

# 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

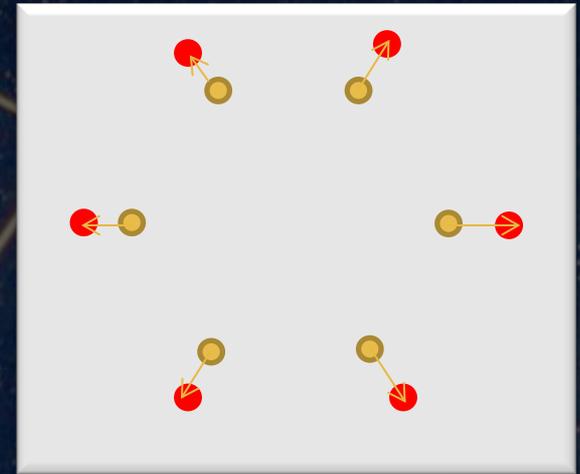


# Remote Ops Remodel

- 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

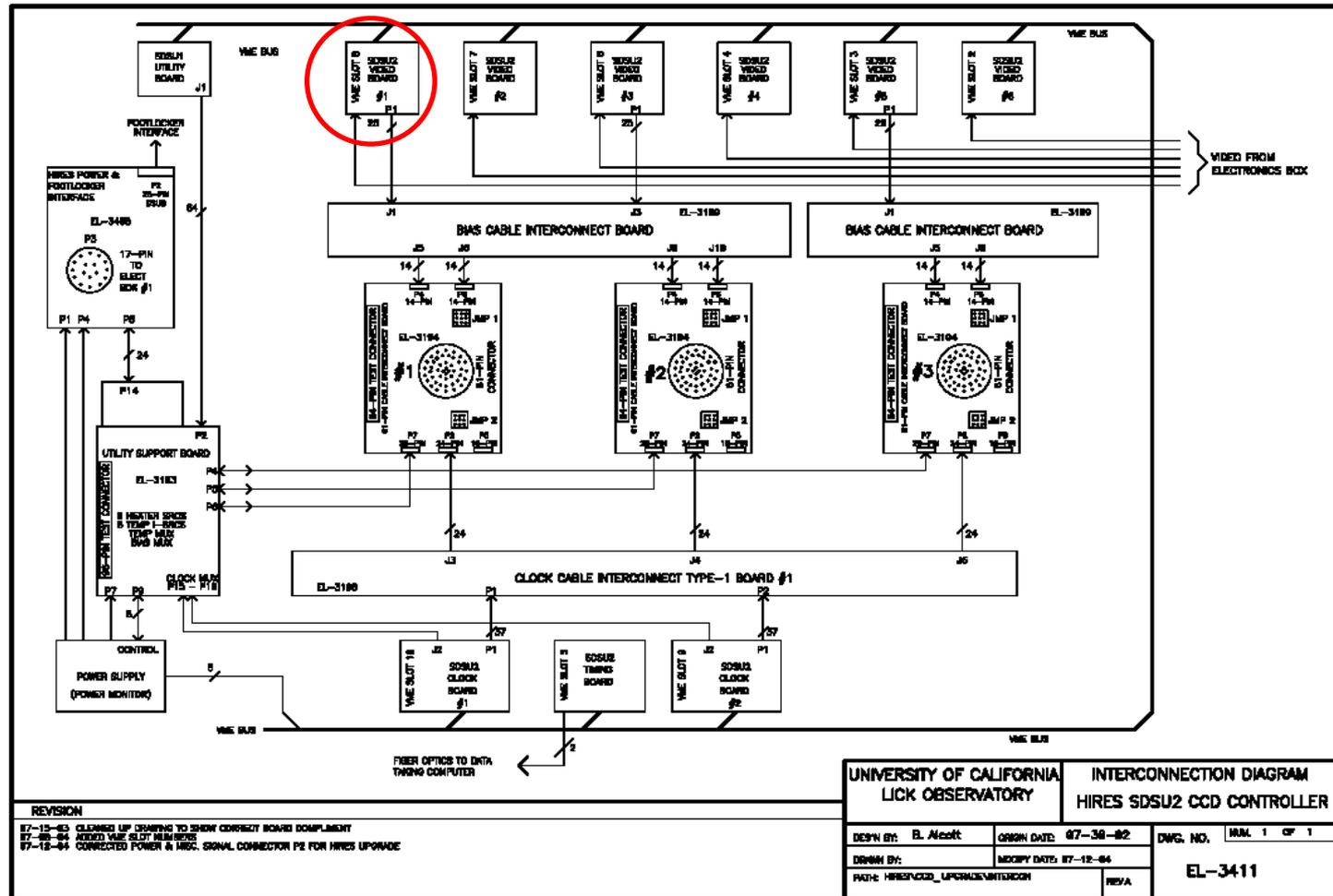
Scott Dahm

# 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 Update



HIRES SDSU CCD Controller Interconnection Diagram

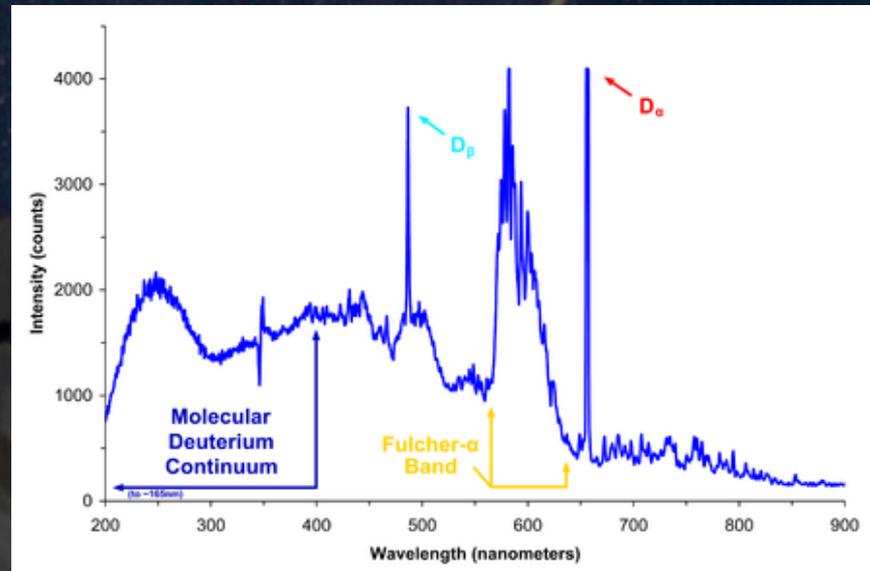


# HIRES Update

- 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

Jim Lyke

# 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

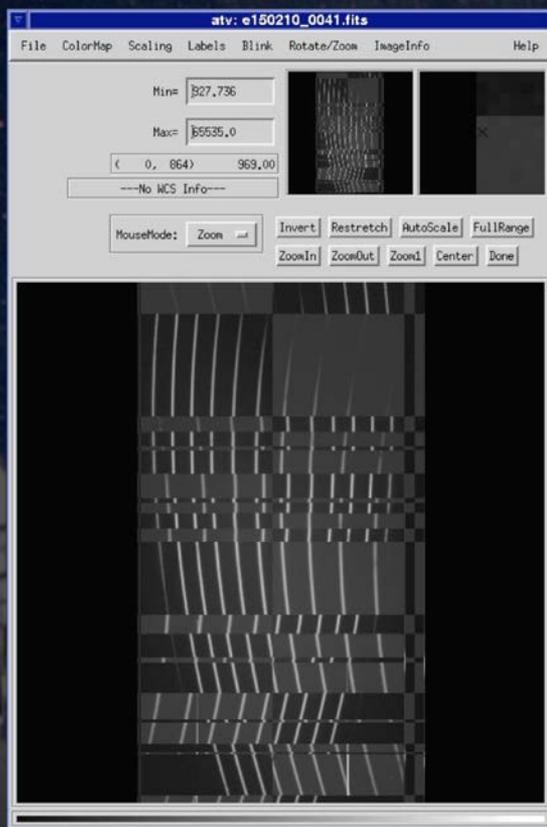
- January 2015
  - Winter storm led to unplanned warmup
  - Vacuum leak led to shortened pump down
  - Soft vacuum and broken ion pump
    - Reduced hold time
    - LN<sub>2</sub> fills at night during January

# ESI

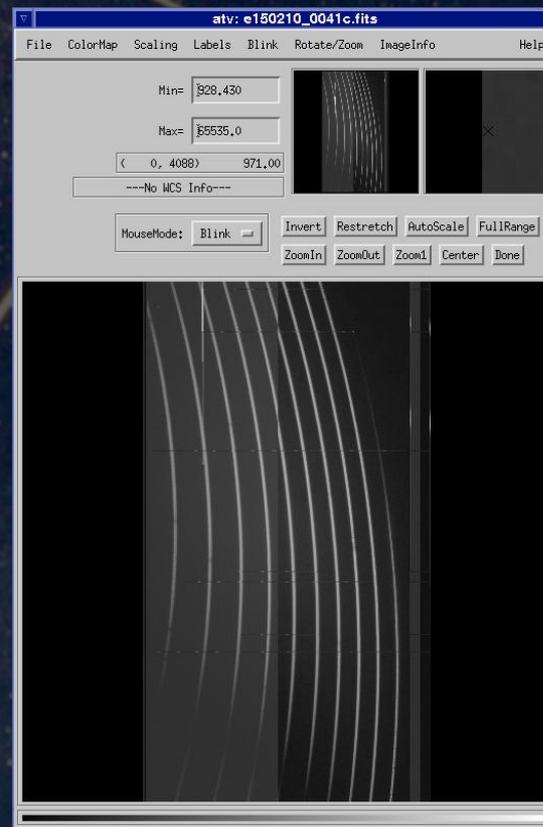
- February 2015
  - Dirty optical fibers mimicked video board problem
  - Analog data were good
  - Interlacing issue in digital transfer

# ESI Dirty Fibers

Raw



Processed



# ESI Mechanism Repeatability

Echelle-Imaging-Echelle



After Re-init



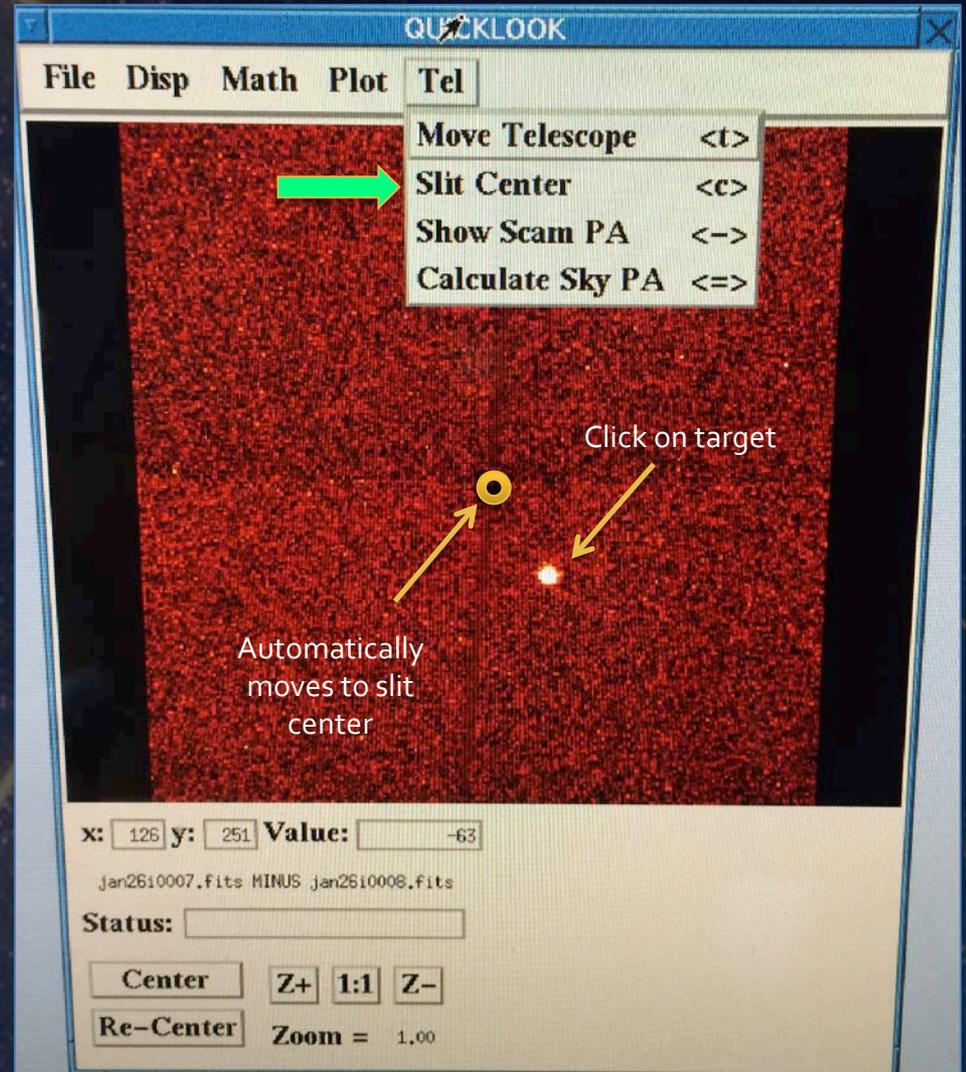


# NIRSPEC

Greg Doppmann

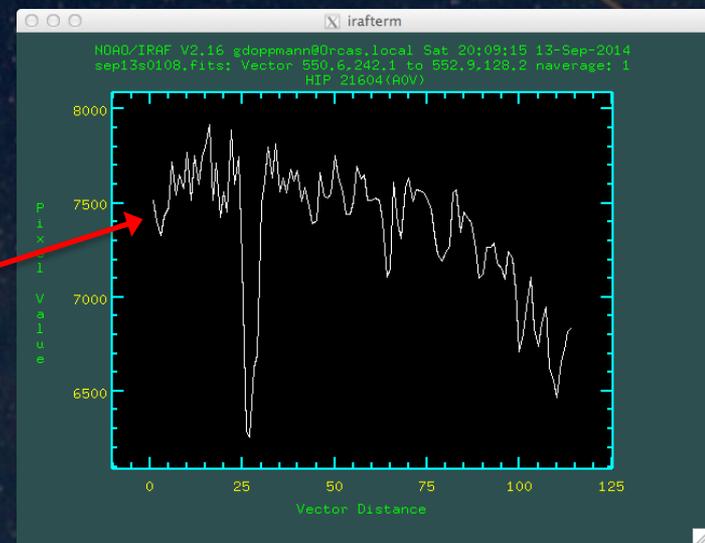
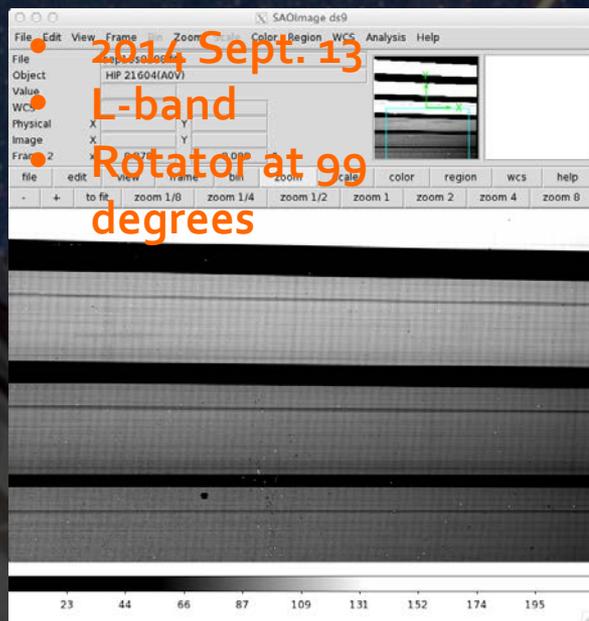
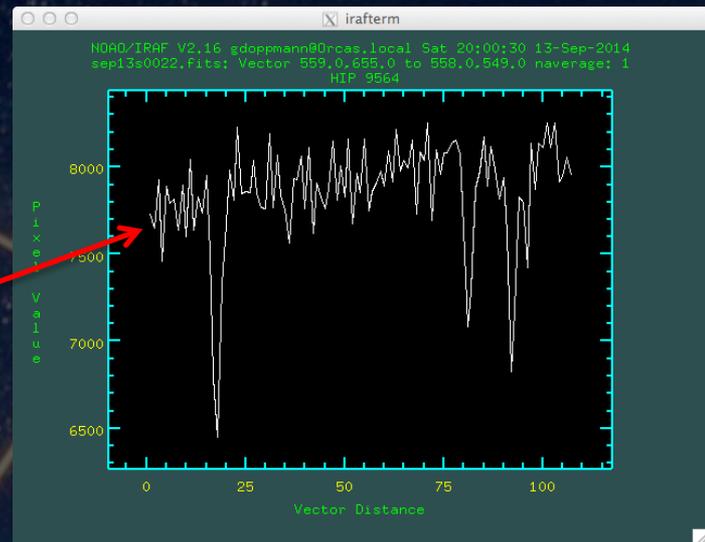
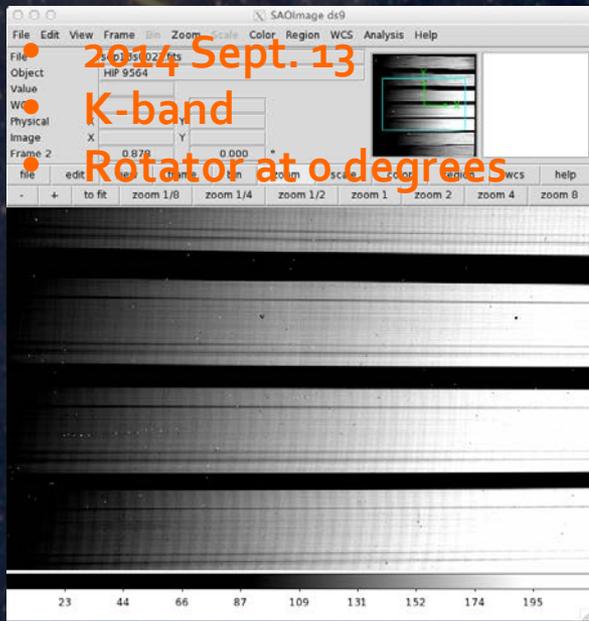
# More Efficient Slit Centering Capability

- 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

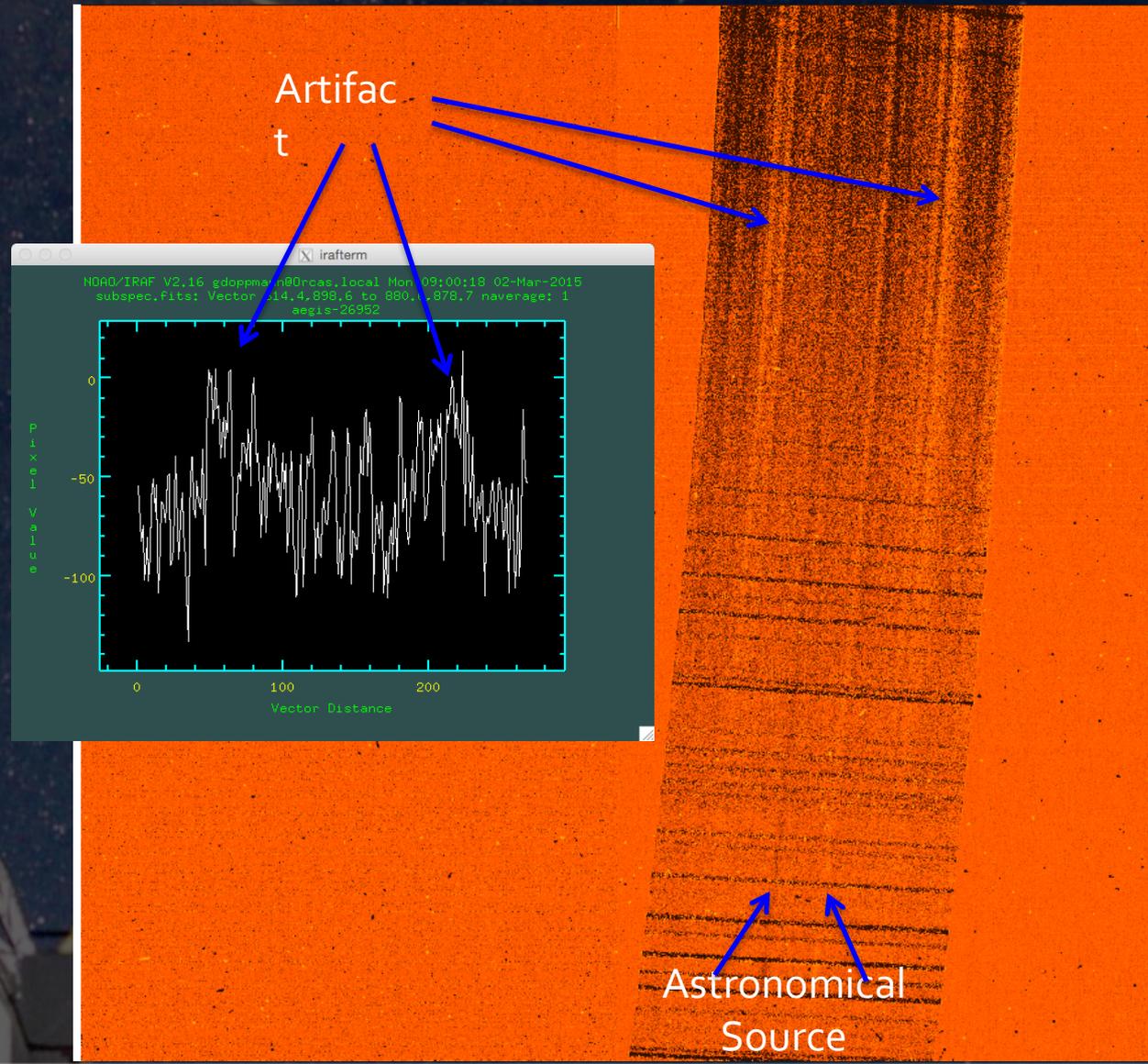
- ✧ Seen in different filters
- ✧ Seen in different slits
- ✧ Artifact depends on Rotator Position
- ✧ Artifact goes away after cleaning cal unit optics – late Sept. 2014



# Dust Emission from NIRSPEC Window

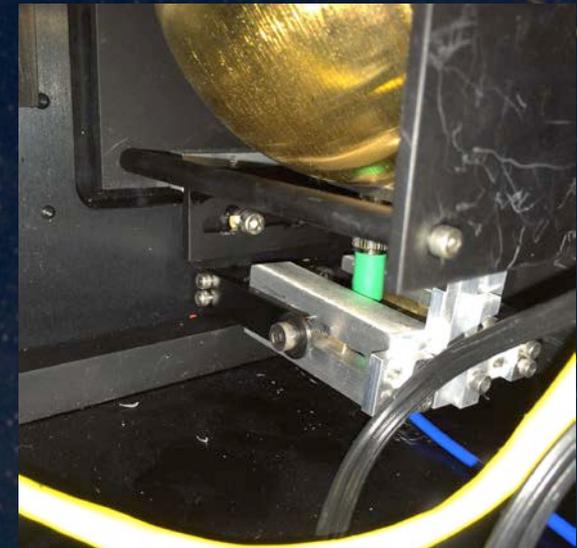
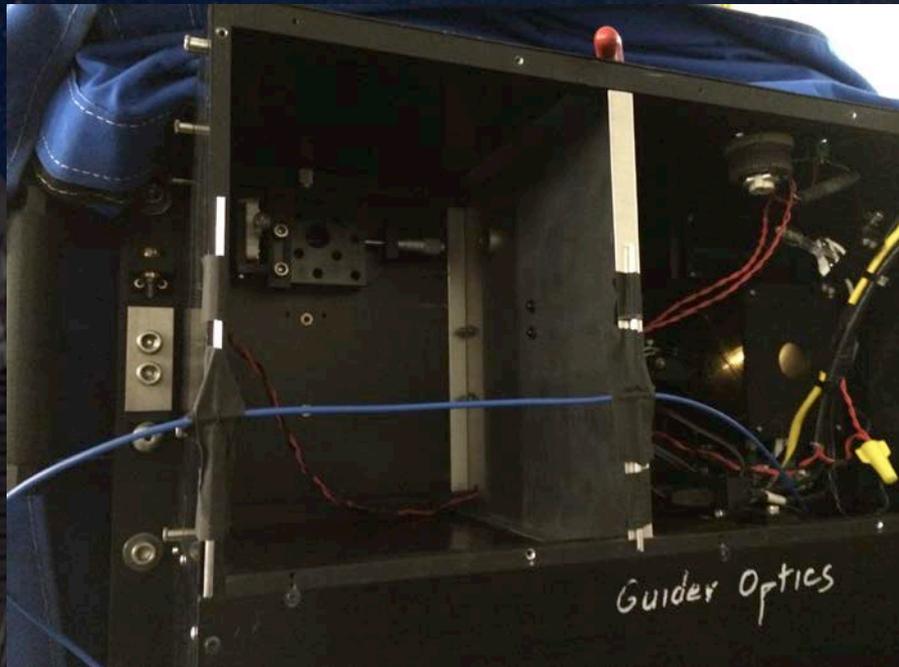
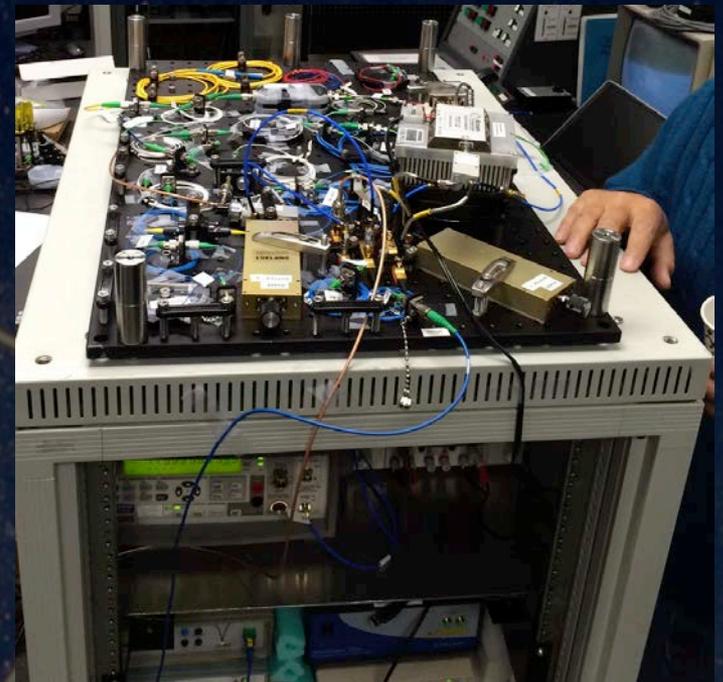
- ✧ Long wavelength emission source
- ✧ Faint
- ✧ Rotator Dependent
- ✧ Confirmed dust on dewar entrance window
- ✧ Attempts to clean window were unsuccessful & introduced cracks

