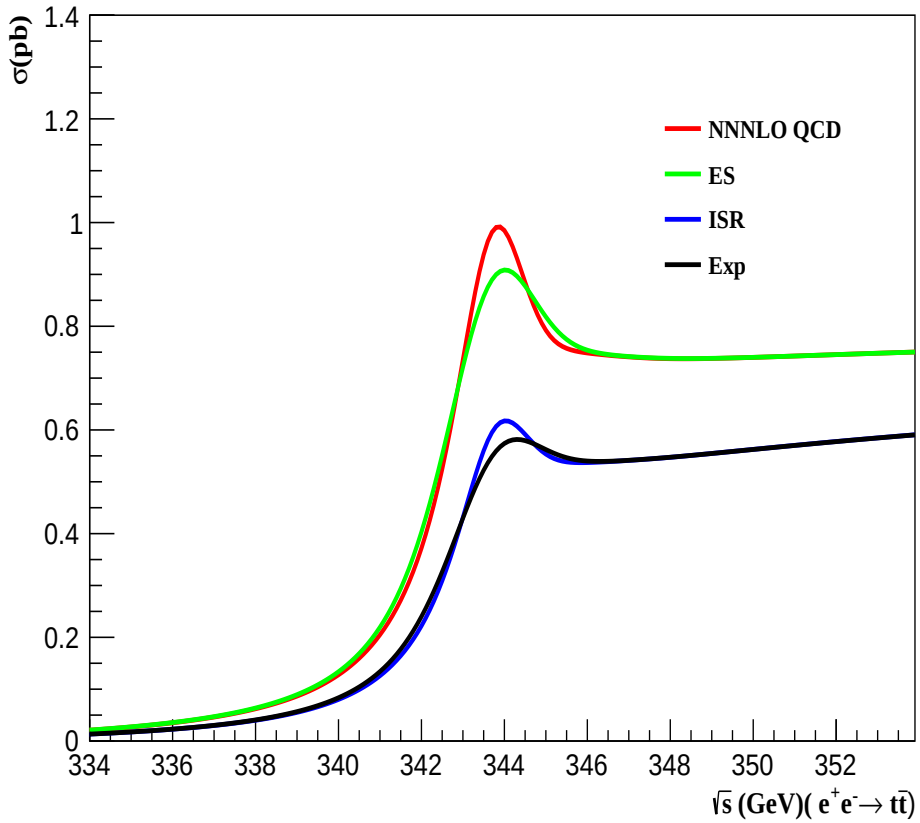
Top quark simulations near threshold at future CEPC

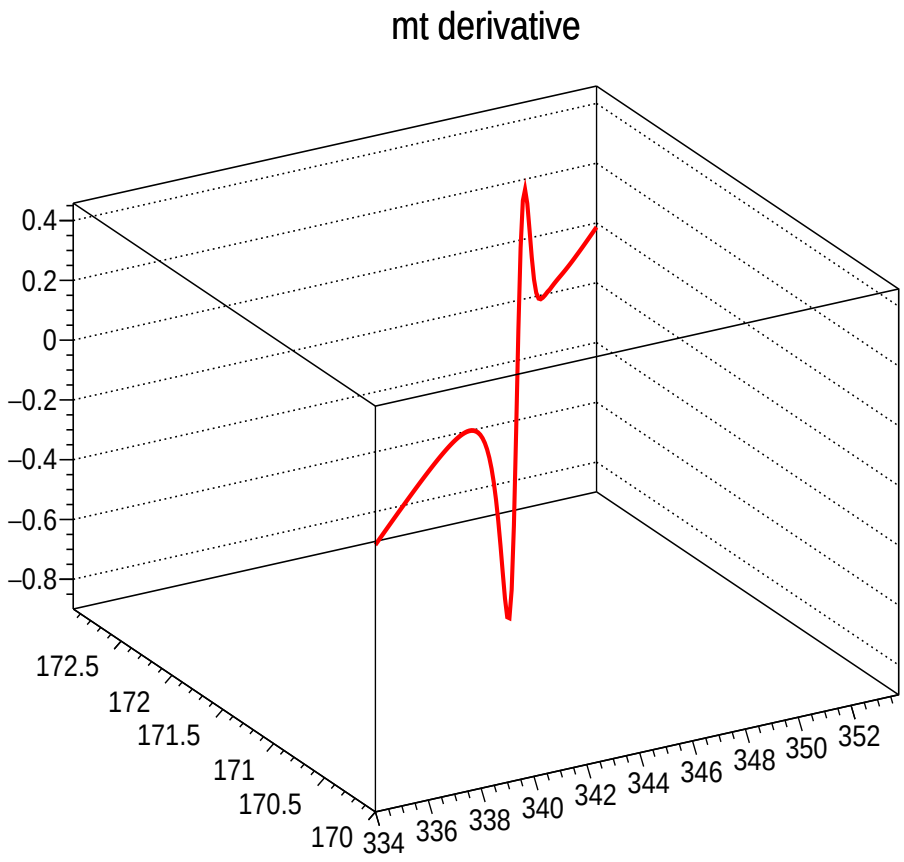
January 15, 2018

1. Minuit fitting:

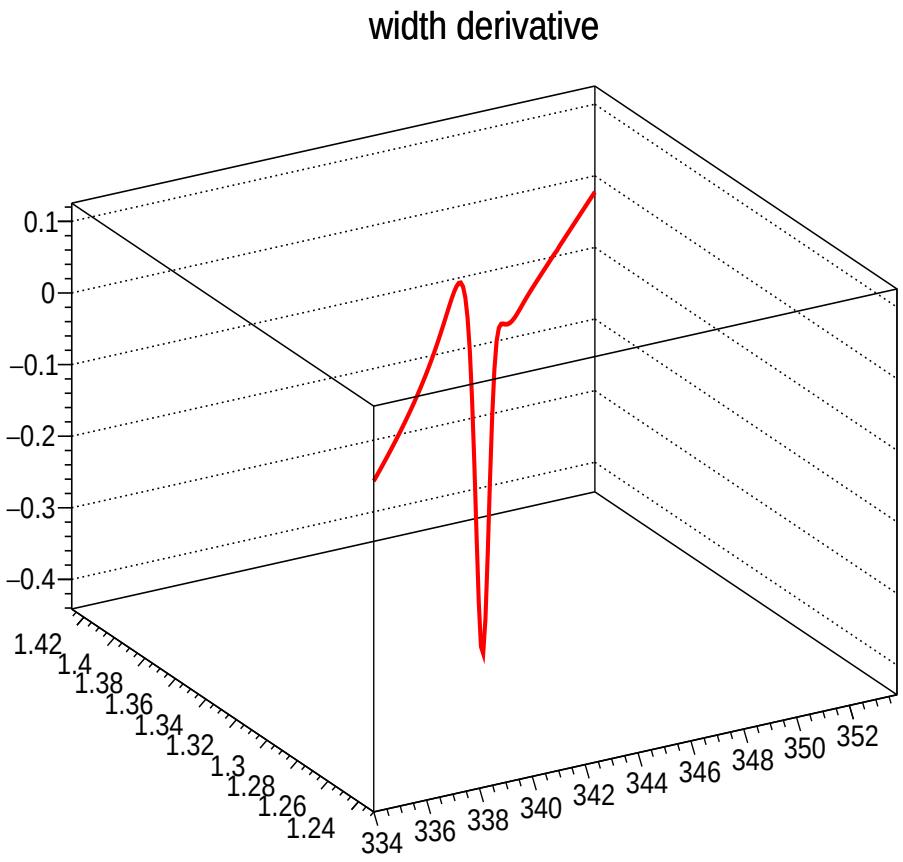
- The fitting is based on two parameters, top mass and top width.
- The changed point is the ISR, we use the new ISR function here.
- The Gaussian energy spread isn't included here.
- The initial values are taken: m_t=171.5 GeV, Γ_t=1.33GeV, α_s=0.1185.



