Period 41
Report to the NOT Council and STC

54^{th} STC meeting & 58^{th} Council meeting
November 14 & 15, 2010

Thomas Augusteijn, Deputy-Director,
NOT, Santa Cruz de la Palma

November 11, 2010

Contents

1 Introduction

This report covers the operations of the Nordic Optical Telescope for period 41: 2010-04-01 to 2010-10-01.

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 41.

A total of 79 fault reports were submitted, with an average time lost of 5 min per fault, for a total down time of 0.4% (0.4% on scheduled observing nights). Of these, 57 reported no time lost, 22 reported < 2 hrs lost, and none reported 2 or more hrs lost.

This compares to a down time of 0.5% over all nights (0.5% on scheduled observing nights) in period 40, and 0.7% over all nights (0.8% on scheduled observing nights) in period 39. Of the 87 fault reports reported in period 40, 58 reported no time lost, 29 reported < 2 hrs lost, and none reported 2 or more hrs lost. Of the 93 fault report in period 39, 63 reported no time lost, 30 reported < 2 hrs lost, and none reported 2 or more hrs lost.

Table 1: Technical down time statistic period 41: 2010-04-01 to 2010-10-01

Night included	Time lost	Nights	Percentage[a]	Last semester	Last summer
All nights	400 min	183	0.4%	0.5%	0.7%
Scheduled observing nights[b]	305 min	137	0.4%	0.5%	0.8%
Technical nights	95 min	25	0.7%	0.2%	1.1%
Service nights[c]	10 min	37	0.1%	0.5%	0.9%
Visitor instruments	0 min	21	0.0%	0.4%	0.2%

[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

Also with reference to Table 2, the general conclusion is that the level of downtime is rather stable with similar amounts of fault reports and no major failures during the past 4 semesters.

2.1 Weather

For period 41 a total of 283hr 43min was lost due to bad weather which corresponds to 17.5% of all the dark time, as compared to 31.8% in period 40 and 10.9% in period 39. The total amount of clear dark time was 1340hr in period 41, as compared to 1390hr in period 40, and 1447hr in period 39.

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 (39 and 40).

Table 2: Down-time statistics for period 41[a]

Syst/Type	Soft		Elec		Optics		Mech		Others		Total		P40/P39	
Telescope	3	00:20	11	01:10	0		0		0		14	01:30	16/30	02:15/05:00
Building	0		3	00:45	0		2	00:05	1	00:00	6	00:50	9/2	02:05/00:00
Computers	5	00:20	1	00:30	0		1	00:00	0		7	00:50	17/12	00:30/00:55
ALFOSC	13	00:05	5	00:30	0		1	00:00	0		19	00:35	15/14	00:50/01:00
MOSCA	0		0		0		0		0		0	00:00	1/4	00:05/00:05
NOTCam	12	00:30	1	00:00	1	00:00	2	00:00	0		16	00:30	7/9	00:20/00:00
StanCam	0		0		1	00:00	0		1	00:10	2	00:10	6/8	00:45/00:45
FIES	10	02:15	3	00:00	0		0		0		13	02:15	11/12	00:55/03:20
Others	1	00:00	0		0		0		1	00:00	2	00:00	5/2	01:30/01:05
Total	44	03:30	24	02:55	2	00:00	6	00:05	3	00:10	79	06:40	87/93	09:15/12:10
P40	44	03:15	21	02:20	1	00:00	12	02:10	9	01:30	87	09:15		
P39	49	05:50	30	04:40	2	00:00	8	01:35	4	00:05	93	12:10		

[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 41, but there was one problem that caused small amounts of down time on various occasions. As it was the single problem that cause the most downtime in the semester I will discuss it here.

- **2010-05-19 to 2010-05-26: StanCam pick-off mirror alignment**: 2hr 0m

  Some work was done on the mirror that folds the light towards the FIES fiber head. At this time the mirror that folds the light to StanCam and which is mounted on the same unit was moved, likely because the glue that fixed the mirror had failed. This led to a change in the projected position of the FIES fibers in the StanCam image used to position targets on the fiber head. This made it impossible to do observations with FIES. Most of the time was lost to realizing this and find the new projected positions of the fibers on the StanCam image. The StanCam folding mirror was later realigned and re-glued.

  The main issue in this case was that after working on the mirror unit no test was done to check the full system of acquiring a target on the FIES fibers.

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	54	8	13[a]	2.6
FIES	50	6	12[b]	3.3
NOTCam	29	7	9[c]	2.4
TurPol	14	–	2	7.0
SOFIN	7	1	1	7.0
MOSCA	4	–	1	4.0
Own[d]	–	3	–	–

[a] Excluding 20 service nights [b] Excluding 10 service nights
[c] Excluding 7 service nights
[d] Test scintillation-correction instrument (Sheffield & Durham,UK)

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

As before, most comments written in the reports during period 41 were very positive, both about the observing system and the support from the staff.

There a few comments about the NOTCam observing system, mostly related to doing spectroscopy not being that straightforward. This partly referred to the description provided in the documentation, and partly to the commands and the way data is displayed. The documentation and the way the data is being displayed has been improved, and we are planning to provided scripts that make changing between imaging and spectroscopy with NOTCam easier.

There were also some comments about improving observing with FIES. One relates to the typical long exposure times with FIES. The rotator on the NOT has a limited range, and sometimes the limit is reached during an exposure. An alarm is given 30 min before the limit is reached, but the is sometime not sufficient. The time when the first alarm is given has been extended and a new command has been made that gives the specific amount of time until the limit is reached so this can be checked at any time. It was also noted that a significant improvement would be a system that automatically keeps a star centered on the fiber. We are investigating this option, but this is not straightforward.

A more general comment was about setting and saving the command parameters used in IRAF. This is being looked at.

5 Operations

5.1 Additional services

5.1.1 Educational activities

There were various courses using the NOT during period 41.Remote observations were done as part of the NOT/OSO Nordforsk summer school, see

`http://www.chalmers.se/nordic-baltic-school ,`

that was held June 14-23 at Onsala Space Observatory in Sweden. For this course we were extensively involved in defining the observations for the different science projects, take back-up observations in advance, and assist during the school.

