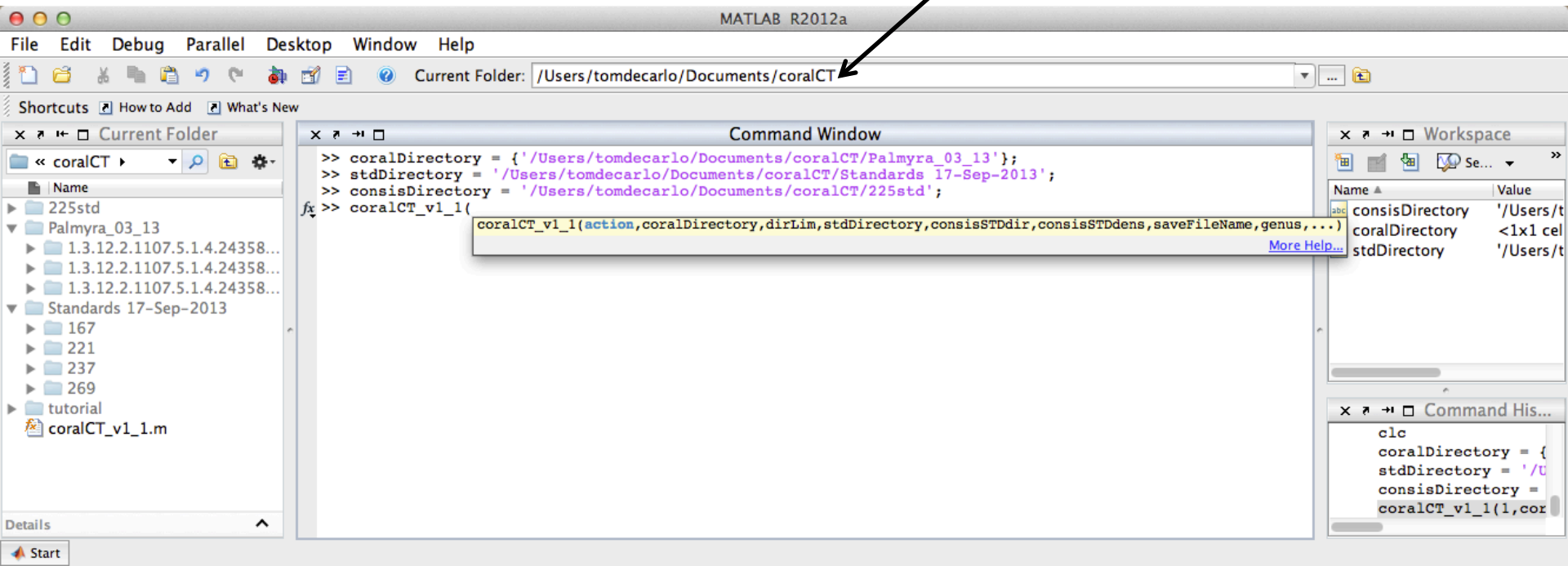
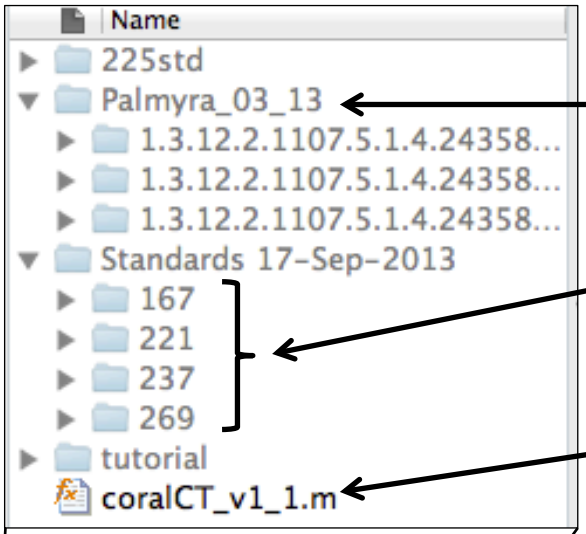
Set path to folder containing coralCT script

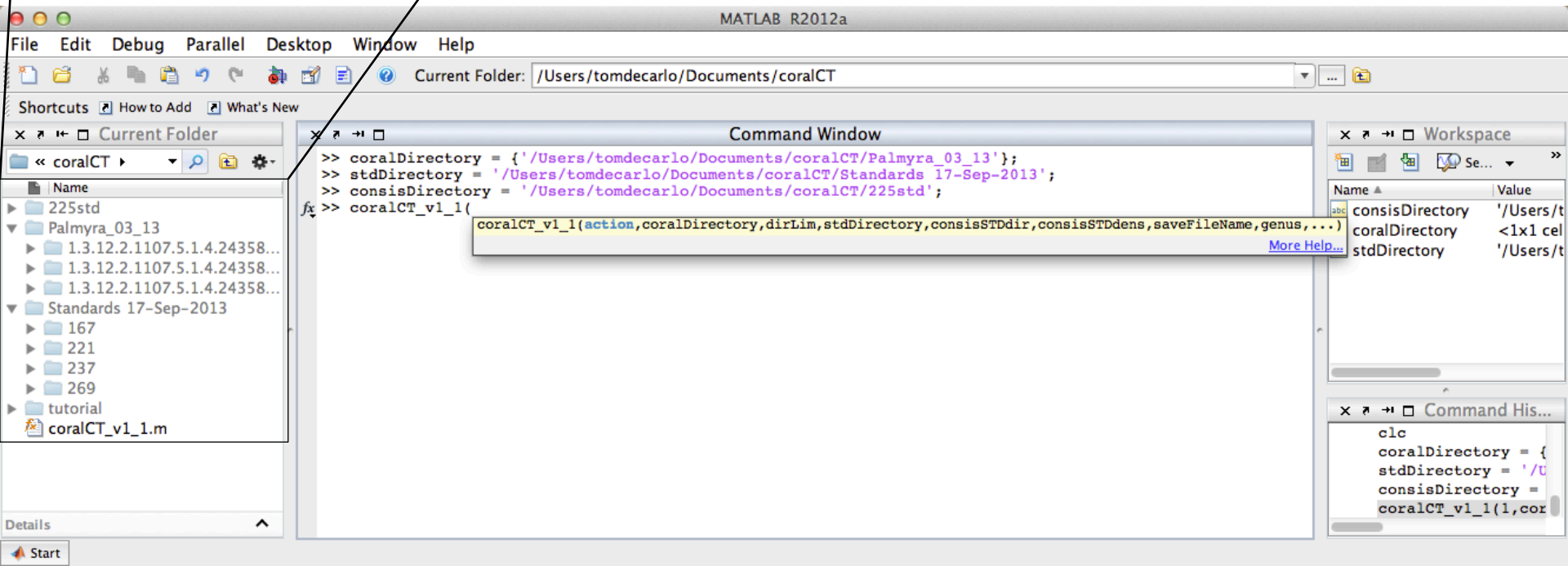




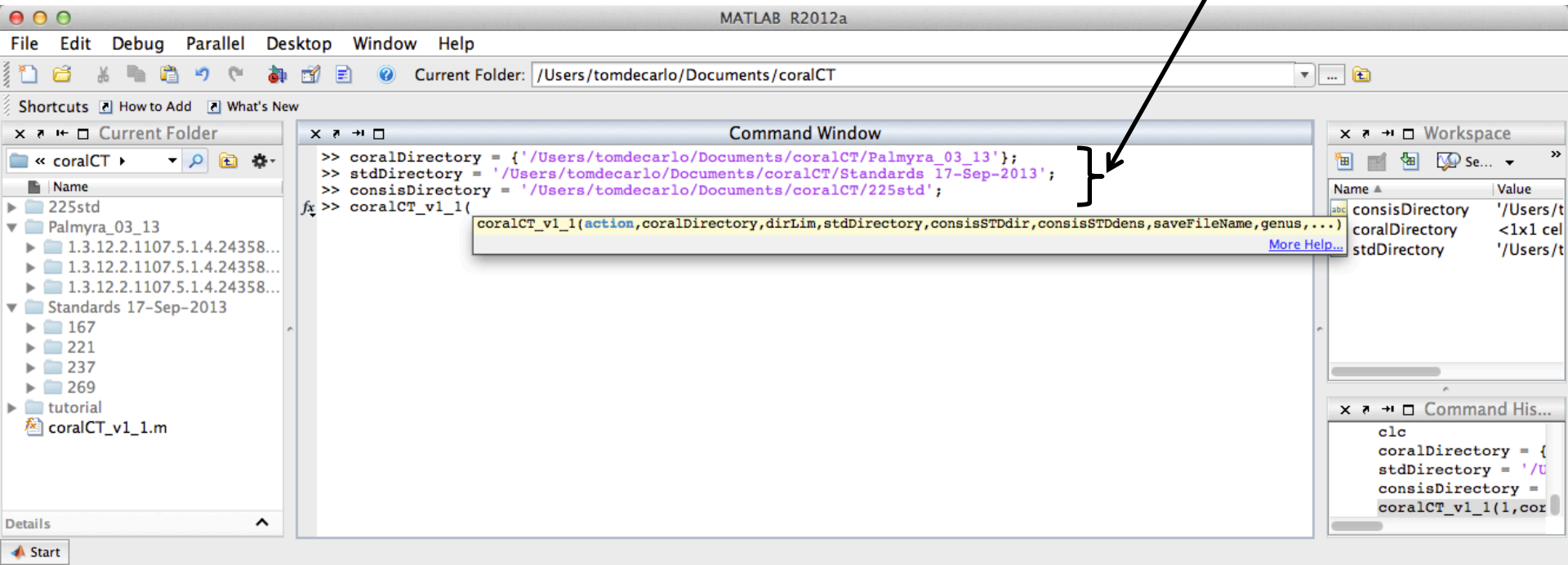
This folder is the path input below. The subfolders here are CT scan spirals

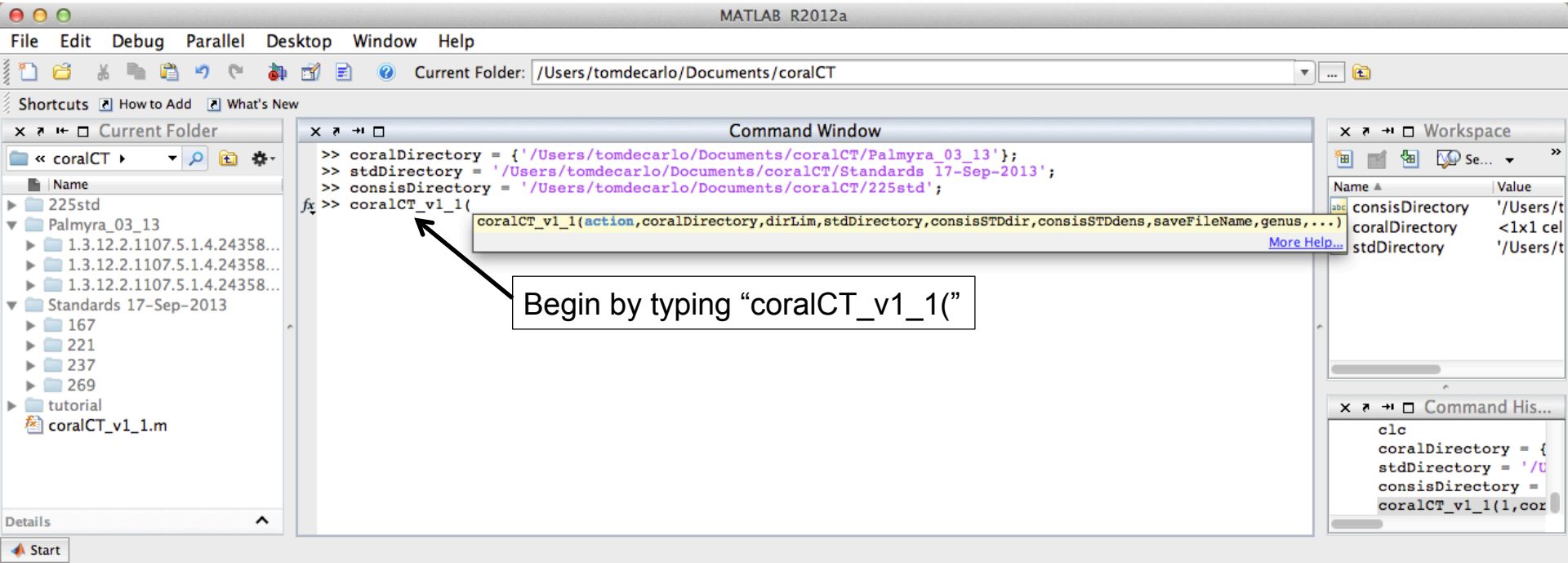
The spirals in the standards folder are named by number

