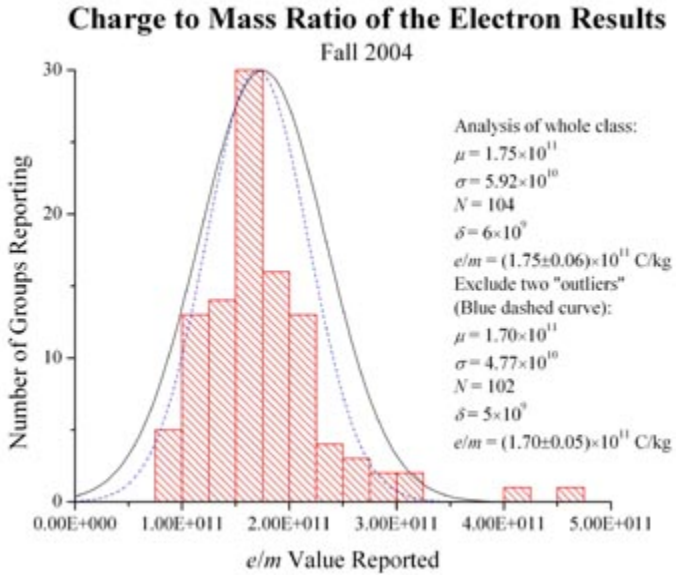
Lab #5A - MAG

Lab #5A, *Magnetic Fields*, is set up in Rockefeller 402, while Lab #5B, *Magnetic Induction*, is set up in Rockefeller 403. Classes in one room at the beginning of the lab period will shift to the other room halfway through the period.

