TITLE

Procedure for using SUS Controller Pitch and Yaw Monitor Signals with Optical Lever Signals to Realign Large Suspended Optics

APPROVALS:		DATE	APPROVALS:		DATE
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Instructions on the use of this document:
1) Laminate this procedure (or place it in a plastic sleeve) and have it available at all times during the installation. (Clean the plastic with isopropyl alcohol and handle it as a class B tool per M990034).
2) Use this realignment procedure as a check list and check off items as the realignment proceeds. Note any discrepancies or deviations and augment with any missing definition. File any significant notes or data from the completed procedure in the electronic log book (such as any deviations); as a minimum note in the electronic logbook that the realignment was completed in accordance with this procedure (cite document number and revision).

1 SCOPE

This procedure is a check list of steps to follow as a guide to realign core optics. It was derived from our experiences realigning the ETMx-2k core optic in BSC5 and the ETMy-2k optic in BSC6. The final results typically improve the dynamic range of the suspension controller in the 'RUN' mode by ~50%.

2 APPLICABLE DOCUMENTS

Listed below are all of the applicable and referenced documents for this realignment procedure. This list gives the latest revisions of the documents; Within the alignment steps, only the document number (and not the revision) is quoted.Pre-requisites

M990034-B	Contamination Control Plan
E000062-C	LOS Installation Procedures for BSC Chambers
E000061-C	LOS Installation Procedures for HAM Chambers
E000065-04	Chamber Entry/Exit Checklist

3 PRE-REQUISITES

- ❑ 1. A cleanroom must be in place over the chamber and operable.
- ❑ 2. The vacuum equipment purge air system must be operable before starting the realignment.
- ❑ 3. The suspension controller, field wiring and satellite electronics box must be installed and tested.
- ❑ 4. The optical lever for the suspended core optic must be installed and operational.

4 PREPARATION

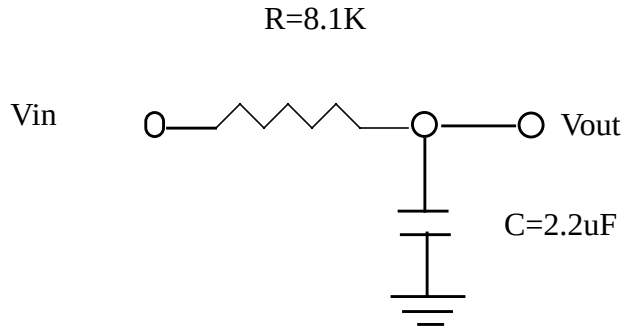
All preparation must be in accordance with the Contamination Control Plan (M990034).-6

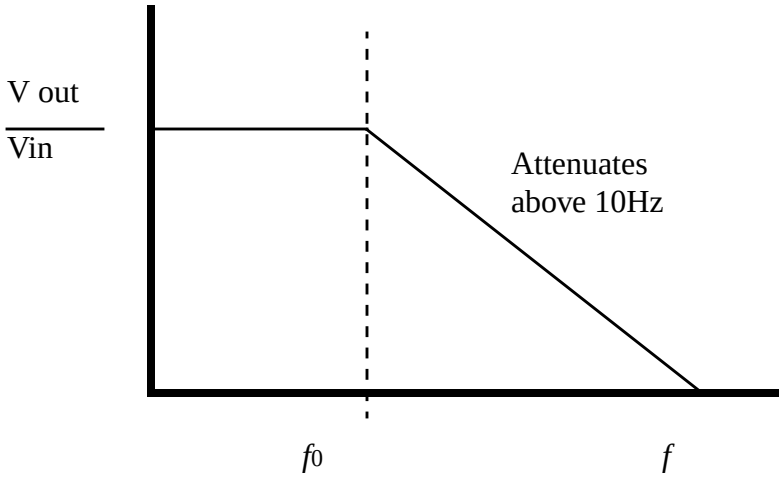
- ❑ 1. Clean the VEA, particularly the floor; Particulates and dust should be removed by mopping with clean water.
  Clean the BSC chamber (wipe or mop with clean water) from the stiffening ring above the door down, as well as the floor in the vicinity of the chamber well in advance of the opening of the vacuum system.
- ❑ 2. Stage clean garments, foil, clean class ‘B’ tools, flashlight, optical lever steering controllers, LP filters, oscilloscope and Two didgital VOMs, BNC cables, LEMO/BNC adaptors, extension cords, multi-plug strips.
- ❑ 3. Insure that there are no large openings to the exterior or the beam tube enclosure where insects or dust can get in.
- ❑ 4. NOTE: Turn ‘off’ chamber illuminator.
  Can easily change the Pitch and Yaw monitors by ~25-75mV (150-330uradians)
  Room lights effect~2mV(12uradians)
  People moving in chambers~5-7mV

5 LOW PASS FILTER USED

Optic moves @ ~ 1Hz

so attenuate above ~ 10Hz





$$f0 = \frac{1}{2\pi T} = \frac{1}{6.3 \times 1.6\times10^{-2}} = 10Hz$$

$$T = RC$$

$$2.2\times10^{-6} \times 8.1\times10^{3} = 1.6\times10^{-2} Sec$$

6 REALIGNMENT STEPS

All realignment steps must be in accordance with the Contamination Control Plan (M990034).

Sequence: The following steps are in a logical and workable sequence. However some of the steps can be done in parallel and some steps can be done at other points in the sequence.

❑ 1. Find the desired alignment of the optic (e.g., by bringing the IR laser spots seen on the CCD cameras onto the ETM and ITM mirrors) or through existing qualified aligment settings pulled from the Burt backup. Make sure that the Control Room is informed and that alignment is not disturbed from remote locations

❑ 2. Before venting the vacuum chamber, record all computer-settable parameters on all suspended optics in the system being used. (FM, ITM, ETM), including gain settings, offsets, and modes ASC setting; optical lever settings;Print record or print Burt backup. Attach copies

❑ 3. Before venting the vacuum chamber, record the Optical Lever SUM, Pitch and Yaw positions and continuously monitor for reference. (optical lever may go off scale after venting(ITMs), but it may be best to leave it alone and wait until the chamber is pumped down again for comparison). Only re-zero if the optical lever is off zero by >.5 unit. Use the DAQ system to Zero Optical Lever. Note Optical Lever redings: PITCH_____ YAW_____SUM_____.
❑ Check box if optical lever has been rezeroed during this step(This does give a maximum sensitivity.)

❑ 4. Before venting the vacuum chamber. Use a digital VOM measure the UL;UR;LL;LR;S coil voltages at the satellite box J3 connector. Use the test cable that has the 25 pin connector adapting to the 5 BCN cables from the optics lab test stand. Measure and record these voltages to a precision of 1/10mV. UL_____UR_____LL_____LR_____S_____

❑ 5. Before venting the vacuum chamber. Use a digital VOM, measure and record the Pitch and Yaw Monitor voltages from the SUS Control Rack through two 10Hz Low Pass Filters, to a precision of 1/10mV. (A ready made set of filters exists at Hanford.) .
PITCH Monitor_____ YAW Monitor_____
NOTE: Long cables need to have an in-line resistor added to compensate for the cable capacitance affecting driver.

❑ 6. Before venting the vacuum chamber. Attach the two 10 Hz Low Pass Filters to an oscilloscope on channels 1 & 2. Set the oscilloscope to 5mV/Div. sensitivity. Zero oscilloscope.
Using the LEMO to BNC cables, connect the SUS Pitch and Yaw Monitors with the filters on the oscilloscope and record measurements. Tee in the two digital VOMs to O-Scope and verify the values read from the VOM.

❑ 7. Before venting the vacuum chamber. Turn ‘off’ the suspension controllers for all the affected optics.

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compare the Optical Lever position to the position prior to venting (zero).

- ❑ 1. Vent Vacuum.
- ❑ 2. Repower the SUS Controller .
- ❑ 3. Recheck and record the Optical lever PITCH and YAW positions and SUM .
  PITCH_____ YAW_____SUM_____
- ❑ 4. Recheck and record the Pitch & Yaw Monitor voltages to a 1/10mV precision; these become the target voltages to be obtained in the alignment procedure before pumping.
  PITCH Monitor_____YAW Monitor_____
- ❑ 5. Adjust the Oscilloscope offsets to put the Pitch and Yaw Monitor voltage spot at the center. (oscilloscope: XY mode). Use a varible dc power source to calibrate the offsets (3.0V battery/ 10k pot)
- ❑ 6. Put the SUS Controller Pitch and Yaw offsets 'bias' to Zero in the RUN mode and/or the ASC 'bias' controls to Zero. See spot move off center on the oscilloscope. If large adjustments are needed it may be necessary to do it with smaller 'bias' changes. (Zero with the PAM screws, move the 'bias', adjust PAMs).
- ❑ 11. While observing the oscilloscope tweak the PAMs to bring the spot back to the center on the oscilloscope. The goal is to get within 2.5 mV. (use a 5mV scale)
- ❑ 12. Clamp optic and complete any additional task involving this chamber.
- ❑ 13. Just before exiting set safety stops to ~ .5mm gap.
- ❑ 14. Recheck and record the Optical lever PITCH and YAW positions and SUM .
  PITCH_____ YAW_____SUM_____
- ❑ 15. Record final readings PITCH Monitor_____ YAW Monitor_____
- ❑ 16. Before pumping on the vacuum chamber. Turn 'off' the suspension controllers for all the affected optics.
- ❑ 17. Turn 'on' the SUS controller and compare the new Optical Lever position with its starting position to verify the alignment improvments and log results.