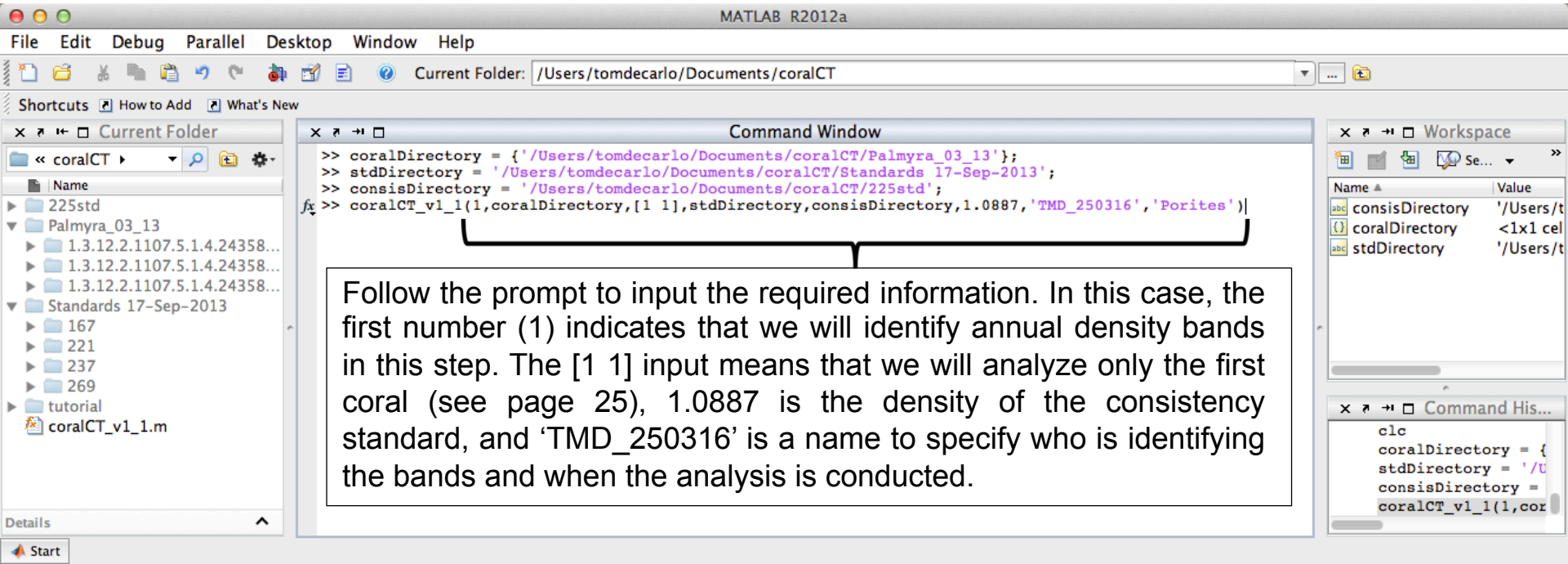
Note that the current folder contains 'coralCT_v1_1.m'



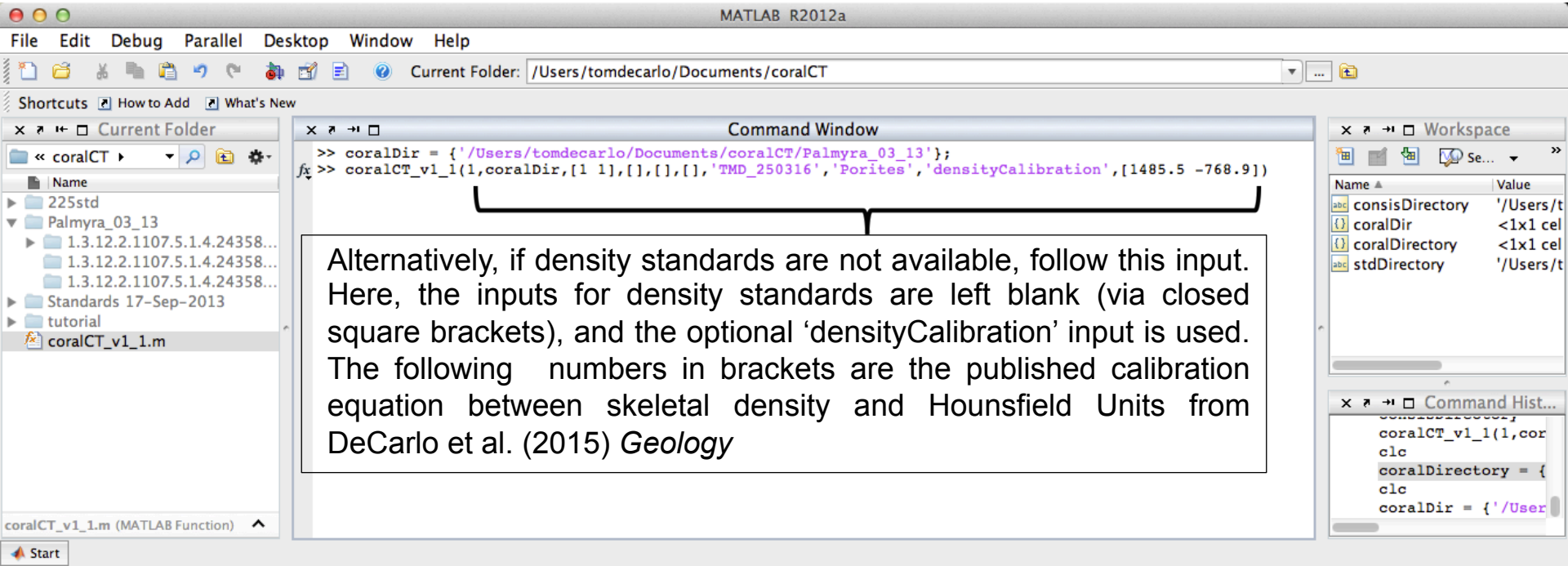
Enter paths to the coral CT scans, the standards scans, and the consistency standard scan. Note that the path for the coral CT scans is in brackets (see page 25)




MATLAB R2012a
File Edit Debug Parallel Desktop Window Help
Current Folder: /Users/tomdecarlo/Documents/coralCT
Shortcuts How to Add What's New
Current Folder
coralCT
Name
225std
Palmyra_03_13
1.3.12.2.1107.5.1.4.24358...
1.3.12.2.1107.5.1.4.24358...
1.3.12.2.1107.5.1.4.24358...
Standards 17-Sep-2013
167
221
237
269
tutorial
coralCT_v1_1.m
Details
Command Window
>> coralDirectory = {'/Users/tomdecarlo/Documents/coralCT/Palmyra_03_13'};
>> stdDirectory = '/Users/tomdecarlo/Documents/coralCT/Standards 17-Sep-2013';
>> consisDirectory = '/Users/tomdecarlo/Documents/coralCT/225std';
>> coralCT_v1_1(
coralCT_v1_1(action,coralDirectory,dirLim,stdDirectory,consisSTDdir,consisSTDdens,saveFileName,genus,...)
More Help...
Begin by typing “coralCT_v1_1(”
Workspace
Name
Value
consisDirectory '/Users/t
coralDirectory <1x1 cel
stdDirectory '/Users/t
Command His...
clc
coralDirectory = {
stdDirectory = '/U
consisDirectory =
coralCT_v1_1(1,cor
Start

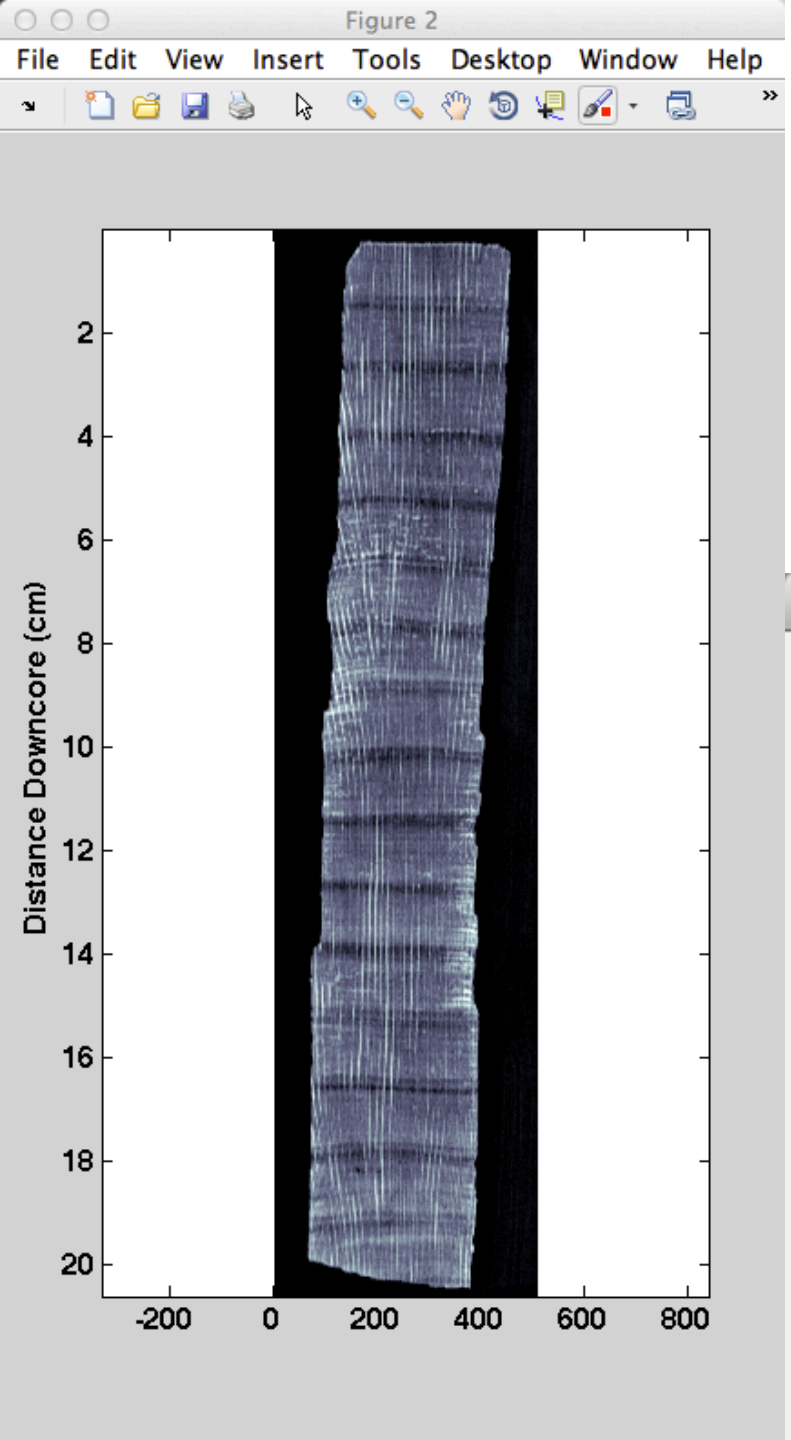


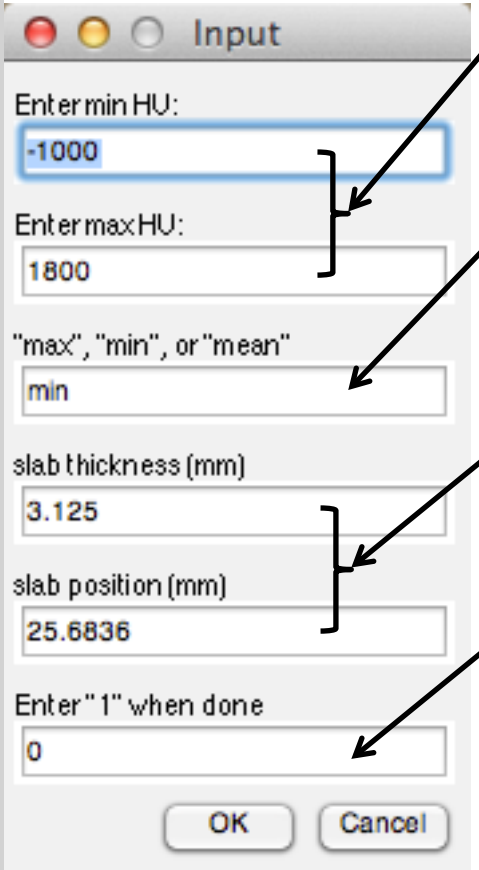
Follow the prompt to input the required information. In this case, the first number (1) indicates that we will identify annual density bands in this step. The [1 1] input means that we will analyze only the first coral (see page 25), 1.0887 is the density of the consistency standard, and 'TMD_250316' is a name to specify who is identifying the bands and when the analysis is conducted.



Alternatively, if density standards are not available, follow this input. Here, the inputs for density standards are left blank (via closed square brackets), and the optional 'densityCalibration' input is used. The following numbers in brackets are the published calibration equation between skeletal density and Hounsfield Units from DeCarlo et al. (2015) *Geology*

Two figure windows will open. The main window shows a slab of the CT scan, and the “Input” window allows the CT scan image to be adjusted



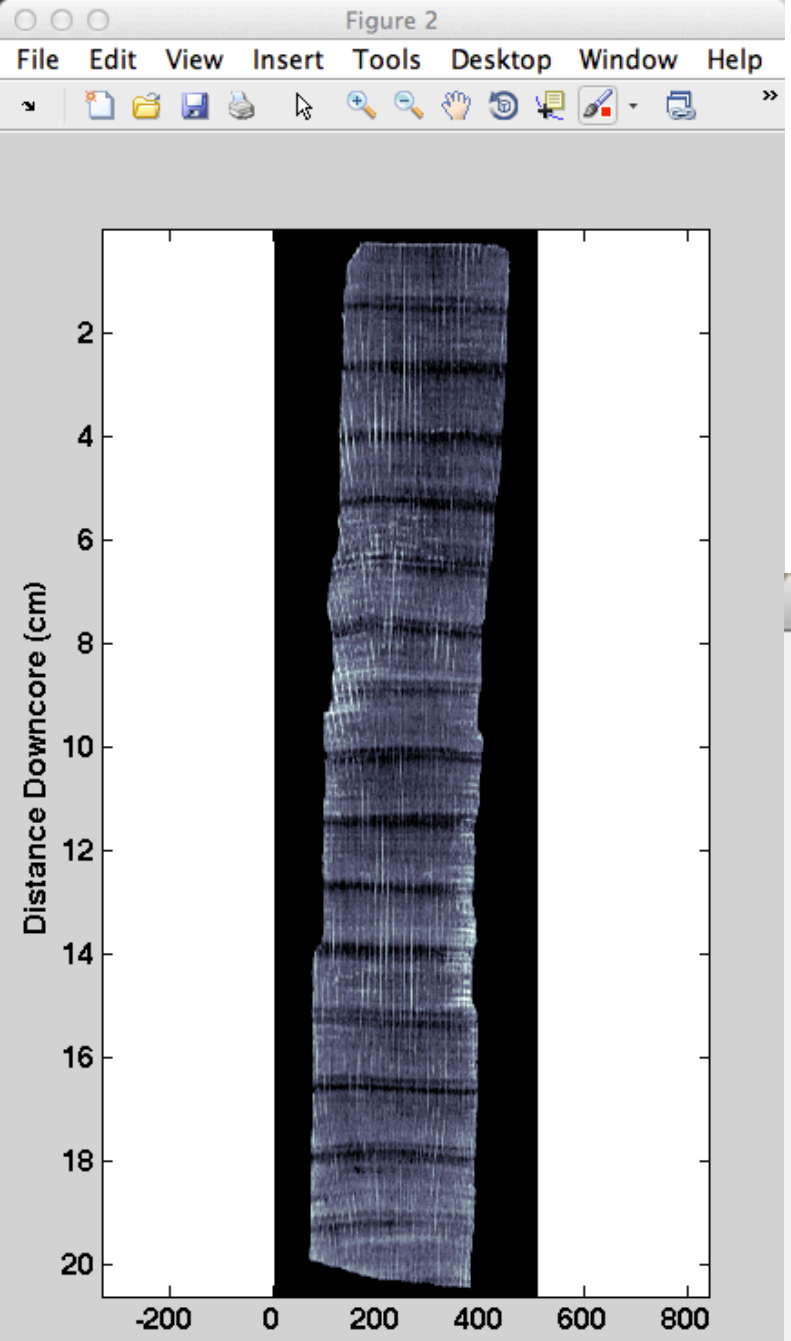


Changing the minimum and maximum HU will adjust the contrast of the image

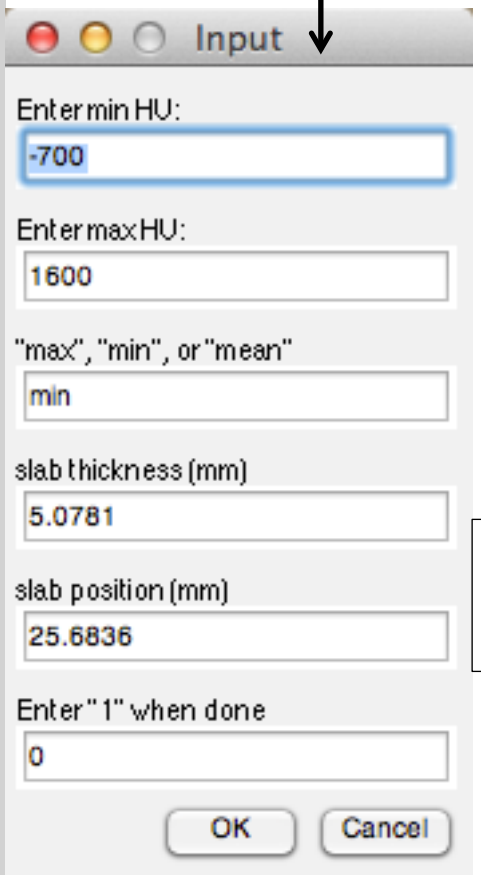
Select which type of projection to use. Generally, ‘min’ projections provide the clearest view of annual bands

Adjusting the slab thickness and position can sometimes improve the clarity of bands

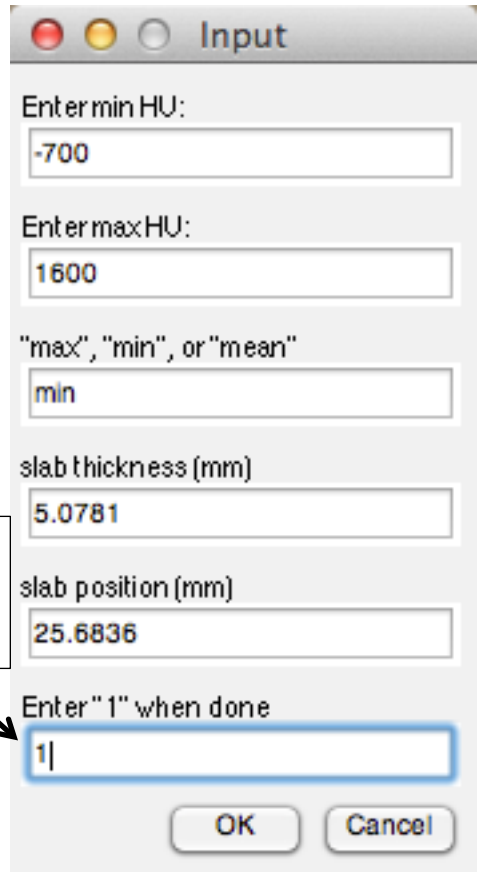
As long as the “0” remains in this box, the above parameters can be tweaked by trial and error. Alternate between clicking “OK” and changing parameters until the best image is achieved.

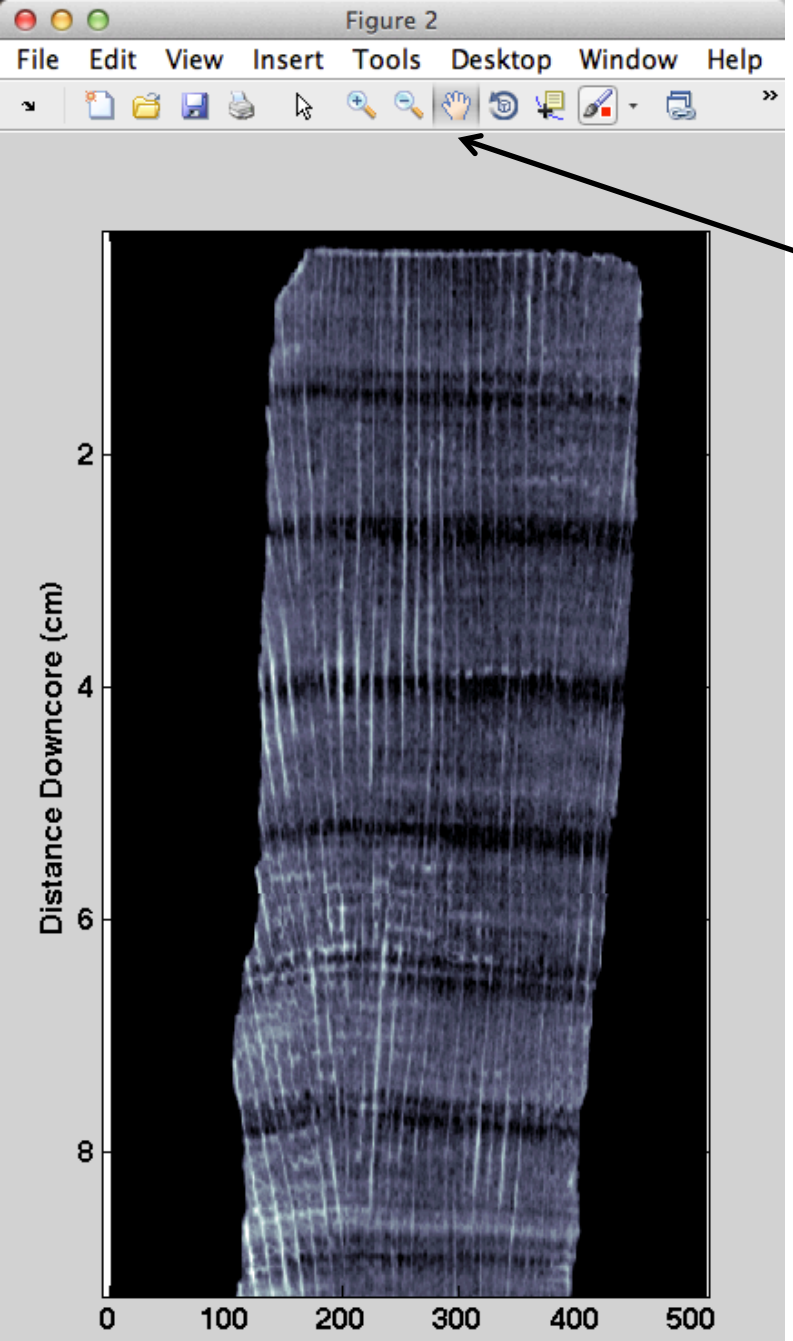


The inputs below provided the clearest image of this particular scan



Set to “1” and click “OK”

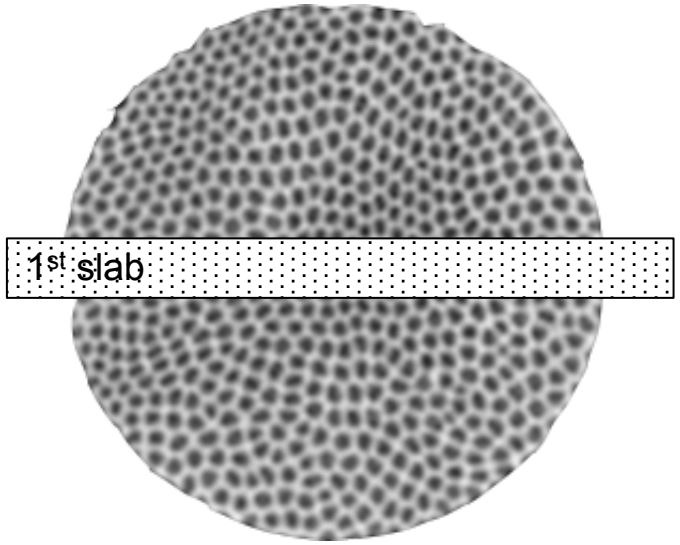


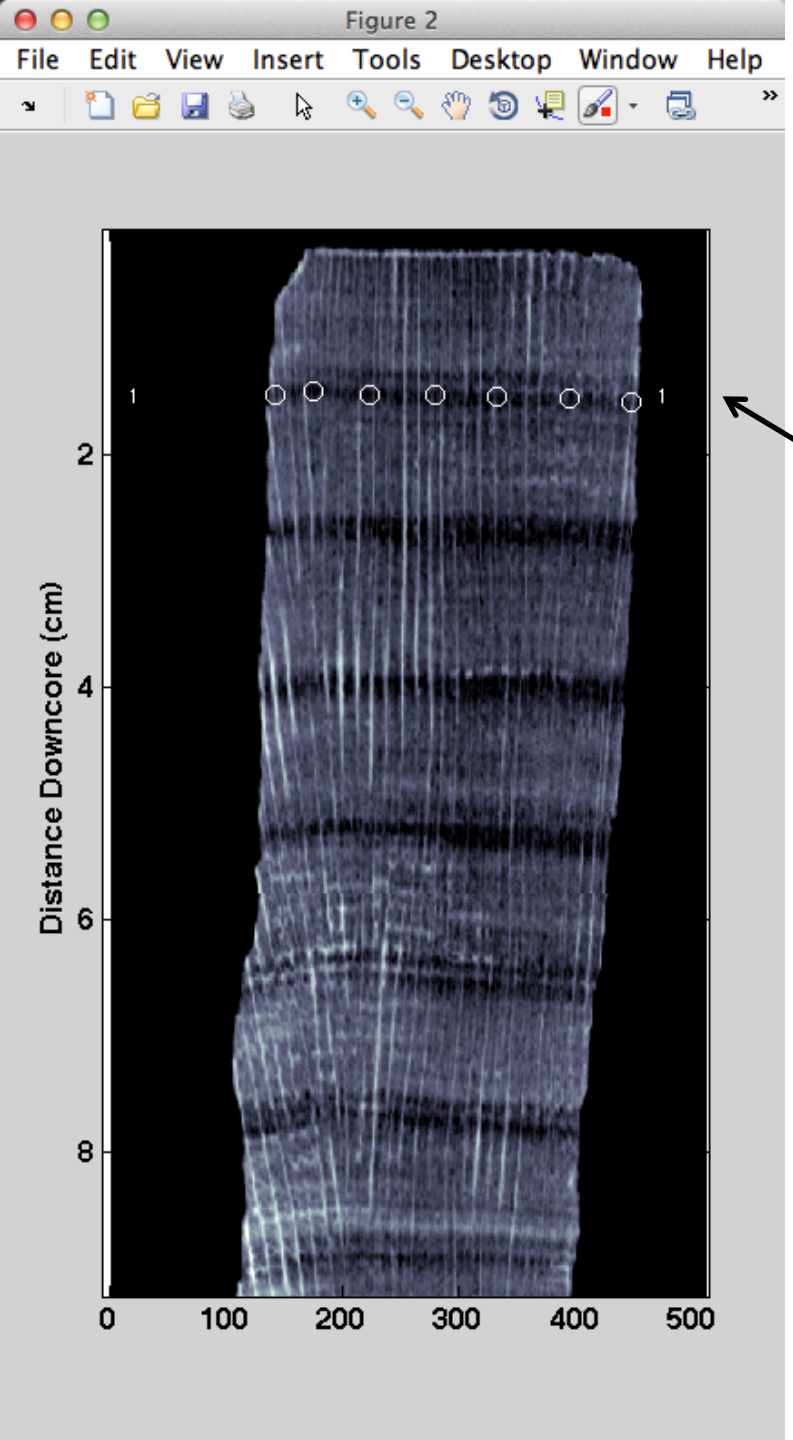


Use the zoom and pan button to set the window with a good view of the top few annual bands

Once the image is set to a good view, press “Enter”

Top-view of core



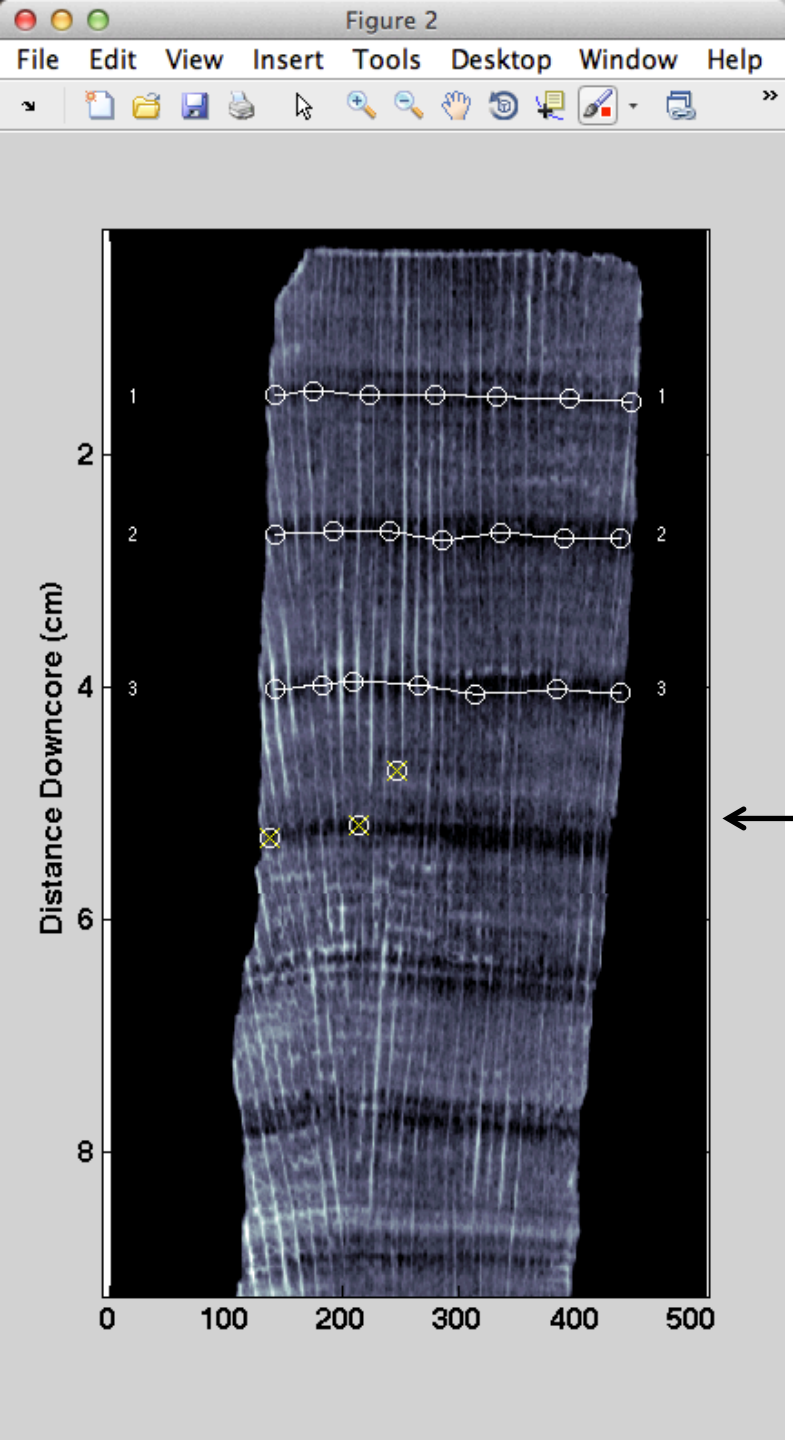


Use the cross-hairs that appear to begin clicking on the first annual band. Dark bands are low density, and are generally more sharply defined than high density bands.

Click in the center of the low density band as much as possible. However, note that the program will automatically adjust the identified bands to best fit the location of the density minimum.

After clicking across the first low density band, press “Enter”. The cross-hairs will disappear and it will be possible to zoom or pan to adjust the image, if needed.

Click “Enter” again, and continue on to the second band.

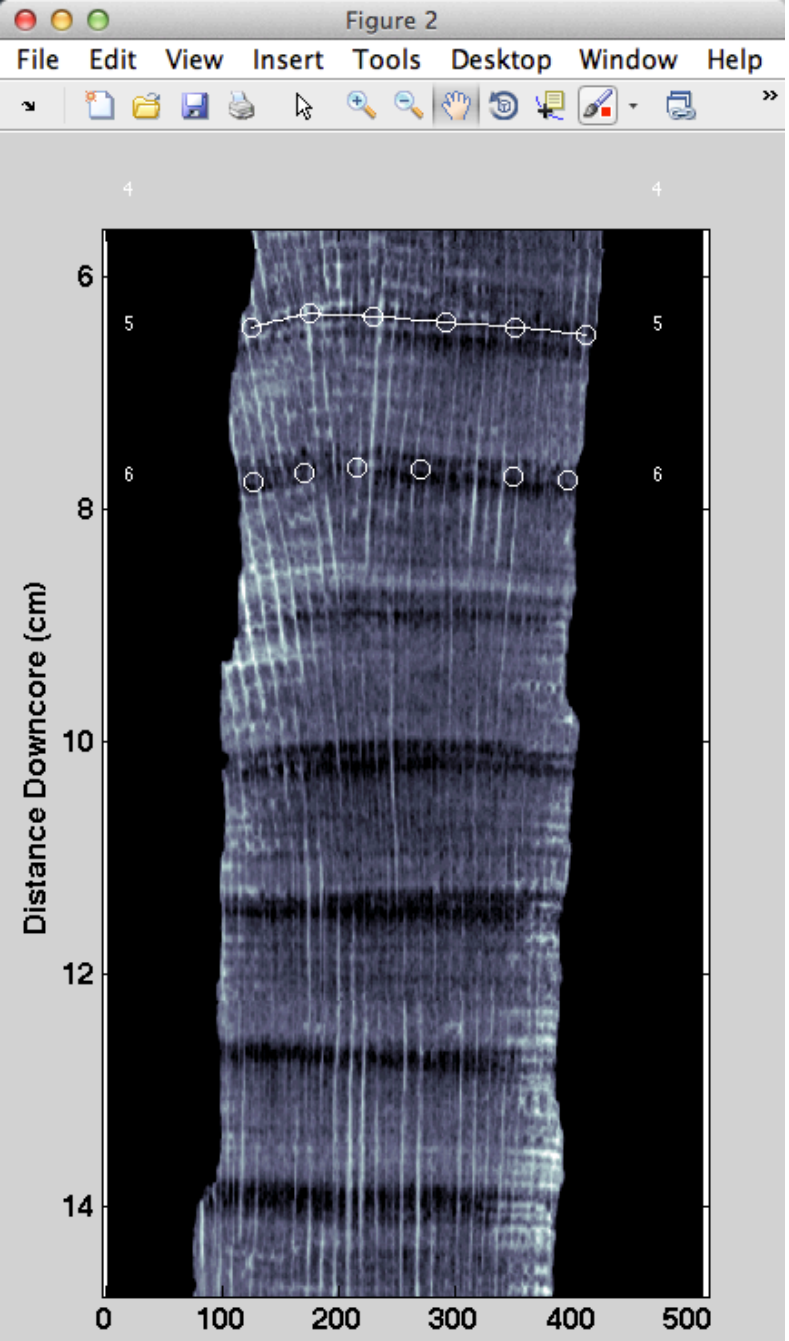


If an error is made while clicking on a band, press the “1” key on the keyboard, and then press “Enter”.

The cross-hairs will disappear and the circles for the present band will be “x’d out”. Those points have now been deleted.

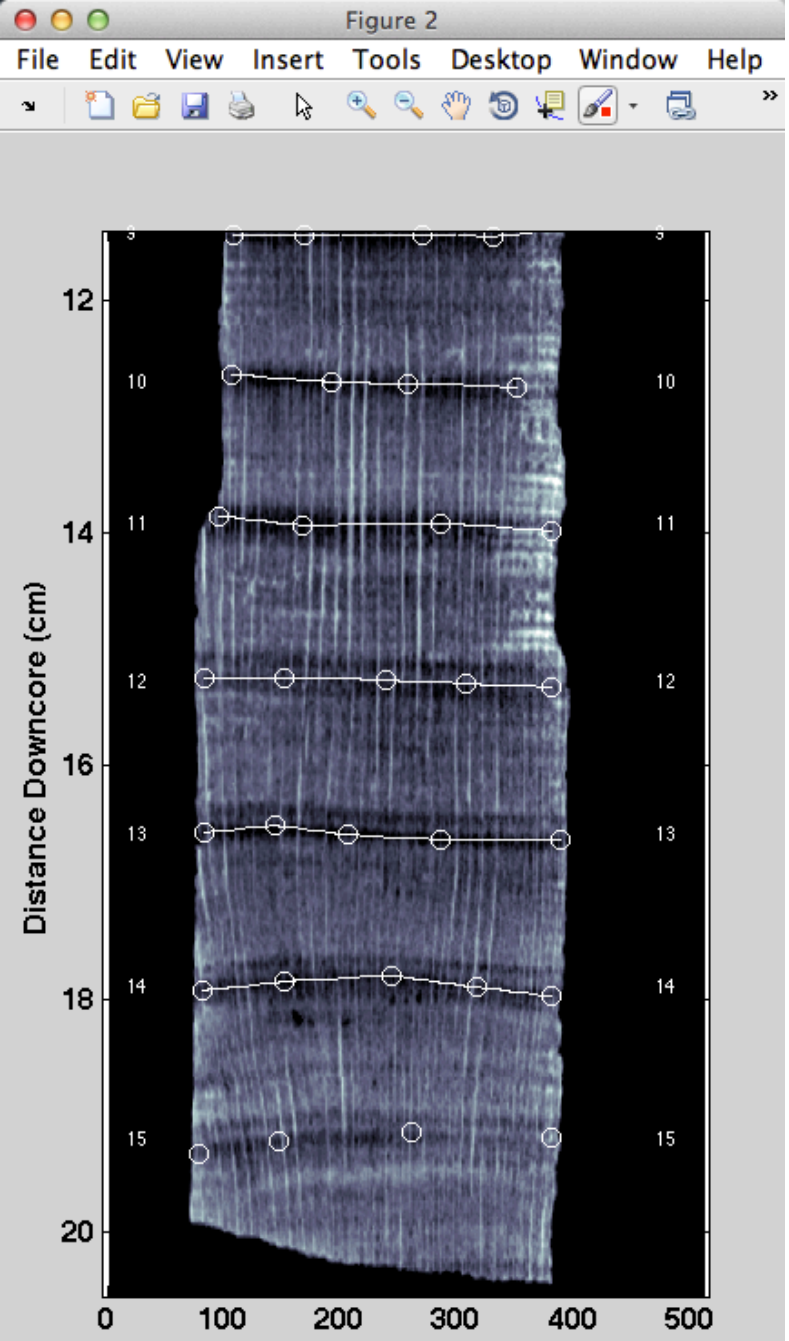
Press “Enter” again, and the cross-hairs will reappear.

Re-define the same band.

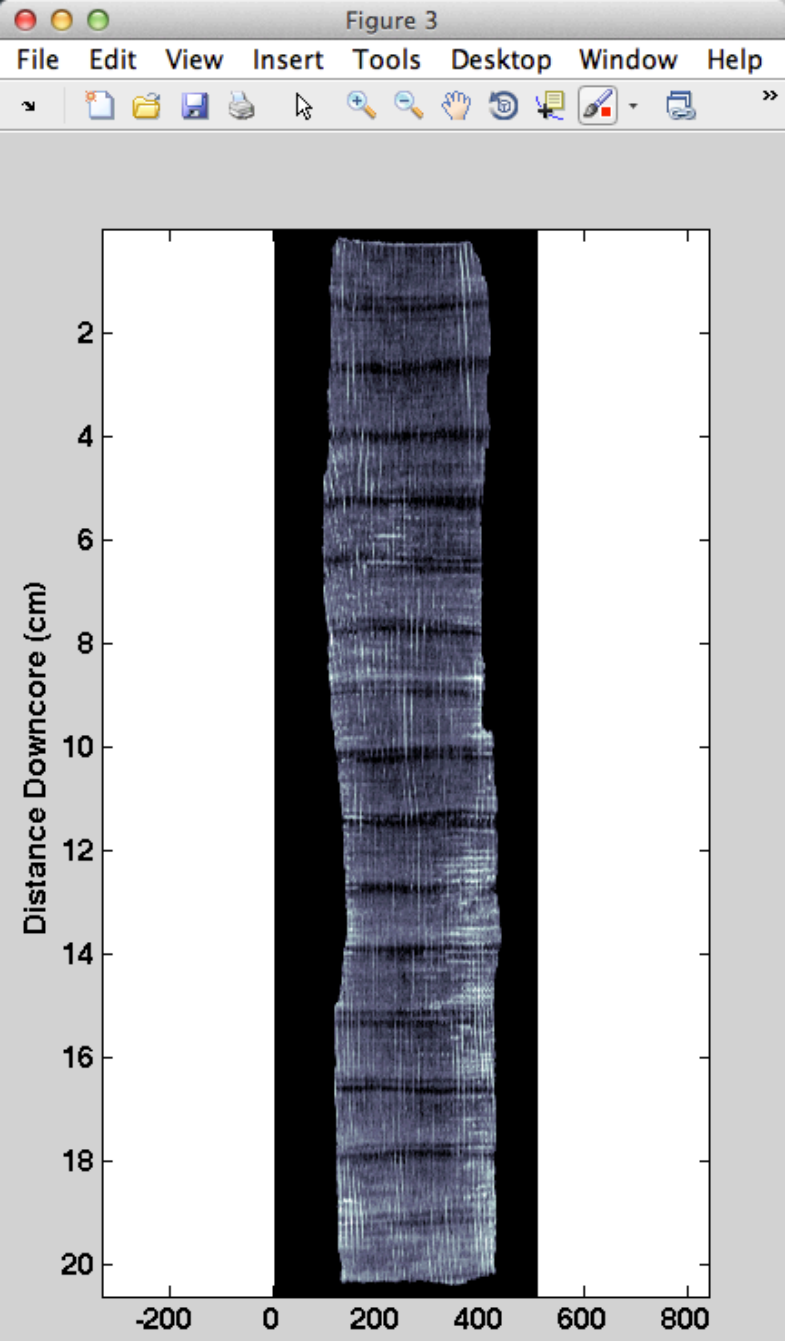


Continue defining bands down-core.

