

LIGO Laboratory / LIGO Scientific Collaboration

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Oct 3, 2013

**aLIGO BSC-ISI, Pre-integration Testing report,
Phase II (before cartridge install)**

E1100848 – V6

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for the SEI team

Distribution of this document:
Advanced LIGO Project

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Introduction

The BSC-ISI testing is performed in three phases:

- 1) BSC-ISI, Pre-integration Testing, Phase I (post-assembly, in the staging building)
- 2) BSC-ISI, Pre-integration Testing, Phase II: Final tests done before insertion in the chamber
- 3) BSC-ISI, Integration Phase Testing: Procedure and results related to the commissioning in the chamber.

The ISI-BSC3 was moved from the Staging building to the VEA test stand May 2013.

This document presents results of tests (Phase II) performed on the ISI-BSC3 (ITMX) before installation in the chamber. Testing performed in May is available in version 1 of this report. Since then suspensions were installed and a new round of testing was performed, between 9/30/13 and 10/4/13. Related test results are presented here.

Tests were performed, and report was written, on the model of H1:ISI-ETMX (BSC9) – E1100849 v1

This unit was tested on the H1:ISI_TST LVEA test stand model. All results are currently, referred to, and saved in:

<https://svn.ligo.caltech.edu/svn/seismic/BSC-ISI/H1/TST/>

Once this report is validated, results will be posted on the SVN at:

<https://svn.ligo.caltech.edu/svn/seismic/BSC-ISI/H1/ITMX/>

The following type of document can be found in the SVN:

- Excell spreadsheet (.xls)
- Data location
- Figures location
- Masses distribution scheme (ppt)



4. Mass distribution

Here is the payload distribution of the ISI. SUS-QUAD is installed. It will be collected prior to the cartridge install.

| Stage 1 | |
|-----------------|--|
| Location | Weight (lb) |
| Corner 1 | 2 Vib Abs, 1x D0902613, 1x D0902616-4 |
| Corner 2 | 2 Vib Abs, 1x D0902613, 1x D0902616-4, 1x -1, 1x -3, 2x -5, 1x -2 |
| Corner 3 | 2 Vib Abs, 1x D0902616 -3, 2x -1 |
| Total | |

Table 1 - Payload Stage 1

Stage 1 payload is unchanged since first installation in the staging building.

Stage 2 - 2612lb - 5% =
2481lb

| Mass Budget - Mass type | Quantity | Weight | Unit | Weight (lb) |
|--------------------------------|-----------------|---------------|-------------|--------------------|
| D1003136 | 2 | 50 | lb | 100 |
| D1003161-21.6 | 6 | 47.5 | lb | 285 |
| D1003161-20.6 | 10 | 45.3 | | 453 |
| 600 lb leg Element | 1 | 600 | lb | 600 |
| type 0 | 1 | .6 | lb | .6 |
| type 1 | 3 | 1.1 | lb | 3.3 |
| type 2 | 1 | 2.2 | lb | 2.2 |
| type 3 | 1 | 4.5 | lb | 4.5 |
| type 4 | 2 | 7.9 | lb | 15.8 |
| type 5 | 3 | 15.6 | lb | 46.8 |
| type 6 | 7 | 27.2 | lb | 190.4 |
| | | | | 1701.6 |

Table 2 - Payload Stage 2

Test result: Passed: X Failed: ___ Waived: ___

5. Basic functionalities just after installing the BSC-ISI on the teststand

▣▣ Pressure sensors

Data can be found in the SVN at:

[/seismic/BSC-ISI/H1/ITMX/Data/Static_Tests/](#)

[-H1_ISI_ITMX_Pressure_Sensors_Check_Raw_20131003.mat](#)

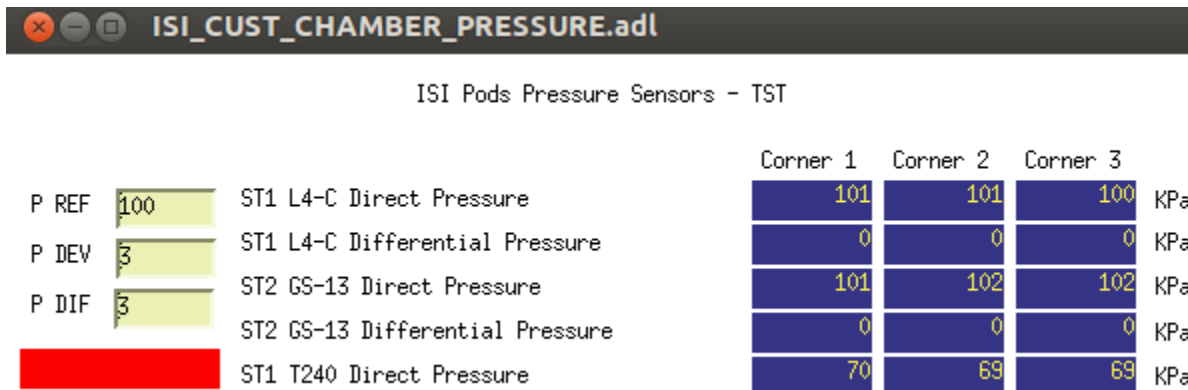
Script(s) can be found in the SVN at:

[/seismic/BSC-ISI/Common/Testing_Functions_BSC_ISI/Version_1/](#)

[-Pressure_Sensor_Check_Raw_BSC_ISI.m](#)

| Sensors | Pressure (cts) | | |
|------------|----------------|----------|----------|
| | Corner 1 | Corner 2 | Corner 3 |
| ST1-L4C-P | -25 | 233 | -1095 |
| ST1-L4C-D | 24796 | 24691 | 24449 |
| ST1-GS13-P | 1245 | 594 | -1107 |
| ST1-GS13-D | 24791 | 25005 | 25115 |
| ST1-T240-P | 13885 | 13504 | 13628 |

Table 3 - Geophones Pressure sensors



Test result:

Passed: X

Failed:

Waived:

i. Spectra

Spectra are consistent between corner. No response drop in low frequency.

Spectra can be found in the SVN at:

seismic/BSC-ISI/H1/ITMX/Data/Spectra/Undamped/

-H1_ISI_ITMX_on_TST_ASD_m_LOC_CPS_T240_L4C_GS13_2020_10_03.mat

-H1_ISI_TST_on_TST_ASD_m_L4C_GS13_Stage_Tilted_2020_10_03.mat

Script(s) used for the *regular spectra test* can be found in the SVN at:

/seismic/BSC-ISI/Common/Testing_Functions_BSC_ISI/Version_1/

[- ASD Measurements Local BSC ISI.m](#)

[- Plot ASD Local BSC ISI.m](#)

Script(s) used for the *tilted spectra test* can be found in the SVN at:

/seismic/BSC-ISI/Common/Testing_Functions_BSC_ISI/Version_1/

– [ASD Measurements Stages Tilted BSC ISI.m](#)

[- Plot ASD Tilted Stage BSC ISI.m](#)

–

Figures can be found in the SVN at :

/ligo/svncommon/SeiSVN/seismic/BSC-ISI/H1/ITMX/Data/Figures/Spectra/Undamped

-H1_ISI_ITMX_on_TST_ASD_CT_LOC_CPS_T240_L4C_GS13_2020_10_03.fig

-H1_ISI_ITMX_on_TST_ASD_m_LOC_CPS_T240_L4C_GS13_2020_10_03_3.fig

-H1_ISI_TST_on_TST_Tilted_ASD_m_LOC_ST1_L4C_2020_10_03.fig

-H1_ISI_TST_on_TST_Tilted_ASD_m_LOC_ST2_GS13_2020_10_03.fig

-H1_ISI_TST_on_TST_Tilted_ASD_CT_LOC_ST1_L4C_2020_10_03.fig

[-H1_ISI_TST_on_TST_Tilted_ASD_CT_LOC_ST1_L4C_2020_10_03.pdf](#)

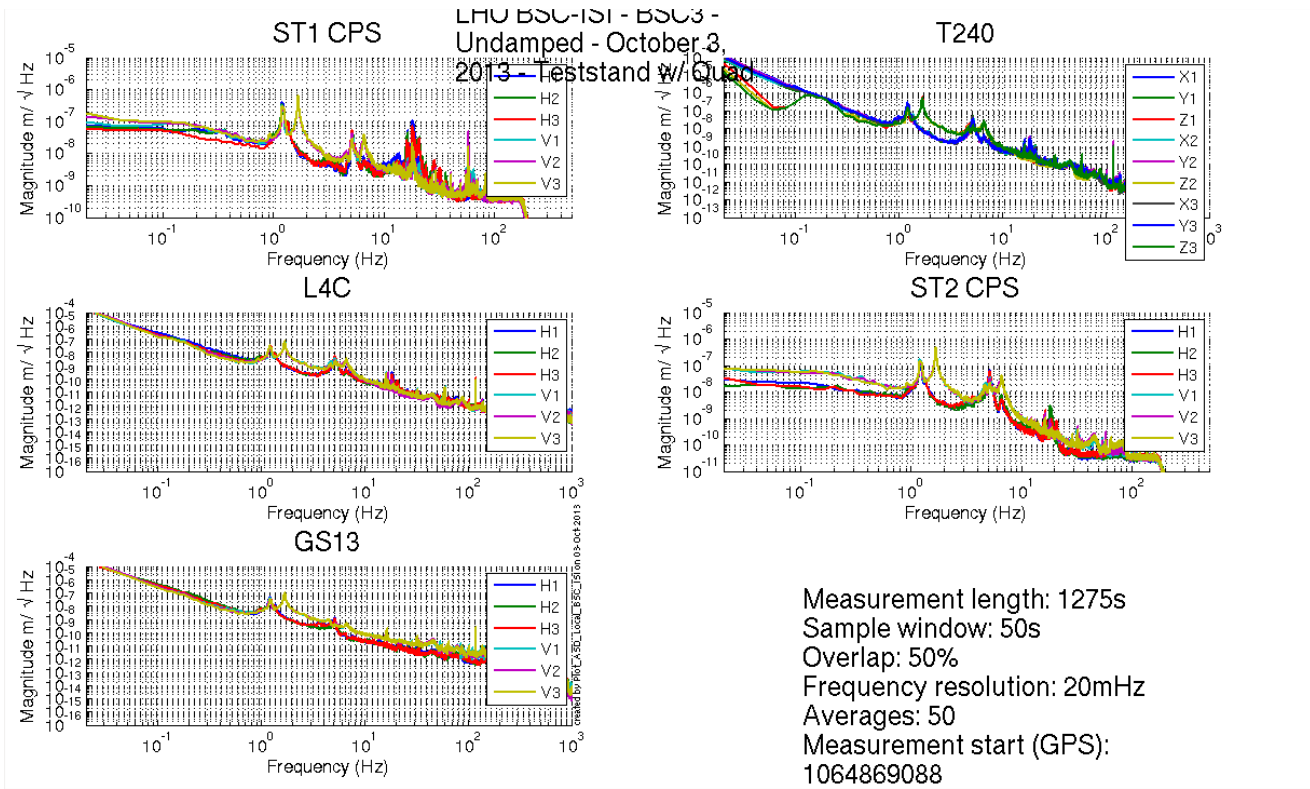


Figure 1 - Spectra inboard instruments - ISI Unlocked

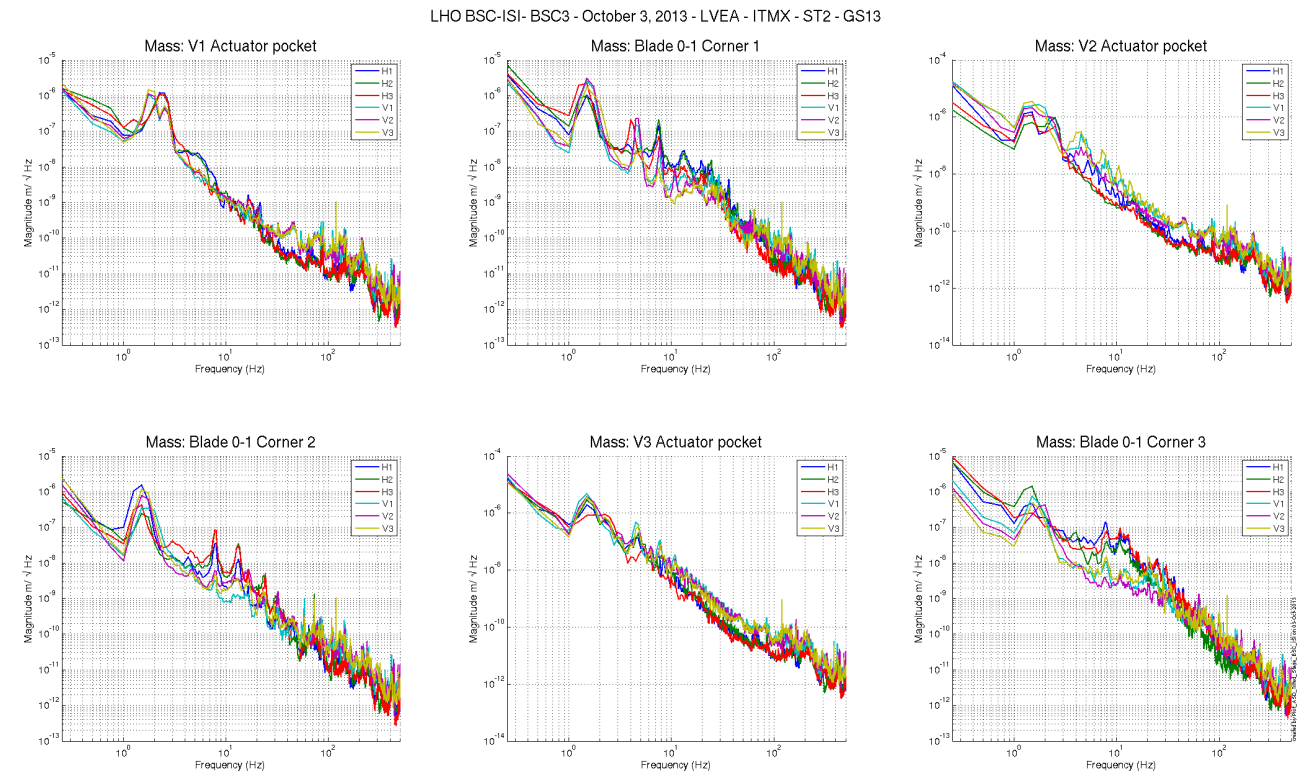


Figure 2 - Spectra inboard instruments - ISI Tilted - ST2

LHO BSC-ISI- BSC3 - October 3, 2013 - LVEA - ITMX - ST1 - L4C

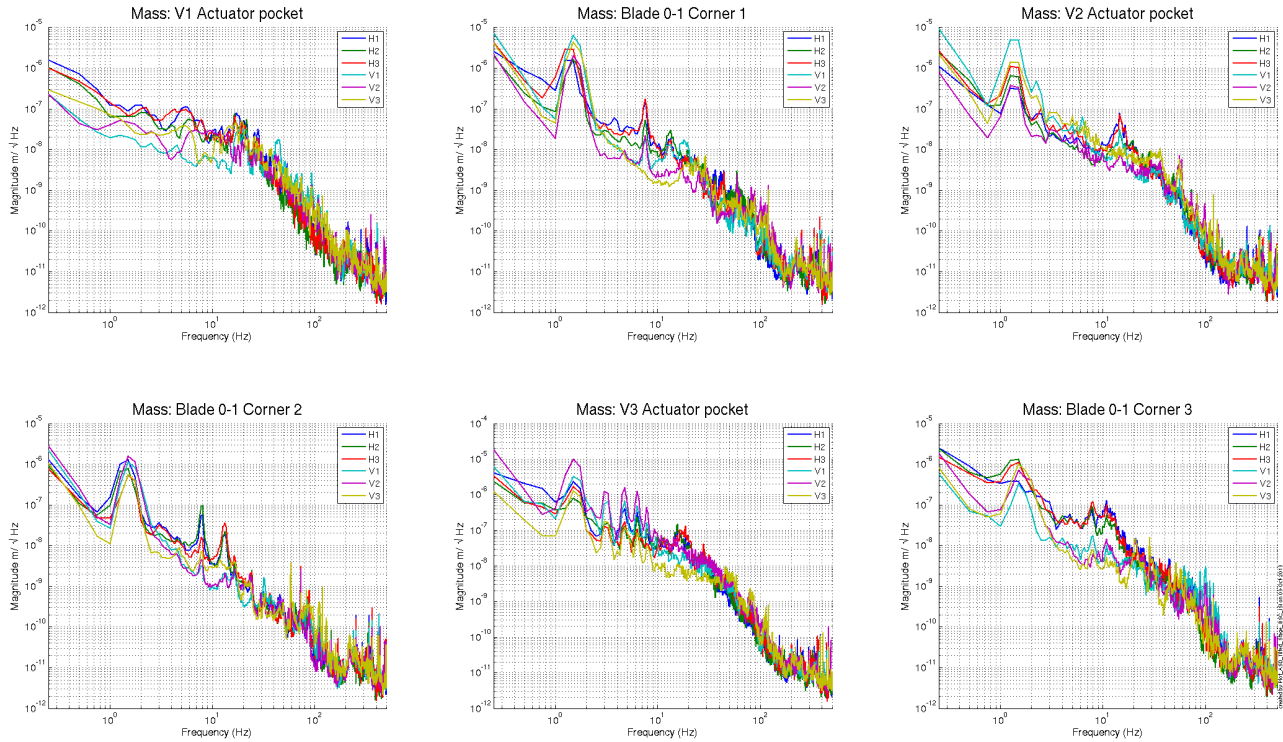


Figure 3 - Spectra inboard instruments - ISI Tilted -ST1

All spectra show a peak around 1.7Hz. With the mass on V1 actuator pocket, the ST1 L4Cs do not have this feature anymore. Same remark applies to the spectra measured in

Test result:

Passed: X

Failed:

Waived:



ii. Actuators-cables resistance

Will be collected 10/04/13.

Test result: Passed: ___ Failed: ___ Waived: X

iii. Offsets CPS Unlocked vs locked

Script(s) used for this test can be found in the SVN:
/seismic/BSC-ISI/Common/Testing_Functions_BSC_ISI/Version_1/
- Offset_STD_CPS_BSC_ISI.m

| Sensors | Table locked | | Table unlocked | | Difference locked - unlocked | |
|----------|---------------|---------------|----------------|---------------|------------------------------|-------|
| | Offset (Mean) | Std deviation | Offset (Mean) | Std deviation | Offset (Mean) | mil |
| ST1 - H1 | 235.66 | 5.7568 | 1.5758 | 23.228 | 234 | 0.28 |
| ST1 - H2 | 118.28 | 3.6626 | -488.55 | 28.032 | 607 | 0.72 |
| ST1 - H3 | 250.35 | 5.1168 | 216.96 | 21.37 | 33 | 0.04 |
| ST1 - V1 | 2167.7 | 4.6584 | 1315.3 | 28.476 | 852 | 1.01 |
| ST1 - V2 | -1484 | 3.635 | -1141.1 | 31.906 | -343 | -0.41 |
| ST1 - V3 | -1480.6 | 5.453 | -858.16 | 29.107 | -622 | -0.74 |
| ST2 - H1 | -437.23 | 18.227 | -443.96 | 25.129 | 7 | 0.00 |
| ST2 - H2 | -4034.7 | 17.325 | -4030.8 | 47.689 | -4 | 0.00 |
| ST2 - H3 | 4486.9 | 13.433 | 3950.4 | 47.372 | 537 | 0.16 |
| ST2 - V1 | -621.7 | 21.267 | -857.79 | 77.945 | 236 | 0.07 |
| ST2 - V2 | 2368.2 | 20.271 | 1994.2 | 81.041 | 374 | 0.11 |
| ST2 - V3 | -652.69 | 19.253 | -93.445 | 77.987 | -559 | -0.17 |

Table 4 - Locked vs Unlocked Position

Test result: Passed: X Failed: ___ Waived: ___

vi. Range of motion

The range of motion measurement is performed by pushing on the table with the actuators, in each direction collinear to the CPS.

Data can be found in the SVN at:

/seismic/BSC-ISI/H1/ITMX/Data/Static_Tests/
-H1_ISI_ITMX_on_TST_Range_Of_Motion_20131003.mat

Script(s) can be found in the SVN at:

/seismic/BSC-ISI/Common/Testing_Functions_BSC_ISI/Version_1/
-Range_Motion_BSC_ISI.m

| Sensor readout (counts) | Negative drive | no drive | Positive drive | Amplitude of the Range of Motion (counts) | Amplitude of the Range of Motion (mil) |
|-------------------------|----------------|----------|----------------|---|--|
| ST1 - H1 | -15767.232 | -23 | 15365.748 | 31133 | 37 |
| ST1 - H2 | -15530.388 | -458 | 15503.408 | 31034 | 37 |
| ST1 - H3 | -15304.828 | 195 | 15714.632 | 31019 | 37 |
| ST1 - V1 | -11096.702 | 1287 | 13686.218 | 24783 | 30 |
| ST1 - V2 | -13168.77 | -1100 | 10995.104 | 24164 | 29 |
| ST1 - V3 | -13302.58 | -899 | 11513.224 | 24816 | 30 |
| ST2 - H1 | -9614.1804 | -419 | 8768.3934 | 18383 | 5 |
| ST2 - H2 | -13225.366 | -3974 | 5267.3394 | 18493 | 6 |
| ST2 - H3 | -5024.0496 | 4078 | 13162.96 | 18187 | 5 |
| ST2 - V1 | -11697.22 | -939 | 9784.8366 | 21482 | 6 |
| ST2 - V2 | -8794.4858 | 2040 | 12862.9 | 21657 | 6 |
| ST2 - V3 | -10705.258 | -62 | 10601.33 | 21307 | 6 |

Table 7 - Range of motion - Actuator drive in the LVEA

| Sensors | Push in positive direction | Push in negative direction |
|-----------------|----------------------------|----------------------------|
| ST1 - H1 | 17750 | -15000 |
| ST1 - H2 | 18000 | -16000 |
| ST1 - H3 | 17500 | -15000 |
| ST1 - V1 | 15000 | -17000 |
| ST1 - V2 | 15000 | -19000 |
| ST1 - V3 | 15000 | -19000 |

Table 8 – Manual Range of motion - Actuator drive in the LVEA

Test result: Passed: X Failed: ___ Waived: ___

vii. Linearity test

Data can be found in the SVN at:

/seismic/BSC-ISI/H1/ITMX/Data/Linearity_Test/
 -H1_ISI_ITMX_on_TST_Linearity_test_20131003.mat

Script(s) can be found in the SVN at:

/seismic/BSC-ISI/Common/Testing_Functions_BSC_ISI/Version_1/
[-Linearity Test Awgstream BSC ISI.m](#)

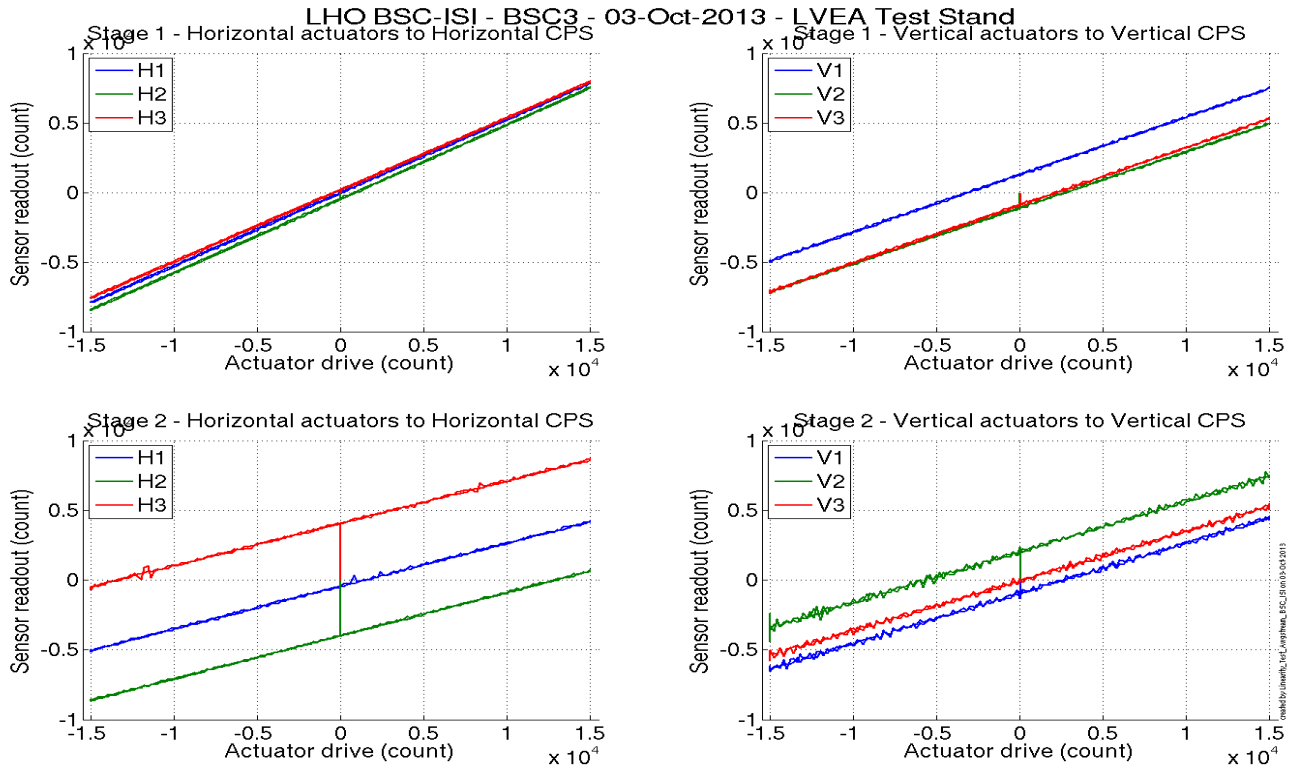


Figure 4 - Linearity test - ITMY- LVEA w/Quad



| | | Slope | Offset | Average slope | Variation from average(%) |
|---------|----------|-------|--------|---------------|---------------------------|
| Stage 1 | ST1 - H1 | .525 | -18 | .524 | .2 |
| | ST1 - H2 | .531 | -450 | | 1.3 |
| | ST1 - H3 | .517 | -203 | | -1.5 |
| | ST1 - V1 | .413 | 1287 | .410 | .82 |
| | ST1 - V2 | .402 | -1095 | | -1.77 |
| | ST1 - V3 | .413 | -907 | | .95 |
| Stage 2 | ST2 - H1 | .307 | -429 | .307 | .17 |
| | ST2 - H2 | .309 | -3969 | | .74 |
| | ST2 - H3 | .304 | 4055 | | -.92 |
| | ST2 - V1 | .359 | -940 | .359 | .20 |
| | ST2 - V2 | .361 | 2019 | | .65 |
| | ST2 - V3 | .356 | -59 | | -.85 |

Table 9 - Slope – Offset Linearity test

Test result:

Passed: X

Failed: ___

Waived: ___

6. Transfer functions and Comparison with measurements done without SUS

1. On the LVEA test stand – With SUS

A little bit saturation occurred on the inertial sensors in the 700mHz-10Hz range.

Measurement data can be found in the SVN at:

SeiSVN/seismic/BSC-ISI/H1/ITMX/Data/Transfer_Functions/Measurements/Undamped/
-H1_ISI_TST_Data_L2L_500Hz_1000Hz_ST1_ST2_20131002-202032.mat
-H1_ISI_TST_Data_L2L_700mHz_10Hz_ST1_ST2_20131002-160148.mat
-H1_ISI_TST_Data_L2L_100mHz_700mHz_ST1_ST2_20131003-020707.mat
-H1_ISI_TST_Data_L2L_10Hz_100Hz_ST1_ST2_20131002-232958.mat
-H1_ISI_TST_Data_L2L_100Hz_500Hz_ST1_ST2_20131002-214502.mat

Concatenated TF can be found in the SVN at:

SeiSVN/seismic/BSC-ISI/H1/ITMX/Data/Transfer_Functions/Measurements/Undamped/
-H1_ISI_TST_TF_L2L_Raw_2013_10_03.mat

Figures can be found in the SVN at:

seismic/BSC-ISI/H1/ETMX/Data/Figures/Transfer_Functions/Measurements/Undamped/
-H1_ISI_TST_TF_L2L_Raw_from_ST1_ACT_to_ST1_CPS_2013_10_03.fig

-H1_ISI_TST_TF_L2L_Raw_from_ST1_ACT_to_ST1_L4C_2013_10_03.fig

-H1_ISI_TST_TF_L2L_Raw_from_ST1_ACT_to_ST1_T240_2013_10_03.fig

-H1_ISI_TST_TF_L2L_Raw_from_ST1_ACT_to_ST2_CPS_2013_10_03.fig

-H1_ISI_TST_TF_L2L_Raw_from_ST1_ACT_to_ST2_GS13_2013_10_03.fig

-H1_ISI_TST_TF_L2L_Raw_from_ST2_ACT_to_ST1_L4C_2013_10_03.fig

-H1_ISI_TST_TF_L2L_Raw_from_ST2_ACT_to_ST1_T240_2013_10_03.fig

-H1_ISI_TST_TF_L2L_Raw_from_ST2_ACT_to_ST2_CPS_2013_10_03.fig

[-H1_ISI_TST_TF_L2L_Raw_from_ST2_ACT_to_ST2_GS13_2013_10_03.fig](#)

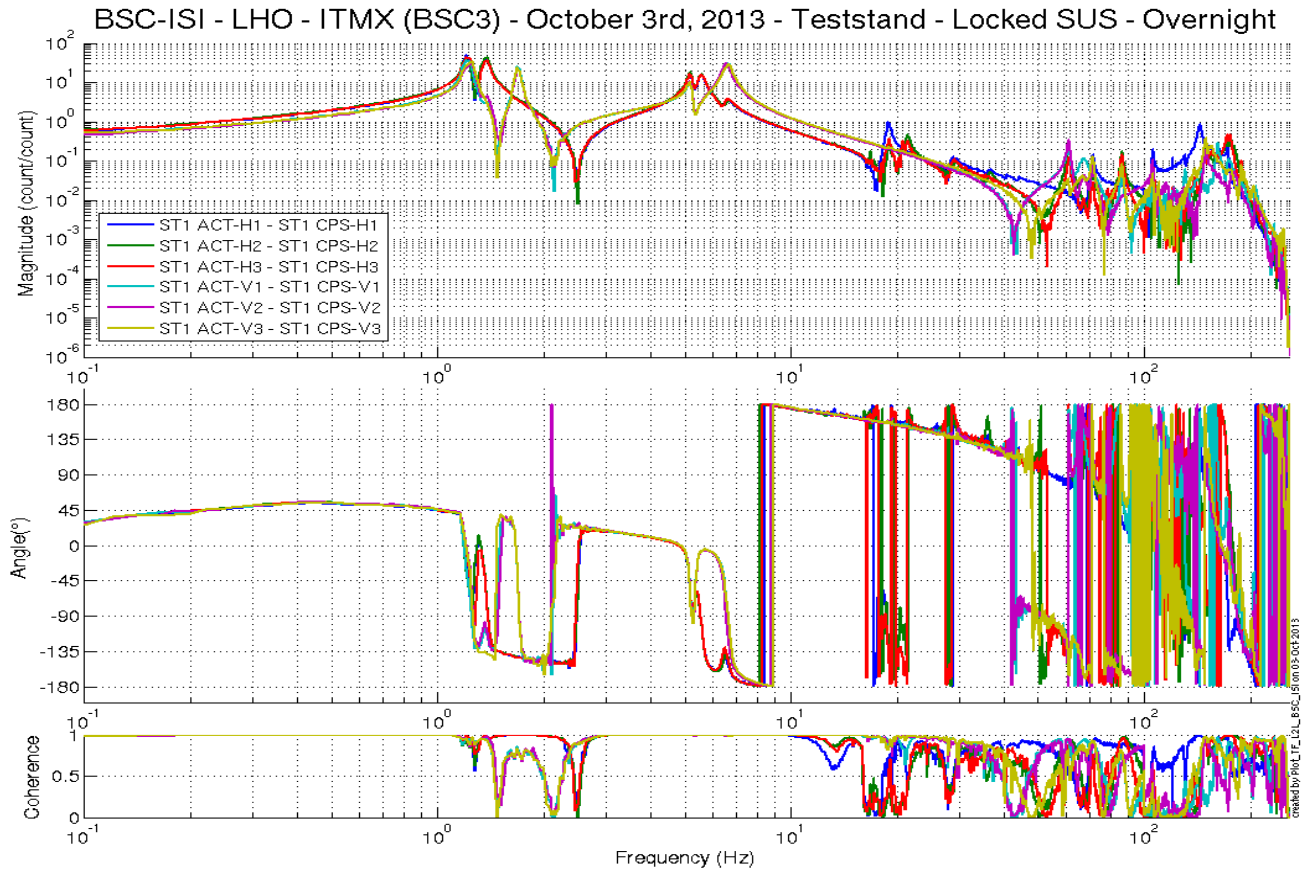


Figure 5 - TF ST1 ACT to ST1 CPS

A few suspicious resonances can be seen above 20Hz. They can also be seen on stage 2. Similar resonances were seen on ETMX as well. Relevant ETMX transfer functions are shown in the next section.

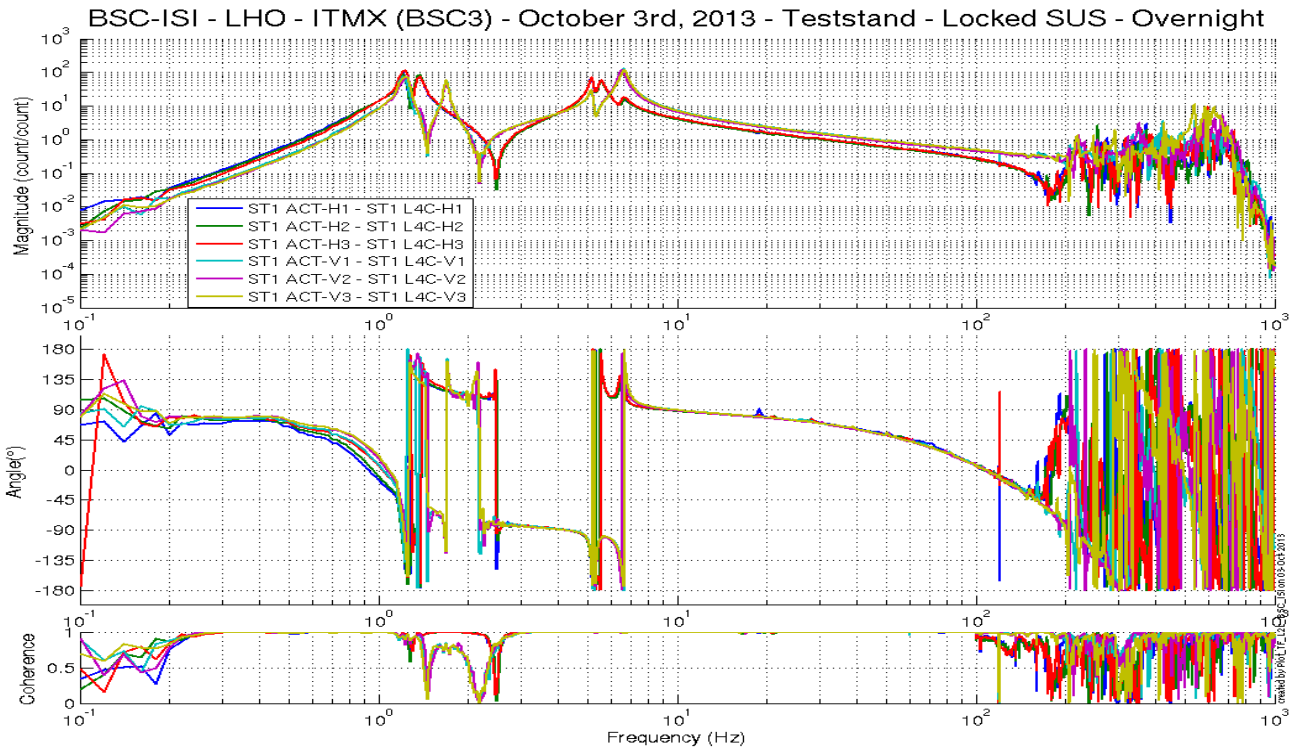


Figure 6 - TF ST1 ACT to ST1 L4C

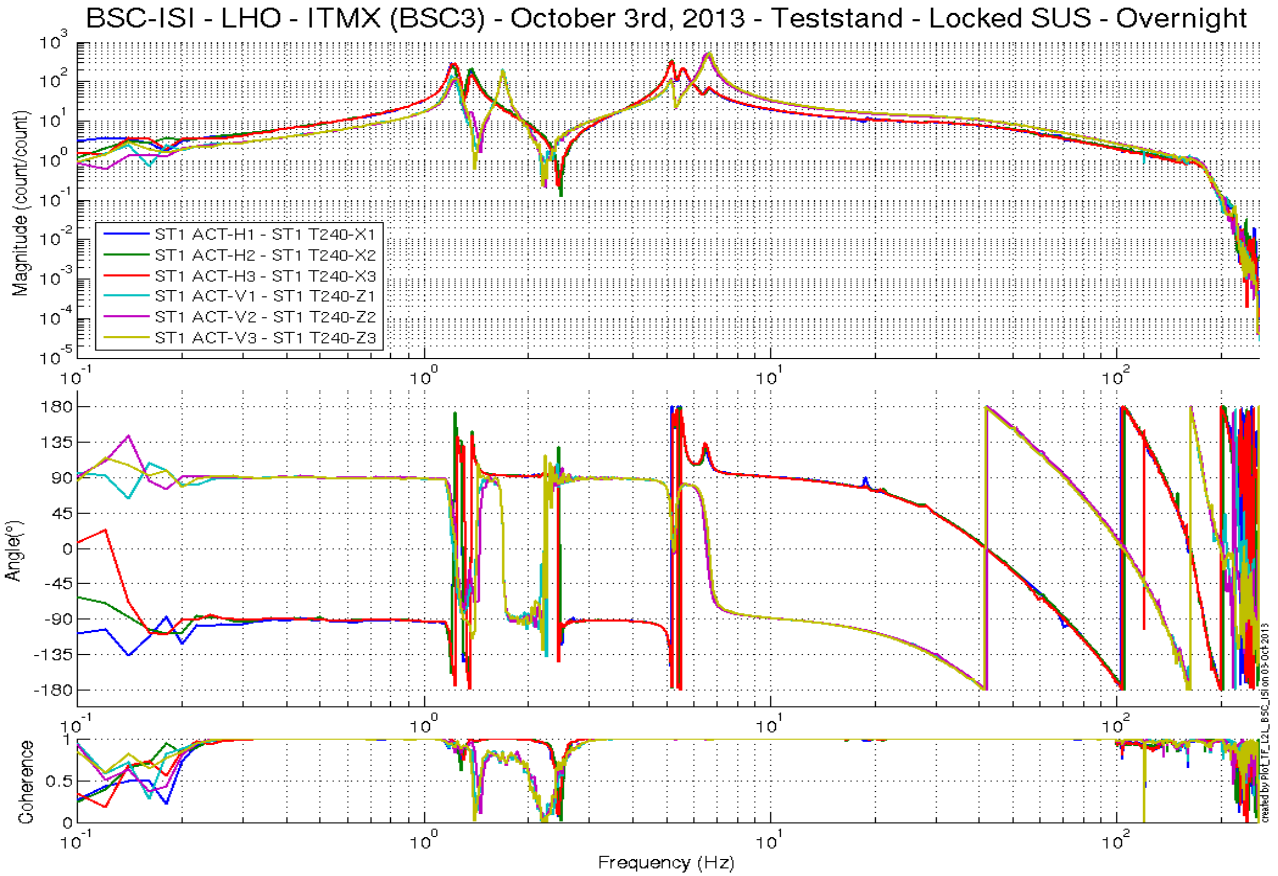


Figure 7 - TF ST1 ACT to ST1 T240

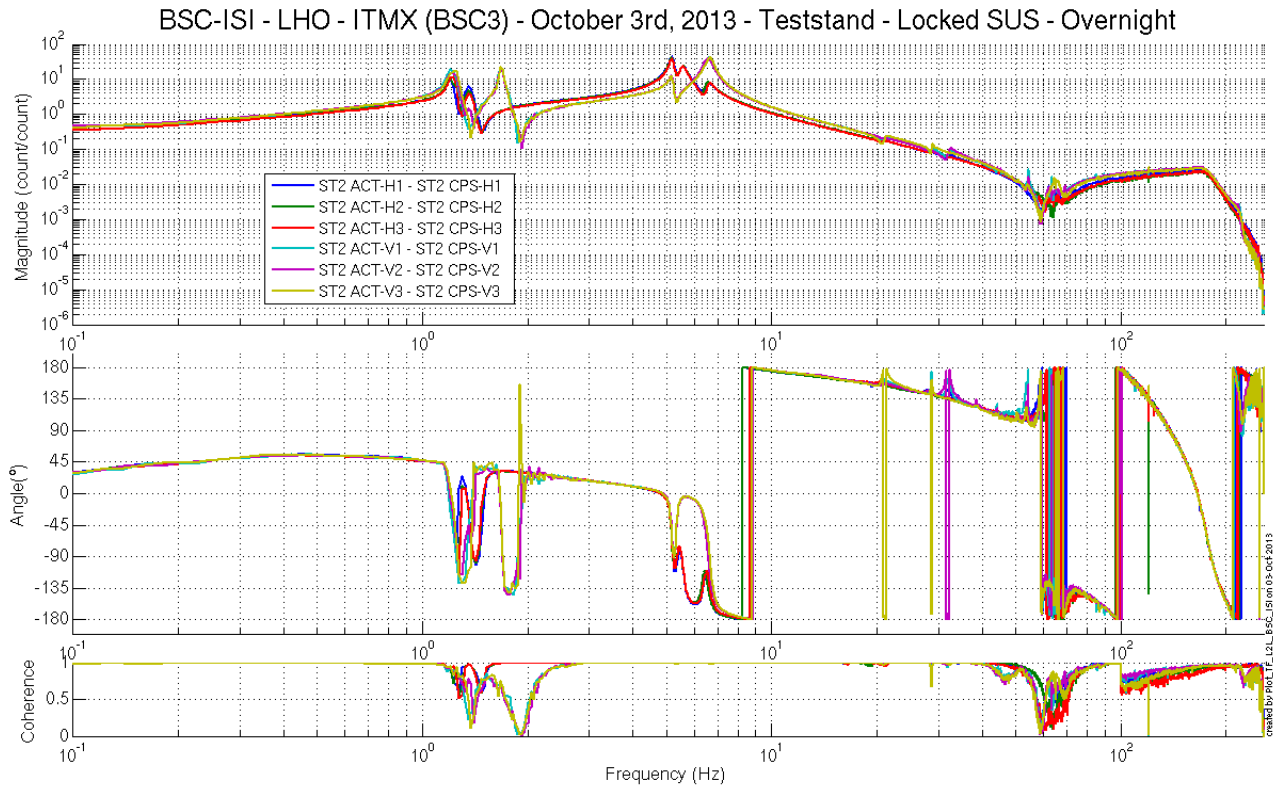


Figure 8 - TF ST2 ACT to ST2 CPS

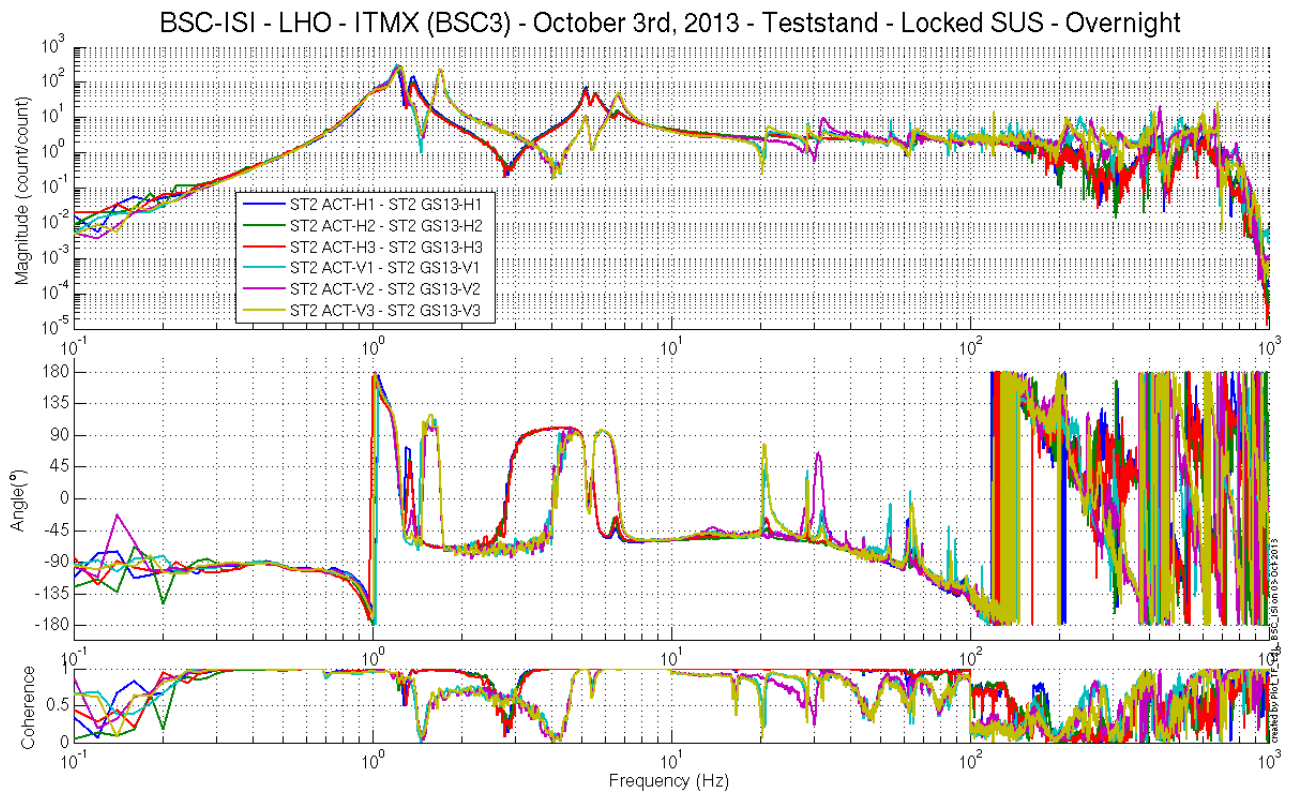
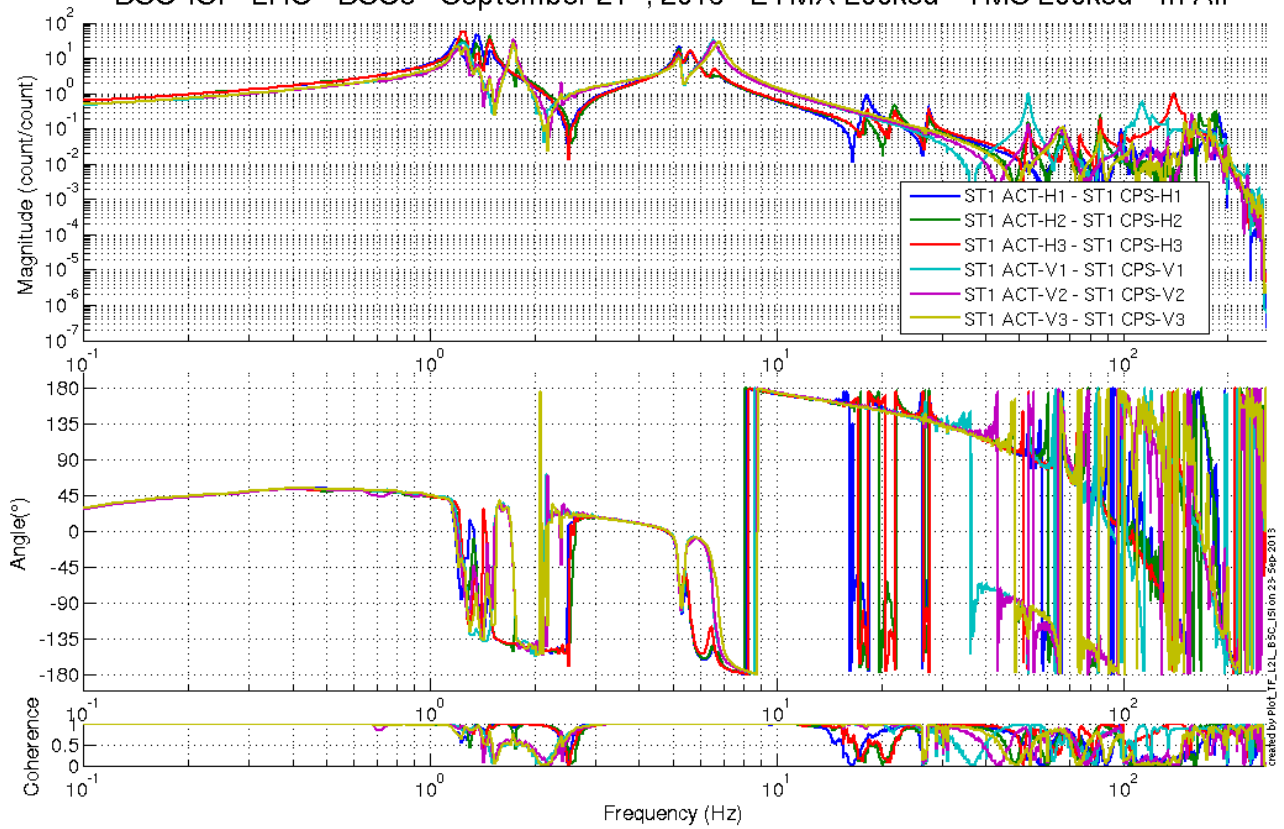


Figure 9 - TF ST2 ACT to ST2 GS13

i. Recent ETMX data for comparison – ST1 CPS

BSC-ISI - LHO - BSC9 - September 21th, 2013 - ETMX Locked - TMS Locked - In Air



BSC-ISI - LHO - BSC9 - September 21th, 2013 - ETMX Locked - TMS Locked - In Air

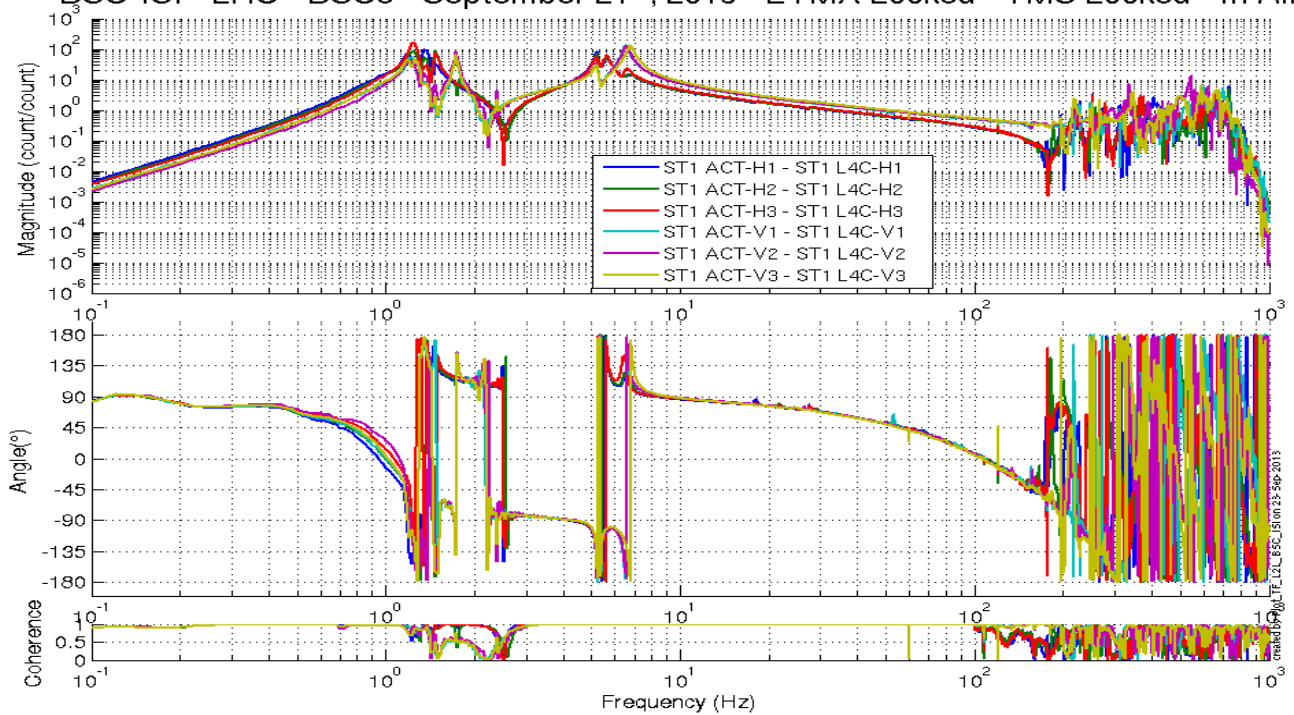


Figure 10 - Recent CPS TF ETMX

ii. Comparisons with measurements prior to SUS install

The following figures shows the comparison between the transfer functions before SUS install (05/03/2013) and after (10/03/2013).

Script(s) can be found in the SVN at:

/ligo/svncommon/SeiSVN/seismic/BSC-ISI/H1/ITMX/Scripts/Misc/
-Comparison_TF_L2L_H1_ISI_ITMX.m

Figures can be found in the SVN at:

-LHO_ISI_ITMX_Comparison_TF_L2L_ST1_ACT_H_to_ST1_CPS_H_20130503_vs_20131003.fig
-LHO_ISI_ITMX_Comparison_TF_L2L_ST2_ACT_H_to_ST2_CPS_H_20130503_vs_20131003.fig

-LHO_ISI_ITMX_Comparison_TF_L2L_ST1_ACT_H_to_ST1_L4C_H_20130503_vs_20131003.fig
-LHO_ISI_ITMX_Comparison_TF_L2L_ST2_ACT_H_to_ST2_GS13_H_20130503_vs_20131003.fig

-LHO_ISI_ITMX_Comparison_TF_L2L_ST1_ACT_V_to_ST1_CPS_V_20130503_vs_20131003.fig
-LHO_ISI_ITMX_Comparison_TF_L2L_ST2_ACT_V_to_ST2_CPS_V_20130503_vs_20131003.fig

-LHO_ISI_ITMX_Comparison_TF_L2L_ST1_ACT_V_to_ST1_L4C_V_20130503_vs_20131003.fig
-LHO_ISI_ITMX_Comparison_TF_L2L_ST2_ACT_V_to_ST2_GS13_V_20130503_vs_20131003.fig

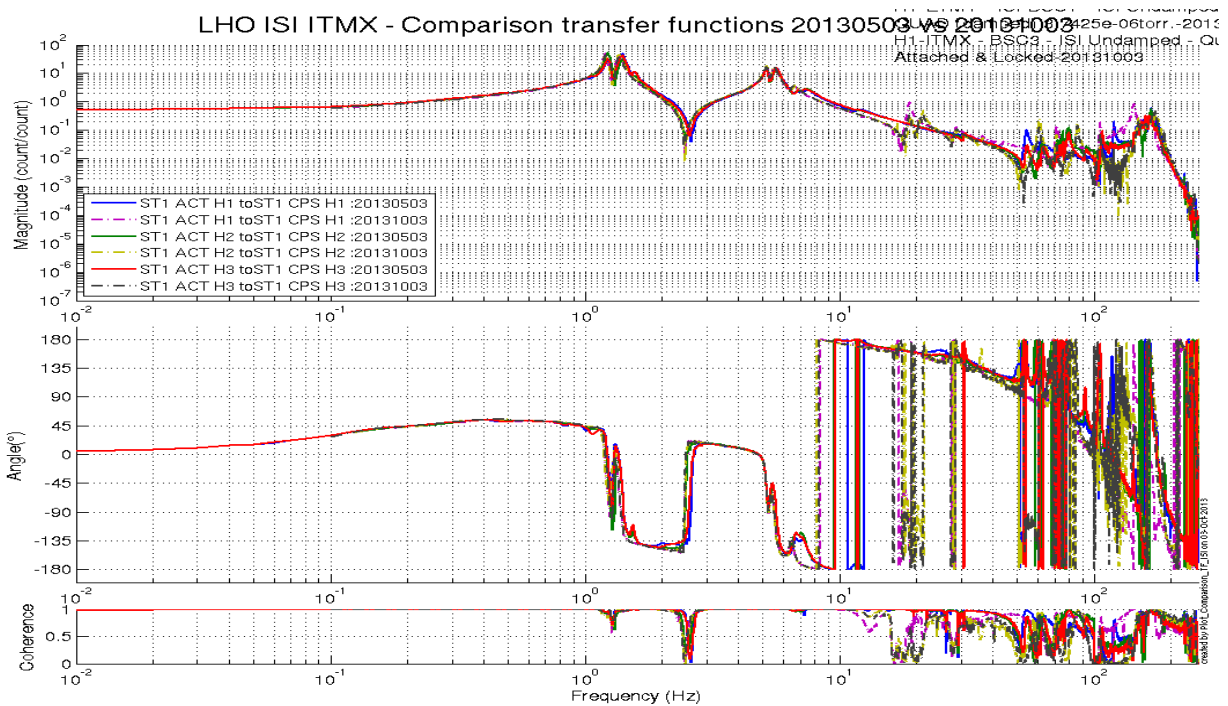


Figure 11 - Transfer functions comparison - ST1 ACT H to ST1 CPS H

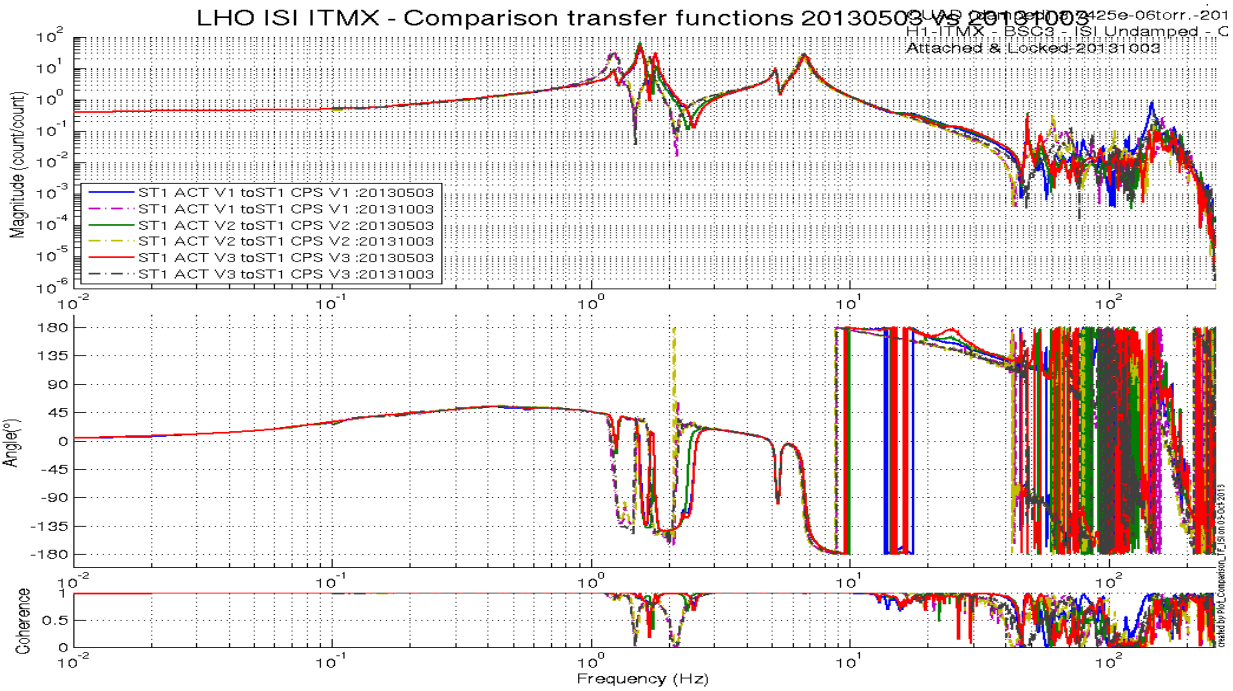


Figure 12 - Transfer functions comparison - ST1 ACT V to ST1 CPS V

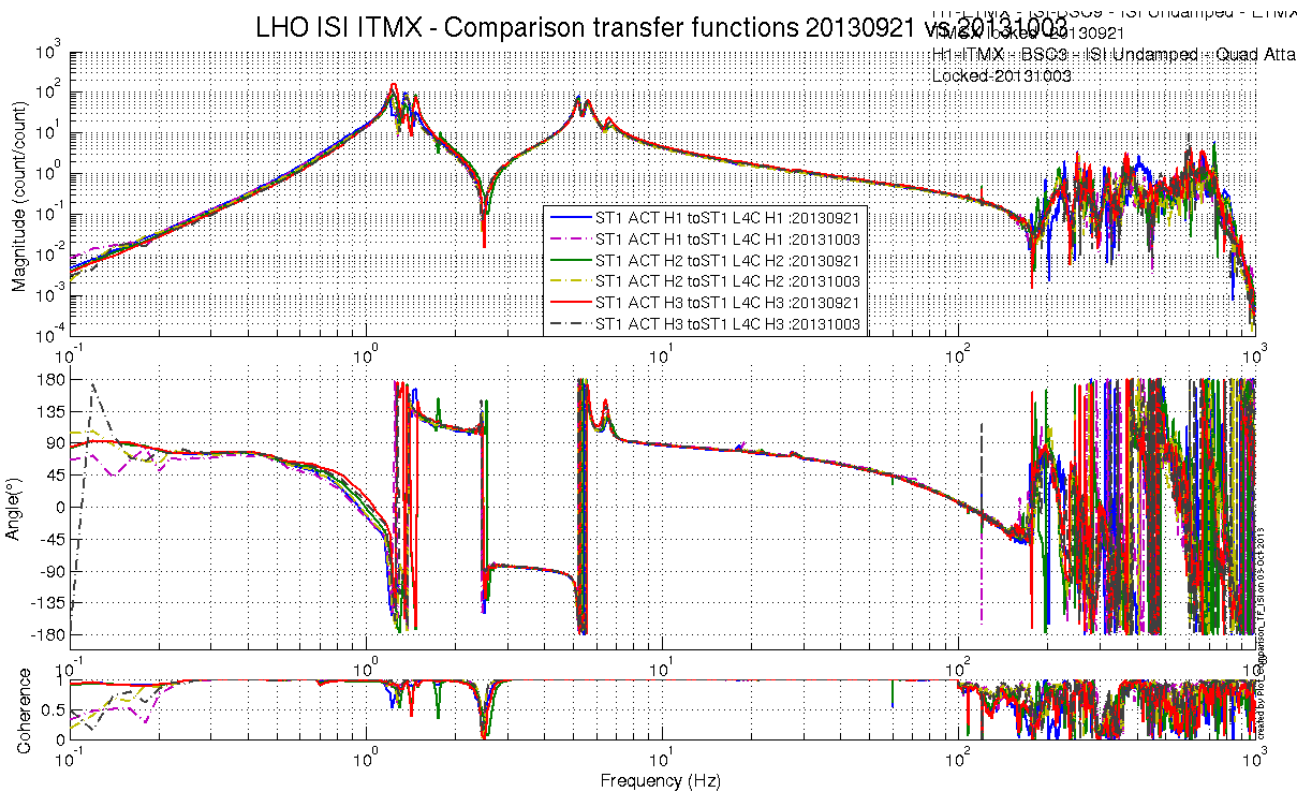
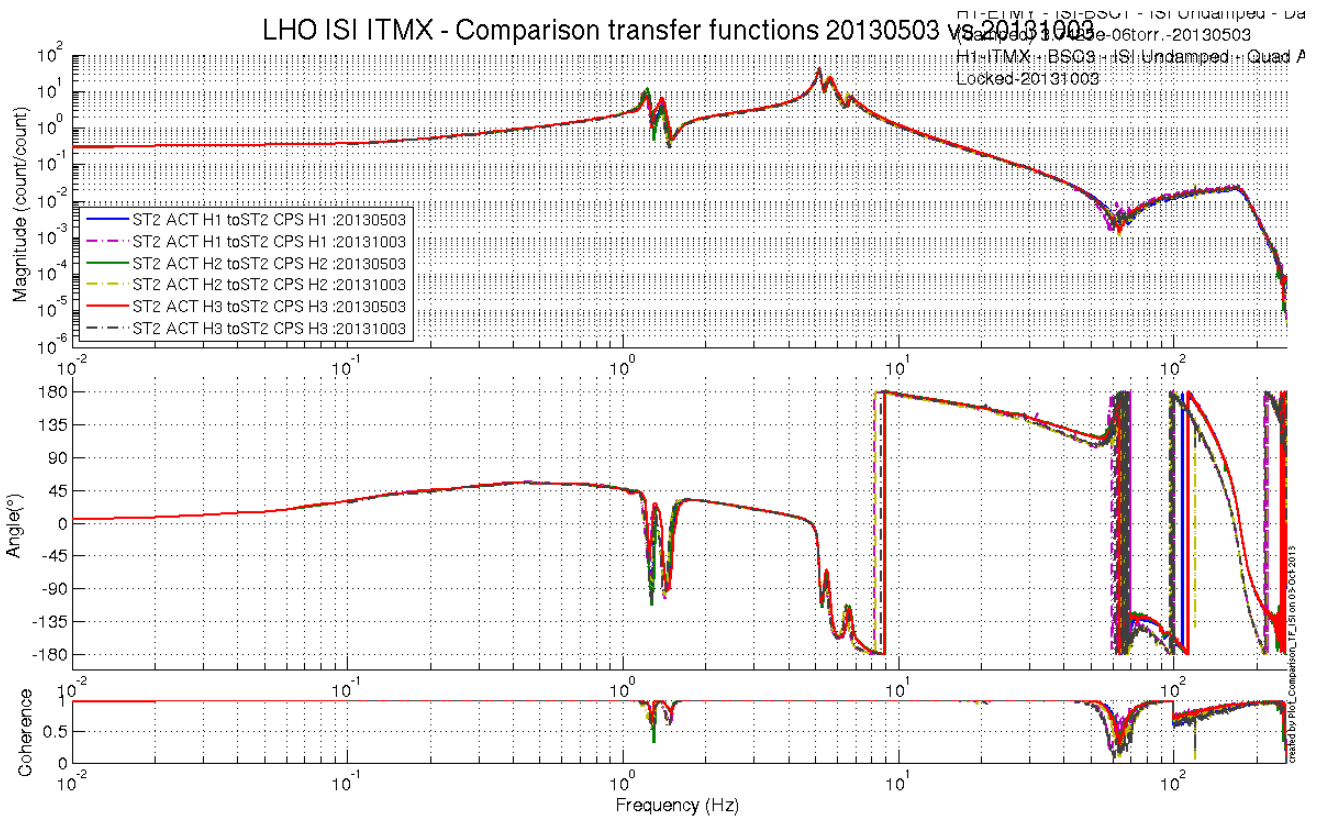
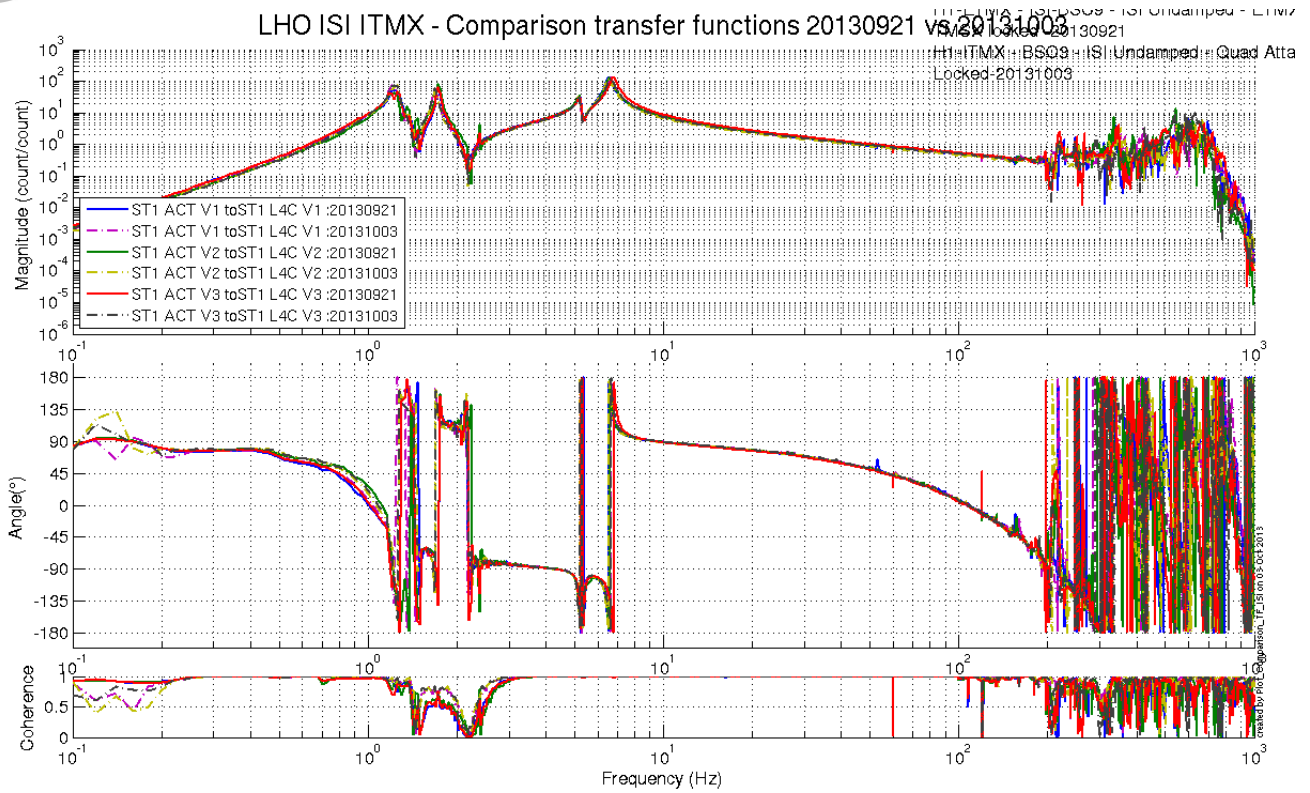


Figure 13 - Transfer functions comparison - ST1 ACT H to ST1 L4C H



LHO ISI ITMX - Comparison transfer functions 20130503 vs 20131003

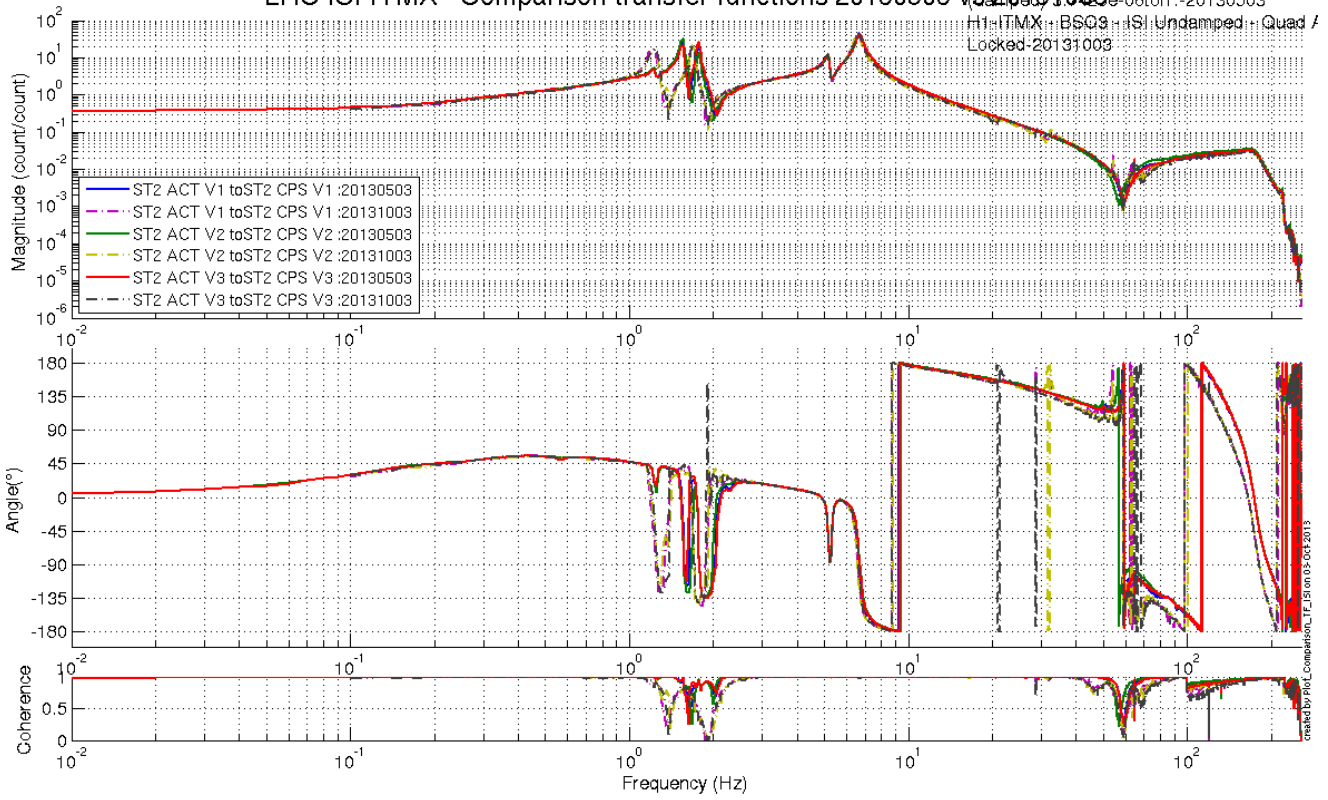


Figure 16 - Transfer functions comparison - ST2 ACT V to ST2 CPS V

LHO ISI ITMX - Comparison transfer functions 20130503 vs 20131003

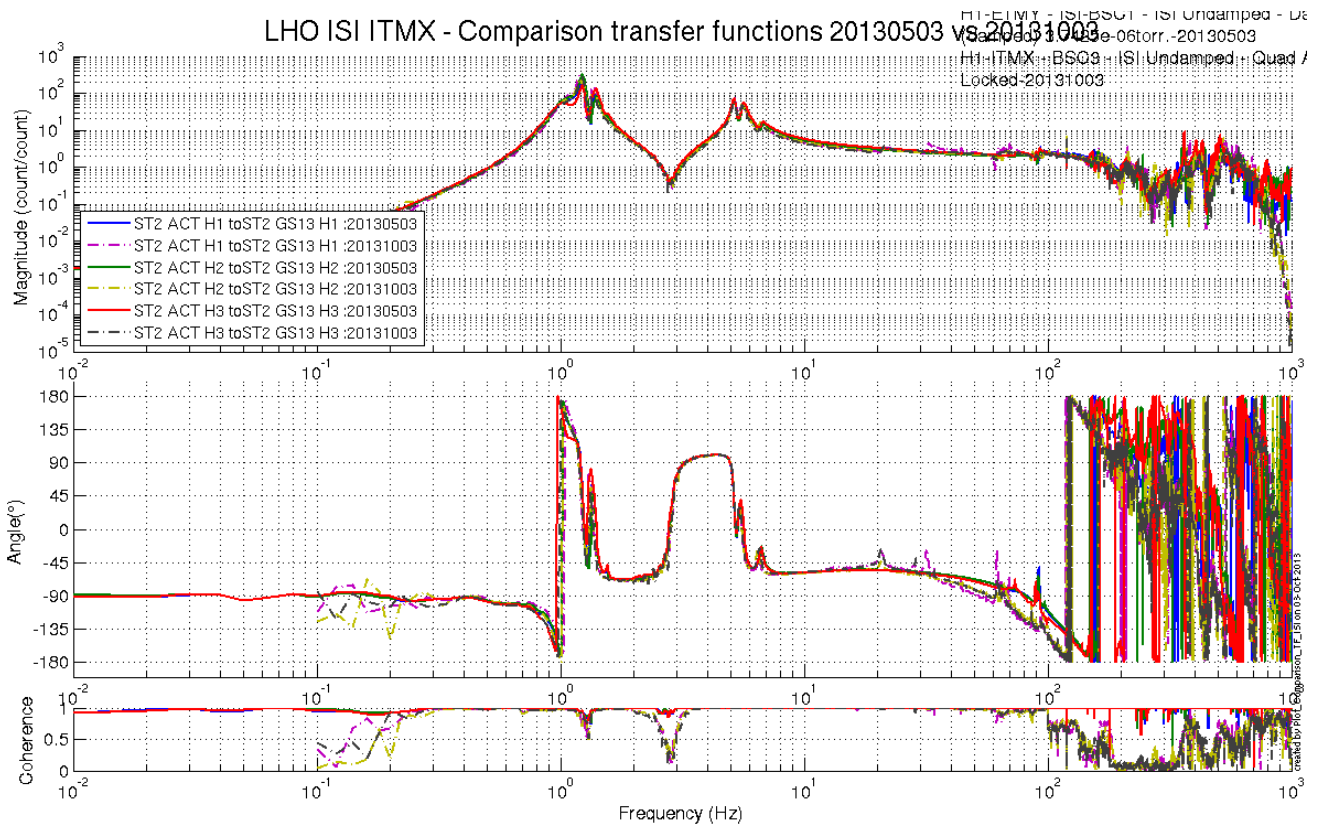


Figure 17 - Transfer functions comparison – ST2 ACT H to ST2 GS13 H

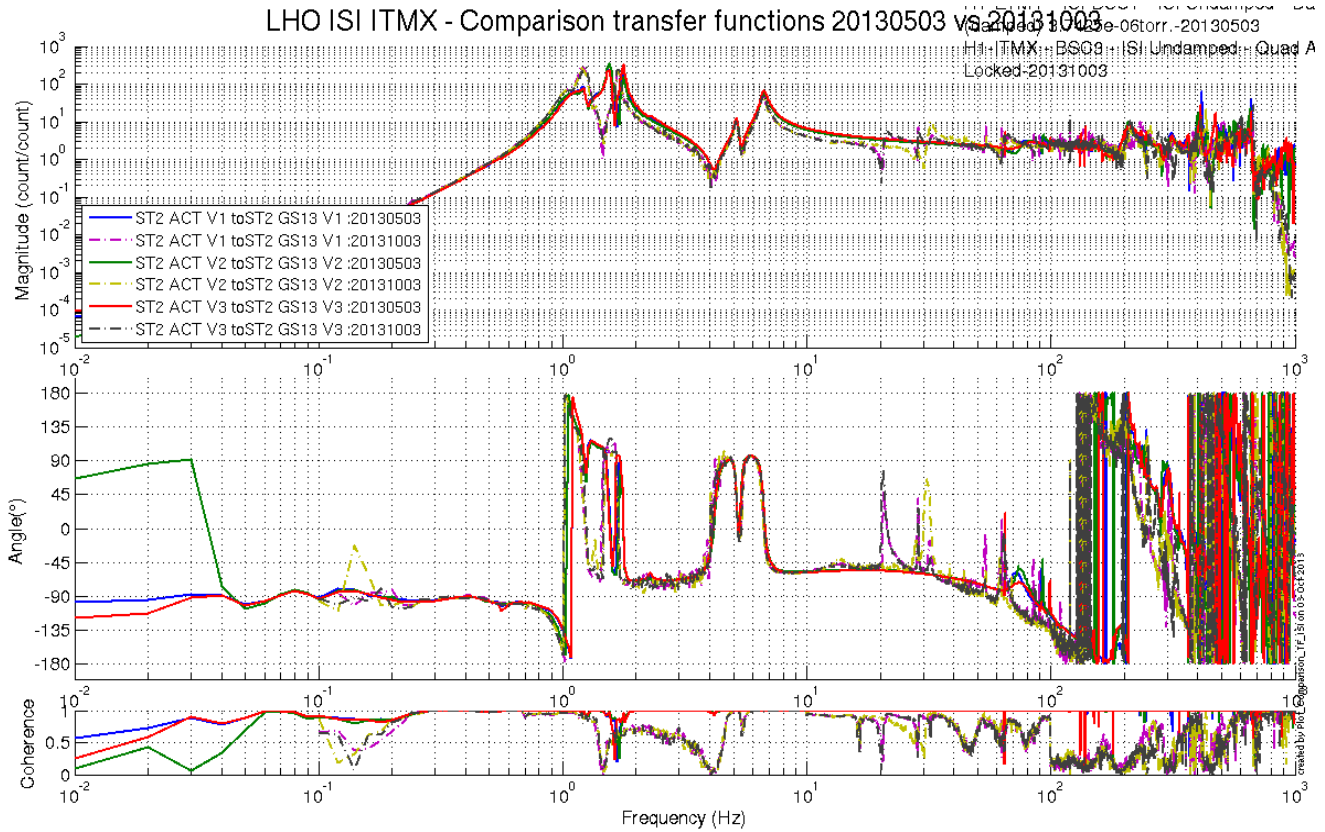


Figure 18 - Transfer functions comparison – ST2 ACT V to ST2 GS13 V

Test result: Passed: X Failed: ___ Waived: ___

7. Conclusion Phase II-a

Tests were validated with the SEI team on the Friday October 4th telecom meeting.

