University of Maryland Baltimore County - UMBC

Phys650 - Special Topics in Experimental Atmospheric Physics (Spring 2009)

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http://userpages.umbc.edu/~martins/PHYS650/

Some Guidance for your next Summary report

- Your weekly summary report should discuss the activities of your week. It is supposed to be a relatively informal and short report but make sure you identify yourself and describe relatively well your activities with drawings, pictures, plots, and text. It does not have to be extensive. One or two pages are fine. More is also OK if needed.

- Make sure you turn it in on time (every Tuesday before noon) so that we can prepare the next discussion.

- The worse you can do is not to turn in your short report. The report is the input for next days discussion and for significant component of your grade (see course description on the web).

This week's report:

There are many items that can be included:

- Homework assignment (next few slides) in preparation for the project

- Calibration of the spectrometer and the results of your measured LED emission spectrum compared with the atmospheric transmittance spectrum

- Update from the Sampling station:
  - Calibration of the Mass flow meter (if you did it this week)
  - Discussion of filter weighing procedure (if you did it this week)
  - Discussion on any activities you did related to the station (this is required for this week's manager but it is optional for the others)

- Any other activity or discussion you find relevant to include

Homework Assignment in preparation for next Class:

- Design the printed circuit board for your LED sunphotomer.
  - Next class, we will provide enough material to manufacture your own board using a manual process. Though this is an old fashion process, it is still effective for several projects.
  - Today there are many companies where you can go online and design and manufacture your printed circuit board in small or large quantities (e.g. http://www.pcb123.com/ or http://www.pcbexpress.com). You may decide to go to one of these sites and purchase (totally optional) your own board before next class.

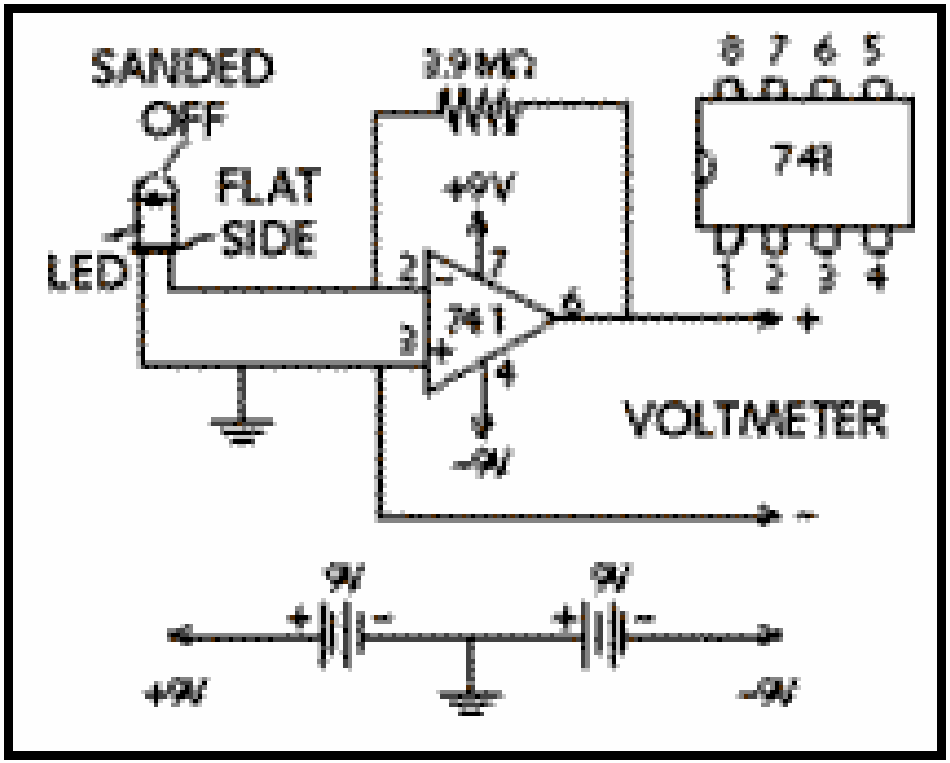
- Think about the mechanical assembly of your system. You need a box that holds the LEDs (allows its alignment with the sun), the batteries, a switch, a voltmeter, and the amplifier circuit, in a small and convenient package. Refer to the Haze Span site (see also the PHYS650 webpage) for reference. We will provide you with a box and the components for your sunphotometer.

- Question for thinking and research: How can you calibrate your sunphotometer in order to have high accuracy measurements of the aerosol optical depth? How accurate do we need aerosol optical depth measurements to be?

Electronic Circuit Diagram for The LED Sunphotometer

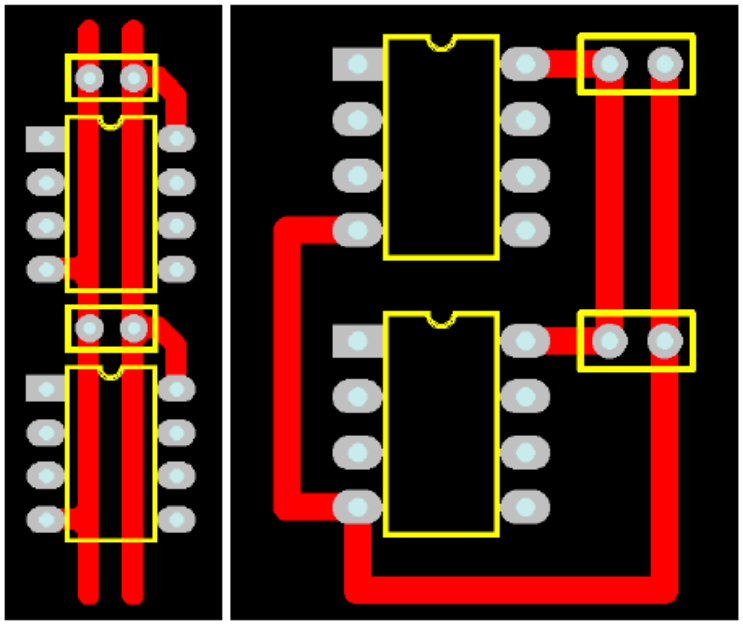
(extracted from F. Mims III, Scientific American)

Pin numbering on 741 opamp and voltmeter polarity corrected. Figure in original Scientific American article had pins 5-8 reversed and voltmeter polarity backwards.

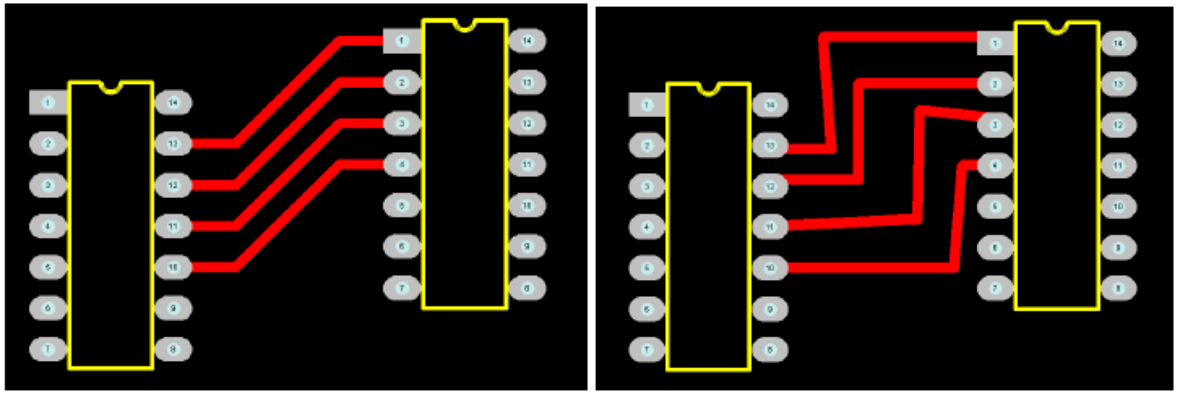


Example of printed circuit board routing design

(from PCB design tutorial, by David L. Jones at www.alternatezone.com):



