Homework n.3 (2024)

Let's consider the article:
J.H. Christenson et al. "Evidence for the 2pi decay of the K02 meson" Phys. Rev. Lett. 13 (1964) 138

From the information that can be gathered from the text and plots of Figs. 2 and 3 evaluate the following quantities and answer the questions:

AFTER FINAL SELECTION FOR SIGNAL EVENTS

1. Number of candidate events after final selection
2. Number of signal events after final selection
3. Number of background events after final selection (make a simple extrapolation to evaluate it, e.g. define a signal region and extrapolate the background from sidebands)
4. The purity of the sample after final selection
5. The significance of the observed signal

BACKGROUND

6. Total number of events collected
7. The total number of background events in the experiment before the event selection
8. The total background rejection factor.
9. The total number of decays to be considered as normalization for the Branching Ratio R evaluation.

REFERRING TO FIG.2(a):

10. Which is the significance of the signal considering a region on the distribution of the invariant mass alone, wide 1 (or 2) bin(s)?
11. What resolution on the invariant mass would have been necessary to get a significance on the observed signal based on the observation of the invariant mass alone (i.e. without the measurement of the angle θ^*) at the same level of the final result in the paper?

GENERAL

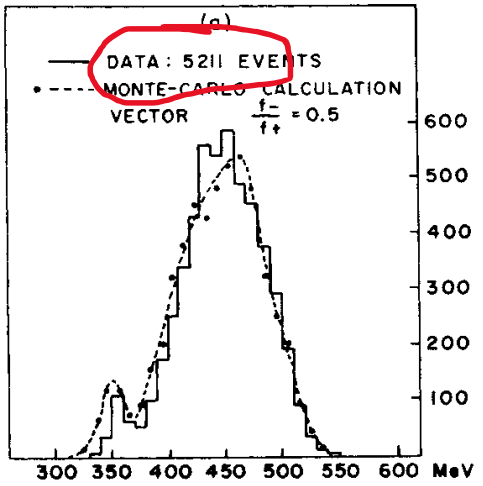
12. Did the authors make an absolute or a relative measurement?
13. Spot the typo in the formula for the evaluation of the CP violation parameter $|\varepsilon|$ (the numerical value of $|\varepsilon|$ is correct).
14. What are the approximations for R in this formula?

