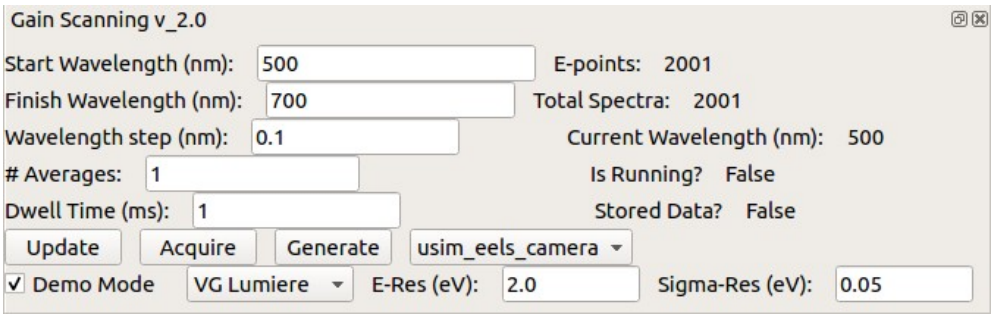
Gain Scanning v2.1.0 – User Manual (but with no users)

Basic interface. We have self explanatory fields. Nevertheless:



Variables:
- **Start Wavelength**: Laser start wavelength, in nm;
- **Finish Wavelength**: Laser end wavelength, in nm;
- **Wavelenght Step**: Laser Wavelength step, in nm;
- **# Averages**: Averages for each wavelength. Averages here is, in fact, a single acquistion with x times **Dwell Time**.
- **Dwell Time**: CCD integration time in ms;
- **E-Res** *[DEMO MODE]*: Energy resonance peak of the simulated resonance;
- **Sigma-Res** *[DEMO MODE]*: Energy spread (FWHM) of the simulated resonance.

 # Averages and **Dwell time** basically define those two camera parameters:
frame_parameters["integration_count"]=int(self.avg)
frame_parameters["exposure_ms"]=int(self.dwell)

Label Status (doesn't allow user-input):
- **E-points**: Laser number of different energies;
- **Total Spectra**: E-points * # Average;
- **Current Wavelength**: Current Laser Wavelength;
- **Is running?**: Acquistion runs in a thread and this says if the thread is alive or not [need check this];
- **Stored Data?**: Boolean to indicate we have data stored or not. **Generate** button empty our data buffer after displaying it at our Data Panel.

Buttons:
Update: Everything runs in a thread so we don't freeze UI. This button updates our Label Status with the thread alive or not. This button also updates our Variables, but only when no acquistion is being done. This is because otherwise the updatd values would be sent to our thread.;
Acquire: Start thread. The thread is a full acquisition including all laser wavelengths. **Is running?** says if the thread is running or not. While it's running, there is not **Stored Data?;**
Generate: If **Stored Data?** is true, this button exports data from each wavelength, already summed up, in our Data Panel.

Drop-down menu:
Available Cameras: Lists available cameras and select the one the user wants to use.
Microscope Selector *[DEMO MODE]*: This drop down selects the microscope [VG Lumiere, VG Cold, ChromaTEM] to use during demo mode. Demo mode is a simple gain resonance simulator in order to help the user make the best possible choice in for the Variables.

Gain Resonance Simulator *[DEMO MODE]*

When the box *[DEMO MODE]* is checked, the user will not be able to Acquire data using **Acquire** button. The user must use the button **Generate** in order to generate a fake gain signal based on the following:

Parameters: **Start Wavelength, Finish Wavelength, Wavelength Step, E-Res** and **Sigma-Res;**

Drop-down Menu: **Microscope Selector;**

VG Lumiere: Gun Energy Spread: 0.55 eV
Gun Instability: 0.35 eV
VG Cold: Gun Energy Spread: 0.35 eV
Gun Instability: 0.1 eV
ChromaTEM: Gun Energy Spread: 0.03 eV
Gun Instability: 0.03 eV