Test result: Passed: X Failed: ___ Waived: ___

Phase IIb Tests after Cartridge Install

Basic Functionality after Cartridge Installation

1. Pressure Sensors

All pressure sensors are working.
 seismic/BSC-ISI/H1/ITMX/Data/Static_Tests/

| Sensors | Pressure (kPa) | | |
|------------|----------------|----------|----------|
| | Corner 1 | Corner 2 | Corner 3 |
| ST1-L4C-D | 99.9 | 99.6 | 98.9 |
| ST1-L4C-P | 0.0 | 0.1 | -0.6 |
| ST1-GS13-D | 100.0 | 100.6 | 101.1 |
| ST1-GS13-P | 0.7 | 0.3 | -0.6 |
| ST1-T240-P | 102.0 | 101.5 | 101.7 |

Table 10 - Geophones Pressure sensors

Test result:

Passed: X Failed: Waived:

2. Spectra

Spectra of the seismometers can be found in the svn at:
 seismic/BSC-ISI/H1/ITMX/Data/Spectra/Undamped/

seismic/BSC-ISI/H1/ITMX/Data/Figures/Spectra/Undamped/

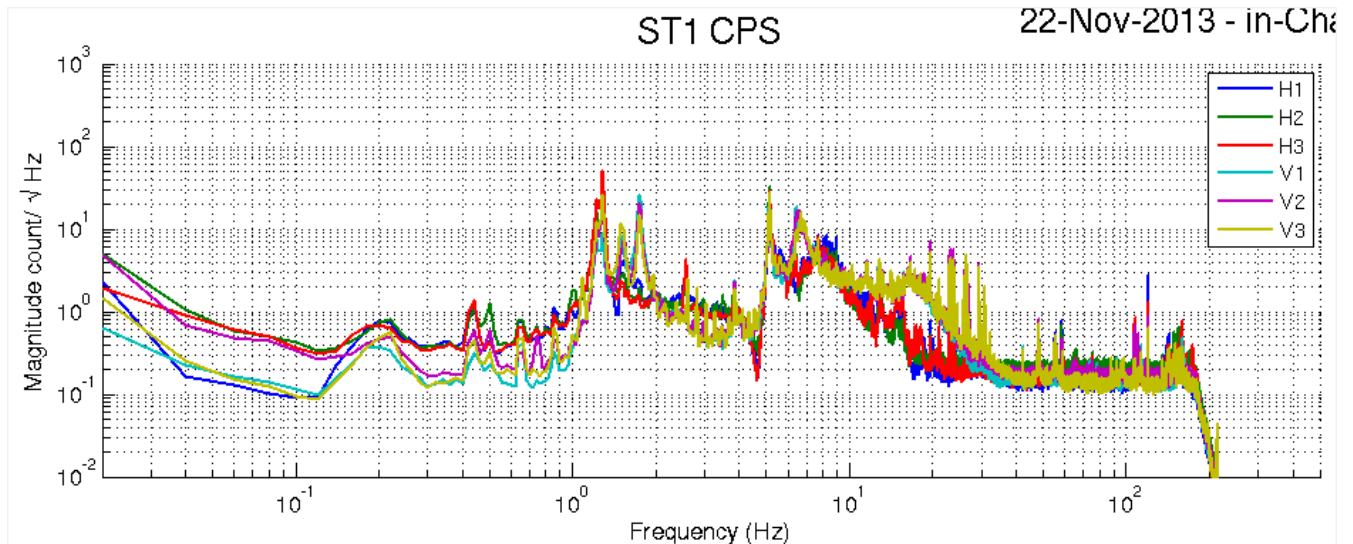


Figure 19 - St1 CPS Power Spectra

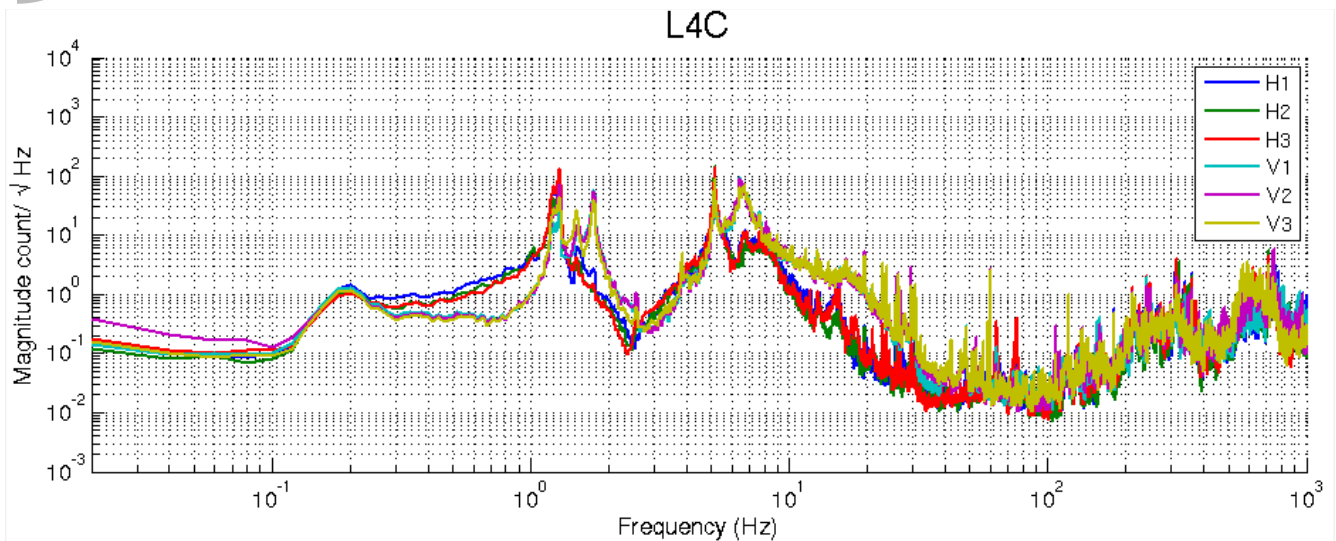


Figure 20 - St1 L4C Power Spectra

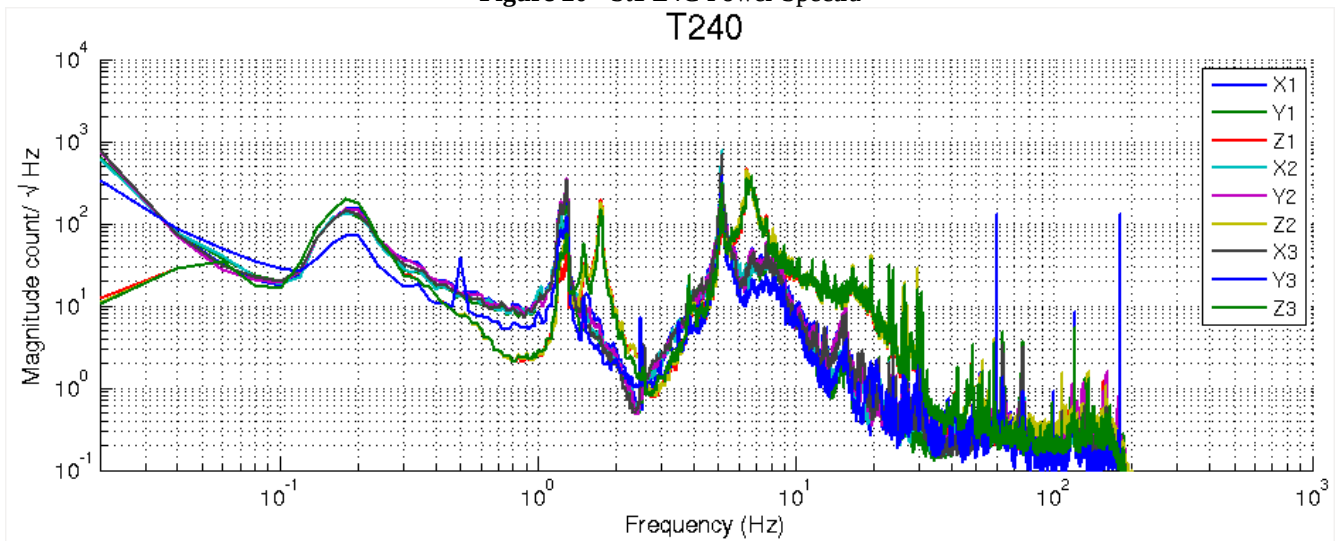


Figure 21 - St1 T240 Power Spectra

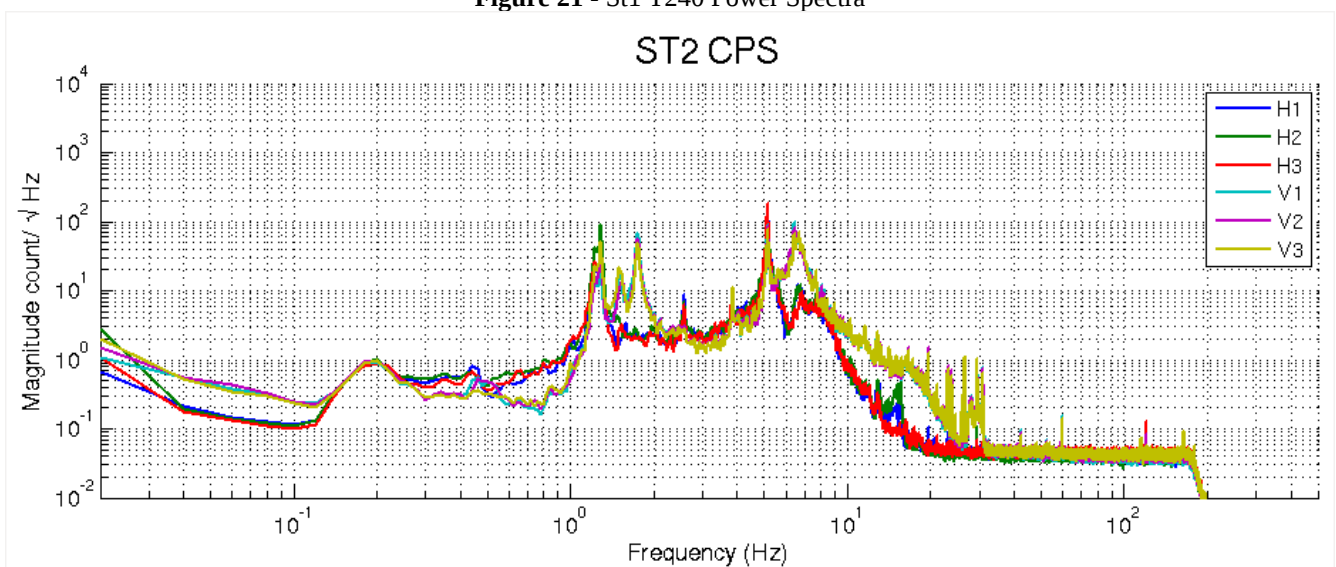


Figure 22 - St2 CPS Power Spectra

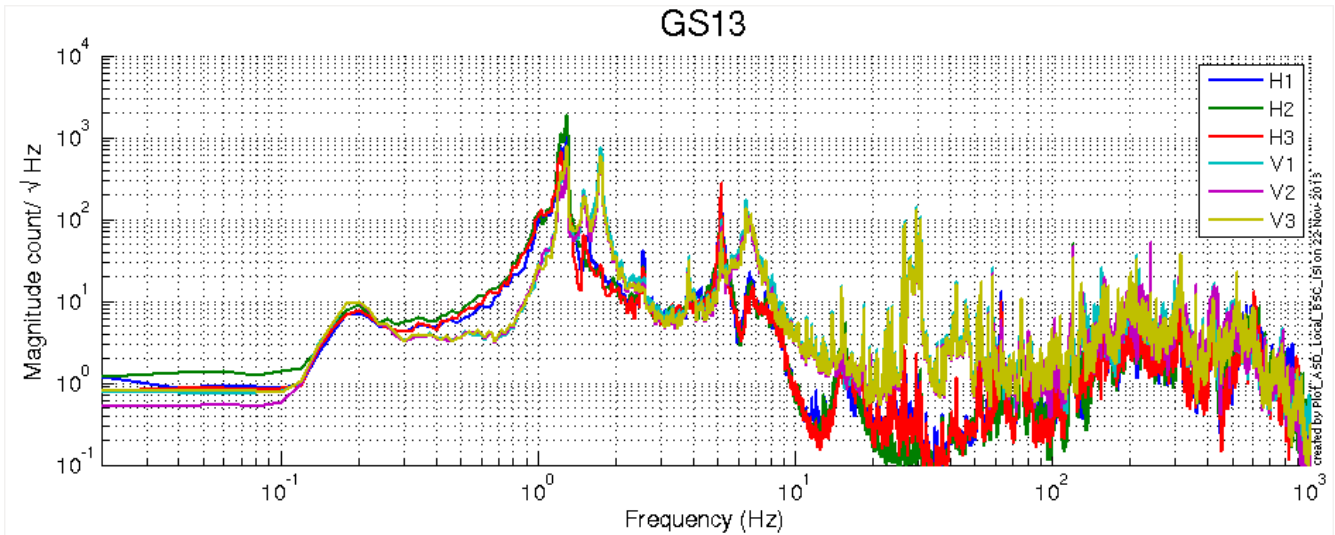


Figure 23 - St2 GS13 Power Spectra

After many trials, this unit passes.

Test result: **Passed:** X **Failed:** **Waived:**

3. Lock Unlock Shifts

| Sensors | Table locked | | Table unlocked | | Difference locked - unlocked | |
|----------|---------------|---------------|----------------|---------------|------------------------------|-------|
| | Offset (Mean) | Std deviation | Offset (Mean) | Std deviation | Offset (Mean) | mil |
| ST1 - H1 | -176.83 | 5.3365 | -783.16 | 28.776 | 606 | 0.72 |
| ST1 - H2 | 19.054 | 5.9156 | -1058.5 | 40.003 | 1078 | 1.28 |
| ST1 - H3 | 257.42 | 6.0686 | 299.77 | 31.682 | -42 | -0.05 |
| ST1 - V1 | 900.05 | 4.0875 | 264.57 | 29.398 | 635 | 0.76 |
| ST1 - V2 | -513.15 | 7.6202 | -924.8 | 26.771 | 412 | 0.49 |
| ST1 - V3 | 450.58 | 10.012 | 948.82 | 23.892 | -498 | -0.59 |
| ST2 - H1 | 181 | 13.895 | 13.583 | 43.453 | 167 | 0.05 |
| ST2 - H2 | 556.57 | 7.6247 | -434.15 | 40.182 | 991 | 0.29 |
| ST2 - H3 | 1321.3 | 7.5117 | -492.5 | 78.539 | 1814 | 0.54 |
| ST2 - V1 | 24.18 | 31.578 | 185.86 | 66.774 | -162 | -0.05 |
| ST2 - V2 | -112.37 | 30.132 | -357.39 | 69.98 | 245 | 0.07 |
| ST2 - V3 | -832.49 | 18.005 | -335.01 | 58.591 | -497 | -0.15 |

Table 11 - Lock/Unlock Shifts.

Locker shifts are within spec.

Test result: **Passed: X** **Failed:** **Waived:**

4. Range of motion

| Sensor readout (counts) | Negative drive | no drive | Positive drive | Amplitude count | mil |
|-------------------------|----------------|----------|----------------|-----------------|-----|
| ST1 - H1 | -16887.402 | -776 | 14866.002 | 31753 | 38 |
| ST1 - H2 | -15579.346 | -1064 | 15411.378 | 30991 | 37 |
| ST1 - H3 | -15679.082 | 300 | 16085.82 | 31765 | 38 |
| ST1 - V1 | -12701.182 | 277 | 13256.642 | 25958 | 31 |
| ST1 - V2 | -13695.652 | -957 | 11821.474 | 25517 | 30 |
| ST1 - V3 | -12040.23 | 971 | 13947.988 | 25988 | 31 |
| ST2 - H1 | -9428.7704 | 18 | 9463.7222 | 18892 | 6 |
| ST2 - H2 | -9906.378 | -432 | 9027.4782 | 18934 | 6 |
| ST2 - H3 | -9880.2426 | -490 | 8876.2002 | 18756 | 6 |
| ST2 - V1 | -10918.784 | 220 | 11339.668 | 22258 | 7 |
| ST2 - V2 | -11616.478 | -378 | 10838.696 | 22455 | 7 |
| ST2 - V3 | -11427.676 | -352 | 10715.468 | 22143 | 7 |

Table 12 - Range of motion under actuator drive

Range of motion is within spec.

Test result: **Passed: X** **Failed:** **Waived:**

5. CPS Linearity Test

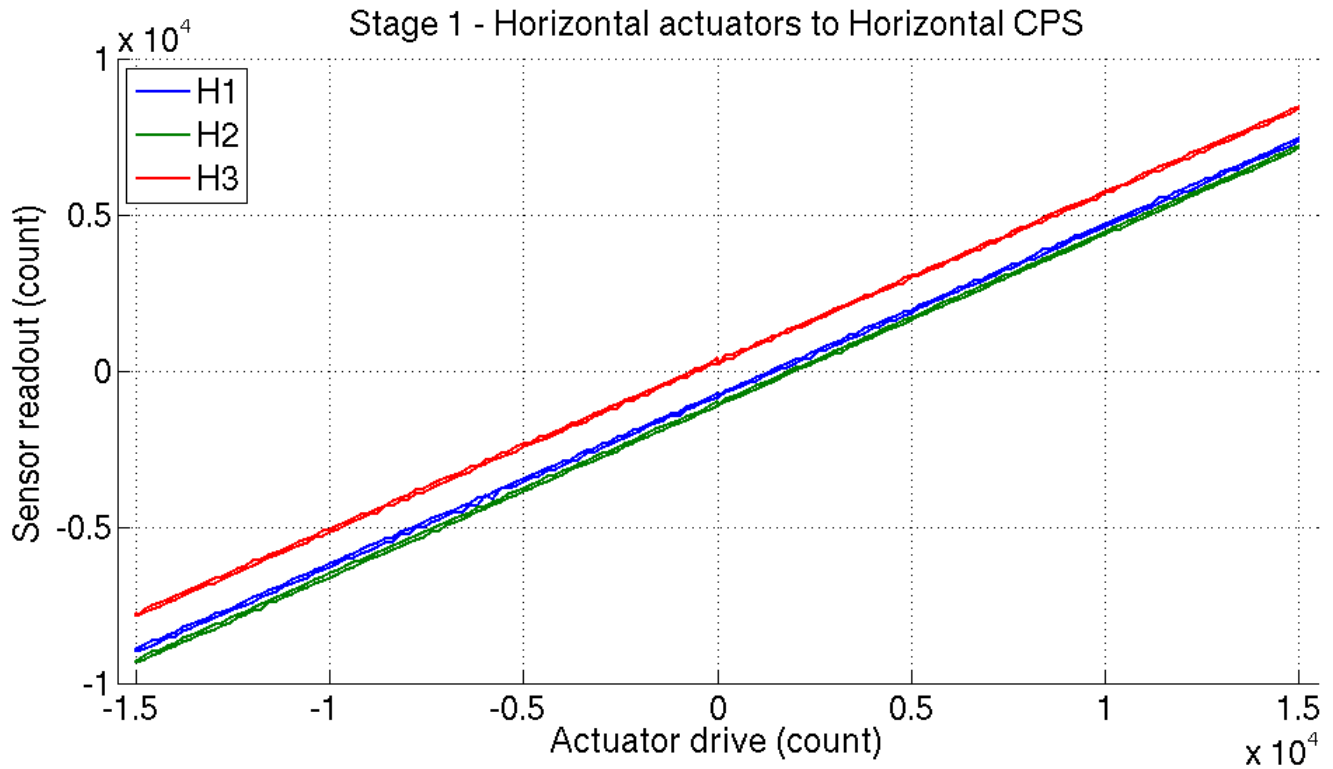


Figure 24 St1 Horizontal Sensor
Stage 1 - Vertical actuators to Vertical CPS

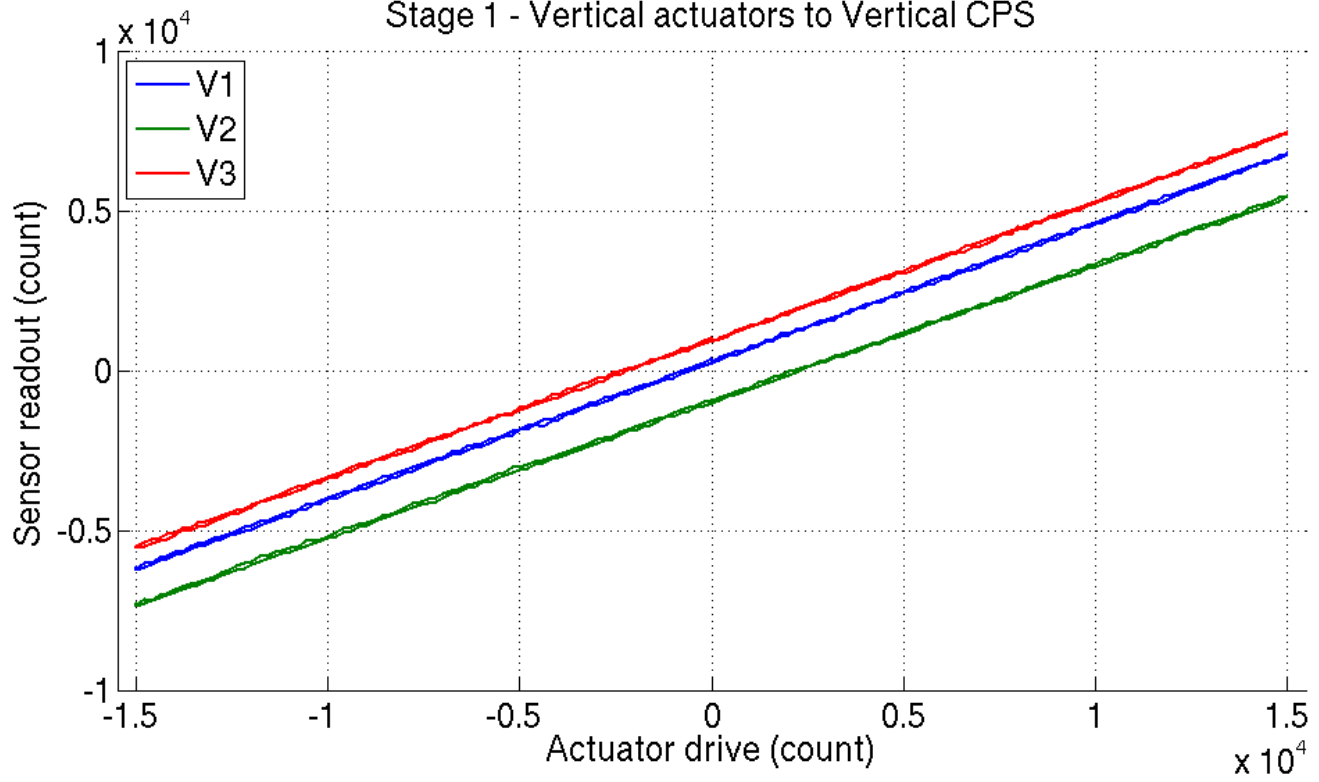


Figure 25 St1 Vertical

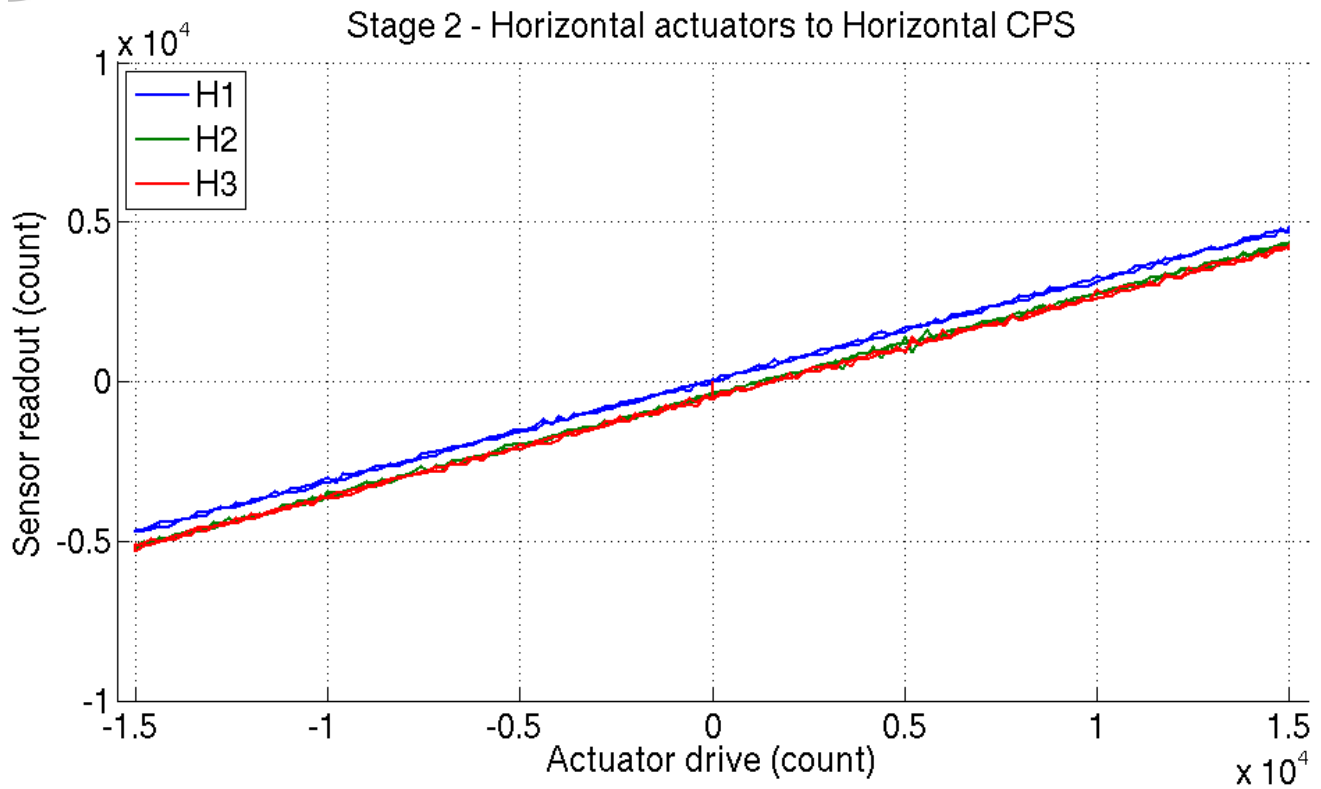


Figure 26 Stage 2 Horizontal

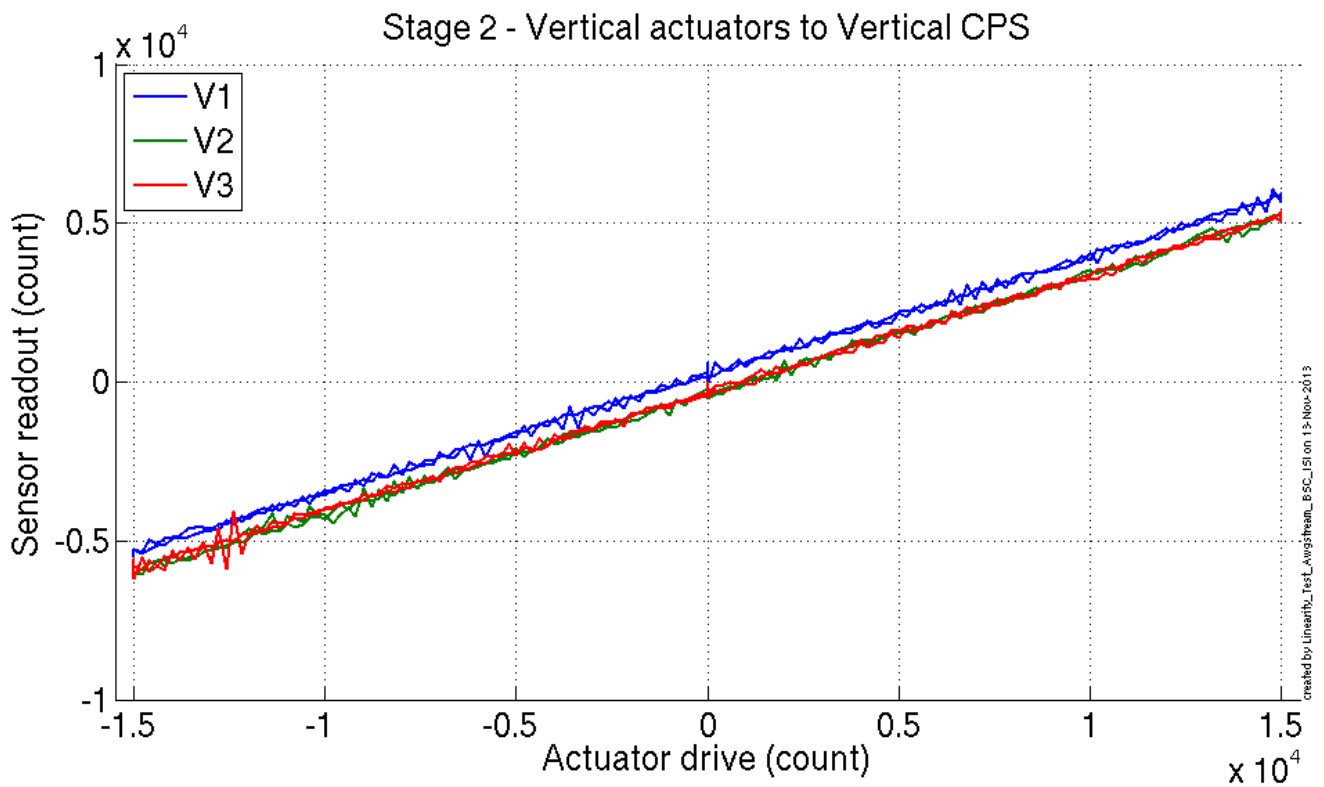


Figure 27 Stage 2 Vertical

CPS linearity is within spec.

Test result: **Passed: X** **Failed:** **Waived:**

| | | Slope | Offset | Average slope | Variation from average(%) |
|----------------|----------|-------|--------|---------------|---------------------------|
| Stage 1 | ST1 - H1 | 0.545 | -763 | 0.545 | 0.02 |
| | ST1 - H2 | 0.549 | -1047 | | 0.69 |
| | ST1 - H3 | 0.541 | 325 | | -0.71 |
| | ST1 - V1 | 0.432 | 310 | 0.430 | 0.50 |
| | ST1 - V2 | 0.425 | -935 | | -1.11 |
| | ST1 - V3 | 0.433 | 980 | | 0.60 |
| Stage 2 | ST2 - H1 | 0.316 | 41 | 0.315 | 0.22 |
| | ST2 - H2 | 0.316 | -418 | | 0.37 |
| | ST2 - H3 | 0.313 | -481 | | -0.58 |
| | ST2 - V1 | 0.372 | 235 | 0.373 | -0.17 |
| | ST2 - V2 | 0.375 | -370 | | 0.66 |
| | ST2 - V3 | 0.371 | -332 | | -0.49 |

Table 13 - Slope – Offset Linearity test

Test result: **Passed: X** **Failed:** **Waived:**

8. Transfer Functions after Cartridge Install

Transfer Functions are located in the SVN at:

/SeiSVN/seismic/BSC-ISI/H1/ITMX/Data/Transfer_Functions//Undamped/
H1_ISI_ITMX_Data_L2L_100mHz_700mHz_ST1_ST2_20131122-010237.mat
H1_ISI_ITMX_Data_L2L_700mHz_10Hz_ST1_ST2_20131121-173602.mat
H1_ISI_ITMX_Data_L2L_700mHz_10Hz_ST1_ST2_20131121-173602.mat
H1_ISI_ITMX_Data_L2L_10Hz_100Hz_ST1_ST2_20131121-215531.mat

L2L concatenated

/SeiSVN/seismic/BSC-ISI/H1/ITMX/Data/Transfer_Functions/Simulations/Undamped/
-H1_ISI_ITMX_TF_L2L_Raw_2013_11_21.mat

BSC-ISI - LHO ITMX - Nov 20th 2013 - Inchamber - Unlocked Damped malfunctioning SUS - HEPI unlocked - overnight

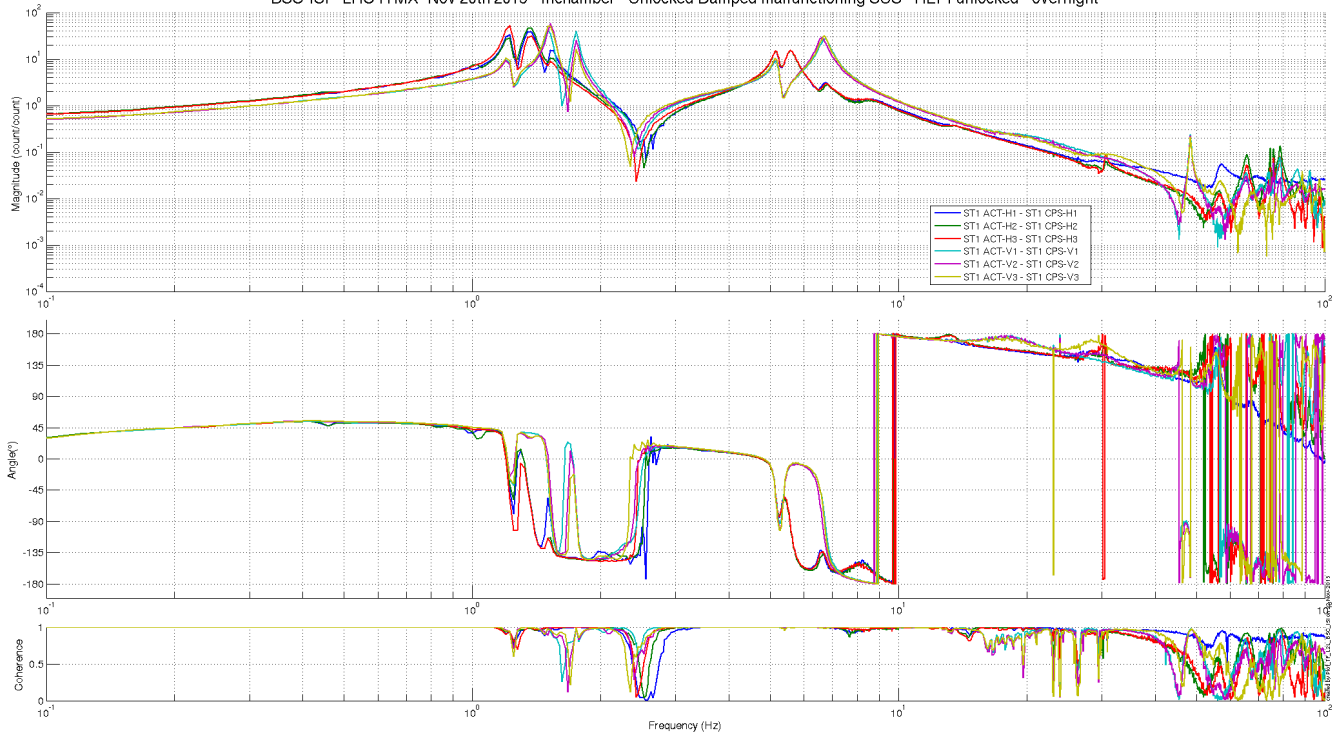


Figure 28 St1 Act to CPS

BSC-ISI - LHO ITMX - Nov 20th 2013 - Inchamber - Unlocked Damped malfunctioning SUS - HEPI unlocked - overnight

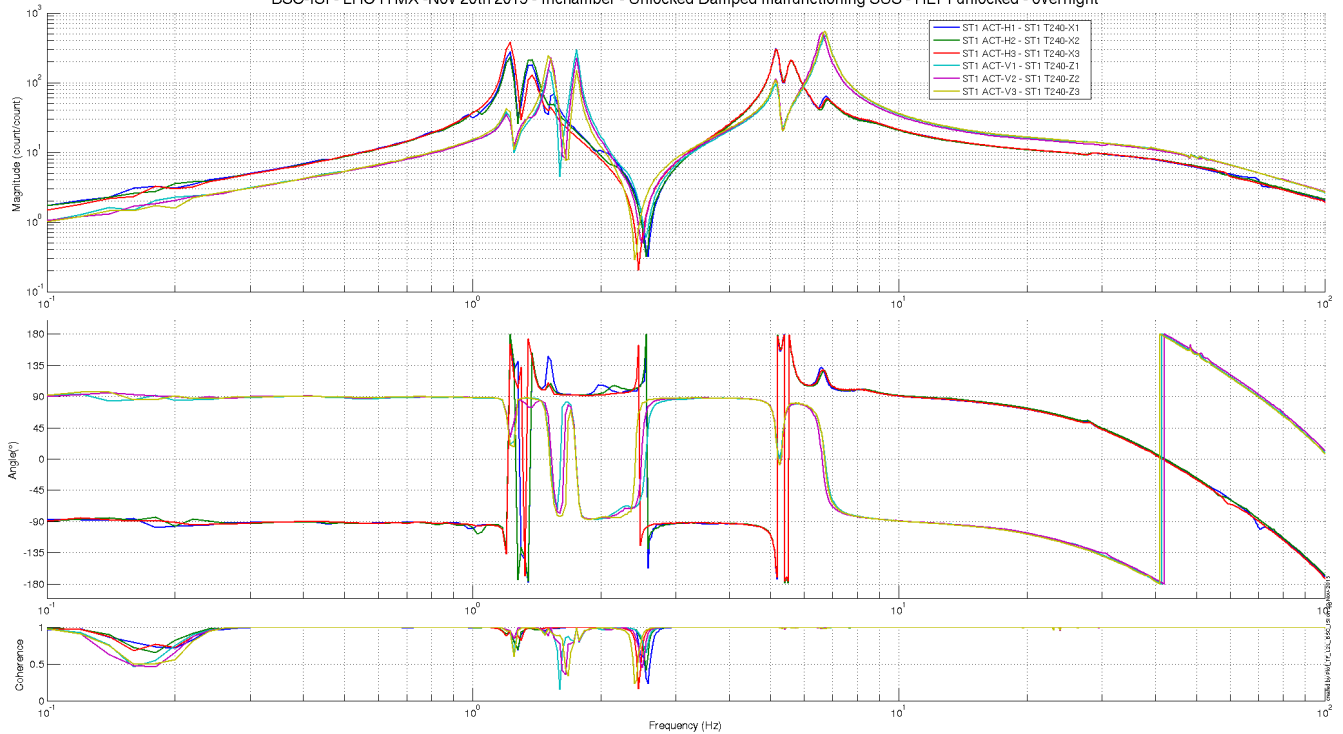


Figure 29 St1 Act to T240

BSC-ISI - LHO ITMX - Nov 20th 2013 - Inchamber - Unlocked Damped malfunctioning SUS - HEPI unlocked - overnight

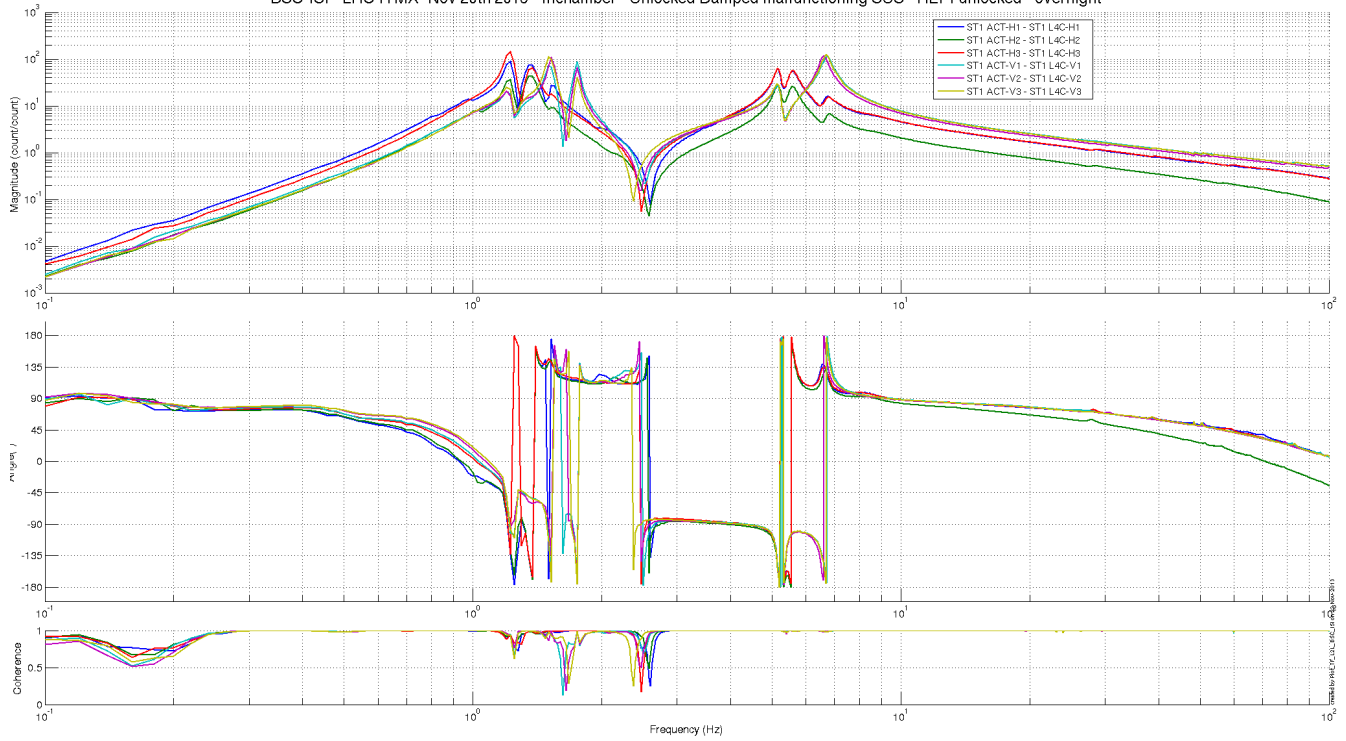


Figure 30 St1 Act to L4C

BSC-ISI - LHO ITMX - Nov 20th 2013 - Inchamber - Unlocked Damped malfunctioning SUS - HEPI unlocked - overnight

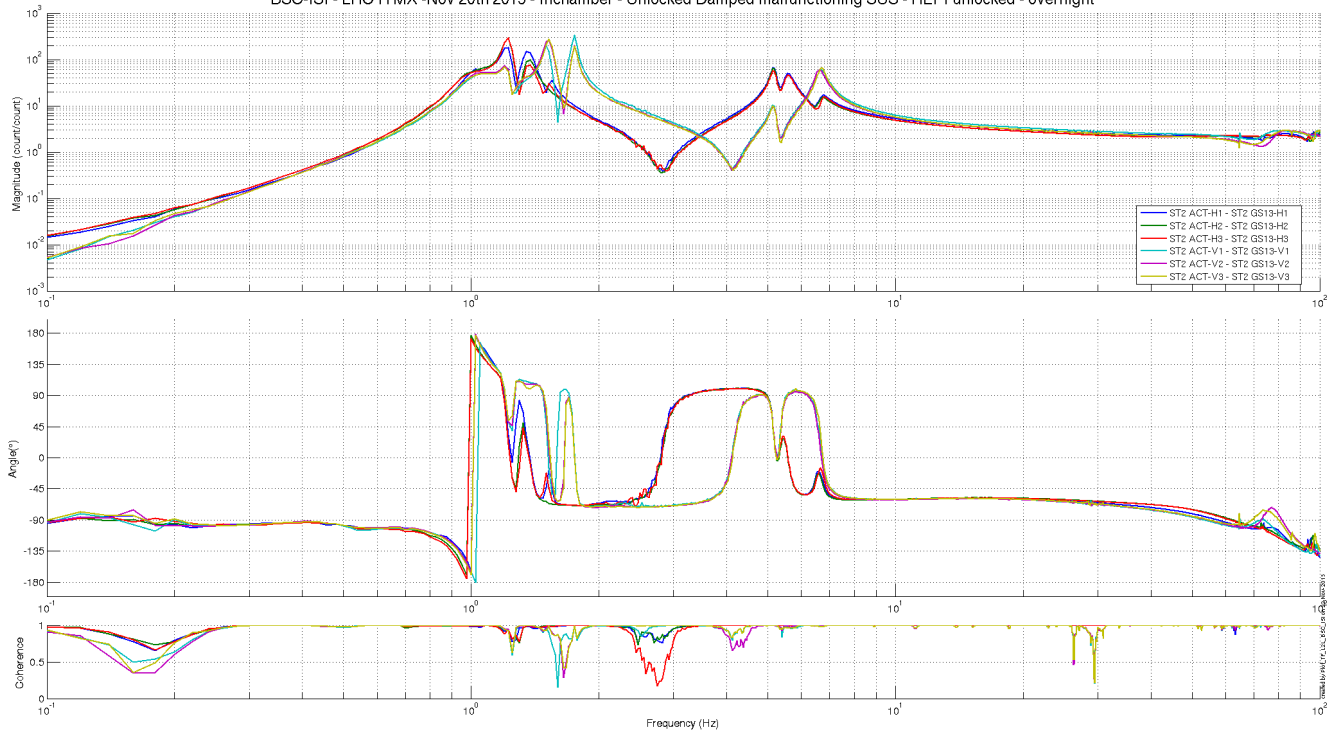
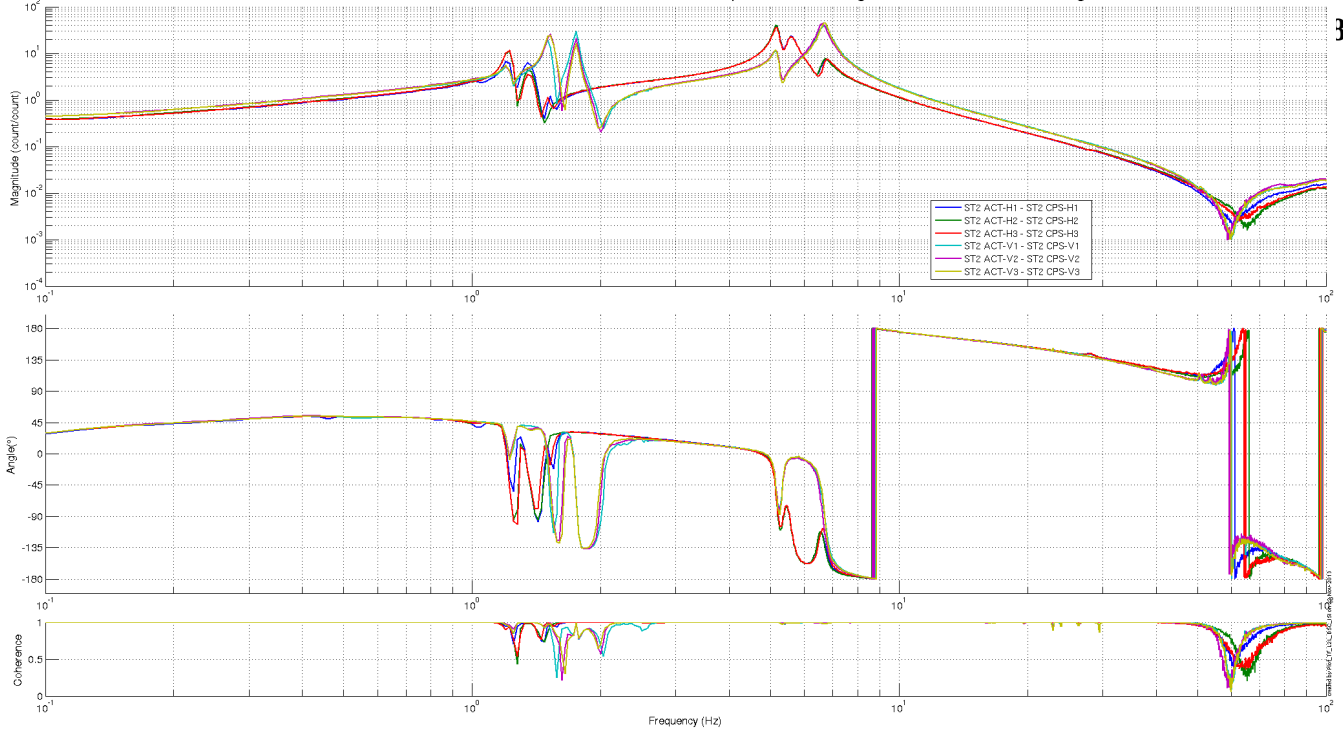


Figure 31 St2 Act to GS13
Figure 32 St2 Act to St2 CPS



Transfer functions look healthy, except for an L4C that seems to have been poorly plugged on the in-air side of the chamber. Will need to keep an eye on this unit during operation.

Test result: **Passed:** X **Failed:** **Waived:**

9. Conclusion Phase II-b

Test result: **Passed:** X **Failed:** **Waived:**