Period 31
AiC Report to the NOT Council and STC

43^{rd} STC meeting, November 28, 2005
&
48^{th} Council meeting, November 29, 2005

Thomas Augusteijn, Astronomer in Charge,
NOT, Santa Cruz de la Palma

November 23, 2005

Contents

1 Introduction

This report covers the operations of the Nordic Optical Telescope for period 31: 2005-04-01 to 2005-10-01.

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 31.

A total of 101 fault reports were submitted, with an average time lost of 24 min per fault, for a total down time of 2.8% (2.3% on scheduled observing nights). Of these, 58 reported no time lost, 38 reported < 2 hrs lost, and 5 reported 2 or more hrs lost.

Table 1: Technical down time statistic period 31: 2005-04-01 to 2005-10-01

Night included	Time lost	Nights	Percentage[a]	Last period
All nights	2430 min	183	2.8%	1.2%
Scheduled observing nights[b]	1390 min	128	2.3%	0.9%
Technical nights	90 min	26	0.7%	4.1%
Service nights[c]	790 min	28	6.3%	3.4%
Visitor instruments	950 min	29	6.8%	0.4%

[a] Assuming an average of 8 hr per night
[b] Excluding technical nights and visitor instruments
[c] Excluding service nights with SOFIN

This compares to a down time of 1.2% over all nights (0.9% on scheduled observing nights) in period 30. For that period 84 faults reports were submitted with an average time lost of 16 min per fault. Of these, 58 reported no time lost, 24 reported < 2 hr lost, and 2 reported 2 or more hrs lost.

Comparing to the last few semesters the overall downtime is significantly higher. The main difference with the last few period is that the 2 main problems that occurred were difficult to solve and caused downtime over several nights. One of these problems occurred during a service observing run and one during an observing run with a visiting instrument, which caused the down time for these categories to be very high.

2.1 Main problems

Below are listed those faults for which 2 or more hours were lost.

- **2005-05-24/27: Power supply unit of the azimuth drive**: 12 hr 05 m

The power supply unit of the azimuth drive of the telescope failed intermittently, often working for extended periods before failing again. This made it very hard to find the cause as several attempts at solving the problem actually resulted in the telescope working again for more than an hour before failing again. In the end, replacing the power supply unit solved the problem and it was noted that there was a poorly soldered diode in the unit which might have caused the intermittent failure. Also, as a result of the problems the hydraulic pads of the telescope had become displaced and had to be realigned.

- **2005-07-24/25: Azimuth power amplifier**: 11 hr 50 m

  Successive crashes occurred in which the telescope started to oscillate before failing. This also caused one of the hydraulic pads of the telescope to become displaced which had to be realigned. The main obstacle in solving the problem was that error messages given by the PLC control unit were not very specific. The PLC code was modified after which it was found that the error was due to one of the azimuth power amplifiers. The amplifier was replace, and we are currently looking for a spare.

- **2005-08-09: Tripped fuse of computer rack**: 2 hr 45 m

  The data acquisition system failed because for a still unknown reason the fuse of the computer rack was tripped. This brought down part of the data acquisition system. Several problems in bring the system back up caused the relatively large amount of downtime. We are planning to change the system such that each computer has its own fuse and one tripped fuse does not bring down the whole system.

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 period (30).

Table 2: Down time statistics for period 31[a]

Syst/Type	Soft		Elec		Optics		Mech		Others		Total		P30	
Telescope	5	00:40	23	19:35	0	–	6	07:45	5	00:25	39	28:25	26	12:25
Building	0	–	4	01:30	0	–	3	00:00	2	00:00	9	01:30	15	00:30
Computers	16	01:15	3	02:45	0	–	0	–	0	–	19	04:00	15	01:45
ALFOSC	8	01:50	1	00:05	2	00:00	1	00:10	2	00:00	14	02:05	9	05:55
MOSCA	2	00:00	0	–	1	00:00	0	–	1	00:00	4	00:00	2	00:00
NOTCam	1	00:00	3	00:15	0	–	2	00:45	0	–	6	01:00	6	01:35
StanCam	0	–	0	–	0	–	3	00:00	1	00:30	4	00:30	5	00:10
Others	0	–	1	00:30	0	–	3	02:30	2	00:00	6	03:00	6	00:00
Total	32	03:45	35	24:40	3	00:00	18	11:10	13	00:55	101	40:30	84	22:20
P30	20	03:20	21	10:55	4	00:00	27	07:35	12	00:30	84	22:20		

[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	110	14	34[a]	2.6
NOTCam	31	4	8[b]	3.1
MOSCA	4	–	1	4
SOFIN	17	1	4	4
TurPol	10	1	2[b]	4
LuckyCam	4	2	1	2
IACUB	3	–	1	3
Aluminisation	–	4	–	–

[a] Excluding 9 service nights
[b] Excluding 2 service nights
[c] Excluding 1 service nights

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

As before, most comments written in the reports during period 31 were very positive, especially about the support from the staff.

Apart from comments related to problems that were also separately entered in the fault data base and comments about the weather there was only one specific request to increase the volume of the sound from the data acquisition computer such that it is clear when an exposure finishes. We hope that with the new data acquisition computers and operating systems this can be improved.

5 Operations

5.1 Environment

Also this summer the weather has been very poor, with especially the second half of the semester being much worse than normal. Also, in September there was a Forest fire which came very close to the residencia and cut-off access to the observatory. For safety reasons the observatory was closed for 3 nights. Fortunately, the smoke and ashes from the fire did not caused any problems at the telescope.

5.2 Safety

Following the installation of an improved system for the reception of radio signals we have bought a base station for the service building and two receivers for the cars. The base station has been installed and the radios for the cars will be installed in the near future.

The issue of the roads to the observatory often being officially closed when they are in principle passable and can be used by the staff from the observatories was discussed in more detail in the CCI Observatory Sub-Commission meeting where progress was reported in negotiating with the local authorities.

5.3 Additional services

5.3.1 Publications

A search was made using the online "full text" search engines (searching for "Nordic Optical") supplied by A&A, MNRAS, and ApJ (which includes AJ and PASP). In total more than 70 refereed publications were added to the publication lists from different years. See

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

5.3.2 Educational activities

As over the past few years a course in observation astrophysics was organized by Stockholm University using the telescope over a period of 5 nights in May. Unfortunately this time the course was heavily affected by the problems with the power supply unit of the azimuth drive and a large part of observing time was lost.

Also, a NORFA-sponsored summer school in Lithuania used the telescope remotely over a period of 4 nights in August. Observations were done using the fast-photometry software running in a remote xterm, while the data were automatically copied to our ftp server for retrieval. The operation of the telescope was done by the NOT staff.

5.3.3 Service observing

A total of 12 nights of service observing were made, excluding the 16 SOFIN nights done in service mode by Dr. Ilya Ilyin. This also does not include a fairly extensive number of observations done for the various ToO and service programs which were executed during technical nights. The service nights consisted of various more or less isolated observing nights spread throughout the semester.

5.3.4 'Fast-Track' Service Program

As decided by the STC, and in collaboration with the head of the OPC, a Service Observing Program has been set-up which has become operable at the start of period 31.

The system that was set-up to receive, evaluate and grade the proposals worked successfully. For the execution of the observations a data-base system was set-up as a tool to assist in selecting the observations to be executed in service mode in an optimal way. This system also serves as observing log and administrative tool, and automatically notifies PIs if observations were made for their proposal. As part of the system the data are automatically copied to the ftp server were the can be retrieved by the PIs.

A total of 8 service nights were spread-out over period 31. During the semester a total of 10 proposals were accepted for execution, of which 9 requested observations with ALFOSC and 1 requested observations with NOTCam. At the end of the semester 2 out of the 10 proposal had been completed. It should be noted that the large majority of the proposals arrived in the middle or toward the end of the semester. Furthermore, most proposals have relatively strong requirements for the observing conditions which together with the relatively poor weather conditions largely explains the low completion rates.

5.4 Observing conditions

After talking with people from the IAC during the CCI meeting in Liverpool in May the dust meter was finally installed in the NOT service building. Unfortunately some problems arose with the software needed to download the data to a computer. At the moment we are still waiting for the software which will be installed on a computer supplied by the IAC.

5.5 Building

5.5.1 Cooling system

Work on the cooling system continued throughout the period. By the end of period 30 the new system was ready and the final switch to the new system awaited the new rotary valve to be installed as part of the move of FIES to its building. This later was foreseen for September but was delayed to the second half of October (see below).

