Lab 11: Electron Acceleration and Deflection by Electrostatic Fields

Philip Kim

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Table 2: Electron Deflection			
X_{obs}	Y_{obs}	Y	F_D
8.3	-2.40, 2.35	2.38	-0.03
8.0	-2.20, 2.05	2.13	-0.08
7.3	-2.10, 1.45	1.78	-0.33
7.0	-1.40, 1.35	1.38	-0.03
6.3	-1.30, 1.25	1.28	-0.03
6.0	-1.20, 1.15	1.18	-0.03
5.3	-1.10, 1.10	1.10	0.00
5.0	-0.50, 1.00	0.75	0.25
4.3	-0.40, 0.50	0.45	0.05
4.0	-0.30, 0.30	0.30	0.00

(a) Measure the distance between the plates s = $\boxed{5.3\ cm}$

(b) Graph $y\ vs.\ x^2$, include error bars. Measure the slope of the graph, slope =?

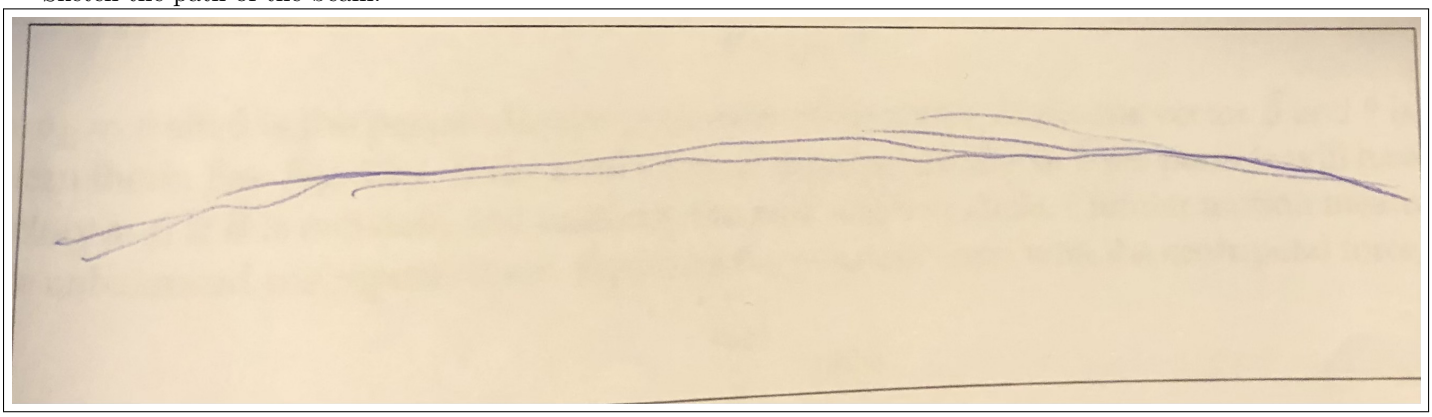
b

(c) From the slope, calculate the correction factor F_D =?

c

Table 3: Thompson's Experiment				
$V_{PS}(kV)$	2.00	2.50	3.00	3.50
I (A)	0.18	0.23	0.28	0.33
B (T)	7.62e-4	9.73e-4	0.12e-2	0.14e-2
e/m (C/kg)				

Sketch the path of the beam:



11.6 Questions

1. Calculate the speed of the electron for the maximum voltage available for acceleration, in meters per seconds.
2. What fraction of the speed of light is this?
3. According to the special theory of relativity, the mass m of an object that is moving with velocity v with respect to an observer is larger than its rest mass m_0. The rest mass is the mass of the object when it is at rest. The equation that describes this phenomenon is

$$m = \frac{m_0}{\sqrt{1-\frac{v^2}{c^2}}},$$

   where $c = 3.0 \times 10^8 m/s$ is the speed of light in vacuum. Evaluate the mass for the electrons in this experiment that are moving at v you calculated in 1. How much larger is this than m_0?
4. Compare your measured e/m from Thompsons Experiment to the known value, $1.76 \times 10^{11} C/kg$.