Charged Higgs search in Triplet Higgs model with e⁺e⁻→WH

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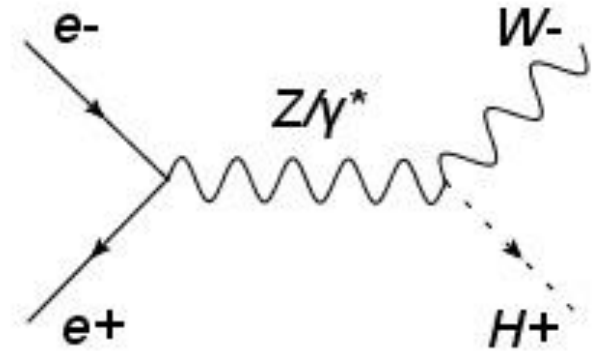Shinya Kanemura[b] , Kei Yagyu[c] , Hitoshi Yamamoto

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About my study

Charged higgs study

- In triplet Higgs models , there is tree level WHZ coupling.
- If charged higgs is enough light, one can search for charged Higgs with e+e-→WH at 250GeV.
- In my study ,charged Higgs mass is reconstructed from recoil mass against W boson.

Schedule until now and from now

●learning how to use ILCSoft and analyze (WW → 4j mode)
●making the generator of e+e- → WH   ← today's talk
●background analysis(WW → 3j mode)   ←
●selection with irreducible background
●analysis of e+e- → WH
●etc.

Generator of WH

Generator of WH process

- making the generator of e⁺e⁻→W$^{\pm}$H$^{\mp}$ process
  - →on-going
  - production of charged Higgs might be OK.
  - decay of charged Higgs is not ready.
  - only e⁺e⁻ → Z → W$^{\pm}$H$^{\mp}$ mode (not include e⁺e⁻ → γ → W$^{\pm}$H$^{\mp}$ mode)

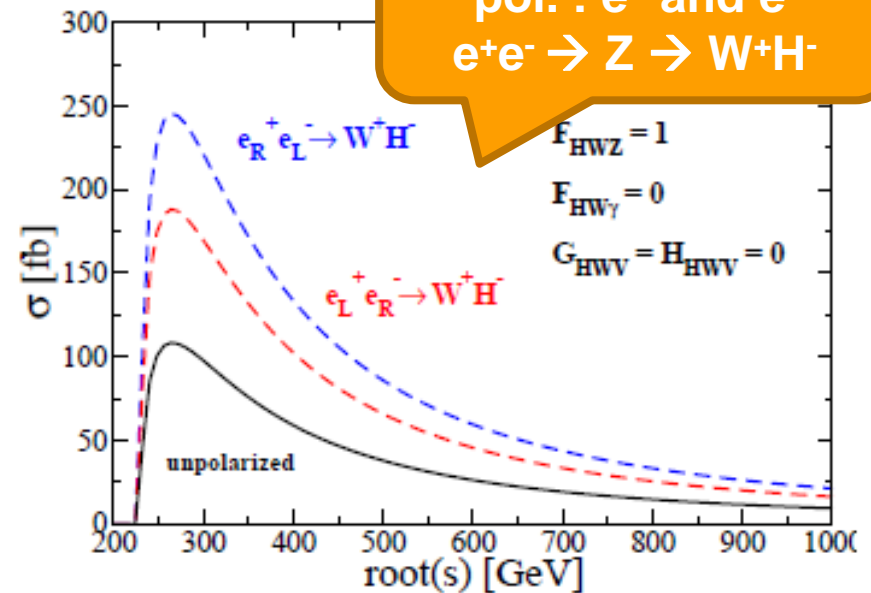- I checked the cross section as a function of Ecm .

W decays to qqbar

e-

e+

Z/γ*

W-

H+
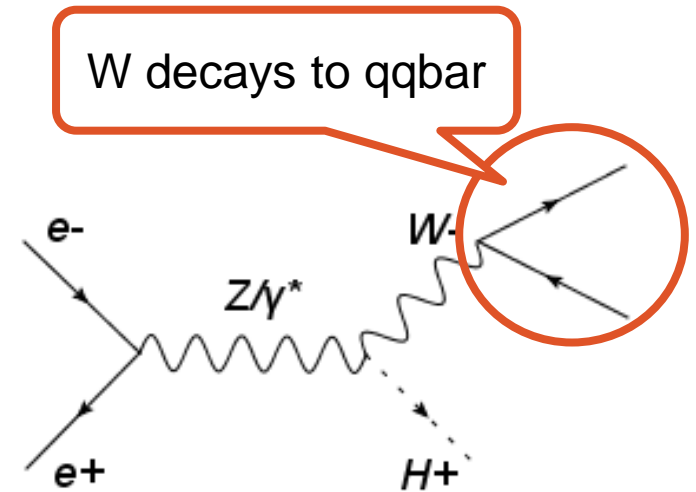
Cross section of e+e-→ $W^{\pm}H^{\mp}$

