Period 39
AiC Report to the NOT Council and STC

51^{st} STC meeting, November 26, 2009
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Contents

1 Introduction

This report covers the operations of the Nordic Optical Telescope for period 39: 2009-04-01 to 2009-10-01.

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 39. A total of 93 fault reports were submitted, with an average time lost of 8 min per fault, for a total down time of 0.7% (0.9% on scheduled observing nights). Of these, 63 reported no time lost, 30 reported < 2 hrs lost, and none reported 2 or more hrs lost.

This compares to a down time of 0.2% over all nights (0.2% on scheduled observing nights) in period 38, and 1.8% over all nights (0.1% on scheduled observing nights) in period 37. Of the 88 fault reports reported in period 38, 66 reported no time lost, 22 reported < 2 hrs lost, and none reported 2 or more hrs lost. Of the 95 fault report in period 37, 63 reported no time lost, 38 reported < 2 hrs lost, and 4 reported 2 or more hrs lost.

Table 1: Technical down time statistic period 39: 2009-04-01 to 2009-10-01

Night included	Time lost	Nights	Percentage[a]	Last semester	Last summer
All nights	730 min	183	0.7%	0.2%	1.8%
Scheduled observing nights[b]	545 min	116	0.9%	0.2%	0.1%
Technical nights	165 min	28.5	1.1%	0.2%	0.1%
Service nights[c]	180 min	38.5	0.9%	0.2%	0.1%
Visitor instruments	20 min	19	0.2%	0.0%	6.8%

[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 then the all time low in downtime last semester, the reported downtime remained low with no major problems occurring during period 39. The downtime over the one year covered by period 38 and 39 is 0.4%.

2.1 Weather

For period 39 a total of 176hr 42min was lost due to bad weather which corresponds to 10.9% of all the dark time, as compared to 38.2% in period 38 and 20.0% in period 37. The total amount of clear dark time was 1447hr in period 39, as compared to 1259hr in period 38, and 1299hr in period 37.

2.2 General overview

In Table 2 the number of faults and total time lost as a function of the system and kind of fault is presented together with the overall numbers for the previous two period (37 and 38).

Table 2: Down-time statistics for period 39[a]

Syst/Type	Soft		Elec		Optics		Mech		Others		Total		P37/P38	
Telescope	6	01:00	21	03:45	0		2	00:15	1	00:00	30	05:00	21/20	19:55/01:50
Building	0		2	00:00	0		0		0		2	00:00	3/6	00:10/00:00
Computers	8	00:00	4	00:55	0		0		0		12	00:55	19/16	02:00/00:45
ALFOSC	11	01:00	1	00:00	0		1	00:00	1	00:00	14	01:00	21/16	03:00/00:50
MOSCA	2	00:00	1	00:00	0		0		1	00:05	4	00:05	2/1	00:35/00:00
NOTCam	5	00:00	1	00:00	2	00:00	1	00:00	0		9	00:00	13/5	00:50/00:05
StanCam	7	00:45	0		0		1	00:00	0		8	00:45	1/3	00:00/00:20
FIES	10	03:05	0		0		2	00:15	0		12	03:20	10/16	03:15/00:20
Others	0		0		0		1	01:05	1	00:00	2	01:05	5/5	00:00/00:00
Total	49	05:50	30	04:40	2	00:00	8	01:35	4	00:05	93	12:10	95/88	29:45/04:10
P37	49	03:25	21	04:20	2	00:10	12	18:35	11	03:15	95	29:45		
P38	52	02:25	18	00:50	2	00:30	8	00:20	8	00:05	88	04:10		

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

2.3 Main problems

There were no faults causing more than 2 hours downtime during period 39, but there was one problem that caused small amounts of down time on various occasions. Although also in total it did not cause 2 hours downtime, it was the single problem that cause the most downtime in the semester so I will discuss it here.

- **2009-07-14 to 2009-08-26: Telescope vibrations**: 1 hr 50 m

  On several occasion there were reports of the telescope making noise and vibrating where a restart of the telescope was needed to solve the problem. Various test and changes were made, none of which provided a clear solution. A return to the old alt/az amplifiers and both altitude tachometers seems to solve the problem. It is believed that by changing any component in the alt/az servo (i.e. amplifiers, PI board, tachos etc) causes it to occasionally go unstable resulting in the reported noised and vibrations. This does imply that a proper tuning of the system is required when replacing any of the components by a different type.

3 Instrument use

Table 3 lists the number of scheduled observing nights and technical nights for each instrument. This covers all nights, including CAT, CCI and guaranteed time. In this table I have also included the number of observing runs, and the number of nights per observing run for each instrument.

Table 3: Instrument use

Instrument	No. of nights		No. of runs	Nights/run
	Scheduled	Technical		
ALFOSC	61.5	10.5	18[a]	2.2
FIES	50.5	5	12[b]	3.3
NOTCam	9.5	6	3[c]	1.3
MOSCA	14	1	3[d]	4.7
SOFIN	10	1	2	5.0
TurPol	2	1	2	1.0
LuckyCam	7	1	3	2.3
None[e]	3	–	–	–

[a] Excluding 21.5 service nights [b] Excluding 10.5 service nights
[c] Excluding 5.5 service nights [d] Excluding 1 service night
[e] Telescope stand-down for aluminisation of mirrors

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

As before, most comments written in the reports during period 39 were very positive, especially about the support from the staff.

There were several requests for improvements and/or enhancements to some of the (new) sequencer observing commands and scripts. As far as possible we have implement these changes, while some requests which require more work or which are more complicated are planned for the future.

Some comments were received about the ALFOSC and FIES webpages containing 'too much' information which makes it hard to find the necessary information for observing. In both cases, a web-page with a 'step-by-step' observing guide was made which provide all the necessary information in a single page.

For high-precision work with FIES it was noted that it would be good to get the intensity-weighted time of mid-exposure which can be derived from the measurements of the exposure-meter. As a stop-gap a little script was made to safe the measurements from the exposure meter to a file with the same base-name as the FIES spectrum which then will have to be analyzed separately. However, we plan to develop this further and provide the intensity-weighted time of mid-exposure as a standard FITS header in FIES exposures. It was also noted that for FIES the centering of the star on the fiber can have an effect on the ∼10 m/s level, where the movie of the fiber head provided for guiding could be used. We are looking at the possibility to make this a specific feature, but already in the current set-up it is relatively easy to make a sequencer script which saves these files which can then later be used for analysis.

