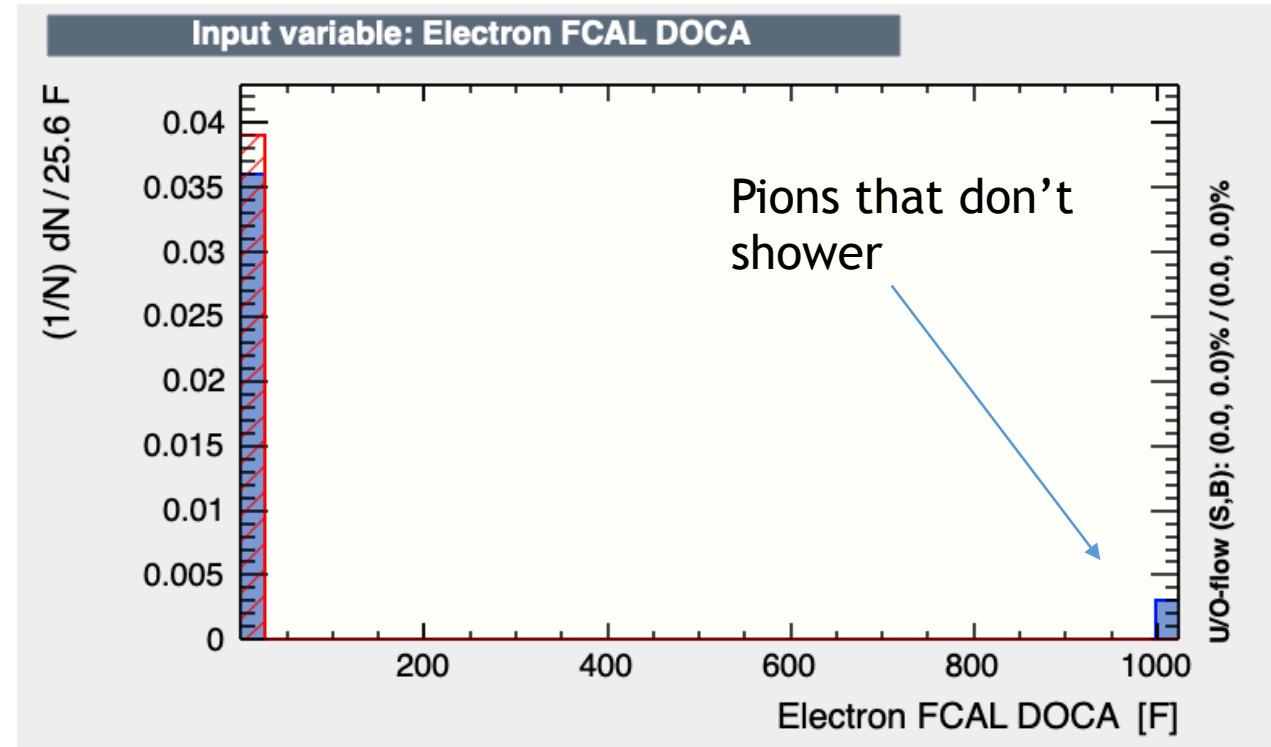
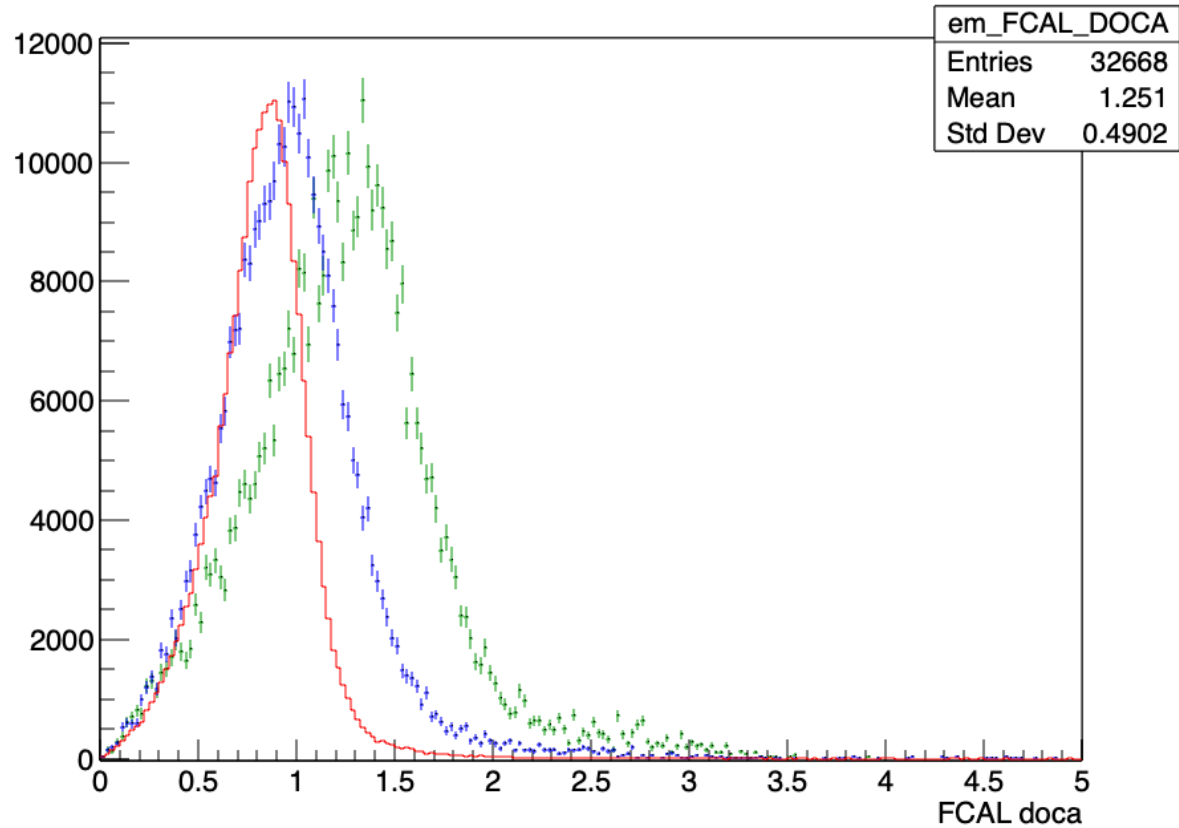


2018 Pion data

2018  $\pi^0 \rightarrow \gamma e^+ e^-$  data

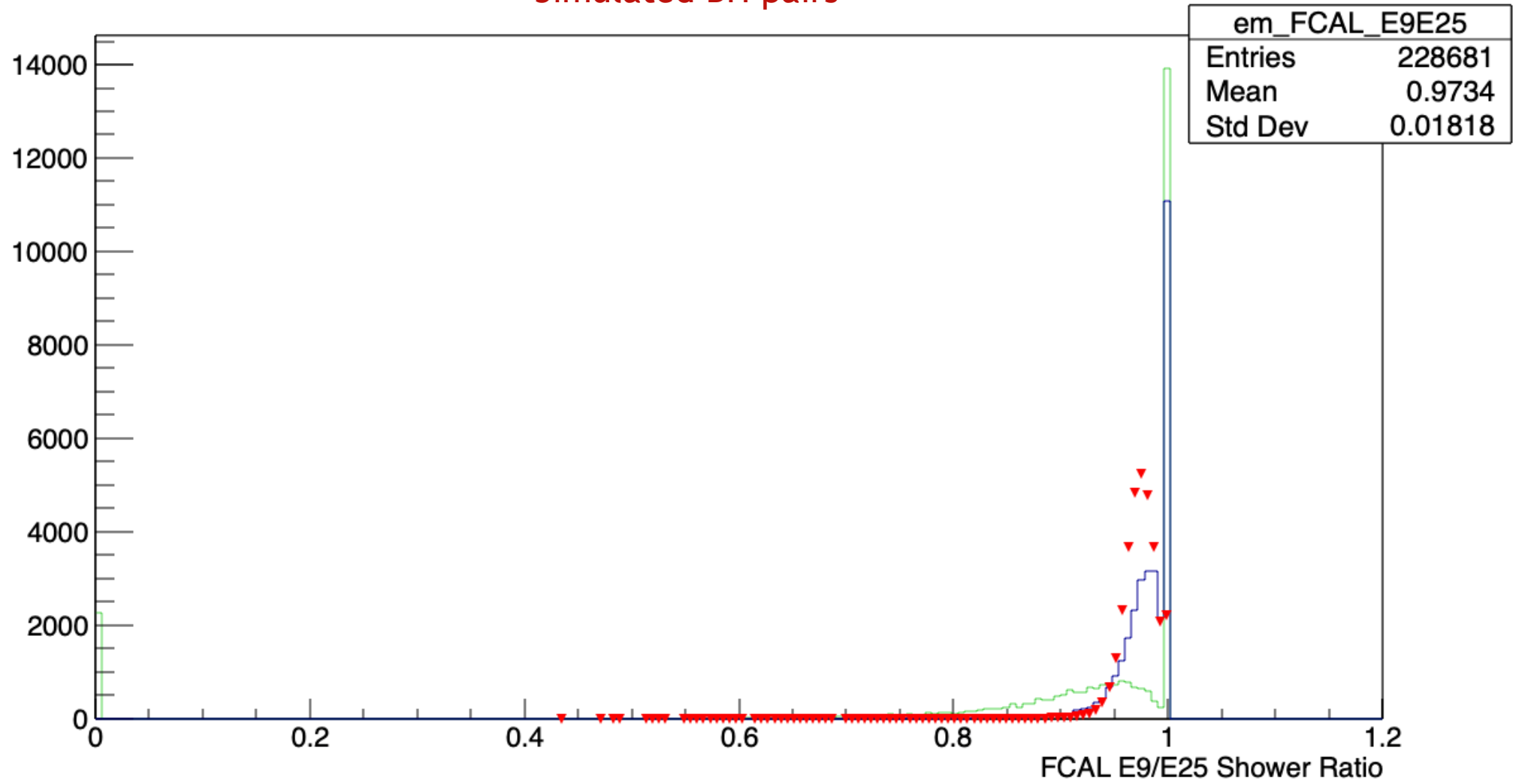
Simulated BH pairs

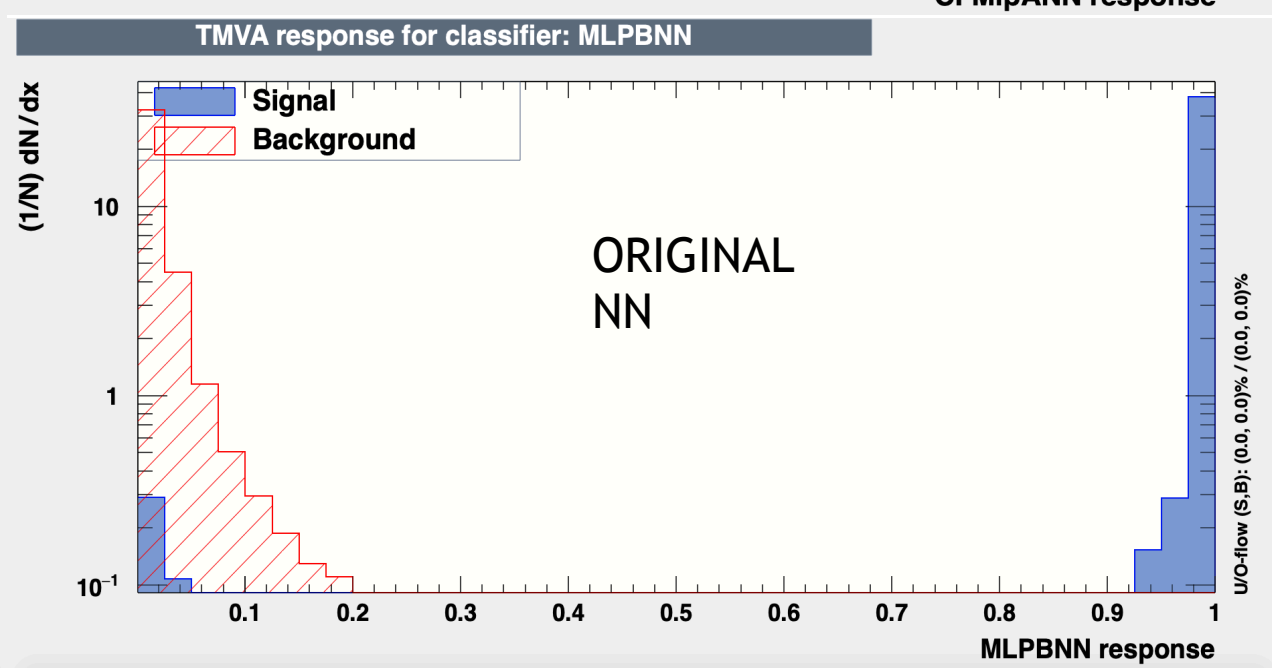
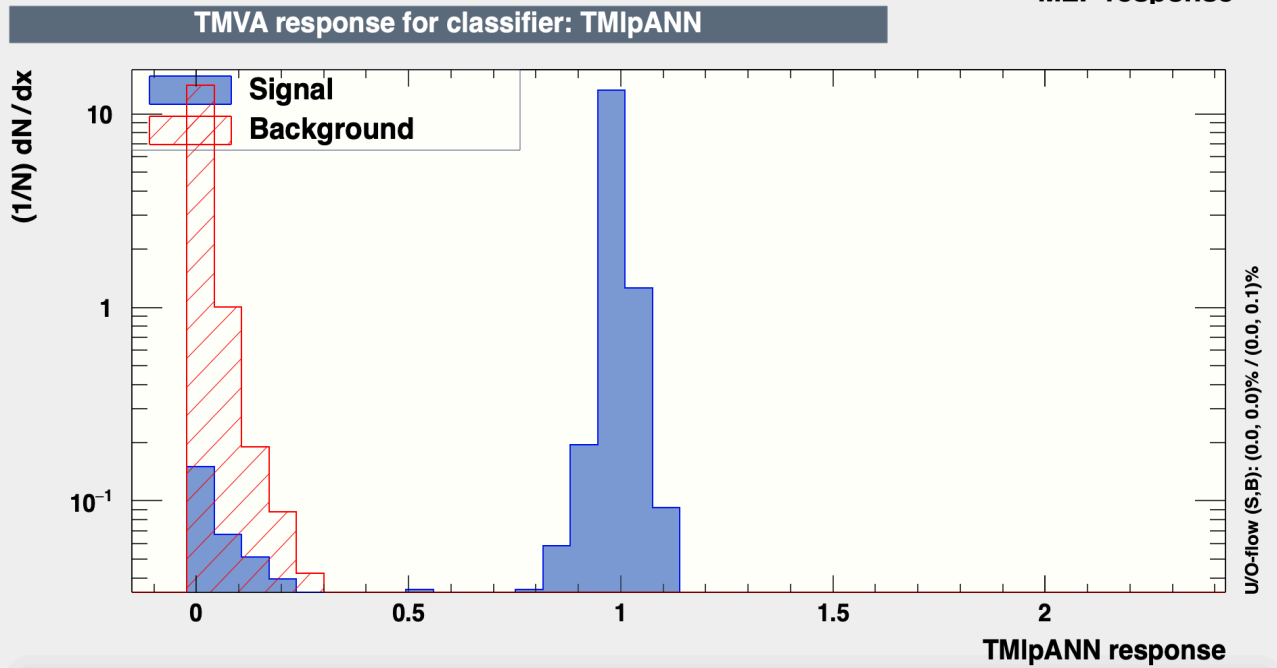
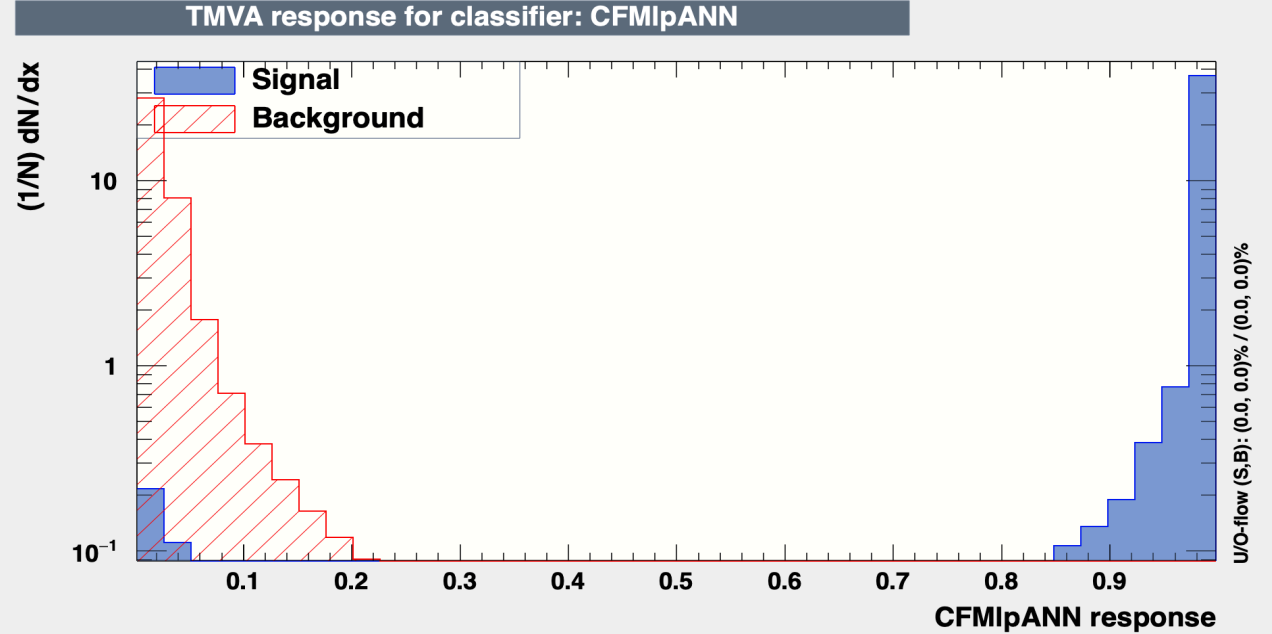
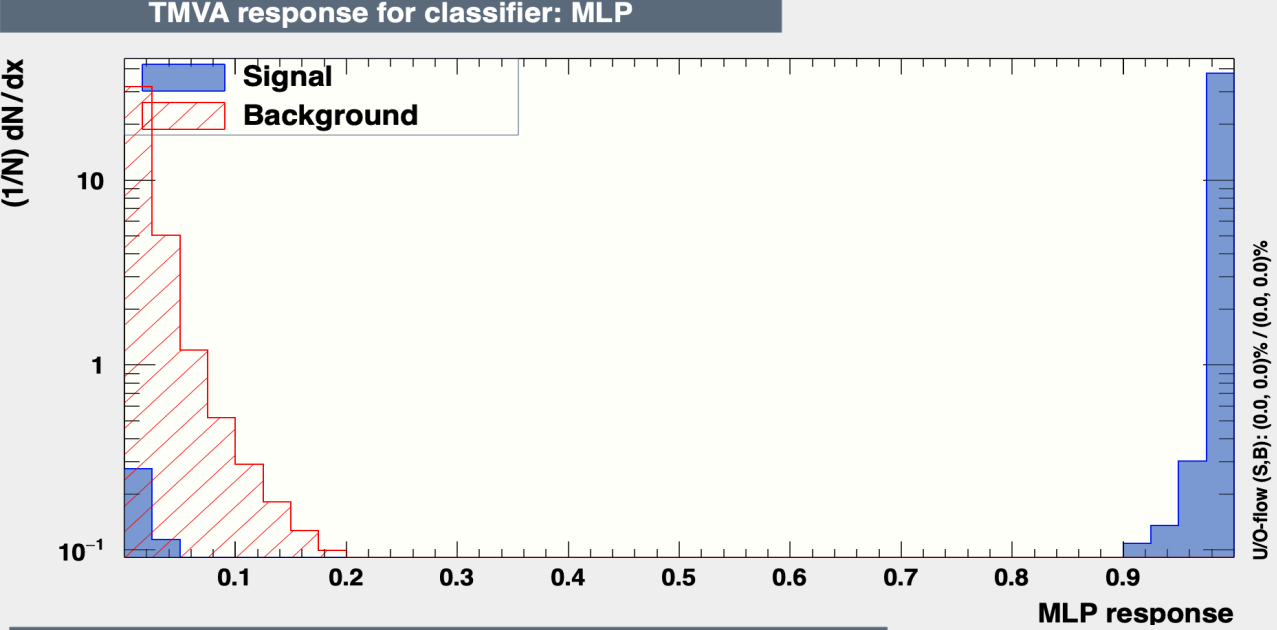


2018 Pion data

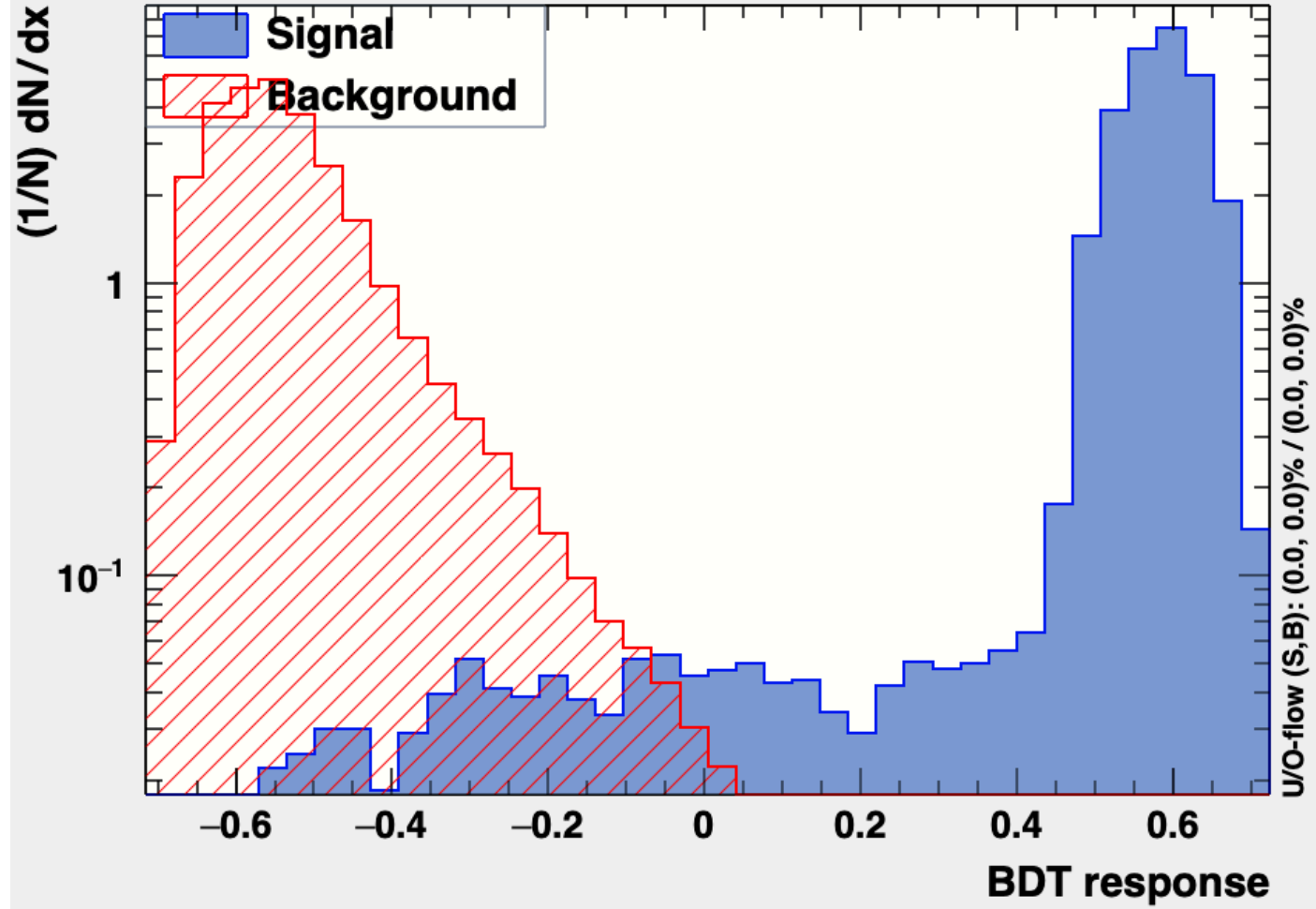
2018  $\pi^0 \rightarrow \gamma e^+ e^-$  data

