Period 29
AiC Report to the NOT Council and STC

41^{th} STC meeting, November 11, 2004
&
45^{rd} Council meeting, November 12, 2004

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Contents

1 Introduction

This report covers the operations of the Nordic Optical Telescope for period 29: 2004-04-01 to 2004-10-01.

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 29.

A total of 77 fault reports were submitted, with an average time lost of 15 min per fault, for a total down time of 1.3% (1.6% on scheduled observing nights). Of these, 64 reported no time lost, 11 reported <2 hrs lost, and 2 reported 2 or more hrs lost.

Table 1: Technical down time statistic period 29: 2004-04-01 to 2004-10-01

Night included	Time lost	Nights	Percentage[a]	Last period
All nights	1140 min	183	1.3%	1.7%
Scheduled observing nights[b]	1040 min	132	1.6%	2.6%
Technical nights	30 min	25	0.3%	0.9%
Service nights[c]	45 min	9	1.0%	%
Visitor instruments	70 min	26	0.6%	0.3%

[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 1.7% over all nights (2.6% on scheduled observing nights) in period 28 (2003-10-01 to 2004-04-01). For that period 63 faults reports were submitted with an average time lost of 29 min per fault. Of these, 37 reported no time lost, 24 reported <2 hr lost, and 2 reported 2 or more hrs lost.

Comparing the two periods the one thing to note is the decrease in faults causing down time. In fact, the number of faults causing down time and the total amount of down time for period 29 are the lowest over the past few years.

2.1 Main problems

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

- **2004-05-05/06: NOTCam filter wheel no. 2**: 5 hr

There were continuous problems with filter wheel no. 2 not reaching its position when moving it to a specific position or when initializing it, which resulted in large amounts of time lost on two nights. As it takes at least 10 days to warm-up and cool-down the instrument this could not be investigated in depth during the observing run and it was decided to change the instrument to ALFOSC.

This was very unfortunate as a lot of effort was spend at the end of 2003 with a complete overhaul of the bearings using new standard commercial bearings. In the end we decided to return to the original method we used with bearings that have a limited lifetime.

- **2004-08-29/09-04: NOTCam filter wheel no. 2**: 8 hr

  The filter wheel no. 2 now failed intermittently throughout the observing period with NOTCam, but it was still possible to reach the desired filter positions after several (many) tries.

  After warming-up the instrument it was found that the bearing for the wheel had not been properly installed after the last problems with the wheel. The bearing was replaced.

  It should be noted that for both these problems the amount of down-time does not take in to account any reduction in science return from the observations due to the limited capabilities of the instrument.

2.2 General overview

The fault data base allows a more detailed overview of the faults that are reported. 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 last period (28).

Table 2: Down time statistics for period 29[a]

Syst/Type	Soft		Elec		Optics		Mech		Others		Total		P28	
Telescope	5	00:20	6	01:30	1	00:00	4	00:20	1	00:00	17	02:10	13	03:05
Building	0	–	2	00:00	0	–	6	00:00	0	–	8	00:00	12	03:40
Computers	16	00:25	2	00:00	0	–	0	–	1	00:00	19	00:25	11	00:40
ALFOSC	2	00:15	0	–	6	00:30	1	00:00	1	00:00	10	00:45	18	21:10
MOSCA	0	–	0	–	0	–	0	–	0	–	0	00:00	0	00:00
NOTCam	3	00:10	5	00:30	2	00:30	2	13:00	1	00:00	13	14:10	2	00:05
StanCam	4	00:15	0	–	0	–	0	–	1	00:15	5	00:30	1	00:10
Others	0	–	3	00:30	1	00:30	1	00:00	0	–	5	01:00	6	01:25
Total	30	01:25	18	02:30	10	01:30	14	13:20	5	00:15	77	19:00	63	30:15
P28	29	05:00	17	24:35	0	00:00	13	00:40	4	00:00	63	30:15		

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

One conclusion that can be drawn from the information in Table 2 is that beyond the problem with the filter wheel in NOTCam there were no other significant problems causing downtime.

