ΛK Femtoscopy in Pb-Pb collisions at 2.76 TeV

λ parameters

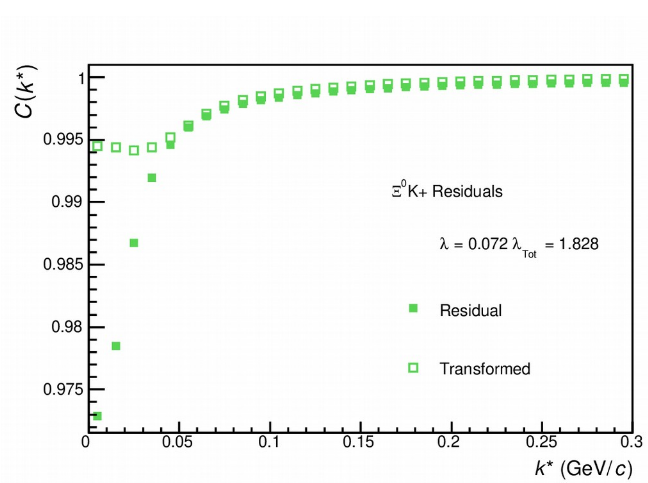
Residual Correlations

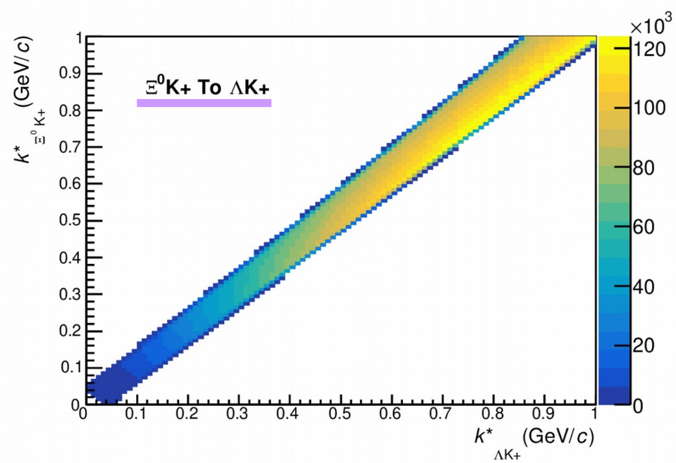
- Not all particles in pairs are primary
- Measured CF is combination of primary signal and transformed residuals
- λ parameters control strength of contribution

- Modeling parent CF
  - Assume same source size and scattering parameters as primary (daughter) system
  - Ξ-K data
  - Coulomb-only simulation

$$\begin{aligned}
C_{\text{measured}}(k^*_{\Lambda\mathrm{K}}) &= \mathcal{N}\left(1+\lambda'_{\Lambda\mathrm{K}}[C_{\Lambda\mathrm{K}}(k^*_{\Lambda\mathrm{K}})-1]+\sum_{i,j}\lambda'_{ij}[C_{ij}(k^*_{\Lambda\mathrm{K}})-1]\right)\\
\lambda'_{ij} &= \lambda_{\text{Fit}}\lambda_{ij}\\
\sum_{i,j}\lambda'_{ij} &= \lambda_{\text{Fit}}\sum_{i,j}\lambda_{ij}=\lambda_{\text{Fit}}
\end{aligned}$$

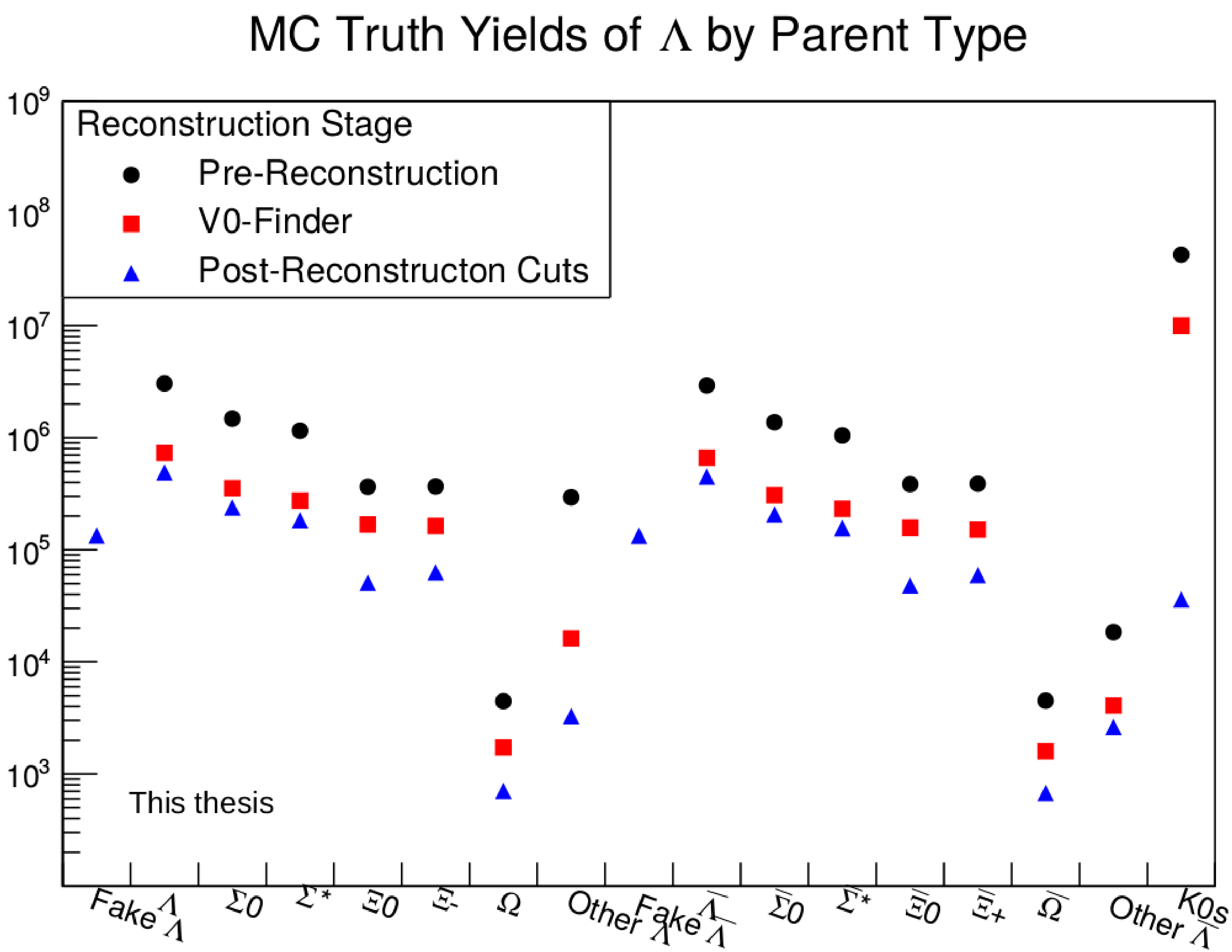
$$C_{ij}(k^*_{\Lambda\mathrm{K}}) \equiv \frac{\sum_{k^*_{ij}} C_{ij}\left(k^*_{ij}\right) T\left(k^*_{ij},k^*_{\Lambda\mathrm{K}}\right)}{\sum_{k^*_{ij}} T\left(k^*_{ij},k^*_{\Lambda\mathrm{K}}\right)}$$





Pair System	λ-factor
ΛK+	0.154
Σ^0K+	0.099
Ξ^0K+	0.072
Ξ-K+	0.069
Other	0.558
Fakes	0.048

Jai's Rec. Efficiency



Effect of Efficiency

- Previously, assumed reconstruction efficiency (R) was equal for all contributors
  - Good approximation EXCEPT possibly for “Other” category
    - Confusing results in Jai’s thesis
    - Currently, trying to reproduce myself

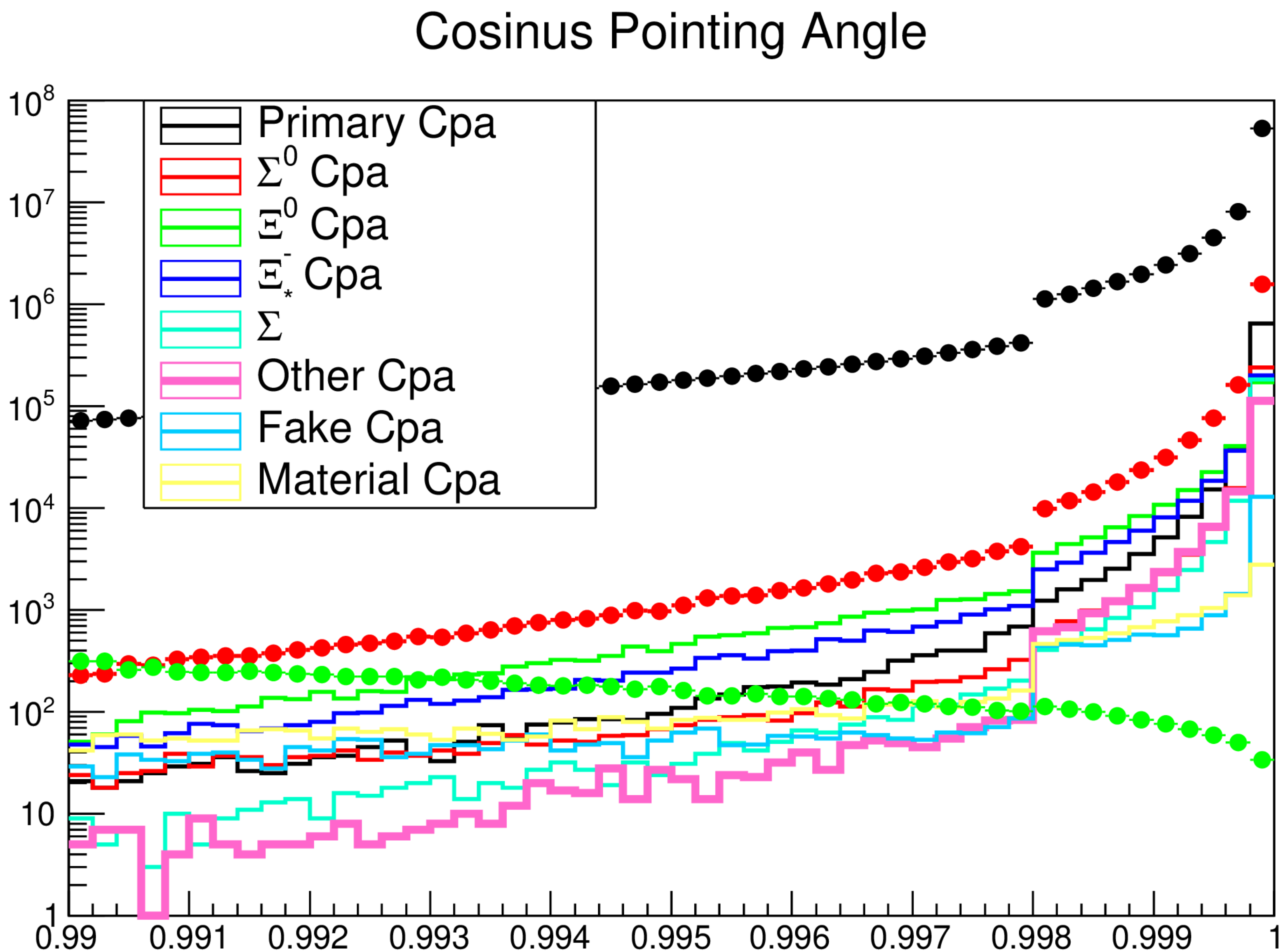
$$\lambda_{AB} = \frac{N_{AB}}{N_{Tot}} = \frac{N_{THERM,AB} \cdot R_{AB}}{\sum N_{THERM,AB} \cdot R_{AB}}$$

- IF “Other Λ” from previous slide is correct
  - R_{other} is an order of magnitude smaller than all other contributors
  - This would effectively increase the λ parameters of all other contributors, while reducing that of “Other”
  - L_{fit} (i.e. scale factor) naturally decreases
  - All other parameters remain approximately the same
- IF “Other $\bar{\Lambda}$” from previous slide is correct
  - Method previously used, assuming equal reconstruction efficiencies, is mostly correct

Pair System	λ-factor	λ-factor
ΛK+	0.154	0.371
Σ^0K+	0.099	0.239
Ξ^0K+	0.072	0.107
Ξ-K+	0.069	0.145
Other	0.558	0.090
Fakes	0.048	0.048

- Is it possible reconstruction efficiency for “Other Λ” vs “Other $\bar{\Lambda}$” differ by order of magnitude?
  - Probably not...

My CPA for Λ



Cosinus Pointing Angle
Primary Cpa
Σ^0 Cpa
Ξ^0 Cpa
Ξ^-_* Cpa
Σ
Other Cpa
Fake Cpa
Material Cpa
10^8
10^7
10^6
10^5
10^4
10^3
10^2
10
1
0.99
0.991
0.992
0.993
0.994
0.995
0.996
0.997
0.998
0.999
1

