Search For Kaon Mass Peak Using Cryo-Target Data

All analysis performed using approximately 33000 events from run 13600. This run was taken with the liquid hydrogen target at positive 72 GeV.

1 Finding Target Position

First, find the location of the target in TPC coordinate system. To do this, I ran the TPC vertex reconstruction software and plotted the Z distribution of reconstructed vertices (see fig.1). As expected there is a peak in the distribution a few centimeters upstream of the TPC window, around -80 cm. I then selected vertices within the window from -75 cm to -90 cm in order to get most of the peak but not too much of the tail, and plotted the X (fig.2) and Y (fig.3) distributions with this cut on Z. X and Y distributions were both fit to a Gaussian. For this analysis I required vertices within 3 sigma of the mean according to these fits.

2 Track Fit Quality Cuts

Next cuts were made on the track fit quality. The distribution of χ^2 per degrees of freedom is shown in fig.4. The number of degrees of freedom is defined as the number of points used in the fit minus the number of fit parameters. The region between 0.1 and 0.4 was selected as indicated by the red lines on the plot. There was also a minimum track curvature requirement.

3 Invariant Mass

Invariant mass was calculated for each pair of oppositely charged tracks associated with a given vertex after all of the aforementioned cuts. Given the lack of particle ID, each was assumed to be a pion.

Background was taken to be either all like charged pairs, plu-plus pairs, or minus-minus pairs. Using minus-minus pairs produced the best result which is shown here. Before doing the subtraction, the two histograms (fig.5) were scaled to have the same area. The result is shown in fig.6

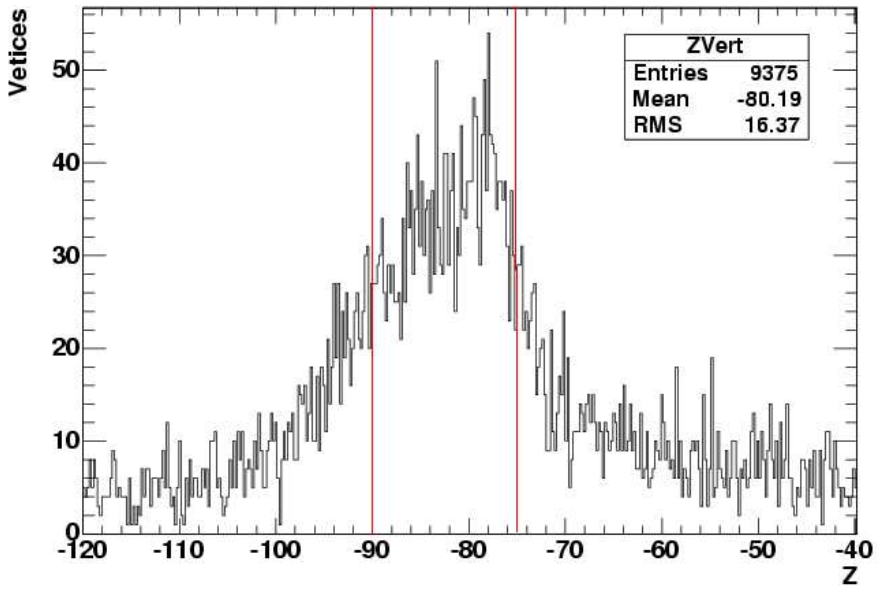

Figure 1: Distribution of vertex z coordinates in TPC frame The red lines indicate where cuts were made.

