
Planning and Scheduling Software for the Hobby•Eberly Telescope

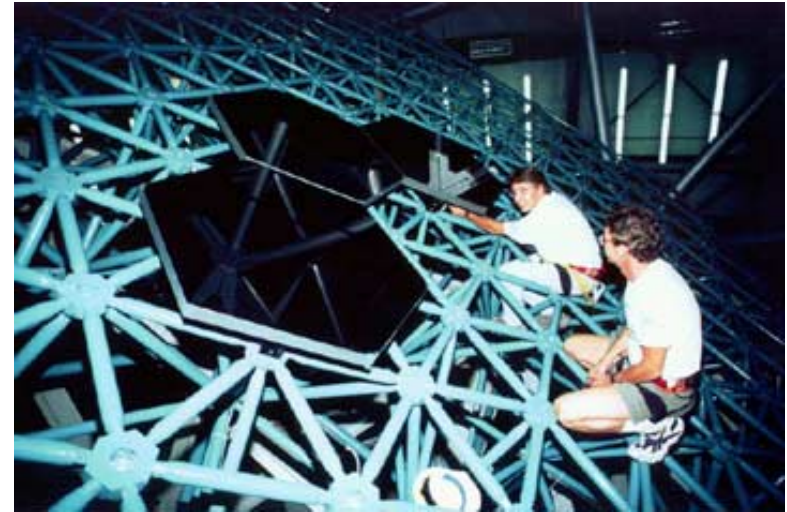
Niall I. Gaffney
Hobby•Eberly Telescope

Mark E. Cornell
McDonald Observatory

What is the HET project?

- ◆ Joint Project: University of Texas at Austin, Penn. State University, Stanford, Ludwig–Maximilians Universität München, and Georg–August Universität Göttingen
- ◆ 9.2–meter class Arecibo–style optical telescope at fixed 55° elevation angle
- ◆ Located at McDonald Observatory near Fort Davis, TX
- ◆ First light expected in Fall 1996
 - Currently 3 of the 91 1–meter hexagonal segments installed
- ◆ Scientific operations within a year of first light
 - Three facility spectrometers: Fiber fed HRS ($R \approx 60,000$), fiber fed MRS ($R \approx 3,000$), and prime focus LRS ($R \approx 500$)
- ◆ Expect 85% queue scheduled operations by 1998

Images of the HET



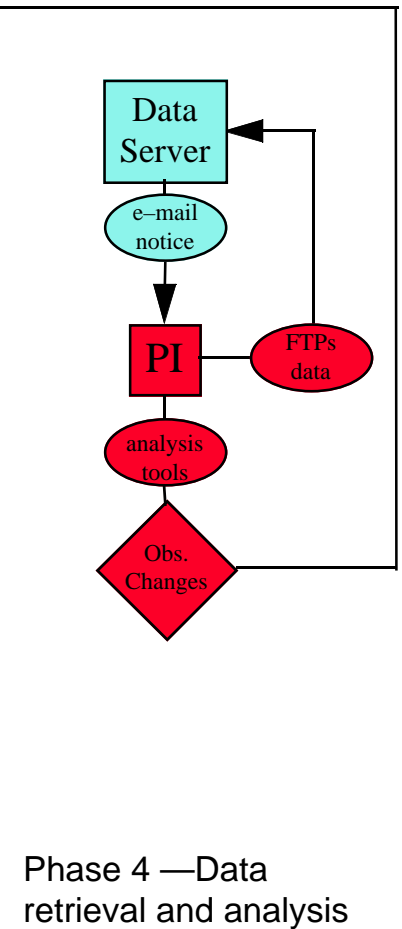
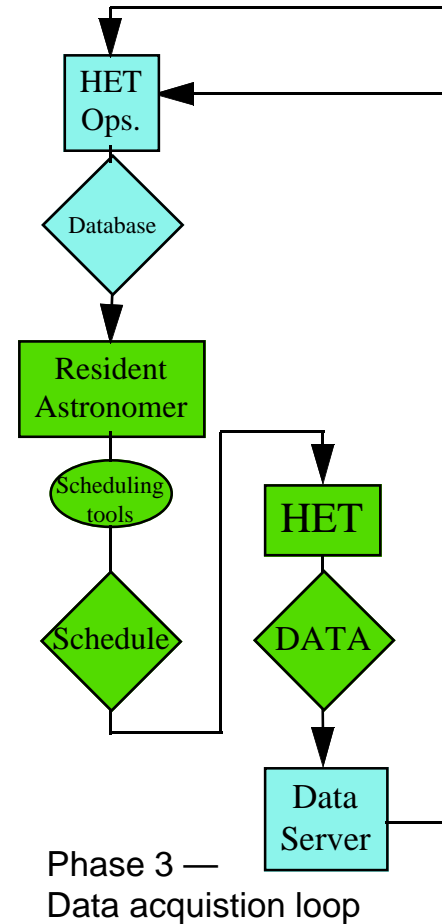
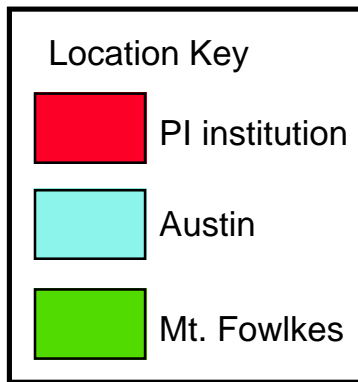
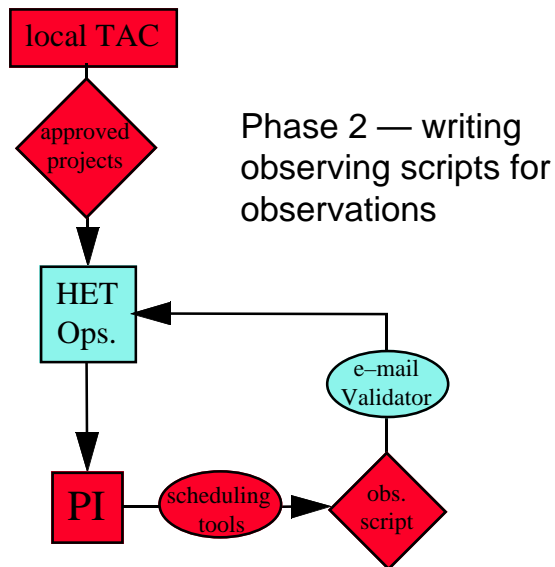
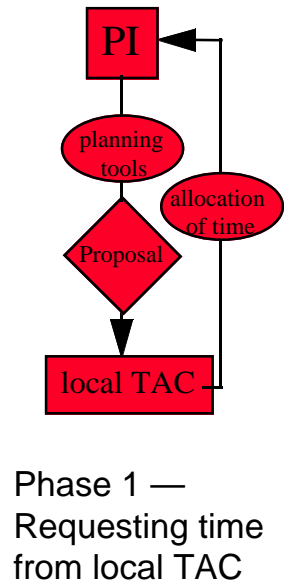
The HET before dome completion in June 1995 (top), first mirror segments installed early June 1996 (top right), and completed HET building (right).