Laura's CPA for Λ

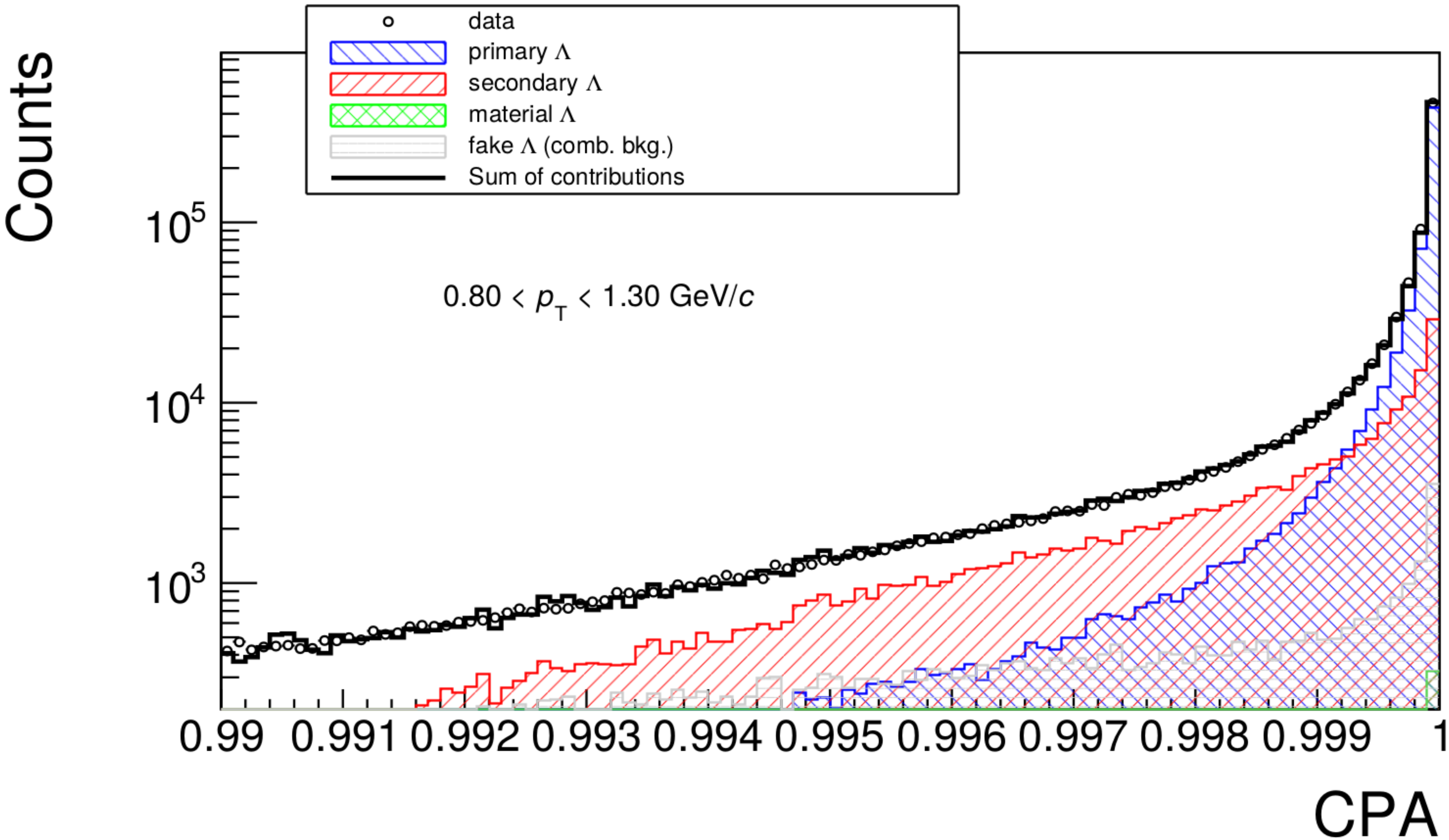
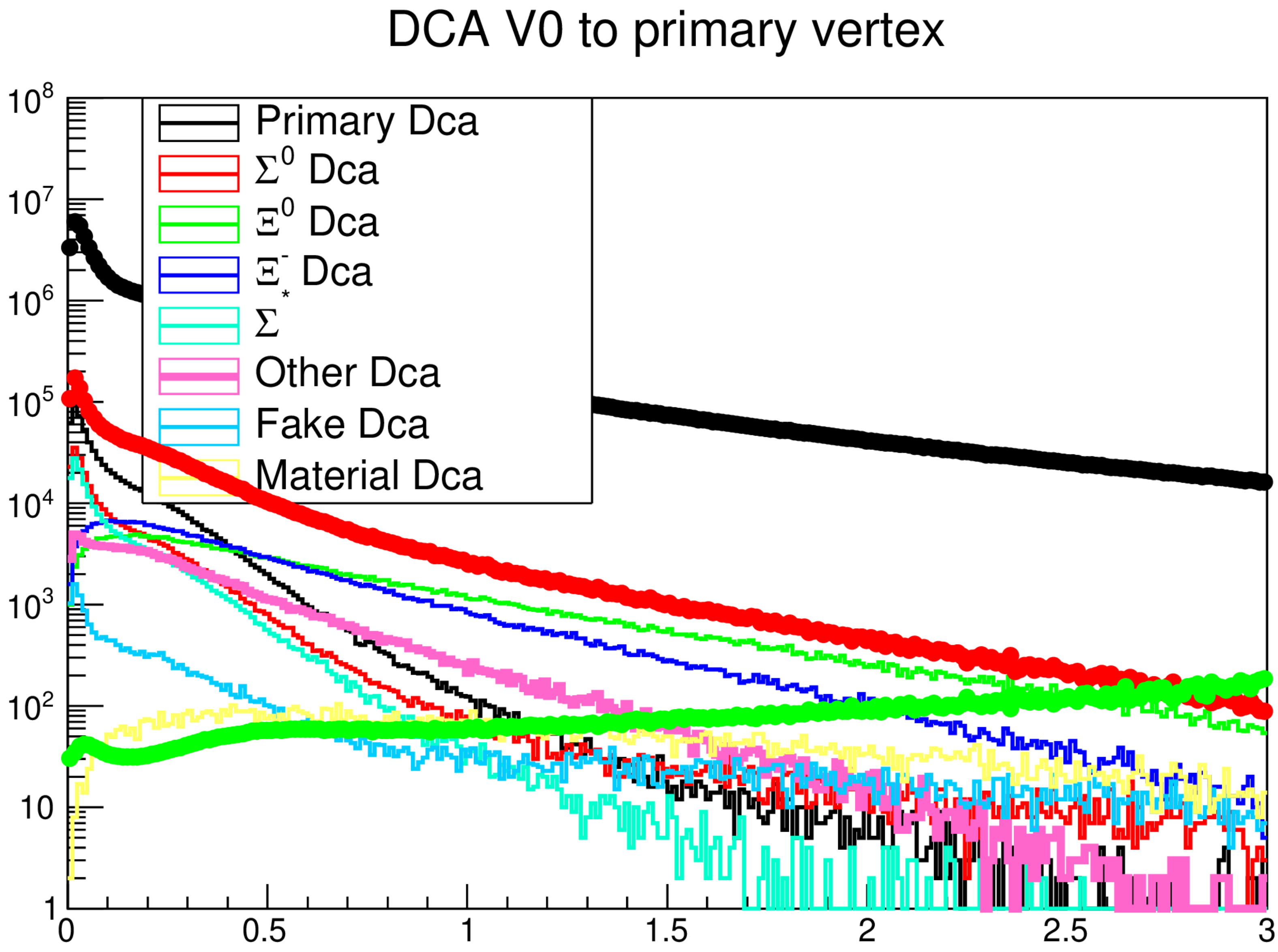


Fig. 30: Template fit to the cosine pointing angle in a p_T interval.

My DCA for Λ


DCA V0 to primary vertex
Primary Dca
Σ0 Dca
Ξ0 Dca
Ξ- Dca
Σ*
Other Dca
Fake Dca
Material Dca
10^8
10^7
10^6
10^5
10^4
10^3
10^2
10
1
0
0.5
1
1.5
2
2.5
3