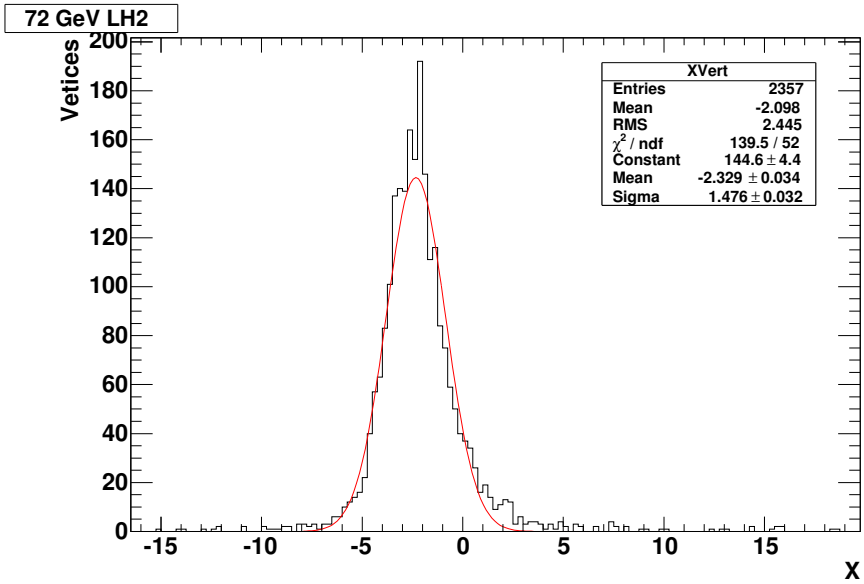

Figure 2: Distribution of vertex x coordinates in TPC frame.

