Palomar Adaptive Optics Test Plan

Title	LGS checkout
Version	1.0
Date released	7/31/2007
Lead	A. Bouchez
Time requested	1 hr.
Required conditions	Sufficiently clear for laser projection near zenith

Purpose

1. Register lenslets to DM and create a new flatmap.
2. Optimize the laser guide star (flux, FWHM).
3. Characterize the laser guide star.
4. Evaluate the performance of the LGS-AO system.

Test procedure

The LGS target should be a V=11 flux calibrator (eg. Tycho 2 star) near zenith, approved for laser project by US Space Command. Begin full procedure 15 minutes before LGS projection window opens. However, steps 2-4 may not be necessary if lenslet-DM registration and flatmap calculation were recently performed nearby. Steps colored blue only need to be performed on the first night of an observing run.

1. Prepare for laser projection
   - 1.1. Confirm that the Laser Status Report has been filed with Space Command.
   - 1.2. Sent aircraft spotters out.
   - 1.3. Raise windscreen.
   - 1.4. Verify that Cass ring is at 335.8°
   - 1.5. Turn on and adjust RADAR.
   - 1.6. Verify that ASCAM and IRCAM are on and shutter signals reset.
   - 1.7. Open coude block.
   - 1.8. BTO configured for 589nm laser and alarm reset.
   - 1.9. Arm alarm system.
   - 1.10. Verify laser focus stage starting positions.

   llt_focus: 11820 (7/24/07)
   acq_z (lgs): 10275 (7/24/07)
   laser_focus: 14000 (7/24/07)

2. Slew to a V=7 SAO star near the LGS target.
3. Setup AO system for NGS.
   - 3.1. Set TAO mode to NGS.
   - 3.2. Click "SETUP FOR NGS" with HOWFS at 500 Hz.
   - 3.3. Stop chopper if running. (R/X)
4. Acquire and register HOWFS.
   - 4.1. Move star behind reflective spot using hand paddle.
   - 4.2. Click "OFFSET + TAKE HOWFS BKG".
   - 4.3. Close TT loop.
   - 4.4. Ask observer to center star at the desired location for LGS acquisition.
   - 4.5. Register DM (coarse and fine).
   - 4.6. Close DM loop.
   - 4.7. Make a new telescope flat map and load.
   - 4.8. Save AO config.

4.9. Ask operator to TX the telescope.

5. Record Acq. images of the target star for flux calibration
   5.1. Slew to the LGS target.
   5.2. Center the star 20" east (right) of the reflecting spot.
   5.3. Adjust Acq. integration time to get ~100 peak counts on star.
   5.4. Record 2 Acq. frames, offsetting the telescope 20" N between. Note FWHM.
   5.5. Center the star behind reflective spot.

6. Request laser propagation.
7. Set up AO system for LGS.
   7.1. Set TAO mode to LGS.
   7.2. Click "SETUP FOR LGS with HOWFS at appropriate value (150 Hz).
   7.3. Start chopper (R/X/E/E).
8. Acquire the LGS
   8.1. Center LGS on the reflective spot using UTTPADDLE.
   8.2. Record centered position of the LLT FSM.
9. Optimize the LGS flux and FWHM.
   9.1. Offset the LGS 20" to the East.
   9.2. Shutter laser and save an Acq. background frame.
   9.3. Optimize LLT focus in 30 µm steps to minimize LGS FWHM.
   bto offset llt_focus 30
   9.4. Optimize Acq focus stage in 2 mm steps to minimize LGS FWHM.
   offset acq_z 20000
   9.5. Optimize laser focus stage in 1 mm steps to maximize return flux.
   bto offset laser_focus 1000
   9.6. Record 2 Acq. frames and note FWHM.
   9.7. Offset the LGS back to the reflective spot.

10. Close the DM loop on the laser.
    10.1. Move LGS_X to LGS position.
    10.2. Click "OFFSET + TAKE HOWFS BKG".
    10.3. Close UTT loop.
    10.4. Closed DM loop.
    10.5. Optimize HOWFS framerate to minimize DM residuals: Open DM and UTT loops, change framerate, take an offset background, close UTT & DM loops.
    10.6. Optimize llt_integral_gain to minimize DM residuals.

11. Acquire the NGS and close TT loop.
    11.1. Set LOWFS framerate to 1000 Hz.
    11.2. Move ACQ_Z to NGS position.
    11.3. Identify NGS in ACQVIEW field and send LOWFS.
    11.4. Click "OFFSET + TAKE LOWFS BKG".
    11.5. Click "ZERO LOWFS CENTROIDS"
    11.6. Close TTM loop.
12. Close focus loop (pulldown on LGSFOC).
    12.1. Close focus loop on LGSFOC tool, gain=1.0
    12.2. Wait for focus to converge to <0.5 mm, then set gain=0.25

13. Check signal level on PHARO

13.1. Initial setup: 25mas FOV, filter BrG, ND 1%, standard cross, 2s integration.
13.2. Adjust the exposure time and filter to get 10-15k peak counts.
14. Open TT loop, offset 60" to sky, and record 3 PHARO background frames.
15. Return to NGS, close TT loop, and set PHARO in continuous acquisition with Strehl estimate displayed.
16. Optimize the Strehl by adjusting the following servo parameters:
16.1. ttm_integral_gain
16.2. dm_integral_gain
16.3. centroid offset file (co_zero, co_default4, co_default2)
16.4. LOWFS focus zeropoint
17. Save 3 PHARO frames in optimized configuration and record average Strehl.

Results (use one column per night)

BTO and servo loop parameters:

UT date			
8.2 LLT FSM position			
9.3 llt_focus			
9.4 acq_z			
9.5 laser_focus			
10.5 HOWFS framerate			
10.6 llt_integral_gain			
16.1 ttm_integral_gain			
16.2 dm_integral_gain			
16.3 cent_offsets			
16.4 LOWFS focus zpt.			

Image data:

Target name			
5.4 Acq. NGS image 1			
5.4 Acq. NGS image 2			
NGS FWHM (pix)			
9.2 Acq. LGS bkgd			
9.6 Acq. LGS image 1			
9.6 Acq. LGS image 2			
LGS FWHM (pix)			
14. PHARO bkgd (3)			
17. PHARO images (3)			
Average K Strehl			

Notes: