

OMC performance

Tip Tilting

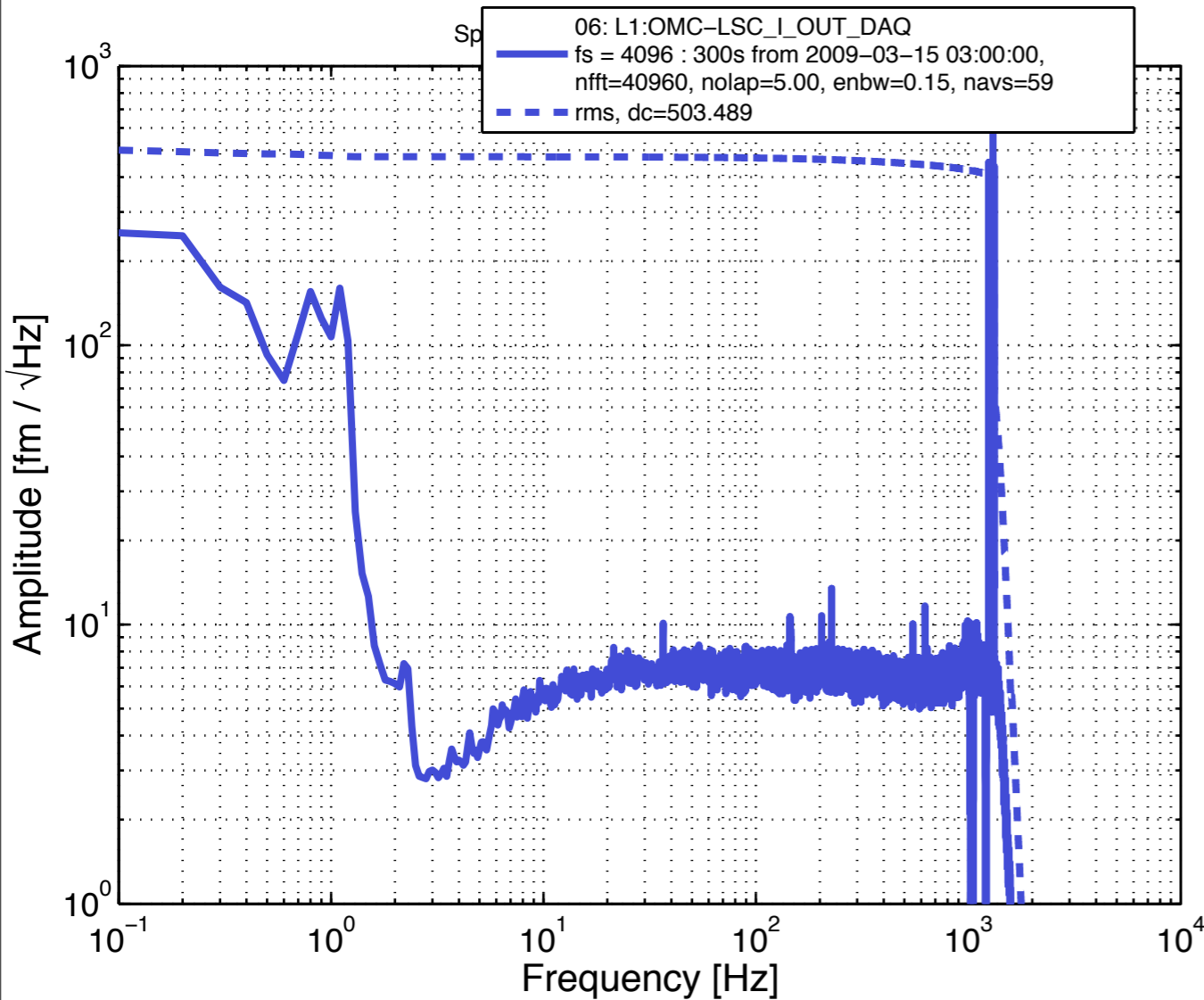
Mode matching control

advLIGO changes



OMC performance



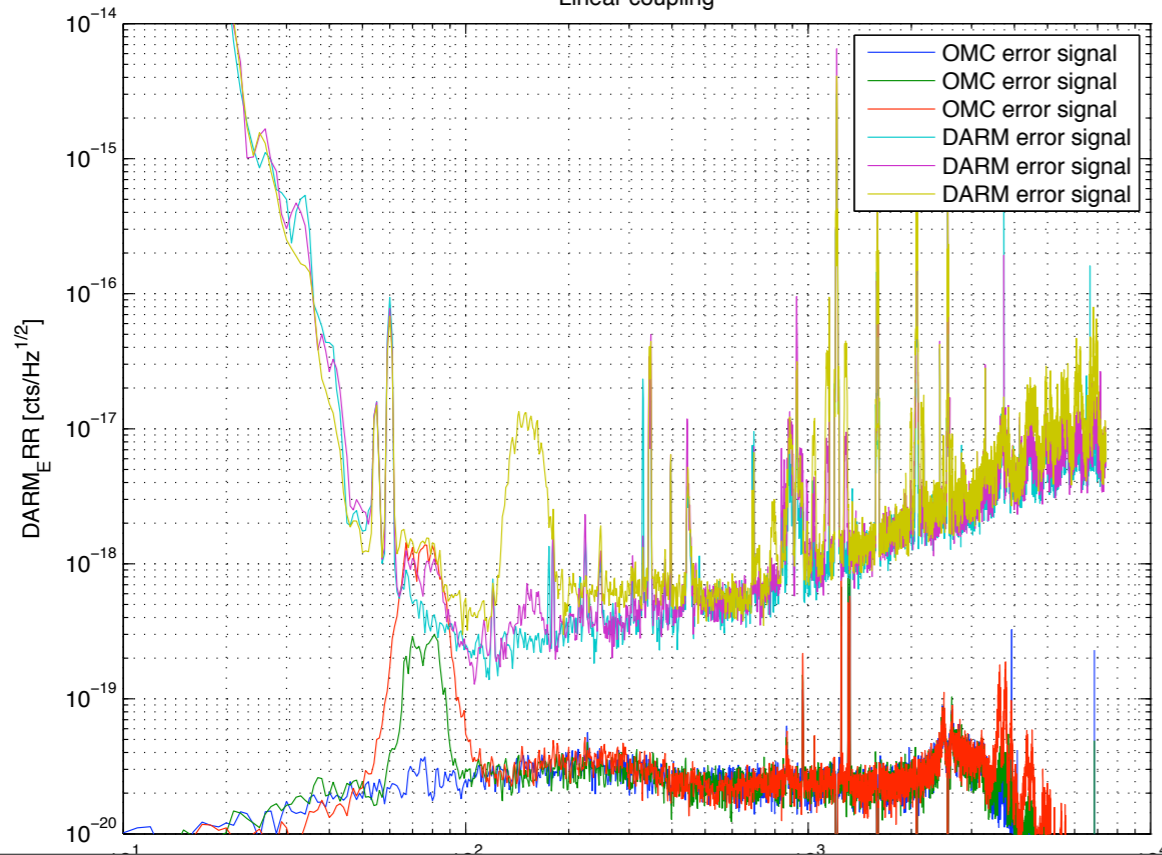
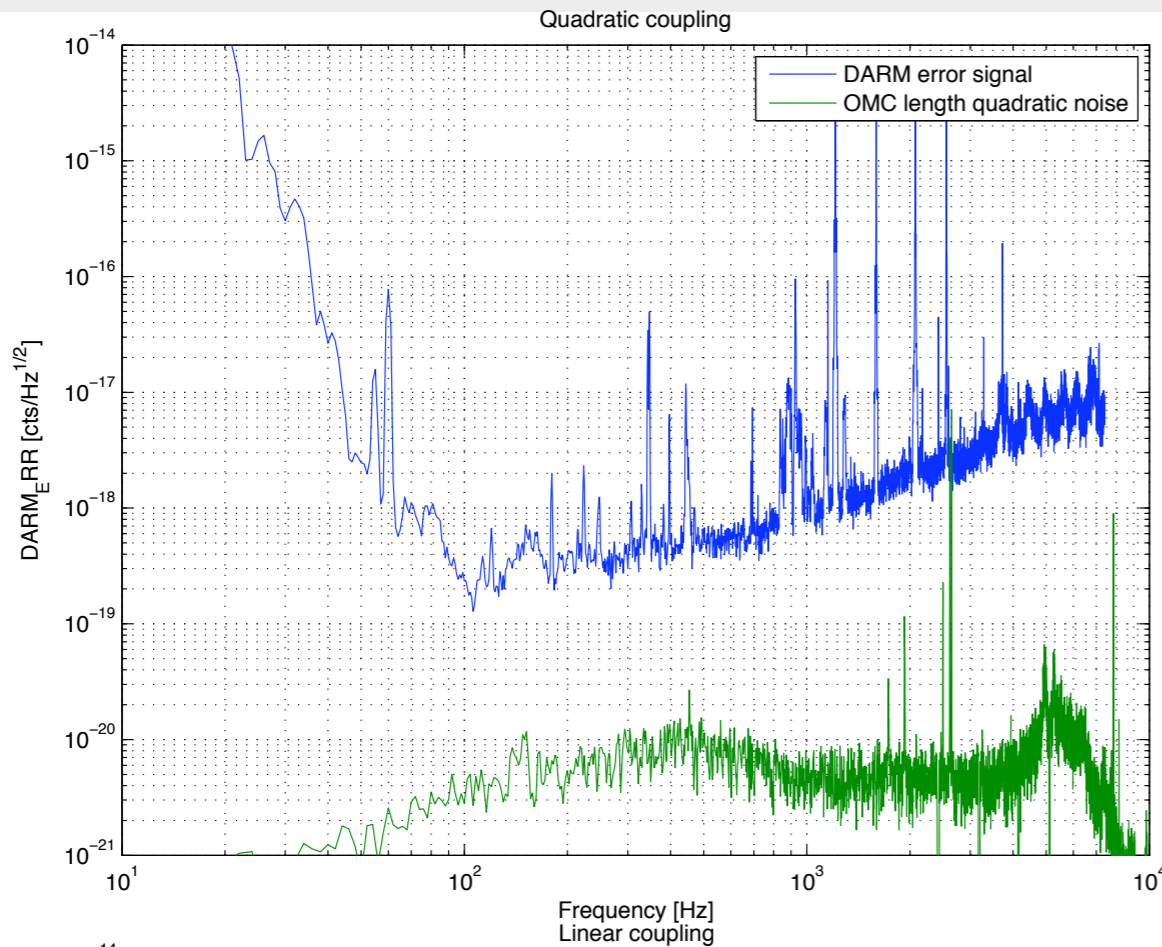


Dither sensing of cavity length

Sensing noise @ 8 fm/
 $\sqrt{\text{Hz}}$

~300 fm RMS residual,
 all below 10 Hz

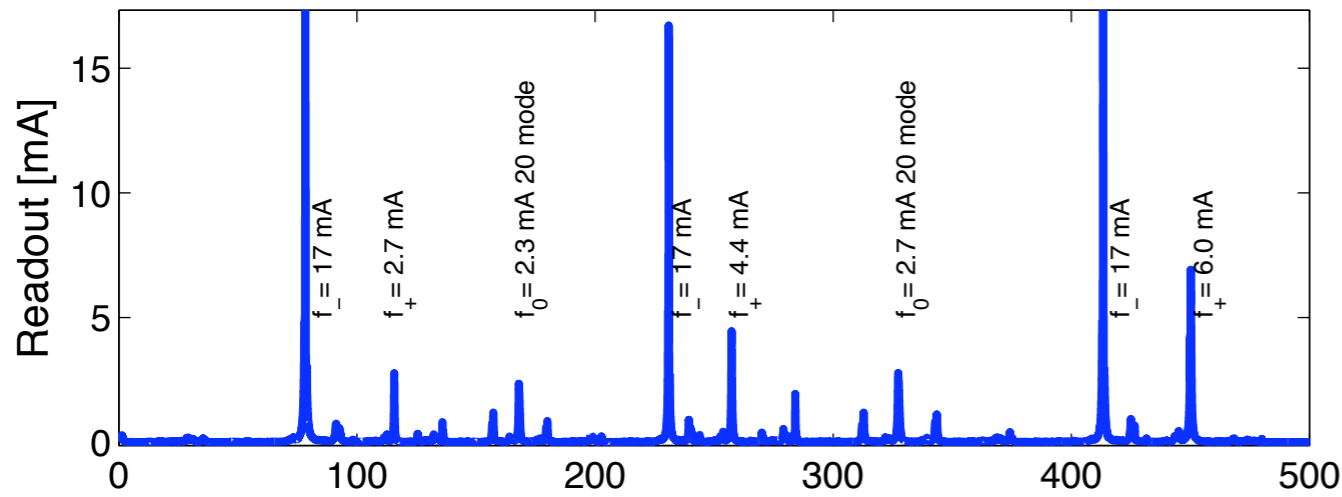
0.3nm/V PZT
 coefficient (both sites)



