

Lineshape of $e^+e^- \rightarrow \pi^+\pi^-\pi^+\pi^-$ around 4.0 GeV

Gao Xinlei

Motivation

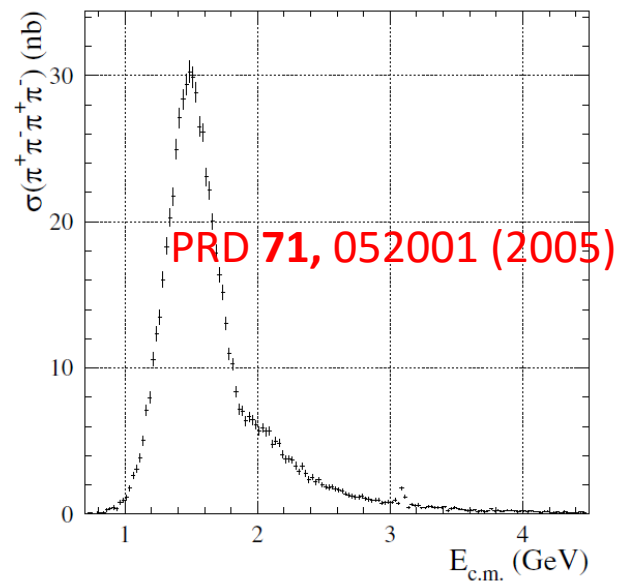


FIG. 8. The e^+e^- c.m. energy dependence of the $\pi^+\pi^-\pi^+\pi^-$ cross section measured with ISR data. The events due to $\psi(2S) \rightarrow \pi^+\pi^-J/\psi$ with $J/\psi \rightarrow \mu^+\mu^-$ (see Fig. 2) have been removed. Only statistical errors are shown.

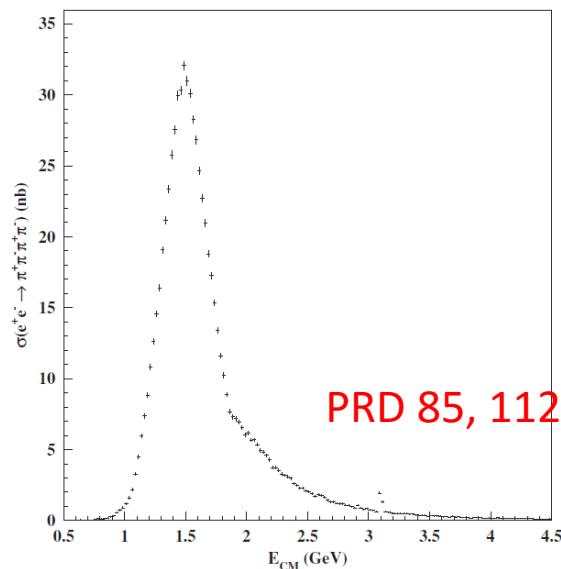


FIG. 9. The E_{CM} dependence of the dressed $e^+e^- \rightarrow \pi^+\pi^-\pi^+\pi^-$ cross section measured from the ISR data. The uncertainties are statistical.

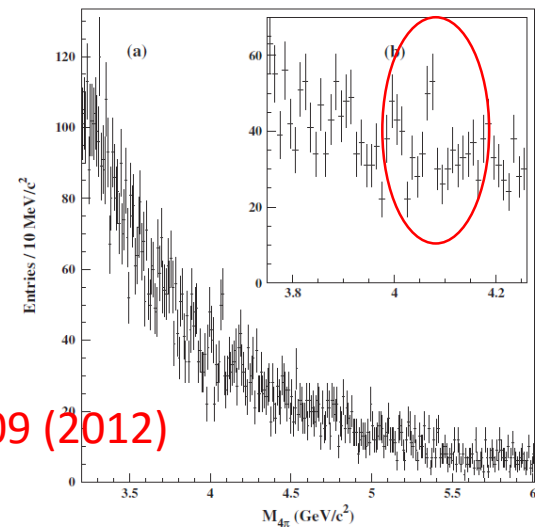


FIG. 14. Invariant $\pi^+\pi^-\pi^+\pi^-$ mass distribution for the data in the invariant mass range $3.2 \text{ GeV}/c^2 < M_{4\pi} < 6.0 \text{ GeV}/c^2$ (a) and $3.75 \text{ GeV}/c^2 < M_{4\pi} < 4.25 \text{ GeV}/c^2$ (inset, b).

identified. **There is a hint of structure just above $4 \text{ GeV}/c^2$.** The inset, Fig. 14(b), shows this feature in more detail.

Possible structure above 4.0 GeV ?

