ILC's search for little higgs with T parity parameters ∽ZHZHmode∽

Eriko Kato

Today's topic

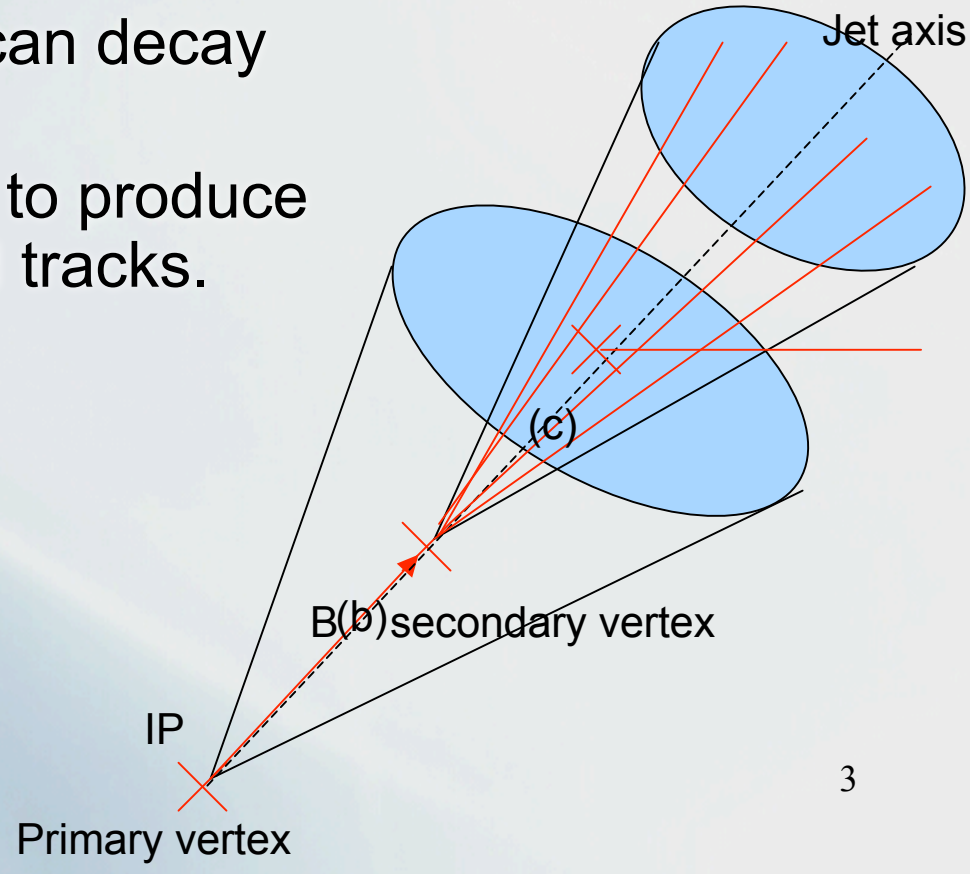
- Study on b-tagging.
  - b-tagging algorithm used in qsim.
  - higgs -> WW
  - cutting

Features of b-jets:

- B-hadron flies a few mm.
- Tracks are diplaced from primary vertex.
- b is heavy thus produce jets with large transverse momentum.
- There are many ways b can decay

  ex) b→c→…etc

  →b jet has the tendency to produce large amounts of charged tracks.



b-tagging algorithm used in quicksimulator

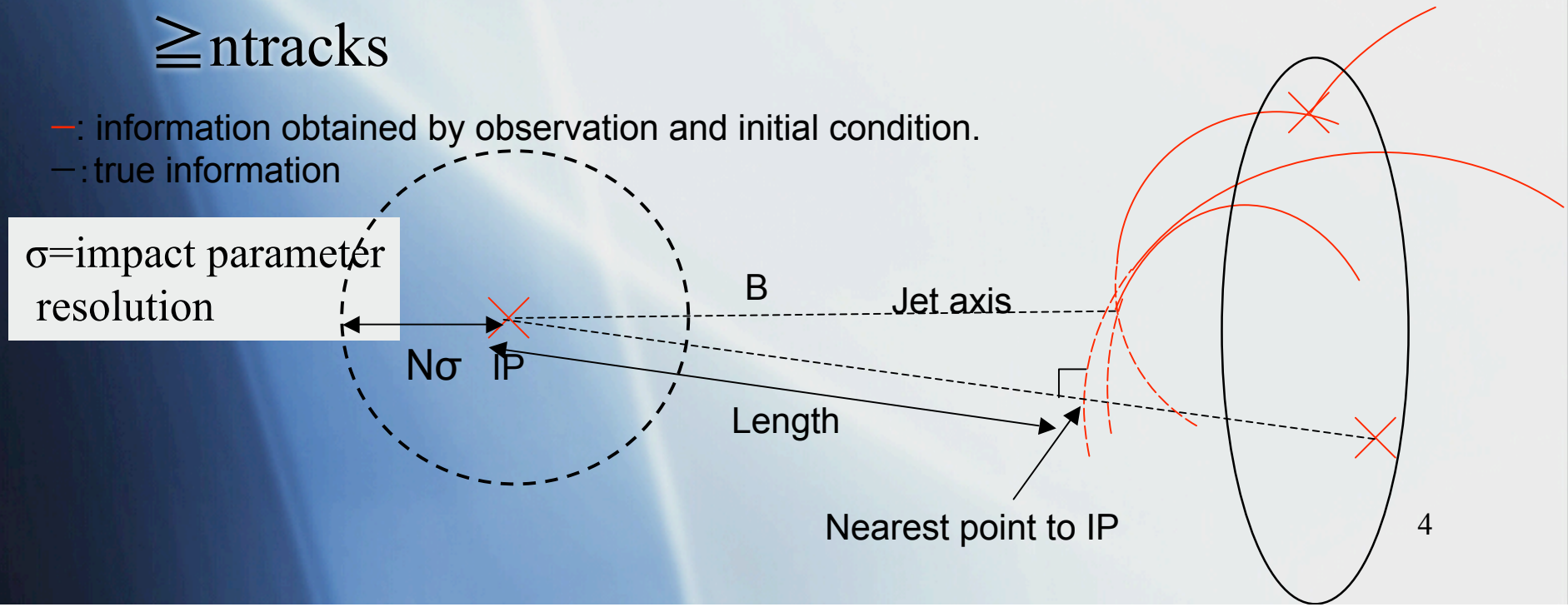
b-tag alogorithm tags jets as b when the events satisfy the following conditions;

1)length between IP and center of the track's circle

$\geqq N\sigma$ (N=1,2,3…)

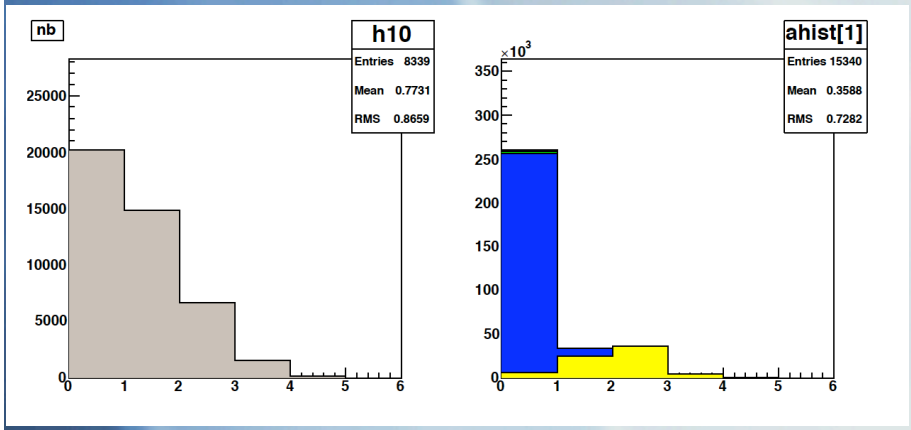
2)No. of tracks outside Nσ radius

$\geqq$ntracks

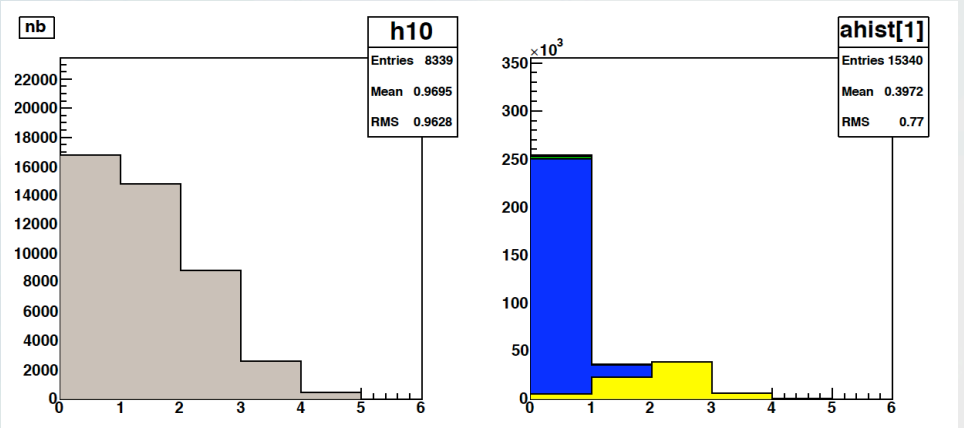


Distribution of # of btag particles

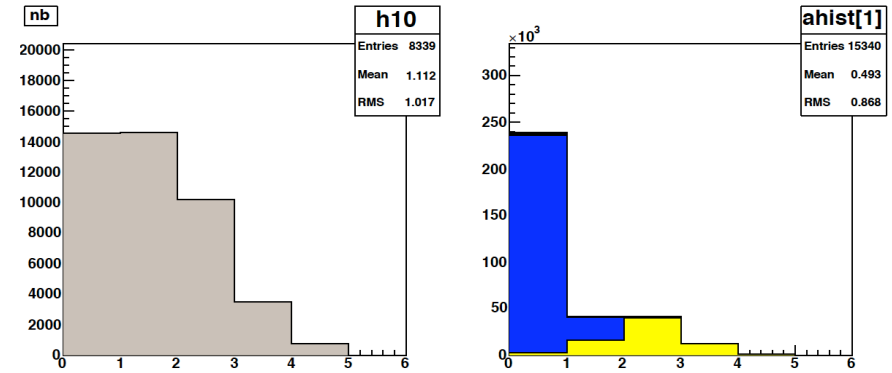
length ≧ 3σ No.tracks ≧ 3



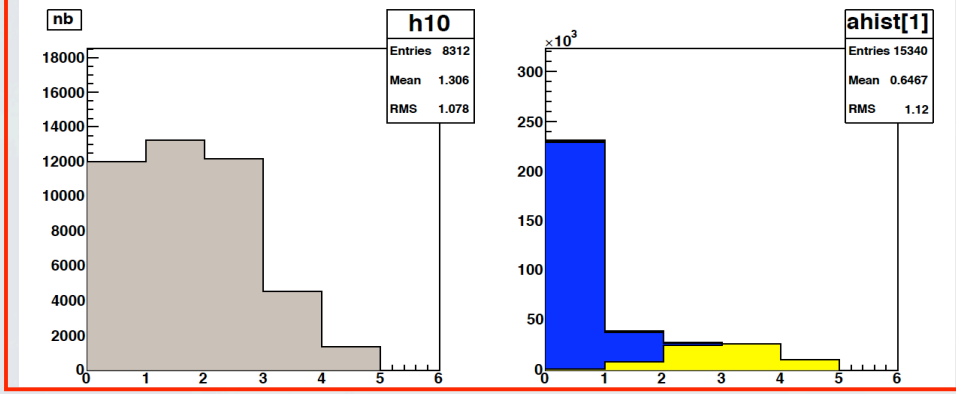
length ≧ 2σ No.tracks ≧ 3



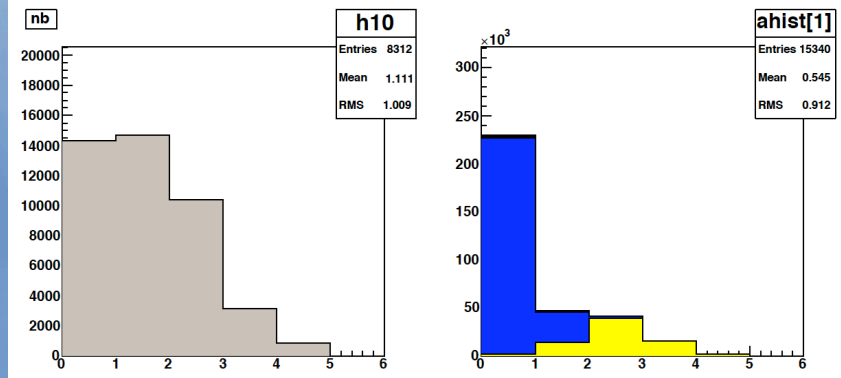
length ≧ 3σ No.tracks ≧ 2



length ≧ 1σ No.tracks ≧ 3



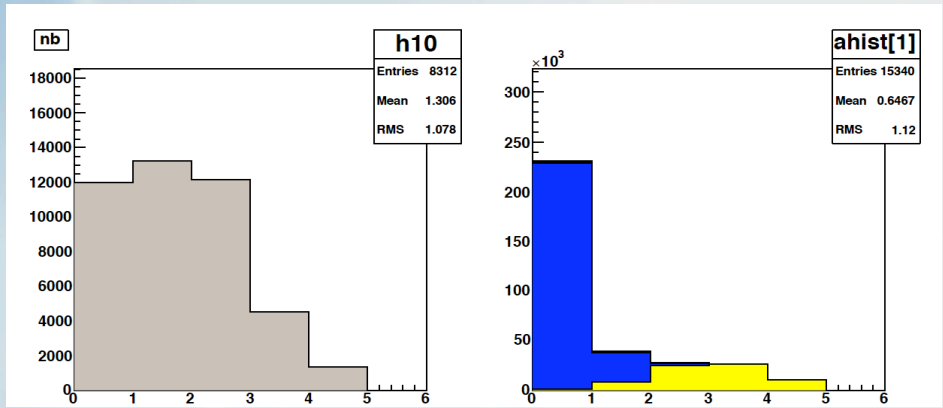
length ≧ 2σ No.tracks ≧ 2



ZHZH(signal)
WWZ(bg)
nnWW(bg)
tt (bg)
WW(bg)

Distribution of # of btag particles

length ≧ 1σ No.tracks ≧ 3



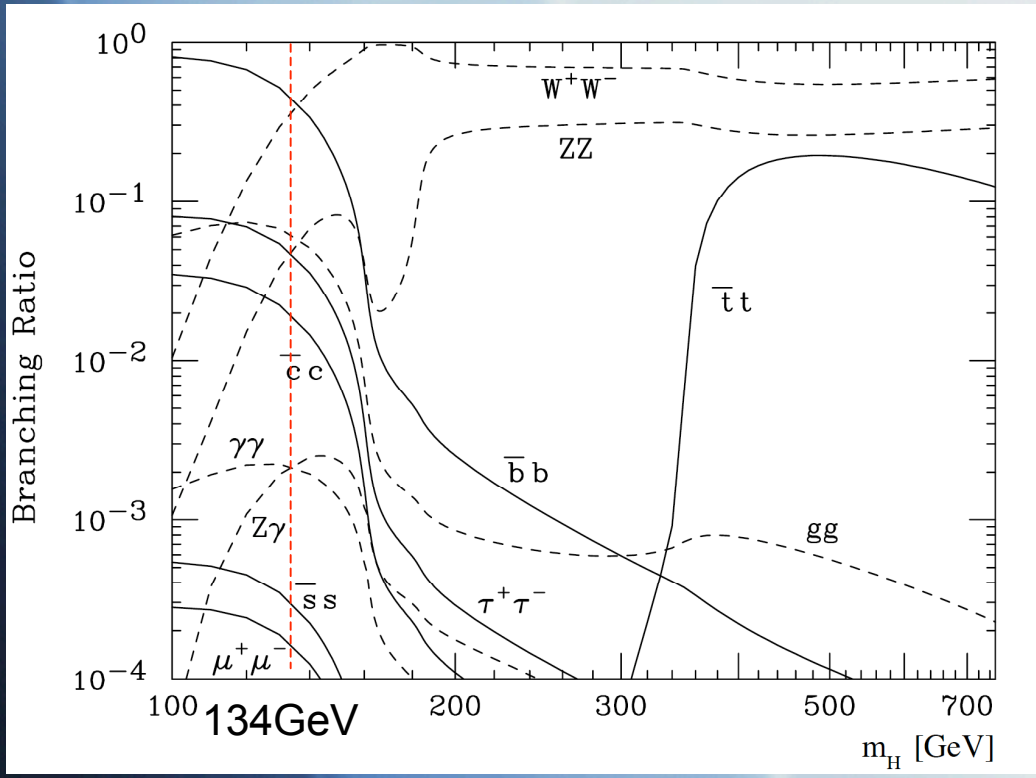
Majority not recognized as a 4 b-jet

->•efficiency of tagging b as b

•other decay modes in sg apart from H->bb

Higgs branching ratio

Standard model information



Pythia information

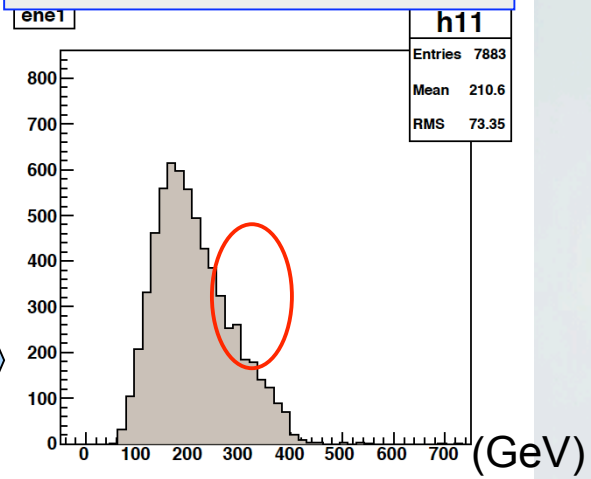
When higgs mass =134GeV

Br(h→bb) =42.35%
Br(h→WW)=39.57%
Br(h→ZZ) =5.50%
Br(h→ττ)= 5.21%
Br(h→gg) =4.49%
Br(h→cc)= 2.31%

Problem with analyzing H->WW

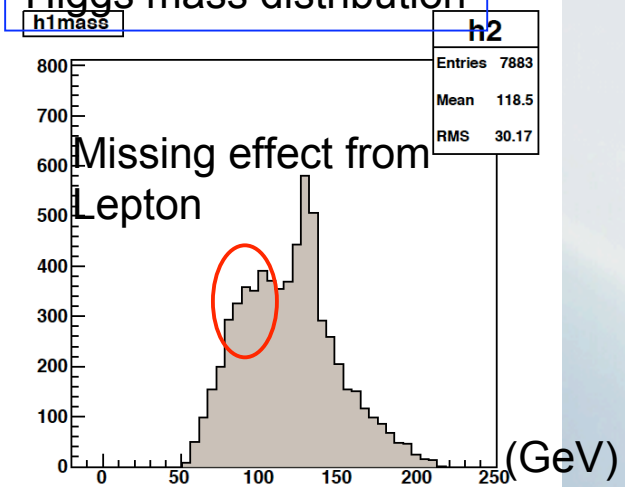
While restricting H to only decay into W
H->WW