We also had the regular on-site observing courses for the Stockholm University (5 nights in May) and the master school in CUO/NBI guaranteed time (3 nights in August).

A detailed description of what is offered to groups that want to use the NOT for an observational course, including general guidelines which describe the various steps in the preparation, was made and is available on our web page at

`http://www.not.iac.es/education/CoursePlanning.pdf`

The project 'Nuestros Alumnos y el Roque de Los Muchachos' to create closer ties between the observatory and the people of La Palma by giving talks to secondary school kids on astronomy at the school and receiving them at the observatory for workshops and guided telescope tours has been developing further. Still, the program is not fully established and it remains to be seen if the full program can be supported only by the astronomers working at the ORM.

As part of the support and training of the NOT students on La Palma, regular meetings have been held with the Nordforsk post-doc and lectures by the staff where held about data reduction of NIR (NOTCam) data and long-slit spectroscopic (ALFOSC) data. An 'internal' workshop is planned on the practise of image data reduction in the optical and NIR.

5.1.2 Service observing

During period 41 a total of 37 nights of service observing were done, excluding the 14 SOFIN nights done in service mode by Dr. Ilya Ilyin (Potsdam). Also, one night of a regular observing run was done in service mode because the observer could not make it in time to La Palma due to the problems caused by the volcanic ashes. The Nordic service nights consisted of various more or less isolated observing nights spread throughout the semester. In addition, 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 38 there were 28 proposals accepted. Of these there were 17 'grade 1' proposals, 10 'grade 2' proposals, and 1 'grade 3' proposal. All the proposals were completed.

In period 39 there were 9 proposals accepted. Of these there were 7 'grade 1' proposals, 2 'grade 2' proposals, and no 'grade 3' proposal. Of the 'grade 1' proposals, 6 have been completed and 1 has been partially completed. Of the 'grade 2' proposals, 1 has been completed.

In period 40 there were 23 proposals accepted. Of these there were 15 'grade 1' proposals, 5 'grade 2' proposals, and 3 'grade 3' proposal. Of the 'grade 1' proposals, 10 have been completed. Of the 'grade 2' proposals, 4 have been completed and the last one is nearly completed. Of the 'grade 3' proposals, 2 have been completed.

In period 41 there were 21 proposals accepted. Of these there were 17 'grade 1' proposals, 3 'grade 2' proposals, and 1 'grade 3' proposal. Of the 'grade 1' proposals, 7 have been completed and 5 have been partly completed. All the 'grade 2' and 'grade 3' proposals have been completed.

Up till now 10 proposal has been received in period 42. Of these there were 5 'grade 1' proposals, 3 'grade 2' proposals, 1 'grade 3' proposal, and 1 is still in the process of being graded. Of the 'grade 1' proposals, 1 has been completed and 1 has been partly completed.

5.2 General

5.2.1 Safety

Various protections were added to machines in the mechanical workshop to comply with the requirements to obtain CE certificates as indicated by the licensed company that checks our installations. The grinding machine was replaced as it was cheaper to replace it than add the extra protections. We are currently waiting for the additions to be inspected by the company. Also some improvements were made to the electrical installation and some illuminated safety signs were replaced.

Several members of the staff attended a specialized driving course to train how to handle a car better under adverse weather conditions.

On one occasion a NOT observer did drive up to the observatory although the access to the ORM was restricted. Actually, a message was left for the observer at the car rental company we had arranged for the observer informing him that the road was officially closed and that he should contact either us or the Residencia, but the observer simply ignored this and drove up without talking to anybody. To try to avoid this in the future a request for a mobile phone number where the observer might be contacted in case of emergency was added to the web form that the PI of a proposal is requested to fill out one month before the start of an observing run. Also the text in the document that is send to the PI at this time about contacting the Residencia (especially in case of bad weather) before driving up was made more explicit.

5.2.2 Weather station

Some problems were encountered with false rain alarms. The sensor of the new weather station sometimes triggered when the dust levels were high, while a new sensor that was bought for the old weather station triggered when the humidity was high. When there is a rain alarm, this directly causes to the telescope to close, and this can interrupt and seriously affect observations. It was found that the best way to avoid false alarms was by combining the data from both sensor, were a closing of the telescope is only triggered if both sensors give an alarm.

5.3 Telescope Building

We have had intermittent problems with the telephone line in the control room, where also the phones in the service building some times do not work well. It was noted that at some moment the phone seemed to work with the telescope in one position, and not work when the building was rotated. It has become clear that the problem likely is somewhere internal to NOT as changing the physical line to the residencia did not solve things.

5.3.1 Drive System

The new building drive was finally installed. After the installation some adjustments were made to the drive system itself and in the telescope control system (TCS) to let the system be smoothly operated. The resulting system tracks the telescope motion very accurately, even during acceleration and deceleration, to the extent that it is has now been possible to use the linear actuator (telescope/building position encoders) measurements to prevent actual building crashes if the building power is cut, usually a consequent of the outside stair light-beam been broken (see below). The safety system was successfully checked by placing an object in path of the staircase causing an emergency stop of the building moving at the highest speed.

Some minor adjustments have been made to the system after its installation, but it has been working without any real problems. For the time being we have the old and the new system existing alongside each other to allow for a switch between the systems as fast as possible (though this is on the mechanical side still a few hours). In the end the idea is to have the new system running for some time before removing the old system completely.

A full set of spares was bought with the building drive and it is expected to last to the end of the lifetime of the telescope (and beyond).

5.3.2 Relative positioning of telescope and building

One of the two pistons that the define the position of the telescope relative to the building in the azimuth direction has not been used until now was found to have a missing wire which was repaired. The two pistons give rather varied results depending on the position of the telescope. However, at low values which happen to be when the telescope is close to the limit switches in either direction on the building, both pistons show well defined and repeatable values. This is now used by the system to avoid "building crashes" (see below) to be able to get as close to the limit switches that would cut the power to the telescope before stopping the telescope. This also mostly removes the main 'disadvantage of the new system that provide less time between the safety system cutting the building power and the telescope being stopped (now in a soft way as compared to the previous "building crashes").

