Advanced LIGO Engineering Change Request (ECR)

ECR Title: Extraction of PSL beam in HAM1 through central viewport

DCC No: E1300676

Date: August 27, 2013

Requester:

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Impacted Subsystem(s):

ISC

Description of Proposed Change(s): We propose to make a chance in the HAM1 design optical layout in order to extract the PSL beam through the central HAM1 viewport, and not through the viewport closest to the PSL as it is now (see figure 1 for the current drawing D1000313-v10). The goal is to have the PSL and ALS beams hitting the same spot on the top mirror of the ALS periscope on ISCT1. The angle between the two beams needs to be large enough to allow the two beams to hit two separate 2" mirrors by the time they reach the bottom of the periscope (the ISCT1 periscope height is 24").

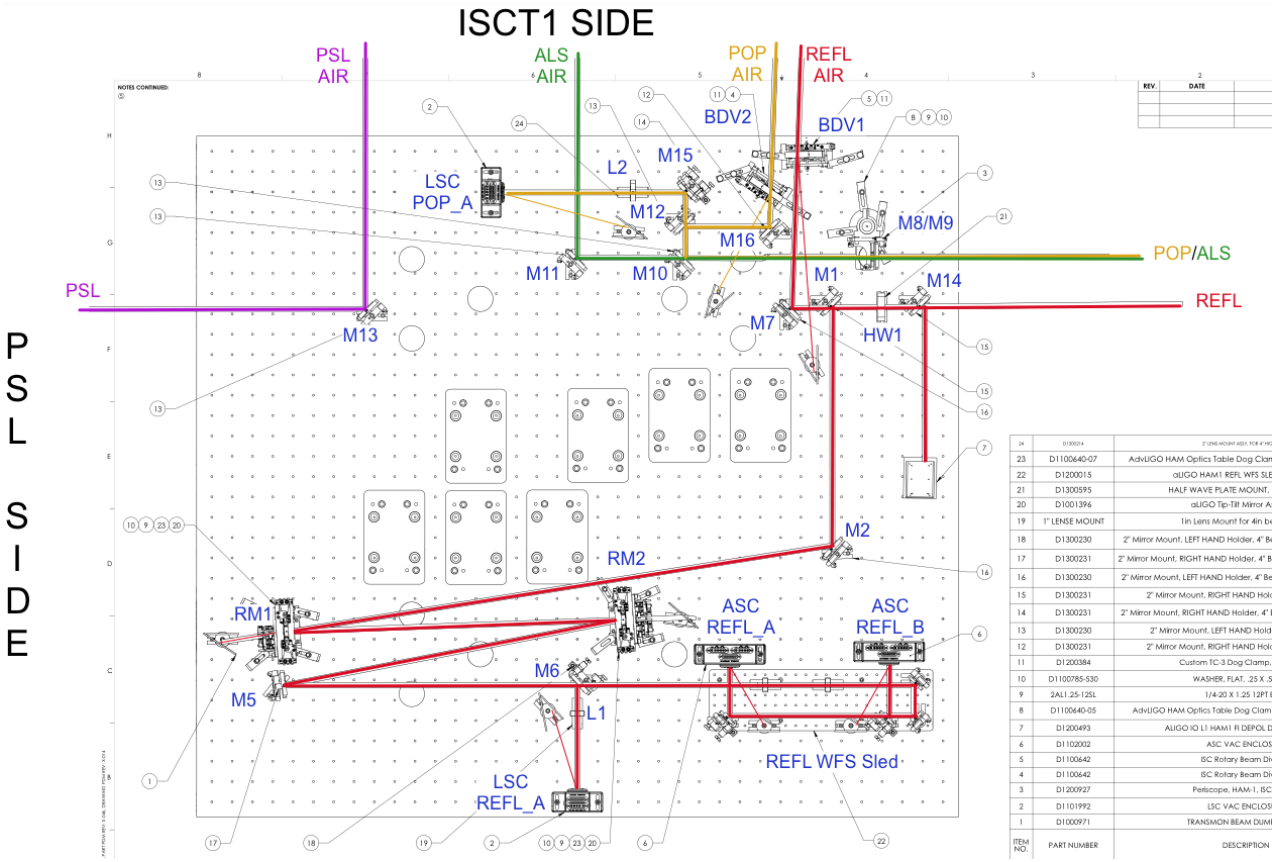

Figure 1: Current HAM1 design layout

The ALS green beam steering mirror, M11, which now hits the center of the central viewport, will shift by 2" toward the PSL side, while the PSL steering mirror M13 will be moved by about 26" toward the HAM2 side.

The beam dump for the LSC POP_A diode will be moved on the other side of the POP beam.

A simplified scheme of the proposed changes are described in Figure 2.

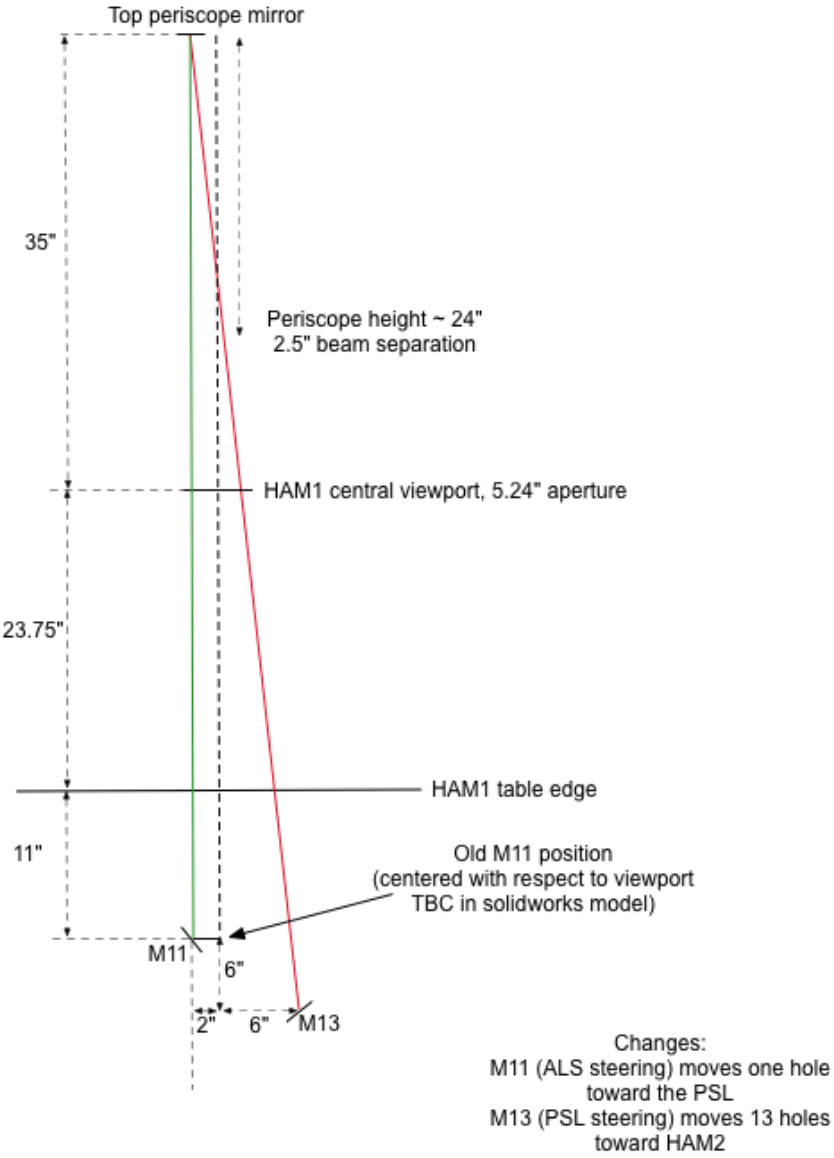

Figure 2: Schematic of the proposed new layout.

