240 GeV Missing Mass Distribution

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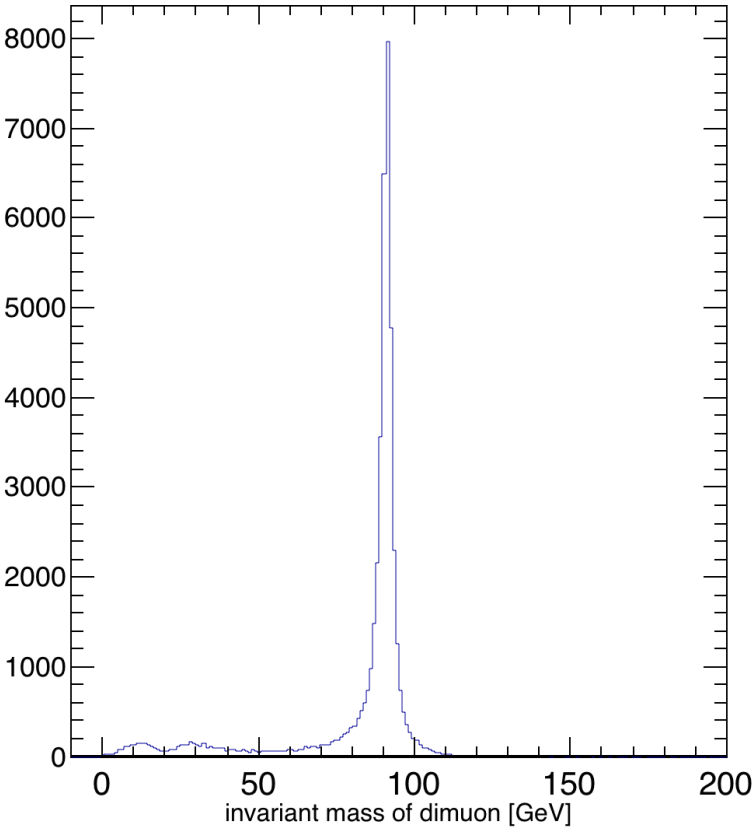
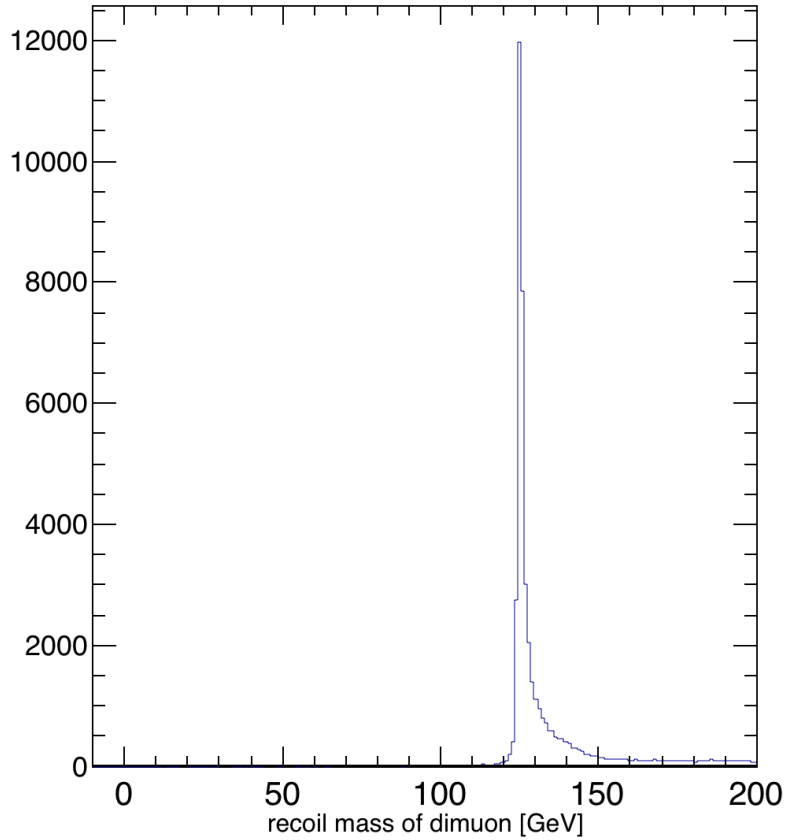
Introduction

