LIGO Laboratory / LIGO Scientific Collaboration

LIGO- E1300841-v2 *LIGO* 02/09/15

aLIGO HEPI H1 ETMY Assembly Validation Report

E1300841

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Distribution of this document:
Advanced LIGO Project

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of the LIGO Laboratory

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Contents

1. Introduction

This document summarizes the steps to be done to validate HEPI assemblies. Corresponding reports must be posted in :

LIGO-E1300454: aLIGO HEPI Testing Reports

2. Sub-Components Testing

- Kaman Inductive Position Sensors: calibration, linearity, factory data, noise measurements (E0900426 – HEPI Kaman Sensor Receiving Analysis - Results posted in the SVN)

- HEPI actuator linearity test (E1100338 – aLIGO HEPI Actuators Test Results)

- L4C test (Q0900007)

3. Load Cells assembly--BSC10

BSC HEPI load cell capacity → 3000 lbs
HAM HEPI load cell capacity → 2000 lbs

	Left Spring (lbs)	**Right Spring (lbs)**
Pier 1	1900	2110
Pier 2	2185	2090
Pier 3	2145	2260
Pier 4	1990	2250

Acceptance criteria:

- The values must not exceed 80% of the load cell capacity (2400lbs for BSC and 1600lbs for HAM).

Test result: **Passed: X** **Failed: ___**

4. Boot Location—Test Not Performed, HR

	Pier 1	Pier 2	Pier 3	Pier 4
Point 1a (Tangential)				
Point 1b (Tangential)				
Point 2a (Tangential)				
Point 2b (Tangential)				
Point 3 (Radial Back)				
Point 4 (Radial Front)				
Point 5 (Vertical)				

	Pier 1	Pier 2	Pier 3	Pier 4
Point 1a (Tangential)				
Point 1b (Tangential)				
Point 2a (Tangential)				
Point 2b (Tangential)				
Point 3 (Radial Back)				
Point 4 (Radial Front)				
Point 5 (Vertical)				

Acceptance criteria:

-

Test result: **Passed: ___** **Failed: ___**

5. Check Stops Gaps—Test Not Performed, HR

The stops must not touch the boot. There is 15 stops per boot, 5 per F bracket.

	Bracket 1	Bracket 2	Bracket 3															
	Gap1	Gap2	Gap3	Gap4 above	Gap4 under	Gap5	Gap1	Gap2	Gap3	Gap4 above	Gap4 under	Gap5	Gap1	Gap2	Gap3	Gap4 above	Gap4 under	Gap5
Pier 1																		
Pier 2																		
Pier 3																		
Pier 4																		

Test result: **Passed: ___** **Failed: ___**

6. Gaps check—Test Not Performed, HR

Four particular gaps need to be check.

Acceptance criteria:

- a 0.08” shim must fit in these two gaps

Issues/difficulties/comments regarding this test: Gap#1 is tricky to reach. At LASTI, the solution found was to tape the shim to an extension (rod, rigid ruler, etc.).
Gap#2 should be reachable by hand.
Gap#3 and 4 are tricky, but should also be doable (no picture)

	Gap#1	Gap#2	Gap#3	Gap#4
Pier 1				
Pier 2				
Pier 3				
Pier 4				

Test result: **Passed: ___** **Failed: ___**

7. IPS Centering-BSC10

Scripts files for processing and plotting in SVN at:
/SeiSVN/seismic/HEPI/Common/Testing_Functions_HEPI/
Offset_STD_IPS_Readback_HEPI.m

Data in SVN at:
/ligo/svncommon/SeiSVN/seismic/HEPI/H1/ETMY/Data/Static_Tests/
LHO_HPI_ETMY_IPS_Read_Back_Unlocked_20140312_11:30.mat

All the loops must be turned off during this test.

	H1	H2	H3	H4	V1	V2	V3	V4
Mean (counts)	-335	-252	-281	-293	129	136	69	283
Accep-tance	+/- 15000	+/- 15000	+/- 15000	+/- 15000	+/- 15000	+/- 15000	+/- 15000	+/- 15000

Test result: **Passed: _X_** **Failed: ___**

8. Sensor ASD

Scripts files for processing and plotting in SVN at:
/SeiSVN/seismic/HEPI/Common/Testing_Functions_HEPI/ASD_Measurements_Local_HEPI.m

