

RECONSTRUCTION OF TAU EVENTS

CEPC Physics Software Meeting

Plan

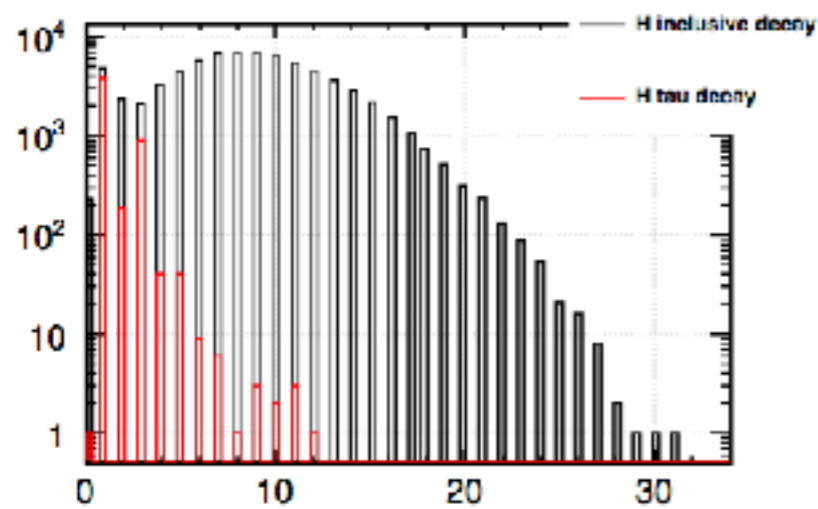
- ❖ Di-Tau recognition
- ❖ Tau Finder

Di-Tau Finder ($\mu\mu H$)

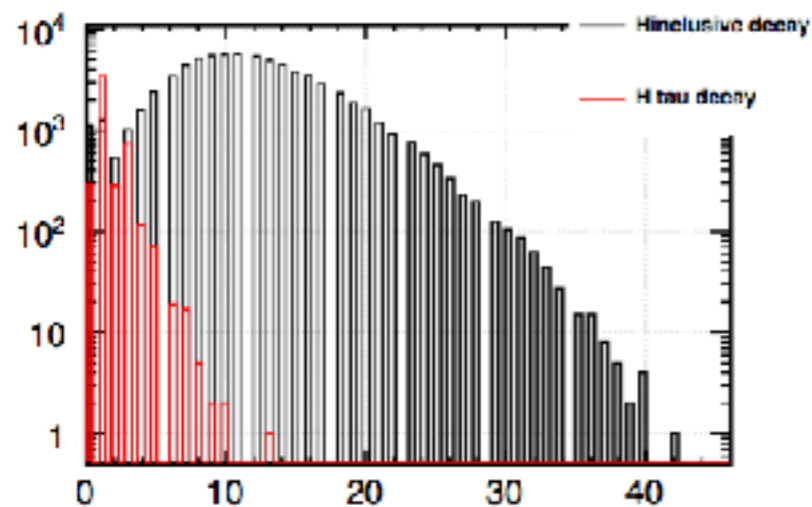
- ❖ Event: $\mu\mu H$
- ❖ Idea: Counting (N_{Tracks} & N_{Photons})
- ❖ Step:
 - ❖ Muon veto ($\text{Inv } M \sim Z_{\text{Mass}}$)
 - ❖ Find leading track (get direction)
 - ❖ Collect particles nearby (cone 1.0)
 - ❖ Collect particles in the other direction
 - ❖ Count number of tracks and photons (in two direction A & B)
 - ❖ Get track-track cones, track-photon cones

Di-Tau Finder

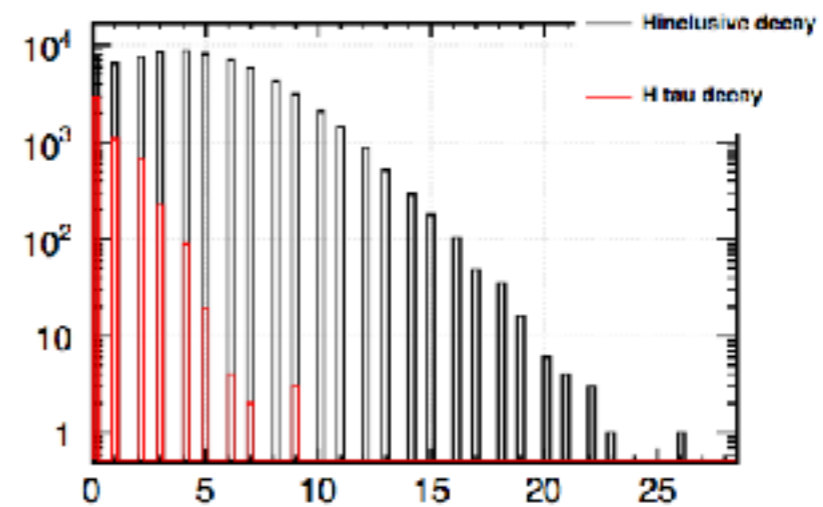
- ❖ Number of tracks and photons in cone A and cone B



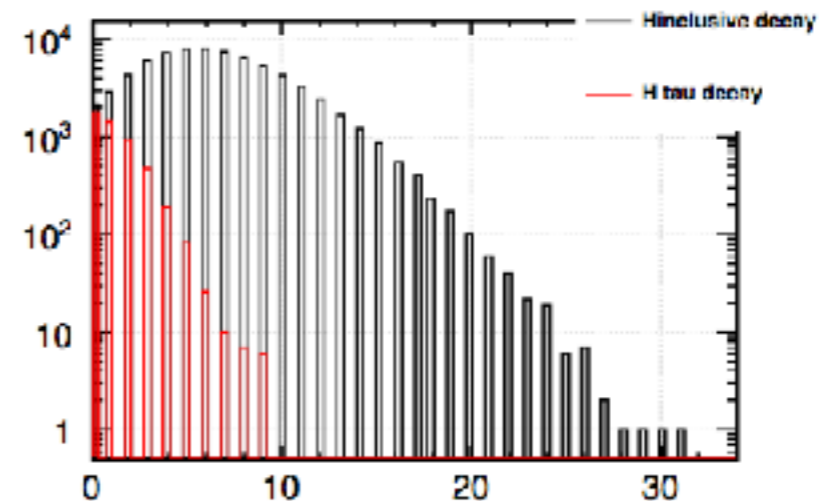
BrecoNch (MCTauNumber!=2)



ArecoNph (MCTauNumber!=2)

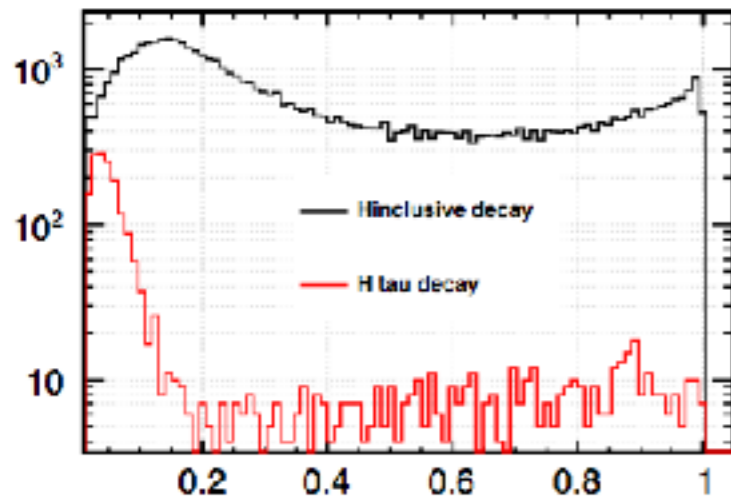


BrecoNph (MCTauNumber!=2)

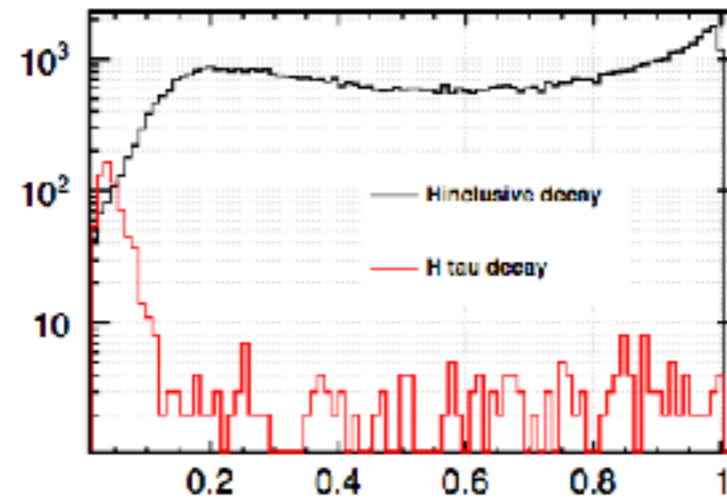


Di-Tau Finder ($\mu\mu H$)

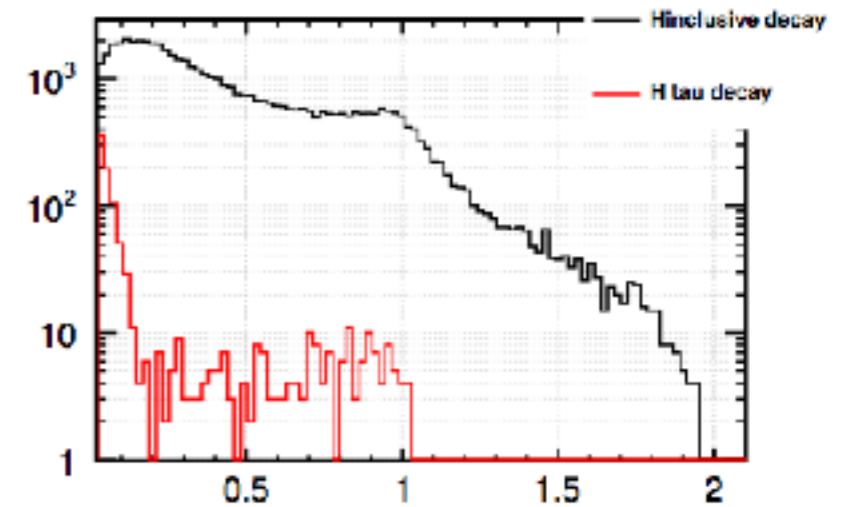
Acone1 {MCTauNumber!=2}



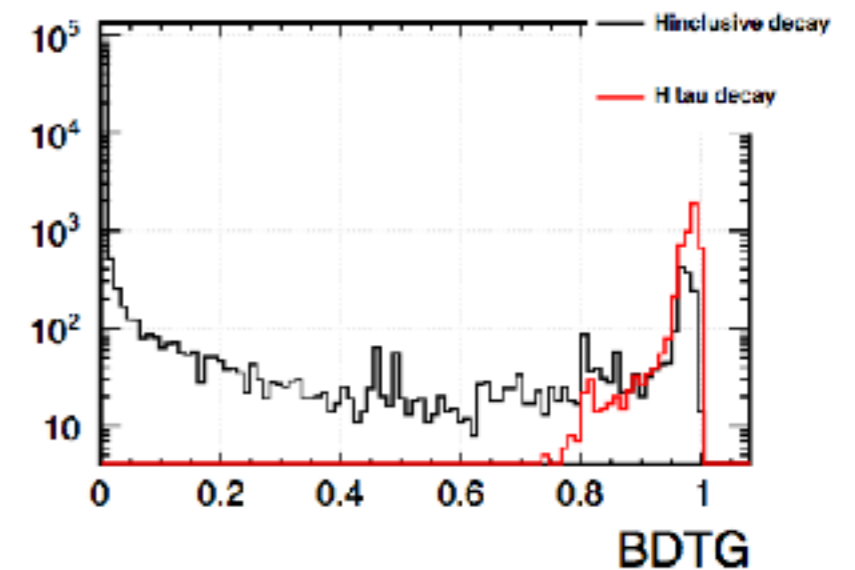
