Period 35
AiC Report to the NOT Council and STC

47^{th} STC meeting, November 22, 2007
&
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Contents

1 Introduction

This report covers the operations of the Nordic Optical Telescope for period 35: 2007-04-01 to 2007-10-01.

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 35. A total of 118 fault reports were submitted, with an average time lost of 11 min per fault, for a total down time of 1.4% (% on scheduled observing nights). Of these, 80 reported no time lost, 34 reported $<$ 2 hrs lost, and 4 reported 2 or more hrs lost.

Table 1: Technical down time statistic period 35: 2007-04-01 to 2007-10-01

Night included	Time lost	Nights	Percentage[a]	Last period
All nights	1320 min	183	1.4%	0.7%
Scheduled observing nights[b]	1145 min	121	1.8%	0.8%
Technical nights	165 min	27	1.1%	0.3%
Service nights[c]	335 min	24	2.6%	0.6%
Visitor instruments	10 min	17	0.1%	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

This compares to a down time of 0.7% over all nights (0.8% on scheduled observing nights) in period 34. For that period 117 faults reports were submitted with an average time lost of 7 min per fault. Of these, 82 reported no time lost, 35 reported $<$ 2 hr lost, and none reported 2 or more hrs lost.

Although significantly higher than the previous period, the down time is still not very high (it is just above the average over the past 6 semester, and below the average if you go further back). The down time in the last period was very low, and the occurrence of only a few problems makes a significant difference in the overall down time. Specifically, in period 34 there was no fault causing a relatively large ($\geq$2 hr) amount of down time compared to 4 in period 35.

2.1 Weather

For period 35 a total of 180hr 6min was lost due to bad weather which corresponds to 11.1% of all the dark time as compared to 36.9% of all dark time in period 34. The total amount of clear dark time was 1443hr 18min in period 35 as compared to 1284hr 54min in period 34.

2.2 Main problems

Maybe one general thing to note is that there were relative many (small) problems that were related to the introduction of new things (new TCS, FIES, new data acquisition computers and software). Currently, we are trying to develop procedures to minimise any possible problems when introducing new things at the telescope. Below are listed those faults for which 2 or more hours were lost.

- **2007-04-02: Slit offset**: 2 hr 00 m

  This was a problem with centring a star on the slit using ALFOSC. After some time it was realized that the observers were trying to follow old instructions and they were pointed to the correct instructions. A careful check was made of all the instructions on the web and in printed form at the telescope.

- **2007-06-19/20: Azimuth motor brushes**: 4 hr 00 m

  Intermittent problems with the tracking were reported. With the help of the more extensive and detailed logging now available it was quickly realized that the problem was likely caused by the brushes in one of the motors failing. Checking in the day time did not show any problems and it was not clear which of the motors had the problem. As changing the brushes is a fairly difficult task which takes a significant amount of time it was decided to change the brushes in the motor where the brushes had been changed the longest time ago. Further testing after worse did not show any problems either but during the next night again problems occurred, now causing even more loss of observing time. The next day the problems with the other motor were now actually seen during testing, and the brushes in that motor were replaced after which the problems disappeared.

  Already for some time we have plans to make access to the motors easier such that changing the brushes takes much less time but that has been postponed because of the absence of Peter Brandt. We now hope to make these modifications in the near future such that any maintenance or repair work will be easier and take less time.

- **2007-06-06: Calibration lamp**: 2 hr 00 m

  Observations were made with FIES using the simultaneous-ThAr calibration mode. It took some time before the observer noted that the lamp did not work any more. As this was also the first time that there was a problem with this lamp it took some time to replace it.

  We are currently working on a testing procedure that will check various things in FIES (including the calibration lamp) in the daytime and notifies staff if there is a problem.

- **2007-09-17: Slit not aligned**: 2 hr 00 m

  The observers followed properly the procedures to centre a star on the slit and take a spectrum, but did not get the results that they expected. In the end they decided to user a different slit with which things worked as expected. It took some time to find out that this was due to errors in making the set-up. The main error was that the specific set-up was not checked, where it was assumed that a previous set-up would still be valid. On top of that, in the set-up the specific name of the slit was given incorrectly (marked as being a horizontal instead of a vertical slit) which made things worse.

2.3 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 period (34).

Table 2: Down-time statistics for period 35[a]

Syst/Type	Soft		Elec		Optics		Mech		Others		Total		P34	
Telescope	8	00:20	12	06:30	0	–	6	00:05	3	00:50	29	07:45	29	03:10
Building	1	00:00	1	00:00	0	–	1	00:00	0	–	3	00:00	5	00:00
Computers	10	00:00	1	00:00	0	–	0	–	2	00:00	13	00:00	18	03:55
ALFOSC	19	04:50	0	–	2	02:00	2	00:00	2	00:00	25	06:50	24	03:40
MOSCA	2	00:00	1	00:05	0	–	0	–	1	00:00	4	00:05	5	01:00
NOTCam	6	00:00	4	00:35	0	–	1	00:00	4	00:15	15	00:50	9	00:10
StanCam	5	00:20	0	–	0	–	1	00:00	2	00:10	8	00:30	7	00:45
FIES	7	02:55	6	02:50	0	–	0	–	1	00:00	14	05:45	4	01:25
Others	1	00:10	1	00:00	0	–	3	00:00	2	00:05	7	00:15	16	00:05
Total	59	08:35	26	10:00	2	02:00	14	00:05	17	01:20	118	22:00	117	14:10
P34	69	10:10	18	01:15	2	00:00	10	00:30	18	02:15	117	14:10		

