NGAO AM2 High Strehl Architecture

Concept Summary

AM2 on Keck 1
feeding all new NGAO, and possibly legacy, instruments
LGS's see AM2 correction
LOWFS see AM2 correction
Go-to control DM's within dNIRI

Interferometer Support

Retain current AO systems in place on Keck 1 and Keck 2

Lasers

Single laser lab with 9 20 W CW Na D2 line lasers
(supports up to 7 d-NIRI IFU channels)

Laser Launch Telescopes **1**

On-axis projection
50 cm diameter
On-axis RC telescope design
Two-mirror transmission > 0.85
Asterism counter-rotates on the sky to negate field rotation

Beam Transfer System

1 Hollow-core photonic crystal fiber per laser beam
Bundle run of 15 fibers (w/ spares)
Approx. 30 m run
Transmission (589 nm) > 0.71
Top-end laser diagnostics package

Real-Time Controller **1**

Single Tomograph RTC
Must handle 8 x 64 x 64 HOWFS input and either 4 x 64 x 64 (Sci + LOWFS) + N x 32 x 32 (d-NIRI) DM cmd outputs

PSF Calibration System

Patrolling camera(s)
Spatial pick-off in Nas focal plane (some field blocking okay)
Detectors TBD

Field Rotation

Lots of 'barrel rotators', for each sensor package & instrument
(El bearing flange to focus distance ~1.767 m helps packaging)

Optics

AM2 only

Laser Guide Star Asterism

Narrow-field instrument
6 Na beacon sci asterism
1 @ field center
5 on fixed pentagon of radius 12"
and 3 Na beacons for 2 TT, 1 TTFA
LOWFS LGS pointed toward LOWFS stars

dNIRI
1 Na beacon per d-NIRI target +
2 Na beacons for 2 TT
Each LGS pointed directly at d-NIRI science target
LOWFS LGS pointed toward LOWFS stars

GLAO instrument(s)
4 Na beacons sci asterism
4 in square of edge length 10 arcmin

Deformable Mirrors

AM2
N = 64 actuators across telescope pupil
Diameter ~ 1.456 m
Final focal ratio = 15.41
(to provide M3 - focus distance of 8 m)

and N x 32 x 32 d-NIRI MEMS
Modest stroke requirement - only handling isoplanatic component of wavefront

Tip/Tilt Correction

AM2 tip/tilt
& 2nd-stage tip/tilt embedded within each fed instrument (if needed)

HO Wavefront Sensors

Narrow-field
6 LGS asterism sensor
Full-field dichroic pick-off before relay
Full atmospheric linear range or Go-to MEMS correction in HOWFS
+ 3 LGS sensors (for TT/TTFA LGS)

dNIRI
Up to 7 x LGS sensors
Full-field dichroic pickoff before instruments
+ 2 LGS sensors (for TT LGS)

GLAO instrument(s)
4 x 32 x 32 LGS sensors
Full-field dichroic pickoff before instruments

LO Wavefront Sensors

Narrow-field
2 TT + 1 TTFA + TWFS
Spatial pick-off in Nas focal plane in annulus 10" < radius < 90"
NIR TT ROI Trackers
NIR 2x2 subap Pyramid
64 x 64 MEMS correction in TT, TTFA WFS
8 x 8 subap (slow) visible S-H Truth WFS (20 sec exposure)

Wide-field
1 TT + TWFS
Spatial pick-off in Nas focal plane (some field blocking okay)
NIR TT Tracker
32 x 32 MEMS correction in TT WFS
8 x 8 subap (slow) visible S-H Truth WFS (20 sec exposure)

Wavefront Sensor ACQ

Narrow-field
2k x 2k NIR camera
and 2k x 2k CCD
Calibrated offset to sci instruments allow use of same cameras for sci acquisition

Wide-field
2k x 2k NIR camera
and 2k x 2k CCD
Calibrated offset to sci instruments allow use of same cameras for sci acquisition
and dNIRI metrology system