aLIGO HAM-ISI, LHO Unit #1, Testing Validation

LIGO-G1000721-v1

July 23, 2010

SEI Team

Goals:

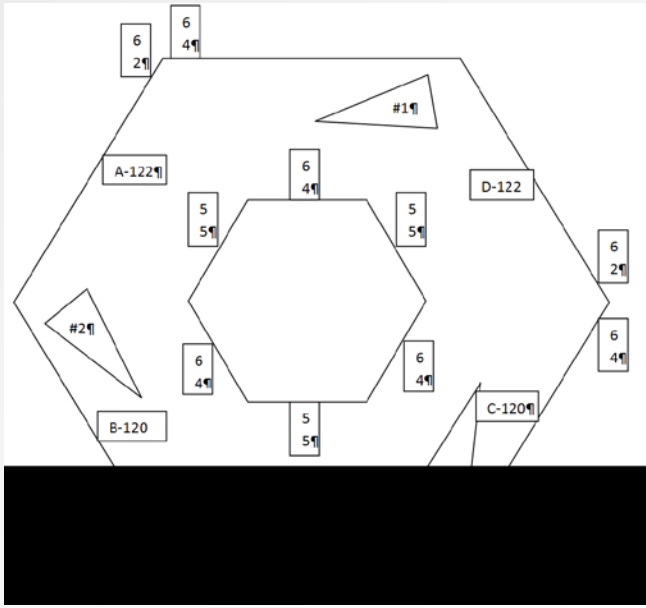
Review the progress done since the testing presentation (G1000692)
Validate the first assembly

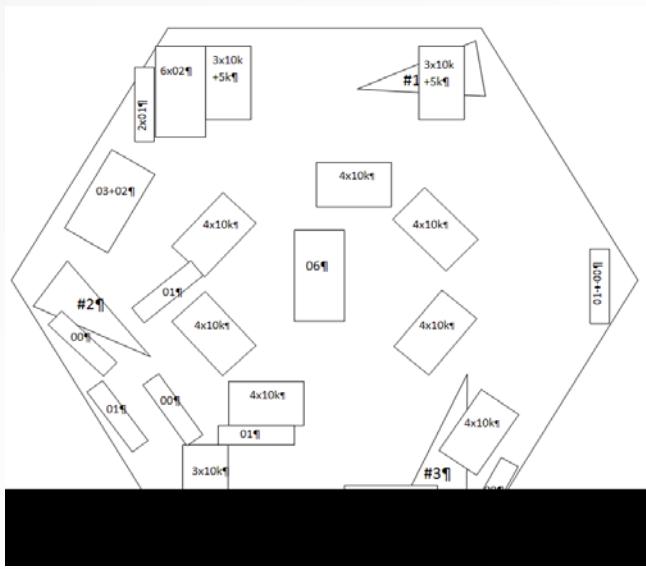
GS13 and actuators pre testing:

Data related to GS-13 post podding.
Actuator data sheet: T0900564-v2.

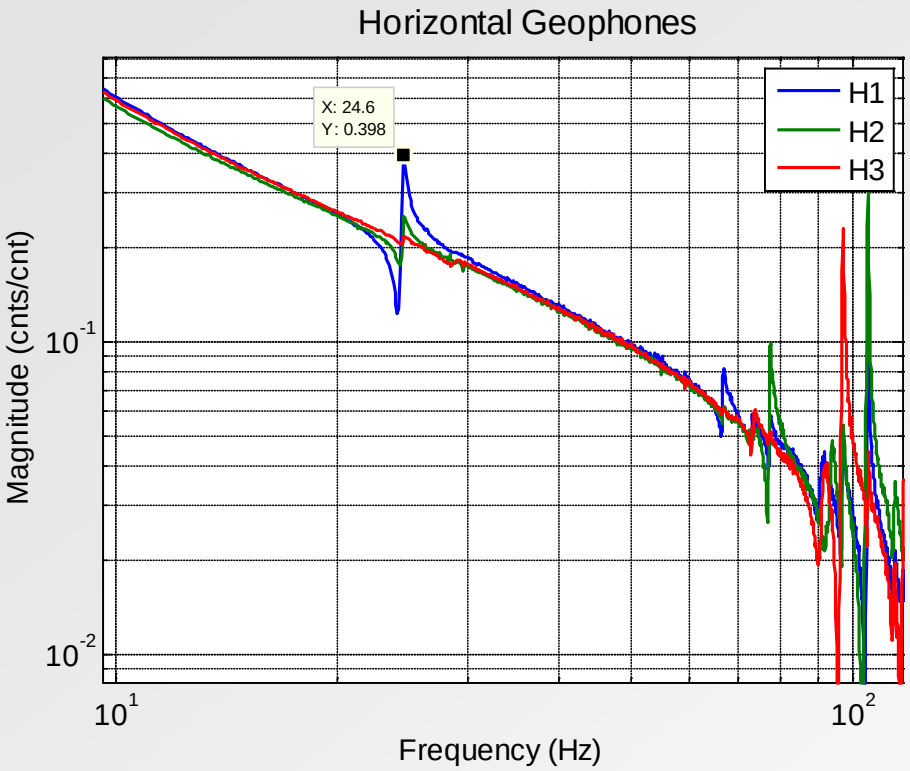
Detailed Mass Budget: has been included in T1000329.

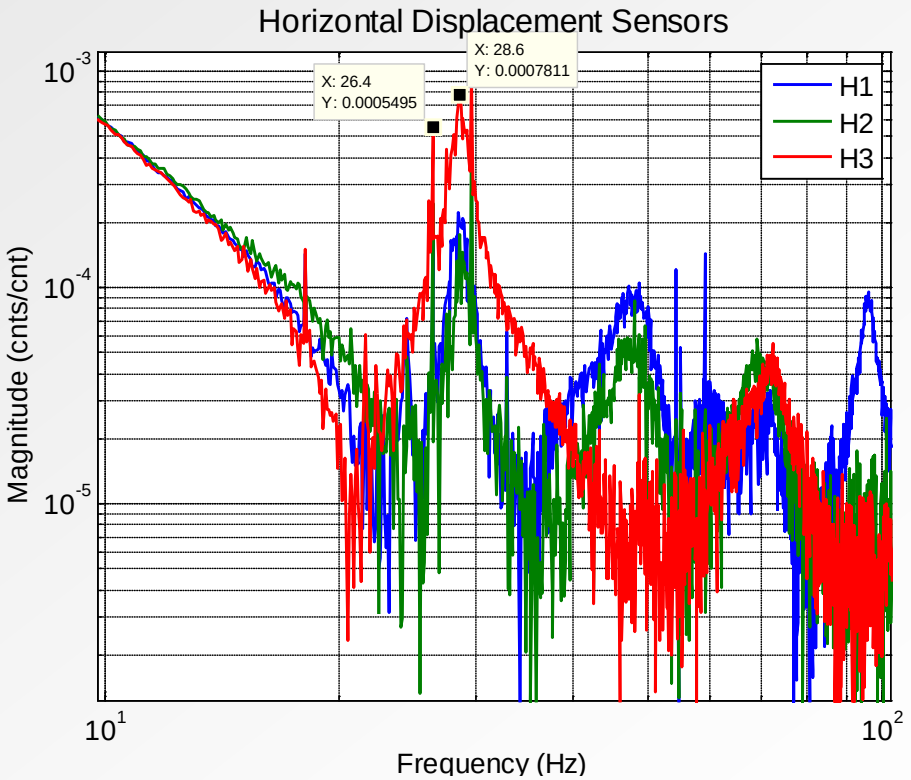
Part #	Type	Mass Kg	Keel #	Walls #	Optical #	Keel Mass	Wall Mass	Optical Mass	
D071200	0	0.25			4	0	0	1	
	1	0.51			8	0	0	4.08	
	2	0.99		3	9	0	2.97	8.91	
	3	2.05			2	0	0	4.1	
	4	3.56	3	3		10.68	10.68	0	
	5	7.03	6			42.18	0	0	
	6	12.27	3	6	1	36.81	73.62	12.27	
D0901075	5kg	5.02			2	0	0	10.04	
	10kg	9.92			37	0	0	367.04	
						Keel Total	Wall Total	Opt Total	Total
						89.67	87.27	407.44	584.38





