

# First look at $\gamma$ -jet Samples using BDT e-ID Algorithm

Hai-Jun Yang  
University of Michigan  
(with X. Li and B. Zhou)

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# Motivation

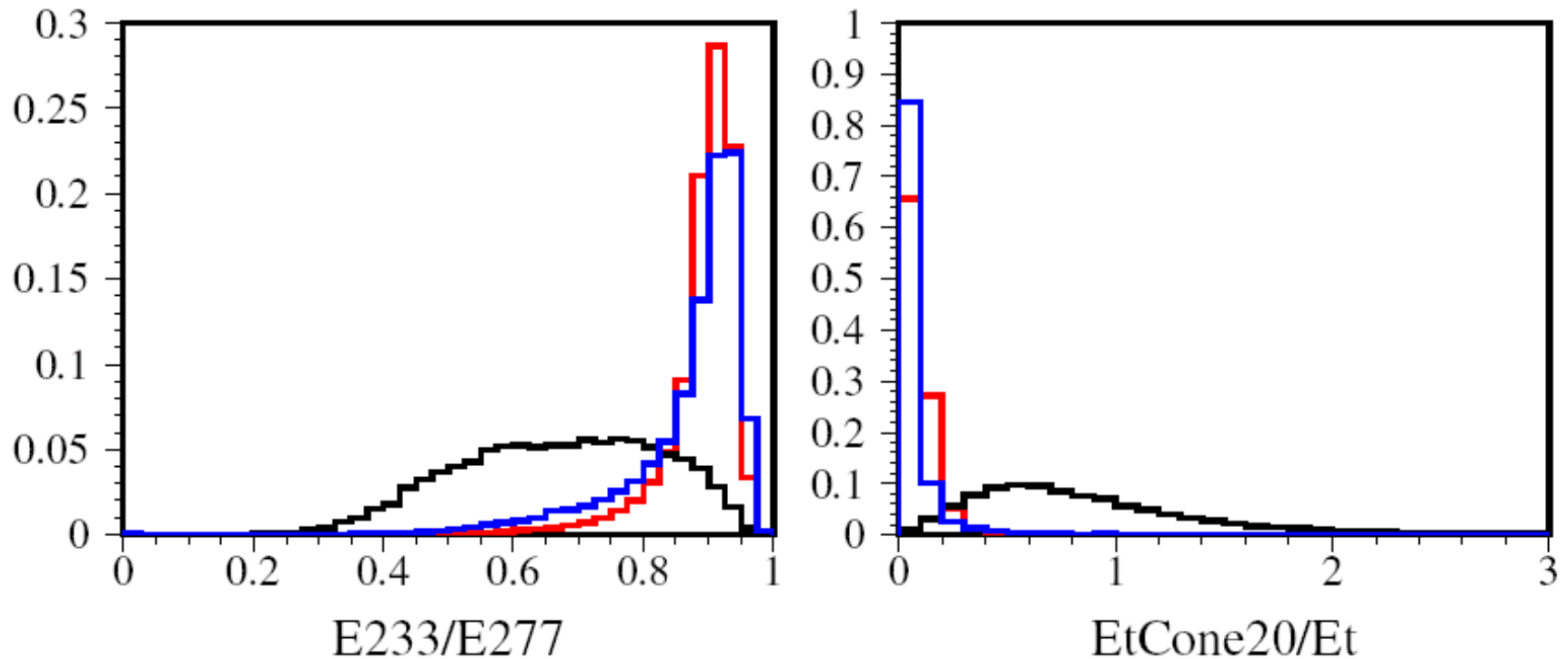
- To estimate the dijet and  $\gamma$  jet rejection rates using various e-ID algorithms (IsEM, Likelihood and BDT).
- MC samples for test include
  - DS108087,  $\gamma$  jet
  - DS105802, JF17 dijet
  - DS106050,  $Z \rightarrow ee$  signal

# MC $\gamma$ jet samples for test

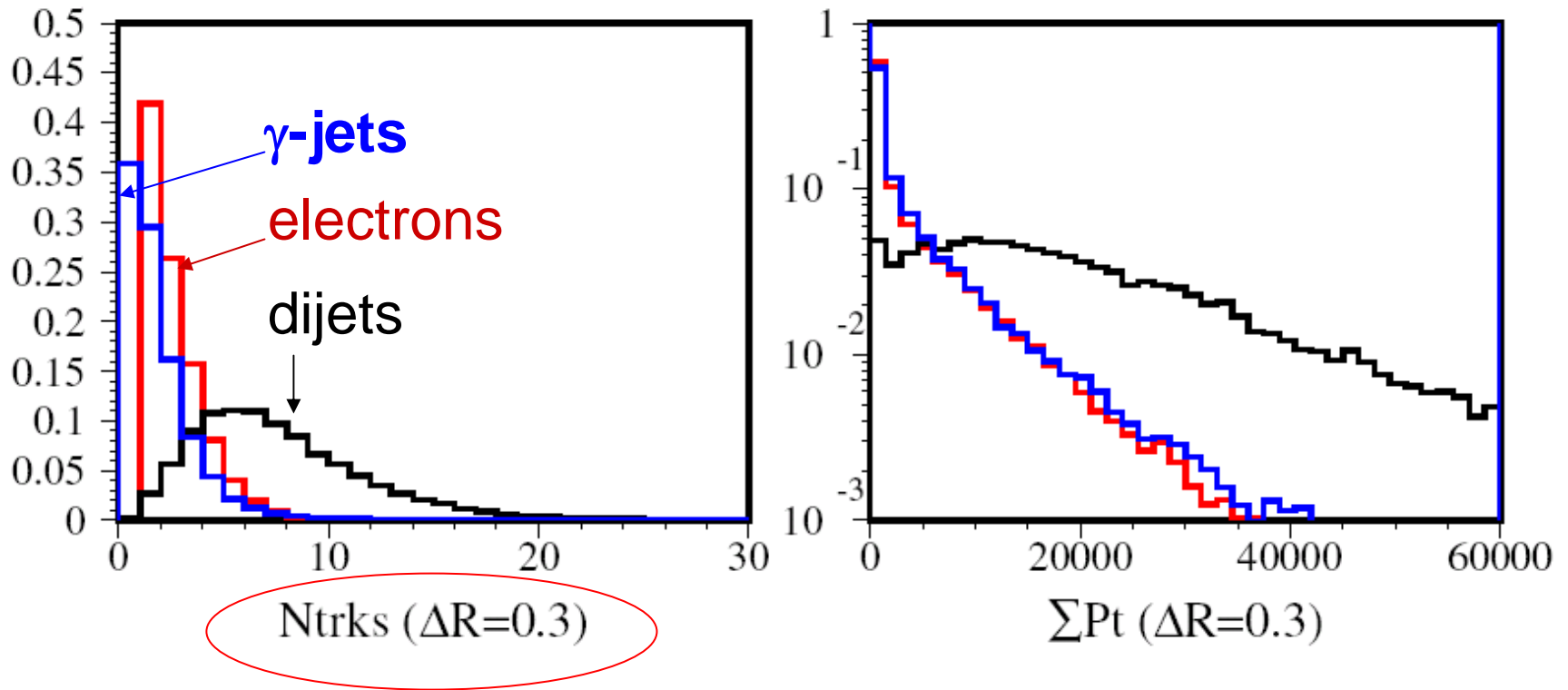
samples	DS108087 $\gamma$ jet	DS105802 JF17 dijets	DS106050 Z $\rightarrow$ ee
N_events	127887	237950	83690
N_candidate Et>17 GeV, $ \eta <2.5$	194046	896818	108550
N_candidate (precuts) With EM/Track match	20441	20994	94153
Rejection/Efficiency after precuts	Rejection 9.5	Rejection 42.7	Acceptance 86.7%

# Comparison of Input Variables

$Z \rightarrow ee$ (106050,red), JF17(105802,black),  $\gamma$  jet(108087,blue)



# Comparison of Input Variables



# Results of IsEM

- $E_t(\text{jet}) > 17\text{GeV}$ , Tight cuts
  - Efficiency ( $Z \rightarrow ee$ ) = 70.9%
  - Rejection ( $\gamma\text{jet}$ ) = 426( $\pm 4.7\%$ )
  - Rejection (jf17) = 3092( $\pm 5.9\%$ )

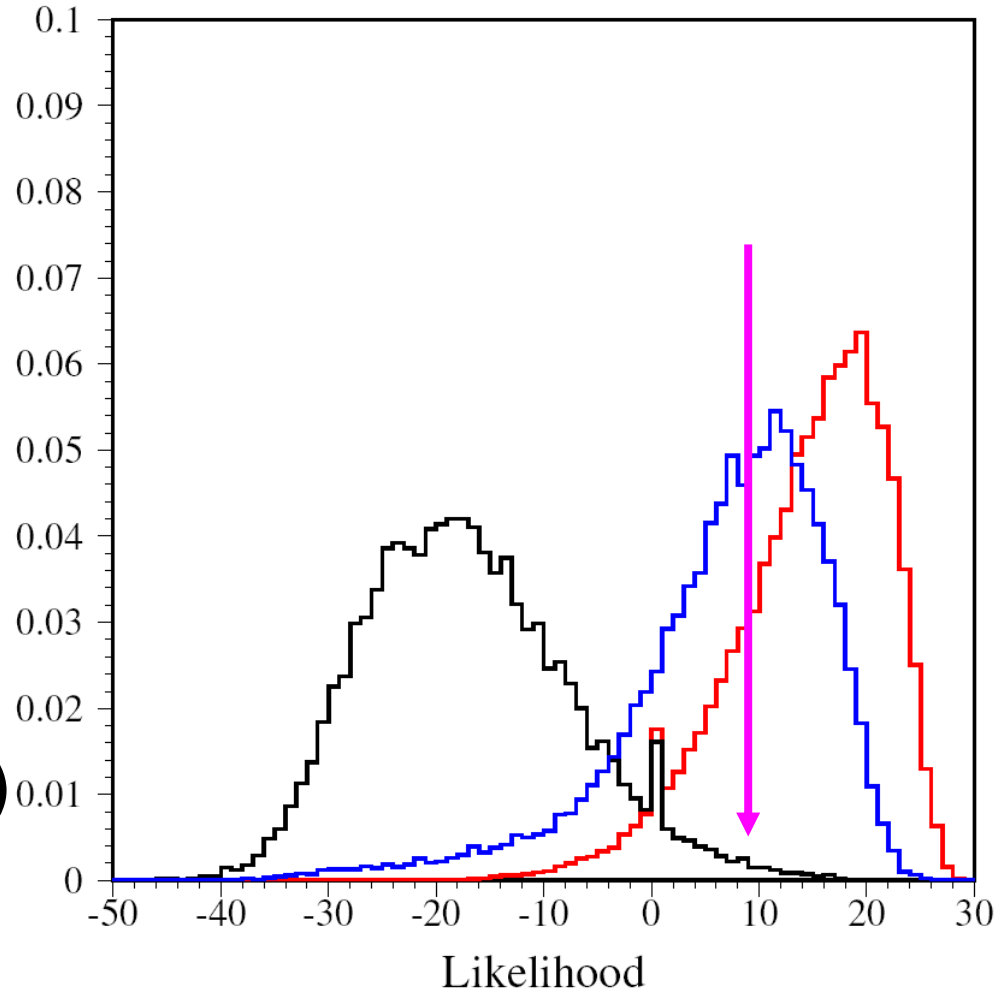
$Z \rightarrow ee$ (106050,red), JF17(105802,black),  $\gamma$  jet(108087,blue)

# e-ID (Likelihood)

$\log(\text{ElectronWt}/\text{BgWt})$

$E_t(\text{jet}) > 17\text{GeV}$

- Efficiency = 71%
- $\text{Rej}(\gamma\text{jet}) = 20 (\pm 1\%)$
- $\text{Rej}(\text{jf17}) = 5200 (\pm 7.6\%)$

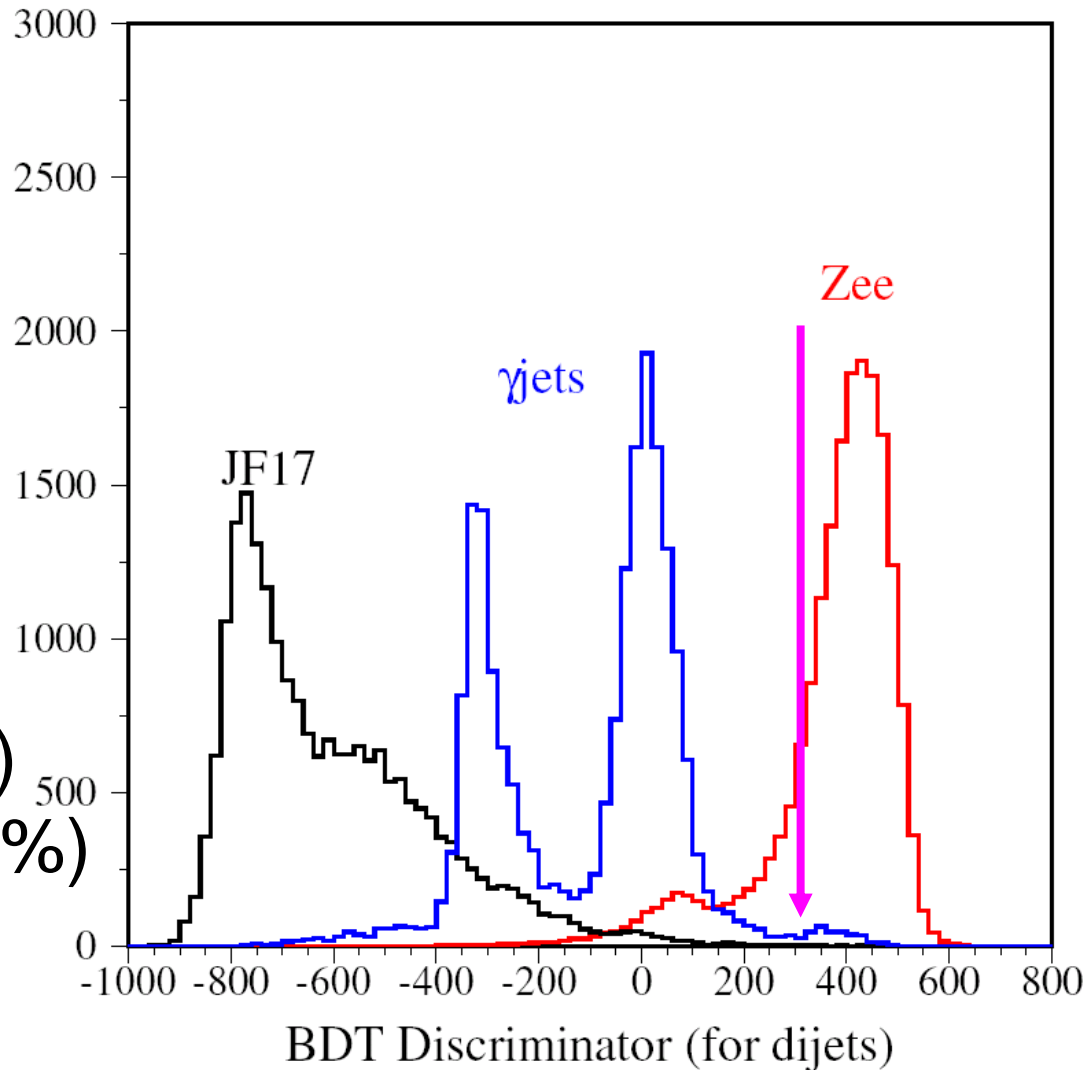


# BDT trained for dijets

e-ID (BDT\_dijet)

