Some ideas for text for ‘Observing’ webpages

Level 1

Observing with SALT

SALT is a fixed altitude telescope, and therefore observing with it is more complicated than observing with most ground-based telescopes. SALT can access ~70% of the sky observable at Sutherland, but only during specific "windows of opportunity". Objects are not always accessible by SALT, even though they may be above the horizon. However, the dates an object can be observed during the course of a year are almost identical to that of a more traditional telescope.

Because of the novel design, namely the fixed altitude (53°) of the telescope and a moving prime focus tracker with a range of only 12° in Hour Angle, SALT can only observe objects that fall within a certain zenith distance ($31^\circ < z < 43^\circ$). This means that the telescope can access a viewing ‘window’ in the shape of an annulus, centred at the zenith (i.e. straight up), but with radii 31° and 43° respectively.

The following is an Hour Angle vs Declination plot of SALT’s viewing window:
Tracking objects involves moving the tracker and its payload as shown in the following diagram:

The tracker can move in X & Y by 3.25 metres in total while the payload itself can tilt by ±8.5º from the Z-axis (perpendicular to X and Y).
Thus an object can be acquired and tracked so long as the tracker/payload stay within the above translational ($\pm 1.625 \text{ m in} \ X \text{ or} \ Y$) and rotational ($\pm 8.5^\circ$ in tip/tilt) limits. SALT can therefore track an astronomical object once it is inside the viewing annulus. Objects rising in the east can be observed as soon as they are $\sim 43^\circ$ from the zenith and can be followed as they rise until they either leave the annulus at $\sim 31^\circ$ zenith distance, or, alternatively, when the tracker hexapods are at their maximum tilt (8.5$^\circ$ from the nominal 37$^\circ$ tilt angle of SALT). A similar situation exists for object setting in the west. In principle it is therefore possible at certain times of the year for an object to be observable twice a night, before it culminates and after.

The following figure demonstrates how the entrance pupil of the telescope “migrates” over the mirror array, leading to a varying collecting area, which is at its maximum value ($\sim 65 \text{ square metres}$) when the tracker is centred (time is arbitrary).
Because the time it takes to cross the viewing annulus is Declination dependent, the amount of time available to observe a target, without moving the telescope in azimuth, varies significantly with Declination. This is illustrated in the following diagram:

The upper dark blue curve shows the theoretical upper limit on the amount of time available to observe an object, as a function of its Declination. For the most northerly objects (+10° > Dec > 0°), this is just less than an hour, while for mid declinations (0° > Dec > -40°), this is ~1.2 hours, and for most southerly declinations (Dec < -40° it increases steeply from ~1.2 hours to a maximum of just over 3 hours. For all except the most northerly or southerly declinations, objects can potentially be observed twice a night at favourable times of the year.

**SALT Observing Presentation**

Want to know more?

Have a look at our [Observing Presentation](#) (NB. This presentation requires frames. Best when viewed with Internet Explorer)
HET Observing for SALT Partners

The SALT-HET Agreement states that in the interval before SALT is commissioned, SALT partners may gain access to the Hobby Eberly Telescope (HET) through trading of future observing time on SALT (post commissioning).

Applying for HET time will follow the guidelines for other HET partners, namely an initial Phase I proposal to a local Time Assignment Committee, and, on acceptance, a Phase II proposal submitted to the HET detailing the observation plan.

Proposal phase ('Phase I')

The first step in the process for obtaining HET time will be an initial proposal phase, which covers the scientific justification and feasibility of the observations. While certain planning tools have been produced for the HET, it is equally, perhaps more, important to also consult the most recent information regarding the instrument performance, much of which resides on the HET Resident Astronomer’s website (http://nexus.as.utexas.edu/hetweb).

To assist a potential PI in writing a proposal, there are several planning tools available from the HET website (http://rhea.as.utexas.edu/HET_software.html), which will also be mirrored on the SALT website (http://ww.salt.ac.za/HET-observing) and its UK mirror site. These tools include the following:

- **When tool**: from an object’s coordinates, provides information on when the HET can observe it.
- **Optimum position tool**: Given an object’s Declination and telescope, gives the optimum telescope azimuth, Hour Angle and tracking time.
- **Position tool**: Given an object’s Declination and telescope azimuth, tells the user the transiting Hour Angle and tracking time.
- **Mirror tool**: Similar to above, but with a graphical schematic of an object’s track across the primary mirror.
- **Merit tool**: A tool for calculating the vignetting and actual exposure time required for a particular track.
- **Time critical tool**: Determines if an object at a given position can be observed at a particular Local Sidereal Time.

Details of the required information and formats for both phases (I & II) of the proposal process can be found at: http://nexus.as.utexas.edu:8081/hetweb/Prop

A standard Phase I proposal form for SALT Partners will be produced shortly by the SALT Project Scientist and placed on the SALT website (http://www.salt.ac.za/HET-observing) for potential PIs observing on the HET. It will be closely based on existing HET proposal forms.

Phase II planning stage

On acceptance of the Phase I observing proposal, the Phase II proposal then has to be submitted. Like for all HET observers, this is done using the information and material provided on the HET and instrumentation on the website http://nexus.as.utexas.edu:8081/hetweb. Instructions are present for the submission of the following information in the Phase II proposal:
1. a target list of object(s) to be observed
2. program notes and contact person/PI
3. finding charts

Both electronic and hardcopy information are then submitted to the HET Resident Astronomer (astronomer@het.as.utexas.edu). Target lists are made up in a standard format, which includes information on the following:

- object name(s)
- object coordinate(s) and equinox
- object brightness
- position angle
- priority of targets (if multi-object proposal)
- instrument configurations
- acceptable image quality in terms of minimum EE50
- brightest acceptable lunar phase
- integration time per visit
- number of exposures per visit
- number of total visits
- comment (calibrations needed, MOS setups, etc.)

Program notes consist of information in the form of a text abstract detailing the following:
- description of the observations
- goals of the analysis
- number of exposures requested of each target
- exposure splits for purposes of cosmic ray cleaning
- time interval between exposures for variability studies
- maximum exposure time (if phase sensitive)
- S/N per pixel at specified wavelength
- calibrations required over and above the standard calibration procedure
- responsible contact person in the case of further information being requested

Finding charts are to be produced in a standard negative (stars black on white background) format of approximately 6 x 6 arcmin, annotated with the following:
- PI name
- Program number
- Object name
- Object Right Ascension
- Object Declination
- Coordinate equinox
- North direction marker (North at top)
- East direction marker (East to left)
- Size of charts (in arcmins)
- Object centred and labeled
- If more than one object on a long slit, then each object to be marked and PA included

Some tools are available on the website for appropriately annotating PostScript finding charts so they conform to the required format. The following is an example:
Level 2
For potential HET observers, tools are available on one of the SAAO Sun workstations to assist in planning an HET observation. Detailed instructions appear here [link to document "Proposing for the HET"]
Level 1

SALT observation planning tools
These pages will be developed over the next year or so. SALT-specific observing tools and proposal scripts will be produced to assist SALT PIs in formulating their observing plans and writing a proposal in a standard format.

It is likely that the SALT Proposal Forms will be written in XML, or similar language, which will allow submission of proposals over the internet. This will include Phase I proposals (scientific justification and technical feasibility) submitted to local Time Assignment Committees (TACs) and probably the detailed Phase II information, which details the exact observing plan for the SALT Operations staff.

An interesting possibility is the use of a novel new XML-based language, initially developed in the US for educational purposes, which has evolved into something called Remote Telescope Markup Language 2.0 (http://ascom-standards.org/RTML/rtml2-def.html). This has been further developed by Rick Hessman (http://www.uni-sw.gwdg.de/~hessman), at the University of Göttingen, into RTML 2.0b.

Appendix

A comparison of effective area for different pupil sizes: