Study of Higgs Self-couplings at ILC

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status

- try to estimate the statistical fluctuation mainly of backgrounds

- try to use bc tagging to further suppress background such as tauvbbcs (dominant after b tagging)

- neural-net training for vvHH analysis

Significance

I: $$1 - p = \int_{-\infty}^{\mu\sigma} N(0,1)$$ ✓ PDG recommended

II: $$1 - p = \int_{-\mu\sigma}^{\mu\sigma} N(0,1)$$

Energy (GeV)	Modes	signal	background	excess significance	
				def I	def II
500	$ZHH \to (l\bar{l})(b\bar{b})(b\bar{b})$	4.7	2.3	2.4σ	2.6σ
500	$ZHH \to (\nu\bar{\nu})(b\bar{b})(b\bar{b})$	3.7	1.6	2.1σ	2.4σ
500	$ZHH \to (q\bar{q})(b\bar{b})(b\bar{b})$	26.4	153	2.1σ	2.4σ
500	combined			4.5σ	4.7σ

P value

excess: assuming there is no signal, the probability of no less than observed events are backgrounds.

$$p = \int_{S+B}^{+\infty} f(x, B, \sqrt{B})\mathrm{dx} \qquad \frac{S}{\sqrt{B}}$$

measure: assuming signal signal exists, the probability of no greater than background events are observed.

