Updates on K^0_S analysis (cut of helicity angle and feed down correction in PV).

Natalia Rogacheva

LHEP, JINR, Dubna

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Selection criteria

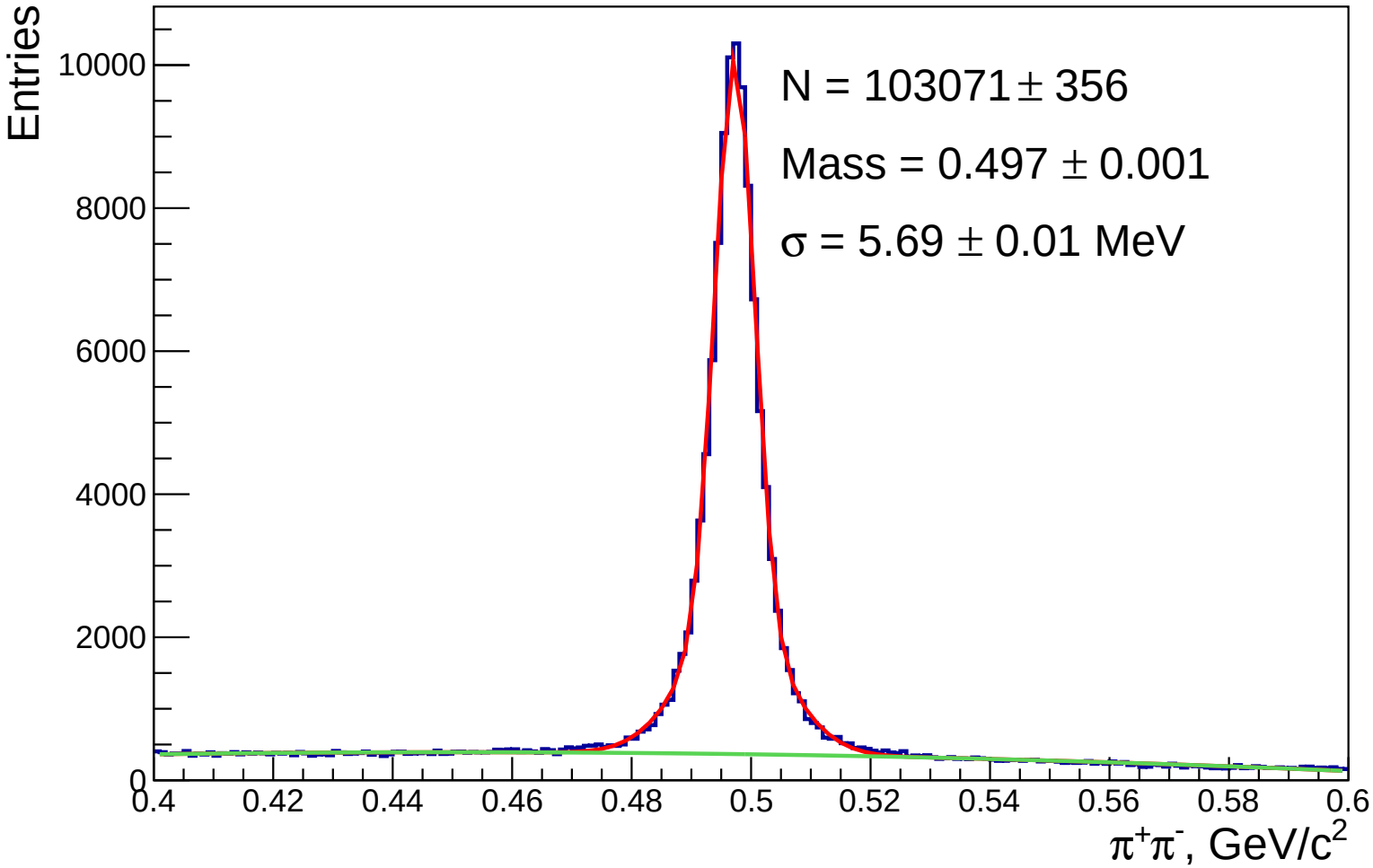
PV and V0 selection:

1. The primary vertex coordinates has a gaussian smearing with $\sigma_z = 30$ cm, $\sigma_x = \sigma_y = 0.1$ cm,
2. Daughters = K^0(-211, 211),Λ(2212,-211),$\bar{\Lambda}$(-2212, 211);
   Bg = (321,-321), (-321,211), (321,-211).
3. For track selection: minimum Its hits = 0;
   total minimum hits = 3.
4. The track candidates were required to be well-fitted and to have a track fit χ^2 over the number of degrees of freedom less than 6 ($\chi^2/NDF < 6$).
5. Minimum χ^2_{V0} track to PV is less than 2.
6. Track extrapolation χ^2 is more than 10.
7. Track fit is converged.

Kinematical cuts:

1. $\theta_{coll} < 0.03$ rad for K^0. This cut selects V^0 events the momentum looking at the PV.
2. $Dist = \sqrt{(x_{SV} - x_{PV})^2 + (y_{SV} - y_{PV})^2 + (z_{SV} - z_{PV})^2}$.
   This cut selects V^0 which decay close to PV. $Dist > 0.7$ cm for K^0_S.

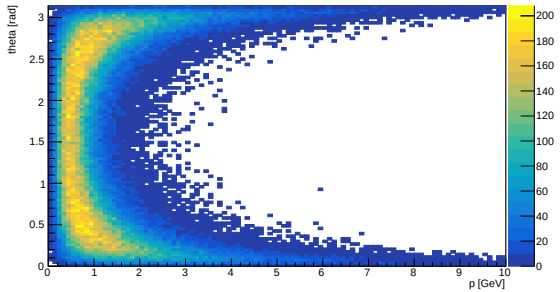
Invariant mass of K^0_S after all cuts

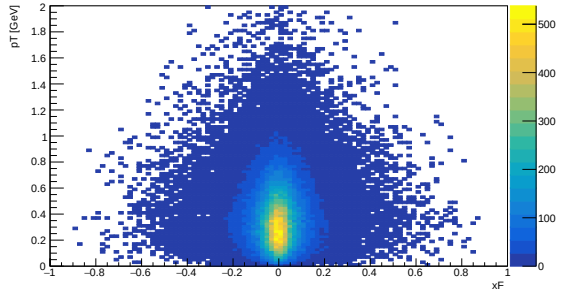


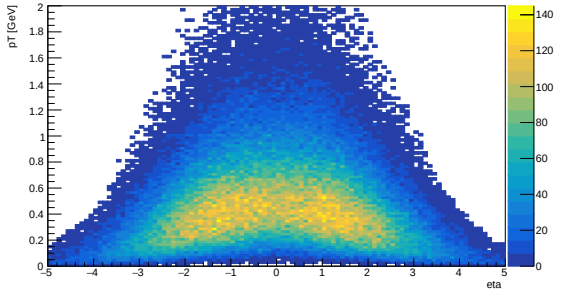
The shape of the K^0_S signal was parametrized by double Gaussian and background was parametrized by the second order polynomial.

The selected V^0 candidates are plated in (p,θ), (x_F, p_T) and (η, p_T) phase space

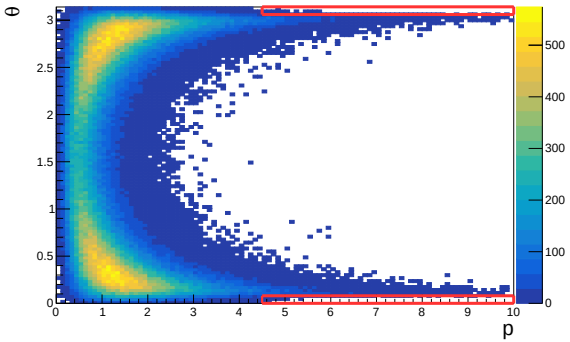
Pure Pythia 8 (true), K^0_S:



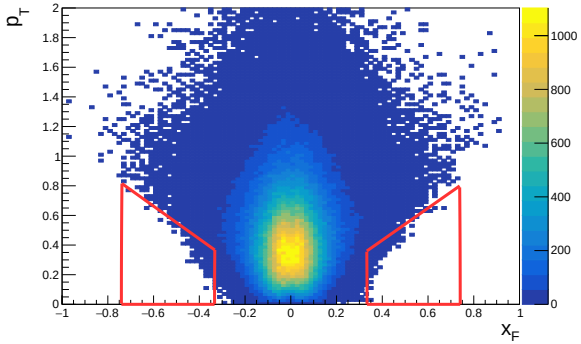




Reconstruction data (RD):

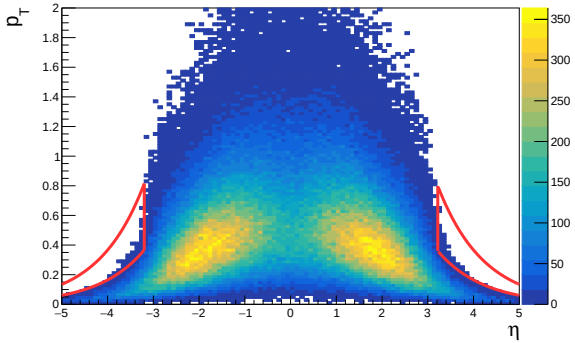


θ - polar angle
p - total momentum



p_T - transverse momentum
x_F - Feynman variable

$$x_F = \frac{2p_T}{\sqrt{S}}$$

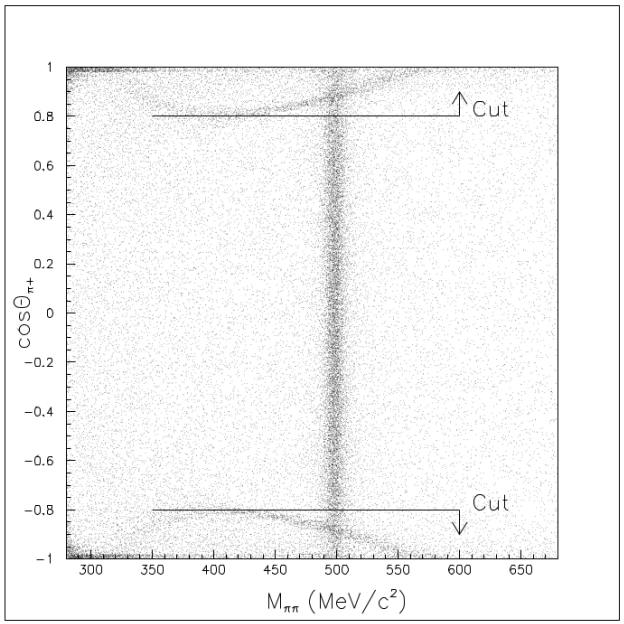


p_T - transverse momentum
η - pseudorapidity

$$\eta = -\ln\left[\tan\left(\frac{\theta}{2}\right)\right]$$

New cuts is helicity angle for selestions K_S^0

Thanks to Mihai Dima.



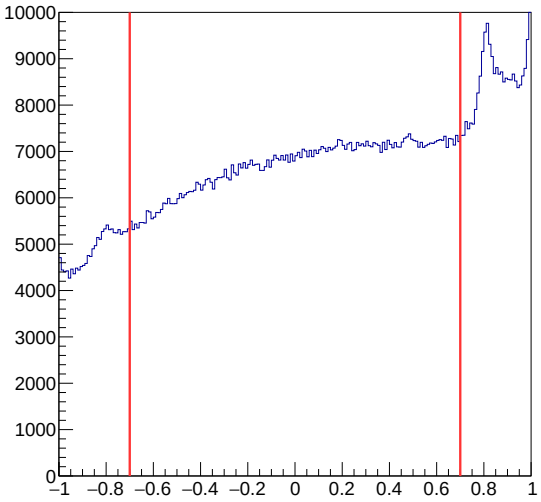
SLAC-483

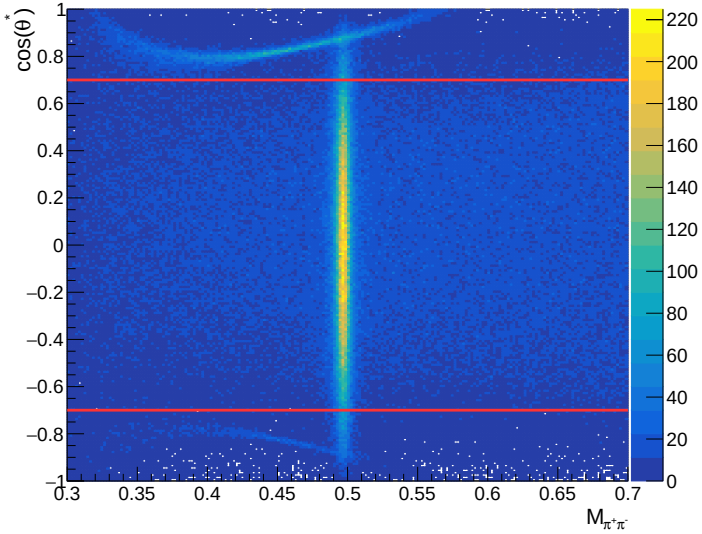
Strange Particle Production in Hadronic Z^0 Decays

