Period 38
AiC Report to the NOT Council and STC

50^{th} STC meeting, May 11, 2009
&
55^{th} Council meeting, May 12, 2009

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Contents

1 Introduction

This report covers the operations of the Nordic Optical Telescope for period 38: 2008-10-01 to 2009-04-01.

2 Down Time

The down time statistics are based on individual fault reports. In Table 1 I give the general down time statistics for period 38. A total of 88 fault reports were submitted, with an average time lost of 3 min per fault, for a total down time of 0.2% (0.2% on scheduled observing nights). Of these, 66 reported no time lost, 22 reported < 2 hrs lost, and none reported 2 or more hrs lost.

Table 1: Technical down time statistic period 38: 2008-10-01 to 2009-04-01

Night included	Time lost	Nights	Percentage[a]	Last semester	Last winter
All nights	250 min	182	0.2%	1.8%	0.8%
Scheduled observing nights[b]	220 min	132	0.2%	0.1%	1.1%
Technical nights	30 min	23	0.2%	0.1%	0.4%
Service nights[c]	35 min	27	0.2%	0.1%	1.1%
Visitor instruments	0 min	20	0.0%	6.8%	0.0%

[a] Taking the average length of time within nautical twilight. Exact numbers for each night are used when looking at "All nights"
[b] Excluding technical nights and visitor instruments
[c] Excluding service nights with SOFIN

The down time statistics are based on individual fault reports. In Table 1 I give the general down time statistics for period 38.

This compares to a down time of 1.8% over all nights (0.1% on scheduled observing nights) in period 37, and 0.8% over all nights (1.1% on scheduled observing nights) in period 36. Of the 95 fault reports reported in period 37, 63 reported no time lost, 28 reported < 2 hrs lost, and 4 reported 2 or more hrs lost. Of the 74 fault report in period 36, 47 reported no time lost, 24 reported < 2 hrs lost, and 3 reported 2 or more hrs lost.

The reported downtime is at an all time low, where it is clear that the main difference has been that no major problem occurred during period 38. The only 'negative' side of being so close to zero is that the down time can really only go up...

2.1 Weather

For period 38 a total of 778hr 23min was lost due to bad weather which corresponds to 38.2% of all the dark time as compared to 20.0% in period 37 and 36.0% in period 36. The total amount of clear dark time was 1259hr in period 38, as compared to 1299hr in period 37 and 1311hr in period 36.

2.2 General overview

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 previous two period (36 and 37).

Table 2: Down-time statistics for period 38[a]

Syst/Type	Soft		Elec		Optics		Mech		Others		Total		P36/P37	
Telescope	9	00:55	10	00:50	0		1	00:05	0		20	01:50	14/21	02:10/19:55
Building	0		3	00:00	0		3	00:00	0		6	00:00	4/3	00:10/00:10
Computers	12	00:45	1	00:00	0		0		3	00:00	16	00:45	11/19	00:15/02:00
ALFOSC	10	00:05	1	00:00	2	00:30	1	00:10	2	00:05	16	00:50	30/21	12:00/03:00
MOSCA	0		0		0		1	00:00	0		1	00:00	0/2	00:00/00:35
NOTCam	5	00:05	0		0		0		0		5	00:05	2/13	00:05/00:50
StanCam	3	00:20	0		0		0		0		3	00:20	2/1	00:15/00:00
FIES	12	00:15	2	00:00	0		2	00:05	0		16	00:20	6/10	02:15/03:15
Others	1	00:00	1	00:00	0		0		3	00:00	5	00:00	5/5	00:00/00:00
Total	52	02:25	18	00:50	2	00:30	8	00:20	8	00:05	88	04:10	74/95	17:10/29:45
P36	38	08:35	22	07:20	1	00:00	4	00:00	9	01:15	74	17:10		
P37	49	03:25	21	04:20	2	00:10	12	18:35	11	03:15	95	29:45		

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

2.3 Main problems

There were no faults causing more than 2 hours downtime during period 38, but there was one problem that caused small amounts of down time on various occasions. This same problem continued in to the current semester causing some more down time bringing the total down time caused by that fault to be over 2 hours so I will discuss it here.

- **2008-11-15 to 2009-04-09: Guide camera filter problems**: 2 hr 30 m

  On several occasions the filter wheel of the guide camera became misaligned vignetting part of the field of view causing problems with the detection and centering of the guide star. Both mechanical and electronic problems were suspected, but more detailed investigations did not show any specific problem. Some changes were made in the way the filter wheel was operated which at first worked very well. In the end things deteriorated quickly at which time it became apparent that a problem in the controller of the filter wheel caused it to work intermittently. Replacing the controller solved the problem.

3 Instrument use

Table 3 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	56	12	17[a]	2.5
FIES	58	3	15[b]	3.3
NOTCam	16	4	4[c]	3.0
MOSCA	9	1	2	4.5
SOFIN	7	1	1	7.0
TurPol	4	1	1[d]	4.0
PolCor2	4	1	1	4.0
FastCam	5	–	2	2.5

[a] Excluding 14 service nights [b] Excluding 9 service nights
[c] Excluding 4 service nights [d] Run 4×1 night

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

As before, most comments written in the reports during period 38 were very positive, especially about the support from the staff.

There were some practical requests such as a new telephone for the control room, a list of phone numbers of other telescopes and a larger screen for the computer used by the observers for data viewing and analysis. It was also noted that the general observers' cookbook and its printer version were somewhat cumbersome to use. All these issue have been addressed in the mean time.

On the instrument side, there was a request to further streamline the target acquisition for FIES, which is something that is work in progress. The main issue raised was that with the set-up provided for spectropolarimetry with ALFOSC the duty cycle can be very poor for bright targets, which are the most likely to be chosen to reach the high signal-to-noise levels needed to detect the typically low values of polarization. For this we have changed the instrument set-up to improve the duty cycle without significantly affecting the use of the instrument for other polarimetry applications.

The TCS has a warning system that notifies the observers when the humidity or the wind speed is to high. It was requested if this can be expanded to also include a warning if there is a fast change in humidity or wind speed to alert the observers of possible unexpected changes in the weather. We are currently looking how best to implement this.

