Hig2inv progress work

Tanyh
2018/12/6

1.Repeat zhenxin's cuts to get the result and compare with my result.✓

2.Add accuracy $\frac{\sqrt{S+B}}{S}$ in table. ✓

3.Change some tight cuts. e.g. ✓

1)the number of photon =0.

2)the number of charged particles < 3.

In order to increase the select effectiveness of signal.

4.Add new cuts to suppress different background. e.g.Doing

1)the total energy of photon.

2)the energy of muon

3)the angle of two muon

4)the total energy of others

5) the energy of Ez

6) costheta and so on.

(Comment from Ryuta)
As I remembered, , , , Manqi also suggests the following points :

* Since the signal selection efficiency of about 40% is a bit low, need to be studied. (<== Off course, this item is partly included in the above list) ✓
* From the sqrt(S+B/S) value, try to optimize the cut conditions so as to increase this value. ✓
* After the requirement of 2 muons, the efficiency would be roughly 90% (<--- this should be calculated exactly), considering that the identification efficiency of about 99%, this cut might drop 10%. This should be checked. ✗

* Maybe it is better to separate the condition of " muon plus>0 , muon-minus>0, charged particle < 3" into 2 cuts, to clearly understand the flow. ✓
* The components of the remain background is not clear for some of background channels, it is better to check explicitly.
In case, using the MC truth information would be better. ✗

ZhenXing's result:

Table 2. Efficiencies of signal and background in the model-independent analysis

	$Z(\mu^+\mu^-)H$	ZZ	WW	ZZ or WW	single Z	$Z(2f)$	$\gamma\gamma$
total generated	35247	5347053	44180832	17801222	7809747	418595861	161925000
$N_{\mu^+} \geqslant 1$, $N_{\mu^-} \geqslant 1$	95.7%	11.95%	0.65%	3.92%	9.75%	1.64%	17.31%
120 GeV $< M_{\text{recoil}} <$ 150 GeV	93.2%	1.71%	0.23%	0.70%	1.93%	0.17%	3.06%
80 GeV $< M_{\mu^+\mu^-} <$ 100 GeV	85.5%	0.68%	0.06%	0.22%	0.22%	0.10%	0.11%
$p_{T\mu^+\mu^-} >$ 20 GeV	80.2%	0.57%	0.06%	0.17%	0.16%	0.02%	0.04%
$\Delta\phi < 175°$	77.8%	0.51%	0.05%	0.17%	0.15%	0.01%	0.04%
BDT cut	63.0%	0.25%	0.01%	0.05%	0.06%	0.01%	0.01%
fit window	62.8%	0.25%	0.01%	0.05%	0.05%	0.01%	0.01%

Figure 10: This is chenzhenxing's result.

My repetition:

93.6%,ManQi expectation ~99% .how to check or modify this value ?

Table 13: Yields for backgrounds and signals at the CEPC(Assume BR($H \rightarrow inv.$)=50%)

Process	ffH_inv	single_w	ZZ	2f	single_z	WW	zorw	zzorww	total_bkg	$\frac{\sqrt{S+B}}{S}$
Total generate	509150	17426250	5704399	444816800	8955800	44763316	1247400	18250750	540438939	
$N_{\mu^+} \geq 1, N_{\mu^-} \geq 1$	15842	1569	647631	7914830	586912	428541	0	838355	10417838	20.390 %
$120GeV/c^2 < M_{Recoil} < 150GeV/c^2$	15001	11	70489	579337	87869	109664	0	99827	947197	6.539 %
$80GeV/c^2 < M_{\mu^+\mu^-} < 100GeV/c^2$	13858	0	25816	378751	12267	25818	0	34521	477173	5.057 %
$20GeV/c < P_t^{\mu^+\mu^-}$	12588	0	19240	63882	8659	22140	0	24584	138505	3.088 %
$\Delta\phi < 175°$	12127	0	18129	47513	8234	20723	0	23913	118512	2.980 %
Select effectiveness	71.7%	0	0.32%	0.01%	0.09%	0.05%	0	0.13%	0.02%	

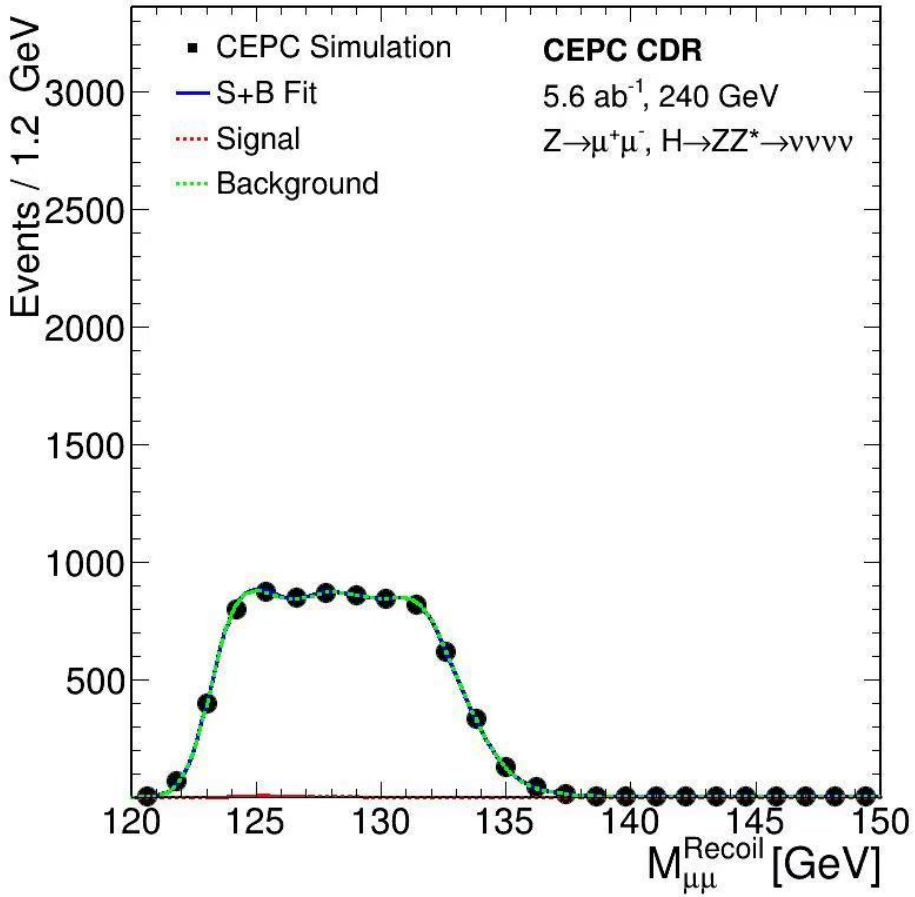
Add some cuts or change cuts region to decrease $\frac{\sqrt{S+B}}{S}$

Table 9: Yields for backgrounds and signals at the CEPC(Assume BR($H \rightarrow inv.$)=50%)

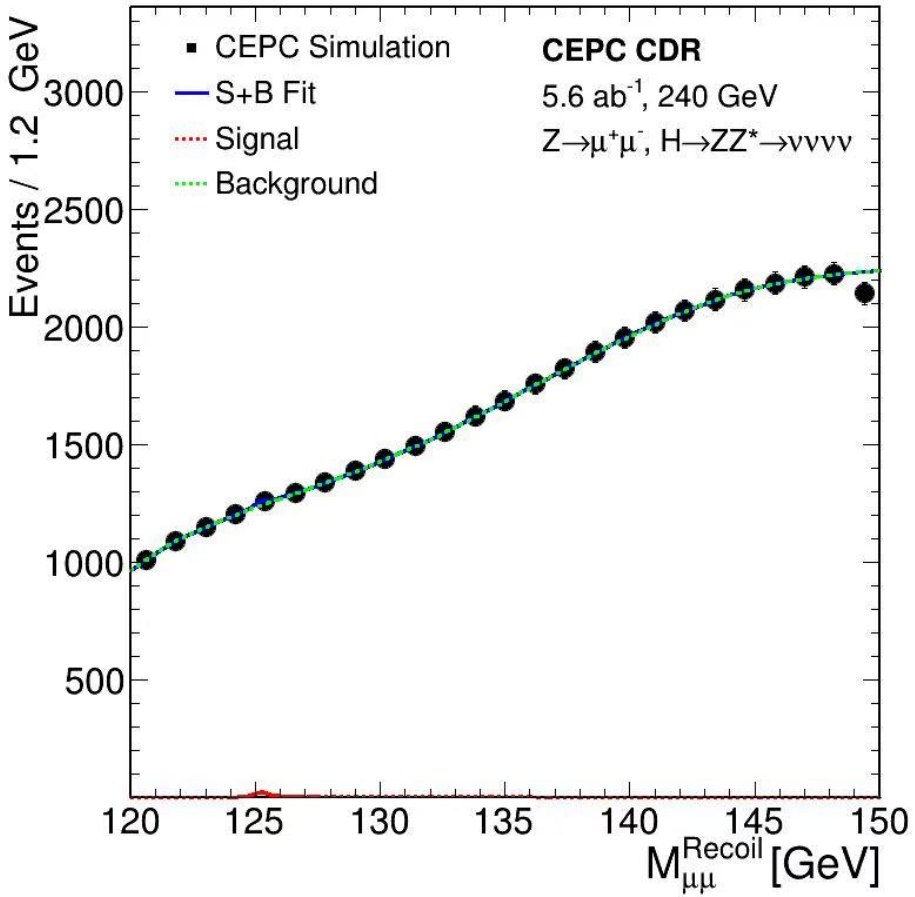
Process	ffH_inv	single_w	ZZ	2f	single_z	WW	zorw	zzorww	total_bkg	$\frac{\sqrt{S+B}}{S}$
Total generate	509150	17426250	5704399	444816800	8955800	44763316	1247400	18250750	540438939	
$N_{\mu^+} \geq 1, N_{\mu^-} \geq 1$	15842	1569	647631	7914830	586912	428541	0	838355	10417838	20.390 %
$120GeV < M_{Recoil} < 150GeV$	15001	11	70489	579337	87869	109664	0	99827	947197	6.539 %
$80GeV < M_{\mu^+\mu^-} < 100GeV$	13858	0	25816	378751	12267	25818	0	34521	477173	5.057 %
$20GeV < P_t^{\mu^+\mu^-}$	12588	0	19240	63882	8659	22140	0	24584	138505	3.088 %
$\Delta\phi < 175°$	12127	0	18129	47513	8234	20723	0	23913	118512	2.980 %
$100GeV < VisibleEnergy < 120GeV$	10867	0	1245	24286	2333	9554	0	12984	50402	2.278 %
$VisibleEnergy < 108GeV$	10817	0	940	23478	2175	8586	0	11704	46883	2.221 %
$N_\gamma \leq 1$	10492	0	782	13563	1984	8103	0	10593	35025	2.033 %
$P_t^{\mu^+\mu^-} < 55GeV$	10347	0	752	13250	1893	7486	0	9804	33185	2.016 %
$\lvert P_z^{\mu^+\mu^-} \rvert < 50GeV$	10305	0	727	12704	1845	7141	0	9428	31845	1.992 %
$84GeV < M_{\mu^+\mu^-} < 96GeV$	9859	0	671	11850	1753	5125	0	6602	26001	1.921 %
$E_\gamma < 6GeV$	9805	0	540	170	1608	4706	0	5629	12653	1.528 %

To suppress two fermions background.

My result: UL(%)=0.74%(without BDT)



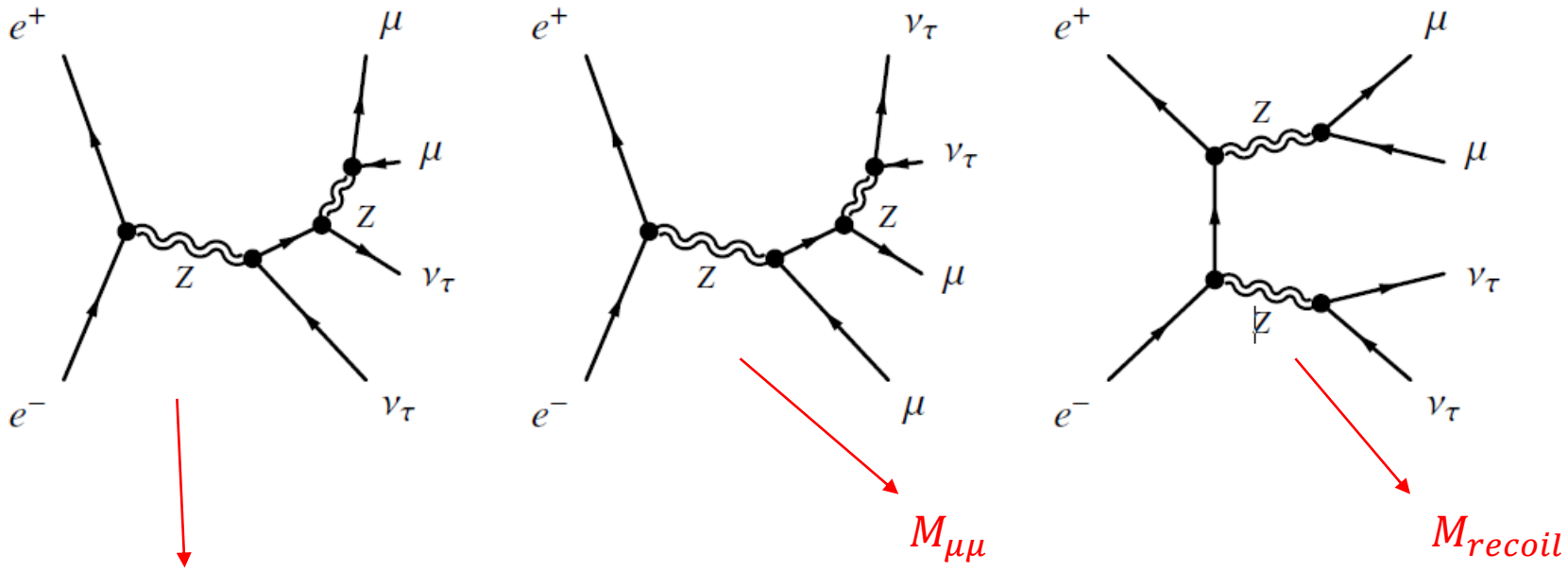
Mo Xin result: UL(%)= 0.60%(with BDT)



From Zhangkaili.

Left background:

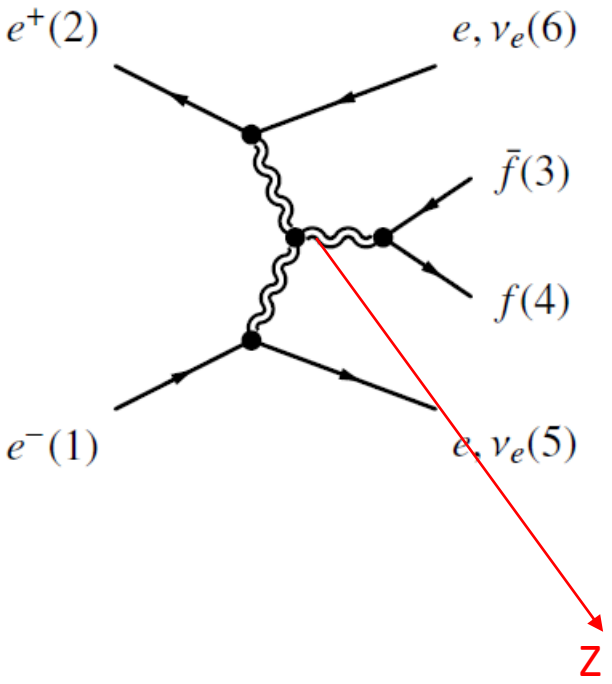
6.14 zz_l0mumu (Left 540)



How to exclude?

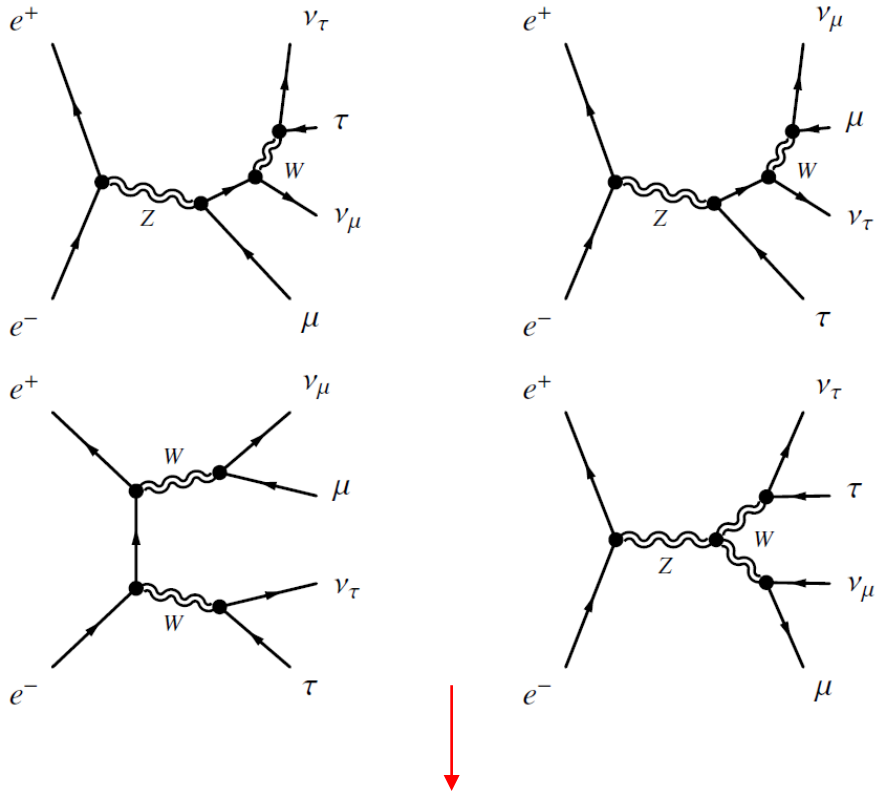
I don’t remember clearly. Maybe Manqi think this kind background can’t be excluded unless we use Mrecoil mass.

