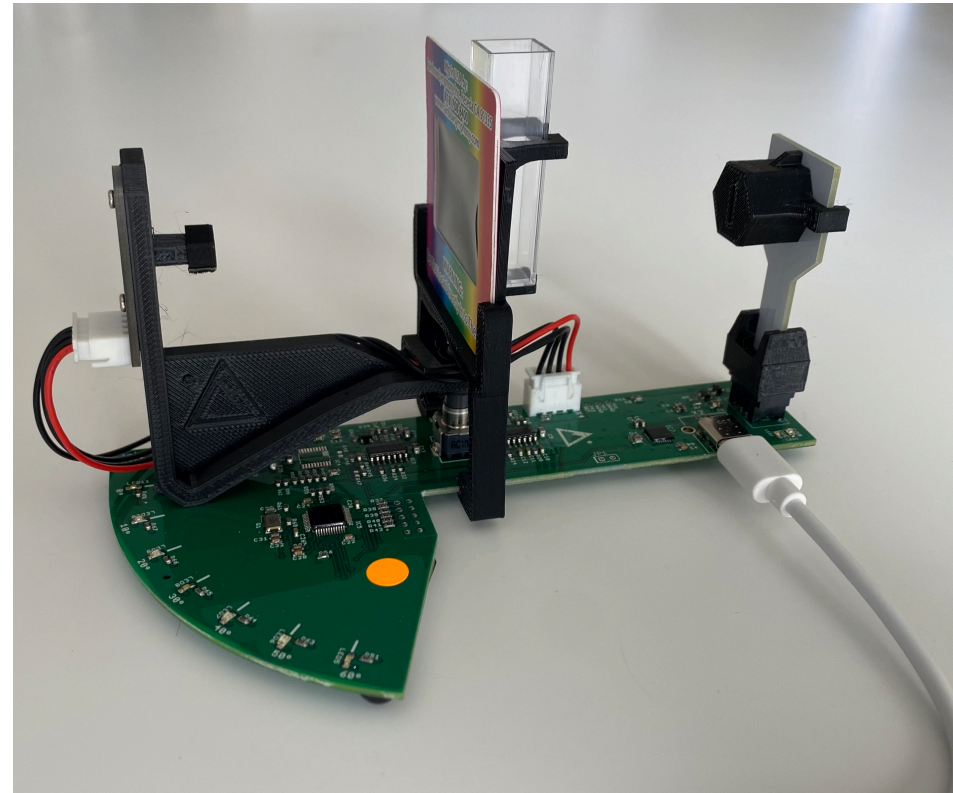
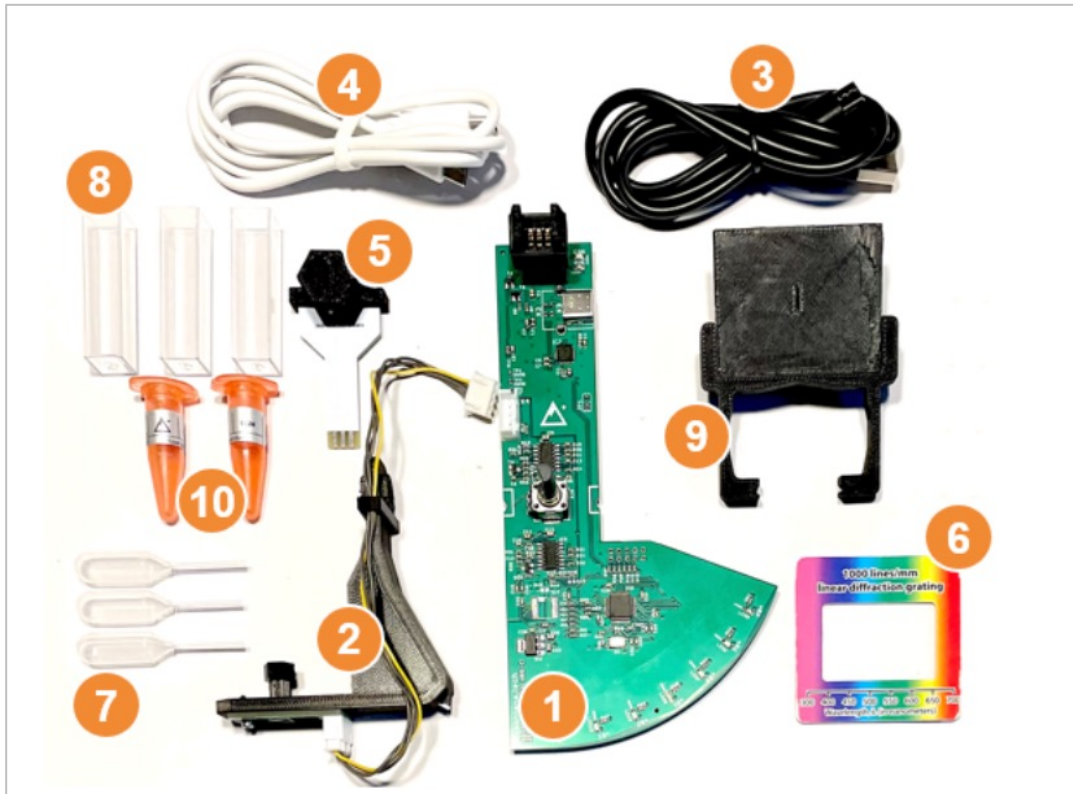


