Weekly Updates

Ryuta

Jan. 16th 2020

Status

- Z(->νν)H(Z->ee, Z*->qq)

  -- Run with the same algorithm used in Z(->ee)H(Z->νν, Z*->qq)

  -- Currently obtained precision is very similar to Z(->ee)H(Z->νν, Z*->qq)

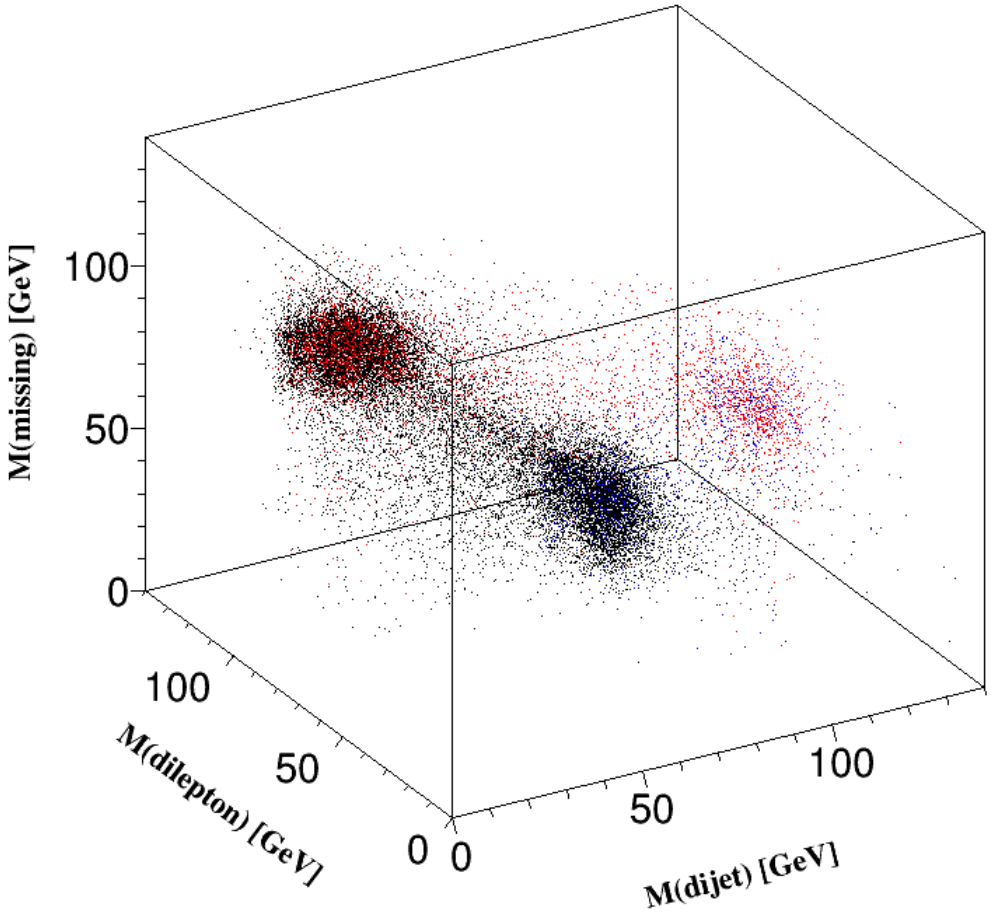
- Preparation of a slide for coming WS

- In this slide,

  -- Idea about the analysis

Phase space overwrap

ee→ZH→ZH(ZZ*)

