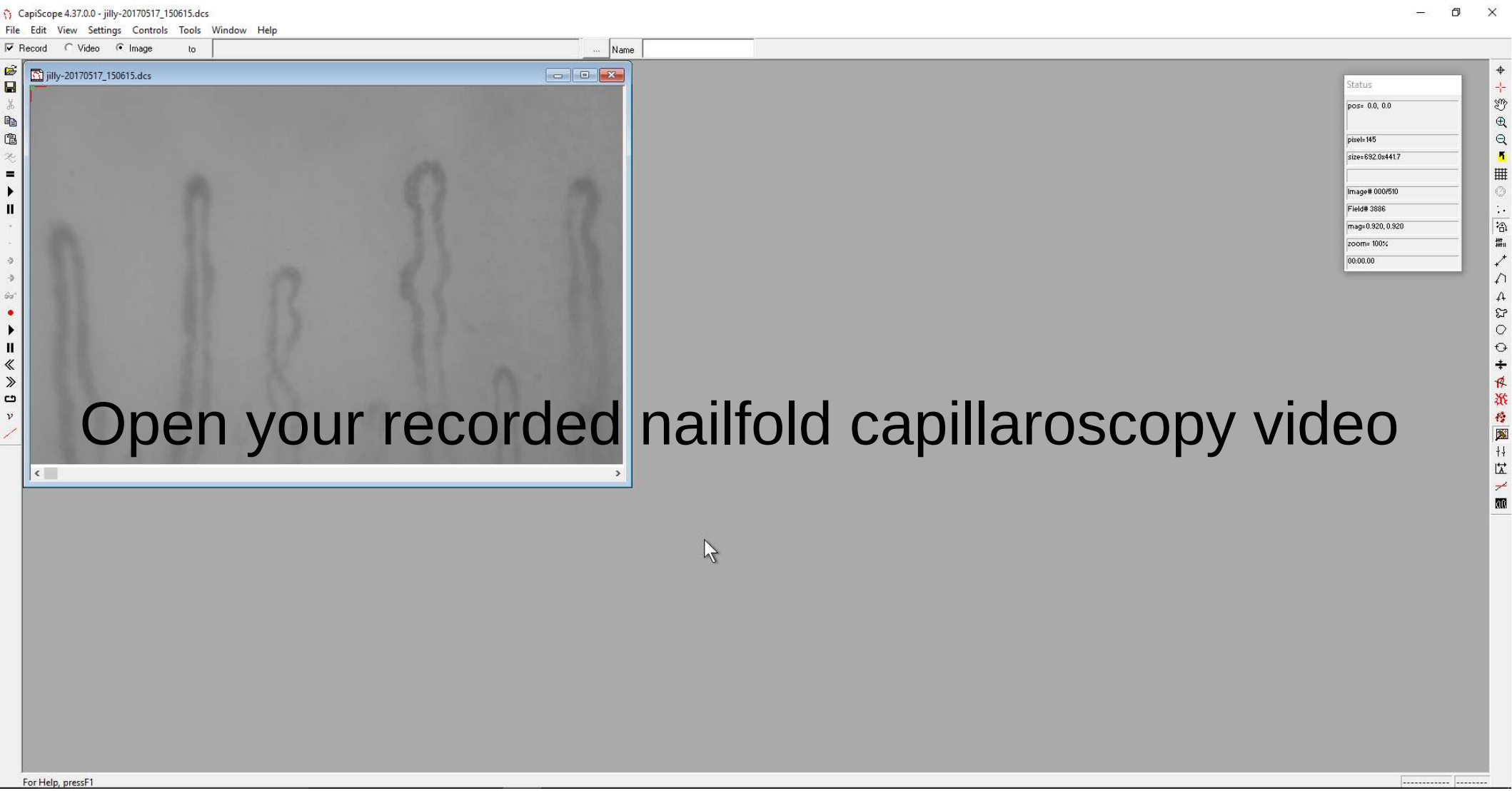
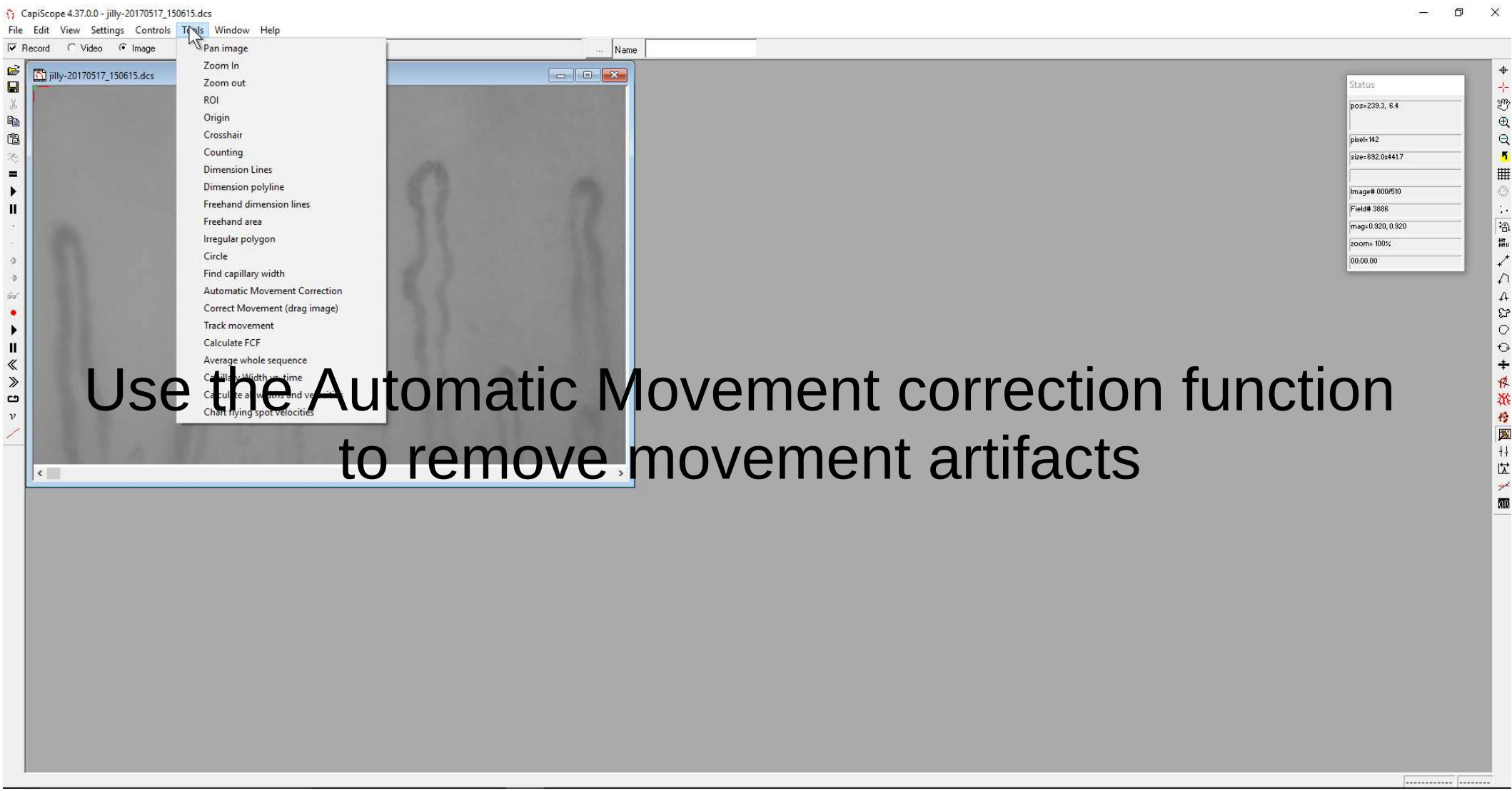
Capillary Velocity

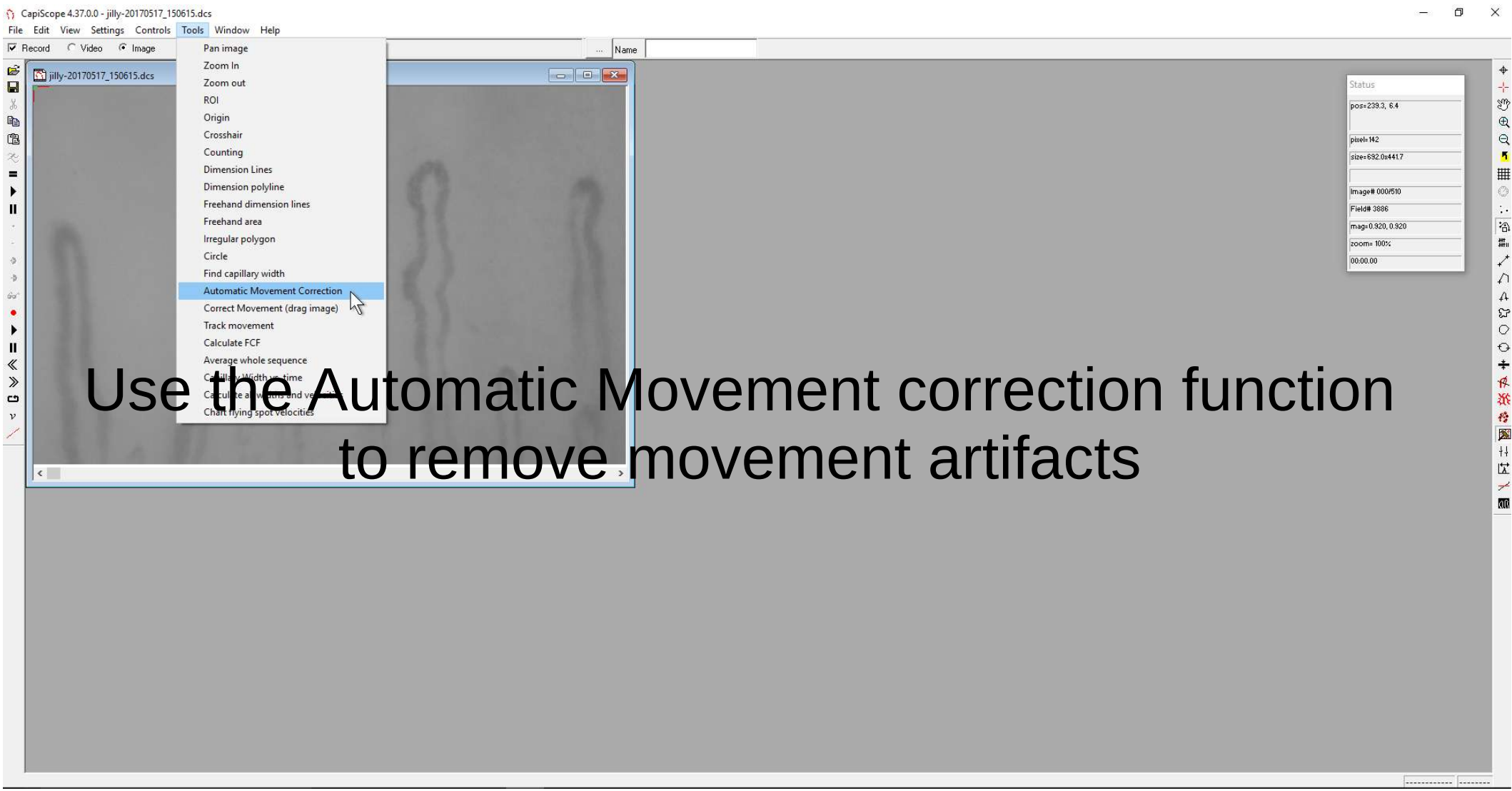


Automatic Movement correction



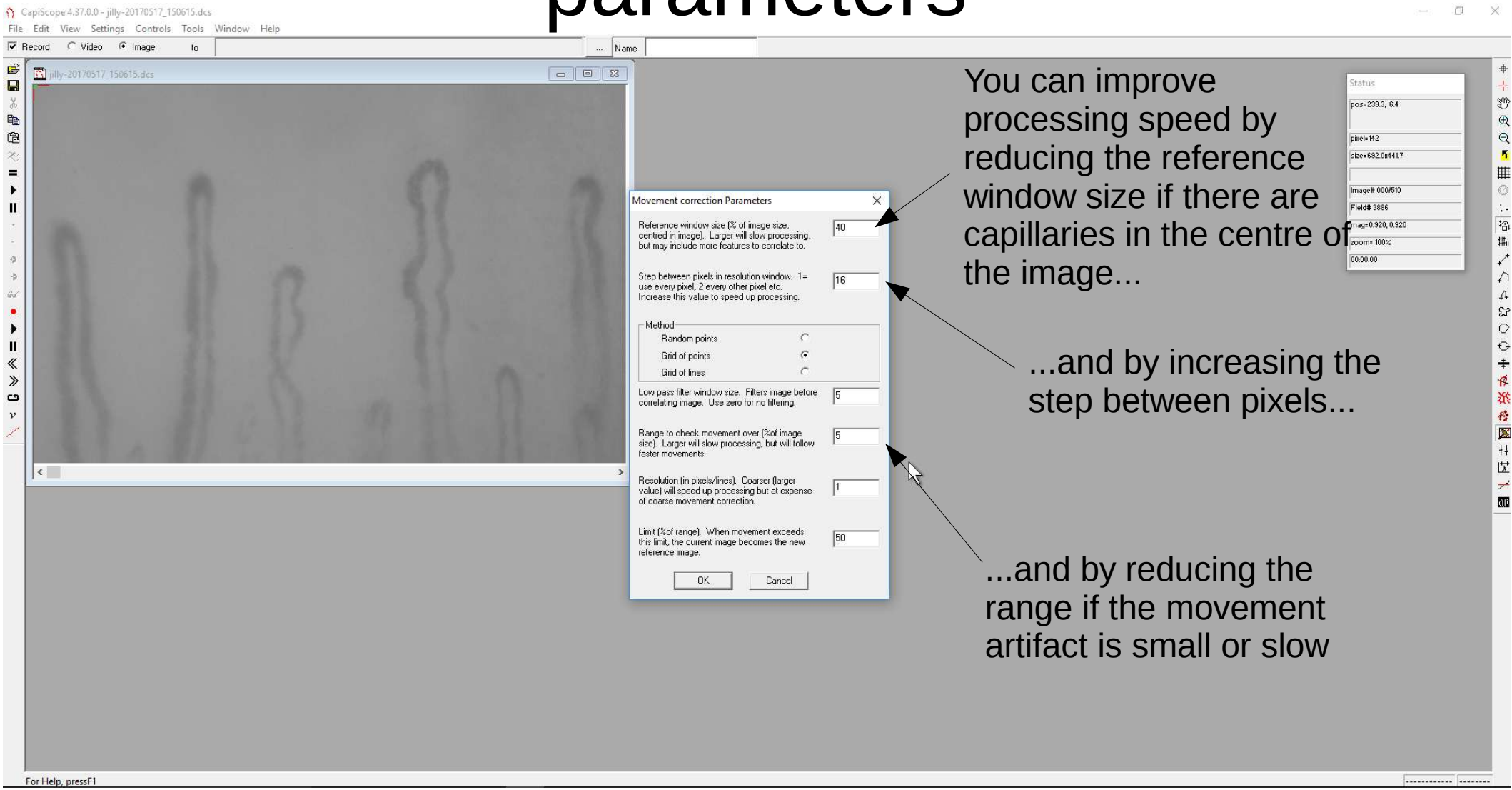
Use the Automatic Movement correction function to remove movement artifacts

Automatic Movement correction



Use the Automatic Movement correction function to remove movement artifacts

Automatic Movement correction parameters

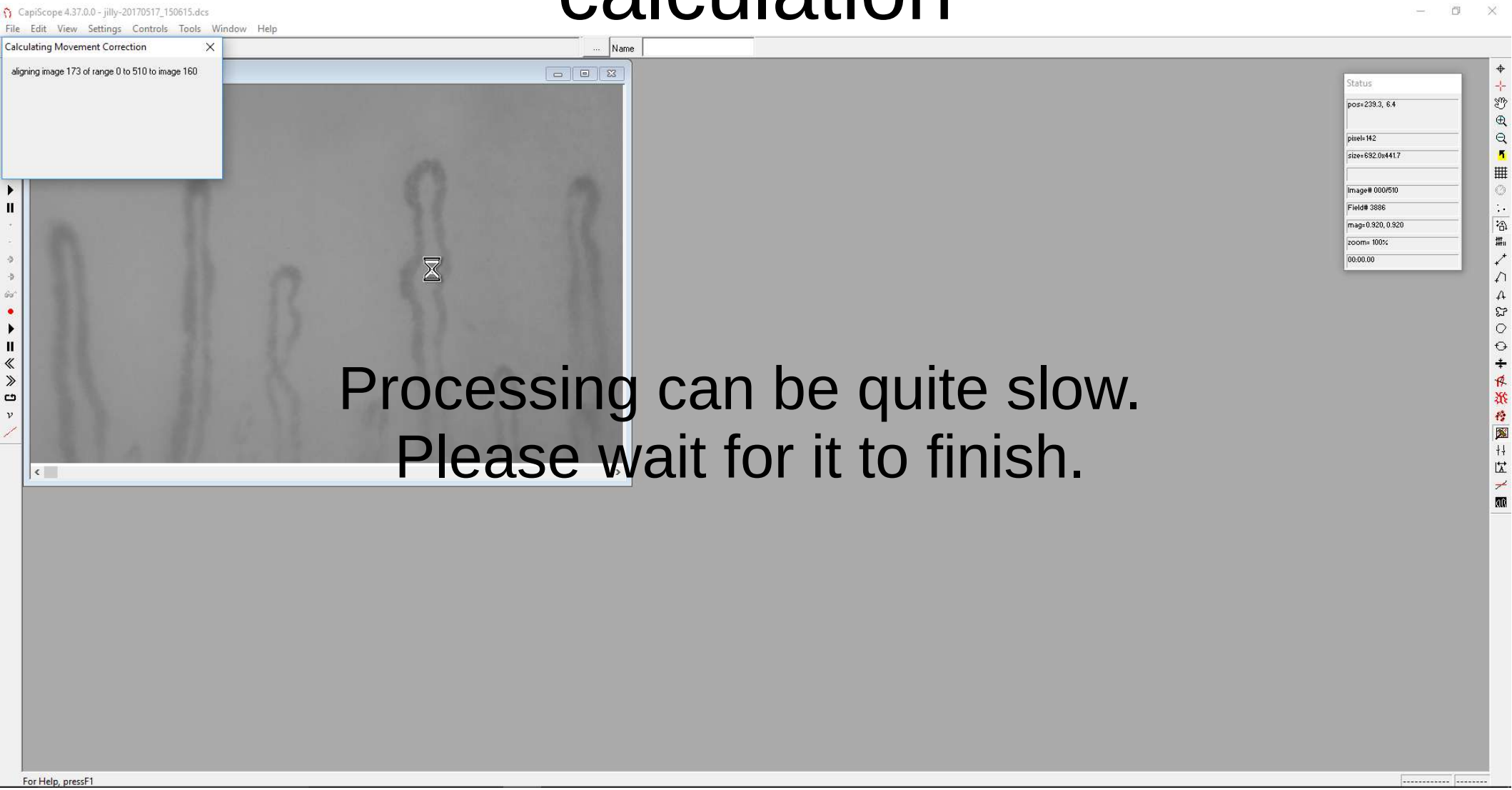


You can improve processing speed by reducing the reference window size if there are capillaries in the centre of the image...

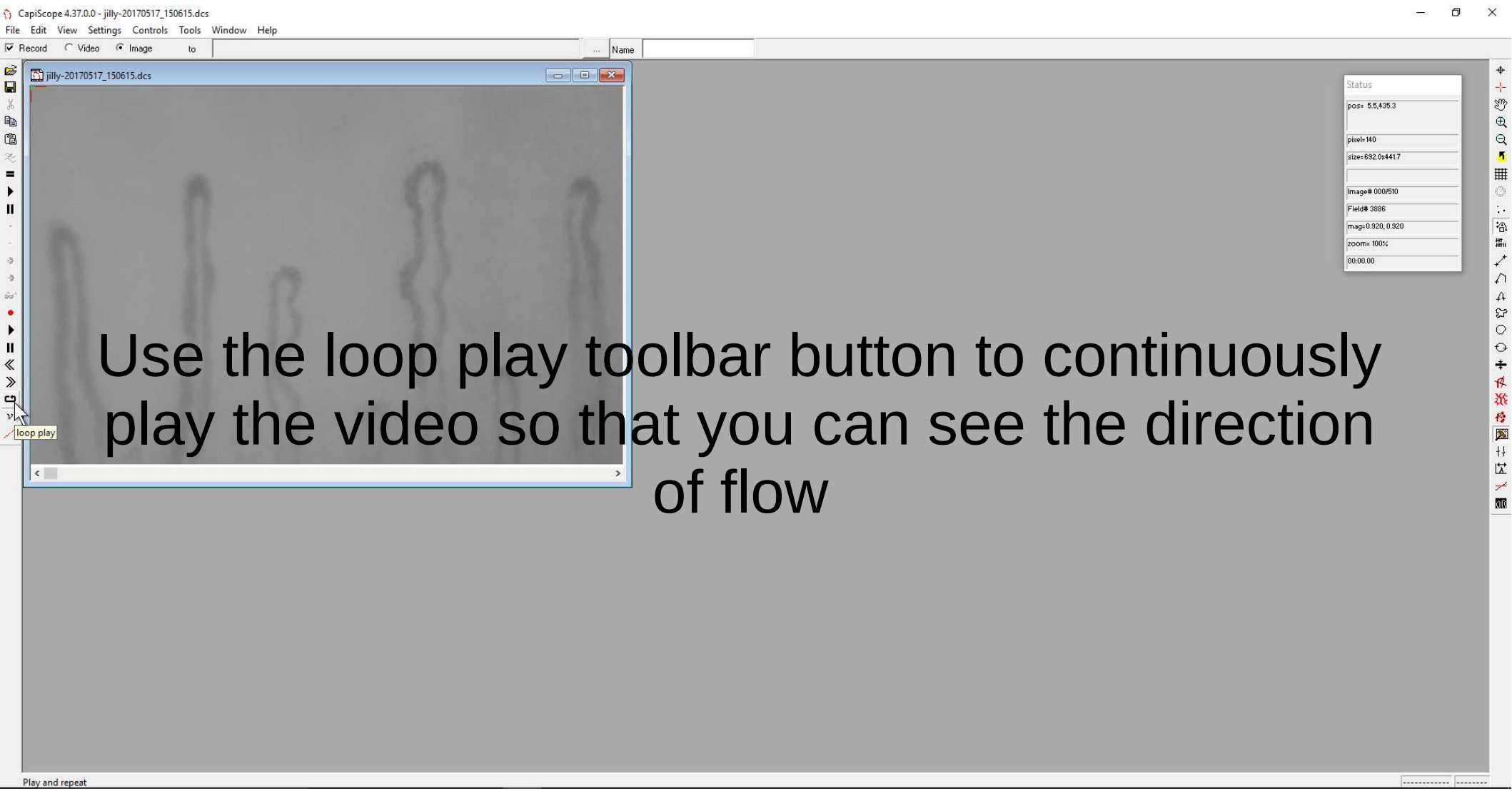
...and by increasing the step between pixels...

...and by reducing the range if the movement artifact is small or slow

Automatic Movement correction calculation

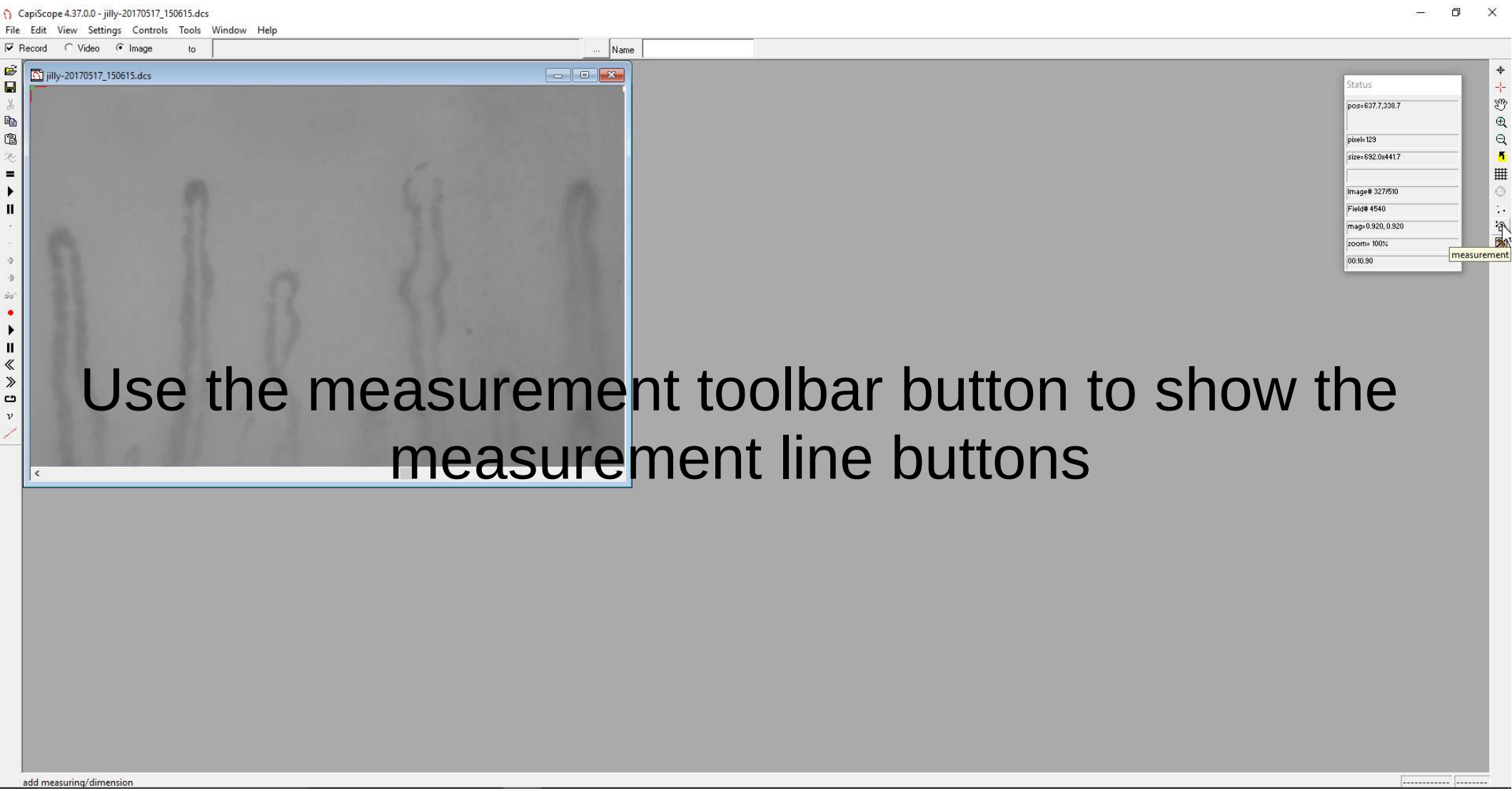


Loop Play



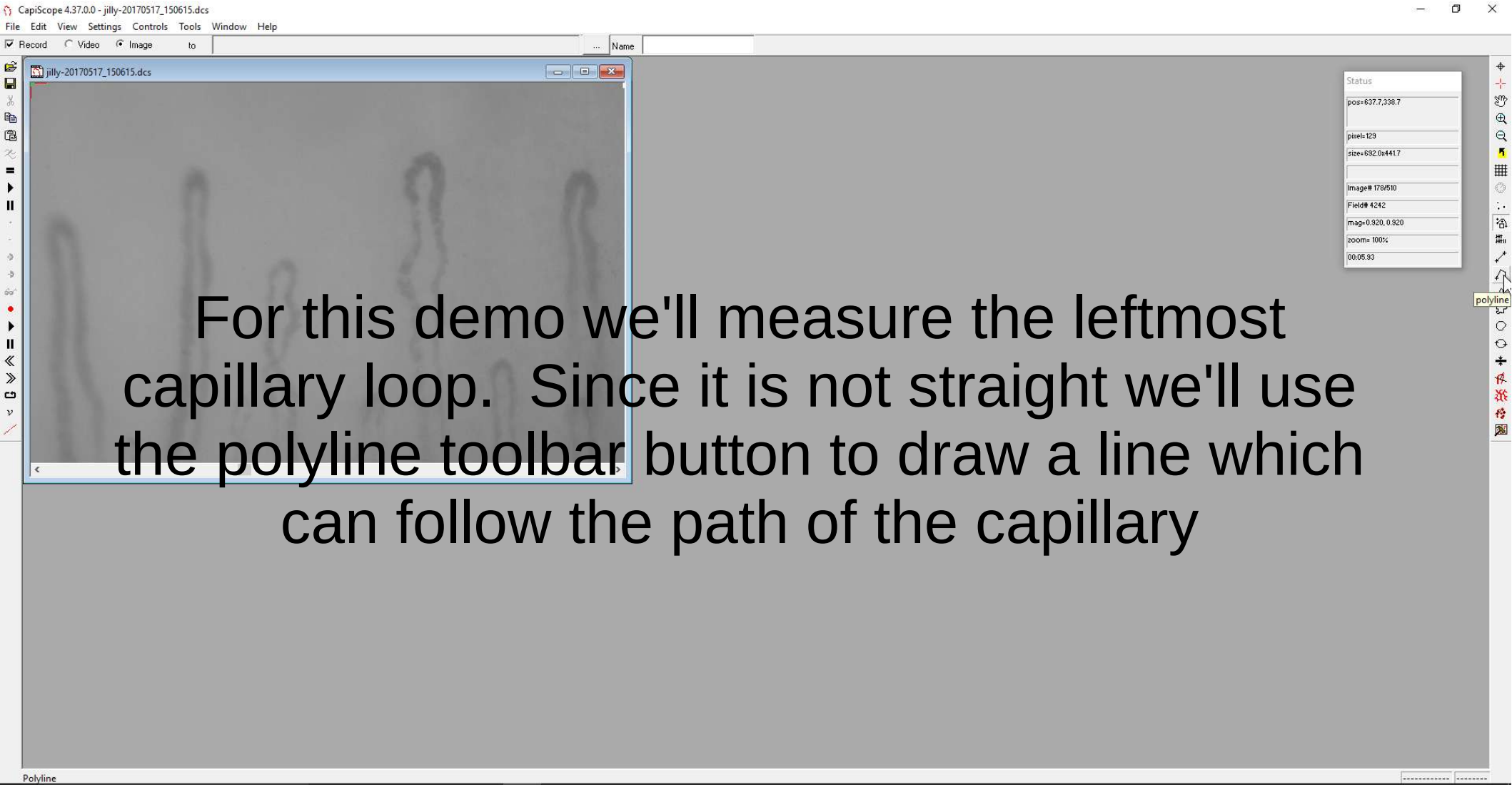
Use the loop play toolbar button to continuously play the video so that you can see the direction of flow

Measurement line



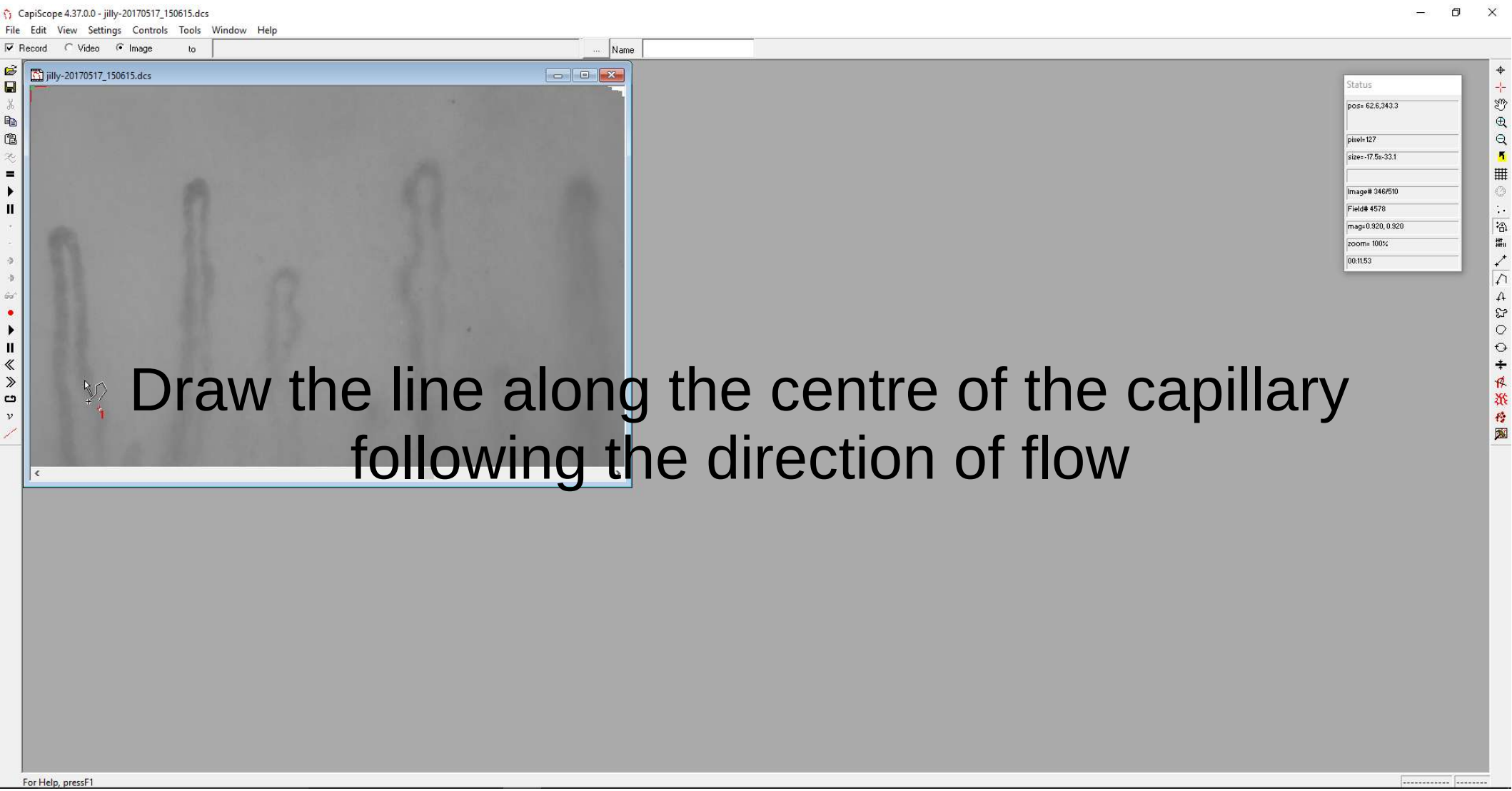
Use the measurement toolbar button to show the measurement line buttons

