# Period 46
# Report to the NOT Council and STC

## $59^{th}$ STC meeting & $64^{th}$ Council meeting
## April 22 & 23, 2013


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# Contents

# 1 Introduction

This report covers the operations of the Nordic Optical Telescope over the period 46: 2012-10-01 to 2013-04-01.

# 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 46.

A total of 94 fault reports were submitted, with an average time lost of 5 min per fault, for a total down time of 0.4% (0.4% on scheduled observing nights). Of these, 68 reported no time lost, 26 reported $< 2$ hrs lost, and none reported 2 or more hrs lost.

This compares to a down time of 0.3% over all nights (0.3% on scheduled observing nights) in period 45, and 0.9% over all nights (1.1% on scheduled observing nights) in period 44. Of the 86 fault report in period 45, 69 reported no time lost, 17 reported $< 2$ hrs lost, and none reported 2 or more hrs lost. Of the 130 fault reports reported in period 44, 95 reported no time lost, 33 reported $< 2$ hrs lost, and 2 reported 2 or more hrs lost.

Table 1: Technical down time statistic period 46: 2012-10-01 to 2013-04-01

| Night included | Time lost | Nights | Percentage[a] | Last semester | Last Winter |
|---|---|---|---|---|---|
| All nights | 507 min | 182 | 0.4% | 0.3% | 0.9% |
| Scheduled observing nights[b] | 407 min | 140 | 0.4% | 0.3% | 1.1% |
| Technical nights | 100 min | 28 | 0.5% | 0.4% | 0.3% |
| Service nights[c] | 235 min | 53.5 | 0.7% | 0.7% | 1.7% |
| Visitor instruments | 0 min | 14 | 0.0% | 0.0% | 0.3% |

[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

Although higher than in the last semester, all the numbers are still at a very low level.

## 2.1 Weather

For period 46 a total of 656hr 19min was lost due to bad weather which corresponds to 32.2% of all the dark time, as compared to 14.1% in period 45 and 22.2% in period 44. The total amount of clear dark time was 1381hr in period 46, as compared to 1394hr in period 45 and 1592hr in period 44.

## 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 periods (44 and 45).

Table 2: Down-time statistics for period 46[a]

| Syst/Type | Soft | | Elec | | Optics | | Mech | | Others | | Total | | P45/P44 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Telescope | 3 | 00:15 | 1 | 00:00 | 0 | | 6 | 01:30 | 1 | 00:00 | 11 | 01:45 | 18/22 | 01:10/09:15 |
| Building | 0 | | 2 | 00:00 | 0 | | 0 | | 0 | | 2 | 00:00 | 5/3 | 00:05/00:00 |
| Computers | 10 | 01:37 | 0 | | 0 | | 0 | | 2 | 00:30 | 12 | 02:07 | 21/23 | 00:47/00:15 |
| ALFOSC | 27 | 02:40 | 5 | 01:05 | 3 | 00:00 | 0 | | 0 | | 35 | 03:45 | 17/45 | 02:00/06:10 |
| MOSCA | 0 | | 1 | 00:00 | 0 | | 1 | 00:00 | 0 | | 2 | 00:00 | 2/2 | 00:00/00:10 |
| NOTCam | 3 | 00:00 | 2 | 00:00 | 0 | | 6 | 00:15 | 1 | 00:00 | 12 | 00:15 | 5/14 | 00:10/00:15 |
| StanCam | 0 | | 0 | | 0 | | 1 | 00:00 | 2 | 00:30 | 3 | 00:30 | 4/4 | 00:05/00:35 |
| FIES | 12 | 00:05 | 1 | 00:00 | 1 | 00:00 | 1 | 00:00 | 0 | | 15 | 00:05 | 8/7 | 00:30/00:20 |
| Others | 0 | | 0 | | 0 | | 1 | 00:00 | 1 | 00:00 | 2 | 00:00 | 6/10 | 00:00/01:20 |
| Total | 55 | 04:37 | 12 | 01:05 | 4 | 00:00 | 16 | 01:45 | 7 | 01:00 | 94 | 08:27 | 86/130 | 04:47/18:20 |
| P45 | 56 | 01:52 | 14 | 02:45 | 0 | | 13 | 00:05 | 3 | 00:05 | 86 | 04:47 | | |
| P44 | 92 | 08:55 | 19 | 02:00 | 1 | 00:00 | 8 | 06:05 | 10 | 01:20 | 130 | 18:20 | | |

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

## 2.3 Main problems

There were no faults that caused more than 2 hours downtime during period 46. If there is any specific issue to mention, then this would be some persistent low-level bugs with the new detector controller and software for ALFOSC. For completeness I add the main problem here.

- **Throughout the semester: CCD control software data base**: 2hr

  On a fairly regular bases there is a problem with the connection to the detector control software data-base. A simple restart of the specific software program solves this problem. This normally takes only a few minutes, but in some cases several restarts of the program are needed. The problem is thought to be caused by some of the libraries of the relatively old computer and operating system used. We are planning to replace the computer and upgrade the operating system and we expect this will solve this problem.

# 3 Instrument use

Table 3 lists the number of scheduled observing nights and technical nights for each instrument. This covers all nights, including CAT, 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 | 71 | 12 | 16[a] | 2.5 |
| FIES | 47 | 7 | 13[b] | 2.8 |
| NOTCam | 22 | 6 | 4[c] | 2.5 |
| MOSCA | 2 | 1 | 1 | 2.0 |
| SOFIN | 11 | 2 | 2 | 5.5 |
| Own | 1 | – | 1 | 1.0 |

[a] Excluding 31.5 service nights [b] Excluding 10 service nights
[c] Excluding 12 service night

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

As before, most comments written in the reports during period 46 were very positive, both about the observing system and the support from the staff.

