



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

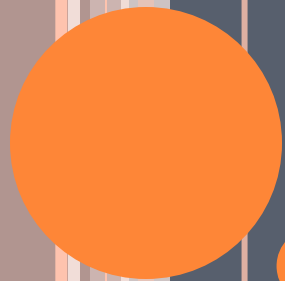
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STATUS

- Lepton ID study
 - Single lepton is OK
 - Optimize likelihood
 - Problem: $Z \rightarrow ll$ finding
 - Change the p.d.f.s to save second lepton more
 - Loosen the operation point for second lepton finding
→ of course, single lepton sample & dilepton sample are exclusive each other
 - Start to apply the lepton ID to the analysis
- Particle ID is stuck...
 - Establishing the strategy and optimization will be started next week...



LEPTON ID

LEPTON ID FOR SINGLE LEPTON

- Signal detection efficiency – set almost same sensitivity
 - Signal is $HH \rightarrow (bb)(WW^*) \rightarrow (bb)(lvjj)$
 - Old means without shower profile & dE/dx

method	Cut based	Likelihood_old	Likelihood_new
Signal(%)	98.1	98.1	97.8

- Background rejection efficiency

method	Cut based	Likelihood_old	Likelihood_new
ttbar – lep+jets(%)	62.2	-	62.4
ttbar – allhad(%)	7.9	3.1	2.3
ttbar – dilepton(%)	47.2	-	17.9
$HH \rightarrow (bb)(bb)$ (%)	-	2.3	1.0

- Note: lepton energy threshold is loosened on likelihood_new
 - From $E(\text{lep}) > 15\text{GeV}$ → $E(\text{lep}) > 10\text{GeV}$

LEPTON ID FOR $Z \rightarrow LL$ DECAY

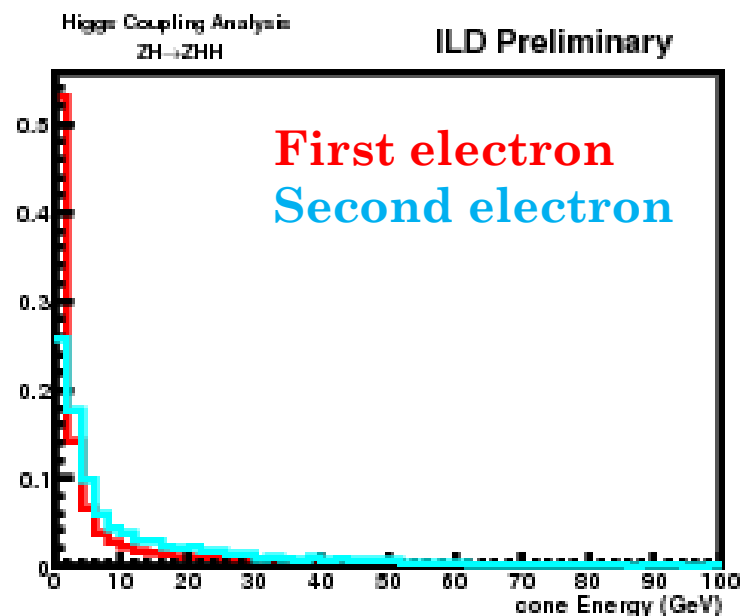
- Problem: e^+e^- finding is so bad...
 - Second lepton finding is difficult
 - As num. of tracks is large in the event, lepton might be buried in the tracks...
 - Change cone energy p.d.f. for second lepton
 - Loosen the operation point for second lepton
- $Z \rightarrow ll$ finding – preliminary result

- Signal efficiency

signal	$Z \rightarrow ee, \mu\mu$
$HH \rightarrow (bb)(WW^*)(\%)$	90.1
$HH \rightarrow (bb)(bb)(\%)$	89.6

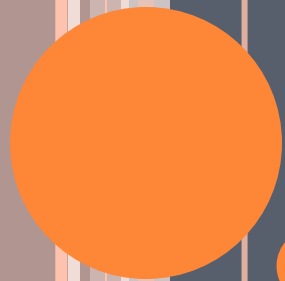
- Background rejection efficiency –use $t\bar{t}$ samples

method	Lep+jets	allhad	dilepton
Cut base(%)	0.79	0.071	17.3
Likelihood_new(%)	0.60	0.050	20.5



TODO

- Apply lepton ID (& jet pairing) to Self-coupling analysis
 - Lep+jets & dilepton+jets first
- Particle ID
 - Optimize and strategy for good particle ID
- Integrating Ecal/Hcal - good estimation in Hcal
 - Very difficult!!
 - Fit function gives up fitting...



PARTICLE ID - BACKUPS

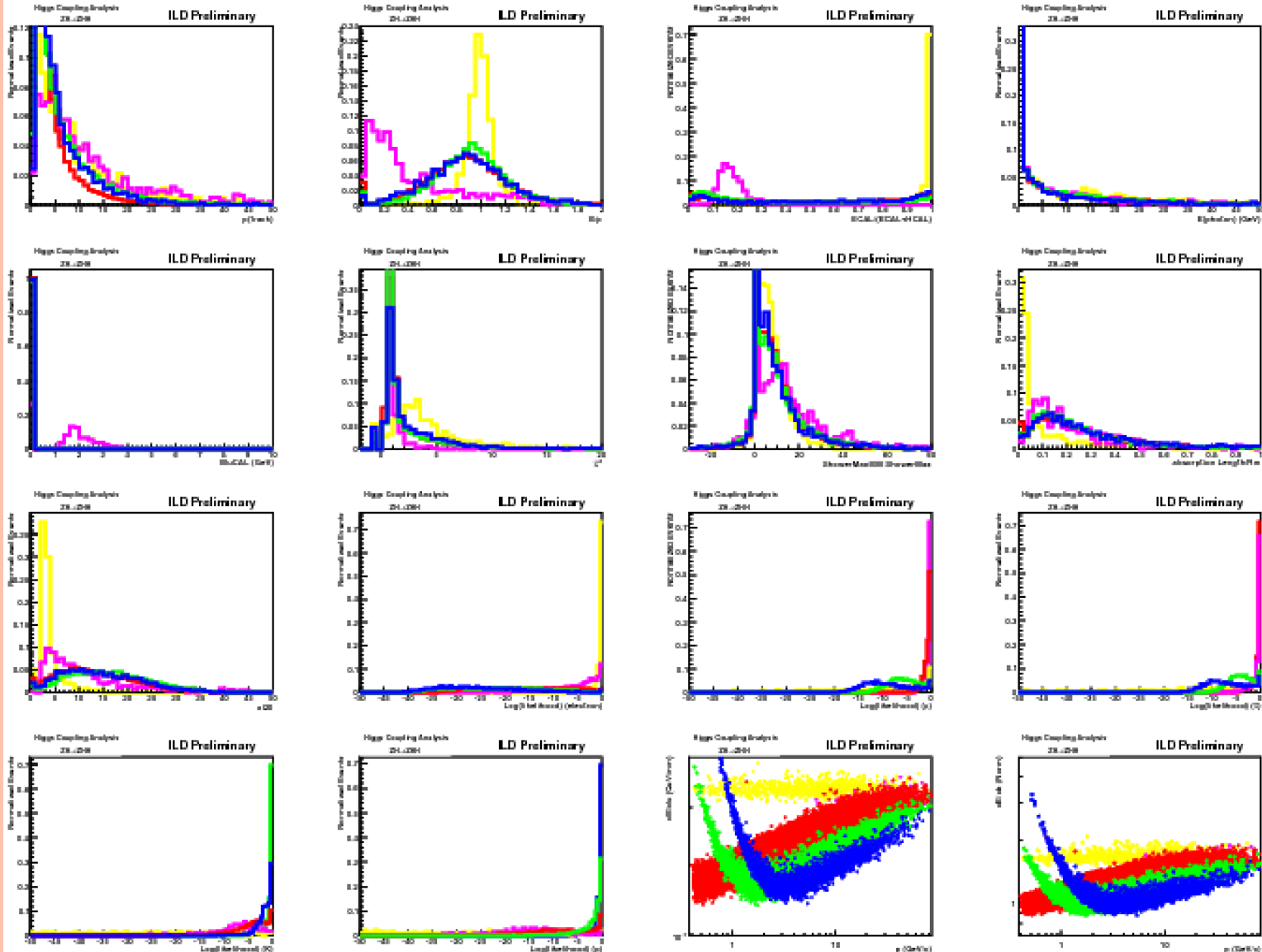
PARTICLE ID STRATEGY

- Based on the likelihood
 - Tracks will be assigned to the particle class with maximum likelihood
- Electron and muon will be identified easily
 - Electron or not
 - Muon or not
 - Hadrons can be classified after electron and muon selection

