Period 43
Report to the NOT Council and STC

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

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Contents

1 Introduction 1

2 Down Time 1
- 2.1 Weather 1
- 2.2 General overview 2
- 2.3 Main problems 2

3 Instrument use 3

4 Comments recorded in End-Of-Night & End-Of-Run reports 3

5 Operations 4
- 5.1 Additional services 4
  - 5.1.1 Educational activities 4
  - 5.1.2 Service observing 5
  - 5.1.3 “Fast-Track” Service Program 5
- 5.2 General 6
  - 5.2.1 Safety 6
  - 5.2.2 Power generator 6
  - 5.2.3 Snow 6
  - 5.2.4 Energy efficiency 6
- 5.3 Telescope Building 7
  - 5.3.1 Safety 7
  - 5.3.2 Drive System 7
  - 5.3.3 Electronics room 7
  - 5.3.4 Control room 7
  - 5.3.5 Old parts 7
- 5.4 Telescope 8
  - 5.4.1 Telescope Control System 8
  - 5.4.2 Telescope drive 8
  - 5.4.3 Reflectivity 9
  - 5.4.4 Mirror support system 9
  - 5.4.5 Balance 9
  - 5.4.6 Pointing 10
  - 5.4.7 Atmospheric dispersion corrector 10
  - 5.4.8 Guiding system 10
  - 5.4.9 Time server 11
  - 5.4.10 Catalogues 11
- 5.5 Observing system 11
  - 5.5.1 Observing scripts 11
  - 5.5.2 Instrument set-up 12
  - 5.5.3 Focus offsets 12
  - 5.5.4 Observing Blocks 12
  - 5.5.5 System status 12
  - 5.5.6 Documentation 13
  - 5.5.7 FITS keywords 13
  - 5.5.8 Data analysis and archiving system 13

5.5.9 Exposure time calculator . . . 14
5.5.10 YNAO . . . 14
5.6 New detector controller and data acquisition system . . . 14
5.7 CryoTigers . . . 14
5.8 ALFOSC . . . 15
5.8.1 Detector controller . . . 15
5.8.2 CCD . . . 16
5.8.3 Observing system . . . 16
5.8.4 Imaging . . . 17
5.8.5 Spectroscopy . . . 17
5.8.6 Polarimetry . . . 17
5.8.7 Fast photometry . . . 18
5.8.8 Dewar . . . 18
5.8.9 Documentation . . . 18
5.9 FIES . . . 18
5.9.1 Instrument . . . 18
5.9.2 Radial velocity stability . . . 19
5.9.3 Observing system . . . 19
5.9.4 Detector . . . 19
5.9.5 FIESTool . . . 20
5.9.6 Quality control . . . 21
5.9.7 FIES building . . . 21
5.9.8 Documentation . . . 21
5.10 NOTCam . . . 22
5.10.1 Instrument . . . 22
5.10.2 Observing system . . . 22
5.10.3 Observing overheads . . . 23
5.10.4 Filters . . . 23
5.10.5 Spectroscopy . . . 24
5.10.6 Detector . . . 24
5.10.7 Vacuum & Cooling . . . 24
5.10.8 Quality control . . . 24
5.10.9 Reduction software . . . 25
5.11 MOSCA . . . 25
5.11.1 Detectors . . . 25
5.12 TurPol . . . 25
5.12.1 Data acquisition . . . 25

1 Introduction

This report covers the operations of the Nordic Optical Telescope for period 43: 2011-04-01 to 2011-10-01.

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 43.

A total of 144 fault reports were submitted, with an average time lost of 8 min per fault, for a total down time of 1.2% (1.3% on scheduled observing nights). Of these, 96 reported no time lost, 47 reported < 2 hrs lost, and 1 reported 2 or more hrs lost.

This compares to a down time of 0.5% over all nights (0.6% on scheduled observing nights) in period 42, and 0.4% over all nights (0.4% on scheduled observing nights) in period 41. 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. Of the 79 fault report in period 41, 57 reported no time lost, 22 reported < 2 hrs lost, and none reported 2 or more hrs lost.

Table 1: Technical down time statistic period 43: 2011-04-01 to 2011-10-01

Night included	Time lost	Nights	Percentage[a]	Last semester	Last Summer
All nights	1165 min	183	1.2%	0.5%	0.4%
Scheduled observing nights[b]	1070 min	157.5	1.3%	0.6%	0.4%
Technical nights	95 min	22.5	0.8%	0.0%	0.7%
Service nights[c]	400 min	50.5	1.5%	1.1%	0.1%
Visitor instruments	0 min	3	0.0%	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 general conclusion is that there was a significant increase in the number of fault reports and the level of downtime. However, with reference to Table 2 and the Section "Main problems" this can largely be explained by the introduction of the new detector controller for the ALFOSC CCD plus some incidental errors. In particular, there does not seem to be any specific trend or any systematics in the frequency or the amount of time lost due to faults.

2.1 Weather

For period 43 a total of 181hr 57min was lost due to bad weather which corresponds to 11.2% of all the dark time, as compared to 38.4% in period 42 and 17.5% in period 41. The total amount of clear dark time was 1442hr in period 43, as compared to 1255hr in period 42 and 1340hr in period 41.

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 (41 and 42).

Table 2: Down-time statistics for period 43[a]

Syst/Type	Soft		Elec		Optics		Mech		Others		Total		P42/P41	
Telescope	6	00:30	2	02:25	0		3	01:00	0		11	03:55	16/14	04:30/01:30
Building	0		3	00:00	0		1	00:00	1	00:00	5	00:00	2/6	01:40/00:50
Computers	16	02:00	5	00:45	0		0		5	00:30	26	03:15	14/7	00:10/00:50
ALFOSC	43	03:35	13	01:55	3	00:00	0		1	00:00	60	05:30	16/19	00:30/00:35
MOSCA	8	03:05	0		0		0		0		8	03:05	2/0	00:15/00:00
NOTCam	6	00:45	2	00:00	0		4	00:55	1	00:00	13	01:40	15/16	01:30/00:30
StanCam	6	00:50	1	00:00	0		0		1	00:00	8	00:50	5/2	01:10/00:10
FIES	4	00:40	2	00:00	0		1	00:20	0		7	01:00	10/13	00:20/02:15
Others	1	00:00	0		0		2	00:00	3	00:10	6	00:10	5/2	00:00/00:00
Total	90	11:25	28	05:05	3	00:00	11	02:15	12	00:40	144	19:25	85/79	10:05/06:40
P42	55	03:40	20	04:35	2	00:05	6	00:45	2	01:00	85	10:05		
P41	44	03:30	24	02:55	2	00:00	6	00:05	3	00:10	79	06:40		

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

2.3 Main problems

There was one fault that caused more than 2 hours downtime during period 43, but I also included the problems with the new detector controller for ALFOSC as this caused in total more than 2 hours downtime spread over the semester.

- **2011-06-22: Building power**: 2hr 25m

  When slewing the telescope the power to the building would be cut. As part of the investigation of some errors in tracking during the daytime (see below) some work was done on the tachometer of the telescope azimuth motor which caused the relation between the signal (voltage) that is send by the Telescope Control System (TCS) and the resulting speed to change. This let the telescope to move too fast for the building to keep pace, resulting in building crashes. The relation was adjusted to the correct range.

- **2011-07-06 (onward): ALFOSC CCD controller**: 2hr 50m

  Many day- and nighttime tests were made with the new detector controller for the ALFOSC CCD and the corresponding new data acquisition software which resulted in several tweaks and corrections. Still, some errors occurred that caused problems during observing after the initial testing phase. Beyond a few minor bugs that did not cause any downtime and are being corrected in updates of the software, there were two main problems that persisted.

  The most serious problem was the apparent sudden loss of the charge-transfer-efficiency of the CCD in the serial (X-) direction. This required every time a shutting down of the observing system and a reset of the CCD controller to correct which takes a short but significant amount of time. In the end this was found to be a problem in the controller when using a binning factor larger than 4 in the serial direction (which is beyond the specifications). The software and the scripts have been modified to avoid using such a high binning factors.

A second recurring problem are timeouts of commands given to the detector controller. This general requires a shutting down and restarting of the observing system. This problem is thought to be specific for the ALFOSC/NOT installation as this has never been seen before and cannot be reproduced outside the NOT environment. It is being investigated if this is caused by the (old) networking libraries on the computer being used, and a change in the setup of the computer network involved is planned.

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 for each instrument.

Table 3: Instrument use

Instrument	No. of nights		No. of runs	Nights/run
	Scheduled	Technical		
ALFOSC	56.5	12	16[b]	2.0
FIES	54.5	5	11[a]	3.8
NOTCam	23.5	4.5	5[c]	3.6
MOSCA	23	1	3[d]	5.0
FastCAM	3	–	1	3.0

[a] Excluding 24.5 service nights [b] Excluding 12.5 service nights
[c] Excluding 5.5 service nights [d] Excluding 8 service nights

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

As before, most comments written in the reports during period 43 were very positive, both about the observing system and the support from the staff.

What is properly most noteworthy is that, beyond some comments referring to faults that were also reported through the fault data base, there were very few comments. Apart from various positive remarks about the increased speed of readout for the ALFOSC CCD with the new controller, the only things that was mentioned more than once is the relative slowness of the CCD readout for FIES which is still using the old detector controller (see below). For the new observing log an option was requested to be able to add comments. This is being implemented. For ALFOSC it was suggested that the acquisition script includes a separate option to set any offset in the telescope focus to zero (as should be the case when using no filter which is the normal case when acquiring a target for spectroscopy). It was noted that there was little difference between simply setting the focus offset to zero or adding it to the acquisition script, while there are cases (e.g., when using a order-sorting filter) where a filter is used and the focus offset is not zero. It was also noted that the staff phone list in the control room was outdated. This list, and the one in the dome were replaced. There was a comment that the time-out of 20 min defined for calibration lamps in ALFOSC was rather short as some calibration exposures needed to be longer than 5 min to reach a reasonable signal level, and it would not be possible to take several exposures without the timeout being activated. It is being looked at how best to account for such cases beyond a simple switching off and on of the lamp in question. One observer noted that when observing with FIES it can be a problem when data from StanCam and FIES are displayed at the same time. Specifically, when acquiring the target from a StanCam image the cursor can be "taken" by the part of the display that is showing a FIES image. This crashes the StanCam target acquisition program. This only happens when a new target is acquired very quickly and, e.g., a calibration exposure is taken with FIES while the telescope is moving to a new target and is only readout when already an image has been taken with StanCam to acquire a new target. A simple workaround has been defined to avoid this specific problem by letting the StanCam target acquisition retry when it fails instead of failing completely and crashing the program. This is being implemented.

5 Operations

5.1 Additional services

5.1.1 Educational activities

Basically as a regular feature we have had various observing courses during the "summer" semester. We especially have been extensively involved with the Nordic-Baltic Research Training Course "Young Stars across Time and Wavelength" that took place at Tuorla Observatory, Turku, Finland, during the period 6-16 June 2011. The course was organised jointly by the NOT, StarPlan (Denmark), Onsala Space Observatory (Sweden), and Tuorla Observatory, with financial support from NordForsk. As during the previous NordForsk training courses, the NOT was used in remote mode. See for details about the course

`http://www.not.iac.es/Turku2011/` .

The NOT was also used in remote mode as part of the 9^{th} NEON Observing School that took place at the Molėtai Observatory, Lithuania, during the period 14 -27 July 2011. See

`http://www.iap.fr/neon/neon_schools/2011/MoletaiProgram2011.html` .

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).

On La Palma we are involved in an observatory wide program to reach all 15 year-old pupils on La Palma. This program includes an astronomy talk (in Spanish) at the schools plus a daytime visit to the observatory with a small astronomy workshop and visits to the telescope(s).

For the students at the NOT a more indepth course was provided in the use of the FIESTool reduction package. It was noted on a few occasion that the basic knowledge of Linux is missing among the students and among some of the younger observers. This is actually an issue in the use of our observing system as it runs under Linux. To provide a minimal basis for the proper use of the observing system a web page is set-up with a short description and a basic list of commands.

5.1.2 Service observing

During period 43 a total of 50 and a half nights of service observing were done. 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 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. Normally, programs submitted during period 39 are formally closed at the end of period 43. However, as the remaining observations are part of already partly completed programs and very little time is required to complete them these programs have been allowed to remain active.

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, 14 have been completed. All of the 'grade 2' proposals have been 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, 14 have been completed and 1 has been partly completed. All the 'grade 2' and 'grade 3' 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, 10 have been completed and 3 have been partly completed. Of the 'grade 2' proposals, 3 have been completed and 1 has been partly 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.

Up till now, in period 44 there has been 1 proposal accepted with 'grade 1'.

5.2 General

5.2.1 Safety

After an inspection by a licensed company some changes were been made to the electrical and mechanical installations. The installation of the safety protection of the machines in the workshop were slightly modified, some new emergency lights were installed and some of them replaced in both the service end telescope buildings. Also some fuses were changed to a different size and some malfunctioning earth leakage breakers were replaced.

As a more regular feature refresher courses and full courses as given by the red cross are offered to the staff.

5.2.2 Power generator

After a lightning storm in march 2011 the external power was lost but the emergency generator did not start. To avoid a repeat of the generator not starting some work was done to improve its functioning. The diesel in the tank was replaced and a maintenance plan has started to replace this on a more regular basis. A complete service of the generator was made by a technical expert. A potential problem with a leaking valve was detected which will be replaced. A special liquid was added to the diesel to improve its functioning at low temperature.

