Electronic Supplementary Material (ESI) for Journal of Analytical Atomic Spectrometry.
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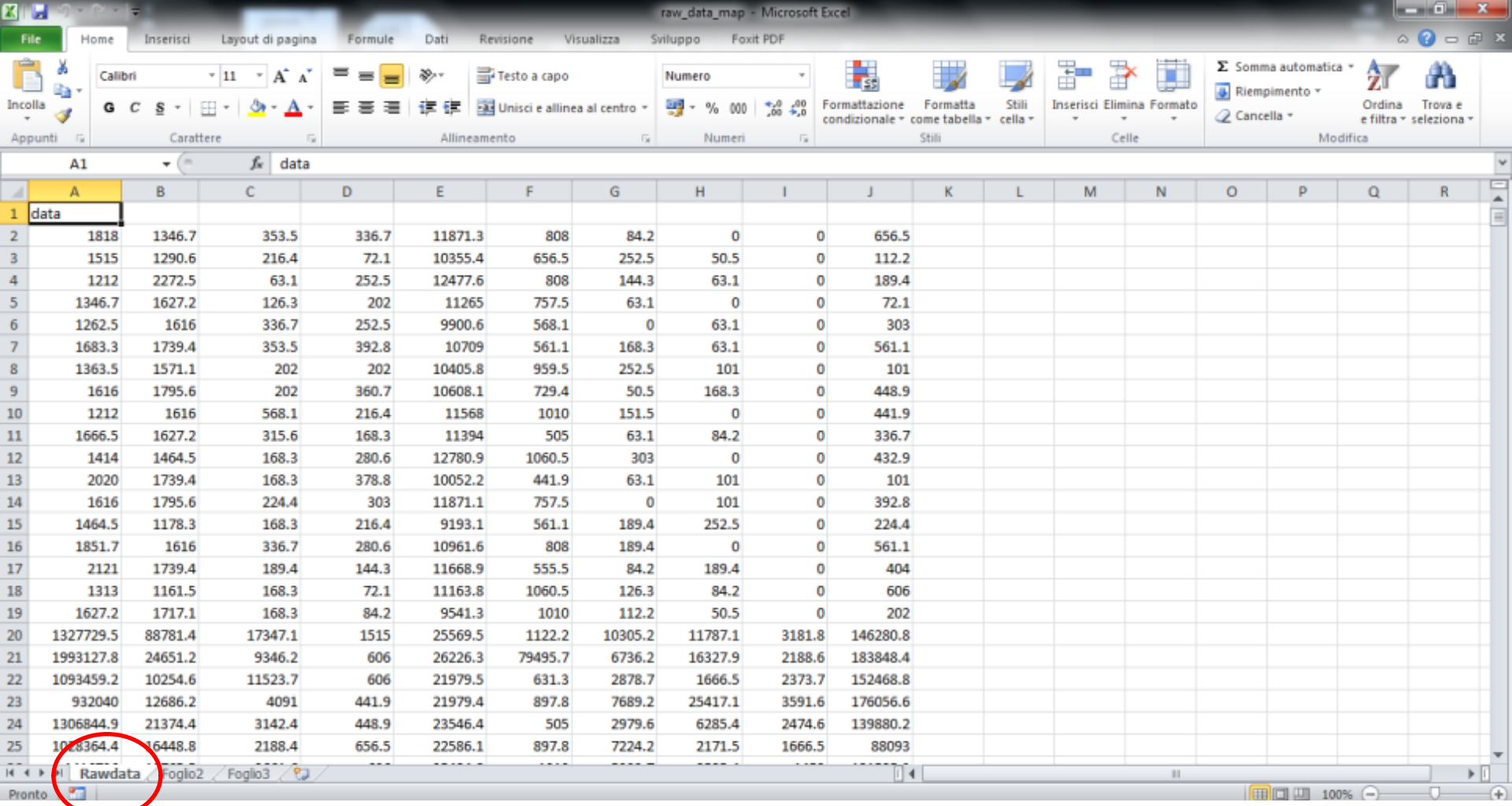
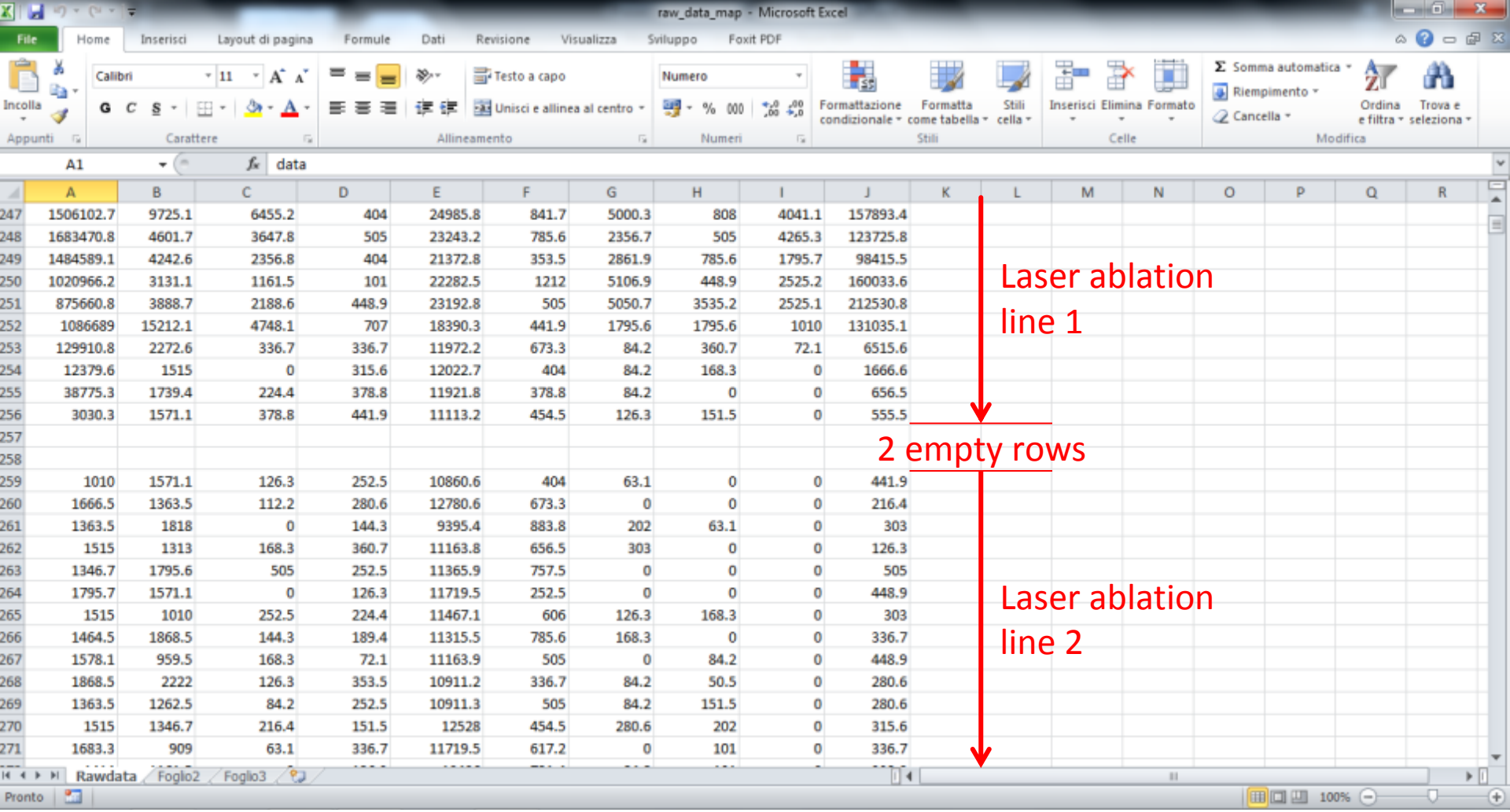
MapIT! guide

- Raw data pre-treatment (slides 1-4)
- Script and MapIT! interface guide (slides 5-25)



	A	B	C	D	E	F	G	H	I	J
1	data									
2	1818	1346.7	353.5	336.7	11871.3	808	84.2	0	0	656.5
3	1515	1290.6	216.4	72.1	10355.4	656.5	252.5	50.5	0	112.2
4	1212	2272.5	63.1	252.5	12477.6	808	144.3	63.1	0	189.4
5	1346.7	1627.2	126.3	202	11265	757.5	63.1	0	0	72.1
6	1262.5	1616	336.7	252.5	9900.6	568.1	0	63.1	0	303
7	1683.3	1739.4	353.5	392.8	10709	561.1	168.3	63.1	0	561.1
8	1363.5	1571.1	202	202	10405.8	959.5	252.5	101	0	101
9	1616	1795.6	202	360.7	10608.1	729.4	50.5	168.3	0	448.9
10	1212	1616	568.1	216.4	11568	1010	151.5	0	0	441.9
11	1666.5	1627.2	315.6	168.3	11394	505	63.1	84.2	0	336.7
12	1414	1464.5	168.3	280.6	12780.9	1060.5	303	0	0	432.9
13	2020	1739.4	168.3	378.8	10052.2	441.9	63.1	101	0	101
14	1616	1795.6	224.4	303	11871.1	757.5	0	101	0	392.8
15	1464.5	1178.3	168.3	216.4	9193.1	561.1	189.4	252.5	0	224.4
16	1851.7	1616	336.7	280.6	10961.6	808	189.4	0	0	561.1
17	2121	1739.4	189.4	144.3	11668.9	555.5	84.2	189.4	0	404
18	1313	1161.5	168.3	72.1	11163.8	1060.5	126.3	84.2	0	606
19	1627.2	1717.1	168.3	84.2	9541.3	1010	112.2	50.5	0	202
20	1327729.5	88781.4	17347.1	1515	25569.5	1122.2	10305.2	11787.1	3181.8	146280.8
21	1993127.8	24651.2	9346.2	606	26226.3	79495.7	6736.2	16327.9	2188.6	183848.4
22	1093459.2	10254.6	11523.7	606	21979.5	631.3	2878.7	1666.5	2373.7	152468.8
23	932040	12686.2	4091	441.9	21979.4	897.8	7689.2	25417.1	3591.6	176056.6
24	1306844.9	21374.4	3142.4	448.9	23546.4	505	2979.6	6285.4	2474.6	139880.2
25	1028364.4	16448.8	2188.4	656.5	22586.1	897.8	7224.2	2171.5	1666.5	88093

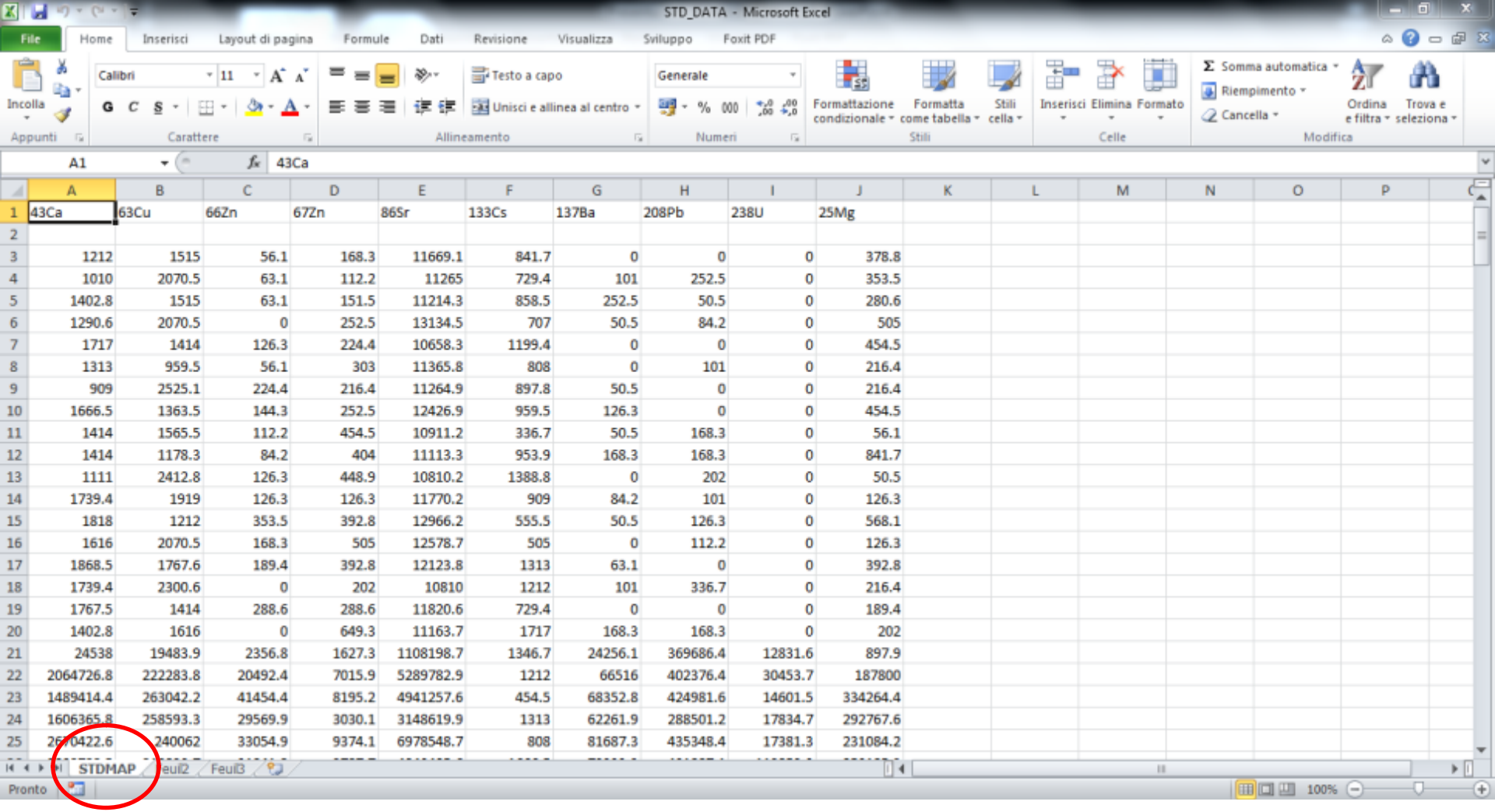
The whole dataset must be copied in a single Excel spreadsheet.
The first row must be a non-numerical string. Type a random word (‘data’ in this case), or copy the name of your elements.
The data sheet must be renamed as ‘**Rawdata**’.