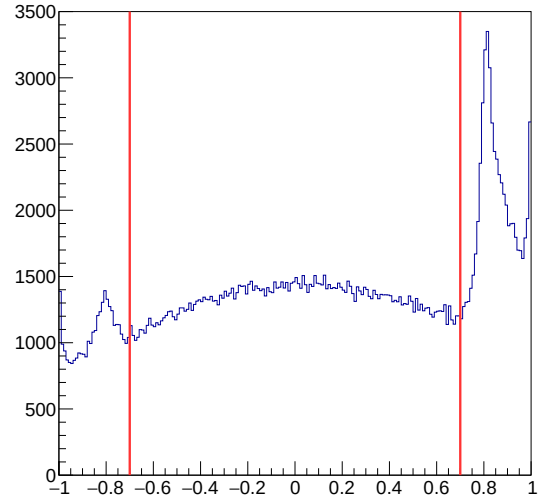
by Kenneth George Baird III

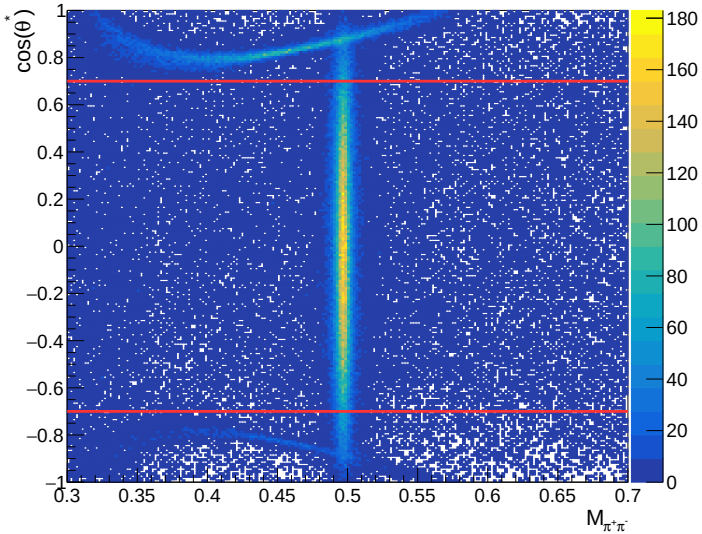
For the K_s^0 analysis, the $\Lambda^0/\bar{\Lambda}^0$ background causes an asymmetric "bump" in the $\pi\pi$-invariant mass distribution, as seen in Figure 6.2, which complicated the fitting procedure. A cut on the "helicity angle" θ^*, defined as the angle between the π^+ momentum vector in the K_s^0 rest frame and the K_s^0 flight direction, was used to remove the Λ^0 and $\bar{\Lambda^0}$ contamination (Fig. 6.3). K_s^0 candidates were required to have $|cos\theta^*| \leq 0.8$, which removed 20% of the K_s^0 signal. This cut also removes the γ-conversion background.

