

Tutorial on how to run “impedimetric_analysis.py”

Prerequisites

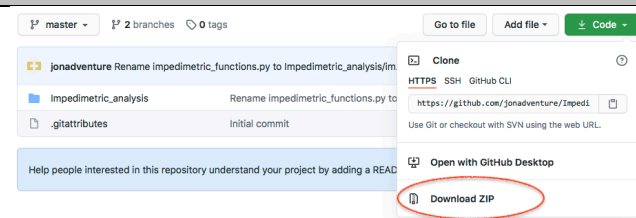
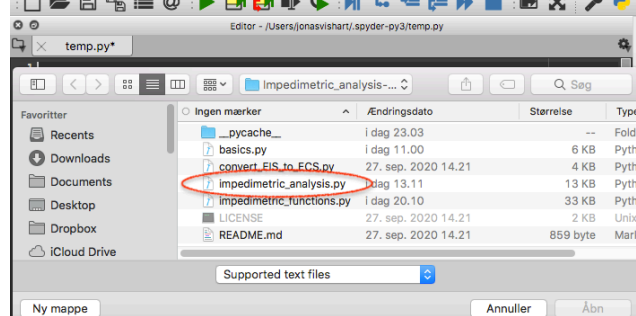
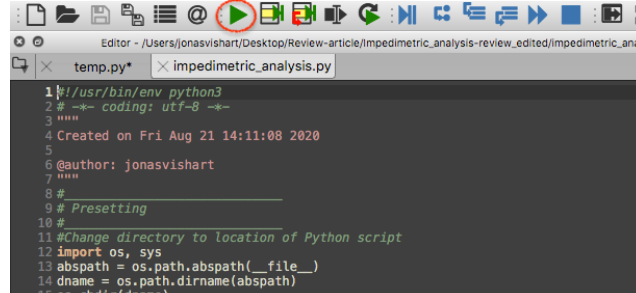
- Python 3.7.0 or a newer version
- Following packages: *Matplotlib, Numpy, Openpyxl, Os, Pandas, Pylab, Re, Scikit-learn, Scipy, Sys, Tkinter (tk)*.

It is highly recommended that programming beginners should use Anaconda¹, in which e.g. Spyder can be used to run Python. Anaconda is easy to install and include various packages and tools.

A package can be installed in Anaconda, follow this tutorial². If using Anaconda with Python 3.7.0 or a newer version, following packages are already installed: *Matplotlib, Numpy, Os, Pandas, Re, Scikit-learn Scipy* and *sys*.

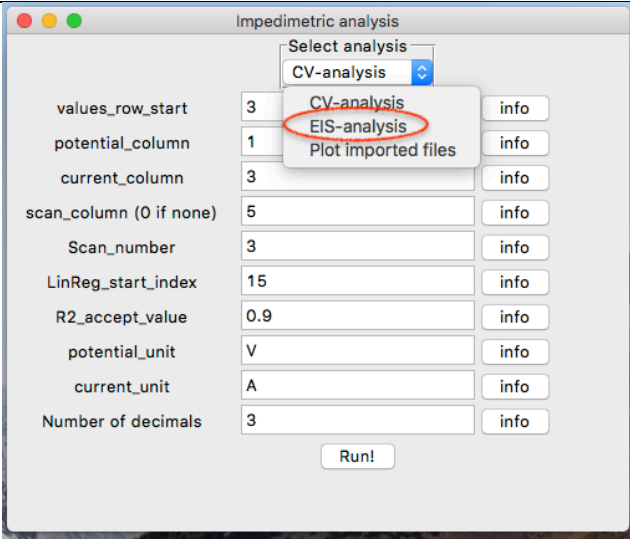
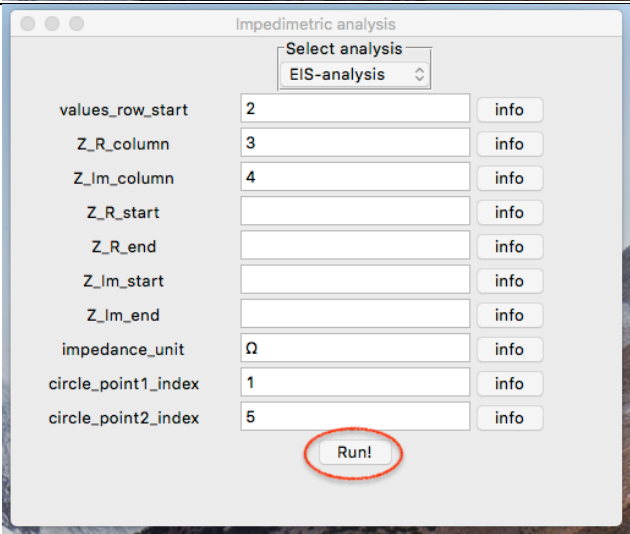
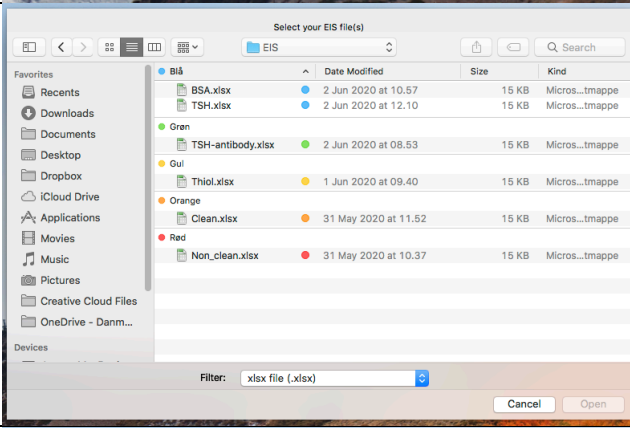
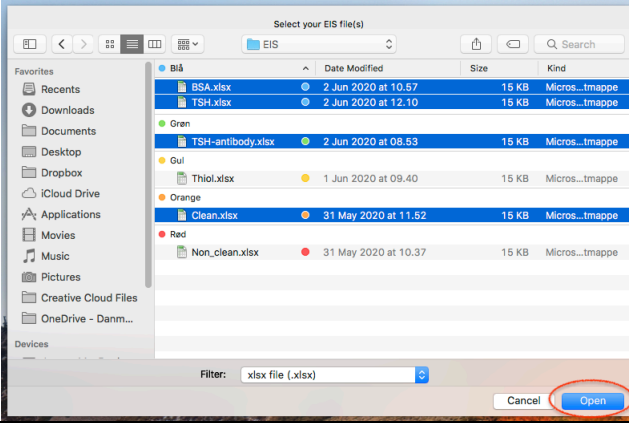
To install remaining packages, open an Anaconda prompt/terminal and type following:

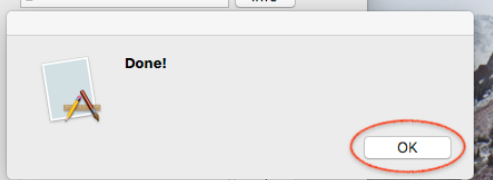
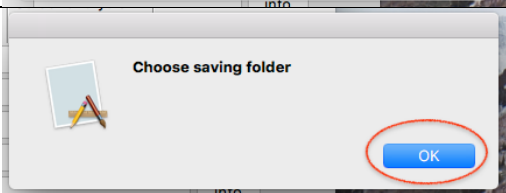
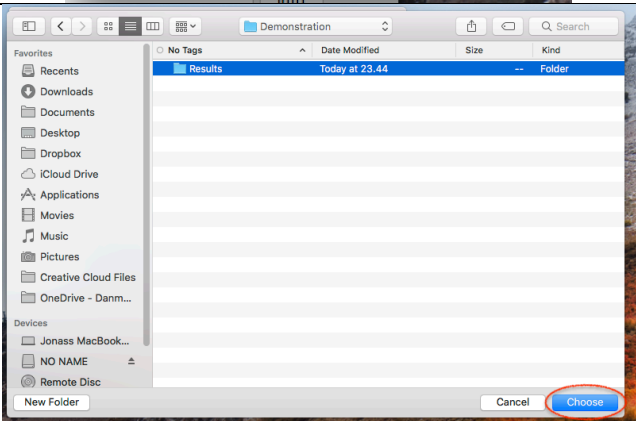
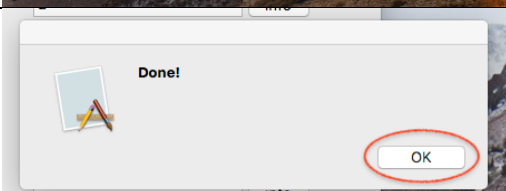
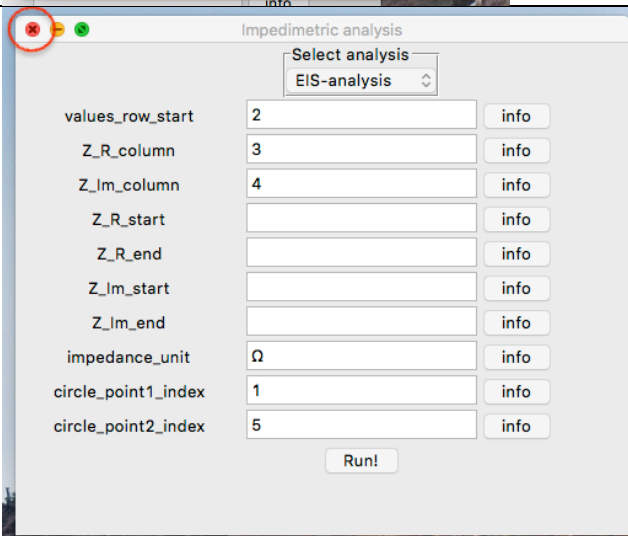
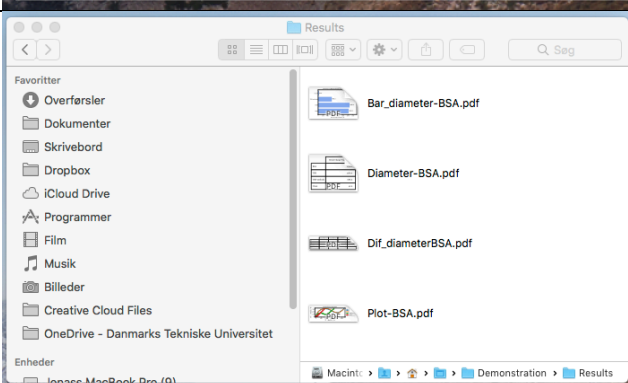
- `conda install openpyxl`
- `conda install pylab`
- `conda install tk`

How to run “impedimetric_analysis.py”		
Step no.	What to do	Image
1	<ul style="list-style-type: none"> • Open Github and access “Impedimetric_analysis” repository • Click “Code” and select “Download ZIP” 	
2	<ul style="list-style-type: none"> • Unzip the “ZIP” file and open “impedimetric_analysis.py” e.g. via Spyder 	
3	<ul style="list-style-type: none"> • Run the code 	

¹ <https://www.anaconda.com>

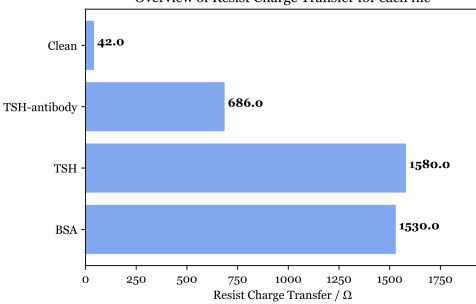
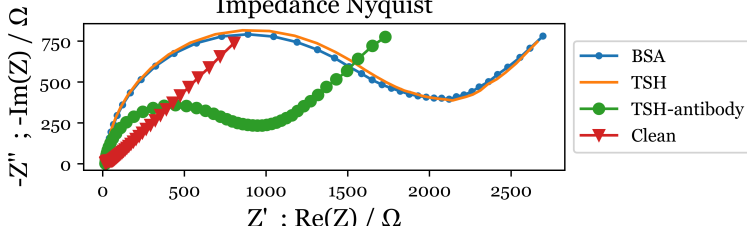
² <https://docs.anaconda.com/anaconda/user-guide/tasks/install-packages/>

4	<ul style="list-style-type: none"> A pop-up appears Select the analysis method to use <p>NOTE: For this tutorial, EIS-analysis is selected, but the procedure is the same for the other techniques.</p>	
5	<ul style="list-style-type: none"> Change the settings if relevant Once all settings are set, click “Run!” 	
6	<ul style="list-style-type: none"> A pop-up appears Select all the excel/csv files to be analyzed by this technique <p>Note, if EIS-analysis is chosen, choose EIS-measurement files only.</p>	
7	<ul style="list-style-type: none"> When the files are selected, click “Open” 	