Following a remark from an observer it was noted that observers should be informed by the support staff in case a cut of the Internet connection is announced. It was noted that when these cuts are announced in advance they are normally indicated on the technical schedule and the person on duty is actually reminded of this by email. The main thing to remember is to also inform the observer(s) of this. It was also noted that it is a task of the ORM administration to post such announcements in the Residencia. If this actually occurs will be checked with the ORM administration.

In a separate email a complaint was received from an observer about inappropriate use of ToOs requests for mildly time-critical observations. This was not really the case, but the staff did not provide the observer with the proper information which let the observer believe there was a real issue. The details were clarified to the observer and the staff was reminded to contact the AiC or the director if they have any doubts about any ToO request.

5 Operations

5.1 Additional services

5.1.1 Educational activities

During period 39 there was again a lot of activity on the educational front. This included the on-site course from the Stockholm University (5 nights in May) and the master school in CUO/NBI guaranteed time (3 nights in August), but the main emphasis has been on the NORDFORSK/Onsala summer school at Tuorla observatory in Finland which which used the NOT in remote mode.

The remote observations for the summer school included imaging and spectroscopy with ALFOSC and imaging with NOTCam spread over 6 half nights. For this the remote observing systems for each instrument including the telescope control, data display, data transfer, communication, remote observing instructions, data reduction/quality control were developed and tested. These systems were largely based on the experience we already had gained with the remote observing school at Molėtai observatory in Lithuania but include some new aspects as this uses different instruments while the bandwidth to Tuorla is significantly higher which allowed a system that is (even) more similar to normal observing at the telescope.

The staff has also been heavily involved in the practical preparations for the school, while extensive support was also provided (both at the telescope and at the course site) throughout the whole school. Feedback from the participants was also collected.

As part of the support and training of the NOT students on La Palma, regular meetings have been held with the NORDFORSK post-doc and lectures about some software applications were organized, while lectures about data reduction of spectroscopic and NIR data are planned.

5.1.2 Service observing

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. The Nordic service nights consisted of various more or less isolated observing nights spread throughout the semester. Also in this semester there was a large number of observations that were done by the staff for the ToO and monitoring programs during technical and Nordic service nights.

5.1.3 "Fast-Track" Service Program

In period 36 there were 19 proposals accepted. Of these there were 10 'grade 1' proposals, 6 'grade 2' proposals, and 3 'grade 3' proposals. All proposals have been completed still during period 39 and no proposal needed to be closed because it expired at the end the period 39.

In period 37 there were 12 proposals accepted. Of these there were 6 'grade 1' proposals, 2 'grade 2' proposals, and 4 'grade 3' proposals. All the 'grade 1' proposals have been completed. None of the 'grade 2' have been completed. Of the 'grade 3' proposals, 2 has been completed. It should be noted that for the 4 remaining proposals no observing instructions were received so the are not and cannot be selected for execution.

In period 38 there were 28 proposals accepted. Of these there were 17 'grade 1' proposals, 10 'grade 2' proposals, and 1 'grade 3' proposal. Of the 'grade 1' proposals, 14 have been completed. Of the 'grade 2' proposals, 9 have been completed and 1 has been partially completed. The 'grade 3' has not been completed. Again, for this latter proposal no observing instructions were received.

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

Up till now 2 proposals have been received in period 40, where 1 is still in the process of being graded. The other proposal received 'grade 1' and this proposal has already been completed.

5.2 Building

5.2.1 Safety

We continued bringing the telescope safety in compliance with Spanish law. An specific Emergency Plan for the telescope was written. Tested of the whole telescope and service building electrical installation were organized which has been partly completed. One item still pending is the check of those machines in the work shop which, because of age, do not have the European CE safety mark.

Effort have been made to organize a basic First aid course in English for the students and staff that are not sufficiently fluent in Spanish, through the local 'Cruz Roja'. They recently indicated that they can offer a 15 hour course. The 'Cruz Roja's contact person noted that more detailed info would be sent by email. When we receive adequate info a course will be organized in the near future.

5.2.2 Drive System

The problems with the communication to the drive system were finally solved by changing to a different adapter. It should be noted that at all times we have asked and followed the instruction and advice from Siemens, and still have so many problems and delays is rather disappointing. All the required functionalities of the system have now been verified and tested and the procedure to replace motors has also been tested and documented. The whole set-up of the new system with the required changes in the setting from the current values has been documented. One main issue remains with the main earth leakage breaker for the drive system sometimes tripping on power up which can also cause the weather station fuse to blow. A possible solution has been proposed by Siemens.

5.2.3 Clean room

This is still pending. Due to the more extensive work and delays with the building motors and other planned activities such as the aluminisation of the telescope mirrors no more progress has been made.

5.2.4 Phones

A new phone system was installed in the telescope building. Two of the phones are hands-free systems where you can clamp the unit to your belt and use a head-set. The system includes a repeater for coverage throughout the building. Some more tests are needed to test the system, specifically as for optimizing coverage in the adjacent FIES building. Also, new phones were installed in the service building and better instructions were provided for the various options that the existing system provides as for communicating between different phones, remote pick-up of phones, etc.

We are running out of spares for the lightning protection of the telephones lines and the specific type is no longer available on the market. A new type of protection was identified and ordered. This new type is not fully compatible with the existing system and some new installation and modification of the installation is required.

5.3 Telescope

5.3.1 Telescope control system

The way the TCS is rebooted has been significantly simplified and is now limited to a single command and a single press on the 'Reset' button without having to power cycle anything. Not only does this reduce the total time for a full reboot from 8–10 min to less than 3 minutes, it also reduces wear on power supplies etc. In principle this also allows in an emergency to let an observer performed this task.

Work has continued on integrate the TCS more in to the general observing system as for status information and operation through sequencer commands and scripts. A main part of this is communication between the TCS and the general data base which has significantly expanded. After this upgrade a major problem was encountered where the network connection to the TCS would get blocked ones every few days where a reboot was needed. The cause of this was identified as being a problem in the OS-9 operating system of the TCS computer system itself. By sub-dividing the data that is being send in smaller chunks which does not cause a clogging-up of the network connection while still allowing to send the full set of information in a reasonable time (a full set of the data is still sent about 2 times per second).

Some new commands have been added, some have been modified and simplifications were made for sequencer use. Practically all documentation has now been updated and revised to reflect the current TCS implementation in all details.

A log interface for handling TCS logs in an easier way is being developed. As it is now it is cumbersome to extract info from them, and the idea is that anyone should be able to get info about selected areas of interest with a web interface. Preliminary specifications and tests were made.

The temperature monitoring system that supplies TCS with the structure temperature measurements used to calculate and correct the telescope focus is rather slowly and only updates once per minute. These measurements have noise (in the measurements and on the line) or can be faulty (e.g., due to failure of one of the various sensors used), which has let to wrongly calculated telescope focus values. To avoid this causing unphysical changes in the telescope focus the TCS has been changed to ignore sudden, steep temperature changes and only follow more steady variations. This protection system is only operative when the dome is open, starting only 20 min after opening as during that time fairly steep temperature changes are normal and hard to separate from noise related changes. In case there are persistent changes that are considered unphysical by the system the observer is warned to check if the changes are real. If there truly is a steep change in temperature, the value can be accepted. Otherwise, the cage can be ignored and the cause of the wrong reported value can be investigated without directly causing large errors in focussing of the telescope.

Some additions and modifications have been made to the set of standard catalogues provided to the users. Some more improvements are currently being prepared.

5.3.2 Safety

There has been a recent case where an observer fell asleep during observing at the night of the night and only woke-up after sunrise with the telescope mirror and dome still open. To avoid this an auto closing system is being developed which closes the telescope at sunrise after a set of warnings are issued on the TCS. A command will be included that allows to keep the telescope open (e.g., to do calibrations of NIR observations) up to a maximum of 60 min. It will only be possible to give this command from the control room.

In general, this system will only be active if the telescope dome is open at the time of sunrise, where the process will continue until the telescope is closed manually, or is automatically closed. If the dome is closed at sunrise this process will not be initiated. When closed, the dome can be opened at any time as is the case now. Preliminary tests of this system have been made.

5.3.3 Aluminisation

A lot of effort was spend on preparing and planning for the aluminisation of the primary and secondary mirrors. Special arrangements were made with the ING to limit the amount of downtime of the telescope as much as possible, and it has now been possible to have the mirrors back from the aluminisation plants after 2 nights. The mirrors were aluminized at the beginning of July and during the third night reassembly of the mirrors was finished. During the first observations after the installation of the mirrors significant coma was seen which was found to be caused by an improper alignment of the secondary mirror. However, still some observations could be done and misalignment of the secondary was correct during the following day. Measurements of the telescope aberrations the following night showed everything to be as good as before, possibly with a slight improvement in the amount of coma over the pre-aluminisation results.

Checks of the reflectivety of the mirrors using reflectometers and measurements of the overall efficiency of the telescope using standard stars have shown a clear increase, but the measured increase in efficiency is lower than expected (∼5-10% in the visual and NIR compared to ∼15%). However, starting shortly before the aluminisation there have been extended periods of calima and it has been difficult to obtain reliable measurements, but an analysis seems to indicate that the aluminisation itself was not so successful. One specific thing to note is the relatively high level of light scattering that are seen in reflectometer measurements taken some time after the aluminisation which are at similar levels to those shortly before the aluminisation, but that might be related to the calima. We are currently looking to what extend things can be improved through cleaning the mirrors with CO_2 and washing.

As a result of dismounting and mounting the mirrors there were some changes in the set-up parameters, in particular to default telescope focus for the various instruments. Both the documentation and the relevant observing scripts were updated. It was noted that the relative focus offsets between the instruments are very stable, and re-measuring the optimal focus for one instrument provided a good indication for the optimal focus for all the other instruments.

It was noted that to check the reflectivity of the telescope mirror (or any other mirror) it is always a hassle to get people from the ING to come with their meter, while our own hand-made meter does not work very well. We will check if we can use and/or share on a regular basis a reflectometer from another telescope (e.g., LT or GTC).

5.3.4 Top unit

The top unit displacement mechanism was worn and gave oscillations that caused the guide stars to move around. After mechanical service the servo parameters were adjusted. A system to detect these oscillations automatically was added to the software.

5.3.5 Amplifiers

Various reports of vibrations from the telescope, typically altitude, were reported during the last few months. Always the problem was solved by changing something in the servo control loop, e.g. disconnecting one or the other tachometers, cleaning the said tachos and finally removing the new alt/az amplifiers. It is believed the main cause of the problem was that the new amplifiers had a slightly too high gain with respect to the old ones (1.62 against 1.5). All the new amplifier gains have now been reduced to $\sim$1.47 and are ready to be tested again.

5.3.6 Adapter

Degradation in the rotator position encoder or its associated electronics has made it necessary to filter the readings to ignore faulty readings. Statistics have show any errors to only appear a few times a day, with some variation between days. Observers will only be notified when the errors become so frequent that they might affect the observation. We are investigating what is precisely the underlying problem so we can look for a definite solution.

5.3.7 Guide star acquisition

Some modifications and improvements were made to the guide star acquisition. In the TCS a permanent offset can be adopted in the pointing (e.g., used when one wants targets to fall on a specific area of the detector) but this offset was not taken in to account when querying the guide star server. This resulted in the guide probe position not being corrected for the offset and depending on the size of the offset the guide star could fall outside of the field-of-view of the guide camera. The permanent offset is now incorporated in the query to the guide star server. A different way of applying (small) permanent pointing offsets is changing the position of the guide-star box in the field-of-view of the guide camera. Originally, the automatic guide star detection and centering system system has at start-up the guide-star box in the center of the field-of-view and at each new preset to a target the star box was recenter. This latter part of the procedure has been eliminated and any change in the position of the star box effectively provides an offset in the pointing.

One of the most stringent limitations on areas available for guide stars is that defined for beam-switching observations with NOTCam which require offsets larger than the field-of-view of the camera (4×4 arcmin for the wide-field camera). To improve this, separate areas were defined for each direction where a bigger area can be used in each separate case. The different options still need to be verified in detail, while we are also looking to further optimize the areas available for guide star selection for different observing modes.

However, also in general it still is possible that no guide star is found. Possible ways to still find a guide star would be to change the target coordinates slightly, use a different field-rotation than the standard one, etc. However, the only way of checking this was by actually changing these values at the telescope. The online guide star search interface was modified to allow for user defined telescope position and instrument field as well as the current pointing. In this way availability of guide stars can be checked in advance, or quickly on the fly at the telescope.