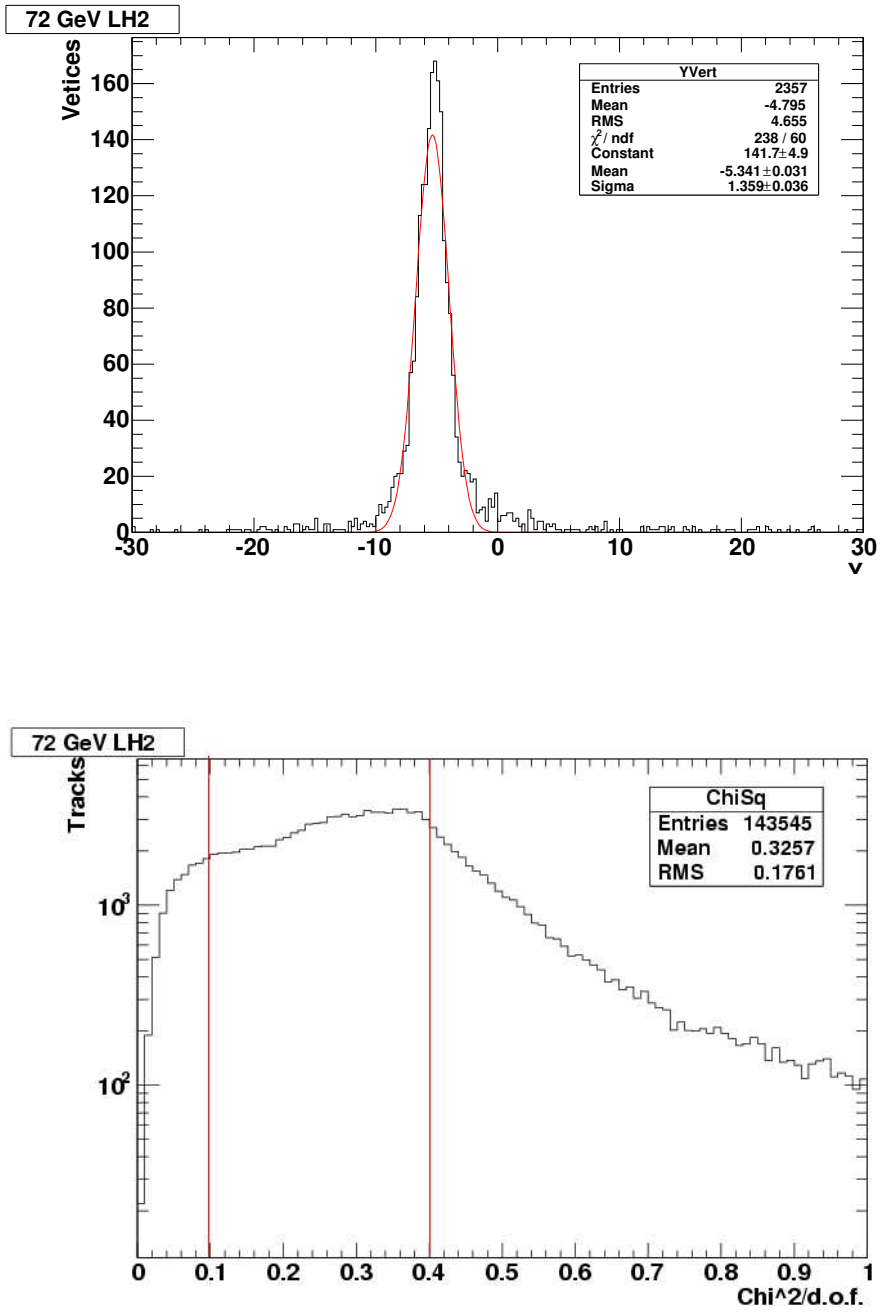

Figure 4: χ^2/d.o.f. for tracks surviving vertex positon cuts. The red lines show where cuts were made on this distribution.

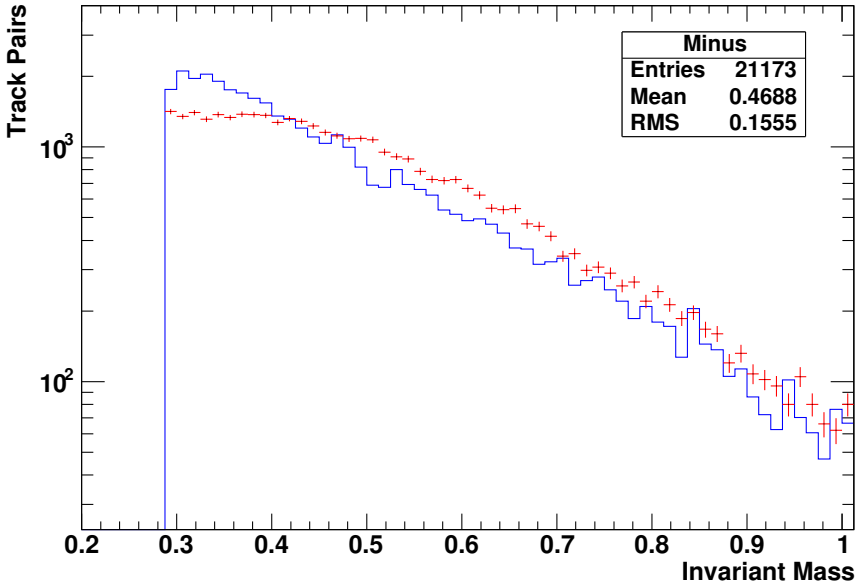

Figure 5: Red: Invariant mass for oppositely charged track pairs. Blue: Invariant mass for minus-minus pairs.

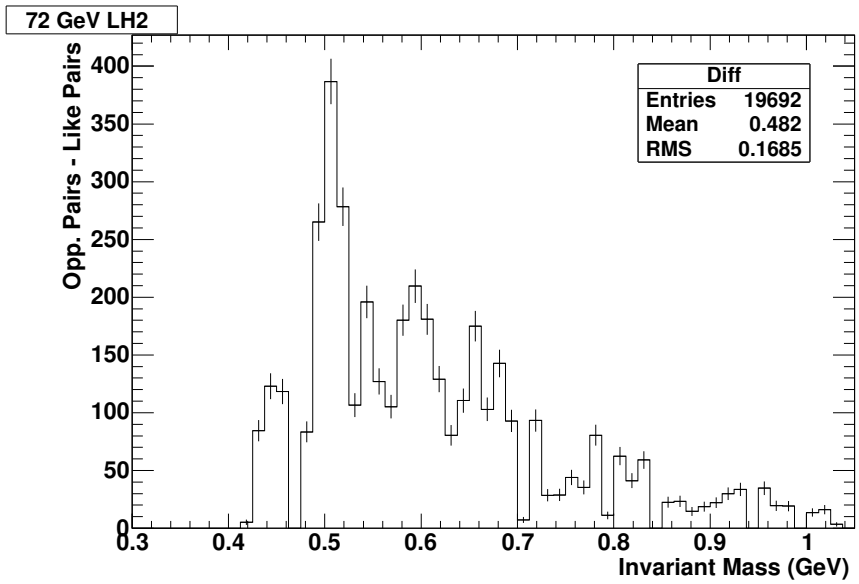

Figure 6: Invariant mass after subtraction.