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	96	14	36[a]	2.6
NOTCam	33	5	5[b]	2.2
MOSCA	–	–	–	–
StanCam	3	–	–[c]	–[c]
SOFIN	18	4	7	2.6
LuckyCam	4	2	1	4
IACUB	4	–	1	4

[a] Excluding 4 service nights
[b] Excluding 2 service nights
[c] All 3 service nights

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

As before, most comments written in the reports during period 29 were very positive. Especially the 'quicklook' facilities for ALFOSC and NOTCam were mentioned a few times.

The only recurring negative comment was about the need for new detector controllers. Further it was noted as desirable to have: observing data made available on DVDs, send the End-of-Night reports automatically in electronic form to the observers, a calibration unit for NOTCam, basic documentation for non-iraf users and, a way to script ALFOSC observations. Also, it was noted that in a specific case the documentation was not sufficiently clear to avoid problems and that some of the information on the web did not agree with (older) paper copies in the control room, and it was noted that the data reduction computer provided to the observers and used in certain application related to observing should not depend on the outside network link.

Also these things have either already been corrected, are under development or are considered to be implemented in the future.

5 Operations

5.1 Safety

With the extension of the sea level office the location of the exit signs and fire extinguishers have been changed and the map showing evacuation routes and the location of the fire extinguishers and the instructions in case of emergency were updated.

With the accident of Markku Verkkoniemi when driving up to the observatory we have extensively reviewed our procedures. The car itself was well maintained, having all its tires and one of the sets of brakes replaced recently. In general, we also couldn't identify any specific action that might have avoided the accident, but it should have been realized earlier that he was missing. Some discussions have already been going on with the TNG and ING to see if the situation can be improve such that nobody can go missing when going up or down the mountain or when being on the mountain. Also, in the next CCI Observatory Sub-Commission meeting general safety aspects will be discussed.

5.2 Goals and Objectives

A set of goals and objectives were defined for the period 1 July 2004 to 30 June 2005, of which a copy is send to the Council together with this report. However, given the current situation these goals and objectives will have to be reviewed.

5.3 Additional services

5.3.1 Service observing

A total of 9 nights of service observing were made, excluding the 14 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.

5.3.2 Service program

The possibility of starting a service observing program were discussed with the director and the head of the OPC. This program is in principle intended for programs needing little time, or to provide payback for time lost to ToO/service programs.

This is further discussed in the report by the head of the OPC.

5.3.3 Educational use

For the second time a course in observation astrophysics was organized by Stockholm University using the telescope over a period 5 nights in May. Again, the courses was well organized and properly prepared in advance. Apart from some work mostly by the computer group in advance, the course did not need much support beyond the standard introduction to the telescope and instruments for ALFOSC and NOTCam on two separate nights.

5.4 Documentation

As much of our documentation is in the form of web pages we decided that we use our web pages to collect all our documentation and keep track of them. The idea is that any new/updated document is put on our web, after which (as before) a 'www-change report' is made which should include the URL of the document that was added or changed. These change reports are now kept in a database, which together with an incremental back-up of the web pages allow to have a record of all the documentation and its changes. As part of this technical drawings of ALFOSC and NOTCam have been put on-line.

Also, various documents related to developments at the NOT have been posted on the web. See

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

Peter Sørensen has been assigned as documentation officer.

5.5 Sea level office

The sea level offices have been further improved. The installation of an air-conditioning unit was finally finished and additional furniture was purchased.

5.6 Service building

The computers, DAT drives, etc. installed in the computer room in the service building are not specified to work at the sometimes extreme humidity levels on the mountain. An airco unit was installed in the computer room. A system just recirculating the air seems to work properly. Some more improvements will be made (humidifier, thermostat, air intake fan).

5.7 ToO observations

A system was set-up to keep track of the different ToO programs as to how much time they have been allocated and the amount they already have used.

5.8 Data saving

The current system to keep track of the data that is being recorded on CDs and that are kept in our archive has been extended to include the NOTCam data that are written on DAT tapes.