Measurement polyline

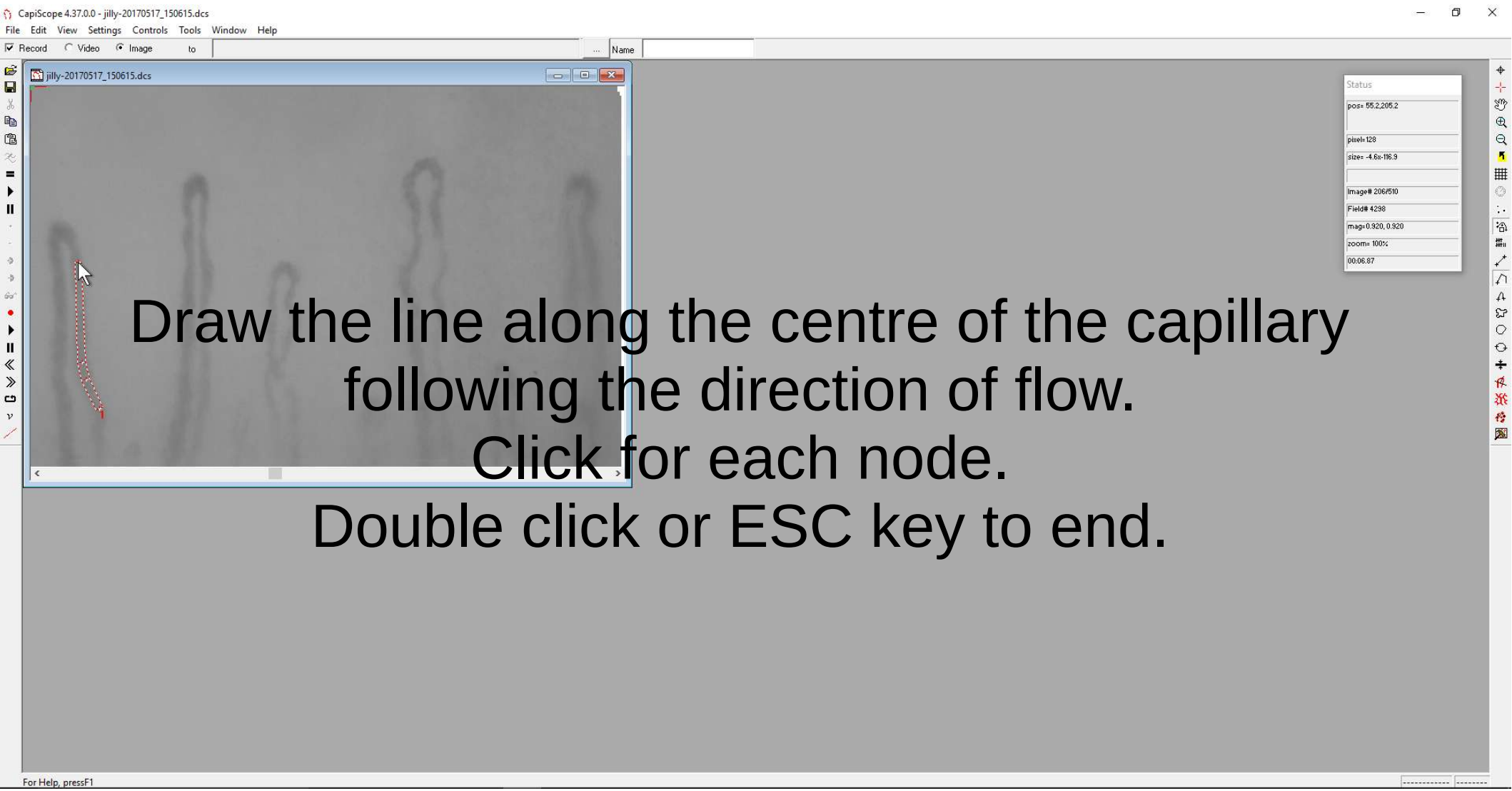


For this demo we'll measure the leftmost capillary loop. Since it is not straight we'll use the polyline toolbar button to draw a line which can follow the path of the capillary

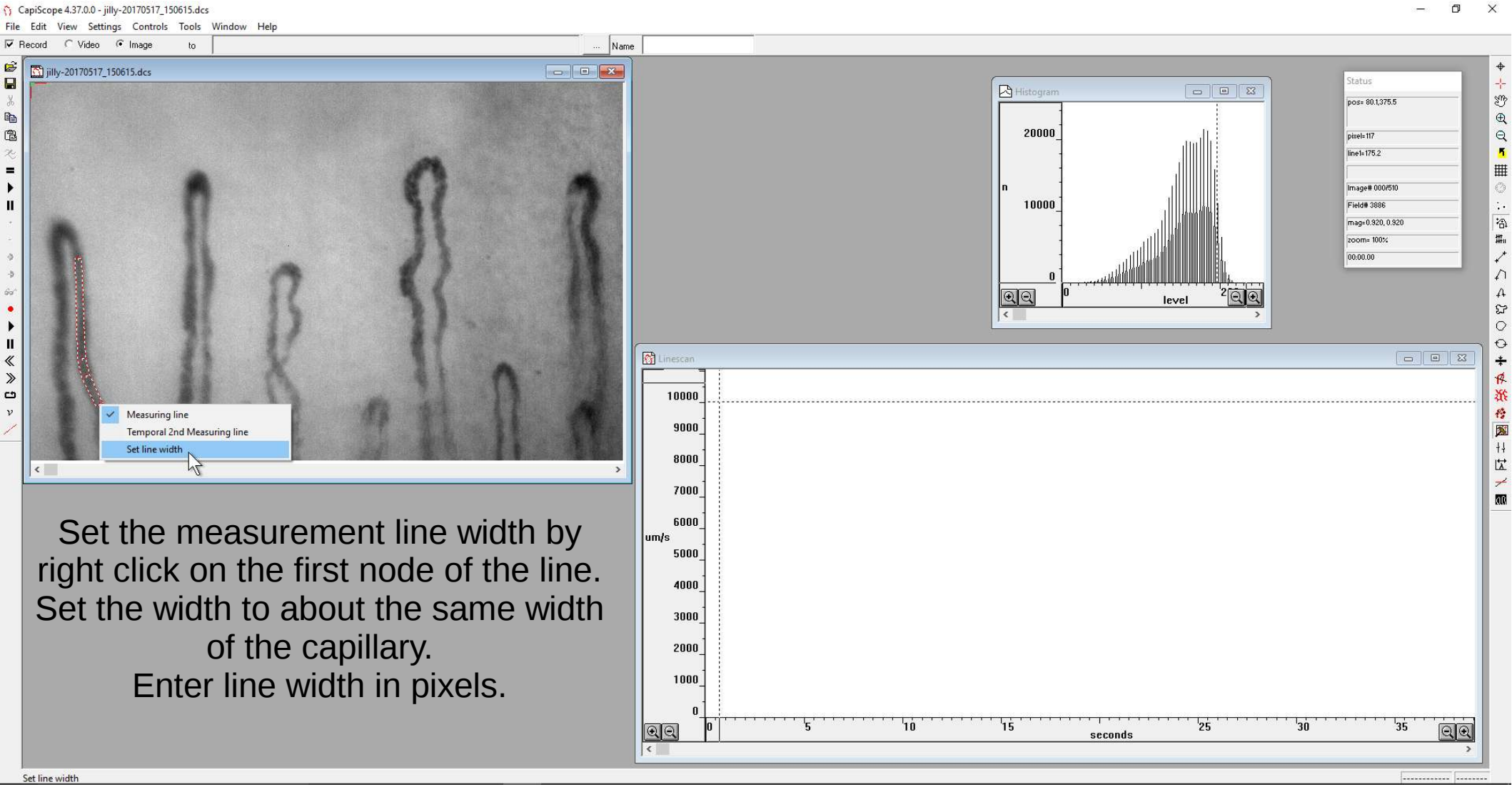
Drawing the Measurement line



Measurement line



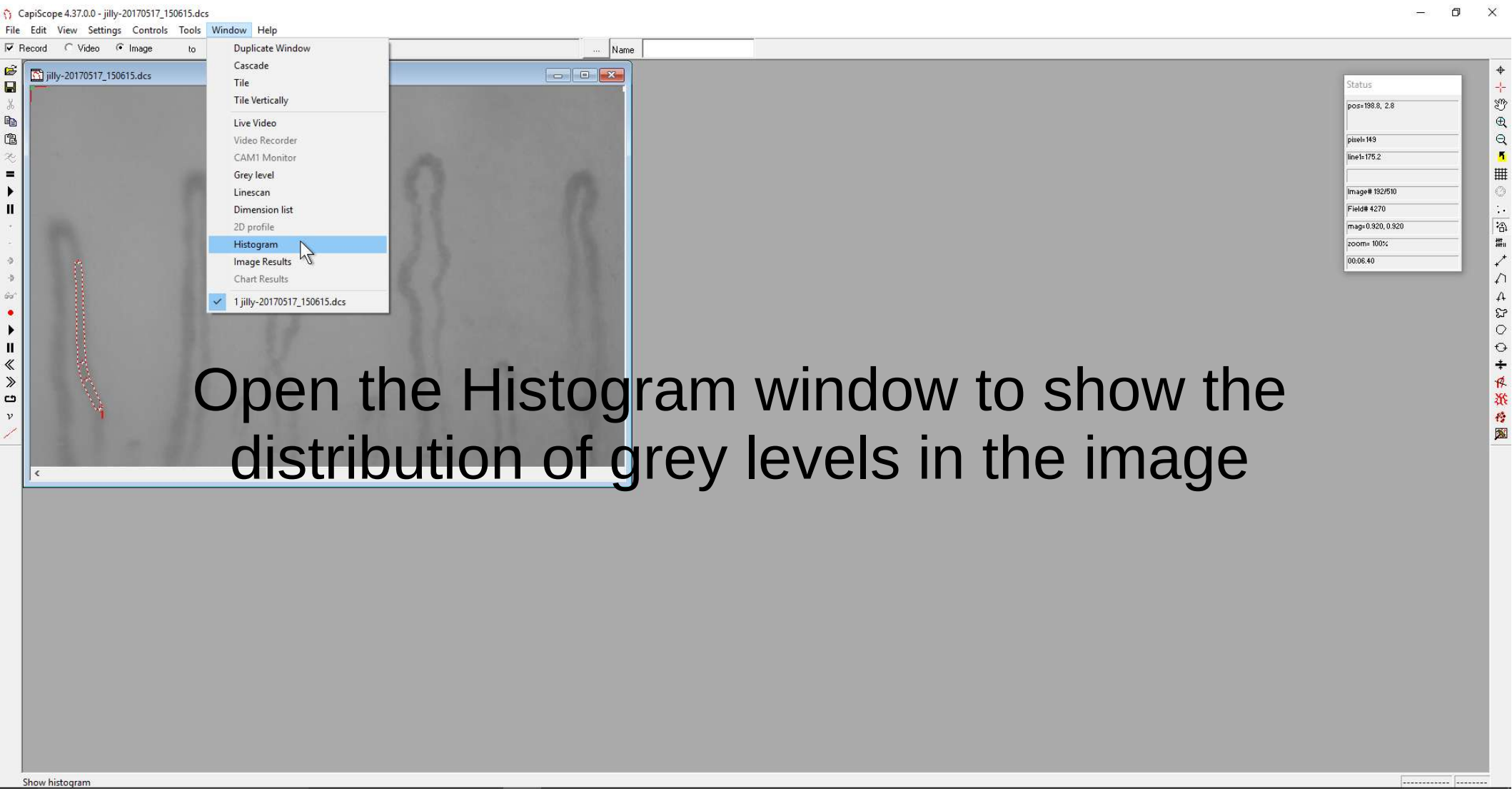
Line width



Set the measurement line width by right click on the first node of the line. Set the width to about the same width of the capillary.
Enter line width in pixels.

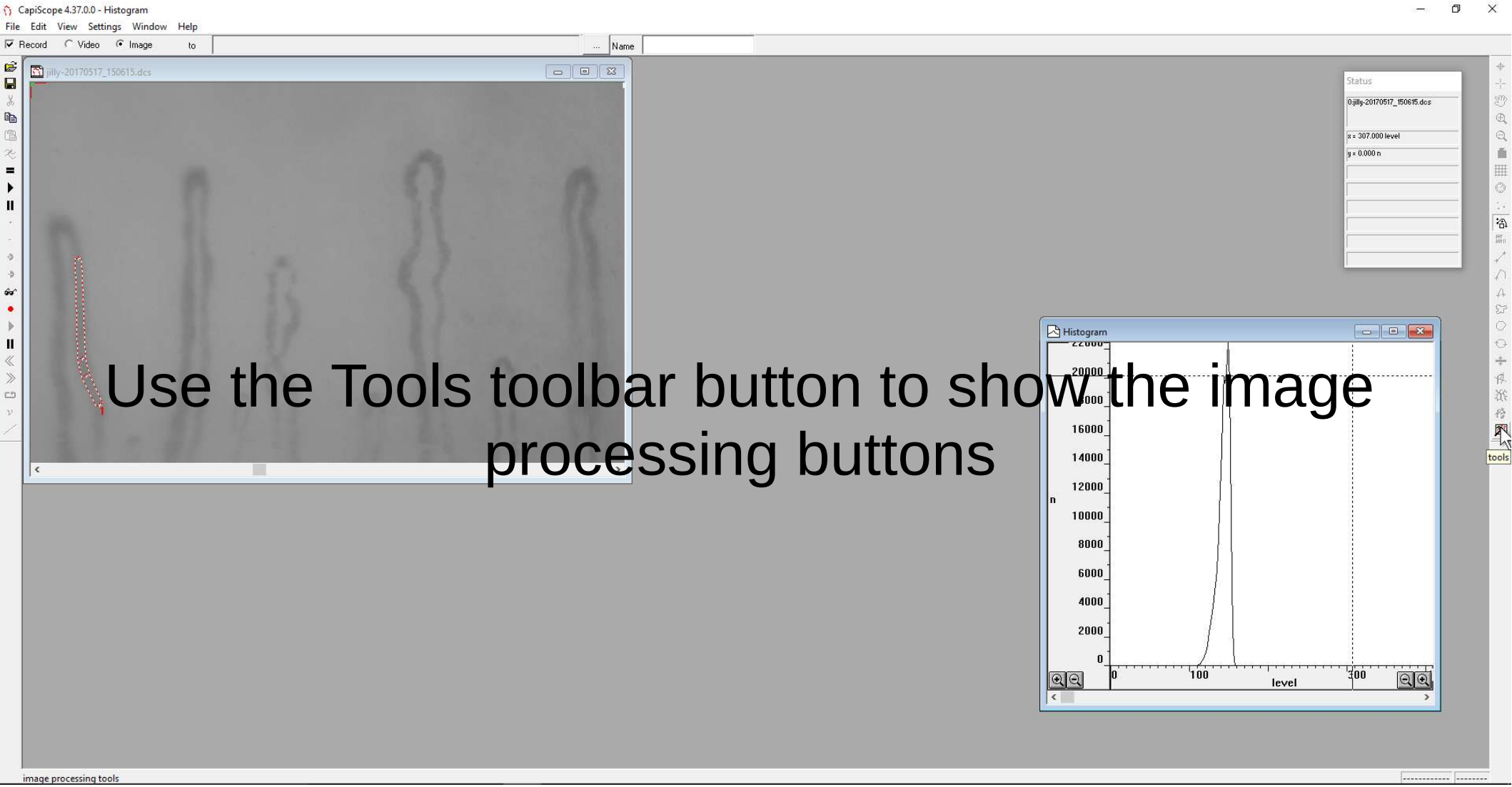
Stop loop play

Open Histogram Window



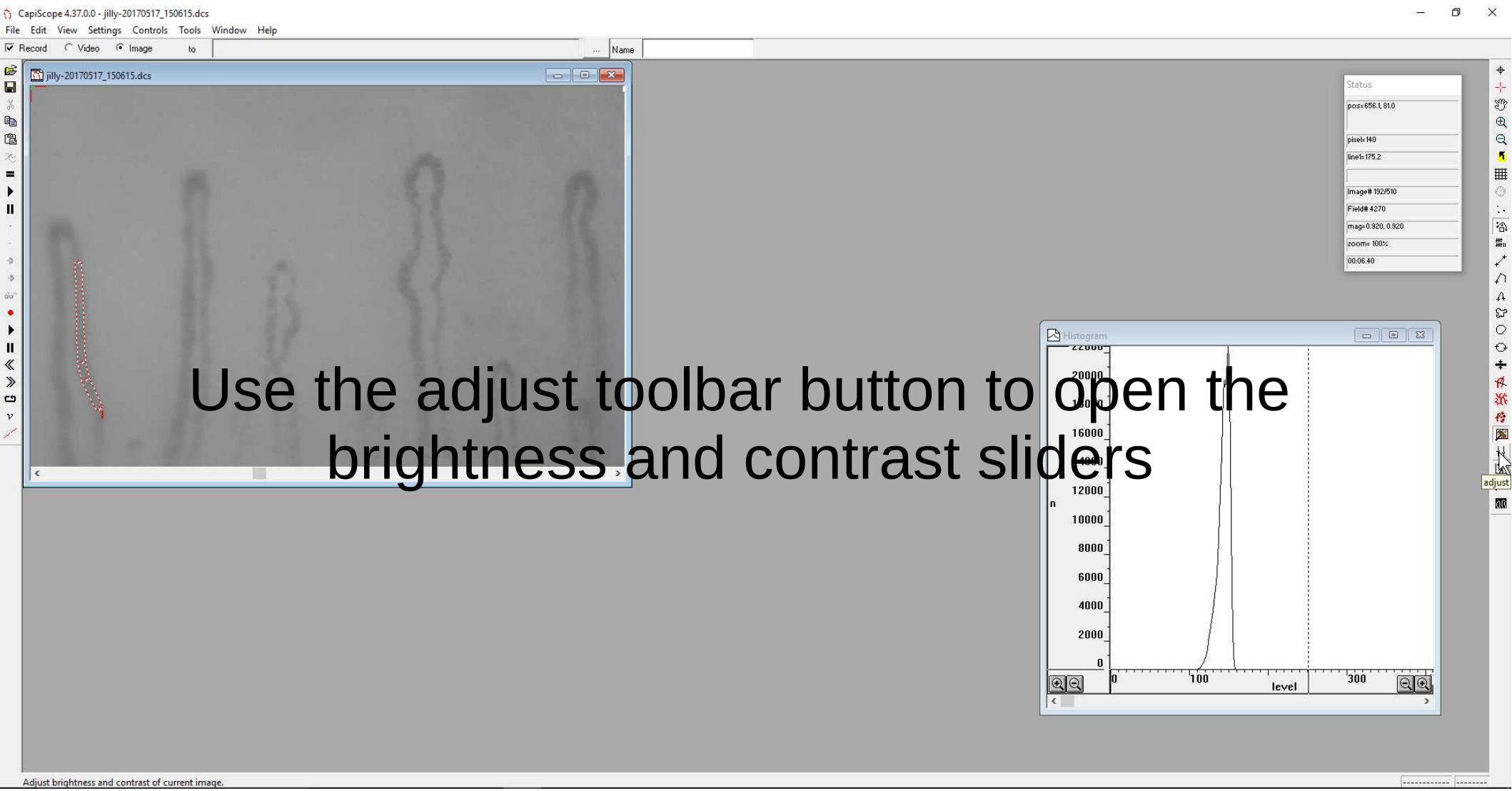
Open the Histogram window to show the distribution of grey levels in the image

Adjusting brightness and contrast



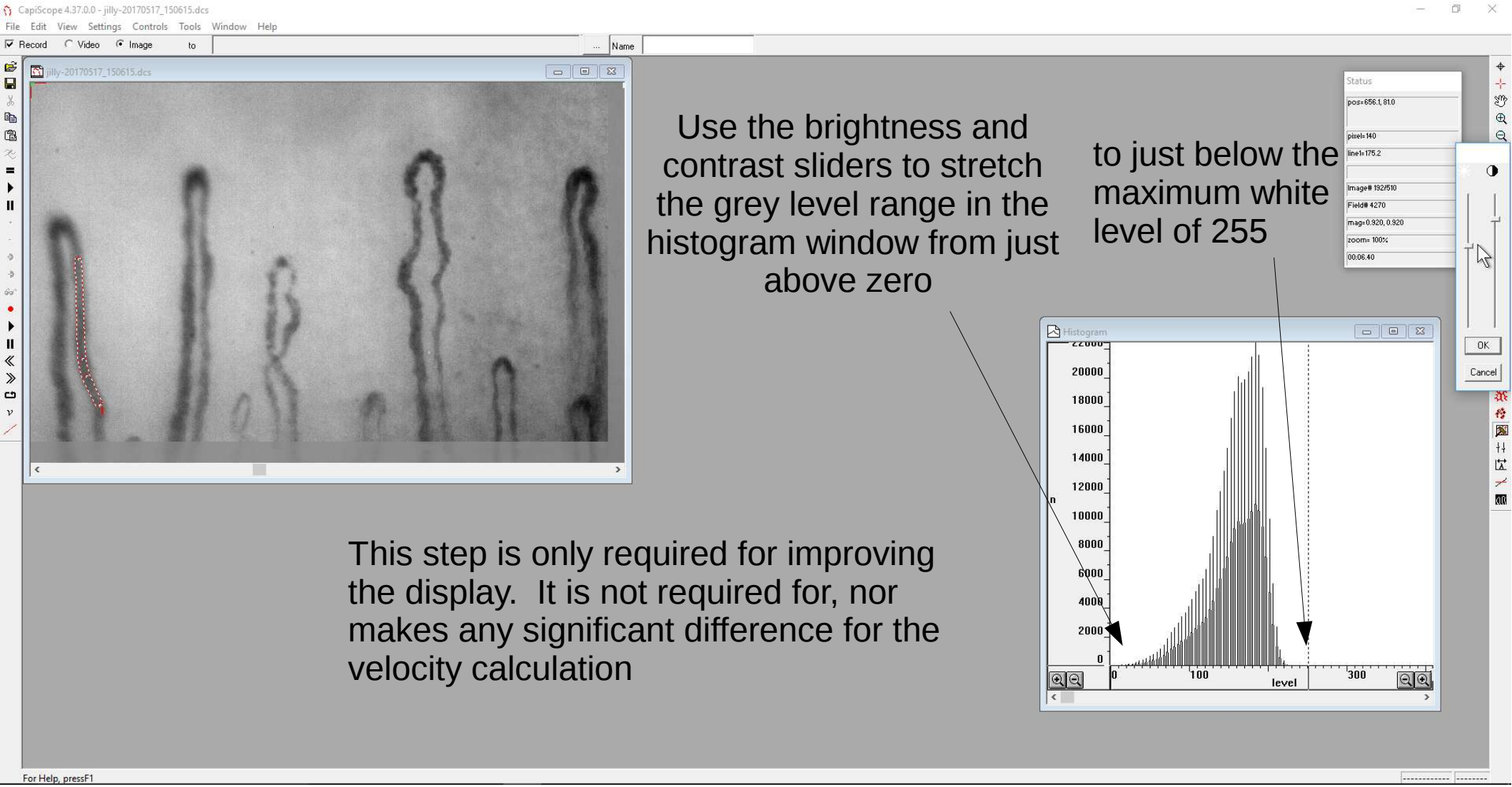
Use the Tools toolbar button to show the image processing buttons

Adjusting brightness and contrast



Use the adjust toolbar button to open the brightness and contrast sliders

Adjusting brightness and contrast

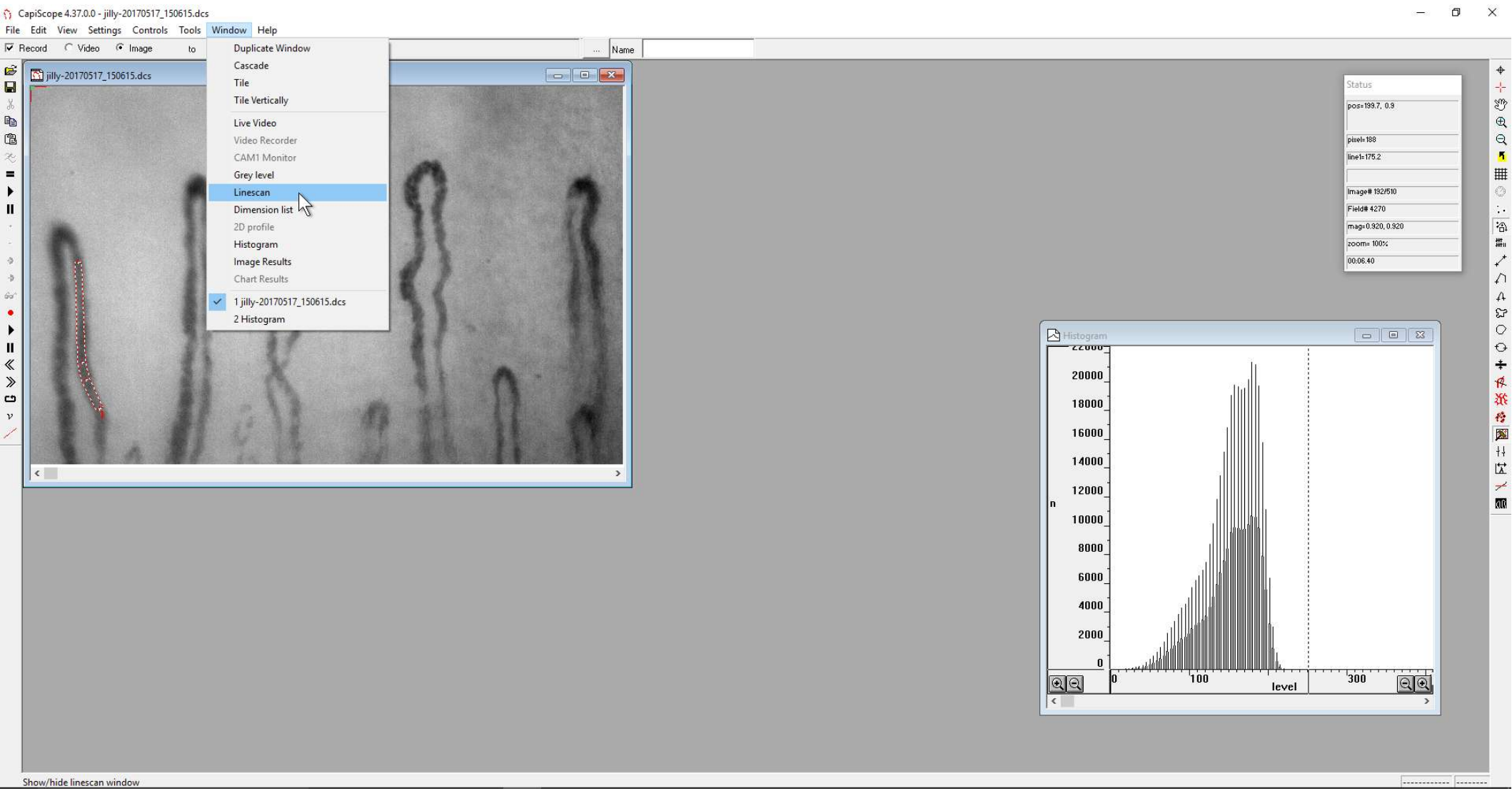


Use the brightness and contrast sliders to stretch the grey level range in the histogram window from just above zero

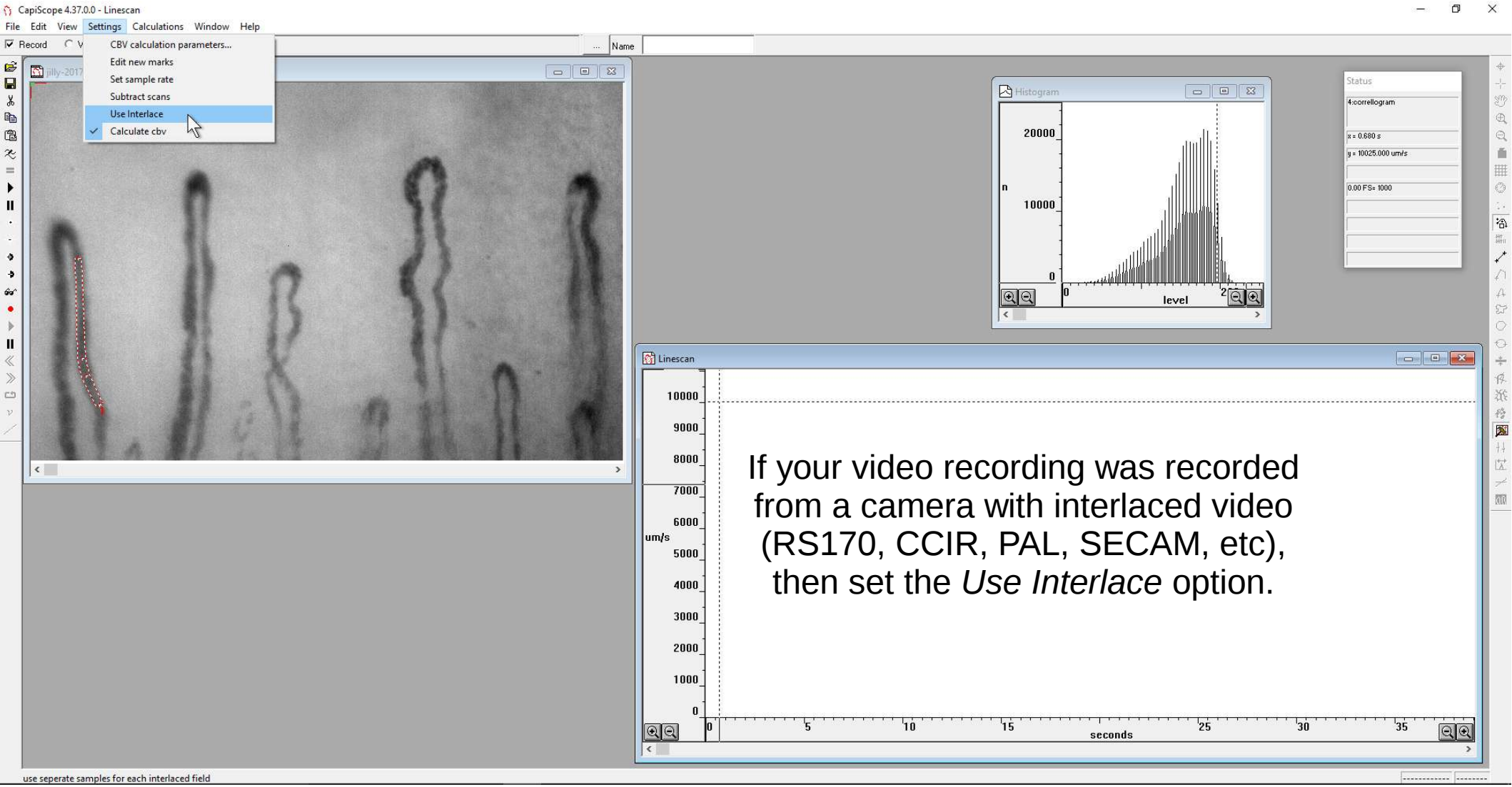
to just below the maximum white level of 255

This step is only required for improving the display. It is not required for, nor makes any significant difference for the velocity calculation

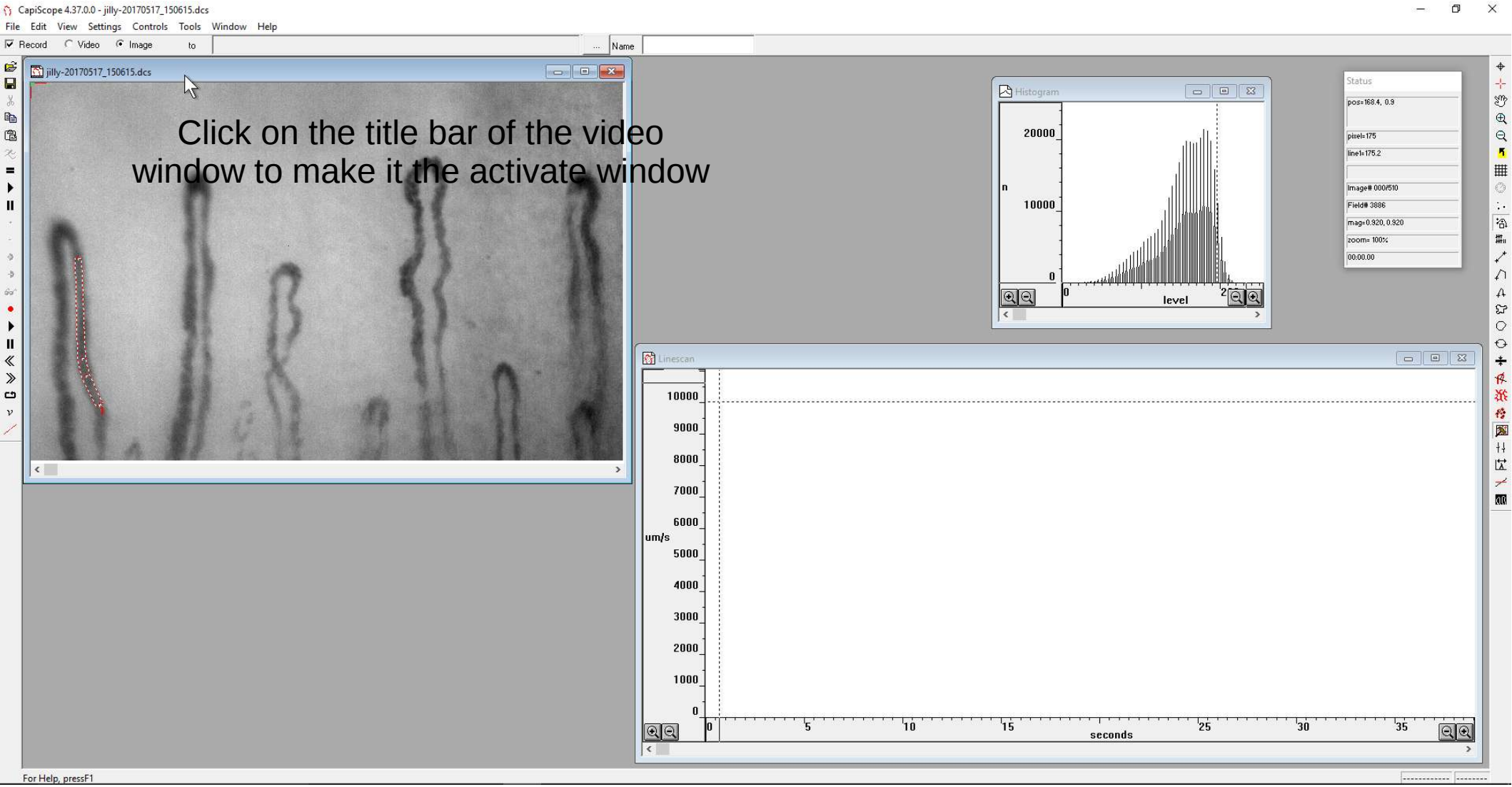
Open the linescan window



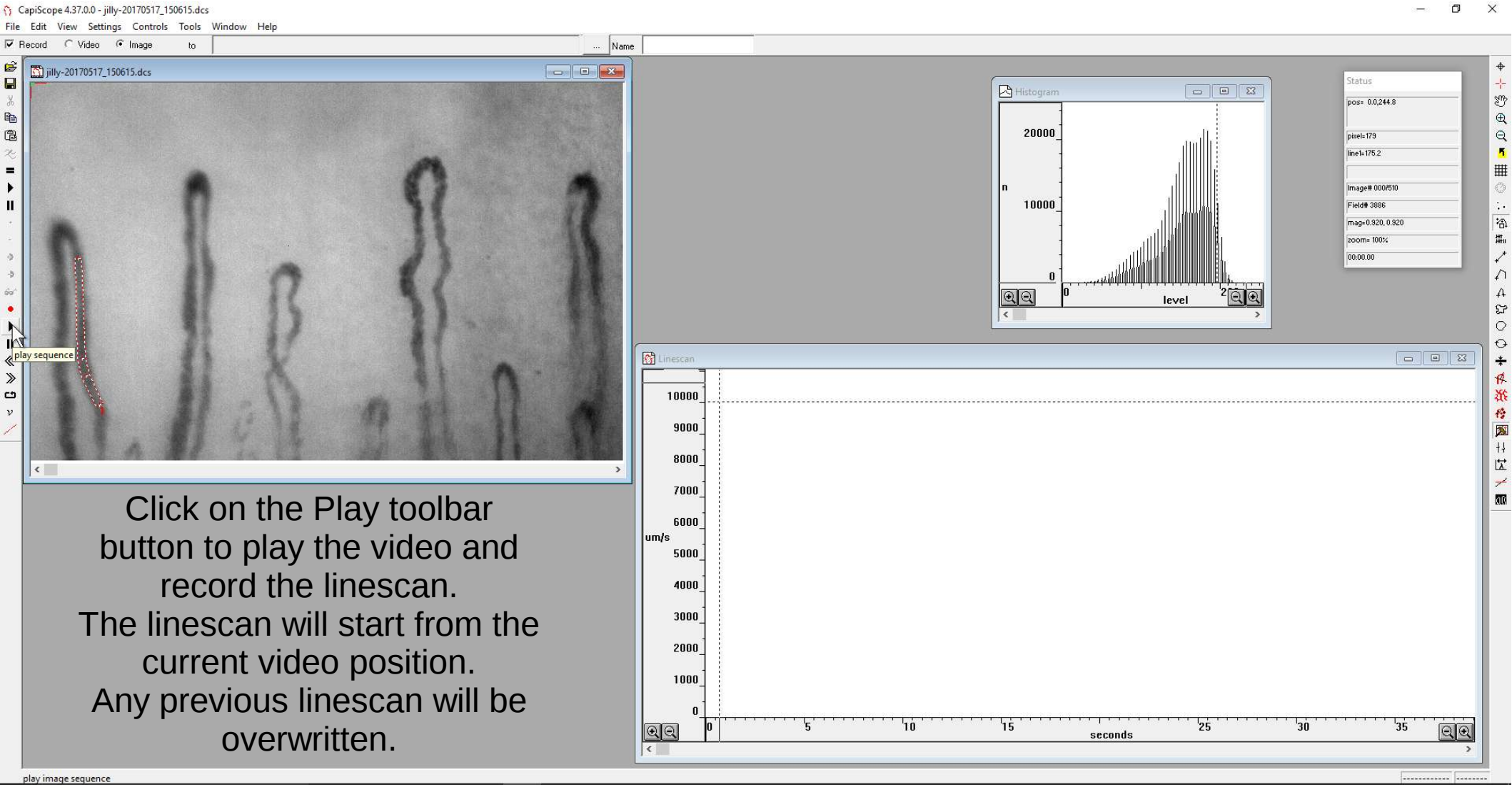
Interlace


CapiScope 4.37.0.0 - Linescan
File Edit View Settings Calculations Window Help
Record
Name
CBV calculation parameters...
Edit new marks
Set sample rate
Subtract scans
Use Interlace
Calculate cbv
Histogram
20000
10000
0
n
level
Status
4:correllogram
x = 0.680 s
y = 10025.000 um/s
0.00 FS= 1000
Linescan
10000
9000
8000
7000
6000
um/s
5000
4000
3000
2000
1000
0
0
5
10
15
25
30
35
seconds
If your video recording was recorded from a camera with interlaced video (RS170, CCIR, PAL, SECAM, etc), then set the *Use Interlace* option.
use seperate samples for each interlaced field

