**CEMAS’s HyperSpy TEM and SEM Analysis Program**

This program allows users to analyze their microscopy data with a helpful GUI. This program requires further development and testing.

# Installation

1. Make sure all components of the project folder (where this file was located) have been downloaded to your device.
2. Follow the instructions for downloading HyperSpy (<http://hyperspy.org/hyperspy-doc/current/user_guide/install.html>)
3. Once HyperSpy has been downloaded, go o the folder HyperSpy -> Spyder. Open Spyder.
4. Within Spyder, open the script “All Parts of Project -> main.py”. You should be able to find main.py in the same folder as this document.
5. Run “main.py”. From the pop-up GUI, you should be able to analyze your data.

# Usage

## Opening Files

1. In the top left-hand corner of the screen, select the “Open” button. From the drop-down menu, select the type of file you wish to analyze (current files include “.spd” and “.spc”). To find the correct file type, one might need to dive deep into the data folder that was collected.

**IMPORTANT:** When uploading the file make sure the names of all related files (such and “.bmp” and “.spc” files that go with “.spd” files) have the same name as the file being uploaded!

1. Wait for a picture or graph of the data to load in the main frame of the window.

## Saving Data Output

When saving text output data:

* Select the “Save” menu in the top left corner of the screen.

When saving images/graphs in the workspace:

* Select the save-icon located beneath the image to save it.

## Periodic Table

If an element is blue, it means at least one line has been added to the signal data. If an element is grey, it means no lines are in the signal data. If the element is red, that means the element is completely disabled and cannot be added to the signal based on HyperSpy’s constraints.

* **Scrolling Over an Element:** When your mouse is over an element, a pop-up appears with the signal and the element lines of the element currently under your mouse overlayed on the figure.
* **Scrolling Away from an Element:** When your mouse leaves an element, the pop-up disappears.
* **Left-Clicking an Element:** When clicking on an element not currently in the signal (grey button), the shell line is added to the signal. When clicking on an element already in the signal (blue button), all shell lines relating to the element are removed from the signal.
* **Right-Clicking an Element:** When right-clicking an element, a menu appears with every possible element shell that could be added to the signal. Within the menu, you can select and deselect shells you want added to the signal. A check beside a shell line means it is currently in the signal, while nothing means it is not being accounted for.

**“Check Element Lines” Button:** On the left-hand side of the application, the “Check Element Lines” button, when clicked, displays a pop-up of all of the current element lines believed to be in the sample.

## “.spd” File Analysis

* **Individual Element Maps:** Once your “.spd” file has been loaded into the program, select the button on the left-had side titled “Element Maps”. By right-clicking on an element map, a menu of possible different colors for the map will appear. Left-clicking any color changes the color of the map.
* **Displaying an Overlay of Certain Element Maps:** Once the element maps are displayed, an overlay map can be created by pressing the “Overlay Map” button on the left-hand side of the screen. A pop-up menu will display different elements that can be chosen; selecting an element adds it to the overlay map, which will appear in the rightmost part of the display. Colors of the individual maps can still be changed, and the changed will be reflected in the overlay.
* **Creating Lines/Shapes on Displays:** Lines can be made on either the original intensity display or the overlay, while other shapes can be made on only the original intensity display. Making a shape on the original intensity display results in the creation of a signal intensity graph; making a line on the overlay results in a line profile of all of the elements currently display The line weight can be input on the left-hand side of the screen using the entry box under “Line Weight”. The shape being created can be chosen using the drop-down menu on the left-hand side of the screen under “Shape Type”. Shapes and lines on figures can be manipulated in the following ways:
  + **Drawing a Shape:** Clicking and dragging on a figure creates the desired shape. Releasing the mouse button finalizes the creation of the shape. If drawing a polygon, after making the initial line, you may click anywhere to add new points the figure. The figure automatically closes, but the closing line will change as you add new points to the figure.
  + **Deleting a Shape:** Right-clicking on a figure with a shape deletes the shape within it and all graphs relating to the information. As soon as you create a new shape, the previous shape will be deleted.

## “.spc” File Analysis

* **Making a Model:** After the intensity figure has loaded, select the “Display Model” button on the left-hand side of the screen. A model will be displayed below the original data.
* **Running an Analysis:** To preform a TEM analysis, after the model has been displayed, select “Run Analysis” on the left-hand side of the screen. From there, a pop-up window will display the possible lines to be analyzed; select all you wish to analyze. **NOTE:** Even if a button appears to be selected when the window is opened, it may not be. Make sure to manually click the button if you wish to analyze said line in the data. Once an analysis is run, all numerical data related to the analysis will be displayed in the bottom right-hand text box.

# Contributing

Pull requests are welcome. Feel free to report all problems and suggest changes.

# License

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