Most comments in the end-of-night reports referred to the weather and faults that were also reported through the fault data base. Only in the end-of-run reports some specific comments were made about the observing system and the general facilities. There was one comment about the torches we provide to move at night between the telescope and the service building being in bad shape. We are looking at purchasing some new, different types of lamps. It was also noted that if there is light in the workshop or electronics lab in the service building this can be clearly seen from the outside during the night. There were various windows with only normal curtains, and proper blinds were purchased and have been installed. The few comments about the observing system are addressed in the specific sections below.

# 5 General

## 5.1 New office

After moving to our new office at the end of October, some new furniture was purchased to adept to the new surroundings, but still some things remain. As a main thing, we are considering the installation of the air-condition system we had in our old office. The main recent change has been the installation of a door to the TNG offices, and the construction of a common TNG-NOT coffee area.

As the new office in San Antonio is directly accessible from the street, an alarm system from the security company 'Securitas Direct' has been installed to protect the premises.

One major issue has been the termination of the rental contract for our former office. To be diplomatic, the behaviour of the owners has been less than decent, making unreasonable claims and charging us for additional costs without warning. In the end we felt obliged to contract an attorney and the termination of the contract was only settled at the end of last year. There was already an increase in the effective cost of the move to the new office due to the delay in the move from July to October (as the rent for the new office is much lower than for the old office), but the contract settlement and the attorney cost significantly increased the cost even more. It is noted that in the longer-term, the cost to rent and maintain the office will be significantly lower than in the past, though in the near-future there will still be some specific extra expenses related to completely settling in to the new office.

## 5.2 Collaboration with the TNG

Beyond specific things like the joint coffee room (see above) and making masks for the ALFOSC MOS mode (see below), there has been some more general interaction with the TNG staff. We have initiated joint TNG/NOT seminars in the TNG conference room, and as part of the joint call for observing proposals we have set-up a joint computer domain (tng-not.iac.es) and web site that we maintain. For the moment this is only used for the joint call, but it is in principle intended for more extensive cross-community use in the future.

## 5.3 Publications

After some comments from somebody noting that our publication lists were likely inflated because we included some non-refereed and/or low-rated journals, a full review was done of all the publications we list. In particular, we only count refereed journal publications in A&A, MNRAS, PASP, ApJ, ApJL, ApJS, Astronomische Nachrichten, Icarus, Nature, and Science, where the specific distribution across these journals is now shown in graphical form on our publication web-page, see:

`http://www.not.iac.es/news/publications/`

Of course, one can always discuss the precise criteria that are applied to include a paper in the list (e.g., we are possibly less complete as for publications in Astronomische Nachrichten, Icarus, and Science, while the ING does not include Astronomische Nachrichten or Icarus in their lists at all) and this might affect the precise numbers, but should not have any strong impact on any general trends or global comparisons with other telescopes (e.g., the publication list for the NOT from the last two years does not include any papers in Astronomische Nachrichten or Icarus, and very few papers in these journals in general).

### 5.4 Accountancy

We are using a rather archaic administration software system dating from well back in the last millennium. Although the system is very primitive, it does cover our needs. However, with the increased digitisation of basically everything it has become feasible to integrate most of the tasks related to administration and accounting, increasing efficiency and saving paper and space in the office.

A few existing programs were tested, but were mostly found to be either too simple or too complex for our needs. The specific wishes for a new system have now been defined in more detail, and we have decided on using a relative simple existing system to which we are adding some specific functionality to meet our needs.

The general objective is to come as much as possible to a "paperless" system. We recently closed the accounts for the 1st quarter of 2013, and we have taken the opportunity to digitise all the documentation so far for this year as part of the exercise. The idea is to continue this such that the documentation can be directly integrated in the new system when it is implemented. The aim is to beta-test the new system before the end of the 2nd quarter of 2013, and have it fully functioning at the beginning of the 3rd quarter of 2013.

# 6 Operations

## 6.1 Safety

A review was made of the risk assessment that was made of working at the NOT. A meeting was held with a representative of the company that did the risk assessment to clarify some issues, and make sure that existing procedures are conforming to the rules. The main issue has been that both the type of work, as well as the way we operate are very different from regular industries or normal companies. This is reflected at least partly in some of the recommendations made by the company that do not make much sense for our situation. It was agreed with the representative that he will again make a full review of our operations before the end of the year.

As part of the sale of an observing night to people from Durham University (UK), and conform to Spanish work and safety laws, a document was written that describes the condition that external workers should follow when at the NOT. This include a form to be signed by each person that has to work at the NOT, in this case in the dome with the telescope, which says that they agree to these conditions. A Spanish version still needs to be produced.

## 6.2 Educational activities

### 6.2.1 Observing courses

As part of a Finnish initiative called the "NOT Science School" selected groups of secondary school kids come to La Palma and participate in observations with the NOT. The development of the program is being funded by the Finnish technology and National Board of Education. Two separate groups of pupils accompanied by some teachers were given half a night at the telescope.

### 6.2.2 NOT Students

All the presentations that were provided as more in-depth courses to the students at the NOT are now collected on the general web page with the guide lines for new students.

## 6.3 "Fast-Track" program

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, 17 have been completed. All 'grade 2' proposals have been completed. The remaining 2 proposals were closed as they expired at the end of period 46. In both cases we actually never received any Observing Blocks so they could not have been executed in any case.

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. All grade 1' and 'grade 2' proposals have been completed. Of the 'grade 3' proposals, 2 have been completed.

In period 44 there were 18 proposals accepted. Of these there were 11 ‘grade 1’ proposals, 6 ‘grade 2’ proposals, and 1 ‘grade 3’ proposal. Of the ‘grade 1’ proposals, 10 have been completed. All grade 2’ and ‘grade 3’ proposals have been completed.