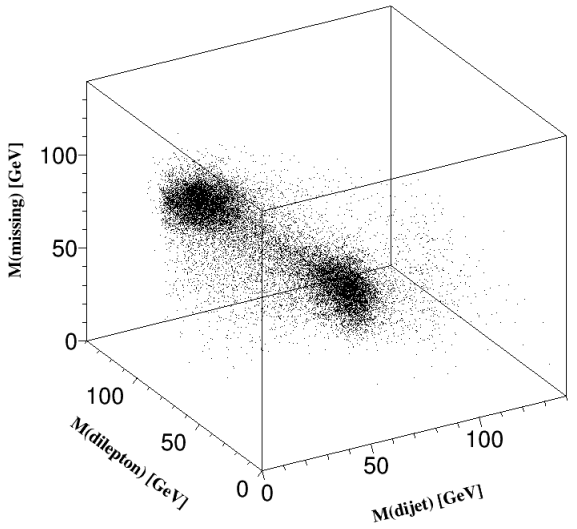


-- μμHνnqq , nnHμμqq

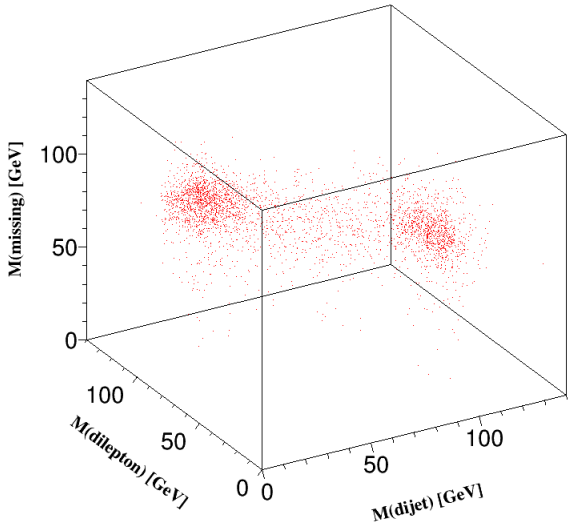
-- nnHqqμμ , qqHnnμμ

-- qqHμμnn , μμHqqnn

