

LIGO Laboratory / LIGO Scientific Collaboration

LIGO- E1300823-v4

LIGO

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**aLIGO HEPI H1 HAM1
Assembly Validation Report**

E1300823-v4

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Distribution of this document:
Advanced LIGO Project

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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

BSC HEPI load cell capacity → 3000 lbs

HAM HEPI load cell capacity → 2000 lbs

	Left Spring (lbs)	Right Spring (lbs)
Pier 1	1050	690
Pier 2	930	1290
Pier 3	880	1070
Pier 4	970	920

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—Measurements not taken-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--Measurements not taken-HR

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

	Bracket 1	Bracket 2	Bracket 3																
	Ga p1	Ga p2	Ga p3	Ga p4 above	Ga p4 under	Ga p5	Ga p1	Ga p2	Ga p3	Ga p4 above	Ga p4 under	Ga p5	Ga p1	Ga p2	Ga p3	Ga p4 above	Ga p4 under	Ga p5	
Pier 1																			
Pier 2																			
Pier 3																			
Pier 4																			

Test result:

Passed: ____

Failed: ____

6. Gaps check--**Measurements not taken-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

Scripts files for processing and plotting in SVN at:

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

Data in SVN at:

/ligo/svncommon/SeiSVN/seismic/HEPI/H1/HAM2/Data/Static_Tests/
_IPS_Read_Back__20131031_15:23.mat

All the loops must be turned off during this test.

The test was performed on October 31st 2013, with HEPI Locked.

	H1	H2	H3	H4	V1	V2	V3	V4
Mean (counts)	8076	-2953	-8150	-1312	170	4531	-1669	-1583
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:

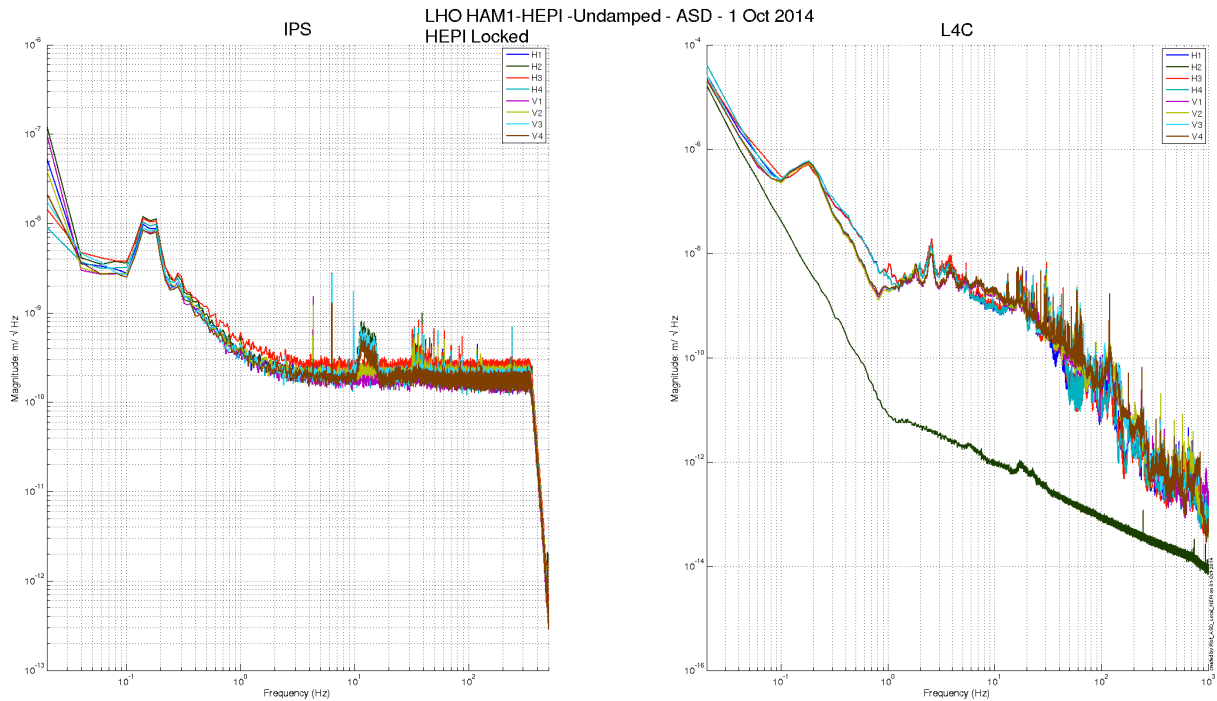
/SeiSVN/seismic/HEPI/Common/Testing_Functions_HEPI/ASD_Measurements_Local_HEPI.m

Data in SVN at:

SeiSVN/seismic/HEPI/H1/HAM1/Data/Spectra/Undamped/
LHO_HPI_HAM1_ASD_m_IPS_L4C_20141001_08:46:07.mat

