Instructions for running the "ν analytics" application

Step by step procedure:

1. Download **Matlab Runtime** for the R2020a version under Matlab Runtime Download (Fig. A1).
2. Install the Matlab Runtime. For Windows users, it might be advised to extract the downloaded zip file before running the setup.exe file.
3. Run (normally by double clicking) the application file "**nu_analytics.app**" for Max OS users or "**nu_analytics.exe**" for MS Windows users; it might take 30-60 sec for the application to completely open, sometimes even longer.
4. if you are using Mac OS Big Sur or later, you might get the following message *"You do not have permission to open the application "nu_analytics". Contact your computer or network administrator for assistance."*. This is simply due to the fact the the OS does not allow you to run application from non-identified developers; this is a feature called Gatekeeper. To solve this problem you need to do the following:
   - you first need to disable the Gatekeeper, to do so run the Terminal app
   - in the command line type "sudo spctl –master-disable"
   - you will then have to enter you Mac OS account password and press enter
   - now your Gatekeeper is disabled; you need to give a permission to run this specific app
   - to do this, you need to type the following command in terminal in Terminal "sudo chmod -R 755 .../nu_analytics.app"; in the previous command you need to replace the "..." with the path where the app is placed. For example if I have the app in the Downloads folder the command should be, "sudo chmod -R 755 Users/antonius/Downloads/nu_analytics.app".
   - when you try to open the app now, you will get the following message "“nu_analytics” is an app downloaded from the Internet. Are you sure you want to open it?"; then you can chose "Open"
   - to keep your Mac protected, you can now enable the Gatekeeper again by typing "sudo spctl –master-enable" in the Terminal app; the app should keep running without a problem even after activating the Gatekeeper again
   - more details about this topic can be found on this youtube video by i Tech (the video is prepared by unknown person with whom I have no connection).
5. Once open, one should see a window as the one shown in Fig. A2. The sequence for using the application is shown in Fig. A3.
6. Press on the "**Import Data**" button.
7. Make sure that your is saved in
   - a Tab-delimited .txt;
   - with columns in order: Time, Δf_1, ΔD_1, Δf_3, ΔD_3, Δf_5, ΔD_5, Δf_7, ΔD_7, Δf_9, ΔD_9, Δf_{11}, ΔD_{11}, Δf_{13}, ΔD_{13};
   - with or without a header row.
8. After choosing the data file (Fig. A4), select the format of the frequency response: (i) not normalized by the overtone number or (ii) normalized by the overtone number (Fig. A5).
9. Select the overtone number which you want to use for plotting the data.

10. Type the density and viscosity of the two kinematic-viscosity-matched-solutions: the default values are for D_2O (Solution 1) and 4.55%wt. glycerol in H_2O (Soltution 2) at 25 °C.

11. Press on the "**Calculate Shifts**" button to start selecting the data points that represent the baseline and response of each solution. While one will select data from one overtone, the calculations will be done on all the overtones for both the frequency and dissipation responses, using the corresponding data points for each of them.

12. The figure will show with the frequency response at the selected overtone versus time. One can zoom in/out and pan the figure using the icons on the top right corner of the plotting area. These icons appear by hovering the mouse pointer over this corner (Fig. A6).

13. Follow the instructions to determine the response for: solution #1 before the adsorbate, solution #2 before the adsorbate, the adsorbate, soltuion #1 after the adsorbate and solution #2 after the adsobate (Figs. A7-A14). Please note that solution #1 and solution #2 have to have the same kinematic viscosity but different density and viscosity. Also, solution #1 and solution #2 have to be same before and after the adsorbate step, e.g., if solution #1 before adsorbate was D_2O then solution #1 after adsorbate has to be also D_2O. The order by which solution #1 and solution #2 is delivered is not important, e.g., solution #2 could be delivered before solution #1; the most important is that the density and viscosity of each solution corresponds to the values entered in step (8).

14. Once done with selecting the data point that represent the different responses, the application will display the results in the tables under ther "3. Results" section as well as a figure. The figure can then imported to different file formats if needed.