5.9 Data reduction computer

A clean-up script was installed on the data reduction computer available to observers in the control room which wipes out everything under the guest account and copies some handy skeleton files, including useful bookmarks. In principle this script should be run before the start of a new observing run, and observers are informed that if they want to keep data created under the guest account they should inform us before the end of the observing run.

To allow for observers to save any data they create under the guest account a DVD burner was bought and installed.

5.10 Building

5.10.1 Cooling system

The work on the new cooling system has started. A plan was made to limited the impact of installing the new cooling system to a minimum.

5.10.2 Electronics

A complete inventory of all the electronic components of the whole telescope and instrumentation systems has been made with the aim of identifying potential single point failures (lack of spares) and where necessary new items were ordered.

5.11 Telescope

5.11.1 Main mirror alignment

It was noted by Michael Anderson that the mirror alignment procedure made after the last aluminization did not work properly and that the current alignment of the mirrors is likely not to be optimal. The main question is the tilt of the focal plane which needs to be checked. Depending on the tilt we should decide what to do after the next aluminization which is for seen for next year.

To check the focal plane tilt a through-focus series of images on a moderately crowded field (an open cluster) was made with ALFOSC and repeated with the rotator turned 180 degrees to separate the tilt of the focal plane from the tilt of the instrument detector with respect to the telescope. The results with ALFOSC were ambiguous and the test was repeated with MOSCA for 4 different rotator positions. The data are currently being analyzed.

5.11.2 Wavefront sensing

A more streamlined version of the WFS reduction software has been made by Anton Norup Sørensen (CUO). The routines are now entirely using IDL, and if no configuration changes are needed, the reduction of a number of images can be performed by a single command.

It was noted that some of the discrepant results found previously were probably due to the WFS mask not being adequately aligned with the pupil.

The analysis of the Wavefront sensor data has resulted in an initial estimate for the correction of the dominant astigmatism aberration against zenith angle. A report of the analysis has been produced "Analysis of WFS Measurements from the first half of 2004". Tests are currently been carried out during technical time to see if the predicted corrections are correct.

5.11.3 Mirror cleaning

Due to Peter Brandt's illness little progress has been made. Recently a monitoring program to check the mirror reflectivity has been started and it is clear that a mirror washing is long overdue. A washing will be done at the first opportunity.

5.11.4 New TCS

At the moment 93% of the programming of the new TCS been implemented, and the main part of the software will be ready soon. Hardware for the adapter and mirror control was purchased and installed in such a way that it can be tested with the new software in daytime and one can switch back to the old TCS before the night.

Several tests were made with the new TCS, where especially a lot of problems were found with the rotator control. This is made more difficult by the fact that the documentation was found to be incorrect.

5.11.5 AltAz power supply

On several occasions the TCS reported a error with the power supply unit of the AltAz motors which cause small amount of time lost. Unfortunately it is not clear what causes these problems, and a new program in the local control unit of the AltAz power supply was made which tries to track this problem.

5.11.6 Pointing

The cause of the pointing variations are still being investigated. Specifically, we want to test the hydrostatic bearings of the telescope.

The pointing variations do seem to be well defined and we have the hope that we will be able to improve the pointing by applying corrections to the current pointing software.

5.12 Autoguider

The guide-probe head supplied by CUO was installed. The increased field of view for the guide probe was determined for ALFOSC and MOSCA and the guide star server software was updated to include this.

For use with FRED we still need an upgrade for the existing aging TV camera, and a new 3rd generation intensified camera was ordered which is expected to provide at least a 2–3 mag improvement over the current system.

5.13 Calibration plans

Developments have continued, mostly centered on providing instructions and tools to perform and analyze measurements. This also serves as a guide line for calibration observations for observers.

As part of a collaboration with John Fynbo of CUO 'pipeline' reduction software for the optical imaging instruments (ALFOSC, MOSCA and StanCam) is being developed. It has now been decided to base the software on a stand-alone pipeline developed by ESO (primarily for the La Silla telescopes/EIS project).