5.2.3 Snow

After heavy snow the access road to the NOT is the last to be cleaned. We looked in to the possibility of purchasing a snow blower type machine to clear snow and improve the accessibility to the NOT during such periods. This was reviewed by the ORM safety committee which concluded that the type of machines considered do not function well with the type of icy snow that occurs at the observatory so it was decided not to purchase these machines.

The main objective considering this option was to potentially limit the time that the especially more isolated telescopes like the NOT are not accessible after a snow storm. It was agreed that on future occasions the ORM administration will consider renting additional equipment at an earlier stage, and/or inform the telescopes that they might consider to do this themselves, to limit the time that telescopes can not be accessed. It was also noted that the new truck that will have to be purchased for common services at the observatory in the coming years is expected to improve the capabilities at the observatory to remove snow.

5.2.4 Energy efficiency

Energy monitoring equipment has been purchased and installed at the telescope to allow for a detailed view of how and where electricity is spend under normal operations. The aim is to identify areas where savings can be achieved. As expected, the cooling system of the telescope is by far the biggest energy consumer (the next biggest that has been measured is the computer room in the service building that uses more than 10 times less). No measurements have been made yet in the telescope building itself. To achieve any savings effort should clearly focus on how the cooling system is used. It is interesting to note that the cooling unit consumes almost the same during nighttime as during daytime.

5.3 Telescope Building

5.3.1 Safety

We have looked at how to guarantee communication from the control room, specifically in the case that the phone line does not work. Various solutions were considered but the only realistic idea was to get an additional line to the Residencia to provide some redundancy. An old line which used to be in the first office in the service building has been connected to the general main wire from the service building to the telescope, also with lighting protection. The wiring has been extended to the control room and a normal telephone connected to the line.

A new heavy duty beeper has been installed outside the telescope entrance stairs warning when the telescope building is moving.

5.3.2 Drive System

A computer was installed to provide a dedicated building drive error display that can also be remotely accessed, thereby giving full remote access to the building drives in case of problems or for test purposes. A more powerful and versatile computer is being purchased for this task.

5.3.3 Electronics room

The new electronics of both the telescope alt/az motors and the building drives were installed in their final permanent location in the racks in the electronics room.

5.3.4 Control room

After a long debate on the suitability of having a wireless transmitter in the control room, we decided to provide WiFi communications in the control room. An access point was purchased for the control room, and another to replace the aging one at the Service Building. Both of them are in service now.

At the telescope, no adverse affects were observed due to the installation of the wireless transmitter.

5.3.5 Old parts

With the final change to the new building drive we are left with the parts of the old drive system we no longer will use but do take up a significant amount of storage space. The same is true for remaining parts of the old TCS system. On the other hand, it was noted that some of the parts still might be useful (as spare parts), while many parts are in working order and might be used (sold to) other people. A review was made were several spares were identified, some old documentation was salvaged and a lot of things were thrown away. The remaining issue is if any of the potentially useful but unwanted spares can be sold.

5.4 Telescope

5.4.1 Telescope Control System

A general issue with warnings and alarms from the TCS is that they are relatively easy to miss (both in sight and sound). TCS log entries are now sent to the observing system and through the general Talker system provide audible and visible warnings on the screen of the observing system.

We are continuously expanding the amount of TCS data that is send to the general observing system data-base. This allows both for better warning and alarm systems, and for more complete and sophisticated observing scripts. This does provide an increased load on the TCS, but through the use of the data-base the number of direct calls to the TCS can be reduced which in turn reduces the load on the TCS.

With the possibility to operate most of our (observing) systems at the mountain remotely there is a safety issue. As the TCS is a closed system it is in principle simple to isolate and exclude commands issued remotely. The command “Inhibit-Remote-Commands” and “Permit-Remote-Commands” were implemented that can only be issued from the TCS user interface in the control room. The commands were fully tested in the control room itself, but a remote test is still pending.

It was noted that the printed documentation for the TCS in the control room was rather outdated and scattered. A printed version of all the information about the new TCS in a single binder was made and all outdated printed information was removed.

5.4.2 Telescope drive

Again we had a case of some jumps of the telescope which affected the data. A more indepth investigation showed that occasionally relatively high tracking errors were seen in azimuth for specific positions of the telescope. Many things were tried, including cleaning the encoders of the azimuth motor, cleaning of the tachometers, checking the hydrostatic pads of the telescope which were slightly adjusted, changing the power amplifiers of the azimuth motors and replacing the brushes in both motors. No more problems were reported with significant excursions of the guide star or the presence of elongated star images which we believe was solved by changing the brushes, but the occasionally relatively high tracking errors are still present. The reported errors correspond to the difference in where the TCS thinks the telescope is and where it thinks it should be, and they typically do not get any larger than 0.1-0.2 arcsec. A detailed check of imaging data does not show any affect on the image quality, where in particular no difference is found in the data at the specific telescope positions were the increased noise is reported.

In the end it was found that the increased noise was directly related to the difference in temperature between the outside and the bottom of the telescope structure. The new cooling system was installed with thermal isolation around the tube where the cooling water goes through the center of the telescope fork where also the azimuth encoder is located. So, the encoder ends up being kept at the low temperature of the cooling water, very different from the outer temperature. By rising the cooling water temperature and later removing the isolation where the encoder is placed, the temperature difference was reduced and the jumps were reduced drastically. This probably could be improved further but we should wait for next summer with higher outside temperatures to be able to test this.

5.4.3 Reflectivity

The last aluminisation of the mirrors in 2009 did see an improvement in reflectivity, but lower by at least 5% compared to previous aluminisations. This effect seems to be limited only to M1. We are seriously considering if a new aluminisation of M1 should be made. An analysis of ALFOSC zero point measurements suggest that the reflectivity in the V, R and i-bands are still similar to the ones measured just after the last aluminisation, while in the U- and B-bands the reflectivity has gone down by a few per cent. The plan is to do a proper washing of M1 and measure the reflectivity of the mirrors directly with a meter owned by the ING (this also includes a measurement of the roughness of the mirror) before coming to a definite decision about aluminising M1 in the coming summer.

5.4.4 Mirror support system

The air drying system of the compressor system used to run the active support of the main mirror is aging and has been failing relatively often. A replacement system was purchased but the unit was damaged during transport. After a long wait we finally received a new unit which will be installed in the near future.

5.4.5 Balance

The telescope rotator has been balanced with ALFOSC, NOTCam and MOSCA by using an arm mounted with the instrument. This arm extends about one meter and has weights mounted at the end. This balances out the uneven weight distribution on the adapter and the instruments. The advantage is that we do not risk any rotator runaways at accidental power losses which can harm the rotator tachometers. The rotator brakes can now hold these instruments at any rotator position and altitude. There is still a tube unbalance which makes the tube want to go upwards at low altitudes and downwards at high altitudes. This is not critical and does not significantly reduce the altitude tracking accuracy. A possible way to correct this has been designed but we still are considering if this is worth the effort.