To protect the guide camera very bright stars (<9 mag) are excluded from the search for guide stars, while for stars brighter than 11.7 mag a grey filter is put in the beam. It has been noted that for the faintest stars in this range the guide star can often only barely be seen and might not be detected by the system. Basically, the change from using the grey to not using it is to steep and a scheme will be implemented where an intermediately attenuating filter will be used for the faintest 'bright' stars.

A different issue is that sometimes stars are selected that are near to stars that are considered too bright. When the automatic star detection and centering system is used this will lead to the wrong star to be selected and centered in the star box, with a corresponding off-set in the pointing. The system will be changed such that no guide star is selected near (closer that the size of the guide camera's field of view) to a star that is excluded because of its brightness.

5.4 Observing system

The sequencer mode observing system is now firmly established for the main instruments. As there is no need for them and to avoid possible confusion the links to the old instructions for starting-up the control software were removed from the main observer pages and moved to the 'staff' pages, in principle only to be used for engineering work.

5.4.1 Sequencer commands

The number of high level scripts available to observers keeps increasing. For a complete listing, see

`http://www.not.iac.es/observing/seq/`

There are various commands (e.g., "expose") which are the same for different instruments, while in general it should also be clear what part of the observing system a command refers to. To distinguish commands for the different parts of the observing system they have different prefixes.

A consistent and simplified naming scheme for the commands have been implemented and the old names have been phased out completely.

A specific issue encountered during the remote observing but having a more general implication is that some of the documentation give abbreviated versions of commands that can only be used in the instrument specific sequencer window or the TCS terminal. The effect is that some commands written in the documentation can not be executed from the (remote) observing system. The documentation is being updated to (also) include the complete sequencer command form such that the specific instruction will be universally valid.

5.4.2 Switching instruments

Work has continued on making it easier to switching between instruments. In principle this is aimed at observers would need to do, e.g., ToO observations or monitoring observations with a different instrument than they use for their own observations (e.g., a FIES observers having to do ALFOSC observations) with which they do not have the specific training or experience to observe. One of the main dangers is that some settings which are different for the different instruments are not changed or set to the wrong value which can cause loss of observing time or produce poor results. The main development has been the implementation of a sequencer script which allows a wide range of TCS parameters to be stored which can be recalled later. In this way, all the settings one has defined for an instrument before switching to an other one can be saved. Together with the already existing telescope set-up scripts for each instrument this significantly simplifies a limits the possibilities to make mistakes when interrupting observations on one instrument, switch to an other instrument for some observations, and returning to the original instrument. Of course, this applies to any observer and these scripts are of general use.

5.4.3 Remote observing

A significant amount of effort was spend on defining and developing the remote observing system for the NORDFORSK/Onsala summer school at Tuorla observatory in Finland. For the course specific instructions were provided for setting-up the system and performing the observations from the remote site. The main issue is as always the band-width which does not allow for the same interface that we use on-site. In itself this is not a major problem, but it does forces us to define set of interfaces & instructions for remote observing. However, the current remote observing system does more closely follow the general set-up and feel of the normal observing system.

Our experience with the observations was very good, and all groups got good data. Thanks to the overall good transfer speed observing went smoothly, practically speaking as if in visitor mode, except for one small problem in the selection of a guide star from small areas when using the beam-switch mode (the only case where a person in the control room had to intervene in the observations). This issue has now been addressed (see below).

Our aim is now to unify the interfaces for on-site and remote observing. We have been experimenting with different technologies, and before the next remote-observing run we plan to install and test a terminal server that would allow us to simplify the technical aspects of remote observing, while allowing the users to interact with our system in the exact same way as locally.

5.4.4 Observing instructions

We have a general observing cookbook which both include general instructions common to all observations, and more specific instructions for the different instruments. It was agreed that it would be better to make instrument specific cookbooks in which only the relevant information appears. This will be made in a modular form such that parts common to more than one cookbook (e.g., the telescope starting-up and closing-down instructions which is relevant to all instruments, or the instructions for StanCam which apply to the use of that instrument but also when observing with FIES) would not have to be updated in each separate copy, with the danger that there are divergent versions of the same information. The work with the instrument specific cookbooks is currently on-going.

5.4.5 New detector controller and data acquisition system

In preparation of new detector controllers and as defined in the development plan, work has continued on the new data acquisition software. A detailed project plan for the development of the software has been prepared in consultation with the software responsible in Copenhagen. A commissioning plan for the new detectors controllers has been prepared as a basis for a purchase and delivery contract, while we have also prepared a test plan for the software which will be used to verify if all the requirement have been met. The work at NOT is progressing according to plan, where the next step will be to test the software together with the team in Copenhagen.

5.4.6 Exposure time calculator

The exposure time calculator is being upgrade to include estimates of the peak counts for both photometry and spectroscopy. This will also include the option to select the specific binning used.

5.4.7 Post-processing and data display

The unified DS9 display and associated post-processing sequencer tasks have been released on all observing systems. Users are already taking full advantage of the integration into the sequencer environment by creating advanced scripts that include such tasks as putting a star on the slit that has not been possible before.

5.4.8 Virtual Observatory

Following a workshop on how to publish data into the Virtual Observatory (VO), it has become clear that our fits header archive is fully adequate to describe the dataset required in the VO framework. When the NOT data archive becomes available online, the steps required to publish the raw and/or reduced data in the VO will be taken.

5.4.9 Observing descriptions & FITS header

One issue in defining the observations and providing proper input to the instrument set-up is the need to provide a complete and well define list of items of the optical elements (filters, slits, grism, etc). From the data base point of view each item should be unique and easily distinguishable (e.g., all the filters are different than all the grisms, each of which have specific numbers), while from the instrument set-up point of view the data-base should provide a way to include the appropriate parameters. Specifically, for each place (wheel) where items can be mounted it should be defined what can be mounted there (e.g., the cross-dispersion grisms can be mounted in the filter wheel), and in what way (horizontal, vertical, blue/red shifted). This defines what one should be able to specify for the set-up of an instrument from the data-base and, vice versa, what the data-base should be able to contain (as defined by the instrument set-up) as for where and how an item is installed. Complete lists have been made for all available optical elements for each instrument. Furthermore, it was defined what are the parameters that need to be specified for each type of element. A conceptual design is being made for the optical element entries in the data base.

Given the need to be able to automatically process images it should be possible to uniquely define the type of observation (imaging, spectroscopy, calibration, test, etc) from the FITS keywords. Our current set of observing description keywords do not follow any specific system and in general the post-processing and analysis tools we use rely mostly on specific instrument keywords (e.g, if there is a slit in the light path) to determine the type of observation. It was considered that the system of ESO using 3 different keywords to define observations giving the category (science, calib, test, etc), the type (object, std, sky, flat, lamp, etc) and (observing) technique (image, spectrum, echelle, polarimetry, etc) where each of them can have more than one entry is well defined and should cover most observations and provide a full description. By following ESO all our data will automatically be "Virtual Observatory" compatible as well and adapting to any reduction packages which can process ESO data should be relatively easy.

Like the above, their are many issues that concern FITS keywords in relation to observations and the resulting data. This is particularly relevant for things like automatic scripts as part of calibration plans, or data reduction and analysis through pipelines, but also for extended Virtual Observatory compatibility of our data and we have planned a specific working group meeting consisting of the astronomy staff and software group to define this in detail.

It was discovered that the FITS keywords for the pixel scale for some of the instruments did not correspond to the latest values. The differences are relatively small, but significant. We are in the process of updating the values to the correct ones.

5.4.10 Data archiving

A more automatic observing data tracking and archiving system has been implemented. This makes the task of archiving the observing data both easier and more reliable. The next step will be the automatic iintegration of the FITS headers of the data in to the archive data base. In the longer the idea is to archive the data in a network enabled storage area which directly relates to the publishing of the NOT data in the Virtual Observatory. In connection to this, we are planning to include the data from the existing archive data on CDs and DVDs in the same storage area.

For safety reasons we also plan to copy the existing archive data to Blu-ray disks which allows a more compact way of storing the data. This copy of the archive will then be located in a separate physical location from the existing one.

5.4.11 Quality control

We are developing web-pages for the imaging instruments where we will provide images and files for download of standard sets of dark, bias images and average flat fields for commonly used (broad-band) filters. In principle the plan is to update these pages regularly with the latest observation as defined through the calibration plans and provide an archive of older calibrations. Web pages have been set-up for NOTCam

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

and ALFOSC

`http://www.not.iac.es/instruments/alfosc/calibration/`

which are being populated with images.

5.5 Detectors

5.5.1 CryoTigers

Numerous problems have occurred with both the StanCam and FIES CryoTiger cooling systems over the passed few months. A feature of the cooling system is that for no obvious reason the cold-head temperature jumps from the nominal -200C to approximately -160C and then after a period that can be a few hours to many weeks it returns to it correct temperature. This property has been seen with CryoTigers at both Mercator and Liverpool telescopes and no explanation is known. Various attempts to try and identify the problem have been tried, including removing the in-line filter/dryer, reverse flushing the cold-head to remove any possible blockage and replacing both the compressor and filter/dryer with new ones. Basically the only reliable thing identified is that switching the compressor off for a while usually helps.

Currently, the StanCam cooling system has all its original parts back and seems to be operating satisfactory, while FIES has a new filter/dryer installed (only recently) and also seems to be operating properly. One issue with FIES is a possible vacuum leak but because the vacuum sensor is disconnected (to remove the electrical noise it induces) the variations in pressure are not known.

5.6 Instruments

In principle all the instruments are kept in the dome at all times, and when not mounted at the telescope are stored there. To avoid contamination by dust and water (which might get in during poor weather) all of the instruments are covered when stored. As these were aging all covers were replaced with new ones.

5.7 ALFOSC

5.7.1 Imaging

Further investigation in to the reported zero point variation has indicated that this might be related to the rotation of the filter in the slot, however this is not well understood. The twilight flats from 2007-2009 indicate that the light distribution changed in B and V about the same time in mid September 2007. The V-band came back to normal at the end of January 2008 and the B-band at end of February 2009. The current flat fields are very similar to the ones before September 2007 and provide a good correction of the raw data.

The tests have shown that rotating the instrument between flat field exposures does improve the resulting flat field by up to a few percent (the report zero-point problems were in the order of several percents).

To make standard star observations easier and more reliable we are planning to make a peak count calculator for the standard stars. The idea is to have a web-page similar to the Exposure Time Calculator where for a given 'ALFOSC' standard star field, filter, seeing and integration time, the peak counts are estimated.

One of the problems with obtaining flat fields during twilight is that is it not always clear what is the most optimal way to obtain flat fields in many filters. Currently we have a script that takes an optimal set of flat fields for a given filter, and the idea is to provide a wrapper script around this script that accepts a series of filters as arguments, and figures out the optimal order of the filters, and then takes sky-flats for all filters in the list.

Both these facilities should make things easier for none ALFOSC users, but also allow for a better definition and planning of observations (e.g., service or ToO observations which require observations of well exposed, but not saturated standard stars).

5.7.2 Filters

During training of the students in, among other things, changing optical elements it was noted that the broad-band filters which are more or less permanently mounted in ALFOSC were rather dirty and the standard set of ALFOSC UBVRi filters was cleaned.

5.7.3 Spectroscopy

The spectra that are extracted using the post-processing system are now made available to the visiting astronomers on a disk accessible to them.

The target acquisition script has been modified to check the guiding status of the telescope before and after acquisition to avoid guiding problems to go unnoticed by the observer.

The system that is used to for the alignment of the optical elements have been moved away from the observers' data reduction computer to avoid any possible interference. The alignment system has now also been included as a sequencer command.

Following the example of the EasyThAr scripts for FIES which checks the illumination level and defines a proper exposure times, similar scripts will be develop to automatically take properly exposed wavelength calibration and flat field exposures. This is especially of use for ToO observations or service observing where a standard set of calibrations can be defined and executed from a script (e.g., to run all the daytime calibrations). As ALFOSC has many configurations, some of which are seldom used or very different from the normal set-up (e.g., an offset slit), this for the moment will only be developed for the most regularly used set-ups.

5.7.4 Polarimetry

By arrangement with Asiago Observatory, Padova, Italy, a "Wedged Double Wollaston" (WeDoWo) prism for one-shot polarimetric observations with ALFOSC will be on loan to the NOT for a three-year period, starting April 1, 2010 (i.e. in Period 41).

