Weekly Updates

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Table : Cut condition

Table 1 Overview of the requirements applied for each Higgs decay channels. further explanations should be given here.

Pre-selections		
$N(l) = 2$, where leptons(l) should pass the isolation criteria $N(\mu^+) = 1$, $N(\mu^-) = 1$ with $E(\mu^{\pm}) > 3$ GeV $N(\mathrm{jet}) = 2$		
$\mu\mu l l \nu\nu qq$	$\mu\mu$ Higgs$\nu\nu$	$\nu\nu l l \mu\mu qq$
$80\ \mathrm{GeV} < M_{\mu\mu} < 100\ \mathrm{GeV}$	$80\ \mathrm{GeV} < M_{\mu\mu} < 100\ \mathrm{GeV}$	$80\ \mathrm{GeV} < M_{\mu\mu} < 100\ \mathrm{GeV}$
$75\ \mathrm{GeV} < M_{jj} < 110\ \mathrm{GeV}$	$75\ \mathrm{GeV} < M_{jj} < 110\ \mathrm{GeV}$	$75\ \mathrm{GeV} < M_{jj} < 110\ \mathrm{GeV}$
$75\ \mathrm{GeV} < M_{\mathrm{miss.}} < 110\ \mathrm{GeV}$	$75\ \mathrm{GeV} < M_{\mathrm{miss.}} < 110\ \mathrm{GeV}$	$75\ \mathrm{GeV} < M_{\mathrm{miss.}} < 110\ \mathrm{GeV}$
$110\ \mathrm{GeV} < M_{\mu\mu}^{\mathrm{recoil}} < 140\ \mathrm{GeV}$	$110\ \mathrm{GeV} < M_{\mu\mu}^{\mathrm{recoil}} < 140\ \mathrm{GeV}$	$110\ \mathrm{GeV} < M_{\nu\nu} < 140\ \mathrm{GeV}$
$20 < N_{\mathrm{PFO}} < 90$	$20 < N_{\mathrm{PFO}} < 90$	$20 < N_{\mathrm{PFO}} < 90$
$\lvert\cos\theta_{\nu\nu}\rvert < 0.95$	$\lvert\cos\theta_{\nu\nu}\rvert < 0.95$	$\lvert\cos\theta_{\nu\nu}\rvert < 0.95$
$0^\circ < \Delta\phi_{ZZ} < 180^\circ$	$0^\circ < \Delta\phi_{ZZ} < 180^\circ$	$0^\circ < \Delta\phi_{ZZ} < 180^\circ$
$\lvert M_{jj}^{\mathrm{recoil}} - M^{higgs}\rvert > 3\ \mathrm{GeV}$	$\lvert M_{jj}^{\mathrm{recoil}} - M^{higgs}\rvert > 3\ \mathrm{GeV}$	$\lvert M_{jj}^{\mathrm{recoil}} - M^{higgs}\rvert > 3\ \mathrm{GeV}$
$\nu\nu$Higgs$qq\mu\mu$	$qql l \nu\nu\mu\mu$	$qql l \mu\mu\nu\nu$
$80\ \mathrm{GeV} < M_{\mu\mu} < 100\ \mathrm{GeV}$	$80\ \mathrm{GeV} < M_{\mu\mu} < 100\ \mathrm{GeV}$	$80\ \mathrm{GeV} < M_{\mu\mu} < 100\ \mathrm{GeV}$
$75\ \mathrm{GeV} < M_{jj} < 110\ \mathrm{GeV}$	$75\ \mathrm{GeV} < M_{jj} < 110\ \mathrm{GeV}$	$75\ \mathrm{GeV} < M_{jj} < 110\ \mathrm{GeV}$
$75\ \mathrm{GeV} < M_{\mathrm{miss.}} < 110\ \mathrm{GeV}$	$75\ \mathrm{GeV} < M_{\mathrm{miss.}} < 110\ \mathrm{GeV}$	$75\ \mathrm{GeV} < M_{\mathrm{miss.}} < 110\ \mathrm{GeV}$
$110\ \mathrm{GeV} < M_{\nu\nu} < 140\ \mathrm{GeV}$	$110\ \mathrm{GeV} < M_{jj}^{\mathrm{recoil}} < 140\ \mathrm{GeV}$	$110\ \mathrm{GeV} < M_{jj}^{\mathrm{recoil}} < 140\ \mathrm{GeV}$
$20 < N_{\mathrm{PFO}} < 90$	$20 < N_{\mathrm{PFO}} < 90$	$20 < N_{\mathrm{PFO}} < 90$
$\lvert\cos\theta_{\nu\nu}\rvert < 0.95$	$\lvert\cos\theta_{\nu\nu}\rvert < 0.95$	$\lvert\cos\theta_{\nu\nu}\rvert < 0.95$
$0^\circ < \Delta\phi_{ZZ} < 180^\circ$	$0^\circ < \Delta\phi_{ZZ} < 180^\circ$	$0^\circ < \Delta\phi_{ZZ} < 180^\circ$
$\lvert M_{jj}^{\mathrm{recoil}} - M^{higgs}\rvert > 3\ \mathrm{GeV}$	$\lvert M_{jj}^{\mathrm{recoil}} - M^{higgs}\rvert > 3\ \mathrm{GeV}$	$\lvert M_{jj}^{\mathrm{recoil}} - M^{higgs}\rvert > 3\ \mathrm{GeV}$

- need to update

Table : analysis efficiency & remaining number of events

From ILC paper(arXiv)

Process	$\sigma[fb]$	ε_{pres} [%]	ε_{total} [%]	$evts_{final}$
$H \rightarrow$ other Higgs decays	374.3	64.6	18.0	14534
$e^+e^- \rightarrow q\bar{q}$	2948.9	2.0	$6{\cdot}10^{-4}$	38
$e^+e^- \rightarrow q\bar{q}\nu\nu$	1317.5	45.8	0.3	7664
$e^+e^- \rightarrow q\bar{q}l\nu$	5561.1	26.3	0.1	12623
$e^+e^- \rightarrow q\bar{q}ll$	3319.6	4.0	0.1	135
$e^+e^- \rightarrow q\bar{q}q\bar{q}$	546.5	3.3	$7{\cdot}10^{-2}$	77
$e^+e^- \rightarrow q\bar{q}q\bar{q}\nu\nu$	71.5	2.2	0.3	358
$e^+e^- \rightarrow q\bar{q}q\bar{q}l\nu$	106.9	1.1	0.04	93
$e^+e^- \rightarrow q\bar{q}q\bar{q}ll$	169.3	1.8	0.05	172
$e^+e^- \rightarrow q\bar{q}q\bar{q}e$ (EPA)	54.2	2.1	0.15	161
$e^+e^- \rightarrow q\bar{q}q\bar{q}e$ (BS)	262.5	3.3	$< 10^{-4}$	-
$e^+e^- \rightarrow q\bar{q}q\bar{q}e$ (EPA)	54.2	2.2	0.14	146
$e^+e^- \rightarrow q\bar{q}q\bar{q}e$ (BS)	262.3	3.2	$8{\cdot}10^{-4}$	4
$e^{\pm}\gamma \rightarrow q\bar{q}q\bar{q}\nu$ (EPA)	287.8	2.0	0.05	306

Table 2 Summary of event selection.

	$\mu\mu H\nu\nu qq$			$\mu\mu Hqq\nu\nu$			$\nu\nu H\mu\mu qq$		
Process	σ[fb]	ϵ[%]	N	σ[fb]	ϵ[%]	N	σ[fb]	ϵ[%]	N
Signal	?	80.0	40						
ZH									
4F									
2F									
	$\nu\nu Hqq\mu\mu$			$qqH\nu\nu\mu\mu$			$qqH\mu\mu\nu\nu$		
Signal	?	80.0	40						
ZH									
4F									
2F									

I'm still considering which one is …
(left one includes the list of background channels that might be better)

Distribution as an example

- Taking mmHZZ channel as an example figures

- raw(after pre-selection) or during cut stage ?

Here, list is (S+B) :

- Mμμ (invariant mass)

- Mμμ (recoil mass)

(- 2D, dijet-missing mass)

- Npfo

- cos(θ) vis.

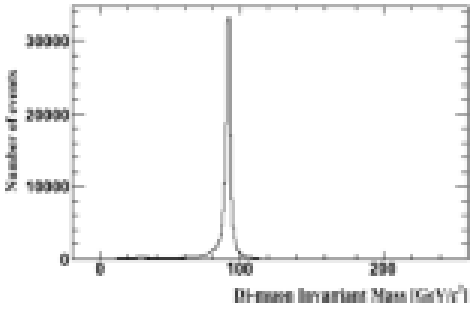

Fig. 4 Npfo distribution. S+B

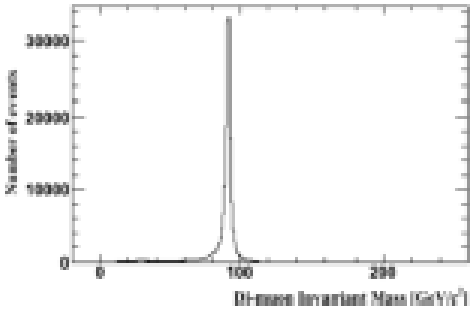

Fig. 5 Cos theta visible distribution. S+B

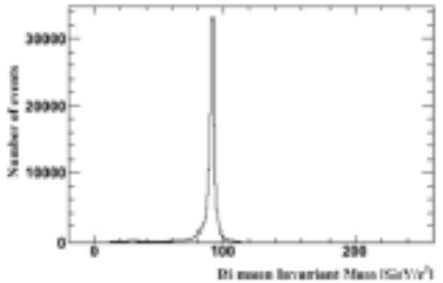

Fig. 2 Dimuon invariant mass distribution. S+B

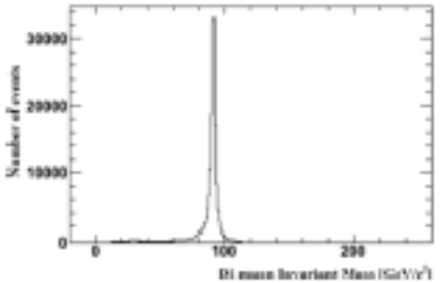

Fig. 3 Dimuon recoil mass distribution. S+ B

References

1. Author, Article title, Journal, Volume, page numbers (year)

2. Author, Book title, page numbers. Publisher, place (year)

negative value of missing mass is an issue. (=need explanation)

Distribution with the fitting

- How about the ZH bg.

  - merge into bg ?

- probably, need to mention(calculate) the N(HZZ, but not the signal)

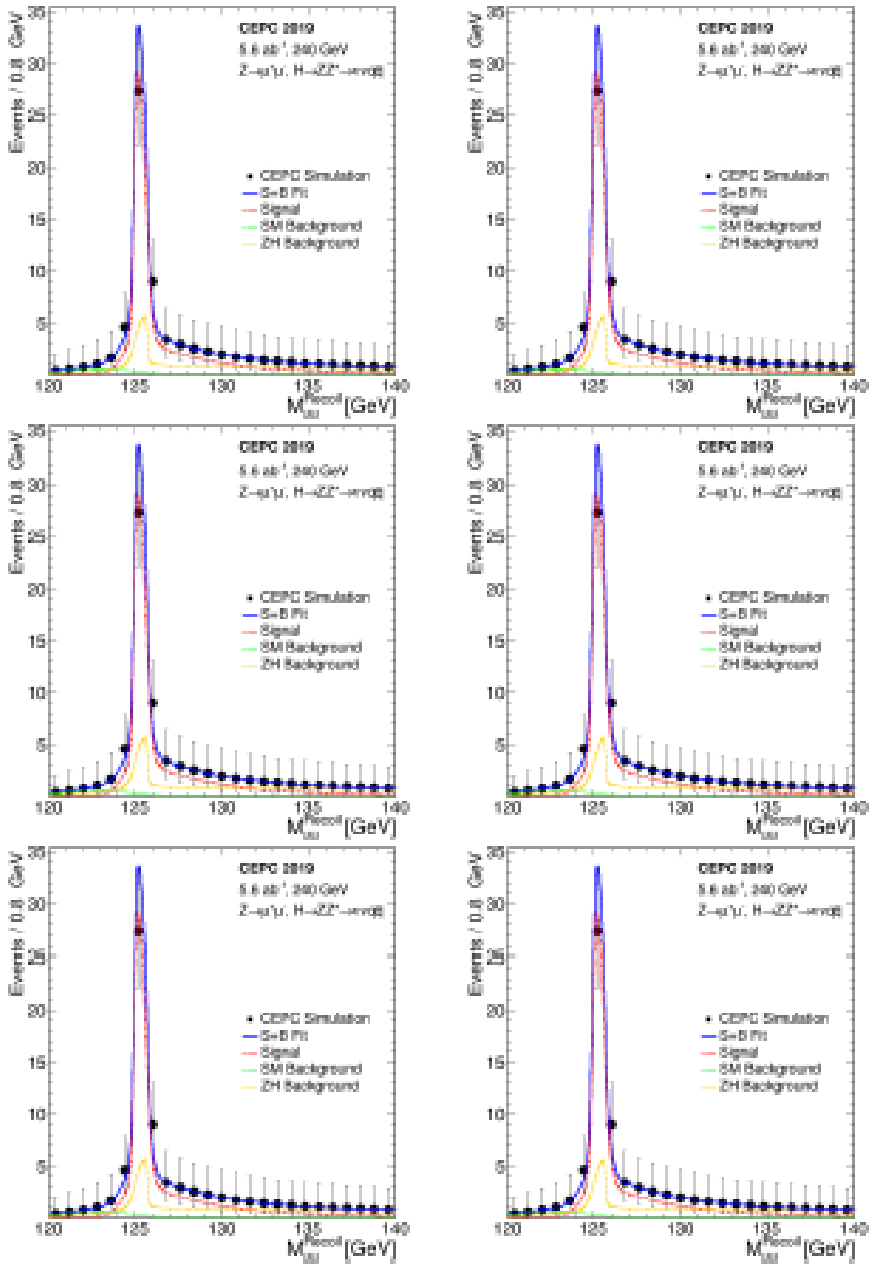

Fig. 6 Recoil mass distributions. further explanations should be given here.

Table : fitting result

Table 3 Statistical uncertainties on the product of the ZH cross section and the branching ratio. further explanations should be given here.

Channel		$\frac{\Delta(\sigma \cdot BR)}{(\sigma \cdot BR)}$ [%]
$Z \to \mu^+\mu^-$	$H \to Z Z^* \to \nu\bar{\nu} q\bar{q}$	10.0
$Z \to \mu^+\mu^-$	$H \to Z Z^* \to q\bar{q}\nu\bar{\nu}$	10.0
$Z \to \nu\bar{\nu}$	$H \to Z Z^* \to \mu^+\mu^- q\bar{q}$	10.0
$Z \to \nu\bar{\nu}$	$H \to Z Z^* \to q\bar{q}\mu^+\mu^-$	10.0
$Z \to q\bar{q}$	$H \to Z Z^* \to \mu^+\mu^-\nu\bar{\nu}$	10.0
$Z \to q\bar{q}$	$H \to Z Z^* \to \nu\bar{\nu}\mu^+\mu^-$	10.0
Combined		10.0

Others:

- how about the “signal or not” ?