	A	B	C	D	E	F	G	H	I	J
247	1506102.7	9725.1	6455.2	404	24985.8	841.7	5000.3	808	4041.1	157893.4
248	1683470.8	4601.7	3647.8	505	23243.2	785.6	2356.7	505	4265.3	123725.8
249	1484589.1	4242.6	2356.8	404	21372.8	353.5	2861.9	785.6	1795.7	98415.5
250	1020966.2	3131.1	1161.5	101	22282.5	1212	5106.9	448.9	2525.2	160033.6
251	875660.8	3888.7	2188.6	448.9	23192.8	505	5050.7	3535.2	2525.1	212530.8
252	1086689	15212.1	4748.1	707	18390.3	441.9	1795.6	1795.6	1010	131035.1
253	129910.8	2272.6	336.7	336.7	11972.2	673.3	84.2	360.7	72.1	6515.6
254	12379.6	1515	0	315.6	12022.7	404	84.2	168.3	0	1666.6
255	38775.3	1739.4	224.4	378.8	11921.8	378.8	84.2	0	0	656.5
256	3030.3	1571.1	378.8	441.9	11113.2	454.5	126.3	151.5	0	555.5
257										
258										
259	1010	1571.1	126.3	252.5	10860.6	404	63.1	0	0	441.9
260	1666.5	1363.5	112.2	280.6	12780.6	673.3	0	0	0	216.4
261	1363.5	1818	0	144.3	9395.4	883.8	202	63.1	0	303
262	1515	1313	168.3	360.7	11163.8	656.5	303	0	0	126.3
263	1346.7	1795.6	505	252.5	11365.9	757.5	0	0	0	505
264	1795.7	1571.1	0	126.3	11719.5	252.5	0	0	0	448.9
265	1515	1010	252.5	224.4	11467.1	606	126.3	168.3	0	303
266	1464.5	1868.5	144.3	189.4	11315.5	785.6	168.3	0	0	336.7
267	1578.1	959.5	168.3	72.1	11163.9	505	0	84.2	0	448.9
268	1868.5	2222	126.3	353.5	10911.2	336.7	84.2	50.5	0	280.6
269	1363.5	1262.5	84.2	252.5	10911.3	505	84.2	151.5	0	280.6
270	1515	1346.7	216.4	151.5	12528	454.5	280.6	202	0	315.6
271	1683.3	909	63.1	336.7	11719.5	617.2	0	101	0	336.7

Each data line must be separated from the next one by two empty rows.

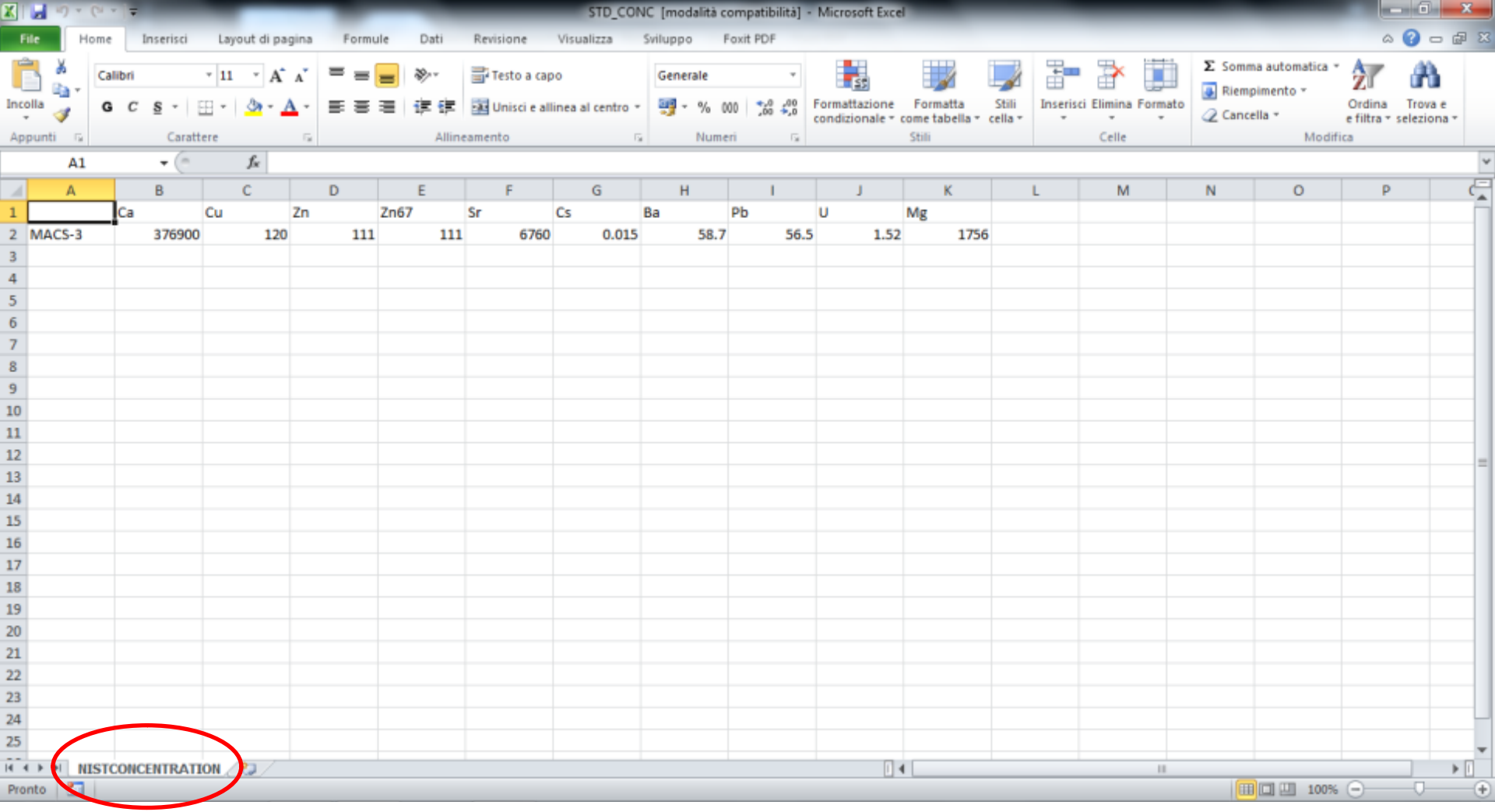
RAW DATA - MAP



43Ca	63Cu	66Zn	67Zn	86Sr	133Cs	137Ba	208Pb	238U	25Mg
1212	1515	56.1	168.3	11669.1	841.7	0	0	0	378.8
1010	2070.5	63.1	112.2	11265	729.4	101	252.5	0	353.5
1402.8	1515	63.1	151.5	11214.3	858.5	252.5	50.5	0	280.6
1290.6	2070.5	0	252.5	13134.5	707	50.5	84.2	0	505
1717	1414	126.3	224.4	10658.3	1199.4	0	0	0	454.5
1313	959.5	56.1	303	11365.8	808	0	101	0	216.4
909	2525.1	224.4	216.4	11264.9	897.8	50.5	0	0	216.4
1666.5	1363.5	144.3	252.5	12426.9	959.5	126.3	0	0	454.5
1414	1565.5	112.2	454.5	10911.2	336.7	50.5	168.3	0	56.1
1414	1178.3	84.2	404	11113.3	953.9	168.3	168.3	0	841.7
1111	2412.8	126.3	448.9	10810.2	1388.8	0	202	0	50.5
1739.4	1919	126.3	126.3	11770.2	909	84.2	101	0	126.3
1818	1212	353.5	392.8	12966.2	555.5	50.5	126.3	0	568.1
1616	2070.5	168.3	505	12578.7	505	0	112.2	0	126.3
1868.5	1767.6	189.4	392.8	12123.8	1313	63.1	0	0	392.8
1739.4	2300.6	0	202	10810	1212	101	336.7	0	216.4
1767.5	1414	288.6	288.6	11820.6	729.4	0	0	0	189.4
1402.8	1616	0	649.3	11163.7	1717	168.3	168.3	0	202
24538	19483.9	2356.8	1627.3	1108198.7	1346.7	24256.1	369686.4	12831.6	897.9
2064726.8	222283.8	20492.4	7015.9	5289782.9	1212	66516	402376.4	30453.7	187800
1489414.4	263042.2	41454.4	8195.2	4941257.6	454.5	68352.8	424981.6	14601.5	334264.4
1606365.8	258593.3	29569.9	3030.1	3148619.9	1313	62261.9	288501.2	17834.7	292767.6
2670422.6	240062	33054.9	9374.1	6978548.7	808	81687.3	435348.4	17381.3	231084.2

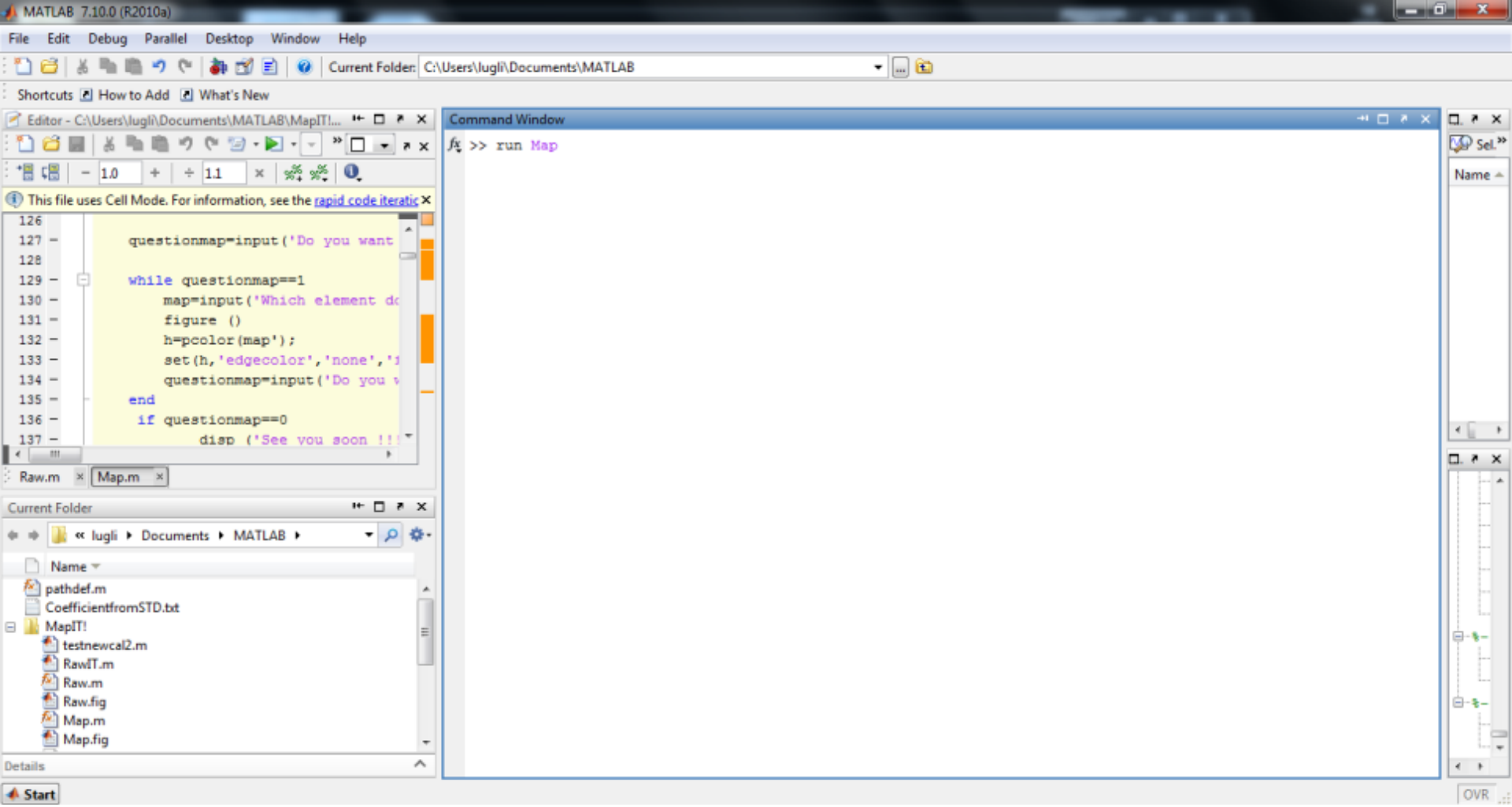
The first row must contain element names.
The second row must be empty.
From the third row, you can paste your data.
The data sheet must be renamed as '**STDMAP**'.