Simulated BH pairs

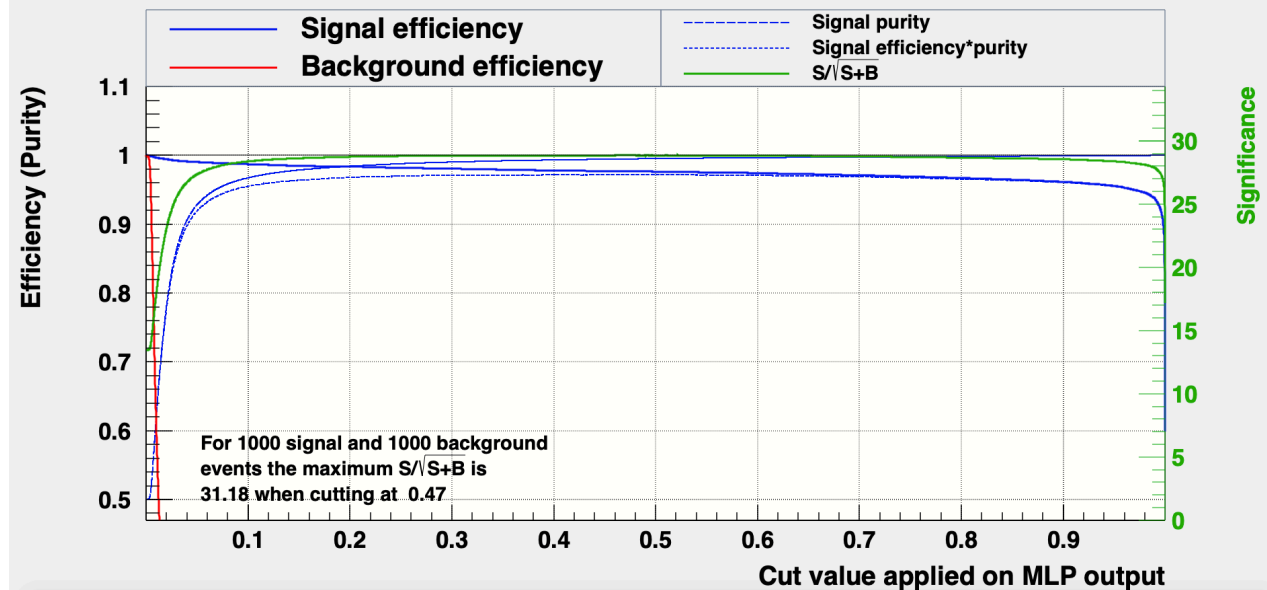




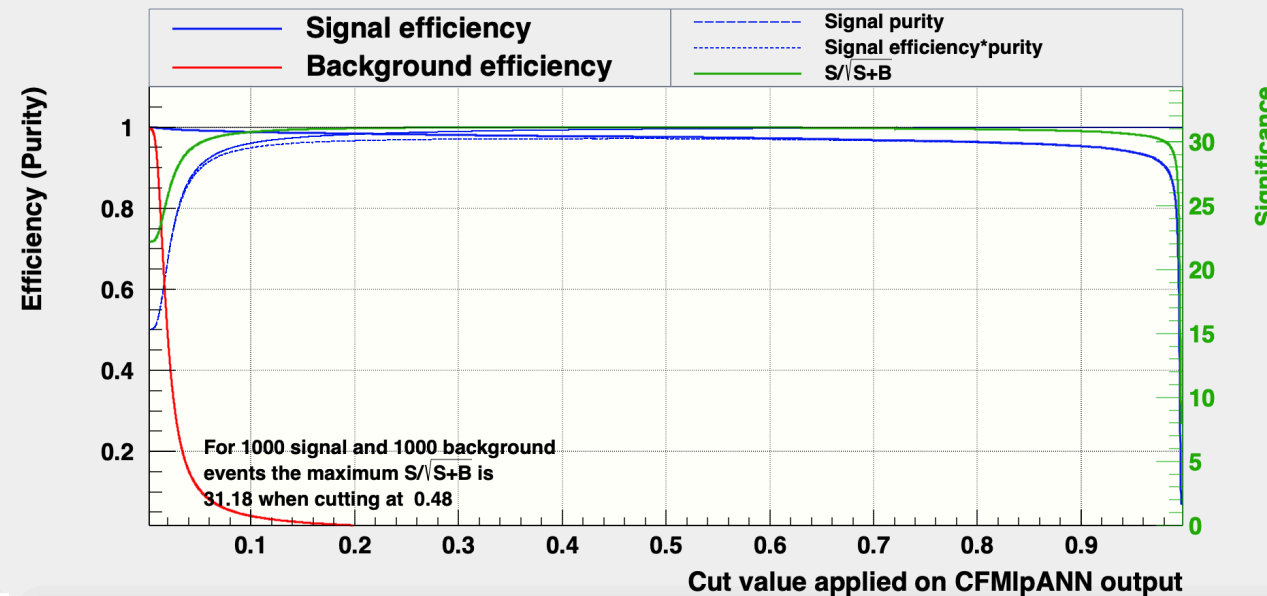
### TMVA response for classifier: BDT



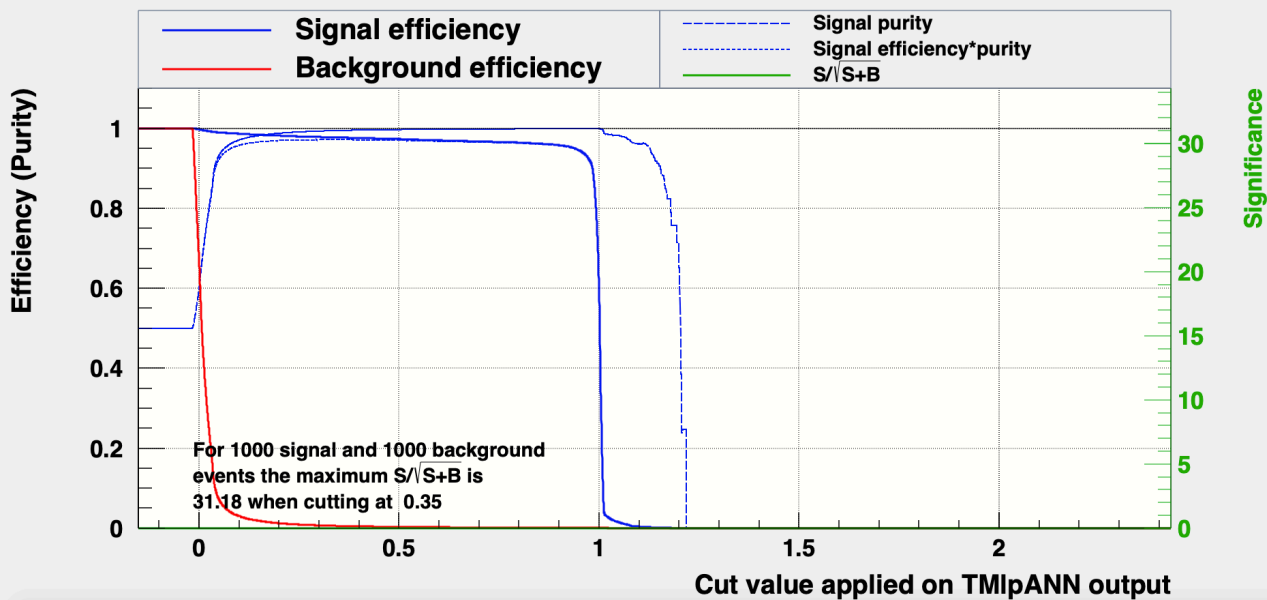
Cut efficiencies and optimal cut value



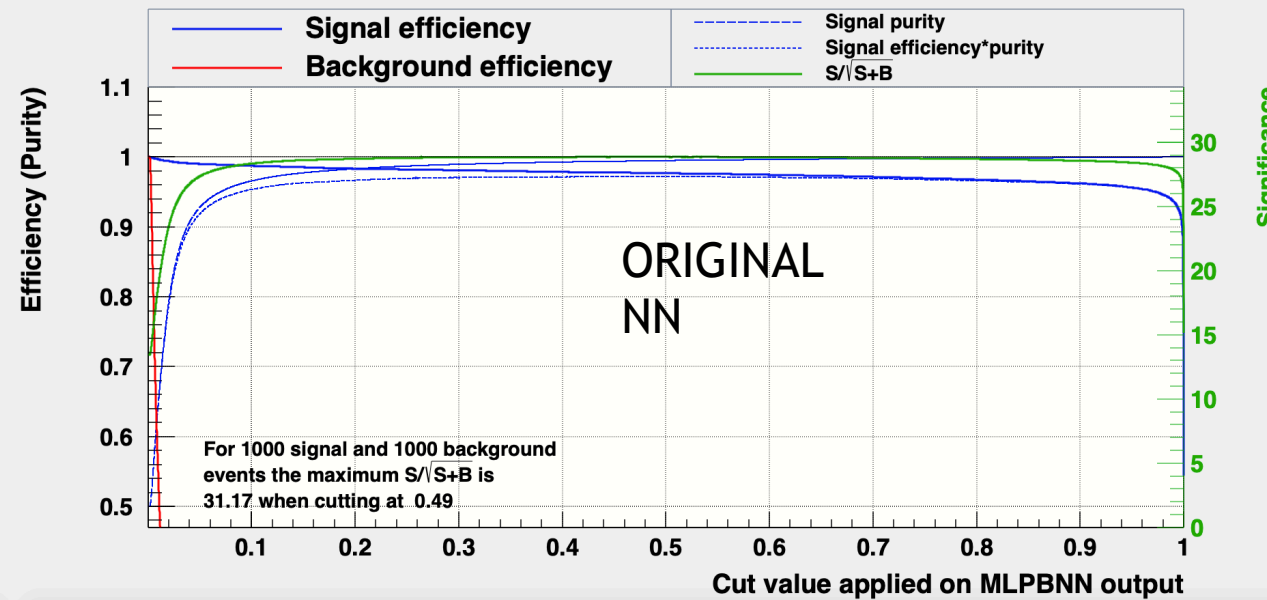
Cut efficiencies and optimal cut value



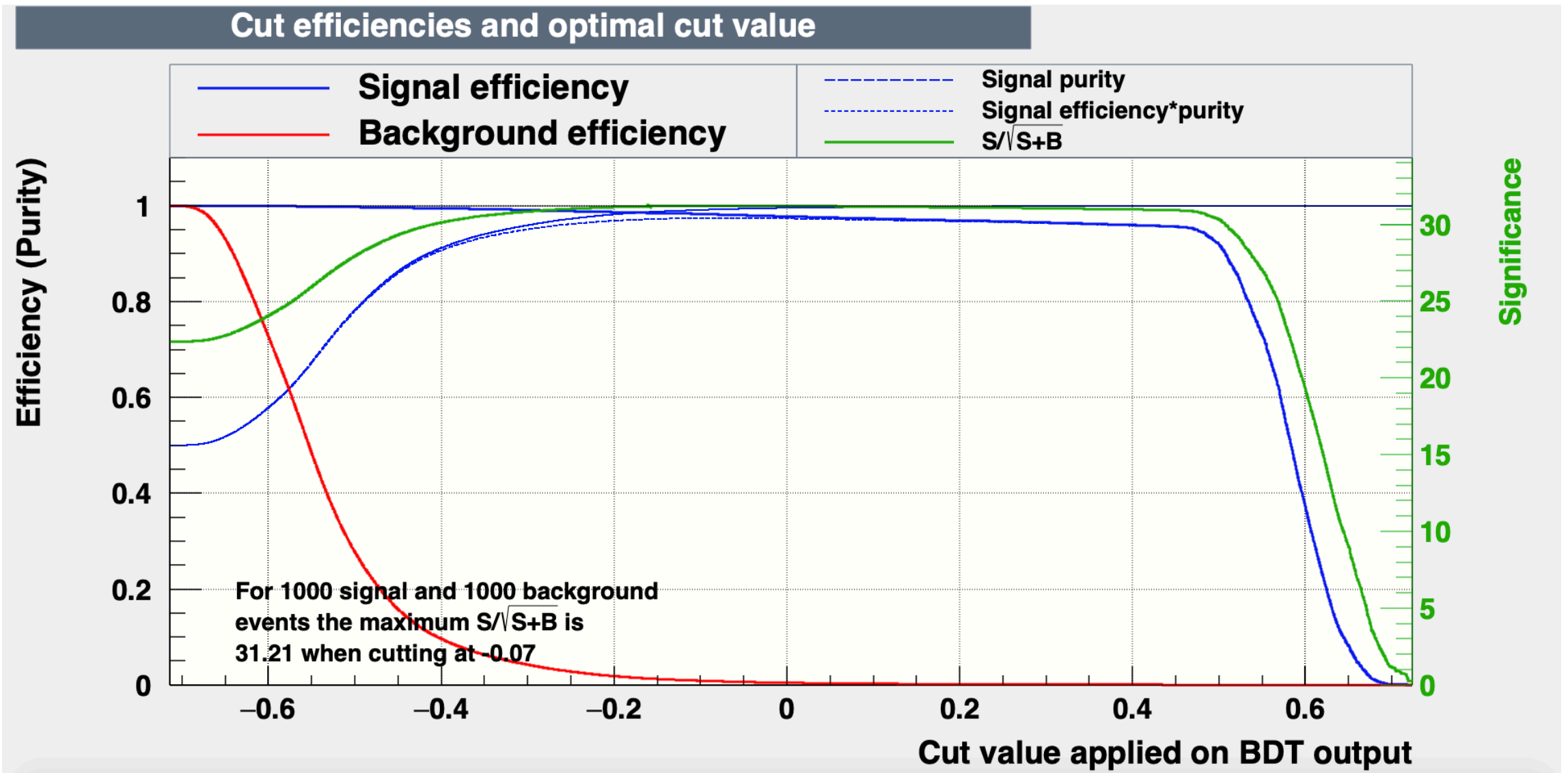
Cut efficiencies and optimal cut value



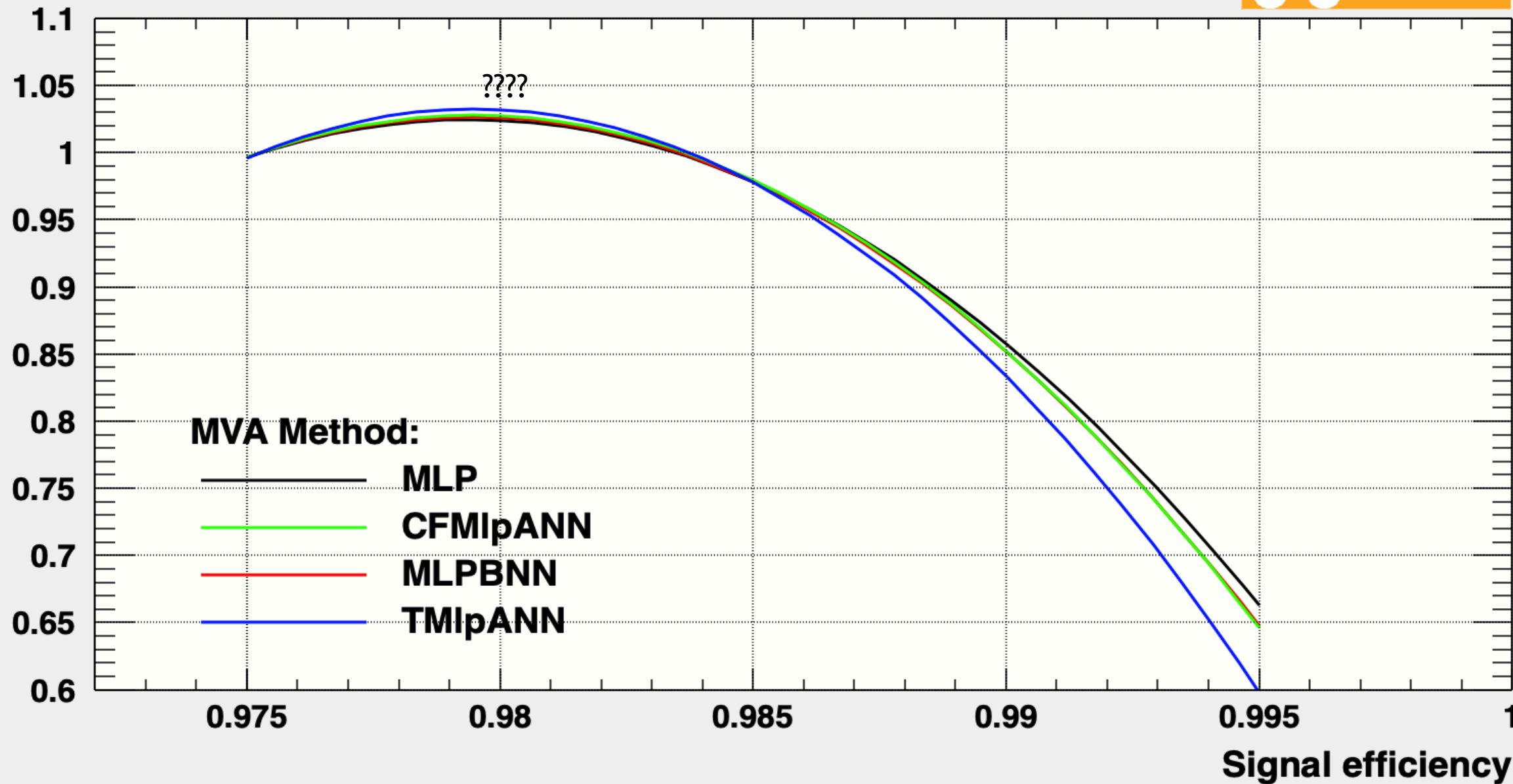
Cut efficiencies and optimal cut value



Next best performing method  
that's not a neural net: Boosted Decision Tree



Background rejection



**MVA Method:**

— MLP

MLP

— CFMlpANN

CFMlpANN

— MLPBNN

MLPBNN

— TMlpANN

TMlpANN

0.975

0.98

0.985

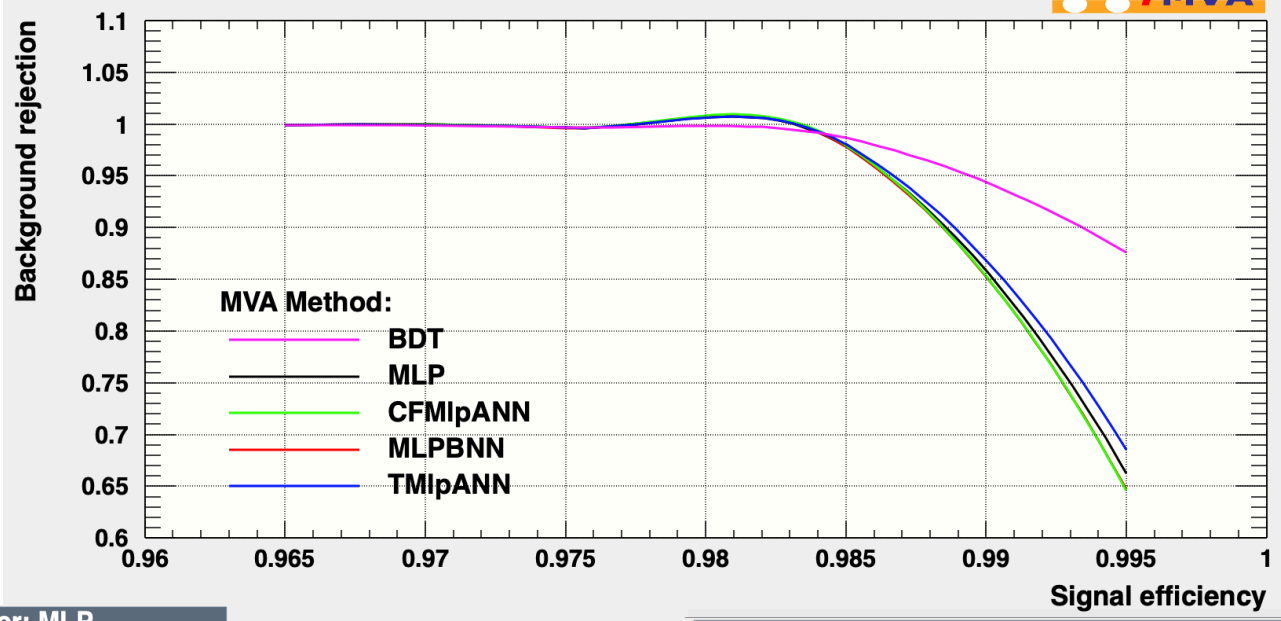
0.99

0.995

1

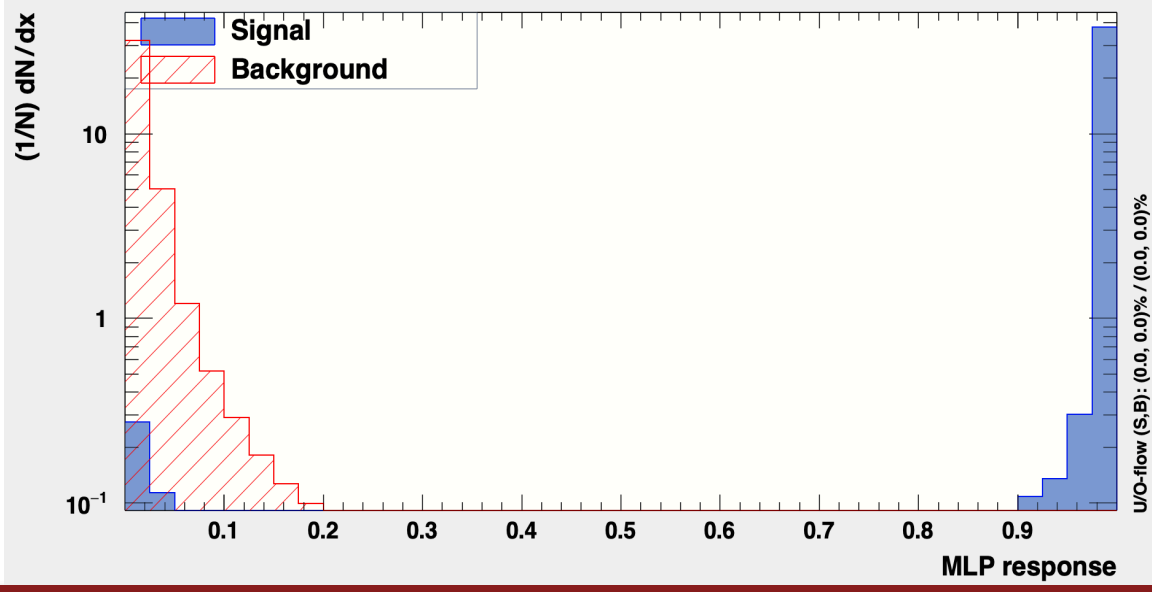
Signal efficiency

### Background rejection versus Signal efficiency

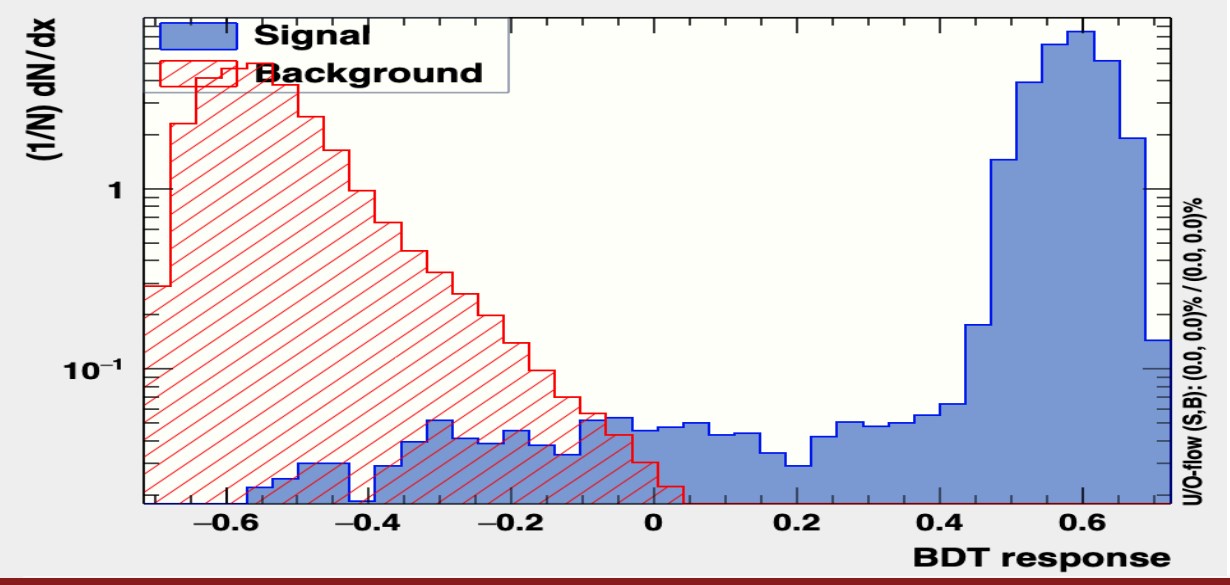


Some questions remain while trying to reconcile ROC curve with classifier outputs

### TMVA response for classifier: MLP

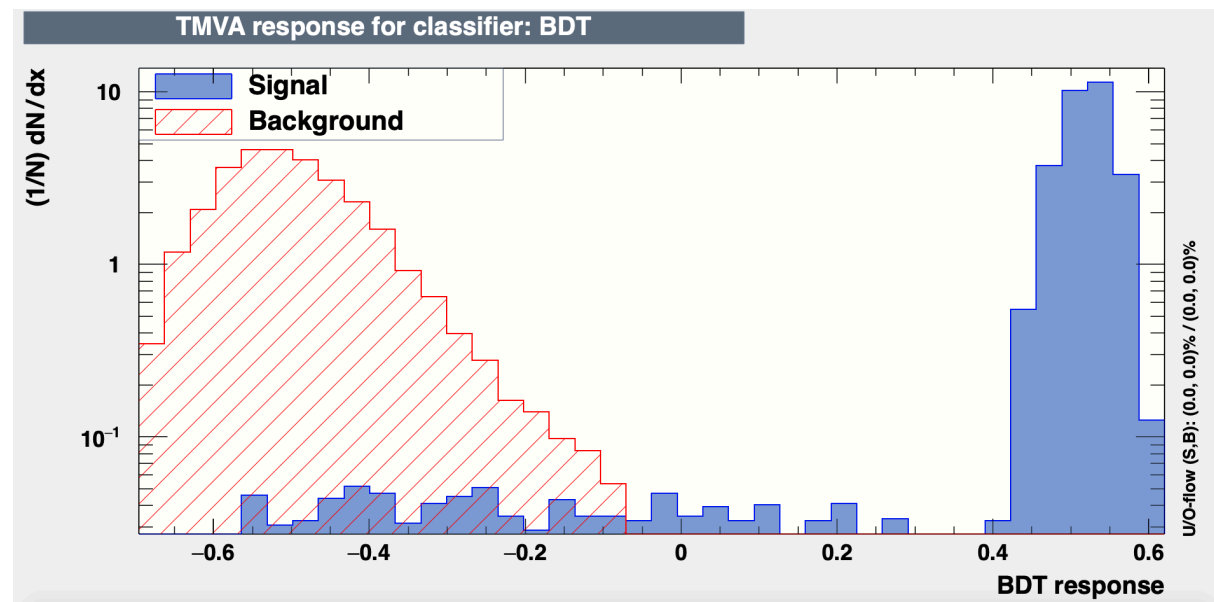
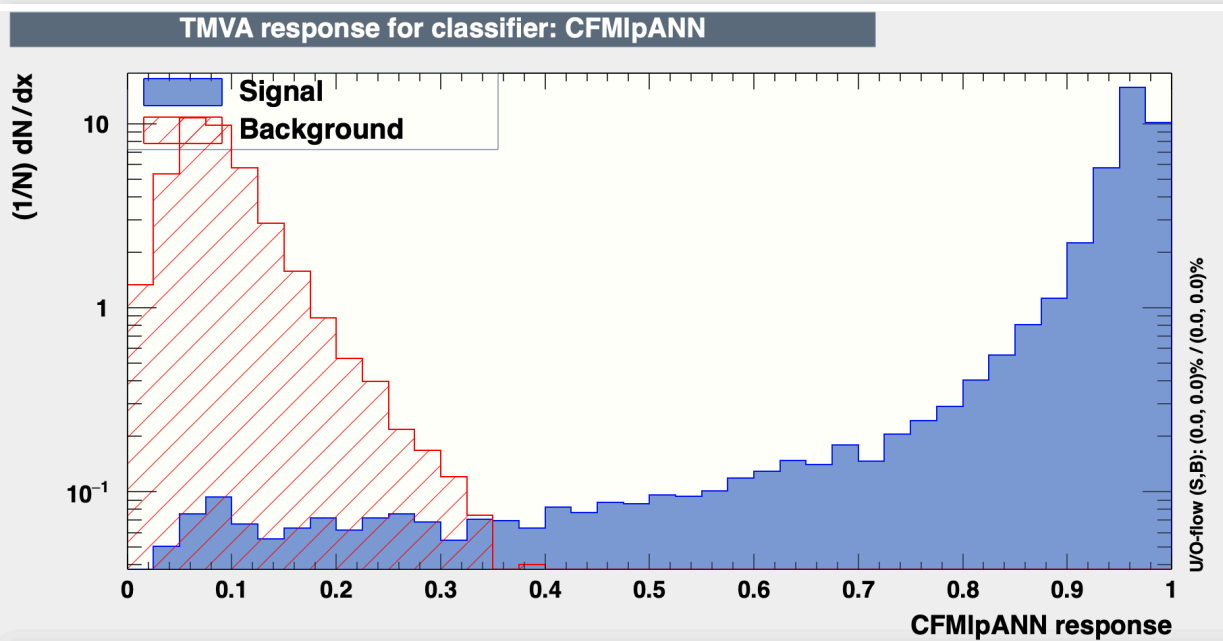
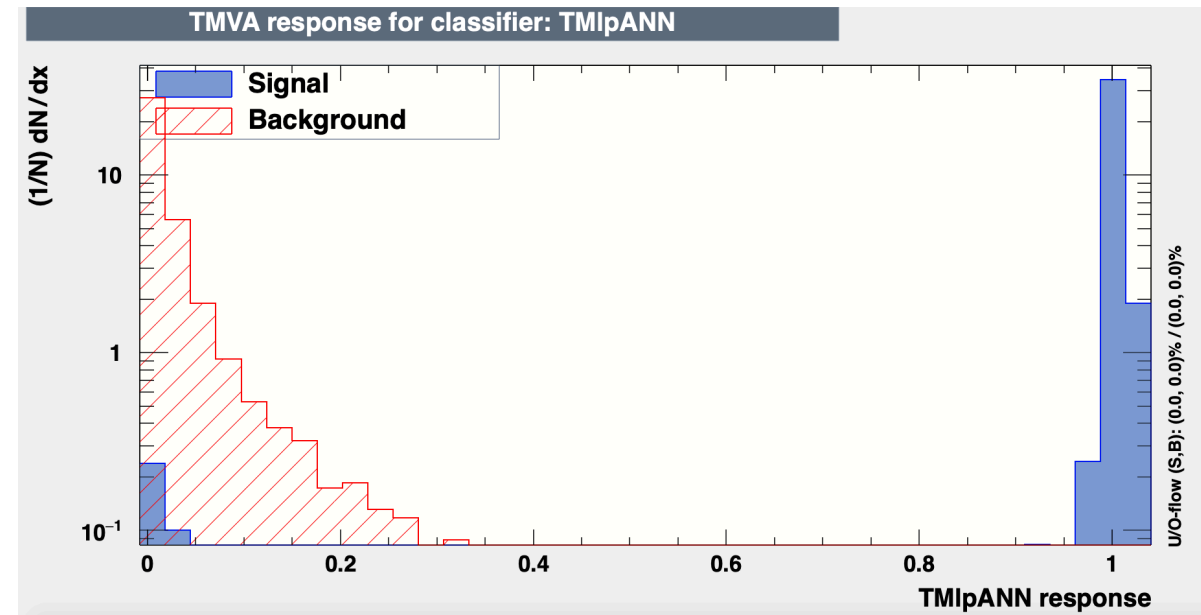
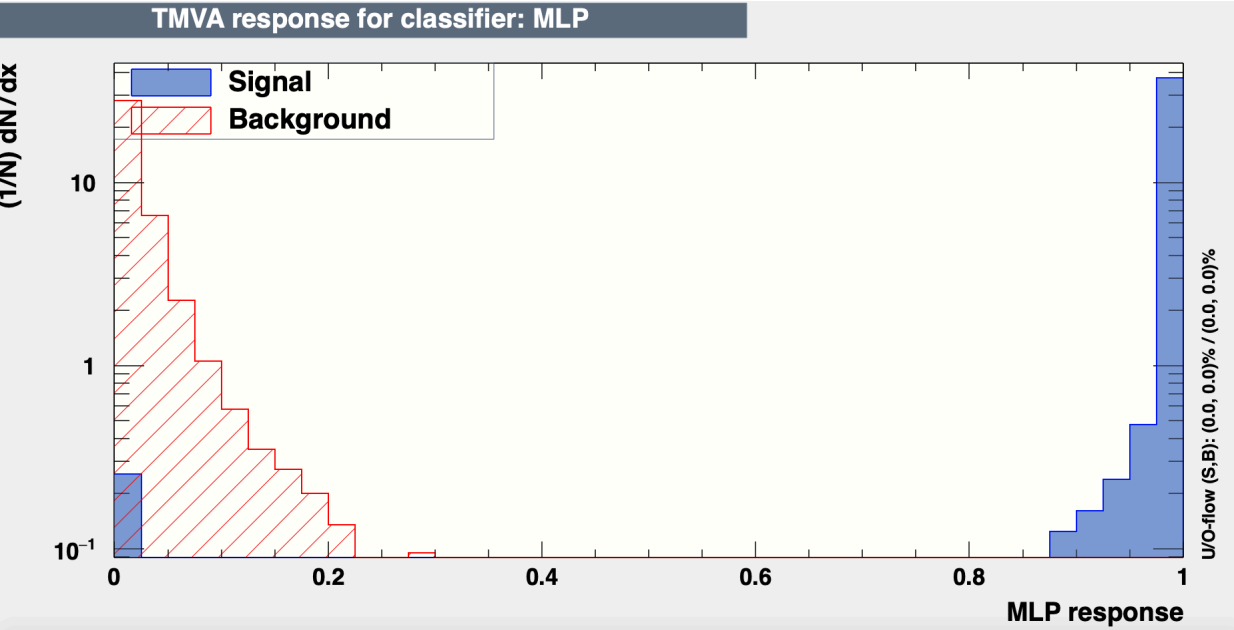


### TMVA response for classifier: BDT





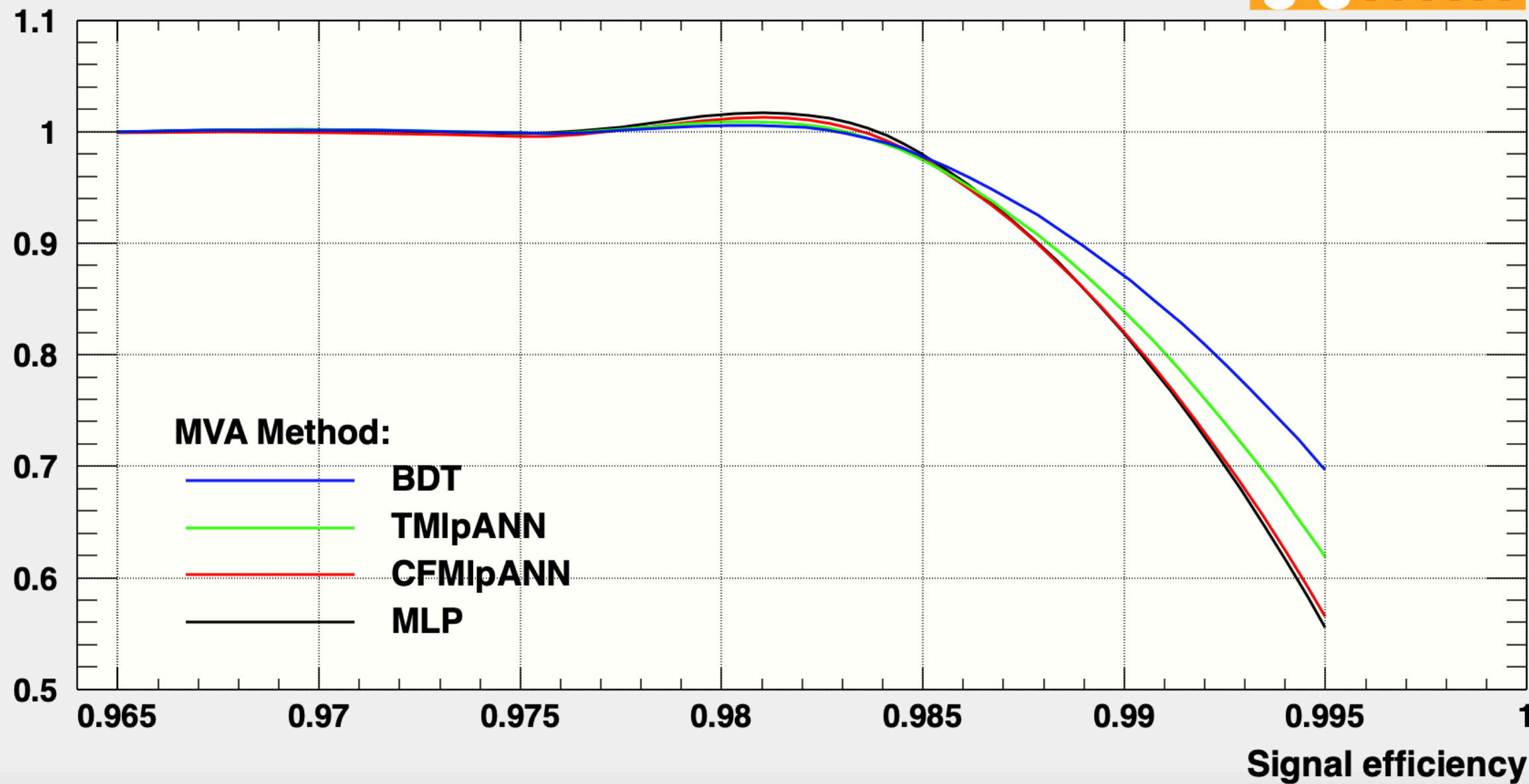
Now with electron pairs trained from  $\pi^0 \rightarrow \gamma e^+ e^-$



# Background rejection versus Signal efficiency



Background rejection



MVA Method:

- BDT
- TMlpANN
- CFMlpANN
- MLP

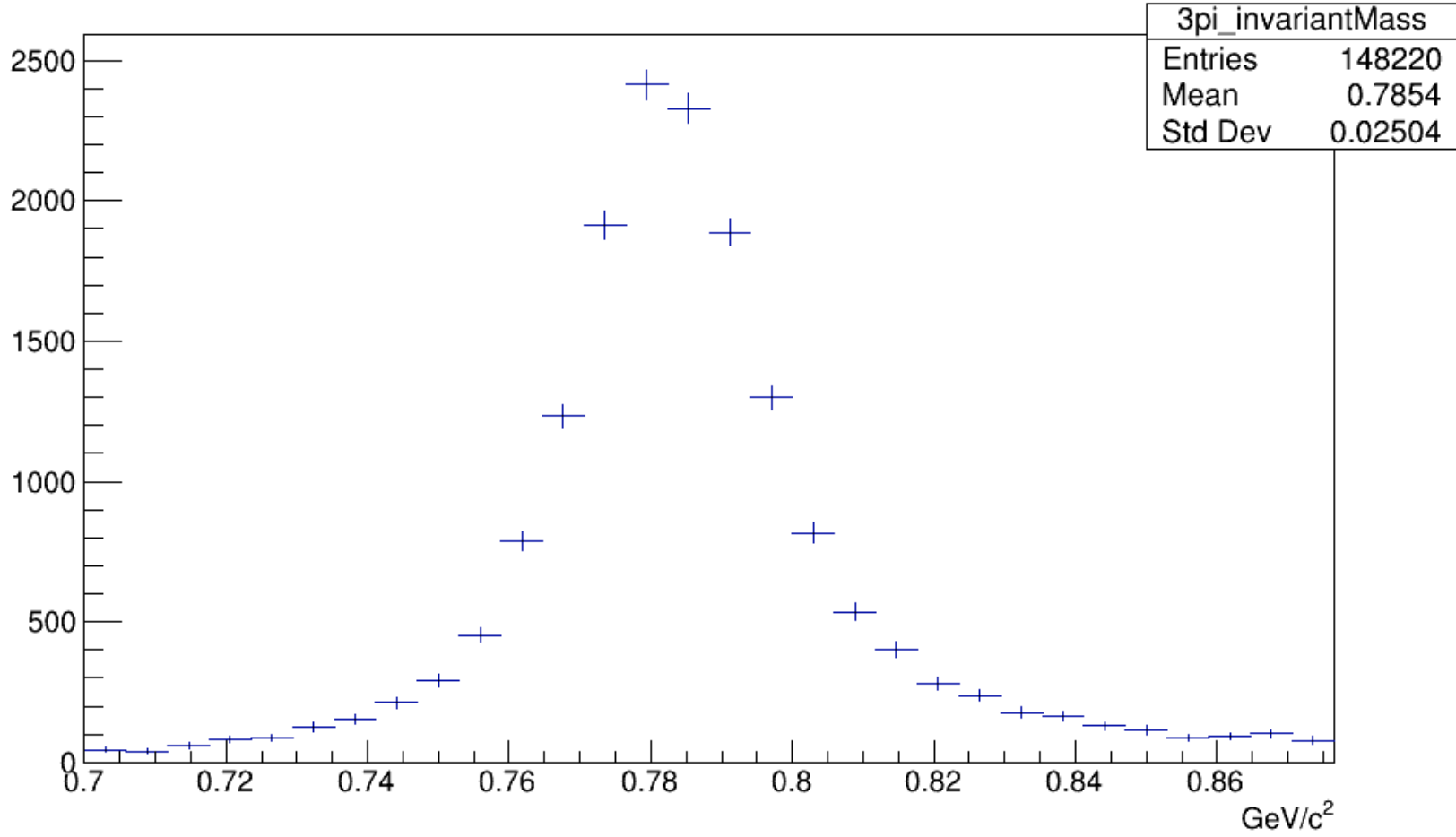
### $\omega(782)$ MASS

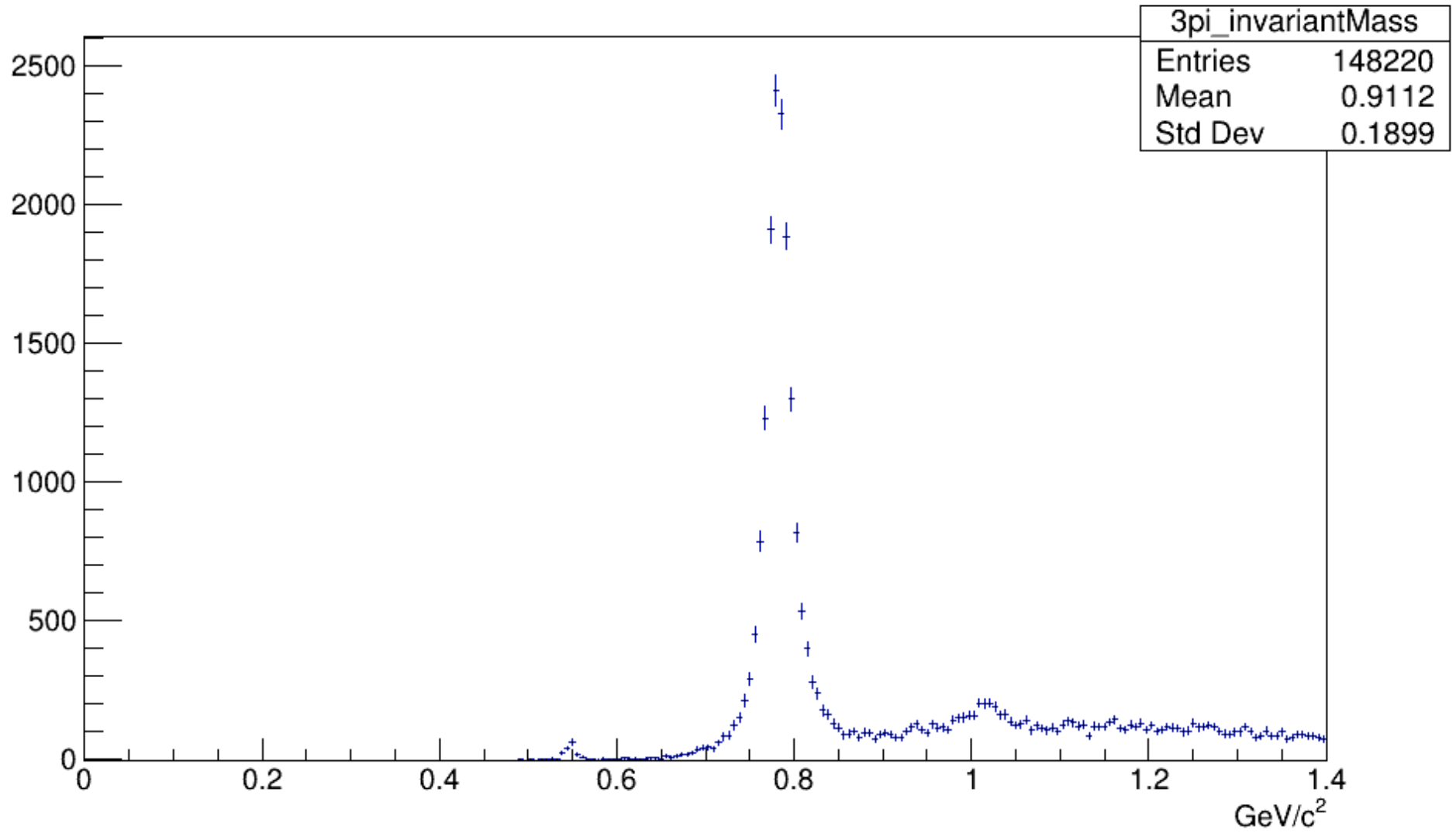
VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
<b><math>782.65 \pm 0.12</math></b>	<b>OUR AVERAGE</b>	Error includes scale factor of 1.9. See the ideogram below.		
$783.20 \pm 0.13 \pm 0.16$	18680	AKHMETSHIN 05	CMD2	$0.60-1.38 e^+ e^- \rightarrow \pi^0 \gamma$
$782.68 \pm 0.09 \pm 0.04$	11200	<sup>1</sup> AKHMETSHIN 04	CMD2	$e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$

### $\omega(782)$ WIDTH

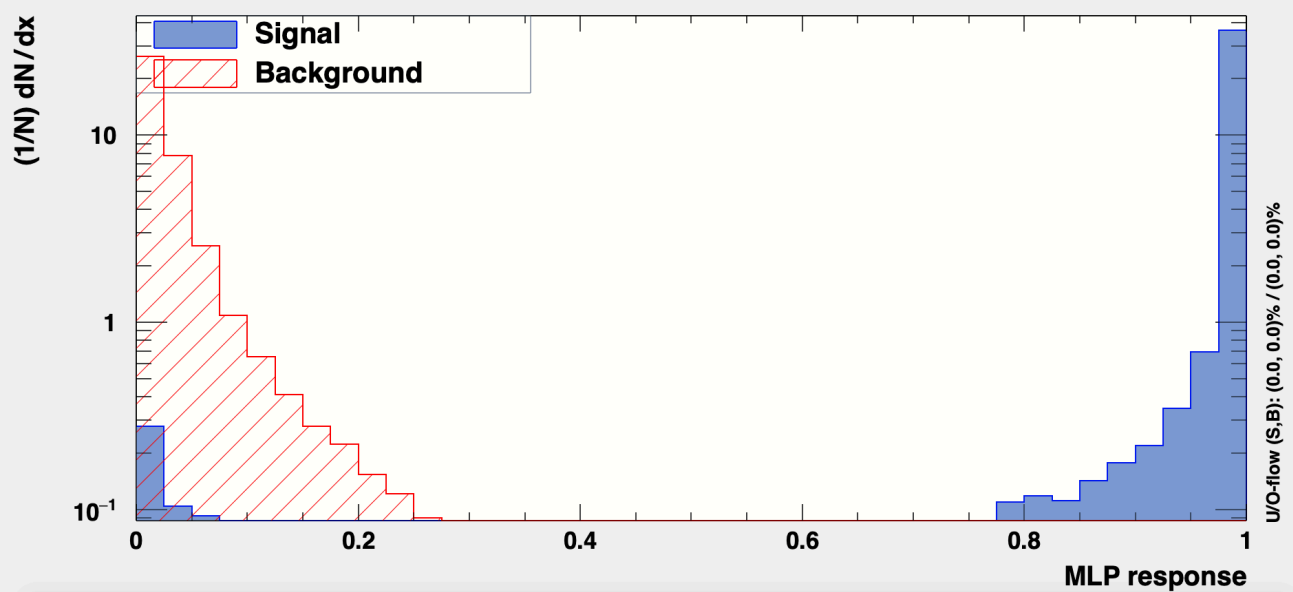
VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
<b><math>8.49 \pm 0.08</math></b>	<b>OUR AVERAGE</b>			
$8.68 \pm 0.23 \pm 0.10$	11200	<sup>9</sup> AKHMETSHIN 04	CMD2	$e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
$8.68 \pm 0.04 \pm 0.15$	1.2M	<sup>10</sup> ACHASOV 03D	RVUE	$0.44-2.00 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$

I select  
 $0.76 < W < .81$

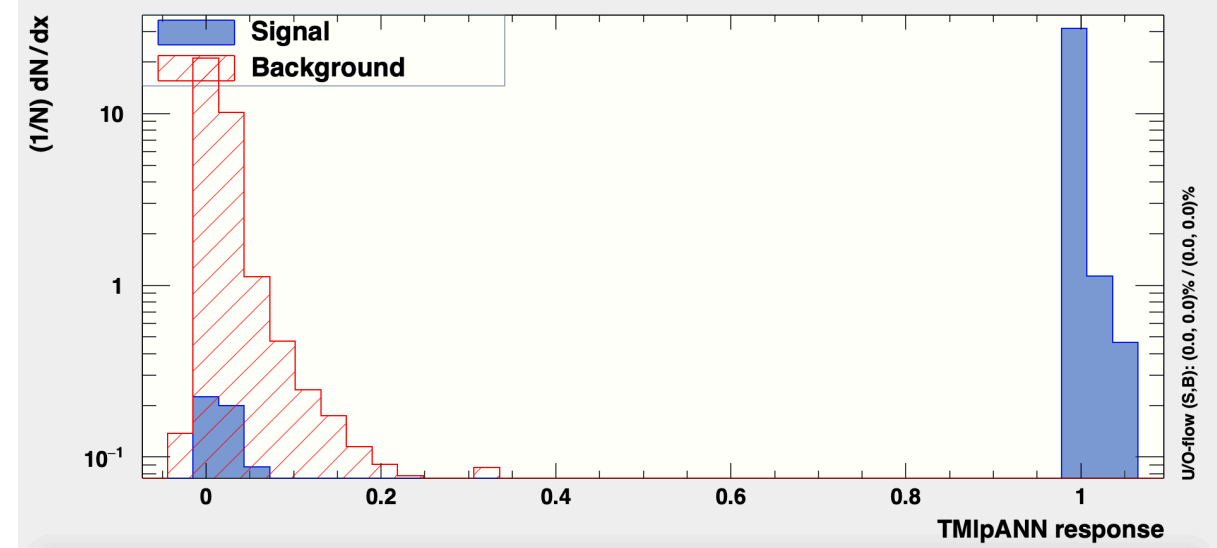




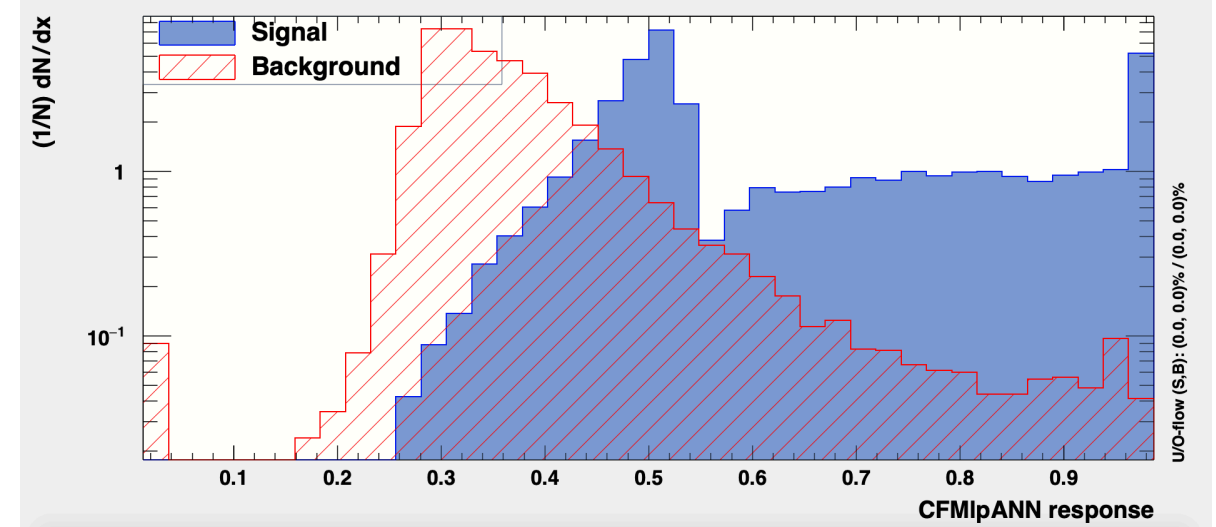
TMVA response for classifier: MLP



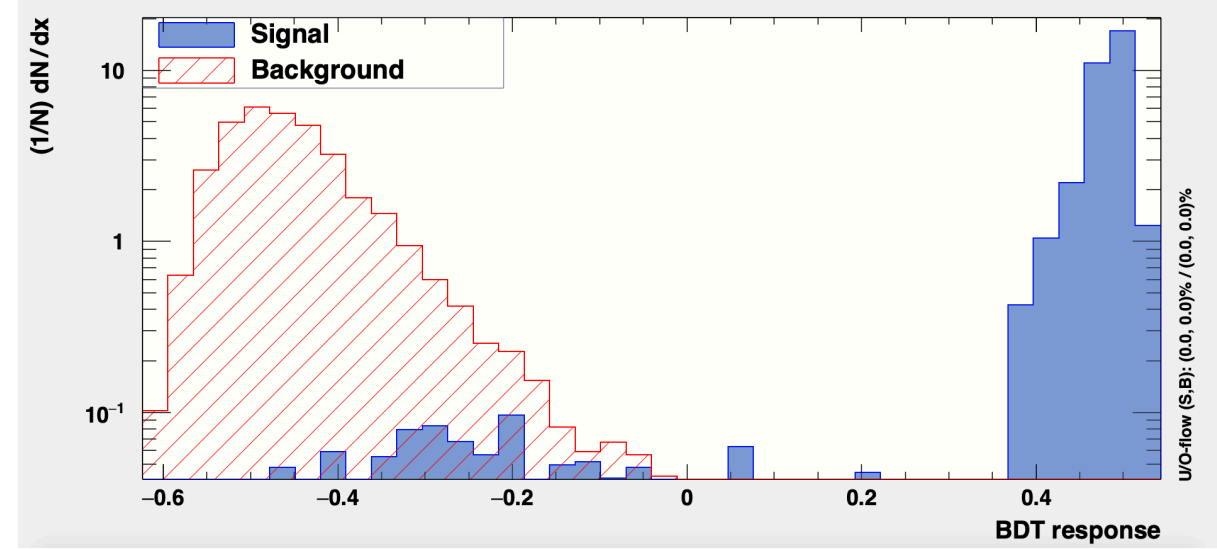
TMVA response for classifier: TMlpANN



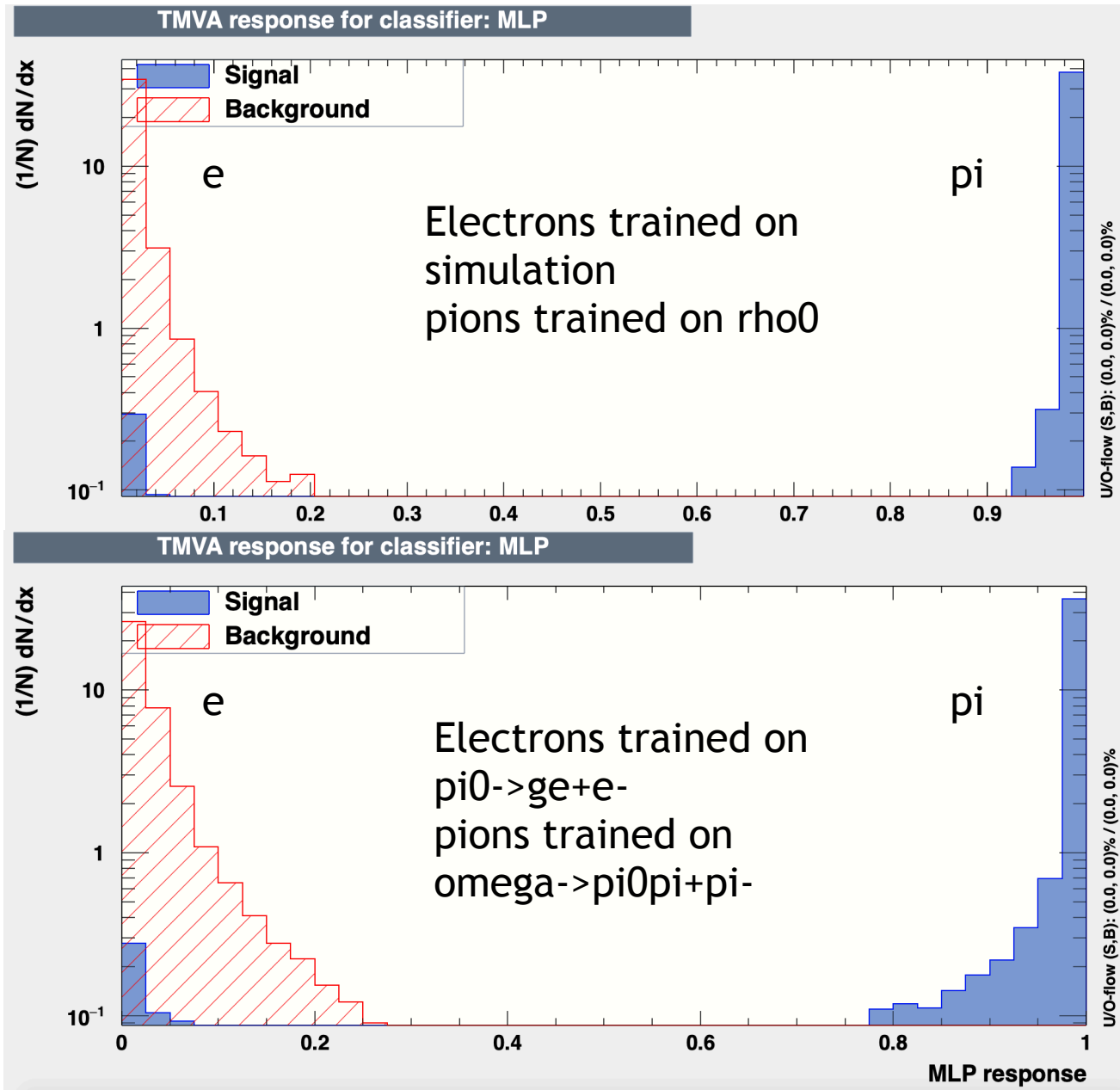
TMVA response for classifier: CFMlpANN

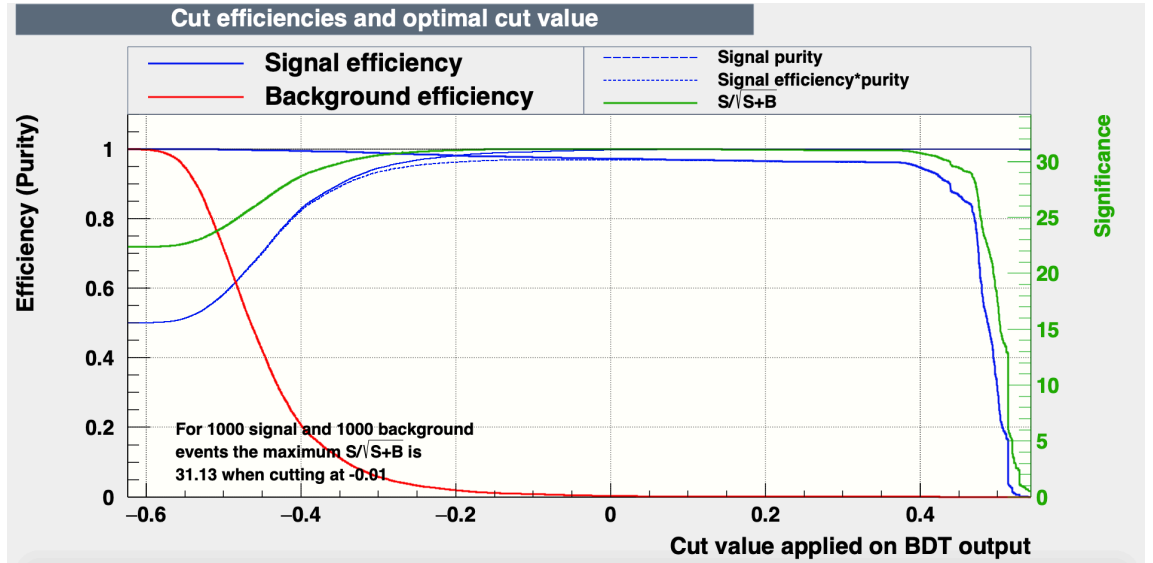
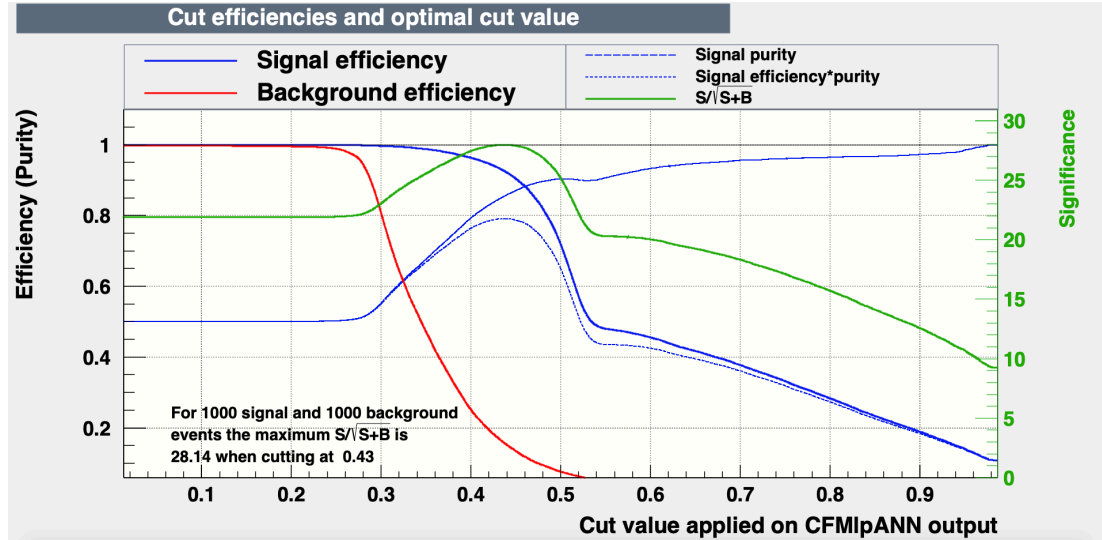
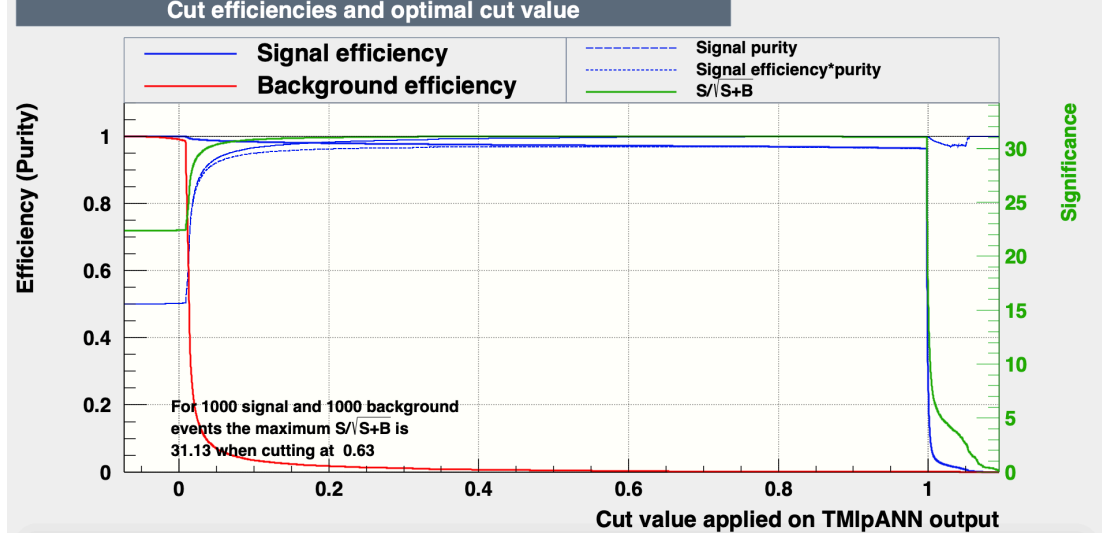
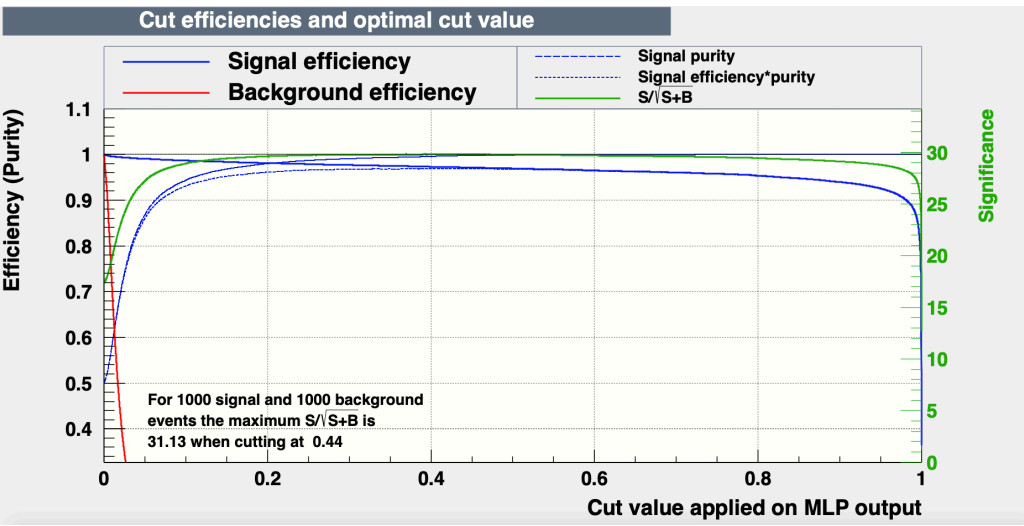


TMVA response for classifier: BDT



No longer training on lab phi of track (removed from the MC training too for this comparison)



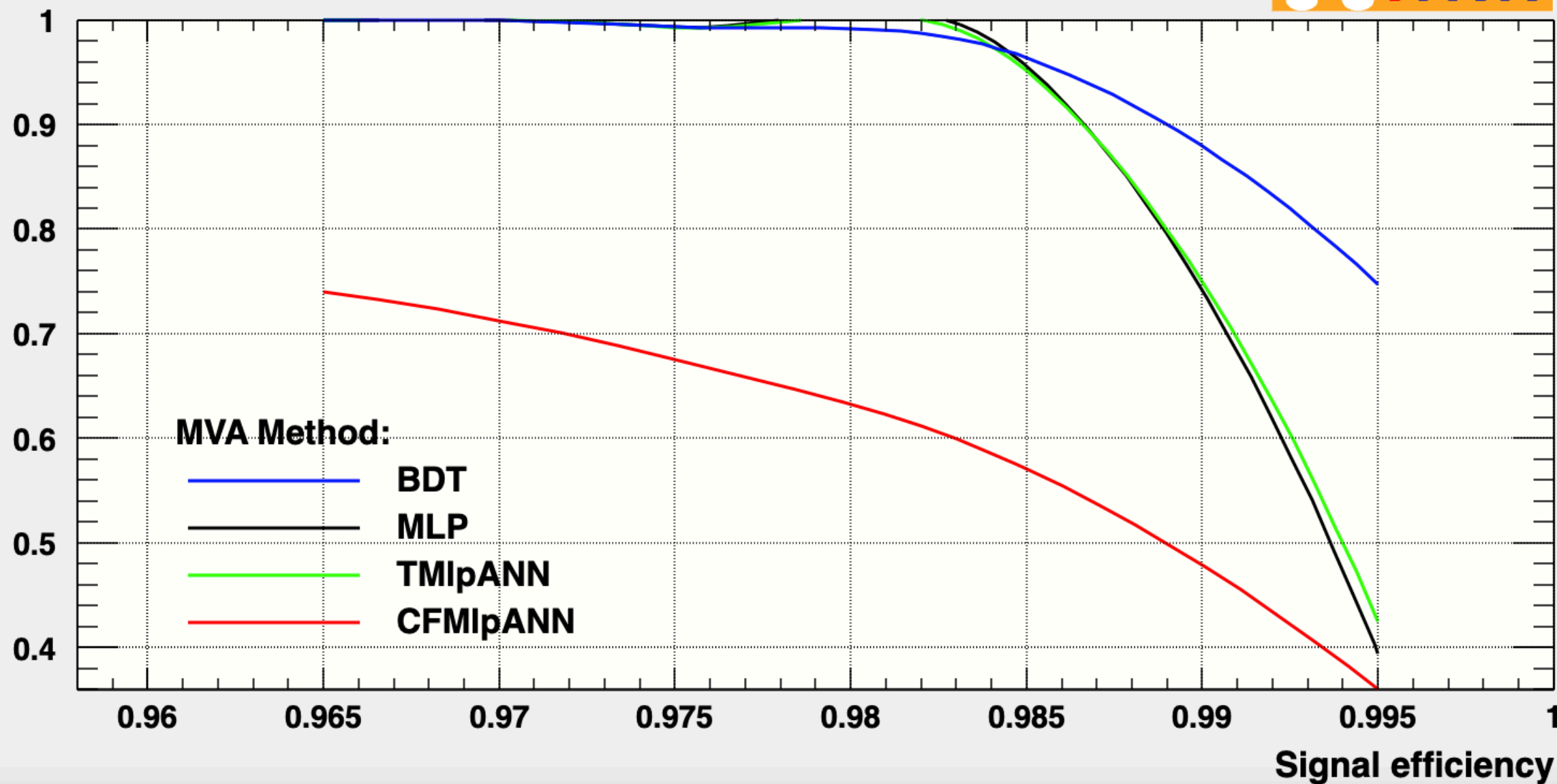


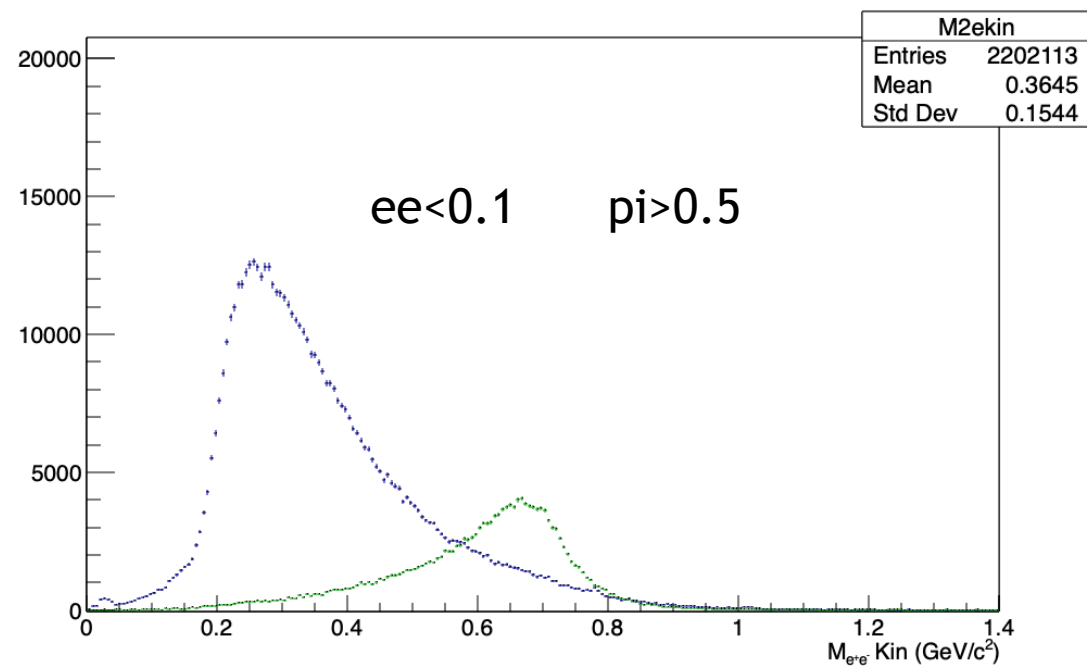
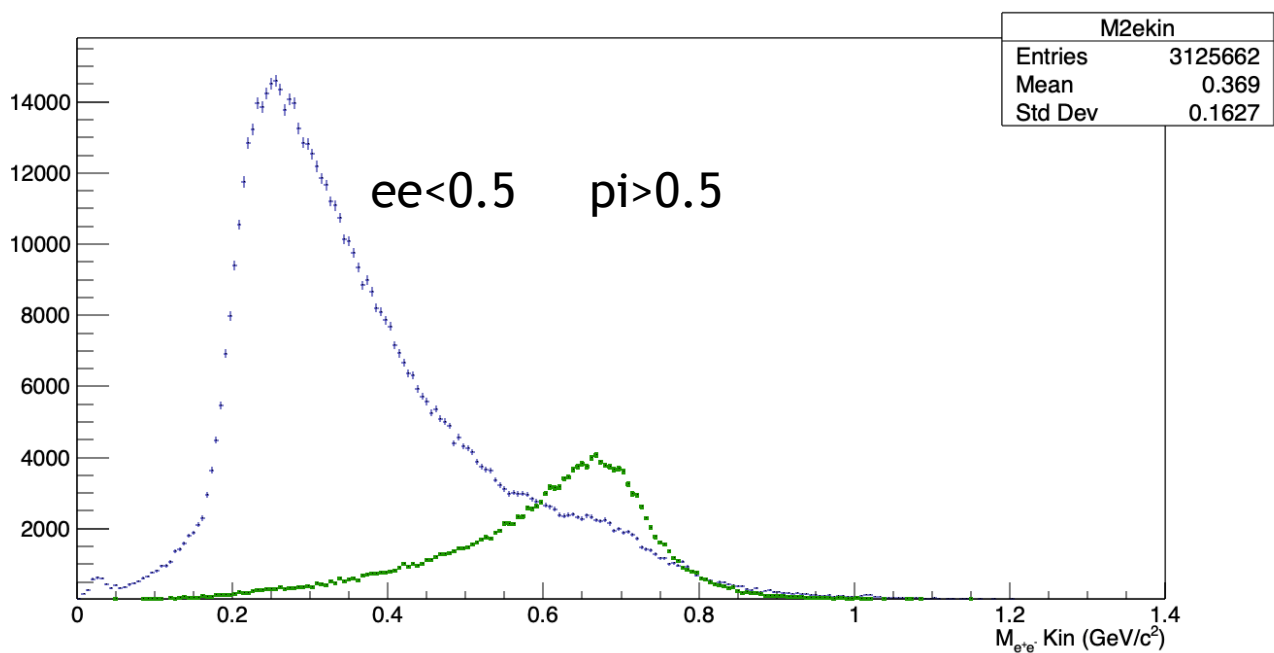
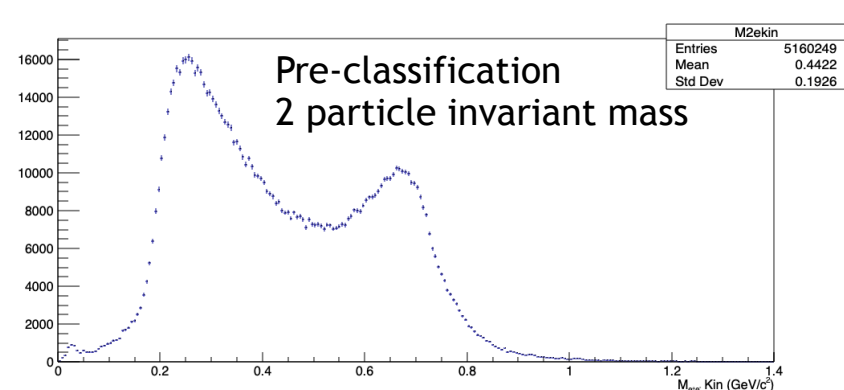
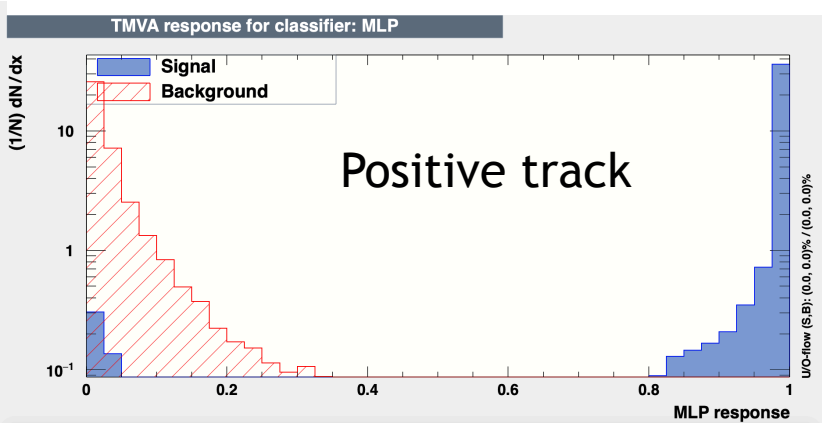
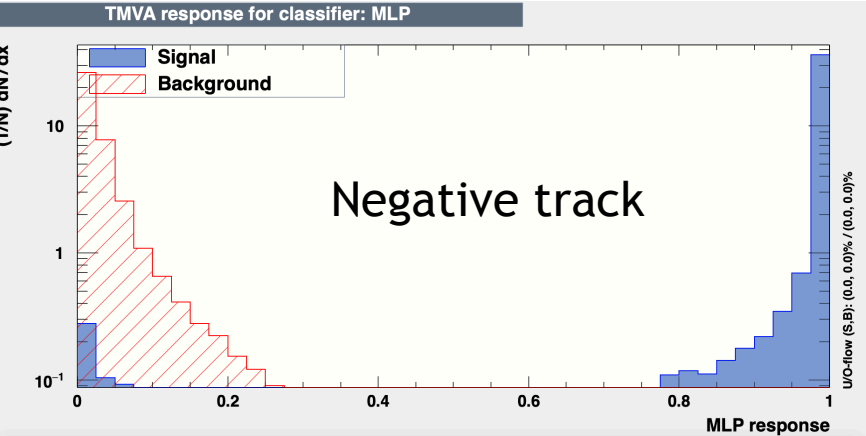