5.14 Filters

It was agreed with the head of the astronomy department of the ING that filters from the ING and the NOT can be offered to both communities. On the respective filter web pages links are provided with a text stating that filters from the other observatory might be used. The handling of the filters themselves, i.e., the responsibility for collecting, maintaining and returning the filter will be with the observatory that borrows the filter.

There was some confusion about the proper cleaning of filters, and instruction were defined and posted on the web.

5.15 ALFOSC

5.15.1 Camera

New optics have been ordered, but no further news was received about when the new camera will be ready or come out to La Palma.

5.15.2 Detector

Continuous problems were encountered when using the BIAS CCD control program in the normal observing set-up with the CCD control card for the multi-window photometry program where there are still some commands that do not work properly.

Test were down to check the gain and linearity with the correct clamp and sample time for the read-out of the CCD with the regular control card. Some of the data still needs to be analyzed, and if the results are OK the settings will be changed permanently to improve the read-out speed from ~90 sec to ~80 sec.

5.15.3 Folding prism

It was noted that the folding prism of ALFOSC was rather dirty. It was cleaned, and this procedure has now been included in the mounting procedure.

5.15.4 Long-slit spectroscopy

A calibration plan for spectroscopy with ALFOSC was drafted which is currently being reviewed.

A high efficiency R~6000 VPH grism centered on Hα/Li I 6708Å and covering the wavelength range 6400–6800Å was designed and ordered by Michael Andersen. Unfortunately, the grism was ordered in the wrong shape (square rather than circular) and we will have to investigate how to mount it in ALFOSC, as it is too big for the current holes in the grism wheel.

New vertical slits have been manufactured in Copenhagen by Niels Michaelsen. These are to overcome slow readout in windowed 'long'-slit mode as the CCD can be windowed in the column direction.

5.15.5 Multi-object spectroscopy (MOS)

A new power supply control card was installed, but the machine needs proper testing.

The software for target acquisition has been improved to include binned data to speed-up the process as it reduces the read-out time for the image. Also, an option to define the position of the fiducial holes manually has been implemented.

5.15.6 Observing tools

The 'Quicklook' data analysis tool for ALFOSC data has been further improved, adding some new features to the existing tasks.

5.16 NOTCam

5.16.1 Wheel bearings

The failure of filter wheel no. 2 in May was relatively shortly after a complete overhaul of the bearings using new commercial bearings. After an extensive review we decided to return to the original method we used with standard SKF bearings cleaned and treated with MOS2 in-house. We know that with this solution bearings can work up to a couple of years, and in the future we just need to change the bearings regularly. As a modification the housings for all the worm gears were replaced with steel ones to give them the same expansion and heat conduction coefficients as the bearings.

5.16.2 Detector

The number of dead pixels in the currently installed engineering grade array has not increased further beyond 5%. The dead pixels are still mainly located on one of the sides of the array, so they don't interfere with observations much. However, we still believe it would be good to change to the science array but this depends on support from CUO.

We are still awaiting a modification of the array controller such that an 'ABORT' command can be implemented in the BIAS detector control program. Further improvements to increase the readout speed will have to wait until the new controller for the detector array is available.

5.16.3 Spectroscopy

The first genuine NOTcam spectroscopy run in July 2004 was successful.

Tests made with wavelength calibration lamps that were purchased show that they can be used with NOTCam when installed in a conical reflector in the Cassegrain baffle attached to the mirror cover petals. A disadvantage is that in this way the light from the lamp does not fill the f/11 telescope beam, and hence inside the spectrograph the lamp light only traverses through the central (i.e. close to on-axis) part of the optics. The idea is to have a quick-fix solution with the power of the lamp controlled from the control room. A design for a lamp holder to be installed in the lid of the Cassegrain baffle that can contain 3 lamps is currently being discussed. The control box has been built for this and is awaiting the installation of a suitable cable between the control room and the telescope.

5.16.4 Filters

Some problems were reported with the new "Östlin" filters, but this might have been due to the problems with the filter wheel. As the instrument has not been on the telescope since this has not be investigated further.

To have unique ID's for all filters, 200 was added to the NOTcam filter ID values.

5.16.5 Focus pyramid

The focus pyramid for NOTCam was delivered to CUO. The next step will be to make a holder fitting the grism wheel.

5.16.6 Instrument initialization

The NOTCam user-interface has been improved such that not all wheels are initialized every time the interface is started-up, and that one wheel can be initialized at the time. This is to avoid excessive turning of the wheels.

5.16.7 Observing tools

Post-processing task were installed to optimize target acquisition on the slit for spectroscopy, and to enable automatic subtraction of a background image.

5.17 MOSCA

5.17.1 Detectors

When MOSCA was mounted it was found that the bias levels of the different CCDs had changed (again), but this time also the gain of one of the CCDs (W20) had changed by $\sim$20%. This was rather worrisome and a full linearity test was made. All the CCDs showed very good linearity and normal RON levels, so it was decided to leave the instrument on the telescope. Also, cards and cables where swapped between the four CCDs without any indication of a problem. No specific problems with the detectors were reported during the run.

A procedures to test the CCDs, and analyze and present the results on the web similar to that for ALFOSC was implemented. This was actually extremely useful when investigating the varying gain level mentioned above.

5.17.2 Light leak

The observer noted some additional light in i'-band images. It is not visible in the twilight flats, and it appears that the number of counts is proportional to the exposure time, not the background level itself. This could be a light leak or a red light source in FASU.

5.17.3 Entrance window

To avoid dust accumulating, cleaning the entrance window of MOSCA was added to the mounting procedure.

5.18 StanCam

5.18.1 Image drift

One of the observers noted that when following a source for an extended period of time the source drifts in the order of 10 pixels ($\sim$1.5 arcsec) per hour. Examination of the data showed that the drift is mostly in the vertical direction with respect to the telescope. The fact that the drift is similar in V and I excludes differential diffraction affects, while the straight tracks for the drifts makes it unlikely to be a problem in the tracking or guiding. The most likely cause is flexure of the camera with respect to the 45 degree pick-off mirror. Checking the mirror fixation itself does not show any slack, but it might be that the whole probe moves.

5.19 FASU

5.19.1 FAPOL

As part of the investigation of the problems with FAPOL in last semester a serious problem has been found with FAPOL in that it unpredictably stops working. The cause of this seems to be related to two things; the safety interlock in FASU between the FAPOL carriage mechanism and the calibration mirror and poor grounding design of the actual motor drive cards. The consequence of both of these is that the motor 18V causes drops on the digital 5V line resulting in a reset of the drive card micro-controller.

A modified code for the FAPOL drive board has been provided by CUO that should detect any loss of position of the FAPOL analysis plate.

5.20 FRED

5.20.1 Filters

A quote was obtained for a standard V filter of a size required to fit in FRAME and give a full field of view. The price was \$ 6 950 ($\sim$5 560 euro) with a delivery time of 12 weeks. We are also requesting quotes for an Hα filter and a Sloan u' filter which are expected to be the most expensive.

The price for the V filter indicates that the total price for a set of UBVRIz' filters will be well over 30 000 euro, with that for a set of Sloan u'g'r'i'z'Hα filters expected to be significantly more.

5.20.2 Trolley

A trolley is being designed to be able to move FRED+FRAME. Drawings of FRAME were obtained from CUO, and Tapio Korhonen was contacted to get drawings of FRED.

5.21 FIES

5.21.1 Management

It was decided that the NOT will take over management of the FIES project. This includes responsibility for the software, getting the lenses and mirrors (re-)coated, etc. We will remain partly relying on support and effort from Aarhus which is also specifically mentioned by them, but it is not clear how that part can be managed by us as we do not have a direct say in how and when they supply their resources.

There has been a meeting on La Palma with Soeren Frandsen in which the project was discussed. Specifically the design of the fibers adapter plus calibration unit was discussed. Also, arrangements were made for the further development of the control software.

Aarhus has supplied a list of the different items Aarhus is getting offers for ((re)coating of various optical elements, fibers, etc.). This includes estimated prices, but not delivery times which makes it hard to define a proper time line for the project, but it seems clear that not all of the different components will be ready before next Spring. The AiC with visit Aarhus shortly before the STC and Council meetings to discuss this.

