Capillary Velocity

Open your recorded nailfold capillaroscopy video

Automatic Movement correction

Use the Automatic Movement correction function to remove movement artifacts

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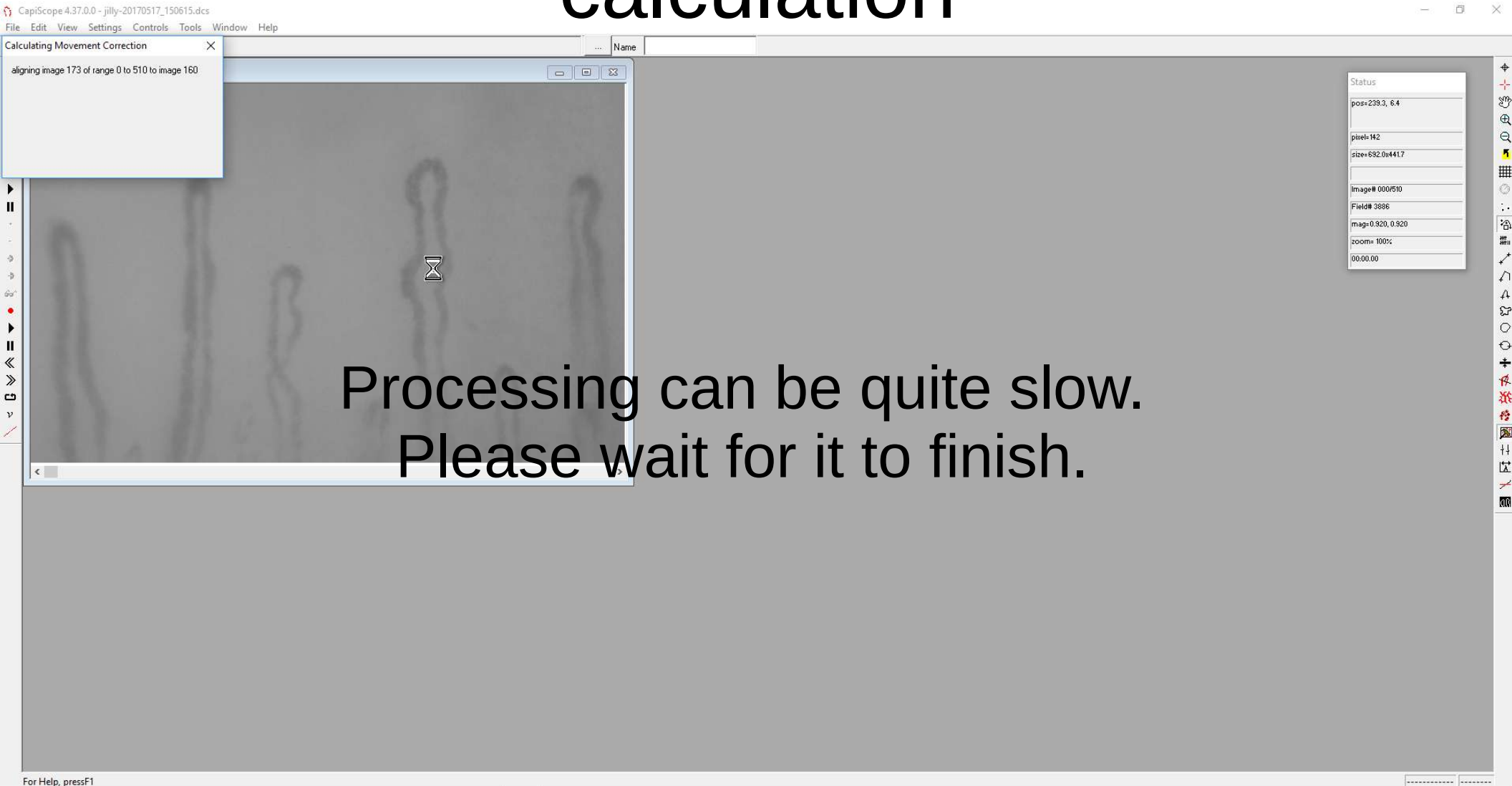KK Technology CapiScope 4.37
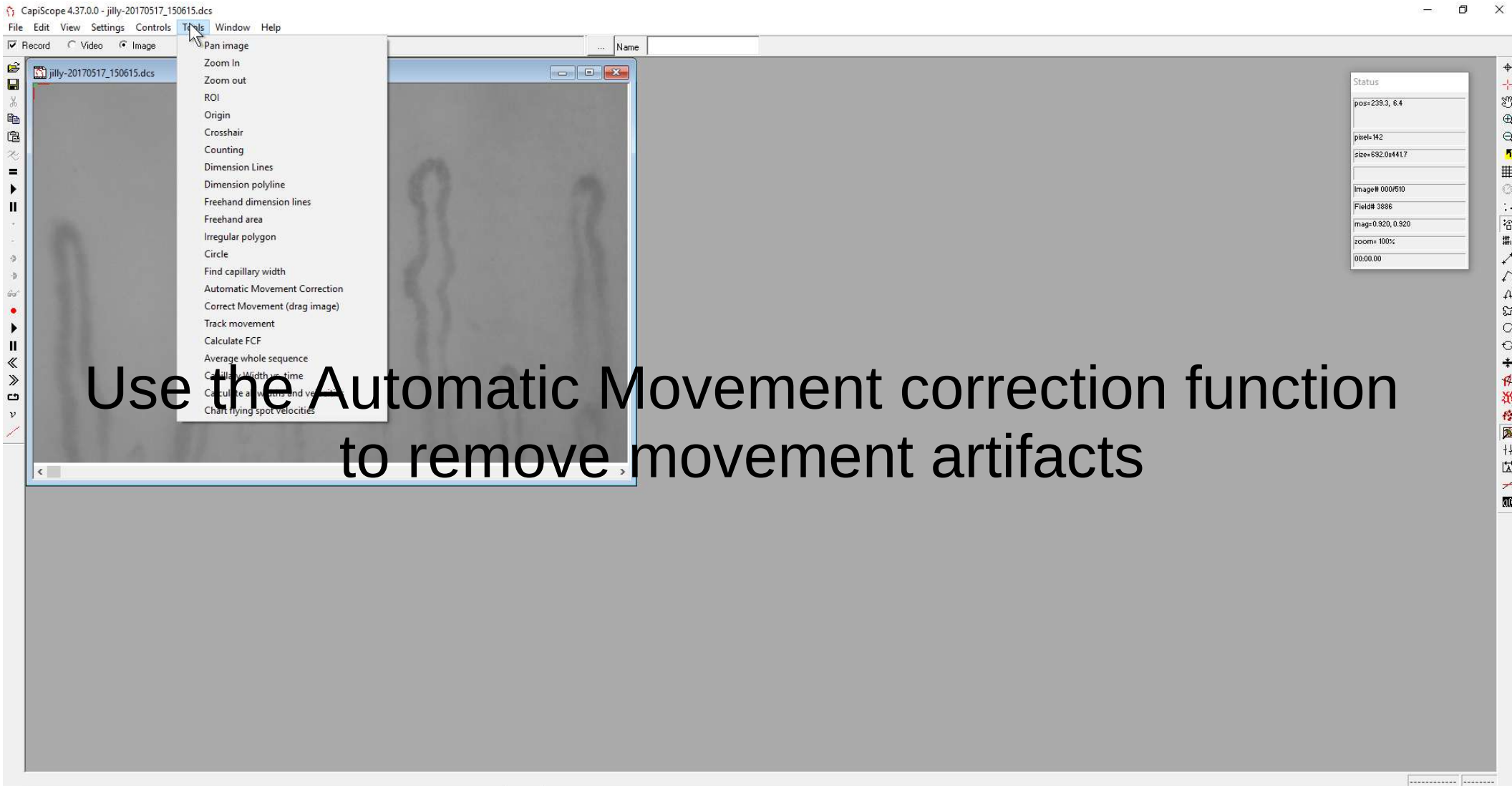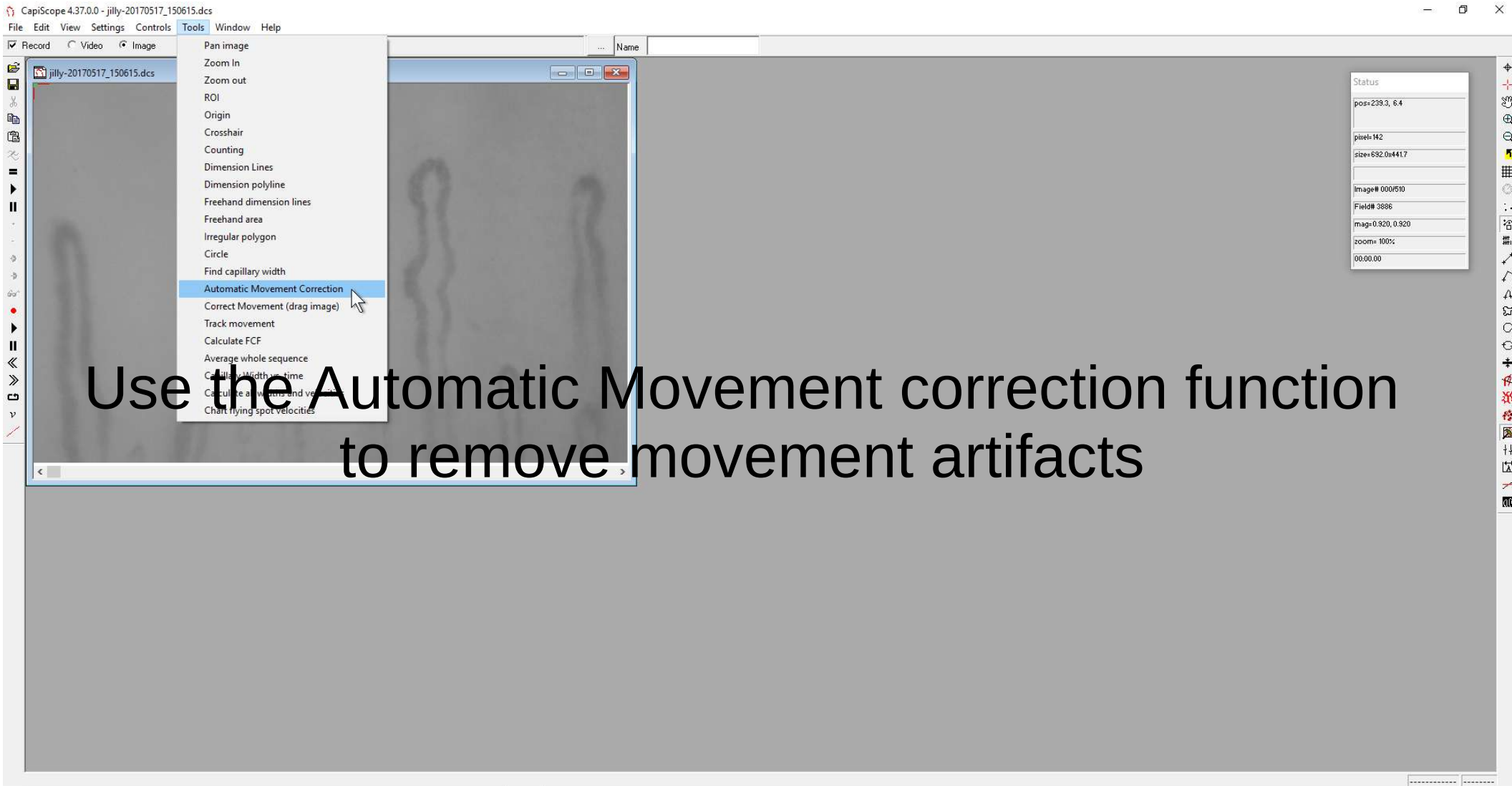
Automatic Movement correction parameters

