Period 44
Report to the NOT Council and STC

57^{th} STC meeting & 62^{nd} Council meeting
April 26 & 27, 2012

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

April 24, 2012

Contents

1 Introduction

This report covers the operations of the Nordic Optical Telescope for period 44: 2011-10-01 to 2012-04-01.

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 44.

A total of 130 fault reports were submitted, with an average time lost of 8 min per fault, for a total down time of 0.9% (1.1% on scheduled observing nights). Of these, 95 reported no time lost, 33 reported $<$ 2 hrs lost, and 2 reported 2 or more hrs lost.

This compares to a down time of 1.2% over all nights (1.3% on scheduled observing nights) in period 43, and 0.5% over all nights (0.6% on scheduled observing nights) in period 42. Of the 144 fault report in period 43, 96 reported no time lost, 47 reported $<$ 2 hrs lost, and one reported 2 or more hrs lost. Of the 85 fault reports reported in period 42, 59 reported no time lost, 26 reported $<$ 2 hrs lost, and none reported 2 or more hrs lost.

Table 1: Technical down time statistic period 44: 2011-10-01 to 2012-04-01

Night included	Time lost	Nights	Percentage[a]	Last semester	Last Winter
All nights	1100 min	183	0.9%	1.2%	0.5%
Scheduled observing nights[b]	1000 min	138	1.1%	1.3%	0.6%
Technical nights	50 min	22	0.3%	0.8%	0.0%
Service nights[c]	445 min	39.5	1.7%	1.5%	1.1%
Visitor instruments	50 min	23	0.3%	0.0%	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 number of fault reports is still at a bit higher level than normal, mostly caused by things related to the introduction of the new detector controller for the ALFOSC CCD. Beyond that, the relatively high percentage of downtime is cause by a single large error (see below).

2.1 Weather

For period 44 a total of 455hr 38min was lost due to bad weather which corresponds to 22.2% of all the dark time, as compared to 11.2% in period 43 and 38.4% in period 42. The total amount of clear dark time was 1592hr in period 44, as compared to 1442hr in period 43 and 1255hr in period 42.

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 (42 and 43).

Table 2: Down-time statistics for period 44[a]

Syst/Type	Soft		Elec		Optics		Mech		Others		Total		P43/P42	
Telescope	11	01:20	6	01:50	0		4	06:05	1	00:00	22	09:15	11/16	03:55/04:30
Building	0		0		0		3	00:00	0		3	00:00	5/2	00:00/01:40
Computers	21	00:15	1	00:00	0		0		1	00:00	23	00:15	26/14	03:15/00:10
ALFOSC	41	06:10	3	00:00	1	00:00	0		0		45	06:10	60/16	05:30/00:30
MOSCA	2	00:10	0		0		0		0		2	00:10	8/2	03:05/00:15
NOTCam	8	00:05	5	00:10	0		1	00:00	0		14	00:15	13/15	01:40/01:30
StanCam	4	00:35	0		0		0		0		4	00:35	8/5	00:50/01:10
FIES	4	00:20	3	00:00	0		0		0		7	00:20	7/10	01:00/00:20
Others	1	00:00	1	00:00	0		0		8	01:20	10	01:20	6/5	00:10/00:00
Total	92	08:55	19	02:00	1	00:00	8	06:05	10	01:20	130	18:20	144/85	19:25/10:05
P43	90	11:25	28	05:05	3	00:00	11	02:15	12	00:40	144	19:25		
P42	55	03:40	20	04:35	2	00:05	6	00:45	2	01:00	85	10:05		

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

2.3 Main problems

There were two faults that caused more than 2 hours downtime during period 44, but the cause of the problem was related so I discuss it together below.

- **2012-02-22&24: Altitude motor**: 6hr 0m

  The telescope stopped tracking and it moved to pointing to the horizon. It was found that one of the altitude motors did not work any more. The brushes for the motor were replaced and the telescope worked again, but pointing the telescope to several targets nothing was seen. It was found the next day that one of the mirror load cells was out of position effectively misaligning the main mirror. We believe this was due to vibration caused by the problems with the brushes of the motor. In the mean time we have updated the TCS software to detect the start of any strong vibrations and power off the telescope to protect it.

  Two nights later intermittent problems appeared with the telescope motion in altitude. A thorough investigation the next day showed that one of the brushes that was installed in the altitude motor had been pushed in too far. All the brushes were removed and new ones were installed. The main problem is the very difficult access to the area where the brushes are installed. A new tool was made to avoid pushing in the brushes too far.

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, OPTICON and guaranteed time. In this table I have also included the number of observing runs, and the number of nights per observing run in visitor mode for each instrument.

Table 3: Instrument use

Instrument	No. of nights		No. of runs	Nights/run
	Scheduled	Technical		
ALFOSC	55.5	11	15[a]	2.1
FIES	55.5	4	14[b]	3.0
NOTCam	19	4	8[c]	2.3
MOSCA	10	1	2	5.0
TurPol	9	1	1	3.0
SOFIN	7	1	1	7.0
FastCam	5	–	2	2.5

[a] Excluding 24.5 service nights [b] Excluding 14 service nights
[c] Excluding 1 service night

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

As before, most comments written in the reports during period 44 were very positive, both about the observing system and the support from the staff.

As last semester, beyond some comments referring to faults that were also reported through the fault data base, there were very few comments (mostly from one person). There was one comment about the overheads being large with NOTCam. These have been reduced significantly over the least few years, and only a new detector controller will reduce this further. For the interfaces to enter catalogues and pointing-scripts it was requested to make it possible to upload ASCII files with a target list. We are looking in to this option. There were a few positive comments plus some suggestions for improvement of the fish-eye view of the night-sky from a camera at GranTeCan that we now present continuously on our weather page. The possibility to see a movie of the data from the current night or previous nights was added. It was noted that the staff on duty did not always report to the observer if they go done for the night, but it is also not so clear if there is any real need for that as it is always clear where the staff might be reached. It was mentioned that the print out of one of the observing cookbooks was out of date and it was replaced with an updated version.

5 Operations

5.1 Additional services

5.1.1 Educational activities

During the semester we had a half night remote observing run as part of the Observational Astrophysics course at Uppsala University, Sweden. There were also 2 group visits from Finnish high-schools that were given some telescope time in technical nights.

Preparations have been started for the observing course for the Stockholm University (5 nights in May), which this year will be held remotely. We especially are involved in the preparations for the Nordic-Baltic Research Training Course "Observational cosmology and the formation and evolution of galaxies" that will take place at Onsala, Sweden, during the period 11-20 June 2012. The course is organised jointly by the Onsala Space Observatory (OSO, Sweden), the Nordic Optical Telescope (NOT, Spain), the Finnish Centre for Astronomy with ESO (FINCA, Finland), and the Institute of Theoretical Astrophysics (University of Oslo, Norway). As during the previous joint training courses, the NOT will be used in remote mode. See for details about the course

`http://www.not.iac.es/Onsala2012/ .`

Soon we will start preparation for the NordForsk "Observational Stellar Astrophysics in the Era of Gaia and Kepler Space Missions" held at Moltai Observatory in Lithuania in July 2012 which will also use the NOT in remote mode. We also will have the regular on-site master school in CUO/NBI guaranteed time (3 nights in August).

For the students at the NOT a more indepth course was provided about the reduction of NOTCam data and about the functioning of CCDs. Shortly, an introduction course on CCD data reductions using IRAF will be given.

5.1.2 Service observing

During period 44 a total of 39 and a half nights of service observing were done, excluding the 7 SOFIN nights done in service mode by Dr. Ilya Ilyin (Potsdam). 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.

In each semester we normally provide support in setting-up instruction web pages and defining observing scripts for the various ToO and monitoring programs. For semester 45 there is one monitoring program that requires observations every night in April with the standby camera StanCam. This instrument is normally not the main instrument in use, and we have been especially involved in the preparation, testing and documentation of the observations such that the execution of the observations and returning to the main instrument in use is done efficiently and smoothly. Up to now the execution of the observations have been successful and not let to any problems or time loss.

5.1.3 "Fast-Track" Service Program

From period 39 there were 2 programs that, although they expired at the end of period 43, but were kept active as they already had been partly complete. One of them was completed successfully and the other one was finally closed at the end of period 44.

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. All of the 'grade 1' and 'grade 2' proposals have been completed. Of the 'grade 3' proposals, 2 have been completed and the remaining 'grade 3' proposal expired at the end of period 44.

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. All the proposals have been completed.

In period 42 there were 26 proposals accepted. Of these there were 18 'grade 1' proposals, 7 'grade 2' proposals, and 1 'grade 3' proposal. Of the 'grade 1' proposals, 15 have been completed. Of the 'grade 2' proposals, 6 have been completed.

In period 43 there were 15 proposals accepted. Of these there were 9 'grade 1' proposals, 3 'grade 2' proposals, and 3 'grade 3' proposal. Of the 'grade 1' proposals, 7 have been completed. Of the 'grade 2' proposals, 2 have been completed. Of the 'grade 3' proposals, 1 has been completed.

In period 44 there were 16 proposals accepted. Of these there were 11 'grade 1' proposals, 6 'grade 2' proposals, and 1 'grade 3' proposal. Of the 'grade 1' proposals, 5 have been completed and 5 have been partly completed. Of the 'grade 2' and the 'grade 3' proposals, none have been completed.

The technical evaluation and processing of fast-track proposals have been changed slightly such that each proposals is assigned to a specific person from the astronomy staff. This person then does the technical assessment, but also any communication with the PI or the head of the OPC about the proposal, and checks and enters the Observing Blocks. Having one and the same person doing this also seems better as a single person has a better overview of all things related to a specific proposal. The task of the manager of the fast-track proposals is now mostly the initial reception of the proposal and assigning it (plus of course doing his own share of getting specific proposals assigned).

5.2 General

5.2.1 Safety

Most of the fixed staff attended a Red Cross first aid course and our safety officer participated as apart of the general observatory safety plan in a specialised course in the use of a defibrillator. The safety officer will also attend courses on 'Trauma care' and 'Mobilisation and immobilisation of an injured person' during this semester.

5.2.2 New office

The plans to have the NOT office next to the office of the TNG have progressed significantly. In preparation of a potential move we first had to sorted-out various basic but essential issues such as access to the Internet, an air-conditioned area for our computer servers, an UPS for our computers, and access to scientific journals via the Internet. On all these issues an agreement was reached with the director of the TNG. We also agreed to install a door physically connecting the offices, have a common coffee area and have access to laboratories and storage space.

The main task now is to come to an agreement with the owner. One issue is that the area where the office is planned is currently completely barren and in principle it was agreed that the owner will arrange for a floor and toilets to be installed and we are currently in direct negotiations about a final rental agreement. No definite agreement has been reach, but we hope to come to a positive conclusion in May. In case we do not come to an agreement we will extend our current rental agreement which ends at the end of July.

Of course, moving will imply some additional cost and specific cost estimates are being obtained for all the main parts. We do expect that if we move the total monthly costs for the rent and services like Internet, library, access to the conference room, etc. will be significantly lower.

One specific issue that will have to be done if we move is to design and implement new networks for the computers and telephones. At that time we will also review these systems to see if specific improvements can be made.

5.2.3 Power generator

During maintenance it was found that one of the cables of the UPS was loose, clearly making sparks. This was repaired and all cables were reviewed. It is thought that this loose connection caused some freezing of the TCS that had occurred a few times but did not recur after the repair.

