# Period 37
# AiC Report to the NOT Council and STC

## $49^{th}$ STC meeting, December 4, 2008
## &
## $54^{rd}$ Council meeting, December 5, 2008

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# Contents

# 1 Introduction

This report covers the operations of the Nordic Optical Telescope for period 37: 2008-04-01 to 2008-10-01.

# 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 37. A total of 95 fault reports were submitted, with an average time lost of 19 min per fault, for a total down time of 1.8% (0.1% on scheduled observing nights). Of these, 63 reported no time lost, 28 reported $< 2$ hrs lost, and 4 reported 2 or more hrs lost.

Table 1: Technical down time statistic period 37: 2008-04-01 to 2008-10-01

| Night included | Time lost | Nights | Percentage[a] | Last semester | Last summer |
|---|---|---|---|---|---|
| All nights | 1785 min | 183 | 1.8% | 0.8% | 1.4% |
| Scheduled observing nights[b] | 610 min | 146 | 0.1% | 1.1% | 1.8% |
| Technical nights | 60 min | 21 | 0.1% | 0.4% | 1.1% |
| Service nights[c] | 60 min | 16 | 0.1% | 1.1% | 2.6% |
| Visitor instruments | 1115 min | 31 | 6.8% | 0.0% | 0.1% |

[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 0.8% over all nights (1.1% on scheduled observing nights) in period 36, and 1.4% over all nights (1.8% on scheduled observing nights) in period 36. Of the 74 fault report in period 36, 47 reported no time lost, 24 reported $< 2$ hrs lost, and 3 reported 2 or more hrs lost. Of the 118 fault report in period 35, 80 reported no time lost, 34 reported $< 2$ hr lost, and 4 reported 2 or more hrs lost.

Although the total down time is slightly higher than in previous semesters, being completely dominated by a single fault, the overall numbers are rather normal.

## 2.1 Weather

For period 37 a total of 324hr 15min was lost due to bad weather which corresponds to 20.0% of all the dark time as compared to 36.0% in period 36 and 11.1% in period 35. The total amount of clear dark time was 1299hr in period 37, as compared to 1311hr in period 36 and 1443hr in period 35.

## 2.2 General overview

In Table 2 the number of faults and total time lost as a function of the system and kind of fault is presented together with the overall numbers for the previous two period (35 and 36).

Table 2: Down-time statistics for period 37[a]

| Syst/Type | Soft | | Elec | | Optics | | Mech | | Others | | Total | | P35/P36 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Telescope | 6 | 00:05 | 5 | 00:55 | 0 | – | 9 | 18:35 | 1 | 00:20 | 21 | 19:55 | 29/14 | 07:45/02:10 |
| Building | 0 | – | 1 | 00:10 | 0 | – | 0 | – | 2 | 00:00 | 3 | 00:10 | 3/4 | 00:00/00:10 |
| Computers | 11 | 00:10 | 2 | 00:00 | 0 | – | 1 | 00:00 | 5 | 01:50 | 19 | 02:00 | 13/11 | 00:00/00:15 |
| ALFOSC | 15 | 02:00 | 4 | 00:30 | 1 | 00:00 | 0 | – | 1 | 00:30 | 21 | 03:00 | 25/30 | 06:50/12:00 |
| MOSCA | 0 | – | 1 | 00:00 | 0 | – | 0 | – | 1 | 00:35 | 2 | 00:35 | 4/0 | 00:05/00:00 |
| NOTCam | 9 | 00:40 | 2 | 00:00 | 1 | 00:10 | 1 | 00:00 | 0 | – | 13 | 00:50 | 15/2 | 00:50/00:05 |
| StanCam | 1 | 00:00 | 0 | – | 0 | – | 0 | – | 0 | – | 1 | 00:00 | 8/2 | 00:30/00:15 |
| FIES | 6 | 00:30 | 4 | 02:45 | 0 | – | 0 | – | 0 | – | 10 | 03:15 | 14/6 | 05:45/02:15 |
| Others | 1 | 00:00 | 2 | 00:00 | 0 | – | 1 | 00:00 | 1 | 00:00 | 5 | 00:00 | 7/5 | 00:15/00:00 |
| Total | 49 | 03:25 | 21 | 04:20 | 2 | 00:10 | 12 | 18:35 | 11 | 03:15 | 95 | 29:45 | 118/74 | 22:00/17:10 |
| P35 | 59 | 08:35 | 26 | 10:00 | 2 | 02:00 | 14 | 00:05 | 17 | 01:20 | 118 | 22:00 | | |
| P36 | 38 | 08:35 | 22 | 07:20 | 1 | 00:00 | 4 | 00:00 | 9 | 01:15 | 74 | 17:10 | | |

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

## 2.3 Main problems

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

- **2008-04-20/21/22: Rotator failure**: 18 hr 15 m

  The cable that guides the "cable twist" which conducts the various communication cables from the devices attached to the rotator to the fixed telescope structure broke. This likely occurred because of wear and tear over the last 18 years since its installation. The poor and incomplete documentation seriously complicated identifying the true problem while repairing the cable took relatively long as accessing the cable is rather difficult and it required a certain type of cable of sufficient length.

  Apart from having a proper spare cable (which is not expected to be needed any time soon) the only action that was taken is to make a general review of all the status parameters in the TCS to see if they are well defined and can be properly identified (e.g., the parameter for the status of a specific part is connected to a signal that can be traced to that part).

- **2008-08-12: FIES calibration shutter**: 2 hr 00 m

  During observations with FIES using the simultaneous ThAr mode it was found that the arc lines were saturated and the target spectrum could barely be seen. The cause was found to be the shutter of the calibration unit in the FIES building not closing. After some time it was found that moving some wires made the shutter work again. During tests later on the problem recurred. No obvious loose contact was found, but after rewiring the connection the problem has not recurred.

## 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 | 76.5 | 10 | 33[a] | 2.0 |
| NOTCam | 12 | 6 | 3[b] | 3.3 |
| MOSCA | 9 | 2 | 2 | 4.5 |
| FIES | 31.5 | 2 | 12[c] | 2.5 |
| SOFIN | 6 | 1 | 1 | 6.0 |
| TurPol | 16 | – | 2 | 8.0 |
| PolCor2 | 6 | – | 1[d] | 4.0 |
| FastCam | 5 | – | 3 | 1.7 |

[a] Excluding 10 service nights [b] Excluding 2 service nights
[c] Excluding 2 service nights [d] Excluding 2 service nights

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

As before, most comments written in the reports during period 37 were very positive, especially about the support from the staff. There were also several very positive comments about the scripting facilities we have been developing, but also various requests for some more and better scripts. This is really a work in progress where some parts are developed further than other, which is mostly governed by specific requests and the needs of the persons making the scripts.