RAW DATA – REFERENCE MATERIAL FILE



The first row must contain element names. Leave cell A1 empty.
The second row must contain the element concentrations in ppm.
Within cell A2, insert the name of the standard reference material.
The data sheet must be renamed as '**NISTCONCENTRATION**'.

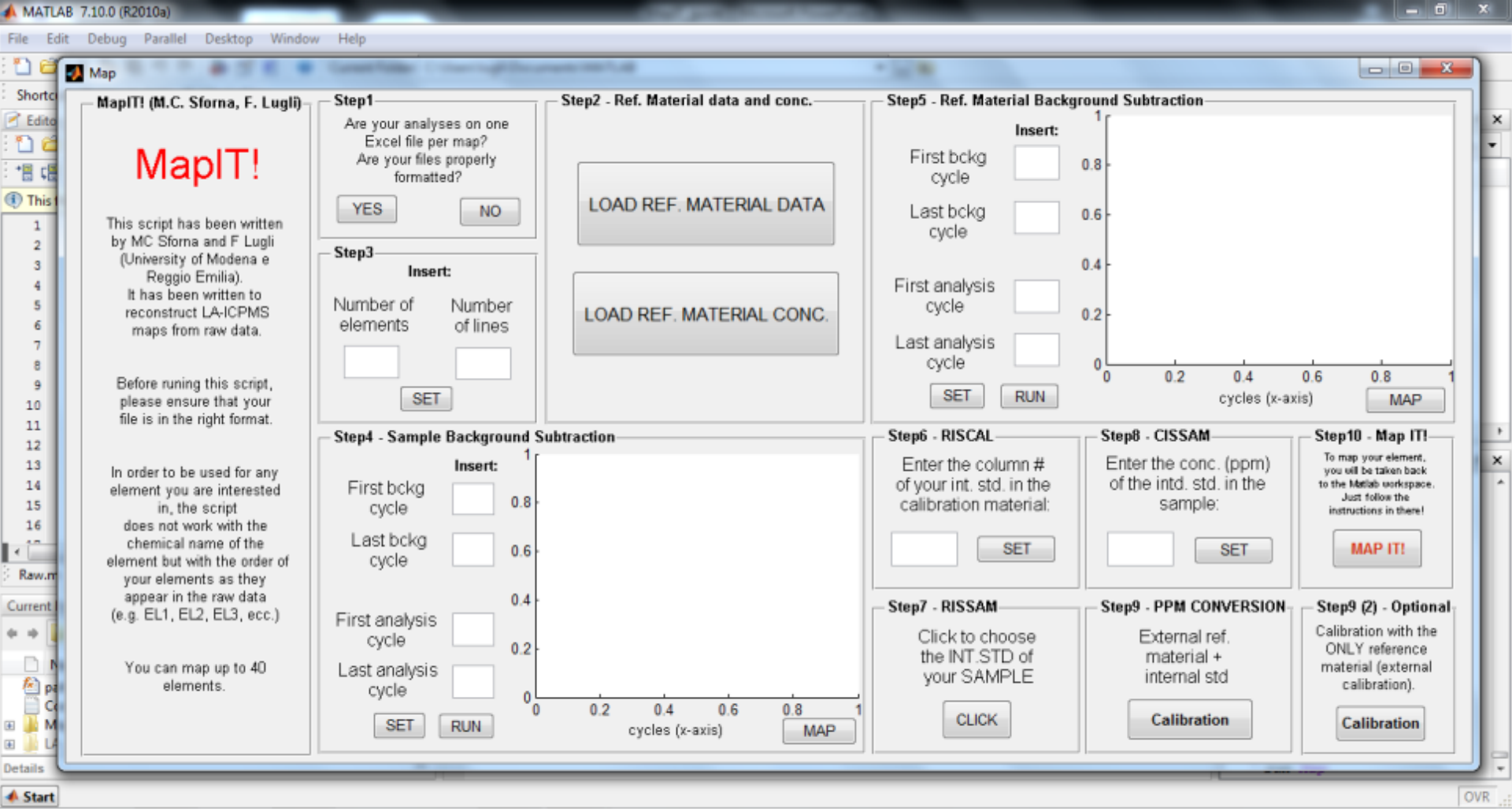
REFERENCE MATERIAL CONCENTRATION FILE



To run the MapIT script, the two files (Mapit.m and Mapit.fig) must be in one of your MATLAB paths.

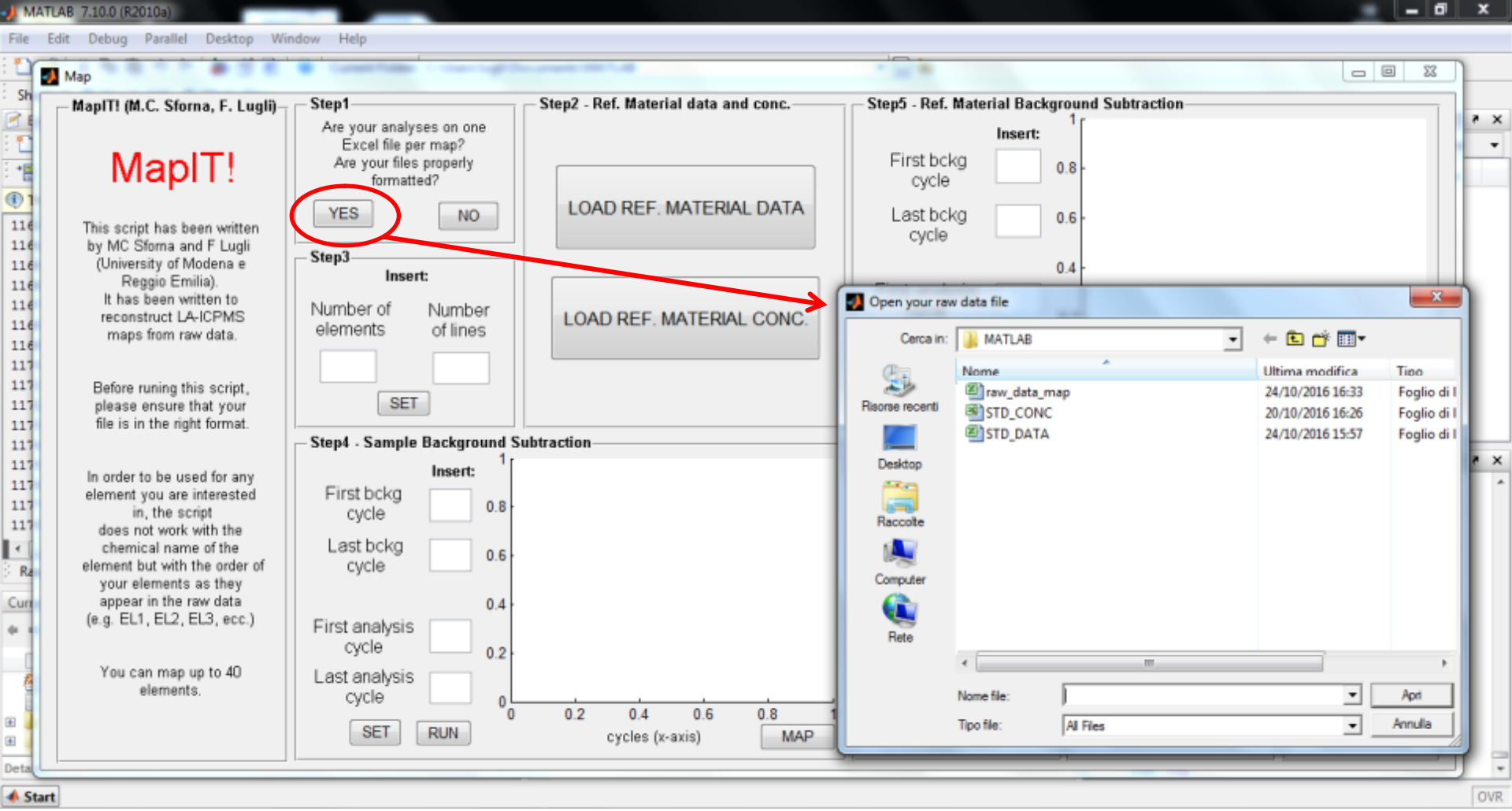
Type '**run Mapit**' in the workspace and enter (keyboard) to open the MapIT interface.

MapIT! - RUN



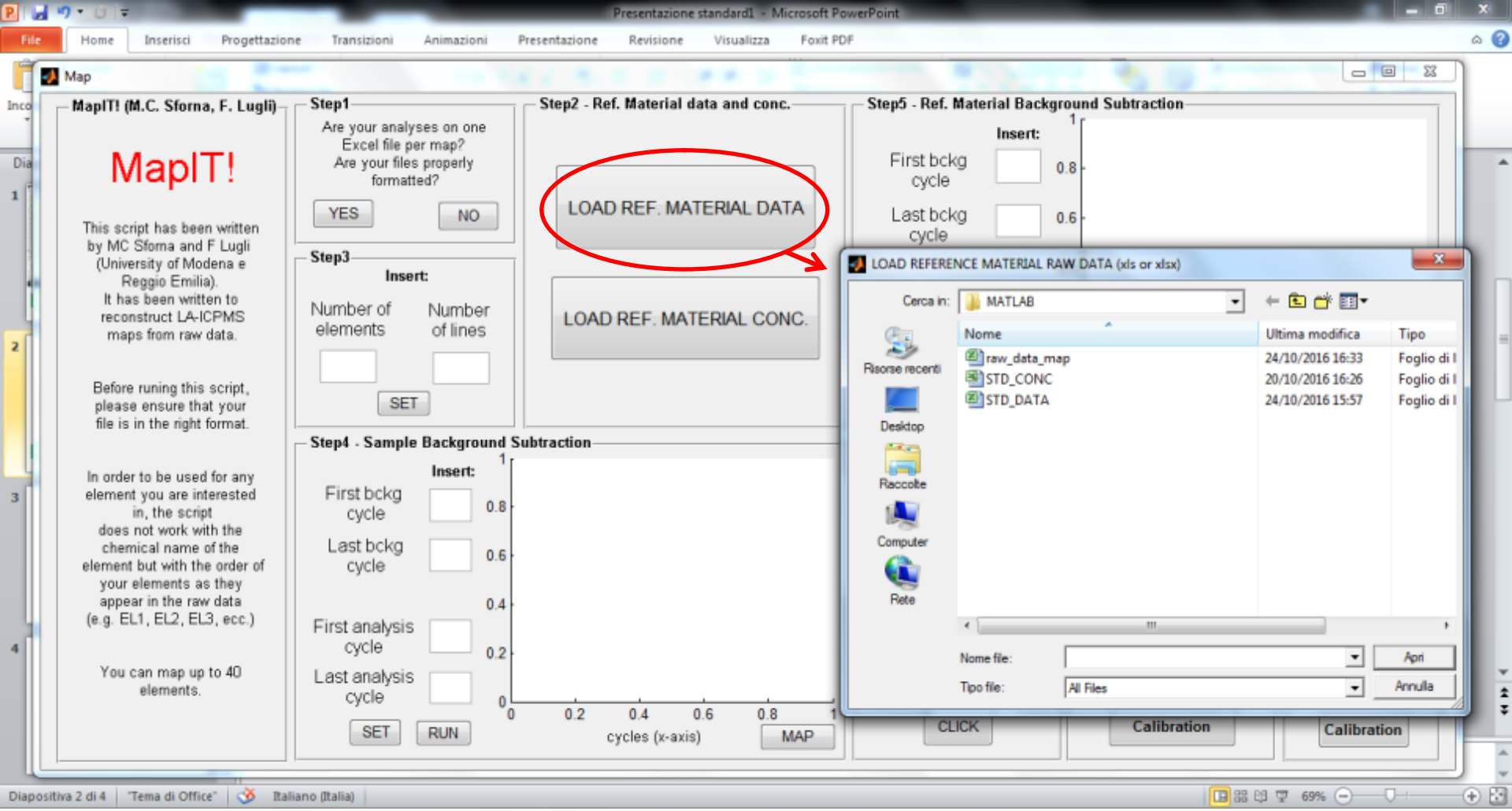
MapIT! brings you to a step by step map building.
Simply follow the step order to avoid possible issues during map building.

