

LIGO-T030133-00-W

MC Notes from 1999 – Mode Cleaner Power Measurements
by Haisheng Rong

These notes were recorded in the MC Notebook at LHO in Dec of 1999.

Submitted to the DCC 7/9/03 by Betsy Bland

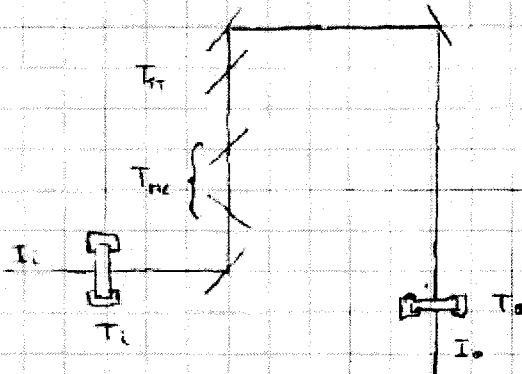
Back up MIC locking params

$$\begin{aligned} M1p &= -0.77 \\ M1y &= -1.800 \\ M2p &= 0.560 \\ M2y &= -2.140 \end{aligned}$$

12-6-99

Measure MC transmission

at output port I_o 0.81 mW
 " " " " I_i 273 mW
 steady reading 30.01
 varies ± 10 mW



* When MC is locked to the "Wrong" TEM mode, maybe p-polarization, the MC transmission is 0.06 mW instead of 0.81 mW.

$$I_o = I_i (T_i \cdot T_{mc} \cdot T_{mr} \cdot T_o)$$

Assume: $T_i = T_o = 99\%$, $T_{mr} = 0.5\%$

$$T_{mc} = (I_o / I_i) / (T_i \cdot T_o \cdot T_{mr}) = 61\% \quad !$$

Measure visibility of MC input coupling

Vdc refl.

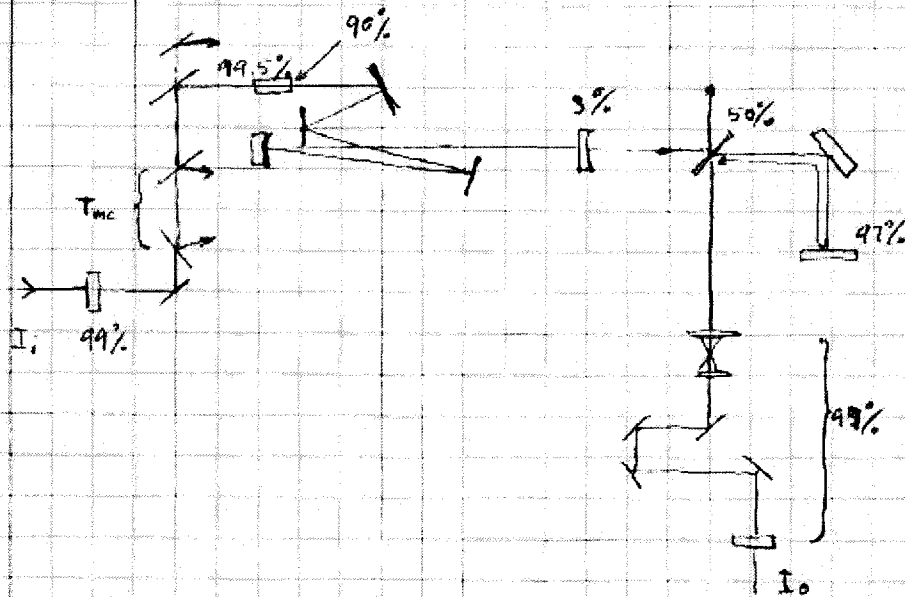
$$\text{min} = 40 \mu\text{V}$$

$$\text{max} = 548 \mu\text{V}$$

$$\frac{\text{max} - \text{min}}{\text{max}} = 93\%$$

12-7-99

MC transmission measurement



$$I_i = 403 \text{ mW} \pm 12, \quad I_o = 1.96 \text{ mW} \pm 0.02$$

$$I_o = I_i \cdot 99\% \cdot T_{MC} \cdot 99.5\% \cdot 3\% \cdot 50\% \cdot 47\% \cdot 50\% \cdot 47\% \cdot 99\%$$

$$I_o / I_i = T_{MC} \cdot 6.26 \times 10^{-3}$$

$$T_{MC} = \frac{1.96}{403} / 6.26 \times 10^{-3} = 78\%$$

$$y = A(1 \pm \epsilon_A) \cdot B(1 \pm \epsilon_B)$$

$$= AB(1 \pm (\epsilon_A + \epsilon_B))$$

12-7-99

locking Michelson

$$I_{\max} = 4.48 \text{ V}, I_{\min} = 40 \text{ mV}$$

$$(I_{\max} - I_{\min}) / I_{\max} = 99\%$$

GM, HR

12-13-99

T_{mc} measurement again same scheme as page 54

$$I_0 / I_i = T_{mc} \cdot 5.84 \times 10^{-3} \quad (T_{RM} = 2.8\%)$$

$$I_0 = 632 \text{ mV}$$

$$I_i = 124000 \text{ mV}$$

$$T_{mc} = 87.3\%$$

$$\text{Visibility } 95.5\% \quad \left(\frac{I_{R(\max)} - I_{R(\min)}}{I_{R(\max)}} \right)$$

$$89.4\% \text{ with best visibility } 97.8\%$$

$$T_{\text{total}} = 1 - 2 \frac{L}{T}$$

$$89.4\% = 1 - 2 \frac{L}{2256 \text{ ppm}} \Rightarrow L = 120 \text{ ppm}$$

$$\frac{L^2}{T^2} \Rightarrow 99.7\% \text{ visibility}$$

$$\text{Finesse } \frac{\pi}{T+L} = 1323$$

1331 ^{from} measured ~~with~~ linewidth

$$T_{mc} = 91.4\% \text{ if corrected mode mismatch}$$

$$\hookrightarrow = 87.3\% \text{ (} \leftarrow 17.45\% \text{)}$$