5.4 Telescope

5.4.1 Telescope control system

So-called "building crashes" occur when the building stops (e.g., because the safety system is triggered or if the drive system fails) and the telescope will (after some time) drive in to a safety switch and its power will be cut. This requires the telescope to be powered-on which takes several minutes. Often, the safety system is triggered by accident and to avoid the unnecessary loss of time the system has been upgraded in two ways. When the telescope is slewing and the power is cut to the building now also the telescope will ramp down its speed in the same way and no crash should occur and only a reset of the safety system is needed. In case when the telescope is tracking and it will not crash immediately in to the building if it stops, the telescope will continue tracking as before but now it will stop if it reaches a given distance from the center position with respect to the building, or when it gets to within a given distance to the limit switch that would cut the telescope power. If the safety system is reset before the telescope reaches this limit, the tracking will just continue. Otherwise the telescope will stop in idle mode until the observer resets the safety system, but no powering-on of the telescope is needed. In all cases, the TCS provides information about what is happening and suggest what should be done to avoid confusion.

With the possibility to operate most of our (observing) systems at the mountain remotely there is a safety issue. In principle people can use the web cams and call the control room to see if anybody is working with the telescope or instrument, but when running (especially automated) observing scripts somebody might not be aware of that and get his/her hands in while a filter wheel rotates or a pick-off mirror is moved. The general idea is to provide commands that can be issued at the telescope and would prevent the use of the telescope or instrument remotely. There is the possibility that this might affect some remote (test) observations and people should use these commands with care, but safety is more important.

As the TCS is a closed system it is in principle simple to isolate and exclude commands issued remotely. Specifically, we will implemented, e.g., called 'Inhibit-Remote-Commands' and 'Permit-Remote-Commands' that can only be issued from the TCS user interface in the control room. For the instruments controlled through the observing system this is a bit more complicated (see below).

Some test were made to move the User Interface, which runs on a rather ancient computer screen to a big color screen by using a regular PC to act as front end to the TCS.

5.4.2 Telescope drive

Several problems with the azimuth motion were encountered during the semester, some causing actual building crashes (caused by the telescope not moving) while others were seen as oscillations of the guide star image. These were caused by the brushes in the 2 azimuth motors having worn out which needed to be replaced on different occasions.

One of the main problem in diagnosing and solving these problem is that it is very hard to replace the brushes. A new system was made to 'mount' the brushes which has been successfully used, but it still is difficult to get the brushes in to the motors and we are looking to see how this can be improved.

On the last occasion we had problems with the brushes it was discovered the observed azimuth oscillations were related to the actual position of the telescope and in fact occurred at 15 degree intervals in azimuth. This was noted as equal to the period of the motors been geared 24:1 to the telescope. It is not clear why we only got problems at certain azimuth angles, with an extent of $\sim$30 degrees of the azimuth motor rotations, though it was discovered than the previous problems also occurred at these positions. It is planned in the near future to open the motor and measure and examine the windings to see if anything obvious can be identified.

When trying to diagnose the problems with the azimuth motion the new alt/az amplifiers were re-installed. To fix the instability problems seen the last time they were used the gains have been reduced from 1.6 to 1.47 i.e. from just above the 1.5 previous amplifier gains to just below them. With NOTCam and ALFOSC mounted no problems were encountered but when SOFIN was on, oscillations sometimes occurred when powering on. After checking the drive it was found that there was an incorrect voltage level on the new enable signal going to the old PI (pre-amp) and pre-load boards. After this was changed to the right value no further problems were reported during the rest of the SOFIN run, or with any other subsequent instruments mounted.

5.4.3 Mirror support system

The air drying system of the compressor system used to run the active support of the main mirror has been failing often recently with water getting in to the system. In general this does not effect the observations directly and a workaround can be applied, but clearly a more permanent solution should be found. Alternatives to the current system are being investigated.

5.4.4 Rotator balance

Especially in the case that asymmetric instruments are mounted on the adapter there is a risk of damage to the rotator drive if the telescope power is lost while pointing away from zenith. Of our core instruments (and the one that is also mounted most often) ALFOSC is the most asymmetric and the precise amount and position of the weight needed to balance the rotator when ALFOSC is mounted was defined. A specific flexure was made and is now part of the standard installation of ALFOSC at the telescope.

5.4.5 Pointing

We are in the process of migrating the telescope pointing model procedure from the TCS to the sequencer which will allow for fully automated (and more specialized, e.g., by instrument) scripting of pointing tests. We are now at the point where sequencer scripts can be made to test the system in full. As the pointing itself, though not optimal, is very stable our main objective is to see if it varies significantly as a function of the instrument that is mounted before looking at improvements of the pointing.

5.4.6 Instrument communication

The communication between the detector controllers for the instruments mounted at the telescope with the different computers in the electronics room goes via a set of fibers through the cable twist. We had some occasional intermittent communication problems between CCD controllers and as a precaution all the fiber connectors on the adapter have been changed.

5.4.7 Catalogues

A new catalogue of blanks fields for flat field calibrations of imaging data made using the Guide Star Catalogue and searching systematically for areas with no stars brighter than a certain magnitude limit has been made available to users. A full list can be found at

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

5.5 Observing system

5.5.1 Safety

With the possibility to operate most of our (observing) systems at the mountain remotely there is a safety issue. In principle people can use the web cams and call the control room to see if anybody is working with the telescope or instrument, but when running (especially automated) observing scripts somebody might not be aware of that and get his/her hands in while a filter wheel rotates or a pick-off mirror is moved. The general idea is to provide commands that can be issued at the telescope and would prevent the use of the telescope or instrument remotely. There is the possibility that this might affect some remote (test) observations and people should use these commands with care, but safety is more important.

In the case of observing system commands moving anything inside instruments that are mounted on the telescope things are somewhat complicated as there is no direct difference when issuing a command from a window on a computer that is opened remotely or locally. Beyond adding checks to individual commands, an option might be to inhibit or permit in general all commands to a specific (part of an) instrument. Of course, a solution is to simply switch-off an instrument, but we will first have a look if there is a (simple/feasible) software implementation. The same issue applies to the use of the telescope, but this is discussed below.

5.5.2 Observing Blocks

We in principle have already all the building blocks to create complete (sequencer) observing scripts. A specific objective over the coming year is the completion and implementation of a fully integrated Observing Block system that will provide a system that allows to completely define observations. Beyond that this can be converted to scripts that execute the observations, the information can be used to check for validity of the observations, and used to define instrument set-ups and plan observations (as already to a certain extend is provided for the fast-track service program). By providing a full description of an observation, this system will also allow for *all* the corresponding keywords to be set to proper values in each exposure. This can then serve as input to any (automatic) post-processing of the data (quality control, archiving, [pipeline-]reduction, etc).

5.5.3 Target acquisition

A new facility was provided for all our core instruments in which target coordinates and target acquisition information (primarily the required position angle) can be provided together with a finding chart. When the form is submitted a sequencer script is generated that will point the telescope, acquire the guide star and displays the finding chart before the prompt is given back so observations such as acquiring a target on a slit or simple imaging observations can be started immediately after the script. This facility will become an integral part of the fully integrated Observing Block system we are developing (see above).

5.5.4 Telescope set-up scripts

For our main instruments scripts exist that set the various parameter of the telescope such as orientation of the detector, telescope focus, autoguider focus, etc to standard values for the given instrument. The primary use is when starting the telescope at the beginning of the night and to be able to quickly change between instruments. A specific issue noted with these scripts is that it sets the field-rot angle which will cause the rotator to start turning immediately. If during the process the telescope is preset to a new target it has occurred that the telescope gives some warning messages and does not (properly) acquired the guide star for the new target. To avoid this, the telescope is simply stopped at the start of these scripts before changing the field rotation angle so it will only take effect when you do a preset.

The set-up scripts have also been changed such that automatic guide star acquisition is activated.

5.5.5 Rotator limit

The rotator on which the instruments are mounted has a limit range of slightly more than 400 degrees. It can occur that a limit is reached and the rotator needs to be rotated by 360 degrees before observations can continue which can interrupt on-going observations. The TCS already displayed the time remaining until a limit will be hit for the current pointing of the telescope, and also warning messages were issued starting 30 min before the limit would be reached. The warning messages have been extended and a new command has been created that can be issued from both the TCS and the sequencer that gives the remaining time before reaching the limit for the current pointing of the telescope. This allows for a specific check to be included in observing scripts to see if an exposure (or a whole set of observations) can be executed before a limit might be reached.

5.5.6 Guide stars

It was found that sometimes guide stars are selected that are near to stars that are considered too bright. When the star is acquired this can lead to the wrong star being selected and centered, with a corresponding off-set in the pointing. The guide star server was changed such that no guide star is selected near a star that is excluded because of its brightness.

5.5.7 Data display

We are in the process of implementing a new feature of the common display where one display an image either according to the orientation on the detector (i.e., the column direction up), or use the world coordinates in the header and display the image such that North is up. This later is specifically included as part of the target acquisition script for slit spectroscopy with ALFOSC where often the instrument is positioned at an angle different from the default (e.g., because the observation is done at the parallactic angle, or the slit needs to be aligned with specific features in the field) and it is difficult to recognized the field when comparing to a finding chart which has the standard orientation with North up.

5.5.8 Data archiving

In the current set-up the prefix for the data files which identifies the date on which the data are taken changes automatically at noon UT each day. When the data archiving is done the system will write all the data with a given prefix (in principle that for the previous night) to DVDs (one copy for the observers and one for our own archive). After the data are burned, the files that were saved are moved to subdirectories with the corresponding instrument specific prefix. If the archiving is done before noon UT (which is normally the case) any data data taken later will not be included in the data that is being burned. A side effect is also that if the data has been moved after the burning, any (re)start of the data acquisition program before noon can generate file names that already exist. In general the data taken during the day are test data, but also those might be worthwhile to save while it would also mean that one has to keep track of which data is worth saving and which aren't (which is at least subjective, if not dangerous).

The way the system should work is that the data prefix is changed before the files are selected for burning. One way would be to only do the data archiving after noon UT, but as this is often done in the morning (sometimes because the observers want their copy early) it would be best if the prefix is at the moment the data archiving process is started. The prefix is set in the detector control program, but as we are going to get a new data data storage system for use with the new data acquisition program and detector controllers it seems better to make any specific changes only in the new software but we are looking for a way how to solve this in the mean time.

5.5.9 Exposure time calculator

A new version of the Exposure Time Calculator was released which now includes estimates of the expected peak counts both for photometry and spectroscopy, both with point and extended sources, and with warnings (e.g., if a target might be saturated in the given exposure time) and clarifying texts. Also binning and multiple exposures has been added as an input options. See

`http://www.not.iac.es/observing/forms/signal/v2.0/index.php`

5.5.10 Weather

A general page has been developed for the staff which provides an overview of all the information relevant to operations such as the weather and the detector and dewar temperatures of the instrument, plus some links to things related to duty tasks.

5.5.11 Observing instructions

A new observers' cookbook 'system' has been made in which general and instrument specific information and instructions are provided in a modular form and a cookbook is defined on an instrument basis. In this way users only receive relevant information, while general information only needs to be updated in a single place. Versions exist for all core instruments, but not all are yet considered to be complete for release.

5.5.12 Observing tools

On one occasion it was found that the web pages from the ING could not be accessed. In fact, various of the applications provided on our 'Observing Tools' are actually links to ING pages. This includes things like 'Visibility Plots' which are rather convenient to use during the night. It should be checked if (all of) the applications that are linked from the ING can be installed on our own computer system such that any (local) break in the Internet does no unduly affect observing.

5.5.13 Documentation

It was noted that the number of sequencer scripts and commands have become very extensive and having separate lists of 'scripts' and 'commands' (as far as there is any distinction) makes it hard for users to find things. It was agreed to combined all the sequencer scripts and commands in single lists for each instrument/system (i.e., ALFOSC, FIES, MOSCA, NOTCam, StanCam and Telescope) following a similar approach to that of the TCS. I.e., one list with 'most-used commands' that only give a brief description of the function and syntax of the most used commands and scripts, one list with 'all commands' grouped by functionality for quick reference, and one list with an extensive description of all commands.

It was decided to use a system in which the command/scripts themselves contain a (short and long) description of how they work, with flags indicating if it is a general or often used script, etc. This is ingested in a data base and the different web pages containing the list of commands/scripts will be generated dynamically using the data base with updated information every time people look at the web pages. Adding and/or changing commands/scripts will then automatically be reflected in the documentation. The existing commands/scripts already contain information like on which other commands/scripts they depend and the same system can also be used to check which are affected when changes are made.

