H->WW Analysis*

in CEPC

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Contents

1 Introduction

Target:

1 Measurement of Br(H->WW*).

2 Measurement of width of Higgs.

3 Test the performance of CEPC detector.

Current:

1 Almost completed analysis of H->WW*->llvv channel(*Depend on the performance of isolated lepton algorithm*).

2 Start analysis of H->WW*->lvqq channel (*Depend on the performance of isolated lepton algorithm and jet energy resolution*).

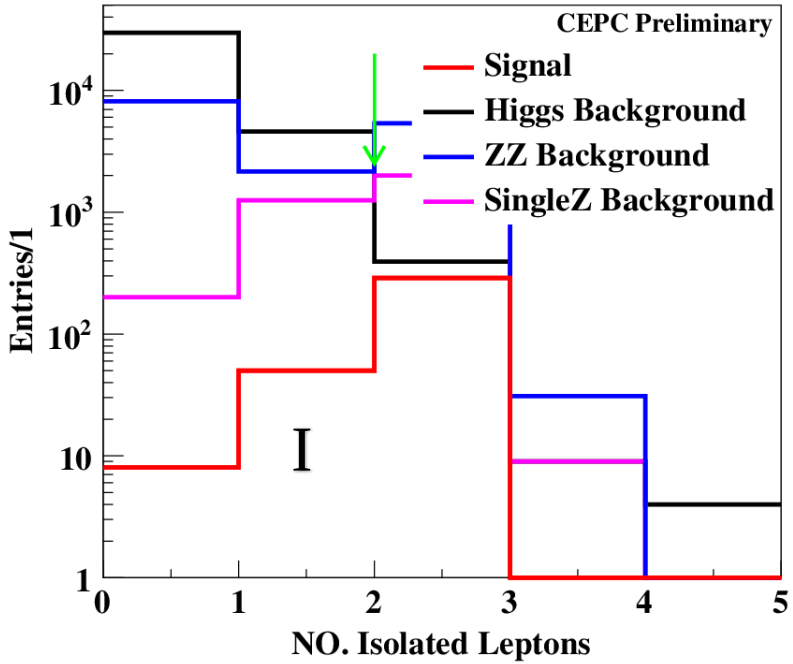
2 Monte Carlo Sample

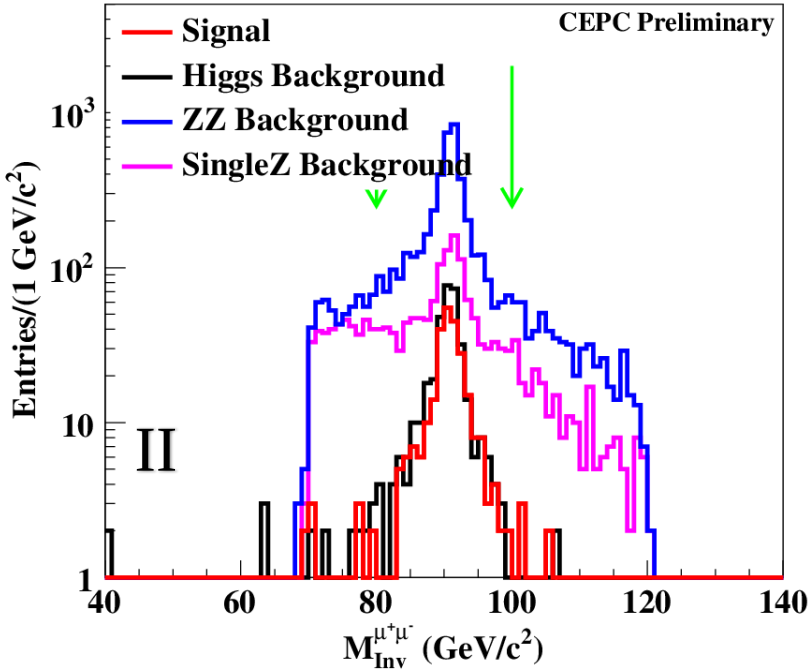
All samples are full simulated by CEPC_v1 and reconstructed by Arbor_KD, and normalized to $5ab^{-1}$.

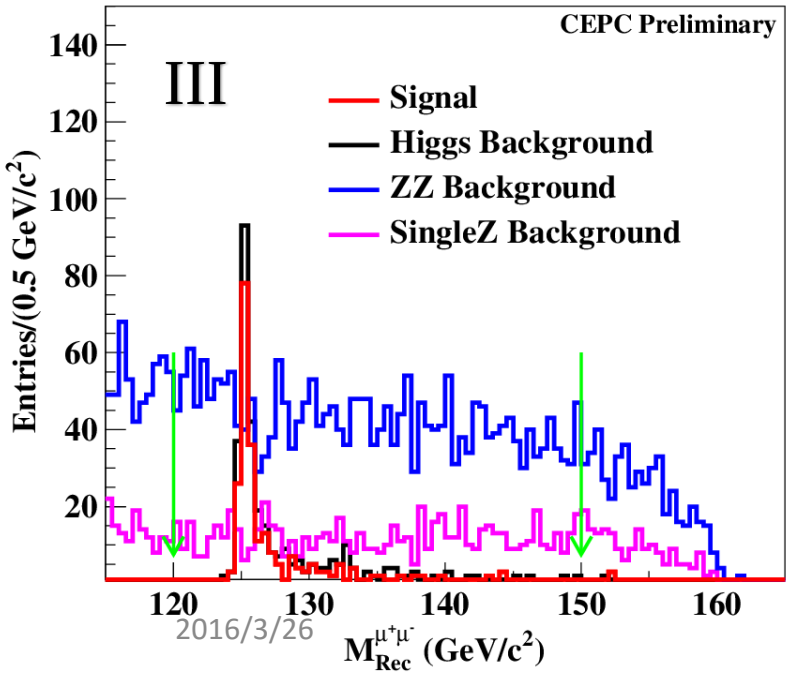
Main background(ZZ and Single Z background) have been pre-selected in MC Truth level(*$E_l > 5GeV$; $70GeV < M_{Inv}^{\mu^+\mu^-} < 120GeV$; $110GeV < M_{Rec}^{\mu^+\mu^-} < 160GeV$*).

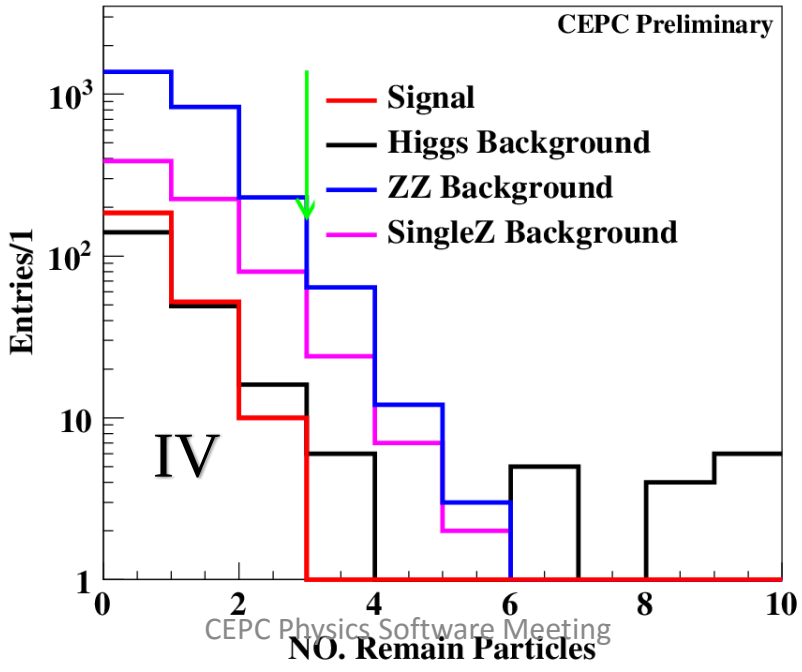
3 H->WW*->lvlv analysis

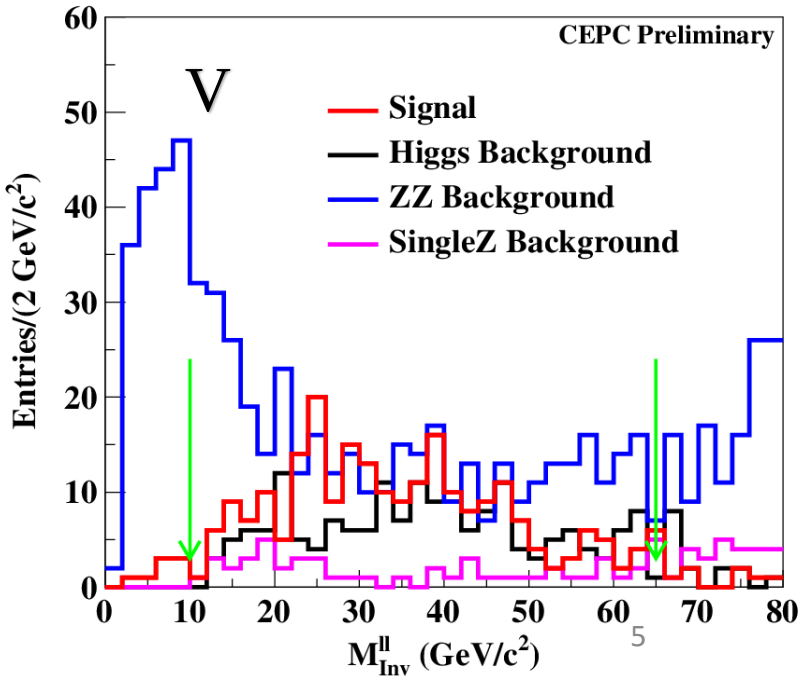
NIsoLep = 2,Nzpole = 2
$80GeV < Mass_{Inv}^{\mu+\mu-} < 100GeV$
$120GeV < Mass_{Rec}^{\mu+\mu-} < 150GeV$
No. Remain Particle < 3
$10GeV < Mass_{Inv}^{l+l-} < 65GeV$