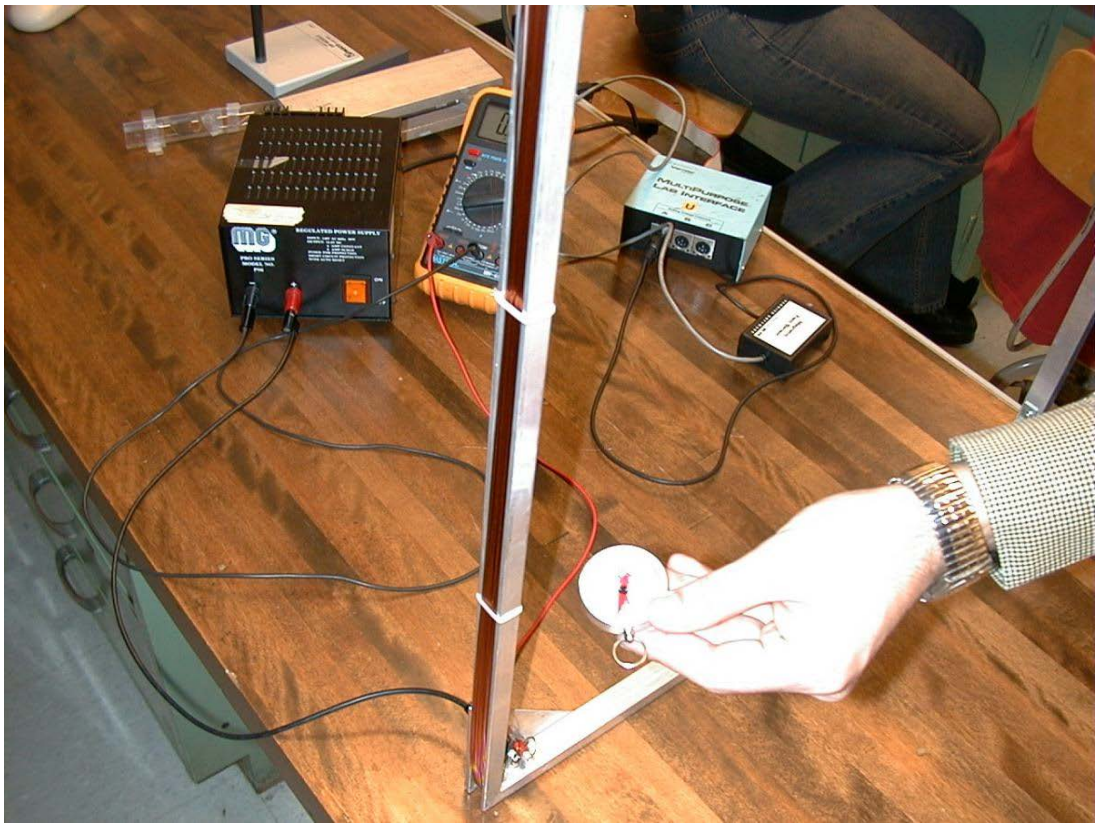
EOM Results

Averaging the 104 groups' values from the Fall 2004 semester for *e*/*m* yields a class value of (1.75 ± 0.06) x 10^{11} C/kg, which is consistent with the accepted value. The figure below has a solid gaussian with a center and standard deviation of the whole class. The class-gaussian seems a bit broader than the histogram because of two reports that seem to be "outliers." Removing those two reports from the analysis yields a value of (1.70 ± 0.05) x 10^{11} C/kg; this value is slightly more than one standard error from the accepted value. The blue dashed curve is a gaussian with the mean and standard deviation of the class less the two "outliers."

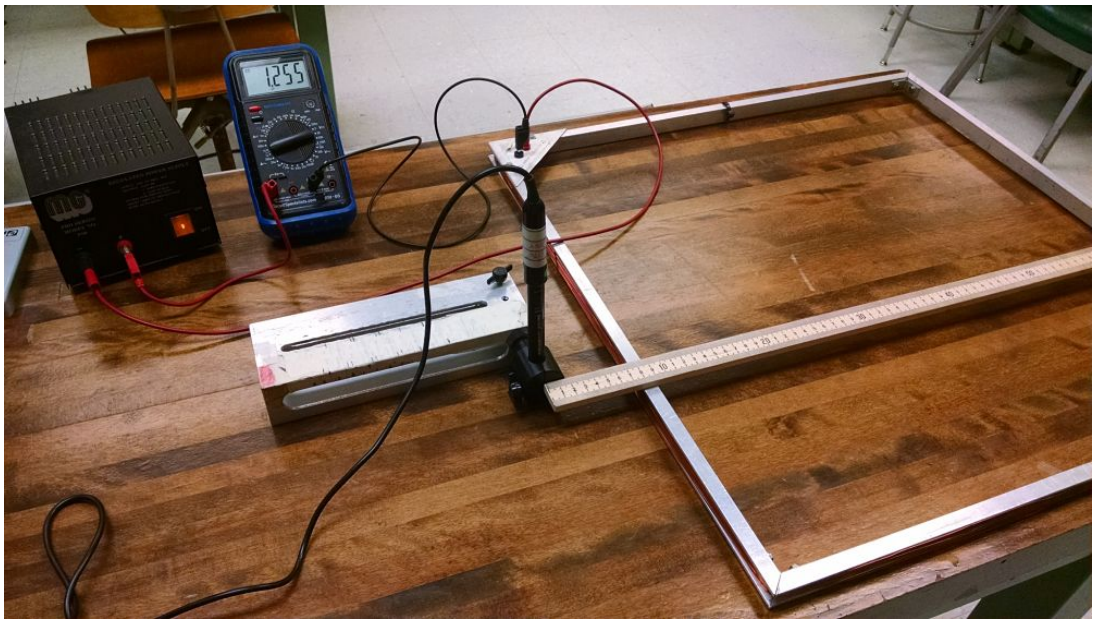


Section D.3. Long Wire

The picture below illustrates the setup with the square coil being held vertical while you probe the direction around a vertical leg of the wire using a small compass.



The picture below shows the setup for measuring the magnitude of the B field of the square coil. Be certain the white dot on the probe faces down. Also check that the positive (*red*) output of the power supply is connected to the positive jack on the square coil. If you have this backwards, you will record negative rather than positive magnetic fields. This won't affect the key results of this section.



Section D.4. Coils & D.5. Disk Magnet

So that the sign of the magnetic field produced by the coil is positive as read by your Hall probe, mount the coil with the banana jacks facing up. The picture below illustrates this setup.

