



DEPARTMENT:

PHYS-494 Senior Research

FACULTY SPONSOR:

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Bryson Marks

PROJECT TITLE:

Assembly, Alignment, and Calibration of a Spectrometer

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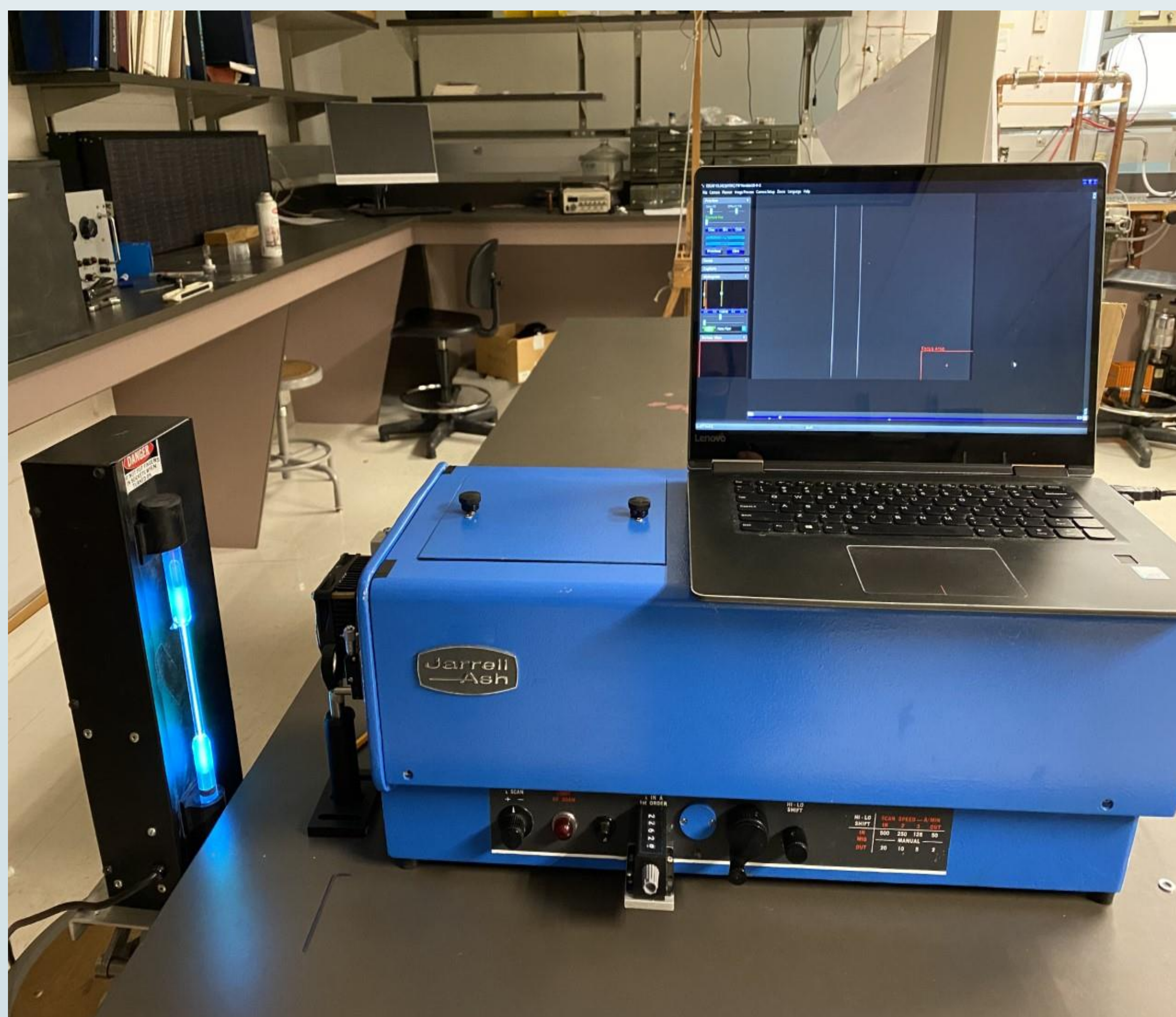
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Abstract

Spectroscopy investigates the interaction between light and matter by observing an emitted spectrum through instrumentation such as a spectrometer. I assembled and optimized a spectrometer from a refurbished spectrograph and CCD camera. This process required adjustments to the gear assembly, the mirror, and entrance optics. I wrote software to analyze the image acquired by the CCD and create an intensity versus wavelength plot and a created a wavelength calibration curve.