5.6 Telescope

5.6.1 New TCS

Due to work on the cooling system, the aluminisation of the mirror, work on the FIES building and the installation of the science grade array in NOTCam the remaining hardware needed to be build for the adapter and mirror control has been delayed. The software effort has been concentrated on the development of the user interface which has proceeded quickly.

5.6.2 Aluminisation

Generally speaking the aluminisation went rather smoothly. Some problems where encountered positioning the mirror back in the cell, but the installation of the mirror cell in the telescope went very fast and we were on sky early in the fourth night, well ahead of schedule. The procedure to measure the mirror's position and place it back after aluminisation worked very well, only requiring a small adjustment afterward.

Photometric zeropoint measured with ALFOSC indicate that the aluminisation improved the reflectivity ranging from $\sim$30% in the UV, to $\sim$20% in the visual and NIR.

5.6.3 Thermal sensors

During the aluminisation a check was made of the thermal sensors attached to the mirror and the mirror cell and two sensors were moved to the surface at the inner edge of the mirror. A further two sensors will be mounted at the outer edge of the mirror. This should give us a better idea of the true temperature of the mirror which might help in improving the optical quality.

5.6.4 Amplifiers

As a consequence of the failure of one of the alt/az power amplifiers we now have no spare, and these amplifiers are obsolete. A search has begun for an alternative replacement and two or three products have been identified.

Since the failure of the alt/az amplifiers the rotator amplifier has been damaged due to water getting into the electronics racks after heavy wind and rain. We are also investigating if it is possible to obtain a replacement for this device from the same manufacturer.

In both of the above cases we may be able to repair the amplifiers in-house, but for the long term commercial replacements would be preferable.

A spare telescope alt/az pre-amplifier printed circuit board was designed.

5.6.5 CCD probe

The adapter CCD-probe split position was modified to improve its position accuracy for use with FIES, such that it can be placed to within a StanCam CCD pixel.

5.6.6 Wavefront sensing

After the replacement of the main mirror, WFS measurements were made and it was found that the same aberrations exist as before aluminisation, i.e. principally the astigmatism zenith dependency is still there. Some more WFS measurements are proposed to verify the TCS zernike values with respect to the measured ones before another attempt can be made to correct the aberrations with the active optics.

One thing that has not been tested after the aluminisation is the level of off-axis aberrations. Any such aberration does not affect observations with the current instruments but might affect observations with FRED, which is also the best instrument to check for it. This will be looked at when it becomes clear when FRED will arrive.

5.6.7 Mirror cleaning

Since the aluminisation the mirror has been CO_2 cleaned a few times, which until now has kept the reflectivity at the same level as that measured just after the aluminisation, indicating that there is no need yet for a washing of the mirror. Especially, there was no change in the reflectivity of the mirror after a CO_2 cleaning following the forest fires close to the observatory which created a lot of smoke and ashes which might have affected the mirror.

5.6.8 Tracking

There were a few reports of elongated star images. A problem with the optics can safely be excluded, though it can be that in some cases the elongation comes from observing with the telescope out of focus or at very high zenith distance where we know there is some variation in astigmatism which is not corrected. One possible thing that might cause elliptical star images are periodic errors in the drives of the telescope. These are in principle corrected in software, but the effect of the periodic errors in the altitude and azimuth drive will vary as a function of the position on the sky and any correction might be more or less effective. Tracking tests did not show any problems, but more tests should be done with the telescope pointing to different areas of the sky.

5.6.9 Pointing

Although the pointing variations are still not properly understood, the pointing variations are very stable and we continue operating with the same pointing model with no complaints.

5.6.10 Adapter

On two occasions problems occurred due to a power cable being damaged when FASU was mounted which cut the power to the adapter effecting things like the autoguider. The cables was rerouted but a more permanent solution should be made.

5.6.11 Autoguider

The limits for which the guide probe vignettes the field of view for ALFOSC and MOSCA was checked following the installation of the new guide camera. The software selecting guide stars was updated and is now set so that it works for all current cassegrain instruments. It was also found when using StanCam that in certain cases the pick-off mirror which re-directs the light to StanCam actually vignettes the guide probe, and the area affected was determined. The only effect of this is that in certain (very few) cases another guide star needs to be selected.