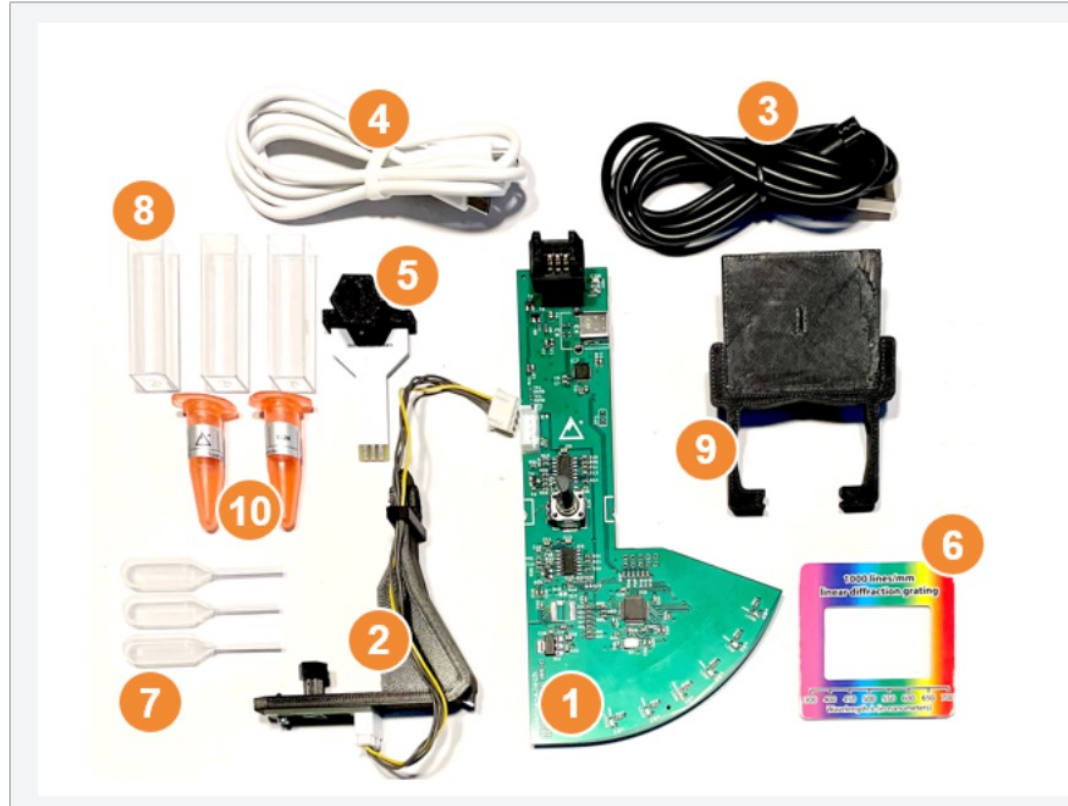
# Constructing Your Own Spectrometer

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



# 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. printed circuit board (PCB) baseplate
2. swivel arm
3. USB cable - one end is USB-A type and one end is USB-C type
4. USB cable - both ends are USB-C type
5. light source
6. diffraction grating \*
7. pipettes
8. cuvette
9. holder
10. food dye samples

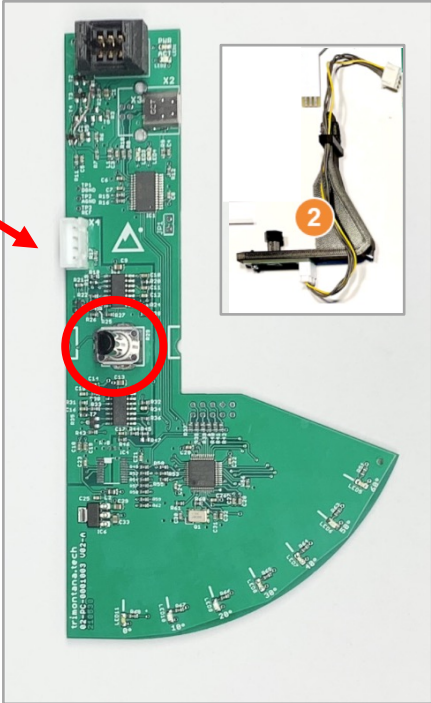
*\*Please do not touch the plastic part of the diffraction grating when you are unpacking.*

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



# Connecting spectrometer swivel arm

1



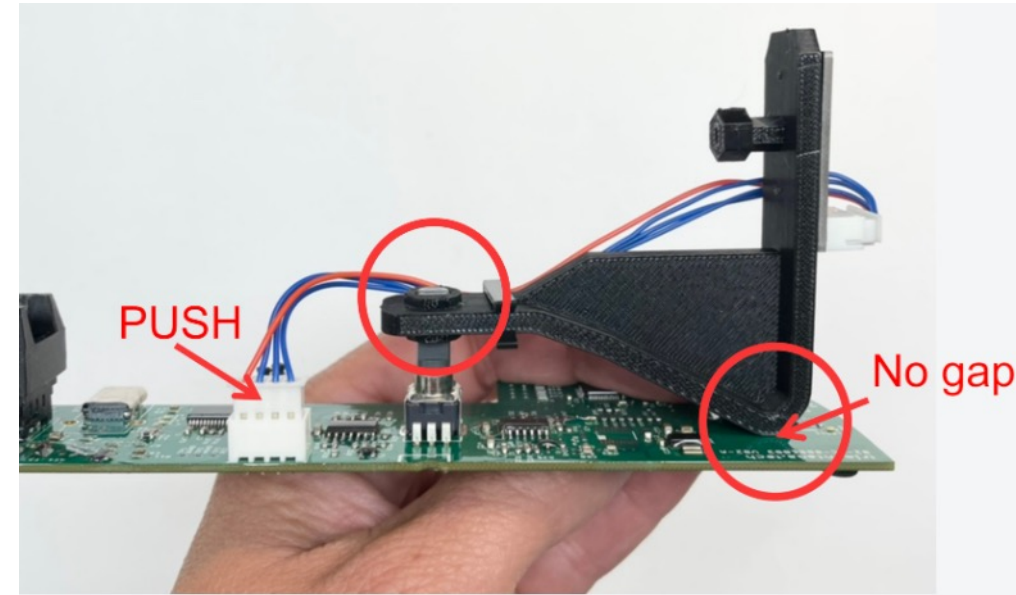
1.) Place baseplate on your table and find your swivel arm (part #2)