The measurement of the distance between the Hall probe and the coil (or magnet) is awkward. If you like, you may use tape to attach your ruler to the setup. The distance in this experiment should be taken as the separation between the Hall probe bar on which the white dot is painted and the center of the coil (or disk magnet). Any uncertainty in setting and measuring this distance should be included in your error bars for this experiment.

Do be careful to insure that the Hall probe is centered over the coil and, later, the disk magnet. Since the coil and magnet mounts have different lengths, you will have to adjust the Hall probe when switching between Sections D.4 and D.5.

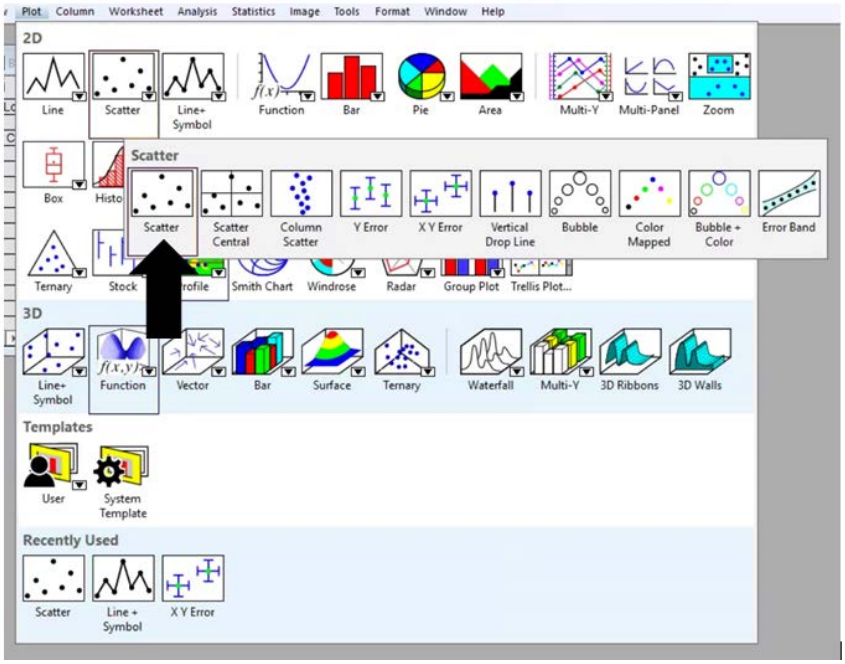
Lab 5 MAG/IND - Origin Guide

So Lab 5 in the E&M labs is split into two parts, MAG(netism) and IND(uction). IND is actually quite straightforward, and doesn't use Origin at all. MAG, on the other hand...

Section D.[3,4,5]:

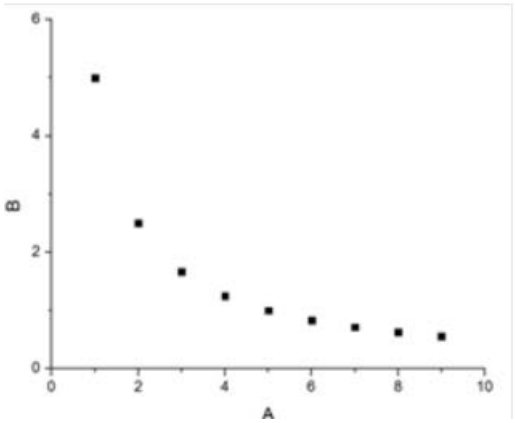
Your goal for these sections is to plot your magnetic field reading "B" against your distance "r."

1. Open Origin and input your data. This should be very easy at this point. If you have error bars, and you should, you can add in extra columns for them.