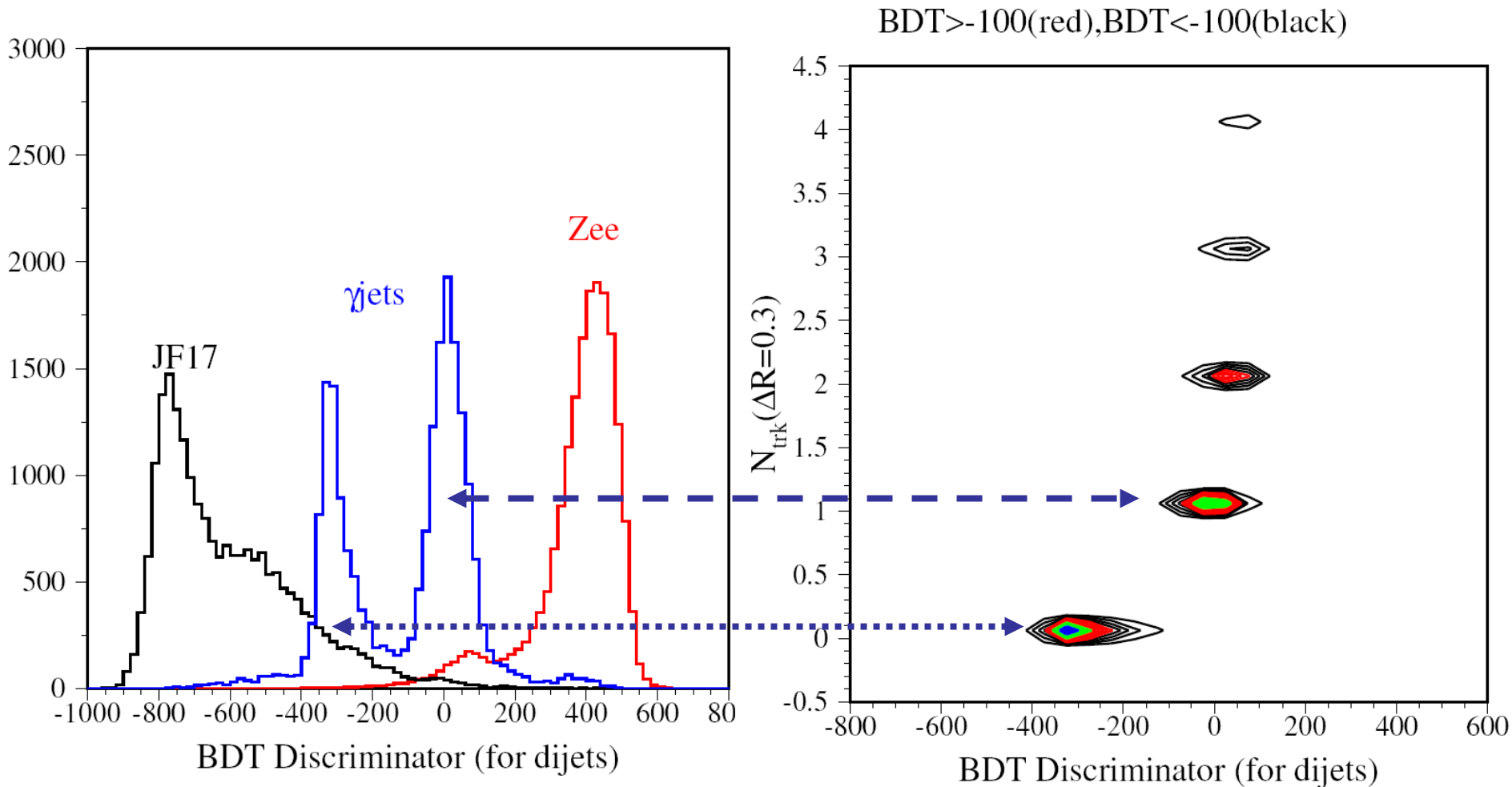
$E_t(\text{jet}) > 17\text{GeV}$

- Efficiency = 71%
- $\text{Rej}(\gamma\text{jet}) = 591 (\pm 5.5\%)$
- $\text{Rej}(\text{jf17}) = 47830 (\pm 23\%)$

