Period 47
Report to the NOT Council and STC

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Contents

1 Introduction

This report covers the operations of the Nordic Optical Telescope over the period 47: 2013-04-01 to 2013-10-01.

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 47.

A total of 69 fault reports were submitted, with an average time lost of 14 min per fault, for a total down time of 1.0% (1.0% on scheduled observing nights). Of these, 46 reported no time lost, 22 reported $<$ 2 hrs lost, and one reported 2 or more hrs lost.

This compares to a down time of 0.4% over all nights (0.4% on scheduled observing nights) in period 46, and 0.3% over all nights (0.3% on scheduled observing nights) in period 45. Of the 94 fault report in period 45, 68 reported no time lost, 26 reported $<$ 2 hrs lost, and none reported 2 or more hrs lost. Of the 86 fault reports reported in period 45, 69 reported no time lost, 17 reported $<$ 2 hrs lost, and none reported 2 or more hrs lost.

Table 1: Technical down time statistic period 47: 2013-04-01 to 2013-10-01

Night included	Time lost	Nights	Percentage[a]	Last semester	Last Summer
All nights	947 min	183	1.0%	0.4%	0.3%
Scheduled observing nights[b]	877 min	163.5	1.0%	0.4%	0.3%
Technical nights	40 min	19.5	0.4%	0.5%	0.4%
Service nights[c]	652 min	38.5	3.2%	0.7%	0.7%
Visitor instruments	30 min	12	0.5%	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 downtime was relative high, but it was mostly caused by a single failure (see below) and is also not extremely high. When taken the total downtime of the last 2 semesters, the total is actually below the longer term yearly average. The total number of fault reports were at an all time low.

2.1 Weather

For period 47 a total of 175hr 25min was lost due to bad weather which corresponds to 10.8% of all the dark time, as compared to 32.2% in period 46 and 14.1% in period 45. The total amount of clear dark time was 1448hr in period 47, as compared to 1381hr in period 46 and 1394hr in period 45.

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 (45 and 46).

Table 2: Down-time statistics for period 47[a]

Syst/Type	Soft		Elec		Optics		Mech		Others		Total		P46/P45	
Telescope	4	00:20	6	06:30	0		1	00:00	1	00:00	12	06:50	11/18	01:45/01:10
Building	0		3	01:00	0		0		0		3	01:00	2/5	00:00/00:05
Computers	7	00:30	1	00:00	0		0		0		8	00:30	12/21	02:07/00:47
ALFOSC	15	01:22	2	01:55	1	00:00	0		1	00:00	19	03:17	35/17	03:45/02:00
MOSCA	0		1	00:00	0		1	00:00	0		2	00:00	2/2	00:00/00:00
NOTCam	4	01:50	1	00:05	1	00:00	1	00:00	2	00:00	9	01:55	12/5	00:15/00:10
StanCam	0		0		0		1	00:00	0		1	00:00	3/4	00:30/00:05
FIES	5	00:40	1	00:00	0		0		2	00:55	8	01:35	15/8	00:05/00:30
Others	0		2	00:40	1	00:00	3	00:00	1	00:00	7	00:40	2/6	00:00/00:00
Total	35	04:42	17	10:10	3	00:00	7	00:00	7	00:55	69	15:47	94/86	08:27/04:47
P46	55	04:37	12	01:05	4	00:00	16	01:45	7	01:00	94	08:27		
P45	56	01:52	14	02:45	0		13	00:05	3	00:05	86	04:47		

[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 47.

- **14-04-2013: Hydraulics system failure**: 6hr

  There was a problem with the oil tank level sensor which did not work properly. As the oil level is fundamental to the system, the sensor is hardwired to stop the telescope control system. This causes the whole systems to fail, and repeated tries to restart the system caused a variety of error message. The sensor value itself is not linked to the control system, so it was not so easy to define where the precise error occurred. The system has been changed such that any future failure will be detected as an alarm from the sensor. As the oil level was correct, the sensor was first by-passed, and later the sensor was cleaned and the wiring checked. After some time the sensor failed again it has now been replaced with a new one.

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	63	7	16[a]	2.5
FIES	62.5	6.5	19[b]	2.8
NOTCam	13	3	2[c]	3.5
MOSCA	15	1	3	5.0
SOFIN	10	2	2	5.0

[a] Excluding 23 service nights [b] Excluding 9.5 service nights
[c] Excluding 6 service night

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

As before, most comments written in the reports during period 47 were very positive, both about the observing system and the support from the staff.

There were very few comments in general, mostly referring to the weather or faults that were also reported through the fault data base. In fact, the only thing specifically commented is the relatively high frequency of Target-of-Opportunity requests, with the suggestion to limit the amount per observing run. This point will be raised at the coming OPC meeting.

5 General

5.1 New office

Over the last few months we have completely settled in to the new office, with as final step the installation of the air-conditioning system we have brought from our old office. This has kept the cost for the office relatively high in this year, but in the longer-term the cost to rent and maintain the office will be significantly lower.

5.2 External collaboration

We have maintained the same level of collaboration with the TNG as started earlier this year. Due to the transition to a new director, no further steps have been taken recently, but the intention is to intensify and deepen our relation in the future.

We also have had a visit by 5 engineers from the Yunnan Observatory in China, which were shown how we operate and maintain the telescope in the day time and at night. They also visited the office, where there were some extensive discussions about how we run our operating system, in particular on the software side. Further collaboration is foreseen with the Yunnan Observatory, but this is expected to remain on the level of sporadic visits and exchange of experiences.

5.3 Administration

During the last few months we have been working towards providing the administration with a program that they can use for better dealing with accounting and keeping track of orders, etc. It was decided to adapt an existing desktop-based program, providing it with a web interface focused on NOT's needs, to reduce the complexity of the full product. The deployment for the first version is intended for this November.

6 Operations

6.1 Safety

A full risk assessment was made of the new office, and the recommendations implemented. The specific risk assessments for the staff were reviewed and updated. Some required changes were made to some of the equipment we have at the observatory, and the representative of the company that does the risk assessment promised to provide a full review of the telescope and service building at the observatory before the end of this year.

6.2 Transport

The NOT owns three cars. One pick-truck is stationed at the observatory, and is used to transport things at the observatory. This car includes the option to use 4x4 wheel drive, and we standard use it to transport the staff between the Residencia and the telescope at the observatory during winter. In case of bad weather, the car is also used to transport the staff to and from the observatory. The other 2 cars are regular car, normally used by the staff to travel to and from the observatory. The oldest of these cars was bought in 2004, and it started to show fairly frequent (be it mostly small) problems. Both cars are regularly in use at the same time, and it was decided to replace the oldest car. To improve safety, and be more flexible during the winter, we decided to look for a car that included the option to use 4x4 wheel drive. Several dealers were approached, and different cars were tested. The best offer was received for a Subaru XV, which was purchased. In the end, correcting for inflation, the cost of the new car was nearly the same as the cost of the old car which did not include 4x4 wheel drive.

6.3 Service observing

During period 47 a total of 38 and a half nights of service observing were done, excluding the 10 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.

6.4 "Fast-Track" program

6.4.1 Proposals

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. There was one remaining 'grade 3' proposal that was closed as it expired at the end of period 47. We actually never received any Observing Blocks for this program, so it could not have been executed in any case.

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. All 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. All proposals have been completed, expect for one 'grade 1' proposals which has very nearly been completed.

In period 46 there were 18 proposals accepted. Of these there were 14 'grade 1' proposals, 4 'grade 2' proposals, and no 'grade 3' proposal. Of the 'grade 1' proposals, 13 have been completed. All the 'grade 2' proposals have been completed.

In period 47 there were 28 proposals accepted. Of these there were 17 'grade 1' proposals, 10 'grade 2' proposals, and one 'grade 3' proposal. Of the 'grade 1' proposals, 12 have been completed and 5 have been partially completed. Of the 'grade 2' proposals, 5 have been completed and 3 have been partially completed. The 'grade 3' was a time-critical proposal that could not be executed at the specific time, so is effectively expired.

In period 48 there are up to now 4 proposals accepted. Of these there are 2 'grade 1' proposals and 2 'grade 2' proposals. One of the 'grade 1' proposals has been partially completed, and both 'grade 2' proposals have been completed.

6.4.2 Observing Block execution

One specific issue under discussion is the seeing requirements provided for the execution of fast-track proposal observations. Currently, one can choose to have a maximum limit of 0.7, 1.0, 1.3, or 'no limit' on the seeing. However, these limits are not specifically related to the distribution of the *observed* seeing at the observatory, and it is not specifically clear at what wavelength or zenith distance this is defined. As a first step, and as also generally used, the seeing has now been defined at a given airmass (1.0) and wavelength (500 nm). The plan is to review the observed seeing (which could either be the DIMM statistics, or as derived from our own [ALFOSC] measurements), and define limits at (e.g.) the 10, 50 and 90 percentile limits. Here, we also are considering to add an additional high limit option (e.g., 2.0 arcsec) apart from no-limit, up to which still reasonable observations can be made for bright targets, but above which any practical observations are in general not possible (e.g., because stars in the field of view can no longer be separated). As part of this more specific definition, an application will be made that provides the corresponding seeing at a given airmass/zenith distance and wavelength/pass-band for a given seeing. This both should clarify to proposers what the given seeing (and airmass limit) implies for the wavelength/pass-band they select, and for the (service) observer to assess if the observations comply with the provided seeing requirement.