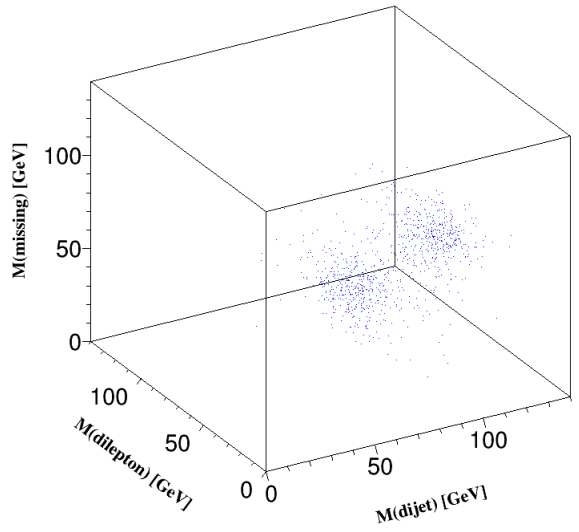
μμHZZ



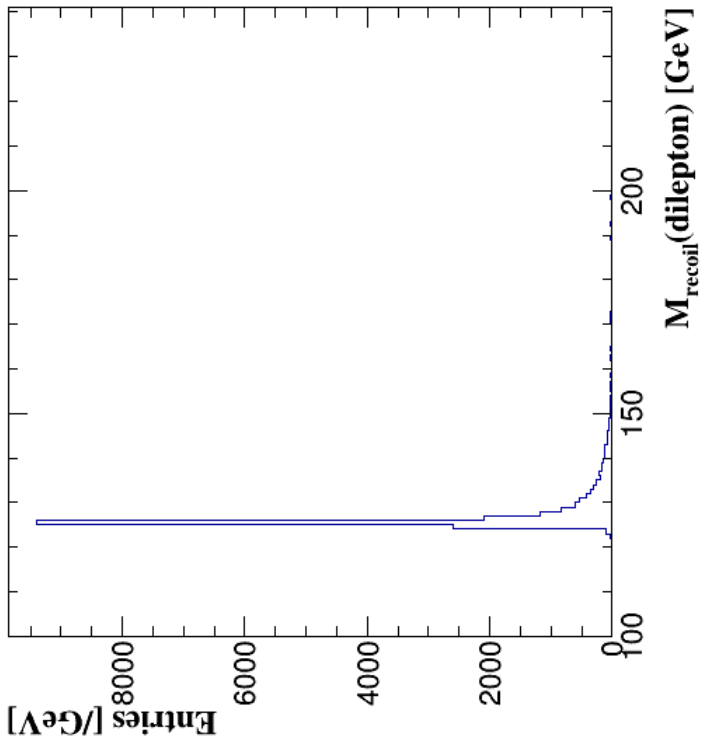
nnHZZ

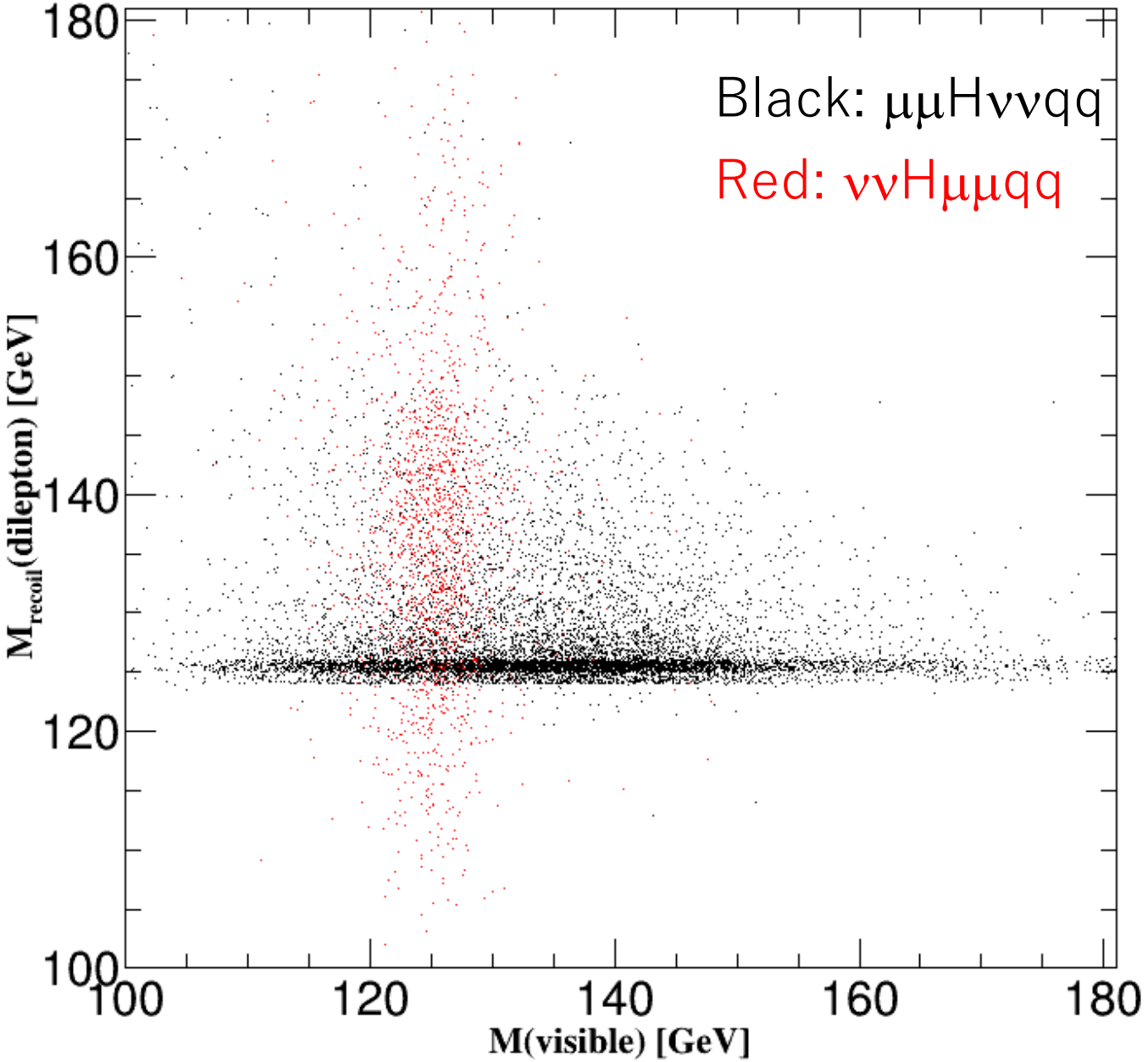


qqHZZ



Recoil M(μμ) vs Visible M(μμqq)



