LIGO Laboratory / LIGO Scientific Collaboration

LIGO- E1300841

LIGO

Date (fixed)

aLIGO HEPI H1 ETMY
Assembly Validation Report

E1300841

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Distribution of this document:
Advanced LIGO Project

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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

<u>Issues/difficulties/comments regarding this test</u>: 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
Acceptance	+/- 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
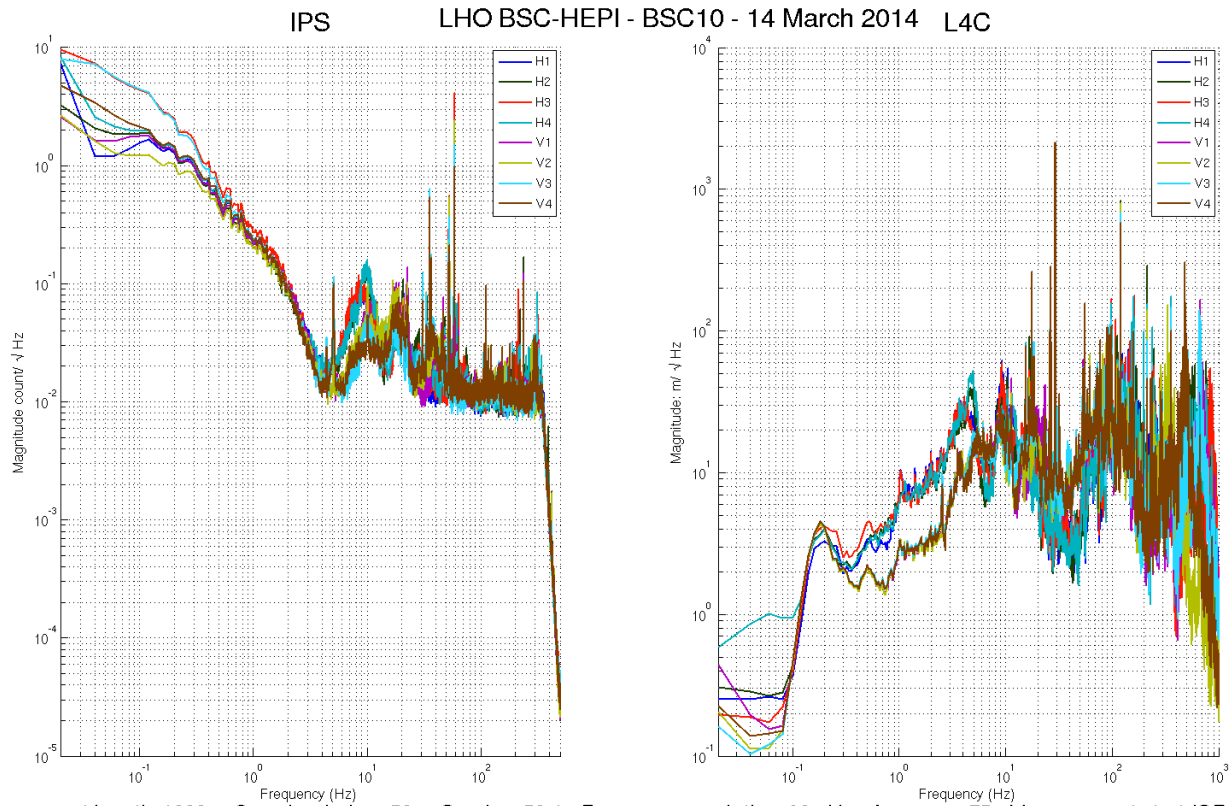
Data in SVN at:
SeiSVN/seismic/HEPI/H1/ETMY/Data/Spectra/Undamped/

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:
- The results in these three tables must be the same (within ???%)If you drive different amounts, why would you expect the results to be the same? HR

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

Horizontal actuators to Horizontal IPS

Vertical actuators to Vertical IPS
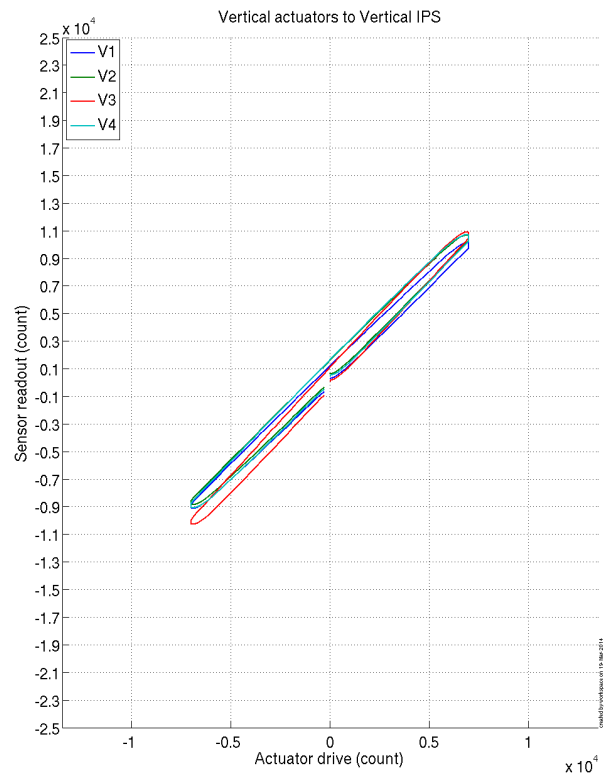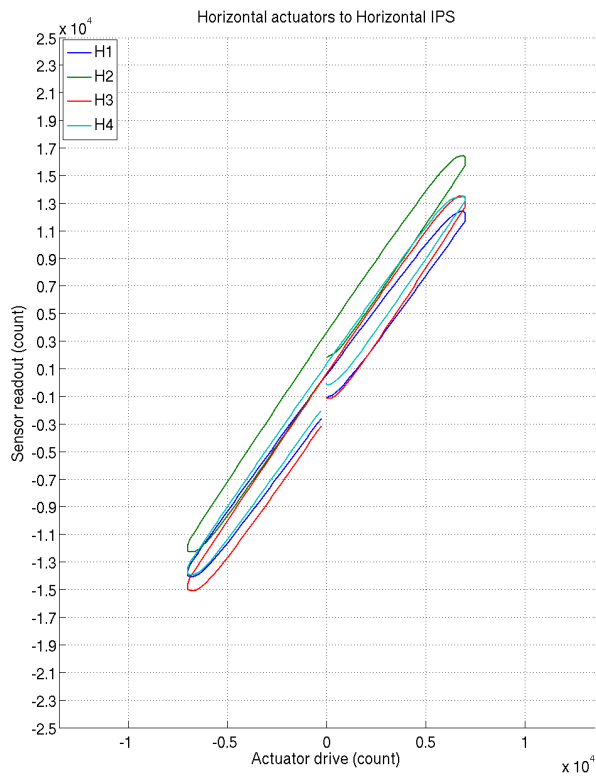
<u>Issues/difficulties encountered during this test</u>: Script modified to insure data retrieval--HR
Acceptance criteria:
- ???????

Test result: 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/HAM2/Scripts/Valve_Check/plot_valve_check.m

Data in SVN at:
SeiSVN/seismic/HEPI/H1/HAM2/Data/Spectra/Undamped/
/SeiSVN/seismic/HEPI/H1/HAM2/Scripts/Valve_Check

Figures in SVN at:
/SeiSVN/seismic/HEPI/H1/HAM2/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_500Hz_1000Hz_20140314-042923.mat
- LHO_HPI_BSC10_Data_L2L_100Hz_500Hz_20140314-194824.mat
- LHO_HPI_BSC10_Data_L2L_10Hz_100Hz_20140314-205735.mat
- LHO_HPI_BSC10_Data_L2L_700mHz_10Hz_20140314-224718.mat
- LHO_HPI_BSC10_Data_L2L_100mHz_700mHz_20140315-021437.mat
- LHO_HPI_BSC10_Data_L2L_10mHz_100mHz_20140315-050717.mat
- LHO_HPI_BSC10_Data_L2L_2mHz_10mHz_20140315-074917.mat

Data is called by Case #2 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/
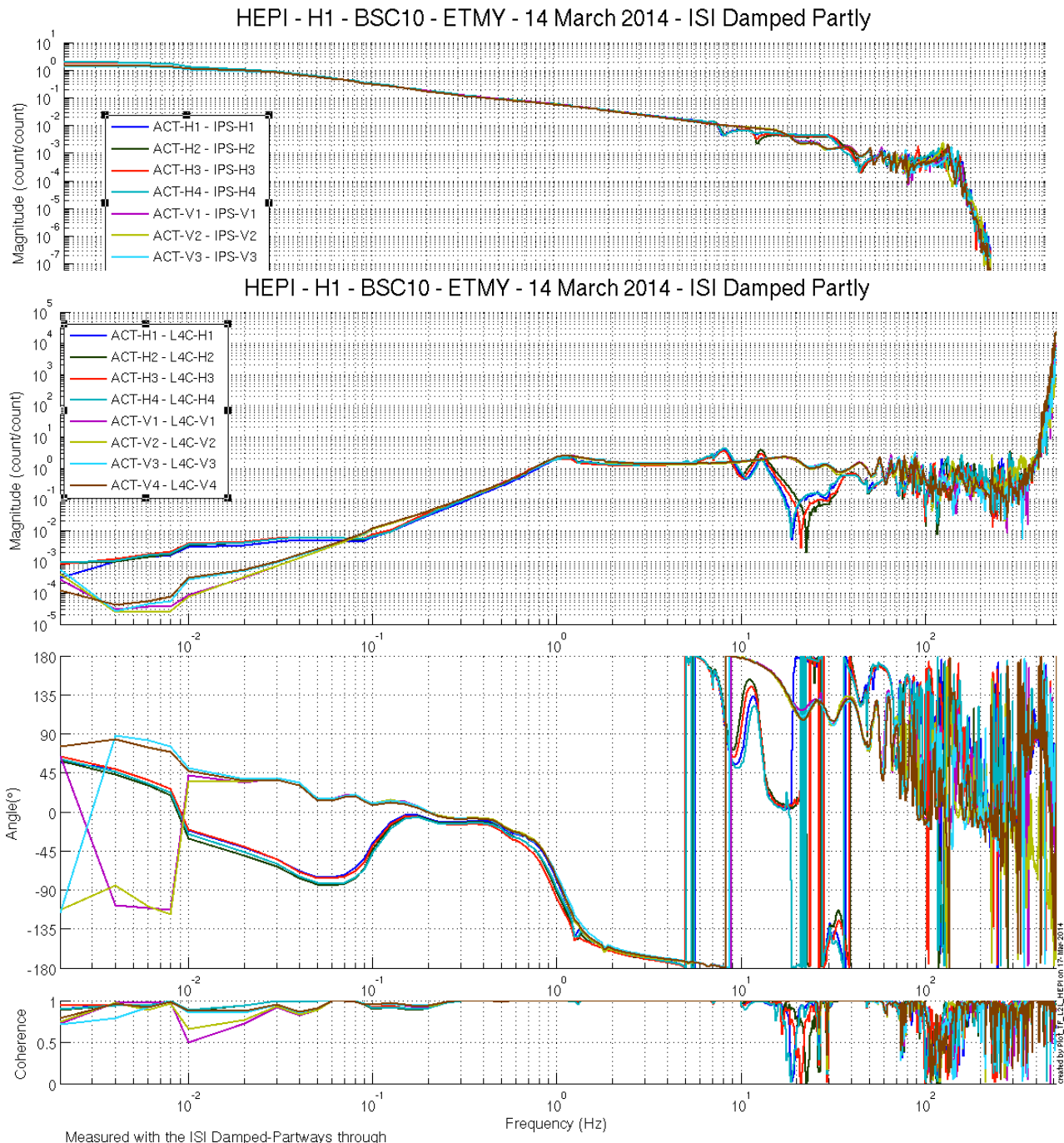- H1_HPI_ETMY_TF_L2L_Raw_from_ACT_to_IPS_2014_03_14.fig
- H1_HPI_ETMY_TF_L2L_Raw_from_ACT_to_L4C_2014_03_14.fig

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_14.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.

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 with HEPI locked, after alignment work was performed. The opposite[NOT] of those values is to be installed as offset of the IPS filter banks when the Isolation loops are turned on. This way, HEPI will be operating in its *preferred alignment* state. This text should be rewritten in respect of the now Bias Position alignment, HR

	IPS Readouts HEPI Locked	Offset Value
H1	0	0
H2	0	0
H3	0	0
H4	0	0
V1	0	0
V2	0	0
V3	0	0
V4	0	0

Issues/difficulties encountered during this test:

Readings were retrieved from LHO aLog # 10659. IPS zero'd after Actuator attachment and alignment verification.

Acceptance criteria:
Offsets were recorded.

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