The modifications in the ISCT1 layout (current version is: D1201103-v13) are:

- shift of the ALS periscope by 2” toward the PSL side
- replacement of top mirror (now a high reflector for 1064nm light) with a high reflector for both 532 and 1064 nm light
- additional 45 degree angled base plate to mount the bottom mirror of the periscope for the PSL beam
- removal of the PSL periscope
- shift of the ALS-M3 steering mirror about 20” toward the ALS periscope

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Reason for Change(s): The HIFO-Y test showed that it is beneficial to extract the ALS and PSL beams from HAM1 through the same top mirror of the periscope on ISCT1 in order to minimize the noise in the green beat note used to lock the arm cavity. This will reduce the relative frequency noise between the green and red beams which sense the arm cavity length, thus facilitating the full interferometer lock acquisition process.

Relevant LHO log entry:
https://alog.ligo-wa.caltech.edu/aLOG/index.php?callRep=7448

LHO HIFO-Y report: L1300176-v1

Estimated Cost: <$1000

Changes in HAM1: no cost

Changes in ISCT1: miscellaneous optical mounts

Schedule Impact Estimate:

Changes in HAM1: no impact - these changes will be carried out when accessing HAM1 for other alignment/installation tasks

Changes in ISCT1: no impact - these changes can be carried out in parallel with other alignment/installation tasks on ISCT1

Nature of Change (check all that apply):
- ☐ **Safety**
- ☐ **Correct Hardware**
- ☐ **Correct Documentation**
- ☒ **Improve Hardware**
- ☐ **Improve/Clarify Documentation**
- ☐ **Change Interface**
- ☐ **Change Requirement**

Importance:
- ☐ **Desirable for ease of use, maintenance, safety**
- ☒ **Desirable for improved performance, reliability**
- ☐ **Essential for performance, reliability**
- ☐ **Essential for function**
- ☐ **Essential for safety**

Urgency:
- ☐ **No urgency**
- ☒ **Desirable by date/event: HIFO-X preparation**
- ☐ **Essential by date/event: _____**
- ☐ **Immediately (ASAP)**

Impacted Hardware (select all that apply):
- ☐ **Repair/Modify. List part & SNs: _____**
- ☐ **Scrap & Replace. List part & SNs:_____**
- ☐ **Installed units? List IFO, part & SNs: _____**
- ☐ **Future units to be built**

Impacted Documentation (list all dwgs, design reports, test reports, specifications, etc.):

ISCT1: D1201103-v13

HAM1 ISC drawing: D1000313-v10

HAM1 top level chamber drawings

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Disposition of the proposed change(s):

The disposition of this proposed engineering change request is to be completed by Systems Engineering and indicated in the "Notes and Changes" metadata field in the DCC entry for this ECR. The typical dispositions are as follows:

- **Additional Information Required**: in which case the additional information requested is defined. The ECR requester then re-submits the ECR with the new information using the same DCC number for the ECR but with the next version number.
- **Rejected**: in which case the reason(s) for the rejection are to be given
- **Approved**
- **Approved with Caveat(s)**: in which case the caveat(s) are listed
- **TRB**: the ECR is referred to an ad-hoc Technical Review Board for further evaluation and recommendation. It is the System Engineer's (or designee's) responsibility to organize the TRB. The System Engineer (or designee) then makes a technical decision based on the TRB's recommendation. Links to the TRB's documentation (charge, memos, final report, etc.) are to be added to the "Related Documents" field for this ECR.
- **CCB**: a change request for approval of additional funds or schedule impact is to be submitted to the Configuration Control Board. Links to the CCB's documentation (CR, etc.) are to be added to the "Related Documents" field for this ECR.

Concurrence by Project Management:

Acknowledgement/acceptance/approval of the disposition is to be indicated by the electronic "signature" feature in the DCC entry for this ECR, by one the following personnel:

- Systems Scientist
- Systems Engineer
- Deputy Systems Engineer