Data Samples

- Boss version: 6.6.4.p01
- R-scan data sets at 4.0-4.2 GeV and All the XYZ data
- Monte Carlo data samples

Signal MC by ConExc with ISR: $e^+e^- \rightarrow \pi^+\pi^-\pi^+\pi^-$

Possible background MC :

Event Selection

● Good charged track

1. $|V_r| < 1 \text{ cm}$, $|V_z| < 10 \text{ cm}$, $|\cos\theta| < 0.93$

2. Muon layers < 3

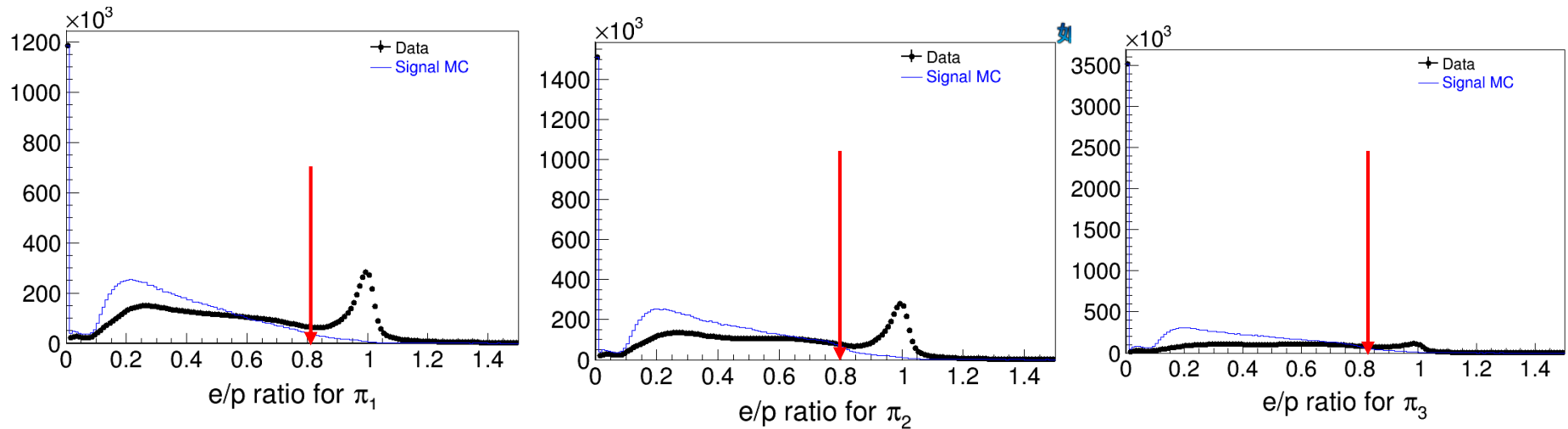
3. Ngood equals to 3 or 4

if Ngood = 3, assuming the obtained 3 tracks are π , the fourth track is reconstructed by recoil method.

if Ngood = 4, select the 3 tracks as pions, whose combination makes the mass of recoil track more close to π .

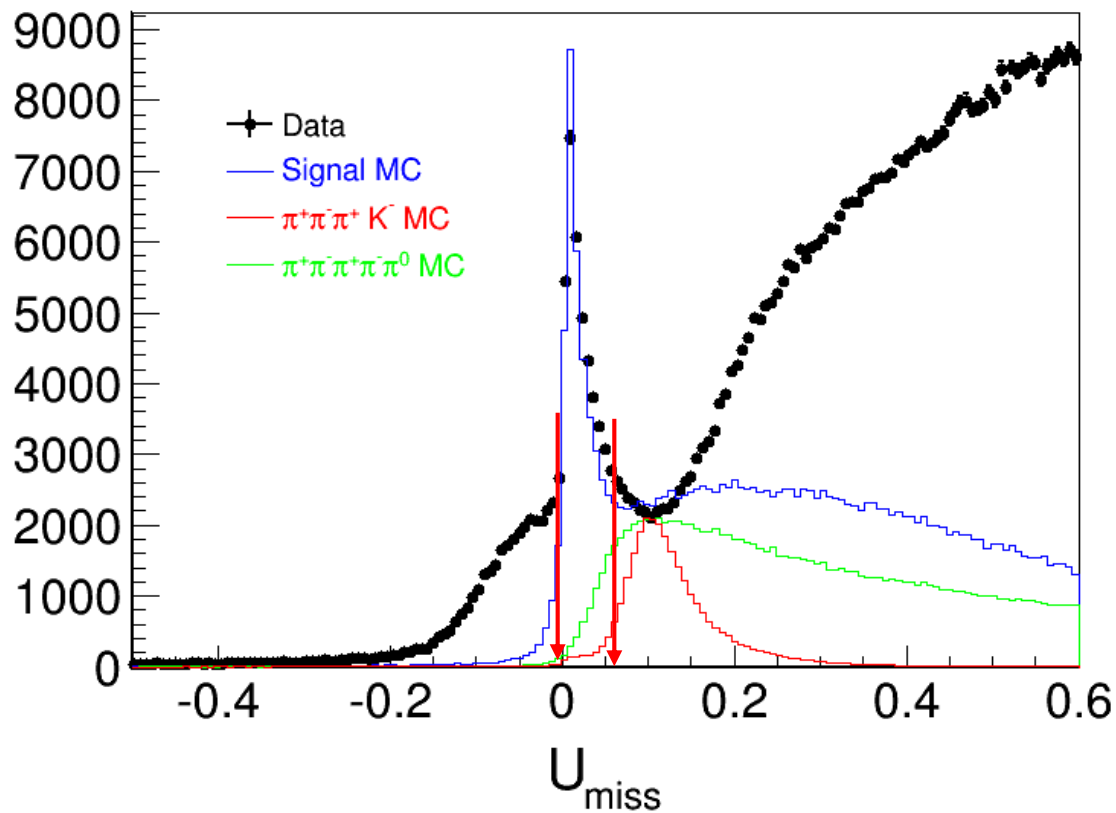
● Vertex fit ($\pi\pi\pi$)

Event Selection



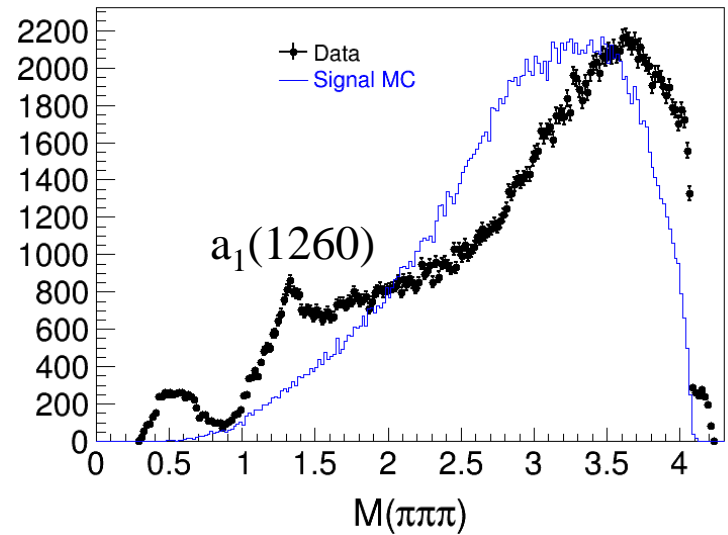
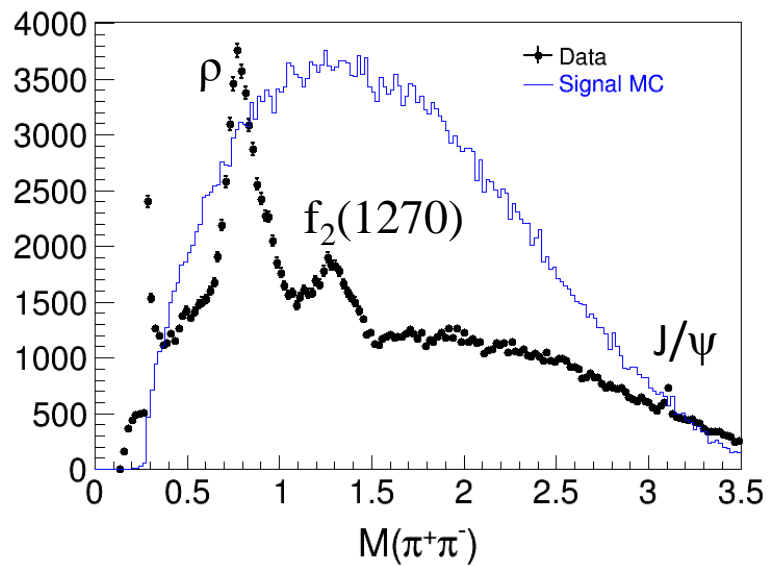
For three tracks: $e/p \text{ ratio} < 0.8$