Acone2 {MCTauNumber!=2}



Acone3 {MCTauNumber!=2}

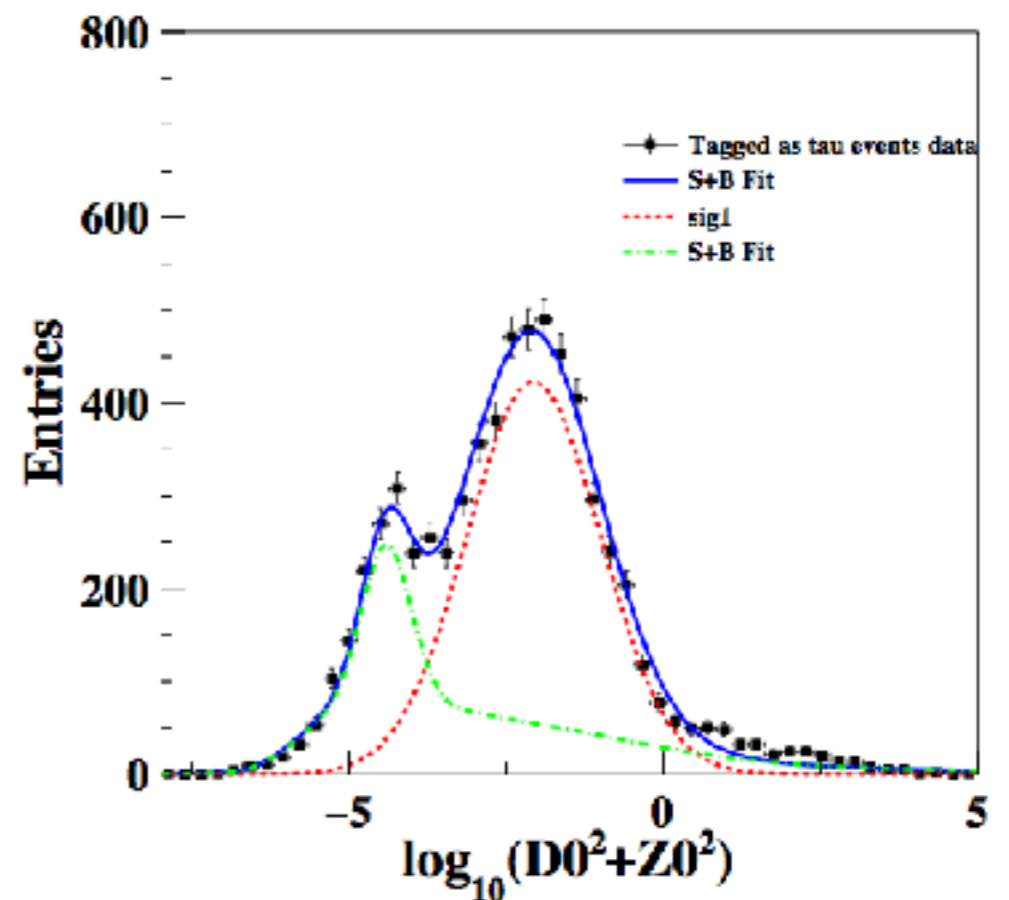
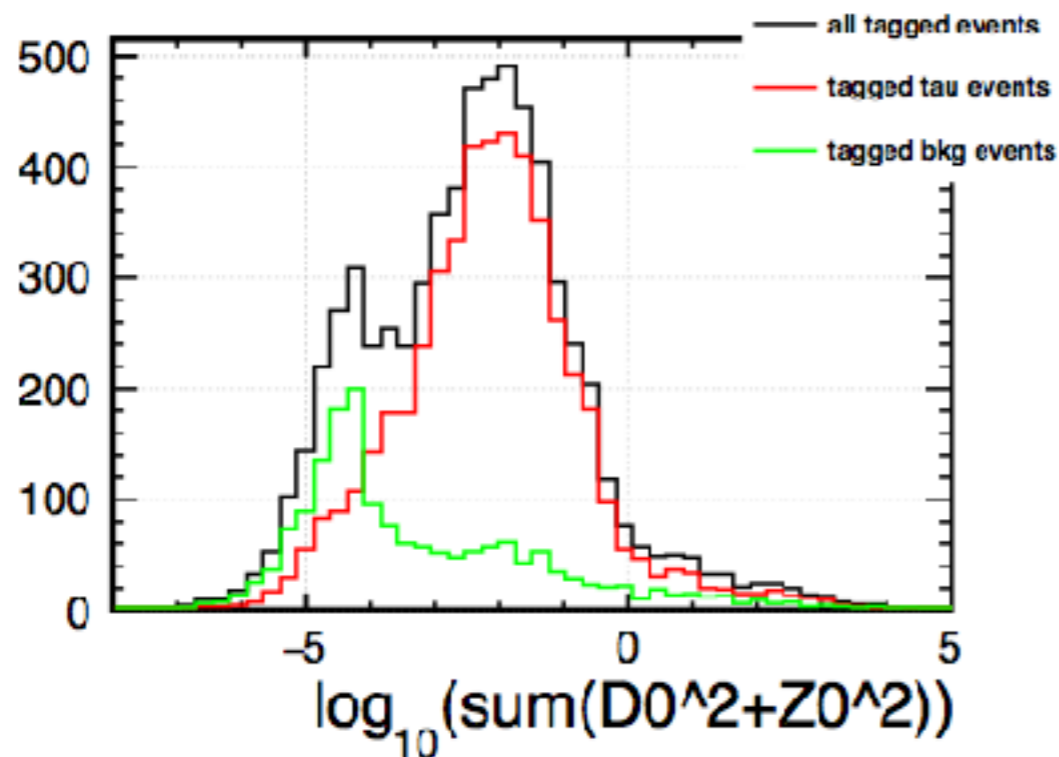


