



Science Steering Committee Meeting

Staff Astronomer and Adaptive Optics Presentations

Virtual Meeting via Zoom

November 11, 2020

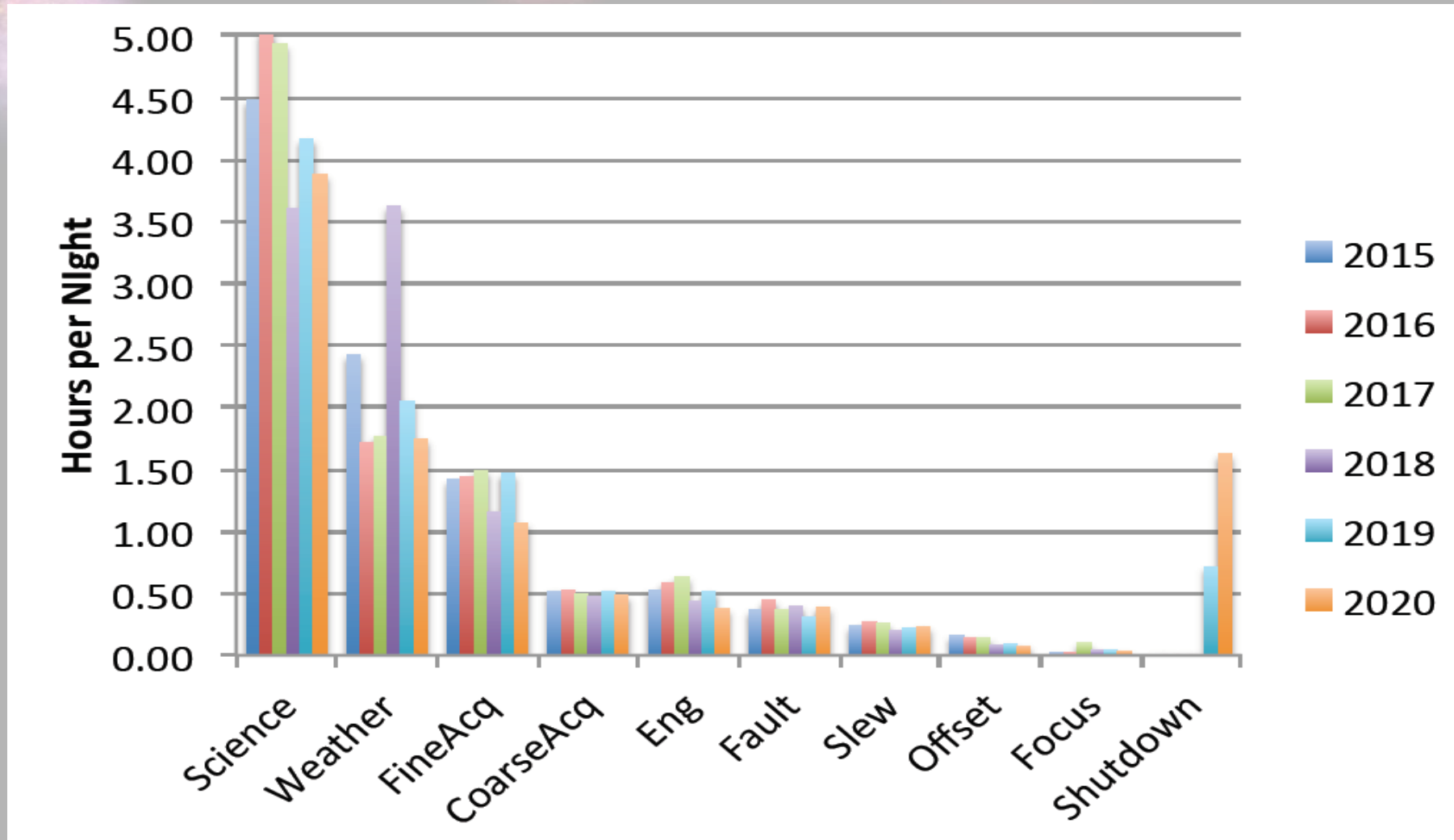
The background of the slide is a deep space image featuring several galaxies and nebulae. In the upper left, there is a bright, multi-colored galaxy with a yellow core and purple and blue outer regions. To its right is a smaller, reddish-pink galaxy. In the upper right, a large, bright galaxy with a yellow and orange core and purple and blue outer regions is visible. The lower half of the image is dominated by a large, complex nebula with a mix of purple, blue, and yellow colors, showing intricate filamentary structures. The overall scene is set against a dark, black background.

Instrument Reports

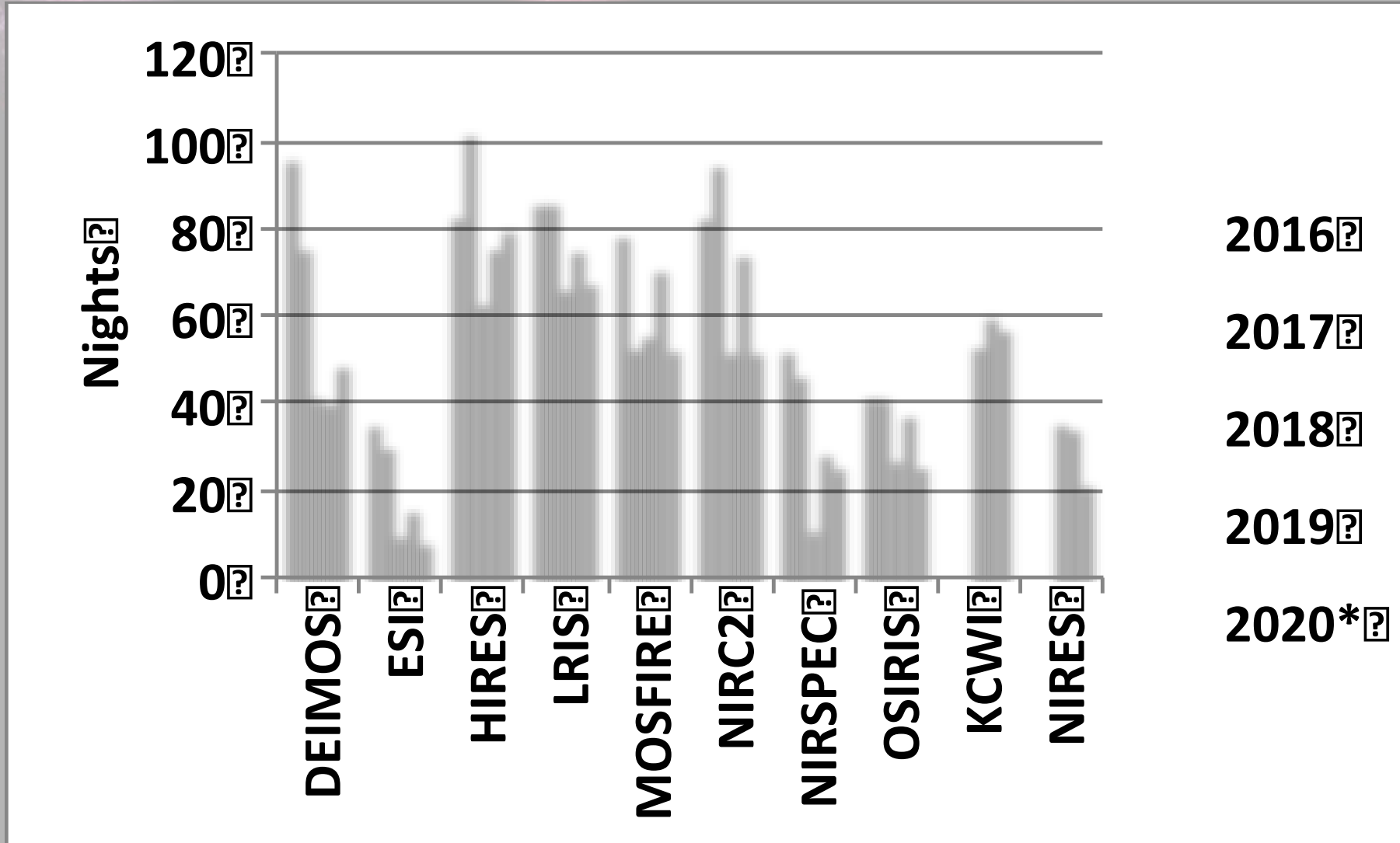


Group 1
General metrics, LRIS, HIRES, OSIRIS

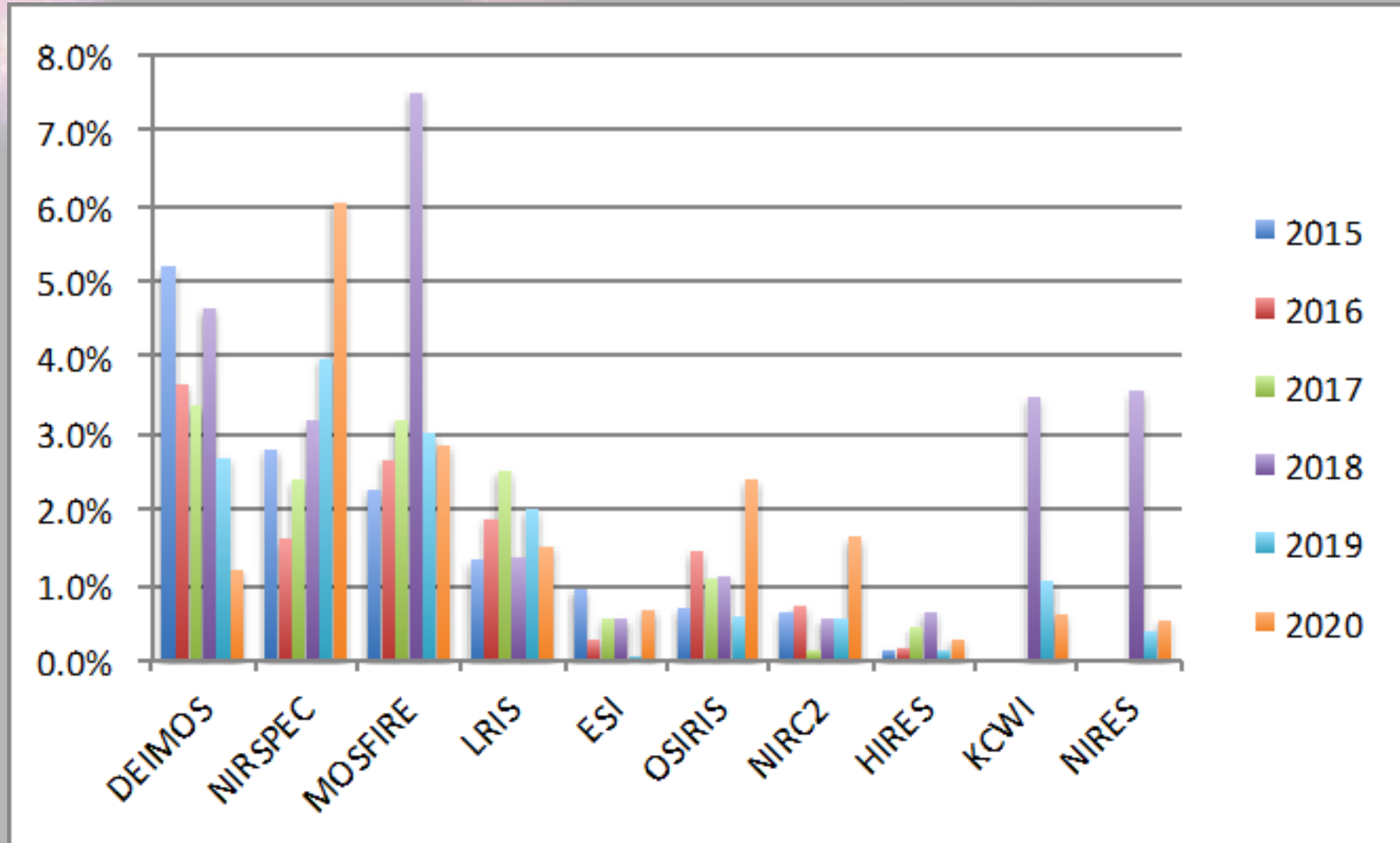
6 Year trends



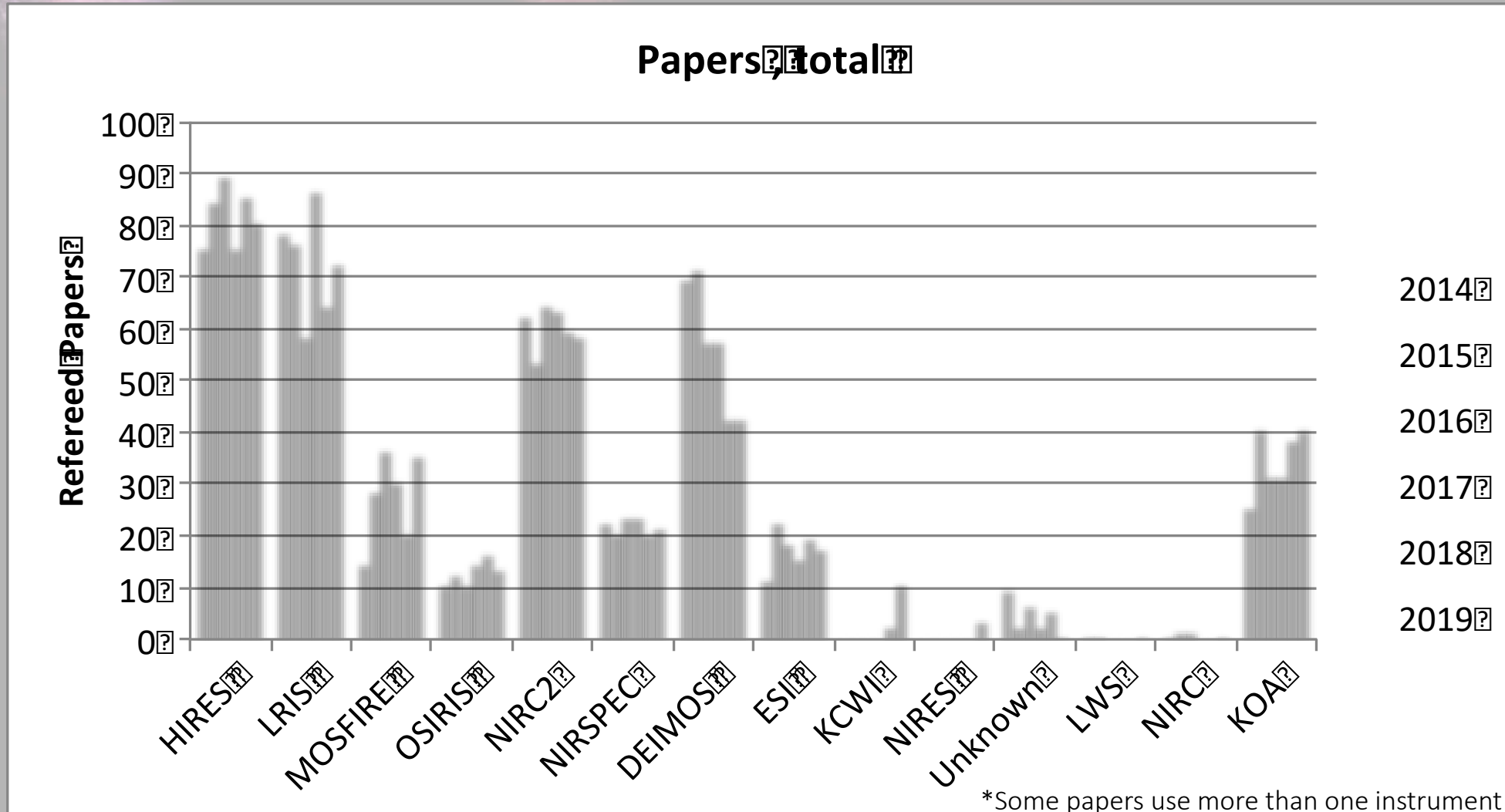
Instrument Use, usable on-sky time



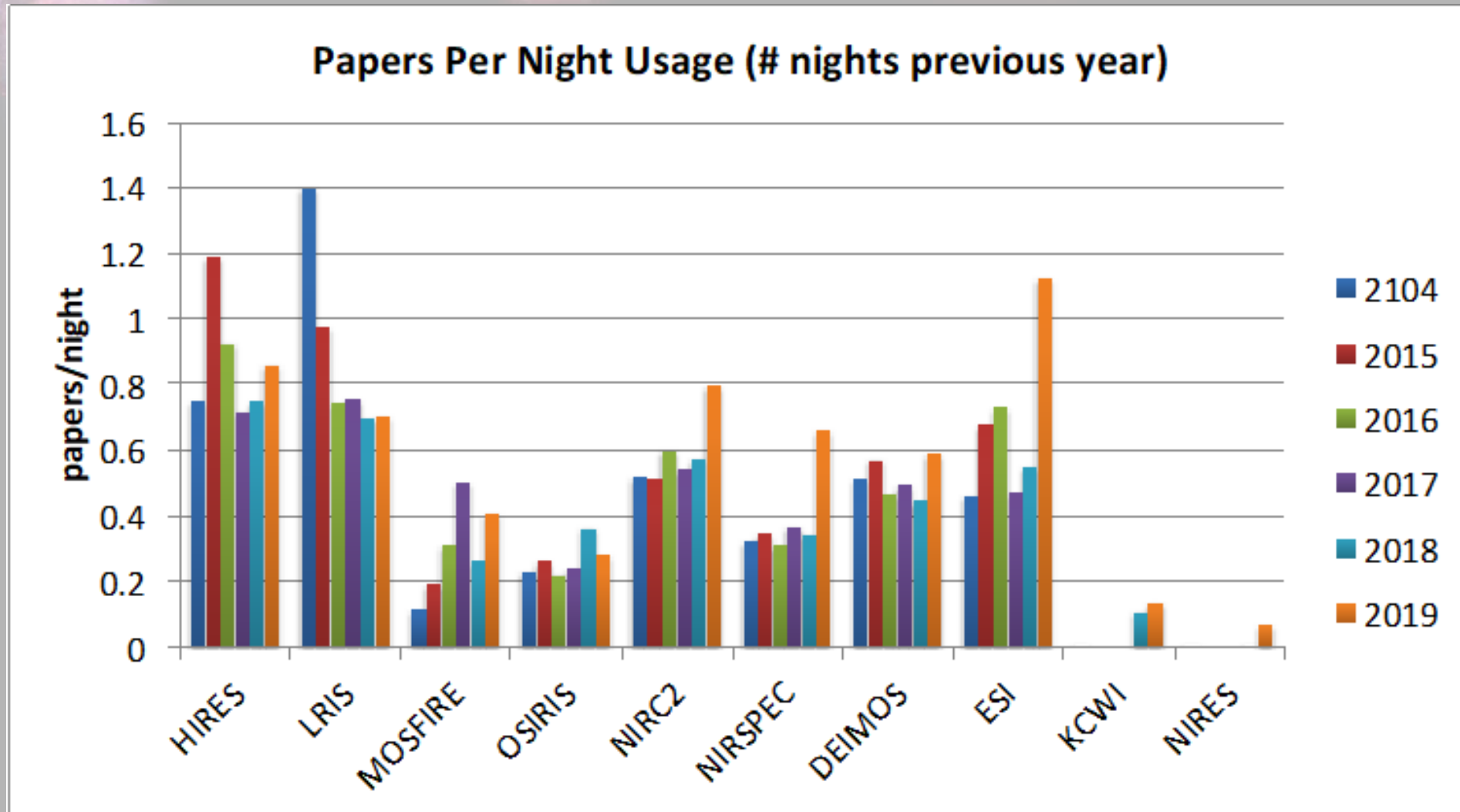
Faults, percentage of on-sky time



Publications



Publications



Risk Matrix

Likelihood of Occurrence	Very Likely >70% within year	Yellow	Orange	Yellow-Orange	Red	Red
	Probable >35% within year	Yellow	Yellow	Orange	Yellow-Orange	Red
	Possible >5% within year	Green	Yellow	Yellow	Orange	Yellow-Orange
	Unlikely <5% within year	Green	Green	Yellow	Yellow	Orange
	Very unlikely <1% within year	Green	Green	Green	Yellow	Yellow
		Negligible: Little to no impact on Observation	Minor: Observation Compromised	Moderate: Observation Interrupted	Serious: Instrument Down one Night	Major: Instrument Down Indefinitely
Risk Severity, Impact						

