0.0.1 Results: ΛK_S^0 and $\Lambda K^\pm$: 10 Residual Correlations Included in Fit

Figure 1 nicely collects and summarizes all of our extracted fit parameters for the case of 10 included residual contributors. Figure 2 presents our extracted fit radii, along with those of other systems previously analyzed by ALICE [?], as a function of pair transverse mass (m_T). Figures 3, 4, and 5 show the experimental correlation functions with fits, assuming 10 residual contributors, for all studied centralities for ΛK_S^0 with $\bar{\Lambda} K_S^0$, ΛK^+ with $\bar{\Lambda} K^-$, and ΛK^- with $\bar{\Lambda} K^+$, respectively. The parameter sets extracted from the fits can be found in Tables 1 and 2.
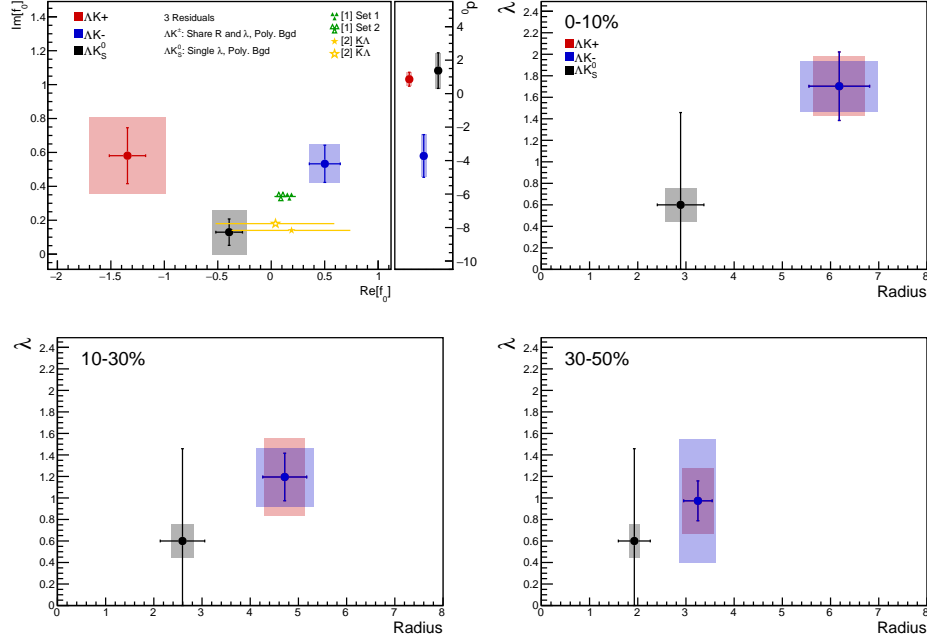

Fig. 1: Extracted scattering parameters for the case of 10 residual contributors for all of our ΛK systems. [Top Left]: $\mathbb{I} f_0$ vs. $\mathbb{R} f_0$, together with d_0 to the right. [Top Right (Bottom Left, Bottom Right)]: λ vs. Radius for the 0-10% (10-30%, 30-50%) bin. The green [?] and yellow [?] points show theoretical predictions made using chiral perturbation theory.
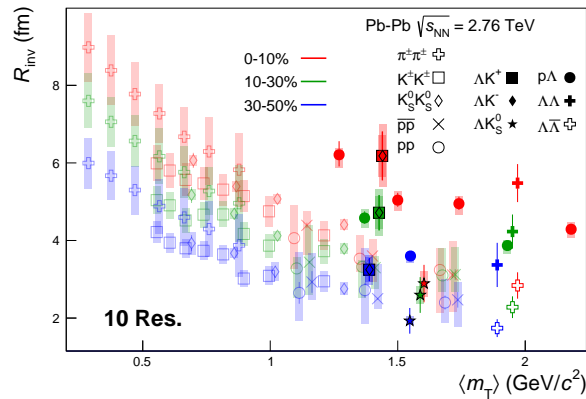

Fig. 2: 10 residual correlations in ΛK fits. Extracted fit R_{inv} parameters as a function of pair transverse mass (m_T) for various pair systems over several centralities. The ALICE published data [?] is shown with transparent, open symbols. The new ΛK results are shown with opaque, filled symbols. In the left, the ΛK^+ (with it's conjugate pair) results are shown separately from the ΛK^- (with it's conjugate pair) results. In the right, all $\Lambda K^\pm$ results are averaged.
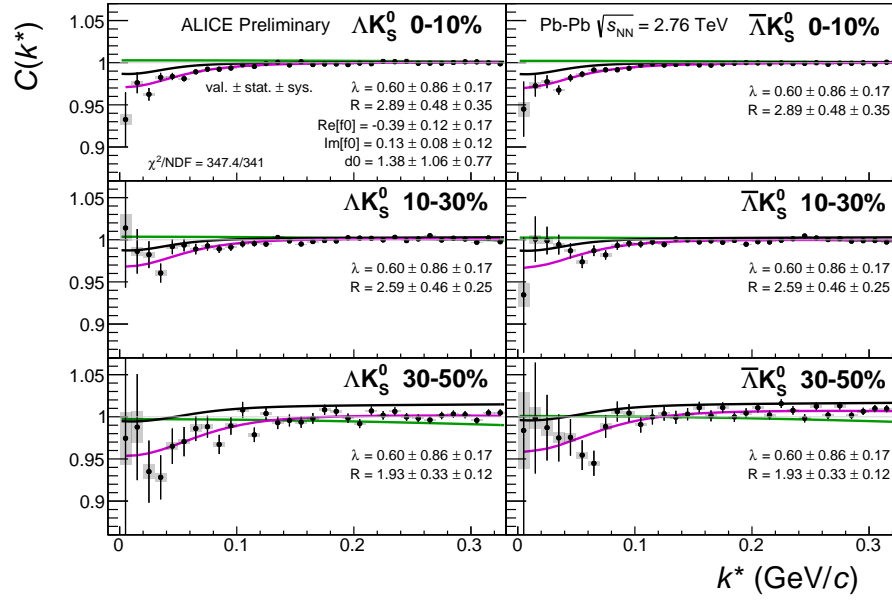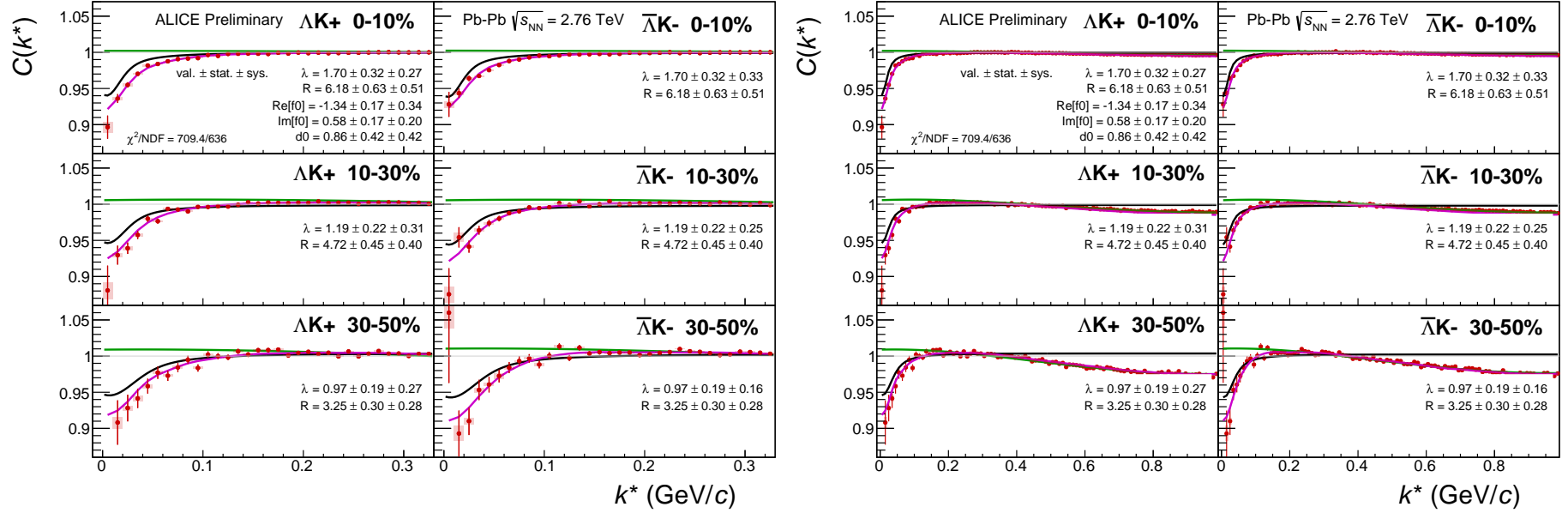
(a) Signal region view ($k^* \lesssim 0.3$ GeV/c)
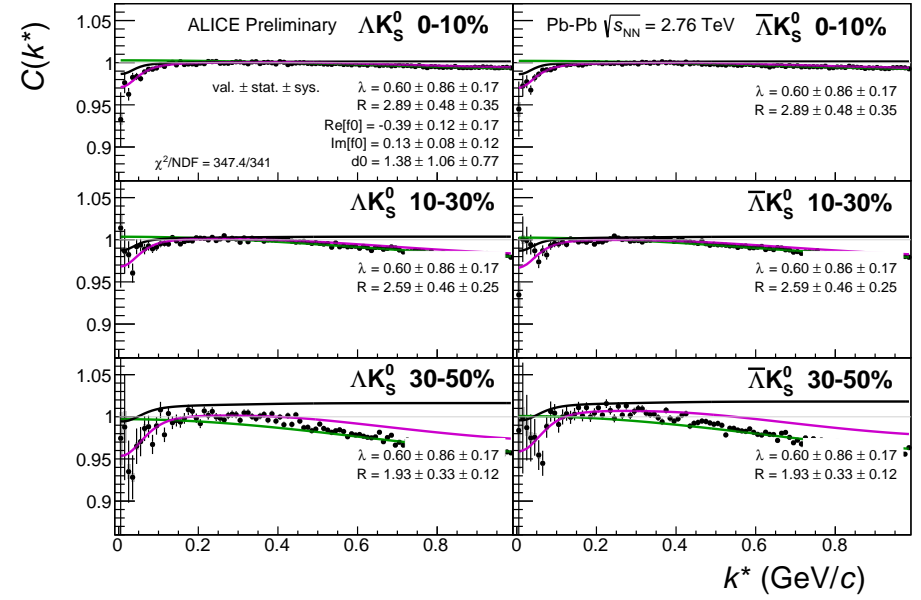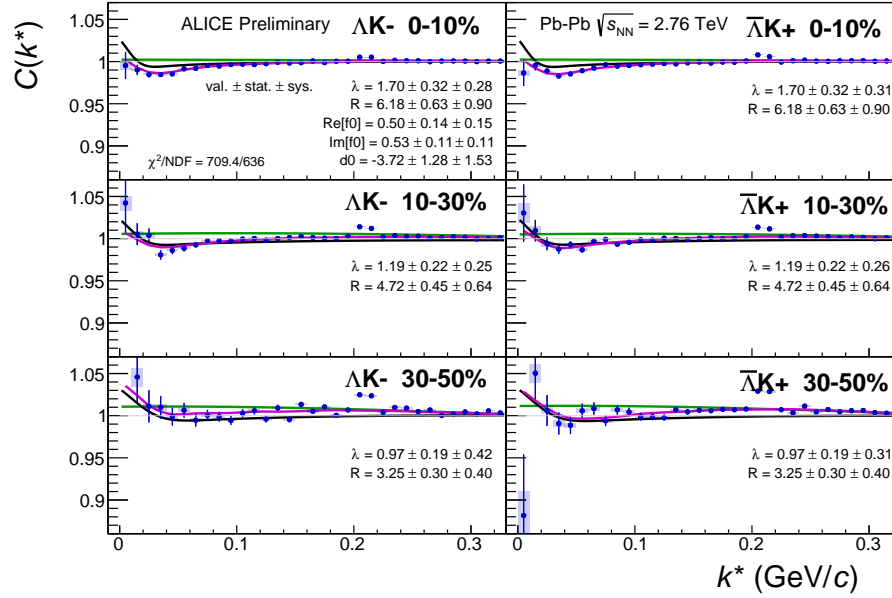
(b) Wide view ($k^* \lesssim 1.0$ GeV/c)