Acquiring the linescan

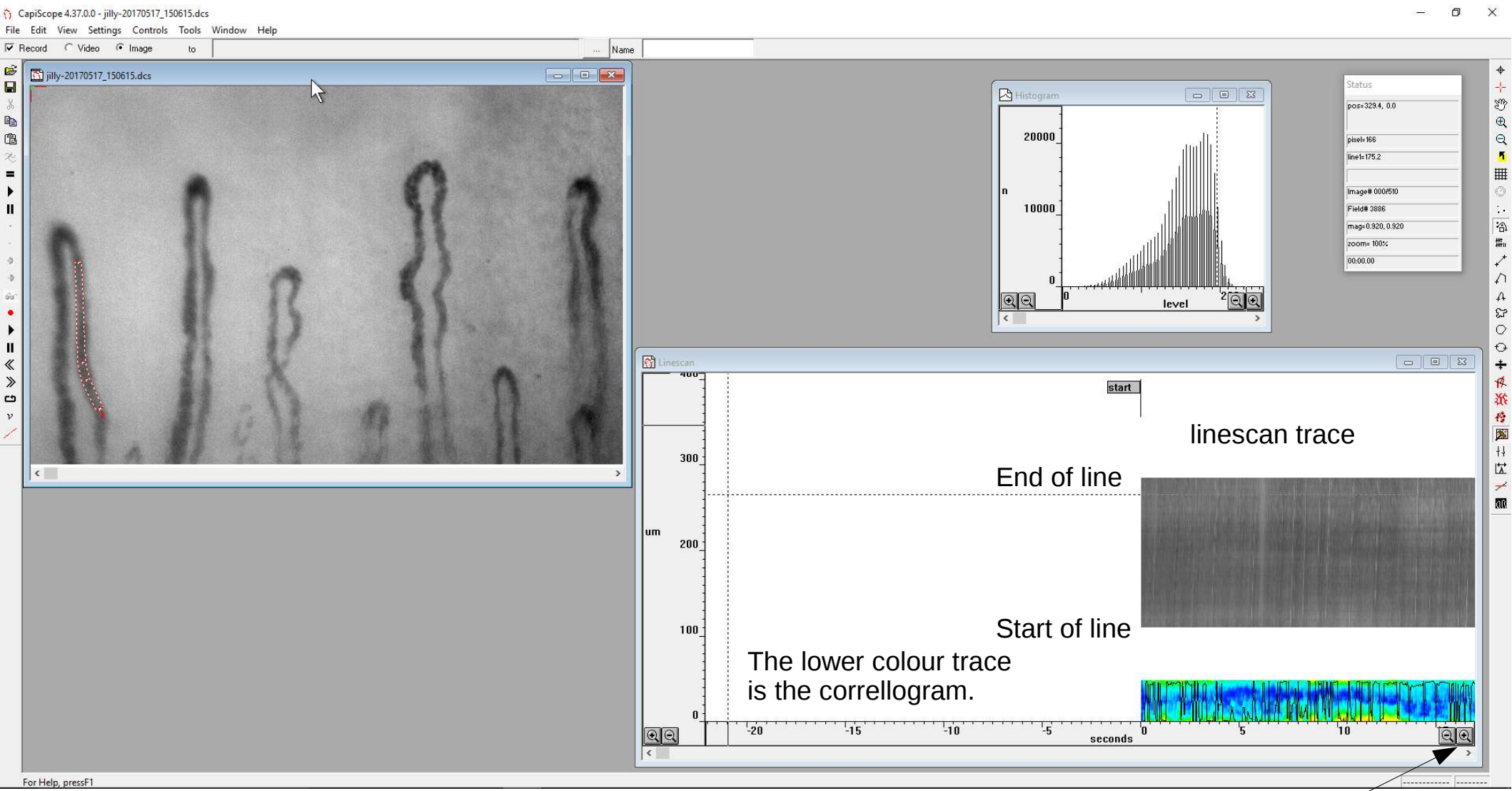


Acquiring the linescan



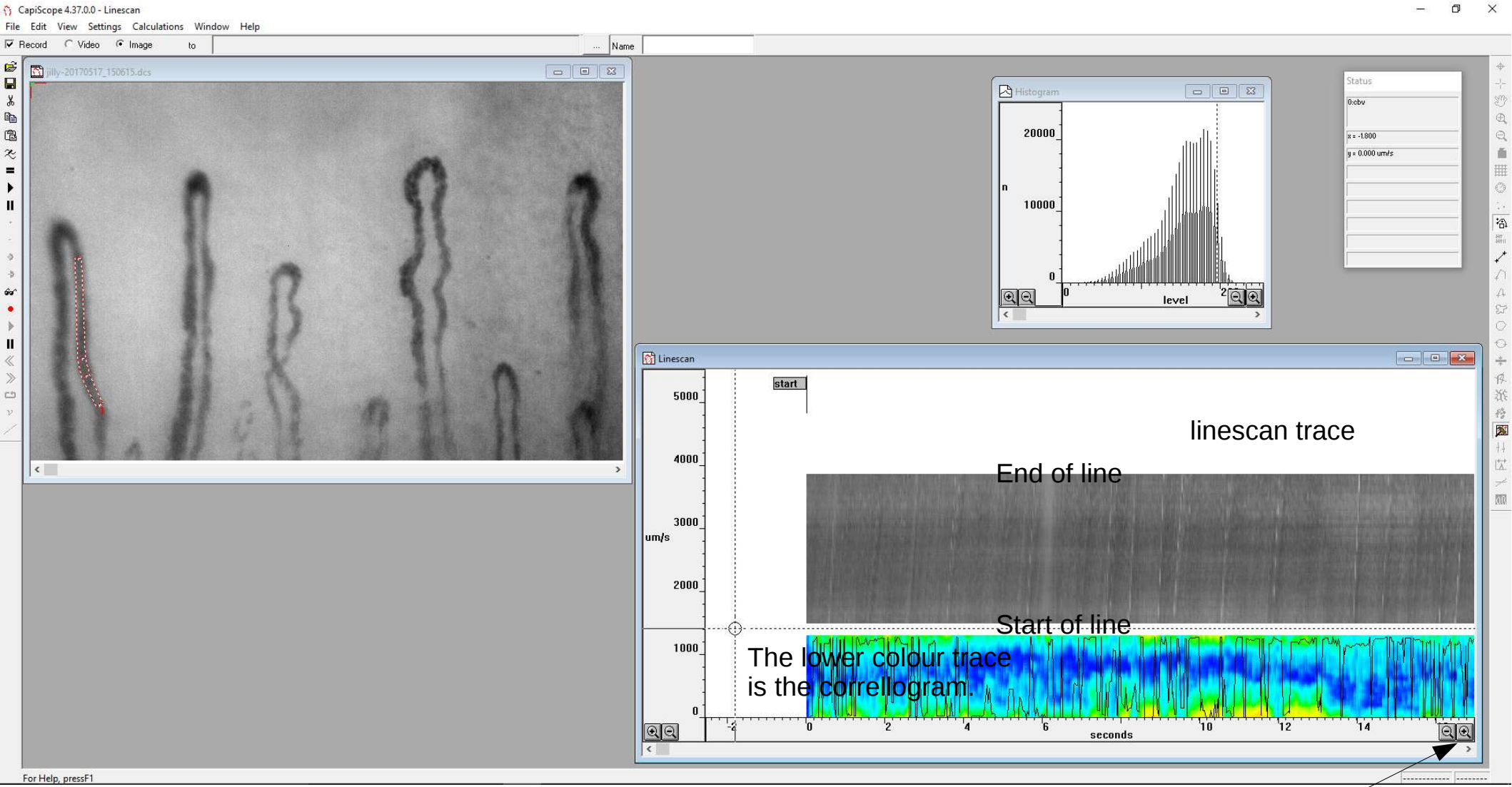
Click on the Play toolbar button to play the video and record the linescan.
The linescan will start from the current video position.
Any previous linescan will be overwritten.