5.21.2 Building

On the 22nd of September the final positive report was presented by the office of the National Park in which the observatory is situated to the Government ('Cabildo') of La Palma. Since them we have been waiting for the final permission from the Cabildo which is based on the reports from the different institutions involved. We have both formally and informally contacted the Cabildo to try to speed-up the process but with still no result (this process is suppose to take 3 weeks in the worst case).

We have already discussed alternatives with the building company, and it seems possible to have all but the instrument move ready before Spring next year.

5.21.3 Optical elements, Fibers, Calibration unit

A quote was received for coating the mirrors, and the price went up from the original estimate of \$ 8 500 to \$ 25 000 so we might have to consider looking for another company. Also, a quote was received for the fiber bundle which turned-out to be relatively cheap at \$ 2 500, and it was agreed to order an extra spare bundle.

The fiber unit design was finalized and the unit will be ordered soon. A conceptual design of an adapter-based calibration-and-shutter unit has been made, which will be manufactured by Aarhus.

5.21.4 Control software

A first version of the instrument control software has been completed, but needs to be tested with the instrument in full working order.

5.21.5 Reduction software

The reduction software package is under development. At the moment data can already be automatically reduced and new calibrations can be generated. The code is currently being optimized.

5.22 Data flow

5.22.1 Data format and FITS headers

It was decided that the best way toward a system with proper data format and FITS headers is to make a post-processing system that takes the data as provided by the BIAS detector control programs and converts it to proper (Multiple Extension FITS) files with adequate and uniform headers. The main advantage is that this will require little change in the BIAS program itself, which can mostly be done in-house.

As a pilot study, a program was developed to convert the data for MOSCA to a MEF file, with separate extensions for each CCD. In the same conversion process all existing headers are reformatted into the format that is recommended by the FITS-standard, and several useful FITS headers are added.

5.22.2 Instrument set-up

A new system to replace the old NOT Instrument Request Forms (NIRF) where observers had to define the requested instrument set-up was replaced by a new automatic system. Based on the proposals and the time allocation which are integrated in our data base, PIs of proposals are automatically reminded approximately one month before the allocated observing run of the instrument set-up they requested in the proposal, and asked to update it if needed.

The reminder also includes general guidelines for visiting astronomer.

5.22.3 The Sequencer

A first complete version to be used with StanCam + FIES has been made, but needs to be tested.

5.23 Computers and software

5.23.1 Data acquisition system

Major problems were encounter with the new instrument computers. It has not been possible to get them to work properly with the old ISA PC interface card needed to interface with the detector controllers. Test are currently being made to try to get it to work, and we are also looking for alternatives.

A new RAID hard disk system with a capacity of nearly 1Tb was purchased together with a gigabit network switch with the idea of increasing the speed and capacity of the data acquisition system. However, at the moment it is not possible to install this system as the current old instrument computers have outdated operating systems which can not incorporate this system.

5.23.2 Data archive

The DVD robotic system was tested extensively and was shown to work properly.

5.23.3 Ftp server

The ftp server has been moved to the observatory. This allows for a faster movement of (ToO) data from the instrument control computers to the ftp site. One of the advantages of this system is that the ftp server will always be available even when the link from the mountain is broken, which is especially important for ToO data.

5.23.4 Network connection

Work on the new microwave connection to the observatory which is being developed by the ING with our help has continued and is now close to being completed.

6 Looking ahead

6.1 Observing conditions

Part of the network activities of the OPTICON contract includes 'Site Characterization' of the Teide observatory and the ORM, concerning things like meteo data, seeing measurements, extinction measurements, etc. The idea is to combine and expand the data from all the different observatories at the sites, which can be of great interest and benefit to all. The project is run by the IAC, but at the moment there is no clear plan available. However, we hope that this project can be developed properly in the coming months.

