Updates of VBF MVA

- New samples VS old samples
- Effect of Higgs pT reweight

Comparison between new and old sample

Old sample

- Combined 1.59639
- low category is [0.26,0.81], vbf significance is 0.670877
- total signal is 7.99586, ggF is 3.22023, VBF is 4.64314, ttH is 0.0223077, WH is 0.0677514, ZH is 0.0423356
- fraction of ggF is 0.402737, of VBF is 0.580693, ttH is 0.0027899, WH is 0.00847331, ZH is 0.00529468
- fitted background : 43.1571

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- high category is [0.81,1], vbf significance is 1.44858
- total signal is 5.66555, ggF is 1.03579, VBF is 4.60648, ttH is 0.00457416, WH is 0.0126007, ZH is 0.00610497
- fraction of ggF is 0.182823, of VBF is 0.813067, ttH is 0.000807363, WH is 0.00222409, ZH is 0.00107756
- fitted background : 7.65112

New sample

- Combined 1.59872
- low category is [0.25,0.82], vbf significance is 0.69981
- total signal is 8.17034, ggF is 3.14066, VBF is 4.89621, ttH is 0.0230355, WH is 0.0679821, ZH is 0.0424626
- fraction of ggF is 0.384397, of VBF is 0.599266, ttH is 0.00281941, WH is 0.0083206, ZH is 0.00519717
- fitted background : 44.205

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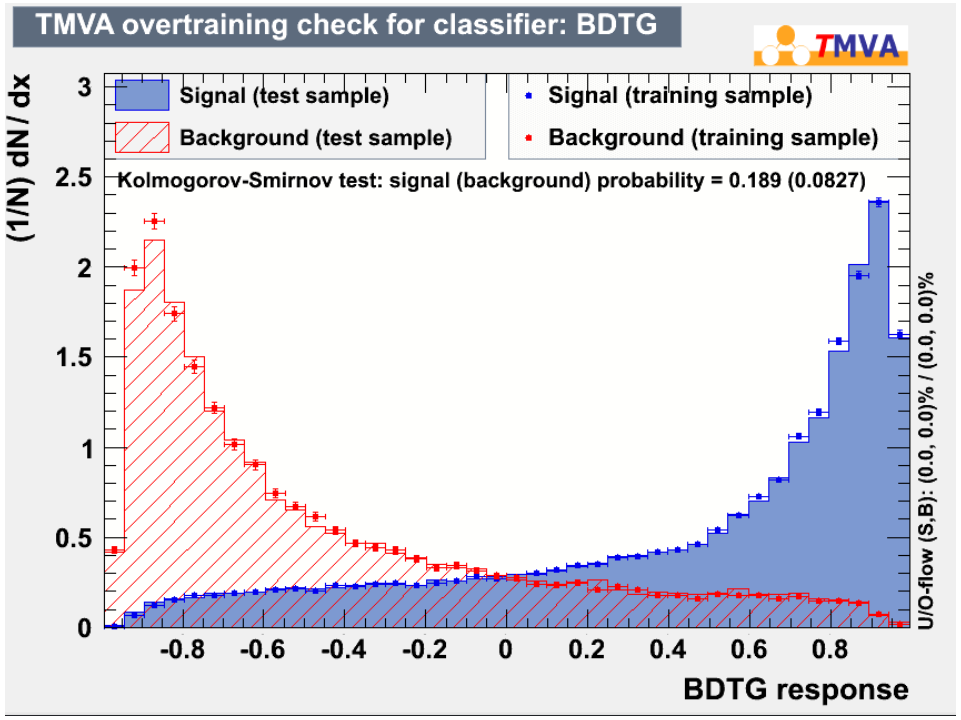
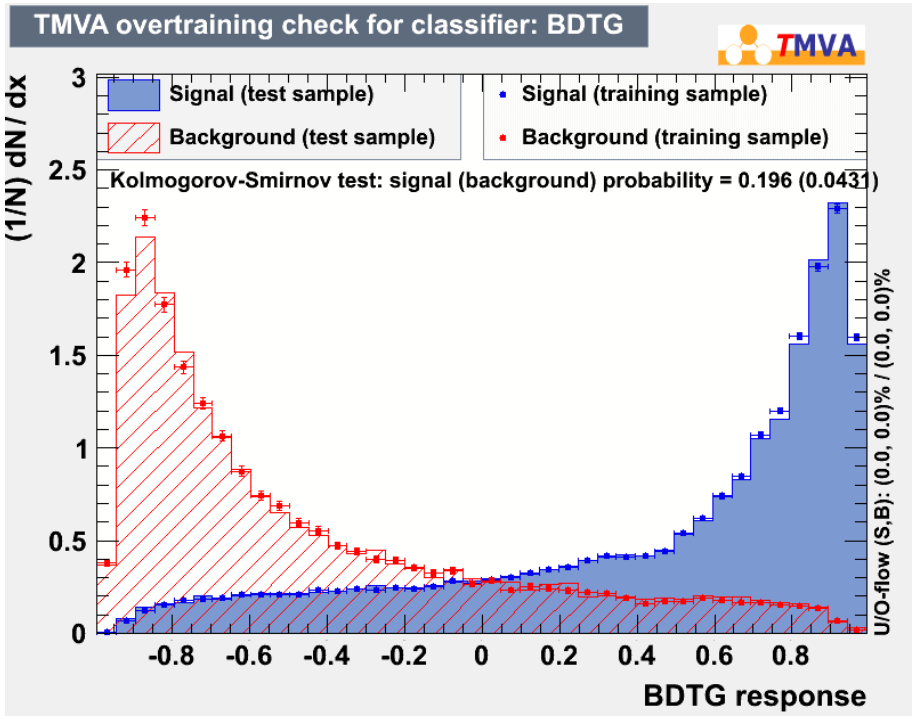
- high category is [0.82,1], vbf significance is 1.43742
- total signal is 5.19084, ggF is 0.854708, VBF is 4.31702, ttH is 0.00407333, WH is 0.0101571, ZH is 0.00487381
- fraction of ggF is 0.164657, of VBF is 0.831662, ttH is 0.000784715, WH is 0.00195674, ZH is 0.000938926
- fitted background : 6.83414

