Request for 1 TeV ttH samples

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with thanks to A. Miyamoto

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Manpower

* ILD analysts working on ttH:
  * Tony Price (Birmingham),
  * Hajrah Tabassam (Quai-i-Azam U., Islamabad)
  * Victoria Martin (Edinburgh)
  * Ryo Yonamine (Sokendai/KEK)
  * T.T. (Tokyo)
  * Keisuke Fujii (KEK)
    * ILD analysts will also work on 500 GeV analysis, as part of building a strong physics case for the ILC.
* In conversation with SiD analysts for ttH:
  * Philipp Roloff, Jan Strube (CERN)

Sample request for ttH

* For ttH, ttZ, ttbb processes at 1 TeV, would like:
  * 10 ab-1 (#evts ~ 260,000) **generated**
  * 2 ab-1 (#evts ~ 26,000) **simulated**

* For 6f processes at 1 TeV:
  * 10 ab-1 (#evts ~ 5×10^6) **generated**
  * **Analysis should decide the preselections to select events to be simulated**

tth, ttZ, ttbb samples @ 1 TeV

A. Miyamoto

Process	beam-pol	processID	xsec(fb)	Nev@2ab-1	DBD (L80R20)	DBD (L80R30)	Max(F,G)
Ptth-6q-hbb	eL.pR	I106401	1.8002	3601	1945	2107	2107
Ptth-6q-hbb	eR.pL	I106402	0.8098	1620	65	57	65
Ptth-6q-hnonbb	eL.pR	I106403	1.0403	2081	1124	1218	1218
Ptth-6q-hnonbb	eR.pL	I106404	0.4680	936	38	33	38
Pttbb-6q-all	eL.pR	I106405	1.5606	3122	1686	1827	1827
Pttbb-6q-all	eR.pL	I106406	0.6910	1383	56	49	56
Pttz-6q-all	eL.pR	I106407	6.3878	12776	6900	7474	7474
Pttz-6q-all	eR.pL	I106408	1.9891	3979	160	140	160
Ptth-ln4q-hbb	eL.pR	I106409	1.7338	3468	1873	2029	2029
Ptth-ln4q-hbb	eR.pL	I106410	0.7801	1561	63	55	63
Ptth-ln4q-hnonbb	eL.pR	I106411	1.0020	2004	1083	1173	1173
Ptth-ln4q-hnonbb	eR.pL	I106412	0.4508	902	37	32	37
Pttbb-ln4q-all	eL.pR	I106413	1.5074	3015	1629	1764	1764
Pttbb-ln4q-all	eR.pL	I106414	0.6666	1334	54	47	54
Pttz-ln4q-all	eL.pR	I106415	6.1520	12304	6645	7198	7198
Pttz-ln4q-all	eR.pL	I106416	1.9164	3833	154	135	154
Total					23512	25338	25417

Requesting 2 ab-1 for tth, ttZ, ttbb (without 2l+2nu channels), total of ~25,000 events.
Samples already available (thanks to Akiya) on the Grid at: /grid/ilc/prod/ilc/mc-dbd

If there is room, would like x2 for training: ~50,000 events (6f events not included here)

Impact on y_t accuracy

- our fast simulation at 500 GeV shows S/B is ~O(1)
  - roughly expect 6x (2x) increase in signal (background) at 1 TeV
- statistical accuracy of δ yt/yt = 0.5*sqrt(S+B)/S
  - calculate relative error on this number from MC statistics of S and B

(S,B) at 1 ab-1	δ yt/yt	Lumi = 1 ab-1		Lumi = 2 ab-1	
		S error	B error	S error	B error
(50,100)	12%	17%	3.3%	12%	2.4%
(100,50)	6.1%	13%	2.4%	9.4%	1.7%
(100,100)	7.1%	13%	2.5%	8.8%	1.8%
(100,200)	8.7%	12%	2.4%	8.3%	1.7%
(200,100)	4.3%	9.4%	1.7%	6.7%	1.2%
(200,200)	5.0%	8.8%	1.8%	6.3%	1.3%

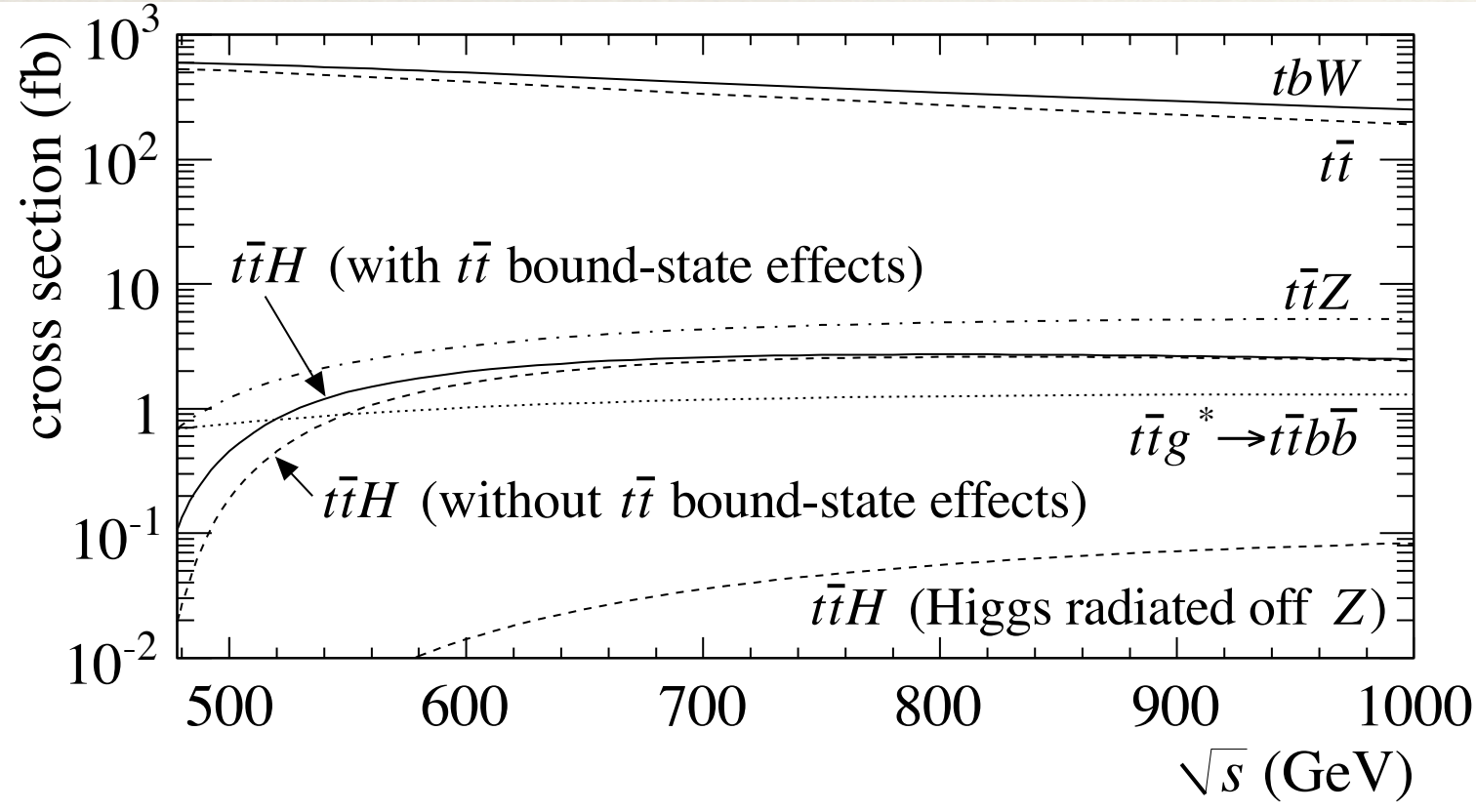
For <10% relative error on top Yukawa, would like 2 ab-1 for S; 1 ab-1 for B sufficient.

500 GeV fast simulation	$t\bar{t}H(6j)$	tbW	$t\bar{t}Z$	$t\bar{t}g^*(b\bar{b})$
no cuts	282.3	980738.5	2406.9	1159.6
single isolated lepton	179.6	340069.0	790.6	397.7
thrust < 0.77	145.7	144999.0	616.7	266.0
$Y_{5\to4} > 0.005$	125.5	12297.7	416.2	113.7
b-tagging	49.0	172.9	53.3	37.8
mass cuts	39.5	23.0	33.9	13.2

process	xsec (fb) @ 500 GeV	xsec (fb) @ 1 TeV
tth	0.45	2.5
ttZ	1.2	5.2
ttbb	0.75	1.3
tbW	580	250

