McPherson/Princeton Raman Control Software

Developed for the Reznik Lab at the University of Colorado at Boulder
by Cole Shank and Hope Whitelock

Getting Started

- For the single monochromator system, ensure that `mono.cfg` is set up as:

  com_port = COM3

- For the triple monochromator system operating in single mode:

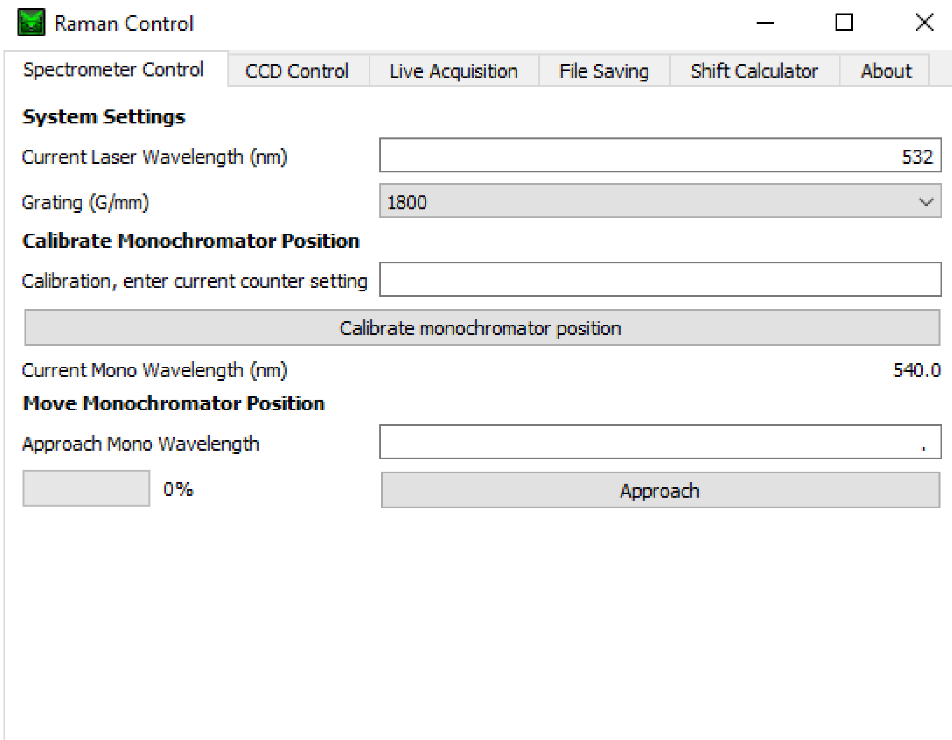
  com_port = COM1

- Triple monochromator system in triple mode is currently not supported.
- The Princeton PyLoN CCD must be cooled using liquid nitrogen before data can be collected. To do so, carefully pour LN_2 into the dewar using a funnel according to the PyLoN manual. It will take around 45 minutes for the detector to reach -120 °C.
- The monochromator and CCD must be calibrated when the program is started. If the software is left running this should only need to be performed once, but can also be done at any time.
- Spectra at the current monochromator position can be obtained using the **1D spectrum** and **2D image** buttons. Wider spectra can be obtained by entering start and stop wavenumbers and using the **Raman spectrum** button.
- Live spectra at the current position can be taken in the **Live Acquisition** tab.
- The most recent spectrum/image can be saved to the desired folder and filename in the **File Saving** tab. All data is automatically saved in the Documents folder.
- The **Shift Calculator** tab provides a convenient calculator for Raman shifts.

Version 1.4 Updated 7/16/2024

First Tab: Monochromator Control

This tab handles control of the monochromator, which is used to select for different wavelengths/wavenumbers/energies.



System Settings

System settings include the current grating and laser in the system. These are pre-filled but can be changed as desired.

Monochromator Calibration

Initial calibration of the software must be performed for correct function. To do this, the current counter number (found next to the PyLoN CCD on the side of the monochromator) must be input. Clicking **Calibrate** will update the current monochromator position in the software to match. Counter and monochromator wavelength are related by a rough factor of 2/3. Note: the monochromator position is the wavelength at the center of the CCD.