MapIT! - INTERFACE



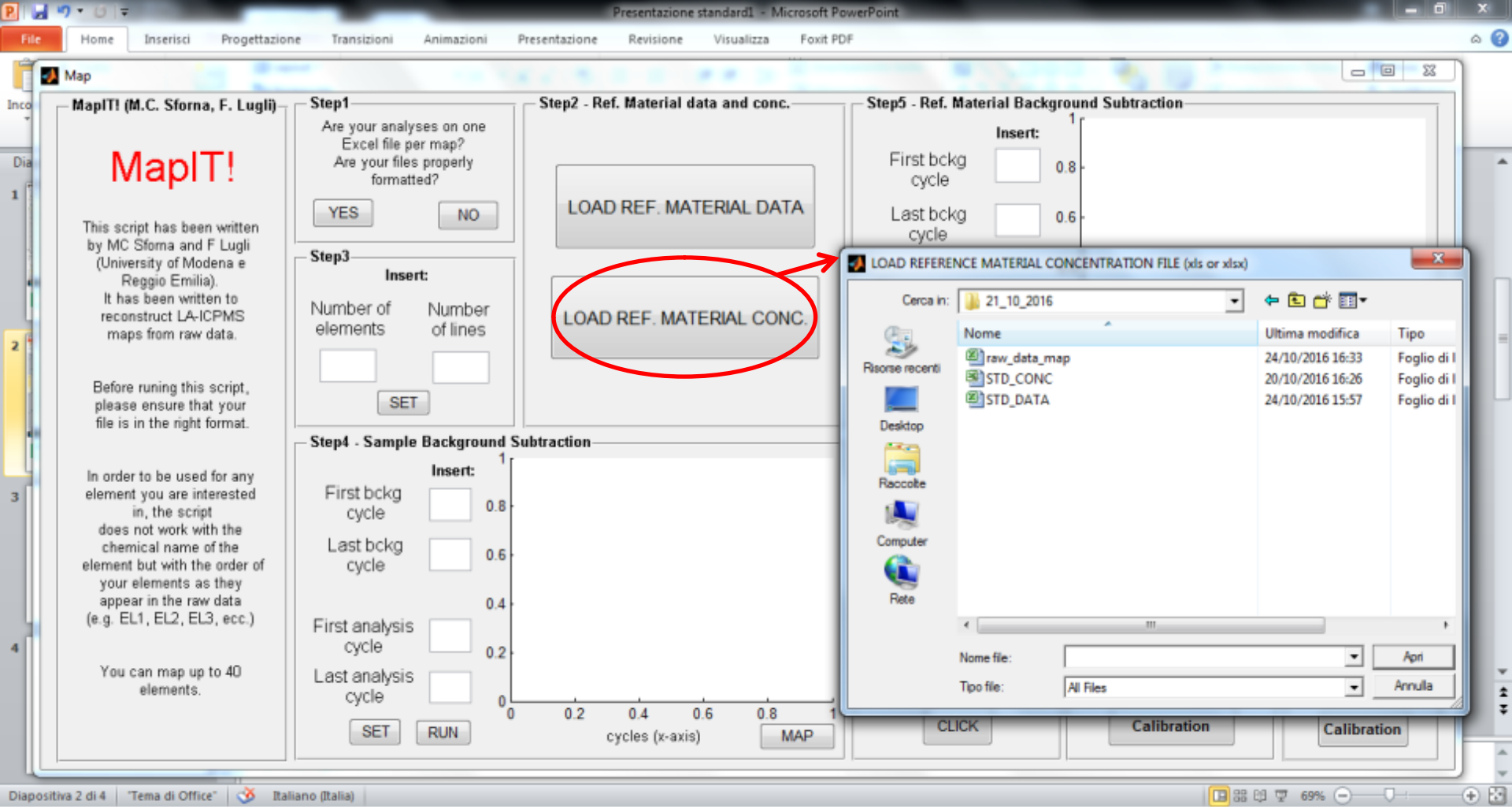
By clicking ‘YES’, you will start the script run.
A window will open asking to load the raw data file for the map.
By clicking ‘NO’, you will end the script.

STEP1



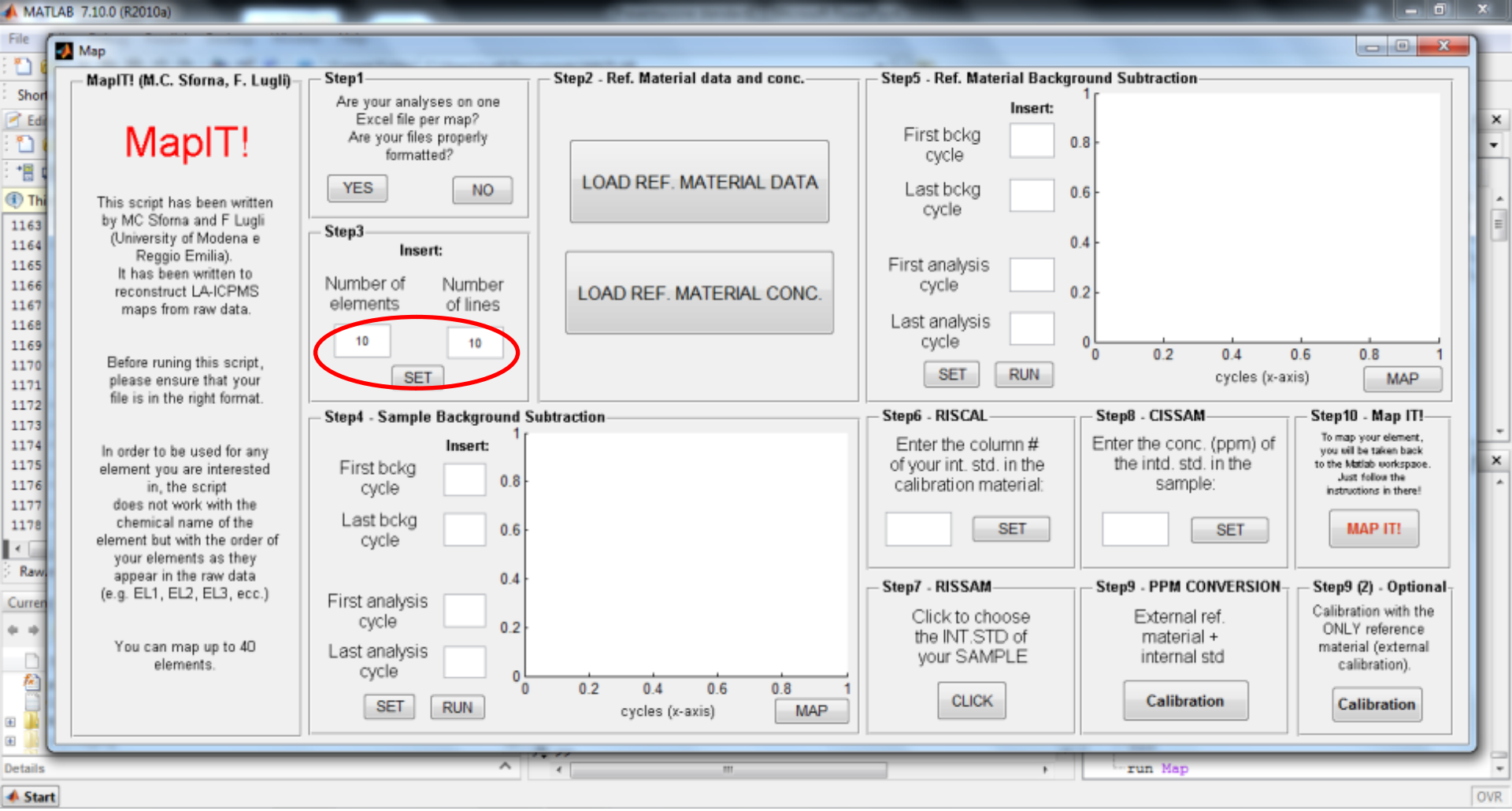
By clicking ‘LOAD.REF. MATERIAL DATA’, a window will appear asking to load the raw data of your reference material.

STEP2



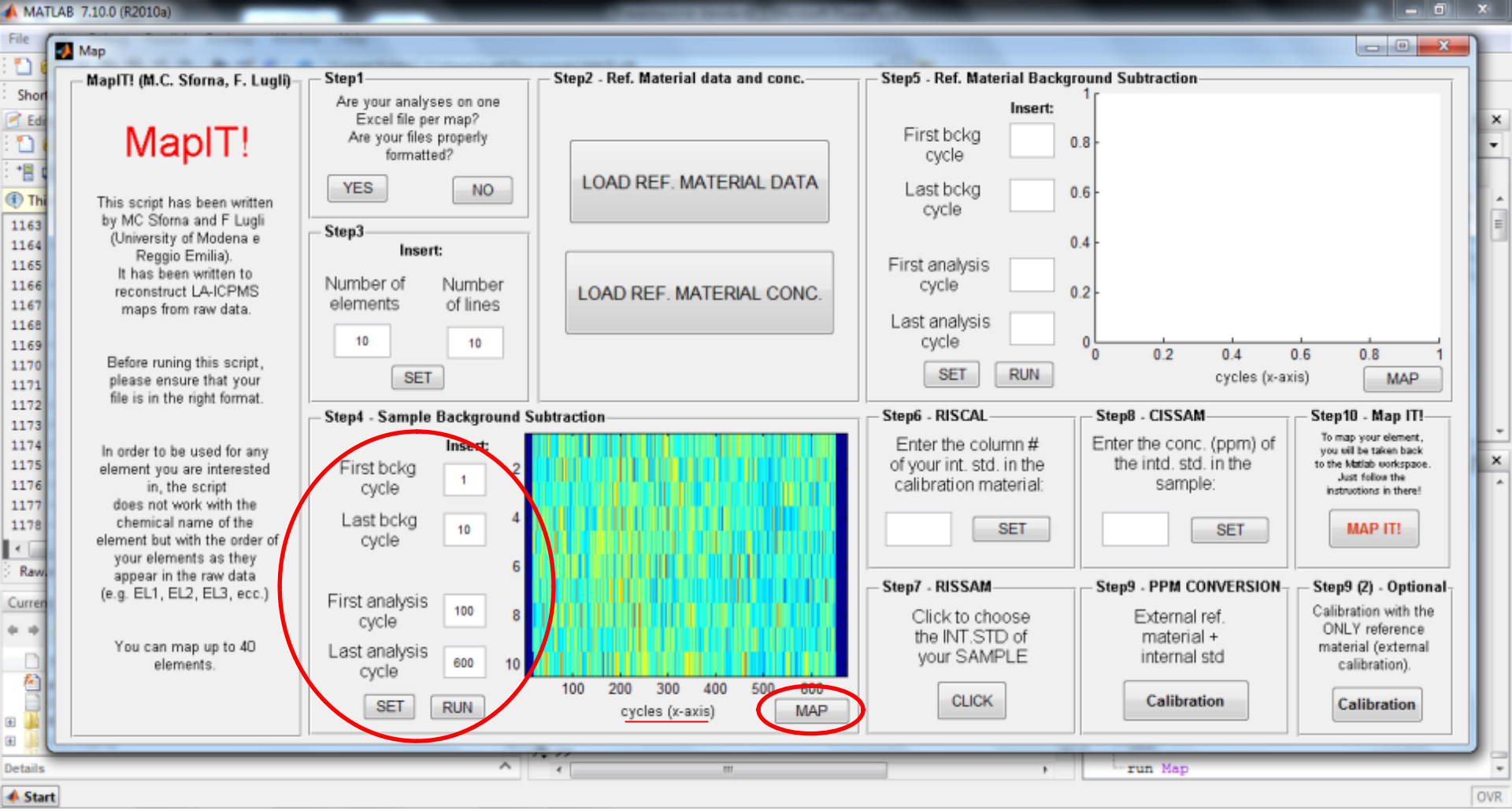
By clicking ‘LOAD.REF. MATERIAL CONC.’, a window will appear asking to load the file with the elemental concentrations of the reference material.

