

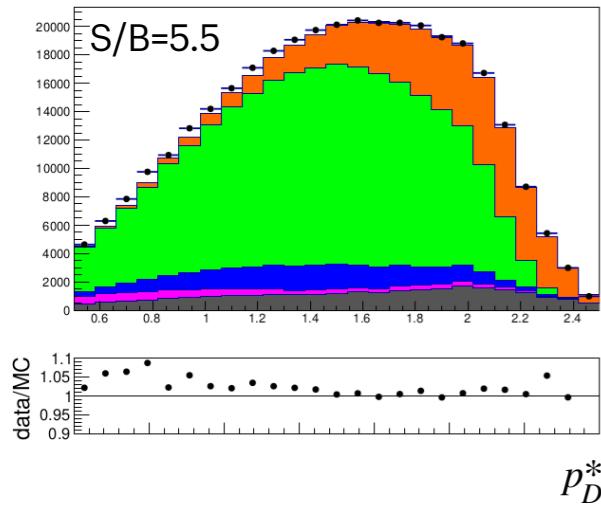
# A simultaneous analysis of $B \rightarrow D\ell\nu$ and $B \rightarrow D^*\ell\nu$ decays

M. Dorigo and M. Mantovano  
(University and INFN Trieste)

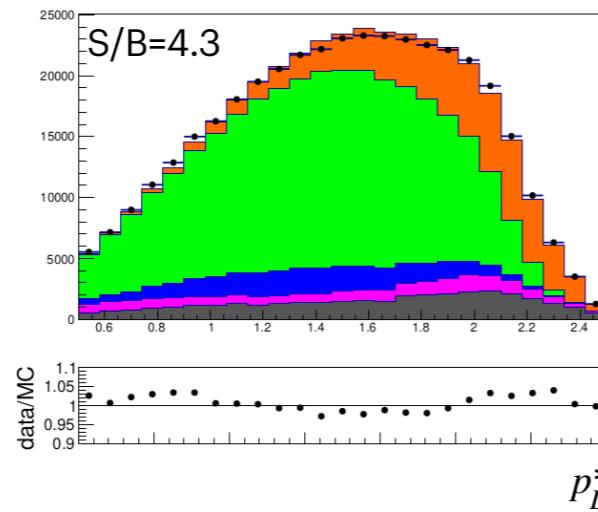
TS Analysis Meeting  
May 13, 2024

# Data/MC agreement: signal region

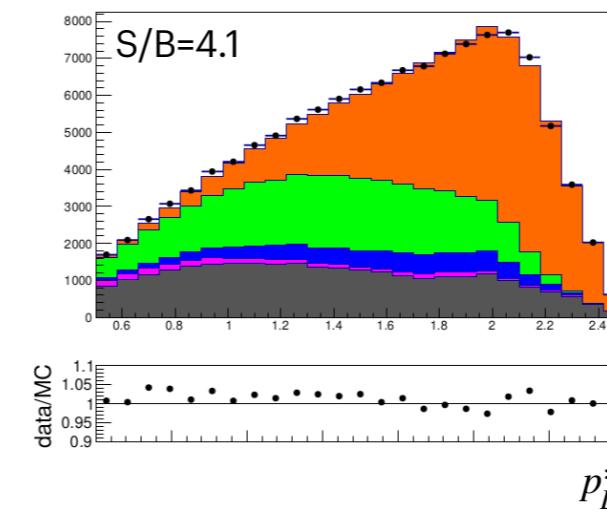
$B \rightarrow D^0 e\nu$



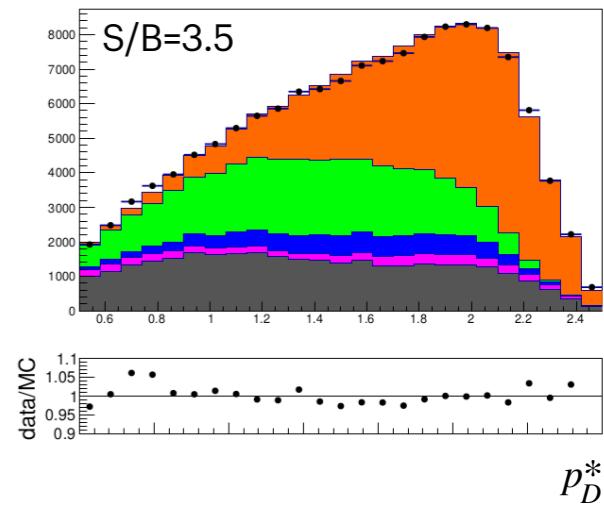
$B \rightarrow D^0 \mu\nu$



$B \rightarrow D^- e\nu$



$B \rightarrow D^- \mu\nu$

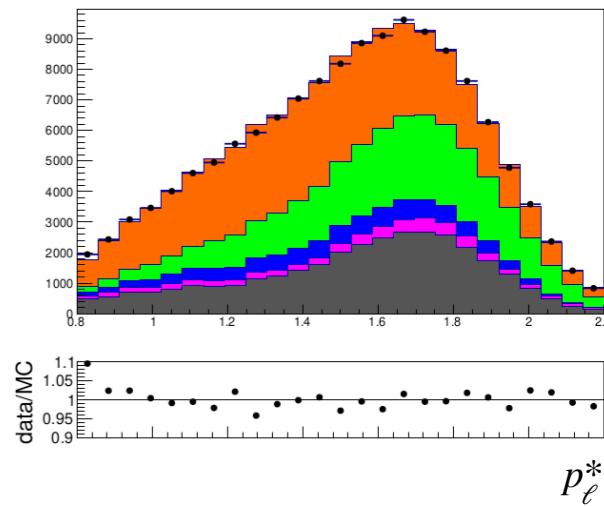
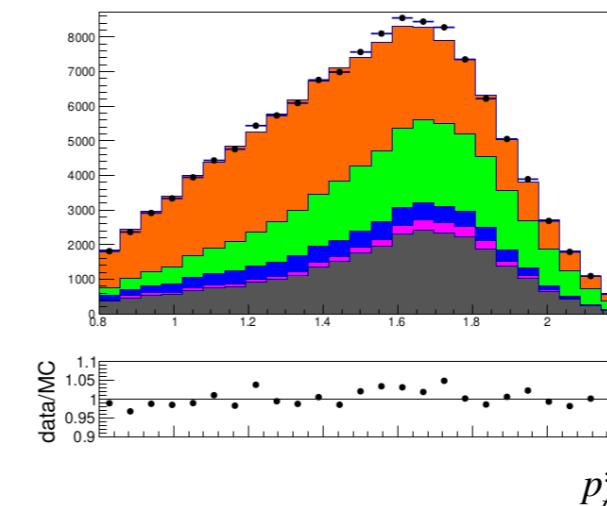
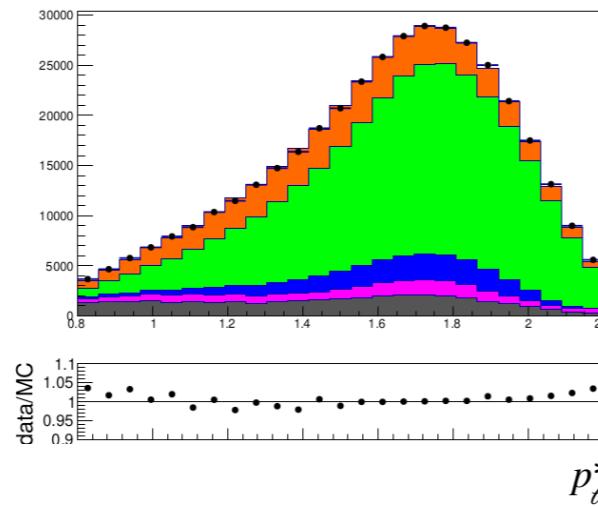
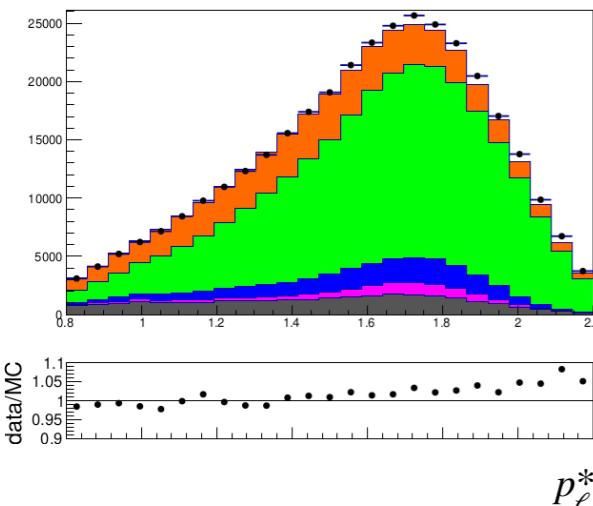


$p_D^*$

$p_D^*$

$p_D^*$

$p_D^*$

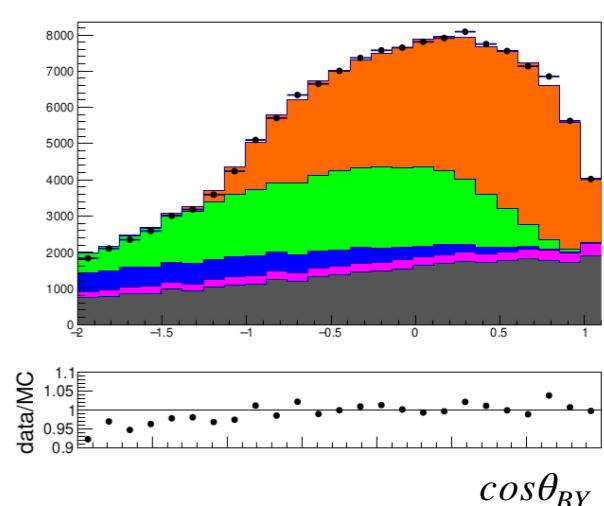
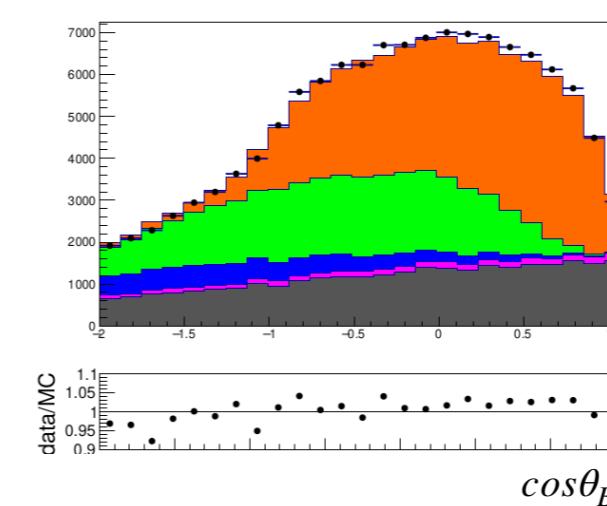
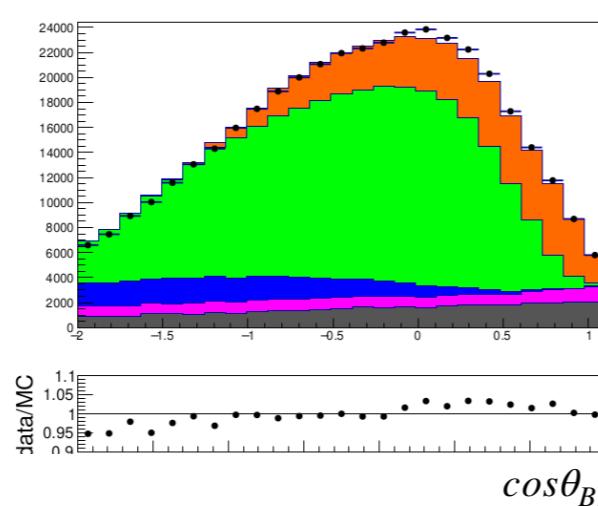
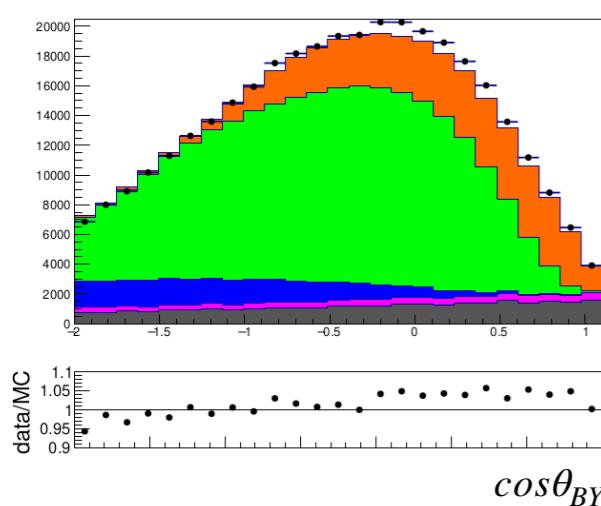


$p_\ell^*$

$p_\ell^*$

$p_\ell^*$

$p_\ell^*$



$\cos\theta_{BY}$

$\cos\theta_{BY}$

$\cos\theta_{BY}$

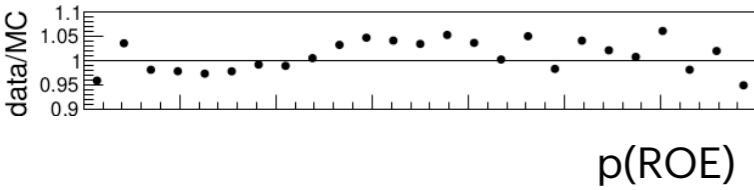
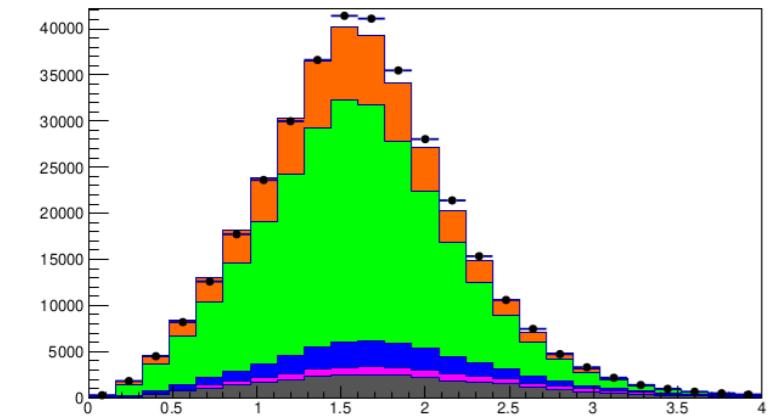
$\cos\theta_{BY}$  2

Data/MC agreement  
ROE variables  
Focus on  $B \rightarrow D^0 e \nu$

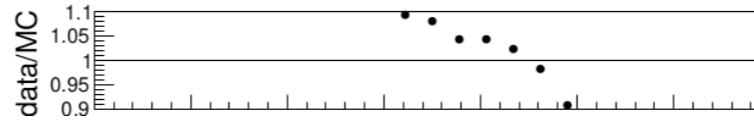
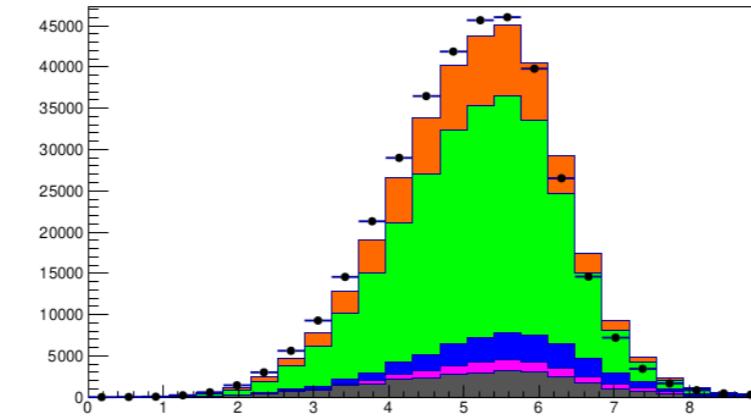
# ROE variables

Could the ROE variables explain the data/MC disagreement?