At CEPC, wifh $\sqrt{s} = 240$GeV, since we have more than 99% percent accuracy to identity muon, we can use an independent way to measure Higgs properties——recoil mass method.
For our analysis, we select the following channel to view the distribution of Higgs mass and missing mass.
For example, $e^+e^- \rightarrow ZH \rightarrow \mu\mu Higgs$, the Higgs can decay to some invisible particles, the missing mass point to the invariant mass of these invisible particles.

- $e^+e^- \rightarrow ZH \rightarrow \mu\mu Higgs \rightarrow \mu\mu ZZ^*$
  /cefs/data/stdhep/CEPC240/higgs/exclusive/E240.Pe2e2h_zz.e0.p0.whiz
- $e^+e^- \rightarrow ZZ \rightarrow \mu\_up$
  */cefs/data/stdhep/CEPC240/4fermions/E240.Pzz_sl.e0.p0.whizard*195
- $e^+e^- \rightarrow ZZ \rightarrow \mu\_down$
- $e^+e^- \rightarrow ZH \rightarrow \mu\mu Higgs$, Higgs decay inclusive

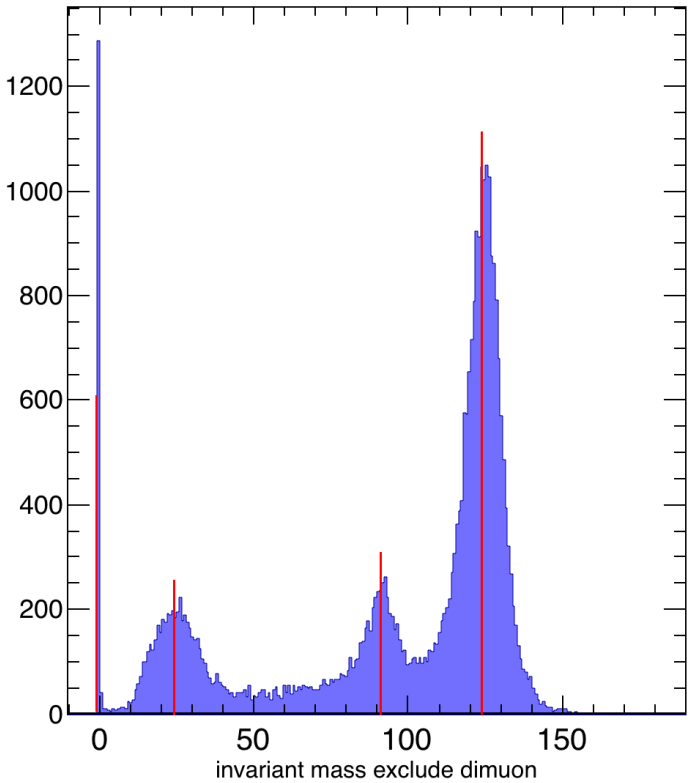
$e^+e^- \to ZH \to \mu\mu Higgs \to \mu\mu ZZ^*$

