

LASER INTERFEROMETER GRAVITATIONAL WAVE OBSERVATORY
-LIGO-
CALIFORNIA INSTITUTE OF TECHNOLOGY
MASACHUSETTS INSTITUTE OF TECHNOLOGY

LIGO- E1100984-v1	10/4/11
SLC Signal Recycling Cavity Baffle Install Hazard Analysis	
Michael Smith	

LIGO Hanford Observatory
P.O. Box 1970; Mail Stop S9-02
Richland, WA 99352
Phone (509) 37208106
Fax (509) 372-8137
E-mail: info@ligo.caltech.edu

LIGO Livingston Observatory
19100 LIGO Lane
Livingston, LA 70754
Phone (225) 686-3100
Fax (225) 686-7189
E-mail: info@ligo.caltech.edu

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

Massachusetts Institute of Technology
LIGO – MS NW22-295
Cambridge, MA 01239
Phone (617) 253-4824
Fax (617) 253-7014
E-mail: info@ligo.mit.edu

APPROVAL SIGNATURES

Eric Gustafson, AOS Group leader Date

Michael Smith, SLC Task Leader Date

David Nolting, LIGO Lab Safety Officer Date

John Worden, LHO Site Safety Officer Date

Rusyl Wooley, LLO Site Safety Officer Date

Brian O'Reilly, Advanced LIGO LLO Installation Lead Date

Michael Landry, Advanced LIGO LHO Installation Lead Date

David Shoemaker, aLIGO Leader Date

Albert Lazzarini, LIGO Directorate Date

1. Scope

This document covers safety concerns related to the assembly and installation of the Signal Recycling Cavity Baffles in HAM4, HAM5, HAM9, and HAM10.

It must be read before beginning the installation of the Signal Recycling Cavity Baffles, and used in conjunction with the SLC and Viewports Installation plan Document, document number LIGO-E1000099-v1.

2. Summary of Hazards

The baffles weigh < 25 lbs, and they will be lifted manually onto the HAM ISI table and slid into position; during this operation, the installer must lean over the table, and could be subject to back strain. The baffle base will be clamped with appropriate dog-clamps; the installer could hurt their hand or fingers by improper use of the torque wrench used to tighten the dog-clamp bolts.

The baffles will be aligned by projecting an infrared autocollimator beam onto an alignment target placed on the baffle. Serious eye hazard could result if the installer does not wear proper safety goggles/glasses.

1. Eye damage from exposure to infrared autocollimator beam (4E)

This hazard is described in detail later in the document.

3. Overview

The signal recycling cavity baffles weigh < 25 lbs, and they will be lifted manually onto the HAM ISI table and slid into position. The baffle base will be clamped with appropriate dog-clamps. The baffles will be aligned by projecting an infrared autocollimator beam onto an alignment target attached to the baffle.

During the assembly and installation of the Mode Cleaner Tube Baffle, a task leader shall be assigned to supervise all activities. The IR beam will require the use of protective goggles/glasses to avoid eye damage. This assembly and installation requires overall common sense and good lab practices. Personnel must have good working knowledge of how to safely use the tools associated with the build and installation, and be aware of the hazards associated with working near a high power infrared light beam. All personnel must have appropriate safety training to work at a LIGO facility.