The capabilities of the prism are described in Padova/Asiago Technical Report no. 18, see:

`http://www.not.iac.es/instruments/alfosc/polarimetry/wedowo_asiagorep18.pdf`

The WeDoWo has been tested earlier at the NOT, and actual performance in ALFOSC is expected to be very close to that described in the Asiago report. We also plan to make a detailed comparison of polarization observations with the WeDoWo compared to those using FAPOL. Current plans are to offer the prism as a standard option in the ALFOSC imaging mode.

5.8 NOTCam

5.8.1 Observing system

With the changes to the guide star areas for different beam-switching options we need to check the modified version of the notcam.beamswitch script.

Already existing NOTCam sequencer scripts, both instrument setup scripts and template observing scripts for imaging mode, got a major upgrade. Two new scripts for staff procedures to do through-focus tests and find the rotation center were made. See

`http://www.not.iac.es/observing/seq/notcam-seq-scripts.html`

The spectroscopy setup scripts still need to be upgraded.

5.8.2 Imaging

To facilitate dome flat field and quality control observations a light regulator for the dome light from the control room was installed, but it did not worked well as the light level was very unstable. New electronics was bought, but this still needs to be tested.

Finally useful data was obtained in JHKs in June of a suitable field in very good seeing to define the optical distortion of the WF camera. The analysis of this data is pending.

5.8.3 Spectroscopy

Some new spectroscopic standard observations were made after the aluminisation and the documentation has been updated. The NOTCam calibration unit for spectroscopy is still only operated manually. We still plan to get this unit on-line so that it can be controlled in software. FITS headers should also be created to provide the proper information for spectroscopic calibration exposures.

As supported by the NOT user group for low resolution spectroscopy we have looked at the possibility to develop a low-resolution spectroscopy mode for NOTCAM. The general idea is to be able to extend the capability of the often-used ALFOSC low-resolution grisms (e.g. #4 and #7), to the NIR. In principle we are thinking of a grism that covers the Z- and J-bands in 2nd order, and the H- and K-bands in 1st order, and a second grism that covers the J- and H-bands in 1st order. We have contacted Michael Andersen to check the feasibility and provide a detailed design which we can use to obtain offers and decide if and what we want to order.

5.8.4 Polarimetry

Finally good measurements of zero and high-polarization standard stars were obtained in J and H in September to access the current polarimetry mode of NOTCam that consist of a set of 4 Polaroids, but the data still need to be reduced and analyzed. Specifically, the quick-look reduction tool for polarization observations still needs some improvements.

It is evident that an upgrade to a dual-beam polarimeter would be the way to go for NOTCam polarimetry (at least for point-like sources), but a full study still needs to be completed.

5.8.5 Detector

- **Quadrant failure**

  At the beginning of the semester there was a problem with one of the quadrants of the NOTCam detector not working. This was described in detail in my last report, where we in the end found that the problem was with a transistor on the mounting board of the detector which was replaced with a spare after which we got signal from all four quadrants again. Also, an interface board needed to be replaced as this had failed due to the problems with the mounting board, where we had to make some (undocumented!) modification to make it work. Since these changes the detector has continued to work properly.

- **Reset level jumps & dark current**

  The modified clock board for NOTCam that should correct the "dark current" problem with the detector has been built and tested both in the laboratory and in the controller, though with the array disconnected. We hope that the sudden jumps seen in the reset level and described with examples on

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

  will also be solved/cured together with the dark-current problem by modifying the clock-boards. It is planned to try the board out on NOTCam in the period after the last NOTCam run in November 2009 and before the next run in February 2010.

  If the modification is successful a full check and characterization of the detector (basically a new detector commissioning) will be needed as we expect all properties to changes at some level.

- **Bad pixels**

  The bad-pixel masks provided up-to-now have not been optimal in the sense that the tool was developed for another array and electronic setup (the engineering grade array and old PCB). Also, it did not work well for clusters of bad pixels.

  New bad-pixel masks are being prepared and made available. The new masks differentiate between zero-valued pixels, "cold" pixels, and "hot" pixels, where "cold" refers to low response compared to the nominal value of neighboring pixels (typically 20-40% lower), "Hot" pixels are few and mostly along the edges for short integrations, but the number is a strong function of exposure time. Zero pixels are mainly dead pixels located in one corner of the array and a few spurious single dead pixels. Also, 2048 more pixels are perceived with zero value, due to a problem the controller has in addressing the pixels in the first readout column. This should disappear with the new controller. The "cold" pixels are scattered over the array, many of them in the bad corner, but those over the array are usually located in small groups. Only one larger bad feature was present when installing the array in 2007, the rest being single pixels or few-pixel groups and the bad corner, in total affecting 0.2% of the array. Over the years this has slowly increased to 0.4% of the array. The increase is likely related to the vacuum problems with have, and in one case a problem with the telescope altitude amplifier which caused the telescope to shake strongly during power-on while NOTCam was mounted.

When the improved characterization of bad pixels is finished and made available, the notcam.cl reduction package will be upgraded to improve the handling of bad pixels.

5.8.6 Observing overheads

There is still an issue with a variable amount of overhead for NOTCam observations which are not fully understood, but is believed to be due to the aging ISA PC-board which interfaces the detector with the data acquisition computer. However, using a "spare" ISA PC board did not show any clear difference. It was suggested to move the whole NOTCam data acquisition system to the old computer 'elizabeth' and try to run the software from this computer.

A special exposure command for NOTCam was suggested in which the dither overhead can be folded into the readout and file storage overhead. This would not solve the problem, but would save significant amount of time on 'normal' overheads and this has now been given high priority.

5.8.7 Vacuum & Cooling

The reason for the warming-up of NOTCam that in the end caused the problems with the detector at the beginning of the semester (see above and the previous report) was that the motor controller of NOTCam had not been switched on after dismounting from the telescope thereby giving null input to the temperature logs, something that was not "detected" by our temperature monitoring system as a fault. The system has now been improved and it now checks if there are new readings twice per day and if not an alarm will be sent by email to the staff.

We still have some minor problems related to filling of LN_2 - slight vacuum leaks which are however rapidly recovered by the cryostat - which are understood to be related to thermal stress around the fill-tube o-rings. A new type of LN_2 filling nozzle was made drilling a cylinder from a specially ordered highly insulating material. The new nozzle is longer than the old one and occupies the whole width of the fill-tube, thereby avoiding leaks to the outer part where the sensitive o-rings are, and at the same time this material insulates between the LN_2 flow and the inner metal of the fill-tube. The experience using the new nozzle is very good, and it is now easier to avoid spilling than before. There are still some very minor changes in the vacuum upon every filling, but quite small (about 6×10^{-6} mbar) and the cryostat recovers quickly. The vacuum 5 months after closing/pumping is better now (1×10^{-5} mbar) than one year ago (5×10^{-5} mbar).

