Lac 3D

Fast and accurate lacunarity calculation for large 3D micro-CT datasets

USER MANUAL
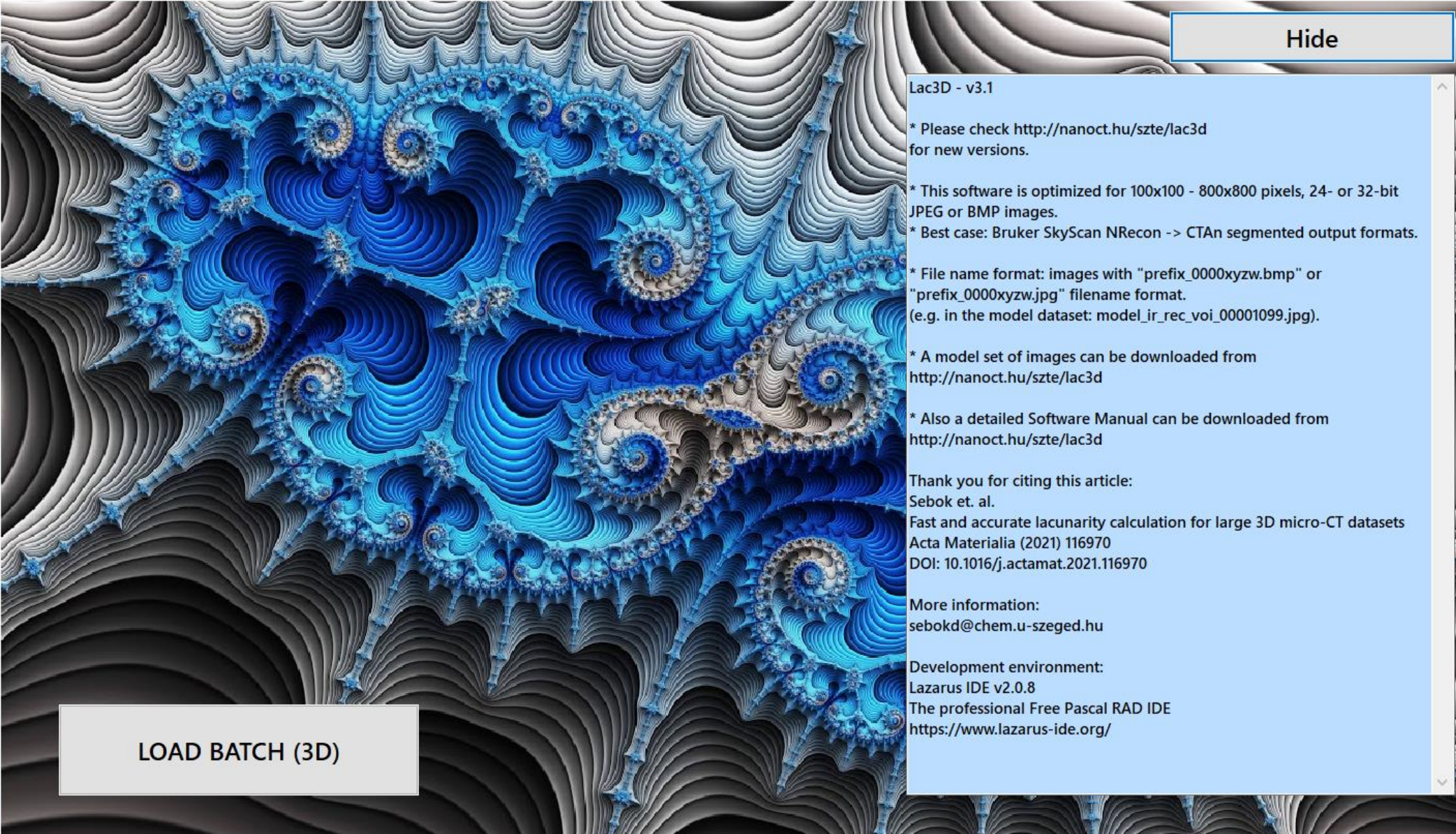
http://nanoct.hu/szte/lac3d

Opening screen

Lac3D v1.0 - 3D Lacunarity Calculator (2020) Daniel Sebok - sebokd@chem.u-szeged.hu - http://nanoct.hu/szte/lac3d

