The WIYN Telescope

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Overview

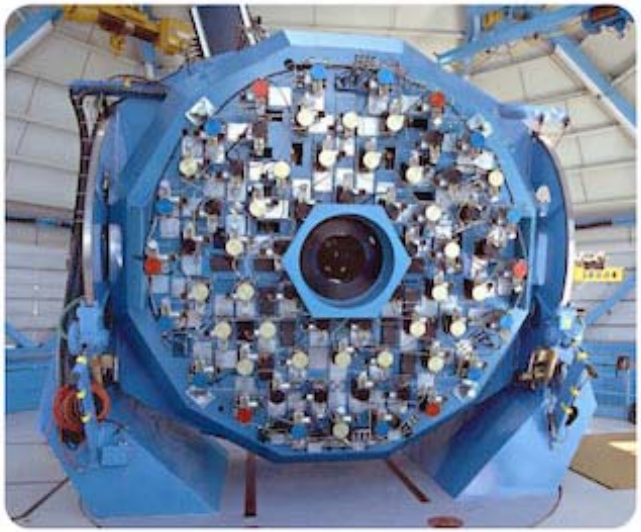
- Present the technical specs and performance envelope of the WIYN 3.5 m telescope, as relevant for the EPDS solicitation. These are covered in detail at the EPDS web page (FAQ and Document Library)

  https://exep.jpl.nasa.gov/epds/workshop/

- Help potential proposing teams to engage fully and elicit feedback.

WIYN

- 3.5 m primary. Alt-Az mount.
- 1.2 m secondary, 1.2 m x 0.8 m tertiary. Richey-Chretien, f 6.3 beam.
- Active optics on primary for mirror shape and collimation, secondary for tip-tilt.
- Small lightweight dome, entire facility designed to minimize thermal mass.

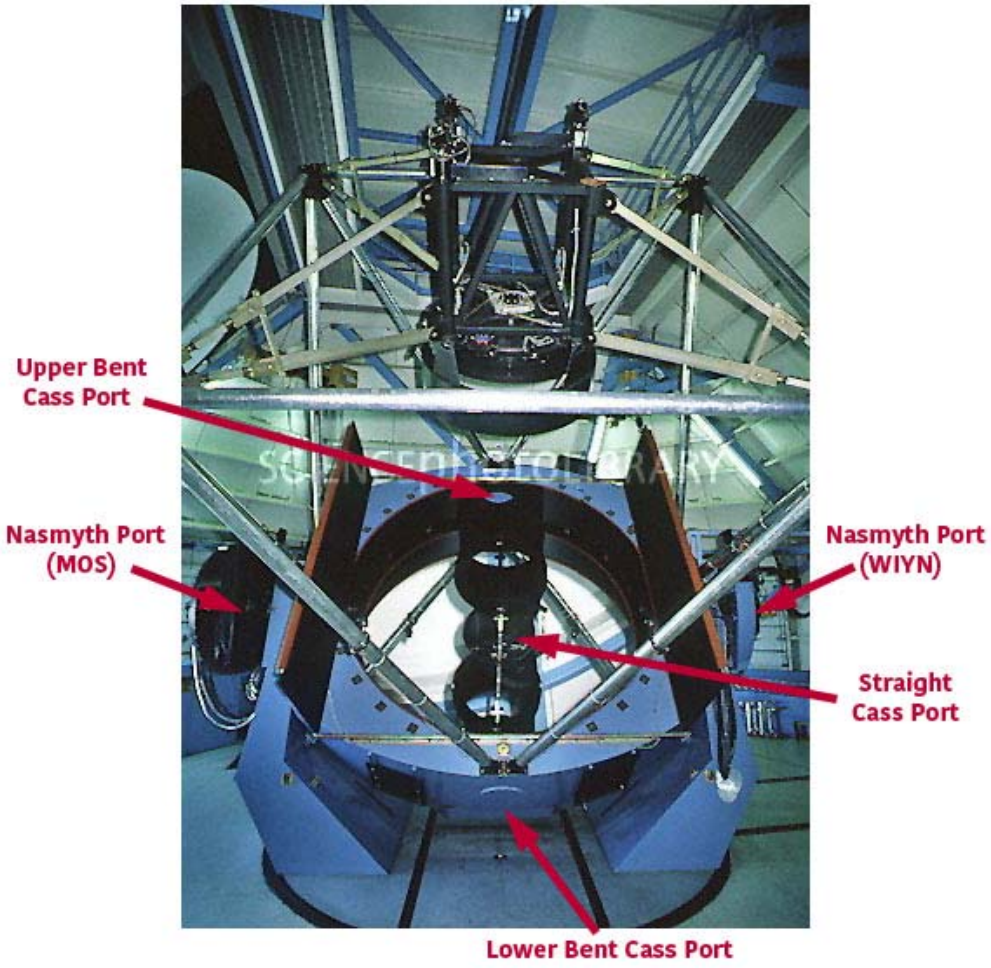




Ports

- **Two fully developed Nasmyth ports:** All current instruments are located on these.
- **Three undeveloped ports:** Two Bent Cass and one Through or Folded Cass. No guiding or de-rotator are currently available.

  Bent Cass: Native f 6.3 beam. Focal distance of about a meter from the mirror cell. Bottom Bent Cass has significant space constraint when telescope is at low elevation.

  Folded Cass: Will need re-imaging optics, since f 6.3 image plane is below the dome floor. Access to tertiary is through this port.



Current Instruments

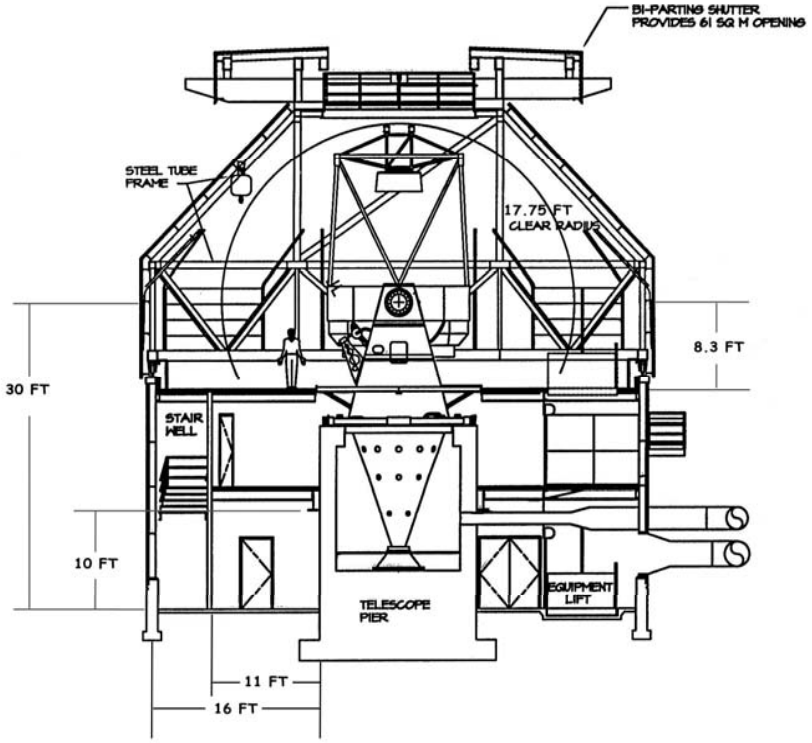
- ODI: Optical imager mounted permanently on one of the Nasmyth ports. Newly upgraded to ~40 arcminute FOV.

On the other Nasmyth are:

- Hydra: Multi-object spectrometer feeding the Bench Spectrograph.
- WHIRC: Near-IR imager with adaptive tip-tilt corrector.
- IFUs: Three fiber bundles, also feeding the Bench Spectrograph.
- WHIRC+IFUs are on an Instrument Adapter module, **and switched out with Hydra in a campaign mode (3-4 months at a time).**

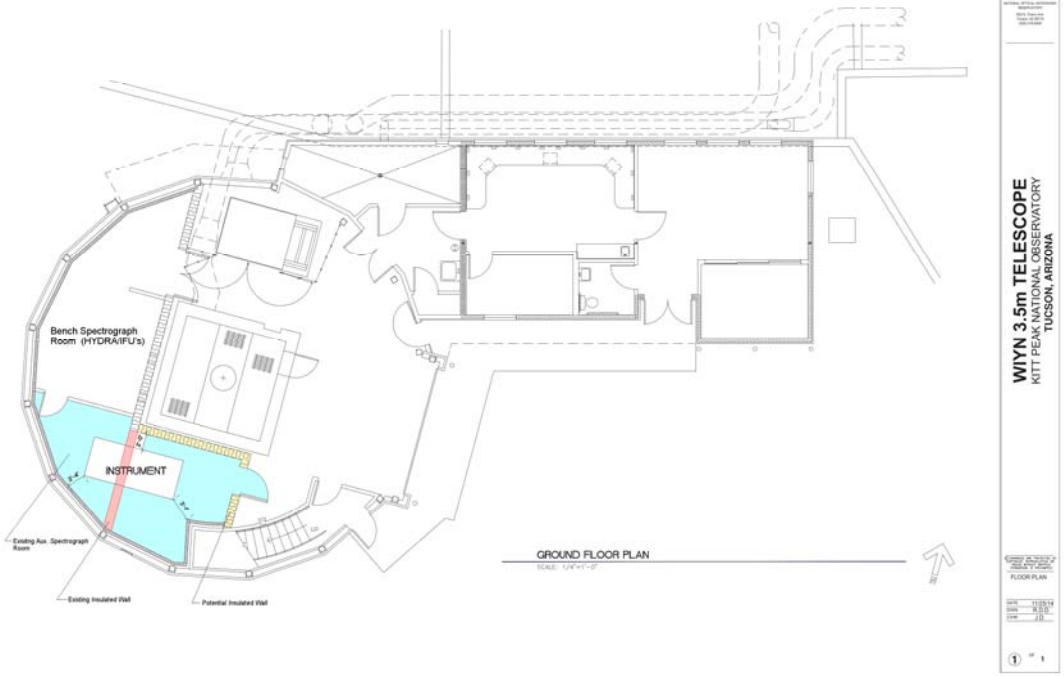
ODI mounted at Nasmyth port

CRW(1



WIYN Enclosure Sectional View

Ground floor plan:
Instrument outline shown within blue area is 11.5 ft x 5 ft.



Slide 6

CRW(1 Capps, Richard W (7400), 3/10/2015

Performance

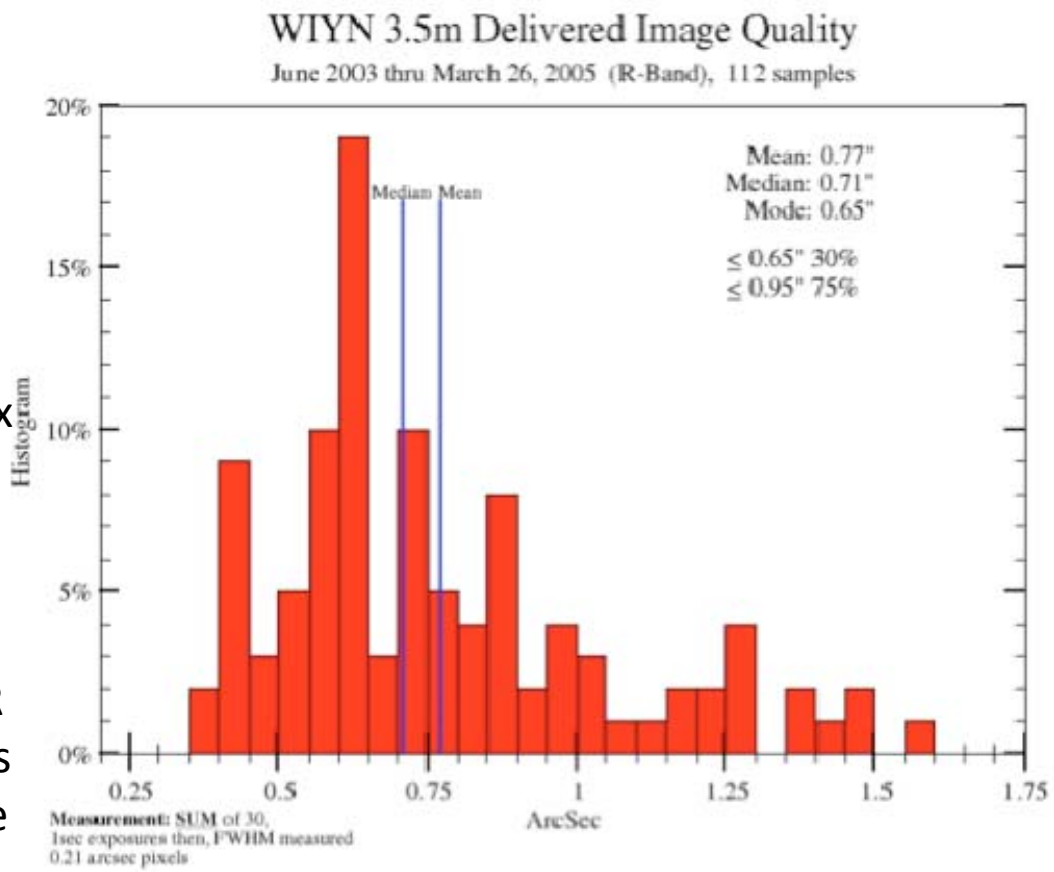
Image Quality

WIYN has good image quality over a wide field.

Seeing is usually variable over fairly short (hours) timescales.

Focus: Active focus correction required to exploit the good seeing. Focus-temperature relation is complex and has been difficult to calibrate. FWHM can change by 10% in 5-10 minutes.

