

**Title: aLIGO Installation Acceptance Document for LHAM4**

This document covers the technical content for acceptance review of a subset of the Advanced LIGO (aLIGO) installation. See document [M1300468](#) for an overview of the aLIGO acceptance process. Acceptance by Systems Engineering is to be indicated in the metadata for this document in the LIGO Document Control Center (DCC).

### 1 Installation Instance/Subset Definition

*Insert a brief description of the subset of the aLIGO equipment which is covered under this installation acceptance document. Complete the entries in the following table. If elements of the table are not applicable, enter "not applicable".*

This installation covers the HAM chamber LHAM5 and all of the equipment within and attached plus associated electronics racks.

<b>Interferometer</b> [L1 or H1]:	<b>L1</b>
<b>Building(s)/Room(s):</b> [e.g. corner/LVEA]	<b>LVEA</b>
<b>Vacuum Chamber(s):</b>	<b>LHAM4</b>
<b>Electronics Rack Designation(s):</b>	L1-SUS-R3. L1-TCS-R1. L1-SUS-C2. L1-SEI-C3. Note that the Capacitive Position Sensor readout boxes which sit on the cable trays do not have an official designation.
<b>Optics Table(s)/Enclosure(s) Designation(s), and other equipment/assemblies related to this installation:</b>	STS-2 Ground Seismometer. L1-TCSHT4R.

### 2 Procedures

If there are any caveats or explanatory notes regarding the procedure documentation cited in the table below, then add these notes to the table entries.

<b>Baseline or initial Installation Procedure(s):</b> <i>[enter linked DCC document #(s); found under <a href="#">E1200023</a>]</i>	<a href="#">E1200615-v3</a> was the initial procedure
<b>As-Built/Installed Procedure(s),</b> either: a) Enter hyperlinked DCC number for revised or red-lined baseline install procedure, and/or b) Enter hyperlinked DCC number for separate document with installation notes on deviations, changes in procedure, changes in tooling, etc., and/or	No as-built notes were recorded in document.  The installation of SR2 occurred on or around 7th March 2013 as recorded here <a href="#">LLO elog #6420</a> .



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c) Enter a list of hyperlinked electronic log entries detailing the experience in applying the baseline installation procedure	
<b>Baseline or initial Alignment Procedure(s):</b> [enter linked DCC document #(s); found under <a href="#">E1100734</a> ]	<a href="#">E1100784-v4</a> was the initial procedure
<b>As-Built/Aligned Procedure(s)</b> , either: a) Enter hyperlinked DCC number for revised or red-lined baseline alignment procedure, and/or b) Enter hyperlinked DCC number for separate document with alignment notes on deviations, changes in procedure, changes in tooling, etc., and/or c) Enter a list of hyperlinked electronic log entries detailing the experience in applying the baseline alignment procedure	<a href="#">E1100784-v7</a> is the as-built alignment procedure, with embedded notes.  The LHAM5 HAM-ISI alignment was complete but was not recorded in the LLO elog. The in-chamber SR2 alignment was completed and is in the LLO elog entry <a href="#">#6871</a> . In addition for embedded notes refer to <a href="#">E1100784-v7</a> .

### 3 Drawings

Enter hyperlinked DCC document number(s) for each drawing in the table below. If elements of the table are not applicable, enter "not applicable". All chamber-level, assembly drawings can be found listed at [E1200562](#) and found linked under [D0901491](#).

Applicable Building/Room Top-Level Drawing(s):	<a href="#">D0901466</a> aLIGO Systems Layout LLO Corner Station
Top-Level Chamber Assembly Drawing(s):	<a href="#">D0900421-v9</a> aLIGO Systems, LHAM5-L1 Top Level Chamber Assembly
Electronics Rack Drawing(s):	All drawings for the racks can be found by navigating through <a href="#">G1001032</a> .
Optics Table/Enclosure Drawing(s):	<a href="#">D1001227-v5</a> TCS Layout.
ITM Optical Lever Drawing(s):	<a href="#">LIGO-G1000700</a> Floor Occupancy, Optical Levers, LLO Corner Station.

### 4 Serial Number Records

Serial numbers are used to track a subset of the parts, particularly active elements (see [M1000051](#)) and electronics (with S-numbered documents; see [T0900520](#)). Enter the hyperlinked DCC document number(s), and name(s) for the highest level assembly(ies) covered by this installation acceptance document in the table below. Also enter the hyperlink to the ICS entry for the instance of this assembly in the Inventory Control System (ICS). If elements of the table are not applicable, enter "not applicable". If elements of the table are not available/missing, then enter "not available".



