The ESO/OAT Second Level Remote Observing Project

Final Test on ESO/NTT : 9 - 11 June 1992

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1 Technical Report

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Introduction

The final test of the "Second Level remote Observing Project" took place at the Astronomical Observatory of Trieste (OAT) on the nights from 9 to 11 June 1992. The project, started in 1989, was aimed at defining and implementing the architecture for a standard portable hardware and software kit for the second level remote observations on NTT from a European astronomical institute, via the Control Centre of ESO/Garching [1].

While it will be up to ESO to define the future strategy for the remote observations on NTT, it was intended that this project be considered a pilot project for the future architecture of the remote observing on VLT.

During three year's work the hardware has been procured, installed and tested, both at OAT and at ESO/Garching [2]. The ESO Pool management software has been fully rewritten in C language, converting it from the old version written in non-portable Fortran for HP A900 systems, and the Extended Pool management software has been designed and implemented [3].

As from September 1991 a number of test nights on NTT were allocated to the project, and the first level remote observing procedures from ESO/Garching have been thoroughly tested. The final test from the Astronomical Observatory of Trieste was intended to demonstrate the feasibility of the second level remote observing and to evaluate the performance of the whole system.

During the three test nights the local astronomers were given the opportunity to carry out astronomical observations on NTT. A preliminary constraint to the observation schedule imposed by the technical side was to give higher priority to short exposures with different instrumental configurations, to better evaluate the response of the distributed system to a heavy load. We believe however that, during the test nights, an acceptable compromise was reached between the technical requirements of the test itself and the wish of the astronomers to use the greater part of the nights for real astronomical work.

Over ten astronomers took part in the observations in Trieste. A technical report of the test will be given In the following paragraphs , together with a summary of the astronomical observations, and the feedback of the users in the remote observing environment.

We wish to acknowledge at this point the presence at OAT during the test of S. D'Odorico, M. Ziebell and G. Raffi from ESO and of L. Fini and E. Covino as observers of the Columbus project and of the Italian Space Agency respectively.

Test Preparation

The Advanced Technology Laboratory of the Astronomical Technologies Group was allocated for the preparation of the second level remote observing room at OAT.

The same facilities available at the first level remote centre at ESO/Garching were replicated. One of the commitments of the project was, in fact, that the observing astronomer should operate with the same configuration and the same interface at the telescope as at the first or second level remote sites. The communication and the computing equipment was installed in the same laboratory.

A 64 Kbps dedicated line, to link OAT and ESO/Garching was leased for 25 days, from May 25 to June 20, for this test. The leasing bureaucracy was cleared separately for the Italian SIP and the German Bundespost, since OAT and ESO were paying for the Italian and German segment of the line respectively. Some problems arose with the Bundespost owing to the fact that the multiplexer to be installed by OAT at ESO was not available on the German market and had not therefore been certified by the Bundespost. OAT had to provide the schematics of the line interface of the multiplexer and a declaration of the manufacturer that the equipments conformed to EEC regulations for EM disturbances. The line was installed on May 25, but further setbacks were experienced by the Bundepost during the first few days, and the link became available only on the evening of May 27. The line interface was X21/V11 at ESO and X21/V35 at OAT. The multiplexers installed by OAT had the standard X21/V11 line interface, with an option for the X21/V35 output. Unfortunately the interface conversion card for the V35 output had been left at ESO during the transfer of the hardware to OAT. These boards, dispatched urgently by ESO on Monday 25 were available at OAT only on the morning of Friday 29. The overall hardware setup is described in separate technical reports [2] and is shown in Figure 1. Here we wish only to report on the work done for the final installation and test.

The data channel

The data channel created no specific problems. The remote observing sub LAN of OAT was cut out from the general OAT LAN, and became part of the ESO remote observing network via a remote bridge.

Almost all the computing resources of the Astronomical Technologies Group of OAT were allotted to the experiment for the period from 1 to 12 June 1992. In view of the interest of the Galileo project in this experiment, also part of the Galileo hardware located at OAT was involved. The local network was made up of three workstations, two HP-425 and one HP-375, all running HP-UX v. 8.0. The HP-375 was configured as an X-Terminal. One workstation HP-425 and the HP-375 were acting as instrument and telescope workstations respectively. The second HP-425 was used as a Midas station.

A separate b/w terminal was used to run two 'talk' sessions respectively with the night assistant in La Silla and with the Control Centre in Garching. To use the "talk' utility (more user friendly than the similar 'write' utility provided by HP-UX) all the users had to log in on a SUN workstation, available both in La Silla and in Garching.

A Sylicon Graphics Indigo workstation was also part of the network. Its disk was NFS-mounted by the Midas station to provide more space for the data and its DAT unit was used for back-up purposes.

An additional router was not available, therefore the remote observing network was physically disconnected by the OAT Local Area Network.

Voice and video channels

The solution for the voice and video channels was not so straightforward . The voice is coded on both sides and compressed to a final bandwidth of 2400 bps.

The video channel, with only mono-directional reception originating from La Silla, is provided by a PC based TV-codec system and can operate at different transmission speeds, producing accordingly a slow-scan-TV-like effect with different refresh rates.

These two channels were routed through Garching although the ESO/Garching Control Centre could not monitor the information flow. The problem was due to the need of connecting the lines of the two different multiplexers installed in Garching, one connecting La Silla and the other one Trieste. Both lines are synchronons and physically configured as DCE. The solution to a synchronus DCE-DCE connection is not so general and straightforward and had to be found going through many variations of configurations. The solution for the video channel was also complicated by the fact that it needed an X21/V11 port. The multiplexers installed by OAT have only V24 ports and two interface converters had to be used. The technical details are reported in [2].

The video boards were delivered by the manifacturer with a four months delay and were available at OAT only at the beginning of June, a few days before the test. Moreover, the hardware version of the boards was unsuitable and not compatible with the application software. As a last resort, after a few days spent attempting to make it function the second set of video boards that were still at ESO werw retrieved. They had been left in Garching in view of the possibility of routing the video channel taking the signal from the analog inputs of the monitor. In this case the signal should have been coded again and transmitted to Trieste. Thanks to the good will of two members of our group, P. Marcucci and C. Vuerli, the video boards were fetched and installed. The video channel became operative at the beginning of the second night.

The hardware installation was completed by two terminals for the control of the multiplexer and of the bridge and by a PC based system for the reception and display of the Meteosat data. It was intended to be used for the images of South America, originated by GOES Satellite and relayed by Meteosat. This was the only item that did not work during the test. The level of the signal relayed by the ground station was too low. The 90 cm parabolic antenna was not sufficient to produce an acceptable output signal to noise ratio. Therefore, the Meteosat images were received perfectly but the images of the weather over Chile were not available.

Preliminary tests

All the equipment was installed at ESO from the 30th of March to 20th of May, for hardware and software tests. After the line ESO/OAT was installed the real test could also start. The first tests were made in simulation mode, connecting the OAT 'second level' system to the Garching 'first level' control centre and to two HP-A900 systems in Garching simulating the telescope and the instrument computers at La Silla reespectively.

From 1 to 5 June A. Wallander from ESO was present at OAT to carry out the final setup and checks.

On June 3 and 4, thanks to R. Buonanno who was allocated three nights on NTT at La Silla, we were allowed to connect our systems with La Silla computers. Consequentely, there were 12 hours (2x6) at our disposal for real testing during the day. The first day was spent almost completely on the set up of the configuration, thus enphasizing how complex the whole system is, and how critical is the overall configuration. It is done completely manually and there is always something missing. Further mention on this point will be made later. On the second day we were able to connect successfully with Garching and La Silla and to verify the complete software procedures.

We want to stress here that the availability of this pre-test phase helped very much in rendering the whole system operative at the beginning of the final test.

Test Runs

We had allocated the nights of 9,10 and 11 June for the final test. For the whole period from 8 to 12 June M. Comin from ESO was present to participate in the test.

On the first night, owing to the preliminary setup at La Silla, we were able to activate the complete remote hardware and software configuration at 18.00 UT. During the preliminary test some software problems surfaced, owing to both a mis-configuration and the presence of software bugs. It took over 10 hours to identify and fix the problems and at 4.00 UT of June 10 we were able to begin with the astronomical observations.

The video channel was not working, for even after the arrival of the boards from ESO, further problems arose in the software installation.

The observations of the first night continued until 11.00 UT.

On the second night we started the tests at 18.00 UT. Some minor problems were indentified and fixed. Some of us worked hard on the installation of the software of the video display package, identified the solution and rendered it operative. Successively the test of the video channel was started. With the help of an interface converter left at ESO the previous night, whilst collecting the video boards, and using the same configuration for the cross-over cable already tested for the voice channel, the video images from the telescope were available at the beginning of the night.

The astronomical use of the system started with a short delay and lasted till 11:00 UT.

The last night was dedicated almost completely to astronomical observations.

During the whole test the Extended Pool had to be restarted a number of times due to communication or software errors. This was not serious as it takes a very short time ($\approx$ 30 sec) to restart the whole system and there is no loss of data or interruption on running exposures.

Some problems in the software were identified during the test but were not fixed. It was decided in fact, that a recognized bug was better than a solution needing a period of testing and was therefore the astronomical use of the system was given higher priority. These problems will be fixed after the test.

In the days before the final test, according to a common design, a program was prepared by M. Comin at ESO to allow the Remote Control Centre of Garching the continuous automatic monitoring of every action carried out at the remote site of Trieste. Hence on activating the monitoring environment, the screens at ESO/Garching were to appear as mirrors of those active at Trieste.

In the general architecture design of the second level remote observing, we considered this monitoring procedure as a qualifying point.

The monitoring environment was almost fully operative but still presented a number of problems at the beginning of the first night and would have required a longer debugging period. We decided again to give higher priority to the astronomical use of the system and postponed the setup of the monitoring program to a later date. However A. Wallander at ESO/Garching was able to monitor fully the activity of the astronomers working at Trieste by manually activating the system in Garching and working on the data routed through the ESO/Garching systems during the entire period .

Technical Remarks

In the following paragraphs a number of remarks are listed, as noted by the staff who conducted the test. These remarks will form the basis for the definition of all the future activity.

- The entire remote observing system may be configured in different modes of operation. The node may be a primary or a secondary node, it may work in 'real mode' (i.e. connected to LaSilla) or in 'simulation mode' (i.e. connected to the A900 systems in Garching) and in both modes the remote nodes may be one or two. Moreover, the hardware configuration may be based on a single workstation (e.g. Garching Control Centre) or on more than one workstation, properly configured. There is often the need, especially during the preliminary setup phases, of switching among these different configurations, with a final setup at the beginning of the astronomical observations. Presently the software configuration is a complex structure based on many configuration files spread among different directories. This makes the manual switch rather awkward and hazardous, for every time something goes missing, resulting often in a lot of time wasted in discerning the reason of a malfunctio, only to discover the fault is simply owing to a wrong configuration. A simple and safe procedure should be implemented in order to make this context switch fast and easy during the course of the observations.
- Owing to errors in the communications or to software problems the XPool processes sometimes need to be restarted. When this happens the restart should be done on the local and remote nodes. Presently a manual procedure exists and can be activated by simply clicking a mouse button. These restart procedures should not be left up to the astronomers' responsibility, and an automatic procedure should be implemented. It must be noted however that the restart of the complete XPool does not cause any damage to the Pool database or to the active exposures, and is rather fast ($\approx$ 30 sec).
- The monitoring at the remote Control Centre of ESO/Garching is considered a qualified point in the general architecture of the remote observing system. The work is almost done and should be completed with a final test phase. To complete the monitoring environment at ESO/Garching it was considered pertinen that in the future the voice link should established via a multi point connection, connecting at the same time the second level site, the Control Centre and the telescope site. The present hardware architecture does not make this problem very easy to solve and will probably require more than one circuit, but it will certainly enforce the role of the Control Centre.
- A final point on the general performance. The time response of the User Interface gave positive results during the experiment. The overall time response is comparable to the performance of the system in Garching and the users seemed quite satisfied. This is a surprising and quite a positive outcome, since more than one level of updating is involved. The problem regarding the transfer of scientific data is more critical. The bandwith of the data channel was set to 32 Kbps. With this speed an image of 1K x 1K pixels is transferred in about 15 minutes, with the compressing algorithms available in the system. Since the original data may be in any case locally saved on magnetic tapes, this time lapse is not so serious. The user generally does not need to retrieve the original data immediately. On the contrary the time required for a quick look with Midas, about 2.5 minutes, is not acceptable to the astronomer, who needs the quick look utility to evaluate the results of very short exposures to optimize the subsequent exposure sequences. We are working on this problem at OAT, as a continuation of the remote observing project, thereupon developing a hardware/software system for the on-line data compression and transmission integrated in the quick look system [4].

The Customs

Amid the concerted efforton the part of several staff members to ensure the successful outcome of the project, the work done to meet the bureaucratic requirements of the customs deserves special mention.

As detailed above a few months before the test all the equipment was transported to ESO/Garching, in order to install and test the hardware and software in view of the future availability of the line between ESO and OAT. A month before the test, part of the hardware was transferred back to Trieste to be installed at OAT.

However, it was deemed necessary to provide a means of transport able to ensure a fast exchange of part of the material for maintenance or upgrading purposes. Therefore we were looking for a simple and quick way of transfering the equipment to and from ESO on a temporary basis, firm in the belief (which turn out to be a sorry illusion) that the problems encountered, would be reduced to a minimum as we would be dealing with EEC countries.

An initial briefing was received by the staff of INFN, who presumedly are experienced in such matters owing to the frequent transfer of hardware to and from CERN, and the chances of setting up a rapid exchange system appeared bleak. Accordingly, the material sholud be delivered more than a week before to an international courier, properly sealed and detailed. A second courier was to be found in Germany for reimportation. No flexibility or fast procedures were possible.

Hunting around for an alternative, another solution was found which appeared, easier and cheaper : the Carnet A.T.A. issued by the Chamber of Commerce.

As a result, after a few days delay, we obtained a wad of modules to be compiled and used for the exportation, transit and reimportation of the equipment. With this papers, we were able to cross the intervening borders in both directions on several occasions, using the OAT van completely loaded down with the packed material and on each occasion queueing in the custom offices together with TIR drivers from all over Europe.

In this manner, we were able to clear the goods at the custom every time. In ten border crossing none of the custom officials ever requested to look at the transported items. They were content simply to fill the relative forms with their decorative stamps. The more stamps they could apply onto the forms, the happier they seemed to be.

For all the Italian, Austrian and German custom officials knew, we could have exported a Cray and reimported a PC.

Even following these apparently easy procedures, which equipment will be exported when and in how many steps the whole expedition (to and fro) will be complete must in any case be defined. Moreover, some obstacles can arise if the reimportations are made in more than one trip.

In such international scientific collaborations, it is not always easy to know how many transfers will be necessary in advance. Therefore it often happens that a hardware component must be exchanged between the collaborating institutions at a very short notice. No official solution has been found to this problem, even within todays' Europe. The only way to exchange these equipment is to resort to smuggling, provided the items are small enough not to catch the custom official's attention !

In spite of all these difficulties and thanks largely to the efforts of many staff members at OAT, from the administration for the paper work to the Astronomical Technology Group for the packing, unpacking, transporting, driving, queueing at the customs etc..., we were able to successfully carry out also this aspect of the project.

Thanks to the acquired know-how in the field, detailed information for future smugglers is available.

2 The Astronomical Observations

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The scientific observations made during the remote observation experiment are reported in the following pages together with a list of problems encountered by the astronomers in the role of 'test observers'. It should be emphasized that the technical aspect of the test took priority over the optimization of the scientific program. In particular short exposures and frequent switching of observing modes and/or instruments to put the highest pressure on the whole remote control system were favoured.