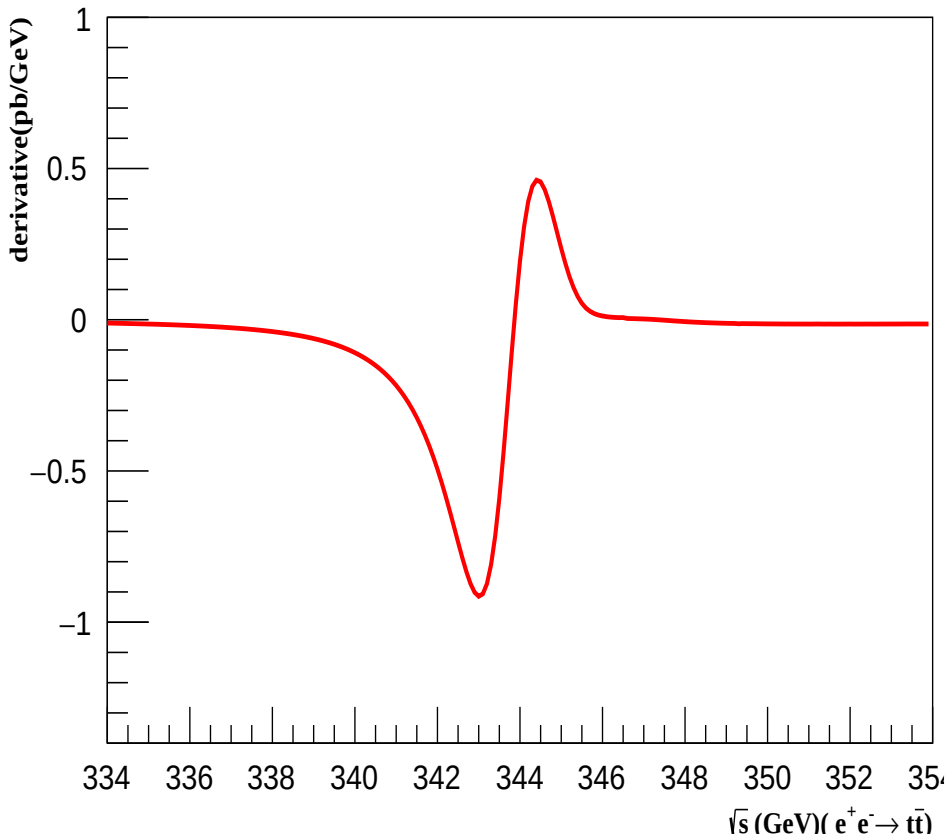
the red line is xsection without ISR, the blue curve is xsection with ISR.



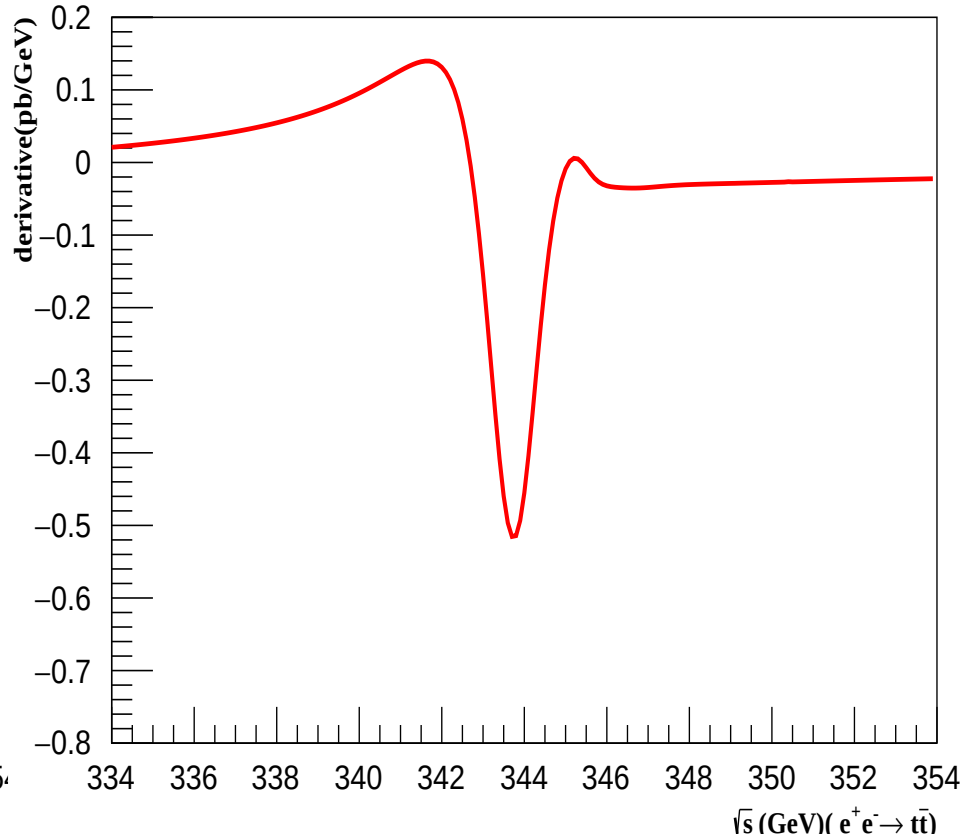
derivative of mt versus $\sqrt{s}$ and mt with Γ=1.33 GeV