6.5 Observatory installations

6.5.1 Uninterruptible power supply

We have decided to instead of changing some parts of the UPS that need replacing as they are aging but which are very expensive, to replace it by a new system. The new system is slightly smaller in capacity, but much more efficient, and capable of maintaining the whole system except the large cooling units (which also the old system did not cover). To simply things we will eliminate separate lines for normal, and uninterruptible power supply. With some modification to the cooling system (see below) this will allow the telescope to stay fully operable also when there is a general power-cut.

6.5.2 Cooling

A new ventilation system was designed that allows to cool by just circulating the cooling water and by-pass the cooling units in case the outside temperature is sufficiently low, and/or there is no external power and we can not run the big cooling units. The system design was modified to be able to regulate the temperature of the cooling water that goes to the telescope, which has to be relatively warm, while keeping the cooling water that goes to the FIES building as low as possible.

6.5.3 Visitor's office

It has been noted that the visitor office in the service building is basically never used, and it was decided to convert it to a storage room.

6.6 Telescope Building

6.6.1 Dome side ports

To improve the ventilation of the dome during the night, the telescope building has side ports that consists of 4 sets of 2 doors. For reasons of safety and the general objective of automating telescope operations as much as possible we are motorising the side-ports. A system similar to home sliding gates was selected, and a single unit including guiding rails and safety stops was ordered for testing. Since the side-ports move in a curve it is necessary to bend the rail to match the radius of the doors, which was done by a company on La Palma. The mechanical system was successfully tested.

To control the motors a system has been designed so the TCS can operate all eight door motors safely. The idea is to have a Programmable Automation Controller (PAC) commanded from the TCS, that in turn operates some modules that replace the push button handsets. The design will also permit semi-automated operation of the motors from push buttons on the dome floor. A mechanism for disengaging the motors so the side-ports can be physically moved will be added. A design of a control box that will contain the electronics for each pair of doors, including the control modules, mains filters, fuses etc has been made and the items for a single box ordered.

As the parts arrive, we will build-up a full system for one of the set of doors, that will be integrated in the telescope control system. Some modifications are consider to the control electronics that come with the motors to provide more flexible control of the door motion.

6.6.2 Thermal Monitoring System

A new board design to replace the existing Thermal Monitoring System (TMS) boards was made. The first test board has been assembled, but due a faulty set of components testing has been delayed. We are waiting for replacement components before testing can continue. Once the hardware is verified then the on-board micro-controller needs programming and functionally testing.

6.7 Telescope

6.7.1 Telescope control system

In parallel to the Telescope Control System (TCS), we have a development system running that is used for testing, and which actually provides a full spare for the TCS. The hard disc of the development system has failed, and we need to replace the disc to both run the development system and as a spare. A shot term workaround solution was designed to allow to reboot the system using floppy discs. It has been difficult to find replacement (solid state) discs, but we were able to ordered 4 of them to have one replacement and one spare for each of the two systems. One of the discs was installed in the development system and found to work properly. If there are no problems with this disk in the coming months, the hard disk in the TCS itself will also be replaced to prevent possible failure while running.

Also the power supply for the TCS development system broke down. Together with an earlier broken one from the old development system (used for network application testing) they were both sent to England for repair. They are now on the way back.

There have been various reports of the TCS getting stuck which were likely traced to an intermittent disc access failure on the CPU board. Using a second CPU board over the last few weeks have shown no more problems and a replacement board should be purchased for the second faulty one. These are quite rare on the market, but we were able to order a refurbished one.

A returning issue noted in our search for spares is that the OS-9 operating system we have is relatively old and does not allow for more modern hardware, and it was decided to look if it was possible to port the TCS to an operating system that is in common use now and can use more modern hardware. One of the main requirements is that no major rewrite of the software is needed, where most changes should be on the level of system calls which is inevitable. It was found that Real Time Linux is the best (and cheapest) option. Such a system would also be an order of magnitude faster than the current system. A more detailed study is needed to see what is required to port the TCS. We do have a full set of spares which should last several years, so there is no strong urgencies.

