Top quark simulations near threshold at future CEPC

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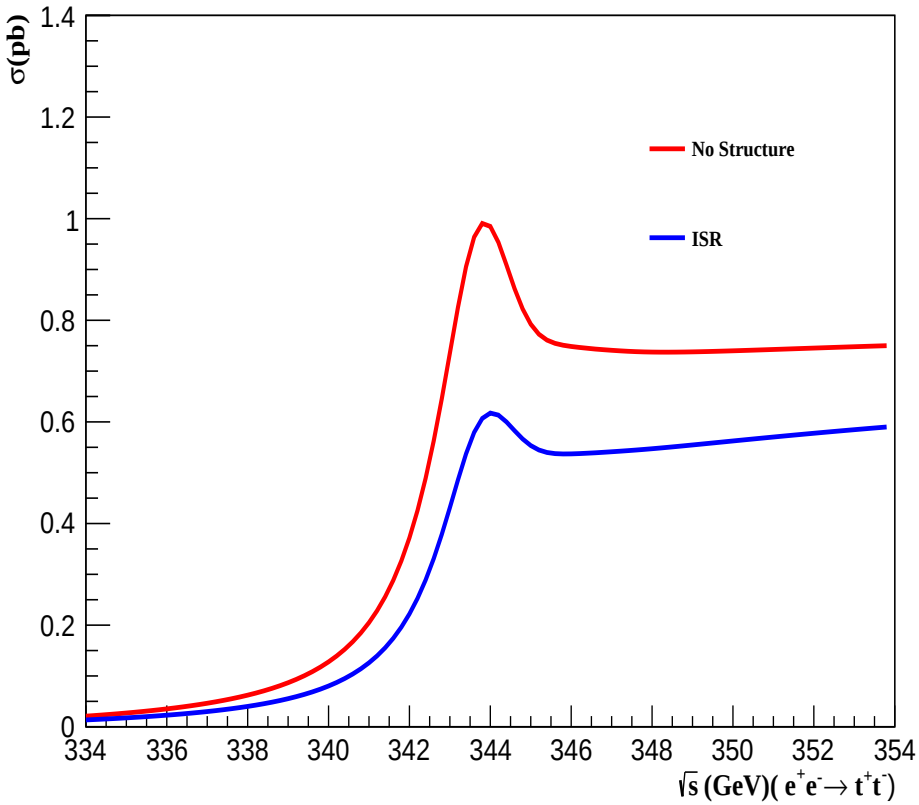
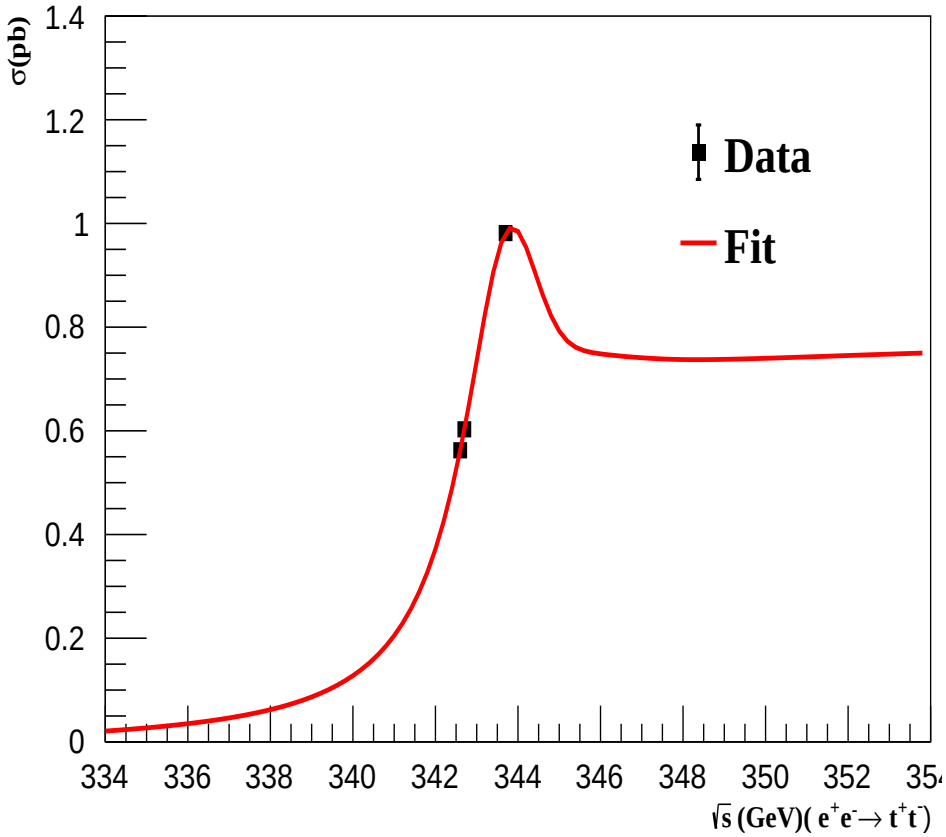
1. Top threshold scan:

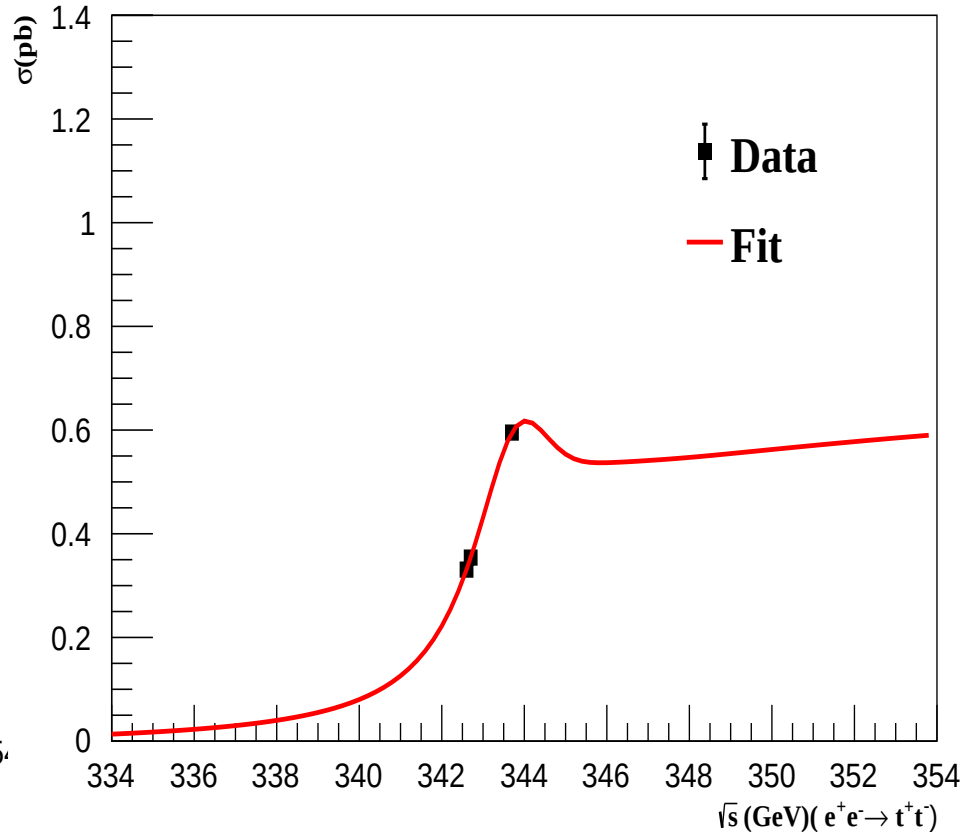
- The fitting is extended to two parameters, top mass and top width.
- The changed point is the ISR, we use the new ISR function here.
- The Gaussian energy spread isn't included here.
- The initial values are taken: m_t=171.5 GeV, Γ_t=1.33GeV, α_s=0.1185.



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



Two-parameter fitting without ISR



Two-parameter fitting with ISR

The energy points, efficiencies, luminosity distributions are taken:

data(GeV)	luminosity(fb^{-1})	efficiency(%)
342.6	33.33	50
342.7	33.33	50
343.7	33.33	50

The final results include both two-parameters fitting and one-parameter fitting:

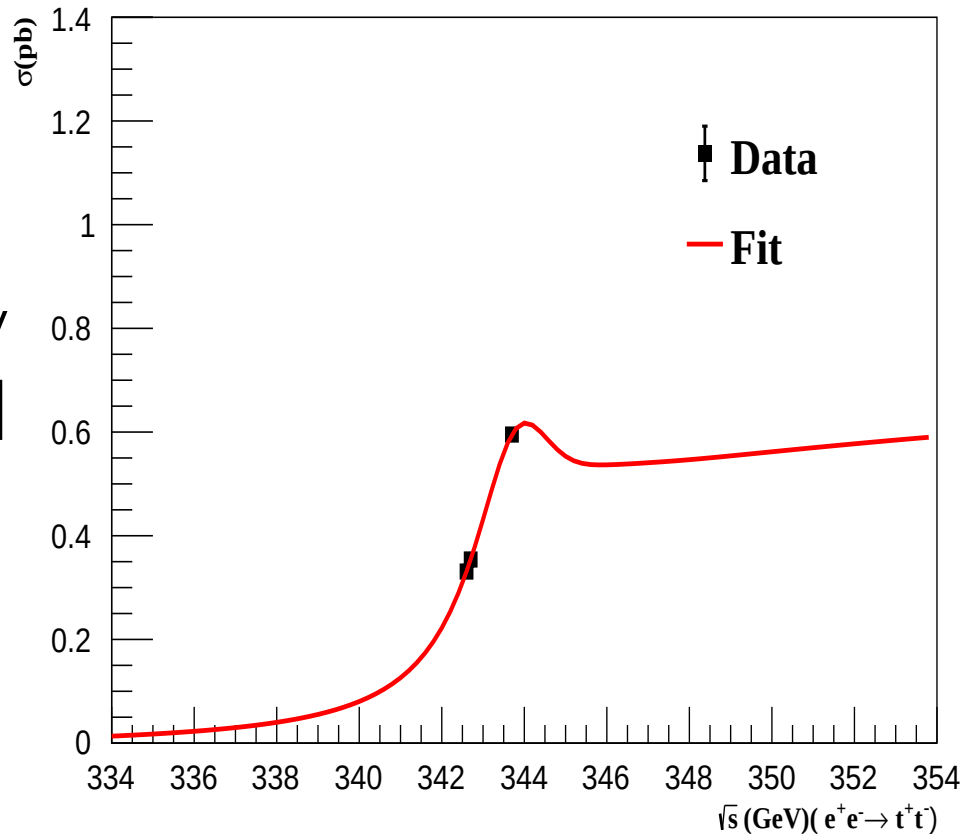
cases	mt	width	δ_{mt}	δ_{width}
without ISR	171.496 GeV	1.33616 GeV	3.63678 MeV	10.7065 MeV
with ISR	171.495 GeV	1.34137 GeV	4.66482 MeV	15.9940 MeV

Two-parameter fitting results.

cases	mt	δ_{mt}
without ISR	171.496 GeV	3.58881 MeV
with ISR	171.495 GeV	4.62915 MeV

One-parameter fitting results.

Replacing the radiator $f(\sqrt{s})$ by $f(\sqrt{s})[1+0.001\times sin\frac{\pi}{10}(\sqrt{s}-334.4)]$



cases	mt	width	δ_{mt}	δ_{width}
with ISR	171.495 GeV	1.34131 GeV	4.66387 MeV	15.9915 MeV

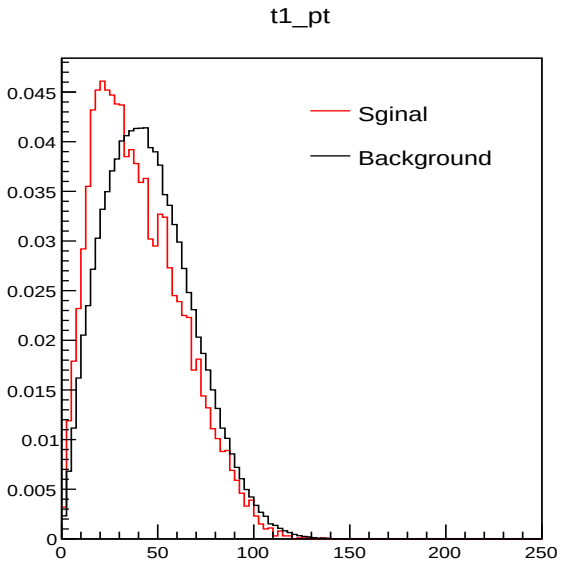
ISR changing.