Training result

Old sample



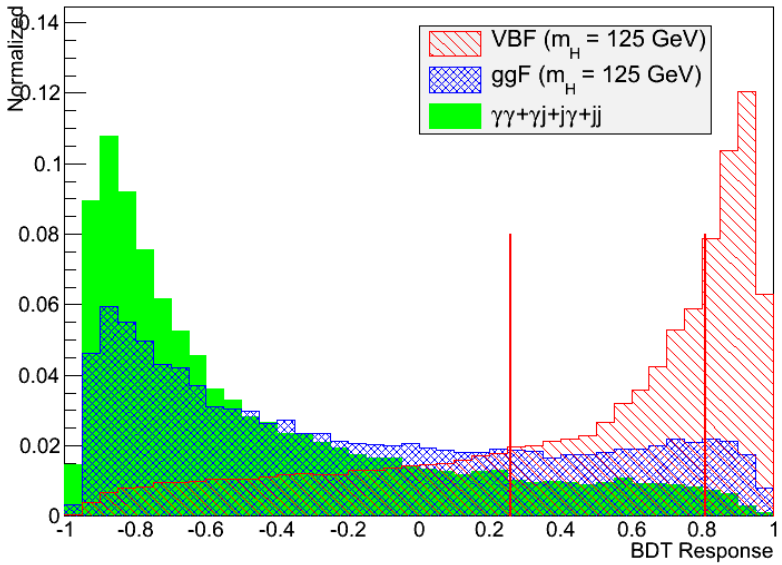
New sample



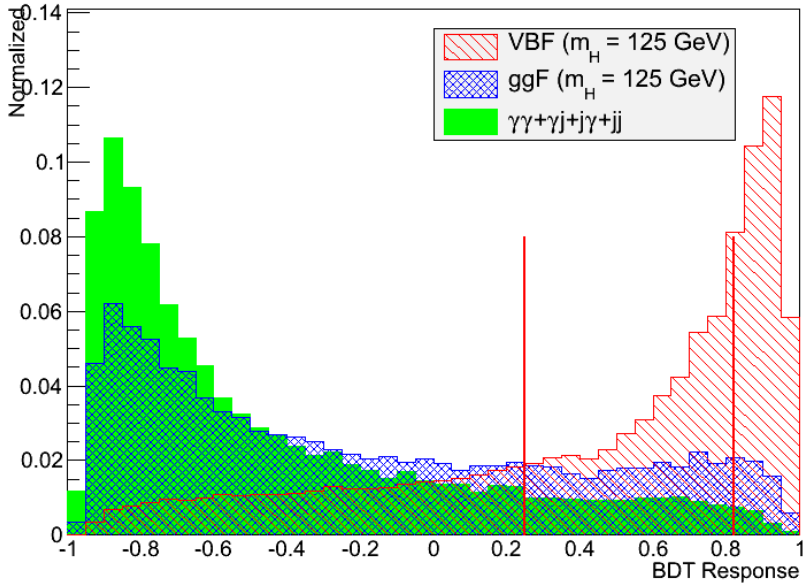
No obvers change in Training result

BDT response

Old sample



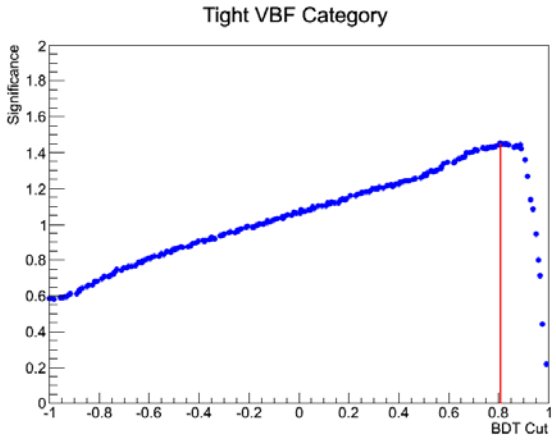
new sample

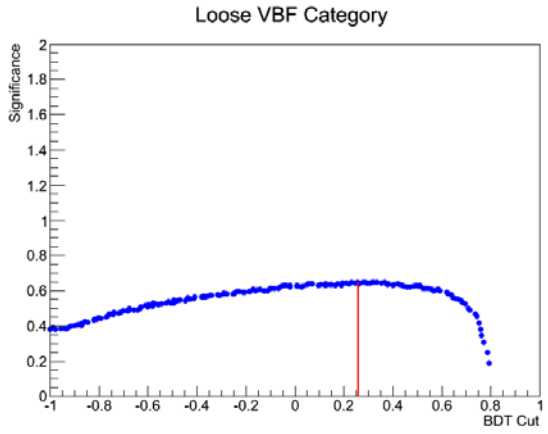


Loose and tight category changed from [0.25,0.81,1] to [0.25,0.82,1]

