

## 0.1 Pair Selection

The femtoscopic analysis of two-particle correlation functions relies on the proper formation of particle pairs. As such, it is important to obtain true particle pairs in the analysis. In particular, contamination from pairs constructed with split or merged tracks, and pairs sharing daughters, can introduce artificial signals into the correlation function, obscuring the actual physics. In an effort to remove contamination, we impose two main pair cuts: a shared daughter cut, and an average separation cut.

The purpose of the shared daughter cut is to ensure the first particle in the pair is unique from the second. For pairs formed of two V0s (e.g.  $\Lambda K_S^0$ ), this cut is implemented by removing all pairs which share a daughter. For example, in the  $\Lambda K_S^0$  analysis, if the  $\Lambda$  and  $K_S^0$  in a potential pair claim the same  $\pi^-$  daughter, the pair is excluded from the analysis. For a pair formed of a single V0 and a charged track (e.g.  $\Lambda K^\pm$ ), the cut removes all pairs in which the charged track is also claimed as a daughter of the V0. This mistake could only occur if, for instance, either a  $K^\pm$  is misidentified as a  $\pi$  or p and used in the V0 reconstruction, or a  $\pi$  or p is misidentified as a  $K^\pm$  in the  $K^\pm$  selection. In the case of a pair formed from a charged  $\Xi$  and a charged track (e.g.  $\Xi^- K^\pm$ ), the cut removes all pairs in which the charged track is also claimed as a daughter of the  $\Xi$ , be it the bachelor- $\pi$  daughter directly, or a daughter of the  $\Lambda$  daughter (a granddaughter of the  $\Xi$ ). In the  $\Xi^- K^\pm$  analysis, as in the  $\Lambda K^\pm$  case, this could only occur if there was misidentification of a  $K^\pm$  as a  $\pi$  or p, or vice versa.

The purpose of the average separation cut is to remove splitting and merging effects, and it is employed in the following way. To calculate the average separation between two tracks, the spatial separation is determined at several points throughout the TPC (every 20 cm radially from 85 cm to 245 cm), and the results averaged. For that  $\Lambda K_S^0$  analysis, which involves two V0 particles, a minimum average separation cut of 6 cm between the like-charge daughters in the pairs was imposed (for example, between the p daughter of the  $\Lambda$  and the  $\pi^+$  daughter of the  $K_S^0$ ). For the  $\Lambda K^\pm$  analyses, a minimum average separation cut of 8 cm was enforced between the  $K^\pm$  and the  $\Lambda$  daughter sharing the same charge (for example, in the  $\Lambda K^+$  analysis, between the p daughter of the  $\Lambda$  and the  $K^+$ ). Finally, for the  $\Xi^- K^\pm$  analysis, a minimum average separation cut of 8 cm was enforced between any daughter of the  $\Xi$  sharing the same charge as the  $K^\pm$  in the pair (for example, in the  $\Xi^- K^-$  analysis, between the  $\pi^-$  granddaughter which decayed from the  $\Lambda$  daughter and the  $K^-$ , and between the bachelor- $\pi^-$  daughter and the  $K^-$ ).

The motivation for the values used in these cuts can be seen in Figures 1, 2, and 3, in which average separation correlation functions are presented. The average separation correlation functions are formed just as for our relative-momentum correlation functions, but we instead bin in average separation. Looking at these average separation correlation functions for like-charge tracks, at lowest average separation we see an enhancement due to track splitting, followed by (at slightly higher average separation) a suppression due to track merging. When the average separation correlation function stabilizes to unity, these effects are no longer abundant, and we choose our cut value. Splitting and merging effects between oppositely charged tracks was found to be negligible, therefore no cuts on unlike-charge tracks were imposed. To summarize:

### Average Separation Cuts ( $\overline{\Delta r}$ )

#### (a) $\Lambda K_S^0$ Analyses

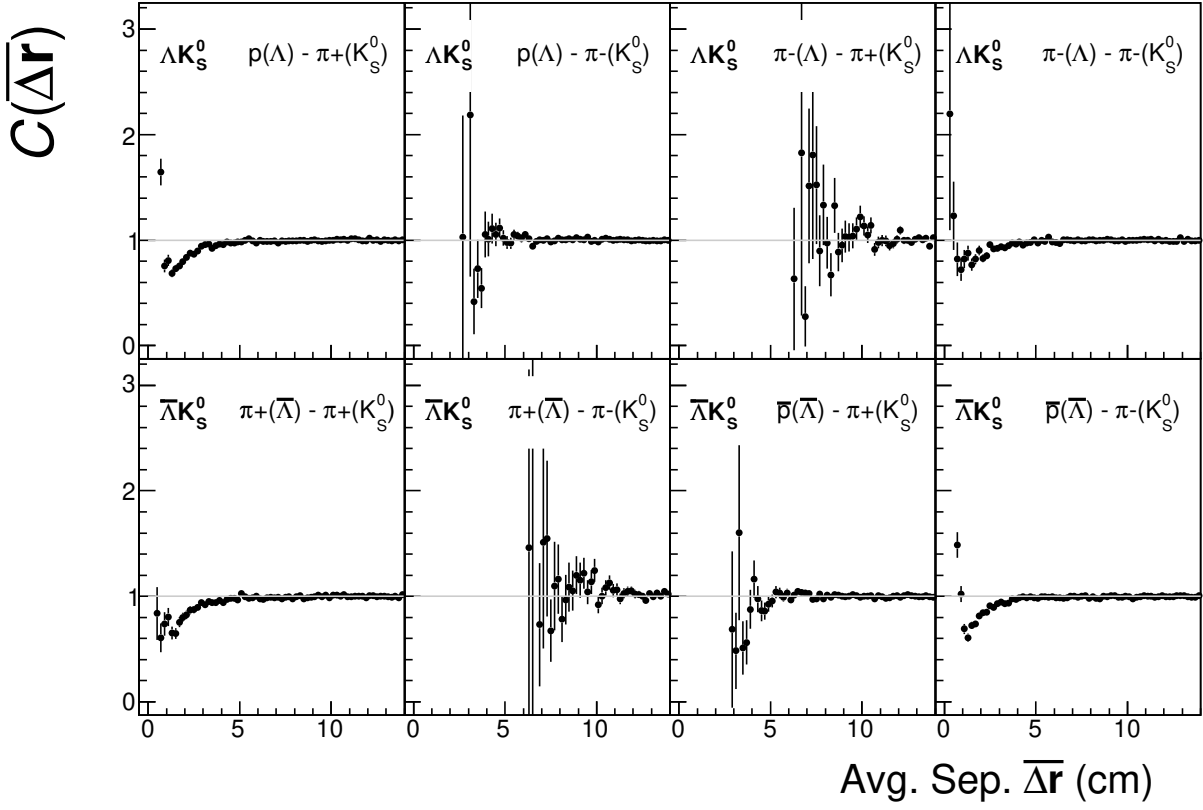
- $\overline{\Delta r} > 6.0$  cm for like-charge sign daughters
- No cut for unlike-charge daughters

