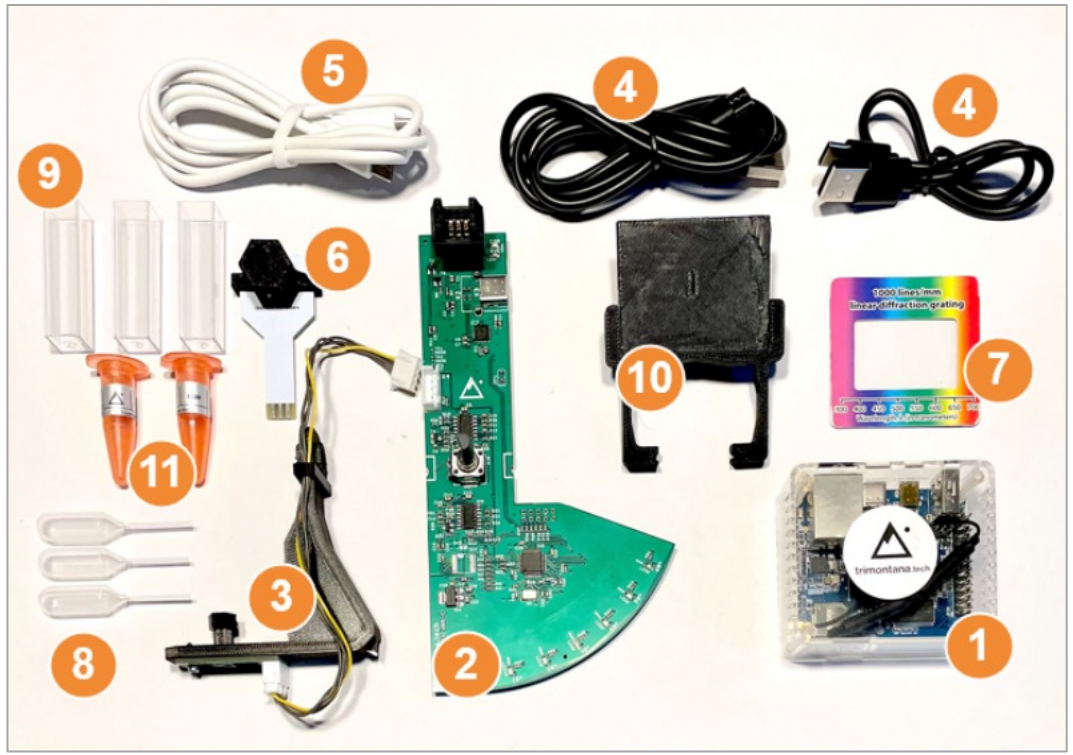
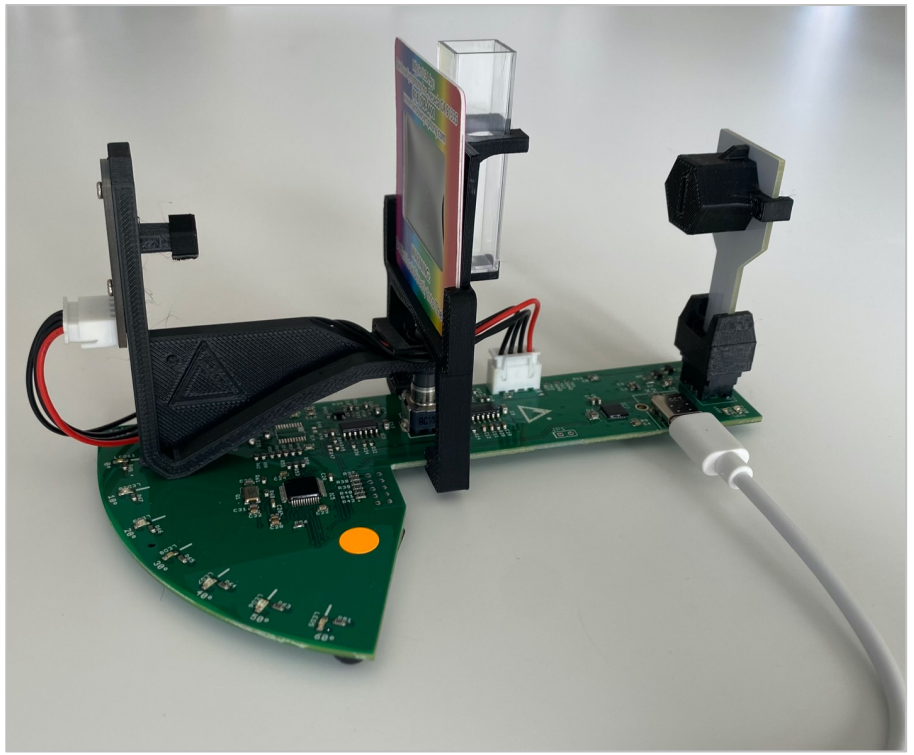
Offline operation via Raspberry/Orange Pi

Constructing Your Own Spectrometer

Pt I of Introduction to Spectroscopy and Data Science: How many dyes are in a collection of colorful samples?





trimontana
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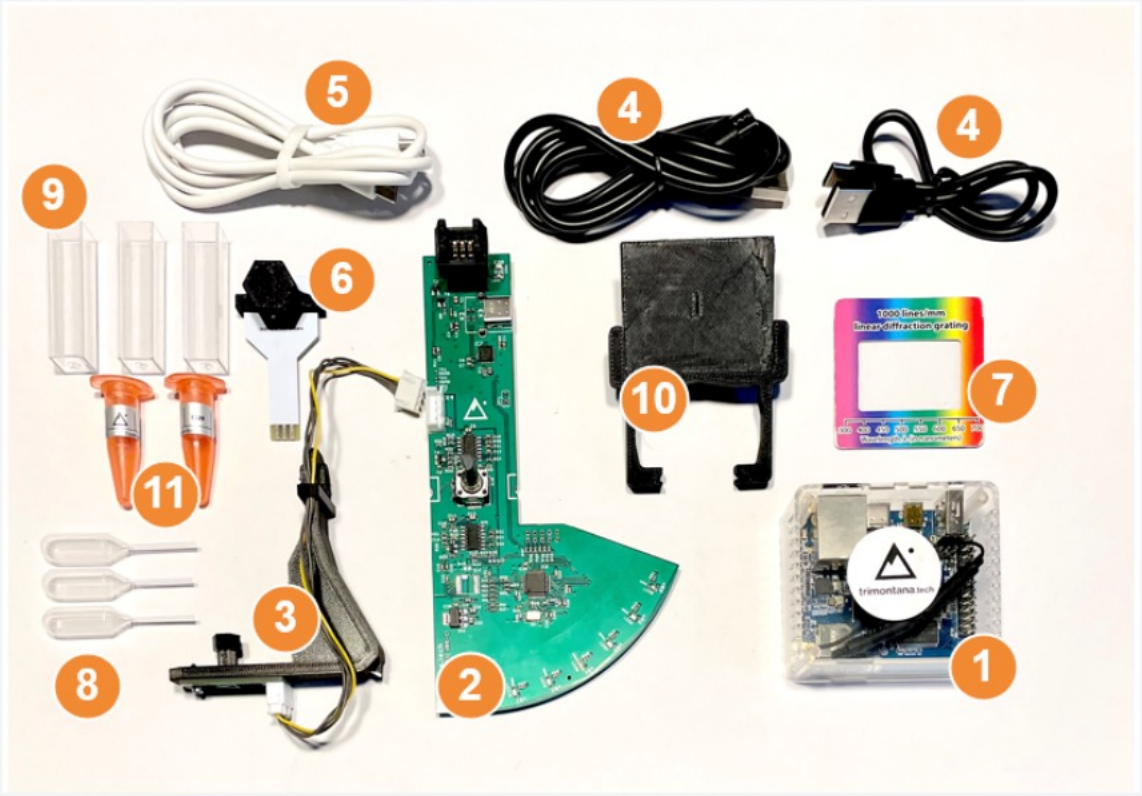
Center for Adapting Flaws into Features

Unpacking your Trimontana spectrometer

When you first unpack your spectrometer, you will have to assemble it. The following steps describe how to put the spectrocope hardware together.



Check that you have all components:

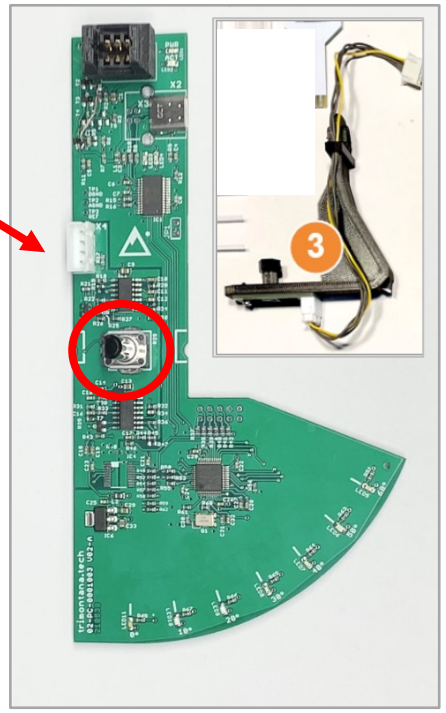
1. Minicomputer (Raspberry Pi or equivalent brand)
2. printed circuit board (PCB) baseplate
3. swivel arm
4. 2x USB cables, one side with USB-A plug and one side with USB-C plug
5. 1x USB cable with both ends of USB-C type
6. light source
7. diffraction grating*
8. pipettes
9. cuvette
10. holder
11. food dye samples