In period 45 there were 12 proposals accepted. Of these there were 8 ‘grade 1’ proposals, 3 ‘grade 2’ proposals, and 1 ‘grade 3’ proposal. Of the ‘grade 1’ proposals, 7 have been completed and 1 has nearly been completed. All grade 2’ and ‘grade 3’ proposals have been completed.

In period 46 there were 17 proposals accepted. Of these there were 13 ‘grade 1’ proposals, 4 ‘grade 2’ proposals, and no ‘grade 3’ proposal. Of the ‘grade 1’ proposals, 10 have been completed and 2 have been partially completed. Of the ‘grade 2’ proposals, 2 have been completed and 1 has been partially completed.

## 6.4 Service observing

During period 46 a total of 53 and a half nights of service observing were done, excluding the 11 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.

## 6.5 Telescope Building

### 6.5.1 Uninterruptible power supply

The UPS system covers our main systems (except the telescope cooling) and is activated in case of an external power failure. The direct loss of power is covered by a set of batteries, while normally the generator will start and provide electrical power until the mains is restored. If for some reason the generator fails to start we will only have power from the batteries which run out after about one hour. If the UPS power fails this can have serious effects, especially on our computer system that would power-down in an uncontrolled way.

We actually had a case during a power-cut where the generator did not start, and it was only because somebody noticed the lack of noise that this was discovered. To detect if we are running on batteries when the power is cut, a system had been made that uses a combination of a power usage monitor that records the output from the generator, and a signal from the TCS that detects when the external power has been cut. The system sends alarm emails in case the generator does not start within a given time. This is only a temporary solution, and a proper system needs to be defined and implemented.

A more general issue is that our UPS is ageing. We have obtained some cost estimates for the parts that need replacing. These parts are fairly expensive, and we are considering buying a new UPS unit. It should be noted that the existing system is rather over-sized if one does not include the cooling system (which actually can not be maintained running even by the existing UPS). Therefore, we are considering buying a completely new unit which is smaller but covers our needs (excluding the cooling system). Such a new system has a similar price to buying the new parts for the existing system, while the new system will be more efficient, so a bit cheaper to run. On top of that, it should be possible to maintain the current battery bank which should lower the price significantly. We are looking for the specific system that would cover our power needs (including the new emergency ventilation system we want to implement [see below] and that will be supported by the new UPS), and would be able to use the current battery bank.

#### 6.5.2 Cooling

With the objective of being able to run the telescope also during a power-cut, we have been designing a new emergency ventilation system that would keep the telescope electronics sufficiently cool also when the cooling system is not running. The system would just circulate the cooling water and by-pass the cooling units, simply dumping the heat through a fan-coil unit next to the cooling unit (well removed from the telescope). We also expect that on many (winter) nights we will be able to cool the telescope building and electronics only using the ventilation system, significantly lowering our power usage and ultimately cost. Offers have been requested for the parts that are needed to modify the system.

#### 6.5.3 Dome

A preliminary design has been made to motorise the side ports so they can be opened and closed remotely. The main idea is to use a design based on a system for automatic sliding gates used at the entrance of driveways. The main advantage is that these kind of systems are made for a usage very similar to that for the side ports, i.e., opening and closing no more than a few times each day, and are readily available also on La Palma. In particular, one might expect to find a system that needs little modification, is highly reliable, requires little maintenance, but is not very expensive. Still, some issues need to be checked properly, in particular the fact that the side ports move in a curve and that each unit is made of two doors. Quotes have been solicited from several companies for a single motor for test purposes. If the one selected is found to be satisfactory a further eight will be purchased along with rack and safety bars for automatic stopping, in case of obstacles in the path of the door or emergencies.

#### 6.5.4 Control room

We have finally started with reorganising the electronics, wiring and furniture in the telescope control room. Some old furniture and a lot of the old wiring no longer in use have been removed.

#### 6.5.5 Thermal Monitoring System

For the TMS (Thermal Monitoring System) there are no spare data acquisition boards and several of the components on the current boards are obsolete. A new design has been made that should be able to read the sensors much faster and communicate the information over Ethernet. Printed circuits boards have been manufactured and it is expected that they can be installed and tested in the second quarter of this year.

### 6.6 Telescope

#### 6.6.1 Telescope control system

Most of the time has been spent on working on the TCS documentation. The plan is to complete this in the current period. During this time we also plan to implement a User Interface for the TCS running on a regular Linux PC. The main idea is to integrate the TCS interface as much as possible with the rest of the observing system, but this might also allow for certain applications like the auto-guider to be run from the PC directly. The safety system alarm status will be integrated in the new TCS User Interface front end.

We have been trying to purchase a spare CPU board for the TCS. After many delays we finally have found an, apparently reliable, supplier. The intention is to buy 3 units for the 2 units we have permanently in use.

#### 6.6.2 Telescope drive

Some small jumps have been observed in the altitude servo system when slewing the telescope. The altitude tachometers and the altitude motor brushes were tested, but nothing specific was found. The maximum speed when pointing the telescope was lowered a bit as a precaution.

#### 6.6.3 Adapter

A returning issue when mounting instruments at the Cassegrain focus at the bottom of the adapter has been that of the screw holes used to mount the different instruments losing their thread so they can no longer be used. In the current situation typically only half of the existing holes available for a given instrument are used. However, these holes (on the adapter plate and the instrument mounting plate) are not specifically prepared for the type of screws and precise alignment required for each instrument. It was decided to do this in a slightly different way, preparing the new holes with the instrument mounted such that there should not be an issue of alignment between the holes on the mounting plate and the adapter. This has already successfully be done for NOTCam. For the FASU filter unit, to which either ALFOSC or MOSCA is attached, this is slightly more complicated as the holes can only be accessed from inside the unit, and we probably need to make a special tool for this.