Laura's DCA for p

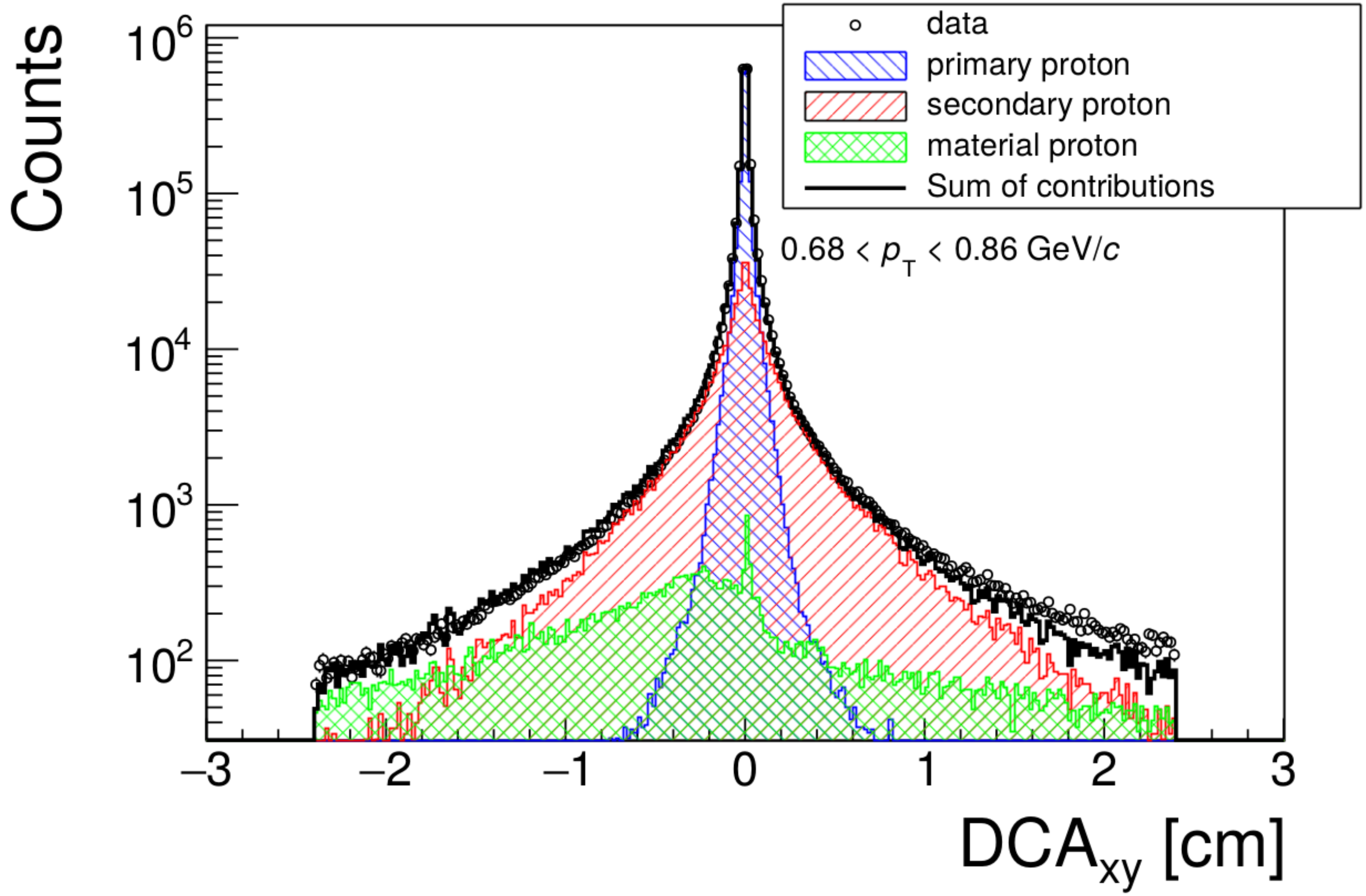


Fig. 26: Adjusted Monte Carlo Templates from Pythia to the experimental data. Due to the shape of the templates one has a good discrimination of the origin of the protons.

λ Parameters

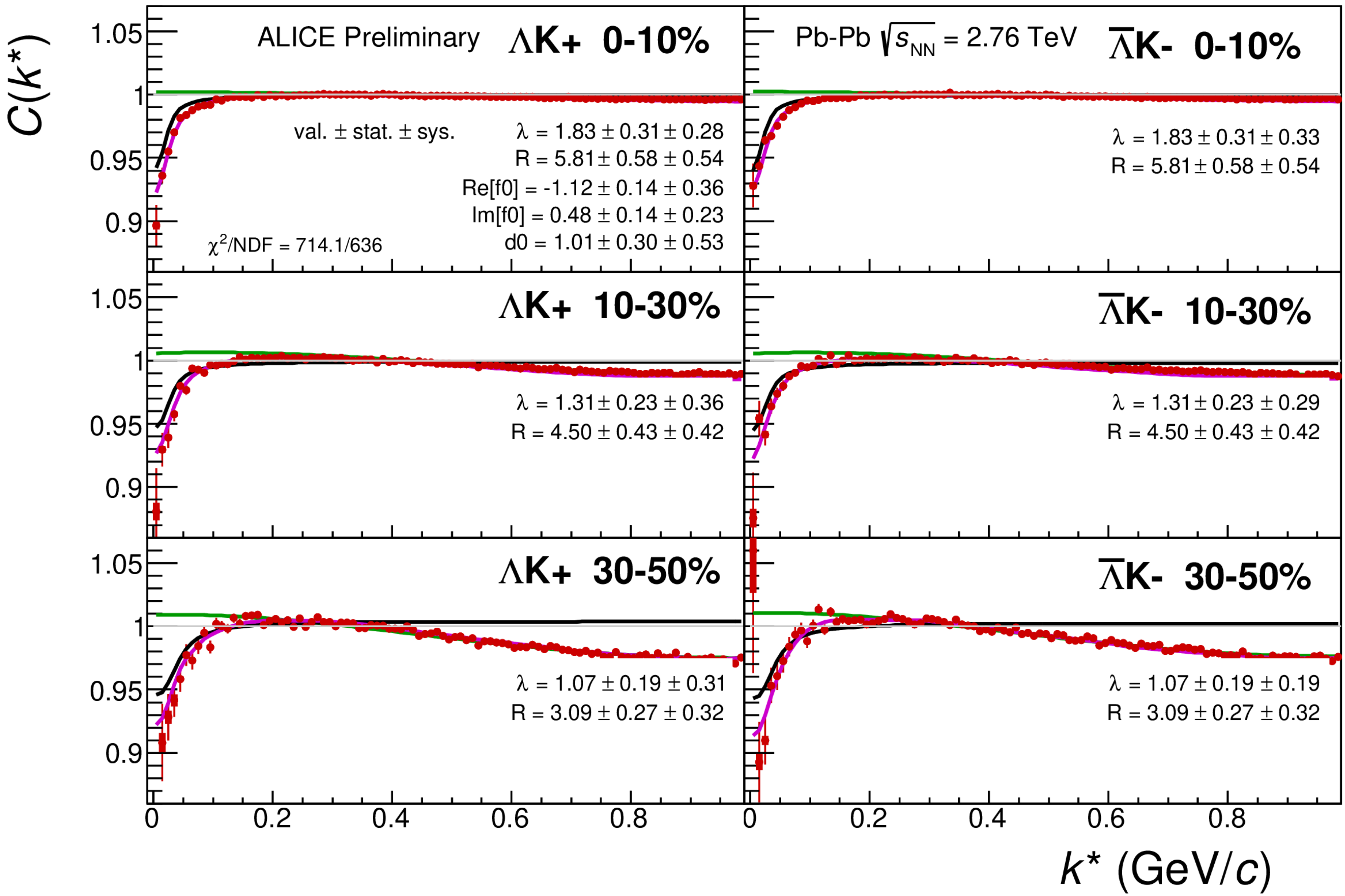
- Λ values for the components of ΛK+, assuming various maximum values of $c\tau$ for parent systems to be considered primary
- Initially, used D.C.$_{max}$ = 5 fm
  - Probably not best, as this splits Σ^{*1385}($c\tau$ = 5.33 fm) and K^{*892}($c\tau$ = 4.11 fm)
- Suggested I use D.C.$_{max}$ = 4 fm
  - For better “apples-to-apples” comparison of 3 residuals vs 10 residuals
- Should probably use, at least D.C.$_{max}$ = 6 fm, so both Σ* and K* considered “Primary” when using only 3 residuals