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

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	74	15	25[a]	2.4
NOTCam	16	3	9[b]	2.1
MOSCA	18	2	5[c]	3.2
FIES	31	1	5[d]	5.0
SOFIN	11	1	3	3.7
TurPol	2	–	1	2.0
PolCor	4	5[e]	1	4.0

[a] Excluding 15 service nights [b] Excluding 1 service nights
[c] Excluding 2 service nights [d] Excluding 6 service nights
[e] Used to conduct observations for small programs in service mode

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

As before, most comments written in the reports during period 35 were very positive, especially about the support from the staff. However, there was also one end-of-night report which specifically marked the support as 'poor'. In the subsequent end-of-run report this was put somewhat milder as 'not so alert support'. As far as clear, one problem was that the support astronomer arrived a bit late at the telescope (but the visiting astronomer had been informed of that in advance), but the main complaint was that the observer was not allowed to open the mirror covers at the start of the night as the support astronomer was worried about the way the sky looked due to high levels of dust visible during sunset and the observer could not take the flat fields during twilight that the observer wanted.

Apart from comments related to problems that were also separately entered in the fault data base and comments about the weather there were only a few specific comments. There were various comments about FIES (specifically with respect to the 'sequencer' program to operate it and the FIESTool reduction package) which were generally positive, but there were some requests to improve the instructions on the web which have been made in the mean time. There was also a comment about the computer in the visitor office in the service building being old and not including the typical software applications. A new computer was installed with the same operating system and standard applications as we have on our regular computers in the sea-level office.

More mixed comments were received about the various monitoring programs which required regular observers to execute observations in service mode for projects that required ∼daily observations. One of the main complaints was that the observations generally took longer than listed. The main issue there was that the time estimate did not take in to account the time needed to determine the proper telescope focus if the observations required a change of instrument. This should be properly taken in to account in any future allocation. Also, in some cases people did not find the instructions completely clear, and we have tried to improve them. Some very specific remarks were received from an observer with experience in service observing at HST and ESO. Beyond the point mentioned above, the most fundamental point made was that in this person's opinion in principle *no* service mode observations should be scheduled for regular users that requires the use of a different instrument than they use for they own program. This is an issue to consider, but we are specifically working towards making any change in the instrument as easy and fast as possible, also in relation to ToO programs.

5 Operations

5.1 Safety

One issue that has sporadically occurred in the past, but especially happened on various occasions in the last semester is the issue of observers getting to the telescope with out a car (either because they do not have a driving license, or because they do not like to drive up to the observatory on the mountain roads). It is specifically mentioned in the email that is send to the PI when time is allocated, in the email that is send as a reminder to the PI (and whomever is indicated as observer if not the PI), and in the general documentation for visiting astronomers on our web pages that the observer should arrange for their own transport both to the observatory, and to and from the residencia to the telescope at the observatory. In principle, there is no problem if the observers arrange for somebody to pick them up, but we have had the experience that observers walked down several kilometres to the residencia in the early morning cold, and one of the observers actually complained we did not have cars for the observers. Especially in cases of bad weather leaving observers at the telescope without proper transport can be a problem and we will try to improve the information to the observers further.

5.2 Additional services

5.2.1 Class room

A set-up was created to use the Service Building as a classroom for teaching purposes. The main feature of the system is a big screen mounted in the service building where the dual-screen of the data acquisition computer in the telescope control room is reproduced 'life' using two projectors. In this way, a big group in the service building can follow what is happening in the control, including verbal explanations, without interfering with the observers in the control room. In the service building we have provided tables and chairs adapted to the available space. As part of the system we also added microphones and web-cameras so that a good impression can be obtained of what happens in the control room and to allow for communication between the control room and the service building, but this latter part needs to be improved.

The system was first tried during the DARS PhD course and the following Master student course during the Copenhagen guaranteed time, both in August. In general, the experience was very positive, but a more extensive evaluation will be made together with the organisers of the course. In the mean time, we also have used the same set-up with the projectors for night visits by large groups of Icelandic astronomy students and Finnish high school students such that they could get an impression of observing while minimising any interference with observations.

What is clear is that having a total in the order of 12 students plus tutors is the maximum that fits in reasonable in the control room and service building during night time and allow for work of the whole group in the service building in daytime.

5.2.2 Service observing

A total of 24 nights of service observing were made, excluding the 11 SOFIN nights done in service mode by Dr. Ilya Ilyin and the 5 night of technical time with PolCor where Dr. Gøran Olofsson executed various small observing programs in service more. Also, a significant number of observations done for the various ToO and monitoring programs which were executed during technical nights. The service nights consisted of various more or less isolated observing nights spread throughout the semester.

5.2.3 'Fast-Track' Service Program

All the proposals for period 31, 32 and 33 have either been completed or closed.