Several FIES observers commented about the start-up procedure of the observing system to be cumbersome and confusing. The whole procedure and the set-up of the system has been made more streamlined and simple.

In a few cases some inconsistencies or small mistakes were noted in some of the documentation, all of which have been corrected. There were also a few comments about the lack of a sofa to rest during long exposures and the need for better chairs in the control room. A sofa has been purchased and a couple of high-quality chairs ordered.

# 5 Operations

## 5.1 Additional services

### 5.1.1 Educational use

This has been a busy period with many observational courses using the NOT. This included the on-site course from the Stockholm University (5 nights in May), the NEON school (6 night in June), the master school in CUO/NBI guaranteed time (2 half nights plus 2 full nights in August), and the DARS PhD course (2 half nights plus 5 full nights in August). Furthermore, remote observations with the NOT were made as part of a course at the Molėtai observatory in Lithuania (5 half nights in August).

It should be noted here that there is a significant extra staff effort associated with these courses. Apart from the need for some additional preparations, the support during the courses is much more extensive, including the introduction to several instruments compared to a single instrument in a normal observing run plus the need to assist various groups of observers, typically throughout the night. In the specific cases of the remote observing course from Molėtai we also had a staff person continuously monitoring the observations, primarily for safety reasons. For these observations, a special remote observing system was developed.

In the mean time we also have had a short (2 hours) training course from Uppsala University observing with FIES and the telescope remotely. Particularly of interest to note in this case is that there wasn't an astronomer from the NOT at Uppsala to assist nor had the tutor at Uppsala use the instrument before. After doing some tests with the observing system using the connection and providing specific documentation in advance, setting-up the connection, starting-up of the system and doing the observations all went very smoothly.

Beyond the evaluations made by the organizers of the different courses, we have also been making our own evaluations based on our own experiences and talking to the tutors and students directly. In general people were very happy with how things were arranged and worked. As far as directly concerning the NOT, the main issue is the need for a better and more timely definition of the specific requirements (e.g., as for the laptops) for each course. Specifically, this should be provided *and* requested well in advance. Also, some of the practical preparations at the observatory (water supply, cleaning, etc) should be specifically organized in advance.

Related to the courses, one of the NOT staff astronomer was a tutor at the NEON school, and the author of this document was at Molėtai during the remote observations to help set-up the system, provide instructions and assist during the observations.

As part of the Molėtai course a booklet is being made for which an article was written outlining the general role of education at the NOT and describing in some more detail what we offer for training courses. A copy of this article will be send together with this report.

Currently we are also actively involved in the planning for the June 2009 summer school in Tuorla, Finland. We have agreed the dates, topics, number of students, qualification requirements and most of the teachers already. The web page of the school is already available and the poster is being designed. First announcement of the school will be out soon.

Led by our new NORDFORSK funded post-doc, monthly meetings with the NOT students have been started. The purpose is to integrate the student group more and provide support. Students talk about their science, NOT duties and possible problems there might be. In the first meeting they estimate the state of their thesis and then in forthcoming meetings we look how they have been proceeding.

#### 5.1.2 Service observing

A total of 16 nights of service observing were done, excluding the 6 SOFIN nights done in service mode by Dr. Ilya Ilyin. The Nordic service nights consisted of various more or less isolated observing nights spread throughout the semester. Also in this semester there was a large number of observations that were done by the staff for the ToO and monitoring programs during technical and Nordic service nights. At some moments this actually does affect the service programs as the ToO and monitoring observation have priority but typically request less time and fitting them in at the last moment effects the execution of service programs a lot, while in some cases there are also service programs which are time critical and are directly affected.

#### 5.1.3 "Fast-Track" Service Program

Some improvement were made to the fast-track service observing data base and interface tool which is used to manage and schedule the observations. The system now allows for specific (time-critical) dates to be defined for observing blocks and every time an observing block is entered into the system the PI of the proposal receives a summary of the information entered to serve as feedback and to allow a check on what was finally entered in the system.

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 4 are completed, 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. All of the proposals have been completed.

For period 36 there were 19 proposals. Of these there were 10 'grade 1' proposals, 6 'grade 2' proposal, and 3 'grade 3' proposal. Of the 'grade 1' proposals, 7 were completed. Of the 'grade 2' proposals, 4 were completed and 1 was completed 1/2. Of the 'grade 3' proposals, 2 were completed and 1 was completed for 9/10.

For period 37 there were 12 proposals. Of these there were 6 'grade 1' proposals, 2 'grade 2' proposal, and 4 'grade 3' proposal. Of the 'grade 1' proposals, 4 were completed and 1 was completed 1/2. None of the 'grade 2' or the 'grade 3' proposals, have been observed.

Up till now 9 proposals have been received for period 38. Of these, 2 are still in the process of being graded, 5 have 'grade 1', 3 have 'grade 2' and 1 has 'grade 3'. One of the 'grade 1' proposals have been completed 1/3.

## 5.2 Building

### 5.2.1 Drive System

The electronics for the building drive has been mounted on a customized frame. Currently the drive system is being programmed to implement the basic tasks of accepting an analogue input control signal and turn the motors. The new drive will directly replace the old electronics. The old drive system will be removed from its rack and the rack modified to allow space for the slightly wider modules of the new system. The various control lines to the TCS will be connected and the motors swapped. It has been checked that the new motors have an identical mounting flange and drive shaft dimensions to the old ones.

A service engineer from Siemens will come at the beginning of December. He will check that our wiring and mounting arrangement meets safety and electrical requirements and then advise on the best programming philosophy and examine our proposed actual installation at the telescope. If this goes as planned we can decide when to change the system. Replacing the whole drive system is expected to take a full day, after which some tuning will be necessary for the system to work properly. As on earlier occasion, we will leave most of the existing system in place such that we can go back to the old system if need be. In principle the changeover is foreseen for the coming spring. To allow time for the fine tuning and to be on the safe side, the change will be scheduled before a technical night.

### 5.2.2 Power supply

Due to a problem with a power supply from a visitor's laptop various issues were raised. The main point was that this problem caused essential computers for operations to fail. We are reviewing the current situation as for the connection to the UPS and the generator, where we want to define how to protect operational critical systems (specifically the computers). One specific idea is to have all computer on their own specific cable with nothing else connected and with an independent fuse and earth-leakage breaker at the switch board.