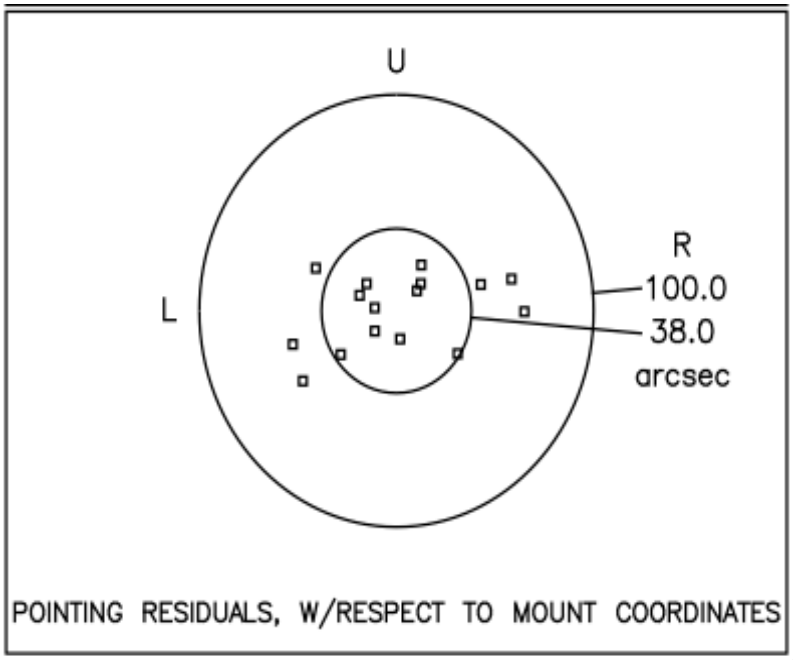
The Instrument Adaptor module provides focus correction. The near-IR imager has dedicated tip-tilt and focus correction as well. ODI has focal-plane ROI video that is used to monitor FWHM.



Performance

Pointing

Current “blind” pointing error is ~ 30 arcseconds RMS. Routine pointing strategy for current operation is offset pointing: go to a bright star within the guider field (typically a few arcmin) then offset to field center. Offset pointing is accurate to sub-arcsecond.



Performance

Wind Shake

Wind is a significant factor (light telescope, tight dome).

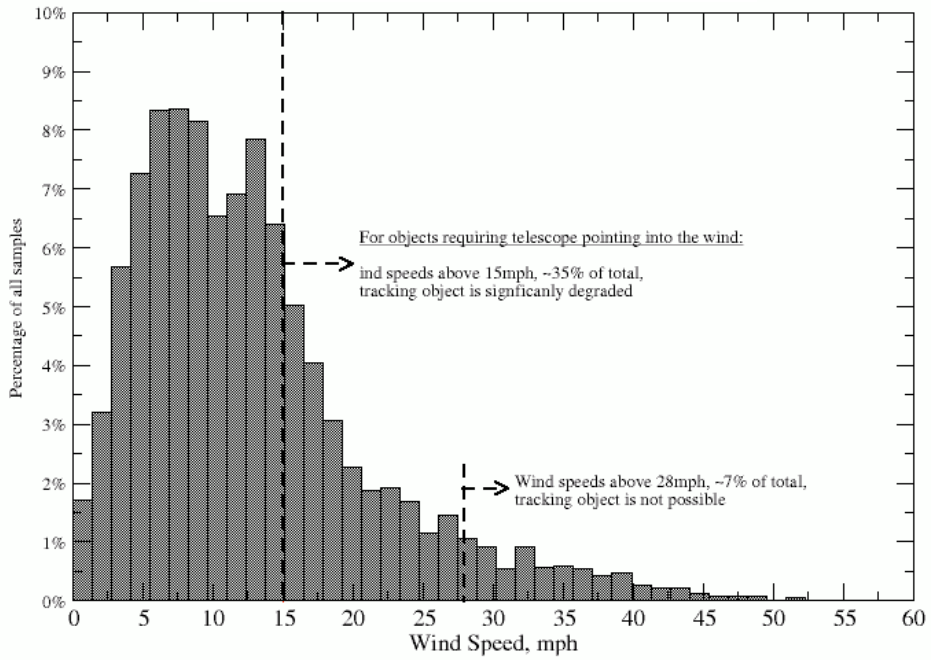
45 mph is closing limit.

Tracking is severely affected/ not feasible at >28 mph (7% of the time).

But image quality can be significantly affected at 15 mph (arcsec jitter).

Up to 30% of sky can be affected.