LN2 Dewar Risk Matrix

Likelihood of Occurrence	Very Likely >70% within year					
	Probable >35% within year				Liquid Cooled Instrument Unplanned Thermal Cycles	
	Possible >5% within year					
	Unlikely <5% within year					
	Very unlikely <1% within year					
		Negligible: Little to no impact on Observation	Minor: Observation Compromised	Moderate: Observation Interrupted	Serious: Instrument Down one Night	Major: Instrument Down Indefinitely
		Risk Severity, Impact				

LN2 Risk

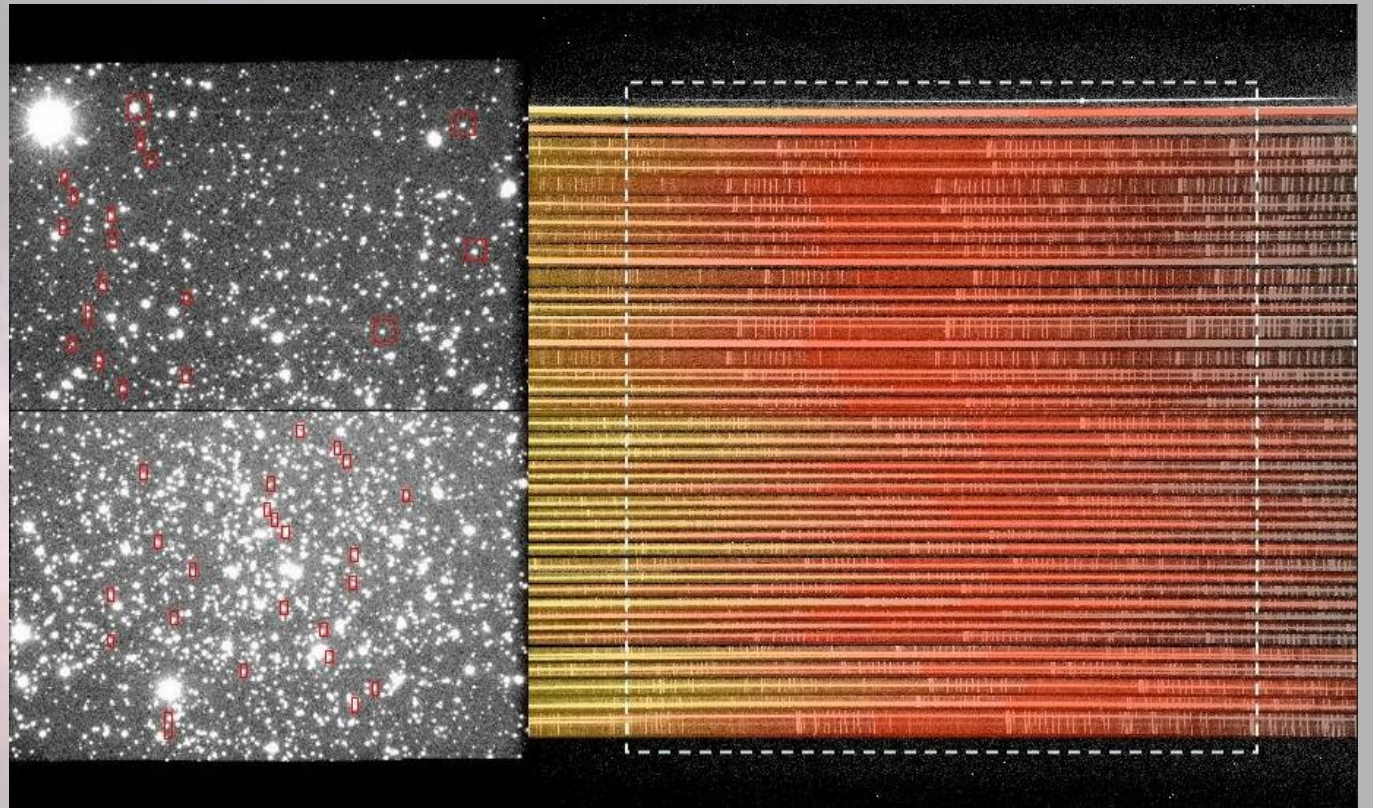
6 out of 10 instruments have LN2 cryostats

Soon to be 8 of 12 with KCRM and KPF

- Supply risk : 2 major interrupts in past year
- Manufacturing plant down
- Force majeure issued due to COVID shortages
- Summit access: Weather, Protests
- CryoStat stability is a significant risk to detectors and optics

Low Resolution Imager and Spectrograph

Dual beam low resolution spectrograph
Range from 3700 to 11000 Angstrom
Imaging, long slit and multi-object spectroscopy
Most productive Keck instrument



LRIS Risk Matrix

Likelihood of Occurrence	Very Likely >70% within year					
	Probable >35% within year		Minor Mechanisms problems			Failure of red ccd before replacement
	Possible >5% within year	Software issues			Minor Mechanism failure Server breakdown Major Mechanisms problems	
	Unlikely <5% within year				Polarimeter failure	Major mechanism failure
	Very unlikely <1% within year					Damage to instrument during LRIS-red upgrade. Damage to optics during reconfig.
		Negligible: Little to no impact on Observation	Minor: Observation Compromised	Moderate: Observation Interrupted	Serious: Instrument Down one Night	Major: Instrument Down Indefinitely
		Risk Severity, Impact				

