LASER INTERFEROMETER GRAVITATIONAL WAVE OBSERVATORY

LIGO Laboratory / LIGO Scientific Collaboration

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Output Modecleaner Suspension ELIGO test plan

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LIGO Science Collaboration

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1 Introduction

The purpose of this test plan is to verify that the OMC SUS suspension is meeting requirements for operation within ELIGO. It is assumed that the OMC SUS has already been tested on the bench as per the Output Modecleaner Suspension Test Plan (E070068-01), and hence many of those tests do not need to be repeated. The tests listed here are to check that the results obtained prior to installation into the HAM tank are repeatable and that the installation procedure has not introduced any problems.

2 List of tests

2.1 OSEM and electronics functionality tests

Check that all OSEMS are functioning and centred.

2.2 Pendulum frequency and transfer function tests

Measure transfer functions (TFs) at the top mass for each of the 6 degrees of freedom using the OSEMs. Check that the TFs are as expected from the MATLAB /Simulink model and that the pendulum frequencies agree with the model to within a few percent. The expected pendulum frequencies can be found in T080104-00-R (Parameter Set and Mode Frequencies for the OMC Suspension).

2.3 Damping tests

Check that the 6 degrees of freedom can be adequately damped (damping times of 10 seconds or less to amplitude of 1/e). Check that the damping works over the required range of alignment from the mean position.

2.4 Dynamic range

Check that the required range of alignment (few 100 microrad TBC) can be achieved.

2.5 Alignment tes

Check that the OMC bench is adequately aligned to allow the OMC to operate (this test needs to be done in conjunction with the ISC group). The OMC should be hanging at a height such that the beam is 101.6 mm +/- 2 mm [4.0 inches] above the HAM optics table. Since the beam runs 20 mm below the lower surface of the baseplate, this implies that the lower surface of the baseplate should be 121.6 +/- 2 mm from the optics table. Regarding the angular alignment, this should be within the range of the tip-tilt mirrors. A difference of 0.5 mm over the length of the baseplate of length 450 mm (which is approx 1 mrad) is acceptable and measurable with a ruler.

3 Input on performance from other systems

3.1 Structure resonant frequencies and interactions with HAM-ISI

The structure resonant frequencies have been previously measured for the structure in a stand-alone mode in bench tests. It is of interest to see if the lowest resonance (expected to be ~ 140 Hz) can be seen in the HAM-ISI transfer function measurements, and if it has any effect on the ISI performance. This investigation requires input from the SEI group.

3.2 Isolation performance as seen from OMC signals

There is no set-up to make a direct measurement of the isolation performance of the double pendulum. Its performance can to some extent be inferred from the TFs taken in 2.2 above. However it may also be possible to use an OMC signal to infer an upper limit to the performance, e.g. by observing the level of jitter. This investigation requires input from the ISC group.