Weekly Meeting

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Monday, April 04, 2016

The framework and samples

- Updated to use FixedCutLoose for the ISO of photons
- Implement the BtagSF
  - Only the weight of Lumiand Xsec isn't used since we don't know the exact Xsec for resonance.
  - Will use the lumiXsecWeight() for SM BKG below.
- Signal samples
  - Non-resonant: SM di-Higgs production - done
  - Resonant: 260 – 500 [GeV], 8 mass points – validated for submission
- Background samples
  - SM single Higgs background
    - ttH, ggH, VBF, WH, ZH
  - Continuum background
    - $pp \rightarrow jjl\nu\gamma\gamma$
  - One sample missed is $l\nu\gamma\gamma$

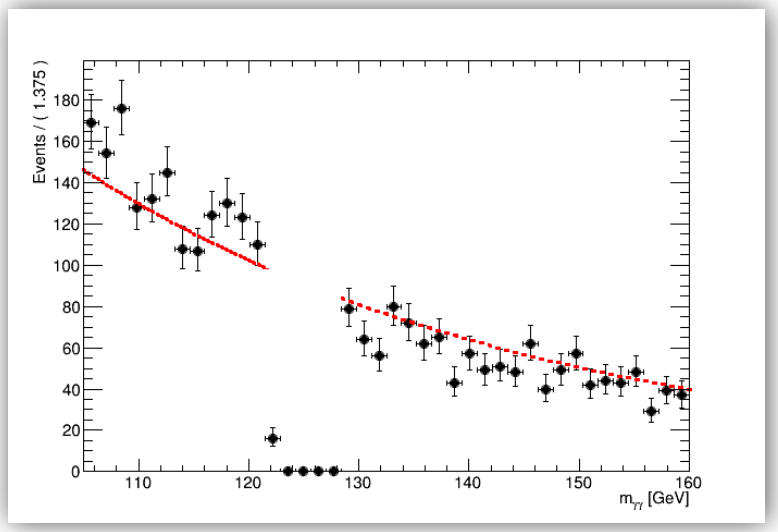
Events Selection

ϵ	SM Higgs Pair
Generated	100%
Trigger	74.2%
GRL	74.2%
Detector DQ	74.2%
has PV	74.2%
2 loose photons	59.7%
e-γ ambiguity	59.1%
tight ID	49.1%
Isolation	43.0%
rel.Pt cuts	39.4%
mass γγ cut	39.2%
At least two jets	34.8%
At least one lepton	16.7%
B-veto	13.4%
Tight mass Window	11.1%

Events Yield

- Continuum background extracted from sideband
  - $\epsilon_{\gamma\gamma}^{B} = 0.1376$
  - $B = \frac{\epsilon_{\gamma\gamma}^{B}}{1-\epsilon_{\gamma\gamma}^{B}} \times 9 = 1.44$
- SM Higgs background: as shown in the table below
- *smhh:*

  $S = \epsilon \times L \times \sigma \times Br(hh \rightarrow WW\gamma\gamma \rightarrow jjl\nu\gamma\gamma) = 0.16$ (assuming $\sigma = 1pb$)



The efficiency $\epsilon_{\gamma\gamma}^{B}$ using e^{ax} for continuous background extracted with 2jets+2photons +0lepton events

Process	Xsec [pb]	Previous Yield	Events Yield	Run1 results (20 fb^{-1})
ttH	0.5085	0.029	0.040	0.08
ggH	43.92	0.036	0.00049	negligible
VBF	3.748	0.0030	0.0080	negligible
WH	1.380	0.071	0.10	0.14
ZH	0.8696	0.034	0.038	0.025

Expected limits

- Using the previous yields
- Toys /without sys
  - expected limit (+2 sig) 50
  - expected limit (+1 sig) 43.3443
  - expected limit (median) 31.1673
  - expected limit (-1 sig) 24.6789
  - expected limit (-2 sig) 23.3254
- Asymptotic/without sys
  - ~29
- Run1 /asymp/without sys
  - 6.2
- Run1 /toys/without sys
  - 4.7 (not too many toys)

Process	Xsec [pb]	Events Yield
ttH	0.5085	0.029
ggH	43.92	0.036
VBF	3.748	0.0030
WH	1.380	0.071
ZH	0.8696	0.034

To-do list

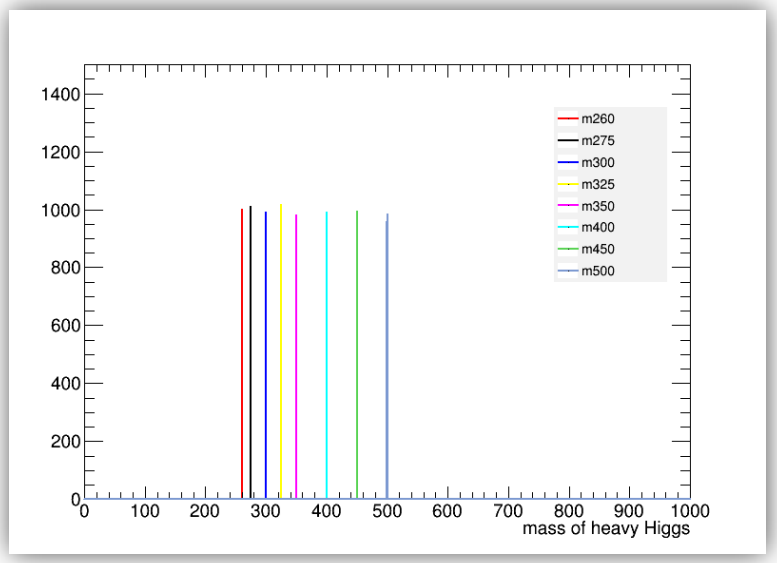
- Get the bkg yields directly by calling the lumiXsecWeight ()
- Optimization
- Get the expected limits using the updated event yields
- Generate the lvyy sample if there isn’t one in the Hgam group

