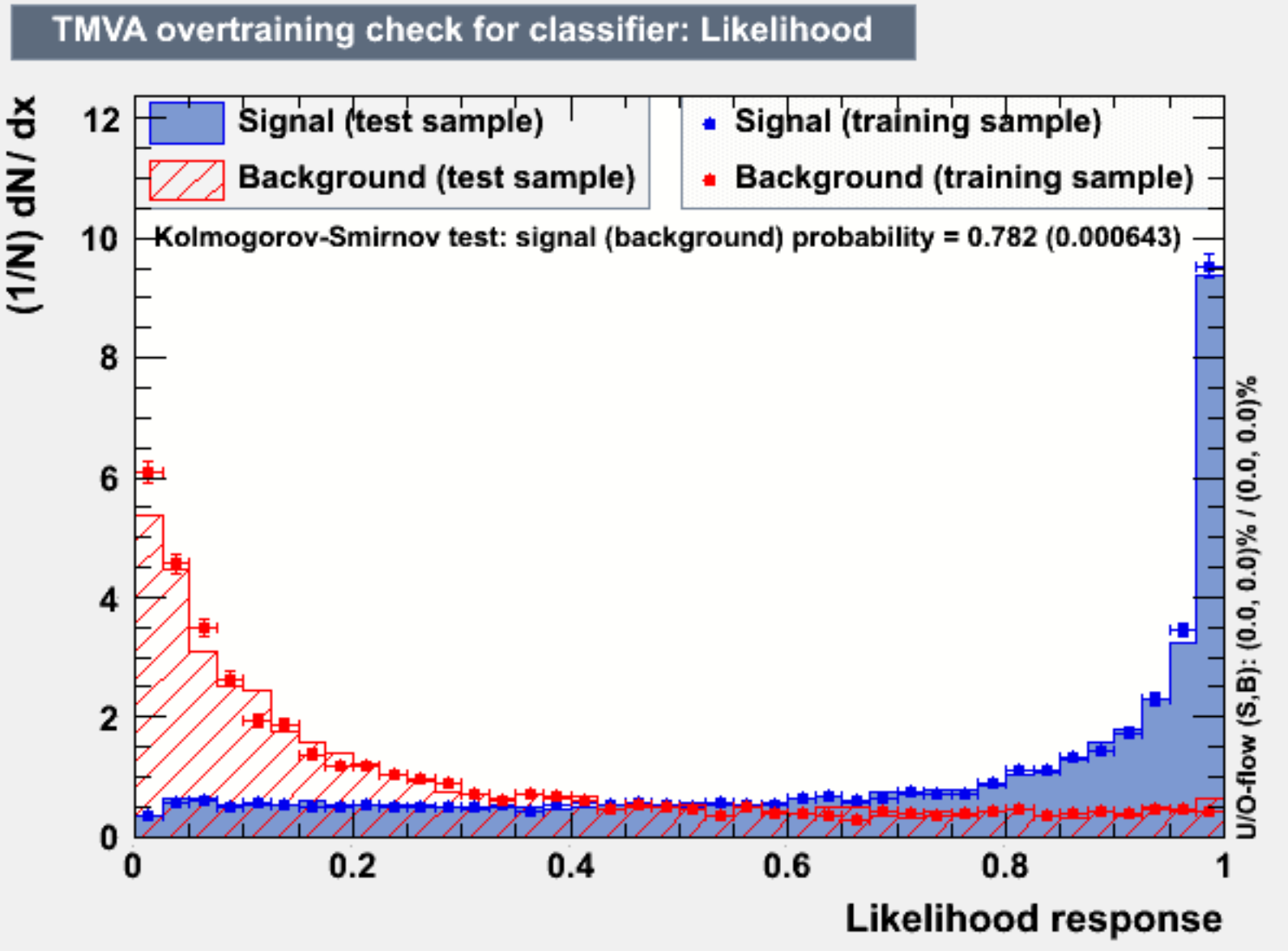
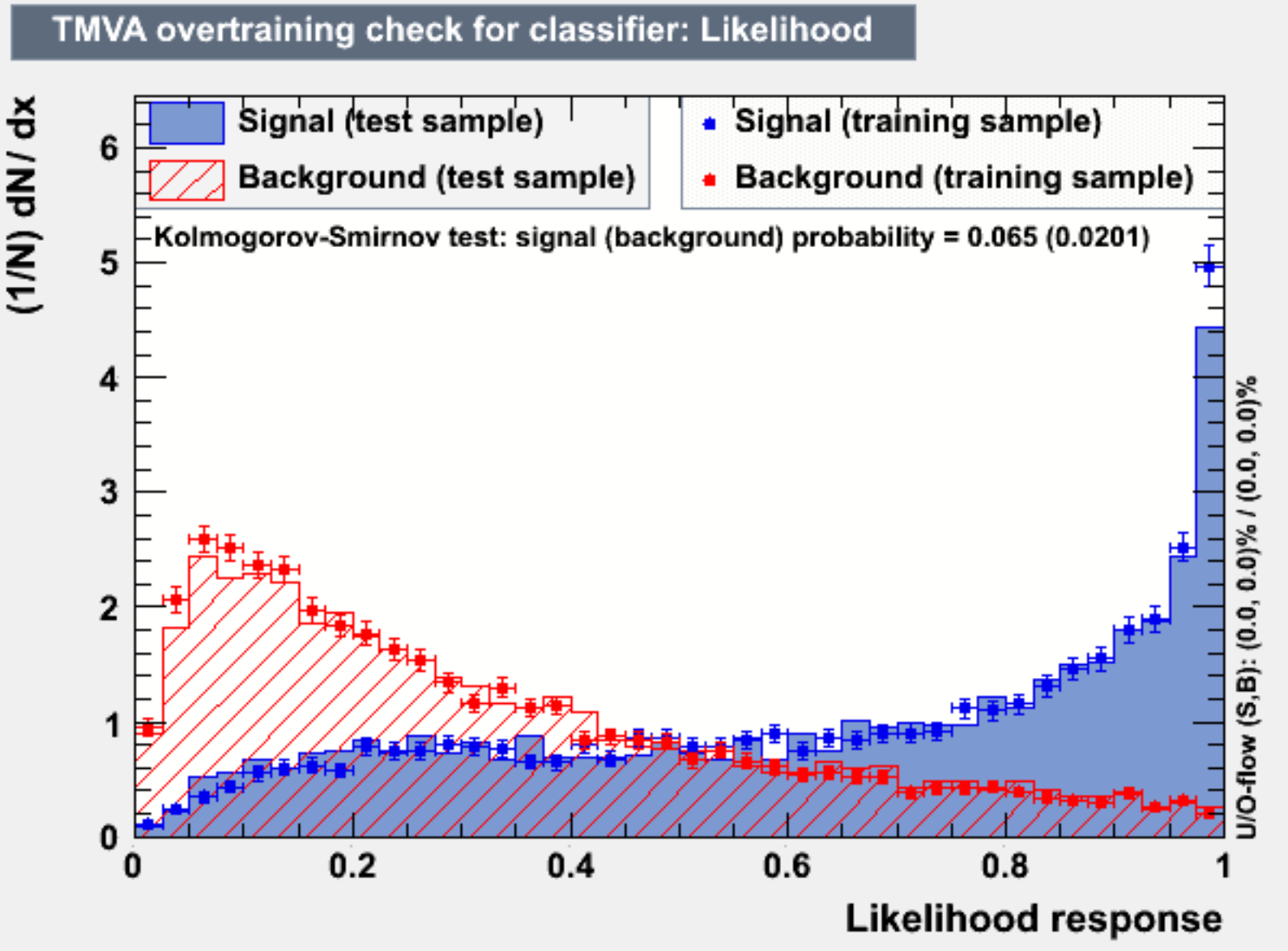
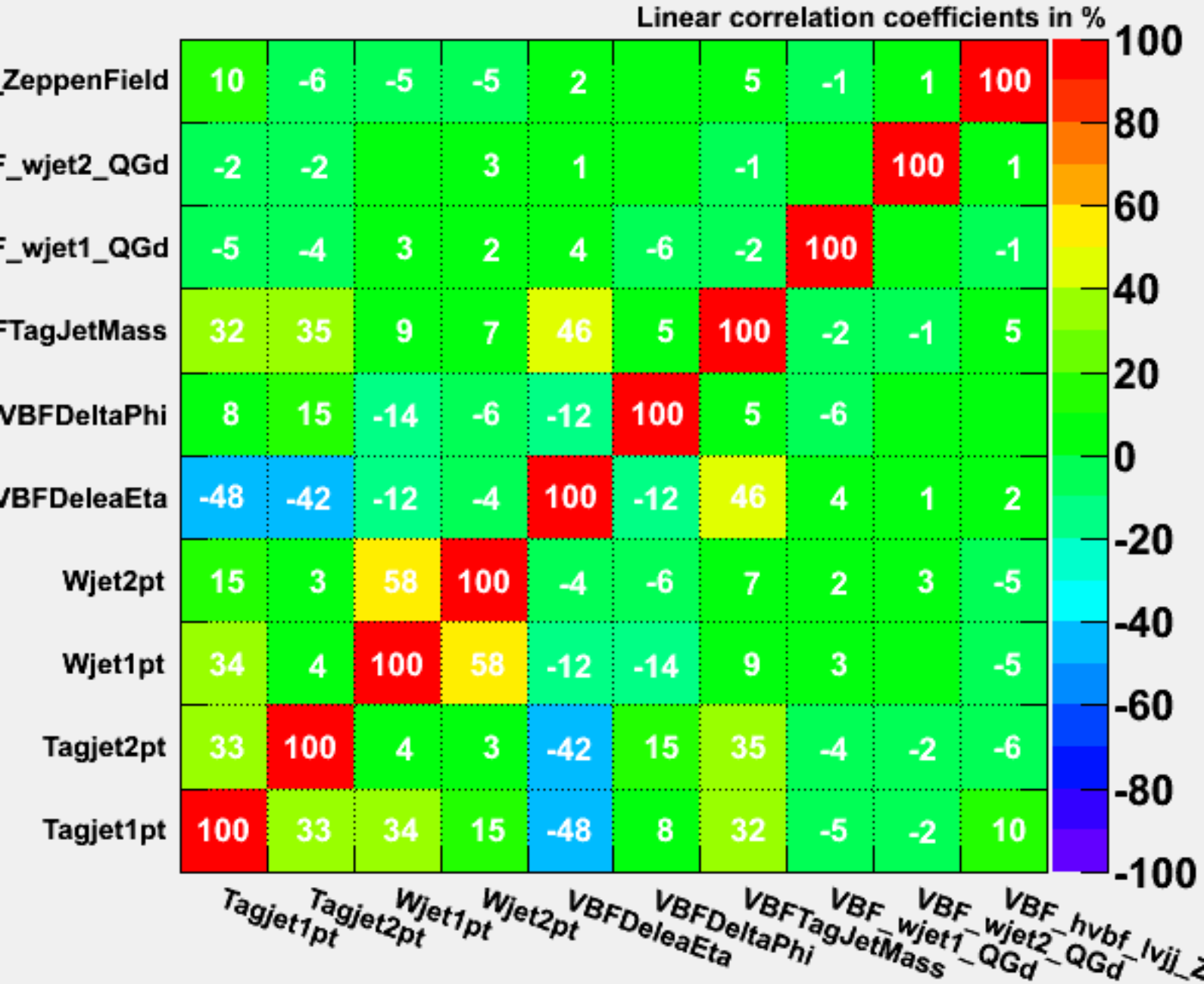
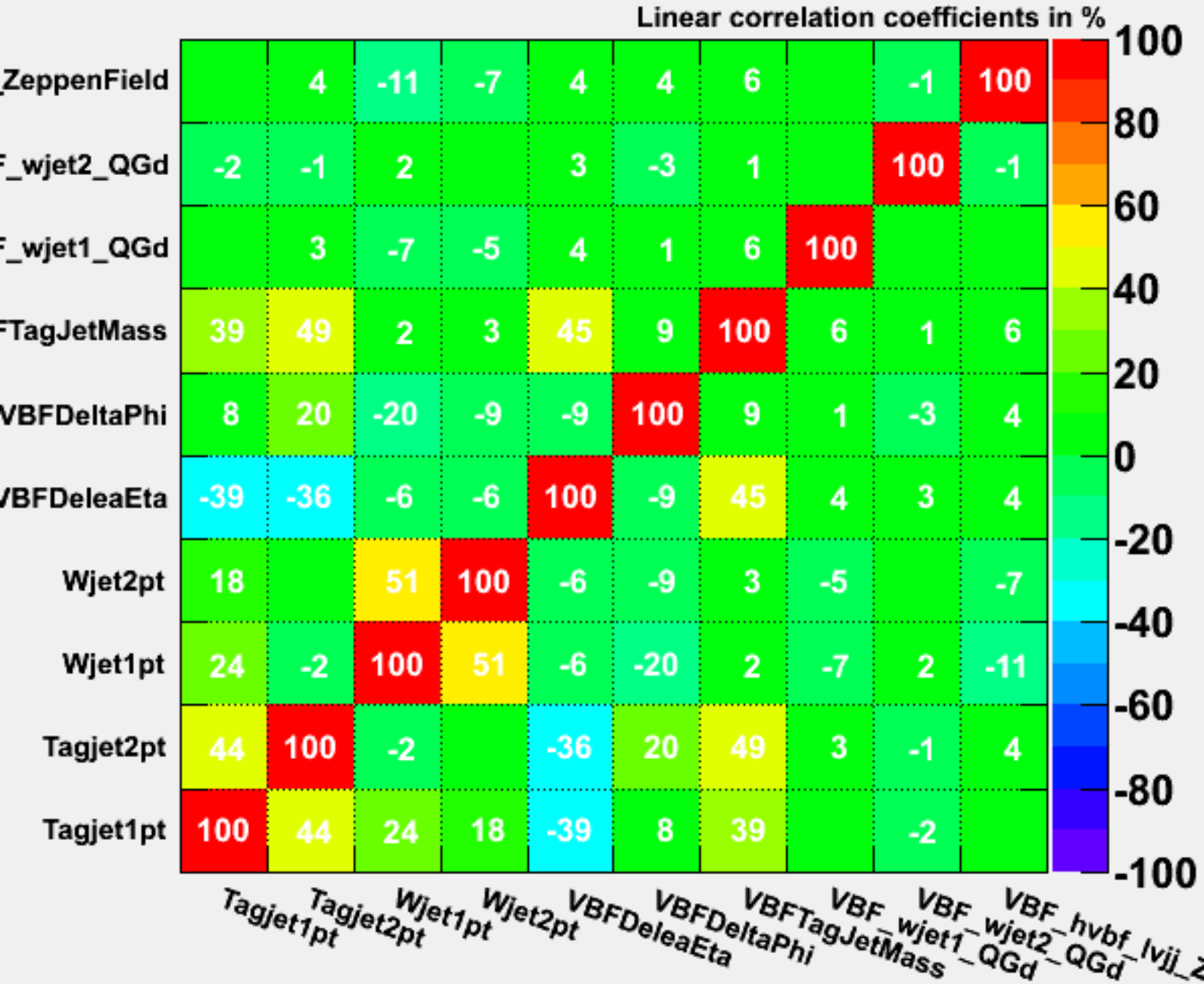

TMVA overtraining check for classifier: Likelihood
Signal (test sample)
Background (test sample)
Signal (training sample)
Background (training sample)
Kolmogorov-Smirnov test: signal (background) probability = 0.782 (0.000643)
(1/N) dN/ dx
U/O-flow (S,B): (0.0, 0.0)% / (0.0, 0.0)%
Likelihood response
0
2
4
6
8
10
12
0
0.2
0.4
0.6
0.8
1


TMVA overtraining check for classifier: Likelihood
Signal (test sample)
Background (test sample)
Signal (training sample)
Background (training sample)
Kolmogorov-Smirnov test: signal (background) probability = 0.065 (0.0201)
(1/N) dN/ dx
U/O-flow (S,B): (0.0, 0.0)% / (0.0, 0.0)%
Likelihood response
0
1
2
3
4
5
6
0
0.2
0.4
0.6
0.8
1

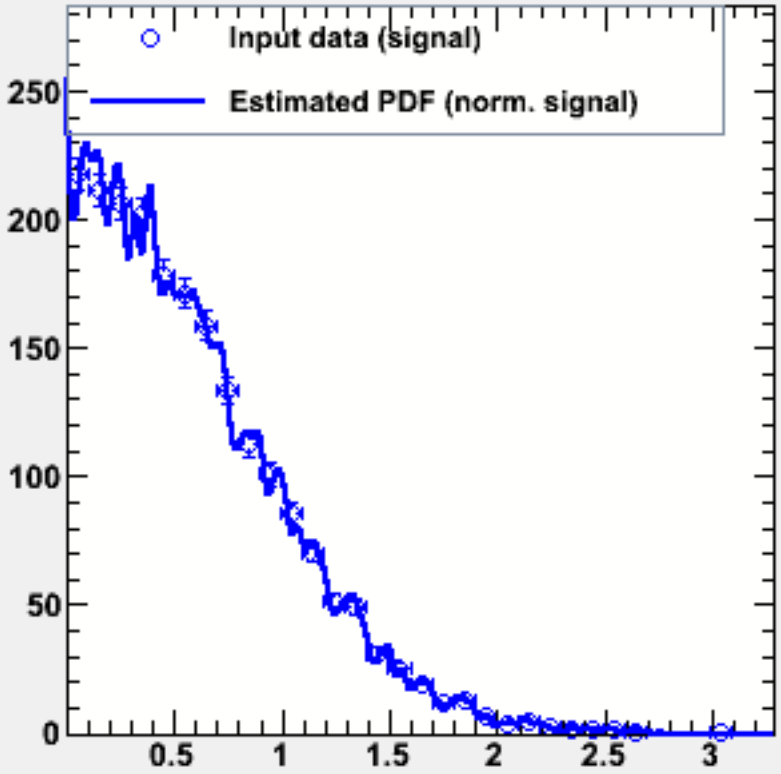
# Correlation Matrix (background)