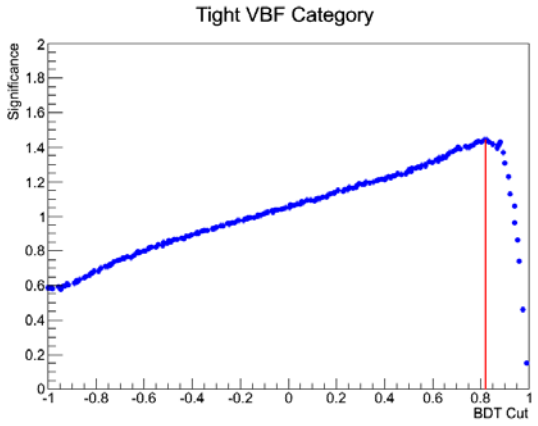
VBF MVA category optimization

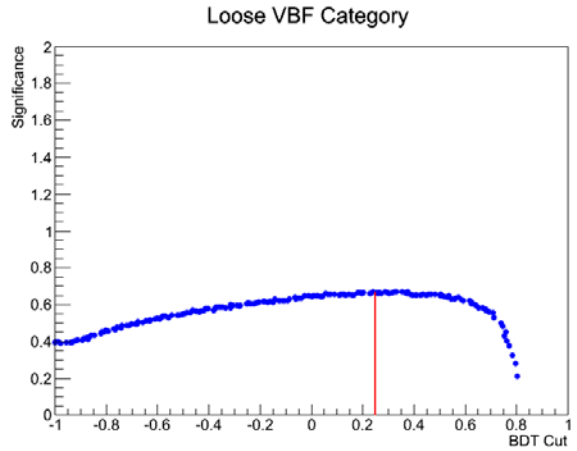
Old sample



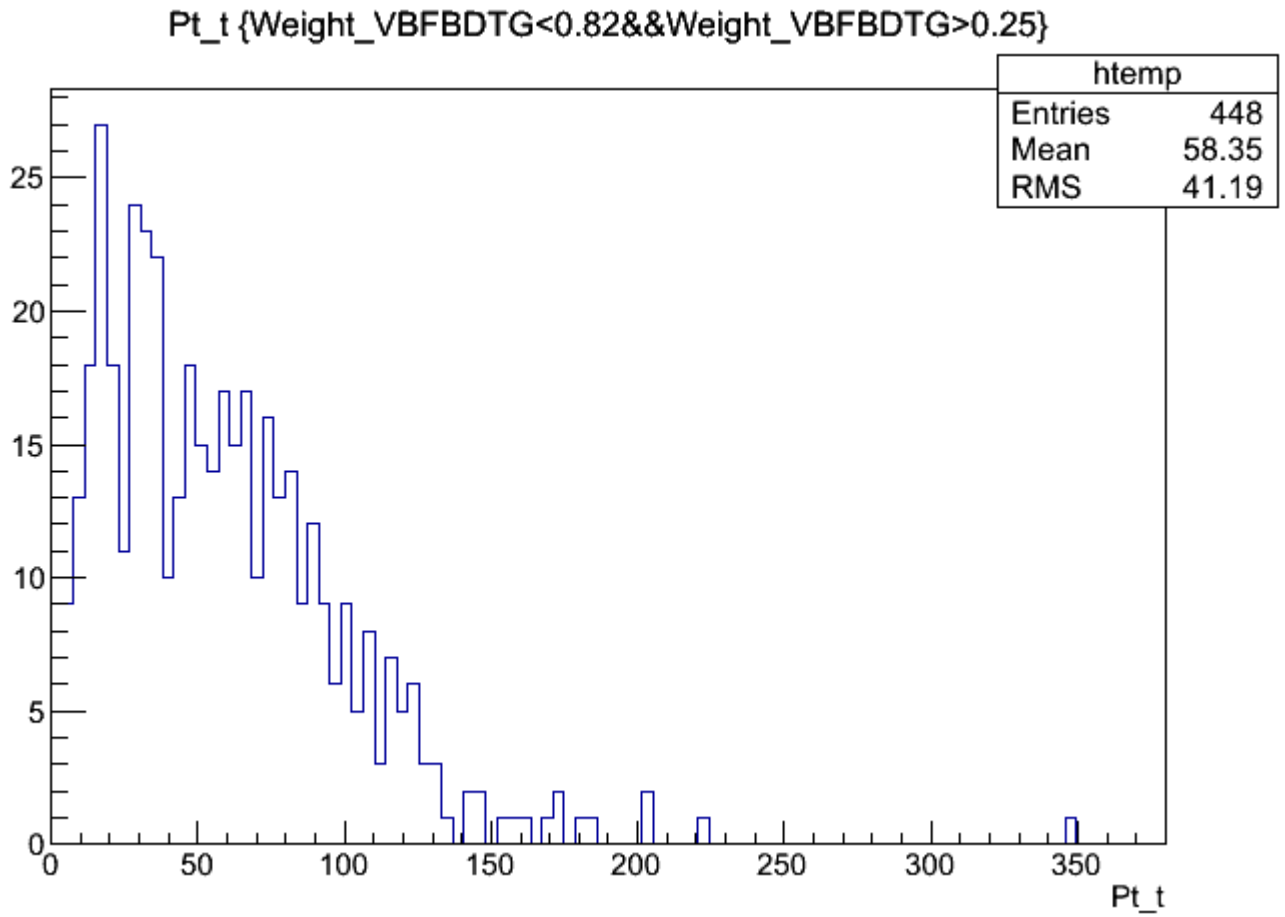


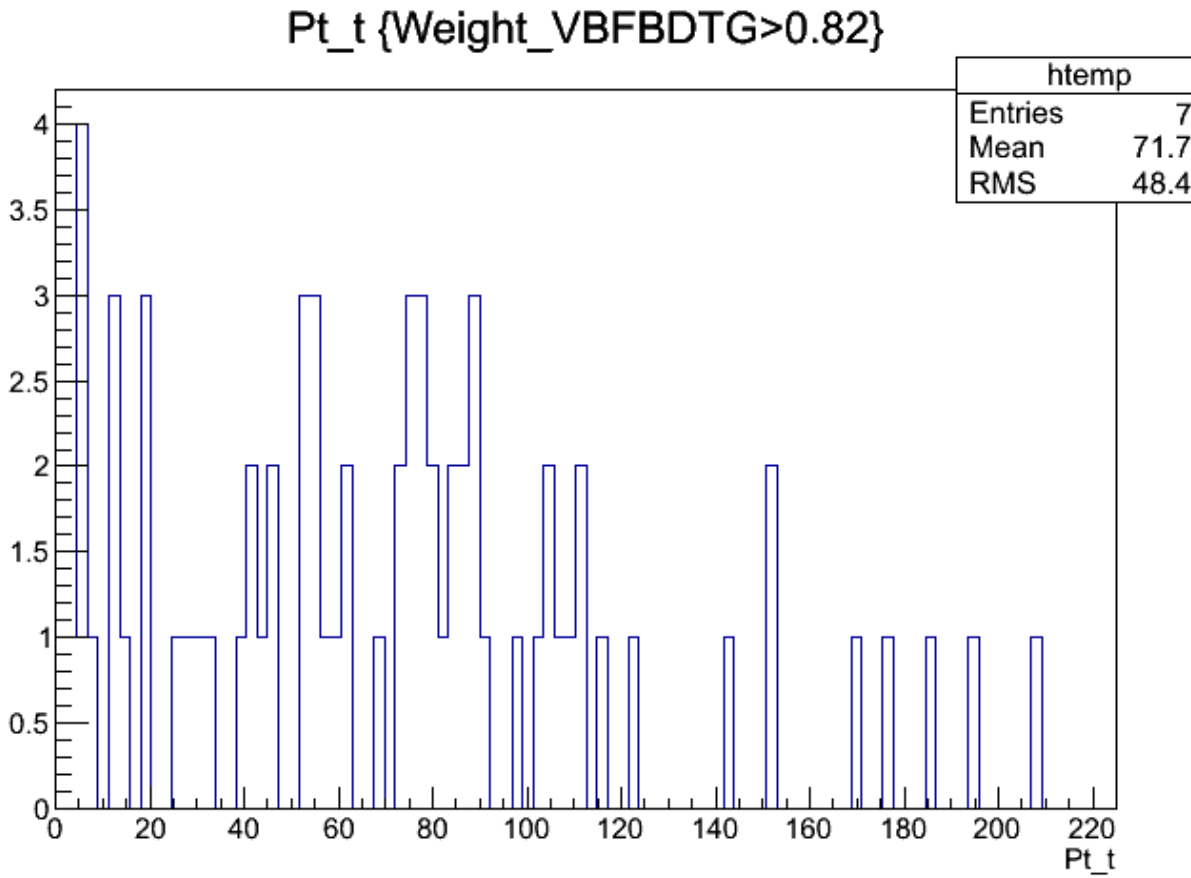
new sample



