Update on 2HDM analysis——BDT

Maosen Zhou

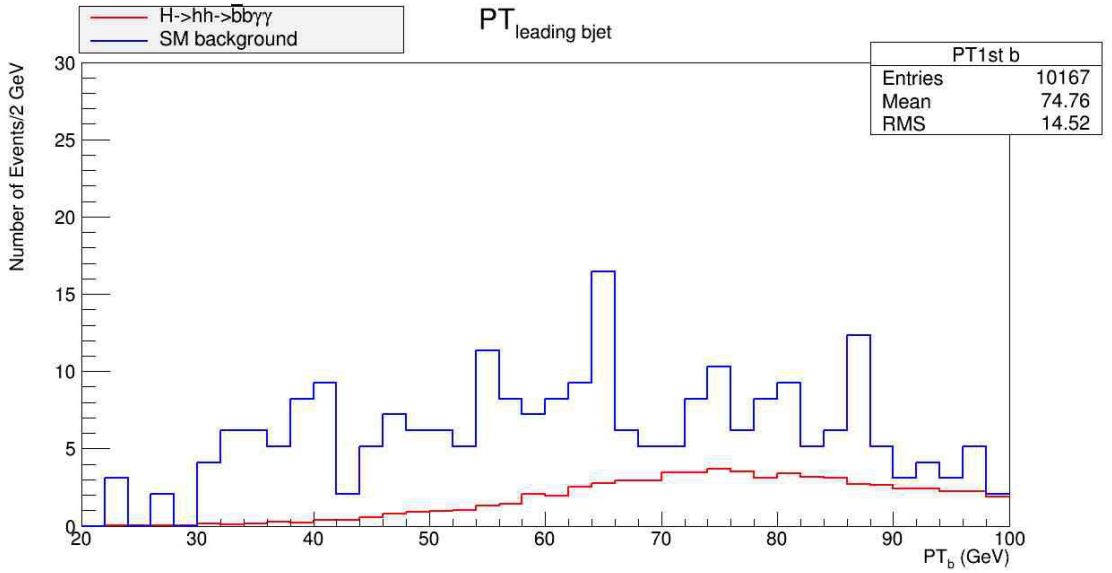
07/05/2014

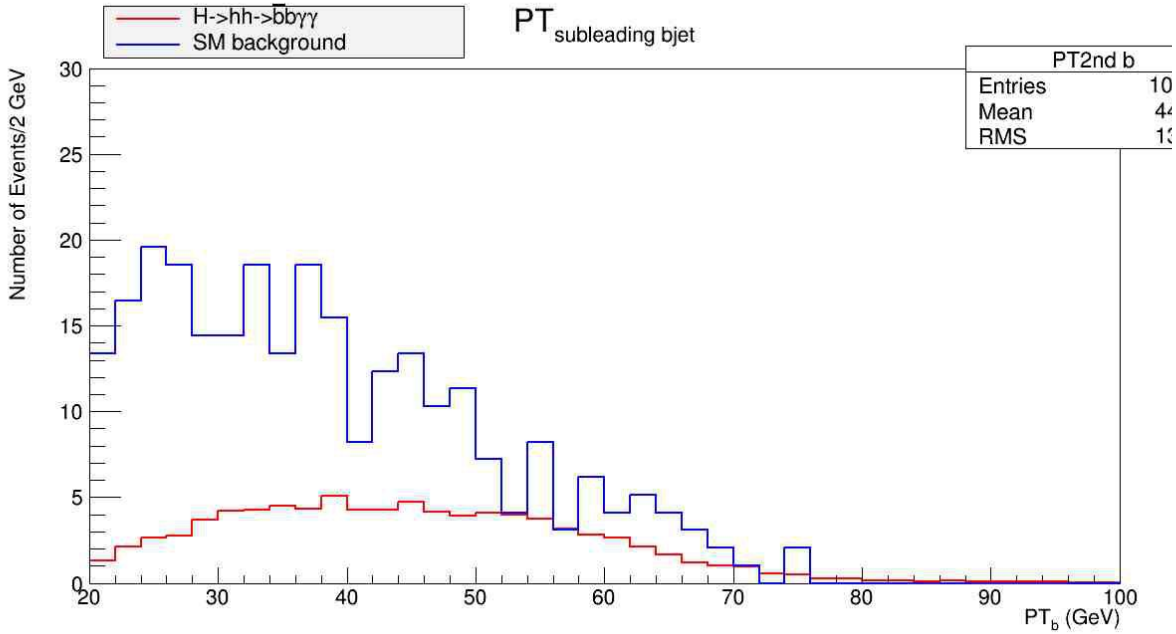
modifications on cut-based

- new cuts:

PTb1>55GeV

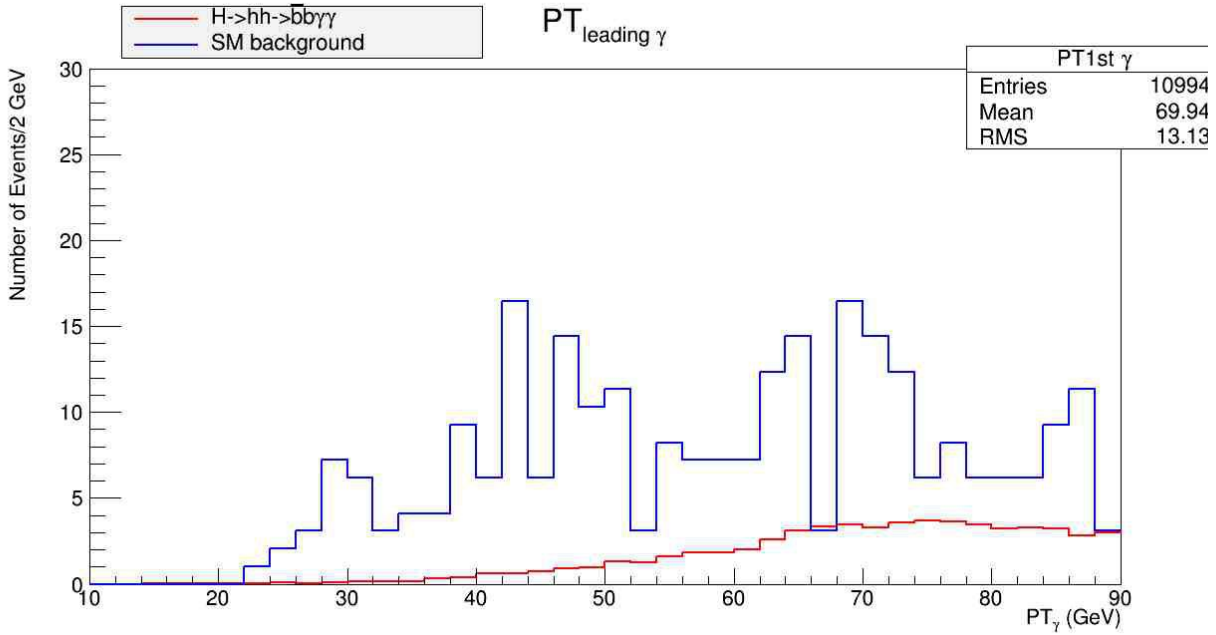
PTb2>30GeV

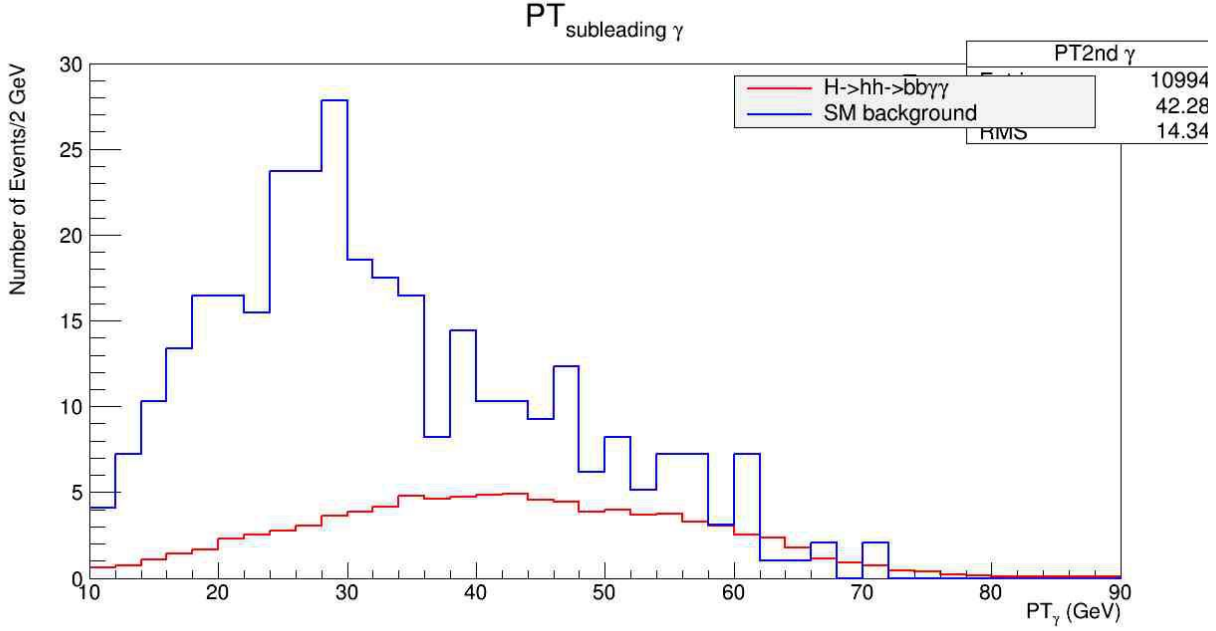




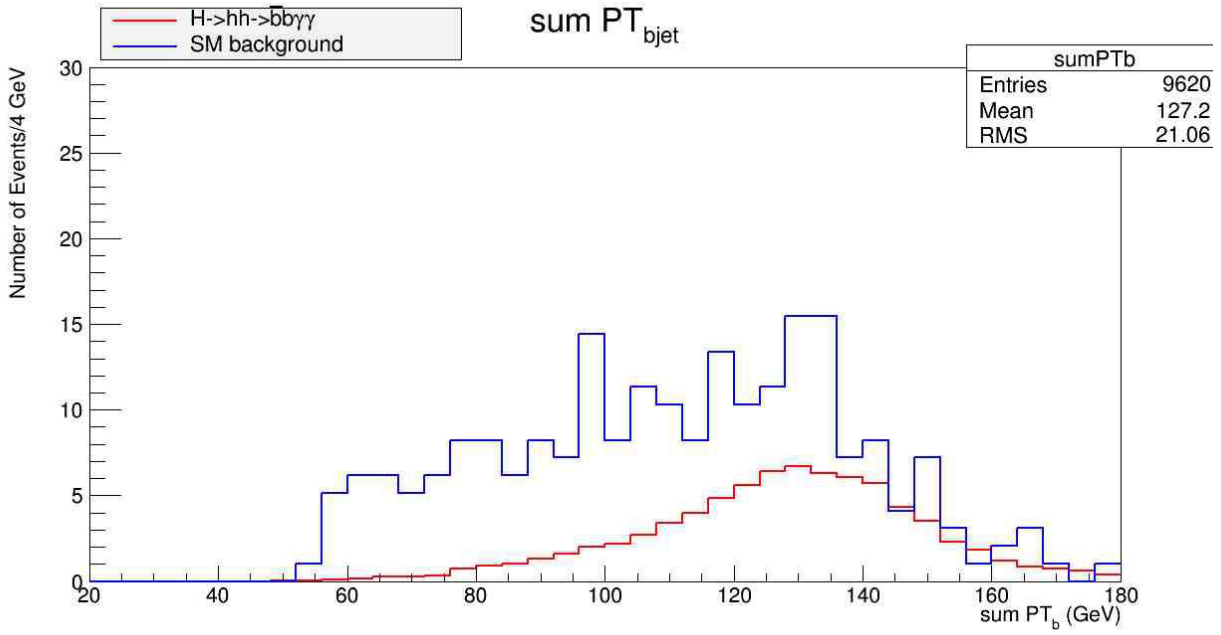
PTa1>60GeV

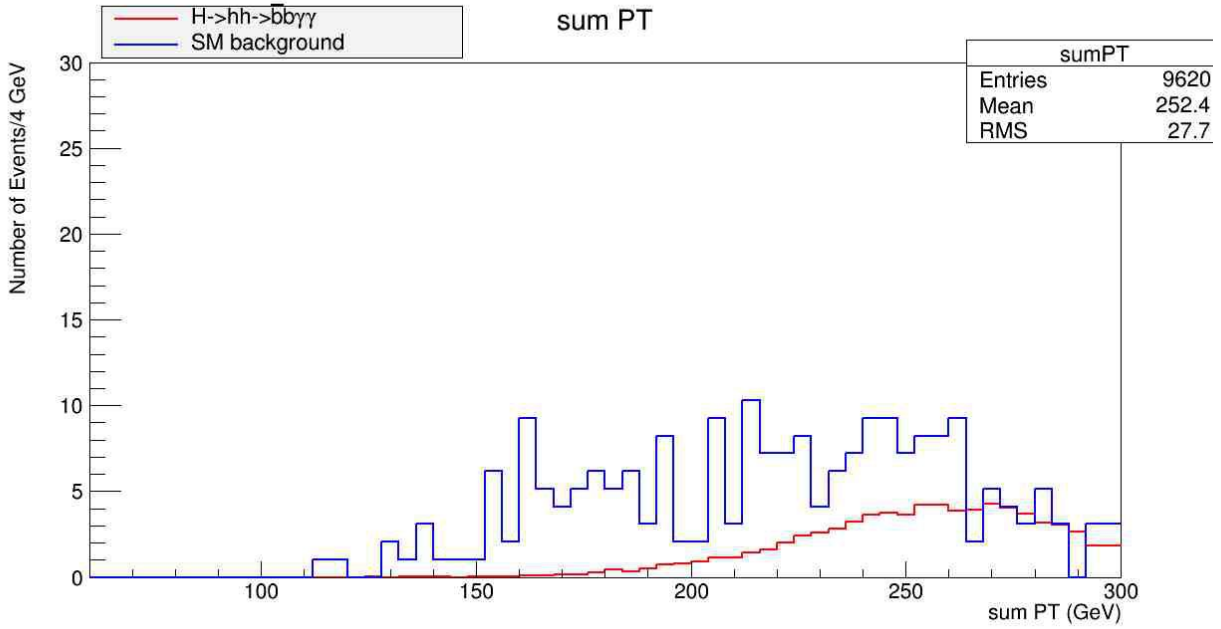
PTa2>30GeV





but PTa/PTb
have high correlations
to sumPT/sumPTb





smaller ?→reasonable

Cuts	σ_{total}	bbaa selection	PT sum	(mbb,maa)	mbbaa
H(300GeV)→bbaa[fb]	1	0.17	0.14	0.071	0.071
bbaa[fb]	6.729*1e3	95	44	0.29	0.12
ttaa[fb]	-	-	-	-	-
S/B	1.5*1e(-4)	1.8*1e(-3)	3.2*1e(-3)	0.24	0.59
$S/\sqrt{B}$	0.39	0.55	0.67	4.2	6.5