2



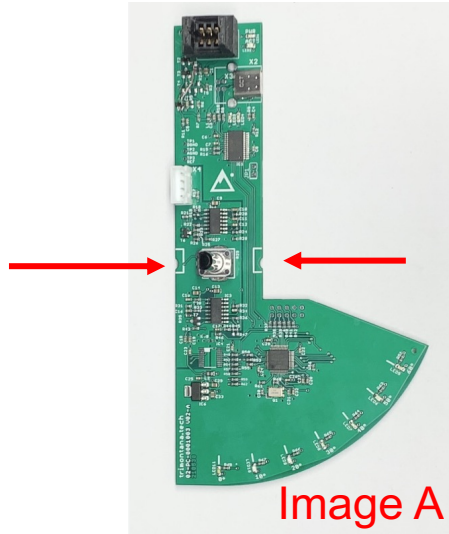
2.) Place swivel arm onto rotating potentiometer knob and push down gently. Plug cable from the detector into socket on the mainboard.

3



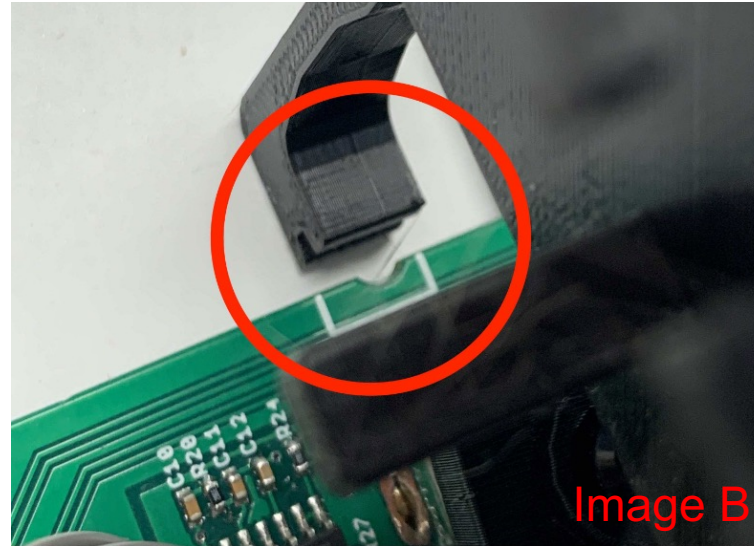
3.) Check that the swivel arm is flush with the potentiometer (see circle) and the plug is pushed into the socket properly. Make sure there is no gap between the bottom of the swivel arm and the baseplate.

# Clipping in cuvette and diffraction grating holder

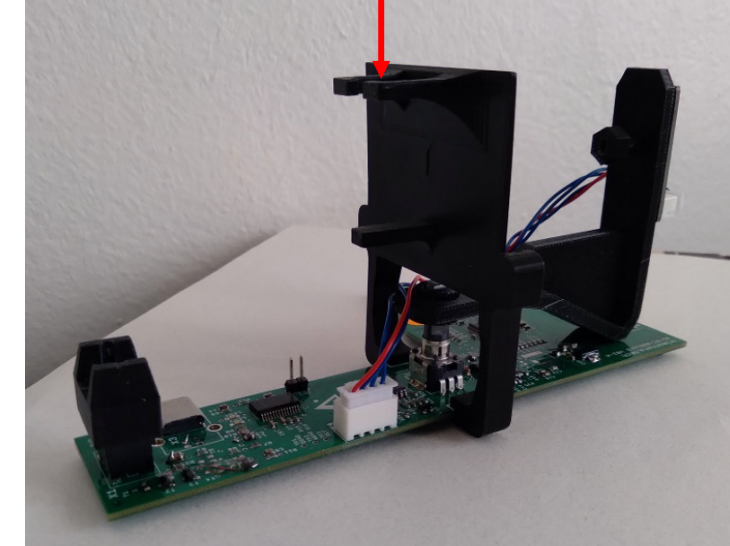


Find your holder (part #9)

