



LIGO Laboratory / LIGO Scientific Collaboration

LIGO- E1200039-v3

ADVANCED LIGO

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Pre-Stabilized Laser Subsystem Acceptance documentation
- L1 PSL-

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Distribution of this document:
LIGO Science Collaboration

This is an internal working note
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Purpose and general description

This document provides links to the acceptance documentation package (as defined in M1100282-v1. (some acronyms are defined at the end of this document)

1 Requirements documentation:

The design requirements document must be brought up to date, and pointers to background material, analyses, etc. added to the Requirements document. Pointers to prototyping endeavors should be included here.

- a. **Design Requirements Document (DRD)** T050036
2. **Supporting documents (models, analyses, ...)**

2 Design overview and detailed design documentation:

The Final Design Document must be brought up to date, and the detailed design made available via a tree structure pointing to the DCC and design vaults. Lower-level software (control laws, basic machine state and reporting) should be documented in this way, pointing to a software version control system.

document	DCC number
main documents	
final design document	T0900649
FD presentation	L1000084
FD committee report (accepted)	L1000084
optical layout	
PSL table layout	T0900610
PSL component list (shape data generated from Visio file, optics, mounts, DCC numbers, etc)	T0900633
list of optics and their data sheets	T1200041
control	
PSL control and DAQ layout	T1200085
electronic infrastructure document (power supplies, racks, crades)	T0900650
function and interface document: injection locking (ILS) and PMC servo	T0900578
ILS / PMC circuit board documentation	T0900577

function and interface document ISS inner loop	T0900630
ISS inner loop circuit board documentation	T0900631 D1001985
PSL monitoring fieldbox circuit board documentation	T0900632 D1002292
aLIGO PSL FSS Modifications	T1100119
aLIGO PSL TTFSS fieldbox	D1100367
aLIGO PSL VCO fieldbox	D1100369
PSL photodiodes design document	T0900618
aLIGO PSL PD mechanical drawings	D1200121
PSL rf electronic components	T0900589
interfaces	
interface document	T0900644
rooms and infrastructure	
laser room design document	T1000028
laser diode room design document	T070195
L1 and H1 PSL/IO optical table and Laser Area Enclosure layout drawing	D1003076
Mechanical Sections and Details - H1 Laser Area Enclosure Acoustic Shell	D1002388
electro-optical components	
aLIGO bow-tie Pre-Mode Cleaner document	T0900616
PMC technical drawings	T1000088
PMC construction manual	T1000430-x0
manuals and descriptions	
user manual 35W laser	T0900646
user manual 200W laser	T0900641
Advanced LIGO PSL Diagnostic Breadboard Instruction Manual	T0900133
Advanced LIGO PSL Diagnostic Breadboard Computer Control Manual	T0900579
PSL EPICS user interfaces	T0900634

Coolant system operating & maintenance manual	T1100373
CDS channel list with short descriptions	T1200092
miscellaneous	
Coolant distribution system schematic	T1100372
drawing list	
spare concept	T0900645
Advanced LIGO PSL Installation Plan	T0900568
aLIGO PSL Safety Plan	T0900614
aLIGO PSL Interlock Concept	T1000005
failure mode document	T080247
Slow_Ethercad_PSL_Control_Chassis	T1100326

Laser Area Enclosure - Cleanroom

DCC #	Description
C1002229-v1	PSL Laser Area Enclosure Cleanrooms - Specifications, Requirements, and Design Considerations
D1002633-v2	Ante-room Plan, H1 Laser Area Enclosure
D1002634-v1	Ante-room Elevations, H1 Laser Area Enclosure
D1002781-v2	Ante-room Plan, H2 Laser Area Enclosure
D1002786-v2	Ante-room Elevations, H2 Laser Area Enclosure
D1002787-v2	Ante-room Plan, L1 Laser Area Enclosure
D1002789-v2	Ante-room Elevations, L1 Laser Area Enclosure

Acoustic Shell Drawings :

DCC #	Description
D1002386-v3	Mechanical Plan, H1 Laser Area Enclosure Acoustic Shell
D1002387-v2	Mechanical Plan and schedules, H1 Laser Area Enclosure Acoustic
D1002388-v3	Mechanical Sections and Details, H1 Laser Area Enclosure Acoustic Shell

D1002389-v2	Room Layout/Framing Plan, H1 Laser Area Enclosure Acoustic Shell
D1002390-v2	Framing Plans and Elevations, H1 Laser Area Enclosure Acoustic Shell
D1002396-v2	Mechanical Plan, H2 Laser Area Enclosure Acoustic Shell
D1002397-v2	Mechanical Plan and schedules, H2 Laser Area Enclosure Acoustic Shell
D1002398-v2	Mechanical Sections and Details, H2 Laser Area Enclosure Acoustic Shell
D1002399-v2	Room Layout/Framing Plan, H2 Laser Area Enclosure Acoustic Shell
D1002411-v2	Framing Plans and Elevations, H2 Laser Area Enclosure Acoustic Shell
D1002391-v3	Mechanical Plan, L1 Laser Area Enclosure Acoustic Shell
D1002392-v2	Mechanical Plan and schedules, L1 Laser Area Enclosure Acoustic Shell
D1002393-v2	Mechanical Sections and Details, L1 Laser Area Enclosure Acoustic Shell
D1002394-v2	Room Layout/Framing Plan, L1 Laser Area Enclosure Acoustic Shell
D1002395-v2	Framing Plans and Elevations, L1 Laser Area Enclosure Acoustic Shell

drawings of PSL components

		35W Laser Container
available at LZH		mechanical design
available at LZH		electrical design
T1100372		cooling water design
		200W High Power Laser Oscillator Container
available at LZH		mechanical design (LZH)
available at neOLASE		mechanical design (NeOLase)
available at neOLASE		electrical design
T1100372		cooling water design
D1200121		OSC monitoring photodiodes mechanical design
D1002164		OSC monitoring photodiodes schematic

		Diagnostic Breadboard Container
T0900133		cabeling reference
T0900133		Breadboard optical layout
T0900133		Simplified schematic of the whole electronics.
T1200078		HV Amplifier module front
T1200078		HV Amplifier module schematic
T1200078		Demodulator front
T1200078		Demodulator schematic
T1200078		Controller 1 module front
T1200078		Controller 1 module schematic
T1200078		Controller 2 module front
T1200078		Controller 2 module schematic
T1200078		Miscelleneaus module front
T1200078		Miscelleneaus module schematic
T1200078		DBB interface adapter (at DBB box)
T1200078		DBB RIN PD schematic
T1200078		DBB RIN PD mechanical design
T1200078		DBB quadrant PD schematic
T1200078		DBB quadrant PD mechanical design
		PreModecleaner Container
D1001618		PMC servo module schematic
T0900577		PMC servo module front
D1001619		PMC field box module schematic
T0900577		PMC field box module front
D1001955		PMC spacer
D1001955		PMC tank

D1002163		PMC photodiode schematic
D1200121		PMC photodiode mechanical design
		Injection Locking Container
D1001618		ILS servo module schematic
T0900577		ILS servo module front
D1001619		ILS field box module schematic
T0900577		ILS field box module front
D1002163		ILS photodiode schematic
D1200121		ILS photodiode mechanical design
D1001811		Heat sink for aLIGO PSL Servo PCB
		Frequency Stabilization Container
D040105-B		FSS table top servo schematic
D040424-A		FSS daughter board
D040469-00		FSS rf summation box
T1100119		TTFSS modification electronic components
D1100371		TTFSS Daughterboard
D1100367		TTFSS field box module schematic
D1100367		TTFSS field box module front
D1100369		VCO field box module schematic
D1100369		VCO field box module front
D980670-00-D		FSS reference cavity
D980676-00-D		FSS tank
D1200164		FSS reference cavity mount
D000214-00-C		FSS reference cavity temperature stabilization schematic
D980454-00-C		FSS rf-photodiode schematic
D989677-00-D		FSS rf-photodiode mechanical design

D1100677		FSS RPD 4inch mount
D1002164		FSS trans-photodiode schematic
D1200121		FSS trans-photodiode mechanical design
D1002841		aLIGO PSL FSS periscope adapter
D1100031		aLIGO PSL FSS periscope adapter angled
D1100676		FSS EOM/AOM mount
		Power Stabilization Container (first loop)
D1001985		ISS servo module inner loop, schematic
D1001986		ISS servo module inner loop, front
D1001998		ISS photodiode schematic
D1200121		ISS photodiode mechanical design
D1002280		Quadrant photodiode for aLIGO PSL ISS
D1003121		ISS inner loop photodiode box
D1002707		aLIGO PSL AOM driver
D1100587		aLIGO PSL AOM Base mechanical drawing
D1100588		aLIGO PSL ISS tube adapter for PMC
D1100589		aLIGO PSL ISS tube mirror base
D1100590		aLIGO PSL ISS tube base
D1100591		aLIGO PSL ISS tube apertures
		Laser Room Container
D1002633-v2		Ante-room Plan, H1 Laser Area Enclosure
D1002634-v1		Ante-room Elevations, H1 Laser Area Enclosure
D1002781-v2		Ante-room Plan, H2 Laser Area Enclosure
D1002786-v2		Ante-room Elevations, H2 Laser Area Enclosure
D1002787-v2		Ante-room Plan, L1 Laser Area Enclosure
D1002789-v2		Ante-room Elevations, L1 Laser Area Enclosure

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D1002393-v2		Mechanical Sections and Details, L1 Laser Area Enclosure Acoustic Shell
D1002394-v2		Room Layout/Framing Plan, L1 Laser Area Enclosure Acoustic Shell
D1002395-v2		Framing Plans and Elevations, L1 Laser Area Enclosure Acoustic Shell
		Laser Diode Room Container
T070195		Laser Diode Room design
D1002292		PSL monitoring fieldbox, schematic