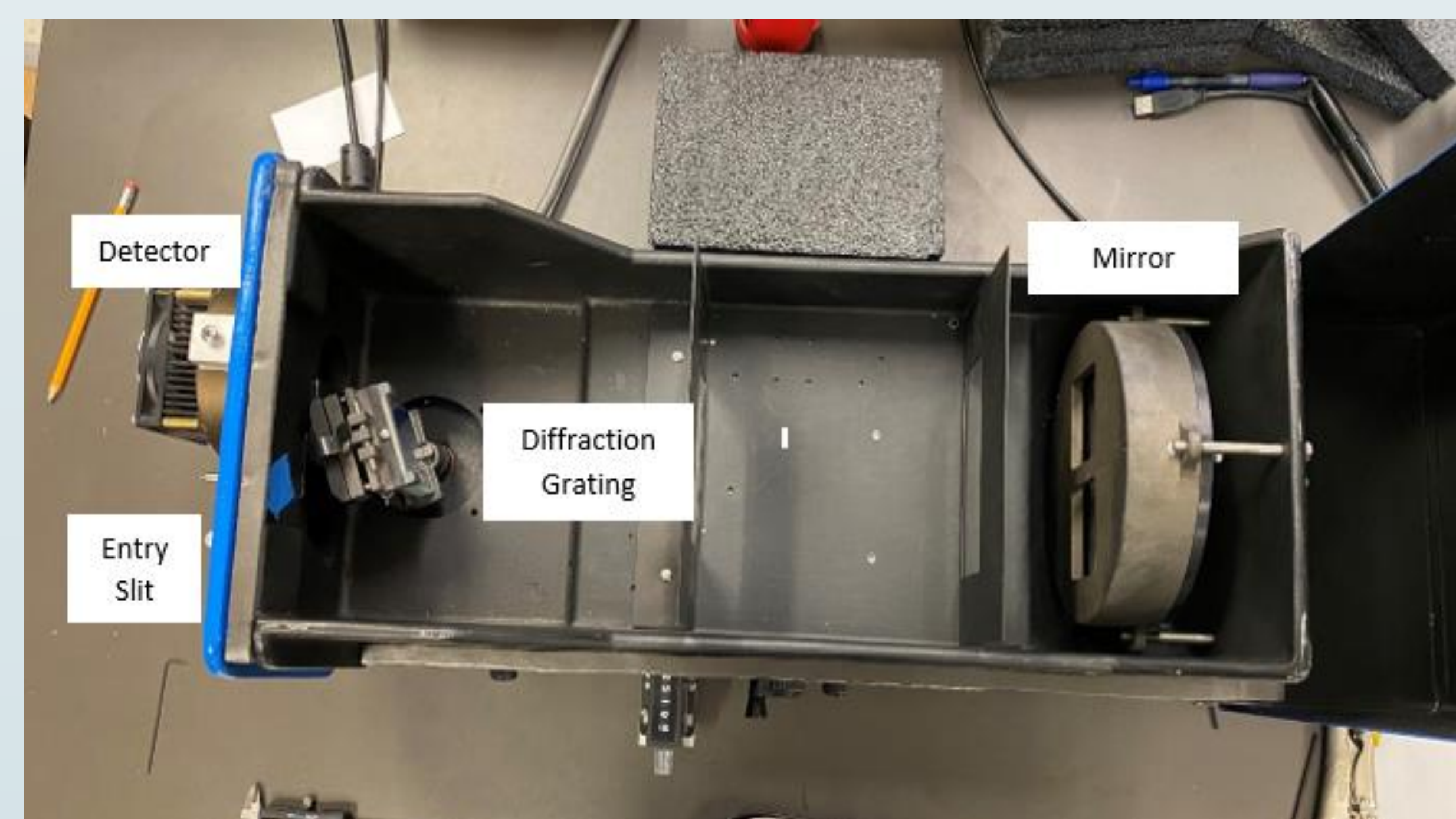