4

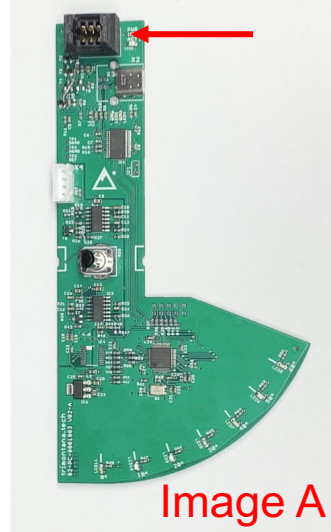


Cuvette holder



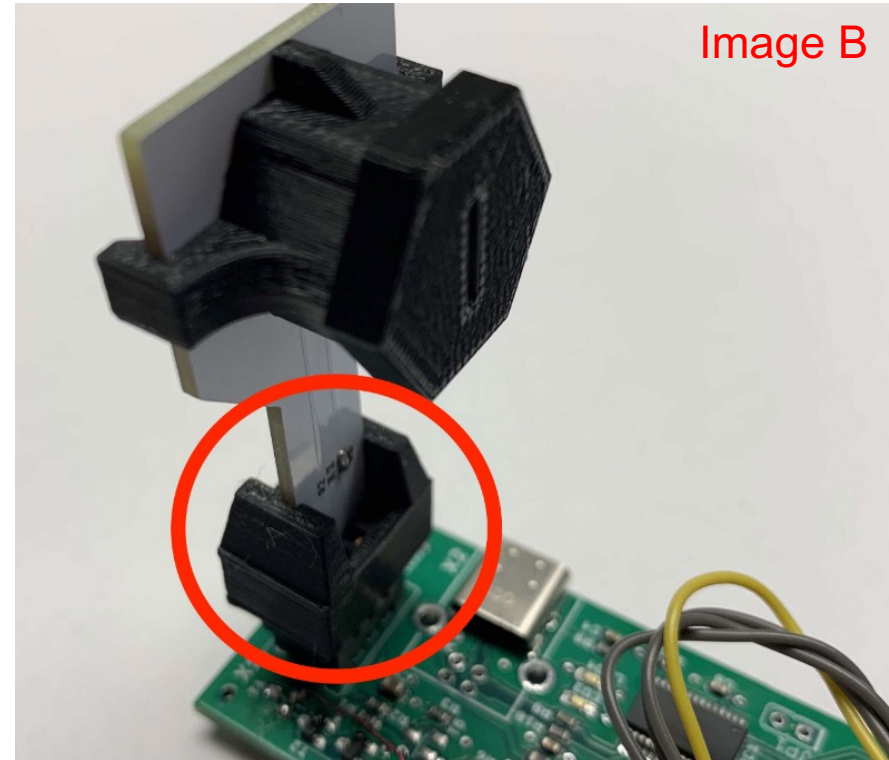
4.) Click cuvette/diffraction grating piece onto baseplate. The side with the cuvette holder should face away from the detector. The feet of the cuvette holder/diffraction grating piece should be aligned with the white lines on the baseplate (show in images A (red arrows) and B (red circle))

# Connecting light source



Find your light source (part #9)

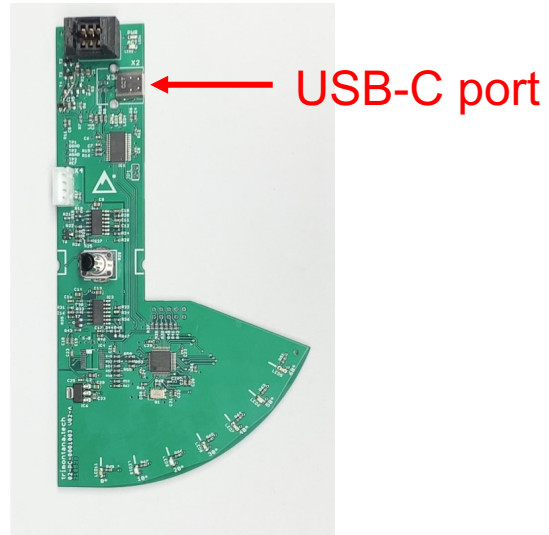
5



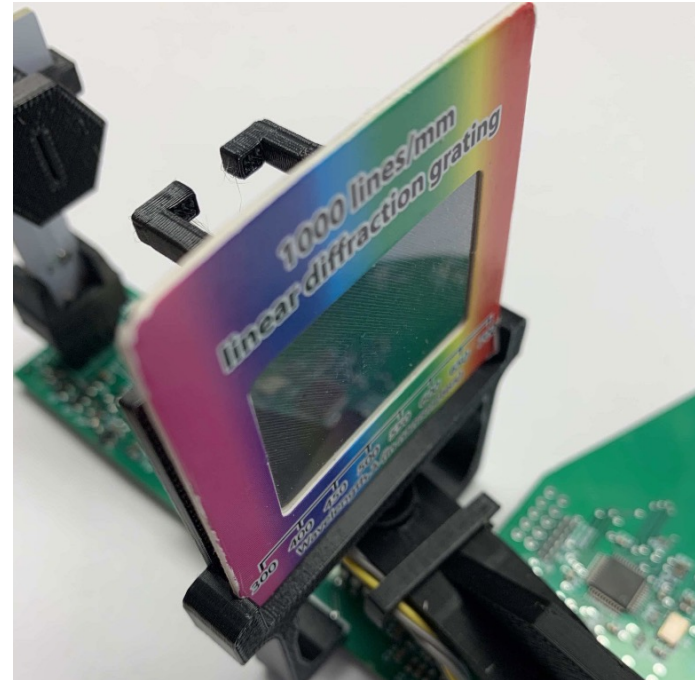
5.) Slide the light source into the connector on the baseplate (connector location shown in images A (red arrow) and B (red circle)). Light source should be facing in towards the detector.



# Installing diffraction grating and connecting USB cable



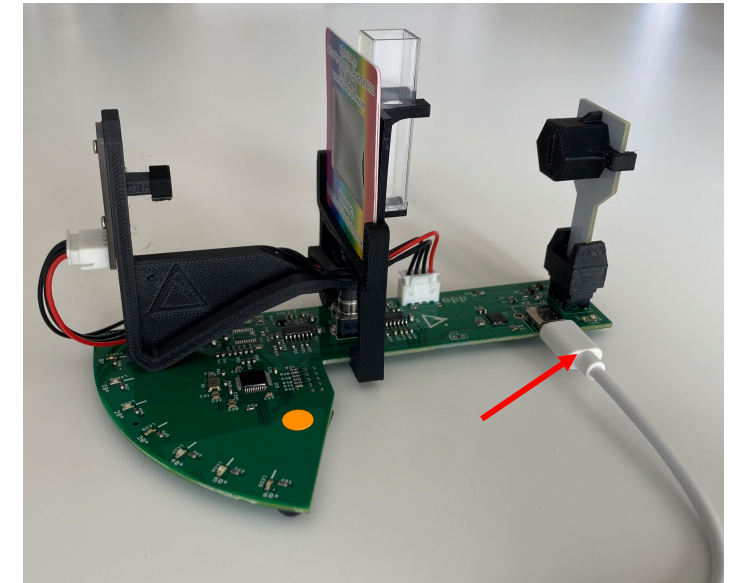
6



6.) Slide the diffraction grating into the grating holder.

**Remember: do not touch the clear plastic!**

7



7.) Plug in the appropriate cable to the USB-C port depending on which ports you have available on your computer

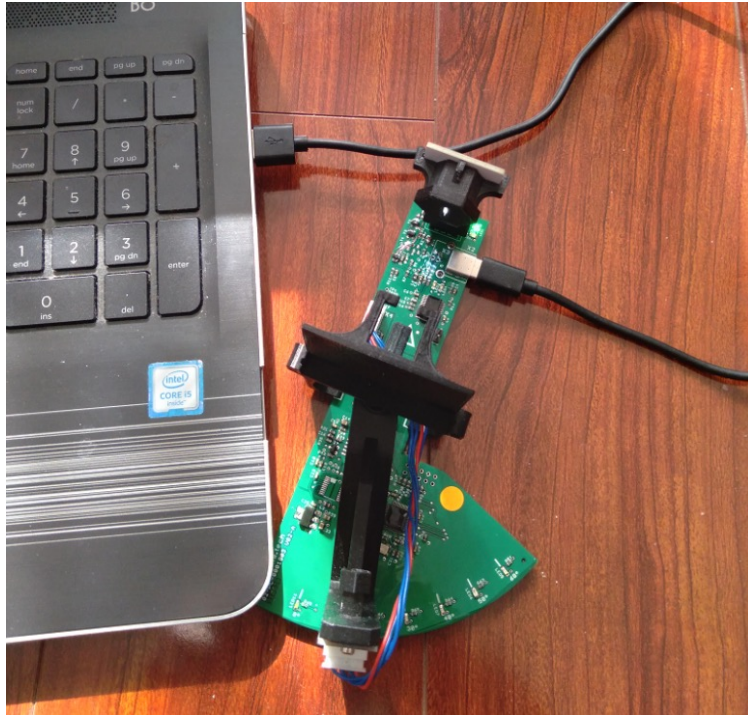
- USB-C to USB-C (OR)
- USB-C to USB-A



Find your diffraction grating and cables (parts #6, #3 or #4)

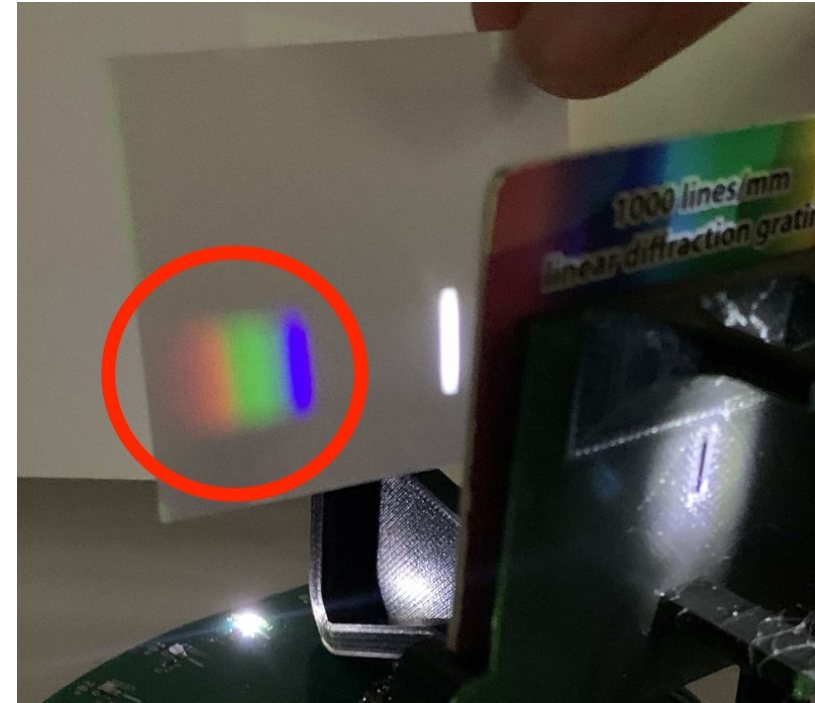
# Connecting your spectrometer

8



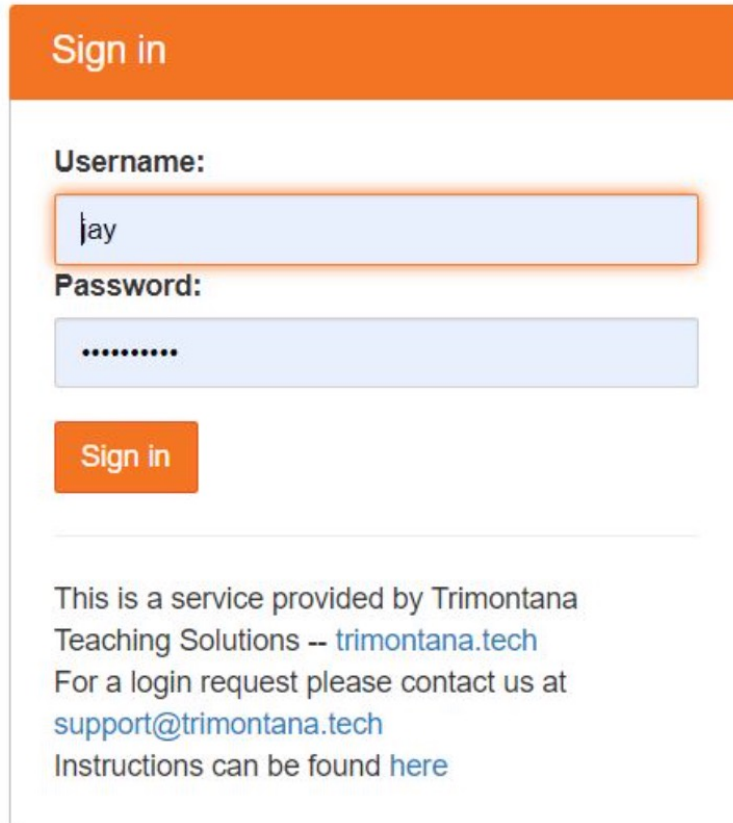
8.) Connect the spectrometer to your laptop or tablet using a USB cable. The spectroscope is now receiving power, and the light source should begin to glow.

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.

# Logging into your course JupyterHub (online operation)



Sign in

Username:

jay

Password:

.....

Sign in

This is a service provided by Trimontana Teaching Solutions -- [trimontana.tech](http://trimontana.tech)  
For a login request please contact us at [support@trimontana.tech](mailto:support@trimontana.tech)  
Instructions can be found [here](#)

10.) In this step you will connect to the repository in which the spectrometer software is located.

Open a web browser, and type the following address into the address bar: <http://hub.trimontana.tech>

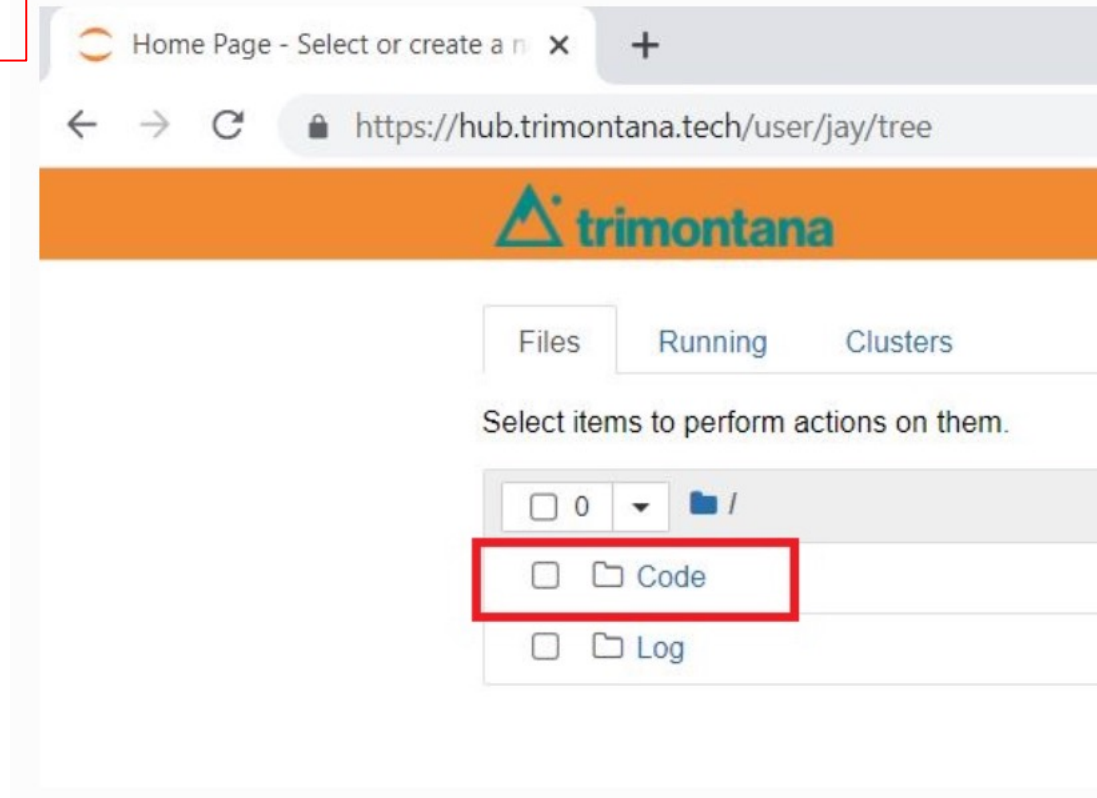
This will take you to the log in screen for the Jupyter hub, the online repository in which the software is stored. Input your username and password. Then click “sign in”

Username and password will be provided by your instructor



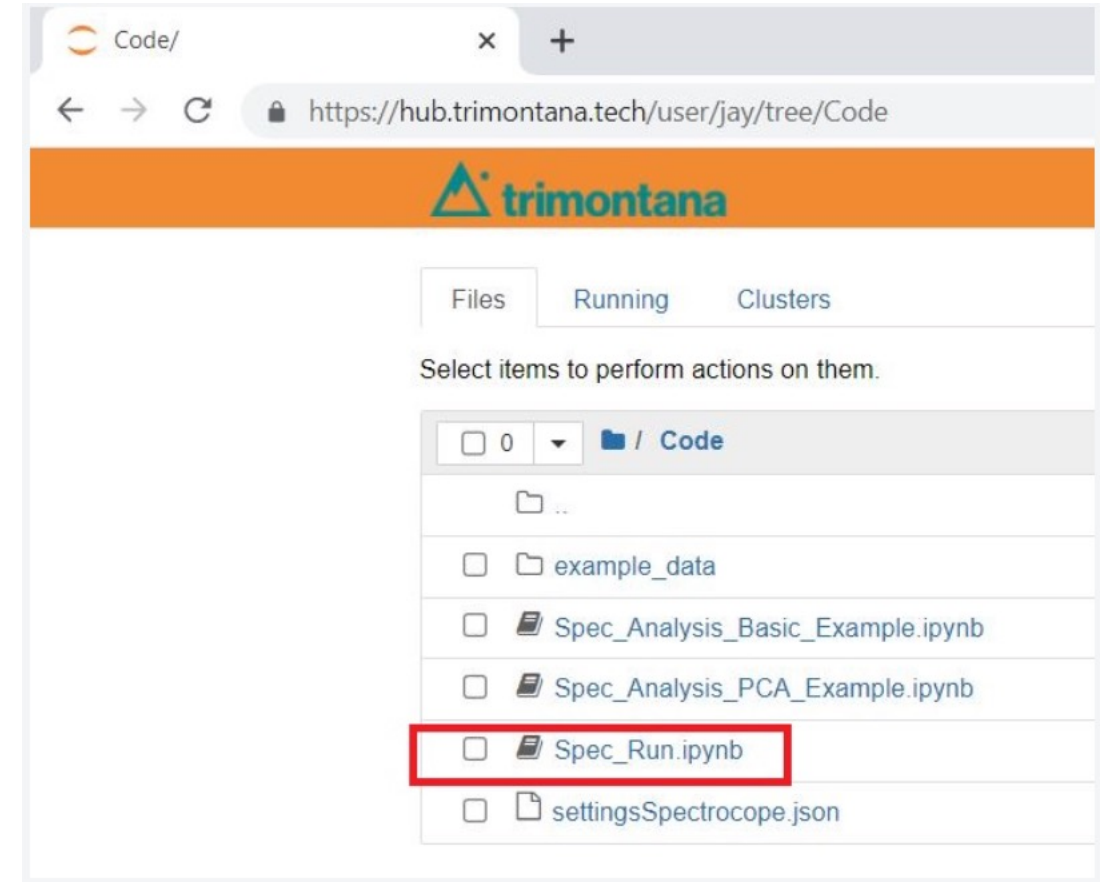
# Checking connection between spectrometer and computer (part 1)

11



11.) Once you are in the main Jupyter hub directory, double click to open the folder labelled “Code”

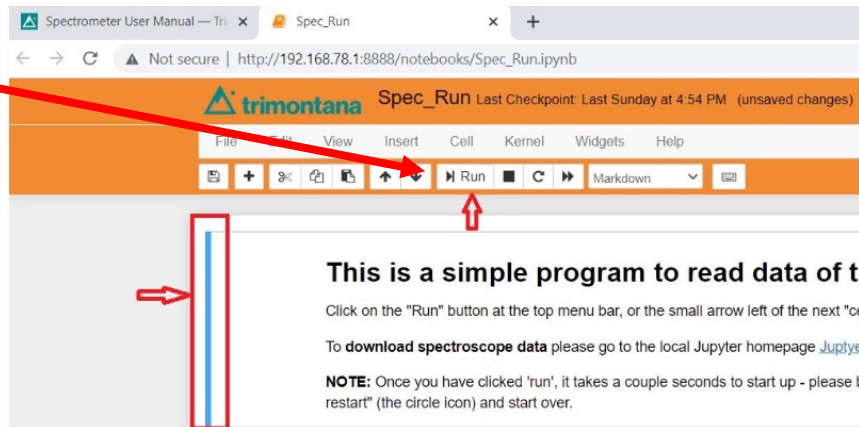
12



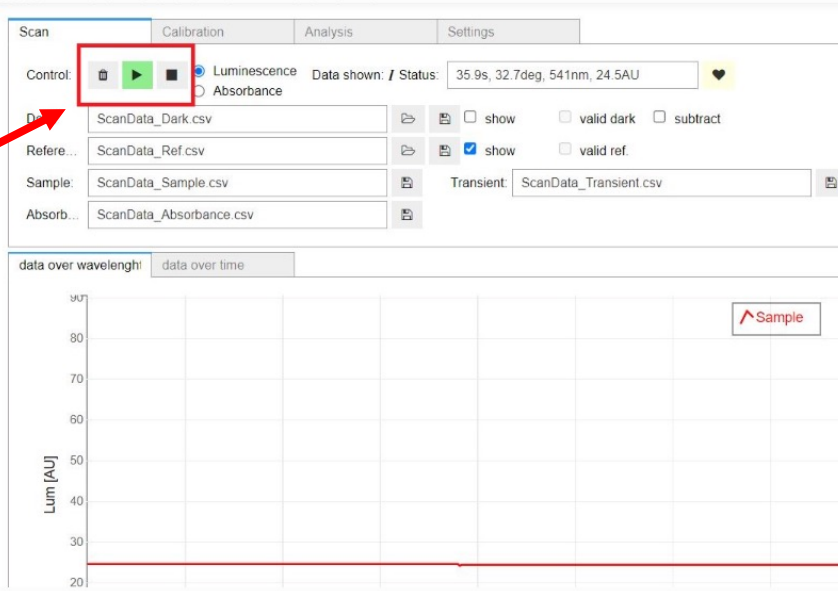
12.) Once the code folder opens, double click “Spec\_Run.ipynb” to open the software page.

# Checking connection between spectrometer and computer (part 2)

“Run”



user interface shown below:



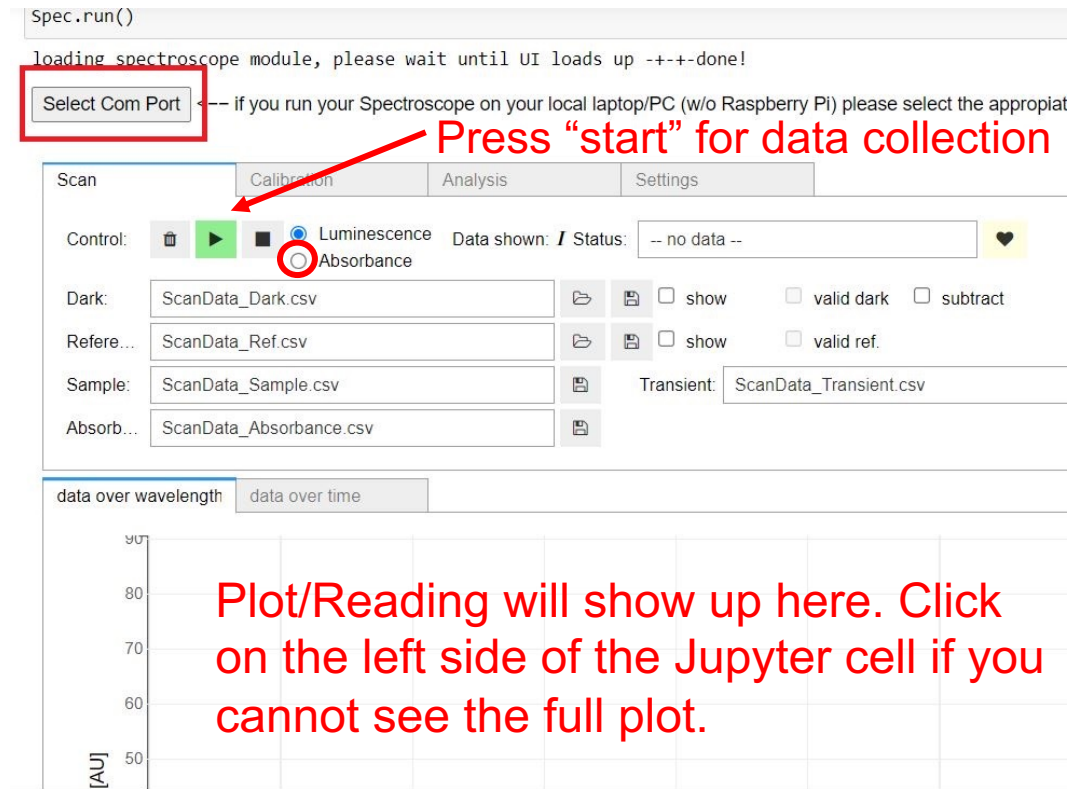
“Start”  
(shown in  
next step)

13.) 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 shows how the user interface will appear.

# Checking connection between spectrometer and computer (part 3)



The screenshot shows the Jupyter interface for the 'Spec.run()' module. At the top, a text box says 'loading spectroscopy module, please wait until UI loads up ---done!'. Below this, a red box highlights the 'Select Com Port' button, with a red arrow pointing to it and the text 'Press "start" for data collection'. The main interface has tabs for 'Scan', 'Calibration', 'Analysis', and 'Settings'. Under the 'Scan' tab, there are controls for 'Control' (a green play button, a black square, and a blue circle with a white dot), 'Dark' (a text input field with 'ScanData\_Dark.csv'), 'Referen...' (a text input field with 'ScanData\_Ref.csv'), 'Sample' (a text input field with 'ScanData\_Sample.csv'), and 'Absorb...' (a text input field with 'ScanData\_Absorbance.csv'). There are also checkboxes for 'show', 'valid dark', 'subtract', and 'valid ref.'. The 'Status' field shows '-- no data --'. Below the controls, there are two tabs: 'data over wavelength' and 'data over time'. The 'data over wavelength' tab is active, showing a plot of '[AU]' (Absorbance Units) on the y-axis (ranging from 50 to 90) against wavelength on the x-axis. A red text box is overlaid on the plot area, stating: 'Plot/Reading will show up here. Click on the left side of the Jupyter cell if you cannot see the full plot.'

14.) Click “Select Com Port” and choose the USB port to which your spectrometer is attached. After selecting the com port, your spectrometer will be able to communicate with the data acquisition program.

Check to make sure your connection is successful by (1) switching the reading from Luminescence to Absorbance (red circle) and (2) rotating the swivel arm while the “Start” button is green (if this button is not green, press it before collecting data). If you should see a reading show up in the plot on the graphical user interface.