ΛK^+ Residuals

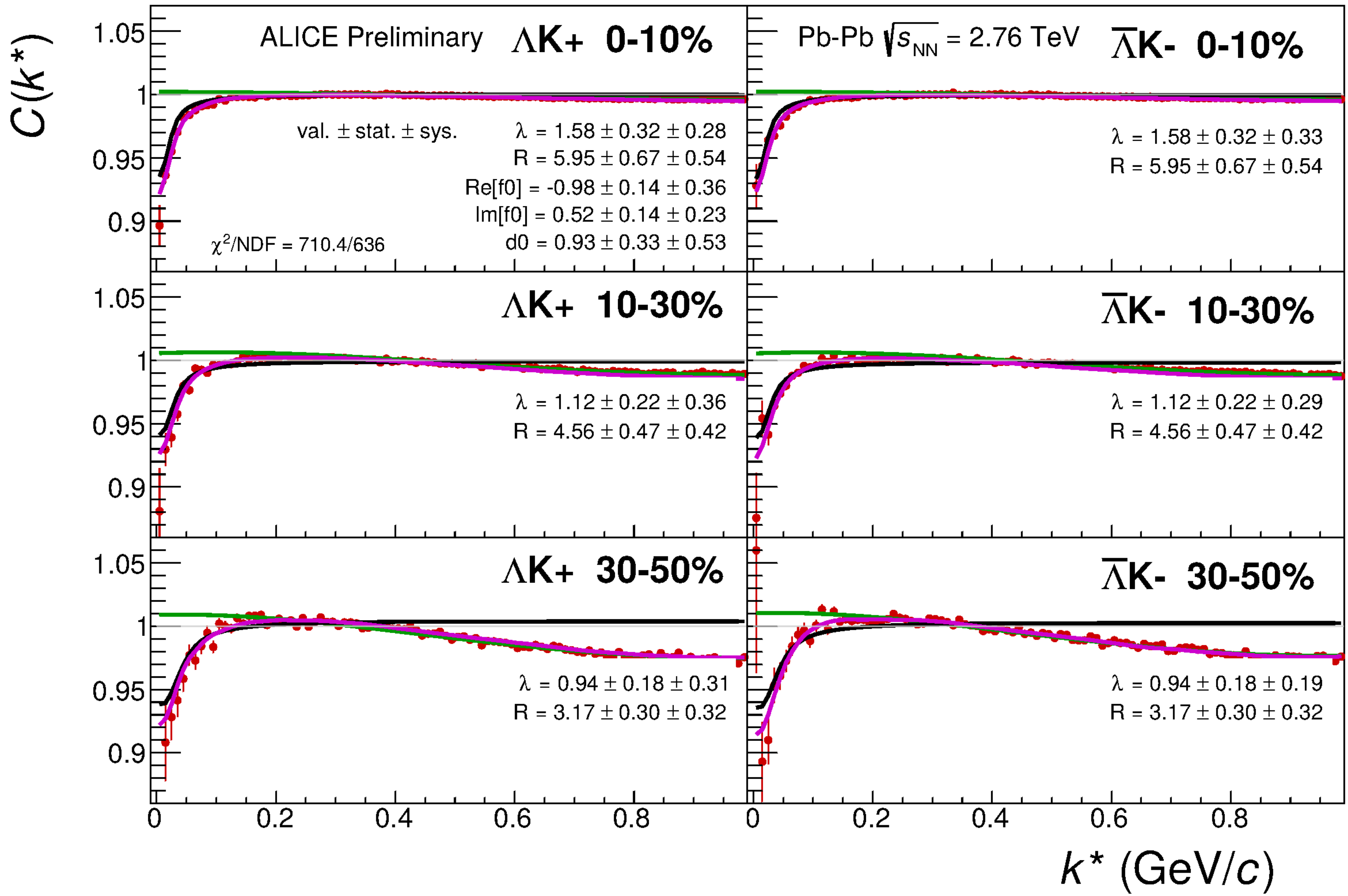
	Decay Length					
Pair System	**0 fm**	**4 fm**	**5 fm**	**6 fm**	**10 fm**	**100 fm**
3 Residuals						
ΛK^+	0.111	0.154	0.228	0.445	0.470	0.508
$\Sigma^0 K^+$	0.099					
$\Xi^0 K^+$	0.072					
$\Xi^- K^+$	0.069					
Other	0.601	0.558	0.484	0.267	0.242	0.204
Fakes	0.048					
10 Residuals						
ΛK^+	0.111	0.154	0.188	0.277	0.301	0.340
$\Sigma^0 K^+$	0.099					
$\Xi^0 K^+$	0.072					
$\Xi^- K^+$	0.069					
$\Sigma^{*+} K^+$	0.046					
$\Sigma^{*-} K^+$	0.042					
$\Sigma^{*0} K^+$	0.042					
ΛK^{*0}	0.039					
$\Sigma^0 K^{*0}$	0.035					
$\Xi^0 K^{*0}$	0.025					
$\Xi^- K^{*0}$	0.024					
Other	0.348	0.305	0.271	0.182	0.158	0.119
Fakes	0.048					