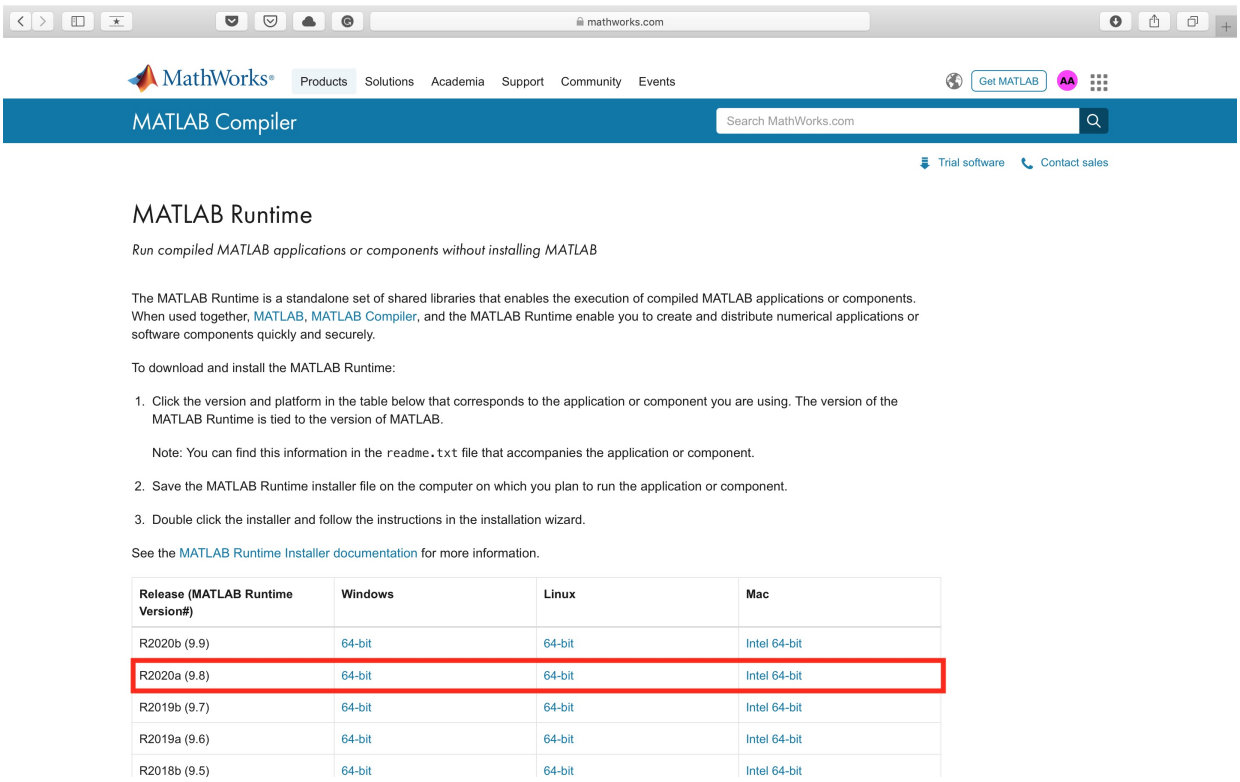

Figure A1: Webpage for downloadng Matlab Runtime. Shown in the red square are the Runtime versions compatible with the application.

