

### 0.0.1 $\Lambda$ Reconstruction

The following cuts were used to select good  $\Lambda(\bar{\Lambda})$  candidates:

#### 1. Shared Daughter Cut for V0 Collection

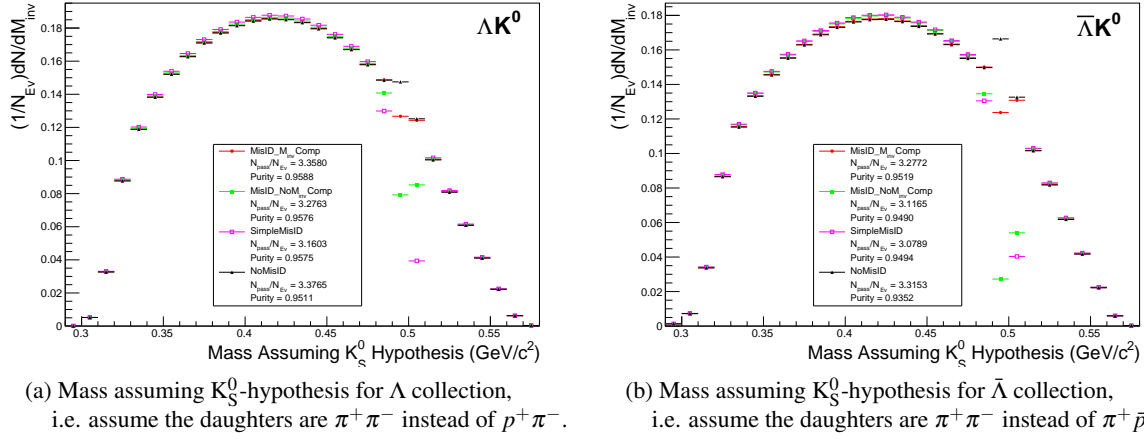
- Iterate through V0 collection to ensure that no daughter is used in more than one V0 candidate

$\Lambda$ selection		
$ \eta $		$< 0.8$
$p_T$		$> 0.4 \text{ GeV}/c$
$ m_{\text{inv}} - m_{\text{PDG}} $		$< 3.8 \text{ MeV}$
DCA to prim. vertex		$< 0.5 \text{ cm}$
Cosine of pointing angle		$> 0.9993$
OnFlyStatus		false
Decay Length		$< 60 \text{ cm}$
Shared Daughter Cut		true
Misidentification Cut		true
Daughter Cuts ( $\pi$ and $p$ )		
$ \eta $		$< 0.8$
Number of clusters in the TPC		$> 80$
Daughter status		kTPCrefit
DCA $\pi p$ Daughters		$< 0.4 \text{ cm}$
$\pi$ -specific cuts		
$p_T$		$> 0.16 \text{ GeV}/c$
DCA to prim vertex		$> 0.3 \text{ cm}$
TPC and TOF $N\sigma$ Cuts		
$p < 0.5 \text{ GeV}/c$		$N\sigma_{\text{TPC}} < 3$
$p > 0.5 \text{ GeV}/c$	if TOF & TPC available	$N\sigma_{\text{TPC}} < 3 \text{ \& } N\sigma_{\text{TOF}} < 3$
	else	$N\sigma_{\text{TOF}} < 3$
$p$ -specific cuts		
$p_T$		$> 0.5(p) [0.3(\bar{p})] \text{ GeV}/c$
DCA to prim vertex		$> 0.1 \text{ cm}$
TPC and TOF $N\sigma$ Cuts		
$p < 0.8 \text{ GeV}/c$		$N\sigma_{\text{TPC}} < 3$
$p > 0.8 \text{ GeV}/c$	if TOF & TPC available	$N\sigma_{\text{TPC}} < 3 \text{ \& } N\sigma_{\text{TOF}} < 3$
	else	$N\sigma_{\text{TOF}} < 3$

**Table 1:**  $\Lambda$  selection

Figure 1a shows the mass assuming  $K_S^0$  hypothesis for the  $\Lambda$  collection, i.e. assume the daughters are  $\pi^+\pi^-$  instead of  $p^+\pi^-$ . Figure 1b is a similar plot, but is for the  $\bar{\Lambda}$  collection, i.e. assume the daughters are  $\pi^+\pi^-$  instead of  $\pi^+\bar{p}^-$ . The  $K_S^0$  contamination is visible, although not profound, in both, in the slight peaks around  $m_{\text{inv}} = 0.497 \text{ GeV}/c^2$ . If one simply cuts out the entire peak, good  $\Lambda$  particles will be lost. Ideally, the  $\Lambda$  selection and  $K_S^0$  misidentification cuts are selected such that the peak is removed from this plot while leaving the underlying distribution continuous. To attempt to remove these  $K_S^0$  contaminations without throwing away good  $\Lambda$  and  $\bar{\Lambda}$  particles, the following misidentification cuts are imposed; a  $\Lambda(\bar{\Lambda})$  candidate is rejected if all of the following criteria are satisfied:

$$- \left| m_{\text{inv}, K_S^0 \text{ Hypothesis}} - m_{\text{PDG}, K_S^0} \right| < 9.0 \text{ MeV}/c^2$$

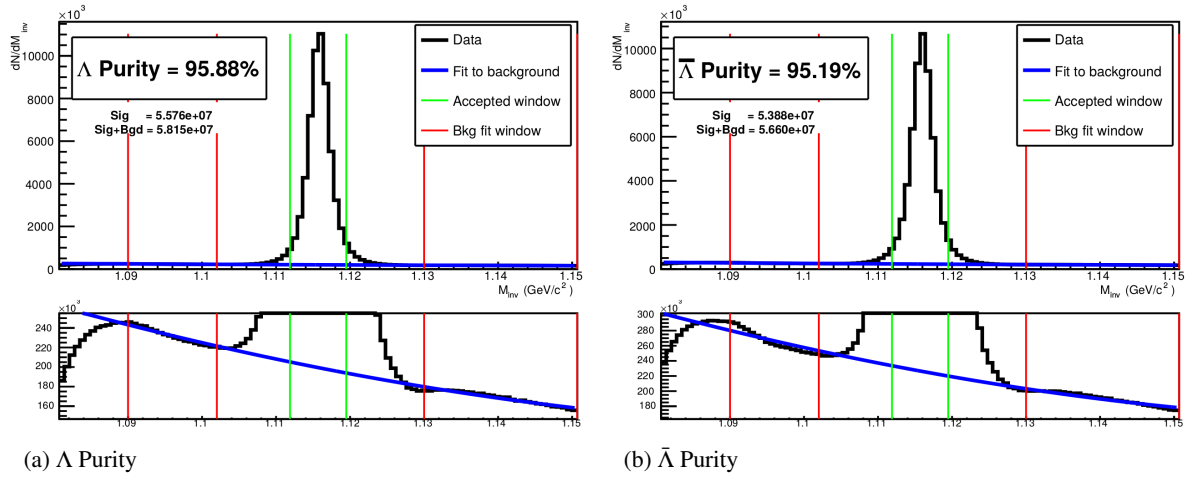


**Fig. 1:** Mass assuming  $K_S^0$ -hypothesis for V0 candidates passing all  $\Lambda$  (1a) and  $\bar{\Lambda}$  (1b) cuts. The “NoMisID” distribution (black triangles) uses the V0 finder without any attempt to remove misidentified  $K_S^0$ . The slight peak in the “NoMisID” distribution around  $m_{\text{inv}} = 0.5 \text{ GeV}/c^2$  contains misidentified  $K_S^0$  particles in our  $\Lambda(\bar{\Lambda})$  collection. “SimpleMisID” (pink squares) simply cuts out the entire peak, which throws away some good  $\Lambda$  and  $\bar{\Lambda}$  particles. “MisID\_NoM<sub>inv</sub>Comp” (green squares) uses the misidentification cut outlined in the text, but does not utilize the final invariant mass comparison step. “MisID\_M<sub>inv</sub>Comp” (red circles) utilizes the full misidentification methods, and is currently used for this analysis. “ $N_{\text{pass}}/N_{\text{ev}}$ ” is the total number of  $\Lambda(\bar{\Lambda})$  particles found, normalized by the total number of events. The purity of the collection is also listed.

– Positive and negative daughters pass  $\pi$  daughter cut implemented for  $K_S^0$  reconstruction

$$- \left| m_{\text{inv}, K_S^0 \text{ Hypothesis}} - m_{\text{PDG}, K_S^0} \right| < \left| m_{\text{inv}, \Lambda(\bar{\Lambda}) \text{ Hypothesis}} - m_{\text{PDG}, \Lambda(\bar{\Lambda})} \right|$$

Figure 2 shows the invariant mass ( $m_{\text{inv}}$ ) distribution of all  $\Lambda(\bar{\Lambda})$  candidates immediately before the final invariant mass cut. These distributions are used to calculate the collection purities. The  $\Lambda$  and  $\bar{\Lambda}$  purities are found to be:  $\text{Purity}(\Lambda) \approx \text{Purity}(\bar{\Lambda}) \approx 95\%$ .



**Fig. 2:** Invariant mass ( $m_{\text{inv}}$ ) distribution for all  $\Lambda$  (a) and  $\bar{\Lambda}$  (b) candidates immediately before the final invariant mass cut. The bottom figures are zoomed to show the background with fit. The vertical green lines represent the  $m_{\text{inv}}$  cuts used in the analyses, the red vertical lines delineate the regions over which the background was fit, and the blue line shows the background fit. These distributions are used to calculate the collection purities,  $\text{Purity}(\Lambda) \approx \text{Purity}(\bar{\Lambda}) \approx 95\%$ .