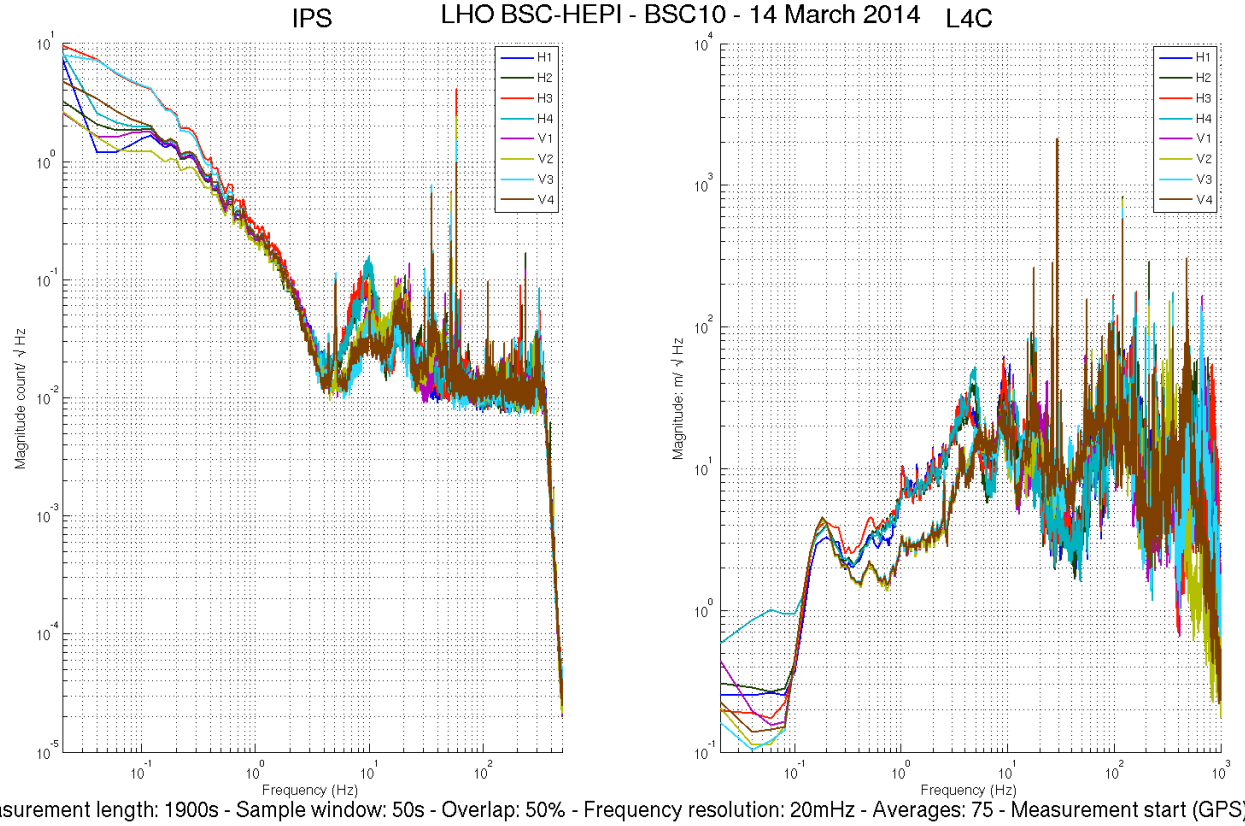
Data in SVN at:
SeiSVN/seismic/HEPI/H1/ETMY/Data/Spectra/Undamped/

H1_HPI_BSC10_ASD_m_IPS_L4C_20140318_08:04:50.mat

Figures in SVN at:

/SeiSVN/seismic/HEPI/H1/ETMY/Data/Figures/Spectra/Undamped/

H1_HPI_BSC10_ASD_m_IPS_L4C_20140318_08:04:50.fig



Measurement length: 1900s - Sample window: 50s - Overlap: 50% - Frequency resolution: 20mHz - Averages: 75 - Measurement start (GPS): 1079190306

Issues/difficulties/comments regarding this test:

Measurements were performed with ISI Lock.

Acceptance criteria: ??????

-

Test result: **Passed: _?__** **Failed: ___**

9. SUS-watchdogs interaction test—BSC10 Test not performed

This test will be obsolete very soon, as the payload-HEPI WD connection is planned for removal.

. Set up a zero value on the payload watchogs.
. Check that the payload watchdog screen of HEPI tripped.

. In the payload watchdog screen, click on the OVERRIDE button and reset the watchdog.

. Do the same process for all the payloads

Acceptance criteria:

- The HEPI must trip when the payload watchdogs are tripped
- The HEPI watchdogs could be reset when the OVERRIDE button is ON

Test result: **Passed: ____** **Failed: ____**

When this test is done, reset everything (OVERRIDE button OFF, put back the value on the payload watchdog).

10.Static Test local drive-BSC10

Scripts files for processing in SVN at:
/SeiSVN/seismic/HEPI/Common/Testing_Functions_HEPI/Static_Test_Local_Basis_HEPI.m
Data File: /SeiSVN/seismic/HEPI/H1/ETMY/Data/Static_tests/
LHO_HPI_BSC10_Offset_Local_Drive_20140313.mat

. ***Drive of 5000 counts***

	H1	H2	H3	H4	V1	V2	V3	V4
H1	9811	-3311	-821	-3436	-74	-239	78	112
H2	-3051	9704	-3725	-755	-193	144	202	50
H3	-737	-3358	9810	-3162	72	56	-88	-256
H4	-3396	-771	-3409	9894	159	77	-302	-58
V1	-104	-160	84	176	6810	1449	-1794	1037
V2	-236	182	47	64	1510	7036	1046	-1836
V3	132	243	-100	-279	-1803	1088	6788	1402
V4	168	103	-299	-5	1196	-1960	1554	7382

Table - Main couplings and cross couplings

Issues/difficulties encountered during this test:

Acceptance criteria:

-

Test result: **Passed: __X__** **Failed: ____**

11. Linearity Test/Range of motion in the local basis

Ran Range of Motion Script and it reported 'Short Range of Motion on V2'

However, the data viewer suggests all the IPS respond very similarly and I'd say the script is not evaluating this properly. Using possibly an old version (Vincent era, from H2 ETMy.)

Scripts files for processing and plotting in SVN at:

/SeiSVN/seismic/HEPI/Common/Testing_Functions_HEPI/Linearity_Test_Awgstream_HEPI.m

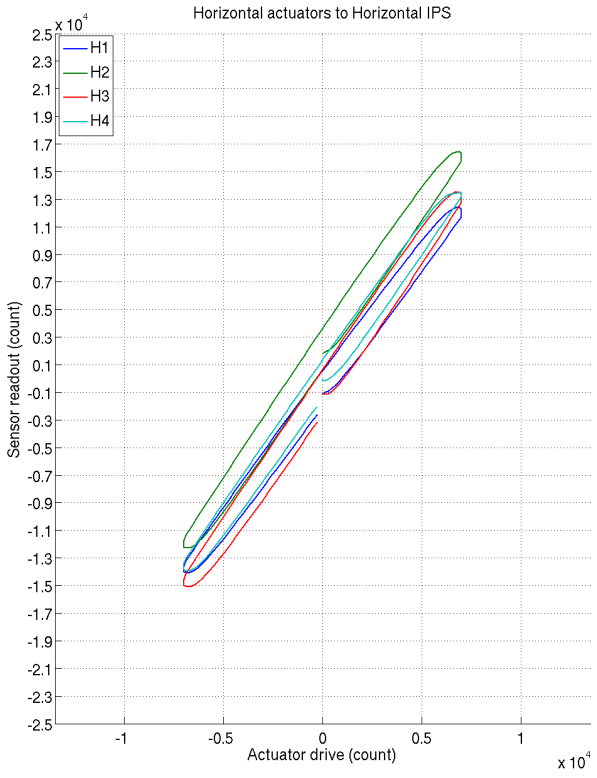
Data in SVN at:

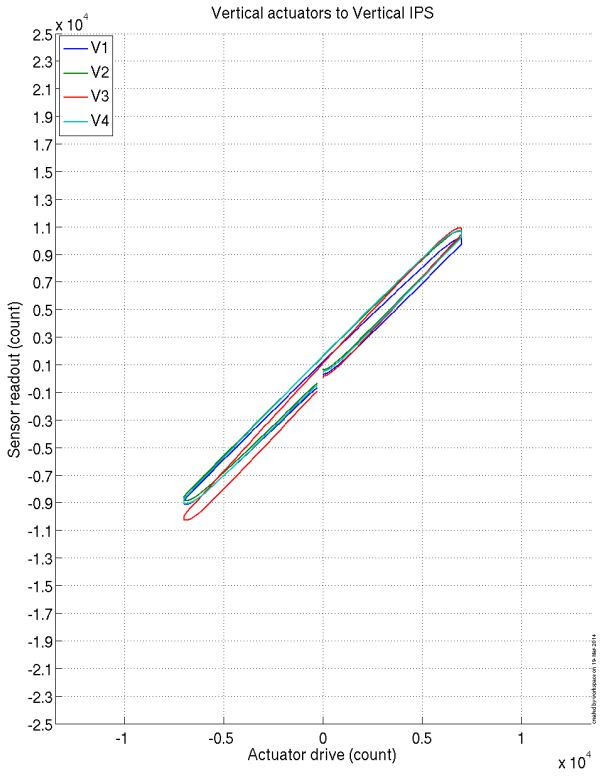
SeiSVN/seismic/HEPI/H1/ETMY/Data/Linearity_Test/
LHO_HPI_BSC10_Linearity_test_20140319T115413.mat

