



HIGGS SELF-COUPPLING ANALYSIS WITH $H \rightarrow WW^*$

Masakazu Kurata

06/06/2014

1

STATUS

- Start to apply particle ID

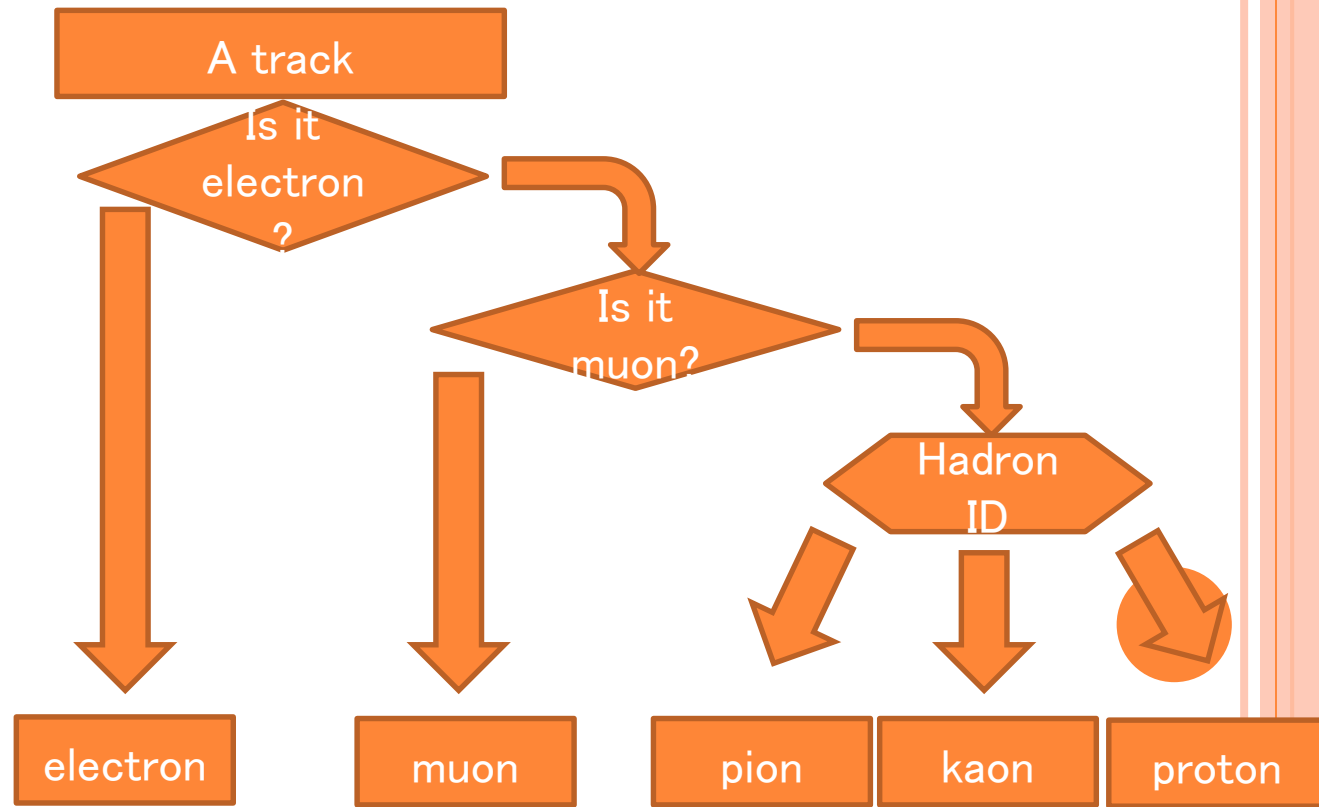
- First, doing track energy correction

- studying the secondary vertex

- Using MC matching & Particle ID
- Invariant mass distribution – 2 prong vertex case

