DCA $\Lambda(\bar{\Lambda})$

| Pair Type | Centrality | Fit Amplitudes | | | | | |
|---|---|---|---|---|---|---|---|
| | | Amplitude | Error | Sig | Amplitude | Error | Sig |
| | | 4 vs 5 mm | | | 5 vs 6 mm | | |
| $\Lambda K^0_S$ | 0-10% | 2.616e-04 | 2.840e-04 | No | -5.282e-03 | 4.887e-03 | No |
| | 10-30% | -1.236e-03 | 1.568e-03 | No | 6.110e-05 | 1.457e-04 | No |
| | 30-50% | -4.664e-02 | 3.295e-02 | No | -1.877e-01 | 7.037e-02 | Yes |
| $\bar{\Lambda}K^0_S$ | 0-10% | -6.093e-05 | 3.827e-05 | No | -9.599e-02 | 1.133e-01 | No |
| | 10-30% | -3.478e-05 | 1.983e-04 | No | -2.846e-04 | 6.743e-04 | No |
| | 30-50% | -2.054e-02 | 2.609e-02 | No | -3.701e-03 | 3.136e-03 | No |

**Table 1:** $\Lambda(\bar{\Lambda})K^0_S$ Analyses: DCA $\Lambda(\bar{\Lambda})$ caption

DCA $K^0_S$

| Pair Type | Centrality | Fit Amplitudes | | | | | |
|---|---|---|---|---|---|---|---|
| | | Amplitude | Error | Sig | Amplitude | Error | Sig |
| | | 2 vs 3 mm | | | 3 vs 4 mm | | |
| $\Lambda K^0_S$ | 0-10% | -1.149e-04 | 1.616e-04 | No | 1.495e-04 | 3.020e-04 | No |
| | 10-30% | 2.336e-04 | 7.234e-05 | Yes | -2.560e-03 | 2.270e-03 | No |
| | 30-50% | -7.966e-03 | 4.151e-03 | No | -1.721e-02 | 6.245e-03 | Yes |
| $\bar{\Lambda}K^0_S$ | 0-10% | 6.657e-05 | 5.808e-04 | No | 7.037e-05 | 2.753e-05 | Yes |
| | 10-30% | -4.373e-04 | 3.529e-04 | No | -4.653e-04 | 3.627e-04 | No |
| | 30-50% | -2.048e-03 | 1.296e-03 | No | -2.871e-04 | 8.150e-04 | No |

**Table 2:** $\Lambda(\bar{\Lambda})K^0_S$ Analyses: DCA $K^0_S$ caption

## 0.1 Systematic Errors: $\Lambda K^0_S$

### *0.1.1 Particle and Pair Cuts*

The cuts included in the systematic study, as well as the values used in the variations, are listed below. Note, the central value corresponds to that used in the analysis.

1. DCA $\Lambda(\bar{\Lambda})$: {4, 5, 6 mm}
2. DCA $K^0_S$: {2, 3, 4 mm}
3. DCA $\Lambda(\bar{\Lambda})$ Daughters: {3, 4, 5 mm}
4. DCA $K^0_S$ Daughters: {2, 3, 4 mm}
5. $\Lambda(\bar{\Lambda})$ Cosine of Pointing Angle: {0.9992, 0.9993, 0.9994}
6. $K^0_S$ Cosine of Pointing Angle: {0.9992, 0.9993, 0.9994}
7. DCA to Primary Vertex of $p(\bar{p})$ Daughter of $\Lambda(\bar{\Lambda})$: {0.5, 1, 2 mm}
8. DCA to Primary Vertex of $\pi^-(\pi^+)$ Daughter of $\Lambda(\bar{\Lambda})$: {0.5, 1, 2 mm}
9. DCA to Primary Vertex of $\pi^+$ Daughter of $K^0_S$: {2, 3, 4 mm}
10. DCA to Primary Vertex of $\pi^-$ Daughter of $K^0_S$: {2, 3, 4 mm}
11. Average Separation of Like-Charge Daughters: {5, 6, 7 cm}