Analysing the linescan



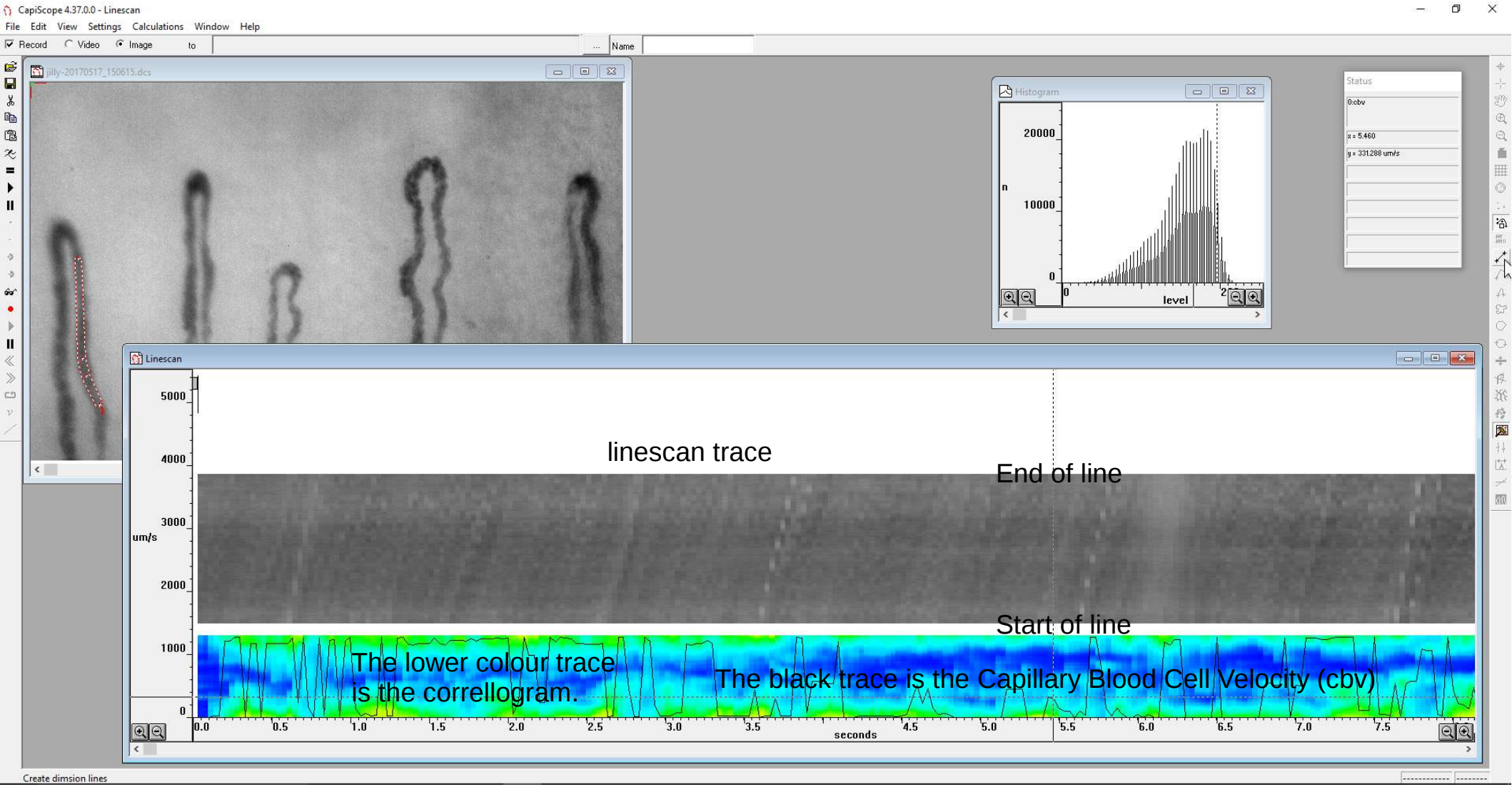
Expand the linescan traces

Linescan chart

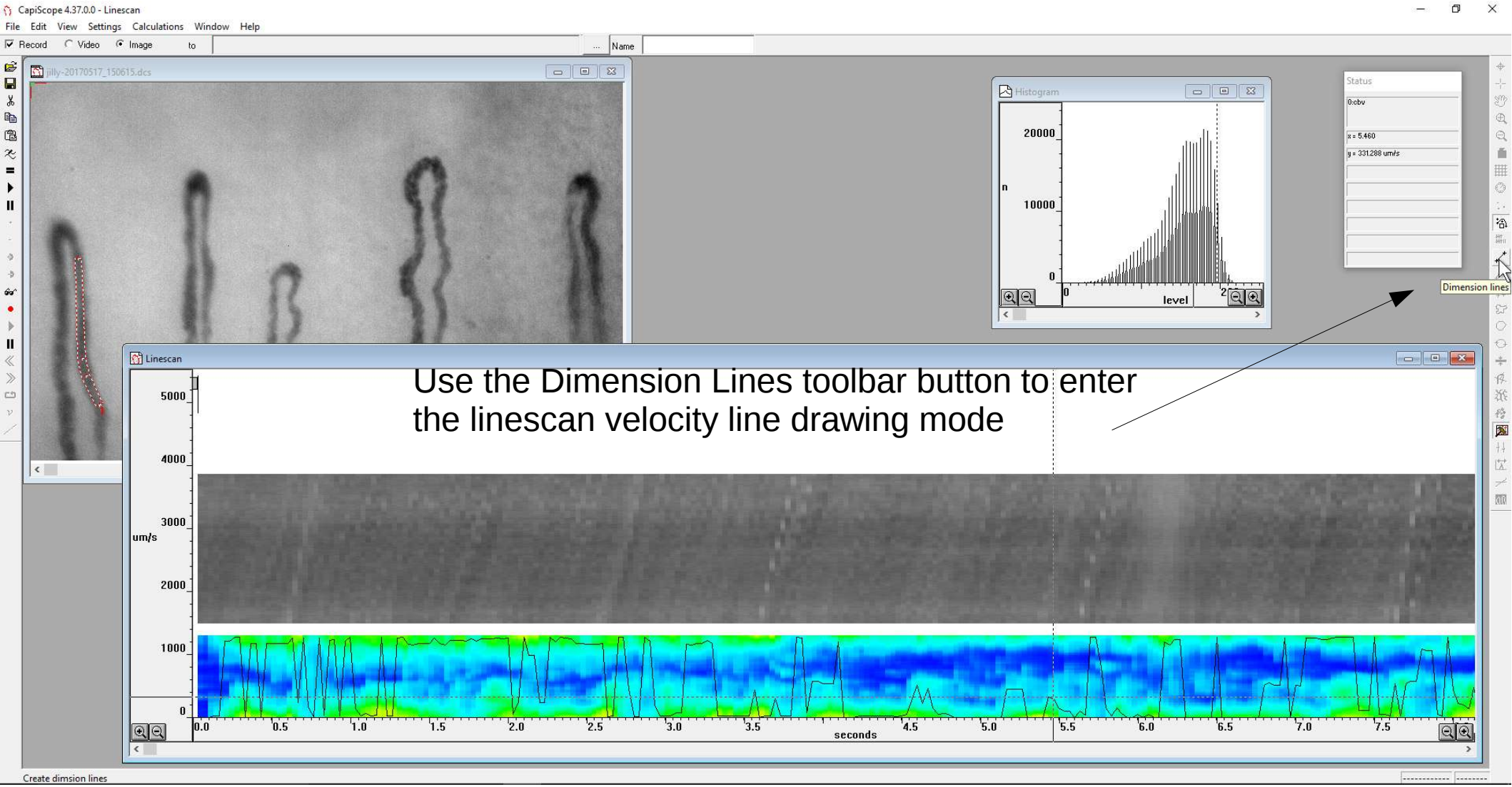


Expand the linescan traces

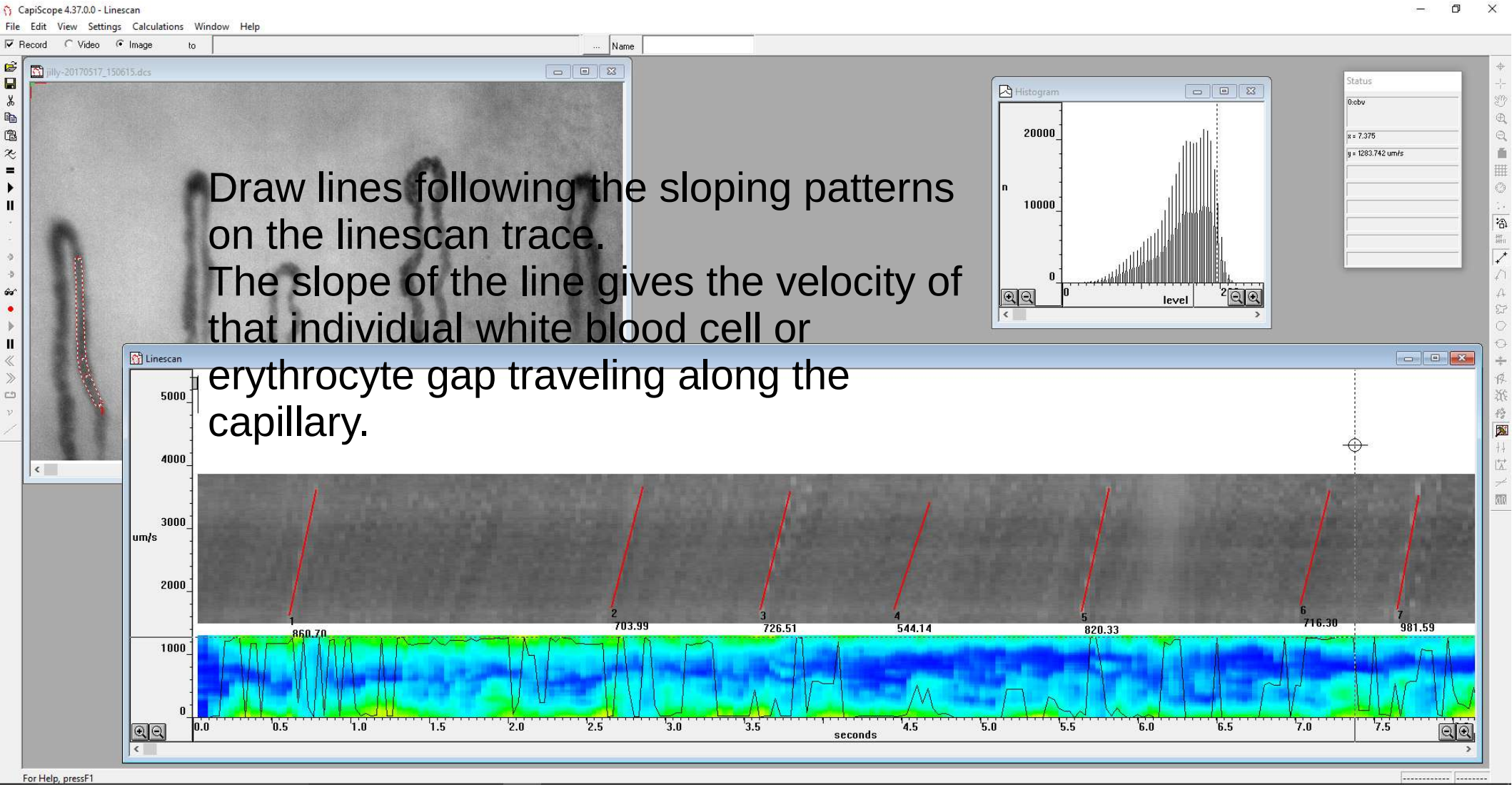
Linescan traces



Estimating cbv

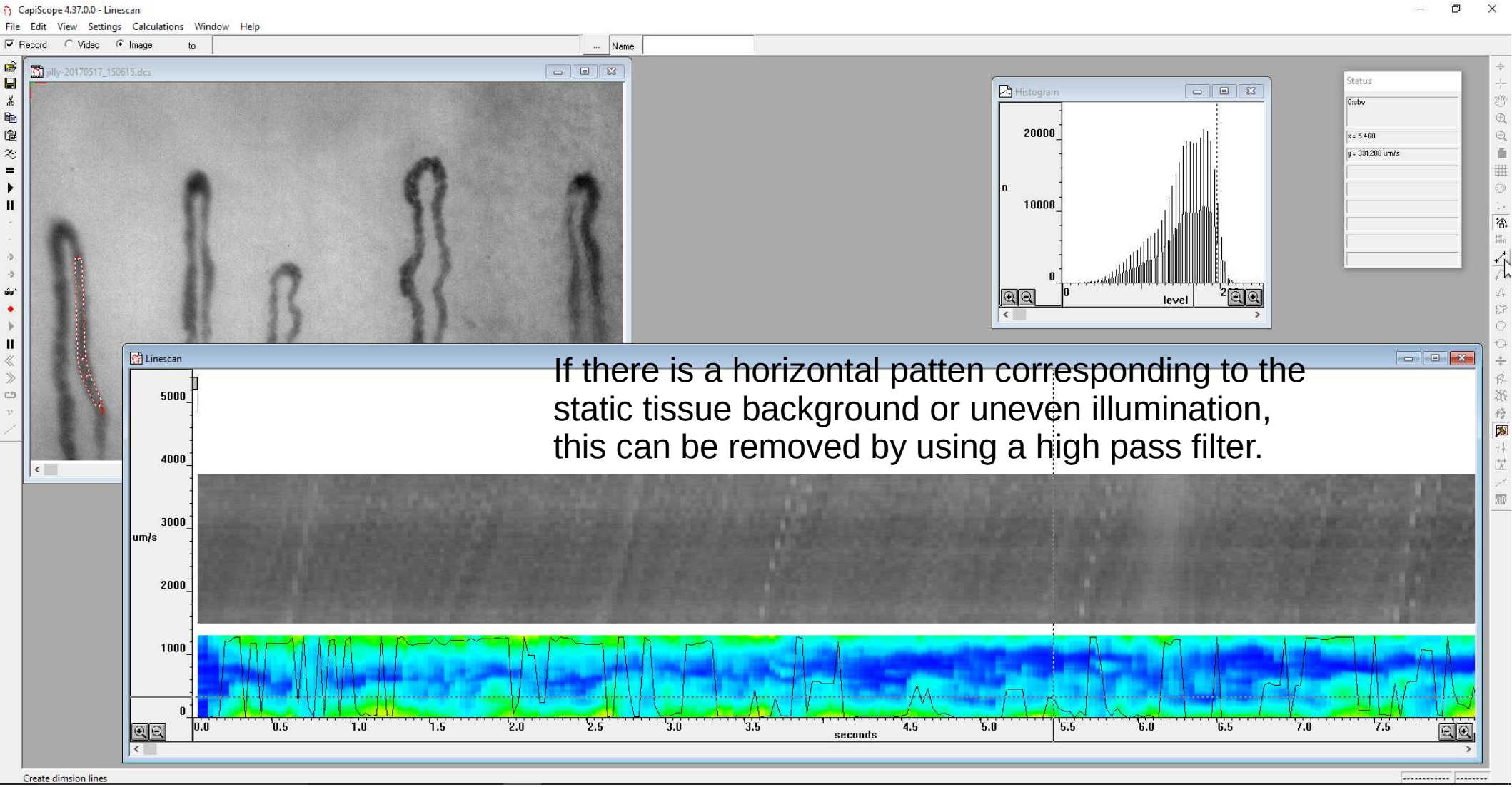


Estimating cbv



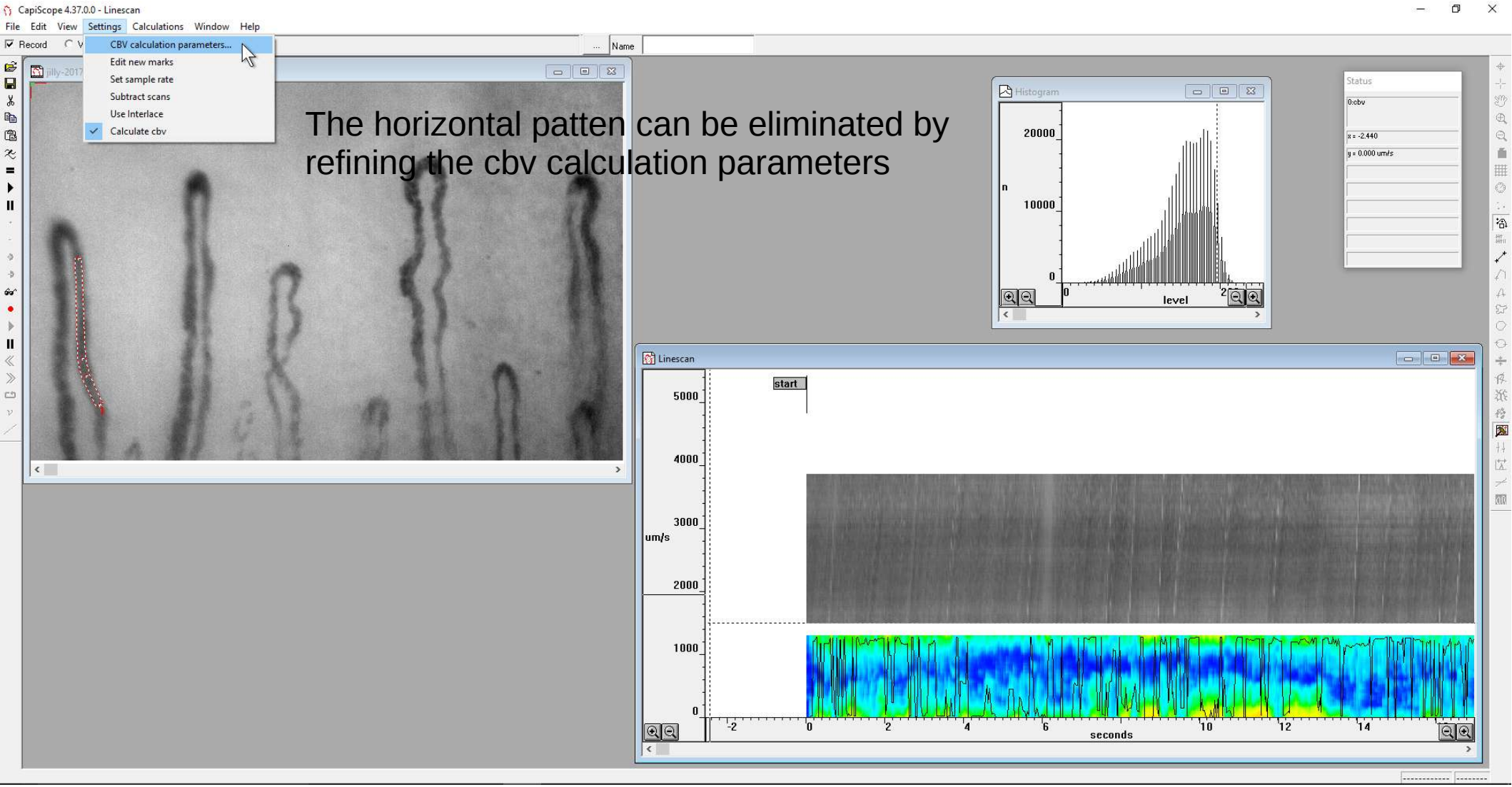
Draw lines following the sloping patterns on the linescan trace.
The slope of the line gives the velocity of that individual white blood cell or erythrocyte gap traveling along the capillary.

Analysing the linescan

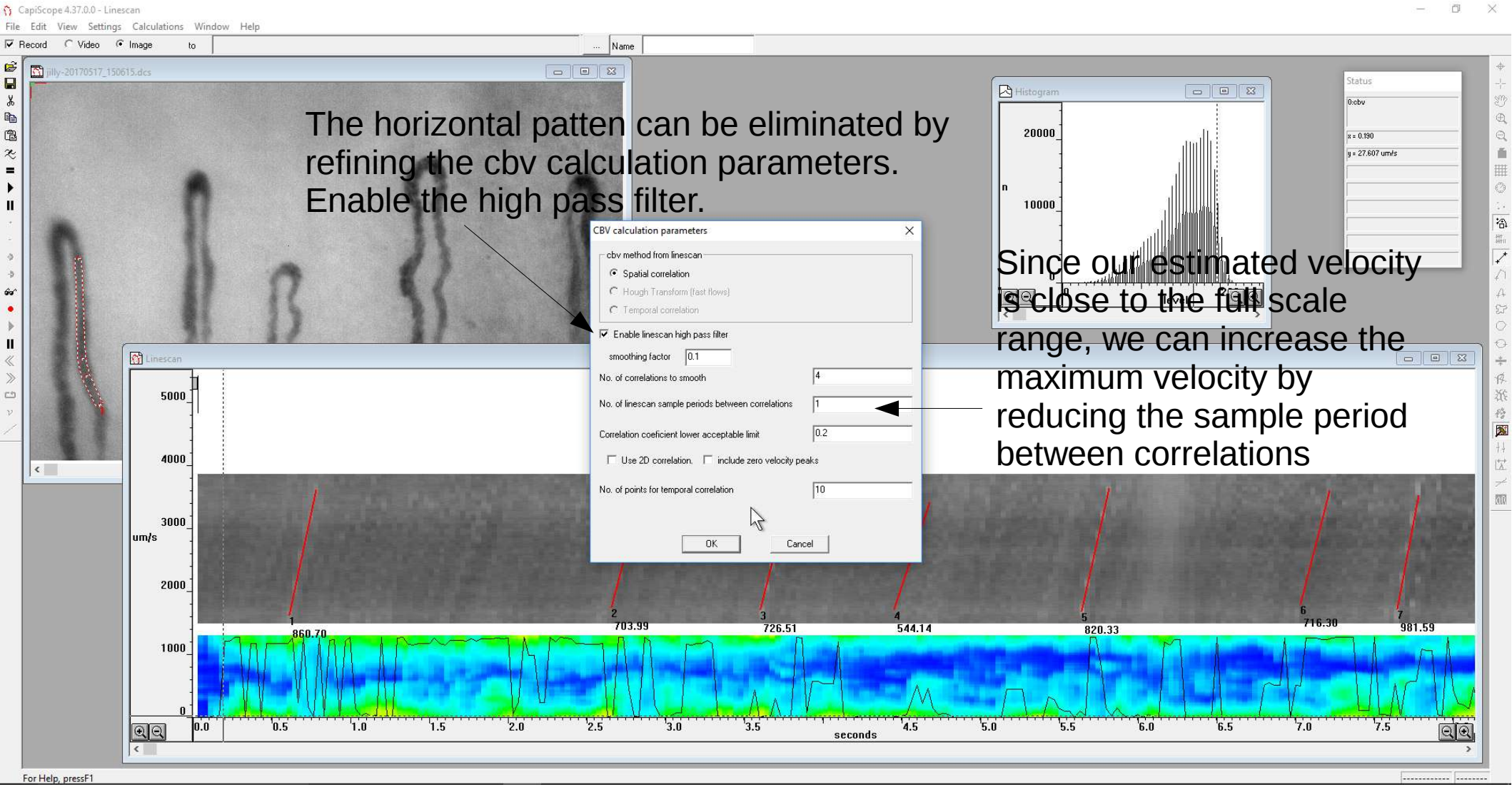


If there is a horizontal patten corresponding to the static tissue background or uneven illumination, this can be removed by using a high pass filter.

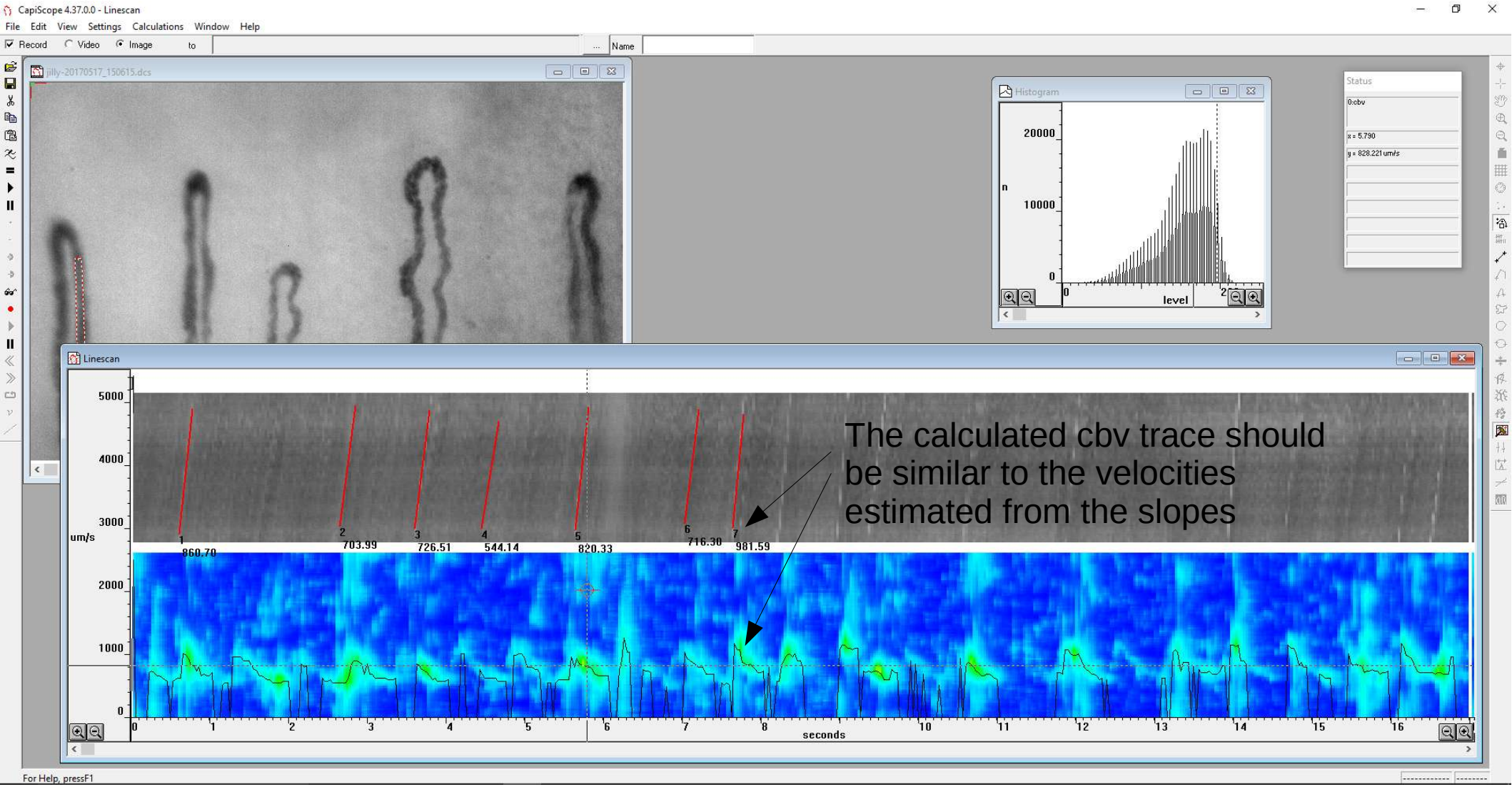
Refining cbv parameters



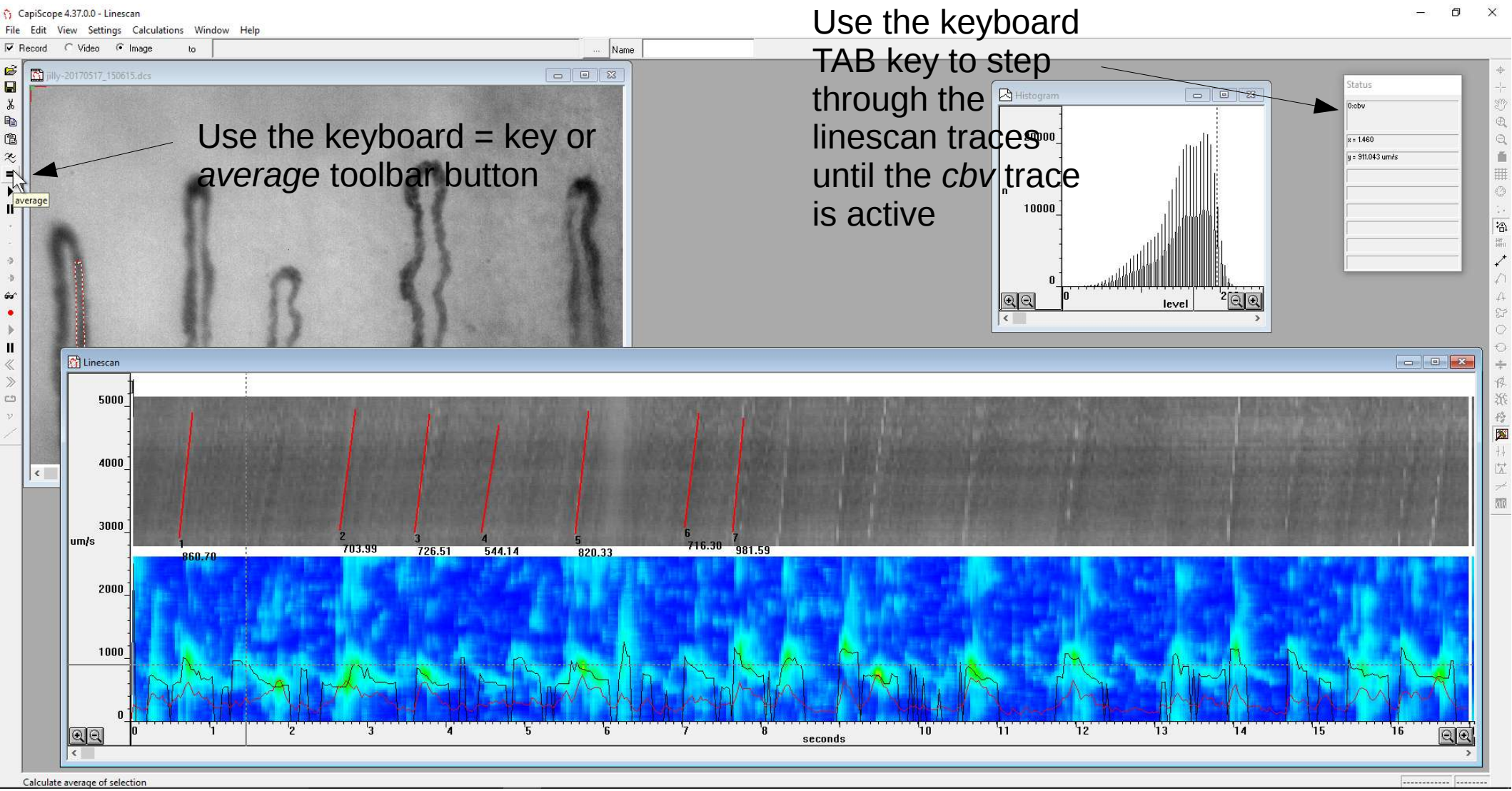
Refining cbv parameters



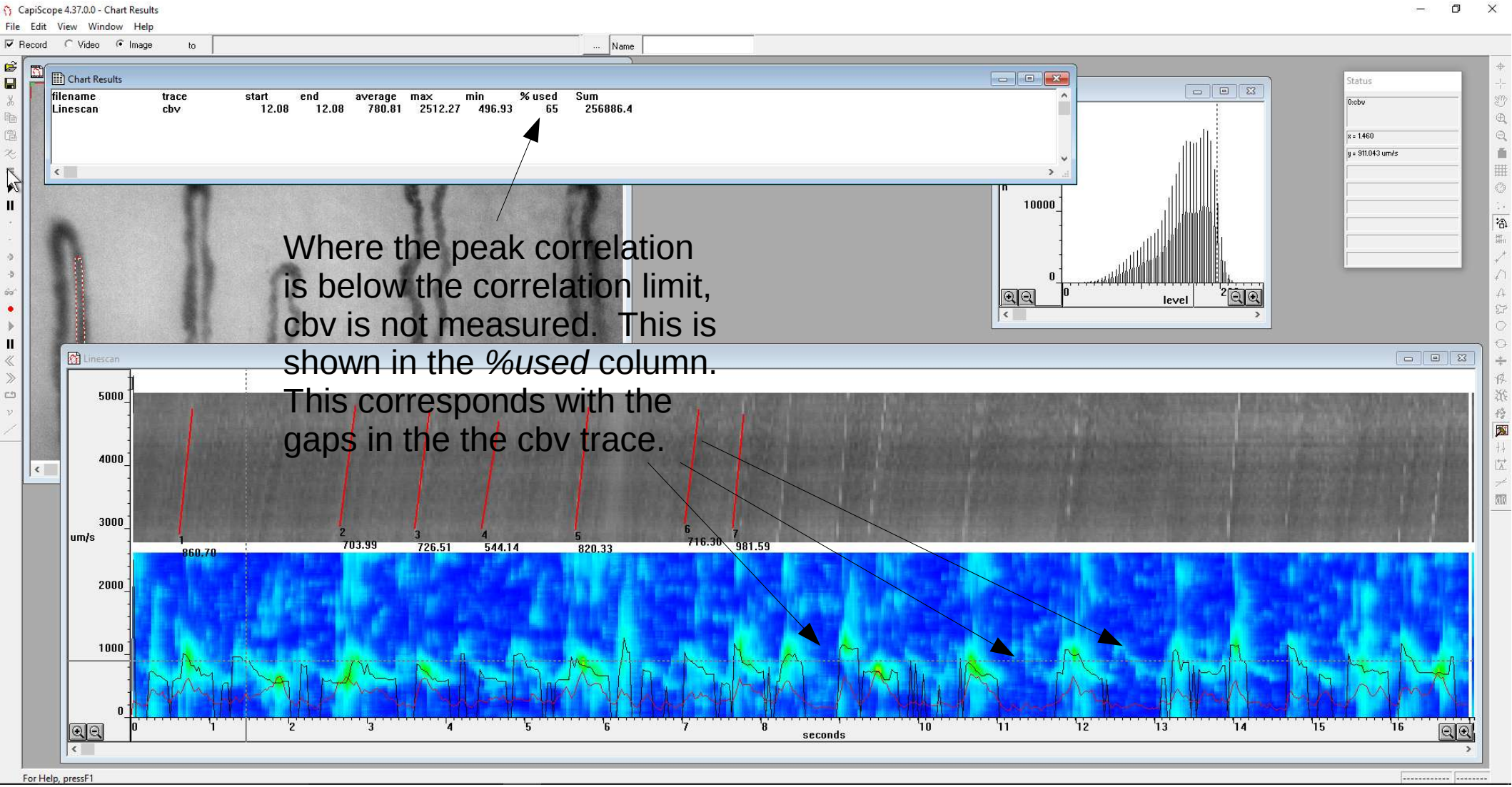
Recalculated cbv



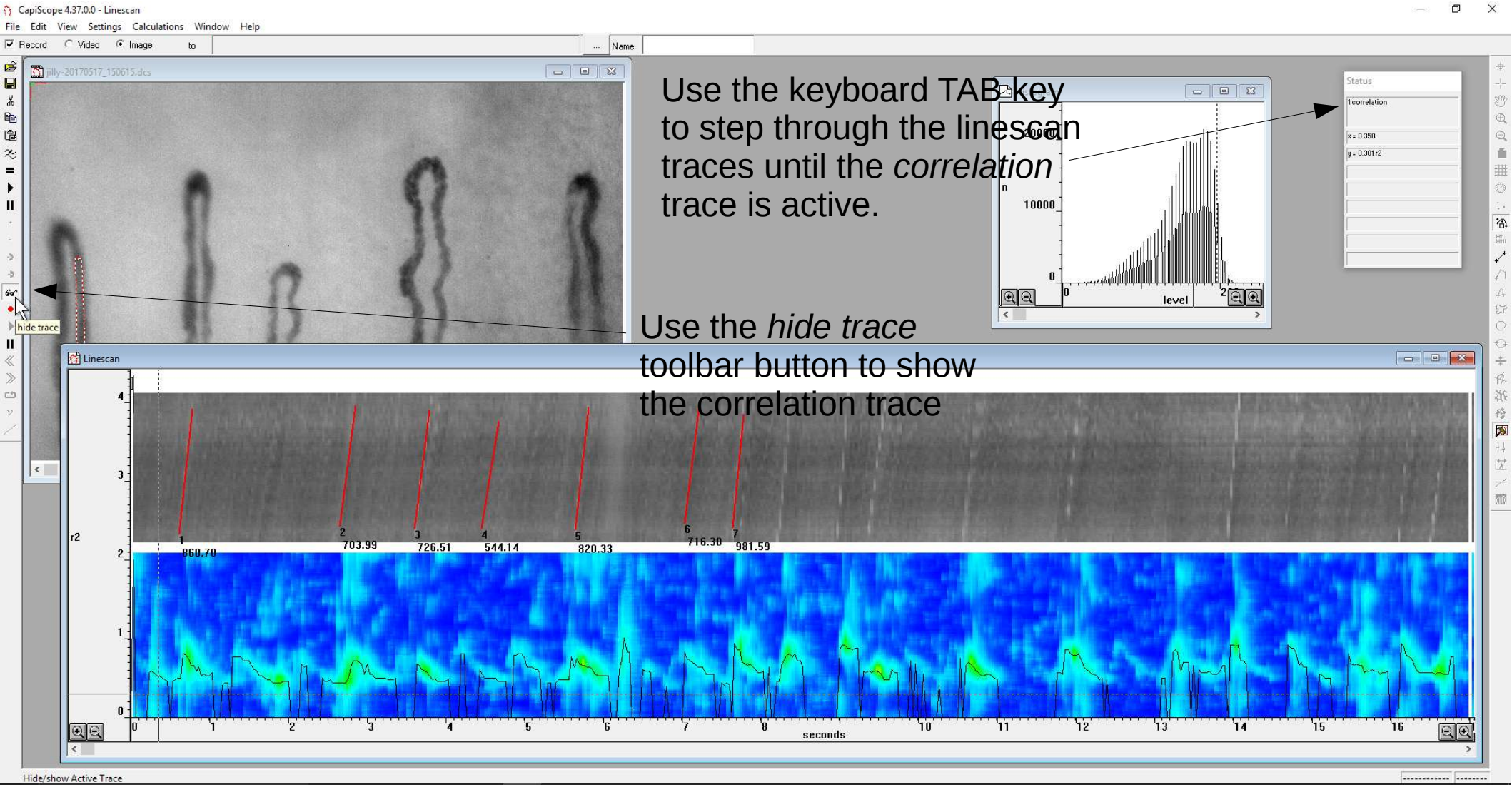
average cbv


Use the keyboard = key or *average* toolbar button
Use the keyboard TAB key to step through the linescan traces until the *cbv* trace is active
CapiScope 4.37.0.0 - Linescan
File Edit View Settings Calculations Window Help
Record Video Image to Name
average
Histogram
level
Status
Linescan
um/s
seconds
Calculate average of selection

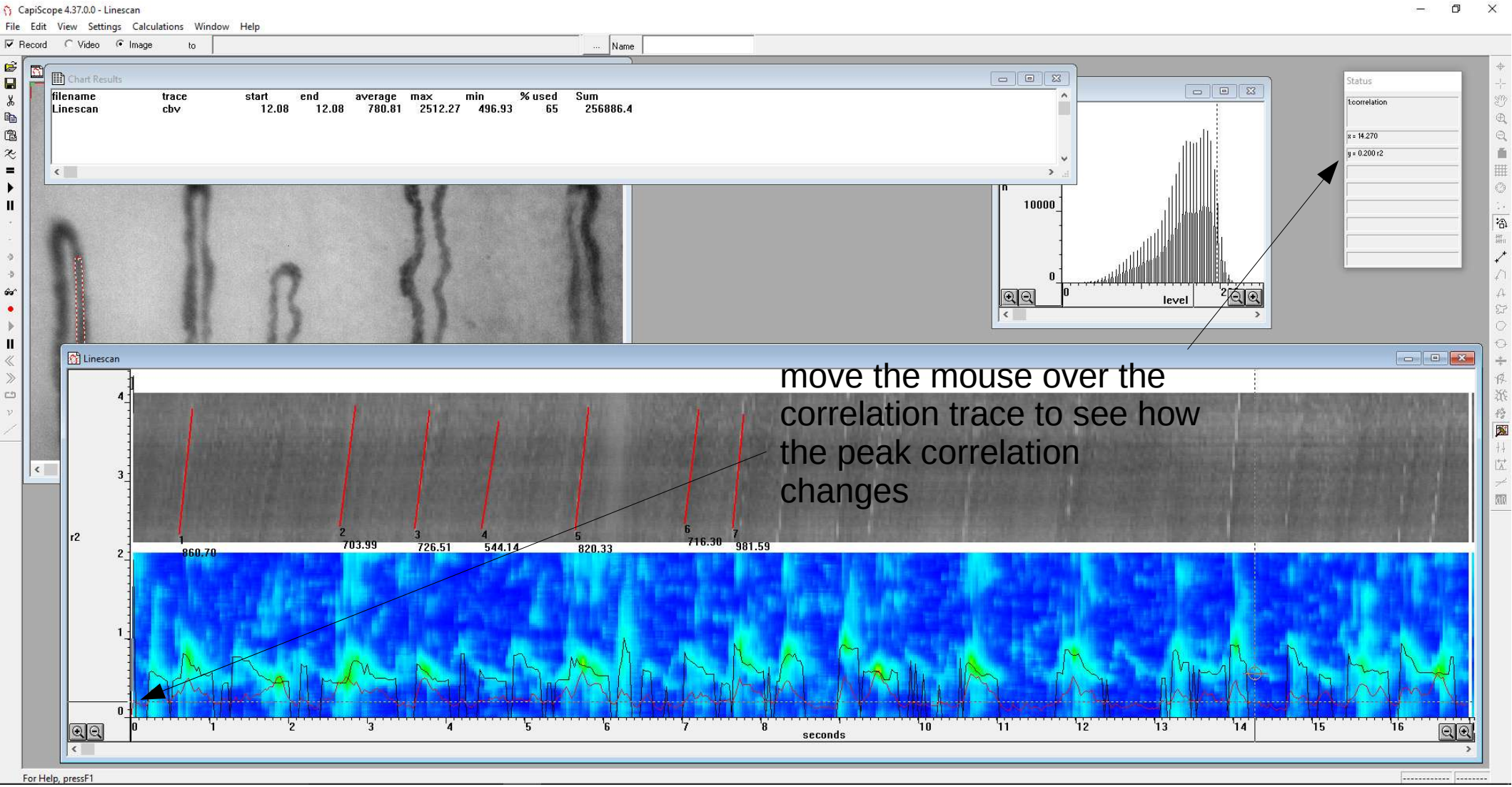
average cbv


CapiScope 4.37.0.0 - Chart Results
File Edit View Window Help
Record Video Image to Name
Chart Results
filename trace start end average max min % used Sum
Linescan cbv 12.08 12.08 780.81 2512.27 496.93 65 256886.4
Where the peak correlation is below the correlation limit, cbv is not measured. This is shown in the %used column. This corresponds with the gaps in the the cbv trace.
10000
0
level
Status
0:cbv
Linescan
5000
4000
3000
um/s
2000
1000
0
1 860.70
2 703.99
3 726.51
4 544.14
5 820.33
6 716.38
7 981.59
0 1 2 3 4 5 6 7 8 seconds 10 11 12 13 14 15 16
For Help, pressF1

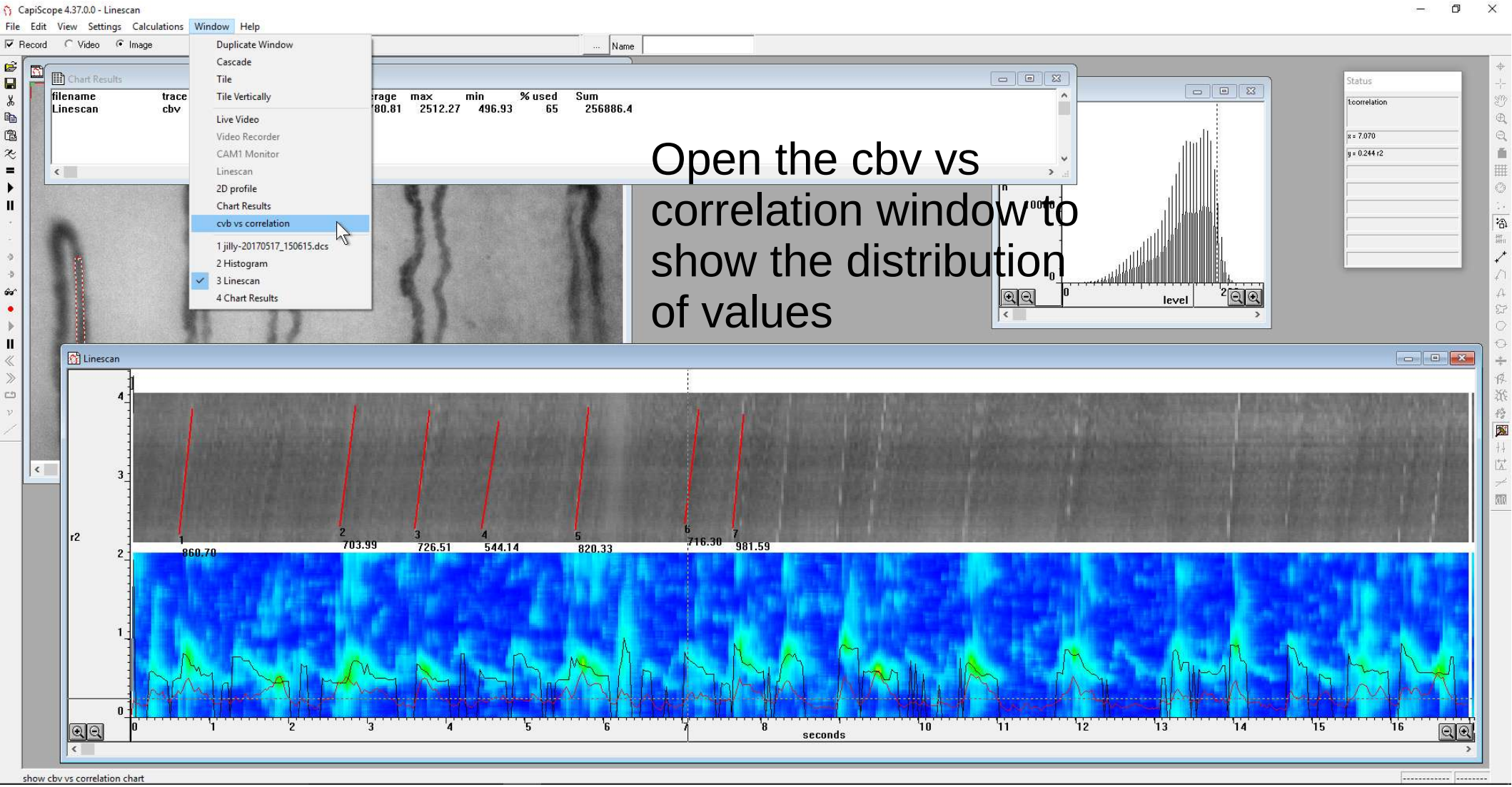
Correlation trace



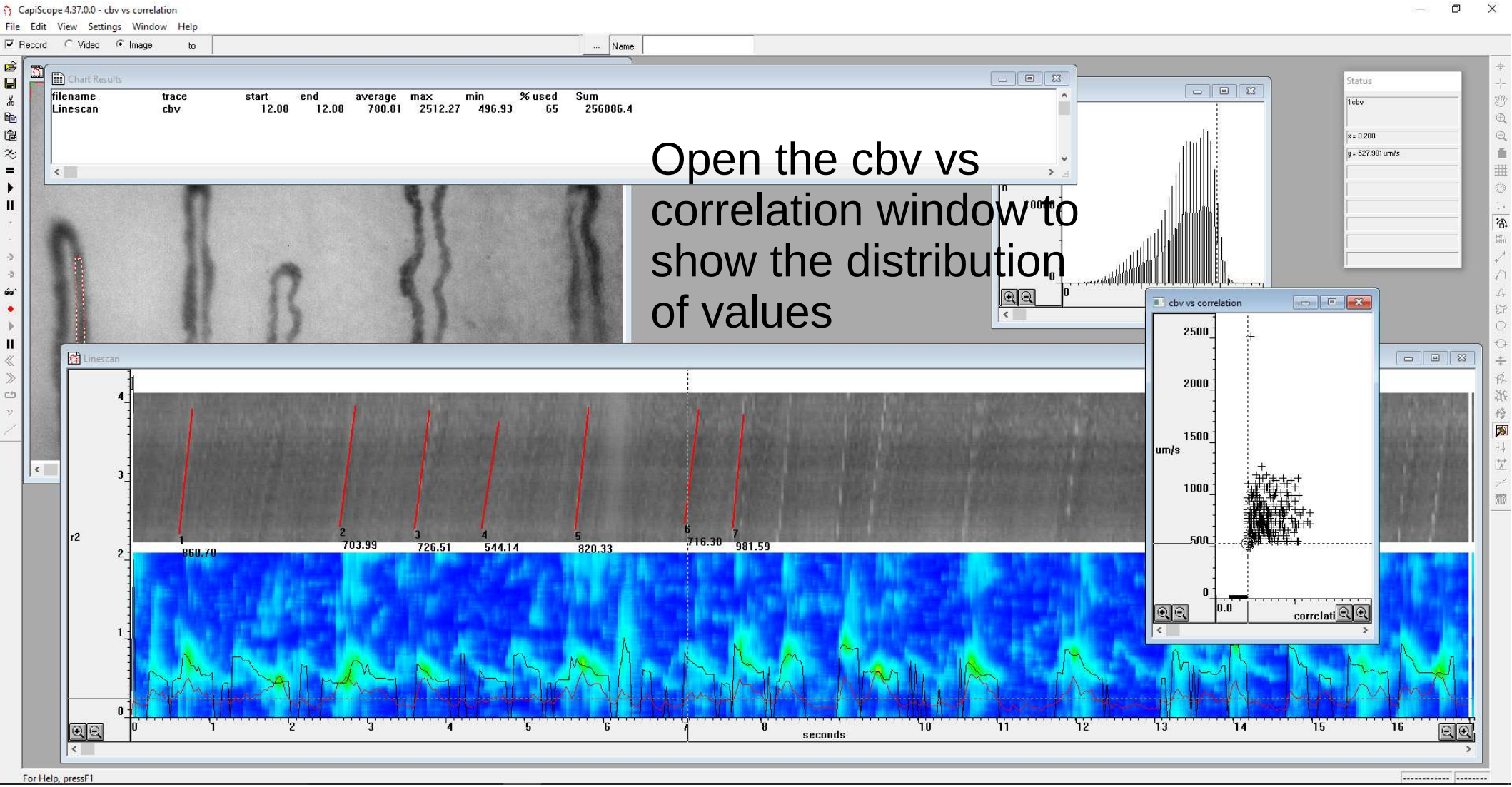
Choosing a correlation limit



Open cbv vs peak correlation

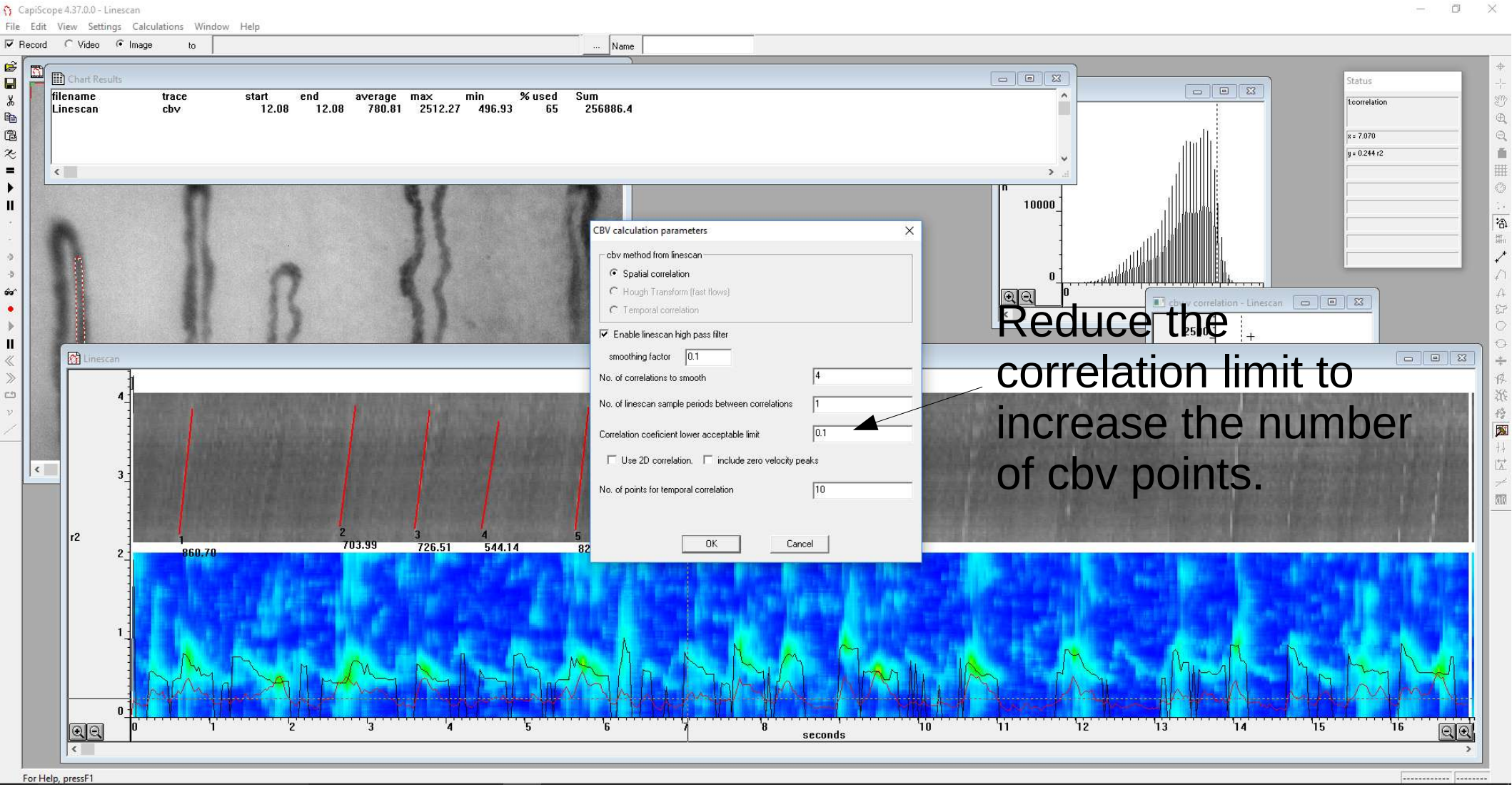


cbv vs peak correlation



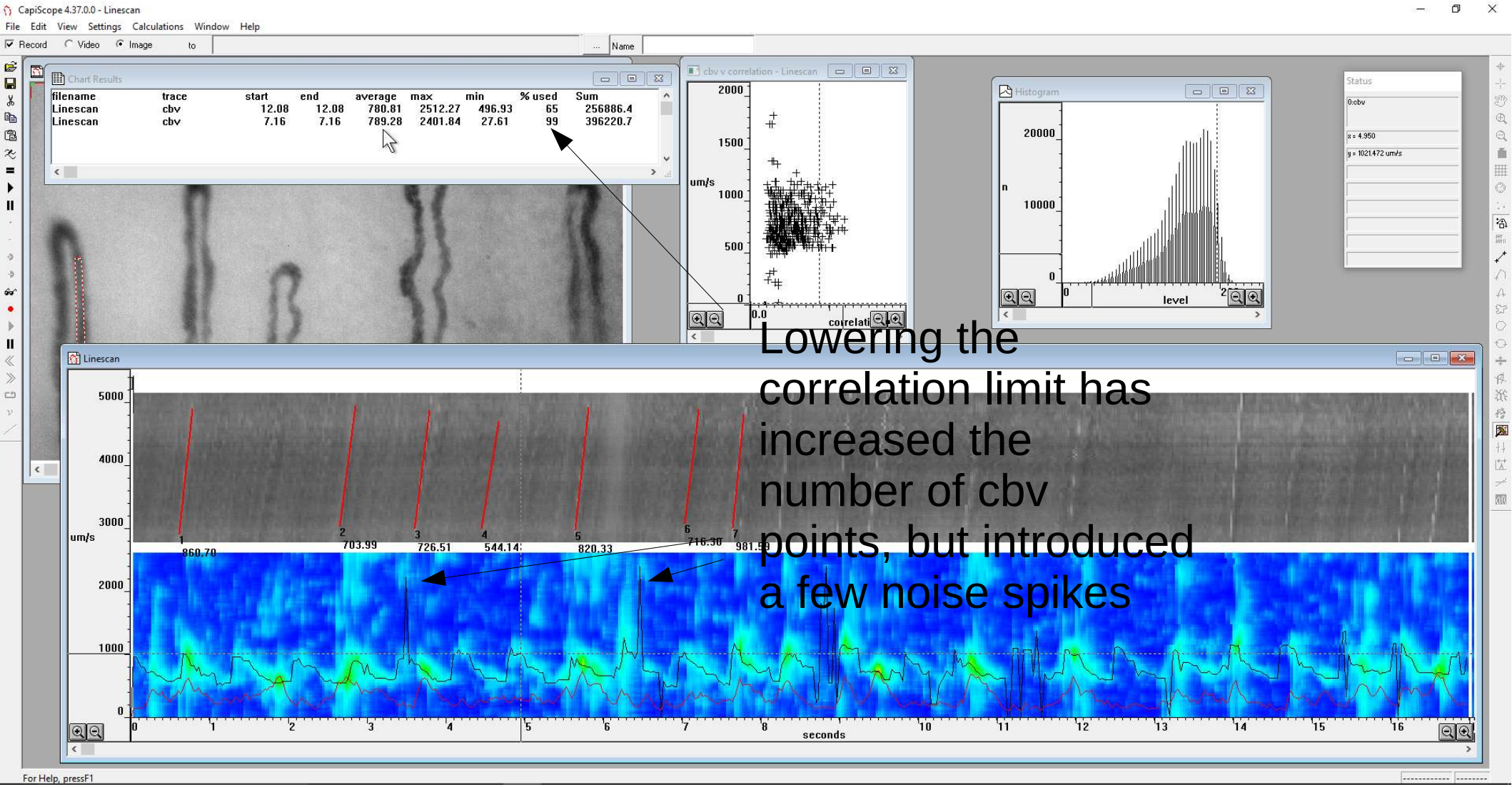
Open the cbv vs correlation window to show the distribution of values

Adjusting the correlation limit

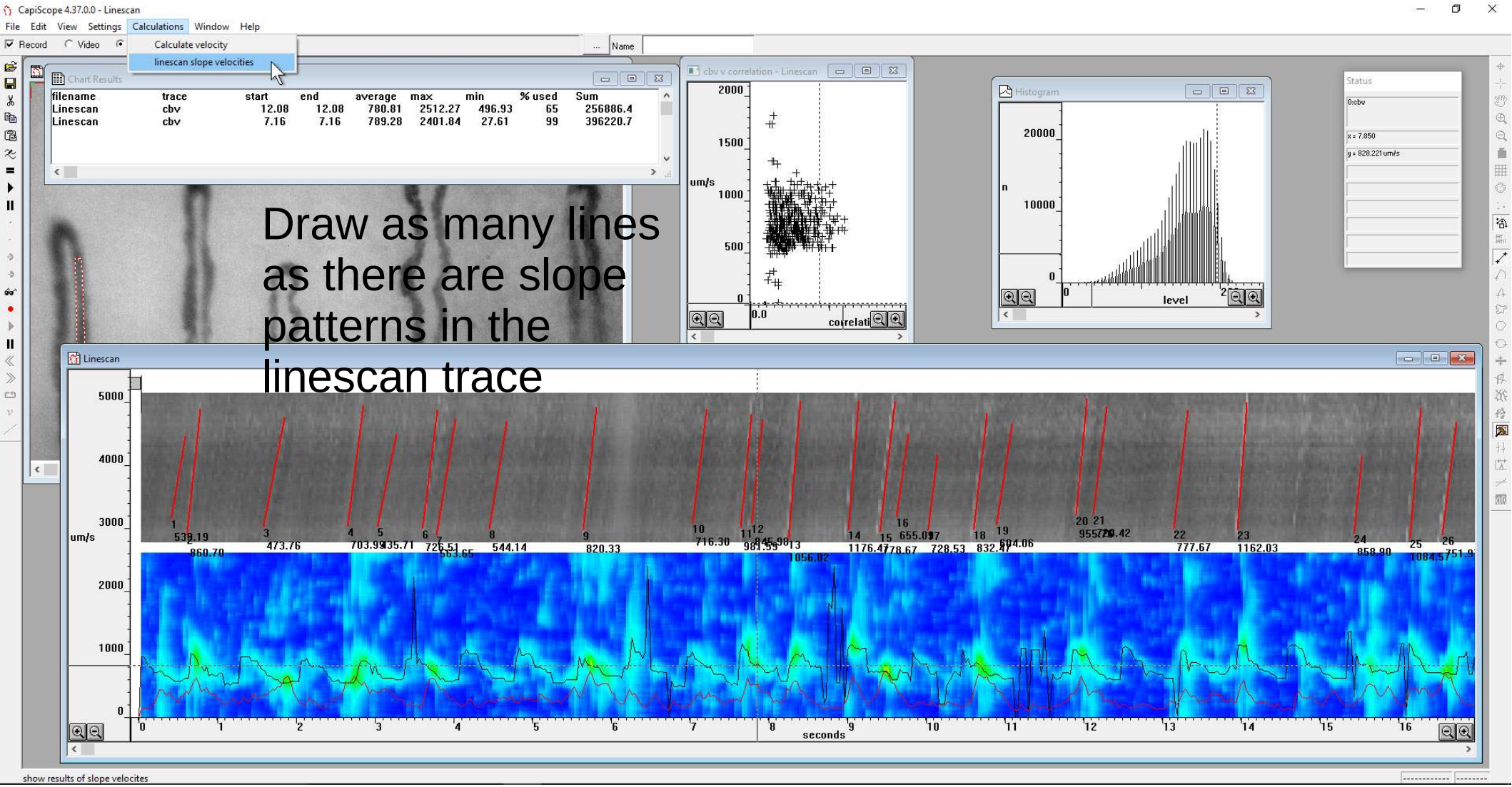


Reduce the correlation limit to increase the number of cbv points.

Recalculated cbv



Cbv from velocity slopes



Cbv from velocity slopes