STEP2



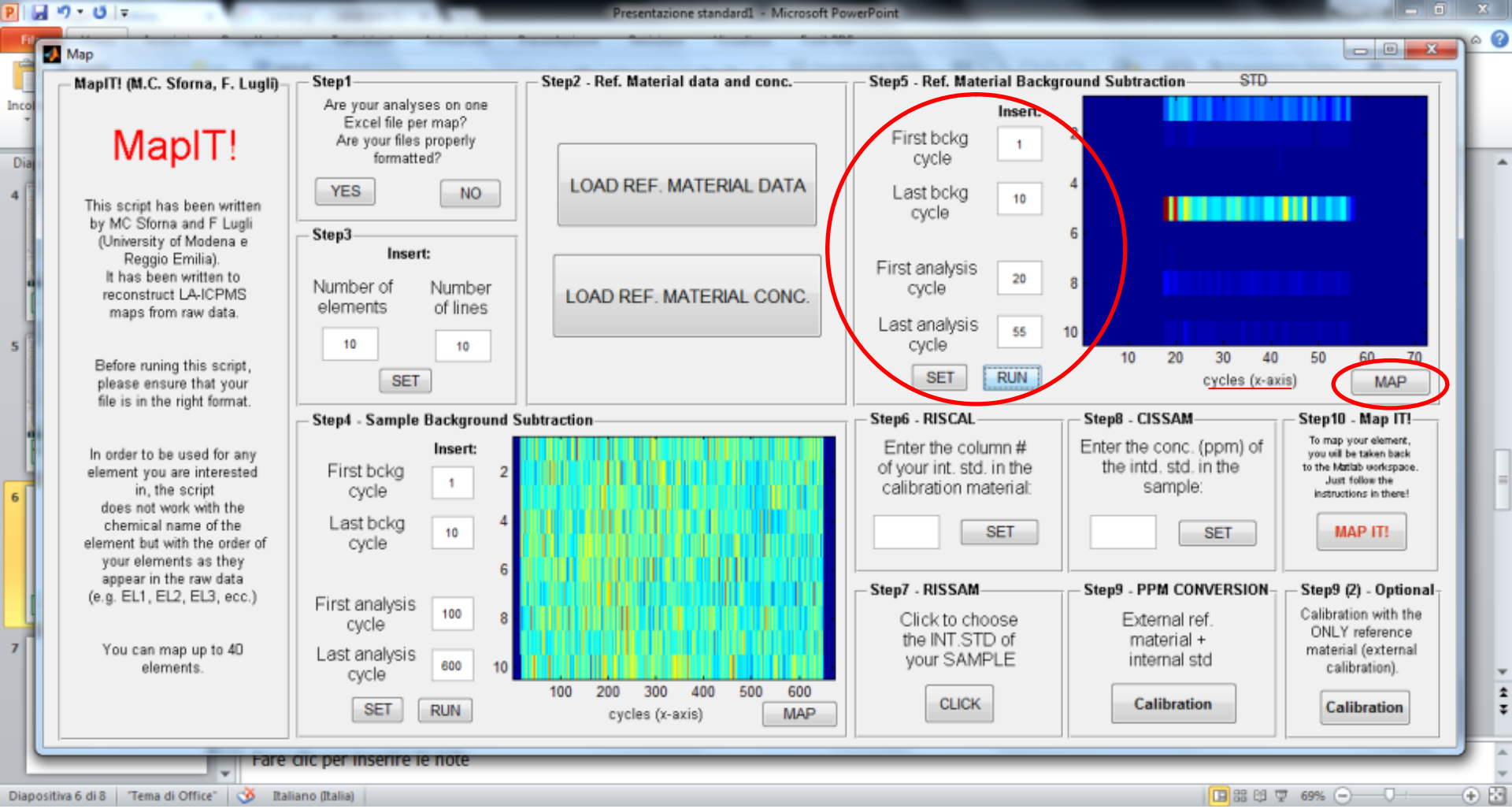
Enter the number of analyzed elements and the number of lines of your map.
In this example, we analyzed 10 elements (^{43}Ca, ^{63}Cu, ^{66}Zn, ^{67}Zn, ^{86}Sr, ^{133}Cs, ^{137}Ba, ^{208}Pb, ^{238}U, ^{25}Mg) making a 10 line map.

STEP3



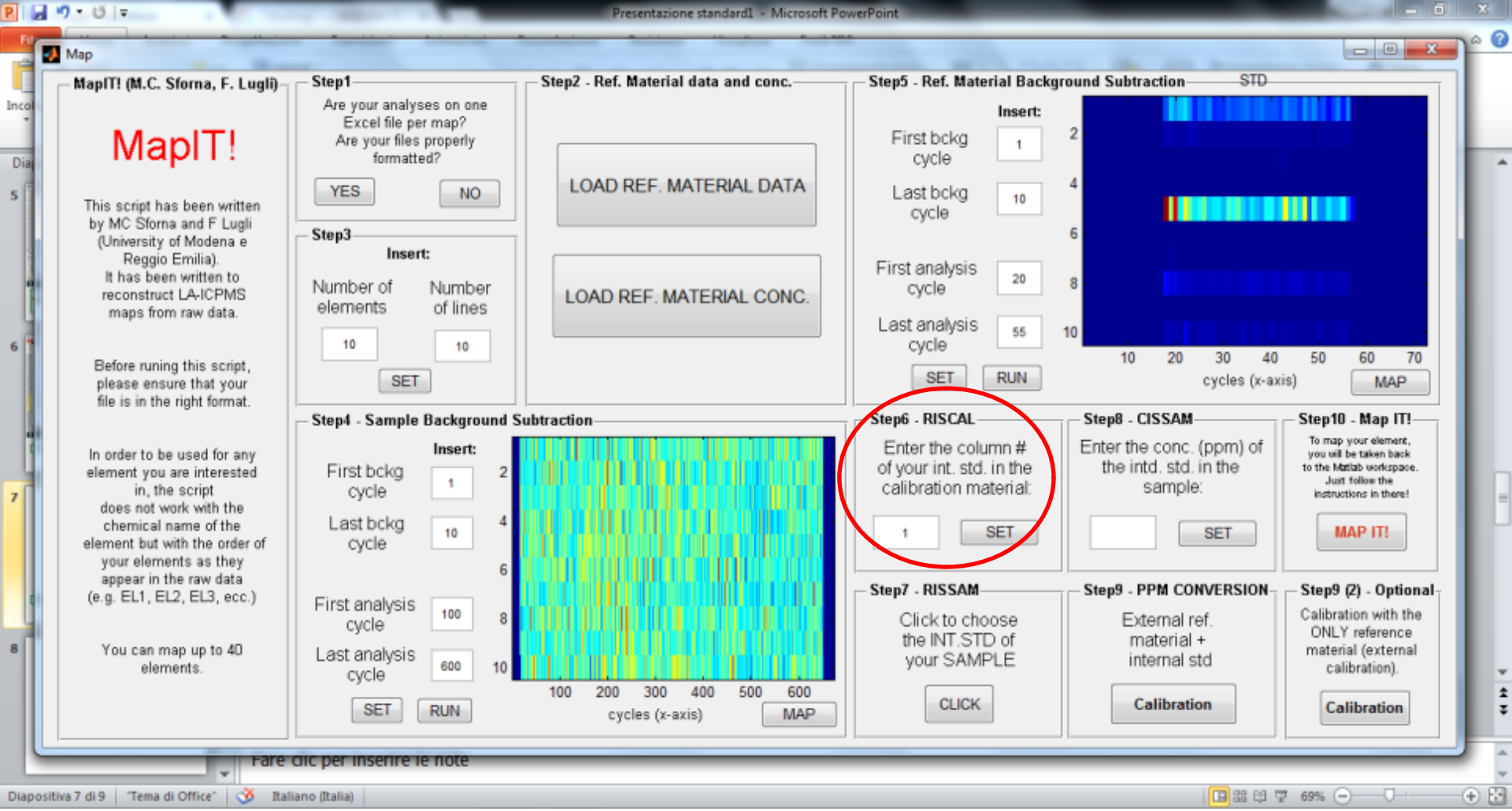
By clicking ‘MAP’, a raw map of the first element of your analysis set appears, helping you to choose the parameters for background subtraction. Then, you can fill the empty fields on the left with the proper cycle number (x-axis) to select the background area and the analysis area. **Do not forget to click ‘SET’ and ‘RUN’.**

STEP4



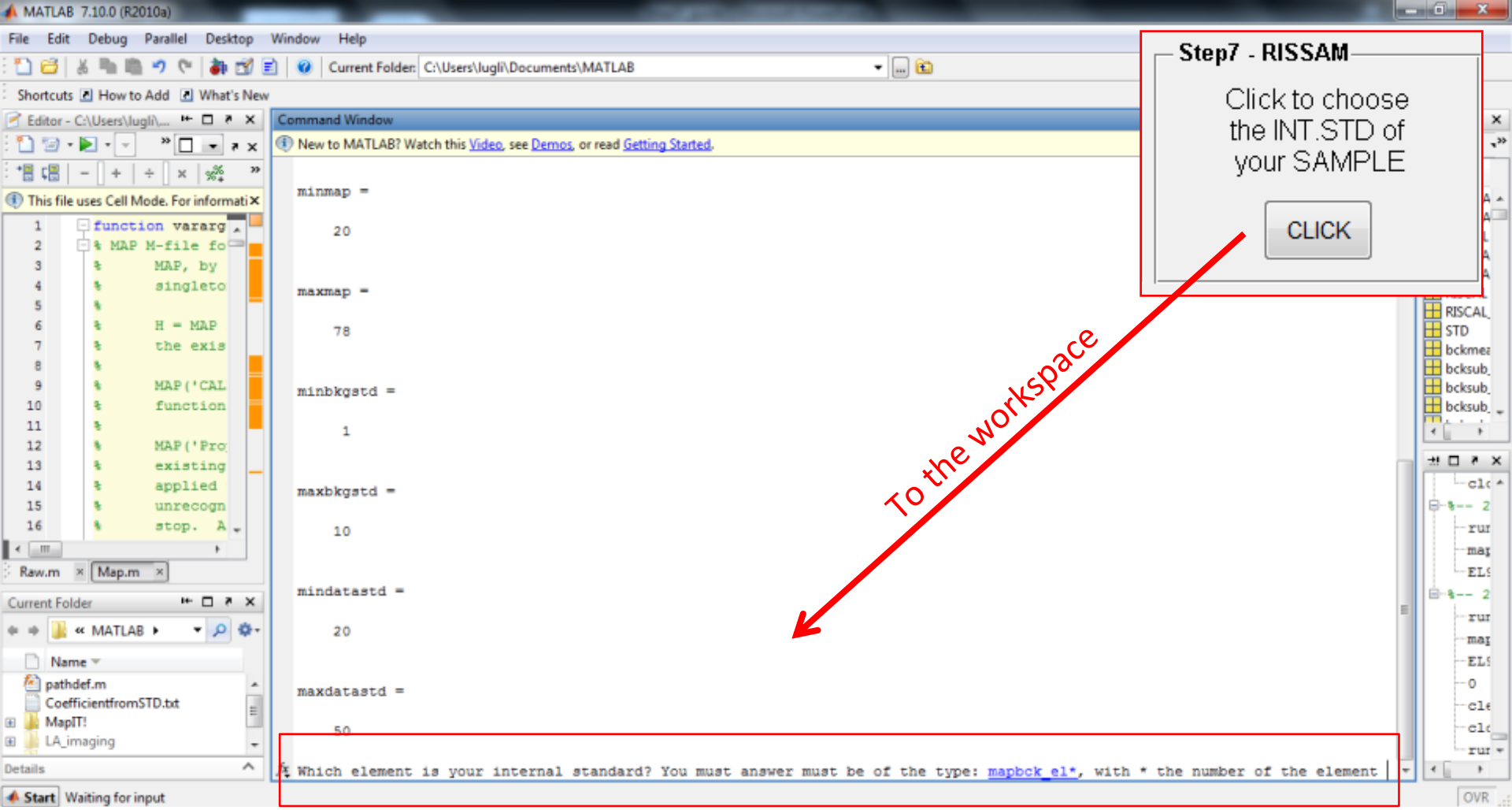
By clicking ‘MAP’, a raw map of the first element of your ref. material analysis appears, helping you to choose the parameters for background subtraction. Then, you can fill the empty fields on the left with the proper cycle number (x-axis) to select the background area and the analysis area. **Do not forget to click ‘SET’ and ‘RUN’.**

STEP5



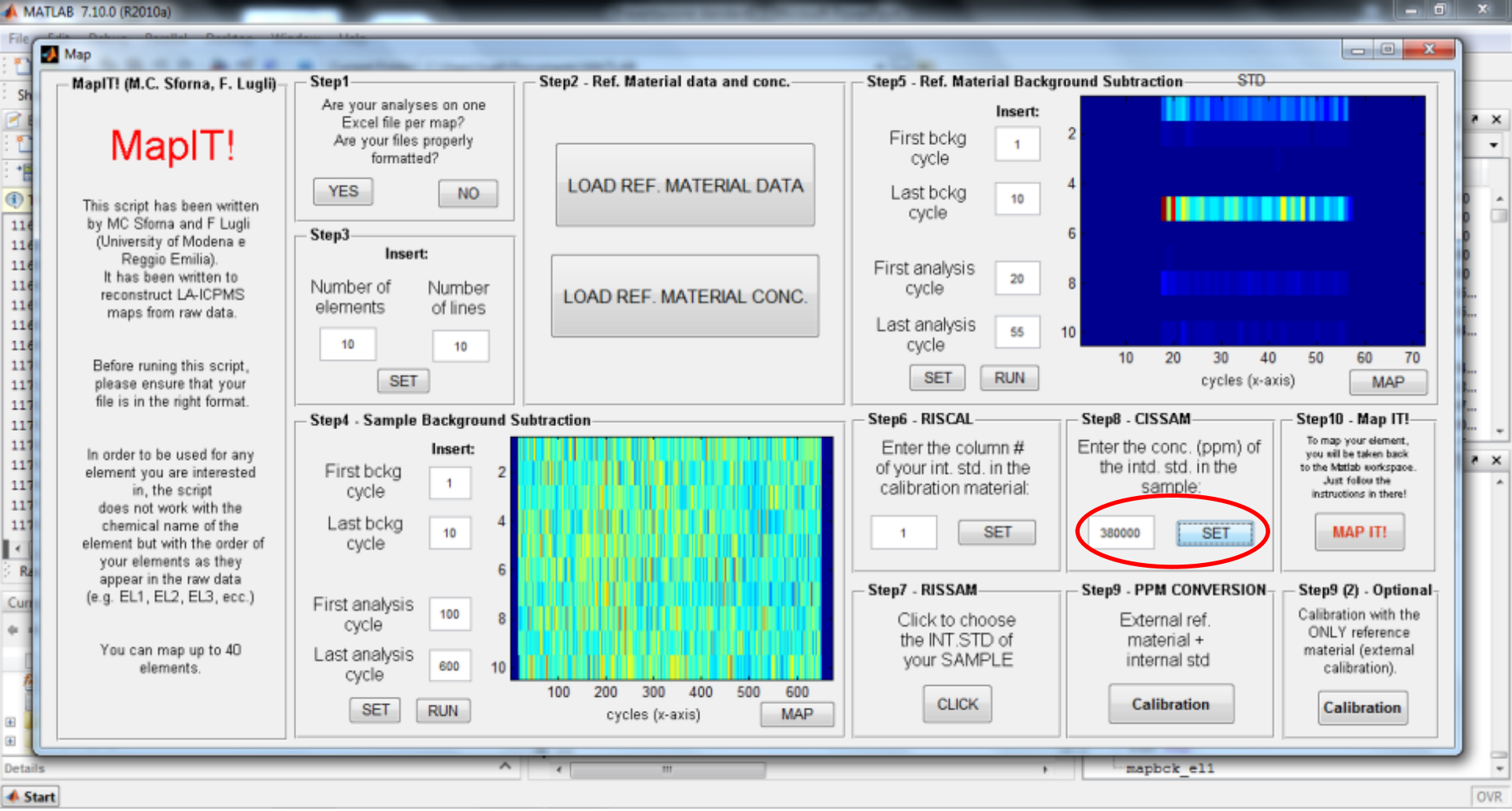
Enter the column number of the internal standard in the reference material.
In this example, we choose Ca as internal standard which is the first element analyzed, appearing in the first column of our raw data. Therefore we enter '1'.