5.8.8 Quality control

All NOTCam detector quality control data consist of darks and dome-flats while NOTCam is mounted on the telescope during daytime. There have been problems with variable lamps as well as variable daylight leakage in through the hatches that make exact calibrations, like linearity tests and shutter tests, difficult. A new dimmer was installed in September in the control room for remotely switching on and adjusting the light level of the lamp by the entrance door in the dome (see above). It is not yet sufficiently well tested for stability, since the data obtained in the last available quality control data set was corrupted by a data acquisition problem. However, there is some problem in tuning the intensity from the control room when not looking directly at the lamp. Also, the lamp itself needs to be changed to another type giving a flatter light distribution. We will further test the dimmer, and if it turns out to be useful we will proceed and change the lamp.

5.8.9 Reduction software

The quick-look IRAF reduction package for NOTCam, notcam.cl, was upgraded to version 2.2 and was used during the Turku summer school. The documentation of the package was also updated. See:

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

Another upgrade of notcam.cl is due soon and will contain an improved mkflat.cl task (providing more accurate flats) as well as an optional handling of bad pixels in the reduction scripts. The quick-look reduction script for standard ABBA spectroscopic observations is still pending.

5.9 FIES

5.9.1 Instrument

As part of maintenance, the StanCam and FIES pick-off mirrors where cleaned with alcohol. It was noted that the FIES mirror shows wear, and a large stain. One of the spare FIES pick-off mirrors was re-aluminized by ING together with our main mirror. The resulting reflectivity is not higher than that of new mirrors and we bought new mirrors from Edmund and measured a reflectivity of 93%,93%,92%,81% in B, V, R and z, respectively. The plan is to replace the mirror in the near future.

The upgrade of the original fiber bundle has proceeded and was refurbished at ESO by Gerardo Avila. The University of Aarhus provided new mechanical parts for the fiber couplings. The “new” bundle was received at NOT, and has been installed from the hole under the telescope to the FIES spectrograph. All 4 fibers transmitted healthy amounts of light after the installation. A new clamp to hold the new fiber bundle at the spectrograph entrance was made to account for the fact that the fibers are wrongly fixed and rotated with respect to the optical axis. The testing and subsequent commissioning of the new bundle is planned in the coming months.

To make any alignment of the fiber easier after any misalignment an XY-slide has been purchased and prepared for installation. This is to ensure proper alignment between the adapter-based calibration fibers and the main astronomical fibers. The slide will be mounted in the adapter plate. The adapter plate itself will be move slightly to allow the position of all fibers to be within the FOV of StanCam.

A continuous check of the power-on status of the top-calibration unit electronics was implemented. If the power is found to be off, the staff will be automatically notified to initialize the box.

The FIES spectrograph itself was refocused, showing a change in focus position from 196 to 198 with no significant change in PSF. The optimal telescope focus for each fiber still needs to be tested by checking count rates at FIES detector as a function of telescope focus.

5.9.2 FIES building

We continue to monitor the temperature in FIES and its building. In the summer it was found that the temperature was not stable in two hot periods lasting more than a week each. We will now try if it help to create shadow over the roof of the building by installing a cloth/tent in the next summer. This should limit the heating of the building and loss of temperature stability.

5.9.3 Observing system

There were a few upgrades. The option to take target exposures with simultaneous ThAr calibration was included in the script generator for FIES. The observing log was modified to occupy less space on the screen and better fit.

5.9.4 Exposure meter

To protect the new FIES exposure meter a device has been designed to monitor the light level near the meter and when it exceeded a certain level (well within the limits of the photo-multiplier), it will cut the power and send a signal for the software to read, indicating what has happened.

An exposure-meter count calculator was developed, see

`http://www.not.iac.es/instruments/fies/emcc/` ,

that calculates for a given fiber/resolution (and as a function of the “color” of the target) the require number of counts from the exposure-meter to reach a specific signal-to-noise. The FIES obstructions related to the exposure meter were updated and improved.

Following a request from one of the observers, we plan for exposures that use the exposure-meter to use the measurements from the meter to calculate an intensity-weighted time of mid-exposure and add this to the FITS header.

5.9.5 Data and Target acquisition

We intend to further improve the target acquisition process, mostly the visual part of the process. We will now also investigate if current telescope pointing is stable enough to directly acquire onto the 20arcsec fiber-heads.

5.9.6 Quality control

We have had a problem with one of the ThAr lamps slowly dying. The scripts used for calibration exposures include a (windowed) test exposure to define the required exposure by looking at a single line. This directly serves as a 'health' check of the lamp. However, it turns out that lines from different excitation levels were decreasing in intensity in a different way which both cause the problem not to be detected immediately and the overall shape of the calibration spectra to change which caused significant shifts in the resulting wavelength calibration. To avoid this, we plan to develop a quality control system that makes a more complete analysis of any exposure using a ThAr lamp (including exposures with simultaneous observations of a target and a ThAr lamps) and checks for line-ratios to avoid this problem effecting the data.

It was noted that increasing the the ThAr lamp exposure time by a factor 6 with respect to to the 'standard' exposure time the RMS around the wavelength solution can be brought down from 80 m/s to 45 m/s. See

`http://www.not.iac.es/instruments/fies/fies-comm.html#stability`

5.9.7 Reduction software

FIES reduction tool was further improved by Dr. Eric Stempels (University of Uppsala). Some minor fixes were made and additional updates were made of the routine for scattered light subtraction, especially beneficial for binned images. The latest version of FIEStool is made available at

`http://www.not.iac.es/instruments/fies/fiestool/FIEStool.html`

An Echellogram mask was identified to improve the merging of the orders for low signal-to-noise spectra. This together with a task to filter cosmic rays (for low signal-to-noise spectra the cosmic rays or spikes are not filtered out optimally) are possible improvements for FIEStool but this depends on help from Dr. Stempels. We plan to add prefabricated master wavelength reference and master order definition files to the FIEStool distribution to help simplify the initial steps in data reduction.

When the new fiber bundle is installed and commissioned it should be investigated how best to reduce simultaneous sky spectra.

5.9.8 Detector

The problem of the missing central columns in AB mode has been solved for odd X binnings. For a binning of 2 in the X-direction the problem still exists and will likely not be fixed for the current controller.

5.9.9 Atmospheric dispersion corrector

In principle all preparations have been made for the installation of the ADC for FIES. A plan is being made for the testing and subsequent commissioning at the telescope.

The the ADC engineering functions will be implemented as TCS commands after the ADC has been installed and verified. The code from the ADC motor controllers have been extracted so it can be programmed in to the spare. The drawings of the ADC on the web have been updated the the latest version.

5.9.10 Documentation

Various updates were made to the observing instructions to account for minor changes in TCS/sequencer commands etc., change of telescope focus, change of advised calibration exposure lengths, and new sequencer scripts. Also the staff instruction have been updated to included the latest changes.

5.10 MOSCA

5.10.1 Data acquisition

MOSCA still needs to be included in the sequencer system. However, the instrument is not used often, while operating the current system is already very simple and we do not consider this a high priority.

5.10.2 Detector

As we had the recurrent problem of the intermittent failure of one of the CCDs again at the start of the semester, we got replacements for the internal dewar wires to the CCD which we thought caused the problems. After that it was not possible to reproduce the fault, the detector bias-level returned to its commissioning state and a successful two week run followed.

During a run in June the problem of an intermittent failure of CCD11 returned. From test in the clean-room it was found that there is a problem with the video channel used by CCD11. Each video board has two analogue channels and for all the four CCDs only one channel on each video board is used. Swapping the damaged video board with another that does not use the broken channel, signal was seen from all four devices and things seem to work properly. However, some unexplained features are see in the form of high and low columns in the CCDs which need to be tested. It should also be noted that all tests have been done at room temperature. Furthermore, this faulty video channel can not explain the apparent "gravity" related properties of the fault at the telescope. Further tests are planned, including 'cold' test on and off the telescope.

5.11 StanCam

The permanent set of filters mounted in StanCam have been cleaned.

5.12 SOFIN

Some problems were encountered with the SOFIN program running on a new computer (in fact our spare data acquisition computer) and the system was reinstalled on the old computer which was in use for operating TurPol. It is not entire clear what the problem is when running on the new computer, and this will need to be investigated in more detail.

5.13 TurPol

5.13.1 Instrument

It was noted that the dark slide is getting harder to pull out (i.e. close) and this should be checked.

5.13.2 Data acquisition

The old SOFIN computer has been in use for some time to operate TurPol. Due to a problem with the SOFIN software on a new computer (see above) this computer was used again to run SOFIN. When trying to use the computer again to run the TurPol data acquisition program could connect to the TurPol CAMAC crate and moved filters and diaphragms, but no integrations were possible and no counts were received. After extensive trouble shooting it was found that no proper signal was received that initiate an integration at the interface between the CAMAC and the acquisition computer.

After trying several more computers the hardware and software was installed on a computer very similar to the original TurPol and everything started to work again. In fact, this computer was already tried before, but at the time no proper care was taken to be sure that the rest of the system (specifically the CAMAC) was configured properly. In the end we concluded that the problem likely was in the connection between the SOFIN computer and the CAMAC interface board which probably was affected by the re-installation of the connection to SOFIN. Beyond a minor problem caused by a separate program running on the this spare computer (which was quickly removed) the system has worked properly since.

To avoid any potential problem we are looking if we do in principle have another similarly old computer to act as a spare in case of an emergency.

5.13.3 Target acquisition

The new permanent pointing offset option provided in the TCS was tested with TurPol and found to work well. The current telescope pointing being good, this allows the target to always come very close to or inside the TurPol diaphragms, speeding up TurPol target acquisition. To improve the system further the plan is to implement the existing ‘handset’ interface used to center a star on a fiber in FIES, and use it to center the targets more quickly in the diaphragm.

5.13.4 Documentation

Several updates and corrections were made in the TurPol documentation concerning trouble shooting tips, the correct numbering scheme of the diaphragms, data acquisition description and instructions how to mount the instrument.

5.14 Standby Camera and Spectrograph

Extensive effort has been made to define the requirement for a standby camera and spectrograph with capabilities similar to the current ALFOSC instrument. Considerations are the available space, requirements for imaging, spectroscopy, polarimetry, but also for calibration unit, an autoguider unit and an ‘adapter’ unit, the latter taking in to account issues such as access to FIES, installation of its ADC and polarimetry units, requirements for NOTCam which will in principle be mounted permanently at Cassegrain (or just any instrument at the Cassegrain), but also the requirement to be able to mount a standby instrument like LuckyCam at a folded Cassegrain focus. Also, with the use of our FITS archive a more detailed analysis was made of the use of ALFOSC over a period of nearly two years to see what are its mainly used capabilities.

Currently the requirements are being reviewed. For the general design itself there is no specific requirement and any possible design such as having separate imaging and spectroscopic light pathways, using a direct mode or a focal reducer, and/or blue and red arms with their respective CCDs are all possible options. However, it is clear that we need some basic constraints on the design before we can come to a more well defined set of requirements that can used to make a design study.

5.15 Computers and software

5.15.1 Computer cabinet

A computer cabinet was constructed in the back half of the visitor office in the service building at the observatory. Communication wires and power lines were installed and modification were made in the switchboard. All the computer servers at ORM will be installed in the room. This will improve the cooling of and the access to the servers in use.

5.15.2 General computer system

The data server for the observation data have been moved to a 'twin' operations database server. The objective is to keep an exact duplicate of that critical machine, to minimize the possibility of data loss and observing time lost due to hardware failures. Both servers work in a "virtual disk" mode, meaning that the database is saved on both machines simultaneously. The second objective (achieving HA - High Availability) was tested with satisfactory results for most circumstances. Some work is needed to make this functional for all cases and then we can ensure continued service, even in the case of partial or total hardware failure of the primary server.

Over the past few years we've been gradually renewing the hardware on our desktops & and servers. It the moment we just have received replacement for our main "home account & mail storage" server. It's also planned to decommission and replace a number of older desktop machines (for administrative & visitor use) with more modern ones.

Also, a number of aging desktop machines haven't been replaced until now because they are used for operation-critical missions (post-processing, etc), meaning that they're in a "frozen" status as we can't afford to just upgrade them without risking incompatibility issues. The advance on the new post-processing system (and other systems) will allow us to also upgrade/replace those computers, providing a more modern environment for the whole NOT.