6f samples @ 1 TeV

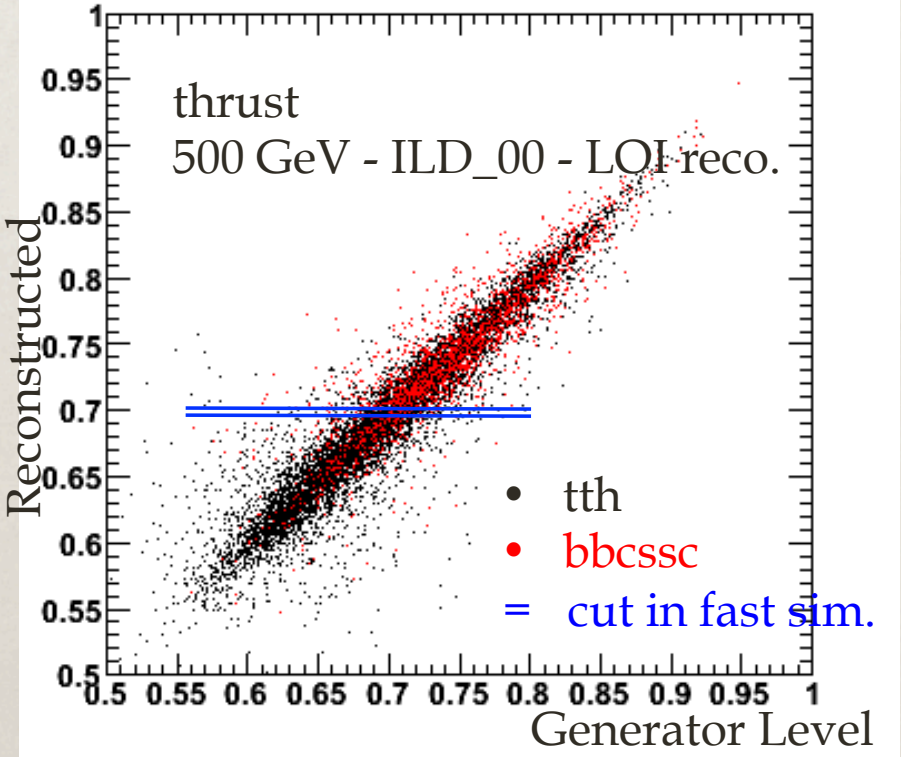
- At 1 TeV: ttbar cross section is ~200 fb, more for non-resonant
  - Would like 1 ab-1 → ~ 0.3 million events

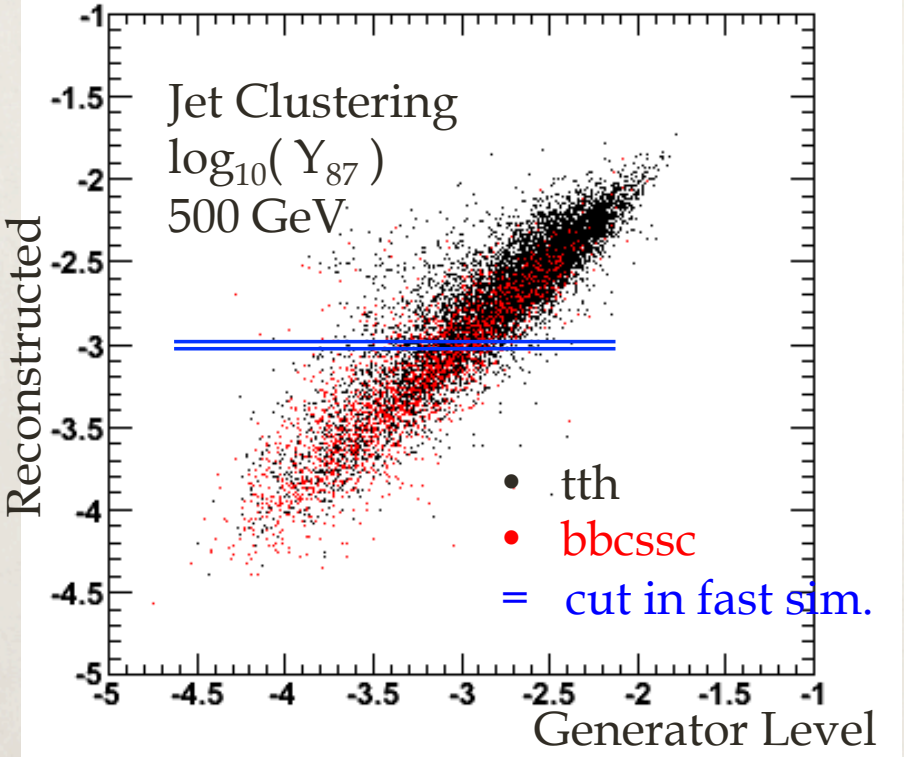


no beam polarizations

Preselections

tth is to be studied in (1) 6 jets + lepton mode, and (2) 8 jets mode.
main cuts in the analysis: event shape, jet clustering thresholds, b-tagging





Generator-level particles: generator status =1, not created in simulation,
neutrino veto, cosTheta<0.997, pT>0.1
Reconstructed Particles: same cosTheta & pT cuts

Some safe cuts may be possible, need more detailed study by analysts.
→ propose to let analysts generate large statistics background samples

Sample request for ttH

- For ttH, ttZ, ttbb processes at 1 TeV:
  - 10 ab-1 (#evts ~ 260,000) **already generated by A. Miyamoto**
    - Note: 10 ab-1 after applying 80/30 beam pol.
    - Common data sample accessible to all detectors (ILD, SiD, CLIC)
  - 2 ab-1 (#evts ~ 26,000) **simulated**
    - ILD + SiD coordination required to ensure analysis of same data
    - Analysts will simulate more if necessary

- For 6f processes at 1 TeV:
  - would like 10 ab-1 (#evts ~ 5×10^6) **generated**
    - Common Sample Group has finished the phase space integration → initial test samples will be looked at by CERN (who will do the SiD analysis)
    - Need to decide who will do the event generation
    - Analysts will choose the suitable pre-selections, to be agreed upon by ILD + SiD