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

Processing can be quite slow.
Please wait for it to finish.

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
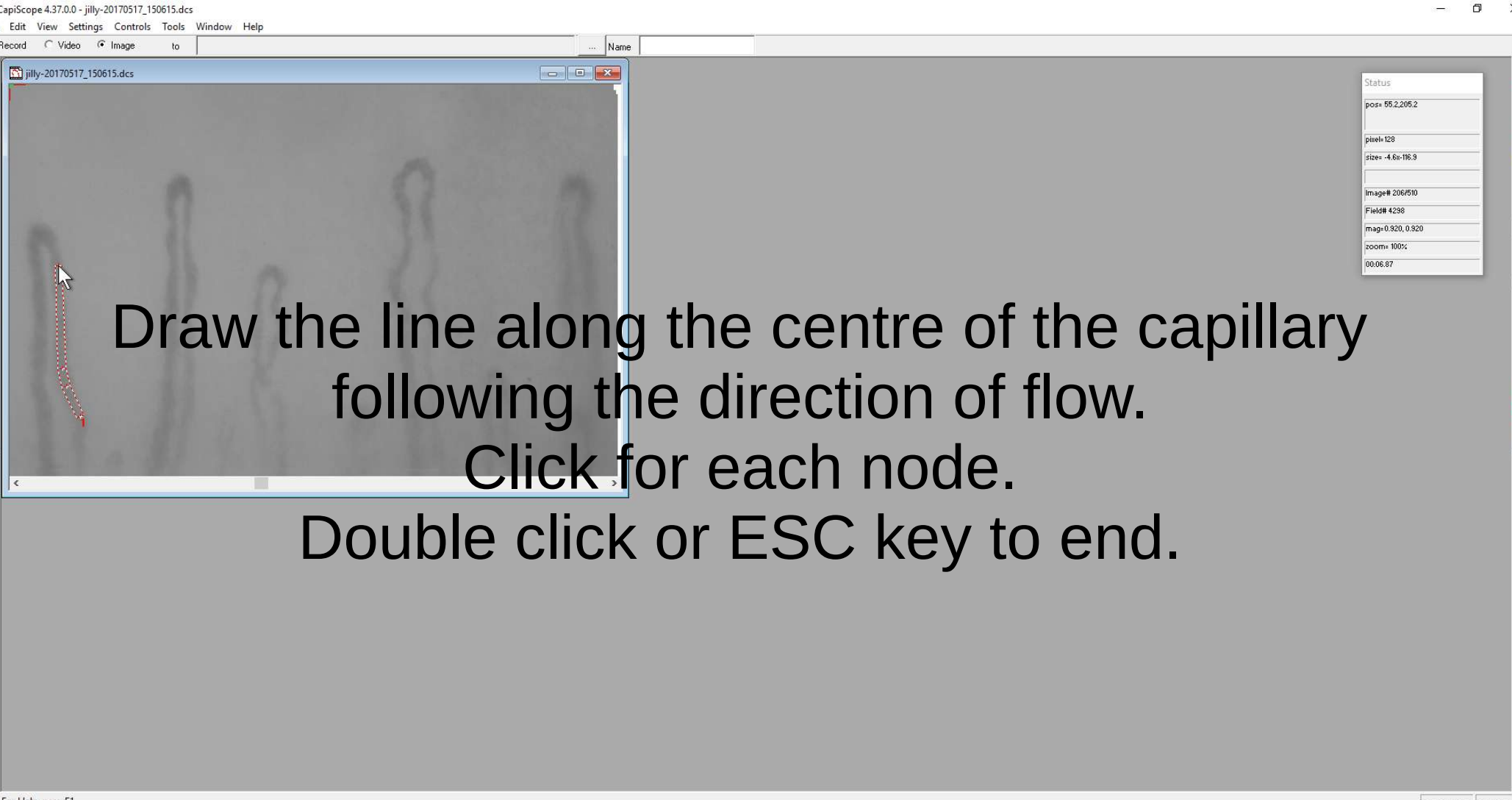
Drawing the Measurement line

Draw the line along the centre of the capillary following the direction of flow

Measurement line

Draw the line along the centre of the capillary following the direction of flow.
Click for each node.
Double click or ESC key to end.

Line width
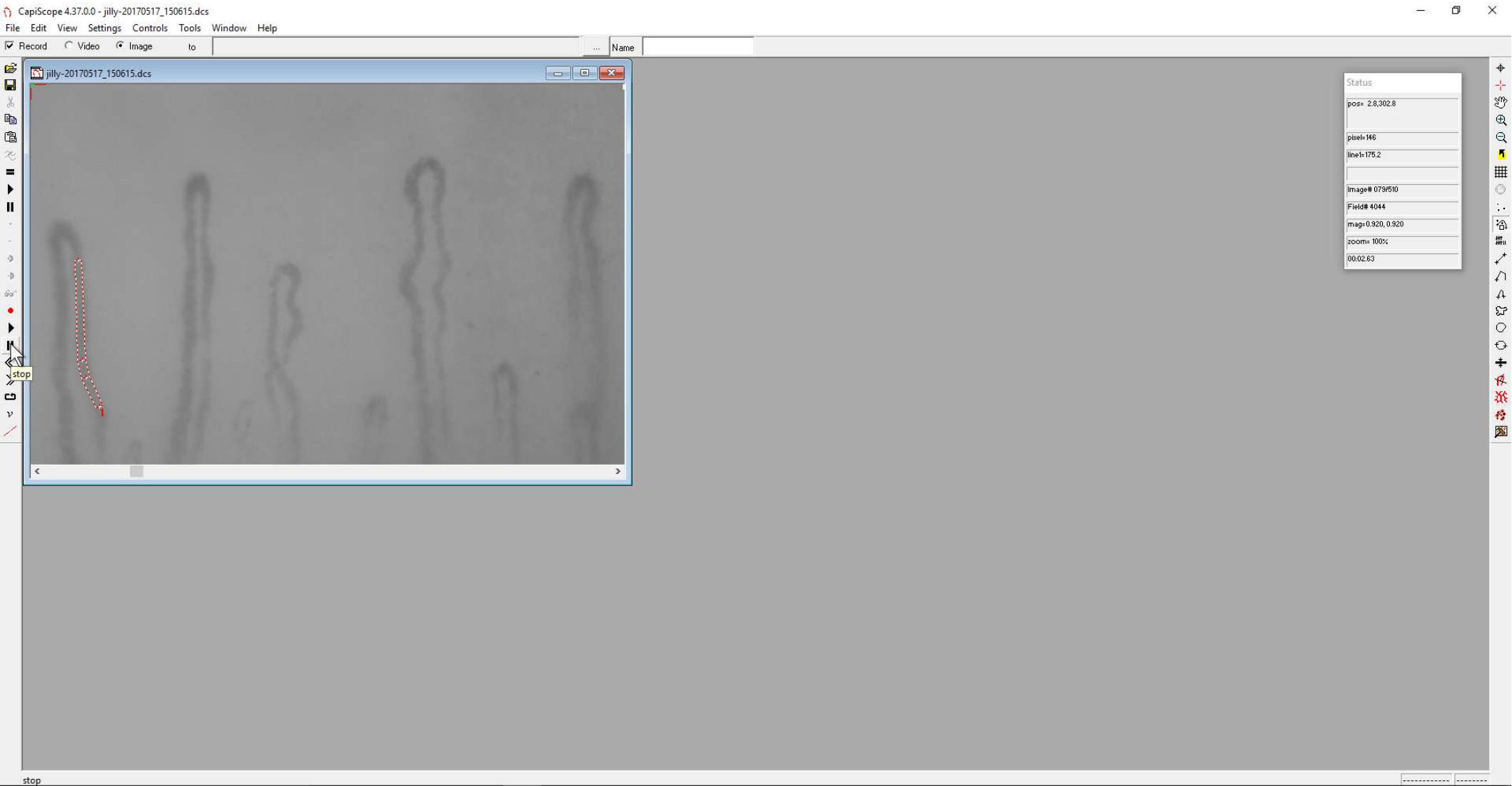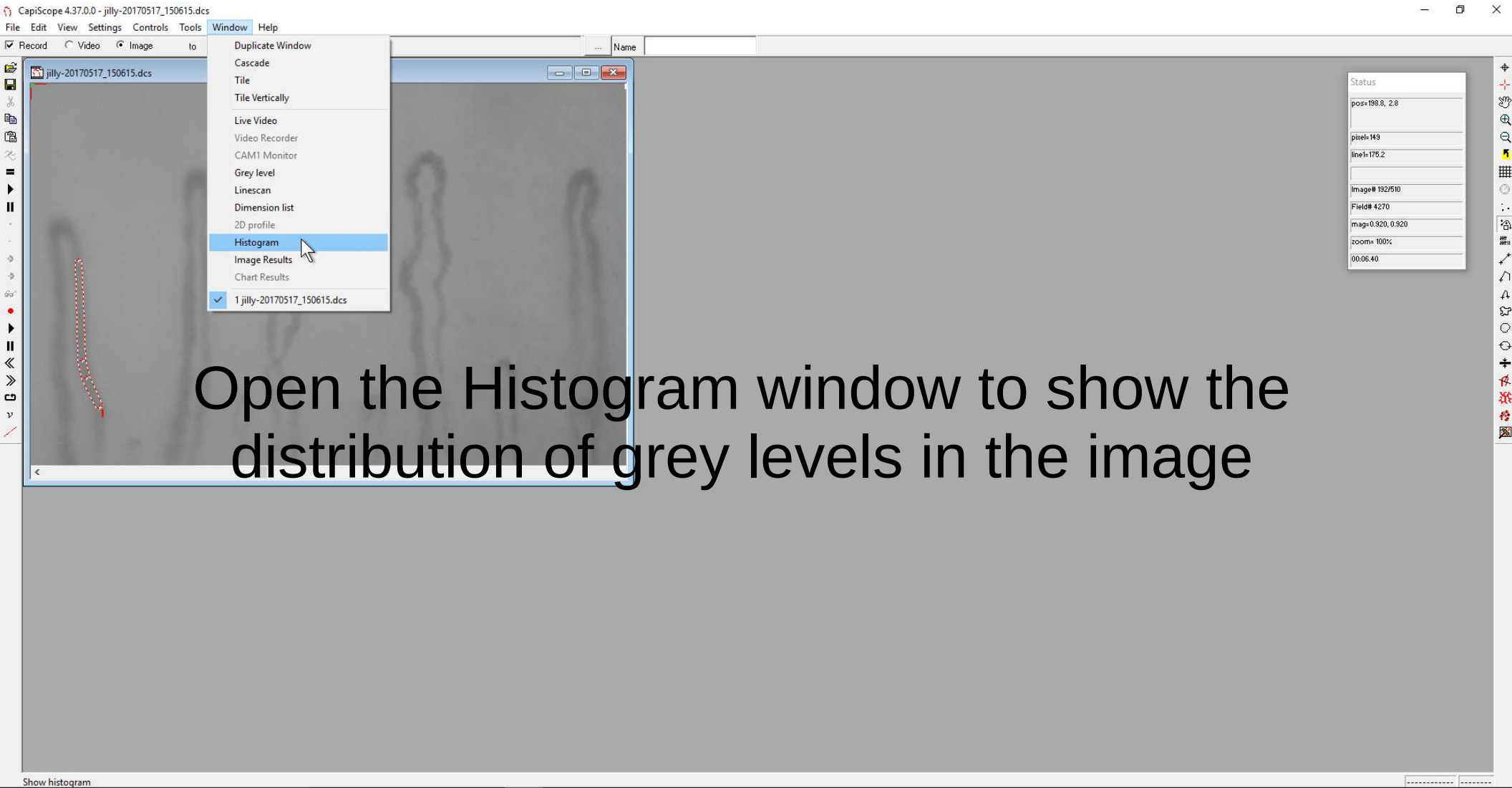

Set the measurement line width by right click on the first node of the line. Set the width to about the same width of the capillary.
Enter line width in pixels.

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Stop loop play

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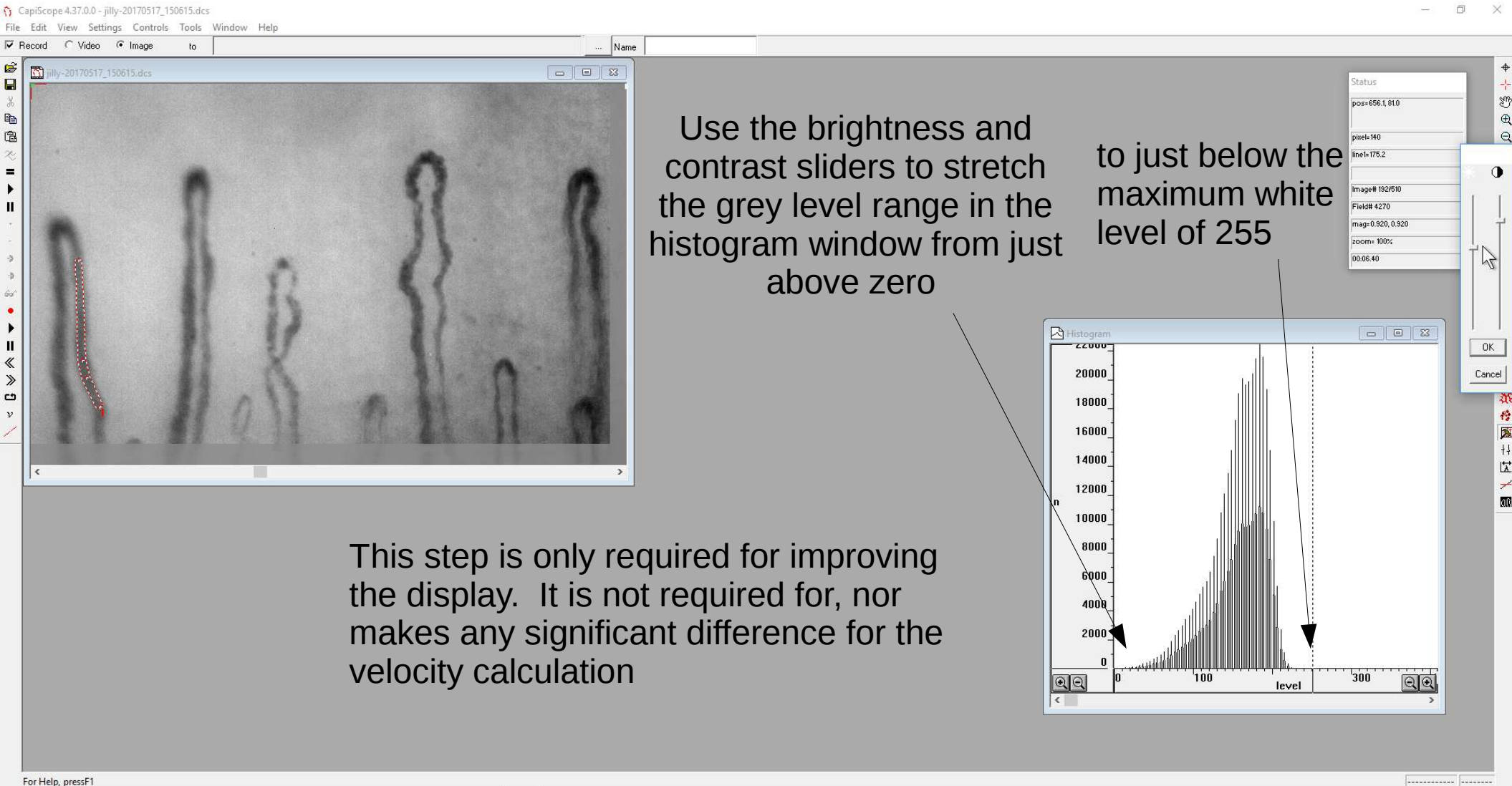
Open the Histogram window to show the distribution of grey levels in the image

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

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Interlace

If your video recording was recorded from a camera with interlaced video (RS170, CCIR, PAL, SECAM, etc), then set the *Use Interlace* option.
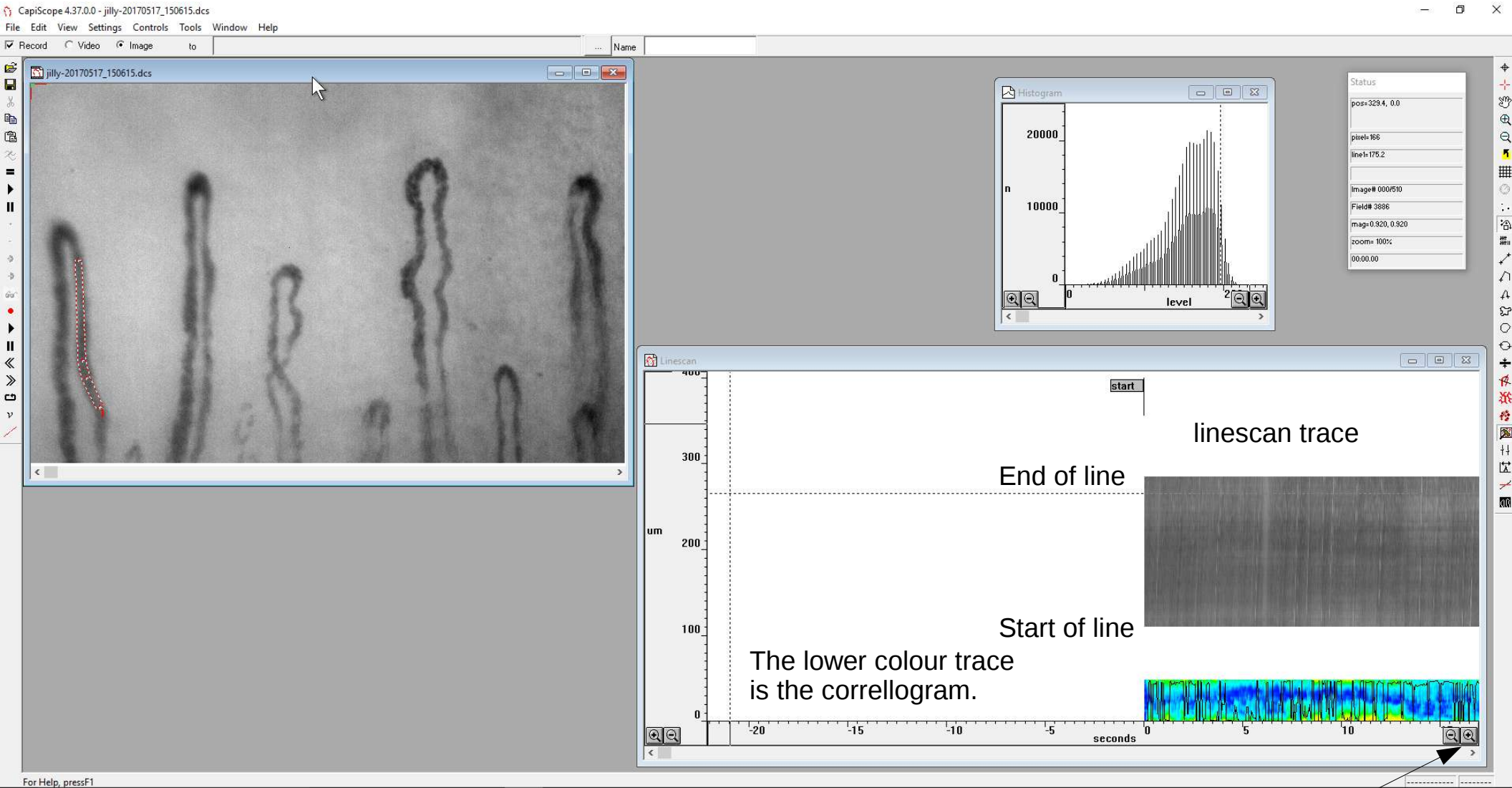
Acquiring the linescan

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

linescan trace

End of line

Start of line

The lower colour trace is the correllogram.

