

# Higgs study

ILC physics and software meeting

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# Current status

$e^+e^- \rightarrow \nu\nu H \rightarrow \nu\nu WW^*$  for DBD analysis

$H \rightarrow WW^* \rightarrow qqqq$  reconstruction

$E_{cm} = 250 \text{ GeV}$ ,  $L = 250 \text{ fb}^{-1}$

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

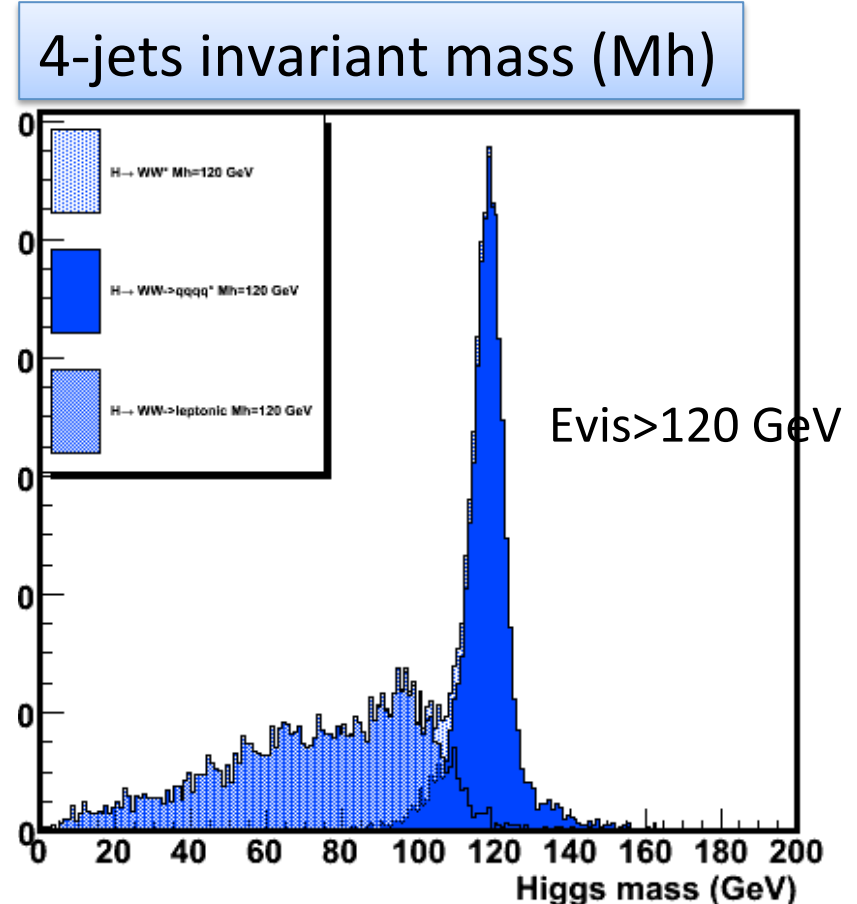
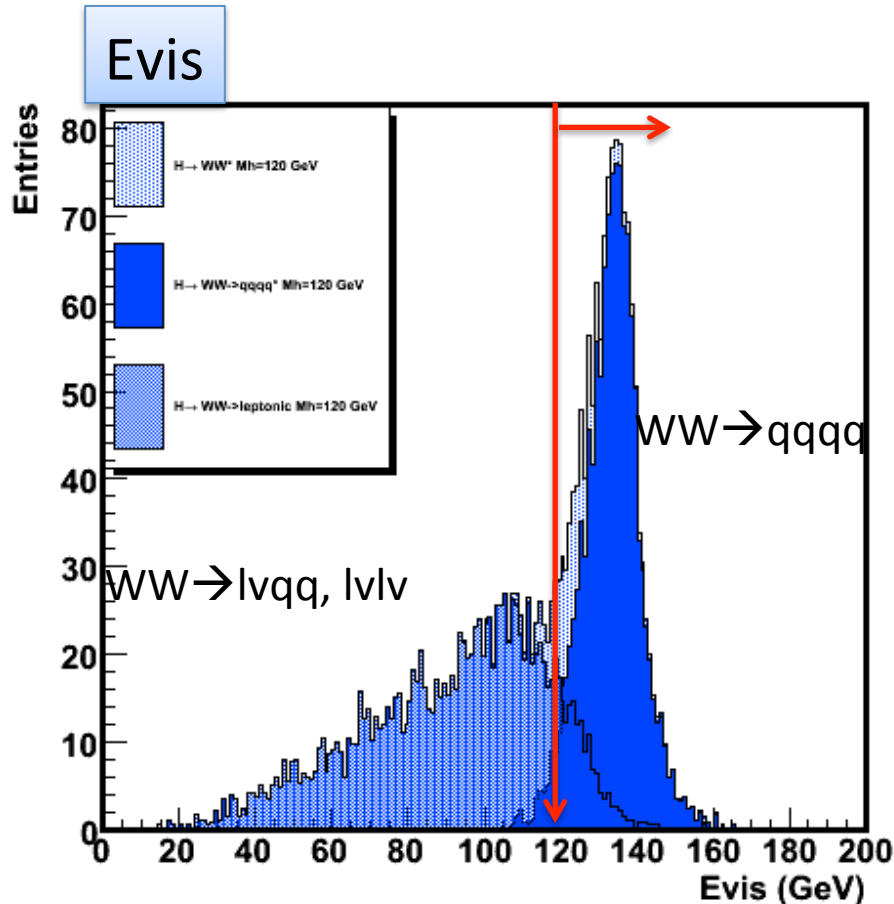
Forced four-jet clustering, then select best jets pair with minimum  $\chi^2$

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

- Evis cut
  - remove leptonic decay mode
- b-likeness, c-likeness cut with 2-jet clustering
  - $H \rightarrow bb, cc$  background reduction

# Evis cut to remove leptonic decay

$H \rightarrow WW \rightarrow qqqq$  can be selected with Evis cut

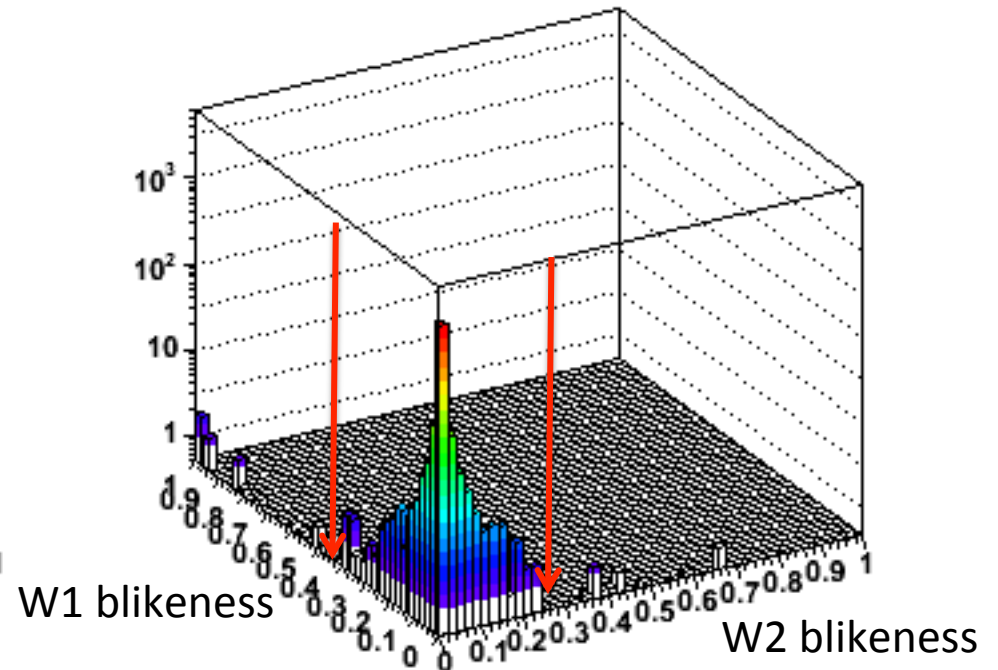
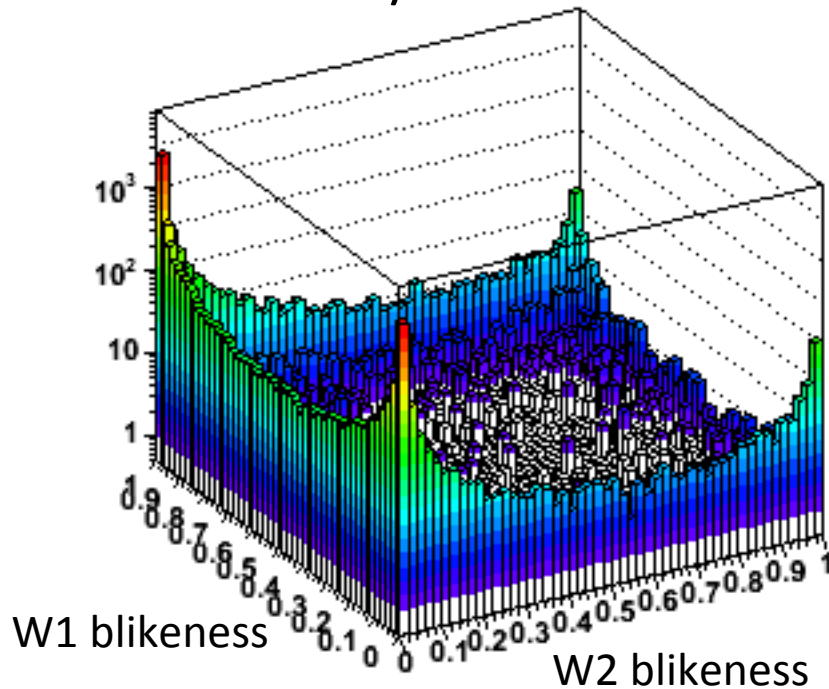


# $H \rightarrow WW^*$ select from $H \rightarrow \text{All}$

$x$ -likeness =  $x_1 x_2 / (1 - x_1)(1 - x_2)$ ,  $x_{1,2}$ : flavor tagging output

$H \rightarrow \text{All}$  w/o  $WW^*$

$H \rightarrow WW^*$

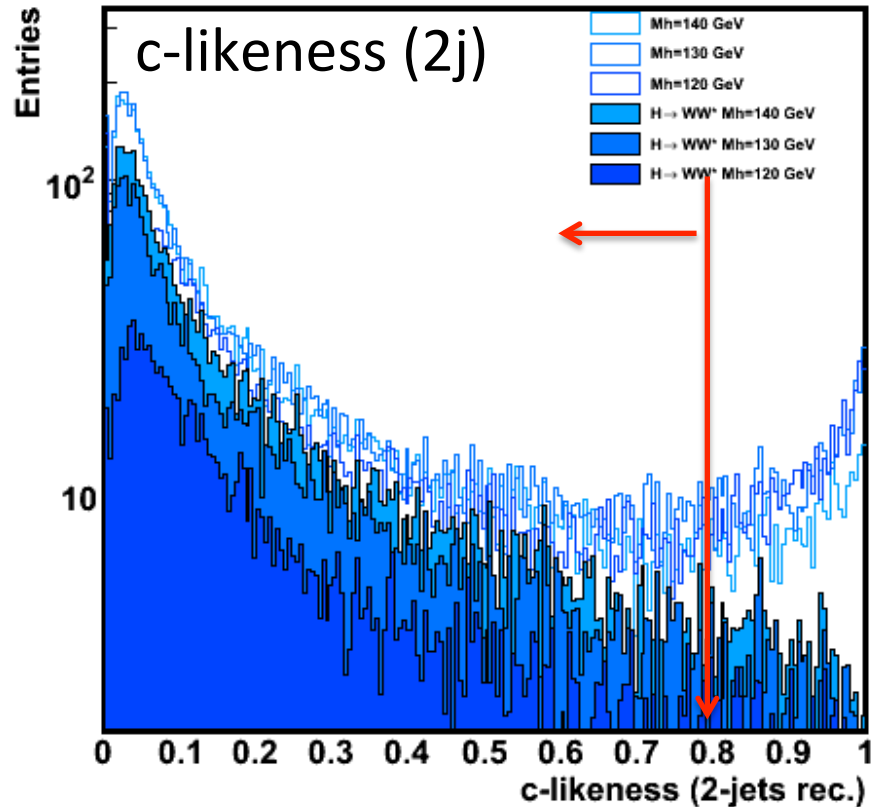
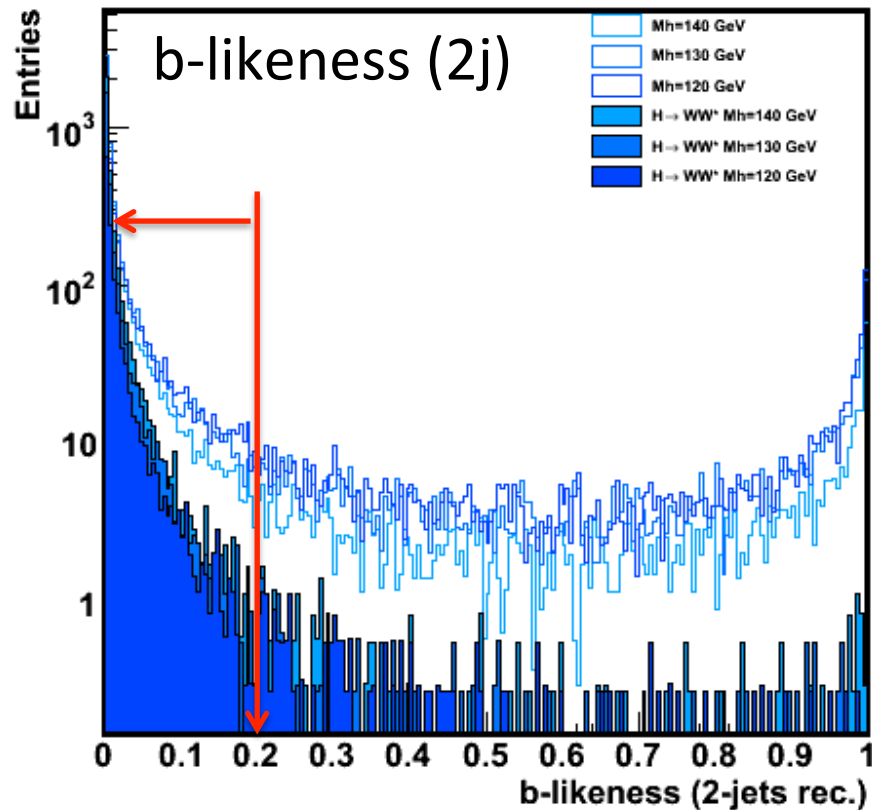


$H \rightarrow bb$  will be a background for  $H \rightarrow WW^*$   
# of b-tagged jet rejection

# $H \rightarrow WW^*$ select from $H \rightarrow \text{All}$

After the  $W1$  b-likeness  $< 0.2$  &  $W2$  b-likeness  $< 0.2$  cut

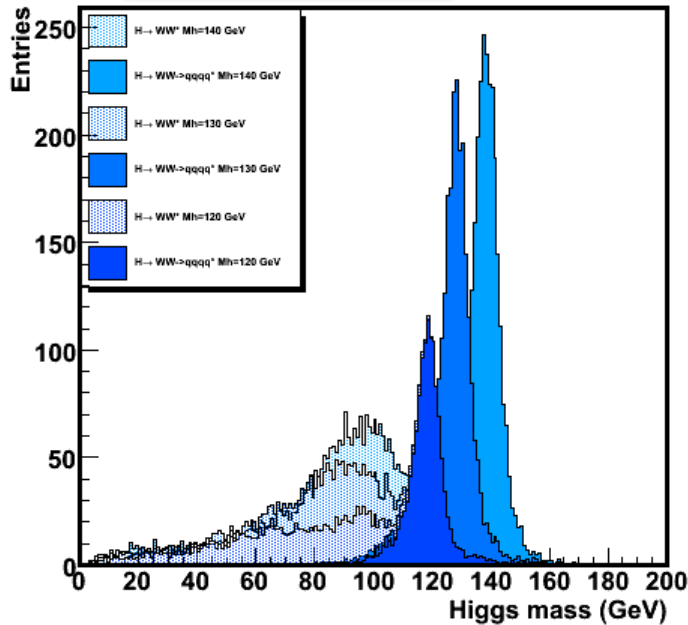
$H \rightarrow bb$  rejection with “2-jet reconstruction” b-likeness, c-likeness