For period 34 there were 8 proposal, of which there were 6 'grade 1' proposals and 2 'grade 2' proposals. Of the 'grade 1' proposals 3 are completed, one is completed for 3/4, one is completed for 2/3 and one is completed for 1/2. Both 'grade 2' proposals were completed.

For period 35 there were 8 proposal, of which there were 6 'grade 1' proposals and 2 'grade 2' proposals. Of the 'grade 1' proposals, 5 were completed and one is completed for 1/3. Neither of the 'grade 2' proposals have been executed.

As for period 36 we already have 8 proposals. Of these there were 4 'grade 1' proposals, 1 'grade 2' proposal, and 1 'grade 3' proposal. One proposal still needs to be assessed and one proposal was rejected, but we expect it to be resubmitted after some technical and scientific points are taken in to account properly. Of the 'grade 1' proposals, 1 was completed and one is completed 1/2. The 'grade 2' and 'grade 3' proposals have not been executed yet.

5.3 Observing conditions

5.3.1 Weather station

The new 'Vaisala' weather station was installed together with a slightly large lightning pole. An improved communication system was installed which connects now both the old and new weather station over an optical fibre Internet link. This eliminates potential lightning damage to the TCS. In the near future we plan to also included the values from the new weather station in our data base. This will allow for a direct calibration of the new system compared to the old, making a changeover relatively simple and allow for one system to serve as a direct back-up for the other.

Recently there have been some problems with the communication from the old weather station to the TCS and the purchase of the new weather station seems to have been very timely.

5.3.2 Dust meter

In the end our staff have set-up the software to get the data from the dust meter and the values are now entered in our data base where we can use them for analysis. The idea is to integrate the measurements in our weather pages.

5.4 Building

5.4.1 Safety system

The material to add an audible alarm outside that sounds when the alarm system is triggered was purchased but still needs to be installed. Also, preliminary plans have been made to move the whole system of status indicators and reset buttons to the control room to provide a better control and overview of the whole system.

5.4.2 Drive System

Currently we are purchasing the components for a new drive system for the telescope building. This includes four motors, amplifiers, servo control electronics and cabling. Some tuning of the system and the TCS is needed and this will also include some down-time of the telescope. The change of the system is planned spring next year.

5.4.3 Rain sensor

The setting of the rain sensor and the way the signal is processed by the TCS has been altered to avoid the occasional spurious alarms. The new set-up has been shown to work properly and we have not had any report of spurious alarms since it was installed.

5.5 Telescope

5.5.1 New TCS

The problem with the communication between the new TCS and the data acquisition programs have basically been solved by changing the way this communication works. For this a new sequencer for the TCS was developed and implemented using the new socket-based interface to the TCS.

Also during this semester various minor upgrades were implemented and work is progressing on the documentation and the logging system.

As part of the set-up provided when using the service building as control room, and in general when using any part of the observing system remotely, a TCS Display application was made. This application can be run on any observing system computer and provides a small window with basic TCS information (coordinates, telescope status, etc). We are planning to extend this application to include the option to display information from the guide star system (e.g., relative position of the star, total measured intensity) such that the guide process can be monitored (e.g., to see if the star does not move out of the box, or if the guide star gets very faint because there are clouds).

5.5.2 Pointing

A new pointing model was made after the first pointing session with the new TCS. This has made a marked improvement to the pointing and also seems to have removed the unexplained variations in the pointing as a function of the time since the telescope power is switched on.

Together with the auto detection and centring system described below, this should allow to provide very accurate pointing.

5.5.3 Tracking

Analysing how the system corrects for periodic encoder errors due to the gears it has been realized that the way these corrections are applied are probably the cause for the residual periodic variations seen in altitude. The variations in the encoder values caused by the imperfect shape and/or centring of a gear are a fixed function of the turns of the gear or, equivalent, a periodic variation as a function of encoder steps. However, while in azimuth a certain amount of encoder steps will cause a certain amount of movement on the sky independent on where you point the telescope (assuming a properly balanced telescope), in altitude flexure will cause a certain amount of encoder steps to be a variable amount of movement on the sky depending on the altitude of the telescope. As the periodic error corrections are applied in degrees on the sky the correction is expected to work well in azimuth but cause residual periodic errors in altitude which vary as a function in altitude (as observed). The way the periodic error corrections are applied in the TCS software will be changed to improve the correction.

5.5.4 Focus

As part of simplifying the switch over between different instrument, focus offsets have been determined between StanCam, and ALFOSC, NOTCam and MOSCA. Although there are variations in the zero-point focus from night-to-night and over the longer-term, the focus offsets appear to be stable which would make a switch of instrument easier, but this needs to be checked in more detail.

5.5.5 Autoguider

When investigating the issue of the telescope pointing it has been noted that also errors of the guide probe can cause variations in pointing. The position of the guide probe is defined in turns of 1024 encoder steps (each ∼0.007 arcsec), where the system keeps track of how many turns has been made by checking the position frequently and deciding that a turn should be added or subtracted if there is a sudden change from large to small encoder values (or vice versa) is detected. This does allow for the possibility that some turns are missed (corresponding to 7 arcsec) which might accumulate over time. It turns out that the guide probe was only reinitialised when ever the TCS was rebooted. This has been changed such that sending the guide probe to park position will initialise the probe. The TCS now also monitors the behaviour of the guide probe and warns the observer if it detects a possible loss of turns.