Why is the HET so different?

- ◆ Very constrained problem: telescope rotates in azimuth, but is fixed in altitude
 - HET azimuth determines when/if an RA & Dec is available
- ◆ Sequencing not simple \Rightarrow entire sky NOT available
 - Limited access to, and time on, an object
 - Tracks depend on declination and telescope azimuth
 - Vignetting function depends on track
- ◆ Track time is limited \Rightarrow make detailed plan ahead of time
- ◆ Many projects (and instrument setups) over the course of a night \Rightarrow queue scheduling
 - Requires a written detailed plan in a standard format

HET Process Flow Charts



Proposal and Scheduling Tools

- ◆ HET planning tools consist of
 - Proposing tools (single objects)
 - Scheduling tools (sequencing observations)
- ◆ Made available for local installation (on Sun Workstations)
 - Uses “standard” freely available packages (e.g., PGPLOT)
- ◆ All based on a TCL/TK GUI running as an overlay for a command line program
 - GUI provides users a simple environment for planning individual observations
 - Command line programs allow users to write planning scripts to make calculations for long lists of objects

Example Planning Tool: S/N

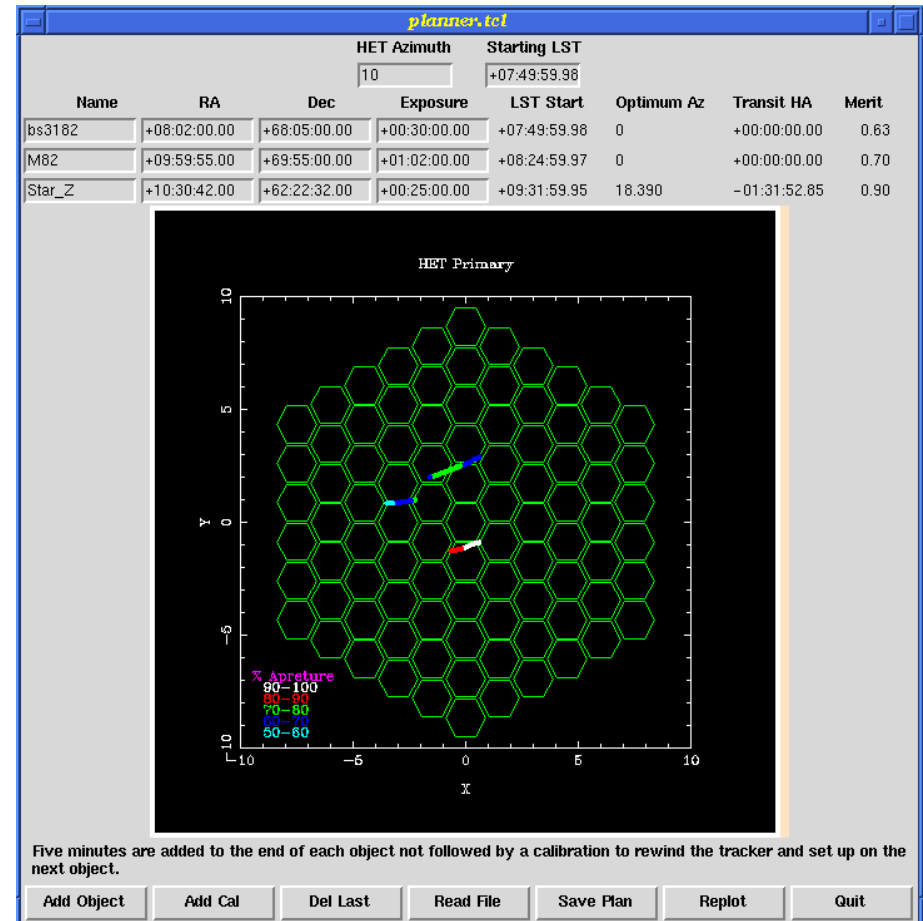
- ◆ Simple tool to estimate performance of the telescope and instruments
- ◆ Estimate S/N or integration time for a particular object given position, instrumental setup, and starting time

The screenshot shows the SN2 software interface with the following data:

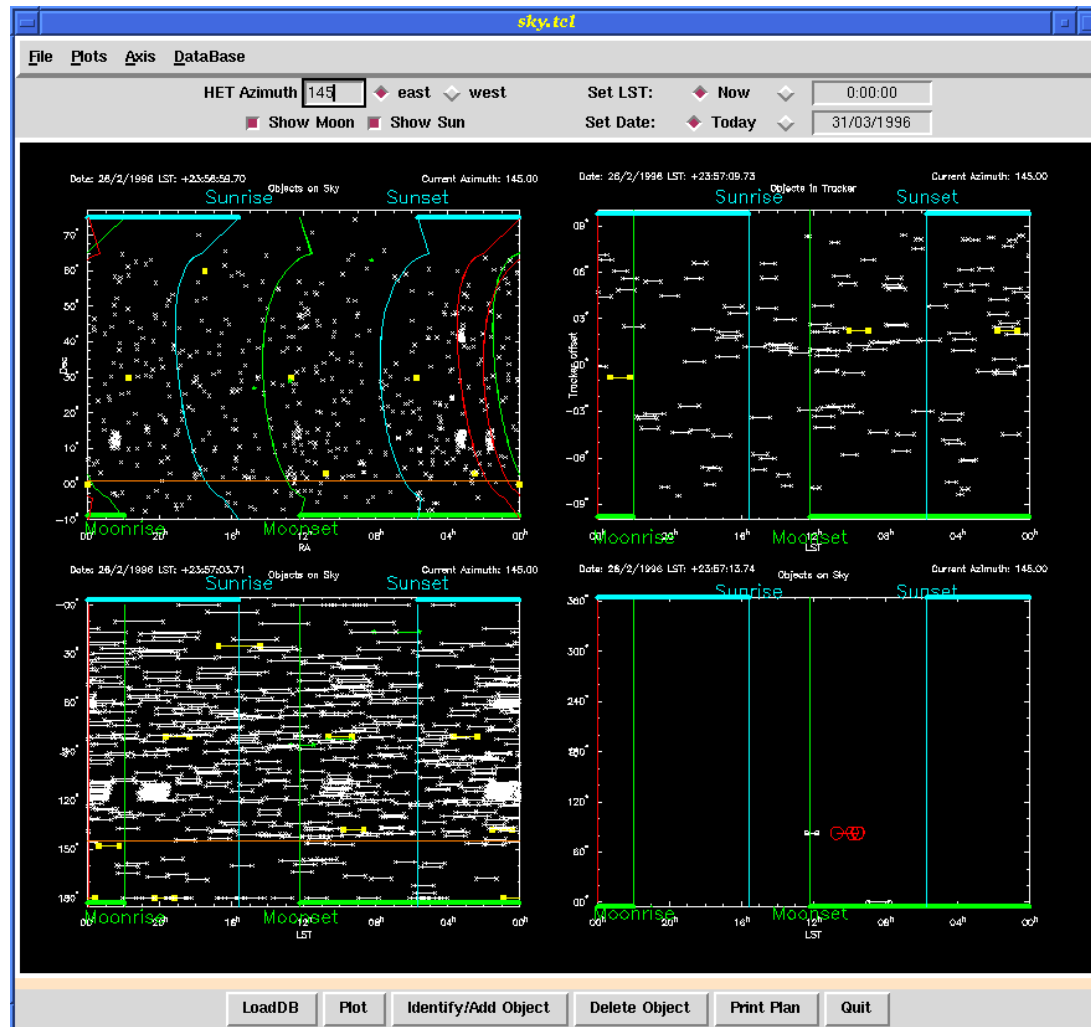
RA	+00:00:00.00	Instrument	UFOE two fibers	
Dec	+65:00:00.00	Resolution	6500	
Lambda (A)	5500	Coadd	1	x 1
Sky (mags)	21.63	Seeing (arcsec)	1.5	
Sky defined by: <input checked="" type="radio"/> Date <input type="radio"/> User				
U. Date	17/09/1996	Opt. Az.	(E) 8.075	(W) 351.925
LST@start	+00:00:00.00	Best LST	+23:15:09.72	+00:43:05.24
Mirrors	91	Earliest LST	+21:57:17.99	+23:25:13.44
Azimuth	0			
Give S/N and Flux				
Flux	14.9	Units	magnitudes	
S/N	50	Track Merit	1.00	
Time (unvignetted)	104.9	Total Time On Object	105.0	
Signal	4057	Dark	1	Background ReadNoise
			21	50
				e-/res element
Quit				

