EMMI is now working smoothly and reliably. Through a well-deserved recognition of his merits, Pierre has now been hired as staff astronomer at the Canada-France-Hawaii Telescope.

I take advantage of this occasion to welcome the newcomers, and to wish success in their new activitities to those who have left us.

Erratum

In the NTT News page that has appeared in The Messenger No. 89, at the bottom of the rightmost column of page 12, reference has been made erroneously to Period 60, instead of Period 59. One should read: ". . . the already described delays . . . have prevented the NTT Team from executing many of the service observing programmes that had been approved by the OPC for the first half of Period 59 . . .".

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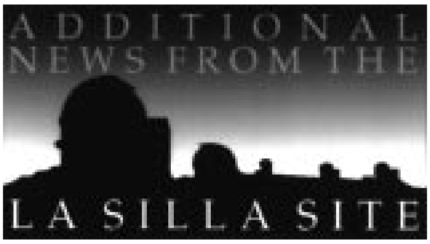

The La Silla News Page

The editors of the La Silla News Page would like to welcome readers of the eighth edition of a page devoted to reporting on technical updates and observational achievements at La Silla. We would like this page to inform the astronomical community of changes made to telescopes, instruments, operations, and of instrumental performances that cannot be reported conveniently elsewhere. Contributions and inquiries to this page from the community are most welcome. *(R. Gredel, C. Lidman)*

SOFI – Current Status

C. LIDMAN

SOFI (Son of ISAAC) is the new IR imaging spectrograph on the NTT. It replaces both IRSPEC, which was decommissioned last year, and IRAC2b which will be decommissioned in 1998. SOFI recently underwent system tests in Garching. Both the spectroscopic and imaging modes were successfully tested. The efficiency of the instrument is almost double that of IRAC2b. The performance of the Rockwell HgCdTe 1024×1024 array and the IRACE controller is excellent. In non-destructive read-out, the read-out noise of the array is a few electrons. This is comparable to the read-out noise of optical CCDs. During November, the instrument will be shipped to Chile. It will be installed on the NTT during December, where it will undergo further system tests. The instrument will be commissioned during March next year and offered as an ESO common user instrument during Period 61.

Further details can be found at the NTT web page: http://www.ls.eso.org/lasilla/Telescopes/NEWNTT/NTT-MAIN.html

Image Quality of the 3.6-m Telescope (Part VI) Now Diffraction Limited at 10 Microns at the f/35 Focus

S. GUISARD, U. WEILENMANN, A. VAN DIJSSELDONK, H.U. KÄUFL, J. ROUCHER, ESO

The images at the f/35 Cassegrain focus of the 3.6-m telescope have never been excellent. As the system (c.f. [1]) was initially installed and used to do only aperture photometry, this was never an issue of major concern. In fact, it could not even be measured directly. Only with the advent of mid-infrared cameras (here TIMMI [2],[3]) the image quality could be measured easily and systematically. Several reports state that the average Image Quality (IQ) over the last years was of the order of 1.5″ FWHM with exceptionally some good images below 1.0″. These images were made with TIMMI at 10 microns, the only instrument and wavelength used presently at the f/35 focus. As a consequence of the less than perfect image quality, the Strehl ratio and hence the sensitivity for point sources was degraded, typically by a factor of two. The IQ was poor compared to the diffraction limit at 10 microns on this telescope (0.7″) and the average seeing at La Silla at the same wavelength (between 0.5″ and 0.7″). This comparison leads to the evidence that the "man-made" degradation of the image is important.

This article summarises investigations, corrective actions and the results finally obtained after several periods of technical time (Work Component

Figure 1: Hard and heavy mechanical work at the observing floor: H. Quichón and P. Alvarez are remachining the spider of the infrared f/35 secondary at the observing floor of the 3.6-m dome.

Figure 2: The team, from left to right U. Weilenmann, S. Guisard, A. van Dijsseldonk, P. Bouchet and J. Roucher "breathing down the neck" of the optical engineer waiting for the output of ANTARES, ESO's portable Shack-Hartmann camera for quantitative image quality assessments.

19 of the 3.6-m Upgrade Project) in October 1996, November 1996 and July 1997 [4].

The technical time in October 1996 was originally foreseen to remove the decentring coma by moving the secondary mirror. This defect was known for long but could never be corrected due to the lack of adjusting range of the spider of the telescope. After mechanical modification of the spider mounts the coma could be reduced from 1.0″ d80% to less than 0.3″. At the same time we discovered a large astigmatism of the order of 0.8″ coming from M2. This astigmatism was due to the (heavy) chopping counterweight of the secondary mirror which was introducing deformations in the mirror. A new counterweight was manufactured from Tungsten (density 19.3!). This allowed to achieve the same dynamical properties in the restricted design space with less than half of the mass of the old device machined from copper as now on average most of the mass of this counterweight is located farther away from the chopping rotation axis. The astigmatism produced by M2 was thereby reduced from 0.8″ to 0.4″. The actual values of coma and astigmatism due to M2 (respectively 0.3″ and 0.4″) have to be added vectorially to the same aberrations arising from M1. Thus the resulting aberrations of the complete telescope depend on the angle of rotation of M2 around its optical axis. The Optical Quality (OQ) of the whole telescope at the f/35 focus therefore varies between 0.4″ and 0.9″ depending on the position of M2, the average being smaller than 0.6″, which means below the diffraction limit at 10 microns. As a comparison, before October 1996 the OQ of the telescope at f/35 was varying between 0.9″ and 1.5″ with an average OQ of the order of 1.2″ when rotating M2.

The test images shown here were obtained during the preparation of the observing run by ESO visiting astronomers, Yan Fernandez and Hans Ulrich Käufl on July 19, 1997. Figure 3 shows the trace through an image of the double star alpha-Centaurus, (separation 1997.5: 15.8 arcsec) using the N2-filter (λ: 9.14–10.43 μm).

For these observations – unfortunately – no external seeing values were available. The image quality for 30-second averages using the standard chopping and nodding observing procedure including the telescope autoguider is 0.9 arcsec FWHM (or 2.8 pixel). Considering 3 s averages, the image quality improves to 0.74 arcsec (or 2.2 pixel). This indicates either a residual image degradation due to the atmospheric tip-tilt or resulting from the auto-guider feed-back loop. The diffraction limit (1.22 λ/D) for these observations is 0.70 arcsec.