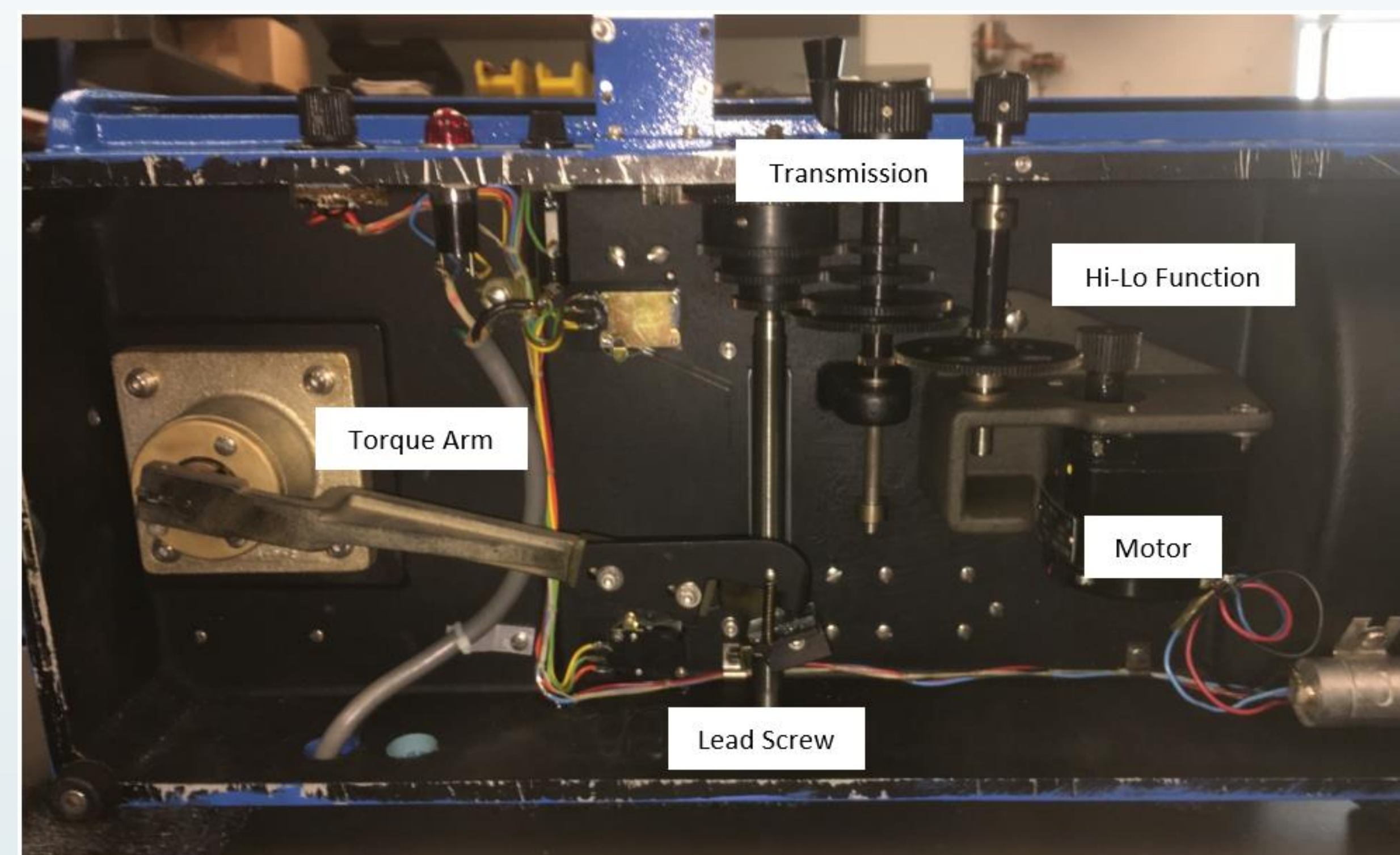
Introduction

A spectrometer utilizes a diffraction grating to separate light into its individual wavelengths that is detected by a CCD. The grating must be adjusted to view specific range of the UV-Visible spectrum that falls upon the CCD. The CCD will produce an image of a spectral line that is analyzed using written software.



Methodology

- Refurbish mechanical components.
- Align optical components and introduce adjustable slit.
- Write software to analyze the images produced by the CCD camera.

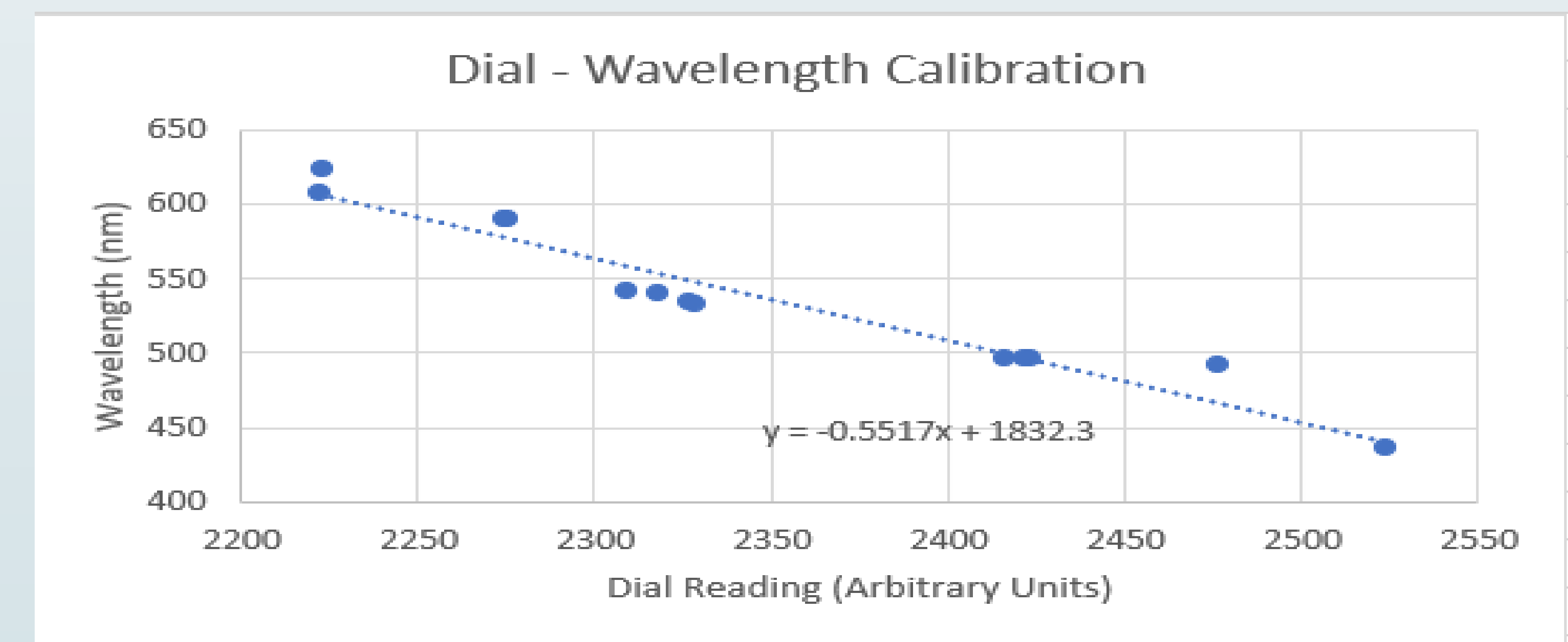
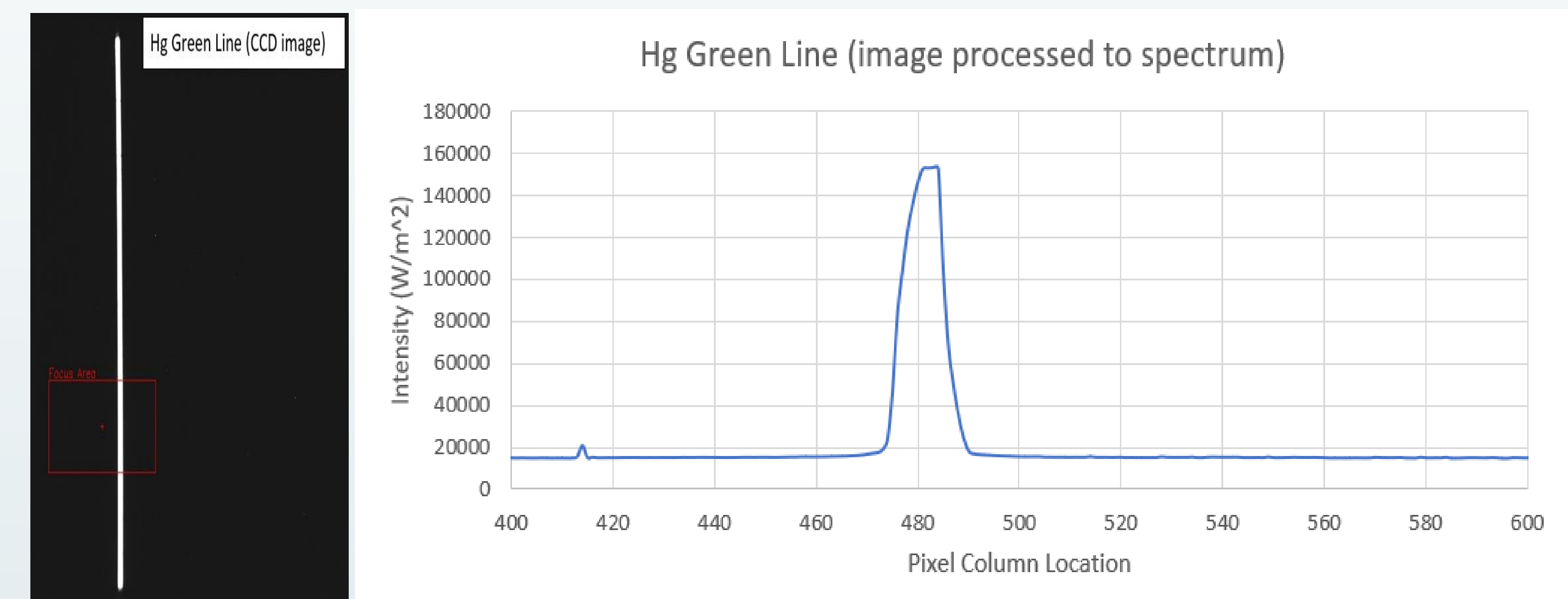


Acknowledgements

This project utilizes the Jarrel-Ash Spectrograph donated to Colorado Mesa University by Chuck Burch as well as the QHY CCD camera donated by the Grand Mesa Observatory.

Results

Removing the abrasions and the low shift function has fixed the mechanical issues associated with the machine. Adding the adjustable slit and adjusting the mirror has fixed the optical issues associated with the machine. Once the mirror was adjusted the images of multiple spectral lines were taken. Using these images of the spectral lines produced by the CCD camera with the software that was written, I was able to create a spectral line curve and a correction curve for wavelength vs dial readings.



Conclusion

After fixing the mechanical components, realigning the optical portion of the spectrometer, and writing software to analyze the image, I created a wavelength calibration curve for the spectrometer. This will allow the user to find spectral lines and immediately correspond the value of the dial to wavelength values. Doing this puts the spectrometer in a position to be used as a piece of scientific equipment.