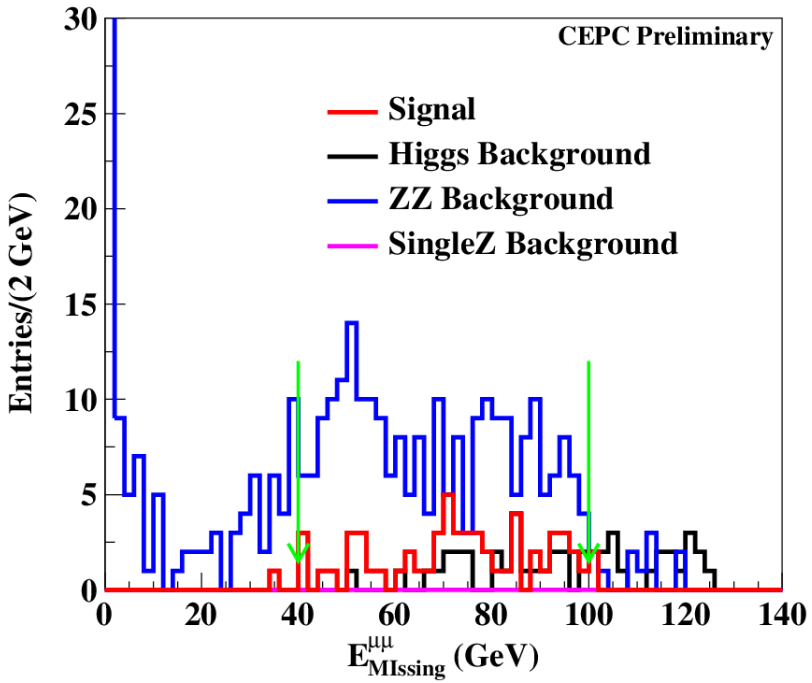


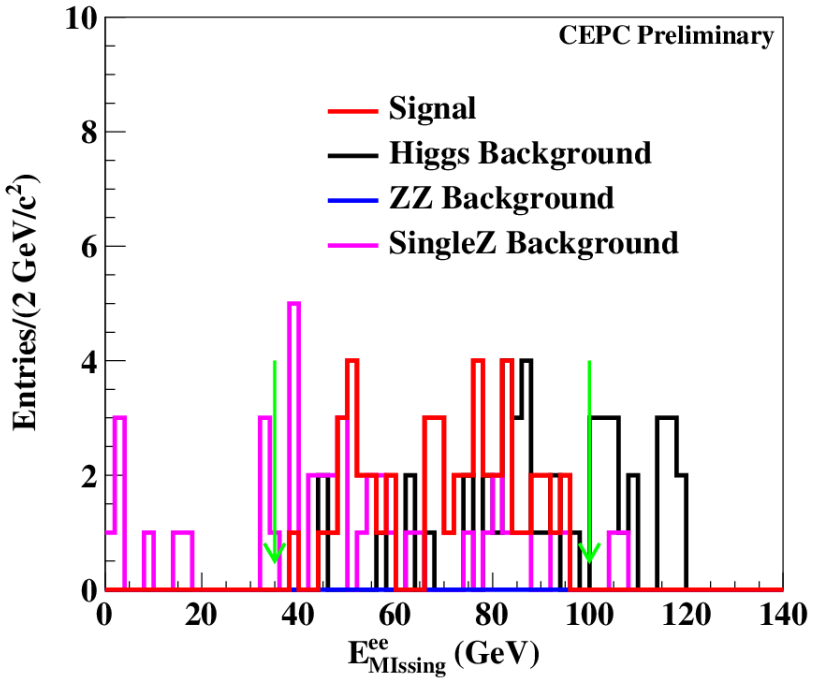


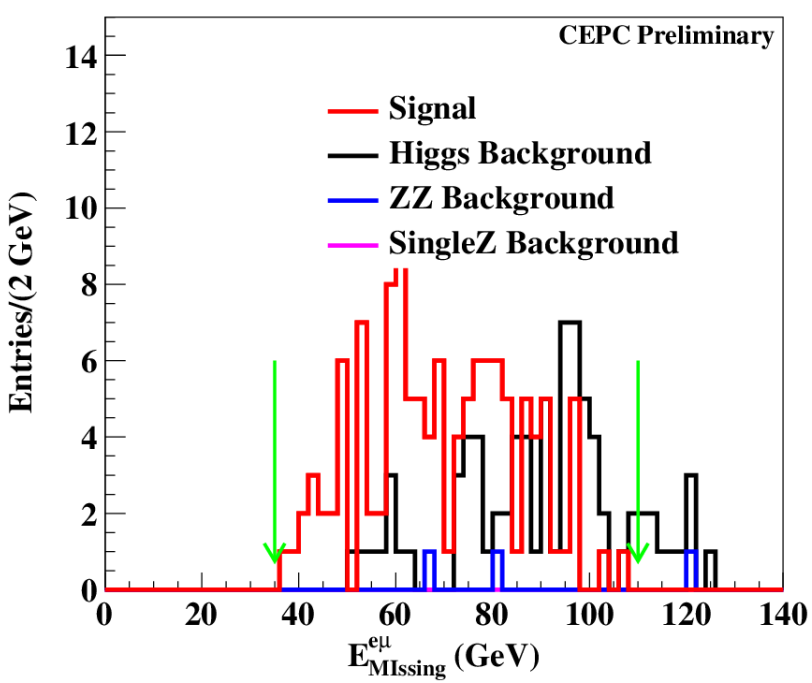




3 H->WW*->lvlv analysis







$40GeV < E_{Missing} < 100GeV$

$35GeV < E_{Missing} < 100GeV$

$35GeV < E_{Missing} < 110GeV$

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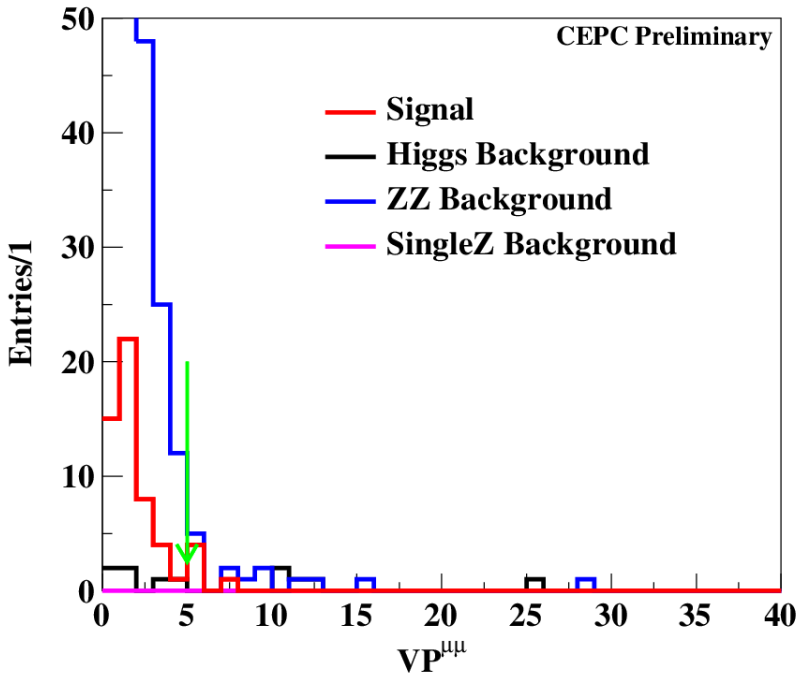
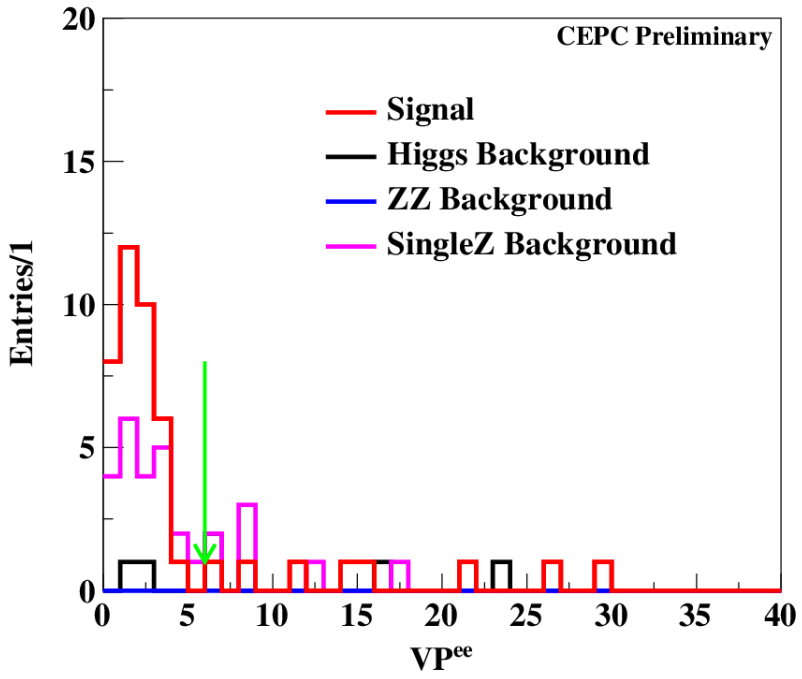
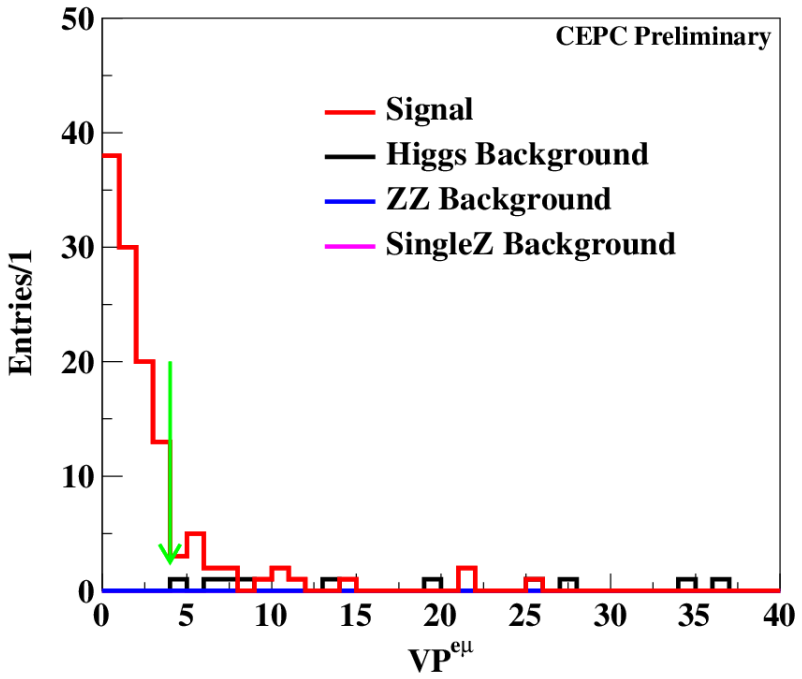
3 H->WW*->lvlv analysis



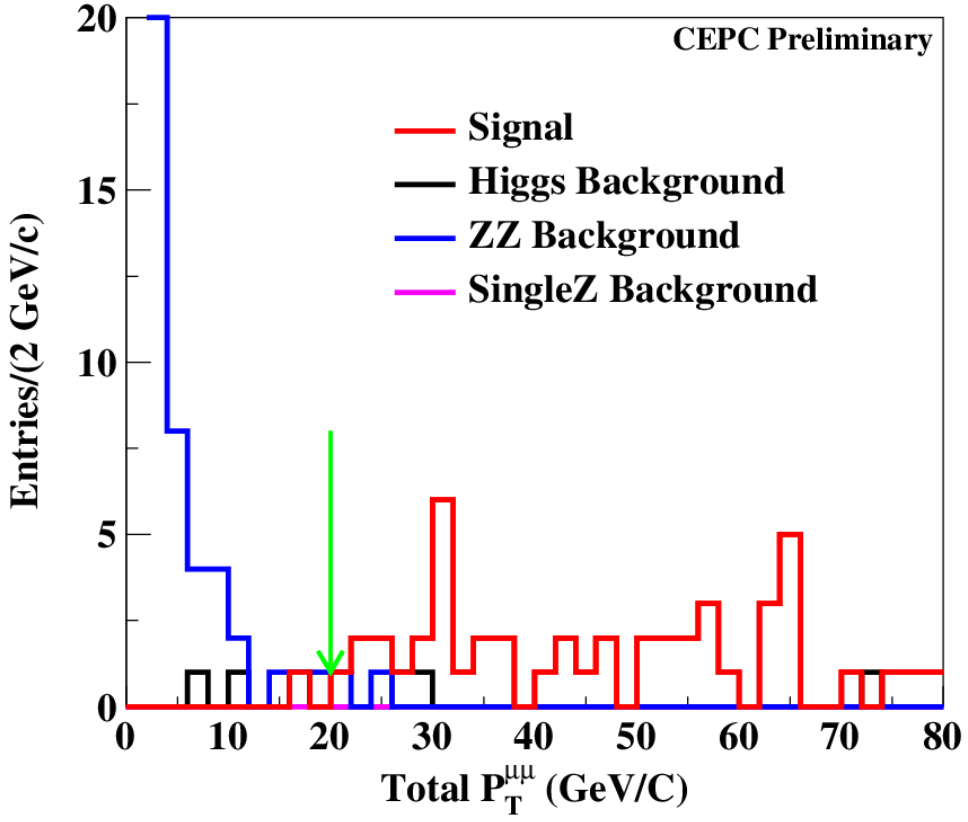


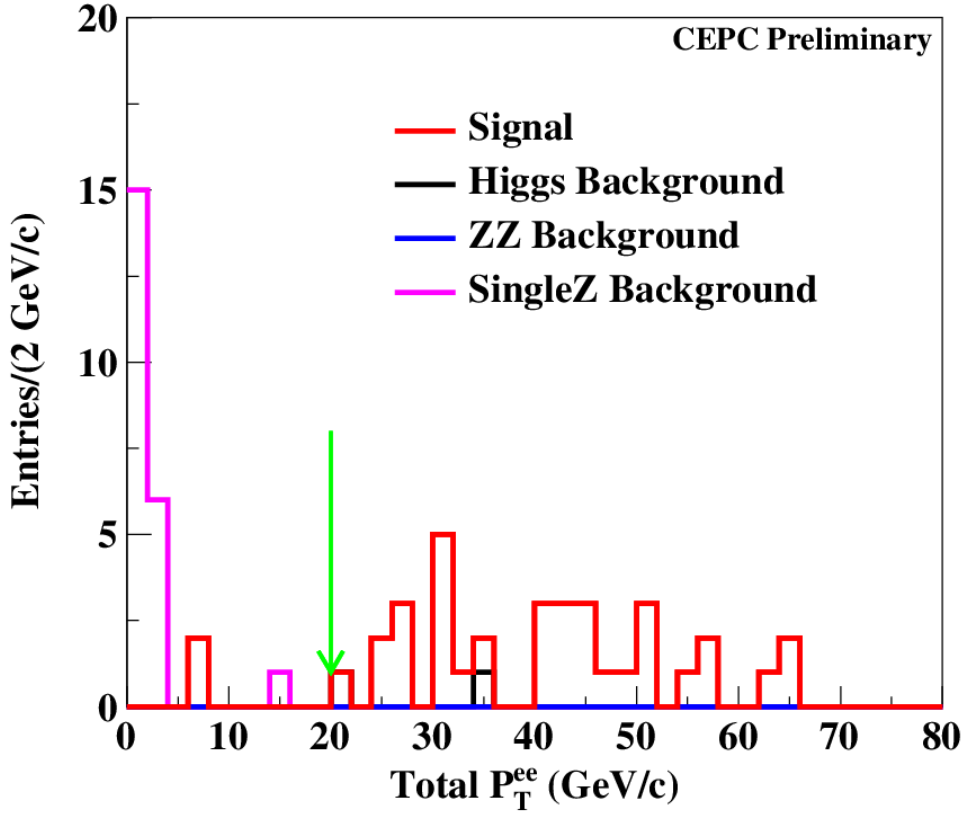


$\sqrt{(D0^2/sigD0^2 + Z0^2/sigZ0^2)} < 5$ $\sqrt{(D0^2/sigD0^2 + Z0^2/sigZ0^2)} < 6$ $\sqrt{(D0^2/sigD0^2 + Z0^2/sigZ0^2)} < 4$

