



SALT Observatory Science Requirements

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1 INTRODUCTION

This document presents the top-level science driven performance requirements for the SALT Observatory. The SALT baseline design is based on the HET Observatory Science Requirement (document SST TR930621) by L. Ramsey. The main change with respect to this is that the tilt of the telescope to the vertical will be 37° for SALT (cf. 35° for the HET), in order to accommodate access to the Small Magellanic Cloud from Sutherland. The organization of this document follows to the extent possible the work breakdown structure of the project. Thus the major telescope elements are optical system, primary mirror, telescope structure, tracker, enclosure and facility and system software and instrument package.

SALT should endeavour to take advantage of the advances in technology which have occurred since the HET was built. This draft incorporates changes suggested by L. Ramsey (19 July 1999) as well as clarification of certain issues raised by the SALT Project Team and Systems Engineer (G. Swart).

2 SUMMARY OF SCIENCE DRIVEN REQUIREMENTS ON TELESCOPE

The SALT will most frequently be used for spectroscopy. For prime focus imaging spectroscopy, spectrophotometry, the requirements are:

- 2.1 A minimum field size of diameter 8 arcmin., with good image quality ($EE(80) < 0.9$ arcsec with a goal of $EE(80) < 0.6$ arcsec).
- 2.2 Every opportunity should be made to allow an upgrade path for the phasing of the primary mirror array at some time in the future.
- 2.3 Accurate tracking, including field rotation.
- 2.4 Low scattered and stray light.
- 2.5 Atmospheric dispersion correction.
- 2.6 Ability to quickly acquire and centre objects on instrumentation entrance slit in both the visible and IR.
- 2.7 Offset guiding capability.

- 2.8 High throughput from 0.34 to 2.5 microns. The low wavelength requirement is set to 0.34 nm, with a goal of 0.32 nm. This may be achieved using new technology coatings, at the risk of loss of sensitivity at longer wavelength, to be maintained at <20%.

Moderate and high resolution spectroscopy may place equally high demands on the SALT. The throughput-resolution product is inversely proportional to the entrance aperture of the spectrograph, which can ultimately be expressed in arcseconds on the sky. Thus the major performance requirement for the SALT is image quality. Additionally, many exciting moderate and high resolution science programs utilize the light gathering power of the SALT to the limit where sky background becomes important. Thus low scattered and stray light is important. High throughput from 0.34 to 2.5 microns, calibration source(s) in the focal plane, excellent tracking and atmospheric dispersion compensation, are all key telescope factors. The SALT prime focus will have an image scale of 5-12 arcsec mm⁻¹. The former will ideally provide for direct injection of an f/4.5 beam into fibres, and represents a compromise between the effects of scrambling, which favours slower f-ratios, and focal ratio degradation, which prefers faster f-ratios. A higher plate scale (fast f-ratio), on the other hand, will lead to a larger field (for a given detector size), which may be more desirable for acquisition/guiding and imaging. To achieve *both* requirements may require an additional optics package (i.e. focal reduction) for these. A fast focus will allow sky background to be reached in relatively short times so that the exposure time limitation of the SALT is not an issue. In addition, some additional optics might be desirable in the case of a fibre-feed instrument, to remove telecentric field effects. The objects of greatest interest for imaging, such as very faint galaxies, QSOs and low surface brightness nebulae are near or below the background sky brightness. Thus it is imperative that the SALT not degrade the contrast in the focal plane. The key requirements for imaging with the SALT in addition to good image quality over a wide well corrected field are low scattered and stray light and low emissivity for IR imaging (H-band).

The restricted viewing window of SALT implies that as much astrophysical information is obtained per unit time interval. This implies maximizing the collecting area of the telescope, minimizing light losses, and optimizing the track trajectory to ensure maximum photon flux. The first requirement calls for optimising the size of the image pupil on the primary mirror array with the SAC centrally located (i.e. tracker centred) and to achieve the maximum time of tracker travel with this maximum pupil size. Deleterious effects of increasing the pupil size need to be assessed when it comes to deciding on the final pupil diameter. Issues like increased size/mass of prime focus instrumentation (from larger spectrograph beam sizes), obscuration and thermal emission by the top hexagon, larger slit widths (from decreased plate scales) need to be addressed.

The effects of dome and building induced seeing shall be minimized to the extent possible. The dome and telescope enclosure shall be so designed that thermal equilibrium is achieved as quickly as possible between the air surrounding the telescope and the ambient air outside. Furthermore, all source of heat will be minimized, and adequate measures taken to avoid discharging heat into or near the dome and enclosure.

SALT SYSTEM REQUIREMENTS

3.1 ENVIRONMENTAL REQUIREMENT

3.1.1 Normal, Marginal and Survival Conditions

	NORMAL OPERATING	MARGINAL OPERATING	SURVIVAL
Temperature	$-5^{\circ}\text{C} < T < 20^{\circ}\text{C}$	$-10^{\circ}\text{C} < T < 25^{\circ}\text{C}$	$-20^{\circ}\text{C} < T < 45^{\circ}\text{C}$
Temperature rate of change	$< 1.5^{\circ}\text{C}/\text{hour}$	$< 2.0^{\circ}\text{C}/\text{hour}$	
Relative humidity	$5\% < \text{RH} < 97\%$ non condensing		occasional exposure to condensing conditions
Steady Wind	$< 60 \text{ km h}^{-1}$	$< 75 \text{ km h}^{-1}$	
Wind Peak Gusts	$< 80 \text{ km h}^{-1}$	$< 90 \text{ km h}^{-1}$	$< 220 \text{ km h}^{-1}$
Other			rain, hail, snow, ice

Definitions:

Normal Operating Conditions: The telescope must meet all performance specifications.

Marginal Operating Conditions: The telescope must operate, but with 20% reduced performance in terms of image quality (EE) and pointing and tracking specifications.

Survival Conditions: The facility must withstand the extreme environmental conditions in a non-operating mode over a 20 year operational lifetime.

3.1.2 Sources of heat

Heat sources in the dome (where 'dome' refers to the open air space surrounding the telescope, i.e. both in the dome itself and that part of the building housing the telescope) must be minimized. Cooling systems must be used where necessary to extract heat, which should be vented well clear of the facility, in a direction opposite the prevailing SW wind (i.e. vented in an E to SE direction). The goal is for all telescope components to maintain thermal equilibrium with outside air temperature when in operation.

3.1.3 Primary mirror protection

Provision should be made for keeping the primary mirrors free from dust. This must be achieved by using the latest technologies in mirror cleaning and dust removal (e.g. CO₂ snow, detergent cleaning, etc). The primary mirror must be protected from possible condensation and precipitation during operation. This should be achieved using a system of humidity meters and rain detectors. Care shall be taken to avoid having obvious roosting sites so as to maintain a clean mirror.

3.2 OPTICAL PERFORMANCE REQUIREMENT FOR SALT SYSTEM

3.2.1 Image quality

The SALT optical-mechanical system, which in the baseline concept comprises the primary mirror array, and its support structure, the four-element reflective corrector (the SAC) and the atmospheric dispersion compensator (ADC), operating in the enclosure and tracking an object, should not degrade the enclosed energy diameter of a point source on a focal surface beyond the following specifications in the absence of atmospheric seeing (median value for FWHM = 0.9 arcsecond).

3.2.1.1 Requirement:

Field angle (arcmin)	EE (50%) diameter (arcsec)	EE (80%) diameter (arcsec)
< 4.0'	0.6"	0.9"

3.2.1.2 Goal:

Field angle (arcmin)	EE (50%) diameter (arcsec)	EE (80%) diameter (arcsec)
< 4.0'	0.4"	0.6"

Inclusive in the above figures are the effects of: optical tolerancing, mechanical positioning of the primary mirror segments (both the support truss, kinematic mounts, mirror mounts, and actuators), the tracker payload support mechanism for the SAC, telescope structure flexure, tracker and hexapod motion and dome seeing. Not included is the intrinsic seeing in a free atmosphere, for which the median value has been measured to be 0.9 arcsec (FWHM). The SALT Science Working Group will be consulted before the formal adoption of the system image error budget. In particular it is important to identify those areas where SALT instruments might correct for image degradation (e.g. implementation of a tip/tilt system in a prime focus instrument to correct for tracker errors). The above total system requirements should be met over the range of normal operational environmental conditions described below, for any given night, at least 90% (goal 95%) of the time.

Good imaging performance should be maintained through an active primary mirror segment alignment system, which should be able to correct for both mechanical flexure and thermal effects, including hysteresis. The baseline design calls for an alignment instrument, which will need to be included in the telescope system, probably located at the centre of curvature of the primary mirror. Once aligned, the mirror array should hold figure for >5 days, with no more than a 10% degradation in image quality. The mirror segments should be kept in alignment using edge sensors, or a better system.

The total time to align the primary mirrors shall be less than 2 hours, with a goal of 1 hour.

3.2.2 Focal surface

The focal surface delivered by the SAC will be flat, with an f/ratio TBD, which is acceptable for optical fibres (i.e. no deleterious Focal Ratio Degradation or undesirable scrambling properties). The current baseline figure is f/4.5, although value as low as f/3.6 will be considered (which may be more desirable for larger pupil sizes). Any telecentric angle variation with field may need to be corrected for the optical fibres. This will form part of the Fibre Instrument Feed, and could be achieved in a variety of ways (e.g. active tilting, fixed zoning, optically).

Any Prime Focus Spectrograph should access the straight-through beam, to minimize reflection losses and possible polarization effects. Other focal stations, perpendicular to the optical axis, will be accessed by 45° fold mirrors (e.g. acquisition guide camera, fibre instrument feed, imaging camera).

3.2.3 Throughput requirements

The telescope will transmit light to the focal surface with minimal losses. We define the optical transmittance as the ratio between photon flux in the focal surface, integrated over the stellar image, and the photon flux from the object in a column incident on the top of the SALT, along its central axis, with a diameter equivalent to that of the pupil. The primary array will have a total effective area greater than 77 m², although the actual light collecting area is dependent on the final pupil size. The table below states

transmittance requirement in three pass bands. This includes the combined total surface reflectivities (i.e. of the primary mirror plus 4-mirror SAC). The effects of pupil obscuration (central obstruction) and obscuration due to the tracker, prime focus platform and instrument, cables, telescope structure, dome, bevels and gaps in the primary mirror array, should not exceed 25% of the light inside the pupil (last column of table). These figures exclude losses in the atmosphere and the ADC optics.

Wavelength (nm)	Reflectance	Total transmittance
340 [*] -450	>65%**	>49%
450-800	>70%	>53%
800-2500	>80%	>60%

(*With a goal of 320 nm. **This requirement may be re-visited if durability of protected silver on the SAC mirrors is inconsistent with maintaining good average throughput over a several year time interval.)

Mirror maintenance will be undertaken regularly to assess both reflectivity and scattering from dust. A capability, such as CO₂ cleaning and/or detergent cleaning, to keep the reflecting surfaces free of dust shall be available at first light. Re-coating of the primary mirrors will take place at a frequency necessary to keep the above performance.

The focal plane will have a pupil that projects to at least 10.2-m diameter on the primary. Obscuration of the pupil by optics, bevels and gaps in the primary, tracker, cables, focal plane instrument, telescope structure and dome will be kept at a minimum (< 25% on the central axis, as with the HET). At a maximum off-axis angle of 8.5°, the obscuration will be kept at a minimum (< 40% following the HET experience).

3.2.4 Exit pupil requirements

The pupil must be baffled to prevent scattered and stray light at the focal surface from being greater than the sky background at any wavelength in the 0.32 to 2.5 micron range. The exit pupil shall be readily accessible, so that it can be adequately baffled. The baffle will need to move to follow the roving pupil. For flat-field and arc calibrations, it will be necessary to illuminate an exit pupil (e.g. at M3 in the baseline SAC). The moving baffle (at the final exit pupil position) will need to simulate the pupil illumination during an observation. This will require the moving baffle to move at much faster rates than during an astronomical track (max. velocity: 32 mm/sec; max. rotational velocity of 6°/sec). An investigation into cooling this baffle, thus minimizing its IR emissivity, shall be undertaken.

3.2.5 Scattered light requirements

A fixed baffle below the SAC will be installed to avoid scattered light entering the SAC.

3.2.6 CCAS tower light scattering

The CCAS tower shall have low light scattering properties. It shall be placed at an azimuth position TBD to minimize any Lunar illumination.

3.3 TELESCOPE STRUCTURE

The telescope structure shall be designed so as to provide a central axis zenith distance of 37°. This structure shall provide a clear aperture at the top of 10.047 meters inscribed diameter on the central axis. Below the top ring, no part of the structure shall obscure the primary mirror array as viewed by the corrector over the required tracking range. The structure shall also provide access for mirror installation and cleaning of primary mirrors so as to maintain high transmittance. In addition it should be designed so as to support trackers that have an instrument package up to 400 kg, comprising prime focus science instrument (300 kg), acquisition camera (50 kg) and fibre instrument feed (50 kg), and have adequate dynamic stiffness to meet

the pointing and tracking requirements. A high priority goal is to have adequate dynamic stiffness to meet the pointing and tracking requirements with a total 500 kg instrument package.

3.4 ACQUISITION AND TRACKING

The tracker components should be consistent with the obscuration specification in section 3.2.3 and minimize scattered light and IR emissivity. A region of diameter 2.5 m and height 2 m above the mount plate should be free of obstructions for all possible positions of the tracker. The length of optical fibre from the focal plane to the main instrument room shall be minimized, in no case to exceed 35 m (goal 30 m) with bend radii more than 0.4 meter. The fibre routing and handling shall be such so as to avoid transmitting any compressive force or tension to the optical fibres through the protective cabling.

3.4.1 Range

This tracker will have access to declinations $-75^{\circ} 22' < \delta < 10^{\circ} 37'$ with a 180° azimuth rotation. The tracker will be able to follow any object along a 12° arc in Right Ascension anywhere in the required declination range. The telescope will have access to azimuth positions and an unobstructed view of the sky from 0 to 390° (except for the CCAS tower) to allow for scheduling versatility and observing efficiency (goal is 540° to enhance observing efficiency).

3.4.2 Absolute Pointing

The telescope will have an absolute pointing accuracy of < 15 arcsecond peak to peak (goal < 10 arcsecond peak to peak) to any accessible point in the sky after an azimuth move.

3.4.3 Offset Pointing accuracy (open loop)

The offsetting accuracy is defined as the ability to place a given point in the sky on the bore-sight once the telescope has acquired another object in the FoV. The tracker will be able to execute offsets from any object within a 8 arcminute diameter field to 0.10 arcseconds point-to-point.

3.4.4 Field acquisition time

The telescope will complete an azimuth slew from any point in the allowable range to any other accessible point to the absolute pointing accuracy within 3 minutes 90% of the time and 5 minutes 99% of the time. When an azimuth slew is not required, the acquisition time will be < 2 min 80% of the time (goal: < 1 min 90% of the time).

3.4.5 Target acquisition time

A Target is defined as a point in the sky. If the target is not visible to the acquisition imager, then the target is defined as an offset from a visible star that is within the focal plane field of view. Acquisition time is defined as the length of time required to put the target at a desired position (a bore-sight), within the offset pointing requirement, from end-of-slew, until start of the integration. Acquisition time will be < 60 seconds (goal < 30 seconds) for $> 95\%$ of potential targets. Another goal will be to allow very rapid re-acquisition of objects (< 2 min) after an azimuth move to extend tracking at the southern and northern limits of the declination range.

3.4.6 Tracking (sidereal rate)

3.4.6.1 Open loop tracking: Open loop tracking, i.e. without feedback from a guider, shall be sufficient to achieve pointing accuracy as specified in 3.4.2 and acquire a guide star within the target acquisition requirement in 3.4.5.

3.4.6.2 Closed loop tracking: Once acquired, the bore-sight will track the target such that the error vector between target centroid and bore-sight will be <0.1 arcsecond RMS over the entire tracking range. Field rotation compensation shall not degrade images at the periphery of the field of view by more than 0.25 arcsecond RMS over the entire tracking range.

3.4.6.3 Azimuth motion during tracking: Although the baseline design calls for no azimuth movement during a track, the possibilities of implementing this have been suggested following the HET experience. This would have maximum benefit for objects in the North or South. Implementation of this option for SALT shall be investigated to see if this is feasible and what the cost implications are.

3.4.7 Tracking (non-sidereal rate)

The tracker shall follow the motions of objects that deviate from the nominal sidereal track rate by as much as 4 arcseconds per second in any direction, meeting the requirement in 3.4.6.

3.4.8 Field Rotation

The tracker system shall provide a rotating mount plate for scientific instruments with absolute positioning accuracy of ~ 1 arcminute r.m.s. in sky coordinates (open loop) and range of 230 degrees.

3.4.9 Heat Removal

Means shall be provided to remove heat generated by scientific payloads of up to 2 kW, as well as acquisition and guiding equipment.

3.4.10 Services provided to PFIP

The Prime Focus Instrument Platform shall provide the following service for instruments:

3.4.10.1 AC power (240V, with a goal of also providing 110V)

3.4.10.2 Pneumatic lines with no leaks.

3.4.10.3 Glycol cooling lines with no leaks.

3.4.10.4 Data cabling (e.g. Ethernet, RS232). Cableways/trays shall be designed to allow easy upgrading or replacement of cables.

3.4.10.5 GPS time pulses.

Details of these should appear in the SALT PFIP Interface Document

3.5 SITE, FACILITY AND ENCLOSURE

3.5.1 Site

The SALT site must allow unlimited access to the sky area provide by the SALT design.

3.5.2 Enclosure

The enclosure and dome shall:

- 3.5.2.1 Be consistent with the SALT system image requirement.
- 3.5.2.2 Shall provide heat protection during the day and ventilation at night so as to allow observations to begin at astronomical twilight with images that meet the requirements.
- 3.5.2.3 Be capable of slew rates commensurate with telescope azimuth drive.
- 3.5.2.4 Have an azimuth range commensurate with the telescope.
- 3.5.2.5 Not vignette the pupil during any track.
- 3.5.2.6 Must be tightly sealed against dust and liquid or frozen precipitation in winds up to 220 km h⁻¹.
- 3.5.2.7 Ventilation fans or natural flow-through ventilation louvres should provide sufficient volume changes of air per hour for the dome/enclosure space to allow inside and outside temperatures to equilibriate after opening [to within 1 degree in 30 min]. In addition, wind buffeting in the case of natural ventilation must be controllable (e.g. by partially or totally closing louvres).
- 3.5.2.8 Shall provide for lightning protection and provide a low impedance path to an independent earth ground.
- 3.5.2.9 Shall be designed such that wind induced vibration is not coupled through the ground to the telescope pier or fibre fed instrument room during observing.
- 3.5.2.10 Will allow routine access to the tracker and instrument package for instrument maintenance. This access will be available to two people simultaneously and independently, i.e. with no additional personnel required.

Provisions for supply dewars, test equipment, including power, data and control lines will be made.

3.5.3 Facility

The SALT facility includes any and all buildings and structures associated with the SALT. The facility shall meet the following requirements:

- 3.5.3.1 Shall not degrade the image quality beyond the specifications above through dissipation of heat from the control building or other structures during normal operating conditions.
- 3.5.3.2 No part of the facility shall be allowed to partly obscure a declination zone permanently. For example a CCAS tower cannot be placed near the south or north points and should be in a position, TBD, which will not affect access to high priority targets, e.g. Magellanic Clouds, centre of the Milky Way. The tower should be placed in a position which minimizes thermal effects and down-stream turbulence. It should also be placed in a position to minimize light reflecting from the Moon into the telescope.
- 3.5.3.3 Provide lightning protection.
- 3.5.3.4 Provide a permanent fixture for mirror removal.
- 3.5.3.5 Electric supplies must all be well grounded and surge protected. Ground-loops must be eliminated.
- 3.5.3.6 Provide an air conditioned telescope control room with computer power, electronic networks and a rest area with toilet, kitchenette, sink, hot and cold water. The control room should have sufficient space for 6 people operating computer terminals, plus additional desk space and room for an additional 10 visitors (not necessarily seated). No heat is allowed to leak into the telescope enclosure, either through doors, elevators, airways, or direct conduction by the buildings structural members. Cableways/trays shall be designed to allow easy upgrading or replacement of cables.

- 3.5.3.7 Provide an air conditioned instrument work area, adjacent to the telescope control room, with instrument and computer power, compressed air, a sink and cold water. This should have sufficient space for 4 people to work comfortably, and have ready access to the control room. During the commissioning phase, personnel would be expected to work in both rooms. The same stipulation as in 3.5.3.6 regarding heat contamination, cableways, etc, shall apply.
- 3.5.3.8 Provide a Main Instrument Room that shall be at least 15-m diameter and 3-m high internally, and shall have access doors a minimum of 2.5-m wide and 3-m high. Cableways/trays shall be designed to allow easy upgrading or replacement of cables. This instrument room must be:
- i) light tight, and free of fluorescent and phosphorescent materials and indicator lamps,
 - ii) thermally stable within 1°C per week and 10°C per year,
 - iii) not be actively air-conditioned,
 - iv) avoid materials that produce dust when scratched or degraded by age,
 - v) have instrument grade power, compressed air cleaned with an oil filter, water and glycol. It shall also be capable of being divided into light-tight subsections, or separate instrument enclosures, so as to allow instruments to be worked on while not disturbing the others. LN₂ must be available for detector cooling,
 - vi) radioactivity and EMI background during normal operations should not exceed that of the local background as judged by measurements in sample locations at Sutherland (e.g. the 1.9-m coude room and dark room, 1.0-m dark room).
 - vii) a floor isolated from those parts of the facility which might be sources of vibration (e.g. ring wall, pier, vacuum plant room).