Higgs energy distribution



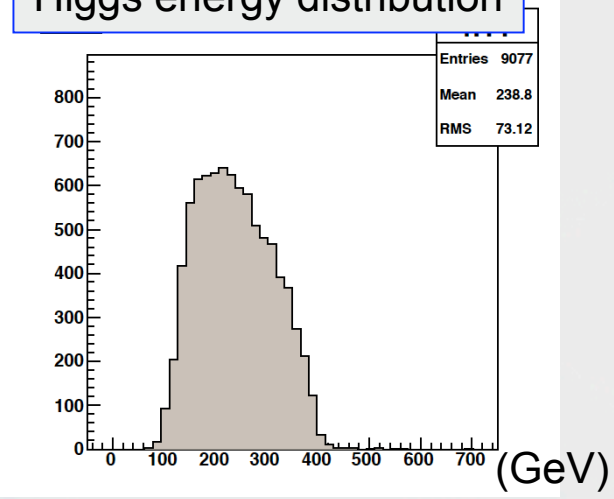
Large missing effect

Higgs mass distribution

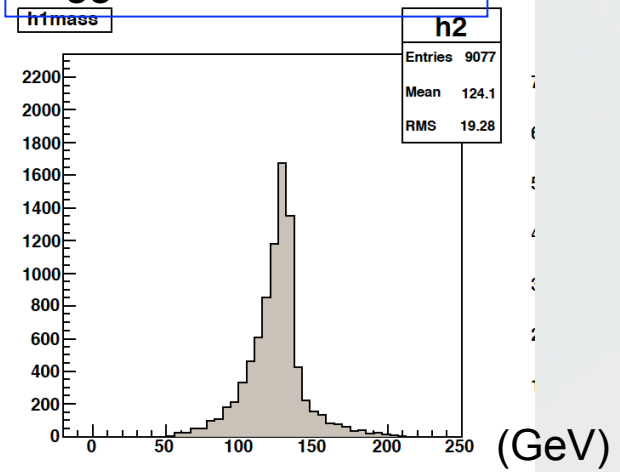


While restricting H to only decay into b
H->bb

Higgs energy distribution



Higgs mass distribution



Distribution of # of btag particles

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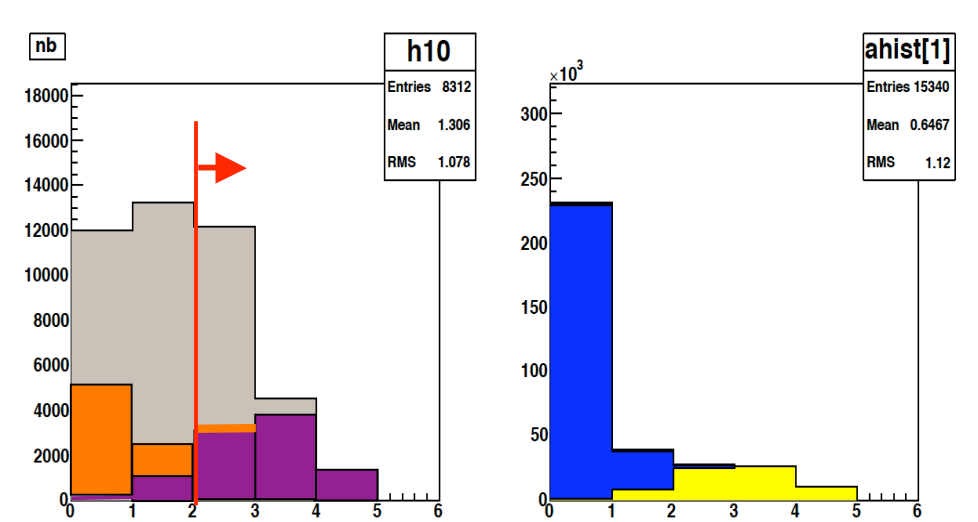
