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PSL spare concept

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1 Purpose of this document

The purpose of this document is to define the general spares plan for the aLIGO PSL subsystem. The underlying concept is presented followed by a detailed list of spare parts.

2 Spare strategy

The general spare strategy assumes, that enough spare components have to be available to cover a 10 year period. (The spare strategy does not cover components that need to be exchanged on a regular basis like laser diodes, chiller filters and DI cartridges etc). Furthermore it is assumed, that a knowledgeable person is available at each LIGO site to perform the following tasks:

- change a laser diode box
- align the 35W front end laser
- change a laser head in the 200W laser
- align the 200W high power laser and the high power Faraday isolator
- replace a control module and adjust the filter parameters
- perform general optics replacement and modematching procedures
- perform general computer administration tasks

User manuals are provide for the lasers and the diagnostic breadboard to guide the alignment tasks.

The following questions guided the choice of spare:

- How high is the risk of failure?
- How easy is it to get a replacement after the fact of a failure (of the shelf component, production lead time, detailed knowledge and training required to produce such a component, single supplier).
- Trade-off between faster replacement of pre-assembled components and costs.

Furthermore we assume that CDS components like computers, chassis, DA/AD/DIO cards anti-aliasing and anti-imaging filters etc. are covered by a LIGO wide spare concept.

3 spare component list

We will have one full functioning 35W front end laser (including NPRO and electro-optical components) at each site. There will be no complete high power stage as a spare but separate units / components that compose the high power stage.

For the pump light fibers we follow the following rule:

- 2 spare front end fibers installed per laser
- one full bundle of 6 fibers available on spool at LHO (in case a full bundle is cut, ...)
- 2 spare high-power-pumplight bundles (à 7 fibers) installed per laser
- 4 spare bundles on spool at LHO, 4 spare bundles at LLO

component	LHO 1	LHO 2	LLO
NPRO	1		1
35 W front end laser			
complete front end laser	1		1
control box (not required for AdvLIGO Laser)	(see HPL stage)		
FE additional optical components (FI, EOM, PD, optics)	1	0	1
chiller (not required for AdvLIGO Laser)	(see HPL stage)		
fibers installed	2	2	2
fiber bundle on spool	1		
HPL components			
HPL electronics NeOLASE			
control box / interlock box/ Beckhoff PC	1 of each		1 of each
oscillator diode box	2		2
power supplies	3		3
TEC electronics plus BUZ (for one diode box)	2		2
all 4 different laser heads, pre-aligned	1		1
Homogenizer	4	4	4
laser crystal	5	5	5
45° dichroitic mirrors	5	5	5
birefringence compensation set (quartz rotator and 4f lenses)	2	2	2
output coupler	5	5	5
complete long range actuator with driver	1		1
PZT with mirror (characterized)	2	2	2
low power shutter	1		1
hp shutter	1		1
flipper with mirror/ solenoid (electromagnetic mount)	2	2	2
installed fiber bundle	2	2	2
fiber bundle on coil	4		4
45° turning mirror / 100ppm	5	5	5

45° turning mirror / HR	5	5	5
faraday isolator	1	1	1
thin film polarizer	5	5	5
calcite wedges	2	2	2
AR windows	5	5	5
Brewster plate / full assembly	1	1	1
Brewster plate	5	5	5
fitting and tubes			
MACOR mechanical components	4	4	4
laser head sealings / set	1		1
chiller set (rack with diode and Xtal chiller)	1	0	1
metric screw set	1		1
set of mirror mounts	1	1	1
set of lens mounts	1	1	1
cable set	1	1	1
DBB			
set of PZT mirrors	1		1
Quadrant photodiode	1		1
reflection PD	1		1
transmission PD	1		1
control electronics	1		1
DBB-CCD	1		1
shutter	2	2	2
other PSL components			
CCDs	2	2	2
high bandwidth PD	2	2	2
FSS rf diode	1	1	1
monitor dioden	2	2	2
ISS photodiode, inner loop	1	1	1
pumplight monitor electronics	1	1	1

high power AOM	1	1	1
PMC	1	1	1
mirrors , lenses, polarizers, retarding plates (low power)			
mirrors , lenses, polarizers, retarding plates (high power)			
high power beam dump	1	1	1
ISS high power AOM	1	1	1
high dynamic range cameras	1	1	1
power meters	1	1	1
LIGO scope (FSS components reuse from iLIGO)			
reference cavity	1		1
rf EOM 21.5 MHz	1	1	1
Ion pump incl. controler	1		1
ISS outer loop (in vacuum assembly)	1	1	1