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Subject: [KNGAO] Solar System - Summary of 01/25/2006 telecon & thoughts

Dear colleagues,

The HST deadline is now passed.... Here a brief summary of our telecon discussion (Jan 25 2006). Sorry for the delay.

Attended by M. Adamkovics, A. Bouchez, J. Emery, F. Marchis, K. Noll.

My tasks:

- The technical overview slides are available on <http://www2.keck.hawaii.edu/realpublic/optics/ScienceCase/NGAO%20technical%20overview.pdf>
 - The KNGAO is regularly updated and you can find some documents on <http://www2.keck.hawaii.edu/optics/ScienceCase/index.htm>
 - First simulated PSFs are available on <http://astron.berkeley.edu/~fmarchis/document/KNGAO/>
- Here the details by Chris Neyman (AO scientist at Keck Obs.).

The files are FITS format with header comments that include seeing, r0, pixel scale, and wavelength. The PSFs are not normalized to any standard magnitude. Does some value make sense? I checked these *.fits files on Linux and windows using ds9.

A few cautions:

- 1) This is a very basic KPAO system better performance can be squeezed out of the system by adding more actuators and better tomography algorithms.
- 2) The simulation run is not long enough to reproduce a long exposure image, so don't try to use these psf for modeling planet finders, close binaries etc.

Basic parameters for the simulation were:

- 5 LGS (x constellation 1 at center)
- bright tip-tilt GS on axis, used for Zernike modes 2, 3,4,5,6 (tip-tilt, focus and astigmatism)
- 32x32 actuator DM conjugate to pupil (1 dm only)
- MVE reconstructor tomography (Ralf can provide details)
- Fried parameter r0 = 19 cm at 0.5 microns

Note: equ. to 0.6" exterior seeing at 0.5 microns

Summary of statistics output at the end of the YAO simulation:

lambda	FWHM[mas]	Strehl	E50d[mas]
0.65	18.2	0.075	392.4
0.85	21.0	0.179	277.7
1.20	27.5	0.355	109.4
1.65	36.6	0.519	90.8
2.20	47.5	0.649	79.5

Science cases:

- Study of multiple asteroids - specifically focusing on KBO?
Simulation, including a comparison with HST and a comparison with previous Keck AO observations
 - * more of them could be observed (we need to quantify this)
 - * estimate of the moon size (knowledge of the PSF linked with photometry/astrometry)
 - * spectroscopy of the moons (high contrast should reduce the halo, so improve the S/N for the spectra)

- What could we do on new satellites of Pluto?
mv(Pluto)~15 - mv(moons)=23-24

- Main-belt & Trojan Asteroids
 - * shape & size (angular resolution is better in V) - how many asteroids can be resolved?
 - * multiplicity (better sensitivity) - linked with KBO
comparison with Sylvia Triple system observations?
 - * surface composition of primary and moons (combining spectroscopy in visible and NIR)

- Spectroscopy in visible and NIR of Galilean satellites
 - * surface composition.What additional information will give us the visible range? (better resolution, additional absorption bands to better characterize these icy surfaces)

- Atmosphere of Jupiter and Saturn
 - * address the problem of wavefront analysis on extended objects
 - * off-axis observations - what will be the anisoplanetic aberration after 3D reconstruction of the phase?
 - * atmospheric activity and compositionadditional member in the planetary committee? (Nancy Chanover:
<http://astronomy.nmsu.edu/dept/html/directory.faculty.nchanove.shtml>)

- Titan
 - * monitor of the atmosphere in visible (detached haze layers) - enough angular resolution?
 - * Characterization of the surface. A better resolution is expected in J band (~200 km?) - could we see seasonal changes (simulation from Cassini map?)

- Comets
 - * nucleus size (good understanding of the PSF is necessary)

- Uranus and Neptune Rings and their interactions with satellites
 - * better contrast

- Uranus and Neptune atmospheres
 - * structure of the clouds in visible?

- Lightning on Giant Planets - altitude of the convection layers.
 - * Observations in eclipse are necessary. quite difficult from the ground.

- Atmosphere of Mars and Venus
- *high spectral resolution instrument
- *What will be the WFS reference?

Some personal thoughts:

- The problem of multiple asteroidal system is quite interesting since we can illustrate the gain in angular resolution (to resolve the primary), the interest of providing a high SR (stability -> sensitivity), and discuss the spectroscopy capability for a large wavelength range (optical+NIR).
- If we combine Titan with other Jovian planet satellite science cases, we can focus our simulations on Titan and address indirectly the use of this instrument for the Galilean satellites (Io & Europa mostly, other Saturnian satellites?).
- If we are considering to include as a third science cases the study of Saturn/Jupiter atmosphere, it will give us the possibility to discuss off-axis quality of KPAO (requirement is a moderate FOV of 60"), but then we will certainly need inputs from specialists in this topic such as Nancy Channover or Mike Wong (UC-Berkeley).

Technical questions for the TSI subcommittee:

- New Figure: Graph SR vs wavelength with various error budgets and for **medium** seeing conditions. Question: What is the exterior seeing considered in the Technical Overview figure?
- New Figure: **angular resolution** vs Wavelength with various error budget. Specifically, what will be the typical angular resolution at 0.70 and 0.45 microns with various reference magnitude and seeing conditions? It will be very useful for comparison with HST...
- How can we estimate the **accuracy** of the photometry/astrometry. It must be linked to the SR stability. Any reference?
- What is the drop off in magnitude expected with KPAO? What magnitude in visible shall we expect a tip-tilt correction mainly (i.e. a significant drop in SR).
- *added*- Profile of the Anisoplanatism aberration. The requirement is 60". What will be the profile of the off axis PSF (elongated toward the Tip tilt star?). How fast will it be degraded?
- *added*- How close to the reality are the C. Neyman PSF simulations? What is the most critical factors for the stability? the tomography reconstruction, number of LGS, number of sub-pupila on the DM, Number of actuators on the MEM?

Next telecon: Feb 6,7 or 8 (Meet-O-Matic will be sent in a few hours).

Let me know your thoughts,
I would like to send the technical questions to the TSI subcommittee Wednesday.

regards

Franck M.

PS: I assumed that all of you can read a formatted text email. if it is not the case please let me know

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