LASER INTERFEROMETER GRAVITATIONAL WAVE OBSERVATORY
- LIGO -
CALIFORNIA INSTITUTE OF TECHNOLOGY
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Pcal End Station Power Sensor Responsivity Ratio Measurements: Procedures and Log

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- Plug in the Blue Satelite Box to the WS_PD connector on the PCAL Chassis, using the DB9/BNC male to DB9 female to power the Blue box. Ensure the Power Source switch on the back is in the proper setting. Plug the BNC cable into the FLuke Voltmeter for now. Plug in the integrating sphere while it is sitting in a safe location. Power on the power sensor and take note of the current temperature of the on-board AD590 using the Fluke Voltmeter.
  WS on-board temperature: ..... 293.1 ..... K

- Make sure that the IFO's ISC LOCK Gaurdian is in a down or idle state, and that it will not try to auto lock. (sitemap / GRD / ISC OVERVIEW)
  DO NOT CHANGE STATE OF GUARDIAN UNLESS APPROVED BY THE ON-SHIFT OPERATOR

- Close the ALS laser shutter via the MEDM screen (sitemap/LSC/Shutters/ISCTX(Y) green beam.) This protects you from the 50 mW ALS green lasers

- Check that SEI ENV is set to Maintenance Mode to Shut Off Sensor correction (The Operator should have done this for Tuesday Maintenance but check anyways.) (sitemap/SEI/ISI SENSOR CONFIG)

1.1 Before starting the measurements

- Record Rx enclosure Digital Thermometer ("Outside" display) = ... 18.9°C ..... deg. C

- Record Rx enclosure Digital Thermometer (" Inside" display) = ... 19.6°C ..... deg. C

- Turn PCAL Interlock bypass to the ON position.

- Set shutter to local

- Disable all three excitations on the Pcal MEDM screen (sitemap/Cal/PcalX(Y)/Excitation):
  1. H(L)1:CAL-PCALX(Y)_SWEPT_SINE
  2. H(L)1:CAL-PCALX(Y)_OSC_SUM
  3. H(L)1:CAL-INJ_MASTER_SW

- Ensure that the ETM pointing is in the "aligned" state, If you cannot tell from the medm screen call the operator and ask them.

- Remove cover from Rx enclosure and verify that Pcal beam spots are close to their nominal locations (centered on the Rx sensor input aperture). If they are not, adjust their positions using the final steering mirrors inside the output section of the Tx module enclosure.

- Open a GPS Clock window (type `gpsclock &` in a terminal window).

2.2 Power sensor measurements

- Connect the Pcal Satellite Box PD MON output to INPUT 1 on the ***BNC to DB9*** interface module mounted in the Pcal transmitter pylon.
- Record GPS start and end times and nominal StripTool output levels during the measurements.

2.2.1 Measurement 1:

- Block the OUTER beam with a razor blade beam block in the Tx module.
- Loop cable around something to ensure that the sphere doesn't fall when the cable is stepped on.
- Place the WS in the INNER beam in the Tx module.

(1)

WS in the INNER beam in the Tx module.				
GPS times		StripTool outputs		
Start Time #1	1417 885 234 ~~097~~	TxPD	0.72304	W
Duration	300 seconds	WSPD	-1.68439	V
End Time #1	1417 885 534	OFSPD	-3.8319	V

2.2.2 Measurement 2:

- Move the beam block to the INNER beam in the Tx module.
- Move the WS to the OUTER beam in the Tx module.

(2)

WS in the OUTER beam in the Tx module.				
GPS times		StripTool outputs		
Start Time #2	1417 885 750	TxPD	0.72275	W
Duration	300 seconds	WSPD	-1.71017	V
End Time #2	1417 886 050	OFSPD	-3.83212	V

2.2.3 Measurement 3:

- Leave the WS in the OUTER beam in the Tx module with the INNER beam blocked.
- Close the shutter in the Tx module.

2.2 Power sensor measurements

- Connect the Pcal Satellite Box PD MON output to INPUT 1 on the ***BNC to DB9*** interface module mounted in the Pcal transmitter pylon.
- Record GPS start and end times and nominal StripTool output levels during the measurements.

