Palomar Adaptive Optics Test Plan

Title	LGS Acquisition and characterization
Date	4/2/07, V5
Lead	A. Bouchez,M. Troy
Time requested	1 hr
Required conditions	Clear.

Purpose
Acquire LGS, focus LLT, determine LGS magnitude and spot size,

Test procedure

1. Setup
   - 1.1. Insure laser operator has started execution of procedure for preparation of laser propagation
   - 1.2. Configure AO to look at sky
     - 1.2.1. Configure telescope for sky (open mirror cover, etc) – zenith only
   - 1.3. Telescope at zenith, at best NGS focus.
   - 1.4. Acquisition camera V filter not installed.
   - 1.5. Move LLT mirror to its default position (determined during LLT alignment)
   - 1.6. Load best available flatmap
   - 1.7. Go to LGS mode
   - 1.8. Move lgs_x to lgs position using lgstools
   - 1.9. Check white light position on HOWFS,
     - 1.9.1. Move SSMs to center if necessary, then move back to sky
   - 1.10. Acq focused at 90 km altitude (NGS focus-2450)
     move acq_z 10250 (for NGS use 12700)
   - 1.11. LLT focused to 90 km altitude (NGS focus - 300).
     bto move llt_focus 11730
   - 1.12. check/set laser focus to correct value
     bto move laser_focus 9000
   - 1.13. Setup acquisition camera:
     - 1.13.1. Start up IDL program *acqview*
     - 1.13.2. Set integration time to 2s
     - 1.13.3. In an appropriate experiment directory: IDL> ao_plot_vid_image
2. Perform final safety checks and propagate laser
3. Acquire LGS on Acq
   - 3.1. If LGS is not in the Acq. FOV, use ellipticity of dichroic spots (apex points to LGS) and Raleigh gradient (brighter towards LGS) to steer it in:
     offset llt_a +X=up; offset llt_b +X=left
4. Calibrate UTT mirror throw (one-time calibration)
   - 4.1. Center LGS in acquisition camera field.
   - 4.2. Record image with ACQVIEW and note time tag in log in Results section.
   - 4.3. Record images dithering laser in a cross pattern (see log).
   - 4.4. Manually center laser behind reflective spot.
5. Focus on Na layer
   - 5.1. Move LGS to clear region of ACQ. field: *offset llt_b +30*
   - 5.2. Rough focus laser spot:

bto offset llt_focus …" in steps of 100
move acq_z … in steps of 300

5.3. Block laser, take and save a 2s background image.
5.4. Focus Acq
5.4.1. ao_focus_loop, current-600, 300, 5, 'acq', 'save_name', sky='sky_name', time=6.0
5.4.2. move acq_z best_focus
5.5. Focus LLT
5.5.1. ao_focus_loop, current-60, 30, 5, 'llt', 'save_name', sky= 'sky_name', time=6.0
5.5.2. bto move llt_focus XXX
5.6. Repeat steps 4.3 and 4.4 again if necessary

6. Determine laser focus (only first night of run)
6.1. Rough focus laser spot, looking at image in acq. camera
bto_control "offset laser_focus …" in steps of 2000
6.2. ao_focus_loop, 0, 2000, 7, 'laser_focus','save_name, sky='sky_name',time=6.0
6.3. bto move laser_focus XXX

7. Take photometry (optional)
7.1. Install V filter in Acq. camera
7.2. Record and save a final set of images for measuring photometry and spot size. *offset llt_a 10* between images.
7.3. Image photometric calibrator
7.3.1. Go to photometric standard NGS, Landolt ~mV=11.0
7.3.2. Move acq_z to NGS focus (*move acq_z 14600*)
7.3.3. Move star to approximate position of LGS
7.3.4. Take two images, with a ~10" dither between them; record star name and image time tags.
7.4. Remove V filter from Acq. camera

Results and conclusions

UTT mirror calibration (section 4)

Mirror commands	llt_a position	llt_b position	Image time tag	x centroid (pix)	y centroid (pix)
centered	-19	19.9	1165393512	468.3	267.3
offset llt_a 20	0.9	19.9	1165393596	455.2	380.8
offset llt_a -40	0.9	59.9	1165393656	271.7	357.3
offset llt_a 20	-19	59.9	1165393694	285.7	238.1

Optimal focus settings (section 5)

UT Date	Dec 6 2006	Dec 7 2006	Dec 8, 2006
LLT focus (µm)	11730	11730	11730
Acq_z (µm)	12350	12246	12230
LGS FWHM (pix)	11.5 (!)	13.5	~19
Laser Focus (µm)	7000	9000	9000

Photometric calibration (section 7)

UT Date	Dec 6 2006	Dec 7 2006	Dec 8 2006
Int. time (secs)		5	
Laser Acq. filenames		laser5	Laser6
		laser6	Laser7
Star ID	Landolt 98-185	Landolt 95_149	Landolt 92_235
Image time tags	landolt98-185_1	95_149_1	Landolt92_235_1
	landolt98-185_2	95_149_2	Landolt92_235_1
Star FWHM (pix)	10	16.5	~17

Notes:
Dec 6, 2006: Fainter star of the pair (mV=10.54) – 2s exposures

Dec 7, 2006: At end of test laser spot was ~20 pixels (versus 13.5 at the start) so it is clear the seeing degraded during the test.

Dec 8, 2006: Very variable seeing, laser was at 7.5W
Laser1 and laser2 focus loops did not have laser locked to Na line
Laser3 was acq camera
Laser4 was LLT
Laser5 was an attempt to do the laser focus, but lens was not well aligned and the BTO kept shuttering the system
Laser8 and laser9 were acq focus loops
Laser10 was LLT focus loop