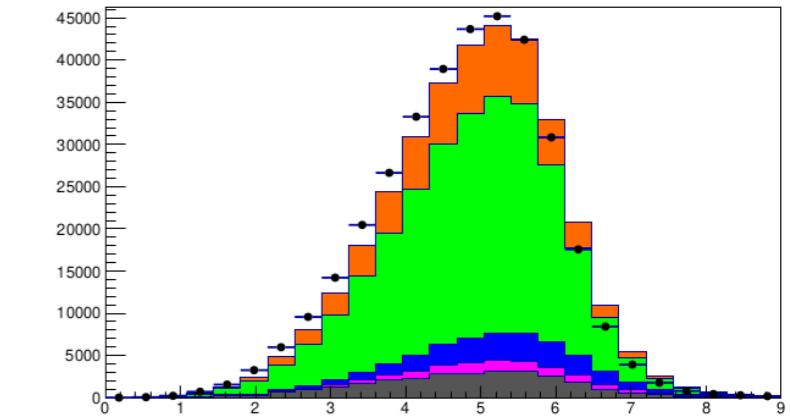
$$B \rightarrow D^0 e \nu$$



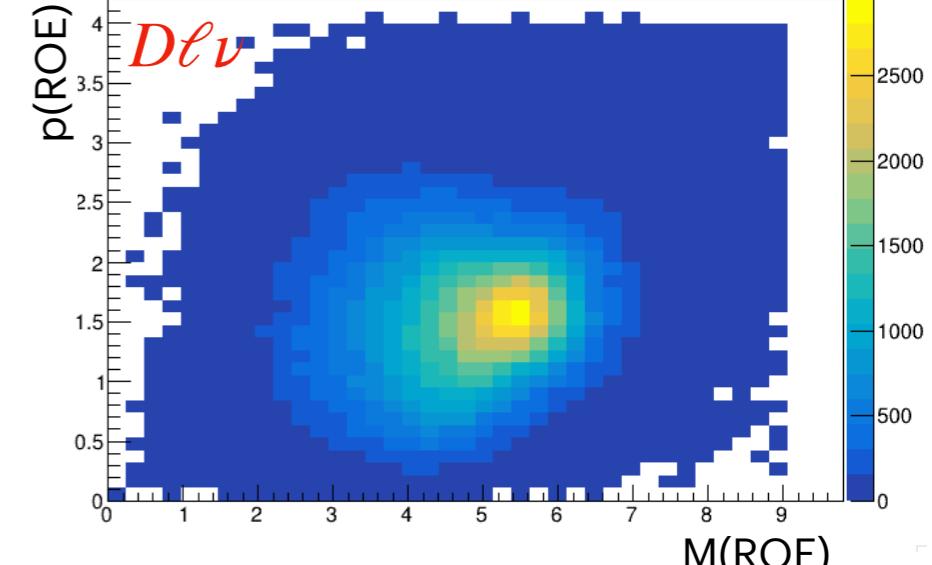
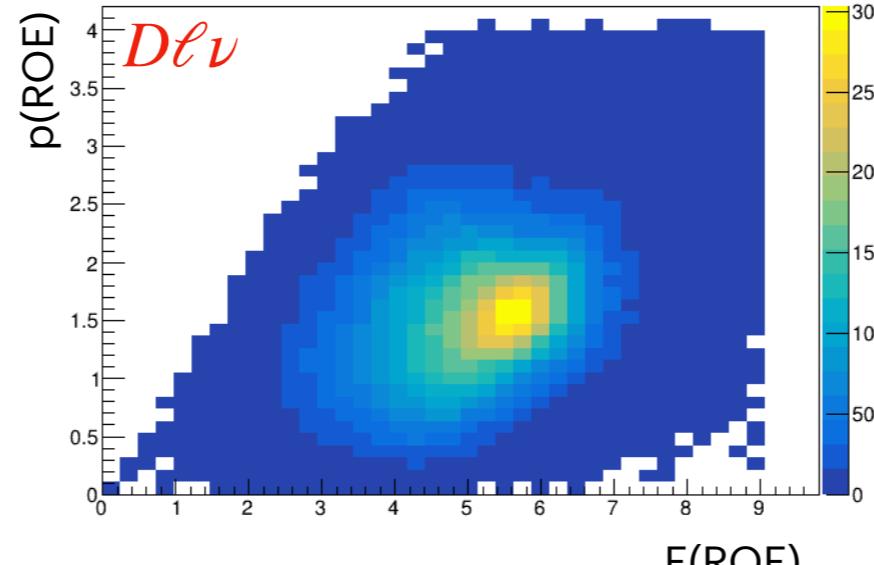
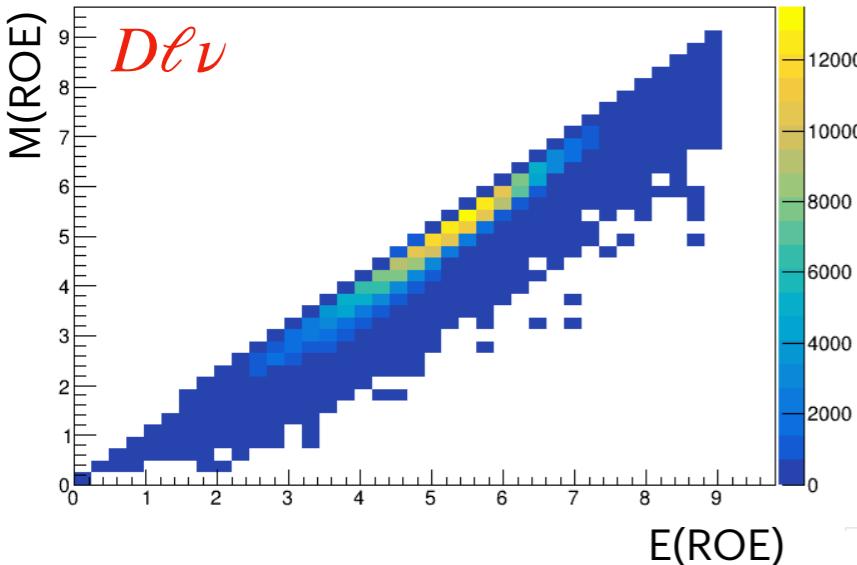
$$B \rightarrow D^0 e \nu$$



$$B \rightarrow D^0 e \nu$$



$M(\text{ROE})$

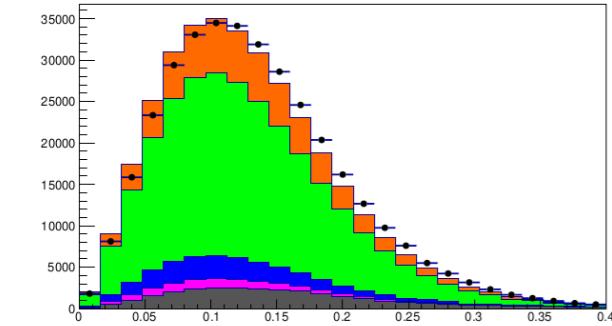


Reweighting the ROE variables to see if data/MC agreement looks better.

Data/MC agreement  
Reweight ROE variables  
Focus on  $B \rightarrow D^0 e \nu$

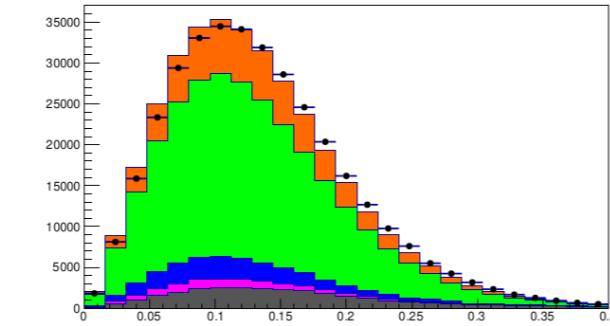
# Reweighting ROE(M) variable: signal region

Starting point



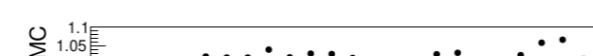
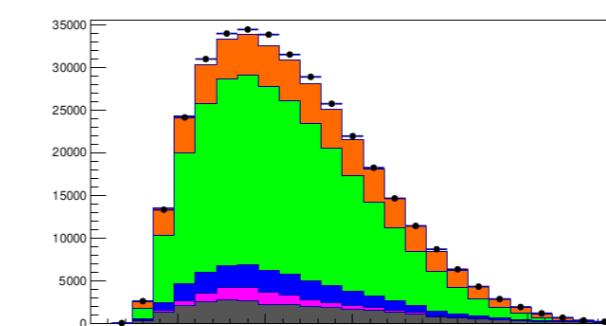
$R2$