New Cuts	σ_{total}	bbaa selection	PT sum	(mbb,maa)	mbbaa
H(300GeV)→bbaa[fb]	1	0.11	0.10	0.053	0.053
bbaa[fb]	6.729*1e3	26	25	0.20	0.094
ttaa[fb]	-	-	-	-	-
S/B	1.5*1e(-4)	4.2*1e(-3)	4.0*1e(-3)	0.27	0.56
$S/\sqrt{B}$	0.39	0.68	0.63	3.7	5.5

mH=500GeV

Cuts	σ_{total}	bbaa selection	PT sum	(mbb,maa)	mbbaa
H(500GeV)→bbaa[fb]	0.4	0.093	0.063	0.019	0.018
bbaa[fb]	6.729*1e3	95	9.6	0.021	0.0093
ttaa[fb]	-	-	-	-	-
S/B	5.9*1e(-5)	2.4*1e(-3)	0.017	0.90	1.9
$S/\sqrt{B}$	0.15	0.75	1.6	4.1	5.9

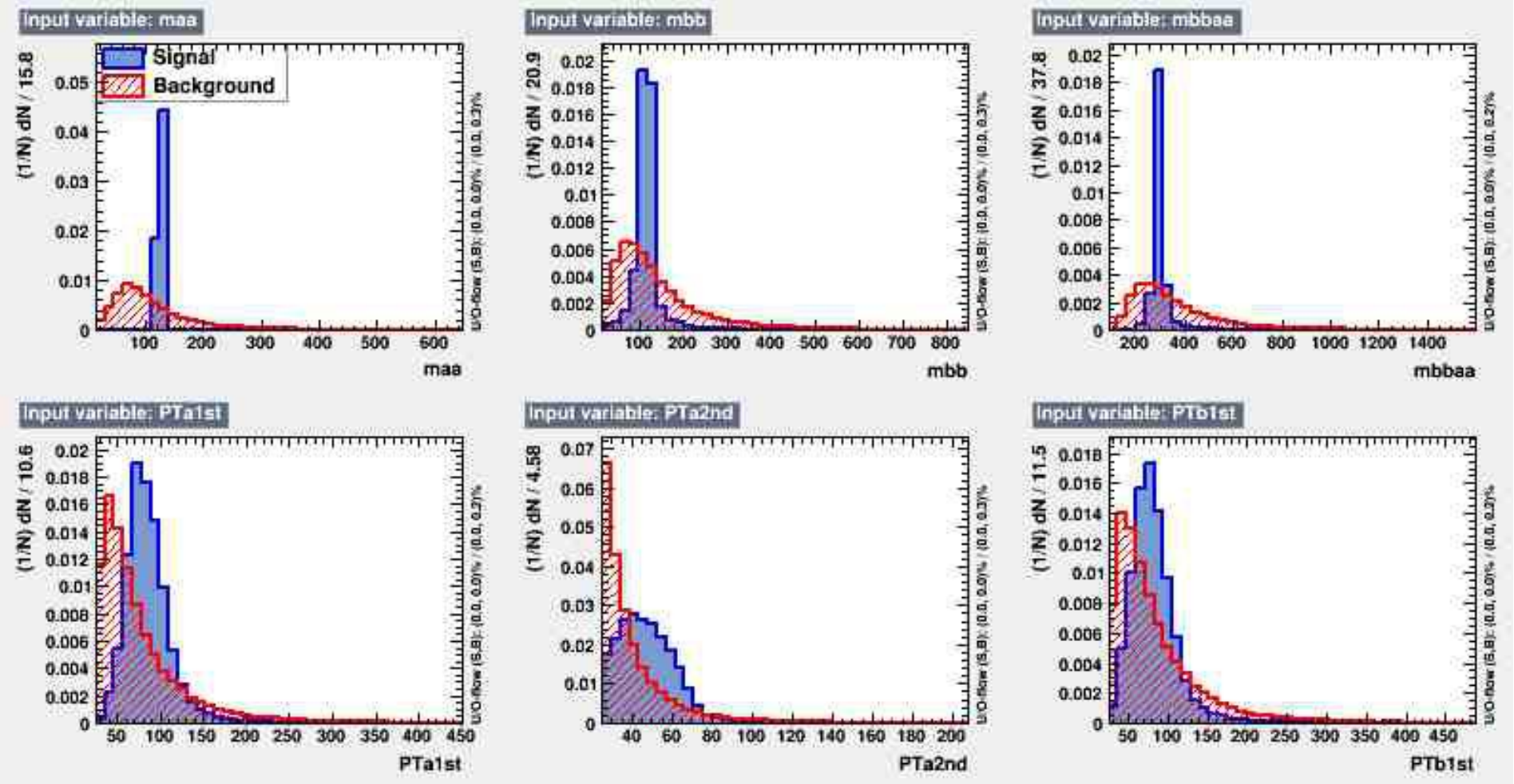
mH=600GeV

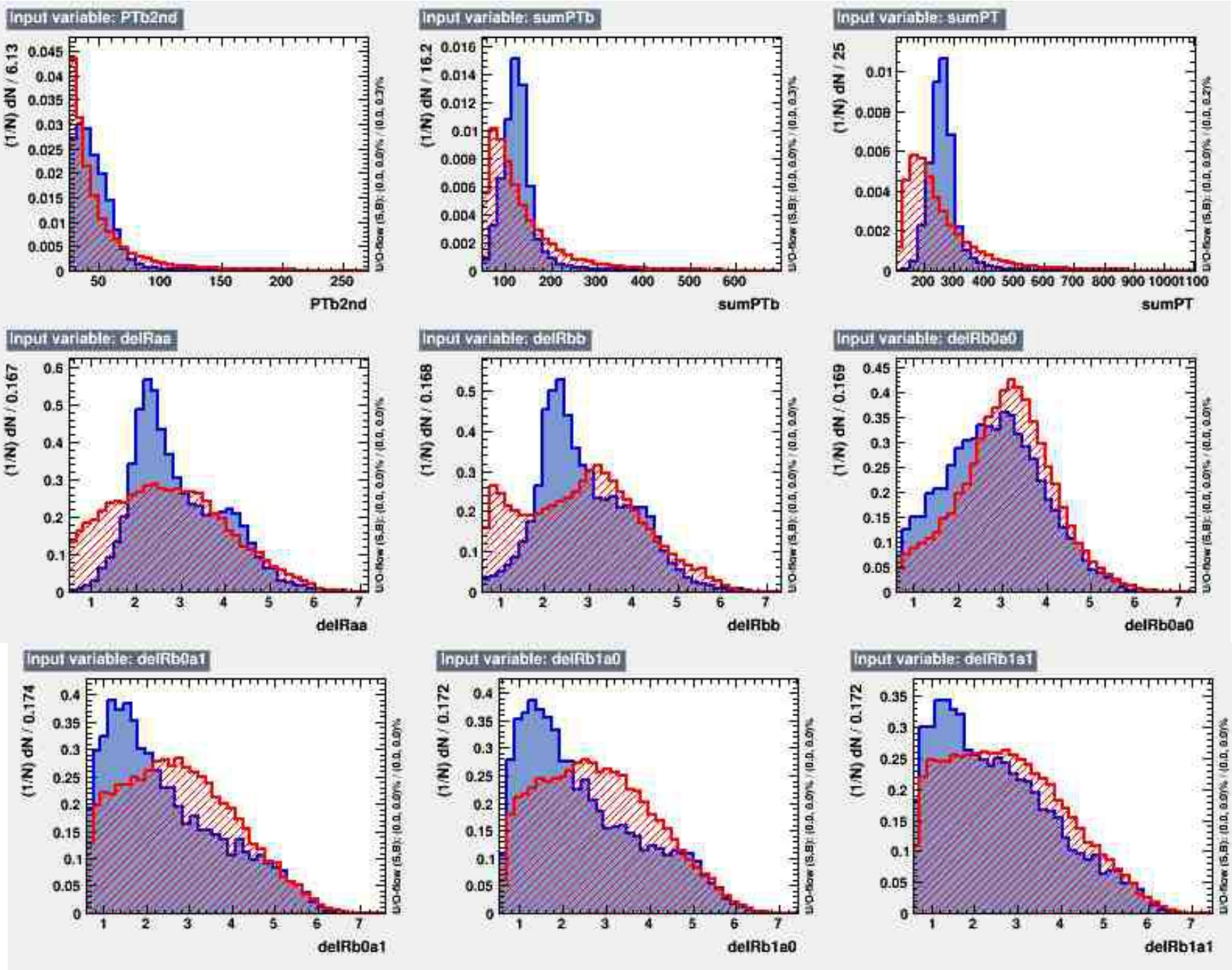
Cuts	σ_{total}	bbaa selection	PT sum	(mbb,maa)	mbbaa
H(600GeV)→bbaa[fb]	0.1	0.025	0.014	0.0031	0.0031
bbaa[fb]	6.729*1e3	95	4.3	0.0062	0.0021
ttaa[fb]	-	-	-	-	-
S/B	1.5*1e(-5)	2.6*1e(-4)	0.033	0.5	1.5
$S/\sqrt{B}$	0.039	0.081	2.1	1.2	2.1