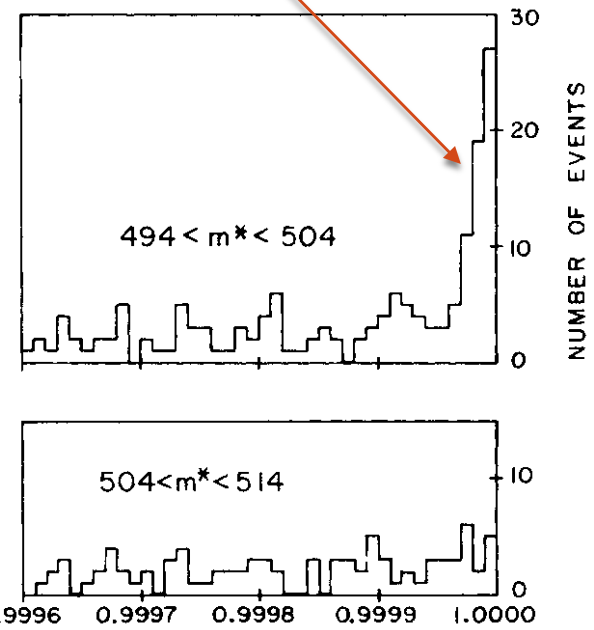
Homework n.2

1. Total number of events collected
   5211

2. Number of signal events after final selection

We obtain 45 ± 9 events in the forward peak after subtraction of background





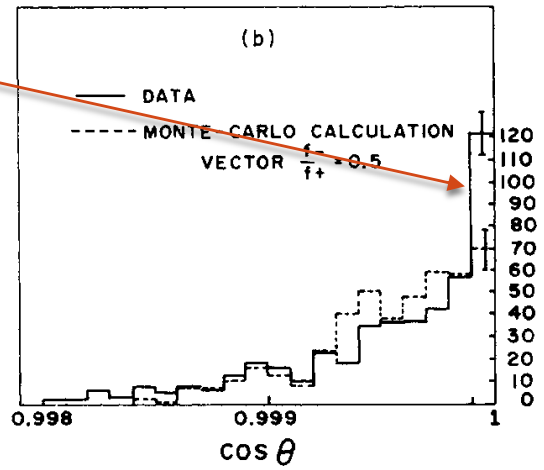
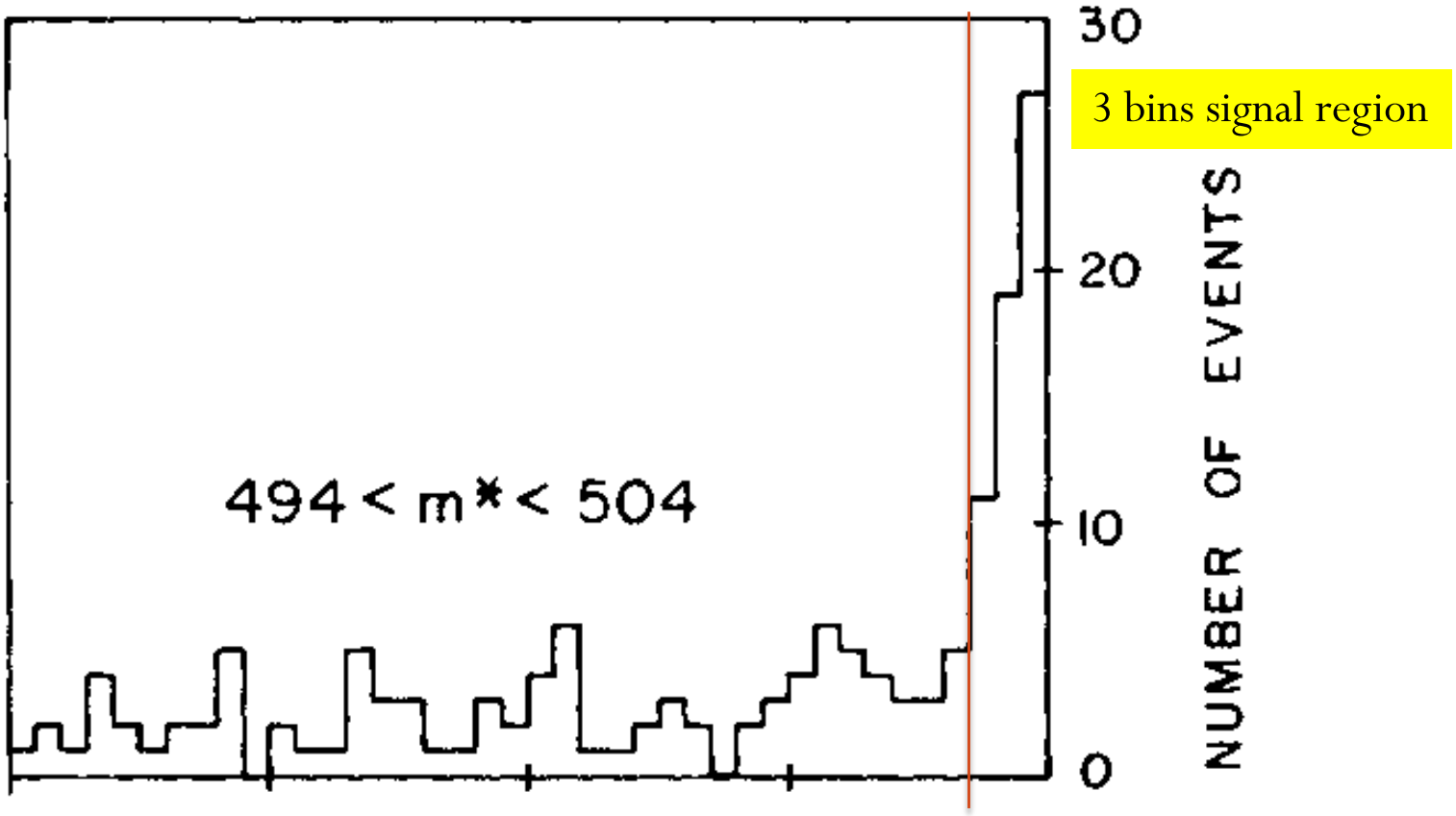


