Higgs BR study

ILC physics and software meeting
Dec. 09. 2011
Hiroaki Ono
Nippon Dental Univ.

Current status

H$\rightarrow$WW*$\rightarrow$qqqq reconstruction
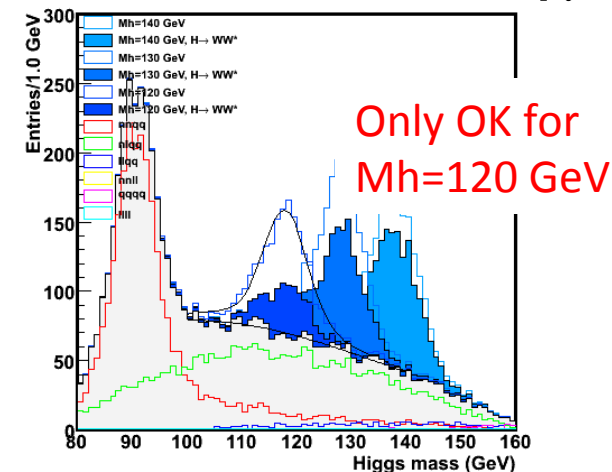
Ecm=250 GeV, L=250 fb-1

P(e+,e-)=(+30%, -80%) $\rightarrow$ P(e+,e-)=(-30%, +80%) right handed pol.

ee$\rightarrow$WW background suppression

Forced four-jet clustering, then select best jets pair with minimum χ^2

$$\chi^2 = \left(\frac{M_W^{\mathrm{Rec}} - M_W}{\sigma_W}\right)^2 + \left(\frac{M_H^{\mathrm{Rec}} - M_H}{\sigma_H}\right)^2$$

Recoil mass or MM=Mz case, not need to consider it

Only OK for Mh=120 GeV

BG should be analyzed separately for different masses
$\rightarrow$Different Higgs masses are used in jet-pairing (4j)

BG reduction summary (Mh=120 GeV)

	Gen	Rec	Mh	MissM	Y-	cos	w-blike	b-like(2j)	Etrk	LR
vvww4j	678	678	611	604	603	579	564	548	536	367
vvww	1486	1408	638	632	629	604	589	573	561	372
vvbb	7101	7101	4628	4585	4001	3816	662	300	293	128
ZH all	10634	10396	6255	6194	5463	5219	1988	1592	1553	915
nlqq	298103	298103	34186	16975	14132	12410	11986	11746	11114	1060
nnqq	63649	63649	2382	2334	1890	1712	1400	1354	1290	230
llqq	335756	335753	5502	2611	2278	913	612	571	535	68
nnll	108074	58504	6249	5553	90	80	80	80	70	0
qqqq	378726	378726	529	172	170	18	11	9	9	2
llll	753964	752157	16913	6836	2159	471	447	432	363	0
SM all	1938270	1886890	65761	34481	20719	15603	14535	14191	13380	1361
Sig.	0.49	0.49	2.28	3.00	3.73	4.01	4.39	4.36	4.39	7.70

Signal significance: 7.70 for H→WW*→4j

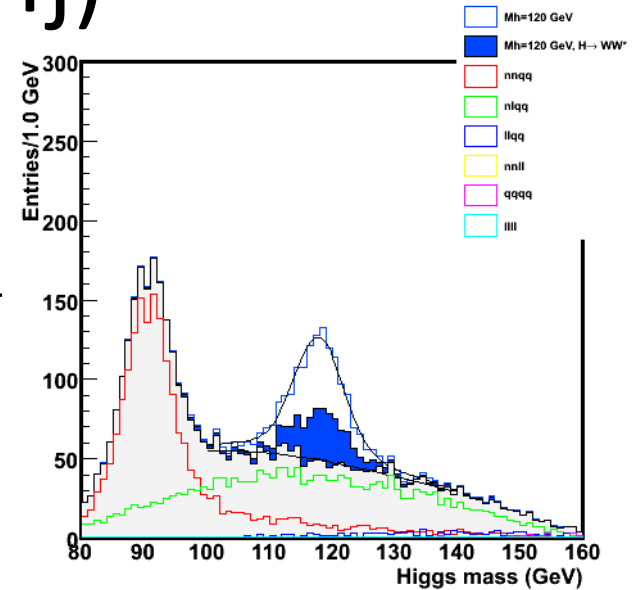# Measurement accuracy of BR(H→WW*→4j)

$$\frac{\Delta \sigma_{WW}}{\sigma_{WW}} = \frac{\sqrt{N_{WW} + N_{BG}}}{N_{WW}}$$

$$\frac{\Delta BR}{BR}\left(H \to WW^*\right) = \sqrt{\left(\frac{\Delta \sigma_{WW}}{\sigma_{WW}}\right)^2 + \left(\frac{\Delta \sigma_{ZH}}{\sigma_{ZH}}\right)^2}$$

Signal significance Sig=7.70

σ_{ZH} accuracy = 2.5 %

Preliminary results

ΔBR/BR(H→WW→4j)=13.2%

at Mh=120 GeV, Ecm=250 GeV, (e+,e-)=(-30%, +80%)

Try to compare at Mh=130, 140 GeV with full-sim.

Different beam pol. for qqH, vvH

- Consider different beam-polarization for previous qqH, vvH study at the Ecm=250 GeV.
  - Beam polarization is optimized for recoil mass study to maximize the Higgs production cross-section. (e+, e-) = (+30, -80%)
  - WW BG suppression will be obtained at electron right-handed pol. (e+, e-)=(-30%, +80%)
  - WW fusion process will be reduced with this beam pol. and critical at 1 TeV (even for 350 GeV?)