01/08/2009 iLog

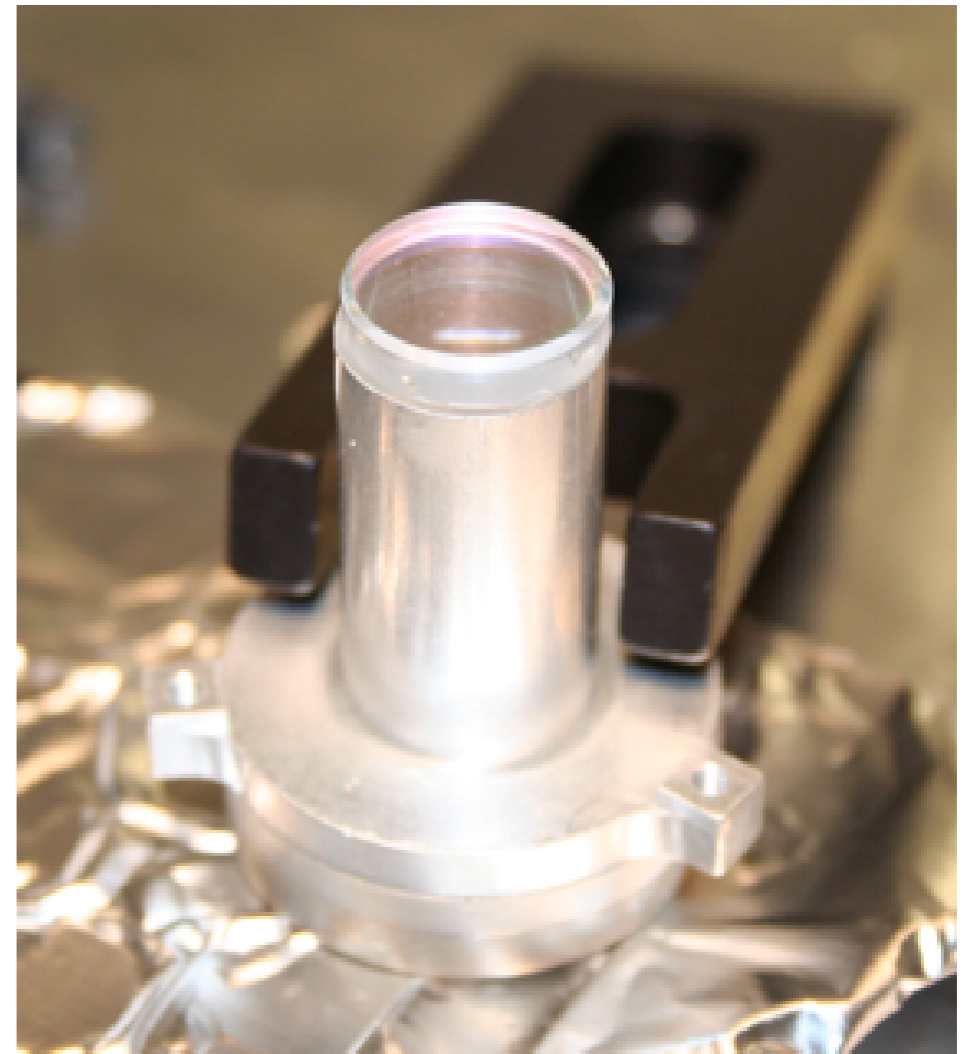
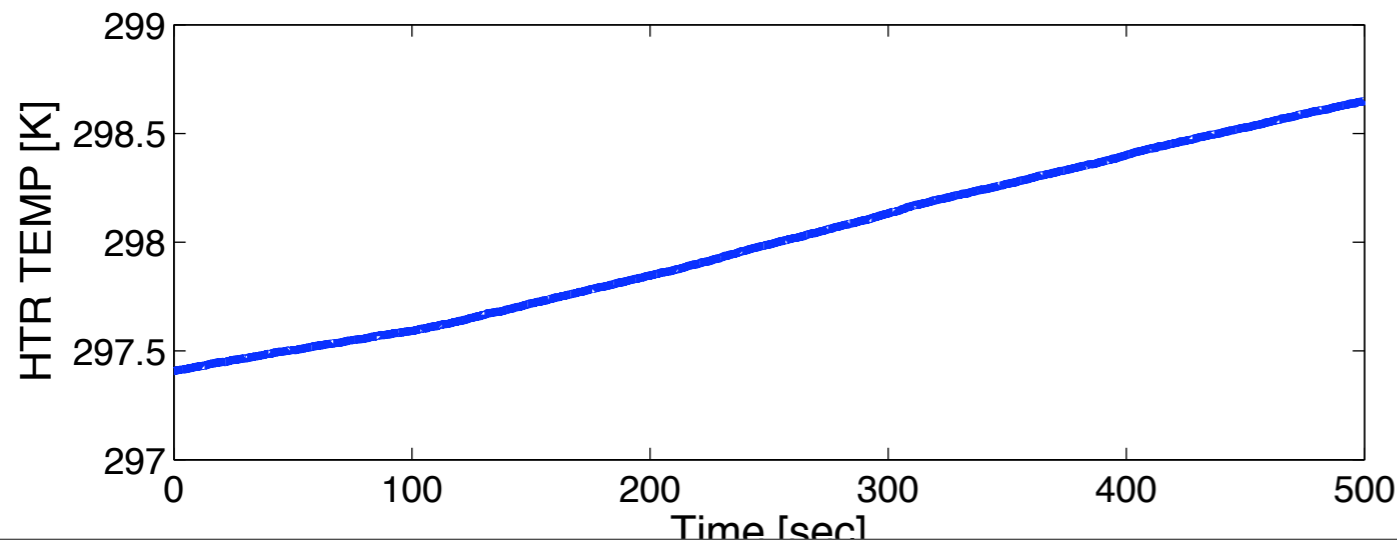
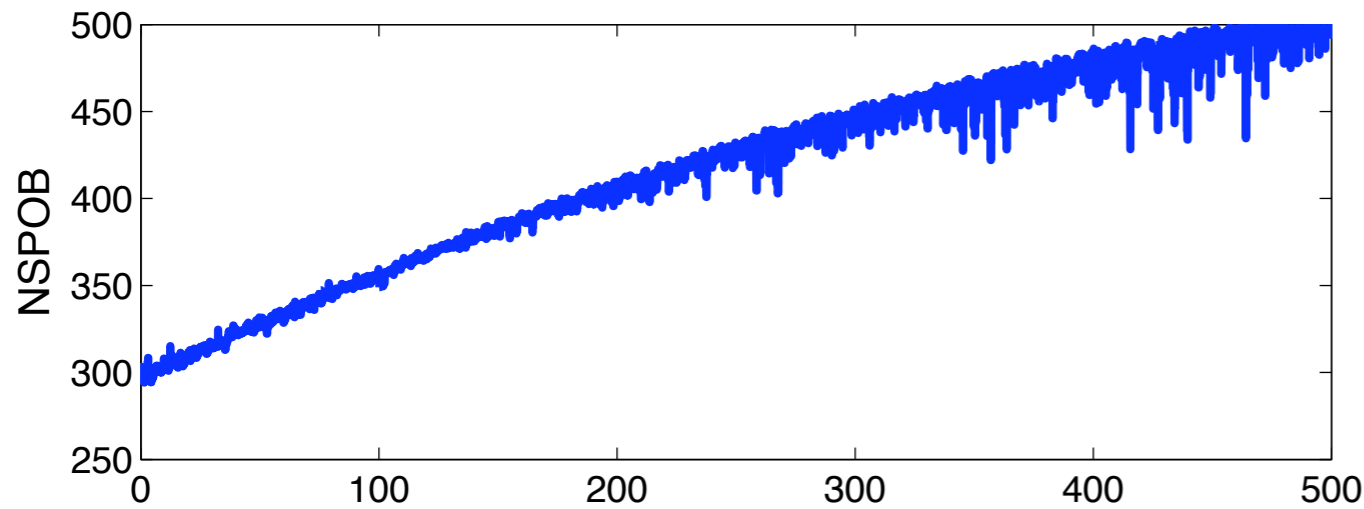
Linear and quadratic
 OMC length noise
 << 10x below DARM

Basic design works well

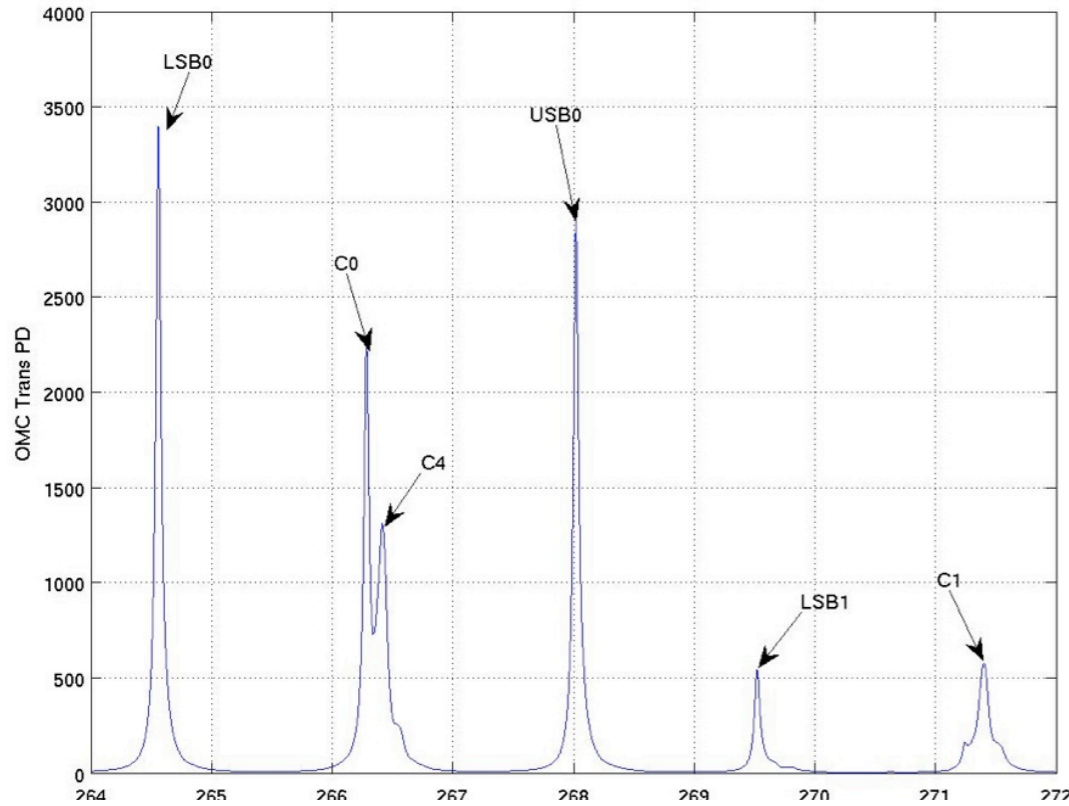


0.5 K, 200 seconds per FSR

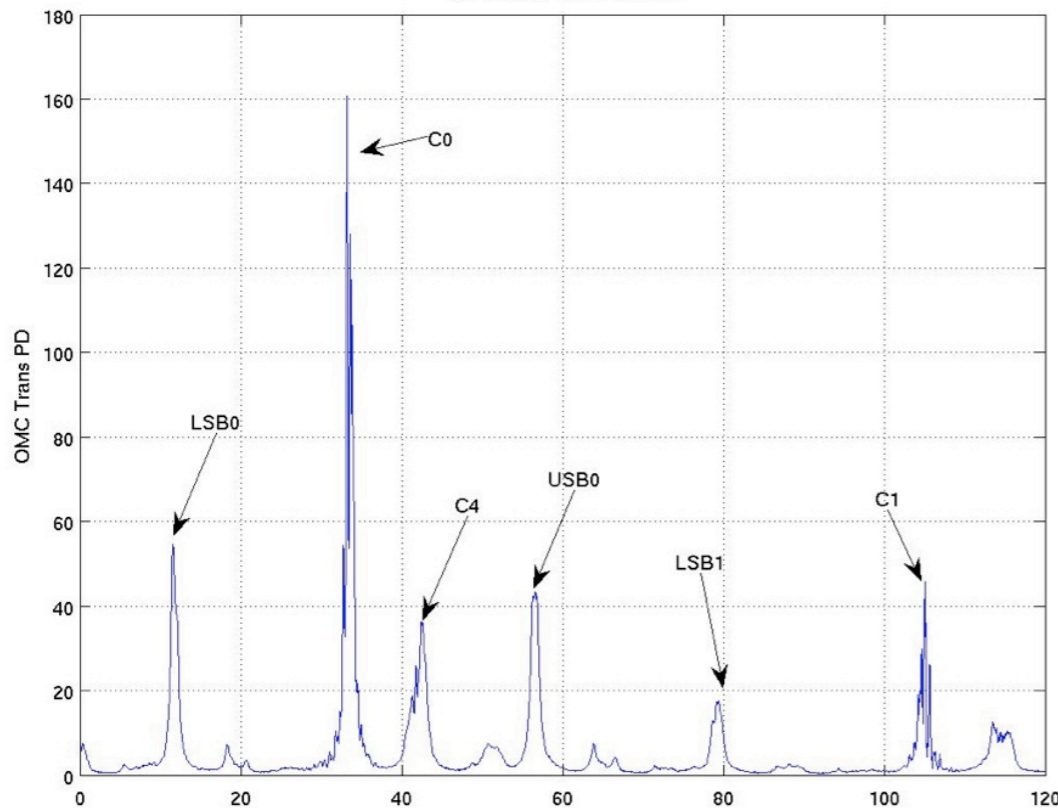
Don't want to go any slower



Modes at 316K



Modes at 300K

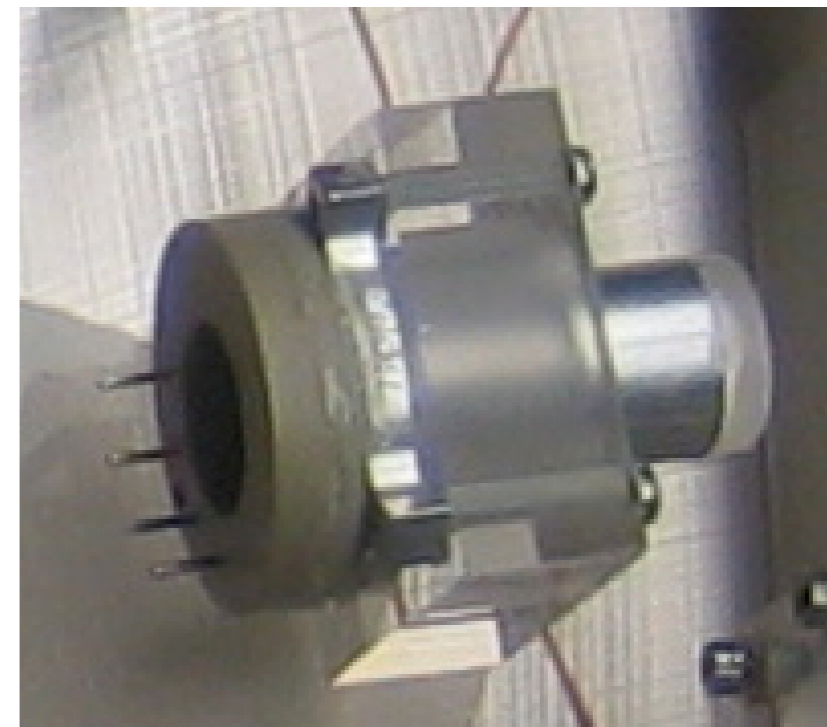


Mechanical adjustment
good

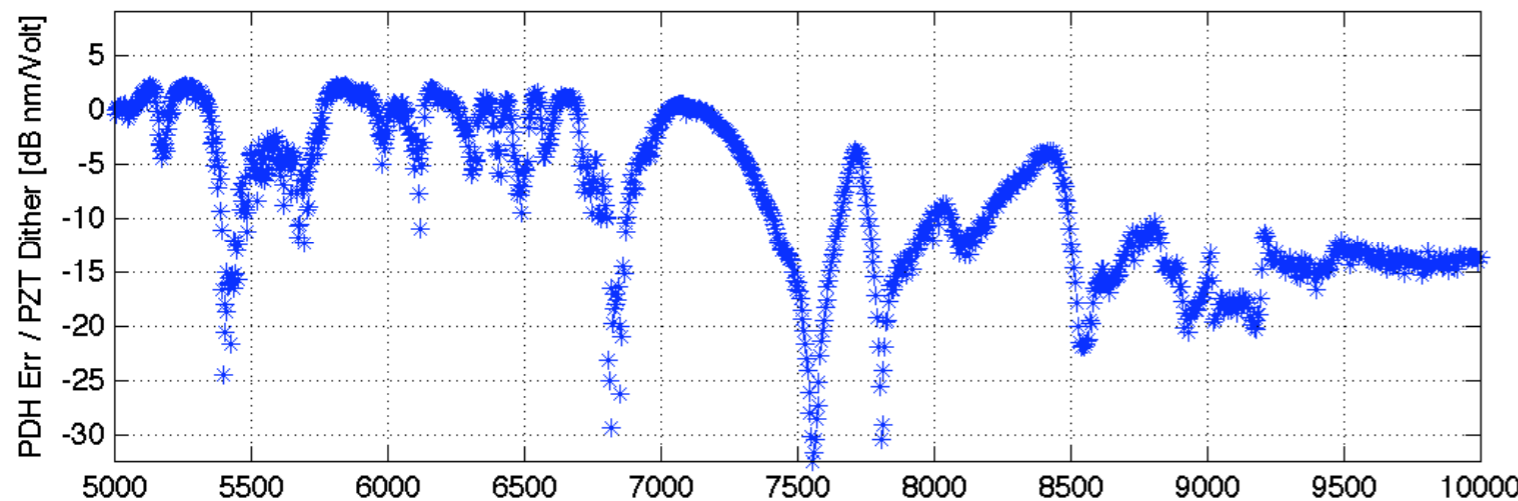
Limiting aperture **bad**

g-factor variance **good**
and **bad**

Alignment shift **bad**

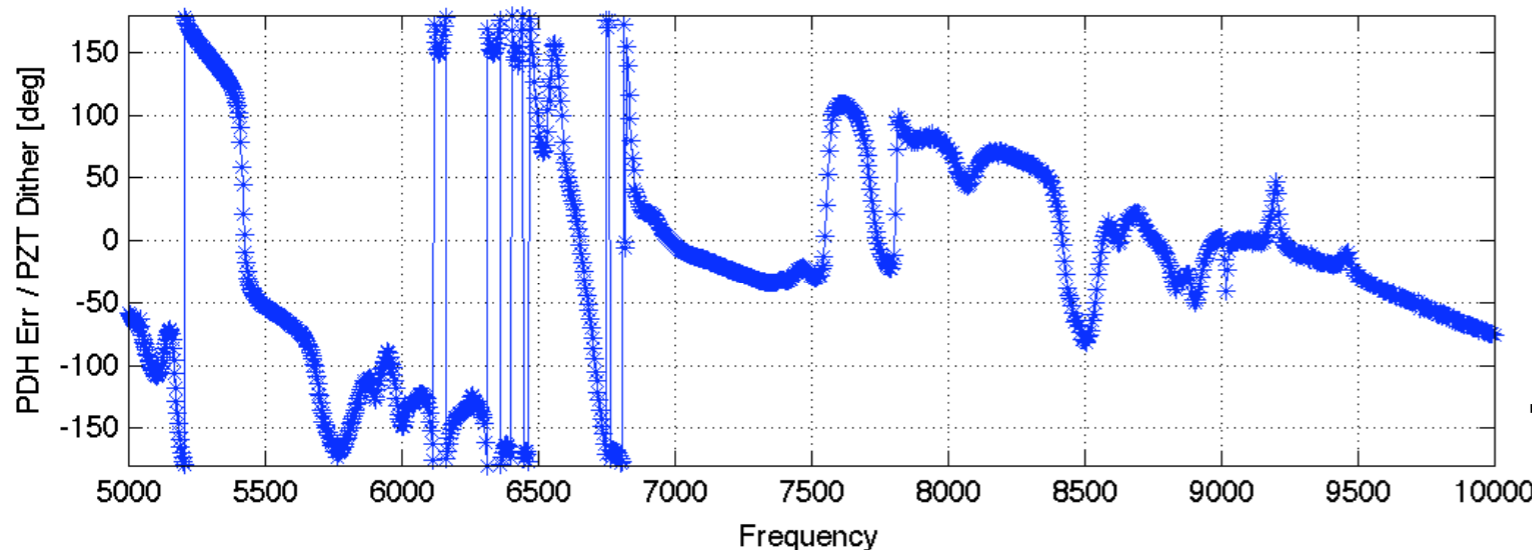


PZT Dither response of OMC

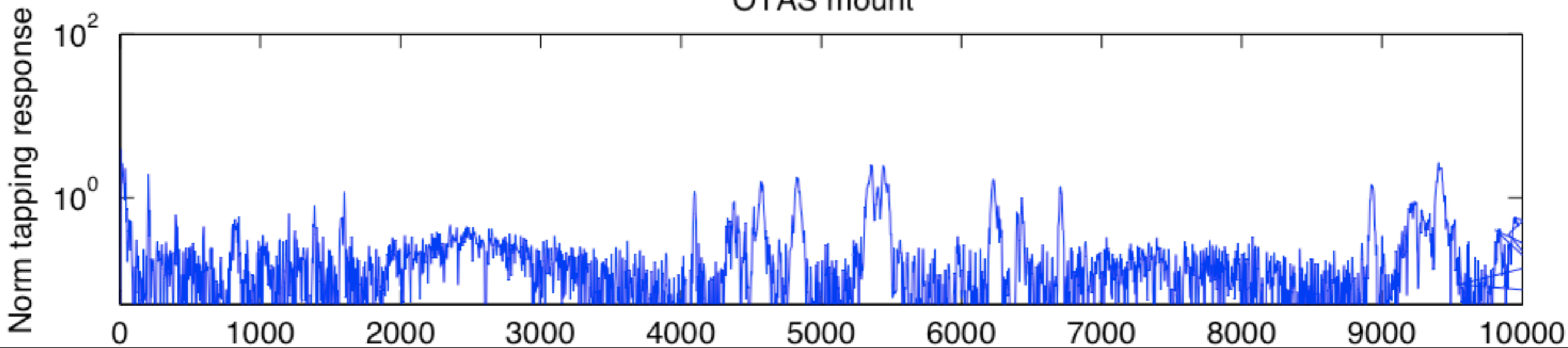


Resonances are
“insulting”

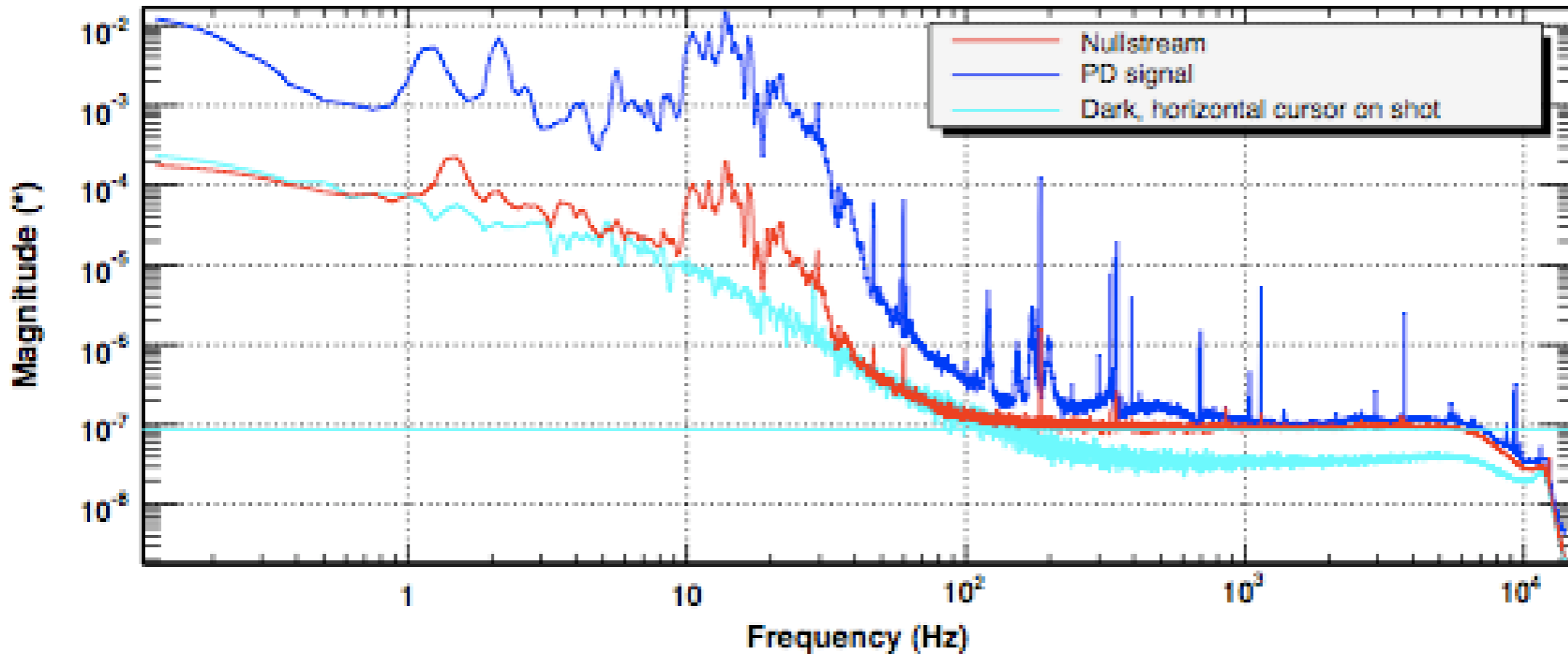
New tombstone/
breadboard with higher
frequency



OTAS mount



Power spectrum



*T0=18/03/2009 09:25:52

*Avg=5/Blk=11L

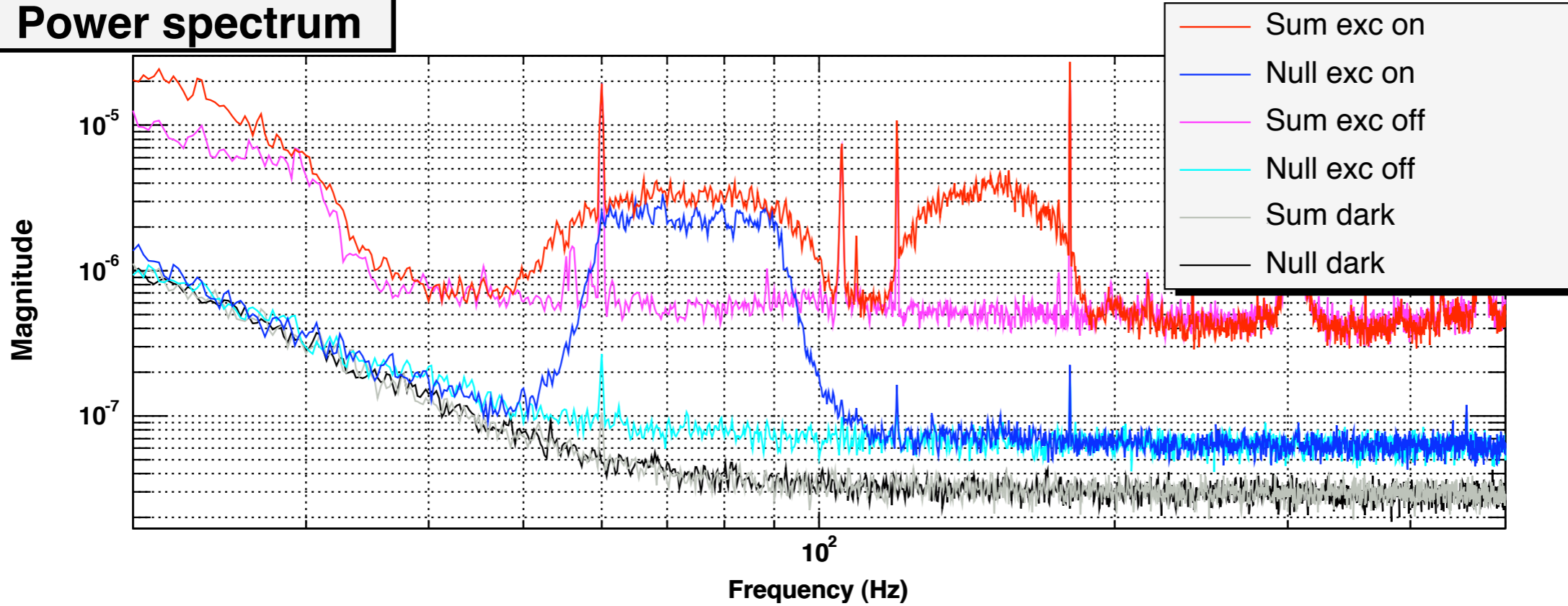
BW=0.187484

In vacuum PDs very **successful** for eLIGO

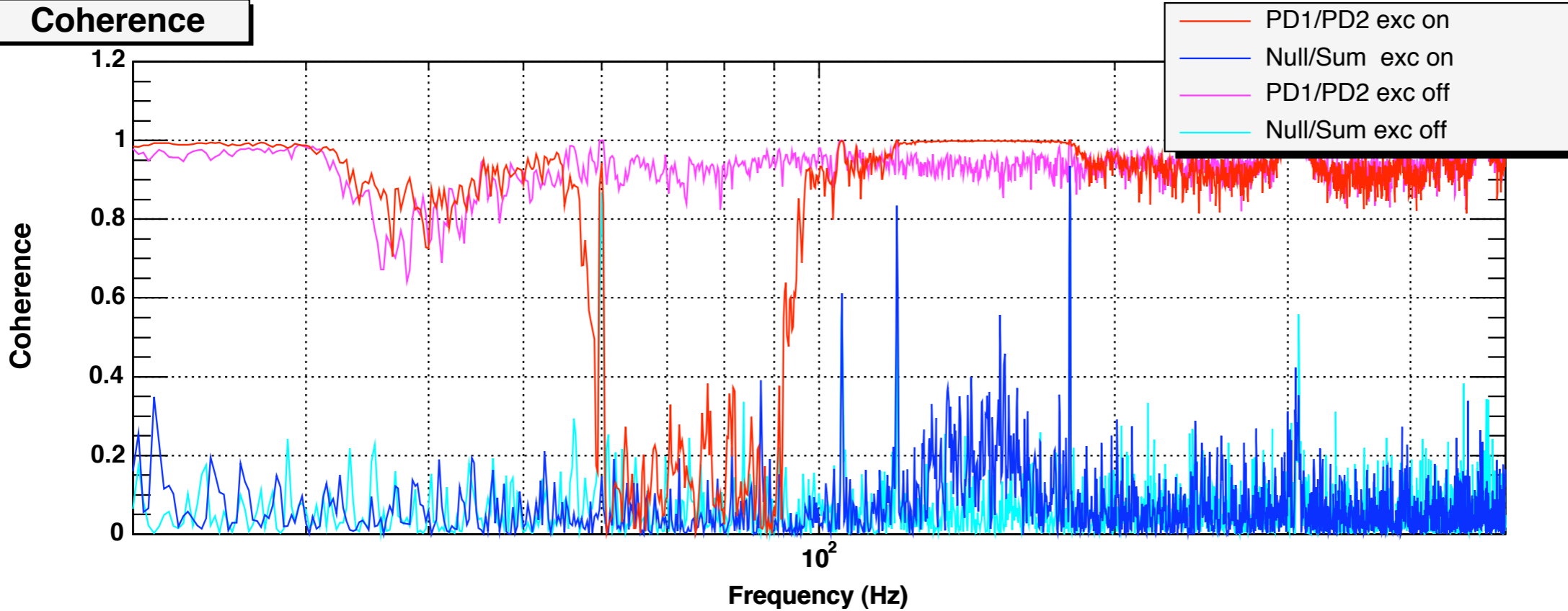
advLIGO needs **development**

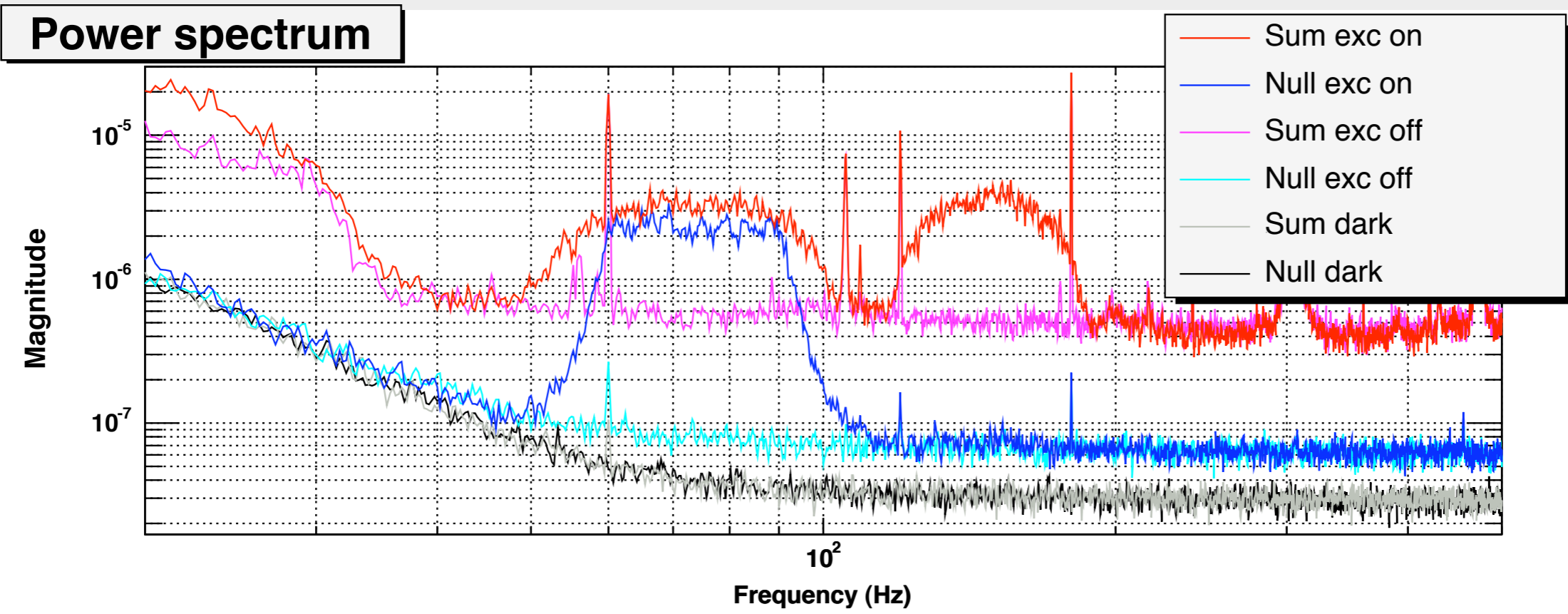
Get preamp off OMC (SUS constraint)