Use the pan button at the top of the figure window to move the view down-core as you go.

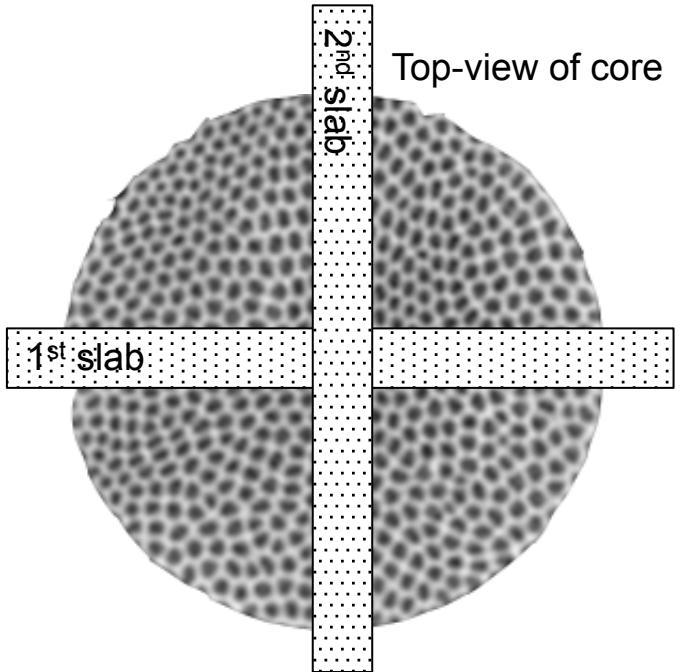


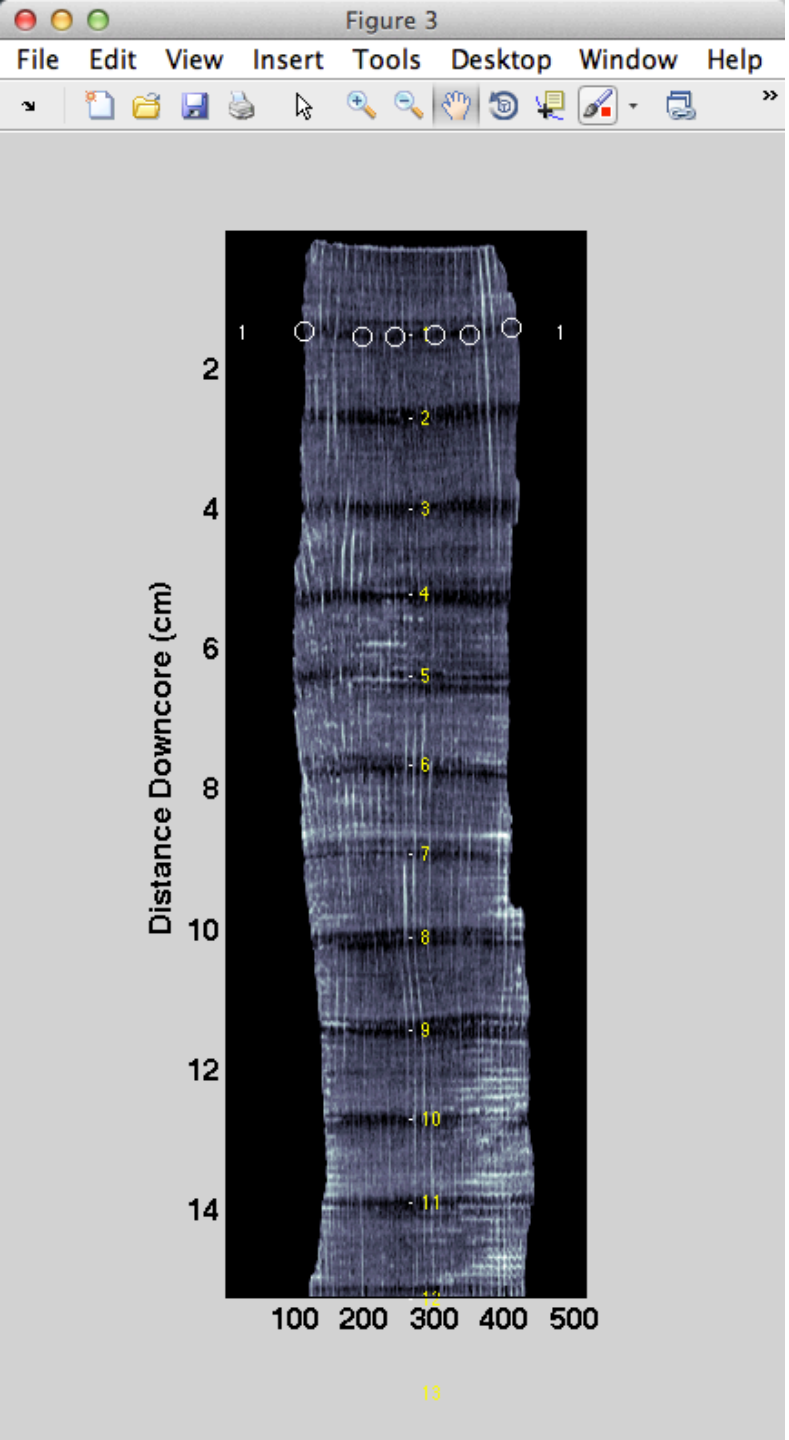
When you get to the bottom of the core, after clicking along the last band, press the “Space bar” on the keyboard, and then press “Enter”.



A new window will appear, which shows another slab perpendicular to the first one.

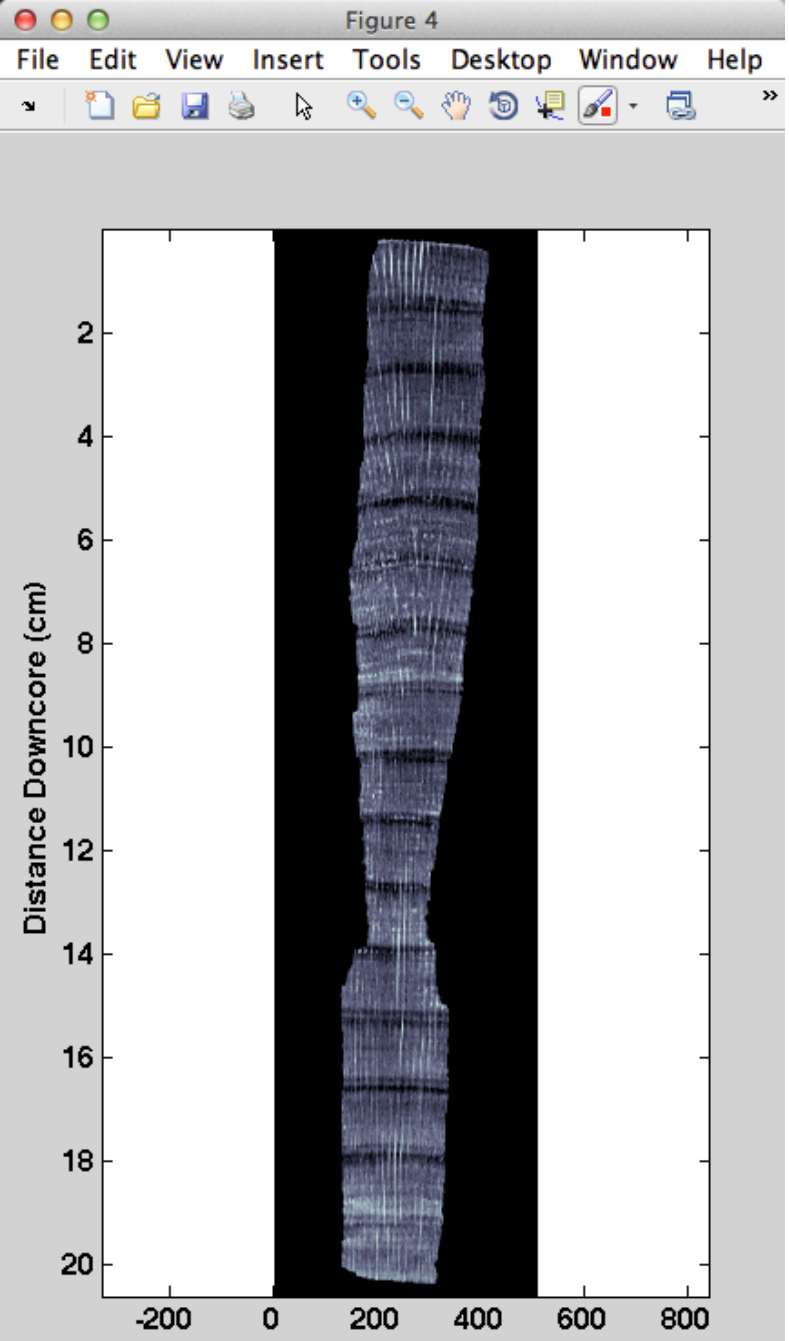
Use the “input” window to adjust the image if needed, but most likely the parameters from the first slab will continue to work well.



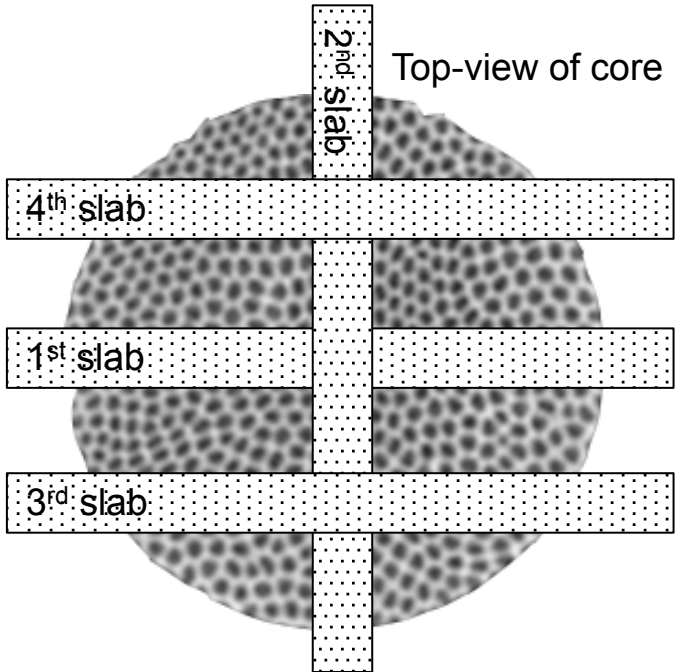


Define bands on this new slab just like on the first one.

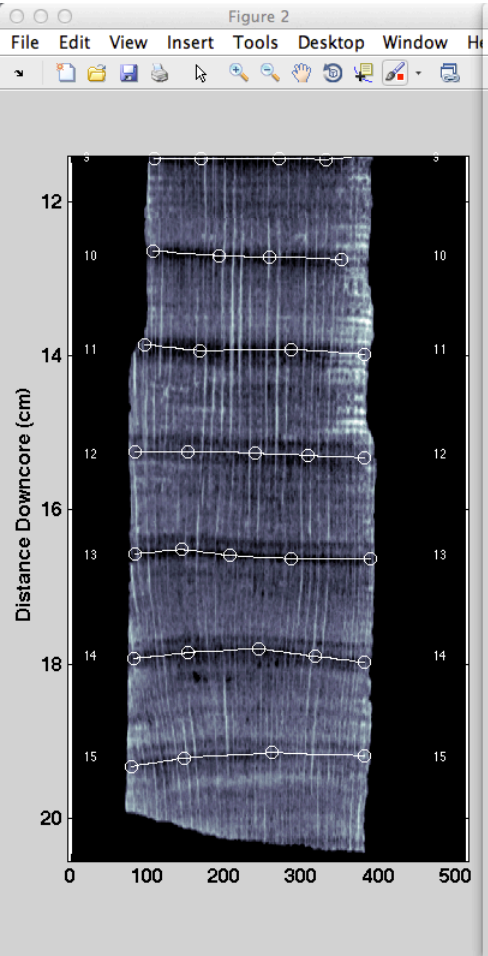
Yellow numbers will appear, indicating where the bands from the first slab intersect the present image. This makes it easy to ensure that your bands in this present image are aligned with those of the first image.