Figures in SVN at:

/SeiSVN/seismic/HEPI/H1/ETMY/Data/Figures/Linearity_Test/

	Slopes	Offsets
H1	1.910	-757
H2	2.081	2180
H3	2.071	-837
H4	2.003	8
V1	1.383	529
V2	1.409	911
V3	1.526	358
V4	1.425	837





Issues/difficulties encountered during this test:

Acceptance criteria:

- ???????

Test result: Looks Good **Passed: _?_** **Failed: ____**

12. Actuator Plate to Shields gap—Test Not Performed, HR

Perform this test ONLY if the range of motion test failed.

Three gaps per actuator need to be checked.

Acceptance criteria:

- A 0.1" shim must fit into the gap #1
- A 0.05 shim must fit into gap #2 and #3

	Horizontal	Vertical				
	Gap #1	Gap #2	Gap #3	Gap #1	Gap #2	Gap #3
Pier 1						
Pier 2						
Pier 3						
Pier 4						

Test result: **Passed: ____** **Failed: ____**

13. Valve Check—BSC-10, Test Not Performed

Scripts files for processing and plotting in SVN at:
/SeiSVN/seismic/HEPI/H1//Scripts/Valve_Check/plot_valve_check.m

Data in SVN at:
SeiSVN/seismic/HEPI/H1//Data/Spectra/Undamped/
/SeiSVN/seismic/HEPI/H1//Scripts/Valve_Check

Figures in SVN at:
/SeiSVN/seismic/HEPI/H1//Scripts/Valve_Check

Acceptance criteria: ????

-

Test result: **Passed: ___** **Failed: ____**

14.Local-to-local measurements

Band (Hz)	Res	Amplitude	Nreps	Time (s)	Time (min)	Time (h)
500-1000	0.25	1.0x1500 – 1500	250	4176*	69.6	1*
100 - 500	0.5	1.0x4000 – 4000	250	4176*	69.6	1.2*
10 - 100	0.25	1.0x4000 – 4000	200	6592*	109.9	1.8*
0.7 - 10	0.05	1.0x4000 – 4000	75	12320*	205.3	3.4*
0.1 - 0.7	0.025	1.0x4000 – 4000	30	10080*	168.0	2.8*
0.01 - 0.1	0.01	1.0x4000 – 4000	10	8960*	149.3	2.5*
0.002 - 0.01	0.002	1.0x4000 – 4000	2	12160*	202.7	3.4*
						16.1*

*: Values Need to be updated

Data files in SVN at:
/SeiSVN/seismic/HEPI/H1/ETMY/Data/Transfer_Functions/Measurements/Undamped/

LHO_HPI_BSC10_Data_L2L_2mHz_10mHz_20140322-071150.mat
LHO_HPI_BSC10_Data_L2L_10mHz_100mHz_20140322-042942.mat
LHO_HPI_BSC10_Data_L2L_100mHz_700mHz_20140322-013656.mat
LHO_HPI_BSC10_Data_L2L_700mHz_10Hz_20140321-220929.mat
LHO_HPI_BSC10_Data_L2L_10Hz_100Hz_20140321-201940.mat
LHO_HPI_BSC10_Data_L2L_100Hz_500Hz_20140321-191021.mat
LHO_HPI_BSC10_Data_L2L_500Hz_1000Hz_20140321-165354.mat

Data is called by Case #4 of:
/ligo/svncommon/SeiSVN/seismic/HEPI/H1/ETMY/Data/Transfer_Functions/Measurements/Undamped/Measurements_List_H1_HPI_ETMY.m

Data collection script files:
/SeiSVN/seismic/HEPI/Common//Transfer_Function_Scripts/