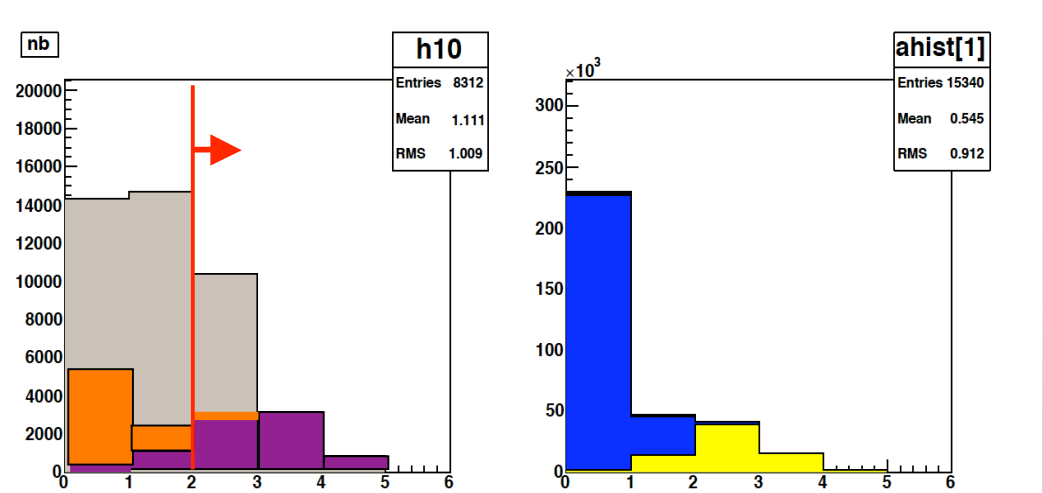


length ≧ 2σ No.tracks ≧ 2



ZHZH(H->bb)

ZHZH(H->WW)

ZHZH
(H-> non of the above
b & H->WW etc)

WWZ(bg)

nnWW(bg)

tt (bg)

WW(bg)

Efficiency

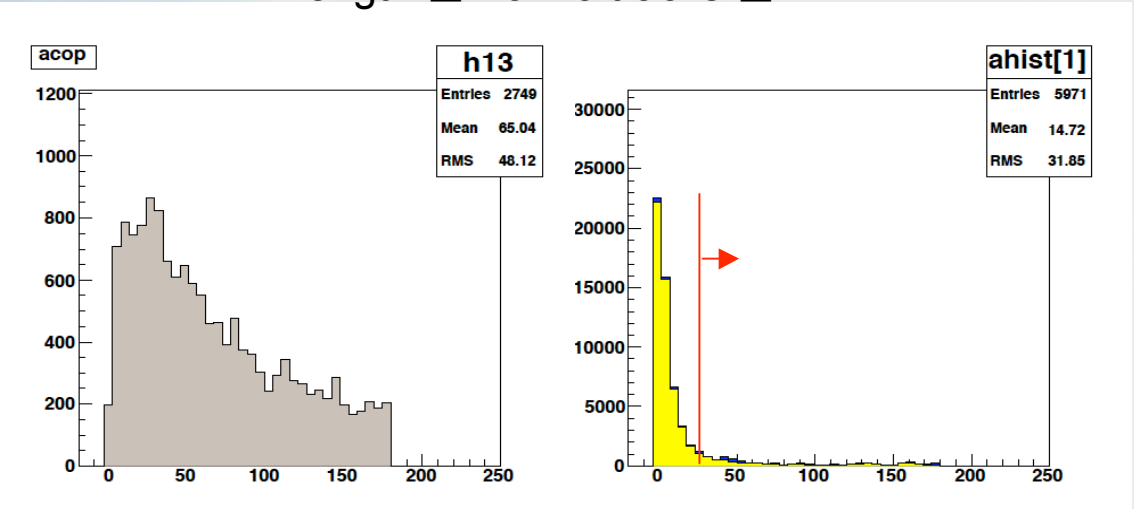
(Nσ,#of tracks)	E_b (±2%)	E_c (±0.5%)
(1,3)	approx. 60%	approx. 15%
(2,2)	approx. 60%	approx. 25%
(3,2)	approx. 50%	approx. 17%
(2,3)	approx. 50%	approx. 8%
(3,3)	approx. 40%	approx. 5%

E_b :The probability of one b-jet being tagged as b

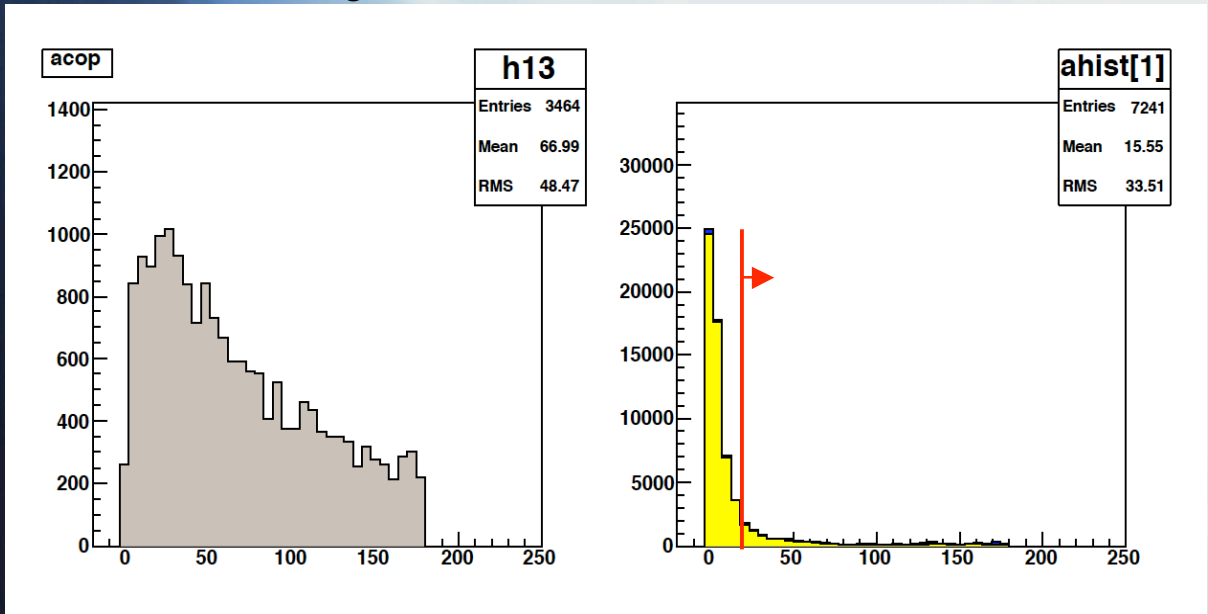
E_c :The probability of one c-jet being tagged as b

acoplanarity

length ≧ 2σ No.tracks ≧ 2



length ≧ 1σ No.tracks ≧ 3



acop>25

Cutting results

#Event No. (efficiency %)	ZHZH	WWZ	nnWW	WW	tt	significance
Cross section (fb)	97.97	5.922	6.682	3932	192.9	
No cut	4.331*10^4	1629	2383	2.592*10^5	7.164*10^4	74.85
(1,3) #b=1cut	1.805*10^4 (41.68%)	21.71 (1.332%)	725.4 (30.44%)	1.995*10^3 (0.7697%)	6.203*10^4 (86.58%)	70.94
(2,2) #b=1cut	1.433*10^4 (33.09%)	29.6 (1.817%)	104 (4.364%)	2.545*10^3 (0.9819%)	5.590*10^4 (78.03%)	59.20
(1,3) #b=1&acop<25 cut	1.376*10^4 (31.77%)	16.78 (1.030%)	577.5 (24.23%)	1.307*10^3 (0.5037%)	7.206*10^3 (10.06%)	144.2
(2,2) #b=1&acop<25 cut	1.081*10^4 (24.96%)	18.75 (1.151%)	84.00 (3.525%)	1.444*10^3 (0.5571%)	6.328*10^3 (8.833%)	121.9

* All events are under the condition chi2<100

$$significance \equiv \frac{sgNo.events}{\sqrt{bgNo.events}}$$

plan

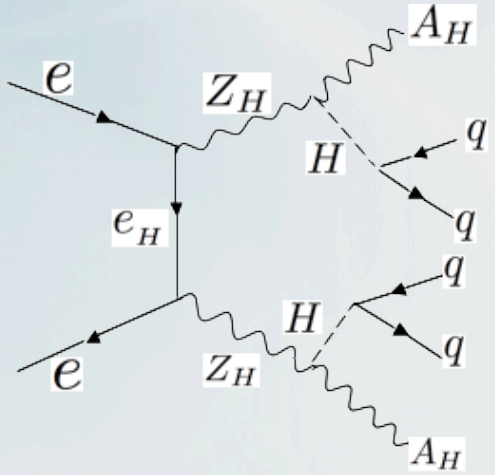
- Fit higgs energy distribution with function and check if any of the cuts have messed with the edge.

  ->decide which parameter set to select.
- Futher study on cutting.

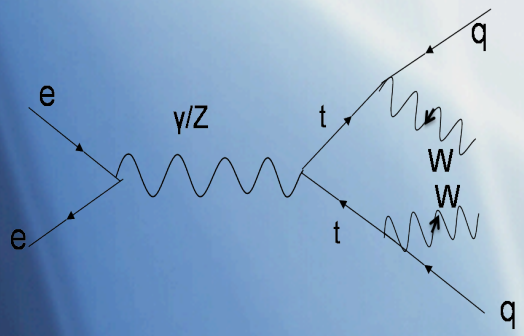
  How to increase significance without cutting the edge of higgs energy distribution.

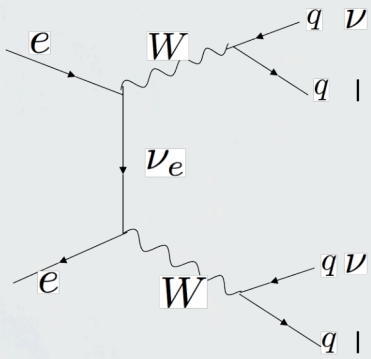
Backup slides

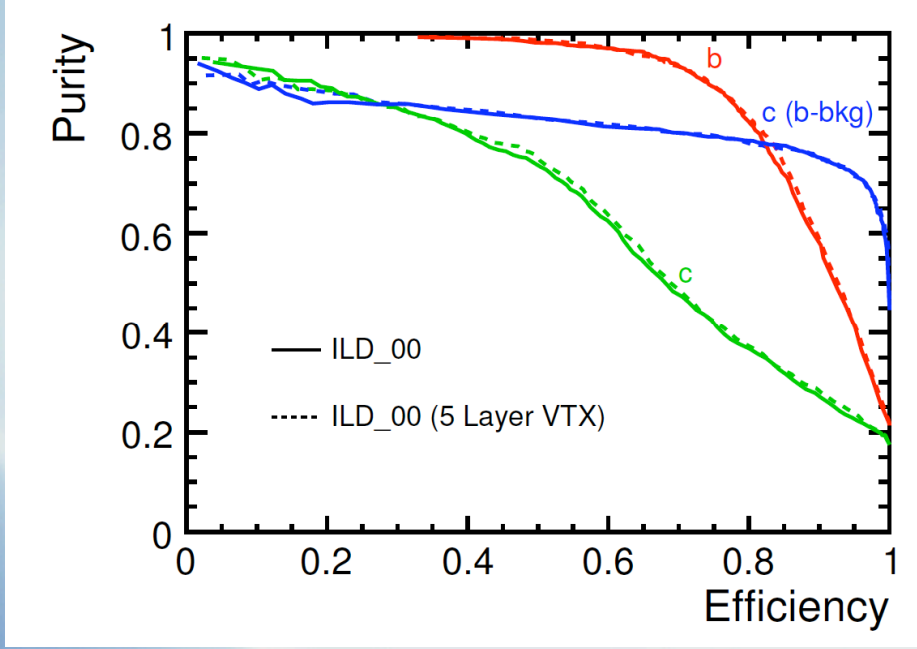
signal



Main background






Purity
Efficiency
0
0.2
0.4
0.6
0.8
1
b
c (b-bkg)
c
ILD_00
ILD_00 (5 Layer VTX)