DCA $\Lambda(\bar{\Lambda})$ Daughters

| Pair Type | Centrality | Fit Amplitudes | | | | | |
|---|---|---|---|---|---|---|---|
| | | Amplitude | Error | Sig | Amplitude | Error | Sig |
| | | 3 vs 4 mm | | | 4 vs 5 mm | | |
| $\Lambda K^0_S$ | 0-10% | 1.743e-05 | 3.776e-05 | No | 1.972e-04 | 2.813e-04 | No |
| | 10-30% | 1.293e-04 | 7.761e-05 | No | -8.925e-05 | 6.165e-05 | No |
| | 30-50% | -8.647e-02 | 9.120e-02 | No | -5.097e-02 | 5.611e-02 | No |
| $\bar{\Lambda}K^0_S$ | 0-10% | -8.539e-06 | 3.914e-05 | No | 5.936e-05 | 3.128e-05 | No |
| | 10-30% | 1.001e-04 | 7.999e-05 | No | -2.452e-04 | 2.952e-04 | No |
| | 30-50% | 4.672e-05 | 1.859e-04 | No | -1.423e-01 | 1.753e-01 | No |

**Table 3:** $\Lambda(\bar{\Lambda})K^0_S$ Analyses: DCA $\Lambda(\bar{\Lambda})$ Daughters

DCA $K^0_S$ Daughters

| Pair Type | Centrality | Fit Amplitudes | | | | | |
|---|---|---|---|---|---|---|---|
| | | Amplitude | Error | Sig | Amplitude | Error | Sig |
| | | 2 vs 3 mm | | | 3 vs 4 mm | | |
| $\Lambda K^0_S$ | 0-10% | -1.383e-03 | 1.201e-03 | No | -2.394e-03 | 2.528e-03 | No |
| | 10-30% | -1.199e-01 | 6.112e-02 | No | -1.673e-03 | 1.620e-03 | No |
| | 30-50% | -1.397e-01 | 5.508e-02 | Yes | -2.249e-03 | 3.303e-03 | No |
| $\bar{\Lambda}K^0_S$ | 0-10% | -3.646e-03 | 2.561e-03 | No | -4.246e-04 | 5.171e-04 | No |
| | 10-30% | 1.800e-04 | 8.734e-05 | Yes | -7.128e-04 | 9.398e-04 | No |
| | 30-50% | -2.813e-02 | 1.883e-02 | No | -1.285e-02 | 9.463e-03 | No |

**Table 4:** $\Lambda(\bar{\Lambda})K^0_S$ Analyses: DCA $K^0_S$ Daughters

$\Lambda(\bar{\Lambda})$ Cosine of Pointing Angle

| Pair Type | Centrality | Fit Amplitudes | | | | | |
|---|---|---|---|---|---|---|---|
| | | Amplitude | Error | Sig | Amplitude | Error | Sig |
| | | 0.9992 vs 0.9993 | | | 0.9993 vs 0.9994 | | |
| $\Lambda K^0_S$ | 0-10% | 4.733e-03 | 2.311e-03 | Yes | -7.459e-05 | 1.768e-04 | No |
| | 10-30% | 5.201e-03 | 2.270e-03 | Yes | -2.253e-05 | 7.593e-05 | No |
| | 30-50% | -6.078e-05 | 6.309e-05 | No | 5.494e-03 | 1.496e-03 | Yes |
| $\bar{\Lambda}K^0_S$ | 0-10% | -2.031e-05 | 8.438e-07 | Yes | -4.978e-05 | 6.433e-05 | No |
| | 10-30% | 3.929e-04 | 2.778e-04 | No | 1.333e-04 | 2.362e-04 | No |
| | 30-50% | 1.770e-03 | 6.120e-04 | Yes | 1.169e-04 | 7.436e-05 | No |

**Table 5:** $\Lambda(\bar{\Lambda})K^0_S$ Analyses: $\Lambda(\bar{\Lambda})$ Cosine of Pointing Angle

$K^0_S$ Cosine of Pointing Angle

| Pair Type | Centrality | Fit Amplitudes | | | | | |
|---|---|---|---|---|---|---|---|
| | | Amplitude | Error | Sig | Amplitude | Error | Sig |
| | | 0.9992 vs 0.9993 | | | 0.9993 vs 0.9994 | | |
| $\Lambda K^0_S$ | 0-10% | -3.282e-04 | 4.102e-04 | No | 7.088e-04 | 3.667e-04 | No |
| | 10-30% | 1.476e-03 | 2.082e-03 | No | 8.069e-03 | 3.961e-03 | Yes |
| | 30-50% | -3.150e-04 | 6.895e-04 | No | 5.057e-03 | 2.639e-03 | No |
| $\bar{\Lambda}K^0_S$ | 0-10% | 5.986e-04 | 4.487e-04 | No | 7.197e-04 | 7.865e-04 | No |
| | 10-30% | 3.562e-03 | 1.378e-03 | Yes | 1.303e-03 | 1.067e-03 | No |
| | 30-50% | 5.878e-02 | 8.703e-02 | No | 1.493e-04 | 1.017e-04 | No |

