

# Change Record for “aLIGO System Design”

Changes from -v2 to -v3 of T010075

1) section 1:

- Explained the situation with aLIGO's 3rd interferometer (H2) in the introduction.
- Added citation of the CQG overview paper on Advanced LIGO

2) section 2.3: Added comments and reference on availability.

3) section 2.4: Noted ground tilt sensing as a possible environmental sensing upgrade in the future.

4) section 2.5: Revised calibration requirements per Lindblom's paper.

5) section 3:

- updated figure 1 of the interferometer configuration. PRC full power is 5.2 kW, was 5.6 kW; arm cavity full power is 750 kW, was 800 kW.
- updated table 1 of interferometer parameters. Schnupp asymmetry is 8 cm, was 5 cm; Added IMC length & finesse; added PRC & SRC lengths.

6) section 3.1:

- To be consistent with the "ALIGO Interferometer Integration" plan (T1200437), dropped reference to operating without signal recycling (mode-0) and updated Figure 2 and Table 2 accordingly.
- Changed the SRM transmission to 35% (from 20%) for the low power, zero degree detuning case.

7) section 3.3: Clarified that remote tuning of the mode-matching of the beam to the interferometer beam in the IO section is a possible future upgrade (not part of the aLIGO baseline).

8) section 3.4:

- Changed the tense (from current to past) regarding the implementation of DC readout for eLIGO.
- Added reference for DC readout in eLIGO.
- Replaced the reference for the 40m DC readout experiment from G070447 to P070125.
- Noted that balanced homodyne readout is a possible future upgrade path.

9) section 3.7: Removed the historical reference to a high initial choice for the aLIGO arm cavity finesse (1200). Listed the technical considerations in the trade-off analysis for the 450 design value for the arm cavity finesse.

10) section 3.9: Added some notes and a reference regarding the trade-off study on test mass aspect ratio.

11) section 3.10:

- Added note that HWS probe beam considerations did not influence the TM coating design.
- Added the reference on titania-doped tantala/silica coatings.

12) section 3.11: Revised the loss breakdown design budget into terms and values more consistent with the COC DRD.

13) section 3.12:

- Corrected ITM ROC: was 1935 m, is 1934 m.
- Corrected CP thickness: was 13 cm, is 10 cm.
- Corrected CP mass: was 26 kg, is 20 kg.
- Removed the H2 FM optic from the table.
- Removed reference to H2 interferometer from Table 3 caption.

14) section 3.16:

- Removed the H2 Fold Mirror from Table 4.
- Corrected the RC optic noise requirement: was  $3e-17$ , is  $1e-17$  m/rHz
- Corrected the OMC noise requirement: was  $1e-11$ , is  $1e-13$  m/rHz

15) section 3.17

- Removed reference to bull's-eye sensors and phase cameras; they are not part of the aLIGO system.
- Removed reference to the dual-beam optical lever for ROC monitoring; this was never baselined.

16) section 3.19: Updated the parametric instability discussion and status; noted observation of PI in L1 and its mitigation with the ring heater.

17) section 3.20: Updated the electro-static charging discussion to include ion pump charging and its mitigation. Pending delivery of the Test Mass Discharge System (TMDS) is also noted.

18) section 4.1: replaced Figure 3 with gwinc-v3 plot. (slightly different than T010075-v2; same as in P1400117). Noted that gwinc-v3 is used (no longer gwinc-v2)

19) section 4.1.1: Updated the quantum noise comparison plot to exclude "mode 0", the case with no SRM, and changed the legend to name modes as per revised Figure 2 and P1400117.

20) section 4.1.3: Updated to gwinc-v3 and a newer M. Barton file derived from the Mathematica model, as recommended on the gwinc-v3 wiki site. Revised all figures generated with gwinc-v3.

21) section 5: For each subsystem, added the document tree root reference and the acceptance documentation references.