24 Hz Resonance:





Position sensors

Step 4 - Set up sensors gap

Table locked	Both ADE boxes on		One ADE boxe ON at the same time	
Sensors	Offset (Mean)	Std deviation	Offset (Mean)	Std deviation
V1	-54	8.0	-52	2.1
H1	35	1.0	12	0.7
V2	-88	2.7	-84	2.4
H2	-12	2.0	-27	1.2
V3	21	0.9	25	0.7
H3	-281	9.4	-258	1.0

Step 5 - Measure the Sensor gap

Sensors	Gap measured on the Jig	Gap measured on the Table	% of change
V1	xx	80	N/A
H1	xx	80	N/A
V2	xx	80	N/A
H2	xx	80	N/A
V3	xx	80	N/A
H3	xx	80	N/A

Step 6 - Check Sensor gaps after the platform release

	Locked	Unlocked	Diff
Sensors	Offset (Mean)	Offset (Mean)	unlocked - locked
V1	-54	-980	-926
V2	-88	237	325
V3	21	-356	-377
H1	35	571	536
H2	-12	787	799
H3	281	11	-270

Position sensors

Step 7 - Check the position sensors sign and range of motion

Y-Axis Up/Down Measurement

	UP	DOWN
V1 (counts)	19402	-18954
V2	18571	-20667
V3	20450	-19306
A (mils)	24	-24.5
B	25	-23
C	25	-21.5
D	24	-22.5

Y-Axis Up/Down Measurement

	UP	DOWN
V1 (counts)	19893	-20444
V2	21078	-18716
V3	17559	-20010
A (mils)	24	-22
B	22	-23
C	25	-23
D	27.5	-22

Position sensors

Step 12 - Vertical Sensor Calibration

Corner	Dial indicator readout for the negative drive	Dial indicator readout for the 0 drive	Dial indicator readout for the positive drive	Difference
A	-19	0.000	18.75	37.75
B	-19	0.000	18.75	37.75
C	-19	0.000	19	38
D	-19	0.000	19	38
Average	-19	0.000	18.875	**37.9**

Sensors	Counts	Counts	Counts	Difference (Counts)
V1	-16961	-1332	14373	31334
V2	-15970	-244	15431	31401
V3	-16449	-863	14687	31136
			Average	**31290**

Vertical sensitivity: 31290/37.9= 826 count/mil

or 826 count/mil * 1/1638 V/count = 0.504 V/mil

or 25400 nm/mil * 1/826 mil/count = 30.8 nm/count

Nominal Calibration

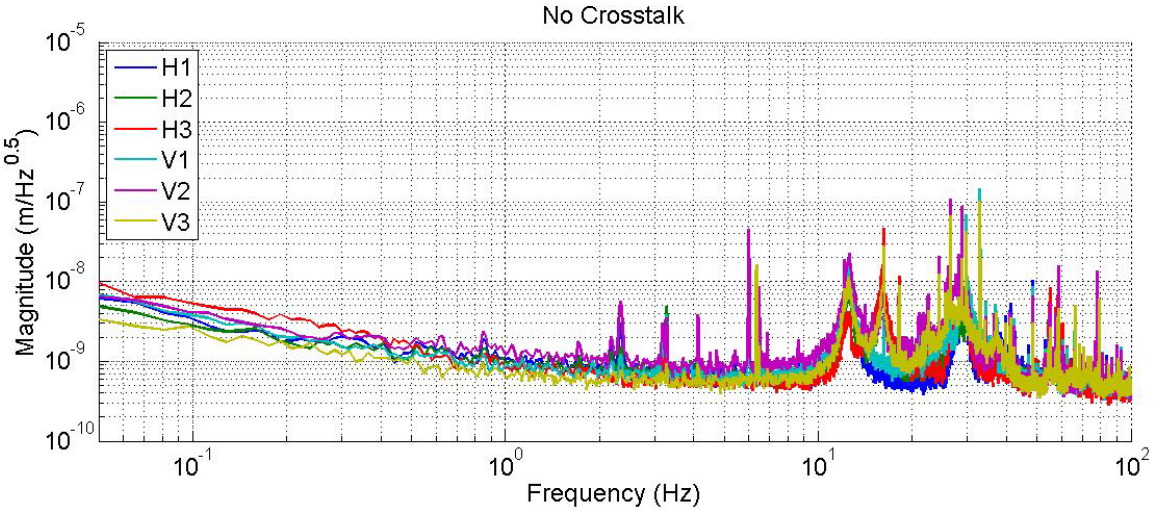
CPS Sensitivity: 20V/0.039" = 20V/39mils = 0.513 V/mil

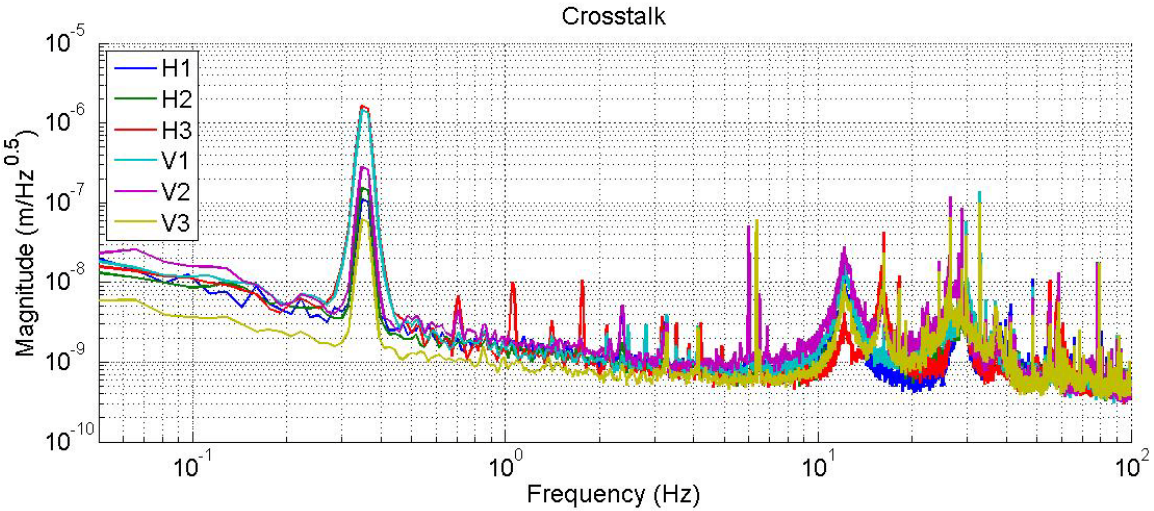
Calibration in counts: 2^{15} / 20 * 20/39 = 840 count/mil

or 25400 nm/mil * 1/840 mil/count = 30.2 nm/count

Deviation = (826-840)/840 = -1.7 %

Calibrated power spectrums





Step 8: Range of motion

- In MEDM, make sure no actuator is driven
- Disable watchdogs by setting 'GEO limit' to 40,000 counts and the 'ACT limit' to 30,000 counts
- Confirm that the limits are counting back towards the 'safe limit' (30K or 40K)
- Pull up the CPS signals (V1, V2, V3) in a data viewer window (DISPPF_V1_IN1_DAQ)
- Pull up the coordinate displacement sensors (X, Y, Z)
- Monitor outputs (X, Y, Z) and (V1, V2, V3, H1, H2, H3)
- Prepare the test (MEDM – ISI_HAM_CONT_Z)
    - Set the gain ramp time to 20s set in the direction you want to test
    - Set up the gain to 0
    - Output ON
    - Add a bias values of 10,000counts (upper limit)
- Run the test by setting the gain to 4.4 (X direction); 5.1 (Y direction); 8.9 (Z direction)
- Write down CPS Values
- Set gain to 0
- Run the test by setting the gain to -4.4 (X direction); -5.1 (Y direction); -8.9 (Z direction)
- Write down CPS Values
- Proceed to another direction

Note: for Z displacement, the table should it the stops after 80,000 counts on Z drive X, Y Z tests are probably sufficient to determine the range of motion of the optic table.

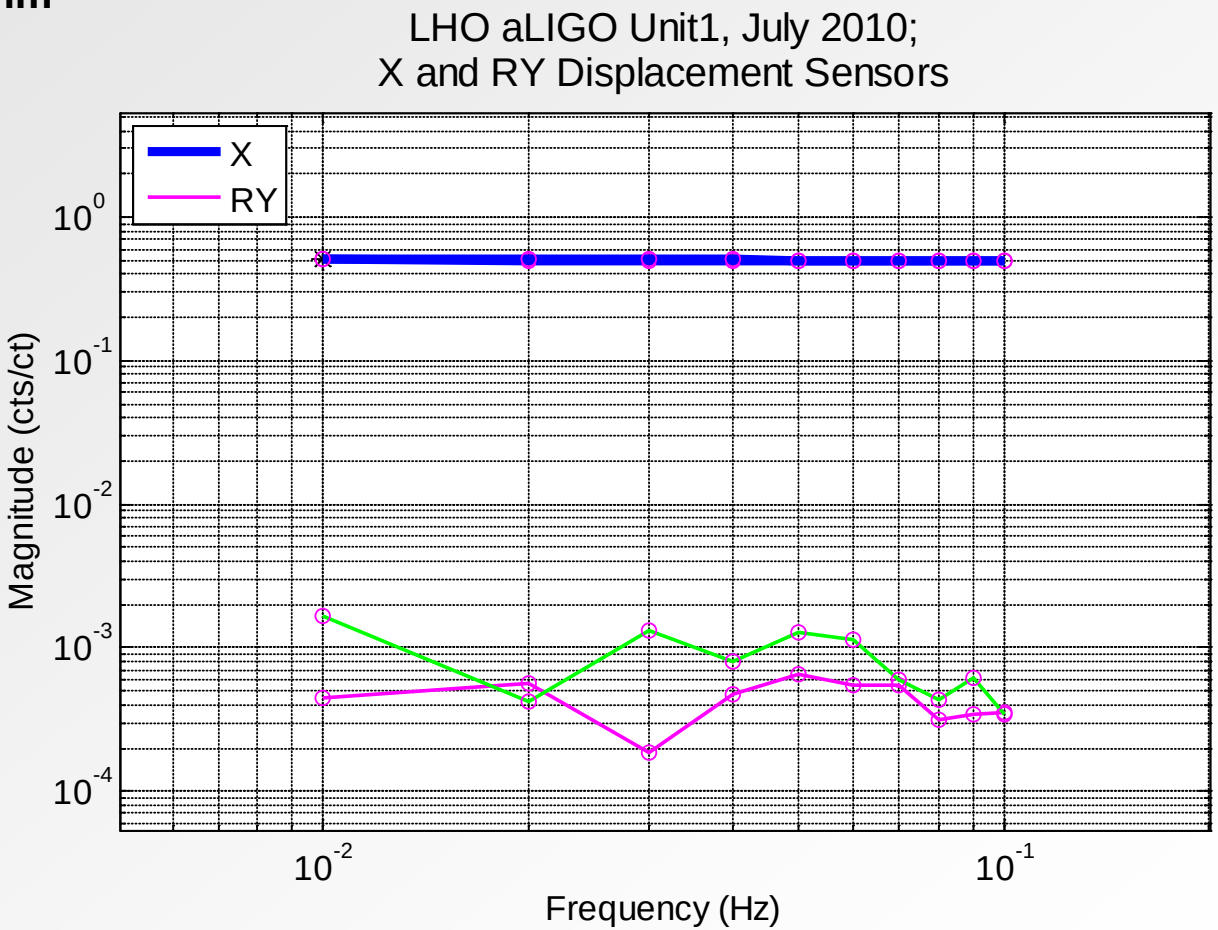
	No drive	X	Y	Z
V1 read out (counts)				
V2 read out (counts)				
V3 read out (counts)				
H1 read out (counts)				
H2 read out (counts)				
H3 read out (counts)				

	No drive	-X	-Y	-Z
V1 read out (counts)				
V2 read out (counts)				
V3 read out (counts)				
H1 read out (counts)				
H2 read out (counts)				
H3 read out (counts)				

LZMP

First measurement, (RY in green).
X offset = 0.24 mm
Y offset = 0.30 mm

Second measurement (RY in magenta)
X offset = 0.14 mm
Y offset = 0.16 mm

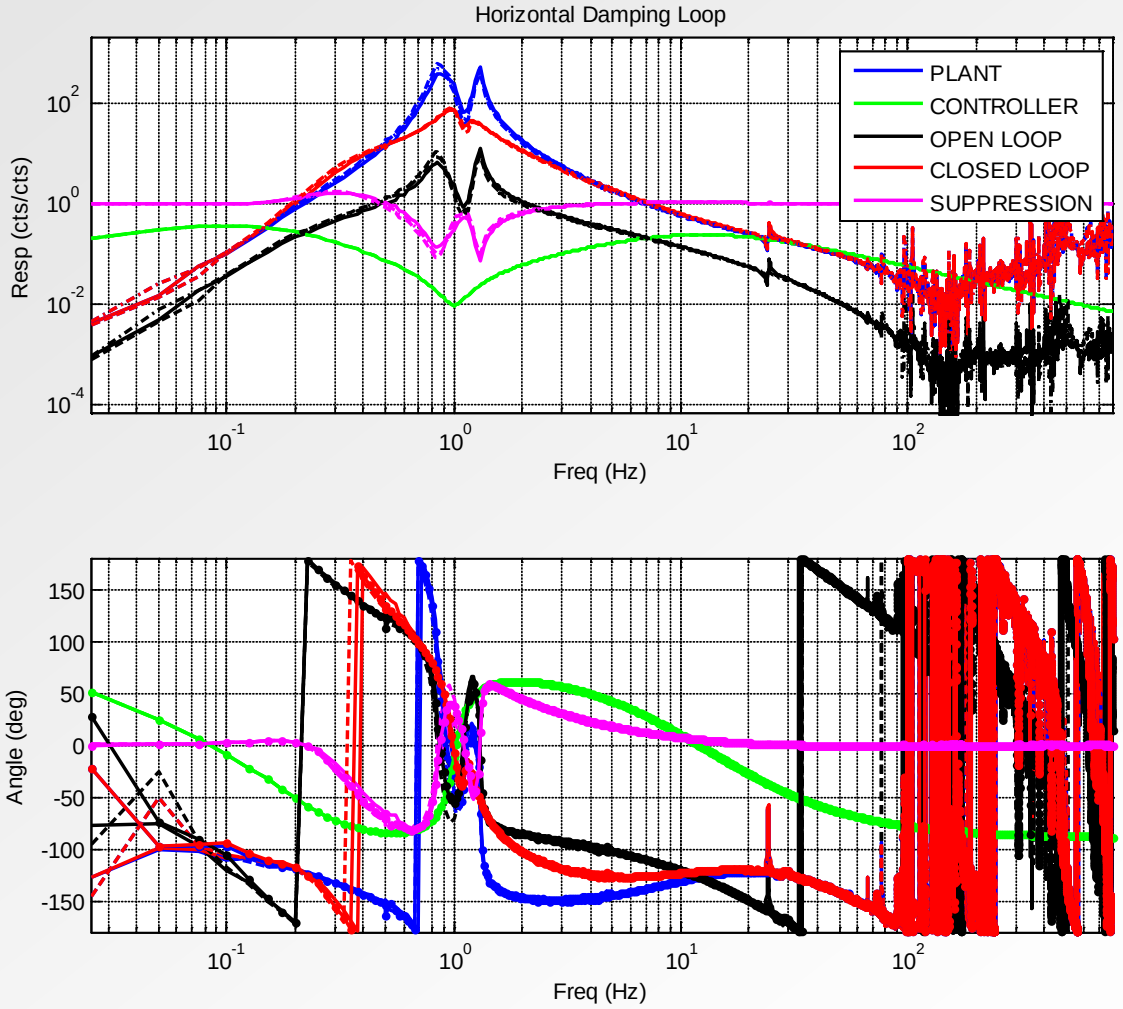


Damping loops

Controller made of:

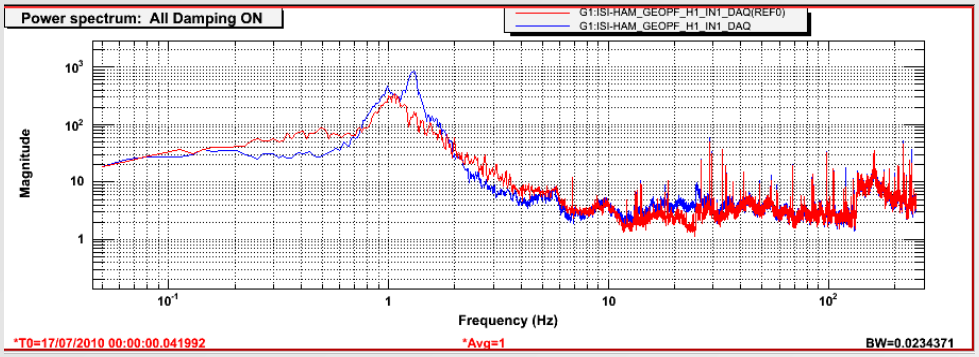
- a compensation filter to account for the difference in the electronics

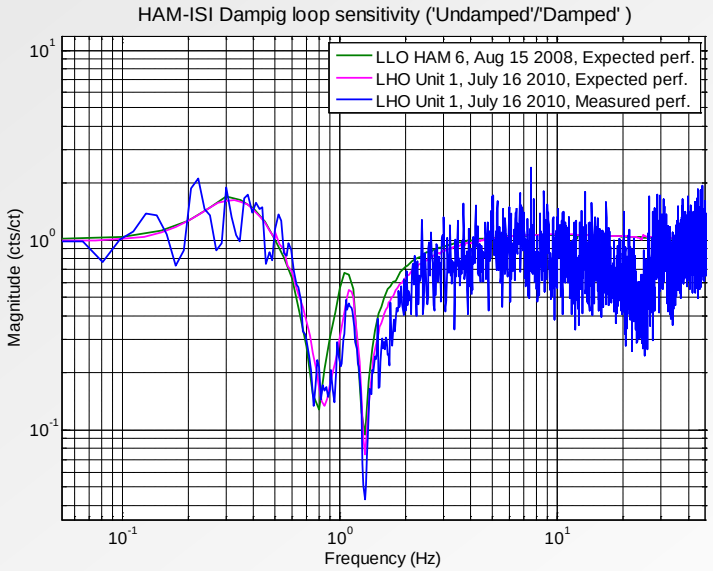
- the original damping loops from eLIGO.



H1: Solid line, H2: Dash line, H3: Dash-Dot line

Damping loops





Conclusion:

One issue:

- 24 Hz resonance: more investigation?

One info:

- Control loops on unit 2

Recent Progress

- Complementary test for range of motion: in progress.
- Mass budget updated
- Calibrated spectrums
- CPS problem solved
- LZMP estimated
- Damping loops installed

Time to move to unit 2?