Interferometry Session 5

Welcome to Martin's Lab Book.
The work in the following section was completed on:

Tuesday, January 24th, 2023
9am – 12pm

in a synchronous manner becoming of a lab workbook.

Aims

- We are supposed to have a green singlet and yellow doublet from the Hg lamp.
- Take a interferogram for finding the green doublet.
- Care was taken to prevent blindness by wearing safety spectacles.
- Estimate the width of the line, and work out the crossing points of the interferogram using calibrate.py. We know that the real wavelength is 546.0nm. Take a FFT.
- Examine the yellow doublet, finding the mean wavelength, line separation, width and then take an FFT of the interferogram.
- Basically, repeat what was done in Session 4, but correctly this time.

Task 10 – The Hg Green line (continued)
The laser may have had instabilities but QM means that the Hg spectral lines must be stable (in normal conditions). So take a long (several mm) interferogram of the green line.

1. *Use this run and equations 4 and 5 to estimate the width of this line.*
2. *Investigate the stability and reproducibility of the distance moved by the stage.*
3. *You might want to do this by looking at the crossing points of the interferogram using calibrate.py. The real wavelength 546.0nm*
4. *What happens if you take an FFT of your interferogram. You should quantify your measurements in this task and remember that measurements are meaningless without errors.*

Preliminary Readings

The re-taking of the data was conducted, following the abysmal session which we refer to as Session 4. For the mercury lamp, which we now switched with the LED on the stand, and wearing UV goggles for protection, we expected for the green waveform to have a single peak in our waveform, which can be roughly seen in **Figure 1** below, although it is cut off on both sides, and is asymmetrically weighted towards the left-hand side.

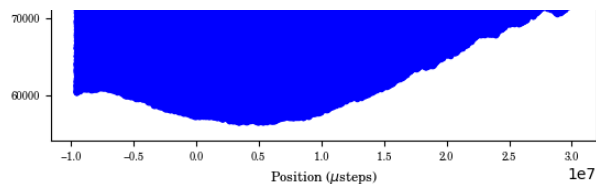**Start Point:** 12.25mm
End Point: mm

Detector 1
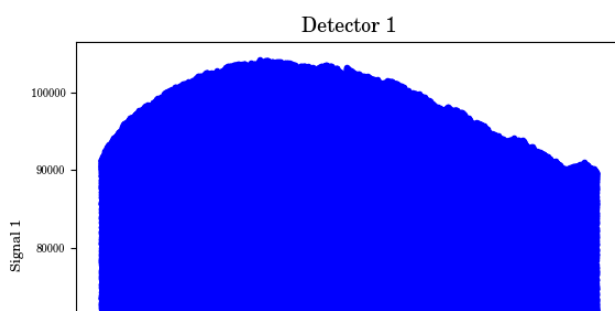
Figure 1: Preliminary data. This is the data for the green singlet waveform, with a single peak, travelling between –10,000,000 micro-steps to about 30,000,000 micro-steps. The peak is approximately around 5,000,000 micro-steps.
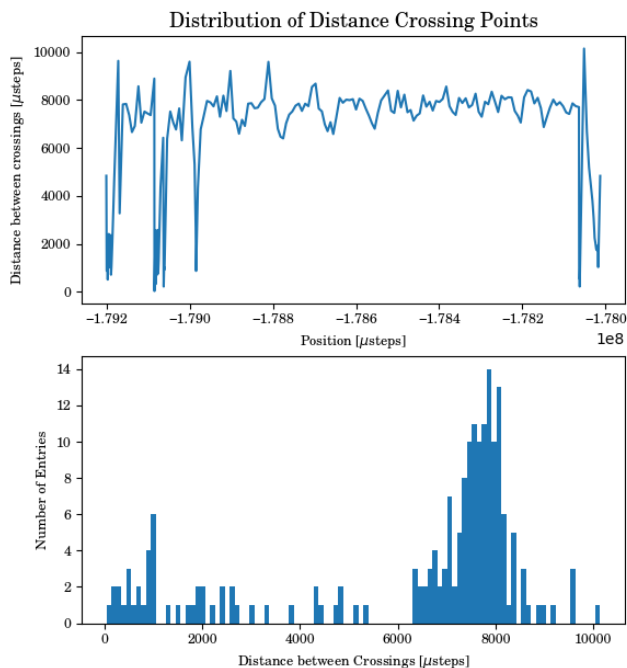

Figure 2: Preliminary data. This shows the distribution of crossing points for the green singlet. The following data was obtained from the *callibrate.py* script below:
[INSERT PARAMETERS]

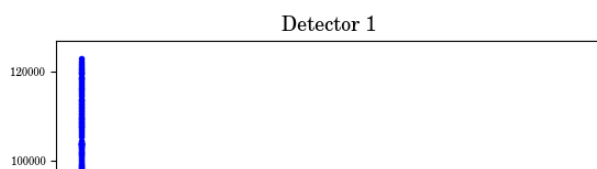**Task 11 – Examine the Yellow doublet (continued)**

Take a long interferogram of the Hg doublet and use it to measure:

1. *The mean wavelength*
2. *The separation of the lines (using equation 3)*
3. *The widths of the lines (using equations 4 and 5)*
4. *Take the FFT of the of the interferogram. Does what you see make sense?*

Final Run –Yellow and Green

End at 120,000,000 micro-steps	11.52mm
Start at 74,519,550 micro-steps	10.23mm

Consequently, this yields a value of **28.36pm**. This is quite a significant deviation from our previously calculated value of 15.6pm.
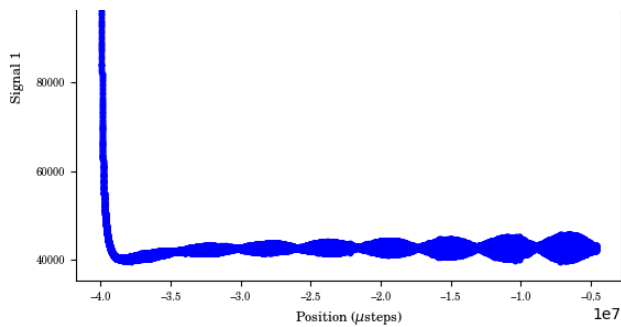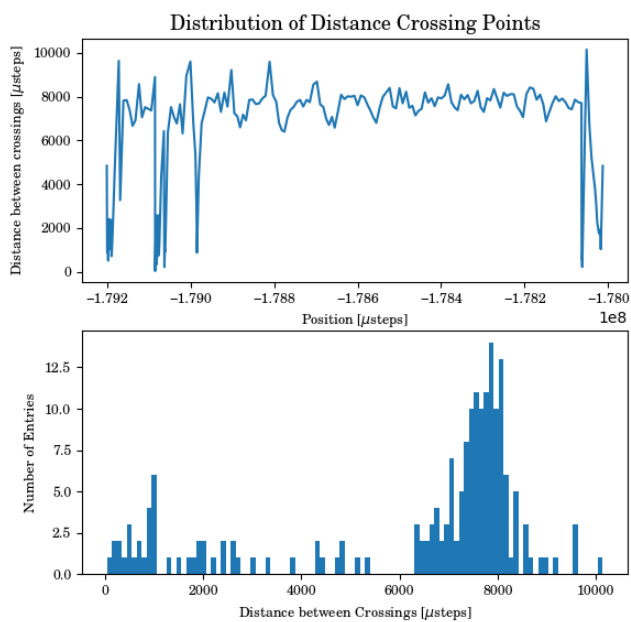

Detector 1

Figure 1: Preliminary data. This is the un-FFT'd data.
Only Detector 1 was in use.

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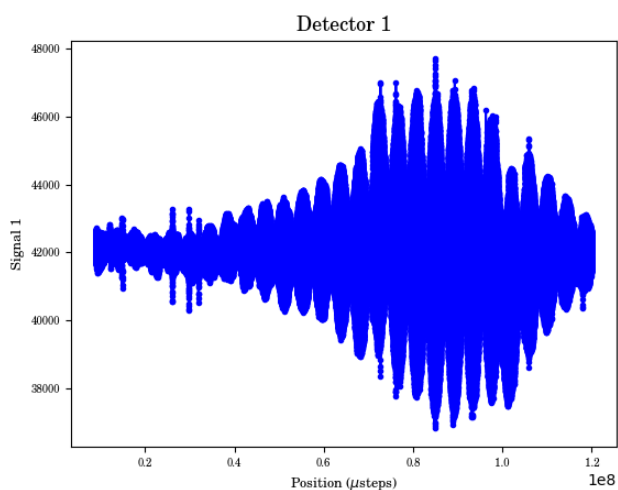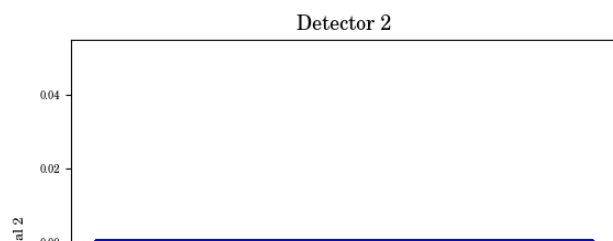Only Detector 1 was in use.

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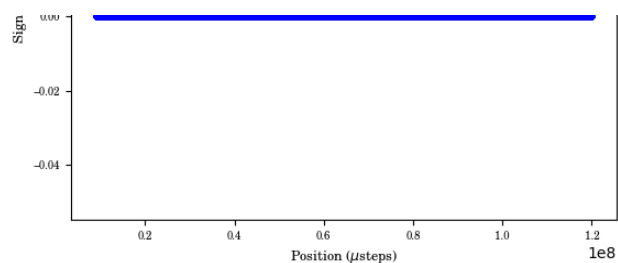Only Detector 1 was in use.