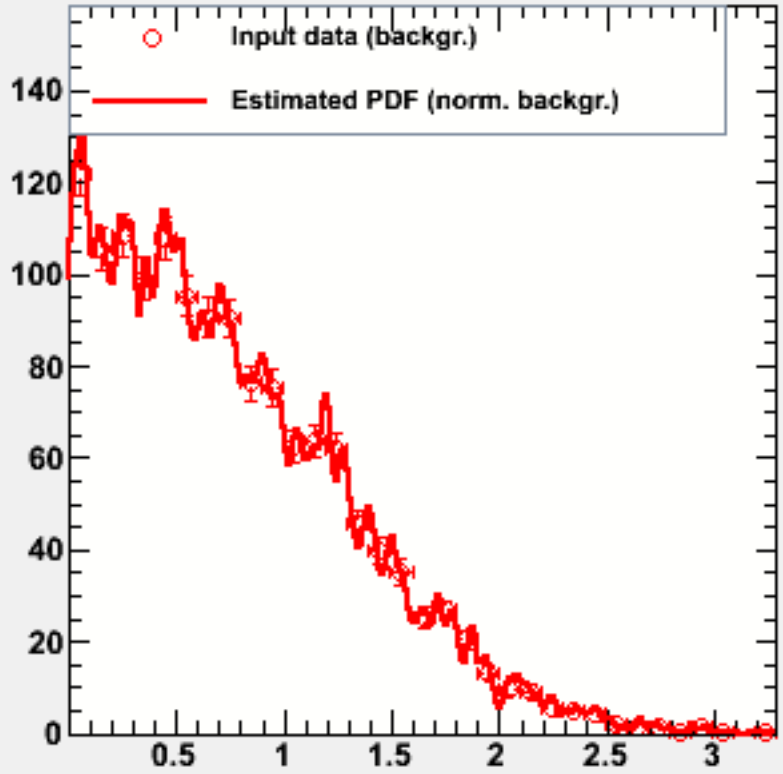
# Correlation Matrix (signal)



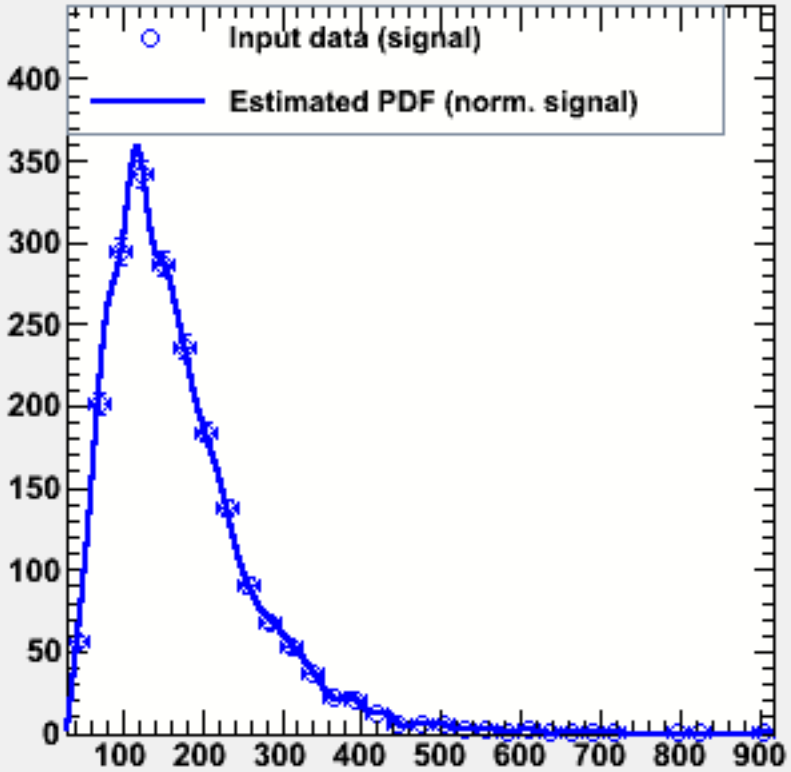
VBF_hvbf_lvjj_ZeppenField signal training