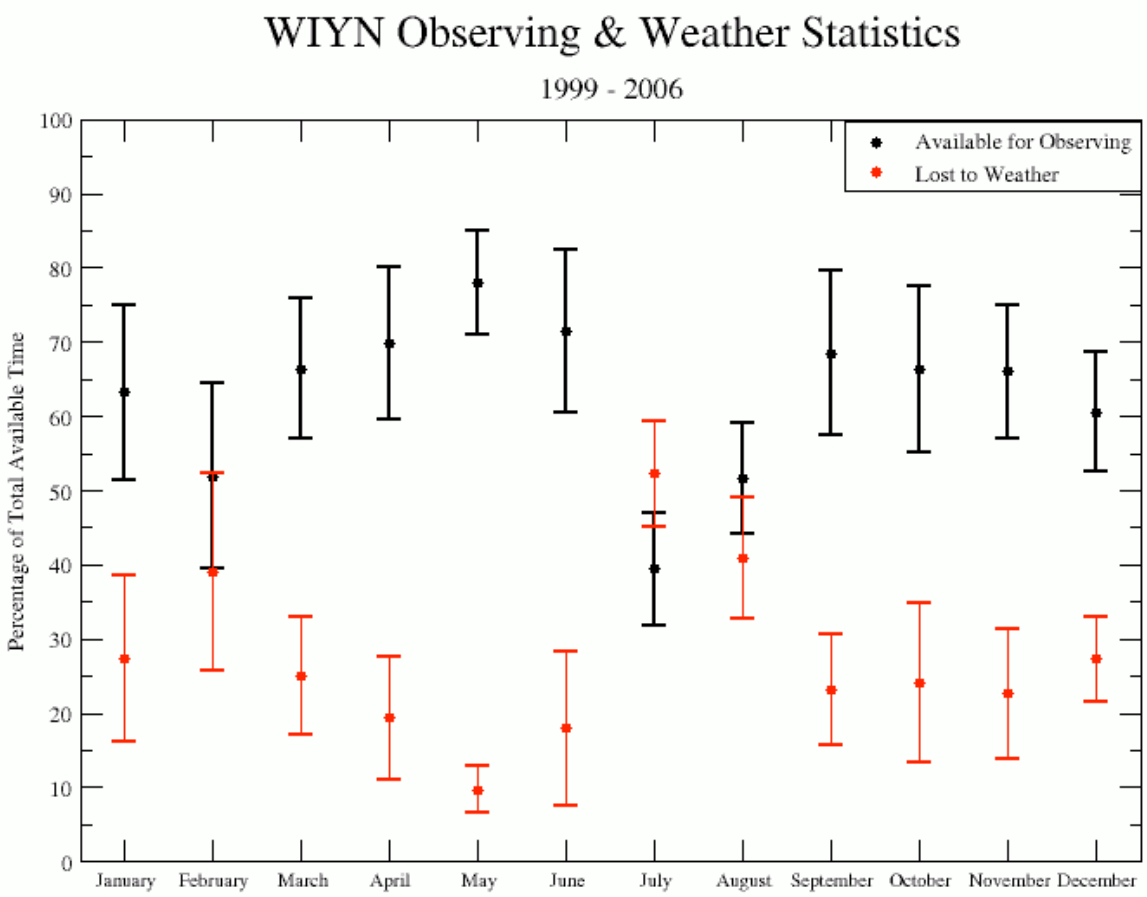
Wind data, 2013



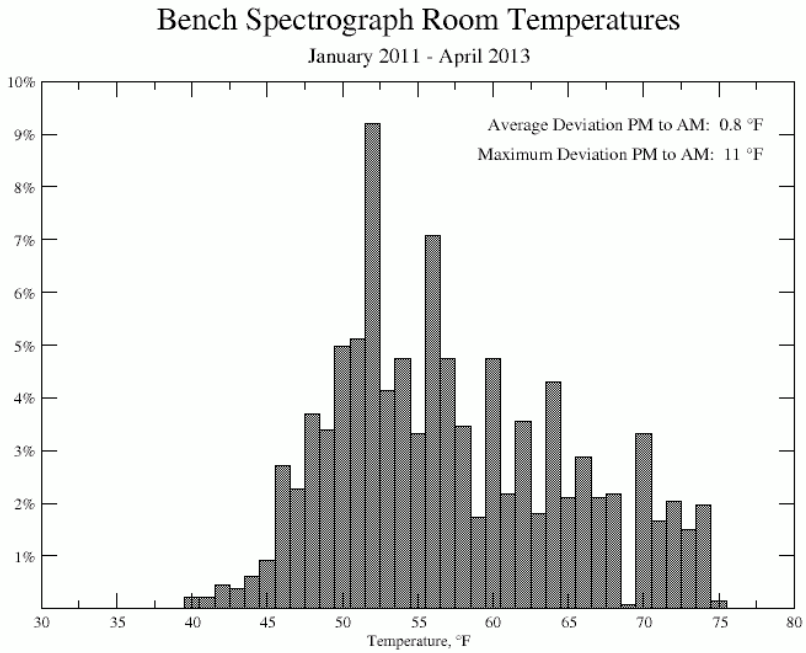
Weather

Monsoon season (Jul-Aug) can have >50% weather loss.

3-4 week shutdown in August.

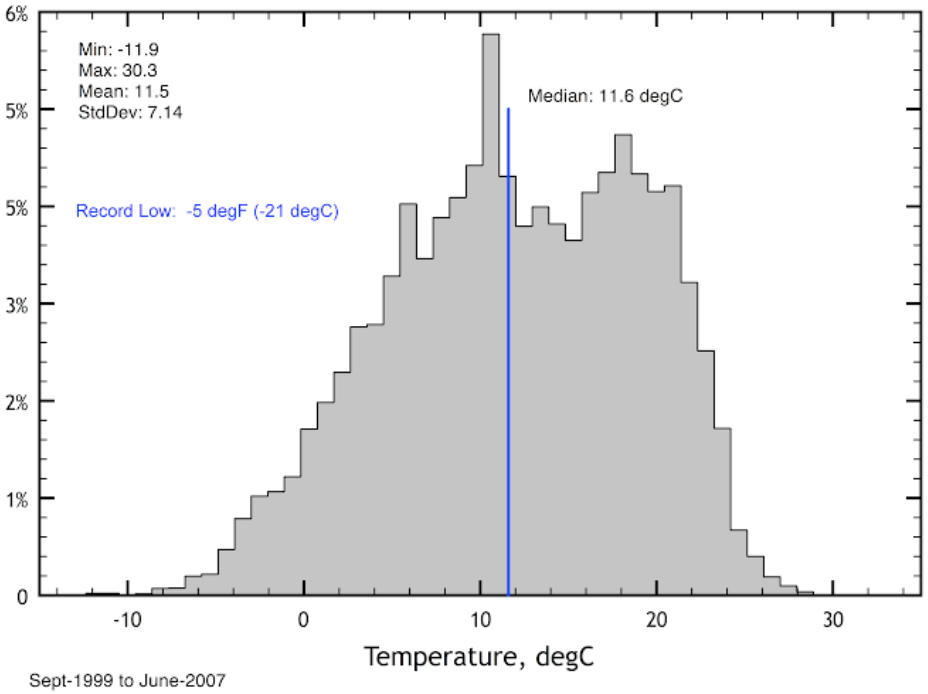


Temperature variations



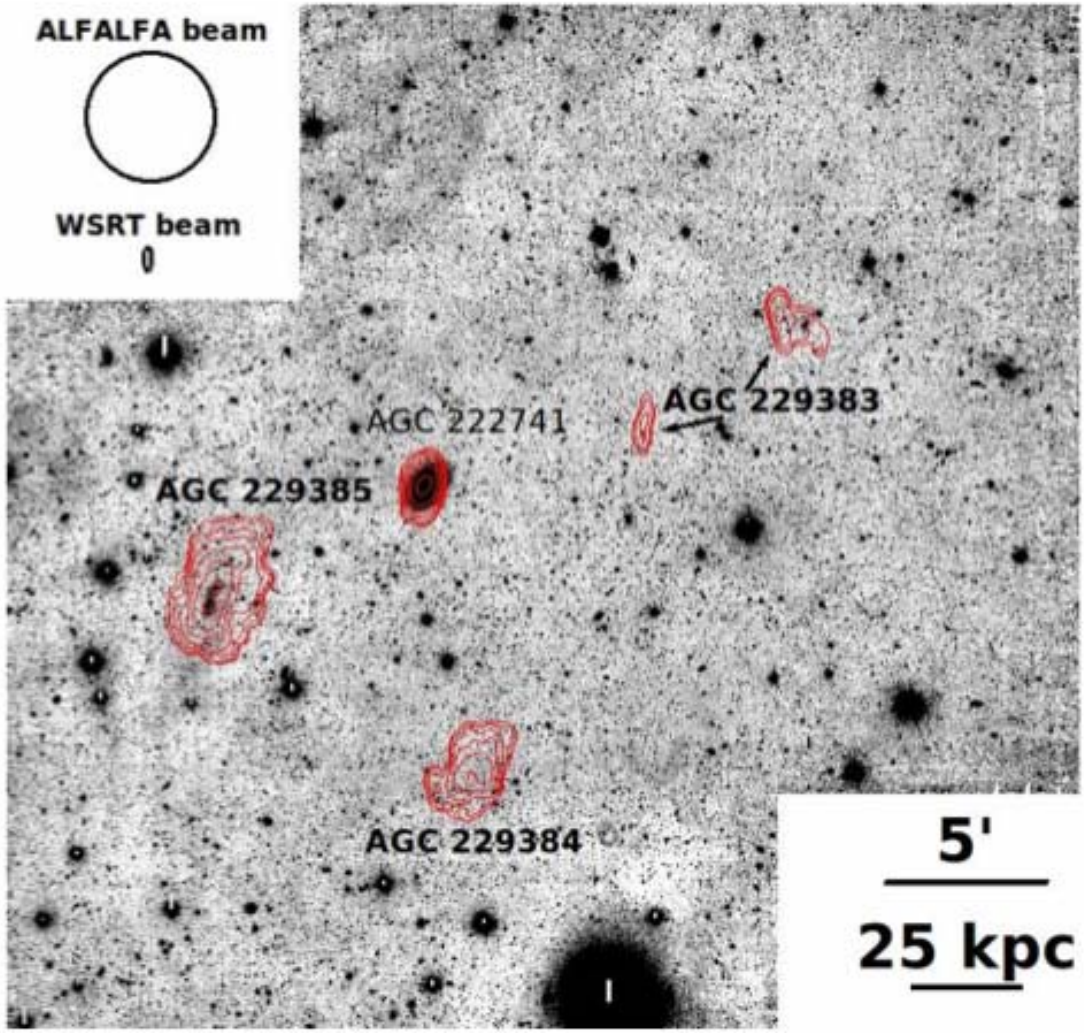
Bench Spectrograph Room

Ambient

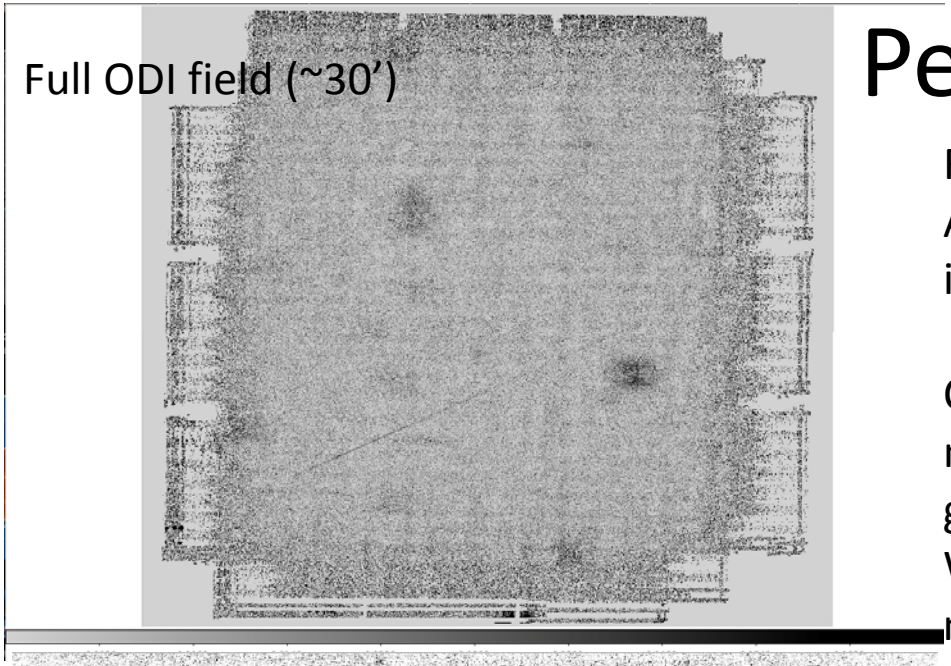


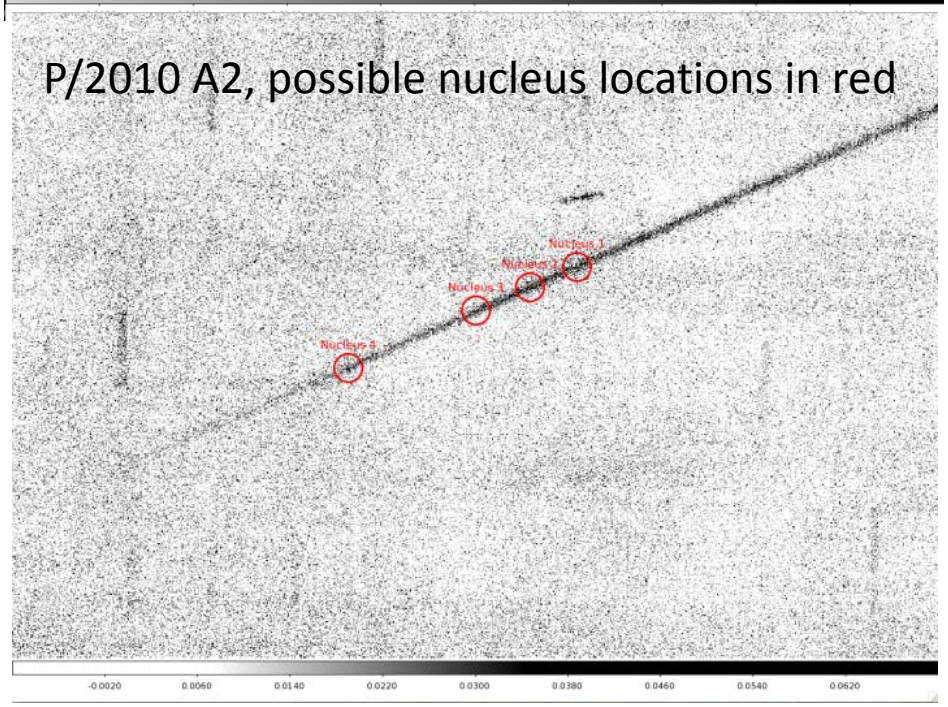
Performance: Science

Janowiecki et al 2015: ODI deep Image (g', r', i') showing detection of low surface brightness galaxies. Features on top left are galactic cirrus, showing exquisite sensitivity to faint light at deep exposure. FWHM is 0.7 to 0.9". FOV is ~0.5 degree. Proof of pointing, tracking, guiding, flat fielding and illumination correction for multiple-hour exposures.

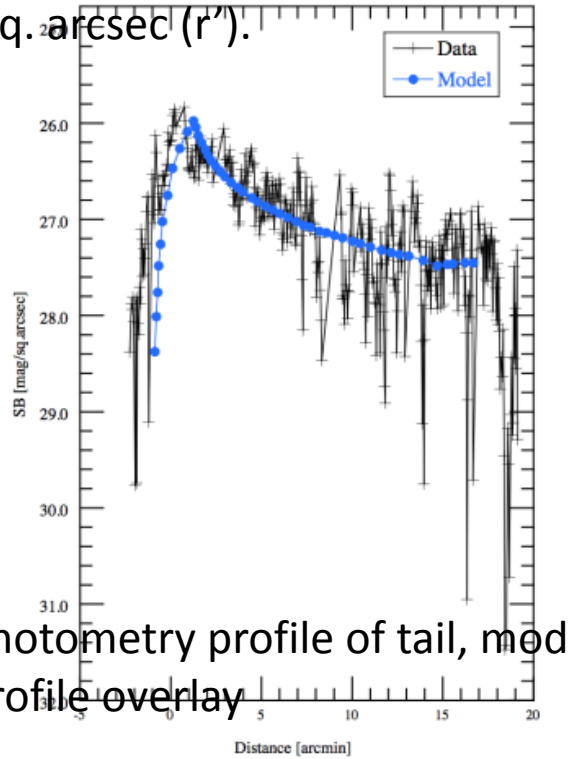


Performance: Science





Rajagopal et al. 2015, in prep:
Asteroid P2010/A2, caught disintegrating into dust, appears as a streak extending about half-degree.
Challenging deep exposure over multiple nights with non-sidereal tracking, guiding.
Wide field. Photometry depth > 27 mag/sq. arcsec (r').



Photometry profile of tail, model dust profile overlay

Port Possibilities

Current instrument suite is located on the two Nasmyth ports. Fully developed with field de-rotators, atmospheric dispersion correction, acquisition, guiding, and focus correction. Spectroscopy instruments have access to calibration sources. Flat fielding is through dome flats.

Port	Mass limit	Moment limit
Bent Cass	400 kg	2000 N-m
Folded Cass	300 kg	12,500 N-m
Nasmyth (IAS)	1000 kg	3000 N-m

The undeveloped ports (2 Bent Cass and 1 Folded Cass) will possibly need:

1) Field Rotator
2) Acquisition/Guider
3) Focus error tracking
4) Sufficient focal back plane spacing to accommodate instrument deployed
5) Wavefront measurement capability

More detail (clearances, mounting plate sketches, FOV etc.) available in EPDS Docs Library

Requirements will be part of ICS study with implementation responsibility delegated to NOAO

Closing

- EPDS web page (FAQ and Document Library)

  https://exep.jpl.nasa.gov/epds/workshop/

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- Floor open for discussion