Click for Instructions
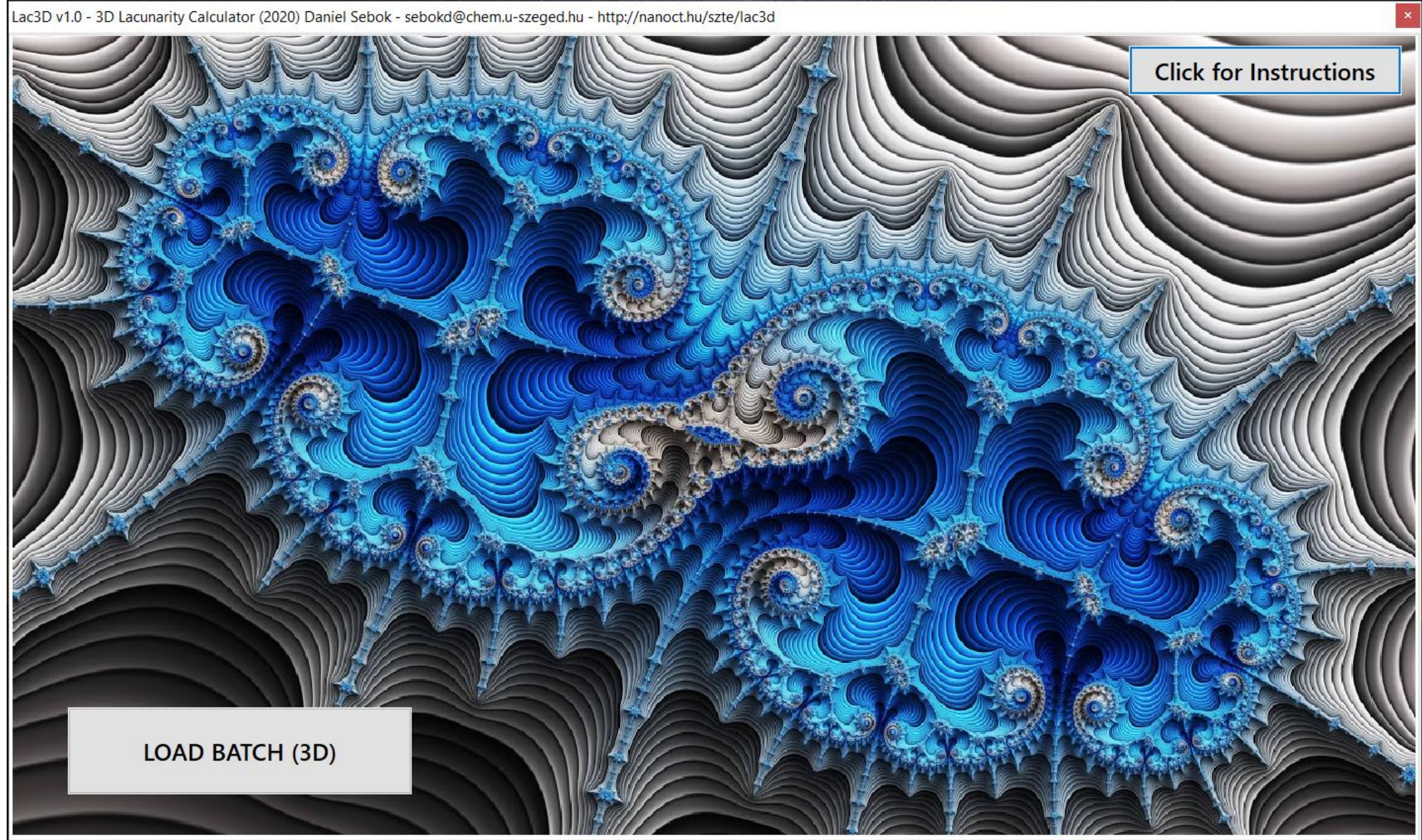
LOAD BATCH (3D)

Opening screen with some short instructions and information

Lac3D v1.0 - 3D Lacunarity Calculator (2020) Daniel Sebok - sebokd@chem.u-szeged.hu - http://nanoct.hu/szte/lac3d

Hide

Lac3D - v3.1

* Please check http://nanoct.hu/szte/lac3d
for new versions.

* This software is optimized for 100x100 - 800x800 pixels, 24- or 32-bit
JPEG or BMP images.
* Best case: Bruker SkyScan NRecon -> CTAn segmented output formats.