**Please do not touch the plastic part of the diffraction grating when you are unpacking.*

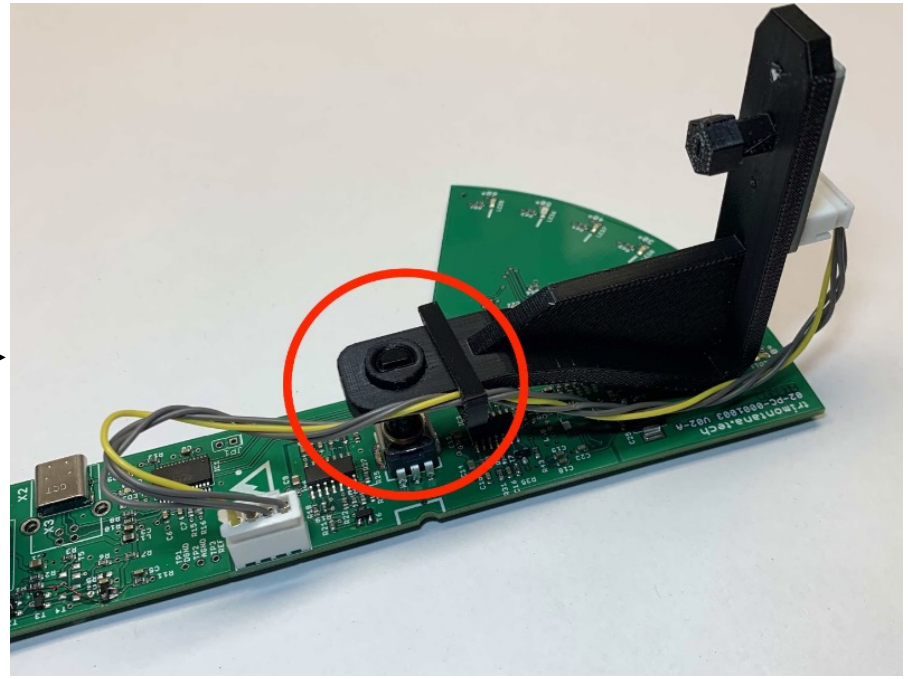
To follow along with **video instructions**, visit: https://vimeo.com/661072244 (Password: Trimontana)
Web instructions available here: https://docs.trimontana.tech/tutorialoffline.html

Connecting spectrometer swivel arm

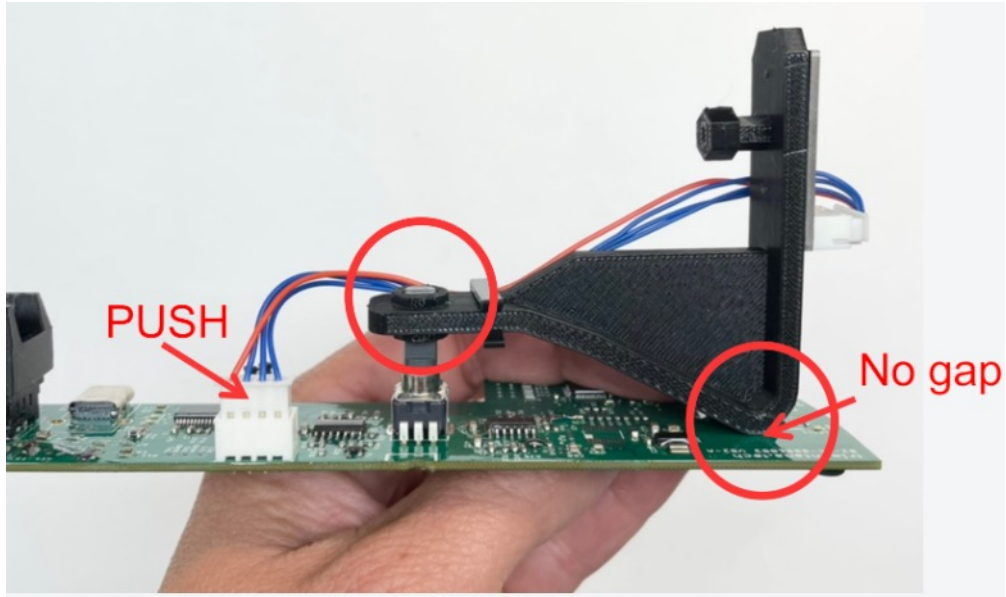
1



2



3

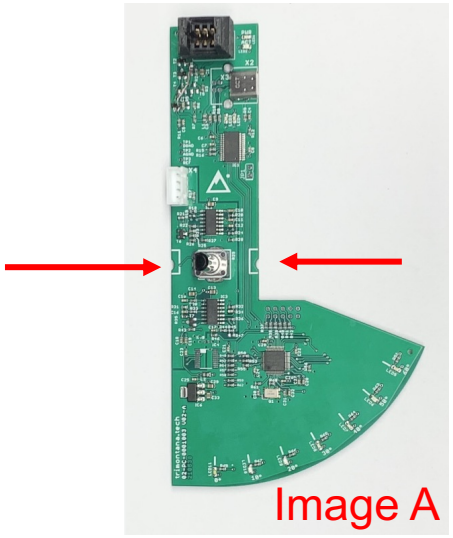


1.) Place baseplate on your table and find your swivel arm (part #3)

2.) Place swivel arm onto rotating potentiometer knob and push down gently. Plug cable from the detector into socket on the mainboard.

