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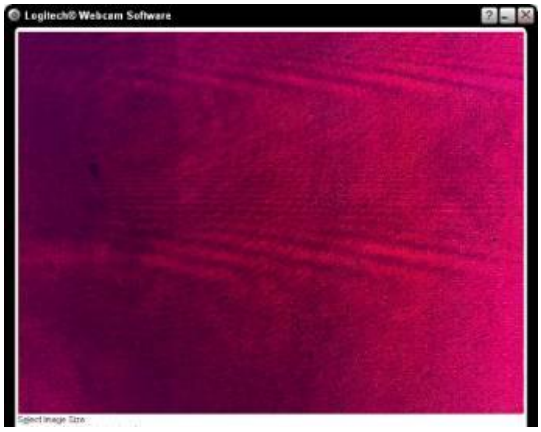
Interferometer

1. Zero optical path difference (OPD)

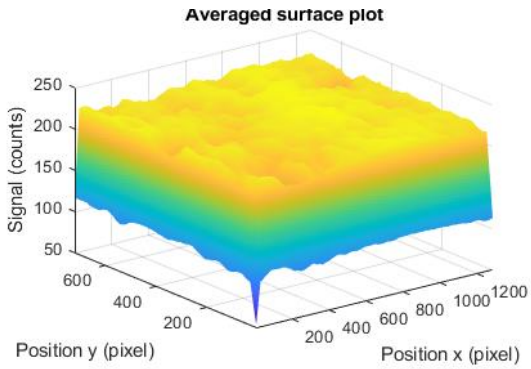
Find the zero OPD position and plot the intensity profile as well as a surface plot for the destructive and the constructive interference cases (**4 plots**). Take care that you use **equal exposure** conditions for both states to show the contrast correctly.

Picture 1 – Destructive interference

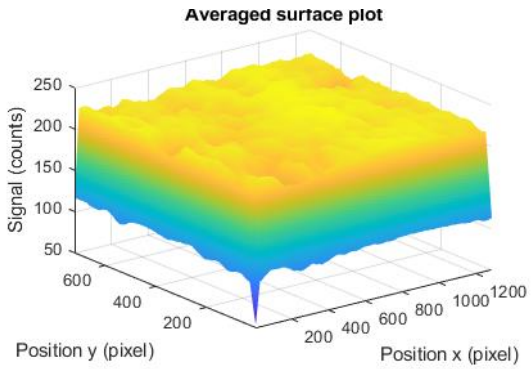


Picture 2 – Constructive interference

Graph 1 - Surface plot destructive interference



Graph 2 - Surface plot constructive interference



Explain why it is so difficult to align for the zero OPD.

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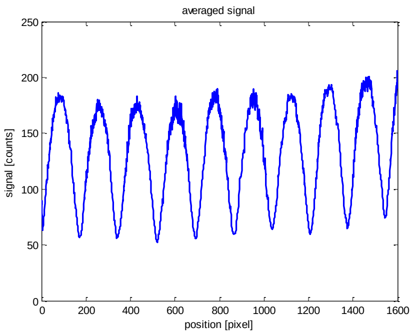
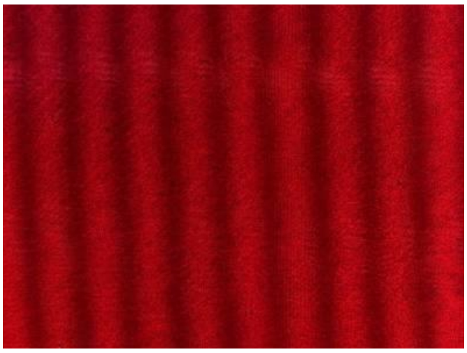
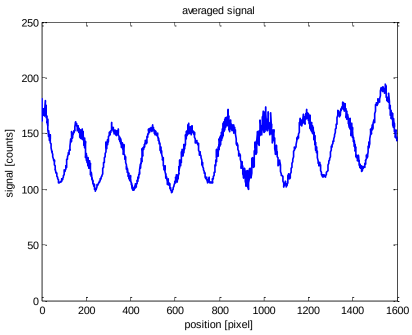
What is the minimum OPD to go from a constructive to a destructive interference?

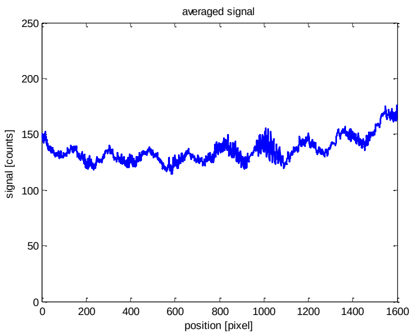
2. Measurement of laser fringe contrast

Show **three pictures** with different contrast and plot their line curve.









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Measure the contrast as a function of position of the translation stage (over more than 1 full cycle of contrast variation, minimum 30 points, use the table below). **Step size 0.1 mm!**

Relative position on the micrometer screw in mm	Contrast $C = \frac{I_{max} - I_{min}}{I_{max} + I_{min}}$
0	

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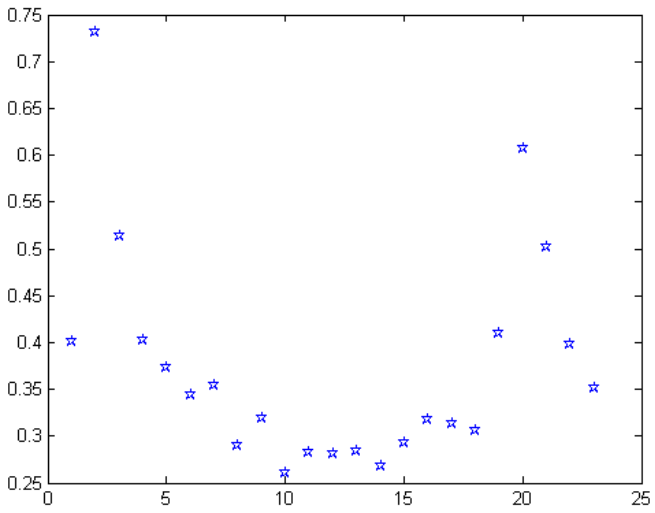
Plot the values (**one graph**).



Contrast versus mirror position. You should plot the position in mm.

You will now calculate the spectral width of the source using the period of the variation. (Eq. 12, where Δz is the period found in your measurement). **You must estimate the error on your measurement** knowing that the spectral width is expressed as

$$D\lambda = \frac{\lambda^2}{\Delta z}$$

To do so, one needs to evaluate the error δΔz on the peak distance from your contrast measurement plot that you have obtained above.

$\delta\Delta z$ =....

Explain how you have obtained this value.
Explanation: …….

You also have to find the error on the wavelength: $\delta\lambda$ = ...

This is **not** the spectral width! It is the wavelength uncertainty from the datasheet.
Now, using $\delta\Delta z$ and $\delta\lambda$, find the **analytical** expression for the error on the spectral width $\delta\Delta\lambda$.

$$\delta\Delta\lambda =$$

Finally, the spectral is: $\Delta\lambda$= ..... ($\Delta\lambda$) $\pm$ ..... ($\delta\Delta\lambda$) =

Explain why the contrast exhibits such a modulation versus the mirror position.

3. WEB - Example

Find an example of an application where interferometry is the key technique. Print a picture; give a **short explanation** and parameters that are measured. Cite correctly.

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(Optional) Personal feedback:

Was the amount of work adequate?

What is difficult to understand?

What did you like about it?

How can we do better?