

### 0.0.1 $K_S^0$ Reconstruction

The following cuts were used to select good  $K_S^0$  candidates:

#### 1. Pion Daughter Cuts

- (a)  $|\eta| < 0.8$
- (b) SetTPCnclsDaughters(80)
- (c) SetStatusDaughters(AliESDtrack::kTPCrefic)
- (d) SetMaxDcaV0Daughters(0.3)
- (e)  $p_T > 0.15$
- (f) DCA to prim vertex  $> 0.3$

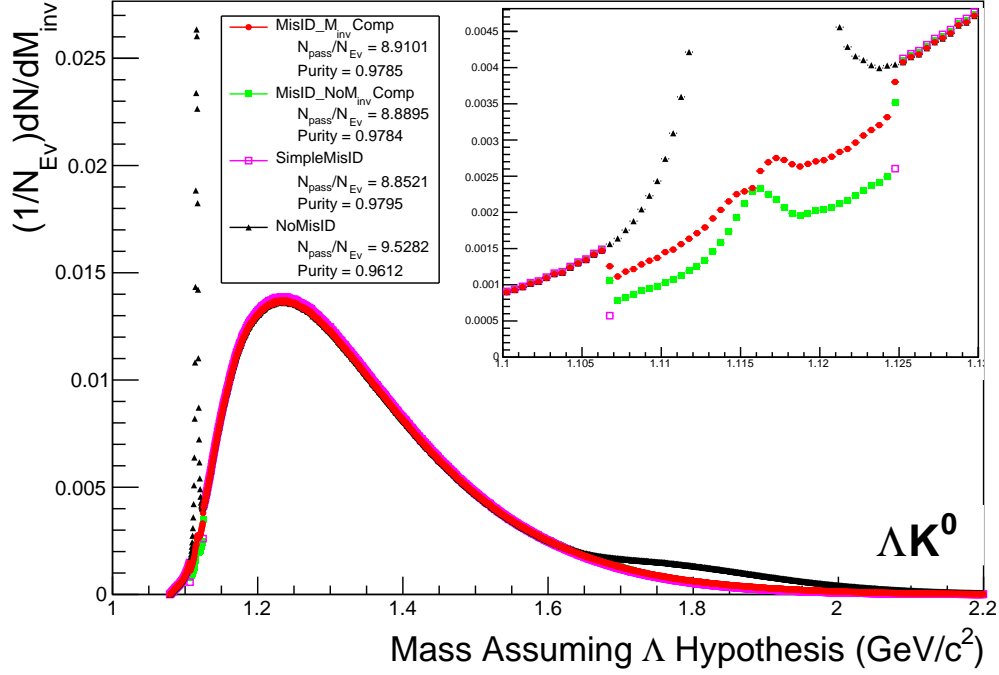
#### 2. $K_S^0$ Cuts

- (a)  $|\eta| < 0.8$
- (b)  $p_T > 0.2$
- (c)  $m_{PDG} - 13.677 \text{ MeV} < m_{inv} < m_{PDG} + 2.0323 \text{ MeV}$
- (d) Cosine of pointing angle  $> 0.9993$
- (e) OnFlyStatus = false
- (f) Decay Length  $< 30 \text{ cm}$

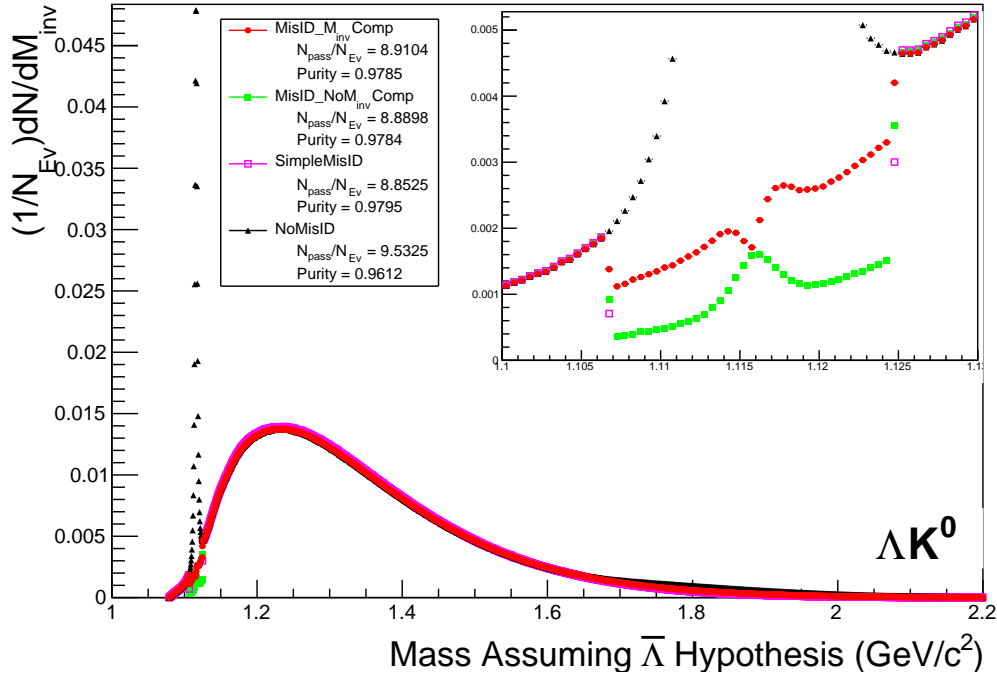
As can be seen in Figure 1, some misidentified  $\Lambda$  and  $\bar{\Lambda}$  particles contaminate our  $K_S^0$  sample. Figure 1a shows the mass assuming  $\Lambda$ -hypothesis for the  $K_S^0$  collection, i.e. assume the daughters are  $p^+\pi^-$  instead of  $\pi^+\pi^-$ . Figure 1b is similar, but shows the mass assuming  $\bar{\Lambda}$  hypothesis for the collection, i.e. assume the daughters are  $\pi^+\bar{p}^-$  instead of  $\pi^+\pi^-$ . The  $\Lambda$  contamination can be seen in 1a, and the  $\bar{\Lambda}$  contamination in 1b, in the peaks around  $m_{inv} = 1.115 \text{ GeV}/c^2$ . Additionally, the  $\bar{\Lambda}$  contamination is visible in Figure 1a, and the  $\Lambda$  contamination visible in Figure 1b, in the region of excess around  $1.65 < m_{inv} < 2.1 \text{ GeV}/c^2$ . This is confirmed as the number of misidentified  $\Lambda$  particles in the sharp peak of Figure 1a (misidentified  $\bar{\Lambda}$  particles in the sharp peak of Figure 1b) approximately equals the excess found in the  $1.65 < m_{inv} < 2.1 \text{ GeV}/c^2$  region of Figure 1a (Figure 1b).

The peaks around  $m_{inv} = 1.115 \text{ GeV}/c^2$  in Figure 1 contain both misidentified  $\Lambda$  ( $\bar{\Lambda}$ ) particles and good  $K_S^0$ . If one simply cuts out the entire peak, some good  $K_S^0$  particles will be lost. Ideally, the  $K_S^0$  selection and  $\Lambda(\bar{\Lambda})$  misidentification cuts can be selected such that the peak is removed from this plot while leaving the distribution continuous. To attempt to remove these  $\Lambda$  and  $\bar{\Lambda}$  contaminations without throwing away good  $K_S^0$  particles, the following misidentification cuts are imposed; a  $K_S^0$  candidate is rejected if all of the following criteria are satisfied:

- $|m_{inv, \Lambda(\bar{\Lambda}) \text{ Hypothesis}} - m_{PDG, \Lambda(\bar{\Lambda})}| < 9.0 \text{ MeV}/c^2$
- Positive daughter passes  $p^+(\pi^+)$  daughter cut implemented for  $\Lambda(\bar{\Lambda})$  reconstruction
- Negative daughter passes  $\pi^-(\bar{p}^-)$  daughter cut implemented by  $\Lambda(\bar{\Lambda})$  reconstruction

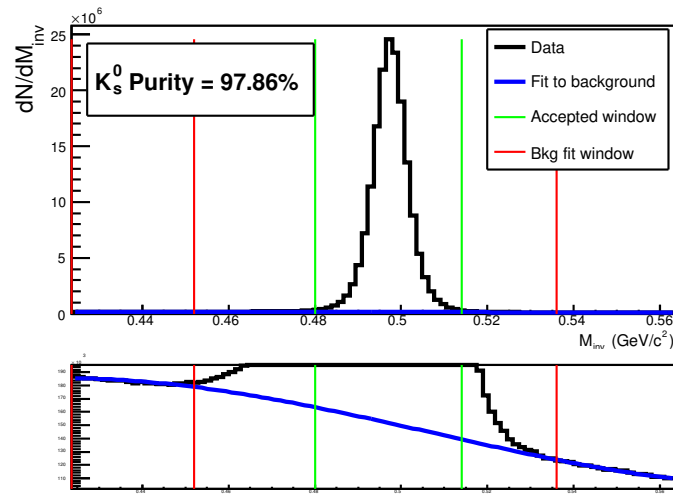


(a) Mass assuming  $\Lambda$ -hypothesis for  $K_S^0$  collection, i.e. assume the daughters are  $p^+\pi^-$  instead of  $\pi^+\pi^-$ .



(b) Mass assuming  $\bar{\Lambda}$ -hypothesis for  $K_S^0$  collection, i.e. assume the daughters are  $\pi^+\bar{p}^-$  instead of  $\pi^+\pi^-$ .

**Fig. 1:** Mass assuming  $\Lambda$ -hypothesis (1a) and  $\bar{\Lambda}$ -hypothesis (1b) for  $K_S^0$  collection. The “NoMisID” distribution (black triangles) uses the V0 finder without any attempt to remove misidentified  $\Lambda$  and  $\bar{\Lambda}$ . The peak in the “NoMisID” distribution around  $m_{inv} = 1.115$   $\text{GeV}/c^2$  contains misidentified  $\Lambda$  (1a) and  $\bar{\Lambda}$  (1b) particles in our  $K_S^0$  collection. “SimpleMisID” (pink squares) simply cuts out the entire peak, which throws away some good  $K_S^0$  particles. “MisID\_NoM<sub>inv</sub>Comp” (green squares) uses the misidentification cut outlined in the text, but does not utilize the invariant mass comparison method. “MisID\_M<sub>inv</sub>Comp” (red circles) utilizes the full misidentification methods, and is currently used for this analysis. “ $N_{pass}/N_{ev}$ ” is the total number of  $K_S^0$  particles found, normalized by the total number of events. The purity of the collection is also listed. Also note, the relative excess of the “NoMisID” distribution around  $1.65 < m_{inv} < 2.1$   $\text{GeV}/c^2$  shows misidified  $\bar{\Lambda}$  (1a) and  $\Lambda$  (1b) particles in our  $K_S^0$  collection.



**Fig. 2:** Invariant mass ( $M_{inv}$ ) distribution of all  $K_S^0$  candidates immediately before the final invariant mass cut. This distribution is used to calculate the collection purity,  $\text{Purity}(K_S^0) \approx 98\%$ .