Fit\_backbone.m

This script will analyze and return the MT backbone in a structure.

You need to set the fit\_params.cr\_start and .cr\_end to be the start and end of the MT contour. These points will define your reference line. You can read the coordinates (in pixels) from ImageJ.

The results will be a structure stored in your workspace. You will also see 3 figures.

Figure 1 is a plot of the contour and the displacement along it. Figure 2 is a kymograph with red lines attempting to find the edges of the MT. (this is not used again and can be ignored) and Figure 3 gives the displacement along the contour and the RMX displacement as a function of length.

Graphical user interface, text, application

Description automatically generated

The output 3 figures. Figure 3 is the most important.

Graphical user interface, application

Description automatically generated

And the output results:

Text

Description automatically generated with medium confidence

Now you want to save the workspace since result has all the info in it you need. Here we will save it as “backbone.mat” and include this file on GitHub. Note you will need the curve fitting toolbox for this to work.

Next we run the “analyze backbones.m” file using our previous result and assigning the output the the various variables in case we want them later :

>> *[acorr,meansigsqr,plateau\_value, plateau\_data,sigmasquared, numSample ,meandY3point,noise\_estimate\_3point,noise\_corr3point,noise\_corr\_abs3point,...*

*sigma\_3\_twoThirds3pt,f, gof, slope, yintercept, Xintercept\_seed\_positions,Lp,Lplower,Lpupper,dYsqr\_3point...*

*] = analyze\_backbones(result)*

When run a window will pop up that is showing you the analysis as follows:

Diagram

Description automatically generated

An example screen shot of the backbone analysis

The top window is the perpendicular displacement of this piece

The second window is the autocorrelation ( MSD) calculation

The third window is the sigma squared ( plateau value)

The fourth window is the sigma^2/3 which should be linear.

Once it runs through the tube a window pops up showing the data with the fit:

Graphical user interface, chart, line chart

Description automatically generated

And the value of Lp for this tube is saved in the workspace :

Shape, rectangle

Description automatically generated

So for this example the Lp value if 6.6 mm with a 95%CI from {6.3 to 7.0}

And save the workspace. Here we save as ‘example\_backbone\_analysis.m’

Then repeat this for each backbone you have and collect the Lp data in PRISM for further visualization and analysis.

To generate Simulated MT run

SIM\_dynamic\_MT.m

You can change the min and max growth length in line 30-31

You can change the number of run and kappa values in lines 48 and 50

You set the ourput dir on line 26 ‘parent folder’ in which sub folders will be created

You can change the BG and BGstdev in lines 113-122 for different runs

When the script is finished the movie will be in the parent folder subdirectory that corresponds to the BG and BGStdev.

It is also very useful to save the entre workspace when the movie is finished so you have all the parameters used for each generated simulated microtubule.