All the targets pointed were selected within research projects currently on-going at the OAT. We anticipate that, given the success of the remote observation experiment, most of the data obtained are likely to lead to relevant scientific results.

The following is a brief description of such research projects.

T Tauri stars;

- The main problems investigated are the mechanism of mass–loss, the dissipation of angular momentum and the correlations between stellar activity and rotation. Echelle spectroscopy have been performed to study the velocity fields in the circumstellar environment. Images of stars suspected to possess optical jets were also obtained in the V, Hα, [NII] and [SII] filters.

Lithium abundance;

- The goal of this project is the determination of the lithium abundance in old, unevolved stars, which can set constraints on the primordial lithium abundance. Red spectra of two extremely metal–poor halo dwarfs([Fe/H]=-3.4 and [Fe/H]=-3.7) were taken, from which Li abundance can be determined using spectral synthesis techniques.

Photometry of gobular clusters;

- Here the effects of the stellar age parameter on the HB morphology are studied. B and V images of two globular clusters were taken, which will be used to construct colour–magnitude diagrams.

Horizontal branch stars in G.C.;

- The purpose of this project is to determine the possible relation between He photospheric abundance in HB stars and the He content, as indicated, for example, by HB morphology. A blue HB star in the globular cluster NGC 6362 (also a target of the previous program) was observed spectroscopically.

Interstellar medium;

- In the framework of the program for the study of halo and intergalactic gas, two background sources have been observed with the aim of detecting NaI absorption lines: (1) a halo sub-dwarf star of known distance to cast light on the location of the intervening gas; (2) a BL Lac object for the detection of halo and/or intergalactic absorptions.

Search of planetary nebulae in galaxies;

- Two galaxies in the Virgo cluster were observed in the attempt to detect Planetary Nebulae candidates. The observations were carried out with EMMI in RILD mode as couples of exposures with the V filter and an OIII filter. The radial velocities of the observed galaxies being lower than 1000 km/s, the OIII/0 filter was used.

Galaxies hosting Seyfert nucleus;

- We aim at the determination of the connection between the active nucleus and the host galaxy. Our investigation is based on optical and infrared observations to obtain colors and color gradients in the V, R, J, H, K bands. V and R images of a selection of 6 Seyfert galaxies from our program were taken.

Evolution of clusters of galaxies;

- The main goal of this project is to determine the evolution of the correlations between optical and x-ray properties of clusters from local objects up to $z \approx 0.35$ in order to set significant constraints on the predictions of current cosmological models. V, R, I images of the cluster 2137.3-2353 ($z \approx 0.313$) to determine the luminosity function and the other main optical properties were taken.

Optical counter-part of radio Einstein ring.

- Optical identification of the candidate Einstein Ring PKS1830-211. Einstein Rings are very powerful cosmological tools. Of particular interest here is their property of mapping the mass distribution of the lensing galaxy. PKS1830-211 has been identified as an Einstein Ring from VLBI maps. Up to now, however, no optical evidence of the nature of PKS1830-211 has been found yet. Several exposures in the I band that we plan to co-add in order to reach the necessary depth have been taken.

The following is a more detailed log of the main scientific obbservations carried out during the 3 test nights. At the end of the log of each night problems that affected us as observers are listed.

The First Night

Twilight at $\approx$ 23 UT.

Due to technical problems, the scientific observations started at $\approx$ 4.00 UT. The following objects were observed :

Object	Mode	Filter/Gr-Grs-Decker-Slit	Exposure time in s.	Program
He 3-1126	EMMI RILD	V,R,[NII],[SII], Hα	total 20	T Tauri stars
SZ 102	EMMI RILD	V,R,[NII],[SII], Hα	total 20	T Tauri stars
SZ 68	EMMI RILD	V,R,[NII],[SII], Hα	total 20	T Tauri stars
E 7	EMMI RILD	V,R	total 20	Standard stars
NGC 7006	EMMI RILD	V,R	total 30	Standard stars
2137-23	EMMI RILD	V	1800	Cluster of galaxies
2137-23	EMMI RILD	R	1200	Cluster of galaxies
NGC 6814	EMMI RILD	V	120	Seyfert galaxies
NGC 6814	EMMI RILD	R	150	Seyfert galaxies
2237+07	EMMI RILD	V	420	Seyfert galaxies
NGC 7469	EMMI RILD	V	180	Seyfert galaxies
MKN 533	EMMI RILD	V	300	Seyfert galaxies
NGC 7682	EMMI RILD	V	200	Seyfert galaxies

At 10.30 UT the control of the telescope was passed over to the night assistant who took sky-flats in all the filters used during the night.

Problems :

- several pool restarts were necessary during the entire night.
- the video channel was not working.

The Second Night

Due to technical problems, the night assistant started a number of exposures at $\approx$ 23.30 UT, having the telescope under his control. The remote observing started at about 0.45 UT . The seeing ranged from $1''.5$ to $1''.2$ during the night. The following objects were observed :

Object	Mode	Filter/Gr-Grs-Decker-Slit	Exposure time in s.	Program
NGC 4639	EMMI RILD	[OIII] (0 redshift)	3600	PN detection
NGC 4639	EMMI RILD	V	300	PN detection
NGC 4639	EMMI RILD	V	120	PN detection
He 3-1126	EMMI REMD	10–5–5"–1".2	1200	T Tauri stars
He 3-1126	EMMI REMD	10–5–5"–1".2	3600	T Tauri stars
Sz 68	EMMI REMD	10–5–5"–1".2	3600	T Tauri stars
Cl 124	EMMI REMD	10–5–5"–1".2	4800	HB stars in NGC 6362
E 8	EMMI RILD	V	4	Standard stars
E 8	EMMI RILD	R	4	Standard stars
E 8	EMMI RILD	I	4	Standard stars
2137-23	EMMI RILD	I	900	Cluster of galaxies
2137-23	EMMI RILD	I	900	Cluster of galaxies
2137-23	EMMI RILD	V	900	Cluster of galaxies
2137-23	EMMI RILD	V	900	Cluster of galaxies
2237+07	EMMI RILD	R	420	Seyfert galaxies
NGC 7469	EMMI RILD	R	180	Seyfert galaxies
MKN 530	EMMI RILD	R	300	Seyfert galaxies
MKN 533	EMMI RILD	R	300	Seyfert galaxies
NGC 7682	EMMI RILD	R	300	Seyfert galaxies
E 8	EMMI RILD	V	4	Standard stars
E 8	EMMI RILD	R	4	Standard stars
E 8	EMMI RILD	I	4	Standard stars

At 10.30 UT the control of the telescope was passed over to the night assistant who took sky-flats in all the filters used during the night.

Problems:

- An exposure sequence was paused being the adaptor/rotator close to the limit.
- a number of pool restarts were necessary during the entire night.
- the video channel was available only after $\approx$ 4.00 UT;

The Third Night

The observations were started at $\approx$ 23.30 UT without any problems. The seeing was $\approx 1''.2$.

The following objects were observed :

Object	Mode	Filter/Gr-Grs-Decker-Slit	Exposure time in s.	Program
NGC 3627	EMMI RILD	V	180	PN detection
NGC 3627	EMMI RILD	[OIII] 0 km/s	600	PN detection
NGC 3627	EMMI RILD	[OIII] 6000 km/s	600	PN detection
NGC 3627	EMMI RILD	[OIII] 0 km/s	1200	PN detection
He 3-1126	EMMI RILD	Hα	total 20 s	T Tauri stars
PG 1303-114	EMMI REMD	10-3-5"-1".2	3600	ISM
G64-37	EMMI REMD	10-3-5"-1".2	3600	Lithium abundance
SA 110	EMMI BIMG	B	10	Photometry of G.C.
SA 110	EMMI RILD	V	5	Photometry of G.C.
NGC 6362	EMMI RILD	V	2×60	Photometry of G.C.
NGC 6362	EMMI BIMG	B	2×240	Photometry of G.C.
NGC TERZAN 7	EMMI BIMG	B	600 + 60	Photometry of G.C.
NGC TERZAN 7	EMMI RILD	V	600 + 60	Photometry of G.C.
PKS 2155-304	EMMI REMD	10-3-5"-1".2	3600	ISM
E 8	EMMI RILD	I	1+3+5	Standard stars
1830-2106	EMMI RILD	I	5×600	Einstein ring
E 8	EMMI RILD	I	1+3+5	Standard stars
G275-4	EMMI REMD	10-3-5"-1".2	4200	Lithium abundance

At 10.30 UT the control of the telescope was passed over to the night assistant who took sky-flats in all the filters used during the night.

General User Comments

The remote observations on ESO-NTT with EMMI from the O.A.Trieste were performed successfully and in a rather smooth fashion. The user interface with the system proved to be efficient and rather simple to use, and capable of guiding even novice observers to an efficient use of the instrument and the telescope.

Some comments and possible improvements to the system are listed in the following pages, together with a number of problems experienced during the observations. We feel that such problems should be taken care of for a safer use of the instrumentation from a remote control station.

- The telescope and instrument setup (NTT + EMMI) is such that a flexible use is extremely easy. In the second and third nights, when most of the technical problems were solved and time was almost entirely dedicated to scientific observations, no less than five different users observed on the same night, changing instrument setup (REMD, RILD, BIMG) quite often. The situation is such that, with the remote observations arrangement, fractions of the night can be allocated to specific users, so as to optimize object visibility, number of calibrations, etc. Furthermore, "bad" nights (e.g. full moon) could be allocated to Garching to train novice users.
- An observer, while preparing and performing an observation, needs to monitor a fairly large number of screens (5). Such a setup makes it difficult for a single person to work efficiently; it is strongly suggested that the presence of two observers is allowed at all times.
- The communication channels between astronomer and N.A. should allow the N.A. to catch the astronomer's attention (e.g. by ringing a bell or popping up a very visible window).
- RILD,REMD,BIMG and SUSI are four distinct instruments and, for clarity, their relative

windows should have different colours. Also, it should be made impossibile to confuse a *start exposure* in BIMG with the corresponding command in RILD.

- When a *start exposure* button is pressed the astronomer should see (without having to open a window) exactly what exposure is he launching (what instrument, which filter, which exposure time etc...). For safety there should be a further control such as an answer to a *are you sure ?* question.

- It should be possible to launch a single exposure without having to define it as a sequence of one exposure.

- The lack of a camera showing the field pointed by the telescope was geatly felt.

- The *move telescope* window should inform the astronomer when the telescope is pointed and ready. At present the only way to guess this is to check that the telescope coordinates stop changing. The same remark applies to the *exposure status* window: there should be a message which informs when the exposure is terminated.

- The U.T. time should be visible somewhere.

- The coordinates input by the astronomer should be visible somewhere.

- There should be a log-file where all exposure are recorded. The file could be generated on the local machine as an ASCII file so that it could be immediately printed out by the astronomer.

- In several cases it is necessary to acquire a short test exposure before launching the real exposure (e.g. in the case of images of very faint objects or when there could be the risk of saturation). The two minutes necessary to load an image on the remote MIDAS display are definitely too long. We feel that the improving of the efficiency of the quick look facility is to be considered a high priority project.

- There should be, locally, tools such as a program which computes the position of the moon, twilight, etc. or a program which plots charts, selecting objects from catalogues.

3 Conclusions

The final test of the 'Remote Observing' project clearly demonstrated the feasibility of second level remote observing, and in the light of this may be considered a success. During the three nights over 30 hours were devoted to the astronomical observations and, as can be inferred by the users' comments, the system proved to be very easy and flexible to operate, considering that most of the observers had no experience in the use of EMMI.

In view of the success of the experiment an open discussion is underway at present on how to proceed, taking into account the possibility of finding a second European partner, and thereby configuring this second round of experiments as a flexible scheduling test involving more than one remote institute.

In the meantime all activity in the field will be centered mainly on improving the robustness of the system, in an attempt to make it really 'astronomer proof', in view of the routine remote observing on NTT that will hopefully be activated from ESO/Garching at the end of 1992.

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