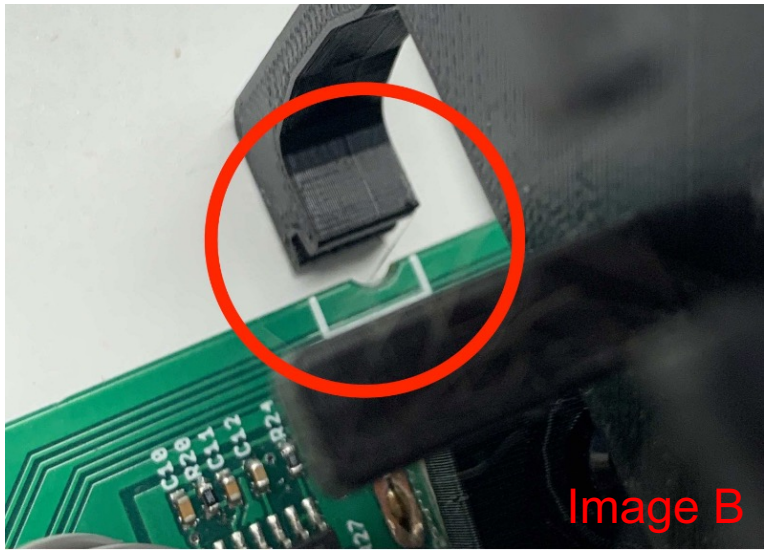
3.) Check that the swivel arm is flush with the potentiometer (see circle) and the plug is pushed into the socket properly. Make sure there is no gap between the bottom of the swivel arm and the baseplate.

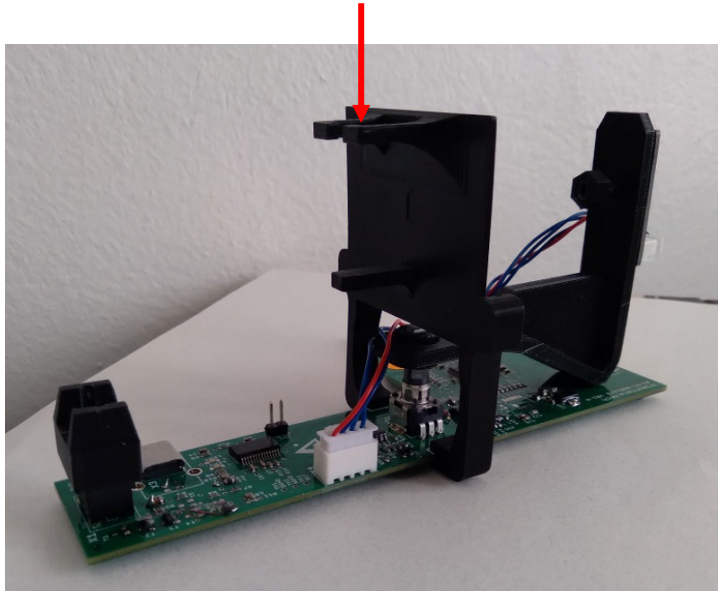
Clipping in cuvette and diffraction grating holder



Find your holder (part #10)