- Run_TF_L2L_500Hz_1000Hz_HEPI.m
- Run_TF_L2L_100Hz_500Hz_HEPI.m
- Run_TF_L2L_10Hz_100Hz_HEPI.m
- Run_TF_L2L_700mHz_10Hz_HEPI.m
- Run_TF_L2L_100mHz_700mHz_HEPI.m
- Run_TF_L2L_10mHz_100mHz_HEPI.m
- Run_TF_L2L_2mHz_10mHz_HEPI.m

Scripts files for processing and plotting in SVN at:
/SeiSVN/seismic/HEPI/H1/ETMY/Scripts/Control_Scripts/Version_5/

- Step_1_TF_Loc_to_Loc_H1_HEPI_ETMY.m

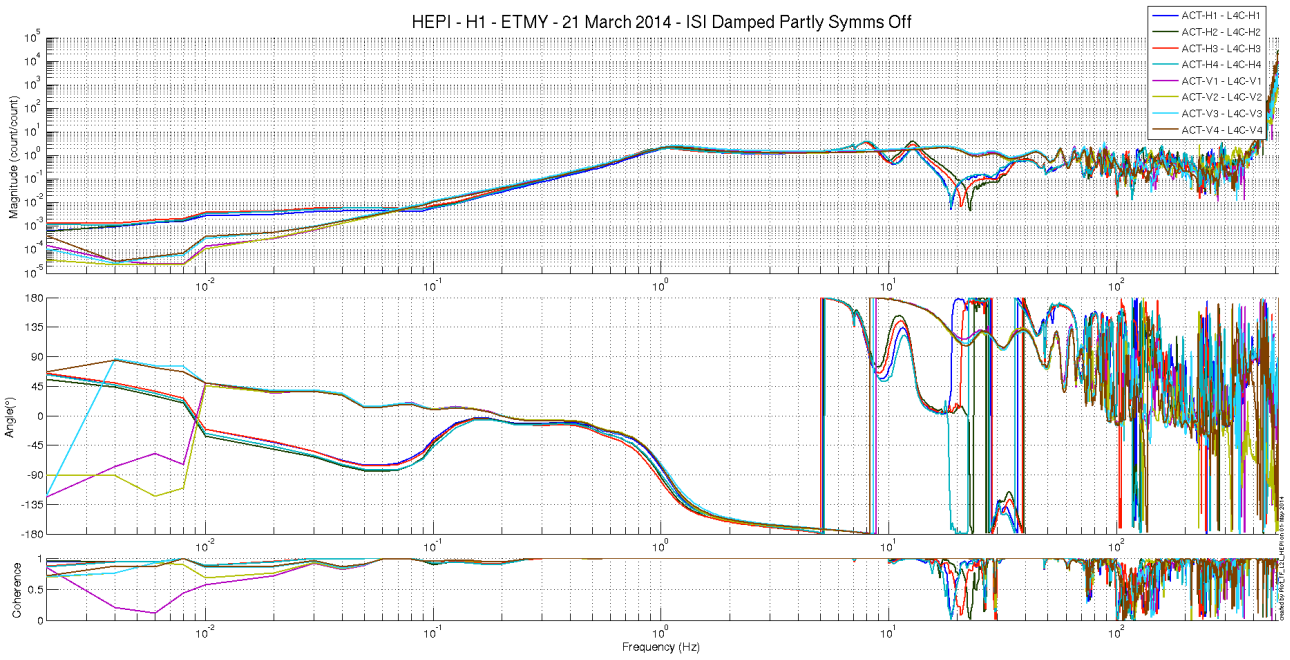
Figures in SVN at:
/SeiSVN/seismic/HEPI/H1/ETMY/Data/ Figures/Transfer_Functions/Measurements/Undamped/