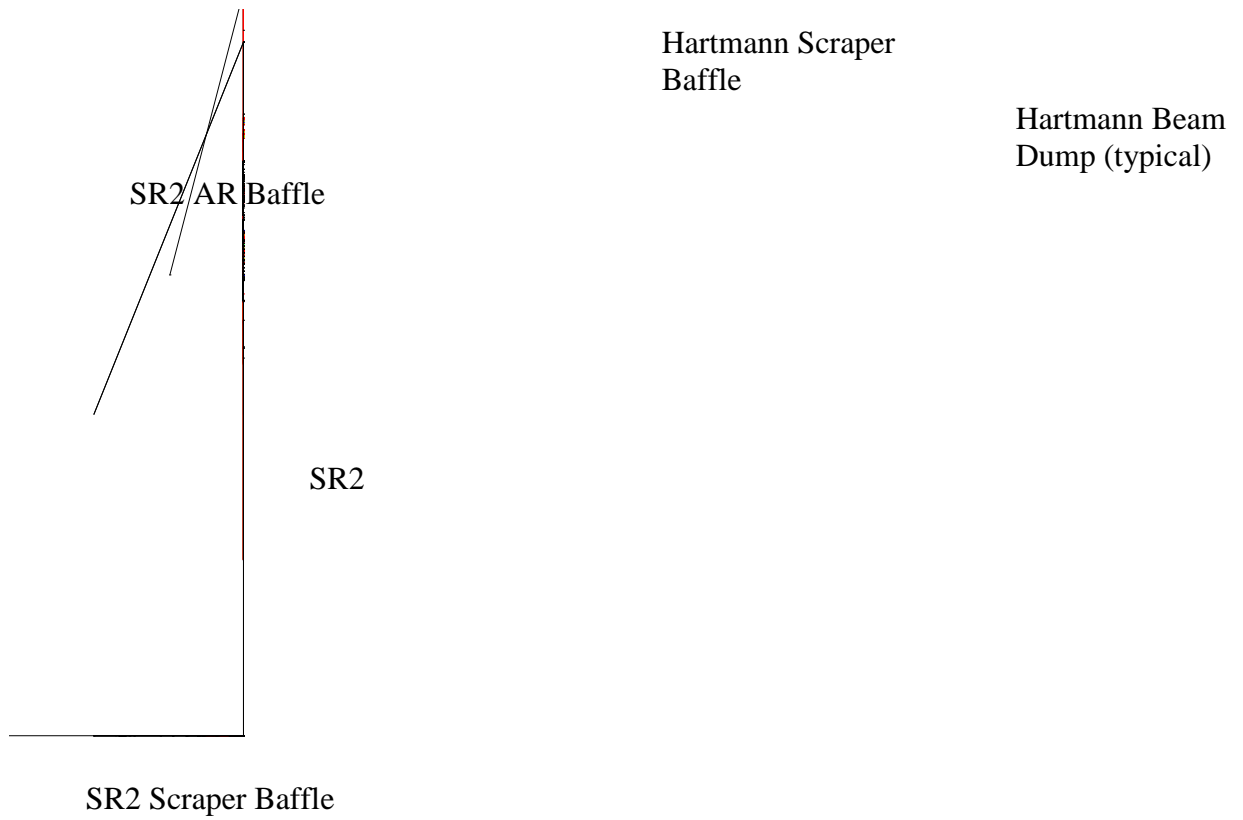


Figure 1: H1 & L1 HAM4: SR2 Scraper Baffle, SR2 AR Baffle, Hartmann Scraper Baffle, Hartmann Beam Dump