derivative of width versus $\sqrt{s}$ and width with mt=171.5 GeV



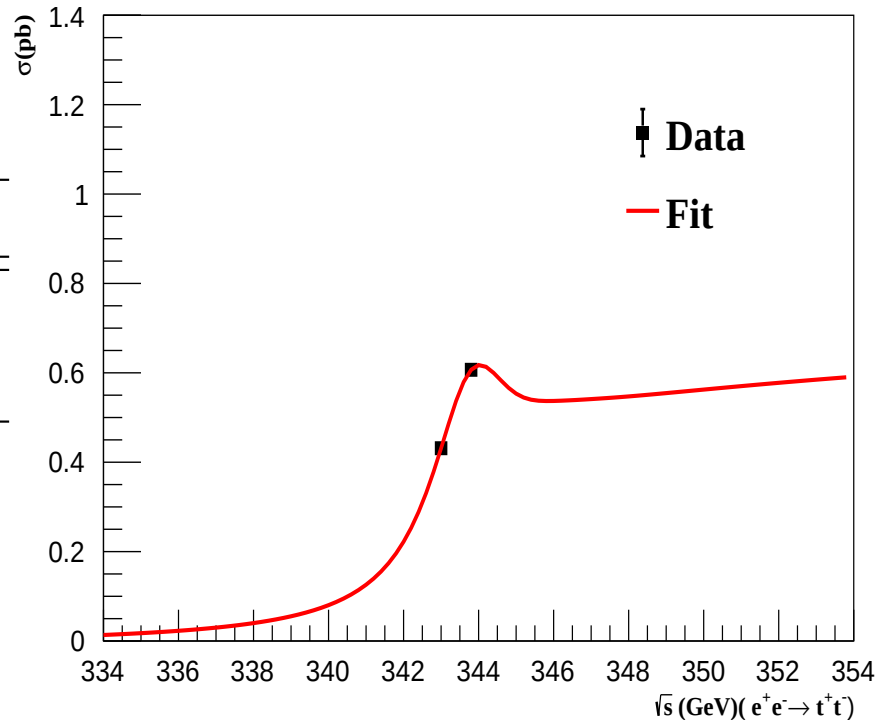
derivative of mt versus $\sqrt{s}$ with mt=171.5 GeV, Γ=1.33 GeV



derivative of width versus $\sqrt{s}$ with mt=171.5 GeV, Γ=1.33 GeV

data(GeV)	luminosity(fb^{-1})
342.8	50.0
343.8	50.0

data-taken.

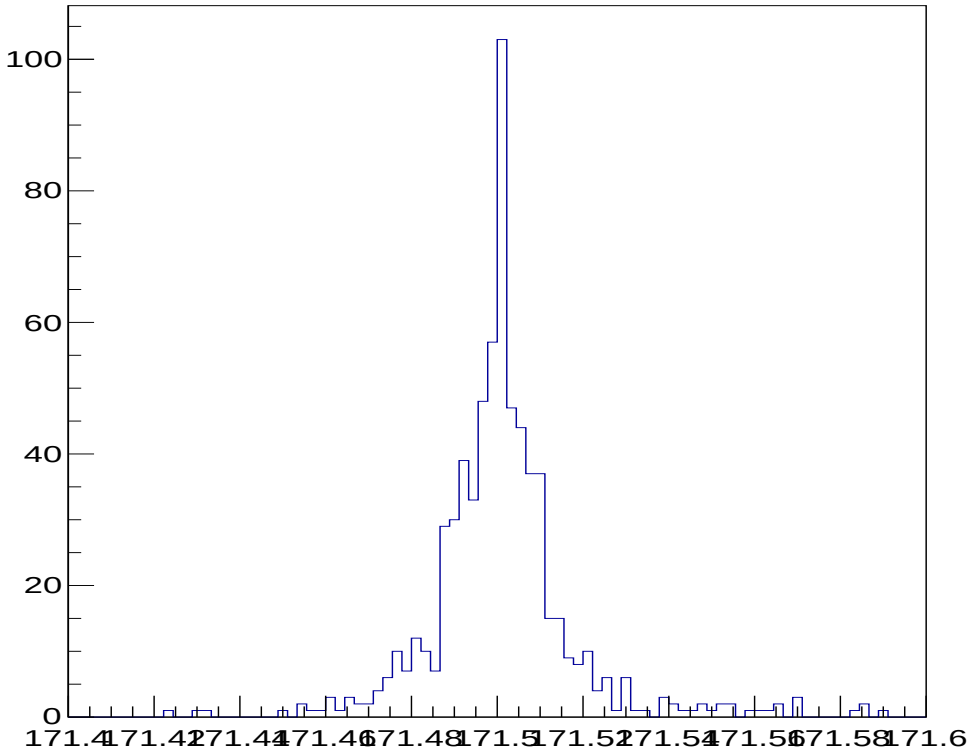


Two-parameter fitting with ISR

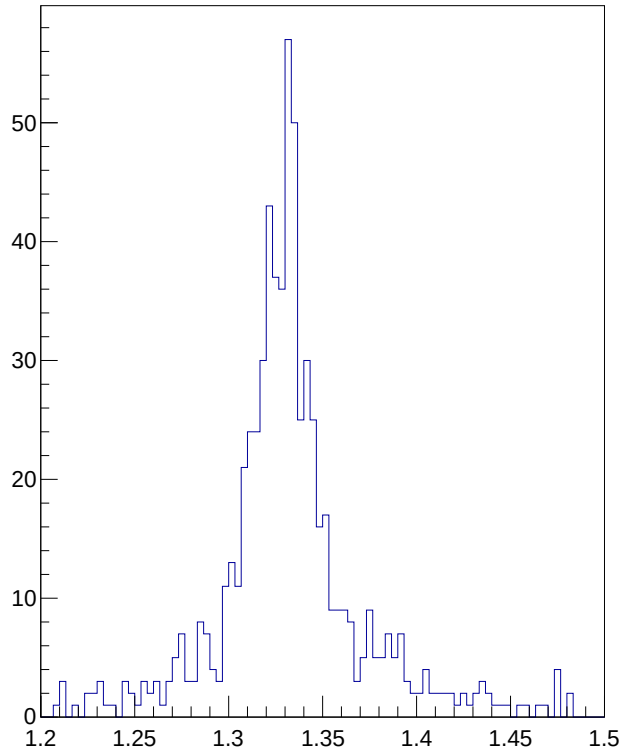
The results are:

cases	mt	width	δ_{mt}	δ_{width}
with ISR	171.500 GeV	1.308 GeV	5.3 MeV	12.9 MeV

The sift of central value due to energy uncertainty(without ISR):



