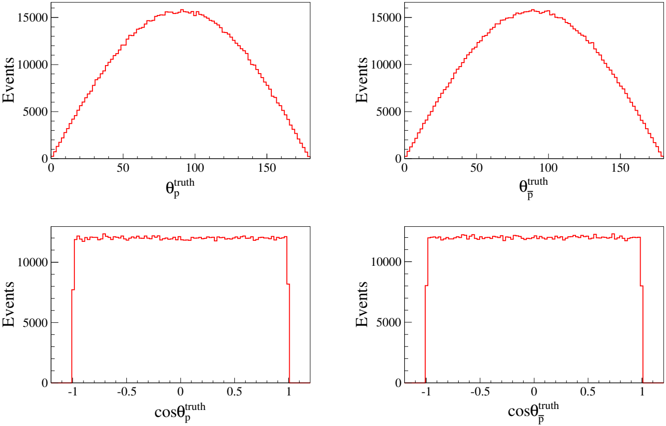
Polarization study of Λ_c: pK_S^0

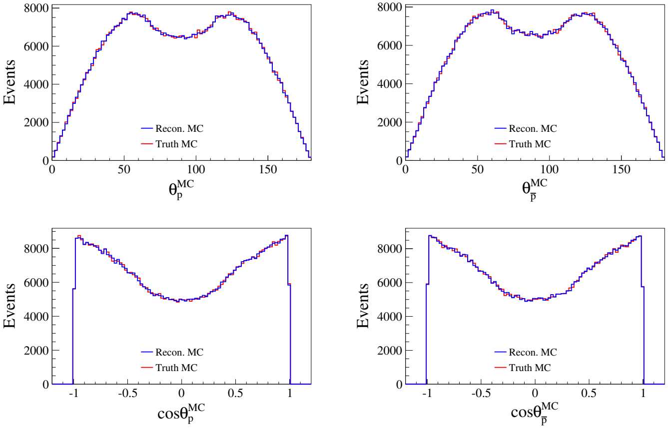
19th, June 2017

MC truth information



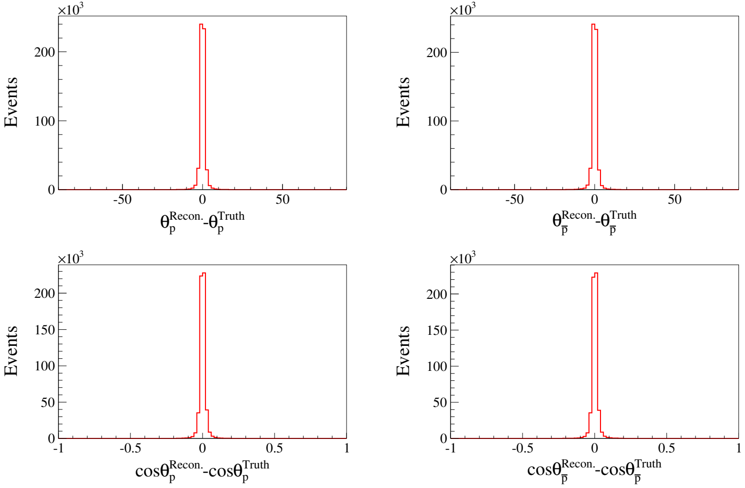
- $e^+e^- \to \Lambda_c^+\bar{\Lambda}_c^-$ simulated with PHSP model.
- $e^+e^- \to \Lambda_c^+\bar{\Lambda}_c^-$, $\Lambda_c^+ \to pK_S^0$, $\bar{\Lambda}_c^- \to$ inclusively: 10^6 events.
- $e^+e^- \to \Lambda_c^+\bar{\Lambda}_c^-$, $\Lambda_c^+ \to$ inclusively, $\bar{\Lambda}_c^- \to \bar{p}K_S^0$: 10^6 events.

Reconstructed information of signal MC



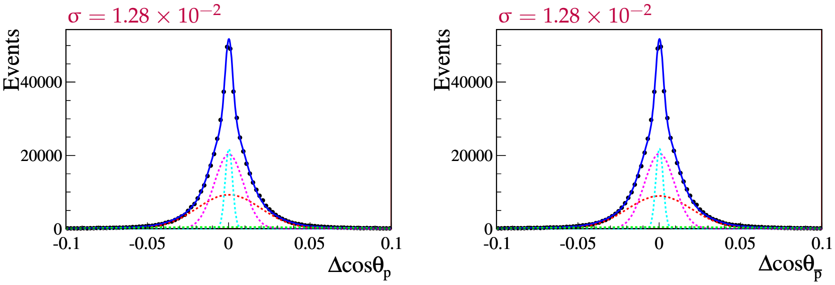
- $M_{K_S^0}^{Inv.} \in (0.478, 0.511)$ GeV/c^2.
- $\Delta E \in$ (-20, 20) MeV.
- $M_{BC} \in (2.276, 2.3)$ GeV/c^2.

Comparing truth and reconstructed MC



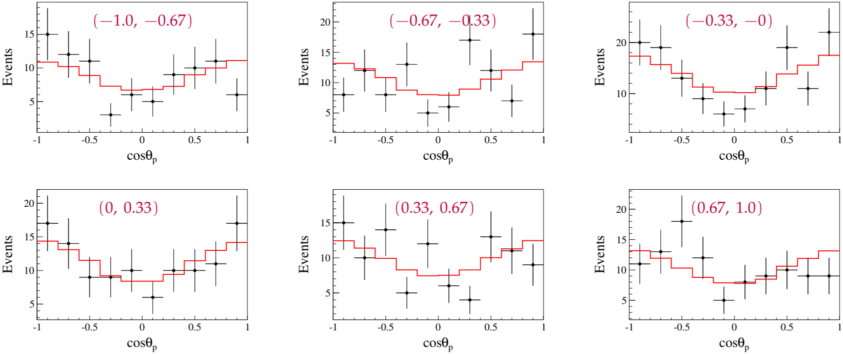
- The distributions are consistent.

Determining the resolution of $\Delta\cos\theta_p$



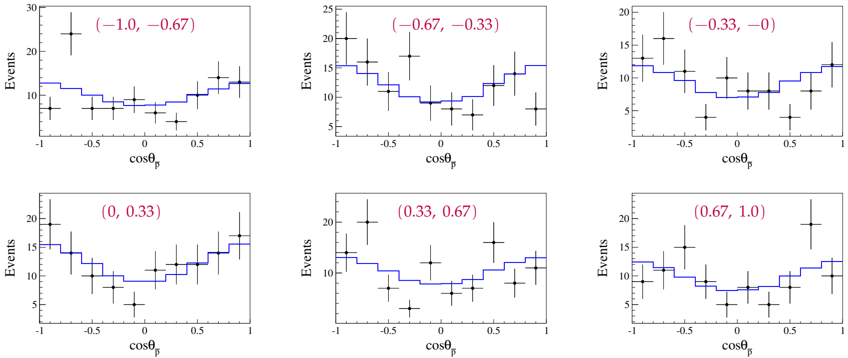
- $\Delta\cos\theta_p = \cos\theta_p^{\text{MCtruth}} - \cos\theta_p^{\text{Recon.}}$.
- Un-binned maximum likelihood fit
- The distributions are fitted by 3-Gaussian functions
- The final resolution is the average with respect to the yields

The $\cos\theta_p^n$ in different $\cos\theta_{\Lambda_c^+}$ bins.



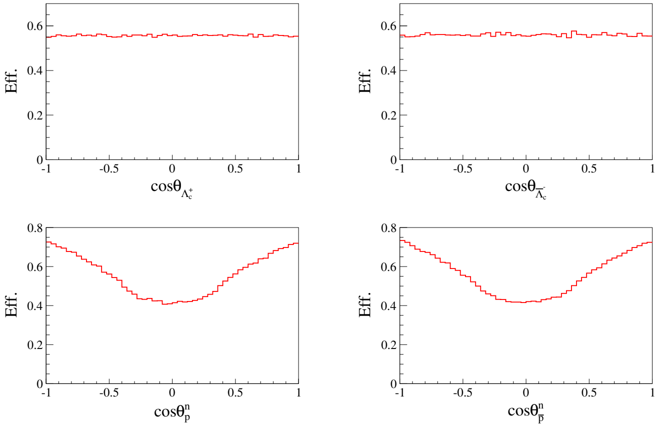
- Divided samples into 6 $\cos\theta_{\Lambda_c^+}$ bins.
- Divided samples into 10 $\cos\theta_p^n$ bins for each $\cos\theta_{\Lambda_c^+}$ bin.
- The MC histogram is scaled based on the ratio of the yields.