* File name format: images with "prefix_0000xyzw.bmp" or
"prefix_0000xyzw.jpg" filename format.
(e.g. in the model dataset: model_ir_rec_voi_00001099.jpg).

* A model set of images can be downloaded from
http://nanoct.hu/szte/lac3d

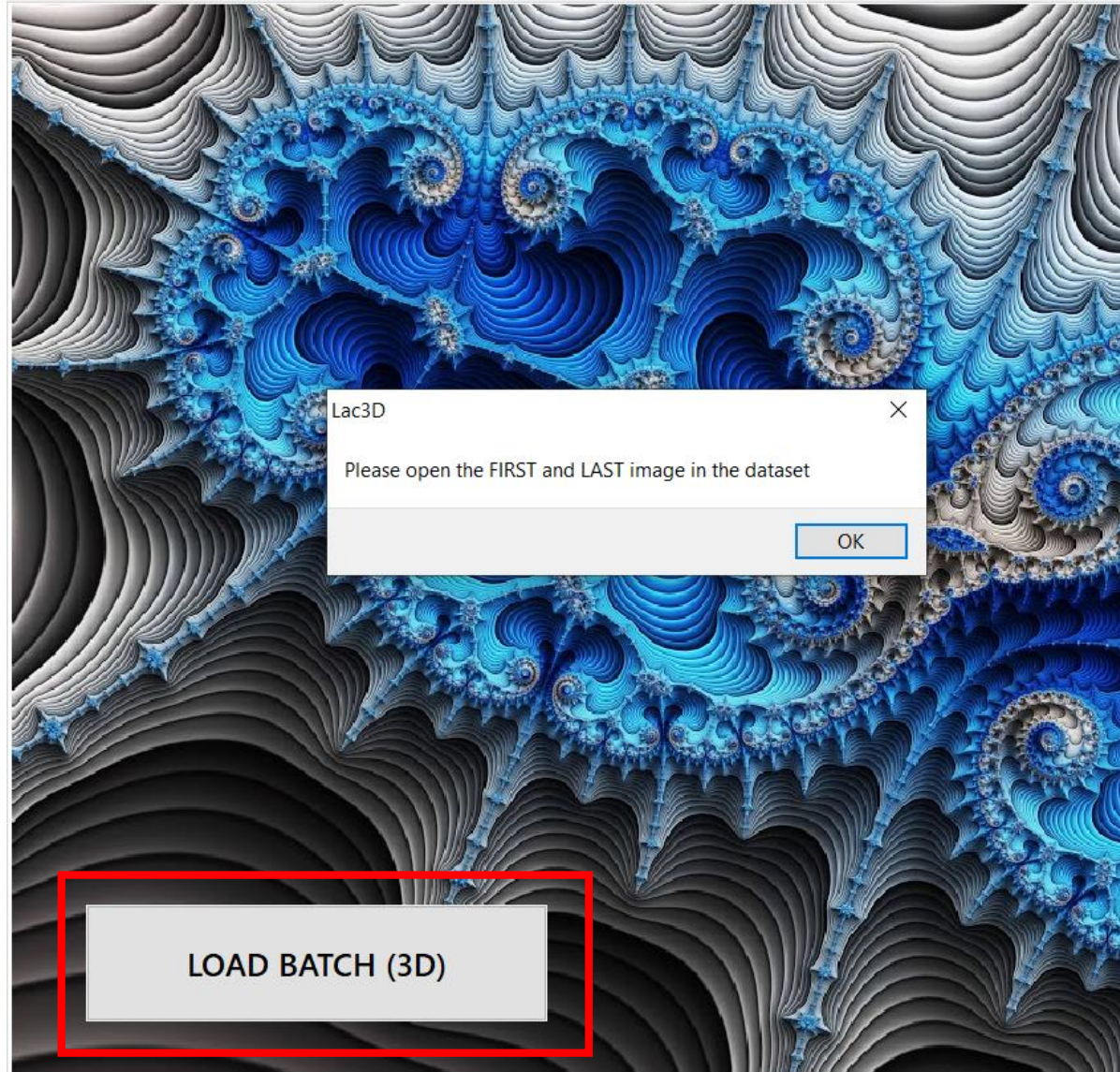* Also a detailed Software Manual can be downloaded from
http://nanoct.hu/szte/lac3d

Thank you for citing this article:
Sebok et. al.
Fast and accurate lacunarity calculation for large 3D micro-CT datasets
Acta Materialia (2021) 116970
DOI: 10.1016/j.actamat.2021.116970

More information:
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Development environment:
Lazarus IDE v2.0.8
The professional Free Pascal RAD IDE
https://www.lazarus-ide.org/

LOAD BATCH (3D)

Loading a batch of micro-CT images

Selection of a volume of interest (VOI)

- On the „Select VOI" tab a suitable volume of interest (VOI) can be determined by selecting a region of interest (ROI, ------).

- The height of the cubic VOI will be set automatically, it is the same as the ROI width.

- (→ *the bottom slice # of the VOI + height must be lower than the top slice # :*
e.g.: 540 + 300 < 1099)

- Tip: by mouse-wheeling over the image, lower or upper slices can be selected.

- After the selection of the VOI it can be sent to process by pressing the Send... button.

- The main properties of the selected VOI are summarized in the table.

TIP: the ROI should be selected on the lowest slice of the VOI !

Checking the volume of interest (VOI)

- The selected volume is automatically saved into a sub-folder, named by the timestamp (saving the VOI can be time consuming process, please be patient !).

- After selecting the VOI it can be checked on „Data Processing" tab.

- Tip: by mouse-wheeling over the image, lower or upper slices can be selected.

Saving the volume of interest (VOI)
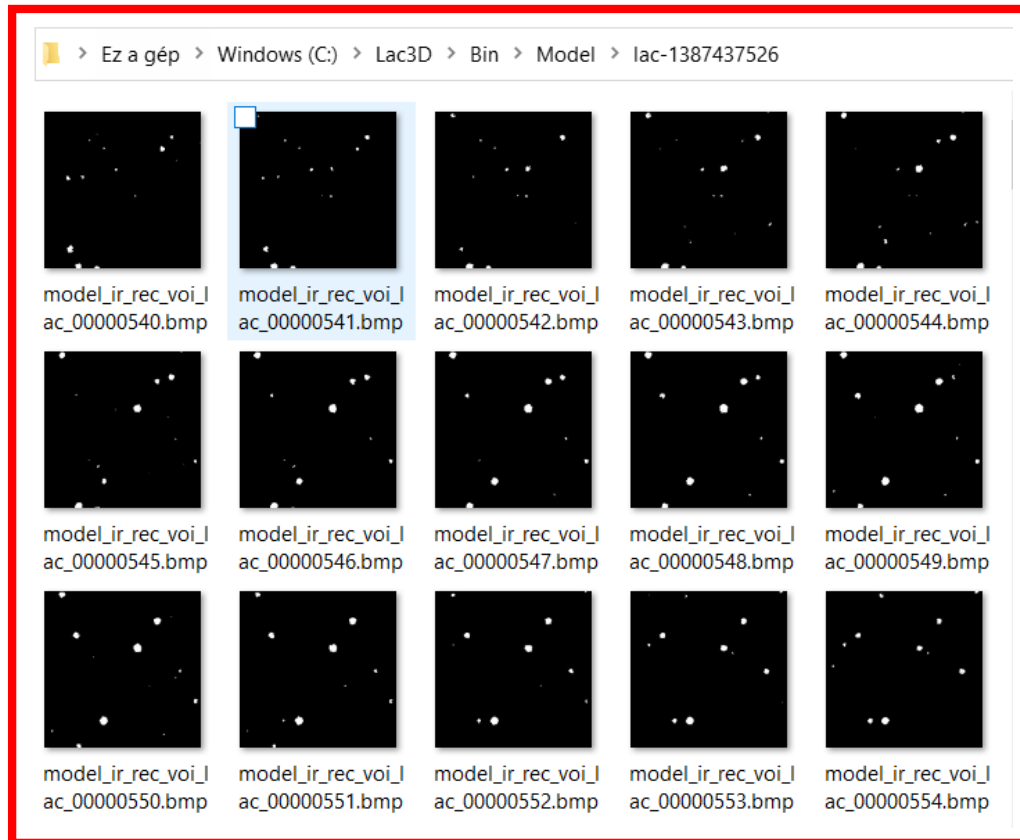
- The selected volume is automatically saved into a sub-folder, named by the actual timestamp.

- These volumes can be 3D-rendered in volume processing softwares, e.g. in Bruker CTVox.
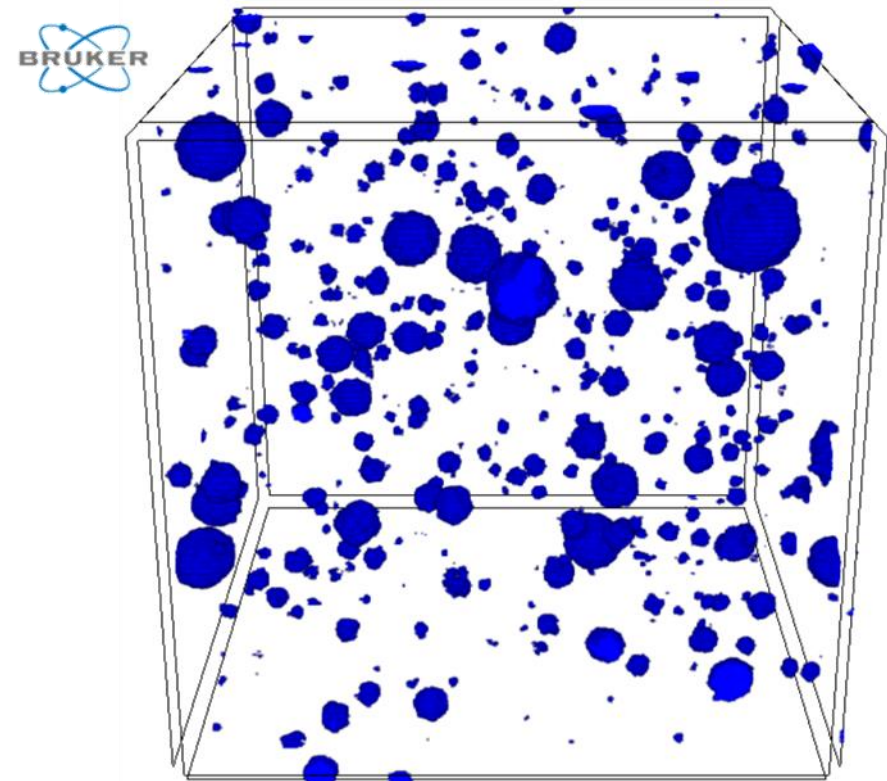
Calculating the box counting dimension and the FGM lacunarity

C:\Lac3D\Bin\Model\model_ir_rec_voi_00000840.jpg

First image: C:\Lac3D\Bin\Model\model_ir_rec_voi_00000400.jpg

Last image: C:\Lac3D\Bin\Model\model_ir_rec_voi_00001099.jpg
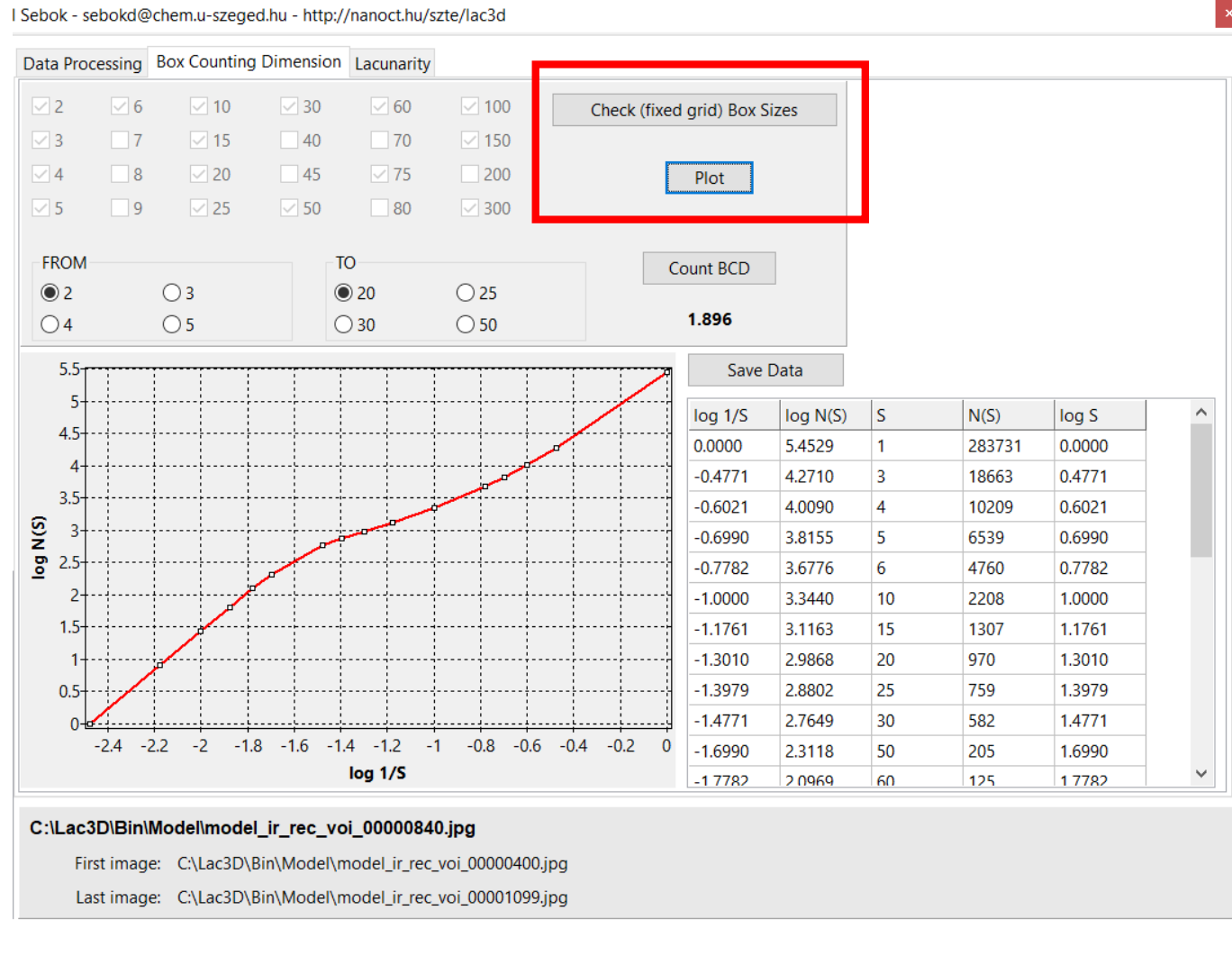
- On „Box Counting Dim" tab, pressing the „Check (fixed grid) Box Sizes" button, the software checks all the possible box sizes that can fit into the VOI.

- After this step, pressing the „Plot" button, the box counting dimension and the FGM lacunarity curves (**latter results on the „Lacunarity" tab**) will be calculated – in one minute.

- The FGM – Fixed-grid method:

D. Sebők et al.,
Fast and accurate lacunarity calculation for large 3D micro-CT datasets,
(2021) Acta Materialia 116970,
https://doi.org/10.1016/j.actamat.2021.116970

- By plotting the log N(S) curves initial range the BCD dimension can be obtained.

Calculating the FGM lacunarity curve _in one minute_

Data Processing	Box Counting Dimension	Lacunarity
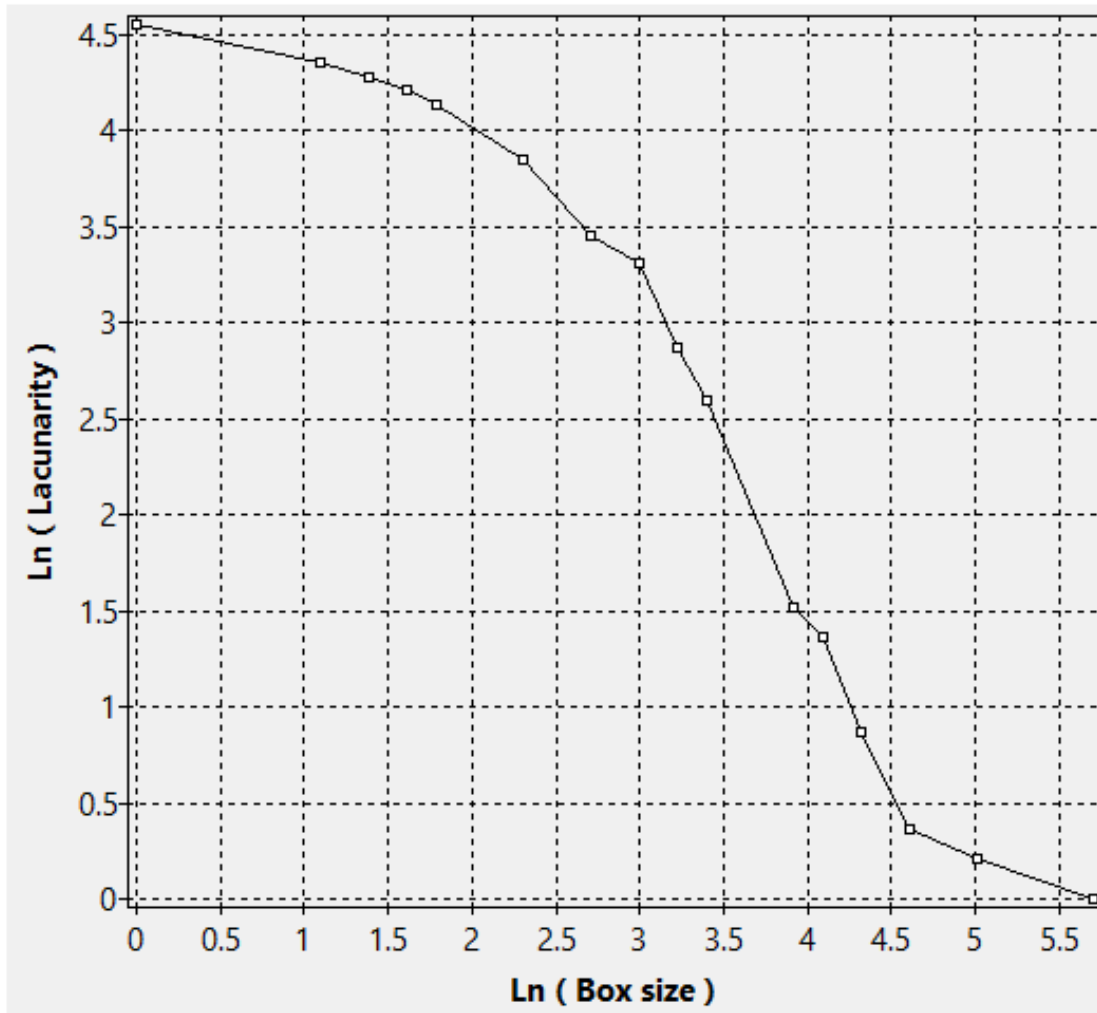
n	ln(n,GBM)	ln(L,GBM)	t (s)	ln(n,FGM)	ln(L,FGM)
				0.0000	4.5556
				1.0986	4.3544
				1.3863	4.2812
				1.6094	4.2093
				1.7918	4.1379
				2.3026	3.8514
				2.7081	3.4524
				2.9957	3.3067
				3.2189	2.8765
				3.4012	2.5978
				3.9120	1.5237
				4.0943	1.3679
				4.3175	0.8684
				4.6052	0.3680
				5.0106	0.2052
				5.7038	0.0000

Calculating the traditional GBM lacunarity curve

n	ln(n,GBM)	ln(L,GBM)	t (s)	ln(n,FGM)	ln(L,FGM)
2	0.6931	4.4336	1 s	0.0000	4.5556
3	1.0986	4.3549	2 s	1.0986	4.3544
4	1.3863	4.2828	4 s	1.3863	4.2812
5	1.6094	4.2125	8 s	1.6094	4.2093
10	2.3026	3.8703	58 s	1.7918	4.1379
15	2.7081	3.5443	183 s	2.3026	3.8514
20	2.9957	3.2329	457 s	2.7081	3.4524
25	3.2189	2.9419	824 s	2.9957	3.3067
				3.2189	2.8765
				3.4012	2.5978
				3.9120	1.5237
				4.0943	1.3679
				4.3175	0.8684
				4.6052	0.3680
				5.0106	0.2052
				5.7038	0.0000

Progress: 100 %   **finished**

Calculate 2, 3, 4, 5, then :

Step:
- ○ 1 ○ 2 ○ 3 ○ 4
- ● 5 ○ 10 ○ 20 ○ 50   to: 25   START

- Calculating the traditional GBM lacunarity curve (■) is a time consuming process, even for a partial range, but it can be useful to check the result of the (full-range) FGM estimation.

- By selecting the increase step and last value of the box sizes used in GBM, the traditional curve can be calculated.

- The results are automatically saved in the subfolder.