It has happened more than once that after an instrument change the setting for the moveable counterweight on the telescope were not changed. A way to provide some short of check on this is to include a check of the counterweight setting when the instrument-name is set in the TCS to one of the instruments mounted at the Cassegrain focus. A warning should be given if the position of the counterweight is found to be significantly different from the default value.

5.4.6 Pointing

The telescope pointing procedure is now done from the sequencer and has been tested and documented. The command records pointing accuracy from 72 stars, chosen from the GSC catalogue in an alt/az equidistant manner. The script is fully automatic, and takes around 1 hour to complete. The pointing data recorded were used to compute a new pointing model. This new script makes it much easier to do tests as it does not require human intervention.

5.4.7 Atmospheric dispersion corrector

There were some problems with the lower prism of the ADC not initialising and the ADC was out of order for some time. It was found that the metal tab on the side of the prism that is used by the (inductive) position sensor to determine the initialisation position, was mounted upside down. This was corrected.

The ADC was primarily designed for use with FIES, but can be also be used with ALFOSC or NOTCam, and documentation concerning the ADC was added to the web pages of these instruments.

The guide star server was modified to take in to account the position of the ADC, including the additional vignetting when the ADC is in the light path.

5.4.8 Guiding system

The problem with the existing X-Y carriage guide-probe system is that the TCS occasionally looses count of the turns and the current method to reduce this error is to run the guide-probe slow, resulting in larger than necessary overheads during observing. A design for installing some simple electronics to take care of the guide probe X/Y turn counting has been made. This would eliminate the risk of loosing turns and thus loosing the guide probe correct position with 7 arcsec per turn of an axis. The speed of the guide probe can then be doubled and things like dithering used a lot in NOTCam observations can be speeded up. In addition some new amplifiers were identified that could replace the existing 25 year old devices. In parallel a spare amplifier will be build with the old design using similarly old spares.

In relation to the system possibly selecting a wrong guide star that happens to be in the field-of-view of the guide camera, it was noted that in principle the offset made by the system when detecting and centering the guide star should be of a similar size; the (variation in) offset being determined by the offset between the pointing model and the center of the guide camera, the RMS of the pointing model and the inaccuracies in the transformation of the guide probe X,Y position to RA & Dec. This implies that a sanity check can be made on the offset that is done when acquiring a guide star after a preset of the telescope, where a warning is given if an offset falls outside the expected range. As a first step for this the offsets that are made are being recorded. On the basis of the limited amount of data obtained up to now a relatively conservative upper limit of 50 arcsec has been set to any offset where a warning is given if the offset is larger.

A fairly fundamental part of current operations with the telescope is the use of the guide star server speeding up the process of acquiring a guide star as part of pointing the telescope. We had some problems with the hard disk which contains the catalogue used by the guide star server and we want to get a working backup disk with the catalogue such that the system can switch-over quickly (and automatically) in case of problems. In relation to this, the idea is to move the guide star server to its own dedicated computer. This can be an inexpensive basic machine where a second clone can be made that can serve as a complete back-up for the system.

5.4.9 Time server

The GPS XLi time server with its antenna mounted on the top ring has not been working since it was damage in a lightning storm and replacing it is very expensive while we do have a working in-house computer-based time server. In principle there is no need to get the XLi system repaired but we do need a proper back-up for the time server. It was mentioned that the old TCS clock system could work as back-up but we could set-up a second in-house time server. We are looking at what provides the best and easiest back-up in case of problems.

5.4.10 Catalogues

The new catalogue of blanks fields to be used for twilight flat field exposures has been updated to exclude fields which are not suitable in the near-IR. The revised catalogue is not suitable for all imaging instruments.

5.5 Observing system

5.5.1 Observing scripts

There were some problems with a wrong observing script being executed as an old and new version had the same name though they were in different directories. The main problem occurs when script made by an observer has the same name as one of the system scripts we provide. The observer should be able to run his/her own script, while an other observer should be executing the system script when using the same name. As each observer is assigned his/her own script directory the system was set-up such that it will only look in the current directory and the system script directories, where scripts in the current directory take precedence.

Some problems were reported with observers finding and (trying to) use old BIAS scripts in the sequencer. All these scripts were located in the different instrument directories and moved to separate directories. To avoid any accidental use, all these files will be saved to a DVD and removed from the system.

In the Talker log the execution of any command is noted but it is often not clear if the commands were executed manually or from a script. To improve this, specific instructions were provided on what should be added to scripts to let it note the start and end of the execution of the script in the log. This was specifically added to all system scripts.

5.5.2 Instrument set-up

The user interfaces for ALFOSC/FASU, NOTCam and MOSCA/FASU where upgraded with a facility to read their configuration information from a database instead of a simple text file. This will make them able to integrate into the new optical element database where all relevant information about optical elements are stored. This is essential for the definition and automated execution of any Observing Blocks (see below). The commissioning of the system for ALFOSC is close to being finished and the versions for NOTCam and MOSCA will follow shortly.

5.5.3 Focus offsets

As for the information provided in the data-base of optical elements, the focus offsets corresponding to any element in the light path needs to be defined. The focus offsets for more than 70 filters have been measured, but still about 30 little used filters remain. Most of the offsets for special elements such as the calcite plates for polarimetry have already been measured.

5.5.4 Observing Blocks

Development of the Observing Block (OB) Generator that will allow observers to define and upload observing block descriptions for later execution is making good progress. The main emphasis has been on developing the interface to define the OBs (with the specific requirements and limitations for each instrument and observing mode). In the near future the focus will move on to the software that will be responsible for the execution of the observing blocks. All the commands needed to execute the observations defined by an OB are already provided by the existing sequencer observing system.

5.5.5 System status

All the status information coming from the observing system has been stored up until now in simple log files. Over the last few months this information has been migrated to a database so it can be queried in a more efficient way. In the process, the messages from the TCS have been integrated into the system status logs, which makes it easier to follow the exact flow of operations when trying to figure out the cause of a problem. A specialised interface to query this data-base, e.g., by type of information or over different time-scales, will be developed in the near future.

Also, a web interface has been implemented for the Talker logging system, including the TCS messages, allowing to view the information all together. In similar fashion, a web application that allows for on-the-fly conversion of FITS images to PNG format has been developed to allow for easy and quick visualisation of any image taken at the telescope directly through a web browser. Both these things can now easily be viewed through the web from anywhere without the need to access the different computers that are part of the observing system. This has proven very useful in situations where remote support has been required, and could also prove valuable for remote observing runs.

