ee->mumu forward-backward asymmetry at CEPC

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Sample production

•Produce five datasets (20 million events each) at collision energies of:

- 91.0216 GeV (Z mass - 1.4σ)
- 91.1248 GeV (Z mass - 0.53σ)
- 91.1876 GeV (Z mass)
- 91.2504 GeV (Z mass + 0.53σ)
- 91.3536 GeV (Z mass + 1.4σ)

where σ = 0.0013 GeV / 0.13%

•Generate four supplementary datasets with collision energies at:

- 90.8557 GeV(Z mass - 1.4σ)
- 91.0619 GeV(Z mass - 0.53σ)
- 91.3132 GeV(Z mass + 0.53σ)
- 91.5195 GeV(Z mass + 1.4σ)

where σ = 0.0026 GeV / 0.26%

•Nominal samples (σ = 0.13%) → Baseline analysis.

•2σ-varied samples (σ = 0.26%) → Quantify systematic uncertainties.

PFO CUTFLOW

- 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
- WP:98%
- Combine all samples（σ = 0.13 %）

CEPCSW 25.3.6	Total	A pair of muons	Z mass window	|costheta|>0.05
Z->mumu	971769	896084	843966	817183(84.1%)

Counting

- Calculate the AFB MC particles using stdhep without any selection cuts.
- Analyze the statistics of post-selected MC particles to correct the forward-backward asymmetry in PFO.

	MC particles wo selections	after selections	Using PFO
Forward events	508088	415583	415574
Backward events	491912	401600	401609
A_{FB}^{μ} or A_{FB}^{obs}	0.0161760	0.0171112	0.0170891
Corrected A_{FB}^{μ}			0.0161551

Energy Spread

- We perform the fit with finer binning intervals and adopt a quadratic function as the fitting model.
- Fit function:

  $y = (-4.09299 \pm 0.00496506) + (6.63137e\text{-}05 \pm 5.4506e\text{-}05) * x + (0.000493598 \pm 5.97101e\text{-}07) * x^2$
- The updated energy spread uncertainty is 2×10^{-5}, consistent with the previous uncertainty magnitude.
- Due to the excessively large statistical uncertainties from direct comparison between the two sample groups, we employ the method of fitting the AFB as a function of ECM