How to generate the look-up table for ONECAL

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Introduction

After a new preset, the NTT image analysis (IA) system takes an image of the pupil dissected through the Shack-Hartmann lenslet array, and based on the displacement of the spots with respect to their reference position at zenith, it computes the amount of aberrations introduced by mirror and telescope flexures. Based on the angle and module of each aberration vector, the IA computes the forces to be applied to the actuators in order to restore the best mirror shape.

There are cases when image analysis is not possible or not reliable (e.g., bad seeing, low altitude, no suitable stars, ...), and for those cases the aberrations are taken from a look-up table to be generated during technical time nights. The table contains aberrations measured at different zenith distances, which are then interpolated for the position reached after preset. The table should be upgraded or checked every time that this is possible, and in particular after mirror interventions (e.g., re-coating).

All actions performed by the AO system are logged by tcs@wt5tcs in a file called

$VLTDATA/tmp/aoActivities.log

An example of the contents of such file is given in Table 1.

Based on the contents of aoActivities.log it is possible to generate the look-up table of aberrations vs. zenith distance. However this works only if the mirror is initialized at zenith, then IA is performed at different zenith distances, and the corrections are **not** applied. In this way the mirror is left free to deform, and aberrations are calculated. The procedure is then:

1. generate data by performing IA at different zenith distances
2. analyze data with software, after clearning aoActivities.log
3. take output table of software tool and update database with new values

1 Generate data

(better this way than what is in Section 6.6.2 of AO Manual)

- to be done only if very good seeing (< 1", the smaller the better)
- go to zenith
- init M1+M2
- repeat several times until the residuals are very small
- From now on, do not apply corrections

  More Details:
  - init AO
  - Targets are M1+M2 (Type is absolute)
    - Init M1+M2
    - Targets NONE (and store!)
  - set reference point (click on reflight):
    - Ref. U. Turret : reflight (REFIA)
    - Dichroic IN
    - RU: pinhole
- Adjust focus (Z only) by eye
- write down UT of start
- Version 1 – short
  1. go manually to a star 5 deg from zenith (azimuth toward wind if wind is low, to keep M1 ventilated)
  2. send a preset to the same position, so NTT will start tracking
  3. with "stella" choose a guide star, with mag ca. 9
     (a) send GP to center field
     (b) send star to reflight (plus the small correction set above)

4. perform 3 image analysis at center field (SEQAO with nr. IA=3, nr. measures=1)
   (do **not apply** corrections)
5. check residuals are < 0.15
6. got to star 5 deg lower distance and iterate
7. until you reach ALT = 25 deg

- Version 2 – long

1. go to a star 5 deg from zenith, to the West
2. perform 3 image analysis at center field
   (do **not apply** corrections)
3. start CYCLAO, averaging 3 image analysis
   (do **not apply** corrections)
4. let CYCLAO run until the star reaches airmass 2.2 ($\sim$ 4h-5h)

- Write down UT of end

2 Analyze data with software

The data analysis is done on the offline machine with user nttopt; the steps are:

1. ssh -Y nttopt@wg5off (.5xxxxxx)
2. copy $VLTDATA/tmp/aoActivities.log to nttopt@wg5off:~/ActiveOptics/AoLog/
3. backup the current file: mv aoActivities.log to aoActivities.yyyy-mm-dd.log
4. copy again to ~/ActiveOptics/Main_ia/lookup_tab/Data
5. go to directory ~/ActiveOptics/Main_ia/lookup_tab/Data
6. edit aoActivities.log and remove all lines except those generated between UT start and UT end that you recorded above
7. also remove lines starting with AVERAGE and the lines coming just after that (see Table 1)
8. Save file as
   aberrations.dat

9. the sw/ to be used is aoAnalysis, and the list of its options can be seen in the source code:

   ~/CURRENTLY_MOD/nttopt/src/aoAnalysis.c

10. for each aberration listed in the source code, look at the plot of aberration vs. zenith distance; e.g.,

    aoAnalysis C 2 0.16

11. to check the x- coma

12. compute the new parameters table for ONECAL:

    aoAnalysis C 0 0.16

13. name the output as res_yyyy_mm_dd.dat

14. check the current values of the ONECAL model

15. if the new values are OK, copy and install

2009-07-06T21:52:	RECALC	NA	89	180	0	0	166.3	166.7	0					
	811	98	14	0	41	-77	-6	0	16	160	14	-146	12	-162
	811	-78	14	0	41	107	-6	0	18	169	14	46	12	-146
	811	-78	14	0	41	107	-6	0	18	169	14	46	12	-146
	13.02	13	13.87	12	10	0	-1.051	0.346	-3.102					
	0	0	10	10645	1814	979	0.03							
2009-07-06T21:52:	RECALC	NA	89	180	0	0	166.3	166.7	0					
	802	97	4	0	39	-90	0	0	19	173	12	-148	7	-147
	802	-79	4	0	39	94	0	0	20	-179	12	44	7	-131
	802	-79	4	0	39	94	0	0	20	-179	12	44	7	-131
	13.02	12.98	13.87	12	10	0	-1.051	0.346	-3.102					
	0	0	10	10623	1812	979	0.03							
2009-07-06T21:53:	RECALC	NA	89	180	0	0	166.3	166.7	0					
	804	98	4	0	41	-76	-1	0	17	166	16	-138	7	-154
	804	-78	4	0	41	108	-1	0	18	175	16	54	7	-138
	804	-78	4	0	41	108	-1	0	18	175	16	54	7	-138
	13.02	12.98	13.87	12	10	0	-1.051	0.346	-3.102					
	0	0	10	10615	1815	979	0.03							
2009-07-06T21:53:	AVERAGE	0	0.01	0	0.01	0.01	0.01	0.02						
	806	-78	7	0	40	103	-2	0	19	175	14	49	9	-140
2009-07-06T22:14:	CORM2	ABSOLUTE	-1.051	0.346	-3.648									
2009-07-06T22:14:	CORM1	ABS	542.5	542.5	726.5	726.5	726.5							

Table 1: aoActivities.log