ROE(M) reweighting



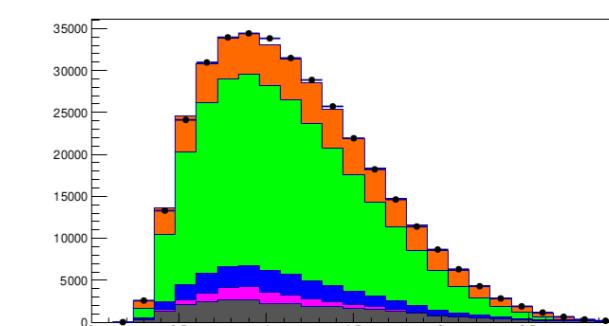
$R2$

Starting point



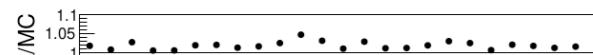
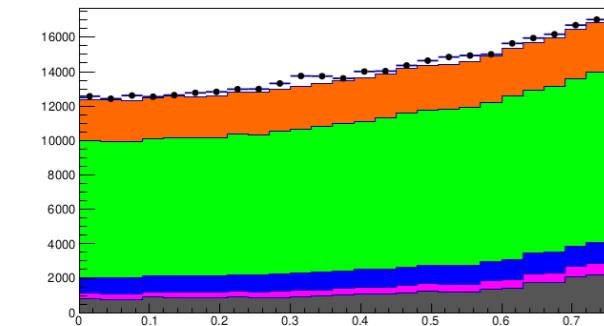
$p_\pi$

ROE(M) reweighting



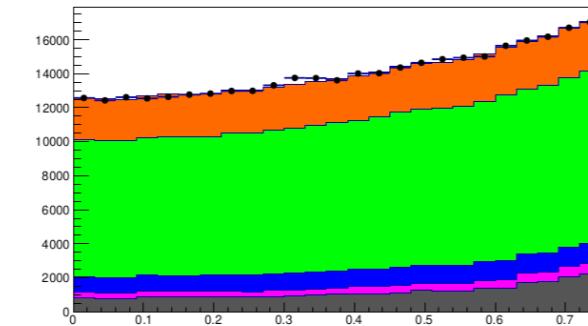
$p_\pi$

$\cos TBTO$



$\cos TBTO$

$\cos TBTO$

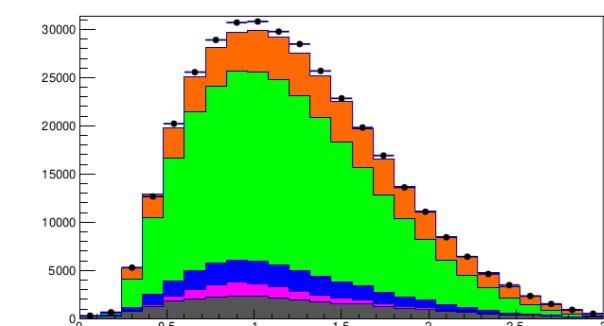


$\cos TBTO$

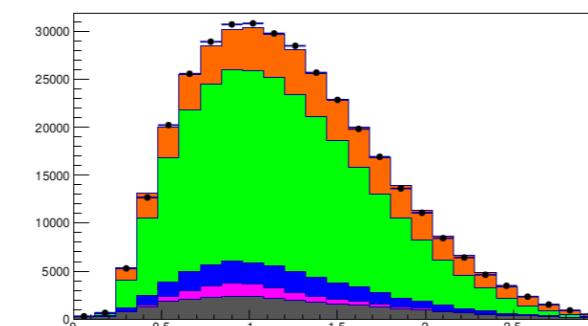
$p_{miss}$

$p_{miss}$

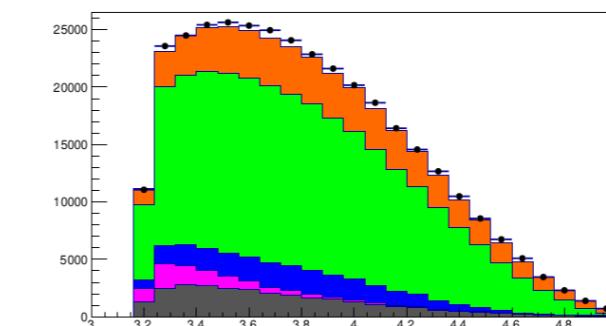
$p_K$



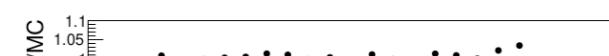
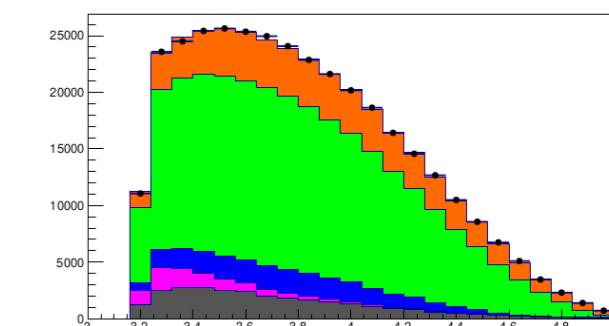
$p_K$



$p_K$



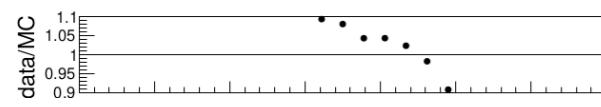
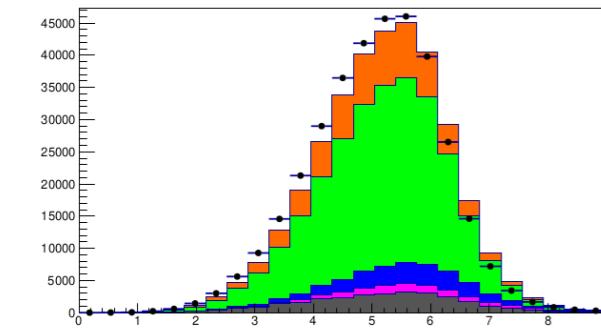
$InvM(Y)$



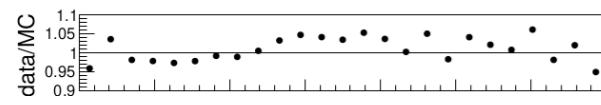
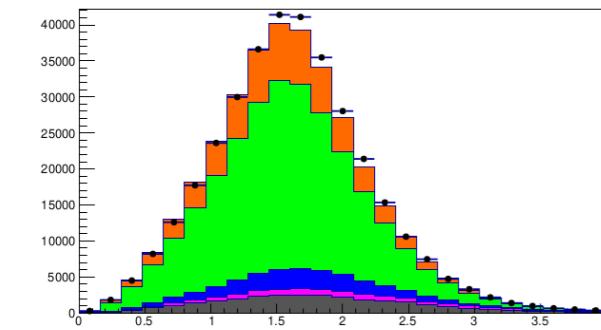
$InvM(Y)$  6

# Reweighting ROE(M) variable: signal region

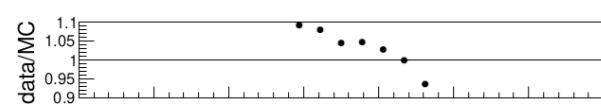
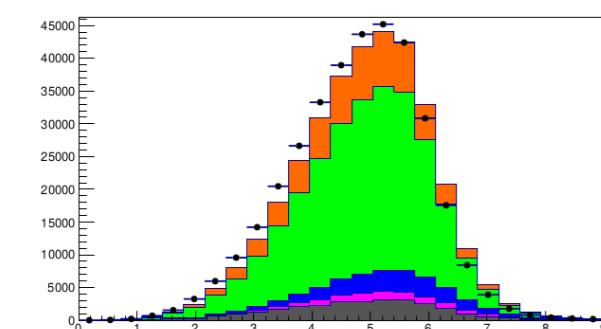
Starting point



$E_{ROE}$

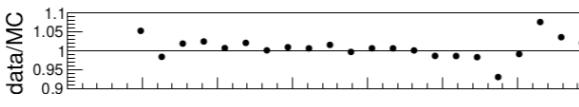
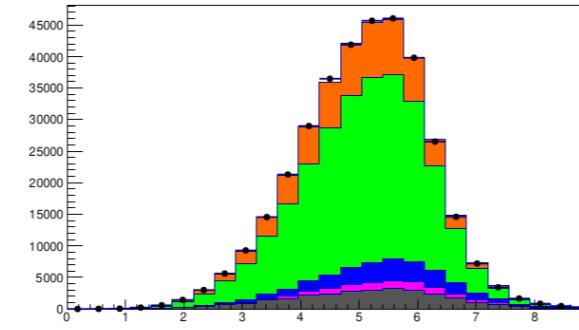


