1. Describe the method you used to estimate the background (i.e., random counts) that is unrelated to the muon decay.  Explain whether your background estimate matches your measurement.  
     
   The number of known background counts is the equation given below:  
   Where is the number of valid starts, is the capture rate, and is the time interval allotted for the decay electron to traverse paddle C. and are 9,537,936 counts and 10μs. In order to obtain , we would divide the total number of counts through paddle C by the elapsed time, which are 76,847,900 and 712,380 seconds, respectively. is then equal to ~107.9 counts/s. With these values we obtained the total number of background counts to be 10289. Then divide this value by the total number of channels in our dataset, 1023, we obtained an estimated background level of 10.06 counts/channel.   
   Below are the measured results for the various fittings to our dataset:  
   Text

   Description automatically generatedAn estimated background level of 10.06 matches the measured background levels for both of the weighted fits. However, the levels from the original and binned fits differ from our estimation by roughly 10%. These results would support that a weighted fit is a better and more accurate model.
2. The travel time of muons from the top of the atmosphere does not affect this measurement of the mean lifetime.  Explain why.

Regardless of whether a muon travels for a longer or shorter distance, the lifetime of muons will be constant. If the altitude of where data collection occurred were to be adjusted, this would only affect the muon flux density, which would then affect the count rate for our data collection.

For example, the first 50 or so channels were omitted from our data set because it showed a large peak around channel 48 due to wear and tear of the PMT. That adjustment made to the data is similar to what would have happened if the muons traveled a longer distance. Although the starting amplitude will change, the decay rate of the model will not.