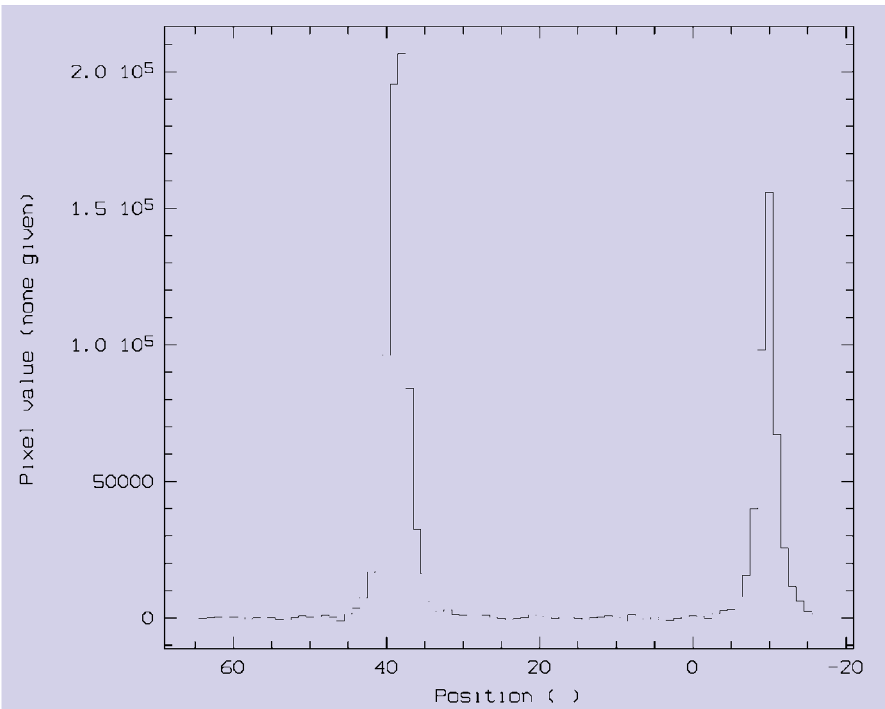

Figure 3: Trace through a 3-second exposure of the double star α Centaurus (separation 1997.5: 15.8 arcsec). For more details, see text.

The 3.6-m telescope is now well prepared for the arrival of TIMMI2, the successor of TIMMI, under construction at the Sternwarte Jena, to be installed end of 1998 (see [5] or http://www.eso.org/observing/vlt/instruments/visir/timmi2/index.html). Slight improvements (removal of the remaining astigmatism of M2, alignment of the mechanical and optical axis of M2 . . .) are still to be done and make sense for observations at shorter wavelengths.

Our thanks go to the mechanic support team who largely contributed to these improvements.

References

[1] A. Moorwood and Anton van Dijsseldonk, 1985, *The Messenger*, **39**, p.1.

[2] H.U. Käufl et al., "TIMMI at the 3.6-m Telescope", 1992, *The Messenger* **70**, p. 67.

[3] H.U. Käufl et al., "TIMMI ESO's new 10 µm Camera/Spectrometer", 1994, *Infrared Physics*, **35**, p. 203.

[4] S. Guisard, "Analysis and Improvement of the Optical Quality of the f/35 focus, Proposition for Further Improvements", 3.6m + CAT Upgrade 3P6-TRE-ESO-019-003, 28th July 1997.

[5] H.U. Käufl et al., 1997, *The Messenger* **88**, p. 8.

