Line-related Commissioning

and some upconversion observations

March 2010 LIGO-G1000286

Robert Schofield (University of Oregon)
Cheryl Vorvick (LHO)
Vladimir Dergachev (CIT)
Ian Simpson (ERAU)

LHO upconversion before and after test mass magnet swap and predicted PAM magnet forces

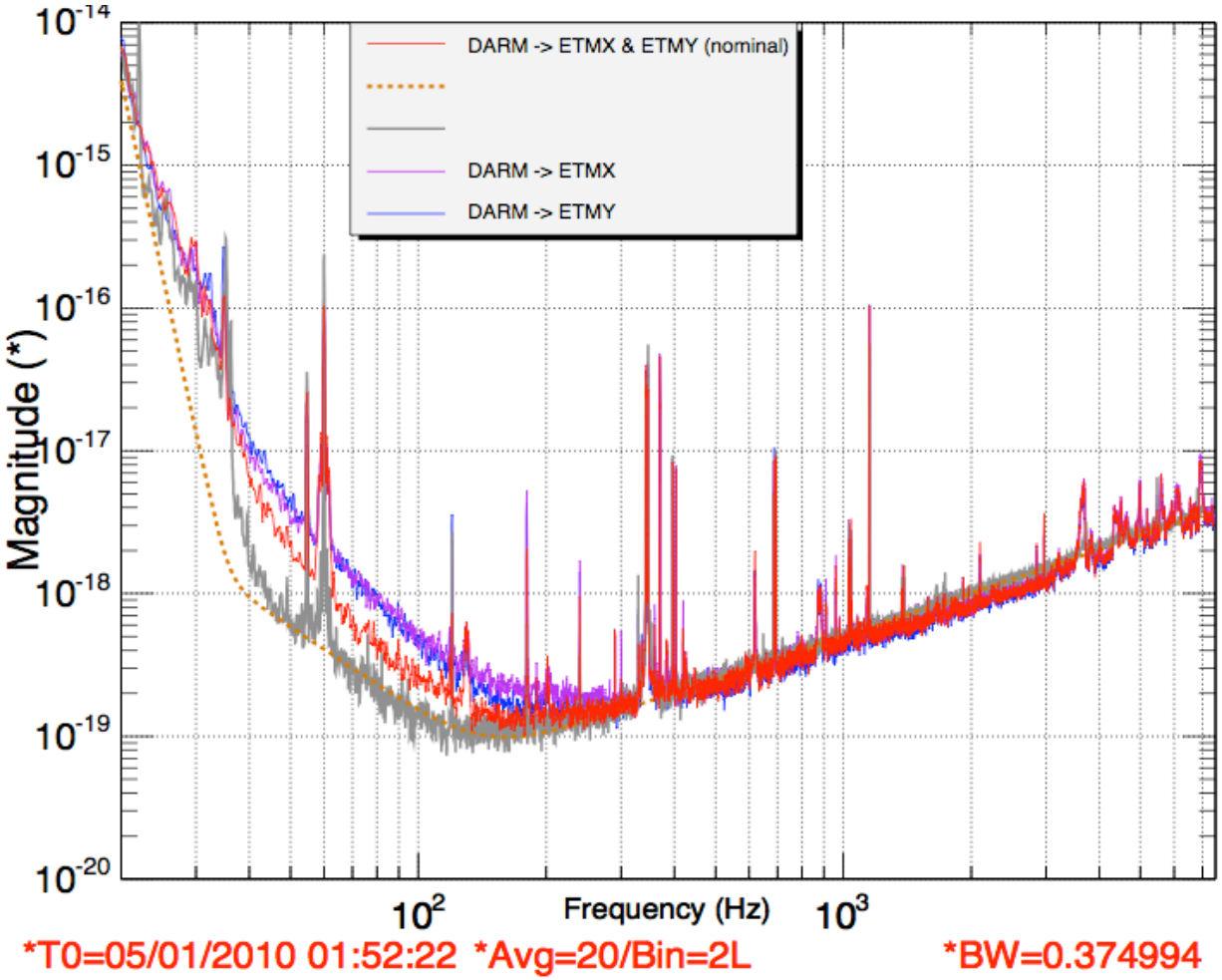
Test mass	Upconversion noise fit to A/f^4 pre-swap A		recent A	ratio	Predicted PAM magnet forces before	after	ratio
ETMX	3.8e-12	b	5.6e-12	1.48	12	8.2	0.7
ETMX		a	6.5e-12	1.72			
ETMY	1.2e-11	c	1.2e-11	1.01	14	8.4	0.6
ETMY		b	1.1e-11	0.90			
ETMY		a	1.3e-11	1.06			
ITMX	3.5e-12		6.2e-12	1.76	24	4.4	0.2
ITMY	7.1e-12		5.3e-12	0.74	49	26	0.5

To test upconversion from individual test masses, directed LSC control to each test mass using Rana's resonant gain technique.

Take home message: TM magnet swap didn't reduce upconversion and no evidence that switching PAM magnets would have helped.

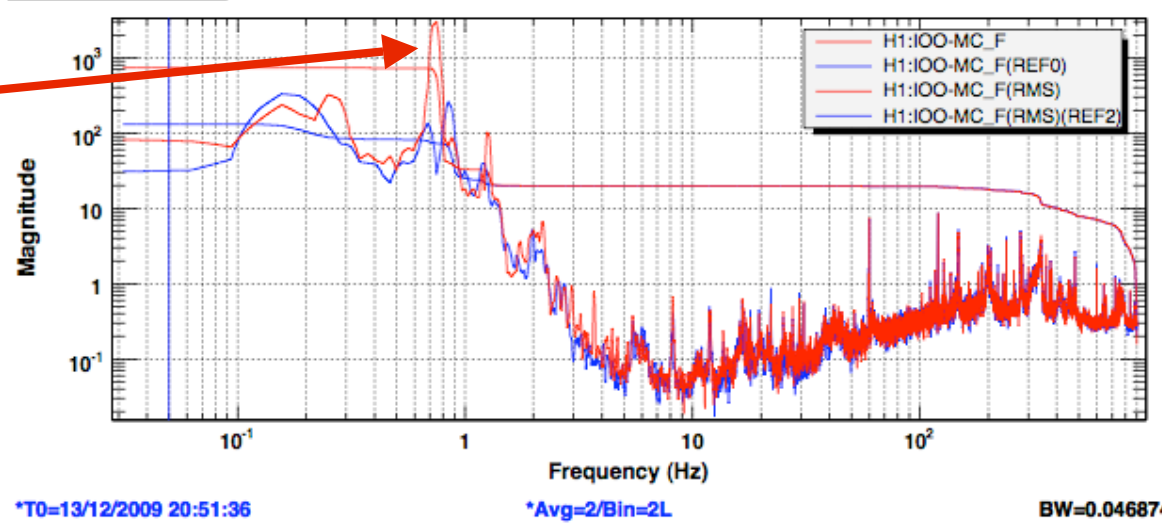
LLO RESULTS ALSO INDICATE THAT PAM MAGNETS DID NOT DOMINATE

At LLO, Test mass magnets were swapped on ETMY and ETMX and PAM magnets were swapped on ETMY. Post-swap upconversion same from each optic.

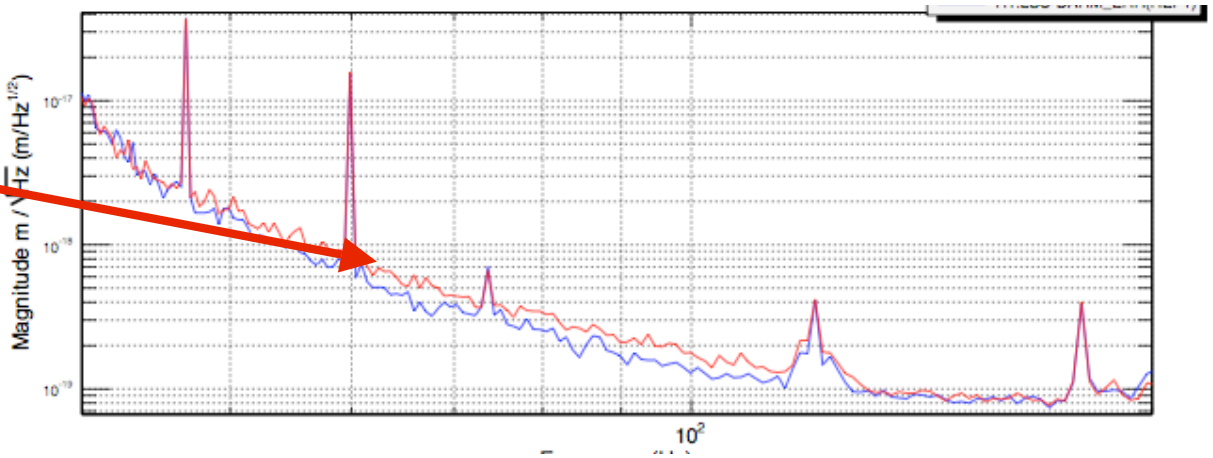


Upconversion goes with coil current not test mass motion

100 fold increase in common mode motion of test masses

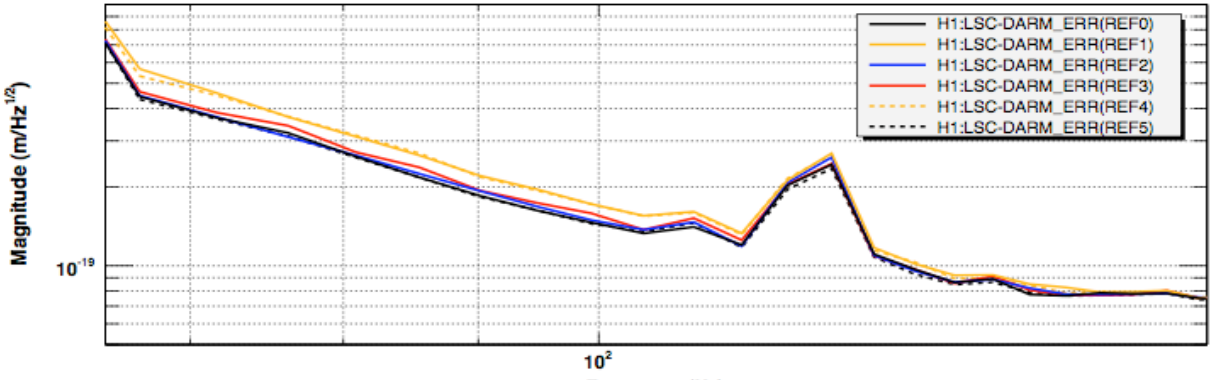


Leads to small increase in upconversion predicted from small increase in coil current due to angular damping

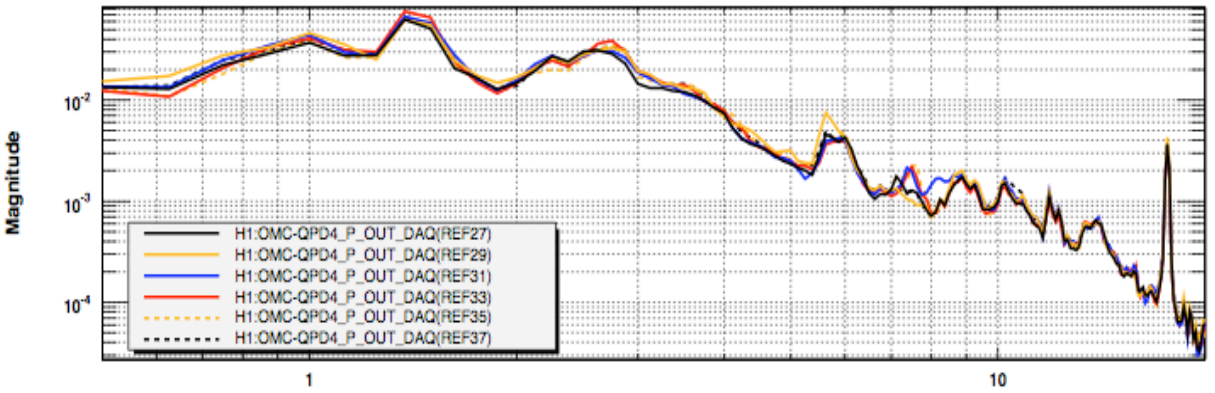


Upconversion goes with coil current not beam jitter

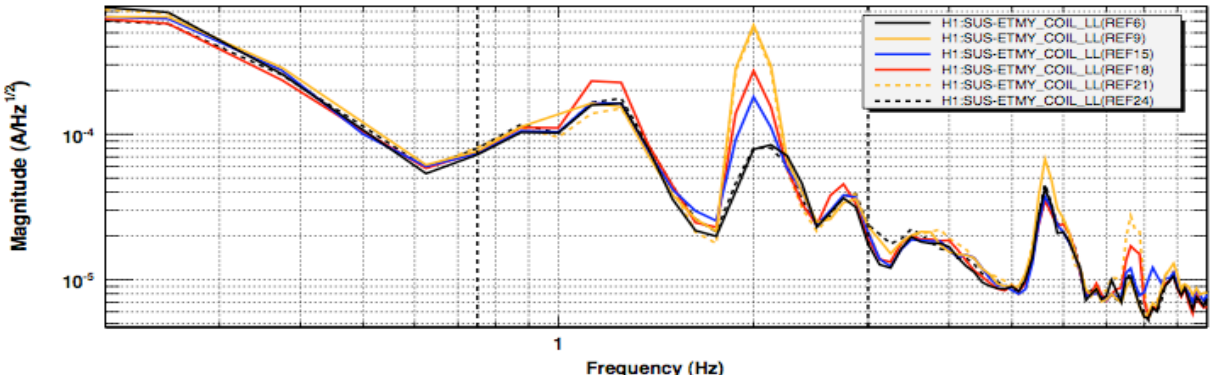
DARM upconversion region



Low f beam jitter from OMC quad diodes (pitch)