$p_{ROE}$

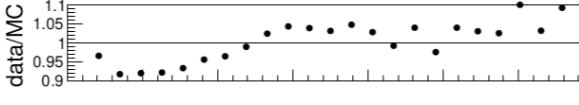
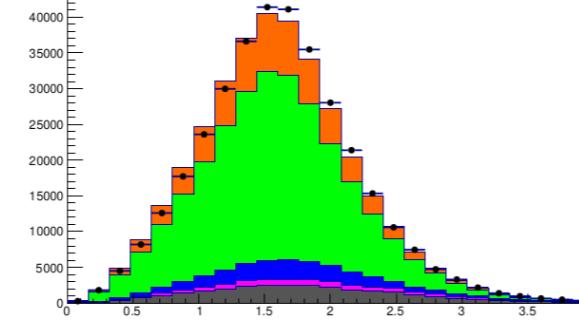


$M_{ROE}$

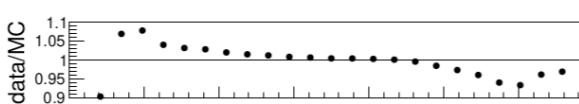
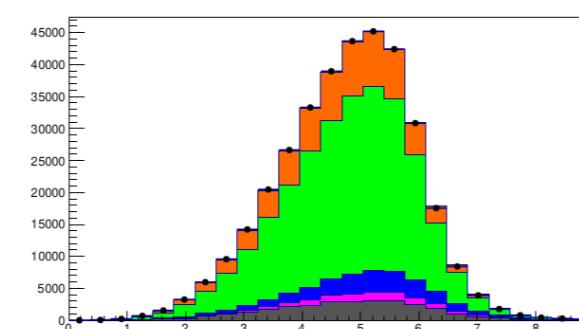
ROE(M) reweighting



$E_{ROE}$

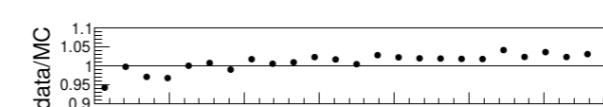
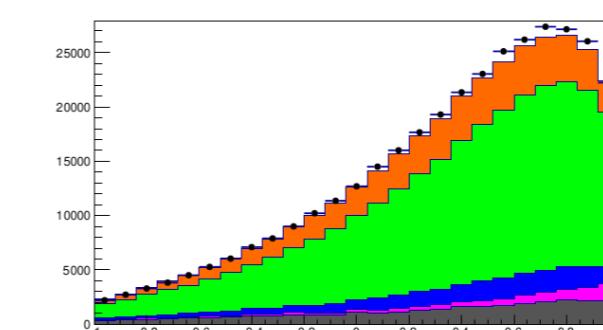


$p_{ROE}$

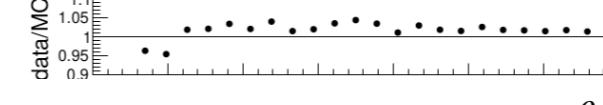
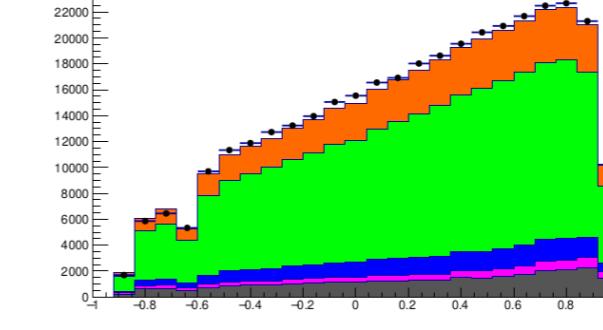


$M_{ROE}$

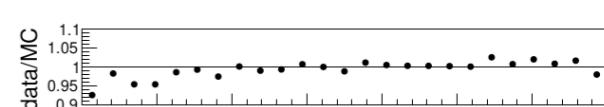
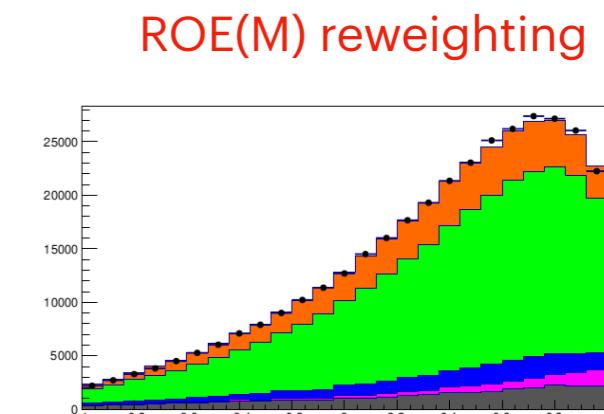
Starting point



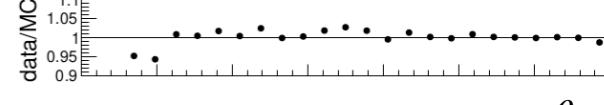
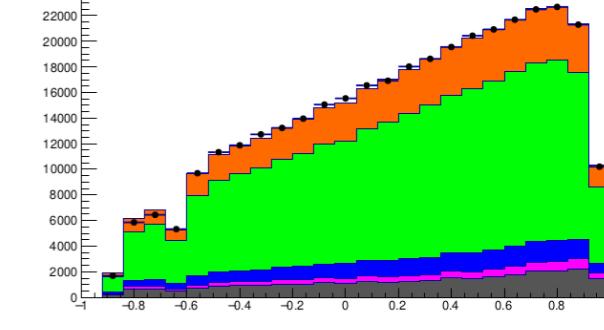
$E_{ROE}$



$\cos\theta_D$



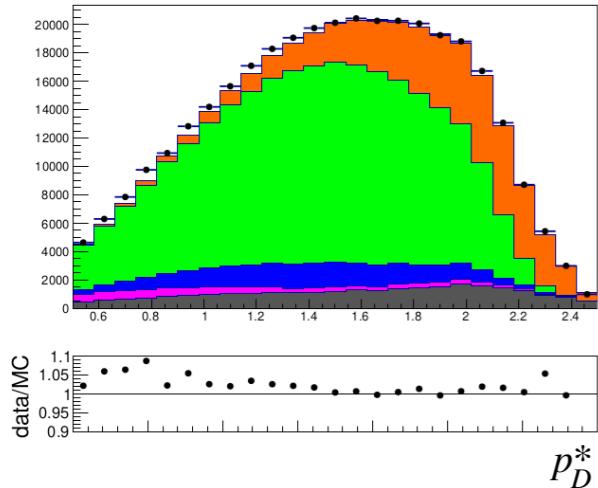
$E_{ROE}$



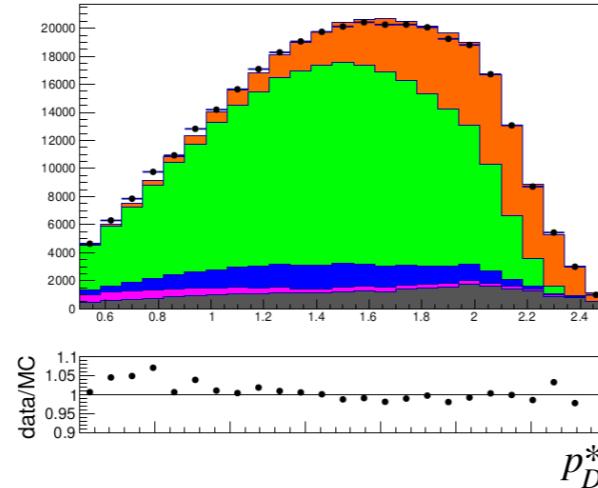
$\cos\theta_D$

# Reweighting ROE variables: signal region

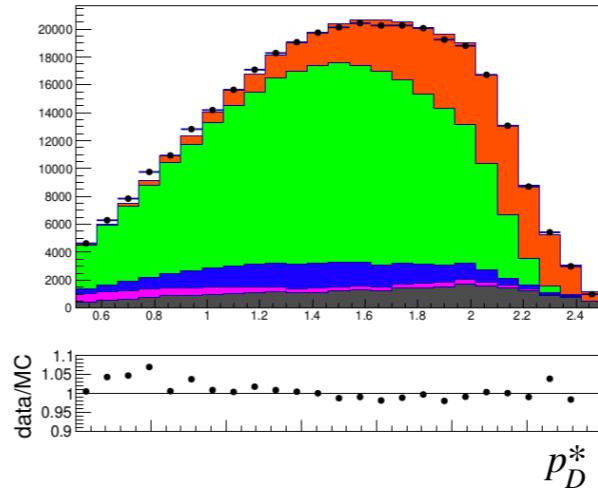
## Starting point



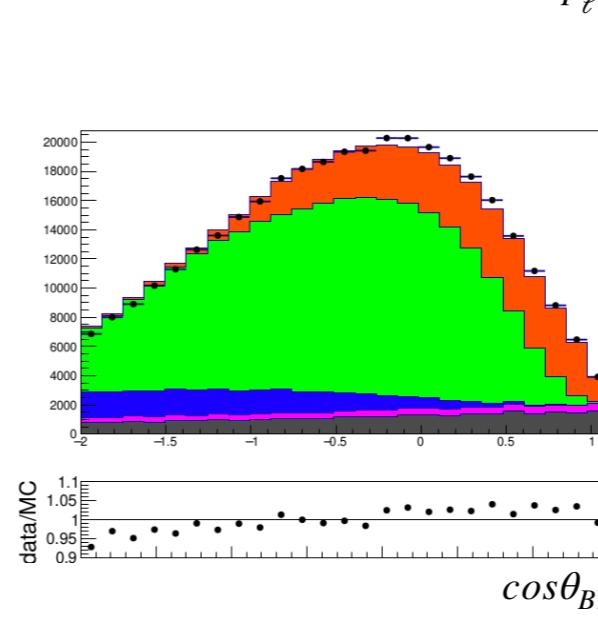
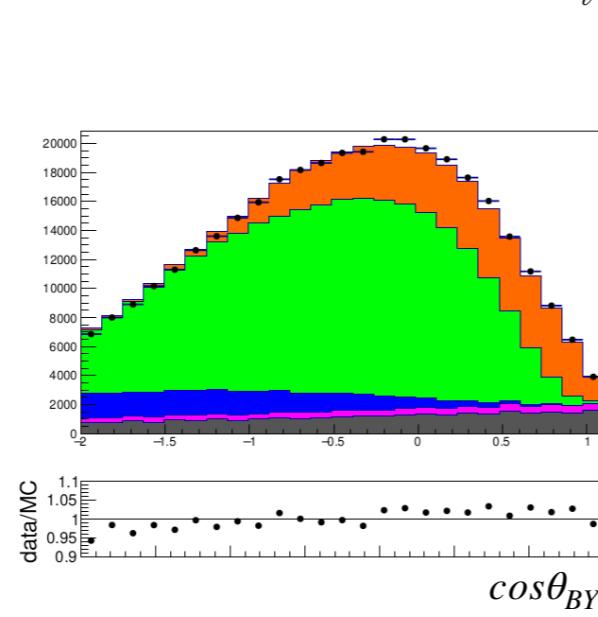
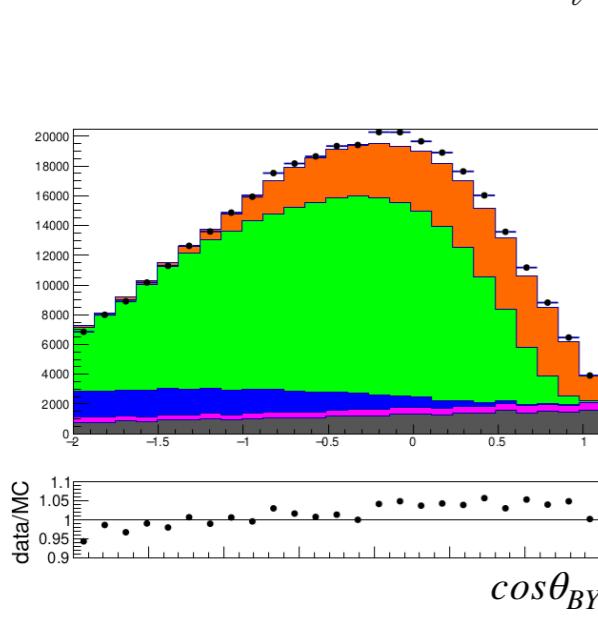
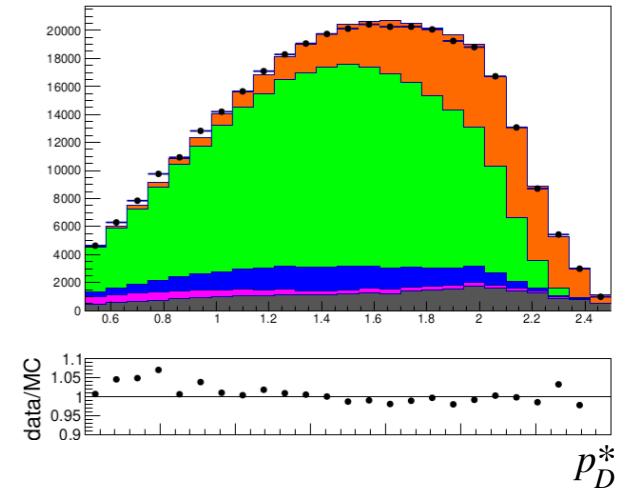
# ROE(M) reweighting



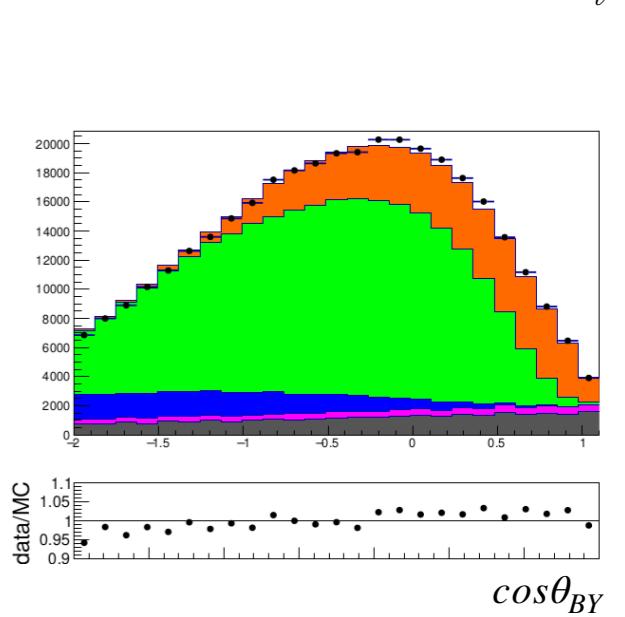
## ROE(P) reweighting



## ROE(E) reweighting

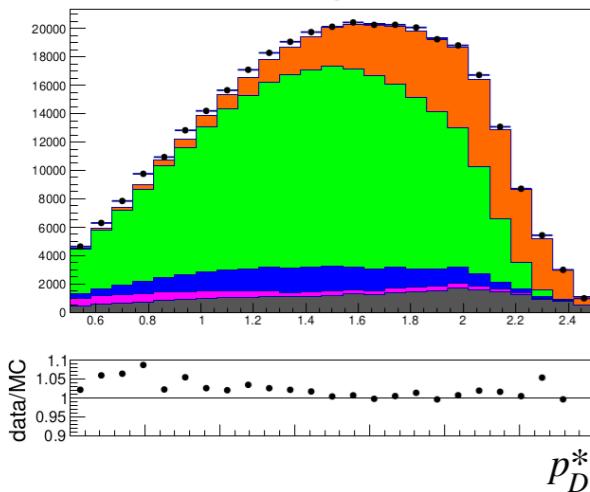


The figure consists of two vertically stacked plots sharing a common x-axis representing the variable  $p_\ell^*$ . The x-axis ranges from 0.8 to 2.2. The top plot shows the distribution of  $p_\ell^*$  with a black histogram representing data, overlaid by a blue histogram for MC simulation. The distribution is unimodal and centered around  $p_\ell^* \approx 1.7$ , with a peak value of approximately 25,000. The bottom plot shows the ratio of data to MC simulation, labeled "data/MC". The ratio is plotted as black dots connected by a line, showing values mostly between 0.95 and 1.05, with a slight upward trend towards higher  $p_\ell^*$  values.

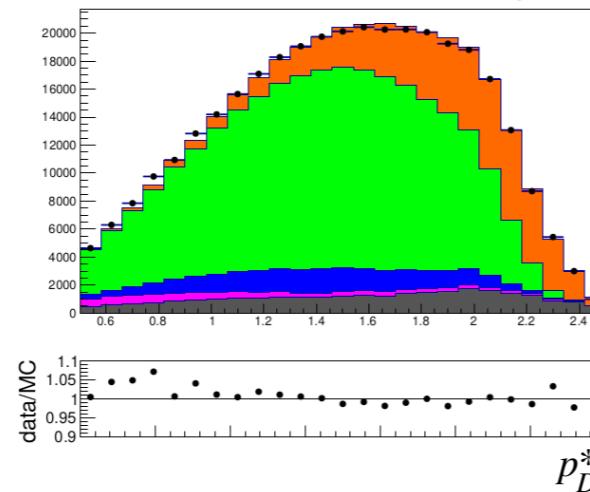


# Reweighting ROE variables: signal region

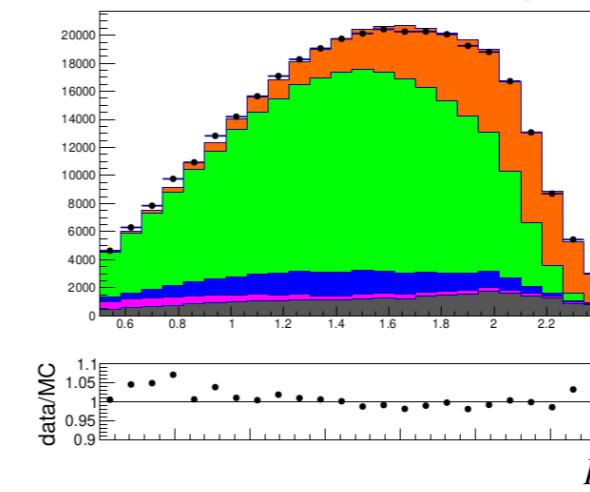
Starting point



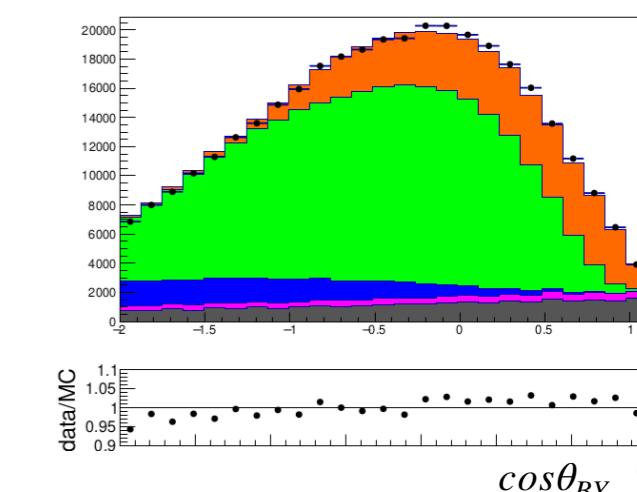
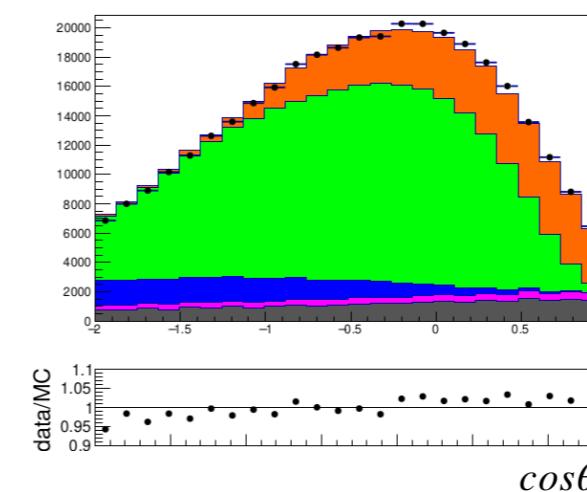
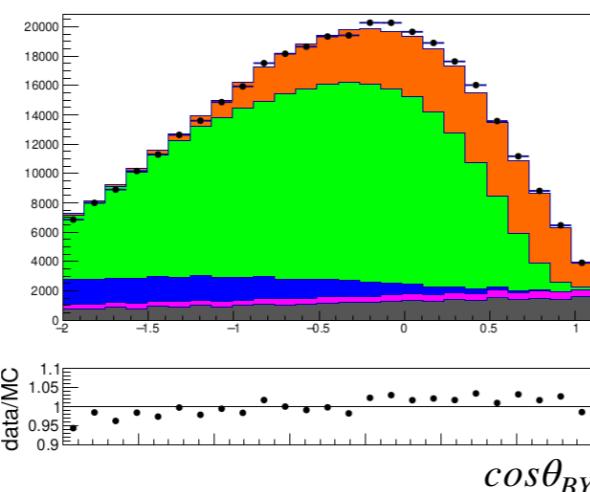
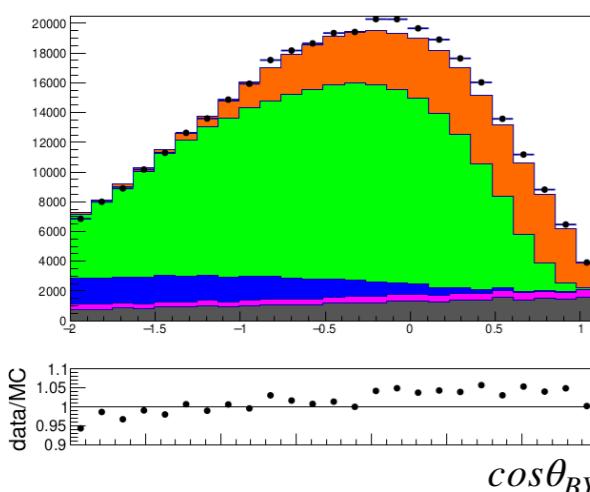
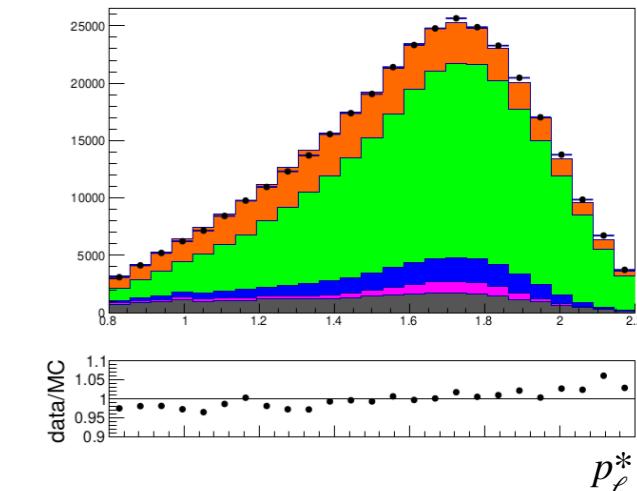
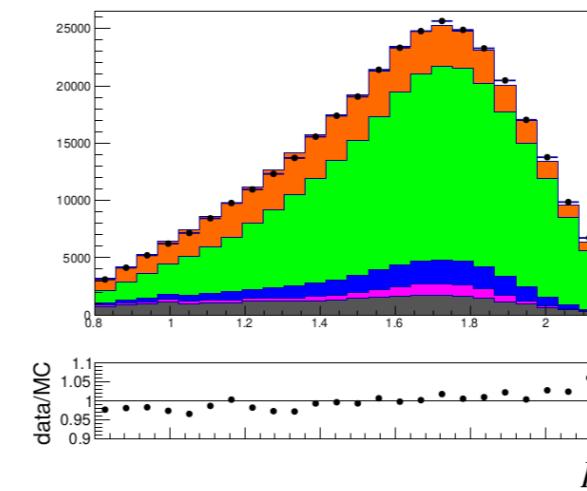
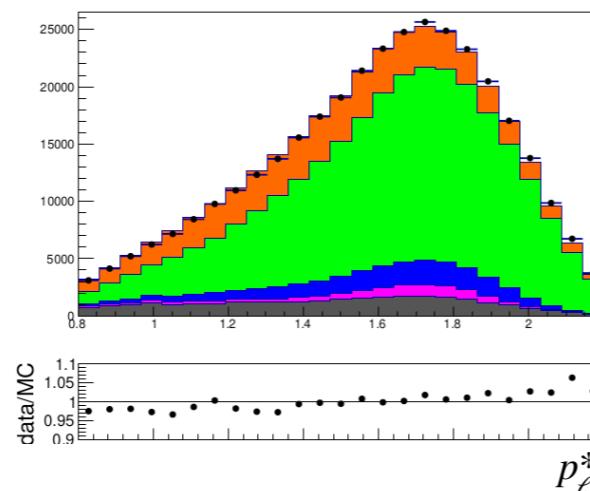
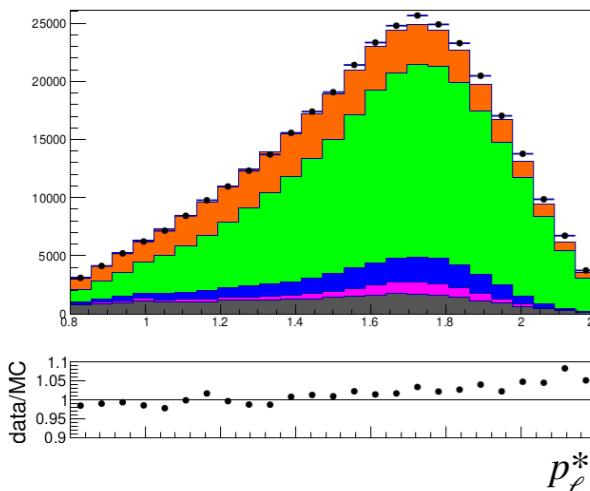
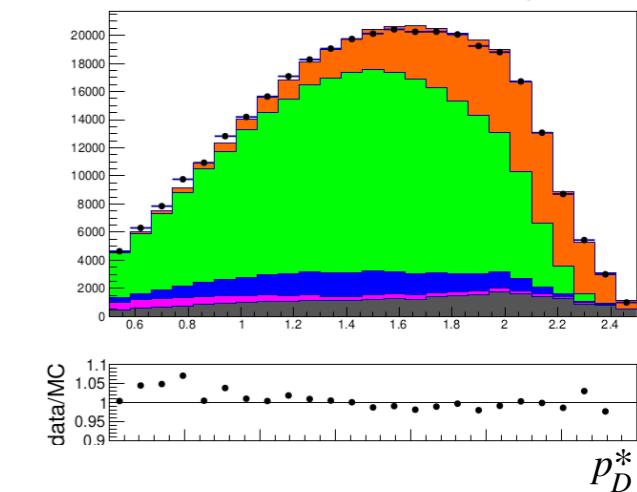
ROE(M)xROE(P) reweighting