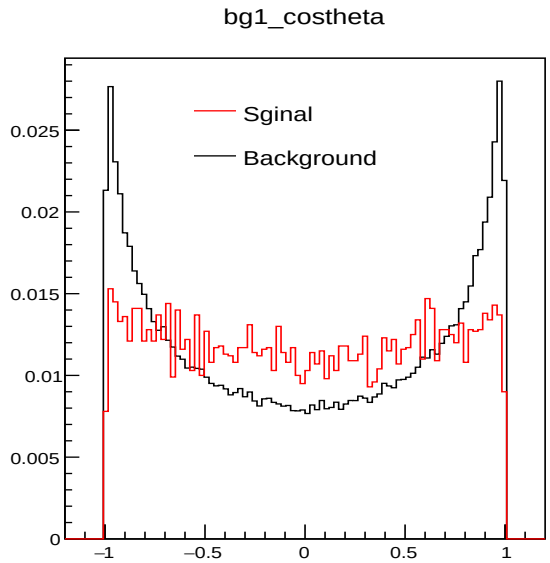
Summary I:
The imapact of top width on mass is few 10 eV, the change results from the uncertainty of ISR cross section(about 0.1 percent) is about few 1 eV.

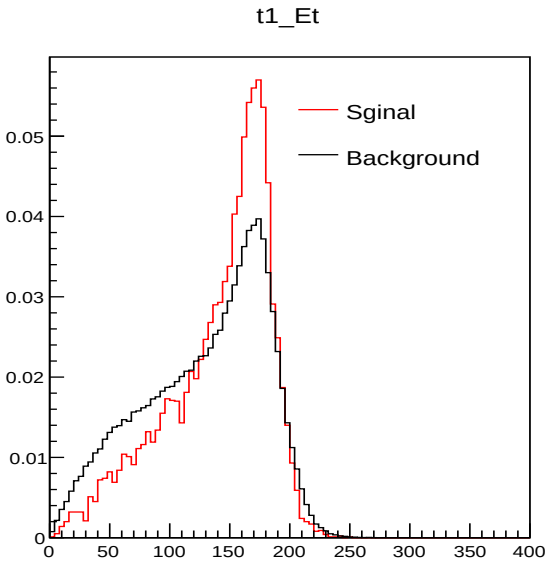
2. Top pair reconstruction

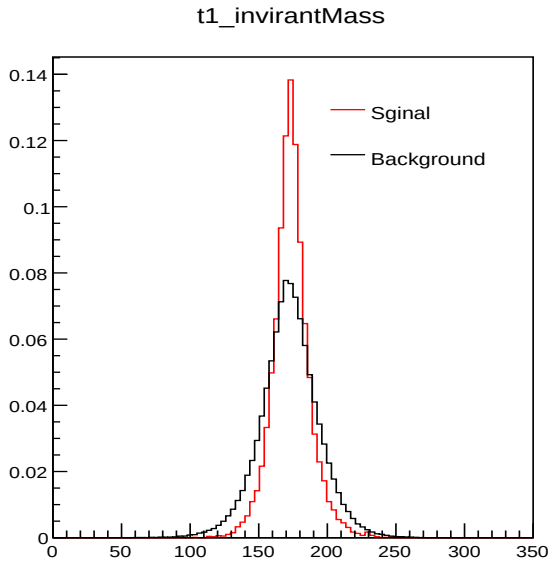
The events are generated by Whizard(by Xin Mo,tree level).

