

LASER INTERFEROMETER GRAVITATIONAL WAVE OBSERVATORY
-LIGO-
CALIFORNIA INSTITUTE OF TECHNOLOGY
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SLC Signal Recycling Cavity Baffle Install Hazard Analysis	
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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

Most of the signal recycling cavity baffles weigh < 25 lbs; the SR2 Scraper Baffle weights approximately 66 lbs. The baffles will be lifted manually onto the HAM ISI table by one or two persons 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.

After installation, 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)
2. Back strain due to heavy lifting
3. Finger damage from torque wrench

These hazards are described in detail later in the document.

3. Overview

Most of the signal recycling cavity baffles weigh < 25 lbs, and they will be lifted manually onto the HAM ISI table and slid into position. The SR2 Scraper Baffle weighs approximately 66 lbs, and must be lifted by two persons onto the HAM ISI table and slid into position. The baffle base will be clamped with appropriate dog-clamps. Following installation, 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.

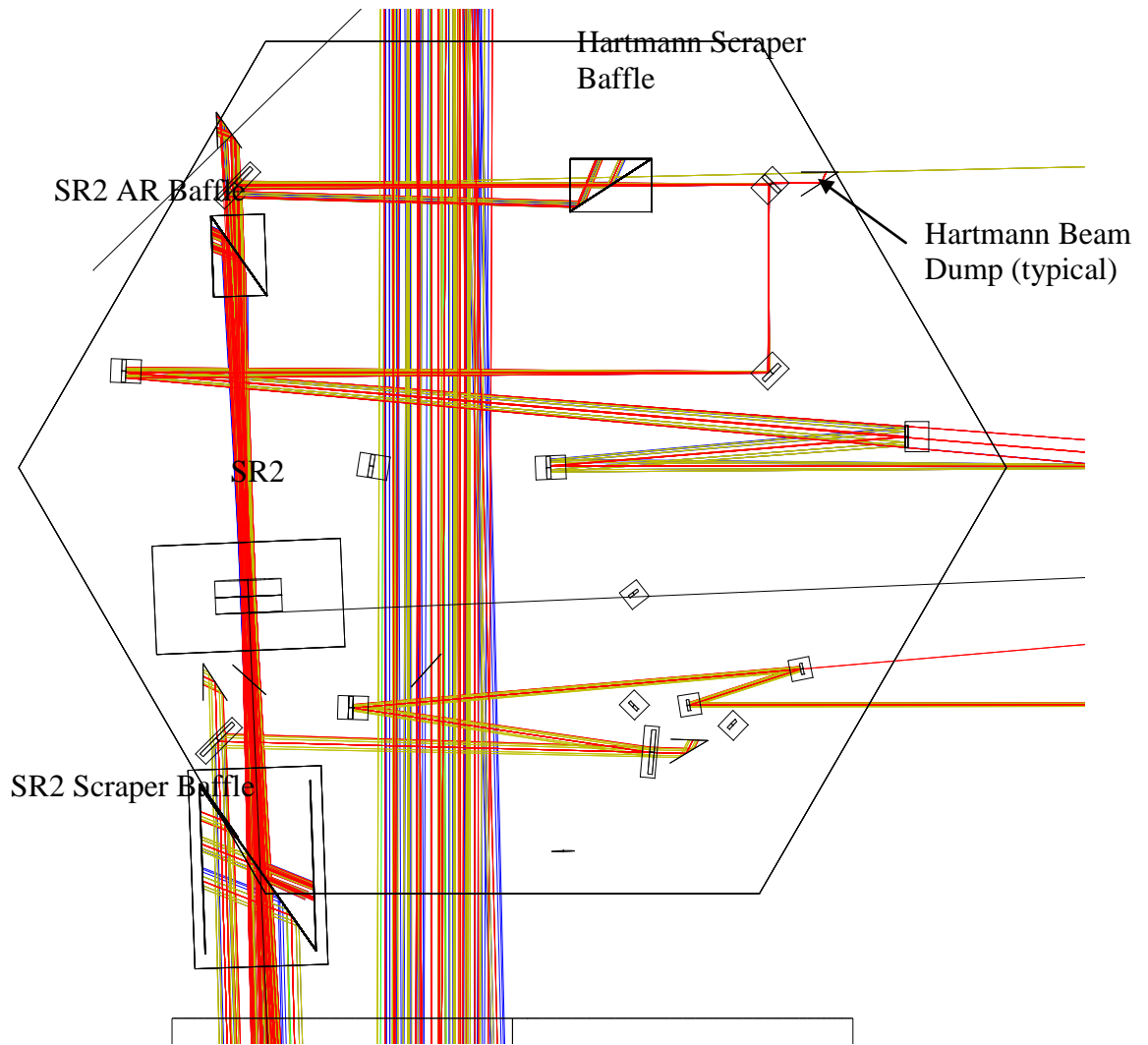


Figure 1: H1 & L1 HAM4: SR2 Scrapper Baffle, SR2 AR Baffle, Hartmann Scrapper Baffle, Hartmann Beam Dump

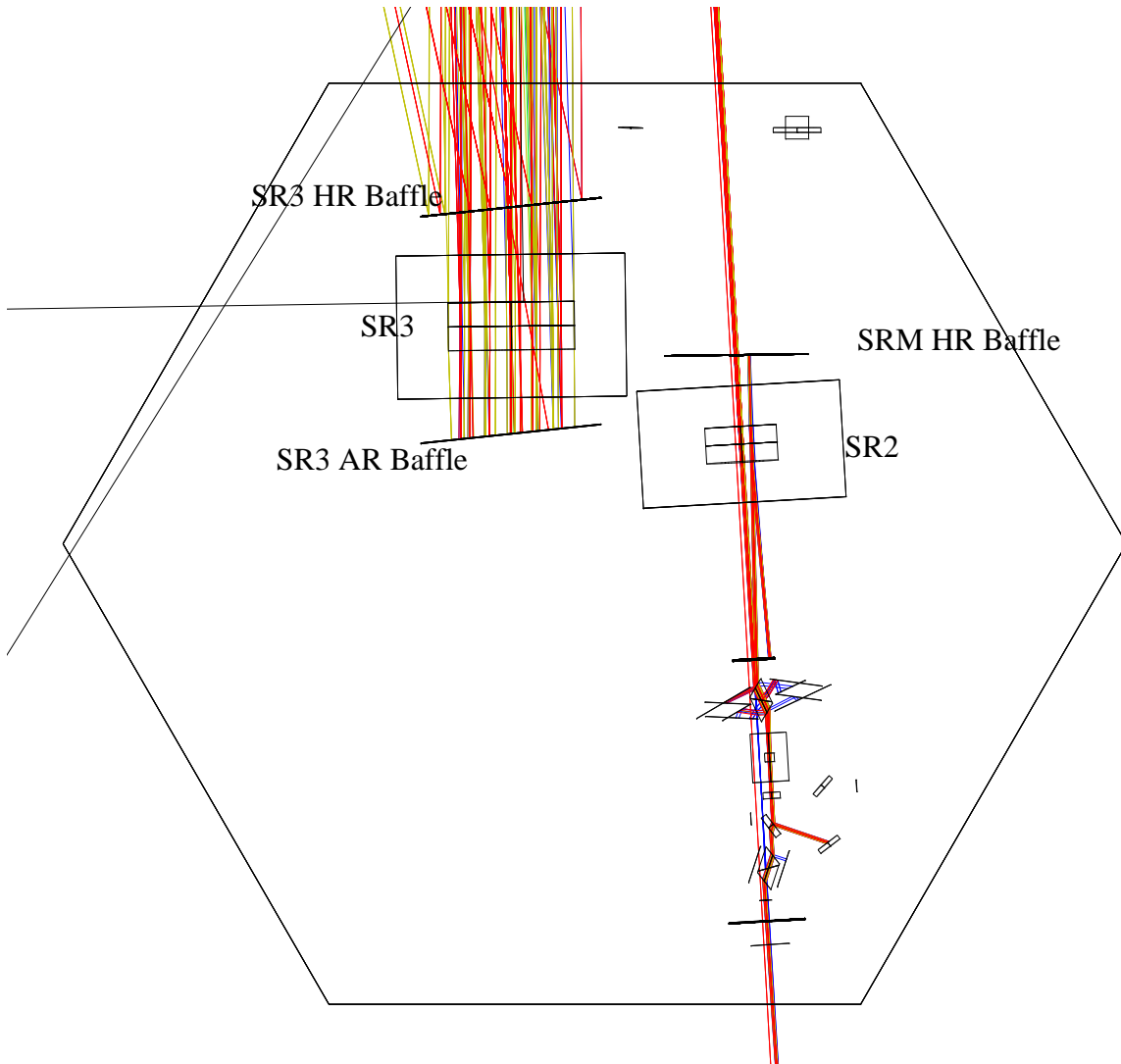


Figure 2: H1 HAM5: SR3 HR Baffle, SR3 AR Baffle, SRM HR Baffle

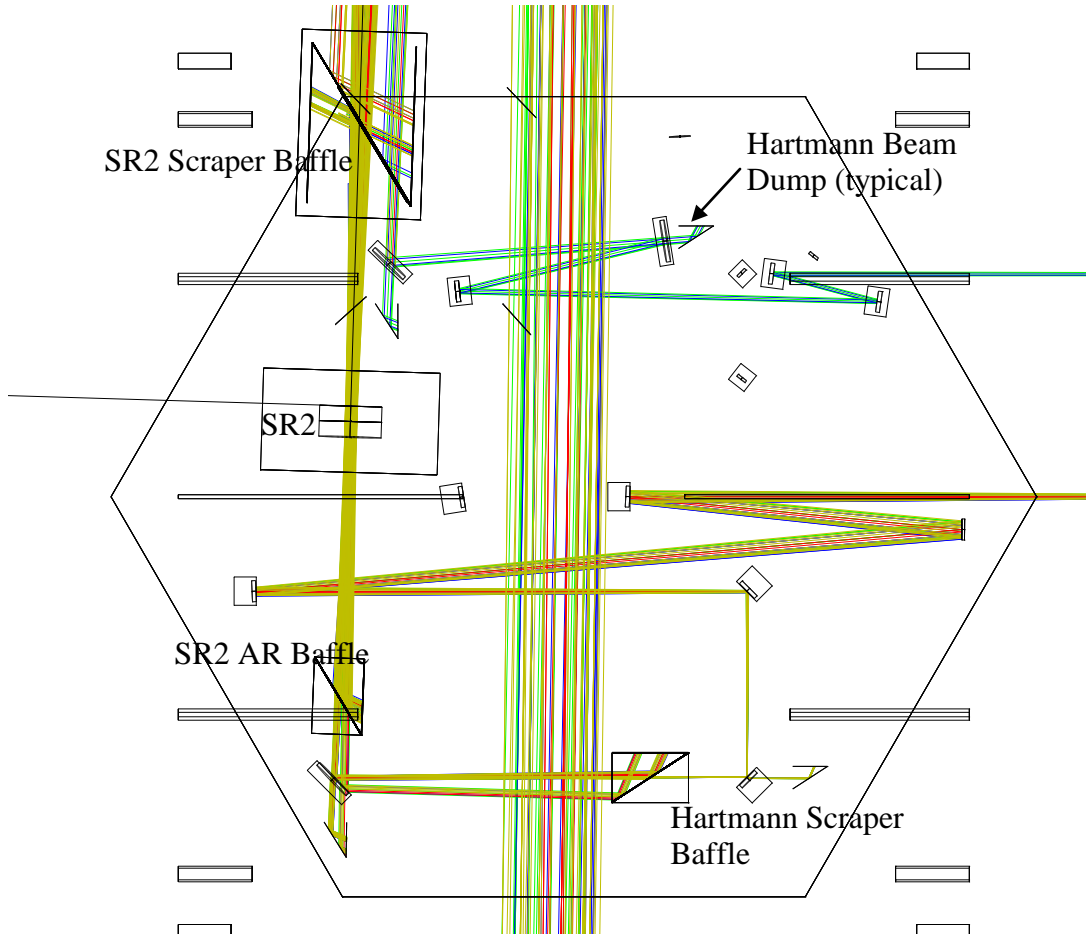


Figure 3: H2 HAM9: SR2 Scrapper Baffle, SR2 AR Baffle, Hartmann Scrapper Baffle, Hartmann Beam Dump

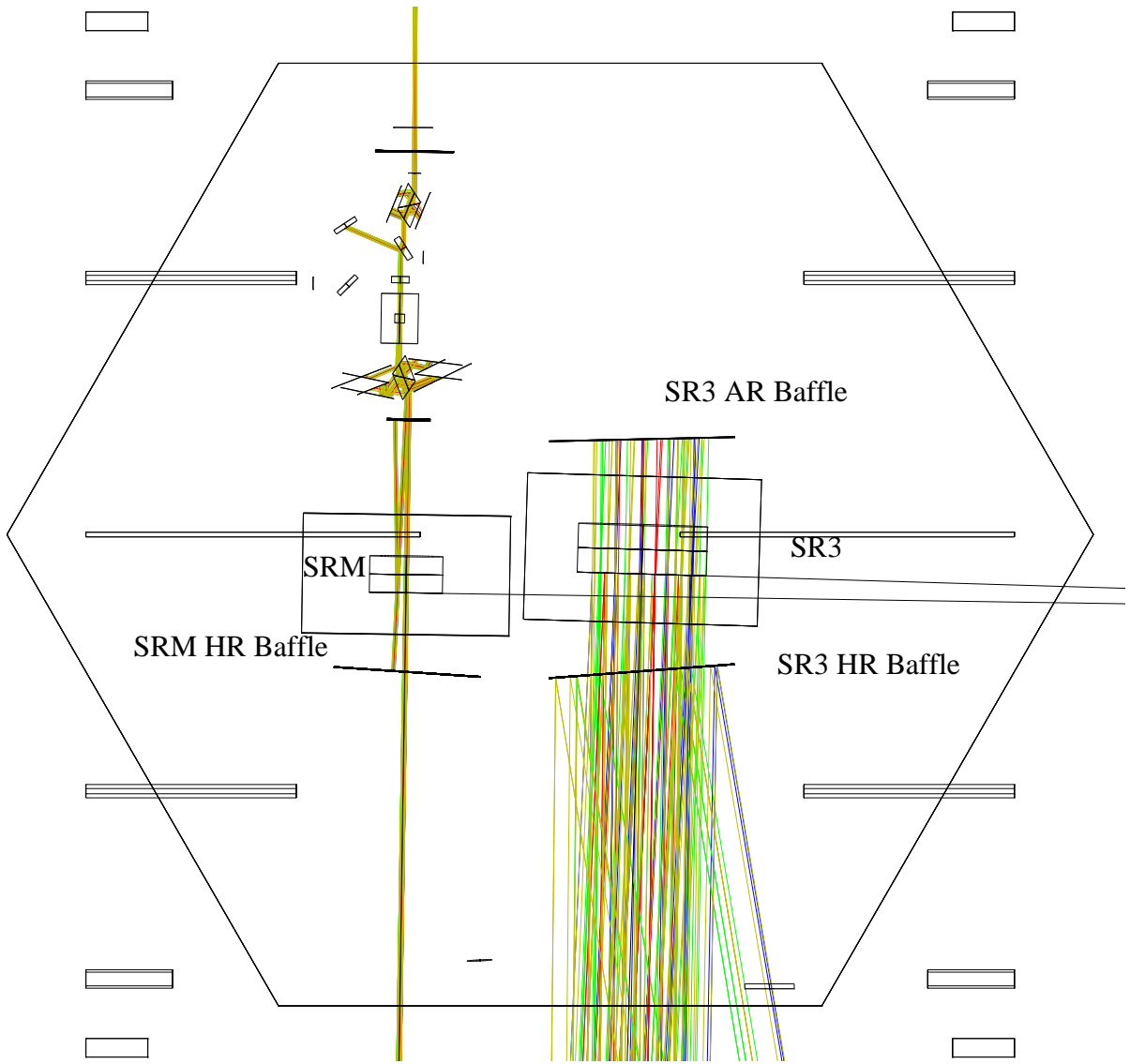


Figure 4: H2 HAM10: SR3 HR Baffle, SR3 AR Baffle, SRM HR Baffle

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. Bodily Injury

Back strain may occur from improperly lifting a heavy baffle onto the HAM ISI table. Fingers may be injured by improper use of torque wrench.

5.2. 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	Retinal damage	Critical	occasional	2C	May cause serious retinal damage	Wear appropriate eye safety glasses goggles	minor	improbable	4E
2	Bodily injury	heavy lifting	Back strain injury	Marginal	occasional	2C	May cause back pain	Use appropriate lifting precautions	minor	improbable	4E
3	Bodily injury	Injury from tools	Finger injury	Marginal	occasional	2C	May cause back pain	Use appropriate tool precautions	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