Low f coil current

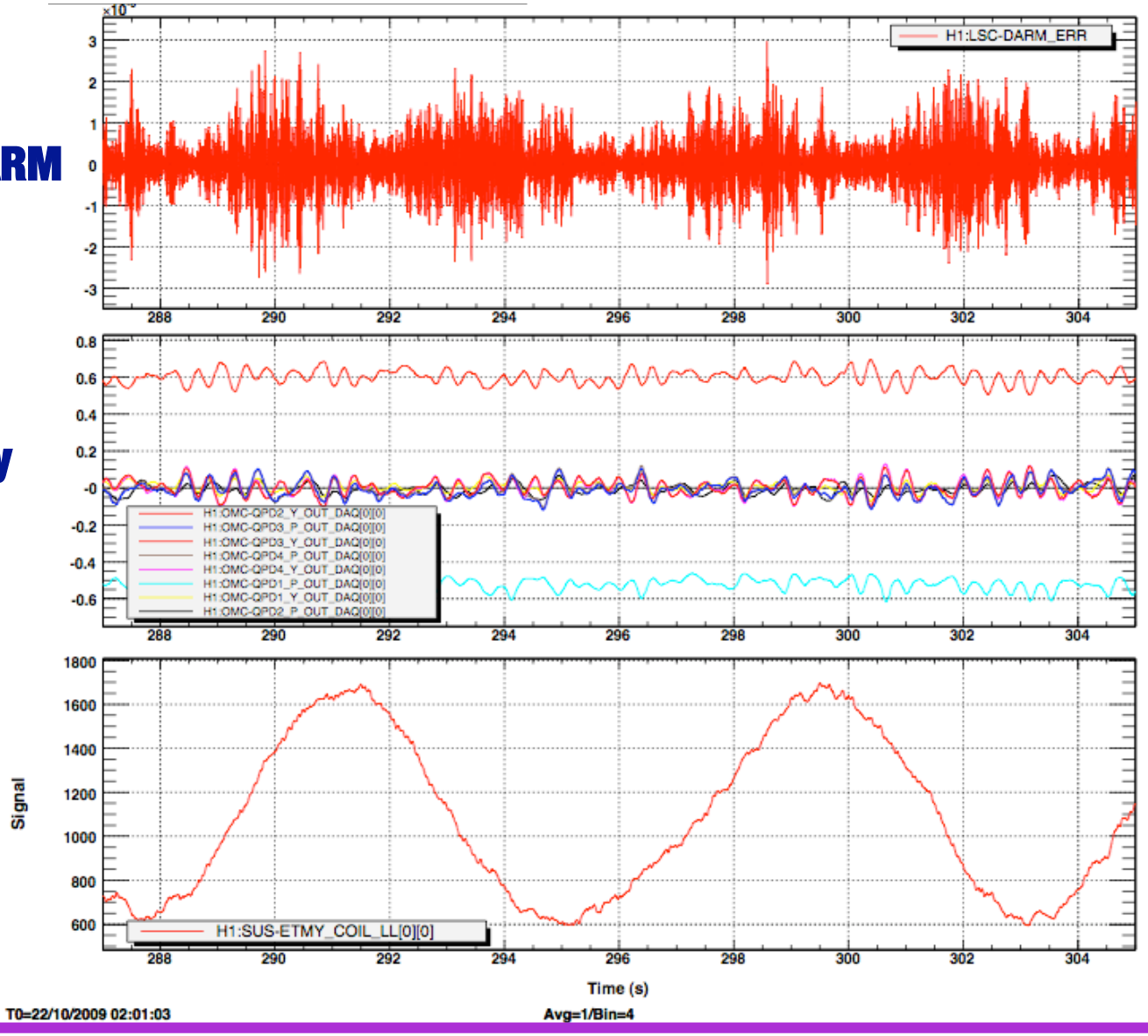


Upconversion bursts go with coil current not beam jitter

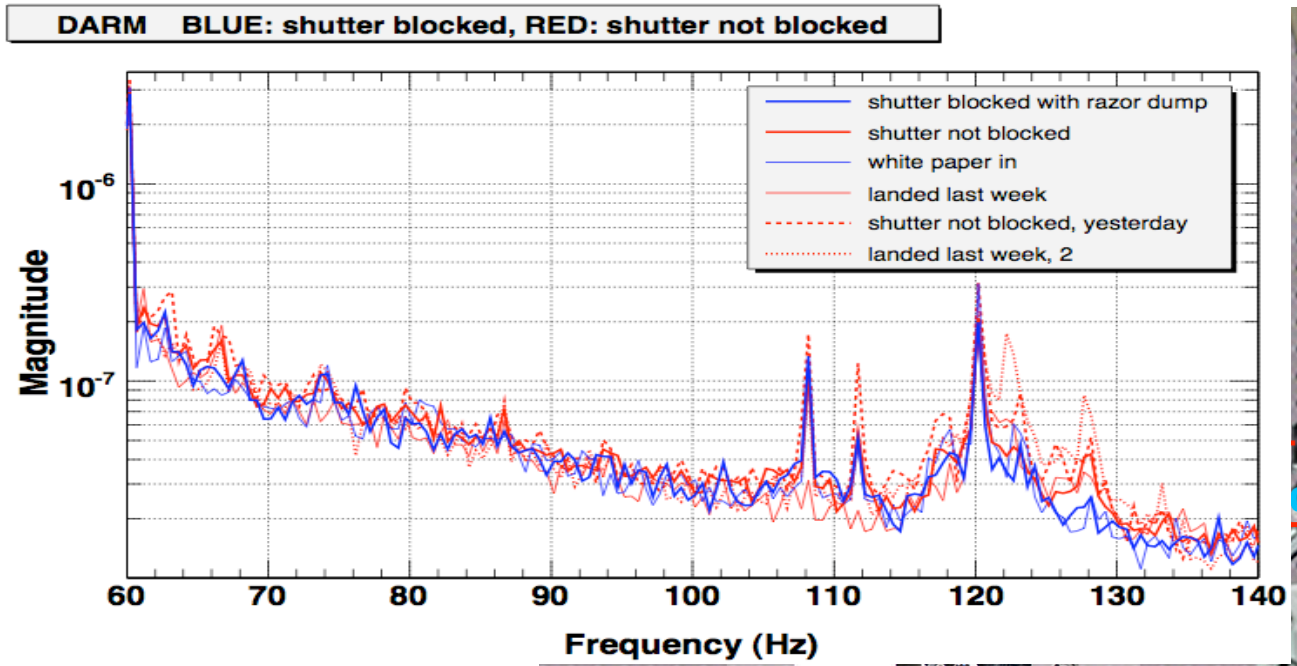
70 - 110 band of DARM

Beam jitter as seen by OMC quad diodes

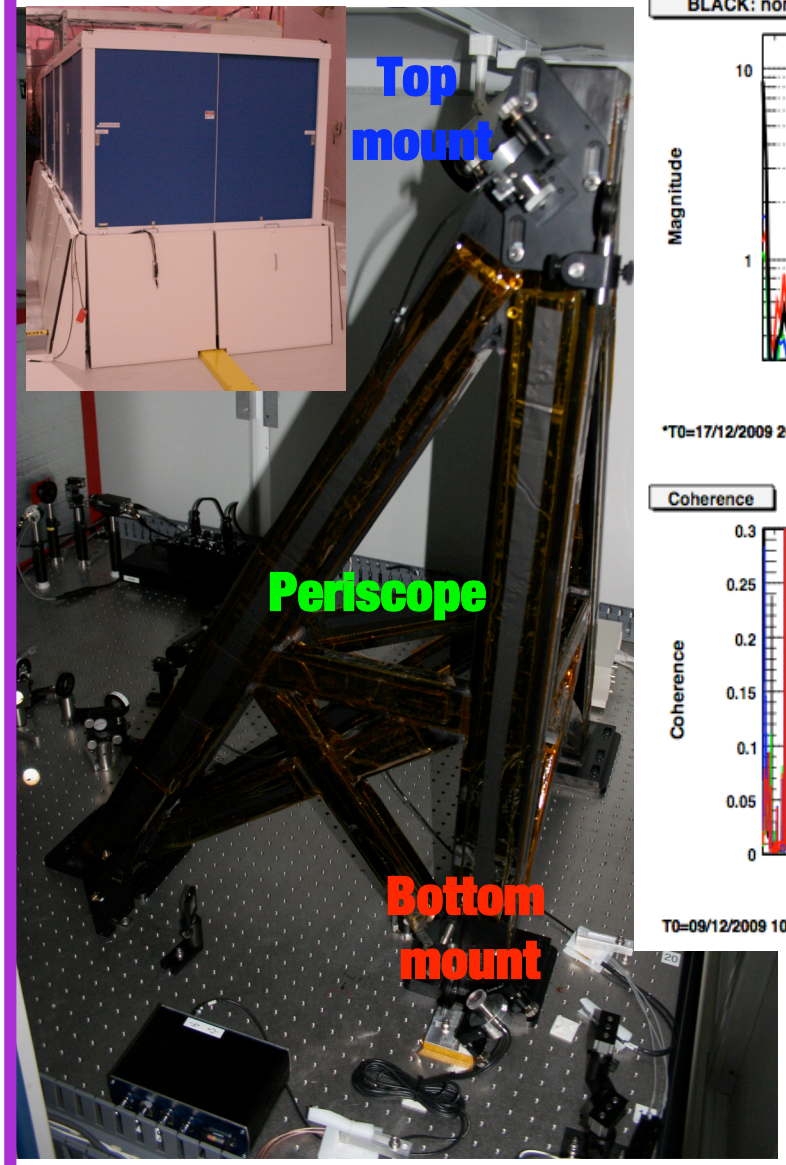
Actuation coil current

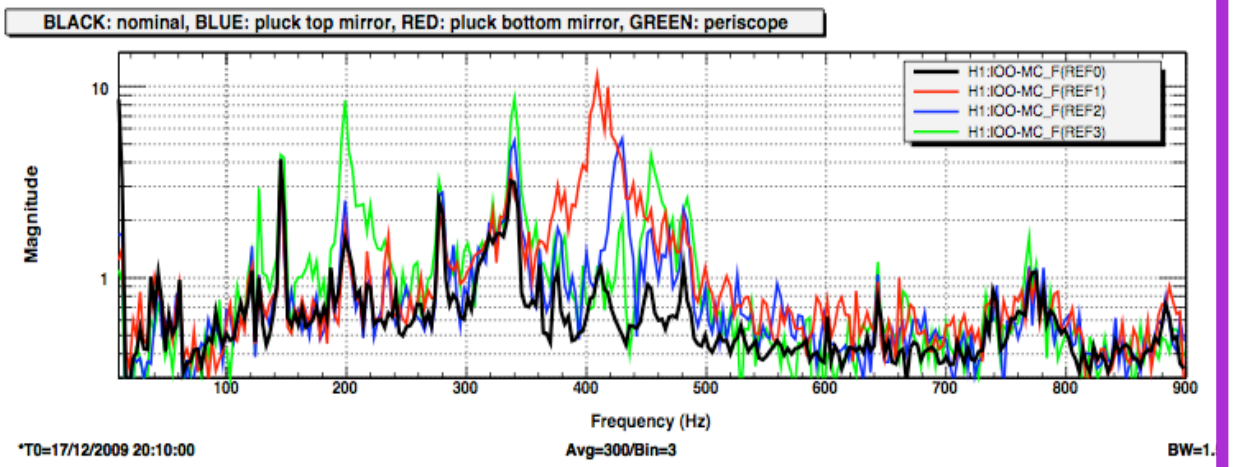


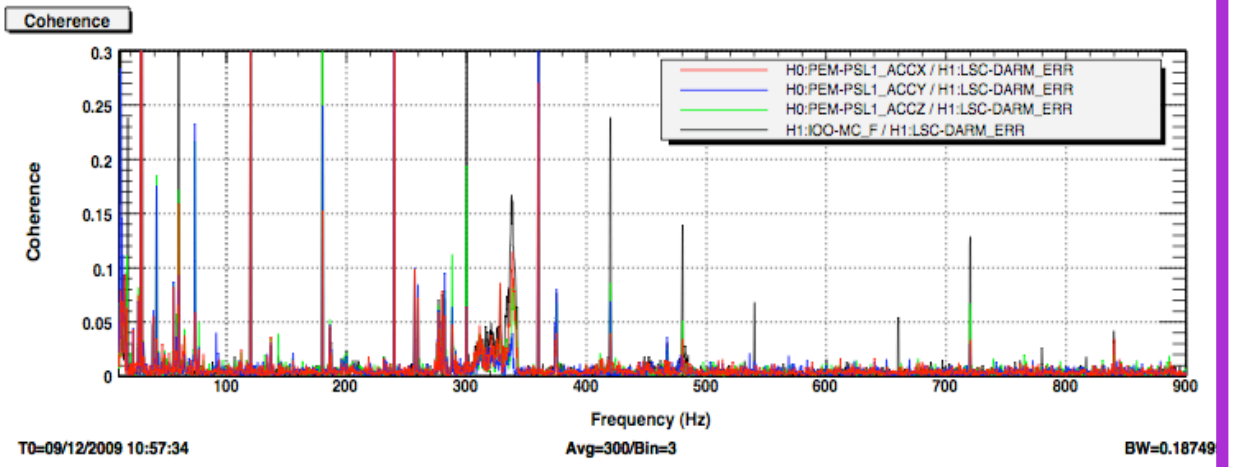
Backscatter from unused S5 shutter makes DARM peaks



PSL PERISCOPE PEAKS IN DARM







Periscope body: 200, 340, 450 Hz

Bottom mirror mount: 410-420 Hz

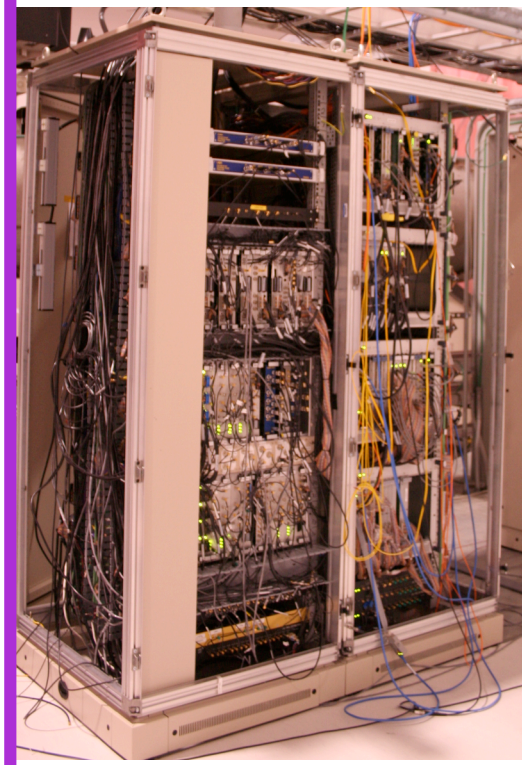
Top mirror mount: 420-430 Hz

340 NOT FIXED YET

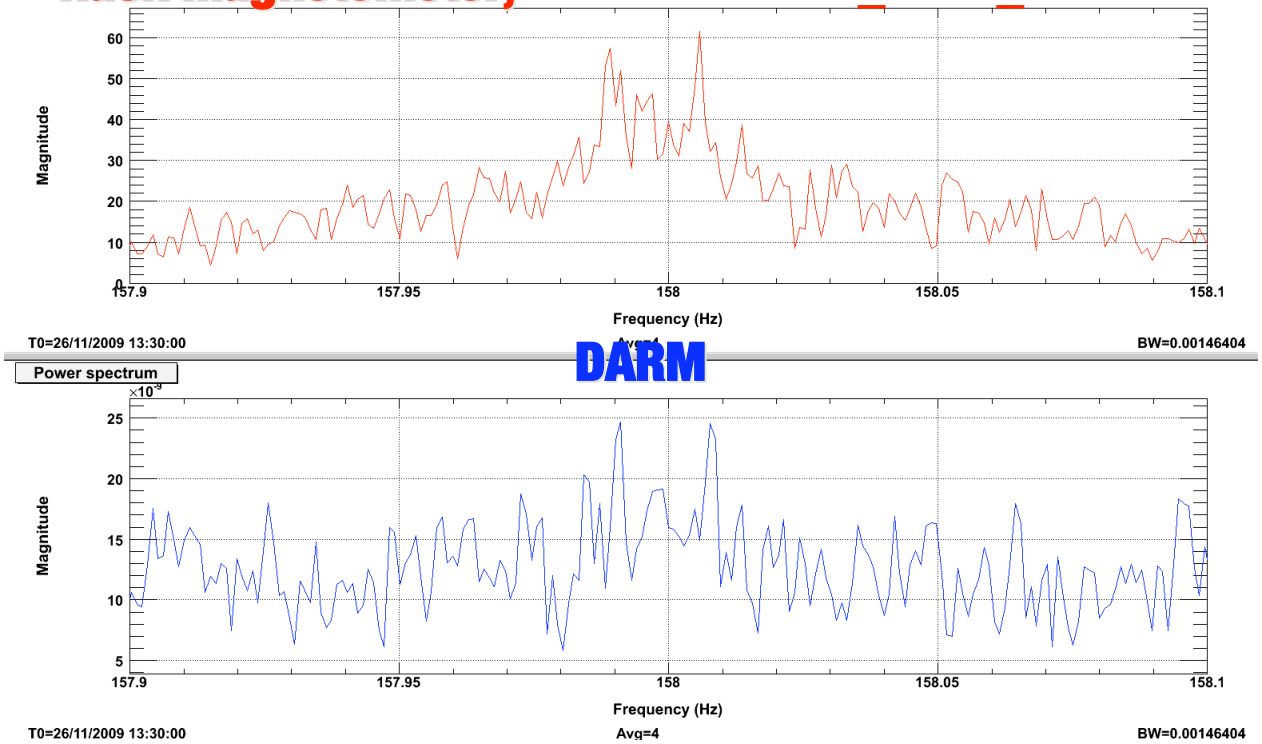
Search for DARM 158 Hz Peak

Ian Simpson, Vladimir Dergachev, Robert Schofield

Ian finds that peak in DARM follows peak in EY rack magnetometer

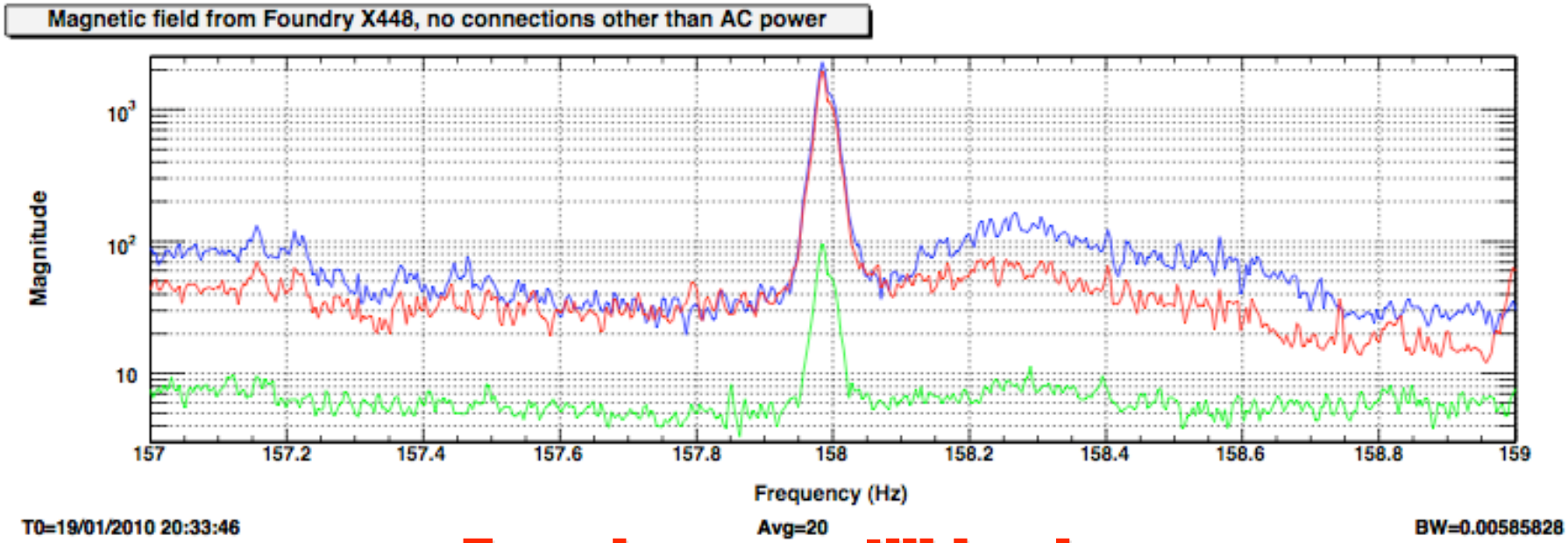


Rack magnetometer, H0:PEM-RACK_1Y22_MAGZ



Using a mobile magnetometer, Vladimir and I found that the 158 Hz peak was strongest by the Foundry ethernet switch

158 Hz Peak from isolated Foundry ethernet switch



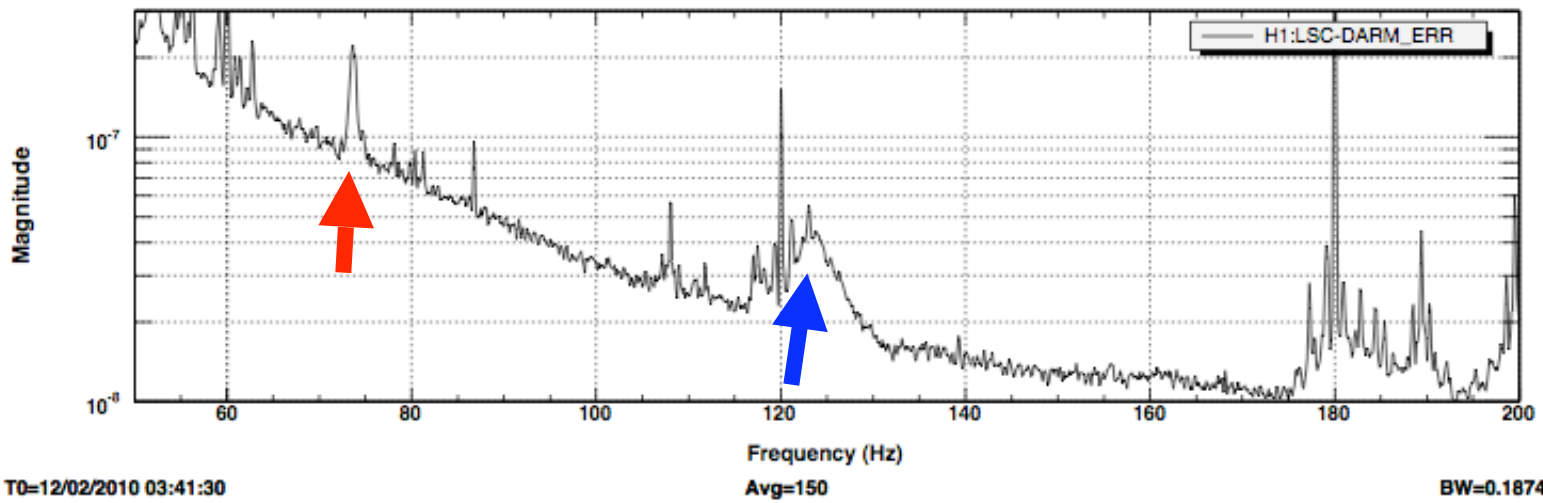
Foundrys are still in place

Lines found in power supply ripple

Frequency	Power supply	Coherence with DARM
140.24	DC +147	0.2
199.57	DC -15	0.15
205.00	lscl0 +5, -12	0.7
210.36	lscl0 +5, +12, -12	0.3
222.00	lscl0 -12	0.5
566.08	lscl0 +5	0.2
568.00	lscl0 +5 -12	0.15
568.04	lscl0 +5	0.15
568.085	lscl0 +5, -12	0.4