5.5.14 Instrument change logs

It was noted that often in discussion about problems people are not sure when certain changes to the system (hardware or software) were made which might have caused the problem. Some information is kept on a personal basis or in log files, but there is no specific place where things can be recorded and checked. In general, no extensive information is needed but just a short title and the date would already help a lot in pointing to, or excluding possible causes for a problem. The idea is to make a general depository where changes are classified in a similar way as our fault reports. This would allow for checks by date, sub-system (e.g., ALFOSC, Telescope, etc) and type (e.g., software, electronics, etc), or a combination of them.

5.5.15 Remote observing system

As it is now, the interface we offer for Remote Observing purposes is fully functional. This is partly achieved by removing the need to present graphical data (i.e., images) that are big or change often, which typically pose a problem when networks are involved (and specially when their latency is high). However, certain observing modes (like long-slit spectroscopy) and instruments (FIES) require as part of their operation displaying data introducing noticeable delays. As far as possible, we provide practical workarounds but this still makes the system somewhat different then when observing at the telescope, while especially the acquisition of the targets on the slit is relatively slow.

Our final objective is to basically have the same system running for remote and on-site observing and we have tested various options as part of the preparations for the NOT/OSO Nordforsk summer school in June. However, the most promising ones turned out not to be stable enough to be used reliable. Our plan is to see if we can find a proper solution before the next observing course 'season' next year.

5.5.16 YNAO

Also with an eye to the future, significant effort was spent on preparing the instrument and CCD controller software for the YFOSC instrument so that it can be used together with the same kind of observing system (the sequencer) as is in operation at the NOT. A plan was made describing the initial steps towards the construction of the YNAO observing system in a similar way to what is in operation at the NOT. This includes two post-processing packages providing observing support to the YFOSC instrument, the NOT display system and a TCS sequencer and status system.

5.6 New detector controller and data acquisition software

Systematic tests were made of the new data acquisition (DAS) program in conjunction with the CCD3 detector controller software. Only minor problems where found which were corrected. The detector status display program was rewritten to adapt to a more modern graphics library which will ensure that no upgrade will be needed in the near future.

The main task will now be the planning and installation of the new controllers and the DAS software. The installation of the CCD3 control software at YNAO (see above) has in that respect been a very good exercise. We do not have any detailed plans as this partly depends on outside effort while we are also constrained by the observing schedule. In any case, the objective is to first install and commission the new system in ALFOSC.

5.7 ALFOSC

5.7.1 Imaging

An application using the new ETC was made that provides specific signal-to-noise calculations as a function of exposure time for all the stars in a given standard star field for ALFOSC. See

`http://www.not.iac.es/observing/forms/signal/v2.0/standard.php`

A fully automatic focusing script was implemented for ALFOSC imaging. For this script, a new catalogue of focus fields spread over the whole sky was generated from the Guide Star catalogue. The script selects an optimal focus field from this catalogue based on the current telescope position (a field that is at an intermediate distance from zenith and which involves the least movement of the telescope and building), it sets-up the instrument and CCD, takes and analyzes the focus images and applies the resulting correction in an iterative process.

The instrument and detector setup present when the script is started is restored when the script terminates so observations can continue immediate. No user interaction is required, and the whole procedure typically takes around 1 minute. This is specifically intended for users that (need to) use ALFOSC (for Target-Of-Opportunity observations) but are not familiar with the instrument, but the speed of the process makes this a very useful tool for anybody.

A common issue with ALFOSC is that different optical elements (like filters, but also the calcites) change the required telescope focus. In principle it would be possible to build-in the relative focus offsets in commands that put an element in the light path, but there are different ways in changing the setup (e.g., through the user interface, but also through sequencer commands), while also more elements might be put in the beam at the same time. The plan is to implemented a script that will check the current instrument set-up, look up the relative focus offsets in a data base, and apply the cumulative offset to the telescope focus.

The automatic script that is provided to take twilight sky flat fields with ALFOSC have on occasions been used with a wrong telescope or instrument setup which effectively resulted in useless data. To limit improper use of this script error and warning checks and messages were added that will either abort the script in case an improper setup is used (e.g., the light path is being vignetted), or give a warning when there might be a problem (e.g., the CCD is windowed and/or binned).

An upgrade was made of the list of photometric standard fields for ALFOSC based on the latest version of the Landolt catalogue (AJ 137, 4186). The new catalogue has 27 Landolt fields with three or more 'well' observed standard star in the ALFOSC field-of-few compared with 14 in the old catalogue. New finding charts are provided indicating the colors of the starts and listing their magnitudes.

5.7.2 Spectroscopy

In a similar way as is already implemented in FIES, we are developing scripts that automatically take properly illuminated calibration spectra for a given set-up. In principle, the scripts takes a short exposure of a small area on the CCD to check the count-rate which by comparison to a desired value defines the required exposure time. The measure count-rate (or resulting exposure time) can also be used to check the health of the lamp(s) used.

We plan to add specific examples on the observing and reduction strategy to best correct for fringes when observing with the red grism #5.

5.7.3 Polarimetry

We have taken some B and R measurements with the FAPOL polarization unit of the standards and candidate standards currently investigated with TurPol in order to find the internal calibration between these two instruments. We also took repeated zero-polarization standards at various rotator position and with many retarder angles. These data are currently being reduced by Tapio.

The 'Wedged Double Wollaston' (WeDoWo) prism for one-shot polarimetric observations with ALFOSC has been tested. Reducing the data has been less straight forward than expected. However, it has been possible to obtain an accuracy with the device which similar to what is obtained from raw FAPOL data using four retarder plate positions.

Also some spectropolarimetry test data was taken with the WeDoWo, but this still needs to reduced and analyzed. Likely more tests will be needed before we can commission this mode.

5.7.4 Detector

The mounting system for the pressure sensor was replaced with electrically isolating pieces to eliminate the noise induced by the actual sensors, so we can now monitor the pressure while operating the detector.