**Table 6:** $\Lambda(\bar{\Lambda})K^0_S$ Analyses: $K^0_S$ Cosine of Pointing Angle

DCA to Primary Vertex of $p^+(\bar{p}^-)$ Daughter of $\Lambda(\bar{\Lambda})$

| Pair Type | Centrality | Fit Amplitudes | | | | | |
|---|---|---|---|---|---|---|---|
| | | Amplitude | Error | Sig | Amplitude | Error | Sig |
| | | 0.5 vs 1 mm | | | 1 vs 2 mm | | |
| $\Lambda K^0_S$ | 0-10% | 0.000e+00 | 0.000e+00 | No | -2.602e-03 | 2.525e-03 | No |
| | 10-30% | 2.964e-07 | 1.165e-06 | No | 1.702e-04 | 9.110e-05 | No |
| | 30-50% | 0.000e+00 | 0.000e+00 | No | 5.775e-03 | 7.524e-03 | No |
| $\bar{\Lambda}K^0_S$ | 0-10% | 0.000e+00 | 0.000e+00 | No | -2.584e-04 | 4.464e-04 | No |
| | 10-30% | 0.000e+00 | 0.000e+00 | No | -3.469e-04 | 1.403e-04 | Yes |
| | 30-50% | 0.000e+00 | 0.000e+00 | No | -6.689e-04 | 1.232e-03 | No |

**Table 7:** $\Lambda(\bar{\Lambda})K^0_S$ Analyses: DCA to Primary Vertex of $p^+(\bar{p}^-)$ Daughter of $\Lambda(\bar{\Lambda})$

DCA to Primary Vertex of $\pi^-(\pi^+)$ Daughter of $\Lambda(\bar{\Lambda})$

| Pair Type | Centrality | Fit Amplitudes | | | | | |
|---|---|---|---|---|---|---|---|
| | | Amplitude | Error | Sig | Amplitude | Error | Sig |
| | | 2 vs 3 mm | | | 3 vs 4 mm | | |
| $\Lambda K^0_S$ | 0-10% | 3.829e-05 | 1.846e-05 | Yes | -4.781e-05 | 8.826e-05 | No |
| | 10-30% | 1.498e-03 | 2.398e-03 | No | 4.245e+00 | 4.457e+01 | No |
| | 30-50% | 3.751e-03 | 2.567e-03 | No | 6.001e-03 | 4.805e-03 | No |
| $\bar{\Lambda}K^0_S$ | 0-10% | 5.680e-05 | 1.816e-05 | Yes | -3.516e-05 | 2.272e-05 | No |
| | 10-30% | 1.539e-04 | 2.857e-04 | No | -1.311e-04 | 4.871e-05 | Yes |
| | 30-50% | 1.410e-03 | 1.734e-03 | No | 4.401e-02 | 1.349e-02 | Yes |

**Table 8:** $\Lambda(\bar{\Lambda})K^0_S$ Analyses: DCA to Primary Vertex of $\pi^-(\pi^+)$ Daughter of $\Lambda(\bar{\Lambda})$

DCA to Primary Vertex of $\pi^+$ Daughter of $K^0_S$

| Pair Type | Centrality | Fit Amplitudes | | | | | |
|---|---|---|---|---|---|---|---|
| | | Amplitude | Error | Sig | Amplitude | Error | Sig |
| | | 2 vs 3 mm | | | 3 vs 4 mm | | |
| $\Lambda K^0_S$ | 0-10% | -4.519e-05 | 2.636e-05 | No | -8.563e-05 | 3.040e-05 | Yes |
| | 10-30% | -8.408e-03 | 7.107e-03 | No | -4.274e-04 | 9.735e-04 | No |
| | 30-50% | 2.064e-03 | 1.619e-03 | No | 1.274e-03 | 1.270e-03 | No |
| $\bar{\Lambda}K^0_S$ | 0-10% | 8.474e-04 | 1.271e-03 | No | 3.787e-04 | 3.383e-04 | No |
| | 10-30% | -7.583e-05 | 5.660e-05 | No | -7.112e-03 | 1.605e-02 | No |
| | 30-50% | -6.532e-04 | 1.388e-04 | Yes | 3.770e-02 | 1.629e-02 | Yes |

**Table 9:** $\Lambda(\bar{\Lambda})K^0_S$ Analyses: DCA to Primary Vertex of $\pi^+$ Daughter of $K^0_S$

DCA to Primary Vertex of $\pi^-$ Daughter of $K^0_S$

| Pair Type | Centrality | Fit Amplitudes | | | | | |
|---|---|---|---|---|---|---|---|
| | | Amplitude | Error | Sig | Amplitude | Error | Sig |
| | | 2 vs 3 mm | | | 3 vs 4 mm | | |
| $\Lambda K^0_S$ | 0-10% | -3.283e-04 | 4.184e-04 | No | 3.117e-04 | 2.151e-04 | No |
| | 10-30% | -7.208e-07 | 3.153e-04 | No | 2.858e-04 | 6.697e-04 | No |
| | 30-50% | 4.434e-02 | 2.574e-02 | No | 2.761e-04 | 1.565e-04 | No |
| $\bar{\Lambda}K^0_S$ | 0-10% | 8.823e-05 | 2.701e-05 | Yes | 9.286e-02 | 1.113e-01 | No |
| | 10-30% | 1.778e-04 | 5.686e-05 | Yes | 1.343e-03 | 1.986e-03 | No |
| | 30-50% | 1.449e-04 | 1.368e-04 | No | -1.887e-04 | 1.605e-04 | No |

**Table 10:** $\Lambda(\bar{\Lambda})K^0_S$ Analyses: DCA to Primary Vertex of $\pi^-$ Daughter of $K^0_S$

Avgerage Separation of Like-Charge Daughters

| Pair Type | Daughters | | Centrality | Fit Amplitude | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Amplitude | Error | Sig | Amplitude | Error | Sig |
| | | | | 5.0 vs 6.0 cm | | | 6.0 vs 7.0 cm | | |
| $\Lambda K^0_S$ | p($\Lambda$) | $\pi^+(K^0_S)$ | 0-10% | 1.665e-05 | 2.087e-06 | Yes | 2.653e-04 | 1.739e-04 | No |
| | | | 10-30% | 2.331e-05 | 4.563e-05 | No | -1.713e-05 | 6.046e-06 | Yes |
| | | | 30-50% | 4.333e-04 | 1.155e-04 | Yes | 7.198e-04 | 1.244e-04 | Yes |
| $\Lambda K^0_S$ | $\pi^-(\Lambda)$ | $\pi^-(K^0_S)$ | 0-10% | 7.361e-06 | 2.047e-06 | Yes | -2.548e-05 | 2.467e-05 | No |
| | | | 10-30% | 4.421e-05 | 3.105e-05 | No | 7.315e-04 | 1.322e-04 | Yes |
| | | | 30-50% | 6.366e-05 | 5.813e-05 | No | 1.154e-04 | 8.695e-06 | Yes |
| $\bar{\Lambda}K^0_S$ | $\pi^+(\bar{\Lambda})$ | $\pi^+(K^0_S)$ | 0-10% | 8.888e-04 | 2.082e-04 | Yes | -5.316e-06 | 3.826e-05 | No |
| | | | 10-30% | 9.162e-04 | 2.614e-04 | Yes | 1.925e-05 | 6.041e-05 | No |
| | | | 30-50% | 1.478e-04 | 4.676e-05 | Yes | 9.973e-05 | 6.549e-05 | No |
| $\bar{\Lambda}K^0_S$ | $\bar{p}^-(\bar{\Lambda})$ | $\pi^-(K^0_S)$ | 0-10% | 1.730e-04 | 1.161e-04 | No | -2.798e-05 | 4.725e-05 | No |
| | | | 10-30% | 1.579e-05 | 5.734e-05 | No | -3.884e-07 | 6.028e-06 | No |
| | | | 30-50% | 1.074e-04 | 3.781e-05 | Yes | 4.932e-04 | 2.440e-04 | Yes |

**Table 11:** $\Lambda(\bar{\Lambda})K^0_S$ Analyses: Avgerage Separation of Positive Daughters

#### *0.1.2 Non-Flat Background*

#### *0.1.3 Fit Range*

#### *0.1.4 Normalization Range*

#### *0.1.5 Momentum Resolution Correction*