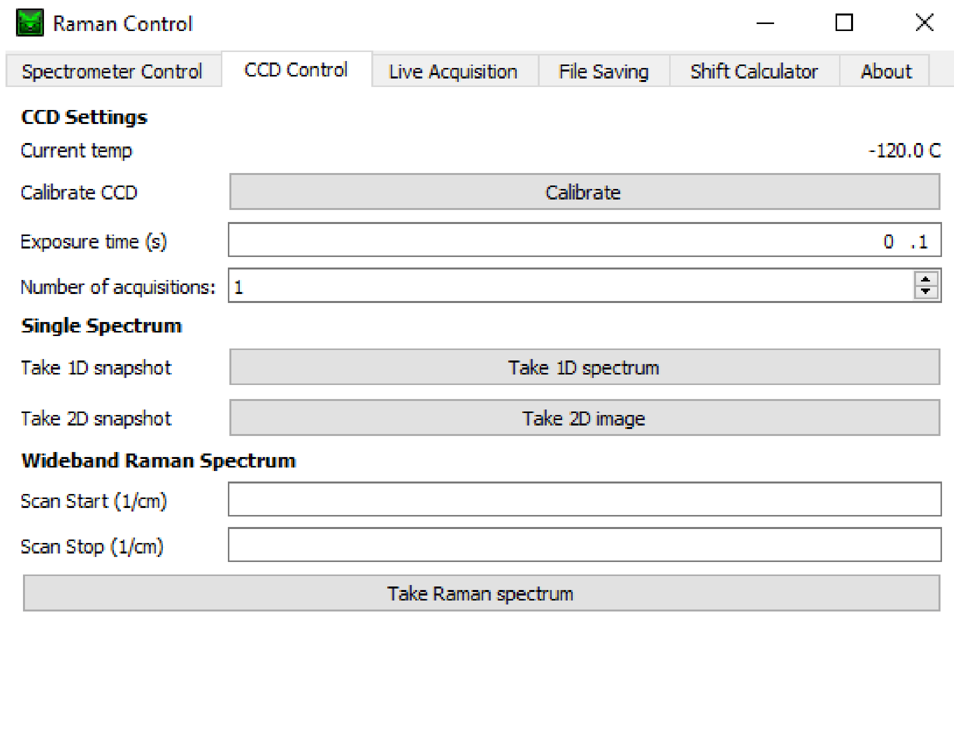
Monochromator Movement

After calibration has been performed, monochromator can be moved to the desired position by entering a wavelength and using the **Approach** button.

Second Tab: CCD Control

This tab handles control of the CCD imager which is used to collect data.

The PyLoN CCD is cooled by liquid nitrogen. Carefully pour LN_2 into the dewar according to the PyLoN manual, being aware that some geysering may occur as the dewar walls cool down. Also, LN_2 can easily spill out of the funnel if it is filled too quickly, so slow pours or small amounts at a time are recommended. Cooling of the CCD from room temperature takes about 45 minutes.



CCD Settings

CCD temperature can be monitored and should be between -100 and -120 °C for best performance.

Calibration of the CCD is necessary for the collection of high precision data. The **Calibrate** button will perform this automatically by shifting the monochromator to center on the laser wavelength. As such, the laser must be on and aligned, and ambient light mitigated via the enclosure and/or dimming the room lights. For correct function, monochromator position must first be calibrated as previously discussed. Calibration spectra are saved in the Documents folder.

CCD exposure time can be changed. For bright samples, values 0.01—1s are sufficient; for dim samples, this can be set up to 9999 seconds (approx. 2.75 hours). If longer scans than this are required, this functionality can be updated in the code.

The number of acquisitions can be set between 1 and 99, with a default of 1. Multiple acquisitions will be taken sequentially and saved as one file.

Single Spectrum

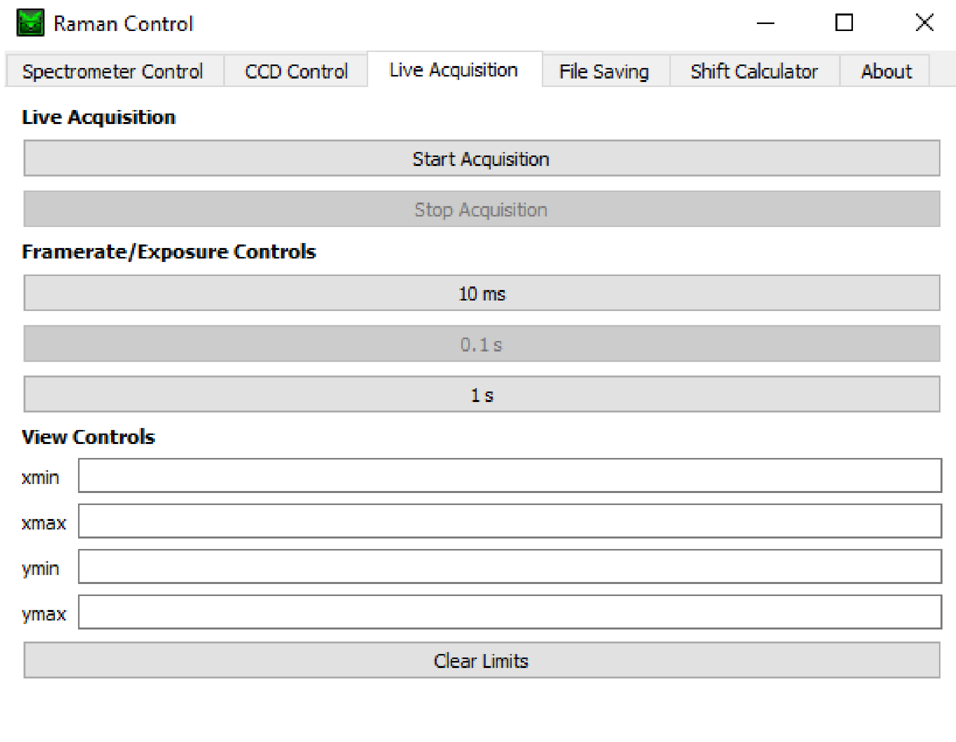
The software offers two snapshot modes, which acquire a 1D spectrum or a 2D image from the detector. These are intended to be used for the collection of high-quality data. The width of these images depends on the grating being used.

Wideband Raman Spectrum

There is also an imaging mode for wider spectra, primarily intended for general mapping of the Raman spectrum for a given sample. This works by taking spectra at different monochromator positions and then stitching them together. There may be some gaps/overlaps in the resulting spectrum, and peak amplitudes may be slightly misrepresented.

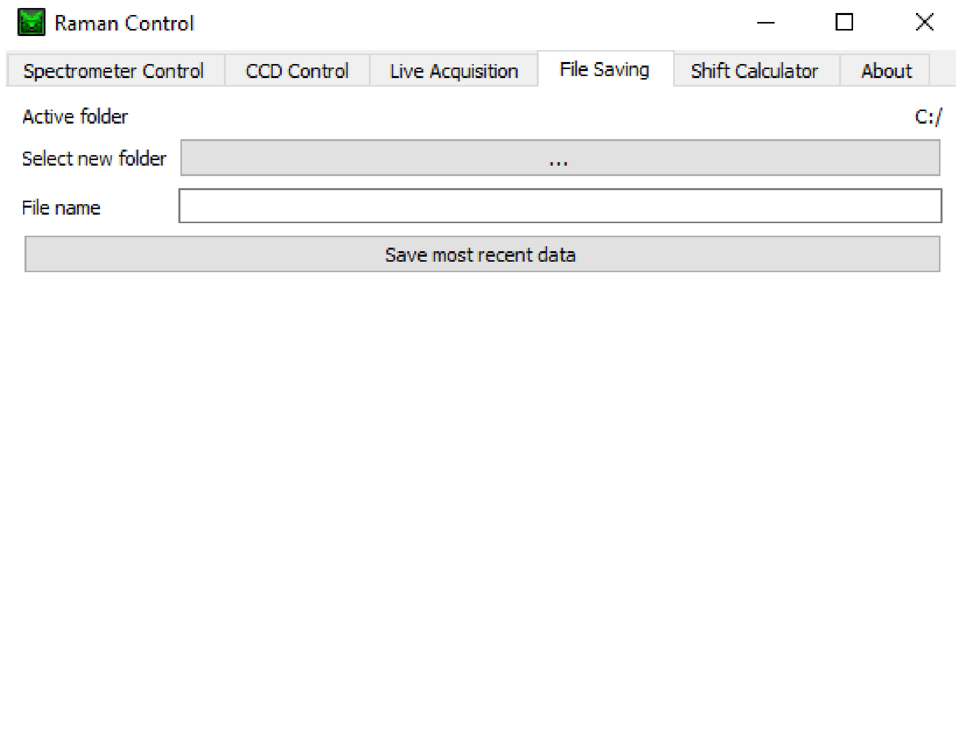
Third Tab: Live Acquisition

This tab handles control of live data acquisition for focusing and alignment purposes.



Fourth Tab: File Saving

This tab handles file saving.

