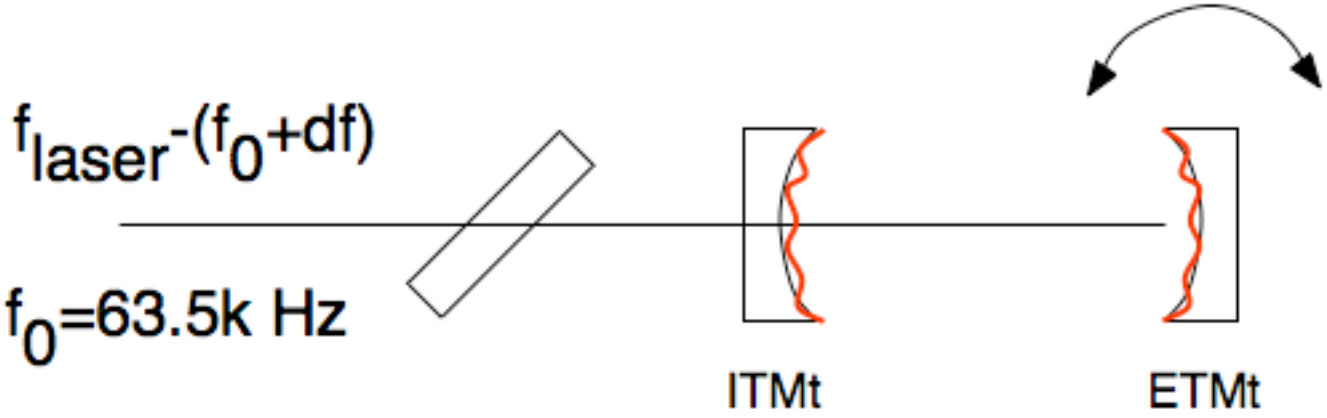
Ambiguity of g measurement

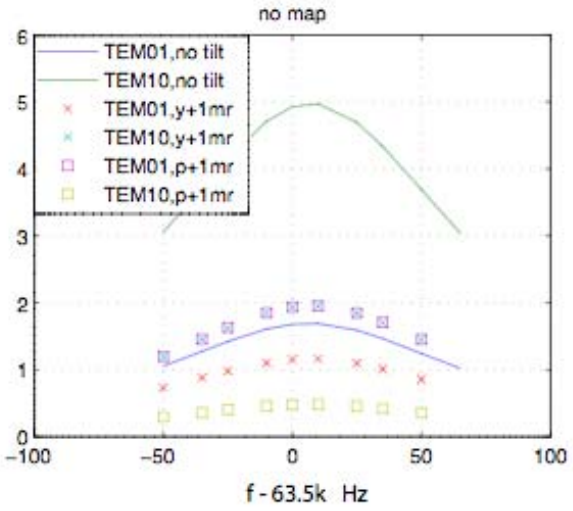
Hiro Yamamoto / Caltech

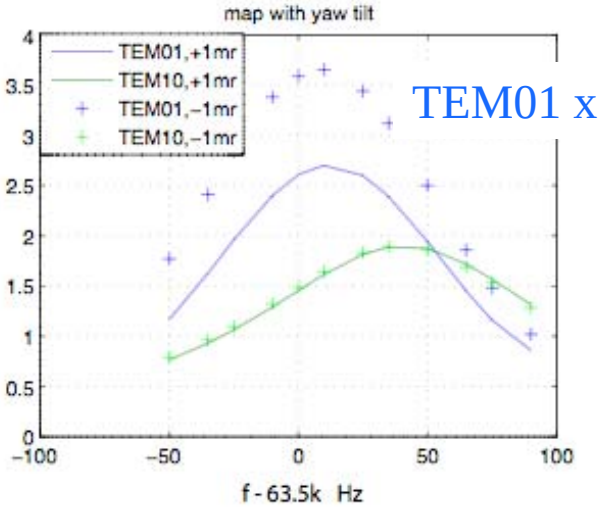
- Lock FP using CR
- Frequency scan TEM01 and TEM10 component of audio SB power in the FP
- With and without mirror phase maps
- With and without ETM tilt in pitch and yaw



Frequency scan of TEM01 and TEM10 power

With no surface aberration, tilts do not introduce resonance frequency change.