Power spectrum



Coherence



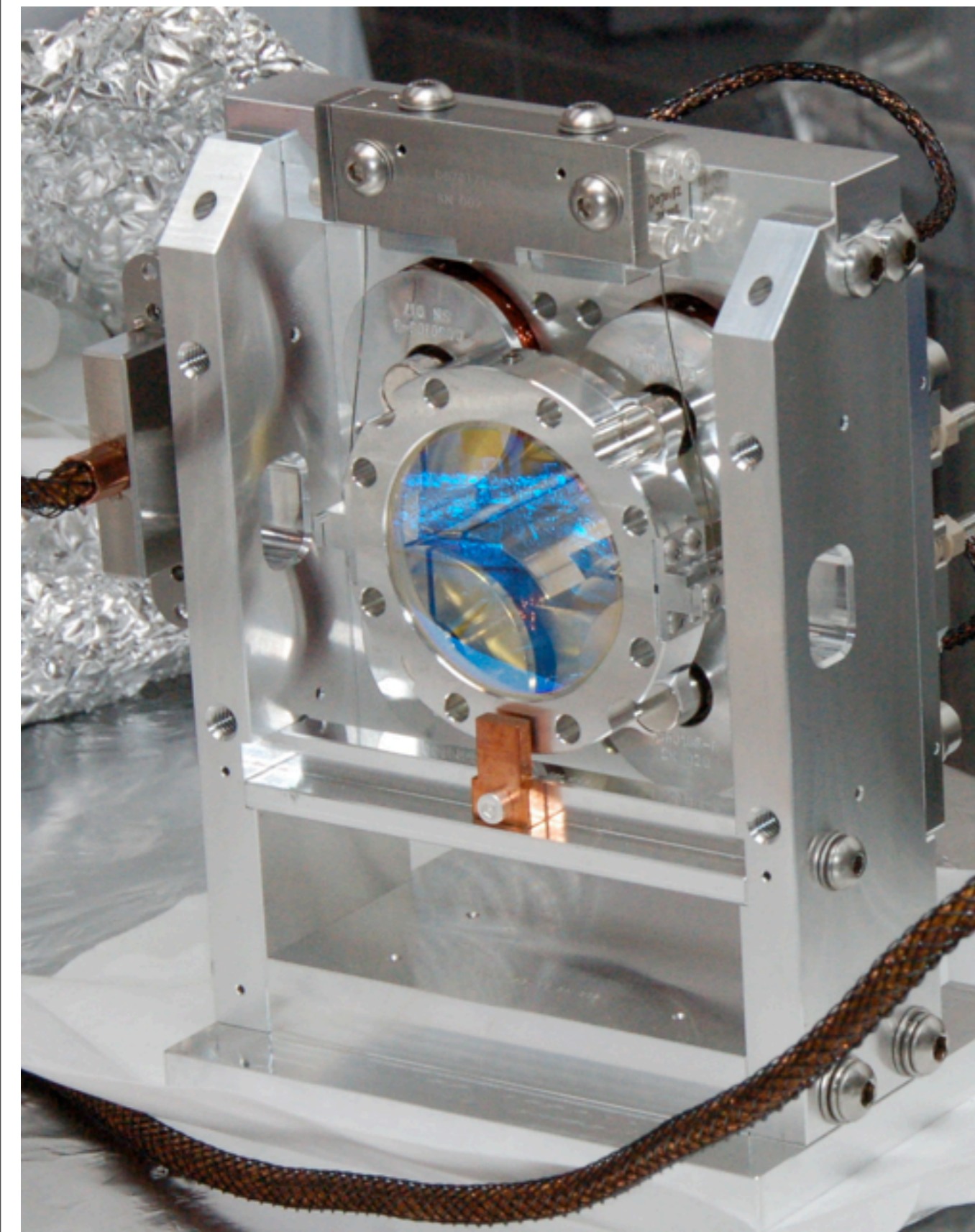


Coherence PD1/PD2 exc on

Definite nullstream noise possible as a function of OMC length noise

Not understood, not a problem *currently*

Tip Tilting



Before:

After:

17:11:30
Thu Oct 9
2008
(Local)

Topic: H1 Author: Nicolas Smith

TipTilt MMT

I ran senseQPD twice to measure the TT->QPD(3,4) matrix. Here is a refer pitch, trial #1:

```
mCon is:
TT1      P1      P2
TT1      0.776   -1.000
TT2      0.588   -1.000
```

Warning!
Control Matrix determinant is -0.18869. This is very small.
Fix the TT - MMT

20:22:14
Sun Oct 12
2008
(Local)

Topic: H1 Author: Nicolas Smith

this is an old matrix, measured on sep 14:

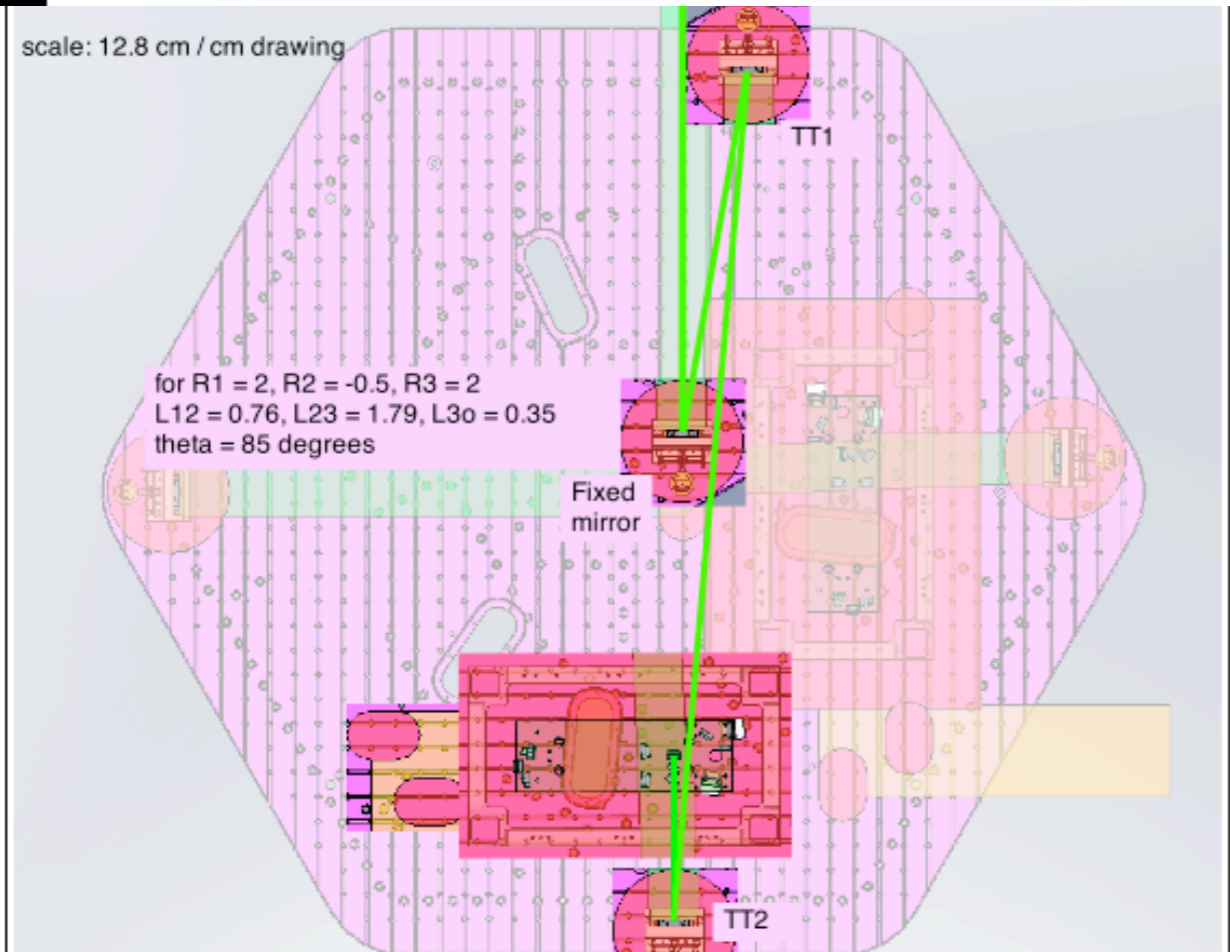
```
mCon is:
P1 P2
TT1 1.000 0.485
TT2 1.000 0.459
```

what a piece of junk!

```
today measured:
P1 P2
TT1 0.235 1.000
TT2 1.000 0.870
```

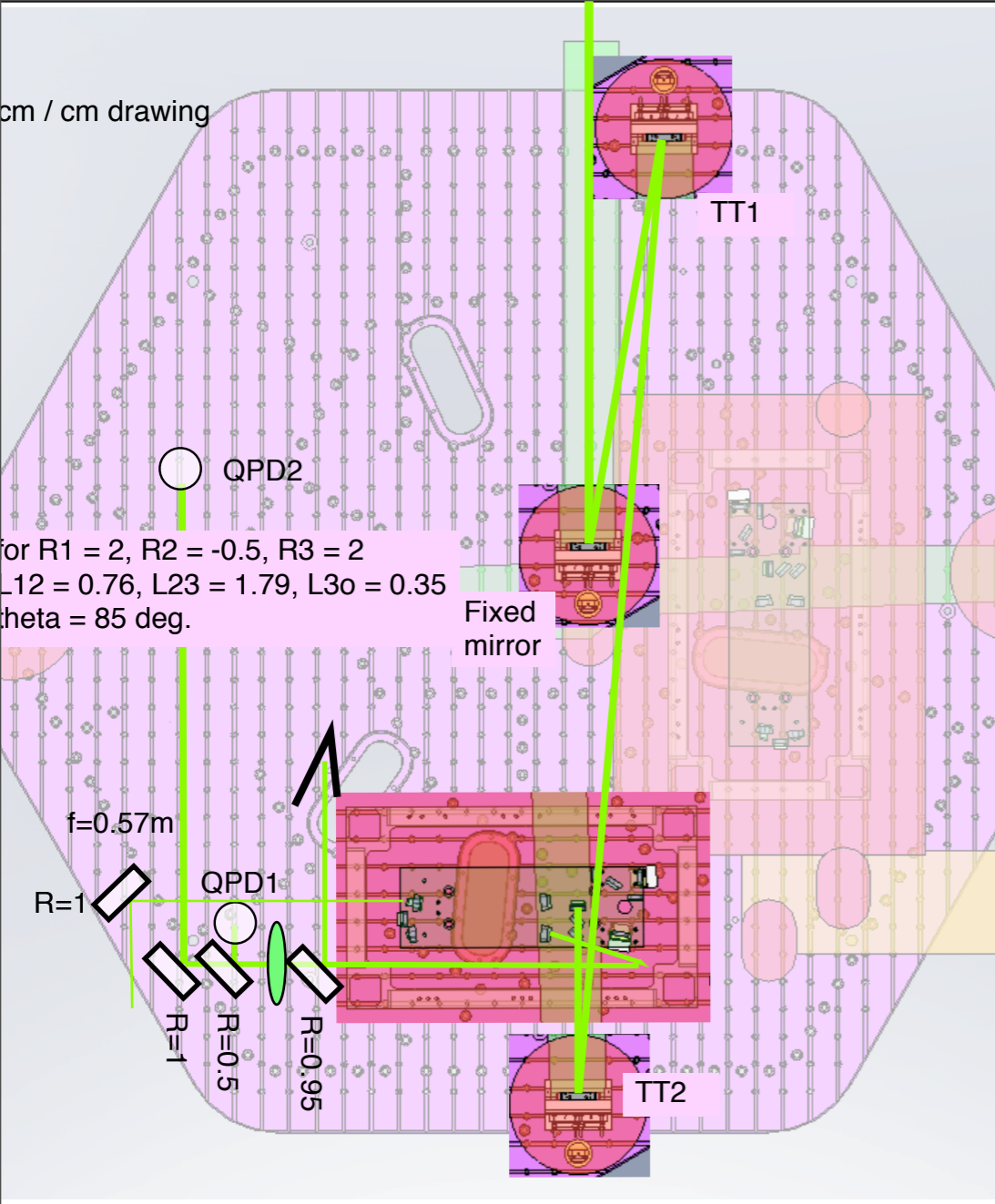
det = 0.85

Looks like 45 degrees rather than 0.