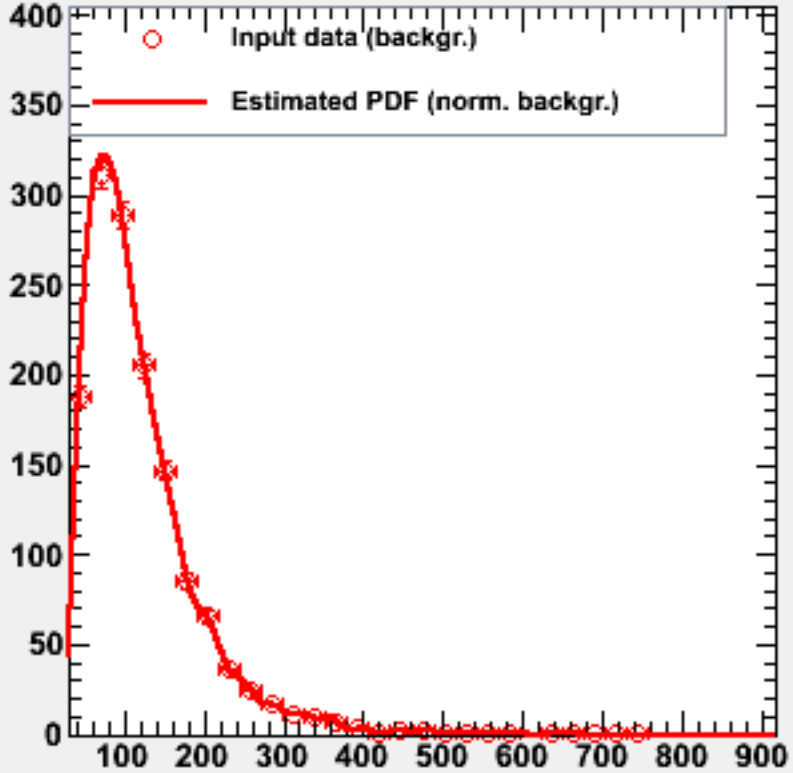

VBF_hvbf_lvjj_ZeppenField background training



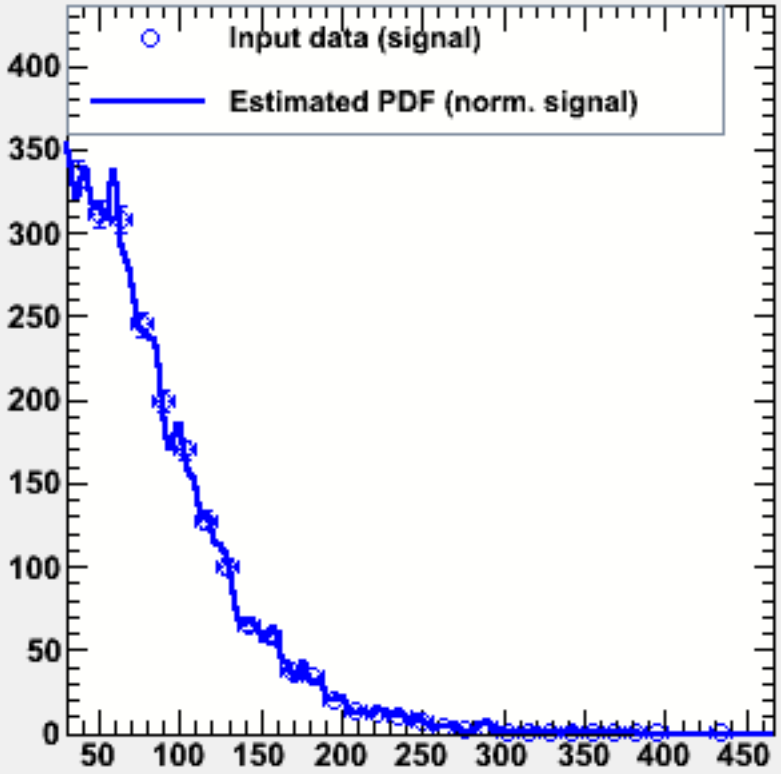
Tagjet1pt signal training



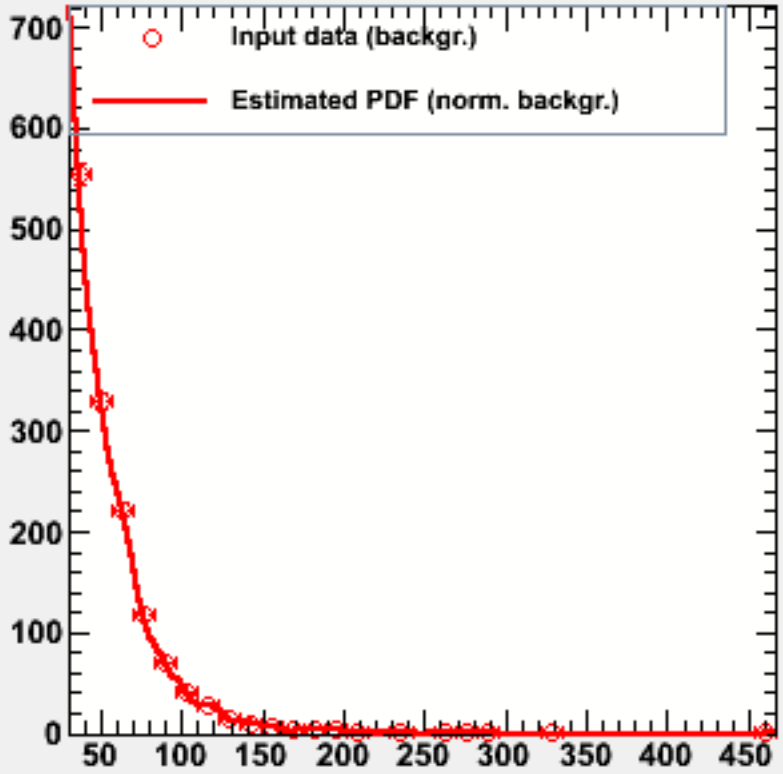

Tagjet1pt background training



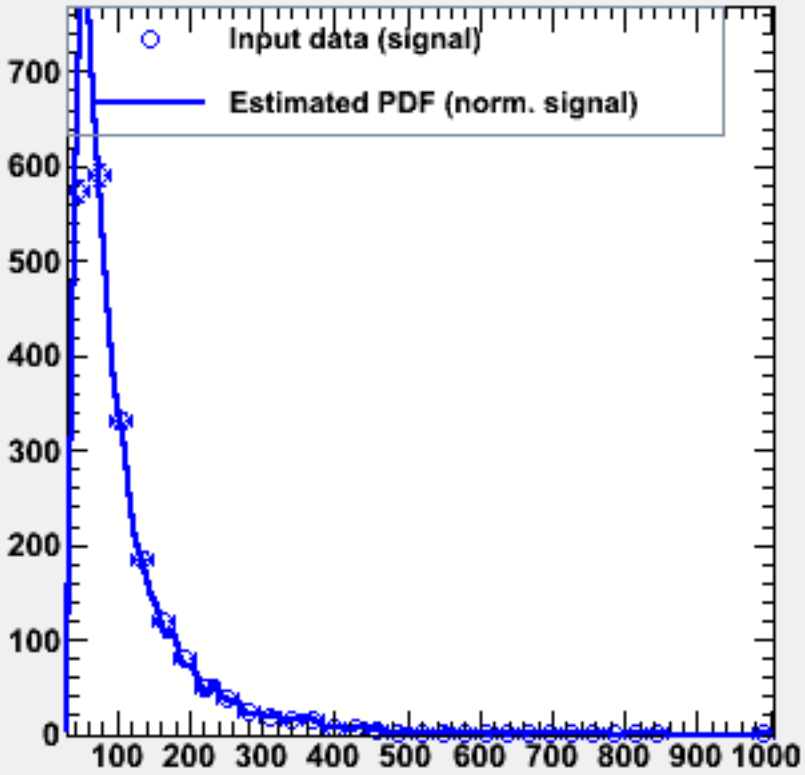
Tagjet2pt signal training



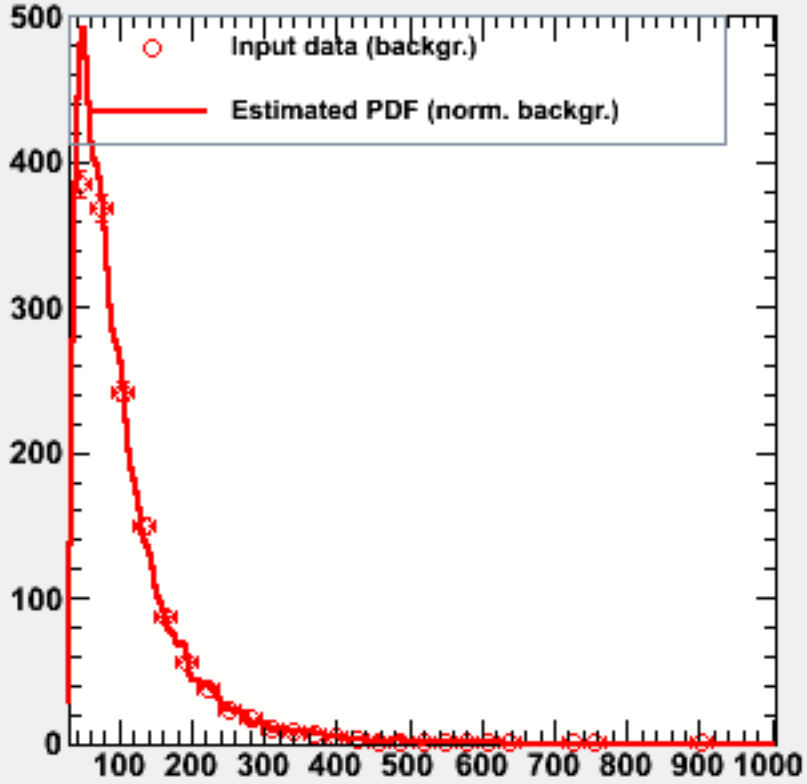

Tagjet2pt background training



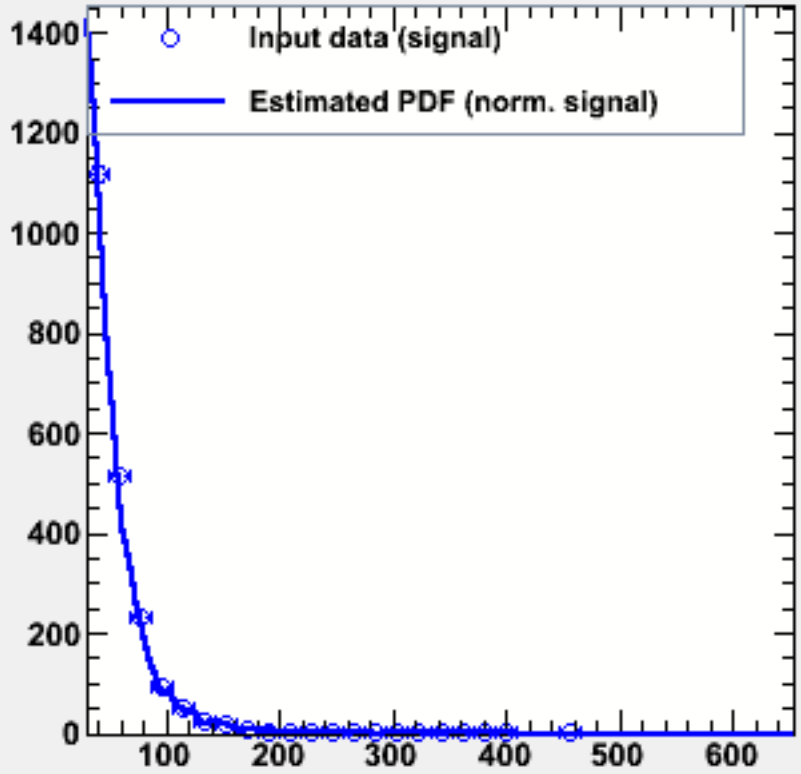
Wjet1pt signal training



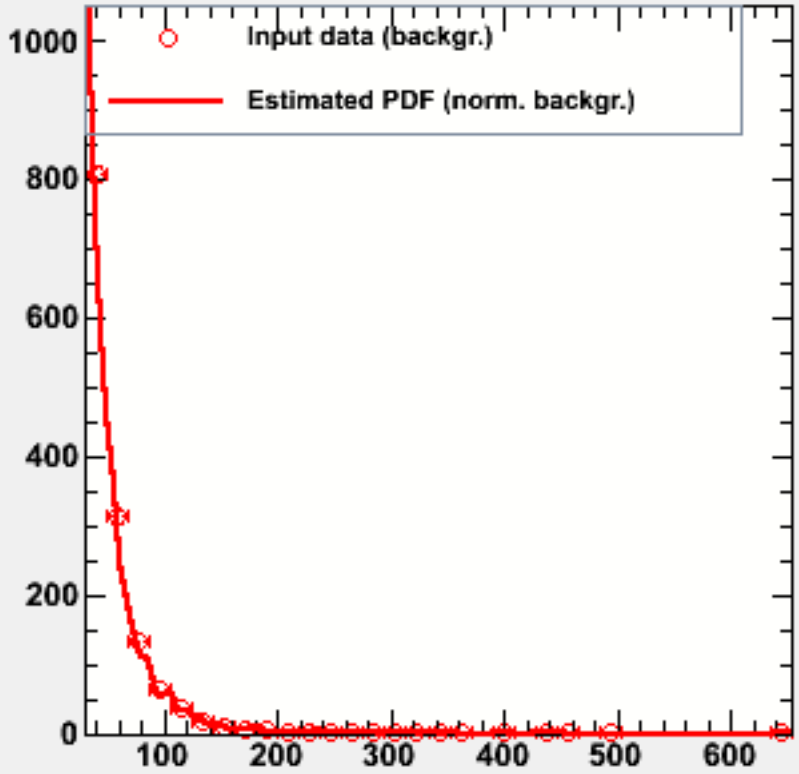

Wjet1pt background training

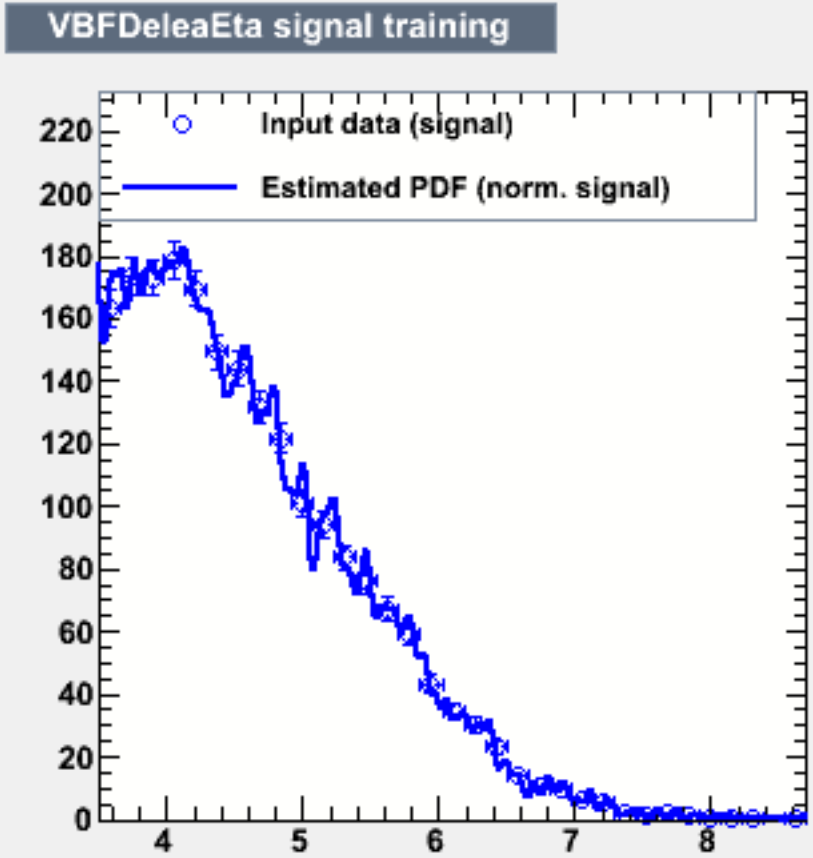


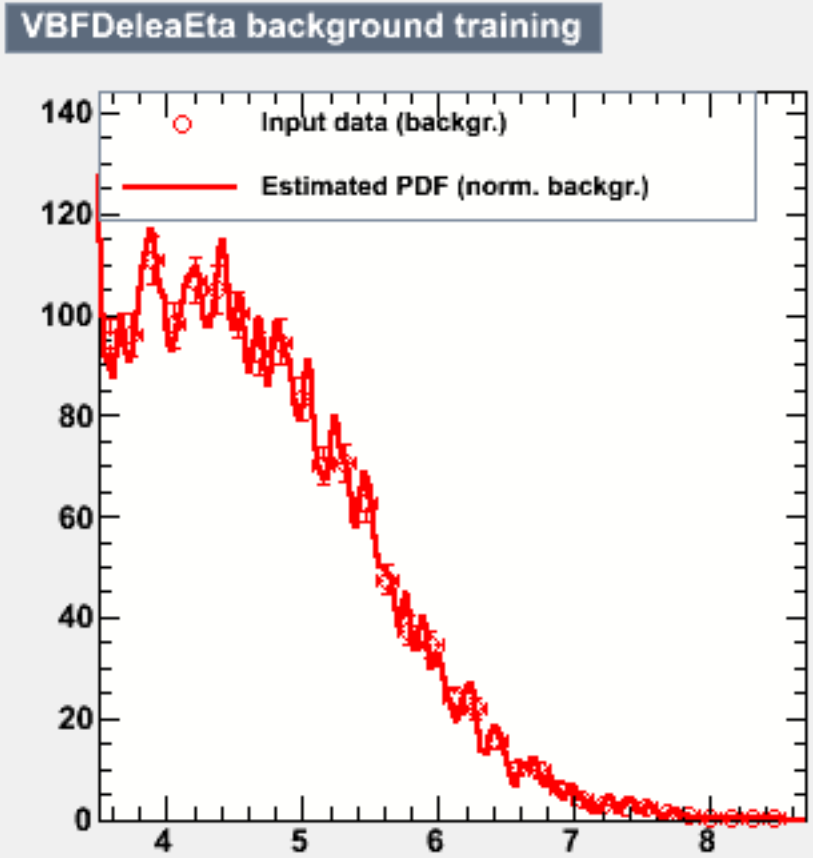
Wjet2pt signal training

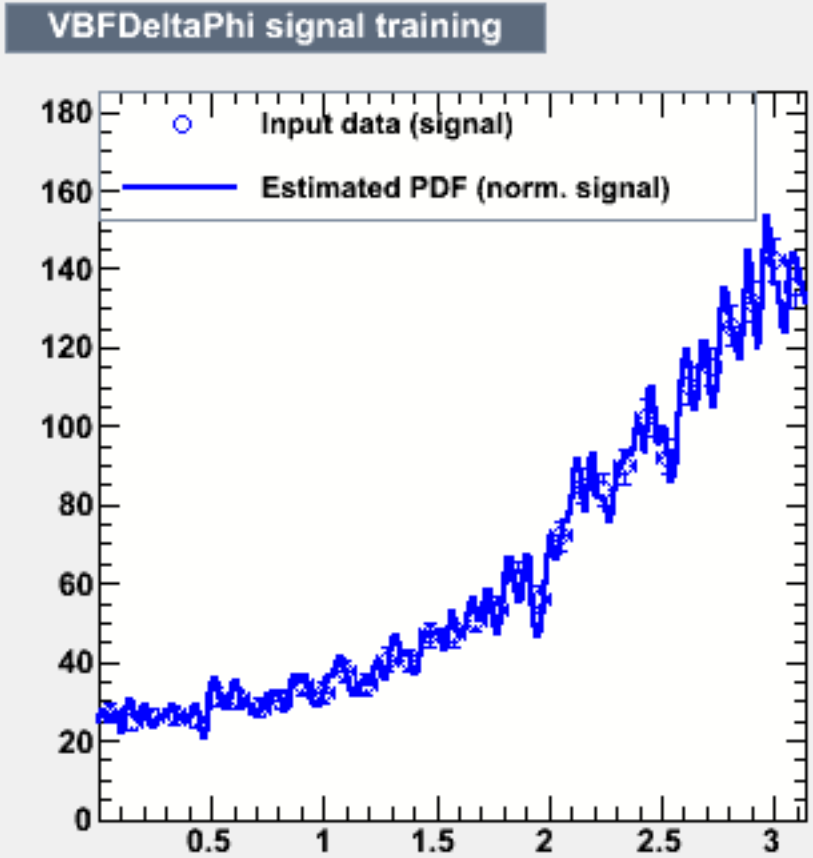


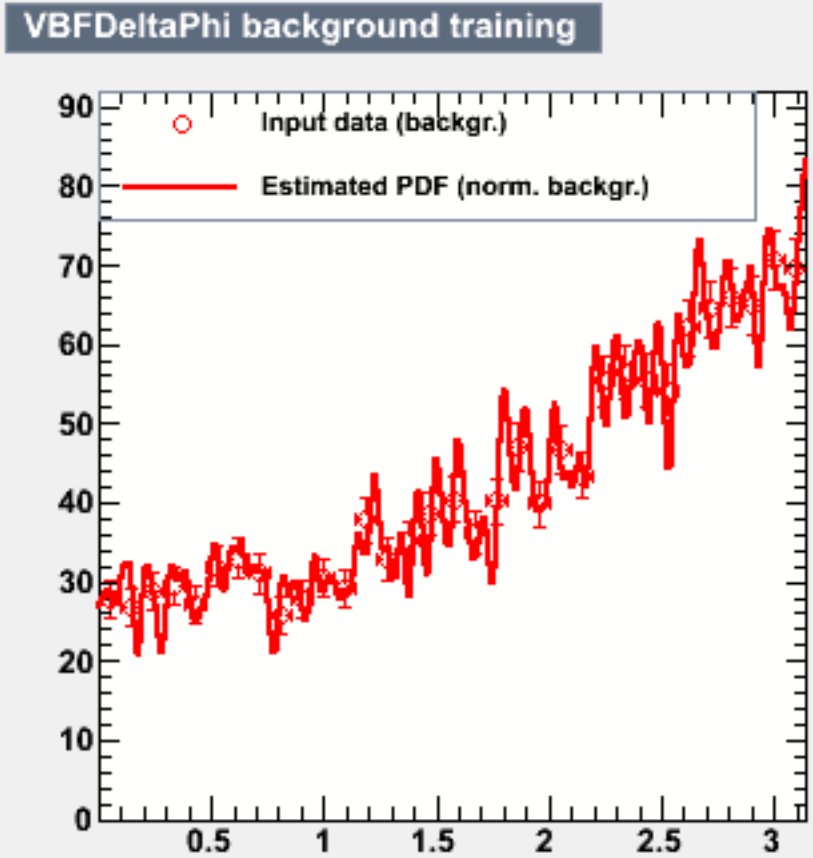

Wjet2pt background training

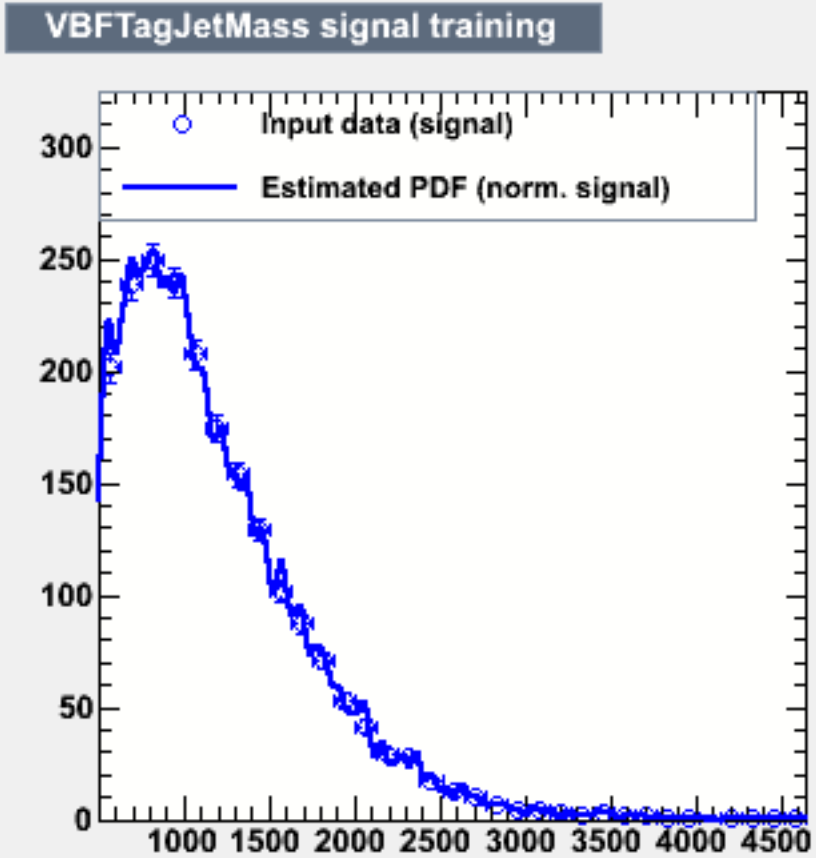


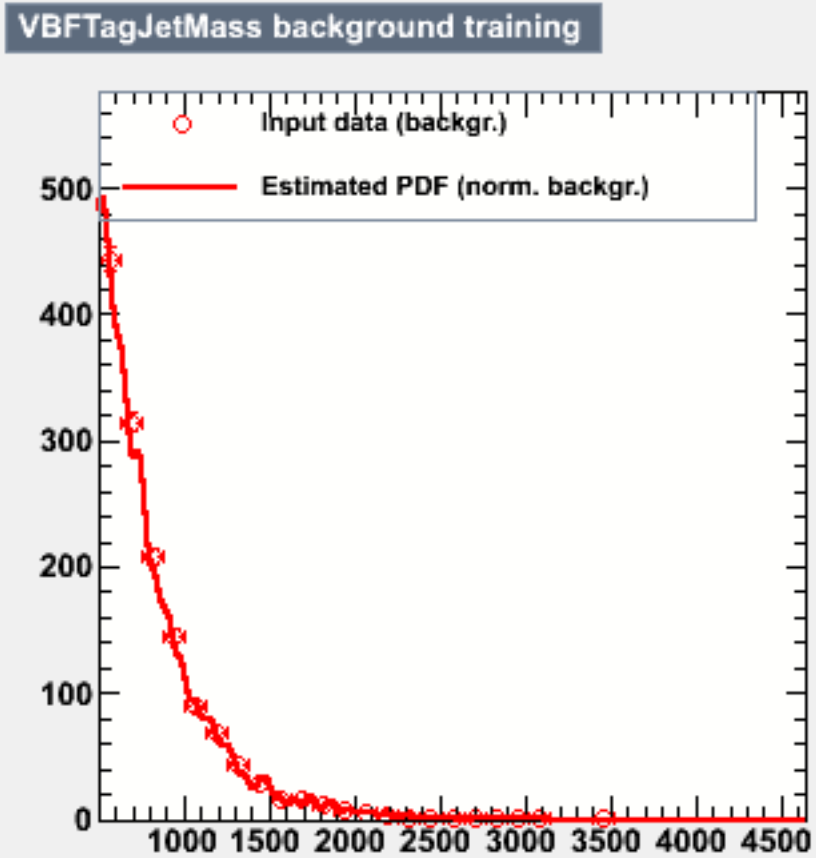

VBFDeleaEta signal training
Input data (signal)
Estimated PDF (norm. signal)
220
200
180
160
140
120
100
80
60
40
20
0
4
5
6
7
8

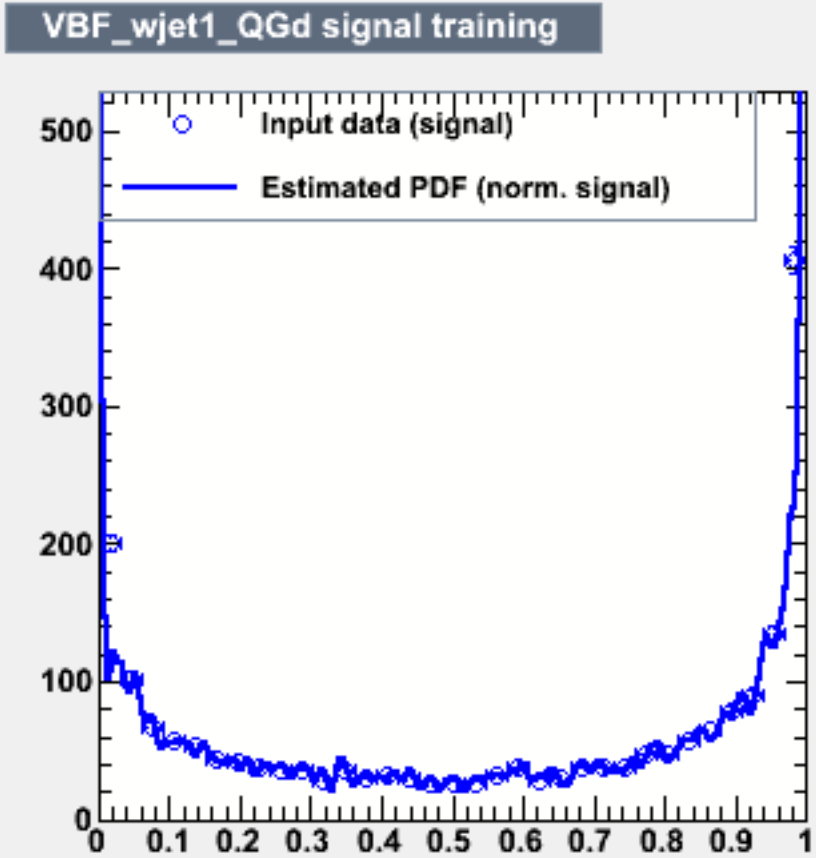

VBFDeleaEta background training
Input data (backgr.)
Estimated PDF (norm. backgr.)
140
120
100
80
60
40
20
0
4
5
6
7
8

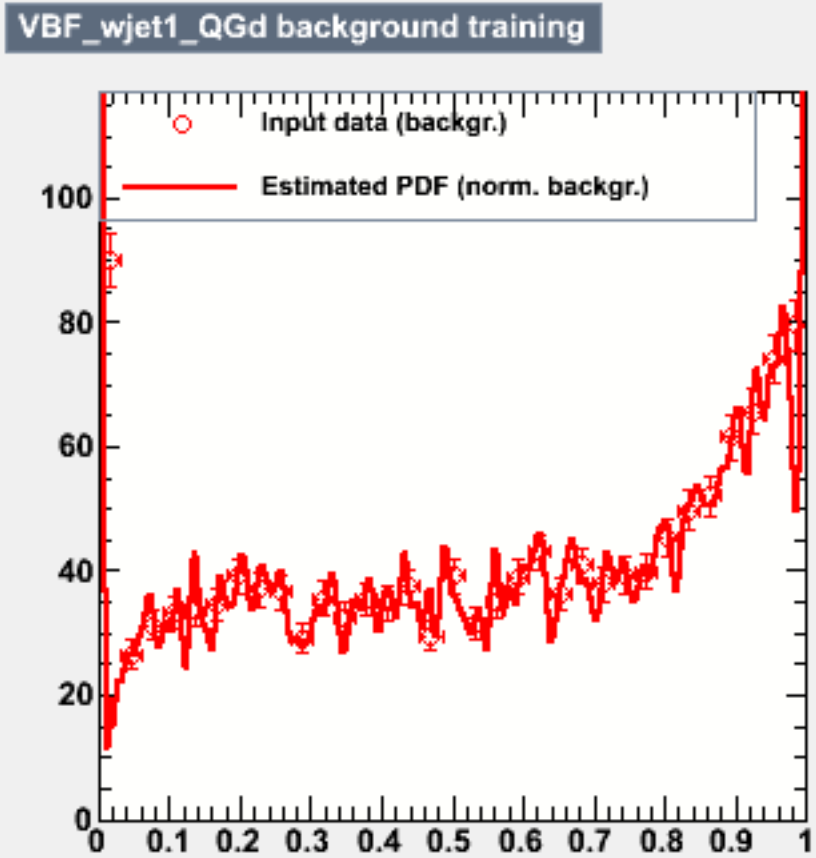

VBFDeltaPhi signal training
Input data (signal)
Estimated PDF (norm. signal)
180
160
140
120
100
80
60
40
20
0
0.5
1
1.5
2
2.5
3

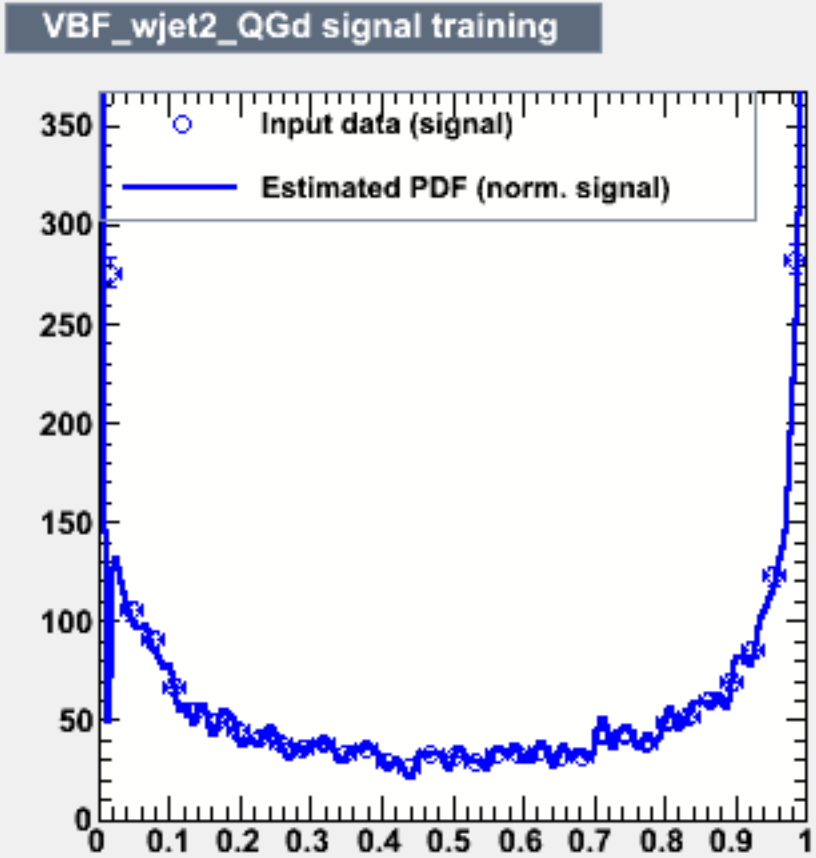

VBFDeltaPhi background training
Input data (backgr.)
Estimated PDF (norm. backgr.)
90
80
70
60
50
40
30
20
10
0
0.5
1
1.5
2
2.5
3