Throughout the TCS, we use direct-current modules (to control the guide-camera focus, the telescope focus, the guide camera position, etc). A possible replacement module for all of them was identified and will slowly be introduced.

There is a general issue as for the network connection of the TCS with the general observing system. All the connections are through a common network, where the load from other traffic sometimes causes problems for the (rather old and limit) system on the TCS. The situation could be improved by providing a separate network for the TCS, and we are looking at how we might implement this.

6.7.2 Mirror reflectivity

The procedure when wet cleaning the main mirror has be changed, where paper is used to dry the mirror instead of blowing air. This both is much faster and leaves less stains on the mirror.

Reflectivity measurements and ALFOSC photometric zero point monitoring suggest that there are no dramatic changes in the reflectivity, just the expected steady decline. The last aluminisation is now more than 4 years ago, but that aluminisation was not completely successful as the reflectivity was not fully restored. The current values are around (or slightly below) the values found shortly before the last aluminisation so it was decided to proceed with the aluminisation that we already tentatively had planned for the coming summer.

6.7.3 Guiding system

Two upgrades have been implemented in the guiding system. When guiding during cloudy weather (especially if there is some Moon light) it sometimes happens the system guides on bright features in the sky which are not real stars, and it can drift away from the proper position without noting there is no a real star. If the system detects that there is a longer-term drift in the position of the estimated guide star position it now will provide a warning. The box in which the guide star is placed was always at the center of the camera, which 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 guide star and the background is reduced, which can be a problem when the sky background is high (during twilight). To avoid this area a new feature is in use where at a preset the star box is placed on a circle with about 5 arcsec radius around the center. This circle has 100 positions, updated one step at every new observing run. The guide probe is counter moved so the pointing remains the same as if the star box is at center. Also the background box is now placed at an optimal position to give the best possible contrast.

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, originally a hardware solution had been designed to do the turn counting. In the end it was decided to replace the encoders themselves with encoders that have the same mechanical properties as the existing ones, but that incorporate the multi-turn counting facility. These new encoders have been ordered. A modification to the TCS will be needed to read and control the extra turn information, but it will be possible to operate the new encoders in exactly the same way the existing ones are used now.

With the new encoders, guide probe speed can be considerably increased and the TCS system load be decreased by lowering the execution speed for the adapter program. Now it runs at highest frequency just for the guide probe turn counting.

6.7.4 Weather information

The interface through our weather page showing a live image from the All-Sky-Camera positioned next to the GTC has been expanded to include the possibility to overlay the position of sources in any source catalogue (e.g., a standard star catalogue or a user's catalogue) to help observers to decide where is the best place to observe in case the weather conditions are not optimal (e.g., clouds, pointing limitations due to the wind, Moonlight).

6.7.5 Mirror cover

There were a few problems reported with particles being in the light path of instruments at the Cassegrain focus. The area above the main mirror was checked, and the mirror covers, the sky baffle lid, and the top half meter inside the baffle were cleaned. The inside of the baffle was found to be very dusty. Also, some of seals were found to be flaky, and loose pieces were removed.

A more thorough check, refurbishment and cleaning of the baffle is planned when we aluminise the mirrors coming summer.

6.8 Observing system

6.8.1 Maintenance and monitoring

There are various tasks that have to be done at certain times (e.g., when something is scheduled), or under certain circumstances (e.g., when a detector is warming up). This is partly run through our 'technical schedule', where we keep track of who is going up to the telescopes and what specific tasks we need to do, and our observing system data-base that contains data such as detector temperatures. From a practical point of view, but also from a safety point of view, the system should be integrated to provide more accurate knowledge of who should be at the telescope and what tasks they need to do. The general idea is to have a more detailed data base system of who might be up when, where warning or alarm systems use the data base to sent messages to the appropriate persons. Such a data base system would also make it easier to add or remove people that are away for extended periods. The main tasks at the moment is to define what the data base should contain, and provide a procedure that extracts the relevant information from the technical schedule and adds this to the data base.

6.8.2 System health check

The avoid any problems, but also to help in trouble shooting in the case of problems, the health of the observing system critical computers should both be monitored and reported independently of any (resulting) problems with applications. Likewise, the health of the network should both be monitored and reported independently of its usage so we would get an error from the network about a link not functioning. We are currently looking what system(s) to use, and how to implement this.

6.8.3 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. As more facilities use the Talker, it has become difficult to view all the information. This also includes the distinction between commands being executed from the command-line, through a user interface, or from a script. The messages provided in the Talker have been re-categorised and/or presented in a more organised way to allow an easier overview. This has been completed for the ALFOSC observing system. Improvement of the Talker information for the observing systems of the other instruments, and for the commands from the TCS will be completed in the current semester.