VARIABLES CHECKED FOR PARTICLE ID

- Almost same as lepton ID, w/o cone energy, $|d_0|$, $|z_0|$

Electron
 Muon
 Pion
 Kaon
 Proton

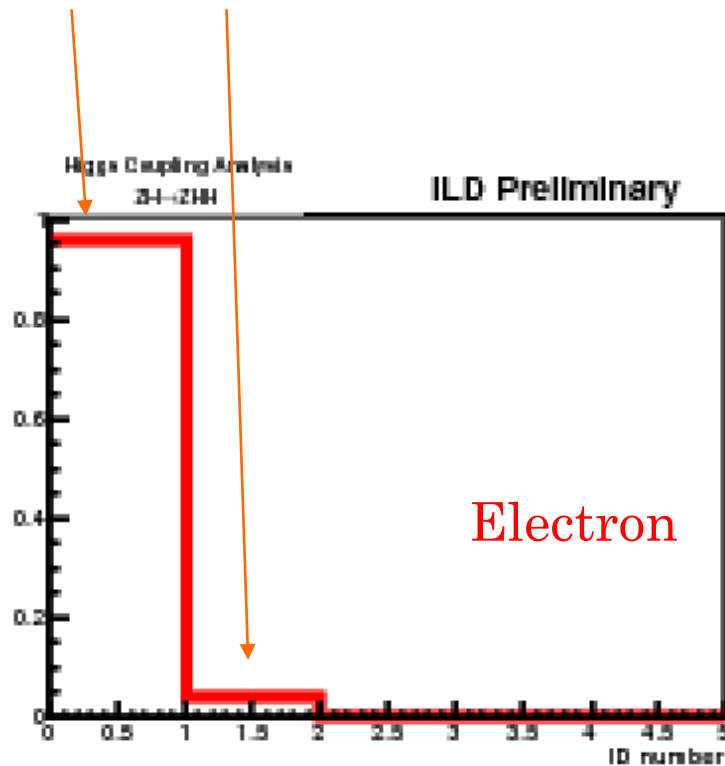


LIKELIHOOD RESULT FOR EACH PARTICLE TYPE

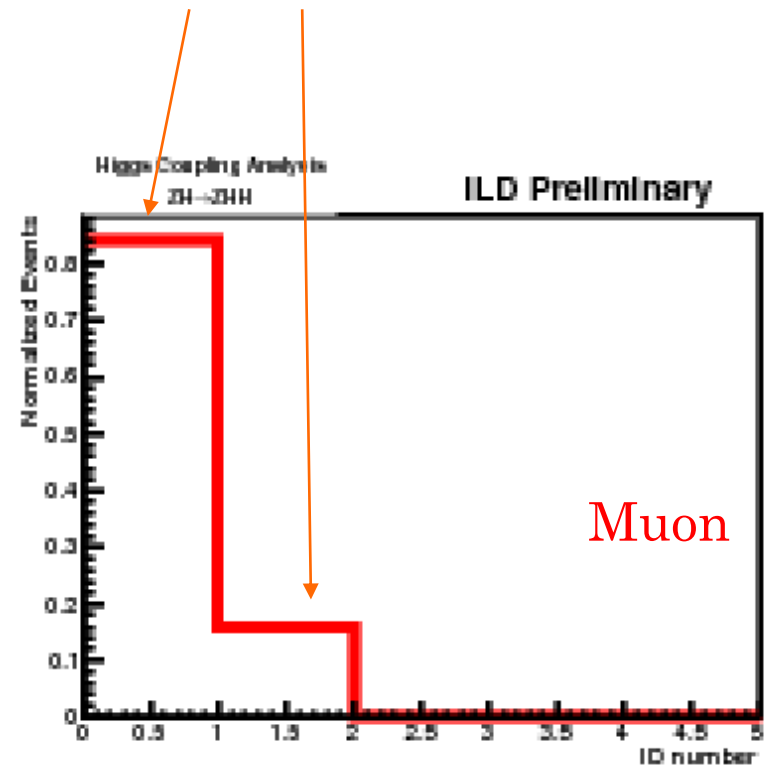
○ Electron & muon

- Check the particle electron or not
- Check the particle muon or not

electron no



muon no



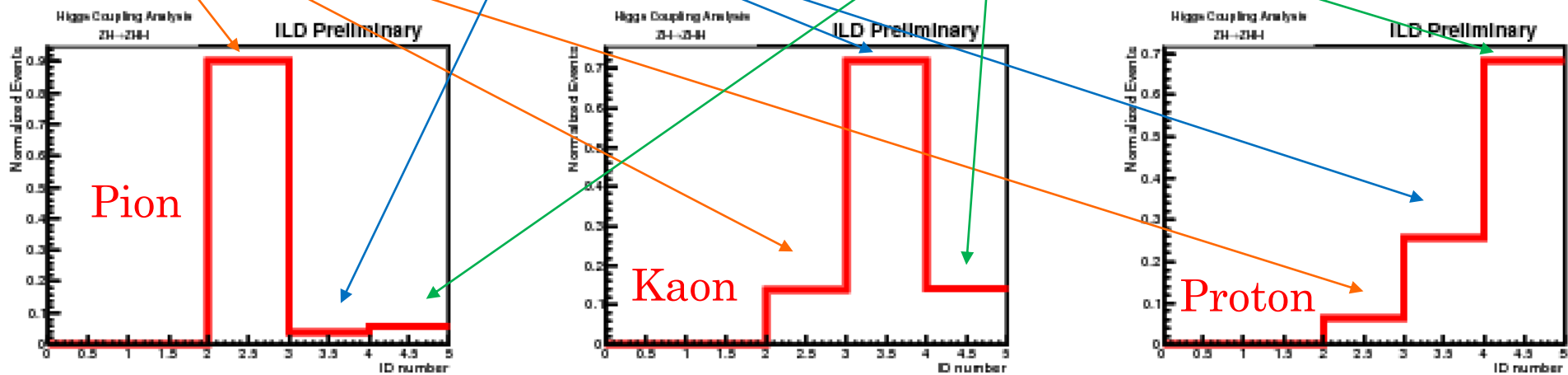
LIKELIHOOD RESULT FOR EACH PARTICLE TYPE

- hadrons
 - Identify each particle type

Pion

Kaon

Proton



TODO

- Solve the efficiency problem
- Apply lepton ID (& jet pairing) to Self-coupling analysis
 - Lep+jets & dilepton+jets first
- Particle ID
 - Optimize and strategy for good particle ID
- Integrating Ecal/Hcal - good estimation in Hcal
 - Very difficult!!
 - Fit function gives up fitting...