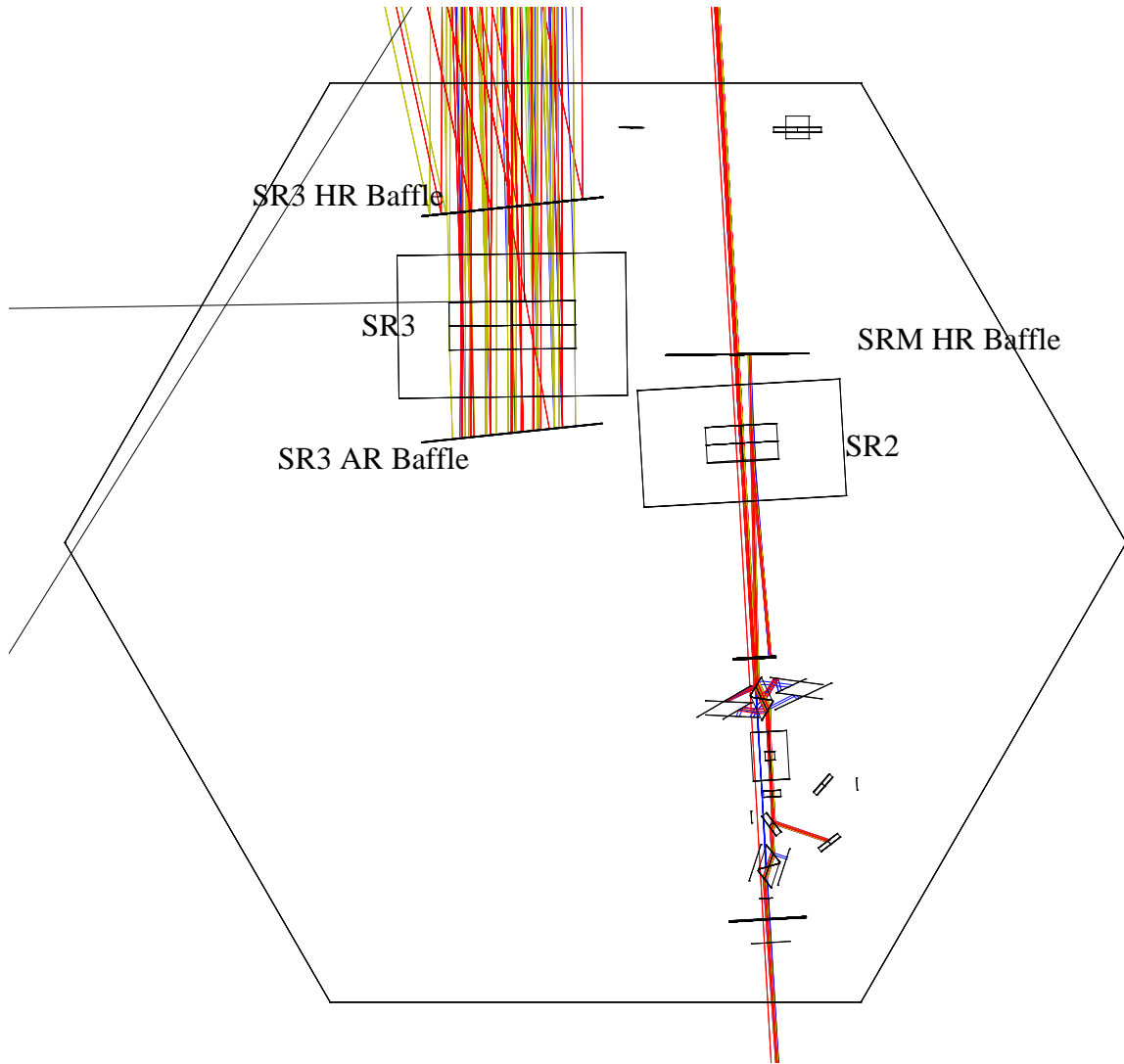


Figure 2: H1 HAM5: SR3 HR Baffle, SR3 AR Baffle, SRM HR Baffle

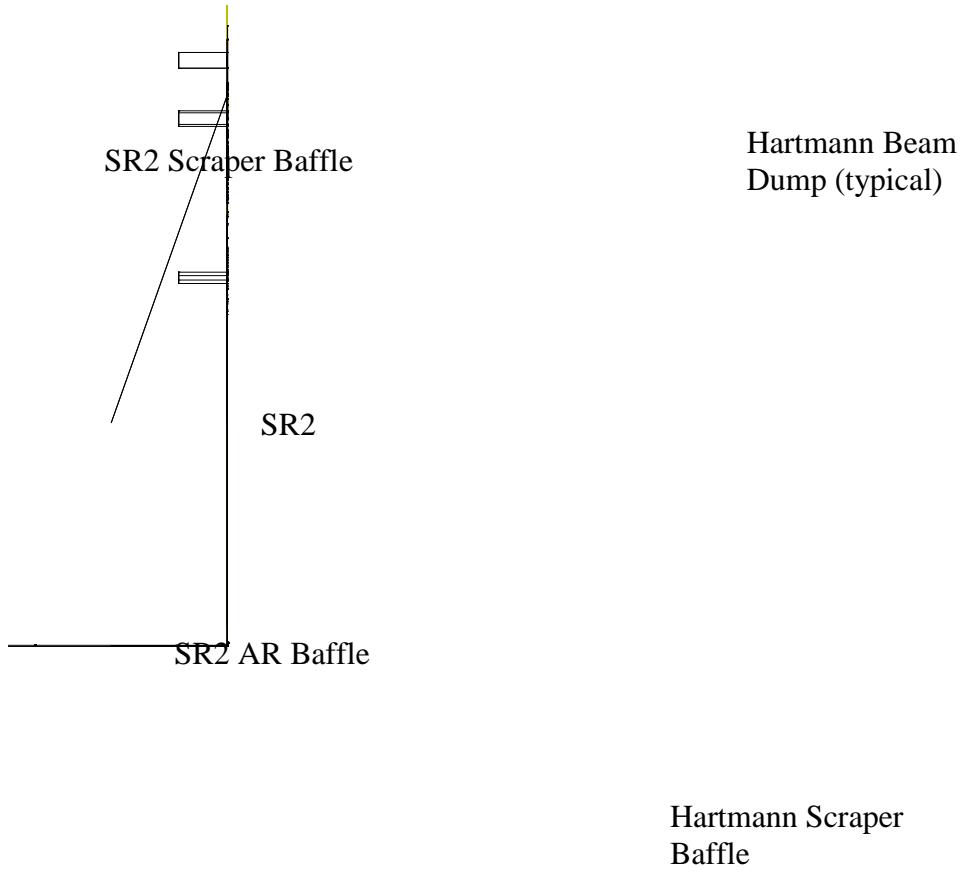


Figure 3: H2 HAM9: SR2 Scrapper Baffle, SR2 AR Baffle, Hartmann Scrapper Baffle, Hartmann Beam Dump