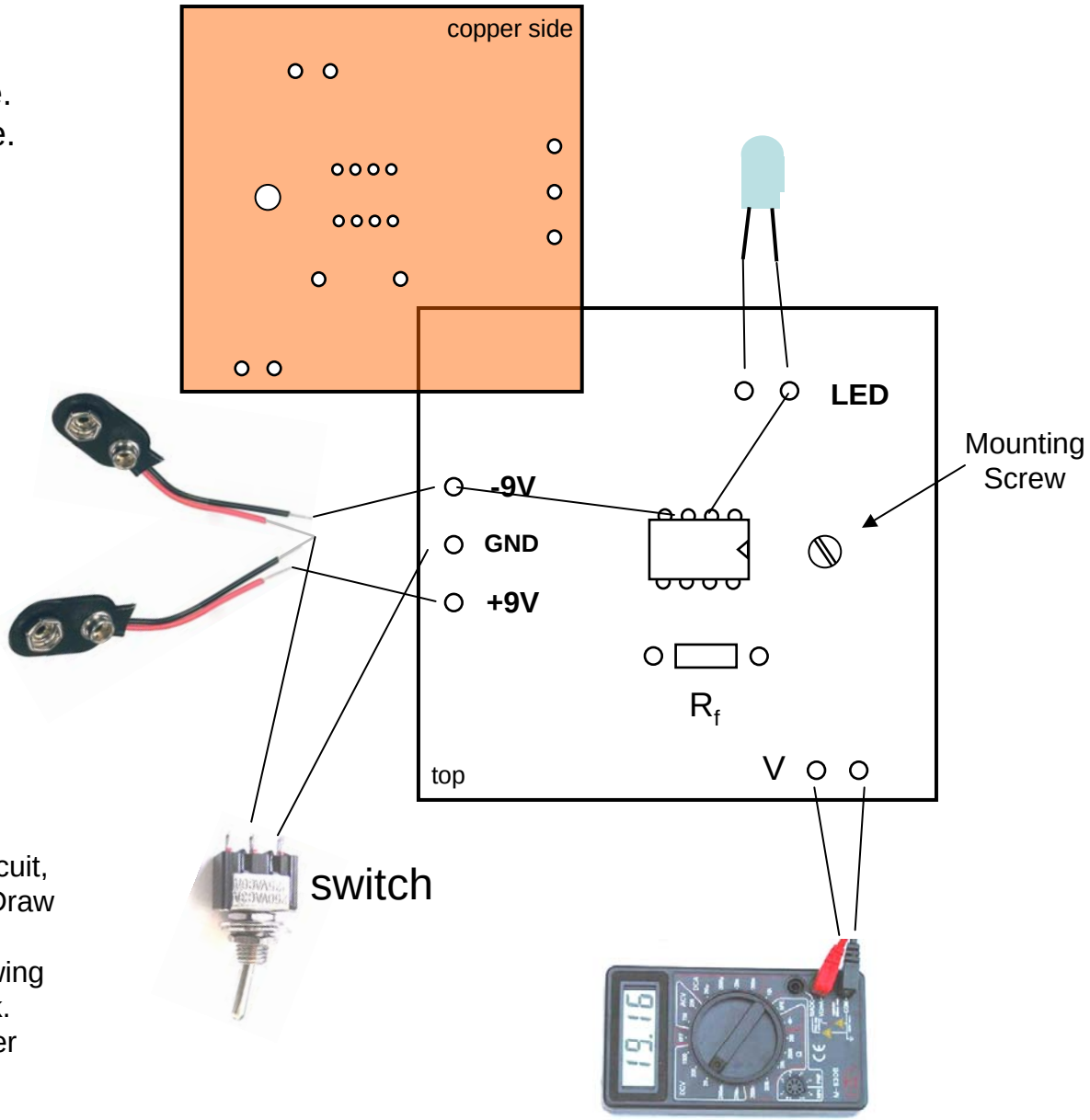
An example of GOOD power routing (Left) and BAD power routing (Right)



An example of GOOD routing (Left) and BAD routing (Right)

Homework Problem: Draw your PCB

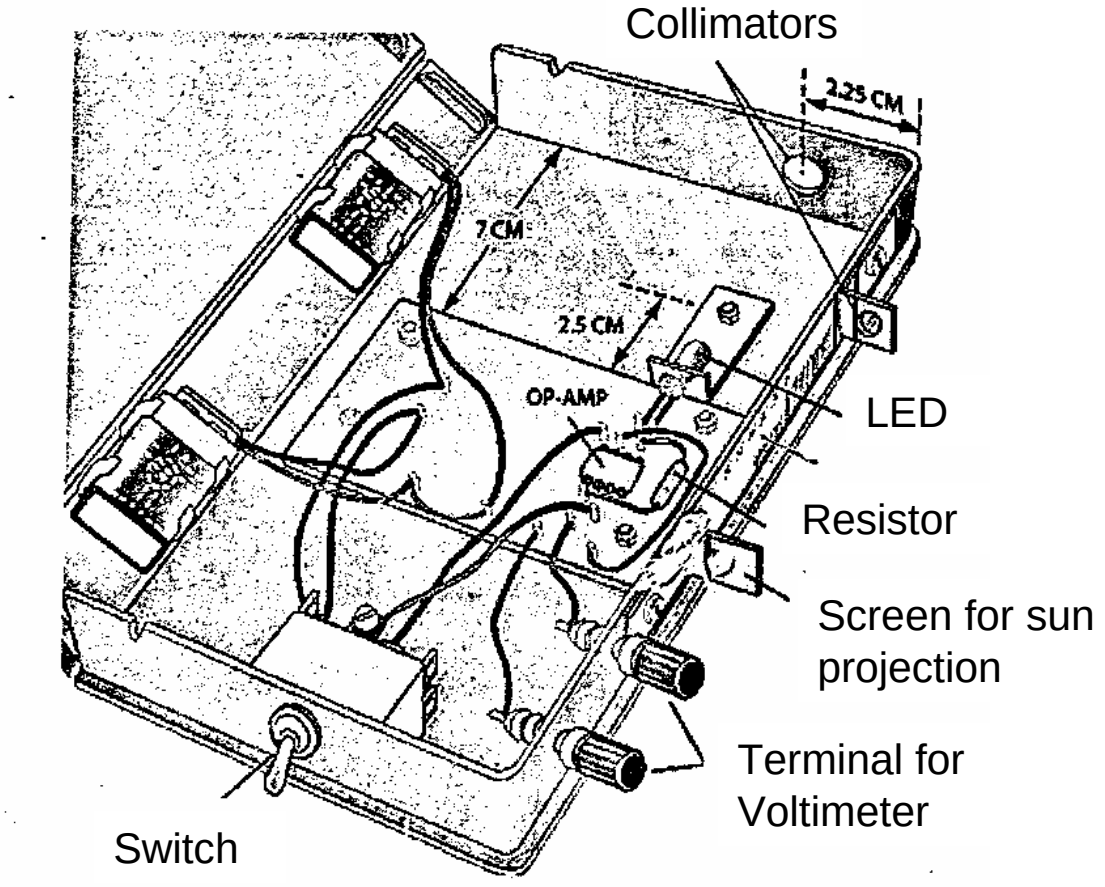
The PCB is an insulated board covered with a thin copper layer. The top side is the component side. The copper film is on the other side. On the copper side you draw the circuit connecting the holes following the diagram in the previous page. The circuit is drawn using a pen with a special ink that resists the corrosion bath in which the PCB is put to remove the unwanted copper. After removing the ink with a solvent, the copper connections between and around the holes are exposed. The components are inserted from the top side and the leads soldered on the copper connections.



For the next class, draw your own PCB circuit, using a pencil and a printout of this slide. Draw the circuit on the copper side of the PCB. During next class you will transfer the drawing to your PCB using a corrosion resistant ink. After removing the unwanted copper, solder your components and wires on the PCB.

Example of Mechanical Assembly:

(extracted from F. Mims III, Scientific American)



Class 3 – experiment: Sun photometer

- Determine the spectral properties of your sunphotometer's detector (Emission x detection)
  - Using Na and Hg spectral lamps, verify the wavelength calibration of the Ocean-Optics spectrometer
  - Calibrate (obtain the experimental $\lambda(\theta)$, eventually linearized) for the prism monochromator: (TBD in class 4)
  - Determine experimentally the detection spectrum of your LED normalized to 1 at the maximum intensity.
    - Based on your data, what color is your LED?
  - Using a prism (or diffraction grating) monocromator determine experimentally the emission spectrum of your LED (TBD in class 4)
    - Is the detection color of the LED the same as the emission color?