VII

3 H->WW->lvlv analysis*





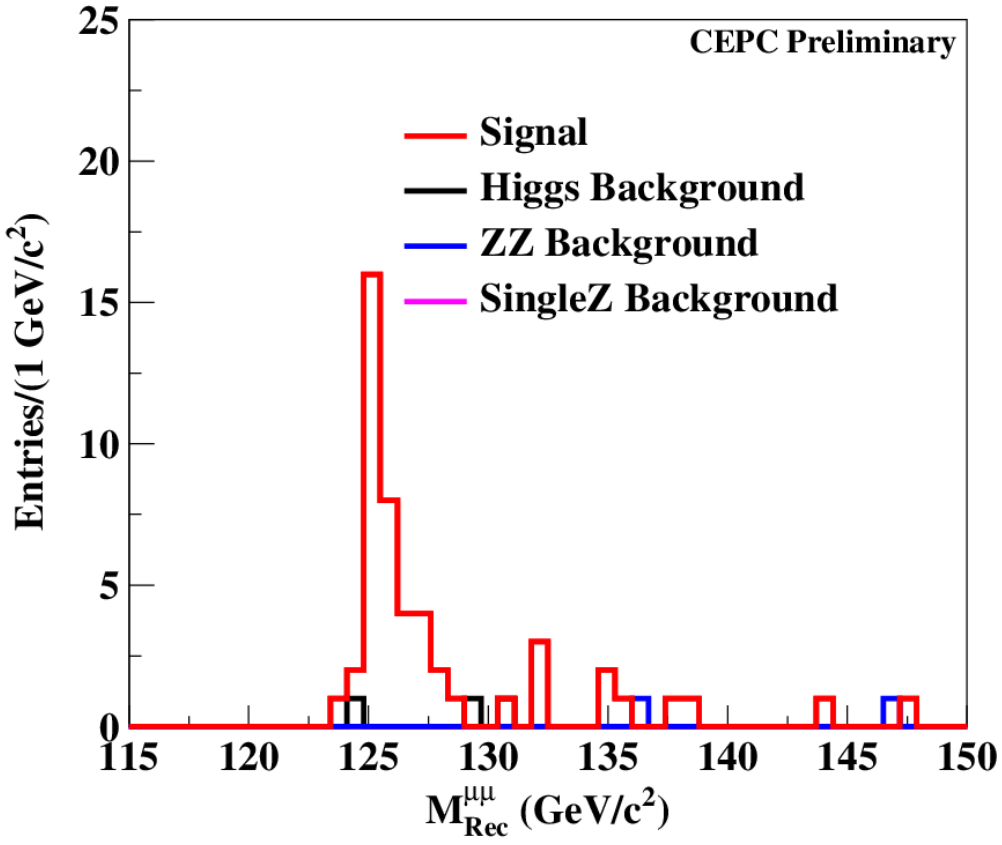
Total Pt > 20

VIII

3 H->WW*->lvlv analysis

Category	Signal	ZH	ZZ	Single Z
Total	348	34624	5499688	7788916
$N_{ZPole} = 2; N_{Isolep} = 2; l = \mu$	77	129	5309	0
80 GeV $< M_{Inv}^{\mu^+\mu^-} <$ 100 GeV	73	124	4143	0
120 GeV $< M_{Rec}^{\mu^+\mu^-} <$ 150 GeV	66	118	2548	0
$N_{Remain} < 3$	66	56	2442	0
10 GeV $< M_{Inv}^{\mu^+\mu^-} <$ 65 GeV	58	46	411	0
40 GeV $< E_{Missing} <$ 100 GeV	55	26	231	0
$\sqrt{(\frac{D0}{sigD0})^2 + (\frac{Z0}{sigZ0})^2} < 5$	54	7	226	0
Total $P_T >$ 20 GeV	52	3	3	0

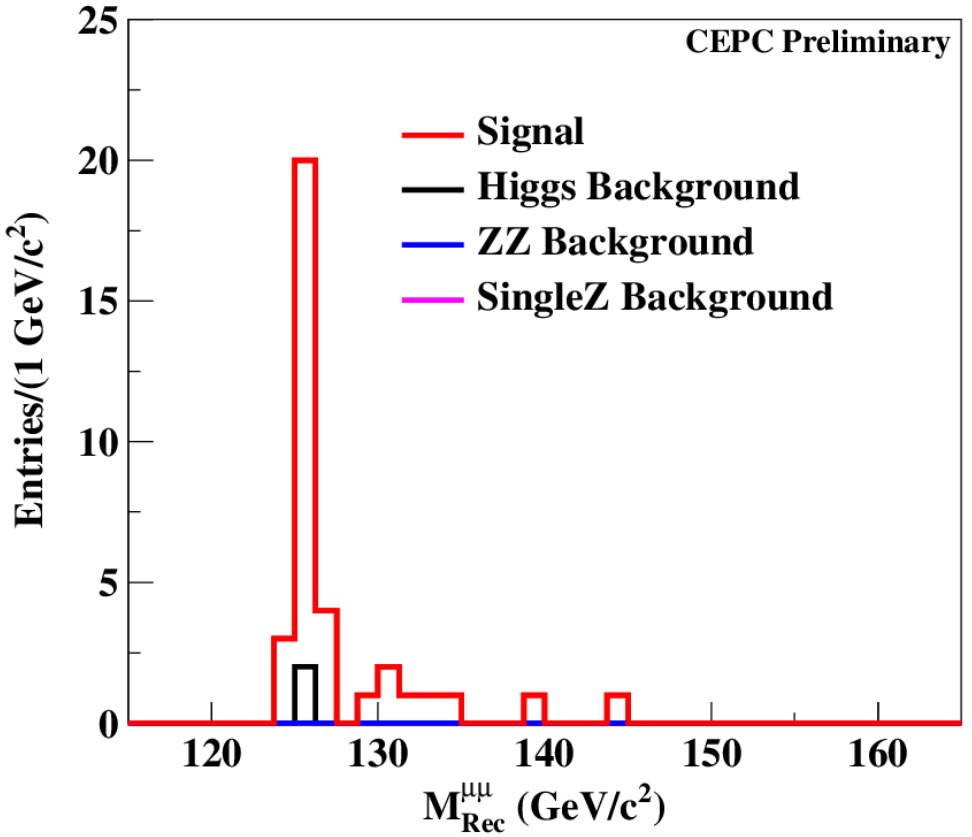
Table 2: Cut chain of $\mu\mu$ final state



3 H->WW->lvlv analysis*

Category	Signal	ZH	ZZ	Single Z
Total	348	34624	5499688	7788916
$N_{ZPole} = 2; N_{Isolep} = 2; l = e$	61	114	4	1807
80 GeV $< M_{Inv}^{\mu^+\mu^-} <$ 100 GeV	53	105	2	1165
120 GeV $< M_{Rec}^{\mu^+\mu^-} <$ 150 GeV	52	101	1	726
$N_{Remain} < 3$	51	60	0	692
10 GeV $< M_{Inv}^{e^+e^-} <$ 65 GeV	49	47	0	49
35 GeV $< E_{Missing} <$ 100 GeV	49	27	0	31
$\sqrt{(\frac{D0}{sigD0})^2 + (\frac{Z0}{sigZ0})^2} < 6$	39	4	0	24
Total $P_T > 20$ GeV	36	4	0	0

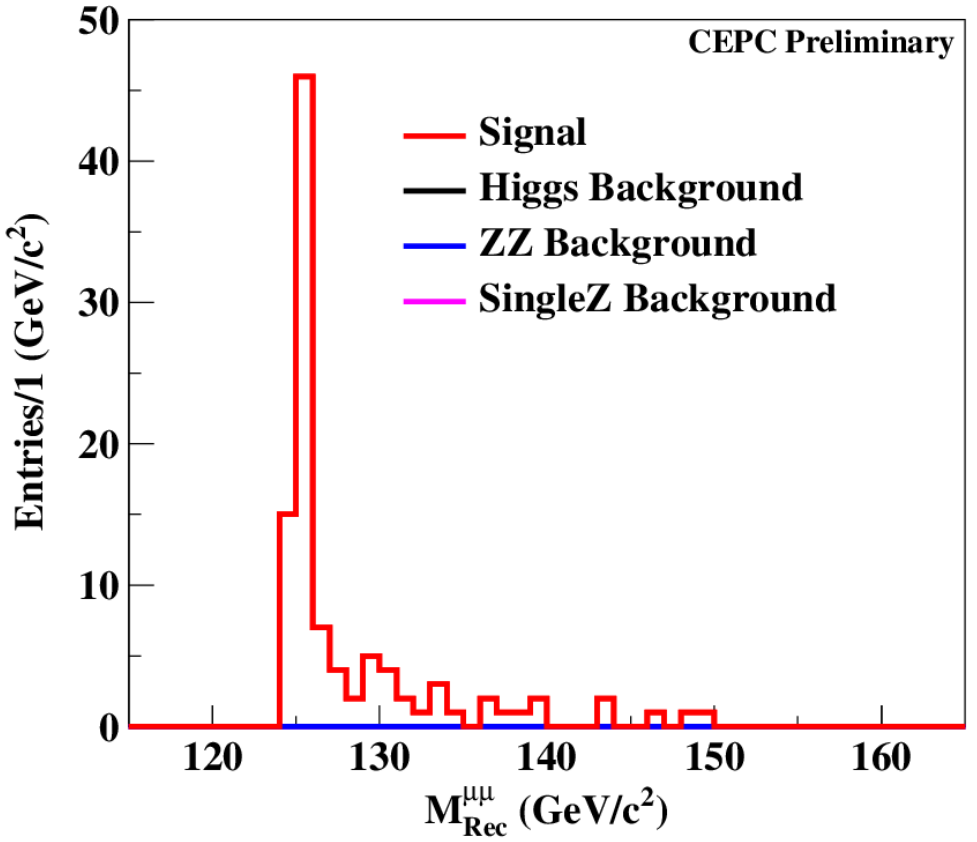
Table 3: Cut chain of *ee* final state



3 H->WW*->lvlv analysis

Category	Signal	ZH	ZZ	Single Z
Total	348	34624	5499688	7788916
$N_{ZPole} = 2; N_{Isolep} = 2; l_1 = e, l_2 = \mu$	147	136	32	1
80 GeV $< M_{Inv}^{\mu^+\mu^-} <$ 100 GeV	134	119	21	0
120 GeV $< M_{Rec}^{\mu^+\mu^-} <$ 150 GeV	130	117	15	0
$N_{Remain} < 3$	130	89	3	0
10 GeV $< M_{Inv}^{e\mu} <$ 65 GeV	123	79	3	0
35 GeV $< E_{Missing} <$ 110 GeV	123	68	2	0
$\sqrt{(\frac{D0}{sigD0})^2 + (\frac{Z0}{sigZ0})^2} < 4$	105	0	0	0