5.5.6 Documentation

It was noted that with the increasing number of sequencer scripts and commands it has become hard to find things. I was agreed that the objective is to fully integrate all the basic scripts and commands in to a data-base and add things like the (short and long) description of how a script works, and if a script is a general or often used script etc., to the scripts themselves so that documentation such as web pages can be generated automatically with update information every time people look at the web pages. A first version for ALFOSC has been made where commands can be selected depending on any combination of Observing Mode, Command Type, Usage and Description. As part of this work, various minor updates to the descriptions of the individual sequencer commands were made.

5.5.7 FITS keywords

As a more continuous task we have been working on improving the FITS keyword information provided in the observing data. Several upgrades have been included in the new acquisition software connected to the new detector controller for ALFOSC. The keywords can now provide a complete description of any given exposure. The next step is to define how to use these keywords in practise (both how to fill them with the correct values, and how to use these values in the processing of a data file).

The interface for the FITS header archive has been improved to provide the principle header information as default.

5.5.8 Data analysis and archiving system

Work on this part of the observing system has been concentrate on two different aspects.

With the aim to make historical data easier to access, and to reprocess some of the old data for analysis, data from the archive CD and DVD disks has been read in to disk. Tools were developed to make it easier to upload the data itself, and to keep track of what has been uploaded, what is pending, and potential problems with faulty media, or missing files. So far, a total of 2 TB of data spanning the period 2008-2011 has been read in. A tool is being developed to assess the data.

In connection with the new data acquisition system related to the new detector controller, a new data storage and analysis system is being planned. A short document was made indicating the initial design and computing requirements. The overall philosophy of the system is to split the need for fast, low capacity storage and slower, high capacity storage and combine it with the need for high capacity, variable computing power for post processing and the low computing power needs for archiving.

A few entry level servers have been bought to replace some aging ones (mainly the DNS/Secondary mail server), which will also serve as a implementation test for the the new data storage and analysis system.

5.5.9 Exposure time calculator

Various updates were made to the Exposure Time Calculator to account for the changes due to use of the new detector controller for the ALFOSC CCD.

5.5.10 YNAO

A second visit was made to YNAO by one of the staff members from the software group together with people from CUO to do some additional work on YFOSC and install and commission the science grade CCD. As a part of our collaboration with the YNAO the work on the basic sequencer environment for their TCS and YFOSC instrument was completed.

5.6 New detector controller and data acquisition system

Further development of the data acquisition system related to the new detector controller has continued throughout the semester. Part of the improvements have been to make the software more generic, i.e., less depending on the NOT environment and easier to adept to any observing system.

The new controller for the ALFOSC CCD was mounted at the telescope on the 23rd of June. After some tests of the controller and the data acquisition software the system has been released for normal use. In general the system works well, but there are still various issues remaining with the controller before full acceptance. A more detailed description of the performance of the new controller is given below.

As a next step in the general upgrade of the detector controllers the requirements for the new camera for FIES will be defined, and the specific software system setup for FIES will be planned and developed. In parallel to this, the specific user requirements for the NOTCam detector controller (different from optical CCDs) will be made. How to proceed with the development in detail will depend on specific agreements with the team in Copenhagen, but also the delivery time for any new CCD for FIES will be an important factor.

5.7 CryoTigers

We have had continuing problems with the CryoTigers, both warming up over a relatively short period of time and a bi-stable nature of the cold-head temperature. When the cold-head temperature is relatively high (∼-160°C in the case of FIES), the system has problems keeping the CCD at the normal operating temperature.

One way has been found to recover from the cold-head temperature being relatively high. If the CryoTiger has been on for at least a few hours, being stable at the high temperature, switch it off for approximately half hour then on again and the temperature usually drops to the correct operating temperature of ∼-199°C. This trick has work for both the StanCam and the FIES systems, but it is not understood why.

5.8 ALFOSC

5.8.1 Detector controller

The ALFOSC CCD was moved to the modified dewar which has the correct mountings and connector for the new controller. The new controller and the modified dewar for the ALFOSC CCD were mounted on the telescope on the 23rd of June. The first nighttime test were made on the 25th of June. During the installation period, the controller was adjusted for optimal noise performance, and the new system was characterised in order to compare its performance to the one of the camera system using the old CCD controller.

A report was made that describes the properties of CCD with the new controller; see:

`http://www.not.iac.es/instruments/development/ALFOSC_Controller_Report.pdf`

The report details the performance of the controller both in relation to its properties in such measures as, e.g., read-out noise and linearity with the ALFOSC CCD, and in its operations through software. The main advantage of the new controller compared to the old controller is the increased readout speed (at the default readout speed of 200 kpix/sec 24.5 sec for full frame readout). In general, the performance of the CCD comply with the specifications, but there are various issues that need to be resolved before the new system can be fully accepted. The report is intended as basis for a comparison with the user requirements to define what is needed for final acceptance of the detector controller and associated software for use with the ALFOSC CCD. The details of what should be done and when it should be done is currently being discussed with people in Copenhagen.

Table 4: Performance CCD with new controller.

Speed kpix/sec	Read out time (sec)	Read out noise ADU	e-
113	41.5	10.5	3.4
200	24.5	12.2	3.9
400	13.5	17.2	5.5
800	9.5	30.6	9.9

A serious issue has been the fairly frequent problems with the horizontal charge-transfer-efficiency which requires a hard reset of the controller to cure. The main problem is that the bias image is significantly affected directly following a reset, showing a strong offset and slope that only disappears slowly with time. It appears that these problems are generated by the use of large (>4) binning factors in the serial (X-) direction, and avoiding the use of such binning basically has removed the need to reset the controller regularly.

The bias level has been found to show some sudden change in average level, but at all times the over-scan provides a proper estimate of the average level. An advantage with the new controller is that we now can provide over-scan in both directions on the CCD. With the old controller we could only provide over-scan in what is normally the spatial direction (along the slit) for spectroscopy. To reduce readout times often people would window the CCD in the spatial direction, excluding the over-scan. With the over-scan provided in the dispersion direction this is no longer an issue.

5.8.2 CCD

A problem with CCD present with the old controller when mounted on the instrument at the telescope was some pick-up noise which showed up like a "pepper-and-salt" pattern of various pixels with a value well above and below the average level. With the new controller this noise has disappeared, but when the detector is mounted on the instrument at the telescope we now occasionally see some pick-up noise with a "pepper" pattern, i.e., a regular pattern of pixels with a value of ~60 ADU (~20 e-) below the average level. From a frequency analysis the noise was found to have a frequency of 13.28kHz. Tests were done with ALFOSC off the telescope with the power for the CCD controller taken from either the telescope or a wall socket. Also the mains earth was disconnected for some tests. In addition, measurements were made with the dewar removed from the instrument and with the dewar mounted but deliberately electrically connected - note the normal situation is the dewar is electrically isolated from the instrument when mounted. For all these situations the pick-up noise was seen. However, also in some of the tests the pick-up noise is intermittent and it appears to be absent lately.

One difference with the new controller is that the data are written in 32 bits instead of 16 bits. This required some changes to the quality control reduction scripts. One direct advantage of the use of 32 bits is the increased dynamical range. With the old controller the CCD would saturate at the maximum value of 2^{16} ADU which corresponded to ~50 000 e-. The maximum level that can now be measured is limited by the level at which the CCD becomes significantly non-linear which is at ~140 000 e-, i.e. nearly a factor 3 higher.

Details tables were produced for the readout times with the new detector controller of the CCD for different read out speeds (113, 100, 400, 800 kpix/second), different window sizes and different binning (1x1 and 2x2). These values are provided on the detector web page and will be incorporated in the estimate of the execution time provided by the observing script generator.

5.8.3 Observing system

Accompanying the change of detector controller there was also a change in the data acquisition system. In principle all the sequencer commands and script are the same as before, but they now command a different CCD control software. As part of the change the detector status display was upgraded. In general the change in the system has gone well, but some specific problems were encountered (see "Main problems" earlier given in this document).

One general issue that effects operation is the behaviour of the commands that effect the size and binning of the area of the CCD that is being readout. In particular, the specific order in which the commands are given determines the precise settings that are obtained. This is being corrected.

With the improved speed in readout time with the new detector controller there is an issue of having very many images in a single night. The naming convention we have been using is such that 4 digits are used and a maximum of 9999 images can be created with the same prefix for a given night. In one of the shortest nights this summer more than 4000 images were generated with the new controller when doing short cycle time-series observations where in a winter night one could have produced more than twice that number, making the generation of more than 9999 images in a night a real possibility. However, it was found that the new detector control software automatically switches to using 5 digits for the image number when reaching 10000 so there is no danger of overwriting existing data.

5.8.4 Imaging

The main thing that was changed in relation to the new detector controller was the automatic twilight flat field "easyflat" script. Beyond the change due to the strongly improved readout time, also the count rate the is aimed for was changed to reflect the change in gain, and to take advantage of the increase in dynamical range this level was also increased. The corresponding documentation was updated.

As part of a review of the target acquisition script for spectroscopy (see below) the pixel scale of the CCD in imaging mode using the UBVRI filters was checked. It was found that for all filters and both directions the pixel scale is consistent with a single value of 0.190 arcsec/pixel.

5.8.5 Spectroscopy

With the change in the dewar the instrument focus had to be redetermine, both for normal spectroscopy and for spectro-polarimetry. The target acquisition script was adapted to work with the data from the new CCD controller. It was also upgraded to check for the telescope focus in case no filter is used during the acquisition, while the instrument focus (either for normal use or for polarimetry) is now read from the data-base such that it automatically checks for the correct value even if these values change.

One thing noted with the use of the target acquisition script is that it is still a relatively slow process. This is largely defined by the need to do more than one iterative step to get a star well centered. 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. Given accurate coordinates, in principle one would expect the overall offset to be the same for all objects and it should be possible to record this offset and apply it as part of the acquisition script removing the need for the first iterative step. However, it is not entirely clear if these offsets are indeed the $\sim$same in all cases and how this applies when using different field-rotation angle and/or a fixed rotator angle (e.g., when pointing using the parallactic angle). To test this, a logging feature was added to the "alfosc.acquisition" script that records the accumulated offsets (both in RA & Dec, and in X & Y detector pixels) together with several relevant instrument and telescope parameters.

The grism holders of the low resolution "cross-disperser" grisms #10-12 where modified such that they can be mounted in both the grism and filter wheel without having to rotate the grisms in their mounting ring.

There was some confusion about the correct procedure to align the slits and grisms in ALFOSC and the instructions for the staff were updated and clarified.

5.8.6 Polarimetry

A review is being made of imaging- and spectro-polarimetry using the FAPOL unit with ALFOSC. The idea is to unify the two modes as much as possible to make things more consistent and make it easier to switch between the modes. The telescope focus offsets for each element used in FAPOL will be measured such that the instrument set-up and use of polarimetry can be automated through the use of observing scripts.

The instructions about polarimetry in the observing cookbook will be updated and expanded to include spectro-polarimetry.

5.8.7 Fast photometry

With the new detector controller we no longer have the option to use the sequencer board developed to do multi-window fast-photometry with ALFOSC. This is not a major problem as the increased readout speed with the new controller allows to get similar readout performance using a relatively large window on the CCD. However, this is an area where things can be improved and we need to define how we can provide time-series observations with minimal overheads. Such a "fast-photometry" option might include specific settings which are not implemented during normal observing (e.g., data saving on the local observing system disk).

5.8.8 Dewar

It was realized that the holding time of the modified dewar with the new CCD controller would be significantly shorted than before. Analysis of the dewar temperature over the first two months showed the holding time to be 15–18 hours, i.e., it is needed to refill the dewar twice a day. One problem is that the data from the temperature sensors is not included in the new controller so the dewar temperature is not under computer control and the temperature can only be obtained be looking at the sensor display itself. This means we can not use an automated temperature control which, given the rather short holding time, increases the risk of an accidental heating up of the CCD.

5.8.9 Documentation

Many updates were made to the documentation related to the CCD, the data acquisition system and various setup and observing scripts, all related to the change in detector controller. As for the CCD controller and its control software, we still need to receive the user manual, maintenance manual and technical manual.

5.9 FIES

5.9.1 Instrument

Because of apparent low light levels from the halogen lamp in the calibration unit on the telescope the alignment of the calibration fiber was checked where it is attached to the arm that positions it in front of the fibers. After determining the rotational alignment and limiting the rotational freedom of the calibration fiber the halogen lamp and also the ThAr lamp give normal count rates.

The photon counting head of the new exposure meter can be damaged, and an interlock system was made to switch the meter off when the door is opened and/or the lights are switched on.

The polarimetry upgrade for FIES designed by Nikolai Piskunov & Andrey Dolgopolov from Uppsala University was planned to be installed in December. However, a problem occurred during manufacturing and this has now been postponed till later.

5.9.2 Radial velocity stability

When doing precise radial-velocity measurements it was found to be important to position the rotator at a fixed angle such that the fibers are stretched the least. The telescope parameters to achieve this are now included in the setup for FIES, while the instructions in the cookbook were updated to advice people to point the telescope such that the rotator always goes to the same position.

A new fiber-shaker was constructed from an old foot-and-leg massage machine. This "2nd generation" shaker (the successor to the initial LEGO device) was used for several tests. The results seem to indicate that if the seeing is stable the shaker does not have any significant effect on the stability of the measured radial-velocities, with the RMS values being below 10 m/s for both the high- and medium-resolution fiber with or without the use of the shaker. 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. No tests were done yet with the high-resolution fiber under variable seeing conditions, but we do not expect this to be very different from the result for the medium-resolution fiber.

The above points to variable seeing being the cause of low stability in radial-velocity measurements and the need of having a shaker available for precise measurements on a permanent basis. Two main issues that we hope to clarify in the coming months is if there is any danger to the fibers in shaking them for extended periods during various nights, and if a reliable system can be made that is capable of doing the shaking over such extended periods.

5.9.3 Observing system

The observing system interface for FIES has been upgraded further to provide a better distribution of the different windows. The post-processing data display for FIES and StanCam have been combined such that it displays both the StanCam acquisition and movie mode data as well as the spectra taken with FIES. The documentation has been updated accordingly.

5.9.4 Detector

Again we have had problems with the vacuum of the FIES detector. This seems to be separate from the CryoTiger not always reaching its operating temperature at $\sim$-199°C, and sometimes getting stuck at $\sim$-160°C. Recently the detector lost vacuum on 3 consecutive occasions with only a few weeks in between. The sealing of the various fixtures (valve, pressure, CCD window) where improved. Also a problem with the functioning of the vacuum valve was found and it was replaced. These changes did not improve the vacuum behaviour. In was noted that the O-ring of the entrance window to the dewar was slightly too large. The proper size was not clear from the drawing we had, so a large set of O-rings of different size and thickness was purchased and after the last episode of loss of vacuum the ring was recently replaced with a properly fitting one. For the moment the system seems to behave better.

One of the main problems related to the loss of vacuum is that we have to enter the FIES room to install the vacuum pump. The pump generates a significant amount of heat where it takes many hours for the temperature to return to the set temperature and stabilise after we have stopped pumping. This means that although the FIES dewar is relatively small and can be pumped in a few hours, typically more than a day is needed before high-precision radial-velocity observations can be done. To avoid this situation, we are planning to extend the vacuum tube that leads from the pump to the dewar such that the pump can be installed outside of the FIES room, in the front room of the FIES building, avoiding heating up the FIES room. A special hole will be made between the two rooms so this tube can be installed permanently. We also are thinking of installing a remotely operable valve on the FIES dewar so there is no need to enter the FIES room at all when the dewar needs to be pumped

With respect to the bi-stability of the CryoTiger operating temperature, our automatic alarm system has been extended to provide separate warnings when the dewar temperature rises from either the lower or the higher stable temperature.

There has been an extended exchange with E2V about a possible replacement CCD for FIES, where the latest offer looks very attractive considering the price. One issue is the delivery time which is 10 month.

5.9.5 FIESTool

The starting up of FIESTool in quick-look mode used during observations has been simplified. The plan is to make the startup 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.

A section was added to the FIESTool web page on how to achieve the best accuracy of the FIES wavelength solution, what IRAF parameters to use to achieve this, and how to set these parameters. Also, a link was added to some MIDAS scripts (written by Andreas Irrgang, University of Erlangen, Bamberg), that can be used to reduce FIES data in the MIDAS environment. These scripts are not maintained by NOT staff.

The master order-definition and master wavelength-solution frames for FIESTool were updated a few times due to the problems with the detector, as pumping of the detector often leads to shifts of the Echellogram on the order of several pixels.

A very minor update of FIESTool was released that fixes the version checking when looking for dependencies for PyRAF (versions 1.10 and later).

5.9.6 Quality control

A quality control script was 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.

5.9.7 FIES building

A new metal roof has been installed. It has been place as a single, slightly tilted roof made of corrugated plates a bit above the white roof as this was a cheaper option. The building temperature has been more stable then ever over the last summer. However, as this summer has not been as hot as the previous one, it is difficult to say how large a difference the new roof made. Still, when comparing to 2009 the situation has improved drastically. Only in August 16-20 we had a slight increase of 0.3 degree in the FIES room and in the spectrograph.

Some time ago it was found that the ventilator in the front room of the FIES building had stopped working, leading to a strong increase of the temperature of the front room but this was not detected directly. The ventilator has been replaced and temperature alarms have now been added to both the FIES room and the front room, so temperature excursions (in both rooms) can be detected in time and minimised, e.g., through some circulation of the air between the FIES room and the front room, or even with the outside.

One of the side effects of the recurring problems with the vacuum of the FIES detector (see above) and the need to pump it is that the FIES room heats up a lot and takes many hours to return to a stable temperature, affecting the observations in the subsequent night. It was noted that the front room of the FIES building is kept at a temperature which is higher that that of the FIES room. This means that it is difficult for any excess heat in the FIES room to be lost and the set temperature for the front room will be set at, or slightly below the value in the FIES room. As the front room has an active cooling system this would also make it an option to open the doors between the FIES room and the front room to limit the heating of the FIES room when pumping.

5.9.8 Documentation

To provide proper documentation of the fiber units and their assembly a document "OPTICAL DESIGN of the FIES fibre assemblies B and C" was written by Bo Lindberg and has been added to the documentation on the web.

Specific instructions were made and added to the web on how to replace calibrations lamps both in the top and bottom calibration unit.

5.10 NOTCam

5.10.1 Instrument

During observations problems arose with positioning filter wheel 2. This filter wheel contains the main broad-band filters but spare JHK filter had been put in the stop wheel in the past just for these kind of problems. The rest of the run was performed with filter wheel 2 fixed in the “open” position, while only filter wheel 1 was used together with the spare JHK filters in the stop wheel. The instrument setup scripts were temporarily modified to avoid accidental movement of wheel 2.

No definite diagnostics could be made so it was decided to warm up and open the instrument. It was found that the flexible coupling between the motor and the worm gear for filter wheel 2 had broken. The reason for this remains unclear. Filter wheel 2 is the wheel that is moved the most, but both wheel and worm gear are easy to move, so it was suggested that perhaps thermal stresses played a role since the motor support is aluminium and the worm gear is steel. New flexible couplings were ordered and subsequently installed for all wheels as a preventive measure.

As the bearings of the different wheels were exchanged 3 and a half years ago it was decided to take the opportunity to replace them. All the bearings looked as new, and it is thought that we do not need to exchange them for preventive reasons as often as believed earlier. The earlier estimate was based on the first years of experience with the instrument, during a phase where the wheels were moved much more often than currently.

5.10.2 Observing system

Since the introduction of the sequencer we have had occasions where the detector control software programme BIAS apparently ignores exposure commands from the sequencer. This has been seen to happen only for NOTCam, not for the other instruments. After a certain timeout, the sequencer gives up and the prompt comes back without any warning. If this happen when running a script, the script continues with its next command, causing any dither script to skip one or more exposures in the sequence.

This spring an extra loop was added to the end of all NOTCam template scripts to check whether the expected number of files had been saved. This at least warns the user that files are missing and additional files can/should be taken if needed. This checking of files is not added to scripts made with the script generator.

Due to the intermittent nature of the problem, extensive test runs were made to investigate it. The problem seems to have become worse over time, but may depend on the occasion, and there is a strong correlation with the exposure time, which is not at all understood. A modification in BIAS was eventually made to do a “retry” of the exposure command if it times out. This works well for the most typical exposure times, but fails for the longer ones. We are looking in to making the work around also functioning for longer exposure times. This work-around at least makes sure that the exposure eventually is made, though at the cost of some extra overheads.

5.10.3 Observing overheads

Although the overheads in observing have been improved significantly with the removal of the observation log and observing system log from the instrument computer, a significant amount of time is spend on reading out and storing each exposure. Especially for the typical short exposures used in the infrared this overhead is significant. It has been a long standing idea to fold the process of doing (small) telescope offsets (dithering) in between exposures in this “dead-time”. The only safe way to do this properly required a new sequencer command “notcam.wait-shutter-closed” that signals when an exposure stops. Since September this command has been implemented in all standard dither scripts offered for NOTCam. Since late October it is also included in the script generator. Timing tests at the telescope shows that with autoguiding we save on average ∼5.6 seconds per exposure, which is exactly as expected from having the readout and the file storage time folded into the time it takes to do a typical telescope offset (10–15 arcsec). The total time spent on a dither pattern has now improved by a factor T_now/T_before = 0.76 for “exp 3” and 0.82 for “exp 10”.

For the ramp sampling mode the command and its benefits still need to be tested.

5.10.4 Filters

When commissioning the new broad band filters Z (0.83-0.93 micron) and Y (0.98 - 1.08 micron) last spring, it became evident that while the Y-band filter was performing according to expectations, the Z-band had a strong leak. Based on testing, the leak was suspected to be partly due to light leaking around the filter edge (owing to it having coating on only one side and being essentially transparent at the edges), and partly due to a red leak in the filter itself.

When NOTCam was opened due to the problems with the filter wheel (see above) we flipped the Z-filter around in its holder and added a cold stop ring on top of it. This lowered the background levels by ∼30% (normalised to the K band to correct for varying thermal backgrounds), but still a major red leak is going through the filter itself. Based on tests we know that this leak is mainly thermal emission from beyond 2.5 microns. A suitable blocking filter mounted in the other wheel would be needed to stop this leak. For details see the commissioning report on

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

Such a blocking filter should let through >95% in the Z-window and block long-wards of 2.4 microns. Quotes have been asked at several filter manufacturers, but apparently such a filter is difficult to make since the chemicals used to block from 1-3 microns also block at 0.8-1.0 microns. After a first estimate of $13 000, we eventually got a quote: two pieces for $2400 (1713 euros) each. We are waiting for an estimate of the cost if we only order one filter. For comparison, the Z filter itself cost 2964 euros.

A cheaper work-around that will help somewhat was suggested by Marcus Wallace at NDC Infrared Engineering who made the Z-band filter. A 5mm thick BK7 glass installed in the other filter wheel should cut a lot more light beyond 2.5 microns while not influencing much the Z-band. Waiting for a quote on this. Another option is a 1 mm Schott KG4 glass, which however will reduce the peak in the Z-band to ∼70%.

5.10.5 Spectroscopy

The internal focus for the 128 micron slit and the Wide-Field camera, as well as for the 44 micron slit and the High-Resolution camera, were determined for the Z and Y filters. These values have been added to the "notcam.setup-spec" together with the option to select the Z and Y-filters for spectroscopy. Measurements of calibration lamps and flux standards were taken for all the ZYJHKs bands and the Wide-Field camera using both the 1mm pinhole as well as the 128 micron slit to characterise the spectroscopy mode completely.

5.10.6 Detector

By the end of 2010 we found a mysterious behaviour in long dark exposures, where both the count level and structure was depending on the internal focus of the instrument, repeatable in several measurements spread over a month. This behaviour disappeared after the instrument was opened in January 2011. It is not at all clear what has changed. We are monitoring the long darks at different internal foci every now and then, but the reported effect from 2010 has not been reproduced after February 2011.

5.10.7 Vacuum & Cooling

The opening of NOTCam in May 2011 was not planned and we had to wait for some spare parts that were ordered. Consequently, there was no time to do a proper baking of the cryostat to have it ready for the next scheduled run. We obtained a vacuum of around 2×10^{-4} mbar, which is about an order of magnitude worse than the typical vacuum from 2008 and onwards. We believe the main reason for this is due to out-gassing of the installed components (the new flexible couplings).

A very precise anti-correlation has been observed between the cold-table temperature and the pressure. The pressure increases slightly when NOTCam is full of LN_2 and decreases when the LN_2 content is low. Since we got the new filling nozzle made of the super-insulating material "torlon", the thermal stresses on the filling tube have decreased substantially, and what we see now is likely related to thermal stresses on the vent tube when LN_2 is spilling out from a full tank. The plan is to exchange the fitting on the vent tube with torlon, as well.

The compressor oil filter of the PTR cooler was exchanged for the second time with a new refurbished unit from Iwatani, Kelvin International Corporation, after 63 199 hours of total runtime. The cost of this was $4225. The previous exchange for maintenance was done at 28 316 hours runtime. Recommended exchange is at every 15 000 hours, but experience shows that (in our case) the oil filter lasts for at least 30 000 hours.

5.10.8 Quality control

New non-linearity correction coefficient images were made available for download from the NOTCam calibration archive. Testing the old coefficient images on new data shows that on average the behaviour is the same, the main difference being individual pixels that are differently affected by dust on the detector since cleaning the array in January of this year. In the new version of the IRAF package "notcam.cl" a script is available for doing the non-linearity correction pixel by pixel on the raw images.

A distortion correction for the Wide-Field camera was made on very good data of a dense stellar field for J, H and Ks. This model has been tested on many datasets from earlier and later dates. In all cases, applying the model improves the images substantially, though in some cases better than others. It is not entirely clear why the correction works less well for some data, as no direct correlation is found with, e.g., rotator position or airmass.

Distortion correction for the new filters Z and Y has not yet been made, although it seems viable to use the J-band model for these two bands.

The twilight flat archive is being continuously updated.

5.10.9 Reduction software

The reduction scripts in the IRAF package "notcam.cl" have been modified to optionally make distortion corrections on the individual images (after flat fielding and sky subtraction, but before shift and add). The model (available as an IRAF database) will be put in the NOTCam calibration archive for download. It has taken a bit longer than expected to get the upgrade of the IRAF package "notcam.cl" to v2.4 finalised with proper documentation and help files, which was considered necessary as we will now make it available for download on our web pages.

5.11 MOSCA

5.11.1 Detectors

Detailed information about the quantum efficiency of the different CCDs in the detector arrays were added to the detector web page. See

`http://www.not.iac.es/instruments/detectors/mosca/index.html`

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. The disk is stored and well protected. It was thought that probably most data ever taken with TurPol was on the disk but also likely the observers had copies of all the (reduced) data. Vilppu Piirola was contacted and said he would be happy if we continue storing the disk until he can take it with him when he comes the next time in La Palma.