estimation of mass systematics

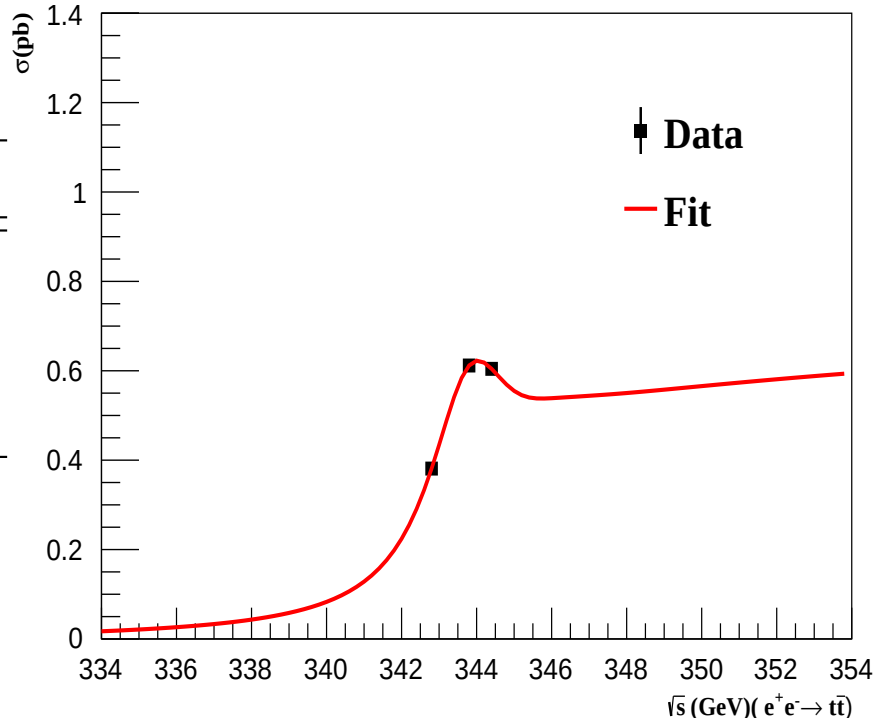


estimation of width systematics

- 3-parameters fitting:

data(GeV)	luminosity(fb^{-1})
342.8	33.33
343.8	33.33
344.4	33.33

data-taken.



3-parameters fitting with ISR

results	mt	width	α_s
central value	171.526 GeV	1.371 GeV	0.1197
stat.err	16.2 MeV	37.2 MeV	0.0008

2. Btag cuts:

process	cross section(fb^{-1})	events
$E350.Ptt\_dtdtutdtutdt.e0.p0.whizard195$	43.252527	10000
$E350.Pzzz\_dddddd.e0.p0.whizard195$	0.040326517	100000
$E350.Pzzz\_uuuuuu.e0.p0.whizard195$	0.013213431	100000
$E350.Pzww\_utututdtutdt.e0.p0.whizard195$	1.5213469	100000

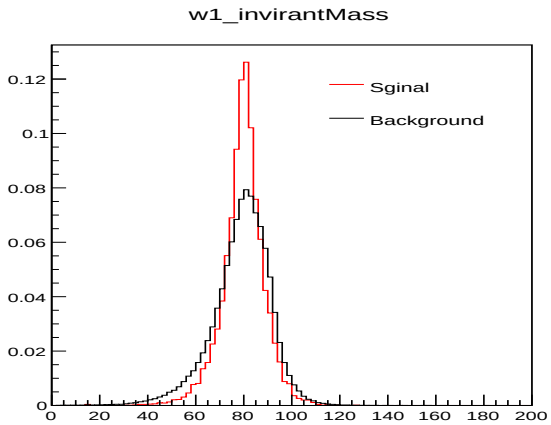
cross section

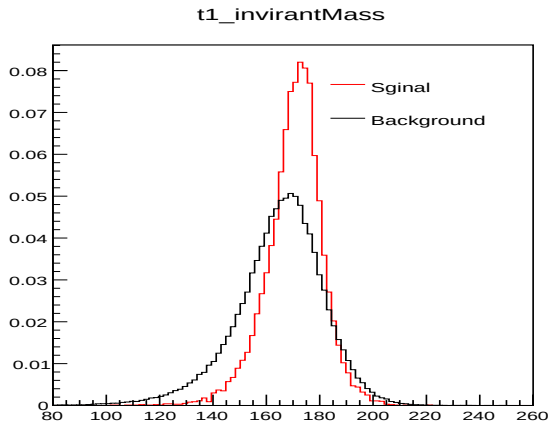
process	cross section(fb^{-1})	events
$E350.Ptt\_dtdtlvlv.e0.p0.whizard195$	11.656258	10000
$E350.Ptt\_dtdtutdtlv.e0.p0.whizard195$	45.566043	10000
$E350.Pzww\_lllvlv.e0.p0.whizard195$	0.58936780	100000
$E350.Pzww\_llutdtlv.e0.p0.whizard195$	2.2178931	100000
$E350.Pzww\_llutdtutdt.e0.p0.whizard195$	2.30305180	100000
$E350.Pzww\_ututlvlv.e0.p0.whizard195$	0.51962634	100000
$E350.Pzww\_utututdtlv.e0.p0.whizard195$	1.6540463	100000
$E350.Pzww\_vvlvlv.e0.p0.whizard195$	0.27943516	100000
$E350.Pzww\_vvutdtlv.e0.p0.whizard195$	1.0329543	100000
$E350.Pzww\_vvutdtutdt.e0.p0.whizard195$	1.0616599	100000
$E350.Pzzz\_ddddll.e0.p0.whizard195$	0.064563515	100000

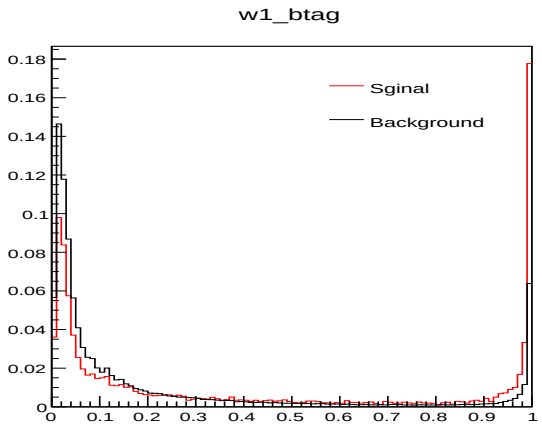
cross section

process	cross section(fb^{-1})	events
$E350.Pzzz\_ddddnn.e0.p0.whizard195$	0.06727436	100000
$E350.Pzzz\_ddllll.e0.p0.whizard195$	0.035538321	100000
$E350.Pzzz\_ddnnnn.e0.p0.whizard195$	0.034468349	100000
$E350.Pzzz\_llllll.e0.p0.whizard195$	0.011159665	100000
$E350.Pzzz\_nnnnnn.e0.p0.whizard195$	0.054654329	100000
$E350.Pzzz\_uullll.e0.p0.whizard195$	0.033171327	100000
$E350.Pzzz\_uunnnn.e0.p0.whizard195$	0.024068653	100000
$E350.Pzzz\_uuuull.e0.p0.whizard195$	0.035005353	100000
$E350.Pzzz\_uuuunn.e0.p0.whizard195$	0.031984135	100000