Example Scheduling Tool

- Requires more detailed GUI
- Uses TCL/TK and TKSteal to create imbedded PGPLOT graphics window
- Uses same command line programs to calculate information about individual observations
- Used to see if being “clever” can utilize HET time more efficiently.
- Used to explore how sensitive plan is to start time and telescope azimuth



Manual Daily Planning Tool



Manual Daily Planning Tool

- ◆ Tool used to manually schedule observations over a night
 - Uses TCL/TK as an overlay for a command line driven program
 - Uses the Starbase astronomical database (John Roll, SAO) to keep track of objects
 - » HET specific calculations added to database functions
 - Has different views of the distribution of objects: RA vs. Dec. LST vs. optimum telescope Az., and LST vs. angular offset from the center of the tracker for a given telescope Az.
 - » Allows user to plan in coordinates that make sense to the telescope or in ones that make sense to astronomers
 - Shows regions where sun and moon light may be an issue
 - Detects scheduling conflicts and allows user to reschedule

Planning Observations

- ◆ Similar to HST's Phase II
 - Somewhat less detailed as plans must be flexible for dynamic queue scheduling
 - More complex than WIYN as we will work on many projects in one night
- ◆ Filling out an observing template form
 - Simple keywords for specifying objects, calibrators, calibration lamps, instrument setups, and telescope setups
 - Simple macro language for describing observations
 - Each plan must contain enough information to carry out observation, but not so much as to hinder its completion
- ◆ Proposals submitted and checked via a proc-mail style e-mail reflector

Data Transfer and Distribution

- ◆ Because a project may span weeks to months and tape distribution would require a large number of man hours, HET uses network data distribution
 - Data is transferred from Mt. Fowlkes to Austin via lp queued ftp program (using KPNO's queued ftp scheme by Rob Seaman)
 - Data in Austin is logged and copied into PI's data directory
 - Data retrieved by PI using ftp
 - » can retrieve entire directory as a compressed tar file
 - Transfers are logged
 - Old data that has been collected by PI copied to a tape archive and removed from disk weekly
 - Possible for user to use common ftp mirroring software to automatically retrieve all new data daily

Querying the status of a project

- ◆ Data and proposal security
 - Each PI given password protected WWW and ftp accounts from which data and status information can be accessed
- ◆ Active monitoring via WWW
 - Public information for last night's status available to all (partner share, who got data, weather/seeing conditions)
 - PI Password security for sensitive information (e.g. names, positions, and setups of observations)
- ◆ Active monitoring via modified GNU–finger
 - Parallels mail status under standard Sun finger
- ◆ Passive monitoring via e–mail notification
 - When new data arrives, e-mail is sent to PI notifying him/her of the latest data acquired for his/her project

Supplemental Information

◆ Choosing guide stars

- User is strongly encouraged to pre-select 2 guide stars within 2 to 3' of object
- Currently using the rgsc program to extract HST guide stars
 - » Both WWW interface and proc-mail email reflector
- Plan to also use the USNO-A star catalog when available

◆ Finding charts (FITS images)

- Using modified skyview (GSFC), DSS extracted images, or other user-supplied FITS image
- Object is marked in the FITS header using the XPOS1 and YPOS1 keywords
 - » location of object then automatically marked in SAOimage with cursor