- ❖ TMVA_BDTG: cut 0.78
- ❖ Sample: total events: 78362 Sig: 4966 Bg: 73396
- ❖ after TMVA_BDTG: Sig: 4890 Bg: 1686
 - ❖ sig eff 98.47% purity:74.36%
- ❖ Compared with Kyushu University
 - ❖ eff 58.1%; purity 94.2%



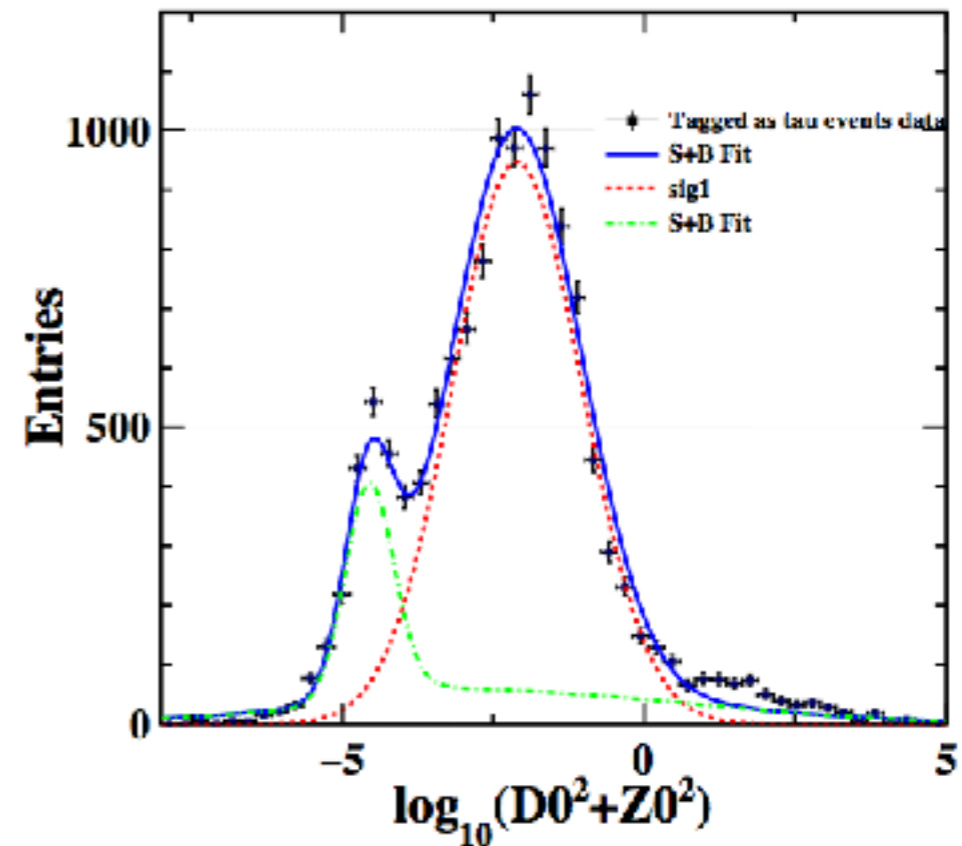
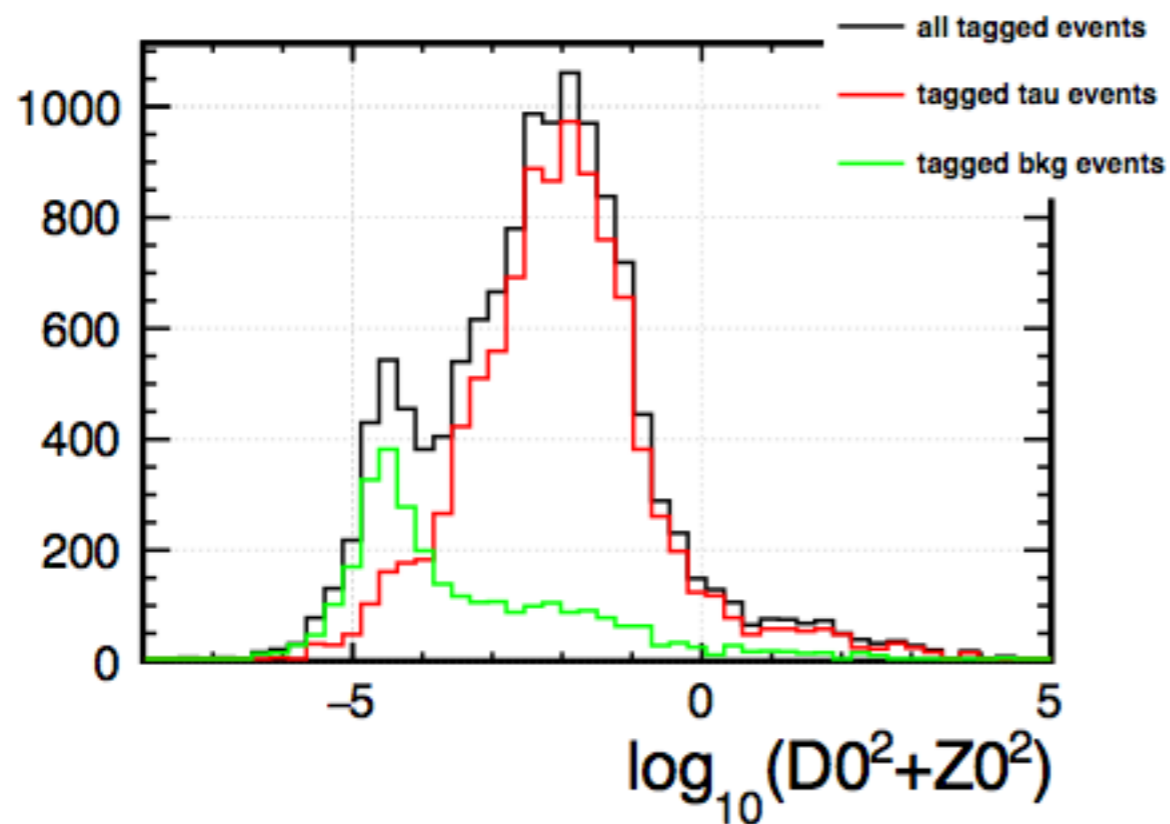
Higgs inclusive Backgrands

