2015 Instrument Talks

The Support Astronomer Group

W. M. Keck Observatory
Personnel Changes

- August: Barbara Schaefer retired
  Carolyn Jordan taking over as Lead OA
- October: Greg Wirth moved to NEON
  Currently recruiting a new SA
- March: Bob Goodrich moving to GMTO
Remote Ops Remodel

• New virtual machines running VNC desktops
  – Larger monitors

• New layout
  – Hydraulic tables; sit or stand during your 14-hour observing nights
  – Large monitor with laptop connection
On-demand IQM

- Replacement for MIRA
- Stepping stone for continuous focus
- LRIS: in operational use
  - Run MIRA at the start of each LRIS block
  - Run on-demand IQM (five minutes) each time thereafter
On-demand IQM, NIRSPEC

• Calibration and testing stage
• Performance looks OK, but planning to replace 5-image prism with 6-image prism
• Deployment time unknown
Continuous IQM

• Interleave IQM frames with guiding frames
• Configuring lab setup for testing and development
• Options to interleaving mode being considered.
  – IQM with LRIS offset guider; guide on slit
  – Guide on IQM images (extensible beyond LRIS)
Slitmask design software

- AUTOSLIT fully “owned” by Keck
- DSIMULATOR “owned,” but updates and new release postponed due to lack of resources
HIRES Update

- Stable operations during 2014/2015
- HIRES Issues:
  - Bias level change on CCD 1 (blue).
    - Attributable to one of two SDSU video boards for CCD1 which generates the bias voltage.
  - Plan to exchange the two video boards.
  - Impact: High gain mode is currently unavailable for CCD1.
HIRES SDSU CCD Controller Interconnection Diagram
HIRES Update

- HIRES Issues (cont):
  - Failure of the SPARC 5 card (CPU) for the motor crate (04 Jul 2014).
    - Replaced with available spare.
    - Additional spare has been acquired.
HIRES Future Plans

- Submitting FY16 Continuous Improvement project for a blue optimized flat field lamp.
- The deuterium lamp originally installed in HIRES provided little continuum flux.
- A new deuterium lamp will provide continuum emission from 300 – 370 nm.
ESI: Quiet 2014, Noisy 2015

• New ESI Master

• Extensive pre-run checkout
  – Finds problems before nighttime
  – January 2015 unplanned warmup
  – February 2015
    • Dirty fibers
    • Mechanism repeatability
ESI

- January 2015
  - Winter storm led to unplanned warmup
  - Vacuum leak led to shortened pump down
  - Soft vacuum and broken ion pump
    - Reduced hold time
    - LN2 fills at night during January
• February 2015
  – Dirty optical fibers mimicked video board problem
  – Analog data were good
  – Interlacing issue in digital transfer
ESI Mechanism Repeatability

Echellette-Imaging-Echellette

After Re-init
More Efficient Slit Centering Capability

- All NIRSPEC slits have common center position in SCAM (+/- 1 pixel: 131,125 (x,y))
- Faster acquisition: Requires only 1 “click”
Artifact in Flat fields linked to dust on Cal Unit Optics

- Seen in different filters
- Seen in different slits
- Artifact depends on Rotator Position
- Artifact goes away after cleaning cal unit optics – late Sept. 2014

2014 Sept. 13

K-band
Rotator at 0 degrees

2014 Sept. 13

L-band
Rotator at 99 degrees
Dust Emission from NIRSPEC Window

- Long wavelength emission source
- Faint
- Rotator Dependent
- Confirmed dust on dewar entrance window
- Attempts to clean window were unsuccessful & introduced cracks

NIRSPEC being serviced to replace window with clean spare

Artifact

Astronomical Source
NIRSPEC Laser Comb Tests

- JPL laser comb signal generated in K2 control room
- Fiber carries signal up to NIRSPEC and into the Cal Unit
- Signal is injected into the Integrating Sphere of NIRSPEC
Dual laser comb lines Successfully imaged onto the NIRSPEC Detector

- Comb lines resolved with echelle grating: 1.5 Å separation
- Power is balanced across both combs for high precision wavelength calibration
- Arc Lamps can be imaged simultaneously
Science Detector Characteristics continued tracking