### 5.2.3 Surveillance system

As part of safety concerns related to using the telescope as part of remote observing a plan was prepared for a system of surveillance cameras to be placed in the dome. These are web-type cameras that can be connected and accessed directly through the network. There are various models that can be sensitive to different light-levels, and which can include pan, tilt and zoom and can be configured to provide alarms (e.g., motion detection in predefined areas in the field of view, contact signals from an entrance door, etc).

We recently bought one such camera for the dome. Our first experiences with it are extremely good, allowing us to see the whole telescope, but also to zoom in and read numbers directly from an instrument display. Based on this, we believe these cameras could also be of great use as part of trouble shooting and development work without being physically at the telescope. We are ordering 3 static low-light-level sensitive cameras, 2 for use in the dome and 1 to replace the outside camera on the weather station, and 2 movable but normal sensitive cameras for use in the control room and the electronics room.

There is of course an issue of privacy, and for each camera that is installed in common areas such as the control room we will provide a master switch at the camera which will allow it to be disconnected.

#### 5.2.4 Clean room

We currently have a small room in the service building which has been set-up as a clean room. To make work, especially with NOTCam, easier and more efficient we decided to make a mountable clean room in the dome. Considering various options, it was decided to set this up next to the entrance door and a design was made. Together with this new "clean room" the idea was to change the existing clean room in the service building to make a bit more room for the small room next to it which contains our computer system. After some discussions it was decided that it would be better to make a new, separate computer room in a different place. This does require a new design which has delayed things.

#### 5.2.5 Energy efficiency

We had some discussion of possible ways to become more energy efficient. Specifically, we will look at simple ways to reduce our power consumption (e.g., low-wattage light bulbs, timers on lights or heaters, etc), but also investigate the possibility to use solar panels (cost and benefits).

### 5.3 Telescope

#### 5.3.1 Telescope control system

The access of object catalogues that are on an external computer has been made easier. The handling of these catalogues will be expanded to include automatic searching and ingesting of specific object coordinates in to the system to preset the telescope. A number of new TCS data items have been defined to be sent to the observing system data base. More items are expected to be added in the near future. The overall objective is to make all the information and the capabilities of the TCS available for use in sequencer observing scripts.

The TCS status display has been rearranged, adding more information and improving their distribution. Some improvements have been made to the documentations and some new parts have been added.

The adapter can rotate over the range -200 to +200 degrees. When pointing for an extended period to a source and depending on the position on the sky, it can happen that the rotator reaches a limit and needs to be rotated 360 degrees. A new feature was added to the TCS interface that indicates the total time remaining before reaching a limit. This is to help judge if an exposure can be safely finished before the rotator reaches a limit, otherwise the rotator can be turned before the exposure is started.

Specifically for remote observations, the TCS Display application which provides a small window with basic TCS information (coordinates, telescope status, etc) and can be run from anywhere in the observing system has been expanded to include information from the guide star system such that the guide process can be monitored.

The system that selects, detects and centers the guide star is now fully implemented. Some minor problems were found where under specific circumstances (e.g., moving to an object very close to the previous object) the system would not work properly. These problems have been corrected and under normal weather conditions the system now always works properly.

The detecting and centering facility has now also be added to the system to do pointing model observations. The final objective is that the whole sequence should be able to run by itself and do a complete pointing sequence automatically.

### 5.3.2 Autoguider

It was noted that the stepper motor controller for the TV filter wheel is 22 years old and it would be good to replace it. The control program is also stored in a RAM with 10-year guaranteed battery backup, but this can be replaced and reprogrammed. We are currently looking for a proper system to replace the whole system.

We have been looking at the focussing of the guide camera. Apart from variations as a function of the (off-axis) position of the guide probe and of the TV-filter used, the focus of TV-camera is directly related to the telescope focus. The idea is to automatically set the TV focus every time a telescope pointing is made. This would make things faster/easier, especially for the non-experienced observers (basically to avoid them making any big mistakes), while people can then still change the TV focus value to whatever value they want after arriving at the target.

### 5.3.3 Amplifiers

Some redesigning and rewiring was needed, which was further delayed by some new parts that were ordered taking very long to arrive. After testing in the workshop, the system was recently connected and the telescope was driven (for safety reasons only) in azimuth using the new system under full TCS control.

Some minor tidying up of the wiring is required and both azimuth and altitude motions tested together. All this is expected to be done in the near future. If everything goes well then drive can be installed and the old one removed. Mechanically and electrically this should be a straight swap.

### 5.3.4 Tracking

An analysis of the reported oscillations of the telescope has been carried out. From the TCS log it can be seen that virtually all the "jumps" are in the azimuth direction. It was considered that the problem may be due to the azimuth tachometers, and the devices were examined and cleaned. Since this operation no large jumps have been reported though smaller ones are still recorded in the TCS log.

Analyzing the data by reading the TCS log and using the time when the jumps occur, the corresponding azimuth and altitude positions were extracted from the database and it has been found that since the tachometers have been cleaned all the recorded (small) jumps occur between azimuth angles 100 to 270 degrees, i.e. south. Measuring the telescope speed at the time of the jumps, they typically occur at nominal tracking rates, not specifically at high tracking rates, which was suspected.

Checking the altitude angles at the times of the azimuth jumps, roughly a uniform distribution around 42 degrees can be seen, which provides no obvious information to the cause.

Recently the wheels driving the telescope were greased. It is not clear yet if that made any difference. It might also be that replacing the amplifier (see above) will solve the problem.

### 5.3.5 Adapter

The problem with the cable twist in the adapter is already discussed above and was also mentioned in last semester's report.

A new connection box for electrical power was installed in the adapter and the wiring was reorganizing for better handling and safety.

The rotator encoder or its associated electronics shows occasional read errors. These are not yet imposing any problem in the positioning. We are logging these errors and if this becomes worse it might be needed to change (part of) the system.

### 5.3.6 Control room

We have continued with cleaning up and reorganizing control room. For the observers we bought a sofa plus a small table, and some high quality chairs were ordered which should arrive soon.

### 5.3.7 Weather station

After several comments about our humidity readings compared to others, the sensor was recalibrated and shown to only need a minor adjustment. The measurements from the new Vaisala weather station where shown to be deviating, but follow a linear relationship with respect to our regular (calibrated) sensor so it can be used if need be.

We had bought a hand-held humidity meter in case of emergency, but that was shown to not work well at all at the most important high-end of the scale.

There are still various issues with the Vaisala weather station with respect to the wind meter and the rain sensor so we are still using the measurements from the old station.

The weather page now also includes an indication on the wind-rose that shows the direction the telescope is pointing so it is easier to see where the telescope is pointing relative to the wind direction which is important in case of strong winds.

At the moment the dust meter is at the IAC for maintenance, but it is expected back in the near future.

### 5.3.8 Mirror cleaning

The mirror has been washed, but as expected the reflectivity of the mirrors has not been completely recuperated. This implies we need to realuminize the mirrors which are in principle planned for the period around full Moon in either May or June.

## 5.4 Observing system

### 5.4.1 System start-up

Various things have been done to make starting-up the different observing systems easier. This both relates to making the starting up of the control software more automated, but also by providing scripts that define a general set-up of the TCS for a given instrument and by providing more detailed instructions how to switch from one system to another (e.g., in the case of ToO observations with ALFOSC for an observer that is using FIES; see below).

### 5.4.2 Sequencer scripts

A growing number of observatory supported sequencer scripts have become available for observers. Using these scripts can greatly increase the observing efficiency and makes it less likely for the observers to make mistakes. A major concern is that any sequencer command or sequencer script is well defined, where it is especially important to consider the effect of any changes (either in [the syntax of] a command or script, or in the way it behaves). Specific rules for this were defined and all existing commands and "standard" scripts were converted to comply with the rules.

A list of all current sequencer commands and scripts available can be found at:

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

#### 5.4.3 Observing blocks

Per definition an Observing Block (OB) gives a full description of a (set of) observation(s). As an integral part of our queue-mode observing as part of the fast-track service program we use OBs to define and schedule observations. Currently the system of OBs is mostly used to provide descriptions of the observations, where the execution is to a large extend done manually. An obvious step is to integrate the OB system with the sequencer system such that it defines scripts which can be executed directly and perform the complete (set of) observation(s).

However, observing scripts are typically rather specialized and very specific, while the OB system should be able to be used by any kind of observer an should be inherently flexible. On the other hand, making a script which would perform all the tasks of an OB while providing all the options is next to impossible. We have discussed this in detail and decide that the way to go is to divide the OBs in basic parts that are specific to an observing mode (e.g., imaging, long-slit spectroscopy, etc). The plan is to make script for each observing mode where separate (sets of) observations can be defined by setting a limited number of (well-defined) parameters (e.g., through pull-down menus or fixed-format input spaces). In this way all the options can be offered through relatively limited scripts which should make defining, checking and executing OBs well-defined. The system should be dynamical in the sense that only when the OBs are queried by the scheduling tool, or are used to execute observations the information will be translated in to specific commands. This will allow to implement the system in steps as to, e.g., how information is used to define which OB to schedule, or how to define what instrument set-up is need to be able to execute a (number of) OB(s), but also how to actually execute the observations (e.g., first only a pop-up window will appear which tells the observer to do something, while later the specific action will be implemented automatically).

#### 5.4.4 Post-processing system

The section of the post-processing system dealing with image display and observing tasks such as analyzing focus pyramid images and performing slitoffsets is experiencing a mayor overhaul. Services are being migrated from being stand-alone IRAF host scripts to become Pyraf driven and fully integrated into the sequencer environment, e.g., so they can be called from a script. In parallel we are also working on a system that will provide a single graphical display that will manage all the raw and post-processed data.

#### 5.4.5 FITS header archive

Fits headers from all core instruments are now automatically ingested into database immediately after being written to disk as part of the post-processing system. A web based search interface to the fits header archive is available for staff. This can be made public but there are of course proprietary rights issues to be addressed first.

#### 5.4.6 End-of-Night reports

Extended EON report information is made available to the observers through the web, including seeing, DIMM and meteorological data graphs and access to fits header information. We are considering to add atmospheric extinction measurements to the report as well. Thumbnails of all images could in principle also be made available if there is a wish for such a feature.

#### 5.4.7 Detector controller

With the planned change to a new CCD controller developed by the NBI at Copenhagen University and as part of our development plan 2008-2010 presented earlier we are now starting the upgrade program.

One of the main tasks is the development of the data acquisition system (DAS) to be used with the detector controller. The DAS will be centered on the CCD3 control program that has been made at NBI and as a basis for the system the functionality of the current BIAS data acquisition program are taken. For the DAS we have prepared a Requirements and Development plan to be executed by people from the NOT and from the NBI and which can be found at:

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

#### 5.4.8 Remote observing

As part of the Nordic-Baltic Research School being organized at Tuorla in June 2009 remote observations will be done with the NOT. In principle any of the core instruments ALFOSC, FIES, NOTCam, MOSCA and StanCam can be used, but this still needs to be defined in detail. Depending of what kind of observations are planned, we will review what is required to be able to do proper remote observations with the instruments, if any software needs to be developed and what we specifically will offer. For observations with NOTCam an important issue to take into account is the large amount of data produced by IR imaging, and it has to be defined exactly how the data transfer will be handled.

### 5.4.9 Computer interdependence

When there is a problem with one or more of the (system-critical) computers it is not always clear when a computer needs to be rebooted and what is needed for that system to come up properly after rebooting.

Specifically, we are working on mapping-out the interdependence of the different system-critical computers such that it is clear what happens if one or more specific computers has failed and what is needed to recover the system.

## 5.5 ALFOSC

### 5.5.1 Data acquisition

A general "optics" script was made that searches ALFOSC and FASU wheels for one or more optical elements (in the form of specific [grism or filter] numbers, or containing a given string), and which returns if the element is present and where it is (wheel name and position). In the case of slits and grisms it can also show the alignment flag, and it can also display the whole content of a specific wheel. The script also allows to actually move the different wheels to put the given items in the light path.

The main objective of this script is to allow to make observing scripts that are not dependent on the specific position of an item in the wheels, while also giving the option to check in a simple way if the elements in a script are actually available. This specifically makes it possible to provide generic scripts for things like ToO observations, but also provide an automated way to check if scripts can be executed with the current set-up, or what is specifically missing. This can be very useful to plan (queue-mode) service observing.

### 5.5.2 Imaging

Some problems have been reported with zero-point variations across the field of view, mainly in the X-direction on the detector. We have done various tests, some of which appear to be affected and others that don't, but in general our test data seem to indicate this is not a problem with the camera itself but with flat fielding. Specifically, flat fields might be different when pointing towards or away from the sun when taking the flat fields and/or when taking them close to sunset/rise or closer to astronomical twilight, or at different angles of the rotator. However, to short this out properly we need flat fields at different times and with different set-ups, but existing flat fields are general taken under very similar circumstances. Some specific tests are needed.

A script that can be used during twilight and automatically takes a (set of) flat field exposure(s) at a proper light level has now been full documented and incorporated as a sequencer script. We plan to develop the option to take (sets of) flat fields for a series of filters which incorporates this script, and which could make taking flat fields during twilight largely automatic.

Following the analyze of the ALFOSC focus measurements (see below), we now plan to concentrate on the seeing measurements. The main objective will be to see if the telescope and instrument works well and what defines the best circumstances (e.g., if the site ports are open, at which wind speed, from what direction). This should indicate how we might improve things and optimize the telescope more, while this might also indicate what to expect given certain circumstances which could be used to assist in scheduling (queue-mode) service observations.

#### 5.5.3 Focussing

Using our data base an extensive study was made of the variation in telescope focus determined with ALFOSC. The telescope is automatically corrected for variations as a function of temperature and elevation of the telescope, but a small residual effect was found in the dependence of the temperature of the telescope structure which actually showed up as a seasonal change in the focus. This effect was only at the level of $\sim$3% and normally should not effect observations in a single night, but applying this correct removed any trend in the data over the whole observed range from $\sim$2 to $\sim$18 degrees Celsius. No remaining trend was found in any of the other parameter that were looked at. There is a small caveat in applying this correction generally as the effect might actually be internal to ALFOSC where the change in telescope focus is to compensate for this variations, but the correction will work for ALFOSC which is most often mounted, and the correction is sufficiently small to normally not effect observations for other instruments in a single night.

From our results it also appears that the telescope focus is constant when ALFOSC is mounted, i.e., unmounting and remounting the instrument does not seem to affect this value, and in principle the same focus might be used for ALFOSC at all times. There is still a rather large spread in individual focus measurements and it might be that there are some systematic effects we have not identified and we still remeasure the focus on a nightly basis to be sure, but in case of poor seeing or when ALFOSC observations need to be done by inexperienced users, taking the standard value is a good guess under all circumstances.

Another result from our investigations is that the procedure that calculations the focus corrections from the imaging data does not work optimal, which might explain part of the observed spread around the average value. The procedure has been improved to provide a better estimate of the correction. Due to the design of ALFOSC we also expect a variation in the focus across the field of view and we plan to investigate this in more detail.

The variation in telescope focus we have found as a function of filter thickness for filters mounted in FASU which are in the convergent beam of the telescope has been investigated in some more detail and found to also show a small variation as a function of central wavelength which is likely due to variations in the diffraction index. This will be investigated in some more detail to provide a more accurate correction.

#### 5.5.4 Multi-window fast photometry

Although quite some effort was spend by Roy Østensen to improve things, there are still some problems when using the "fast photometry" sequencer board with the regular BIAS data acquisition program. The main effect of this is that the board needs to be swapped every time multi-window fast photometry is done, and we can not offer fast photometry at all times.

#### 5.5.5 Filters

For all filters with diameters of 75mm and larger which can only be mounted in FASU, holders have been made. A new design for the 75mm square filters has been incorporated for all filters to protect them better and reduce any possible light leaks.

#### 5.5.6 Spectroscopy

Finally all the ALFOSC grisms were marked to specifically indicate the direction in which they should be mounted to avoid mistakes. The staff scripts used to align the slits and grism were converted to sequencer scripts following the general rules for the documentation and implementation of these scripts.

A web page was created which gives some some background info on the fringing in ALFOSC spectra and hints on how to observe and how to reduce the data in order to beat down fringes in red ALFOSC spectra. This can be found at:

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

As part of the calibration plan, the grisms efficiencies and level of fringing will be measured and the information on the webpages updated.

The procedure to put a star on the slit will be incorporated in to the sequencer system in which it will become a single streamlined target acquisition routine. We are also thinking of including the procedure to align a slit with feature in the field (e.g., 2 stars) into the same routine.

#### 5.5.7 Polarimetry

It was noted by observers that the read-out time for certain spectropolarimetry observations is a major issue. To improve this the "calcite plus slit" was rotated to a vertical position such that the CCD can be windowed in that direct which improves the readout time significantly. To actually do spectropolarimetry, also the normal slit-less calcite needed to be rotated to be able to center the target. For normal imaging polarimetry this is not a problem. There is only an issue for "fast" polarimetry, but the slit-less calcite can be rotated back for those cases.

The slit-lets used for spectropolarimetry were all measured and found to be narrower than their name implied. The ALFOSC slit page were updated to indicate the actual widths of the slit-lets.

Observations were done to determine the intrinsic accuracy of polarimetry observations as a function of the number of half-wave plate positions. In principle 4 positions should be sufficient, but it has been found that at least in certain cases the accuracy is much lower then one would expect. One would expect 8 positions or even 16 positions to remove any systematic effect that might be presented and the corresponding data were taken but still need to be analyzed.

#### 5.5.8 Detector

There is a recurrence of some low level pick-up noise with the ALFOSC CCD. This has been there in the past and had disappeared, but it has shown up again (be it at a lower level then before). In some exceptional cases this can effect observations. Several tests were made but no obvious cause or solution has been found.

Occasionally also horizontal “stripes” are seen in ALFOSC images. The lines appear to have values corresponding to the previous exposure (e.g., a bright “stripe” if a bias frame is taken after a flat field image, or a dark “stripe” if a flat is taken after a bias frame) and this does not seem to be limited to using either the normal data acquisition program or the fast-photometry program, nor using the corresponding sequencer boards. Investigation the stripes has been inconclusive. Images with the CCD disconnected show no structure implying no problems with the controller or up-stream electronics.

#### 5.5.9 Documentation

The current web pages for ALFOSC contains many links and some effort has been made to improve the distribution and overview. We are close to a final design following the NOT “style” and expect the new web page to be implemented in the near future.

### 5.6 NOTCam

#### 5.6.1 Data acquisition

The sequencer for NOTCam is now in full use, various standard scripts were made and all commands and observing scripts were documented following the established rules.

We are planning to upgrade the sequencer observing script generator to include beam-switching, and define more common standard observing scripts for general use, including one specifically aimed at polarimetry observations.

### 5.6.2 Target acquisition

The different areas available for guiding defined for NOTCam have been implemented and tested in the TCS. This means that we can now auto-guide in all observing modes without risking that the guide probe enters a forbidden area and thereby stopping the autoguiding. This is a fundamental improvement for the beam-switch observing mode. As long as the correct guide area is entered by the user, the telescope will be able to auto-guide both in ON and OFF positions. The NOTCam step-by-step guide has been updated accordingly.

### 5.6.3 Imaging

Since the commissioning of the new science grade array some more experience with this new detector has been gained and it has become evident that the use of differential sky-flats to make master flats does not work as well as with the previous arrays because the remnants of the reset ramp is now visible in the master flat. A closer look at the data taken with the engineering grade array when testing the new PCB shows that the new PCB introduces a stronger and more persistent "reset anomaly". The consequence of this is that the method of obtaining flat fields must be revised. Dome flats taken with multiple reads do get rid of the reset ramp, but multiple reads require a minimum exposure time of $\sim$20 seconds, which is too much for differential twilight flats since the useful twilight slot is limited. Investigations are currently being made on the quality of such dome-flats and on the recommendations for NOTCam calibrations and data reductions.

The imaging quality control (basically sky level and zero-point monitoring) is still handled on a manual level only. The script which reduces the standard star images, makes the photometry and feeds the result into the database needs to be finished.

### 5.6.4 Spectroscopy

Still a post-processing procedure providing quick-look reduction of spectroscopic data needs to be defined and implemented.

### 5.6.5 Polarimetry

An important improvements with the sequencer is the ability to change filters and focus inside scripts. This is fundamental for a proper use of the Polaroids. Now one can rotate between the 4 angles (0, 45, 90, and 135 deg) per dither position, thereby making NOTCam polarimetry with a relatively frequent cycling possible. This is crucial in order to minimize transparency changes and make the measurements more reliable.

Some first polarimetry tests were made with the Polaroids of a highly polarized and a zero-polarization standard. A reduction script "pol.cl" was developed to do the image reduction, place apertures on the stars to do aperture photometry and give preliminary polarization results. As noticed earlier the image quality of the Polaroid filters is not very good. They may warp in the cold vacuum. Some scattered light is sometimes seen in the background (perhaps reflections). Preliminary results of these data are inconclusive. More accurate analysis of the existing data and more measurements are needed. In order to assess the instrumental polarization and its stability we need to measure the same zero-pol standards several times and at different orientations of the rotator. The high polarization star gives reasonable values. Unfortunately, we have not had a photometric night with NOTCam recently.

#### 5.6.6 Detector

The problem with the varying “dark-current” has not developed further. The idea was to modify the clock drives to run within specification from 0 to 5 V (rather than from 0 to $\sim$3.5 V in NOTCam). This needs the assistance of Preben Nørregaard (CUO).

#### 5.6.7 Observing overheads

One of the main persistent issue has been a general increase in the observing overheads for NOTCam. The observing overheads are divided into three main types: readout overhead, data storage overhead, and telescope dither overhead. Because of the way the data acquisition was designed for NOTCam (not optimized for many dithers and short exposures typical for IR work), and because of the long readout time of the controller, the overheads are already substantial to start with. Several tests were made with NOTCam run differently, old vs. new acquisition program, local versus remote disk file storage, controlling the CPU time of the computer, etc.

Some of the increases in overheads are understood. The time it takes to complete a telescope offset has slightly increase to assure that the telescope has stopped moving before a new exposure is taken. Likewise, the main reason for the higher “data storage overhead” was due to a safety feature that was introduced because of problems related to the communication between the data acquisition computer and the TCS. This feature was removed, but there is still a small increase due to the detailed way that the sequencer works and due to the fact that the data is not stored on a local but external disk.

The “readout overheads”, on the other hand, are less well understood. Specifically, there are night to night and month to month variations. Moreover, for the ramp-sampling mode there are frequent events of much larger overheads, a kind of extra hick-up in the data acquisition, where the whole program could stall completely for up to 90 seconds during an exposure command.

As part of the investigation in to the unexplained overheads of the readout times especially of NOTCam some tests were done using the old instrumentation computer and MOSCA. One potential source of the extra readout time is due to repeated reads caused by PC board read errors. With MOSCA and the old marissa PC board lots of read errors occurred but by using the same board but with a different PLD (main control chip) installed no read errors occurred. Recording all the occurrences of read errors with NOTCam and comparing this number with the readout time should show if this is the cause of the overheads.

#### 5.6.8 Vacuum & Cooling

Since the exchange of the NOTCam entrance window in March 2007 and the extensive baking of the whole cryostat, the vacuum obtained with NOTCam warm (+20 deg) after pumping was better than ever since its arrival to the NOT. However, when cooling NOTCam there were substantial vacuum losses during the first filling of LN2. It was suggested that the problem could be related to age degradation of the various O-rings, and new O-rings have been purchased. Nevertheless, upon a holding time test made in late April it became evident that the vacuum indeed was very good, better than hitherto achieved with NOTCam. The detector temperature stabilized at -191 degrees when running on the PTR alone (i.e. empty of LN2). NOTCam has been kept cold since, and the vacuum has behaved well all the time. The average pressure has slowly settled down from $1.1 \times 10^{-4}$ mbar in April to $5.0 \times 10^{-5}$ mbar in September, i.e. approximately as good as earlier. We had expected better, though, given the good vacuum obtained warm.

There must have been some vacuum losses during cooling with LN2 related to the O-rings in the filling tube, but not more serious than allowing the cryostat to quickly recover by itself (via the charcoal getter) to an acceptable vacuum, and over the longer run to a good vacuum. We have chosen to leave NOTCam cold until the next needed opening. Then we will exchange the O-rings. Since the vacuum losses were directly related to the LN2 filling, we will now use a longer and much thinner LN2 filling nozzle for the next cool-down to ensure a very slow filling of the vessel with a much more restricted LN2 flow. We expect less thermal stresses in the area around the O-rings inside the filling tube although the filling will take much longer. (The use of thinner and longer filling nozzles was avoided earlier due to the risk of damaging sensitive parts inside the tubes.)

### 5.7 FIES

#### 5.7.1 Instrument

It was decided to upgrade the old fiber bundle A to make it a proper spare. The fiber bundle was removed from the telescope to be refurbished. The bundle is now at ESO with Gerardo Avila. Aarhus will provide new mechanical parts for the fiber couplings.

A problem occurred with the top calibration unit where the arm (to direct the light from the calibrations lamps) and the mask got out of position due to a low voltage problem. Both were realigned and the positions recalibrated. Also a power switch was made for the top calibration unit. There is still an issue with the mounting of the fiber arm which often gets miss-aligned and needs to be fixed properly.

Since the shutter model was changed stray light was entering so a baffle was installed around the fiber-spectrograph coupling. Also, the two large tubes in the front room that bring the fiber and electrical power into the FIES building have been sealed as these were potential sources of heat.

The small pickoff mirror on the guide probe used to redirect the light to the FIES fiber-head was cleaned.

The last components of the focus electronics of FIES that were affected by the lightning storm from last year were replaced. The still need to be tested in detail.

### 5.7.2 Data and Target acquisition

The various observing scripts were converted to comply with the rules for sequencer scripts. Also some improvements were made to some of the scripts.

Given the improved pointing and the introduction of the system to detect and center guide stars, the overall accuracy of the pointing is only limited by the accuracy in the know position of the guide star, and more importantly, the accuracy to which the optical distortions are taking in to account in the positioning of the guide camera. The overall accuracy is expected to be better than a few arcsec which offers the possibility to acquire stars directly on the fiber head without the need to first acquire the star with StanCam which would speed up the target acquisition process. This needs to be investigated.

The StanCam filters are an integral part of the target acquisition and guiding when observing with FIES. It is now documented that these filters should not be manually moved to other positions. This because target-acquisition scripts currently rely on these positions to be fixed. We are working on a system where the contents of the StanCam filter cartridge will be reported to the data base such that acquisition scripts can find the correct location of the filters and do not need to rely on the filters being in a specific slot.

The data acquisition software was modified to set the format for FIES CCD images to 2198x2052 where it used to be 2148x2052. There are now 50 extra over-scan columns which is needed to be able to properly implement the AB read-mode.

### 5.7.3 Observing system

Starting up the FIES observing system required various steps, while the observer ended up with many overlapping windows on the screens. A new start-up of the system was made which simplified the whole procedure with a less crowded and more logical distribution of the many windows. This has also let to a much more condensed FIES instruction pages.

### 5.7.4 Exposure meter

The exposure meter for FIES was received from Aarhus, it was mechanically installed into FIES and the system was tested. The measurements from the meter were integrated in the FIESTA status display, and the use of the meter was integrated in the sequencer software. The system was commissioned together with the new FIES observing system start-up.

Currently the exposure meter does not work when the simultaneous ThAr is being used, but we have not decided yet how this will be done in practise.

### 5.7.5 Reduction software

Some minor improvements and fixes were made by Eric Stempels (University of St Andrews, UK). Several other improvements are being considered, but there is no specific time-line for this.

A script will be made for FIESTool to enable automation of the pre-reduction of calibration images. This will allow everybody to make a basic set-up for the use of FIESTool.

### 5.7.6 Remote observing

A specific observing system was development to do remote observing with FIES. This included software to operate the instrument and telescope, but also modifications to the status displays, and specific systems to transfer the data and center the target on the fiber. Also, a system was set-up for the staff present at the telescope to monitor things.

The system was extensively used during the "Observational Stellar Astrophysics School 2008" held at Molėtai observatory in Lithuania, and was a great success. The same system was also later successfully used for a 2 hour observing run as part of a training course from Uppsala University

A more detailed description is given an the article that was written as part a booklet made for the Molėtai course which is send together with this report.

### 5.7.7 ALFOSC support for FIES users

One of the problems of having override observations possible at any time is that there is a possibility that the requested observations are not using the instrument that the observers are using themselves. For the case of using StanCam while people are observing with, e.g., NOTCam specific instruction have already been available for a long time, while the observations to be executed are also rather straightforward.

However, for FIES observers any override request will likely be for observations with ALFOSC, and observing with ALFOSC can be significantly more complex then with StanCam (e.g., doing spectroscopy), while starting-up the ALFOSC observing system is also not trivial. We specifically considered 3 things: The need to start-up both the ALFOSC and FIES software, describe how any observations are done, and what to do during the introduction

Given the need to show the ALFOSC observing system during the introduction we have added specific instructions to the observing guide (which are also be used as a guide line during the introduction) and we specifically extended the introduction for FIES observers to start half an hour earlier (this does not apply to observers in Spanish time as they do not over any such override observing programs). The detailed instructions include pictures of the observing system to serve as a graphical reminder because people might after a few nights not remember things in any detail as they are not using ALFOSC for their regular observations.

The long-term objective is to provide scripts that automate the observations as much as possible (in principle fully automatic for imaging observations).

#### 5.7.8 Quality control

Because of continuing problems with the illumination of the low-resolution fiber by the top calibration unit, the gain-RON monitoring is now using fiber #3. There are some problems with the monitoring scripts (the process often stalls) which needs to be fixed.

One of the main objectives is to derive and specify the long-term wavelength zero-point accuracy for observations with and without simultaneous ThAr mode.

For the different calibration exposures there are script which first take a (windowed) test exposure to define the required exposure time. To monitor the health of the calibration lamps the idea is to record the results from these scripts in a data base.

The results from all the different quality control scripts will need to incorporated in the main NOT database.

#### 5.7.9 CryoTiger

Given that both FIES and StanCam are essential for observing with FIES and both use a CryoTiger we have decided to buy a complete spare system such that in the case of any major problems we can simply replace the failing system. We only recently received an offer and we are now in the process of purchasing the spare.

#### 5.7.10 FIES building

A new cooler was added to the FIES pre-room. Active cooling was necessary as simple air refreshing can not keep the temperature constant in summer. At the moment we are waiting for a proportional valve control to complete the system.

The three so-called Aarhus temperature sensors, which give the lowest noise reading, have been recently moved so that they read the room temperature near the ceiling, inside the white box and inside the black box. Looking at their readings it can be seen that the heating control of the instrument room is coping well while the outside temperature has fluctuated between about +10C and -2C.

#### 5.7.11 Temperature Monitoring System

We still need to improve the FIES and building temperature-control loops, to make the excursions around the reference temperature smaller, and to avoid short oscillations (with period less than 2 hours). To monitor the effect of temperature variations an automated temperature-stability analysis tool should be made based on measuring shifts in the Echellogram.

#### 5.7.12 Atmospheric dispersion corrector

The connection between the FIES ADC and the TCS and the control system for the ADC were made and tested. What remains is the installation of the ADC and some cabling inside the adapter.

#### 5.7.13 Documentation

A new main webpages following the NOT "style" was implemented. Also, a new cookbook-style reference guide was made that gives the user an overview of all necessary observing steps. The various FIES web pages were improved and a page was added with information about flux and radial velocity standard stars.

Some time has been spent trying to identify what components and documentation is missing for FIES. This has resulted in the discovery that documentation was lost in transit from Aarhus to the NOT. As a consequence it is difficult to know what we have and what is missing to the extent that some "reverse engineering" of FIES has been necessary, taking it apart and examining how it works.

Various drawings of part of the fiber-unit and and calibration unit were added to our webpages. Our local set of mechanical drawings is now complete.

### 5.8 MOSCA

#### 5.8.1 Data acquisition

MOSCA is the last remaining instrument that needs to be converted and integrated in the sequencer system. When changing to the sequencer we will also implement a new post-processing quick-look procedure that will merge the images from the different CCDs while mimicking the true physical gaps between the CCDs as much as possible. A corresponding "telescope offset" tool will be made that allows to mark any object on the combined mosaic image and move it to a desired position.

Due to the problem of lack of an over-scan of the MOSCA imaged and the desire to increase the length of the NOTCam frame command, it was proposed that more memory be installed on the PC interface board. the memory was purchased and added to the board but due to a problem with the programming of the PLD (main control chip) of the interface board, it was unable to "see" the extra memory correctly. After some investigation it was found that internal memory addressing on the board was wrongly implemented and the extra memory actually appeared higher up in the address space at intervals of 32MB, making it unusable. Preben Nørregaard (CUO) was asked if it was possible to resolve this problem but nothing has been done yet.

#### 5.8.2 Detector

The problem of one of the MOSCA CCDs failing at certain telescope pointings returned. An inspection of the instrument was made in the clean-room and during tests it was found that simply tightening down the front window flange caused the signal to disappear, suggesting a possible shorting between two items could be causing the problem. With the front plate off and monitoring the output of the CCD with an oscilloscope it was found that it was possible to reproduce the fault by moving the constantan wires that pass the signals from the dewar connector to the actual CCD.

Inspecting the wires under a microscope it was possible to see what could be some minor damage on a couple of the wires, but no obvious place where you could conclusively say was the cause of any fault. All the wires were moved so that they could not touch any part of the dewar walls. After reassembly the instrument it continued to work properly and has been used without any faults for one run since.

We are currently considering if we should replace the affected wire bundle or not. There is a certain risk in replacing the wires (the CCD is not protected electrically when the wires are not connected) but there is also a change that the error returns as has happened in the past. At least one difference is that now we know where the error is.

#### 5.8.3 Web-page

A new main web-page for MOSCA following the NOT "style" will be implemented in the near future.

### 5.9 StanCam

#### 5.9.1 Pick-off mirror

The CCD-probe with the pick-off mirror that redirects the light from the telescope to StanCam does not have any specific sensors system to assure its accuracy. To check the precision of the system, tests were made with the telescope at different positions and moving the mirror in and out. It was found that the position of stars was repeatable within ∼0.5 pixel (0.1 arcsec).

#### 5.9.2 Documentation

A new main web-page for StanCam following the NOT "style" was implemented. Also, some small updates and improvements were made to the pages.

### 5.10 SOFIN

It is planned to provide a separate computer specifically for the pipeline reduction of the data.

### 5.11 Computers and software

#### 5.11.1 Network

Together with the ING a 100Mb connection was rented which connects us to the 1Gb link from the observatory to the outside world. Previously we had two links (normal + backup) from our offices to the ORM and then down, which was our way out of La Palma. Now we keep the backup line up to ORM, but our access to the Internet is more direct.

Unfortunately, this new link has showed to be flawed as of lately, and it has brought back the issue of alternative routes for us to use when there are failures in the connection. The new link, however, brings us a scenario where we may use one of two routes leading to different points to deliver our network traffic, and actually that's how we are solving the current problem with the 100Mb connection while it's properly repaired.

Until now we have been working with static routes, meaning that each time one of this routing changes are needed, someone has to actually change values in a few places and, potentially, also cabling. The new routes have added an extra step that implies contacting with someone at IAC to make changes on their equipment if we want a proper working connection.

The solution is to switch to a fully dynamic routing, that switches the traffic from one circuit to other when needed, propagating changes over the network where needed. This would benefit both the traffic from the ORM and from the offices in Santa Cruz. This requires a few changes in hardware (both at our offices and at ORM) and to ask the IAC to do some other (software) changes on their side. We are currently looking for the appropriate hardware and we are preparing an implementation plan.

#### 5.11.2 Computer cabinet

The original plan was to expand the current computer cabinet in the service building which contains the main rack of our computer and network system to make them more easily accessible and provide more space for additional devices. However, expanding the room turned-out not to be that simple while not providing that much more room and also reducing the space in the existing clean room next to it. There is also a visitor's office in the service building which contains some cupboards and a desk plus desktop computer for use by the visiting astronomers. We are now planning to use half of that room to become a new computer cabinet, which will still leave room for the desk plus computer, while the cupboards will be moved elsewhere. This will actually make any construction work easier as this can be done without effecting the existing installations, but we still need to make a detailed design. The idea is to get this work done at the same time as the clean room facility at the telescope (see above).

#### 5.11.3 General computer system

There are various more points related to the general computer system:

- **Web plus ftp server**:

  We had some unexpected failures with the new web server (which was a refurbished one), and new hardware was purchased and the server was put back to work.

- **Back-up system**:

  After searching for appropriate storage hardware to run the system, we have chosen some networked storage facility that will cover not only the backup requirements, but for our current and future storage needs (at least for the next few years).

  Where it makes sense (as defined by our backup policy), the backups are done in an incremental fashion, allowing for access to days or weeks of previous data. We are looking at some possible additions that might be desirable.

- **Virtualizing services**:

  Some of our internal services, previously run by separate, old, less powerful computers (centralized software and licencing servers), have been substituted upon hardware failure.

  The obvious way to replace them would have been just a newer, more powerful computer that integrated all the services, as none of them are really demanding. However, some of the services are tied to a certain configuration (machine name, Ethernet MAC, etc), so we needed to have them, at least, "logically" separated.

  Instead of buying new machines to substitute each one, we have chosen the "virtualization" way, where a computer serves as a host for several other "virtual" computers that run within it, allowing us to cleanly isolate services in different environments, emulating the existence of hardware when needed and, in some cases, just copying the contents of the old computers to the virtual ones without having to reconfigure anything.

  Also, this allows as to add new "machines" whenever we want to provide new isolated services within the CPU and memory constraints of the host machine (e.g., the above mentioned backup system is managed by one of those virtual computers).

- **Observational course data**:

  The usual policy for NOT is that we offer the obtained data to the visitor the next day (on DVD media). Of course, there are times when it would be desirable to access the data during the same night it is being obtained, and the observational courses that are held at NOT are maybe the most relevant example.

After some problems derived from the visitors accessing the data in an improper way, it has been decided to offer the images in the same way service mode observations are offered: through a read-only copy sitting on our FTP server.

The mechanisms to do that without having to complicate the procedures for the observers and the staff have been developed and implemented.