Session 4 - Tasks 10 -11

Tuesday, January 10, 2023 9:00 AM

Aims for session-

Set up the interferometer for the mercury lamps
Take readings for the green line
Take readings for the yellow doublet
For each estimate the spectral line width, find crossing points and take a FT

Task 10

UVP penray mercury lamps are made up of mercury vapour and a mixture of inert gases. Typical intensities are outlined in the table below.

Typical Intensities of UVP Pen-Ray Lamps				
Lamp Current	***Typical Intensit y 254nm @ 0.75" (microw atts/cm2)***	***Typical Intensit y 365nm @ 0.75" (microw atts/cm2)***	***Lamp Operati ng Voltage***	***Lamp Body Tempera ture (degrees C)***
90-0012-01 (Model 11SC-1)				
5 mA AC	2000	65	375	55
10 mA AC	3600	105	330	80
15 mA AC	4400	145	300	100
25 mA AC	4750	215	260	145
35 mA AC	4100	330	230	185
90-0019-01 (Model 11SC- 1L)				
20 mA AC		1213	280	120
25 mA AC		1280	260	145
30 mA AC		1298		
35 mA AC		1255	230	185
90-0020-01 (Model 11SC-2)				
5 mA AC	1150	30	240	60
10 mA AC	1850	50	215	85
15 mA AC	1900	70	200	105
25 mA AC	1700	130	185	155
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

35 mA AC	1500	210	190	200
90-0004-01 (Model 3SC-9)				
5 mA AC	800	50	590	30
15 mA AC	3300	130	600	39
25 mA AC	5400	200	570	48
35 mA AC	6700	250	530	54
50 mA AC	6900	300	480	64

To use the mercury lamp we first ensure that we wear safety goggles when making adjustments as the uv wavelengths from the mercury lamp can damage our eyes.

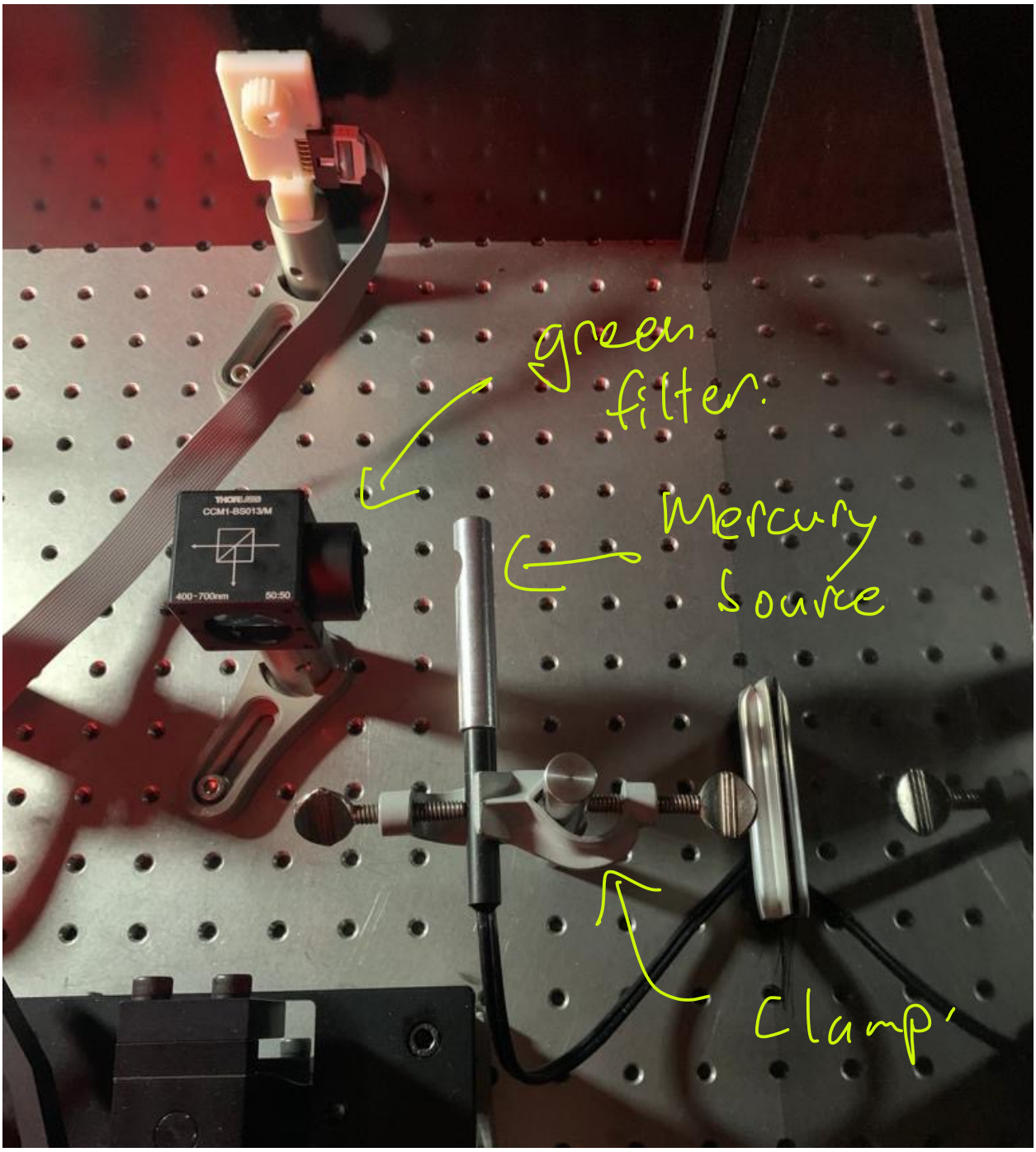

Fig 42. our new setup for the interferometer, same as previous set up but with the mercury source clamped so it's incident on the beam splitter with a green filter.

We have changed the set up to look like **fig 42.** Where we have replaced the source with a mercury lamp and placed a green filter in front of the beam splitter so that we only get the green spectral line from the mercury lamp.

We will now run a very long interferogram. A couple mm long, we've chosen 4mm to start with. We've set the start point for the motor to be at 4.29 mm and are going to have the motor turn for 5 mm which is the equivalent of 10 full revolutions of the motor.

Using our theoretical microstep conversion of 1 micro step equals 15.6 picometres we will need approx 260 million microsteps for the motor.

Will take around 30 mins with a rate of 140,000. We have also set the micrometer so that we know that within our 4mm range we will pass through the null point.

However, this session, after taking our data for both filters we have realised that our mercury lamp hadn't been connected properly and therefore wasn't on.

So we retook our data for task 10. The interferogram is shown in **fig 42.**

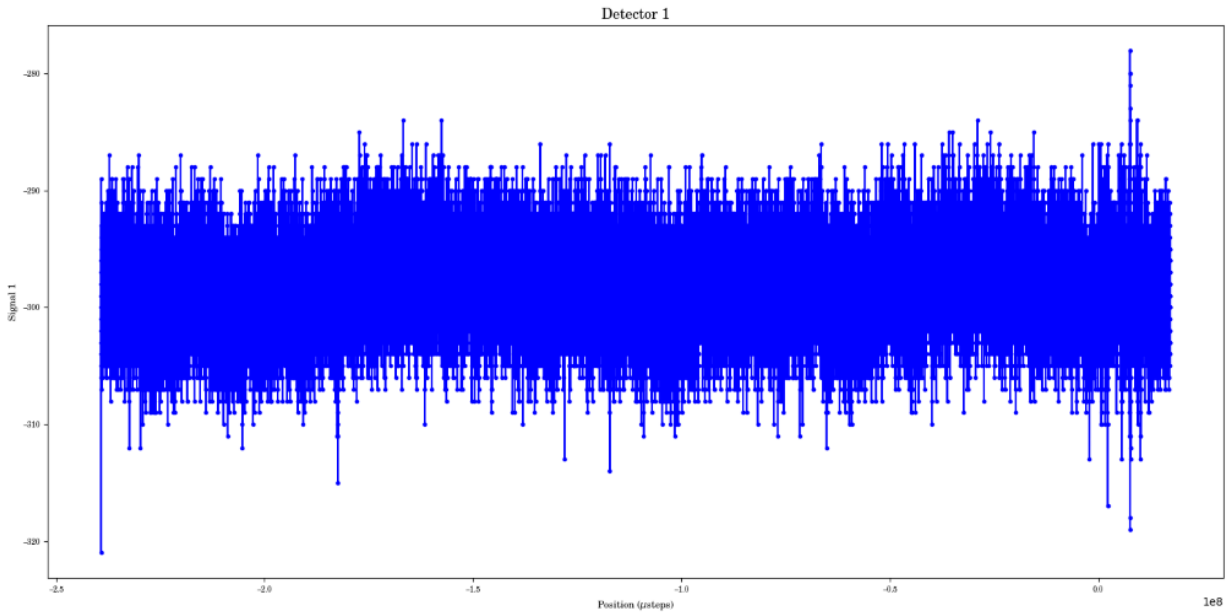

Fig 42. quickplot of signal (intensity) against position for the mercury source with the green filter. Clear to see that there is not a sinusoidal pattern

However, it doesn't look as expected with no sinusoidal features. We believe this may be because our set up wasn't correct. We think we should have blocked off the sides of the source so that they couldn't reach the mirrors or the detector apart from going through the beam splitter. We think the problem is that unlike the other sources we have used, the mercury lamp source doesn't just send all waves out in a straight line and we think the casing isn't perfect so some rays could have interfered with our results.

Before trying again we have decided to speak to a demonstrator. After conferring with a demonstrator, we are now sure that our corrected set up - shown in **fig 43. -** should yield correct data.

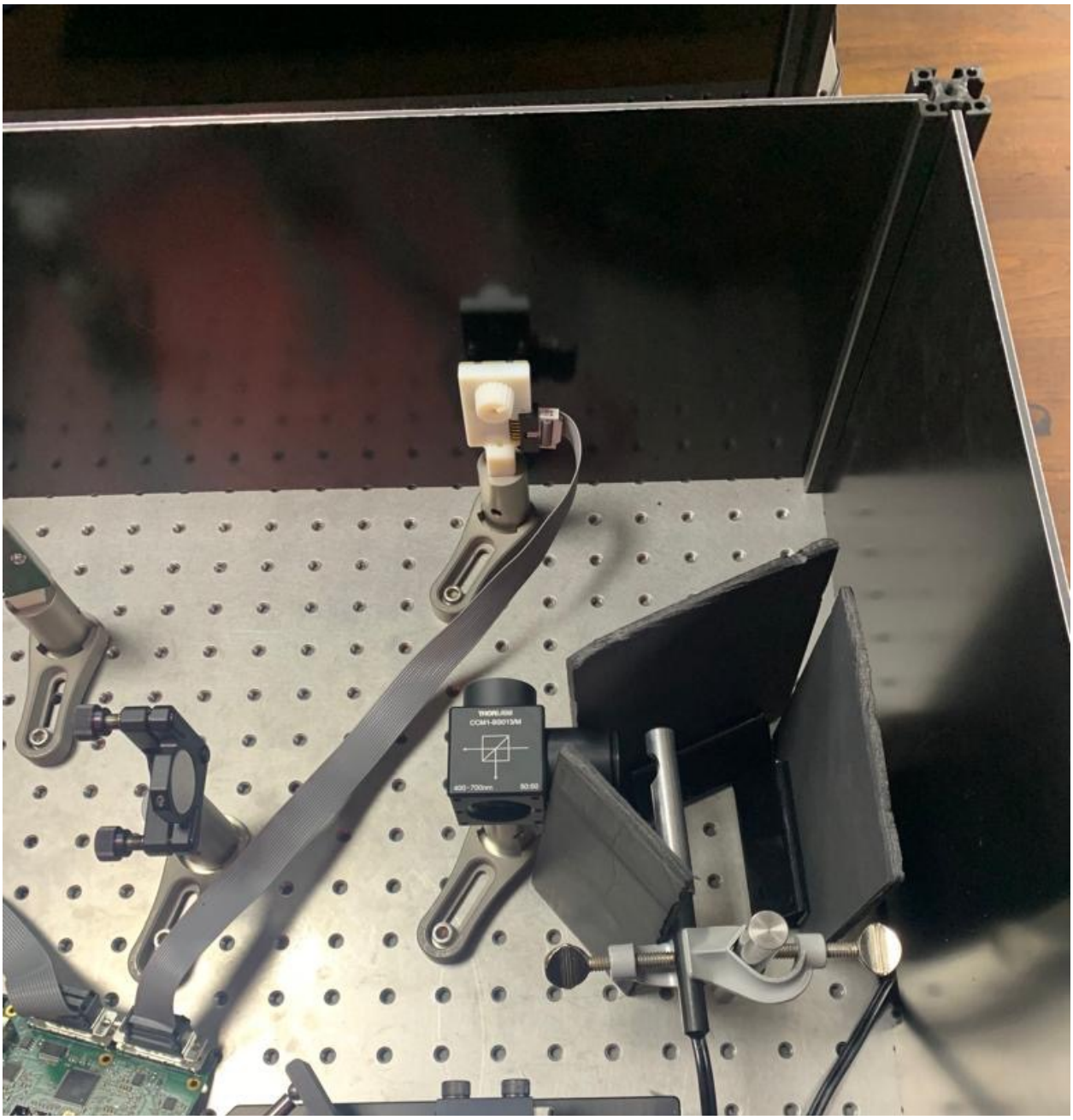

Fig 43. the updated set up - exact same as fig 41. but now we have blocked the mercury lamp so that light will only pass through the beam splitter. We also moved the green filter to the other side of the beam splitter purely for convenience as we will need to switch it out with the yellow later.

We've also been advised to increase the gain of the detector . We had lowered it for the other sources but the mercury lamp is a less intense source and looks much dimmer. Therefore, we think we should have had the gain higher. By adjusting the gain whilst running a the motor we have now got clear sinusoidal curves. However, there isn't time this session to take the long interferogram so we now aim to do that next session.

Although this session didn't result in meaningful data being taken, with the help of the demonstrators and lab technicians we have adjusted the gain on the detector so that we now see clear sinusoidal patterns and will be able to take meaningful data next session. This part the lab book is included for completeness.

Task 11

Now we're going to do the exact same thing but instead of the green filter we replace it with the yellow filter so we can investigate the yellow doublet.

We have decided to allow the mercury lamp to cool down completely before we do this task as we don't want the lamp to get too hot in case that affects our data or damages the lamp.

We used the exact same range and set up to obtain the interferogram and ran it.

However, as stated above, we hadn't connected the mercury lamp properly and hence did not obtain any data. This is only kept in here for completeness sake.