- NIRSPEC being serviced to replace window with clean spare



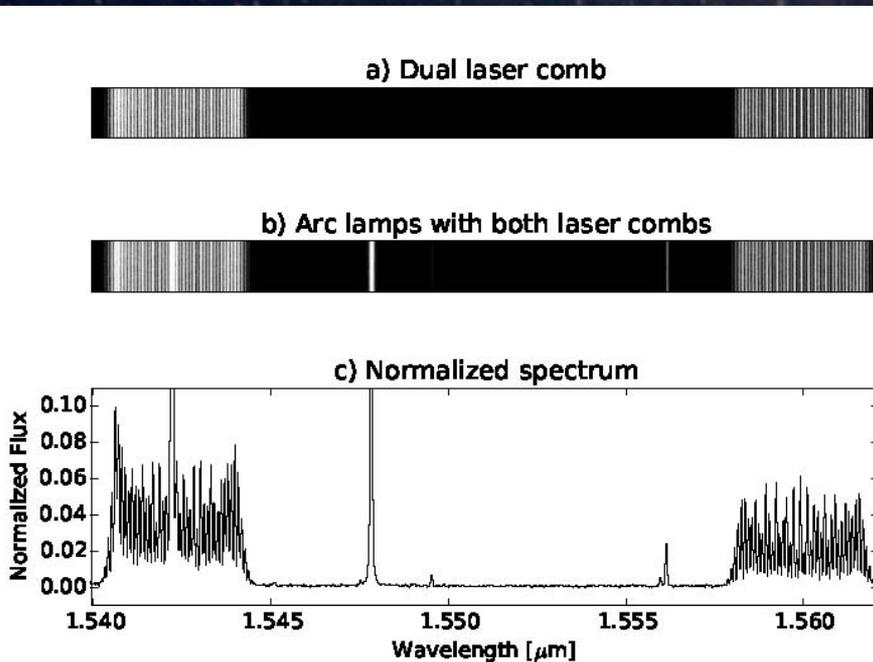
# NIRSPEC Laser Comb Tests

- 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

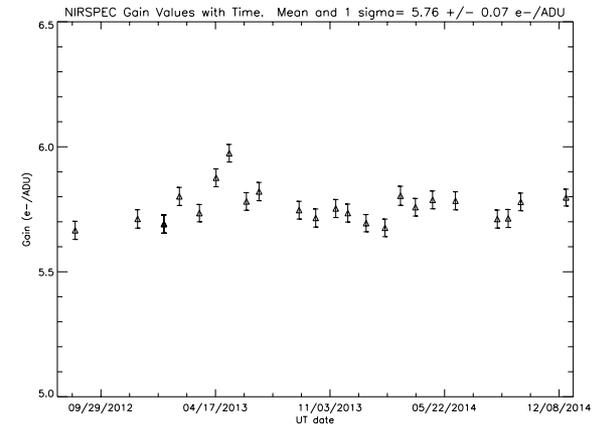
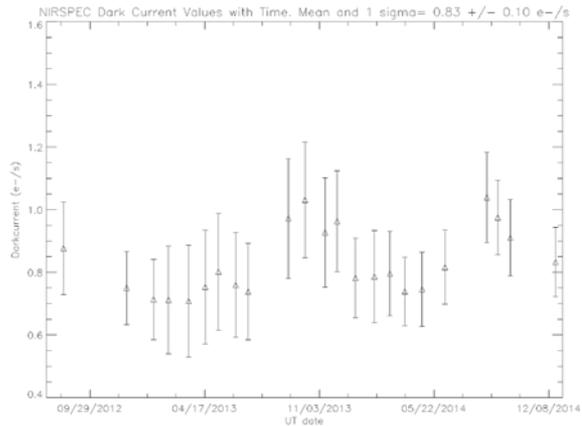


# Dual laser comb lines Successfully imaged onto the NIRSPEC Detector

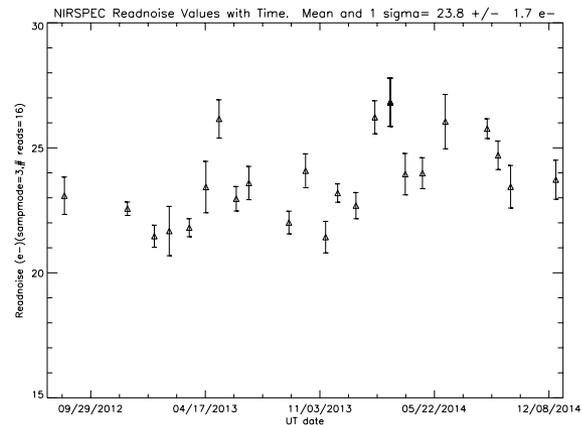
- Comb lines resolved with echelle grating: 1.5 Å separation
- Power is balanced across both combs for high precision wavelength calibration
- Arc Lamps can be imaged simultaneously



# Science Detector Characteristics continued tracking



Dark Current:  
 $0.83 \pm 0.10 \text{ e-}/s$



Readnoise:  
 $23.8 \pm 1.7 \text{ e-}$

Gain:  
 $5.76 \pm 0.07 \text{ e-}/ADU$

# Proposed NIRSPEC Upgrade

- New Science detector (SPEC), H<sub>2</sub>RG (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), H<sub>1</sub>RG (1024 x 1024)
  - Long  $\lambda$  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



LRIS

Luca Rizzi

# Red side grating

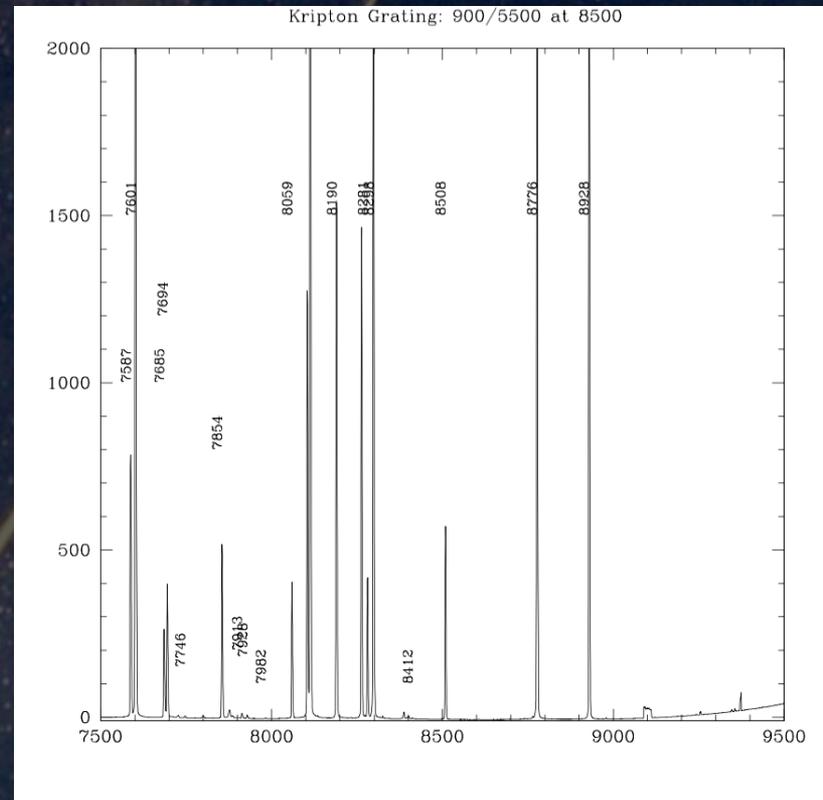
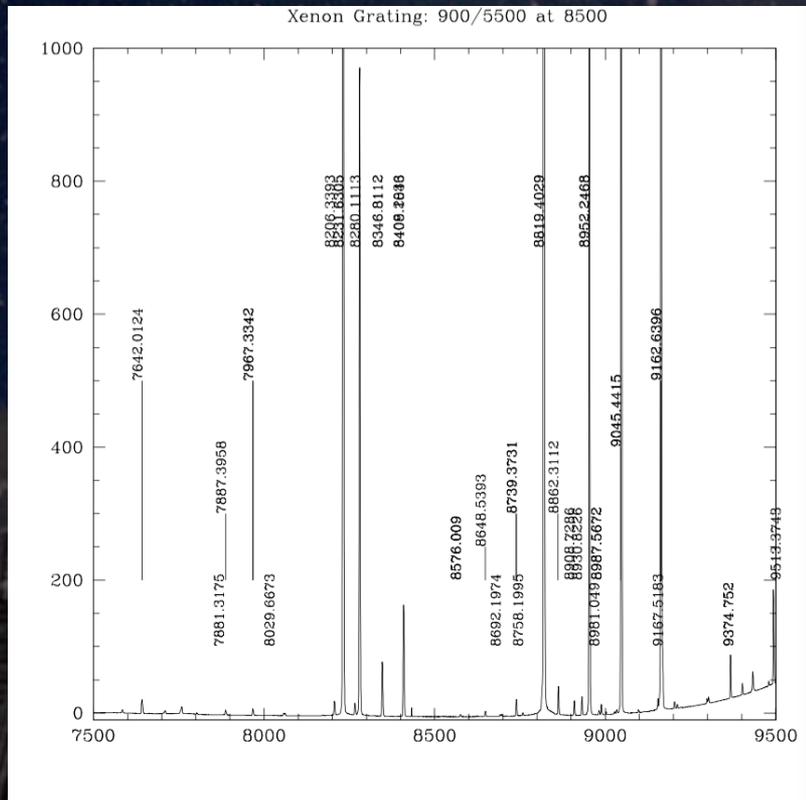
- Observers reported large ( $> 100$  pixels) shifts in the positioning of the red side grating tilt
- The problem was traced to uncertainties in the absolute position of the tilt encoders when the grating is inserted

# 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

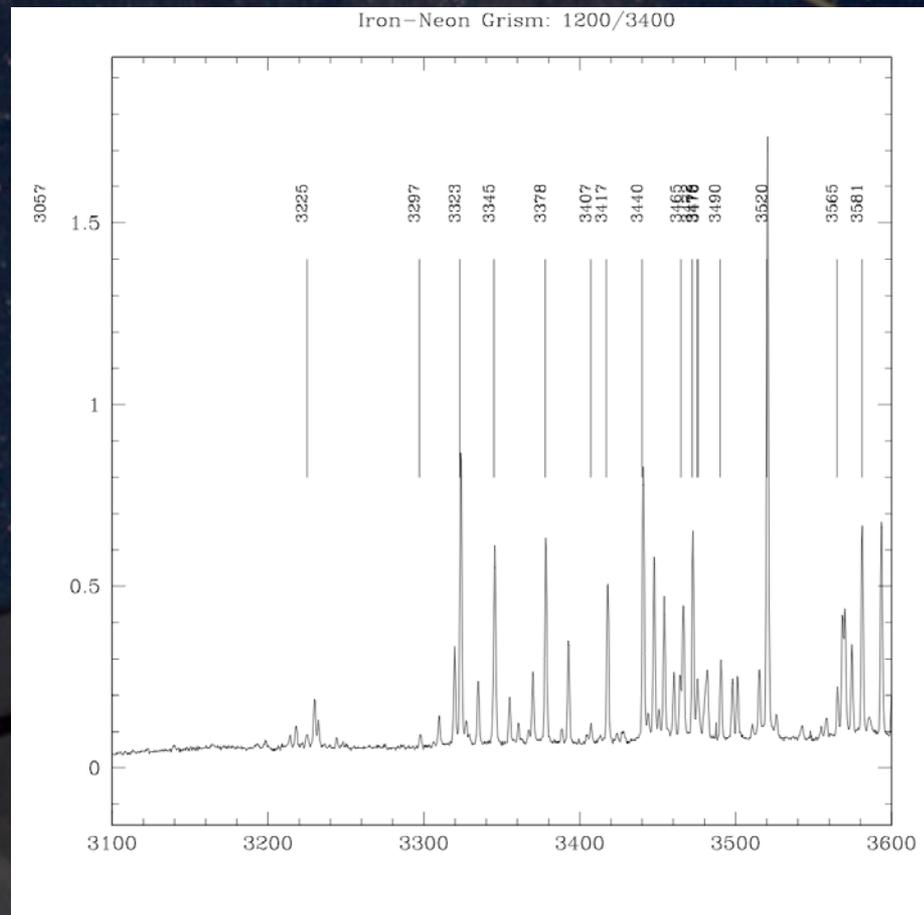
# New LRIS calibration system

- Calibration available for Kr and Xe



# New LRIS calibration system

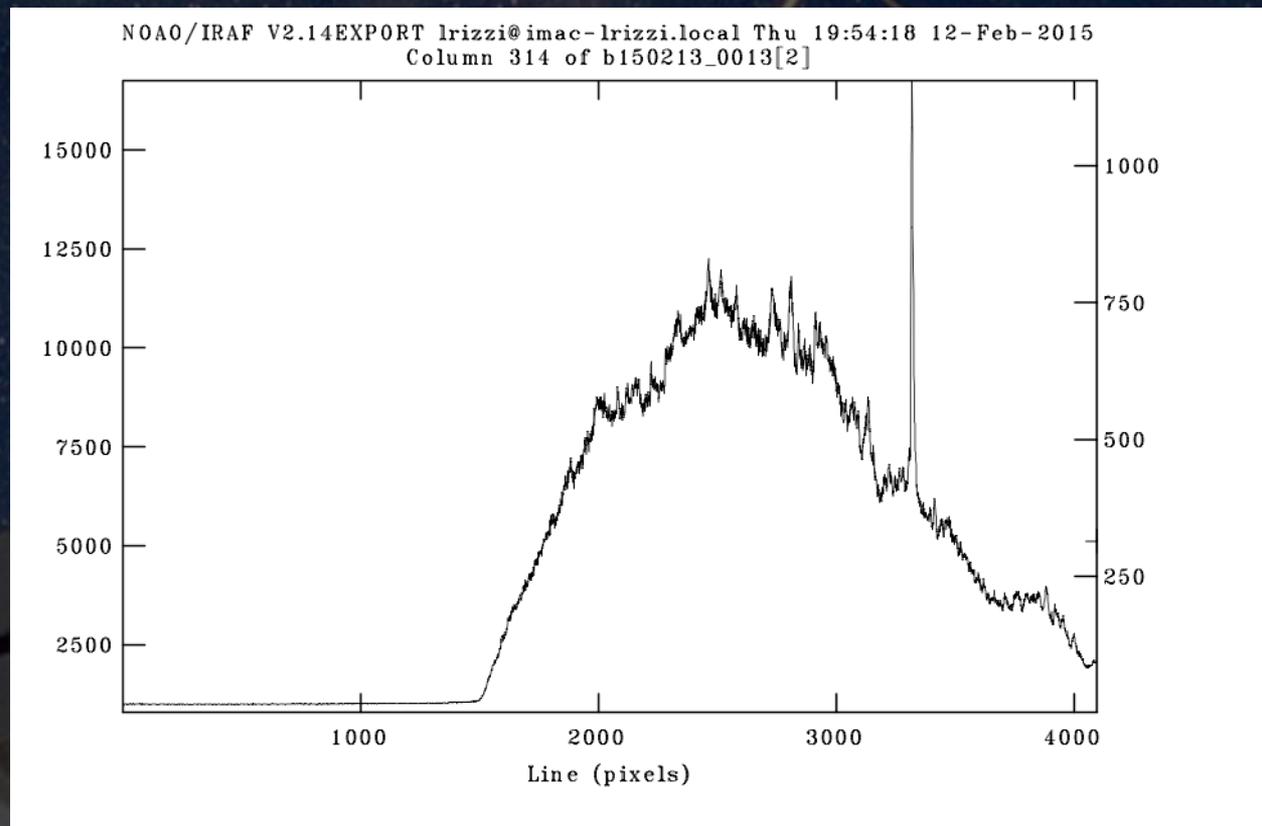
- Calibration available for Fe-Ne



# New LRIS calibration system

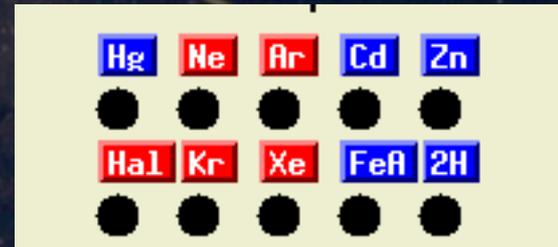
- Flat field spectrum for Deuterium lamp

400/3400  
30 seconds



# New LRIS calibration system

- New XLRIS
- New Calibration gui



# Data Reduction Pipelines

Luca Rizzi

# Keck I DRPs

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

# Keck II DRPs

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



# MOSFIRE DRP

Luca Rizzi

# 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



### / MosfireDRP

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](mailto:mosfiredrp@gmail.com)



is maintained by Mosfire-DataReductionPipeline.

This page was generated by GitHub Pages using the Architect theme by Jason Long.

Downloaded 25 times  
since January 15

# Pipeline support

The screenshot shows the GitHub interface for the repository 'Mosfire-DataReductionPipeline / MosfireDRP'. At the top, there are navigation buttons for 'Unwatch' (12), 'Star' (2), and 'Fork' (3). Below this, the 'Issues' tab is selected, with other tabs for 'Pull requests', 'Labels', and 'Milestones'. The main content area is a form for creating a new issue, featuring a 'Title' input field, 'Write' and 'Preview' tabs, and a large text area for comments. A green 'Submit new Issue' button is at the bottom right. On the right side, there are settings for 'Labels' (None yet), 'Milestone' (No milestone), and 'Assignee' (No one—assign yourself). A vertical sidebar on the far right contains various utility icons.

Mosfire-DataReductionPipeline / MosfireDRP

Unwatch 12 Star 2 Fork 3

Issues Pull requests Labels Milestones

Title

Write Preview

Markdown supported Edit in fullscreen

Leave a comment

Attach images by dragging & dropping, selecting them, or pasting from the clipboard.

Submit new Issue

Labels None yet

Milestone No milestone

Assignee No one—assign yourself

# Pipeline support

7 Open 8 Closed Author Labels Milestones Assignee Sort

- DATASEC keyword in the rectified outputs and DS9** help wanted 1  
#15 opened 17 hours ago by monodera
- Wavelength calibration to very long slit** help wanted 2  
#14 opened a day ago by YuichiHarikane
- Arc wavelength solution** help wanted 5  
#13 opened 3 days ago by MosfireDRP
- First steps towards the reduction of long2pos** enhancement 3  
#12 opened 12 days ago by MosfireDRP
- Possible problem with CSU.py** 0  
#11 opened on Jan 17 by lucarizzi
- LongSlit reduction** enhancement 2  
#10 opened on Jan 14 by MosfireDRP
- DRP fails on file names that do not follow the standard pattern** enhancement 3  
#9 opened on Jan 14 by MosfireDRP
- Cannot use compressed .fits.gz files for flats** 8  
#8 opened on Jan 8 by followthesheep
- Improvements to the installation/instruction manual** 4  
#7 opened on Jan 8 by MosfireDRP
- Internal discussion: the variance array** question 4  
#6 opened on Jan 6 by lucarizzi
- Compatible with Ureka 1.4?** question 1  
#5 opened on Jan 5 by anstockton
- S/N Error Array Discrepancy** question 3  
#4 opened on Jan 5 by sdahm
- Double peaked emission line: nod shift issue?** help wanted 6  
#3 opened on Jan 5 by jhyoon79
- Test submission** help wanted 0  
#2 opened on Dec 10, 2014 by lucarizzi
- Low signal to noise in small data sets** enhancement 2  
#1 opened on Dec 10, 2014 by MosfireDRP

# Pipeline development

## Git clones



**4**  
Clones

**3**  
Unique cloners

## Visitors



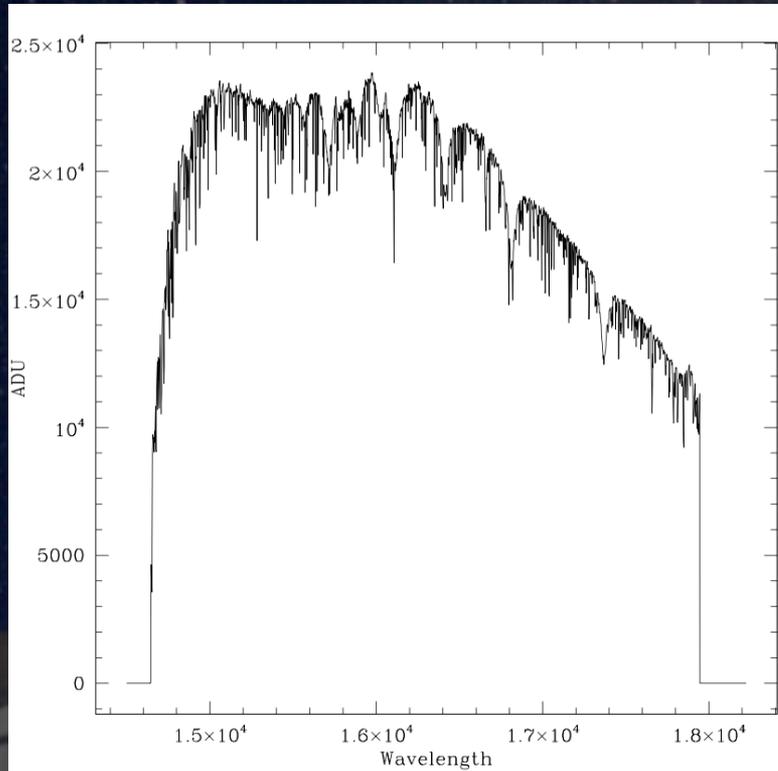
**424**  
Views

**30**  
Unique visitors

# Pipeline development

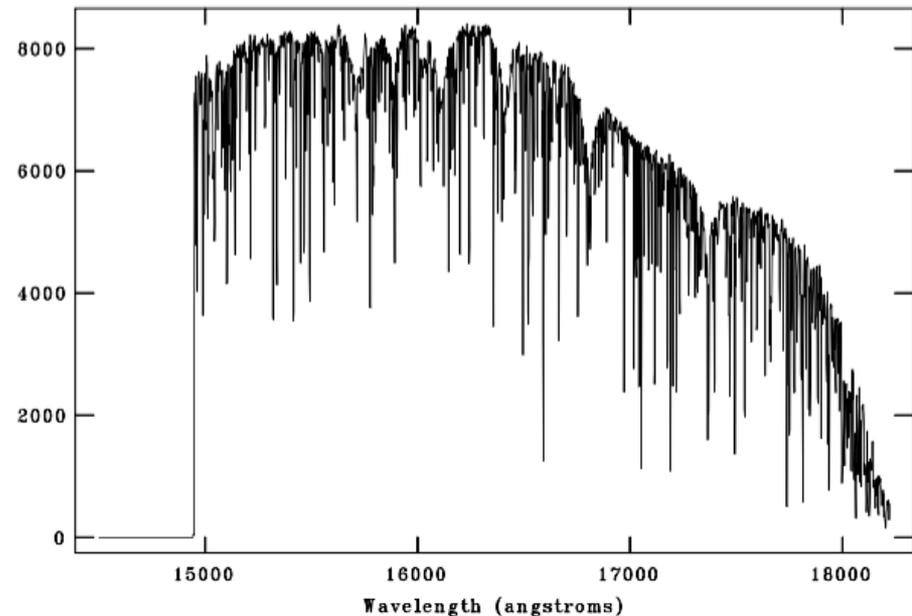
- Formal **Version 1.0** released on December 16
- **Longslit** reduction developed and being tested
- **Long2pos** developed for non-spectrophotometric case and being tested
- Expected release date: **May 2015**