A system is under development where guide stars are automatically detected and fully automatically (or after selection by the observer) moved into the guide box after which guiding is switched on. This system still needs to be verified under varying (weather) conditions, but it is clear that the automatic mode can not be used under all circumstances. One of the problems is the relative small computing power of the TCS computer, and the current plan is to move the image from the guide camera that is used to detect the stars to another computer. With the increased computing power and the possibility to use sophisticated image processing software that are widely available it should then be possible to make a very reliable search and detect program. This would allow the process of selecting a guide star to be controlled without direct interaction with the TCS. Together with the information about the guide star we plan to provide on the TCS Display application described above, this would provide the possibility to control the whole process of pointing the telescope, selecting a guide star and following the guiding process as part of remote observing applications.

5.5.6 Mirror support system

We have had some problems with the mirror support system. The head of the compressor that was installed some months ago did not work properly and a new head was ordered and installed. As we had directly purchased a new spare compressor when the last unit broke this did not cause any problem as the new spare unit could be used. There was also some problems with the dryer of the compressor system which required some modification of the system.

5.5.7 Balancing

We have been thinking of improving the balance of the rotator, especially for the cases that asymmetric instruments are mounted as this can cause problems if for some reason the telescope has to be powered-on when pointing some distance away from zenith. One of the problems was that the movable counterweight for various instruments already has to be set to the highest value where adding any extra weight to the rotator would require to add weight to the top part of the telescope to compensate. However, it was found that with the additions of weight to the telescope as part of the new TCS, the balance has changed and the movable counterweight settings are significantly lower, being close to the lowest value when no instrument is mounted. This now opens the possibility to add weight to the rotator and balance it properly.

5.5.8 Amplifiers

Most of the work has been completed in preparation for the new alt/az amplifiers for the telescope, and their installation was planned for October, but when looking at exactly how it would interface to the TCS it was decided it would be safer to incorporate some better isolation between the amplifier power and the TCS power lines. This has resulted a some changes in the design that have already been defined but still needs implementing. A general software switch has been made in the TCS which will allow to simply switch from the old to the new system.

5.5.9 Encoder electronics

New replacement electronics for the Inductosyn incremental encoders has been purchased. This was done because all the existing electronics are as old as the telescope where it will be hard to find proper spares in the future.

5.5.10 Remote observing

A fundamental issue when allowing remote operation of the telescope is safety. We are currently working on plans for a video surveillance system and an alarm system that controls access to the telescope building and the observing floor.

5.5.11 Wavefront sensing

Using the ALFOSC WFS setup a lot of data has been acquired but it has been found difficult to interpret the results. Attempts to apply corrections based on the ALFOSC WFS results have not been successful.

Using the analysis tools for the image quality database which provide ellipticity, position angle and seeing for all the individual images we have looked at the applied active optics astigmatism correction and the resulting ellipticity and position angle, where the proper corrections should produce images with a random distribution of position angles with small ellipticity amplitudes. However, results on different occasions are not consistent.

It is currently unclear how to proceed, also because we do not really have in-house expertise to study this problem in more depth.

5.5.12 Mirror cleaning

Occasionally the mirrors have been cleaned with CO_2 and washed, and currently the measurements show that the reflectivity of both mirrors are only slightly degraded compared to the values shortly after aluminisation. Also given that we will likely be able to wash the mirror more often with the return of Peter Brandt, there is no need for an aluminisation of the mirror(s) in the near future.

5.5.13 Adapter

Most of the hardware has been prepared to reduce the amount of cabling and connect power cords around the adapter, but it still needs to be installed.

5.6 Imaging Quality Control

All the imaging data from the past several years have been processed and entered in to our image quality data base. The analysis of these data have already proven to be very useful in checking the optical quality of the telescope, where it is clear that the current image quality is no longer affected by the tracking problems reported in the past, and regularly very good image quality is reached with all optical imaging instruments everywhere on the sky. The fact that there is no strong trend toward more elliptical images for the best seeing measurements shows that any image distortion in the system (mechanical or optical) is not very large.

We now also have an automatic focus analysing program for ALFOSC, where extensive tests has show it to be very reliable and we are now developing a script which will automatically take focussing data, process it and apply any necessary correction to the focus. This application is specifically intended for observers that need to do observations with ALFOSC when they are not using that instrument themselves.

5.7 Photometric zero-points

No progress has been made with setting up a general photometric zero-point data base. The current plan is to first automate the photometric reduction programs and standardise the results for ingestion in the data-base. This data base will provide a way to better monitor the performance of the telescope and can be used by astronomers in the analysis of their data.

5.8 Filters

A filter data base has been set-up which includes minor modifications to the filter names as used in the FITS headers, and includes the measured thicknesses of the filters. In the future this will be used to automatically calculate the required telescope focus offset when using a filter in the convergent beam, e.g., when installed in FASU or in StanCam.