The $\cos\theta^n_{\bar{p}}$ in different $\cos\theta_{\bar{\Lambda}_c^-}$ bins.



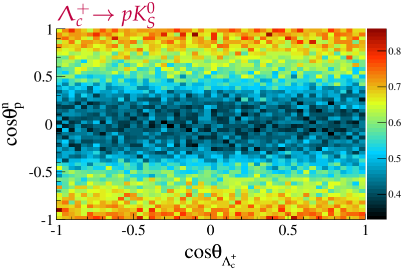
- Divided MC samples into 6 $\cos\theta_{\bar{\Lambda}_c^-}$ bins.
- Divided samples into 10 $\cos\theta^n_{\bar{p}}$ bins for each $\cos\theta_{\bar{\Lambda}_c^-}$ bin.
- The MC histogram is scaled based on the ratio of the yields.

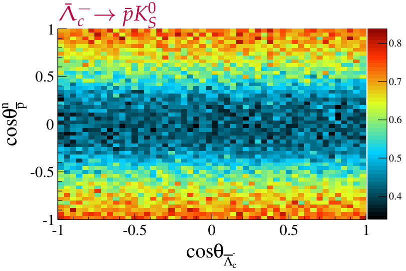
The acceptance w.r.t. $\cos\theta_{\Lambda_c}$ and $\cos\theta_p$



- Divide MC samples into 50 $\cos\theta_{\Lambda_c}$ and 50 $\cos\theta_p$ bins.
- A total of 2×10^6 events are generated
- The acceptance are found to be one-dimmensinal

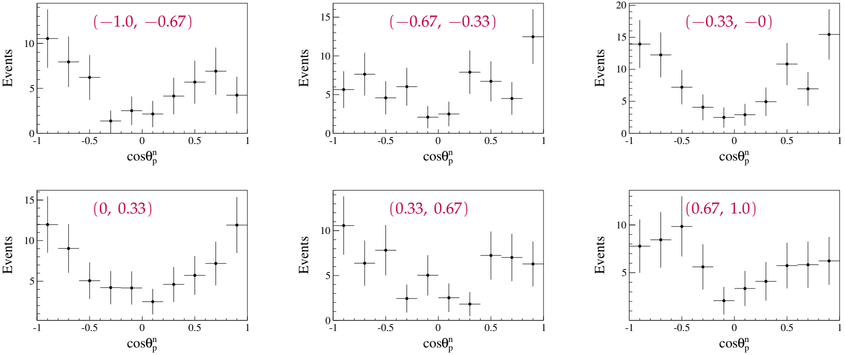
The two-dimensional acceptance matrix





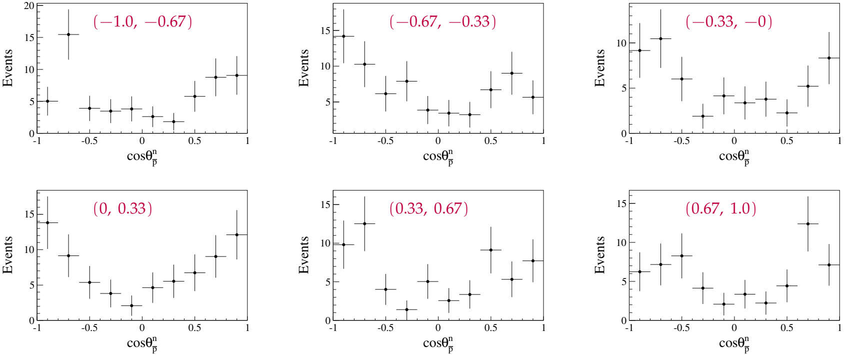
- Divide MC samples into 50×50 bins
- A total of 2×10^6 events are generated

$\cos\theta_\Lambda^n$ in different $\cos\theta_{\Lambda_c^+}$ bins of $\Lambda_c^+ \to pK_S^0$



- Divide data samples into 6 $\cos\theta_{\Lambda_c^+}$ bins.
- Correct data event-by-event with one-dimensional detection efficiency.
- The detection efficiencies are obtained using 10^6 events.