cross section

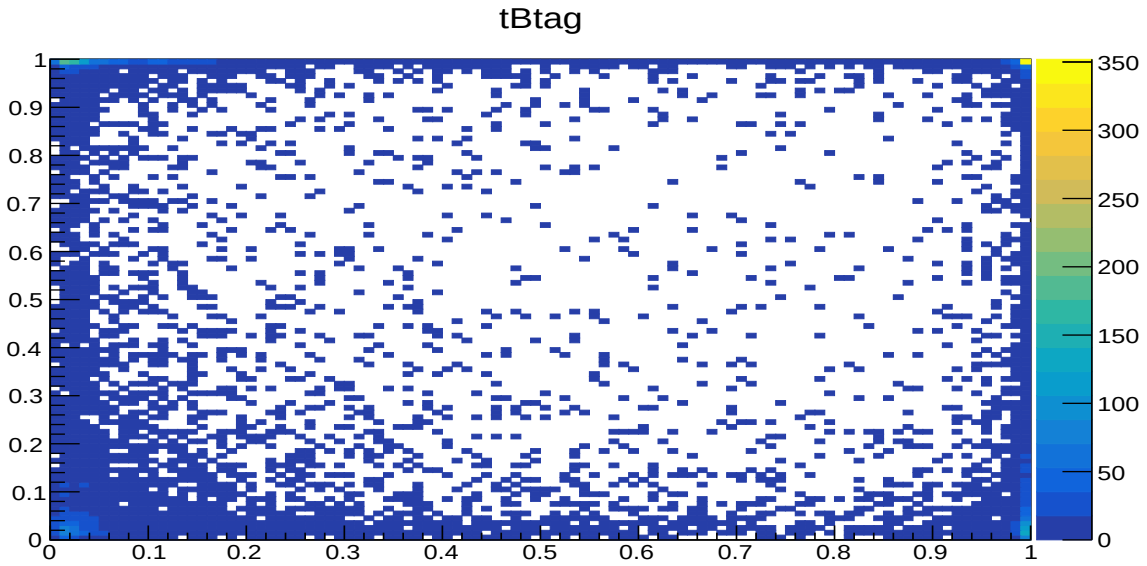


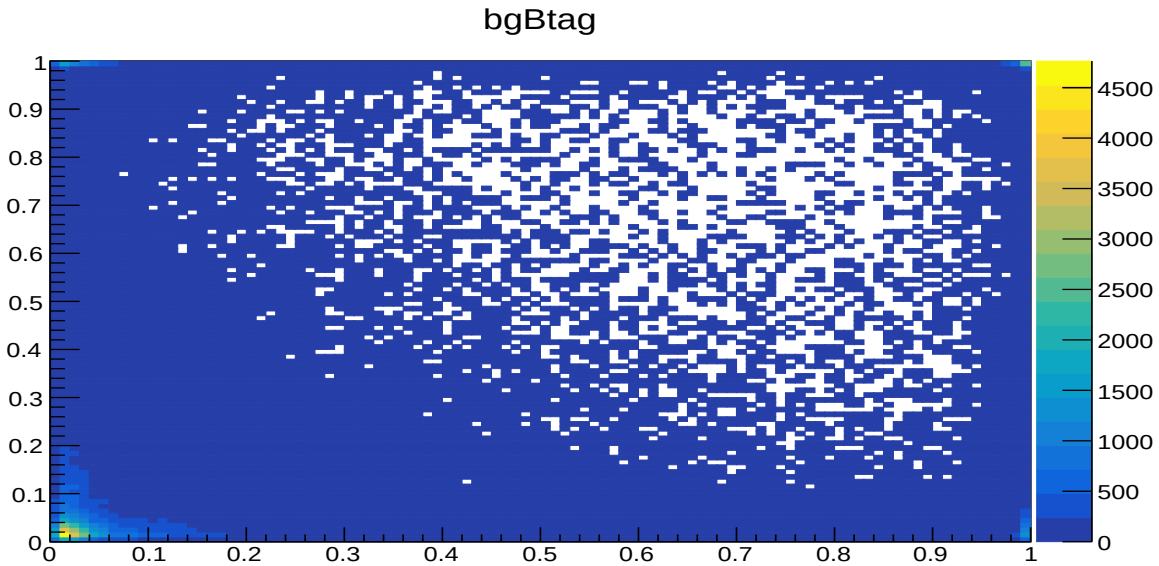




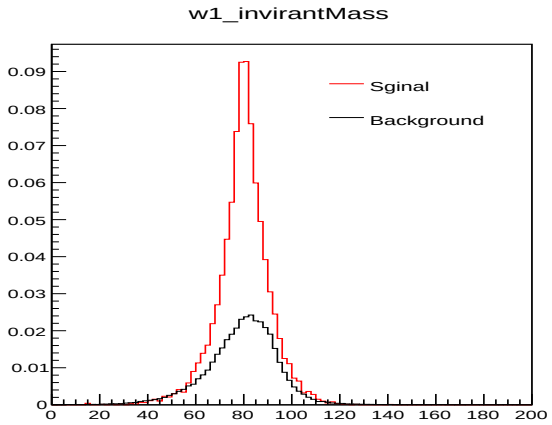
without cut

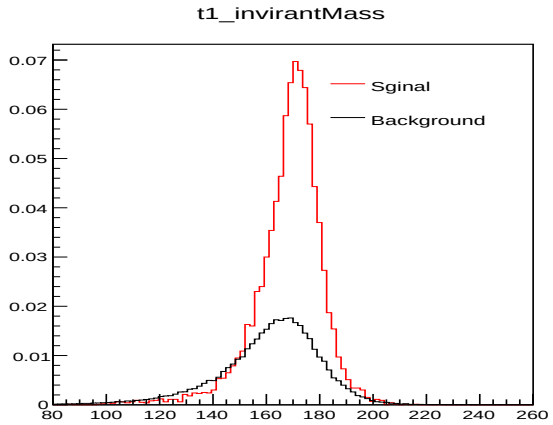
cuts	events_Sign	events_BG	Significance	Purity
none	10000	199797	46.5279	0.500543