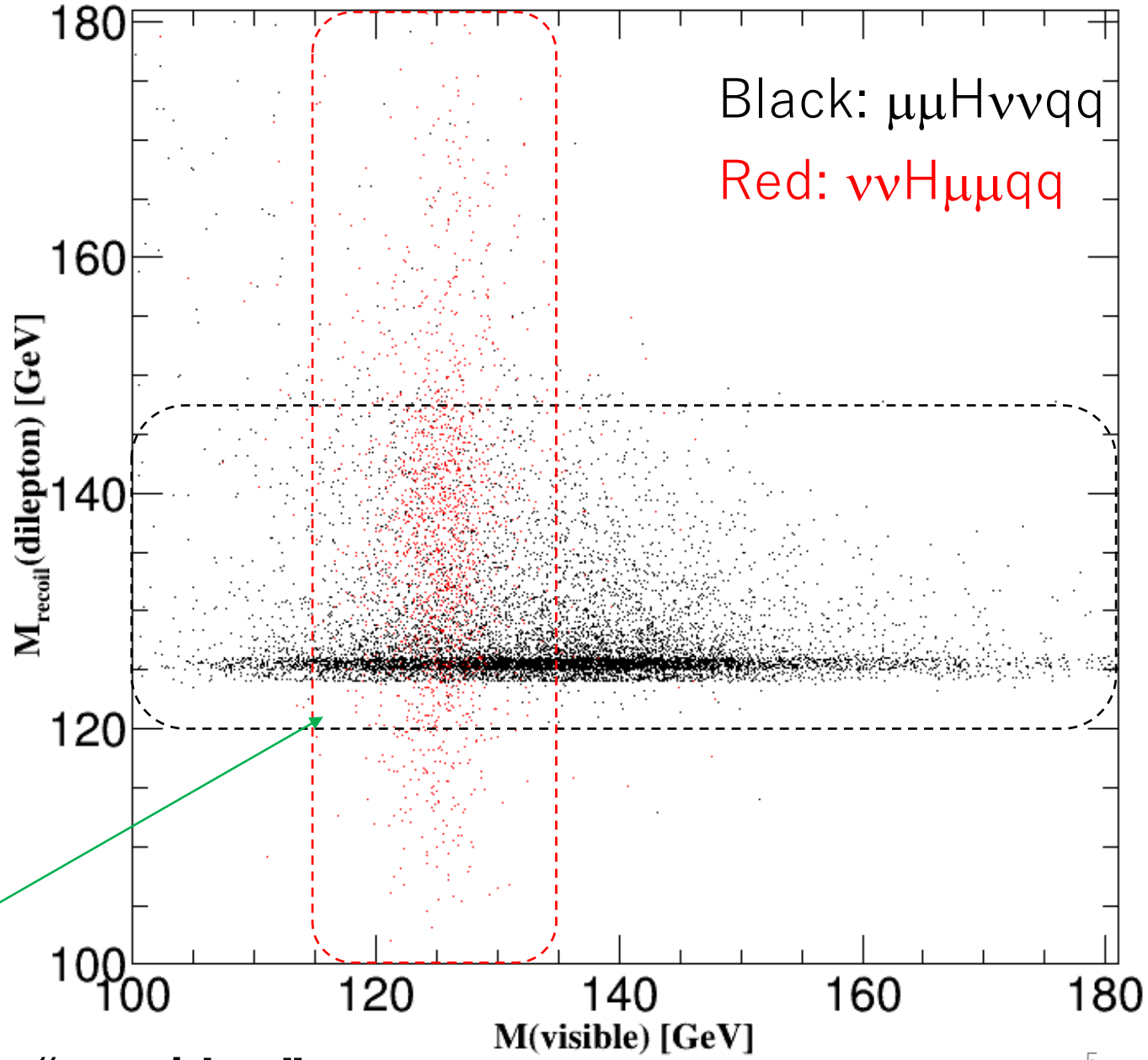


For μμHννqq :

120 GeV < M^{rec}(μμ) < 142 GeV

For ννHμμqq :

115 GeV < M(μμqq) < 135 GeV



This box region is the overwrap region

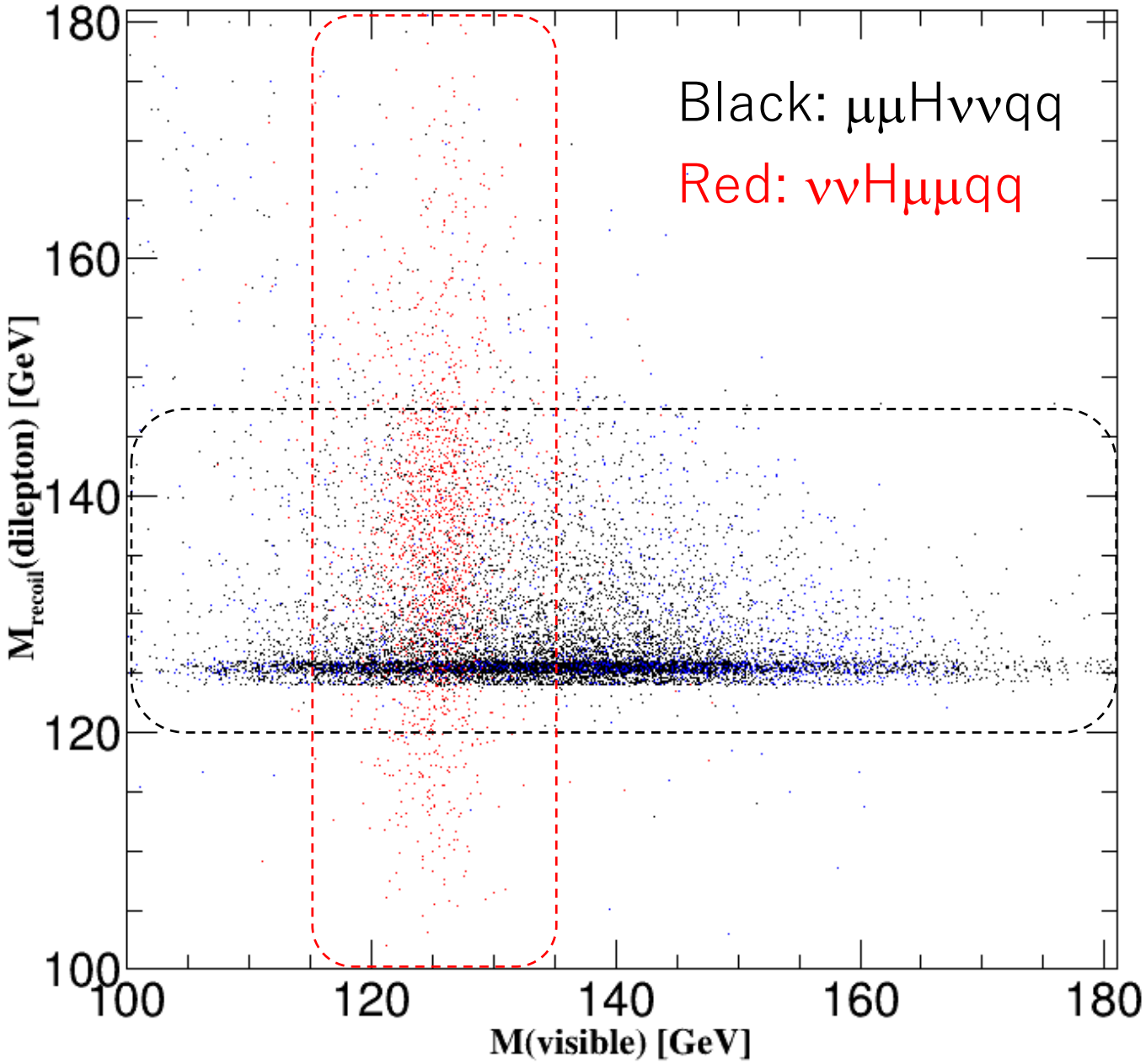
Current cut flow contains further “masking”

The blue scatter plots is “μμHWW” background, which is the main background for this two channels.

the event selection on μμHWW is loosely applied:

-- M(dimuon)>M(di-jet)
-- M(di-jet) < 50 GeV
-- M(Missing) > 70 GeV

So far, we analyze both Black and Red box separately, and there are significant overwrap events.