# Background rejection versus Signal efficiency

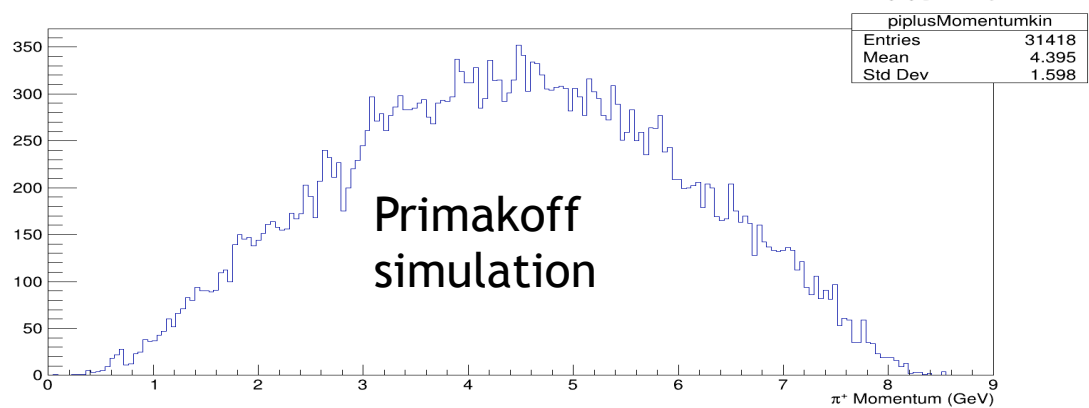
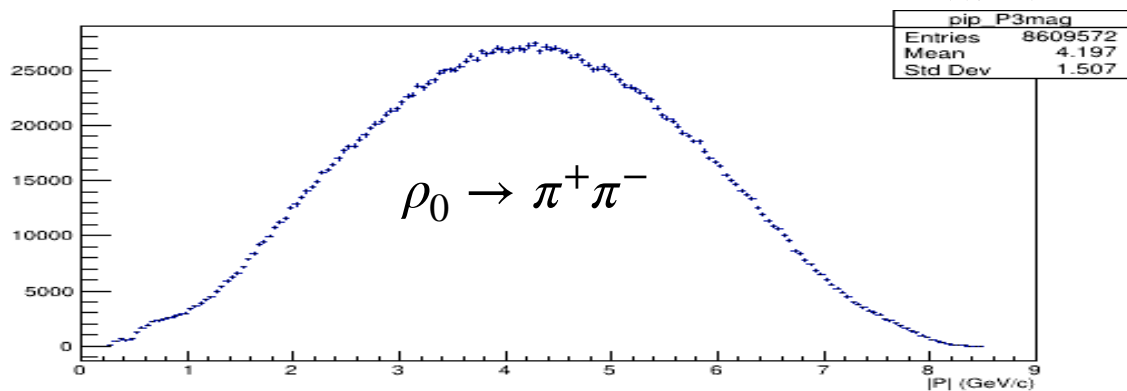
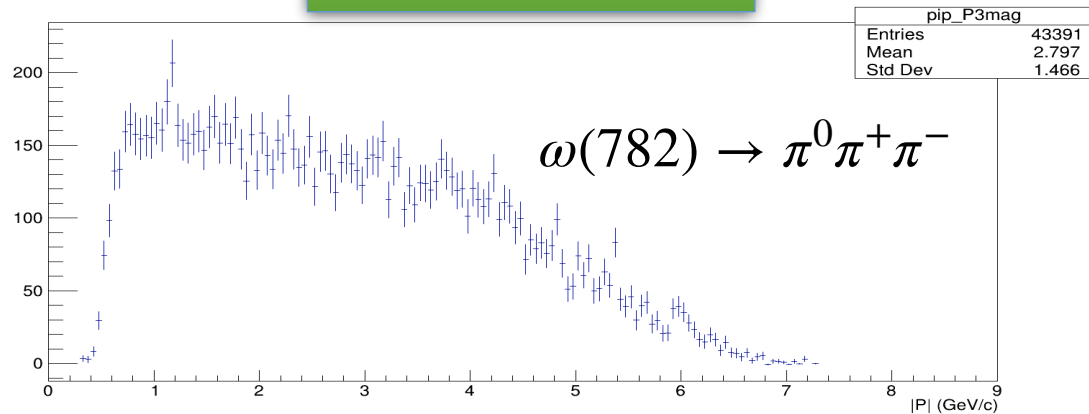


Background rejection

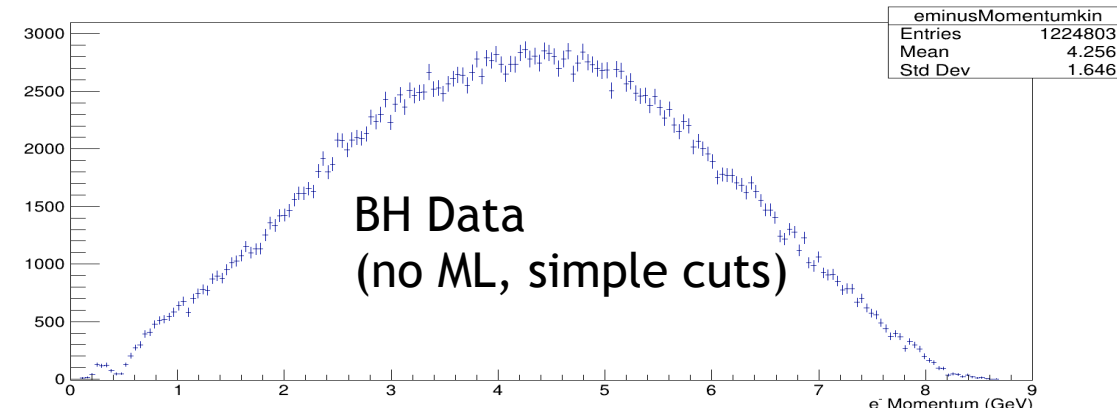
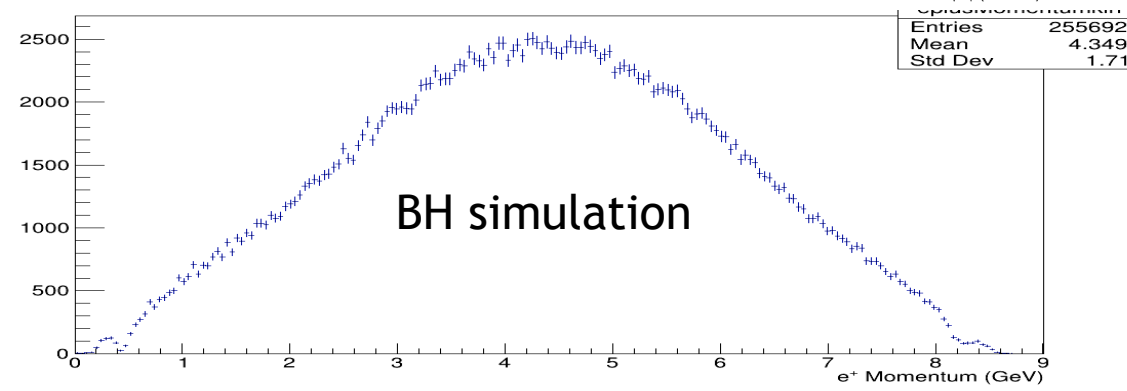
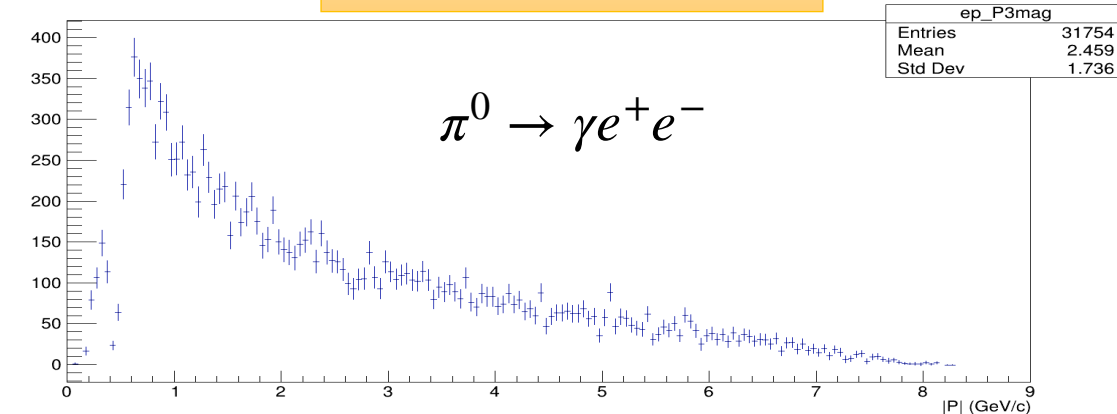




# PI PLUS MOMENTUM



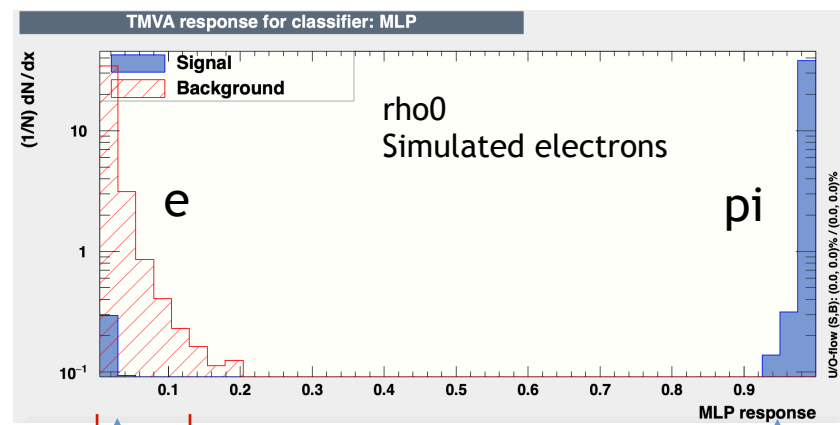
# POSITRON MOMENTUM



Integral procedure:  
MVA response histograms have **40 bins**.

Background peak integral: bins 0 to 5  
Signal peak integral: bins 31 to 40

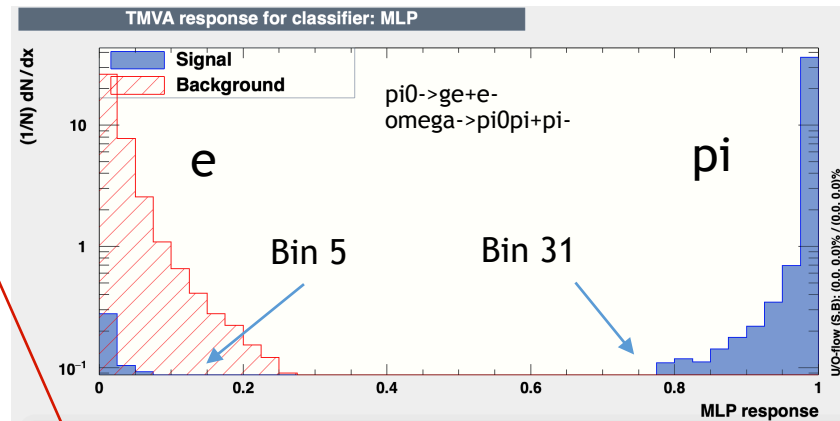
I keep the bounds of integration the same for both rho0 and omega(782)



Background peak

Signal peak

$$\frac{\int_0^5 N_{\rho_0}(x)dx}{\int_{31}^{39} N_{\rho_0}(x)dx} = \frac{0.76404053}{39.046492} = 0.019567456$$



Background peak

Signal peak

$$\frac{\int_0^5 N_{\omega(782)}(x)dx}{\int_{31}^{39} N_{\omega(782)}(x)dx} = \frac{0.67999367}{38.519641} = 0.017653167$$