- Kinematic cuts: Pt, Et, $cos\theta$

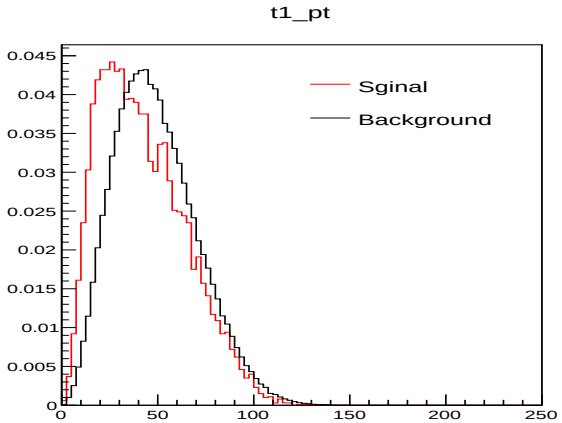


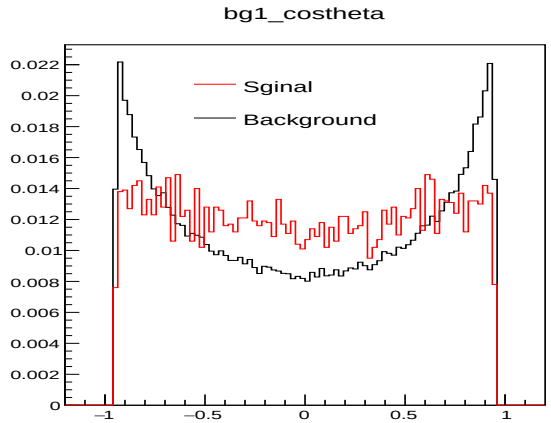


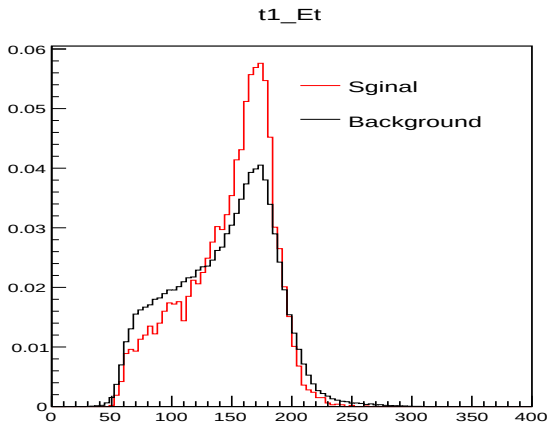


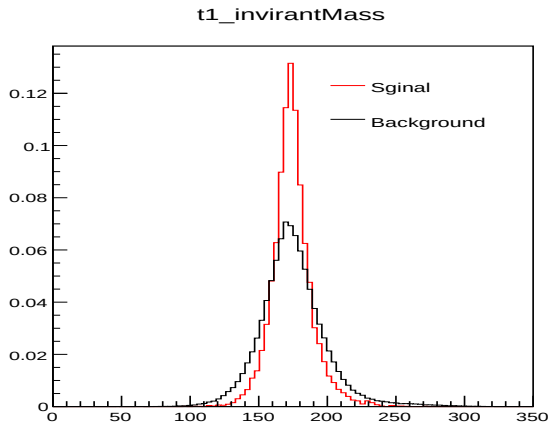


Without any cut.



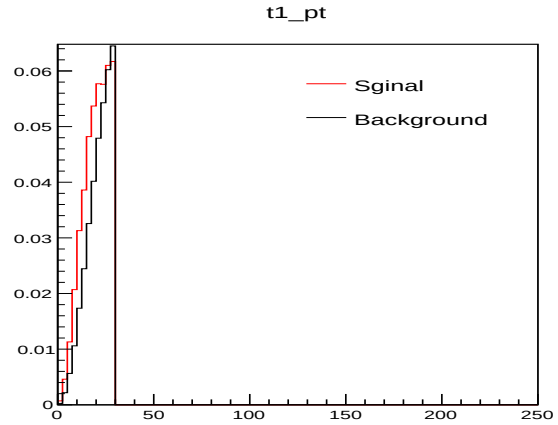


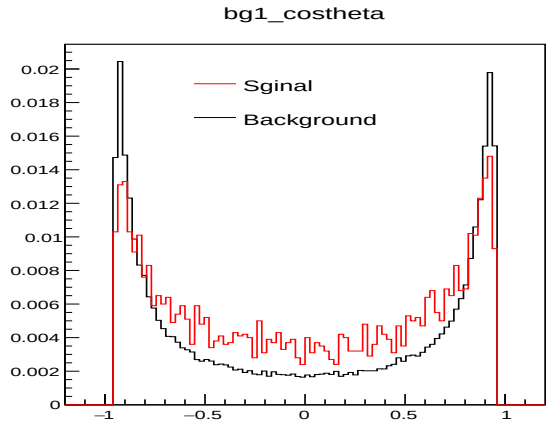


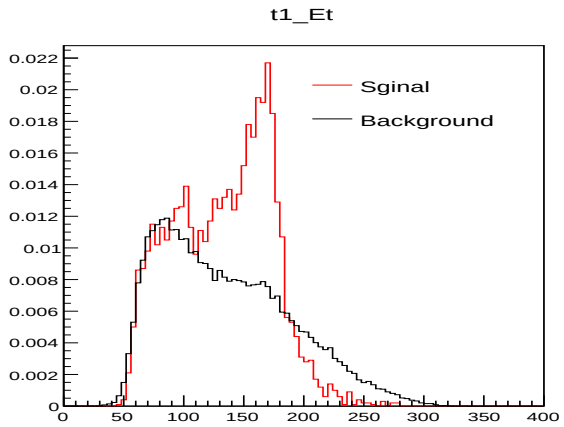


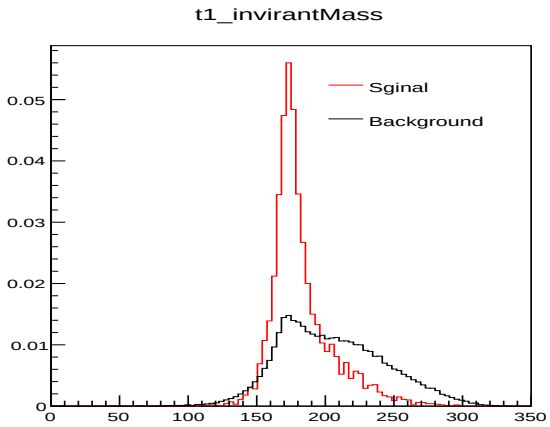
cuts	events_Sign	events_BG	significance	Purity
$\lvert cos\theta \rvert \leq 0.95$	9707	185137	21.9908	0.0498193