5 Operations

5.1 Additional services

5.1.1 Educational activities

During period 38 we have had a short (2 hours) training course from Uppsala University observing with FIES and the telescope remotely. Most of the work during the semester has been concentrated on preparations for the NORDFORSK/Onsala summer school at Tuorla observatory in Finland which will use the NOT in remote mode. The planned observations include imaging and spectroscopy with ALFOSC and imaging with NOTCam. For this, requirements were defined for the remote observing systems for each instrument including the telescope control, data display, data transfer, communication, remote observing instructions, data reduction/quality control and the set-up at the remote side. This is largely based on the experience we already have gained with last year's remote observing school at Molėtai observatory in Lithuania but do include some new aspects as this uses different instruments while also the (expected) bandwidth to Tuorla is significantly higher which allows a system that is (even) more similar to normal observing at the telescope.

Currently we are in the process of testing or setting-up tests for the different parts including using the connection to Tuorla. A full-blown test involving all the part that are going to be used is also planned before the start of the school.

The staff has also been heavily involved in the practical preparations as for designing a poster, setting-up a web-page including an automatic application form, selecting the students, project definitions, observing preparation, and doing back-up observing.

During the STC and Council meetings we also will have the on-site course (5 nights) from the Stockholm University.

As part of the training of the NOT students presentations by the staff were organized on detectors and data reduction of NOT data using IRAF.

5.1.2 Service observing

A total of 27 nights of service observing were done, excluding the 7 SOFIN nights done in service mode by Dr. Ilya Ilyin. The Nordic service nights consisted of various more or less isolated observing nights spread throughout the semester. Also in this semester there was a large number of observations that were done by the staff for the ToO and monitoring programs during technical and Nordic service nights.

5.1.3 "Fast-Track" Service Program

In period 36 there were 19 proposals accepted. Of these there were 10 'grade 1' proposals, 6 'grade 2' proposal, and 3 'grade 3' proposal. Only 1 'grade 2' proposal remains to be completed.

In period 37 there were 12 proposals accepted. Of these there were 6 'grade 1' proposals, 2 'grade 2' proposal, and 4 'grade 3' proposal. Of the 'grade 1' proposals, 4 have been completed and 1 was partially completed. None of the 'grade 2' have been completed. Of the 'grade 3' proposals, 1 has been completed and 1 has been partially completed.

In period 38 there were 28 proposals accepted. Of these there were 17 'grade 1' proposals, 10 'grade 2' proposal, and 1 'grade 3' proposal. Of the 'grade 1' proposals, 6 have been completed and 5 have been partially completed. Of the 'grade 2' proposals, 6 have been completed and 2 have been partially completed. The 'grade 3' has not been completed.

Up till now 4 proposals have been received in period 39. Of these, 1 is still in the process of being graded, 2 have 'grade 1', and 1 proposal was rejected.

5.2 Building

5.2.1 Safety

To conform to Spanish law, risk assessments were produced by our insurers PREVIMAC including details of were we do not yet meet the Spanish safety laws. The consequence is that a lot of time is being spent producing an Emergency Plan document and evacuation procedures for the telescope and resolving issues where we do not comply with specific safety aspects.

5.2.2 Electricity supply

An error was discovered with the transformers that measure the electricity consumption. This was repaired.

A new alarm outside has been installed. Any time the entrance light path is cut when the telescope power is on the buzzer in the control room sounds and you now also get another buzzer outside. So, if you go down to the service building and you cut by mistake the light path you also get a warning outside which is useful if nobody is left in the control room. If you are fast enough you can return and reset the safety system without loosing the telescope power.

5.2.3 Drive System

The electronics for the new Siemens building drive system were mounted and installed in racks. Extensive tests were done and preparations were made to allow for the installation of the electronics and the motors along the current system for final testing and commissioning.

Early in 2009 an engineer from Siemens visited to assist in the programming of the new electronics and a preliminary commissioning was done with all four motors connected in the Service Building.

Due to some unexpected problems with the software (not been able to identify the exact motors attached because they were connected in a different order to that during the initial programming in the Service Building) and then the subsequent failure of a programming adapter it has been impossible to complete the installation. A replacement adapter was received recently (being delayed by more than a month although delivery was promised within 10 days and the piece was send via a courier service) but that also did not work. It is not clear if the failure is due to the adapter itself or the connector in which the adapter plugs in. We are currently in contact with Siemens about this.

5.2.4 Web-cams

Various new cameras have been purchased and were installed on the observing floor, in the control room, in the electronics room and on the weather station mast. These cameras will be used to monitor activity at these locations as to avoid danger to personnel and equipment when telescope and/or instruments are being operated remotely. The cameras can also serve the purpose of assisting the staff in fault diagnostics when they are not at the telescope.

The cameras in the telescope building can only be remotely used when they are switched-on manually be a person in the room where the camera is installed. Notices advising people of the presences of the cameras and instructions on how to switch the cameras on and off are posted in each room and in the general instructions to the observers. To avoid possible unwanted outside access to the cameras a system has been implemented to allow only time limited password access to the cameras (e.g., access for a staff member from his home). A web page is being developed to provide a simple overview of all web cameras from within the password protected IntraNOT web pages. None of the data from the web cameras which are installed inside the telescope building are being archived.

The intention is to also use these cameras during the coming remote observing school at Tuorla to provide a better view of the operations of the telescopes and as part of the communication between the remote observing site and the control room.

5.2.5 Clean room

A preliminary design has been made for a mountable clean room to be installed in telescope dome. However, due to the more extensive work and delay with the telescope amplifiers and building motors no more progress has been made.

5.3 Telescope

5.3.1 Telescope control system

Much background work has been done on integrating the TCS more in to the overall observing system. The main issues are the communication between the TCS and the rest of the observing system, and the limited capacity of the TCS system itself. As part of this, modifications are continuing to be made to the TCS to expand the level of communication and to export certain tasks to other, more powerful computers. Specific objectives are, e.g., to make switching between instruments (like ALFOSC and FIES) during the night simple, and allow for a easier handling of TCS logs. The idea is to export this to the general observing system computers.

It has also been decided to change the TCS interface (currently on a VT100 compatible console) with software emulators running on a computer sporting a bigger screen. This will allow to integrate both the TCS user interface and error console on one screen, while also providing more space to present the information better.

Standard catalogues are now read in to the TCS at boot time and resides as a built in service in case one wants to preset to a given standard star. A general web-page was set-up with information on the different catalogues:

`http://www.not.iac.es/observing/tools/standardcatalogs.html`

5.3.2 Safety

The issue of safety in case the telescope is controlled remotely was considered in more detail. The general objective is to build in specific protections in commands like moving the telescope that is given from the remote observing system, e.g., including a message asking the observers if they did contact the staff at the telescope, but this can also include all kinds of other alarms, actions, etc (e.g., an alarm bell plus a few seconds delay before executing the movement). One specific thing is that of remote access to the TCS when the remote observations have finished. Specifically, the TCS access code can now be changed at any time without the need of a reboot of the TCS.

5.3.3 Pointing

The pointing has been very reliable and stable, but some tests were made with MOSCA and ALFOSC. The results need to be analyzed. The motivation of these tests is to check if the weight of the instrument is an important factor for the pointing model.

5.3.4 Tracking

One interesting result with the new amplifiers is that it can be seen that the azimuth pre-load seems very small, which could be the reason for the jumps we have seen recorded in the log for this axis. In general, the telescope oscillations seems to have decreased, this can also be an effect of the azimuth and altitude tooth wheels being greased in November.

When differential tracking with autoguiding with a moving guide star box some warnings and display info have been added, especially of importance when the star box approaches an edge.

Tests with unguided tracking have been made with a differential speed of 600+ arcsec/hr, using star trails. They indicate that over a 600 sec exposure the telescope tracks at the specified rate, as determined from the total length of the trails, and any excursions in the trail are small. It is hard to quantify this in detail, but the precision in either of these measures is better than 1 arcsec.

5.3.5 Control room

Some more improvements were made to the control room. A new sofa and table were installed plus two high-quality chairs. Also the cabling in the control room was cleaned up and various Internet access cables are provided permanently at different locations in the control room.

5.3.6 Autoguider

After a 'blue' filter was installed in the autoguider TV filter wheel, we have been experiencing problems with positioning the wheel which could usually be fixed by requesting the filter again. Recently the problem deteriorated to such an extent it could take half an hour of trying before getting the desired (or any) filter. Looking at the actions of the wheel while been commanded to move it became clear the problem didn't lie with the actual wheel but probably with the controller. Using an almost identical controller designated for a fiber view which never got installed and exchanging the memory chips between the units, the spare one worked and the TV filter wheel was restored to its normal operation. The spare now in use is of the same age and running time, 21 years powered on, but it has remained passive for all that time. New controllers have already been purchased and once they are programmed will replace the old unit now in place.

The focussing of the autoguider camera has now been made automatic such that it will be set to the expected value based on the telescope focus every time a telescope pointing is made. This should make things faster/easier, especially for the non-experienced observers (basically to avoid them making any big mistakes), while people can then still change the TV focus value to whatever value they want after arriving at a target.

5.3.7 Amplifiers

The new amplifiers with power supplies were installed in March. They were taken in operation in April and have been operating for all nights since. For the moment they are sitting in front of the electronic racks and will be integrated in the rack when long term stability has been proven (in the order of half a year).

5.3.8 Adapter

The automatic fuse for the adapter mains was replaced since it was reported to be off when the switch was on (though trying to make it fail had no result).

The earth leakage breaker for the power socket intended for visitors' instruments was replaced with a non lightning sensitive type.

5.3.9 Weather station

It was found that the new Väisälä weather station gave unreliable wind speed data, especially at temperatures less than about 6° C. The weather station was sent back to the manufacturer for repair. The station was also upgraded at the same time and we recently received it back and it still needs to be properly tested.

The dust meter is still at the IAC for maintenance. It is not clear when it will be re-installed.

5.3.10 Aluminisation

The mirrors have continued to be occasionally washed and cleaned both with CO_2 and water. M1 has clearly gone down in reflectivity, but also M2 is noticeably getting worse. Both mirrors are scheduled for aluminisation during the full Moon period in early July.

Beyond a thorough cleaning of the lower part of the telescope, we will also try to take the opportunity to do things in the adapter (e.g., clean the pick-up mirrors) which are normally hard to reach, and do things that would be hard to fit in the normal operations schedule (e.g., pump StanCam CryoTiger head, take out and clean the StanCam filters).

A detailed plan for this will be defined in advance.

5.4 Observing system

5.4.1 Post-processing and data display

Observing tasks that previously were controlled through a dedicated post-processing interface have been rewritten and integrated into the sequencer environment. This both simplifies the observing system and enables scripting of tasks that previously was not possible.

A new 'common' DS9 display will be responsible for displaying incoming images and also serve as the display for any observing task requiring analysis of images. The option of exporting the common DS9 display to virtually any X server makes this setup ideal for high bandwidth remote observing sessions. The automatic analysis of incoming images through SExtractor makes it possible to mark saturated objects and give seeing statistics directly on the displayed image.

This new post-processing system has been released for MOSCA and ALFOSC and will be released for the remaining instruments over the next few months.

5.4.2 Observing descriptions and execution

Specifically for service observing the general description of observations, in the form of Observing blocks (OBs), and the execution of observations through (sequencer) scripts have up to now been handled by two different web forms. Beyond this we also have been and are developing more, and more extensive, sequencer observing scripts. The obvious thing to do is to integrate these to make the definition and execution of observations easier and more reliable.

One of the main problems in this is allowing for flexibility without making things too complex as this is counter to the idea of making it easier and more reliable. To avoid this we have decided to limit the definition of any OB to a single instrument *and* observing mode (e.g., ALFOSC-imaging, NOTCam-spectroscopy, etc). For each of these combinations we now have defined which parameters need to be set and what the available options should be for each parameters. In this way we limit the number of parameters in each case (e.g., no slit or grism needs to be defined for imaging) and we can provide specific options in a limited number of input windows and pull-down windows. The next step will be to define how each parameter setting is "translated" to a specific (set of) sequencer command(s) or script(s). The final step would to provide an interface to define instrument+observing-mode specific OBs and an application that translates this to a complete sequencer script that combines all the commands and scripts that are defined by the parameters for execution.