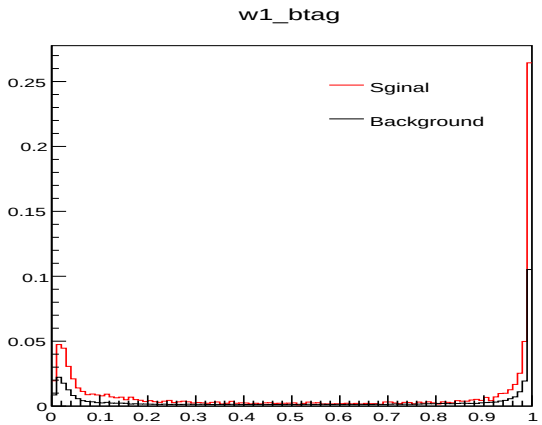

tBtag
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
50
100
150
200
250
300
350


bgBtag
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
500
1000
1500
2000
2500
3000
3500
4000
4500

without cut

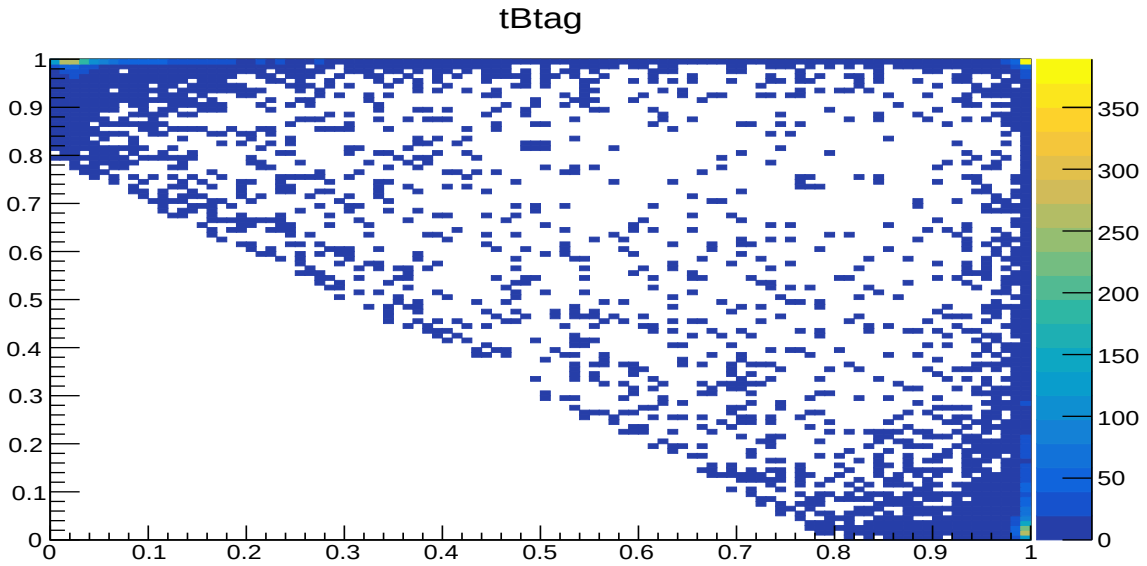


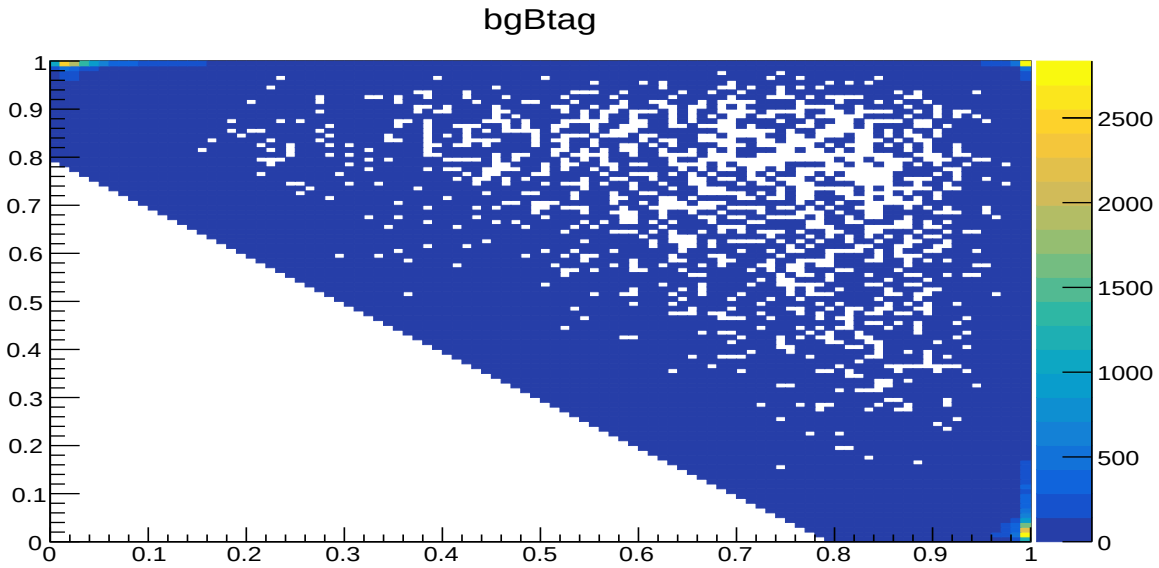




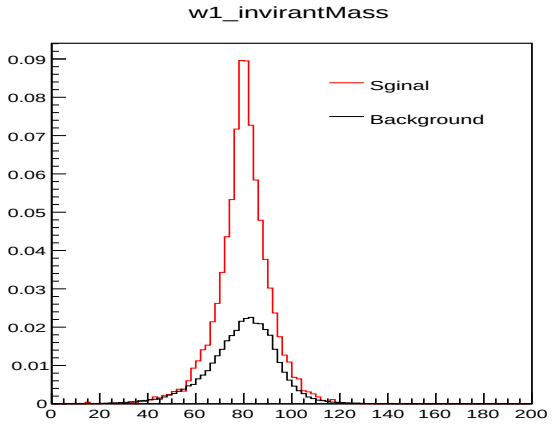
btag1+btag2≥0.8

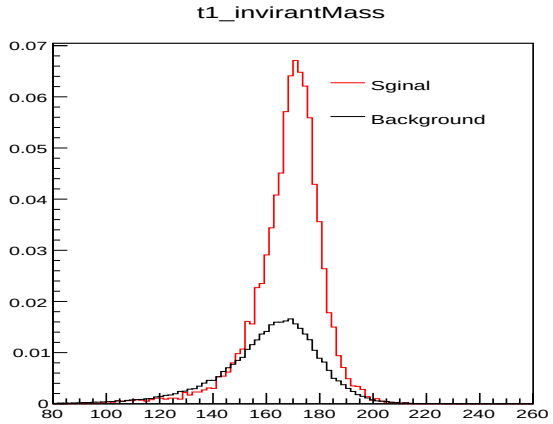
cuts	events_Sign	events_BG	Significance	Purity
btag1+btag2≥0.8	8684	75150	51.2097	0.69823