3 Residual

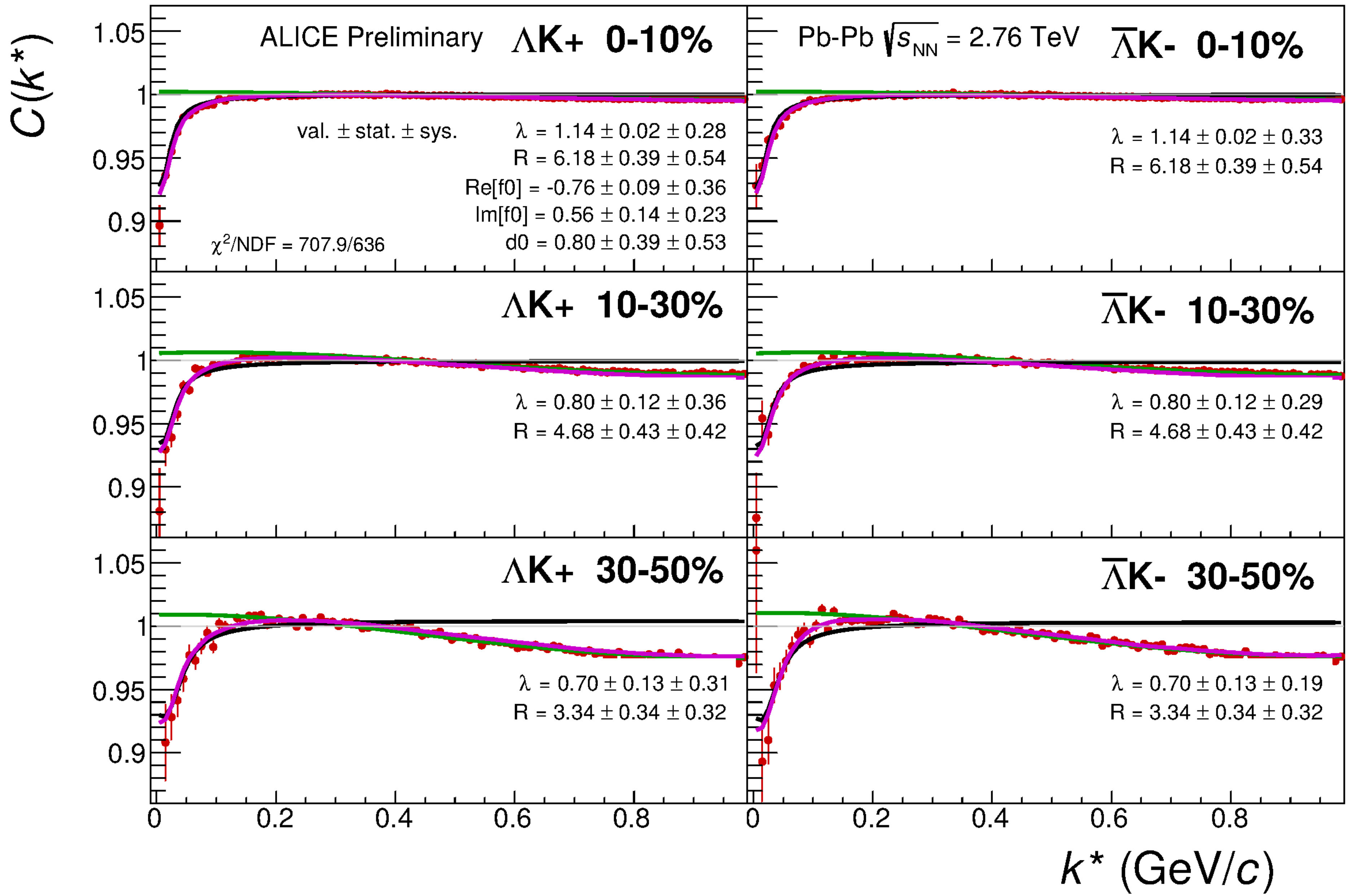
NRes=3; D.C.$_{max}$ = 4 fm



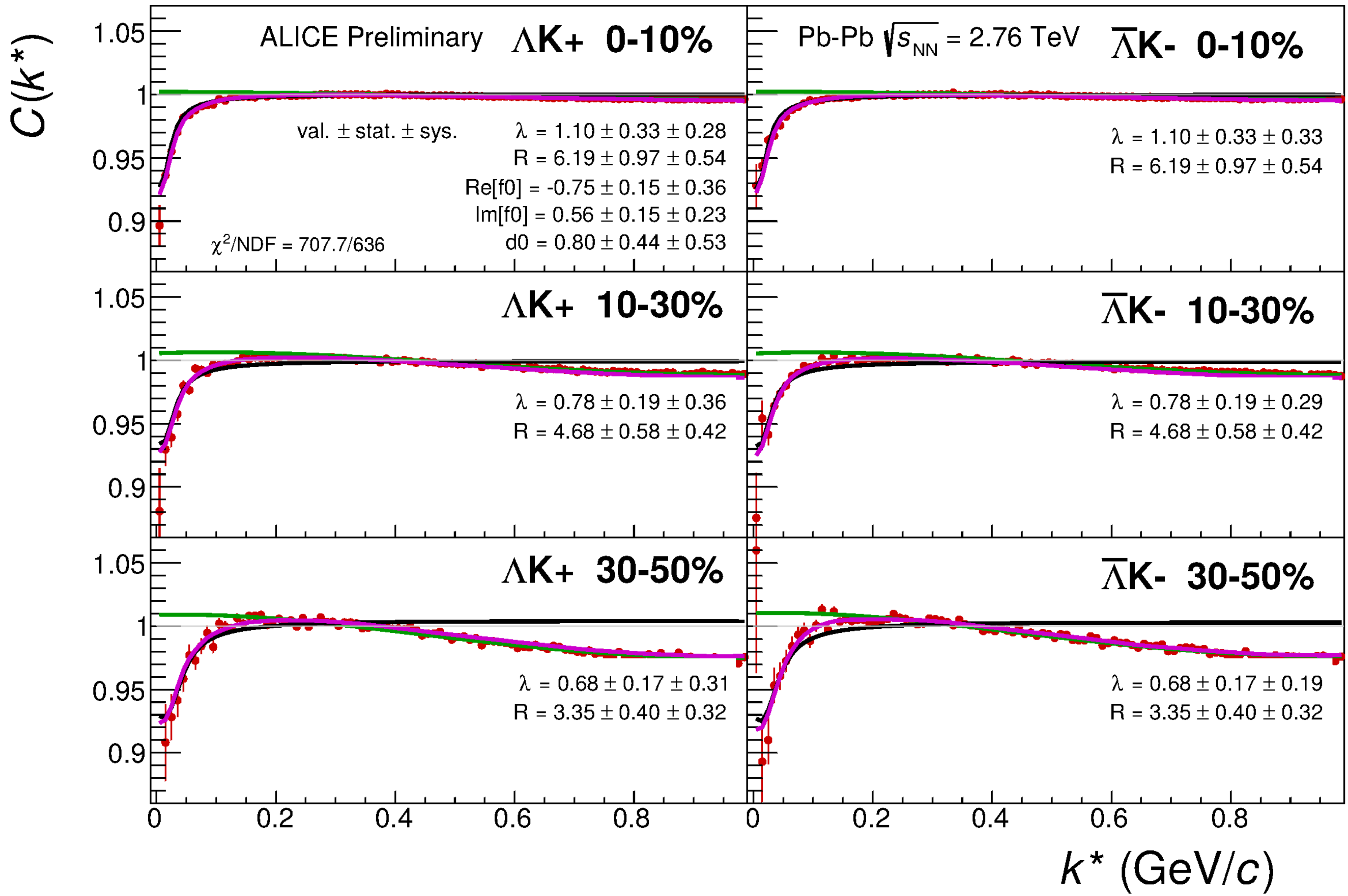
NRes=3; D.C.$_{max}$ = 5 fm



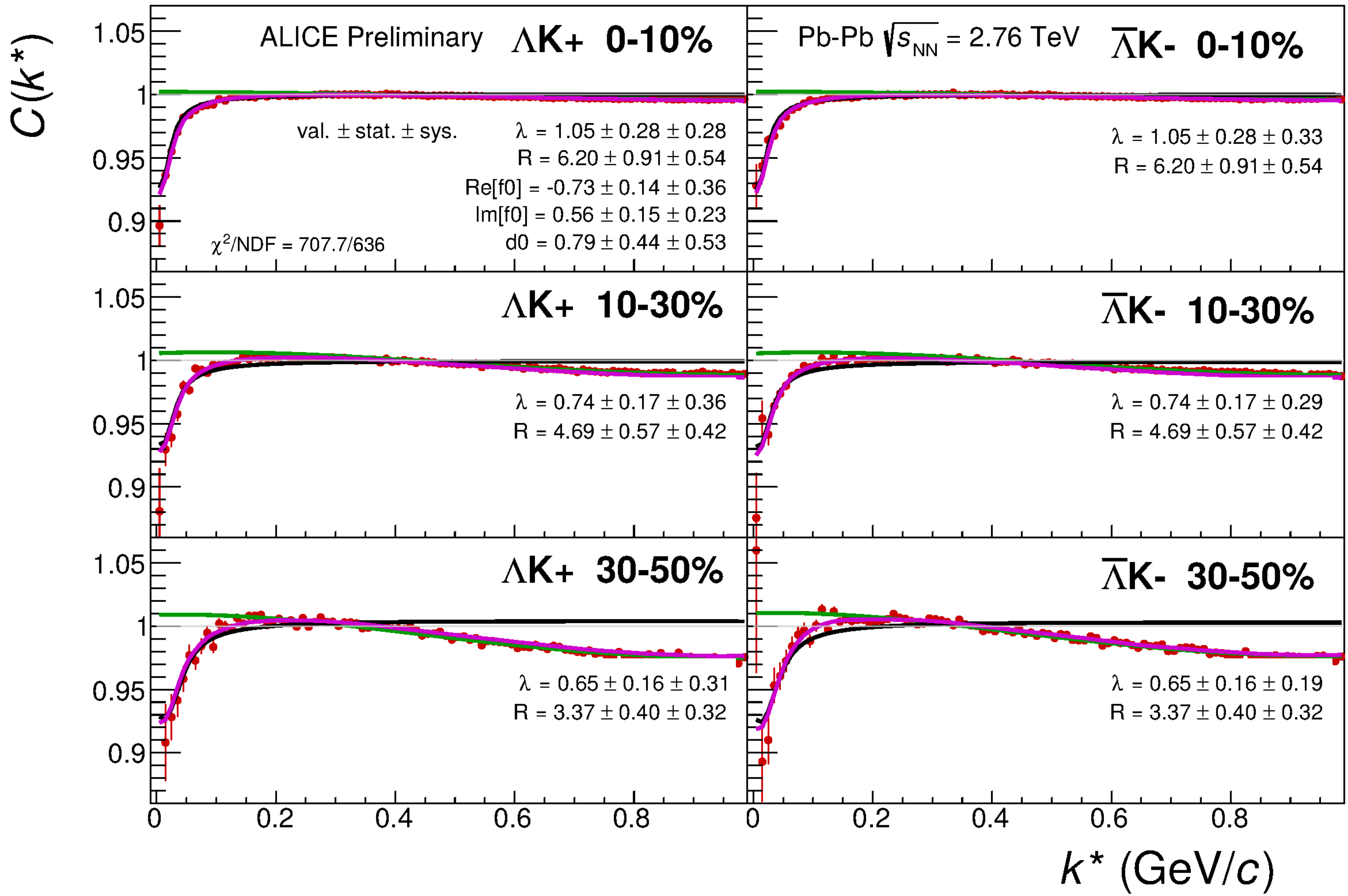
