AiC Report to NOT STC
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Contents

1 Introduction

This report covers the operations of the Nordic Optical Telescope for the period 2002-03-12 to 2002-09-17.

This report has a slightly different set-up from the previous reports. Specifically, I have tried to limit the report to the relevant changes that occurred during the period. The main part of the report dealing with operations is now divided in two parts; the first part looks at operations during the reporting period, and the second part looks at expected changes in the coming months.

A very significant part of this report was prepared with the help of Amanda Kaas who was acting AiC until the 1^{st} of August.

In the future I would like to fix the reporting periods to 6 months, running parallel with the observing period: i.e. 1^{st} of April to 30^{st} of September; and 1^{st} of October to 30^{st} of March. I also intend to provide more detailed statistics on technical down-time and time lost due to weather, which should provide a better idea of changes with time.

2 Down Time

In Table 1 the down time statistics for the period 2002-03-12 to 2002-09-17 are reported, where time lost as < 1 hr is counted as 1 hr. In a total of 49 End-Of-Night reports faults were reported, with an average time lost of < 55 min per fault. Of these, 27 reported no time lost, 15 reported < 1 hr lost, and 7 reported 2 or more hrs lost.

Table 1: Technical down time statistic 2002-03-12 to 2002-09-17

Night included	Time lost	Nights	Percentage[a]	Last period
All nights	< 45 hr	188	< 3.0%	< 1.9%
Scheduled observing nights[b]	< 30 hr	137.5	< 2.0%	< 1.2%
Technical nights	< 15 hr	32.5	< 5.8%	–
Visitor instruments	< 0 hr	18	0%	–

[a] Assuming an average of 8 hr per night
[b] Excluding technical nights and visitor instruments

This compares to a down time of < 1.9% over all nights (< 1.2% on scheduled observing nights) in the period 2001-09-13 to 2002-03-12. In that period 48 fault were reported, of which 35 reported no time lost, 8 reported < 1 hr lost, and 5 reported 2 or more hrs lost. The main difference between the current reporting period and the last reporting period is the time lost due to the problems with the primary mirror radial supports (see below).

Below are listed those faults for which 2 or more hours were lost. In principle, also repetitive errors which lose little time but occur frequently would be included here.

- **2002-04-13: Rotator encoder broken**: All night

  (Technical night.) The encoder of the rotator failed because of lightning during a snow storm. The encoder was replaced, which due to its position is very time consuming.

- **2002-04-14: Problems with multiplexer and FAPOL software**: 4 hr

  (Technical night.) The multiplexer between the instrument and the computer died and the FAPOL software had been wiped off the disk. Both these things were probably also caused by the lightning in the previous night. As this was a mix of problems, it took some time to sort out the real causes. In the end, the FAPOL software was re-installed and the multiplexer was replaced. The original multiplexer was later repaired.

- **2002-06-01: Aluminisation**: 4 hr

  (Technical night.) Various problems occurred when restarting observations after the re-aluminised mirrors were installed on the telescope. The problems included a broken optical fiber between NOTCam and the computer, computer problems, and some problems with the drying device for the compressed air of the mirror support system which needed cleaning, while the lack of a pointing model slowed down observations

- **2002-06-09: 'Blanks' catalogue**: 2 hr

  (Technical night.) Time was lost the observer had some problems with the catalogue with blank fields on the TCS. Detailed instructions exist in the manual (also on the web). Furthermore, the support astronomer was not contacted at the time, and the total amount of time lost should normally have been much more limited.

- **2002-06-17: Problems with ALFOSC user interface**: 2 hr

  (Technical night.) For unknown reasons the serial port on the computer on which the ALFOSC UIF is running was not configured properly. After reconfiguring the port things worked fine.

- **2002-08-08: Radial mirror supports came lose**: All night

  During the afternoon it was found that 4 of the 10 lower radial supports of the primary mirror had gotten unglued. This was detected during altitude tests with the new TCS, but it is not clear if these tests caused the problem. However, before reinstalling the aluminised primary mirror some rubber blocks which physically limited the vertical movement of the primary mirror were removed. It is believe that this might have allowed the mirror to move upward too much with respect to the radial support. Such a movement would create a big torque on the invar pads that connect the radial supports to the mirror, which could have caused them to break lose.