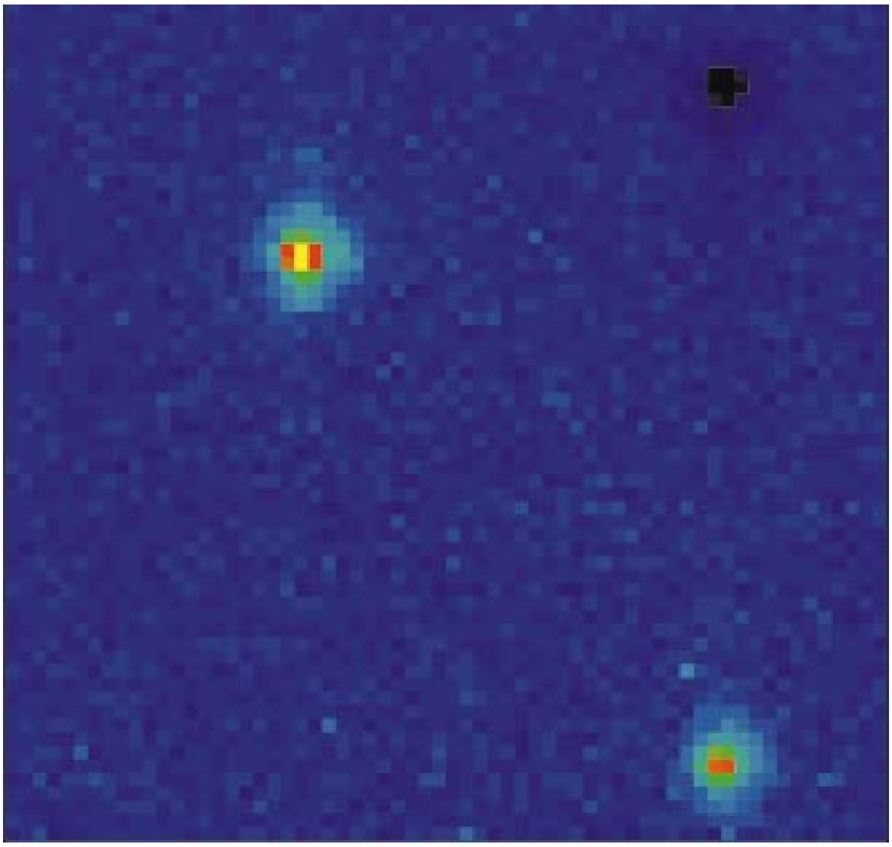

Figure 4: Colour plot of the image of α Centaurus. For more details, see text.

Image Quality of the 3.6-m Telescope (Part VII) Installation of a Spring System in the 3.6-m M1 Mirror Cell

R. GREDEL, S. GUISARD, G. IHLE

The installation of load cells in the 3.6-m M1 mirror cell in April 1997 (see June issue of *The Messenger*) allowed us for the first time in the history of the 3.6-m telescope to measure the forces exerted by the astatic levers on the main mirror. These measurements were required to optimise the force distribution among the three support rings, and to determine the characteristics of a spring system to correct for the aberrations of M1.

For the three axial support rings A, B, and C, the levers support 4385.0 kg, 4467.6 kg, and 2096.4 kg, respectively. These are fractions of 0.4005, 0.4080, and 0.1915, of the total weight of M1. The errors in the measurements are less than 0.05%. The force distribution is close to optimal fractions of 0.4080, 0.4024, and 0.1896, for rings A, B, and C, respectively, as calculated by Lothar Noethe and Franz Koch. The present load distribution results in wavefront aberrations of 9.7 nm RMS. This is significantly smaller than the errors introduced by the polishing errors of M1. Thus, it was decided not to modify the load distribution among the three rings.

The load distribution among the astatic levers in the outer ring follows a sinusoidal pattern. This is required to correct for the polishing errors of M1. As explained in detail in previous articles in *The Messenger* by Stephane Guisard, a degradation of the image quality occurs away from Zenith. This is mainly caused by the re-appearance of the intrinsic aberrations of M1, because the force exerted by the astatic levers are diminished by a factor which is proportional to cos(ZD), where ZD is the zenithal distance of the telescope. The corrective forces superimposed to the astatic support of M1 are thus not constant. In order to have a constant correction independent of ZD, it was decided to install a spring system in the M1 mirror cell. This idea was originally suggested by Rudolph le Poole, who spent two months on La Silla as an external consultant to the 3.6-m team. The springs exert a force on M1 which is independent of ZD.

The compensating force required by the springs was calculated for each lever in all three rings. It is up to 90 kg, positive for some, negative for others. With the addition of the springs, the weight of the astatic levers had to be adjusted. For most of the levers, this was achieved by moving the lever arm horizontally. For a few levers, weights up to 15 kg had to be added. The springs were installed during 10 nights of technical time in September.

Final image quality checks were performed with CCD #32 right after the spring installation. Unfortunately, the weather was very bad. Like many other observers who come to La Silla these days, we are not exempt of the effects of this year's very strong El Niño. The few measurements we have suggest that the optical quality of the 3.6-m away from Zenith has improved. The triangular term Z10 is now independent of ZD and near 0, except for one position at ZD = 60 degrees to the south, where it is 0.35 arcsec. This is most probably caused by the lateral support of the M1. Other aberrations such as astigmatism have not improved. They are believed to arise from a non-adequate lateral support as well. Because of these problems, it is planned to replace the analogue pressure regulator for the lateral support. In the coming months, we wish to install a servo control of the pneumatic pads with loop closure over the lateral load cell readings.