Figures in SVN at:

/SeiSVN/seismic/HEPI/H1/HAM2/Data/Figures/Spectra/Undamped/
LHO_HPI_HAM1_ASD_m_IPS_L4C_20141001_08:46:07.fig



Measurement length: 1900s - Sample window: 50s - Overlap: 50% - Frequency resolution: 20mHz - Averages: 75 - Measurement start (GPS): 1096213583

Issues/difficulties/comments regarding this test:

Measurements were performed with all PreFilters ON. **Spectrum of H2 L4C indicates a bad L4C. Invasive to replace.**

Acceptance criteria:

■

Test result:

Passed:

Failed: X

9. SUS-watchdogs interaction test

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 watchdogs.
- . 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

Scripts files for processing in SVN at:

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

Data in SVN at:

SeiSVN/seismic/HEPI/H1/HAM1/Data/Static_Tests/
LHO_HPI_HAM1_Offset_Local_Drive_20130606.mat

. Drive of 5000 counts

	H1	H2	H3	H4	V1	V2	V3	V4
H1	7736	-3730	-399	-1530	-122	188	229	-194
H2	-3631	7710	-1769	-470	180	-214	-255	210
H3	-294	-1903	8472	-4076	238	-340	-102	102
H4	-1696	-527	-4210	7843	-390	238	89	-261
V1	47	178	174	-394	7616	464	-1300	554
V2	409	-304	-414	200	492	7386	586	-1178
V3	468	-339	-161	51	-1340	685	7936	473
V4	-17	196	22	-252	522	-976	449	6017

Acceptance criteria:

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

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

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:

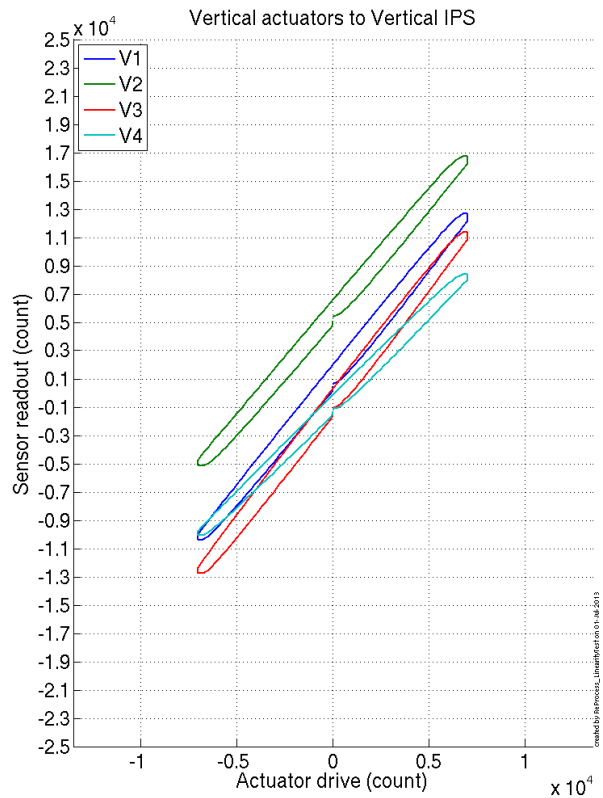
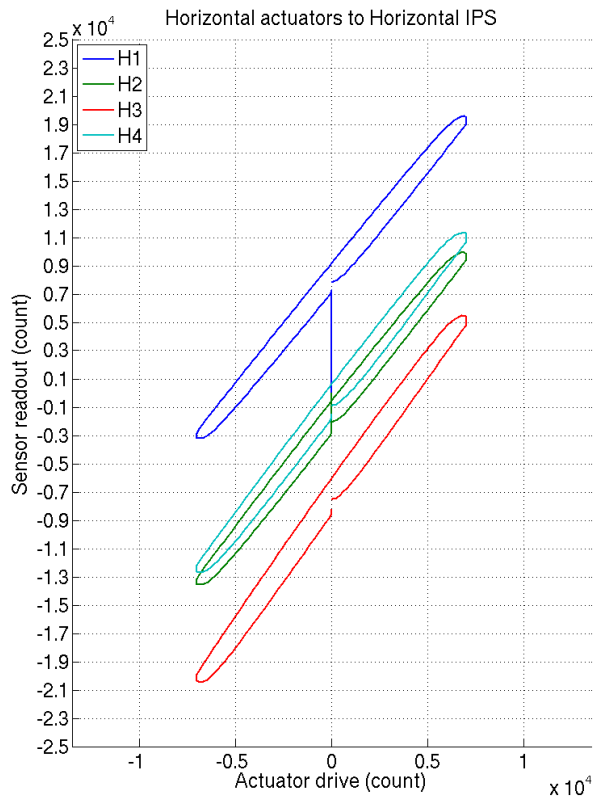
SeiSVN/seismic/HEPI/H1/HAM1/Data/Linearity_Test/