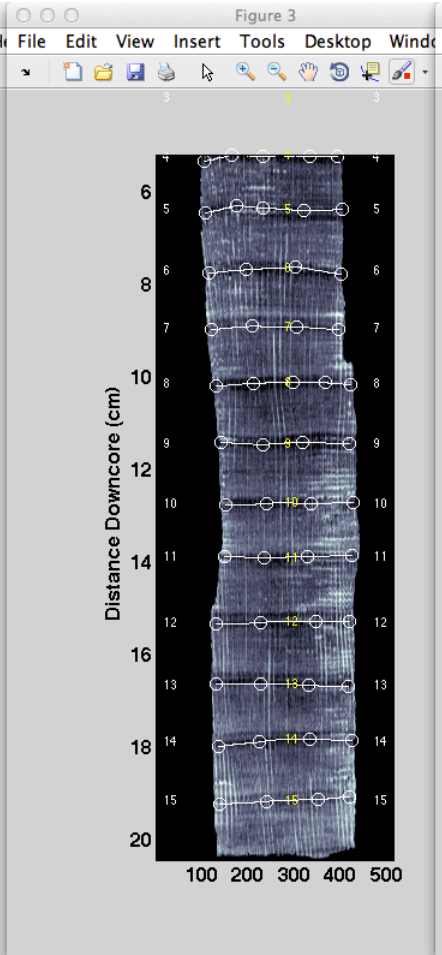


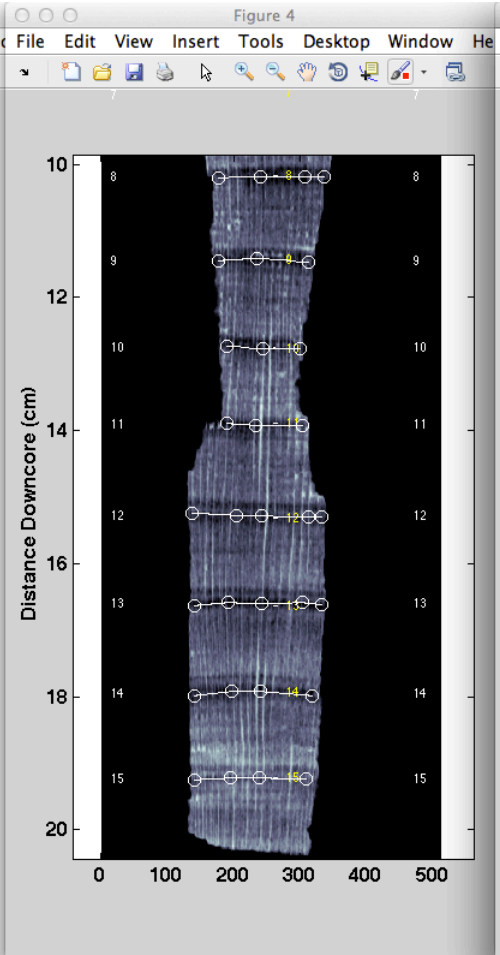
Once you are done with the 2nd slab, a 3rd will appear. This slab is parallel to the 1st, but offset slightly.

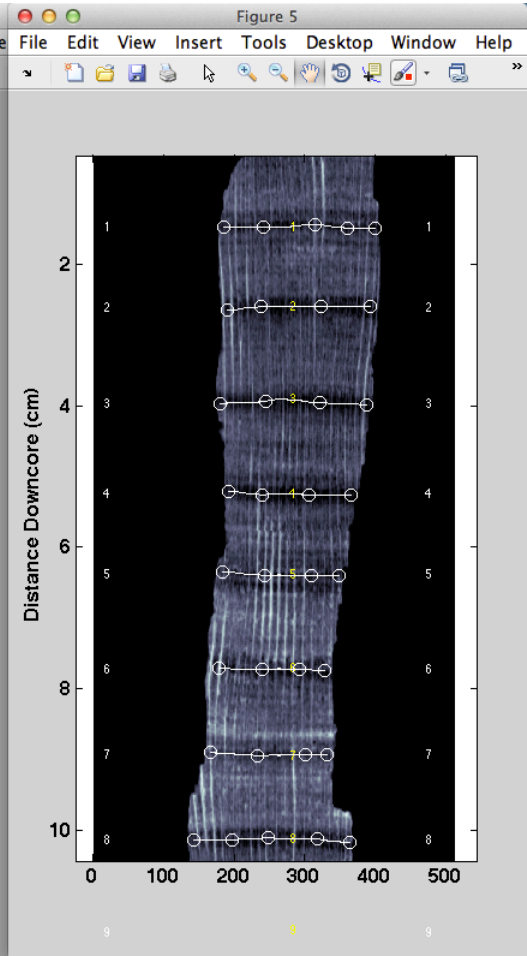


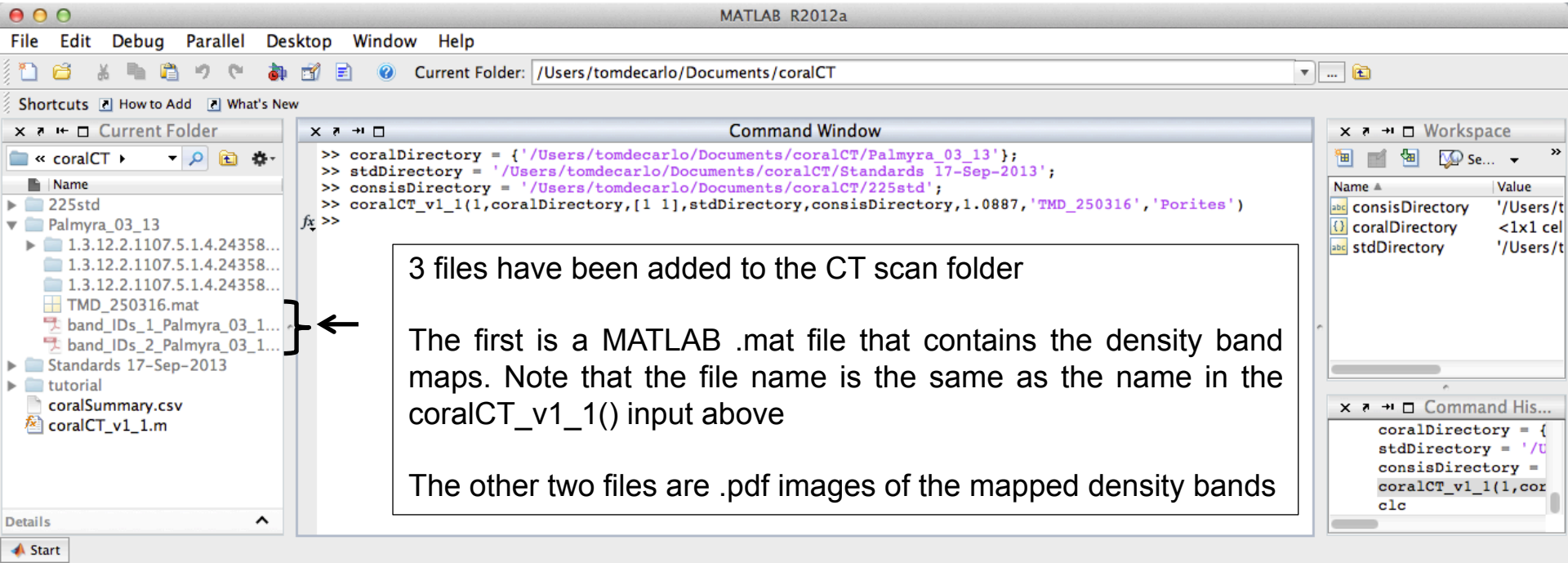
In total, you will define the bands on 4 slabs.









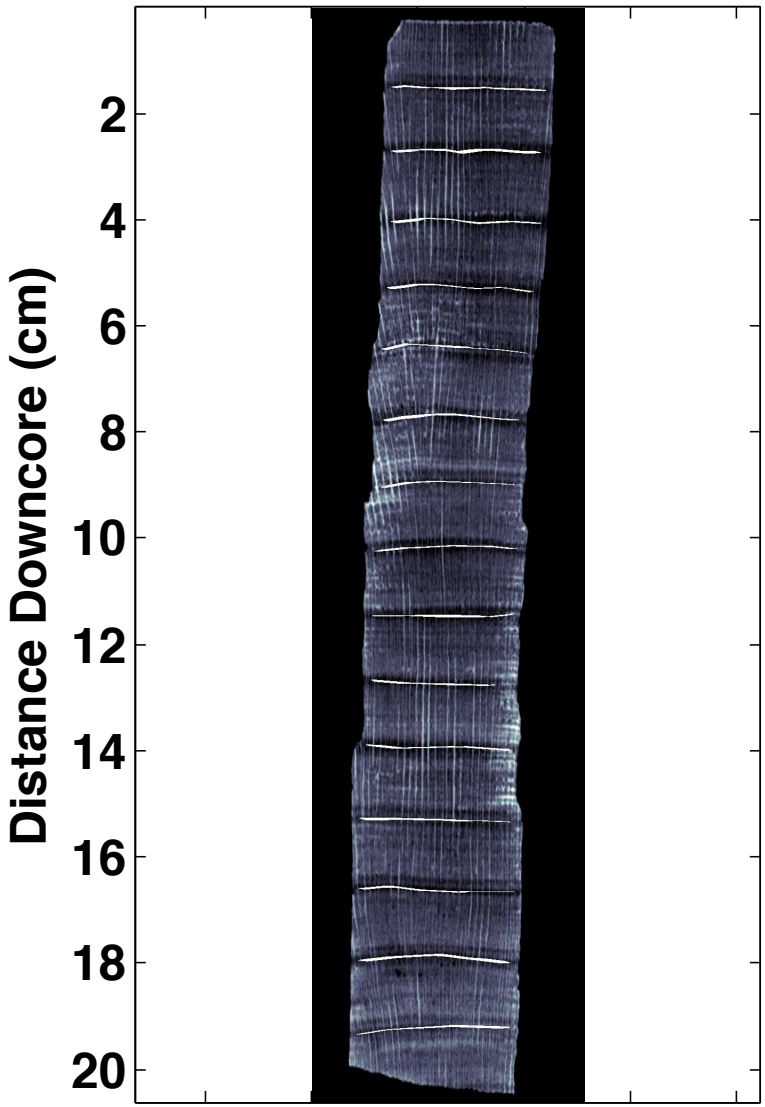


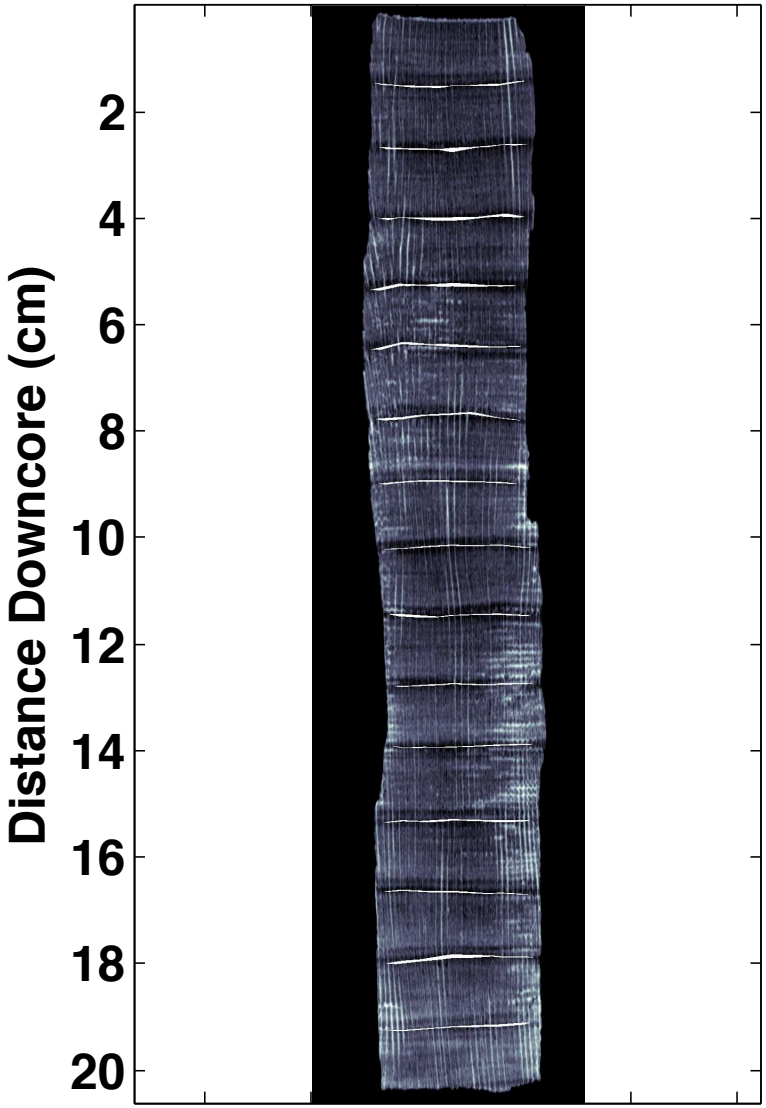
3 files have been added to the CT scan folder

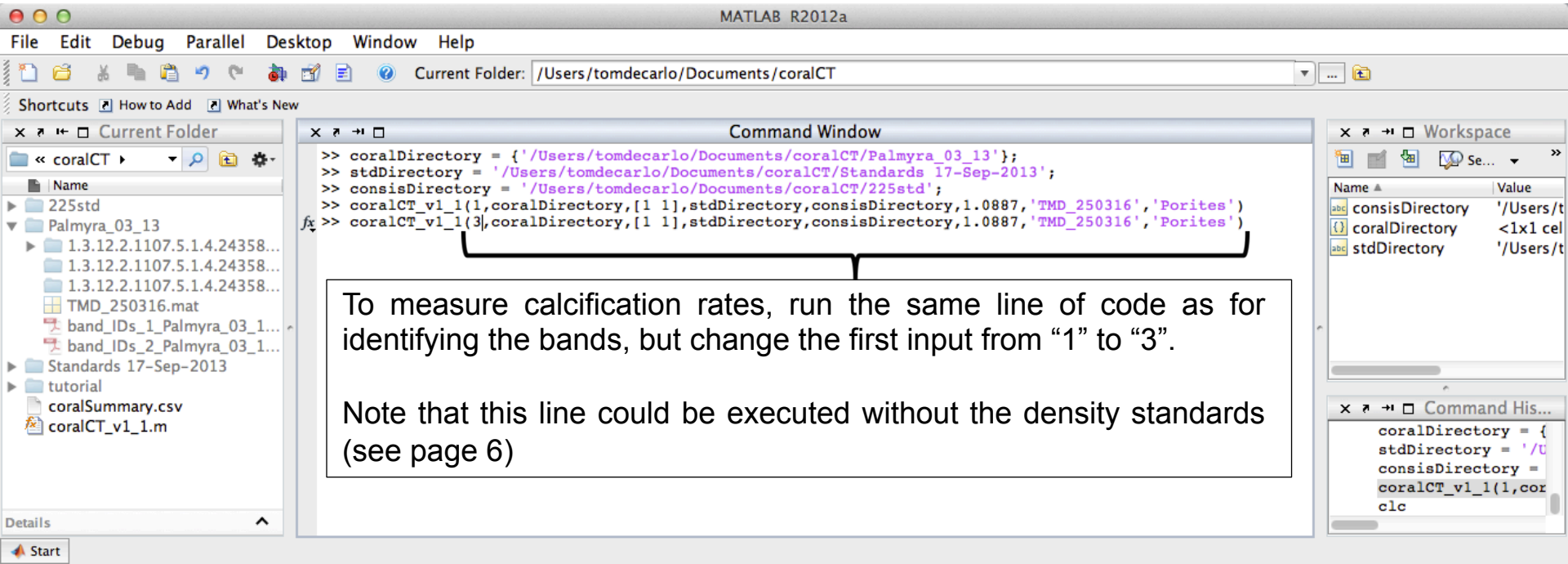
The first is a MATLAB .mat file that contains the density band maps. Note that the file name is the same as the name in the coralCT_v1_1() input above

The other two files are .pdf images of the mapped density bands

The two .pdf files produced show the locations of the mapped density bands (in white) on top of the CT slabs. The two images are the first 2 slabs analyzed, which are perpendicular to each other.

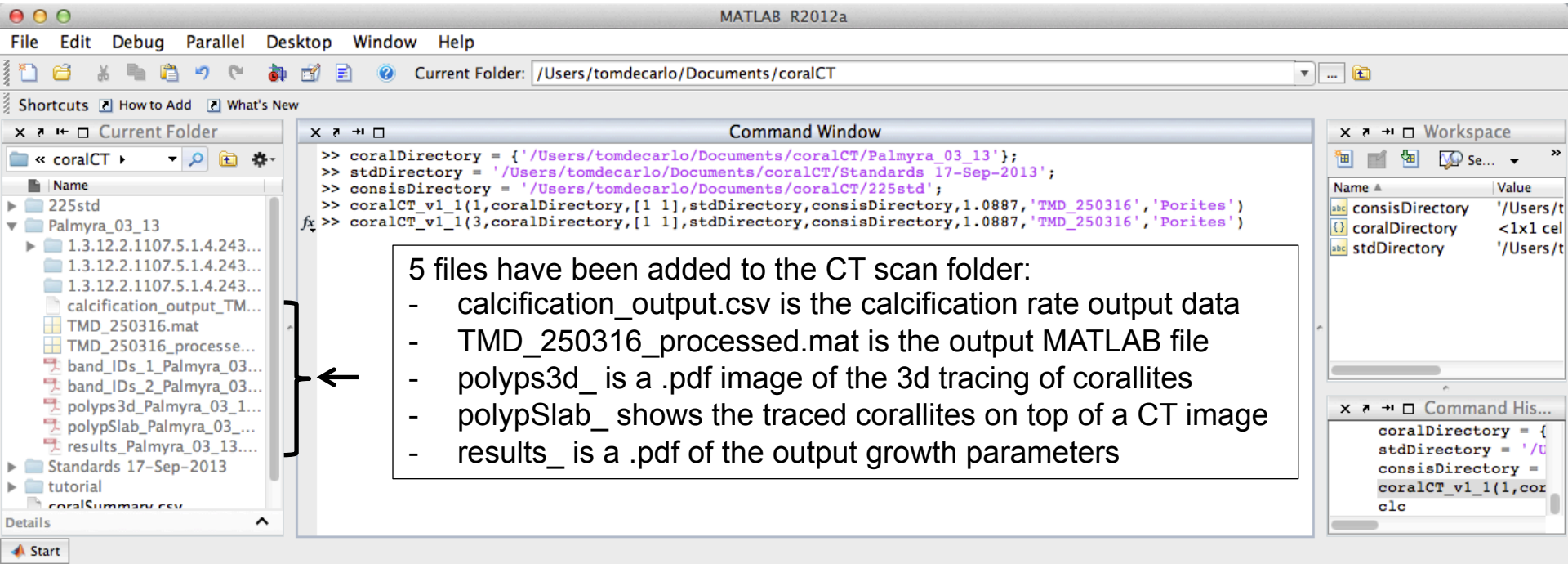






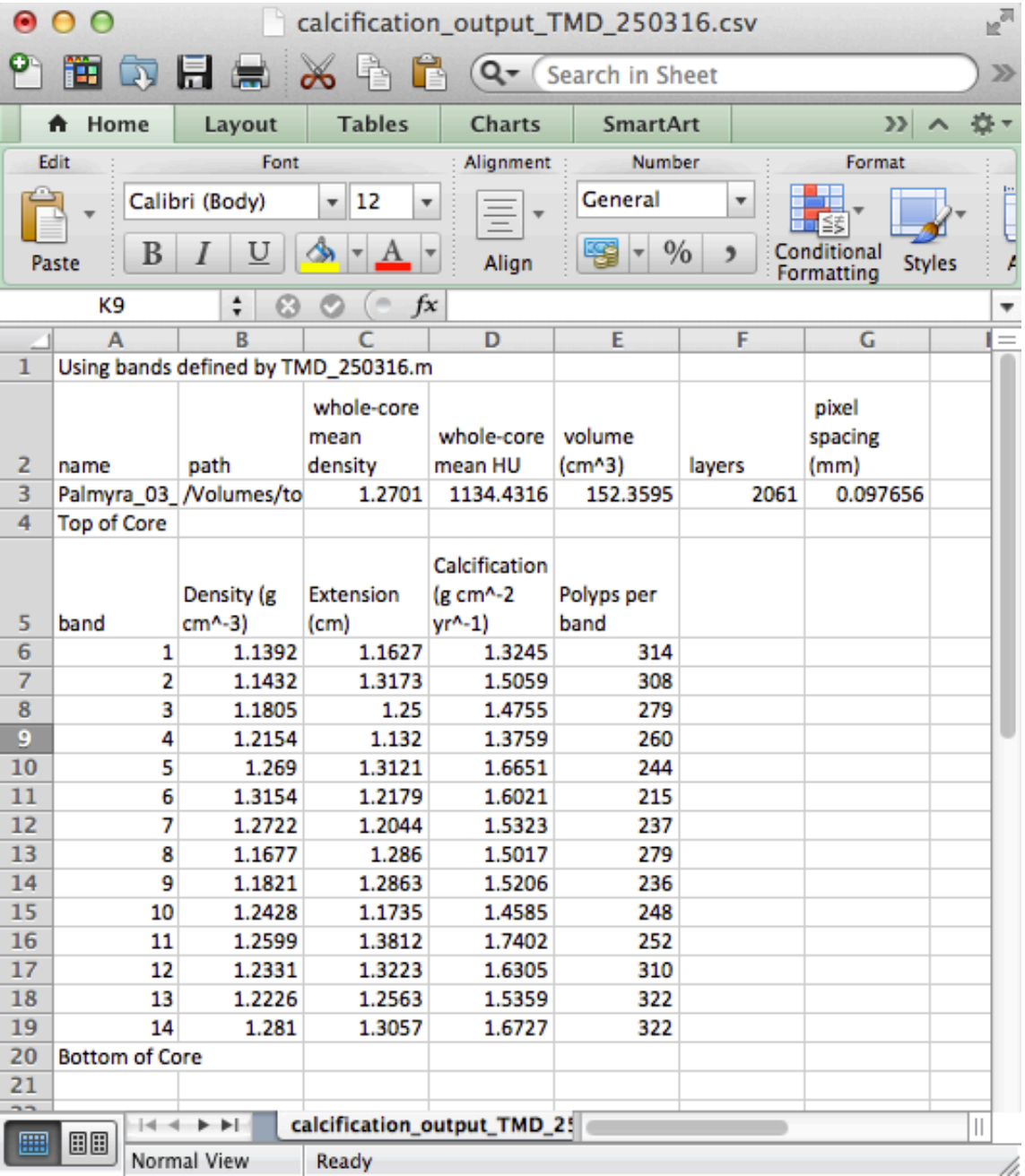
To measure calcification rates, run the same line of code as for identifying the bands, but change the first input from “1” to “3”.

Note that this line could be executed without the density standards (see page 6)



5 files have been added to the CT scan folder:

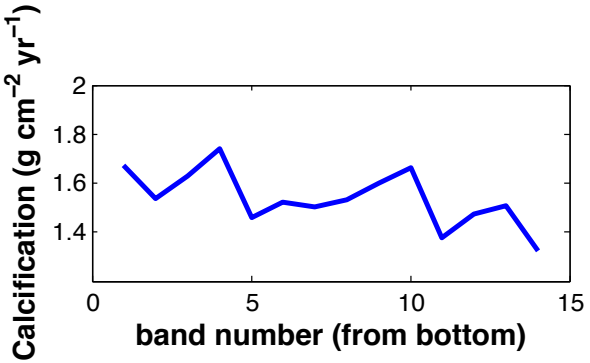
- calcification_output.csv is the calcification rate output data
- TMD_250316_processed.mat is the output MATLAB file
- polyps3d_ is a .pdf image of the 3d tracing of corallites
- polypSlab_ shows the traced corallites on top of a CT image
- results_ is a .pdf of the output growth parameters

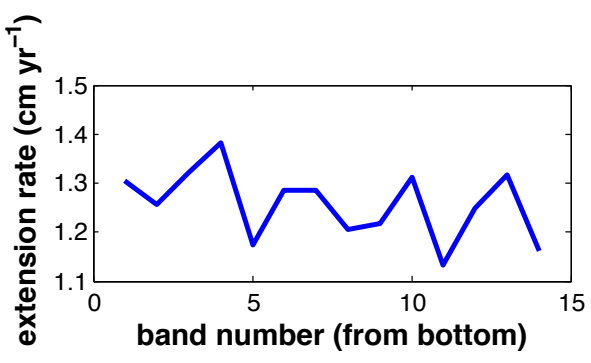


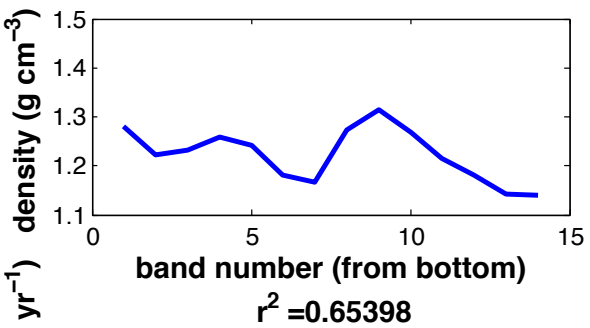
	A	B	C	D	E	F	G
1	Using bands defined by TMD_250316.m						
2	name	path	whole-core mean density	whole-core mean HU	volume (cm^3)	layers	pixel spacing (mm)
3	Palmyra_03_	/Volumes/to	1.2701	1134.4316	152.3595	2061	0.097656
4	Top of Core						
5	band	Density (g cm^-3)	Extension (cm)	Calcification (g cm^-2 yr^-1)	Polyps per band		
6	1	1.1392	1.1627	1.3245	314		
7	2	1.1432	1.3173	1.5059	308		
8	3	1.1805	1.25	1.4755	279		
9	4	1.2154	1.132	1.3759	260		
10	5	1.269	1.3121	1.6651	244		
11	6	1.3154	1.2179	1.6021	215		
12	7	1.2722	1.2044	1.5323	237		
13	8	1.1677	1.286	1.5017	279		
14	9	1.1821	1.2863	1.5206	236		
15	10	1.2428	1.1735	1.4585	248		
16	11	1.2599	1.3812	1.7402	252		
17	12	1.2331	1.3223	1.6305	310		
18	13	1.2226	1.2563	1.5359	322		
19	14	1.281	1.3057	1.6727	322		
20	Bottom of Core						
21							

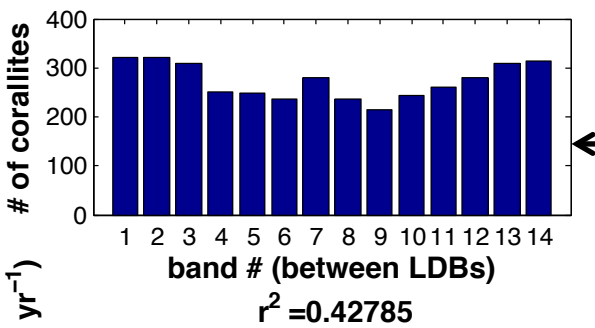
Output .csv file with annual density, extension, and calcification data

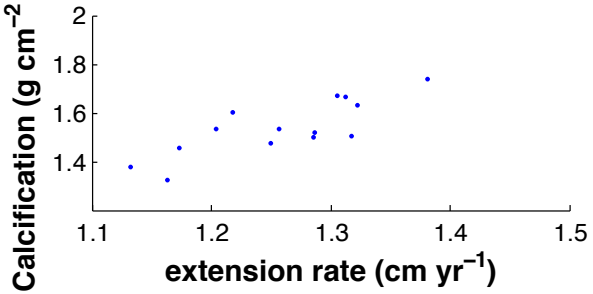
Output .pdf plots of growth parameter time series