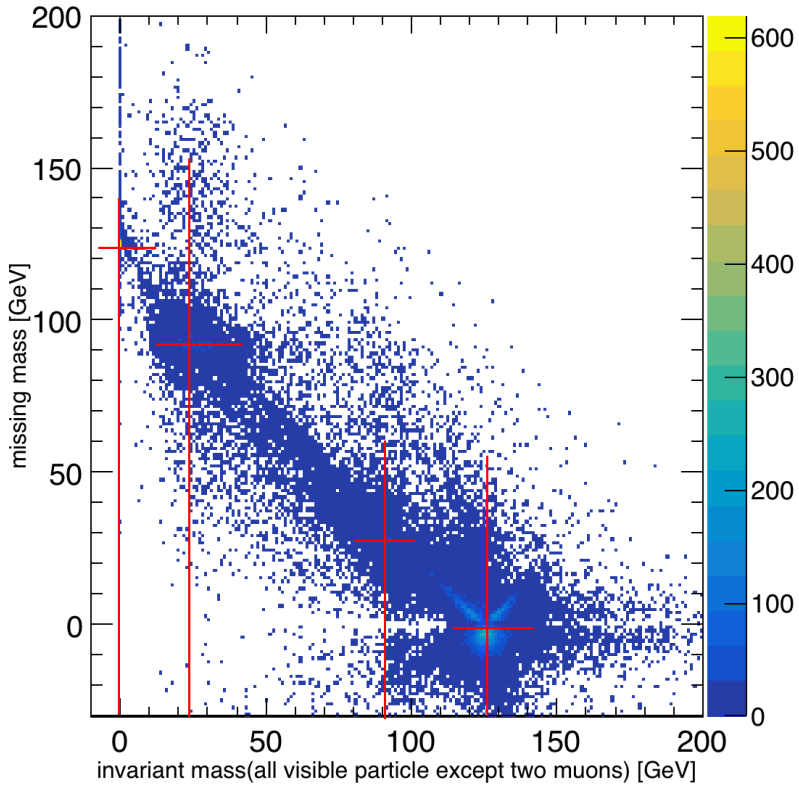




- For channel $e^+e^- \to ZH \to \mu\mu$, the left graph shows the invariant mass distribution of these two muons, the peak local at 91GeV.
- The right graph shows the recoil mass distribution of these two muons, the peak local at around 125GeV, I did't scale it.
- From these two graphs, we can say our sample has no problem.

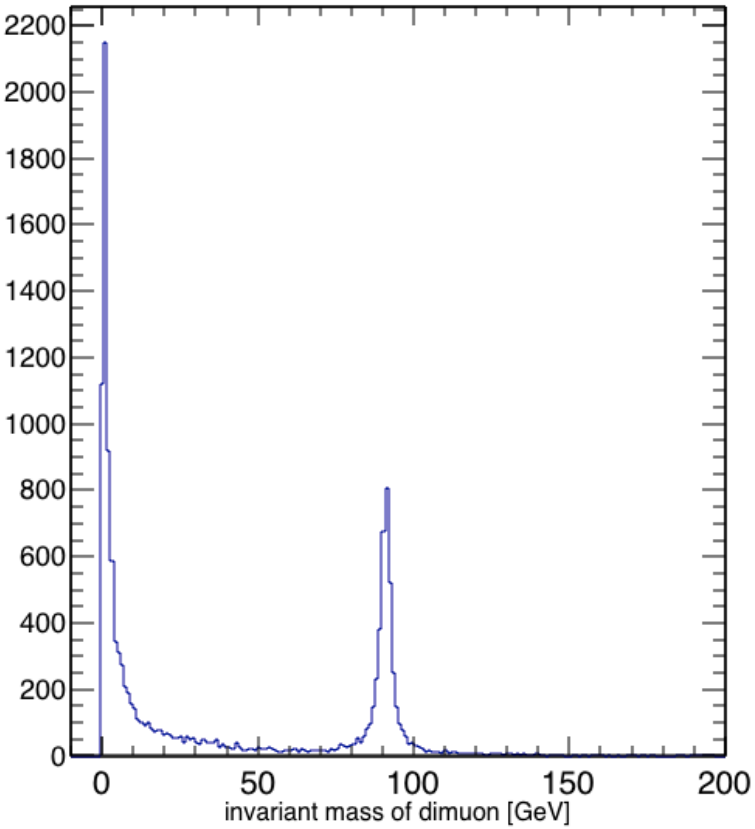
$e^+e^- \to ZH \to \mu\mu Higgs \to \mu\mu ZZ^*$

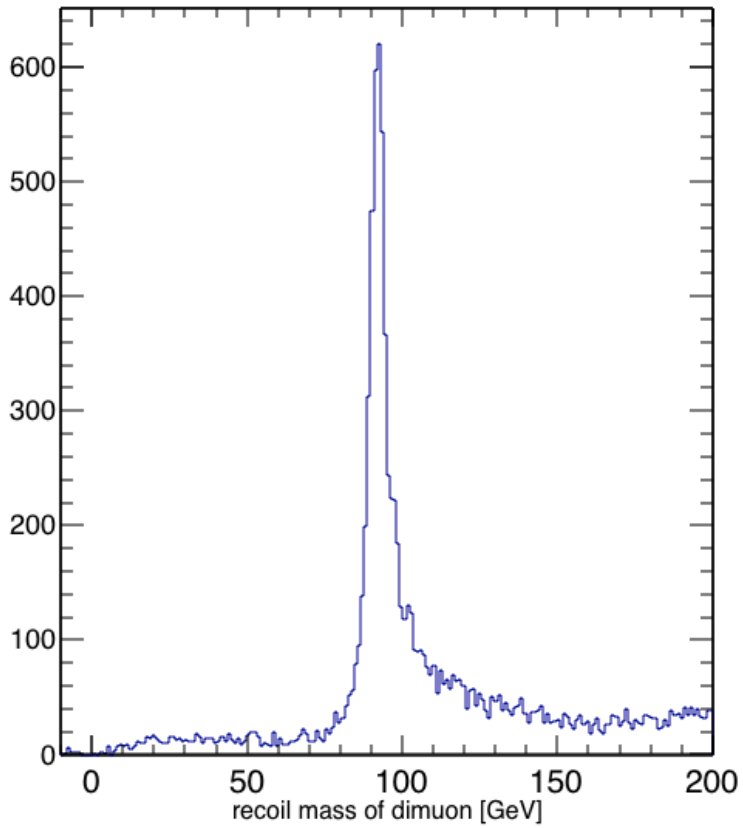




- The left graph is the invariant mass distribution of all ArborPFO exclude two muons, correspond to the mass of Higgs. Since this Higgs decay to ZZ^*, limited by the Higgs mass, one of the Z boson is on shell and the other off shell.We can see four peaks at this distribution, the peak at zero corresponding to the total invisible decay mode, the peak at the Higgs boson mass is corresponding to the total visible mode, the other two peaks are corresponding to the conjugation case where $Z \to visible$, $Z^* \to invisible$ and $Z \to invisible, Z^* \to invisible$.
- The right graph is the relationship between *Higgs* mass and missing mass, we can see four highlight region corresponding to four peaks of left graph

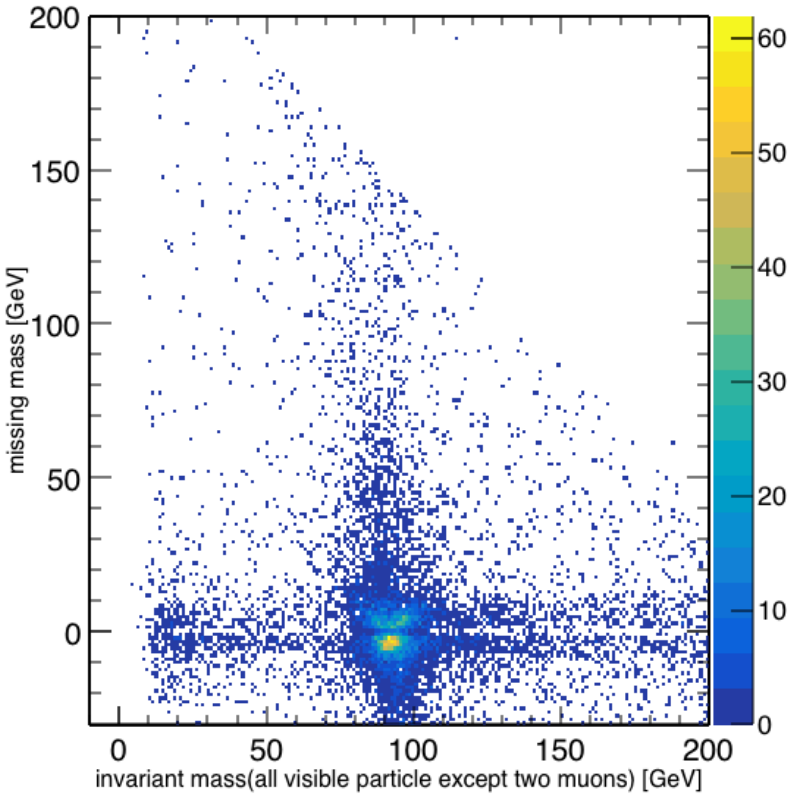
$e^+e^- \to ZZ \to \mu up$

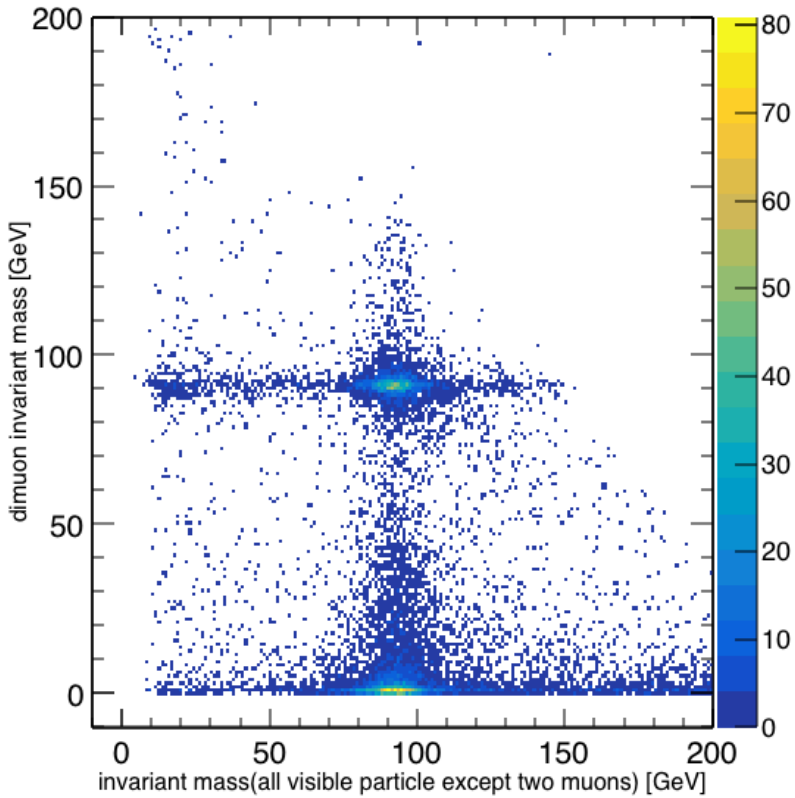




- For $e^+e^- \to ZZ \to \mu up$, one Z decay to two muons, and the other Z decay to two up quarks, left graph is the distribution of two muons invariant mass. We can see there are two peaks 0 GeV and 91GeV, 0 GeV corresponding to two muons came from a gamma.
- The right graph is the recoil mass distribution of these two muons.

