Short Status Report of ttH Study

5th Sep. 2015

The 43st general meeting of the ILC physics working group

Yuji Sudo

Kyushu University

Updates

- new 6f samples
- jet pairing by Maximum likelihood method

- new 6f samples are not stored values of cluster shape

  → back in cut based isolated lepton selection

- $\sqrt{s}$ = 500 GeV, M_H = 125 GeV, $(Pe^-, Pe^+)=(-0.8,+0.3)$

Production cross section

Process	σ (fb)
$e^-e^+ \rightarrow tth$	0.4088
$e^-e^+ \rightarrow ttZ$	1.974
$e^-e^+ \rightarrow ttg(bb)$	1.058
$e^-e^+ \rightarrow tbW$	918.4 (new sample)

Decay mode	Branching ratio
h→bb	0.577
tt→bqqbqq	0.457
tt→blvbqq	0.438
tt→blvblv	0.105

($e^-e^+ \rightarrow tbW$ 912.5 (dbd sample))

- Expected # of signals and Backgrounds(@500fb^{-1})

ttH(tt→6j, H→bb)	**53.9**	ttH(tt→all, H(nobb))	86.4
ttH(tt→lv4j,H→bb)	**51.6**	ttZ	987
ttH(tt→lvlv2j, H→bb)	**12.3**	ttg(bb)	529
		6f	459200

cross section of new 6f samples

New Sample

(fb)	eLpR	eRpL
yyveev	20.14	7.56
yyvelv	39.57	15.03
yyvlev	39.61	15.04
yyvllv	78.70	30.08
yyveyx	117.08	44.51
yyvlyx	231.62	89.05
yyxyev	116.89	44.53
yyxylv	231.25	88.92
yyuyyc	164.44	64.37
yycyyu	165.47	64.06
yyuyyu	166.56	64.54
yycyyc	163.32	60.65
total	**1534.7**	**588.3**

DBD Sample

(fb)	eLpR	eRpL
yyveev	20.17	7.567
yyvelv	39.60	15.04
yyvlev	39.50	15.04
yyvllv	78.72	30.14
yyveyx	117.0	44.54
yyvlyx	232.1	88.91
yyxyev	116.9	44.38
yyxylv	232.0	88.90
bbuyyc	164.2	63.89
bbcyyu	164.0	63.94
bbuyyu	159.3	64.20
bbcyyc	159.8	63.86
total	1524.6	590.45

Jet Pairing with Maximum Likelihood method

- likelihood templates are made with signal event
- use reconstructed jets matching with MC truth within cosθ>0.9
- choose a combination which maximize the likelihood value

- 8jets

* 2D likelihood template
cos(tt), cos(bb(higgs))
cos(bW(anti-top)), cos(bW(top))
top1 mass, W1 mass
top2mass, W2 mass

- 2l2ν+4jets

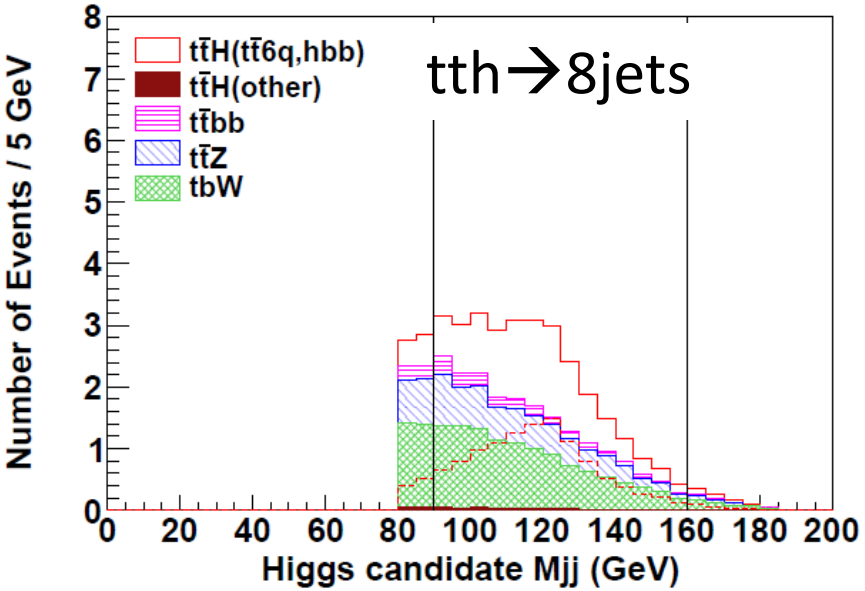
* 2D likelihood template
cos(tt), cos(bb(higgs))
* 1D likelihood template
b1l1 mass
b2l2 mass