ROE(M)xROE(E) reweighting



ROE(P)xROE(E) reweighting

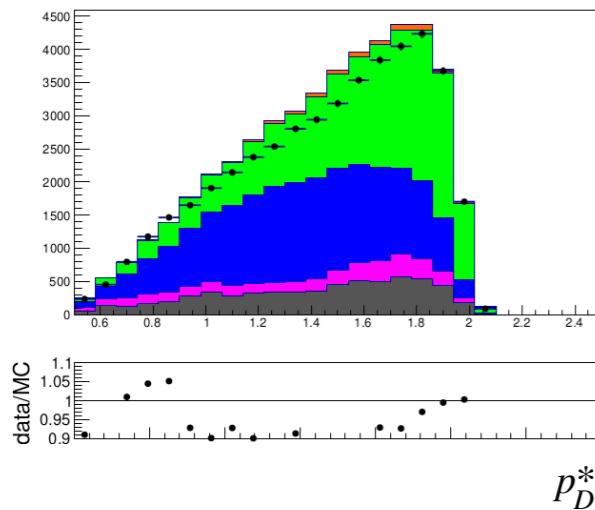


# Backup

# Reweighting ROE(M) variable: $\cos\theta_{BY}$ sideband

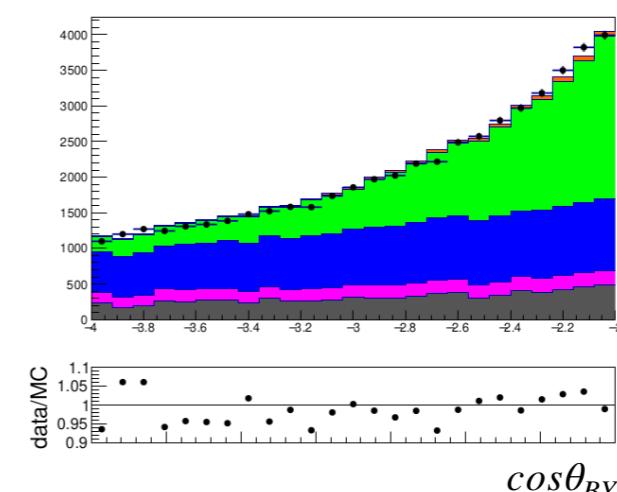
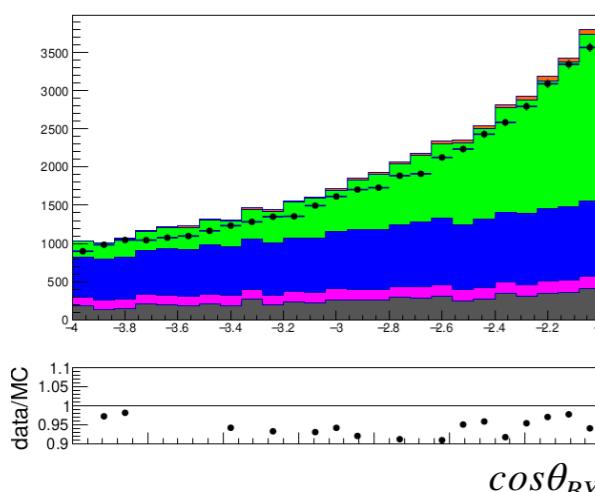
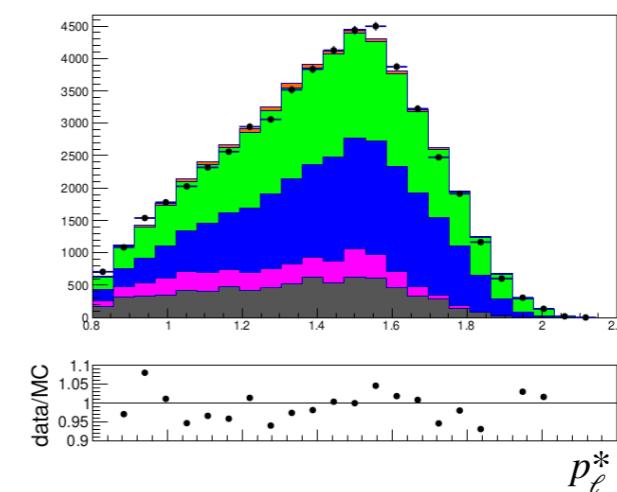
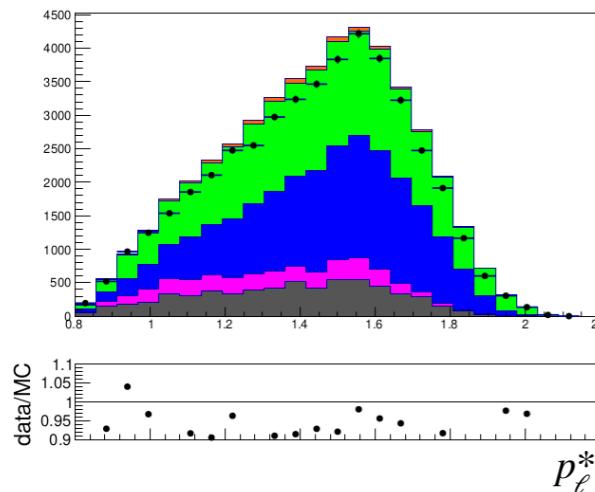
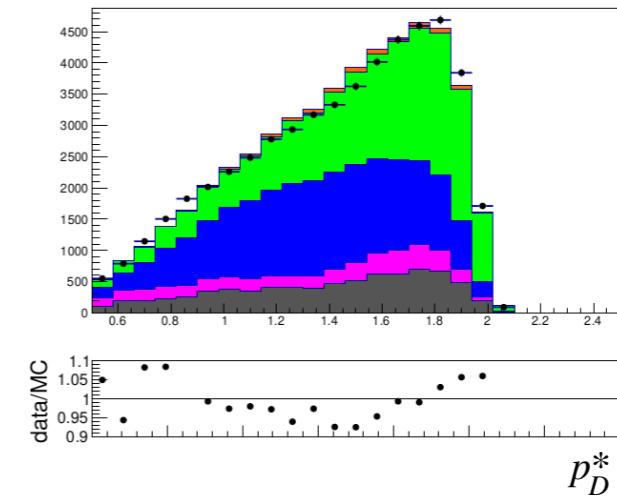
$B \rightarrow D^0 e \nu$

Starting point



$B \rightarrow D^0 e \nu$

ROE(M) reweighting



# New sample: $B \rightarrow D^0 e \nu$