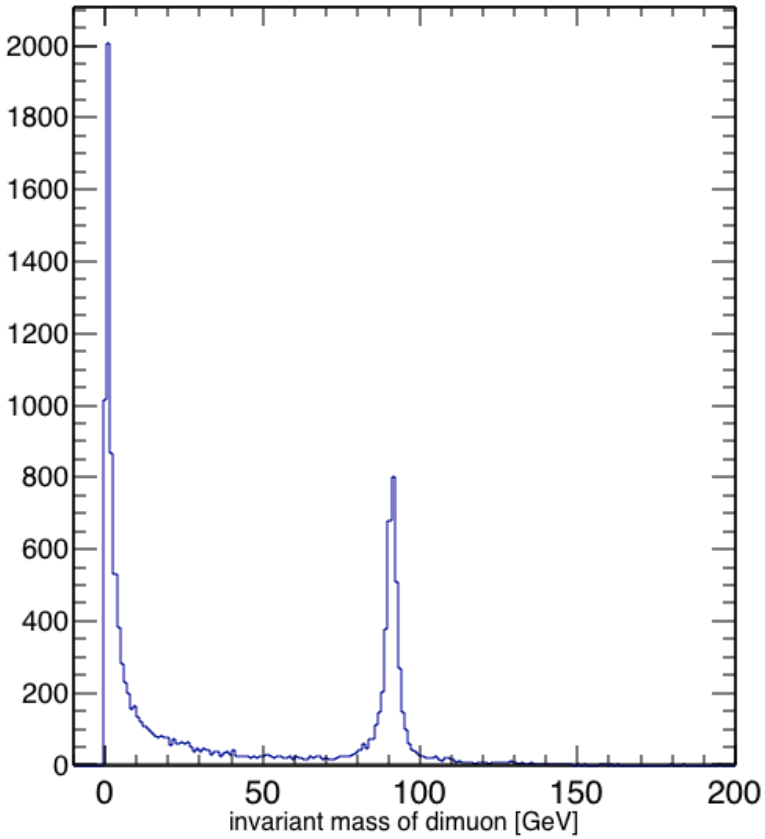
$e^+e^- \to ZZ \to \mu up$

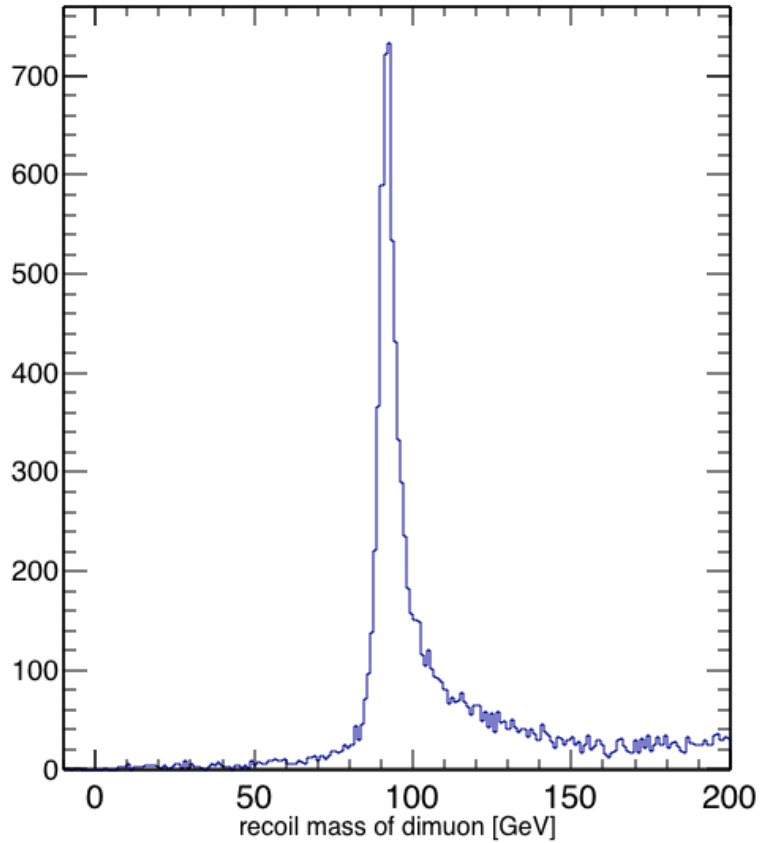




- The left graph is the relationship between missing mass and Z mass.
- The right graph is the invariant mass relationship between one Z(decay to two muons) and the other Z(decay to two up quarks), we can see there are two highlight region, corresponding to the left graph of last slide.

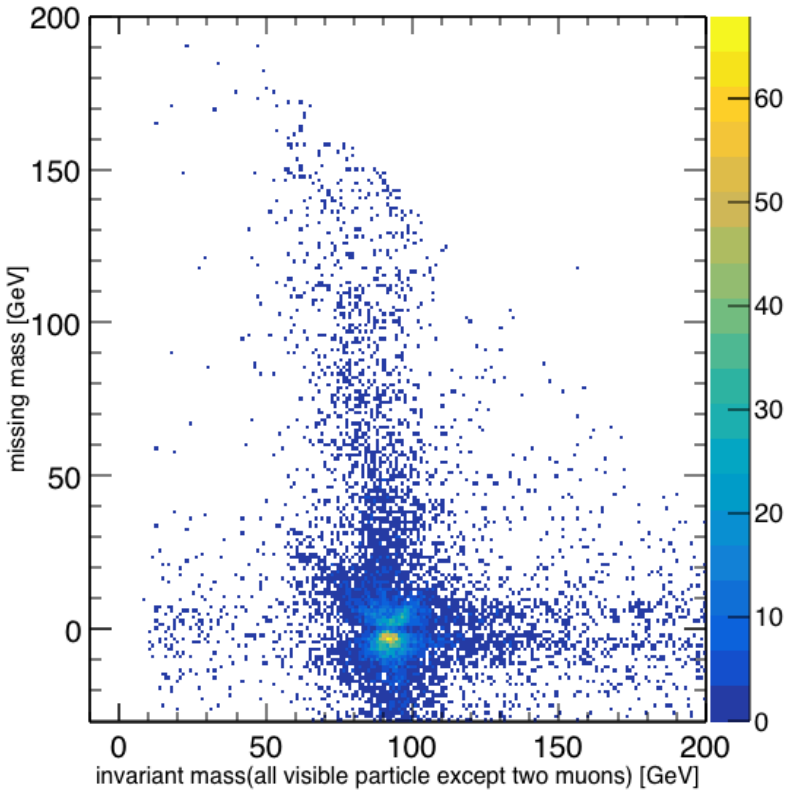
$e^+e^- \to ZZ \to \mu down$

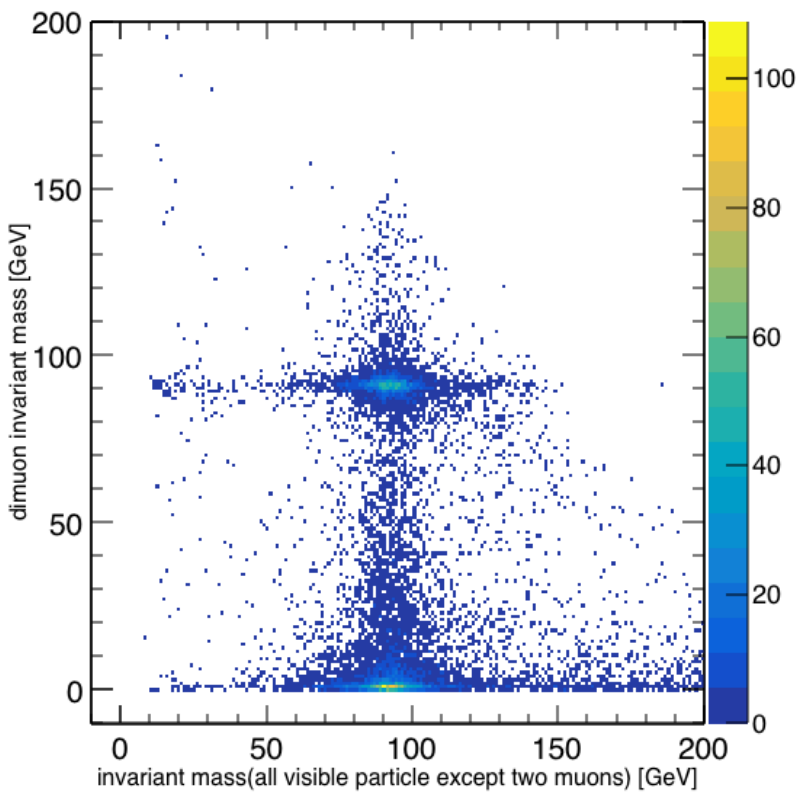




- For $e^+e^- \to ZZ \to \mu down$, one Z decay to two muons, and the other Z decay to two down quarks, left graph is the distribution of two muons invariant mass.
- The right graph is the recoil mass distribution of these two muons.

