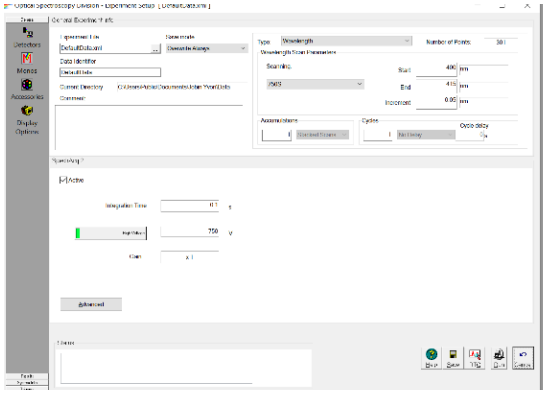
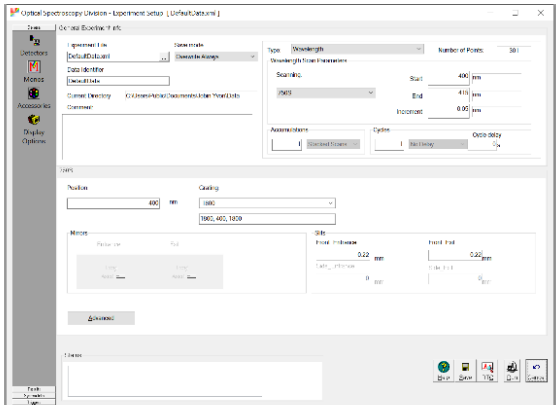
H2D2 Procedure

Getting Familiar with the monochromator and its operation



- Open the Synergy Program – One of the faculty must do this.
- Open Collect-> Experiment Setup
- On this pop-up, enter the Detectors Tab (shown in pic to the right)
    - Turn on the PMT by entering the High Voltage at 750V and clicking the HV button to bright green.
        - Dark green or 0V is off.
- Click on the Mono tab on the left of the pop-up.
- Make the front and exit slits the same at 0.022mm.
    - Show at right as 0.22mm, set to 0.022mm.
    - Select the detectors tab again.
- Turn on the light source (Hg or H2D2).
    - If H2D2, align the lens to focus the light on the slits.
        - Open the manual slit all the way.
        - Darken the room
        - Position to the lens so that the focused vertical line of light is on the slits.
        - If you need a flashlight to help find the slits, use it.



- In the detectors tab, select an integration time of 0.05s, Increment of 0.01nm and appropriate Start and End wavelengths for the scan.
    - For Hg: Start = 545.5nm and End 546.5nm
    - For H2D2: Start = 655.7nm and End 546.7nm
- Hit run.
    - During a run, you'll see the data being taken in real time.
    - You can hit abort at any time.
        - The run is not lost. What data was collect is displayed and available for use.
    - A small window appears asking for you to name the run. This is not necessary; you can just hit cancel.
- The data appears as a graph.
- The raw data is accessible through the data tab at the bottom of the graph window.
    - Select All and copy out to Excel for instance for saving into the cloud.

- When taking any data, take several trial runs narrowing in on the data with smaller Start and End wavelengths with smaller increments.

- Eventually, you'll want the Start wavelength beginning just as the data is rising into the curve with an increment of 0.0001nm.
    - Having a bunch of noise data collection before the curve just wastes time.

Calibration

- Setup the Mercury lamp as the light source.
- We're going to calibrate on the 546 nm line of Hg.
- Setup the scan as above about 546 nm.
    - While taking the data, measure the weather using the Digital Pocket Weatherman (temp, humidity, and pressure).
    - Obtain the index of refraction from the Nist Edlen calculater.
        - https://emtoolbox.nist.gov/Wavelength/Edlen.asp
- Take the data after narrowing in.
- Extract the data and fit the data to a Gaussian extracting the best first wavelength.
- Look up the accepted value of the 546nm line to at least 6 significant figures.
    - Adjust the vacuum wavelength to the wavelength in air by modifying it by the index of refraction.
- Calibration:
    - Back in the Synergy software, Collect - > Real Time Control -> Monos
    - In the Position Control Window, enter the best fit wavelength extracted from the data fit.
        - This puts the monochromator's diffraction grating into the position of the center of the 546nm peak.
    - Click on "Calibrate 750S" and enter the air wavelength (vacuum adjusted by the index of refraction).

Data

- Take the data for the first 4 Balmer lines
    - Take the weather data at the same time.
    - Each of the observed lines are the wavelengths in air.
    - Convert them into Vacuum using the index of refraction
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