LHO_HPI_HAM1_Linearity_test_20130701T135904.mat

Figures in SVN at:

/SeiSVN/seismic/HEPI/H1/HAM1/Data/Figures/Linearity_Test/

LHO_HPI_HAM1_Linearity_test_20130701T135904.fig



	Slopes	Offsets
H1	1.64	8117
H2	1.70	-1725
H3	1.88	-7355
H4	1.74	-626
V1	1.65	1095
V2	1.58	5712
V3	1.73	-692
V4	1.32	-848

Issues/difficulties encountered during this test: **The V4 Actuator would appear to be weak. When**

the platform is unlocked, this test must be repeated. The Parker Valve may need replacing.

Acceptance criteria:

Test result: Passed: ? Failed: X

12. Actuator Plate to Shields gap--Measurements not taken-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--Measurements not taken-HR

Scripts files for processing and plotting in SVN at:

/SeiSVN/seismic/HEPI/H1/HAM1/Scripts/Valve_Check/plot_valve_check.m

Data in SVN at:

SeiSVN/seismic/HEPI/H1/HAM2/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)	Resolution	Amplitude	Nreps	Time (s)	Time (min)	Time (h)
500-1000		4000 - 4000*	250	4176*	4176	1*
100 - 500	0.5	4000 - 4000*	250	4176*	69.6	1.2*
10 - 100	0.25	4000 - 4000*	200	6592*	109.9	1.8*
0.7 - 10	0.05	4000 - 4000*	75	12320*	205.3	3.4*
0.1 - 0.7	0.025	4000 - 4000*	30	10080*	168.0	2.8*
0.01 - 0.1	0.01	4000 - 4000*	10	8960*	149.3	2.5*
0.002 - 0.01	0.002	4000 - 4000*	2	12160*	202.7	3.4*
						16.1*

*: Values Need to be updated

Data files in SVN at:

/SeiSVN/seismic/HEPI/H1/HAM1/Data/ Figures/Transfer_Functions/Measurements/Exc/
 LHO_HPI_HAM1_Data_L2L_500Hz_1000Hz_exc_20130612-172146.mat
 LHO_HPI_HAM1_Data_L2L_100Hz_500Hz_exc_20130613-200310.mat
 LHO_HPI_HAM1_Data_L2L_10Hz_100Hz_exc_20130613-211226.mat
 LHO_HPI_HAM1_Data_L2L_700mHz_10Hz_exc_20130613-230210.mat
 LHO_HPI_HAM1_Data_L2L_100mHz_700mHz_exc_20130614-022932.mat
 LHO_HPI_HAM1_Data_L2L_10mHz_100mHz_exc_20130614-052213.mat
 LHO_HPI_HAM1_Data_L2L_2mHz_10mHz_exc_20130614-080413.mat

Data is called by Case # of:

/ligo/svncommon/SeiSVN/seismic/HEPI/H1/HAM1/Data/Transfer_Functions/Measurements/
 Measurements_List_H1_HPI_HAM1.m

Data collection script files:

/SeiSVN/seismic/HEPI/Common//Transfer_Function_Scripts/
 - Run_TF_L2L_10mHz_100mHz.m
 - Run_TF_L2L_100mHz_500mHz.m
 - Run_TF_L2L_500mHz_5Hz.m
 - Run_TF_L2L_5Hz_100Hz.m
 - Run_TF_L2L_100Hz_1000Hz.m

Scripts files for processing and plotting in SVN at:

/SeiSVN/seismic/HEPI/H1/HAM2/Scripts/Control_Scripts/release/
 - Step_1_TF_Loc_to_Loc_H1_HEPI_HAM1.m

Error in Routine when step runs...**Figures in SVN at:**

/SeiSVN/seismic/HEPI/H1/HAM2/Data/ Figures/Transfer_Functions/Measurements/Undamped/

-

Storage of measured transfer functions in the SVN at:

/SeiSVN/seismic/HEPI/H1/HAM2/Data/Transfer_functions/ Simulations/Undamped/

-

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

Issues/difficulties/comments regarding this test:**Acceptance criteria:**

- On IPS, the phase must be 0° at DC
- On geophones, the phase must be 90° at DC
- 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 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.

	IPS Readouts HEPI Isolated	Cartesian DOF	TARGET
H1	8550	X	194300
H2	-1810	Y	-318400
H3	-8210	Z	-121900
H4	-1000	RX	7700
V1	-1430	RY	-73200
V2	-4250	RZ	-17100
V3	-5310	HP	-26000
V4	-1600	VP	-8400

Issues/difficulties encountered during this test:**Acceptance criteria:**

Valves collected from medm 10 March 2015 with platform Isolated to nominal position.

Test result:Passed: X Failed: