H→WW* study

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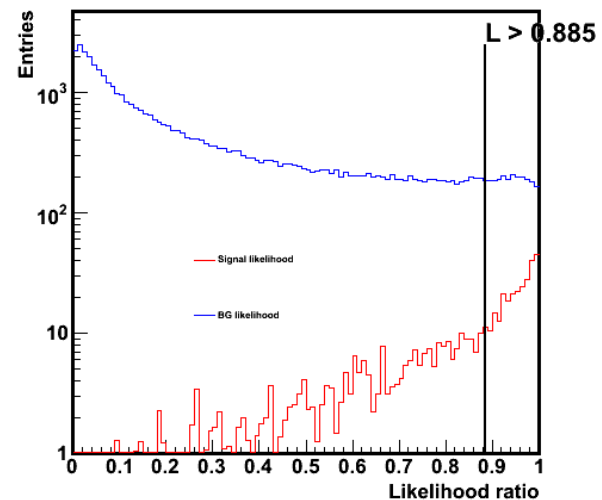# Analysis of H$\rightarrow$WW* (4j)

Same cuts with Takubo-san's analysis

1. 70 < Miss mass < 140 GeV
2. W11 Y minus > 0.0005
3. $|\cos\theta_h|$ < 0.95
4. Max E_{trk} < 30 GeV
5. W1/W2 b-likeness < 0.2 (No b-jets)
6. b-likenss (2j) < 0.2 (Reject H$\rightarrow$bb)
7. likelihood > 0.7

Likelihood variables

1. Missing mass
2. $\cos\theta_h$
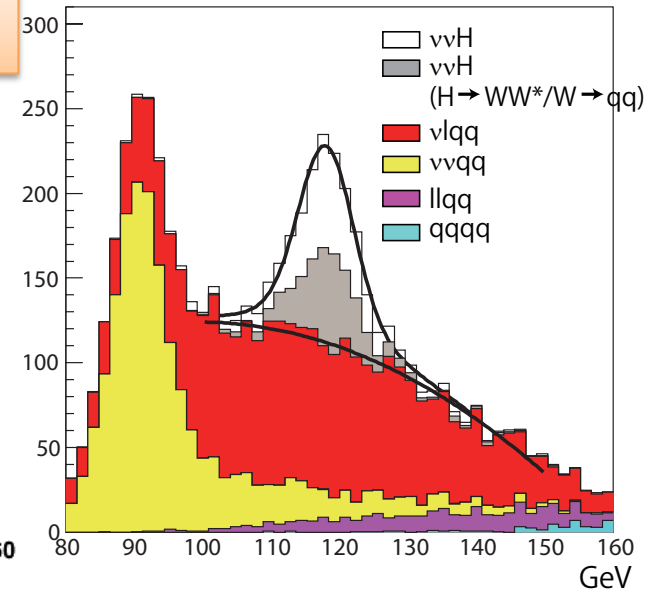3. W11 Y34
4. W1 b-likeness
5. # of charged tracks

Higgs mass

Evis

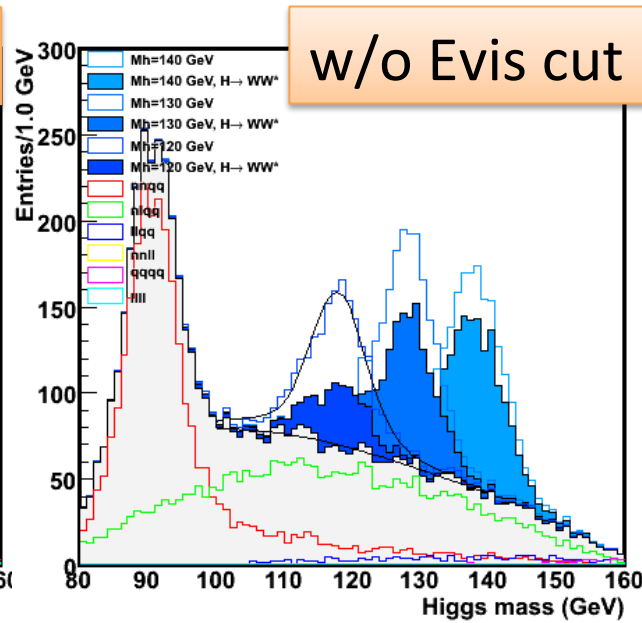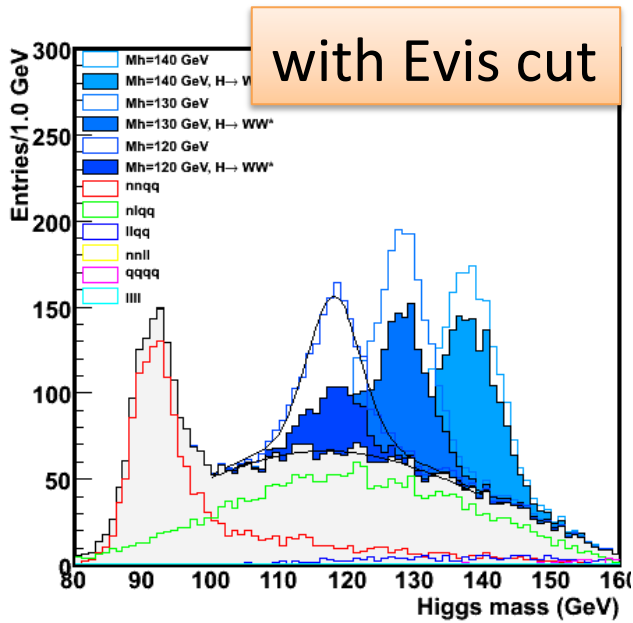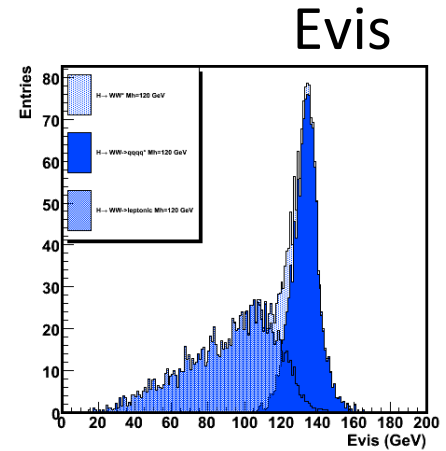Compare with takubo-san's result

Ecm=250 GeV, L=250 fb-1

Difference from the Takubo-san's cut : Evis (W→νl rejection)

with Evis cut

w/o Evis cut

Likelihood cut discriminant looks different → Caused by b-likeness and Y34 variable

Background reduction summary

	All	Rec	Mh	MM	Y-	cosθ	wblike	blike(2j)	Etrk	LR	Eff.
vvww(4j)	678	678	611	604	603	579	564	548	536	367	54.2%
vvww	1486	1408	638	632	629	604	589	573	561	372	25.1%
vvbb	7101	7101	4628	4585	4001	3816	662	300	293	128	1.8%
ZH all	10634	10396	6255	6194	5463	5219	1988	1592	1553	915	8.6%
nlqq	298103	298103	34186	16975	14132	12410	11986	11746	11114	1060	0.4%
nnqq	63649	63649	2382	2334	1890	1712	1400	1354	1290	230	0.4%
llqq	335756	335753	5502	2611	2278	913	612	571	535	68	0.0%
nnll	108074	58504	6249	5553	90	80	80	80	70	0	0.0%
qqqq	378726	378726	529	172	170	18	11	9	9	2	0.0%
llll	753964	752157	16913	6836	2159	471	447	432	363	0	0.0%
SM all	1938270	1886890	65761	34481	20719	15603	14535	14191	13380	1361	0.1%

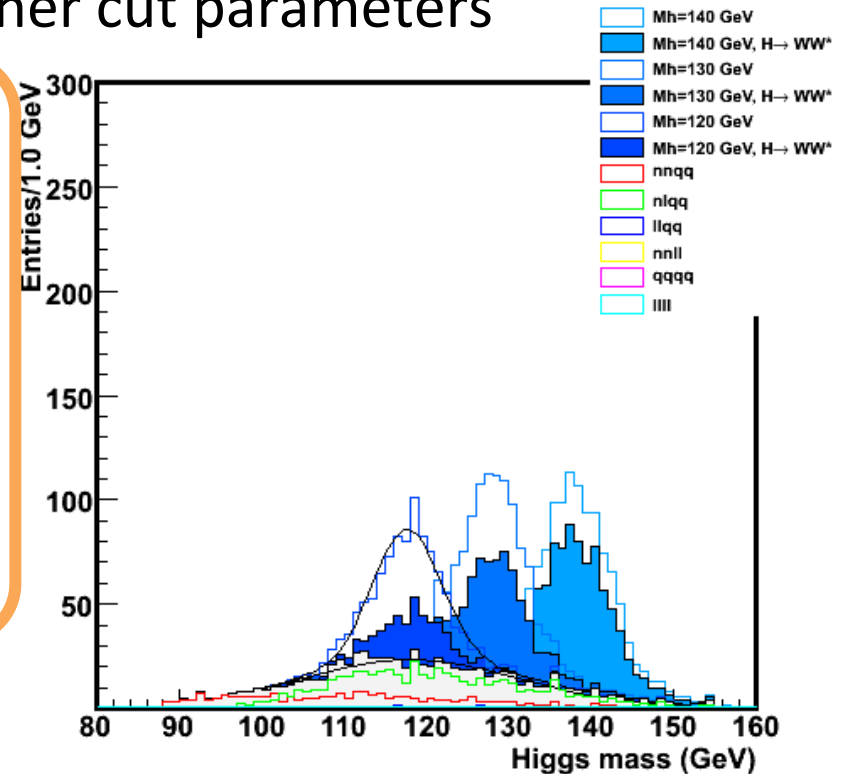H→WW(4j) Signal significance: 7.7
Takubo-san's results: 7.6

Update cut parameters

Now try to improve with some other cut parameters

1. MissingMass> 60 GeV
2. $|\cos\theta_h|$ <0.95
3. 10 < Pt < 70 GeV
4. |Pl| < 60 GeV
5. Sum of coneEjet < 120 GeV
6. # of charged tracks > 10
7. # of PFOs > 40

Likelihood variables

1. Missing mass
2. $\cos\theta_h$
3. MW1
4. Acoplanarity
5. # of charged tracks

Legend:
- Mh=140 GeV
- Mh=140 GeV, H→ WW*
- Mh=130 GeV
- Mh=130 GeV, H→ WW*
- Mh=120 GeV
- Mh=120 GeV, H→ WW*
- nnqq
- nlqq
- llqq
- nnll
- qqqq
- llll

Background suppression is improved but signal significance is reduced
→ Need to optimize cut parameters
Signal significance ~ 7.0

Takubo-san's cut summary

Process	No cut	After cuts	$\mathcal{L}_{\mathrm{cut}} > 0.79$	$N_c = 2$
$\nu\nu H(H \to \mathrm{all})$	10,634	1,518	756	546
$\nu\nu H(H \to WW^* \to 4\text{-jet})$	680	512	348	258
$\ell\ell\ell\ell$	753,964	46	0	0
$qqqq$	378,726	8	3	2
$\ell\ell qq$	335,762	409	94	70
$\nu\ell qq$	299,866	8,571	1,063	692
$\nu\nu\ell\ell$	103,704	3	0	0
$\nu\nu qq$	63,649	1,090	207	110
SM all		10127	1367	