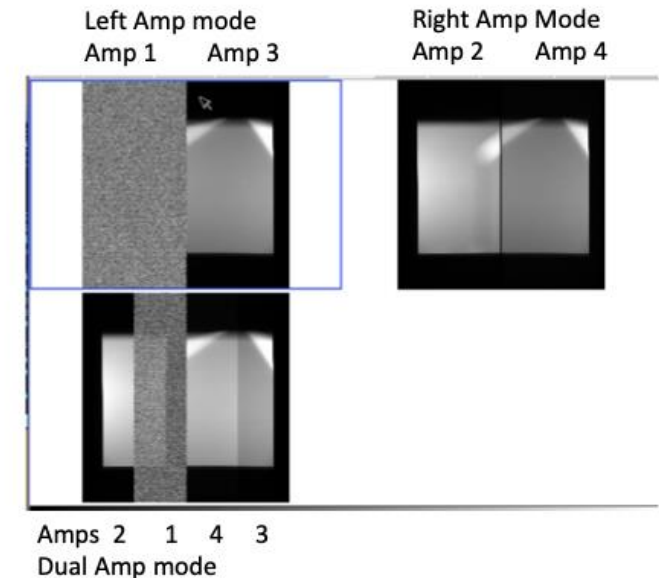
Main Issues

	Amp Mode 2	Amp Mode 1	Amp Mode 4	Amp Mode 3
Gain Dual	1.16	-24	280	1.24
Gain Left		37.6		1.26
Gain Right	1.14		263	

	Amp Mode 2	Amp Mode 1	Amp Mode 4	Amp Mode 3
Flux Dual	50k	2k	1.3k	44k
Flux Left		2k		37k
Flux Right	48k		1.3k	

	Amp Mode 2	Amp Mode 1	Amp Mode 4	Amp Mode 3
RN Dual	4.98	-64.7	227	4.99
RN Left		99		5.2
RN Right	4.98		212	

30 June 2020

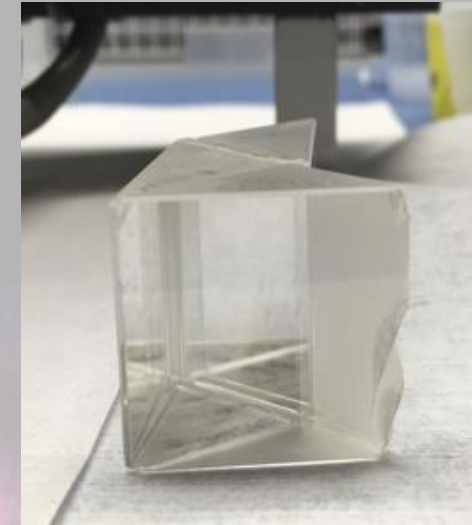
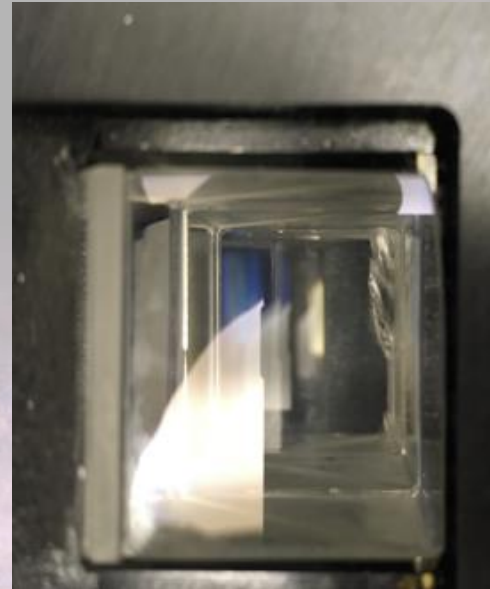
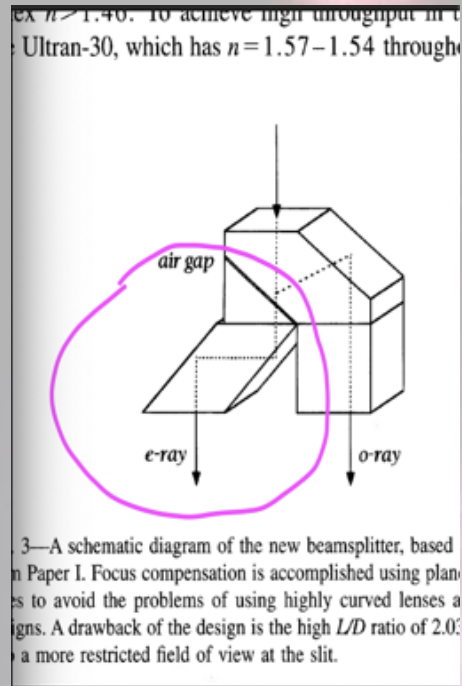


- Red side detector is failing (2 amplifiers are not working, 3rd is unstable)
- Several mechanisms are unreliable
- Several worn out parts (grinding noises, broken cables)
- Software is incompatible with Linux, with keyword history, and DSI
- Continuous problems cause strain on summit crew to keep the instrument on sky
- Polarimeter beam-splitter is broken