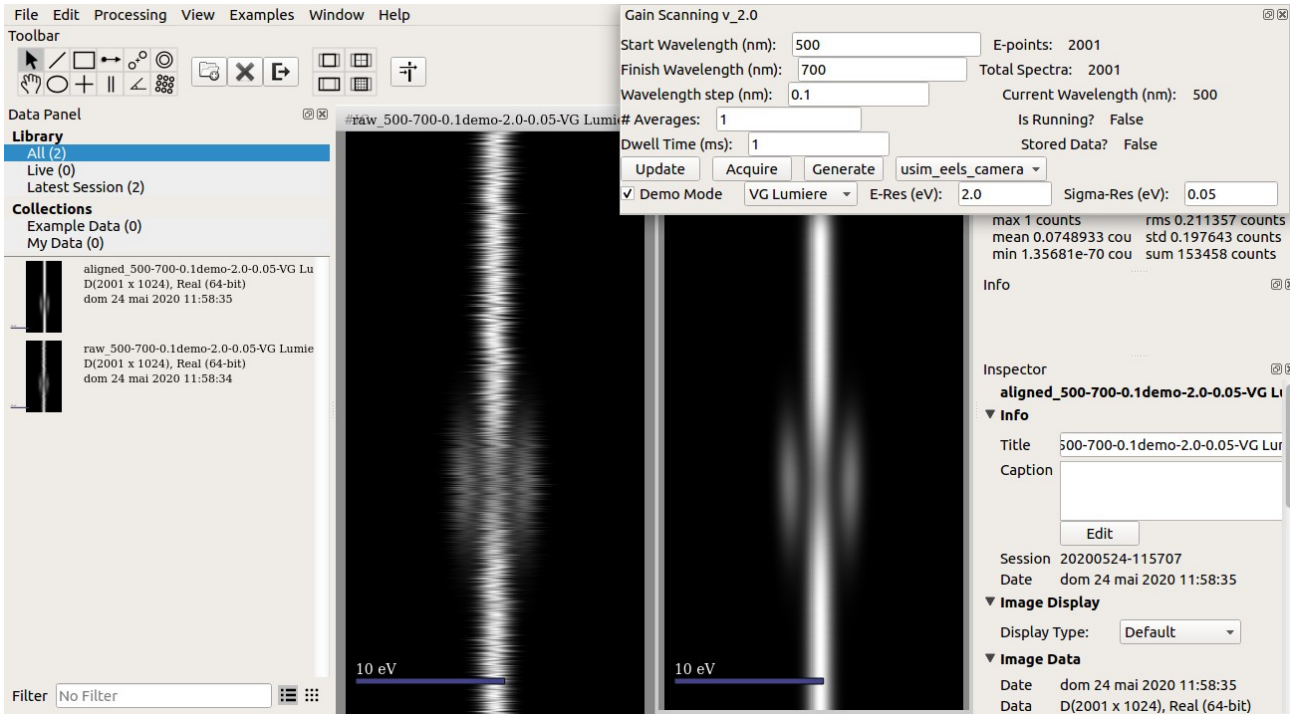


Figure 1: [DEMO MODE] for VG Lumiere, E-Res = 2.0 eV and Sigma-Res= 50 meV.

For *VG Lumiere*, **E-Res** = 2.0 eV and **Sigma-Res** = 50 meV, **Generate** button gives the two outputs above. One is the raw generated image and the other is the aligned image, done internally by the module. Those two types of image are also the output of normal acquisition, using a CCD camera via **Acquire** button and after uncheck *[DEMO MODE]* check button.