Fig. 3: Fits, with 10 residual correlations included, to the ΛK_S^0 (left) and $\bar{\Lambda} K_S^0$ (right) data for the centralities 0-10% (top), 10-30% (middle), and 30-50% (bottom). The lines represent the statistical errors, while the boxes represent the systematic errors. A single λ parameter is shared amongst all. Each analysis has a unique normalization parameter. The radii are shared between analyses of like centrality, as these should have similar source sizes. The scattering parameters ($\mathbb{R}f_0$, $\mathbb{I}f_0$, d_0) are shared amongst all. The background is modeled by a (6th-)degree polynomial fit to THERMINATOR simulation. The black solid line represents the primary (ΛK) correlation's contribution to the fit. The green line shows the fit to the non-flat background. The purple points show the fit after all residuals' contributions have been included, and momentum resolution and non-flat background corrections have been applied. The extracted fit values with uncertainties are printed.

(a) Signal region view ($k^* \lesssim 0.3$ GeV/c)

(b) Wide view ($k^* \lesssim 1.0$ GeV/c)

Fig. 4: Fits, with 10 residual correlations included, to the ΛK^+ (left) and $\bar{\Lambda}K^-$ (right) data for the centralities 0-10% (top), 10-30% (middle), and 30-50% (bottom). The lines represent the statistical errors, while the boxes represent the systematic errors. All $\Lambda K^\pm$ analyses are fit simultaneously across all centralities (0-10%, 10-30%, 30-50%). Scattering parameters ($\mathbb{R}f_0, \mathbb{I}f_0, d_0$) are shared between pair-conjugate systems (i.e. a parameter set describing the ΛK^+ & $\bar{\Lambda}K^-$ system, and a separate set describing the ΛK^- & $\bar{\Lambda}K^+$ system). For each centrality, a radius and λ parameters are shared between all pairs ($\Lambda K^+, \bar{\Lambda}K^-, \Lambda K^-, \bar{\Lambda}K^+$). Each analysis has a unique normalization parameter. The background is modeled by a (6th-)degree polynomial fit to THERMINATOR simulation. The black solid line represents the primary (ΛK) correlation's contribution to the fit. The green line shows the fit to the non-flat background. The purple points show the fit after all residuals' contributions have been included, and momentum resolution and non-flat background corrections have been applied. The extracted fit values with uncertainties are printed.
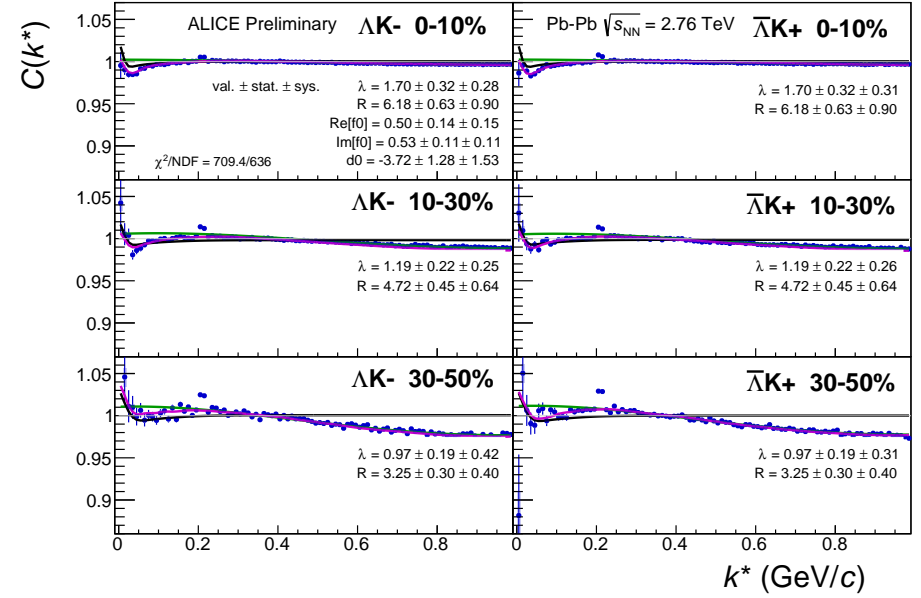
(a) Signal region view ($k^* \lesssim 0.3$ GeV/c)

(b) Wide view ($k^* \lesssim 1.0$ GeV/c)

Fig. 5: Fits, with 10 residual correlations included, to the ΛK^-(left) with $\bar{\Lambda}K^+$ (right) data for the centralities 0-10% (top), 10-30% (middle), and 30-50% (bottom). The lines represent the statistical errors, while the boxes represent the systematic errors. All $\Lambda K^\pm$ analyses are fit simultaneously across all centralities (0-10%, 10-30%, 30-50%). Scattering parameters ($\mathbb{R}f_0$, $\mathbb{I}f_0$, d_0) are shared between pair-conjugate systems (i.e. a parameter set describing the ΛK^+ & $\bar{\Lambda}K^-$ system, and a separate set describing the ΛK^- & $\bar{\Lambda}K^+$ system). For each centrality, a radius and λ parameters are shared between all pairs (ΛK^+, $\bar{\Lambda}K^-$, ΛK^-, $\bar{\Lambda}K^+$). Each analysis has a unique normalization parameter. The background is modeled by a (6$^{\text{th}}$-)degree polynomial fit to THERMINATOR simulation. The black solid line represents the primary (ΛK) correlation's contribution to the fit. The green line shows the fit to the non-flat background. The purple points show the fit after all residuals' contributions have been included, and momentum resolution and non-flat background corrections have been applied. The extracted fit values with uncertainties are printed.
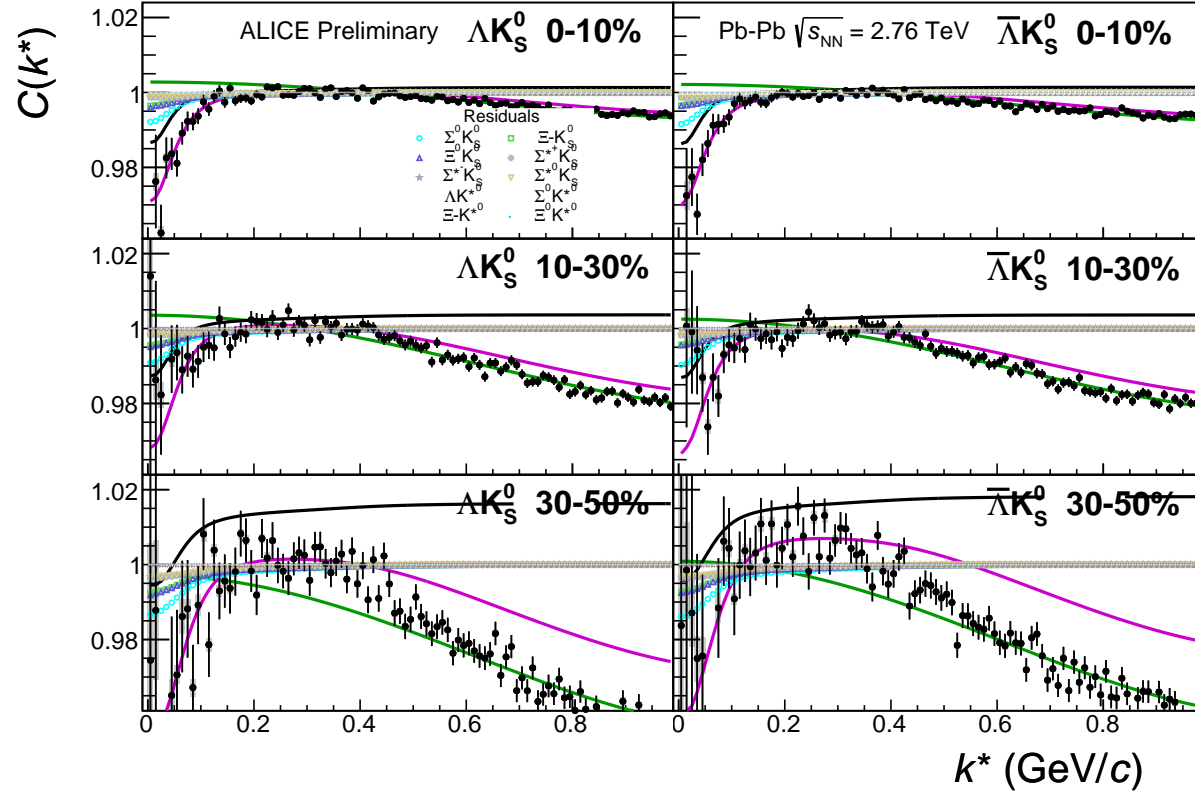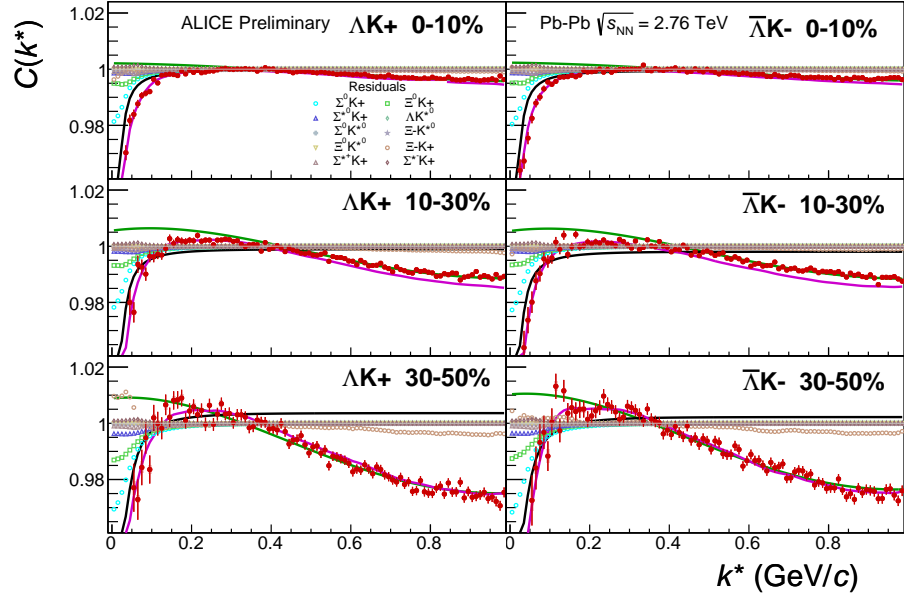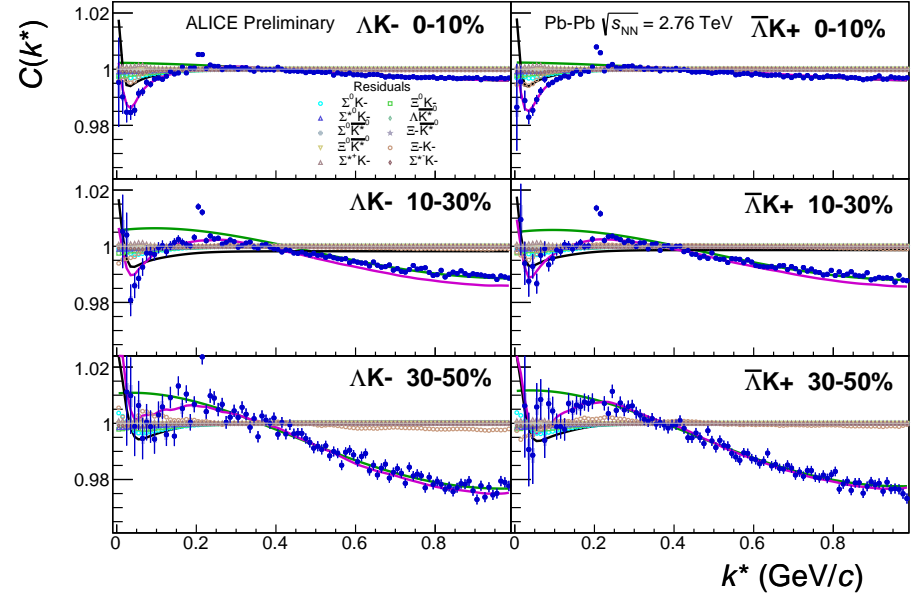
Fig. 6: Fits, with 10 residual correlations included and shown, to the ΛK_S^0 (left) and $\bar{\Lambda} K_S^0$ (right) data for the centralities 0-10% (top), 10-30% (middle), and 30-50% (bottom). The ten parent pairs used for the residual correction to the ΛK_S^0 ($\bar{\Lambda} K_S^0$) fit are $\Sigma^0 K_S^0$, $\Xi^0 K_S^0$, $\Xi^- K_S^0$, $\Sigma^{*(+,-,0)} K_S^0$, ΛK^{*0}, $\Sigma^0 K^{*0}$, $\Xi^0 K^{*0}$, and $\Xi^- K^{*0}$ ($\bar{\Sigma}^0 K_S^0$, $\bar{\Xi}^0 K_S^0$, $\bar{\Xi}^+ K_S^0$, $\bar{\Sigma}^{*(+,-,0)} K_S^0$, $\bar{\Lambda} \bar{K}^{*0}$, $\bar{\Sigma}^0 \bar{K}^{*0}$, $\bar{\Xi}^0 \bar{K}^{*0}$, and $\bar{\Xi}^+ \bar{K}^{*0}$).

(a) $\Lambda K^+(\bar{\Lambda}K^-)$ fits with residual contributions shown for the centralities 0-10% (top), 10-30% (middle), and 30-50% (bottom)

(b) $\Lambda K^-(\bar{\Lambda}K^+)$ fits with residual contributions shown for the centralities 0-10% (top), 10-30% (middle), and 30-50% (bottom)

Fig. 7: Fits, with 10 residual correlations included and shown, to the ΛK^+ & $\bar{\Lambda}K^-$ (left) and ΛK^- & $\bar{\Lambda}K^+$ (right) data for the centralities 0-10% (top), 10-30% (middle), and 30-50% (bottom). The ten parent pairs used for the residual correction to the ΛK^+ ($\bar{\Lambda}K^-$) fit are $\Sigma^0 K^+$, $\Xi^0 K^+$, $\Xi^- K^+$, $\Sigma^{*(+,-,0)}K^+$, ΛK^{*0}, $\Sigma^0 K^{*0}$, $\Xi^0 K^{*0}$, and $\Xi^- K^{*0}$ ($\bar{\Sigma}^0 K^-$, $\bar{\Xi}^0 K^-$, $\bar{\Xi}^+ K^-$, $\bar{\Sigma}^{*(+,-,0)}K^-$, $\bar{\Lambda}\bar{K}^{*0}$, $\bar{\Sigma}^0\bar{K}^{*0}$, $\bar{\Xi}^0\bar{K}^{*0}$, and $\bar{\Xi}^+\bar{K}^{*0}$).

Fit Results $\Lambda(\bar{\Lambda})K_S^0$

System	Centrality	Fit Parameters				
		λ	R	$\mathbb{R}f_0$	$\mathbb{I}f_0$	d_0
ΛK_S^0 & $\bar{\Lambda}K_S^0$	0-10%		2.89 ± 0.48 (stat.) ± 0.33 (sys.)			
	10-30%	0.60 ± 0.86 (stat.) ± 0.16 (sys.)	2.59 ± 0.46 (stat.) ± 0.23 (sys.)	-0.39 ± 0.12 (stat.) ± 0.16 (sys.)	0.13 ± 0.08 (stat.) ± 0.13 (sys.)	1.38 ± 1.06 (stat.) ± 0.62 (sys.)
	30-50%		1.93 ± 0.33 (stat.) ± 0.11 (sys.)			

Table 1: Fit Results $\Lambda(\bar{\Lambda})K_S^0$, with 10 residual correlations included. Each pair is fit simultaneously with its conjugate (ie. ΛK_S^0 with $\bar{\Lambda}K_S^0$) across all centralities (0-10%, 10-30%, 30-50%), for a total of 6 simultaneous analyses in the fit. A single λ parameter is shared amongst all. Each analysis has a unique normalization parameter. The radii are shared between analyses of like centrality, as these should have similar source sizes. The scattering parameters ($\mathbb{R}f_0$, $\mathbb{I}f_0$, d_0) are shared amongst all. The background is modeled by a (6$^{\text{th}}$-)degree polynomial fit to THERMINATOR simulation. The fit is done on the data with only statistical error bars. The errors marked as "stat." are those returned by MINUIT. The errors marked as "sys." are those which result from my systematic analysis (as outlined in Section **??**).

Fit Results $\Lambda(\bar{\Lambda})K^\pm$

System	Centrality	Fit Parameters				
		λ	R	$\mathbb{R}f_0$	$\mathbb{I}f_0$	d_0
ΛK^+ & $\bar{\Lambda}K^-$	0-10%	1.70 ± 0.32 (stat.) ± 0.28 (sys.)	6.18 ± 0.63 (stat.) ± 0.54 (sys.)	-1.34 ± 0.17 (stat.) ± 0.36 (sys.)	0.58 ± 0.17 (stat.) ± 0.23 (sys.)	0.86 ± 0.42 (stat.) ± 0.53 (sys.)
	10-30%	1.19 ± 0.22 (stat.) ± 0.36 (sys.)	4.72 ± 0.45 (stat.) ± 0.42 (sys.)			
ΛK^+ & $\bar{\Lambda}K^-$	30-50%	0.97 ± 0.19 (stat.) ± 0.31 (sys.)	3.25 ± 0.30 (stat.) ± 0.32 (sys.)	0.50 ± 0.14 (stat.) ± 0.14 (sys.)	0.53 ± 0.11 (stat.) ± 0.11 (sys.)	-3.72 ± 1.28 (stat.) ± 1.33 (sys.)

Table 2: Fit Results $\Lambda(\bar{\Lambda})K^\pm$, with 10 residual correlations included. All $\Lambda K^\pm$ analyses are fit simultaneously across all centralities (0-10%, 10-30%, 30-50%). Scattering parameters ($\mathbb{R}f_0$, $\mathbb{I}f_0$, d_0) are shared between pair-conjugate systems (i.e. a parameter set describing the ΛK^+ & $\bar{\Lambda}K^-$ system, and a separate set describing the ΛK^- & $\bar{\Lambda}K^+$ system). For each centrality, a radius and λ parameters are shared between all pairs (ΛK^+, $\bar{\Lambda}K^-$, ΛK^-, $\bar{\Lambda}K^+$). Each analysis has a unique normalization parameter. The background is modeled by a (6$^{\text{th}}$-)degree polynomial fit to THERMINATOR simulation. The fit is done on the data with only statistical error bars. The errors marked as "stat." are those returned by MINUIT. The errors marked as "sys." are those which result from my systematic analysis (as outlined in Section **??**).