Activities

Project	Description	Status
User interface	Focus GUI upgraded to support binning and windowing	Complete
Low level software	Lserv (mechanism) upgraded to support keyword history	Complete
Refurbishment	Cost analysis of a complete overhaul of the instrument	Not started
Pipeline	Deployment of LRIS Pypelt module	Not started
Red CCD	Upgrade of red side CCD	Scheduled for March

Polarimeter damage

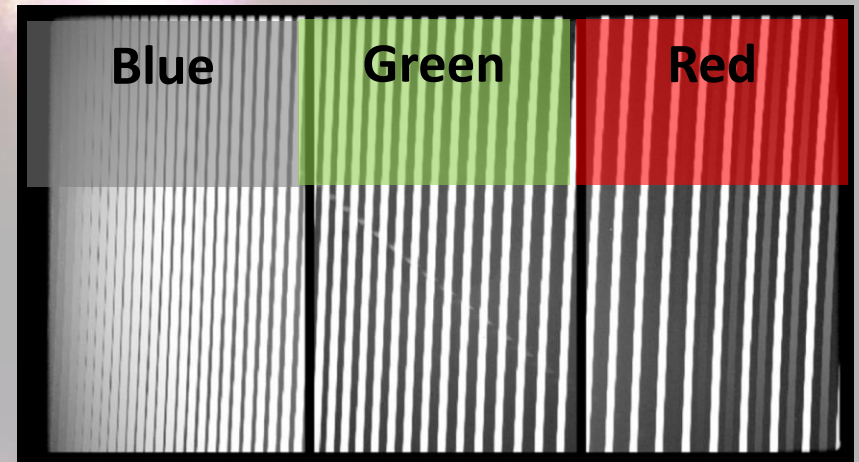


- The e-ray prism detached from the o-ray prism in the beamsplitter
- That the detachment might have caused a chip on the e-ray calcite prism and the o-ray prism
- We are looking into sending the polarimeter back to Karl Lambrecht Co. for assessment

HIRES

G. Doppmann

- High Resolution ($R \sim 25,000 - 85,000$) Optical Echelle Spectrograph on Keck I
- Commissioned in 1993, detector upgraded 2004
- On-slit guiding
- Extensive Cross-dispersed Coverage:
 - 45 orders
 - 0.3 - 1.0 microns
 - 3 chips 2048 x 4096



Detector	MIT-LL 2048×4096
Pixel Size	15 microns
Low Gain	1.9 -> 2.06, 2.2 -> 2.16, 2.2 -> 2.18 electrons/ADU (B,G,R)
High Gain	0.78, 0.86, 0.84 electrons/ADU (B,G,R)
Read Noise	2.8 -> 2.73, 3.1 -> 2.74, 3.1 -> 2.85 electrons (B, G, R)
Linear Limit	39,800, 37,900, 38,400 ADU (B, G, R)
Wavelength Sensitivity	0.36 - 1.0 microns

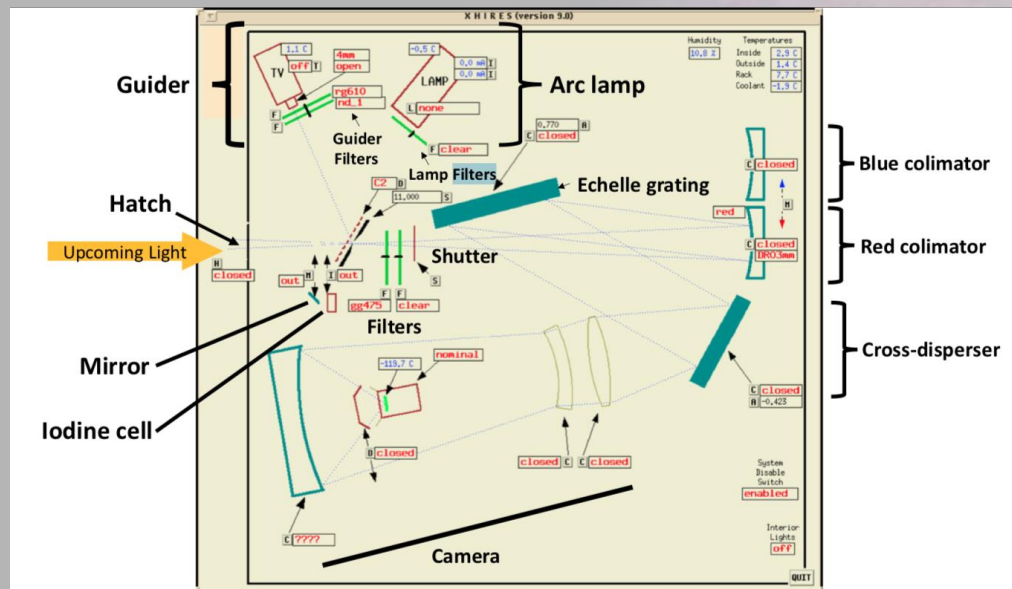
HIRES Risk Matrix

Likelihood of Occurrence	Very Likely >70% within year		Intermittent noise artifacts on CCD detector			
	Probable >35% within year					
	Possible >5% within year					CCD dewar warm up
	Unlikely <5% within year		Degradation of optical coatings		CCD shutter fails	<ul style="list-style-type: none"> • CCD crate fails • Solaris-based server fails
	Very unlikely <1% within year					<ul style="list-style-type: none"> • Motor crate fails
		Negligible: Little to no impact on Observation	Minor: Observation Compromised	Moderate: Observation Interrupted	Serious: Instrument Down one Night	Major: Instrument Down Indefinitely
Risk Severity, Impact						

Stable Operations in 2020

Full year using operational improvements:

- Linux upgrade for user interface: vm-hires
- Compact HIRES mechanism GUI replaces old XHIRES GUI (allows increased VNC screen space)



Covers: Mixed

Hatch: Closed

Rotator: In

Lamp mirror: Out

Iodine cell: Out

Aperture: C5

Filter 1: clear

Filter 2: clear

Shutter: Closed

Blue coll.: DB00mm

Echelle: 0.0200

Cross disp.: 0.4105

Detector: Idle

Phys: 234.60

Calibration lamp

Enc. temp 0.2 C

Lit time 0 s

Active lamp none

Filter ng3

Cathode 1 0.0

Cathode 2 0.0

Guide camera

Enc. temp 12.0 C

Power on

Aperture open

Focus 0mm

Filter 1 clear

Filter 2 clear

Environment

Inside 6.8 C

Outside 5.2 C

Rack 14.4 C

Coolant -5.0 C

Humidity 0.1 %

Lights off

Automatic

Cathode curr. On

Guider focus On

Coll. focus On

Detector and dewar status

Det. temp -130.0 C

Setpoint -130.0 C

Dewar N2 50.1 %

Res. N2 93.5 %

Work Done

Issue: HIRES enclosure Roof Leak

- Extreme Rain event caused dome-leaked water to pool on top of HIRES enclosure
- Crack in enclosure roof allowed pooled water to drip into HIRES enclosure
- No direct contact with Optics or CCD dewar
- Period of Elevated humidity ($>60\%$ RH) over next 2 days
- No evidence of water in data (via comparison flats @ 1% level)

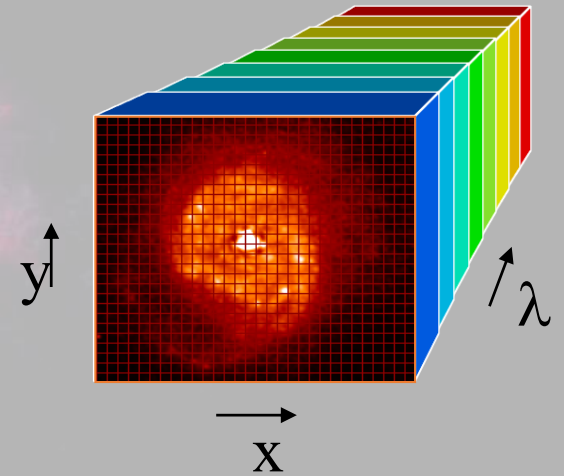
Resolution:

- Roof Re-sealed at the Top
- Dry conditions inside HIRES return to normal levels (RH $< \sim 3\%$)



OSIRIS

- Near-infrared integral field spectrograph and imager, with K1 AO
- **Spectrograph:** 20 mas to 100 mas lenslet scales, small rectangular FoV (up to 4.8" x 6.4")
- **Imager:** 10 mas pixel scale, 20"x20" FoV
- Can take spectroscopic and imaging data simultaneously



OSIRIS Risk Matrix

Likelihood of Occurrence	Very Likely >70% within year	IMAG: Fell filter bad image quality	AO faults		Mechanism failure	
	Probable >35% within year			Data reduction challenges		
	Possible >5% within year					
	Unlikely <5% within year				Windows detector server failure	
	Very unlikely <1% within year					
		Negligible: Little to no impact on Observation	Minor: Observation Compromised	Moderate: Observation Interrupted	Serious: Instrument Down one Night	Major: Instrument Down Indefinitely
		Risk Severity, Impact				

Update since last year

- **Updated** quicklook tool to display images with correct orientations
- **Improved** image sharpening for both spectrograph and imager
- **Provided** NIRC2 like scripts for imager, e.g. igoi, bxy3
- **Migrated** control software, scripts, VNCs from Solaris to Linux

Additional accomplishments

- **Installed** new Holographic Aperture Mask (HAM)
- **Realigned** imager pupil mask
- **Fixed** recmat issues, recalculated named positions for the lenslet mask stage

Current issue

- Spectrograph lenslet mask stage is not responding to move commands.
- Troubleshooting outside the dewar:

Re-homing stage

Stopping/starting the lenslet mask service and re-homing

Driving in motor steps, but summit technician heard no sound

Power cycling the motor controllers

Swapping motor controller cables

Work

- *Service OSIRIS*, lenslet mask stage repair (November)

We hope to keep OSIRIS stable for all the AO changes coming with KAPA

Community-driven tasks:

- Spectrograph wavelength calibration error study, with UCLA

Likely from differences in the pupil between scales

Looking into:

OSIRIS timeline of hardware opening and changes

How well the cameras and collimator are aligned

- Imager data reduction pipeline, with UC Berkeley KAPA group