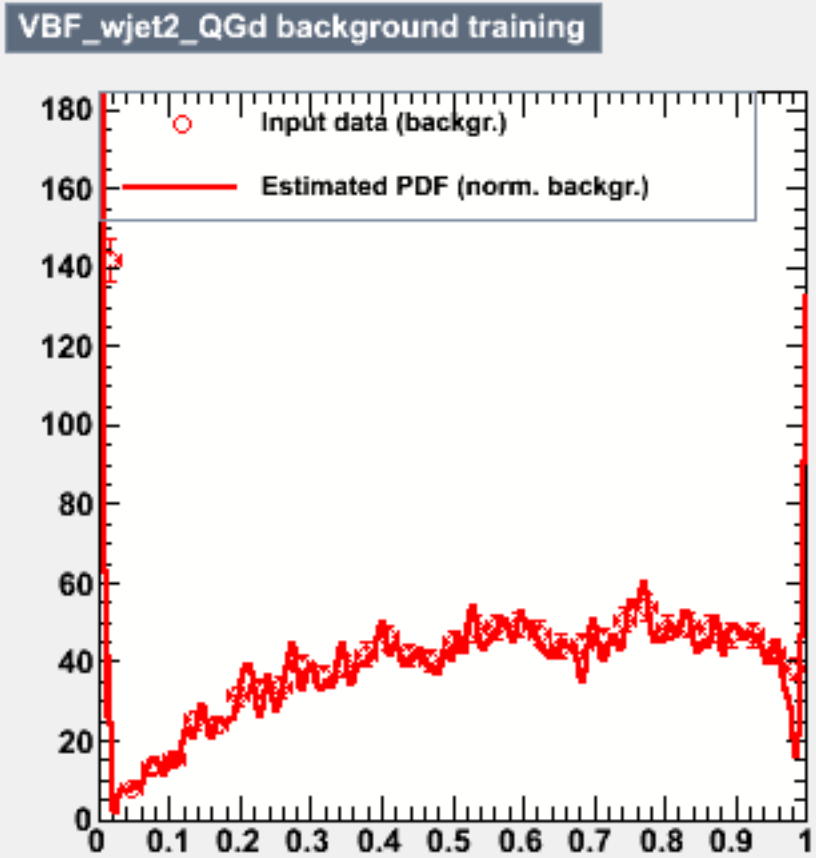

VBFTagJetMass signal training
Input data (signal)
Estimated PDF (norm. signal)
300
250
200
150
100
50
0
1000 1500 2000 2500 3000 3500 4000 4500

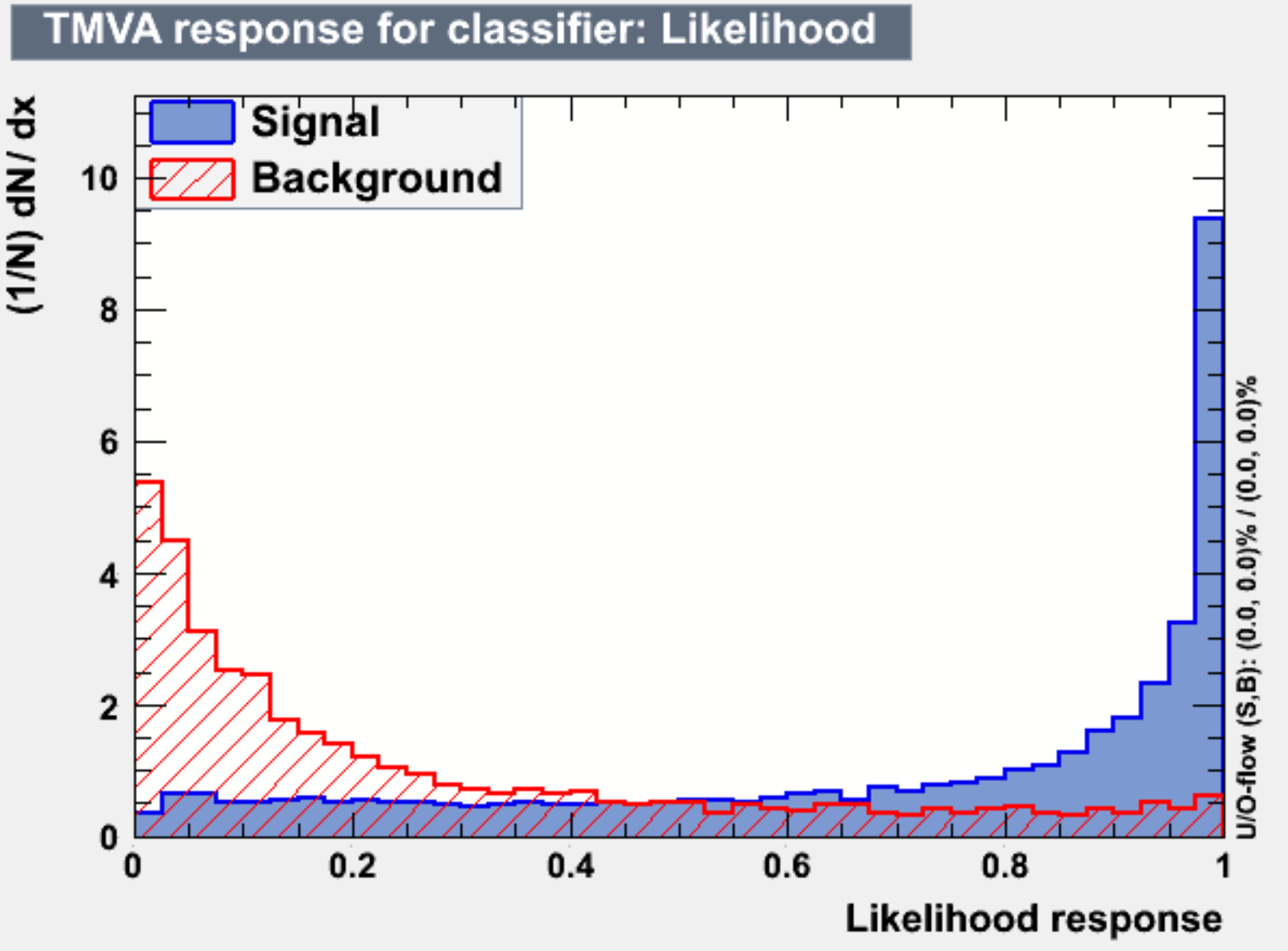

VBFTagJetMass background training
Input data (backgr.)
Estimated PDF (norm. backgr.)
500
400
300
200
100
0
1000 1500 2000 2500 3000 3500 4000 4500

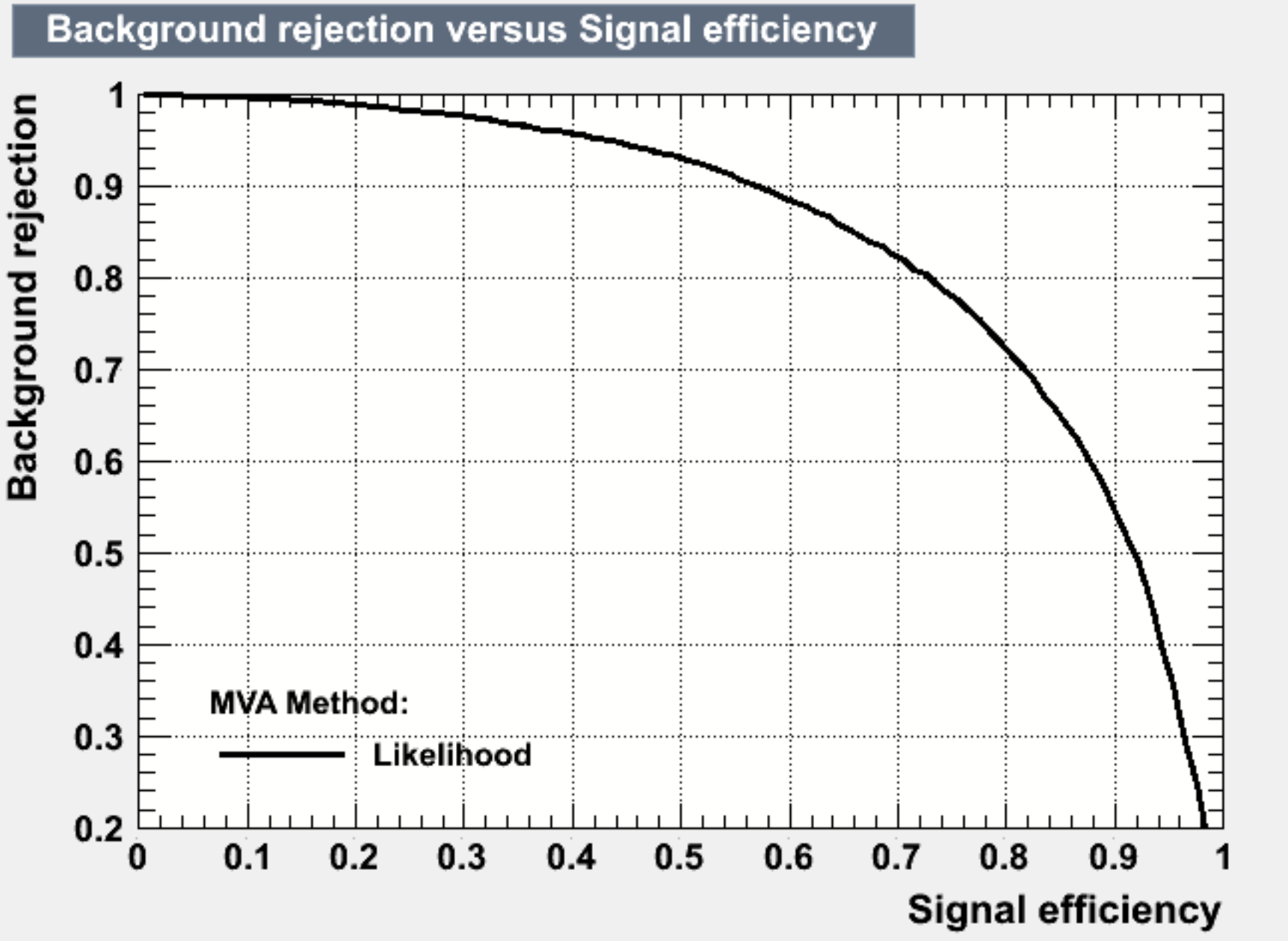

VBF_wjet1_QGd signal training
Input data (signal)
Estimated PDF (norm. signal)
500
400
300
200
100
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

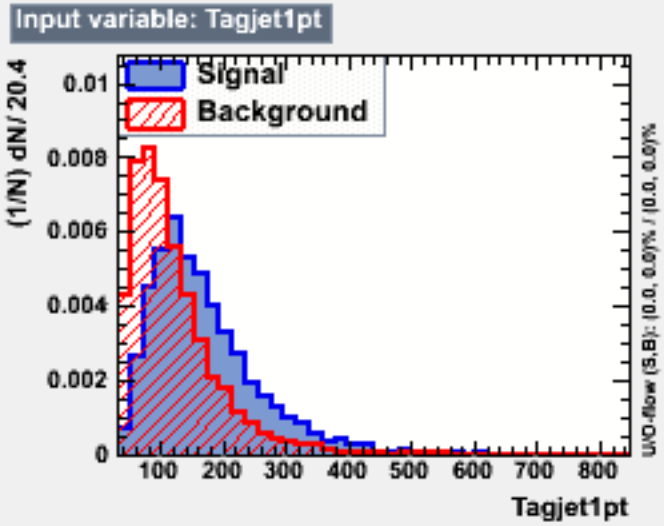

VBF_wjet1_QGd background training
Input data (backgr.)
Estimated PDF (norm. backgr.)
100
80
60
40
20
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

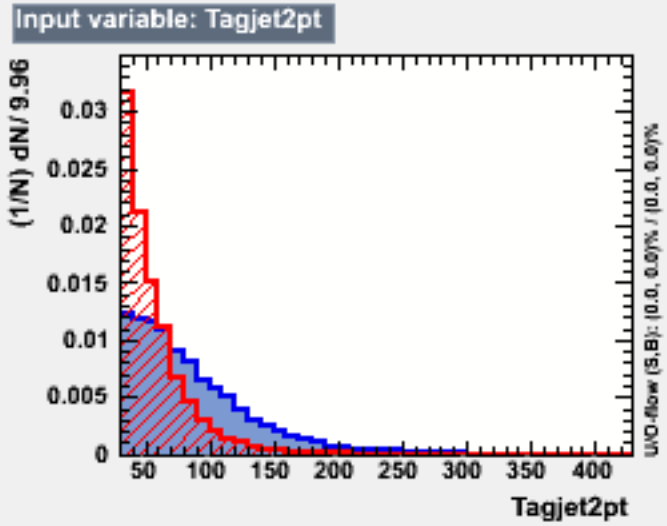

VBF_wjet2_QGd signal training
Input data (signal)
Estimated PDF (norm. signal)
350
300
250
200
150
100
50
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

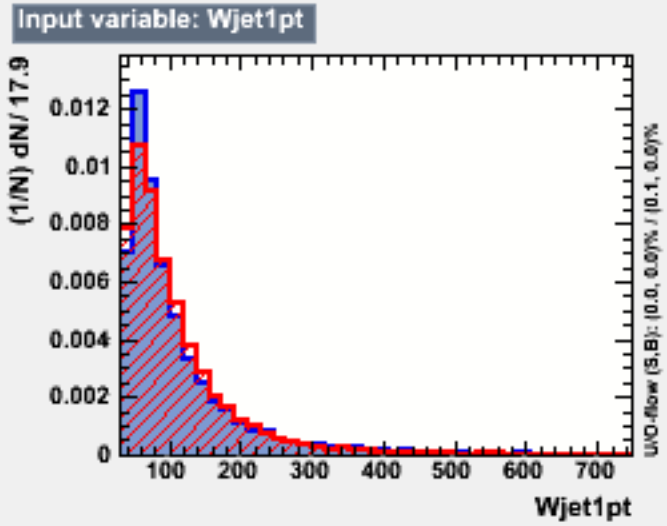

VBF_wjet2_QGd background training
Input data (backgr.)
Estimated PDF (norm. backgr.)
180
160
140
120
100
80
60
40
20
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

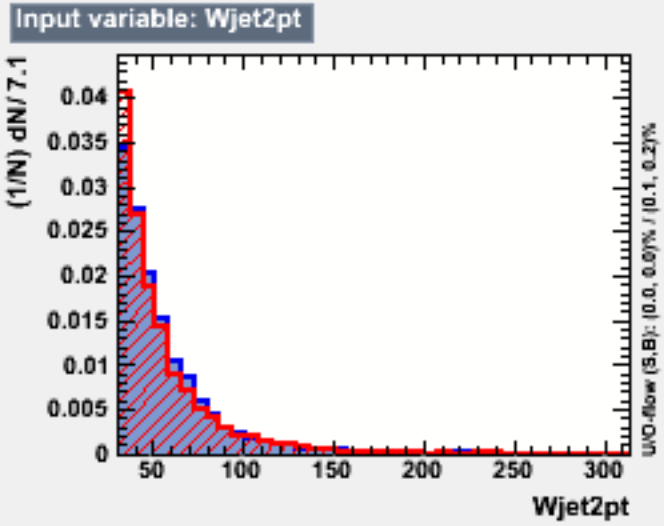

TMVA response for classifier: Likelihood
Signal
Background
(1/N) dN/ dx
10
8
6
4
2
0
0
0.2
0.4
0.6
0.8
1
Likelihood response
U/O-flow (S,B): (0.0, 0.0)% / (0.0, 0.0)%

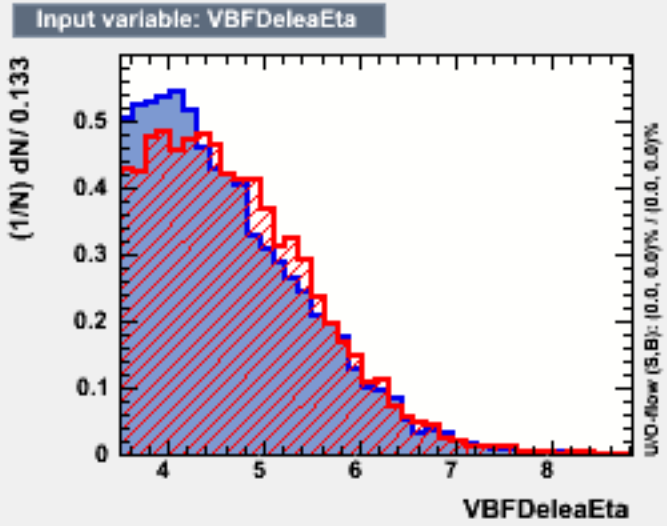

Background rejection versus Signal efficiency
Background rejection
Signal efficiency
MVA Method:
Likelihood
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

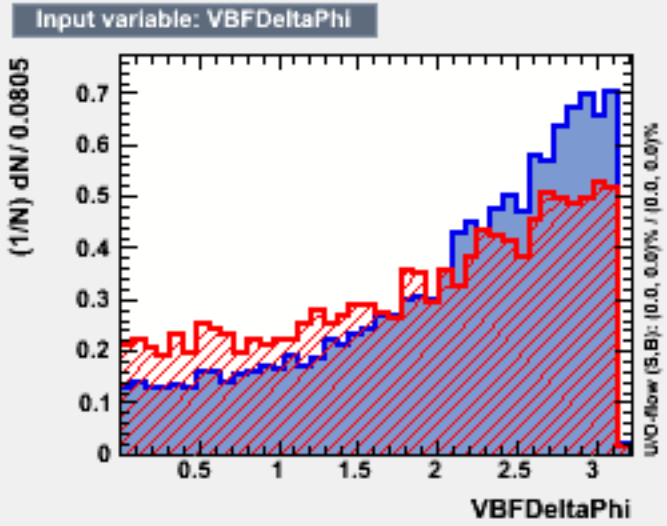

Input variable: Tagjet1pt
Signal
Background
(1/N) dN/ 20.4
Tagjet1pt
U/O-flow (S,B): (0.0, 0.0)% / (0.0, 0.0)%

