Period 28
AiC Report to the NOT Council and STC

40^{th} STC meeting, May 13, 2004
&
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Contents

1 Introduction

This report covers the operations of the Nordic Optical Telescope for period 28: 2003-10-01 to 2004-03-31.

2 Down Time

As in the last report, the down time statistics are now based on individual fault reports instead of what was reported in the general end-of-night reports. In Table 1 I give the general down time statistics for period 28.

A total of 63 fault reports were submitted, with an average time lost of 29 min per fault, for a total down time of 1.7% (2.6% on scheduled observing nights). Of these, 37 reported no time lost, 24 reported $<$ 2 hr lost, and 2 reported 2 or more hrs lost.

Table 1: Technical down time statistic period 28: 2003-10-01 to 2004-04-01

Night included	Time lost	Nights	Percentage[a]	Last period
All nights	1815 min	183	1.7%	3.5%
Scheduled observing nights[b]	1555 min	98	2.6%	2.3%
Technical nights	180 min	32	0.9%	3.3%
Visitor instruments	80 min	53	0.3%	6.4%

[a] Assuming an average of 10 hr per night
[b] Excluding technical nights and visitor instruments

This compares to a down time of 3.5% over all nights (2.3% on scheduled observing nights) in period 27 (2003-01-04 to 2003-09-31). For that period 107 faults reports were submitted with an average time lost of 28 min per fault. Of these, 67 reported no time lost, 31 reported $<$ 2 hr lost, and 9 reported 2 or more hrs lost.

Comparing the two periods, there are two things to note. In general, the total number of fault reports has decrease by more than 40%. Secondly, the number of cases with 2 or more hrs lost has decrease a lot with respect to last semester, which largely explains the significant decrease in down time. One could also say that the last semester was in that respect rather out of the ordinary in both the number of faults with more than 2 hrs lost and the total amount of downtime.

2.1 Main problems

Below are listed those faults for which 2 or more hours were lost. Also repetitive errors which loose little time but occur frequently (if present) are included here.

- **2004-01-02/04/08: Building safety system problems**: 3 hr 35

On various occasions the safety system was activated and stopped the telescope. The sensors at the bottom of the stairs to the telescope were cleaned and repositioned. Also, the relay that checks the phase of the signal from the sensors was replaced as incorrect readings from this relay might also tricker the safety system (though the problem was most likely caused by the sensors themselves).

- **2004-02-28/03-01: FAPOL retarder plate**: 20 hr

  The FAPOL retarder plate used for polarimetry did not rotate, or only rotated intermittently. It was found that the fuse holder of the power supply for the rotator motor was not making good contact, causing the retarder plate to not always rotate. The problem was compounded by the fact that the system does not detect if the rotator does not rotate. We are currently looking to get the motor controller card reprogrammed to include this.

2.2 General overview

The new fault data base allows a more detailed overview of the faults that are reported. In Table 2 the number of faults and total time lost as a function of the system and kind of fault is presented together with the overall numbers for the last period (27).

Table 2: Down time statistics for period 28[a]

Syst/Type	Soft		Elec		Optics		Mech		Others		Total		P27	
Telescope	6	02:00	5	00:45	0	–	2	00:20	0	–	13	03:05	24	08:57
Building	0	–	3	03:35	0	–	6	00:05	3	00:00	12	03:40	12	24:10
Computers	6	00:30	3	00:10	0	–	1	00:00	1	00:00	11	00:40	24	02:00
ALFOSC	14	01:05	3	20:00	0	–	1	00:05	0	–	18	21:10	15	02:25
MOSCA	0	–	0	–	0	–	0	–	0	–	0	–	2	00:40
NOTCam	0	–	2	00:05	0	–	0	–	0	–	2	00:05	17	10:15
StanCam	1	00:10	0	–	0	–	0	–	0	–	1	00:10	11	02:15
Others	2	01:15	1	00:00	0	–	3	00:10	0	–	6	01:25	2	00:00
Total	29	05:00	17	24:35	0	–	13	00:40	4	00:00	63	30:15	107	50:42
P27	46	05:55	24	27:37	5	03:00	24	07:45	8	06:25	107	50:42		

[a]For each system-type category the total number of faults and total time lost are given

One conclusion that can be drawn from the information in Table 2 is that beyond the problem with ALFOSC and the safety system of the building there were no other significant problems causing downtime.

3 Instrument use

Table 2 lists the number of scheduled observing nights and technical nights for each instrument. This covers all nights, including CAT, CCI and guaranteed time. In this table I have also included the number of observing runs, and the number of nights per observing run for each instrument.

Table 3: Instrument use

Instrument	No. of nights		No. of runs	Nights/run
	Scheduled	Technical		
ALFOSC	80	16	32	2.5
NOTCam	11	8[a]	5	2.2
MOSCA	7	–	2	3.5
SOFIN	34	4	13	2.6
SIRCA	8	–	1	8
IACUB	7	–	2	3.5
OPTIMA	4	1	1	4
FIES	–	3[b]	–	–

[a] One night assigned to Östlin

[b] Tests with FIES were spread-out over many nights always together with another instrument mounted at Cassegrain

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

As before, most comments written in the reports during period 28 were very positive.

Comments were made about the desirability of having a focus pyramid for NOTCam, a warning message at the start of an observation with ALFOSC if the calibration lamp is in, and the possibility to make and execute observing scripts. We are actually in the process of purchasing a focus pyramid for NOTCam, and we are already working for some time on the development of an observing script system. A warning message concerning the calibration mirror in ALFOSC is being considered.

5 Operations

5.1 Safety

The staff safety instructions have been updated. This has been particularly important with the recently periods of bad weather on the mountain, including snow, ice and continuous high humidity. Also included are the use of the warnings of bad weather conditions from the ORM administration, and the new night porter.

5.2 Goals and Objectives

Up to now the set of goals and objectives defined for the period 1 July 2003 to 30 June 2004 appear to be working reasonably well. Most goals are being met more or less in time, and only very few things were noted that were not included.

The current plan is to defined a new set of goals and objectives for the period 1 July 2004 to 30 June 2005, and discuss this with the staff before the middle of June. After that, the general goals and objectives will be presented for approval to the Council.

5.3 Building

5.3.1 Rotary valve

A new rotary valve at the base of the telescope to allow water for the cooling system to circulate was designed and built. It has a much large central hole than the current valve to give space for more cables (specifically the fibers which connects the telescope with FIES when it is installed in its new housing).

5.3.2 Scaffolding

Construction of a scaffolding ∼2 meters below the telescope base inside the 'cathedral' (i.e., inside the pillar that supports the telescope) was recently started. The idea is to make the installation of new equipment (e.g., the new rotary valve) and any maintenance work in this area easier and safer.

5.3.3 Electronics

Work is still in progress on an inventory list of all the electronic components and sub-systems of the telescope, building and instruments. The idea is to identify all the items that we don't have spares for so hopefully avoid any serious problems due to failures of unknown systems. Also to clarify where possible if the documentation we have matches the actual system it described, mainly this is verifying circuit diagrams.

5.3.4 Cooling system

A detailed plan was made for an upgrade of the cooling system, to a more efficient, higher capacity system which would reduce the maintenance and running cost. The cost for this is estimate to be in excess of 100Keuro. A detailed plan will be presented.

5.4 Telescope

5.4.1 Wavefront sensing

Some somewhat confusing results were obtained. Last summer a significant astigmatism was noticed in the NOT primary mirror, and it was found that this had probably been introduced after the aluminisation of the mirrors in 2002. The astigmatism was corrected to pre-aluminisation levels by applying suitable corrections to M1 in the active optics system. In March 2004 a couple of hours of WFS measurements were made. As before, only significant variations in aberration with zenith distance was found for spherical aberration and especially astigmatism. However, the variation in astigmatism had a negative dependence on zenith distance instead of the positive dependence found before.

Part of these differences might be caused by a different alignment of the mask used for the measurements. Some tests were made in early April to try and verify the results but the data are inconclusive and further more extensive measurement are planned.

We are currently also looking into the possibility of getting assistance in analyzing the WFS data from an optical engineer at the CUO.

5.4.2 Pointing

No more reports were received about poor pointing but our extensive tests have shown that the pointing varies significantly. The main result we found is that the pointing varies within a night, specifically it appears to depend on the time since the telescope power is switched-on (which is typically somewhere near the end of the afternoon). The pointing shows deviations in both azimuth and altitude which vary ∼sinusoidally as a function of azimuth, where the phase and amplitude of these sinusoids change with time. This means that any pointing can be either good or bad depending on when and where you are pointing, and not necessarily on when the last pointing model was made. In fact, we have not changed pointing model in the last 6 months.

We are currently still investigating what might cause the pointing to vary as a function of time since power-on of the telescope.

5.4.3 The new TCS

The programming of the new TCS has progressed somewhat faster, and at the moment 85% has been implemented. The current estimated finishing date is July 2004 (note that this now includes catalog handling which was note included before). One thing which was not properly taken into account, and might effect progress is the need to check the software with the hardware which has already required some modifications to the telescope hardware. Also, continued work on the pointing problem discussed above has affected progress.

Note that the user interface is not included in the above. We have had some discussion about the user interface, but a final design still has to be defined.

5.4.4 Mirror cleaning

Since the aluminisation in May 2002 the M1 and M2 mirrors have been C02 cleaned nine times. The last cleaning was in March and the reflectivity of M1 after CO2 cleaning was ∼3.5% less than just after aluminisation. The mirror cleaning procedures were studied, and a draft document was written on the current procedures and plans for the future. A "wet" cleaning of the mirrors is planned for May the 25th.

To help with monitoring the reflectivity, and agreement was made with the optical engineer of the ING to measure the reflectivity *and* the scatter of the mirrors on regular (∼6 weeks) intervals. This will also provided a valuable cross calibration of our own reflectometer.

5.5 Autoguider

A report has been written describing an upgrade plan for the NOT autoguider system both for the existing X–Y carriage system and include a discussion for a potential fixed large format CCD system for the new adapter.

As part of the upgrade, the new guide-probe head supplied by CUO was successfully installed and tested in April. This nearly doubles the field of view for the guide probe when used with ALFOSC or MOSCA, due to the significant reduction in vignetting and resulting in an approximate doubling of the available number of guide stars. For this system to be used with FRED a more sensitive guide camera is required, but due to the limited space only two possible cameras have been identified and we are still waiting for a reply on some specification details.

5.6 Adapter

A feasibility study was requested from CUO for a new adapter, including a two-channel (blue and red optimized) standby CCD camera. This document has recently been received, and still needs to be reviewed.

5.7 Calibration plan

A general calibration plan was drafted to monitor the performance of the telescope, instrument and their detectors. This incorporates the zeropoint monitoring for the optical imaging instruments (ALFOSC, MOSCA and StanCam) which is now regularly carried-out and can be a valuable tool in defining the best strategy in cleaning the mirrors. The overall calibration plan is currently being reviewed.

5.8 ALFOSC

5.8.1 New Camera

It was found that indeed there was a problem with the coating of the optics of the new camera. It was decided to buy new optics and built a new camera.

5.8.2 Detector

It was found that the settings for the clamp and sample time for the new CCD are wrongly set by BIAS when it starts up (they are set correctly in the CCD controller). The effect of this is that the read-out time for the CCD is ~90 sec. Tests were made to check the gain, read-out noise and linearity with the proper values for the clamp and sample time. The read-out time with these settings is reduce to ~80 sec.

Various changes were made to the software on the CCD control card that is used with the multi-window photometry program. This has removed a lot of the problems using the BIAS CCD control program in the normal observing set-up (mostly commands that were not working properly). Some final tests will be made to see if everything works with both the multi-window photometry software and the normal BIAS program (which currently uses a different control card), such that the same control card can be used for both.

The procedures to test the CCD, and analyze and present the results on the web have now been fully implemented. See

`http://www.not.iac.es/instruments/qc/`

5.8.3 Observing tools

The 'Quicklook' data analysis tool for ALFOSC data has been further improved, and is very much appreciated by the observers.