$\cos\theta_{\bar{p}}^n$ in different $\cos\theta_{\bar{\Lambda}_c^-}$ bins of $\bar{\Lambda}_c^- \to \bar{p}K_S^0$



- Divide data samples into 6 $\cos\theta_{\bar{\Lambda}_c^-}$ bins.
- Correct data event-by-event with one-dimensional detection efficiency.
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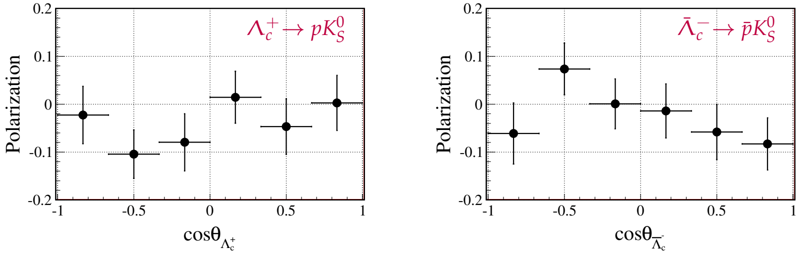
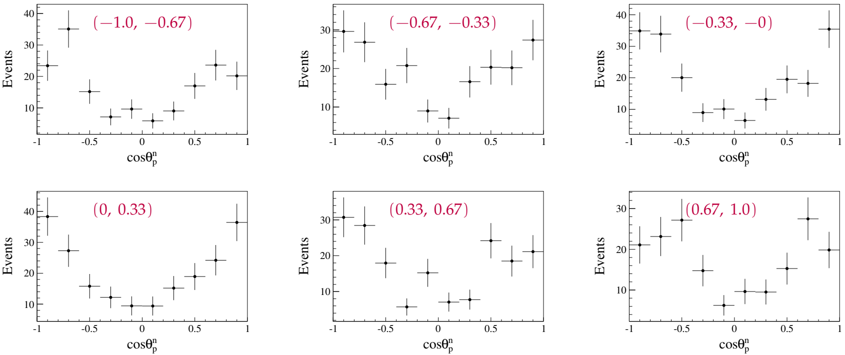
The polarization distributions w.r.t. $\cos\theta_{\Lambda_c}$



- Divide data samples into 6 $\cos\theta_{\bar{\Lambda}_c^-}$ bins
- The vertical axis: Polarization $= 3 \cdot \alpha_{sysm.} \cdot P_n = < \cos\theta_p^n >$
- The error is calculated via $\sigma = \sqrt{\frac{1}{N-1}(< \cos^2\theta_p^n > - < \cos\theta_p^n >^2)}$

$\cos\theta_p^n$ in different $\cos\theta_{\Lambda_c}$ bins of $\Lambda_c^+ \to pK_S^0$



- Charge conjugate sector is combined in MC and data
- Divide data samples into 6 $\cos\theta_{\Lambda_c}$ bins.
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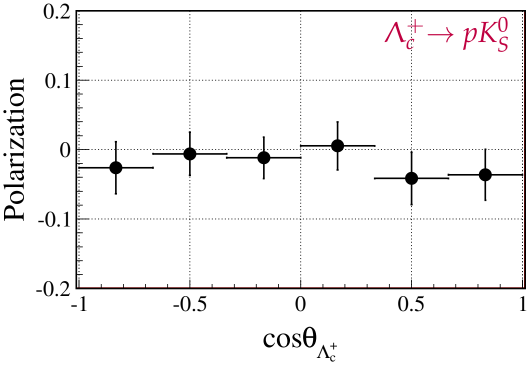

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