8	<ul style="list-style-type: none"> Pop-up text “Done” appears Click “OK” 	
9	<ul style="list-style-type: none"> Pop-up text “Choose saving folder” appears Click “OK” 	
10	<ul style="list-style-type: none"> Pop-up appears Select the folder for which the output plots shall be saved Once selected, click “Choose” 	
11	<ul style="list-style-type: none"> Pop-up text “Done” appears Click “OK” 	
12	<ul style="list-style-type: none"> You can now close the initial pop-up by clicking the red cross in the upper left 	
13	<ul style="list-style-type: none"> The plots can be found in your selected folder 	

Comments on the different plots obtained from EIS-analysis

A total of four different plots are obtained in a successful EIS analysis.
See an example below.

Plot	Comment																									
<div>Overview of Resist Charge Transfer for each file</div> 	A bar chart of the estimated semicircle diameter for each of the selected files.																									
<table><tr><th colspan="2">Resist Charge Transfer / Ω</th></tr><tr><td>BSA</td><td>1530.0</td></tr><tr><td>TSH</td><td>1580.0</td></tr><tr><td>TSH-antibody</td><td>686.0</td></tr><tr><td>Clean</td><td>42.0</td></tr></table>	Resist Charge Transfer / Ω		BSA	1530.0	TSH	1580.0	TSH-antibody	686.0	Clean	42.0	A table of the estimated semicircle diameter for each of the selected files.															
Resist Charge Transfer / Ω																										
BSA	1530.0																									
TSH	1580.0																									
TSH-antibody	686.0																									
Clean	42.0																									
<table><tr><th></th><th>BSA Resist Charge Transfer: 1530.0 Ω</th><th>TSH Resist Charge Transfer: 1580.0 Ω</th><th>TSH-antibody Resist Charge Transfer: 686.0 Ω</th><th>Clean Resist Charge Transfer: 42.0 Ω</th></tr><tr><td>BSA Resist Charge Transfer: 1530.0 Ω</td><td>0.0</td><td>50.0</td><td>-844.0</td><td>-1488.0</td></tr><tr><td>TSH Resist Charge Transfer: 1580.0 Ω</td><td>-50.0</td><td>0.0</td><td>-894.0</td><td>-1538.0</td></tr><tr><td>TSH-antibody Resist Charge Transfer: 686.0 Ω</td><td>844.0</td><td>894.0</td><td>0.0</td><td>-644.0</td></tr><tr><td>Clean Resist Charge Transfer: 42.0 Ω</td><td>1488.0</td><td>1538.0</td><td>644.0</td><td>0.0</td></tr></table>		BSA Resist Charge Transfer: 1530.0 Ω	TSH Resist Charge Transfer: 1580.0 Ω	TSH-antibody Resist Charge Transfer: 686.0 Ω	Clean Resist Charge Transfer: 42.0 Ω	BSA Resist Charge Transfer: 1530.0 Ω	0.0	50.0	-844.0	-1488.0	TSH Resist Charge Transfer: 1580.0 Ω	-50.0	0.0	-894.0	-1538.0	TSH-antibody Resist Charge Transfer: 686.0 Ω	844.0	894.0	0.0	-644.0	Clean Resist Charge Transfer: 42.0 Ω	1488.0	1538.0	644.0	0.0	A table that compares the semicircle diameter for all the files and show the differences.
	BSA Resist Charge Transfer: 1530.0 Ω	TSH Resist Charge Transfer: 1580.0 Ω	TSH-antibody Resist Charge Transfer: 686.0 Ω	Clean Resist Charge Transfer: 42.0 Ω																						
BSA Resist Charge Transfer: 1530.0 Ω	0.0	50.0	-844.0	-1488.0																						
TSH Resist Charge Transfer: 1580.0 Ω	-50.0	0.0	-894.0	-1538.0																						
TSH-antibody Resist Charge Transfer: 686.0 Ω	844.0	894.0	0.0	-644.0																						
Clean Resist Charge Transfer: 42.0 Ω	1488.0	1538.0	644.0	0.0																						
<div>Impedance Nyquist</div> 	A plot of all the selected files.																									