A problem with the charge-transfer-efficiency of the CCD at low light levels was found. This was detected when averaging a few hundred 30-sec exposures, where specific columns show the signal to be smeared out along the column. This is not visible in the individual spectra, while spectra with stronger illumination this effect is not visible either. As far as we can tell, this effect is stable in the detector and seems likely to be feature of the detector itself. In this specific case, the data can be (partly) corrected while in most cases the effect will not be detectable. However, we need to substantiate this in more detail and define under which circumstances this might effect observations. As this might be something intrinsic to this type of CCD and given that the FIES CCD is similar we will check if this effect is present as well. We do note that given the type of observations done with FIES we do not expect this to have any effect on the data.

5.7.5 FASU

On several occasions it was found that the FASU wheels had turned on there own, including twice when people were actually working with the wheels. It was found that the micro-controller on the drive board was somehow causing this to occur. Replacing the device with a spare solved the problem.

5.8 NOTCam

5.8.1 Observing system

A returning problem when observing with NOTCam is that occasionally observations are skipped. The precise cause is not known but is being investigated. In general it concerns only one in a series of many (short) exposures, and having one image less can easily be missed. In many cases this is an image in a dither pattern where losing an image can affect the final reduction significantly. In the case when a dither script is used it is actually known a priori how many images should be produced at the end, and the scripts will be changed such that in case less images then expected are created the user is warned that an image might have been lost. This will also include an automatic message to the staff so they know something happened without having to check the data themselves.

5.8.2 Filters

As suggested already in 2006, NOTCam would benefit from an upgrade to the full near-IR broad-band filter set corresponding to the UKIRT photometric system ZYJHK used for instance in UKIDSS. This meant purchasing the new standard filters Z (0.84-0.93 μm) and Y (0.97-1.07 μm). After getting quotes from several companies, it was agreed to accept the offer from NDC Infrared Engineering. They had the Y-band filter in stock but the Z-band filter turned out to be a bit more complicated to make. On their second try they managed to make a Z filter with a much smaller red leak and also a relative high efficiency on >70%. The red-leak is significant, but after consulting some potential users we came to the conclusion that the expected effect on the data are acceptable. We do believe there are better Z-band filters available, but we expect those to cost as much as 5 times more and we consider that expected improvement not to warrant the price. We are current planning to install the new filters in January 2011. When we have determined the zero-points for these new filters they will be added to our Exposure Time Calculator

It was realized that the transmission curves published online for the NOTCam filters were not entirely consistent, in the sense that the plots were correct, while the data files had not been wavelength shifted to correct for the offset between using a pinhole and a slit for the calibration (with shifts ranging from 0.0015 to 0.0025 μm). After some detective work the problem was solved, and all the data files were corrected and a note about it was added to the web page.

Prompted by a user question regarding narrow-band filters mounted in the parallel beam, a note was added to the NOTCam filter web page with a recipe of how to calculate this shift.

5.8.3 Imaging

To see the behavior of the illumination pattern tests observations were made with a narrow-band filter of a pure emission line source (a bright Herbig-Haro object) that was scanned across the field-of-view. Aperture photometry on the target after flat-fielding and sky-subtraction show strong declines in the flux of around 20% in the far corners (which at least partly can be due to the known optical distortion which was not corrected for), but over the main of the field-of-view (i.e., up to at least 100 pixels from the edge) there is no measurable flux loss.

The new 'quality control' lamp for dome-flats, darks etc. remotely controllable from the control room, has been calibrated and all documentation is updated.

5.8.4 Spectroscopy

The NOTCam calibration unit for spectroscopy (three lamps of halogen, argon and xenon mounted on the inside of the telescope baffle lid), is now under full computer control and the status of the lamps is included in the FITS headers. Some extra safety aspects were added to the TCS where it is not allowed to switch on the TV if any of the lamps is on.

A script similar to the one already used for ALFOSC to take calibration exposures has been tested and released. As part of the observing sequence, the mirror cover needs to be closed and opened afterwards, which is included in the script. For safety, the script will not open the mirror covers after the calibration exposure unless the upper hatch is already open, and it will not switch on the guide TV unless the mirror cover is open. The documentation has been updated to include the new usage of the calibration lamps.

The status of the lamps we need to be added to the NOTCam user interface such that it is easier to see if the lamps are on or not. We also plan to include the status of the lamps in the mirror cover also for other instruments as the lamps are always there independent of which instrument is mounted.

The design for the new low-resolution ($R \sim 700$) grisms was made and a quote was obtained for the two grisms of 22 000 USD. The 2 order sorter filters that would need to be bought would add a further ∼4000 Euros. Given the price we tried to re-asses if adding this option was really worth the money. Specifically, several potential users were contacted directly about if they were still interested and if they had any specific preference for one of the two grisms. The clear preference of the users seems to be for the short-wavelength range and we are looking if we can find a cheaper supplier.

5.8.5 Detector

Recently a problem was noted with high level of counts in darks when using the high-resolution (HR) camera. It was found that this was actually a feature related to the internal camera focus. The affect is there, independent of which camera is used, when the focus is set for the HR-camera imaging at a value of 20. The effect already starts to be noticeable at a focus value of 1000. The idea is that light from inside NOTCam can reach the camera when the focus mechanism is at low values, and the problem might be solved by improving the baffling. We are looking possible solution to be implemented during the next opening of NOTCam planned for January 2011.

The evolution of the array in terms of the increased amount of cold pixels (from 0.2% to 0.4% of the array) over 2008 - 2009 is clear and means it is getting difficult to find clean vertical areas for the locations of the spectra obtained in ABBA mode. It is noted that some of the "bad" areas disappear with time, and we intent to clean the array (by blowing dry air) on the next opening of NOTCam.

There are various ways in which the performance of the array can be improved the readout can be optimized and a document was produced with suggestions to provide some extra functionality on the new array controller.

5.8.6 Observing overheads

The NOTCam observations have significant overheads. Both the telescope dither overhead and the data acquisition related overheads are well understood but the overheads in readout, on the other hand, are not well understood. It should be noted that the current readout overhead can add up to 40% overhead to NOTCam observations, and the amount is variable with time.

The cause of the readout overheads is believed to be due to an aging ISA PC-board. However, testing a "spare" ISA PC board gave no improvement. Installing the NOTCam SEQUENCER in an "old type" computer did give quite dramatic difference with the readout overheads being as small as at the very start. A drawback is the longer time needed to store files.