#### 6.6.4 Mirror support system

The compressor head of the old air compressor of the mirror support system had broken. As a new unit is very expensive, we decided to try to repair the compressor head. The manufacturer of the compressor had noted it was not a viable option to repair the head. It took some time to get the proper parts, but in the end the parts did arrive and the head was repaired. Since then the old system has been running for more than a month and the new system we had as a spare is a spare again. We have now also ordered a second compressor head as a spare.

#### 6.6.5 Baffle lamps

There was a potentially severe problem with the calibration lamp unit for NOTCam spectroscopy attached to the mirror cover at the top of the sky baffle. One of the lamps had broken and it was replaced. Shortly afterwards the lamp again did not work, and it was found that the assembly holding the baffle lamps was jammed between the mirror cover and the M1 baffle, actually preventing the cover fully closing. We believe this problem explains a jam of the FIES calibration arm in the adapter where I small piece of glass was found in the mechanism, and a large amount of "dust" being found on the ALFOSC folding prism. The problem was caused by the particular design and the lack of a well defined way with clear instructions on how a lamp should be replaced. The mounting was repaired and spare lamps installed, but a proper design for the lamp unit will be made, with special attention to how lamps can be replaced and with clear instructions and or indications on how a lamp should be replaced.

An other issue related to the baffle lamp unit was that the specific status of the lamps (on or off) was only provided in the TCS. This had the potential of the lamps being on without the observer being aware of this. A status display was made and added to the observing systems for the different instruments.

#### 6.6.6 Mirror reflectivity

Observations of standard stars have not shown any strong deterioration, though some more detail measurements with a reflectometer are needed to get more precise results. In particular, the average zero points in the different filters are at most a few percent lower than just after the last aluminsation and there still does not seem a strong need for a re-aluminisation. We have tentatively scheduled an aluminisation of the main mirror for next year summer.

#### 6.6.7 Guiding system

In our current set-up for the guiding camera, the box in which the guide star is place is always at the center of the camera. This has caused this specific part of the camera to become less sensitive due to the star image "burning in". This is an issue as the contrast between the star and the background is reduced, which can be a problem when the sky background is high (during twilight). To avoid this the idea is to change the position of the star box regularly to avoid affecting specific areas on the camera too much. The plan is to change (on a daily basis) the default position of the "star box" in a random way over an area close to the center of the camera. By displacing the camera probe which holds the camera by the same amount in the opposite direction the star box will, to high precision, point to the same area on the sky so this should not affect the resulting pointing. By making the positioning of the star box and the correction in the position of the guide probe an integrated part of the TCS, the effect of changing the star box position will be complete transparent to outside users and none of the observing system software or observing scripts would need to be changed.

As reported earlier, the TCS occasionally looses count of the number of turns the guide-probe motors make and to minimise this problem the speed of the probe is limited. To not overload the TCS with this task a hardware solution has been designed to do the turn counting. A printed circuit board has been produced and assembled and is currently been tested.

#### 6.6.8 Communication

After some positive experiences using Skype to contact with staff the idea is to provide some hardware to develop a more specific infrastructure that allows this to be used more. In particular, a specific installation is being considered for the control room where a standard set-up with observer account, headset and a (more or less) mobile web-cam should be provided to make it easier to assist the observer.

#### 6.6.9 Weather information

As part of our weather pages, we include a live image from the All-Sky-Camera positioned next to the GTC. Beyond showing the right Ascension and declination when placing the cursor in the image, we now show where the telescope is pointing currently, and added a wind-rose in the same coordinate system as the camera image. In the same display we now also show thumb-sized images taken from all-sky surveys of the area on the sky where the telescope is point. All this information is only visible to local NOT users, and this is often used by observers during the night. In the near future we will also indicate on the display what is the maximum allowed zenith distance when the wind-speed is too high. All this is to help observers to decide where is the best place to observe in case the weather conditions are not optimal.

### 6.7 Observing system

#### 6.7.1 Observing Blocks

Requirements for the software layer responsible for translating the Observing Block (OB) description into a set of executable sequencer commands and scripts have been defined. This layer is called the "OB Compiler". Compiler modules for the ALFOSC Imaging and Spectroscopy modes are the first to be developed and are expected to be ready for testing during the summer. The compiler module for FIES will be the next.

A interface that allows to control the execution of an OB in a verbose mode is being developed in parallel. This "executer" system will include a graphical interface that allows to execute as a whole, or in parts the resulting set of sequencer commands and scripts defined by the OB, with the option to stop or pause at intermediate steps, skip certain parts or abort execution at any time.

#### 6.7.2 Observing scripts and commands

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. Extensive instructions were provided with examples on how errors can (and should be) handled when writing an observing scripts. This was added to the general guide on how to create scripts.

A command 'wait-camera-state readout' exists that allows for scripting of tasks to be done in parallel (e.g., moving a filter wheel) while a detector is reading out. There is actually a danger in the use of this command in case there is no on-going exposure and the command will be waiting indefinite. A more generally applicable command 'wait-camera-state not-integrating' was made that side steps this potential problem, while the documentation for the existing 'wait-camera-state readout' command was updated to warn for the potential danger when using this command.

In order to increase the overall efficiency of the observing systems, a new functionality is being added to the exposure commands that makes it easier to use the readout time. Instead of waiting for the readout to finish, this time can be used for setting up a new instrument- or telescope configuration.

### 6.7.3 FITS headers

A review is being made of the FITS header keywords at the NOT as defined in the document "FITS observation files at the NOT" (Saskia Prins, 2004). Beyond some specific changes that have occurred since that time, we are cross-checking the headers with the new FITS standard version 3.0 (2010) and the updated ESO Data Interface Control document version 5 from 2011. An update to the original FITS document is made as a reference for FITS headers at the NOT, and as a working document for the actual implementation of new FITS headers. A first draft of the document is expected to be circulated among the staff in the near future.