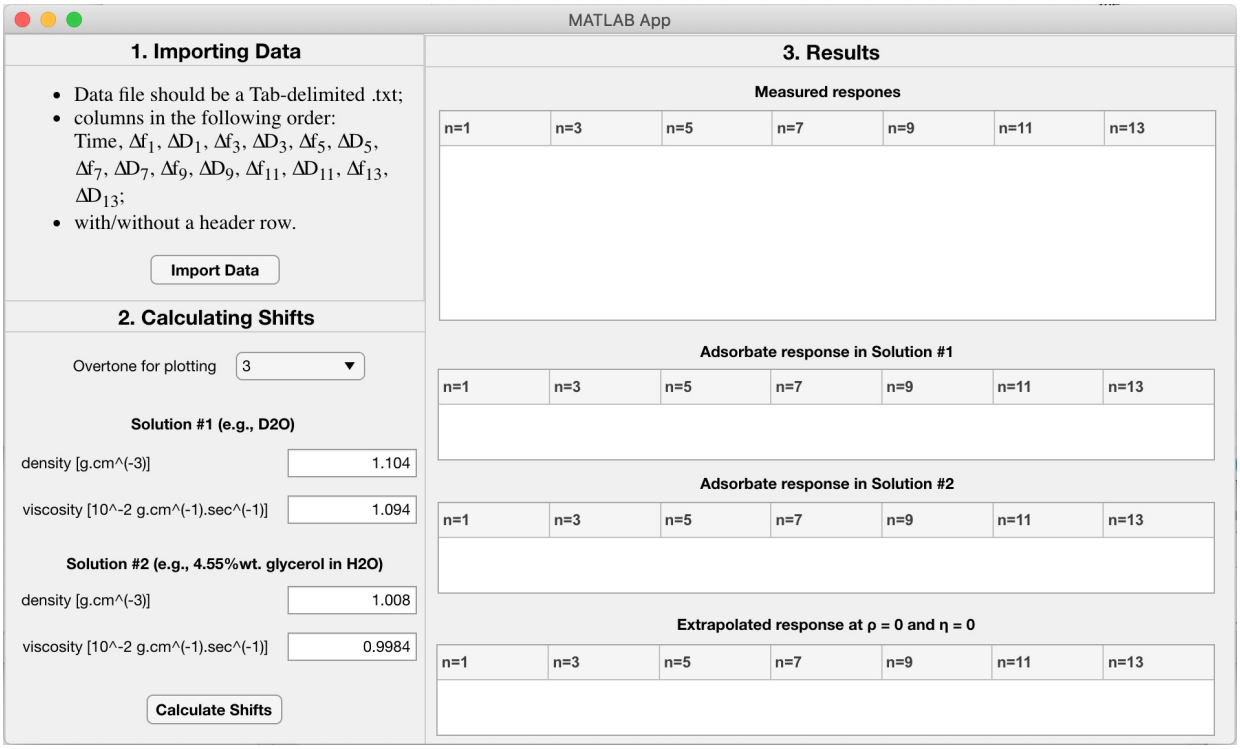

Figure A2: The application layout. The application has three sections: 1. Importing data; 2. Calculating Shifts; and 3. Results.

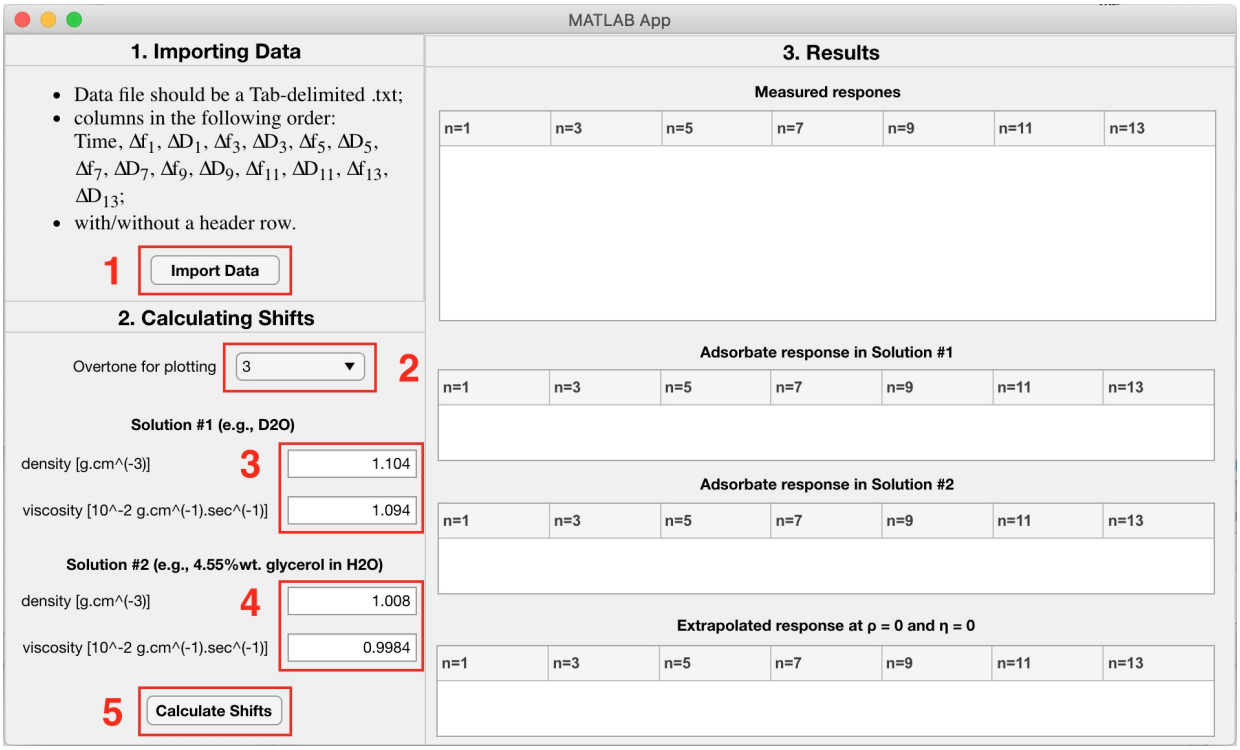

Figure A3: Steps for running the application. The listed steps are to be followed when running the application: (1) Import the data file; (2) Select the overtone to be used for plotting; (3) Input the density and viscosity of solution #1; (4) Input the density and viscosity of solution #2; and (5) Calculate the different shifts.

