Comparison of my cut and Ma Tian's cut

I. INTRODUCTION

This note describes determination of $K_S^0 \to \pi^+\pi^-$ reconstruction efficiencies in data and Monte Carlo. The measured efficiency of K_S^0 factors out the following parts:

- The track-finding efficiency for two pions.
- Secondary vertex fit and decay length fit, in addition to K_S^0 mass window requirements: $|M_{\pi^+\pi^-} - M_{K_S^0}| < 12\,\mathrm{MeV}/c^2$ ("3σ" cut, where $\sigma \approx 4\,\mathrm{MeV}/c^2$).
- The flight significance cut: $L/\sigma_L > 2$.

- **K_S^0 reconstruction**
  - ✓ Track selection
    $|Vr| < 10$cm, $|Vz| < 30$cm, $|\cos\theta| < 0.93$
  - ✓ PID: Prob π > Prob K and Prob π > Prob P
    $N_{\pi+} >= 1$ and $N_{\pi-} >= 1$
  - ✓ Second vertex fit: $L/\sigma_L > 2.0$
  - ✓ Remove the cosmic rays using time of flight:
    $|T(\pi^+) - T(\pi^-)| < 5$ (ns)
  - ✓ Remove the beam-associated background:
    χ^2 (second fit) < 120

Using the K_S^0 reconstruction uncertainty from Ma Tian, and assuming the PID is 1% for each π

Radius of beam pipe: 6.3cm

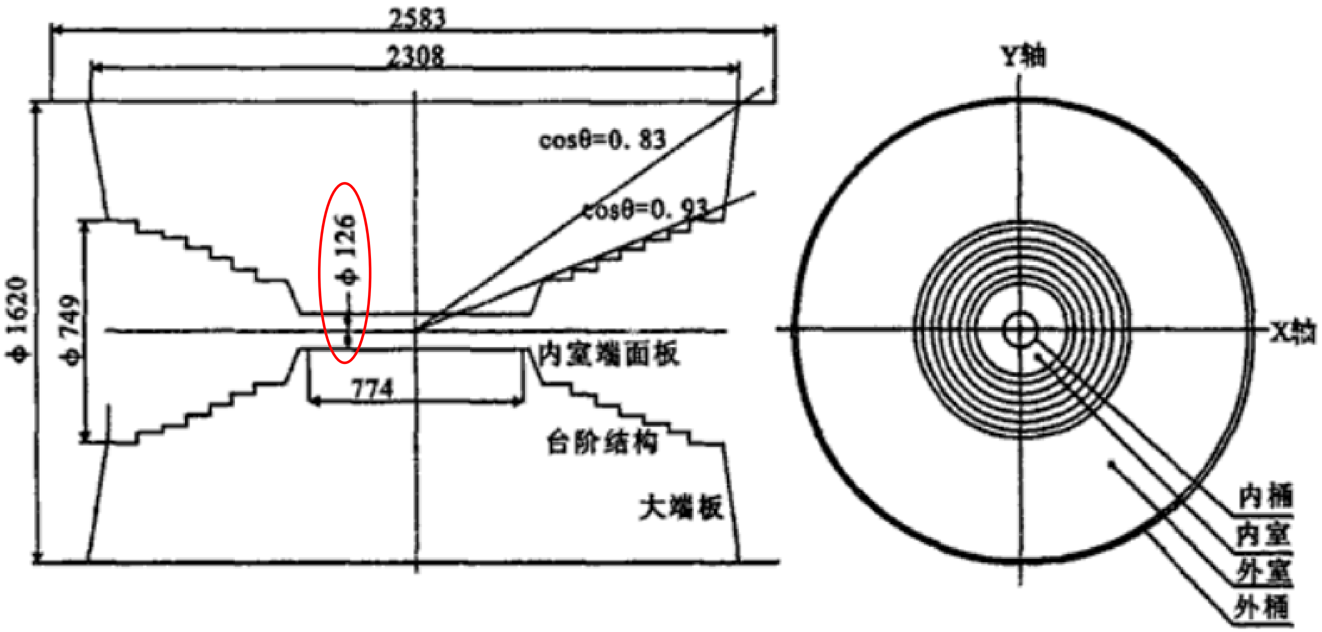
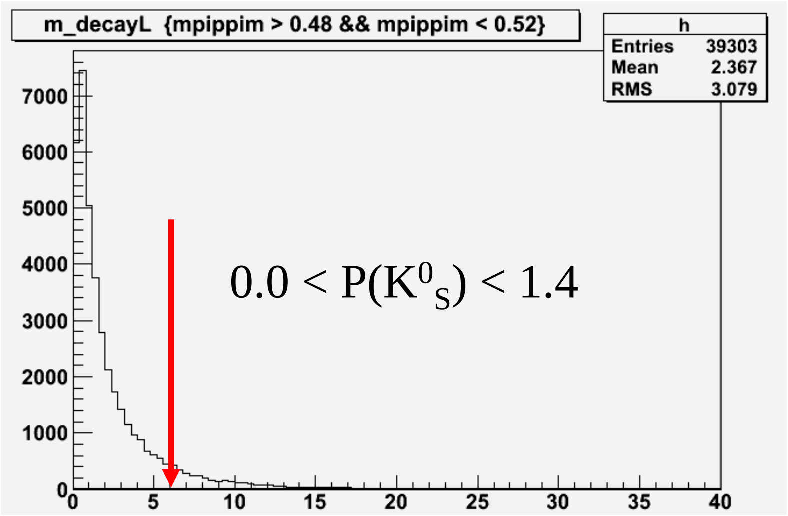


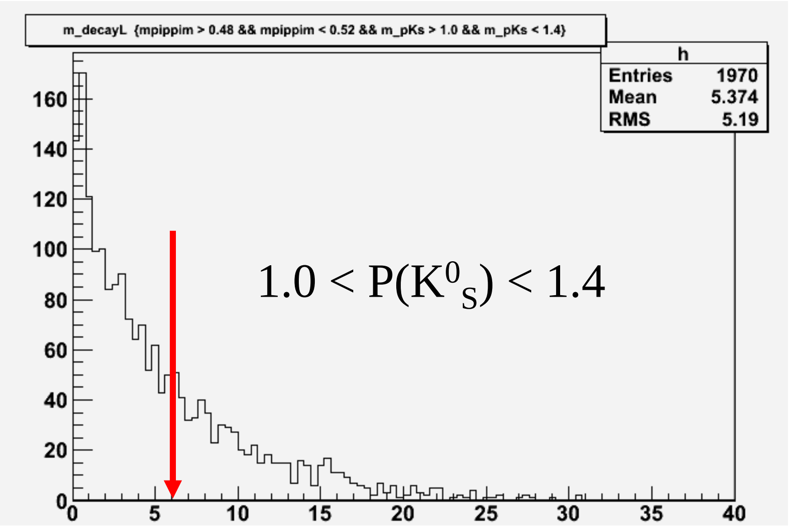
图 1　漂移室总体结构图

Decay length of K^0_S



Decay length of K^0_S

K^0_S events of (L<6)/(L>6)
35732/3571 = 10.0



Decay length of K^0_S

K^0_S events of (L<6)/(L>6)
=1306/664 = 2.0

Memo version 5.0

BESIII Analysis Memo

BAM-00281

August 27, 2017

First measurement of $e^+e^- \to pK^0_S\bar{n}K^- + c.c.$ above 4.0 GeV

7.4 $K^0_{\rm S}$ Reconstruction

The K_S reconstruction is studied using two samples $J/\psi \to K^*(892)^\pm K^\mp, K^*(892)^\pm \to K_S\pi^\pm$ and $J/\psi \to \phi K_S K^\pm\pi^\mp$, and the systematic uncertainty is estimated as 1.2% [29]. Taking into consideration additional PID for two opposite-charged pions from the $K^0_{\rm S}$ candidate in our analysis, which is different from the Ref [29], the systematic uncertainty for the $K^0_{\rm S}$ reconstruction is conservatively taken as 2.3%, where the PID efficiency difference for each pion between MC and data is 1.0% [26].

K_S^0 uncertainty from Ma Tian

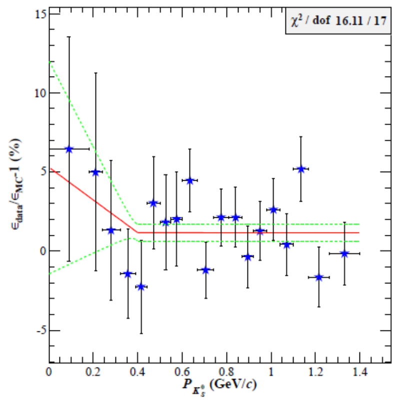


FIG. 13: Fits to combined momentum-dependence for the systematics of $K^0 \to K_S^0$ reconstruction efficiency.

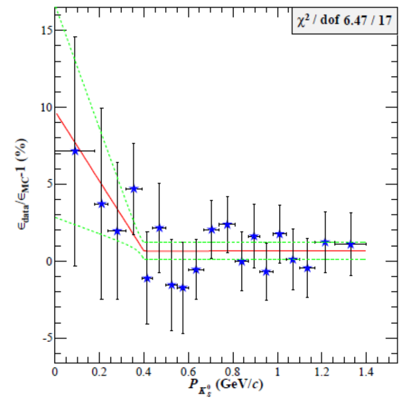


FIG. 14: Fits to combined momentum-dependence for the systematics of $\bar{K}^0 \to K_S^0$ reconstruction efficiency.

$$\epsilon_{\rm sys}^{K^0\to K_S^0} = (1.22 \pm 0.53)\%, \epsilon_{\rm sys}^{\bar{K}^0\to K_S^0} = (0.80 \pm 0.53)\%. \quad (5)$$

We averaged two results and gained the data-Monte Carlo discrepancy of K_S^0 reconstruction as $(1.01 \pm 0.53)\%$.

Fig. 14. The corresponding K_S^0 systematics, $\epsilon_{\rm sys}^{K_S^0}$, obtained in this fashion and given by

$$\epsilon_{\rm sys}^{K^0\to K_S^0} = \left(\frac{\epsilon_{\rm data}}{\epsilon_{\rm MC}}\right)_{K^0\to K_S^0} - 1 = \begin{cases} 0.0528 - 0.103\ p & (0 < p < 0.40) \\ 0.0116 & (0.40 < p < 1.40) \end{cases} \quad (1)$$

$$\epsilon_{\rm sys}^{\bar{K}^0\to K_S^0} = \left(\frac{\epsilon_{\rm data}}{\epsilon_{\rm MC}}\right)_{\bar{K}^0\to K_S^0} - 1 = \begin{cases} 0.0975 - 0.227\ p & (0 < p < 0.40) \\ 0.0067 & (0.40 < p < 1.40) \end{cases} \quad (2)$$