  During the afternoon and the start of the night preparations were made to glue the invar pads back to the mirror again, after which they were left to dry.

- **2002-08-08: Mirror pads drying**: 2 hr

  Tests during the day had shown that the glue had not dried completely, and experience had shown that it typically takes three times longer for glue to dry at the observatory than under normal conditions. To be absolutely sure that the pads would stay glued, the time to let the glue dry was extended to 24 hr, as compared to the normal 8 hr drying time.

In the mean time the rubber blocks to limit the movement of the mirror have been reinstalled. Detailed check have not shown any problems with either the newly glued pads, or the other pads. The recovered sheets of glue from the pads that got lose are being examined to make sure that a deterioration of the glue might have contributed to the pads getting lose, which would imply that the other pads might follow soon.

3 Instrument use

Table 1 lists the number of scheduled observing nights and technical nights for each instrument. This covers all nights, including CAT, CCI and guaranteed time. Note that StanCam is not included, but normally has been available when ALFOSC was not mounted.

Table 2: Instrument use

Instrument	No. of nights	
	Scheduled	Technical
ALFOSC	114	16
NOTCam	19.5	6.5
Turpol	4	–
SOFIN	12	4
LuckyCam	3	–
IACUB	3	–
Aluminisation	–	6

4 Comments recorded in End-Of-Night & End-Of-Run reports

As before, most comments written in the reports were very positive.

There were a few comments about the fact that macros to run a set of observations in BIAS can not be aborted in a simple way. Also, the 'addtime' command in BIAS does not work.

There were a few request to get more extended information in the FITS keywords (object name, coordinates, which calibration lamp in use, etc.). Also, it was mentioned a few times that it would be nice to have the telescope focus automatically corrected when changing filter. To be able to provide these things we will need a proper user interface which connects to the different subsystems (telescope, instrument, etc.).

It was pointed out that the accuracy of the timing of the observations is not sufficient for certain applications. A new GPS central time service unit is being ordered.

5 Operations

5.1 Telescope

5.1.1 Mirror aluminisation

The NOT primary and secondary mirror were realuminised on the 27th of May 2002. The previous aluminisation took place in May 1997 for M1 and June 1995 for M2. The whole procedure started by dismounting the mirrors on the 24th of May, and the mirrors were transported back to the NOT on the 29th of May. While the mirrors were out, the telescope center section was machined to improve roundness and centering of the primary mirror.

Alignment was done on the 30th of May, and a report on the alignment procedure is currently being made.

The throughput was tested with ALFOSC and StanCam on the 31st of May. Results for StanCam show the following sensitivity improvements:

Table 3: Sensitivity improvement

Filter	After/Before
U	1.59
B	1.51
V	1.36
R	1.32
I	1.29

Also, the position of the top unit of the telescope was checked and corrected.

5.1.2 Mirror support

A new Atlas Copco SF2 air compressor motor for the primary mirror support system has been purchased as spare. The current unit was bought 10 yr ago as spare, and replaced the unit that broke down in September 2001. The new spare should prevent a possible ∼2 week down-time period if the current 10 yr old unit also brakes down.

5.1.3 TCS

It was discovered that the field rotation as a function of position was not calculated correctly, as it did not take the pointing model into account. As far as could be determine this has been the case as long as the telescope has been in use. In principle this causes relatively small differences between the calculated and true rotation rates of the observed fields, but close to zenith where the rotation rate is large this effect can become significant. The TCS code has been corrected.

5.1.4 The new TCS

The programming of the new TCS has only slowly progressed in the last 6 month, and at the moment 51% has been implemented (only 7% more since the last report). The main reasons for the slow progress has been time spend on other duties and work on correcting problems with the current TCS. To improve this situation, the work schedule of the software engineer has been changed such that he has less regular duties, and he can concentrate his efforts on the new TCS. Currently, the new TCS is expected to be finished before summer 2003.

5.2 ALFOSC

5.2.1 Long-slit spectroscopy

A new echelle-mode grism combination, grisms 13+10, has been commissioned, to give medium resolution (R=4000) in the blue end of the optical spectrum. Grism 13 is normally used with an order sorting filter in 3rd order, but can also be used with a cross-disperser. Grisms 13+10 give a good alternative for grisms 9+10, as spacial overlap is not a problem for this new combination. For medium-resolution spectroscopy bluer than 4250Å this option is preferred over grisms 9+10. The orders of grism 13 are too long for the chip: the total wavelength coverage is 3350-3610 (5th order), 3720-4430, 4770-5830, 7020-8660 (2nd order). See

`http://www.not.iac.es/new/technical/astronomical/instruments/alfosc/grisms/`

Four cut-on filters (GG420, GG475, OG515, OG570) have been purchased which are needed for optimal use of the red part of the various wavelength regions offered by the grisms. These filters have been tested and documented, and can be requested for use. See

`http://www.not.iac.es/technical/astronomical/instruments/alfosc/blockers.html`

5.2.2 Multi-object spectroscopy (MOS)

First normal visitor run occurred in June 2002, where no fault were reports. The pre-imaging had been made by staff during technical time and the masks were machined at CUO.

5.3 NOTCam

The 9th commissioning run end of March (3 nights) was entirely lost to bad weather. NOTCam was offered in visitor mode on April 1st. No time was lost to technical problems. The 10th commissioning run in June (1 night) gave the first photometric dataset after shutter problem was solved. Visitor runs in June and July went smoothly. NOTCam was left to warm up in August. The 11th commissioning run in September (1/2 night) was spent on photometric standards for zero points and testing of the photometric scatter across the FOV for both cameras in the broad band filters.

5.3.1 Software

Bug fixes to the BIAS software were made by Jens Klougart in mid-March. At the same time a command for taking darks using the *ramp-sampling* readout mode was added. A new 32Mb PC card buffer now allows as many as $N = 14$ frames to be read out with the *ramp-sampling* commands **frame t N**, compared to the $N = 5$ before March 2002.

Bjarne Thomsen is working on an optimal linear regression calculation for the datasets taken using the *ramp sampling* readout mode.

5.3.2 Cooling

The long hoses for the PTR have arrived. Priority was given to work on the dome cooling this summer. When the long hoses are installed, NOTCam will be running with the PTR also when mounted on the telescope. This should keep the detector at a more stable temperature and limit bias drifts. A preliminary solution has been found to limit spilling of LN2 during night time. It is however, still recommended not to point much below airmass ~ 2.

5.3.3 The detector

There is still some pick-up noise. Disconnecting the pressure sensor does not improve it. A few days was spent on swapping cables and quadrant boards, but no improvement so far. The interference pattern has stripes at a level of about 10-20 ADU peak to peak, and the pattern varies with time. Generally, for background limited broad band imaging the pattern disappears with a normal number of dithered frames used to median combine an image.

5.3.4 Data storage

The CD jukebox is now being sent back to the provider. In the end it never worked flawlessly. Around 10 Gb of data is obtained on an efficient night. This could be reduced by a more sophisticated and flexible way to select how to save the data, e.g. not storing all the "reset" frames. For the time being an automatic system has been installed which saves the incoming NOTCam data simultaneously on two DSS-3 DAT tapes (one for the archive and one for the observer). When the jukebox is back and working the data on DAT tape will be copied to the CD archive.

5.4 StanCam

Some problem where encountered over the last months with keeping StanCam cold. On various occasions the camera warmed up and lost its vacuum. This is probably due to the short holding time of the dewar combined with the design of the dewar which results in spilling of LN2 at relatively low zenith distances. The plan is to install a CryoTiger to keep the camera cold continuously.

5.5 FASU

5.5.1 FAPOL

Commissioning started in April. Some hours lost to problems after the thunderstorm and daytime testing prohibited because of rotator dismounting. Essentially FAPOL was found to work well. The zero angle position of the holder was adjusted. The software behaved well. Only the imaging mode was tested with both the half wave and the quarter wave plate installed. FAPOL is not designed to be easily mounted and dismounted from FASU. For this reason, changes between half-wave and quarter-wave plates must be done by staff only, and should generally not be requested during the night, perhaps not even during one observing run. It was found that we needed to adjust the holder of the calcite plate which goes into the aperture wheel in order to get the slit in the focal plane. Accurate measurements allowed us to go as close as 1mm from the focal plane without any risk of touching the folding prism. Such a holder has been made.

The FAPOL observing run which was scheduled later in April was entirely lost to bad weather. Commissioning will be continued after January 2003.

5.6 Filters

For various recently purchased, but also for some older NOT filters, transmission curves are not yet available. Until recently we have had the transmission of our filters scanned by the ING. Since the ING scanner is broken, we have investigated obtaining transmission curves with ALFOSC using a Tungsten flatfield lamp as light source.

In general we can get good results, but in the far blue the red lamp does not emit enough photons such that the transmission curves are incorrect due to contamination by scattered red light. Eleven transmission curves, as measured with ALFOSC, have been added to our filter data base on the WWW pages. See http://www.not.iac.es/technical/astronomical/filters/ .

6 Looking ahead

6.1 Mirror cleaning

The mirror cleaning procedures are currently under review. There are indications that washing of the mirrors provides better results than CO_2 cleaning. However, CO_2 cleaning does give improvements and is much easier to perform. To get a proper idea of the relative benefits of the cleaning methods and their frequency we intend to start a monitoring programme of the zero-points in different broad-band filters with ALFOSC and/or StanCam. Furthermore, we intend to buy a new reflectometer that also measures scatter which is not measured by the current meter. The idea is to correlate these measurements and information about the weather (humidity, dust) with the times of cleaning, and decide what is the best strategy to clean the mirrors.

6.2 ALFOSC

6.2.1 Long-slit spectroscopy

A program to observe standard stars for all grisms will be started whenever the observing schedule allows. The start of the program was postponed to after the aluminising session last summmer. Since then, we had no photometric nights during ALFOSC technical time in order to get the data. Once obtained, the standard star information will be incorporated in the WWW-based ALFOSC SN estimator. This will allow potential users of ALFOSC in spectroscopic mode to estimate the required observing time when applying for time.

A full set of slits will be purchased which are rotated by 90 degrees with respect to the current set. As the grisms can also be mounted rotated by 90 degrees, it will be possible to select the option to have the dispersion direction along the rows of the CCD instead of the columns. For an equal number of rows or columns, a window limited in rows can be read-out much faster, and for star-like objects where a window can be used the overheads will decrease. The disadvantage of this set-up is that bad columns can not be avoided, but if this is a problem depends on the wavelength of interest to the observer.

6.3 NOTCam

6.3.1 NOTCam cooling: PTR & LN2

The long hoses for the PTR have arrived. The plan is to install the cool unit, which produces a lot of heat, in the machine room, and run up the hose to the observing floor where they will be permanently connected to NOTCam.

6.3.2 NOTCam BIAS

Still the absence of an 'ABORT' command in the BIAS programme which runs NOTCam is a problem. The aim is to implement this in relatively short order. Further improvements to BIAS to increase the readout speed will have to wait until the new controller for the detector array is available.

6.3.3 NOTCam Spectroscopy

Grism holders have been made and tested in Copenhagen, and are now at the NOT.

A new grism design has been considered. This design will allow separate J (5th order), H (4th order), and K (3rd order) observations with spectral resolution of about R=1300 for a 0.94 arcsec slit width and the wide-field camera. We will be ordering such a grism shortly.

It has been confirmed that pinholes in the aperture wheel can be imaged in focus on the detector, in all three main filters. For this reason we do not anticipate considerable problems regarding the focusing of NOTcam in spectrographic mode with all the necessary optics installed.

6.4 StanCam

Given the problems with keeping StanCam cold, a CryoTiger has been ordered to be able to keep the camera cold without the need to refill it continuously. Like for the PTR of NOTCam, the idea is to install the unit in the machine room and run up the hose to the observing floor. The plan is to send StanCan to CUO for testing, before shipping it back with the CryoTiger unit. In principle, when ALFOSC is mounted, StanCam can be shipped without harm to the observations. However, at the time of writing no firm dates have been set.

6.5 MOSCA

The current plan is to have MOSCA coming to La Palma in October, where the technical time starting October 18^{th} will be used to test the camera. The first observing run would then by November 2^{nd}.

6.6 FRED + FRAME

FRED is expected to be ready in October, after which it will be send to Copenhagen, where it will be tested and integrated with FRAME (the filter/shutter unit) and MOSCA II before being sent to La Palma. It probably will not arrive on La Palma before the end of the year, and commissioning is expected to extend into period 27.