3.6 CONTROL SYSTEM, SOFTWARE, AND COMMUNICATIONS

3.6.1 Control System

The basic control system shall meet the acquisition and tracking specifications. Basic environmental information on conditions inside and outside the dome such as temperature, humidity, wind speed and direction, barometric pressure and dew point shall be available to the control system.

An engineering data logger should record various observatory parameters (environmental), the status of the telescope (e.g. motors, compressors, tracker, hexapods) and instruments, for the purposes of recording fault histories and aiding in diagnostics.

3.6.2 Observer/Operator Interfaces

System software shall provide a visual display, and computer-readable output of:

- 3.6.2.1 The telescope position in Right Ascension and Declination (with precession to an arbitrary epoch); Local, Universal and Sidereal times; the zenith distance and the airmass;
- 3.6.2.2 The current environmental data;
- 3.6.2.3 The instrument plate rotation;
- 3.6.2.4 The last measured seeing and transparency values.

The system shall also provide:

- 3.6.2.5 A visual display of the acquisition field for the operator, in standard North-up, East-left orientation with any field rotation removed. Overlays of slit and fibre positions should be provided on a GUI.
- 3.6.2.6 A capability for the operator to acquire objects using simple mouse-controlled commands.
- 3.6.2.7 The operation and control computer with all the information necessary to acquire and observe the object: coordinates, magnitude of object, offset star coordinates, exposure time, and instrument configuration.

The system software shall be capable of operating the telescope in astronomer-at-the-telescope, queued observing and service observing modes.

3.6.3 Communication

Telephone, fax and computer network links should be provided to the outside world, as well as to the rest of the Sutherland observatory complex. Internet access must be available to all SALT partner institutions to allow the input of observing programs/parameters, Phase II observing plan, to ascertain the status of on-going programs and to allow FTPing of proprietary data files for PIs, and uploading/download observing and proposal templates, etc.

Some automatic distribution of current telescope and instrument status, including possible image information, to the SALT Website shall be provided for the purposes of public 'eavesdropping' of SALT operations.

Internet connectivity to support all of the above shall mean the adoption of a minimum specification (TBD) of the bandwidth of connections from Cape Town to Sutherland.

3.7 MAINTENANCE SAFETY AND RELIABILITY

3.7.1 Reliability

The amount of down-time due to system failure and/or scheduled maintenance of telescope systems should not exceed 2% of night time hours during science operations phase. The tracker shall be capable of up to 70 traverses per night over a lifetime of 20 years consistent with the above reliability requirement.

3.7.2 Safety, fail-safe modes

The capability shall exist to install a protective cover over the primary mirror during servicing of the tracker and focal plane instruments. The dome shutter must close in less than 3 minutes, and must be able to be closed in the event of electrical power or shutter motor failure. An emergency shutdown system must exist.

3.7.3 Maintenance

The maintenance down-time at night should not exceed 2% (goal is to carry out all scheduled maintenance during daylight hours).

3.8 FIRST LIGHT INSTRUMENT PACKAGE

A commissioning instrument must be available at engineering first-light (when only a subset of the mirror segments may be available). This instrument requires an imaging capability to enable an assessment of the telescope performance in terms of image quality, tracking and pointing accuracy, and throughput.

3.8.1 Atmospheric dispersion compensation

Atmospheric dispersion compensation shall be provided. The compensator shall have secondary dispersion less than 0.15", and 95% external transmission over the wavelength range from 320 to 850 nm. The atmospheric dispersion compensator will introduce no more than a 5% degradation of the image at 500 nm over the requirements in 3.2.1. The goal for the ADC is to correct for dispersion over the 320-1800 nm range. The atmospheric dispersion compensator must be readily removable, automatically, so as to be compatible with a queue-scheduled mode of operation.

3.8.2 Acquisition

An acquisition camera shall provide imaging of the entire science field of view (defined by the SAC). It shall be capable of obtaining images suitable for identification of objects with brightness between 0 and 21st visual magnitude in 5 seconds or less integration over the entire tracking area. A suitable science-grade CCD shall be employed, enabling the acquisition camera to serve as the commissioning instrument. The acquisition guiding system shall be capable of recording, as a time series, the image quality parameters (seeing FWHM) and transparency (flux).

3.8.3 Guiding

A guiding camera shall be capable of imaging 2 sub-fields anywhere within the science field of view, and possibly to larger radius (with increased vignetting). It shall be capable of obtaining images suitable for guiding anywhere in the SALT sky access range with exposure times of 1 second, or less, inclusive of readout time. It shall also be capable of recording and plotting guide star FWHM, transparency, and guide error signals.