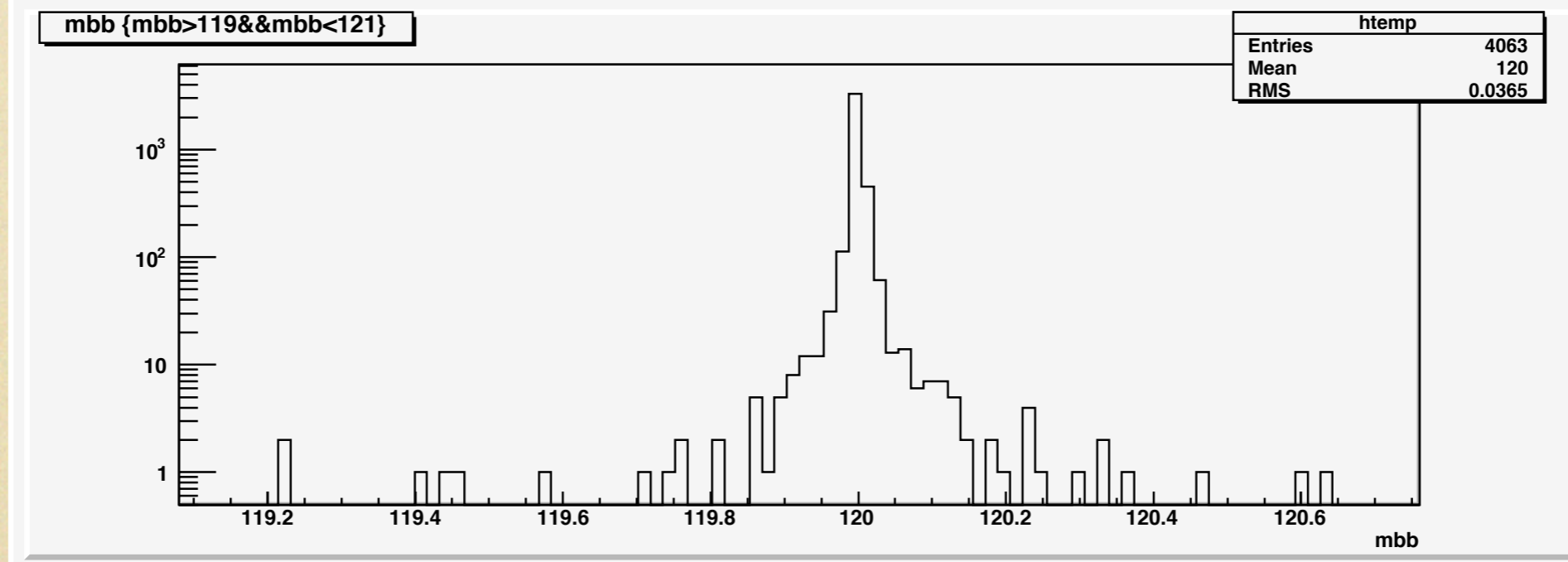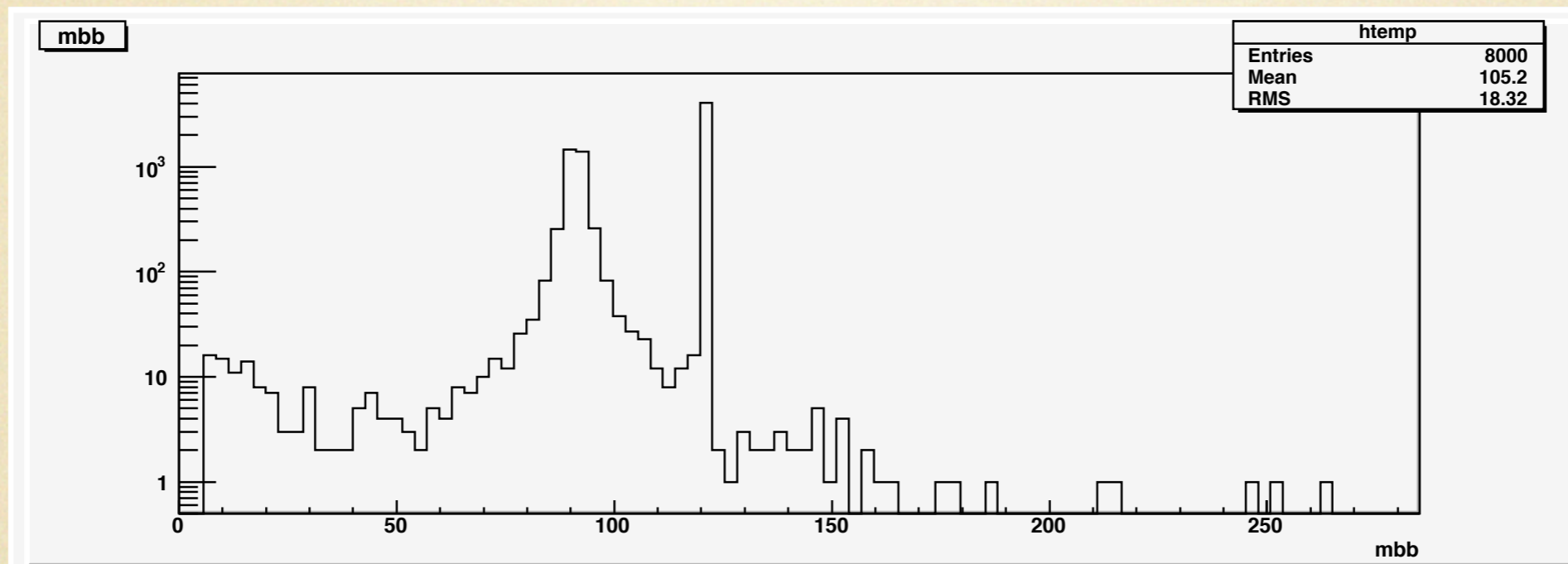$$p = \int_{-\infty}^{B} f(x, S+B, \sqrt{S+B})\mathrm{dx} \qquad \frac{S}{\sqrt{S+B}}$$

Energy (GeV)	Modes	signal	background	significance	
				excess	measurement
500	$ZHH \to (l\bar{l})(b\bar{b})(b\bar{b})$	4.7	2.3	2.4σ	1.7σ
500	$ZHH \to (\nu\bar{\nu})(b\bar{b})(b\bar{b})$	3.7	1.6	2.1σ	1.5σ
500	$ZHH \to (q\bar{q})(b\bar{b})(b\bar{b})$	26.4	153	2.1σ	2.0σ
500	combined			4.5σ	3.8σ

I. give the confidence how significantly we can observe the ZHH events

II. give the confidence how accurately we can measure the X-section or coupling

check of qqbbH backgrounds in qqHH analysis

backup