In parallel, discussion are currently going on about the possible installation at the NOT of a dust meter owned by the IAC. Although the details of operations are not clear, the idea is to get continuous measurements in computer readable form. Together with the throughput measurements provided by the calibration plans and the reflectivity measurements of the mirrors this can provide very interesting data about the effect of dust and the usefulness of cleaning the mirrors with CO_2, or washing them.

6.2 Telescope and building

6.2.1 Cooling system

Soon the new rotary valve and the flexible tubes connected to it are going to be tested, and if everything goes fine they will be installed. The new cooling system will be installed early next year.

6.2.2 New TCS

The autoguider should be integrated in the new TCS, and the remaining new hardware should be installed. The new software should be finished soon, and the main task would be testing it with the (new) hardware. The main danger for delays lie in this area as it is not clear how easy this will be, or if we encounter more problems like with the rotator.

Other remaining tasks are the design and implementation of a user interface, and defining and implementing the interaction with the autoguider.

6.2.3 Mirror aluminization

Based on the results provided by the measurements of the mirror with the reflectometers and of the throughput of the telescope plus instruments provided by the calibration plans we should decide if the mirrors should be aluminized next year.

6.2.4 Wavefront sensing

The correction determined from the analysis of the Wavefront sensor data should be checked. Based on the results these active optics correction should than be implemented in the (new) TCS.

6.3 Autoguider

The new camera should be installed and commissioned. The guide-star server should be upgraded such that it automatically finds a new star in case the current guide star moves out of the field of view when doing a combined telescope offset. Also, we should consider including a better guide star catalogue (e.g, the USNO catalogue).

6.4 Calibration plans

One of the main tasks will be to further develop software tools to reduce and analyze the data. A major improvement would be the pipeline for the optical imaging instruments (ALFOSC, MOSCA and StanCam) which is expected to be finished in this semester. Further development of this system will include NOTCam imaging and ALFOSC spectroscopy.

6.5 ALFOSC

6.5.1 Camera

We hope the new optics for the camera will arrive in this semester.

6.5.2 Spectroscopy

It has been agreed with Michael Andersen that he will study the possibility of making other VPH grisms to replace and/or supplement the current set of grisms. Depending on this study we can decide if we should order some of these grisms.

The spectroscopic calibration plan should be implemented.

6.5.3 Detector

If the tests are OK with the correct clamp and sample time these values will be installed permanently. We will also look at the possibility of reading out the CCD using two amplifiers to half the read-out time.

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. In this way, this card can be installed permanently for use with either the normal set-up or for multi-window photometry.

6.5.4 Multi Object Spectroscopy

The CNC machine needs to be tested. If it works properly, we can also used it to sort-out the problems with the flipping of the masks made using the new distortion map.

6.6 NOTCam

6.6.1 Detector

Because of the problem with the wheel bearing NOTCam is currently warm. The next observing run is only in the second half of January, so this is a good opportunity to change the detector to the science array, but this depends on support from Preben Nørregaard (CUO).

The issues of the abort command and a new detector controller still remain.

6.6.2 Wheel bearings

With the current situation for the wheel bearings we need to consider how often we need to replace the bearings, i.e., how often is a warm-up of the instrument necessary. One idea is to test one of the bearings extensively to determine its expected lifetime.

Possibly a new and more thorough procedure for treating the bearings will be introduced in the future.

6.6.3 Imaging

A calibration plan for imaging will be defined and implemented.

6.6.4 Spectroscopy

To be able to get slits properly in focus with the HR camera the range over which the focus mechanism can move needs to be extended. This is planned to be done together with the installation of the science array and tests of the wheel bearings.

The design for a simple wavelength calibration unit should be decide, and the system should be installed and commissioned.

In the longer-term one should look at getting a new calibration unit with proper interface to the lamp with the corresponding header information. The final design will likely include a lid separate from the mirror cover petals which can be closed and opened quickly.

6.7 MOSCA

6.7.1 Detector

Anton Norup Sørensen (CUO) was contacted about the observed changes in gain, and he agreed that it was worrisome but that the performance appeared normal. He suggested to do some more test before the next time the instrument was scheduled and to change a resistor in the pre-amp of the CCD to get (back) a similar gain to the one for the other CCDs.