### 6.7.4 Information system

We have a common information system (called the "Talker") that contains the information produced by any (automatic or commanded) action of the observing system. This includes basic information about the action, but also warning and alarm messages (which are colour-coded). One can also view "DEBUG" message, but these are normally not shown. There is also a lot of information presented in the sequencer window when executing a command or script. It was decided that any information in the sequencer window should be limited to specific instructions to the user and general descriptions of the action being executed. Specific results of executing a command or script (e.g., the offset the telescope needs to do), and the specific actions being executed should (also) appear in the Talker. However, it is not easy to discern any potentially relevant information (e.g., an estimate of the seeing for imaging data obtained through a post-processing system) between all the other messages on the Talker if it is not a warning or alarm message (which stand-out as they are shown in orange and red). To make it easier to find this information, a new type of information definition has been added (called "ASTRO") that appears as green in the Talker. We are in the process of implementing this setting for selected message, and we are also reviewing which messages can and should be classified as DEBUG instead of as normal message so it will normally not appear in the Talker and make the other messages more visible.

### 6.7.5 Reduction software

For visiting astronomers a script was made that sets-up and starts a full IRAF session on the data-viewing and reduction computer in the telescope control room.

#### 6.7.6 Instrument computers

A custom made new computer rack has been purchased for the new observing system computers which are longer (deeper) than the old rack permitted. The rack was specifically designed to fit in the available space. It was made locally on la Palma, significantly reducing the cost.

#### 6.7.7 Data management system

As the amount of data archived by the NOT keeps growing and due to the increment in size and frequency of the produced data as a result of the use of the new controllers (on ALFOSC, but planned for others) we need better data management, both to keep overheads at a minimum; to make a better (and faster) on-site post-processing; and also to improve the distribution of data both to visiting astronomers, to external entities (ToO, Service) and to our archival infrastructure. This implies both a procedural change and a renewal of some of the operation-critical hardware.

In particular, the desired "dataflow" should be decided taking in to account current developments such as the new Observing Block system, and the full definition of data through their FITS headers (potentially indicating how they should be processed, distributed and archived). The detailed policy is currently being discussed, and the plan is to implement the hardware and software changes as for archiving and data delivery to the users during the current period.

#### 6.7.8 Detectors

Two E2V CCD231-42 detectors with Deep-Depletion silicon and a broad-band Multi-2 AR coating and with the added E2V fringe suppression process have been delivered to Copenhagen University on April 2, 2013. As part of the programme to take over the testing and characterisation of CCDs, a visit to Copenhagen will take place April 15–26, 2013 to learn and gain some practical experience in the procedure used. This will probably include the writing of a commission report for the two new identical CCDs for FIES and ALFOSC.

Some preliminary work has been done by looking through the existing IDL code for analysing the test data. Since we will probably not want to use IDL, an existing program written in Python to determine the linearity has been modified to be compatible with the Copenhagen IDL version. It is hoped that if the test and characterisation is moved to La Palma all the analysis code can be ported to Python.

#### 6.7.9 New detector controller

The development of the new high-speed fiber transfer PCI express interface board is progressing and the first version of the circuit board is foreseen to be produced during May 2013. The development of the controller for FIES will be coordinated in a way that it can be delivered with the PCI express board in the controller.

#### 6.7.10 CryoTigers

A new spare compressor has arrived, with a spare external in-line filter. Also, the tools needed for refilling the system has been purchased so there is no longer a need to burrow this from other telescopes. We now have a full working system that can replace one of the systems in use on short notice.

### 6.8 ALFOSC

#### 6.8.1 Detector controller

The detector controller for ALFOSC does not include the detector temperature control, and a separate temperature controller is used but this has no connection to our computer system, i.e., the temperature is available only from the controller display. Unfortunately, the temperature controller cable can have a bad connection to the dewar causing the heater (of the detector) being switched on continuously. This gives a high dark current and in one case this caused some problem especially affecting long spectroscopic exposures. It was noted that from a bias exposure it is easy to see there is a problem as there is a clear slope in the read direction in the data. An automatic procedure is being made that checks this and detects any changes as soon as possible.

Quality control of the ALFOSC detector indicates that with the current controller there is less readout noise when using amplifier B than amplifier A. The plan is to change to Amplifier B being default. However, is was found that the controller software does not provide for the option of windowing when using amplifier B. Some work-arounds can be used to still being able to use amplifier B at all times, but this needs to be fully implemented before we can offer this option to the users.

#### 6.8.2 Observing system

A new script alfocs.alfosc-calibs was made that takes biases frames and spectral calibration frames for all instrument set-ups and CCD window settings used in a particular night. Per setup, the script takes 11 biases, 5 spectral flats, and 1 arc for each arc lamp. In principle the script is intended to be run at the end of an observing night. It can be run at any time for any night, but likely the instrument set-up will have changed. The instrument set-up is checked for inconsistencies in the current set-up versus the set-up used during the night. Any such inconsistent set-ups will be skipped, with a warning on the Talker.

Various updates were made to the instrument control software, improving error messages, warnings, time-outs, and status reporting of some of the ALFOSC/FASU mechanisms. Also, various minor updates/fixes were made to sequencer scripts, some of this being streamlining efforts to cut down on overheads.

To optimise a fast-photometry mode using the new CCD controller and data acquisition system we will define how we can provide time-series observations with minimal overheads to effectively replace the fast-photometry mode available with the old detector controller. As part of this, a review will be made of the different commands involved in observing to see if some of the delays can be made smaller to limit the overall delays as much as possible.

A system will be implemented in the data acquisition system that allows the requested exposure time to be corrected for relative delays between opening and closing the shutter. This will include a full set of image keywords that describe all the timing parameters (requested exposure, applied correction, etc).

#### 6.8.3 Spectroscopy

The script to acquire a target on the slit now allows for an additional step where the user can do a manual telescope offset to fine-tune the centering of the object in the slit. Due to the asymmetric design of ALFOSC, there is some variation in the position of the slits due to flexure, and especially for narrow slits this option is of use.

It was mentioned that regular programs often requested the 5 arcsec slit, while the 10 arcsec slit is part of the fixed set-up for ALFOSC needed for some ToO programs. Also, the 1.2 arcsec slit effectively has the same with as the 1.0 arcsec slit, which is also part of the fixed set-up. Sometimes requests for the 1.2 or 5 arcsec slit generated conflicts between the set-up for the regular program and for ToO programs. There seems no specific difference or advantage for spectroscopic observations in using the 5 arcsec slit instead of the 10 arcsec slit, while there is no real practical difference between the 1.0 and 1.2 arcsec slit, and it was decided to no longer offer these slits. Any mention of the slits was removed from the ALFOSC “slits” web-page. In the “List of available optical elements” the slit has been labelled as ’decommissioned’. Note that the slits are of course still available if need be.

#### 6.8.4 Multi-Object Spectroscopy

After many years were the MOS mode was used little, it has been requested relatively often over the last few semesters. This has raised a few issues. One is that the machine at the NOT to make the MOS masks was not working properly, and masks are actually made in Copenhagen. Furthermore, the software needed to make the mask design from imaging data is a private copy made by Michael Andersen (NBI, Copenhagen). This has not been a major issue as there were few MOS runs, but this needed to be reviewed given the increased demand.

A review was made of the state of the CNC machine at the NOT that could produce masks on site. It was determined that even if we could repair it and get it to work properly, we do not have the tools or the expertise to maintain it and keep it in working order. One possible option that has arisen is that the TNG has a similar machine to make masks for their own instrument, and a trail run was made of making a copy of an existing mask. Direct comparison of the new and existing mask showed a very good match. The slits produced with the TNG machine were also of good quality, though the width was relatively high (2.9 arcsec). There are still various issues. The material they use is both shiny and thin, i.e., it can not simply be mounted in the ALFOSC slit wheel, while there might be an issue with reflections. The TNG does have a finer tool to make narrower slits, but these would still only be just under 2.0 arcsec wide, while we normally aim for 1.5 arcsec slits on the masks. There are some additional cost involved in making the masks at the TNG.

Some tests were made to determine the distortions in the field of view of ALFOSC which is needed to produce proper mask designs (which requires the specialised software). These tests indicate that this transformation is rather straightforward and could be done without a need for the software.

Our intention is to come to a well defined procedure how masks for a MOS run should be produce, with the specific aim to have everything under direct control on La Palma.

### 6.8.5 Polarimetry

A remaining issue has been the status of the FAPOL polarimetry unit with respect to our integrated data base system. In particular, to have the correct name of the retarder plate that is mounted to appear both on the display of the user interface and in the FITS header of the observing data, this has to be entered in 2 separate and unrelated places. The user interface was changed such that in both cases the status is obtained from the data base.

### 6.8.6 New detector

One issue to consider when changing to a new CCD camera (see above) is that the pixel size is slightly larger (15 vs 13.5$\mu m$). This results in a slightly larger spatial size and wavelength step per pixel. In particular, we will have a slightly larger field-of-view and wavelength range (for the higher resolution grisms). It was noted that the old CCD for ALFOSC that was replaced in 2005 also had 15$\mu m$ pixels, and when it was replaced by the current CCD the instrument camera optics were replaced, keeping the projected size of the pixels practically the same. However, measurements made at the time indicated that the old optics matched to the 15$\mu m$ pixels appeared to have a higher throughput than the current optics, in particular in the red where the new CCD will be especially attractive because of its high QE and low fringing. The optics consistent of the camera barrel, that can be used to focus the instrument, and the entrance window of the dewar. To see if there is truly such an advantage in going back to the old optics the idea was to do measurements with the same set-up and the current CCD, with the current and the old optics. We have been able to locate the old barrel with the optics in it, but we have not been able to locate the old dewar entrance window. Still, we have tried to measure the difference only changing the barrel, but as the current dewar entrance window is not matched to the optics in the old barrel we have not been able to properly compare the measurements. However, we are looking at doing some new tests in the coming months.

There were some questions about the exposure level to which the ALFOSC CCD can be used safely with the new controller. In particular, it was noted that the documentation was not so clear. An important thing to note is that the relevant level for observing is actually the level where non-linearity effects become important which is significantly below the level where true saturation of the signal occurs (which is way below the maximum level where the controller becomes digitally saturated which was an issue with the old controller). This was clarified in the documentation.

## 6.9 FIES

### 6.9.1 FIES building

The summer of 2012 showed excessively long periods of too warm temperature in the FIES room. That summer clearly was the warmest since FIES was placed in its dedicated building. The thermal deviations were long term, and it takes a few days for the building to cool after the outside air has dropped. It seems clear that all the insulation only delays the heat reaching the FIES room and when a period of too hot weather is long enough the room will warm up. Possible solutions to this are raising the temperature at which the FIES room is kept and improve the cooling.

The plan is to increase the FIES room temperature and paint as much as possible the outside of the building and the surrounding area white. Both should be done before the summer. The room temperature has already been increased by 1 degree, but we might consider a further increase.

A long standing issue has been that if the FIES dewar needs to be pumped, a lot of heat is generated in the room itself, affecting the temperature stability. To allow pumping the FIES dewar without heating the FIES room a system was designed where the dewar (through an extended tube) is connected to a pump in the front room. All the required parts have been purchased, but to be able to install the tube connecting the pump with the dewar, a 10cm diameter hole needs to be drilled through 25cm of armed-concrete from the front room to the FIES room. We are looking for a specific period when to do this with minimal impact to observing programs.