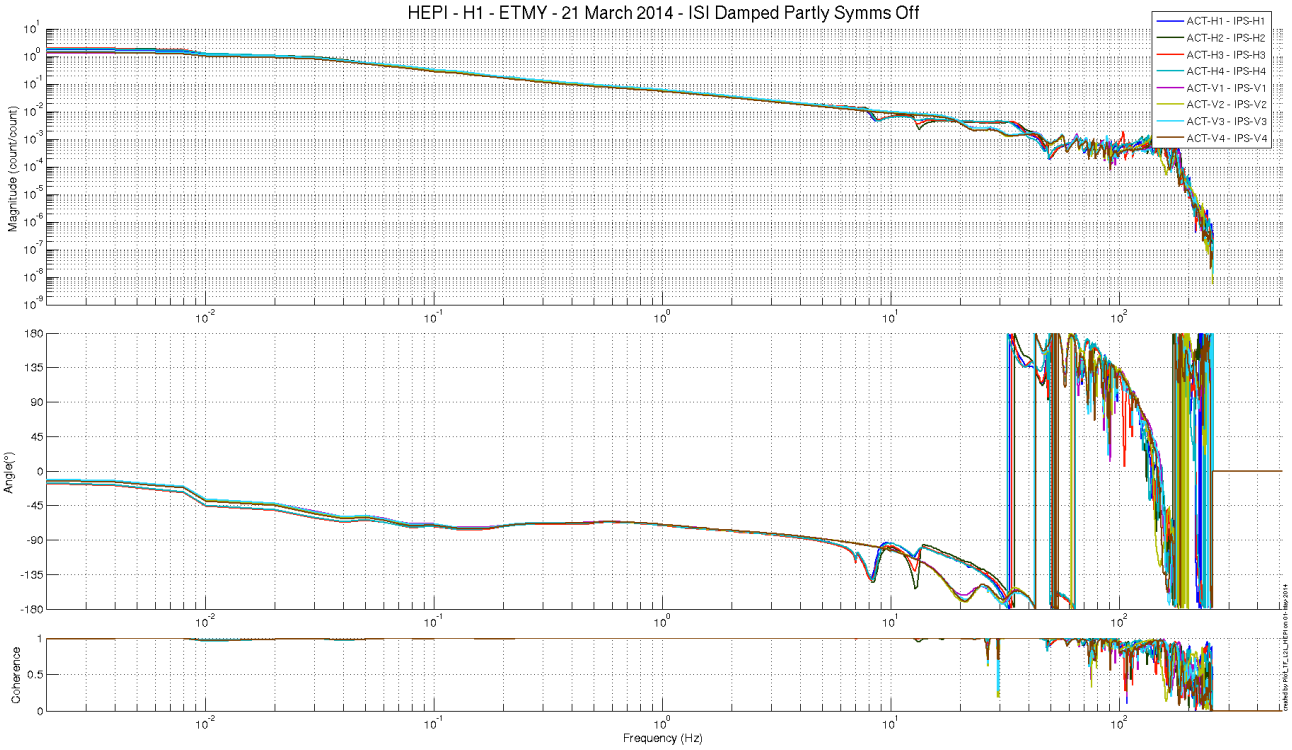
- H1_HPI_ETMY_TF_L2L_Raw_from_ACT_to_IPS_2014_03_21.fig
- H1_HPI_ETMY_TF_L2L_Raw_from_ACT_to_L4C_2014_03_21.fig

Storage of measured transfer functions in the SVN at:
/SeiSVN/seismic/HEPI/H1/ETMY/Data/Transfer_Functions/Simulations/Undamped/

- H1_HPI_ETMY_TF_L2L_Raw_2014_03_21.mat

The local-to-local transfer functions are presented below.





Issues/difficulties/comments regarding this test: – BSC10, SYM filters on—this may be an issue? Also, started ISI damped but Stage2 tripped at the beginning of the H1 .7—10Hz band, and Stage1 tripped during the V2 2-10mHz TF. Will rerun w/o sym filter if possible.
Version2-- Updating TFs with Symm filters off.

Acceptance criteria:

- On IPS, the phase must be 0º at DC
- On geophones, the phase must be 90º at DC—Not sure if this is true, HR
- Identical shape in each corner

Test result: **Passed: _X_** **Failed: ___**

15. Alignment offsets:

Those are the IPS readouts that were recorded, after alignment work was performed—These numbers would nominally be all zero because after alignment and we attached the actuator and got a confirm that alignment was good, the IPS would be set to zero. However, once testing commences, the platforms will settle more, splay out if you will etc.
The numbers below are with the platform now in its nominal alignment and where the system operates. These values are good for the performance of the IPS. Much above 15000 would start to approach badness where the response loses linearity

	IPS Readouts HEPI Isolated	Cartesian DOF	TARGET
H1	-2575	X	145400
H2	2020	Y	29500
H3	1650	Z	-144800
H4	-4360	RX	-10900
V1	-4060	RY	8400
V2	-2650	RZ	6700
V3	-2640	HP	-24200
V4	-2450	VP	-9900

Issues/difficulties encountered during this test:
Readings were retrieved from medms 9 Feb 2015.

Acceptance criteria:
Values near and certainly above 15000 should be reduced by centering or other action.

Test result: **Passed: _X_** **Failed: ___**