Case 1:

Unify both region into one.

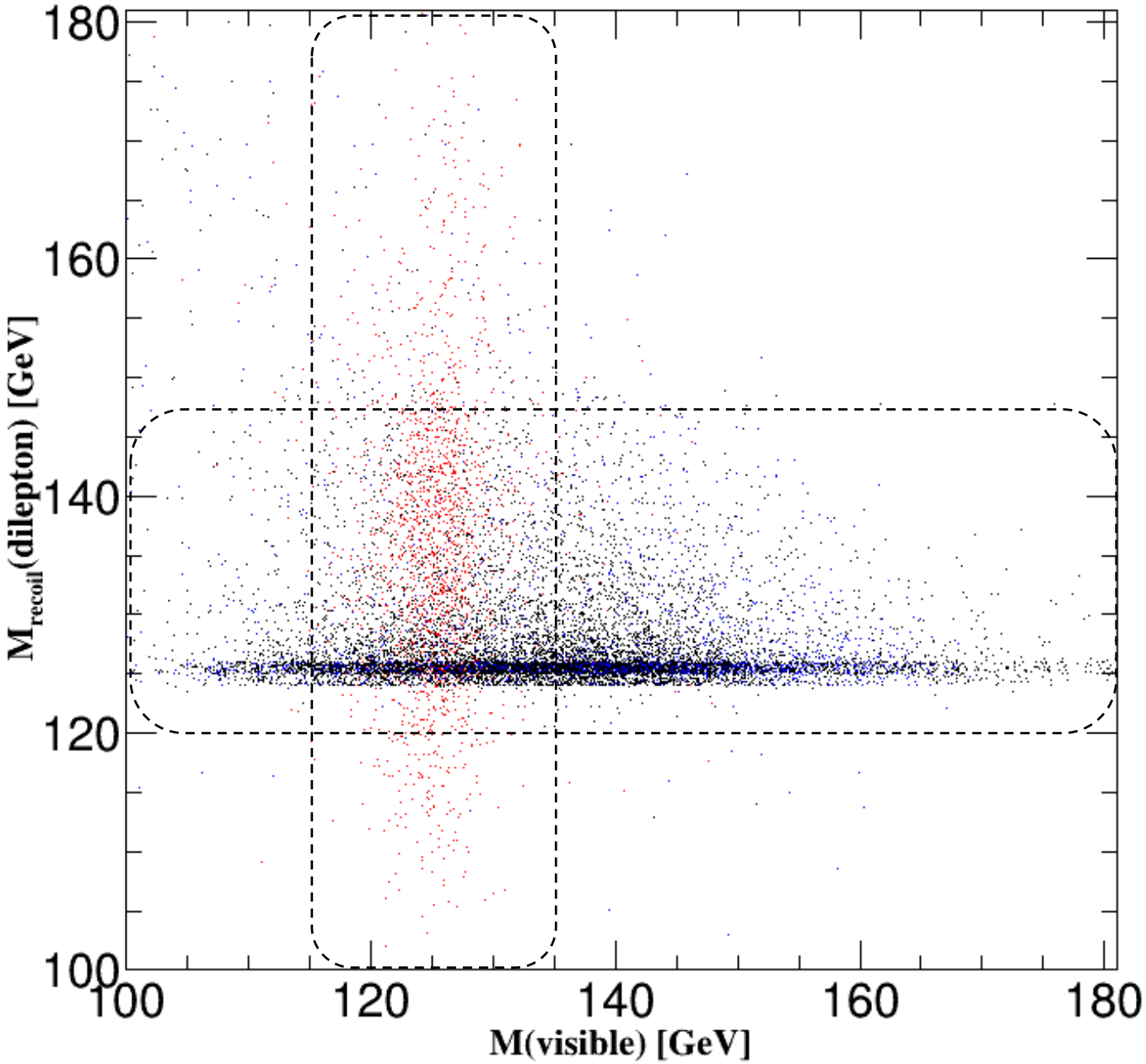
Signal : $\mu\mu H\nu\nu qq + \nu\nu H\mu\mu qq$

Bg. : $\mu\mu HWW$

Fitting parameter : $M^{rec}(\mu\mu)$?

