

LASER INTERFEROMETER GRAVITATIONAL WAVE OBSERVATORY  
- LIGO -  
CALIFORNIA INSTITUTE OF TECHNOLOGY  
MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Technical Note

LIGO-T2400163-v3

2024/06/03

**Pcal End Station Beam Location  
Displacement: Procedures and Log**

Pcal Team

California Institute of Technology  
LIGO Project

Massachusetts Institute of Technology  
LIGO Project

LIGO Hanford Observatory

LIGO Livingston Observatory

<http://www.ligo.caltech.edu/>

End Station: X-End Date: 24-08-25  
 Beam Movement Performed By: Flanagan, R Savage

## 1 Checklist before departure to EX

Check all the following items before heading to the end station.

### Coordination with operator

- Notify the operator on shift about the procedure. Include who is going and for how long (tentatively) you plan to be there.
- Make sure that the IFO's ISC LOCK Guardian 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.)
- 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)

### Items needed for the procedure

- Target cover for integrating sphere input port **with the corresponding - metric - allen key**. Both should be in the same bag.
- Beam height gauge to use as a square
- Fluke handheld digital voltmeter (take a spare 15V battery)
- 6 ft. BNC male to BNC male
- BNC female to banana male double plug
- Two IR viewing cards: high and low power
- IR laser glasses**

## 2 At end station

### Before starting Pcal work in VEA

- Transition VEA to **LASER HAZARD** status.
- Call the Control Room (ext. 202) to notify them of the laser status change.

## Before starting procedure

- Turn PCAL Interlock bypass to the ON position.
- Set shutter to local.
- Connect the Fluke voltmeter to the 'Rx PD Mon' output on the pcal interface module (D1400153) via the BNC cable using the adapter.
  - Note the <sup>polarity</sup>~~polarization~~ on the adapter.
  - The tab on the adapter should be at the negative input on the FLUKE meter.
  - Signal from the Rx sensor should be around 3.5 V.

Time (local): 1033 Rx. voltage signal (V): 3.384

- Remove cover from Rx enclosure and evaluate position of the pcal beams relative to the last change. 18.1°C indoor 1039 as found photo ~10:42 FL phone
- Placing the target on integrating sphere:
  1. Switch laser shutter to 'Close'.
  2. Place target on Rx input port.
  3. Orient target with alignment tool. such that the line on the target is perpendicular to plane of the table (vertical). "1/4 1/5 mm gap of the bottom"
  4. Switch laser shutter to 'Open'
- Grab one of the allen wrenches for the actuators on the mirror mounts from the pcal bag on top of the pylon.
- Remove the small cover from the top of Tx enclosure.

## Beam movement

Fill in the table at the end of the document while following the list. Include the voltage value recorded before doing any movements (above), write 'pre' for the step.

1.  Record voltage value.
2. Block the outer beam with a beam dump. Note, the beam dump should be at an angle from the incident beam such that the portion of light reflected from it propagates away from the inner beam.
  - Record voltage value.
3. Move the inner beam to the desired position by carefully rotating the pitch and yaw screws of the inner beam mirror. The voltage from the voltmeter should reach a maximum when the beam is optimally centered. Note, the beam will move horizontally by adjusting the lower (yaw) screw, and vertically by adjusting the upper (pitch) screw.

- Record voltage value.
- 4. Remove the beam dump when done moving the inner beam.
  - Record voltage value.
- 5. Place cover on Tx module.
- 6. Switch laser shutter to 'Close'.
- 7. Remove the target and any other components that do not belong to the pcal Rx module.
- 8. Turn the laser shutter to 'Open'.
  - Record voltage value.
- 9. Place covers on the Rx module.

### Before leaving VEA

- Set the shutter control to **Remote** on interface module.
- Make sure **ALL** covers are well placed and screwed.
- Turn the interlock bypass to **OFF**.
- Transition VEA back **LASER SAFE** status.
- Call the Control Room (ext. 202) to notify them of the laser status change.

→ Concerned about power  
→ See offset from  
SERVO

End Station: X-End Date: 24-06-25  
 Beam Movement Performed By: FLhuang, KSavage  
 Beam moved: Inner Outer  
 Previous move: center Current move: Up  
 position

Rx voltage values between steps		
Step	Local time	Voltage
Initial	1033	3.384
	1045	1.683
Target ON	1053	1.520
Move Up	1111	1.496
Target off	1115	1.083
Both beams	1116	3.383

Outer beam blocked, no target  
 Inner beam only

1mV would be 7HOPs, maybe bring keithley  
 Last week value (1.522)

Notes:

Neither pitch or yaw adjustments improved the signal after the move.

pre x Rx  
DARMX

5/7/21  
center

5/14/24  
right

5/21/24  
center

5/28/24  
down

6/4/24  
C

6/11/24  
L

6/18/24  
C

6/25/24  
U

7/2/24  
C

Rx / Tx | Amplitudes to see if  
if agrees