

# $\nu\bar{\nu}H, H \rightarrow \gamma\gamma$ Status

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Regular Friday Meeting

February 20, 2015

## H $\rightarrow$ $\gamma\gamma$

- Code has changed since LCWS13.
- Current preselection seems worst.
- Debugging the origin of those differences.
  - Comparing current version of my code with version Nov. 2013.
- Origin of those differences understood.

1	Preselection
2	$(\text{cone}E_m < 3.76 + 0.066 * E_m)$ && $(\text{cone}E_l < 0.0545 + 0.092 * E_l)$
3	$\text{met} > -326 + 1.25 * E_{\text{vis}}$
4	$ \cos(\theta_{\gamma}^*)  < 0.98$
5	$\cos(\theta_{\gamma}) < 0.98$
6	$\text{cone}E(\gamma_1) +$ $\text{cone}E(\gamma_2) < 8$
7	$M > 140 \text{ GeV}/c^2$
8	$120 < M(\gamma, \gamma) < 132 \text{ GeV}/c^2$

$E_m$  ( $E_l$ ):  $\gamma$  from di-photon system with highest (lowest) energy.

## 1 LCWS13

## 2 Current Code

- 2f and 4f contributions much larger than before with the same cuts.
- Origin of those differences from changes in preselection.
- The most significant change seems relaxing the minimum  $\gamma$  energy.

## 3 Using November 2013 code.

- Consistent with 1.

Process:	signal	vvaa	2f	4f	aa.4f	5f	6f	Signf
Xsec:	0.387	41.6	2.64e+04	3.24e+04	210	143	1.18e+03	-
Expected:	193	2.08e+04	1.32e+07	1.62e+07	1.05e+05	7.17e+04	5.89e+05	-
Generated:	7.83e+04	7.02e+05	3.3e+06	3.27e+06	1.11e+05	8.16e+04	4.74e+05	-
Cut1:	169	8.07e+03	2.9e+04	5.33e+04	75	75.5	350	0.56
Cut2:	163	7e+03	2.01e+03	3.89e+03	1.97	1.76	11.3	1.43
Cut3:	161	6.56e+03	352	1.15e+03	0.989	0	1.88	1.77
Cut4:	159	6.3e+03	323	1.05e+03	0	0	1.82	1.8
Cut5:	153	4.29e+03	161	232	0	0	0.0177	2.21
Cut6:	149	4.08e+03	121	198	0	0	0.0177	2.21
Cut7:	132	3.01e+03	80.4	115	0	0	0	2.29
Cut8:	125	717	13	0.377	0	0	0	4.26

Process:	signal	vvaa	2f	4f	aa.4f	5f	6f	Signf
Xsec:	0.387	41.6	2.64e+04	3.24e+04	210	143	1.17e+03	-
Expected:	193	2.08e+04	1.32e+07	1.62e+07	1.05e+05	7.17e+04	5.84e+05	-
Generated:	7.82e+04	7.52e+05	3.3e+06	3.25e+06	1.11e+05	8.16e+04	4.25e+05	-
Cut1:	179	1.32e+04	1.01e+05	2e+05	506	554	346	0.318
Cut2:	174	1.14e+04	3.07e+04	5.47e+04	98.3	109	91.9	0.558
Cut3:	172	1.07e+04	1.11e+04	1.94e+04	34.3	27.6	27.4	0.843
Cut4:	168	9.78e+03	5.48e+03	1.04e+04	21.6	13.7	24.4	1.05
Cut5:	161	4.76e+03	4.35e+03	3.4e+03	0.147	1.3	7.04	1.43
Cut6:	160	4.67e+03	4.16e+03	2.92e+03	0.147	0	5.17	1.46
Cut7:	140	3.38e+03	3.2e+03	2.25e+03	0.147	0	3.3	1.48
Cut8:	126	811	169	62.8	0.147	0	0	3.68

Proc.:	signal	vva	2f	4f	aa_4f	5f	6f	Signf
Xsec:	0.387	41.6	2.64e+04	3.24e+04	210	143	1.17e+03	-
Exp.:	193	2.08e+04	1.32e+07	1.62e+07	1.05e+05	7.17e+04	5.84e+05	-
Gen:	7.82e+04	7.52e+05	3.3e+06	3.25e+06	1.11e+05	8.16e+04	4.25e+05	-
Cut1:	170	1.27e+04	4.19e+04	9.23e+04	238	252	438	0.442
Cut2:	164	1.06e+04	2.6e+03	1.17e+04	25.6	25.2	22.9	1.03
Cut3:	162	1.01e+04	628	6.25e+03	13.7	5.93	8.2	1.24
Cut4:	160	9.24e+03	511	3e+03	7.88	2.6	7.83	1.4
Cut5:	153	4.53e+03	204	260	0	0	0.000899	2.14
Cut6:	149	4.31e+03	156	226	0	0	0.000899	2.15
Cut7:	132	3.17e+03	102	124	0	0	0.000899	2.23
Cut8:	125	760	13.2	0.376	0	0	0	4.16

Process	LCWS	NEW CODE
2f_z_bhabhag	0	6.7
2f_z_h	0	0
2f_z_l	13.3	162.4
4f_leptonic	0.4	62.8
4f_hadronic_semileptonic	0	0