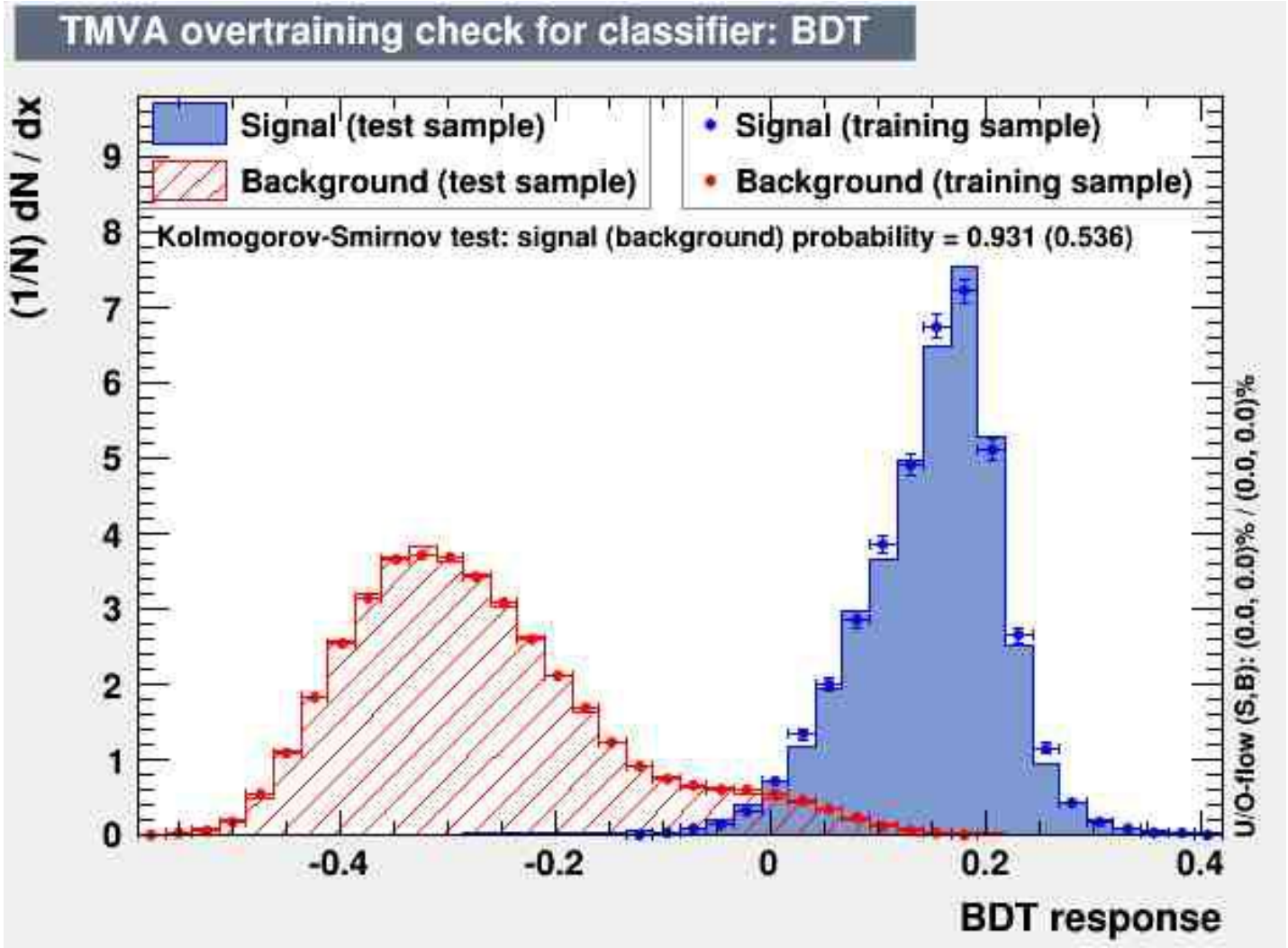
- a shame! calculation error...

BDT analysis

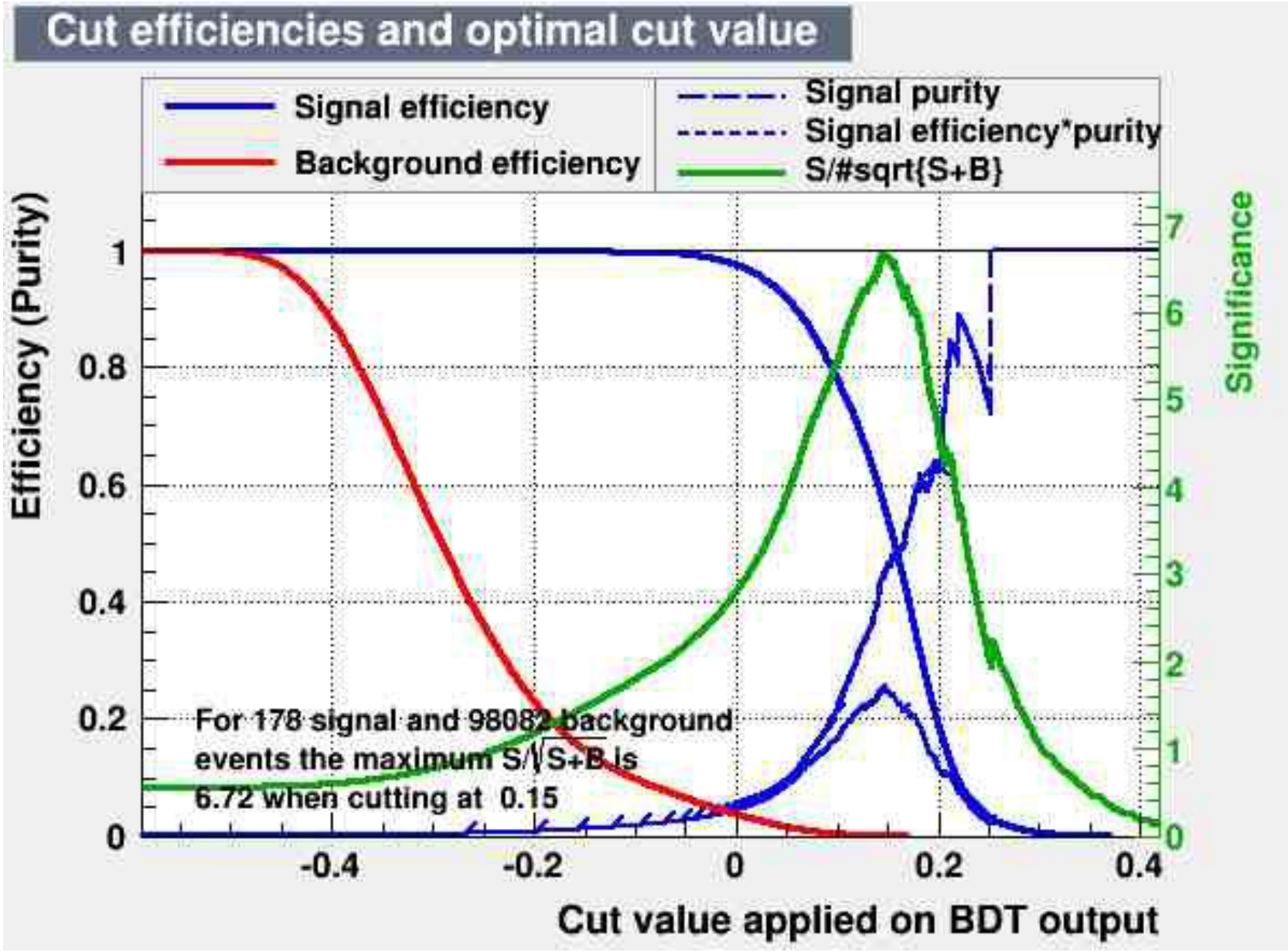
- input variables for training:
  maa,mbb,mbbaa,PTb1st,PTb2nd,PTa1st,PTa2nd,delRa1b1,delRa1b0,delRa0b0,delRa0b1



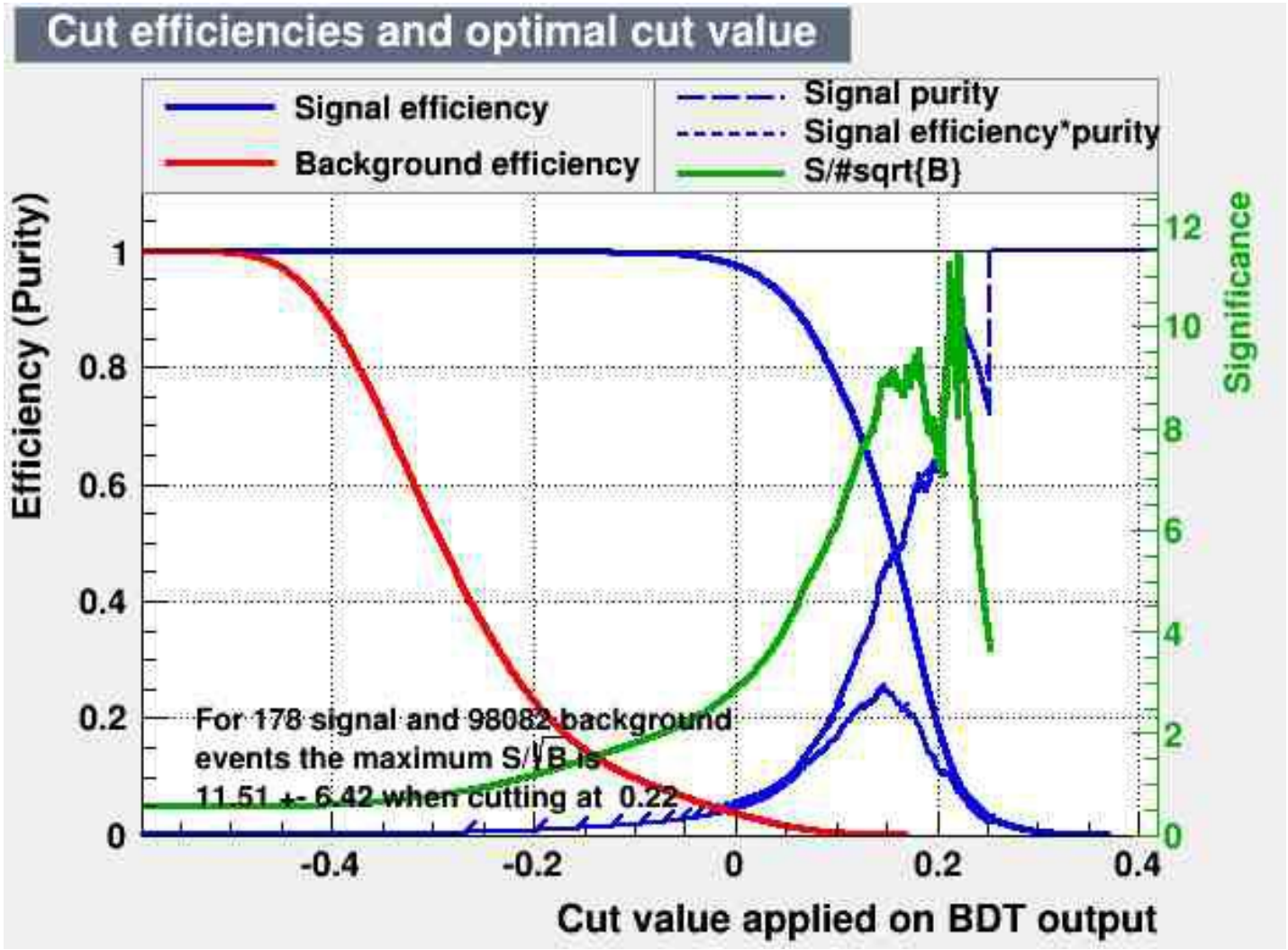

Input variable: PTb2nd
(1/N) dN / 6.13
PTb2nd
Input variable: sumPTb
(1/N) dN / 16.2
sumPTb
Input variable: sumPT
(1/N) dN / 25
sumPT
Input variable: delRaa
(1/N) dN / 0.167
delRaa
Input variable: delRbb
(1/N) dN / 0.168
delRbb
Input variable: delRb0a0
(1/N) dN / 0.169
delRb0a0
Input variable: delRb0a1
(1/N) dN / 0.174
delRb0a1
Input variable: delRb1a0
(1/N) dN / 0.172
delRb1a0
Input variable: delRb1a1
(1/N) dN / 0.172
delRb1a1


TMVA overtraining check for classifier: BDT
Signal (test sample)
Background (test sample)
Signal (training sample)
Background (training sample)
Kolmogorov-Smirnov test: signal (background) probability = 0.931 (0.536)
(1/N) dN / dx
U/O-flow (S,B): (0.0, 0.0)% / (0.0, 0.0)%
BDT response
0
1
2
3
4
5
6
7
8
9
-0.4
-0.2
0
0.2
0.4

max S/sqrt(S+B) = 6.72@BDT cut= 0.15

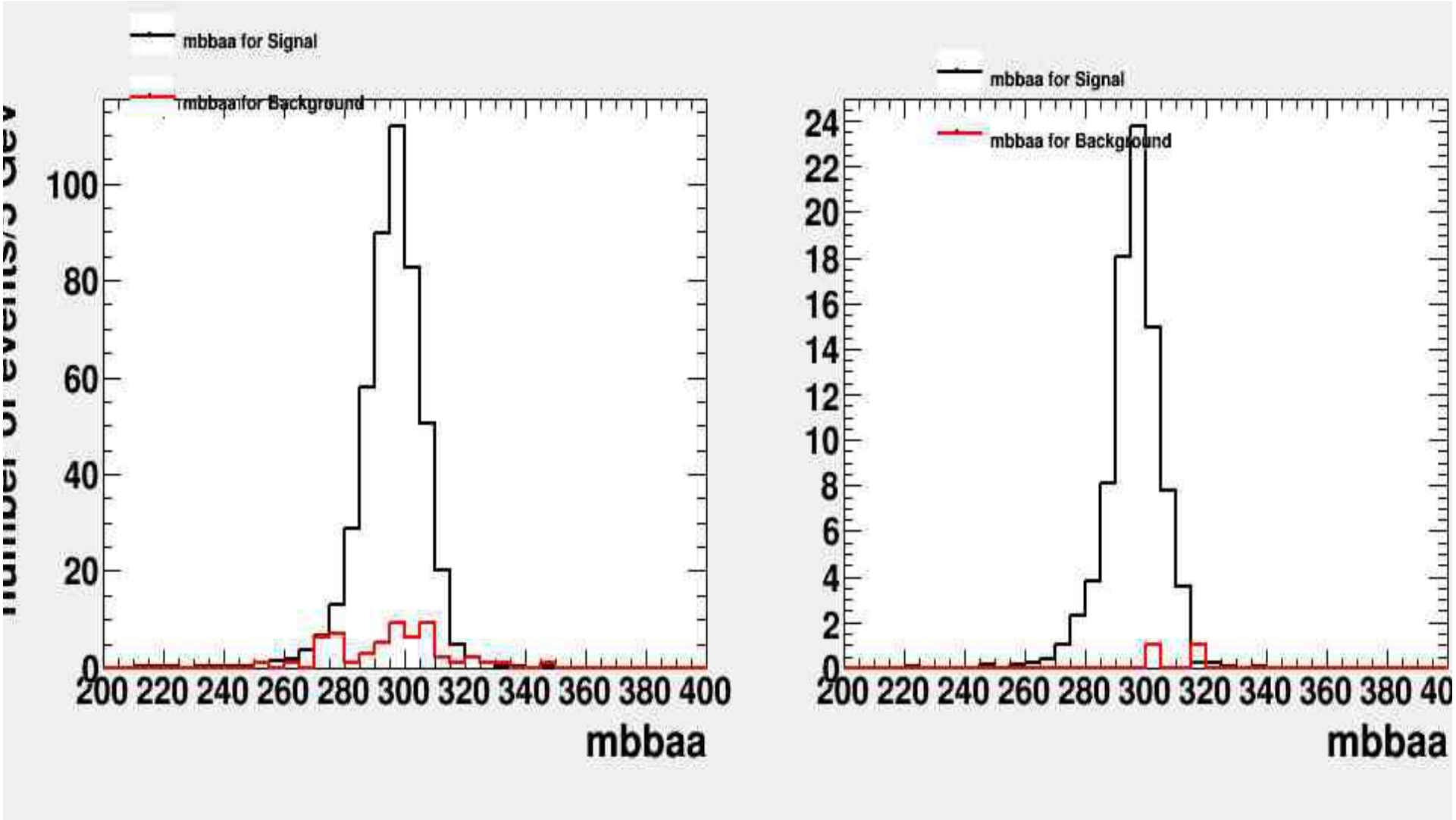


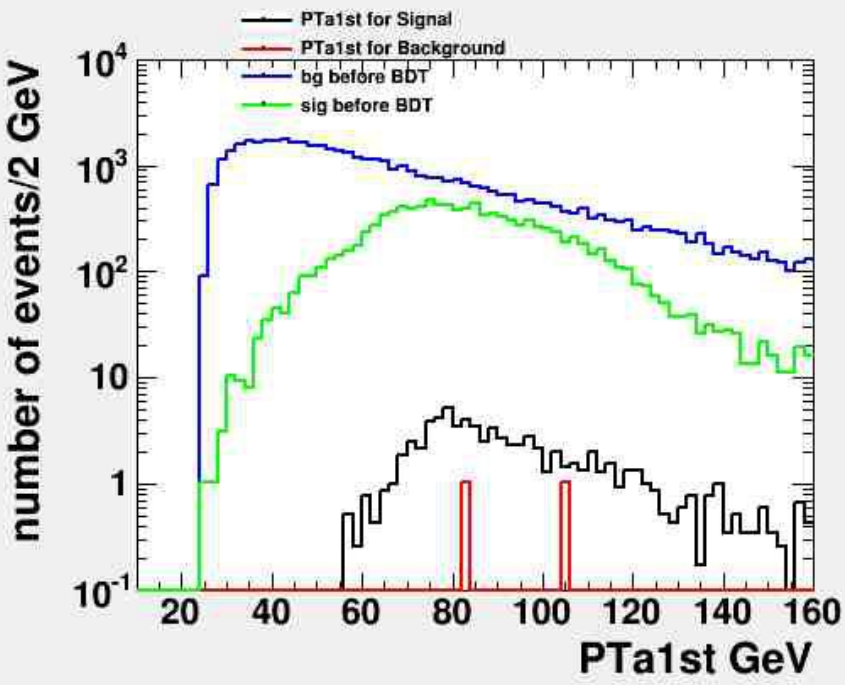
optimal BDT cut :0.22,max S/sqrt(B)=11.51

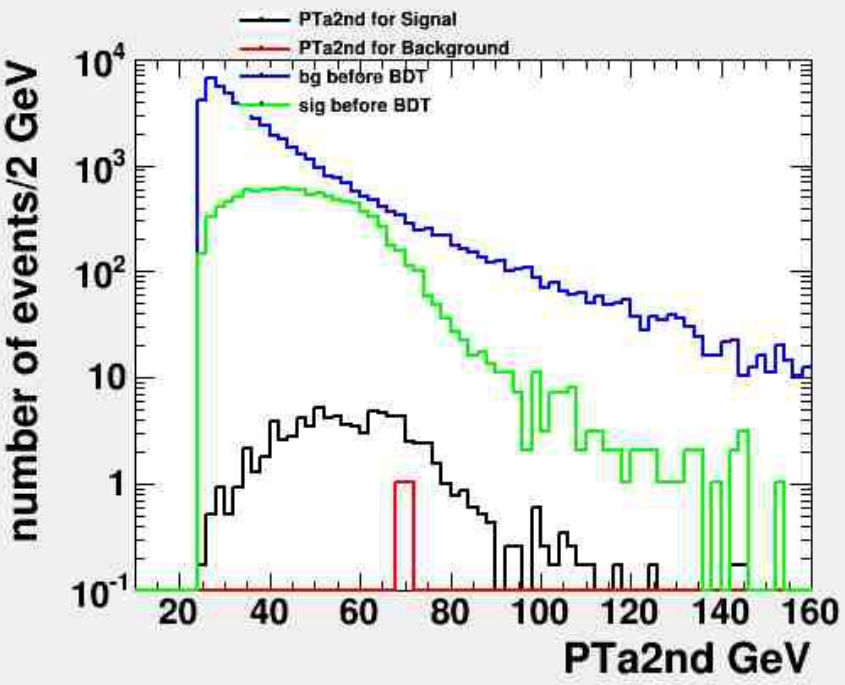


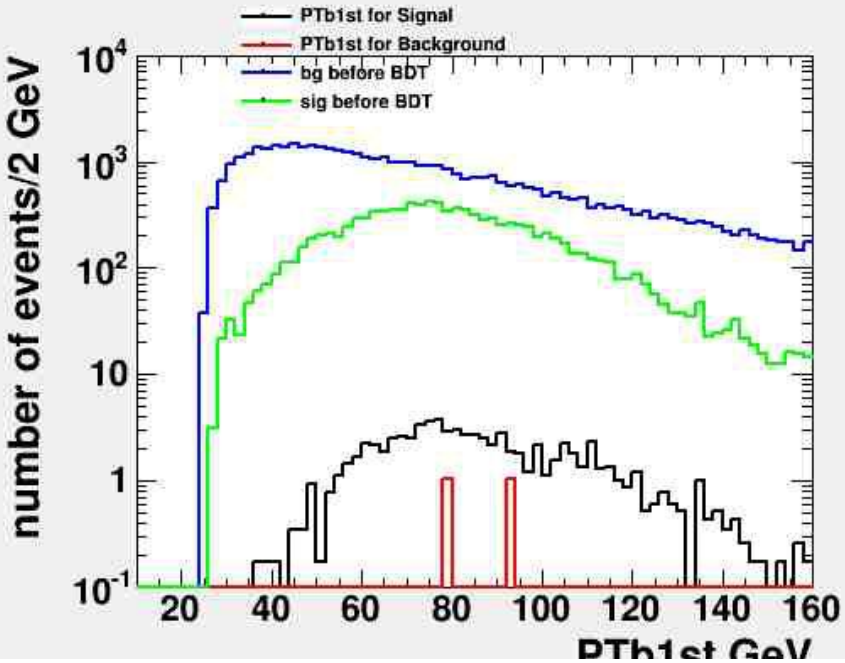
74% improvements comparing to 6.6 obatained by cut-based

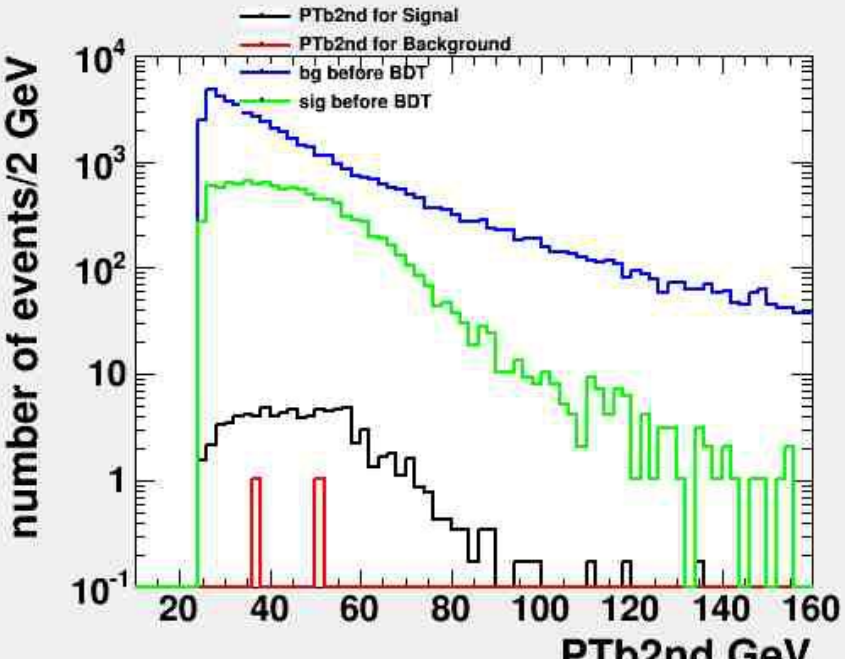
BDT > 0.15 vs BDT > 0.22

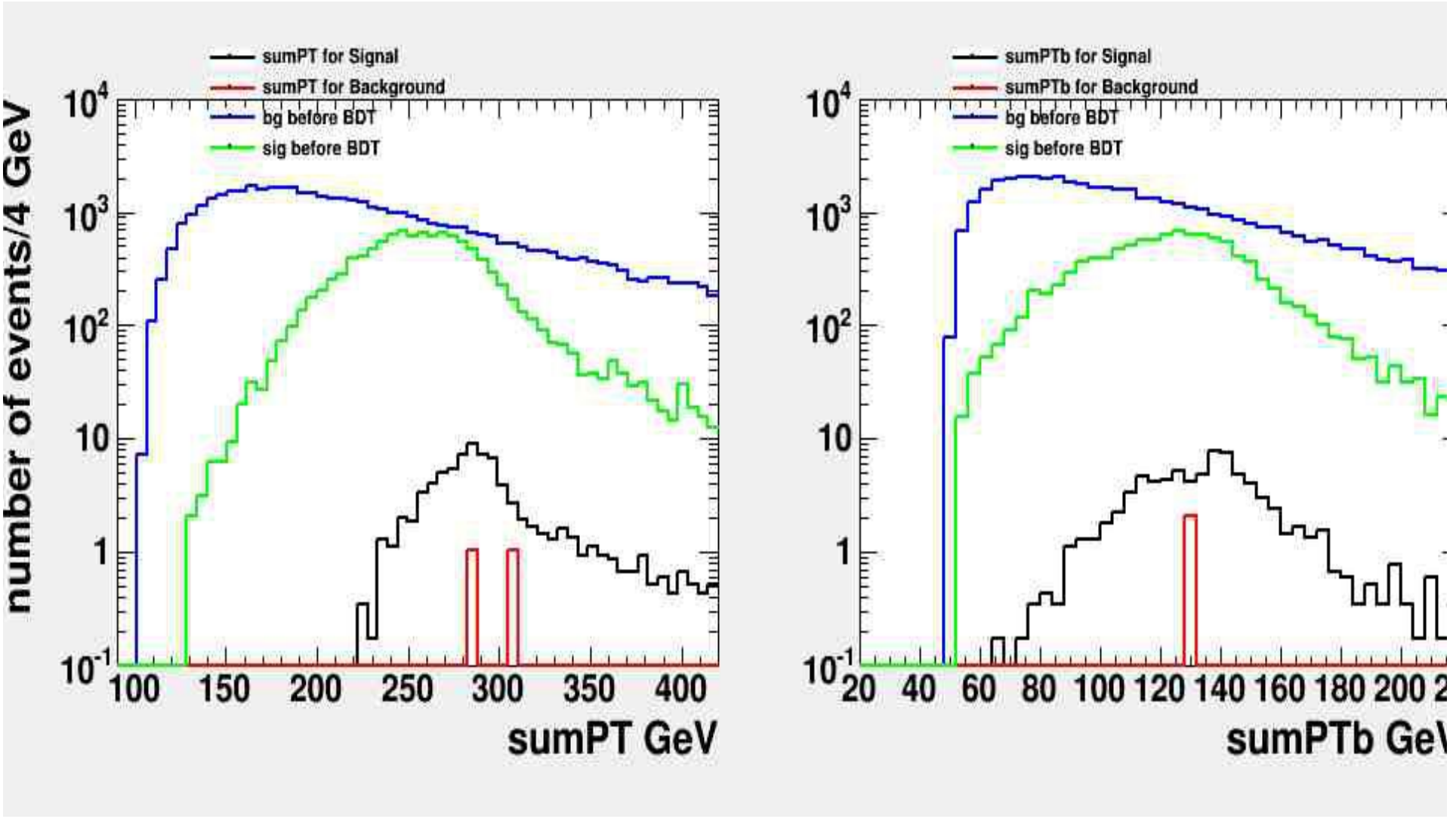


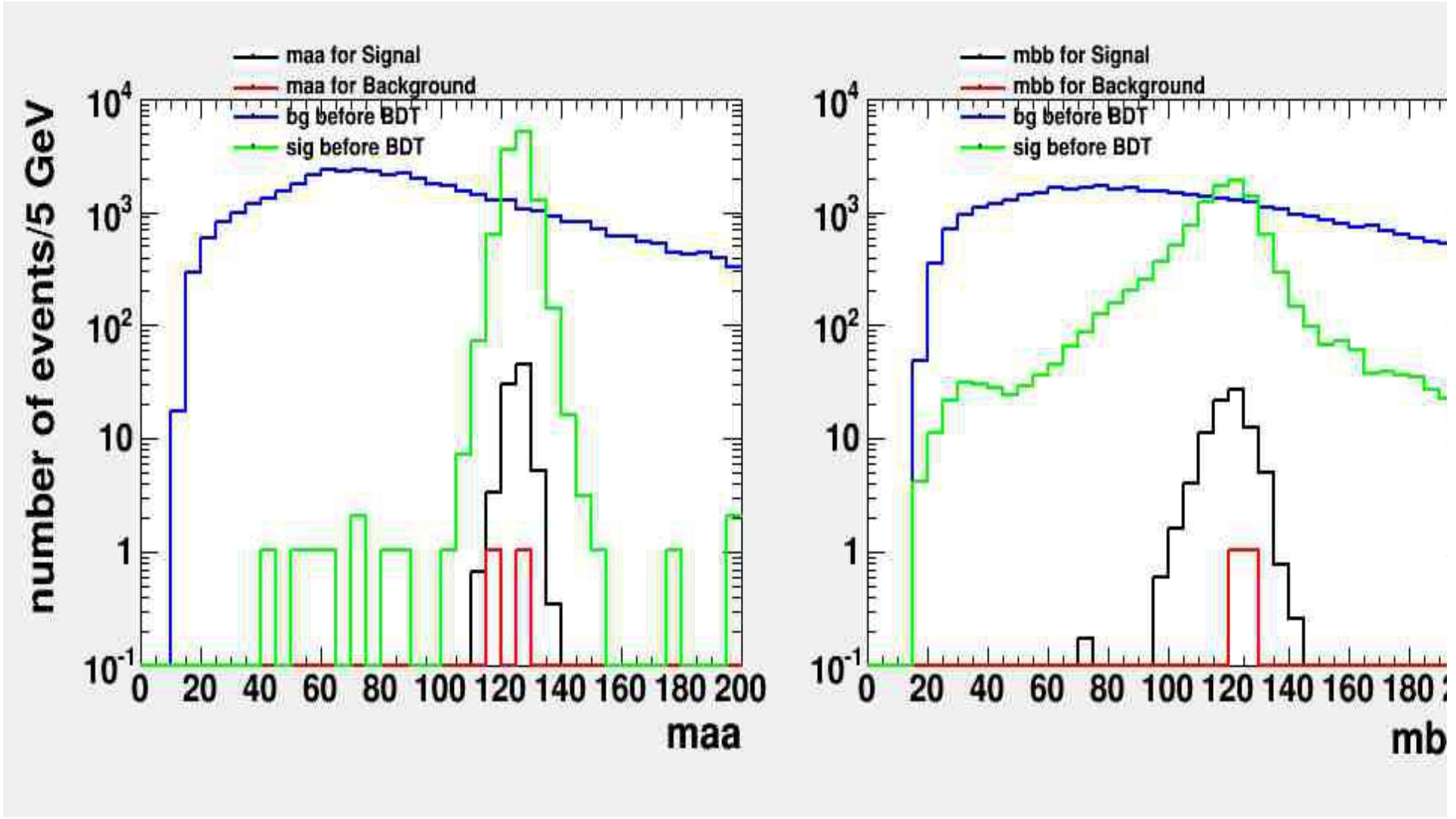

PTa1st for Signal
PTa1st for Background
bg before BDT
sig before BDT
number of events/2 GeV
PTa1st GeV

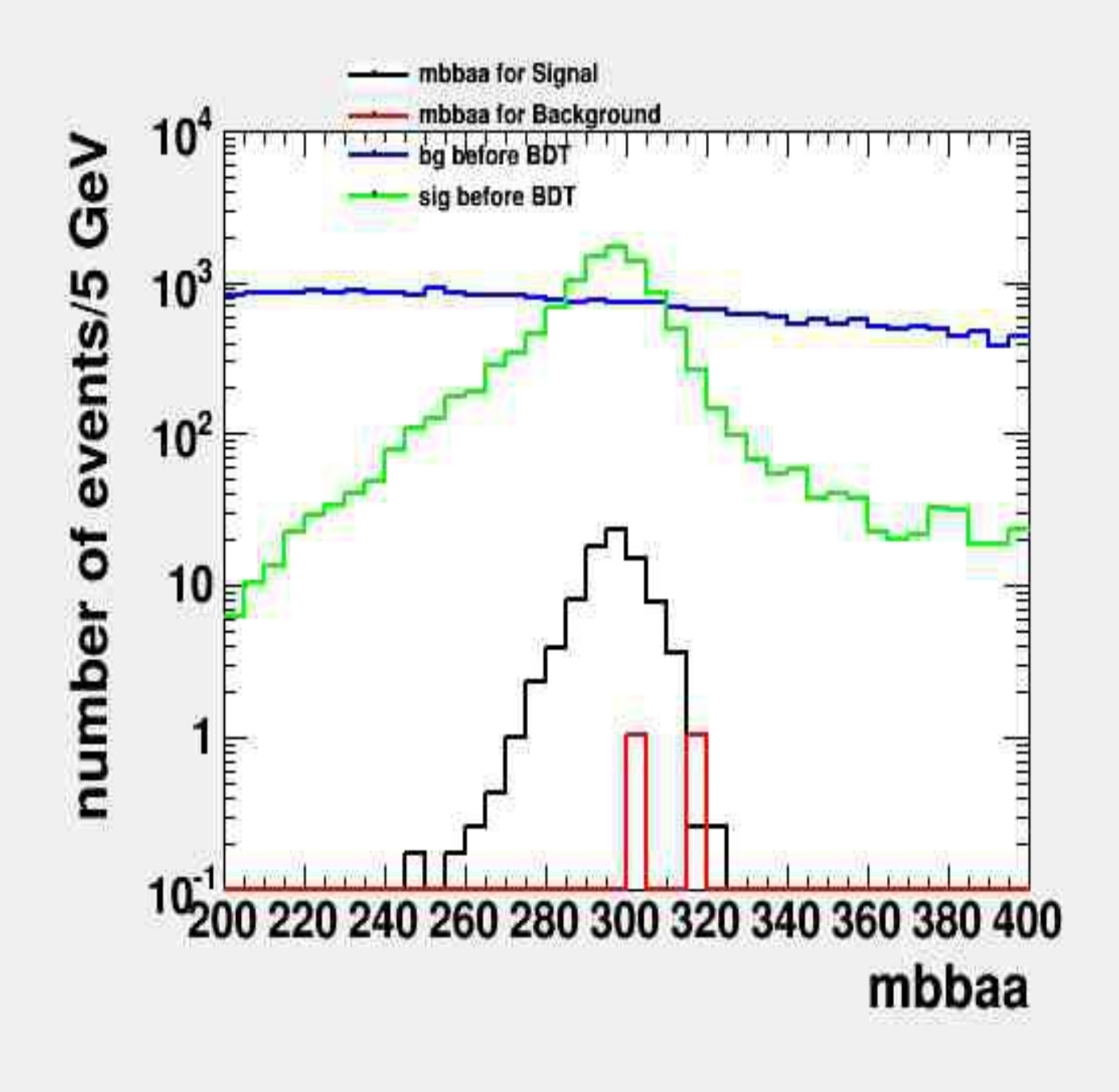

PTa2nd for Signal
PTa2nd for Background
bg before BDT
sig before BDT
number of events/2 GeV
PTa2nd GeV


PTb1st for Signal
PTb1st for Background
bg before BDT
sig before BDT
number of events/2 GeV


PTb2nd for Signal
PTb2nd for Background
bg before BDT
sig before BDT
number of events/2 GeV
PTb2nd GeV


sumPT for Signal
sumPT for Background
bg before BDT
sig before BDT
number of events/4 GeV
sumPT GeV
sumPTb for Signal
sumPTb for Background
bg before BDT
sig before BDT
sumPTb GeV


maa for Signal
maa for Background
bg before BDT
sig before BDT
number of events/5 GeV
maa
mbb for Signal
mbb for Background
bg before BDT
sig before BDT
mb


mbbaa for Signal
mbbaa for Background
bg before BDT
sig before BDT
number of events/5 GeV
10^4
10^3
10^2
10
1
10^{-1}
200 220 240 260 280 300 320 340 360 380 400
mbbaa

to do

- paper writing: complete draft version before May 15