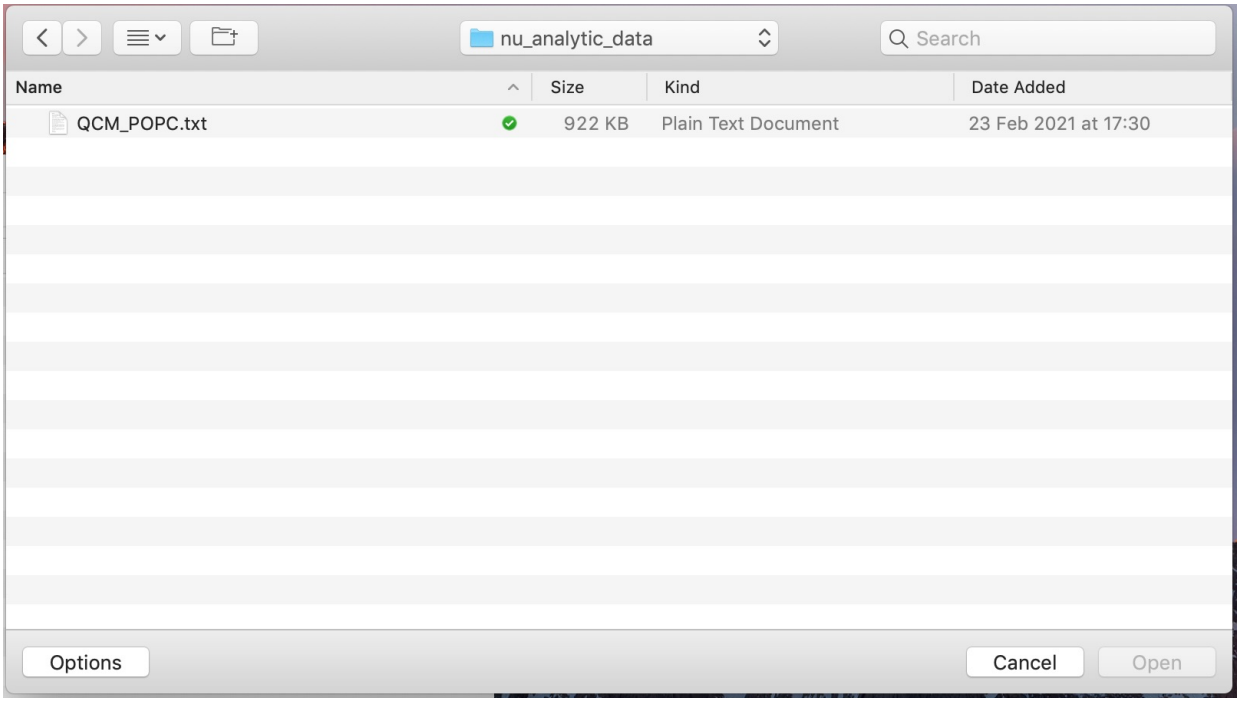

Figure A4: Importing data. After clicking on the "Import Data" button, one will be prompted to chose the data file.

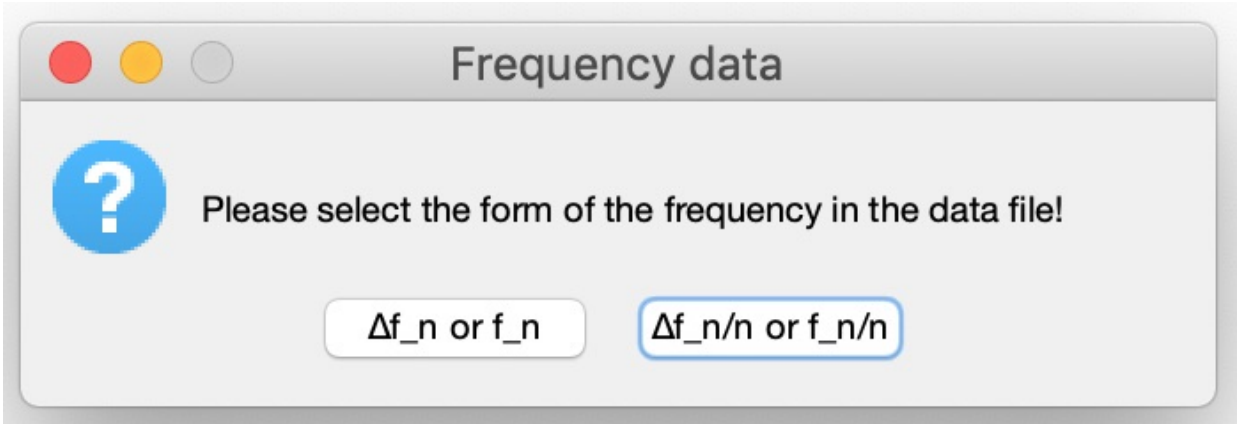

Figure A5: Frequency data format. After selecting a data file, one will be prompted to specify the format of the frequency data: not-overtone-normalized (Δf_n or f_n) or overtone-normalized ($\Delta f_n/n$ or f_n/n).