# Pipeline development



Longslit observation of HIP13917

NOAO/IRAF V2.14EXPORT lrizzi@imac-lrizzi.local Sat 17:56:51 07-Feb-201  
[long2pos\_H\_posA\_eps.ms.fits]: posA 5000. ap:1 beam:1



Long2pos observation of HIP65210



# OSIRIS

Jim Lyke

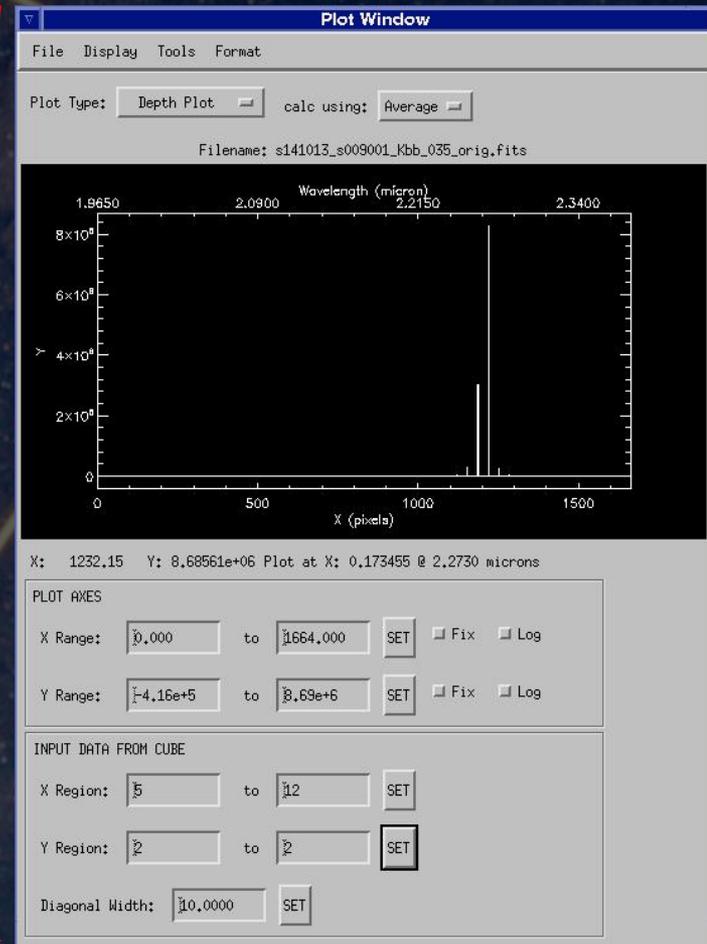
# OSIRIS DRP Issues

- 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

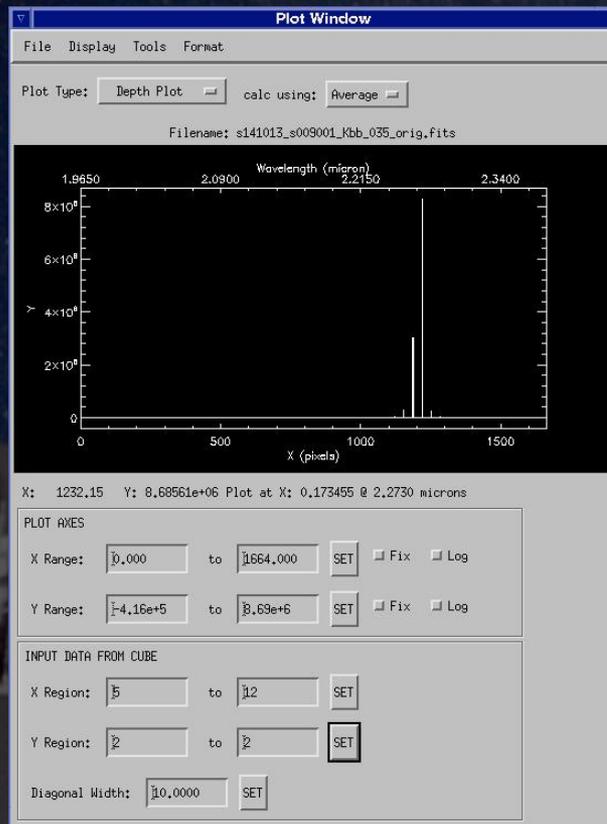


# Bad Spaxel Spectra

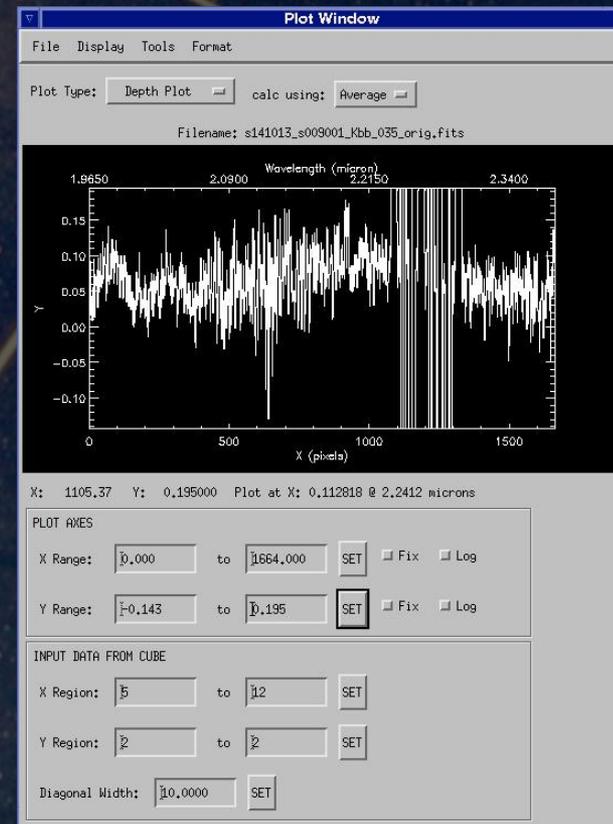


# Badness is Localized

Full Scale

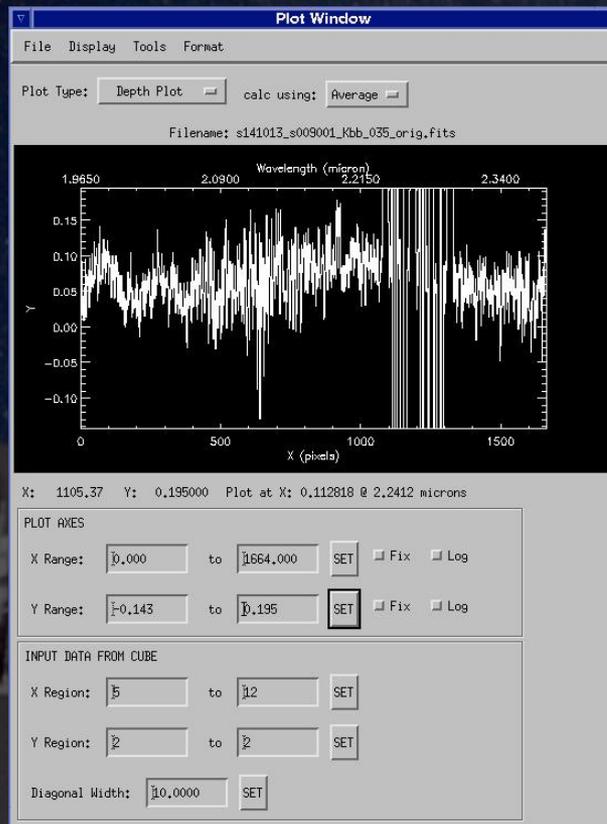


Y-axis zoomed

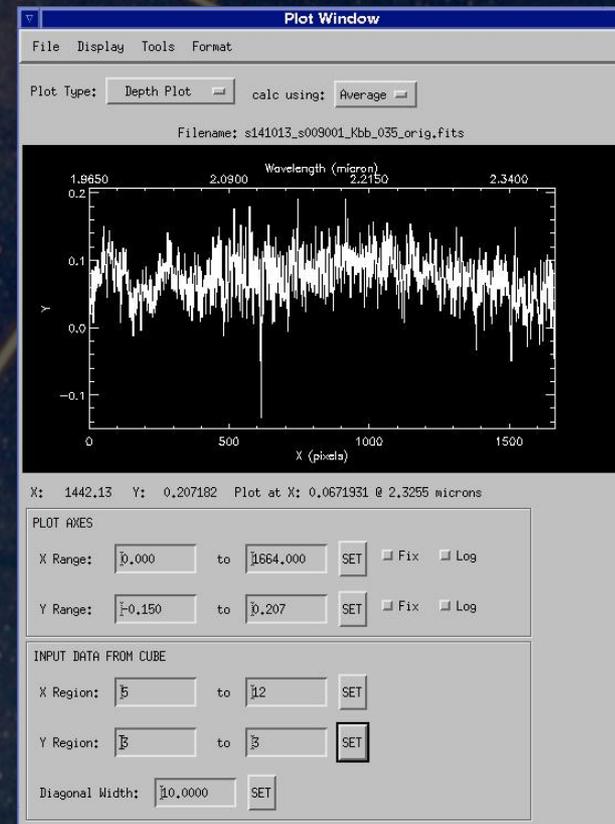


# Spectra are Good

## 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

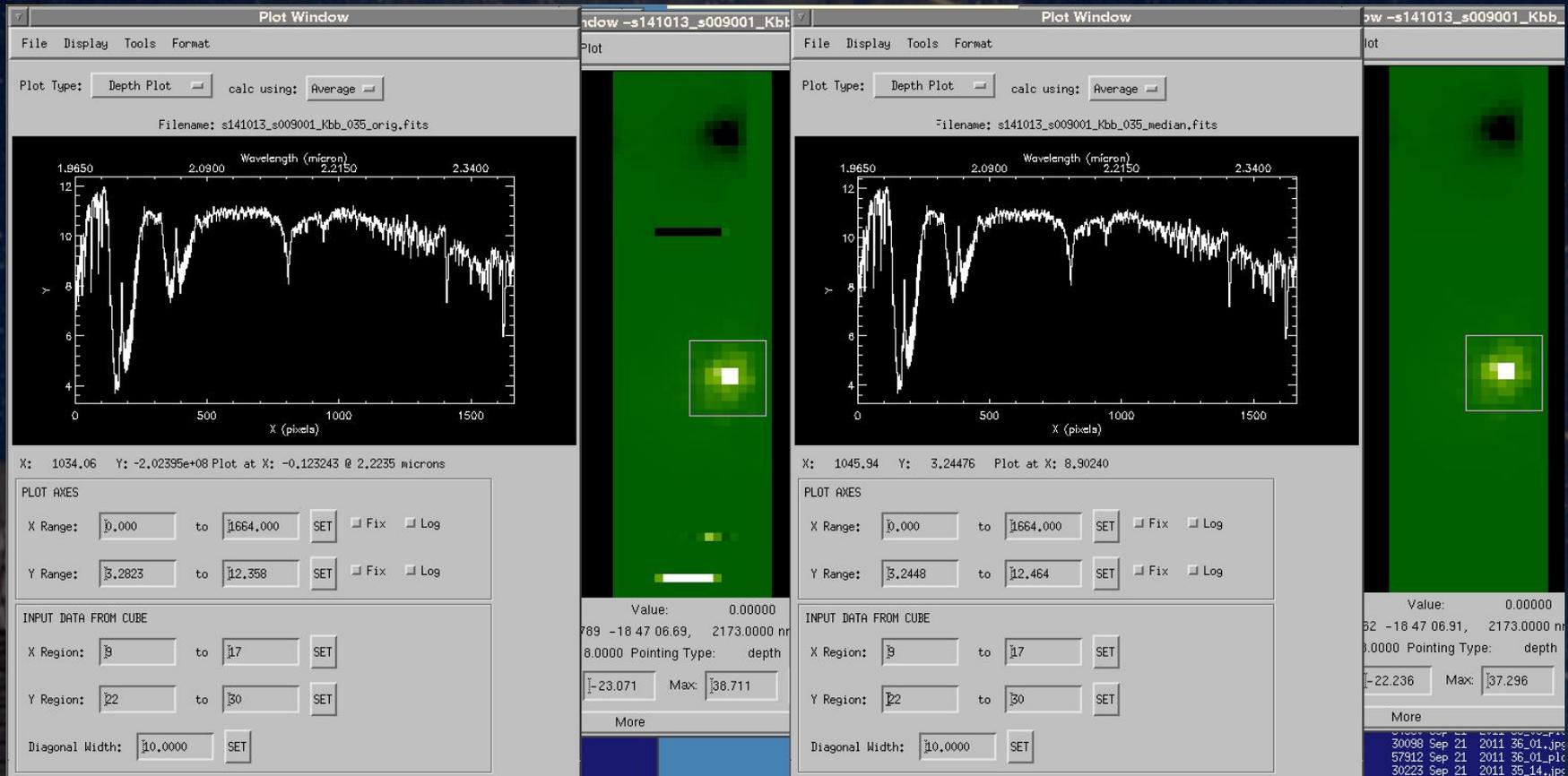
## Pros

- Straightforward
- Removes badness before it begins

## Cons

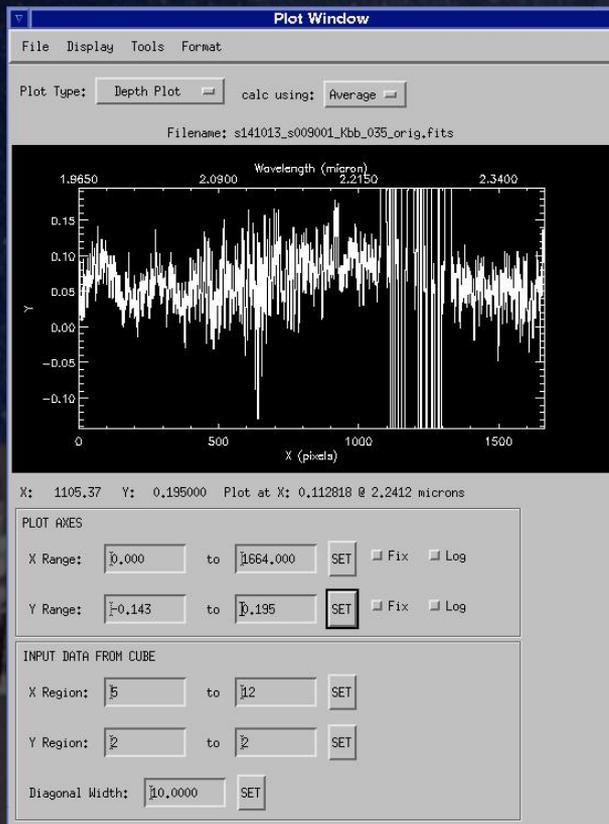
- Must redo cals
- Cannot fix older recmats

# Median Scan Method

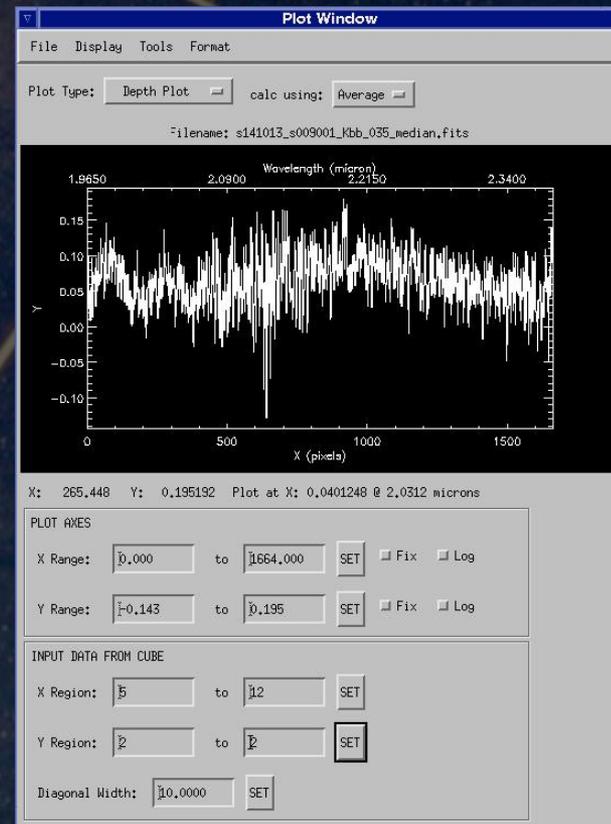


# Median Results

Before

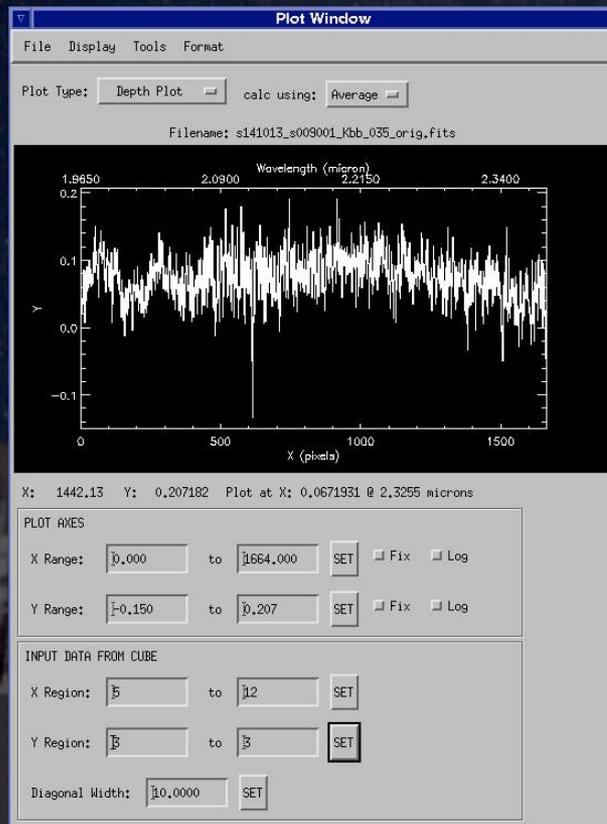


After

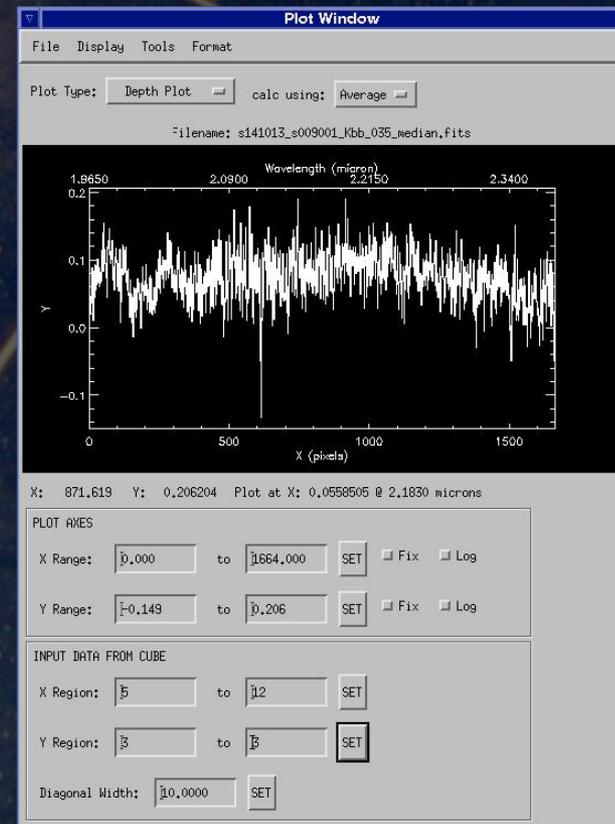


# Median Results

Neighbor before



Neighbor after



# Remove Spurious Values

- Must define spurious
  - Pixel values above 0.8 (mkrecmatrx\_000.c)
- Create new (clean) version of recmat

## Pros

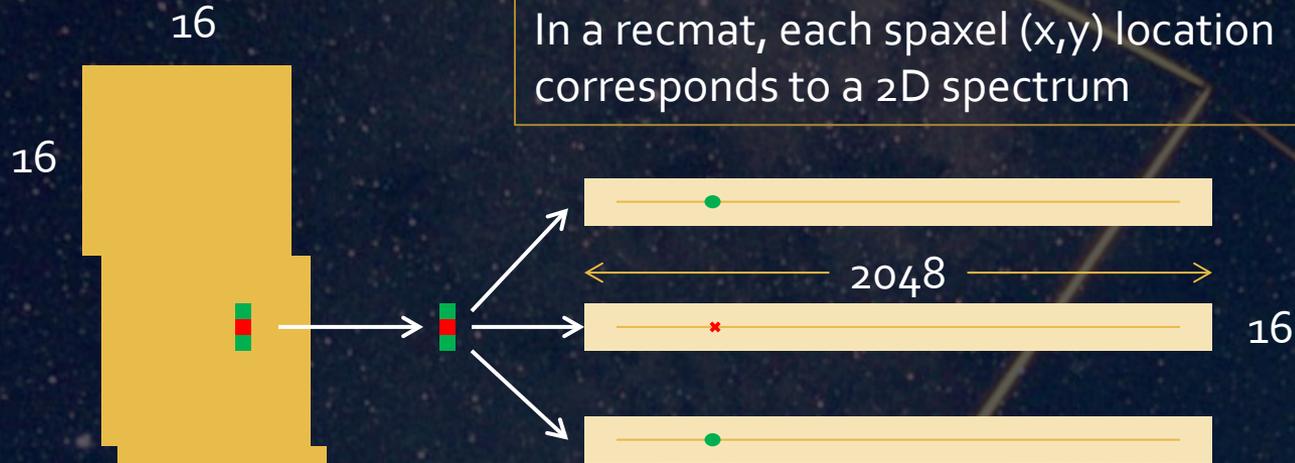
- Fast
- Fixes even old recmats
- Similar to what DRP does now