cutting cosθ.



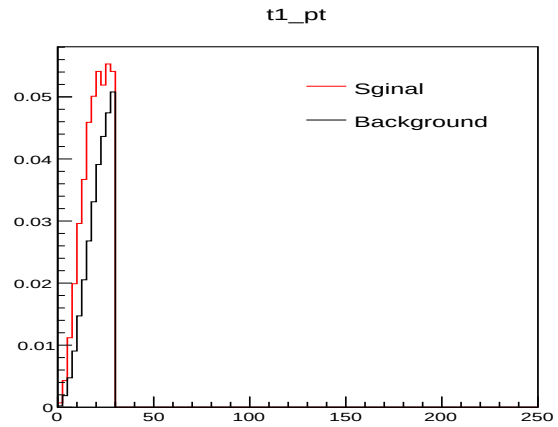


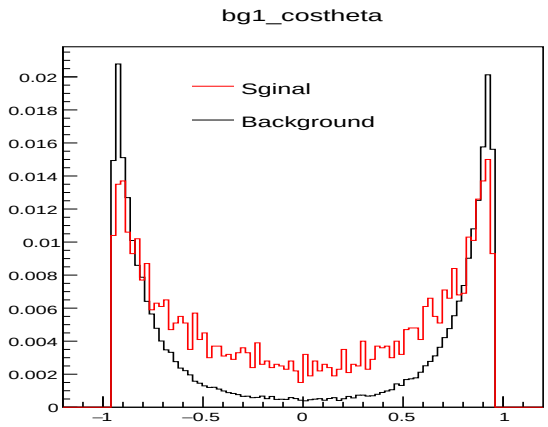


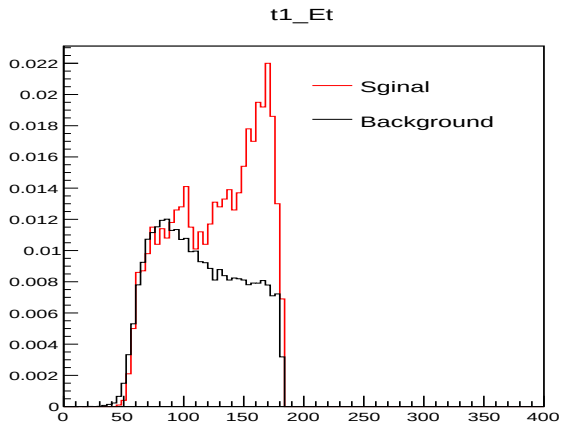


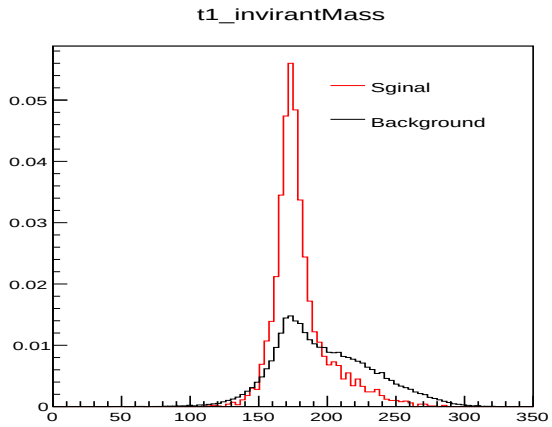
cuts	events_Sign	events_BG	significance	Purity
$\lvert cos\theta \rvert \leq 0.95$, Pt$\leqslant$30	4471	72020	16.1659	0.0584513

cutting cosθ and Pt.









cuts	events_Sign	events_BG	significance	Purity
same, Et$\leqslant$182	4138	58391	16.5482	0.0661773

cutting cosθ, Pt and Et.