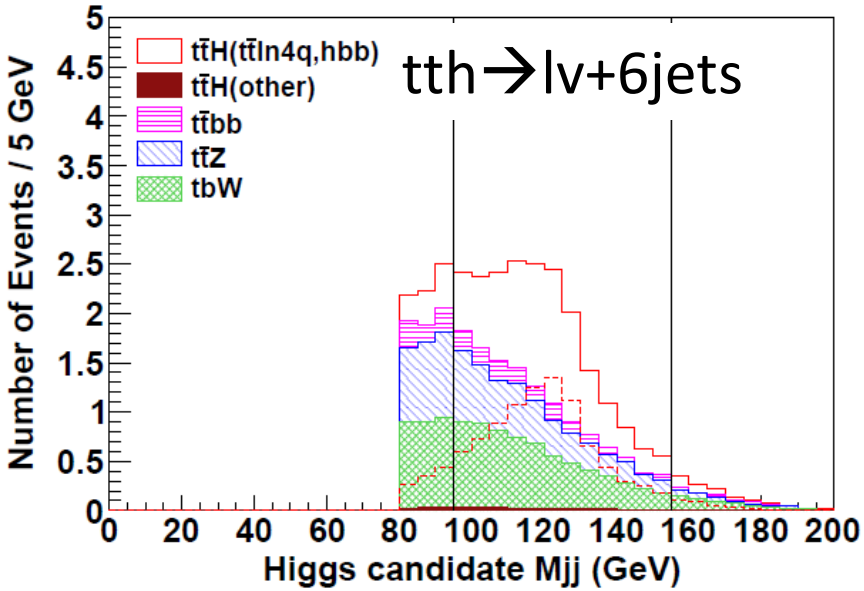
- lν+6jets

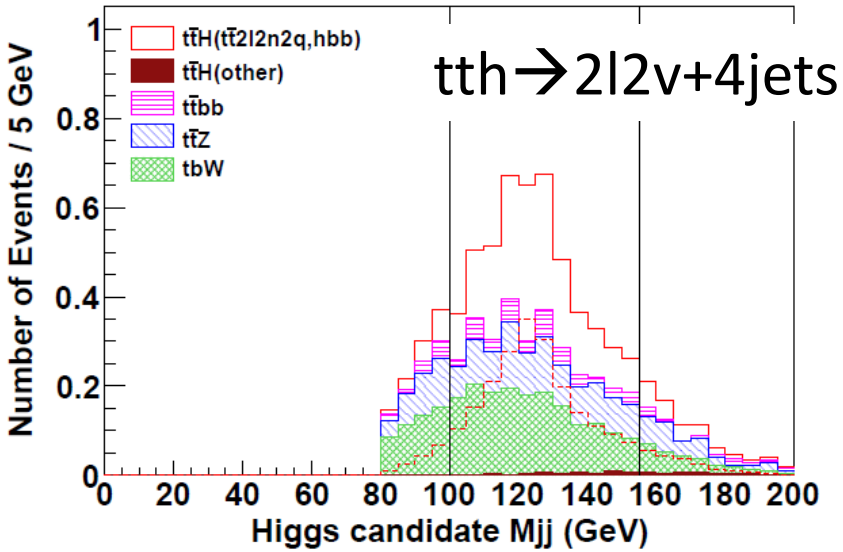
* 2D likelihood template
cos(tt), cos(bb(higgs))
cos(bW(anti-top)), cos(bW(top))
cos(q2(anti-t)e^-), cos(q1(anti-t)e^-)
q1: uptype , q2: down type
* 1D likelihood template
top1mass
W1 mass
top2 mass

- ~10% improvement of an efficiency of correct higgs bb pair

higgs candidate M_{bb} (500 fb^{-1})







Significance ($S/\sqrt{S+B}$)

tth→8jets * event selection cuts are the same as previous one currently.

Integrated Lumi. (fb^{-1})	(-0.8,+0.3)	(+0.8,-0.3)
500	2.01	1.36
200	1.26	0.85
1600	3.60	2.46

tth→lv+6jets

Integrated Lumi. (fb^{-1})	(-0.8,+0.3)	(+0.8,-0.3)
500	1.91	1.30
200	1.21	0.82
1600	3.45	2.36

tth→2l2v+4jets

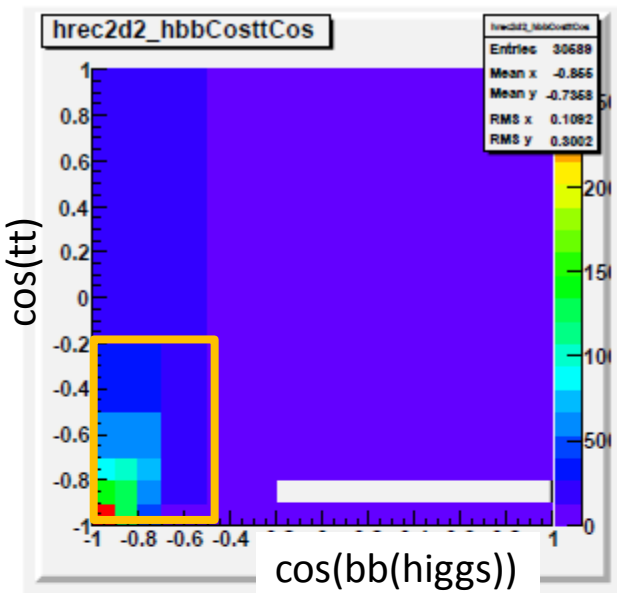
Integrated Lumi. (fb^{-1})	(-0.8,+0.3)	(+0.8,-0.3)
500	0.88	0.61
200	0.54	0.37
1600	1.60	1.13

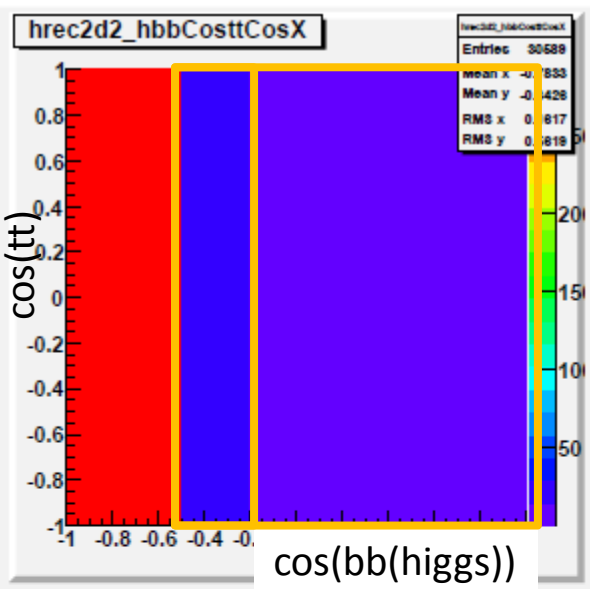
plan

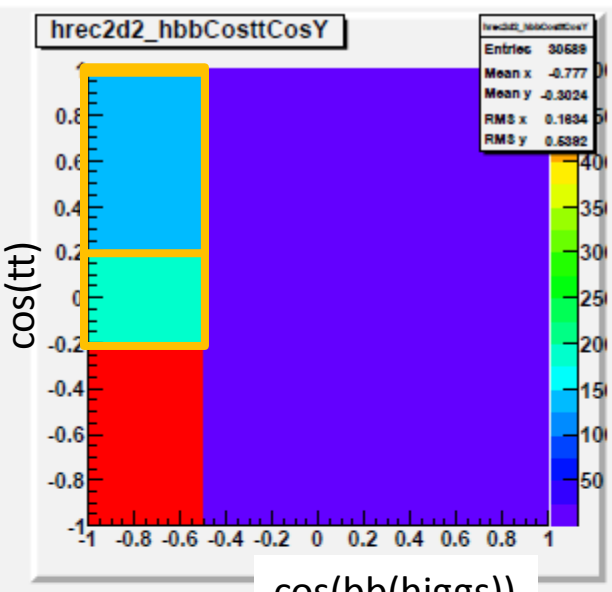
- Optimize event selection cuts with new 6f samples
- try to use 4b tagged category for the 6f shape
  - a few ~ several hundreds events are available for the tth to lv+6 and 8 jets analysis
  (several tens of events are available for tth to 2l2v+4jets)

backup

Log likelihood templates1 (8jets)





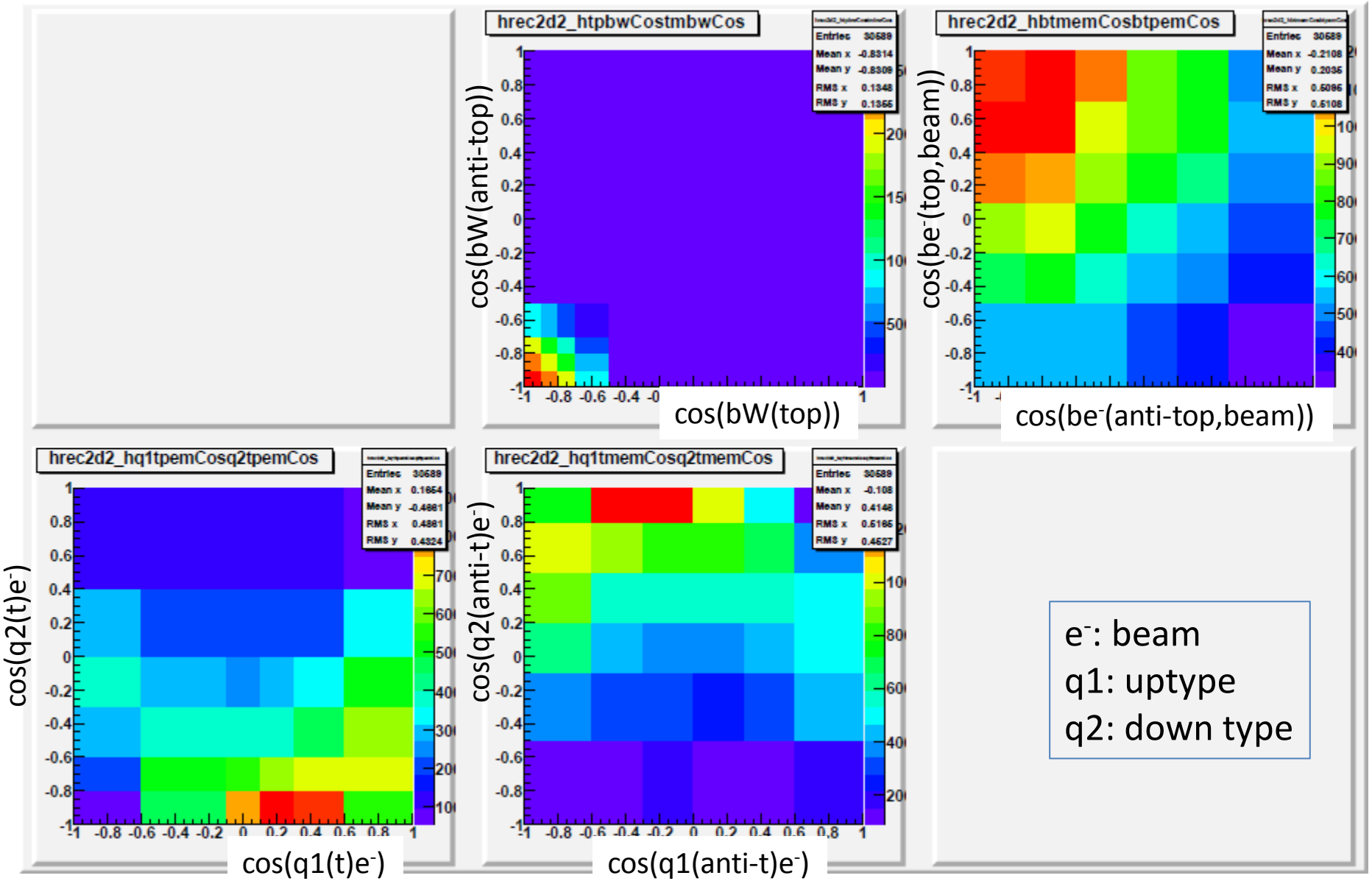


region 1
x < -0.5
y < -0.2

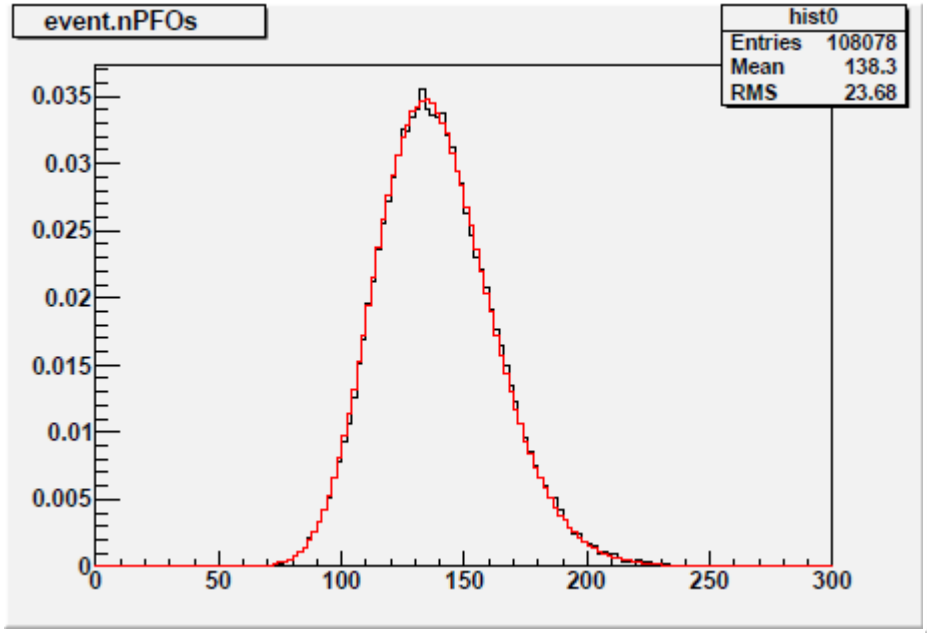
region 2
x >= -0.5
-0.2<= y <=1

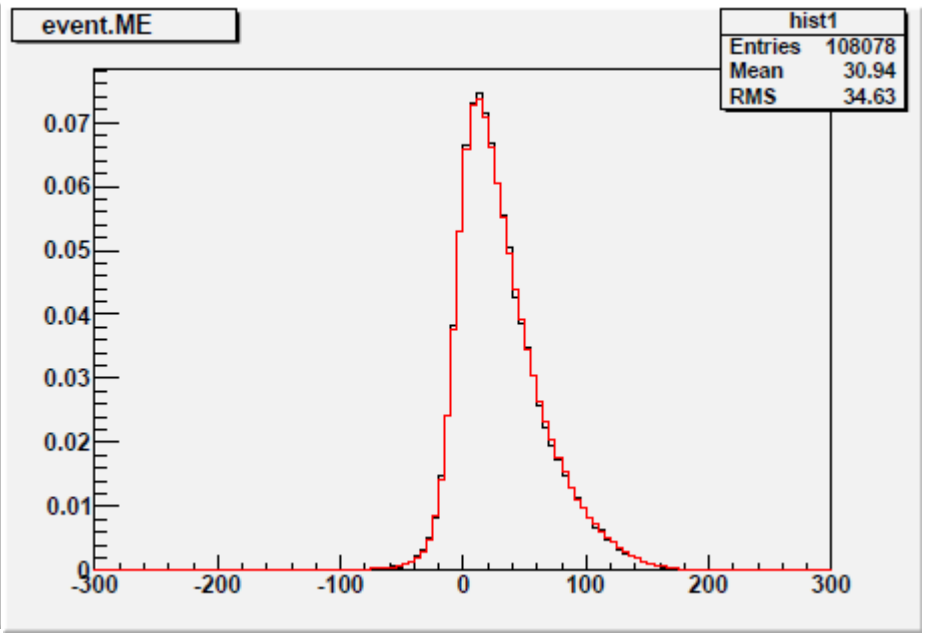
region 3
x < -0.5
-0.2 <= y

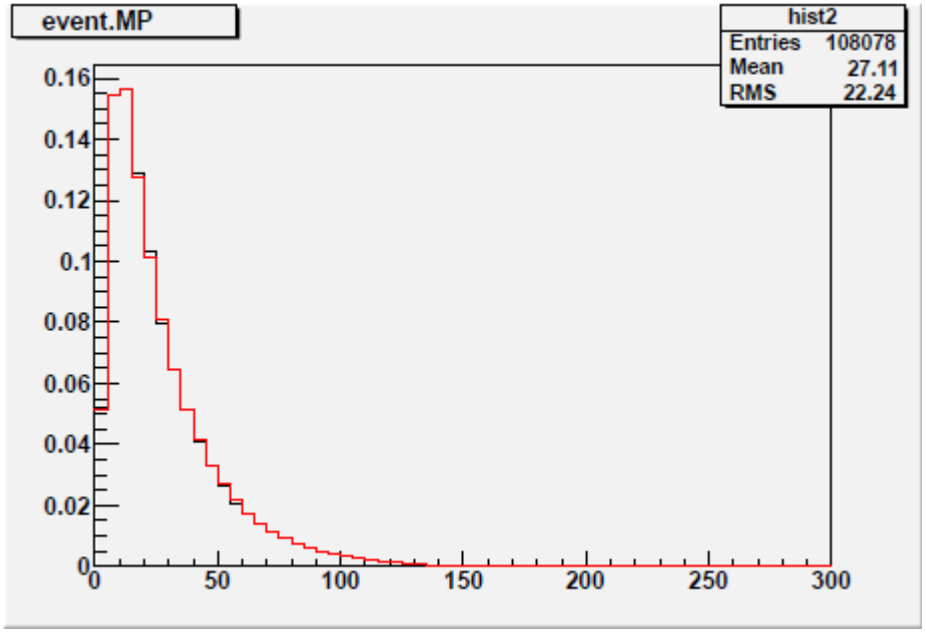
Log likelihood templates2 (8jets)