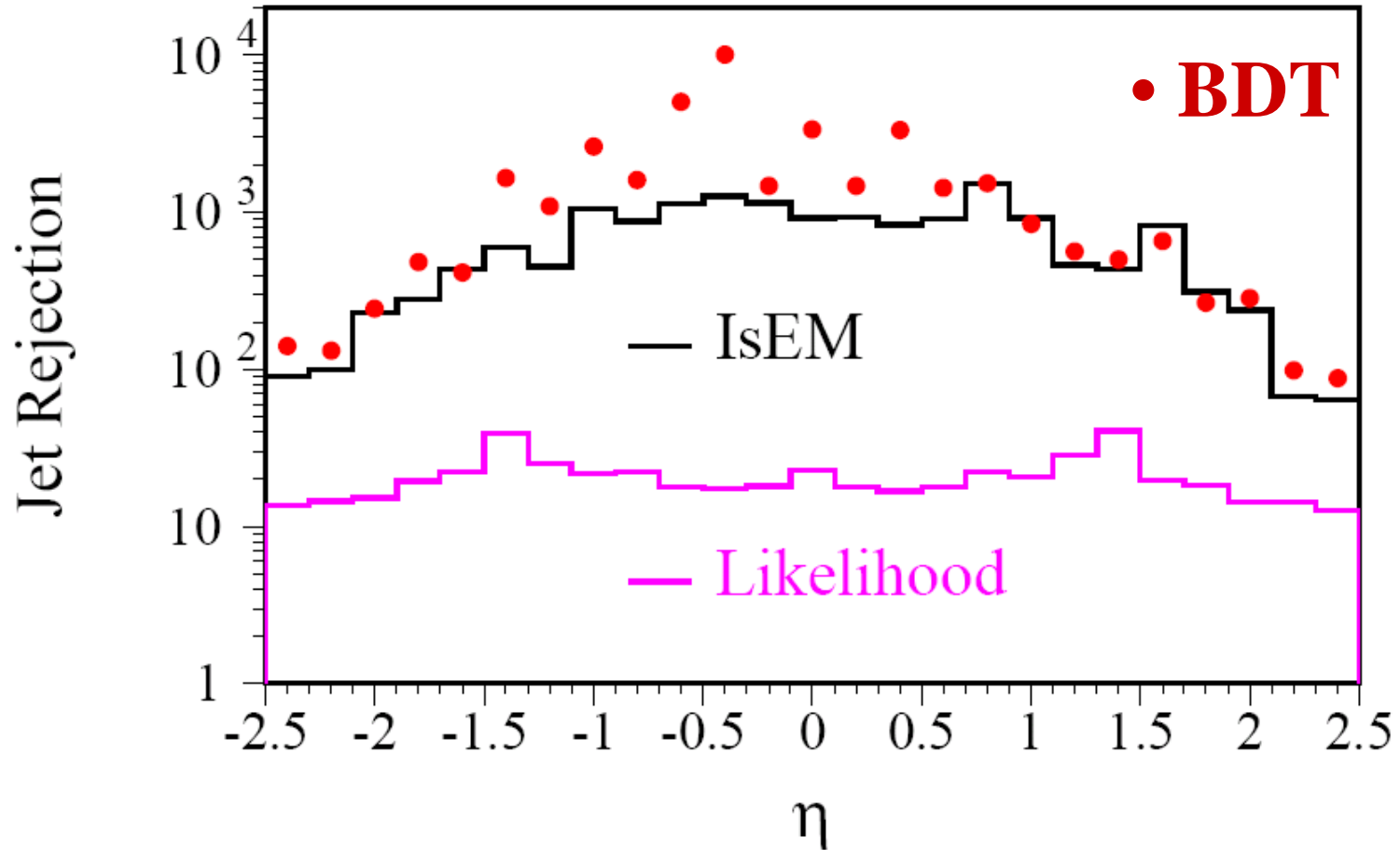




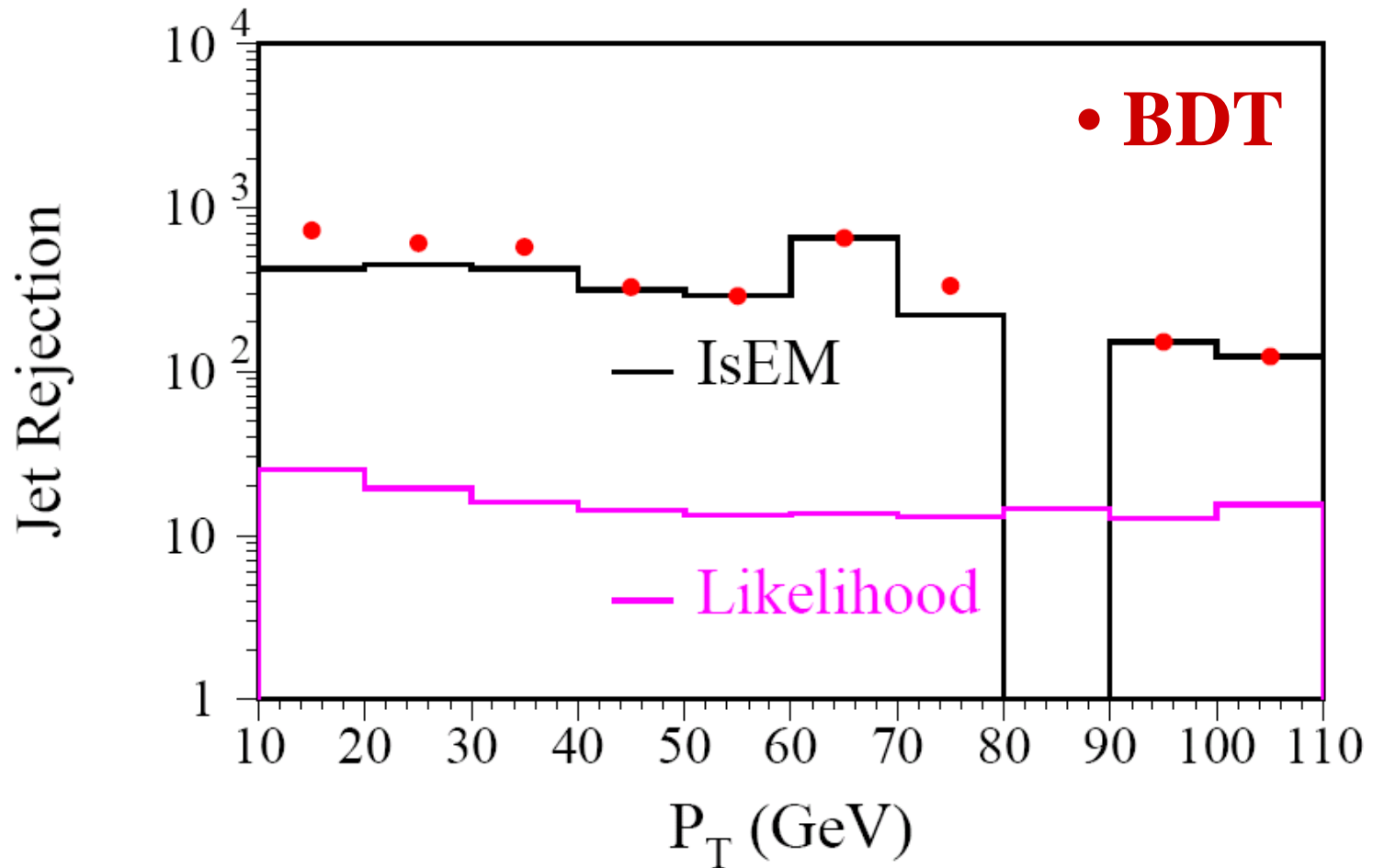
# BDT peaks in $\gamma$ jet samples?