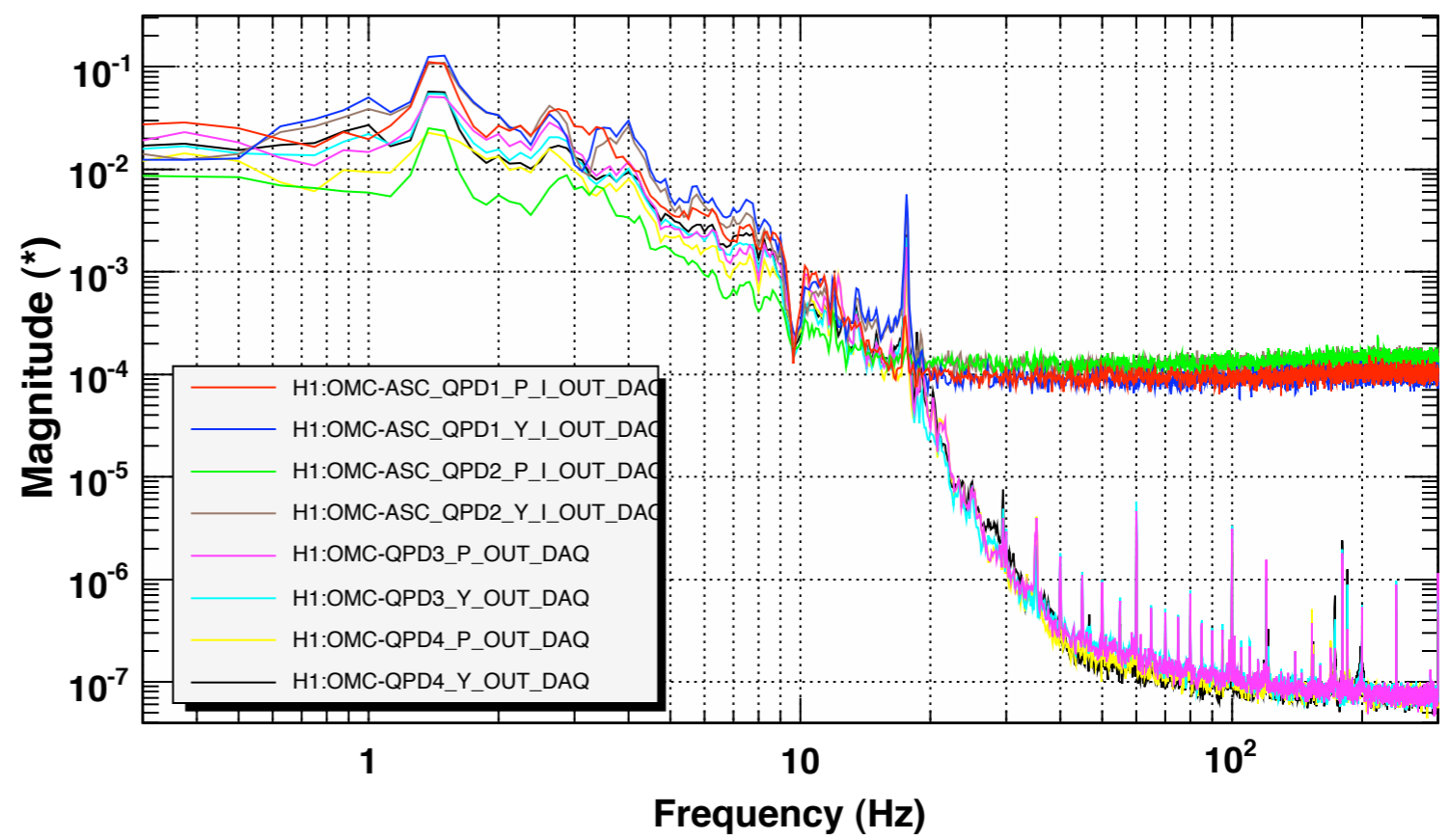


More **complex**

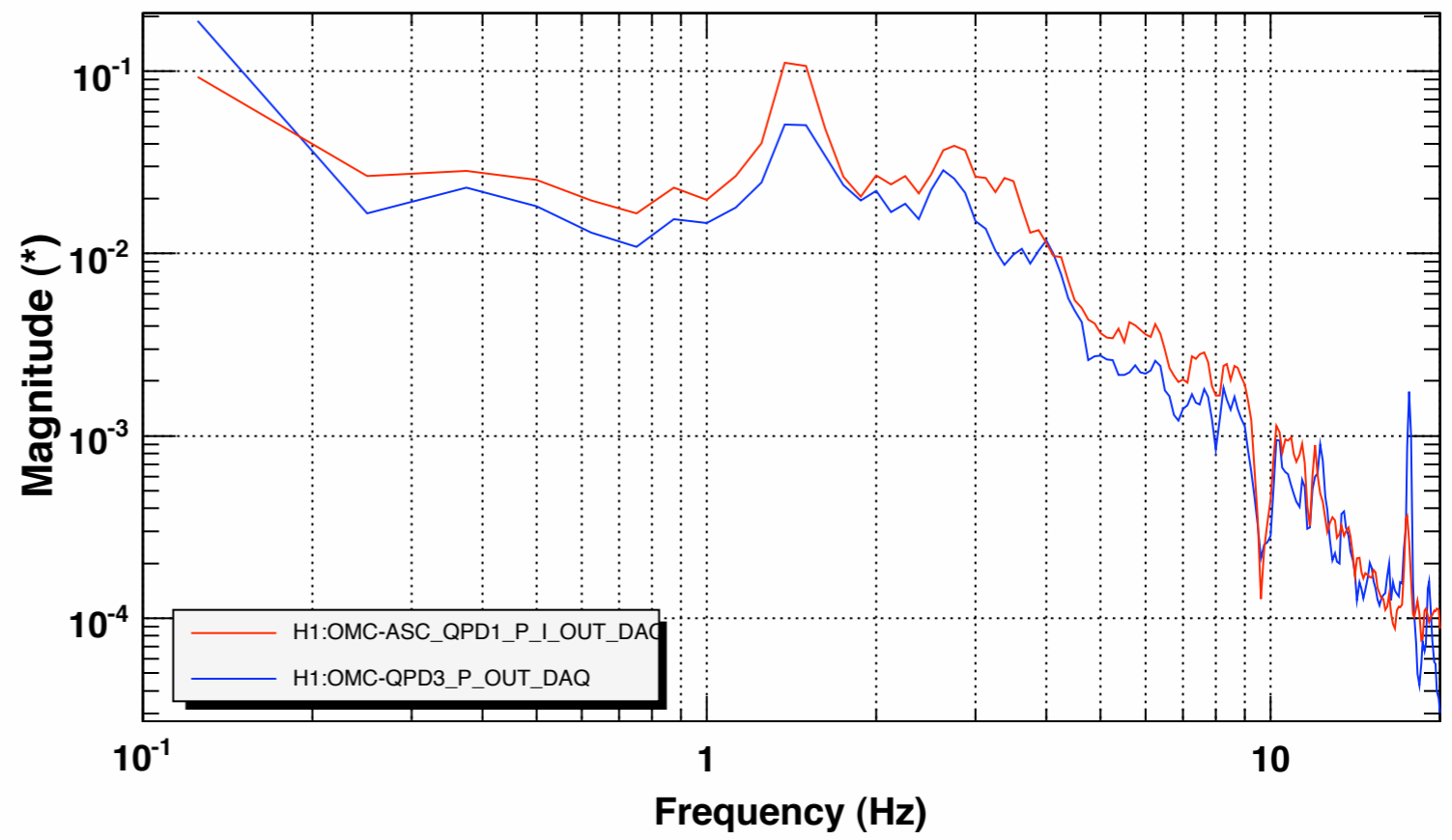
Better, **lower noise control**



Power spectrum



Power spectrum

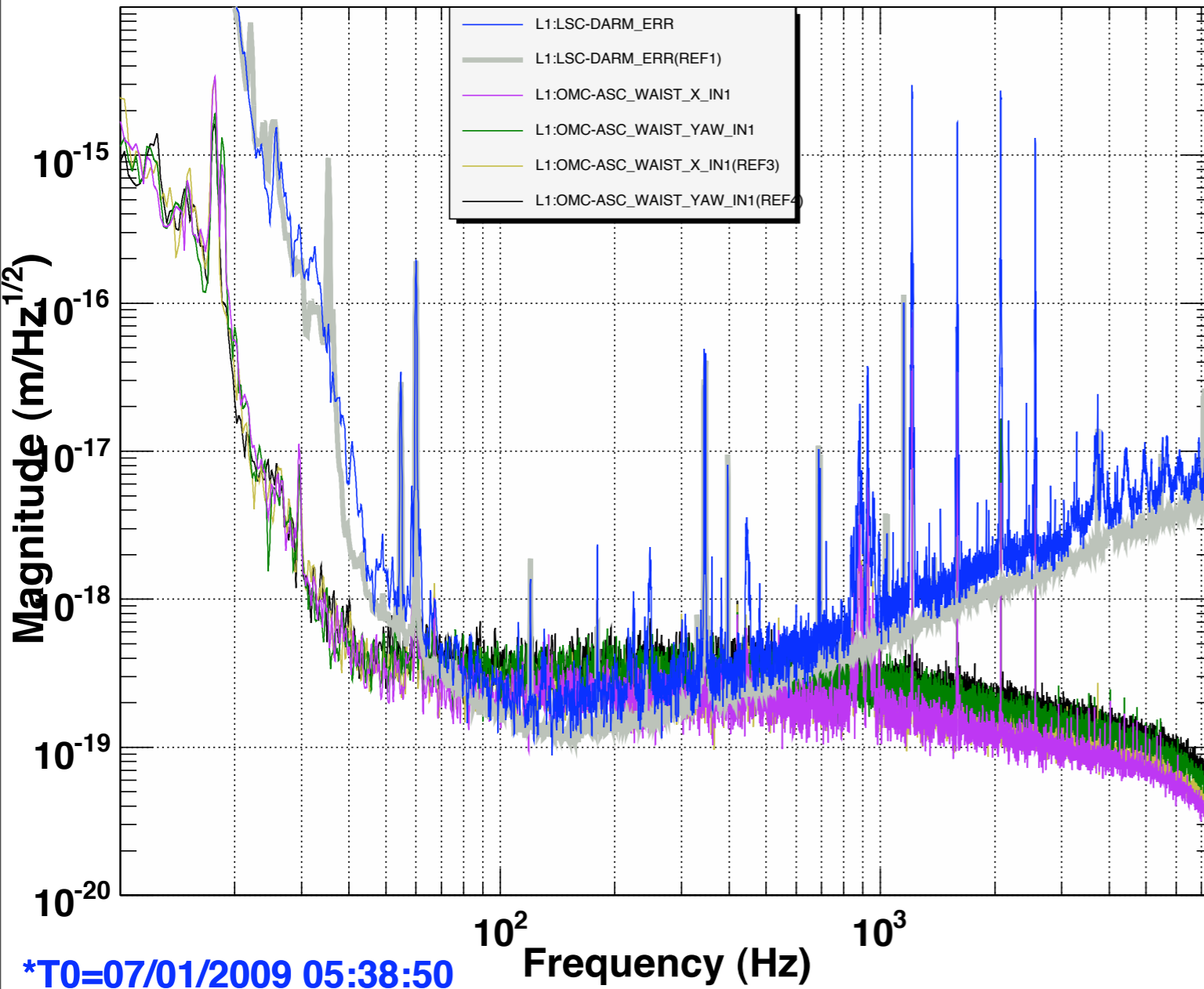


No dither

High hi freq. noise

High power issues

Coupling to WFS (?)



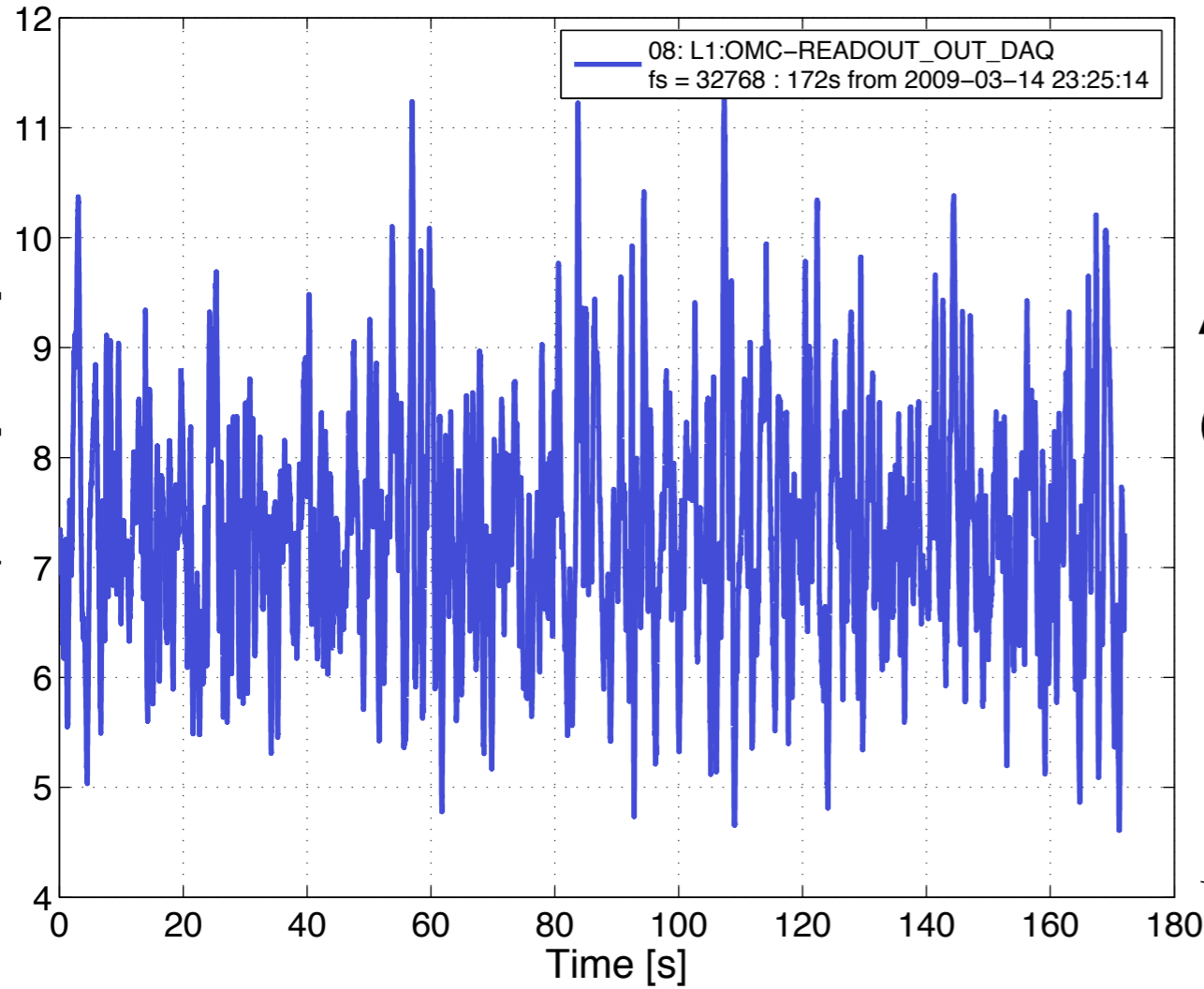
QPD estimates of alignment noise coupling

Sensor noise **limited**

Includes linear/quadratic **estimate**

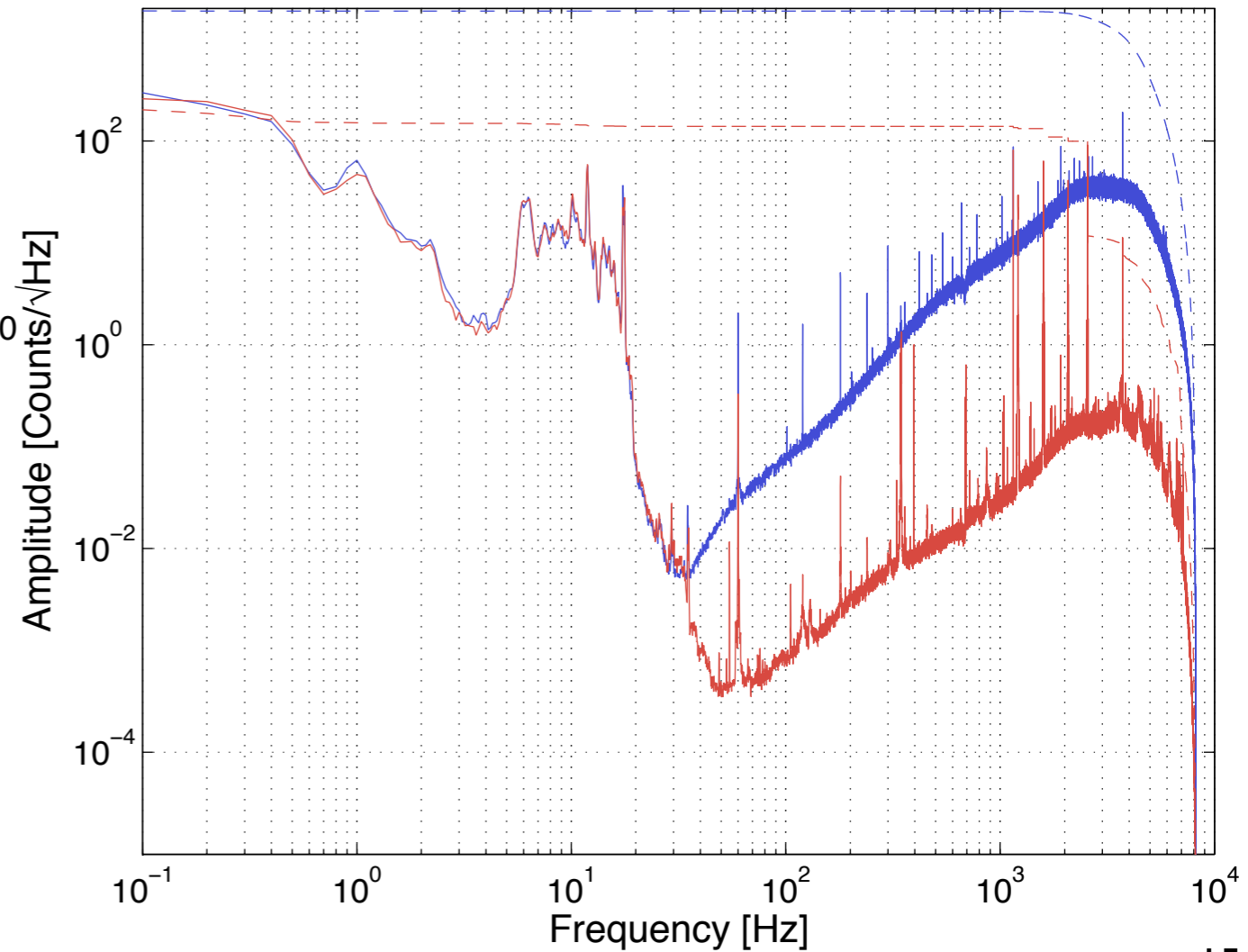
Red herring

Time-series plot

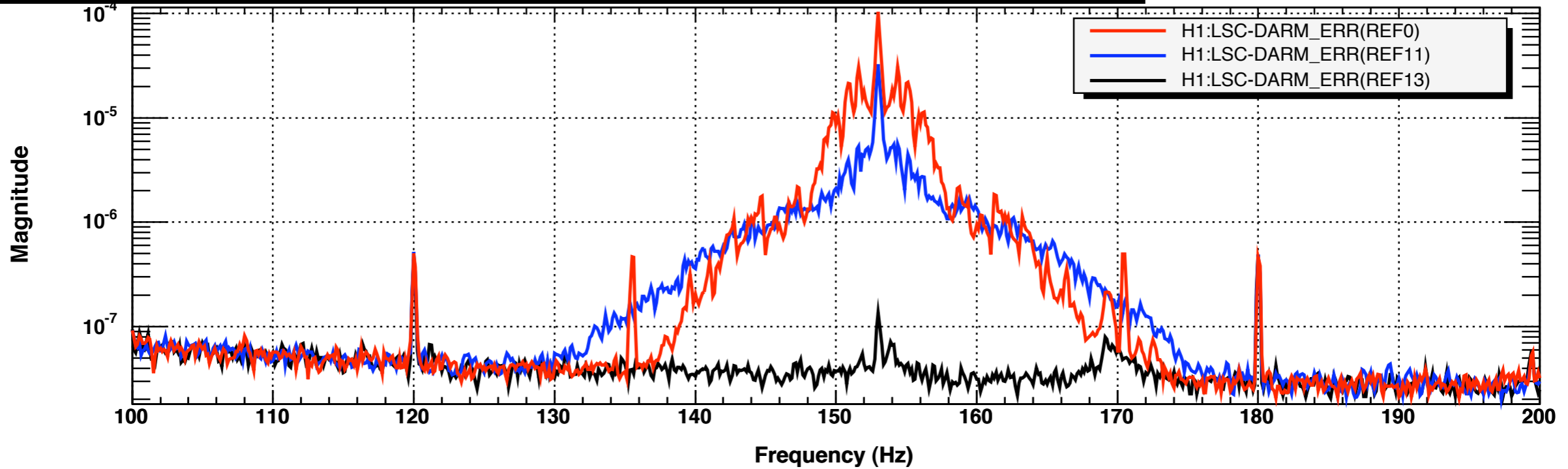


Before DC, RIN ~ 15%
After DC, DARM_CTRL exact

Spectrum plot using Hanning window



DARM - BLACK: nominal, BLUE: injection into H1:OMC-TT2_SUSPOS_EXC, RED: shaking with outside shaker

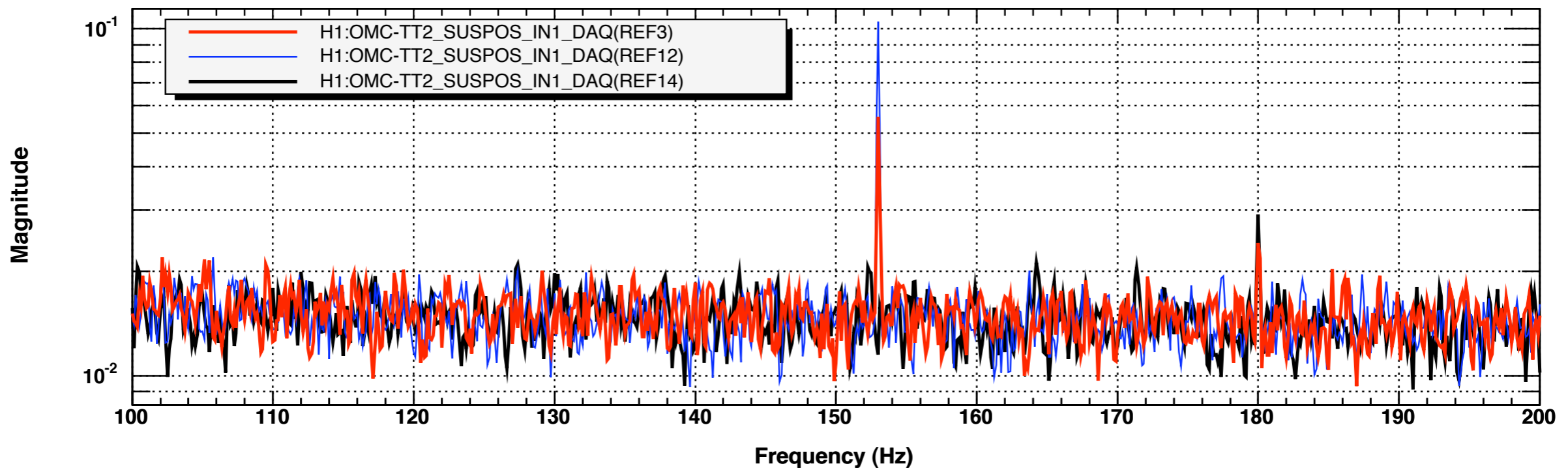


*T0=16/01/2009 19:59:07

Avg=15

BW=0.187499

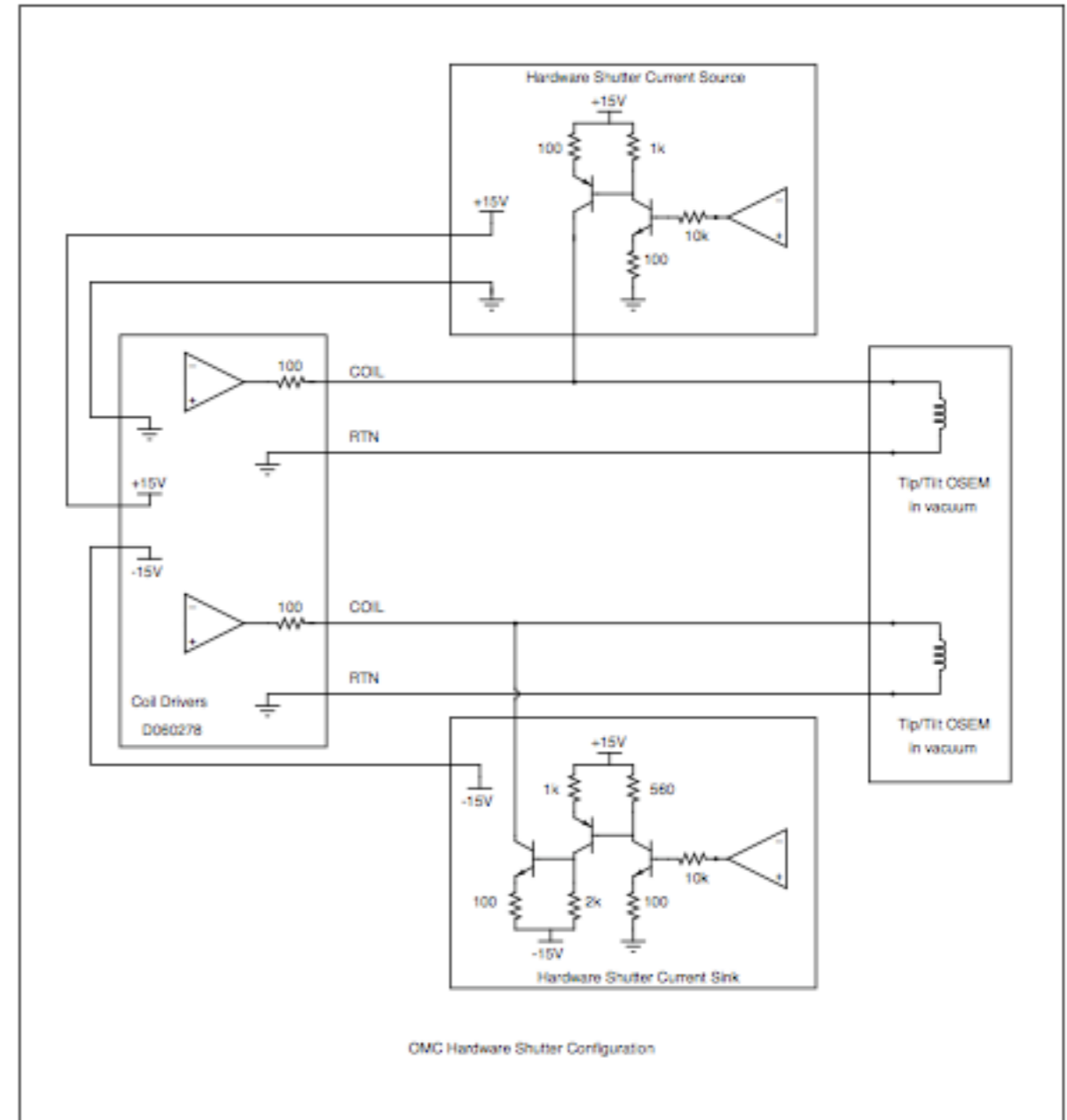
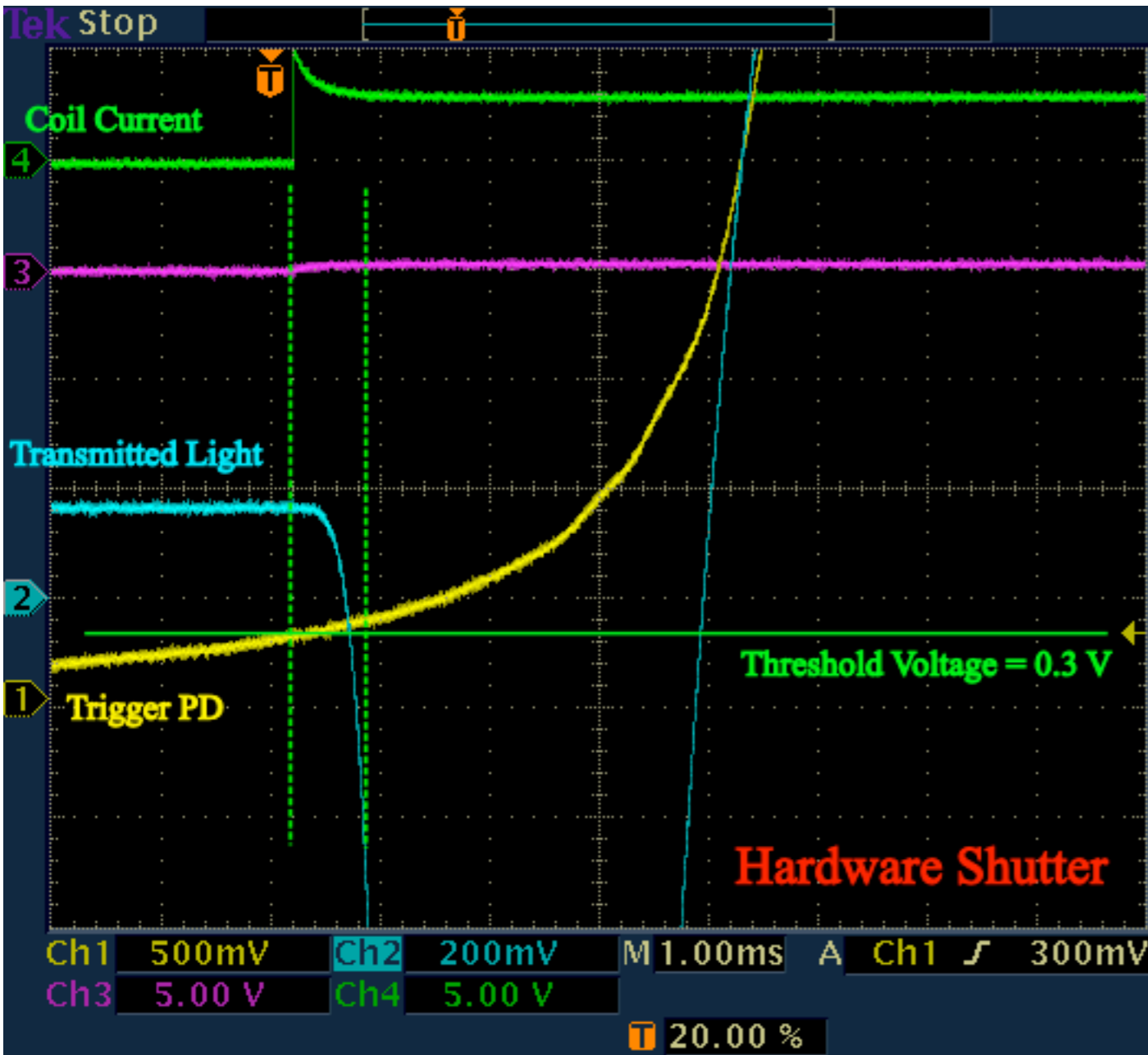
Tip tilt 2 shadow sensors, position signal - colors same as above



*T0=16/01/2009 19:47:39

Avg=15

BW=0.187499



00:58:09
Fri Jan 23
2009
(Local)

Topic: H1

Author: Stefan Ballmer

Fringe wrapping on DC readout when driving RM PIT

Subentry

Nic, Matt, Lisa, Stefan

We tried wiggling the RM at 3Hz in PIT and YAW in order to distinguish different blobs on the AS port camera. We didn't gain much insight there, but stumbled on something odd:

Driving RM PIT a 3Hz produces a very clean fringe-wrapping signal in DARM_ERR, with the knee moving up to ~300Hz (for the max drive that doesn't break lock). The curious thing is that a YAW drive of the same amplitude does not produce any noise. Also, the signal is not present in an RF readout.

This coupling mechanism could be responsible for some of the observed "glitchiness".