The guide star server software has been transported to a none IDL version. Also a new version of the guide star catalog was installed. Together with the new camera that was installed at the end of period 30, this dramatically increased the number of available guide stars. We had some case where no guide star was found on the predicted position, and a web tool was developed to provide positions of alternative guide stars. This problem was investigated further and we believe the problem was caused by selecting sources from the catalog based on their blue (J-plate) magnitude which apparently include many spurious detections. The guide star selection was switched to the red magnitudes which provides both less spurious detections and more detected sources that can be used by the guide camera.

In the current situation and under normal weather conditions we basically always require the use of a 5-magnitude neutral density 'Grey' filter, and we are looking at the possibility to limit the area over which guide stars are selected to limit any problems when doing offsets where one wants to keep the same guide star. Limiting the area over which guide stars are selected might also be used in the future to improve the pointing.

5.7 Optical Filters

Characterization of all existing optical filter was completed. Central wavelength and passband width information is now available for all optical filters. See

`http://www.not.iac.es/instruments/filters/filterlist.html`

5.8 ALFOSC

5.8.1 Detector

Tests were made using the BIAS CCD control program in the normal observing set-up with the CCD control card for the multi-window photometry program to look at the remaining problems with some of the commands. Unfortunately still some problems remain with some of the commands, mainly with the FITS headers that are provided.

5.8.2 Photometric zero-points

As part of the calibration plan a new web-page was set-up for the monitoring of the photometric zero-points with CCD #8. See

`http://www.not.iac.es/instruments/alfosc/zpmon/ccd8zp.html`

5.8.3 Spectroscopy

Because of its rectangular shape it was decided to mount the grism rotated by 90 degrees such that the grism can be properly aligned without the need of modifying the grism wheel or having problems partly vignetting the beam. The special holder was designed and made at Copenhagen University. When the grism is mounted it gives the dispersion along the rows of the CCD, and can hence only be used with our set of 'vertical' slits. The resolution of the grism is highest of all ALFOSC grisms (including the Echelle grisms), and results in R=10000 for a 0.5 arcsec slit (2.5 detector pixels), with a corresponding dispersion of $0.254 \mathring{A}$/pixel. The peak system efficiency, including atmosphere, telescope, instrument and detector, is well above 30% (which is the highest peak efficiency of all ALFOSC grisms), but falls down quite steeply away from the central wavelength.

The Multi Object Spectroscopy mode target acquisition software was modified to allow for use with the 90 degree rotated VPH grism and the software was improved by adding a new analysis task that allows for binned images.

5.9 NOTCam

5.9.1 Old detector

The zero level pixels in the engineering grade array, first believed to be pixels dying because of repeated thermal cycling, increased in number gradually from Jan-2003 through 2004 from 1% to around 5%, but suddenly in 2005 jumped to ~30%. However, it was found that the overal signal level had drifted ~4000 ADUs towards zero, causing a large increase of apparent zero level pixels. Only slight modifications to the bias voltages of the detector were needed to restore the original reset level. Since May-June 2005 the number of zero pixels on the engineering grade array is again around 1%. The reason for the varying reset level is believed to be some drift in the array itself.

5.9.2 New detector

The installation of the NOTCam science array was planned for September, but it was postponed at the last moment and it was finally installed in NOTCam on October the 20th.

The installation was made with the help of Preben Nørregaard (CUO) and went very smoothly. Unfortunately the weather did not cooperate and no on-sky tests could be made, but test showed that the new array has much better cosmetics than the engineering grade array. Specifically, it is less effected by areas with bad pixels and the flat field is much smoother, showing less variations over both the short and large scale. The array has also a much larger range over which it is linear (upto ~70 000e$^-$ compared to ~45 000e$^-$), but the read-out noise was found to be slightly higher at 14-15 e$^-$ compared to 10-12 e$^-$.

We have not been able to test the new detector on the sky, but test taken with the lamps in the calibration unit indicate that there is no serious tilt of the array and (assuming the lamps are more or less stable) the sensitivity appears to be at least 30% better than for the old array. Clearly, this latter needs to be checked with standard stars as soon as we get clear sky on a NOTCam night.

For more information on the new array see

`http://www.not.iac.es/instruments/notcam/sci-grade-arr.html`

For a preliminary report on the commissioning tests see

`http://www.not.iac.es/instruments/notcam/comm-sci-arr.txt`

5.9.3 Holding time

Since several months we have experienced problems with the vacuum and the LN_2 hold-time, which decreased from 5 to 2–3 days. As part of the work done before the installation of the new detector the outer O-rings of the fill and vent tubes of the LN2 tank were examined and found to be out-of-shape. New O-rings were installed, but this did not solve the problem.

5.9.4 Wheel bearings

Also before the installation of the new detector all the bearings of the different wheels were exchanged with new and newly lubricated bearings. The lubrication procedure was improved to get a more homogeneous layer of MOS2. None of the old bearings were found to be critically bad.

5.9.5 Calibration unit

The new calibration unit installed in the lid of the Cassegrain baffle with Xe, Ar and Halogen lamps was commissioned. The current set-up works adequately and there does not seem to be a need for a more elaborate calibration unit.

5.9.6 Filters

The spare JHKs filter set was mounted in the stop wheel. This was done as a preventive measure such that observations with these most frequently used filters is still possible if we have problems with the filter wheels. A spacer was added to the holder of the original J filter to prevent stray light.

With the calibration unit in place, some of the NOTCAM filter have been scanned using NOTCam spectroscopy. See

`http://www.not.iac.es/instruments/notcam/filters/`

The four narrow-band filters purchased by G. Ostlin have been tested and found to have a severe red-leak. They were dismounted and sent back to the owner.

5.9.7 Spectroscopy

Medium-resolution spectroscopy with the high-resolution camera saw first light and was commissioned. See

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

This completed commissioning of the NOTCam spectroscopic mode.

5.9.8 Focus pyramid

The focus pyramid was calibrate for use with the high-resolution camera, and the result was implemented in the post-processing script at the start of period 32 but still needs to be tested.

5.10 MOSCA

The post-processing system for MOSCA to provide proper data format (MEF files) and FITS headers has been installed and used. It now has also been successfully used with the new instrument computer.

A side effect of the new data format is that the CCD quality control script needed to be updated.

5.10.1 Detector

The possibility of changing a resistor on the MOSCA video board to bring the conversion factor of CCD W20 in line with the other three was looked at. However, we do not have the type of resistors used (chip resistors) and the value given on the circuit diagram is inconsistent with the value expected and it is impossible to read the value off the device, since it is only $\sim$1mm $\times$ 2mm in size. The main issue with having a different gain in one of the CCD is that it is generally not possible to scale and display the mosaic image as a whole as part of the image will appear complete white or black. To get around this problem we are developing a post-processing procedure that scales the mosaic image such that all quadrants/CCDs are visible when displayed.

5.10.2 Light leak

Further tests has shown that additional light seen in images taken in the I- and Z-filter with MOSCA comes from the adapter and that the light source is located in the direction of the CCD probe somewhat away from the entrance hole of FASU.

5.10.3 Web page

Example reduction instruction for MOSCA data were provided on the web.

5.11 StanCam

A study was made to look for possible improvements to the current system. One conclusion from the report was that a significant improvement could be made by changing the standby pick-off mirror which has a reflectivity of only $\sim$62%. It was impossible to remove the coating off the existing mirror so it was decided to acquire a new one. Specification were defined and a mirror ordered.

The most obvious improvement to the instrument is a change of the very low efficiency detector. A 2kx2k device with 15μm pixels would be the best solution in the current situation, providing the maximum 3.6 arcmin squared field-of-view with a sampling of 0.11 arcsec per pixel compared to the current 3 arcmin squared sampled at 0.176 arcsec. Depending on the device, the expected gain in efficiency with a new CCD would be a factor $\sim$1.5 in the red and a factor $\sim$2 in the blue.

Further improvements, allowing for a larger field-of-view would require modification of the filter mechanism and/or the pick-off mirror unit, were also specified in more detail.

5.12 FIES

5.12.1 Building

Construction has continued throughout most of the summer and the bulk of the work was finished by the end of the semester when the move of the instrument and the installation in the building was planned with the help from people from Aarhus. In the end the visit by the Aarhus people was postponed till the second half of October and the instrument table was actually moved to the building on the last day of the semester.