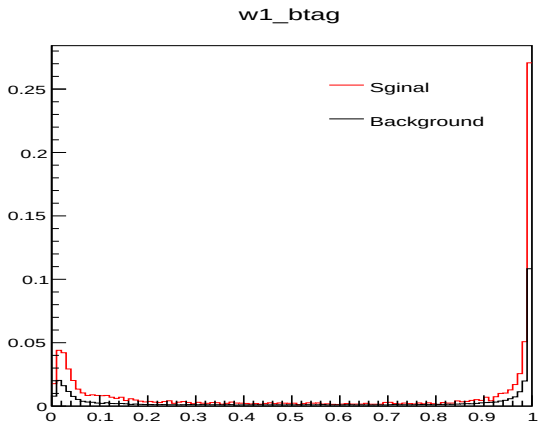




$$\text{btag1} + \text{btag2} \geq 0.8$$

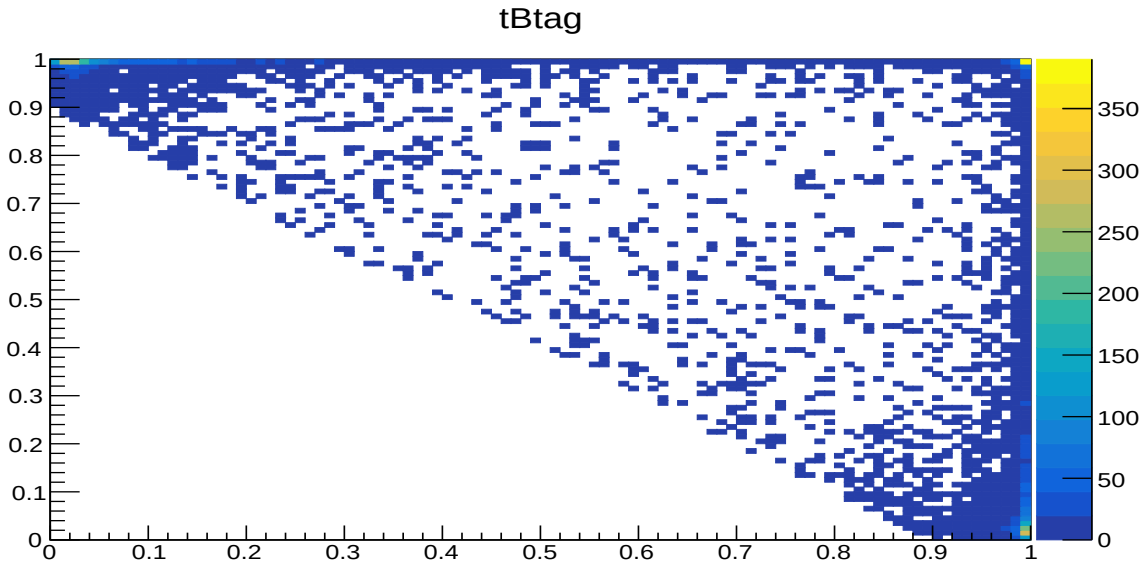


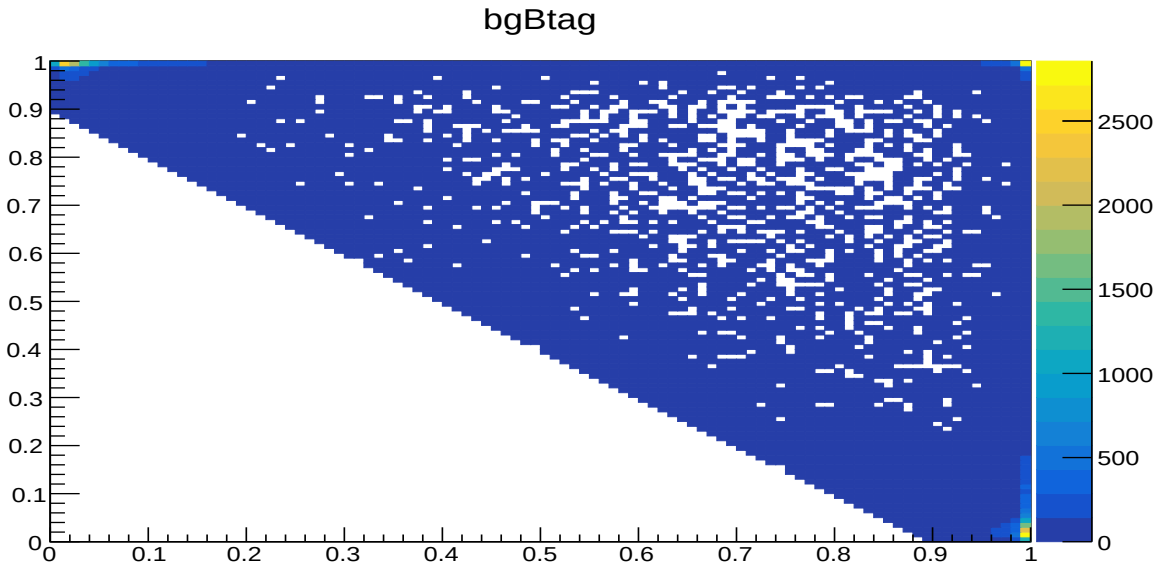




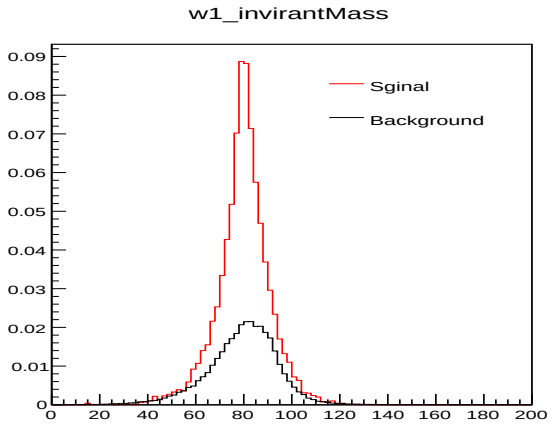
$$btag1 + btag2 \geq 0.9$$

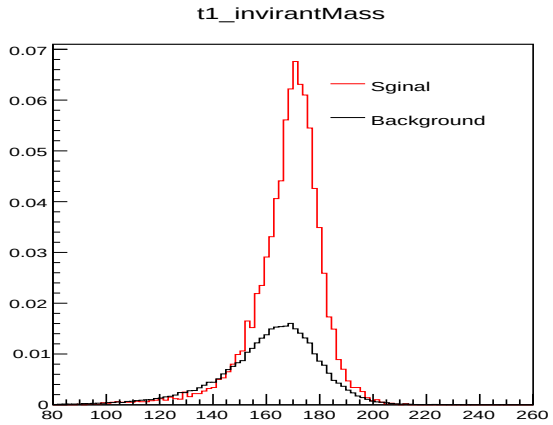
cuts	events_Sign	events_BG	Significance	Purity
$btag1 + btag2 \geq 0.9$	8468	69686	50.9437	0.708722

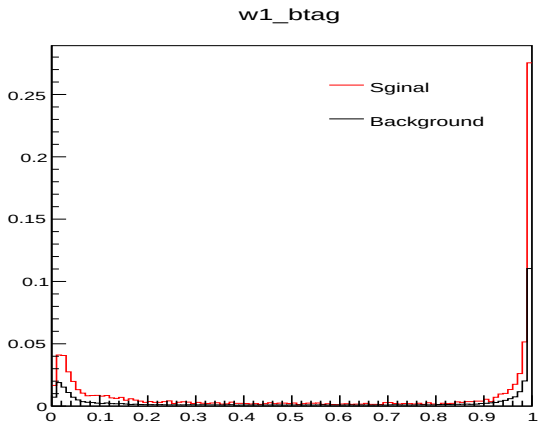




$$btag1 + btag2 \geq 0.9$$

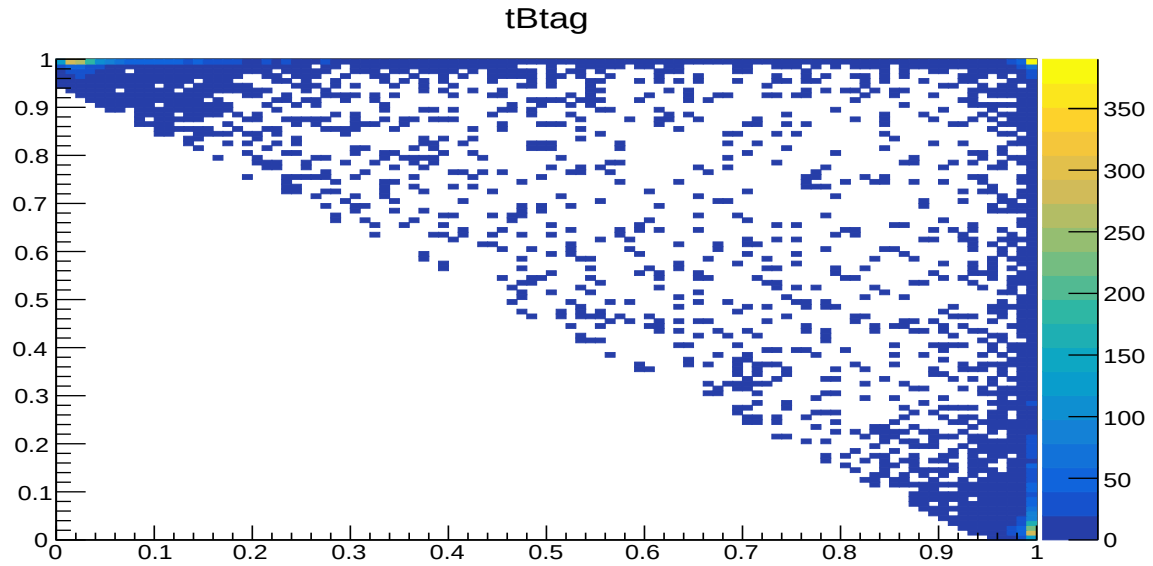


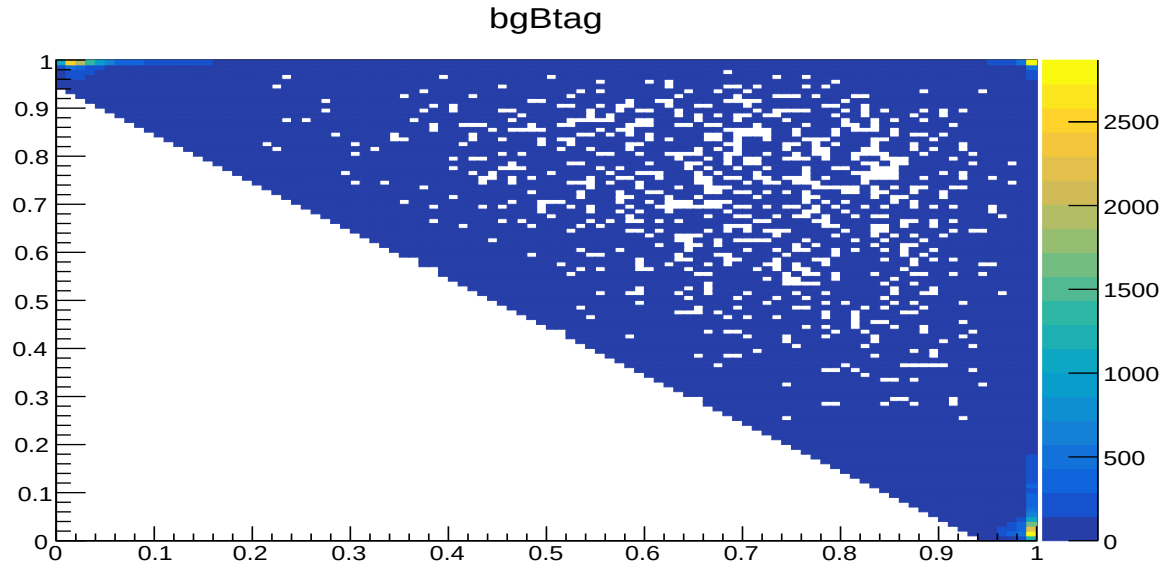




$btag1 + btag2 \geq 95$

cuts	events_Sign	events_BG	Significance	Purity
$btag1 + btag2 \geq 95$	8348	67237	50.7425	0.713141





$$btag1 + btag2 \geq 95$$

The results of 2-dimensions btag cutting:

cuts	events_Sign	events_BG	Significance	Purity
btag1+btag2$\geq$0.8	8684	75150	51.2097	0.69823
$btag1 + btag2 \geq 0.9$	8468	69686	50.9437	0.708722
$btag1 + btag2 \geq 95$	8348	67237	50.7425	0.713141

Summary:

- The energy points are optimized according to the derivatives of parameters;
- The backgrounds still need to be depressed.