STEP6



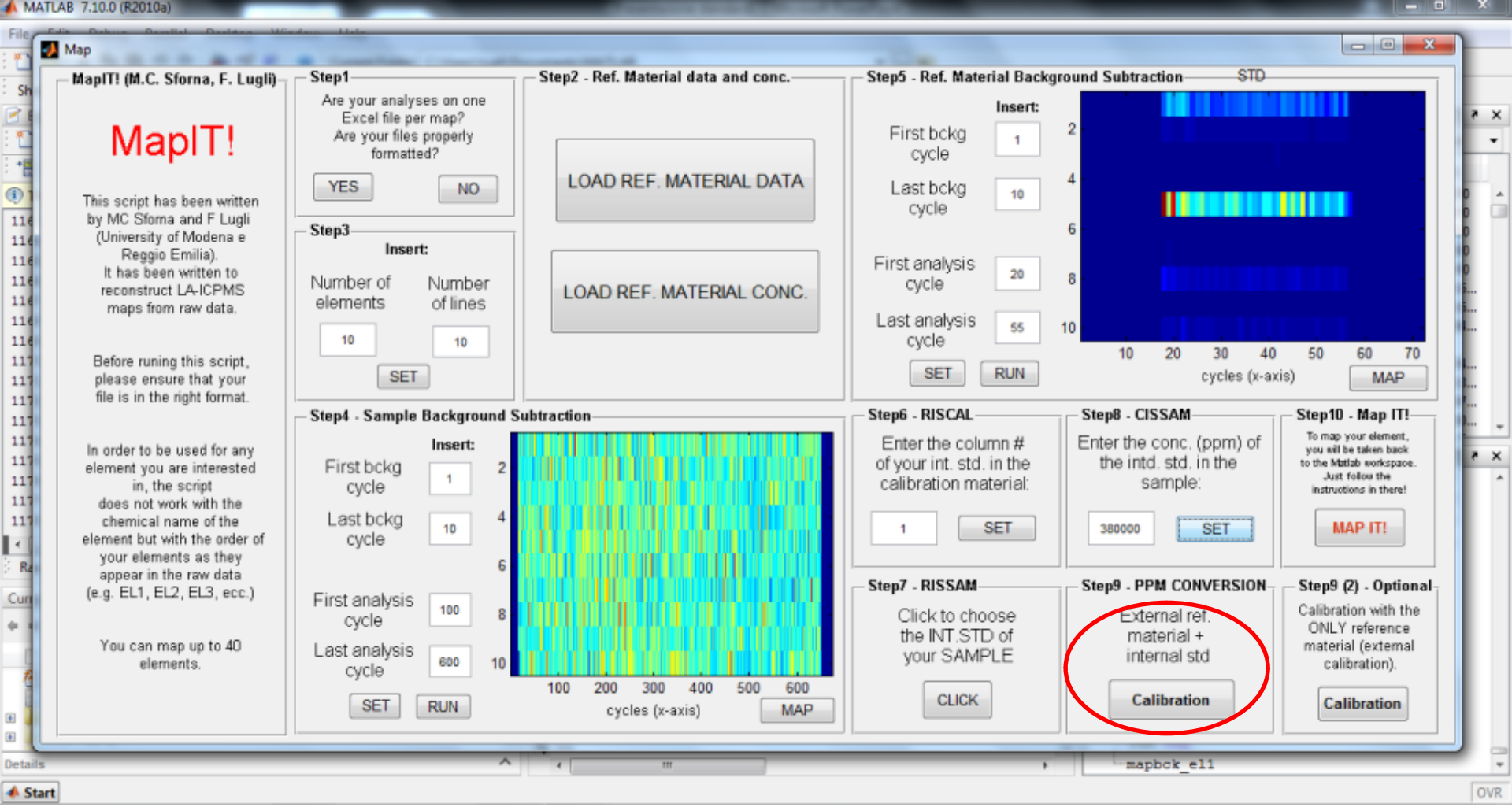
The ‘CLICK’ button brings you back to the MATLAB workspace. Here, you have to enter the internal standard of your sample, typing ‘**mapbck_el***’, with * the number of the element as it appears in the raw data, and enter (keyboard). In this example, we choose Ca which is the first element analyzed, appearing in the first column of our raw data. Therefore we typed ‘mapbck_el1’.

STEP7



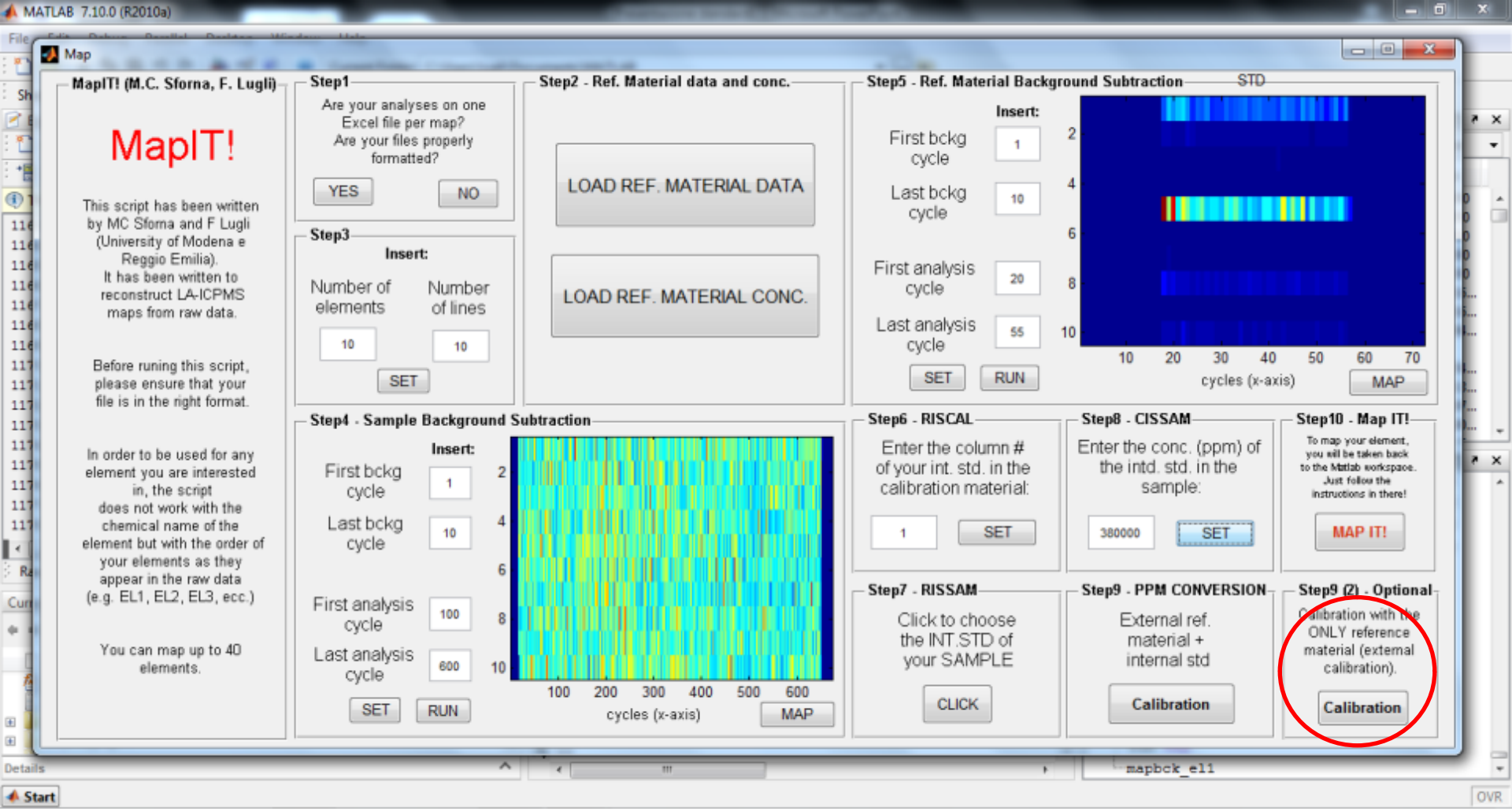
Enter the concentration (ppm) of your internal standard in the sample. Do not forget to click ‘SET’. In this example, the Ca concentration of our sample is 380000 ppm.

STEP8



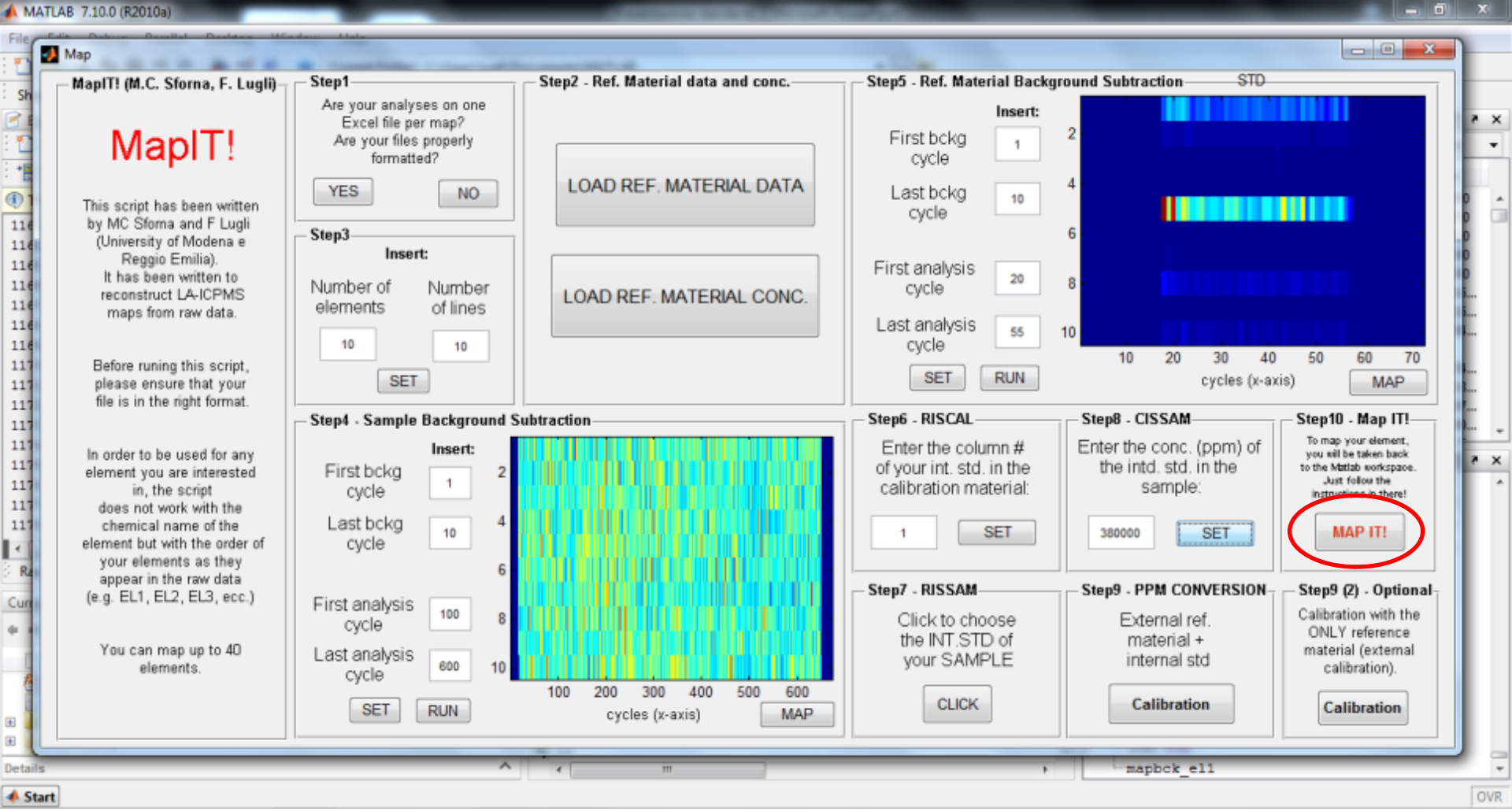
By clicking ‘Calibration’, your raw data will be converted in ppm using both the internal standard and the reference material (see Longerich et al., 1996). **If you would like to calibrate ONLY with the reference material, skip this step and go to STEP9 (2).**

STEP9



To calibrate ONLY with the external reference material, **skip STEP6, 7, 8 and 9** and click the 'Calibration' button of STEP9 (2).

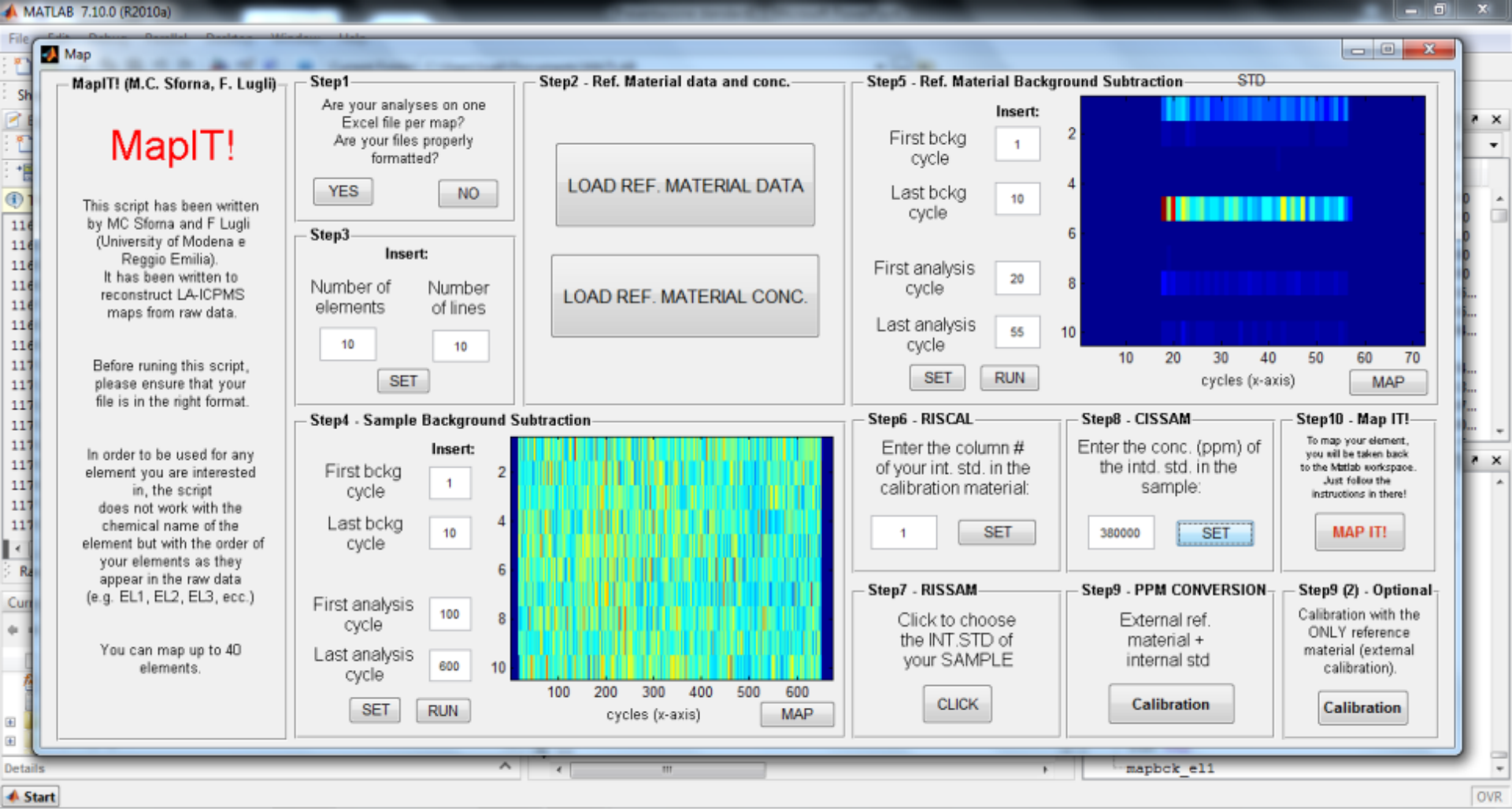
STEP9 (2)



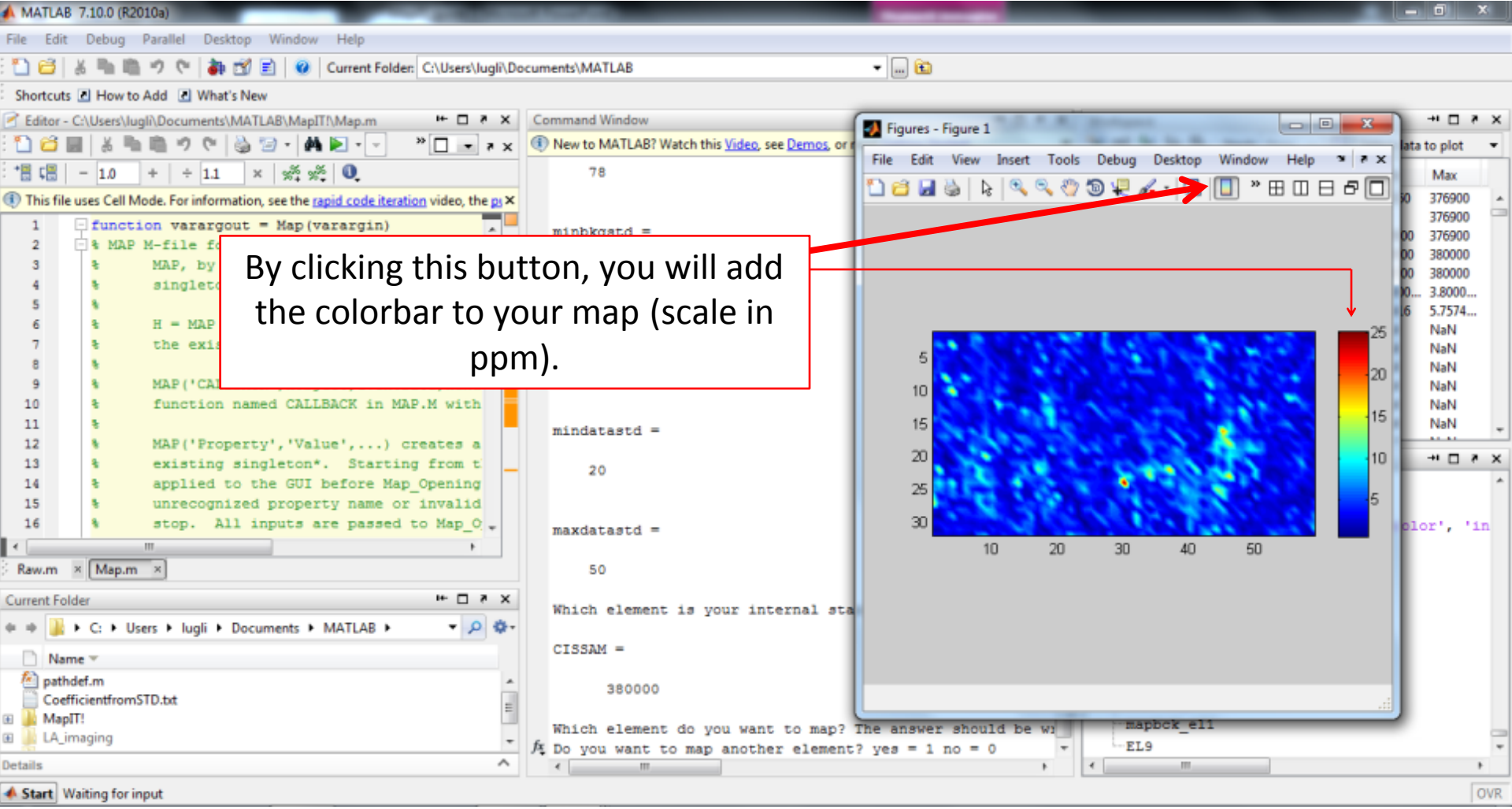
By clicking ‘MAP IT!’, you will be go back to the MATLAB workspace. You can choose the element to map by typing EL*, with * the number of the element as it appears in your analysis, and enter (keyboard). Otherwise, you can map an element ratio typing EL*./EL*.

After that, a text string will appear in the workspace, asking if you would like to map another element. Typing ‘1’ (= yes) you can make another map, typing ‘0’ (= no) you will end the script. You can repeat this process an unlimited number of times.

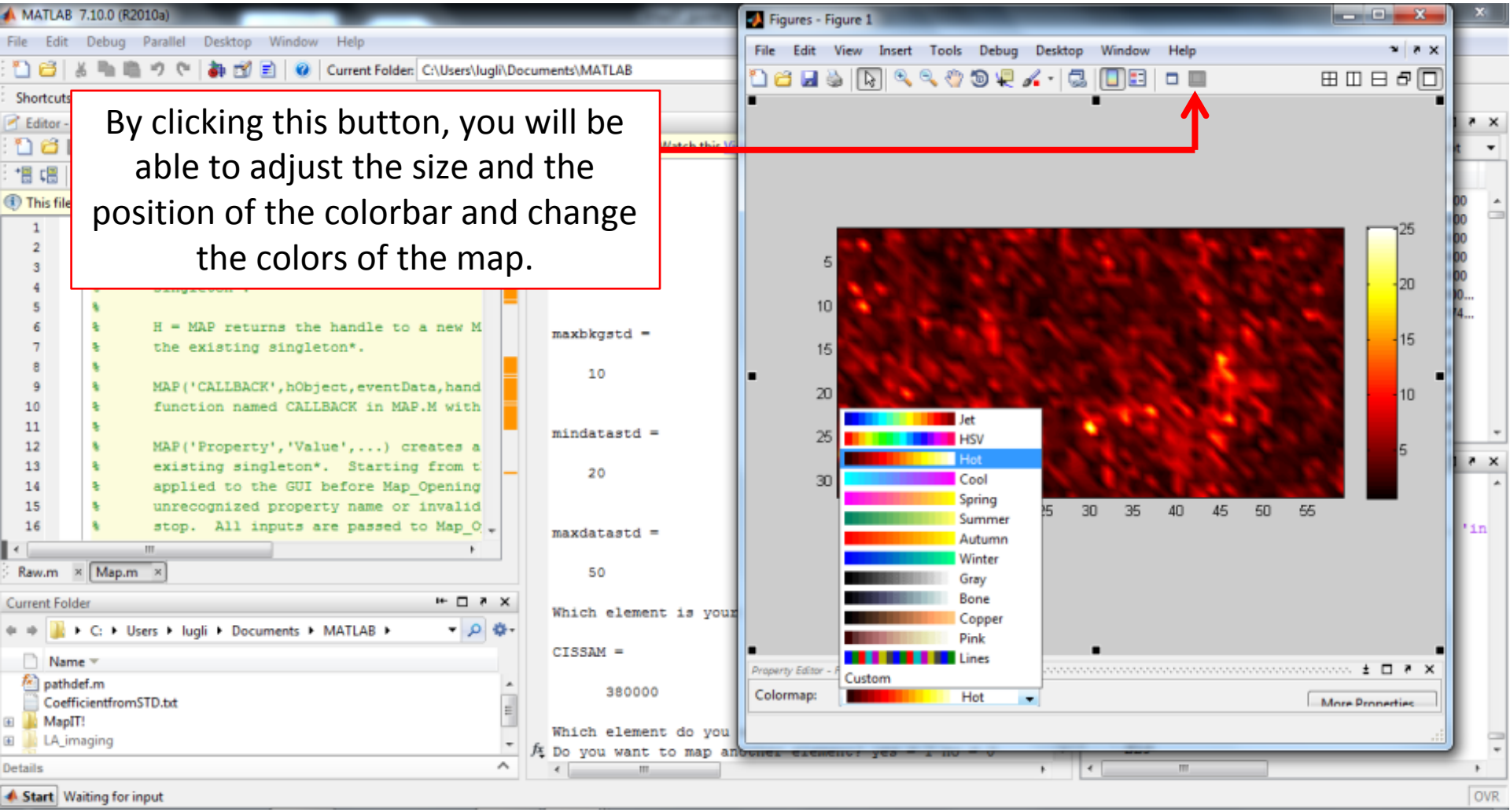
STEP10



You can change the range of the data considered for the map (STEP4) and/or other parameters (STEP5, 6, 7, 8).
Do not forget to APPLY the changes to your data by clicking the proper buttons.
Then, recalibrate (STEP9).


By clicking this button, you will add the colorbar to your map (scale in ppm).

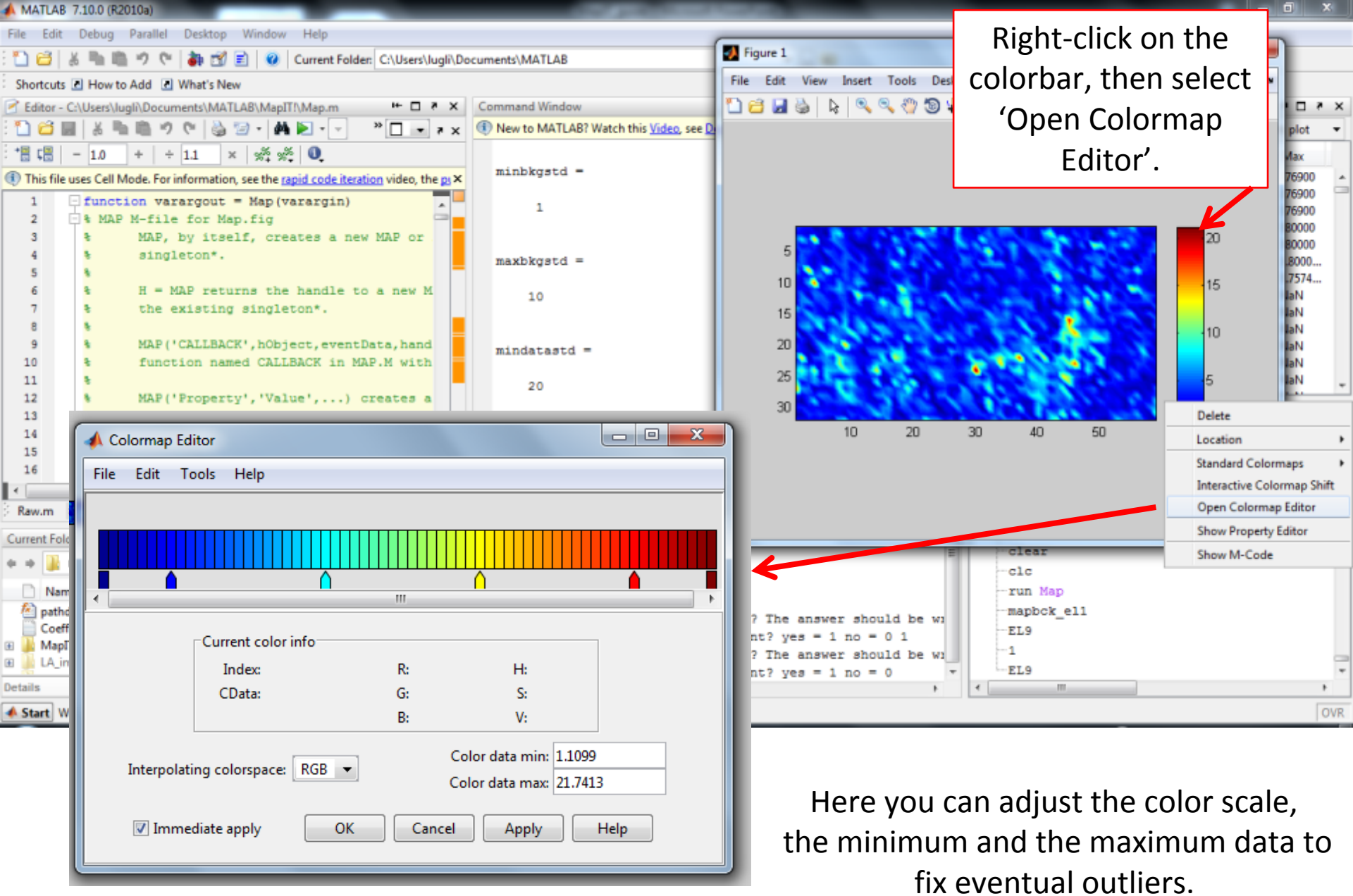
MAP FIGURE



More info:

https://mathworks.com/help/matlab/creating_plots/plotting-tools--interactive-plotting.html

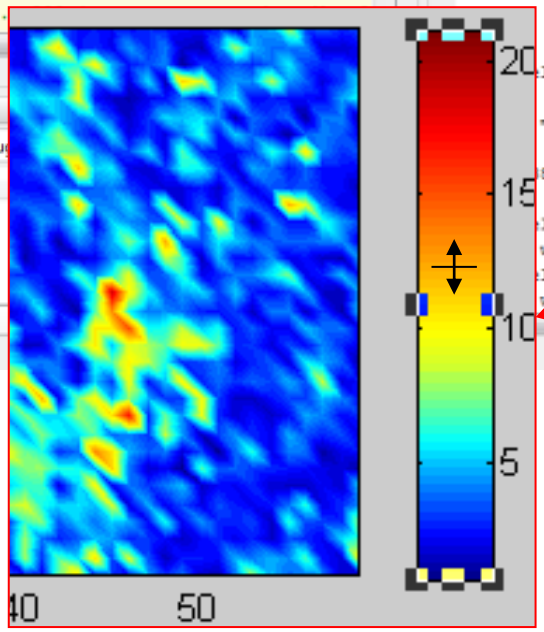
MAP FIGURE



Here you can adjust the color scale, the minimum and the maximum data to fix eventual outliers.

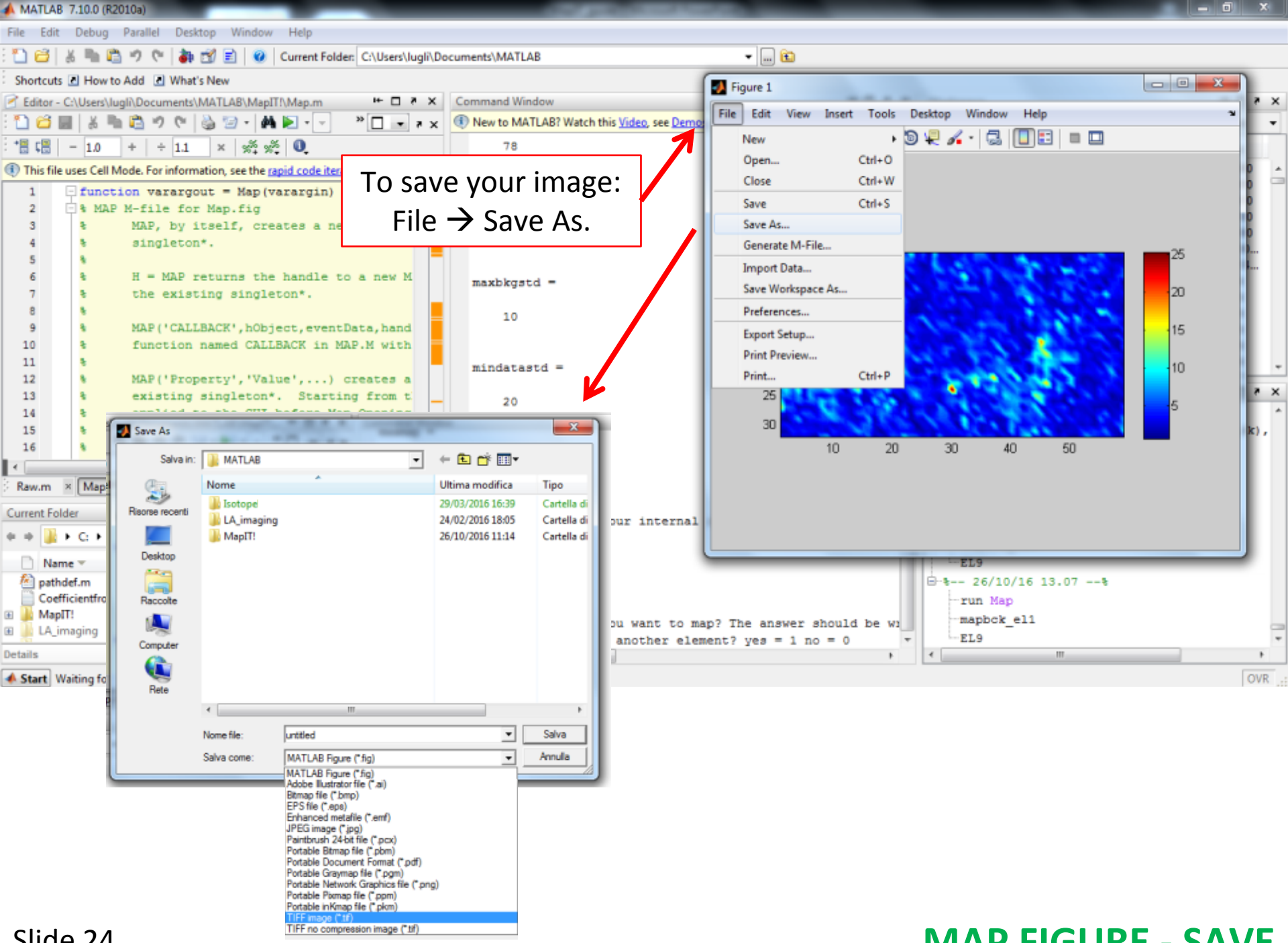
MAP FIGURE

Right-click on the colorbar, then select ‘Interactive Colormap Shift’.

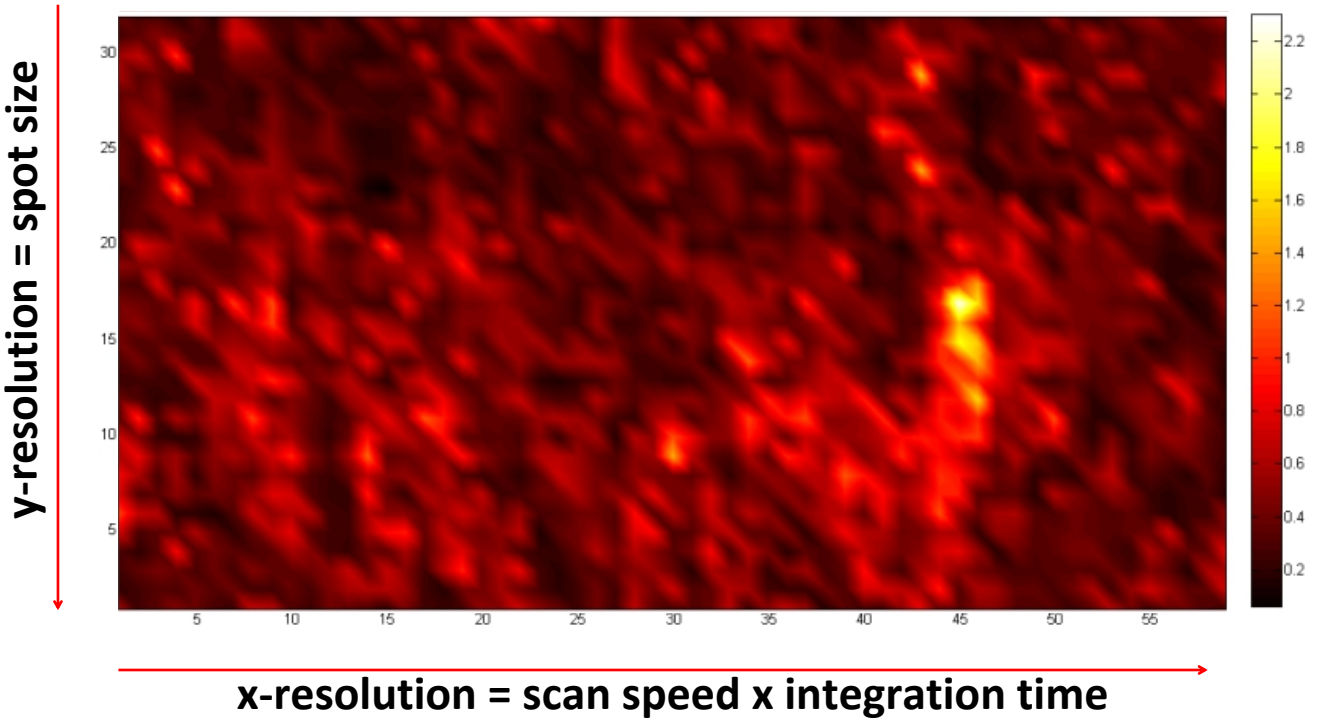


You can interactively change the scale, simply dragging the color.

MAP FIGURE



MAP FIGURE - SAVE



Y-axis image resolution is equal to the spot size of the laser scans. In this work, we employed e.g. a spot size of 40 µm.
X-axis image resolution is equal to the scan speed (20 µm/s, this work) multiplying the integration time (0.644 s, this work). We therefore obtain a x-axis resolution of c.a. 13 µm for the present map.
Since the MapIT maps always have square pixels, the final sizes of the map may not be realistic.
We therefore suggest two different possible approaches.

1) Work with the same resolution in both axes, varying for example the scan speed (e.g. 60 µm/s x 0.644 s = ~40 µm) or the spot size.
2) Employ the preferred scan speed. Calculate the resulting x-resolution, then resize the image with a graphic software or with MATLAB itself. In this case, with a 40 µm y-resolution and a 13 µm x-resolution, we should shrink the x-axis to the 32.5% (=13*100/40) of its actual size.

MAP SIZE ADJUSTMENT