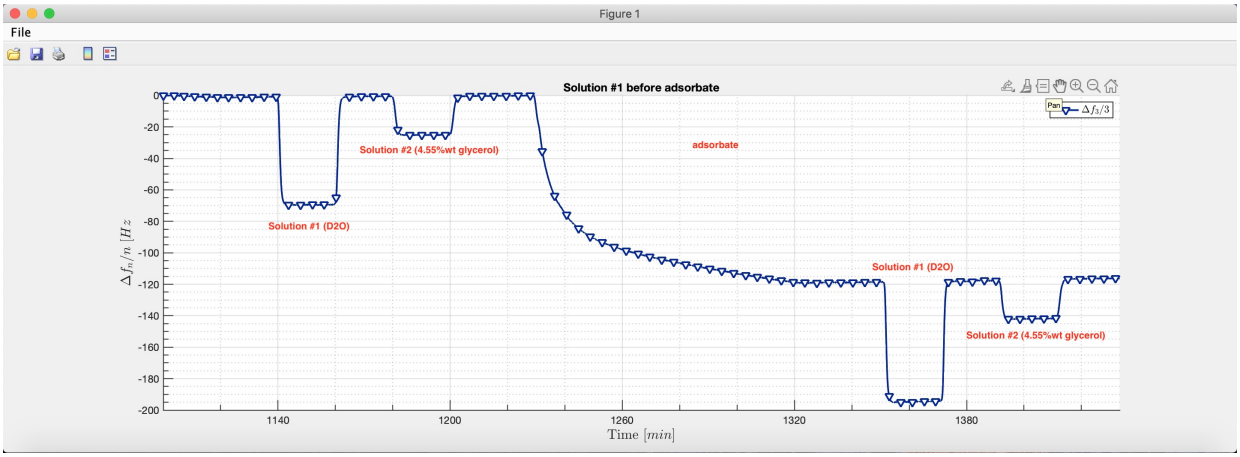

Figure A6: Plotted Data. After click on the "Calculate Shifts" button, the frequency versus time will be plotted at the selected overtone. If one hovers by the mouse pointer over the right top corner, different icons for zooming and panning the figure will appear. Annotated in red are the different solutions delivered in this sample experiment; such annotation will not show when running the application.

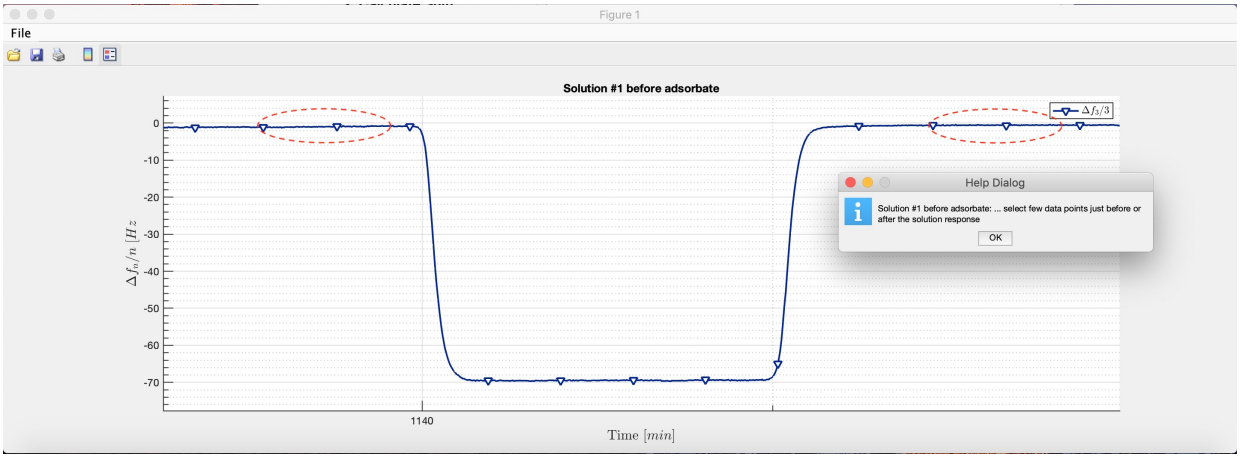

Figure A7: Selecting the baseline for "Solution #1 before adsorbate". One will then be prompted to select data points that represent the baseline of "Solution #1 before adsorbate"; these could be data points before or after applying the solution as indicated by the dashed red elipses. One needs to press the "Ok" button before being able to select the data points.

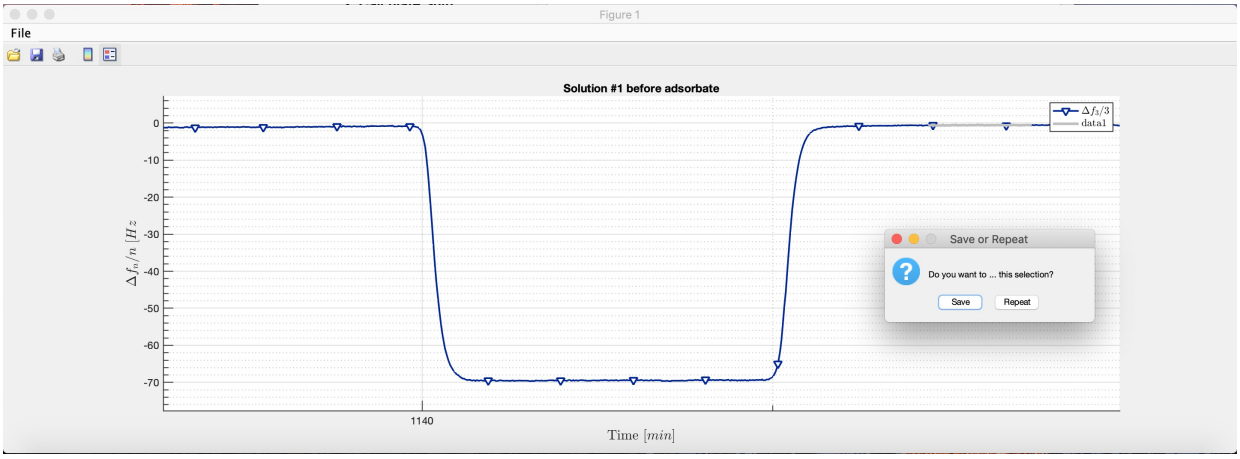

Figure A8: Selected data points confirmation. After selecting the data points, they be shown in gray. One can either use/save this selection or repeat it by clicking on either "Save" or "Repeat".

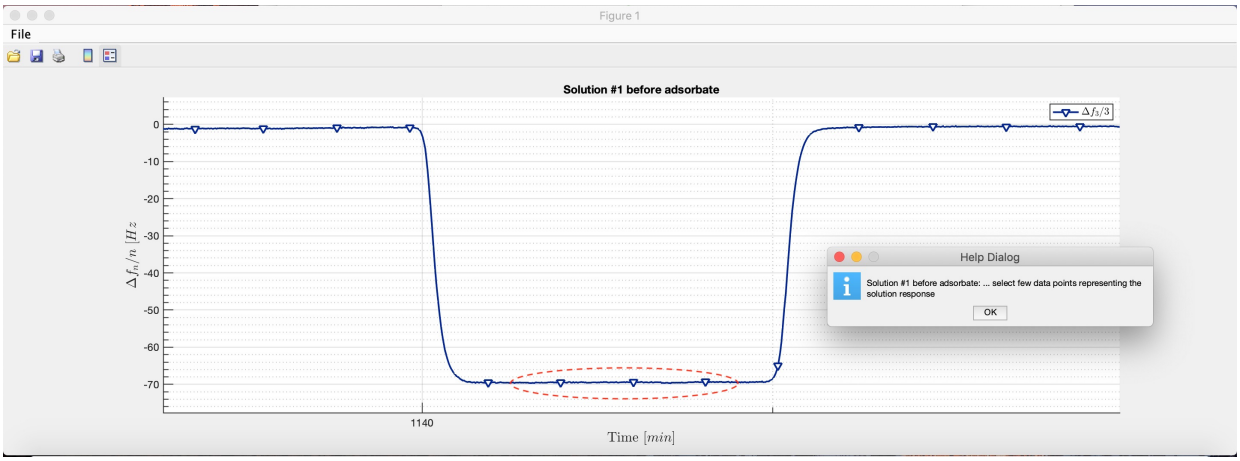

Figure A9: Selecting the response for "Solution #1 before adsorbate". One will then be prompted to select data points that represent the response of "Solution #1 before adsorbate"; for the given sample data, these data points are indicated by the dashed red elipse. One needs to press the "Ok" button before being able to select the data points.

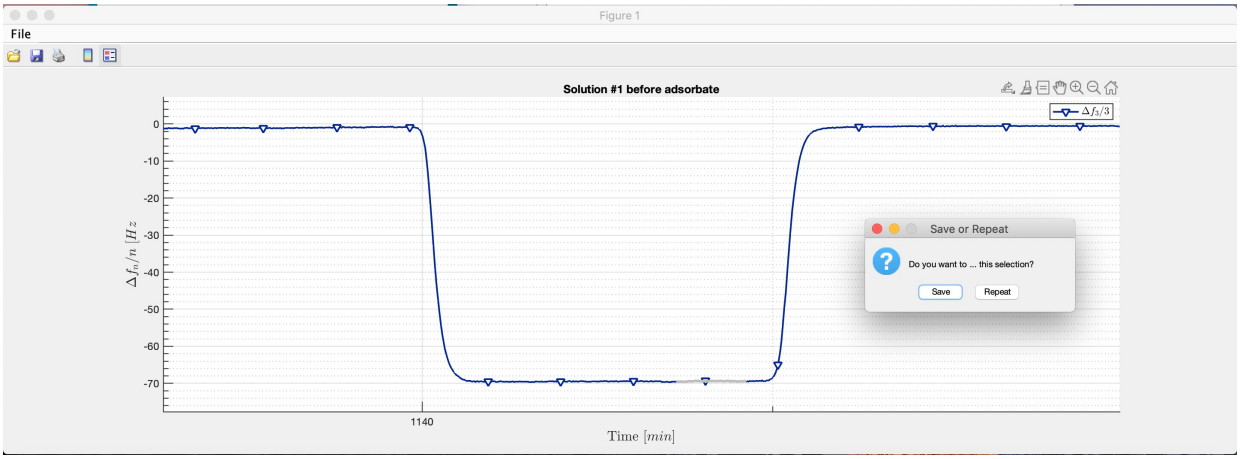

Figure A10: Selected data points confirmation. After selecting the data points, they be shown in gray. One can either use/save this selection or repeat it by clicking on either "Save" or "Repeat".

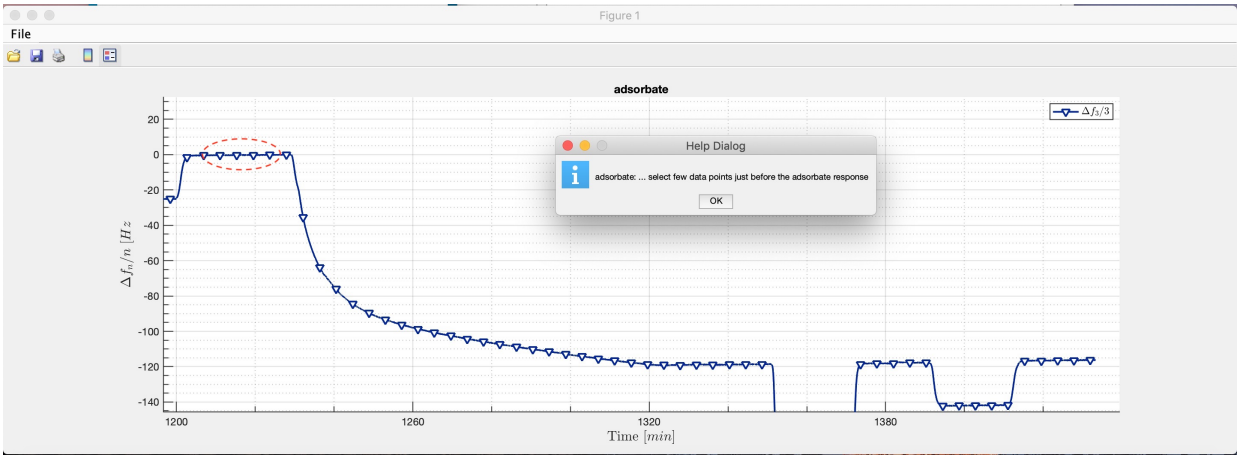

Figure A11: Selecting the baseline for the "adsorbate". After selecting the data points for "Solution #1 before adsorbate" and "Solution #2 before adsorbate", one will then be prompted to select data points that represent the baseline of the "adsorbate"; for the given sample data, these data points are indicated by the dashed red elipse. One needs to press the "Ok" button before being able to select the data points.

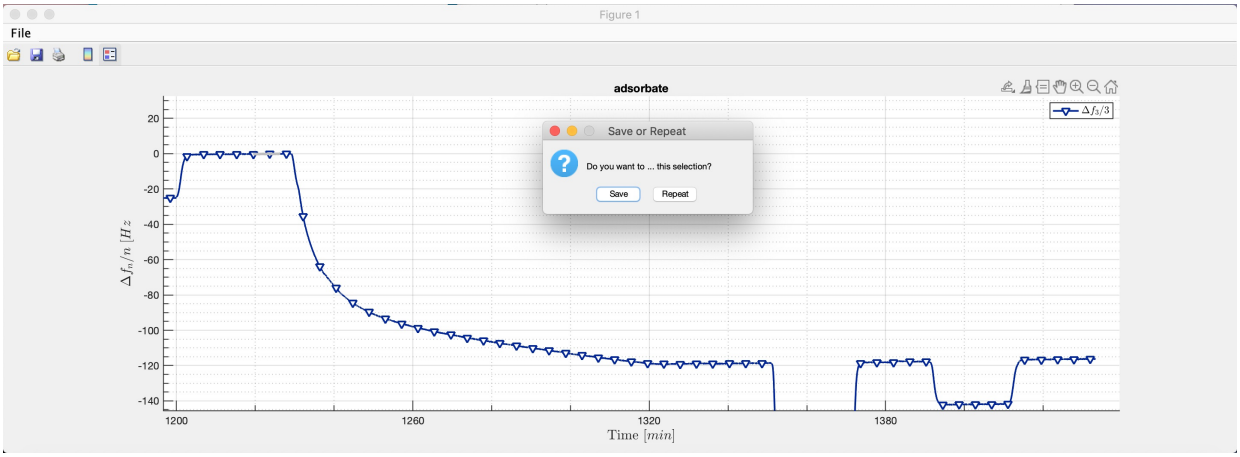

Figure A12: Selected data points confirmation. After selecting the data points, they be shown in gray. One can either use/save this selection or repeat it by clicking on either "Save" or "Repeat".

