This code is to be used for quick analysis of preliminary results of the luminescence data from WinView file. The WinView file will have to have and .SPE extension. This code takes in the luminescence file, locates the boundaries of the individual race tubes based on luminescence activity, calculates total luminescence activity of individual race tubes per hour, and outputs plots showing the luminescence intensity on the y-axis and time (in hours) on the x-axis.

GENERAL INSTRUCTIONS ON CODE USAGE

**VS Code, Python, and Jupyter Notebook**

To use the script, I suggest installng Python, VS Code, and Jupyter Notebook package to your computer.

Follow below links to install Python and Visual Studio code respectively.

python.org

<https://code.visualstudio.com/download>

In the terminal of the VS code, write the following command to check if Python is installed and is visible in Visual Studio Code.

*python –version*

Once you made sure that Python is installed, run the following command in the terminal:

*pip install jupyter*

*pip install numpy*

*pip install scipy*

*pip install matplotlib*

*pip install skimage*

*pip install pandas*

Alternatively, you also just use Google Colab. Just go via the following link

<https://colab.research.google.com/>

and upload the code file and the SPE file. However, it might take a bit time to upload large files.

**Code**

There are three parts for code in general: loading WinView SPE luminescence file, figuring out the boundaries of the race tubes, and calculating luminescence of every race tube.

Now, the boundary detection can be done manually. For this, however, you will need to open the WinView SPE file using WinView software in the lab. There, you will have to navigate and find the coordinates as you would have done with the excel script and enter the corresponding coordinates in respective arrays.

You have to specify the background by considering the region where there are no race tubes. You can see that from the graph here.

The comments in the code should provide additional guidance as well.

**NOTE**

In cases where outmost precision is needed, it is best to double check the results and analyze the luminescence using previously used excel script.

**STEP-BY-STEP ANALYSIS**

To run each block of code, select the block of code and press Ctrl + Enter.

1. Select the number of race tubes you have. You may need to come back and change the number depending on how you laid out the race tubes, since there could be gaps that could be interpreted as individual race tubes. In such a case, you should change the number\_of\_race\_tubes variable to a higher number.b
2. Load the file in the multiimage variable. The file can be a full path or a relative path if your script is in the same folder as the .SPE file

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1. Below is the code part that shows the detection of boundaries. Every single red star is where luminescence stops, therefore it should theoretically indicate where the race tube edge is.

A computer screen shot of text

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A graph with blue lines and red dots

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1. Notice however, just after 600, there is a red peak star at the deep trough, and a red star right after it is the beginning of a luminescence peak. This area between them will be interpreted as a race tube by default. In order to count in the last race tube, you will need to change the number of race tubes variable to 19 or enter troughs manually with the help of WinView software.

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1. Since the first meaningful red star is the second one, the index to write in the starting trough index is 1. This is because python has zero indexing.
2. LEFT\_BOUND and RIGHT\_BOUND mean the horizontal start and end of race tube luminescences. This might result in counting in the areas of race tube where there is no luminescence.
3. Background coordinates are entered in the BACKGROUND\_TOP and BACKGROUND\_BOTTOM variables; the start and end of background rectangle will be LEFT\_BOUND and RIGHT\_BOUND

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1. If you are planning to enter boundaries from WinView manually, enter y-coordinates from WinView in the BOUNDARIES\_FROM\_WINVIEW variable, and start and end x-coordinates into LEFT\_BOUNDARIES\_FROM\_WINVIEW and RIGHT\_BOUNDARIES\_FROM\_WINVIEW variables respectively.

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1. Background calculating is optional; you will need to unhash the line about the background

A screen shot of a computer program

AI-generated content may be incorrect.

1. The above block of code is for plotting the luminescence data. If you want to have csv file outputs into your folder, put “True” in the get\_csv\_output variable. Note that it will populate your folder with csv files instantly, and the names for the files will be of the format “race tube number + raw.csv”. For example “1raw.csv”.

A screen shot of a computer program

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1. The above codes do the following:
   1. Prepare coordinates for vertical lines every 24 hours
   2. Select which kinds of plots you would like – raw, raw showing the trend, or detrended
   3. The last 4 lines of code iterate through the luminescence\_array for detrending processing

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1. This is the part where trend is calculated. You can choose a polynomial order of any number, but be mindful of overfitting (higher polynomial numbers) or underfitting (lower polynomial numbers)

A screen shot of a computer code

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1. In the above code, change get\_detrended\_csvs to “True” in order to get detrended csv files in your folder. This will be necessary for future Fourier transform analyses. The filename format will be “race tube number + detrended.csv”. For example, “1detrended.csv”.