- Beamstrahlung = 0 , Beamwidth = 0 , Bremsstrahlung = 0
- m_H = 150 GeV
- pol. : P(e-, e+) = (+-100%,0%)
- $e^+e^- \to Z \to W^{\pm}H^{\mp}$ (WH production via gamma* is turned off)

σ[fb]

Graph1 : cross section of ee→WH.
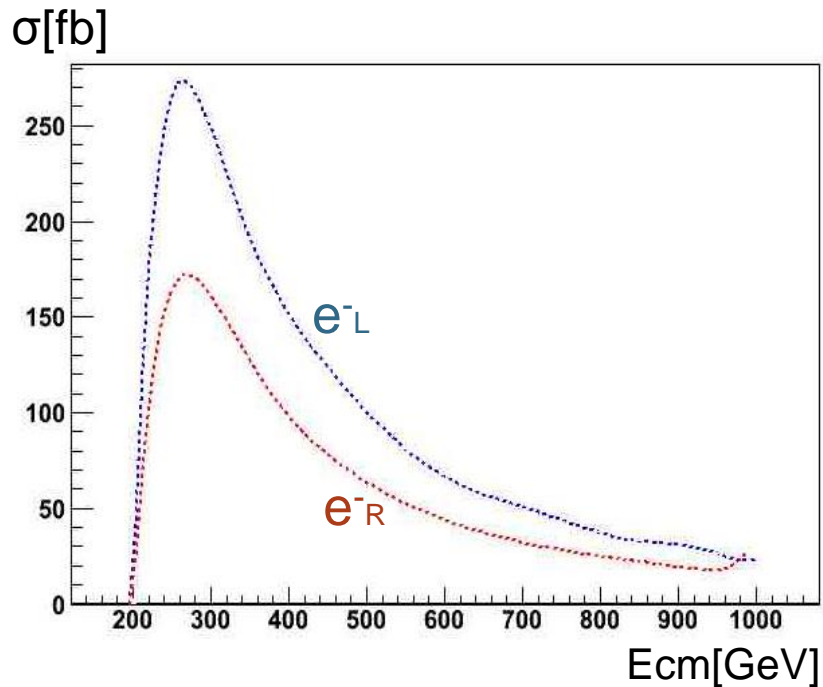
m_H = 150 GeV
pol. : e+ and e-
$e^+e^- \to Z \to W^+H^-$

S. Kanemura, K. Yagyu and K. Yanase,
Phys. Rev. D 83, 075018 (2011).

Cross section of $e^+e^- \rightarrow W^{\pm}H^{\mp}$

There is a difference between cross section by our generator and one by theorists.

→ Even the parameters were set the same as theorists ones, cross section was not changed.

Table.1 : used palameter in the generator and the theory.

	generator	theory
$\sin^2\theta_w$	0.222249945	0.233431554
α	1/137	1/128
mz	91.188 / 91.1876	91.1875
mw	76.949 / 80.385	79.8382077

↑**GENNumcon.h / jsf.conf**

Table.2 : changed value and cross section.

	no change	GENNumConf.h				jsf.conf			
		$(\sin\theta W)^2$	α	mZ	mW	$(\sin\theta W)^2$	α	mZ	mW
Ecm (GeV)	300	300				300			
cross section (fb)	251.733	251.733	251.733	-	251.733	-	-	-	251.733

→I will check where are the parameters defined.

Reconstruction

WW→3j reconstruction

- If charged Higgs decays into taunu, it is easy to reconstruct.

- We first study exclusive 3jet analysis for WH → qqtaunu, then move to other charged Higgs decay modes.

- Since the WH generator is not ready yet, WW→ qqtaunu is used to study for selection variables .
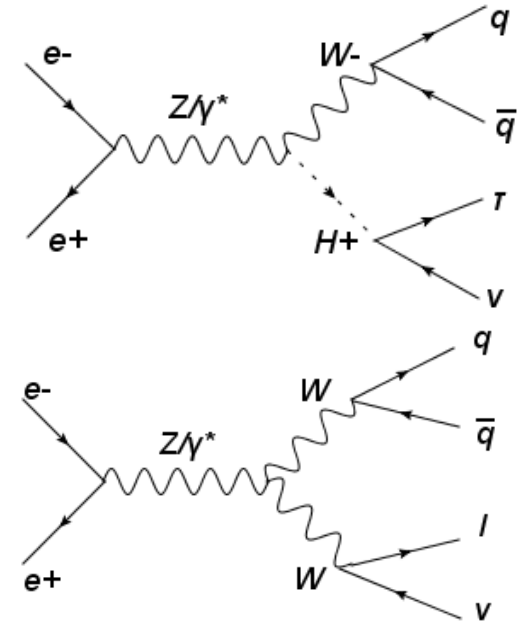
● forced 3-jet analysis using Durham algorithm
 - W boson is reconstructed by pairing di-jet
   which gives the smallest χ^2

● H mass (or W mass) is calculated by recoil mass method
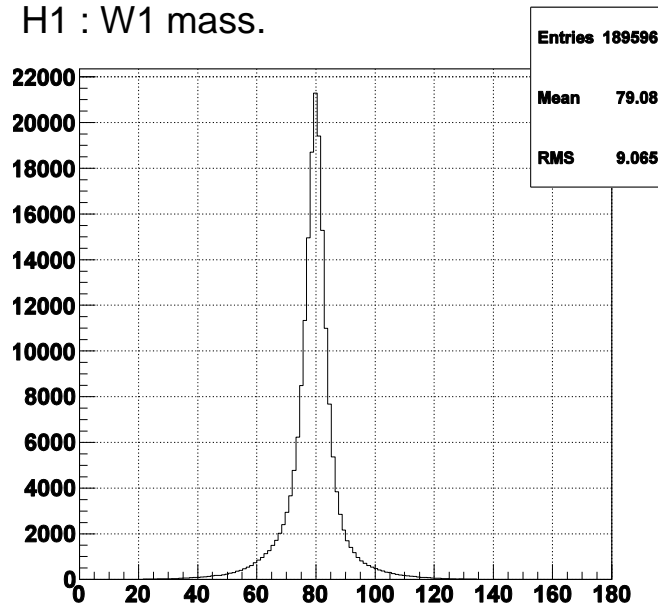
$$\chi^2 = (\frac{M_j - m_W}{\sigma_W})^2$$

M_j：mass of jet pair
m_W：mass of W(= 80.0GeV)
σ_W：mass resolution(= 4.8GeV)

WW→3j reconstruct

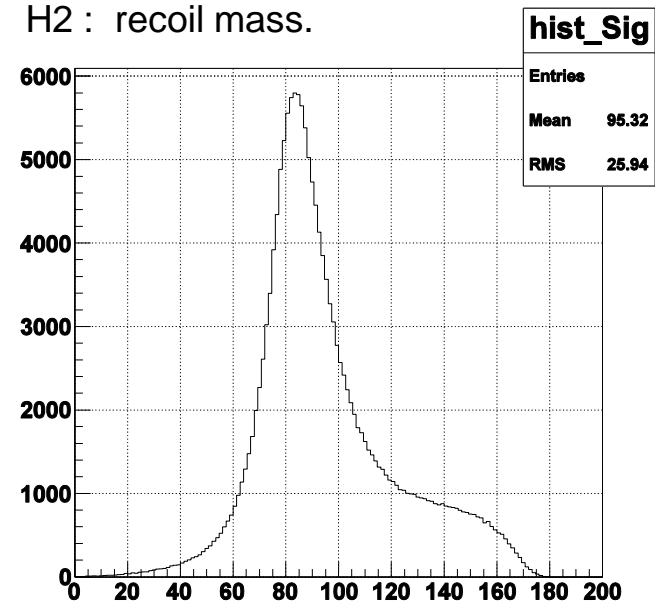- W mass from dijet and W(or H) mass from recoil method.
  - fit mean - W1 mass : 79.74±0.01 GeV
    - recoil mass : 83.88±0.08 GeV

W mass cut : 70<mw<90

H1 : W1 mass.

Entries	189596
Mean	79.08
RMS	9.065

H2 : recoil mass.

hist_Sig	
Entries	
Mean	95.32
RMS	25.94

polarization : P(e+,e-)=(-0.3,+0.8)
center of mass energy : 250 GeV
integrated luminosity : 250 fb^{-1}

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2014/1/18

Summary and plan

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- Generator of WH
  - Making the generator is on-going.

  <next step>
  - check the difference between ours and theorists
  - Adding charged higgs decay
  - Making event samples of WH

- 3jet analysis for WW
  - analysis for WW 3 jet reconstruction is on-going.

  <next step>
  - try to look at jet mass to eliminate tau jet extend to WH signal
  - check other background
  - measure charged Higgs mass and cross section