No more observing runs are scheduled in the current semester, and it depends when any observing run might be scheduled in the next semester before we decide when to do this.

6.7.2 Light leak

Some tests should be made with a pinhole the next time MOSCA is mounted. Again, it depends when MOSCA is scheduled the next time.

6.8 StanCam

6.8.1 Image drift

Tests should be made to define the source of the drift observed with StanCam.

6.8.2 Pick-off mirror

It was realized that the 45 degree pick-off mirror on the CCD probe that feeds the light to StanCam was probably not aluminized since its installation. The plan is to aluminize it as soon as possible.

6.8.3 Possible improvements

Possible improvements and/or alternatives to StanCam (new CCD, replace/amend with [a] LuckyCam) should be considered and a development plan defined.

6.9 FASU

6.9.1 FAPOL

The problems with reseting of the drive card micro-controller should investigated further. Modifications to the power system mainly with extra decoupling of the power lines is hoped to resolve this but full tests still need to be done. Also, the modified code for the FAPOL drive board needs to be commissioned.

6.9.2 Calibration mirror

It was noted that the pick-off mirror for the calibration unit in FASU was very dirty, leading to increased exposures times for calibrations with ALFOSC. The idea is to have this re-aluminized together with the StanCam pick-off mirror (see above).

6.10 FIES

6.10.1 General

In principle all the tasks have been defined and, given the information provided by Aarhus, we should be able to set-up a time-line for the whole project. The main uncertainty is still the building, but in any case we should have the permit well before Spring next year and, even if we are not able to do part of the construction during the Winter, the building should be ready early Spring. Also, considering that the expected delivery times are not clear for various components of the instrument (e.g., we are still searching for a company to coat the mirrors) we do not expect to have everything ready with the instrument before that time either, and the problems with the building permit do not appear to delay the project much. At the moment the main question seems to be more if we can/should do some of the testing with the telescope still in the dome.

In any case, overall commissioning of the instrument in its building is planned for Spring next year.

6.10.2 Control software

The instrument control software needs to be tested and commissioned. A graphics status display is under development.

6.10.3 Reduction software

A first version of the reduction package will be installed and tested.

6.11 SOFIN

All the developments are pending until the new cross-dispersion prism is polished. There are also plans to renew the quarter-wave plate to replace it with a better achromatic version.

6.12 Computers and software

6.12.1 Data flow

For the moment we will concentrate on implementing a post-processing system to provide images with proper data format and FITS headers. The main objective will be to provide this for ALFOSC and NOTCam data.

Also, we will continue work on integrating the different aspects (data archiving, observing logs, observing schedule, technical schedule, etc) in a single system.

6.12.2 Data acquisition system

Work will continue to solve the problem with the old ISA PC interface card in the new instrument computers. Depending on this, and the fact that CUO might not be able to deliver a new array controller in the near future, we are considering to make a compatible PCI card that can communicate with the exiting controllers and can be used in modern computers.

6.12.3 Service program

It is for seen to have a service observing program where relatively short programs are executed in service mode on specific nights by the staff. The precise details of how this program would work needs to be defined (by the OPC and/or the STC), but some way will be needed to ingest and process proposals and the accompanying observations that are requested.

6.12.4 Various

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

- *Data storage system*: If the problems with the instrument computers are solved the new RAID disk and the gigabit switch can be installed.
- *The Sequencer*: Development will continue of the Sequencer with the commissioning of the system for StanCam + FIES. The next step would be to incorporate ALFOSC in the system.

- *Data archiving*: With the failure of the CD carousel and the preference expressed by observers to not get DAT tapes (often preferring DVDs) we have decided to switch our archiving system completely to DVDs. For this we will have to define the specific way the data (from the different instruments and different nights) will be stored.
- *Mail server*: The Mail server will be moved to ORM to provide faster access, and guarantee access by observers.
- *Network access*: It is expected that the new microwave link between the observatory and the office will become available.
- *User account backup system*: A proper backup system for the staff user accounts should be defined and implemented.