Expand the linescan traces

Linescan chart

Linescan traces

Estimating cbv

Use the Dimension Lines toolbar button to enter the linescan velocity line drawing mode
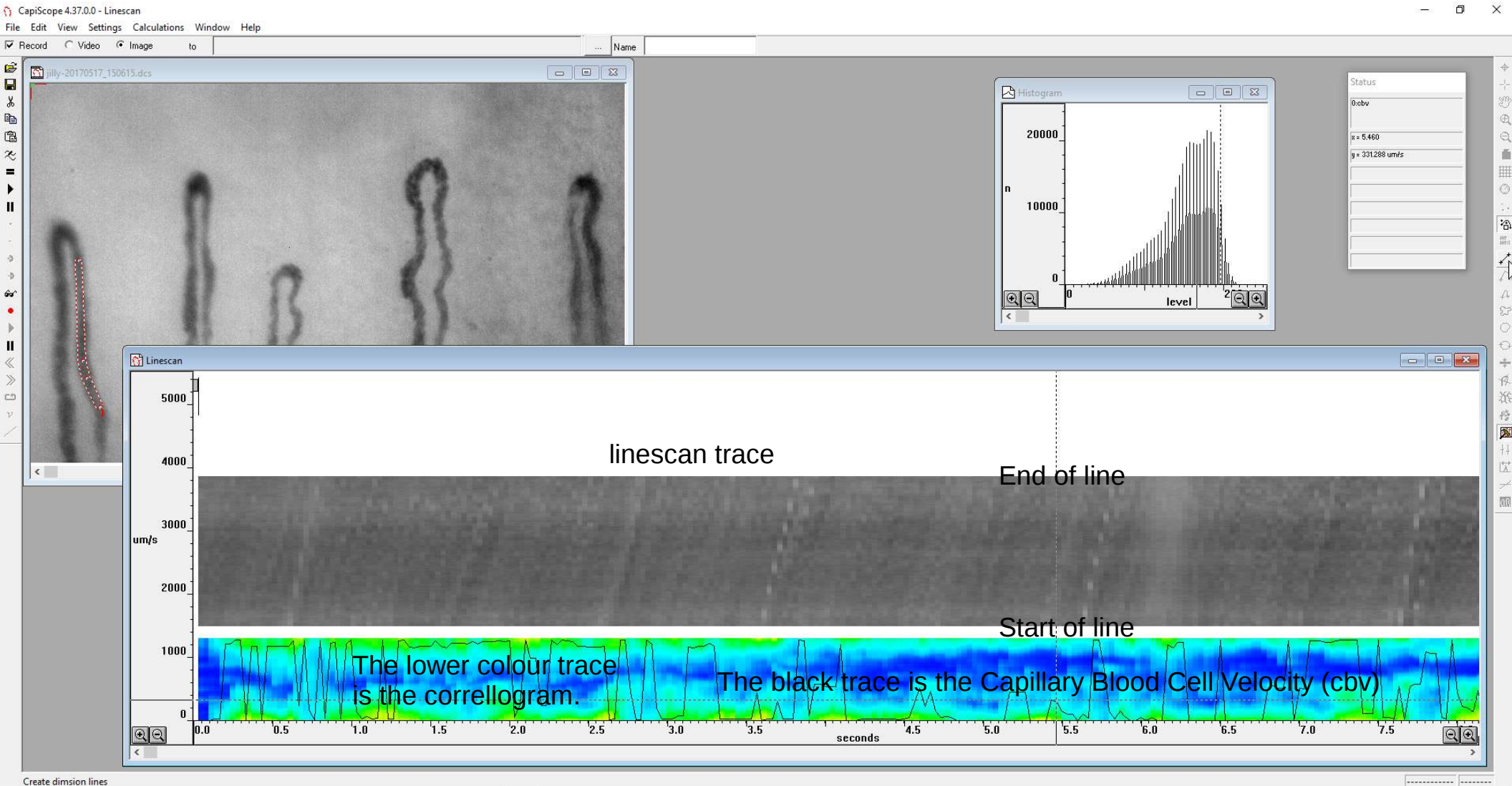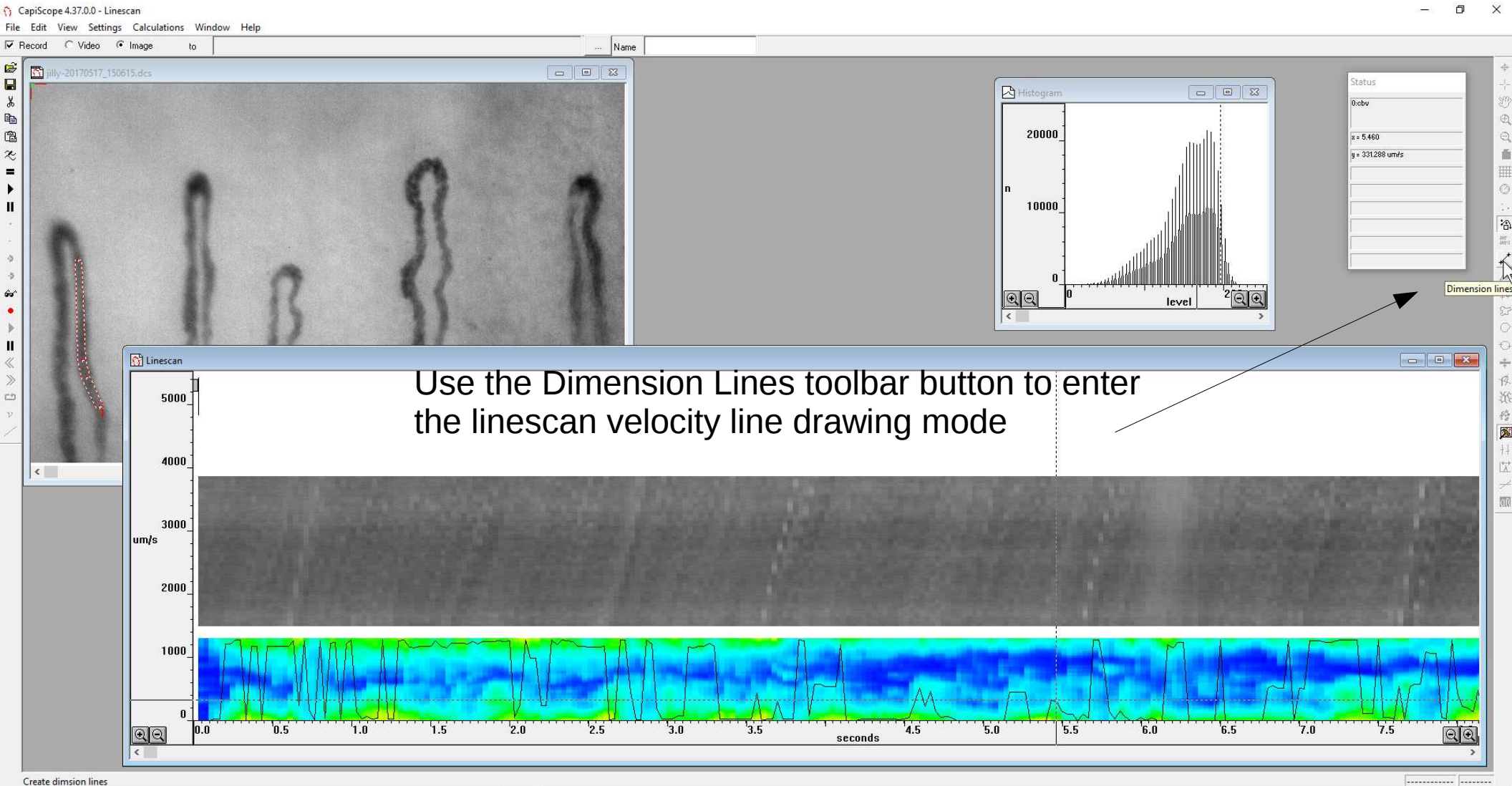
Estimating cbv