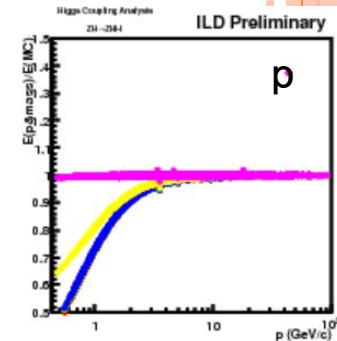
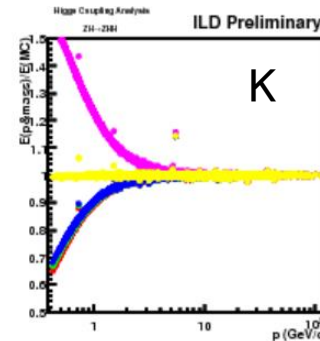
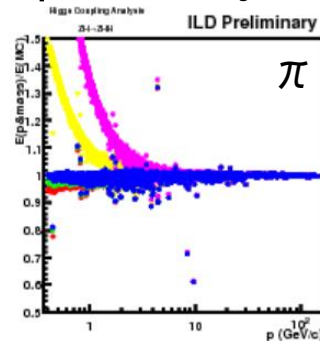
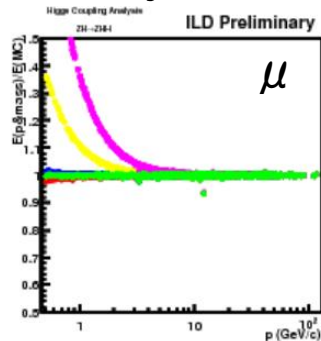
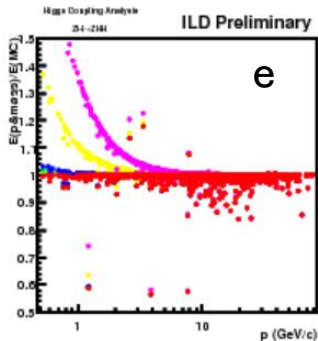
- Preliminary strategy

- Electrons and muons can be identified easily → check first
- Is it good?



ENERGY DIFFERENCE FROM TRUTH

- Momentum dependence of $E(p\&mass)/E(Truth)$
 - Masses are introduced from PDG
 - From the energy correction view point:
 - Electron: smeared due to radiation → should be identified independently
 - Proton misID affects energy measurement largely
 - Muon & pion: misID doesn't affect energy measurement as expected → from other view points (e.g. b-tagging), to distinguish these two will be important
- should identify muon independently



Electron

Muon

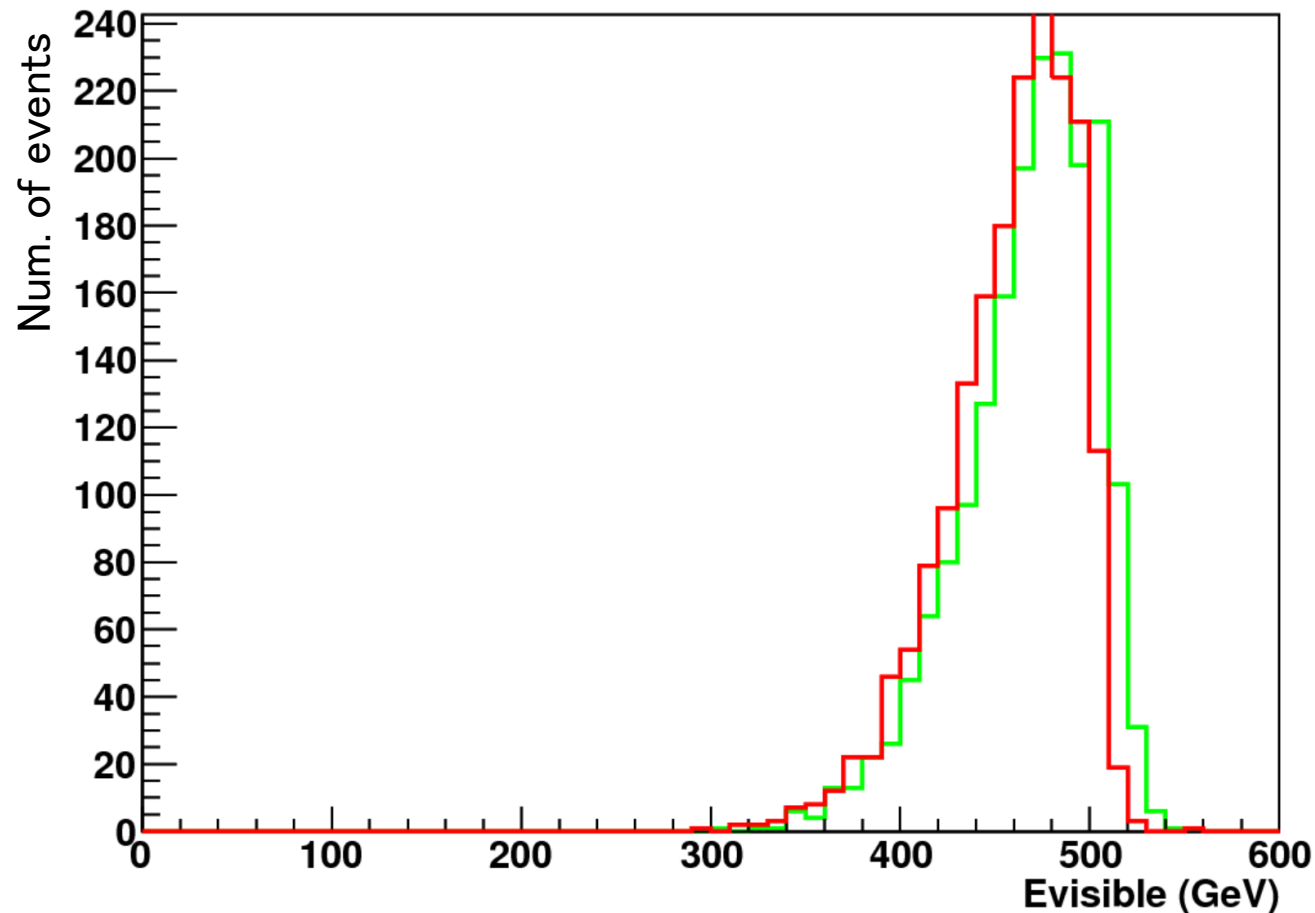
Pion

Kaon

Proton

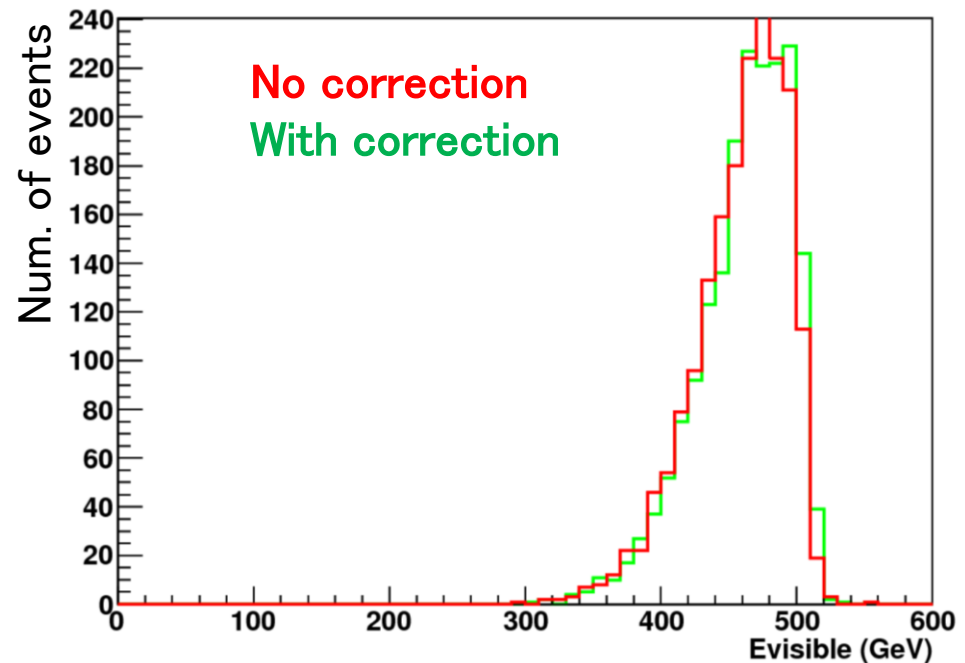
TRACK ENERGY CORRECTION

- Check by visible energy
- Using $qqHH \rightarrow qq(bb)(bb)$ – no hard neutrino in the process
- Looks overestimated...
 - Due to misidentified Kaons and protons?



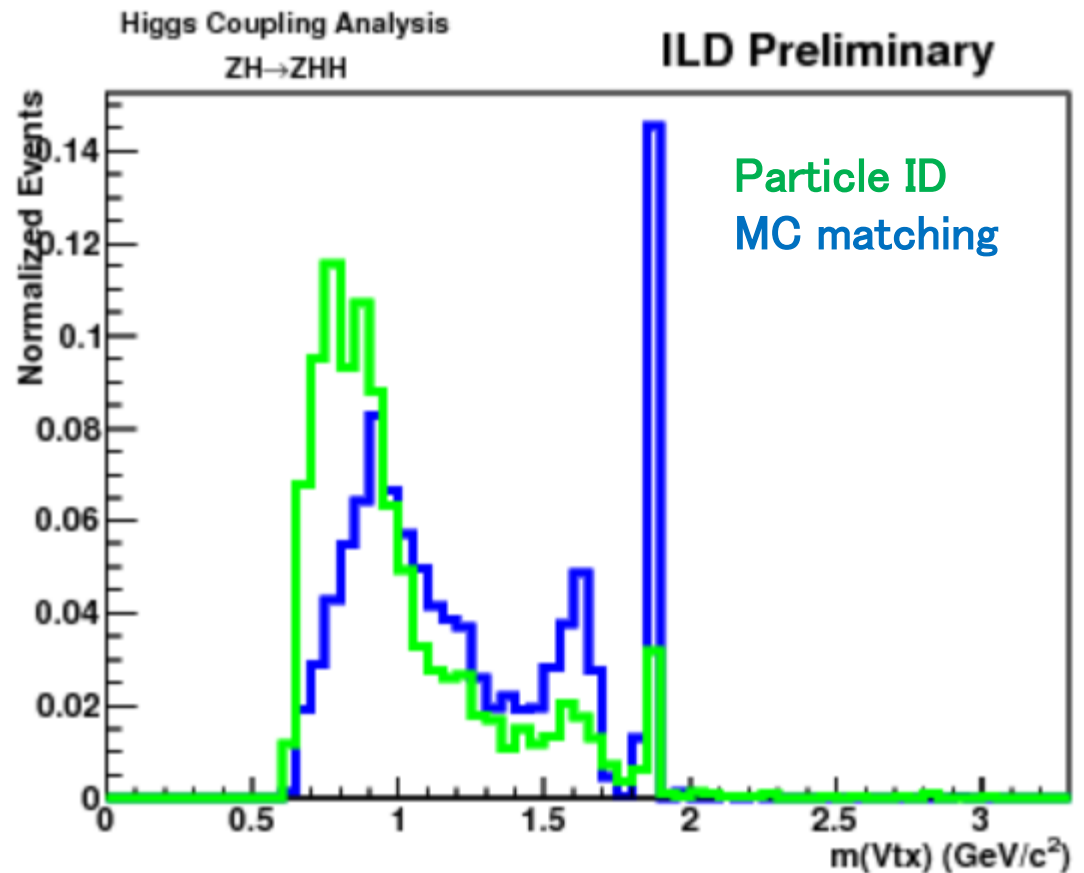
REJECTED TRACKS

- Some tracks don't have a qualification to be identified as certain particle because of their small posterior probability
- It should be necessary to “reject” those tracks, especially Kaon and proton, because of overestimation of their energy correction
→set some threshold on the probability
- So far, all the rejected tracks are assigned as pions, because energy correction is small and there seem many pions in the event
- After introducing “reject” – better, but very small correction effect...



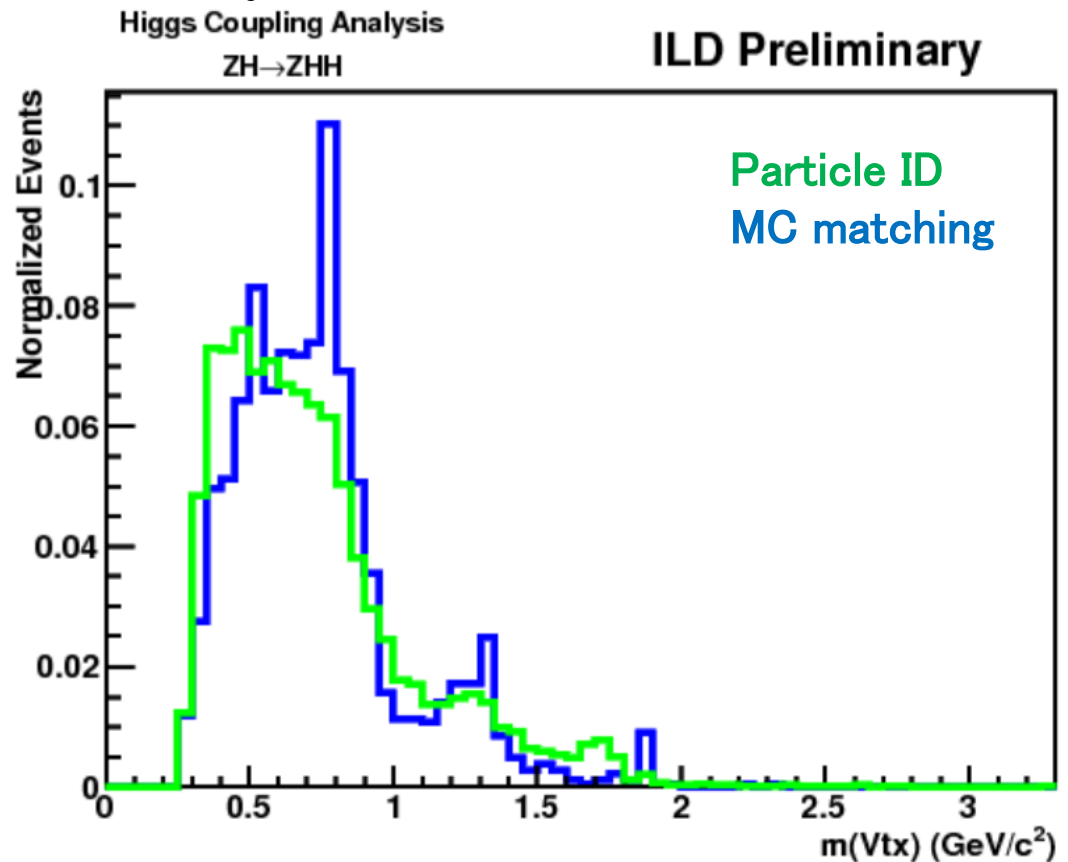
MASS OF 2-PRONG VERTEX

- Invariant mass of the tracks
 - Vertex is from LCFIPlus
 - $K^+ \pi^-$ candidates in b -jet($b_{\text{tag}} > 0.9$) – total charge is zero
 - Comparing Particle ID result to MC matching result
 - MC matching is very low efficiency



MASS OF 2-PRONG VERTEX

- Invariant mass of the tracks
- Vertex is from LCFIPlus
 - $\pi + \pi$ candidates in b-jet($b_{tag} > 0.9$) – total charge is zero
 - Comparing Particle ID result to MC matching result
 - MC matching is very low efficiency



TO DO

- Optimize the particle ID algorithm more
 - Reject threshold is necessary so far
 - Good estimator for energy correction is necessary

- Secondary vertex study
 - Checking other prongs case
 - K+something looks important
 - How to study the vertex – need help