6.8.4 Telemetry

Over the years the volume of daily collected telemetry has been on the rise. Right now we have 26 million rows storing detailed telemetry (mainly from TCS and the observing computers) for the last two years.

While a very valuable tool for trouble shooting and system analysis in general, right now it is difficult to browse the data, and the storage structure is rather rigid and inadequate for our needs. A specific software application will be made for efficient extraction, storage and browsing of the information.

6.8.5 Observing Blocks

Observing Blocks (OBs) provide a full description of a observation in terms of telescope, instrument and exposure requirements. A full interface exists for ALFOSC, NOTCam and FIES observations. The software needed to translate such an OB description into a set of executable sequencer commands has been developed for the ALFOSC “Imaging” and “Spectroscopy” modes and is being tested. The compiler modules for the remaining instruments/modes will be developed and tested during the coming months.

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.

6.8.6 Data archive

The online interface providing access to the FITS header archive has been updated with an image preview facility and direct download option of the raw FITS file.

6.8.7 FITS headers

Work is done to review and define the full set of FITS header keywords used at the NOT. This work is based on the description of "FITS observation files at the NOT" made in 2004. Many upgrades have been done since, and a cross-check with the new FITS standard version 3.0 (2010) and the updated ESO Data Interface Control document version 5 from 2011 was made, while it was also realized that several keywords needed to be added to the list. A first draft of the updated document was circulated some time ago, and a second one will be circulated during the coming weeks. The objective is to complete the document and implement the changes and additions to the keywords in the current semester.

6.8.8 Remote access

For any remote use of the observing system, be it as part of a remote observing school or tests from sea-level, bandwidth might be an issue. It was noted that the use of VNC graphical desktop sharing is both very convenient and should be less depend on band-width. The use of such a system is being tested, both under normal conditions and for a low band-width case, to see if this provides a good solution.

6.8.9 Detectors

We expect to be able to commission the new (e2v CCD231-42) detectors for FIES and ALFOSC (e2v CCD231-42), each with a fully upgrade detector controller. However, this depends on the specific agreement we can make with the NBI in Copenhagen, Denmark, as for the schedule, but the plan for both CCDs is to be on the Telescope before the summer. The upgrade in the controller should address various pending issue from the commissioning of the current controller for the ALFOSC detector, and includes detector temperature control.

For the NOTCam detector array the development of the new high-speed fiber transfer PCI express interface board is required. To not delay the commissioning of the ALFOSC and FIES detectors we no longer require all the controllers to be compatible, i.e., the PCI express interface board is not required in the ALFOSC or FIES controllers. Given the development work, we do not expect the NOTCam detector controller to be available before the end of next year. Depending on the precise agreement we can make with the NBI, we are considering to look at other options as for (existing) IR detector controllers. It is noted that the latter would require more development work on our data acquisition system, but this might be the better solution.

6.9 ALFOSC

6.9.1 Observing system

To increase the observing efficiency, all exposure commands (including dark exposures) have now a flag ("-f") implemented which returns the prompt to the system during readout. A further improvement is to include this option in dither scripts such that the telescope offset is done during CCD readout. This was tested using full frame readout, but there are timing issues when small detector windows are used (i.e. when the readout time is only a few seconds).

6.9.2 Imaging

The automatic "alfosc.easyflat" script has been updated to allows exposure levels up to 250 000 ADU instead of 150 000, to be able to obtain more flats per twilight. The script will also be expanded to automatically generate combined flat fields from the acquired data for quality control and quick look post-processing purposes.

The Photometric Standard stars web page have been expanded to include u'g'r'i'z' data from SDSS fields. The idea is to also update the Exposure Time Calculator to include the SDSS filters.

To optimise a fast-photometry mode using the new CCD controller and data acquisition system we are defining how we can provide time-series observations with minimal overheads to effectively replace the fast-photometry mode available with the old detector controller. Preliminary tests have shown that for a 100x100 pixel readout window on the detector, a reduction in the fixed overheads in the order of 50% can be made. More development on generating the correct FITS header for short cycle times is being made.

6.9.3 Spectroscopy

The ALFOSC spectroscopic calibration script "alfosc.calibexp" was made compliant to the general "-f" calling convention; i.e., return of the command prompt during readout.

As part of the ALFOSC set-up, it is possible to have a grism installed in the filter wheel. The software used to align slits and grisms was upgrade to allow for this. Also, the quicklook spectral reduction script now works when a grism is in the filter wheel.

6.9.4 Multi-Object Spectroscopy

As there have been more requests for Multi-Object Spectroscopy (MOS) with ALFOSC, it has become clear that a permanent solution should be found for the system to define and manufacture the MOS plates. Up to now we have depended on the goodwill from the NBI in Copenhagen in assisting with software and making the masks for free, but this is no longer sustainable. We are currently working on software tools to help users design MOS masks, define a standard way to transform the user's design to the format needed by the cutting machine, and agree where the masks will be manufactured. For the latter, tests are being made at the TNG to see if they can manufacture the MOS masks. Specifically, it is being tested if the correct slit width and mechanical support for the mask can be made. Else, some form of agreement would have to be made for the manufacturing of the masks at the NBI. We hope to have the full system as for the definition, design and manufacturing of the masks, in place by the start of the next observing semester.

6.9.5 Polarimetry

Part of the optics used with the FAPOL polarimetry unit is a calcite mounted in the slit wheel of ALFOSC. When checking the calcite after some report of features in the images when doing polarimetry with FAPOL, it was noted that the calcite was rather dirty. It was tried to clean the calcite by blowing some air on it, but it was not possible to remove the dirt. In principle, for the reduction only normal flat fields taken with the specific filter used for the observation is sufficient. The question is if, and by how much, the dirt on the calcite might have influence on the results, and if there is any additional reduction step needed that would improve the results.

6.9.6 Detector controller

In principle, the noise properties of the detector are mildly better when using Amplifier B instead of A when reading out the detector. However, there are problems with the geometry of windows when using Amplifier B as this was not implemented in the detector controller when it was delivered. A solution to circumvent this and make the geometry commands produce the correct windows for amplifier B was made. Further changes to geometry related FITS keywords as used by specific observing applications (e.g., spectroscopic target acquisition) is needed before this Amplifier option can be offered.

Some structure was noted in data taken with a binning by 2 in the X direction on the detector. This pattern is stable, and can be corrected in the reduction. It is believe the pattern is caused by some specific settings in the controller which can be adjusted.

6.10 FIES

6.10.1 FIES building

The outside of the building and the surrounding area were painted white. It was found that there was a strong gradient in the temperature in the front room, being highest close to the door to the FIES room. This was thought to be due to the CryoTiger which is close to the door, and the CryoTiger was moved across from the outside entrance door. Also, the cooling water which is used to regulate the temperature in the front room is set higher in the summer to avoid problems with the telescope tracking, which limits the cooling capacity and might indirectly affect the temperature in the FIES room. This should be improved with the changes to the cooling system (see above).

It was also decided to increase the nominal temperature at which the FIES room is kept by one degree. For this, two temperature loops will have to be adjusted and tweaked, but due to schedule constraints this was not done in time for summer 2013. If the cooling water problem can be solved, possibly there is no need for this rise of the nominal temperature of the FIES room and spectrograph.

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. For this a hole from the front room to the FIES room was made. As the wall is made of armed-concrete a company had to be contracted with a proper drilling machine.

6.10.2 Instrument

A poster describing the FIES instrument was presented at the Potsdam ThinkShop titled ”High-resolution Optical Spectroscopy”. A subsequent proceedings paper has been accepted for publication in Astronomische Nachrichten. The paper is the first to present FIES in its current location, offering the three resolution modes.

6.10.3 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.

6.10.4 Target acquisition

To assist in identifying the target, a red marker has been added indicating the pointing axis of the telescope when displaying the StanCam data used to acquire the target for FIES.

6.10.5 On-fiber guiding

An implementation was made of the freely available Phyton “pyguide” routines. This software is used to improve the accuracy by which an object is kept on the fiber during an exposure by analysing the reflected light from the object around the fiber itself. This “on-fiber” guiding routine works in parallel with the telescope autoguider and makes small adjustments to the telescope pointing if the object has moved away from the fiber center. One of the main challenges to this project is to account for the fact that the image of the fiber itself is moving. It has therefore been necessary not only to determine the object position with respect to the nominal fiber position, but also to continuously re-determine the actual fiber position by analysing the fiber viewing images. The on-fiber guiding mode is now offered on technical nights for further testing, and will soon be available for general usage.

The image-analysis software in “pyguide” may also be used to automate the first direct-imaging target acquisition step.

6.10.6 FIESTool

Very small changes were made to FIESTool, and a revised version (1.3.2.2) was released. This version does not change the internal workings of FIESTool, but it is a collection of bug fixes that lets FIESTool work with newer versions of a number of libraries.

FIESTool is being used under various operating systems, and over the years people have noticed difficulties when it comes to installing all the dependencies that FIESTool uses. To circumvent this problem, we have created a Virtual Machine (VM) running on Oracle VirtualBox, a free VM solution, which contains a pre-installed Linux system with all the software needed to run FIESTool. This effectively reduces installing FIESTool to downloading the VM. This solution has been tested privately by a few users, and also in the recent FINCA School that made remote use of NOT's services. The feedback has been encouraging, and we are planning to provide it along with FIESTool itself.

A upgrade of FIESTool will likely be needed when the new FIES CCD arrives. We are considering to invite the creator of FIESTool, Eric Stempels from Uppsala University, to come to the La Palma when the CCD is being commissioned.

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.

6.11 NOTCam

6.11.1 Instrument

For a variety of reasons (changing some of the optical elements installed, clean the pressure sensor, exchange some O-rings) it was decided to warm-up and open NOTCam. This is currently on-going.

6.11.2 Observing system

As part of the NOTCam calibration plan, we intend to provide NOTCam darks every night taken with all the exposure times and read modes used in a night. In order to do this automatically at the end of every night, a script called "notcam.notcam-calibs" was developed that takes 10 darks in each of the exposure times and modes used during a night. This script has been implemented, and information about how to use has been included in the NOTCam Cookbook.

6.11.3 Imaging

The best way to obtain imaging flats with NOTCam is differential twilight flats. The differential mode cancels both the thermal component and the dark. In principle, one could use differential dome flats with the lamps on and off, but at the NOT we have no flat field screen and the inside of the dome is highly structured (and daylight leaks through the hatches). The flat field stability has been checked on a few master flats taken with the WF camera and the JHKs filters. There seems to be a larger difference between consecutive nights due to pointing on the sky than if the same blank field is repeated. This points to scattered light and different light distributions, and we decided to re-install the WF-camera imaging mask, a square mask in the aperture wheel to limit stray light in the system. Because the aperture wheel has only 4 large slots (+ 8 small) we decided to remove the 64 micron slit in order to find space for this mask. The mask was tested once in 2003, but not for twilight flats.

The photometric response over the FOV may not be flat even after having divided by the nightly flat field. For many IR arrays the so-called photometric surface correction (or illumination correction) is needed, believed to originate in scattered light in the system. A model made by observers for the

H-band has been described and made available for download to the public through the NOTCam calibrations web page:

`http://www.not.iac.es/instruments/notcam/calibration.html#illu`

Full data sets for the J and Ks bands are still pending, while the possible effect of the new WF imaging mask (see above) should be investigated for the H-band model first

Also, a new KG2 filter was installed to reduce the Z-band red leak. This needs to be tested.

6.11.4 Spectroscopy

NOTCam spectroscopy mode uses the 3 lamps installed on the inside of the baffle lid as a calibration unit. The Argon lamp usually switches on with a delay, but the delay time is variable. The Argon lamp has been exchanged for a new one, but the problem persists. No correlation with dome temperature has been found. The script for night-time in-situ calibrations, "notcam.easy-calib", has been programmed to switch on the lamp as early as possible (as soon as the TV is switched off, while mirror covers are closing), and to do Argon arcs for all setups first. But even in this mode, it happens that Argon exposures are taken with the lamp actually off. Tests show that the lamp can come on relatively fast, i.e. within a few seconds, or relatively slow, up to 2 minutes. There seems to be no way to predict this. The introduction of an extra "wait" for Argon in the script will cause extra overheads and may not always be needed. The script will be modified to take a test exposure and verify that the lamp is on before taking the calibration data, and this loop should be started already while the mirror cover is closing.

Acquiring the target on the slit for NOTCam spectroscopy has up to now been done in a relatively manual way compared to the acquisition scripts available for ALFOSC and FIES. The procedure for NOTCam has two extra complications compared to optical spectroscopy: 1) sky subtraction may be needed to see the target in the acquisition image and 2) flexure of the instrument requires the slit position to be determined at every pointing. The plan is to complete and implement the ""notcam.acquisition" script in the current semester.

6.11.5 Detector

The NOTCam engineering grade array (SWIR1) has been sold to the NBI under a contract where we can borrow it back over a period of 2 months as a spare in case our science array needs replacement. This would still not be a longer term solution in case of problems, and as a precaution an informal quote for a replacement Hawaii 1k array was obtained from Teledyne. The availability was confirmed, and a price estimate of US$35 000 was provided. However, it is not clear what quality array to expect. For this an official quote must be requested.

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

The investigate this more, we need to monitor the array, but as this accumulates 1 GB of data every day, a script was made to analyse the images, store the results, and delete the data. The results still needs to be analysed in detail.

6.11.6 Vacuum & Cooling

Over the past few years we are having problems when filling NOTCam with LN_2. It manifests itself in that the LN_2 tank seems to be full, i.e., it is impossible to get more LN_2 in, thought the tank should be empty because of boiling off, and the temperature sensors show that the system is not as cold as it is when the dewar is full. It is impossible to get an inspection camera into the tank, so we can only speculate what is going on. Our hypothesis is that over the years water vapour has entered into the LN_2 tank. After a longer period of storage on the telescope floor, this water freezes to a lump of ice that limits the available space for LN_2 entering through the fill tube. It has repeatedly been seen that as soon as NOTCam gets mounted on the telescope and moved around for a while, the cooling recovers and it is again possible to fill the full amount of LN_2 into the tank. It was suggested to warm up NOTCam and to try to remove water from the LN_2 tank, and by the end of May NOTCam was warmed up in the dome while being all the time on the pump. The LN_2 tank was first dried by blowing nitrogen gas through it and then pumped. With this procedure the charcoal getter was not baked, but still the resulting vacuum turned out to be very good and reached $1\,10^{-5}$ mbar. This showed that such a simplified procedure can be used in the future to improve the vacuum. After having cooled NOTCam down to -80 degrees with the PTR, the filling with LN_2 was started. During this procedure, however, the good vacuum was lost as soon as LN_2 was poured into the tank. This points again to thermal stresses on the fill tube O-rings. These O-rings had been exchanged earlier, and it was realized that it is probably time to exchange them again, as they could have become stiff and deformed.

The flexible steel hoses that carry helium gas in the closed-loop PTR cooler are exposed to continuous stress. We have used the same hoses since 2001, and both hoses (supply and return) have been repaired a couple of times. Repairing hoses is time-consuming and a spare hose, being pressurised and ready for exchange, was purchased from Kelvin International. The new spare PTR hose will replace the worst of the current hoses, i.e. the supply hose.

6.12 MOSCA

6.12.1 Observing system

The sequencer command mosca.wheels that set the FASU filter wheels was optimised such that it will move both wheels at the same time when commanded, instead of moving one wheel at the time.

6.13 StanCam

6.13.1 Dewar

We have had recurring problems with the dewar warming up and losing vacuum. One of the problems is that we do not have a proper pressure sensor, and it is not easy to decide if the problem is a true loss of vacuum, or a problem with the cooling, leading to warming-up and increasing pressure. The dewar was refurbished from the vacuum point of view. Most of the O-rings were replaced. At the first try, the dewar could not hold the vacuum properly, so all the O-rings were cleaned and re-installed. When changing the O-rings, it was found that some of the O-rings were not the precise size as given in the documentation, so not all could be replaced. Proper O-rings were purchased, but have not been installed yet. It is still also not clear if the cooling system might have caused some of the problems, and a full cleaning of the cooling system with nitrogen gas, and a refill with the cooling gas might be needed if the dewar warms-up and losses vacuum again.

6.14 Computer system

6.14.1 Modernisation

Most desktop computers at the NOT are 4-6 years old. Many are on the limit as for data storage, while the computer power (CPU) can not be upgraded (due to technology changes), and will need to be replaced. It is also planned to change the standard Linux operating system used in the computers. We have been using Ubuntu for more than 8 years now, but certain policy changes on this distribution are making it less attractive for our line of work. To not require major changes, we intend to use similar system (potentially, Linux Mint, an Ubuntu derivative). As a test, the laptops used by visiting schools have been reinstalled using Linux Mint, with satisfactory results.

6.14.2 Remote access to NOT network

Because of changes that were introduced in the NOT offices' network topology, during the move to the new building, to rationalise it and make it easier to protect and manage, we now can implement certain features in a more secure way, and we have introduced the possibility for users to connect to certain services using a Virtual Private Network. This is particularly useful for roaming users, or to access certain services (like email) from hand-held devices (as it is now common to carry around smart-phones with some kind of network access).

6.14.3 ORM network

Following the changes made to the computer network at the office, the plan is to reconfigure the network at the ORM in the same way. I.e., make it easier to control and protect the computational resources, and to better isolate the Operations critical hardware (TCS, Observing Computers, etc). As the implementation will require extensive downtime for the computers at ORM, it is planned to be done during the realuminising of the telescope mirrors in the coming summer.