Science with HET

What you need to know, how to get good data

from proposal to publication

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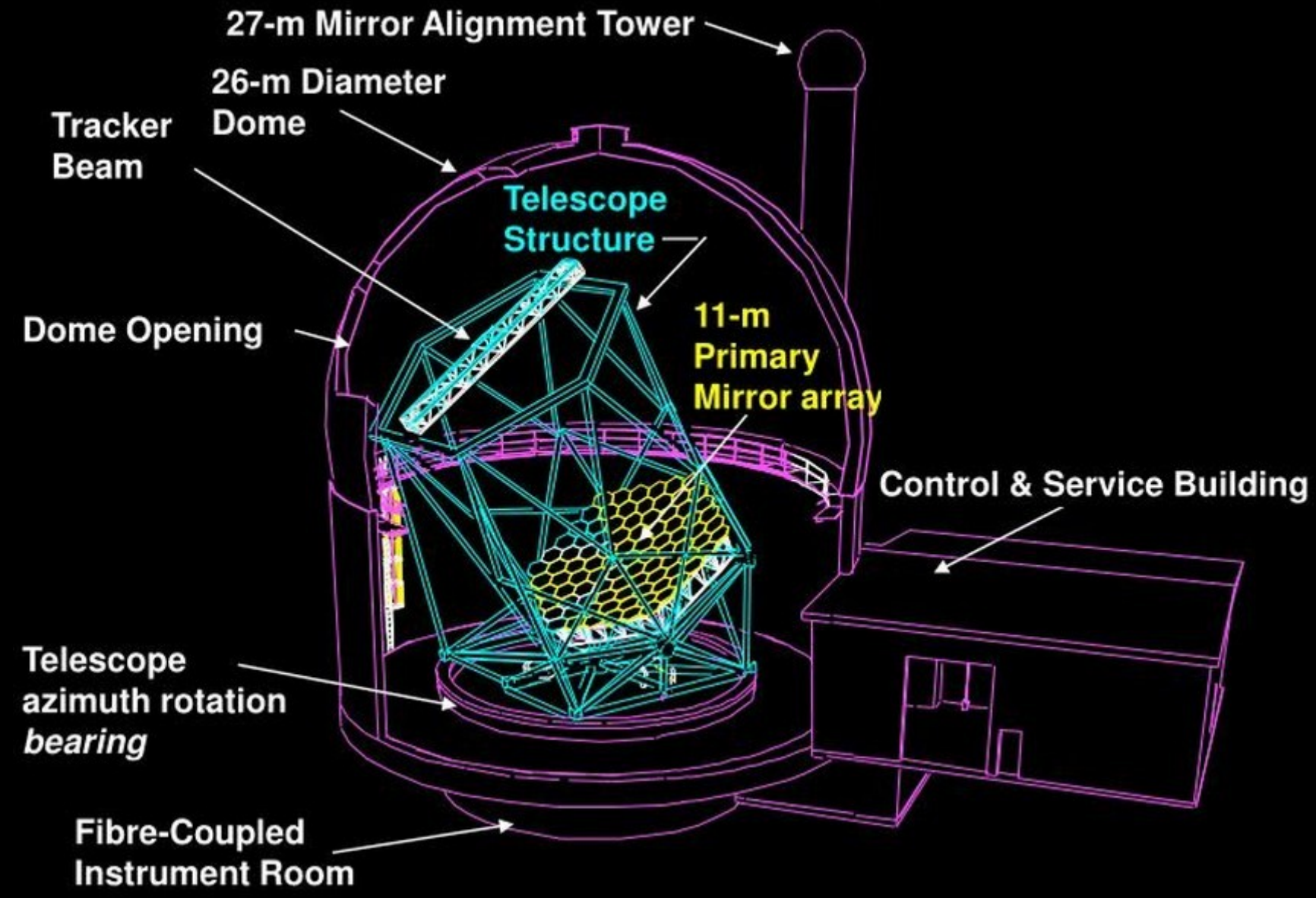
HET Science Operations Manager

Outline

- Telescope system overview
- Goals of HET science operations
- Phase II
  - Critical TSL keywords
  - Common mistakes/suggestions
- Phase III
  - Feedback and information about your data

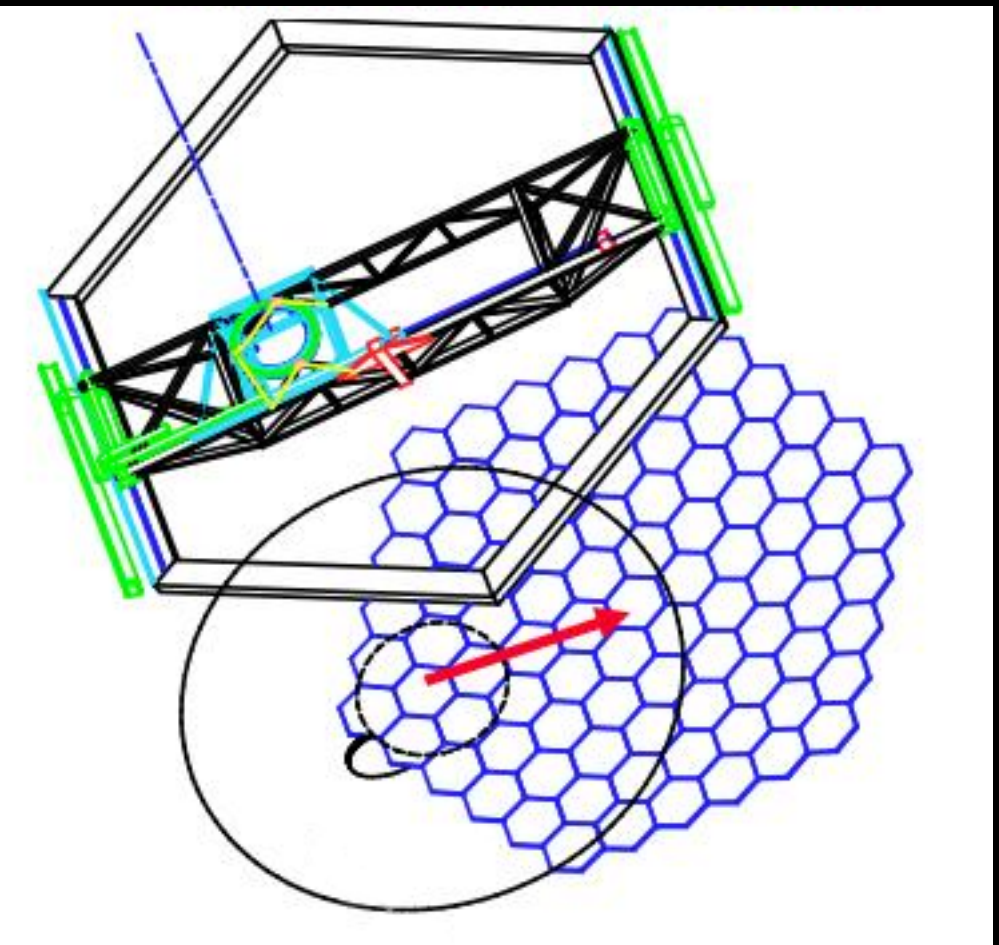
The telescope



“Tracking” targets

Fixed elevation (55 deg), move mirror only in azimuth

Move “tracker” to follow objects on the sky



Requires strategic planning through queue observing to optimize telescope time use.

At center, area of 8.5m mirror (unobscured)

At edge, area of 6.1m mirror (~50% of possible!)