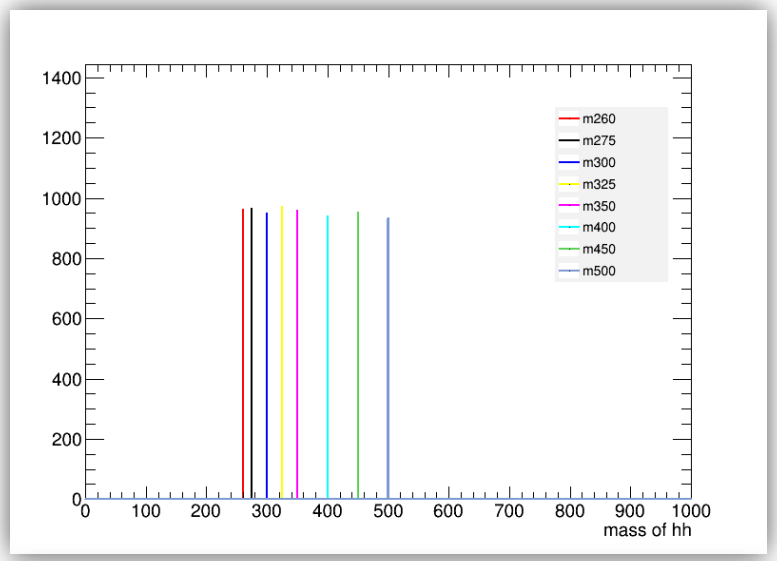
BACKUP

MC NLO Resonance Validation of $hh \rightarrow WW\gamma\gamma$

Three categories

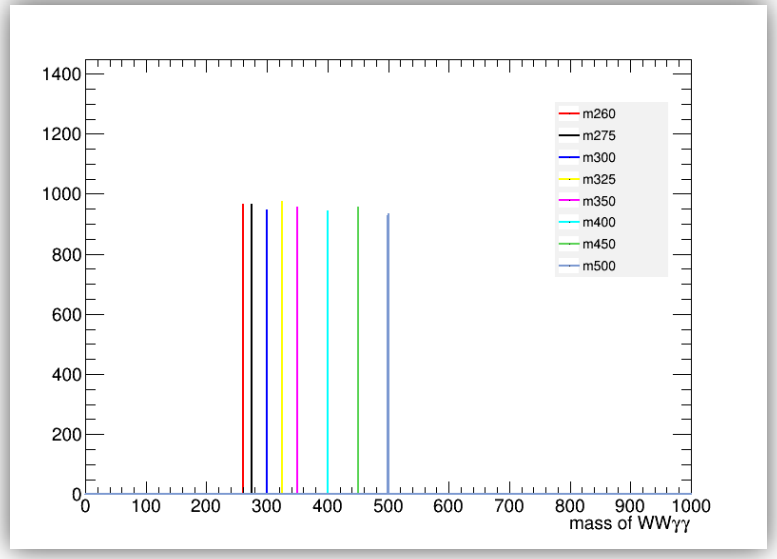
- leplep: $hh \rightarrow WW\gamma\gamma \rightarrow l\nu l\nu\gamma\gamma$
- hadlep: $hh \rightarrow WW\gamma\gamma \rightarrow l\nu jj\gamma\gamma$
- hadhad: $hh \rightarrow WW\gamma\gamma \rightarrow jjjj\gamma\gamma$

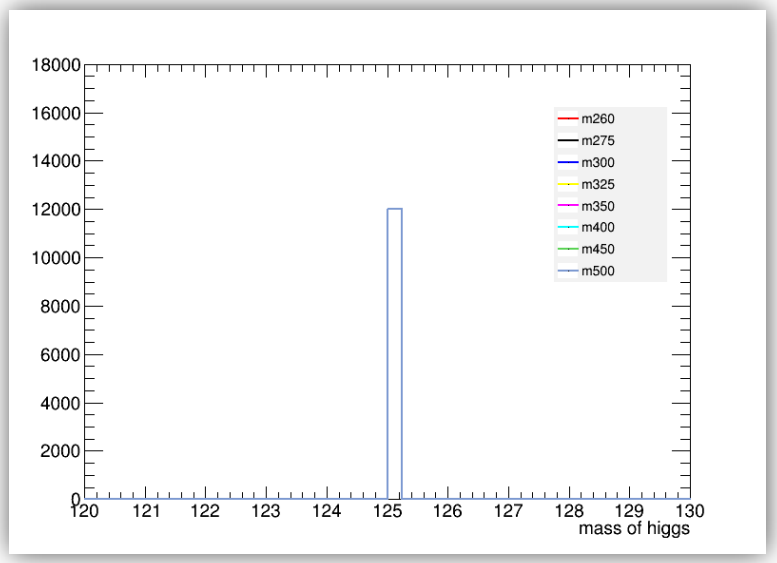


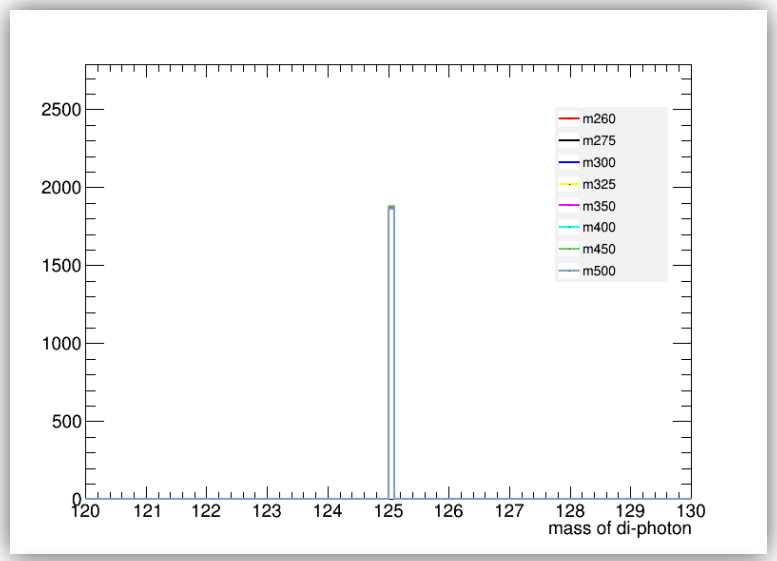


Mass related to heavy Higgs

Mass points: 260, 275, 300, 325, 350, 400, 450, 500 GeV

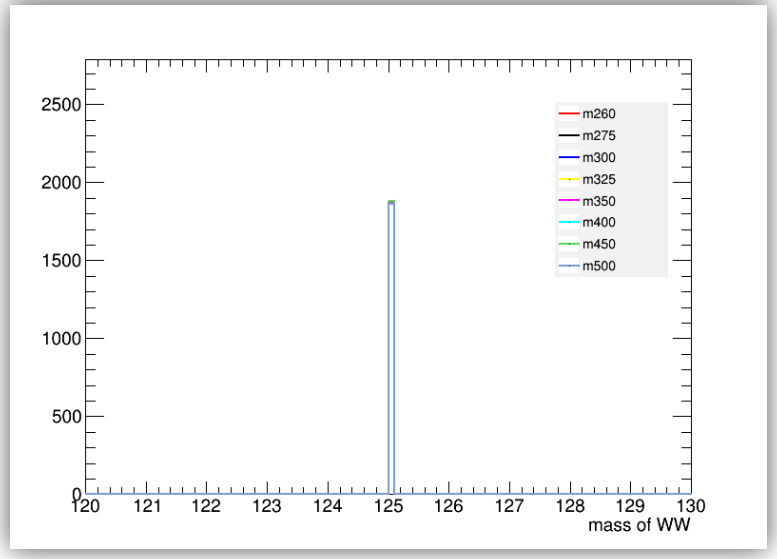


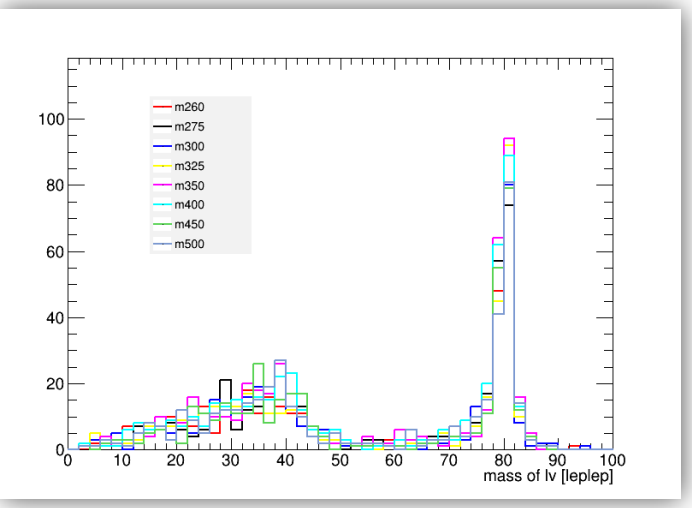


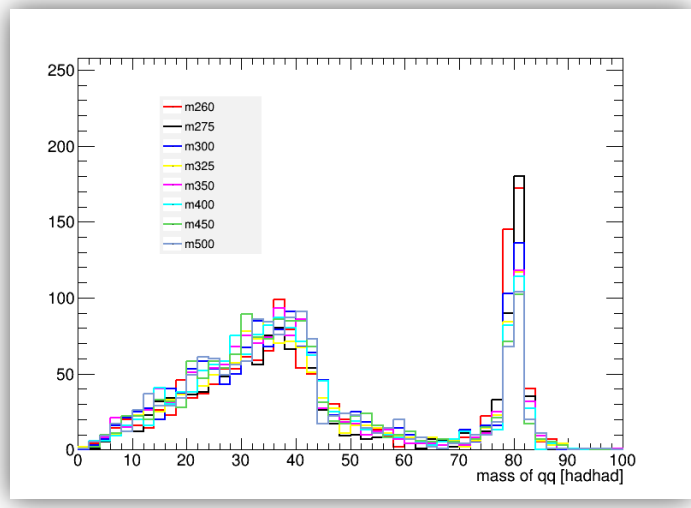


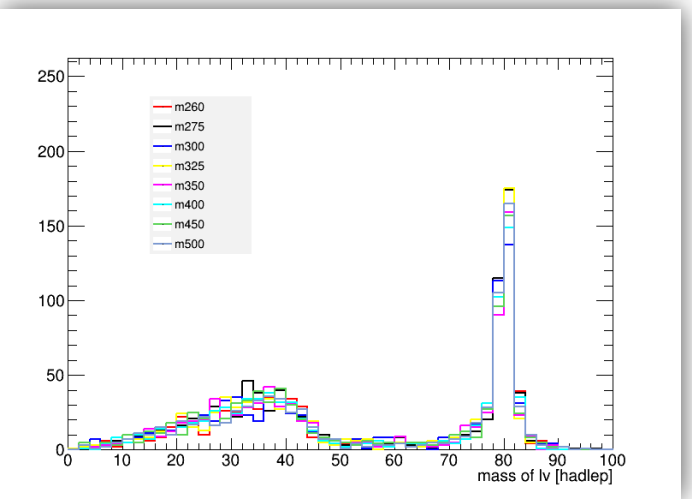
Mass related to SM Higgs

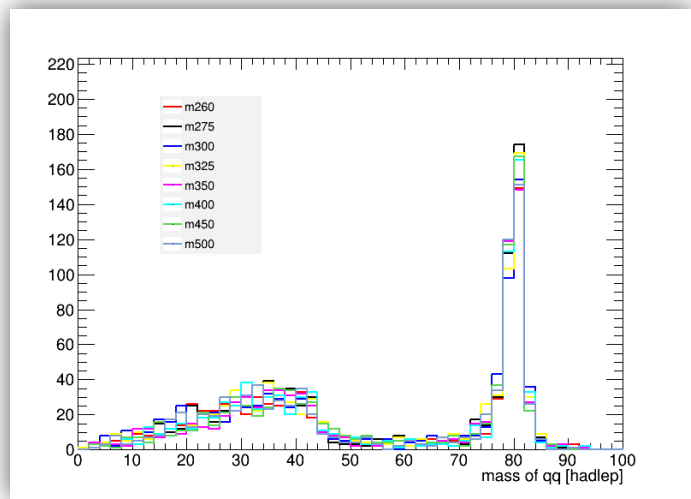
Mass: 125.1 GeV



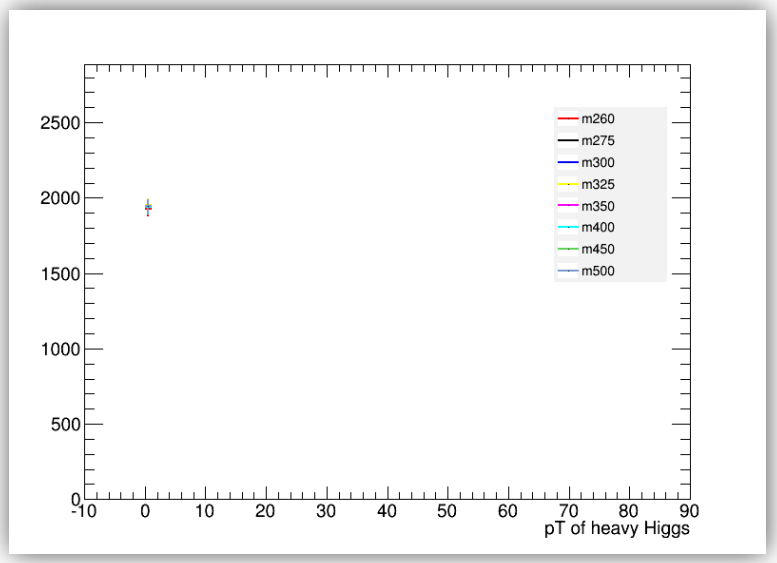


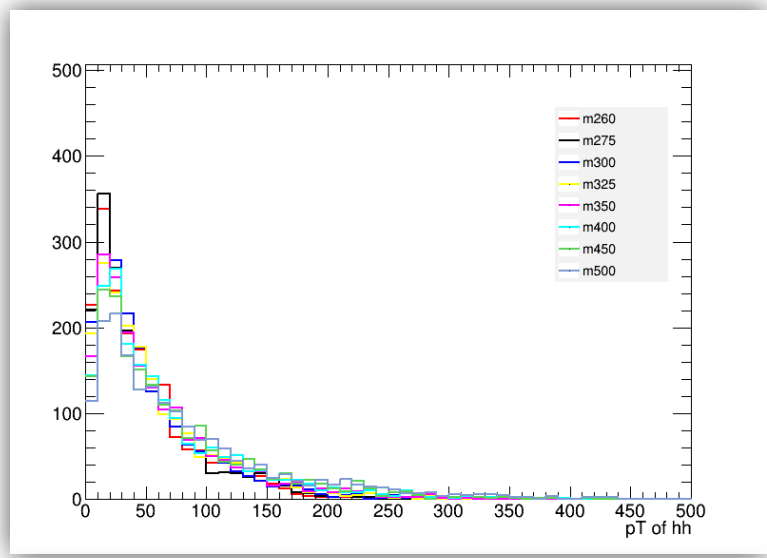




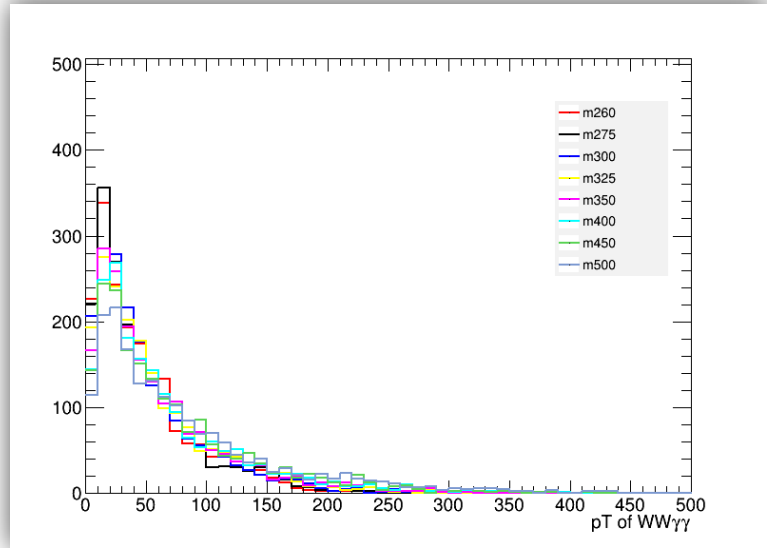


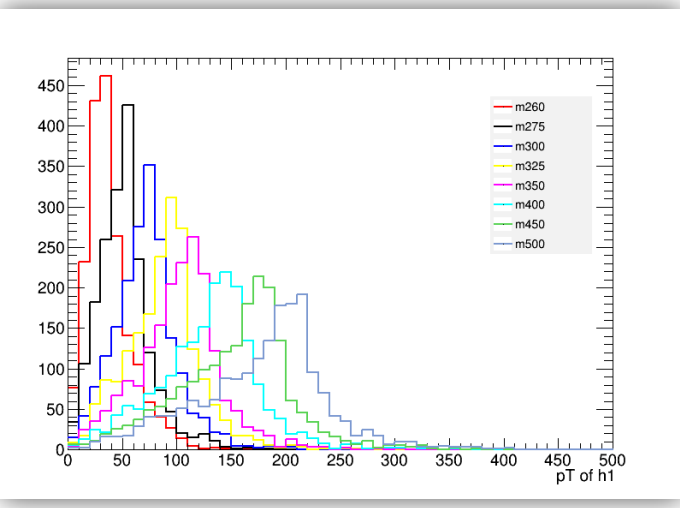
Mass related to W boson in leplep, hadlep, hadhad decay modes

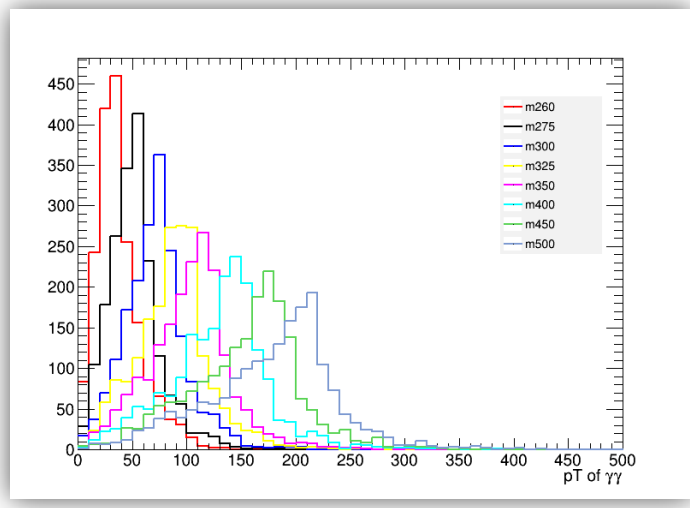


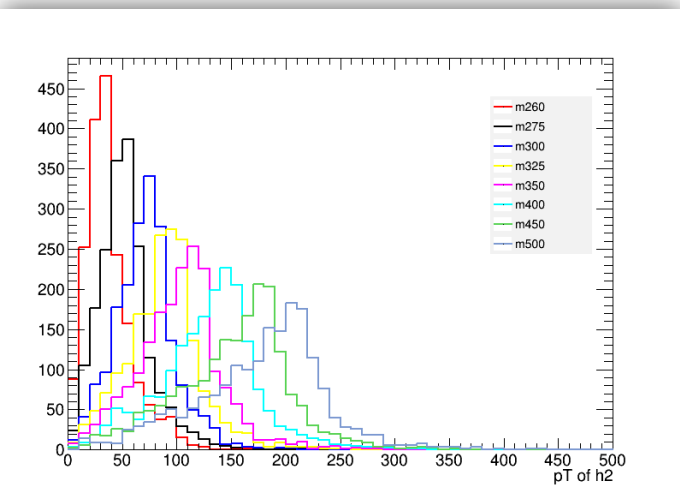


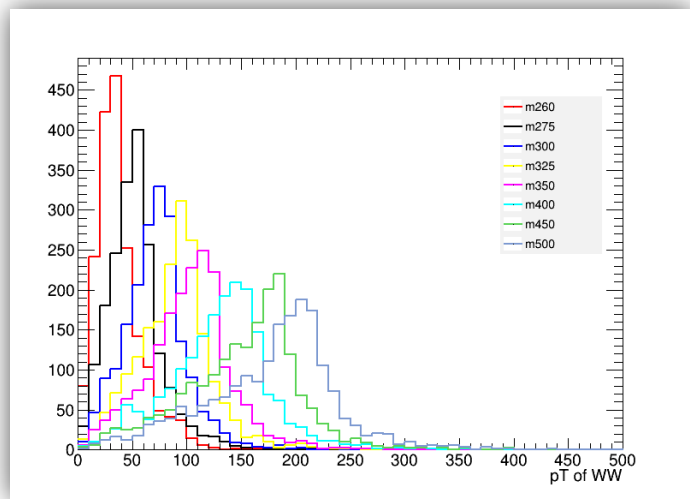
pT of heavy Higgs
pT of hh system
pT of $WW\gamma\gamma$ system



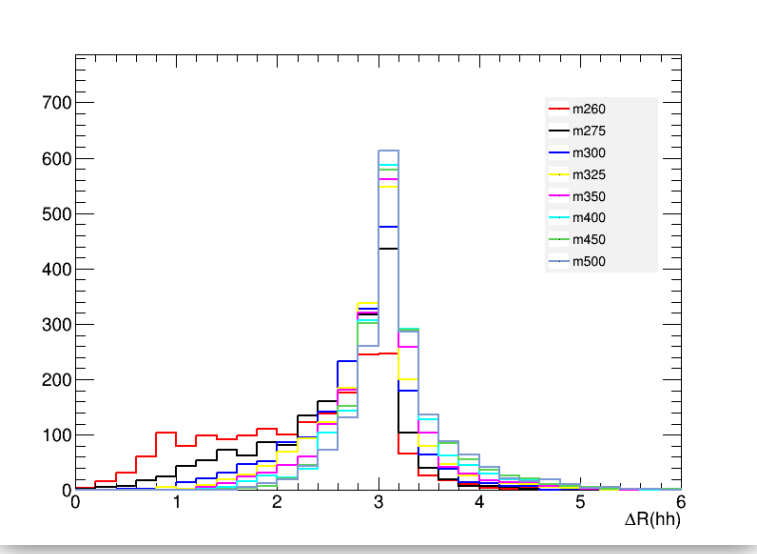




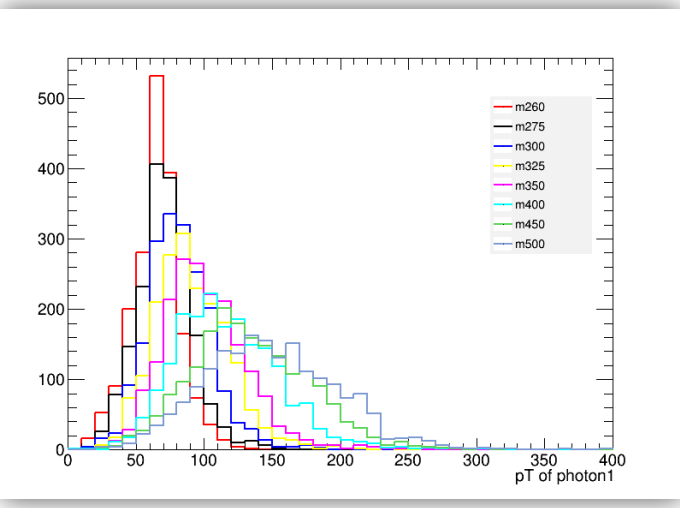


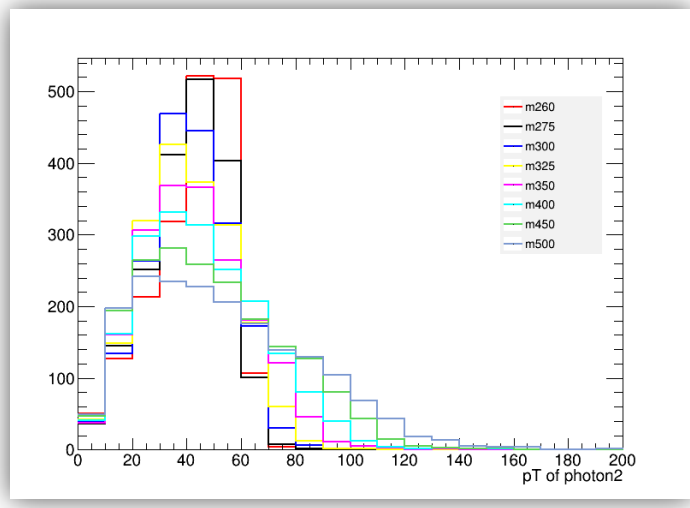


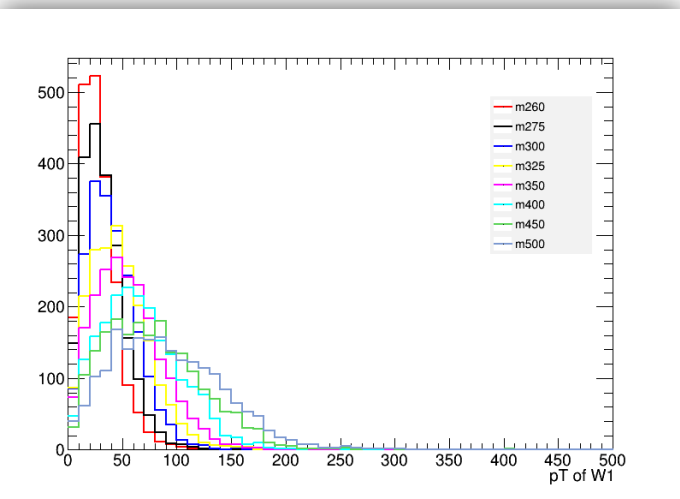
pT of SM higgs, WW system and di-photon system

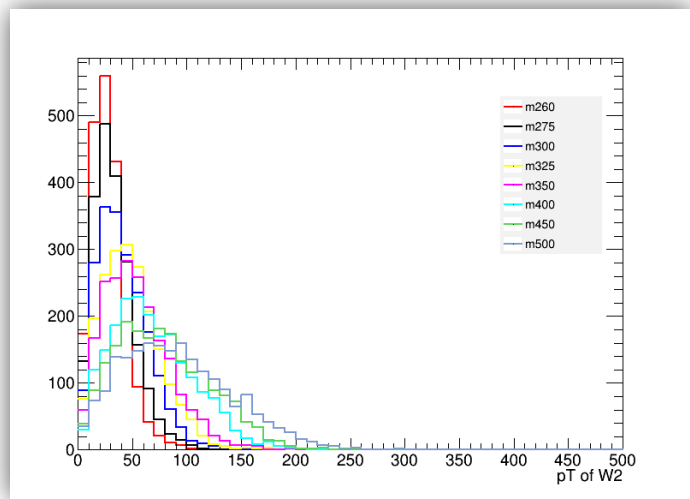


Delta R between two SM higgs

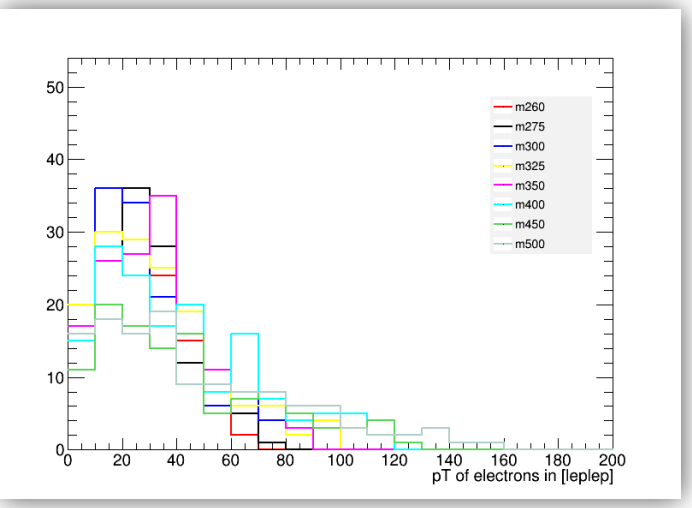


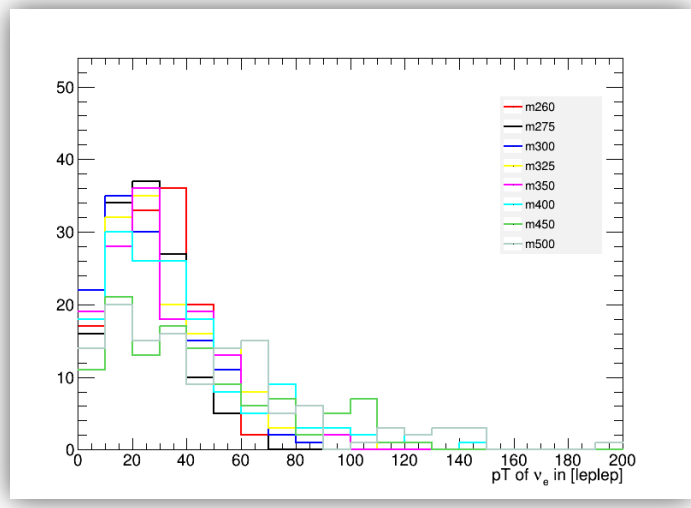


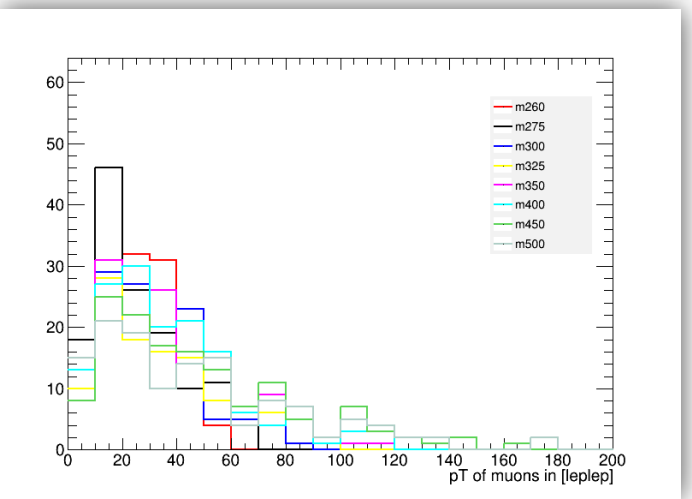


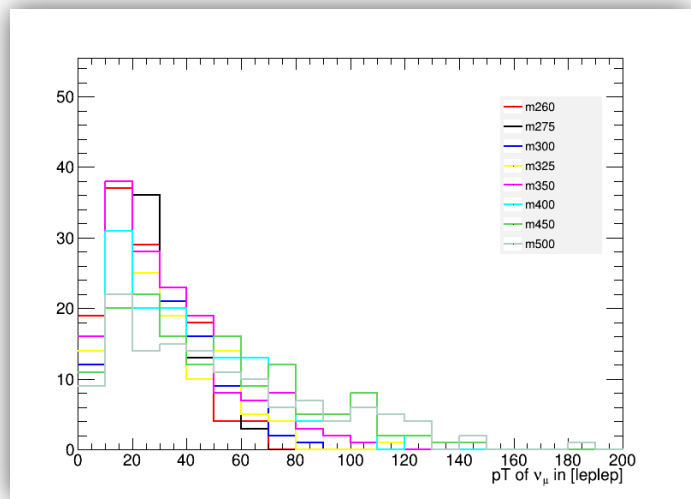


pT of W boson and photons

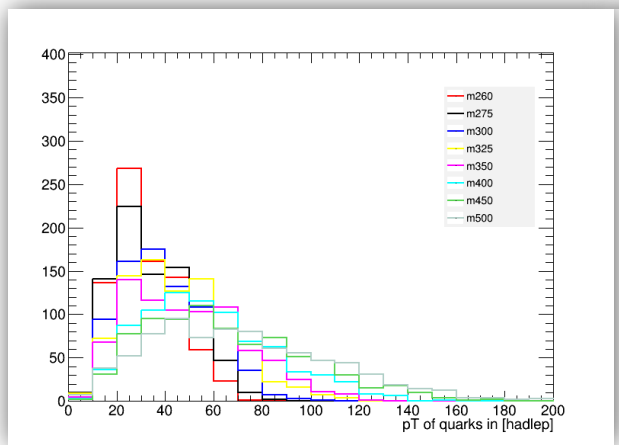