### 6.9.2 Instrument

We have some on-going problems with FIES stalling when doing calibrations. Both the controller (MOXA device) and the moving parts of the calibration unit in the adapter get power from the same source. It is suspected that the controller does not get sufficient power when, e.g., the arm or mask is moved, which causes the device to temporarily switch-off. As the control basically forgets what it was doing it also does not provide any proper feedback and the software stalls. The idea is to get a separate power supply for the controller to solve this.

In the past, we have had problems with the ThAr lamp (slowly) dying which causes variable shifts in the effective wavelength of the lines in the calibration spectra affecting the wavelength solution, particular important for radial-velocity work. The standard daytime calibration procedure now includes an automatic alarm system distributed by email to the duty staff in case the quality control system detects symptoms of a dying lamp.

### 6.9.3 Radial velocity stability

To monitor the radial-velocity stability and be able to assess possible improvements a dedicated test and monitoring program has been set-up. Frequent radial-velocity standard star measurements are obtained to study the long-term and short-term stability of the instrument. Incoming data are automatically reduced with FIESTool, and a dedicated analysis tool is being developed.

### 6.9.4 Observing system

It was noted that there is an issue with the exposure meter when in use while the command addtime is used to change the overall exposure time. In particular, if the exposure time was reduced, the exposure meter would continue to operate. If not stopped manually this can interfere in subsequent exposures. The exposure command using the exposure meter was modified to allow completely transparent use of the meter. Every time an exposures is started a very long (6 hours) exposure time is given to the exposure meter so that it will count until the desired count level is reach, or 6 hours have passed. If time is added to the science exposure (as long as the total exposure time is no longer than 6 hours) there is no problem as the exposure meter will continue. If time is subtracted, the exposure is aborted, read out or the science exposure reaches its time limit, the exposure meter will be automatically stopped.

### 6.9.5 Polarimeter

We hope to receive, install and commission the polarimeter in the near future.

### 6.9.6 Target acquisition

A new method of keeping the star on the fiber, using telescope offsets was implemented. This now makes it possible to both acquire the object and keep it on the fiber without using autoguiding. In this way, observations of bright FIES targets can be made early in the evening, or late in the morning when autoguiding is not possible. This whole system is now an integral part of the normal user interface, where the system will automatically detect if the autoguider is working or not, and indicate this to the user.

### 6.9.7 On-fiber guiding

As it is now, to keep a star on the fiber we use the telescope (auto)guiding to follow the star, but visual check the light reflected from the fiber head to see if the star moves out, manually correcting if needed. We have been looking at the option of doing direct on-fiber guiding, i.e., use the image from the fiber head to steer the telescope and keep the star in the fiber using software. An advantage of using such a system is that this would make sure that the star is maintained in the center of the fiber at all times, likely improving the radial-velocity stability.

A system to do on-fiber guiding is used at the Mercator telescope on La Palma for their HERMES high-resolution spectrograph, and a check of the system in action looks very promising. They use freely available Python "pyguide" routines, which could be implemented in our observing system for FIES. The image-analysis software in pyguide may also be used to automate the first step in acquiring a source in which a full-frame, direct image is used to select a target and move the telescope such that the light of the star is directed to the selected fiber.

The software also appears as a viable option for the NTE slit-guiding system.

### 6.9.8 New detector

The new CCD is physically 10% bigger then the current CCD which allows to sample the wavelength range of 370-830nm instead of the current 370-730nm. A new dewar for FIES is under construction in Copenhagen to accompany the new CCD controller. With the new controller the read-out times should go down from 90 sec to about 30 sec per frame.

### 6.9.9 FIESTool

Some trouble-shooting needed to be done for FIESTool being able to work with the new IRAF release and on some new operating systems.

We are close to implementing the system were FIESTool will automatically reduce all incoming data. The system includes a graphical tool that allows the observers to view the automatically reduced data, while the reduced data will also be provided to the observers together with the raw data.

## 6.10 NOTCam

### 6.10.1 Detector controller

On a few occasions the actual exposure times delivered by the array controller were found to be only a fraction of the requested exposure times, with the array controller deciding to read out before it should, while the header information contains only the "commanded exposure times. When taking short exposure this problem can actually be easily missed.

A program was made that for every exposure checks that the time it takes to complete the command, i.e. exposure time plus the expected overheads, is above a minimum number. If not, an error message is issued with the content "You should power-cycle the array controller. The program has been now running for several weeks with no problems detected so far. The program actually records the overheads for each exposure, and can be used to systematically monitor if, and how the overheads vary with time.

Since the introduction of the Sequencer we have had spurious occasions where the detector control software apparently ignores exposure commands from the Sequencer. This has been seen to happen only for NOTCam. After waiting for a certain amount of time it gives up without any warning or error, effectively causing the skipping of exposures (e.g., in a dither pattern). Extensive tests show that, although the problem is intermittent, it has become worse over time, and there is a strong direct correlation with the exposure time. The cause is not understood, but a modification inside the detector controller software was made to detect the problem and retry taking an exposure. This is done up to a 10 times, and an error is given if it still does not work. Though this causes some overheads, it works for most exposures.

### 6.10.2 Observing system

Similar to the alfosc.alfosc-calibs script, a notcam.notcam-calibs observing script is being developed that checks the kind of exposures taken in a given night and takes the required number and types of dark exposure needed for data reduction.

### 6.10.3 Imaging

The weather has not allowed to make proper distortion models for the Z and Y filters. The same also applies to data needed to determine the illumination correction in the J and Ks bands. We will attempt to obtain the required data as soon as possible.

### 6.10.4 Spectroscopy

An specific observing script called notcam.easy-calib was made that provides an automatic and optimal way to get all the required on-sky spectroscopic calibrations

There still is an issue with the Argon lamp in the sky baffle used for NOTCam spectroscopic wavelength calibrations sometimes switching on very slowly. Replacing the lamp has not improved things. The plan is to modify the easy-calib script to include a test exposure with the Argon lamp, including a loop to wait until it is properly switched on before taking the calibration data.

We are also planning to make a script notcam.acquisition similar to the alfosc.acquisition, that executes the whole procedure to center a target on the slit.

### 6.10.5 Detector

The reset level, i.e. the count level of the pre-integration readout of the array, is supposed to be stable. When commissioning the array, it was adjusted to an optimal level, i.e. a level that maximises the dynamical range and minimises bad pixels, by setting the dc-offset voltages. Over the years we have experienced various jumps in this level, needing a re-adjustment of the voltages each time.

Monitoring the reset level in each quadrant every hour over a period of 10 days gave an approximate linear relation, with the count level increasing by 750 ADU per 1 degree increase of the detector temperature. During this monitoring no jumps were detected. On the assumption that past changes in reset-level were caused by differences in detector temperature a level was select where normal temperature variations of the detector would not cause the reset level to go so low that the count levels could go below zero. However, a few months later the count level had jumped off this relation by $>$ 1000 ADU and the reset level had to be adjusted again. Further investigations are needed if there is something else which causes changes in the reset level (e.g., power-cycling the controller). A script is being made to monitor the reset value doing some basic statistics on dark images produced as part of regular observing, recording the results in a database for analysis.

A new, fixed data transmission fiber for the NOTCam detector controller was installed. This makes mounting and dismounting the instrument easier, faster and safer for the fiber. Additionally, NOTCam data can be obtained while the instrument is not mounted, which makes fault finding and offline diagnostics and testing easier.

### 6.10.6 Vacuum & Cooling

The flexible steel hoses that carry helium gas in the closed-loop PTR cooler are exposed to continuous stress during mounting and dis-mounting and also when the telescope moves. We have used the same hoses since 2001. In spite of trying to minimise the stress on the hoses, several times we needed to repair one of the hoses because of helium leaks. The cracks were always found near the instrument end, which allowed for a "simple fix by cutting $\sim$10cm off from the end of the hose. This procedure takes some hours of work as the hose needs to be evacuated and then refilled, and the exact location of the crack needs to be found. To make this simpler, it was decided to purchase an extra hose so we can simply swap the hose and repair the broken hose off the telescope.

A spare hose was ordered which arrived by the end of February, but it had a wrong diameter, 30cm instead of the 20cm we had specified. The manufacturer have told us it is better to use this diameter because it allows for better flow, but the larger tubes are actually much stiffer which is a problem. After some time the company finally agreed to replace the tubes, and at the moment we are awaiting their arrival.

We also had some problem with overheating of the cooling water of the PTR making it at times impossible to stabilise it within the allowed range of 10-30 degrees. Investigating the water cooling circuit it was found that the water was dirty. Proper cleaning of the circuit, and exchanging the water has improved the behaviour somewhat. However, it looks like the main problem is the inter-cooler which is very rusty. This unit was hand made for use with SIRCA, and we are trying to find a similar system.

### 6.10.7 Reduction software

A new version 2.6 of the IRAF NOTCam reduction package "notcam.cl was installed in the data reduction computer in the control room. It includes a better handling of the detector edges by using a proper rejection mask, and a distortion correction as an option in the skysub.cl script. The documentation will be fully updated before the package is released for common use.

In a new version of the package it is planned to include a script for the image reduction part of spectroscopy data taken in the ABBA mode.

## 6.11 MOSCA

### 6.11.1 Observing system

The script mosca.wheels similar to alfosc.wheels was commissioned. This script takes as argument the specific filter you want independent of in which wheel it is mounted, and makes sure that the other wheel is set to 'open. Also, a script mosca.focus-offset was made to determines which filter is in the light path and applies a proper offset to the telescope focus. Both these scripts makes it easier to script observations.

## 6.12 StanCam

### 6.12.1 Detector controller

The StanCam CCD controller is very old and is incompatible with all other controller currently in use. This makes the issue of repairs or replacement in case of failure an issue, especially as StanCam is an essential part for observing with FIES. Fortunately it was found that an early, three generations old ALFOSC controller we still have does have compatible boards which can be used as spares. One remaining issue is that we do not have a spare for the specific controller EPROM. This can be transplanted to a spare board, but the EPROM might fail itself. We have requested copies of the software that is in the EPROM (for StanCam but also for other detectors) from Copenhagen. We are also considering reading the EPROMS, and a reader is being purchased. However, there is an inherent danger in taking out the EPROM and using the reader.

In the longer run, when the FIES CCD and controller are replaced, we should consider mounting the FIES detector in the StanCam dewar and use its controller. It will require to establish if the existing CCD 'spider' will go directly into the StanCam dewar and if the dewar connectors can be simply transplanted, otherwise a new StanCam dewar would be needed.

### 6.12.2 Dewar

We have had some failures of the StanCam dewar temperature and pressure. During an inspection it was found that the O-rings for both the pressure and vacuum sensor were damaged and needed replacing. Since all the O-rings are the same age it was decided to replace them all. Details for all the O-rings were requested from Copenhagen and two full sets have been purchased.

Some of the O-rings have been replaced, but to minimise the risk of damaging the CCD the O-rings for the connections to the CCD were left untouched. After pumping and starting to cool it was clear there was a problem with the vacuum and the dewar was warmed up. Since the size of the O-ring specified for the dewar window was slightly different to the original, the old O-ring was put in again and all the other O-rings checked. After this, the vacuum has been maintained properly.

## 6.13 Computer system

It was noted that a number of our desk-top computers in the office are rather old which generates some issues when upgrading the software and operating system, and we intend to substitute them with newer hardware over the next few months.

The black & white printer in the office was showing signs of wear & tear and the costs for spares turned out to be a significant fraction of the cost for a new one so we decided to replace it.