

tth study

2015/03/27

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tth ($h \rightarrow bb$) significance

- optimize cut point of event selection to maximize $S/\sqrt{S+B}$

$$S/\sqrt{S+B}$$

(P_e, P_{e^+})	(-0.8,+0.3)		(+0.8,-0.3)	
Lumi. (fb^{-1})	500	1600	500	1600
8 jets	2.17	3.89	1.40	2.53
lv + 6 jets	2.00	3.58	1.29	2.32
2l2v + 4 jets	1.02	1.83	0.72	1.31

measurement precision at different \sqrt{s}

$M_H = 125 \text{ GeV}, (P_{e^-}, P_{e^+}) = (-0.8, +0.3)$

$ttH (H \rightarrow bb) 500 \text{ fb}^{-1}$

$\sqrt{s} : S/\sqrt{S+B} : |\Delta y_t/y_t| \%$

500 : 3.13 : 16.6

520 : 5.26 : 9.88

550 : 7.72 : 6.73

$ttH (H \rightarrow bb) 1600 \text{ fb}^{-1}$

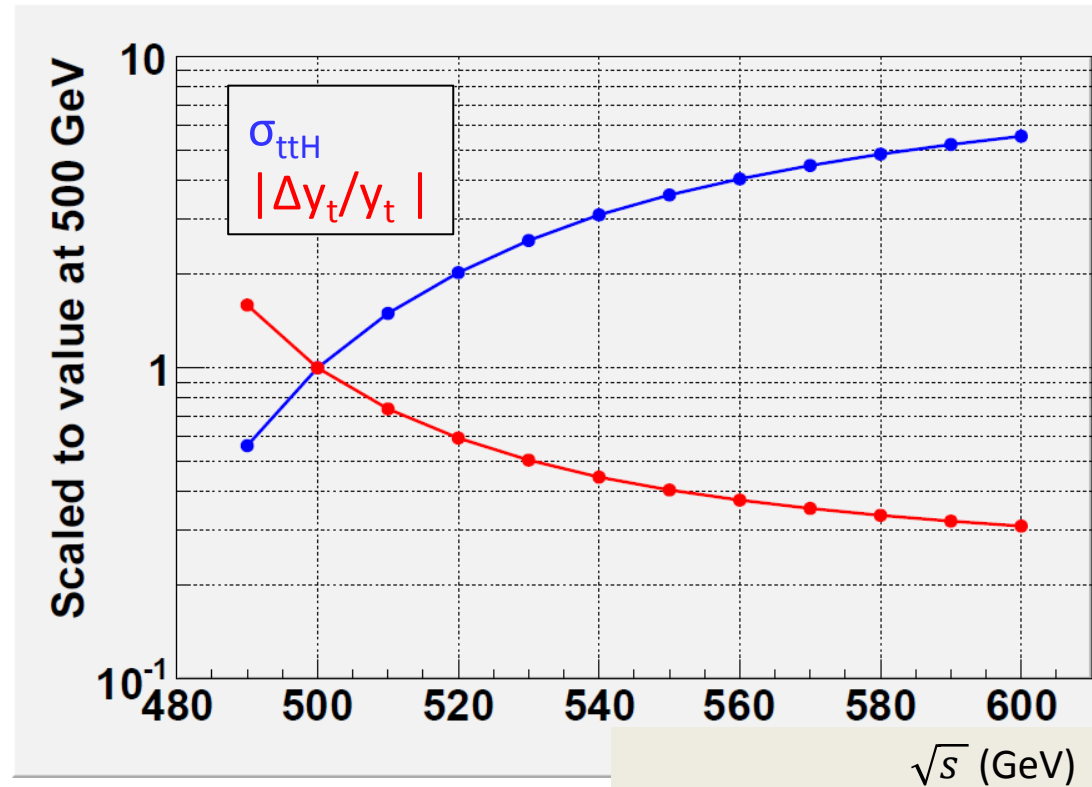
$\sqrt{s} : S/\sqrt{S+B} : |\Delta y_t/y_t| \%$

500 : 5.60 : 9.28

520 : 9.45 : 5.50

550 : 13.9 : 3.73

$\sigma_{ttH} = 0.485 \text{ fb @ } 500 \text{ GeV}$



* Same MC samples are used for all analysis.

Backup

event selection

Event Selection 8 jets

- Jet clustering : Durham algorithm
$$Y_{ij} = \frac{2\min\{E_i^2, E_j^2\}(1 - \cos \theta)}{E_{\text{cm}}^2}$$
 - forced 8 jet clustering for tth \rightarrow 8jets channel
 - ✓ “ $Y_{87} > 0.00038$ ” + “ $Y_{87} \leq 0.00038 \ \&\& \ Y_{76} > 0.004$ ”
- Isolated Lepton ID with BDT
 - ✓ require no Isolated lepton
- ✓ b candidate jets ≥ 4 (b likeness $\geq 0.85, 0.8, 0.6, 0.2$)
- reject events with very forward jets
 - ✓ $|\text{Jet } \cos\theta| \leq 0.99$
- Jet paring, $\chi^2 > 13.3$
- $M_{jjj} > 140$ (top candidate 3 jet mass)
- Leading 2 jets energy sum < 188 (Gev)
- smallest 3 jets energy sum > 60 (GeV)
- $95 < M_{jj} < 160$ (GeV) (range of higgs candidate M_{jj})

Event Selection In+6 jets

- Jet clustering : Durham algorithm
$$Y_{ij} = \frac{2\min\{E_i^2, E_j^2\}(1 - \cos \theta)}{E_{\text{cm}}^2}$$
 - forced 6 jet clustering for tth \rightarrow 6jets channel
 - ✓ “ $Y_{65} > 0.0016$ ” + “ $Y_{65} \leq 0.0016 \ \&\& \ Y_{54} > 0.006$ ”
- Isolated Lepton ID with BDT
 - ✓ require exact one Isolated lepton
- ✓ b candidate jets ≥ 4 (b likeness $\geq 0.85, 0.8, 0.6, 0.2$)
- reject events with very forward jets
- ✓ $|\text{Jet } \cos\theta| \leq 0.99$
- Missing Energy > 20 GeV
- Jet paring, $\chi^2 > 30.5$
- $M_{jjj} > 140$ (top candidate 3 jet mass)
- Leading 2 jets energy sum < 197 GeV
- smallest 2 jets energy sum > 66 GeV
- $95 < M_{jj} < 160$ GeV (range of higgs candidate M_{jj})

Event Selection 2l2n+4 jets

- Jet clustering : Durham algorithm $Y_{ij} = \frac{2\min\{E_i^2, E_j^2\}(1 - \cos\theta)}{E_{\text{cm}}^2}$
 - forced 6 jet clustering for tth \rightarrow 4jets channel
 - ✓ “ $Y_{43} > 0.002$ ”
- Isolated Lepton ID with BDT
 - ✓ require exact two Isolated leptons
 - ✓ 4 b jets (b likeness $\geq 0.85, 0.8, 0.6, 0.2$)
- reject events with very forward jets
 - ✓ $|\text{Jet } \cos\theta| \leq 0.99$
- Missing Energy > 20 GeV
- Jet paring, $\chi^2 > 12.5$
- Leading jet energy < 112 (Gev)
- smallest jet energy > 38 (GeV)
- $100 < M_{jj} < 155$ (GeV) (range of higgs candidate M_{jj})

MC stat.

tth, ttz, ttbb: 100k~200k events

tbW(DBD samples): 10k~100k events

Expected # of events @ 500fb⁻¹

- $\sqrt{s} = 500 \text{ GeV}$, $M_h = 125 \text{ GeV}$, $(P_{e^-}, P_{e^+}) = (-0.8, +0.3)$
- production cross section
- Branching ratio

Process	σ (fb)
$e^-e^+ \rightarrow tth$	0.485
$e^-e^+ \rightarrow ttZ$	1.974
$e^-e^+ \rightarrow ttg(bb)$	1.058
$e^-e^+ \rightarrow tbW$	979.8

Decay mode	Branching ratio
$h \rightarrow bb$	0.577
$tt \rightarrow bqqbqq$	0.457
$tt \rightarrow blvbqq$	0.438
$tt \rightarrow blvblv$	0.105

- expected # of signals and Backgrounds(@500fb⁻¹)

tth(tt6j, hbb)	63.9	tth(ttlN4j, hbb)	61.3
tth(ttall, hnobb)	102.6	ttZ	987
tth(ttlvlv2b, hbb)	14.6	ttg(bb)	529
		tbW	489902

Lepton ID

- muon selection



- electron selection



- tau (e)



- tau(muon)



- tau (1-prong)



- tau(3-prong)