During the remote summer school in June 2010, it was discovered that "talker" program that provides the observing system log caused a lot of the overheads and a new talker was written. In practice, killing the talker when observing also improves efficiency in local mode, and it was realized that all other usage of the data acquisition computer (such as the electronic obslog) can influence the data acquisition rate. It was decided to move the BIAS program to its own machine, since it often needs a high percentage of the CPU. This computer has to be of a given old type known to have less problems reading the ISA PC board. We are in the process of obtaining such a computer.

In principle, the new controller should solve our current problems with long readout time and large overheads. In the mean time a special exposure command for NOTCam was suggested in which the dither overhead can be folded into the readout and file storage overhead. Depending on the type of NOTCam observations being made, this can save a very significant amount of time per night.

5.8.7 Vacuum & Cooling

Since March 2008, when the entrance window was replaced, the NOTCam cryostat has behaved well. It has now been kept cold since May 9th 2009 with no incidents, a new record of 1.5 years cold. Apart from the improvement due to the new entrance window, the recent good results are also thanks to 1) an improved alert system and 2) an improved LN2 filling nozzle that does not cause vacuum leaks due to thermal stress, and 3) it probably also benefits from the proper baking of the entire cryostat done in March 2008. We are considering to include a similar baking as a preventive measure during the next opening of NOTCam planned in January 2011.

A minor problem with faulty readings of the cryostat pressure and four temperature detectors still remains unsolved. The Internet plug has been eliminated as a possible cause of the problem. There seems to be a problem with every 1-2 out of 1440 readings on the average, nothing systematically. It is also clear by now that the problem does happen also when NOTCam is mounted at the telescope.

The leakage of the PTR hoses requiring refilling with high-quality Helium about once a month suddenly got worse in June. The leakage was located to be close to the instrument end, and was fixed by cutting the tubes shorter. Mounting instructions were improved to make sure the hoses are treated with more care when moving NOTCam across the dome floor. Quotes were obtained for spare hoses.

5.8.8 Quality control

The quality control analysis scripts initially written in IDL have been translated to python and somewhat simplified and improved. The translated code has been tested and compared to the old. Some added features are currently being tested, such as reset-level monitoring, automatic production of bad-pixel masks etc. After this the script will be released.

5.8.9 Reduction software

An upgraded version of the "notcam.cl" IRAF reduction package for NOTCam was released. Improvements include the "mkflat.cl" task providing more accurate flats, a few bug-fixes, as well as an optional handling of bad pixels in the "reduce.cl" and "reduce_bs.cl" tasks.

The non-linearity of NOTCam was modeled pixel-by-pixel with a 3rd order polynomial and the correction coefficients are available as images from the down-loadable NOTCam calibration archive. The correction has been tested on dome-flats as well as standard stars. The non-linearity exceeds 1% just above 20 000 ADU, and the correction seems to work well up to levels of 46 000 ADU in the raw data (where the non-linearity is 5%). The correction has been tested on dome-flats taken at various dates, as well as on bright standard stars.

A new task "mklincor.cl" was made to correct the non-linearity of raw images, and add the corrected image as an extension to the Multi-Extension-Fits file of the raw image. It will be added to a new upgrade of the "notcam.cl" IRAF package foreseen for early 2011. It is also planned to include an extra option in the "reduce.cl" and "reduce_bs.cl" scripts to correct for the optical distortion.

5.8.10 Documentation

The NOTCam Calibration web page has been updated, as well as the download archives for flats and bad-pixel masks. The Manual for "NOTCam Remote Observing" was also updated before the NOT/OSO Nordforsk summer school in June 2010.

The NOTCam "Cookbook" (also called step-by-step observing guide) was updated to include : 1) the new usage of the calibration lamps, 2) the use of the new Target Acquisition Scripts, 3) more up-to-date info on auto-guiding, and 4) more info on available template scripts.

5.9 FIES

5.9.1 Instrument

Some problems were reported with the radial-velocity stability of the spectrograph when using the medium-resolution fiber (RMS$\sim$30 m/s) when compared to measurements done with the medium-resolution fiber on the old fiber bundle (RMS$\sim$10 m/s). Tests were made placing a radial velocity standard at different positions at the fiber entrance, with different zenith distances and with different rotator distance. No conclusive answer was found why the fiber in the current bundle seems to behave different than the fiber in the old bundle. However, it is clear that some care should be taken to center the target in the fiber as deviations of up to 50 m/s can be expected if not centered properly, while it also is advisable for the stability of the radial velocity to always observe with the rotator at the same angle so the relative position of the fiber with respect to the light coming from the secondary is the $\sim$same.

Similar observations with the high-resolution fiber did not show an increase in spread, giving similar RMS values to those obtained with the medium- and high-resolution fibers on the old bundle. It also seems that observers that use the medium-resolution fiber with simultaneous ThAr exposures do not see an increase in the spread of the data compared to the old bundle.

We have been looking at a design for pressure control around the FIES table to increase the stability of the spectrograph, but before we better understand the apparent change in stability with the medium-resolution fiber there seems little sense in pursuing this at the moment.

The current fiber bundle does have a working sky fiber, and we still lack a proper testing and assessment of this mode. Analysis of some blue-sky frames for the 2 medium-resolution fibers involved has yielded the following results:

- The target fiber appears to be more efficient than the sky fiber with a mean difference in throughput of 29%, increasing towards the red. The increase in throughput in the red is a bit strange, since the fibers to the best of our knowledge are exactly the same.
- Beyond 6700Å the inter-order distance gets so small that it starts to affect the scattered light subtraction significantly. At 6700Å the difference in the reduced spectrum using only the target fiber, or using the simultaneous sky mode is >2.5%.

The old FIES pickoff mirror was replaced with a new mirror with a durable "enhanced-aluminium" coating. The new mirror has about 10% better reflectivity than the old one.

5.9.2 FIES building

It was decided to improve the insulation of the roof by adding small pebbles. For this, the existing large boulders on the roof were distributed more evenly, the large holes were filled up with smaller stones, and the pebbles where spread on top of this. The layer of stones on top of the roof is now much more uniform and thicker, with the top being formed by the small pebbles. The amount of received radiation should be the same, but the emitting surface provided by the pebbles should be much larger, while the space between the top layer of pebbles and the roof of the building itself probably also acts as an insulating layer.