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
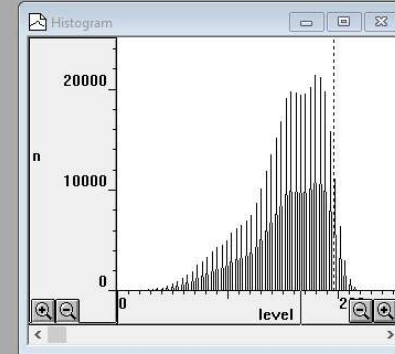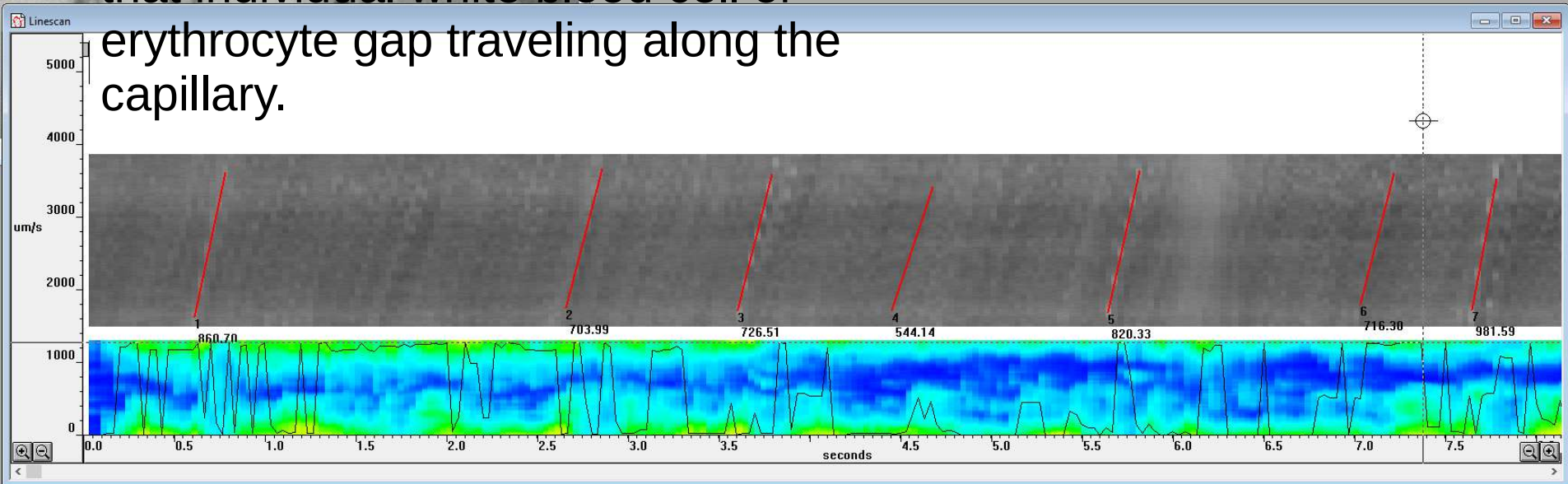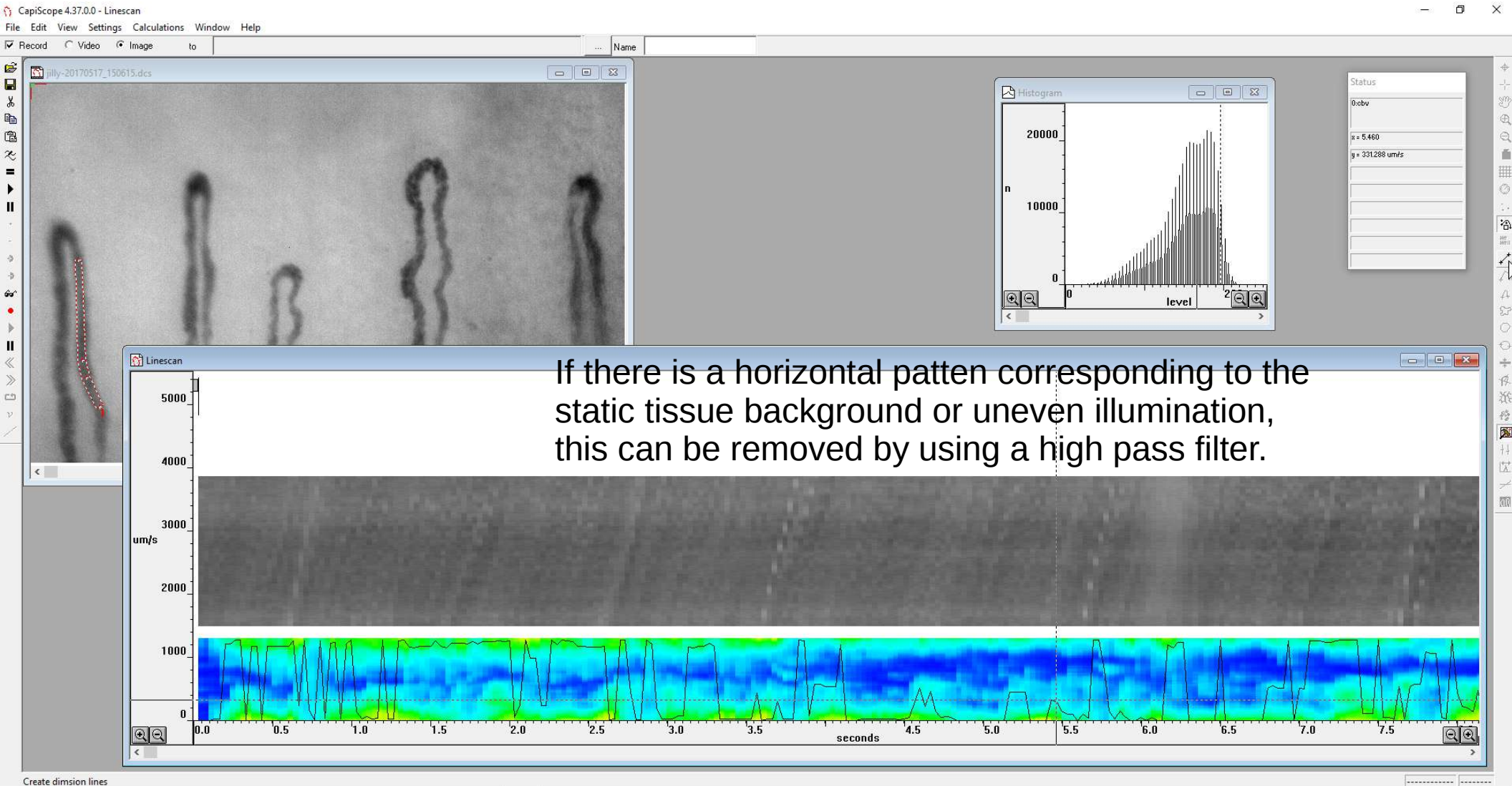
The horizontal patten can be eliminated by refining the cbv calculation parameters
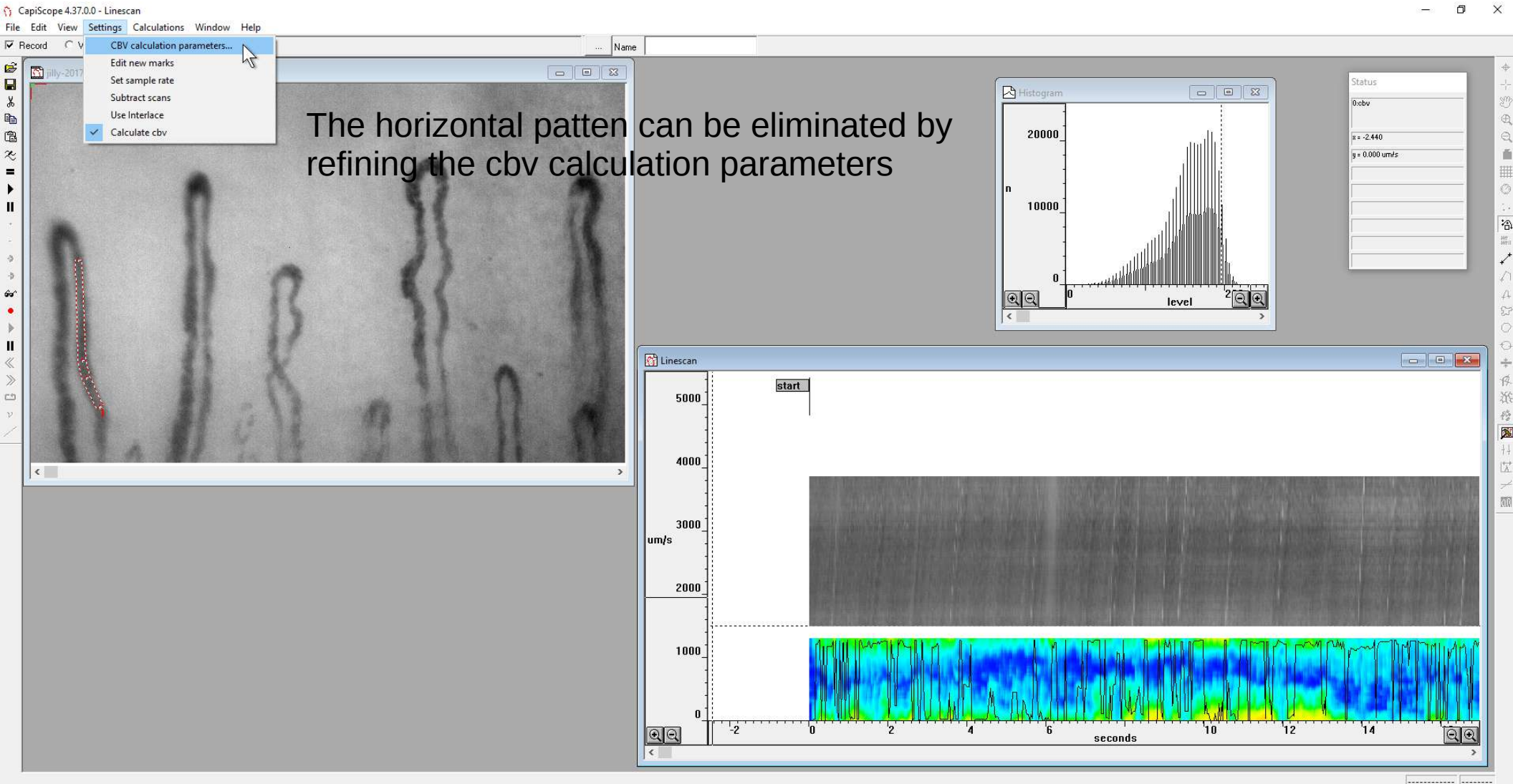
Refining cbv parameters