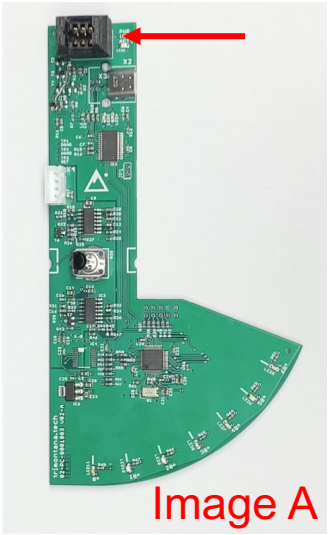
4





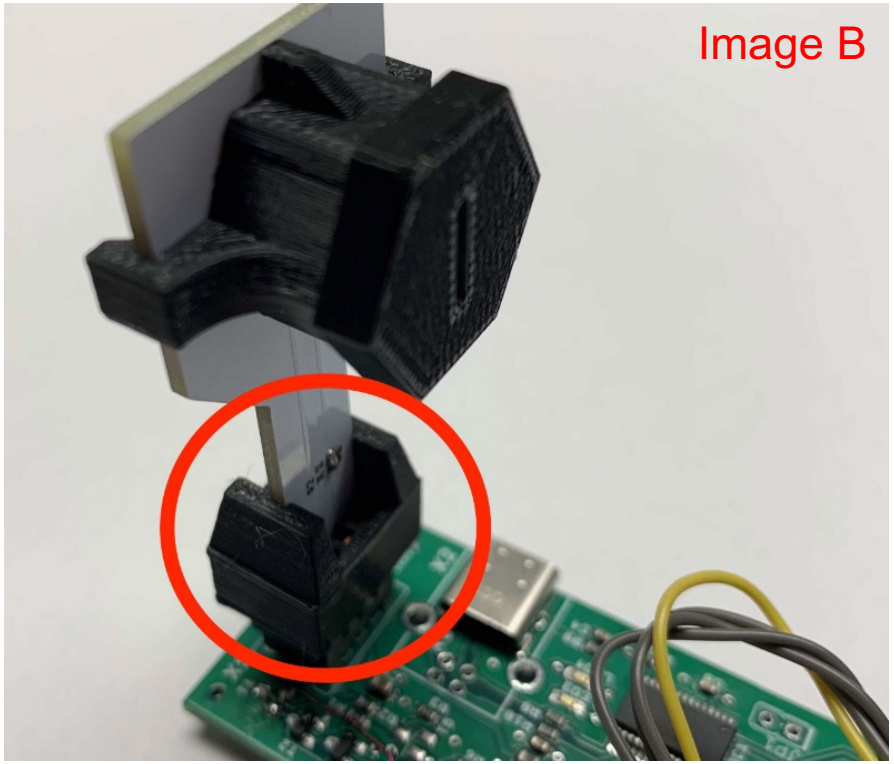
4.) Click cuvette/diffraction grating piece onto baseplate. The side with the cuvette holder should face away from the detector. The feet of the cuvette holder/diffraction grating piece should be aligned with the white lines on the baseplate (show in images A (red arrows) and B (red circle))

Connecting light source and installing diffraction grating



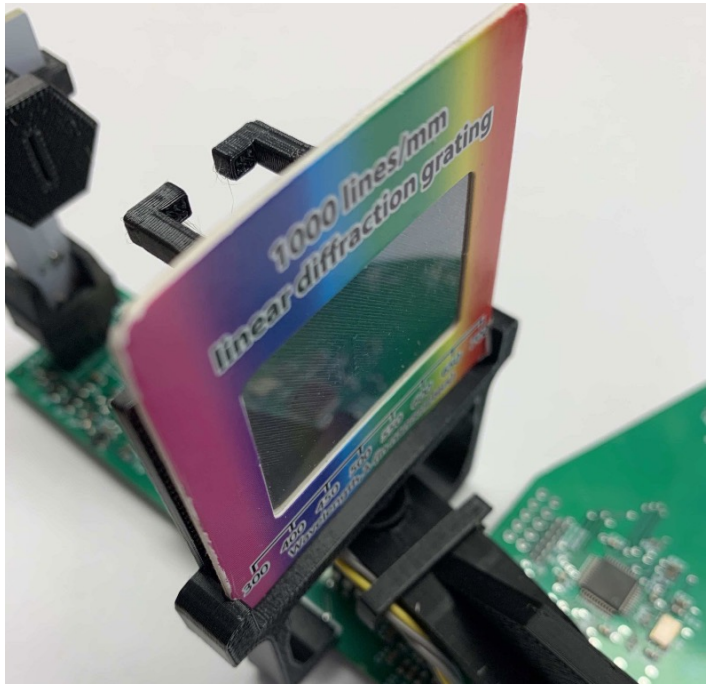
Find your light source and diffraction grating (parts #6 and #7)

5



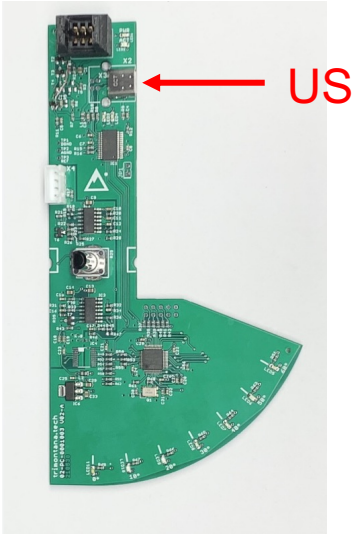
5.) Slide the light source into the connector on the baseplate (connector location shown in images A (red arrow) and B (red circle)). Light source should be facing in towards the detector.

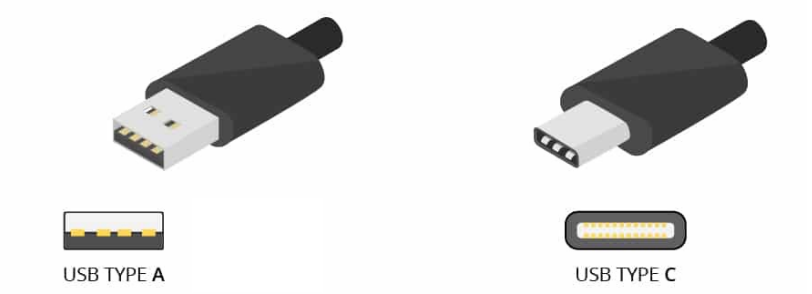
6



6.) Slide the diffraction grating into the grating holder.
Remember: do not touch the clear plastic!

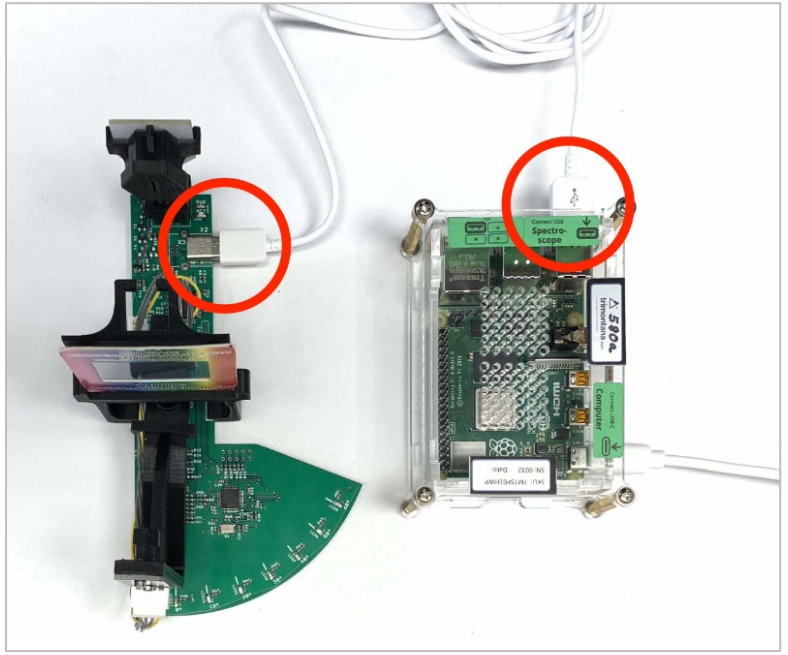
Connecting spectrometer to mini computer



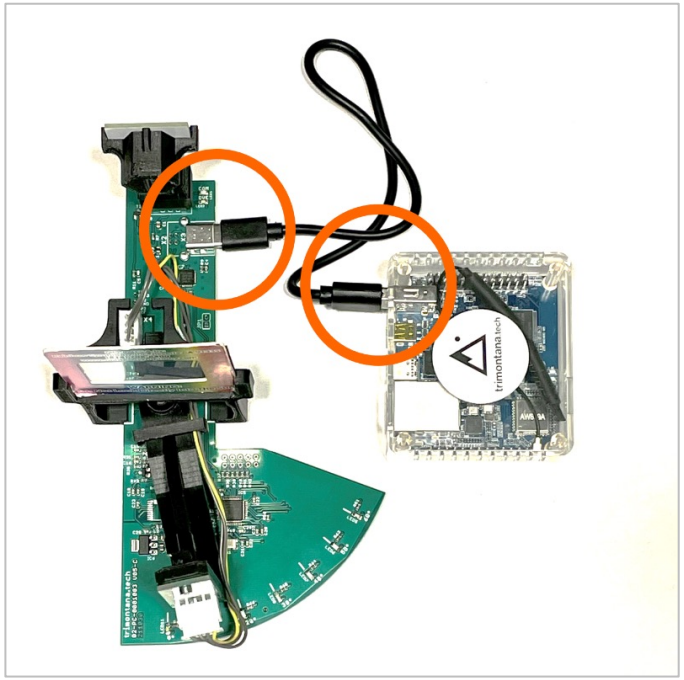


7

For Raspberry Pi system:



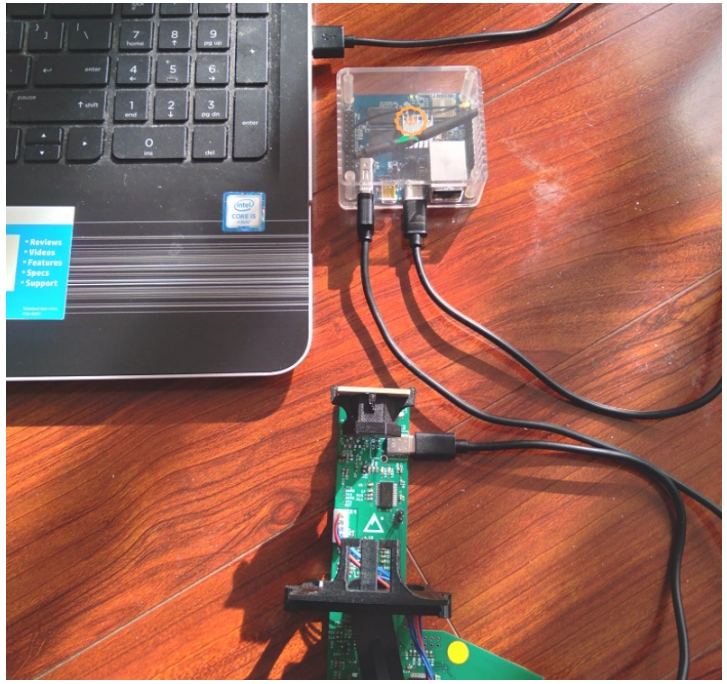
For Orange Pi system:



7.) Use a USB cable to connect your spectroscope to the minicomputer. The Raspberry Pi model of minicomputer is shown in the left photo above. The Orange Pi model of minicomputer is shown in the right photo above. In either case, you will plug the smaller end of the USB cable into your spectroscope, and the larger end into your minicomputer.