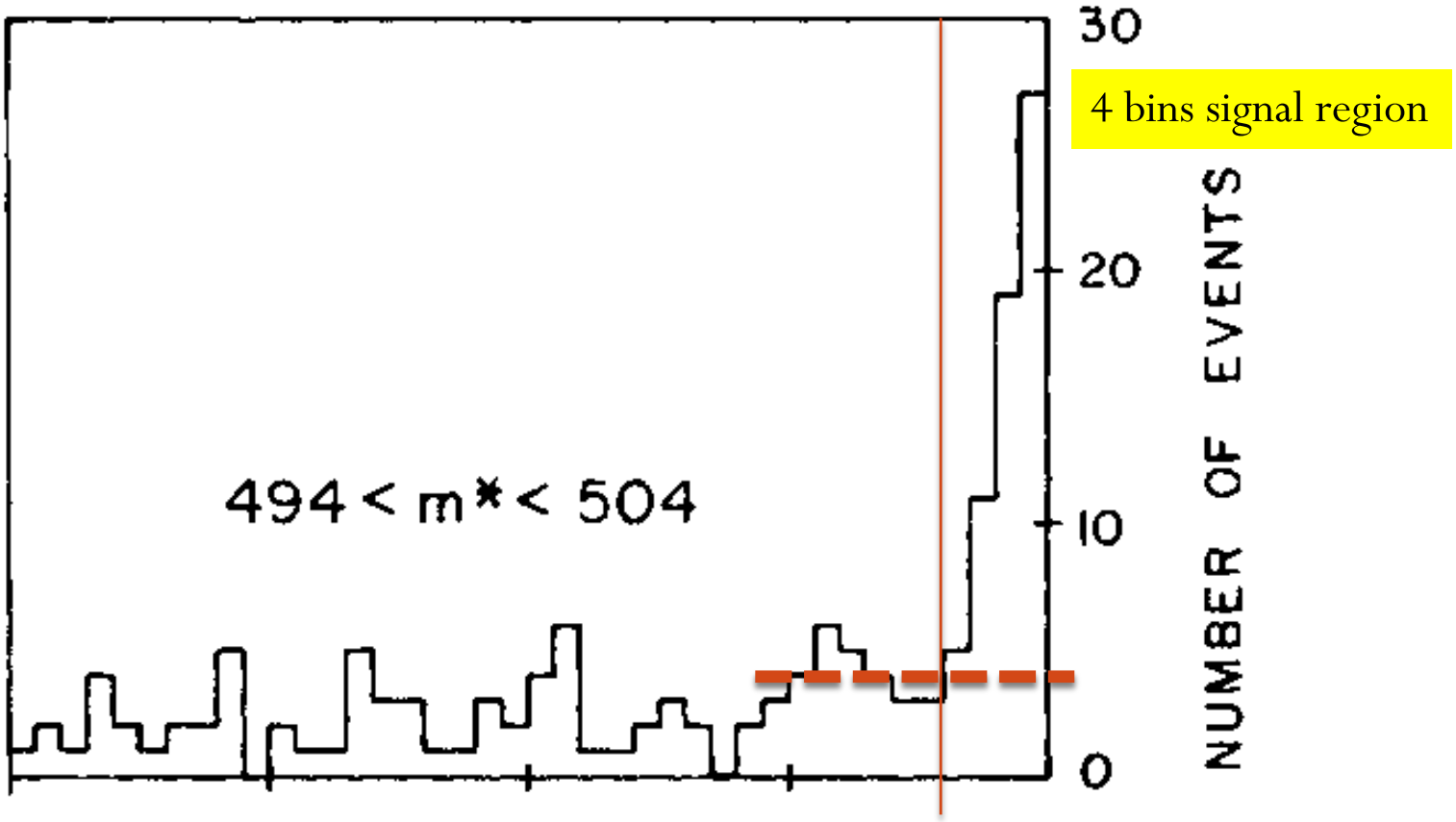
FIG. 2. (a) Experimental distribution in m^* compared with Monte Carlo calculation. The calculated distribution is normalized to the total number of observed events. (b) Angular distribution of those events in the range $490 < m^* < 510$ MeV. The calculated curve is normalized to the number of events in the complete sample.



S=45

N=57 = S+B => B=12 => 4/bin

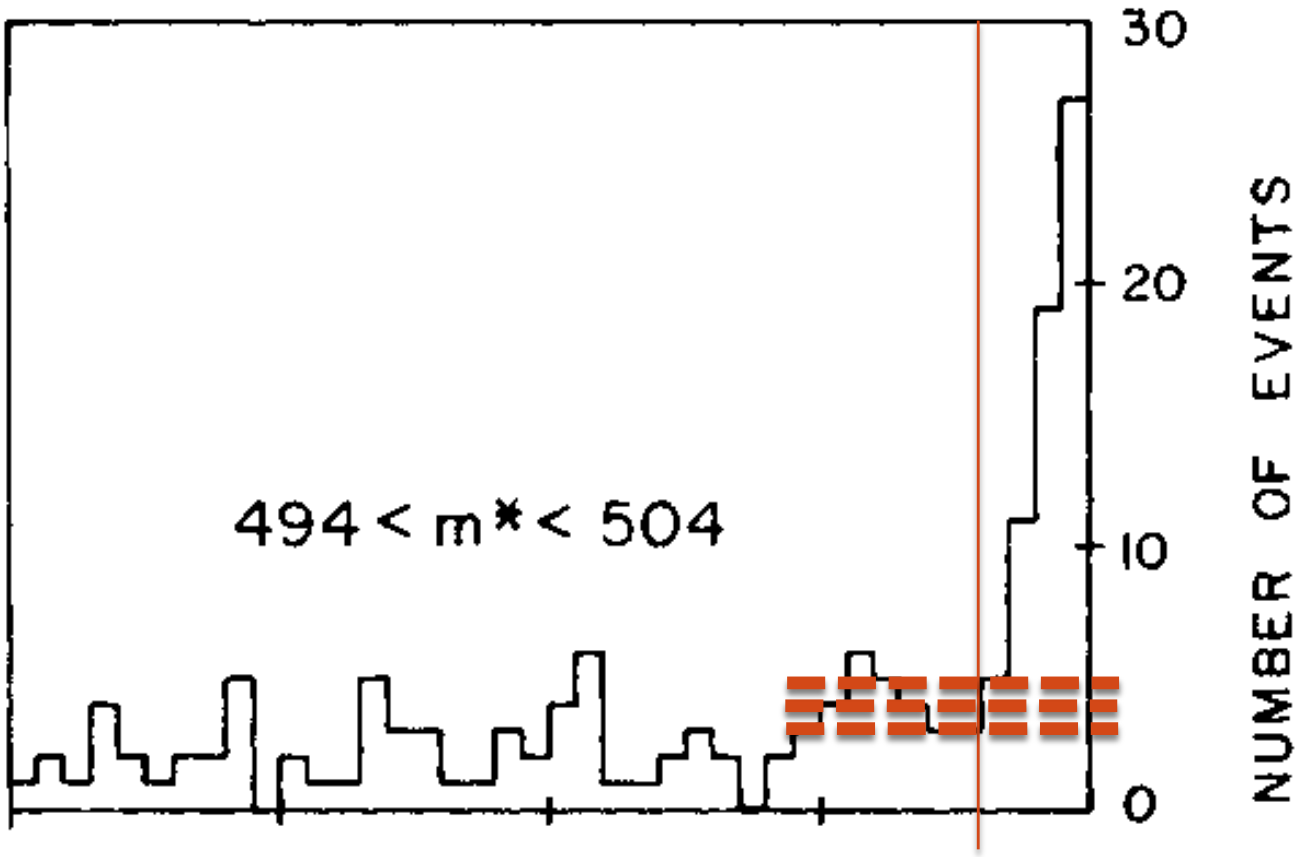
from sidebands a background level is extrapolated between B=4/bin and B=4.25/bin



S=45

N=62 = S+B => B=17 => 4.25/bin

from sidebands a background level is extrapolated between B=4/bin and B=4.25/bin



S=45

N=62 = S+B => B=17 => 4.25/bin

from sidebands a background level is extrapolated between B=4/bin and B=4.25/bin