5.3 Telescope Building

5.3.1 Safety

The second half of the alarm system display panel has now failed. This primarily only serves to indicate where the alarm system has been triggered, and replacing it turns out to be very expensive. Like the other half, this half has now also been replaced by a simple panel with LEDs. We are already planning to integrate the alarm signals in to the TCS user interface and we will keep the current system until then.

5.3.2 Drive System

A new dedicated computer has been installed in the control room to monitor the building drive system. This computer is in permanent contact with the drive system so that any error that occurs can be registered. This is a Windows PC so it is per default disconnected from the net to avoid any disturbances from Windows updates (which even resulted in the PC rebooting itself). In case of remote trouble shooting this machine can be accessed from an external PC (after being connected to the net).

5.3.3 Dome

We have some continuous problems with a oil leak from the return flow pipe of the motor of the upper hatch. The area is difficult to access and we are looking at how best to repair this. Only the telescope structure is affected, not the main mirror, and for the moment we have only cleaned the affected areas as much as possible.

As part of making the operation of the telescope more automated and improve the safety of the telescope a system is being designed to automate the closing of the side-ports.

5.3.4 Power cuts and cooling

During the semester there have been a few unscheduled power cuts at night during which the telescope had to be shutdown as the cooling system can not be run on the UPS back-up system. In the current situation the TCS will detect the power-cut and allow for 5 minutes before shutting down the telescope to avoid problems with overheating of the equipment in the electronics rack which can have serious affects on the functioning of the telescope, potentially damaging things. However, it was noted that likely the more modern equipment we have now is less sensitive than the old equipment.

Currently the TCS actually does not have any direct information about the temperature in the electronics rack and a system is being designed such that the TCS knows the temperature at all times. With this system it will be possible to let the telescope continue operating as long as the temperature is not too high and give timely warnings in case the temperature gets close to the limit. The TCS should also be aware if the power generator of the UPS is functioning, as the batteries alone do not allow for the telescope to operate for any extended period.

Looking in this issue in more detail it was noted that often we are actively cooling when only ventilation would be sufficient. Currently we are looking at modifying the cooling system including a by-pass system where we only cool the water in a passive way to provide for the ventilation (including the electronics rack). Especially at night, this should always provide sufficient cooling and allow to continue observing during a power cut. Also during normal operations there are many days that the outside temperature is so low that the passive cooling system would be sufficient which should provide significant savings on our power consumption.

As part of maintenance, 5 out of the 10 cooling fans in the service loft were replaced. Out of the 5, 3 were complete dead and 2 were moving only very slowly.

5.3.5 Thermal Monitoring System

We depend on the old Thermal Monitoring System (TMS) for measuring various temperatures around the telescope including for telescope focus correction and the water temperature of the cooler for NOTCam. The data are obtained through a set of sensor blocks and there is no working spare for these units. A significant effort went into calibrating and installing the present temperature sensors and to be able to keep on using them a new design to replace the sensor blocks is under development. A basic design has been made based partly on the old version but with newer components and with the interface changed to Ethernet.

5.3.6 Old documentation

A review was made of the documents related to NOT that were stored in Lund. All the relevant material (design papers, manuals, etc.) that was found was send to La Palma and is now mostly stored at the observatory.

5.4 Telescope

5.4.1 Telescope Control System

Additional data from the TCS were included in the data base to make almost all relevant TCS data easily accessible for investigations and statistics. The software responsible for sending and logging telemetric data from the TCS has been updated to handle more than a 1000 parameter updates two times per second, very valuable for fault tracing. We are now close to the capacity of the data base system.

A front end User Interface to the TCS running on a regular Linux PC is being developed. The main idea is to integrate the TCS interface as much as possible with the rest of the observing system, but might also allow for certain applications like the auto-guider to be run from the PC directly. Some work went into designing and writing software that will enable the capture of data from the current TCS using its current user interface, to avoid having to redesign that part of the software. This software will allow us to show the old user interface, as an "engineering mode", but also means "super users" will have access to the old interface. This component of the system is modular and will be integrated in a graphical interface that will be developed as the next step.

Some improvements to the TCS were made including a check of the telescope counterweight setting when the instrument mounted at the main Cassegrain focus is specified. The instrument setting is also included in logging data so variations in pointing can be traced as a function of instrument. A warning was added to the TCS in case the access code is changed from the control room user interface since this code is fundamental in scripted observing. Supervision of the data rate from TCS to the data base has been implemented to warn in case the rate goes down. This can effect the data consistency when using not yet updated data.

There have been various reports of the TCS getting stuck which were likely traced to an intermittent disc access failure on the CPU board. Using a second CPU board have shown no more problems and a replacement boards will be purchased as spare.

5.4.2 Telescope drive

There recently were some problems with the altitude motor brushes which let to some strong telescope vibrations that caused one of the telescope load cells to be displaced. Protection against altitude oscillations has been implemented where the telescope power is switched off if this occurs.

Work is is progress to improve the handling of the periodic encoder errors for the altitude and azimuth axes. These 1.0 and 0.5 degree errors are an effect from the physical design of the two encoder discs where one disc is fixed and the other one rotates. They each have 360 segments. A new approach has been defined where a model with relevant parameters will be applied to the calculated position before applying it to the actual encoder.

5.4.3 Mirror support system

The new M1 compressor dryer has been installed. It is an active cooling type system made by Atlas Copco. The old system has been refurbished and we are preparing it to be available as a spare.

5.4.4 Reflectivity

M1 was washed in early December and after that cleaned two times with CO_2. The ALFOSC zero point measurements (until the end of February 2012) indicate values similar to those shortly after re-aluminisation of the M1 in July 2009. Unfortunately, the reflectometer from the Liverpool telescope we have been using is broken and we do not have recent reflectivity measurements of the mirrors. However, the results from the zeropoint measurements are sufficient positive and we decided to postpone re-aluminisation of the mirrors we were considering for this summer.

5.4.5 Guiding system

A rather long standing issue is that of keeping track of the number of turns the guide probe position encoders make. Likely due to access load on the TCS it can loose (accuracy in) the position of the guide probe and consequently in the resulting position of the telescope, and this issue reduces the speed at which the guide probe can be moved. Using a microcomputer keeping direct track of this can alleviate this problem, both allowing for higher speeds of the guide probe without the danger of loosing counting of the turns, and reducing the CPU load on the TCS that no longer needs to keep track of the turns itself.

5.4.6 Catalogues

A full review of all the fields in the Blanks catalogue used for flat fielding has been made. Optical night time images are now provided for all fields and the number of stars of certain brightness indicated for each field.

5.5 Observing system

As a last addition to our InfoSystem the option has been provide to add comments to the FITS header of files. The contents of this header is now also shown on the observing log part of the InfoSystem.

It was noted that error messages that appear in the Talker are not always that clear. However, there is also a limit to the amount of text that can be written on one line. The plan is to have the error messages in the InfoSystem linked to more detailed explanations (in existing web-pages).

To make it easier for the user to know if all the required programs in an observing system are running, a system was made that provide direct and visible information about the successful start of these programs. If any of these programs fail to start, an error message will be presented to the user with information about the required action to take. This system is now in use with the observing systems for FIES, NOTCam and ALFOSC.

5.5.1 Instrument set-up

The optical element database design was complete and data describing existing relations between mechanisms (wheels, slides, etc.), elements (slits, filters, etc.) and orientations (with respect to the instrument or detector) have been entered. Complimentary, a web application allowing to view and modify certain aspects of the optical element database content (e.g., location) has been developed. This system has now been implemented for ALFOSC and is planned to be implemented for NOTCam and FIES.

Three new FITS headers were implemented to reflect the orientation of the optical elements.

5.5.2 Observing scripts

There is a general issue with error handling in observing scripts, in particular the way this is (not properly) handled in (self made) observing scripts. General instructions are being be added to the guide on how to create scripts describing how errors can (and should be) handled when writing an observing scripts.

5.5.3 Observing Blocks

A preliminary version of the new Observing Block generator has been made for ALFOSC and is currently been reviewed. The next step will be to develop a system (the "Executer") that translates the observing description as defined by the Observing Block in to a set of existing sequencer commands and scripts. The system will include an interface that should allow to execute as a whole or in parts the resulting set of sequencer commands and scripts, with the option to stop or pause at intermediate steps, skip certain parts or abort execution at any time.

5.5.4 Calibration data sets

In relation to Observing Blocks (which in principle are aimed at defining night time observations) and (the execution of) service observing in general we need to define what are the standard daytime calibrations that are required for different set-ups. (In a service observing context, what are the calibrations we provide beyond any night time calibrations defined in the OBs.) E.g., for imaging that would be a set of (11) bias frames (with the window used for the observations) plus a set of (3) twilight flat fields each exposed to give 100 kADU (as defined in easyflat). In the end, this is just the practical side of the calibration plans but this is specifically interesting for more complicated observing modes which are not often used and this then provides both info to any persons that is planning (service) observations, but also for us when executing service observations. In general a lot of information exists, but this is rather spread out and the plan is to make separate web pages for each instrument with all the information, including practical issues on how to execute the calibration observations which might be more complicated for things like polarimetry.

5.5.5 FITS keywords

One of our main objectives is to implement a system that sets a number of keywords in the headers of each FITS file that provides a complete and unique description of each data file as for the observing set-up, the type of observation and the observing technique used. The is strongly linked to the OB system that will be involved in setting these keywords, and to the data acquisition and archiving system that will use this information.

5.5.6 Data analysis and archiving system

In connection with the new data acquisition system related to the new detector controller, a new data storage and analysis system is being planned. However, the current system we use is aging and we are considering to replace the hardware we use to make copies of the observations to DVD for the observer and for the archive. In particular, we are considering to separate the copying of data for the observers and for archiving, where for archiving purposes a system can be made that better uses the capacity of the DVDs (or, for that matter, Blu-ray disks) in a more optimal way. E.g., the latter could be a system that simply saves all the data generated by all observing systems as soon as some criteria related to the total amount of data are met. For observers a system is considered where all the data during an observing run is saved and only handed over at the end of the run, not every night. Here we are thinking of providing a form, e.g., similar to the instrument set-up form, in which observers can indicate if they plan to copy the data themselves, or want one or more copies of the data on media (possibly providing address details where to send the data). On the basis of the policy we want to implement the proper hardware requirements can be defined.

5.5.7 Data base monitoring

To meet the ever increasing dependency of our observing system on an efficient and robust database system, a commercial "Monitor and Advisor" tool has been purchased, allowing for detecting and correcting potential problems.

5.5.8 Weather information

The IAC now provides water vapour data. These measurements are obtaining with the help of the GPS network using specialised software. Water vapour measurements are especially useful for IR observations and the latest results is now presented on our weather page. Also the seeing measurements form the TNG DIMM were added (plotted together with the ING RoboDIMM data).

Recently a fish-eye all-sky camera (SkyCam) was installed at GranTeCan, providing an image of the sky day and night. Especially the night view can be very useful when observing to check for clouds and a link to the images from this camera was provided on the weather page. The possibility to see a movie of the data from the current night or previous nights was added. We also provide the option to download these movies.

We also provide an overlay with an AltAz coordinate grid on the SkyCam image, on which internal to the NOT network we also indicate the present pointing of the telescope. We are planning to replace this with a grid indicating Hour Angle and Declination. A collaboration has also been setup with GTC to look into developing software that will turn SkyCam into an extension mapper and cloud detector.