At 20W, broad peaks contaminated spectrum when TCS was on

Work by Cheryl Vorvick, Robert Schofield

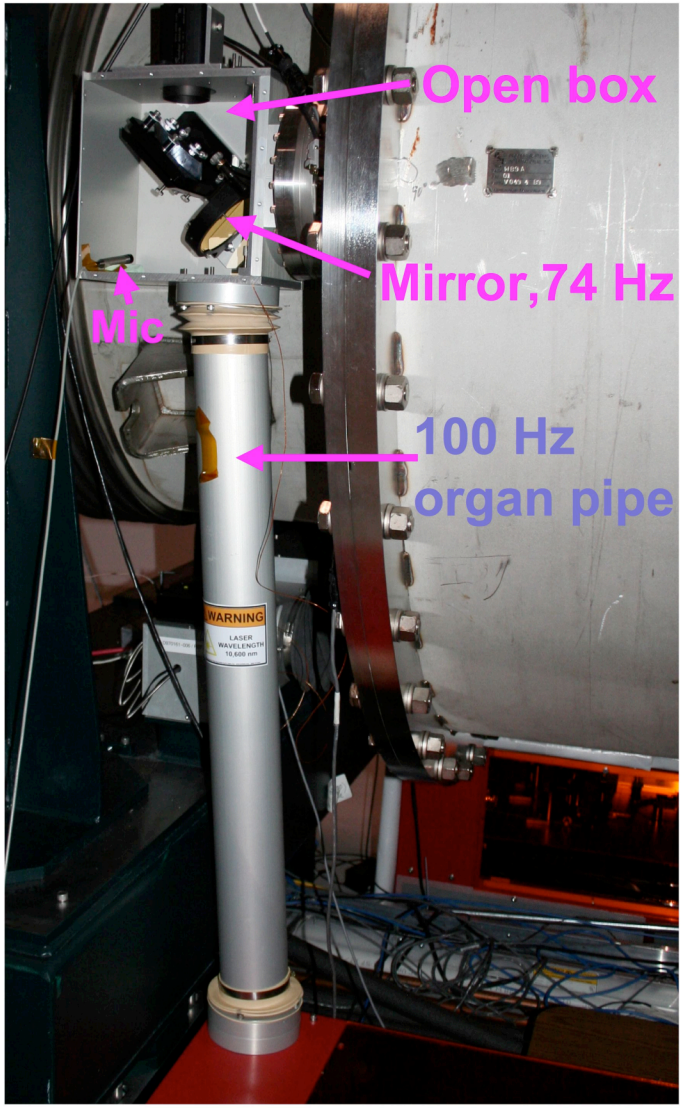


Tracked with accelerometer to TCS periscope mirrors,

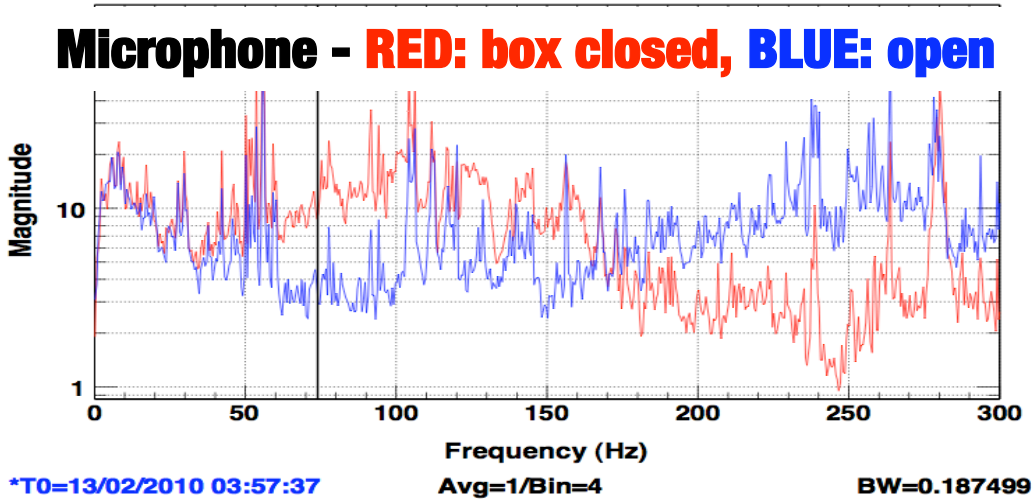
= top

= bottom

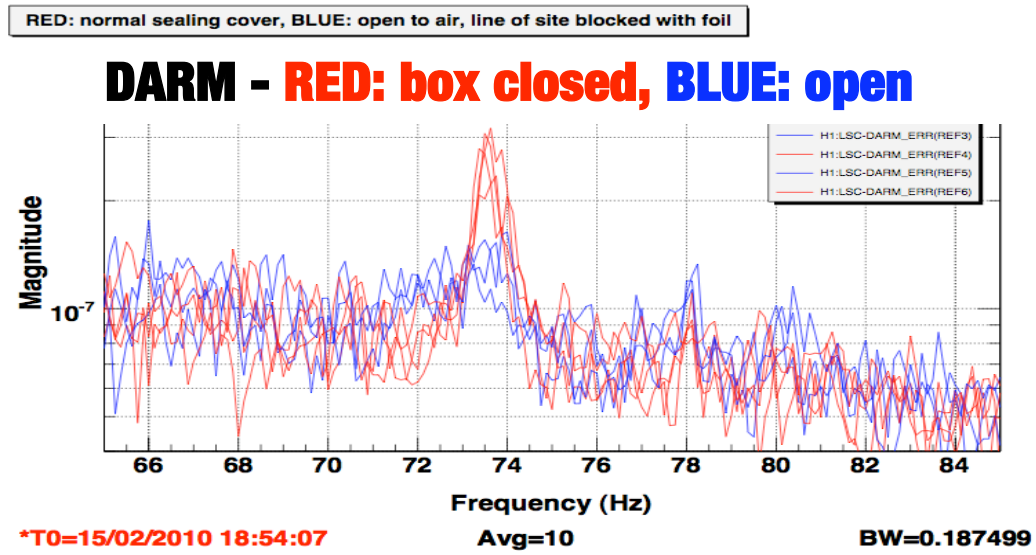
74 Hz peak driven by organ pipe resonance



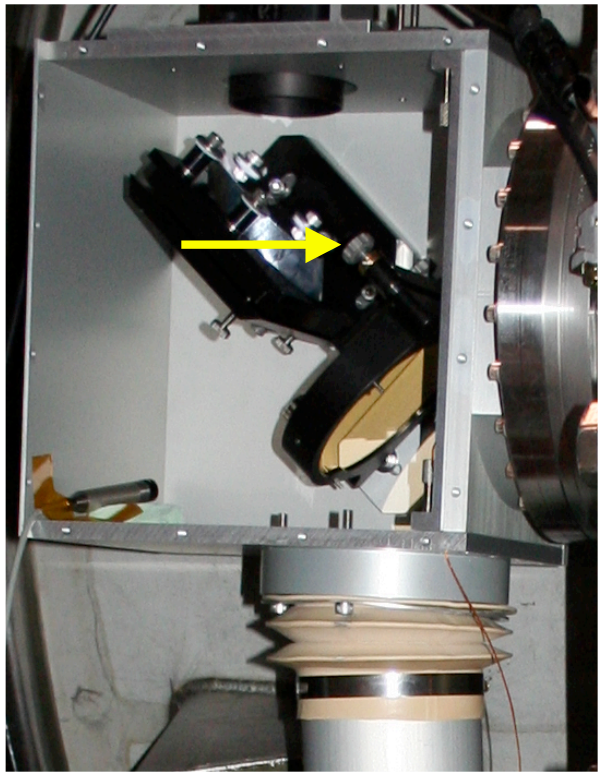
RED: normal sealing cover, BLUE: open, BLACK line at location of peak

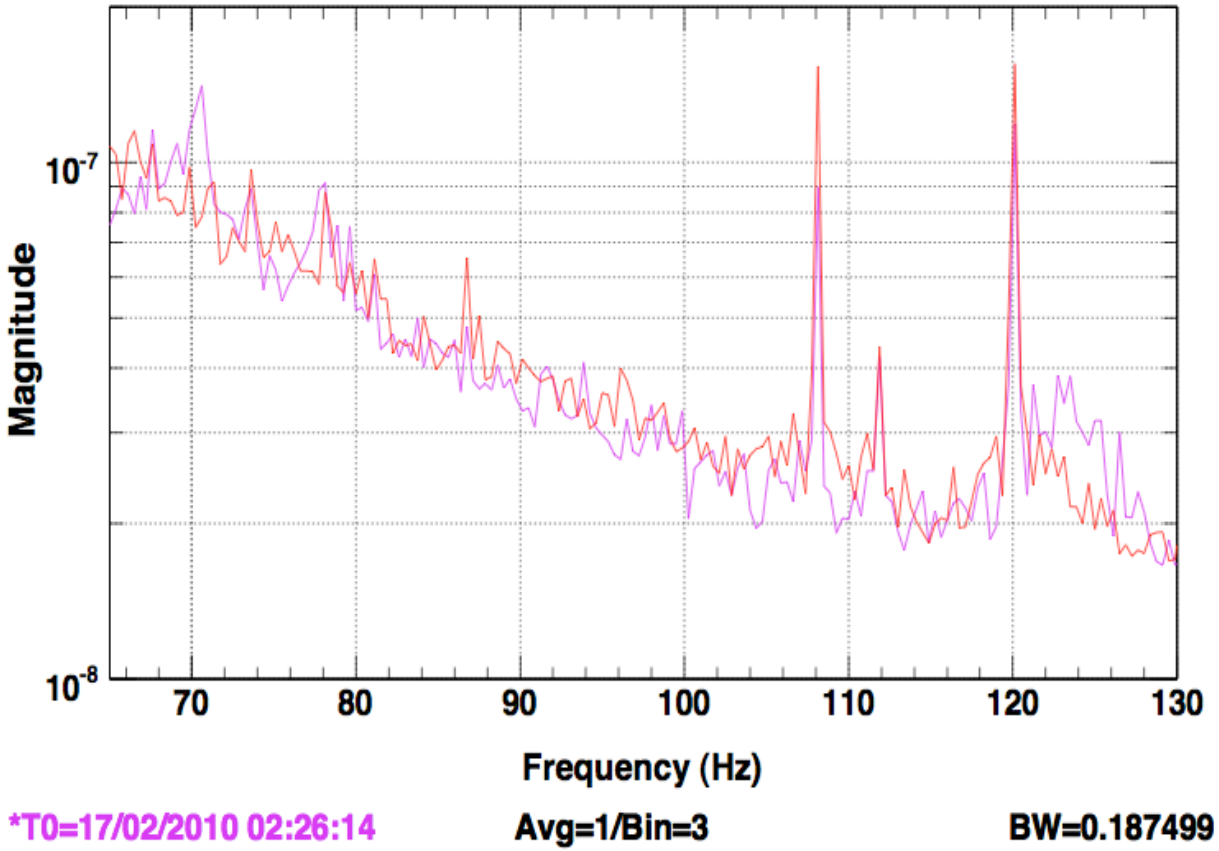


RED: normal sealing cover, BLUE: open to air, line of site blocked with foil



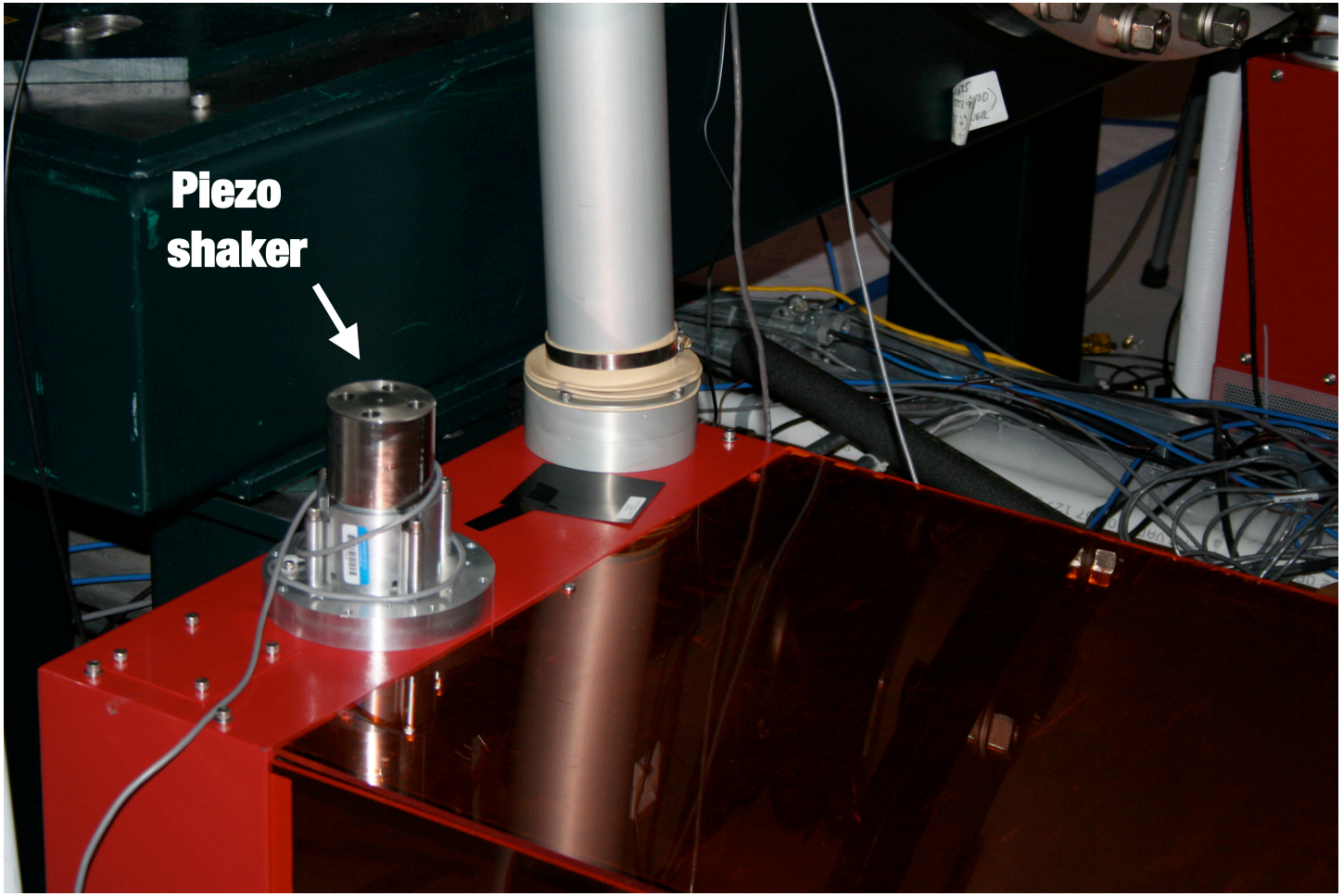
Might get bigger improvement by reducing coupling





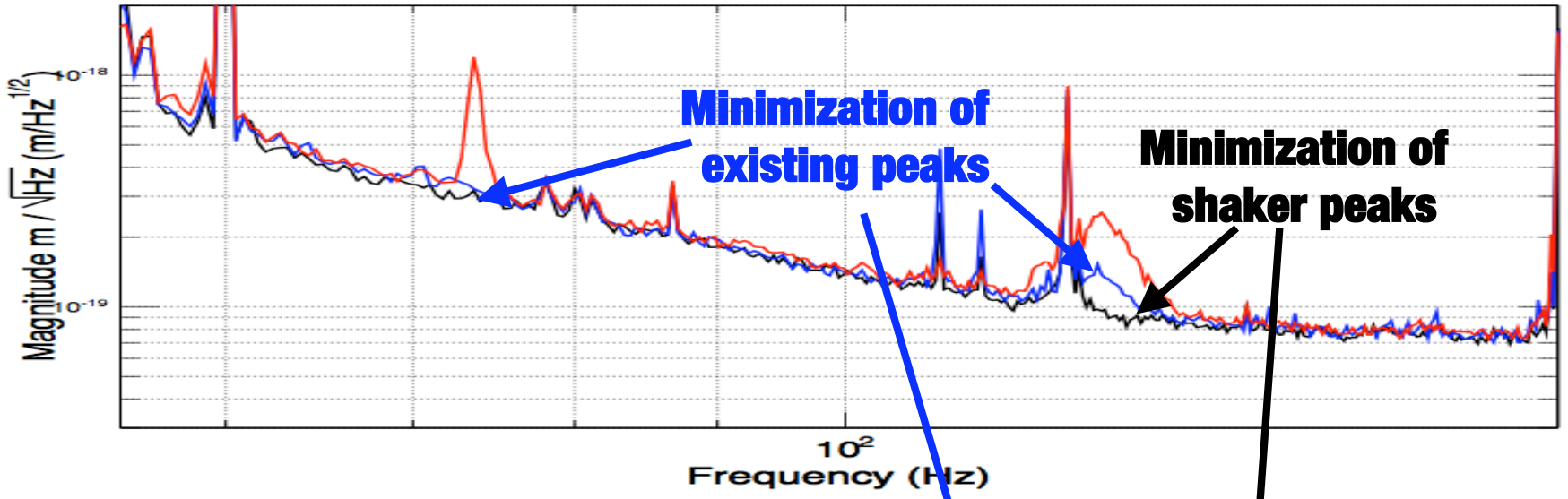
Difference between red and blue is 20 degrees on mirror knob

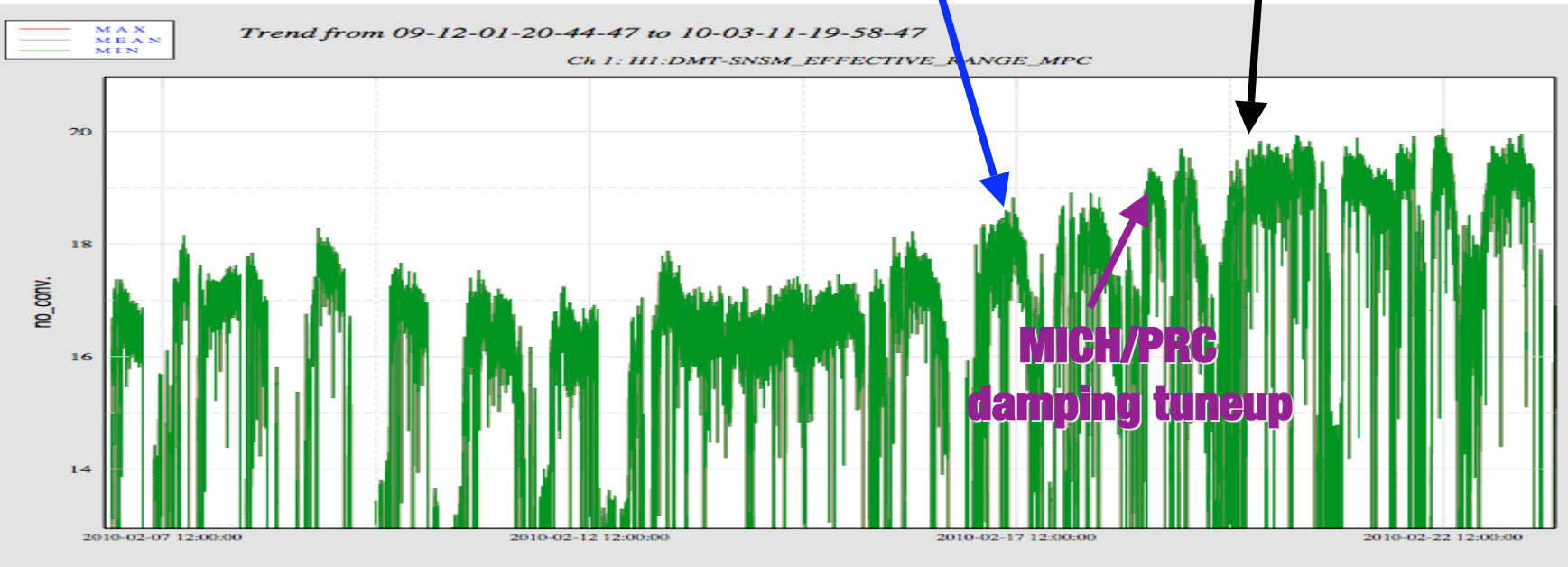
Shaking to produce larger peaks for minimization



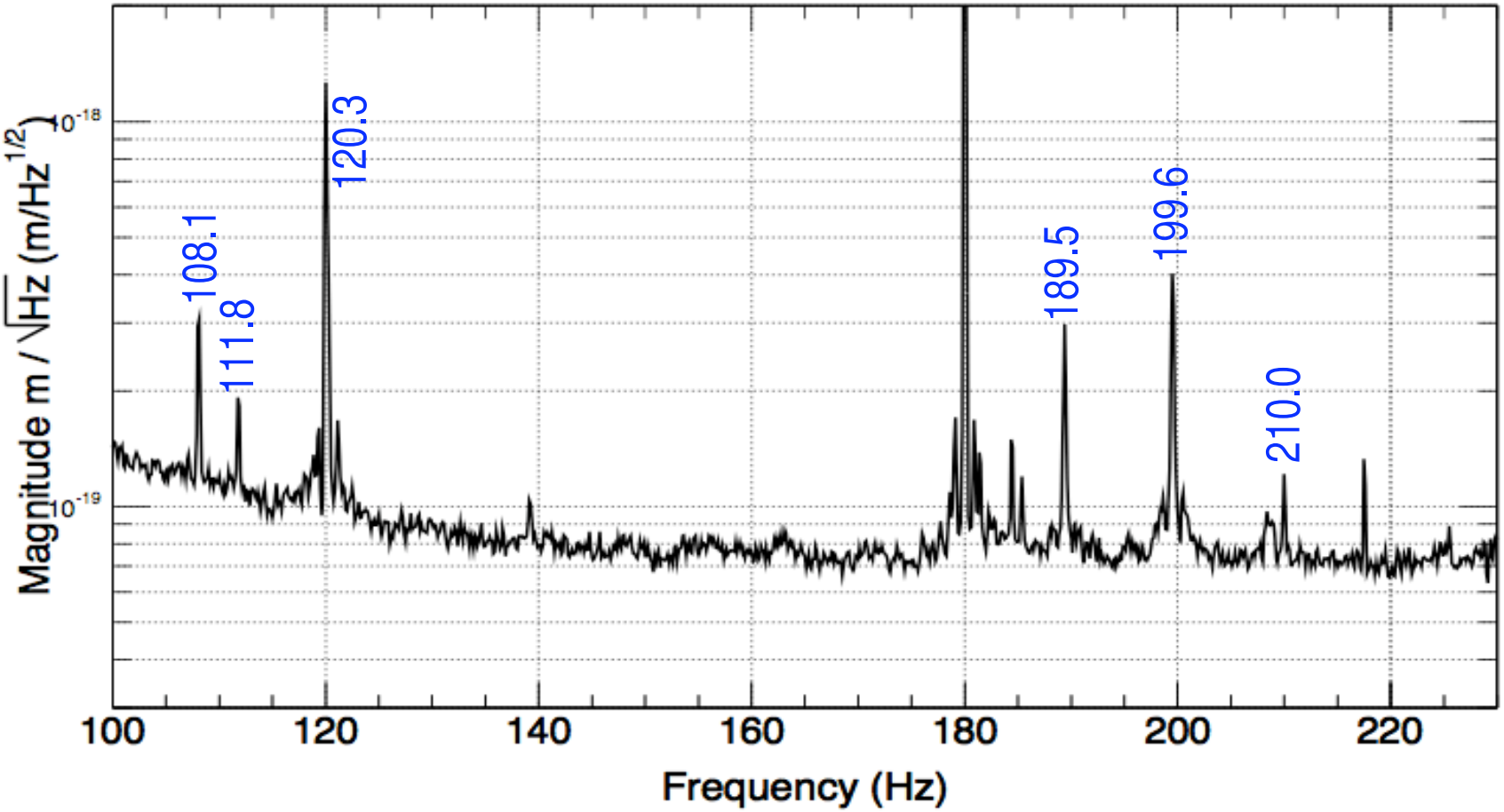
Resulting Improvement

(made possible by the 20W crew, Matt, Lisa, Nic)





UNIDENTIFIED: JITTER PEAKS



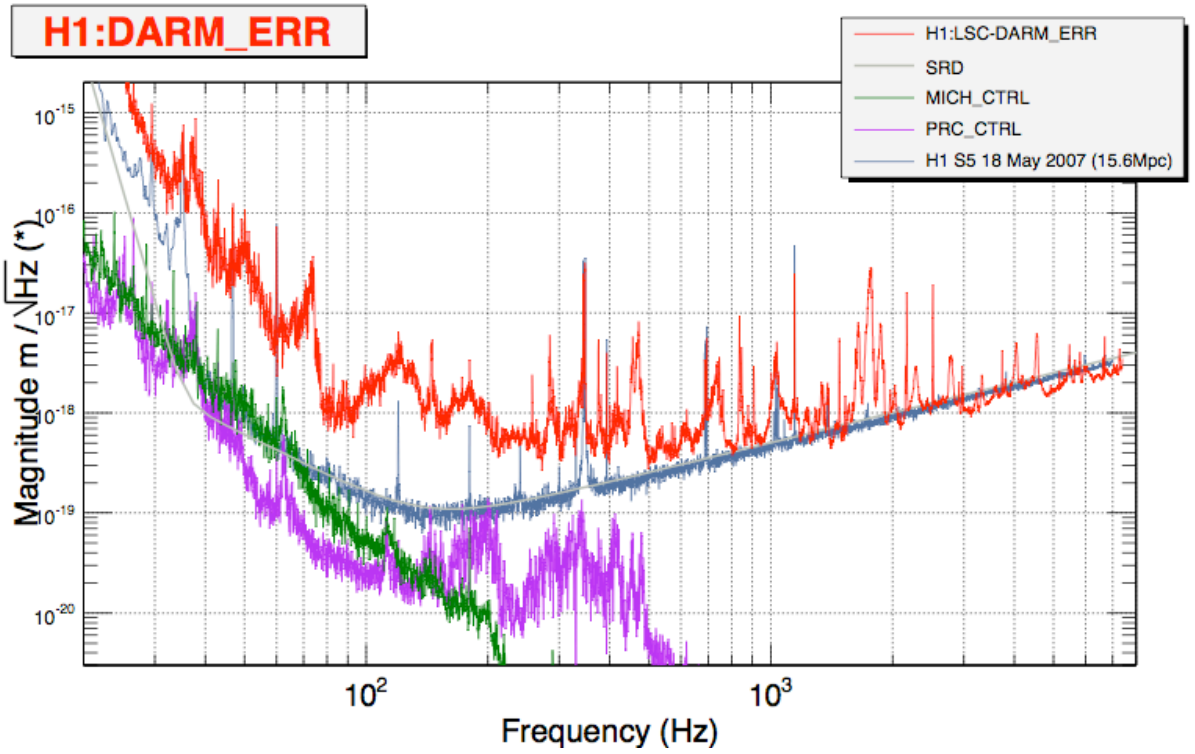
T0=20/02/2010 08:45:54 Avg=200 BW=0.187493