5.12.2 Instrument

The camera front lens, CCD window and cross-disperser prism were coated. A new multi-fiber unit was ordered and tested, but G. Avila (ESO) characterized some parts as "not good".

A new calibration unit was designed by Bo Lindberg and made by Aarhus. The unit, consisting of a ThAr and halogen lamp and that also has a fiber selection slide, was mounted on the telescope adapter and is being tested.

The FIES web-pages were updated and FIES was added to the list of available instruments. See

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

5.12.3 Reduction software

The FIES pipeline has been updated to be able to ingest the new FIES formats and headers as provided by the post-processing system (see below) into the pipeline, which have been tested for windowed and binned data and adapted where necessary.

5.13 SOFIN

The new LF5 cross-dispersed prism has been successfully re-polished and is currently being tested.

A new user interface for the SOFIN control program is being developed. The system is running under Linux and includes the control command console, quick look and analysis facility, and a number of real-time process displays to monitor the CCD status and the photon counter.

5.14 FRED

It is still not clear when FRED would be coming out, but Tuorla Observatory has agreed to make the handling tool needed to move FRED+FRAME at the telescope. Also a replacement was bought for the lost CCD which was tested at CUO.

5.15 Data flow

5.15.1 Data saving

As part of the upgrade of the data acquisition and archiving system we have changed the way the data is being saved. In the old system the data for all the different instruments were saved in different directories but using the same prefix and images with the same name (but taken by different instruments) could exist. The new system defines separate file names for images from different instruments (e.g., ALob250001.fits for image taken with ALFOSC).

5.15.2 Data format and FITS headers

NOT2MEF (the software that changes data formats into MEF, flips data to have standard orientation, and writes additional FITS headers) has been successfully installed on the observing computers for MOSCA and FIES. It is ready to be installed for the other instruments as well, probably after the change of the data acquisition computers. All the main functionality have been implemented.

Also, ways have been looked at of coding multi-amplifier information into headers that are easily understood by data reduction packages. As part of looking at the possibility of reading the ALFOSC CCD through 2 amplifiers, data have been processed which afterwords could be run through 'standard' IRAF tasks to perform photometric measurements.

A GUI-based tool to edit the instrument definition files for ALFOSC and MOSCA in a consistent way has been developed and is being tested. The system is based on a revised list of filter names, with central wavelength and width information for all filters, plus passband and photometric system for the standard wide-band filters, and addition comments (with redshift information if applicable) for narrow-band filters.

5.15.3 Data base system

The system has been further enhanced automatically notifying the staff of support duties, requested instrument configurations and technical task that need to be performed. The main objective of this is to make sure that the staff is aware in time of the tasks that are needed to have the telescope and instruments in the best possible shape and can plan for this if needed.

5.16 Computers and software

5.16.1 Data acquisition system

New data acquisition computers for MOSCA/NOTCam and for FIES have been successfully tested, installed and commissioned.

5.16.2 Network connection

A new contract was signed by the IAC with Telefonica providing 34 Mb from the sea-level to the ORM and out to Tenerife compared to the 2 Mb provided before. This significantly improved access.

5.16.3 User account disk space

The disk space for the user accounts in the sea level office was upgraded.

6 Looking ahead

6.1 Telescope and building

6.1.1 Cooling system

The new cooling system is being taken in operations after the installation of the new rotary valve. For safety, the old system will remain in place for some time before being dismantled.

6.1.2 New TCS

As the work on the hardware and the user interface can be done in parallel the project is not affect by the delay in the development of the hardware and the system is foreseen to be ready toward the end of the semester, with the commissioning shortly after that.

6.1.3 Tracking

Further tracking tests should be made to see if there are any problem with the tracking that might cause elongated star images and to see if the corrections for the periodic errors in the altitude and azimuth drive can and/or should be improved.

6.1.4 Wavefront sensing

The latest tests should be evaluated and the resulting active optics correction should than be implemented in the (new) TCS.

6.1.5 Thermal Monitoring System

The Thermal Monitoring System which, e.g., provides the telescope structure temperature to the TCS needed to keep the telescope focused, is still running on an old MSDOS computer. The idea was to port it to a Linux computer when the new TCS would start operating, but the network interface failed which makes the shift obligatory.

One big advantage of porting the system is that the temperature data will be stored in a database which allows for a much more refined analysis.

