Weekly Report

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Single Higgs usage

342282 ggH H->inc
342285 ZH H->inc
342284 WH H->inc
342283 VBFH H->inc
346345 ttH dilep H->all;346344 ttH semilep H->all;364343 ttH allhad H->all

Basic selections

- 2 same sign leptons,Lep_pt,B veto,Zveto ,PLV,Njets
- Somehow the name of some variables have changed. Perform with a looser working point for lepton:
  Drop “tight” requirement
- Efficiency are calculated by $eff = \frac{\#events\ after\ selc}{totalEvents}$

ggH

input	total	ee	mumu	emu
SS lepton	2.24%	3.60%	0.60%	2.72%
pt_l1, match	0.80%	1.27%	0.12%	1.06%
B veto	0.78%	1.27%	0.12%	1.01%
DY	0.72%	1.20%	0.12%	0.92%
Zveto	0.69%	1.07%	0.12%	0.92%
PLV	0.21%	0.32%	0.02%	0.29%
Njet	0.02%	0.02%	0.00%	0.03%

- gn1 efficiency 0.89%
- Acceptance times efficiency =3/2000000=0.00015%
- Expected number $80fb^{-1} * 4858fb * 0.00015\% = 0.58$
- Probabilities to same sign lepton pair violate charge conservation in SM ？

VBFH

input	total	ee	mumu	emu
SS lepton	3.43%	5.87%	1.40%	3.60%
pt_l1, match	1.35%	2.64%	0.45%	1.28%
B veto	1.25%	2.51%	0.40%	1.16%
DY	1.20%	2.38%	0.35%	1.16%
Zveto	1.11%	2.05%	0.35%	1.16%
PLV	0.45%	0.79%	0.20%	0.45%
Njet	0.02%	0.00%	0.05%	0.00%

- gn1 efficiency 0.99%
- Acceptance times efficiency =1/600000= 0.00016%
- Expected number $80fb^{-1} * 3782fb * 0.00016\% = 0.48$
- Probabilities to same sign lepton pair violate charge conservation in SM ？

ZH

input	total	ee	mumu	emu
SS lepton	5.09%	5.24%	2.14%	16.80%
pt_l1, match	3.42%	3.74%	1.45%	10.54%
B veto	2.97%	2.98%	1.34%	9.63%
DY	2.86%	2.95%	1.30%	8.99%
Zveto	2.37%	1.67%	1.30%	8.99%
PLV	1.48%	1.20%	0.90%	4.72%
Njet	0.13%	0.18%	0.04%	0.36%

- gn1 efficiency 4.53%
- Acceptance times efficiency 0.006%

- Expected number
  $80fb^{-1} * 869.6fb * 0.006\% = 4.17$

- Probabilities to same sign lepton pair
- H->WW->lvlv/lvqq/qqqq , Z->ff(f=v,l,q)

WH

input	total	ee	mumu	emu
SS lepton	35.45%	34.20%	33.38%	37.28%
pt_l1, match	24.88%	23.22%	24.27%	26.06%
B veto	23.11%	21.60%	22.76%	24.07%
DY	22.56%	20.88%	22.31%	23.54%
Zveto	21.64%	17.01%	22.31%	23.54%
PLV	15.27%	11.61%	16.73%	16.22%
Njet	0.68%	0.45%	0.30%	1.02%

- gn1 efficiency 2.34%
- Acceptance times efficiency 0.016%

- Expected number
  $80fb^{-1} * 1380fb * 0.016\% = 17.6$

- Probabilities to same sign lepton pair

✓H->WW->lvqq, W->lv

ttH

input	total	ee	mumu	emu
SS lepton	8.93%	10.34%	7.61%	8.98%
pt_l1, match	6.32%	7.23%	5.49%	6.34%
B veto	1.73%	1.92%	1.53%	1.75%
DY	1.68%	1.88%	1.49%	1.70%
Zveto	1.62%	1.61%	1.49%	1.70%
PLV	0.98%	0.93%	0.94%	1.04%
Njet	0.35%	0.33%	0.33%	0.37%

- gn1 efficiency 14.86%
- Acceptance times efficiency 0.052%

- Expected number
  $80fb^{-1} * 508.5fb * 0.052\% = 21.15$

- Probabilities to same sign lepton pair

✓tt->WbWb->lvqq , H->WW->lvqq

signal

input	total	ee	mumu	emu
SS lepton	28.80%	28.24%	28.50%	25.91%
pt_l1, match	24.65%	24.11%	24.33%	22.27%
B veto	22.73%	22.38%	22.59%	20.42%
DY	22.35%	22.03%	22.23%	20.09%
Zveto	21.74%	19.74%	19.92%	20.09%
PLV	17.28%	14.87%	15.00%	16.97%
Njet	10.21%	7.43%	7.50%	11.40%

- gn1 efficiency 21.65%
- Acceptance times efficiency 2.21%

- Expected number
  $80fb^{-1} * (0.8643 + 0.4180 + 0.1336)fb * 2.21\% = 2.51$
- Probabilities to same sign lepton pair

✓ H->WW->lvqq, H->WW->lvqq

- Leptons should decay from different WW pair , otherwise we will get OS leptons
- However there are still events after same sign charge selection from ggH, VBFH process

Fluctuation. For instance, only 1 out of 6 million survives for VBFH , while the cross section are larger then signal

Tight and isolation for lepton are crucial for separating bkg and signal

- Total single higgs contribution: 0.58+0.48+4.17+17.6+21.15 =44
- Nonres dihiggs :2.51

- Single H in non-resonant (% of bkg)

ggH	VBFH	WH	ZH	ttH
0.013%	0.0094%	0.093%	0.39%	0.474%

- The single Higgs are still relatively small compared to the total background

- Quite loose compared to preivous optimizations, so some numbers may change

Summary

- yield, selection efficiency and fraction wrt total background for main single-H backgrounds
- Main contribution from WH and ttH

TO DO

- Specify the process of the single higgs samples

  ggH, H->WW, VBFH H->WW,

- Determine the variables to be used