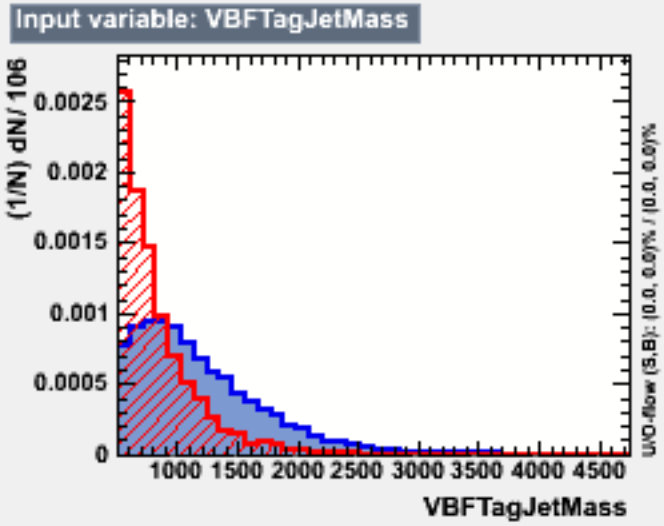

Input variable: Tagjet2pt
(1/N) dN/ 9.96
Tagjet2pt
U/O-flow (S,B): (0.0, 0.0)% / (0.0, 0.0)%

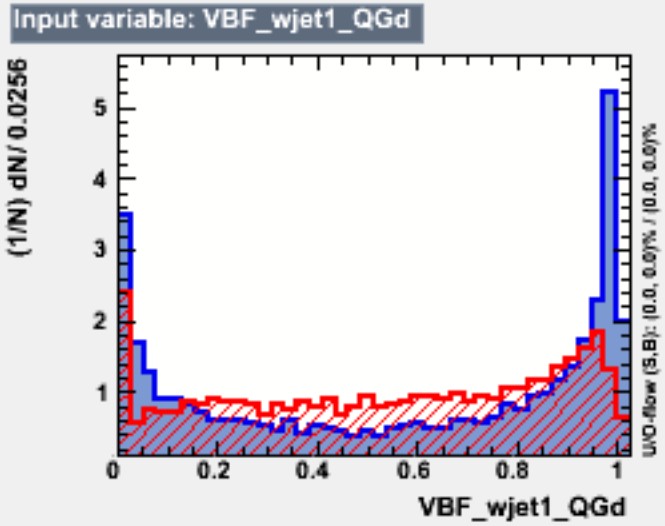

Input variable: Wjet1pt
(1/N) dN/ 17.9
Wjet1pt
U/O-flow (S,B): (0.0, 0.0)% / (0.1, 0.0)%

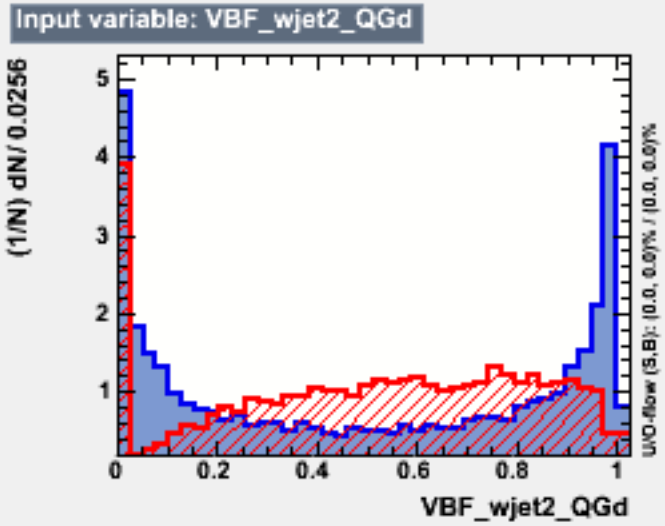

Input variable: Wjet2pt
(1/N) dN/ 7.1
Wjet2pt
U/O-flow (S,B): (0.0, 0.0)% / (0.1, 0.2)%

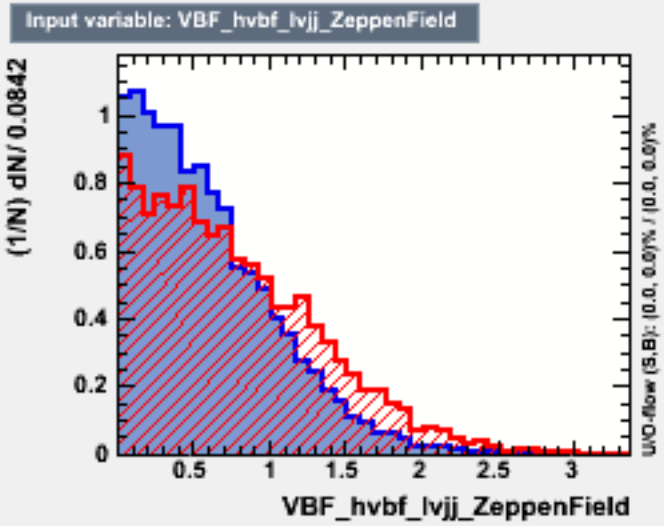

Input variable: VBFDeleaEta
(1/N) dN/ 0.133
VBFDeleaEta
U/O-flow (S,B): (0.0, 0.0)% / (0.0, 0.0)%


Input variable: VBFDeltaPhi
(1/N) dN/ 0.0805
VBFDeltaPhi
U/O-flow (S,B): (0.0, 0.0)% / (0.0, 0.0)%


Input variable: VBFTagJetMass
(1/N) dN/ 106
VBFTagJetMass
U/O-flow (S,B): (0.0, 0.0)% / (0.0, 0.0)%


Input variable: VBF_wjet1_QGd
(1/N) dN/ 0.0256
VBF_wjet1_QGd
U/O-flow (S,B): (0.0, 0.0)% / (0.0, 0.0)%

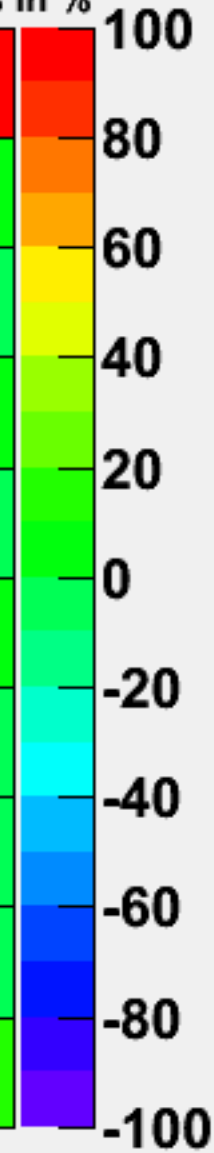

Input variable: VBF_wjet2_QGd
(1/N) dN/ 0.0256
VBF_wjet2_QGd
U/O-flow (S,B): (0.0, 0.0)% / (0.0, 0.0)%


Input variable: VBF_hvbf_lvjj_ZeppenField
(1/N) dN/ 0.0842
VBF_hvbf_lvjj_ZeppenField
U/O-flow (S,B): (0.0, 0.0)% / (0.0, 0.0)%

# Correlation Matrix (background)

Linear correlation coefficients in %

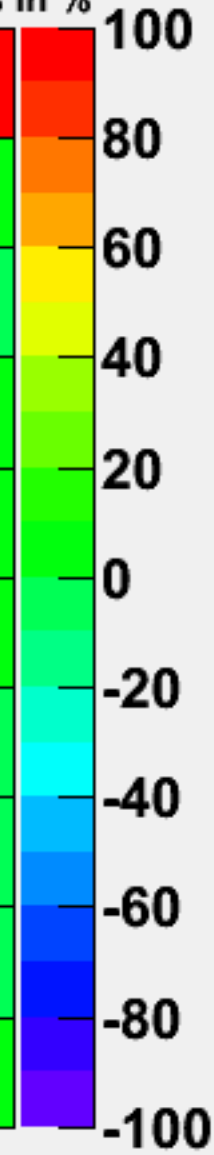
| | Tagjet1pt | Tagjet2pt | Wjet1pt | Wjet2pt | VBFDeleaEta | VBFDeltaPhi | VBFTagJetMass | VBF_wjet1_QGd | VBF_wjet2_QGd | VBF_hvbf_lvjj_Z |
|---|---|---|---|---|---|---|---|---|---|---|
| _ZeppenField | 10 | -7 | -4 | -3 | 2 | -1 | 5 | -1 | | 100 |
| F_wjet2_QGd | -2 | -1 | 1 | 2 | | -2 | -3 | 1 | 100 | |
| F_wjet1_QGd | -4 | -5 | 3 | 1 | 4 | -5 | -1 | 100 | 1 | -1 |
| FTagJetMass | 31 | 34 | 10 | 5 | 46 | 5 | 100 | -1 | -3 | 5 |
| VBFDeltaPhi | 7 | 17 | -14 | -7 | -12 | 100 | 5 | -5 | -2 | -1 |
| VBFDeleaEta | -48 | -42 | -13 | -5 | 100 | -12 | 46 | 4 | | 2 |
| Wjet2pt | 17 | 3 | 57 | 100 | -5 | -7 | 5 | 1 | 2 | -3 |
| Wjet1pt | 36 | 5 | 100 | 57 | -13 | -14 | 10 | 3 | 1 | -4 |
| Tagjet2pt | 31 | 100 | 5 | 3 | -42 | 17 | 34 | -5 | -1 | -7 |
| Tagjet1pt | 100 | 31 | 36 | 17 | -48 | 7 | 31 | -4 | -2 | 10 |



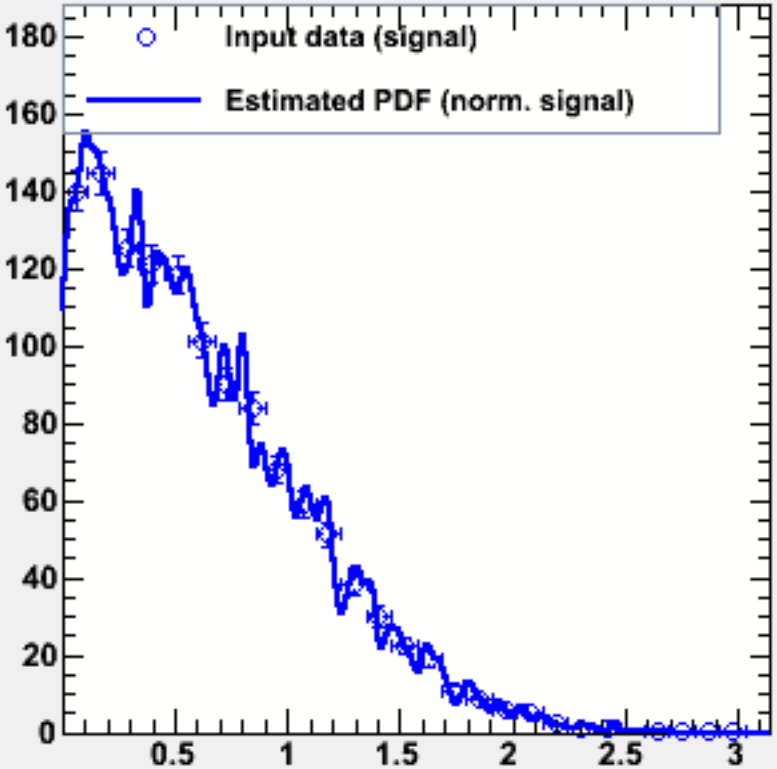
# Correlation Matrix (signal)

Linear correlation coefficients in %

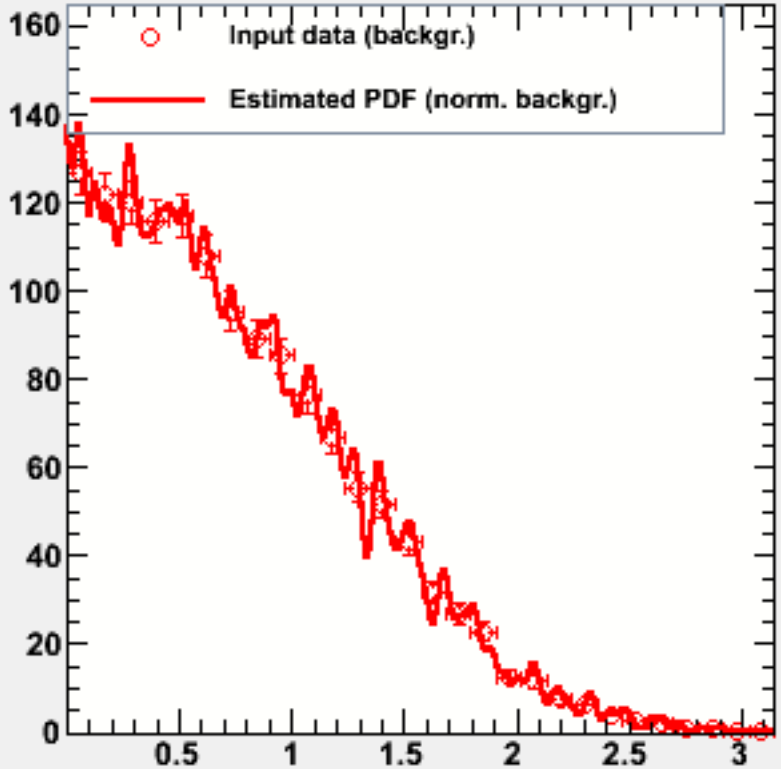
| | Tagjet1pt | Tagjet2pt | Wjet1pt | Wjet2pt | VBFDeleaEta | VBFDeltaPhi | VBFTagJetMass | VBF_wjet1_QGd | VBF_wjet2_QGd | VBF_hvbf_lvjj_Z |
|---|---|---|---|---|---|---|---|---|---|---|
| _ZeppenField | | -1 | -6 | -7 | 7 | 1 | 3 | -1 | | 100 |
| F_wjet2_QGd | 1 | | 3 | 1 | 2 | | 3 | | 100 | |
| F_wjet1_QGd | 5 | 7 | -4 | -1 | 1 | 3 | 10 | 100 | | -1 |
| FTagJetMass | 46 | 54 | 8 | 2 | 40 | 12 | 100 | 10 | 3 | 3 |
| VBFDeltaPhi | 9 | 21 | -18 | -13 | -10 | 100 | 12 | 3 | | 1 |
| VBFDeleaEta | -36 | -33 | -11 | -2 | 100 | -10 | 40 | 1 | 2 | 7 |
| Wjet2pt | 15 | -3 | 48 | 100 | -2 | -13 | 2 | -1 | 1 | -7 |
| Wjet1pt | 37 | | 100 | 48 | -11 | -18 | 8 | -4 | 3 | -6 |
| Tagjet2pt | 42 | 100 | | -3 | -33 | 21 | 54 | 7 | | -1 |
| Tagjet1pt | 100 | 42 | 37 | 15 | -36 | 9 | 46 | 5 | 1 | |



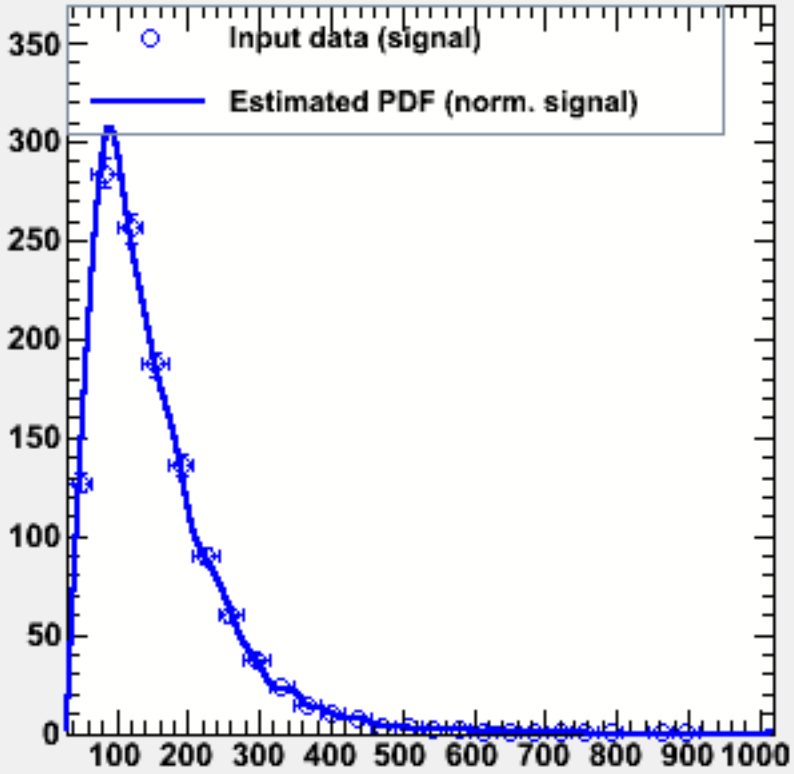
VBF_hvbf_lvjj_ZeppenField signal training



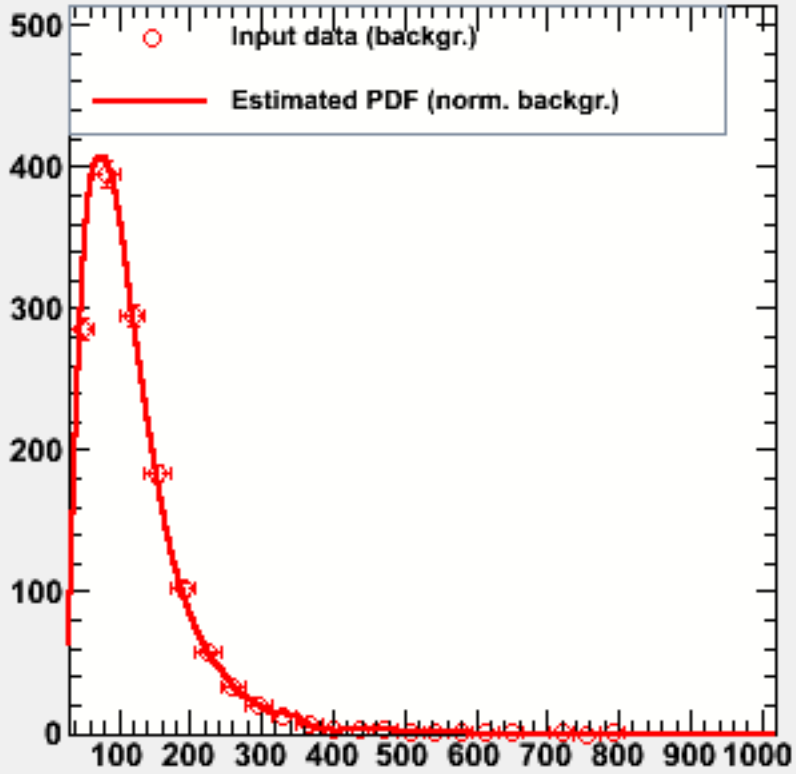

VBF_hvbf_lvjj_ZeppenField background training



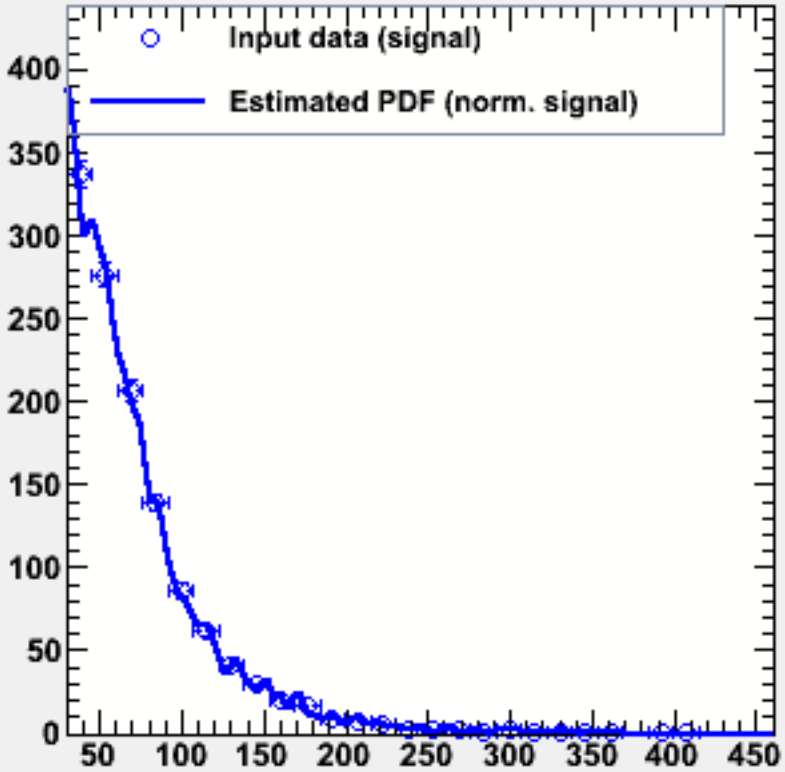
Tagjet1pt signal training



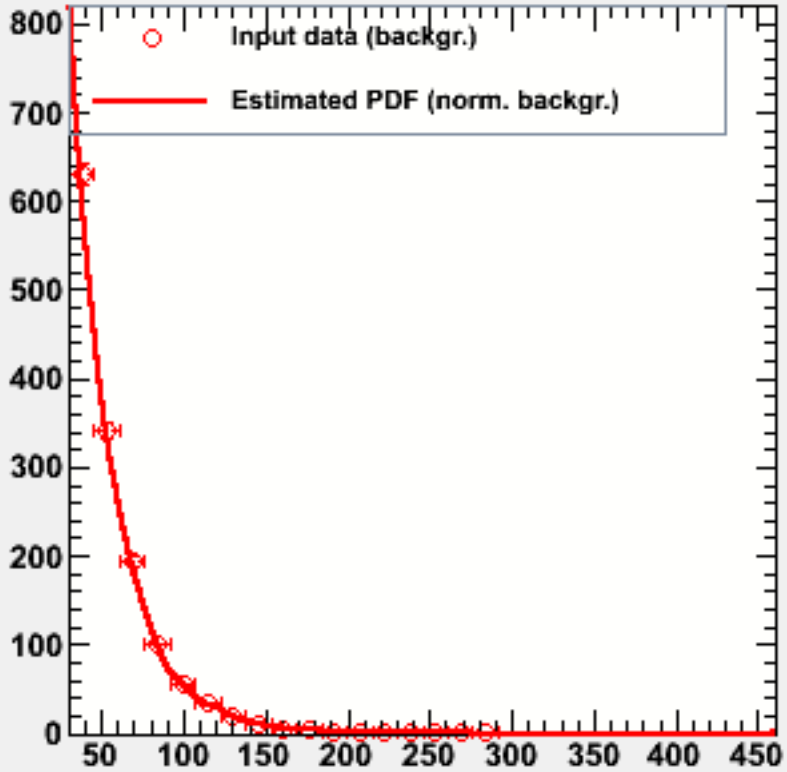

Tagjet1pt background training



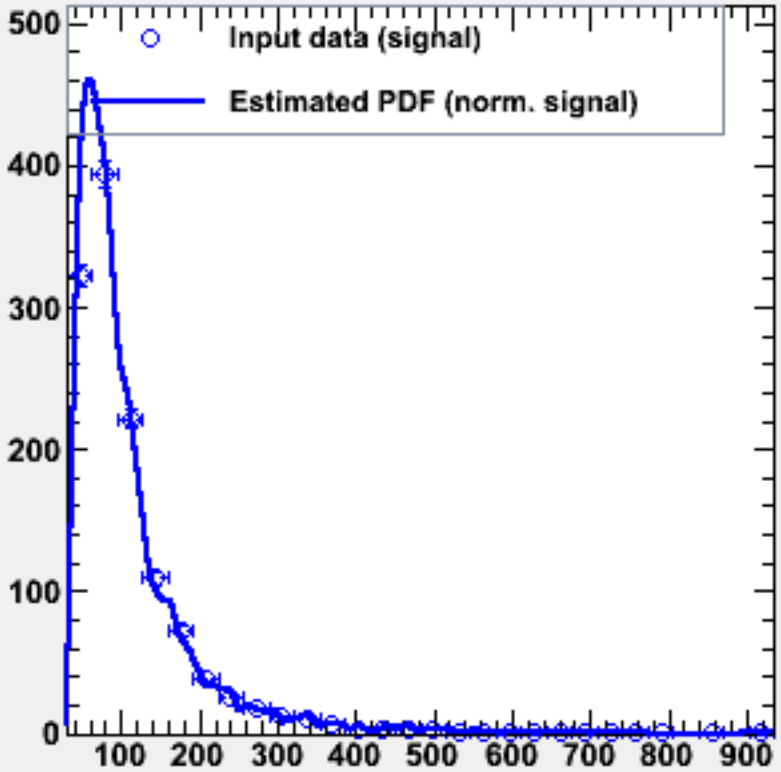
Tagjet2pt signal training



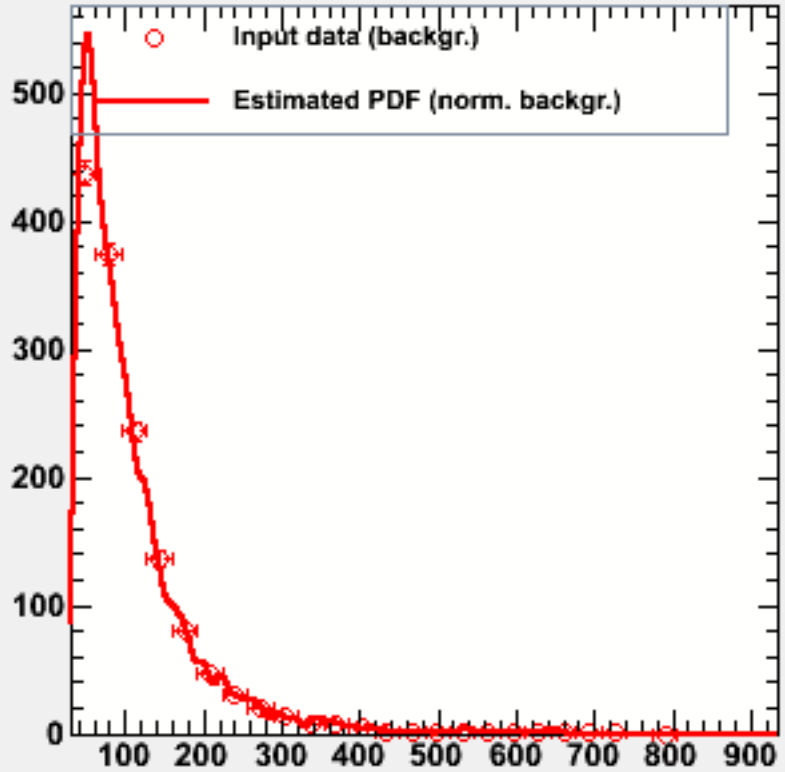

Tagjet2pt background training



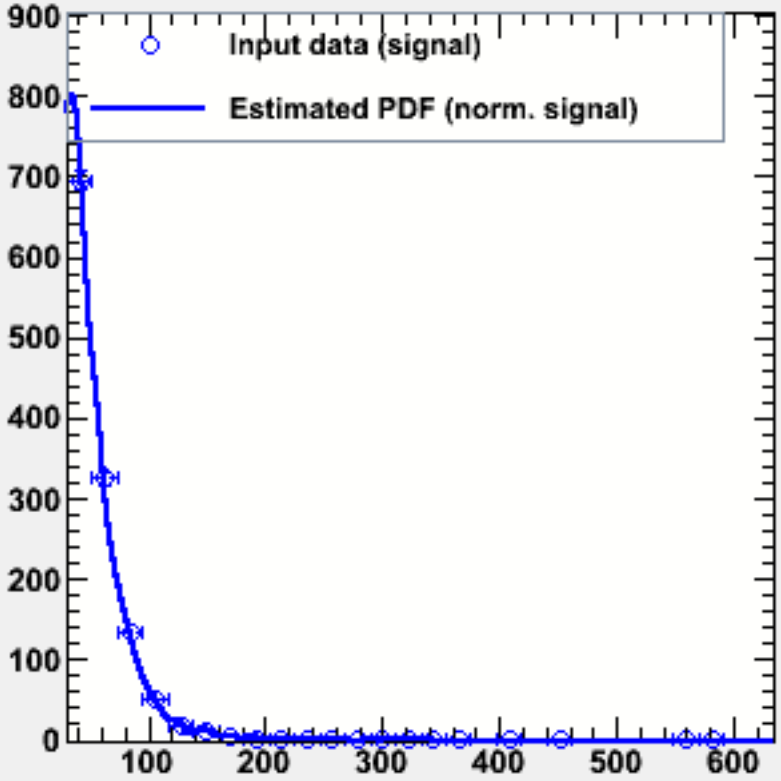
Wjet1pt signal training



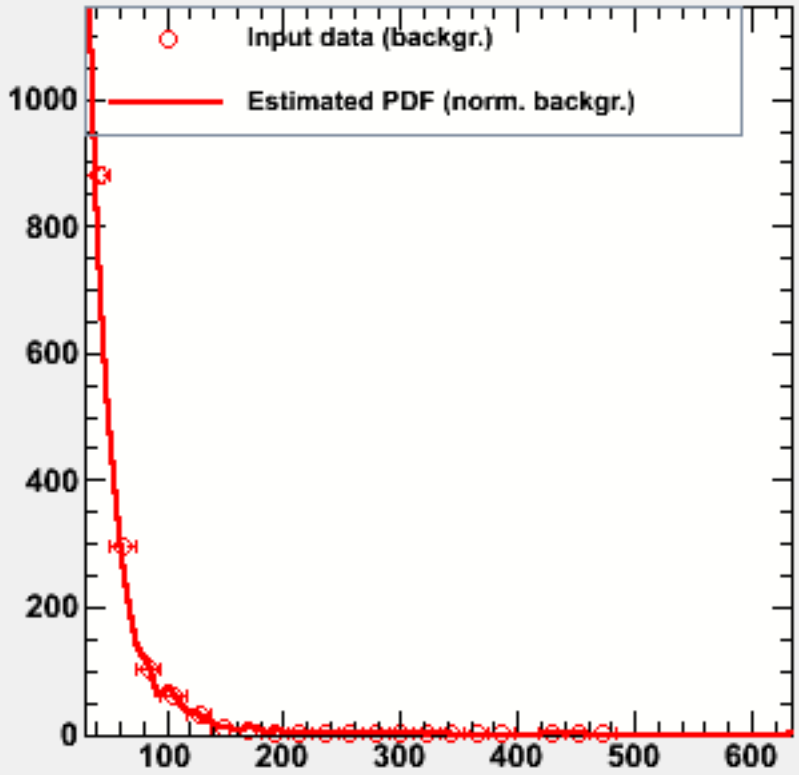

Wjet1pt background training

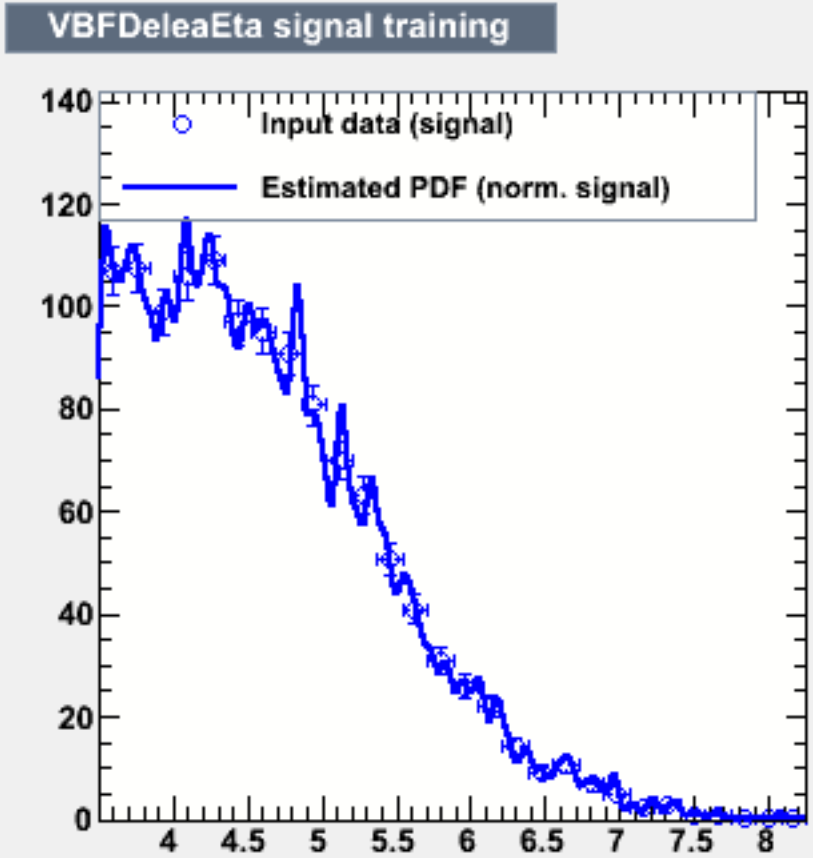


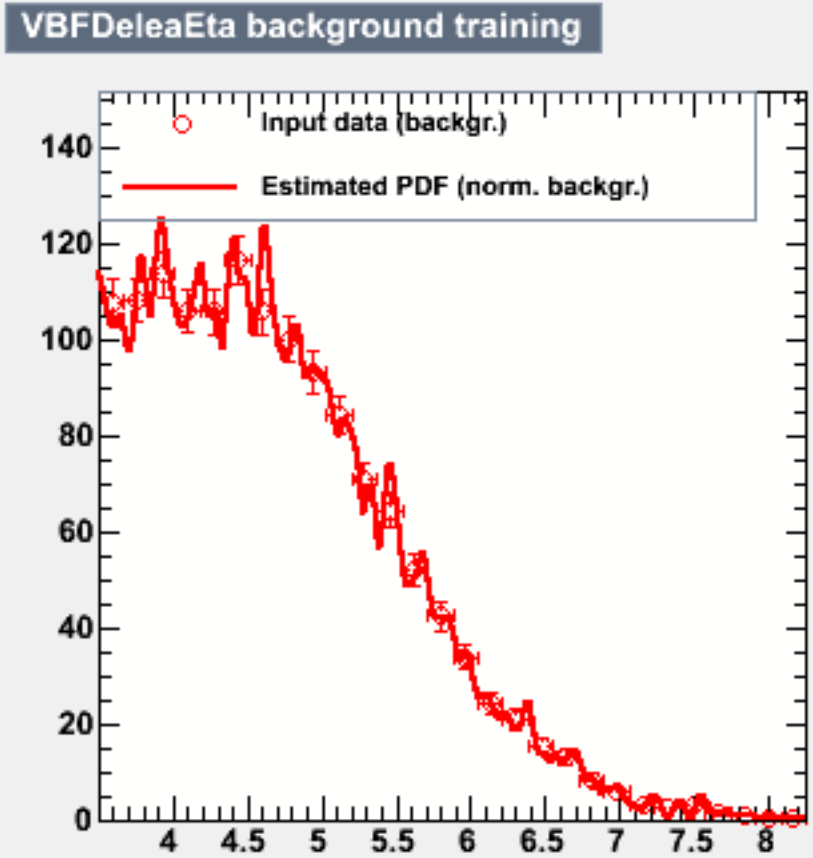
Wjet2pt signal training

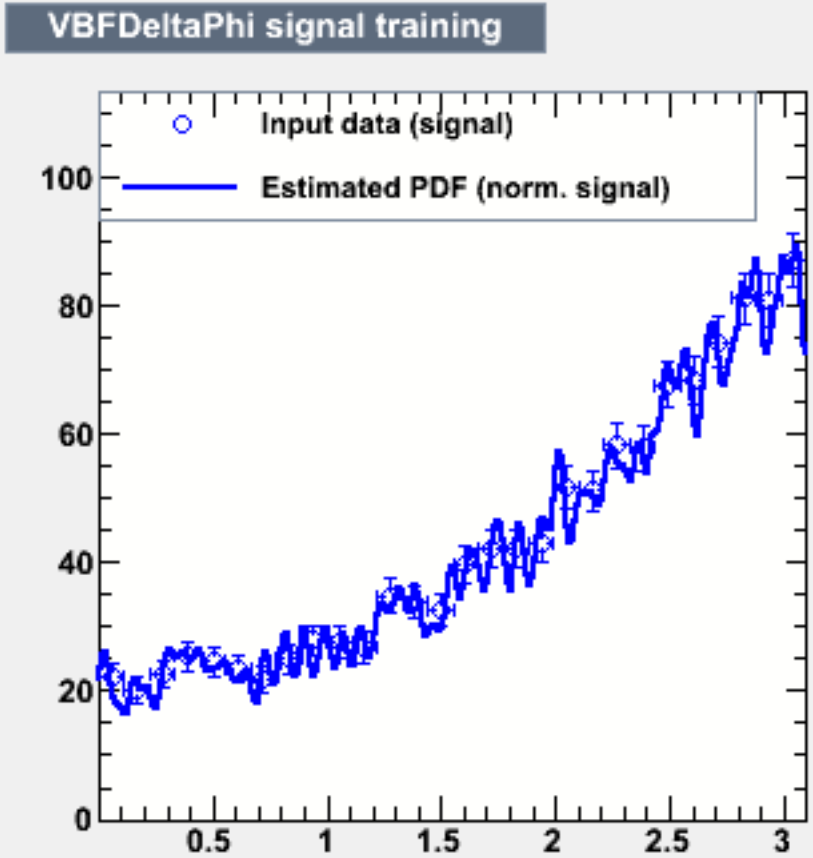


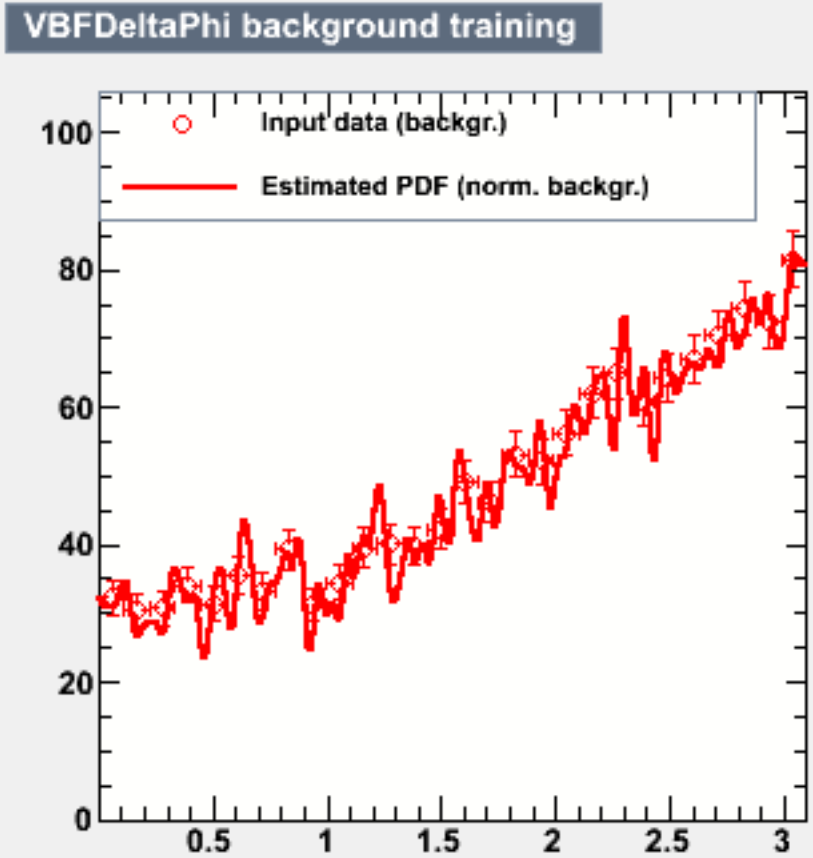

Wjet2pt background training

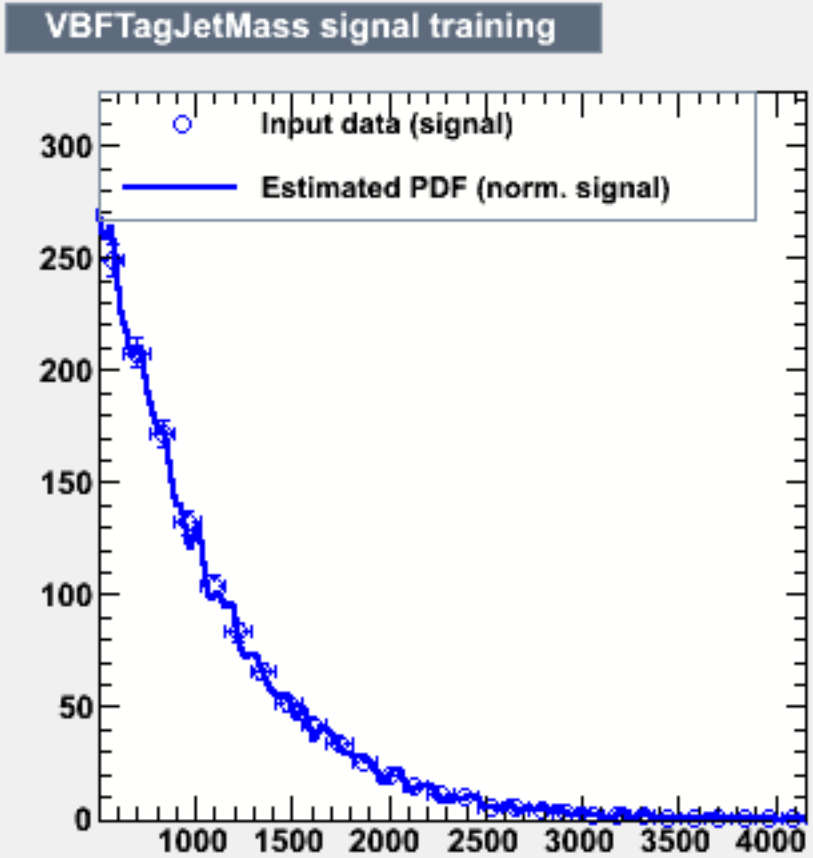


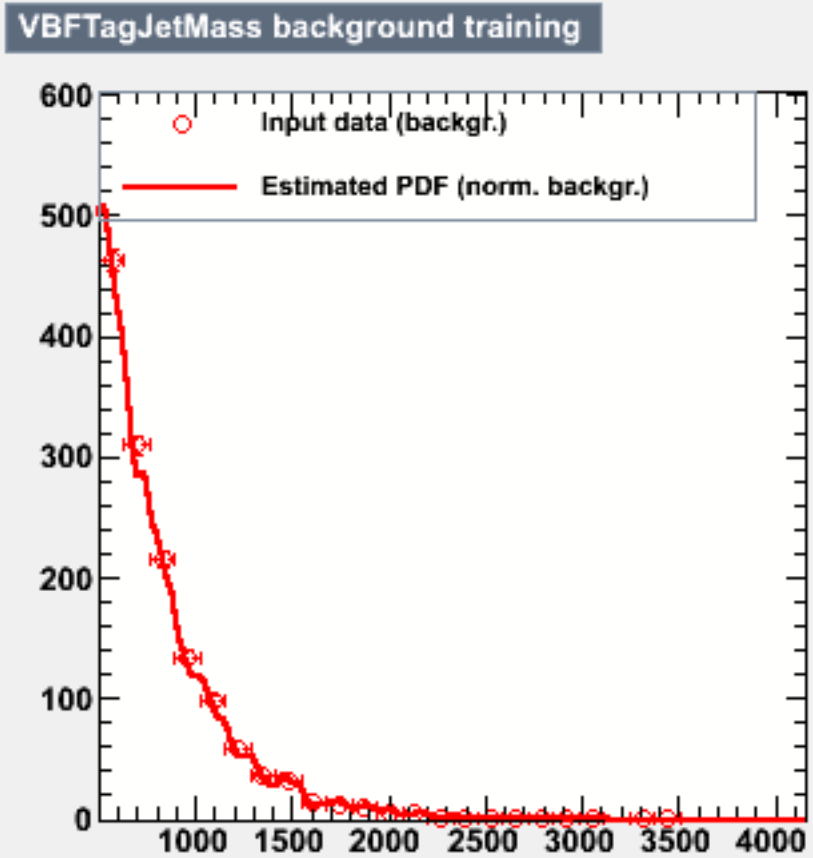

VBFDeleaEta signal training
Input data (signal)
Estimated PDF (norm. signal)
140
120
100
80
60
40
20
0
4
4.5
5
5.5
6
6.5
7
7.5
8

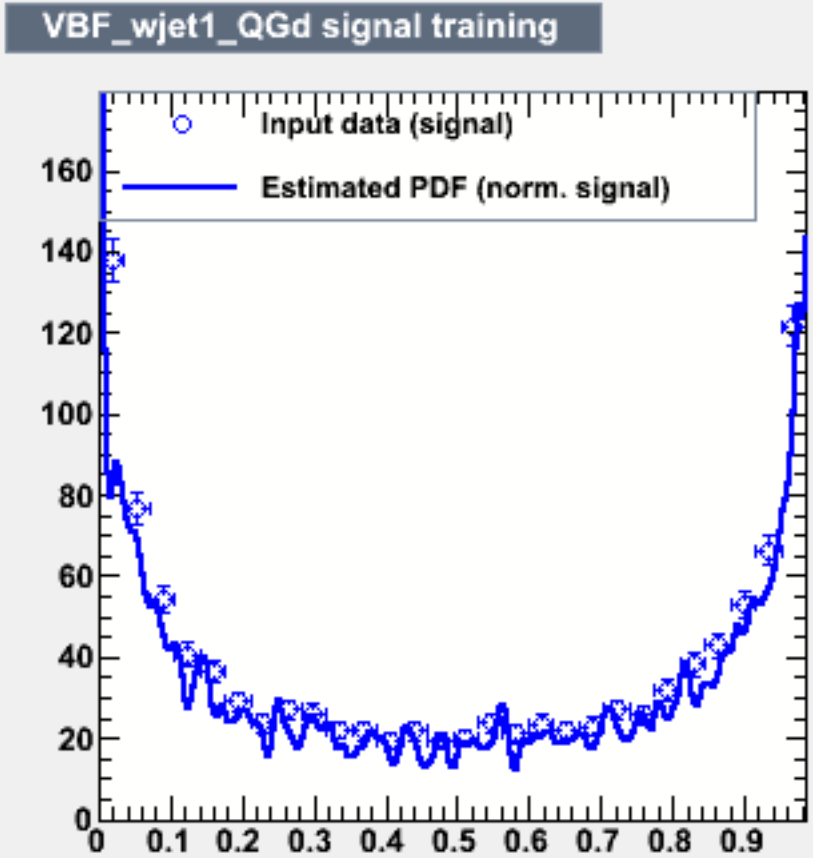

VBFDeleaEta background training
Input data (backgr.)
Estimated PDF (norm. backgr.)
140
120
100
80
60
40
20
0
4
4.5
5
5.5
6
6.5
7
7.5
8

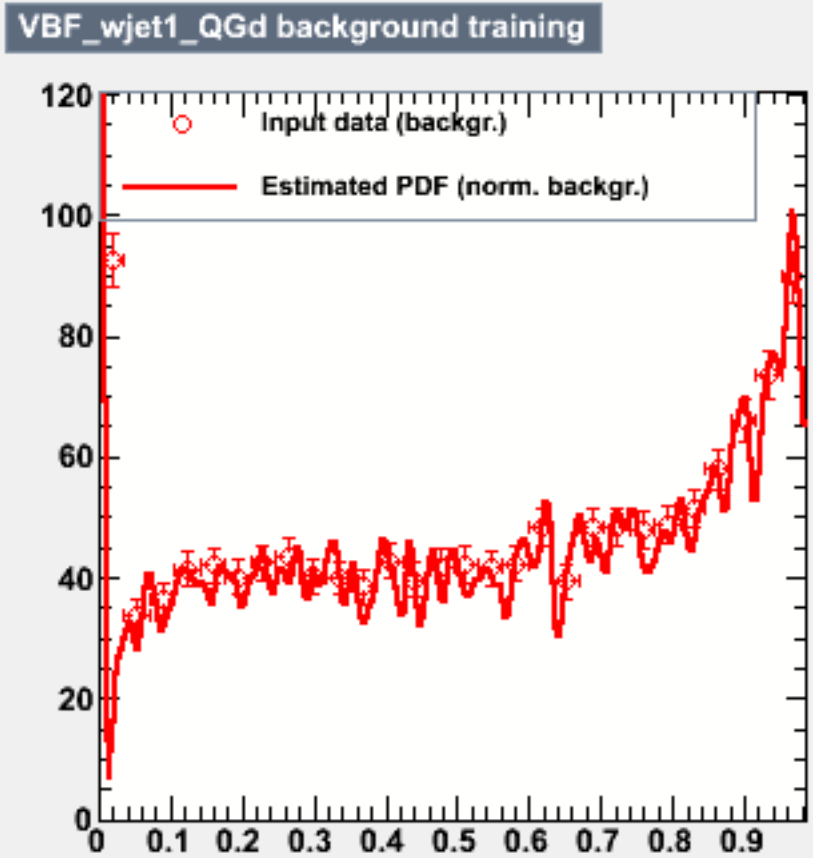

VBFDeltaPhi signal training
Input data (signal)
Estimated PDF (norm. signal)
0
20
40
60
80
100
0.5
1
1.5
2
2.5
3


VBFDeltaPhi background training
Input data (backgr.)
Estimated PDF (norm. backgr.)
0
20
40
60
80
100
0.5
1
1.5
2
2.5
3

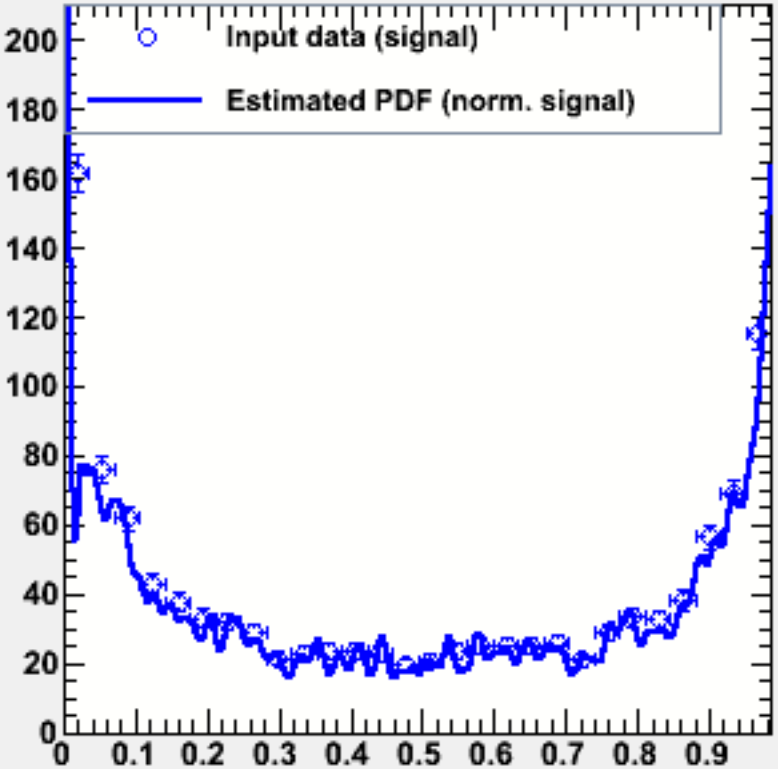

VBFTagJetMass signal training
Input data (signal)
Estimated PDF (norm. signal)
0
50
100
150
200
250
300
1000
1500
2000
2500
3000
3500
4000


VBFTagJetMass background training
Input data (backgr.)
Estimated PDF (norm. backgr.)
0
100
200
300
400
500
600
1000
1500
2000
2500
3000
3500
4000

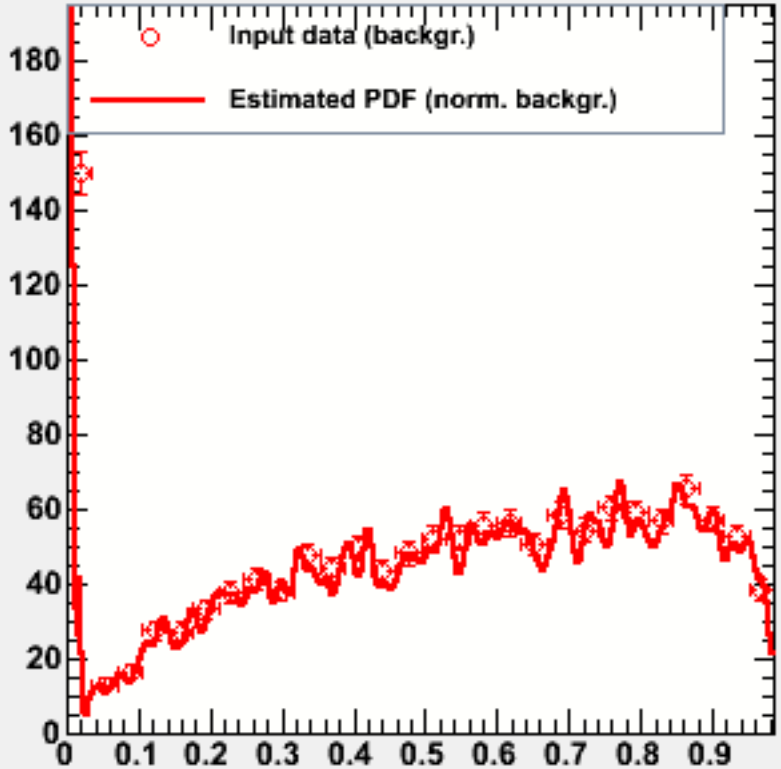

VBF_wjet1_QGd signal training
Input data (signal)
Estimated PDF (norm. signal)
0
20
40
60
80
100
120
140
160
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9

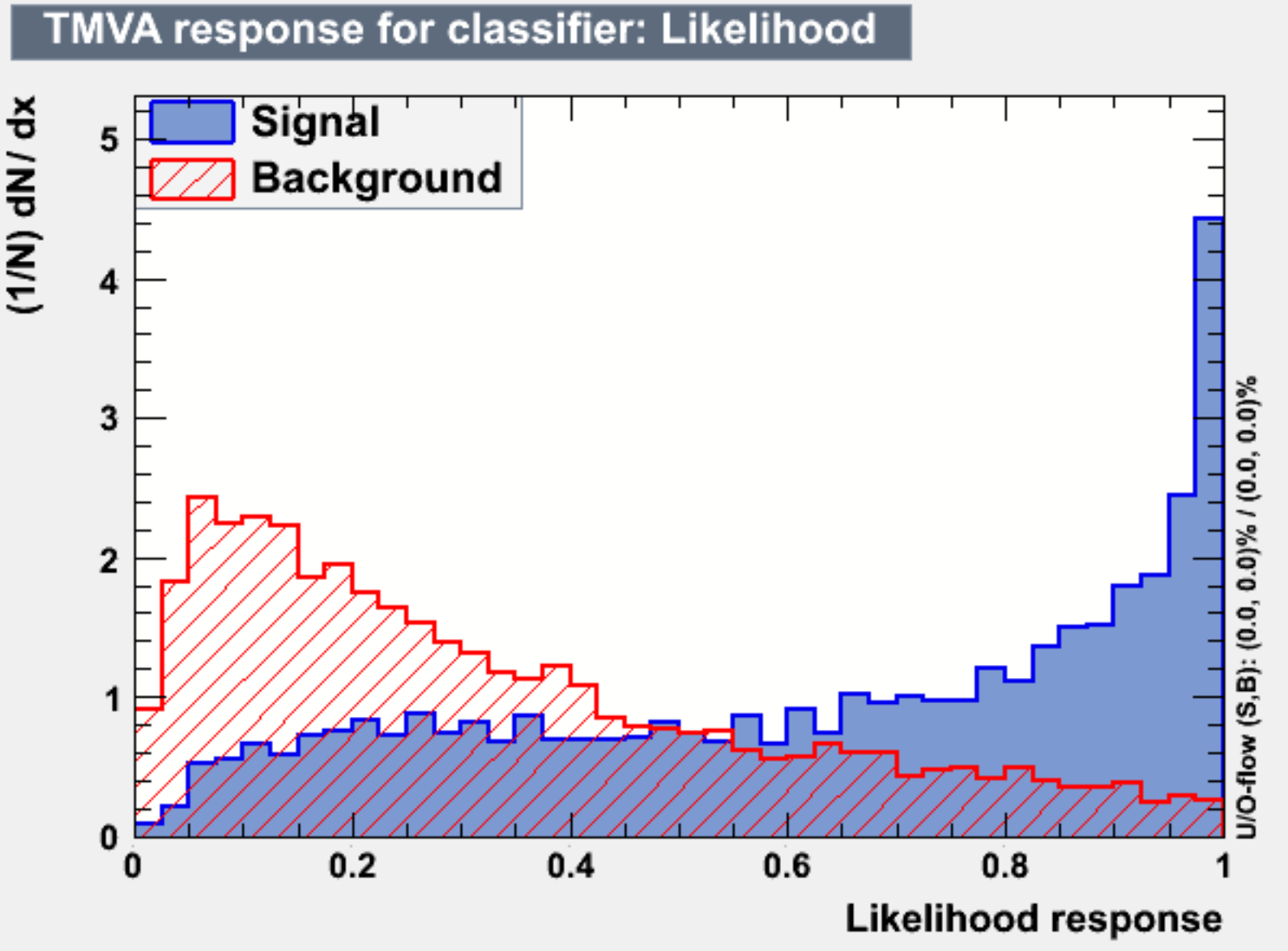

VBF_wjet1_QGd background training
Input data (backgr.)
Estimated PDF (norm. backgr.)
0
20
40
60
80
100
120
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9

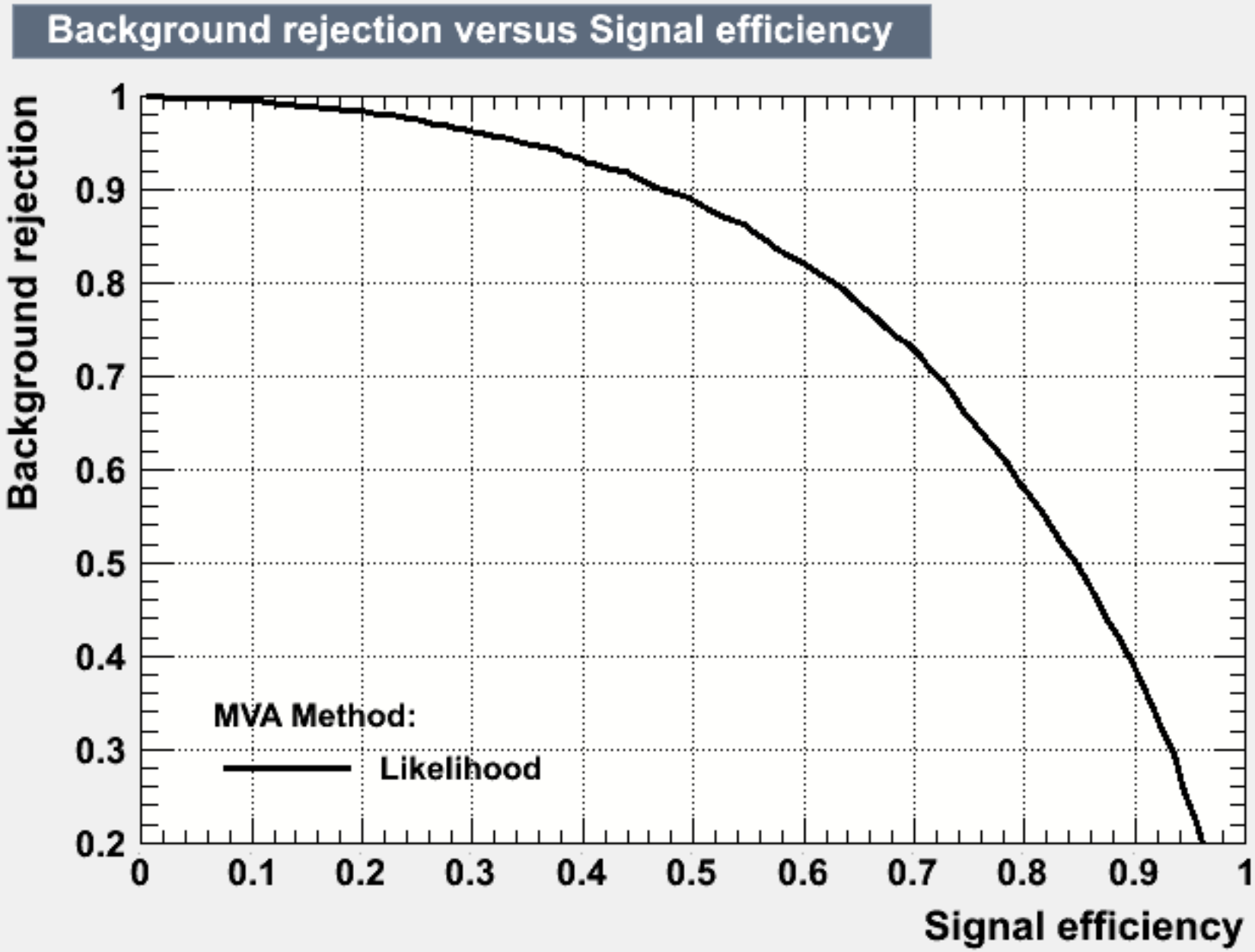
VBF_wjet2_QGd signal training

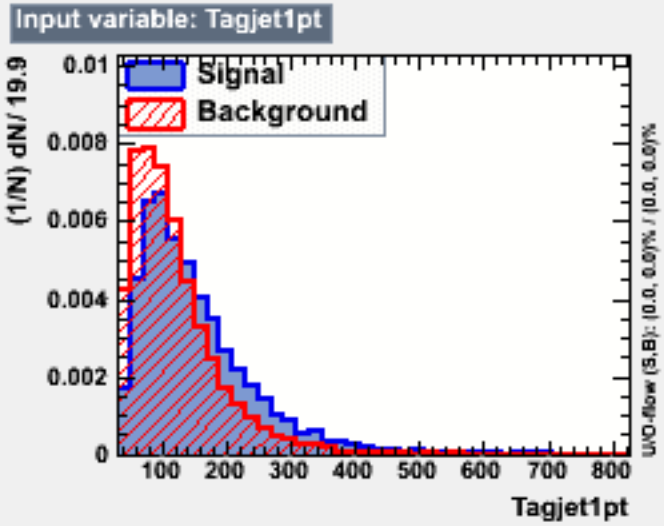


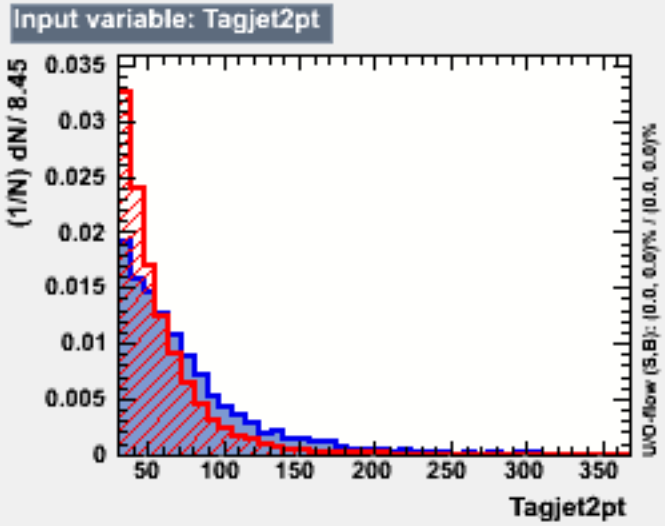

VBF_wjet2_QGd background training

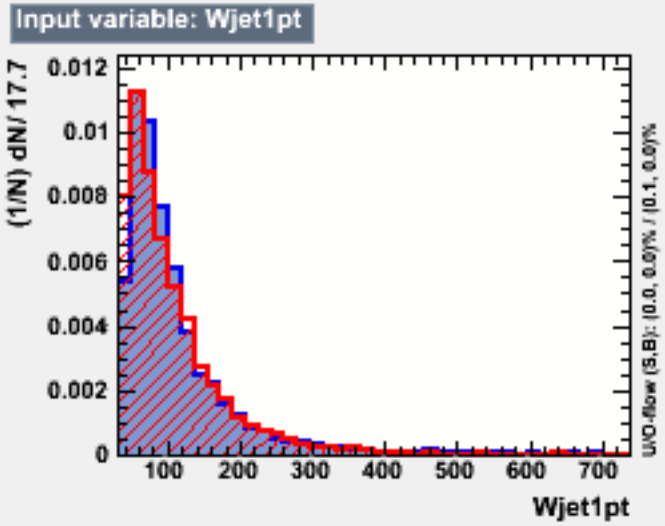


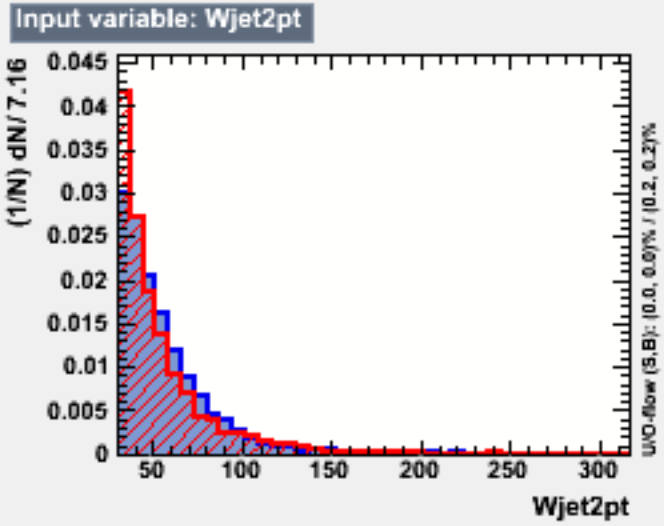

TMVA response for classifier: Likelihood
Signal
Background
(1/N) dN/ dx
0
1
2
3
4
5
0
0.2
0.4
0.6
0.8
1
Likelihood response
U/O-flow (S,B): (0.0, 0.0)% / (0.0, 0.0)%

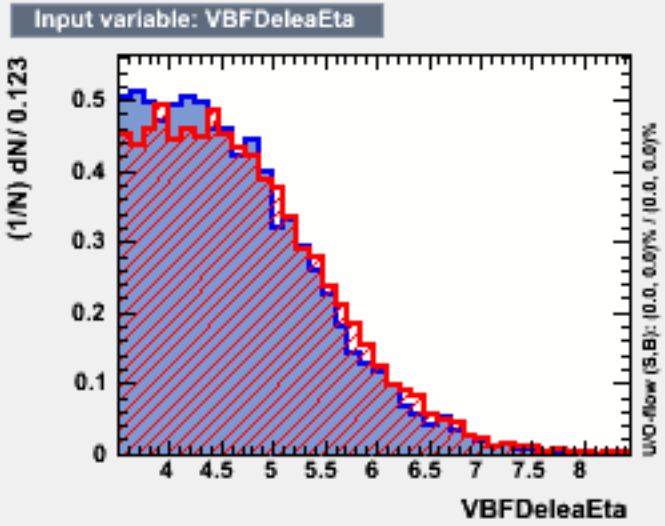

Background rejection versus Signal efficiency
Background rejection
Signal efficiency
MVA Method:
Likelihood
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

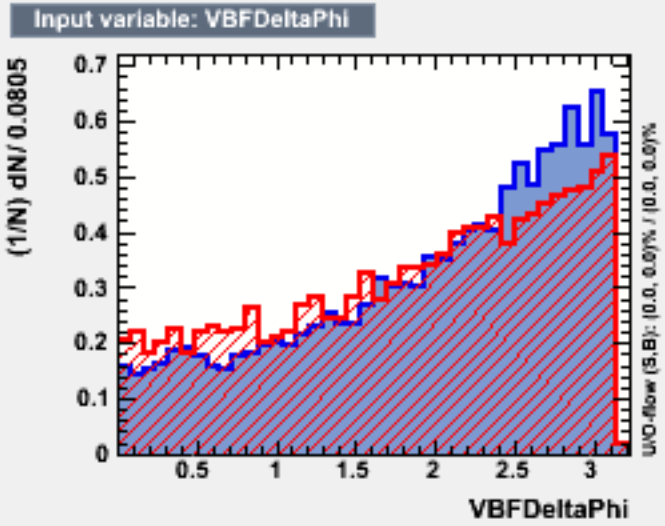

Input variable: Tagjet1pt
Signal
Background
(1/N) dN/ 19.9
Tagjet1pt
U/O-flow (S,B): (0.0, 0.0)% / (0.0, 0.0)%

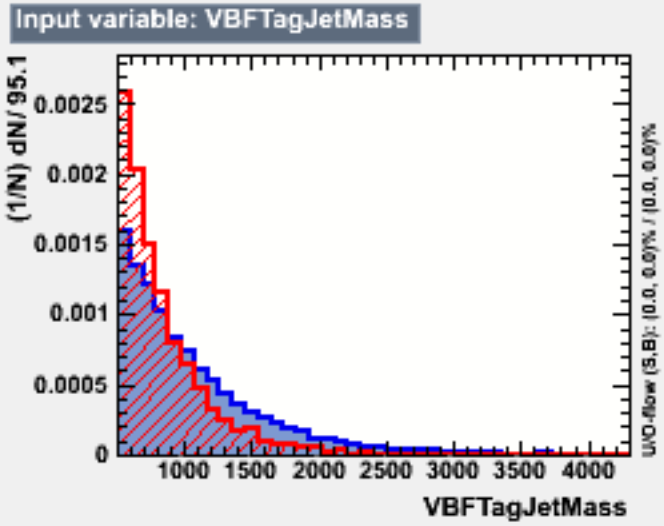

Input variable: Tagjet2pt
(1/N) dN/ 8.45
Tagjet2pt
U/O-flow (S,B): (0.0, 0.0)% / (0.0, 0.0)%

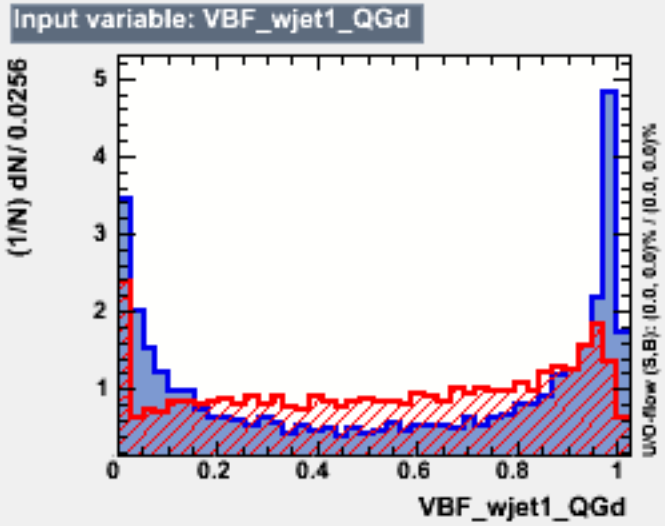

Input variable: Wjet1pt
(1/N) dN/ 17.7
Wjet1pt
U/O-flow (S,B): (0.0, 0.0)% / (0.1, 0.0)%

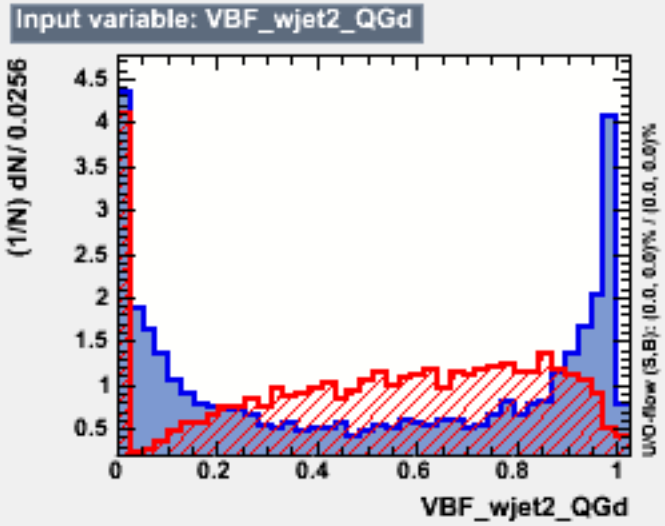

Input variable: Wjet2pt
(1/N) dN/ 7.16
Wjet2pt
U/O-flow (S,B): (0.0, 0.0)% / (0.2, 0.2)%

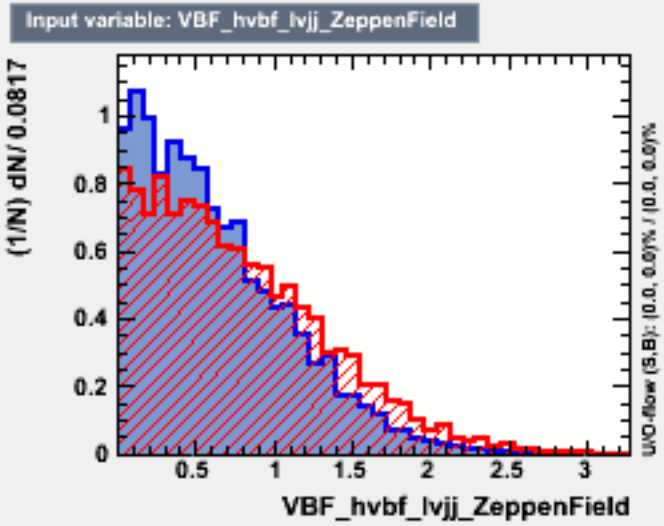

Input variable: VBFDeleaEta
(1/N) dN/ 0.123
VBFDeleaEta
U/O-flow (S,B): (0.0, 0.0)% / (0.0, 0.0)%


Input variable: VBFDeltaPhi
(1/N) dN/ 0.0805
VBFDeltaPhi
U/O-flow (S,B): (0.0, 0.0)% / (0.0, 0.0)%


Input variable: VBFTagJetMass
(1/N) dN/ 95.1
VBFTagJetMass
U/O-flow (S,B): (0.0, 0.0)% / (0.0, 0.0)%


Input variable: VBF_wjet1_QGd
(1/N) dN/ 0.0256
VBF_wjet1_QGd
U/O-flow (S,B): (0.0, 0.0)% / (0.0, 0.0)%


Input variable: VBF_wjet2_QGd
(1/N) dN/ 0.0256
VBF_wjet2_QGd
U/O-flow (S,B): (0.0, 0.0)% / (0.0, 0.0)%


Input variable: VBF_hvbf_lvjj_ZeppenField
(1/N) dN/ 0.0817
VBF_hvbf_lvjj_ZeppenField
U/O-flow (S,B): (0.0, 0.0)% / (0.0, 0.0)%