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# Tasks After S2

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Peter Fritschel, Daniel Sigg



## “Left Over”

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- ❑ Seismic retrofit at LLO
- ❑ Microseismic peak reduction (LHO)
- ❑ DAC (ADC) replacement
- ❑ ISS
- ❑ Photon calibrator
- ❑ RFI cleanup, linear power supply
- ❑ Laser  $\nu$  stabilization: FSS/MC/CM (good enough?)
- ❑ Operate at full 6W, multiple AS PDs
- ❑ ASI servo, REFLQ servo?
- ❑ WFS



# New problems to solve

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## *Thermal lensing*

- Present RF sideband efficiency is very low
  - Efficiency: TEM<sub>00</sub> SB power at anti-symmetric port, relative to input SB power
  - H1 efficiency: ~6%
  - Need a stable PRM: lack of ITM thermal lens makes  $g_1 \cdot g_2 > 1$
  - Currently see some lensing in H1; analysis in progress
- Possible solutions
  - Change RM (w/ new ROC); 6 month lead time
  - Add the missing heat to ITMs with another source
  - 20-25 W PSL with additional LWE amplifier (a la Stanford)



# New problems to solve

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## ***Optical gain (light) increase for LSC PDs***

### □ Dynamic range problem

- Lock acquisition photocurrent: ~100 microamp vs detection photocurrent of ~100 milliamp: 1000x range
  - ❖ And optical gain will increase with PRM stability, reducing acq. current
- EO shutter range: 200-700
- Solutions:
  - ❖ Two EO shutters running in series
  - ❖ Separate PDs for locking (low power) and running (high power)

### □ AS port power extrapolation

- $P_{AS} \sim 200W \cdot (1-C)/2 \cdot (4-5)$
- H1:  $P_{AS} = 500-600 \text{ mW} \Rightarrow 4$  detectors
- L1:  $P_{AS} = 20-30 \text{ mW} \Rightarrow 1$  detector



# New problems to solve

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## ***Shot noise sensitivity***

- AS port: project a factor of  $\sim 2$  shortfall
  - Reasonable SB efficiency with thermal lensing will get us there
  - Output mode cleaner for AS would also get factor of  $\sim 2$ , may also be desirable to eliminate scattered/junk light
- Pick-off detector (MICH & PRC sensing)
  - POB beam is weak, poor shot noise sensitivity
  - Will improve with PRM stability
  - Could install PO PD at POX/POY (more light)
  - Use reflection port?
  - Things to investigate: what determines the PRC  $\rightarrow$  AS\_Q coupling?  
How much bandwidth is needed in the PRC loop?



# New problems & tasks

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## ***Acoustic peaks: Scattering/Clipping***

- ❑ Peaks occur in 80-1000 Hz band, at a level 10-100x the SRD
  - Clearly beam centering & focusing on the diodes is important
  - Not yet clear what role scattered light plays
  - A proper SB mode will most likely help
- ❑ Actions to take:
  - revise beam line and dump ALL ghost beams on dedicated dumps
  - mount cameras to image beam on photodetectors; add pico-motors for remote centering
- ❑ Should consider:
  - Active ISCT beam direction stabilization: *beam direction shifts due to high power already seen*
  - Acoustic isolation improvements: ISC tables only, or all LVEA?
  - Modify output periscopes: stiffer, damped
  - Mount Faraday isolators onto ISC tables
  - Larger in-vacuum Faraday, larger EO shutters



# New tasks

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- ❑ Read & process more LSC ADC channels
  - Rolf looking into hardware/software improvements
- ❑ Getting higher input power
  - Replace lossy PMCs
  - Tune up or replace PSLs
  - Check for lossy MCs; clean mirrors?
  - Need a good place to park the misaligned RM beam
- ❑ Locking with higher power
  - Not easy on H1, even with only 2.7 W into MC
- ❑ ASC
  - WFS 5 for one arm alignment
    - ❖ Automatic initial alignment procedure
  - digital IOO WFS servo
- ❑ 2K recycling loss problem
  - replace ITMX