5.9 Observing

5.9.1 Observing set-up

We have continued work on simplifying the general set-up of the observing system such that it is easy to start-up the system. The main objective is to make it easy to switch from using one instrument to an other. In general, it is now well defined and documented how to switch between the main Cassegrain instruments and FIES, but it is still needed to better define the change from FIES to the Cassegrain instruments. The main work is now in making scripts which automate these tasks as much as possible. In certain cases this also includes developing new commands/procedures to allow things to be execute from a script.

Also, a 'clean-up' script was develop for the 'obs' account on the data acquisition computers that removes all the files which are not necessary and restore things to a standard set-up. This script is in principle ran at the start of each observing run.

5.9.2 Script generator

The observing script generator has now been extended such that scripts can be uploaded to the observer's account at the telescope in a sub-directory corresponding to the proposal number. With the introduction of the sequencer for the different instruments the generated scripts need to be made compatible. A preliminary version generating sequencer compatible scripts for ALFOSC has been made. With the ability of the sequencer to talk to various subsystems there is a need to significantly expand the capabilities of the script generator. A specific objective is to integrate as much as possible the instrument and telescope operations in the script generator. This will simplify observing and increase efficiency.

5.10 Detectors

One of the limiting factors on the efficiency of observations are the current slow, outdated detector controllers. An upgrade to more modern, state-of-the-art controllers is needed. This will also require an upgrade of the data acquisition system. A definite decision about which detector controller we will select is expected to be taken around the end of the year, after which we will define a more detailed plan. We will start the detector controller upgrade program in the next period (37).

5.11 ALFOSC

5.11.1 Detector

Various more tests were made to identify the source of the noise in the ALFOSC detector. The tests included swapping the ALFOSC dewar+detector with the StanCam detector. No noise was detected in the StanCam detector, and when re-installing the ALFOSC detector the noise had disappeared. It is still not clear what the cause of the noise was, but the noise has not been seen again.

5.11.2 Data acquisition

The main development has been the successful testing, and commissioning of the sequencer for ALFOSC. This also included a significant update and change of the documentation. The changeover has been very smooth, and in general people are very positive about the possibilities of the system. Currently there are already various sequencer observing scripts that are commonly used. We intend to review the different scripts during the semester and see which ones are truly of common interest and what is needed to make them proper standard scripts.

5.11.3 Spectroscopy

A task to put 2 stars on the slit was developed for the sequencer. The plan is to also make other post-processing tasks sequencer tasks, in general those that are directly related to observing (like 'slitoffset'), where tasks that are to further analyse a resulting image can/should be post-processing tasks.

We still need to define and update the efficiencies and amount of fringing with CCD#8. The vertical 0.5 arcsec slit was scratched and will be replaced. Also, an inventory will be made of all calibration lamps to see if sufficient spares are available.

Vallery Stanishev (Stockholm University), who regularly uses ALFOSC for a ToO program on SNe, has quantified the 2^{nd}-order contamination when using grism 4 without an order sorter filter. Based on this he has developed an empirical method to correct low-resolution astronomical spectra for second-order contamination. For SNe, which have broad spectral features, this method works very well. The results have been published in 'Astronomical Nachrichten' and a copy of the paper is provided on the ALFOSC web page.

5.11.4 Polarimetry

A quick-look linear polarimetry imaging reduction tool was developed which measures polarisation from four consecutive exposures where the user needs to mark the images of the target in the first image. The program will be further developed (specifically the error estimate) and the documentation will be expanded.

After some delay, astronomers from the Instituto de Astrofísica de Andalucía and from the DARK institute in Copenhagen have now received all the funding and have started a project to purchase a Wedged double Wollaston (WeDoWo) to do linear polarimetry with ALFOSC. We expect to receive and test the WeDoWo before the end of the current period.

5.11.5 Focus measurements

The ALFOSC focus measurements in the data base were analysed and no obvious trends were found indicating that the standard correction (as a function of altitude and temperature) are adequate. However, the data do show a large scatter and there is also a long term trend which clearly shows the need to measure the focus each night.

5.12 NOTCam

5.12.1 Detector

To correct the design error which causes the varying 'dark-current', a plan for the electronics upgrade has been made on the basis of the information we have from Preben Nørregaard (CUO) regarding a new printed-circuit-board to be installed and tested in NOTCam. This work will start the 21^{st} November 2007. We will install and commission the new Science Grade Array as soon as the array electronics has been modified, tested, and found to improve the dark current. This is preliminarily scheduled for early December.

Recently, interference pattern have intermittently been seen in low background images. It is similar in appearance to the pick-up noise problem we used to have before 2003. However, the read-noise on the detector is not affected. It appears now and then, and when it is visible the peak-to-peak amplitude is at most 5 ADUs, i.e., much lower than the typical 20 ADU we had before. Some tests were made to localise the source of the noise, but without success.

5.12.2 Data acquisition

The way the telescope offset command in the data acquisition programs work, e.g., used in beam-switch mode which typically involves telescope offset sizes of 240 arcsec, has been improved. There is a allowed region for the guide-probe. In the past, a telescope offset which would move the guide probe outside the allowed area would not be executed. If this happened in the middle of script doing a dithering pattern this would mean that subsequent images would be taken in the wrong place. Now, the guide probe is stopped and autoguiding is switched off but the telescope offset is still performed. The observer can then acquire a new guide star and restart guiding without loosing the observing sequence.