#### (b) $\Lambda K^\pm$ Analyses

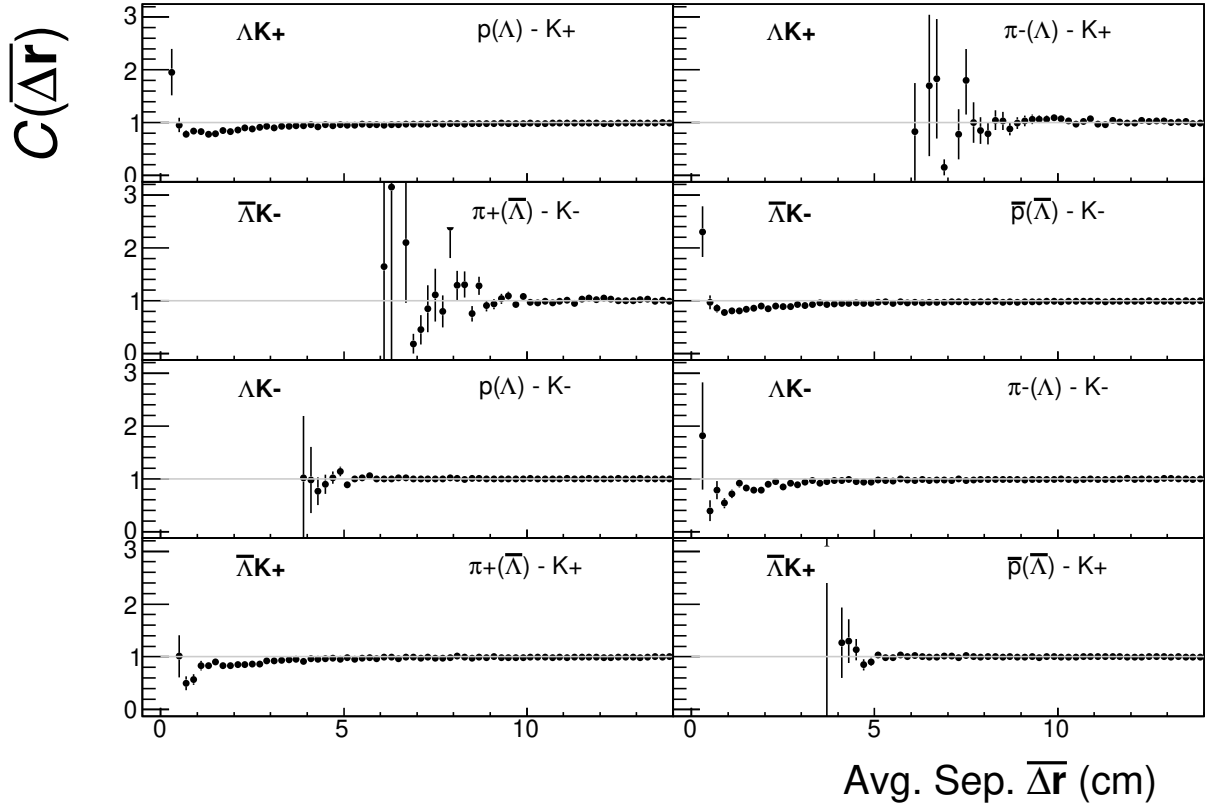
- $\overline{\Delta r} > 8.0$  cm for daughter of  $\Lambda(\bar{\Lambda})$  sharing charge sign of  $K^\pm$
- No cut for unlike-charge

#### (c) $\Xi^- K^\pm$ Analyses

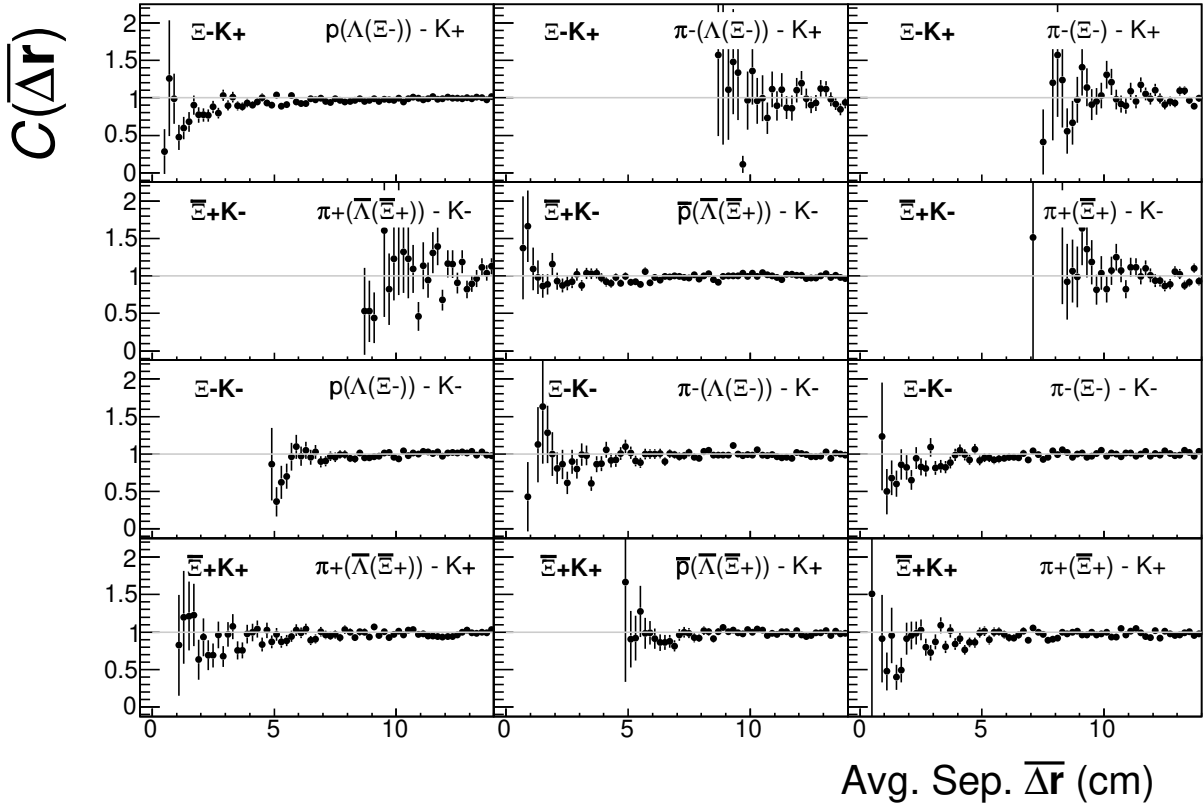
- $\overline{\Delta r} > 8.0$  cm for any daughter of  $\Xi$  sharing charge sign of  $K^\pm$
- No cut for unlike-charge



**Fig. 1:** Average separation ( $\overline{\Delta r}$ ) correlation functions between the daughters of  $\Lambda(\bar{\Lambda})$  hyperons and the daughters of  $K_S^0$  mesons in the  $\Lambda(\bar{\Lambda})K_S^0$  analyses. The top row shows results from the  $\Lambda K_S^0$  system, and the bottom shows the  $\bar{\Lambda} K_S^0$  system. The text in the top right of each subfigure indicates the daughters studied, and the mother of each daughter is shown in parentheses “()”; e.g. the top left shows the  $\overline{\Delta r}$  correlation between the p daughter of the  $\Lambda$  and the  $\pi^+$  daughter of the  $K_S^0$ .



**Fig. 2:** Average separation ( $\overline{\Delta r}$ ) correlation functions between the daughters of  $\Lambda(\bar{\Lambda})$  hyperons and the  $K^\pm$  mesons in the  $\Lambda(\bar{\Lambda})K^\pm$  analyses. The rows differentiate the analysis; from top to bottom:  $\Lambda K^+$ ,  $\bar{\Lambda} K^-$ ,  $\Lambda K^-$ ,  $\bar{\Lambda} K^+$ . The text in the top right of each subfigure indicates the particle tracks studied, and, if applicable, the mother of a given particle is shown in parentheses “()”; e.g. the top left shows the  $\overline{\Delta r}$  correlation between the p daughter of the  $\Lambda$  and the  $K^+$ .



**Fig. 3:** Average separation ( $\Delta \mathbf{r}$ ) correlation functions between the daughters and granddaughters of  $\Xi$  hyperons and  $K^\pm$  mesons in the  $\Xi^- (\Xi^+) K^\pm$  analyses. The rows differentiate the analysis; from top to bottom:  $\Xi^- K^+$ ,  $\Xi^+ K^-$ ,  $\Xi^- K^-$ ,  $\Xi^+ K^+$ . The text in the top right of each subfigure indicates the particle tracks studied, and, if applicable, the mother of a given particle is shown in parentheses “()”; e.g. the top left shows the  $\Delta \mathbf{r}$  correlation between the p granddaughter of the  $\Xi^-$  (i.e. the p daughter of the  $\Lambda$  which decayed from the  $\Xi^-$ ) and the  $K^+$ . As a second example, the top right shows the  $\Delta \mathbf{r}$  correlation between the bachelor- $\pi^-$  daughter of the  $\Xi^-$  and the  $K^+$ .