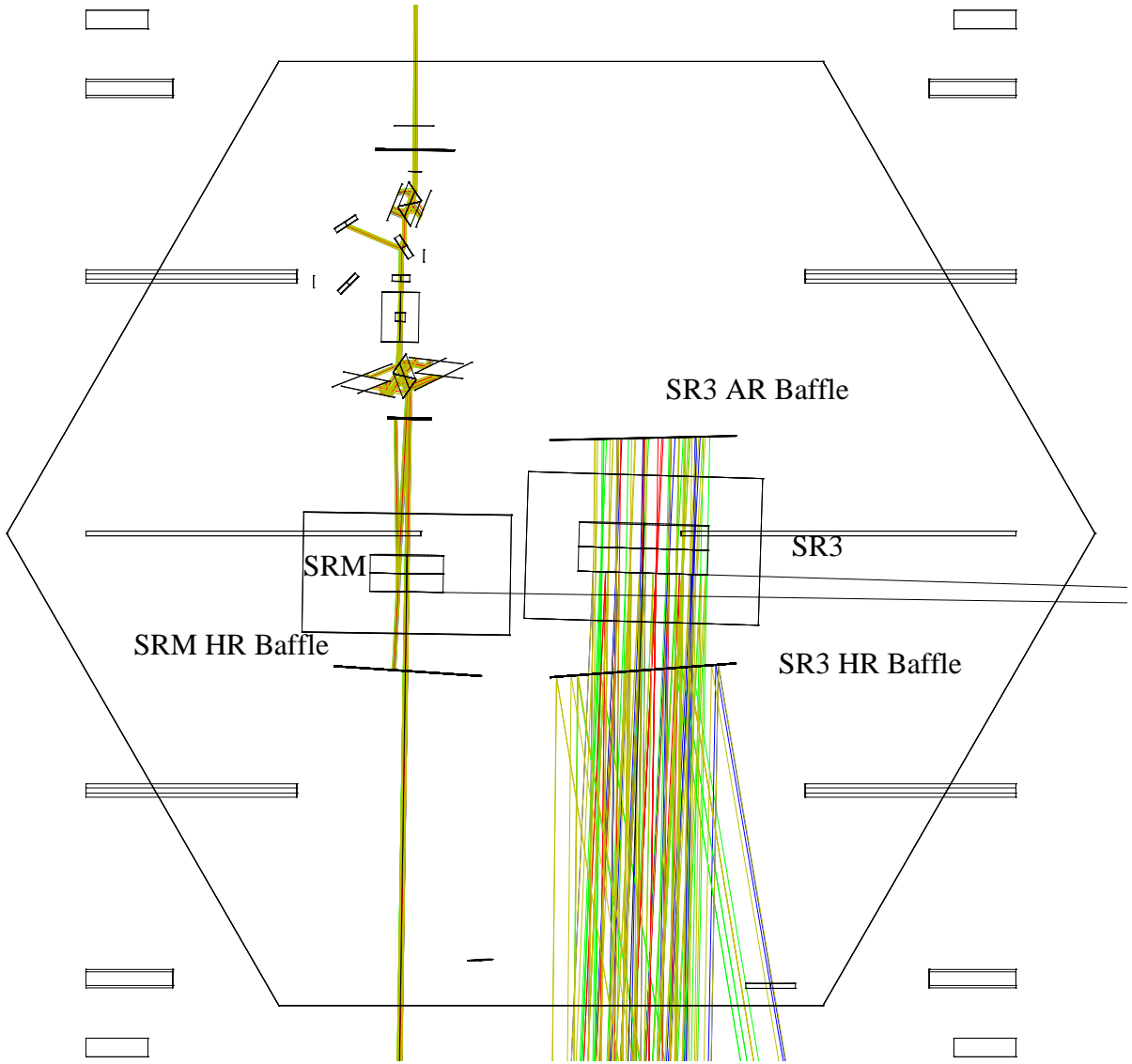


Figure 4: H2 HAM10: SR3 HR Baffle, SR3 AR Baffle, SRM HR Baffle

4. Related Documentation

SLC and Viewports Installation Plan (LIGO- LIGO-E1000099-v1)

Advanced LIGO Safety: Processes and Guidelines (LIGO-M070360)

LIGO Project System Safety Plan (LIGO-M950046)

LIGO Hanford Observatory Contamination Control Plan (LIGO-M990034)

Chamber Entry/Exit Checklist (LIGO-E000065)

LIGO Hanford Observatory Laser Safety Plan (LIGO-M020131)

LLO Safety Procedure documents (<http://www.ligo-la.caltech.edu/contents/internalmain.htm>)

5. Hazard Analysis

5.1. Eye Hazard

The infrared autocollimator beam may have a power level exceeding 1 W; looking directly into the beam may cause retinal damage.

6. Manifold/Cryopump Baffle Hazard Analysis Severity Table

Item #	Hazard	Cause	Effect	Unmitigated Severity	Unmitigated Probability Level	Unmitigated Risk Index	Comment	Mitigation	Mitigation Severity	Mitigated Probability Level	Mitigated Risk Index
1	Eye damage	Looking directly into IR autocollimator beam	Injury to personnel	Critical	occasional	2C	May cause serious retinal damage	Wear appropriate eye safety glasses goggles	minor	improbable	4E

Hazard Severity	Category	Definition
Catastrophic	1	Death or permanent total disability, system loss, major property damage or severe environmental damage.
Critical	2	Severe injury, severe occupational illness, major system or environmental damage.
Marginal	3	Minor injury, lost workday accident, minor occupational illness, or minor system or environmental damage.
Minor or Negligible	4	Less than minor injury, first aid or minor supportive medical treatment type of occupational illness, or less than minor system or environmental damage.

Probability	Level	Individual Item
Frequent	A	Likely to occur frequently or continuously experienced.
Probable	B	Will occur several times in the life of an item.
Occasional	C	Likely to occur some time in the life of an item.
Remote	D	Unlikely but possible to occur in the life of an item.
Improbable	E	So unlikely, it can be assumed occurrence may not be experienced.

SEVERITY OF CONSEQUENCE	PROBABILITY				
	E Improbable	D Remote	C Occasional	B Probable	A Frequent
1 Catastrophic					
2					

Critical					
3					
Marginal					
4					
Negligible					

Hazard Risk Index
1A, 1B, 1C, 2A, 2B, 3A
1D, 2C, 2D, 3B, 3C
1E, 2E, 3D, 3E, 4A, 4B
4C, 4D, 4E

Risk Code Criteria
Unacceptable
Undesirable (Directorate decision required)
Acceptable with review by Directorate
Acceptable without review