The number of observatory supported sequencer scripts has been further expanded and are more and more used by observers. More complex and extensive scripts are also being developed by one of the groups that have a target-of-opportunity (ToO) program running at the telescope. Together with the further integration of our observing system and the above described developments the idea is that in the future the observer will need to run a script which will, as far as possible, execute the ToO observations automatically, and guide the observer through its execution and afterwards the return to the original observing set-up.

As part of allowing for full scripting of observations also all the (post-processing) procedures that process the data to allow its analysis as part of the observations (e.g., to define if the data are of sufficient quality, or to identify an object to be place in the slit for spectroscopic observations) are now fully integrated sequencer commands and scripts.

5.4.3 Sequencer commands

There are various commands (e.g., "expose") which are the same for different instruments, while in general it should also be clear what part of the observing system a command refers to. To distinguish commands for the different parts of the observing system they have different prefixes. However, it was noted that the different prefixes used for sequencer commands are not always intuitive or even consistent. This has partly a historical reason and is partly based on the different subsystems of the observing system used. It was generally agreed that it would be better to simplify this, where the general 'rule' should be that, beyond any TCS command, any sequencer command used for a specific instrument should have as prefix the instrument name. A 'justification' for this would be that in this way any set of commands given in a specific sequencer command window can simply be copied to a script file where only a single prefix needs to be added to the commands to make them universally executable.

The new scheme has largely been implemented but all scripts should be checked and corrected to include these changes so for a time the old prefix and the new prefix will be valid before the old ones are phased out.

5.4.4 Telescope presetting

We are planning to make an application that given target coordinates and a finding chart will generate a sequencer script that is uploaded to the appropriate script directory and does the telescope presetting and displays the finding chart.

This application will be made available to outside users as a web form which should have the following entries/options: imaging or spectroscopy (for the later case it should be defined if horizontal or vertical slits will be used), target name, coordinates, epoch, required position angle (or, only for spectroscopy, if the parallactic angle should be used). All this defines to what values 'enter-object' and 'field-r', or 'i-p-a', should be set and if 'Preset to selected' or 'Preset to par ang' should be used. When the telescope is moving the finding chart can be displayed. It is then up to the observer to decide how to proceed, e.g., just taking an image to view the field for comparison, or (for ALFOSC) use 'alfosc.acquisition'.

In principle this facility should be available for all instruments, but as a first step a version for ALFOSC will be made. As this includes all possible parameters, making similar versions for all instruments should be simple.

5.4.5 Observing instructions

Following the automatic email system we have to remind observers one month in advance of an upcoming observing run, we now have also implemented an automatic system in which we provide (instrument) specific information about preparing the observations. This basically gives a short summary of what is needed in preparation, mostly consisting of relevant links.

5.4.6 FITS header

A public interface to the FITS header archive has been developed. Access is given to FITS information of images older than 1 year (the propriety period):

`http://www.not.iac.es/observing/forms/fitsarchive/`

This interface will be further developed and improved.

Given the need to be able to automatically process images it should be possible to uniquely define the type of observation (imaging, spectroscopy, calibration, test, etc) from the FITS keywords. Our current set of observing description keywords do not follow any specific system and in general the post-processing and analysis tools we use rely mostly on specific instrument keywords (e.g, if there is a slit in the light path) to determine the type of observation. Of course we can invent our own system, but that requires that we should carefully consider how to do this ourselves. On the other hand, it would make things more difficult if we change the name of the existing keywords. It was considered that the system of ESO using 3 different keywords to define observations giving the category (science, calib, test, etc), the type (object, std, sky, flat, lamp, etc) and (observing) technique (image, spectrum, echelle, polarimetry, etc) where each of them can have more than one entry separated by commas is well defined and should cover all possible observations. The keyword naming used by ESO is rather cumbersome and also to be in some sense backward compatible it was agree to use our existing keywords (OBS_TYPE for 'category' and IMAGETYPE for 'type') and add a third keyword (name to be defined) to describe the observing technique used and provide a full description using the parameters as defined by ESO. In this way all our data will be automatically "Virtual Observatory" compatible in this respect as well and adapting to any reduction packages which can process ESO data should be relatively easy.

5.4.7 Quality control

We are in the process of commissioning a new generation of quality control software, designed as modules ("libraries") that can be seamlessly integrated with other pieces of software, allowing also for automation and inclusion in the normal post-processing flow.

This has been completed for ALFOSC; see for a graphical representation of the results:

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

The software for the remaining instruments will be upgrade over the next few months.

5.4.8 Data saving and analysis

With the increase in post-processing and (automatic) analysis of the observing data we will need to consider how we manage the data saving and data processing. Specifically, we need to define the best set-up for the data saving and data processing servers. The final objective is to integrate the network of data acquisition, data saving and data processing computers.

5.4.9 Detector controller

Based on the requirements in the “Data Acquisition System, Requirements and Development plan”, the design of the software components making up this system are being made in collaboration with the group at Copenhagen University. There has been extensive contact and there is continuous coordination regarding the development and a detailed plan including division of tasks and a time line was made. Currently, the module that collects information from the TCS and instruments for the FITS header of the images is being developed at NOT. Further work on the different modules and integration of the whole system will continue throughout the current semester.

5.4.10 Remote observing

Extensive preparation were made for the remote summer school in Turku in June. Based on the planned observations with ALFOSC (imaging and spectroscopy) and NOTCam (imaging) the requirements were defined for the remote observing system including back-up solutions for slow transfer rates. A specific issue is the data rate for NOTCam which are much higher than for other instruments.

Some tests have been conducted to decide the best way of providing access to the instrument control interface. The bandwidth from ORM to Tuorla has been sampled at different times to determine maximum and (expected) minimum bandwidth. A “test set-up” has been made locally by artificially reducing the network bandwidth available to a local computer, simulating the (worse) expected conditions. This experiment has been used to determine what parts of the interface can be “exported” under such conditions. In any case, we will also provide a back-up solution for the case of a severely restricted Internet connection.

For the course specific instructions will be provided for setting-up the system and performing the observations from the remote site.

5.4.11 Computer interdependence

To avoid that a problem with one or more of the (system-critical) computers cause more, and more extensive problems the role and risks for each computer and how that might affect (directly or indirectly) other computers has been documented. Where applicable, the procedure how to correct problems (what to do and in what order) has been defined and included in the documentation.

5.5 ALFOSC

5.5.1 Data acquisition

Several new high-level ALFOSC sequencer scripts where created for the instrument setup, spectroscopic target acquisition and spectroscopic calibration exposures. These scripts were prompted by requirement for the service observing programs but are very useful for general use, i.e., in visitor mode as well. E.g., the whole process of acquiring and centering a star on a slit can be done with a single command.

Also, a script is being developed for making sky flats that allows for a series of filters as arguments, figures out the optimal order of the filters and then takes sky-flats for all these filters.

5.5.2 Imaging

Specific catalogues were provided that are included in the TCS upon start-up, where any of the standard stars (or field of stars) can be accessed at any time without the need to load in a catalogue or read-in the coordinates separately. Apart from the ease of use, this also allows for simpler ways to define scripts (e.g., a general scripts for standard star observations).

Current the post-processing system that analysis the imaging data is being developed further to also include a astrometric and photometric calibration.

Further investigation in to the reported zero point variation has shown this is not due to FASU shutter or any miss-alignment of the filter. Rotating the filter by 90 degrees between the 2 allow positions in the filter wheel slot does give significant differences in the flat field, but a factor $\sim$2 less and in a different direction than those reported. We have been able to show that the changes coincides with a change in position of some filters in the instrument, but it is still not clear what is the specific cause. Analysis of recent data show that the zero-point is stable.

5.5.3 Filters

It was reported that in some cases when moving the filter wheel in ALFOSC the system notes that the filter did not arrive and the FITS header shows the filter status as 'MOVING'. It is thought that the wheel actually does move and arrives in the right place but that the system status gets confused.

We are checking at what encoder position the filter wheel was at those times where the filter header says 'MOVING' during observations which constantly switched between 2 filters. If the wheel moved properly the encoder position should be different from that during the preceding and subsequent observations but the same as the ones one step further removed. This will at least show that there is no problem with the data itself, though the issue of the wrong status will still have to be solved.

5.5.4 Spectroscopy

Tests were made with a new FeAr lamp which has shown that for ALFOSC it is does not provide a good alternative for the ThAr lamp. Specifically, the FeAr lamp shows undesired broad bands of emission, while the sharp lines are not brighter than that of the ThAr lamp.

The efficiency and fringing properties for all grism are now measured with the current CCD, and the information on the web pages were updated.

The vertical 0.5-arcsec slit that was scratched has been replaced with a new one.

5.5.5 Multi-Object-Spectroscopy

For MOS observations slit masks need to be prepared in advance. In the current situation we rely on help from Copenhagen University not only to manufacture the masks but also to let observers run the software to process imaging data and define the distribution of slit-lets on the mask as it turns out that our own software can not handle the current data format. This is clearly not an optimal situation. Depending on any future demand for this observing mode we will review if we need to consider upgrading our own software to be able to handle the current data format and generate mask designs for the machine that makes the masks in Copenhagen.

In the mean time an overhaul was made of the ALFOSC MOS user documentation pages to reflect the current situation properly.

5.5.6 Polarimetry

Polarimetry measurements were taken with FAPOL in the B and R filter of the standard stars and candidate standard stars currently investigated with TurPol in order to find the relative calibration between these two instruments. We also took repeated zero-polarization standards at various rotator positions and with many retarder angles to check for any systematic effects and check if the accuracy can be improved. These data are being analyzed.

The ALFOSC calcite plates (one open, one with slit) were rotated 90 degrees and aligned in order to save overheads when doing (high time resolution) spectro-polarimetry. In this way the readout time for the typical spectro-polarimetry windowing went down from 40s to 13s. These changes have been tested and documented.

At some moment there was some confusion on which retarder plate was installed in FAPOL. To make this more visible, the name of the mounted retarder plate is now displayed on the FAPOL status window.

The quick-look data reduction tool for linear polarimetry will be further developed to allow for the analysis of data with a different number of retarder plate angles (4, 8 or 16) and/or a different set of angles (e.g., using 90°, 112.5°, 135°, and 157.5°, instead of 0°, 22.5°, 45°, and 67.5°). The analysis of the data will also be added as part of the automatic post-processing of the data.

No progress has been made with the Wedged double Wollaston that would be purchased by astronomers from the Instituto de Astrofísica de Andalucía and from the DARK institute in Copenhagen to do linear polarimetry with ALFOSC.

5.5.7 Detector

Noise on the ALFOSC CCD appearing as bands continued to be present. Initially it was assumed the noise was pick-up of some kind, though after numerous tests with the cables no improvement could be made. At some moment the noise started to become worse to such an extent it could affect the science. By exchanging some of the ALFOSC controller boards with similar ones from the SOFIN CCD controller, eventually it was found that the clocking board in the ALFOSC controller was the source of the noise and a spare was installed which has solved this problem.

5.5.8 Documentation

A new main web-page for ALFOSC following the NOT "style" was implemented. See

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

Several updates and additions were made to the internal staff pages documenting specific maintenance and configuration tasks. A full list of all the optical elements we their corresponding name (string) as shown in the instrument status display and given in the image FITS headers has been added. Various small updates were made to the user documentation related to ALFOSC spectroscopy, and the calibration-exposure overheads for grism #3 and for Echelle mode were added.

The ALFOSC Sequencer scripts documentation page was also updated to reflect new scripts and new features in older scripts

5.6 NOTCam

5.6.1 Data acquisition

The NOTCam teloffset program occasionally caused problems in the past because the communication with the TCS was via RPC calls. A new teloffset code was made, based on reading the info from the database. The new NOTCam teloffset was tested early March and some bugs were found and corrected. Tested again in early April, and no problems reported, so probably it works well.

5.6.2 Imaging

Like for the optical (see under ALFOSC) specific catalogues were provided that are included in the TCS upon start-up.

All NOTCam detector quality control data are taken with darks and dome-flats while NOTCam is mounted on the telescope during daytime. There have been various problems with variable lamps as well as variable daylight leakage in through hatches etc. that make the exact calibrations like linearity tests and shutter tests difficult. We need stable lamps that can be turned down sufficiently low. Then the telescope will be pointed to the best altitude to avoid daylight leakage while doing the quality control.

A light regulator for the dome light from the control room was installed, but it did not worked well as the light level was very unstable. New electronics was bought, but these need to be tested.

5.6.3 Spectroscopy

The NOTCam calibration unit for spectroscopy is still only a temporary solution with arc and halogen lamps mounted on the inside of the telescope baffle lid, completely manually controlled. We are currently looking at getting the operation of the calibration under computer control, which will also allow to get the status in the FITS header keywords.

Still a post-processing procedure providing quick-look reduction of spectroscopic data needs to be defined and implemented.

5.6.4 Polarimetry

As reported half a year ago, we need more observations of polarized and zero-polarization standards in photometric conditions in order to assess the current polarimetric mode of NOTCam. Unfortunately, the weather has not helped. Some data was obtained in March of one zero-polarization and one high-polarization standard in the J and H filters, but the apparently clear night was probably not quite photometric. The preliminary data reduction gives quite a high polarization for the zero-polarization standard. Thus, commissioning of these polaroids continues.

It is evident that an upgrade to Wollaston prisms would be the way to go for NOTCam polarimetry, but we have not yet looked in to this option.

5.6.5 Detector

- **Quadrant failure**

  Due to an accidental loss of vacuum of NOTCam the vessel was recently opened. Before closing, the detector was checked and found to be working. After closing and starting to pump the detector was checked again, this time one quadrant only gave zeros. After extensive investigations it was found that one of the interface boards that was connected to the quadrant was broken, but replacing it with a similar board from one of the other quadrants did not solve the problem and it was concluded that there must be a second failure closer to or on the quadrant.

  Spare interface boards were supplied by Copenhagen University, but replacing the boards there was still no signal from the quadrant. It was then decided to remove the detector array from its mounting board and it was found that the output pin of the quadrant on the mounting board was at zero rather than 5V which indicated that a transistor was damaged. The mounting board was replaced with a spare after which we got signal from all four quadrants again. We believe the transistor of the mounting board was damaged due to the failure of the interface board, and the only thing not clear at the moment is what caused the original failure of the interface board.

  In the cause of trying to solve this problem, it was found that the documentation on the interface boards (both here *and* in Copenhagen where they were originally manufactured) were incorrect and part of the design had to be guessed. In fact, after cooling the instrument down to normal operating temperature it was found that part of the detector could not be read properly because a resistor that was installed was wrong by a factor $\sim$40. Replacing this resistor it now appears that all works properly.

- **"Reset" anomaly**

  As reported previously, the science array (SWIR3) in combination with the electronic upgrade gave some problems with the flat-fielding procedure previously used. There is now a more persistent "reset anomaly", and this has unwanted effect in differential flats that the dc-gradient does not subtract out well. See report at

  `http://www.not.iac.es/instruments/notcam/staff/newpcb.html`

  for details. As a preliminary solution we considered correcting the effect during the reductions. Now the script "mkflat.cl" in the NOTCam quick-look reduction package has the option of correcting for the dc-gradient. See the above report for an example. This method seems to work well.

  The stronger "reset anomaly" does not only affect the differential flats. As is well known, it affects all images where there is a sudden change in background levels. This happens when you change filter, camera, or exposure time etc. The typical solution is to take a test exposure to let the detector "stabilize" on the brightness level, alternatively, to skip the first image when reducing the data. If there is variable background due to moonlit clouds, however, it will be very hard to achieve nice images.

- **Reset level jumps**

  Another effect discovered over the last months is sudden jumps in the reset levels. It was known that there have been changes earlier. With the engineering grade array in 2004-2005 there was a substantial drift in this level, and we had to apply higher dc-offset voltages on each quadrant. Thus, changes in the level has been seen to happen before. The new thing is the sudden jumps to very low levels, down to 1000 adu or less when default is 6000 adu, and then recovering. The images with low reset levels are almost always useless. The effect is very variable. See for examples and a description

  `http://www.not.iac.es/instruments/notcam/staff/newpcb/newpcb.html`

- **"BIAS" voltages**

  A solution of how to modify the clock-boards was designed and boards were send from Copenhagen University. Modification to the clock driver board have been made to correct the voltage levels. A plan will be made for the testing and implementation of these boards.

5.6.6 Observing overheads

In summary: both the telescope dither overhead and the acquisition related overheads (such as file storage time) have increased from 2006 to 2008, but these increases are well understood since they are part of an improved system, more accurate pointing in the first case, and the sequencer in the latter case. The readout overheads on the other hand are not understood. Their cause is believed to be due to an aging ISA PC-board. Nevertheless, using a "spare" ISA PC board for testing gave no difference. Then, changing to a faster PLD on a similar PC board seemed to solve the problems related to reading (at least no read errors were reported) on an old data acquisition computer (elizabeth), but when this was tried on the currently used computer (marissa), no improvement was found. More tests are planned.

It should be noted that the current readout overhead problems can add up to 40% additional overhead to NOTCam observations. The amount is quite variable, and this also makes planning the time-line of the observations difficult.

A special exposure command for NOTCam has been suggested in which the dither overhead can be folded into the readout and file storage overhead which would save some time but some development is needed. In any case, the problem with readout overheads is the dominating problem at the moment.

5.6.7 Vacuum & Cooling

Exchanging the NOTCam entrance window in March 2008 plus extensive baking of the whole cryostat, resulted in a better than ever vacuum. When cooling down with LN2 there were problems, which are now fully understood to be related to thermal stresses around fill-tube o-rings. The cryostat recovered these losses well. A holding time test showed better than ever results. The average pressure settled from 1.1E-4 mbar in April to 5.0E-5 mbar in September from when on it has stayed practically constant. Thus, NOTCam stayed nearly 1 year cold without any problems, its longest period ever.

