MEPP - Homework #2

1) **Total number of events collected**

From a corrected sample of 22700 K_2^0 decays 5211 events were collected.

2) **Number of signal events after final selection**

Selecting only events in the forward peak between 494 MeV and 504 MeV we find (45 $\pm$10) events from H target and (45 $\pm$ 9) from Beryllium. Moreover more or less 10 of these events are from coherent regeneration. This numbers are corrected for efficiency.

3) **Significance of observed signal**

significance = S\σ(S) = 45\10 = 4.5

4) **Number of background events after final selection**

Taking a mean background of 3 events per bin in figue 3b and taking as the signal region the last bin (27 events) we get 3 background events.

5) **The purity of the sample after final selection**

The purity of the signal is then 27-3 / (27) = 88%

6) **The number of background events observed in the experiment before the final selection.**

If we have 5211 total events and (27-3) signal events with 3 background events in the candidate sample, then (5211-24) = 5187 is the number of total background events.

7) **The total background rejection factor**

Therefore the ability to reject background is R = 5187/3 = 1728

8) **The total number of decays to be considered as normalization for the Branching Ratio R evaluation**

The total number of decays to be considered is the number of observed events corrected for the efficiency of the apparatus so as stated in the paper 22700 total decays.

9) **Did the authors make an absolute or a relative measurement?**

The authors made a relative measurement since they measured R as the ratio of the number of decays into 2 pions and the number of charged decays.

10) **Spot the typo in the formula for the evaluation of the CP violation parameter $|\epsilon|$ (the numerical value of $|\epsilon|$ is correct).**

Based on dimensional analysis we need at least the two lifetimes to be divided in the formula, if we compute $|\epsilon|^2 = R_T(\tau_1/\tau_2)$ we in fact get the correct result.

11) **What are the approximations for R in this formula?**

The adopted approximations are basically two : in the expression for R they consider a normalization that only accounts for charged modes, moreover since $|\epsilon|$ is assumed to be small the total state normalization is approximated with $\sqrt{1+|\epsilon|^2} \approx 1$.