May 24th

-Going through the alignment process by placing a piece of paper at one of the setup marking the height of the laser then placing the same paper at the other end to make sure its at the same height

-laser and interferometer table are properly aligned

-with just the laser pointing at the movable mirror checking to see if the beam hits the center of the mirror and reflects back into the aperture, which it does

- setting up in the michelson mode for experiment 1

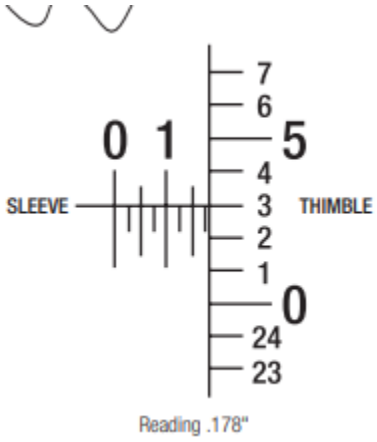
-attached the beam splitter at a 45 degree angle and adjust the mirror and angle of the beam splitter so that the two sets of dots align with each other, each set has one bright dot in the middle with 2 or 3 less bright ones to the side, same spacing for each set

- wasnt getting any fringes at first just a big blob but found another adjustment knob for the mirror and was able to get a fringe pattern on the screen

- the screen wasnt aligned with the fringes so moved the screen to be aligned

Experiment 1

Part 1



- For micrometer: ~~each large number on sleeve is 0.1", the smaller tick marks are 0.025"; on the thimble, each mark is +0.001". 0.1" = 2540um, 10um = 3.937e-4 in.~~
    - It's actually 1 marking on the thimble = 1um, 1 large marking on the sleeve = 100um, 1 small mark on the sleeve = 25um

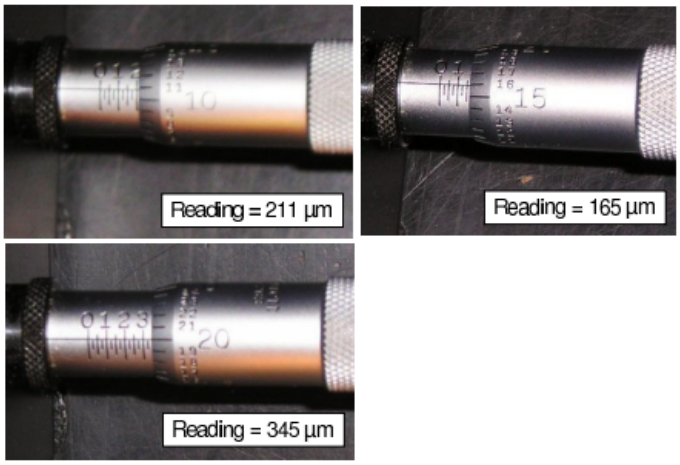


Figure 1.4: Micrometer readings. The course division equals to 100 μm, and smallest division on the rotary dial is 1 μm (same as 1 micron). The final measurements is the sum of two.

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- Did one full ccw turn to 0 to reset the backlash going to count 20 fringes, starting with sleeve at 5 and thimble at 0, end with sleeve at 5 and thimble at 7
- Reset in same way, with same start, end at 5 and 7.5
- End at 5 and 7
- End at 5 and 7
- End at 5 and 7
- End at 5 and 7.5
- End at 5 and 7.5