2.2.1 Measurement 1:

- Block the OUTER beam with a razor blade beam block in the Tx module.
- Loop cable around something to ensure that the sphere doesn't fall when the cable is stepped on. (12)
- Place the WS in the INNER beam in the Tx module.

WS in the INNER beam in the Tx module.				
GPS times		StripTool outputs		
Start Time #1	1417 891 285	TxPD	0.72269	W
Duration	300 seconds	WSPD	-1.68414	V
End Time #1	1417 892 185	OFSPD	-3.83226	V

2.2.2 Measurement 2:

- Move the beam block to the INNER beam in the Tx module. (13)
- Move the WS to the OUTER beam in the Tx module.

WS in the OUTER beam in the Tx module.				
GPS times		StripTool outputs		
Start Time #2	1417 892 290	TxPD	0.7227	W
Duration	300 seconds	WSPD	-1.71215	V
End Time #2	1417 893 190	OFSPD	-3.8322	V

2.2.3 Measurement 3:

- Leave the WS in the OUTER beam in the Tx module with the INNER beam blocked.
- Close the shutter in the Tx module.

(6)

WS in the Rx module. Shutter CLOSED in the Tx module.				
GPS times		StripTool outputs		
Start Time #6	1417 887 305	TxPD	0.00018	W
Duration	60 seconds	WSPD	0.00381	V
End Time #6	1417887 365	OFSPD	-0.0107	V

2.2.7 Measurement 7:

(7)

- REMOVE the beam block from the OUTER beam in the Tx module.

WS sensor in the Rx module, both Inner and Outer beams on it				
GPS times 420		StripTool outputs		
Start Time #7	1417 887 ~~405~~	TxPD	0.72276	W
Duration	300 seconds	WsPD	-3.3521	W
End Time #7	1417 887 720	OFSPD	-3.8324	V

2.2.8 Measurement 8:

(8)

- CLOSE the shutter in the Tx module
- Replace WS sphere with the Rx sphere at the Rx Module.
- Open the shutter in the Tx module
- Verify that the Pcal beam spots are centered on the input aperture of the Rx sensor (photograph spot locations on white card).

Both Inner and Outer beams on Rx sensor in the Rx module.				
GPS times		StripTool outputs		
Start Time #8	1417 888 020	TxPD	0.72279	W
Duration	300 seconds	RxPD	0.71307	W
End Time #8	1417888 320	OFSPD	-3.8319	V

2.2.9 Measurement 9:

- CLOSE the shutter in the Tx module.

3. open /ligo/gitcommon/Calibration/pcal/O4/ES/scripts/pcalEndstationPy/config.py
4. edit the Lines 6, 7, and 8 with the values from your procedure. IFO String is just the IFO and arm you did the measurements at. Usually looks like 'LHO_EndY' or something similar. The date code its a D followed by the date written in this format: 'DYYYYMMDD'.
5. edit the Lines 13,14, and 8 with the GPS values from your procedure during the start of the each Martel Voltage injections.
6. edit the Lines 19 -27 with the GPS START times for each measurement written in your procedure, then save the document.

6.a If using personal computer kinit yourself

7. Get the date of the latest WS_GS Lab Measurement that was considered to be a good measurement from the pcal/O4/lab/measurements/reviewed_measurements/ directory
8. Run the command:

   ```
   python3 generate\_measurement\_data.py --$WS "PS#" --date "YYYY-MM-DD"
   ```

   Where the WS is the PS# of the Working Standard you took down to the End Station, and the Date is the latest date of the last reviewed WS_GS measurement. Once it is running you you will see times series plots of the Martel Voltage injections, and all the measurements you have made. Make sure that those plots don't have any obvious issues before closing them.
9. then switch directories to the pcalTrends with the the command

   ```
   cd ../pcalTrendsPy/
   ```

10. then run

    ```
    python3 pcalPublishReportsV4.py LHO_EndY t[datecode]
    ```

    where the date code is the date code found in the config.py file you opened in step 3
11. Once this is done you can push this to the master branch on the git repository with a

    ```
    git commit -a -m "Notes about your Es measurement"
    ```

12. Once you have commited your changes run a

    ```
    git push
    ```

    to push the new measurement to the remote git repo.

Add to alog

Add the plots of the time series of the measurements, their ratios and the generated trend plots to an alog, along with a scan of this procedure and the beam alignment photo.