Dark Current: 0.83 ± 0.10 e-/s

Readnoise: 23.8 ± 1.7 e-

Gain: 5.76 ± 0.07 e-/ADU
Proposed NIRSPEC Upgrade

- New Science detector (SPEC), H2RG (2048 x 2048)
  - Dark Current reduction (0.8 e-/s -> 0.01 e-/s)
  - Readnoise reduction (23e- -> 4.5e-)
  - Increased QE
  - Smaller pixels (27um -> 18um)
  - > 6.5 times reduction in time to achieve same SNR
- New Slit Viewing Camera Array (SCAM), H1RG (1024 x 1024)
  - Long λ sensitivity, L & M band on-slit guiding
  - Precise slit positioning at long wavelengths
  - Science quality images with new SCAM
- New Control Electronics
  - Replace obsolete Transputer control with network based control architecture
  - Share common spares pool with MOSFIRE and OSIRIS
  - New Temperature controllers for SPEC and SCAM
Red side grating

- Observers reported large (> 100 pixels) shifts in the positioning of the red side grating tilt
- The problem was traced to uncertainties in the absolute position of the tilt encoders when the grating is inserted
Red side grating

• We fixed the problem by adding a forced homing of the stage when the grating is inserted. Overhead is minimal (about 60 seconds) and only happens on grating changes.

• No problems reported since the fix was introduced.
New LRIS calibration system

- Calibration available for Kr and Xe
New LRIS calibration system

- Calibration available for Fe-Ne
New LRIS calibration system

- Flat field spectrum for Deuterium lamp

400/3400
30 seconds
New LRIS calibration system

- New XLRIS
- New Calibration gui

<table>
<thead>
<tr>
<th>Arc Lamps</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hg</td>
</tr>
<tr>
<td>Zn</td>
</tr>
</tbody>
</table>
Data Reduction Pipelines

Luca Rizzi
## Keck I DRPs

<table>
<thead>
<tr>
<th>Instrument</th>
<th>DRP/DRT</th>
<th>Author(s)</th>
<th>WMKO support</th>
<th>KOA DRP status</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIRES</td>
<td>MAKEE</td>
<td>T. Barlow</td>
<td>No</td>
<td>Used for processing</td>
</tr>
<tr>
<td>HIRES redux</td>
<td>J. Prochaska</td>
<td>No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LRIS</td>
<td>Low-Redux</td>
<td>J. Hennawi, S. Burles, J. Prochaska</td>
<td>No</td>
<td>Raw data only</td>
</tr>
<tr>
<td>Starlink+Pamela+Molly</td>
<td>D. Levitan</td>
<td>No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kelsonware</td>
<td>D. Kelson</td>
<td>No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MOSFIRE</td>
<td>Mosfire DRP</td>
<td>N. Konidaris, C. Steidel</td>
<td>Support and Development</td>
<td>Raw data only</td>
</tr>
<tr>
<td>OSIRIS</td>
<td>OSIRIS DRP</td>
<td>OSIRIS DRP team, OSIRIS Keck Support Team</td>
<td>Support and Development</td>
<td>Used for processing</td>
</tr>
</tbody>
</table>
### Keck II DRPs

<table>
<thead>
<tr>
<th>Instrument</th>
<th>DRP/DRT</th>
<th>Author(s)</th>
<th>WMKO support</th>
<th>KOA DRP status</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEIMOS</td>
<td>Deep2 pipeline</td>
<td>DEEP2 team</td>
<td>No</td>
<td>Raw data only</td>
</tr>
<tr>
<td></td>
<td>IDL tools</td>
<td>P. Capak</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Kelsonware</td>
<td>D. Kelson</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>ESI</td>
<td>ESIRedux</td>
<td>J. Prochaska</td>
<td>No</td>
<td>Raw data only</td>
</tr>
<tr>
<td></td>
<td>MAKEEE</td>
<td>T. Barlow</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>NIRC2</td>
<td>KOA-only tools developed in house</td>
<td>H. Tran, KOA</td>
<td>N/A</td>
<td>Used for processing</td>
</tr>
<tr>
<td>NIRSPEC</td>
<td>WMKONSpect</td>
<td>Keck NIRSPEC support team</td>
<td>?</td>
<td>Under development</td>
</tr>
<tr>
<td></td>
<td>REDSPEC</td>
<td>UCLA IR lab</td>
<td>No</td>
<td></td>
</tr>
</tbody>
</table>
MOSFIRE pipeline at WMKO

• The transfer of responsibility for the pipeline project to WMKO is complete

• Distribution, support and development are carried out in house, with valuable contributions from the original team and community members
Pipeline distribution

Mosfire DRP

This is the central repository for the MOSFIRE DRP developed by N. Konidaris and C. Steidel at Caltech, and currently hosted at the WMK Observatory.

If you need help with the pipeline or to report a problem, please visit our issue tracking page hosted at GitHub. Please note that you need a free GitHub account to submit a ticket.

The currently release installation and reduction instructions are provided in the DRP manual.

The development and support team includes:

Marc Kassis, Luca Rizzi, Jim Lyke at W. M. Keck Observatory

Nick Konidaris, Chuck Steidel at Caltech

Tuan Do at Dunlap Institute for Astronomy and Astrophysics, University of Toronto

For direct communication with the support and development team, please email mosfiredrp@gmail.com

Downloaded 25 times since January 15
Pipeline support
# Pipeline support

<table>
<thead>
<tr>
<th>Title</th>
<th>Label</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>DATASEC keyword in the rectified outputs and DS9</td>
<td>help wanted</td>
<td>#15 opened 17 hours ago by monocera.</td>
</tr>
<tr>
<td>Wavelength calibration to very long slit</td>
<td>help wanted</td>
<td>#14 opened a day ago by YulohHar/kane</td>
</tr>
<tr>
<td>Arc wavelength solution</td>
<td>help wanted</td>
<td>#13 opened 3 days ago by MostfireDRP</td>
</tr>
<tr>
<td>First steps towards the reduction of long2pos</td>
<td>enhancement</td>
<td>#12 opened 12 days ago by MostfireDRP</td>
</tr>
<tr>
<td>Possible problem with CSU.py</td>
<td></td>
<td>#11 opened on Jan 17 by lucarizzi</td>
</tr>
<tr>
<td>LongSlit reduction</td>
<td>enhancement</td>
<td>#10 opened on Jan 14 by MostfireDRP</td>
</tr>
<tr>
<td>DRP fails on file names that do not follow the standard pattern</td>
<td>enhancement</td>
<td>#9 opened on Jan 14 by MostfireDRP</td>
</tr>
<tr>
<td>Cannot use compressed .fits.gz files for flats</td>
<td></td>
<td>#8 opened on Jan 8 by followthesheep</td>
</tr>
<tr>
<td>Improvements to the installation/instruction manual</td>
<td></td>
<td>#7 opened on Jan 8 by MostfireDRP</td>
</tr>
<tr>
<td>Internal discussion: the variance array</td>
<td>question</td>
<td>#6 opened on Jan 6 by lucarizzi</td>
</tr>
<tr>
<td>Compatible with Ureka 1.4?</td>
<td>question</td>
<td>#5 opened on Jan 5 by anstockon</td>
</tr>
<tr>
<td>S/N Error Array Discrepancy</td>
<td>question</td>
<td>#4 opened on Jan 5 by sda/hm</td>
</tr>
<tr>
<td>Double peaked emission line: nod shift issue?</td>
<td>help wanted</td>
<td>#3 opened on Jan 5 by jhyoon79</td>
</tr>
<tr>
<td>Test submission</td>
<td>help wanted</td>
<td>#2 opened on Dec 10, 2014 by lucarizzi</td>
</tr>
<tr>
<td>Low signal to noise in small data sets</td>
<td>enhancement</td>
<td>#1 opened on Dec 10, 2014 by MostfireDRP</td>
</tr>
</tbody>
</table>
Pipeline development

Git clones

<table>
<thead>
<tr>
<th>Date</th>
<th>Clones</th>
<th>Unique cloners</th>
</tr>
</thead>
<tbody>
<tr>
<td>02/07</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>02/08</td>
<td></td>
<td></td>
</tr>
<tr>
<td>02/09</td>
<td></td>
<td></td>
</tr>
<tr>
<td>02/10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>02/11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>02/12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>02/13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>02/14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>02/15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>02/16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>02/17</td>
<td></td>
<td></td>
</tr>
<tr>
<td>02/18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>02/19</td>
<td></td>
<td></td>
</tr>
<tr>
<td>02/20</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Visitors

<table>
<thead>
<tr>
<th>Date</th>
<th>Views</th>
<th>Unique visitors</th>
</tr>
</thead>
<tbody>
<tr>
<td>02/07</td>
<td>20</td>
<td>10</td>
</tr>
<tr>
<td>02/08</td>
<td>40</td>
<td>10</td>
</tr>
<tr>
<td>02/09</td>
<td>20</td>
<td>10</td>
</tr>
<tr>
<td>02/10</td>
<td>40</td>
<td>10</td>
</tr>
<tr>
<td>02/11</td>
<td>20</td>
<td>10</td>
</tr>
<tr>
<td>02/12</td>
<td>40</td>
<td>10</td>
</tr>
<tr>
<td>02/13</td>
<td>20</td>
<td>10</td>
</tr>
<tr>
<td>02/14</td>
<td>40</td>
<td>10</td>
</tr>
<tr>
<td>02/15</td>
<td>20</td>
<td>10</td>
</tr>
<tr>
<td>02/16</td>
<td>40</td>
<td>10</td>
</tr>
<tr>
<td>02/17</td>
<td>20</td>
<td>10</td>
</tr>
<tr>
<td>02/18</td>
<td>40</td>
<td>10</td>
</tr>
<tr>
<td>02/19</td>
<td>20</td>
<td>10</td>
</tr>
<tr>
<td>02/20</td>
<td>40</td>
<td>10</td>
</tr>
</tbody>
</table>
Pipeline development

- **Formal Version 1.0** released on December 16
- **Longslit** reduction developed and being tested
- **Long2pos** developed for non-spectrophotometric case and being tested
- Expected release date: **May 2015**
Pipeline development

Longslit observation of HIP13917

Long2pos observation of HIP65210
OSIRIS DRP Issues

• Bad spaxels appear to be caused by recmats
• Spurious pixel values in recmat spectra
• Two current paths of investigation
  – Poor cosmic ray rejection
  – Remove spurious recmat values
• Other paths
  – “bad” pixel handling when building recmats
OSIRIS DRP Issues
Bad Spaxel Spectra
Badness is Localized

Full Scale

Y-axis zoomed
Spectra are Good

Bad Spaxels

Neighboring row
Poor CR Rejection

- Avoid with median of scans
  - Take 5 spectra per lenslet mask position vs. 1
  - Turn off DRP’s CR rejection
  - Build Recmat

Pros
- Straightforward
- Removes badness before it begins

Cons
- Must redo cals
- Cannot fix older recmats
Median Scan Method
Median Results

Before

After
Median Results

Neighbor before

 Neighbor after
Remove Spurious Values

• Must define spurious
  – Pixel values above 0.8 (mkrecmatrixx_000.c)

• Create new (clean) version of recmat

Pros
• Fast
• Fixes even old recmats
• Similar to what DRP does now

Cons
• Must be sure recmat pixel is bad
In a recmat, each spaxel (x,y) location corresponds to a 2D spectrum. A bad spaxel (■) can be created by a high absolute value pixel (X) within the 2D spectrum. Replacing the high abs. value pixel with the average of the corresponding pixels in the surrounding spaxels (●) will "clean" the recmat.
OSIRIS Clean Method
OSIRIS Clean Results

Before

After
OSIRIS Clean Results

Neighbor before

![Plot Window](image1)

Neighbor after

![Plot Window](image2)
Median vs. Clean
Next Steps

• Bad pixel handling in building recmats
  – Values outside the “normal”
    • Forced to zero
    • Discontinuities in recmat spectra
  – Try the “clean” method at the beginning

• Median scans for all modes
  – 2 months
OSIRIS Upgrades Update

**SPEC: NSF ATI**
- PI: Larkin, Co-I: Ellis, Adkins
- H₂RG in hand at UCLA
- Focus mechanism nearing design completion
- Detector controller and server software in development
- First light Jan 2016

**IMAG: Moore Foundation**
- PI: Fitzgerald/Ghez
- H₂RG in hand at UCLA
- 10 mas pixels, 20” FOV
- Optical design nearly finalized
- Design review July 2015
- Installation late August 2015
OSIRIS Imager Survey

• Sent to all OSIRIS users since 2010

• Questions
  – Shall we upgrade imager filters?
  – If so, which ones shall we remove?

• Results
  – Ability to observe bright targets (1% filters)
  – Most support MKO broadbands (YJHKs/Kp)
  – Few do not wish to duplicate NIRC2
  – One suggestions to match TMT IRIS filters
OSIRIS Imager Filter Usage
38967 files at night with OSIRIS the selected instrument
NIRC2

Hien Tran
Vortex Coronagraph Installation

- L-band vortex coronagraph
  - Planned for Mar. 17, 2015
  - NIRC2 now being warmed
- Service mission anticipated to take 1 day
- Two new coronagraph masks to replace grids of holes in the slit mask stage (SLS)
- Cold heads to be purged
- Work done on AO bench to support new coronagraph:
  - Pupil realignment
  - Reduce L-band image elongation
  - New L-band calibration source
Vortex Coronagraph Installation

- L-band vortex coronagraph
  - Planned for Mar. 17, 2015
  - NIRC2 now being warmed
- Service mission anticipated to take 1 day
- Two new coronagraph masks to replace grids of holes in the slit mask stage (SLS)
- Cold heads to be purged
- Work done on AO bench to support new coronagraph:
  - Pupil realignment
  - Reduce L-band image elongation
  - New L-band calibration source
Other Updates

- Improved recovery script for Alad server crash:
  - Shutdown and restart GUIs automatically
- Tklogger popup to alert of Alad crash
- Scripts launched to monitor detector characteristics
- Source for "K-band glow" identified
- Monitoring intermittent temperature instability of 2-stage cold head
Reduced Fault Times

- 148 Nights in 2014
- Time saved: ~80 hrs per year

MOSFIRE Time Lost

- Time lost less weather and engineering

Bar chart showing MOSFIRE Time Lost for different years and categories.
CSU Avoidance Strategies

CSU Fatal Errors on sky

- Moves now in series with telescope slews
- 30 hours lost to CSU moves per year
Missed Telescope moves

- 1 every 3000 nods
- Communication problem with Keck I

- Keyword Gateway implemented
- Deployed to all instruments
MOSFIRE slit drift

- Observed drift along the slit
- ~1 pix per hour
Slit Drift Model

- Diff flexure
- Function of elevation and rotation

\[ \Delta y_{pix} = A \left[ \cos(\text{RotP}) \cos(\text{El}) - \cos(\text{RotP}) \cos(\text{El}_0) \right] \]

\[ \Delta x_{pix} = B \left[ \sin(\text{RotP}) \cos(\text{El}) - \sin(\text{RotP}) \cos(\text{El}_0) \right] \]
CSEM collaboration

• Sparing:
  – IMCU board spare repaired and functioning
  – Spares for all but one board: MACU driver

• Problems we are addressing
  – Fix amplifier board cold sensitivity (ongoing)
  – Identify cause of “Fatal Errors”
2015 Tasks

• Slit drift
  – Update guiding software
  – Possible first test at the end of April

• Work with CSEM
  – diagnose the electronics temperature dependency
  – Modify all 92 boards

• Slitmask design software updates
Reduced Fault Times

- 148 Nights in 2014
- Time saved ~80 hours
CSU Avoidance Strategies

CSU Fatal Errors on sky

- Rotator near a bad angle
  - Continue? [Y|N] >

- Moves now in series with telescope slews
- 30 hours lost to CSU moves
Missed Telescope moves

- 1 every 3000 nods
- Communication problem with Keck I

- Keyword Gateway implemented
- Deployed to all instruments
MOSFIRE slit drift

- Observed drift along the slit
Slit Drift Model

- Diff flexure
- Function of elevation and rotation

\[ \cos(\text{rot}) \times \cos(\text{el}) \]
CSEM collaboration

• Sparing:
  – Determined fault with spare IMCU board
  – Spares for all but one board: MACU driver

• Problems we are addressing
  – Fix amplifier board cold sensitivity (ongoing)
  – Identify cause of “Fatal Errors”
2015 Tasks

- Slit drift
  - Update guiding software
  - Possible first test at the end of April

- Work with CSEM
  - Diagnose the electronics temperature dependency
  - Modify all 92 boards

- Slitmask design software updates
DEIMOS

Marc Kassis
DEIMOS Actions in 2014/2015

- Minor software updates
- Replacement of host computer
- Servicing mission to address grating system
- New blue grating
Software Updates

• More flexibility in calibration GUI

• DSIMULATOR served at Keck
Keamano Upgrade

• UCO Lick Scientific Programming Group: Steve Allen, Kyle Lanclos, Will Deich, Bob Kibrick

• Keck Staff: Marc Kassis, Liz Chock, Al Honey

• Goals:
  – Replace host computer with Sun V240 running Solaris 10
  – Update portions of the control software
  – All software now under version control
Grating servicing mission

- **UCO Lick Staff:** Dave Cowley, Jim Ward, Brad Holden, Steve Allen, Will Deich
- **Keck Staff:** Luca Rizzi, Steve Milner, Gary Anderson, Nick Souminen, Dwight Chan
- **Goals:**
  - Replace worn, custom components
  - Grating system is more reliable
  - FCS maintains position with grating clamped at all rotator angles
- **DEIMOS out of service 6 weeks starting January**
DEIMOS time loss

Excludes telescope faults, weather, and engineering
Grating Mechanisms
Critical grating tilt components are worn

Drive sector
Drive wheel
Drive roller
Worn Parts

- Bering housing
- Sector Wheel
Grating 3 Flexure

Before

After
Believe we can do better

- Grating 3 flexure is good.
- -180 is good for grating 4
- We know we have not optimized the clamp pin position
2015 Tasks

• Grating Service Mission continued effort
  – Tune grating clamp positions
  – Adjust limit switches in tilt mechanisms
  – Update the software with new values
  – Rerun flexure tests
  – Repair damaged video board

• Non-service mission work
  – Diagnose and repair noisy amplifiers
  – Replace a V-band filter
  – Investigate feasibility of commission grating port 5
AO Operations

Randy Campbell
LGSAO in 2014

- 10th year of LGSAO Science
  - 126 Science Nights
    - Keck II: 89
    - Keck I: 37
  - 33 Engineering Nights
    - Keck II: 19
    - Keck I: 14

10 Year Averages for LGSAO

- Overheads (inst+tel+ao): 30%
- Open Shutter Science Time w/LGSAO: 35%
- Weather: 23%
- Laser Traffic Control: 1%
- Aircraft: 0%
- LCH: 2%
- Laser faults: 3%
- AO faults: 4%
- Other (inst+tel): 2%

1029 total LGS Science Nights over 10 years
LGS Trends

- Weather loss for LGS in 2014 28%
- Fault loss 8% (AO+laser+other)
- Overheads trending up
  - Perhaps due to increase in partial nights
AO Performance Metrics

LGS Strehl (NIRC2 only)

LGS FWHM (NIRC2 and OSIRIS)
Keck II AO Bench Tweaks

1. Improved pupil nutation (K-mirror)
2. Improved Telescope/NIRC pupil registration (OAPs)
3. Future solution for L-prime elongation (IR Dichroic wedge rotation)
   - Removes lateral chromatic dispersion
   - But introduces a pupil mis-alignment and ~200 nm of astigmatism.
   - Future coordinated adjustments should solve this problem

Telescope pupil image before and after alignment with NIRC2 “largehex” mask
2015 Priorities

- Science operations
- Performance improvements
  - AO bench optical alignment
  - Keck I FST efficiency
  - Computer upgrades
- Transition TRICK to operation
- Transition KII CLS to operation
- Transition NGL to operation
- Support PSF reconstruction projects
- Vector vortex coronagraph project
- Fix vignetting (NIRC2 Wide)
- Complete “SkyTiles” project
  - USStratCom coordination
- MLOG coordination
- LTCS improvements
- TBAD deployment coordination
- Further develop AO PM program
- Overhaul AO web pages

Sharpened L-prime image of thermal fiber source after dichroic rotation

L-prime image of thermal fiber source before dichroic rotation
Current Status

• 10 years of operation this past August
• Archive data from ALL 10 past and current instruments
  – Newly acquired data and all previously acquired data
  – Publicly released for all but two (NIRC, LWS)
  – ~70 % of data are public
• Current holding: 35 TB
  – 15,000 program nights, 2.6 million files over 20 years
  – Reduced (level-1) browse products for HIRES, NIRC2, OSIRIS, LWS
KOA Holding & Usage

• Growth in archive queries and data download
  • 1.4 Mil queries
  • 15.1 TB downloaded (> 1.3 Mil files)

• Increased growth in refereed papers citing KOA (86 to date)
MOWG Findings

• Advertisement of KOA’s capabilities and content
  – SPIE, ADASS, KSC, AAS, KSM

• Improved methods of file naming & searching
  – Filename translator script
  – Will implement as download option

• Publish lessons learned from building and operating KOA
  – Presented in two papers at 2014 Astronomical Telescopes + Instrumentation (Montreal)
KOA Future Plans

- Public data release for NIRC and LWS (July & Sep. 2015)
- Automated DRPs and level-1 data for all instruments
- Serving full set of keywords for all instruments
  - Better calibration association
  - Improved and more advanced searches (e.g., instrument “modes”)
- Interactive viewers for NIRC2 and OSIRIS reduced cubes
- VO compliant services
- Formation of archive users’ group
  - Guide priorities for new services
Mainland Observing

Greg Doppmann
Mainland Observing Sites

🌟 Primary Sites (10 total)
🌟 Secondary sites (4 total)
Mainland Observing Updates

- UCB remote observing site relocated to new campus (2 stations operational)
- Stanford now operational as a secondary remote site
- UCSD second remote station coming on-line soon