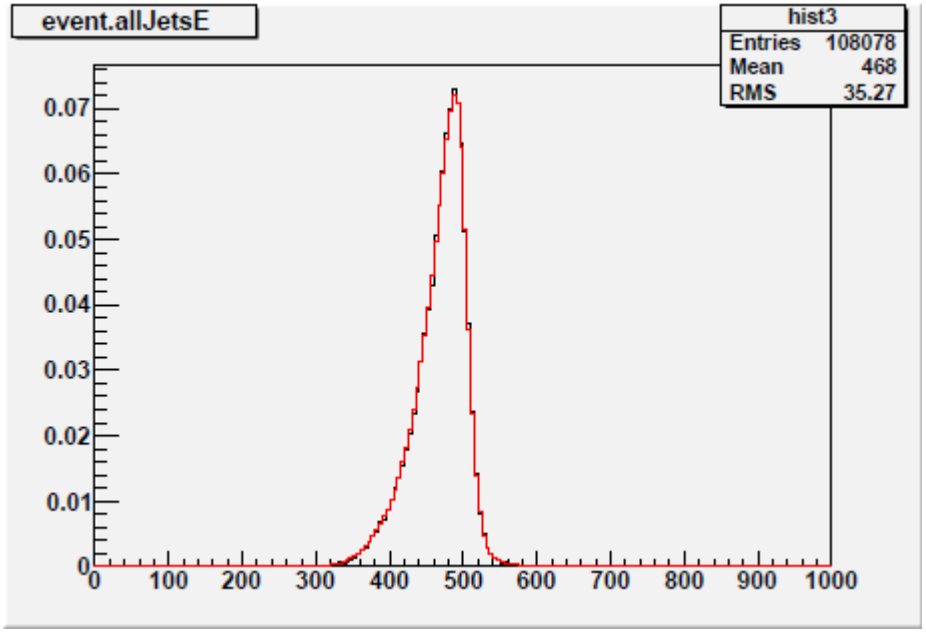


compare yyuyyc new and DBD samples

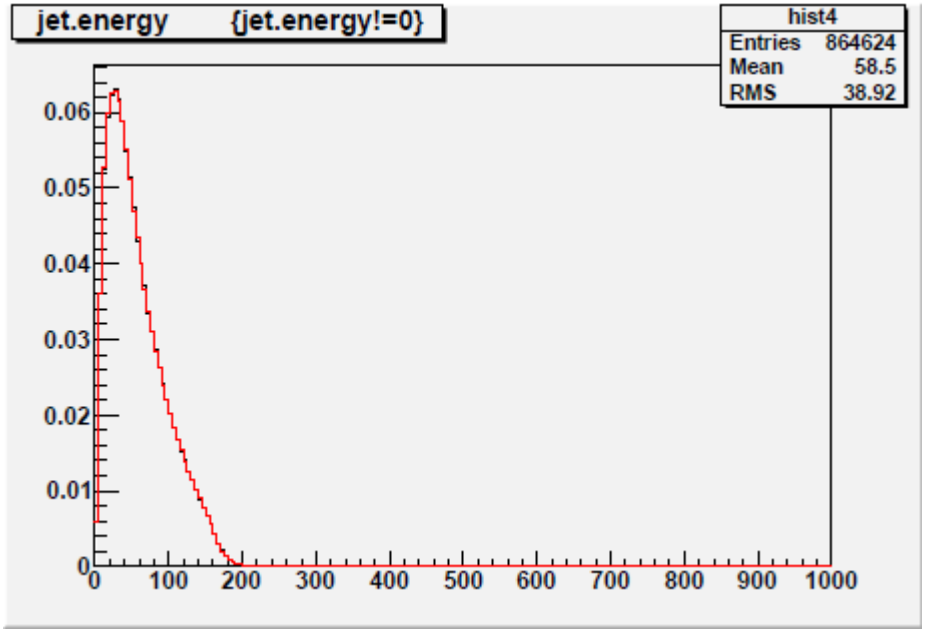


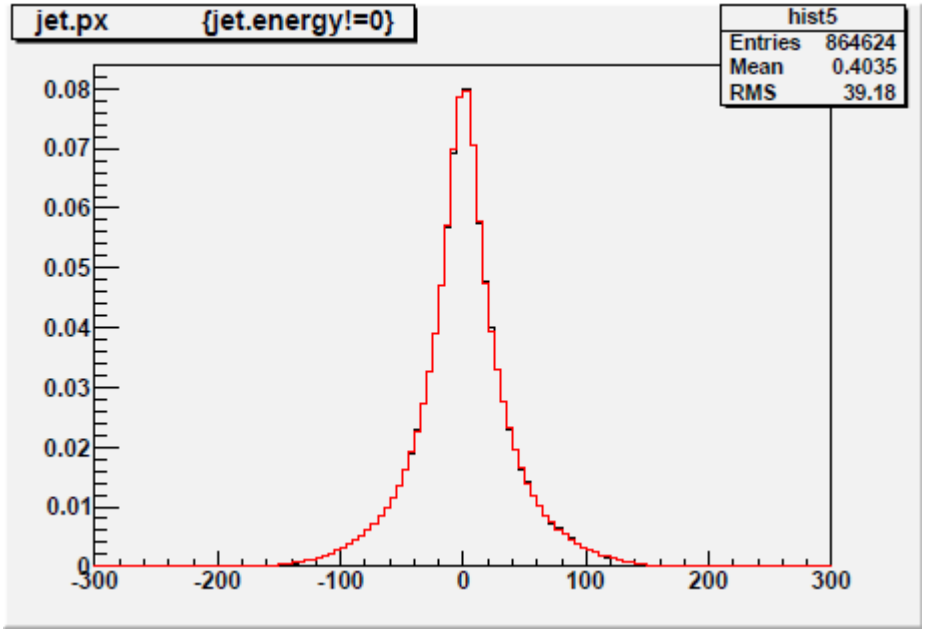


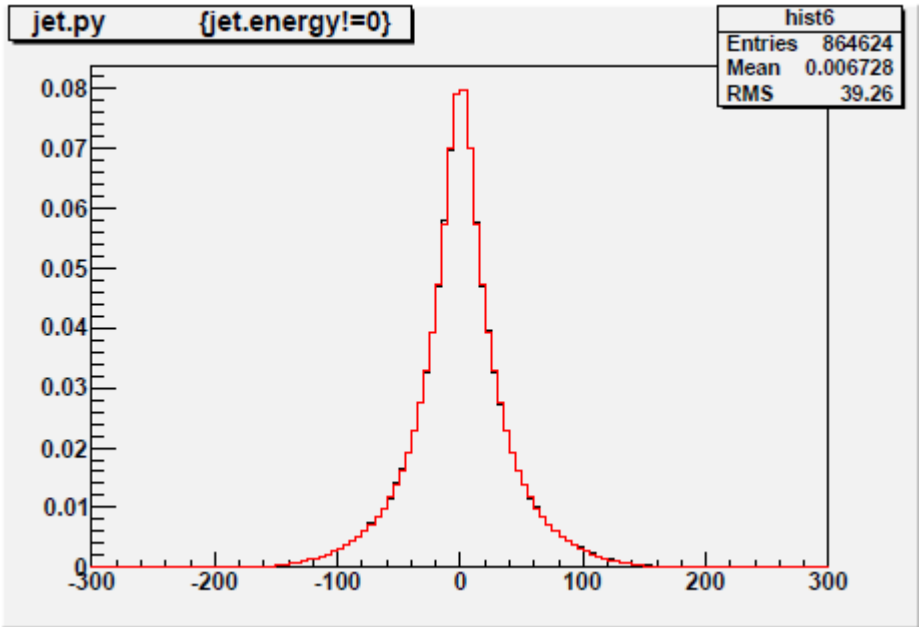


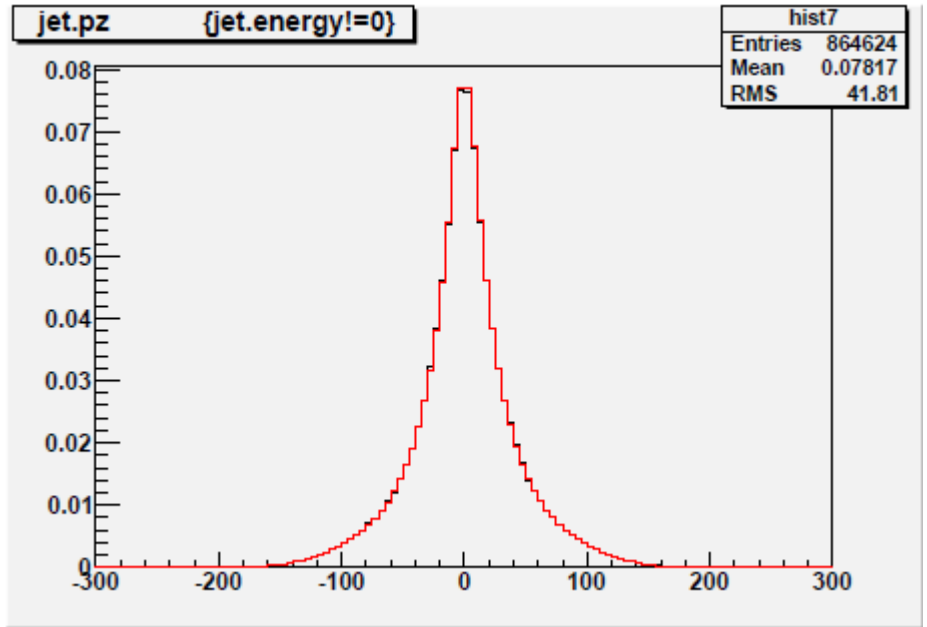


compare yyuyyc new and DBD samples









compare yyuyyc new and DBD samples