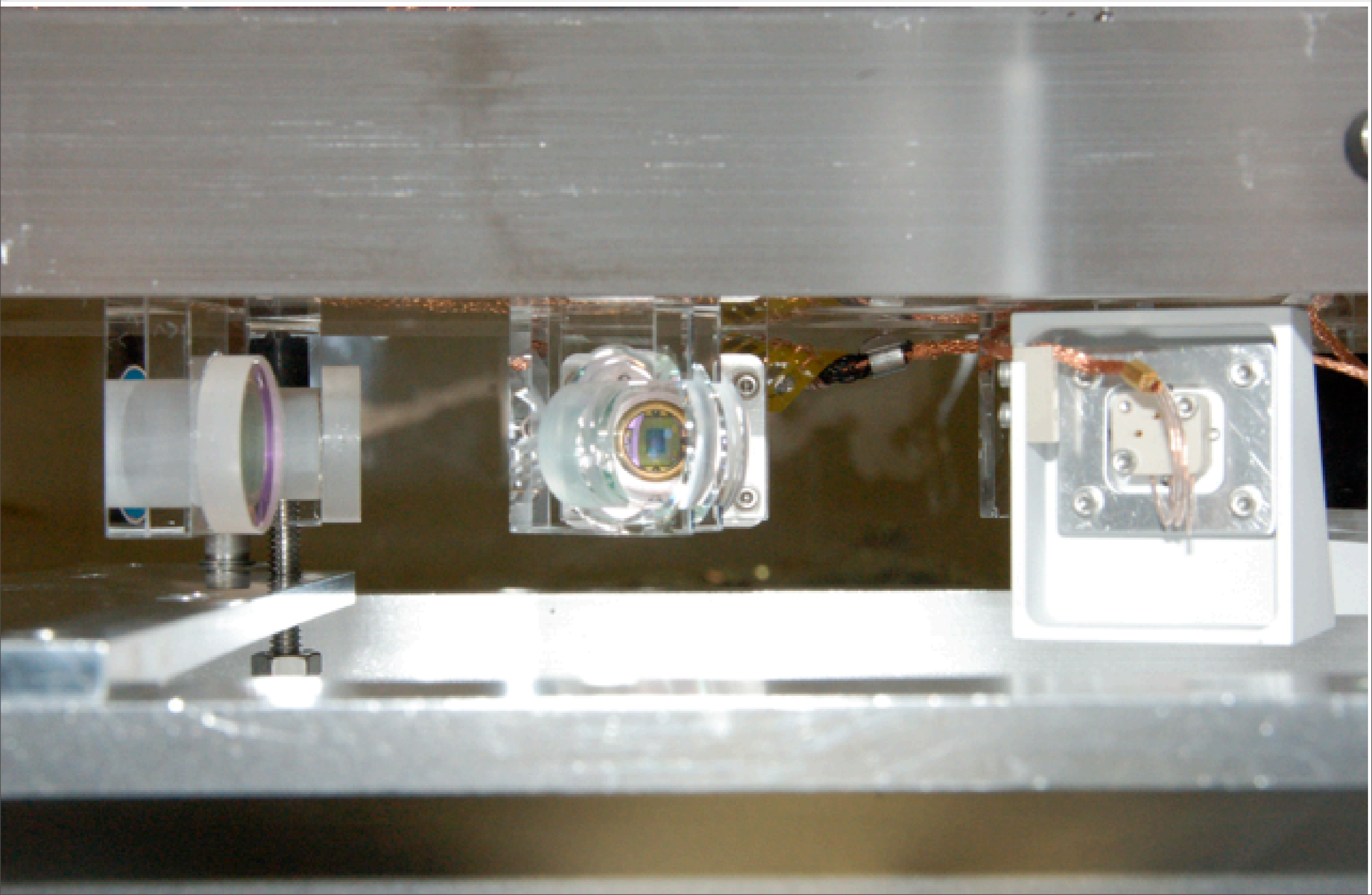
- [Stefan Ballmer](#)

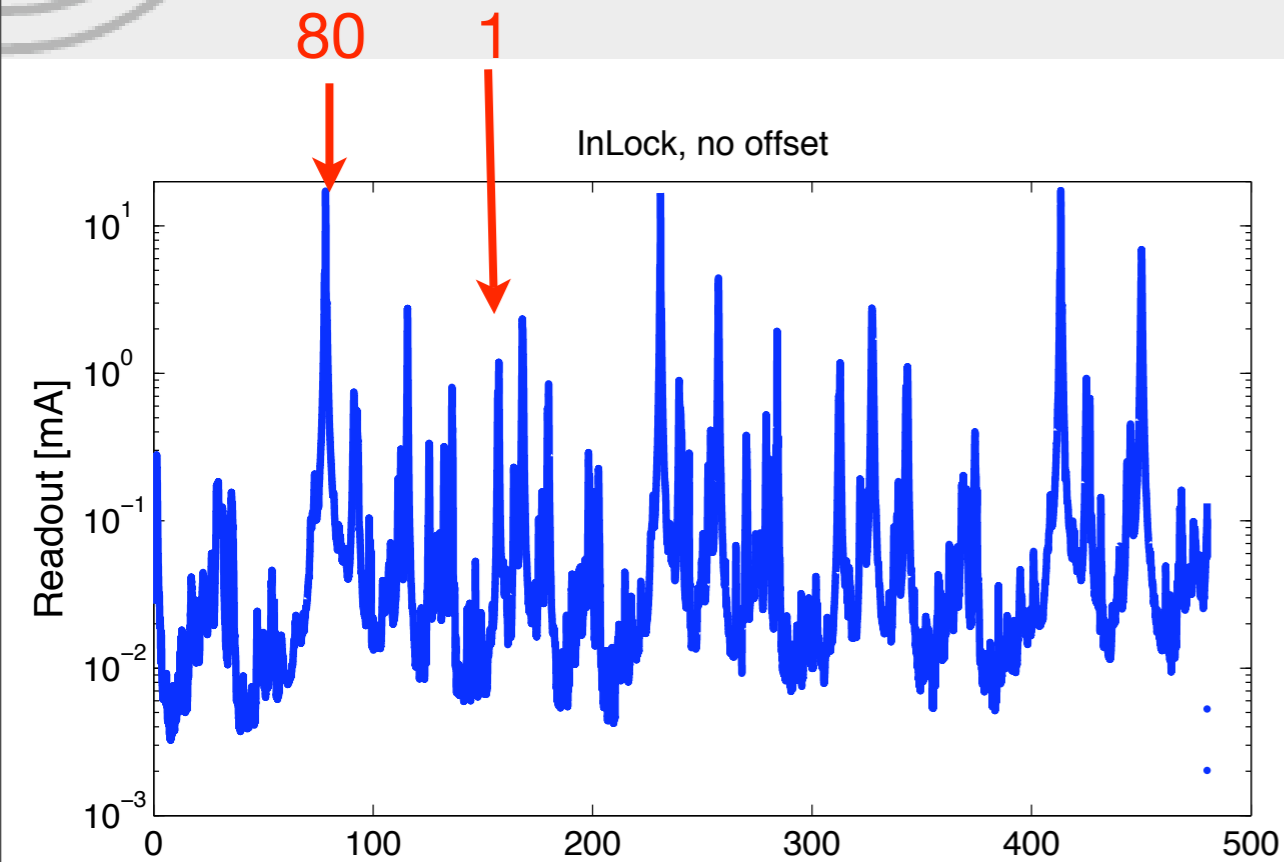
<http://ilog.ligo-wa.caltech.> ([ref url](#))

A2L for tip/tilts but we don't have sensor for L.

Look at linear scattering and diagonalize?

Mode matching

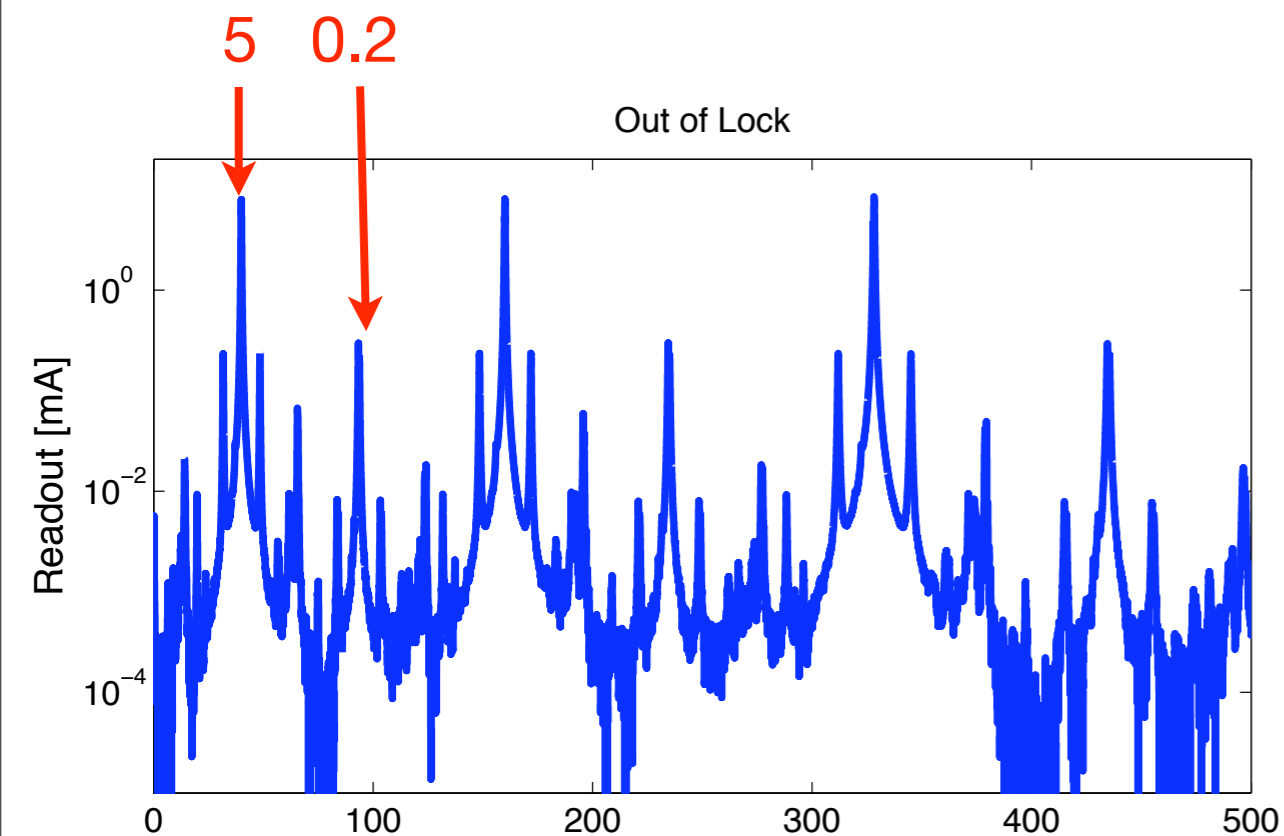




Livingston

$n+m=2\sim 5\%$

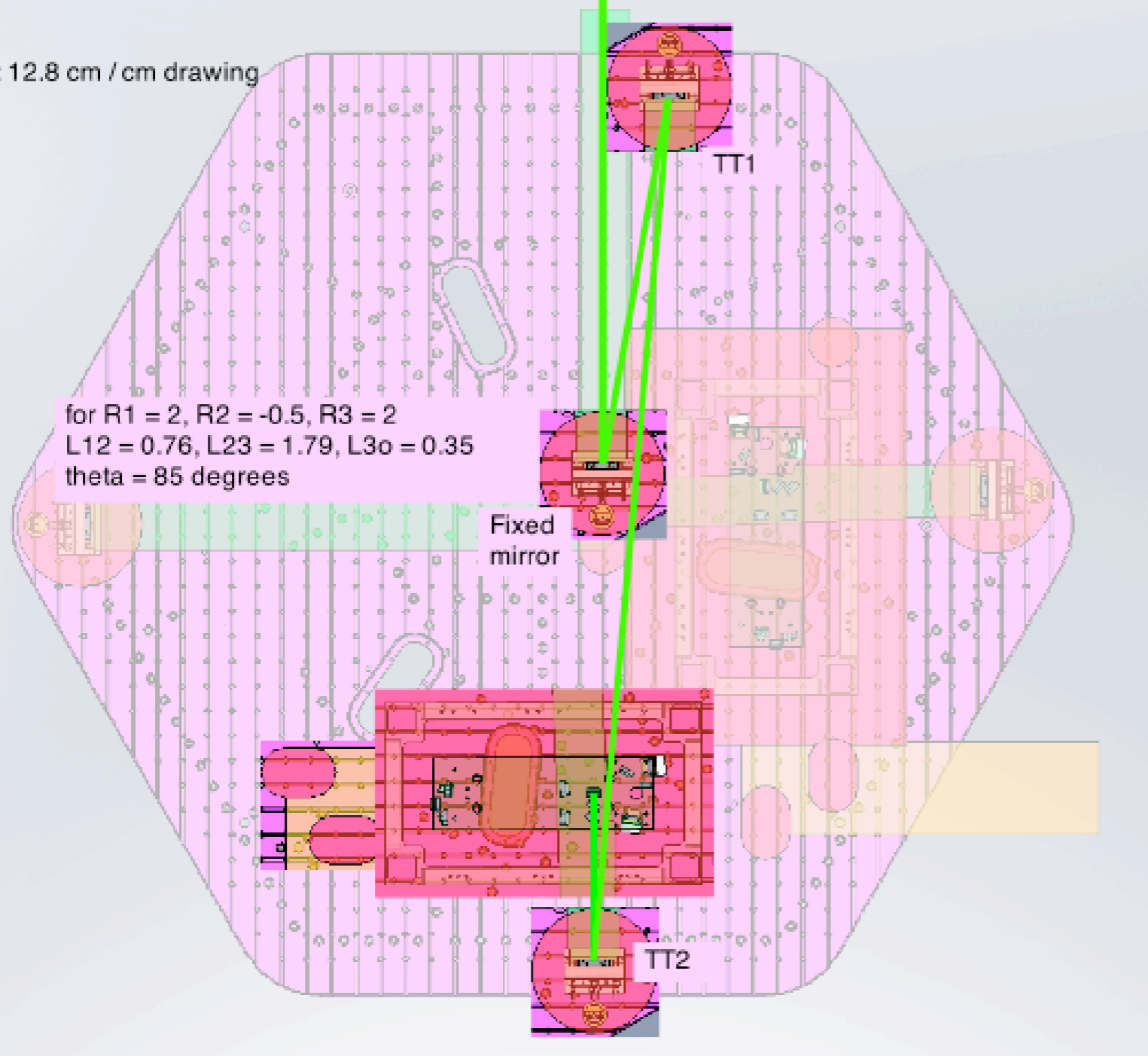
no evidence for IFO
power dependence



Hanford

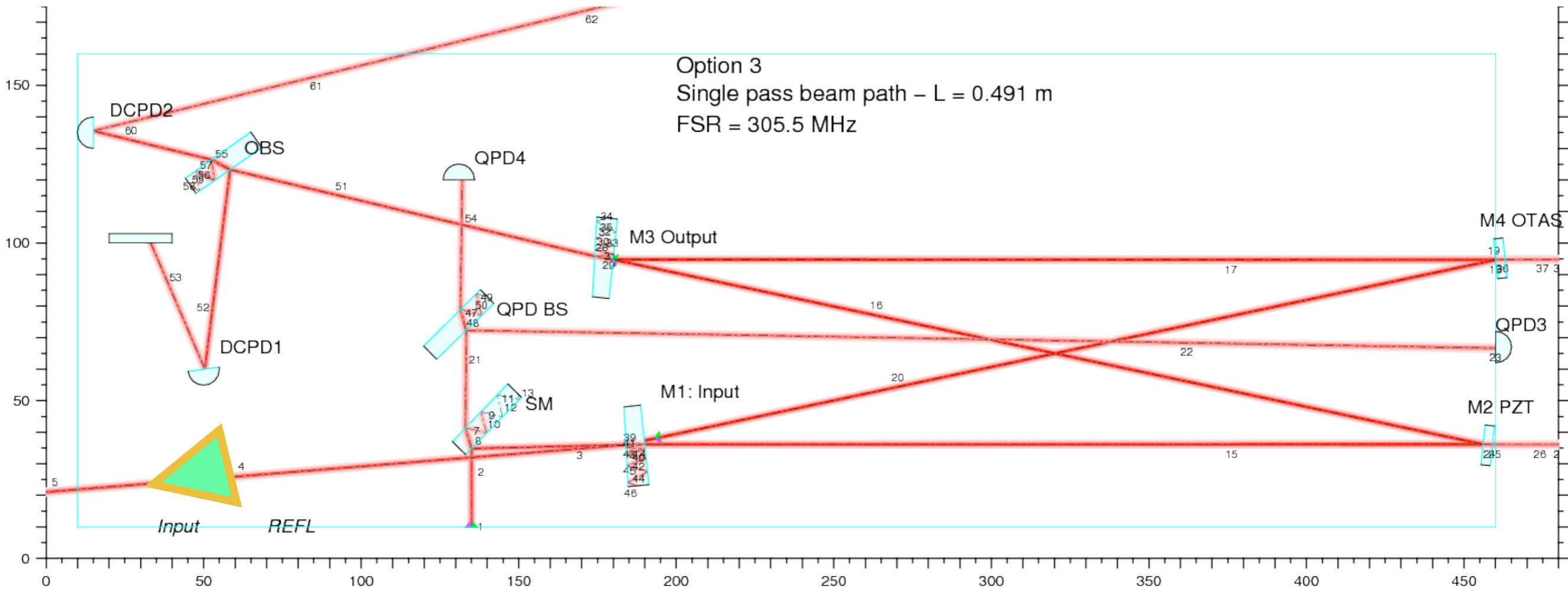
IFO heating
dependent optical
gain

scale: 12.8 cm / cm drawing



Variable mirror ROC?