As a spin-off of the service observing programs, a generator to make mosaic observing scripts was installed. This generator can also been used for MOSCA. See

`http://www.not.iac.es/observing/forms/service/scriptOB.php`

5.8.4 Long-slit spectroscopy

A new grism with a resolving power of ∼2000 covering the wavelength range 3550–5100Å, was received and commissioned. See

`http://www.not.iac.es/instruments/alfosc/grisms/grism16.html`

Michael Andersen has designed a medium-resolution VPH grism centered on Hα/Li I 6708Å, covering the wavelength range 6400–6800Å, and giving a resolving power of R∼7000 for a 1 arcsec slit. The peak efficiency of the grism is expected to be 90 percent, making the total efficiency of ALFOSC on the NOT better than that of the spectrograph ISIS on the WHT 4.2m telescope. This efficiency is also much better than that of ALFOSC in Echelle mode (with a R∼4000 and a 0.5 arcsec slit).

It was noted by the instrument working group on low-resolution spectroscopy that it was difficult to do proper flat fielding in the blue. Tests were made that showed that it actually is possible to flat field in the blue to a level well below 1%. However, it has turned-out to be very difficult to find a spare for our current UV-bright lamp on the market, as UV light is seen as a health hazard and most lamps come with inbuilt UV shielding. We bought a Blue-bright lamp instead.

5.8.5 Calibration unit

The ALFOSC control software was improved to include an automatic switch-off of all the lamps and the retraction of the calibration unit when exiting the UIF. Also, the status of the mirror and the different lamps is now added to the FITS headers of the data files.

5.8.6 Multi-object spectroscopy (MOS)

We bought new control cards for the MOS CNC machine at the NOT, but there is still a problem with the electronics that needs to be solved.

A new distortion map was made for the new CCD plus new camera. However, at the moment there is still a problem with the orientation of the masks produce being either flipped in software or hardware.

5.9 NOTCam

5.9.1 Lift mechanism

A new table and lift mechanism was made such that NOTCam can now be opened completely inside the clean room.

5.9.2 Wheel bearings

Given the problems with the wheel bearings in NOTCam we had in semester 27, a complete overhaul of the bearings was made in November 2003.

New standard commercial bearings were purchased and were treated by a company in England. The company cleaned the bearings of their normal lubricant and coated then with a special coating. For all the worm drives these new bearings were installed. The method for doing the change of bearing has been documented on the web. Also for the camera wheel, one of the the spacers was replaced with a slightly thicker one which made the movement easier, though with no observed play of the wheel. It was found that although the focus mechanism had a none standard size bearing (it is thinner than the normal catalog units) a standard size bearing would fit. These have been purchased and also treated in England, but not installed.

From our own experience and tests done at the ING we expected these bearings to last well over a year. However, last week we again had a major problem with one of the filter wheels and it is suspected that this was again caused by the wheel bearings which were newly installed only half a year ago.

It still needs to be confirmed that the problem is Trula with the bearings, but if so we need to look for an alternative solution for the bearings. One such alternative are bearings which have been qualified for space operations. We actually looked at these type of bearing as an option for the overhaul but, apart from these bearings being very expensive, we could not obtain proper information from the Spanish distributer of the company. We now plan to pursue the option of buying these bearings further (e.g., buying them through an other country).

5.9.3 The detector

The number of dead pixels in the currently installed engineering grade array was found to have increased from $\sim$1% in the beginning of 2003 to nearly 5% at the end of 2003. These dead pixels are mainly located on one of the sides of the array, so they don't interfere with observations much. However, there is a clear tendency for the fraction of dead pixels to increase with the number of thermal cycles. During 2003 NOTCam had to be warmed-up and opened 6 times. We should carefully consider when to replace the current array by the science grade array, especially taking into account possible future thermal cycles. After the last opening the number of dead pixels was at slightly above 5%.

To improve the pumping efficiency mainly for NOTCam but also for all our instruments, some extra vacuum equipment was purchased. The main idea was to change from the existing 25mm diameter tubes to 40mm that should improve the performance of the pumping. Also purchased were two pressure sensors and a controller/display so it is possible to see the pressure both at the pump and inside the dewar being pumped, simultaneously. This will remove the guess work in knowing when to open the valve for a dewar with a unknown vacuum and make the procedure safer.

The procedures to test the array, and analyze and present the results on the web have now been fully implemented. See

`http://www.not.iac.es/instruments/qc/`

These procedures will actually be very useful when we install the science array.

5.9.4 Pressure sensor

We had some problems with one of the pressure sensors in NOTCam, showing a sudden change in pressure. Leak tests were made using He gas and the Residual Gas Analyzer, but no leak was found. An extra bottle of He gas was ordered and the leak test is now made part of the procedure to close NOTCam.

5.9.5 Filters

The Z (maybe better called Y; see Hillenbrand et al. 2002, PASP, 114, 708) and He $\mathrm{I_B}$ 2.059μm filters originally ordered in 1999 arrived and were installed. Also, four filters ordered by Göran Östlin arrived and were installed. Three of these filters were substitutes of filters that arrived earlier but were found to be faulty. These "Östlin" filters are available for general use.

5.9.6 Camera

Two square masks were made and anodized to limit the amount of scattered light for the imaging modes with both the HR and WF cameras. They were tested, but the improvement was found to be marginal for the WF camera and the mask was taken out again (to allow space for a long slit).

5.9.7 Spectroscopy

Wavelength calibration lamps (Argon and Xenon) have been ordered and will be tried out in the lid on the Cassegrain baffle, where we expect the main problem to be low count rates, but preliminary tests with the Argon lamp have shown this not to be a problem. The flatfield lamp in the lid on top of the Cassegrain baffle has been proven to be useful for NOTcam, but the location is not optimal as at night the mirror cover need to be closed in order to make calibration exposures.

The problem with the focusing of the HR camera to be able to do higher resolution spectroscopy (R$\sim$6000) and other types of science that require aperture wheel items to be in focus on the detector, can be solved mechanically by machining the front off the aperture wheel unit and moving the aperture wheel unit by 2mm away from the collimator. Possibly, the lenses in the HR camera itself could be repositioned instead, but this should be looked at by an optical engineer. The latter option will most likely change the scale of the HR camera in imaging mode.

New holders have been made for the slits to be used with the WF camera, after experiments showed that the previous holders might play a role in the deformations of the slits when cold. The new holders are made of copper, which should have a similar expansion coefficient as the slits which are made of a thin copper/nickel laminate.

Further upgrades to the spectroscopic capabilities of NOTcam, e.g., R$\sim$6000 with the HR camera and R$\sim$800 with the WF camera, are still awaiting input from Nordic astronomical community regarding science drivers etc.

5.9.8 Focus pyramid

The vacuum grade epoxy intended for making the pyramid was tested and found to resist any amount of thermal cycling. The prisms for the focus pyramid have now been ordered.

5.9.9 Detector controller

We are still awaiting a modification of the array controller such that an 'ABORT' command can be implemented in the BIAS detector control programme. Further improvements to increase the readout speed will have to wait until the new controller for the detector array is available.

5.9.10 Commissioning

A list of NOTCam commissioning status (for imaging mode) and remaining tasks to be done was prepared.

5.10 MOSCA

5.10.1 General use

It is noted that MOSCA is not requested often. However, if one looks at the proposals there are various programs that request ALFOSC when MOSCA (mostly because of its increase efficiency in the blue) would be more suitable.

5.10.2 Detectors

The varying bias levels of the 4 CCDs was investigated. The bias levels for the different CCDs were changed to be more similar. Tests were made to see if the observed variations in bias level effects the final reduce results, and it was found that basically in all cases these variations do not have a significant effect.

5.11 StanCam

5.11.1 Cooling

The cooler was installed in the service loft below the observing floor, and the tubes have been re-routed through the fork of the telescope. It has since operated without any problems together with NOTCam and its (PTR) cooler and tubes.

5.11.2 Detector

The procedures to test the CCD, and analyze and present the results on the web have now been fully implemented. See

`http://www.not.iac.es/instruments/qc/`

5.12 FIES

5.12.1 Building

Finally all the design papers were received and we are currently in the process of obtaining the required permits. The current estimate is that we should have all the paperwork done by August, though we are trying to speed-up the process somewhat.

We already have contacted various companies for offers for the construction work so we can start as soon as we have the permits. It appears that the cost will be significantly higher than the 30Keuro estimated before due to the remoteness of the site. The construction work itself is expected to take less than one month.

5.12.2 Detector

A new CCD with cryotiger was been installed which has made FIES a fully functional high-res (R=60000) spectrograph, with a wavelength coverage of 3800-8300Å.

A special 'skew' readout mode has been developed for FIES. This readout mode makes it possible to choose a lower resolution for the spectrograph thus enabling observations of fainter objects. An additional advantage of the readout mode is the reduced readout time (for example for R=10000, readout time is 15 seconds). Further development may reduce the readout time to less than 5 seconds for all resolutions, including the normal (unbinned) resolution of 60000.

5.12.3 Overall efficiency

In November and December 2003 standard star exposures have revealed that the current efficiency of the spectrograph is similar to that of SOFIN (about 3%).

5.12.4 ADC

The installation of the mechanical part of the ADC turned out to be complicated due to some (partly undocumented) modifications that had been made to the adapter in the past.

Possible options were discussed with Niels Michelsen (CUO) who will design a mechanical support unit for the FIES ADC. The TCS has been identified as the best candidate to serve as the control program for the ADC. Aarhus will provide a control program to operate the ADC in engineering mode, which can serve as a basis for the TCS version.

5.12.5 Reduction software

A document describing the basic user requirements for a dedicated quick-look and 'pipeline' reduction package was written.

There is now a sufficiently large set of data obtained with FIES that can serve as a first test bench for developing and testing the automated data processing. The development of the reduction package has started and already various parts of the reduction package and its graphical user interface have been made, and are being tested.

5.13 Computers and software

5.13.1 Data flow

An overall objective is to integrate all aspects of data gathering, data handling and data processing in to a single system. A web-service project was started to unify the data flow in the proposal 'cycle'. This framework involves handling proposals, observing and technical schedules, various feedback forms and the data archive. This project touches many aspects of operations, and is being implemented in parts.

5.13.2 FITS headers

Extensive FITS header information are an essential part of the data flow for such things as a (searchable) data archive, and local post-processing like automatic logging, quicklook facilities, quality control tools and pipeline data reduction.

A study was made of the current FITS headers in the data files from the different NOT instruments, and a document was written containing a complete list including requirements and definitions of the data file format and headers necessary to described the data from the different instruments properly. Visiting astronomers would also strongly benefit from the proposed enhancements to the FITS headers, since data reduction can be more straight forward and less time-consuming. Furthermore, it is important to have uniform and adequate FITS header information that adhere to internationally defined standards and conventions when NOT data is to be considered for use in virtual observatory systems.

To look for possible improvement to the current system, a pilot study was made using the CFITSIO libraries for post-processing of data files from the detector array controllers into Multiple Extension FITS files with FITS-standard compliant headers.

5.13.3 The Sequencer

Development of this system that provides an interface between the instrument control software and the telescope system, and which will allow script observing have continued. This system is based on shell scripts, and is currently being developed for use with StanCam + FIES.

It was decided to use SOAP instead of CORBA as middle-ware. Currently, performance tests are being made with SOAP to verify that the needed calls can be made in a sufficiently short time. A preliminary draft has been made to define the interface behavior between the different components. A test implementation of a Sequencer enable version of BIAS was made.

5.13.4 Web server

The existing web server has been replaced and was installed at the observatory. A mirror server has been set up in the sea-level office, which serves as backup and development server. One of the advantages of this system is that the web server will always be available even when the link from the mountain is broken, which is especially important when working at the telescope.

The web-pages themselves have undergone a complete redesign, improving structure, navigation and readability. Redundant and out-of-date pages have been removed. Many existing web services have been rewritten to improve functionality. This includes for instance the weather station and signal-to-noise calculator. The further updating of the pages is a continuous process, but it is expected that most improvements to the pages will be made in the near future.

5.13.5 Network connection

With our assistance, the ING has developed a plan for a microwave connection to the observatory. An agreement is being set-up with a local company. Currently we are waiting for the paperwork to be finished.

The new link will provide a ($\sim 10\times$) faster, and more reliable network link.

5.13.6 Various

Various software and computer developments have occurred in the past few months. Below I list the most relevant things.

- As an experiment, data on DVDs was given to some observers with good feedback. However, in dry weather the regular DVD drives failed.
- The problem with the CD carousel have continued, and we are now testing a new robotic system that writes DVDs (or CDs) and automatically prints labels on them. We had some problems with the special DVDs that were delivered with the system as they turned-out to have scratches on them which made the tests fail. We are currently continuing testing with DVDs purchased locally.
- Software for backing-up home directories has been selected. However, it is still an open question what the final hardware configuration will be. E.g., this might be the CD carousel which we probably can/will not use for data saving at the observatory, or removable hard disk drives.
- As part of the expansion of the sea-level office, the network was reorganized, a gigabit switch was installed and all desktop wall connections were enabled for gigabit.
- Both the hardware and the software of the DNS name server was upgraded to provide faster, and especially more reliable network access.

- To provide up-to-date versions of some of the software applications commonly used by people, network installation instead of local (i.e., limited to a specific computer) installations were provided for IRAF and Acrobat Reader. In the future, with each new (version of an) application we will decide if we should provided it either as a network or local installations such that we limited the amount of work, while having as much as possible up-to-date versions of applications. In general we should aim for network installation, which should be considered in the set-up of new computers in the network (as for compatibility in hardware and operating systems).

6 Looking ahead

6.1 Telescope and building

6.1.1 New TCS

The installation and testing of the new software should be finished in this semester. The next task will be the design and implementation of a user interface. The interaction with the autoguider has to be defined and implemented.

6.1.2 Electronics

The inventory list of all the electronic components and sub-systems of the telescope, building and instruments will be finished. On the basis of this we will see what spares might need to be bought and/or look for ways that parts can be replaced, e.g., in software.

6.1.3 Rotary valve

The rotary valve will be installed.

6.1.4 Mirror cleaning

The mirrors will be washed and a system of monitoring the reflectivity and scatter of the mirrors will be set-up. The final aim is to define procedures to decide when and how to clean the mirrors best.

6.2 Calibration plan

The overall calibration plan will be reviewed and started. One of the main tasks will be to develop software tools to reduce and analyze the data. Defining these tasks and starting their development will be the main objective for the coming semester.

We are currently planning together with John Fynbo of CUO to hire a research assistant to develop 'pipeline' reduction software for the optical imaging instruments (ALFOSC, MOSCA and StanCam). A draft document with the user requirements has been made. A significant part of the software already exists, and the package is expected to be ready within a year. Further development in this collaboration would be to include the reduction of NOTCam imaging data and ALFOSC spectroscopic data.

6.3 ALFOSC

6.3.1 Optics

It is clear that the camera optics need replacing. It turned-out to be difficult to get the proper glass for the new optics, but his now seems to be resolved. The current expectation is that the new camera would be arriving toward the end of the semester.

6.3.2 Detector

The final tests should be made with the modified control card for multi-window photometry using BIAS. The gain, read-out noise and linearity of the CCD should be tested using this card with the correct clamp and sample time (in fact, the multi-window photometry set-up already uses the correct clamp and sample time), after which this card can be installed permanently for use with either the normal set-up or for multi-window photometry.

6.3.3 Multi Object Spectroscopy

The remaining electronic problem with the CNC machine should be checked, and repaired if possible. Also, the flipping of the masks made using the new distortion map should be sorted-out.

6.3.4 Coronography

Some initial tests were made with the coronographic mask. See

`http://www.not.iac.es/instruments/alfosc/corono.html`

On sky tests are planned for the near future.

6.4 NOTCam

6.4.1 Wheel bearings

If the current problems with the filter wheel are truly due to the bearings, we should try to purchase as soon as possible proper replacements and install them in all wheels.

6.4.2 Detector

The increase in dead pixels in the engineering grade array currently in use makes it even more important to consider installing the science grade array. However, we should carefully consider when to do this in relation to any further openings and warming-ups of the instrument. An obvious time to consider the change would be with the possible change in bearings.

6.5 MOSCA

6.5.1 Detector

A procedures to test the CCDs, and analyze and present the results on the web similar to that for ALFOSC will be implemented soon.

6.6 FASU

6.6.1 FAPOL

As noted in Sect. 2 the most serious problem in semester 28 was the problem with the FAPOL retarder plate. A lot of observing time was lost because the system does not detect if the rotator actually works. We are currently in contact with CUO to modify the control card such that it checks its position every time in has made a full turn. A similar system exists for the wheels in ALFOSC, and this should be a relatively simple modification.

6.7 FIES

6.7.1 General

An extensive 'to-do' list was prepared detailing the different items needed before common-users status of FIES as a stand-by instrument can be accepted. This needs to be discussed with Aarhus and it should be decided who is responsible for which task, and what the order and priority of these tasks should be.

6.7.2 Building

Efforts will be made to speed-up the processing of requesting the permits. Further offers from construction companies are expected soon, and we should be able to start construction as soon as possible, hopefully before the end of the semester.

6.7.3 Optics

Some of the optical components will be (re)coated before the instrument will be placed in its building. Bo Lindberg (Aarhus) will design a new fiber unit, with a new coupling to the telescope. The required fiber length to run from Cassegrain to the building is about 45 meters. A dedicated Cass calibration unit needs to be designed. The expected peak efficiency after these upgrades is about ∼8% (atmosphere+telescope+instrument+detector).

6.7.4 ADC

The new support unit for the ADC will have to be made and the control software will need to be written and added to the TCS.

6.7.5 Control software

Currently there are 2 basic programs to operate FIES and its detector. The detector program 'BIAS' should be partly re-written to melt in with our new operational software environment (the 'Sequencer'). The same holds for the control program that operates the moving parts in FIES and its calibration unit, and additionally this program will have to be adapted to operate new items yet to be designed (e.g. a new calibration unit, Hartman doors, a new exposure meter, etc.).

6.7.6 Reduction software

The plan is to have the quicklook reduction software and interface completed, and make a preliminary version for the science grade reduction interface and software.

6.8 SOFIN

All the developments are pending until the new cross-dispersion prism is polished.

6.9 Computers and software

6.9.1 Data acquisition system

We are currently working on an upgrade of the data acquisition system. A new RAID hard disk system was purchased and is being tested. This system is used for data saving during observations, and will expand our capacity from 300Gb to nearly 1Tb.

We also have purchased new instrument control computers. This will both increase the speed of the system, but will also allow the installation of a more up-to-date operating system. The hardware has been tested, and the FIES computer will be the first to be commissioned.

Related to the upgrade of the RAID hard disk and the instrument computers is an upgrade to a gigabit network switch. A test setup has be made at the sea-level office.

The overall goal is to increase the speed and capacity of the data acquisition system, while this is also required as part of the planned data quality control and pipeline reduction programs.

6.9.2 Various

Various software and computer developments are planned. Below I list the most relevant things.

- *The Sequencer*: Development will continue of the Sequencer with the implementation of the StanCam BIAS program enable for use with the Sequencer. Also, the interaction with the TCS should be tested and implemented.
- *Data archiving*: Tests with the robotic DVD (and CD) write and labeling machine will be ended soon. Depending on the results, we will decide how to proceed and what to offer to visiting astronomers. The CD carousel might be used for the backup system of the SLO computers
- *Data flow system*: We will continue work on various aspects (proposal processing and scheduling, fits headers, data archiving, observing logs, the sequencer, data reduction software, etc.) of our general data flow system. An overall plan will be made to define all the different components in the system. The main aim of this is to avoid any inconsistencies or incompatibilities in the system
- *FITS headers*: An especially important task will be to look for possible improvements to the current system regarding FITS headers and data file format. We are specifically looking in to setting-up a post-processing system of the data files coming from the detector controller to generate data files with a proper file format and FITS headers. Most likely this will require some (limited) modifications of the BIAS data acquisition program.
- *Network access*: Following the web server, the ftp server and the Mail server will be moved to ORM to provide faster access, and guarantee access by observers. Hopefully, also the new microwave link will become available.