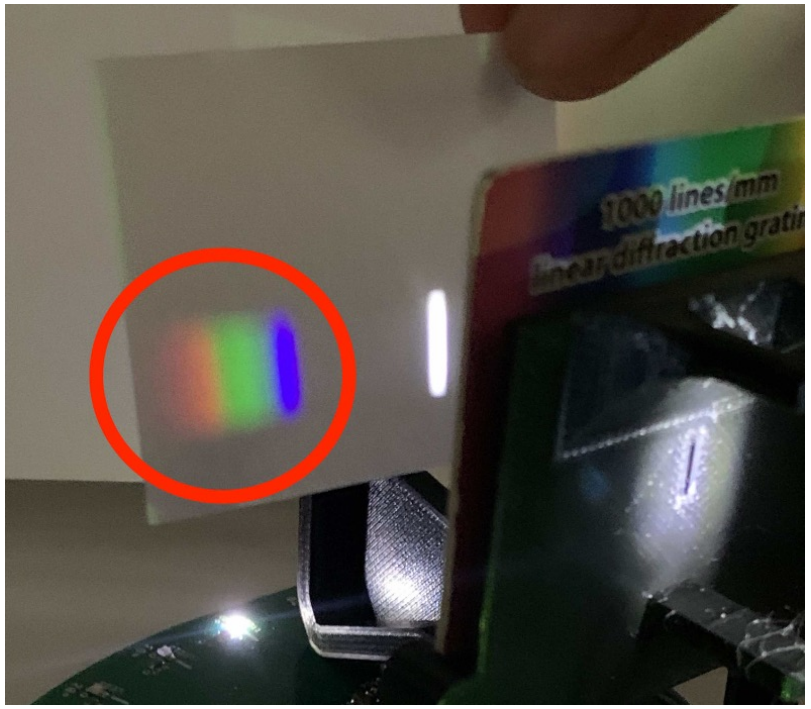
Connecting your spectrometer to your computer

8



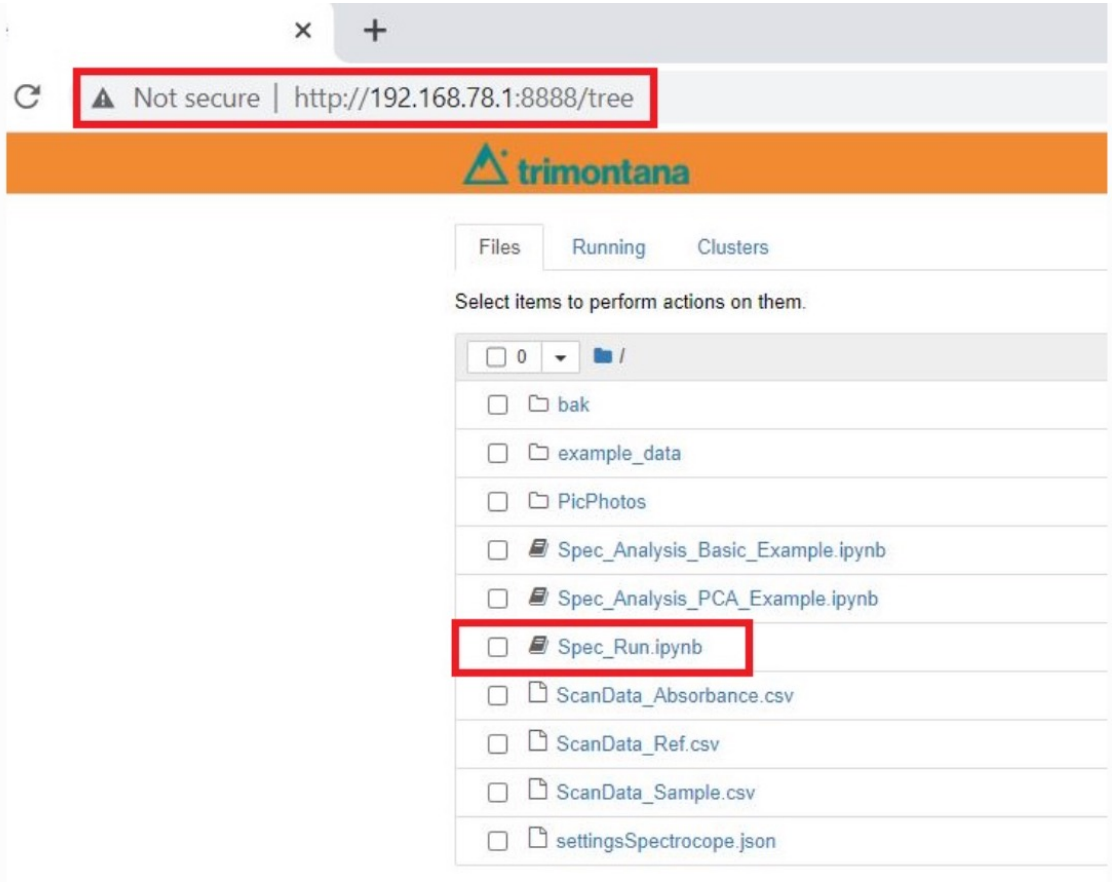
8.) Use the USB-C to USB-A cable to connect the minicomputer/Pi with your laptop or tablet. Once your minicomputer is connected to your laptop or tablet, power will be supplied to both the minicomputer and your spectroscope. You should see lights come on in the minicomputer, and the light source of the spectrometer will begin to glow.

9



9.) Now that power is supplied to the spectroscope, you can check to confirm that the spectrometer is assembled and functioning properly. To perform the check, place a piece of paper in front of the detector. You should see a rainbow on either side of the central light beam.

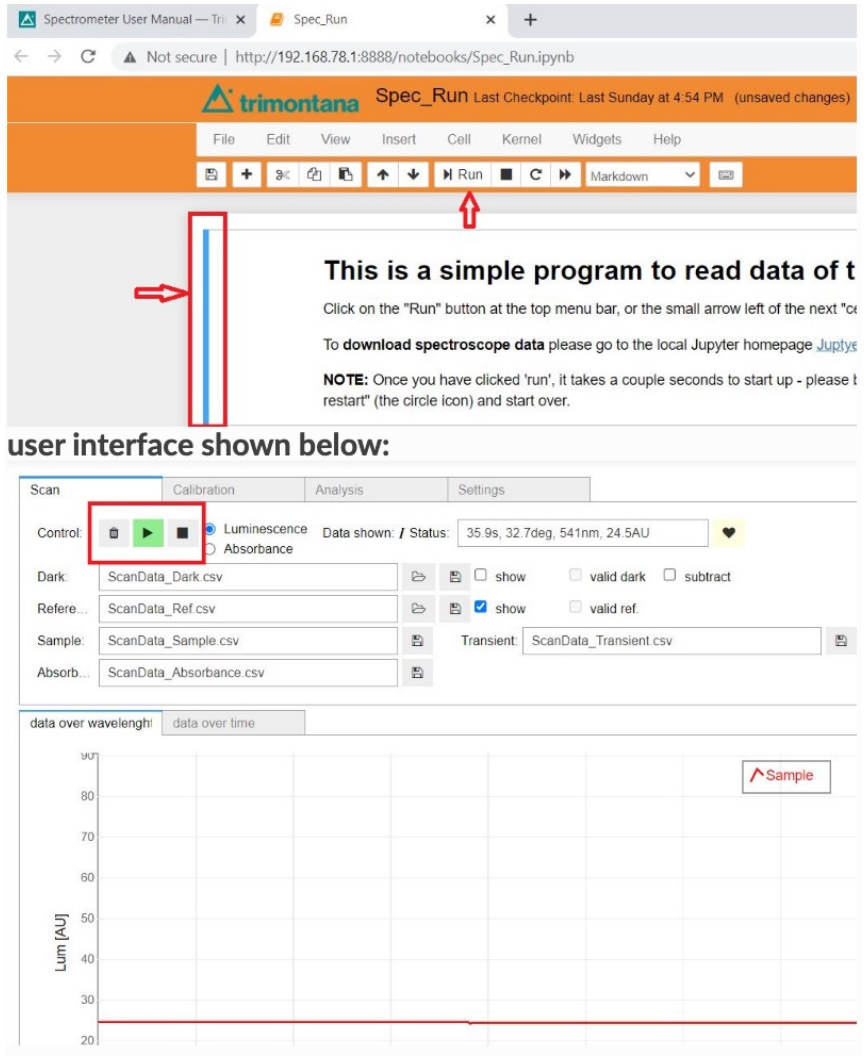
Checking connection between spectrometer and computer (part 1)



10.) In this step, you will access the repository in which the spectroscope software is stored. To begin, open a web browser and enter the following address into the address bar: http://192.168.78.1:8888/tree . This address takes you to the repository where you will find the software to communicate with the spectroscope. The software program to collect data and calibrate your hardware is called **"Spec_Run.ipynb".** Double click on **Spec_Run.ipynb** to open the software.

Note: it may take some time for your mini computer to connect. If you aren't able to reach the website initially, wait a few minutes with your mini computer/spectrometer connected to your computer, and then refresh your browser.

Checking connection between spectrometer and computer (part 2)



11.) In this step, you will generate the software user interface by executing the cells (boxes) of code on the Spec_Run.ipynb page.

In this software, a blue line appears adjacent to the active cell containing instructions for the data acquisition program. Press “Run” to process the commands of the active cell and advance to the next cell.

NOTE: When processing the commands of a given cell, wait until the asterisk in the brackets adjacent to “In” turns to a number.

Process the program cells one at a time until the spectrometer user interface (UI) is loaded. The bottom image on the left shows how the user interface will appear. You will learn how to use this software during the first day of your.