6.1.6 Autoguider

The plan is to limit the area where to select guide stars such that combined offsets can be done with less risk of loosing the guide star because the guide probe gets out of range or resulting in the guide probe vignetting the instrument. The objective is to allow for as big offsets as possible. Also, combined with a future automatic system to detect and center the guide star, a smaller area with less variation in distortion should provide a very accurate pointing of the telescope.

6.1.7 Webcams and weather station

With the new cooling unit there is no longer a clear view through the windows in the service building to the telescope and the web cam has been moved to the outside corner of the building. For this, a weather resistant unit was bought. Also a second unit will be place at the weather station, looking down on the loading ramp. This will give a better view of the area in front of the telescope and the entrance to the telescope and the stairs down to the FIES building which will allow for a better assessment of the situation in case of bad weather.

For the webcam at the weather station a new network connection will be installed. It should also be considered if the connection from the instruments in the weather station should be changed to also use the network connection which will allow a more versatile use of the measurements, and for the instruments themselves it should be check if adequate spares exist and/or if new units should be purchased.

6.1.8 Control room

With the arrival of the new TCS there will be many of the old computer equipment that can be removed from the control room. Also, after the old cooling system is dismantled there will be a lot of storage space in the machine room. This provides a good opportunity to remodel and improve the control room.

6.2 Detector controller

During the visit of Preben Nørregaard (CUO) to help with the installation of the science array for NOTCam he showed a first proto-type for the new detector controller. The current plan is to test and develop this controller with the FRED mosaic camera which is currently at CUO which then can be tested at the telescope in the place of MOSCA.

6.3 ALFOSC

6.3.1 Camera optics

The new optics have been finished and the camera and entrance window of the CCD dewar have been send to Copenhagen to be replaced. The new optics will be tested in the near future. This will also require a re-determination of the efficiencies of the observations with the filters and grisms with the new camera.

6.3.2 Calibration plan

As part of continues work on the calibration plan the spectroscopic monitoring will be integrated in the webpages and the online wavelength calibration of spectra using the QuickLook tool will be expanded to more grisms.

6.3.3 Data acquisition

An upgrade version of the BIAS data acquisition program will be installed and commissioned together with the new data acquisition computer. Also, a new none-IDL user interface will be developed and implemented.

6.3.4 Spectroscopy

Considering the high efficiency achieved with the new VPH grism we should consider to purchase more grisms. We will also investigate the possibility if getting new high-quality vertical and horizontal slits

6.3.5 Polarimetry

A quick-look post-processing script will be developed and implement for linear polarimetry observations.

6.3.6 Detector

We still hope the that control card for multi-window photometry can be modified (by Roy Østensen) so it can be used with the BIAS CCD control program in the normal observing set-up. Currently he is also working on including a special polarimetry mode in the code.

6.3.7 Multi Object Spectroscopy

No progress was made and the CNC machine still needs to be tested. With the possible need for vertical slits for ALFOSC it is of some interest of getting this done in the near future.

6.4 NOTCam

6.4.1 Detector

Still on-sky tests are needed to verify the efficiency and alignment of the science grade array.

During the installation of the new array some tests were made of the dark current. The behavior with exposure time is similar to that with the engineering grade array, but it is not well understood. A closer look at the design of the controller showed some inconsistencies which need to be investigated in more detail and might require some modification of the controller.

Following our experience with the old detector we will monitor the reset levels. This will later be included in the quality-control procedure.

Also, there are plans to define a more time-efficient clean-array command which would limit any possible memory effects due to over-exposure.

6.4.2 Calibration plan

The final part missing is a calibration plan for imaging with NOTCam which will be developed and implemented in this semester. As part of this a script will be made to measure zero-point magnitudes from a set of JHKs images of a standard field.

6.4.3 User interface

A new none-IDL user interface will be developed and implemented for NOTCam on the new data acquisition computer.

6.4.4 Reduction package

A small NOTCam reduction package is being developed under IRAF with a few scripts that will provide some standard reduction steps tailored to NOTCam data.

6.4.5 Filters

With the NOTCam calibration unit most of the NOTCAM filters will be scanned using NOTCam spectroscopy.

6.5 MOSCA

6.5.1 Light leak

Further investigation is needed to locate the source of the additional light, but we probably will need an IR camera to pinpoint the source precisely.

6.6 StanCam

6.6.1 Pick-off mirror

The new pick-off mirror has arrived but it should first be attached to a special holder so it can be mounted. When it is mounted the efficiency and optical quality of StanCam will be tested.

6.6.2 Filter mechanism

The current filter mechanism is very old and fails rather often. Generally the system can be recovered easily, but when this happens at night no more observations with StanCam can be made which might affect monitoring or ToO observations. A review will be made of the system to look for any possible cause for the more frequent failures and if the current system can be modified such that it becomes more reliable or if we should consider designing a new mechanism.

6.7 FIES

6.7.1 Building

Network connection and electricity have been installed and the building has been complete insulated, where the idea is to provide temperature control by keeping the instrument room at a constant high temperature. Some concern have been expressed about humidity, but we expect that with the draining system and the special protection installed, together with the relatively high temperature of the room this will not be a problem. At the moment we have a portable de-humidifier in the building to help lower and stabilize the humidity, and temperature and humidity sensors were installed to monitor the behavior. On the bases of what happens during the coming winter we will decide if any additional measures are needed.

6.7.2 Instrument

The re-coating of the mirrors is still pending. After the move of the table the instrument was re-assembled and the optics was aligned by people from Aarhus. Also the new instrument computer was installed.

The precise status of the multi-fiber unit is not clear and it needs to be checked whether the unit can still be used. A detailed planning is needed if it is necessary to get a new multi-fiber unit. Also, the mirrors still need to be re-coated and it is not entirely clear what needs to be done and how long it will take. These issues will be sorted-out by Søren Frandsen and Bo Lindberg.

After the move to the new building, two backup fibers were installed in the telescope but both were damaged due to the difficulty of handling these fibers as they were mounted in a very stiff outer tube. The damaged new 100micron fiber was used to test the instrument after its move and all seems to be OK with the spectrograph.

Although the calibration unit is basically working, both hardware and software of the unit need to be optimized.

6.7.3 Software

All the main parts of the control software work but further testing and final commissioning is still needed. Testing of the reduction software is now being done with real data from the instrument but the final tweaking can only be done after work on the instrument has been completed.

6.7.4 Testing and commissioning

Testing will continue throughout the semester, but when commissioning can take place will largely depend on when the re-coated mirrors and the multi-fiber unit will be installed.

6.8 Computers and software

6.8.1 Data flow

As part of a further integration of the system an observing log is being developed that includes information on the proposal for the observing run, general weather conditions, down time due to weather or technical problems, and a listing of the data for each night.

6.8.2 Data acquisition system

A new data acquisition computer will be installed for use with ALFOSC and StanCam. When this is done we will be able to installed the gigabit switch which will conclude the hardware upgrade of the data acquisition system.

6.8.3 Data saving

With a full complement of staff we expect to be able to finally get the robotic DVD burning and labeling system to work. One of the points to consider for the data saving and archiving system are data reduction pipelines and calibration plans. E.g., do we provide a sub-directory for the reduce data, or do we copy data taken as part of the calibration plan in separate directories.

6.8.4 Operating system upgrade

An upgrade of the operating system of the computers in the sea level office is needed because installing new applications, libraries or newer versions of them is very difficult, if not impossible. This is currently being implemented and includes a rationalization of the applications provided to everybody with the aim of standardizing this as much as possible.

6.8.5 Security

The web server was recently compromised and the best solution is reinstalling the system. At the same time the operating system will also be upgraded.

As part of computer security the operating system of the firewall will be checked and probably upgrade. Also, a security audit will be made of the machines outside the firewall. These machines are no direct threat to NOT's security, but they can work as a point of entrance to the protected network.

6.8.6 Various

Various software and computer developments are planned. Below I list the most relevant things.

- *Spam*: A review will be made of the Anti-spam system and possible enhancements will be considered.
- *Scratch disk file system*: Typically the users work with very large data files and it will be checked if the XFS file-system can improve the performance of the system when working with such files.

- *Common services computer*: A new system will be set-up for the common service (home directories, mail folders, etc).
- *Computer rack*: Separate fuses should be installed for the computers in the rack in the service building to avoid the failure of one taking out the whole system.
- *User account backup system*: A proper backup system for the staff user accounts should be defined and implemented.