Example of tracking

Consider observing a target in the east:

Mirror/structure points E

Tracker moves to top, then tracks downwards as target rises (following reflection)

“track” = “trajectory”

Pointing east with stars rising vertically

Pointing east with stars rising vertically

Pointing east with stars rising vertically

Pointing east with stars rising vertically

Pointing east with stars rising vertically

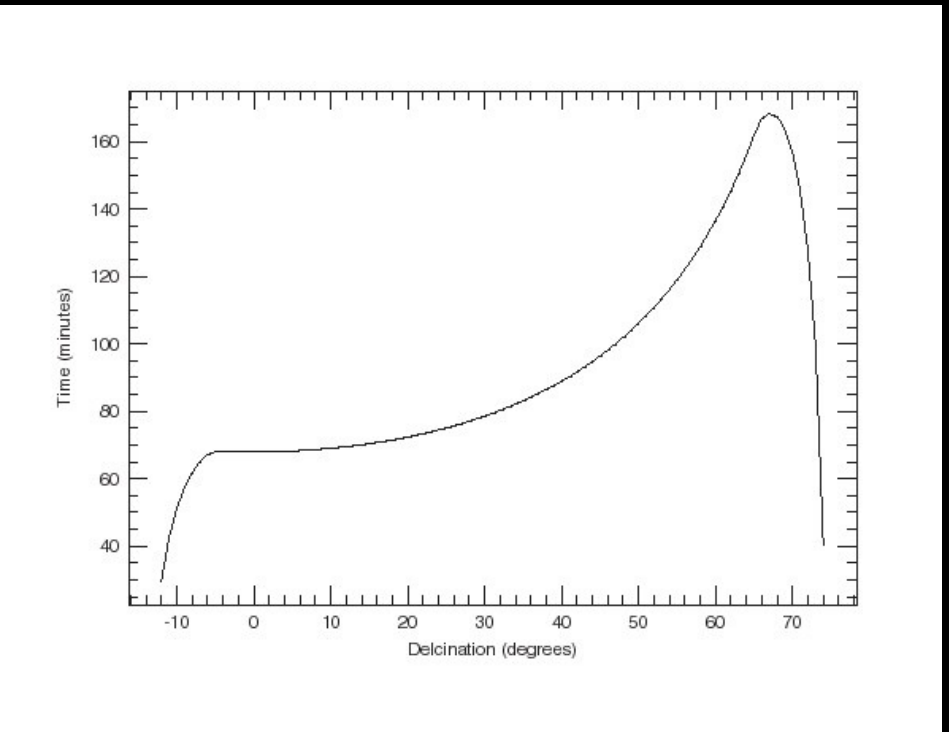
Pointing east with stars rising vertically