5.6 Detectors

5.6.1 New controller and data acquisition system

There are still various issues with the operations of the new detector controller for ALFOSC. Beyond our data acquisition software that has been upgrade to correct some errors, there are still various issues that are specific to the software that interfaces with the controller, and some that are specific bugs in the controller. A system was set-up by us that is also used by the people in Copenhagen to keep track of problems and solutions. Many issues have been resolved or are at least understood, but we have selected to improve the system only in big steps, not upgrading things every time a problem is solved to have as much as possible a well defined and stable system. A related issue is the decision to upgrade the PCI fiber interface card to the newer PCI express standard (see below), where we want this upgrade to also be included in an upgraded version of the detector controller for ALFOSC to not have different versions in operation at the same time.

The development of the NOTCam array controller was started with an initial assessment of the possibilities and limitations of the controller system design. This was needed in order to have a clear basis to define the user requirements for the new controller and data acquisition system for NOTCam. To be able to reach the readout speed originally aimed for it was agreed with the development team in Copenhagen to upgrade the design and use the newer PCI express standard interface card that connects the controller with the computer that operates it. A complete set of user requirements is in the final review stage and will be sent to Copenhagen shortly. These user requirements are significantly more extensive then those for the (optical) detector controller in ALFOSC as it includes things specific to IR arrays, while it also includes various additional commands that do not exist with the current detector controller and data acquisition software.

The planning for the new detector controller for FIES is not clear as this depends on a decision to buy a new detector. However, the user requirements will not be very different from those for ALFOSC. As soon as the situation for the FIES detector becomes clear we will review how best to fit it in with the development for the NOTCam detector.

To minimise any interaction with the rest of the observing system, the plan for the future is for each detector controller to be operate through a dedicated computer, while the control of all instruments will be done from one common instrument control computer. This common instrument control computer is in the process of being installed, configured and tested. The will ease script execution and provide a way of distributing the computing power needed to control instrument(s) and detector controllers. ALFOSC will be the first instrument to use this new setup and it is foreseen to solve specific software problems seen in the current setup with the new controller.

5.6.2 CryoTigers

We still experience occasional problems with the CryoTigers. We had recurrent problems with the FIES detector heating up and losing vacuum. As described in the last report, we tried various things with the dewar of the FIES detector to improve its holding time. In the end it was found that replacing the compressor of the CryoTiger solved the problems, with the dewar temperature and pressure staying at significantly lower values than before. For StanCam we also saw some episodes where both the detector temperature and pressure would go up (we do not have dewar temperature reading), but after some time (a few hours at most) the temperature and pressure would go down again. As the vacuum can not recuperate by itself we concluded it is actually the dewar temperature that rises and falls. Again, this pointed to the CryoTiger where the idea was that the cold head would occasionally get blocked. The cold head was cleaned by reversing the flow of the cooling gas for a few hours simply swapping the hoses. Since that time the detector temperature and pressure have behaved normally.

It was noted that the StanCam CryoTiger is aging while the FIES CryoTiger has already been partly replaced and we are looking at the option to replace some broken parts, or buy a full new system as a complete spare.

5.6.3 Vacuum pumps

A new vacuum sensor was bought. It has been used to calibrate the 2 units in the vacuum pumps. Also, the pump normally station in the dome was serviced and cleaned, polishing vacuum connections and replacing some O-rings. Since that, better vacuum was obtained using the pump.

5.7 ALFOSC

5.7.1 Detector

As noted above, an upgrade to the detector controller will take longer. This also means the controller still does not provide the data of the temperature and pressure sensors. There is a temporary telemetry controller for the temperatures so we can at least read them by eye, and we now have found a way to read this data electronically. In the near future we plan to connect this to our network so the values can be read by the computer and entered in our data base. This will then allow us to add this to our monitoring system that warns when a dewar is heating up and should be filled. This is especially relevant for the ALFOSC detector as with the new controller the holding time has been reduced to 15-18 hrs, i.e., it needs to be filled more than once a day.

There have been some issues with the bias level varying, depending on the order in which commands are given. A post-processing programme has been made that calculates the bias level and the dispersion (as measure of the read-out noise) using the over-scan in the serial and parallel directions on the CCD whenever available and shows the results overlaid on the displayed image.

With the old data acquisition program a parameter existed to corrected the requested exposure time for relative delays in opening and closing the shutter such that the effective exposure time of an exposure taken with the CCD corresponds to the requested exposure time. This correction was found to be $\sim$+0.1 sec, i.e., the effective exposure time is slightly shorter than the request exposure time. This value is actually significant for short exposure times of a few seconds (e.g., used for standard star observations). However, the new system does not include such a parameter and will need to be added. In particular, the requested exposure time send to the CCD controller will be the value corrected for this 'shutter error', while the header giving the exposure time in the resulting images should given the requested exposure (which in principle should correspond to the effective exposure time). A separate header will be created to show the 'shutter error' in use at the time the exposure was taking.

5.7.2 Observing system

As a result of the change in the default size of the readout of the CCD in the parallel direction some post-processing tasks used by some of the observing scripts had to be adapted to accommodate this.

Various scripts also had to be modified to work with the new optical element data base. The alfosc.acquisition script used to acquire a target on a slit for spectroscopy was upgraded to automatically use the correct telescope focus depending on if no filter or an order-sorter filter was used. To allow for non-standard use of the script a flag was added which will make the script not update the focus.

5.7.3 Instrument focus

A long standing issue is that when using the filters in ALFOSC it has been the practise to use the telescope focus to correct for the change in focus, while in fact it is the instrument focus that should be changed. In principle this is not a big effect and not a problem for normal observing, but when changing from imaging polarimetry to spectro-polarimetry the internal focus is different as the slit is on top of a calcite and positioned somewhat higher than the normal slits. To (also) allow for differences in instrument focus to be applied for different instrument set-ups, this should be added to the optical elements data base. As a first step the plan is to just add the option for each elements to define the instrument focus, where for most elements this will be simply set to zero, maintaining the current situation. A longer-term objective is to define for each optical the correct settings for the telescope and instrument focus and implement these values.