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Assembly DCC D-Number	Assembly Name	ICS entry
D0900421	aLIGO Systems, LHAM4-L1 Top Level Chamber Assembly	ICS entry click here <a href="#">D0900421</a> . Note that this ICS entry is in good shape and seems complete, except for viewports, when compared against M100005.
D1000513	HEPI	N/A (assembly and install done in 2004, before ICS)

## 5 Testing

All post-installation, stand-alone, in situ, checkout/testing (phases 2 and 3 per [M1000211](#)) must be completed, be successful and be documented:

- phase 2: pre-installed, post-storage, test results for the assembly (testable item)
- phase 3: stand-alone, in situ test results for the assembly (testable item)

Note that integrated testing (phase 4 testing per [M1000211](#)) is covered under the system acceptance review, not this installation acceptance review. In the table below, enter hyperlinked DCC document number(s) for all of the relevant testing for the major subassemblies/subsystems covered within this installation instance/subset. If elements of the table are not applicable, enter "not applicable". If elements of the table are not available/missing, then enter "not available".

Subsystem	Testable Item	DCC document numbers	
		Phase 2	Phase 3
SEI	HAM-ISI	<a href="#">E1200103</a>	
SEI	HEPI	N/A	<a href="#">E1300925</a>
SUS	SR2 Suspension	<a href="#">E1400117</a> (under <i>Test Results</i> )	
AOS/SLC/Viewports	Leak and pressure testing.	<a href="#">E1200445</a> . Leak and pressure testing was completed, refer to above link. All viewports were tagged at time of inspection and testing.	Visual inspection in-situ not completed, refer to bug list.
AOS/SLC/Baffles	OFI Impulse Hammer Modal Testing L1 SRM AR, SR3 HR and SR3 AR Baffles	N/R	<a href="#">LLO aLOG 7144</a> . All 3 baffles at this alog entry.
AOS/TCS/HWS	HWS alignment and measurement.	<a href="#">E1300225-x0</a>	



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### 6 Installation Completeness

If/as applicable, provide a hyperlink reference to a list of remaining tasks to be completed before the installation is finished (i.e. a 'punch' list).

Installation tasks remaining to be completed:	<b>All items are installed.</b>
ICS Assembly Record needs to be updated	There are some small issues with ICS which are affecting this task. Still need to add viewports, and perhaps misc. other items to the ICS records.

### 7 Installation/Integration Issues and ECRs

If/as applicable, provide a hyperlinked list of integration issues and Engineering Change Requests (ECRs) encountered during installation and which are relevant to the installation subset/instance covered by this acceptance document. See [M1300323](#) for a description of the Integration Issue and ECR Tracker.

The format of the url for the bug tracker is as follows e.g.

\*[https://services.ligo-wa.caltech.edu/integrationissues/show\\_bug.cgi?id=826](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=826)

<i>bug_id*</i>	<i>priority</i>	<i>bug_status</i>	<i>resolution</i>	<i>short_desc</i>
825	Highest	NEW	---	LHAM4 Issue Tracker
461	Normal	CLOSED	WORKSFORME	Move HAM-ISI Optical Levers to HSTSs
459	Highest	CLOSED	DUPLICATE	Add XTerm window pop-up for BSC-ISI and HAM-ISI transition command buttons
399	Highest	CLOSED	WONTFIX	Particle Counts in cleanrooms; HAM3, HAM4, HAM5-HAM6 need cleaning
355	Highest	CLOSED	FIXED	Modify HAM-ISI and BSC-ISI simulink control filters to monitor gain for ODC
140	Highest	CLOSED	FIXED	ECR HAM-ISI model and MEDM screen update
108	Highest	CLOSED	WONTFIX	Light transmitted through the HAM OptLev mirrors may scatter into OSEMs, PDs
513	High	ACCEPTED	PENDING	Stray reflections from HAM4 HWS in-vacuum optics are potentially corrupting the HWS return beam



LASER INTERFEROMETER GRAVITATIONAL WAVE OBSERVATORY

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399	Highest	CLOSED	WONTFIX	Particle Counts in cleanrooms; HAM3, HAM4, HAM5-HAM6 need cleaning
94	Highest	CLOSED	FIXED	HAM4 Extension needs helicoils
761	Highest	ACCEPTED	PENDING	In Situ, Visual Inspections of All Viewport Windows