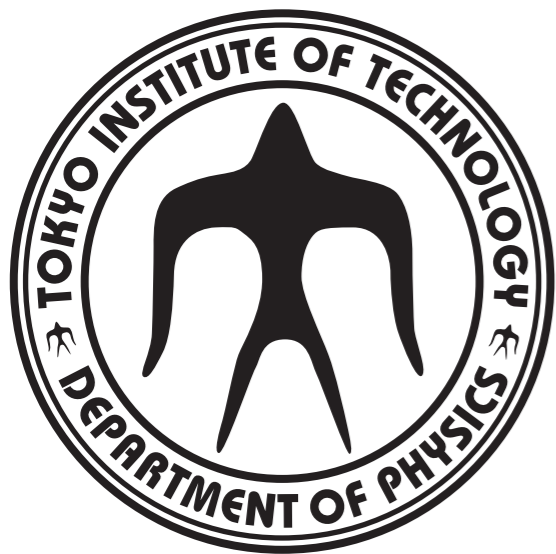# Status Report

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- Analysis using Delphes
  - Pythia samples in lxplus shared directory are used
  - Total ET cut is removed because S/√N dose not depend on with or without this cut
  - New event selection was tried but not succeeded
  - Resolution of hadronic calorimeter and coverage of b-tagging are changed and compared

Result of cut base analysis

- Pythia samples in lxplus shared directory are used
- Fixed b-tagging efficiency (b: 60%, c: 10%, light: 1%)
- 100fb^{-1} is assumed
- Signal region is defined as $100 < M_{bb} < 130$ GeV
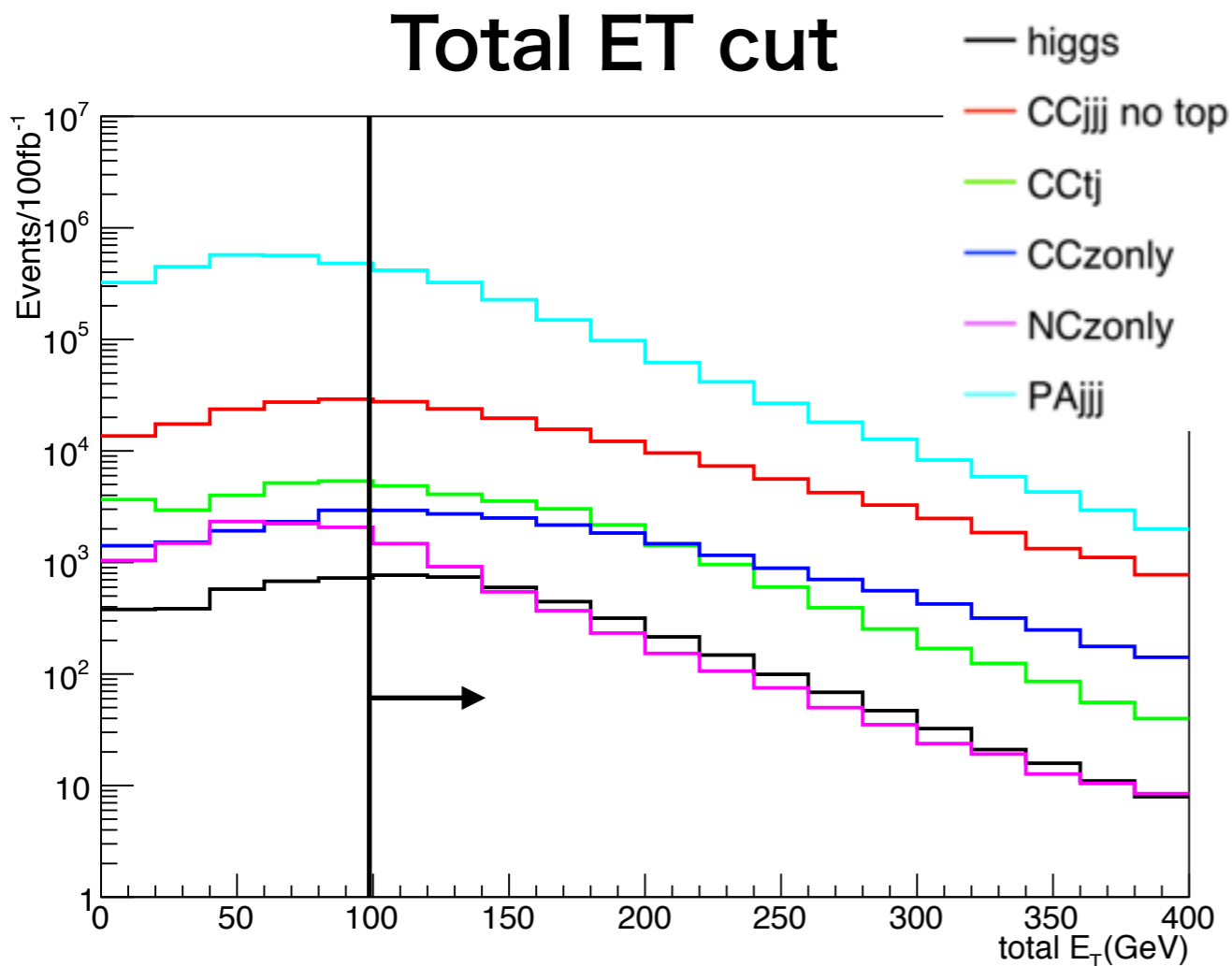- Without total ET cut (explained in next slide)

2 b-jets mass
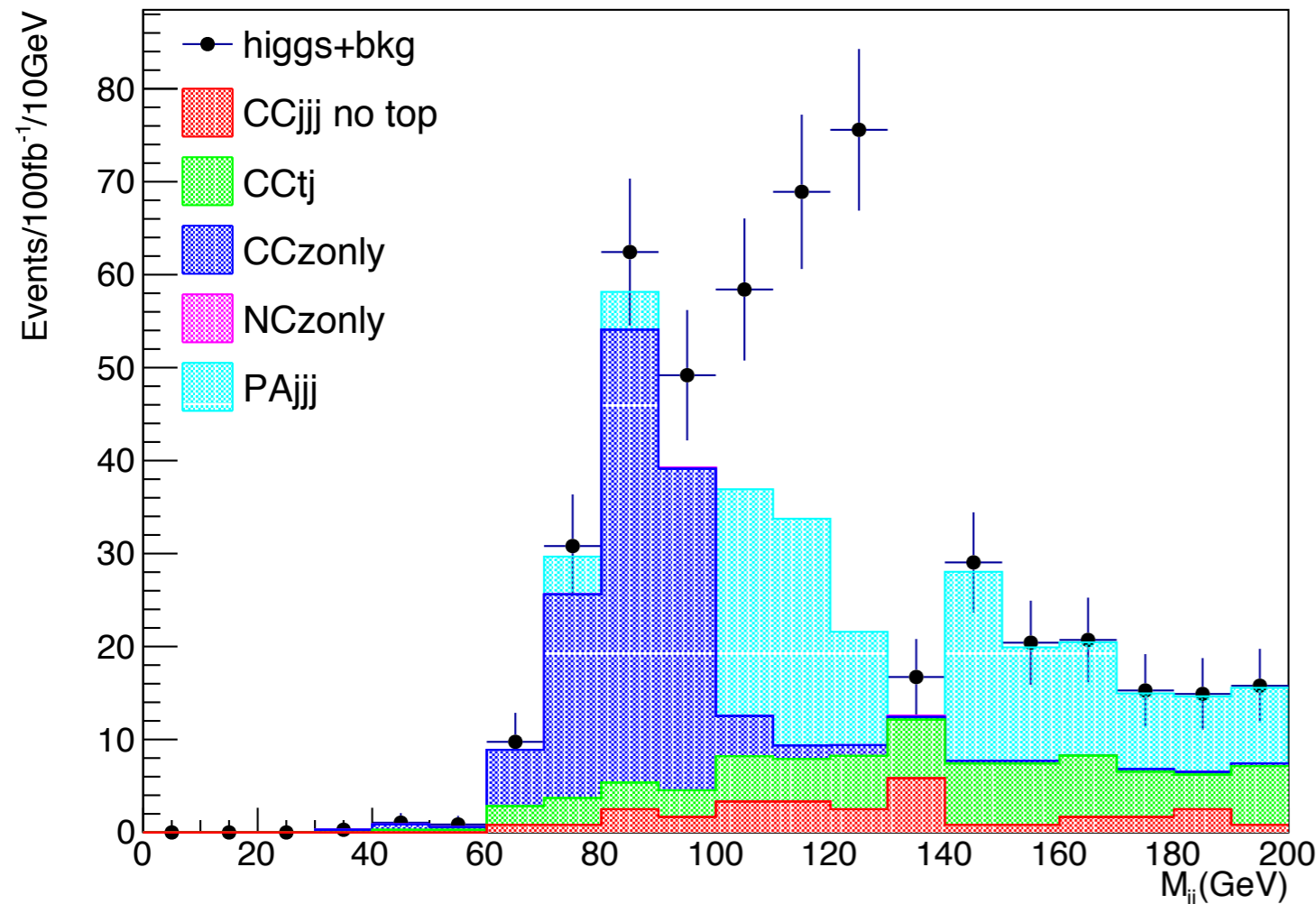
Used sample

	σ (pb)	Nsample	N/σ (fb^{-1})
CC: H->bb	0.063	200K	3170
CCjjj no top	2.5	300K	120
CCtj	0.43	150K	350
CC Z only	0.29	100K	345
NC Z only	0.13	100K	770
PAjjj	38	900K	22

Total ET cut

- Total ET cut is not so important for S/√N because shape of distribution w.r.t each sample is almost same

Total ET cut

Events in signal region

	With total ET cut	Without total ET cut
CC: H->bb	110±2	119±2
CCjjj no top	9±3	9±3
CCtj	15±2	17±2
CCzonly	7±1	7±1
total CCbkg	31±4	33±4
NCzonly	0	0
PAjjj	61±16	73±17
total NCkbg	61±16	73±17
S/√N	11.4±1.0	11.5±1.0

- S/√B dose not depend on with or without total ET cut
- Subsequent analysis is performed without total ET cut

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New event selection

- Using Njet>=3 and Nbjet>=2 cut, events with 2 b-jets (no other jets) were removed

- I considered if 2 b-jets events can be selected

  - Top and W mass cut, and light-jet η cut can't be applied

  - Analysis was performed without these cuts

Result including 2 b-jets events
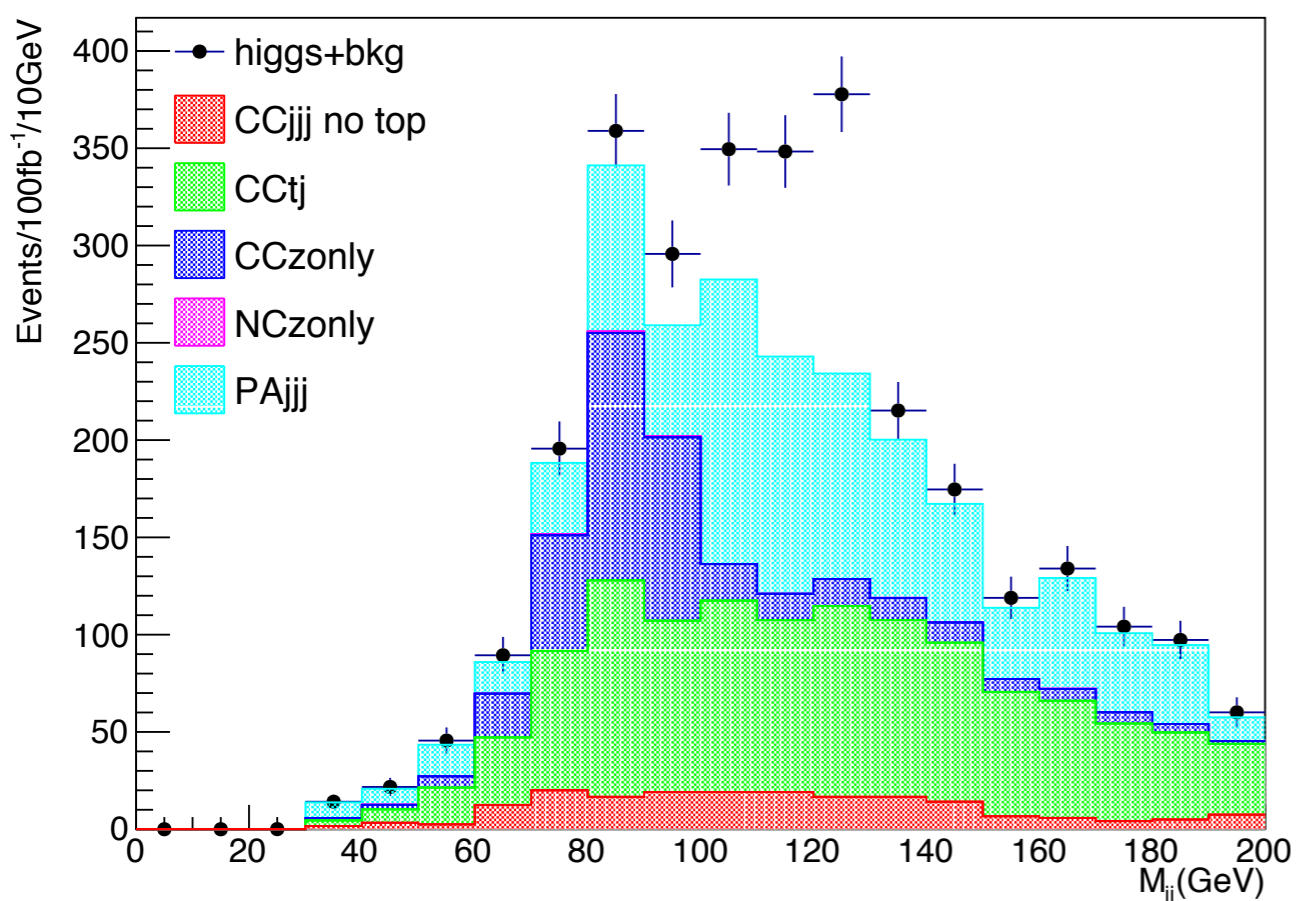
	default	default + 2b-jets events
CC: H->bb	119±2	316±3
CCjjj no top	9±3	55±7
CCtj	17±2	285±9
CCzonly	7±1	46±4
total CCbkg	33±4	386±12
NCzonly	0	0
PAjjj	73±17	374±39
total NCkbg	73±17	374±39
S/√N	11.5±1.0	11.5±0.3

- Reducing bkg is difficult for 2 b-jets events

Resolution of hadronic calorimeter

HCal resolution

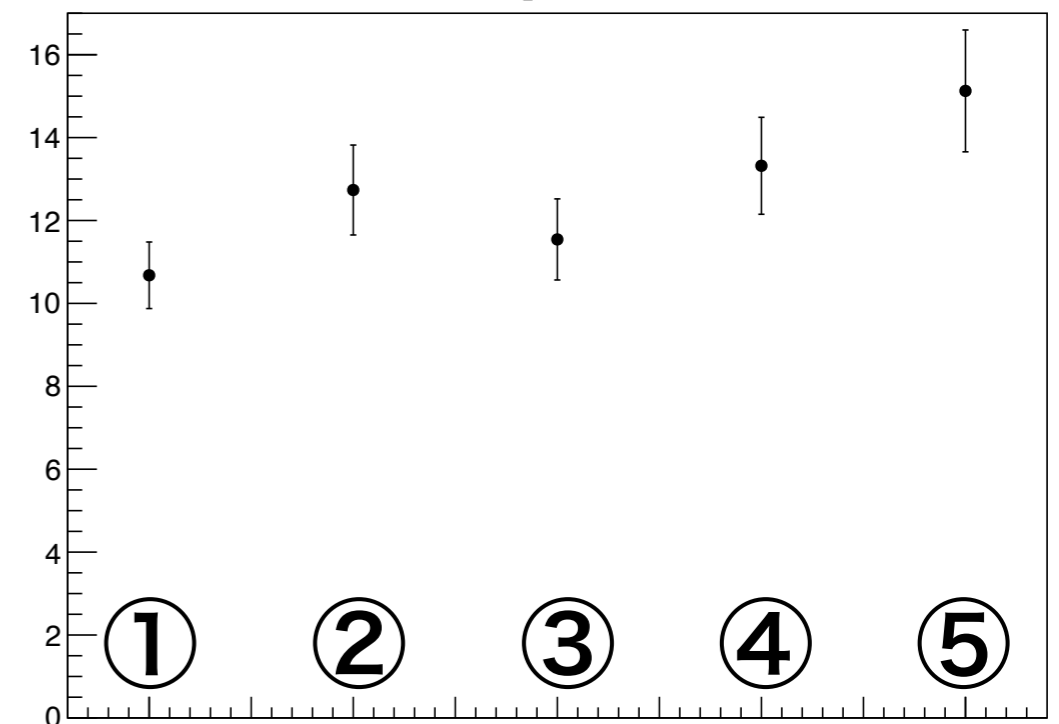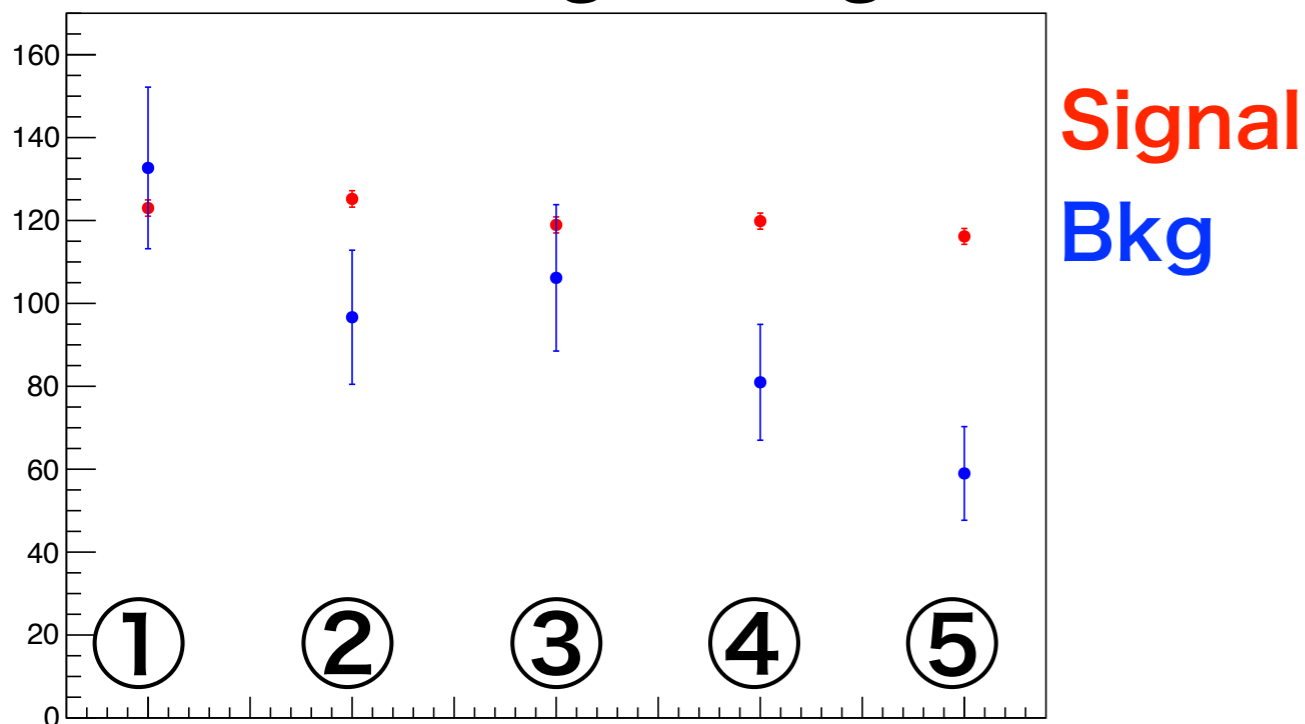$$\frac{\sigma}{E} = \frac{a}{\sqrt{E}} + b \ (|\eta| < 3)$$

$$\frac{\sigma}{E} = \frac{c}{\sqrt{E}} + d \ (3 < |\eta| < 5)$$

	a(%)	b(%)	c(%)	d(%)
①	6	60	10	120
②	4.5	45	7.5	90
③	3	30	5	60
④	2.25	22.5	3.75	45
⑤	1.5	15	2.5	30

Better

Events in signal region

S/√N

Signal
Bkg

- Since better resolution of HCal decrease background events and keep signal events, S/√N become better

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Coverage of b-tagging

- η distribution of b-tagged jets were strange because coverage of b-tagging was defined by the eta of true parton
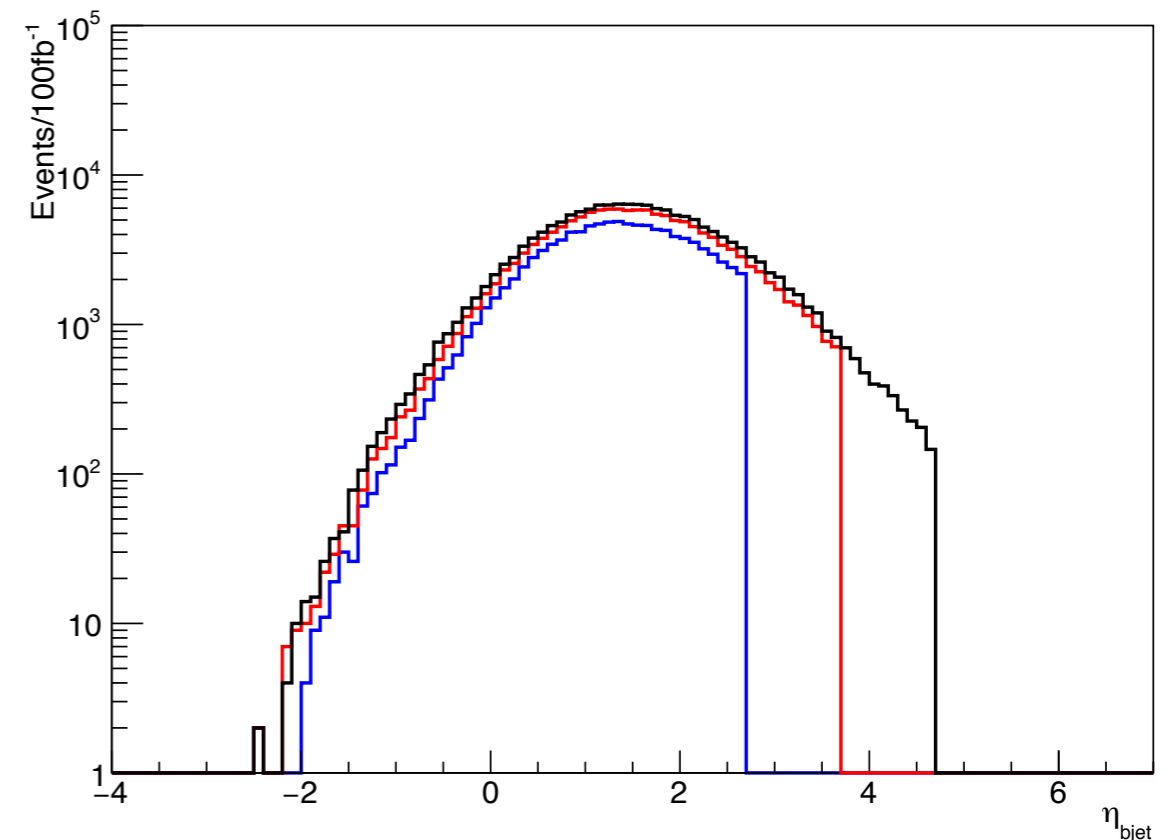- I redefined the coverage of b-tagging by η of jets

- **B-tag coverage**
  ① $|\eta|<2.7$ ② $|\eta|<3.7$ ③ $|\eta|<4.7$
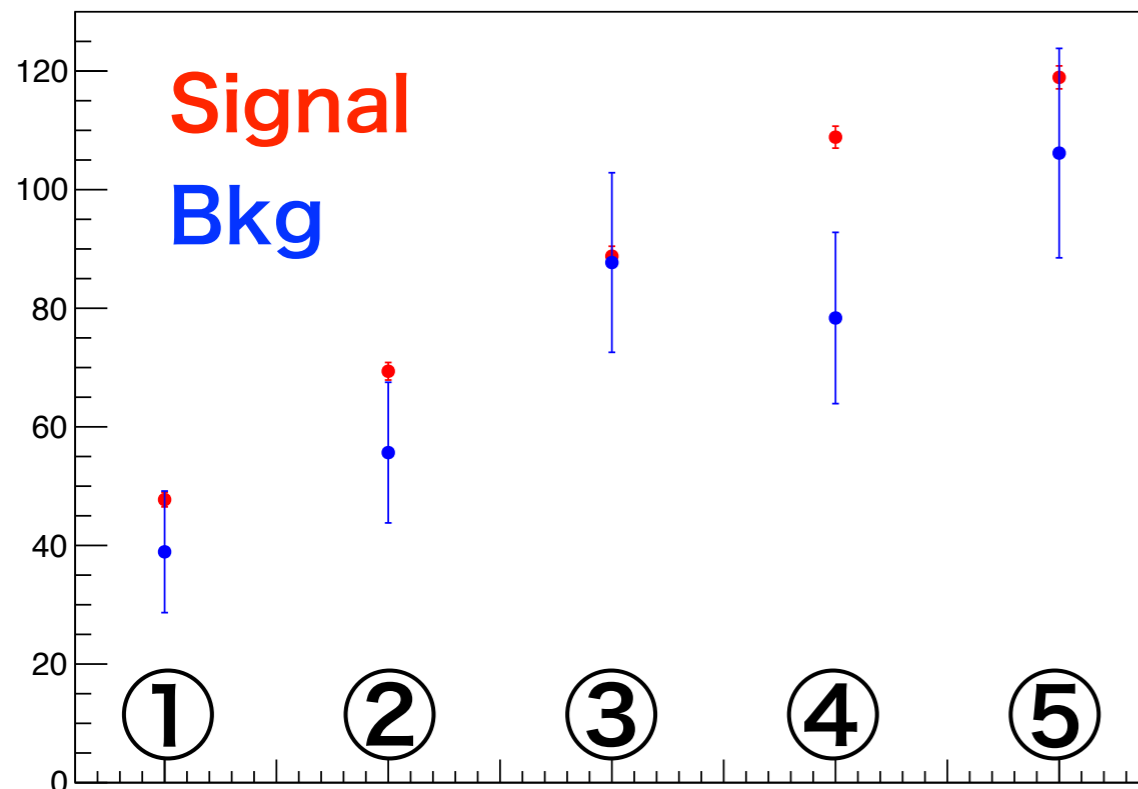
default
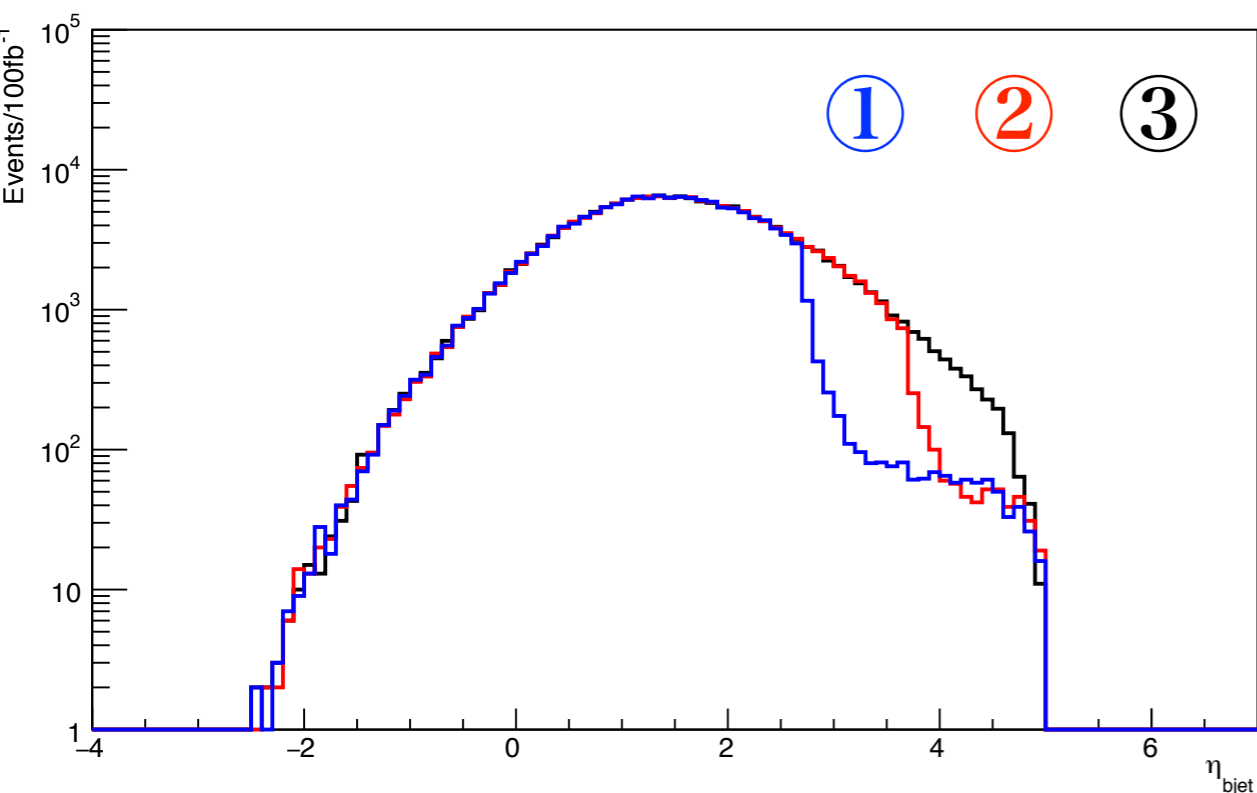
after modification

Coverage of b-tagging

- Wider coverage of b-tagging increase both signal and background events

- S/√N dose not become better simply as coverage of b-tagging is expanded

- Tighter cut or additional cut need to be applied as coverage is expanded

Wider

	Coverage
①	$|\eta|<2.7$
②	$|\eta|<3.2$
③	$|\eta|<3.7$
④	$|\eta|<4.2$
⑤	$|\eta|<4.7$

Events in signal region

Signal
Bkg

S/√N
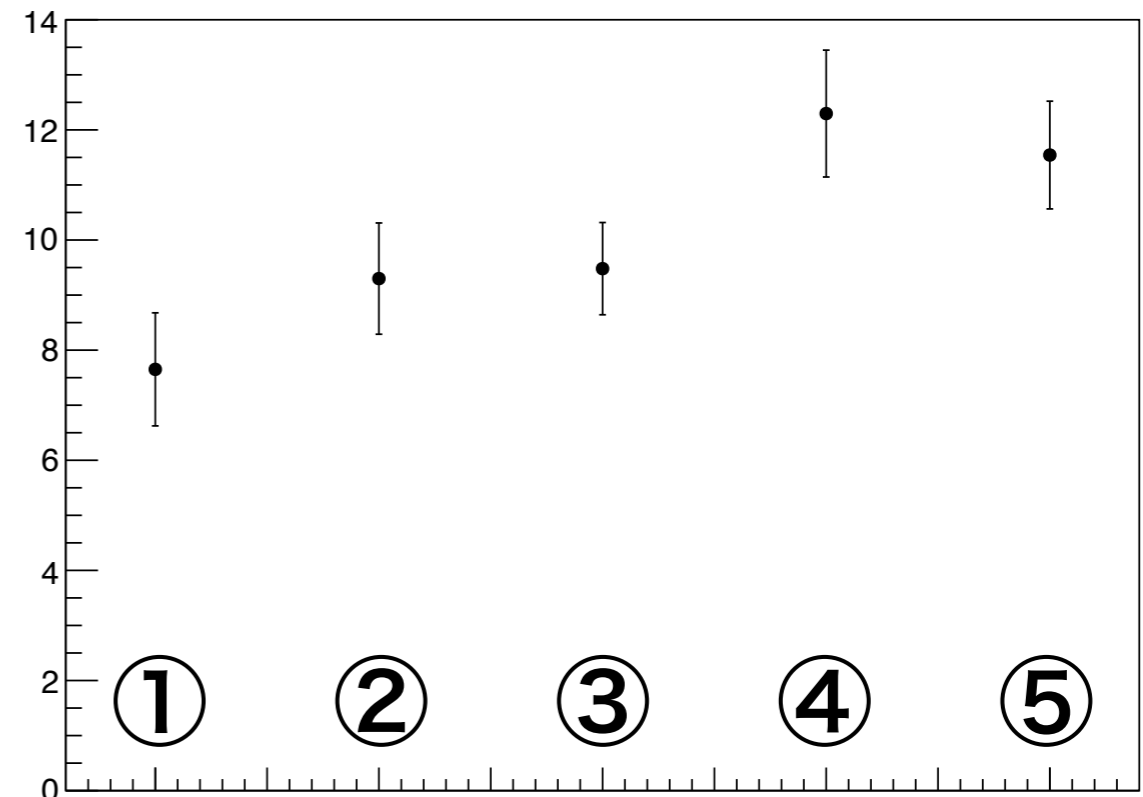
Summary

- Analysis using Delphes
  - Pythia samples in lxplus shared directory are used
  - Total ET cut is removed because $S/\sqrt{N}$ dose not change
  - Using 2 b-jets (no other jets) events is tried but dose not lead to good result
  - Better HCal resolution makes good background reduction
  - Wider coverage of b-tagging increase both signal and background, so tighter or additional cut need to be added to result in good $S/\sqrt{N}$
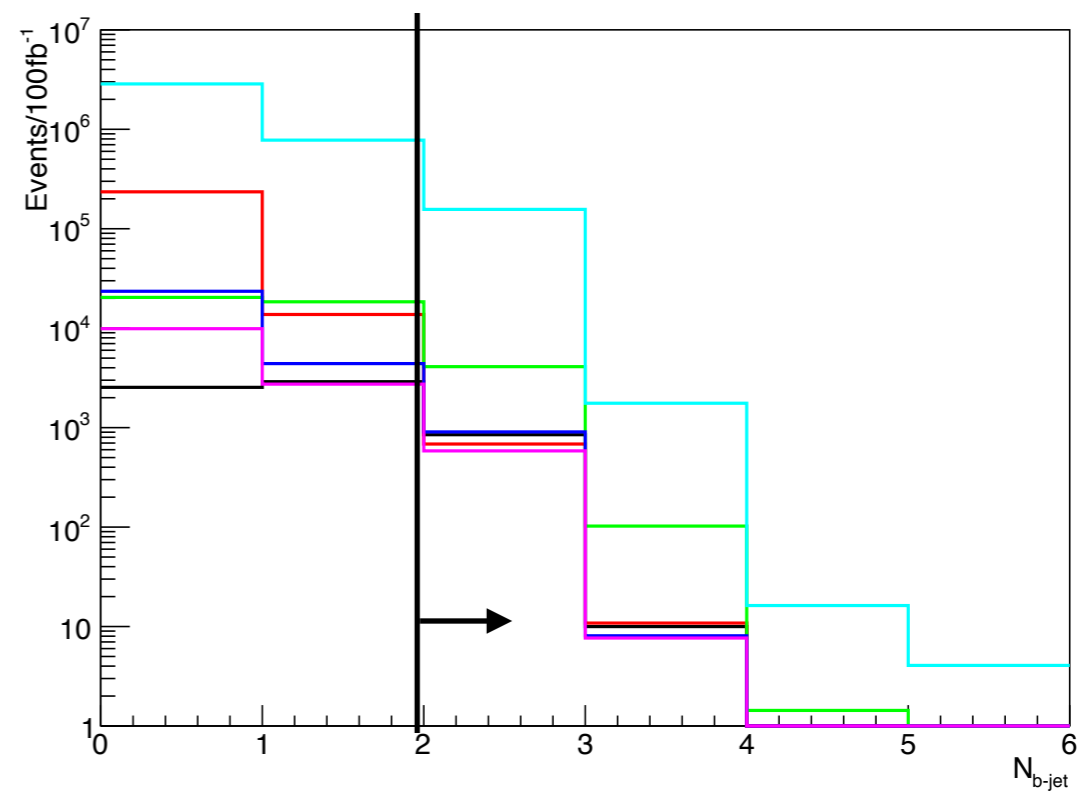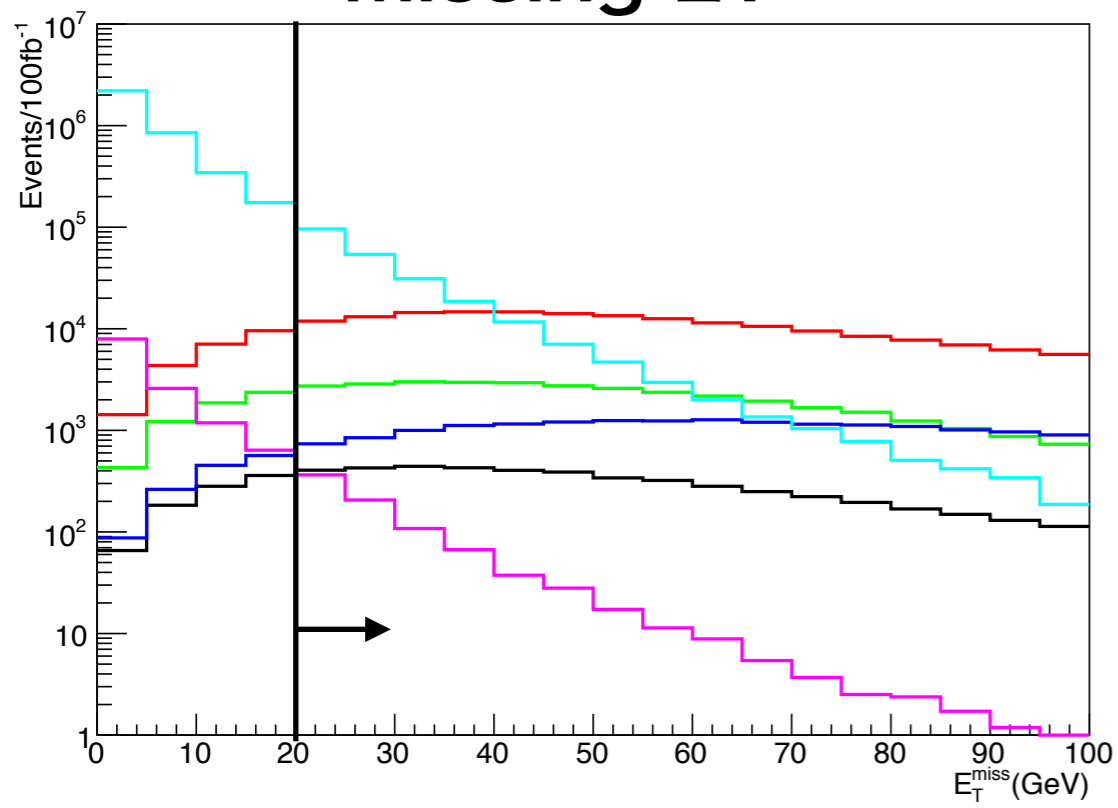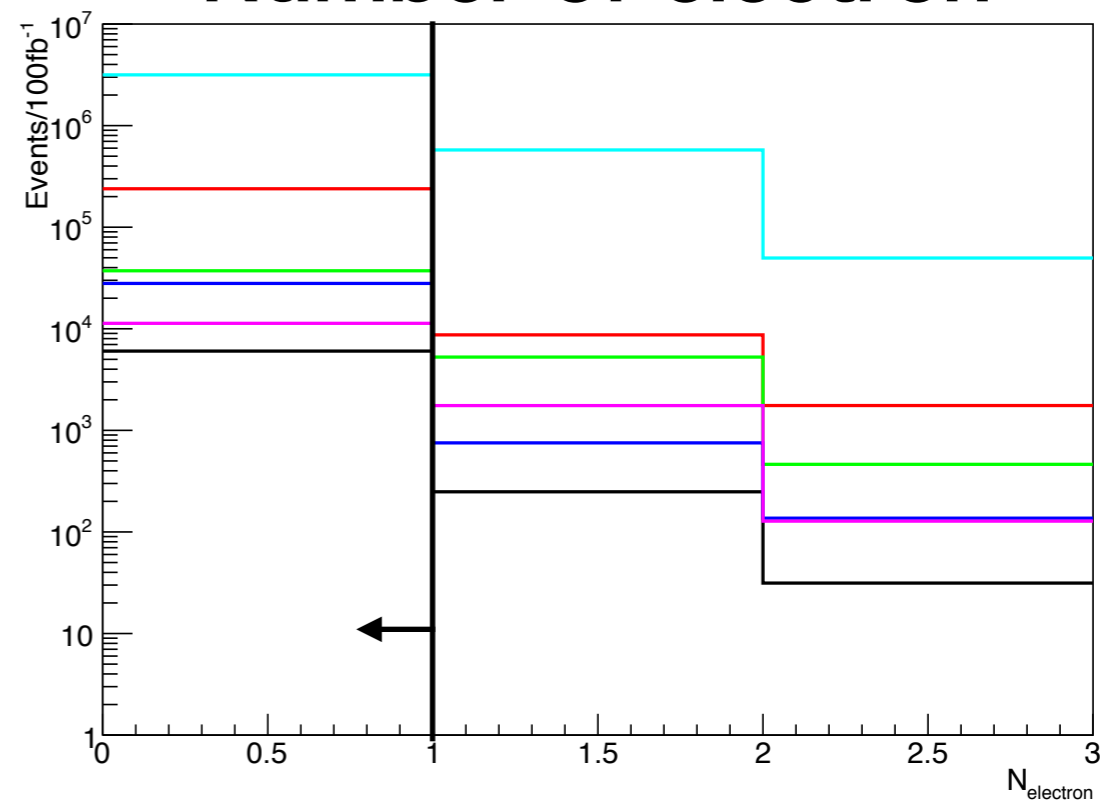
backup

Cut parameters

Number of jet (PT>20GeV)
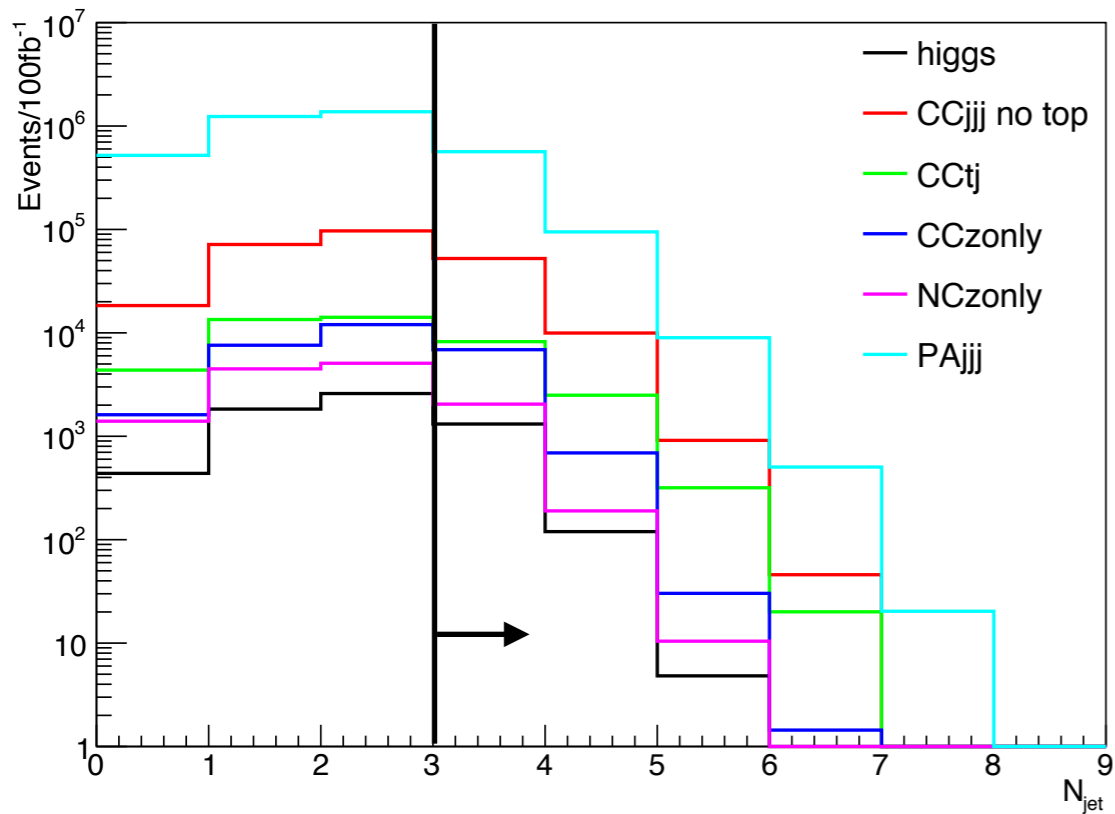
Number of b-jet (PT>20GeV)
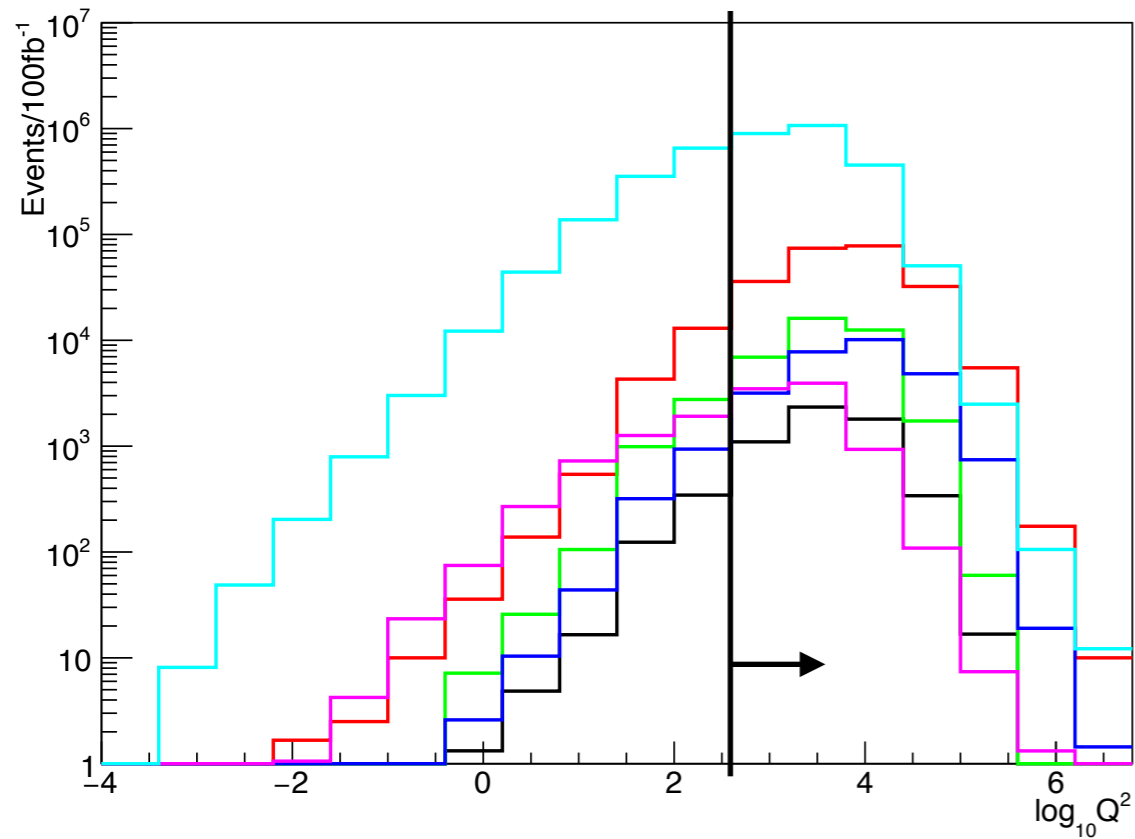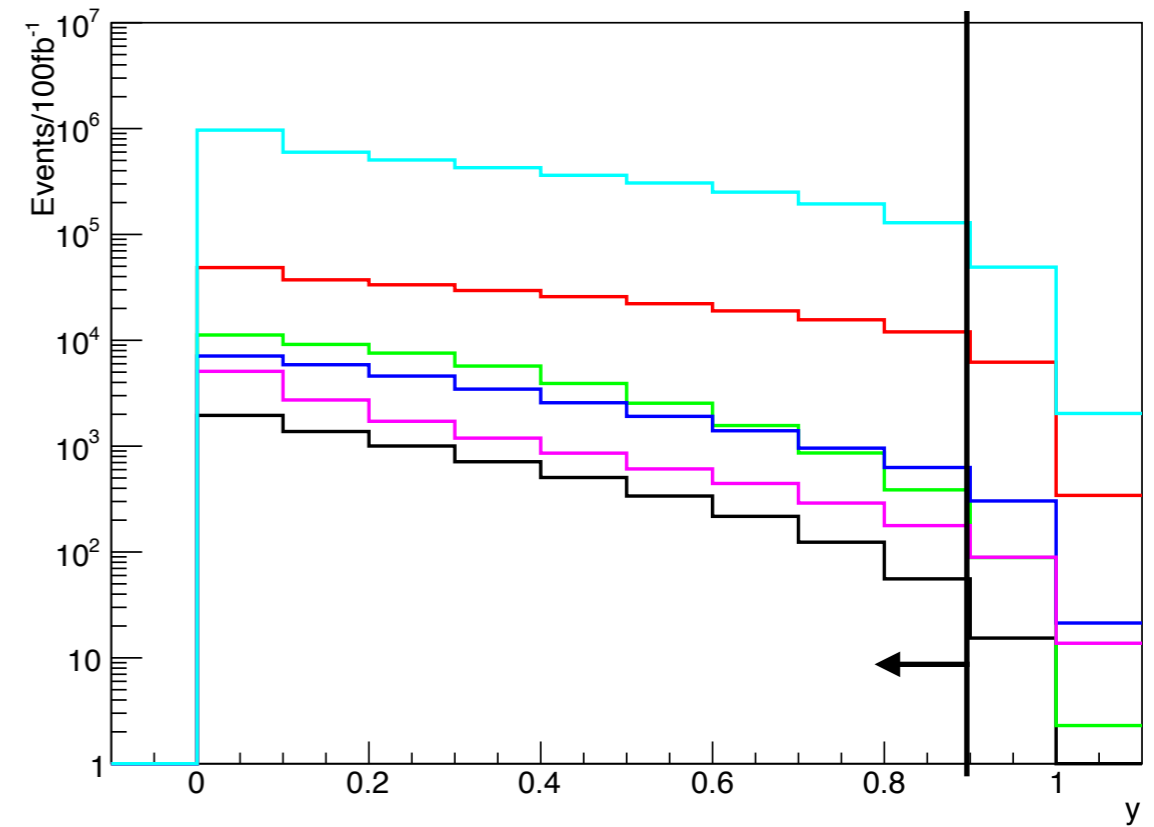

Missing ET

Number of electron
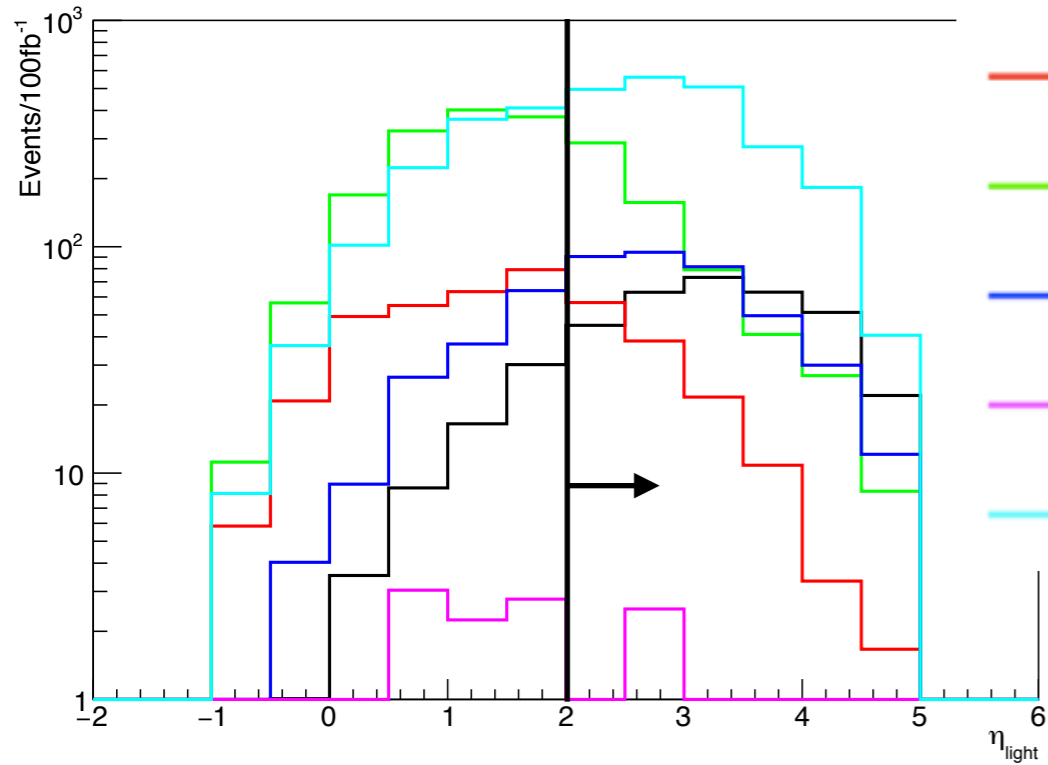
Cut parameters

Momentum transfer Q

y

— higgs
— CCjjj no top
— CCtj
— CCzonly
— NCzonly
— PAjjj

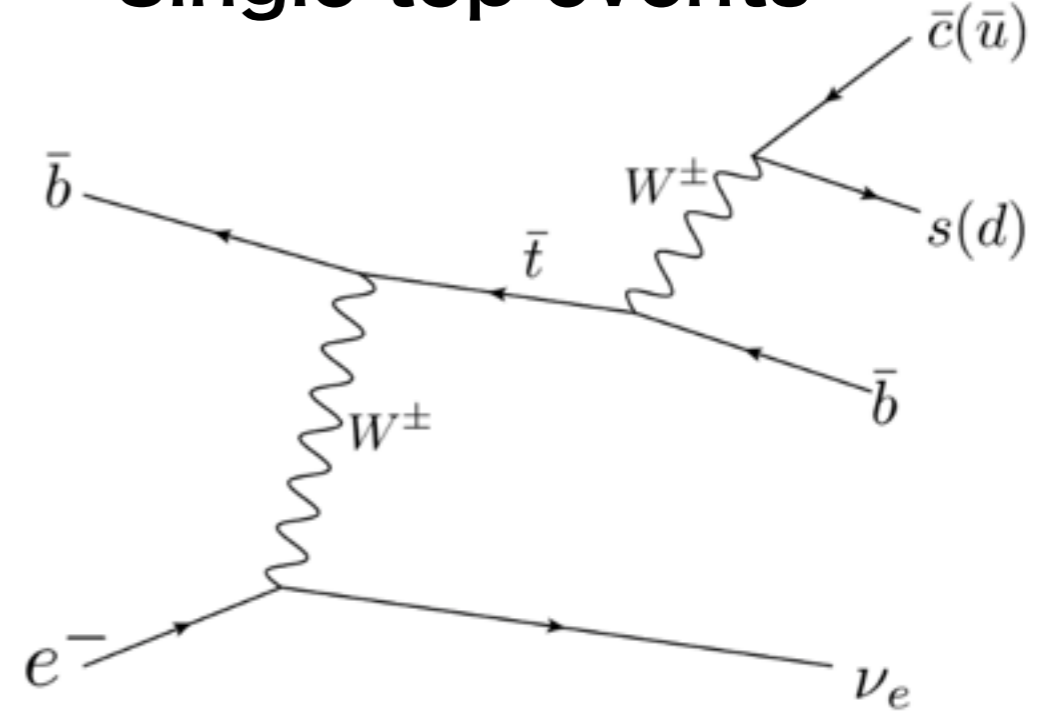$$Q_h^2 = \frac{(\sum_{hadron} p_x)^2 + (\sum_{hadron} p_y)^2}{1 - y_h}$$

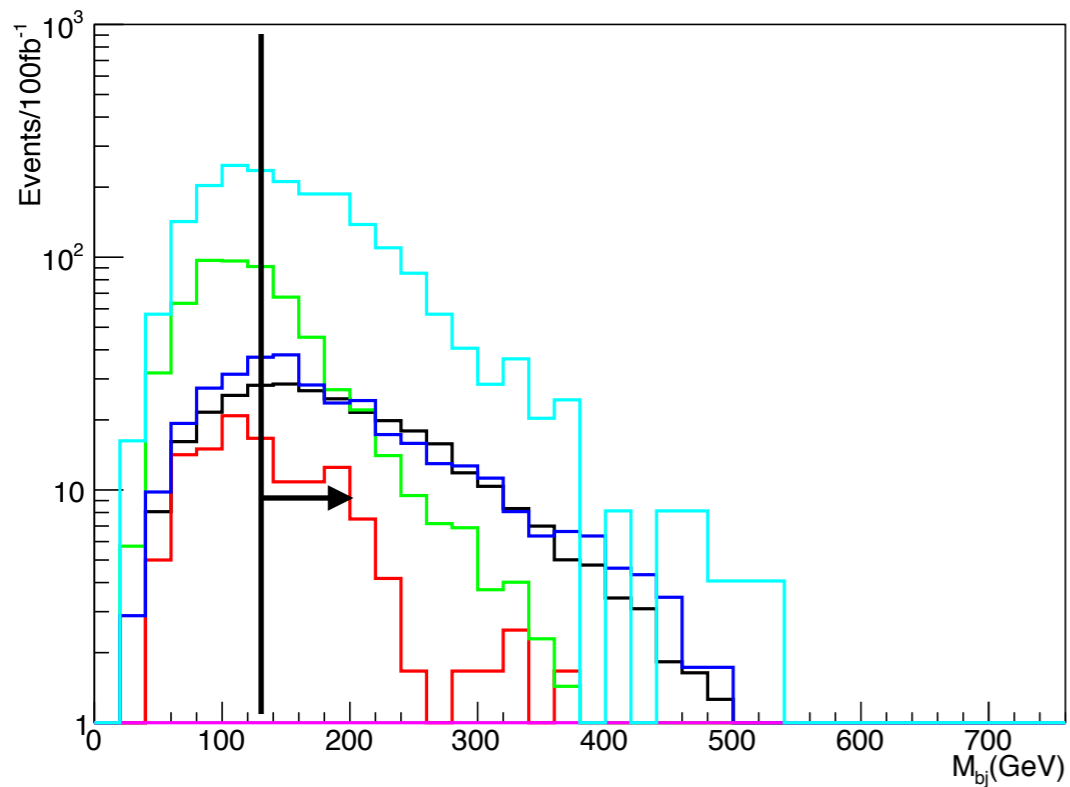$$y_h = \frac{\sum_{hadron}(E - p_z)}{E_e}$$
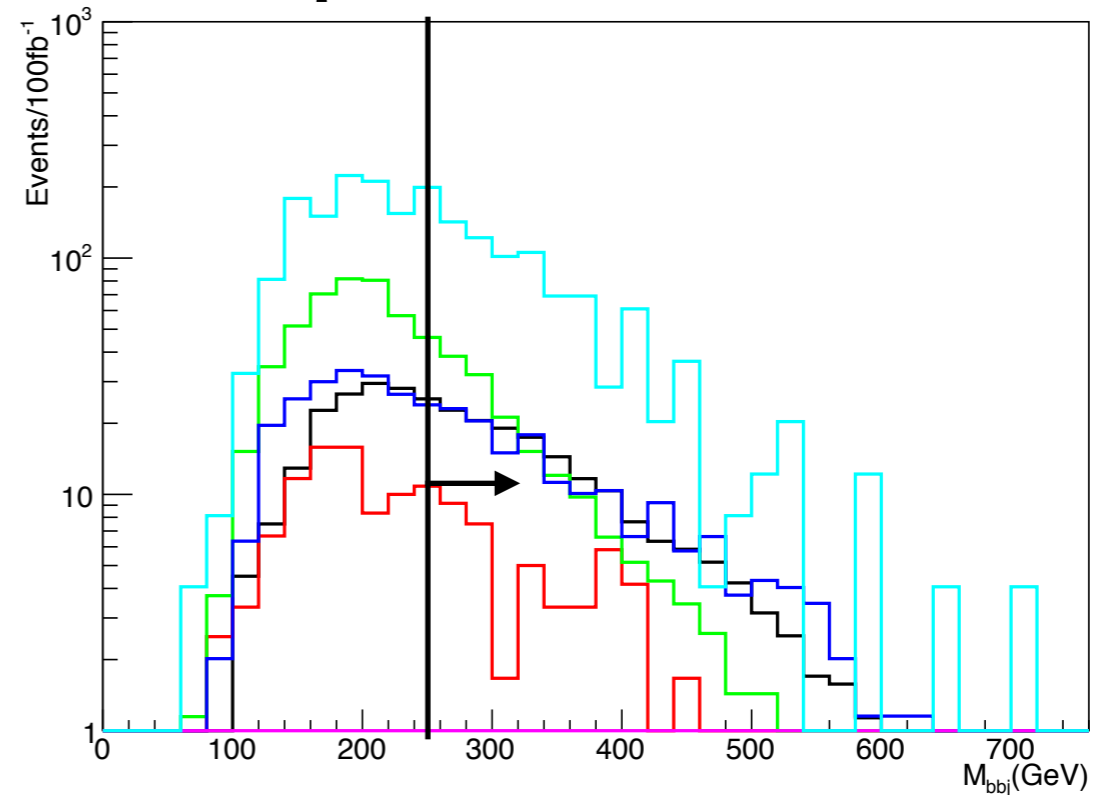
Cut parameters

Light jet η

Legend:
- higgs
- CCjjj no top
- CCtj
- CCzonly
- NCzonly
- PAjjj

Single top events

W mass ($M_{b,light}$)

Top mass ($M_{b,b,light}$)

Cut parameters

Δ𝜙 between 2 b-jets and missing ET

CC: H->bb

PAjjj