LASER INTERFEROMETER GRAVITATIONAL WAVE OBSERVATORY

LIGO Laboratory / LIGO Scientific Collaboration

LIGO-E0900043-v1 *LIGO* 23 February 2009

LHO HAM6 incursion procedure – Feb 09

M. Landry, N. Smith, K. Kawabe

Distribution of this document:
LHO

This is an internal working note
of the LIGO Laboratory

California Institute of Technology
LIGO Project – MS 18-34
1200 E. California Blvd.
Pasadena, CA 91125
Phone (626) 395-2129
Fax (626) 304-9834
E-mail: info@ligo.caltech.edu

Massachusetts Institute of Technology
LIGO Project – NW22-295
185 Albany St
Cambridge, MA 02139
Phone (617) 253-4824
Fax (617) 253-7014
E-mail: info@ligo.mit.edu

LIGO Hanford Observatory
P.O. Box 1970
Mail Stop S9-02
Richland WA 99352
Phone 509-372-8106
Fax 509-372-8137

LIGO Livingston Observatory
P.O. Box 940
Livingston, LA 70754
Phone 225-686-3100
Fax 225-686-7189

1. Required Equipment

1 1 1 1 1	Class A Class A Class A Class A Class A	(waivered) CVI 95/5 beamsplitter fork and fastener (*already in HAM6*) 2” post and DLC mount (*already in HAM6*) TT0 curved mirror (already in HAM6) TT0 SUS
1 2	Class B Class B	Foil-clad beamscan rail and head Pan of tools
1 1 1 1 1		Beamscan computer CDS laptop computer Monitor Box foil Tripod and iris

1. Installation Goals

This document details modifications to the optical path on the SEI ISI in the HAM6 chamber at LHO. Additionally, other opportunistic in-chamber tasks are detailed. A summary list of tasks includes

1. Swap the first steering mirror after the septum window (static-mounted curved mirror) for a passive tip-tilt (suspended) mirror)
2. Extract the OMC REFL beam out of the east (-y) end of HAM6 via modifying the current REFL beam dump position, placing it downstream of a new 95/5 beamsplitter that leaks 5% of the beam to air
3. Isolate the OMC DC PD cable at the vacuum feedthru by moving QPD cables to another port
4. Document the dummy weight attached to the glass bench of the OMC, via photos and and a count
5. Estimate the beam pitch from the new steering mirror to the tip-tilts and into the OMC.
6. Perform in-air transfer functions of all six degrees-of-freedom of the HAM6 ISI

2. Procedure:

Steps to be completed *prior to vent*:

1. Confirm the Q of the suspended passive tip-tilt mirror is approximately 5
2. Write and submit HAM6 work permit. Note work around septum window
3. Record ISI displacement sensor values
4. Lock the full IFO, relieve WFS and align the ITM for a single bounce alignment fiducial
5. Align OMC, then set QPD offsets with single bounce beam, making note of offsets. Note TT control outputs, TT OSEMs. Align locked IFO to beacon dither. Unlock and align to ordinary dither. Compare control outputs
6. Record OMC SUS shadow sensor values
7. Mark tripod spot on floor with plumb bob, and measure height of viewport. Estimate ISCT6 position and thus upper periscope postion for OMC REFL and TRANs beams
8. Setup dividers to isolate HAM6 and beam from the remainder of the LVEA, for laser safety purposes
9. Confirm K. Mailand at Caltech deliver of the new beam dump for the modified OMC REFL beam

Steps to be *completed after the vent but prior to HAM6 door removal*:

1. Revisit OMC alignment to QPDs. Note TT control outputs
2. Record, again, ISI displacement sensor values
3. Record OMC SUS shadow sensor values

The following steps of the procedure assume the H1 HAM6 chamber has been vented and all three doors of HAM6 have been removed, *but Task work (below) has not started*:

4. Revisit OMC alignment to QPDs. Note TT control outputs
5. Record, again, ISI displacement sensor values
6. Record OMC SUS shadow sensor values
7. Confirm beamscan rail position for TT swap is appropriate, i.e. fully sensitive and not obstructed by hockey puck masses

8. Assess TT1 and TT2 pendulum, side, pitch and yaw modes

Task I: Tip Tilt Install

1. Lock ISI table
2. Zero OMC SUS offsets
3. Set beamscan rail on +x side of TT2 on HAM6 ISI, where there is available space and a view of TT1. Steer TT1 to point beam along beamscan rail
4. Take measurements along several points on beam scan. Record data, including x, y, width and position for each measurement along rail
5. Remove curved mirror from static mount; install in passive tip tilt TT0 suspension. Set TT0 in place. Readjust TT0 pitch with PAM magnets. Set yaw via suspension cage position. Adjust as necessary
6. Alignment can be set by maintaining pointing onto rail. Adjust TT0 position until beam scan reproduces the same data
7. Restore TT1 position and confirm alignment into OMC. Reassess TT0 Q measurement to see if it has changed after mirror swap. May require small correction to Q, and confirmation of alignment into OMC
8. Remove rail
9. *Confirm TT hardware shutter and TT software shutter actuate in the same direction*

Task II: OMC REFL extraction

10. Remove OMC REFL glass V-beam dump
11. Install new steel beam dump (or glass dump temporarily, if steel dump is not ready)
12. Ensure QPD3 and QPD4 feedback is on
13. Install 95/5 splitter to leak OMC REFL beam out of –y HAM6 viewport
14. Point OMC splitter to send the REFL beam to the iris mounted on the tripod, which is placed at the viewport center position
15. Lock OMC
16. If possible, find both REFL and TRANS beams at the the putative ISCT6 upper periscope position. Position as you like'm
17. Manually center QPD1 and QPD2 using AF WFS steering mirrors

Task III: Vacuum feedthru mods

18. Move in-air OMC cable #118 and the associated in-vacuum cable from flange D4-A/TOP to D4-B/TOP, as per D070592-02, isolating the DCPD cable and allowing QPD signals to share the same conflat

Task IV: OMC bench assay

19. Assess how much additional weight is on the glass bench of the OMC. Count thin metal weights at each corner of the OMC and note their locations. Document with photos/drawings such that mechanical models can be updated

Task V: Beam pitch investigation

20. Estimate the pitch of the beam from the septum window to TT0, from TT0 to TT1, from TT1 to TT2, and from TT2 into the OMC

Task VI: In-air ISI transfer functions

21. Excite and measure six in-air coordinate transfer functions (X, Y, Z, RX, RY, RZ) of the HAM6 ISI, from 20-500Hz, in order to assess differences in resonant frequencies and Q's of the structures, as observed in the BSC prototype

Task VII: Exit

22. Unlock HAM6 ISI
23. Relevel ISI table
24. Confirm install of new AR-coated viewport on the east side of HAM6
25. Confirm cabling OK on HAM6 ISI – dressed appropriately, strain relieved at both ends
26. Astrowatchers, new operators: did they get a look inside HAM6?
27. Exit checks: cf. E0900029-v1