Single Z (Left 1608)



The same to zz background.

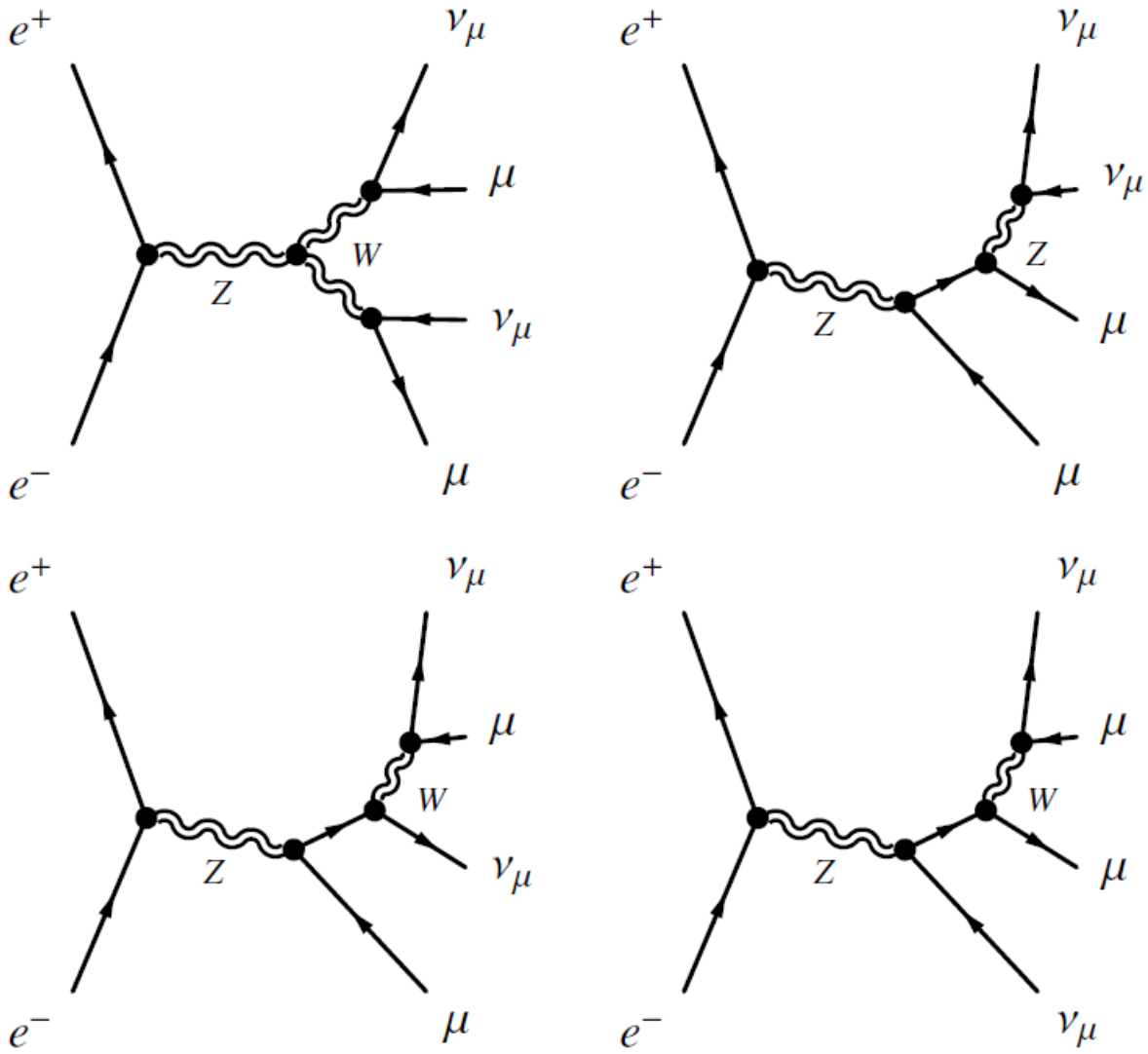
WW (Left 4706:main(ww_l0ll)



I think this background can be excluded.

How to exclude? E_μ^{min}? Or others? I don't know.

ZZorWW: (Left 5629:main zzorww_l0mumu)



Next Plan

New cuts?or other?