NICI Status Report

Gemini Users’ Meeting
June 14, 2007
Foz do Iguaçú, Brazil
NICI Current Status

- NICI passed pre-ship acceptance tests in Hilo in Oct. 2006
  - AO performance was good
  - Mechanisms performed well
  - Punch list items identified
  - Flexure well within spec and highly repeatable
- NICI arrived on Cerro Pachón in January
- Assembly and testing in the CP lab was completed successfully in Jan.
- Successful first commissioning run completed during the last week of Feb.
MKIR modified baffles around detector housings and installed masks around both detectors, reducing light leaks.

MKIR found and fixed vented screws in the light path for one channel, and an unused reference hole that had been bored all the way through in the other channel.

Additional improvements may be possible.

Background now meets spec of ~1 e/s in both channels.
Static AO system tests were quite successful, yielding 75–85% strehls at H, meeting design requirements.

Dynamic performance, using a rotating phase screen turbulence generator, revealed a number of issues with the DM and its mount.

Acceptance test results confirm that the dynamic AO performance at 1.6 μm is S~30% (0.7" seeing) to 50% (0.45" seeing); meets spec.

Measured static PSF (L) and model PSF (R) compared.
CILAS DM Performance Issues

- Thick face sheet limits DM actuator stroke (minimum radius ~17m)
- Two edge actuators failed before commissioning
- Dominant residual error found to be tip/tilt due to M2 vibrations
- Power spectrum of residual errors revealed high-Q harmonics at ~300 Hz due to the 3-point mount, forcing the use of low servo gains (g~0.5) to avoid instability

*In practice this all means the seeing conditions in which NICI with the CILAS DM can operate may be limited.*
AO performance was good and loops closed immediately in first tests

Initial strehl \( \sim 20-25\% \) at H and K with CILAS DM

Loops closed in 0.6 to 0.9 arcsec optical seeing

New UH DM tested in May shows promise

- Smaller minimum radius of curvature
- Higher lowest resonant frequencies

AO optimization just starting

5 min NICI image of GL229b (lower) taken during first commissioning run compared to Palomar and HST images
Brown Dwarf Gliese 229B

Palomar Observatory
Discovery Image
October 27, 1994

PRC95-48 - ST ScI OPO - November 29, 1995
T. Nakajima and S. Kulkarni (CalTech), S. Durr
On-sky AO tests

- Coronagraphic performance looks very good
  - Image is clean and relatively free of diffraction
  - Semi-transparent mask makes it possible to see the star and register images
  - Differential imaging works very well

5 minute NICI image of GL 229B (left) compared to IRTF image taken with CoCo
The team is trouble-shooting a number of problems in preparation for the next commissioning run:

- Thermal enclosure overheating problem
- High-level software needs to be completed and tested
- CILAS DM fixed, tip-tilt stage fixed
- Filter wheel reliability
- Secondary mirror vibrations fixed
- Software and electronic protection of APDs
- Install and test new Hawaii DM
NICI Campaign

- Planet search campaign of 50 nights awarded to an international team lead by Mike Liu (Hawaii)

- Campaign observing will be scheduled in “modified queue” blocks. During those blocks, campaign observations will be executed by Gemini staff whenever weather conditions are good enough, and revert to regular multi-instrument queue when they are not.

- Campaign will not start until performance can be verified (e.g., by replacing the DM)
Predicted Performance

Detailed estimates or models were provided to support the campaign proposals process:

- Contrast
- Guide star brightness
- Strehl ratio and natural seeing
- Wavelength dependence