NRes=3; D.C.$_{max}$ = 6 fm



NRes=3; D.C.$_{max}$ = 10 fm

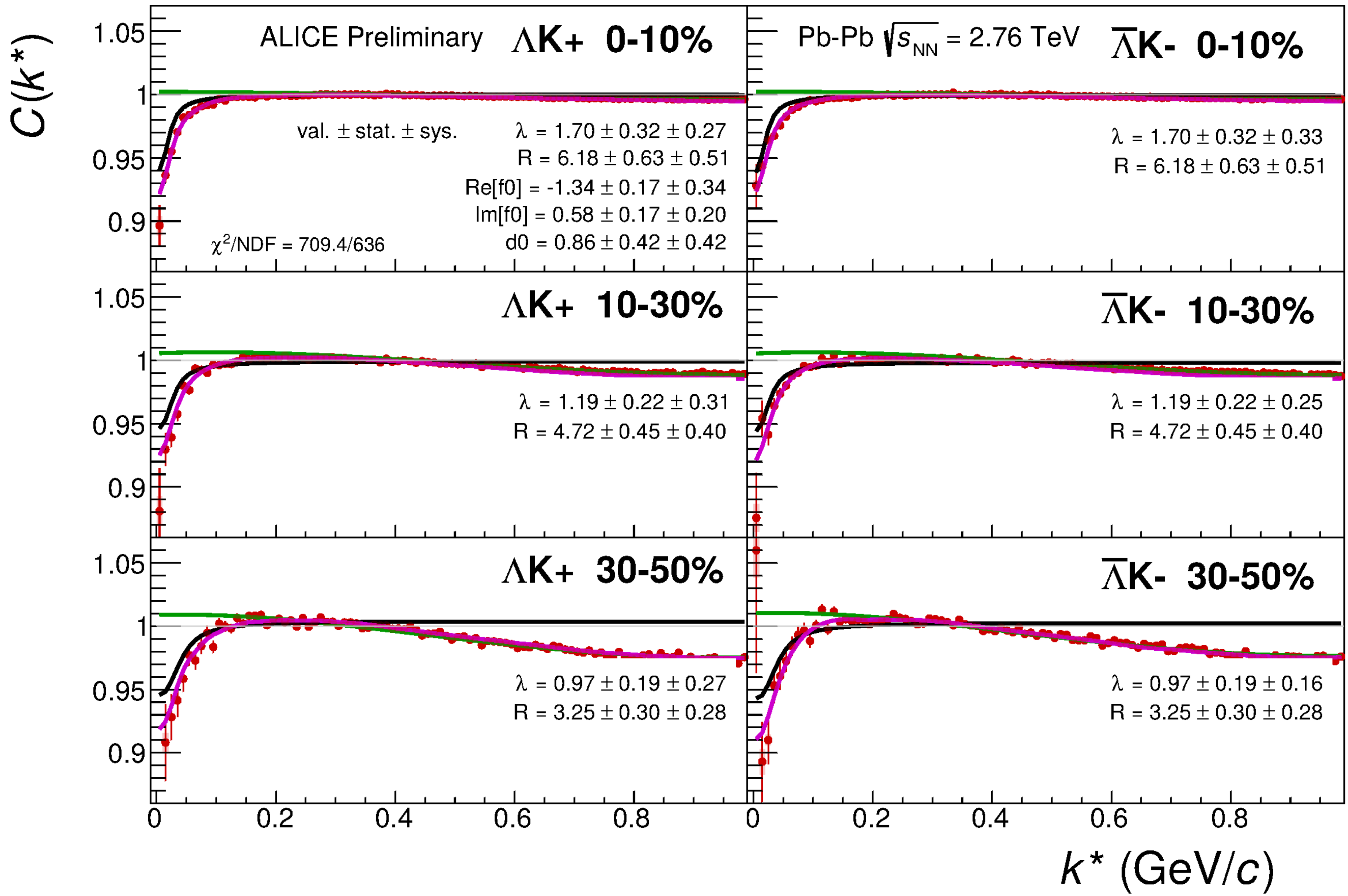


NRes=3; D.C.$_{max}$ = 100 fm

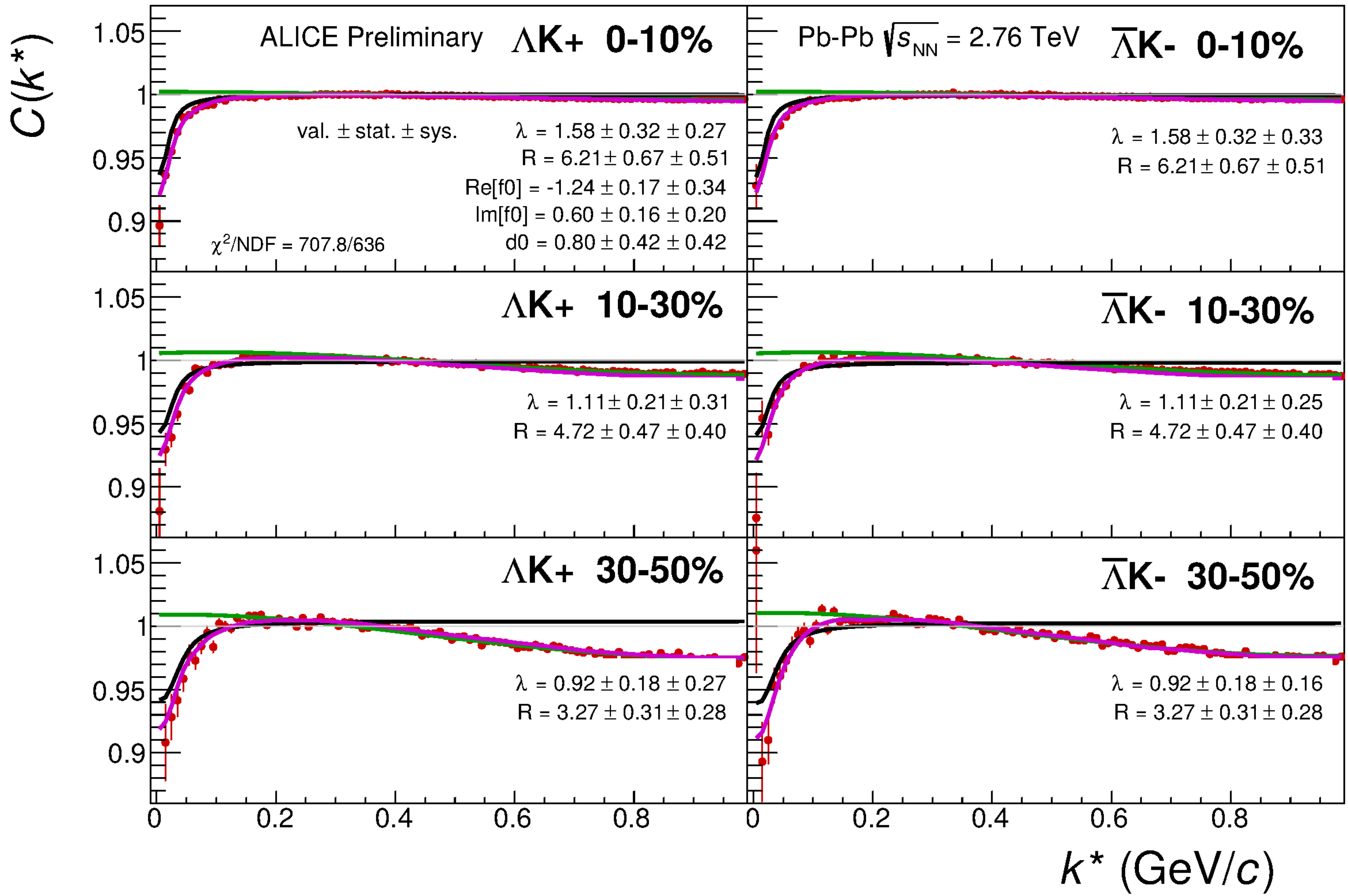


10 Residual

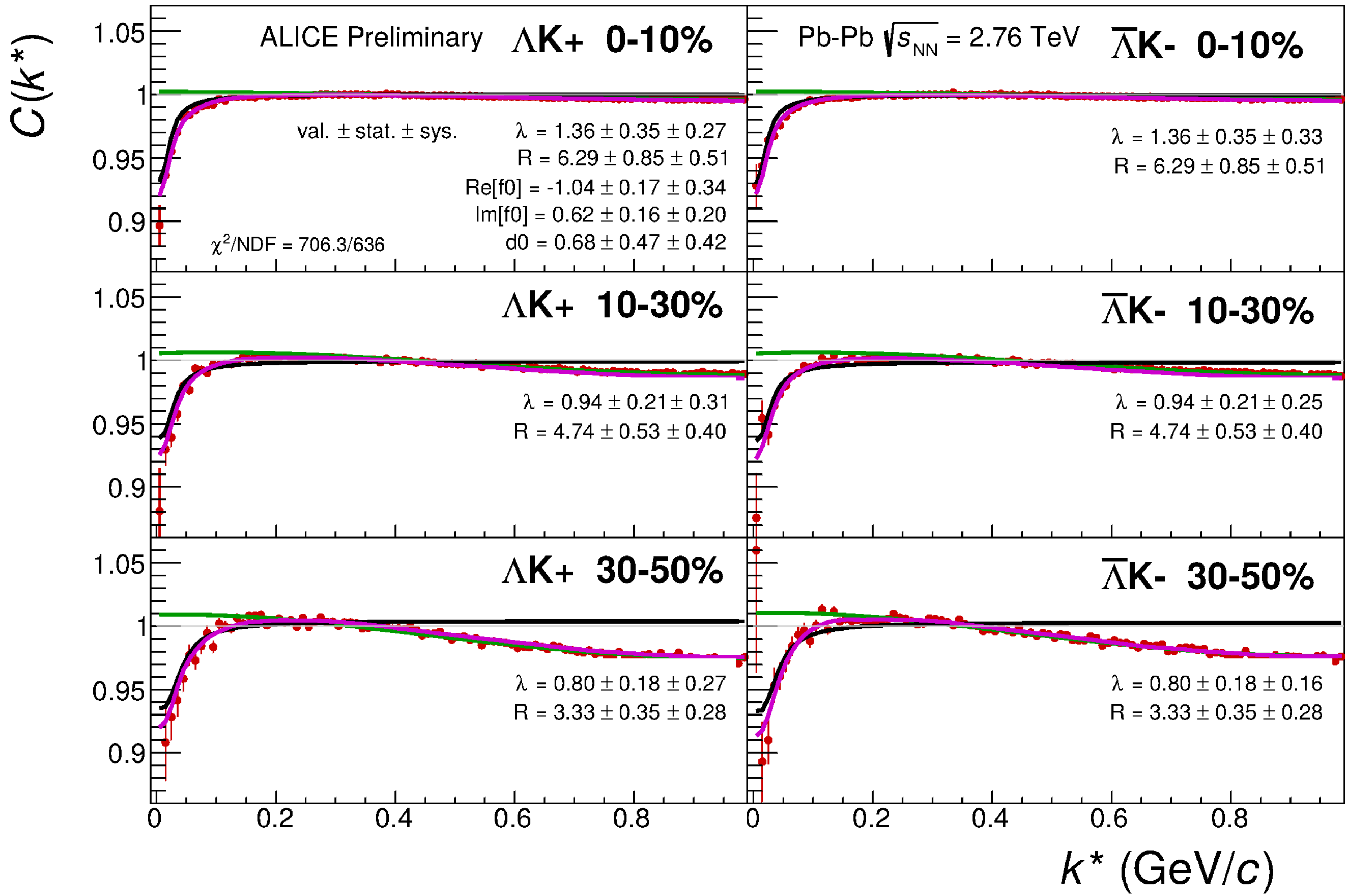
NRes=10; D.C.$_{max}$ = 4 fm



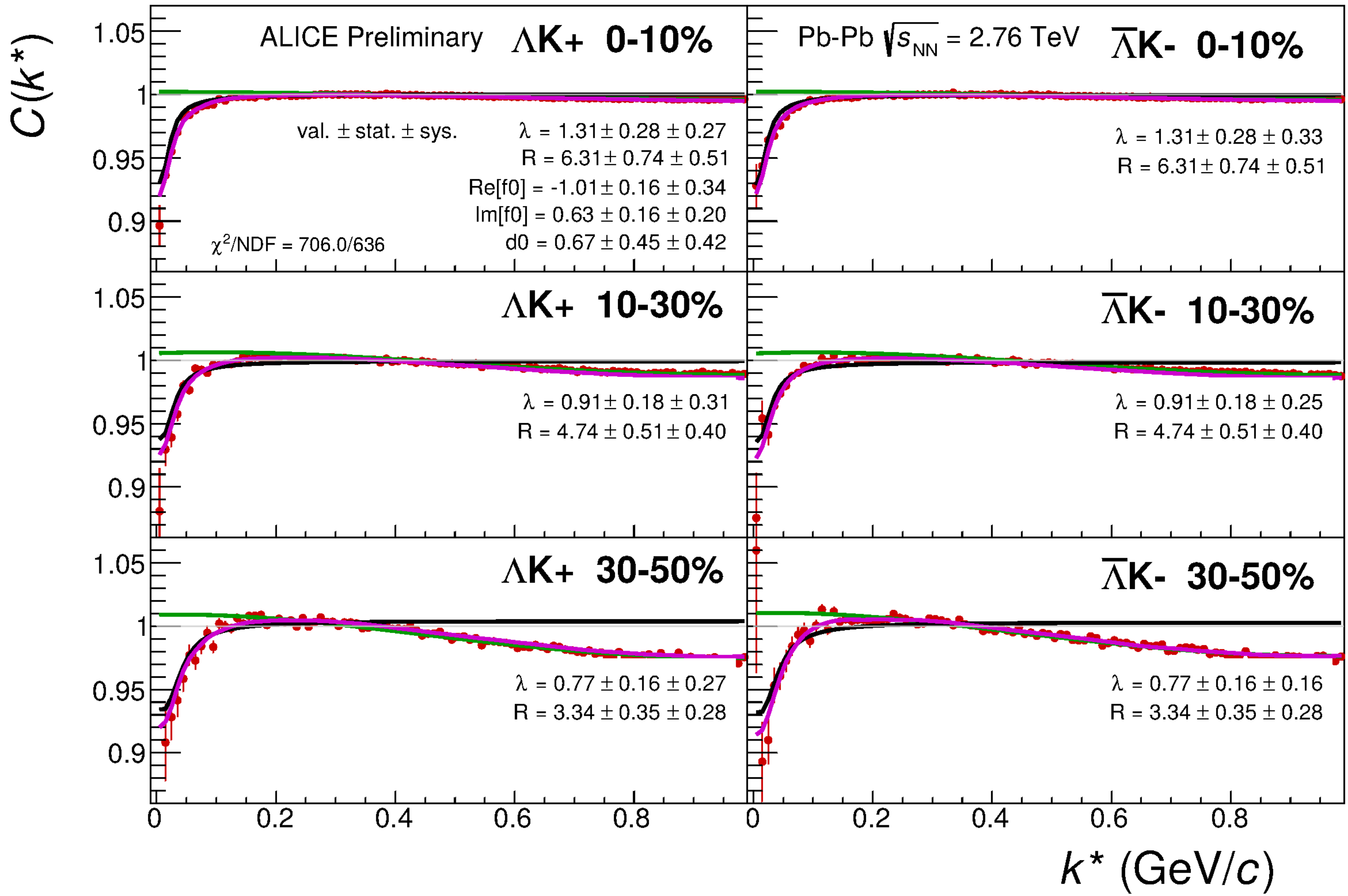
NRes=10; D.C.$_{max}$ = 5 fm



NRes=10; D.C.$_{max}$ = 6 fm



NRes=10; D.C.$_{max}$ = 10 fm



NRes=10; D.C.$_{max}$ = 100 fm