Table 1: Cut chain of $e\mu$ final state



4 H->WW*->lvqq analysis

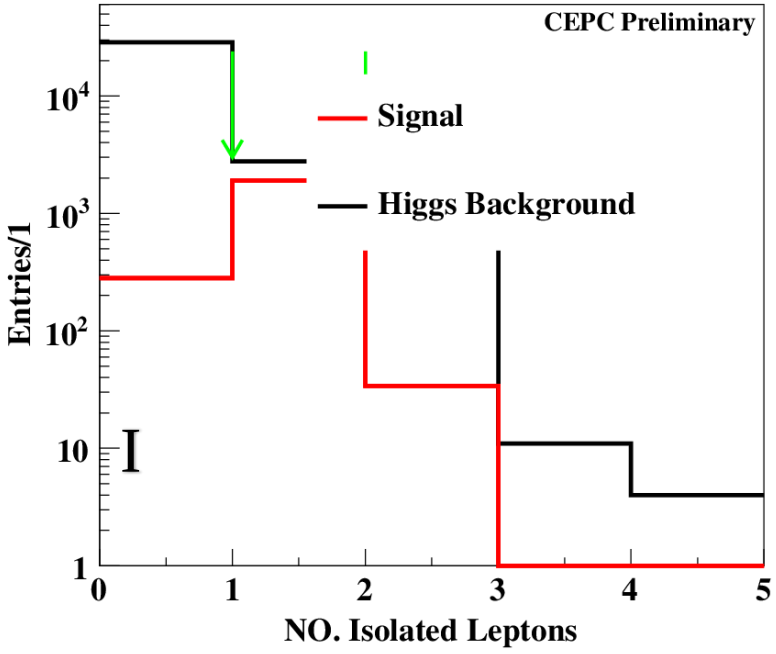
NIsoLep = 1,Nzpole = 2,Njet = 2

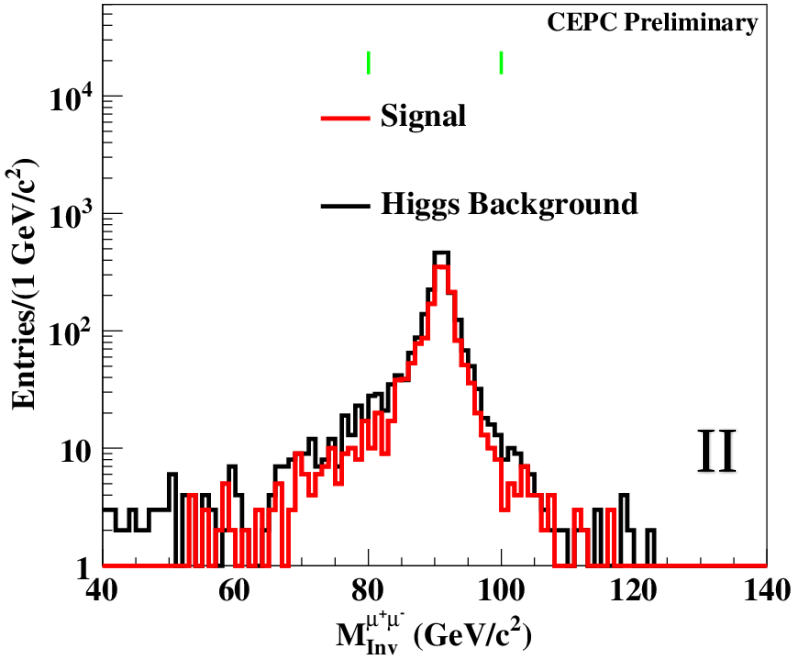
80GeV $< Mass_{Inv}^{\mu+\mu-} <$ 100GeV

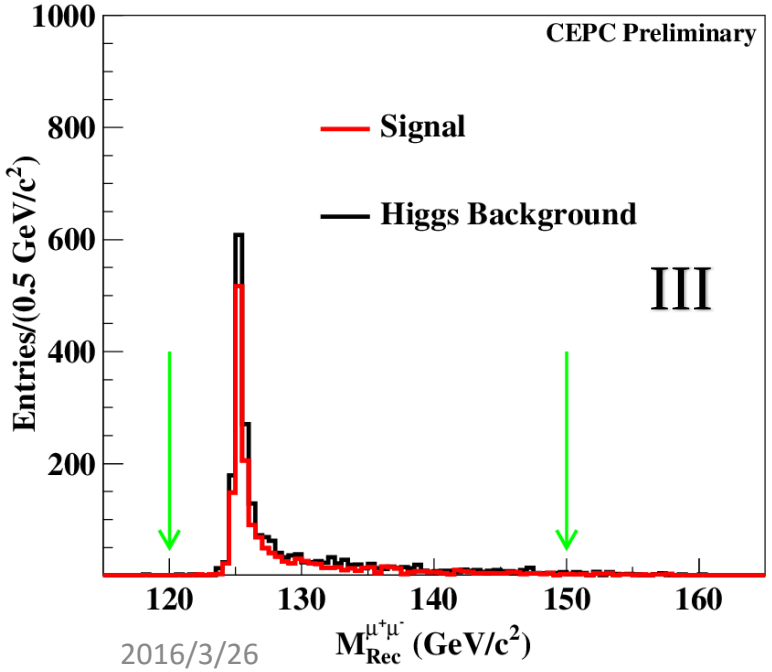
120GeV $< Mass_{Rec}^{\mu+\mu-} <$ 150GeV

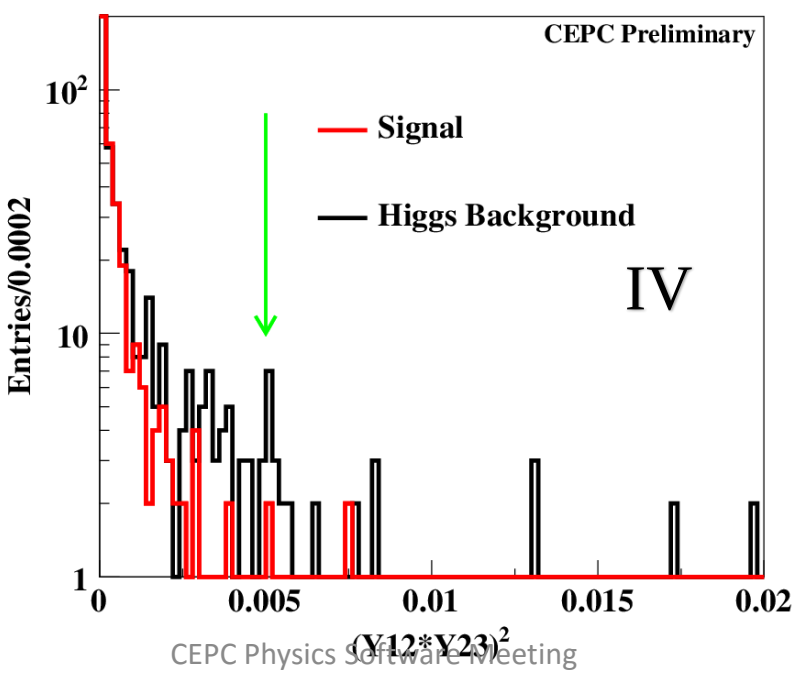
(y12*y23)^2 <0.005

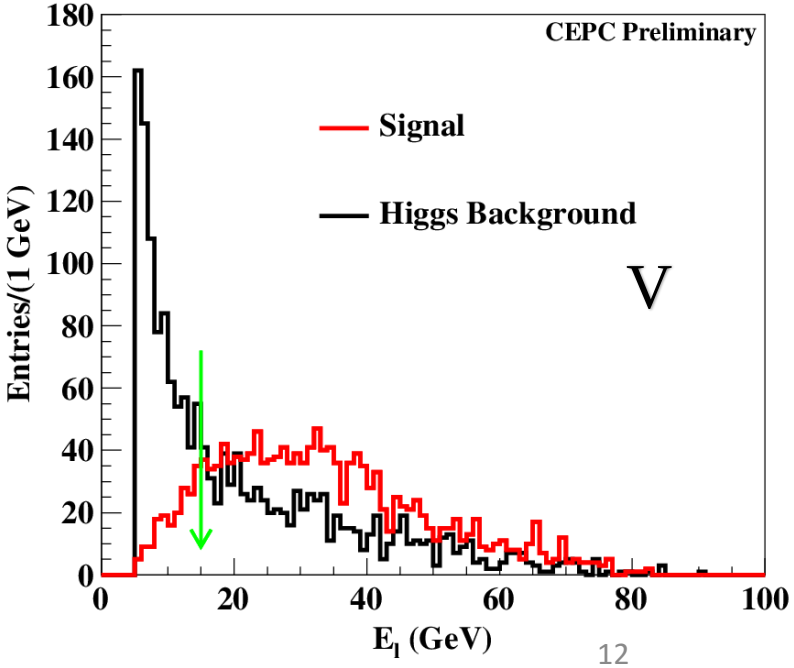
E_lepton > 15GeV





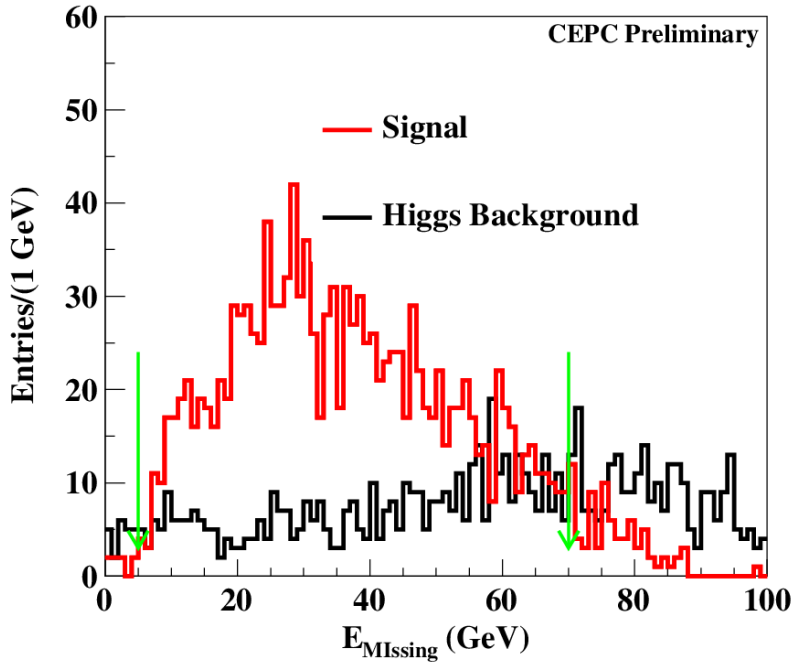


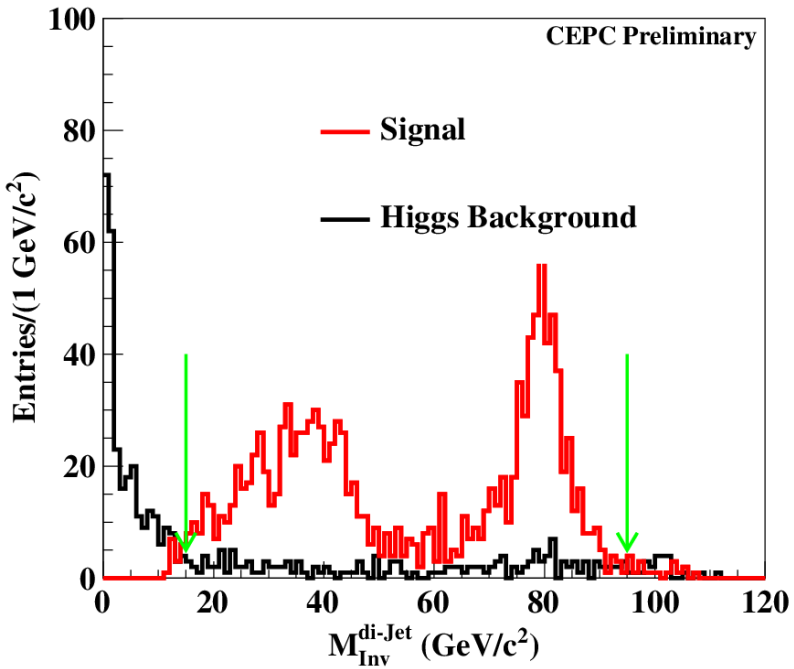


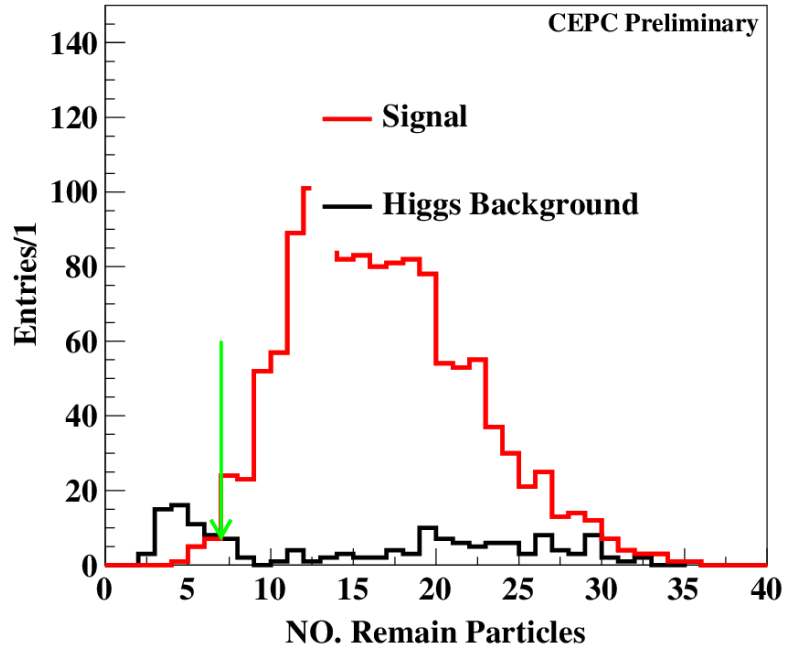


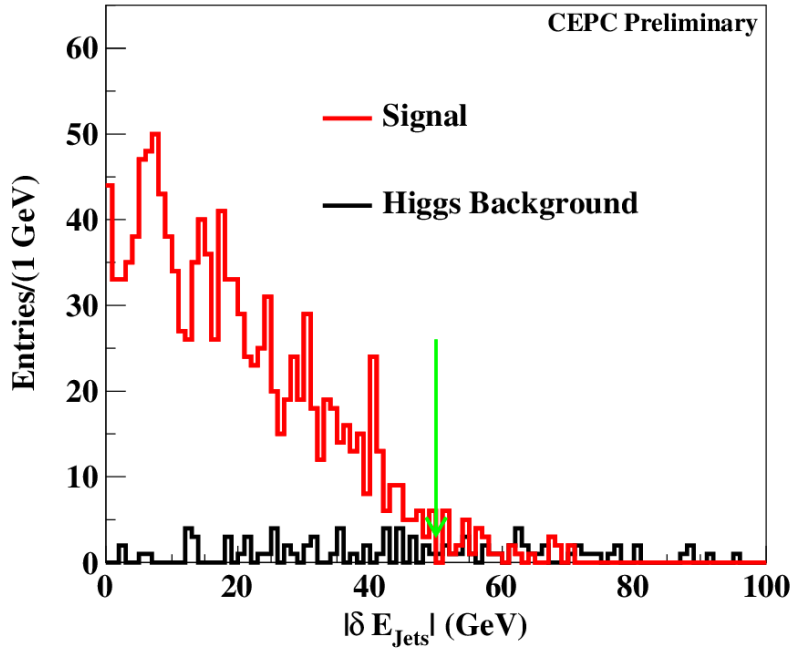
4 H->WW*->lvqq analysis

$5\text{GeV} < E_{Missing} < 70\text{GeV}$
$15\text{GeV} < Mass_{Rec}^{di-jet} < 95\text{GeV}$
No. Remain Particle >7
|E_jet1-E_Jet2|<50





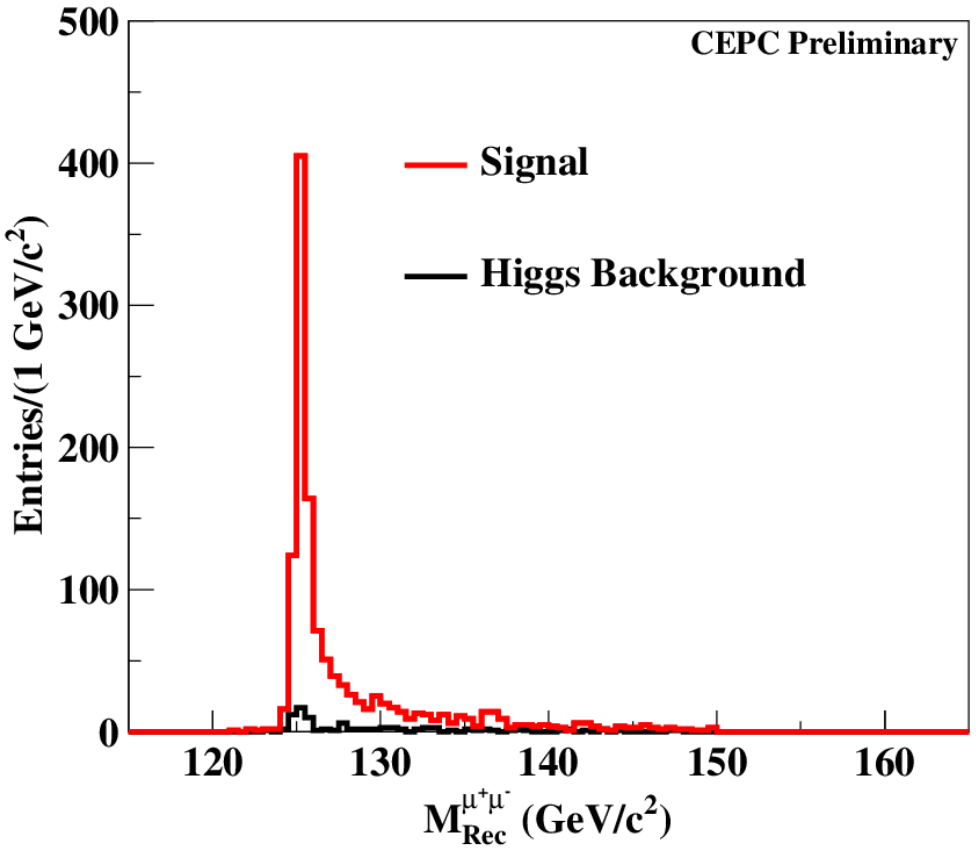




4 H->WW*->lvqq analysis

Category	Signal	ZH
Total	2112	32291
$N_{ZPole} = 2; N_{Isolep} = 1; N_{Jets} = 2$	1853	2524
$80\ \text{GeV} < M^{\mu^+\mu^-}_{Inv} < 100\ \text{GeV}$	1665	2173
$120\ \text{GeV} < M^{\mu^+\mu^-}_{Rec} < 150\ \text{GeV}$	1610	2109
$(Y12 * y23)^2 < 0.005$	1601	1687
$E_{lepton} > 15\ \text{GeV}$	1416	841
$5\ \text{GeV} < E_{Missing} < 70\ \text{GeV}$	1325	464
$15\ \text{GeV} < M^{di-Jet}_{Rec} < 95\ \text{GeV} < 6$	1289	156
$N_{Remain} > 7$	1252	96
$\lvert\delta E_{Jets}\rvert < 50\ \text{GeV}$	1217	55

Table 4: Cut chain of semi leptonic decay of $H \rightarrow WW^*$



5 Comparison

Category	Signal	Background
$l_1 = e, l_2 = \mu$	105±10.2	0.0
$l = \mu$	52±7.6	6
$l = e$	36±6.3	4

Relative precision of branch ratio from H->WW*->llvv channel is 7.01%.

Mr. CHEN Zhenxing:

Relative precision of branch ratio from two full leptonic decay channel and semi leptonic decay channel is 4.4%.

5 Plan

Z Decay / W Decay	ll	vv	tau tau	qq
lvlv				
lvqq				
qqqq				
Tau+X				

Green: undone
Yellow: 25%
Orange: 50%

Shown in this Table, there are a lot of work to do.

Short-term Goal:
1 Finish the Z->ll(e,u) and W->lv or W->qq analysis;
2 Optimize the isolated lepton algorithm.

Long-term Goal: Try to finish whole work with YU Dan together, shown in table.

Thanks