- ❖ $H \rightarrow WW^*$ & $W \rightarrow$ leptons (including taus)
- ❖ Impact parameters: $D0, Z0$ (Sum of leading track in two cone)
- ❖ Fit result:
 - ❖ sig: $4.6582e+03 \pm 8.15e+01$
 - ❖ BR: $6.03 \pm 0.17 \%$



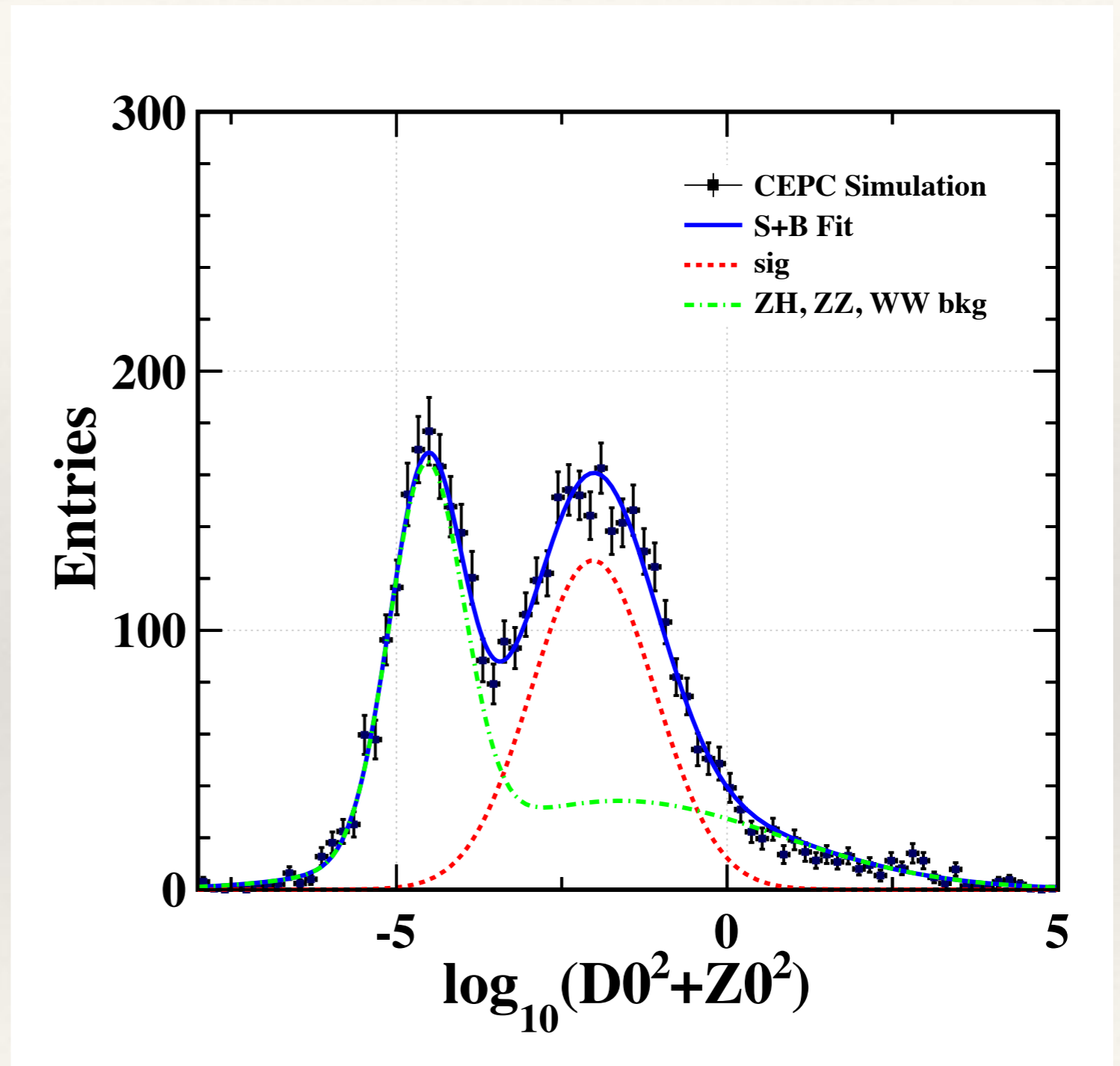
Di-Tau Finder (nnh)

- ❖ Sample: total events: 156488 Sig: 10028 Bg:146460
- ❖ after TMVA_BDTG: Sig: 9852 Bg: 2971
 - ❖ sig eff 96.24% purity:76.83%
- ❖ Fit result:
 - ❖ sig: $9.5930e+03 \pm 1.12e+02$
 - ❖ BR: $6.13 \pm 0.07 \%$



SM Backgrands

- ❖ ZZ, WW->leptons (including taus)
- ❖ Fit result:
 - ❖ sig: $1.8338e+03 \pm 8.86e+01$
 - ❖ bkg: $2.5558e+03 \pm 9.26e+01$
 - ❖ 1060000 events:
 - ❖ Br: $3.37\% * 6.32\% \sim 2.13\%$
 - ❖ calculated: 1.77%



Tau Jet Finder

- ❖ Idea:

- ❖ collect particles passing an energy threshold (minEn) within a cone (cone_s)
- ❖ count track number / photon number in cone_s
- ❖ calculate invariant mass and $\log_{10}(D_0^2 + Z_0^2)$ in cone_s
- ❖ calculate energy fraction (EnFrac) of particle in cone_s and energy in a bigger cone (cone_1)

- ❖ Cuts:

- ❖ $\text{InvMass} < 2\text{GeV}$
- ❖ $\log_{10}(D_0^2 + Z_0^2) > -7$
- ❖ $\text{Ncharged} < 6 \ \&\& \ \text{Nphoton} < 5$

- ❖ Parameter tuned:

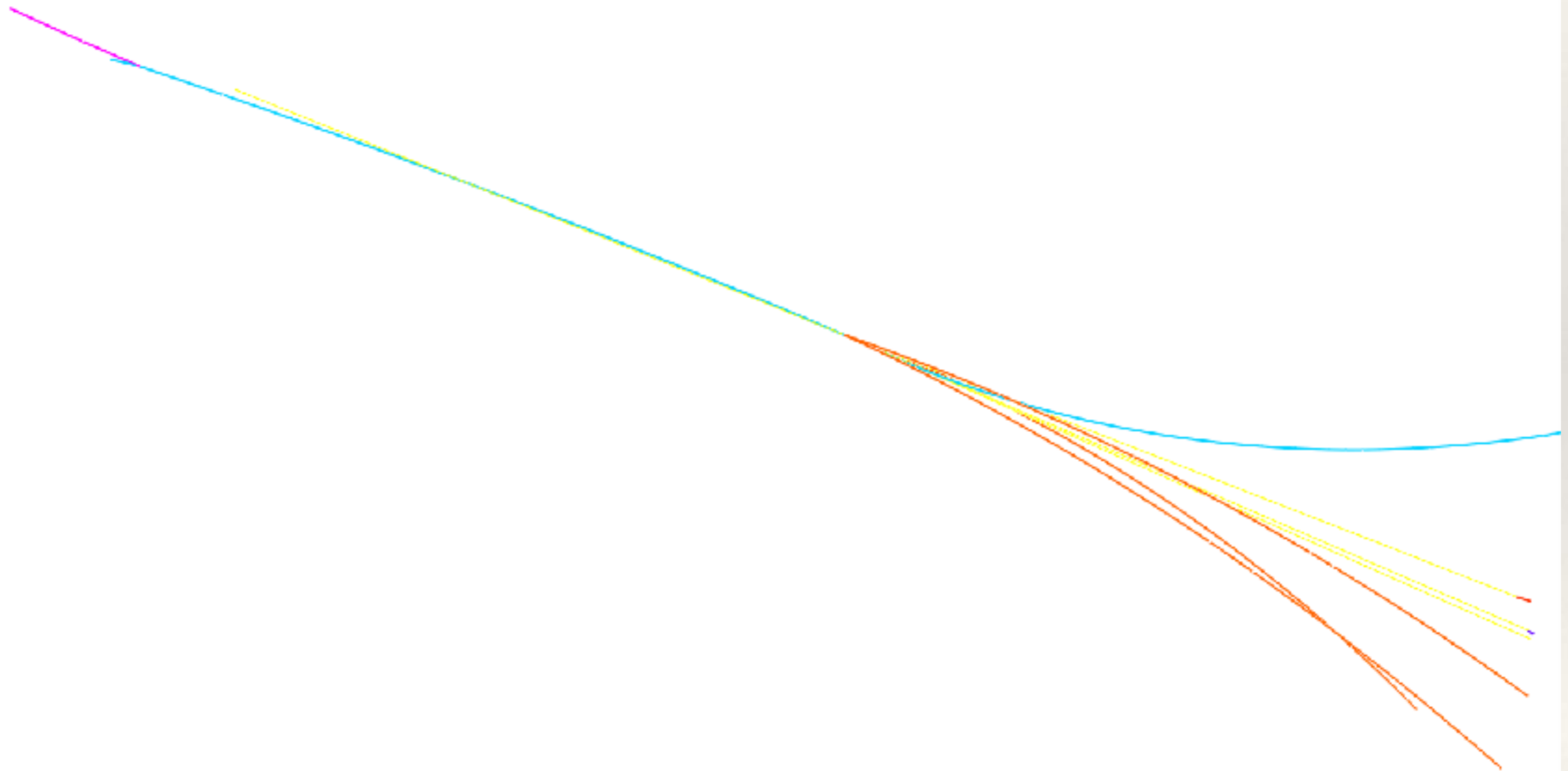
- ❖ cone_s: 0.3
- ❖ cone_1: 0.6
- ❖ minEn: 2GeV
- ❖ EnFrac: 0.92

Tau Jet Finder (z-pole events)

- ❖ Tagging rate (wo / w decay mode choose):
 - ❖ sig: 57.21% / 49.64%
 - ❖ bkg:
 - ❖ b: 6.92% / 3.71%
 - ❖ c: 9.33% / 4.44%
 - ❖ s: 11.49% / 4.96%
- ❖ Tagging rate (Kyushu):
 - ❖ sig: 20.64%
 - ❖ bkg:
 - ❖ b: 2.38%
 - ❖ c: 3.33%
 - ❖ s: 3.10%

Mistagging

DRUID, RunNum = 0, EventNum = 7



Summary

- ❖ Di-tau finder test on SM backgrounds
- ❖ Tau jet finder method tuning on z-pole events
- ❖ To do
 - ❖ Tau jet finder:
 - ❖ parameters still need to be tuned
 - ❖ decay modes analysis
 - ❖ Asymmetry study

Thank you
for
your attention!