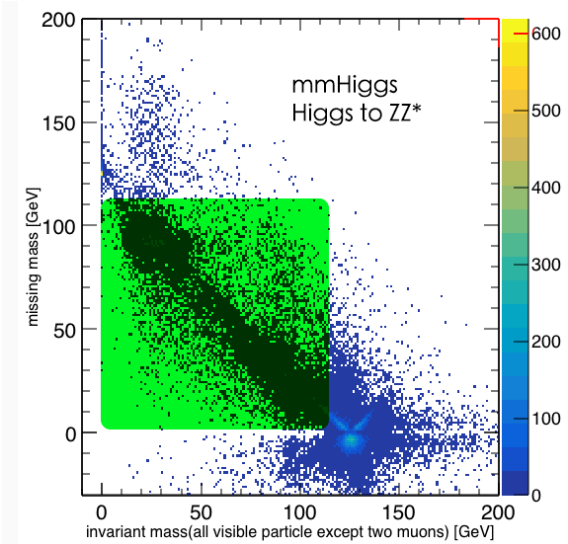
$e^+e^- \to ZZ \to \mu down$

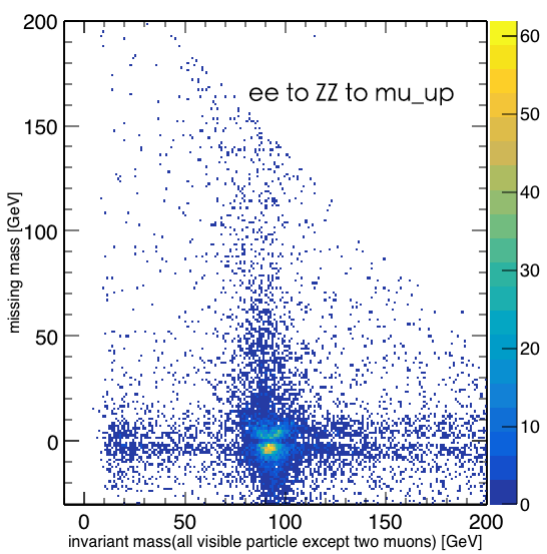


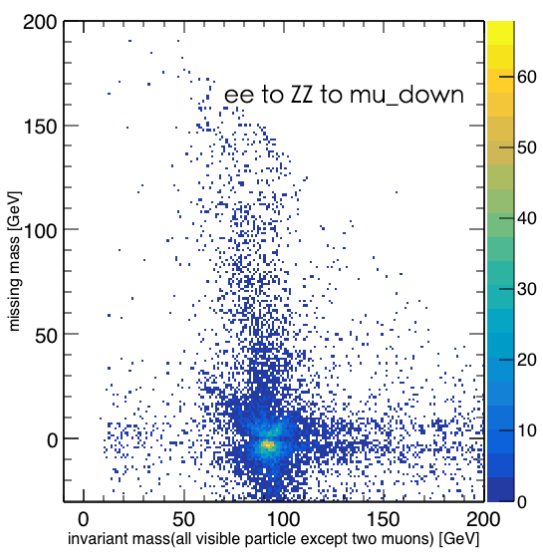


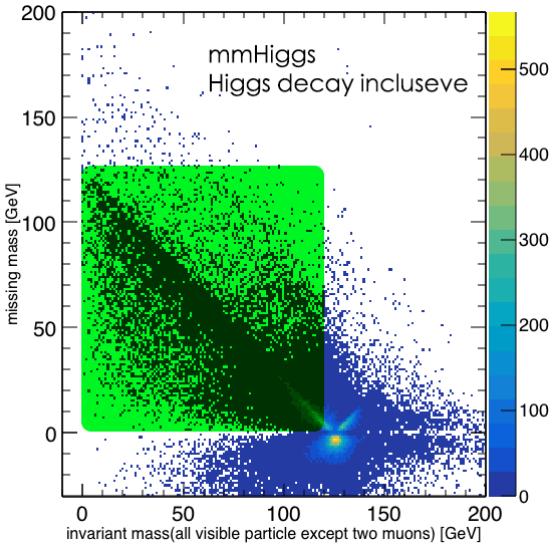
- The left graph is the relationship between missing mass and Z mass.
- The right graph is the invariant mass relationship between one Z(decay to two muons) and the other Z(decay to two down quarks), we can see there are two highlight region, corresponding to the left graph of last slide.

conclusion









- Based on our analysis, we can separate $\mu\mu Higgs$ from $ZZ \rightarrow \mu\_up(\mu\_down)$.