ANALYSIS

The non-linear behavior of the original data set makes it very difficult to obtain a value for *e/m*. A model will be devised that will linearize the data with a slope of that line equaling *e/m*.

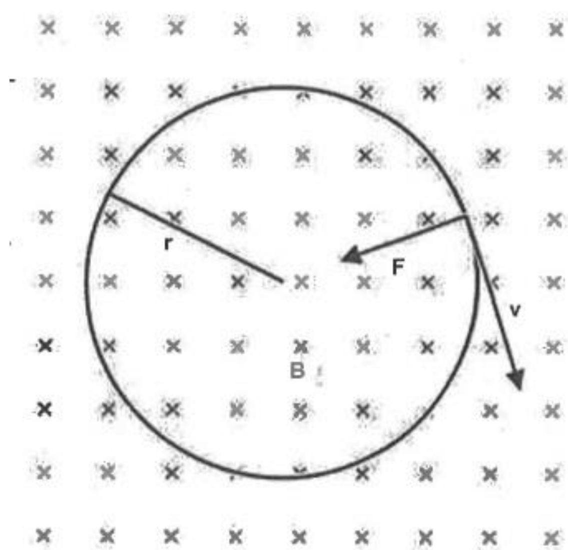

FIGURE 2: Diagram of electron movement in the e/m tube

An electron moving perpendicular to a uniform magnetic field experiences a Lorentz force

$$F = e * v * B \tag{1}$$

This creates a centripetal force on the electron

$$F = \frac{mv^2}{r} \tag{2}$$

Setting these two forces equal

$$e * v * b = \frac{mv^2}{r} \tag{3}$$

Solving for e/m

$$\frac{e}{m} = \frac{v}{Br} \tag{4}$$

But the electron’s velocity is dependent only on the accelerating voltage (U)

$$v^2 = 2U * \frac{e}{m} \qquad (5)$$

To avoid square roots, we square Equation (4)

$$\frac{e^2}{m^2} = \frac{v^2}{B^2 r^2} \qquad (6)$$

Equation (6) can now be re-written using Equation (5)

$$\frac{e^2}{m^2} = \frac{2U * \frac{e}{m}}{B^2 r^2} \qquad (7)$$

Simplifying

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

If one plots,

$$B^2 r^2 \; versus \; 2U \qquad (9)$$

then one should obtain a linear plot with a slope of *e/m*.

We have reviewed this document and fully support its content – Aric M – Frank Z- Greg W –Jeremy W