# BDT trained for dijets



# BDT trained for dijets

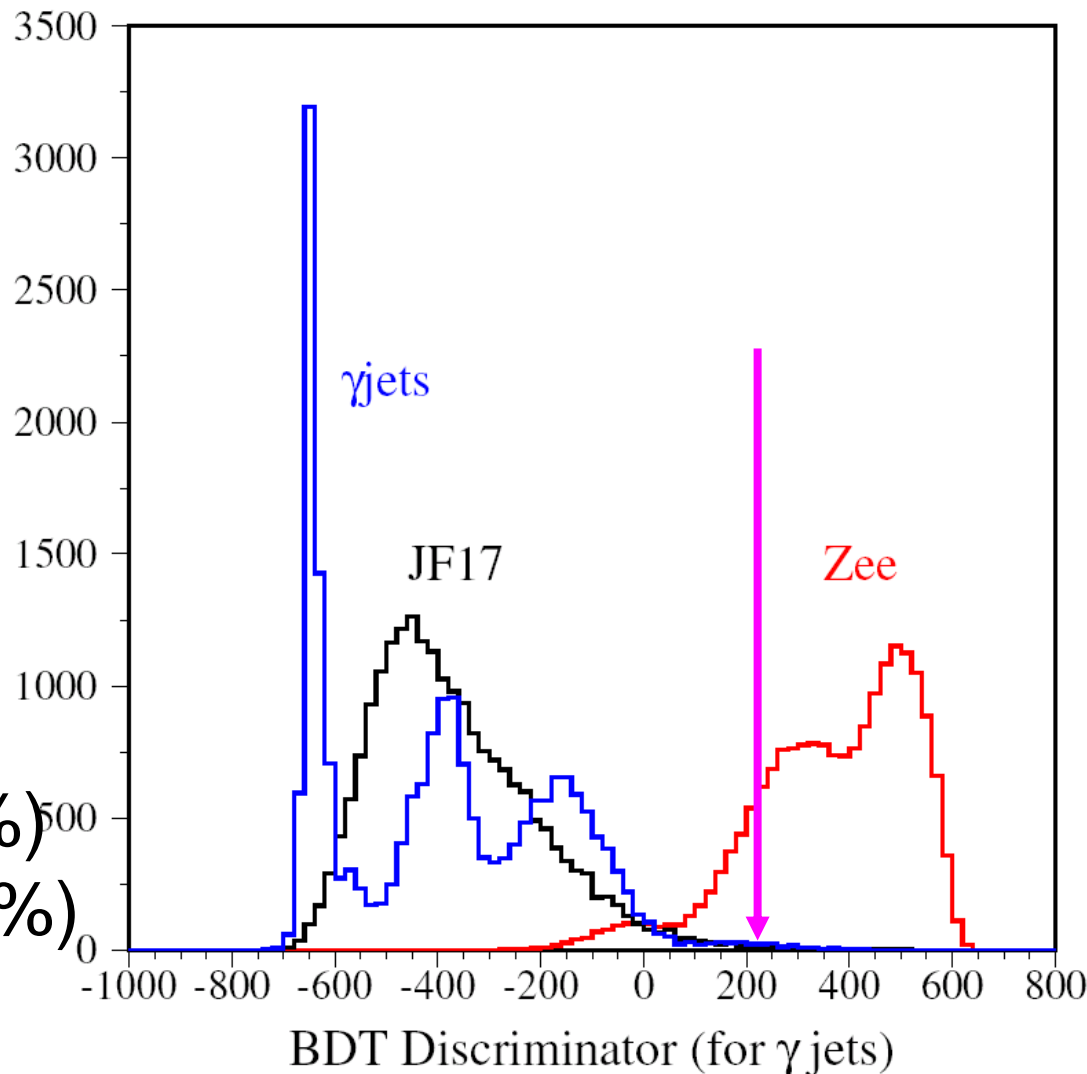


# BDT trained for $\gamma$ jets

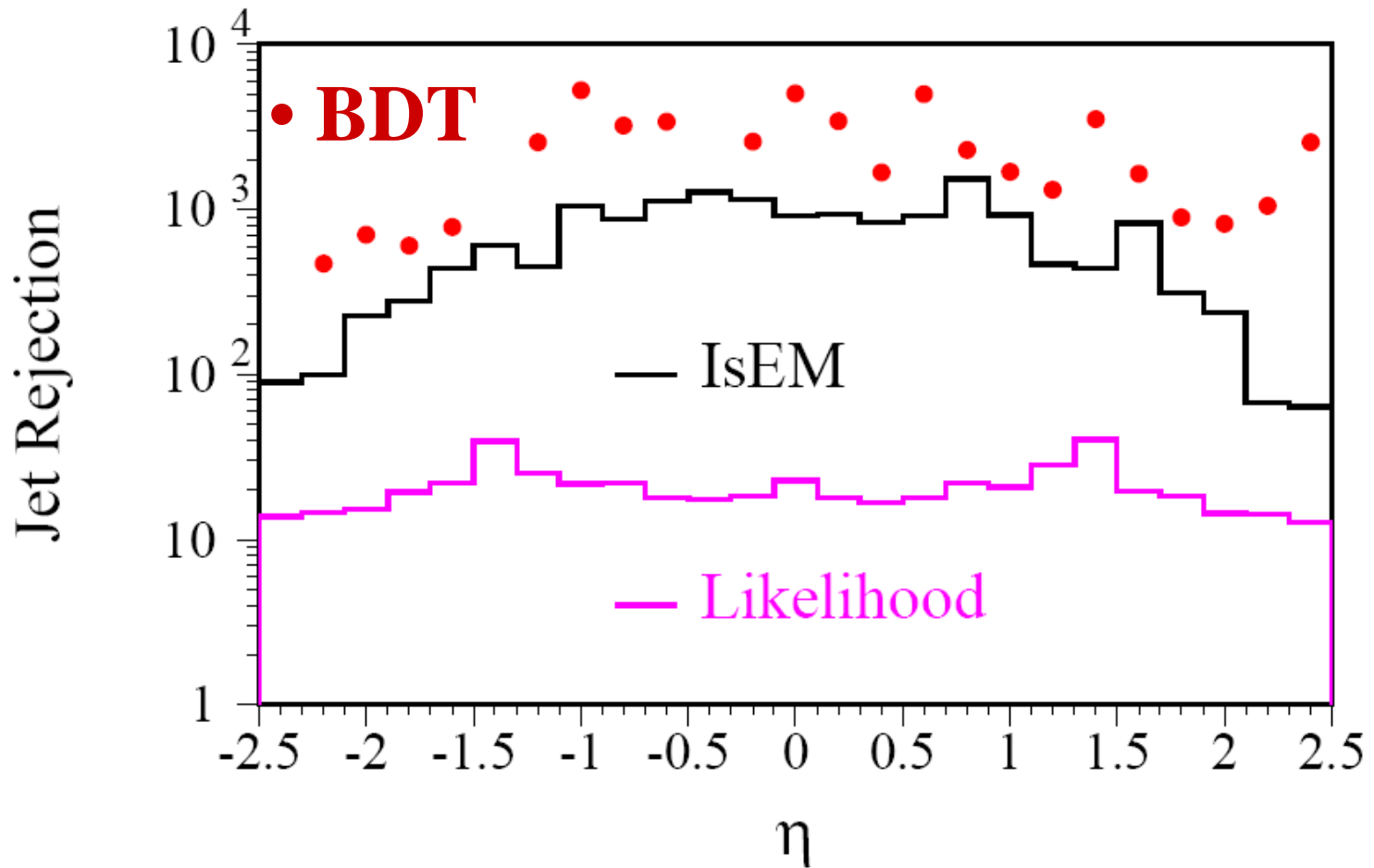
e-ID (BDT\_ $\gamma$ jet)

$E_t(\text{jet}) > 17\text{GeV}$

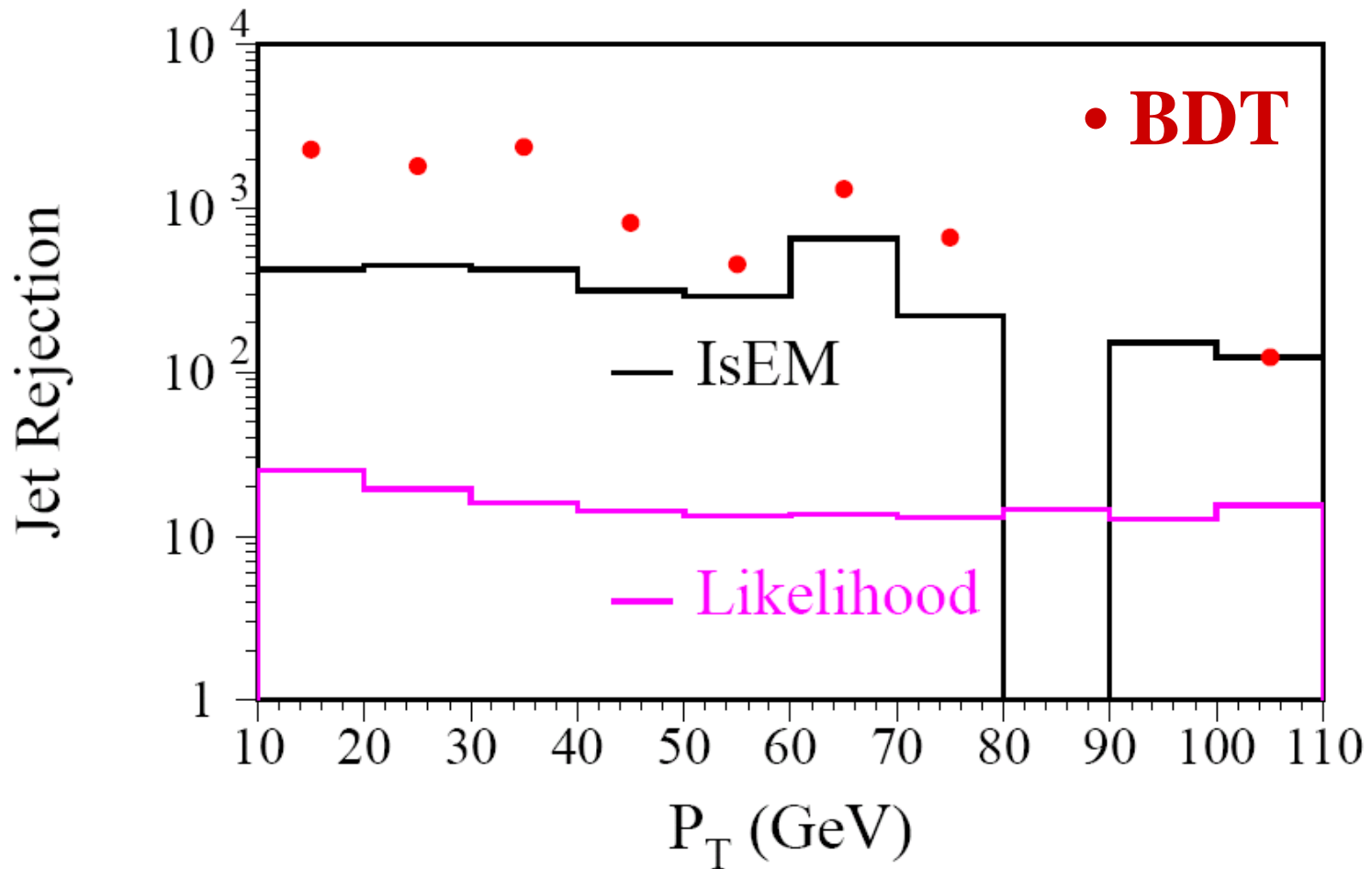
- Efficiency = 71%
- $\text{Rej}(\gamma\text{jet}) = 1788 (\pm 9.6\%)$
- $\text{Rej}(\text{jf17}) = 19081 (\pm 15\%)$



# BDT trained for $\gamma$ jets



# BDT trained for $\gamma$ jets



# BDT trained for dijets (top 10 vars)

Rank	Input variable	Gini index
1	Etcone20 / Et	46.08%
2	E2tsts1-Emins1(Emax2-Emin in LAr. 1 <sup>st</sup> )	8.60%
3	No. of TRT hits / No. of B-layer hits	6.68%
4	deta1 between track and EM cluster	5.21%
5	Number of pixel hits	4.48%
6	F1(frac. of E deposited in LAr. 1 <sup>st</sup> samp)	4.32%
7	Ethad1/Et (E leakage in hcal. 1 <sup>st</sup> samp)	3.94%
8	E237 / E277	3.41%
9	Eta of inner track	2.33%
10	Number of B-layer hits	2.19%

# BDT trained for $\gamma$ jets (top 10 vars)

Rank	Input variable	Gini index
1	Number of B-layer hits	21.49%
2	Ntrk ( $\Delta R=0.3$ )	17.94%
3	$\Sigma Pt$ ( $\Delta R=0.3$ )	11.41%
4	Number of pixel hits	11.17%
5	E233 / E277	5.79%
6	E237 / E277	4.77%
7	No. of TRT hits / No. of B-layer hits	4.52%
8	deta1 between track and EM cluster	4.49%
9	Etcone20 / Et	4.20%
10	F1(frac. of E deposited in LAr. 1 <sup>st</sup> samp)	1.97%



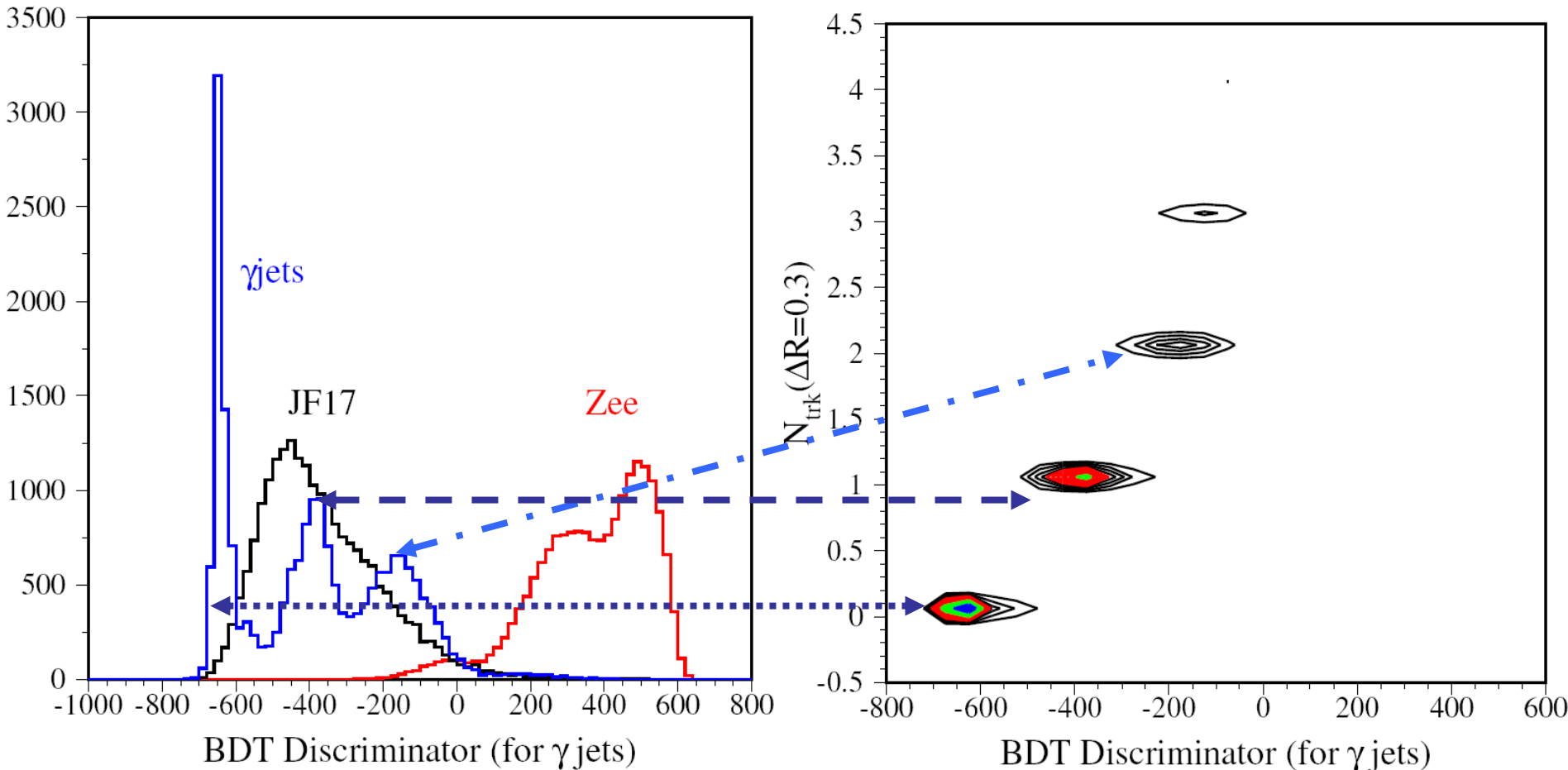
# Summary

e-IDs \ samples	DS108087 $\gamma$ Jet Rejection	DS105802 JF17 dijets Rejection	DS106050 Z $\rightarrow$ ee Acceptance
IsEM (tight)	426( $\pm$ 4.7%)	3092( $\pm$ 5.9%)	71%( $\pm$ 0.4%)
Likelihood	20( $\pm$ 1.0%)	5200( $\pm$ 7.6%)	71%( $\pm$ 0.4%)
BDT (for dijets)	591( $\pm$ 5.5%) 426( $\pm$ 4.7%)	47830( $\pm$ 23%) 27176( $\pm$ 17%)	71%( $\pm$ 0.4%) 77%( $\pm$ 0.3%)
BDT (for $\gamma$ jets)	1788( $\pm$ 9.6%)	19081( $\pm$ 15%)	71%( $\pm$ 0.4%)