This improved things but still small temperature excursions were noted during the hottest summer days. White pebbles were added to the roof, but it was believed that this probably would not make much difference given the thick layer of pebbles that already exists. If was discussed if adding a second 'false' roof on the white 'lid' in the center of the building with a gap between them night help, but it was noted that this specific area does not seem become as hot as the rest of the roof. Maybe the solution would be to (only) add a 'false' roof (with a gap between) on top of the rest of the roof.

5.9.3 Target acquisition

An observer noted that it was not clear what the scale was on the images provided in the fiber-viewing movie which made it hard to decide what step-size to use when trying to center a star. The script that displays the movie images and also draws the cross centered on was changed to include a line and the corresponding size showing the scale on the screen.

The use of narrow-band filters was tested for acquisition of very bright stars on the FIES fibers. This to be able to use longer exposure so the images are less effected by scintillation affects and the stars can be better centered on the fiber, in order to not introduce shifts in the radial velocity. Using a narrow-band filter turned-out not to be adequate, and in the end a solution was found using a Strømgren y filter and a ND=2 neutral density filter.

It is planned to speed-up the target acquisition process by doing the first full-frame StanCam image in binned 4x4 mode, instead of binned 2x2.

5.9.4 Quality control

As note above. There is an issue with the radial velocity stability of FIES when using the medium-resolution fiber, though with the high-resolution fiber the results seem to be reasonable. A general problem is that we still do not have any plan or system to test and analyze the stability of the system (using any of the fibers).

A test and analysis program will be defined and implemented. For the data reduction it was agreed with Lars Buchave that we can use his programs to reduce the data.

A quality control script will be made that checks for changes in ThAr line-ratios in order to detect the "dying-lamp" phenomenon. A database will be made of the results to monitor the calibration lamps.

5.9.5 Detector

The mounting system for the pressure sensor was replaced with electrically isolating pieces to eliminate the noise induced by the actual sensors, so we can now monitor the pressure while operating the detector.

Although the FIES cold head is now close to -200 degrees again it is clear that we still do not really know what is going on, nor have any guarantee it will stay at such a low temperature. The main suspicion is that the vacuum of the dewar is poor and slowly degrading, but we do not have a properly working pressure sensor.

A vacuum sensor has been fitted with the electrically isolated clamp system. It was found that this caused light contamination. The dewar was opened and some baffling was added by PB which blocks the light.

5.9.6 Atmospheric dispersion corrector

The Atmospheric Dispersion Corrector (ADC) is now fully installed and operational. First tests revealed problems with prism positioning which was found to be caused by too wide drive belts for the belt wheels. The positions of the 2 prisms have been calibrated and all operational modes verified. Sequencer commands to operate the ADC need to be made while the status and value of the ADC should be displayed on the FIES status display and added to the data FITS headers.

From on-sky tests it was found it has a 3.1 arcmin field-of-view and the measured throughput was found to be 88-91% in the optical, 85% J&H, and 67% in K. Although the ADC is primarily developed for use with FIES, it can for some cases be valuable for other instrument as well. The ADC is located under the 'roof' of the adapter, and swings into the telescope beam above the FIES and STANCAM pickoff mirrors.

5.10 MOSCA

5.10.1 Data acquisition

As the last of the core instruments, MOSCA, is now completely under sequencer control. The documentation has also been updated to fully reflect this.

5.11 StanCam

5.11.1 Detector

There have been some problems with the vacuum of the StanCam dewar causing the detector to heat up when reading-out often (e.g., in the movie mode used when observing with FIES). The movie mode script itself has been modified to read-out less often after the initial phase when a target is being centered to in general reduce the heating. However, the fundamental problem is that the value from the pressure is not computer readable so any loss of vacuum can not be automatically detected in advance.

The StanCam dewar vacuum is now read by the controller controller through the RS232 port. To integrate this into the observing system a connection is needed to Ethernet and a program needs to be written to send the command to read the pressure and record the value.

5.12 TurPol

5.12.1 Data acquisition

The data acquisition with TurPol is slightly improved by using the auto-positioning-full for auto-guiding, also default for the other instruments. This actually makes a sufficient pointing correction that the target now always lands inside or very close to the diaphragms. The documentation has been updated accordingly.

The computer we had chosen as TurPol spare did not work properly (it refused to work correctly with the controller board). Instead, we found a suitable computer among the ones that were not being used at the KVA.

The main computer for TurPol failed the same day we were testing the spare (the CPU was blown due to poor cooling) and so we replaced it with the spare. Further testing of the original control computer (with new parts) has shown a more fundamental damage (or a faulty component replaced with another faulty one - to be determined). We are still lacking a functional replacement computer.

5.13 Computers and software

5.13.1 Network

Our network was designed in a time when NOT was connected to the Internet solely through the ORM's network. This situation changed some time ago and the design is becoming a problem in terms of flexibility and security. Changes will include protecting all computers in our network, as right now the visitor computers (and staff laptops) are exposed to the Internet.

Considering adaptations to future changes (for example, implementation of IPv6 as the main Internet protocol) will be included in this redesign.

5.13.2 Reset/reboot observing computers

There have been occasions where certain programs interfere with normal observations (e.g., because it uses a lot of CPU, or because a certain process does not work properly). As a way of stopping any process that might be running, the data acquisition computer and florence might be rebooted (e.g., before the start of each observing run).

Instruction were provided for any staff member how to reboot the instrument computers, the terminal computer through which these computers are operated, and the visitor's data reduction computer.

5.13.3 Computer maintenance system

Given the issue of potential problems with computers, and the general need for maintenance of our computer system (specifically that at the observatory) it was noted that in principle there are a lot of applications and indications (provided by the computers themselves) that might help with providing warning or error messages about the computers, or about the system in general. The main objective is to have a system that monitors the computers and provides warning and error messages so it can be determined if (preventive) maintenance is required. In relation to general maintenance, it will also be checked what is needed as for spares (or spare systems) to secure as much as possible continuous operation of the observing critical computer system.