Incorporate heater into tip/ tilt similar to OMC “feature”



Optocad 0.83c, 05 Oct 2008, AsBuilt-LHO.ps

Incorporate REFL diode onto OMC
Incorporate AFWFS?

How to sense mode matching?



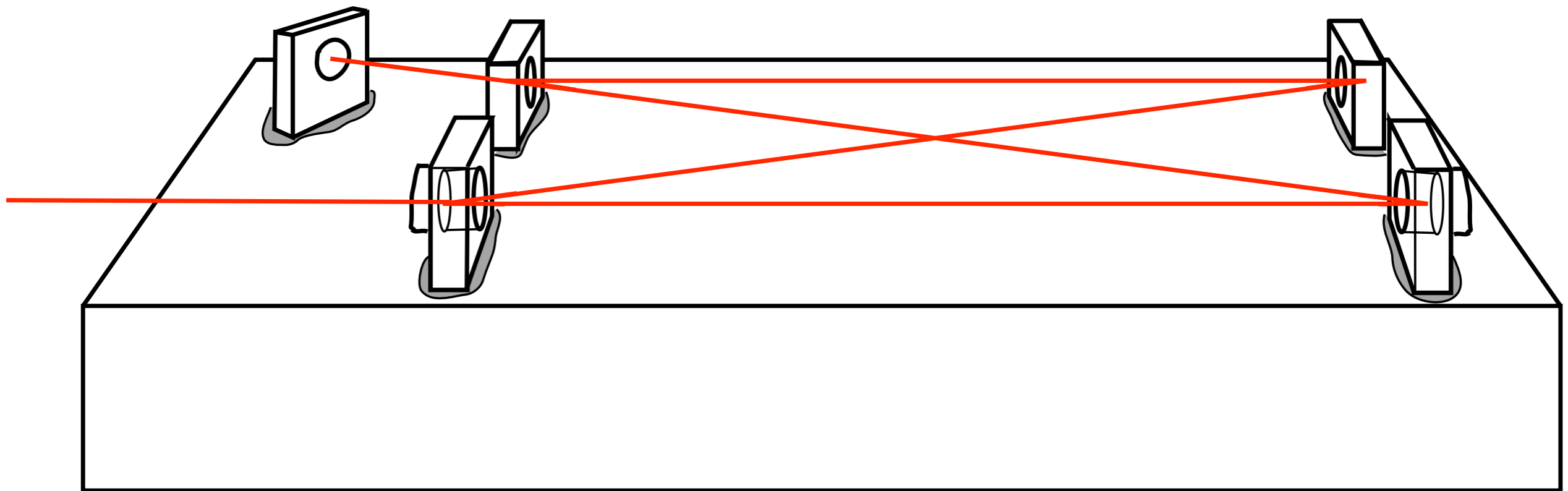
LIGO

advLIGO Changes

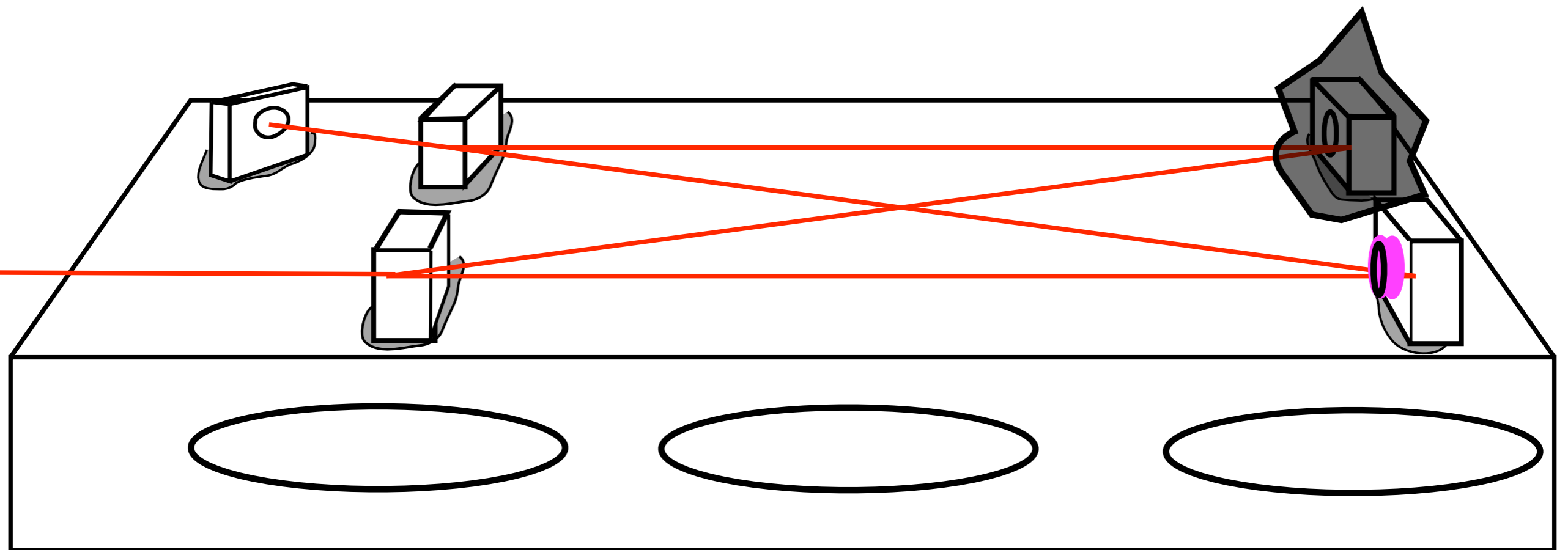
Waldman
ISC Face2Face
Caltech 3/2009




Improve mechanical characteristics
get pre-Amps off OMC?
DCPD radiator mounting, design

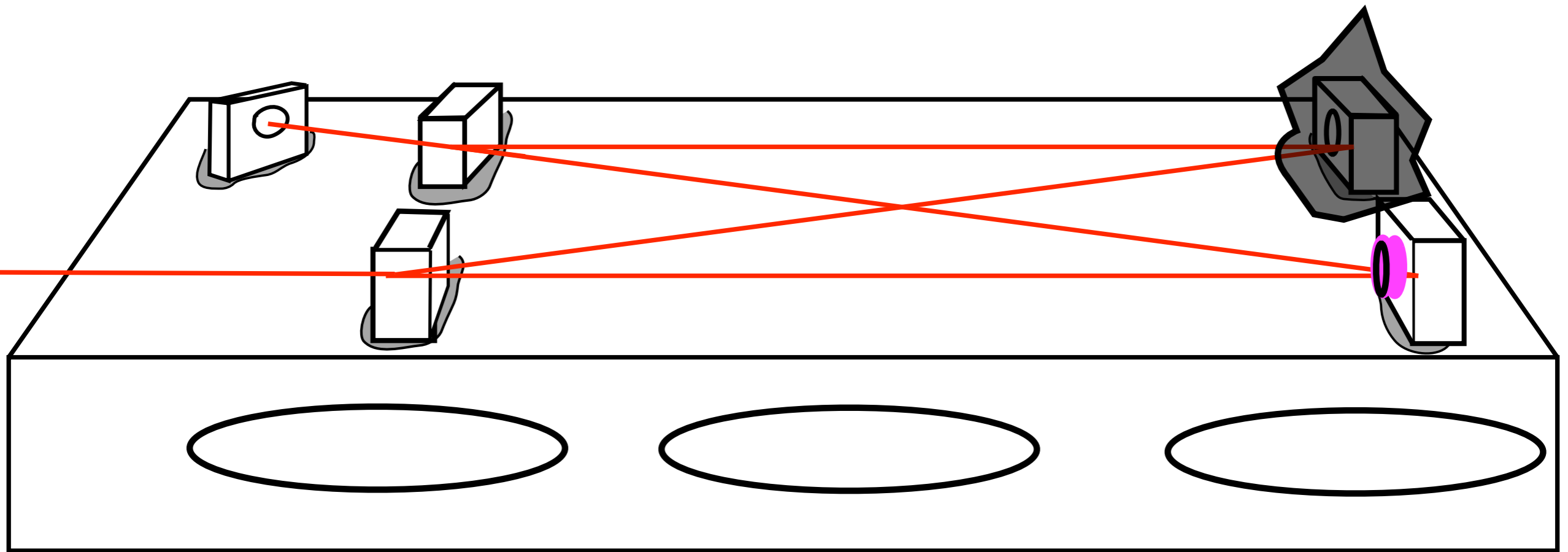


Improve mechanical characteristics
get pre-Amps off OMC?
DCPD radiator mounting, design

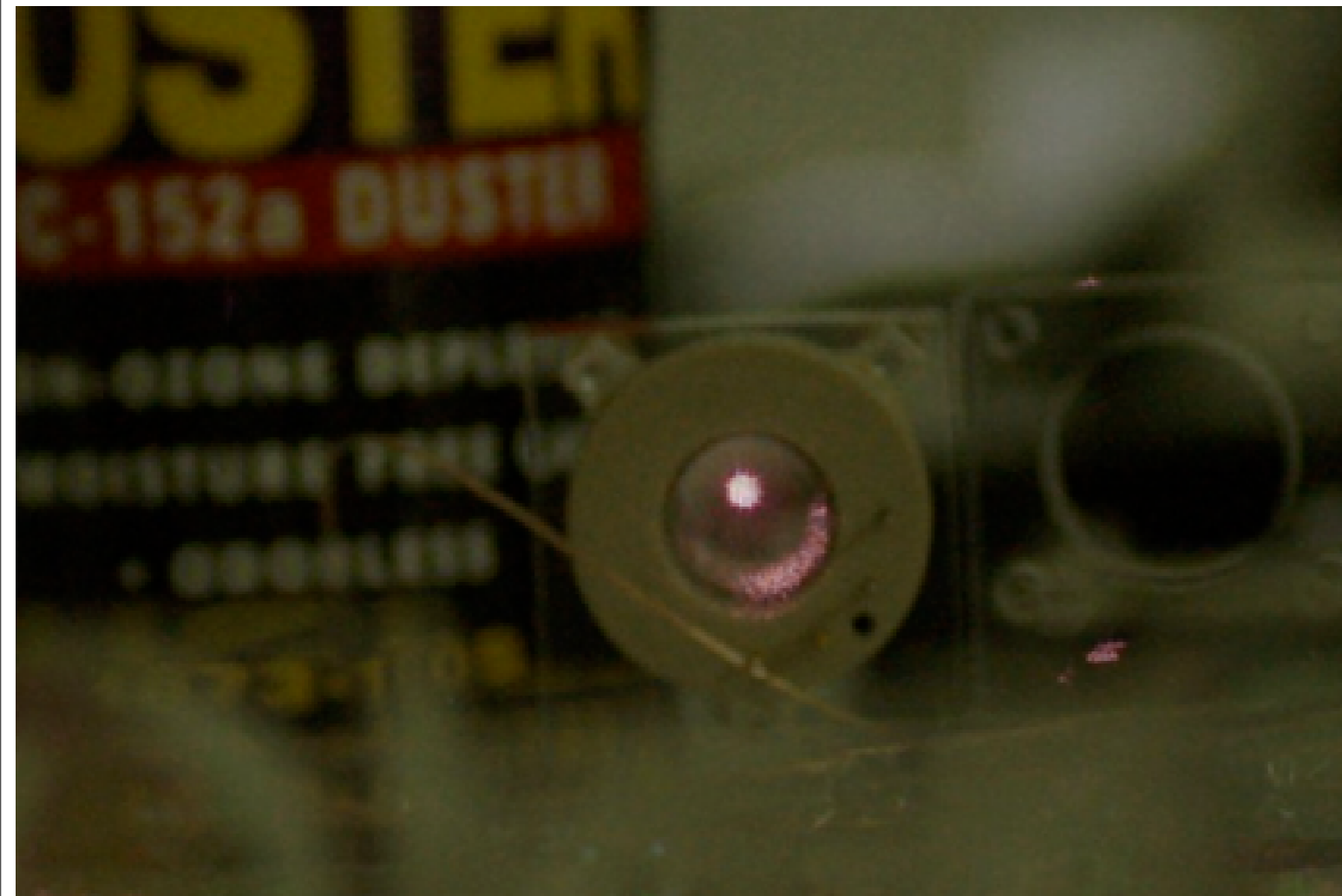
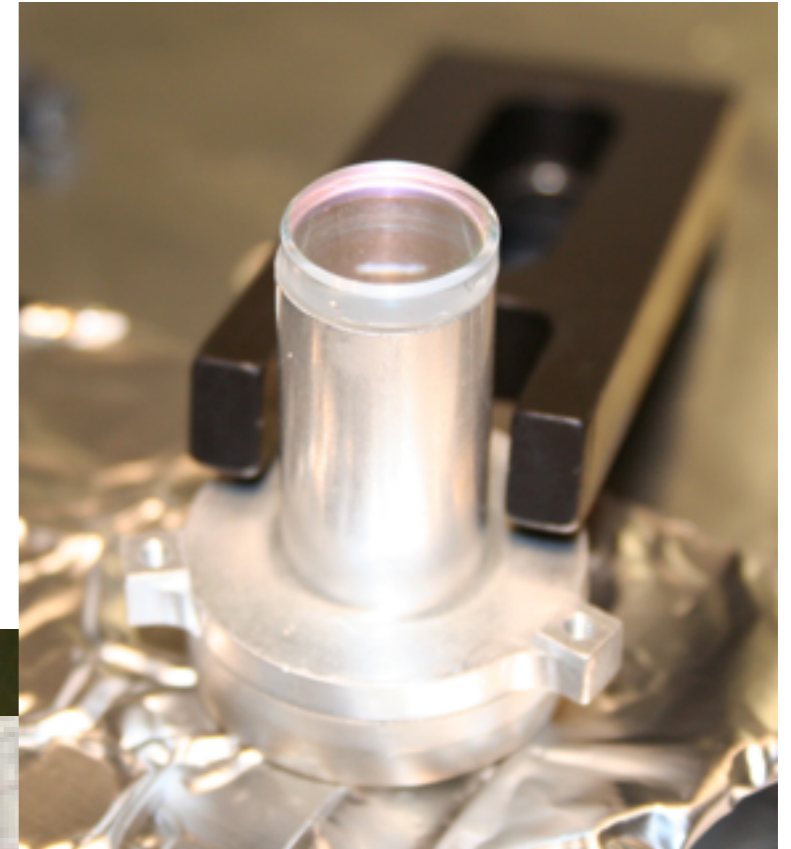


Improve cavity scattering, loss
Possibly reduce nullstream issues

Improve cavity scattering, loss
 Possibly reduce nullstream issues



Slow actuator, mechanical connection



- Baseline AFWFS
- Analog mod/demod and run front ends at 16 kHz
- Incorporate REFL on OMC
- Incorporate AFWFS on OMC?
- Improve Tip/Tilt isolation
- $1/f$ noise in DCPD tests
- Variable mode matching

- Adjustable g-factor
- Calculate angle noise based on Lisa's work
- Baffle DCPD diodes
- Stiffen OMC breadboard, tombstones
- Stick with $\omega \sim 500 \text{ um}$, $\phi_g / \pi \sim 1-1/4$
- Stick with low range PZT, high range HTR