## Cons

- Must be sure recmat pixel is bad

# OSIRIS Clean Recmat

Lenslet geometry

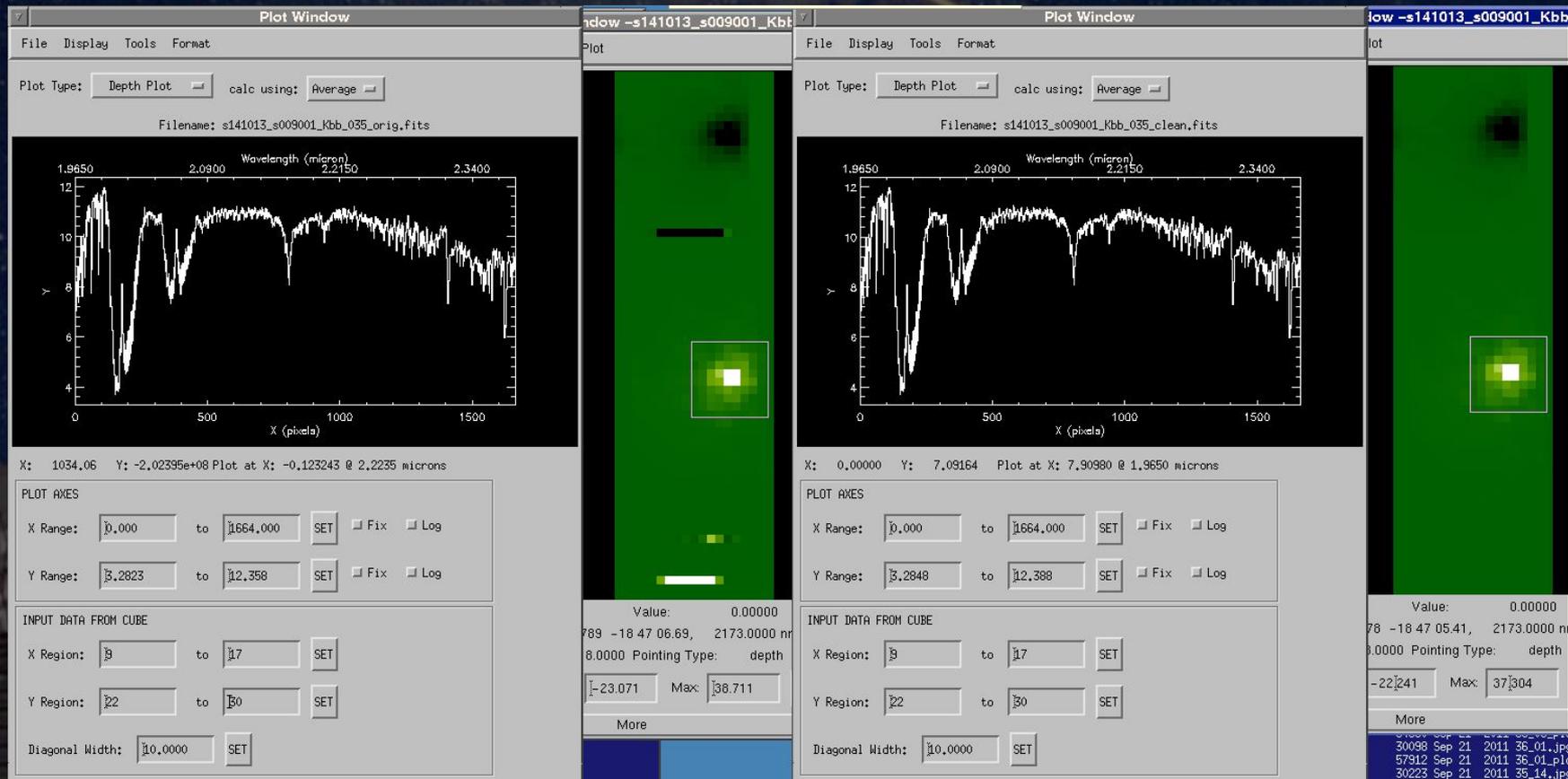


In a recmat, each spaxel  $(x,y)$  location corresponds to a 2D spectrum

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

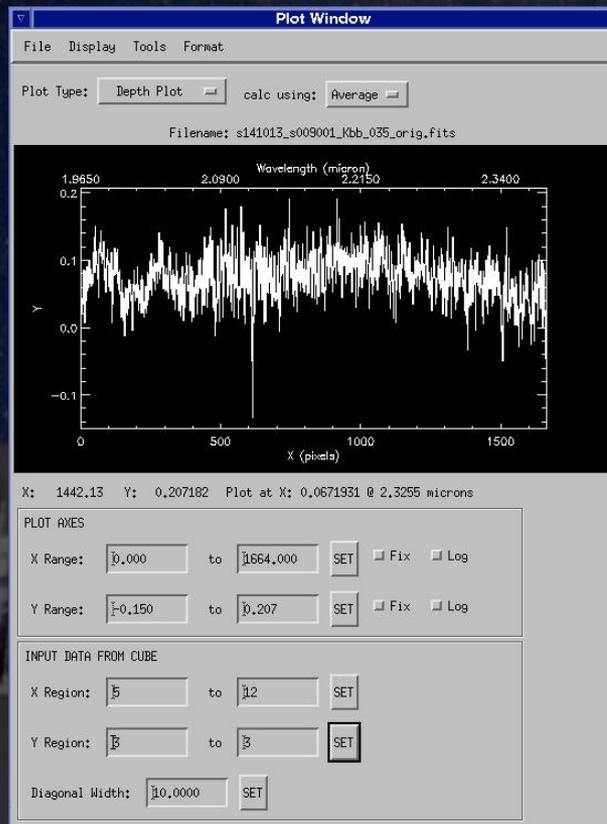
# OSIRIS Clean Method



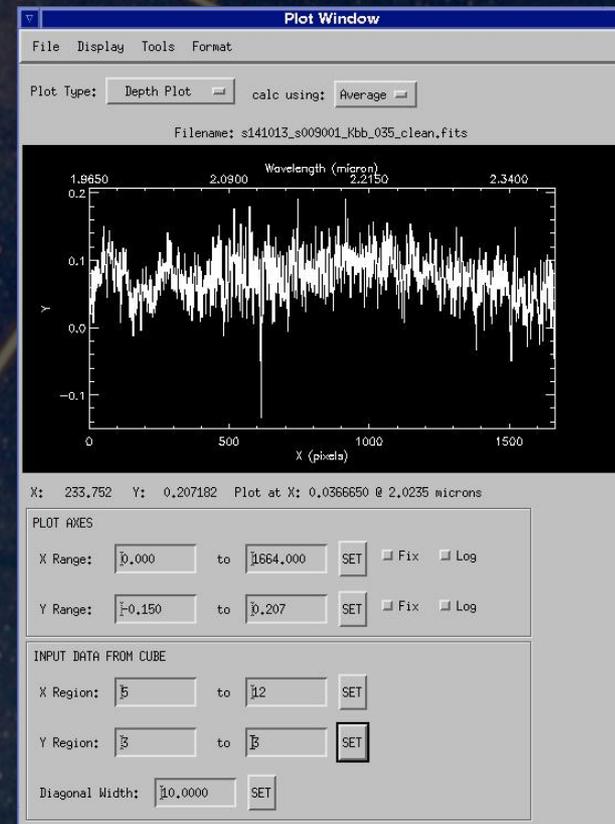


# OSIRIS Clean Results

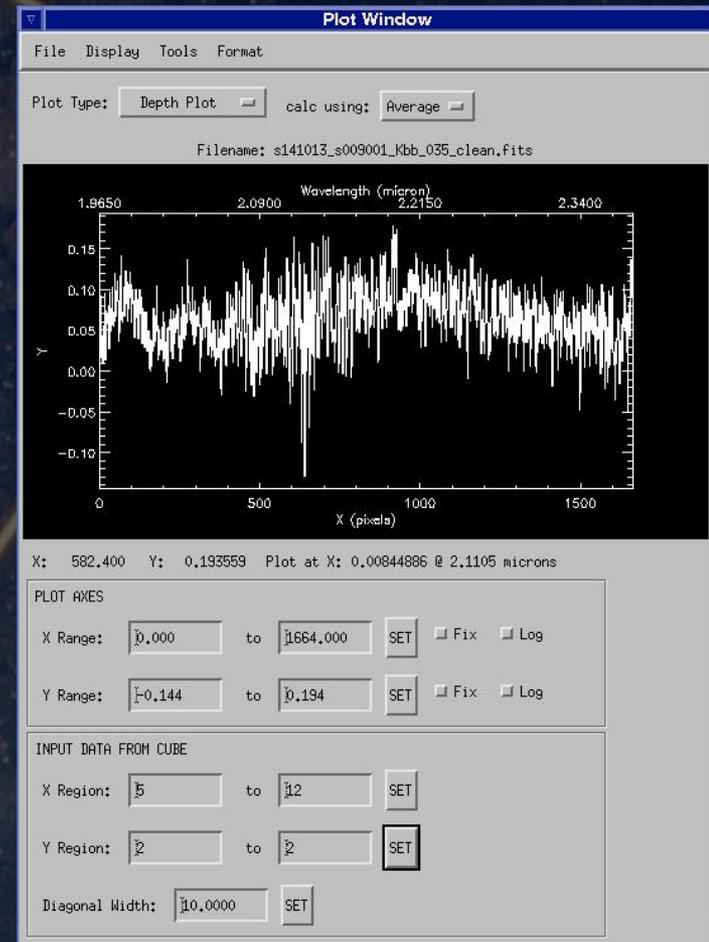
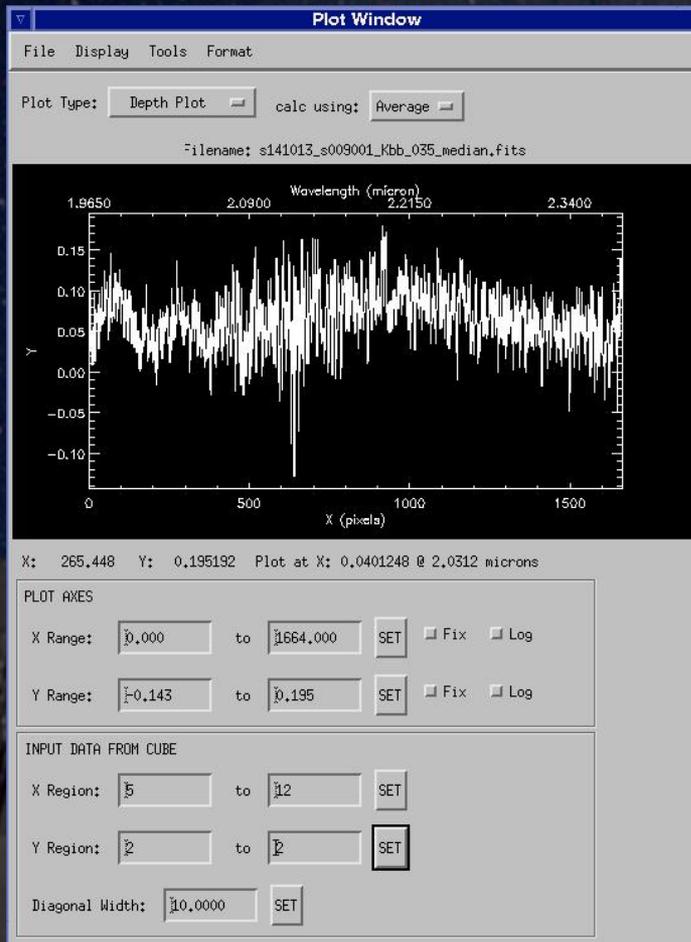
Neighbor before



Neighbor after



# 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

- H<sub>2</sub>RG 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

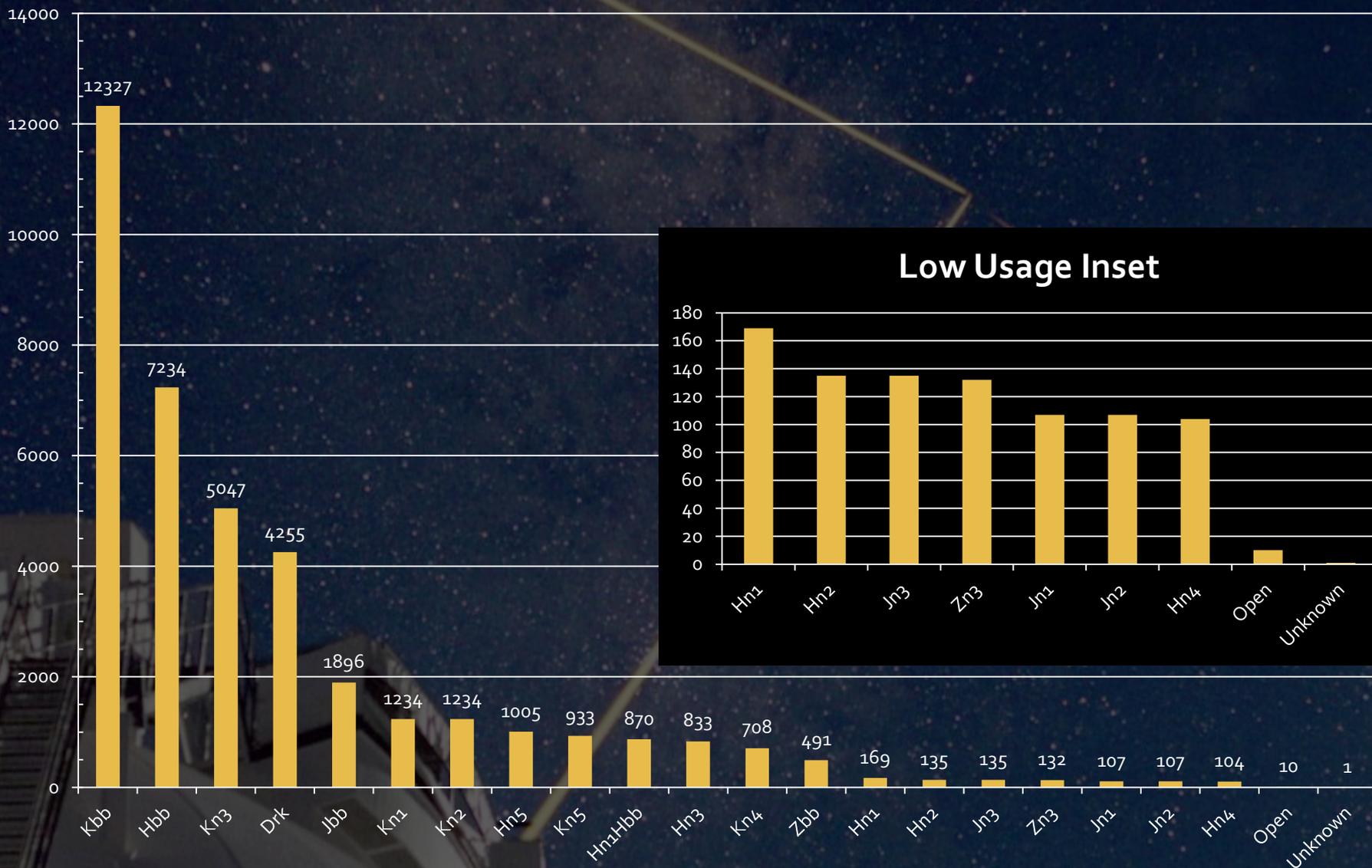
- H<sub>2</sub>RG in hand at UCLA
- 10 mas pixels, 20" FOV
- Optical design nearly finalized
- Design review July 2015
- Installation late August 2015

# 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



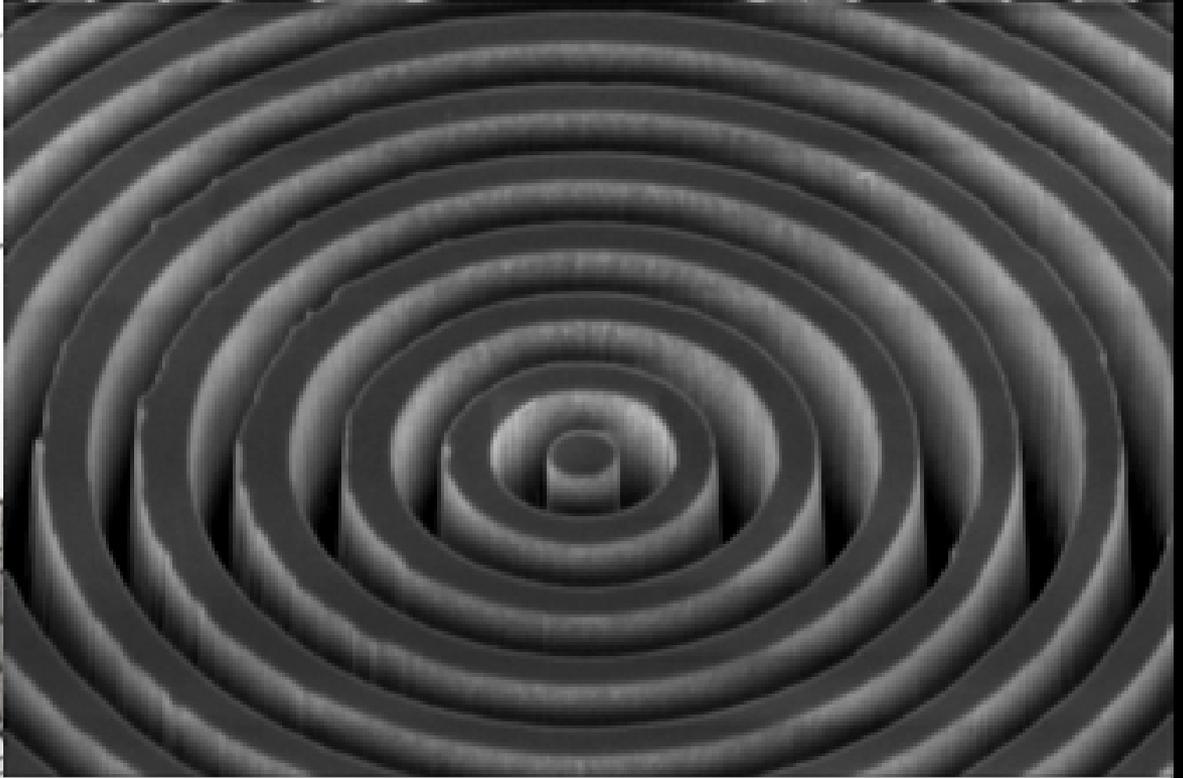
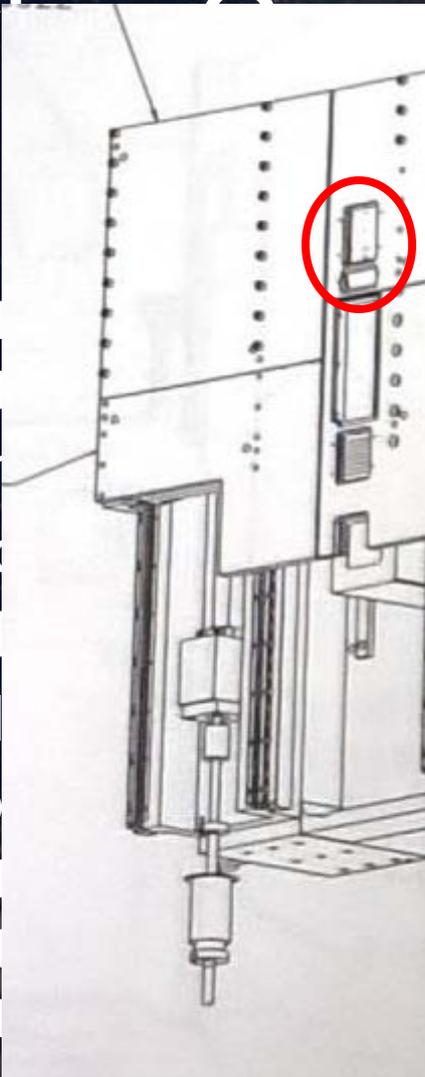


NIRC<sub>2</sub>

Hien Tran

# Vortex

- L-b
- 
- 
- Ser
- Two
- in t
- Col
- Wo
- 
- 
- 



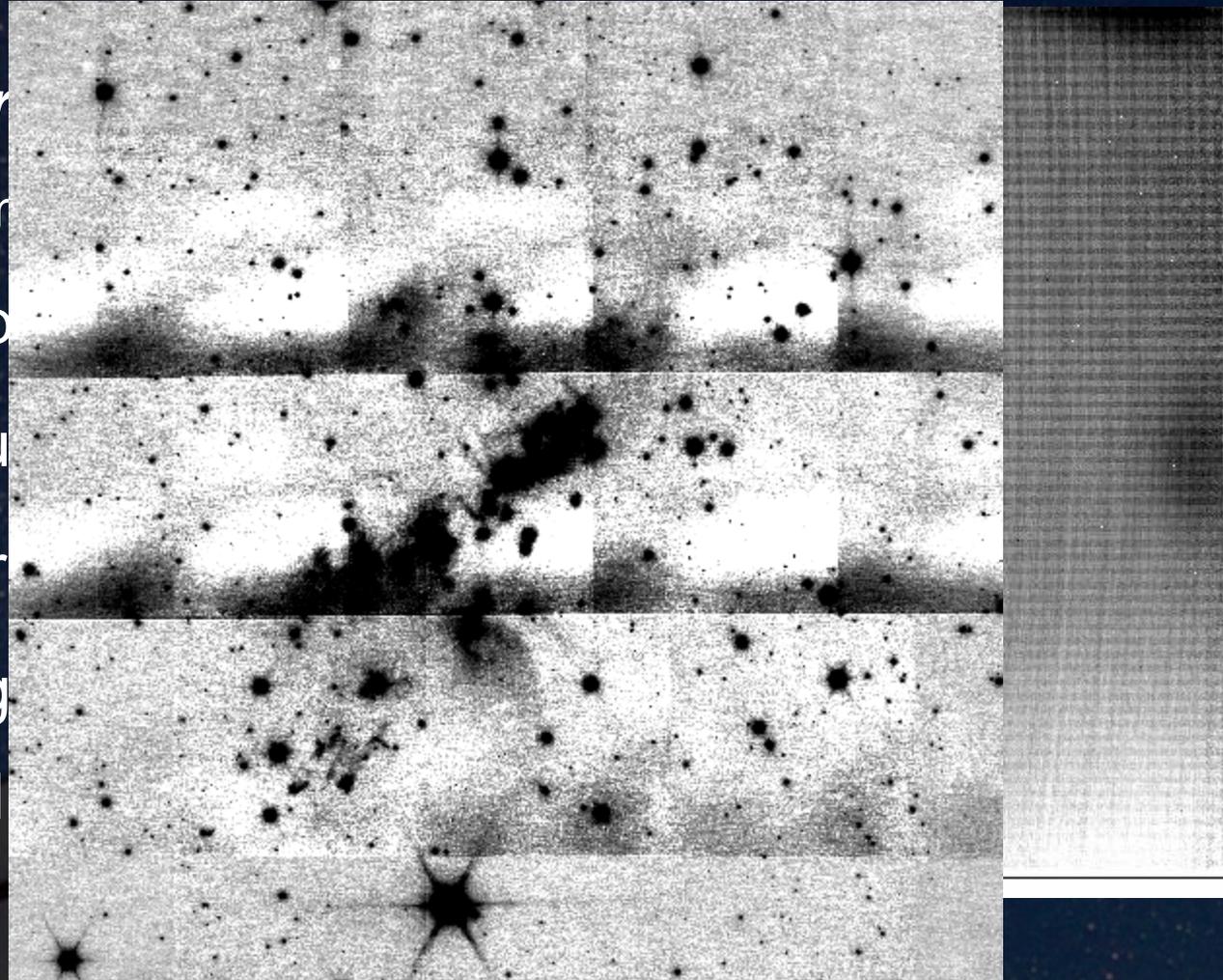
10  $\mu$ m | 7 Mar 2014 EHT = 3.00 kV | WD = 9.3 mm | Probe = 200 pA | ZEISS

# 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 *r*  
– Shutdown
- Tklogger p
- Scripts lau
- Source for
- Monitoring  
stage cold



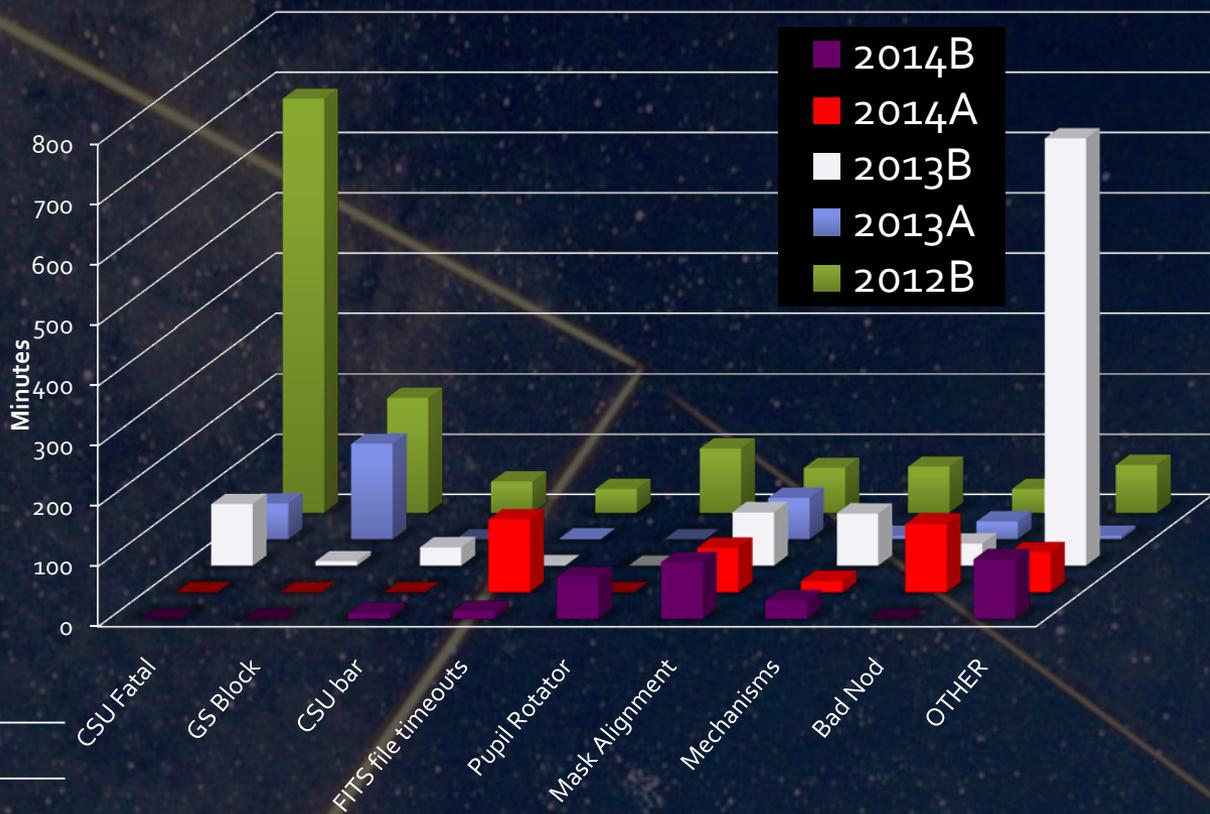


# MOSFIRE

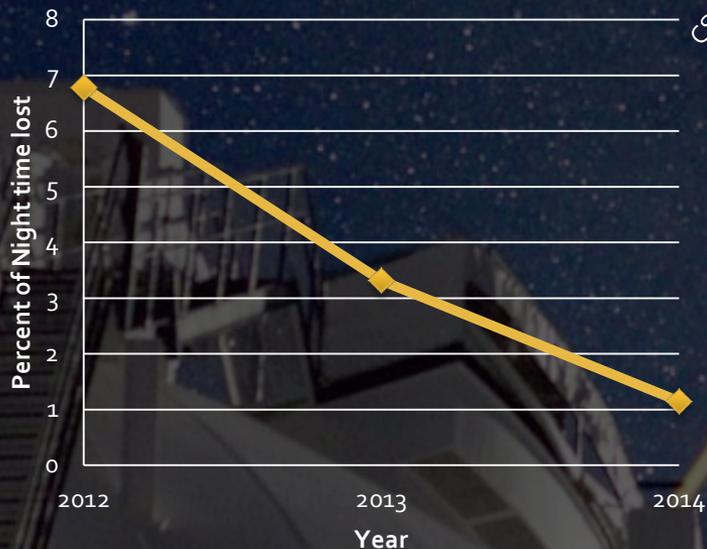
Marc Kassis

# Reduced Fault Times

## MOSFIRE Time Lost



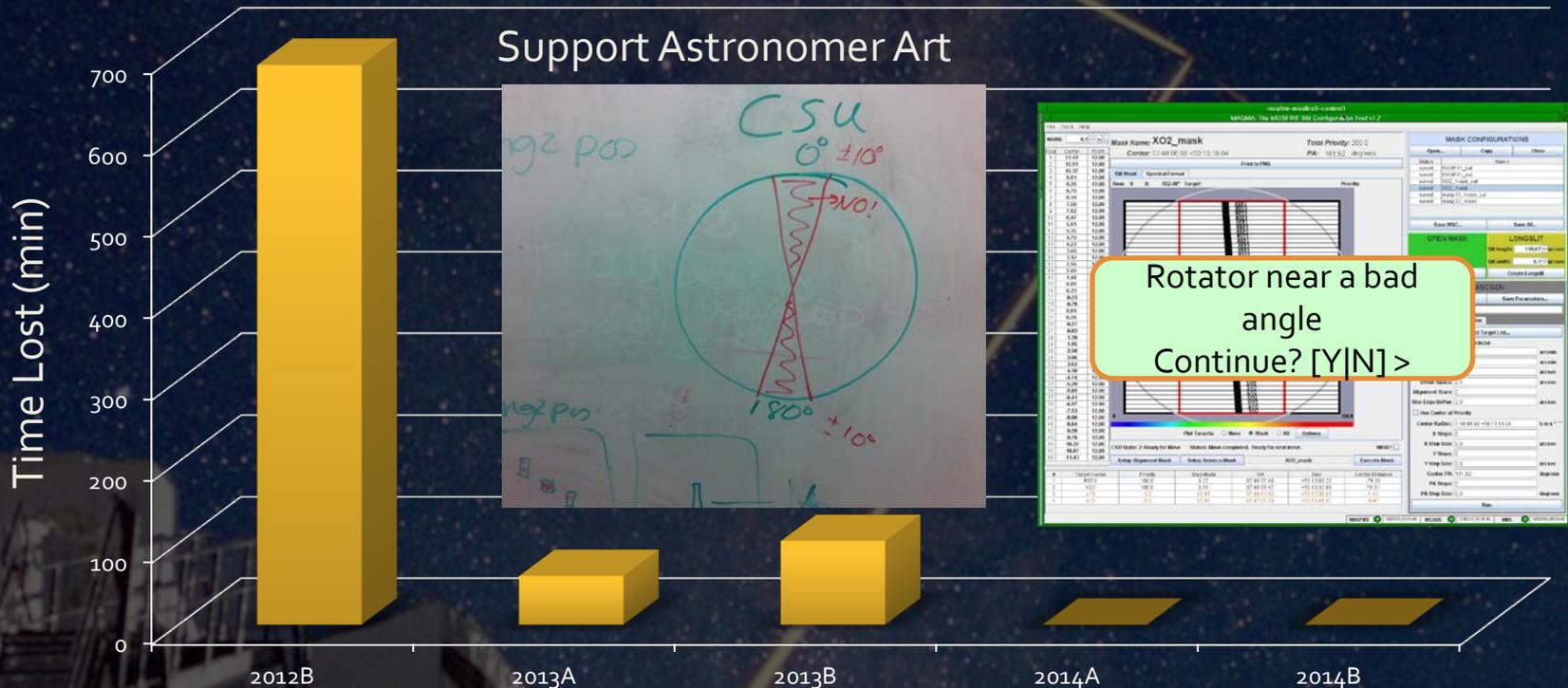
### Time lost less weather and engineering



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

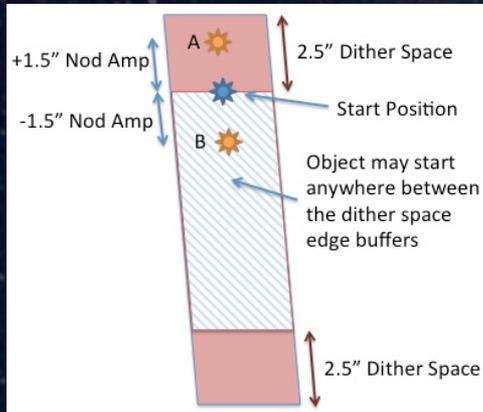
# CSU Avoidance Strategies

CSU Fatal Errors on sky

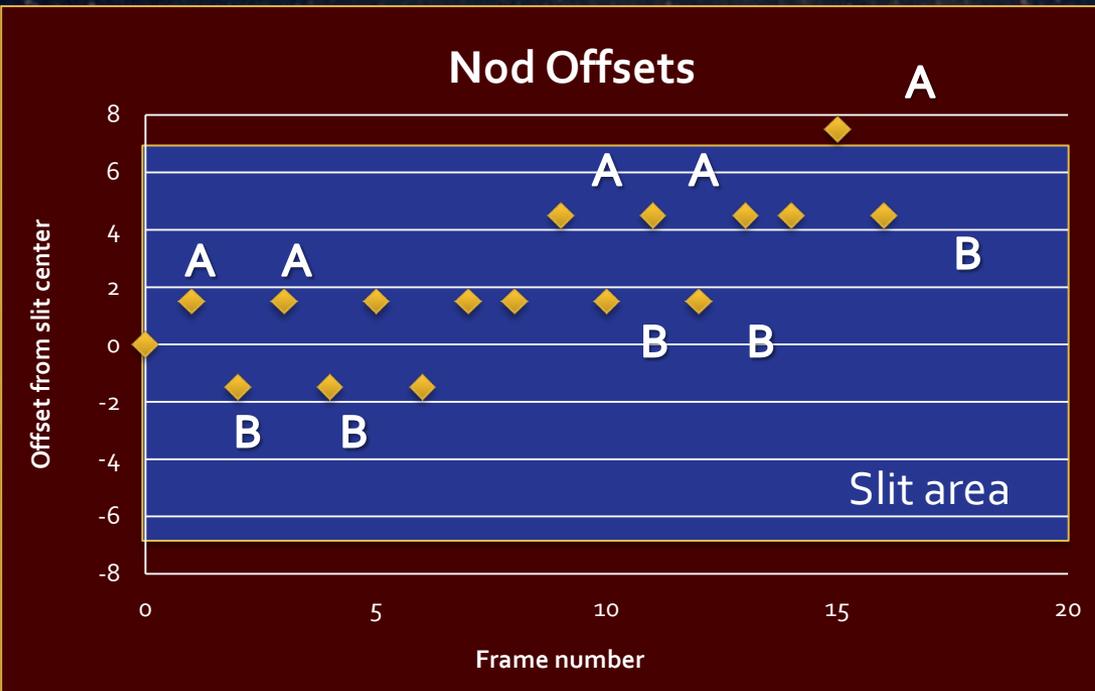


- Moves now in series with telescope slews
- 30 hours lost to CSU moves per year

# Missed Telescope moves

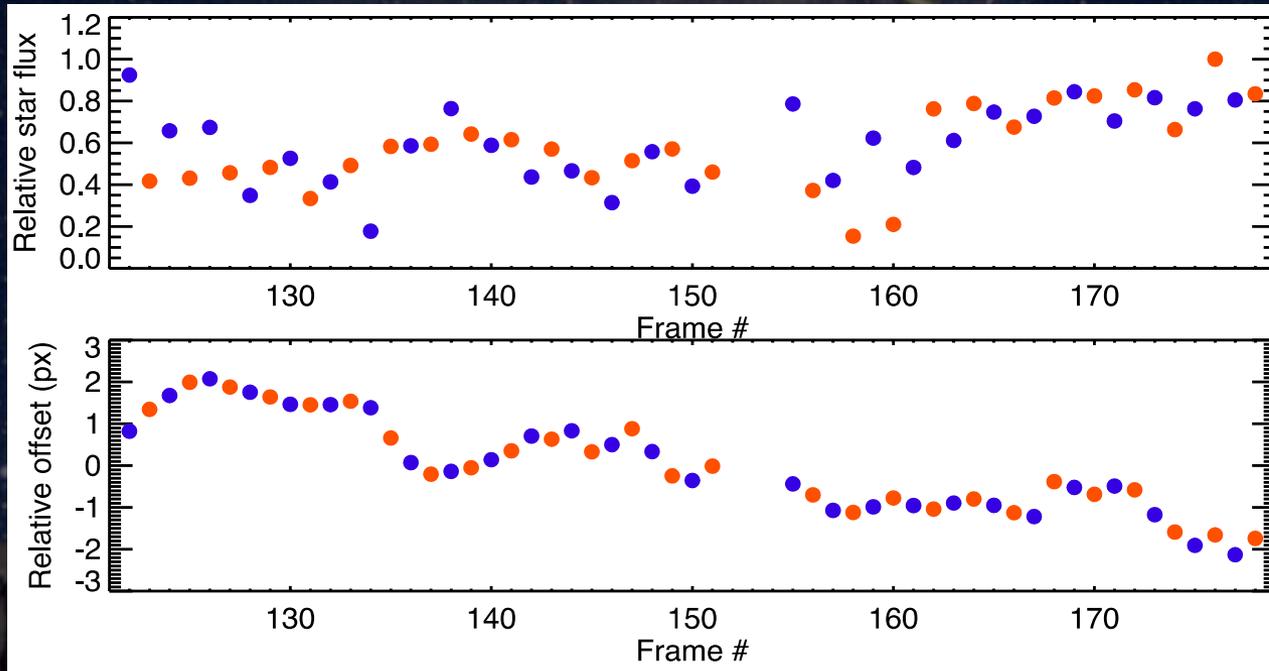


- 1 every 3000 nods
- Communication problem with Keck I



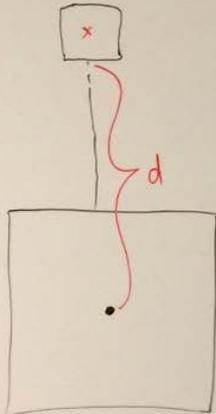
- Keyword Gateway implemented
- Deployed to all instruments

# MOSFIRE slit drift



- Observed drift along the slit
- $\sim 1$  pix per hour

# Slit Drift Model



RotP = -180°

gvec compresses separation  
⇒ pushes "objects" higher on detector

A = 4.5  
B = 3.0

(RotP, EL)  
[-390 → -30]

(RotP<sub>0</sub>, EL<sub>0</sub>) set at point of mask alignment

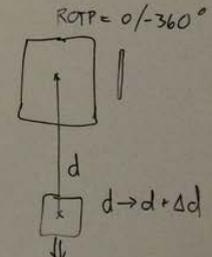
[SLIT DIR]  $\Delta y_{pix} = A [\cos(RotP) \cos(EL) - \cos(RotP_0) \cos(EL_0)]$

[⊥ SLIT]  $\Delta x_{pix} = B [\sin(RotP) \cos(EL) - \sin(RotP_0) \cos(EL_0)]$

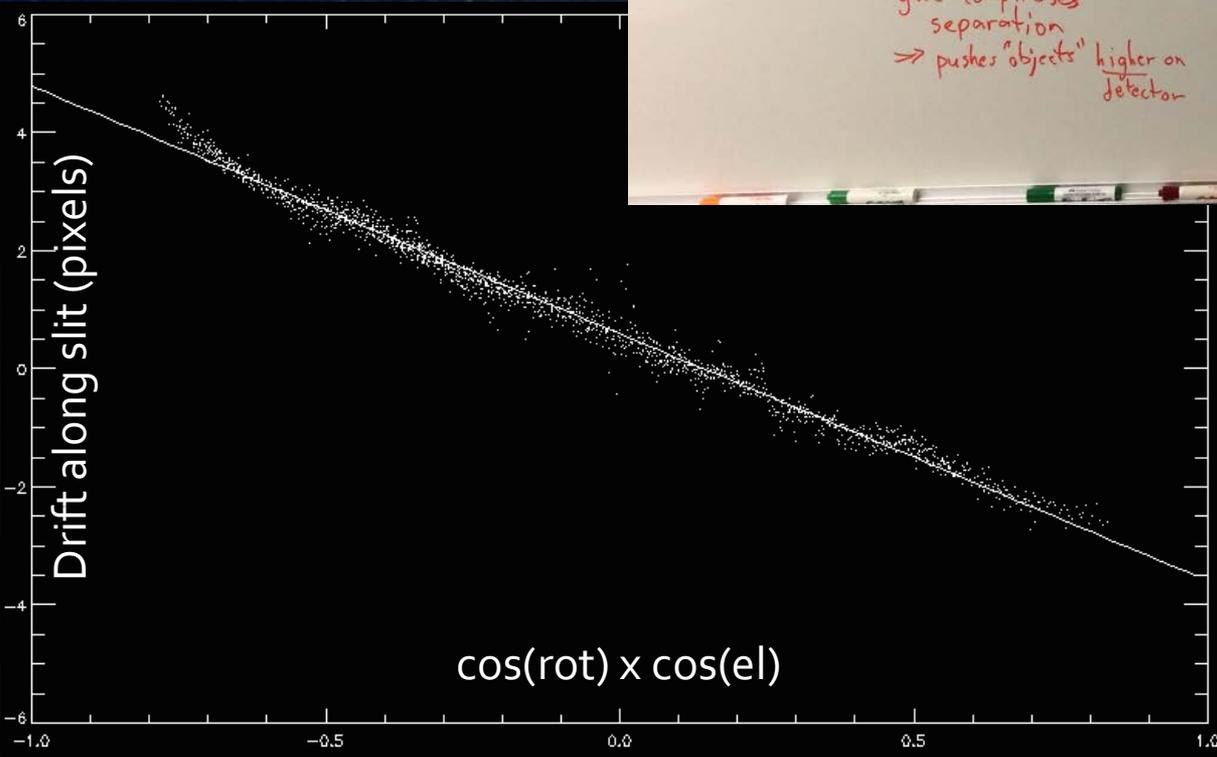
RotP = -360°

gvec stretches d ⇒  
pushes objects lower on detector  
[Amplitude larger?]

RotP = 0 / -360°



d → d + Δd



- Diff flexure
- Function of elevation and rotation

# 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

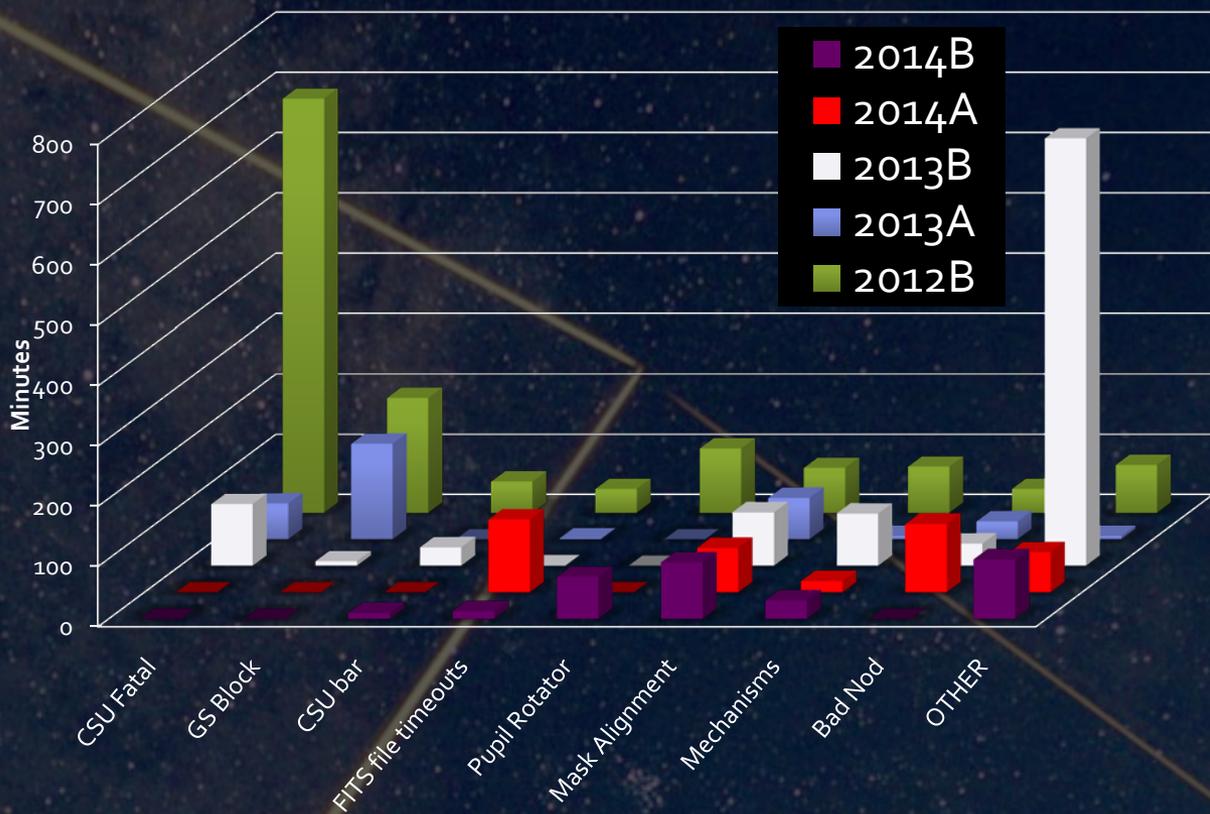


# MOSFIRE

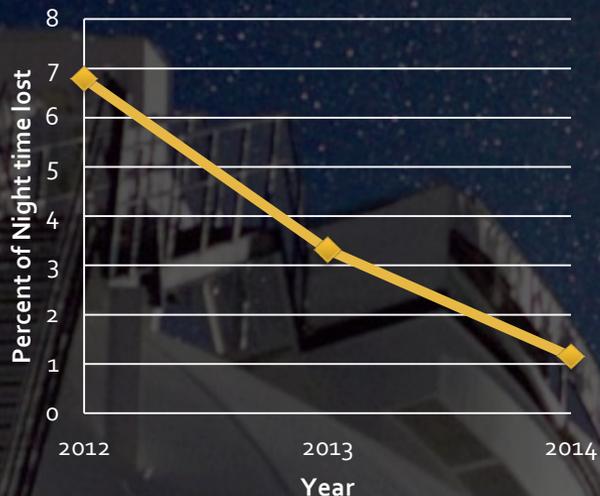
Marc Kassis

# Reduced Fault Times

MOSFIRE Time Lost



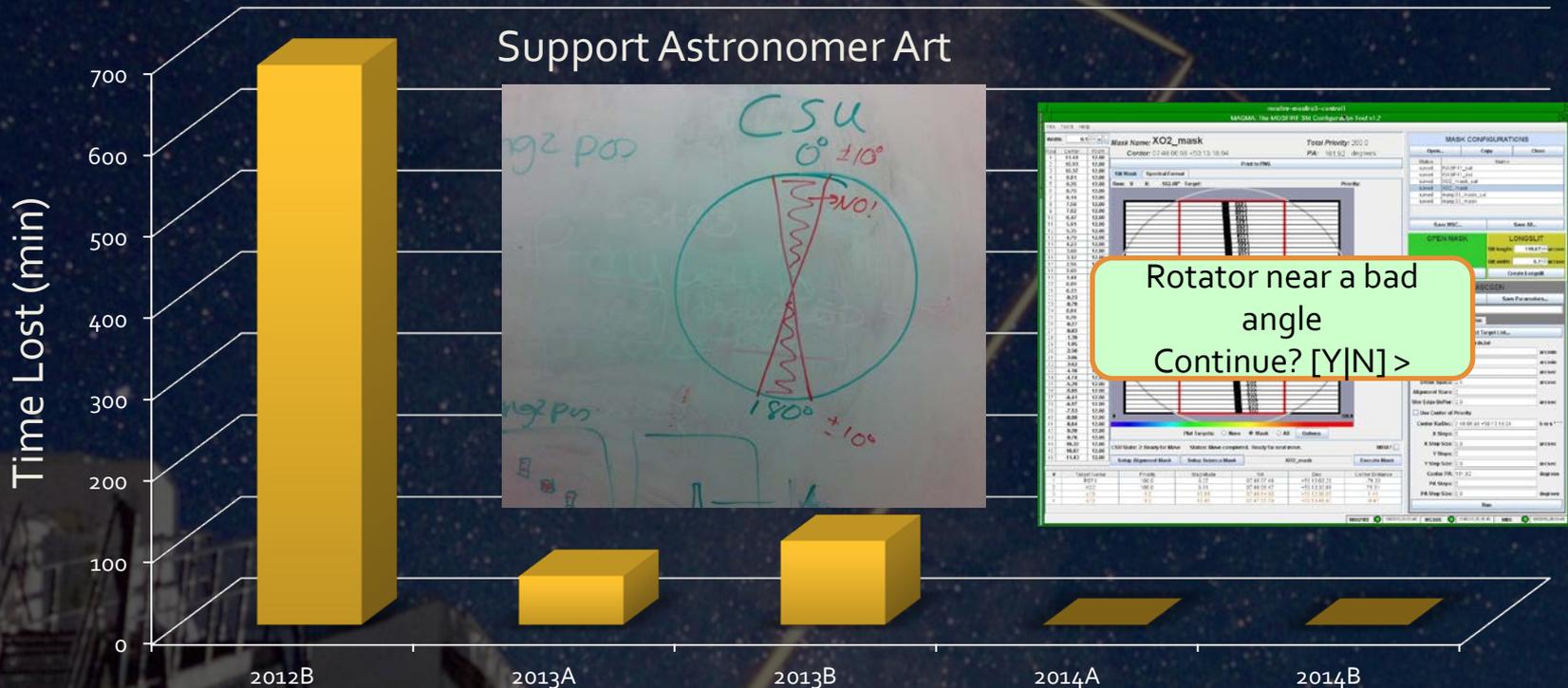
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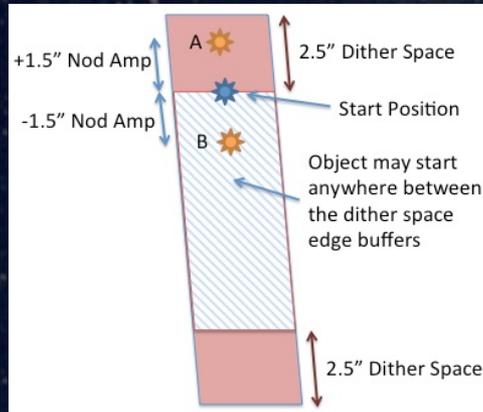
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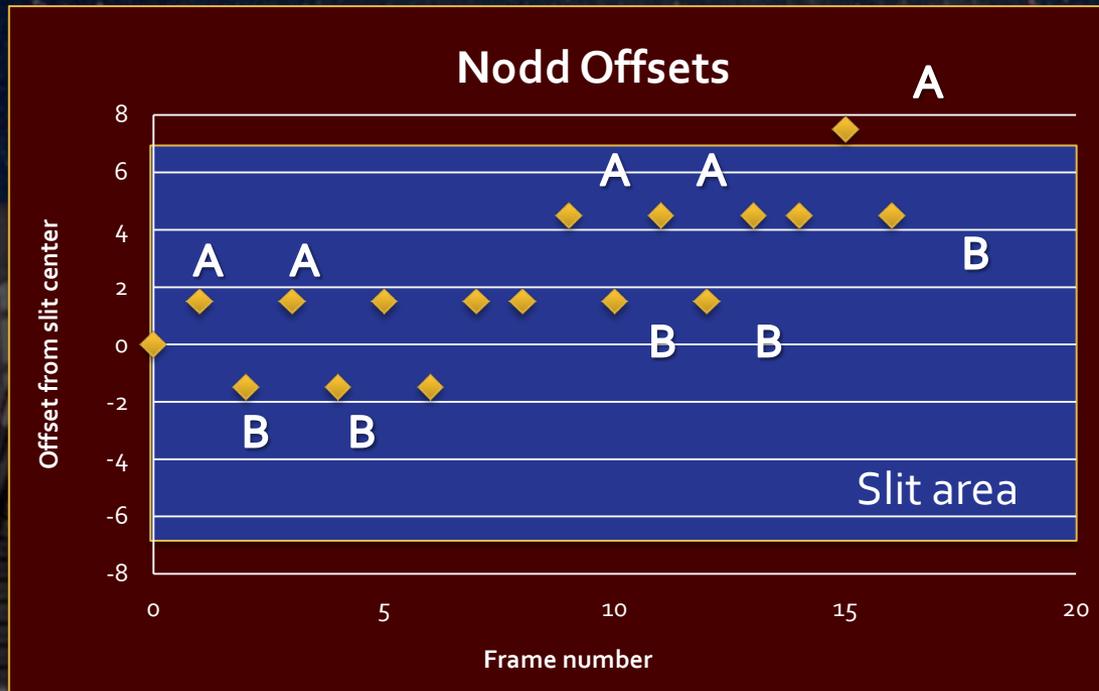


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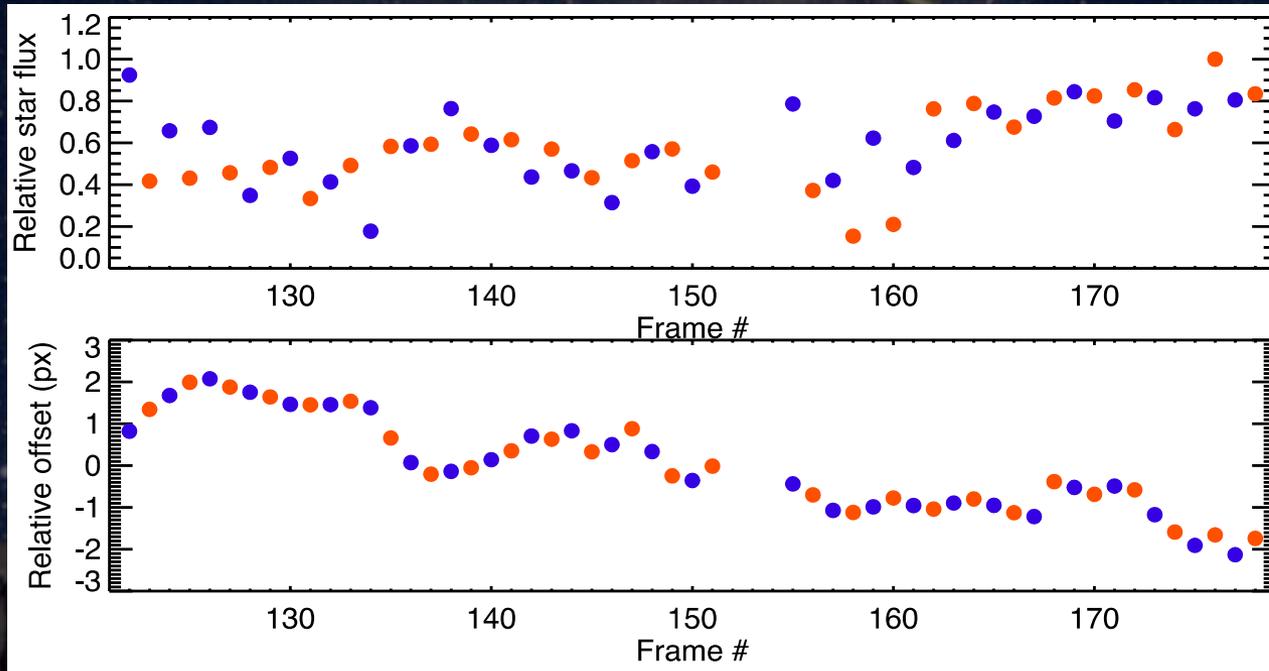


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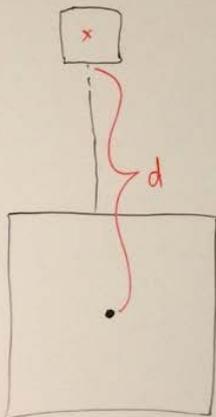
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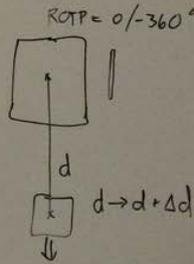
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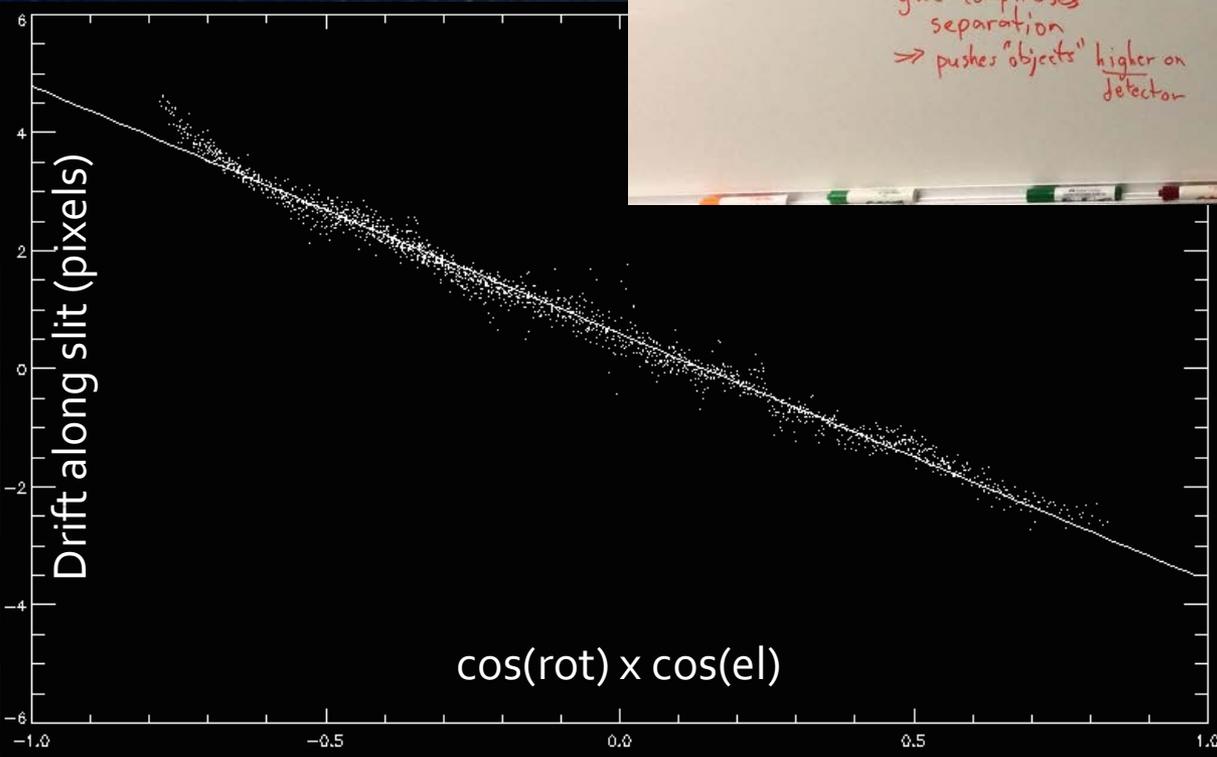
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# 2015 Tasks

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  - 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

DEIMOS Calibration Tool

SLIT WIDTH  
Typical slit width: 1.0 arcsec

ARCS  
Quantity: 1 Exposure time: 1 sec  
Select lamps:  Ne  Ar  Kr  Xe  
 Cd  Zn  Hg

FLATS  
Quantity: 3 Exposure time: 6 sec

SLITMASKS  
 f1n2m1  f1n2m5  f2n2m9  
 f1n2m2  f2n2m6  INDEF  
 f1n2m3  f2n2m7  GOH\_X  
 f1n2m4  f2n2m8

OPTIONS  
 Wait for FCS updates between exposures?  
 Do end-of-night shutdown when done?

ESTIMATED TIME  
Time required for these exposures: 63 min

PROGRESS  
0%

STATUS  
Select settings above and press GO to begin

GO ABORT RESET QUIT

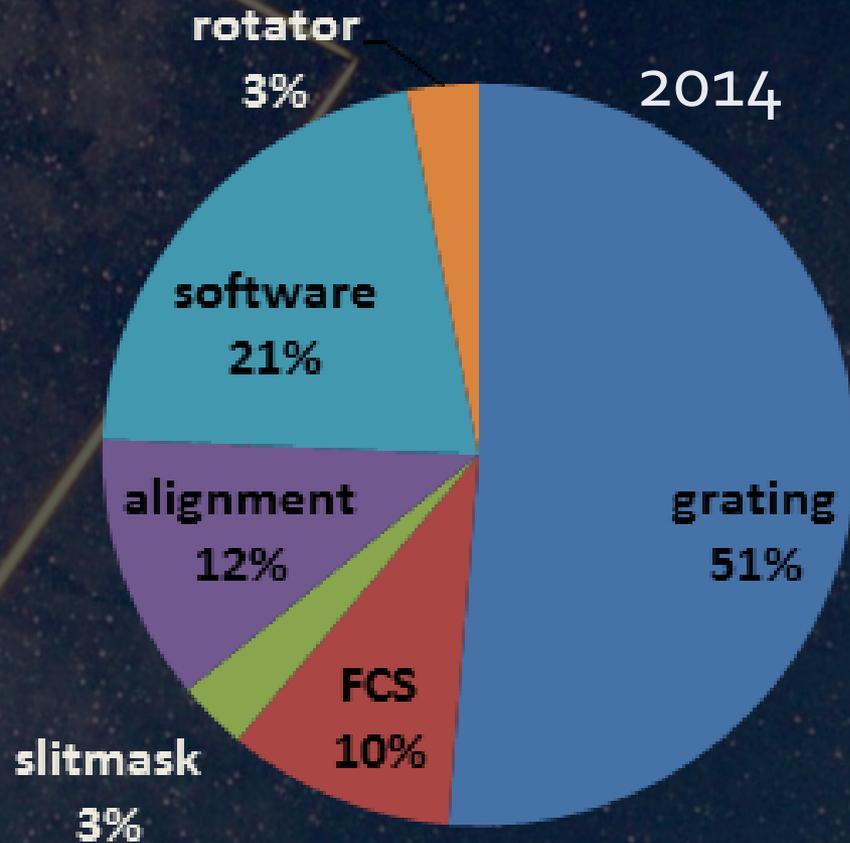
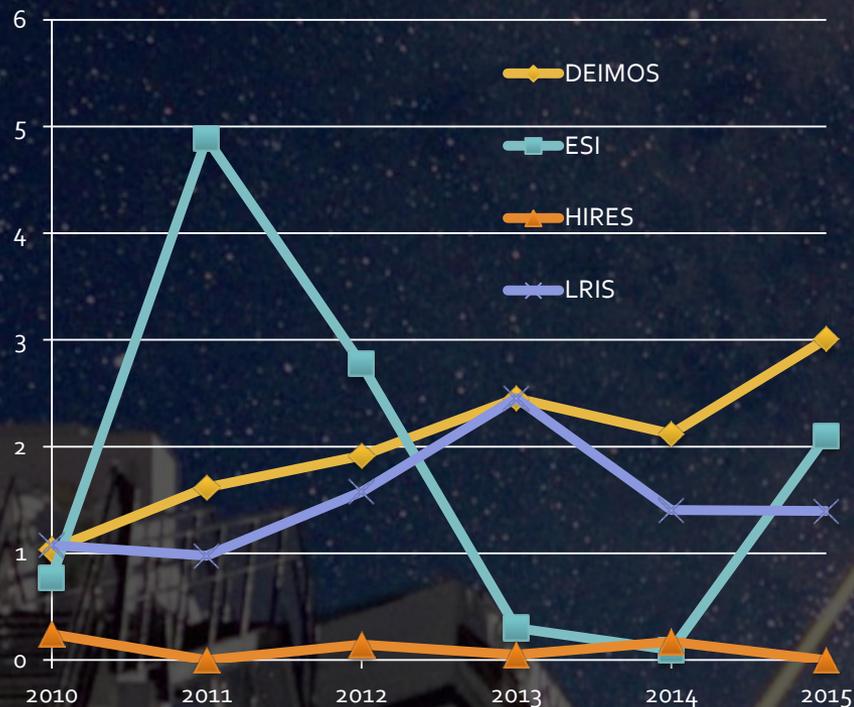
# Keamano Upgrade

- 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

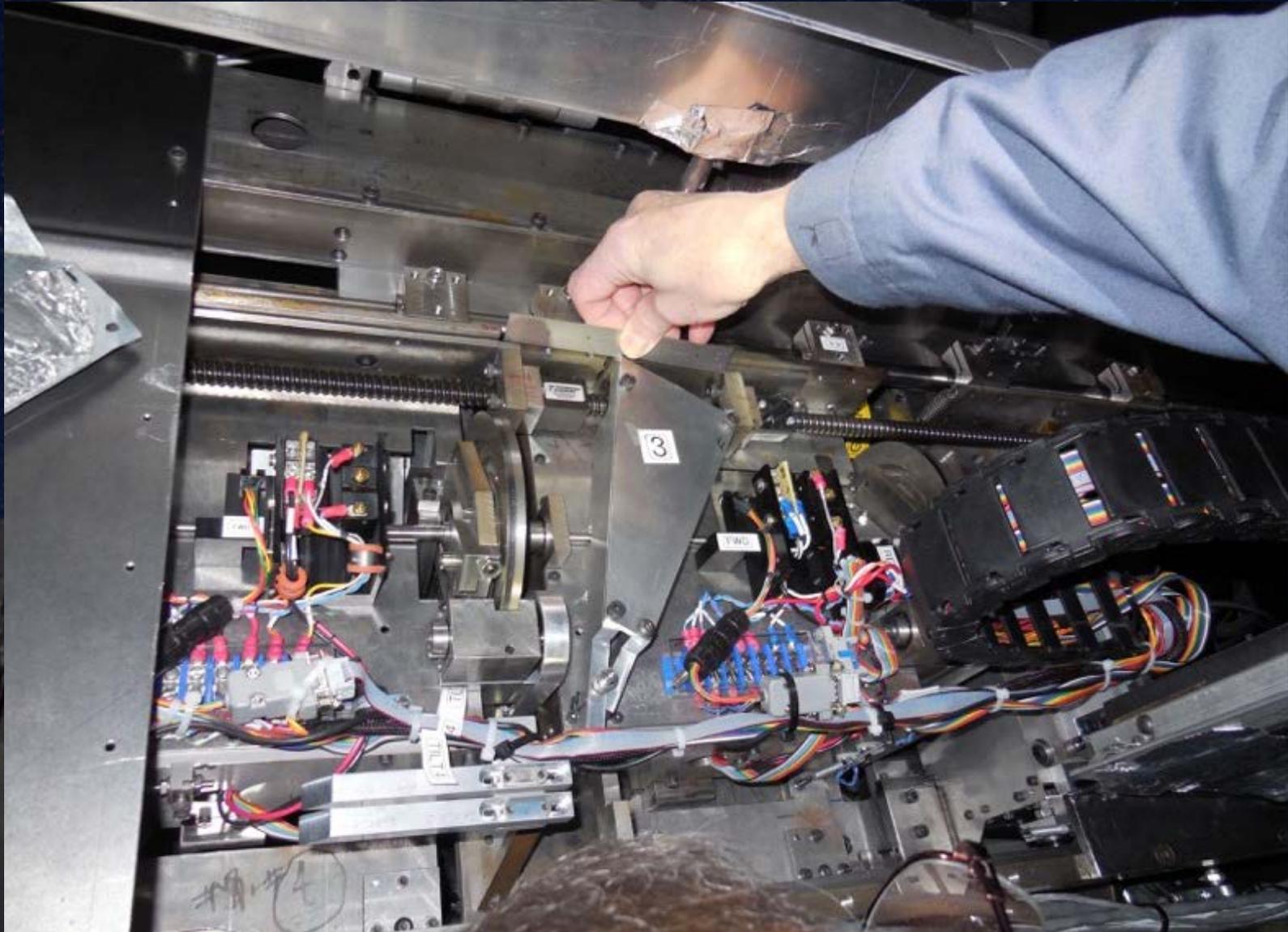
- UCO Lick Staff: Dave Cowley, Jim Ward, Brad Holden, Steve Allen, Will Deich
- Keck Staff: Luca Rizzi, Steve Milner, Gary Anderson, Nick Souminen, Dwight Chan
- Goals:
  - Replace worn, custom components
  - Grating system is more reliable
  - FCS maintains position with grating clamped at all rotator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