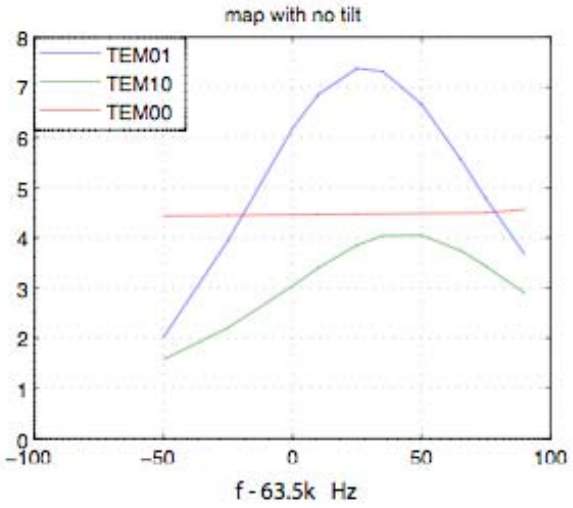


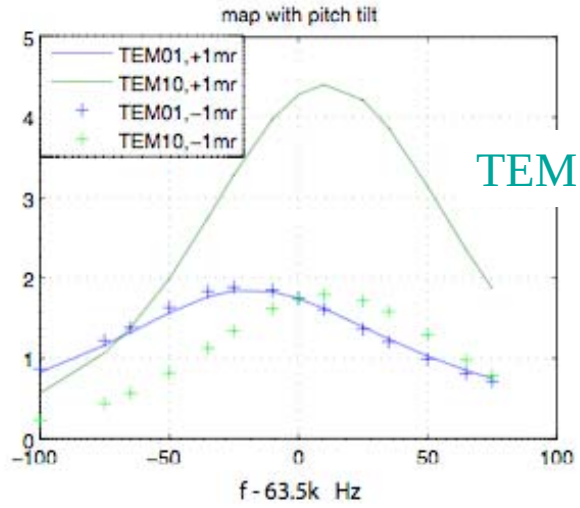


TEM01 x 100

There is no difference between + and - tilts, but the difference of magnitudes could introduce different alignment.

With phase maps, resonance frequencies change. TEM01 and TEM10 have different shifts.





TEM10 x 100

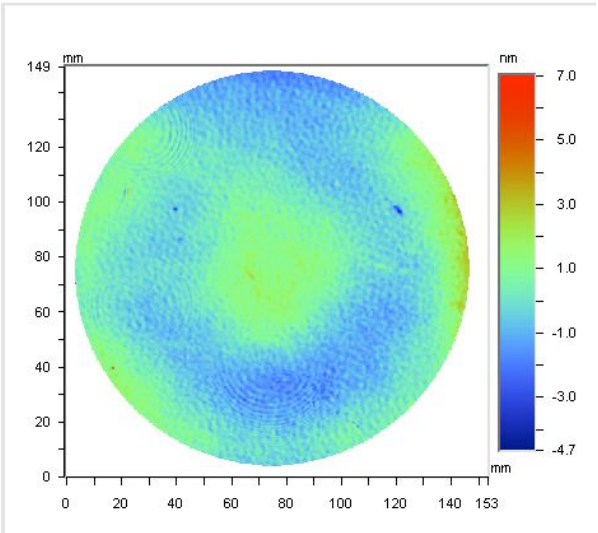
Summary of frequency shift

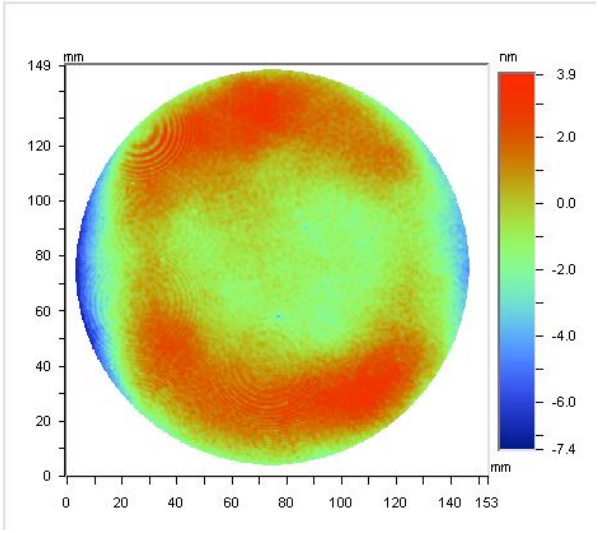
Resonance frequency at 63.5kHz + df

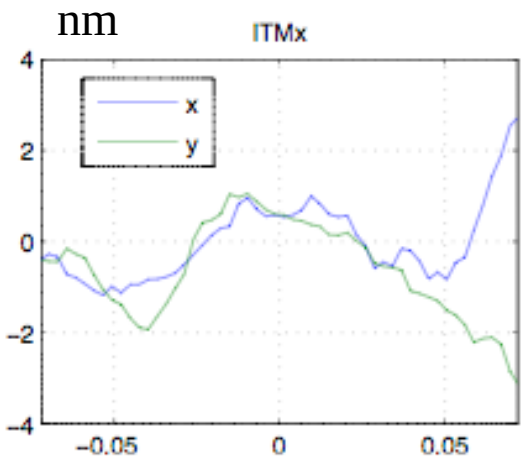
	No phase map			With phase maps				
	no tilt	yaw 1 μr	pitch 1 μr	no tilt	yaw 1 μr	yaw -1 μr	pitch 1 μr	pitch -1 μr
TEM01	6.4	6.4	7.5	33	12	7.4	-17	-20
TEM10	7.3	7.5	7.3	43	41	39	12	13

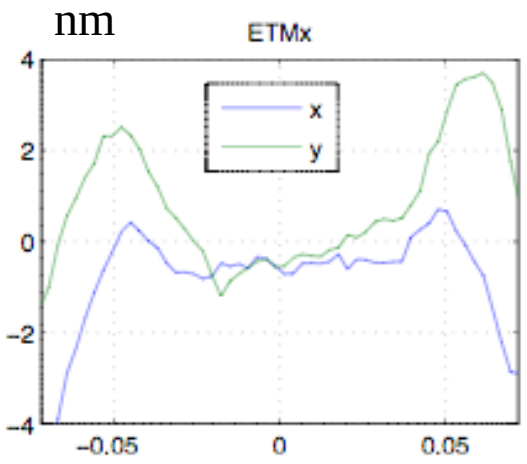
$$\frac{dR_{ITM}}{R_{ITM}} = \frac{\sin(2\eta)}{(1-\frac{L}{R_{ETM}})\frac{L}{R_{ITM}}}\frac{\pi}{f_{FSR}} = 6.2\times10^{-4}\,df \qquad dR_{ITM}(m) = 8.8\times df(Hz)$$

What are we looking at ?





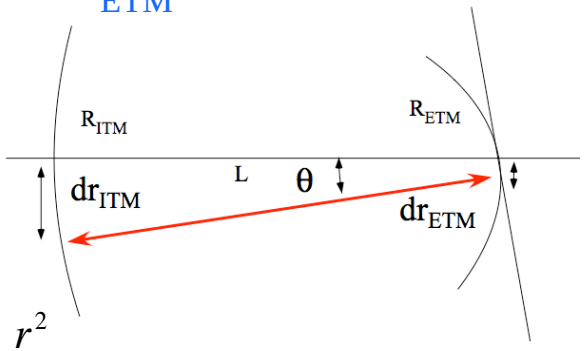




θ_{ETM}=1μ induces shifts

dr_{ITM}=5.9mm

dr_{ETM}=4.2mm



$$\Delta = \frac{r^2}{2R}$$

$$\Delta(ITM) = 32nm,$$

$$\Delta(ETM) = 62nm \ @ \ r = 3cm$$

$$\frac{dR}{R} = \frac{\delta\Delta}{\Delta} \sim a \ few \ \%$$