中國科學院高能物理研究所
Institute of High Energy Physics, Chinese Academy of Sciences
中国高等科学技术中心
China Center of Advanced Science and Technology

Study of $D^0/\bar{D}^0 \to K^0_S/\pi^0\pi^+\pi^-$

Xinchou Lou, **Jinfei Wu**

2025-03-14

Introduction

- I'm trying to select the process $D^0/\bar{D}^0 \to \pi^+\pi^-\pi^0$ to check the performance of PID and vertex fit.
- The MC samples are from $e^+e^- \to Z \to b\bar{b}$ at $\sqrt{S} = 91.2$ GeV,
  - /cefs/higgs/zhangkl/Production/2501/eeqq/E91.2_eebb/
    /Reco/ana_E91.2_eebb_*.root
- The version of CEPCSW is **tdr.25.3.2**, and the selection codes are from Chenguang (Thanks for his help).
- Several small bugs are fixed, such as m_{π^0}, selection of neutral objects.
  - May have some impact on the final results.

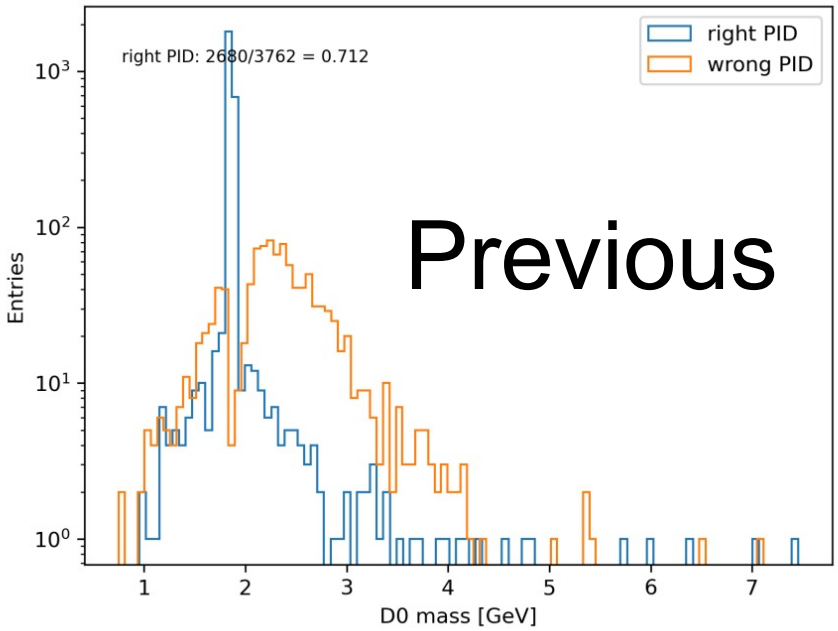
Preliminary results

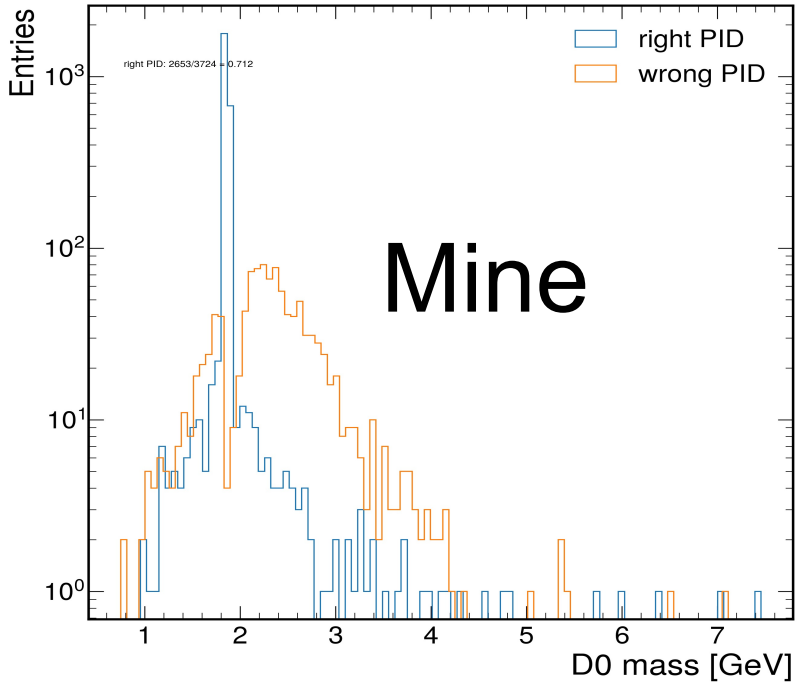
- I calculated the cutflow and purities after different selection criteria, then compared them with previous results.
  - Mine is red, and previous results are blue.
  - The difference is from the cuts are different.

Cuts	Efficiency [%]		Purity [%]	
2 tracks reconstructed	94	94	-	-
Vertex reconstructed	87	87	-	-
$1.85 < M_D < 1.88$ GeV	64	64	1.5	1.6
charged pair	64	64	1.8	1.8
Kinematic > 0	63	63	1.8	1.8
Chi2 < 4	58	58	2	2.1
Only 1 π^0	58	58	12	12
PID	58.2	58.4	91	91

Preliminary results

- The distribution of $M_{K^{\pm}\pi^{\mp}\pi^0}$ in the process $D^0/\overline{D}^0 \to K^{\pm}\pi^{\mp}\pi^0$.

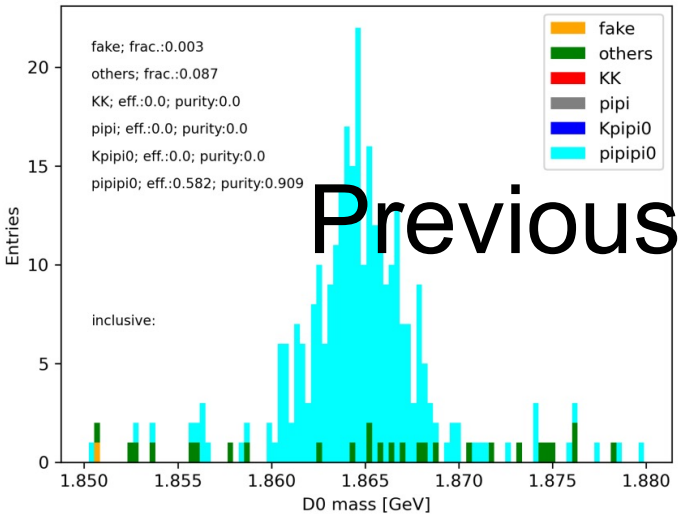


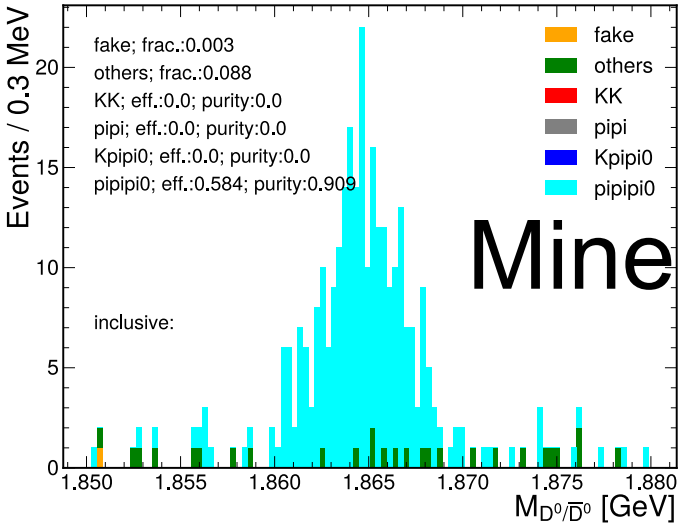


- The 2 plots are quite similar to each other, and the fraction of correct PID are same, ~71%.

Preliminary results

- The distribution of M_D in the process $D^0/\overline{D}^0 \to inclusive$.



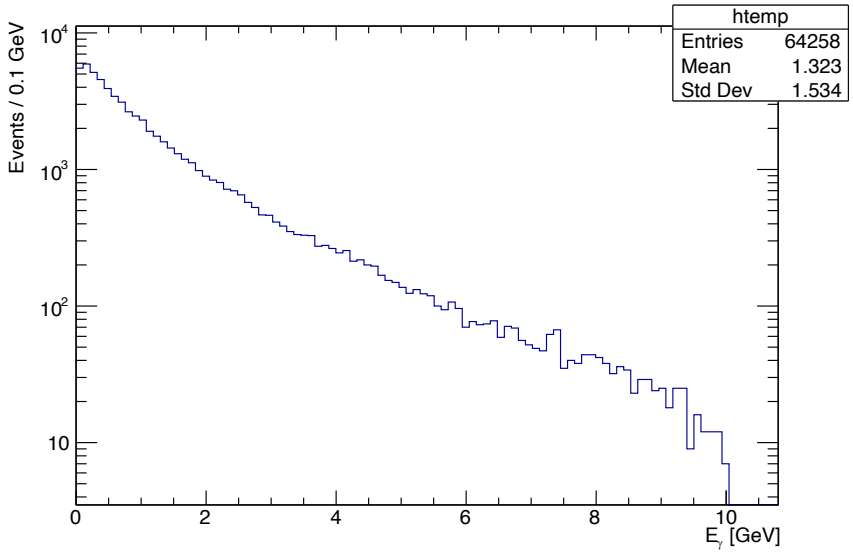


- Till now, the π^0 we used to build $D^0/\overline{D}^0$ is the truth π^0, that could not be retrieved in the reconstruction in future.

- So I tried to form a π^0 with 2 photons, $\pi^0 \to \gamma\gamma$.

Preliminary results

- The truth distribution of E_γ from π^0 in the process $D^0/\overline{D}^0 \to \pi^0 + X$.

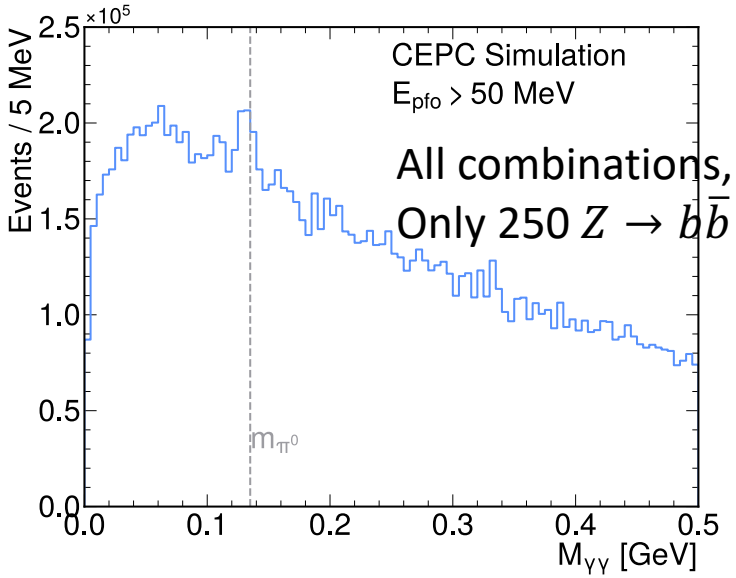


The E_γ is small, compared to other process, such as $H \to \gamma\gamma$.

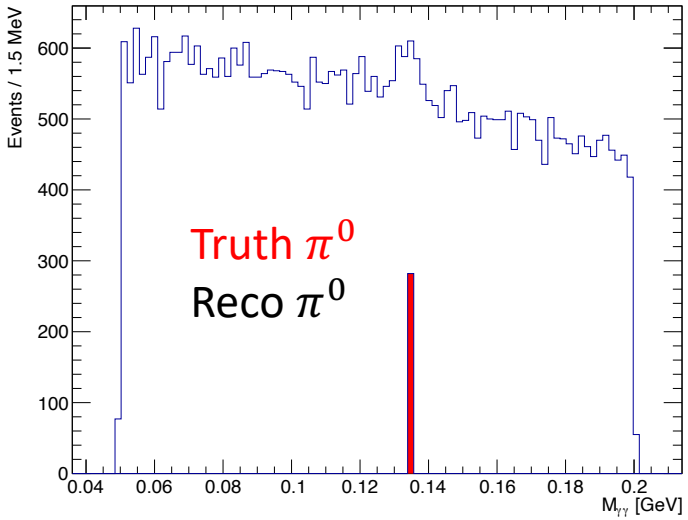
- Besides, there is no photon ID in current MC samples. We also include some neutral hadrons in current EMC PFOs, such as K_L^0.
  - The energies of most EMC PFOs are less than 50 MeV, and I remove these PFOs in the reconstruction of π^0.

Preliminary results

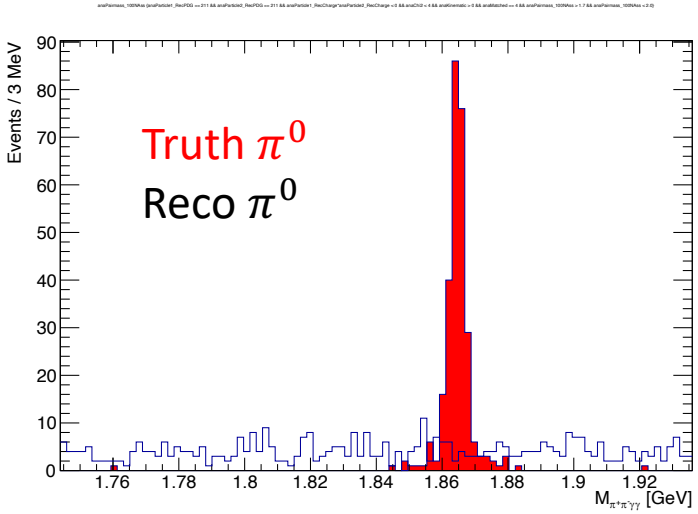
- The distributions of $M_{\gamma\gamma}$.



$M_{\gamma\gamma}$ for the $D^0 \to \pi^+\pi^-\pi^0$



- The distribution of $M_{\pi^+\pi^-\gamma\gamma}$.

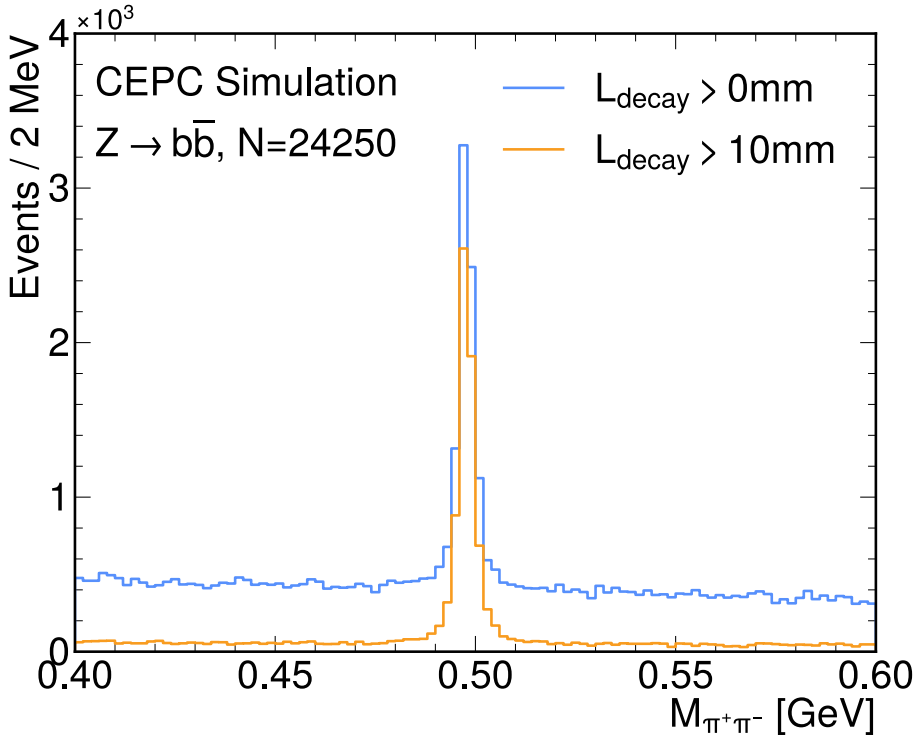


Preliminary results

- I also tried to reconstruct the process $\bar{B}^0 \to D^{*,+}\pi^-, D^{*,+} \to D^0\pi^+, D^0 \to K_S^0\pi^+\pi^-, K_S^0 \to \pi^+\pi^-$.

- The distributions of $M_{\pi^+\pi^-}$.

2 tracks reconstructed
Vertex reconstructed
$0.4 < M_{\pi^+\pi^-} < 0.6$ GeV
charged pair
Kinematic > 0
Chi2 < 4
PID



Backup