U_{miss} of π

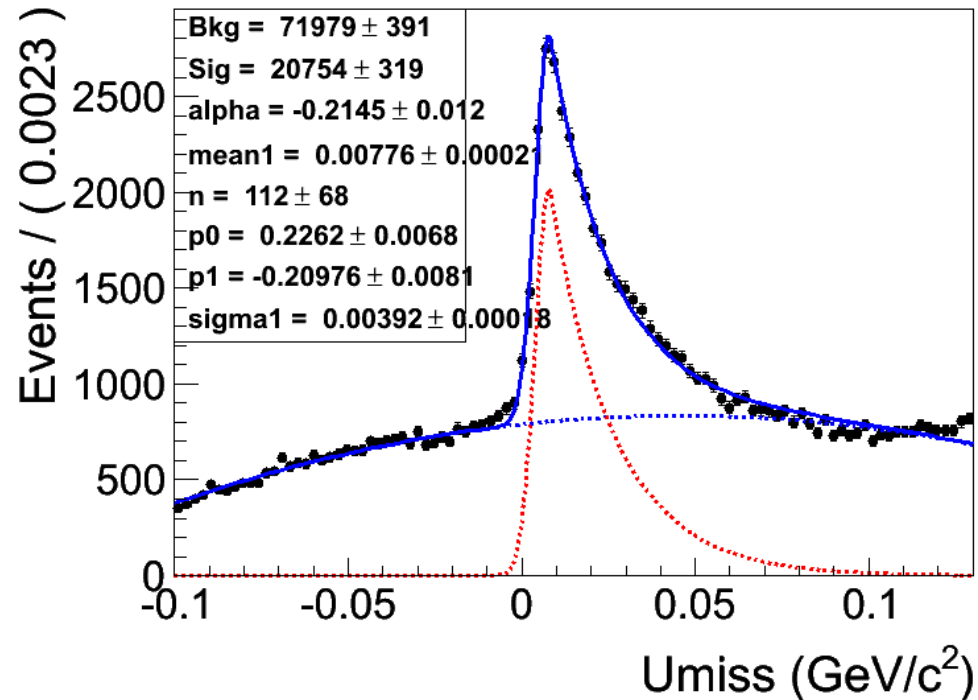


For recoiled π : $U_{\text{miss}} = E - P$

Comparison between MC and data



Fitting for the U_{miss} of π



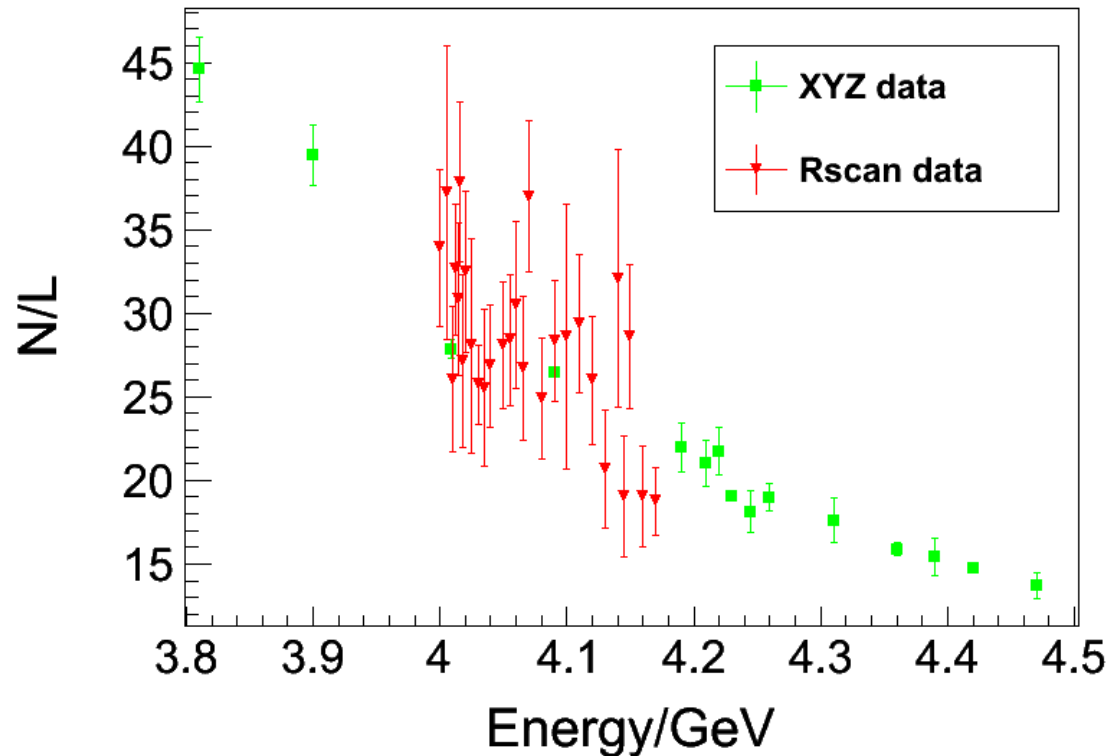
For recoiled π : $U_{\text{miss}} = E - P$

Fitting function:

Signal: crystal ball

Background: two order of Chebyshev

Lineshape of $e^+e^- \rightarrow \pi^+\pi^-\pi^+\pi^-$



No obvious structure around 4.0 GeV!

Summary

- 1, Rough lineshape for $e^+e^- \rightarrow \pi^+\pi^-\pi^+\pi^-$ is obtained.
- 2, No obvious structure around 4.0GeV is found.