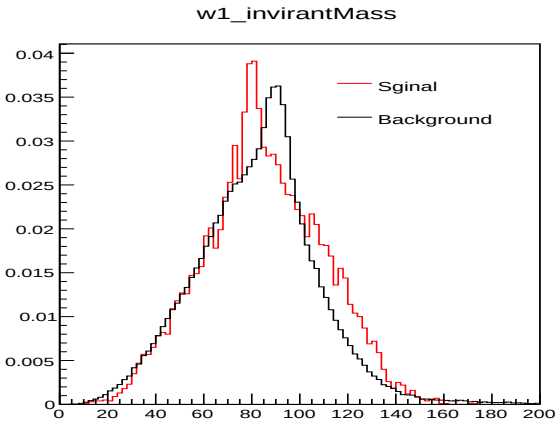
Summary II:

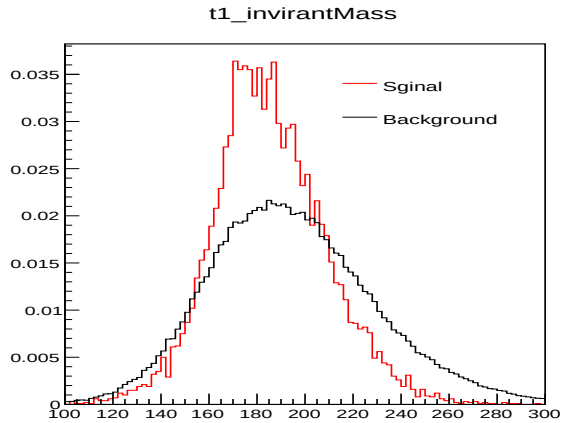
cuts	events_Sign	events_BG	significance	Purity
$\|cos\theta\| \leq 0.95$	9707	185137	21.9908	0.0498193
$\|cos\theta\| \leq 0.95$, Pt$\leqslant$30	4471	72020	16.1659	0.0584513
same, Et$\leqslant$182	4138	58391	16.5482	0.0661773

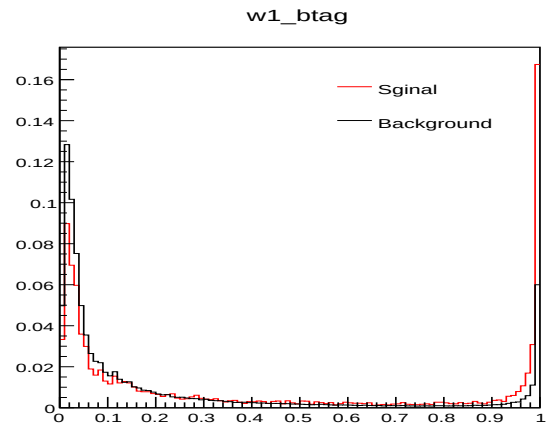
cutting cosθ, Pt and Et.

- Btag cuts

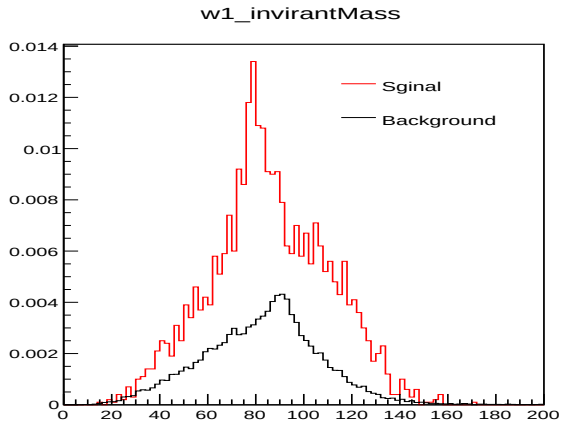
Considering the constrain on medial W pair, as following:

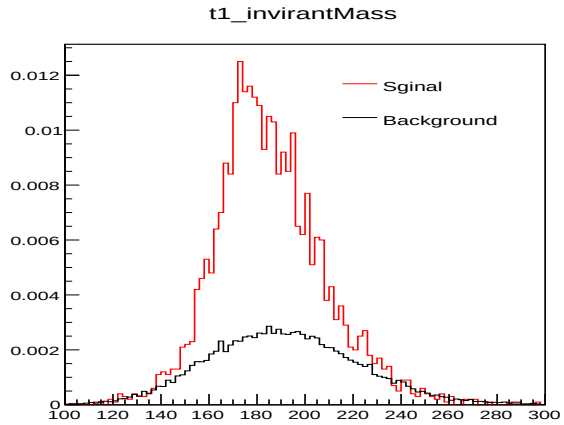


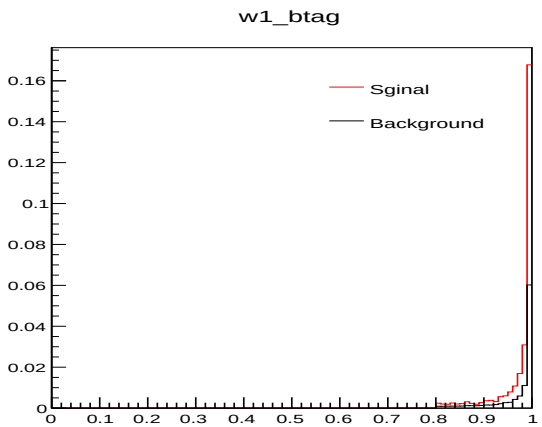




cuts	events_Sign	events_BG	significance	Purity
$\lvert cos\theta \rvert \leq 0.95$	12072	232410	24.4149	0.0493779

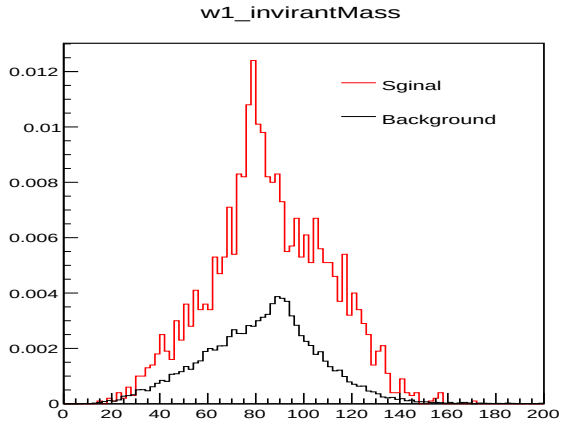


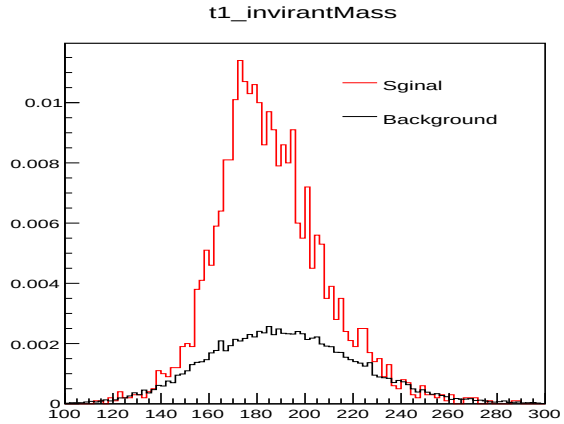


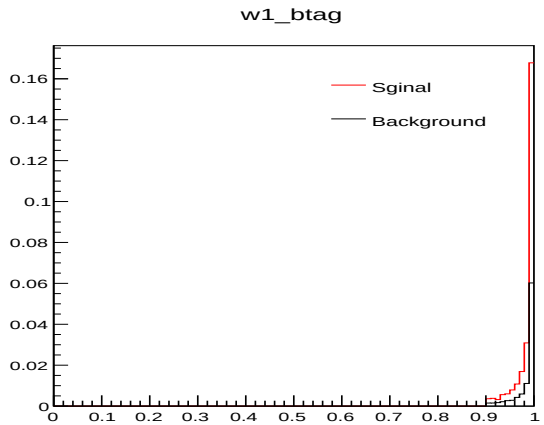


cuts	events_Sign	events_BG	significance	Purity
$\lvert cos\theta \rvert \leq 0.95$,btag$\geq 0.8$	2795	20840	18.1804	0.118257

cutting cosθ, btag.







cuts	events_Sign	events_BG	significance	Purity
$\lvert cos\theta \rvert \leq 0.95$,btag$\geq$0.9	2565	18733	17.5759	0.120434

cutting cosθ, btag.

Summary III:

cuts	events_Sign	events_BG	significance	Purity
$\|cos\theta\|$ $\leq$0.95,btag$\geq$0.8	2795	20840	18.1804	0.118257
$\|cos\theta\|$ $\leq$0.95,btag$\geq$0.9	2565	18733	17.5759	0.120434

cutting cosθ, btag.

Summary:

- The imapact of top width on mass is few 10 eV;
- The impacts on top mass or width from the uncertainty of ISR cross section(about 0.1 percent) is about few 1 eV;
- In order to depress the backgrounds, the current cuts still need to improved.