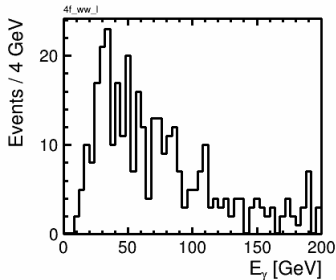
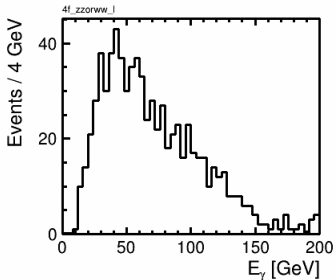
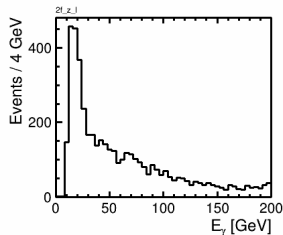
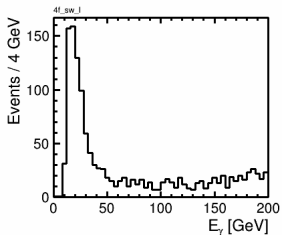
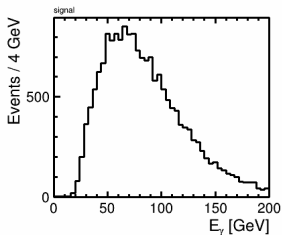
- Looser preselection introduces more background leptonic decays.
- At lcws13 i was asking  $E_{\text{PFO}}(\gamma) > 25 \text{ GeV}$
- This requirement was changed to  $E_{\text{PFO}}(\gamma) > 10 \text{ GeV}$
- $E(\gamma) > 25 \text{ GeV}$  doesn't reject these events.
  - $E_{\text{PFO}}(\gamma) \neq E(\gamma)$  ( $\gamma$  split/Bremsstrahlung recovery)



## $E_{\text{PFO}}(\gamma) > 10$ not well motivated

- At 500 GeV , signal is negligible for  $E_{\text{PFO}}(\gamma) < 20$ .
- In the other hand, Z decays peak in that area.

# $\gamma$ PFO (Before Bremss./split Recovery)



## Status

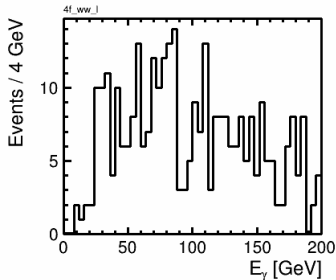
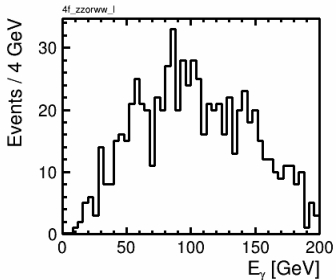
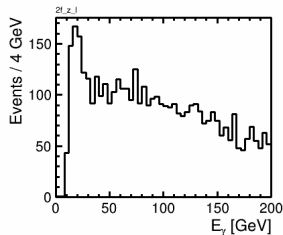
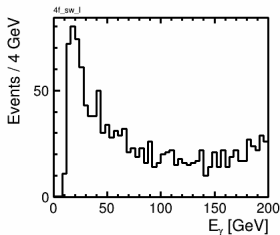
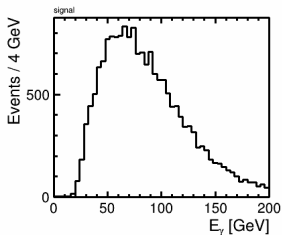
- Found the origin of the differences in the cut tables between lcws13/current code.
- Relaxing  $\gamma$  energy requirement in the preselection introduce additional 2f/4f leptonic backgrounds.
  - The numbers are now consistent with those showed at LCWS13.

## Plan

- Reoptimisation of the final cuts.

# Back Up slides

# $\gamma$ PFO (After Bremss./split Recovery)



## Added 2 DST-MERGED Missing Files (@ 500 GeV)

- `ae_evlxy.eW.pL`
- `ae_exxyy.eW.pL`
- DST for these processes were available.
  - But they haven't being merged.
- I have merged then, uploaded to the GRID.
  - Registered replicas at DESY and KEK.
  - `/ilc/prod/ilc/mc-dbd/ild/dst-merged/500-TDR_ws/5f/ILD_o1_v05/v01-16-p05_500/rv01-16-p05_500.sv01-14-01-p00.mILD_o1_v05.E500-TDR_ws.l37341.Pae_evlxy.eW.pL-00001-DST.slcio`
  - `/ilc/prod/ilc/mc-dbd/ild/dst-merged/500-TDR_ws/5f/ILD_o1_v05/v01-16-p05_500/rv01-16-p05_500.sv01-14-01-p00.mILD_o1_v05.E500-TDR_ws.l37345.Pae_exxyy.eW.pL-00001-DST.slcio`
- Also copied to disk in kekcc.
  - `/group/ilc/soft/samples/mc-dbd/ild/dst-merged/500-TDR_ws/5f/ILD_o1_v05/v01-16-p05_500`
- If you are running over DST-MERGED at 500 GeV you need to add these processes in your scripts.