SPECIFICATION

TITLE

LIGO Cavity Lengths and Core Optic Positions

APPROVALS:	DATE	REV	DCN NO	BY	CHK	DCC	DATE
DRAWN: D. Coyne	9/7/00						
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APPROVED:							
DCC RELEASE:							

Version 1 change: Shifted the beamsplitter (BS) for the 4 km interferometer so that the chief ray passes through the geometric center of the optic in order to maximize interference contrast.
Version 2 change: Corrected an error in the beamsplitter (BS) center position for the 4 km interferometer. This change was caught before the BS was installed. Also removed the previous core optic positions which were marked "obsolete" in order to reduce the potential for confusion.

1.0 Scope

This specification lists the locations of the LIGO core optics and cavity lengths for the as-built configuration. There are a number of technical documents which discuss the cavity length determination, ray tracing of the core optics and approximate positions of the LIGO core optics. This is meant to be the definitive source of the final positions and cavity lengths.

2.0 Reference Documents

The following documents are reference information on the LIGO cavity lengths, modulation frequencies and core optic positions. This document supersedes these documents.

T960122-00 M. Zucker, P. Fritschel, "Proposed initial detector MC and RC baseline lengths", 7/12/96.
T960181-00 J. Camp, "Initial Length Precision of LIGO Suspended Cavities"
T970068-00 D. Coyne, "recycling Cavity and Mode Cleaner Cavity Baseline Dimensions", 2/23/97.
T970091-00 D. Coyne, "Determination of the Wedge Angles for the Core Optic Components", 3/28/97.
T970156-03 D. Tanner, "LIGO Cavity Lengths and Modulation Frequencies", 3/17/98.
E990083-A D. Rose, M. Smith, IFO COC and Beam Coordinate Data", 3/15/99.

3.0 Core Optic Positions and Cavity Lengths

The following pages contain the positions of the LIGO core optics in the global coordinate system. The notation is the same as in T970068 (in particular, see the layout sketches in the appendix).

Revised ITMx_2k and ITMy_2k positions & ETM positions:						**(AS_BUILT)**	
		positions (mm)				**path**	
description	**point**	**x**	**y**	**z**	**n**	**reflection**	**refraction**
RM HR surface center	p3	12184.0	9060.0	43.0		0	0
BS first surface center	p4	9162.6	9059.6	-14.0	1	3021.938	3021.938
BS second surface center	p5	9116.1	9072.7	-14.8	1.44963		3091.979
FMy HR surface center	p6	199.6	9072.4	-96.3	1		12008.85
ITMy AR surface center	p7	199.6	**9470.3**	**-98.1**	1		12406.78
ITMy HR surface center	p8	199.6	**9569.1**	**-98.1**	1.44963		12550
FMx HR surface center	p9	9162.6	-199.6	-98.4	1	12281.52	
ITMx AR surface center	p10	**9587.8**	-199.6	**-100.3**	1	12706.78	
ITMx HR surface center	p11	**9686.6**	-199.6	**-100.3**	1.44963	12850	
						12850	12550
				avg. RC cavity length =		12700	
				RC asymmetry =		300	
Larm	2009120						
ETMy HR surface center		199.6	2018689.1	-98.1			
ETMx HR surface center		2018806.6	-199.6	-100.3			

Revised ITMx_4k and ITMy_4k positions and ETM positions:						**(AS_BUILT)**	
N.B.: These COC positions are for Lrc=9184.0 mm, Lmc=12245.4 mm, Larm=3995055 mm and f=24482 Hz							
		positions (mm)				**path**	
description	**point**	**x**	**y**	**z**	**n**	**reflection**	**refraction**
RM HR surface center	p3	-4596.0	212.0	26.0		0	0
BS first surface chief ray intercept	p4	-199.4	212.6	-57.0	1	4397.383	4397.383
BS second surface chief ray intercept	p5	-152.9	199.5	-57.8	1.44963		4467.425
BS front face center	pc	-191.1	221.0	-57.3			
ITMy AR surface center	p7	-199.4	**4707.7**	**-98.1**	1	8892.695	
ITMy HR surface center	p8	-199.4	**4805.2**	**-98.1**	1.44963	9034.034	
ITMx AR surface center	p10	**4572.2**	199.5	**-100.9**	1		9192.695
ITMx HR surface center	p11	**4669.7**	199.5	**-100.9**	1.44963		9334.034
						9034.034	9334.034
				avg. RC cavity length =		9184.034	
				RC asymmetry =		300.0001	
Note: The BS is positioned so that the chief ray passes through the optic geometric center							
in order to maximize interference contrast.							
Larm	3995055						
ETMy HR surface center		-199.4	3999860.2	-98.1			
ETMx HR surface center		3999724.7	199.5	-100.9			
BSCy center		0	4000000				
BSCx center		4000000	0				
(ETM-BSC center)y		-199.4	-139.8				
(ETM-BSC center)x		-275.3	199.5				