# DEIMOS time loss

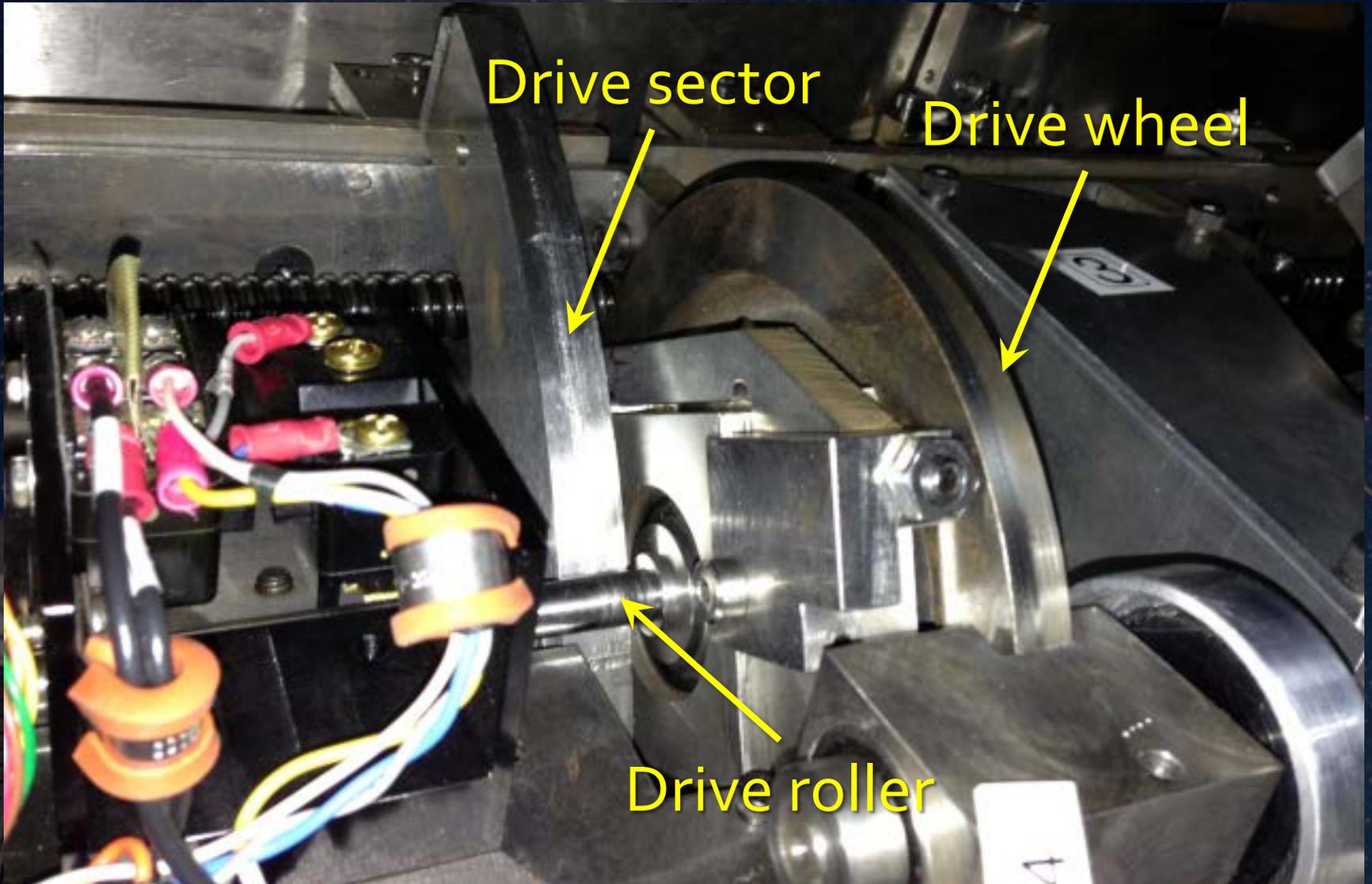


Excludes telescope faults,  
weather, and engineering

# Grating Mechanisms



# Critical grating tilt components are worn

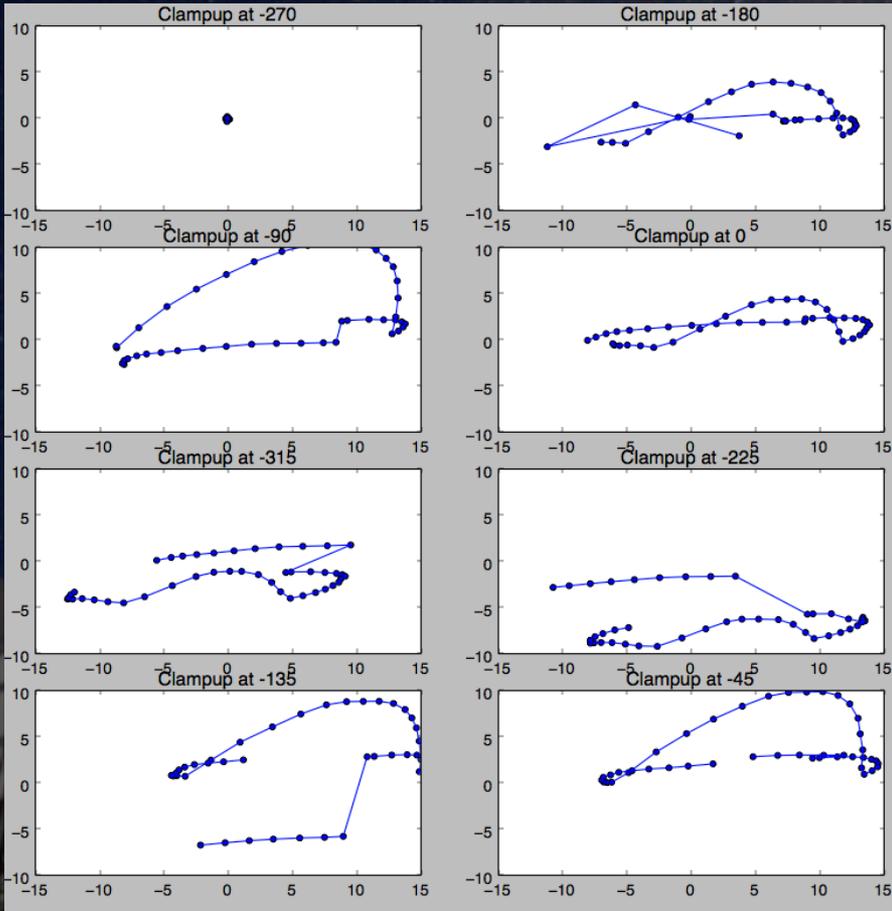


# Worn Parts

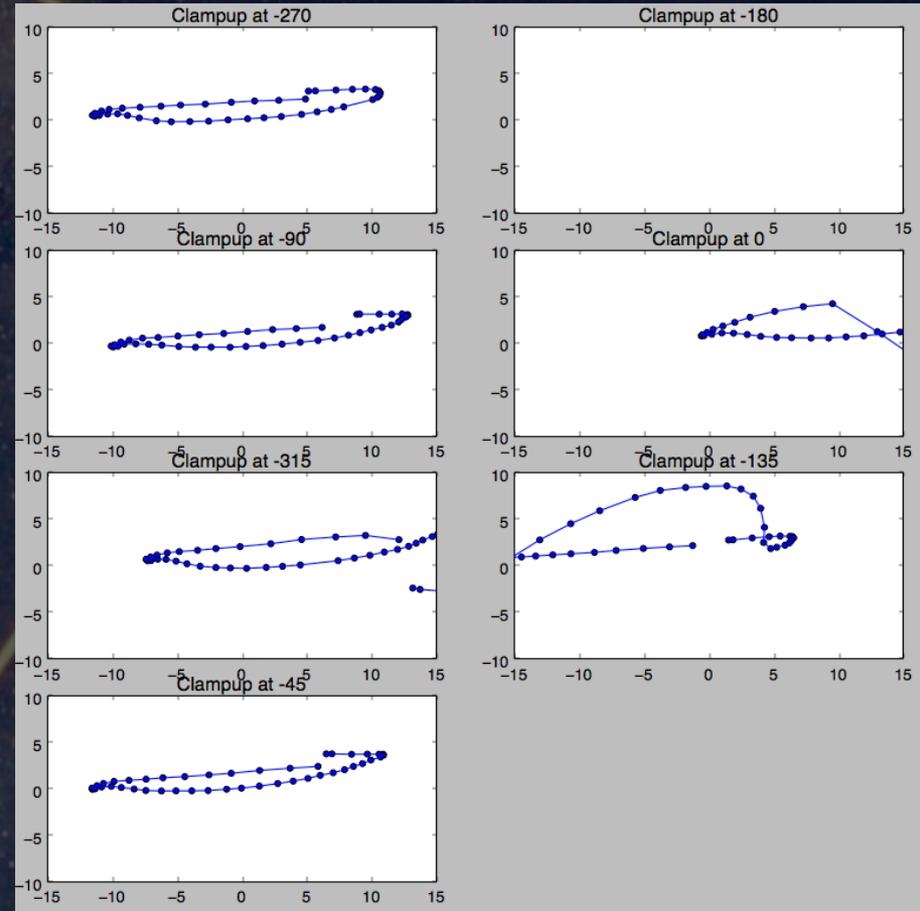
- Bering housing
- Sector Wheel



# Grating 3 Flexure

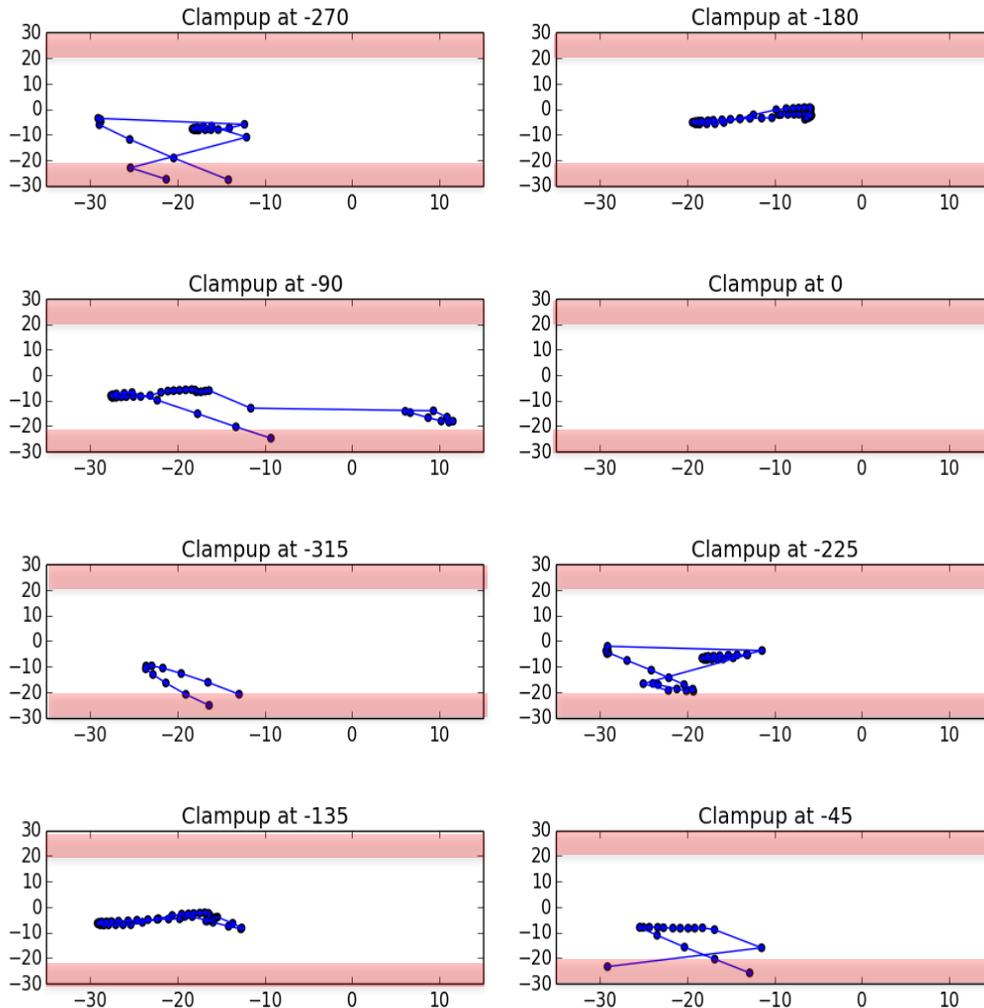


Before



After

# Grating 4 Flexure



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

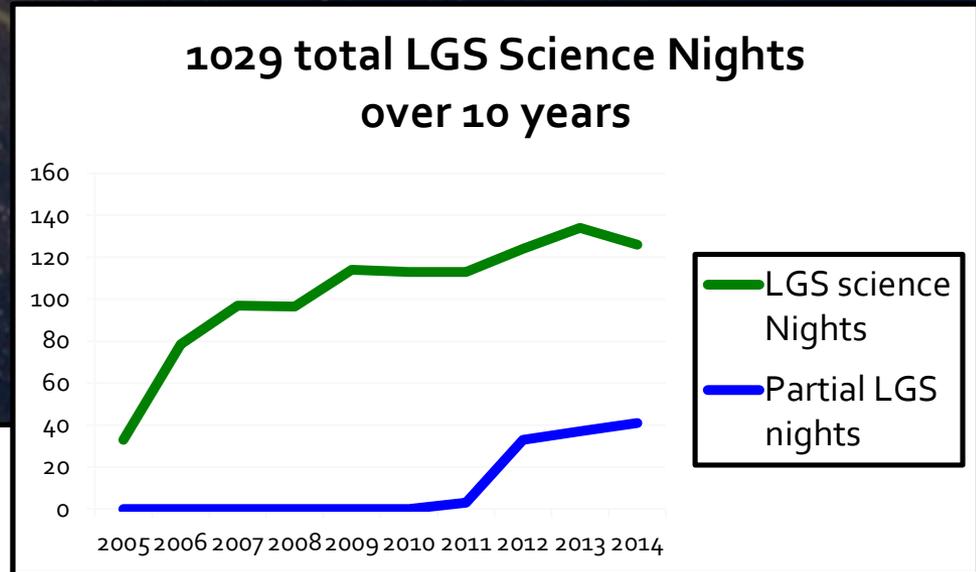


# AO Operations

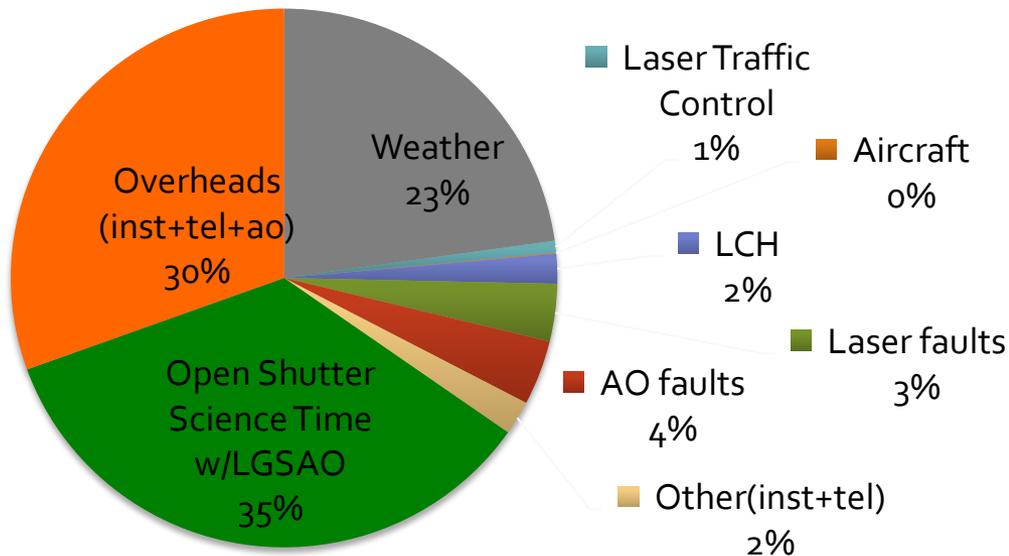
Randy Campbell

# 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

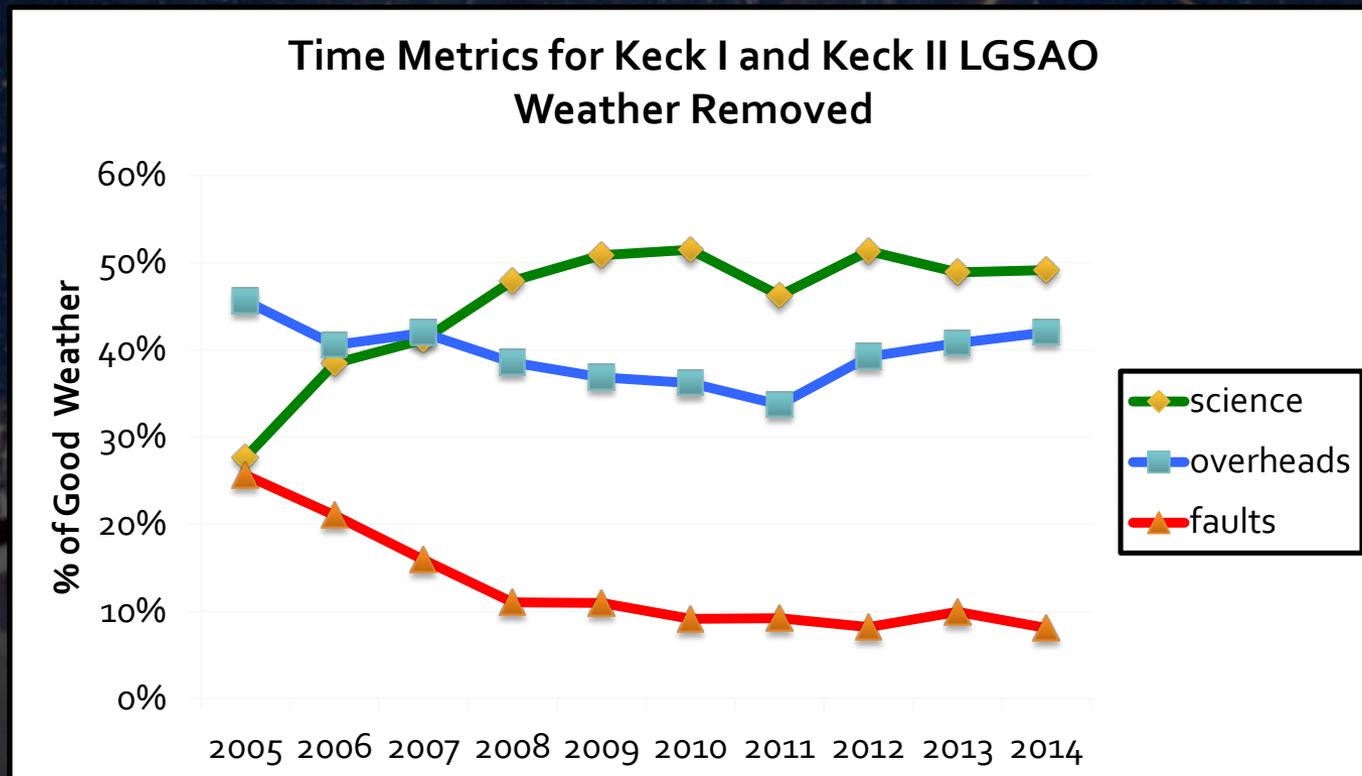


## 10 Year Averages for LGSAO



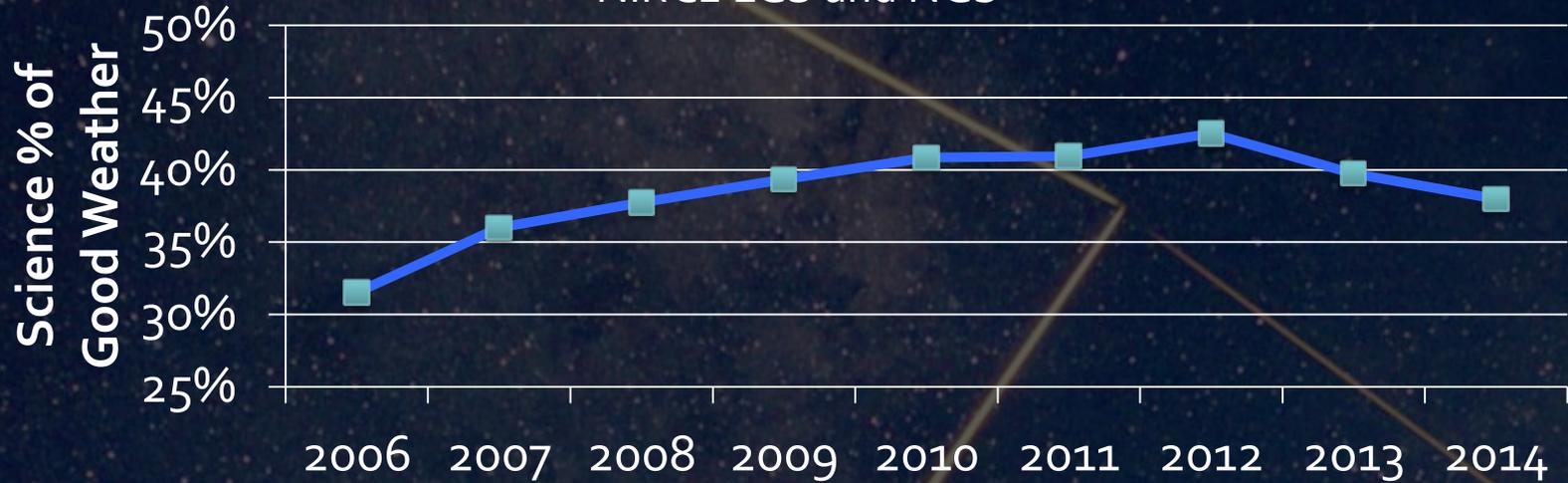
# LGS Trends

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

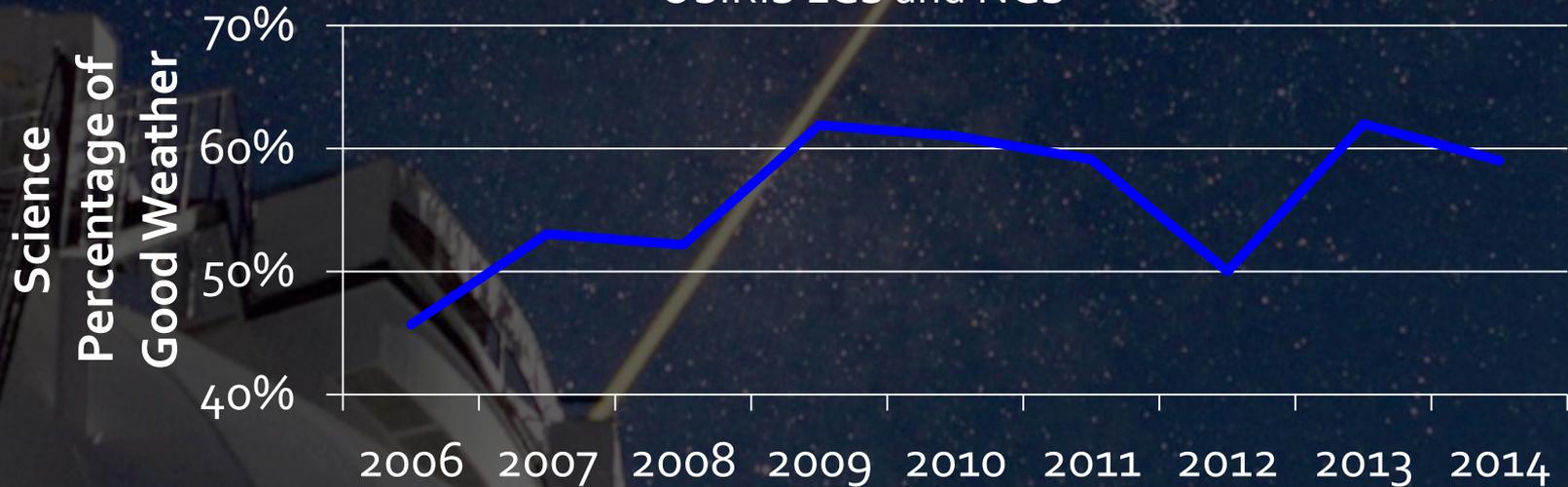


# Efficiency

NIRC2 LGS and NGS

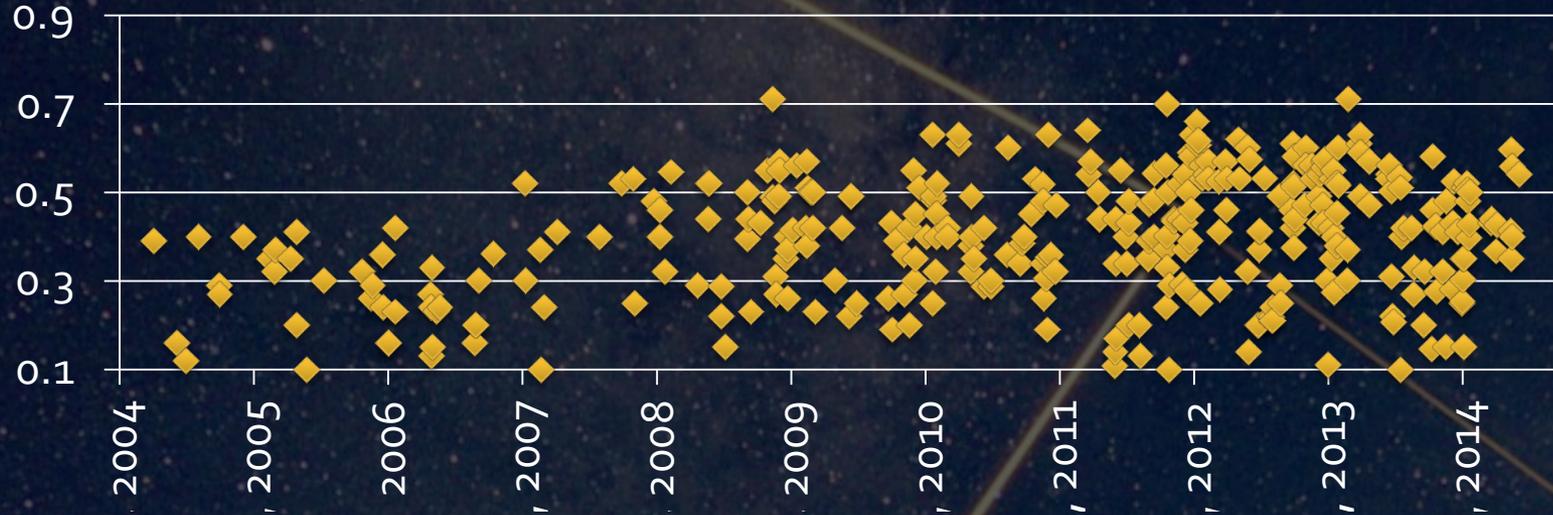


OSIRIS LGS and NGS

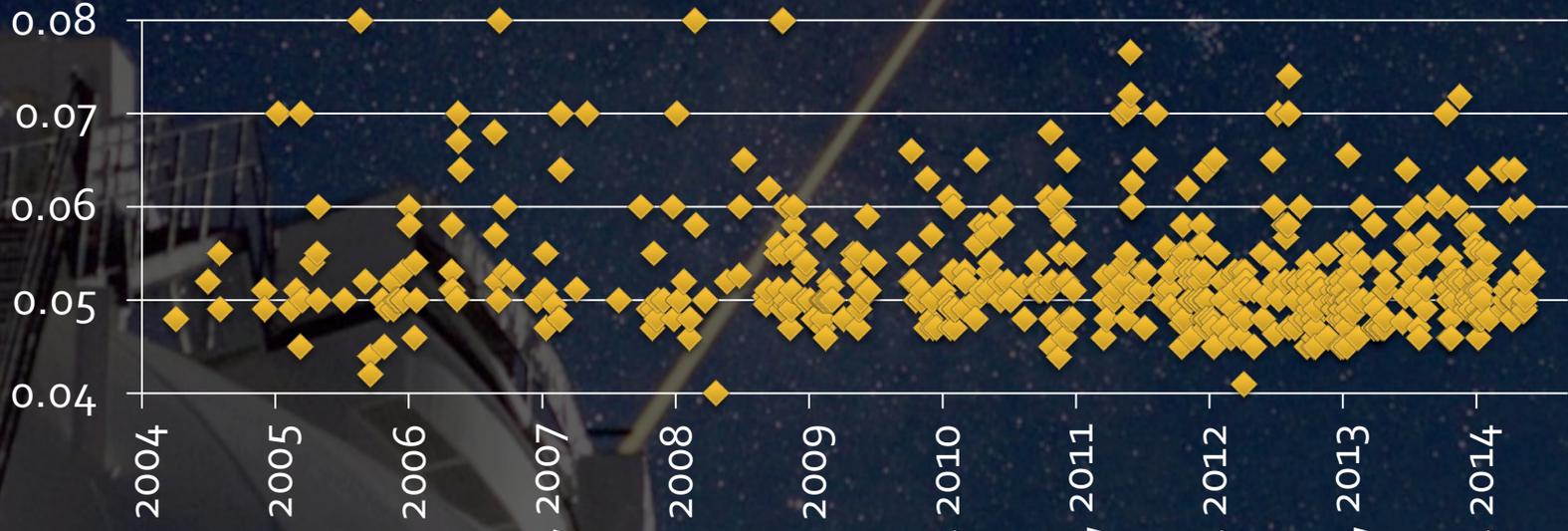


# AO Performance Metrics

LGS Strehl (NIRC2 only)

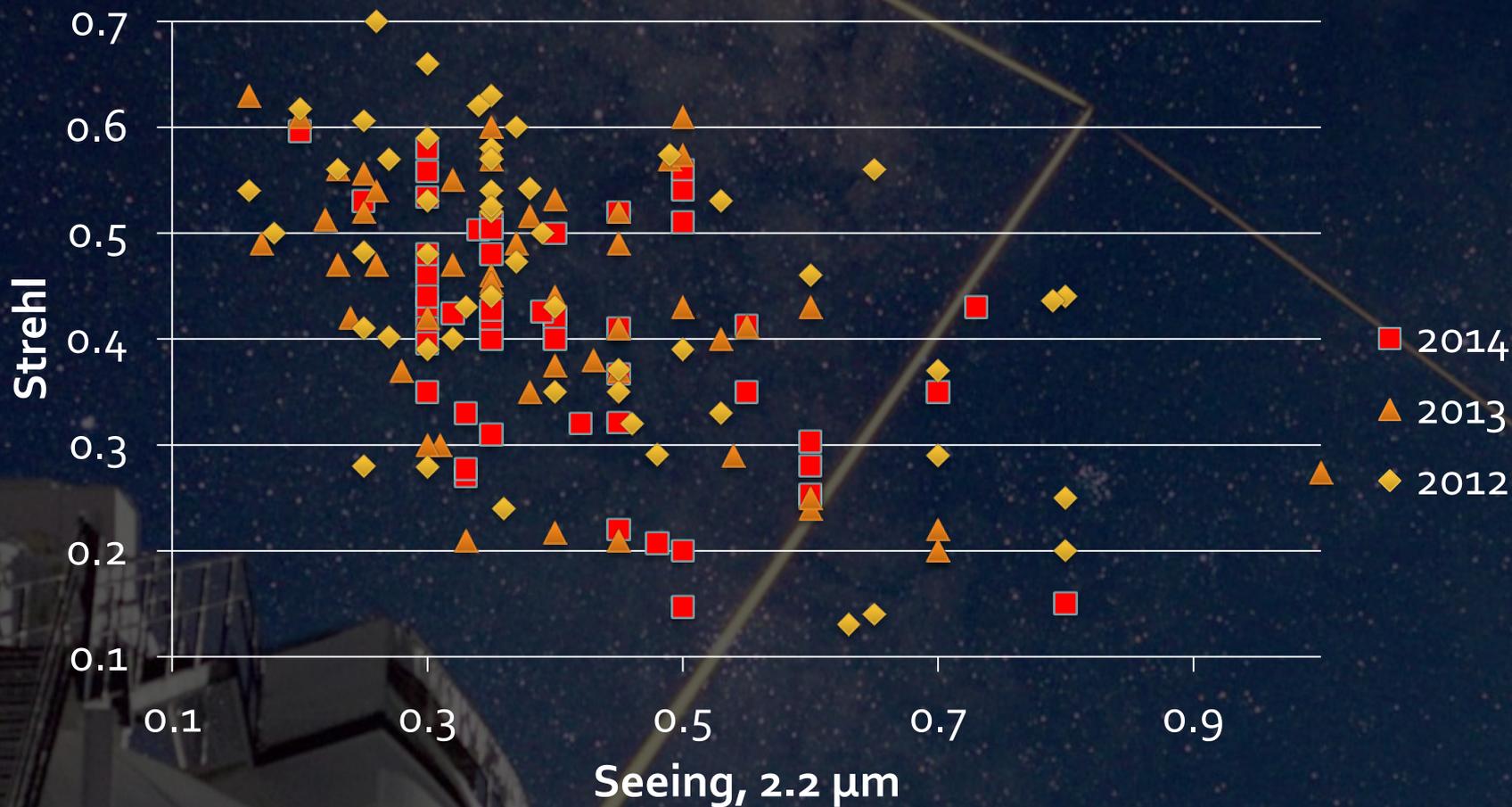


LGS FWHM (NIRC2 and OSIRIS)



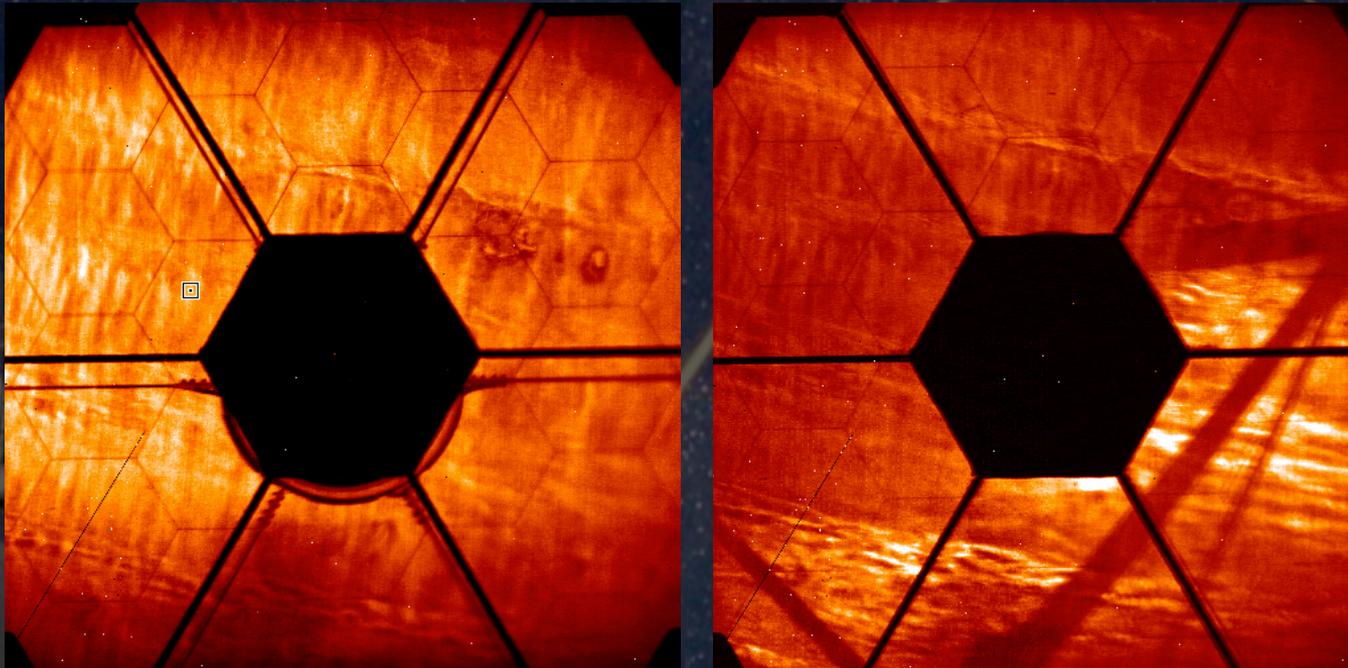
# AO Performance Metrics

## LGS Strehl vs. Seeing



# Keck II AO Bench Tweaks

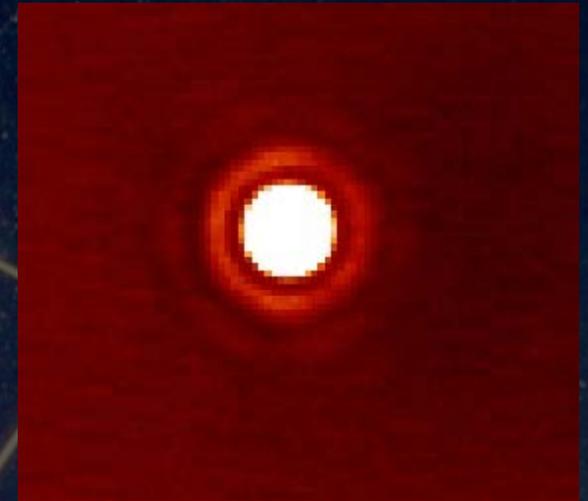
1. Improved pupil nutation (K-mirror)
2. Improved Telescope/NIRC pupil registration (OAPs)
3. Future solution for L-prime elongation (IR Dichroic wedge rotation)
  - Removes lateral chromatic dispersion
  - But introduces a pupil mis-alignment and  $\sim 200$  nm of astigmatism.
  - Future coordinated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



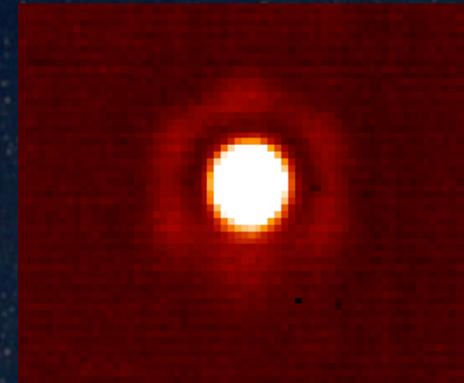
Telescope pupil image before and after alignment with NIRC2 "largehex" mask

# 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

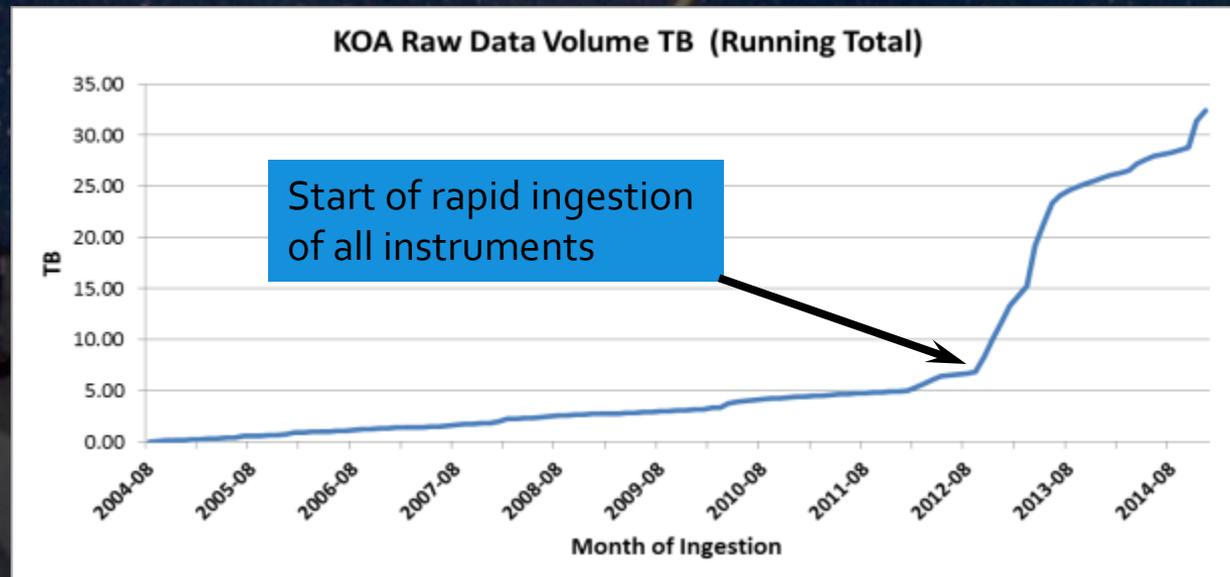
A night-time photograph of the Keck Observatory. The sky is dark blue with numerous stars, some of which are blurred into long, diagonal streaks, indicating star trails. Two bright, yellowish-green laser beams originate from the bottom left and extend upwards and outwards across the sky. In the bottom left corner, the white, curved structure of the observatory's upper levels and a metal staircase are visible.

# Keck Observatory Archive

Hien Tran

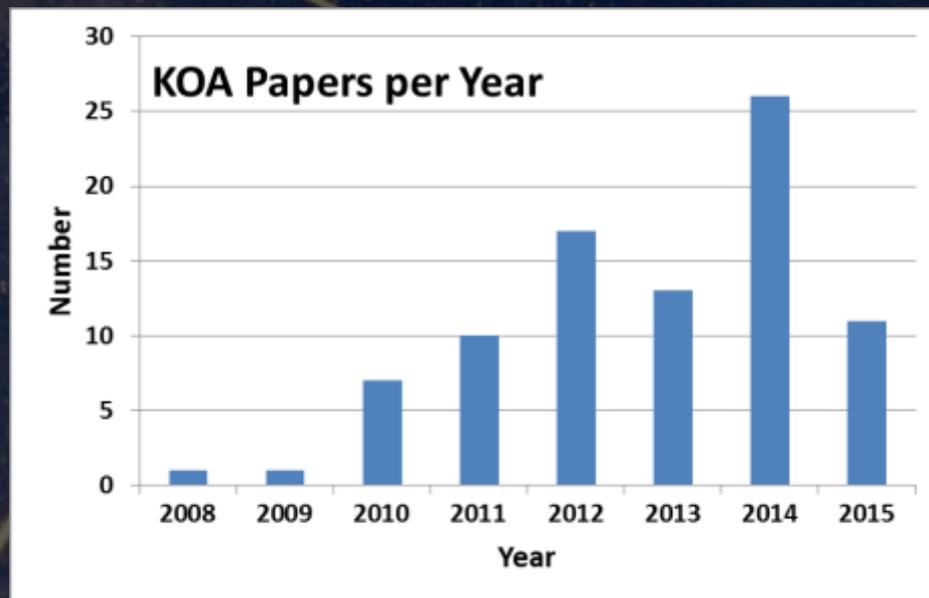
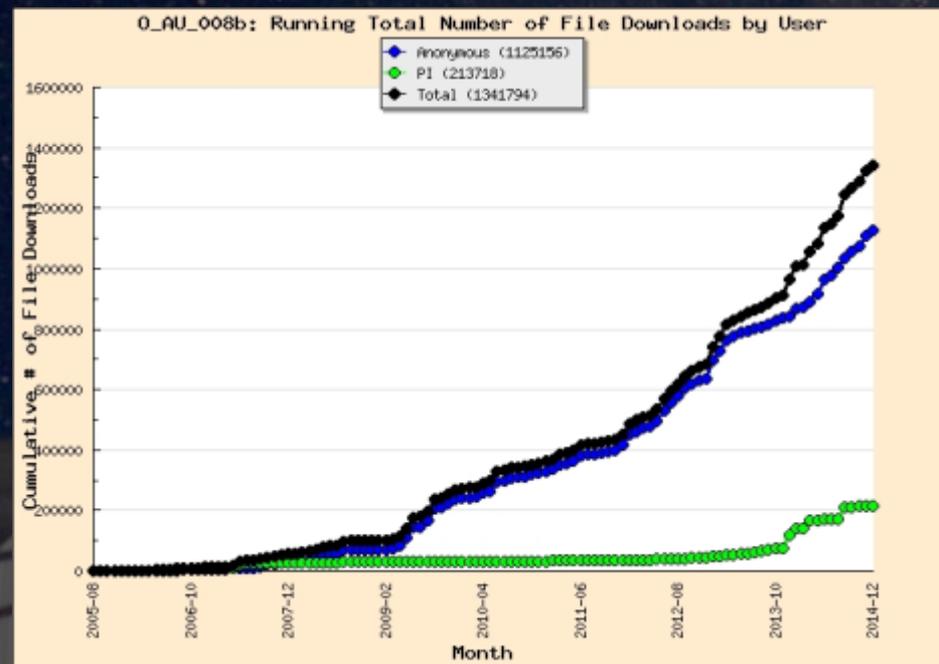
# Current Status

- 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, NIRC<sub>2</sub>, OSIRIS, LWS



# KOA Holding & Usage

- Growth in archive queries and data download
- Increased growth in refereed papers citing KOA (86 to date)



- 1.4 Mil queries
- 15.1 TB downloaded (> 1.3 Mil files)

# 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



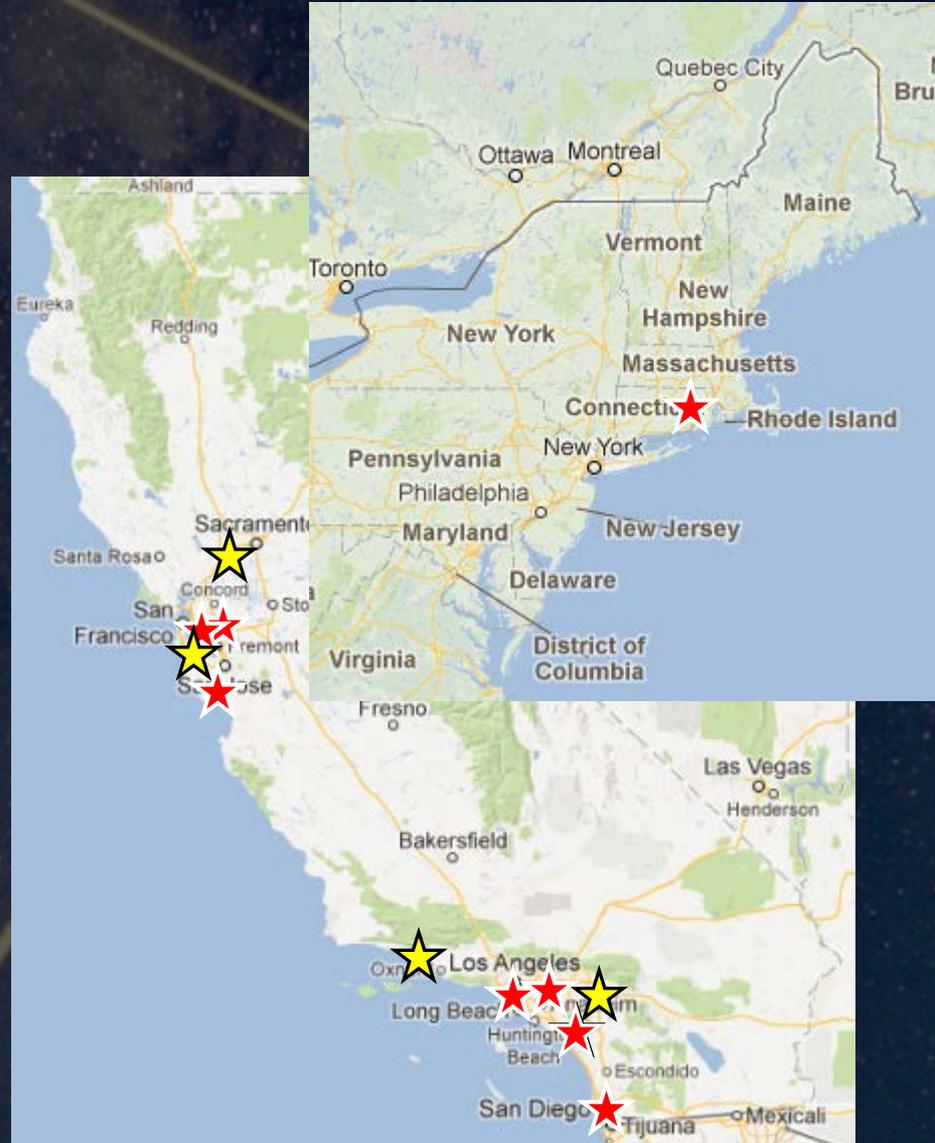
# Mainland Observing

Greg Doppmann

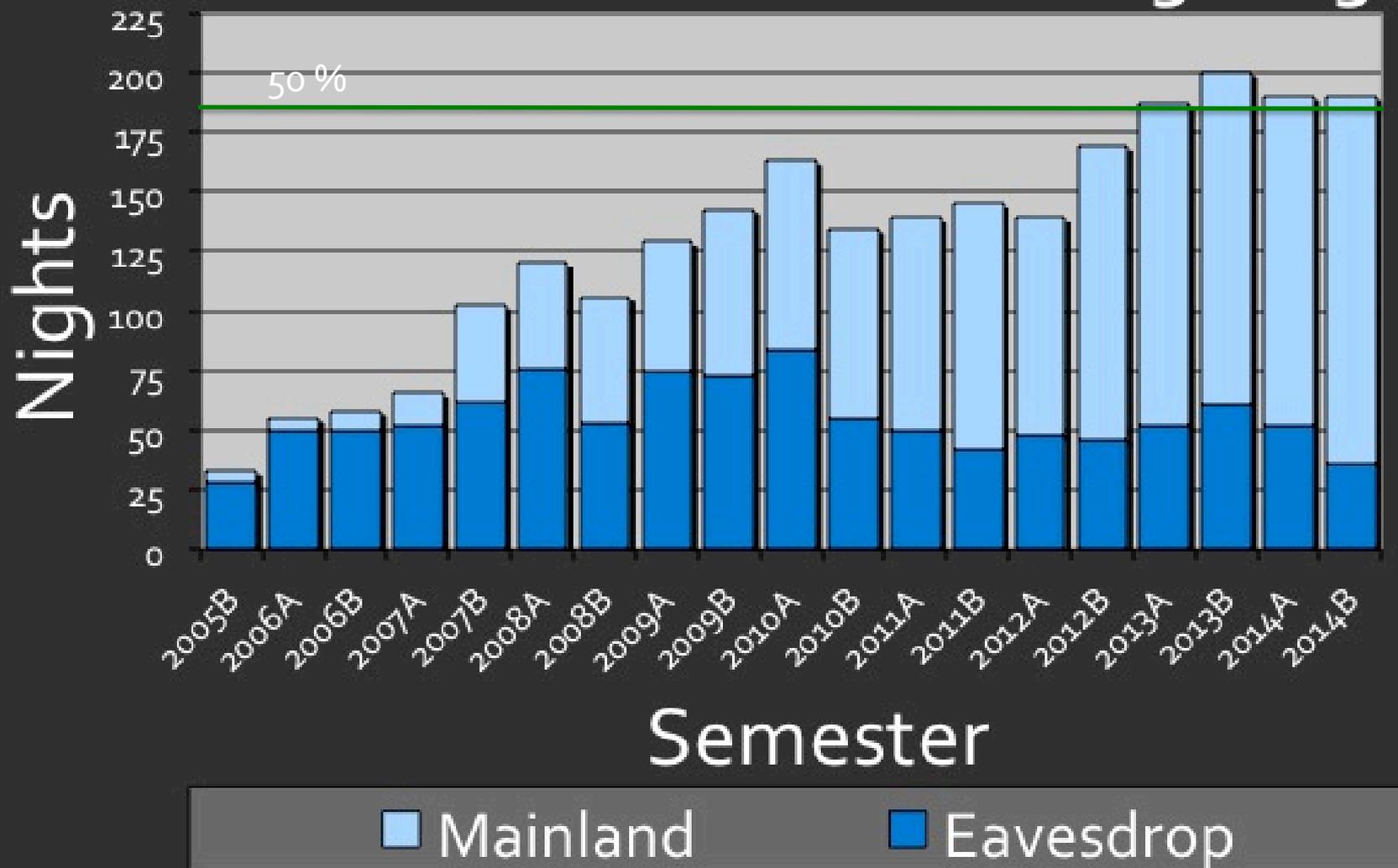
# Mainland Observing Sites

★ Primary Sites (10 total)

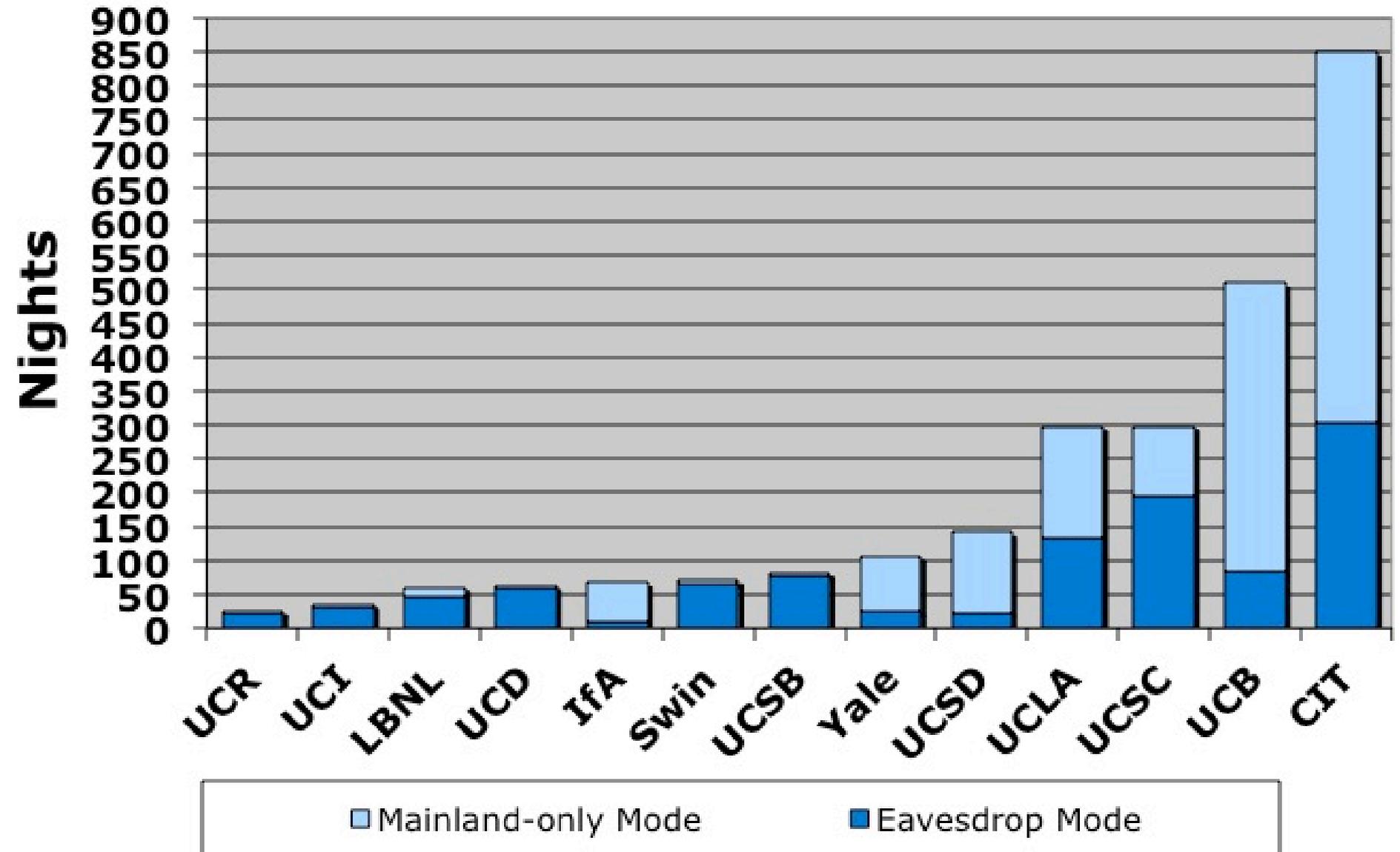
★ Secondary sites (4 total)



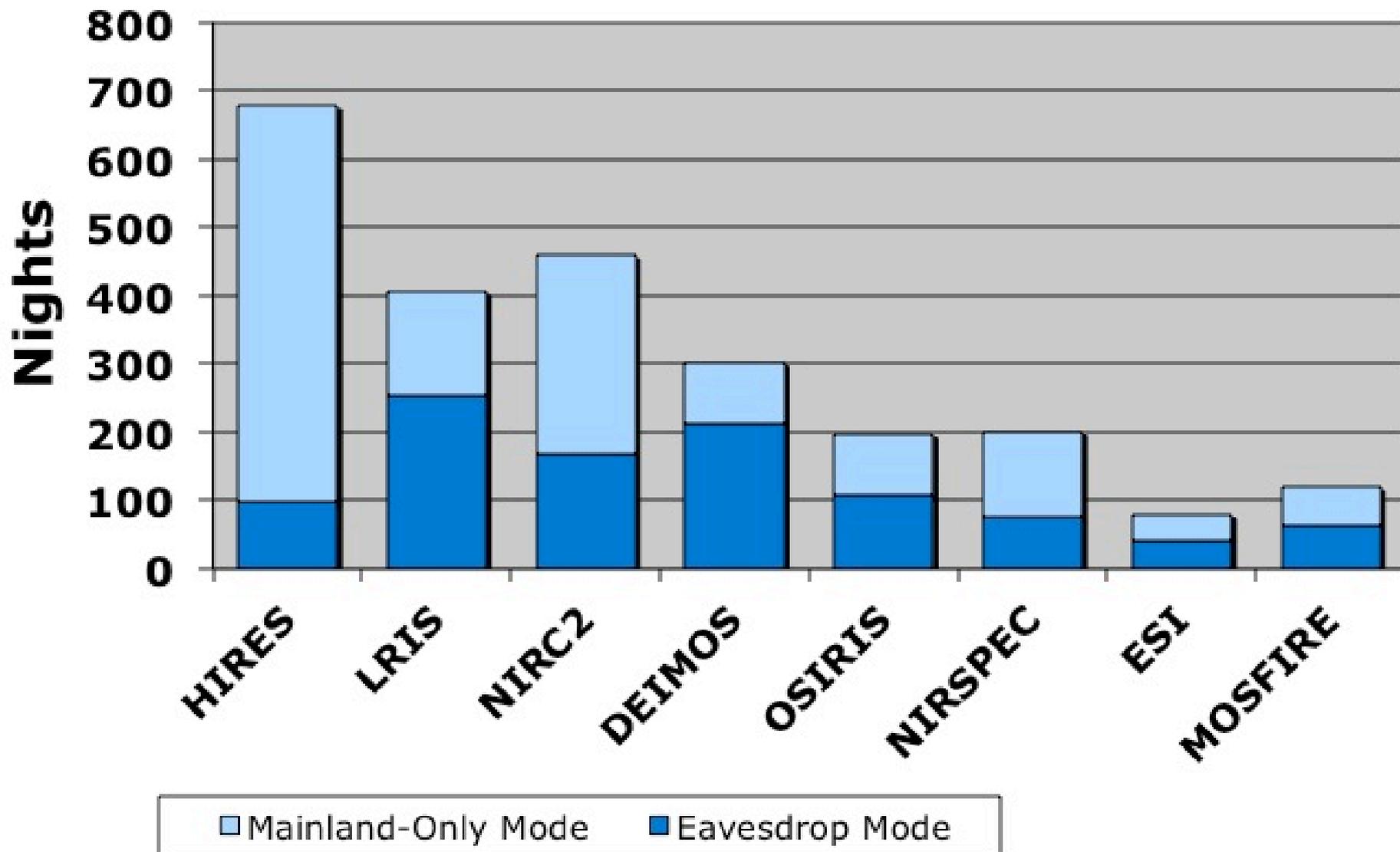
# Keck I+II Mainland Observing Usage



# WMKO Remote Usage by Site



# WMKO Remote Usage by Instrument



# 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