5.7.4 Imaging

To determine the alignment of the detector with the focal plane of the telescope we have made various through focus tests doing a series of exposures stepping the telescope focus in between. We have seen variations of the best focus from the center to the edge, and from one side to the other indicating some misalignment, but tests at different telescope and rotator positions have given rather different results. We plan to investigate this further to understand what is causing this.

Two narrow-band and one intermediate-band blue filter were provided by G. Östlin and their characteristics were added to our data base.

5.7.5 Spectroscopy

A basic design will be made for a script that automatically takes properly exposed arc and flat field exposure similar to the existing FIES scripts. This design should form the basis to provide these kind of scripts for the most often used spectroscopic set-ups with ALFOSC.

When acquiring a target on the slit the first step typically involves an offset in the order of 10–20 arcsec as the center of the slits do not coincide with the pointing center. As the resulting offset typically has an error of a few percent (a few 0.1 arcsecs) a second iteration is needed in basically all cases. We plan to analyse the data collected over the last few months to see if there is any systematics in the offsets so a first automated telescope offset can be done at the start of the acquisition, speeding up the process.

To avoid an imbalance of the grism wheel in ALFOSC the weight was measured for all grism-wheel items and the corresponding list on the web was updated.

To avoid having calibrations lamps being left on by accident there is a time-out which automatic switches them off after 1200 sec. However, if the lamp is switched-on again (e.g., from a script) during this time the time-out is not reset and it can occur that the lamp switches off during an exposure. This was corrected such that the time-out is reset independent on if if is already switched-on or not.

A fault occurred in which a text string was entered in the file containing the slit positions causing the alfosc.acquisition script to fail. A wrapper script was made that allows you to use a regular editor and which analyses the contents of the file when finishing editing, letting you know if everything is OK or not, and correcting some errors automatically. The script still needs to be fully checked, while it is also being expanded to include editing other set-up files.

5.7.6 Polarimetry

It was decided to simplify and streamline the FAPOL polarimetry mode. In the new mode, FAPOL will always be used with the internal focus set to 1070 both for imaging and spectroscopy. This should improve the ease with which FAPOL setup and observations can be done. The telescope focus offsets for each element used in FAPOL was measured such that the instrument set-up and use of polarimetry can be automated through the use of observing scripts.

Since 2008 we have had the calcites mounted vertically in order to speed up readout when doing fast spectro-polarimetry. This made sense with the old detector controller as the difference was 40s versus 13s readout time. With the new controller it is in the worst case 8s versus 5s. Therefore, it was decided to change the orientation of the calcites permanently back to horizontal (i.e. horizontal polarimetry slitlets), thereby avoiding the need to rotate the grisms which would mean a non-standard set-up (which can be an issue for ToO and monitoring programs) and requires a more extensive set-up (different slits for normally mounted grisms and rotated grisms) which sometimes causes problems.

The section in the ALFOSC Cookbook about imaging polarimetry will be updated, and a section about spectro-polarimetry will be added.

5.7.7 Fast photometry

To optimise a fast-photometry mode using the new CCD controller and data acquisition system we will first define how we can provide time-series observations with minimal overheads to effectively replace the fast-photometry mode available with the old detector controller.

5.8 FIES

5.8.1 Instrument

The exposure command used with the exposure meter in FIES takes as input the total counts wanted from the meter at which the exposure should stop, and the maximum exposure time where the exposure will be stopped if the total count from the meter has still not been reached. The input value for the total counts for the exposure meter is a very large number typically in the order of 10 million where it is easy to add or forget a digit. To reduce any possible problem the option '-m' was added to the exp-count command which will interpret the number given as millions. A warning is given in the value is not in the range 0 to 300.

The fies.easythar used for standard wavelength calibration exposures with the ThAr lamps was upgrade to allow the user to scale-up the exposure time with respect to the standard exposure time. This allows to overexpose the few bright lines, but bring up a forest of many fainter lines. This is useful for high-precision radial-velocity work.

Often at the start of the night when using FIES one is only waiting for the sky to get dark enough so the autoguider TV camera can be switched-on to start observing. More in general, when observing (very) bright targets the sky background is not really important for observations with FIES, but it can limit the use of the autoguider. Furthermore, as StanCam provides fiber viewing there is no absolute need to be autoguiding to be able to observe with FIES. The plan is to defined what are the precise requirements to allow for observations with FIES without using the autoguide camera. In particular, the target acquisition should also be possible when not guiding, while the system used to position and keep the target in the fiber should also function (properly) when not guiding. Based on the requirements we will consider implementing this option.

We hope to receive and commission the polariser in the coming months.

5.8.2 Radial velocity stability

As reported before, when the seeing is variable the RMS value of the radial-velocities measured with the medium-resolution fiber is much worse ($\sim$25 m/s) but when the shaker is used the RMS become $\sim$10 m/s, i.e., nearly as good as under stable seeing conditions. Test with the high-resolution fiber shows it not to be significantly affected by variations in seeing and we found the intra-night velocity accuracy with this fiber to be 4–6 m/s. Observers report that the longer-term stability with the high-resolution fiber is $\sim$10 m/s.

An upgrade of the FIES fibre-shaker is being made such that you can determine what state the machine is in and see if it is running or not. This will help to make it possible to script observations with the shaker. How to use the shaker from within the sequencer and how to use the web cam that looks at the shaker was documented, while some more photos of the new fiber shaker were added.

A fundamental issue in determining the capabilities of the system and being able to assess possible improvements is to define a proper test and monitoring plan. This will establish a base-line and define the procedure to assess possible improvements. Our main priority for FIES is to implement this.

5.8.3 Observing system

We have had the situation in which the stancam.movie command was left running at the end of an observing night. Although not a very serious issue the system was changed such that the movie is automatically stopped at the end of the night.

5.8.4 FIESTool

FIESTool has been updated to properly process data taken with the simultaneous-sky mode (using the medium-resolution fibers 2 and 3) such than when online FIESTool will reduce and show the star spectrum in fiber 3.

We still are working on our plan to make the startup of FIESTool fully automatic as part of the startup of the FIES observing system. In this way we can also ensure that all the observations are reduced on the fly. This is part of our plan to add as a service the automatically reduced data of the observations to the copy of the raw data we provide to the observers.

However, FIESTool is being used as an on-line reduction tool to assess the quality of the obtained data and running FIESTool fully automatic in the background does not allow for this. To solve this problem, a dedicated graphical client has been written to be run on the computers the observer can access. This client will cover the plotting functionality that the users get from FIESTool, with the added benefit of plotting multiple images at once, allowing easy comparison.

5.8.5 FIES building

The temperature setting for the front room was lowered by 2 degrees to allow for excess heat in the FIES room to be removed quicker. The precise temperature difference with the FIES room is not clear as there are doubts about the precise calibration of the sensors, but the front room which is actively cooled is now thought to be colder than the FIES room.

To limit the heating of the FIES room we are still looking at the option to never have the vacuum pump in the FIES room. For this an extended tube should be installed which allows the dewar to be connected to a pump in the front room. Also, a remotely operable valve should be installed on the FIES dewar so there is no need to enter the FIES room at all when the dewar needs to be pumped, while the excess heat generated by the pump does not enter the FIES room either. Note that this also implies that we do not need to touch the detector dewar anymore to attach the tube of the vacuum pump. We have noted in the past that touching the dewar causes shifts of the detector and consequently shifts in the Echellogram which can affect the long-term stability. Also, on one occasion the noise in the detector increased because some cables connected to the controller were accidentally moved.

5.9 NOTCam

5.9.1 Detector controller

When NOTCam came to the NOT in 2001 it was foreseen that a new controller would arrive soon. NOTCam has given useful data but its potential has been limited by the old controller and the design of the data acquisition software. Compared to similar instruments NOTCam has very large overheads for short exposures, introduced mainly by the long readout time but also by the way data is handled. This limits the use of typical observing modes in the near-IR (averaging of multiple short exposures) and fast photometry. In addition, the darks are not well understood, and the measured dark current is very high and also variable. There is a dead column in the centre of the array which is due to the design of the old controller. The DC-gradient (or “bias tilt”) across each quadrant is not a smooth gradient, but has several jumps that are not always subtracting out well, producing stripes or bands in the images. It is also not possible to abort an ongoing integration.

We have had no access to the lower level commands in order to experiment with readout and exposure modes recommended by detector experts to minimise for instance the well known “reset anomaly” problem for this type of arrays. All the above problems are expected to be solved with the new controller. The user requirements for the new controller and data acquisition system for NOTCam have been defined and detailed in a draft document.

5.9.2 Observing system

Since the introduction of the Sequencer we have had occasions where BIAS apparently ignores exposure commands from the Sequencer. After a certain amount of time the sequencer gives up and continues with its next command. This causes any dither script to skip an exposure (or more) in a sequence. The phenomenon is not limited to scripts, but also when giving exposure commands after each others on the command line. Extensive tests in September showed that, although the problem is intermittent, it seems to have become worse over time, and there is a strong correlation with the exposure time. A modification inside the data acquisition software was eventually made to do an automatic "re-try" of the exposure command if it is not executed. This works well for the most typical exposure times, but fails for longer exposure times. Until the underlying cause of the problem is found, this work-around at least makes sure that the exposure eventually is made, though at the cost of some extra overhead. The new controller should in principle not have this problem.

5.9.3 Observing overheads

Folding telescope offsets in dithering scripts in to the readout of an exposure has been added. Typically 5–6 sec are now saved per exposure/dither by moving the telescope while reading out after the shutter has closed. This is very useful for short exposures such as twilight sky flats, and bright standards. For 3-10 sec exposures this means that the execution time of a dither is 20-25% shorter. For the "frame" command no tests were made yet. In this readout mode, the shutter closes after the last readout, but the file storage time can be considerable (6-7s) and this will be folded into the time needed to offset the telescope.

It was noted that in some cases the displaying of data being readout caused an effective increase in the overheads. For these cases the commands notcam.autoshow_on and _off were made to be able to switch the automatic data displaying during readout on or off. The corresponding commands were also implemented for ALFOSC and StanCam.

A systematic measurement of overheads was made in order to disentangle the different sources of the overheads. The results are described in the NOTCam User's Guide under the section "What are the overheads?", see:

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

The ultimate solution to the rather particular NOTCam overheads is the arrival of the new controller. The sooner we get the new controller, the sooner NOTCam can show its full capabilities.

5.9.4 Imaging

A model of the distortion of the Wide Field camera was made for the JHKs bands. The model is based on high quality data from a stellar rich field in Baade's window from June 2009, using 2MASS positions as reference. The data, composed of 9 offset images per filter, gives a grid of about 2300 accurate X-Y positions per band. In January 2012 the model, presented as IRAF/geomap database files, was made publicly available for download. In the NOTCam quicklook reduction package v2.4, distortion correction is added as an option in the tasks, and if selected, the individual images are corrected before aligning and combining. Only specific models exist for the J, H, and Ks bands, and for narrow-band filters it is suggested to use the nearest (in wavelength) model, while for Z and Y primarily the J-band model is used. The correction always improves the images, but for not fully understood reasons for some data it is better than other. We have found no dependence on rotator position or altitude.

The plan is to obtain high quality data to make distortion model for Z and Y filter.

The scatter in the photometric measurements of a standard star measured at difference positions on the array is believed to be limited by the flat fielding errors. For high signal-to-noise data the scatter is below 1–2 percent after correction for non-linearity and optical distortion. Data has now been taken in photometric conditions to map the illumination correction for the wide-field camera with the JHKs filters

5.9.5 Filters

The NOTCam Z-band filter (0.83-0.93 micron) red leak was determined to be mainly at wavelengths red-ward of the K filter. A proper blocking filter was searched for - it should have a >95% transparency in the Z-window and block long-ward of 2.4 microns.

As suggested by our contact at NDC Infrared Engineering (who made the Z-band filter but the company is closed now), one cheap way of reducing the red leak would be to add another 5 mm of BK7 glass, or potentially 1 mm of KG4 glass. We discussed these alternatives with Customs Scientific and got a quote (444 euros plus freight) for both which was accepted. Both filters were installed in NOTCam in March and tested in April. When crossing BK7 with the Z-band the sky background relative to Ks, a measurement of the thermal leak, went from 0.88 to 0.61. The background is still 10 times higher than the Y-band background. The measured throughput in the Z-band went down by ∼10% The KG4 filter blocks the red leak better but has a very low throughput in Z. These measurements need confirmation, as the data was taken in very bad conditions with very high backgrounds, but preliminary data shows that the leak can only be partially reduced, and in hindsight we should probably have gone for the expensive Barr Z filter in the first place.

5.9.6 Spectroscopy

The baffle lamps used by NOTCam were added under TCS control, and the lamp status is written to the data-base. The status is now shown in the NOTCam user interface, while it is also written to the FITS headers of NOTCam data. Later these headers will also be added to the FITS headers of data from the other instruments as the baffle lamps are a permanent feature of the telescope independent of NOTCam.

The notcam.calibexp script to take calibration data was upgraded to use the tcs.store and restore scripts that allows to record and restore the status of the TCS. NOTCam spectroscopic calibration exposures require the mirror cover to be closed and opened, and the scripts allow to get back to the correct autoguider filter and restart the autoguiding after the calibrations.

Data to characterise spectroscopy in the Z and Y-filter spectroscopy, have been analysed and preliminary results have been presented.

5.9.7 Vacuum & Cooling

Since there was no time for a two-stage baking of NOTCam after the May 2011 opening (which was not planned), and since the vacuum obtained was a merely 2^{-4} mbar, we had decided to do a proper baking at the next planned opening. This took place in March to install the two new blocking filters. However, the time between NOTCam runs was not long enough to do a two-stage baking, so we did only a one-stage 8 days baking at 37 degrees. It resulted in no better vacuum than we had from before, an order of magnitude worse than what we had from 2008 onward. We need a longer-term monitoring to say whether we have out-gassing or micro-leaks. A proper two-stage baking is foreseen for a future opening (none planned for the moment).

There was a major concern about the LN_2 holding time for NOTCam since early January 2012. In storage (not mounted) NOTCam is refilled with LN_2 typically every 5th day. This interval became shorter and shorter, and each time it was only possible to fill less and less LN_2 into the tank. The problem with the short holding time and the apparently small capacity of the tank fixed itself every time that NOTCam was mounted on the telescope. Thus, moving the instrument around seemed to help, and it was speculated that water had accumulated in the LN_2 tank, forming a frozen layer which would divide the tank in two parts and inhibit filling the whole tank.

When opening NOTCam in March, the relative humidity measured at the fill and vent tubes of the LN_2 tank was about 40% while the ambient air in the clean room was at 15%. Based on a few experiments it seemed that: 1) water in the tank may freeze as a layer, and 2) pumping a bottle filled with water will take out the water eventually. Therefore, the tank was pumped until the relative humidity of the air coming out of the tank was $<$15%. Since then the holding time is better than ever (10 days between LN_2 fillings!), but we need to monitor this for a longer period.

Due to problems with the block of TMS sensors which include the water temperature of the PTR cooler for NOTCam we do not have a way to detect if the PTR is on or not. An independent system was developed to monitor the NOTCam PTR compressor status. It was decided that the water temperature would provide the most useful information about the compressor since it defines both if the unit is running and also its performance. When this system is implemented the water temperature will be read using a digital temperature sensor and provided over the Ethernet.

A Helium leak was detected in the PTR system. The leak was found to originated in a crack in the flexible part of the supply hose, close to the instrument end, near the previous point of repair, a very vulnerable location where hoses are bent during operation. The tube was cut 10 cm, re-welded, vacuum pumped and refilled with Helium.

5.9.8 Reduction software

The quick-look reduction package for IRAF was upgraded to version 2.4 which includes a script to correct raw data for non-linearity, as well as an upgrade of the reduction scripts which now have the capacity to do (optional) Wide-Field camera distortion correction. For more info see:

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

The reduction package is now made available for download.

5.9.9 Documentation

The NOTCam web documentation was updated to include a link to the Quicklook Reduction Package. A section was added on the optical distortion model The section on Data Reduction in the User's Guide was updated for the new version notcam.cl v2.4. Photos were added of the last NOTCam opening and the instructions on how to install filters in NOTCam was updated.

5.10 MOSCA

5.10.1 Detectors

A recurrent feature with the MOSCA detectors is that the bias level of the CCDs change and have to be adjusted. A new command was made that makes it easier to find the correct bias level of the CCDs. With this command the support astronomer can directly send low level commands to the camera controller. This task is normally done before each run when the instrument is mounted.

5.11 StanCam

The colour terms for the standard UBVRI used in StanCam were added to the web pages. The data was kindly provided by Vallery Stanishev (Centro Multidisciplinar de Astrofísica in Lisbon, Portugal).

5.12 TurPol

5.12.1 Data acquisition

Some time ago the TurPol computer failed and it was replaced with an other computer where in principle we should have all the relevant software. However, we still do have the hard disk of the old computer. This hard disk was handed to Andrei Berdyugin, to be taken back to Turku and given to Vilppu Piirola.

5.13 Computer system

It was noted that our home directories slowly were getting bigger. In was felt that the main reason was that most people simple added more data to their directory without backing up older, no longer used data. USB disks were purchases such that each staff person can make back-ups easily.