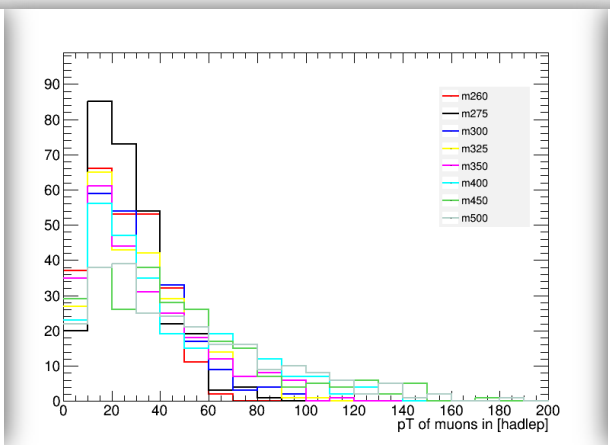


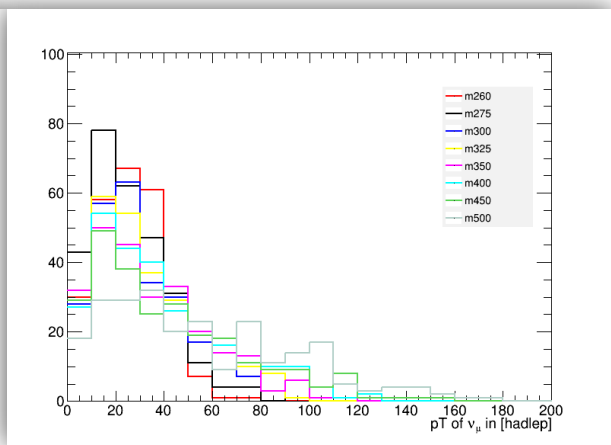




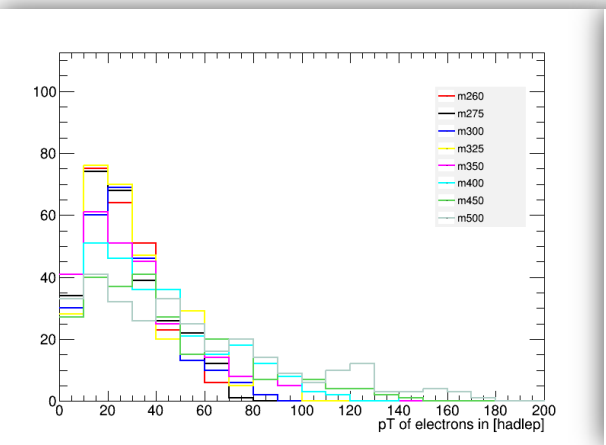
pT of leptons in leplep category

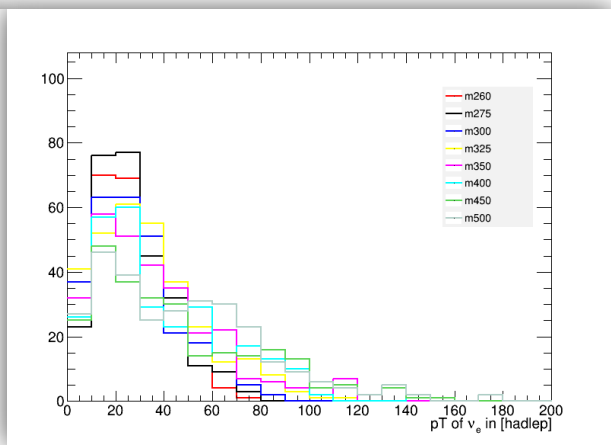


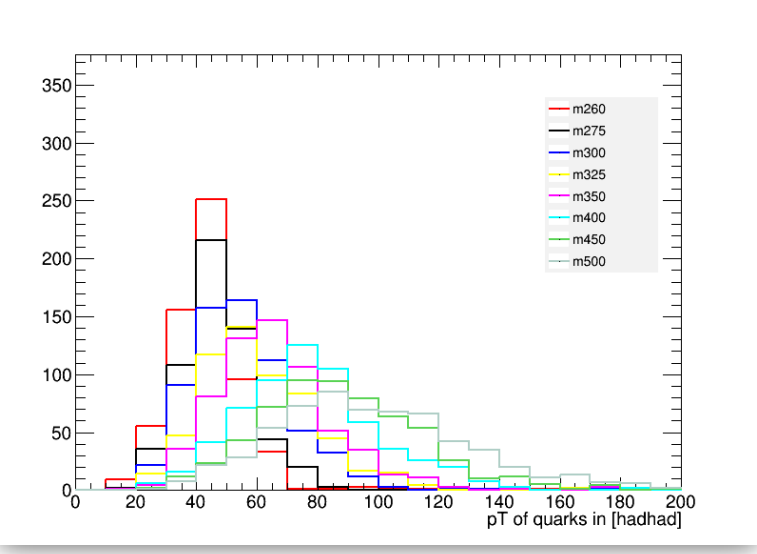




pT of quark and leptons in hadlep category







pT of quark in hadhad category