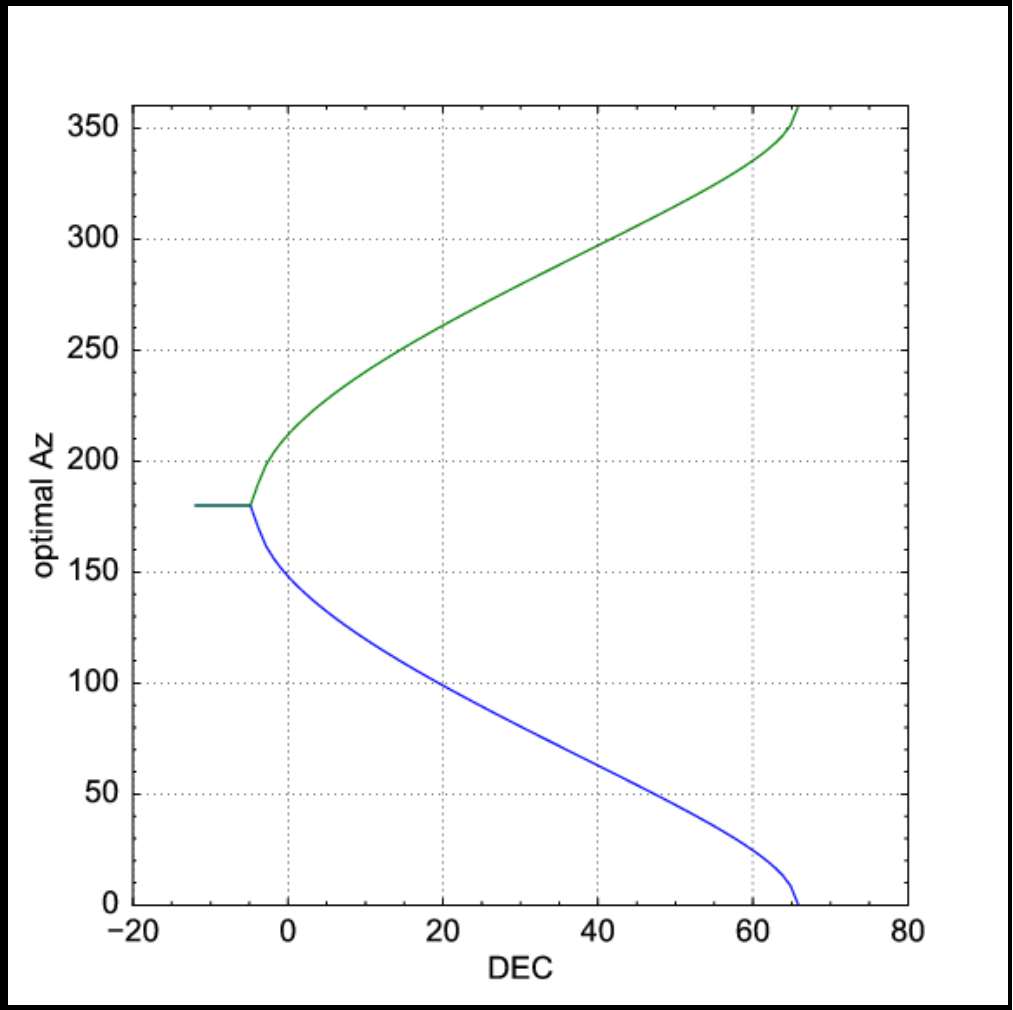
Optimal tracks
declination vs azimuth

Most declinations have E and W tracks

Extreme N and S have a single track

Track length varies from 30-170min!

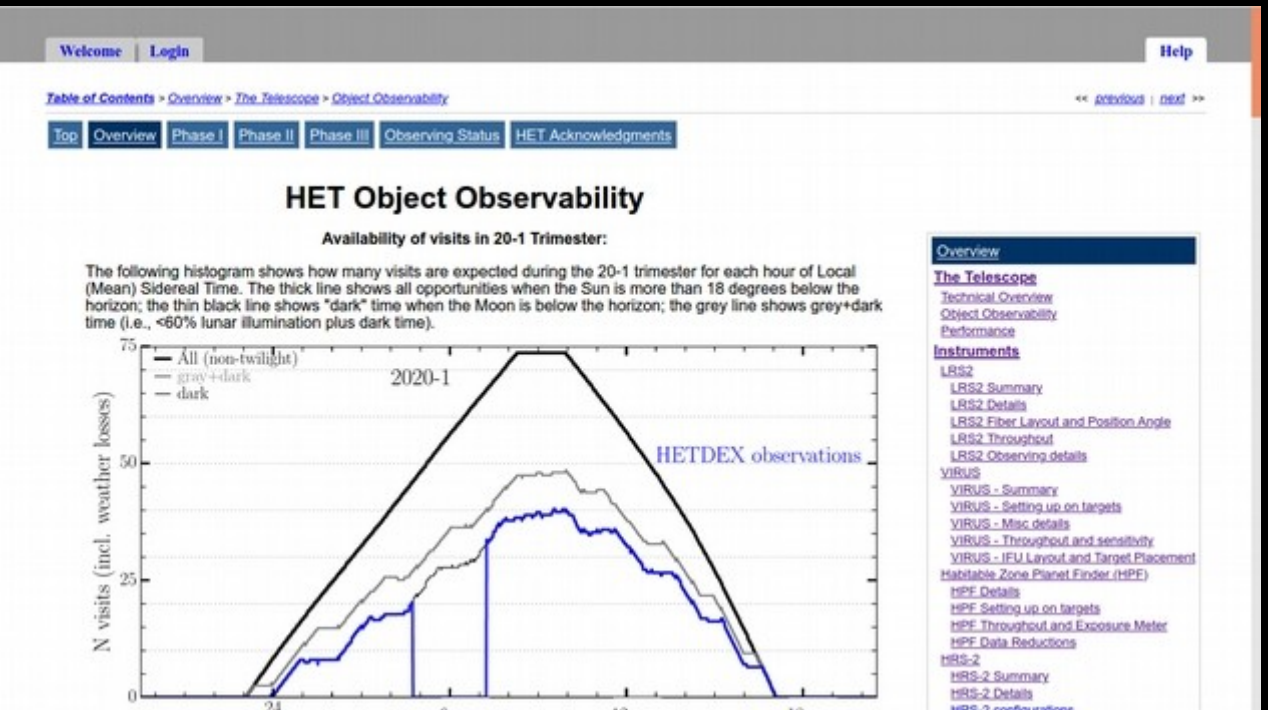


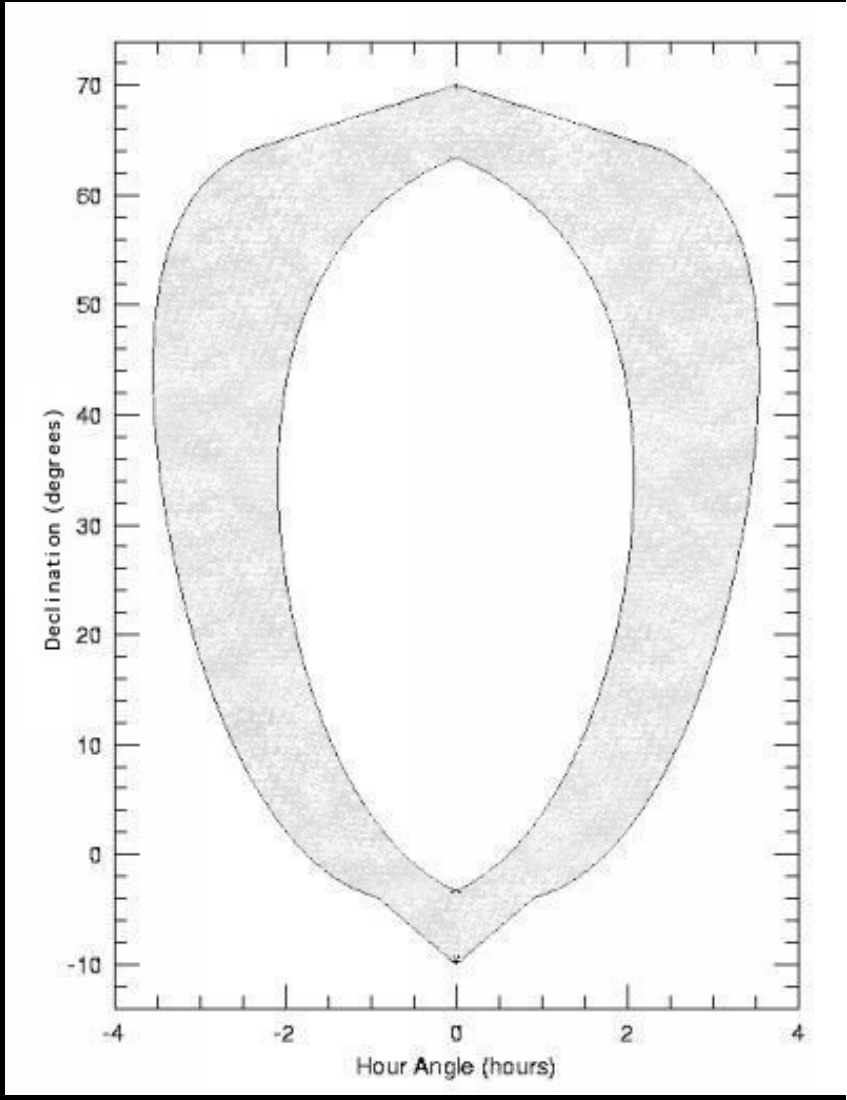


Planning targets

Observability annulus, conceptually useful if planning one or two targets

We provide automated tools on: hydra.as.utexas.edu/?a=help&h=1





Tool to see availability of visits for programs of any size:

https://github.com/sjanowiecki/HET_observability

HET science ops goals

Primary aim: **program completion**

TACs allocate priorities/time to PIs for programs;
we try to complete all requested observations
and achieve quality requirements

We can only observe the targets that PIs submit
In 19-3, PIs at UT only used 71% of allocated hours

Don’t hesitate to contact us (early and often) if the
documentation does not answer your questions

Phase II

https://hydra.as.utexas.edu/?a=help&h=49

submitting technical details about your observations

Many keywords in Target Submission Language (TSL), some optional

NB: we automatically assign proper motion if none specified, using positional matching with GAIA catalog – set your PM!

Some obvious keywords (RA, Dec, exposure time, etc)

others can be more subtle and have impacts:

- sky condition requirements
- setup method
- grouped observations
- synoptic constraints
- SNGOAL for HPF

Full TSL details: https://hydra.as.utexas.edu/?a=help&h=73

Sky conditions

SKYTRANS = ‘N’, ‘S’, ‘P’ Transparency: <50%, 50-95%, >95%
__N__ot spectroscopic, __S__pectroscopic, __P__hotometric

SEEING = FWHM in arcsec rarely sub-arcsecond, typically FWHM 1.2” - 2.5” during science

SKYBRIGHT_G = 14 - 23 mag/arcsec^2 sky surface brightness
_R, _I are measured in SDSS g/r/i filters
Typically 18 is suitable for bright time.

We take these seriously, so give realistic constraints for your scientific requirements whenever possible.

Setup method

Or, how we acquire your targets

An Acquisition Camera can be inserted into the beam:

“DirectACAM” setups for LRS2 and HPF use this camera to actively “guide” your target into correct position, then it retracts.

“ACAMblind” setups for LRS2 and VIRUS use blind offsets to nearby stars to position your target as requested.

“HPFACAM” setups use the specialized HPF acquisition camera which has very fine pixels for high precision setups on bright stars.

“DirectGuider” is a specialized setup intended for HETDEX where we use the known positions of pre-selected guide stars to do a very fast (1-4 minute) low-precision setup which is useful for VIRUS.

Instrument	LRS2	VIRUS	HPF
Avg setup*	6.2 min	4.5 min	6.9 min

*Averages from Sep2019-Jan2020; we advise assuming a 10min setup for planning purposes

Grouped targets

Targets may be submitted in groups, defined by **GNAME**

Must be a unique name for each group.

Important to specify type of group (**GTYPE**):

To be observed on the **same** night:

- "SEQ" must be observed in precisely this order
- "AND" may have other observations between members

To be observed across **multiple** nights:

- "ORD" may have other observations between members
- "POOL" only observes **NUMTODO** targets from group

"SEQ" often used to take sky spectra immediately after targets

Synoptic constraints

SYNDATE: restricts observations to certain nights (using UT dates)

N.B. “<” means “<=” and “>” means “>=”

“>20200101” means on/after Jan 1 2020 UT (civil night of Dec 31)

“20200102-20200105” means on those 4 nights only

SYNFREQ: requested min and max frequency between visits

“RAND1-2” means min of 1 day between visits, max of 2 day (e.g., cannot be observed twice on same night)

“RAND4-6” means a target goes on “hold” for 3 nights after it is observed, and that at most 6 days should pass between visits

Phase-blocking is also an option, but little-used since more complex.

SN goal (HPF only)

SNGOAL: desired SNR for spectra taken with HPF, as defined by HPF team as continuum SNR at 1.07um in Order #18

Can calculate with HPF exposure time calculator:
http://psuastro.github.io/HPF/Exposure-Times/#hpf-exposure-time-calculator

Very useful for the RAs to know what SNR you expect.

Common mistakes/misunderstandings

"Visit" = number of separate times to set up on and observe source
(note, could have E visit and W visit on same night, 1/track)

Longer visits are not always better: pupil illumination drops to ~50% near the start/end of most trajectories. Two short visits may give you more photons (per minute of time) than one long.

Always assume a 10-minute setup time when estimating feasibility. While our setup times are often faster, this prevents running out of track before the end of your requested exposure time.

Completion rates at each priority are higher than some assume:

	Pri 0	Pri 1	Pri 2	Pri 3
19-2	96%	89%	91%	72%
19-3	95%	91%	89%	65%

Phase III

https://hydra.as.utexas.edu/?a=help&h=8

Queue observing means you can optimize your program throughout the trimester

Each night we observe targets for you, you get an email
- Observed targets are also in your Hydra PI interface

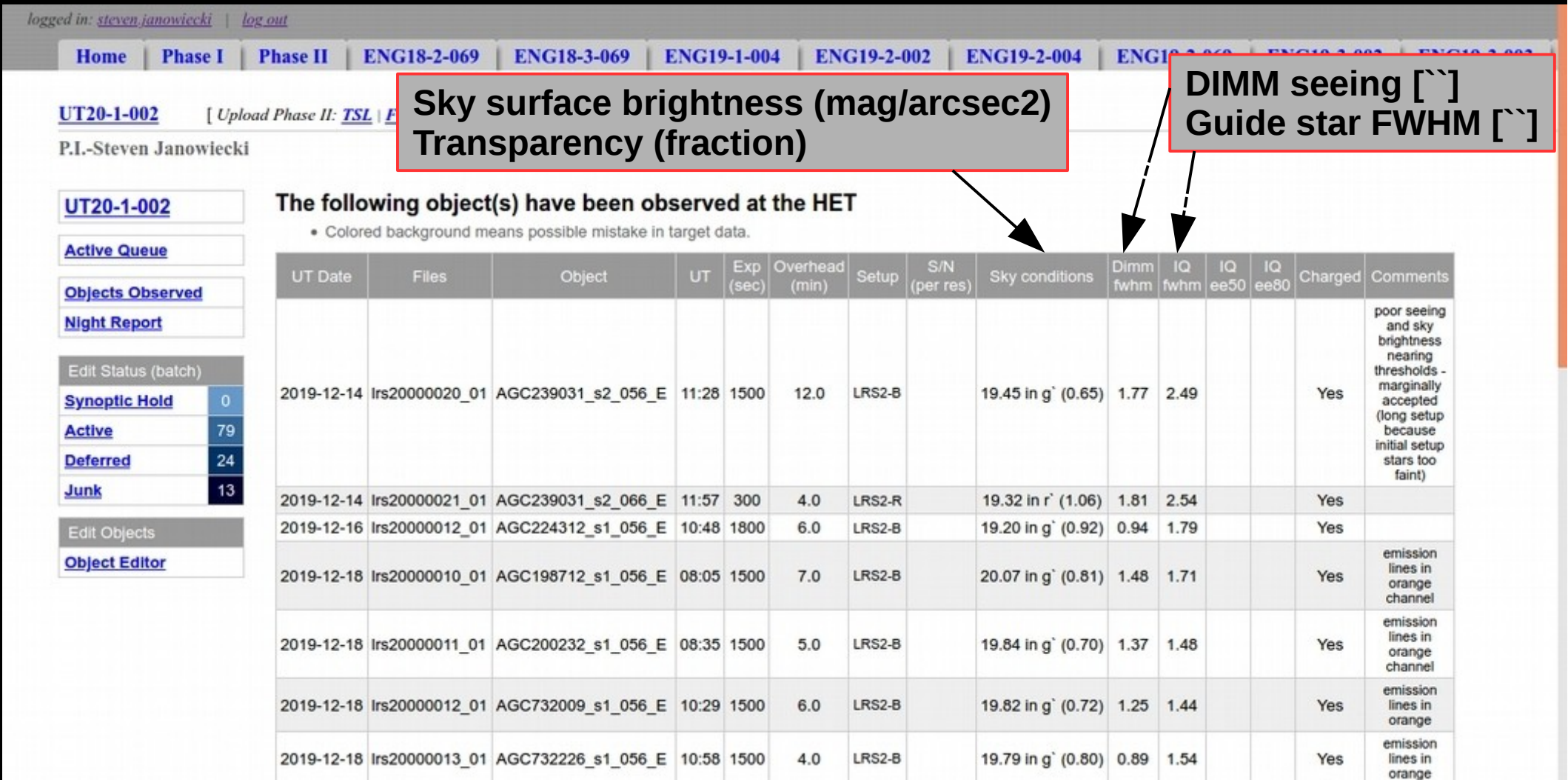
If quality does not meet your requirements, get in touch
- Observations can be “rejected” and re-observed

It pays to be pro-active!

Feedback and info about your data

New sky quality information in “Objects Observed”

(still a relatively new feature! If you find errors/bugs, let us know)



logged in: steven.janowiecki | log out

Home | Phase I | Phase II | ENG18-2-069 | ENG18-3-069 | ENG19-1-004 | ENG19-2-002 | ENG19-2-004

UT20-1-002 [Upload Phase II: TSL | F

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UT20-1-002
Active Queue
Objects Observed
Night Report

Edit Status (batch)

Synoptic Hold	0
Active	79
Deferred	24
Junk	13

Edit Objects
Object Editor

The following object(s) have been observed at the HET

- Colored background means possible mistake in target data.

UT Date	Files	Object	UT	Exp (sec)	Overhead (min)	Setup	S/N (per res)	Sky conditions	Dimm fwhm	IQ fwhm	IQ ee50	IQ ee80	Charged	Comments
2019-12-14	lrs20000020_01	AGC239031_s2_056_E	11:28	1500	12.0	LRS2-B		19.45 in g` (0.65)	1.77	2.49			Yes	poor seeing and sky brightness nearing thresholds - marginally accepted (long setup because initial setup stars too faint)
2019-12-14	lrs20000021_01	AGC239031_s2_066_E	11:57	300	4.0	LRS2-R		19.32 in r` (1.06)	1.81	2.54			Yes	
2019-12-16	lrs20000012_01	AGC224312_s1_056_E	10:48	1800	6.0	LRS2-B		19.20 in g` (0.92)	0.94	1.79			Yes	
2019-12-18	lrs20000010_01	AGC198712_s1_056_E	08:05	1500	7.0	LRS2-B		20.07 in g` (0.81)	1.48	1.71			Yes	emission lines in orange channel
2019-12-18	lrs20000011_01	AGC200232_s1_056_E	08:35	1500	5.0	LRS2-B		19.84 in g` (0.70)	1.37	1.48			Yes	emission lines in orange channel
2019-12-18	lrs20000012_01	AGC732009_s1_056_E	10:29	1500	6.0	LRS2-B		19.82 in g` (0.72)	1.25	1.44			Yes	emission lines in orange
2019-12-18	lrs20000013_01	AGC732226_s1_056_E	10:58	1500	4.0	LRS2-B		19.79 in g` (0.80)	0.89	1.54			Yes	emission lines in orange

HET science operations

We are here to get you the best HET data possible!

To help us do that:

- submit targets early and accurately
- verify your data quality as they come in
- request new features if they don’t exist
- request information/help if documentation is inadequate

Help us make HET perform at the highest levels, and please make good use of your privileged access to a 10m-class telescope, with data reduction pipelines for all instruments!!

This is an amazing opportunity.

Further resources

Overview of HET documentation on Hydra:
https://hydra.as.utexas.edu/?a=help&h=1

Object Observability page on Hydra:
https://hydra.as.utexas.edu/?a=help&h=20

Trimester reports:
https://het.as.utexas.edu/HET/hetweb/TACReport/tacreport.html

Contact the Resident Astronomers at:
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Or me, Steven Janowiecki, at:
janowiecki@utexas.edu