The previous plan of exchanging O-rings has therefore become less of an issue, and in principle the cryostat vessel now behaves very well. What remains to be improved is the procedure for cooling down from a warm state to avoid thermal stresses around the O-rings in the filling tubes. If we can avoid vacuum losses during cool-down we probably could keep the instrument cold continuously for significantly longer than 1 year.

5.6.8 Reduction software

The IRAF package notcam.cl has been upgraded further with the addition of an optional software suppression of the dc-gradient in the script that makes master flats from differential twilight flats, while the the imaging reduction scripts for normal and beam-switch mode can now work even though no stars are found for alignment. In this case the coordinates will be used for alignment, giving a slightly worse registration. Trimming of images is set as an option.

The documentation of how the package works, which is found in the section "Reductions" in the NOTCam User's Guide, was updated. See:

`http://www.not.iac.es/instruments/notcam/guide/observe.html#reductions`

The reduction package will be developed further to include tasks to reduce an ABBA spectroscopic observation and to reduce polarimetric imaging. Also, the handling of bad pixels will be improved in all routines.

5.7 FIES

5.7.1 Instrument

The FIES focus mechanism electronics were repaired and tested. The camera focus is now back under computer control.

To upgrade the original fiber bundle and make it a proper spare it was removed from the telescope and is current with Gerardo Avila at ESO who is preparing the bundle. The exit slit for the high-resolution fiber is the last item to be added before the bundle can be shipped back to the NOT. After it arrives a plan will be made to install and test it. Depending on the test results we will decide how to proceed.

Following the problems we had with the top calibration unit there are still a few pending issues.

A better mounting needs to be design to make it more stable. To make any alignment of the fiber easier after any misalignment an XY-slide has been purchased, but this still needs to be mounted and calibrated. To avoid further electrical problems in the top-calibration-unit electronics box cable terminators need to be installed.

One of the issues with flat fielding the spectrograph is the low light level in the blue. It will be investigated if we can make a flat-field light-source that is bluer.

The optimal telescope focus will be tested for each fiber by checking count rates at FIES detector as a function of telescope focus.

5.7.2 FIES building

We continue to monitor the temperature in FIES and its building. This summer we hope to be able to determine if the current temperature-control loop and the new front-room cooling system is also able to maintain the temperature stable during hot calima periods.

5.7.3 Exposure meter

The exposure meter has been fully calibrated and documented and is now fully integrated in the FIES operating software. The exposure meter is not yet available for the simultaneous-ThAr mode.

To protect the new FIES exposure meter a device has been designed to monitor the light level near the meter and when it exceeded a certain level (well within the limits of the photo-multiplier), it will cut the power and send a signal for the software to read, indicating what has happened.

5.7.4 Data and Target acquisition

A new target acquisition script has been added that does the whole process of acquiring and centering a star on a fiber. Some further improvements of this script are already planned.

We will also investigate if current telescope pointing is stable enough to directly acquire onto the 20arcsec fiber-head mirrors.

The status of the StanCam filter provided by the TCS and used in the target acquisition will be integrated in the observing system such that the acquisitions scripts can define the proper filter to be used without relying on the set-up not changing.

5.7.5 Quality control

From a sequence of ThAr spectra taken during a continuous 28 hours run Dr. Eric Stempels (University of St. Andrews, UK) measured the Echellogram shift due to atmospheric air-pressure variations. The ThAr spectrum shifts by approximately 120 m/s per millibar (hPa). Note that the diurnal atmospheric pressure 'tide' amounts to about 1 hPa peak-to-peak amplitude. When using simultaneous-ThAr mode this air-pressure effect is largely calibrated out.

Note that normally the drifts due to temperature changes should be (much) lower than those due to pressure effects, as the temperature is kept constant (within 0.1 degree) in the FIES room and spectrograph.

Using the latest version of FIEStool and simultaneous ThAr mode, an intra-night velocity zero-point accuracy of 5m/s can be achieved for well illuminated spectra.

The next step in looking at the stability of the spectrograph is to derive and specify the long-term wavelength zero-point accuracy for observations with and without simultaneous ThAr mode.

For the different calibration exposures there are script which first take a (windowed) test exposure to define the required exposure time. To monitor the health of the calibration lamps the idea is to record the results from these scripts in a data base.

5.7.6 Reduction software

FIES reduction tool was further improved by Dr. Eric Stempels. The main new features include: a task which can analyst an incoming ThAr and replace the previous wavelength solution on the fly; an improved extraction of interlaced ThAr by not recentering the orders and eliminating the 'clean' algorithm. This improves the intra-night precision of radial-velocity measurements to 5 m/s, as long as the interlaced orders are properly defined, and have not too large widths, and; a complete rewrite in Python of how scattered light is subtracted. This method also works on low-resolution (2x2 binned) spectra.

FIEStool is now also script-able (FIESscript). This allowed the calibration sequencer script fies.calibs to be updated and provide the user the option to automatically pre-reduce the newly obtained calibration data (flats, ThAr, biases) into fresh master-frames, which will be used by the online FIEStool. This means that users can now automatically insert fresh calibration data into FIEStool just by running FIEScalibs.

A further improvements to be made are is the addition of a filter for cosmic rays. For low S/N spectra the cosmic rays or spikes are not filtered out optimally. Pre-fabricated master wavelength reference and master order definition files will be added to the FIEStool tar-ball distribution to help simplify the initial steps in data reduction (order definition and first wavelength solution).

5.7.7 CryoTiger

We are still in the process of purchasing a complete spare CryoTiger system (for the FIES and StanCam CryoTigers). They main problem has been finding a transport company to ship it from Madrid to La Palma. As the CryoTiger has a special gas and is a pressurized equipment special transport is needed and the company that sells the CryoTiger had difficulty arranging the transport. They recently got an offer and we should receive the spare in the near future.

5.7.8 Detector

The issue of some missing columns when using the dual AB-amplifier read-out mode stills needs to be solved.

5.7.9 Atmospheric dispersion corrector

There has not yet been the possibility and time to install the ADC for testing. Maybe this might be done during aluminisation of the mirrors in July.

5.7.10 Documentation

A new condensed step-by-step guide has been made for FIES observers. The instructions for observers have also been updated to include the specific steps that are needed in case FIES observers need to perform ALFOSC override observations. Also, information about the exposure meter and the intra-night wavelength stability were added and various updates were made to the observers instructions and the staff pages to account for several minor changes. More detailed information of the top calibration unit electronics were added to the instrument documentation.

5.8 MOSCA

5.8.1 Data acquisition

MOSCA is the last of our instruments to be included in the sequencer system. This will make it possible to organize and execute the observations with this instrument at the same level of flexibility as the rest of the instruments.

A new post-processing quick-look procedure was implemented that merge the images from the different CCDs while mimicking the true physical gaps between the CCDs as much as possible. A corresponding “telescope offset” tool was made that allows to mark any object on the combined mosaic image and move it to a desired position.

5.8.2 Detector

MOSCA ran for almost two years without problems and then the intermittent failure of one of the CCDs returned. The detector stopped working at specific orientations of the instrument. During tests in the lab it was found the error could be reproduced by simply moving the internal dewar wires to the CCD.

In April 2009 it was finally decided to get replacement wires, which were made in Copenhagen sent down and installed. In the 10 observing nights following the installation the problem has not returned. It was also interesting to note that after the new wires were installed another problem associated with a variable bias level for the same CCD seems to have corrected itself and returned to the post-commissioning value.

5.8.3 Web-page

A new main webpages following the NOT "style" was implemented.

5.9 StanCam

It was noted that there was no "StanCam" sequencer command to change filter. In fact, as this is done by the TCS the command is tcs.ccd-filter. However, this is not all that logical from a StanCam user's point of view and an equivalent StanCam sequencer command (stancam.ccd-filter) was made.

5.10 SOFIN

The control computer has been replaced (the old one was donated to TurPol in December, see below). The aim is to run a new pipeline for the automatic data reduction of SOFIN spectra, which became possible with the new computer. A new polarimetric calibration model is being tested which would allow to improve the accuracy of the Stokes polarized spectra in a broader spectral range.

5.11 TurPol

The hard disk of the computer used to operate TurPol failed and the computer was replaced with the old SOFIN computer. All the TurPol software was installed in this 'new' computer which has been used without any problem on several observing nights since. The newer computer provides a better network connection which makes the data copying much easier.

The power supply of the laptop used to operate the S-BIG TV camera has failed and was replaced with a laboratory power supply.

5.12 Standby FOSC

We have the plan to develop a “Standby” version of ALFOSC in the adapter to form a permanent set-up together with NOTCam at Cassegrain providing UV-optical and IR imaging, polarimetry and low-resolution spectroscopy, together with high-resolution optical spectroscopy provided by FIES at folded Cassegrain. As a first step in the process we are defining the user requirements for such an instrument. The basic questions are what we need as for imaging, spectroscopy and polarimetry capabilities (field-of-view, pixel size, number of mountable filters, gratings or grisms, slit length, polarization unit, calibration unit, etc). Also, for a design study we have made drawings of the space envelope available for the proposed Standby FOSC assuming the current adapter housing and NOTCam mounted at Cassegrain.

We have collected most of the required information, but the different parts need to be integrated in a consistent general overview of the requirements.

5.13 Computers and software

5.13.1 Data saving and analysis

With our needs for the coming years in mind, we have over the last year bought extensive networked storage media (SAN). The first use for this storage area has been the centralization of backups, implementing our Backup Policy, giving us two weeks worth of copies of the staff data, plus periodical backups for every important service (databases, software for the instrument computers, web server - providing also a secondary web server).

The oldest of our data archive, mainly on CDs/DVDs, are getting old and it has been demonstrated that those media degrade. This has been noted before and we will start moving the historical archive into the storage area over the next few months. This will allow us to do a number of things with the data: re-storing it on more modern, bigger storage, like Blu-ray; but also will serve as a ”live” archive, letting us reprocess data at will and making it easier to access the data that has become public.

5.13.2 Network

To make our network system less prone to cuts the idea is to switch to a fully dynamic routing that switches the traffic from one circuit to other when needed, propagating changes over the network where needed. This has to be coordinated with the IAC.

5.13.3 Computer cabinet

A design was made to make a computer cabinet in the back half of the visitor office. Preparations were made in the office and work will start in the near future.

5.13.4 General computer system

There are various more points related to the general computer system:

- **Desktop computers**:

  A number of routine hardware purchases have been conducted in order to replace older/aging hardware. As a result, most of the staff (and 100% of the astronomy staff - students included - which needs the extra computing power) is now using modern desktop computers (no more than 2 years old).

- **"Duty" laptop**:

  Given the availability of wireless connection in the rooms in the Residencia we have bought one laptop for the staff on duty to use while at Residencia. E.g., to facilitate a first-stage remote assistance to the observers during the night.

- **Virtualizing services**:

  A number of our services (eg. IDL license server) have been suffering crashes due to ageing hardware. To avoid future problems, we have started a "virtualization" program. This allows us to run a number of "virtual" computers inside a more powerful one and migrate them easily to other "virtualizing" servers in case of hardware failure or the need of more resources.

  The virtualization is recommended in cases where there are hardware restrictions (e.g.,. the IDL server requires a certain machine name and network hardware address).

- **Data-base server**:

  The database servers have been extended on capabilities introducing functions for astronomical use (e.g., DECIMAL2HMS/HMS2DECIMAL). The additions have been documented, along with a quick reference on implementing new functionality.

- **Hardware review**:

  Following a few recent hardware failures on critical machines at SLO, we are going to conduct a review of the current hardware to decide if we need spare parts to keep in store for quick change or even complete substitutions in case of ageing ones.

- **Minor upgrades**:

  Some minor hardware upgrades were made on various machines (mainly adding memory where needed).