Palomar Adaptive Optics Test Plan

Title	**LGS BGS Performance Optimization**
Date	12/5/2006, V1.0
Lead	M. Troy
Time requested	2 hr
Required conditions	On sky with LGS lock

Purpose

The goal here is to optimize and characterize the LGS AO performance when locked on a bright (mV~10) TT guide star. Note that in general this procedure is iterative. We will start by "roughing" on the values and then iterating again.

We assume that at the start of this procedure the AO system is locked on the LGS and TT GS. The star should be ~2 hours East.

Test procedure

1. Note seeing from MASS/DIMM, if MASS/DIMM not running then take seeing measurement using latest telescope flat map
2. "Rough" in Servo loop gains
   2.1. Configure PHARO to take ~10 second exposures to estimate Strehl. In all steps here take 3 PHARO exposures and note all Strehls.
   2.2. HOWFS DM gain
      2.2.1. Note Strehls at DM gains of 0.05, 0.1, 0.15, 0.3, 0.6
      2.2.2. Set gain to "optimal" gain
   2.3. LOWFS TT
      2.3.1. First insure maximum pixel values are less then ~6000Dn due to current problems noted in photon transfer curves
      2.3.2. Note Strehls at TT gains of 0.05, 0.1, 0.15, 0.3, 0.6, 0.8, 1.0
      2.3.3. Set gain to "optimal" gain
   2.4. UTT gains
      2.4.1. Note Strehls and UTT residuals at UTT gains of 0.2, 0.4, 0.8, 1.6, 3.2
      2.4.2. Set gain to "optimal" gain
   2.5. Repeat above steps
3. Determine optimal HOWFS frame rates.
   Here we want to use the wavefront error budget to estimate the optimal frame rate for the HOWFS. Use the spreadsheet at XXX, enter in the seeing, LGS flux, LGS spot size, and d0 (from the MASS/DIMM) to determine the optimal frame size. If this frame rate is significantly different then the current frame rate then try it, if not try frame rates ½ and 2x the current frame rate.
   3.1. Set WFS to new frame rate
   3.2. Take WFS sky
   3.3. Take PHARO image to determine Strehl, also note TT residuals
   3.4. Repeat above three steps using 2nd frame rate.
4. Note seeing from MASS/DIMM, if MASS/DIMM not running then take seeing measurement using latest telescope flat map
5. Check static centroid offsets

Here we want to try various centroid offset files to quantify improvements in Strehl.

    5.1.   Load co_zero centroid file

        load wfp=ho,cent_offsets=aocp:/tables/cent_offsets/co_zero

    5.2.   Take a PHARO image to determine Strehl

    5.3.   Repeat above two steps fro co_default4, co_default2, co_default and co_zero

6. Check the LOWFS focus

    6.1.   In acqview set the LOWFS zero point to 1 mm, click on one shot button, wait for loop to settle

    6.2.   Take a PHARO image to determine Strehl

    6.3.   In acqview set the LOWFS zero point to -1 mm, click on one shot button, wait for loop to settle

    6.4.   Take a PHARO image to determine Strehl

    6.5.   Interpolate between data to determine optimal LOWFS zero point and set the new value

    6.6.   Take a PHARO image to determine Strehl

7. Note seeing from MASS/DIMM, if MASS/DIMM not running then take seeing measurement using latest telescope flat map

8. DM to lenslet registration

The question here is does the performance improve when the DM to lenslet registration is performed on a star? We assume the WFS has been registered recently to a star or white light

    8.1.   Optimize DM gain

        8.1.1. Measure and record Strehls at DM gains of current value, current value/2 and current value *2

    8.2.   Note the SSM positions

    8.3.   Register DM using laser, note how far pupil is moved as well as new SSM positions.

    8.4.   Optimize DM gain

        8.4.1. Measure and record Strehls at DM gains of current value, current value/2 and current value *2

    8.5.   If performance is better using star registration then revert to those SSM positions and re-measure Strehl to confirm performance.

9. Note seeing from MASS/DIMM, if MASS/DIMM not running then take seeing measurement using latest telescope flat map

10. Measure UTT servo bandwidth

    10.1.   Leave TT lock closed, but set log interval to a slow rate < 5fps?

    10.2.   open DM loop, put on telescope flat map

    10.3.   Stop all plots

    10.4.   set log interval to a reasonable value (depends on frame rate, if running at 200Hz try log interval of 2)

    10.5.   Insure log data type is all except for pixels for HO

    10.6.   For the following gains record start time, stop time, take 2 pharo images and record frame number and Strehl: 0, 0.05, 0.1, 0.15, 0.2, 0.4, 0.8, 1.6, 3.2, 0

11. Note seeing from MASS/DIMM, if MASS/DIMM not running then take seeing measurement using latest telescope flat map

12. Measure DM servo bandwidth

    12.1.   Leave TT lock closed, but set log interval to a slow rate < 5fps?

    12.2.   Leave UTT lock closed

    12.3.   Lock DM Loop

    12.4.   Turn off lgsfoc loop

12.5. Stop all plots
12.6. set log interval to a reasonable value (depends on frame rate, if running at 200Hz try log interval of 2)
12.7. Insure log data type is all except for pixels for HO
12.8. For the following gains record start time, stop time, take 2 pharo images and record frame number and Strehl: 0.0, 0.05, 0.1, 0.15, 0.2, 0.4, 0.8, 0.0
13. Note seeing from MASS/DIMM, if MASS/DIMM not running then take seeing measurement using latest telescope flat map
14. Faint light reconstructors/centroid calculations
    14.1. Use pixel_gains_all
           load wfp=ho, pixel_gains=aocp:/default/pixel_gains/pixel_gains_all
    14.2. Re-take WFS sky
    14.3. Load reconstructor alpha0r0001.txt
           load wfp=ho, reconstructor=aocp:/tables/reconst/<filename>
    14.4. Measure Strehl with PHARO
    14.5. Decrease DM gain, by a factor of two and re-measure Strehl
    14.6. Set DM gain back to original value
    14.7. Repeat above 4 steps for reconstructors alpha1r01.xt and alpha1.txt
    14.8. Repeat above 6 steps increasing the HOWFS frame rate by a factor of 2.

Results and conclusions