The horizontal patten can be eliminated by refining the cbv calculation parameters. Enable the high pass filter.

Since our estimated velocity is close to the full scale range, we can increase the maximum velocity by reducing the sample period between correlations
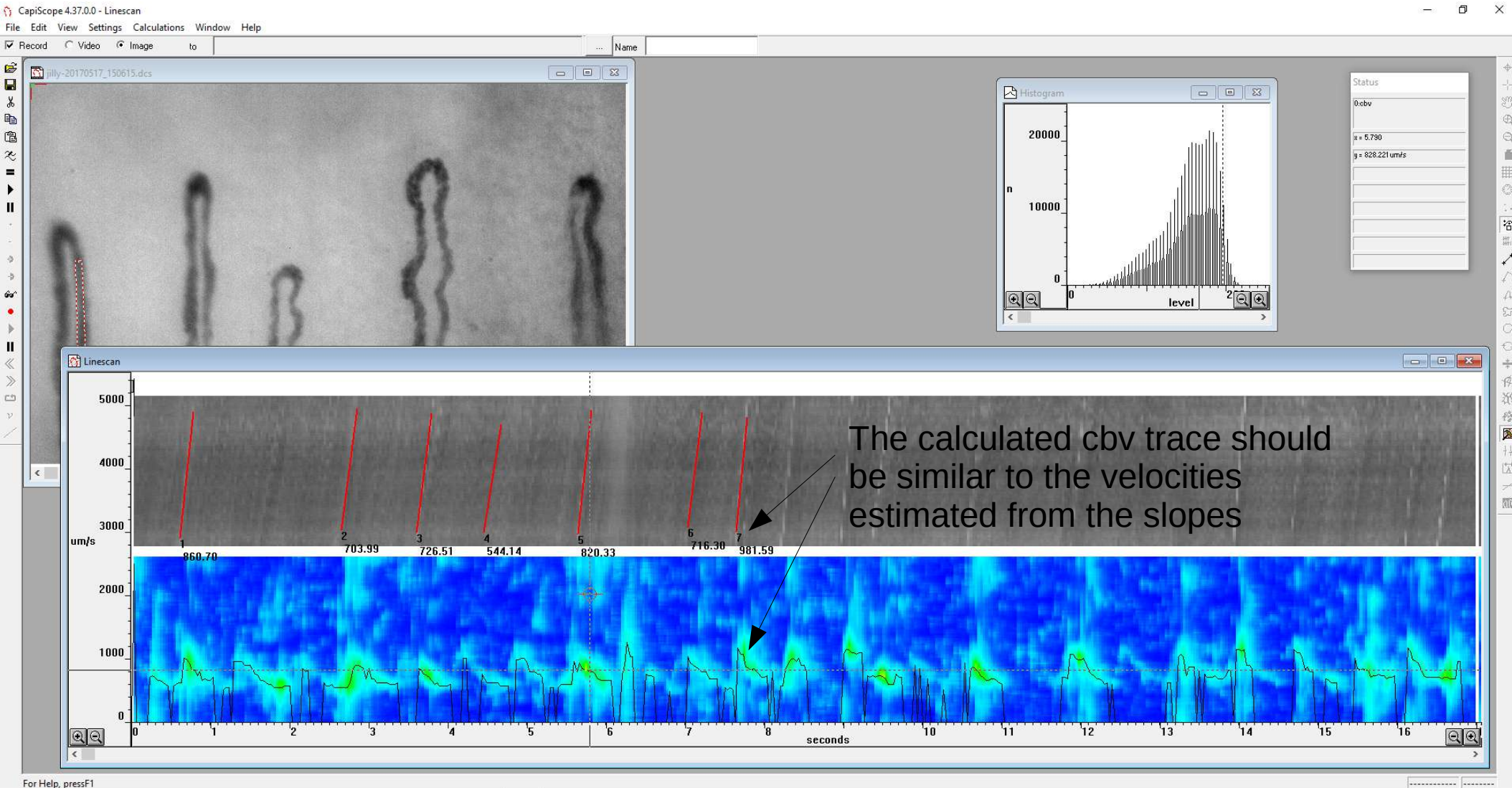
Recalculated cbv

The calculated cbv trace should be similar to the velocities estimated from the slopes