Result (after calculating each trial and averaging all): $\lambda = 720nm$

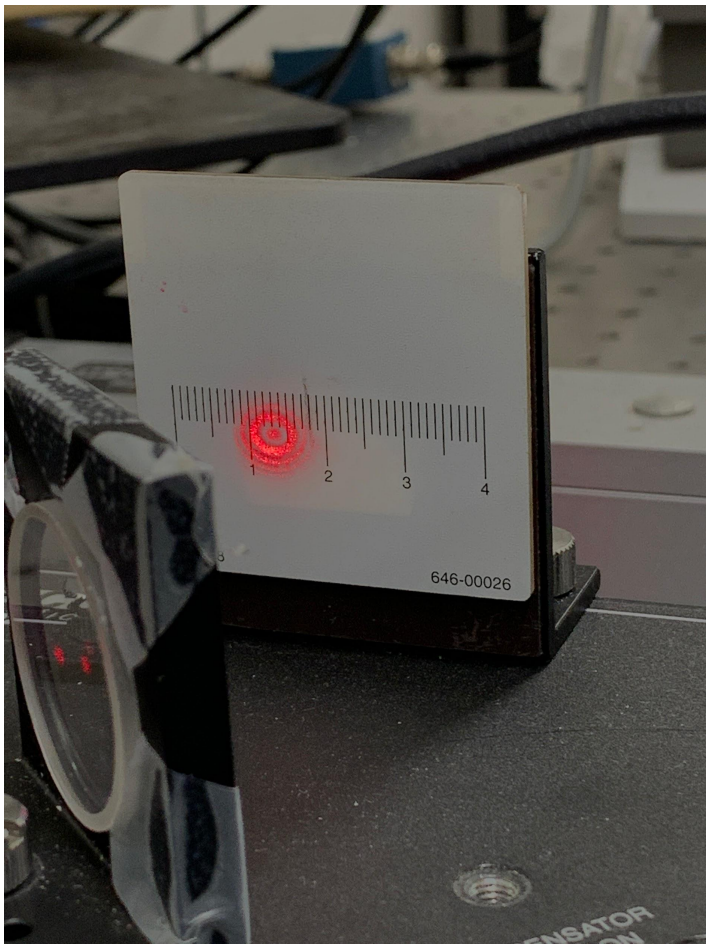
- <u>Tim (5 trials)</u>
- Using 1cm mark as reference (placing the line in between fringes)
    - Also resetting the micrometer and using 1 rotation ccw method to remove backlash
- Start at 500um end at 507.5um
- 500um -> 506.8um
- 500um -> 506.8um
- 500um -> 506.7um
- 500um -> 507um

Result (after calculating each trial and averaging all): $\lambda = 696 \pm 13nm$

- <u>Adding compensator</u>
    - 500um -> 506.6

- 500um -> 506.7
- 500um -> 507
- 500um -> 506.7

Result (after calculating each trial and averaging all): $\lambda = 675 \pm 8\, nm$

- Micrometer error: $\pm\ 0.1um$
- $N = 20 \pm 0.5$
- Some error discussion: backlash, error from incoming light (without compensator), table vibration
- 

Part 2

- Not quite sure where to place the polarizer?

Experiment 2

- Aligned the fixed mirror in the same way as the last experiment, making sure the two sets of dots are aligned with each other before placing the lens on the front component holder
    - We know that it's aligned bc the pointer matches up with the 0 on the base of the interferometer, therefore the vacuum plate is perpendicular to the laser.

- Since this is a vacuum pump, “zero” is the P_{atm}
- Procedure will be to start at the initial Pressure at 0Hg which is atm pressure then slowly increase the vacuum pressure until 10 fringes have passed through our reference mark at which time we will record the final pressure
- Taped down the rotational pointer so that the chamber stays perpendicular to the beam
    - 13.5 Hg
    - 13 Hg
    - 13.75 Hg
    - 13.5 Hg
    - 13.5 Hg
- Realized that we will need multiple pressure readings from different number of fringes in order to get a graph of the index of refraction vs pressure
- Taking 6 measurements of the pressure for fringe counts from 8-12
- $m = \frac{2d}{\lambda}(n_f - n_i) = \Delta N\ (number\ of\ fringes)$
- d = 3.0 cm (given in manual)
- Pump error (in in.Hg): $\pm\ 0.01$
    - Some equipment error: vacuum chamber not sticking to the frame, so had to keep the entire vacuum apparatus as still as possible to keep a constant position of the fringes
- 12 fringes started to get a much larger uncertainty as it was harder to pump the air out so going to do 7 fringes instead
- Plotting n vs P was downward slope, as $P_{absolute}$ decreases with increasing fringe count
- $P_i - P_f = 76 - P_f$, P_f increases with fringe count