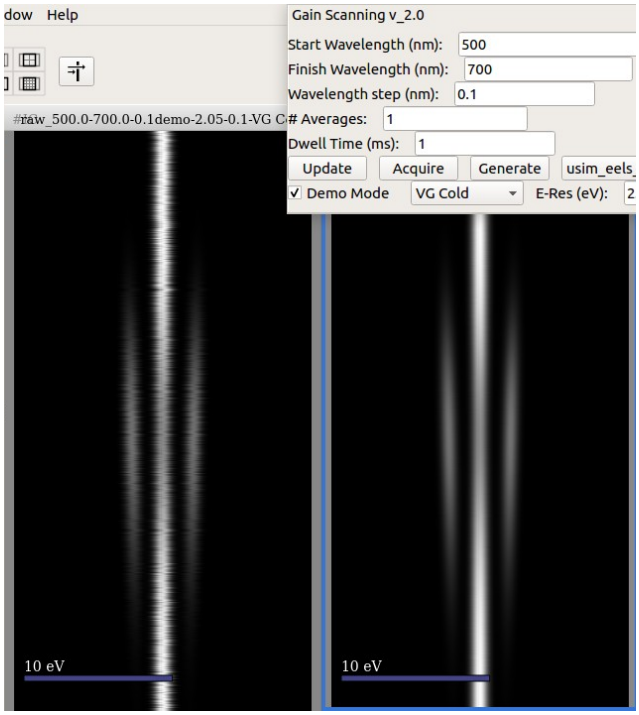


Figure 2: [DEMO MODE] for VG Cold, E-Res = 2.05 eV and Sigma-Res= 100 meV.

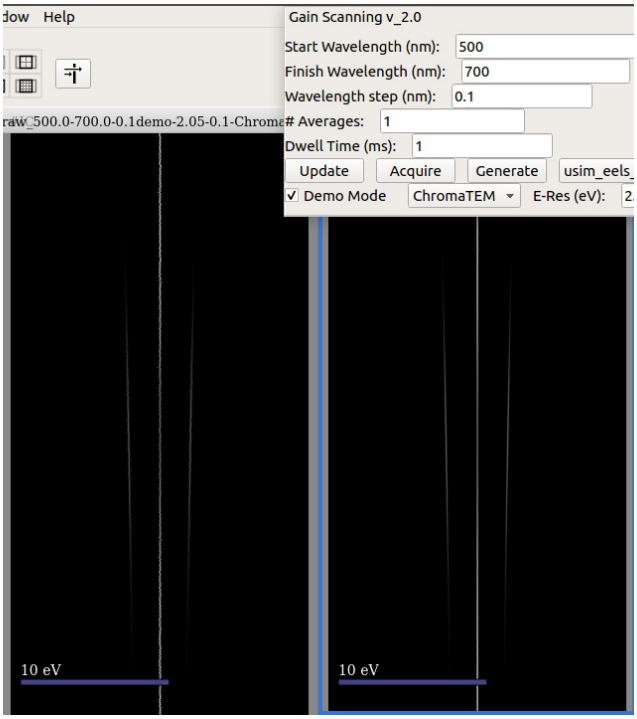


Figure 3: [DEMO MODE] for ChromaTEM, E-Res = 2.05 eV and Sigma-Res= 100 meV.

Figure 2 and 3 show similar examples for *VG Cold* and *ChromaTEM*, respectively. The idea is not only compare performances between microscopes but also pick the best parameters for your acquistions, specially **Start, Finish and Step Wavelength**.

General Instructions

With [*DEMO MODE]* unchecked:
- When pressing **Acquire**, nothing happens in Label Status until you press **Update**. After pressing update, **Is Running** shows True, Current Wavelength, shows current wavelength and **Stored Data?** shows False because acquisition is still running. If you press **Generate**, nothing will happen.
- After acquistion is finished, you will see in the terminal "Acquistion Finished". If you press **Update**, **Is Running?** is False, **Stored Data?** is True and **Current Wavelength** shows the same as **Finish Wavelength**.
- Finally, you press **Generate** and you will see "Plotting..." at the terminal. Each one of your E-points will be displayed in library in a single file, explained better in the section below (Dta Analyses). **Stored Data?** is, again, False.

Data Analyses

- Two files are always automatically displayed at user Data Panel. A raw and an aligned files. Alignment is done internally using raw file. For clarity:

```
def align_chrono(eels_data, eels_data_aligned):
        ind_max = []
        for i in range(len(eels_data)):
            ind_max.append(np.where(eels_data[i]==np.max(eels_data[i]))[0])
            eels_data_aligned[i] = np.roll(eels_data[i], -ind_max[i]+ind_max[0])
```

- Calibrations are also already performed using **Start, Finish** and **Step Wavelength**. Note your file has a dimension of (**E-Points** x len(data_item.data[0])). Last item is in fact our camera effective pixel, which accounts for camera horizontal number of pixels and current binning factor.
- Note also that our *[DEMO MODE]* doesn't require a camera and thus its dimension is unrelated to camera. Camera pixel size was arbitraly assigned with 1024 pixels while binning factor is 1. Thus, in *[DEMO MODE]*, our both generated files have a dimension of (**E-Points** x 1024) .