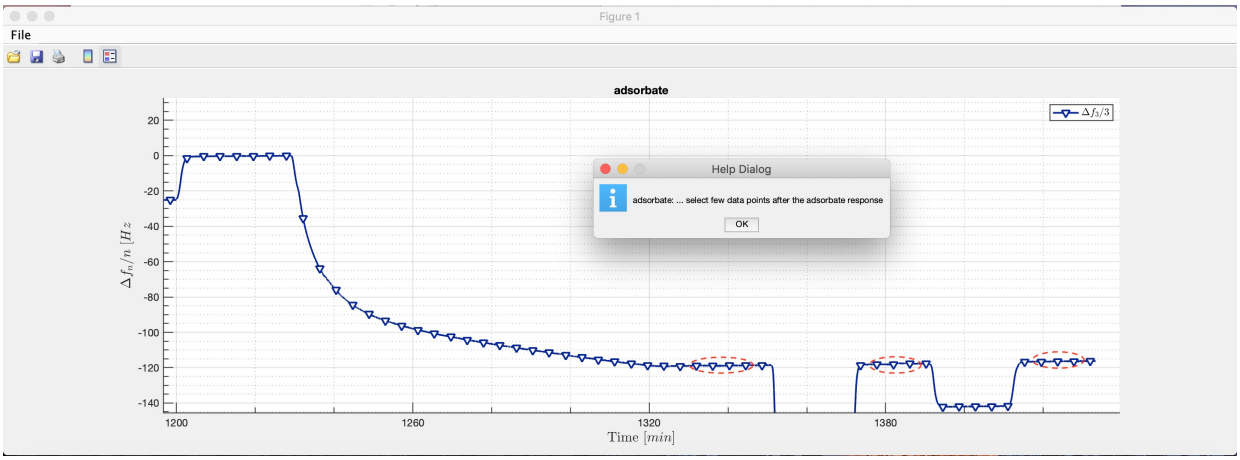

Figure A13: Selecting the response for for the "adsorbate". One will then be prompted to select data points that represent the response due to the "adsorbate"; for the given sample data, these data points are indicated by the dashed red elipses. One needs to press the "Ok" button before being able to select the data points.

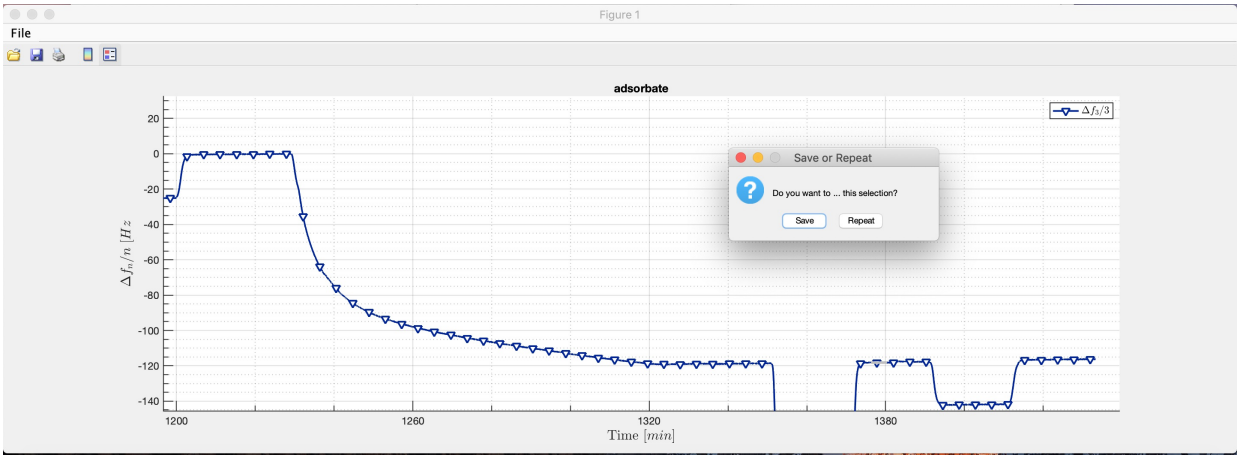

Figure A14: Selected data points confirmation. After selecting the data points, they be shown in gray. One can either use/save this selection or repeat it by clicking on either "Save" or "Repeat".