Palomar Adaptive Optics Test Plan

Title	LGS Acquisition and characterization
Date	12/06/06
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. Configure AO to look at sky
     - 1.1.1. Configure telescope for sky (open mirror cover, etc) – zenith only
   - 1.2. Telescope at zenith, at best NGS focus.
   - 1.3. Acquisition camera V filter not installed.
   - 1.4. Move LLT mirror to its default position (determined during LLT alignment) [-11,53]
   - 1.5. Load best available flatmap
   - 1.6. Check white light position on HOWFS,
     - 1.6.1. Move SSMs to center if necessary, then move back to sky
   - 1.7. Acq focused at 90 km altitude (NGS focus-2450)
     move acq_z 12350 (for NGS use 14600)
   - 1.8. LLT focused to 90 km altitude (NGS focus - 300).
     bto_control "move llt_focus 11730"
   - 1.9. check/set laser focus to correct value
     bto_control "move laser_focus 7000"
   - 1.10. Setup acquisition camera:
     - 1.10.1. Start up IDL program *acqview*
     - 1.10.2. Set integration time to 2s
     - 1.10.3. 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_control "offset llt_focus …" in steps of 100
     move acq_z … in steps of 300
   - 5.3. Detune 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_name', time=6.0
5.4.2. ao_read_focus, data,file='save_name'
5.4.3. move acq_z best_focus
5.5. Focus LLT
5.5.1. ao_focus_loop, current-100, 50, 5, 'llt', 'save_name', 'sky_name', time=6.0
5.5.2. ao_read_focus, data,file='save_name'
5.5.3. bto_control "move llt_focus XXX"
5.6. Repeat steps 4.3 and 4.4 again if necessary

6. Determine laser focus
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, current-3000, 1000, 6, 'laser_focus','save_name,'sky_name',time=6.0
6.3. ao_read_focus,data,file='save_name',/total_flux
6.4. bto_control "move laser_focus XXX"

7. Take photometry
7.1. Install V filter in Acq. camera
7.2. Record and save a final set of detuned and tuned 2s Acq images for measuring photometry and spot size.
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.

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		
LLT focus (µm)	11730		
Acq_z (µm)	12350		
LGS FWHM (pix)	11.5 (!)		

Photometric calibration (section 7)

UT Date	Dec 6 2006		
Star ID	Landolt 98-185		

Image time tags	landolt98-185_1		
	landolt98-185_2		
Star FWHM (pix)	10		

* Fainter star of the pair (mV=10.54) – 2s exposures