

GENERAL MACH-ZEHNDER ALIGNMENT PROCEDURES

I. LIGHT SOURCES

a.) HeNe LASER (START W/ 2 MW LASER / USE ÉTENDUE FL=2.5CM LENS AS BEAM EXPANDER WHEN NEAR FRINGES)

b.) Na LAMP (USE ONLY AFTER OBTAINING HeNe FRINGES / FRINGE CONTRAST LESS WHEN NEAR Na DBL LINES / MYLAR DIFFUSER HELPS)

b.) Hg LAMP (LOW PRESS. Hg. MAY WORK AS ALTERNATE TO ABOVE Na LAMP \Rightarrow NO LOW CONTRAST FRINGES AS IN CASE OF Na LAMP.)

c.) WHITE LIGHT [USE ONLY AFTER OBTAINING Na (OR Hg) FRINGES / USE ONLY WHEN NEAR ZERO-PATH DIFFERENCE / USE W/O MYLAR DIFFUSER WHEN LOCATING (WLF) WITH DIFFRACTION GRATING / USE W/ MYLAR DIFFUSER AFTER OBTAINING (WLF) FOR BETTER CONTRAST (i.e. FILAMENT DIFFUSED)]

II. ELEMENT PLACEMENT [SEE FOLLOWING PAGES FOR POSITIONING M_1 / BS_1 / M_2 / M_3 / BS_2]

III. MISCELLANEOUS

a.) APPROACH ZERO-PATH DIFFERENCE \Rightarrow COLLAPSING BULLS-EYE.

b.) LEAVING ZERO PATH DIFFERENCE \Rightarrow EXPANDING BULLS-EYE.

c.) PROJECT BS_2 EXIT IMAGE ON SCREEN (OR NEARBY WALL) FOR LARGER FIELD (HELPS DETERMINING COLLAPSING OR EXPANDING BULLSEYE)

d.) PENTAPRISM MAY RAISE (OR LOWER) BEAM PLANE WRT OPT. TABLE. (WLF STILL ATTAINABLE). HOWEVER, INSERTING ALIGNMENT MIRROR (M_A) \neq RETROREFLECTING ($M_A \rightarrow M_3 \rightarrow BS_1 \rightarrow M_1 \rightarrow L$ / AND $M_A \rightarrow M_2 \rightarrow BS_1 \rightarrow M_1 \rightarrow L$) W/ APPROPRIATE VERT. ADJUST. \Rightarrow BEAM PLANE PARALLEL WRT OPT. TABLE.

e.) FINAL (WLF) ADJUSTMENTS DONE ON:

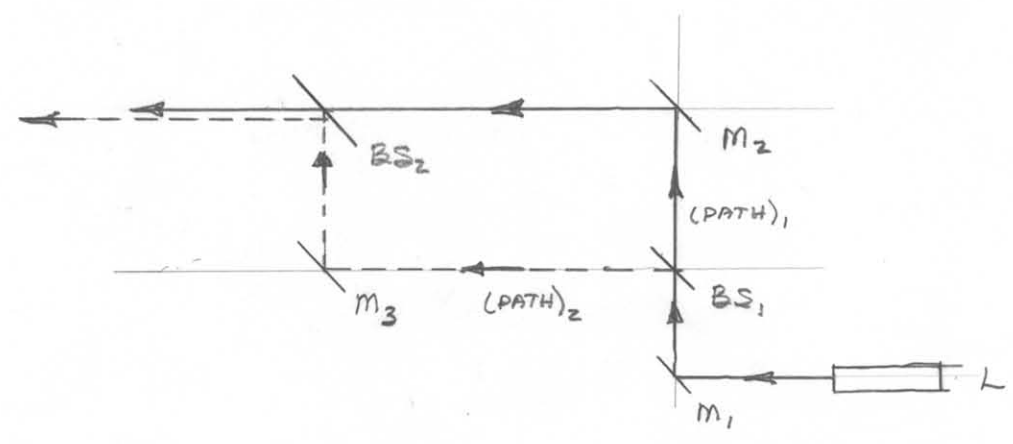
- M_2 (SOME HORIZ. / MAYBE A TAD VERT.)

- BS_2 (TRANSLATION / SOME HORIZ. / TAD VERT.)

600A-2 = 8
 431 = 4
 GM-2 = 6

MACH-ZEHNDER (3-SETUPS)
 (USE 2'X4' OPTICAL TABLE)

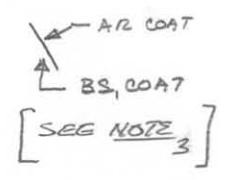
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$$L = (2\text{mw LASER} + \text{SUPPLY}) + (2^\circ \text{ PIN}) + \frac{\text{STOCK CABINET}}{(VPH-2/MB-3)}$$

$$M_1 = (2 \times 2^\circ \text{ F.S. MIRROR/MM-2}) + (4^\circ \text{ PIN}) + \frac{\text{STOCK CABINET}}{(VPH-3/BUP-2)}$$

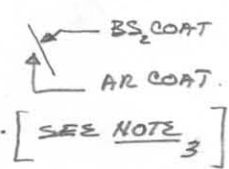
$$BS_1 = \left(\phi = 2^\circ \text{ NON-WEDGE BEAMSPLITTER / GM-2} \right) + (1^8 \text{ PIN}) + (VPH-2/MB-3) \rightarrow$$



$$M_2 = (\phi = 2^\circ \text{ F.S. MIRROR / 600A-2 / SPACER / MB-3})$$

$$M_3 = (\phi = 2^\circ \text{ F.S. MIRROR / GM-2}) + (1^8 \text{ PIN}) + (VPH-2/MB-3)$$

$$BS_2 = \left(\phi = 2^\circ \text{ NON-WEDGE BEAMSPLITTER / 600A-2 / 431 / MB-3} \right) \rightarrow$$



ALIGNMENT EXTRAS

- ① PRISM [(VPH-2/MB-3) + (2° PIN) + (PRISM TABLE) + (PENTAPRISM)]
- ② MIRROR [(VPH-2/MB-3) + (2° PIN) + (2x2° F.S. MIRROR/MM-2)]

NOTE 1 = LIGHT SOURCES

- ① HeNe LASER] SPREAD BEAM WITH $\frac{\text{FROM ETENDUE}}{FL = 2.5 \text{cm LENS} + \text{PIN}} + (CA-1) + (8^\circ \text{ PIN}) + \frac{\text{STOCK CABINET}}{(VPH-2/BUP-2)}$
- ② Na LAMP
- ③ WHITE LIGHT (DESK LAMP)] DBL MYLAR DIFFUSER HELPS.

NOTE 2 = BS2 OUTPUT ON 431 TRANSLATOR SO (PATH)1 = (PATH)2

NOTE 3 = FOR COMPENSATION, BS COATING OPPOSITE BS2 COATING (DESK LAMP → BLUE HALO ON ONE SIDE & NO HALO ON OTHER SIDE) (FOR ABOVE M-Z LAYOUT TO WORK, BS1, BS2 ORIENTATION WILL BE CORRECT AUTOMATICALLY!)

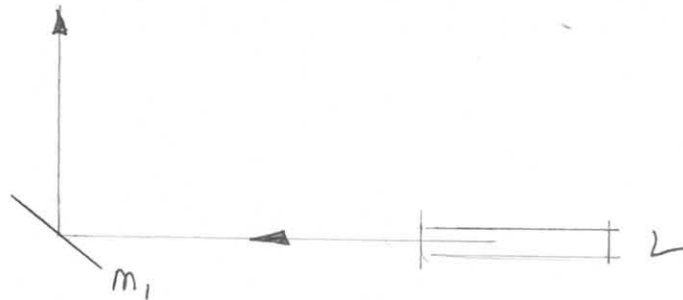
* = COMPLETE ASSEMBLY IN MACH-ZEHNDER SET-UP BOXES.

M₁ PLACEMENT

- I. PLACE m_1 @ 90° TO BEAM / RETROREFLECT.
(THIS INSURES BEAM SOMEWHAT PARALLEL TO OPTICAL TABLE)



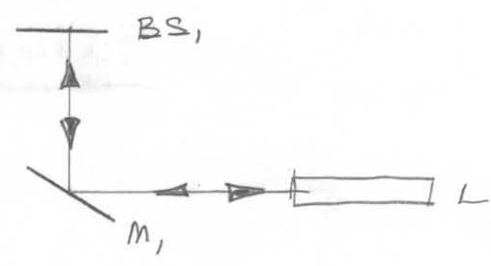
- II. PLACE m_1 @ 45° TO BEAM (EYEBALL / \perp TO L-AXIS)



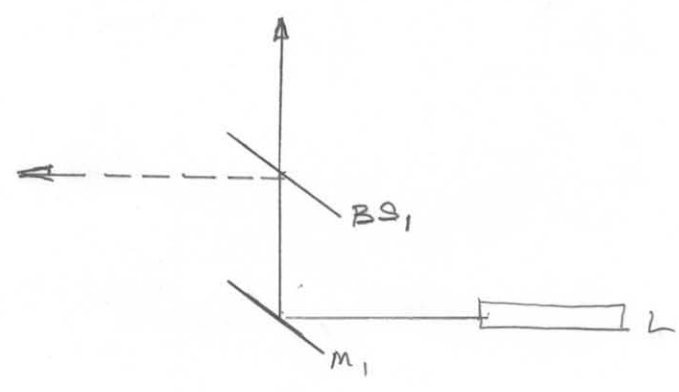
BS, PLACEMENT

06-06-94

I. PLACE BS, @ 90° TO BEAM / RETRO REFLECT /
(DO NOT MOVE BS, VERT. ADJ, FROM NOW ON)

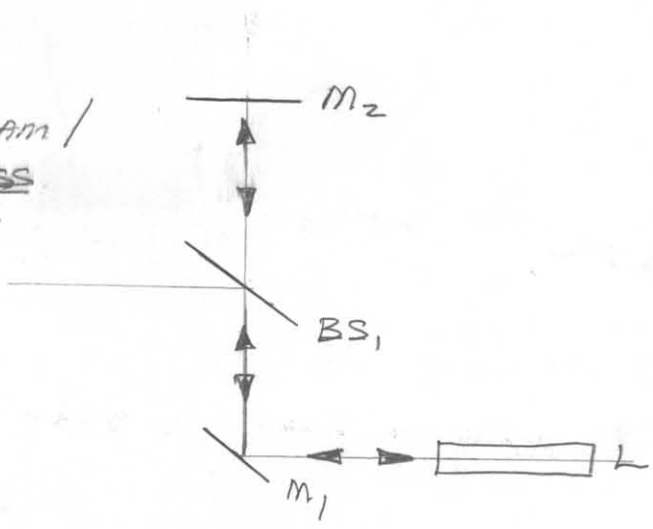


II. PLACE BS, @ $\sim 45^\circ$ TO BEAM (EYEBALL / PARALLEL TO L-AXIS)

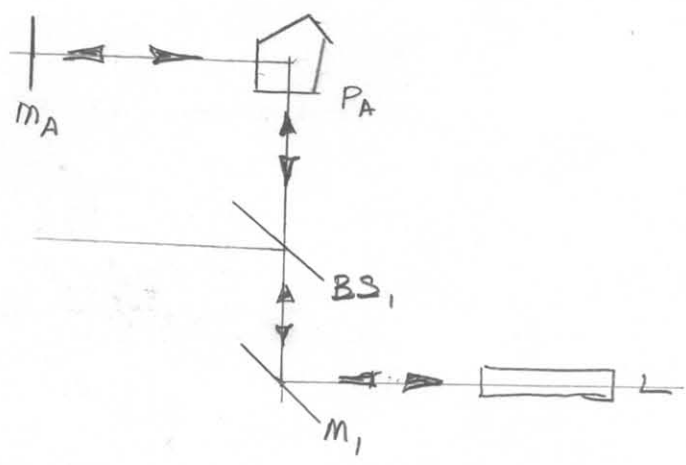


M₂ PLACEMENT

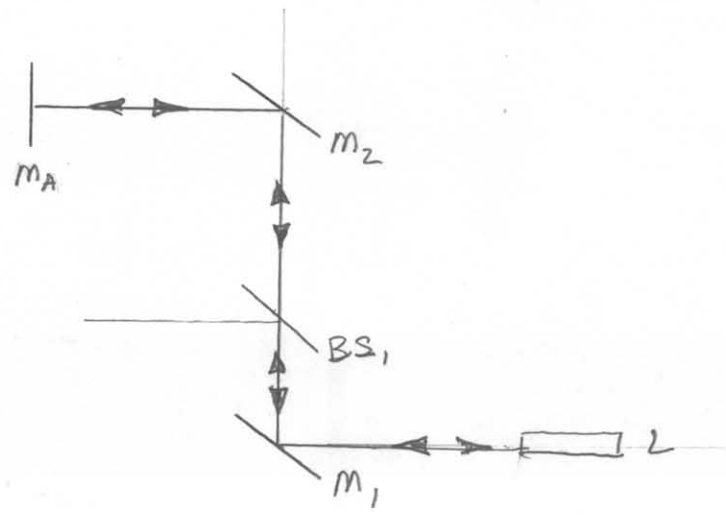
I. PLACE M_2 @ 90° TO BEAM /
 RETRO REFLECT / DONT MESS
W/ M_2 VERT. ADJ. FROM
NOW ON



II. REPLACE M_2 W/ [ALIGN. PENTAPRISM (P_A) + ALIGNMENT MIRROR (M_A)]
 ADJUST M_A TO RETRO REFLECT BEAM BACK TO L.

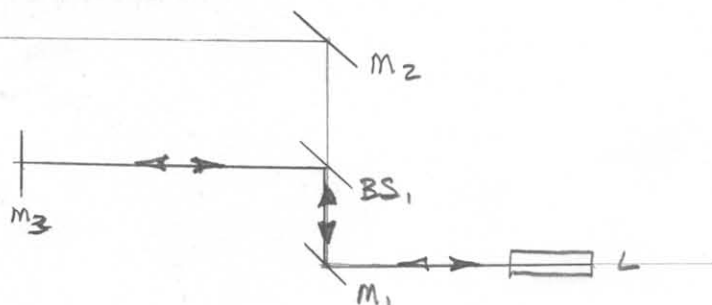


III. REPLACE P_A WITH M_2 @ 45° TO BEAM / ADJ. M_A (VERT. ONLY) $\frac{1}{2}$
 M_2 (HORIZ. ONLY) TO RETRO REFLECT BEAM BACK TO L / REMOVE M_A .
 $\therefore BS_1 // M_2$

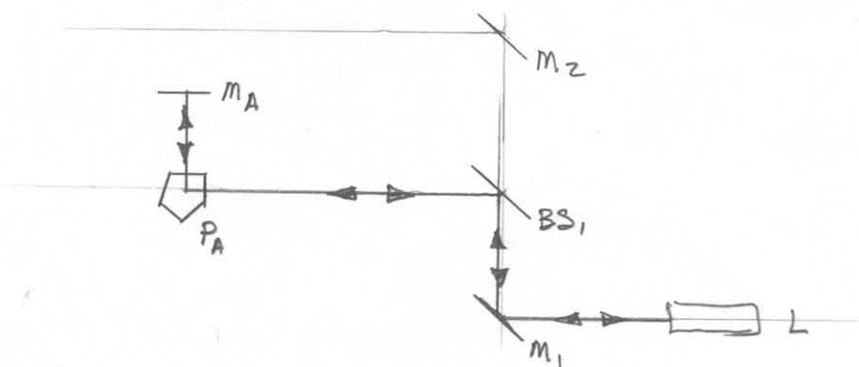


M_3 PLACEMENT
(SIMILAR TO M_2)

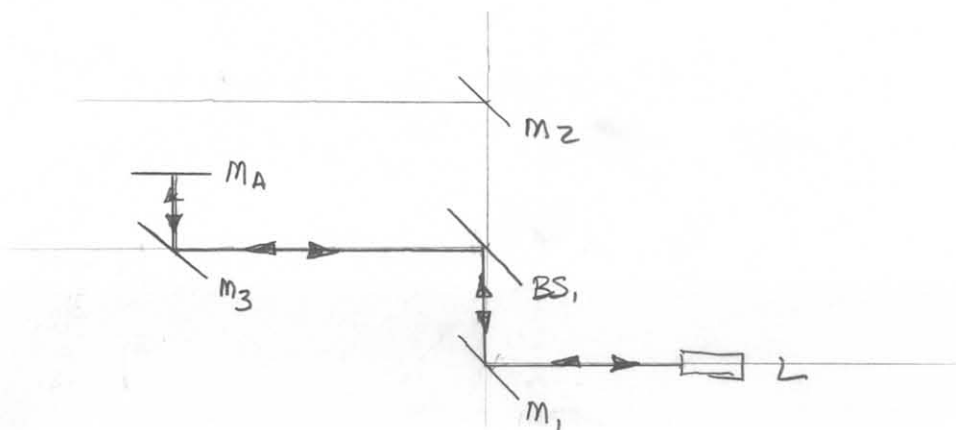
- I. PLACE M_3 @ 90° TO BEAM / RETROREFLECT / DONT MESS
w/ M_3 VERT. ADJ FROM NOW ON



- II. REPLACE M_3 [w/ ALIGN. PENTAPRISM (P_A) + ALIGN. MIRROR (M_A)] /
 ADJUST M_A TO RETROREFLECT BEAM BACK TO L.

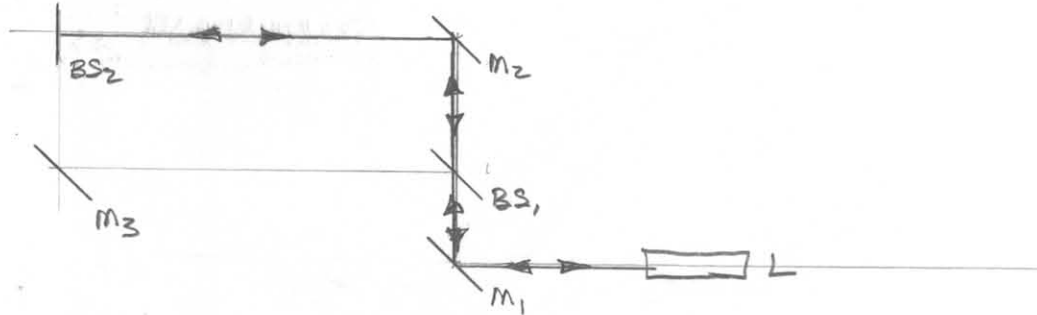


- III. REPLACE P_A w/ M_3 @ 45° TO BEAM / ADJ. M_A (VERT ONLY) & M_3 (HORIZ ONLY)
 TO RETROREFLECT BEAM BACK TO L. / REMOVE M_A /
 $\therefore BS_1 // M_3$



BS₂ PLACEMENT

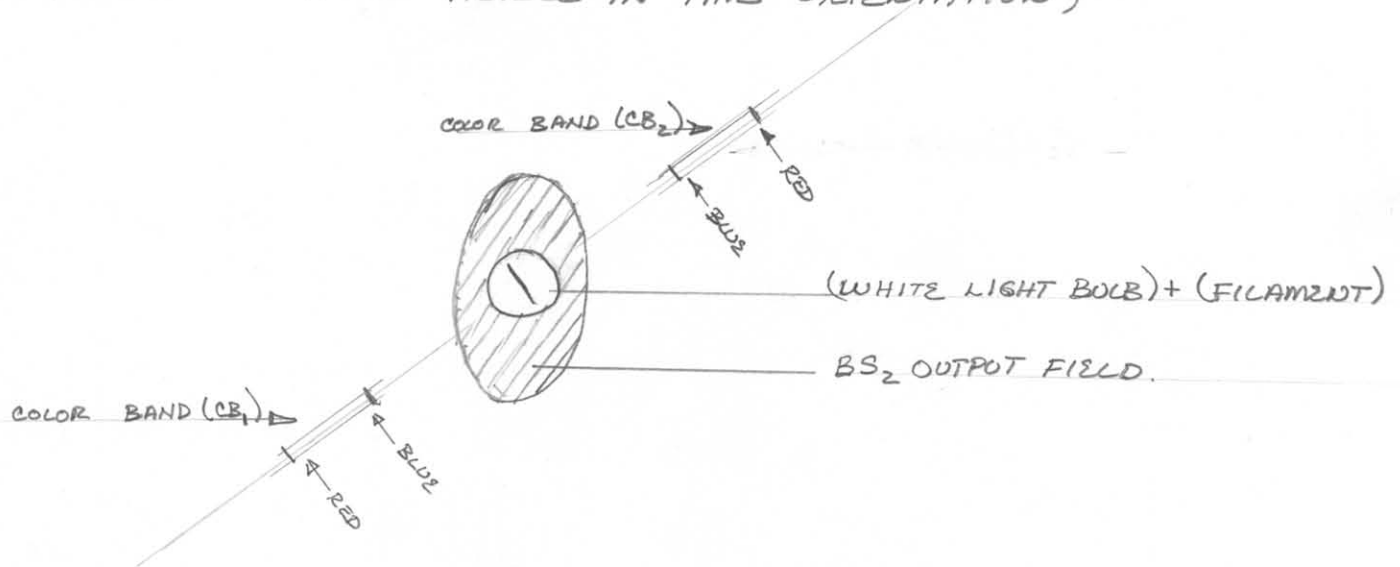
- I. PLACE BS₂ @ 90° TO BEAM [(PATH)₁, OR (PATH)₂] / RETRO REFLECT /
NO MAJOR MESSING W/ VERT ADJ FROM NOW ON.



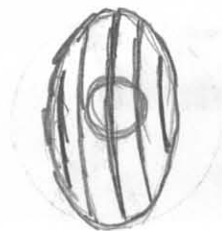
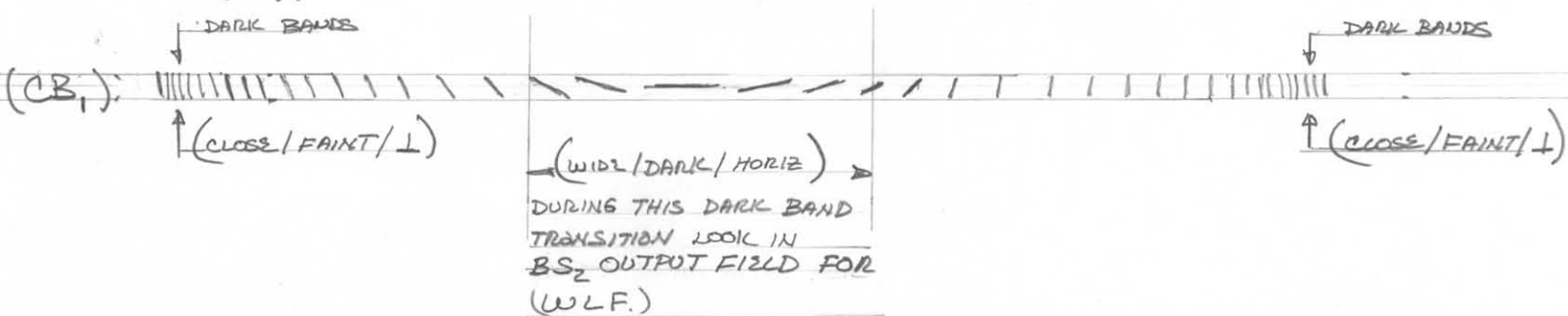
- II. CAUTION: BS₂ MUST BE ORIENTED "OPPOSITE" BS₁. (USE BLUE HALO FROM
 III. PLACE BS₂ @ 45° TO BEAM₁ & BEAM₂. (ie. COINCIDENT BEAMS) (WHITE LIGHT TEST)
- NOTE: [FOR M-Z LAYOUT TO WORK, BS₁ & BS₂ ORIENTATION]
 WILL BE CORRECT AUTOMATICALLY!

USE OF A 2X2 DIFFRACTION
GRATING FOR FINDING M-Z
WHITE LIGHT FRINGES (WLF)

1. CENTER WHITE LIGHT BULB (DESK LAMP.)
IN BS_2 OUTPUT FIELD.
2. HOLD GRATING CLOSE TO YOUR EYE.
3. ORIENT COLOR BAND \perp TO FILAMENT AXIS.
(DARK BANDS MOST VISIBLE IN THIS ORIENTATION)



4. FOCUS YOUR EYE ON (CB_1 , / ORG-YEL-GREEN AREA)
5. WHEN NEAR ZERO PATH DIFFERENCE (Δ TRANSLATION OF BS_2)
(CB_1) WILL HAVE DARK BANDS WHICH GO THRU THE FOLLOWING TRANSITION:



INTERFERENCE FILTERSFOR VIEWING M-ZWHITE LIGHT FRINGES (WLF)

<u>CWL (nm)</u>	<u>COLOR</u>	<u>WLF</u>	<u>PATH LENGTH CHANGE FOR VISIBLE WLF (mm.)</u>
402.0	VIOLET.	NOT VISIBLE.	—
435.7	BLUE.	BARRELY VISIBLE.	—
501.6	BLUE-GREEN.	MED. VISIBILITY	10/100
545.9	GREEN.	GOOD VISIBILITY	13/100
576.8	YELLOW	MED VISIBILITY	10.5/100
610.5	ORANGE	MED VISIBILITY	10.5/100.
NONE	—	GOOD VISIBILITY (w/DIFFUSER)	1/100
NONE	—	GOOD VISIBILITY (w/O DIFFUSER)	1/100

NOTES

- ① (WLF) RANGE w/ NAKED EYE $\approx \frac{1}{100} = 10$ mm
- ② (WLF) RANGE w/ GREEN FILTER $\approx \frac{13}{100} = 130$ μ
- ③ (WLF) RANGE w/ DIFF. GRATING $\approx \frac{30}{100} = 300$ μ

MACH-ZEHNDER WHITE LIGHT FRINGES *

- OBTAINED BY WALKER/SYLVESTER - SPRING 1994.
- OBTAINED BY HARLANDER/SYLVESTER - 06-08-94.

* USING. (L) + (M₁) + (BS₁) + (M₂) + (M₃) + (BS₂)
COMPONENTS IN PHYSICS 625 LAB (1335 ST.)