ee->mumu forward-backward asymmetry at CEPC

Jiawei wan , Shuo Han

Sample production

- Using the Whizard package produced 1 million Z->mumu
- Process the sample into rec.root in the CEPCSW 25.3.6 environment
- Then use the changed missingET package to process it into ntuple
- We wrote Geliang's PID into the MissingET package
- The AFB of this sample is 0.0164
- The PID algorithem today only uses TOF+TPC+Calorimter, because MuonBarrelTrackerHits / MuonEndcapTrackerHits are empty in our rec.root, this will be fixed, but muon selection performance is already very good with 90% WP.

PFO CUTFLOW

- We wrote Geliang's PID into the MissingET package
- Reco-level selection for a pair of opposite charge muon from Z with muon ID
- Selection in a ±10 GeV Z mass window
- Count for muon- costheta > 0 or < 0

CEPCSW 25.3.6	91.2GeV Z ->mumu	Z->bb	Z->tautau
Total	984488	44550	197845
PID selection	879328	3222	9799
Z mass window	826419(93.98%)	0	9
Wrong selection	24(0.003%)	0	4
costheta > 0	420746	0	1
costheta < 0	405649	0	4

- The background error is 5e-6
- The probability of choosing the wrong ID is 5e-6

PFO vs MCP

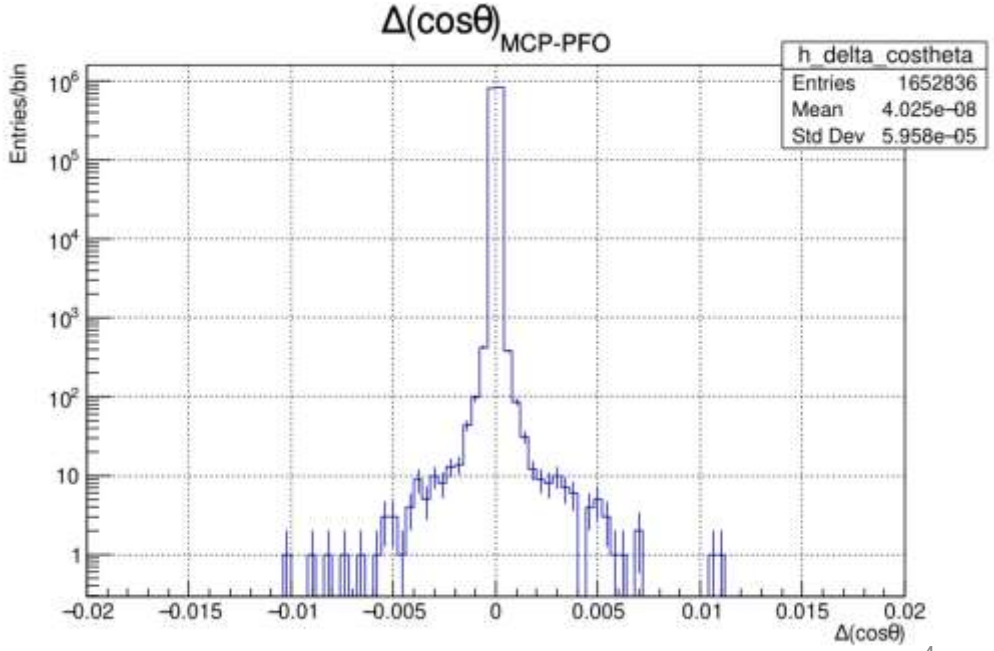
PFO Results

- Events: 826418
- Forward: 420774
- Backward: 405644
- AFB:0.0183079

MCP Results

- Events: 826418
- Forward: 420754
- Backward: 405664
- AFB: 0.0182595

- Match PFO to MCP with deltaR < 0.05
- The deviation of PFO from MCP is 5e-5
- The charge match rate is 100%



Summary

- We successfully defined the Z->mumu selection at the reco level and the AFB at the reco level
- The AFB will increase after filtering the Z mass window, and this will be corrected back by comparing the truth results
- We currently consider 5 errors:

  mis-identification：5e-6

  background comtamination: 5e-6

  charge mis-identification：0

  angular reconstruction (delta_theta)：5e-5

  energy spread uncertainty：2e-5
- This is consistent with the CEPC CDR estimate of the total error of 5e-5, with the main error coming from detector acceptance/alignment