

## RESULTS AND CONCLUSIONS

According to Figure 3, plotting  $2U$  versus  $r^2B^2$  does yield a linear plot. Ideally, the slope of the plot should be equal to the electron-to-mass-ratio, or “e/m”. The 2 lines plotted in Figure 3 represent the full range of possible slopes that fit all of the data. Those slopes fall within the range of  $1.865 \times 10^{11} \pm .135 \times 10^{11} \frac{C}{kg}$ . Applying the usual method of rounding the final result, our experimental value for e/m is  $2 \times 10^{11} \pm .1 \times 10^{11} \frac{C}{kg}$ . This agrees with the accepted value of e/m  $1.758820024 \times 10^{11}$  to within uncertainties.

The uncertainty in the final result is on the order of 5% of the average value. This seems to imply that there is some room for improvement. Rewriting Eq. (7) as

$$\frac{e}{m} = \frac{2U}{r^2B^2}, \quad (8)$$

one can take the total differential to obtain

$$d\left(\frac{e}{m}\right) = \frac{2}{r^2B^2}dU - \frac{4U}{r^3B^2}dr - \frac{4U}{r^2B^3}dB. \quad (9)$$

Treating infinitesimally small changes in  $e/m$ ,  $U$ ,  $r$  and  $B$  (traditional calculus notation) as experimental uncertainties, Eq. (9) can be rewritten as an error equation as follows.

$$\delta\left(\frac{e}{m}\right) = \frac{2}{r^2B^2}\delta U - \frac{4U}{r^3B^2}\delta r - \frac{4U}{r^2B^3}\delta B. \quad (10)$$

The first term is an expression that illustrates how small uncertainties in  $U$  translate into small uncertainties in  $e/m$ , the second term illustrates how small uncertainties in  $r$  translate into small uncertainties in  $e/m$  and the third term illustrates translates how small uncertainties in  $B$  translate into small uncertainties in  $e/m$ .

An error-analysis table can be constructed where the first two terms in Eq. (10) serve as column headings. With this table one can identify the dominant source of error. The third term which relates to magnetic field, will not be listed in the error-analysis table as the current, and subsequently the magnetic field, was treated as a constant in our experiment.

We have reviewed this document and fully support its contents- Aric Moilanen - Greg W Frank zoladz –Jeremy W