To avoid images being effected by an integration starting before the telescope has come to a complete rest, some fine-tuning is still needed in the dithering procedures. Tests with very large dither steps (240 arcsec) and very short exposures (3s) with the HR camera in very good seeing (0.3 arcsec) have given some elongated/double stars. This must be improved at the TCS level such that a feedback is given from the TCS when the telescope is fully at rest (i.e., tracking/guiding). In this way the offset command given from the instrument knows when to start guiding. If guiding is started when the star is in the corner of the autoguider box, the telescope will be moved to get the star in the centre, and for short exposures in good seeing this produces elongated or double stars. While waiting for such an implementation in the TCS, sleep commands must be added in the scripts for observations with large dithers. Implementing a proper system will optimise the whole procedure as no exposure will be started too early or too late.

The first tests of the sequencer for NOTCam are under way and depending on the results it will be decided when to offer the sequencer in visitor mode. A plan will be made to define all the changes (specifically documentation) that are needed for a proper changeover.

5.12.3 Imaging

New test images were obtained under 0.3 arcsec seeing with the HR camera to see if there is any affect introduced by the vibrations of the PTR cooler. Taking data with the PTR on and off it has not been possible to see any difference in the average PSF.

The plate scale for the HR-camera was determined (0.078 arcsec/pix) and the optical quality found good all over the FOV. For a seeing of 0.44 arcsec on a combined image made of 9 shifted and added individual images, the stars have ellipticity 0.02 to 0.05 all over the FOV. See

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

5.12.4 Spectroscopy

A 'quick-look' post-processing procedure for spectroscopy still needs to be made.

5.12.5 Polarimetry

A few tests were made with the current polarimetry mode available (4 polaroid sheets) observing zero-polarisation standards and high-pol standards, but the results are somewhat inconclusive. It is not clear whether this is due to variable sky, the observing strategy, or the quality of the polaroids (or a mixture). However, with the sequencer it will be possible to cycle through all 4 polaroids per dither position. This is believed to be a better observing strategy. With the sequencer further polarimetry tests will be made and the results will be documented on the web.

It is suggested to upgrade NOTCam with a better mode for linear polarimetry that is 1) more sensitive and 2) less vulnerable to sky transparency variations. Using Wollaston prisms both the ordinary and the extraordinary component (of the orthogonally polarised beams) are obtained in the same exposure and sky transparency variations will cancel out. The requirements, proposed solution and a cost estimate are currently being defined.

5.12.6 Imaging calibration plan

As part of the calibration plan, JHKs photometric zero-points are provided on the web, and flat fields and bad pixel files are made available from an archive on the web. The streamlining of the analysis and database input still needs some more work.

5.12.7 Quick look reduction

The quick-look reduction tools available since April 2007 will be upgraded to include reduction scripts for the beam-switch mode, as well. In the new version it will be possible to use the RA/DEC keywords to define the shifts such that only one script is needed for any small step dithering pattern and another one for beam-switch dithering observations. Until now the RA/DEC values output from the TCS to the image header keywords were too inaccurate, but the cause of the problem was recently found (output coordinates were not corrected for periodic errors of the encoders). A future version will also include a script for reducing polarimetric observations.

5.12.8 Wheel bearings

It is now approximately 2 years ago that the wheel bearing were replaced and to avoid possible problems we had planned to replace them in the coming year. Taking the opportunity that NOTCam will be opened to replace the printer circuit board and install the science array we have decided to move this forward and already change the bearings now.

5.12.9 Motor Controllers

New code has been installed and tested for all the NOTCam wheels and the shutter. The instrument users interface software will have to be updated to generate the proper error status. The focus motion still needs some work. This is somewhat complicated due to hysteresis in the focus movement.

5.12.10 Cooling

NOTCam has not been open since the 19^{th} of January 2007 and the the vacuum behaviour has been very good since the vacuum leak problems were fixed. In principle, while being stored off the telescope NOTCam can be kept cold using only the PTR cooler, but in practice it is much safer to always have it filled with LN2 (which means refilling every 5-6 days) in the case of power-cuts due to bad weather or any PTR failure. An automatic warning system is now set-up with a conservative temperature limit. Even if the warnings start going off in the evening, it is safe to wait until the next morning to fill NOTCam, provided that the PTR is running well.

The maintenance of the PTR cooler (consisting in changing the compressor oil filter and the rotary valve for helium flow) has been going on since May 2006. After having received 3 rotary valve units (one wrong model, two tested but malfunctioning) our contact person at Kelvin International Corporated has arrived at the conclusion that our PTR rotary valve was fabricated according to a special design. All documentation on this unit is lost, and the only way to get it maintained is to send our working unit back to Iwatani in Japan for documentation and back-engineering. We have been told that they are capable of doing this in one week. Therefore, the rotary valve will be dismounted, packed and shipped over the period we are working on the detector and wheel bearings (see above), and a new rotary valve should be back before the end of the year.

Because it has been so difficult to do the PTR maintenance, we have been looking around at alternative solutions. The PTR solution was once selected because it has a cold head with non-moving parts with essentially infinite lifetime, provided that the oil-filter in the compressor is maintained well. There is also no need for special anti-vibration mountings, as is the case for other coolers. Prices for a system similar to the PTR are around 15 000 Euros.

5.13 FIES

5.13.1 Aftermath of lightning storm

As a consequence of the lightning strike on the FIES building in March 2007 a lot of time was spent identifying and repairing damaged parts of the instrument electronics. During the work it was necessary to move the CCD controller and for no clear reason this resulted in an increase in readout noise from the detector. Repositioning the controller, switching things off, it was impossible to return to the original 3e- noise level. Eventually, after removing most of the control electronics to the front room the excess noise disappeared though the exact reason for this is not understood.

After replacing the FIES temperature monitoring system that was also destroyed by the lightning, noise was seen on all the temperature readings. The source of this noise has not been identified, though the actual temperature sensor units themselves are suspected, and has been found to have a frequency that vary with a period of 11 to 16 seconds. A preliminary solution to this has been to apply a software filter to the data before recording.

Also, shutter electronics, the electronics of the FIES camera focus mechanism, and the bottom calibration unit that were 'affected' by the lightning storm were repaired.

In the mean time, a new lightning protection was designed and is being installed. This system is separate from the lightning protection of the telescope building and has its own grounding point close to the FIES building. The damage to the FIES building was primarily caused by the relatively large distance to the telescope building which did not provide sufficient protection when lightning hit the FIES building.

5.13.2 Building

The 12 temperature sensors (with 0.01 degree accuracy/precision) were re-installed in and around the spectrograph. These are necessary to relate any Echellogram shift to physical phenomena on the spectrograph table, and for further tuning of the temperature stability. These sensors are now part of the general data base of the thermal monitoring system (TMS).

The area in front of the main door and the roof-stones were painted white to attempt to increase the FIES-room temperature stability. For the same reason, a metal screen was installed on the west wall to reduce the effect of heating by the sun. Also, a new (bigger) ventilation fan was installed in the front room. However, during warm days the temperature inside the building still goes above the reference value. Solutions are either to increase the temperature which we try to maintain, or add active cooling. Both these solutions have there disadvantages. It was also suggested to use a different reference temperature in summer. This is not the preferred solution, but maybe it is the 'easy' thing to do.

An other issue with the temperature in the FIES room are the oscillations introduced by the temperature control loops, and it is clear that the on/off control loops need the be replaced by proportional loop electronics. This should both remove oscillations and make excursions around the reference temperature smaller.

5.13.3 Fibre bundle

Given the low efficiency of the high-resolution fibre and the fact that due to a manufacturing error the medium-resolution simultaneous-ThAr mode could not be used it was decided to prepare and install a new fibre bundle. This was done in June 2007 together with people from Aarhus University in Denmark and Gerardo Avila from ESO. Unfortunately, only 3 out of the 4 fibres worked properly but the 3 show optimal throughput. As the 4^{th} fibre does not work, the planned 'simultaneous sky spectrum mode' cannot be offered. The new bundle does offer, besides the high-resolution simultaneous-ThAr mode, now also medium-resolution simultaneous-ThAr mode. The efficiencies of the new bundle were entered in the Exposure Time Calculator. One thing that still needs to be decided is whether to upgrade the old fibre bundle to serve as a proper spare.

5.13.4 Instrument

In the coming period we plan to make baffles around the Halogen lamp vent in the calibration unit at the telescope to block light pollution of the dome. We also plan to test and install an exposure meter inside FIES which is being developed and build by people in Aarhus.

One thing that was noted is that when using the simultaneous-ThAr mode there is an issue of contamination of the stellar spectrum by the (strong) arc lines when the star is not very bright. It should be investigated what is the optimal solution as a function of the signal in the stellar spectrum and the arc spectrum, the stellar spectral type (e.g., early type stars have very few lines), and the required accuracy.

5.13.5 Atmospheric dispersion corrector

A redesigned atmospheric dispersion corrector (ADC) was delivered from Denmark. Tests on the bench were done to verify operation and it seemed to work though some problems were encountered particularly with significant delays in the response of the program to the movement of the arm. The ADC was mounted in the adapter but when it was requested to move it failed. The ADC was then removed from the telescope and testing back on the bench found that one of the mechanical relays used to control the arm was sticking. Also during this test the spring plate used to move the arm broke off, probably due to fatigue. A new spring plate was designed and delivered by Niels Michaelsen (CUO) and modifications to the arm made to accommodate this. Because of the long delays of controlling the arm motion over an Internet connection it was decided to change the control of the arm motion to be directly operated through the TCS input/output system, making the timing much more accurate. After a closer look at the relay electronics board it was found that this could be replaced by a proper motor controller single integrated circuit. A new board has been design to do this. Also, all the electronics that were originally mounted on the ADC will be moved to a separate control box mounted outside the adapter to allow for easier access. It is hoped that the ADC can be installed again early next year.

5.13.6 Target acquisition

With StanCam not also working in sequencer mode, the whole operation of FIES can be made in sequencer mode. Specifically, this allows the target acquisition to be streamlined further using sequencer scripts. This will need to be tested and documented before it can be offered.

5.13.7 Focussing

In principle there is one general telescope focus setting for all fibres. However, we will test the optimal telescope focus for each fibre in more detail by checking count rates at the FIES detector as a function of telescope focus. A script will be made to simply the focussing for FIES.

5.13.8 Reduction software

With the help of Eric Stempels (St Andrews University) the FIESTool reduction package is being improved to enable automation of the pre-reduction of calibration images. An automated calibration script will be made that ensures that basic calibration frames are taken for FIESTool. The wavelength solution in FIESTool will be improve allowing for new ThAr frames to be used automatically. There will also be a way to use the ThAr frame obtained closest in time to the target spectrum.

5.13.9 Calibration plan

As part of the work toward a complete calibration plan, scripts will be made to monitor the radial-velocity stability of the system. Also, the results of the FIES detector quality control scripts and the results from the FIES standard-star efficiency measurements will be incorporated in the main NOT database, and an automated procedure will be made for the temperature-stability analysis (based on Echellogram shifts). The specify wavelength zero-point accuracy will be defined for observations with and without simultaneous ThAr mode.

The final objective is to define and set-up a system that defines and monitors the accuracy and stability of the system which describes the properties of the system and indicates if there are any problems.

5.13.10 Spectro-polarimetry

There is still nothing clear about an spectro-polarimetry option with FIES.

5.13.11 Solar experiment

A solar experiment was set-up to measure solar oscillations using FIES by observing the blue sky with a bare fibre. On the outside of the FIES building a small box was installed which contains an iodine cell in front of an optical fibre. The fibre goes through the wall in to the FIES building and can be connected to the instrument.

The experiment will provide input to feasibility studies of the SONG network by establishing a partial prototype of a key part of the SONG instrument. In particular, it will give us experience with the analysis of iodine-stabilised data. Furthermore, this experiment will provide an indication of whether an iodine cell should be installed permanently as a front-end to FIES.

5.13.12 Documentation

Many improvements were made to the documentation, both in the instructions for the support staff and in the user manual. Also, instruction were prepared for the monitoring programs. The mechanical drawings of the different parts of the system have been added to our web data base. Currently, the main part missing is still a maintenance manual.

5.14 MOSCA

5.14.1 Data acquisition

The main development will be the testing and commissioning of the sequencer for MOSCA, included a significant update and change of the documentation. As the instrumental set-up is similar to StanCam and basically all the required interfaces have been made for either StanCam or ALFOSC (FASU) we expect this to be a relatively simple task.

5.14.2 Detector

Some more tests were made to test the alignment of CCD #7 (the former ALFOSC CCD) that was installed a few months ago when one of the CCDs from the original mosaic failed. A direct comparison of the different CCDs show that CCD # 7 has a slight offset and tilt with respect to the average of the other CCDs, but the differences are similar to the tilts seen in the other 3 CCDs and the offsets between them. We, therefore, conclude that the CCD is fairly well aligned, but tests under very good seeing conditions are needed to see if small changes to the mounting of the detector cryostat might optimise the alignment of the whole mosaic a bit more.

5.15 StanCam

5.15.1 Data Acquisition

A sequencer for StanCam has been the successful tested and commissioned. An update of the documentation was made.

5.15.2 CryoTiger

As a consequence of a failure of the hoses of the StanCam Cryotiger it lost gas and stopped cooling. The location of the leaks were found and as an emergency solution the hoses from FIES were used for StanCam. While this was done the self sealing valves of one of the hoses failed and more gas was lost. The damaged hoses were repaired on the island but one of the repairs still had a small leak, this second leak was also repaired. With the assistance of the Liverpool Telescope we were able to refill both the StanCam and FIES cooling systems but the operating temperature of the FIES system is now only -160C, where -200C is expected. This is believed to be due to contamination of the cold-head and we are planning to de-contaminate the system.

Replacement gas and a new set of hoses were purchased but took a very long time to arrive.

5.16 SOFIN

No further news has been received.

5.17 Computers and software

A lot of effort has gone in to the migration to the new web server. It is expected that we will make the switch to the new system sometime beginning of December. Most noticeable for the outside world will be a new weather page, with real-time measurements of the dust levels and external seeing and extinction measurements. Internally, the switch to the new server and the usage of dedicated database servers makes our setup much more secure and flexible.

5.17.1 Network

A wireless system is now provided by the IAC at the residencia.

The bandwidth of the network link from the observatory to Tenerife is being increased further to 1Gb at a relatively small increase in price. This increase in bandwidth is especially of interest for such things as remote observing as part of summer schools. However, this link does not include the NOT sea-level offices, and together with the ING we are now arranging for a separate connection to this high-speed line. This connection will only be 100Mb, but that is still a significant increase.

5.17.2 DVD Jukebox

We still continue to have problems with the DVD jukebox and can therefore not use the automated data saving system. It was found that the system suffers from hardware problems (probably due to excessive heat), and so it writes an excessive number of bad DVDs, and the system suffers from software problems, possibly due to interactions with the kernel. The latter is not easy to reproduce and therefore hard to fix. As a result, we had to go back to the old data saving system and we are still looking for a solution.

5.17.3 General computer system

Two new laptops were purchased and setup. We plan to use the old laptop that was used as 'travel' laptop by the staff as a permanent computer at the residencia.