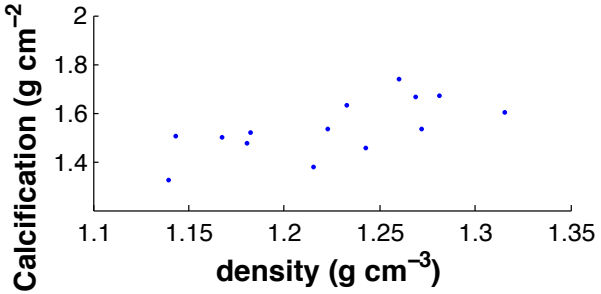




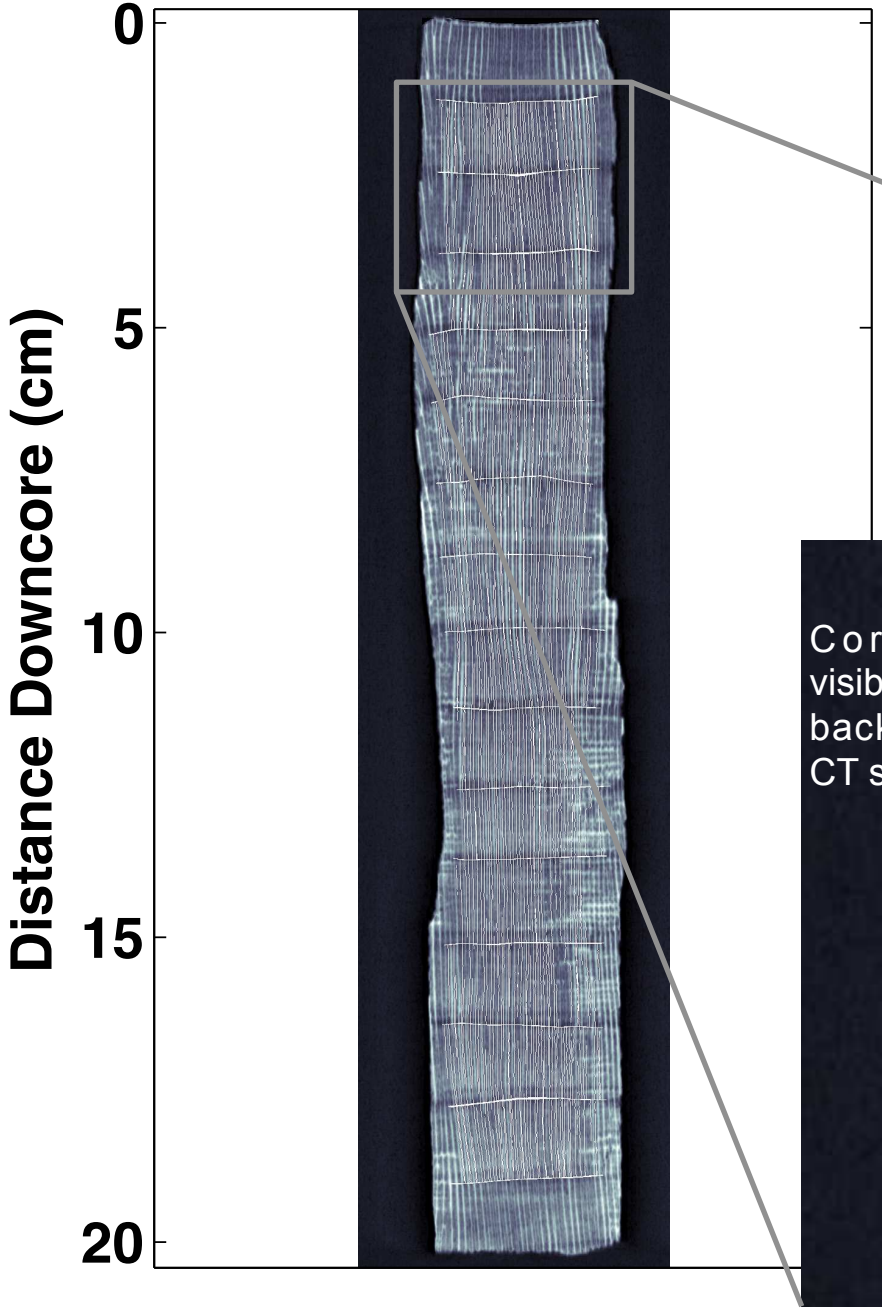






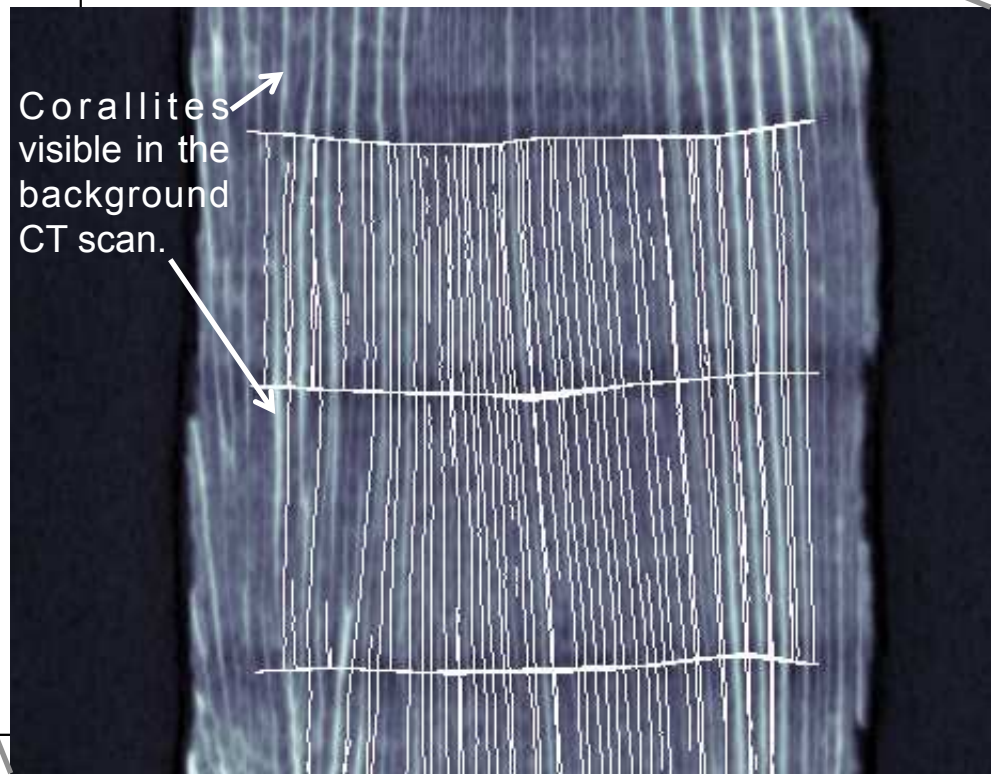


As a quality control check, look at the plot of corallites per year. Ideally, there will be 200-300 per year for a 3-cm diameter *Porites* core. Of course, the number of corallites will be different across species and with different size cores.

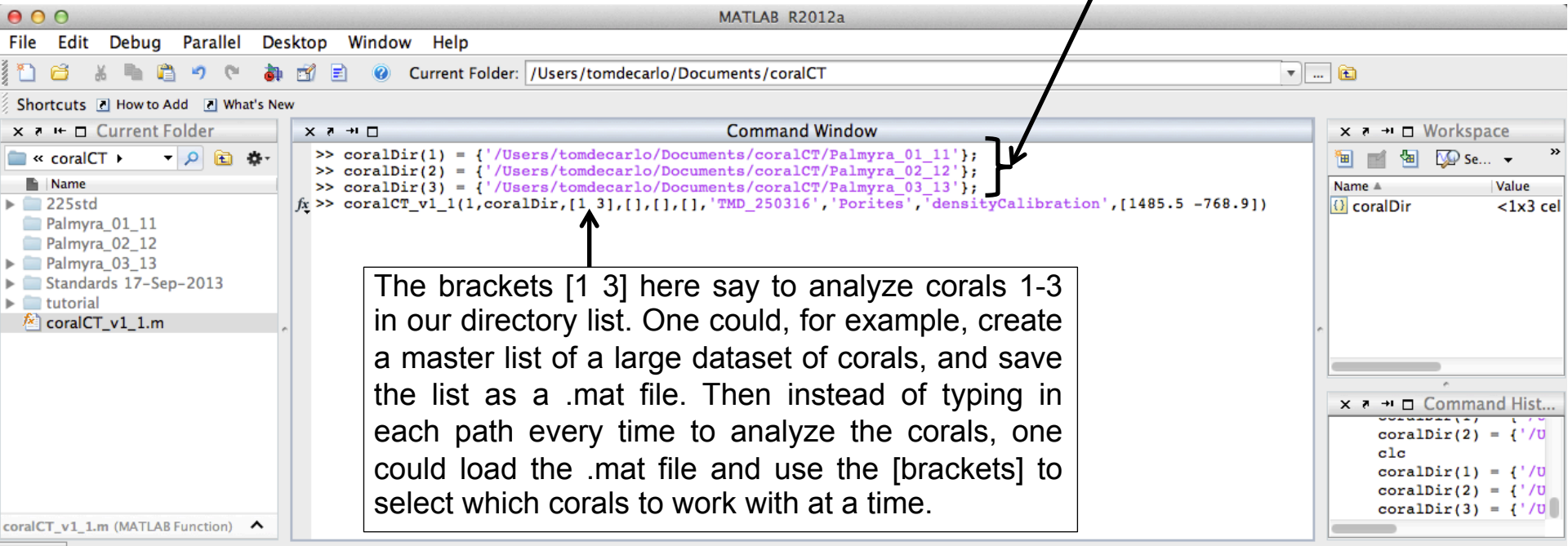


Look at the .pdf file of corallite traces printed on top of a CT slab. Here, the white lines are the paths of each traced corallite within the same region of the core as the slab. The corallites should be visible in the background CT image, and the general growth direction should be consistent with the traced corallites.

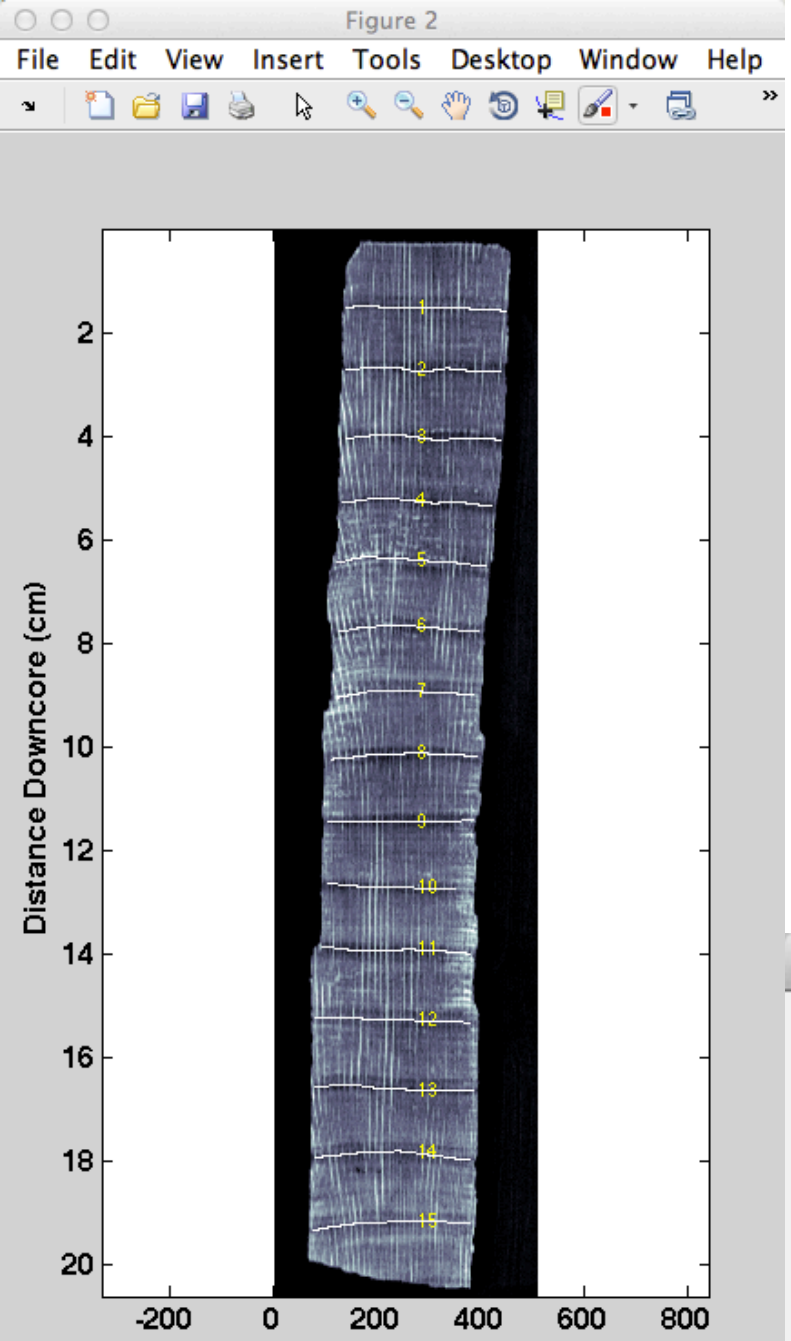
Note that some corallites may seem to disappear – this is only because they were traced outside of this particular slab – so do not worry about this.



You may enter the paths for multiple corals in the directory. When one coral is finished, the code will immediately move on to the next.



The brackets [1 3] here say to analyze corals 1-3 in our directory list. One could, for example, create a master list of a large dataset of corals, and save the list as a .mat file. Then instead of typing in each path every time to analyze the corals, one could load the .mat file and use the [brackets] to select which corals to work with at a time.



Banding maps may be edited by using the "2" action input into the coralCT() line. The existing map will be loaded and an editing dialog box will appear alongside, as indicated here.