Very non-stationary:

probably should be notched from burst search

Jitter peaks not excited vibrationally in LVEA or EY

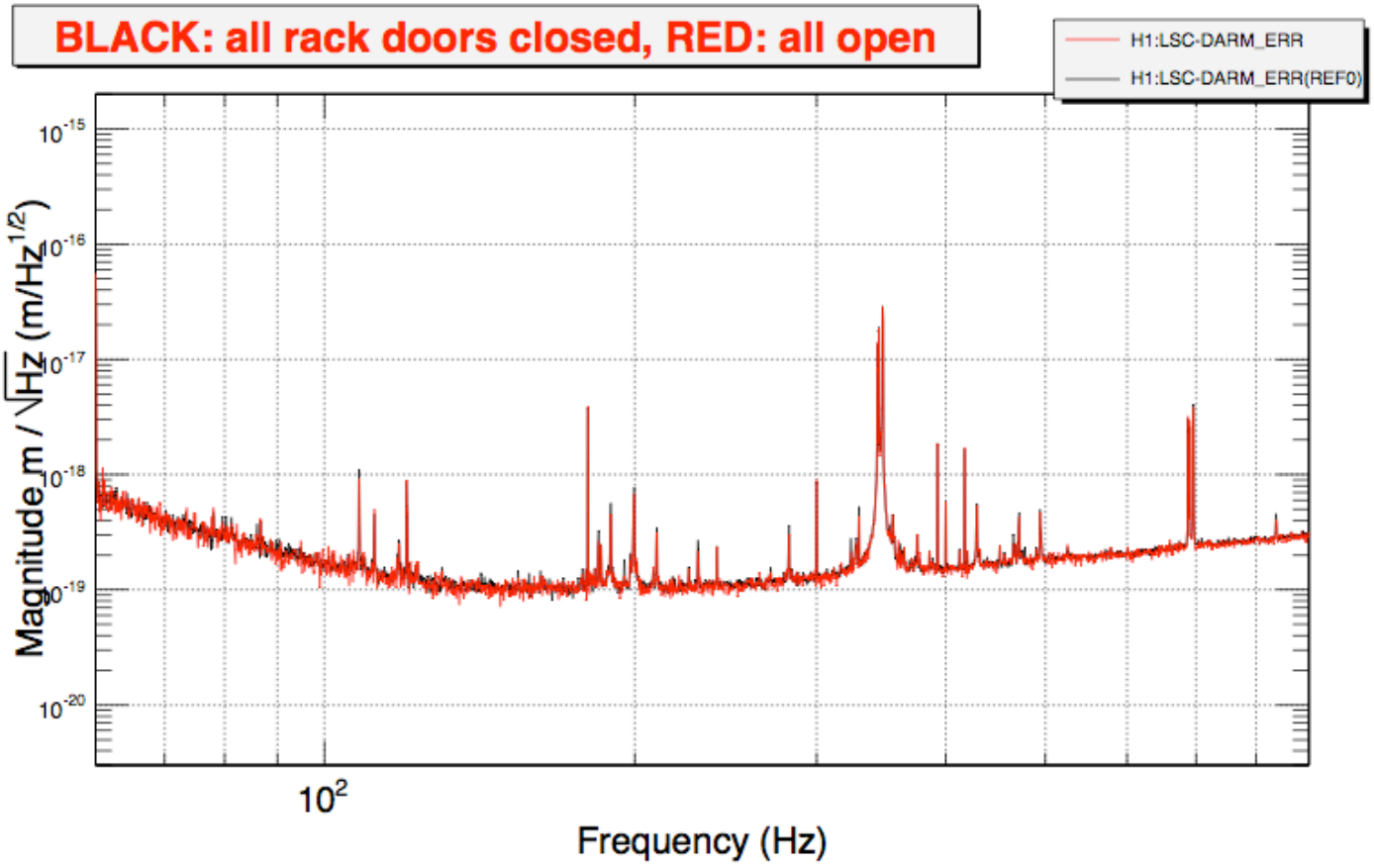
LVEA acoustic injections do not excite jitter peaks

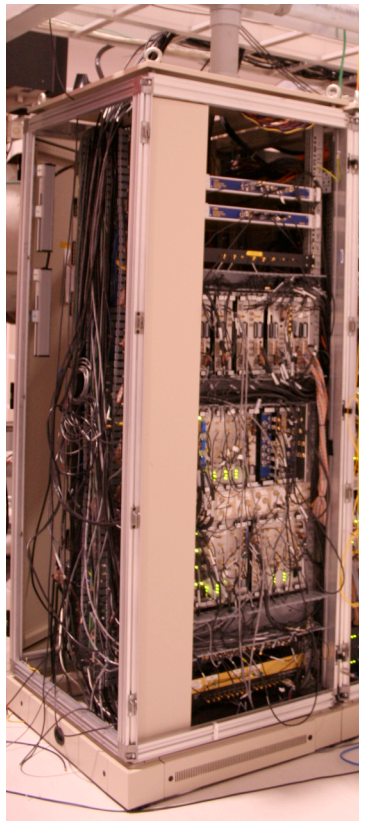


Nor does tapping on every optics table

Next steps: excite HAM6 using ISI, vibrate EX

Not temperature sensitive
(unlike S5, rack doors can be closed)

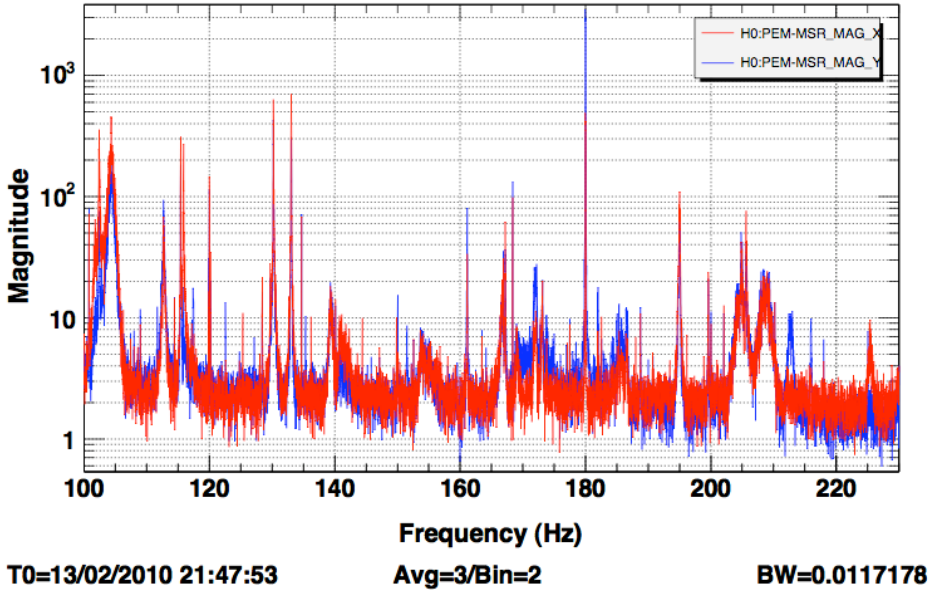




Rack with doors and sides removed for S5

Not found in magnetometer searches

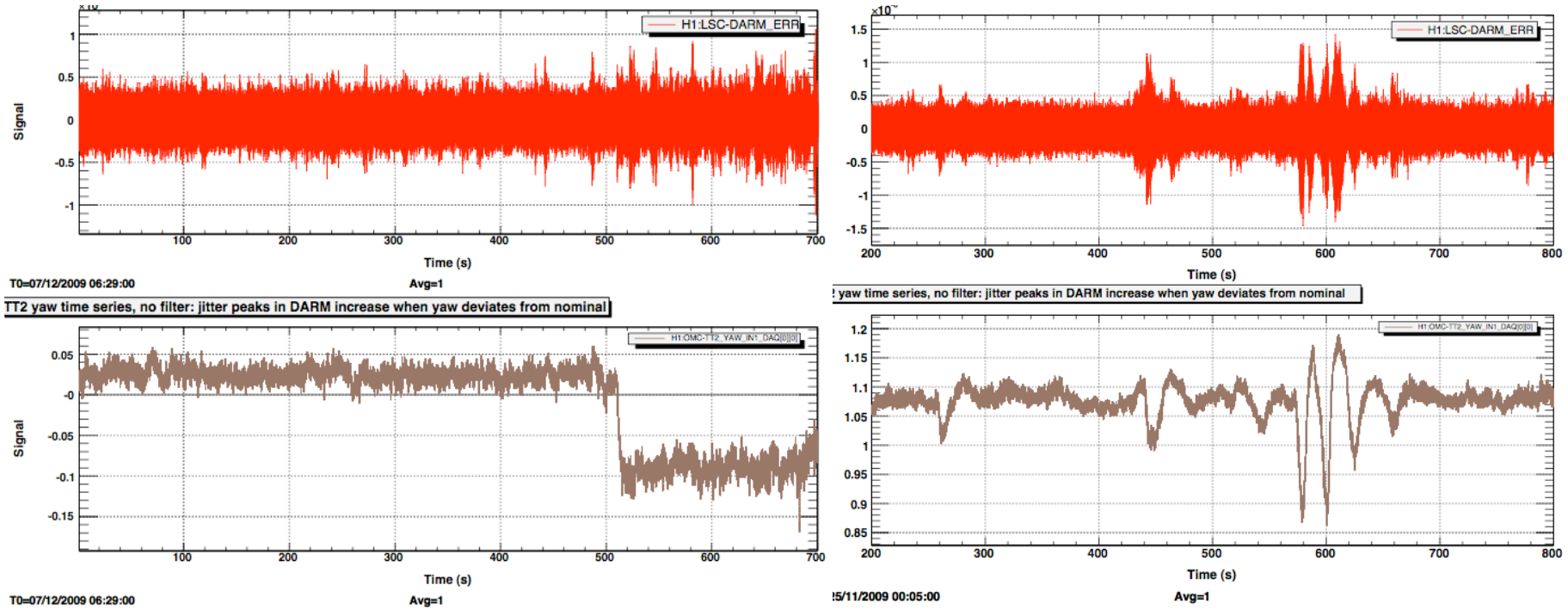
Magnetometer searches at 121 separately recorded locations



Location photograph and magnetic spectrum

Variations in stationarity with Tip-Tilt 2 Yaw

DARM time series 185-230 Hz band



TT2 Yaw raw time series

Low frequency drift seems to have gone away after reseating shadow sensor cables

Summary

1) We are still looking for the dominant source of upconversion. The source must be Barkhausen - like but not the TM or PAM magnets (e.g. Barkhausen from suspension wires).

2) Source of 158 Hz (Foundry switch), and 340 Hz (PSL periscope) lines found.

3) 9 lines, coherent with DARM, found in power supply ripple.

4) Broad, range-reducing lines from shutter backscatter and from thermal compensation system (driven by organ pipe) eliminated.

5) New shaker-based TCS alignment technique developed.

6) Doors to electronics cabinets can be closed.

7) Source of jitter lines not yet found. Notch these lines from burst and glitch searches?