vvh @ 1TeV benchmark study for DBD

ILD meeting @LCWS12

Oct. 24 2012

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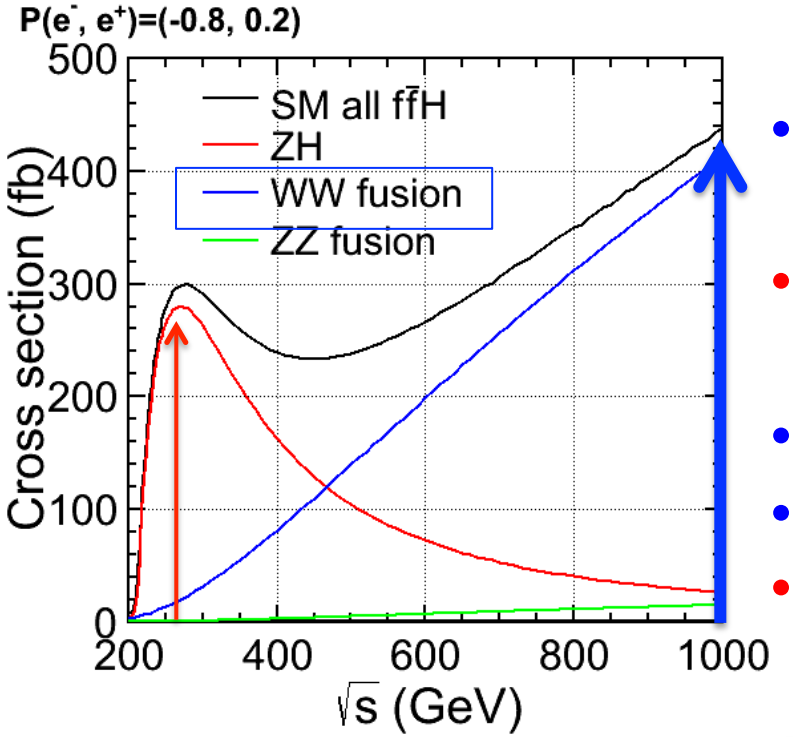
vvh @ 1TeV benchmark study

$e^+e^- \rightarrow \nu\nu h$ at 1 TeV: detector benchmarking process

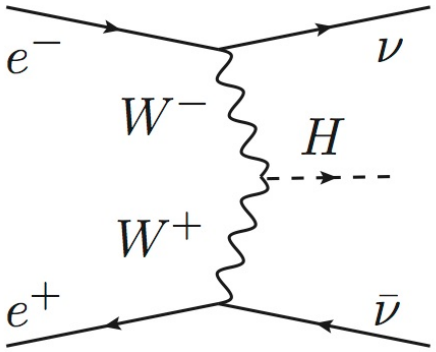
Observable: cross section times branching ratios (σ×BRs)

Decay channels: h→bb, cc, gg, WW*, μμ (by Calancha)

Performance of Jet clustering , flavor tagging, Jet E resol.



Main production: WW-fusion ($e^+e^- \rightarrow \nu\nu h$)



- Larger cross section than ZH@250 GeV
- L=250 fb^{-1}→L=1 ab^{-1} (500 fb^{-1} for both pol.
- $(e^+, e^-)=(0.2, 0.8)$
- γγ→hadron BG overlay
- 2f, 4f major BGs are only considered at this moment

γγ→hadron background with k_t jet clustering

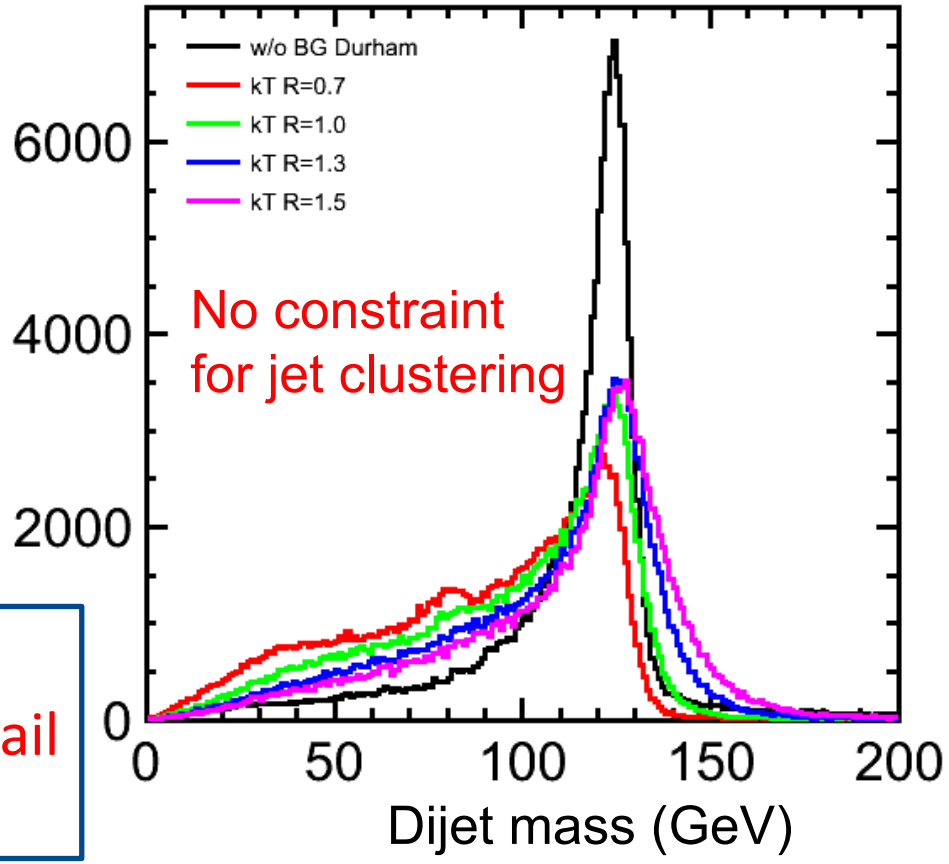
Use latest v01-16-p03 samples with γγ→hadron BG overlaid

1. Apply k_t two jet clustering
2. Get associated PFOs into new collection
3. Reapply LCFIPlus flavor tag and jet clustering

R=1.0~1.3 looks better
→Set R=1.1 at this moment

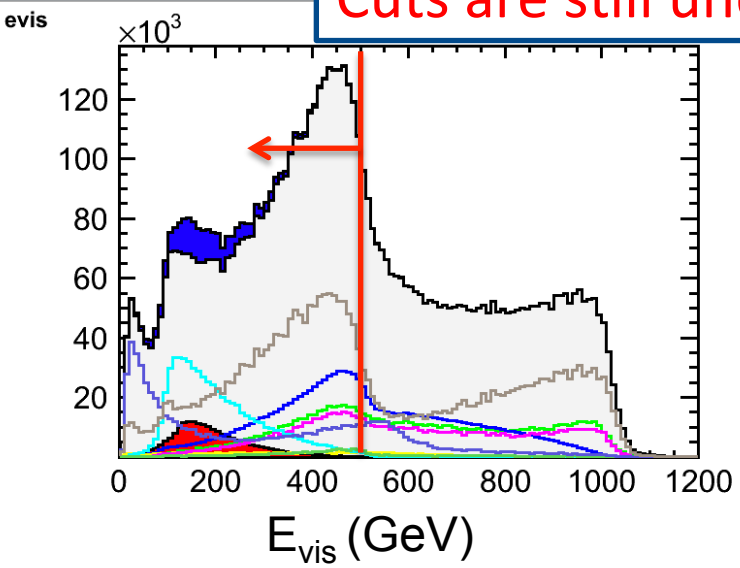
No constraints for jet clustering
→Need to investigate more detail of γγ BGs contribution

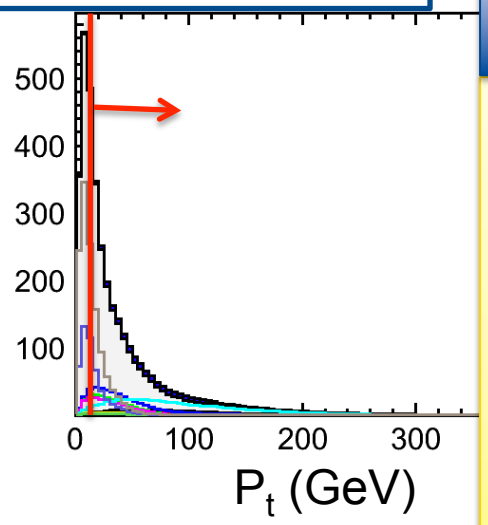
Dijet rec. with γγ→hadron BG

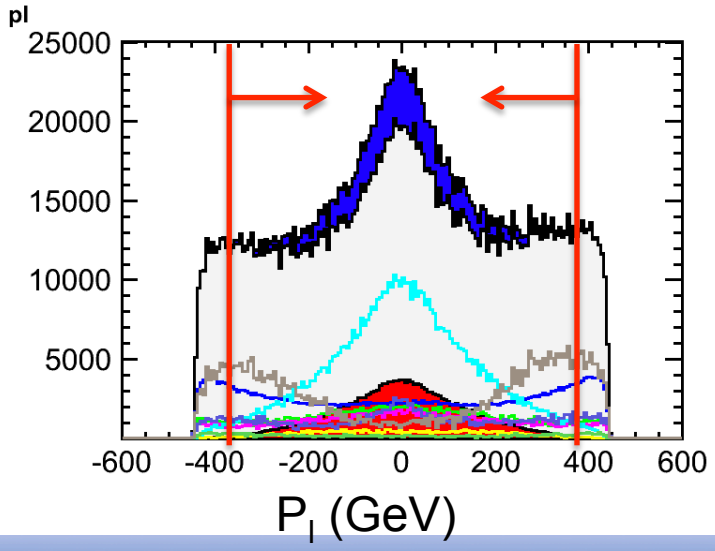


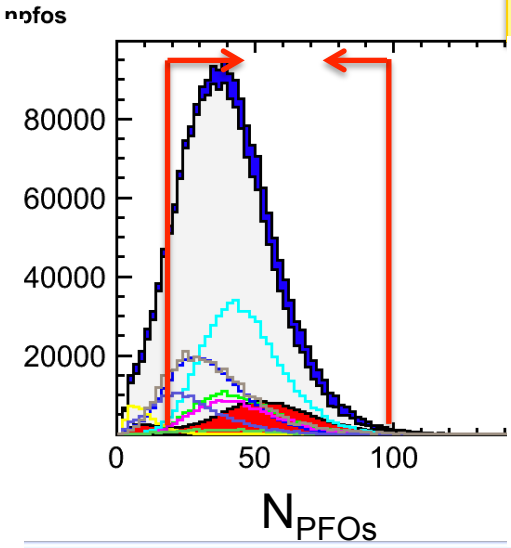
Background reduction with REC files

Cuts are still under optimization



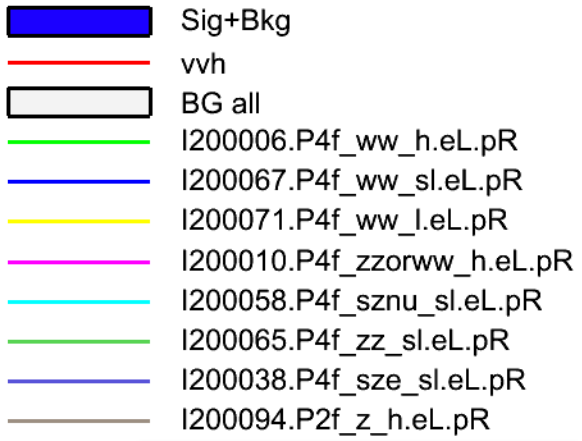






Cut condition

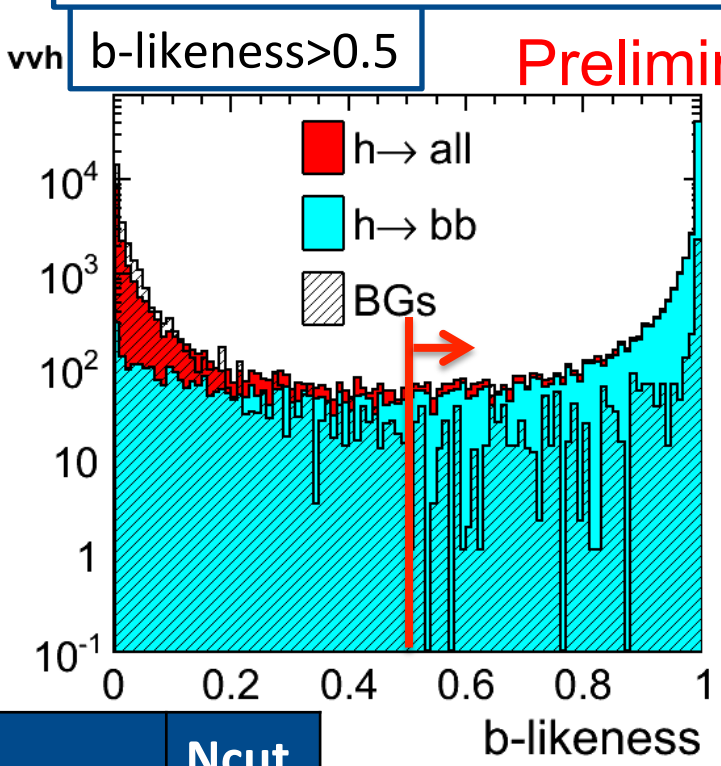
1. Evis < 450 GeV
2. Pt > 15 GeV
3. |Pl| < 450 GeV
4. 20 < NPFOs < 100
5. $|\cos\theta_h| < 0.95$
6. $110 < M_h < 140$ GeV



Major BGs only

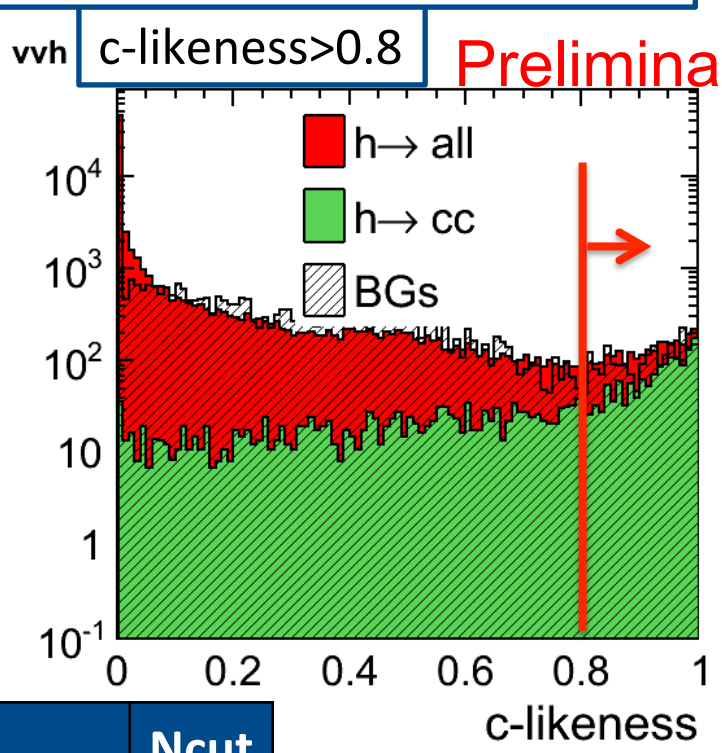
LCFIPlus flavor tagging with qq250 weights file

LCFIPlus working well, need to compare with previous LCFIVTX



	Ncut
h→bb	51,943
h→Other	891
BGs	3,869

h→bb
Signal purity: 92%
Significance: 218



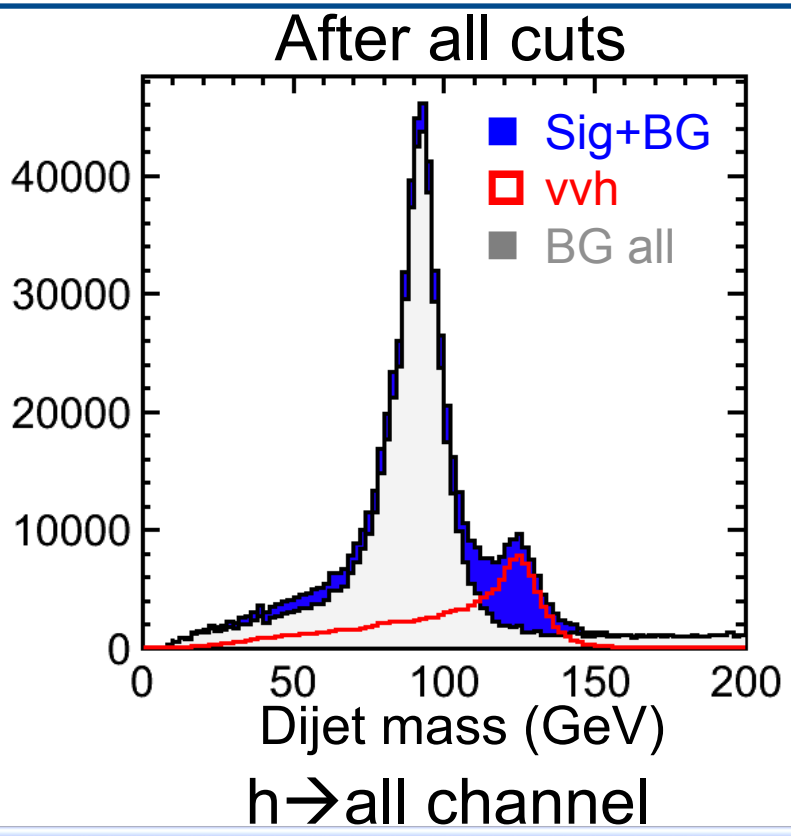
	Ncut
H→cc	1,384
H→Other	1,260
BGs	2,177

h→cc
signal purity: 29%
Significance: 20

Reconstructed dijet mass distribution

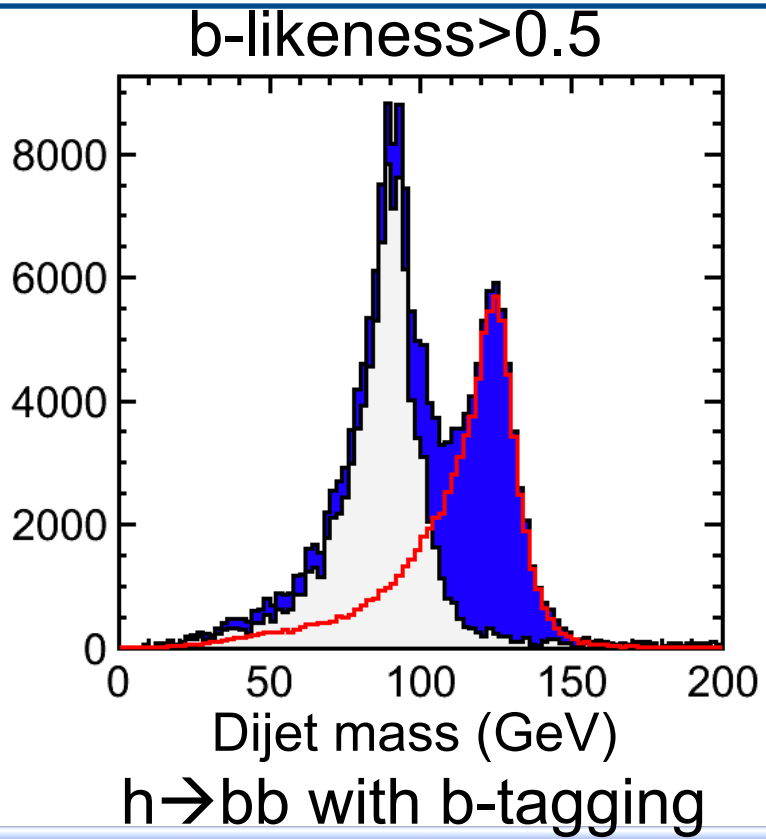
1. Reconstruction with the k_t two jet clustering
2. Apply all the selection criteria (Only consider 2f, 4f major BGs)

Need to evaluate γγ→hadron BG contribution in final reconstruction



h→all channel

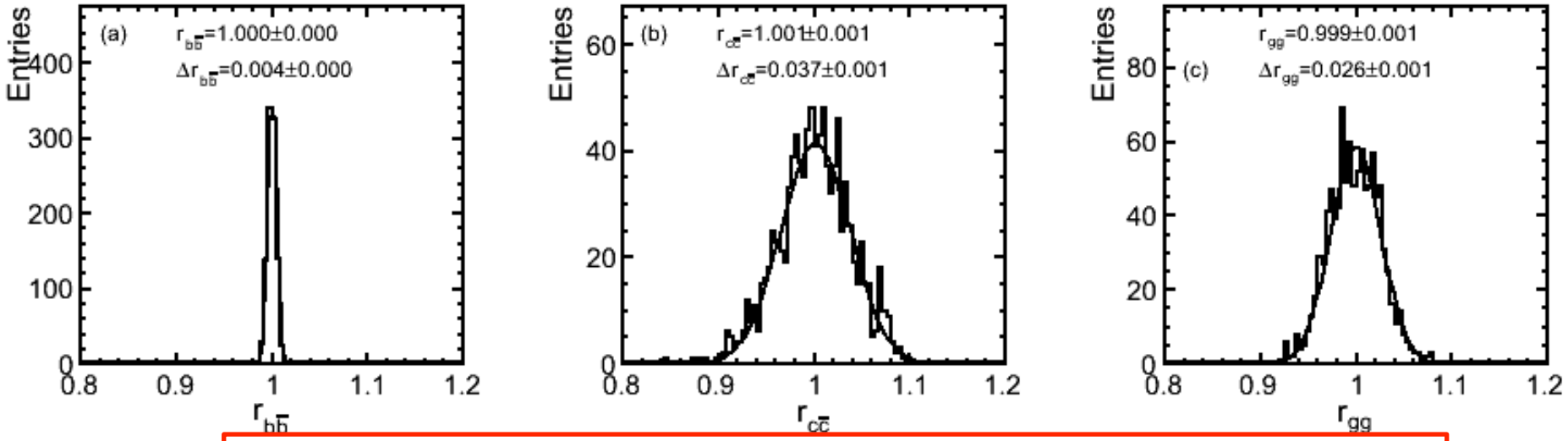
b-tag



h→bb with b-tagging

Apply template fitting scheme

Fitted results with template fitting



Very preliminary results only with major BGs
Analysis scheme is checked and looks working

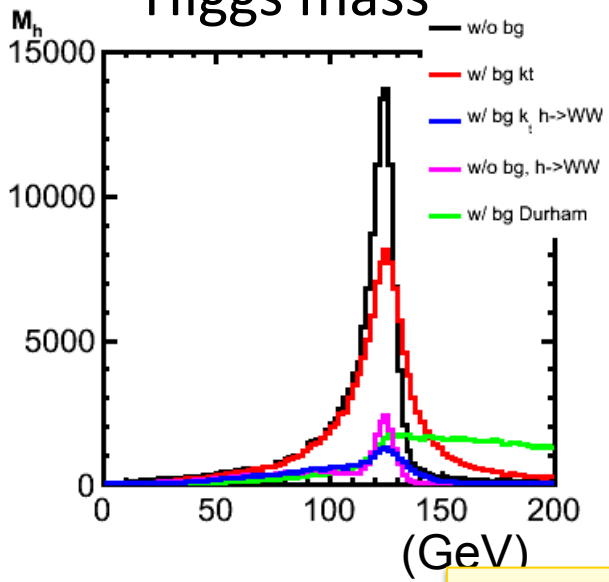
L=500 fb^{-1}, $(e^-,e^+)=(-0.8, +0.2)$
2f, 4f major BG only
→ Need to include other possible BGs

Channel	ΔσBR/σBR
h→bb	~0.5%
h→cc	~5%
h→gg	~3%

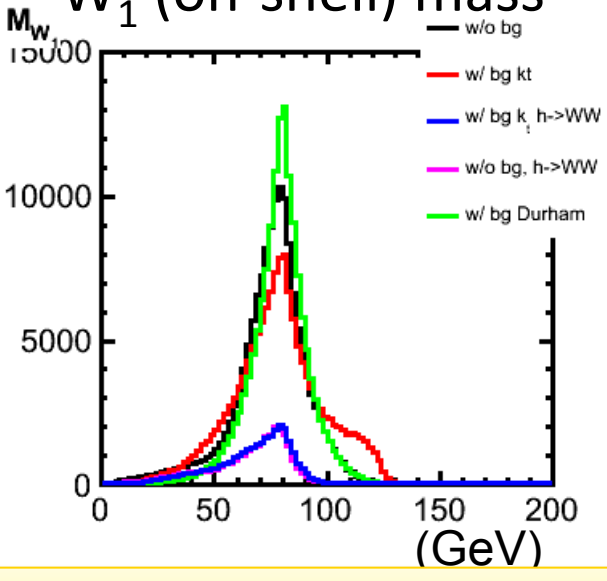
H→WW study

Consider H→WW*→qqqq hadronic decay channel
k_t four jet clustering is tested w/ or w/o γγ background

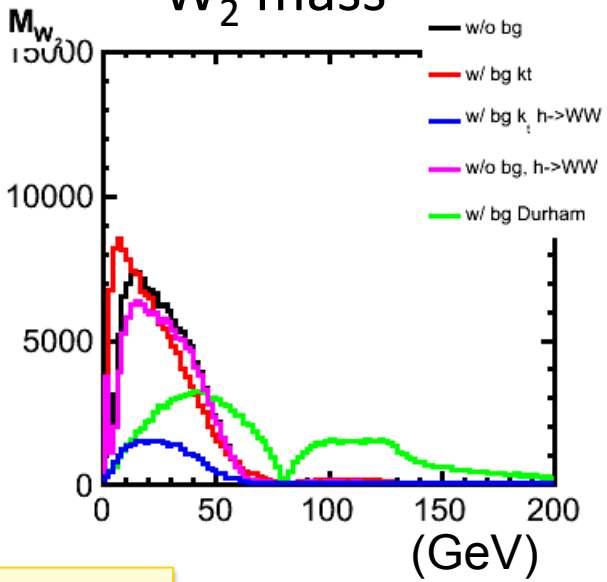
Higgs mass



W_1 (on-shell) mass



W_2 mass



νν+4j final state ($M_{4j}=M_h$, $M_{2j}=M_W$)

k_t Jet clustering suppress the γγ background

This study is also still ongoing…

Backup

σBR accuracy with template fitting

Prepare flavor templates of h→bb, cc, gg signal and BGs

$r_{xx}=\sigma BR/\sigma BR^{SM}(h\rightarrow xx)$

$N^{data}=\Sigma r_{xx} * N^{template}(h\rightarrow xx)+N^{BG}$

(r_{xx} is a fitted parameter)

1000 times of Toy MC is applied to evaluate the accuracy of σBR