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

average cbv

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.
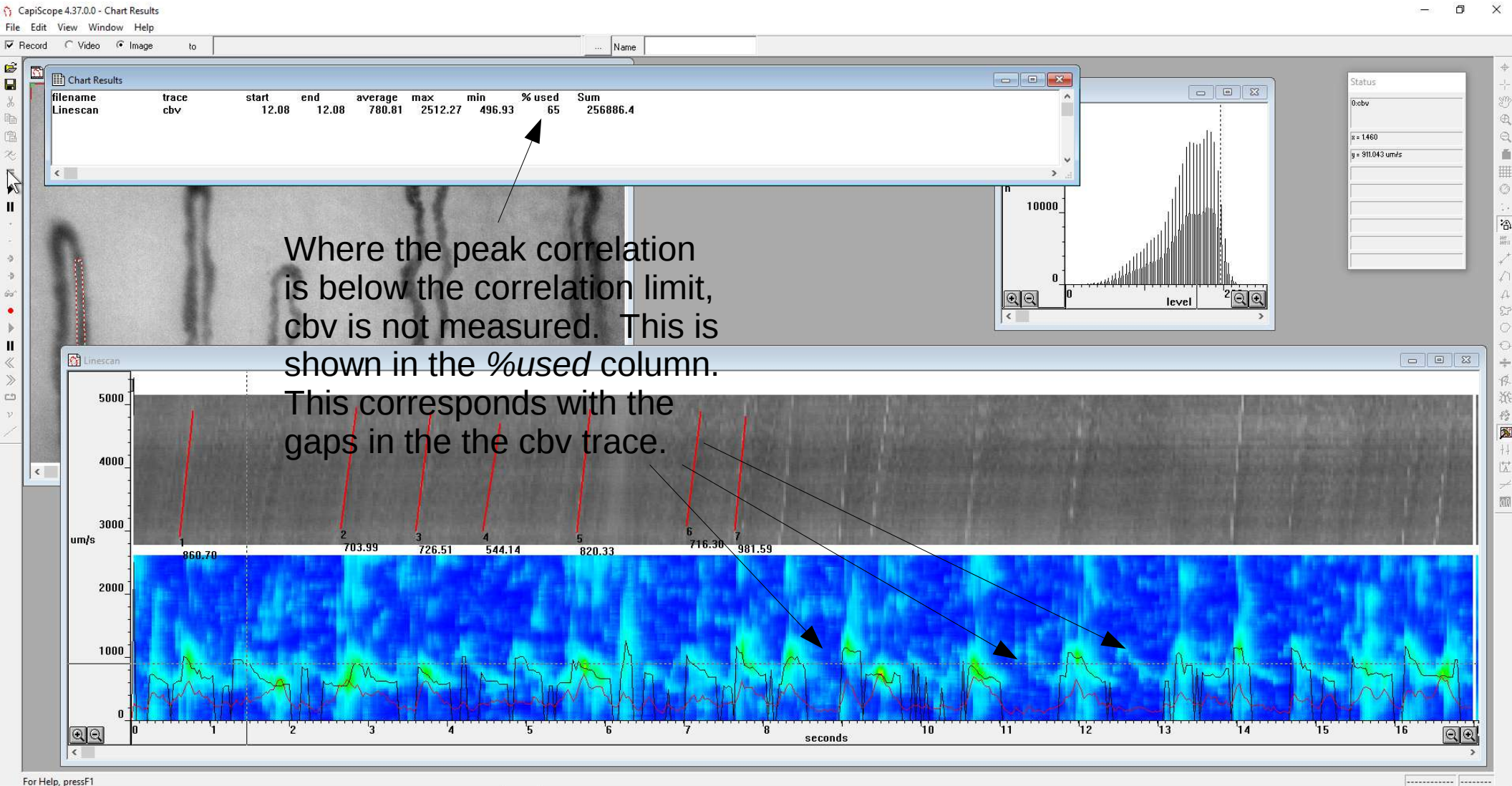
Correlation trace

Use the keyboard TAB key to step through the linescan traces until the *correlation* trace is active.

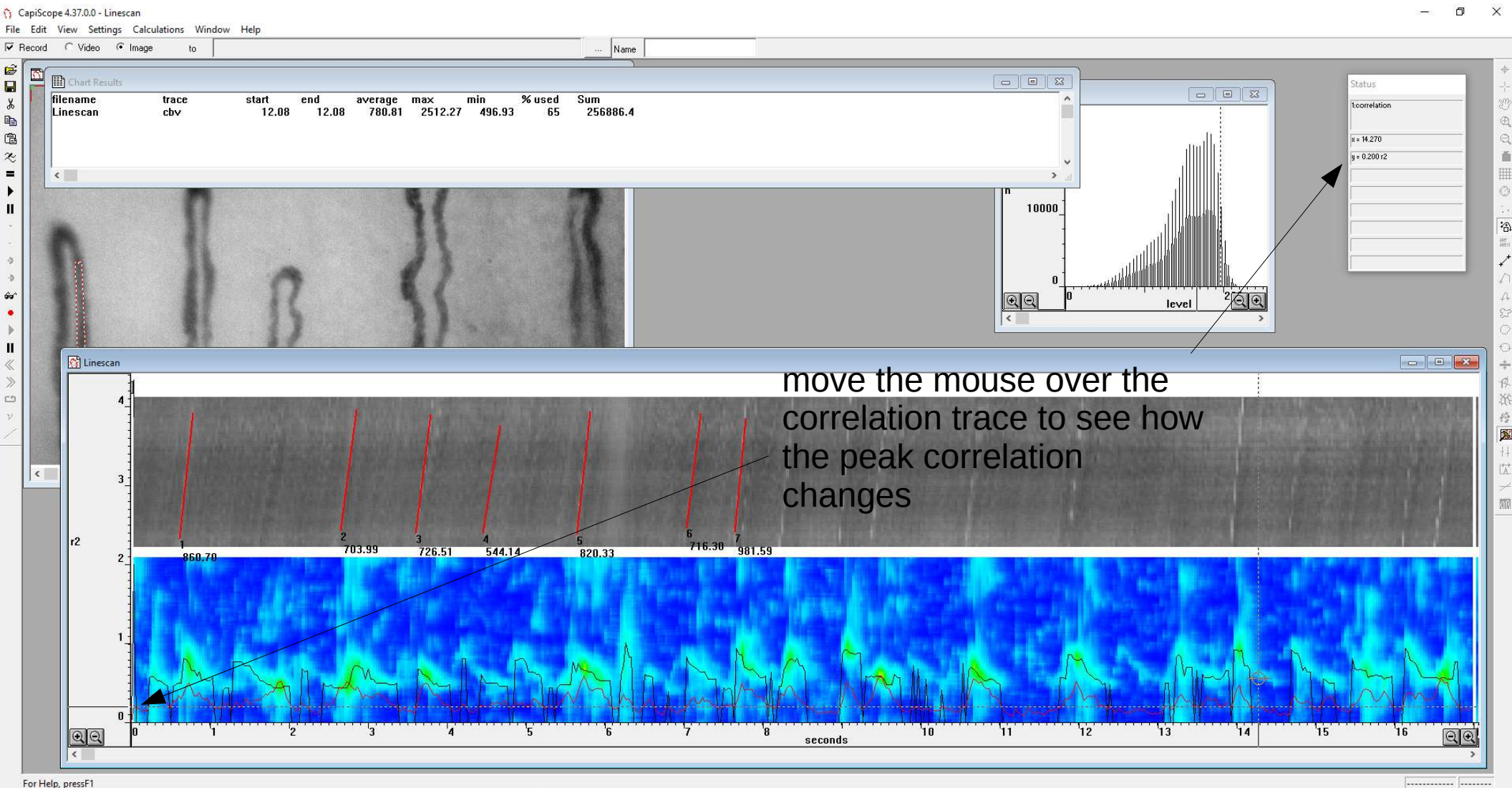Use the *hide trace* toolbar button to show the correlation trace

Choosing a correlation limit

move the mouse over the correlation trace to see how the peak correlation changes

Open cbv vs peak correlation

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

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

Draw as many lines as there are slope patterns in the linescan trace

Cbv from velocity slopes

Average velocity of all slope lines is shown as the last row