# 4-jet invariant mass

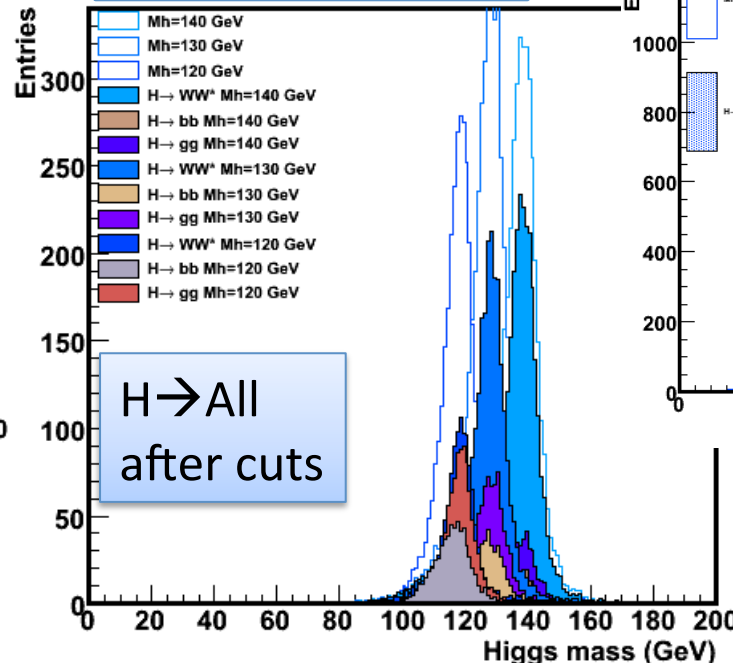
$H \rightarrow WW^*$  with forced four-jet clustering,  $M_h = 120, 130, 140$  GeV  
 $E_{cm} = 250$  GeV,  $L = 250 \text{ fb}^{-1}$ ,  $P(e^+, e^-) = (-30\%, +80\%)$

$H \rightarrow WW$  only

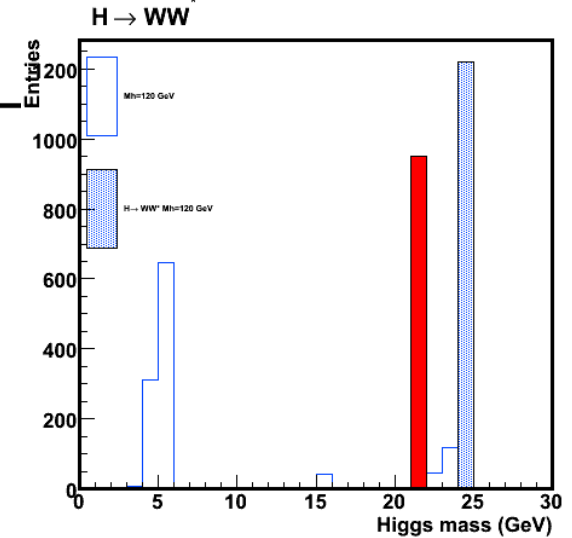


$E_{vis} > 120$  GeV  
 $W_{1,2} \text{ b-likelihood} < 0.2$   
 $\text{b-likelihood}(2j) < 0.2$   
 $\text{c-likelihood}(2j) < 0.8$

Still remaining  $H \rightarrow gg, bb$



$H \rightarrow \text{All}$   
 after cuts



4-jets invariant-mass distribution

# Reconstructed Higgs mass dist.

BG: WW, ZZ (vvqq, vlqq, llqq, qqqq, qq, vvll)

$E_{vis} > 120 \text{ GeV}$   
 $70 < \text{MissingMass} < 140 \text{ GeV}$   
 $P_{jmax} < 30 \text{ GeV}$   
 $-\text{Log}(Y_{minus}) < 4$   
 $-\text{Log}(Y_{plus}) < 4$   
 $W_{1,2} \text{ b-likeness} < 0.2$   
 $b\text{-likeness}(2j) < 0.2$   
 $c\text{-likeness}(2j) < 0.8$

Need to improve with

- Likelihood variable cut

Takubo-san's analysis