D1002293		PSL monitoring fieldbox, front
D050339		Delay Lines
D1100115		PSL CCD breakout panel
T1200085		PSL top level control design, rack location, rack partition, wiring
		Laser Table Container
T0900610		PSL table layout
D1002708		aLIGO PSL table power distributor
D1002929		aLIGO PSL Power monitoring PD, schematics
D1200121		aLIGO PSL Power monitoring PD, mechanical design
D1002657		aLIGO PSL standard mirror mount base
D1002659		aLIGO PSL off-grid mirror mount base, variant 1
D1002660		aLIGO PSL off-grid mirror mount base, variant 2
D1002662		aLIGO PSL beam dump holder for mirror mount base
D1002658		aLIGO PSL 0deg mirror mount base
D1100580		aLIGO PSL mirror base AOM diffracted beam
D1100582		aLIGO PSL PBS mount
D1100631		aLIGO PSL beam dump holder for PBS mount
D1100583		aLIGO PSL low power attenuator
D1100584		aLIGO PSL high power attenuator
D1100585		aLIGO PSL waveplate base
D1100586		aLIGO PSL power meter mount
D1100592		aLIGO PSL lens mount rail (SDS 40)
D1100593		aLIGO PSL lens mount (SDS 40)
D1100594		aLIGO PSL lens mount rail
D1100595		aLIGO PSL lens mount, option 1
D1100596		aLIGO PSL lens mount, option 2

D1100597		aLIGO PSL lens mount adapter (SDS 40)
D1100120		aLIGO PSL CCD post

3 Materials and Fabrication specifications:

Any special materials, or treatment of materials including preparation for in-vacuum use; this may be integrated into the Design documentation.

4 Parts and spares

Parts and spares inventoried: All elements of aLIGO must be recorded in the ICS or in the DCC using the S-number scheme. As-built modifications for parts or assemblies should be found here.

- see tables in: *L1 Pre-Stabilized Laser Subsystem Testing and Acceptance E1100716*
- see ICS for US components
- components shipped from Germany (will be added to ICS after transfer of title)

detailed shipping list for Livingston					
Component	DCC-number	Amount	Spares	Total	
200W high power laser (HPL)					
High power laser "2010/11/LLO1"		1		1	
Front-End Laser Head		0	1	1	
		0			
Cables NeoLase		4		4	
Laser diode boxes (NeoLASE)		4		4	
Control Box		1		1	
Interlock Box		1		1	
Front End Diode Box		1		1	
NPRO Driver		1		1	

PC NeoLase		1		1
Power supply NeoLase		6		6
		0		
Fiberbundle, 75m, 4 fibers		4		4
Fiberbundle, 75m, 4 fibers		0	6	6
Stress reliefs (fixes fiber bundles at housing)		4		4
Counternuts (fixes fiber bundles in Be-Ri mount)		4	3	7
		0		
Ocean Optics HR4c4042 (spectrometer)		0	1	1
spectrometer driver		0	1	1
100m patch control fiber		1	1	2
Ext.Powermeter		1		1
		0		
Cable for Long range actuator (LRA)		1		1
LRA, including driver		0	1	1
Fiberswitch		0	1	1
HPL Water				
Water manifold LZH (underneath optical table)		1	1	2
Watermanifold Shutter/PowerHeads (small one at housing)		1		1
Watermanifold Pumpchambers (above pump chambers)		0	4	4
Water manifold (IO and laser external components)		1		1
Pressure valve (connected to diode chiller for "table water")		1		1
Water manifold x-Tal + LH (big one at housing)		0	1	1
Water connectors		0		
Flow sensors		0	4	4

PUN hoses		0		
Silicone hoses (Red)		0		
		0		
HPL Mechanics				
Faraday Isolator		0	1	1
Laserhead		0	4	4
external shutter		0	1	1
internal shutter		0	1	1
Piezo		0	1	1
Flowsensor-POM		0	1	1
Pump chamber		0	4	4
Beri X-Y-mount		0	5	5
Halo aperture, including several insets		0	1	1
4f- aperture for alignment		4		4
Piezo-Stage		0	1	1
Modematching Holder		0	2	2
Beam dump brewster plate		1		1
Beam dump TFP		1		1
Entrance/output windows		0	2	2
Brewster mount		0	1	1
Iris apertures		3		3
Mount for testing fiberbundles		1		1
Thorlabs parts		0		
		0		
HPL Optics				
Homogenizer in laser head		0	4	4
Homogenizer		0	4	4
Xtals in laser head		0	4	4

Xtals		0	5	5	
Dichroic mirrors		0	4	4	
50% output coupler		0	5	5	
45° mirrors 10ppm		0	5	5	
45° mirrors HR		0	5	5	
TFP		0	5	5	
Calcite wedges		0	2	2	
DKDP crystals		0	2	2	
AR windows		0	3	3	
Brewster plate		0	5	5	
1,5" mirror		0	1	1	
Mode-matching-set		1		1	
		0			
HPL Tools					
Parts of housing 2010/11/LLO1		2		2	
Toolbox LZH		1		1	
Metric Screw Box		1		1	
PMC	D1001955	1	1	2	
ISS-Box	D1003121	1	1	2	
Periscope Rod		2	0	2	
Periscope Mounts		4	1	5	
Periscope Adapter normal	D1002841	3	0	3	
Periscope Adapter special	D1100031	1	0	1	

Shutter		2	1	3	
Shutter Mounts	D1100581	2	0	2	
Mirrors					
Mirror Bases (Standard Design)	D1002657	20	10	30	
Mirror Bases (Offgrid Design oP)	D1002659	7	2	9	
Mirror Bases (Offgrid Design mP)	D1002660	1	1	2	
Plates for Mirror Bases (Offgrid Design mP)	D1002660	1	1	2	
Mirror Bases Dump Holder	D1002662				
Mirror Bases (0deg Design)	D1002658	1	0	1	
Mirror Base AOM Diffracted Beam	D1100580	1	1	2	
Mirror HR		27	8	35	
Mirror Ts=1%		3	4	7	
Mirror Tp=50%		1	2	3	
Mirror Tp=0.20%		3	5	8	
Mirror 0deg		1	2	3	
Mirror Tp=200ppm		1	2	3	
Mirror Mount U100-A-2H-LH		18	8	26	
Mirror Mount U100-A-2H		18	8	26	
distance plate for mirror mounts					
PBS		5	2	7	
PBS Mount	D1100582	5	1	6	
Dump Holder	D1100631				
Low Power Attenuator	D1100583	1	2	3	
High Power Attenuator	D1100584	1	1	2	

Wave Plate Mount Base	D1100585	7	1	8	
precision Rotationmount		1	1	2	
Half-wave plates HP		1	1	2	
Rotationmount		6	1	7	
Half-wave plates		3	1	4	
Quarter-wave plates		3	1	4	
Low Power Dumps (Thorlabs)					
Mounts (Throlabs)					
Medium Power Dumps		1	1	2	
High Power Dumps		1	2	3	
Power Meter (08.0468, 08.0469)		1	1	2	
Power Meter Mounts	D1100586	1	1	2	
Photo diodes					
Power Mon PD (PD1)	D1002929	1	1	2	
PMC Locking PD (PD2)	D1002163	1	1	2	
FSS refl. (PD3)		1	1	2	
FSS trans. (PD4)	D1002164	1	1	2	
ILS Locking PD	D1002163	0	1	1	
OSC PD AMP	D1002164	0	1	1	
OSC PD INT	D1002164	0	1	1	
OSC PD BP	D1002164	0	1	1	
OSC PD ISO	D1002164	0	1	1	
AOM		1	1	2	
AOM Base	D1100587	1	1	2	
AOM Driver	D1002707	1	1	2	

AOM Slider		1	1	2	
AOM Mount 9071		1	1	2	
ISS Tube Adapter PMC	D1100588	1	0	1	
Mirror Mount (KCB1)		2	0	2	
Base Tube Mirror	D1100589	2	0	2	
Base Tube	D1100590	1	0	1	
SM1RC		1	1	2	
SM1T2		2	2	4	
SM1T10		2	0	2	
SM1L03		0	2	2	
SM1L05		0	2	2	
SM1L10		2	0	2	
SM1L20		2	0	2	
SM1L30		0	2	2	
SM1M30		1	0	1	
SM1V10		4	2	6	
Tube Aperature	D1100591	10	0	10	
Rail 1m		1	1	2	
Rail 0.4m		1	0	1	
Rail 0.2m		2	0	2	
Rail slider		9	4	13	
SDS 40		6	1	7	
Alignment Adapters		2	0	2	
Alignment Adapters inner part		4	0	4	
Lenses					
FS f=-50 Quioptiq		2	1	3	

FS f=300 Quioptiq		2	1	3
FS f=400 Quioptiq		1	1	2
BK7 f=50 (PDs)		2	0	2
BK7 f=80 (DBB)		1	0	1
BK7 f=100 (FE to DBB, PD)		2	0	2
BK7 f=150 (FE to DBB, DBB, FSS)		3	0	3
BK7 f=200 (FSS)		3	0	3
Lens Mounts on Rail with SDS 40	D1100592	4	1	5
Lens Mounts no Rail with SDS 40	D1100593	2	0	2
Lens Mounts on Rail no SDS 40	D1100594	2	0	2
Lens Mounts simple	D1100595	1	1	2
Lens Mount no Holder needed	D1100596	5	1	6
SDS Adapter	D1100597	8	1	9
Lens Holder X-Y		1	1	2
Lens Holder		8	2	10
TFP		2	2	4
Tool Box		2	0	2
screws				
Cables				
13m LEMO 00 cables		55	0	55
0.5m LEMO 5pin cables		2	1	3
2m LEMO 5pin cables		3	1	4
13m SMA to LEMO		2	2	4
13m LEMO 0S to LEMO 0S		1	1	2
2m SMA to BNC		3	1	4

13m 4-pin LEMO		1	1	2	
13m LEMO 0S to LEMO 2-pin		1	1	2	
13m BNC to LEMO 00		1	1	2	
13m SMB to BNC		1	1	2	
13m LEMO 5pin to LIGO		4	2	6	
13m BNC auf SMA (1 gewinkelt)		2	1	3	
GEO male to GEO male		1	1	2	
Adapter Power Meter		1	1	2	
13m Shutter cable		2	1	3	
labeling stuff					
9-pin Sub-D 50m		35	2	37	
25-pin Sub-D 50m		5	2	7	
Electronics					
Monitoring Fieldbox	D1002292	1	1	2	
ILS/PMC fieldbox	D1001619	2	2	4	
ILS Servo	D1001618	1	1	2	
PMC Servo	D1001618	1	1	2	
ISS	D1001985	1	1	2	
Delay Lines	D050339	2	2	4	
TTFSS Fieldbox	D1100367	1	1	2	
VCO Fieldbox	D1100369	1	1	2	
TTFSS Daughterboard	D1100371	1	1	2	
TTFSS modifaction electronic components	T1100119	1	1	2	
Power Distributor	D1002708	2	1	3	
CCD		6	1	7	
Adapter C-Mount-SM1 (SM1A10)		6	1	7	

CCD Mounts	D1100120 + NP	6	1	7	
Brakeoutpanel	D1100115	1	0	1	
power cables		6	1	7	
signal cables		6	1	7	
LEMO					
1m LEMO 00					
2m LEMO 00					
5m LEMO 00					
ABF.00.250.CTA LEMO BNC Adapter		10	0	10	
ABA.00.250.NTL BNC LEMO Adapter		10	0	10	
ASA.00.250.NTL LEMO SMA Adapter		10	0	10	
ASF.00.250.NTA SMA LEMO Adapter		10	0	10	
FRT.00.250.CTA00 shorted		5	0	5	
FRT.00.250.CTA50 50 Ohm Resistor		10	0	10	
FTR.00.250.CTA Winkel		5	0	5	
RMA.00.250.CTM female-female Adapter		20	0	20	
FTL.00.250.CTF T-Connectors		20	0	20	
FTY.00.250.CTF Y-Connectors		10	0	10	
FFS.00.250.CTCE31 single connector		20	0	20	
DPE.99.123.8K Crimping tool		1	0	1	
Gewindeschneider M2					
Gewindeschneider M3					
Gewindeschneider M4					
Gewindeschneider M6					
Gewindeschneider 6-32					
Gewindeschneider 8-32					

NG3 filter 1mm				3	
NG3 filter 2mm				3	
NG3 filter 3mm				3	
NG4 filter 1mm				3	
NG4 filter 2mm				3	
NG4 filter 3mm				3	
NG5 filter 2mm				3	
NG5 filter 3mm				3	
NG9 filter 1mm				3	
NG11 filter 1mm				3	
NG11 filter 2mm				3	
NG11 filter 3mm				3	
RG850 filter 3mm				5	
Hosts 50m				1	
Laserdiodes (Neolase)			5	5	
DBB					
Breadboard with side and top plates		1	0	1	1
Small cover plate		1	0	1	1
Electronic crate		1	1	2	2
HV		1	1	2	2
demod		1	1	2	2
misc		1	1	2	2
fieldbox		1	1	2	2
cali		1	0	1	1

HV power supply		1	0	1	1
CCD power supply		1	0	1	1
Lemo 00 cable, 13m		7	1	8	8
Lemo 3pin, 13m		2	1	3	3
Lemo 4pin, 13m		5	1	6	6
Lemo 0S, 13m		1	1	2	2
Shutter cable, 13m		1	1	2	2
Geo 4pin, 13m		1	1	2	2
Geo 5pin-Sub-D, 13m		1	1	2	2
Geo 5pin-Sub-D, 5m		1	1	2	2
US power cable		1	0	1	1
CCD cable, 13m		1	0	1	1
CD-ROM with documents		1	0	1	1
Adapter fieldbox		3	0	3	3
spare shutter		2	0	2	2
spare QPD		2	0	2	2
heat cond. foil and washer for QPD		1	0	1	1
spare TPD		1	0	1	1
spare RPD		1	0	1	1
spare CCD		2	0	2	2
spare PZT		2	0	2	2
spare servo for ML		2	0	2	2
gap pad for shutter		1	0	1	1

5 Assembly procedures:

All assembly procedures must be in the DCC and annotated or updated for lessons learned. Storage, if used, should be described here along with procedures to maintain the equipment in good condition (e.g., purge frequency). Transportation procedures and cautions must be noted. Assembly procedures for the larger sub-assemblies like the high power laser, 35W front-end laser, DBB are available from LZH, neoLASE or AEI.

Installation procedures: *All installation procedures must be in the DCC and annotated or updated for lessons learned.*

- Advanced LIGO PSL Installation Plan T0900568

6 Test documents

Test rationale, plans, and data for each unit must be documented as described in M1000211. That tree structure should be pointed to by the overall tree structure laid out in this Acceptance prescription. The top-level objective is to make clear how the measurements performed, which often will not directly measure a required performance parameter, give confidence that the subsystem will fulfill the requirements.

aLIGO PSL Testing and Commissioning Documentation E1000443-x0

1. aLIGO PSL Testing- Phase 1: Testing prior to integration E1000703-x0
 - a. PSL Testing: High-Power-Laser (HPL) E1000722-x0
 - i. PSL Testing: HPL sub-assembly component tests E1000728-x0
 1. HPL electronic (Control-Box, Frontend Diode-Box, Interlock-Box, PSL-Computer)
 - a. High Power Laser (HPL) electronic test procedure E1000444
 - b. High Power Laser (HPL) electronic test report - OBS1 E1000445
 - c. High Power Laser (HPL) electronic test report - OBS2 E1100116
 - d. High Power Laser (HPL) electronic test report - OBS3 E1200190
 - e. High Power Laser (HPL) electronic test report - spares E1200191
 2. HPL Diode-Box
 - a. High Power Laser (HPL) laser diode box test procedure E1000446
 - b. High Power Laser (HPL) laser diode box test report - OBS1 E1000447
 - c. High Power Laser (HPL) laser diode box test report - OBS2 E1100117
 - d. High Power Laser (HPL) laser diode box test report - OBS3 E1200190
 - e. High Power Laser (HPL) laser diode box test report - spares E1200191
 3. HPL front end laser (in paper form at AEI)
 4. HPL pump light fiber E1100214, E1100444, E1200193
 5. HPL chiller (in paper form at AEI)
 6. HPL injection locking electronics
 - a. Locking photodiodes
 - Locking photodiodes test procedure T1000479
 - testplan for ILS PDs installed in L1 is in S1103594
 - Locking photodiodes test report S1107859
 - Locking photodiodes test report S1107852
 - Locking photodiodes test report S1107851
 - injection locking modules
 - Injection Locking and PMC Locking Fieldbox Module Test Plan T1000343
 - injection locking modules test report S1103536 LLO
 - injection locking modules test report
 - injection locking modules test report
 - injection locking modules test report

injection locking modules test report

- **HPL monitoring diodes**
 - Monitor photodiodes test procedure T1000478
 - L1 monitor photodiodes**
 - Monitor photodiodes test report S1103592 (L1 ref. cav. trans)
 - Monitor photodiodes test report S1103593 (L1 ref. cav. trans, spare)
 - testplans for all mon. PDs installed in L1 are in S1103594
 - Hanford monitor photodiodes**
 - testplans for all mon. PDs installed in H2 HPL are in S1107826
 - Monitor photodiodes test report S1107849
 - Monitor photodiodes test report S1107853
 - Monitor photodiodes test report S1107854
 - Monitor photodiodes test report S1107861
 - Monitor photodiodes test report S1107862
 - Monitor photodiodes test report S1107855
 - Monitor photodiodes test report S1107863
 - Monitor photodiodes test report S1107865
 - Power monitor photodiode test procedure** T1000668
 - L1 monitor photodiodes**
 - Power monitor photodiode test report S1107864
 - Power monitor photodiode test report S1107860
 - Power monitor photodiode test report S1107858 (L1 spare)
 - Power monitor photodiode test report S1107857
 - Power monitor photodiode test report S1107856
 - Power monitor photodiode test report S1103590 (L1 installed)
- ii. **PSL Testing: HPL test procedure (LZH after assembly of sub-components)**
 - a. PSL Testing: HPL OBS1 test protocol E1100213
 - b. PSL Testing: HPL OBS2 test protocol E1100955
 - c. PSL Testing: HPL OBS3 test protocol E1200192
- ii. **PSL Testing: pre-mode cleaner (PMC) E1000723-x0**
 - a. **PMC testing**
 - a. PMC test procedure T1000429
 - b. PMC OBS1 test protocol E1100123 S1102964
 - c. PMC OBS2 test protocol S1107832
 - d. PMC OBS3 test protocol: test plan in GIT wait for S-number to put into DCC
 - e. PMC spares LLO test protocol E1100124 S1102965
 - f. PMC spares LHO test protocol S1107833
 - g. PMC spares LHO test protocol: test plan in GIT wait for S-number to put into DCC
 - b. **PMC locking photodiode**
 - a. PMC locking photodiode test procedure T1000479
 - b. PMC locking photodiode test report S1107847 SN35 PMC H2
 - c. PMC locking photodiode test report S1107850 SN37
 - d. PMC locking photodiode test report S1107848 SN44

- e. PMC locking photodiode test report S1103588 SN26 PMC LLO
- f. PMC locking photodiode test report S1103589 SN27 PMC LLO spare
- c. **PMC locking electronic module**
 - a. Injection Locking and PMC Locking Fieldbox Module Test Plan T1000343
 - b. PMC locking electronic module test report S1107798
 - c. PMC locking electronic module test report S1107814
 - d. PMC locking electronic module test report S1103538
 - e. PMC locking electronic module test report S1103539
 - f. PMC locking electronic module test report: test plan in GIT wait for S-number to put into DCC
 - g. PMC locking electronic module test report: test plan in GIT wait for S-number to put into DCC
- iii. **PSL Testing: diagnostic breadboard (DBB)E1000724-x0**
 - a. DBB OBS1 test protocol E1100120
 - b. DBB OBS2 test protocol S1107846
 - a. OBS2 DBB calibration module S1107840
 - b. OBS2 DBB fieldbox S1107842
 - c. OBS2 DBB misc module S1107838
 - d. OBS2 DBB demodulator module S1107835
 - e. OBS2 HV module S1107834
 - c. DBB OBS3 test protocol : wait for S-number to put into DCC
 - d. DBB spares LLO test protocol E1100121
 - a. OBS2 DBB fieldbox S1107837
 - b. OBS2 DBB misc module S1107839
 - c. OBS2 DBB demodulator module S1107836
 - d. OBS2 HV module S1107802
- iv. **PSL Testing: power stabilization (ISS)E1000725-x0**
 - a. aLIGO PSL ISS sensing box test plans
 - PSL ISS-Box Test Plan template E1000748
 - PSL ISS inner-loop photodiode testplan template E1000473
 - PSL ISS inner-loop quadrant photodiode testplan template E1000467
 - PSL ISS OBS1 and spares LLO test plan portfolio E1100125
 - PSL ISS OBS2 test plan portfolio E1200187
 - PSL ISS OBS3 test plan portfolio E1200188
 - PSL ISS LHO spare test plan portfolio E1200189
 - ii. aLIGO PSL ISS servo module test plans
 - ISS servo module test plan - OBS 1 S1103557
 - ISS servo module test plan - LLO spare S1103556
 - ISS servo module test plan - OBS2 S1107804
 - ISS servo module test plan- LHO spare - S1107805
 - ISS servo module test plan- OBS3
 - a. **PSL Testing: frequency stabilization (FSS)E1000726-x0**
 - c. table top frequency stabilization servo - field box
 - TTFSS fieldbox S1107816-x0
 - TTFSS fieldbox S1107844-x0
 - TTFSS fieldbox S1103554-x0
 - TTFSS fieldbox S1103905-x0

- iv. table top frequency stabilization servo - field box
 - VCO fieldbox S1107815-x0
 - VCO fieldbox S1107845-x0
 - VCO fieldbox S1103555-x0
 - VCO fieldbox S1103906-x0
- e. PSL Testing: miscellaneous components E1000727-x0
 - i. monitoring field box
 - monitoring field box OBS1 and spare LLO E1100127
 - monitoring field box OBS2_3 and spare LHO E1100126
 - f. Injection Locking and PMC Locking Fieldbox Module
 - Injection Locking and PMC Locking Fieldbox Module test report S1103541
 - Injection Locking and PMC Locking Fieldbox Module test report S1103540
 - Injection Locking and PMC Locking Fieldbox Module test report S1103542
 - Injection Locking and PMC Locking Fieldbox Module test report S1103543
 - Injection Locking and PMC Locking Fieldbox Module test report S1107806
 - Injection Locking and PMC Locking Fieldbox Module test report S1107809
 - Injection Locking and PMC Locking Fieldbox Module test report S1107808
 - Injection Locking and PMC Locking Fieldbox Module test report S1107808
 - Injection Locking and PMC Locking Fieldbox Module test report: test plan in GIT wait for S-number to put into DCC
 - Injection Locking and PMC Locking Fieldbox Module test report: test plan in GIT wait for S-number to put into DCC
- 2. aLIGO PSL Testing-Phase 2: After shipment before installation E1000704-x0
 - only visual inspections were done before installation
- 3. aLIGO PSL Testing-Phase 3: stand-alone PSL testing after installation E1000705-x0
 - a. neoLase test document (Laser Diodes, computer control, interlock)
 - OBS1 E1100539
 - OBS2 E1100540
 - OBS3 E1100541
 - b. PSL performance and acceptance document
 - OBS1 E1100716
 - OBS2
 - OBS3
 - c. enclosure, table legs, etc
 - i. table leg testing
 - a. L1 table leg installation and test document T1200172
 - b. H2 table leg installation and test document
 - c. H1 table leg installation and test document
 - ii. acoustic testing H2 enclosure T1200171-v1
(Robert Schoefield thinks results are representative for H1 and L1 too)
 - iii. miscellaneous relevant environmental tests
 - . magnetic fields from chiller
- 4. aLIGO PSL Testing-Phase 4: PSL part of integrated PSL/IO testing E1000706-x0

7 User interface software

User interface software, and the test routines indicating proper functioning of the software, must be described in words and have code under configuration control (SVN). Watchdog and Guardian routines must also be treated in this way.

- four PSL related RT control modules (ISS, DBB, PMC, FSS) under version control
https://redoubt.ligo-wa.caltech.edu/svn/cds_user_apps/trunk/psl
 - the models are in the ../psl/l1/models tree
 - the c-code used in the models is in the ../psl/l1/scr tree
 - once H1 and H2 PSLs are installed the plan is to have all PSL related RT models, MEDM screens and scripts in the ../psl/common area
- several EPICS MEDM user interfaces exist, all are under version control in
https://redoubt.ligo-wa.caltech.edu/svn/cds_user_apps/trunk/psl
 - as of Jan 2011 all LLO files are in the ../psl/LLO directory ,
 - once H1 and H2 PSLs are installed the plan is to have all PSL related RT models, MEDM screens and scripts in the ../psl/common area
- several scripts exist to perform DBB measurements and generate noise reports, the scripts are under version control in https://redoubt.ligo-wa.caltech.edu/svn/cds_user_apps/trunk/psl
- there are no PSL related watchdog and guardian routines

8 User's manual:

A manual appropriate for operators, covering alignment/adjustments and normal operations, must be available (and in the DCC). It must describe what not to do as well, and give clear guidance and cross-pointers to activities which require safety considerations. It must be accessible from standard user screens.

manuals and descriptions	
user manual 35W laser	T0900646
user manual 200W laser	T0900641
table layout with component list (incl. DCC of optics and mounts etc.)	T0900610
control and DAQ topology and rack layout	T1200085
Advanced LIGO PSL Diagnostic Breadboard Instruction Manual	T0900133
Advanced LIGO PSL Diagnostic Breadboard Computer Control Manual	T0900579
PSL EPICS user interfaces	T0900634
LLO PSL training session	G1100837
HPL quick start guide	T1100383

How-to change between high and low power mode of the PSL
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T1200025

9 Troubleshooting:

A guide must be developed that helps understand common error messages and events, and provides guidance for recovery and repair procedures as appropriate. Safety issues must be flagged.

- currently there is no Troubleshooting guideline as no *typical* errors occurred in the operation of the reference system, we have, however, started a troubleshooting section on the PSL wiki and will update this list
- we are testing a regular maintenance procedure to compensate for the aging of the PSL laser diodes, once this procedure is finalized a document will be put into the DCC
- **Safety** documentation
Safety documentation must be in the DCC for all phases of the subsystem development, including any needed for normal use or foreseen maintenance/repair scenarios.

aLIGO PSL Safety Plan	T0900614
aLIGO PSL Interlock Concept	T1000005
LLO 200 W PSL Installation SOP	M1100038
Hazard Analysis	T1000160

Acronyms

AOM	Acousto-Optic Modulator
CB	Control Box
CCD	Charge Coupled Device (camera)
DB	Diode Box
DBB	Diagnostic Bread Board
DCC	Document Control Center
EPICS	Experimental Physics and Industrial Control System: a set of Open Source software tools, libraries and applications developed collaboratively and used worldwide to create distributed soft real-time control systems for scientific instruments
FE	Front End
FSR	Free Spectral Range
FSS	Frequency Stabilization Servo

IL	Interlock Box
LAE	Laser Area Enclosure
LED	Light Emitting Diode
LD	Laser Diode
LDR	Laser Diode Room
LH	Laser Head
LHO	LIGO Hanford Observatory
LLO	LIGO Livingston Observatory
HPFI	High Power Faraday Isolator
HPO	High Power Oscillator?
ISS	Intensity Stabilization Servo
LVEA	Laser Vacuum Equipment Area
medm	a Motif graphical user interface for designing and implementing control screens, called displays, that consist of a collection of graphical objects that display and/or change the values of EPICS process variables
NPRO	Non-Planer Ring Oscillator
OPC	Open Process Control is a software application that acts as an API (Application Programming Interface) or protocol converter
PD	photodiode
PMC	Pre-Mode Cleaner
PS	Power Supply?
PSL	Pre-Stabilized Laser
PZT	Lead zirconate titanate, a piezo-electric actuator
RSD	remote shut down
RIN	Relative Intensity Noise
RPN	Relative Power Noise
rt	real time
TEC	Thermo-Electric Cooler Power Supply
UG	unity gain
VNC	Virtual Network Computing (VNC) is a platform-independent, graphical desktop sharing system that uses the RFB protocol to remotely control another computer
WinCAM	CCD camera for beam shape analysis