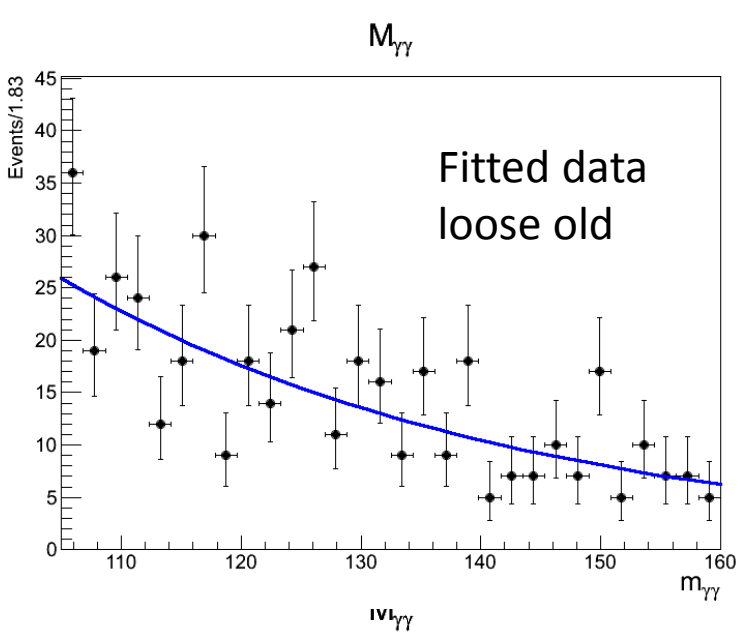


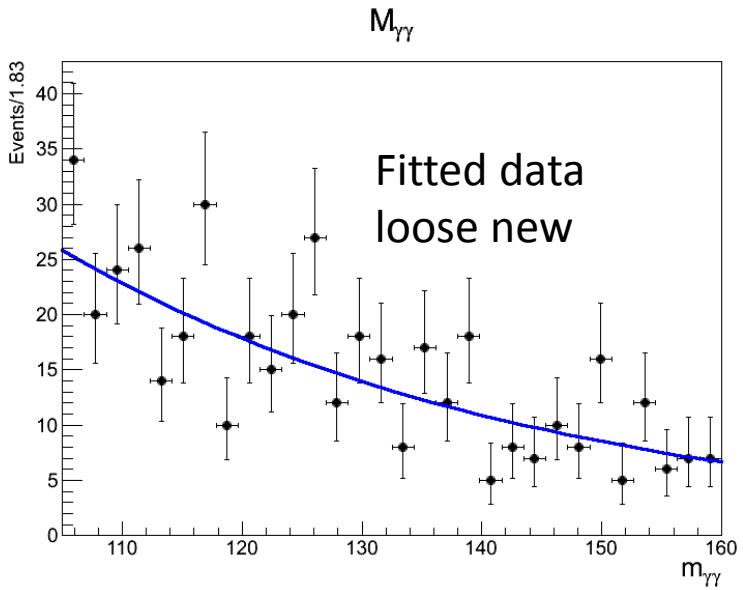
Pt_t in low and hight category

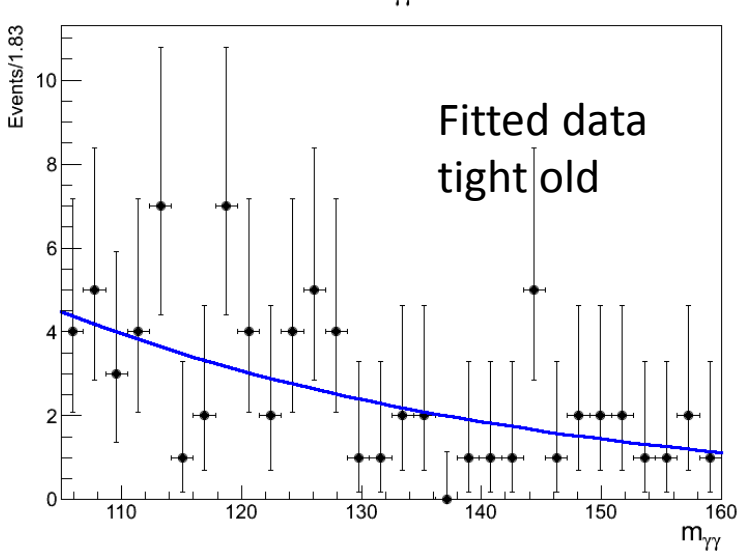


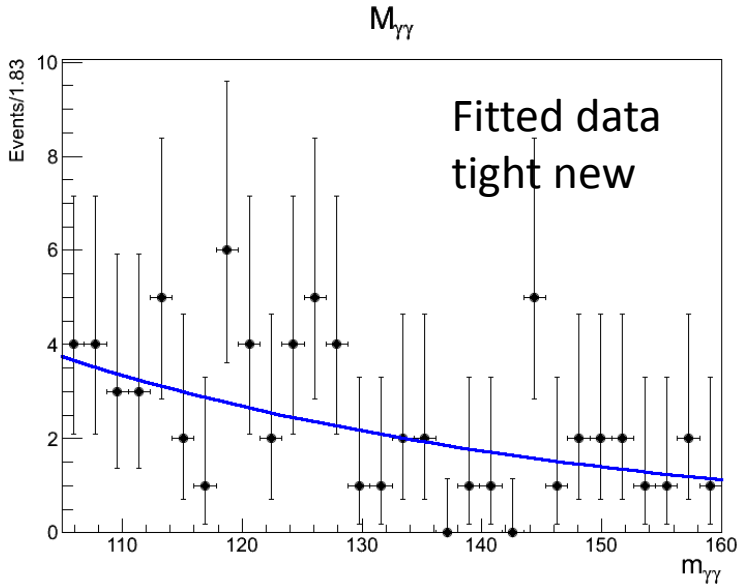


Fitted data


$M_{\gamma\gamma}$
Events/1.83
Fitted data
loose old
$m_{\gamma\gamma}$


$M_{\gamma\gamma}$
Events/1.83
Fitted data
loose new
$m_{\gamma\gamma}$


Events/1.83
Fitted data
tight old
$m_{\gamma\gamma}$


$M_{\gamma\gamma}$
Events/1.83
Fitted data
tight new
$m_{\gamma\gamma}$

conclusion

- the changes in new sample is very small
- Our analysis is stable

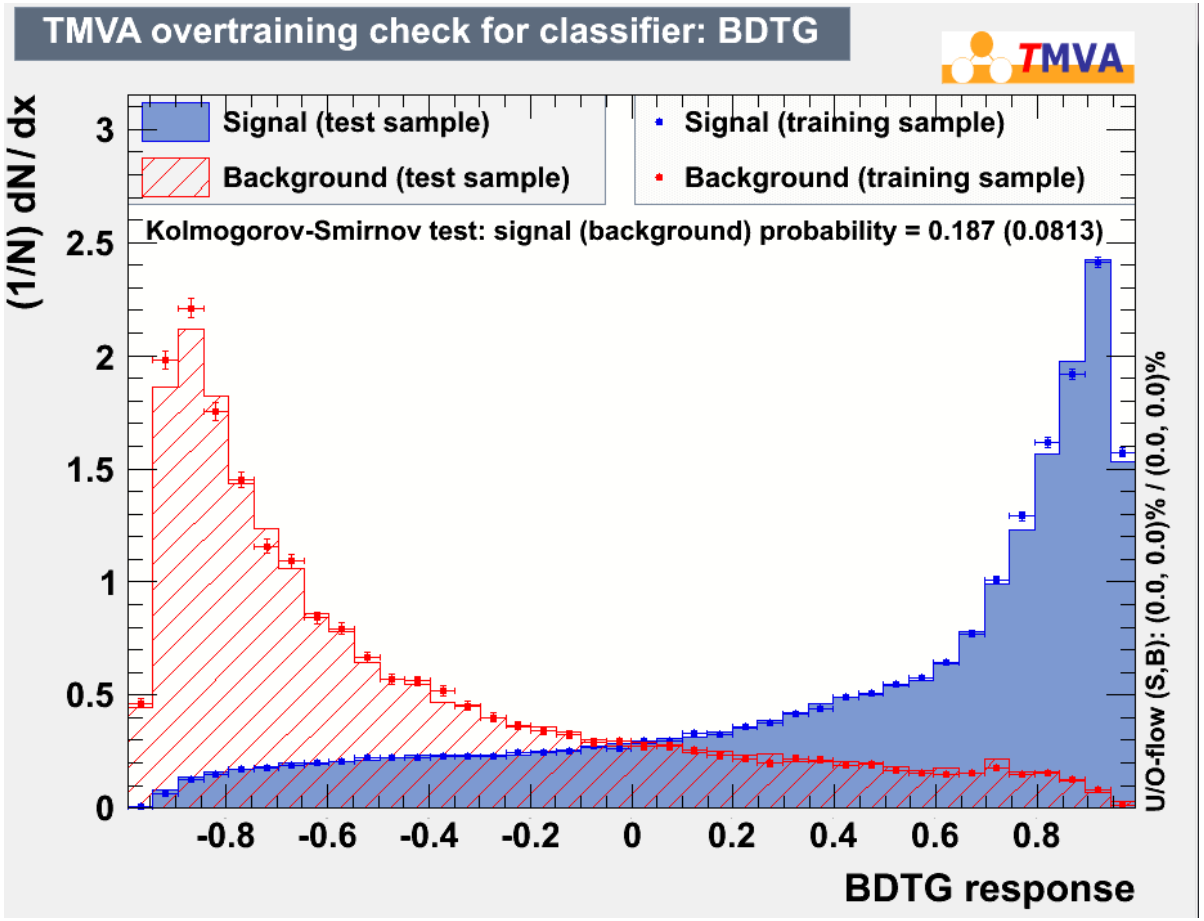
Higgs pT reweight effect

Unreweighted results: drop the Higgs pT weight by divide the total weight by pT weight

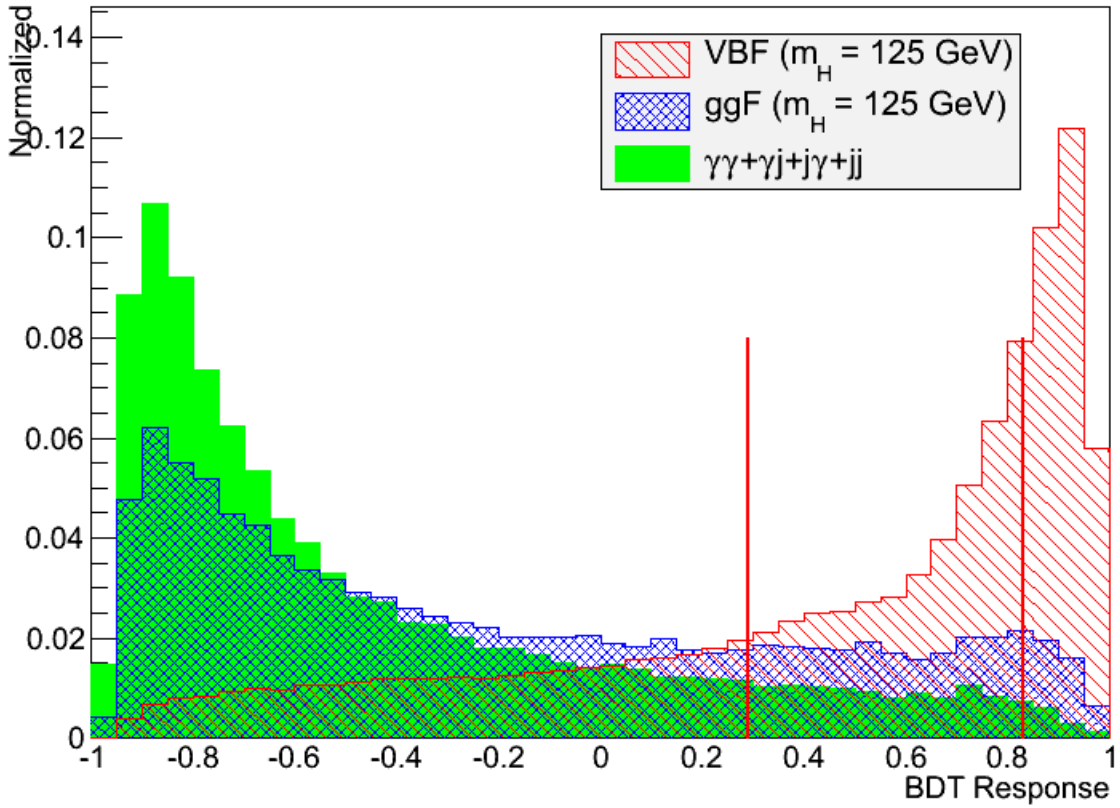
- low category is [0.29,0.83], vbf significance is 0.722629
- total signal is 8.04562, ggF is 3.0079, VBF is 4.91438, ttH is 0.0220911, WH is 0.0633767, ZH is 0.0378924
- fraction of ggF is 0.373856, of VBF is 0.610814, ttH is 0.00274573, WH is 0.00787717, ZH is 0.00470969
- fitted background in 5GeV mass window is 41.6321

- Categorization is [0.29, 0.83, 1] with combined significance 1.58477

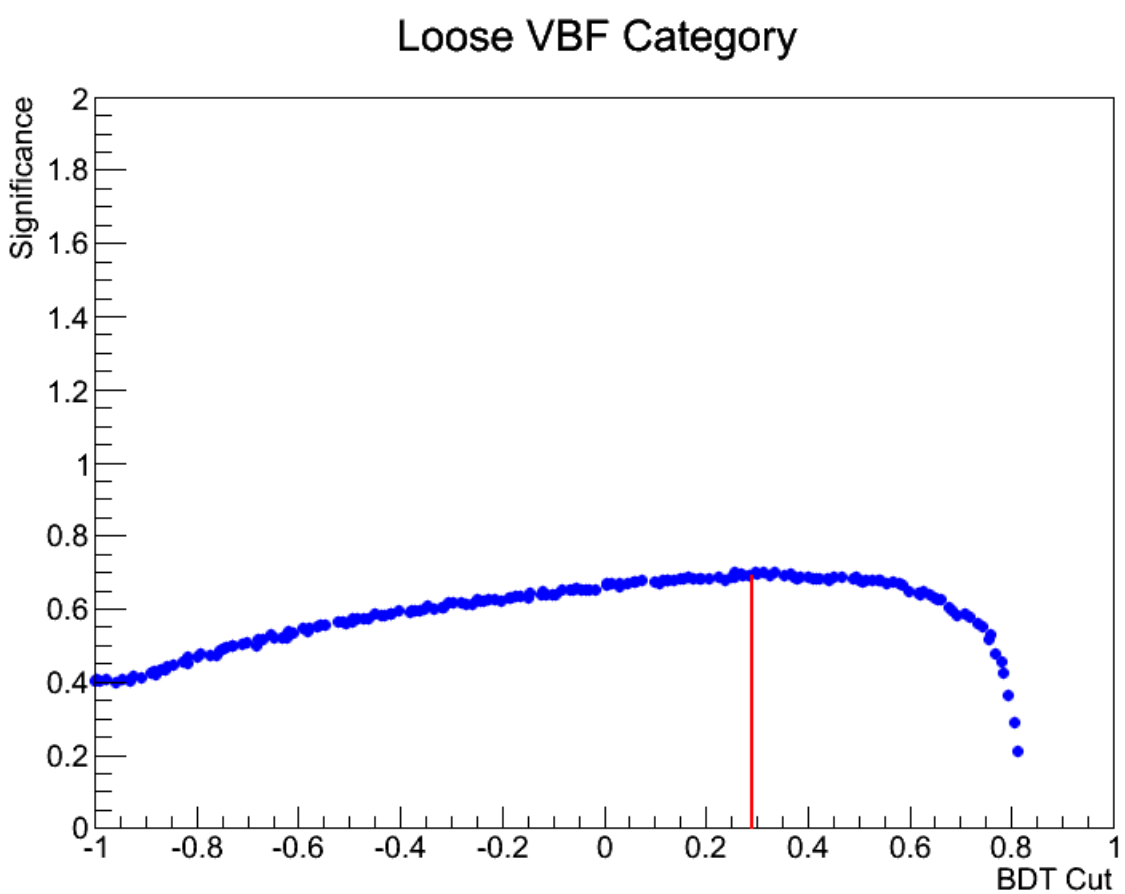
PLOTS

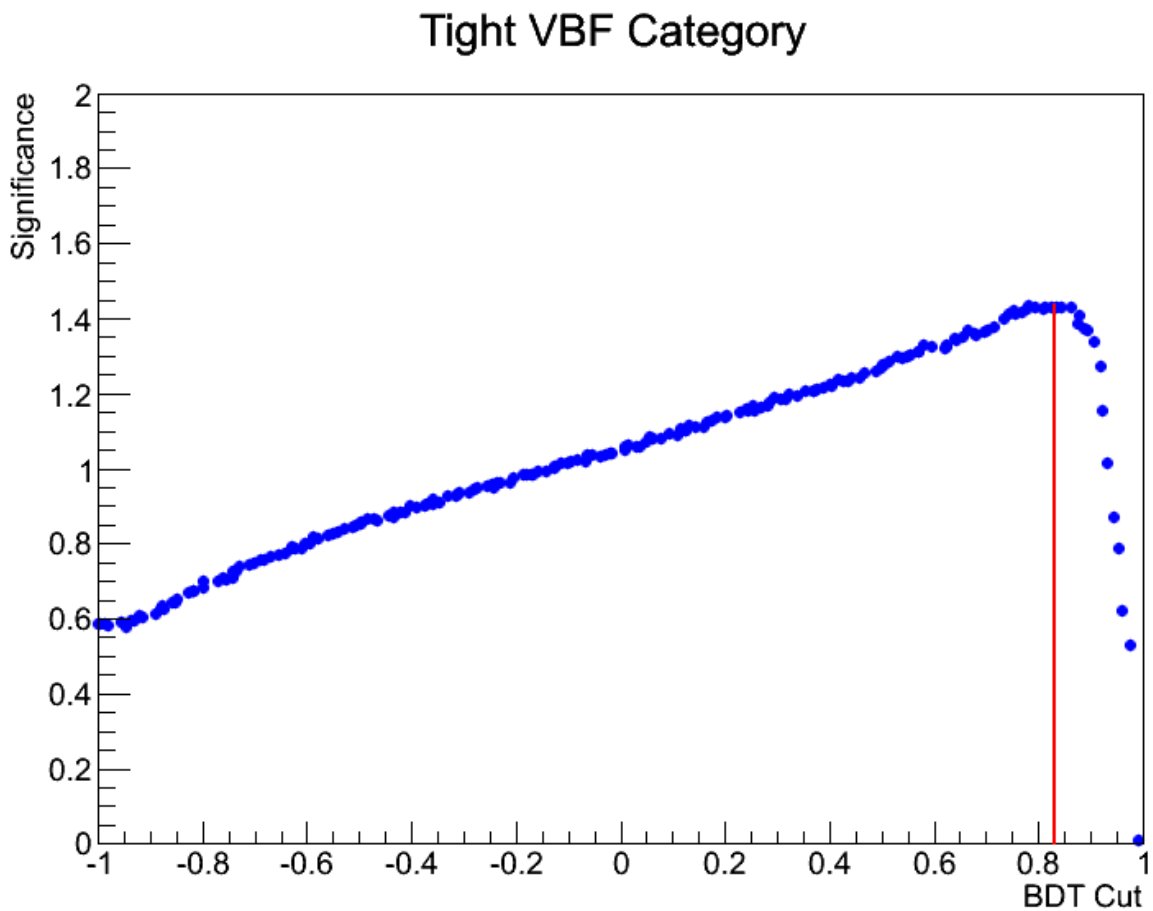

TMVA overtraining check for classifier: BDTG
TMVA
Signal (test sample)
Background (test sample)
Signal (training sample)
Background (training sample)
Kolmogorov-Smirnov test: signal (background) probability = 0.187 (0.0813)
(1/N) dN/ dx
U/O-flow (S,B): (0.0, 0.0)% / (0.0, 0.0)%
BDTG response
0
0.5
1
1.5
2
2.5
3
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8

BDT response



VBF MVA category optimization





conclusion

- About 1% improve by this reweight.

- Higgs pt reweight can reduce the ggf fraction

(would bias ggF predictions down by ~25%, e.g. give us a too high expected μVBF) according to Dag's talk last meeting

More Systematic?

	Old tight	Old loose	New tight	New loose					
VBF signal	4.64314	0.580693							
ggF	3.22023	0.402737							
Bk model	7.65112	43.1571							
purity	0.813067	0.580693							
Significance	1.44858	0.670877							
Combined significance	1.59639								