Helicity angle ($|cos\theta^*| \leqslant 0.7$) for K^0_S at SPD



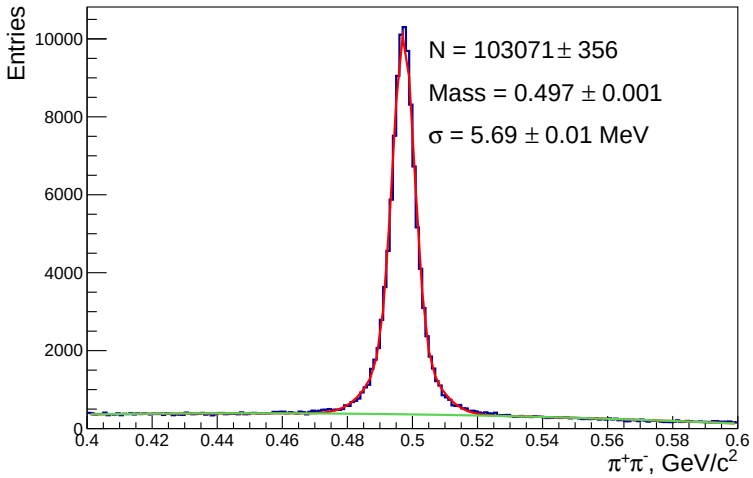


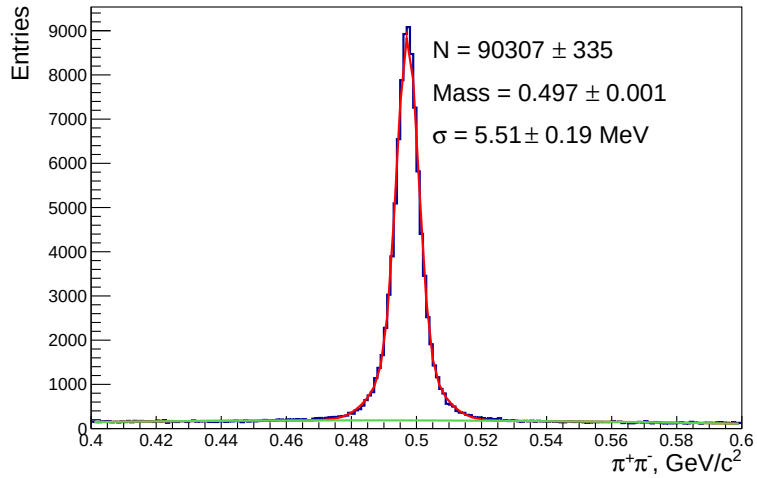




Invariant mass of K^0_S for previous analysis and add the cut helicity angle

$$|cos\theta^*| \leqslant 0.7$$

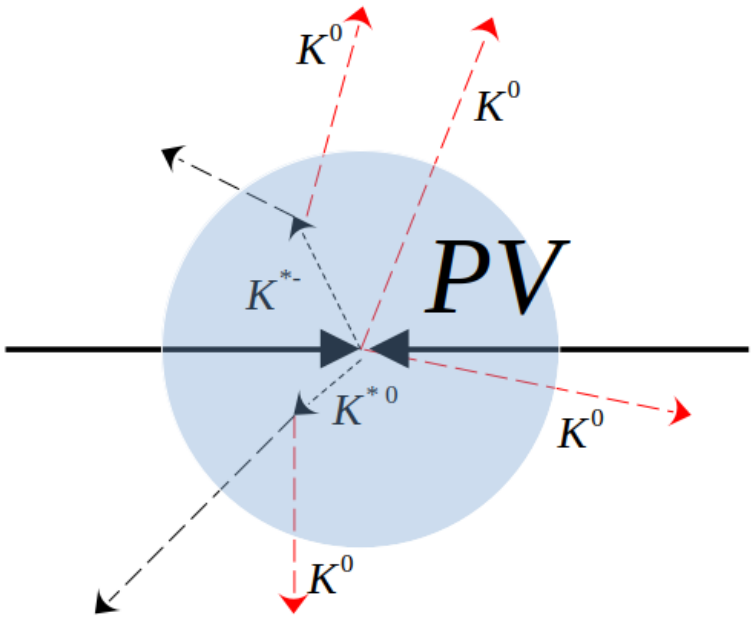




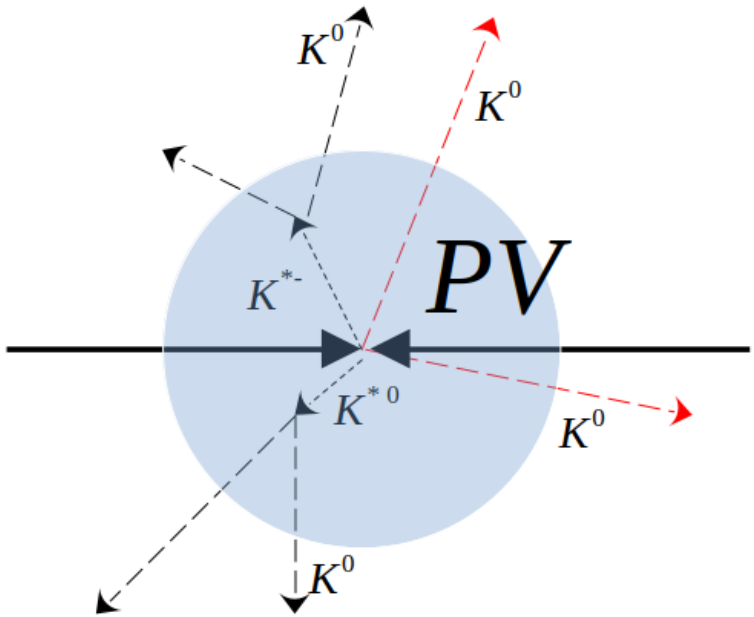
The shape of the K^0_S signal was parametrized by double Gaussian and background was parametrized by the second order polynomial.

Feed down correction in PV

In previous analysis



In current analysis



$N(K^0_{true} inPV)$ $N(K^0_{true,direct} inPV)$

$$C0 = \frac{N(K^0_{true} inPV)}{N(K^0_{true,direct} inPV)}$$

Factorization of the MC correction

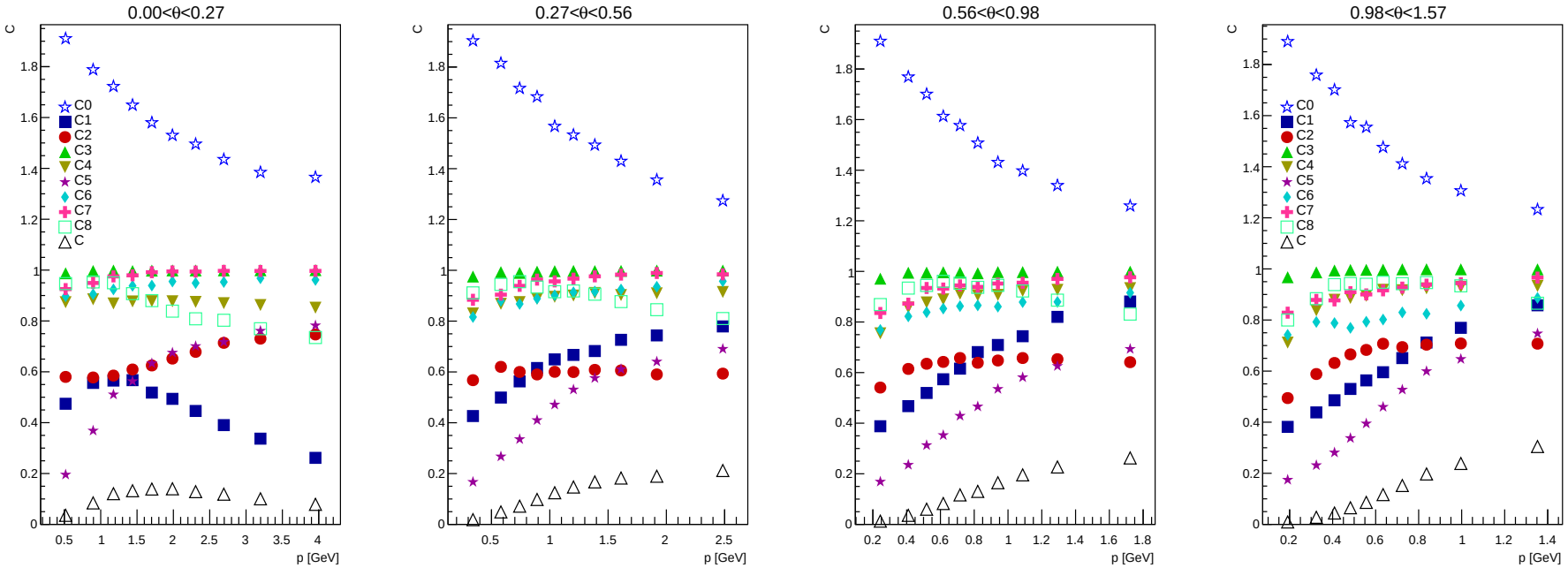
$$C = \frac{N(RD)}{N(true)} = C0 * C1 * C2 * C3 * C4 * C5 * C6 * C7 * C8$$

$$C0 = \frac{N(K^0_{true}\, inPV)}{N(K^0_{true,direct}\, inPV)} - \text{feed down}$$

$$C1 = \frac{N(3hits)}{N(K^0_{true})} \qquad C2 = \frac{N(\chi^2/NDF_{tr1,2}<6)}{N(3hits)}$$

$$C3 = \frac{N(\chi^2_{V0}<2.0)}{N(\chi^2/NDF_{tr1,2}<6)} \qquad C4 = \frac{N(\chi^2_{tr1,2}\, toPV>10)}{N(\chi^2_{V0}<2.0)} \qquad C5 = \frac{N(convergency==1)}{N(\chi^2_{tr1,2}\, toPV>10)}$$

$$C6 = \frac{N(\theta_{coll}<0.03)}{N(convergency==1)} \qquad C7 = \frac{N(Dist>0.7)}{N(\theta_{coll}<0.03)} \qquad C8 = \frac{N(|cos\theta^*|\leqslant 0.7)}{N(Dist>0.7)}$$



Conclusion and TODO

1. Analysis of the K_S^0 reconstruction efficiency was performed. The new cut (helicity angle) is added for selection K_S^0 to suppress background.
2. MC correction was factorized. Included feed down correction in PV.
3. Next step is to include feed down correction outside PV.