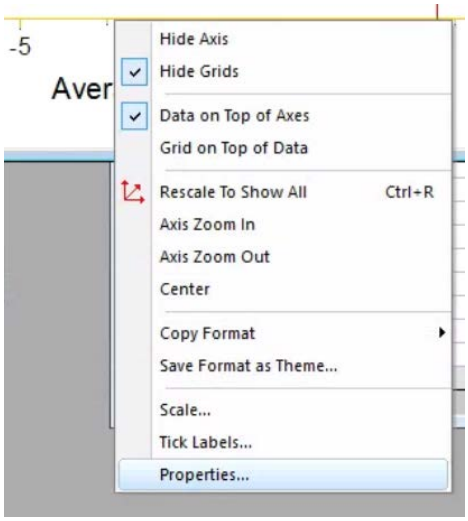
2. Once you have your data, go to *Plot->Symbol->Scatter*. Make sure that none of your data is selected, otherwise you will most likely not get the plot you want.

3. Choose "r" for your X axis and "B" for your Y axis, putting the error bars where they need to be (Xerror and Yerror respectively). Click OK; if you see instead ADD, press that, and then press OK.



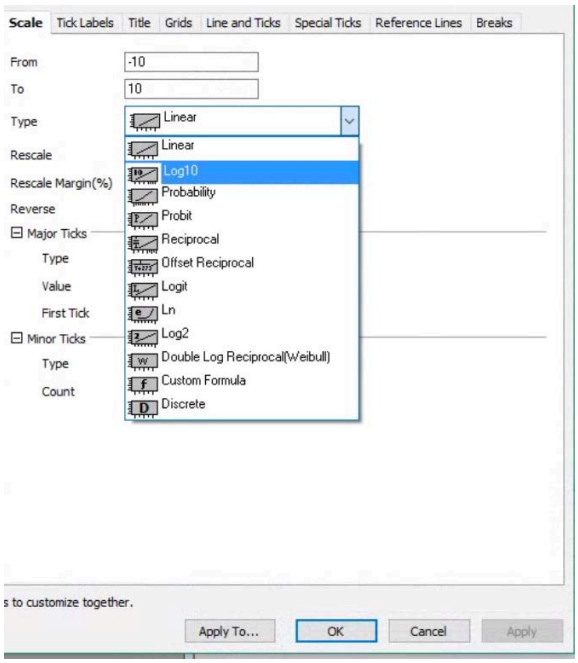
4. You have your plot, now you need to play with it. The hardest part here is putting the plot into Log-Log scale. For reference, your data should like something like the graph above in terms of general shape.

a. Right-Click on one of your Axis, which one doesn't matter, since it is the same set of instructions for both.



b. Click *Properties* down at the bottom of the drop-down list. This will bring you to a new screen with a few strange images all over it.

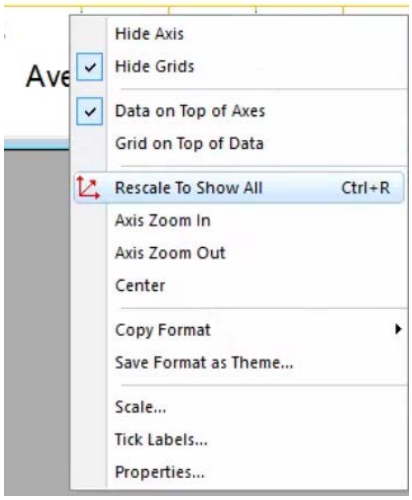
c. Click the drop-down list where it says "LINEAR." Within those options, click on "LOG10."



d. You won't see any sort of immediate change to the graph, but that is OK. Go to the left-hand side of this box, where it says "HORIZONTAL" and "VERTICAL." Click on the one that is **NOT** selected, and change that one from "LINEAR" to "LOG10."

e. Press OK.

5. Your Graph should have changed rather dramatically. That is fine, for we can fix this. Right-click on one of the axis and click the option near the top that says something along the lines of "RESCALE." It should have a nice image next to it. This will make your graph look like a normal graph.



6. Once your graph looks normal, all you have left to do it plot a Linear Fit. You should be aware by now how to do this. The information that you are really looking for is the value of "b" given by the fit; this will be the experimental exponent of your "B"-to-"r" relationship.

7. Go through the same process for parts 4 and 5. The data is different, but the process is the same!