-- $M^{rec}(\mu\mu)$ distribution will not be sharp

-- Need to apply exactly the same cuts



Case 2:

Define two regions for each analysis cut.

Signal1 : μμHννqq + ννHμμqq

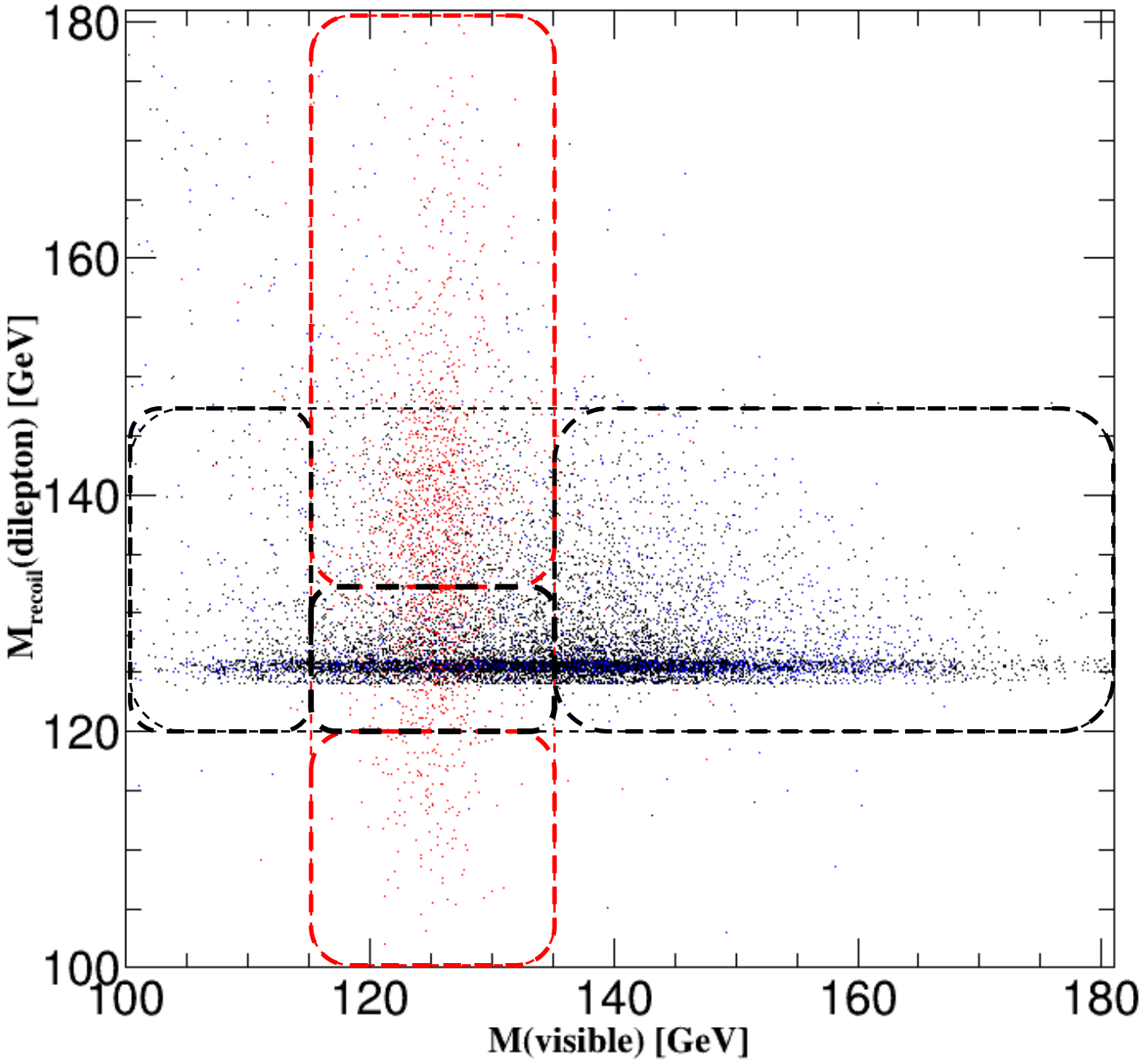
Bg.1 : μμHWW

Signal2 : ννHμμqq + μμHννqq

Bg.2 : μμHWW

-- Simultaneous fitting of 2 distributions

-- Since there are no overwrap, we can treat all of , μμHννqq + ννHμμqq , as signal .
Also part of μμHWW is reduced.



Calculation (what we have)

1. Roughly, for $\mu\mu H\nu\nu qq$, the event number is as follows.

(before, “not vvHZZ cut” is applied)

N(signal: $\mu\mu H\nu\nu qq$) : 70, N_B(HZZ: $\nu\nu H\mu\mu qq$) : 50, N_B(HWW): 10 → $\frac{\sqrt{S+B}}{S} = 16.9\%$

so as, N(signal: $\nu\nu H\mu\mu qq$) : 70, N_B(HZZ: $\mu\mu H\nu\nu qq$) : 50, N_B(HWW): 10 → $\frac{\sqrt{S+B}}{S} = 16.9\%$

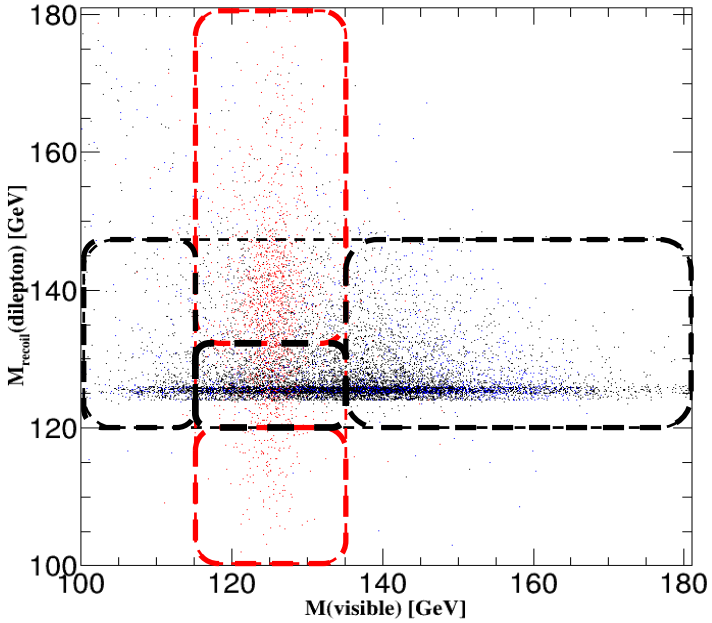
→ Combined precision is calculated as 11.95%

Calculation (from Case2)

2. From here, the number should be checked.

Black region: N(signal: μμHννqq) : 60, N_B(HZZ: ννHμμqq) : 25, N_B(HWW): 10

Red region: N(signal: ννHμμqq) : 50, N_B(HZZ: μμHννqq) : 30, N_B(HWW): 10?



By simultaneous fitting, we can treat both N(signal) & N_B(HZZ) as signal if there is no overwrap, and only HWW is the background

→ N_S=60+25+50+30 = 165, N_B = 20 ? $\frac{\sqrt{S+B}}{S} = 8.2\%$

I'm not sure the fitting could results in this way. This is ideal case

Comments

・ If these assumptions are fine, it is wroth to try, how to divide two regions, etc.

・ Numbers assumed in previous page is based on my assumption (from my eye on distributions) , therefore, it might be not the case, even the consideration steps are fine.

To do List

・Analysis related
  -- Comments from Manqi (something general and is good one)

items I can think:
  -- simultaneous fitting
  -- kind of cut unification within 5(6) channels, which is connected to the draft and/or better understanding of bg.
  -- (further electron channels)

・CEPC note
・Draft