

## Project 1 (Sept. 5, 2006)

### Power measurements

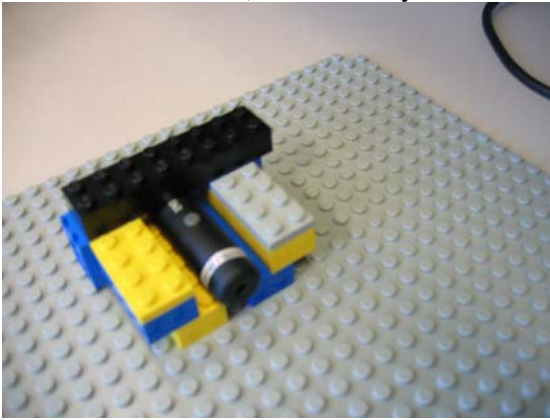
The goals of this activity are to:

- a) get you to think about mean and peak power measurements and pulses of light
- b) get you started with some basic lego activities
- c) work as team

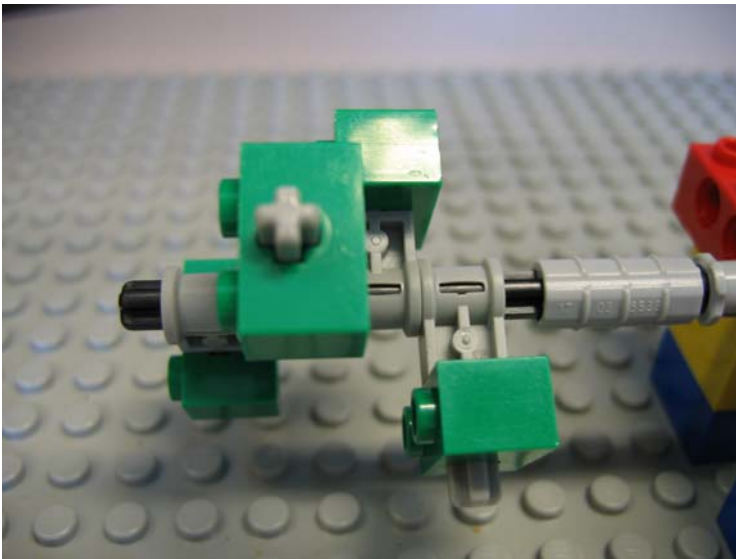
### Set up:

Your set-up will consist of six main components:

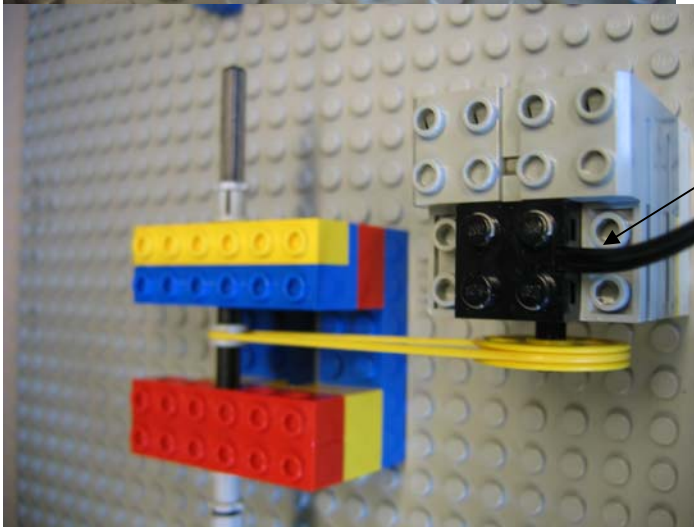
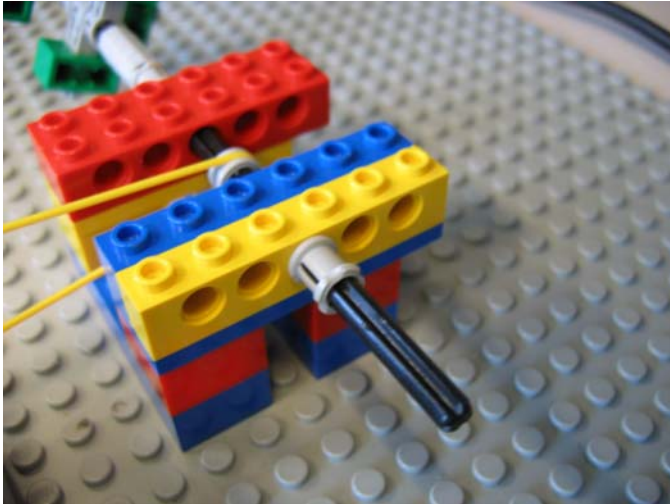
1. A laser holder (onto which you will obviously mount your laser)



2. A beam chopper, that you will use to block the laser beam over specific time intervals

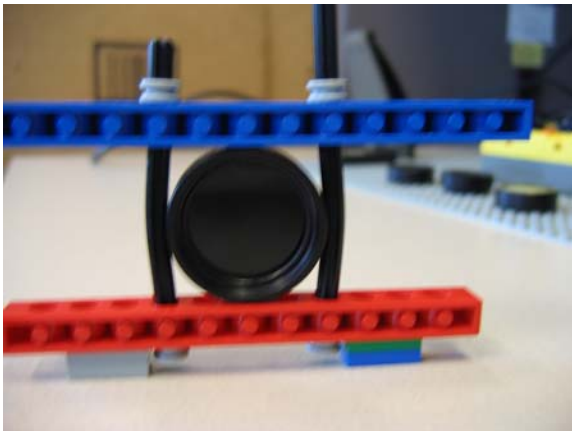


3. A holder for your beam chopper that also includes a motor that you will control to move the chopper

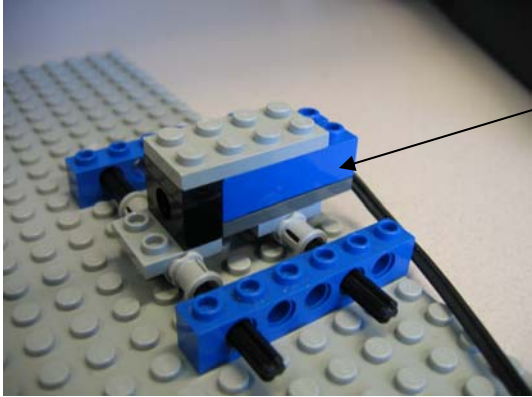


Motor for turning chopper; connects to RCX

4. A filter and filter holder to attenuate the laser beam so that the detector doesn't saturate



5. A sensor and a sensor holder to record the laser power that makes it past the chopper.



Sensor; connects to RCX

6. A driver that will allow you to move your lego parts and acquire data.

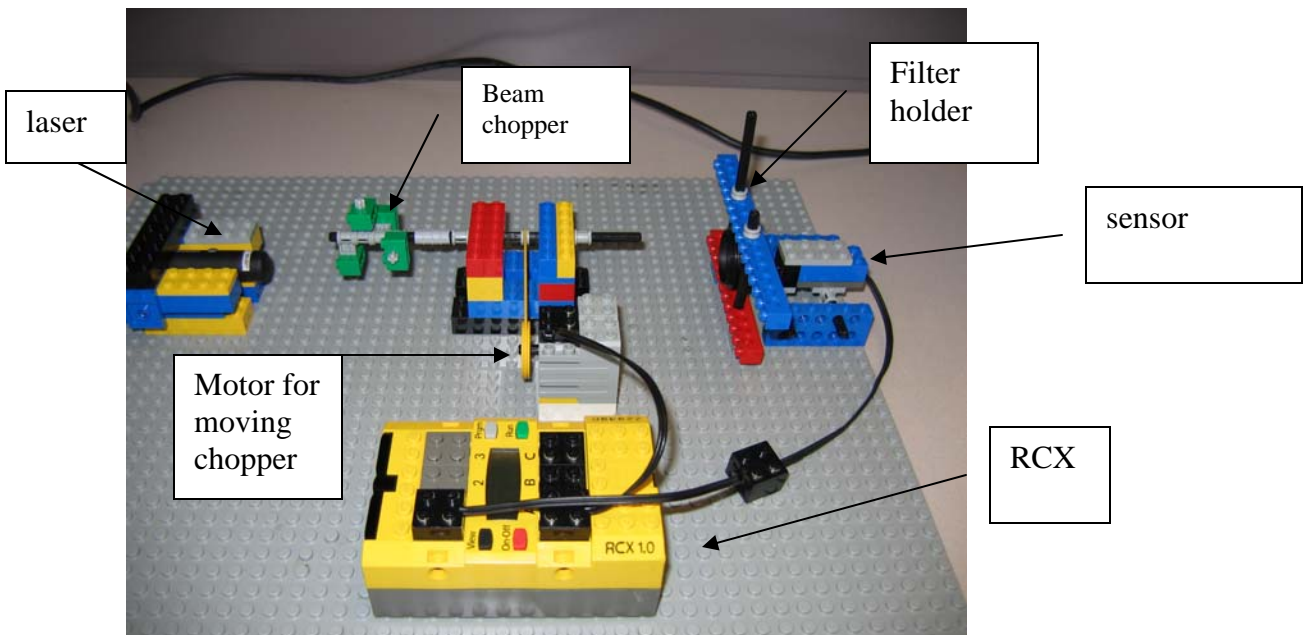
Each one of you should be responsible for setting up one of the parts. Then you should work together to line the parts up, take the data and discuss your results.

You should line up the chopper so that the laser beam hits the green blocks as they turn.

Make sure your filter holder and filter do not block the beam entirely. If you put a piece of paper behind the filter you should see a little light coming through.

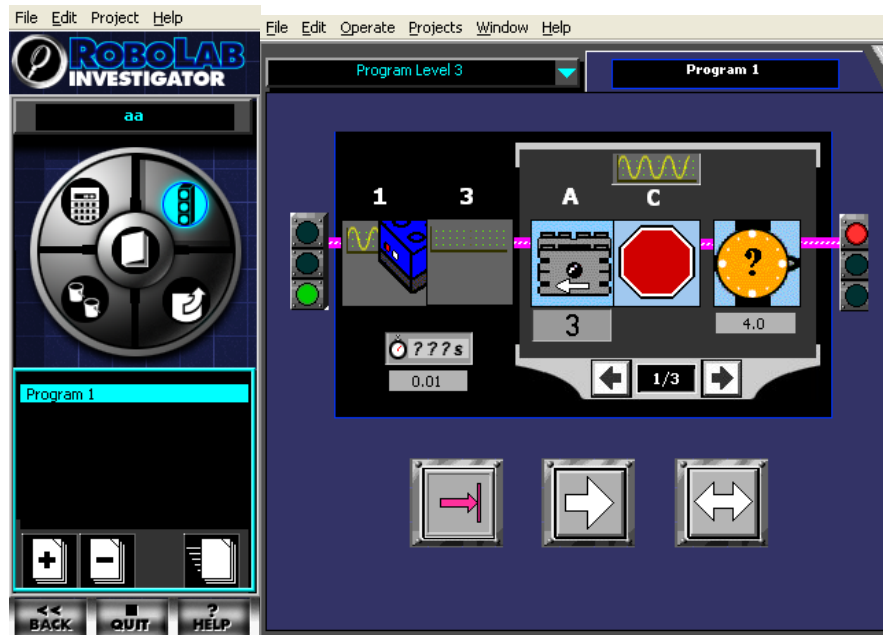
Line up your sensor so that when the laser beam goes through the chopper it hits the sensitive area of the sensor.

Hook your sensor to Channel 1 of the RCX and the motor to Channel A. When you're done, your set-up should look like this:

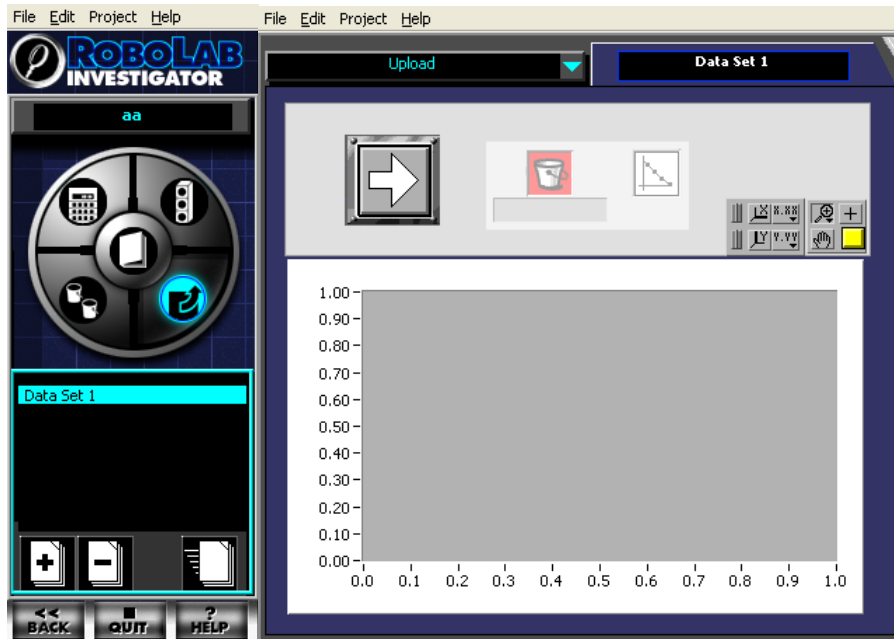


### Taking power measurements:

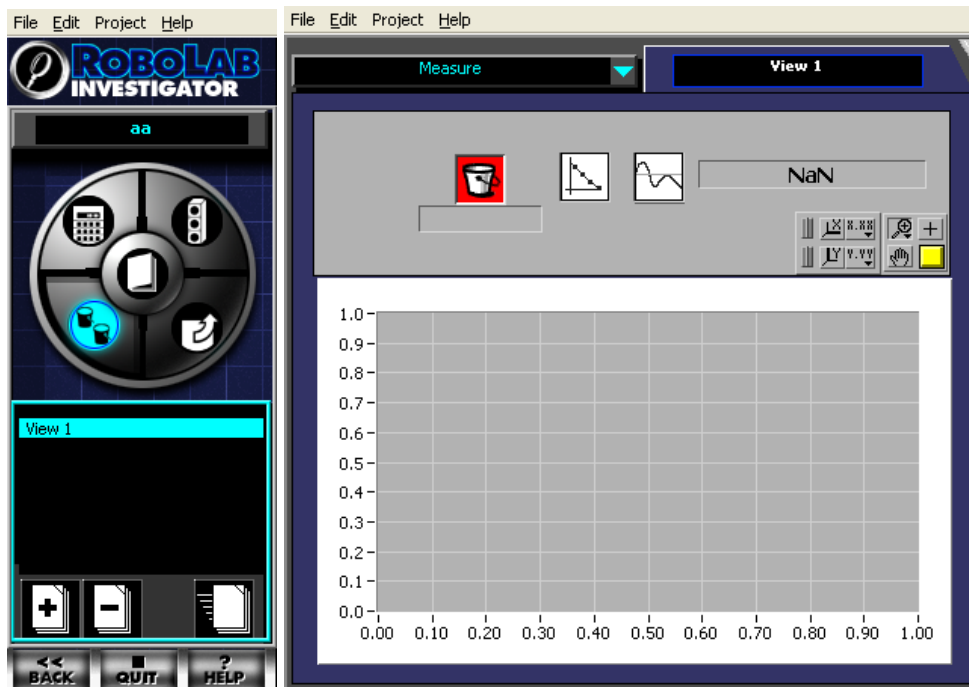
1. Open ROBOLAB and click on INVESTIGATOR.
2. Open the laser intensity project. You should see the following settings.



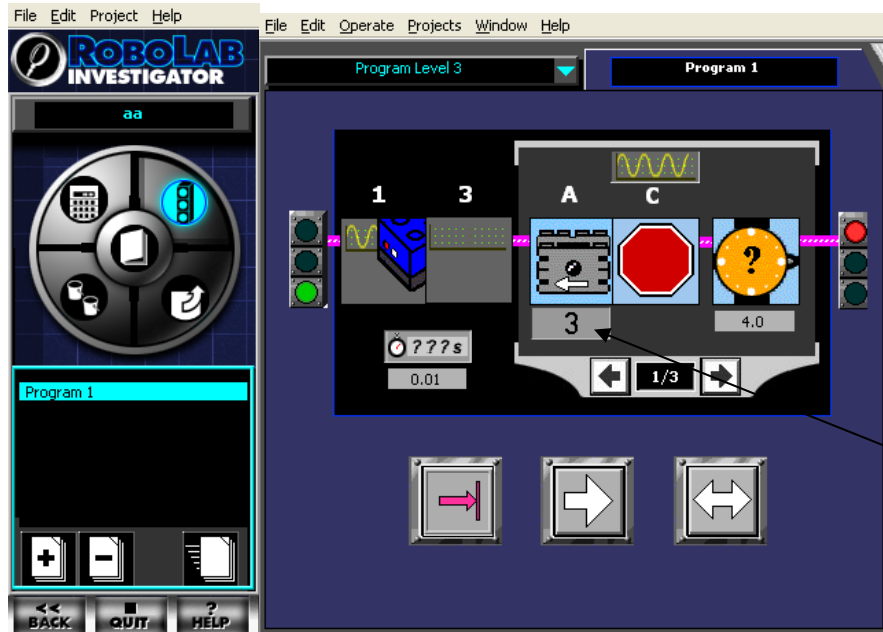
3. Upload the program to the RCX by clicking on the white, middle arrow.
4. Turn the laser on and then run the program by clicking the green Run button on the RCX.
5. Upload the acquired data back onto the computer. Press the icon with the arrow on the bottom right of the circle that is at the left hand corner of the panel. The icon is shown in blue below. Create a new data set by clicking on the "+" button each time you upload new data. Instead of Data Set 1, you can change the name to something more meaningful to you. Click on the white arrow to upload the data. Select a specific color bucket (data bin) that will correspond to this specific data set.



6. Now press the left bottom icon of the circle to do some analysis. Select the “Measure” mode from the top left control bar, make sure the bucket is the color that corresponds to the data you just took and set the second icon to the right of the bucket to correspond to the means icon. You should see a number right next to the icon that corresponds to the mean power for your measurements.



7. Write the mean value in the table below
8. Repeat steps 4 through 7 two more times.
9. Press the top right icon of the circle so that you can see again the initial panel.



10. Click on the icon that has the number “3” underneath it and select number “5”.
11. Repeat steps 3 through 7 once and then steps 4 through 7 two more times.
12. Switch the speed back to 3 and remove the green blocks from your chopper.
13. Take three sets of data and record the mean power for each set.

| Measurement                            | Mean |
|--|------|
| Trial #1 (slow speed)                  |      |
| Trial #2 (slow speed)                  |      |
| Trial #3 (slow speed)                  |      |
| Trial #1 (fast speed)                  |      |
| Trial #2 (fast speed)                  |      |
| Trial #3 (fast speed)                  |      |
| Trial #1 (smaller chopper blades—slow) |      |
| Trial #2 (smaller chopper blades—slow) |      |
| Trial #3 (smaller chopper blades—slow) |      |

Questions to consider:

1. Are the power measurements reproducible for the same settings?
2. Did the average power change when you changed the speed of the chopper? Why not or why yes? (Consider making a time plot of your power readings)
3. Did the average power change when you removed the green blocks from the chopper? Why not or why yes?