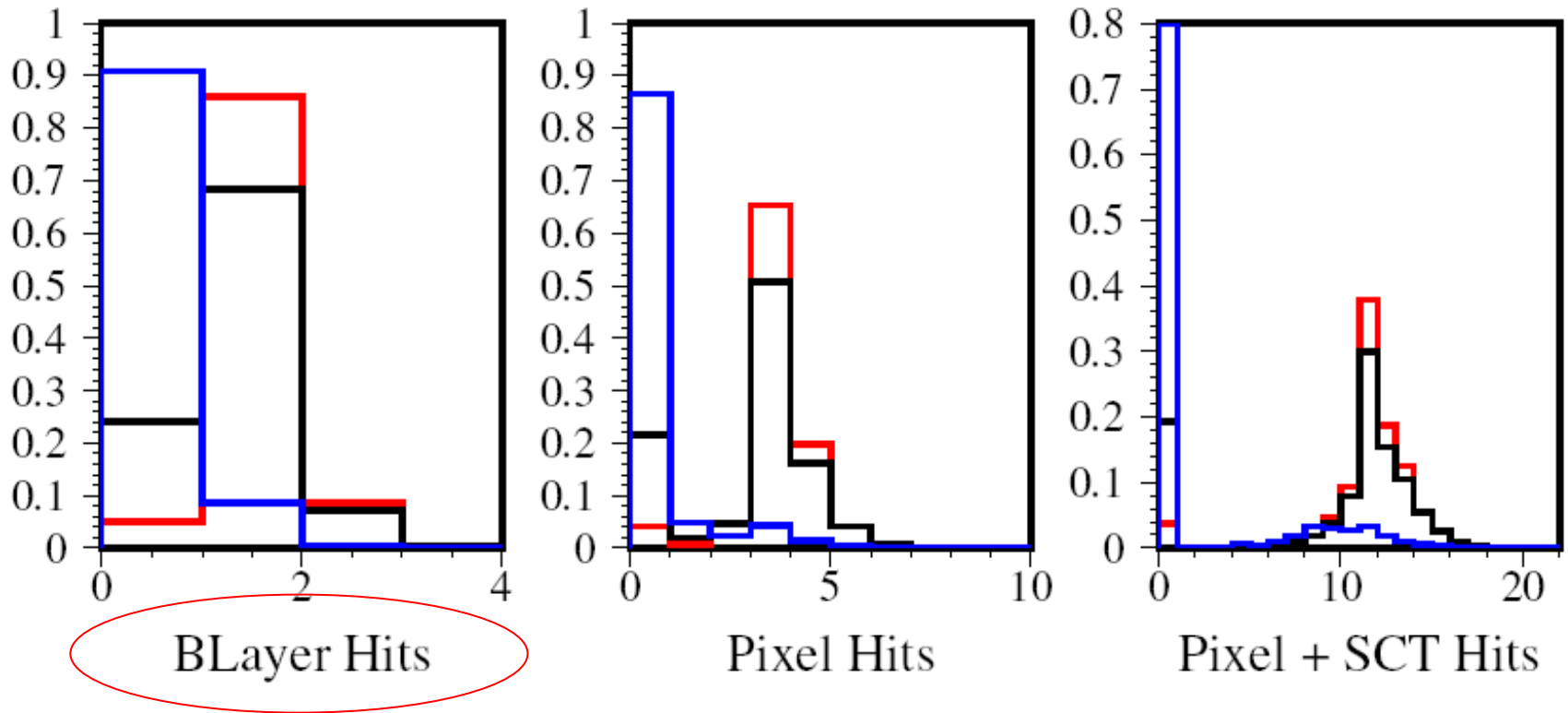
# Backup Slides

# BDT peaks in $\gamma$ jet samples?

BDT > -300 (red), BDT < -300 (black), BDT < -500 (blue)

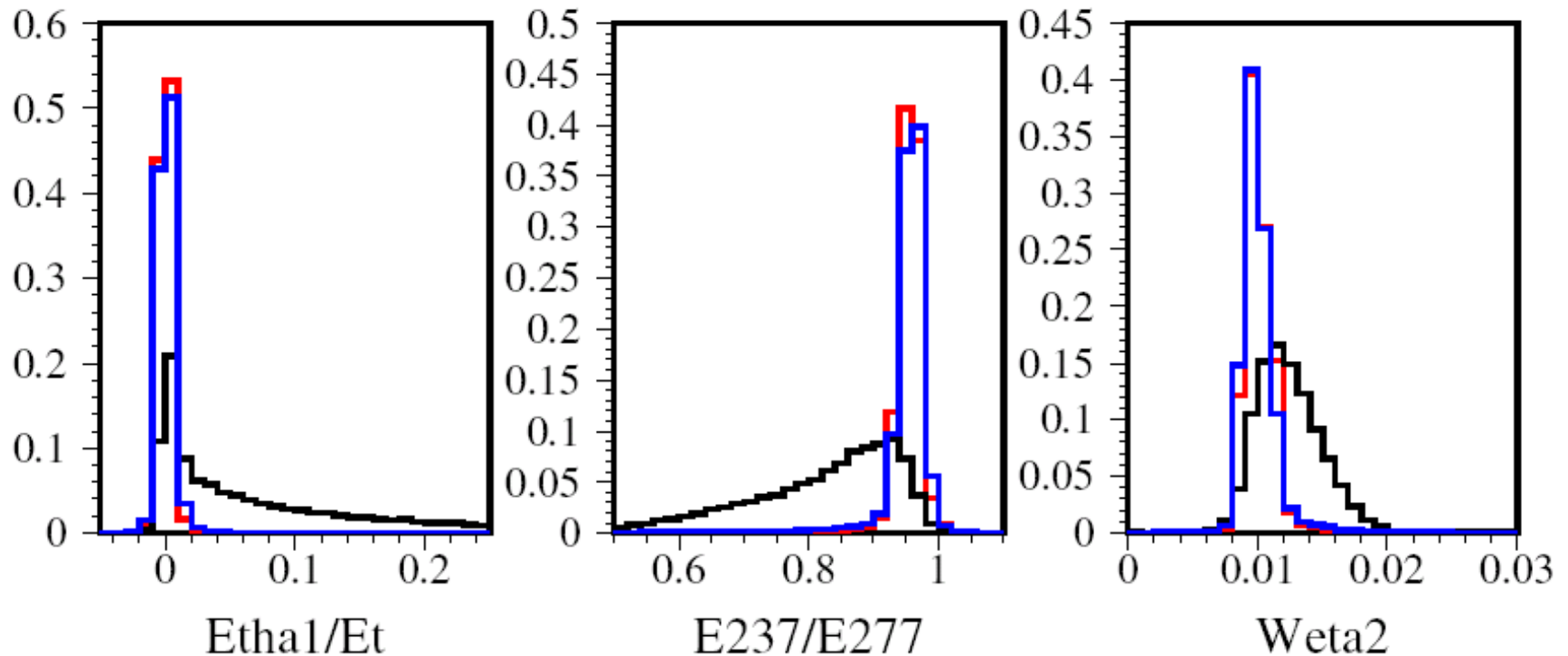


# Comparison of Input Variables

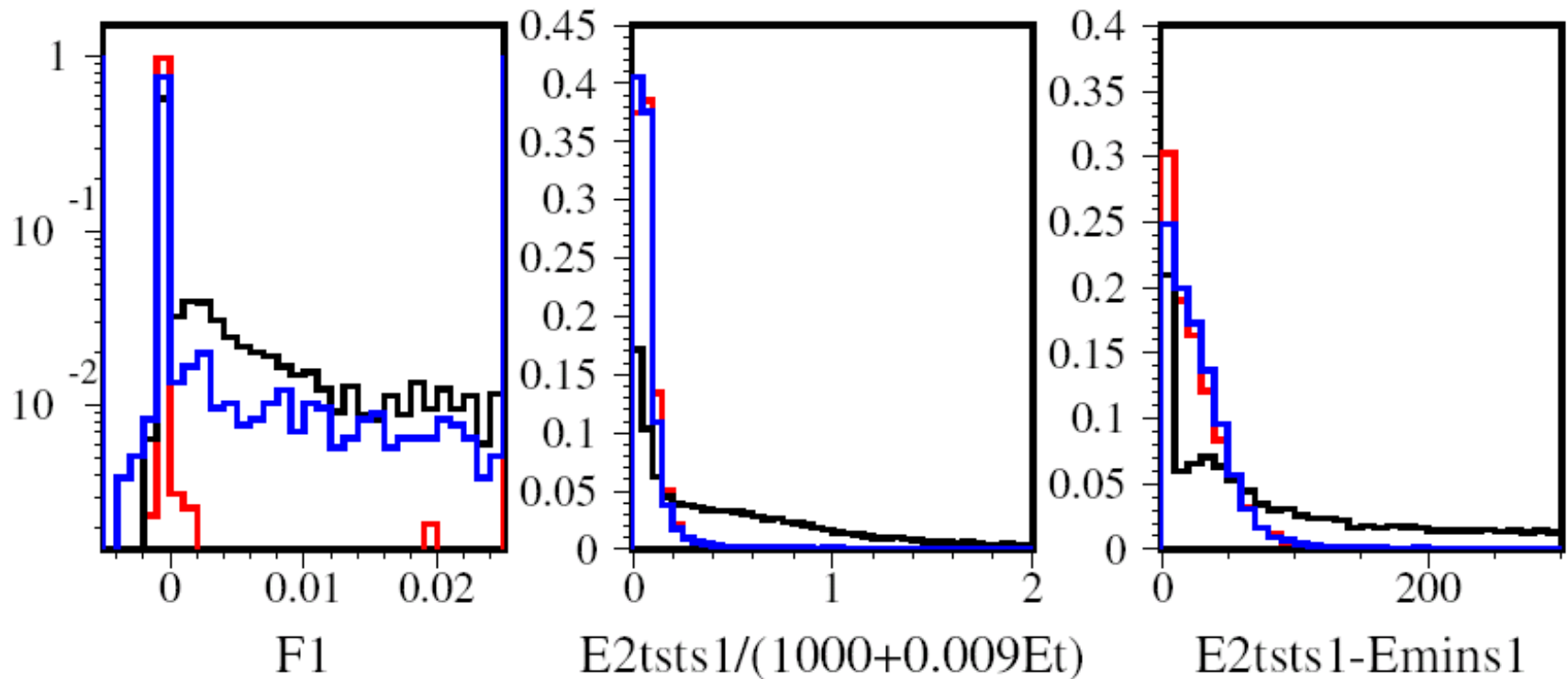


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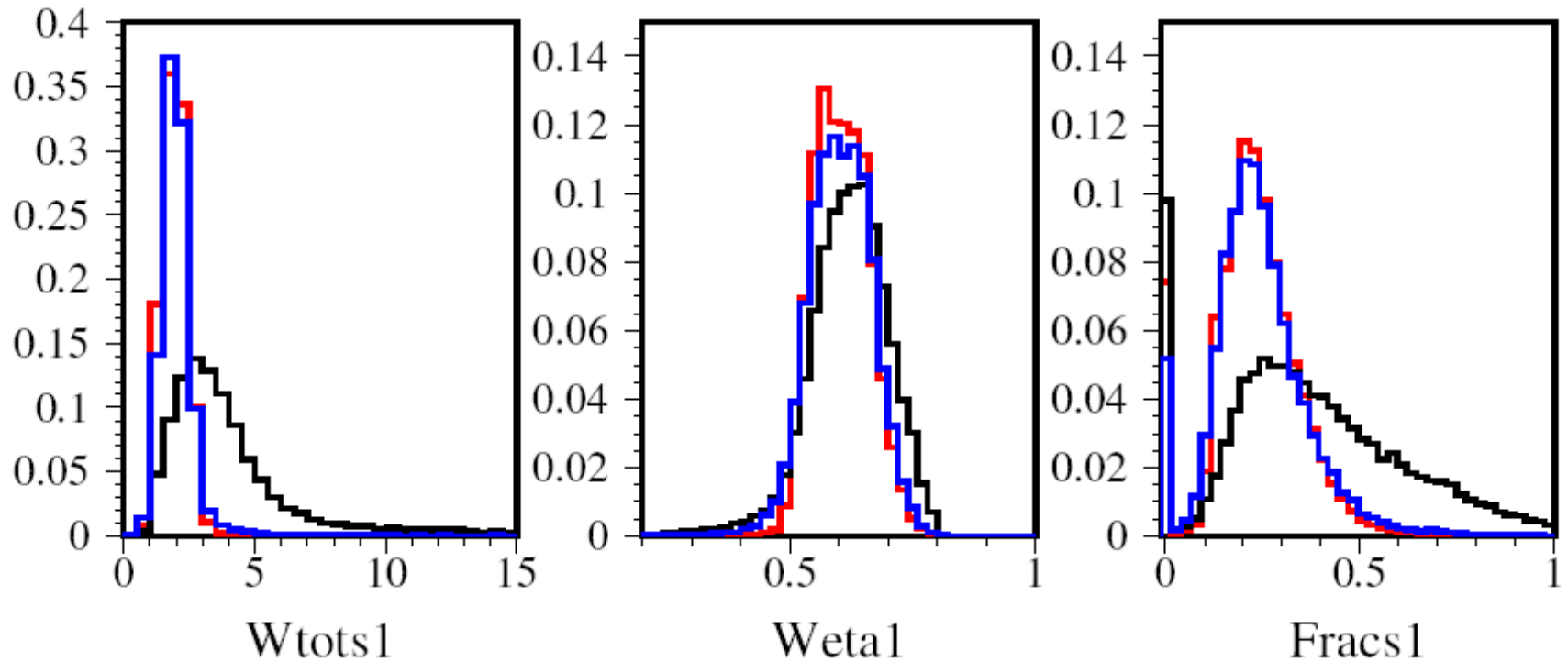


# Comparison of Input Variables



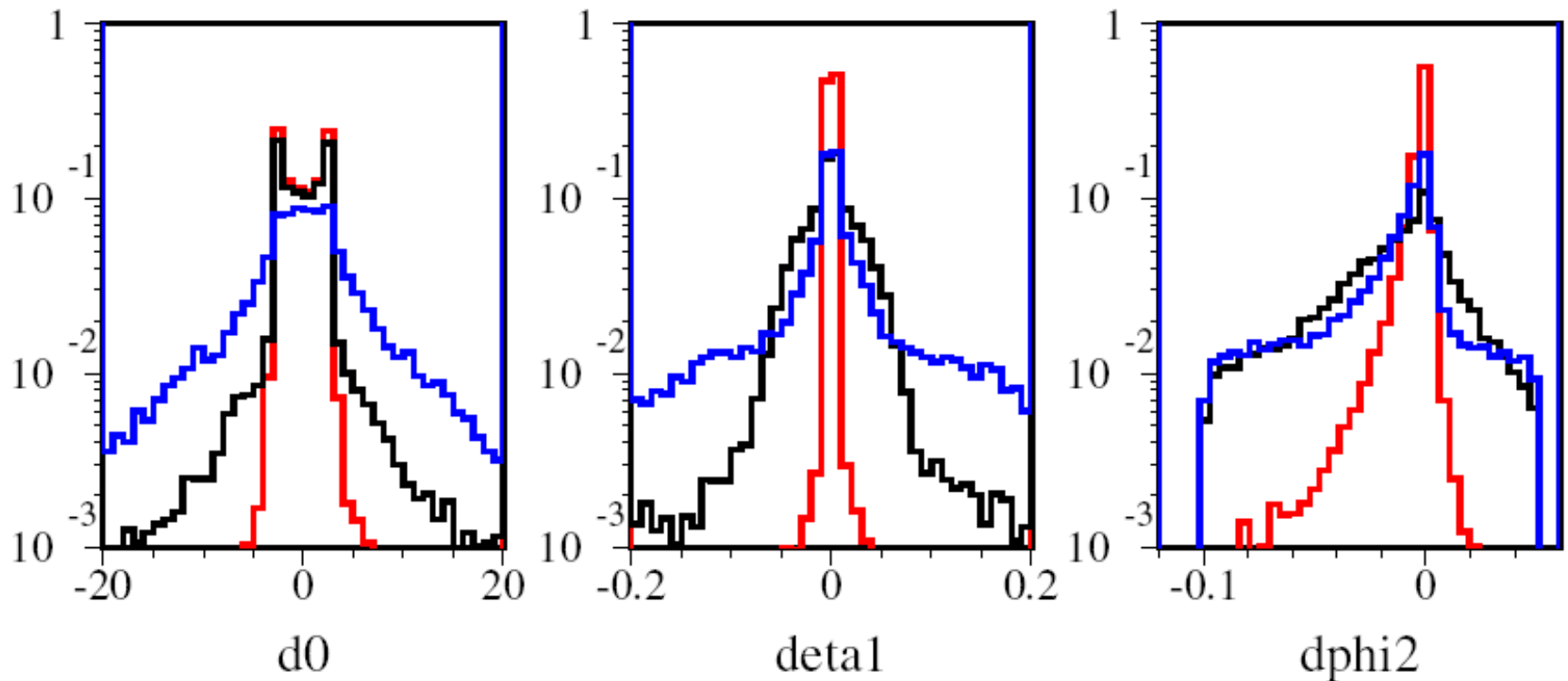
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# Comparison of Input Variables