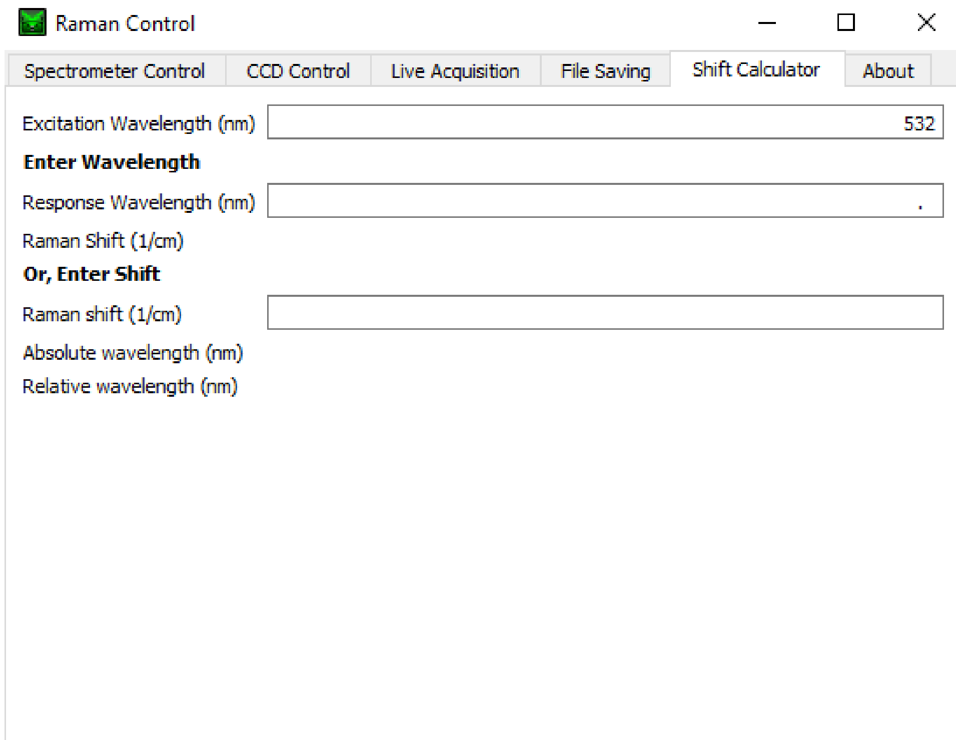


First, an active folder must be selected. This is the location that any selected data will save to. A valid file name (no extension) must be entered. Ensure that the intended file does not already exist, or errors including crashing may occur.

Note: All data is saved to the Documents folder under a timestamp so that it may be recovered later if it is not saved manually.

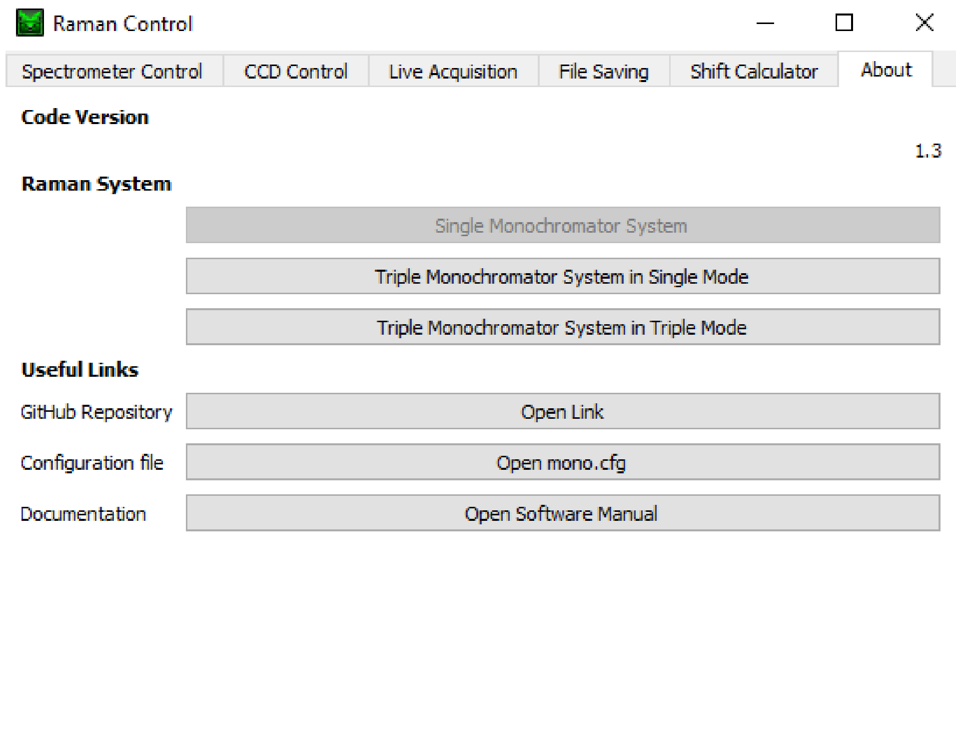
Fifth Tab: Shift Calculator

This tab provides a convenient means of calculating Raman shift, going from wavenumber to wavelength or vice versa.



Sixth Tab: About

This tab provides useful information and links.



Raman System

This section allows selection of the system in use. Currently this does not do anything other than update the configuration file, but in the future, this may enable seamless use of this software with a variety of different setups.

Useful Links

This section contains links to the GitHub repository, where underlying code and files are hosted; the configuration file, for manual updating or verification of the values housed there; and this software manual.

Planned Updates:

- Cryo-/temperature control