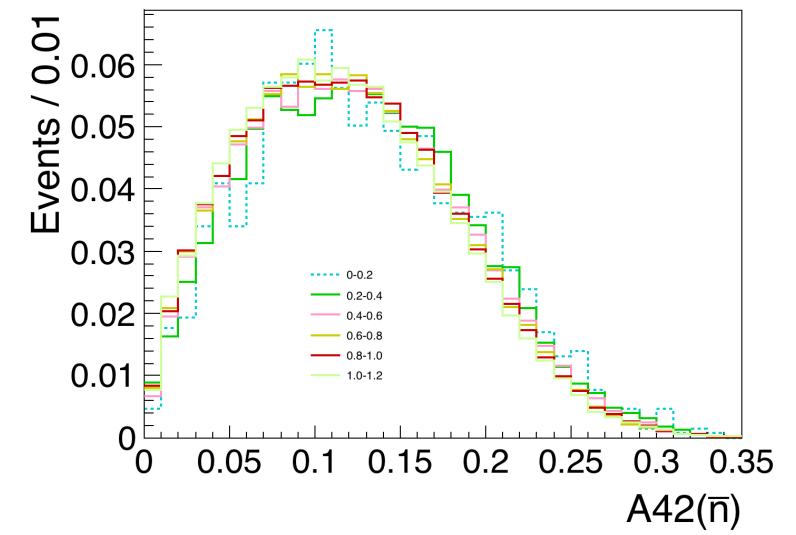
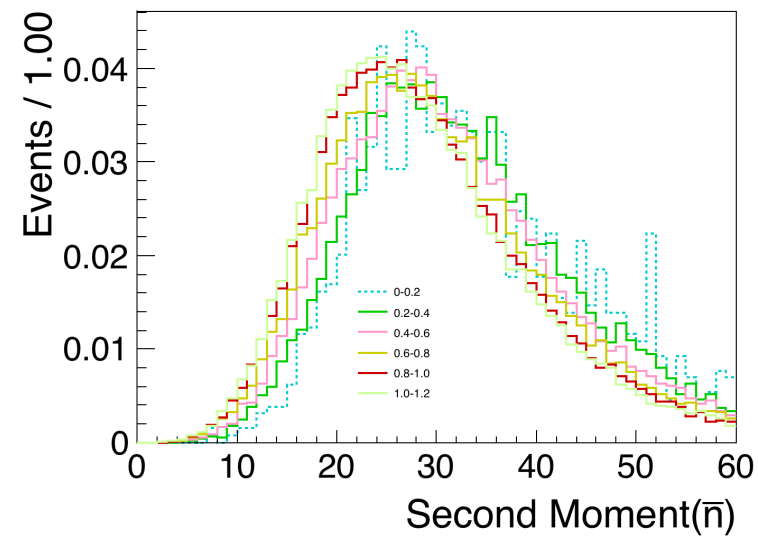
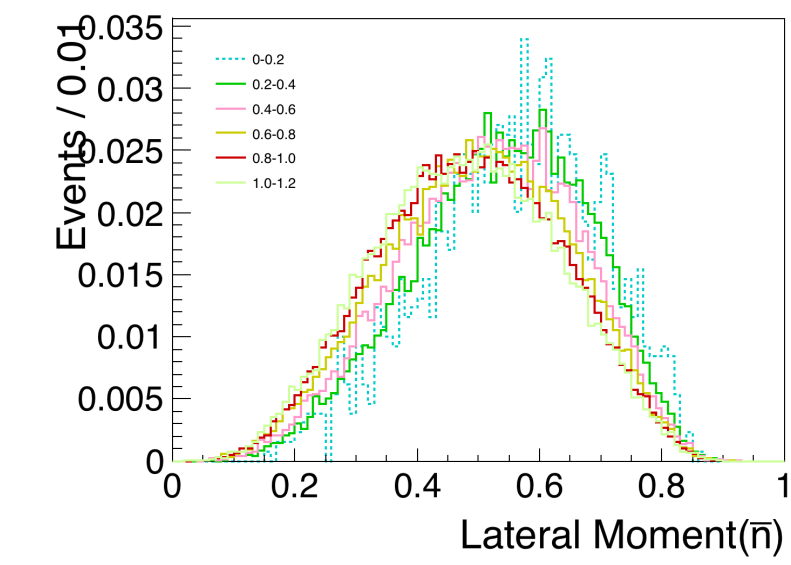


hit efficiency and energy



veto efficiency and energy

nbar shower seems right.  
Maybe the ratio of gamma to nbar is wrong.



$\theta < 40, 0.9 < E(\text{shower}) < 1.1$

# check for MLP

