The quality of the data obtained in both modes appears excellent. We will report on the detailed results with this configuration in the forthcoming issue of the *Messenger.*

On November 10, EMMI entered regular use by visiting astronomers.

H. DEKKER and S. D'ODORICO, ESO

Who Needs Nebular Filtres?

Bruce Balick, University of Washington, is interested in soliciting an order for interference filters in imaging and spectroscopy (for order separation) of galactic nebulae. These filters are quite expensive, but significant discounts can be obtained if multiple filters are ordered together. It is suggested that interested parties contact Bruce Balick directly at the following address: Astronomy FM-20, University of Washington, Seattle WA 98195, USA (Bitnet: BALICK@UWAPHAST).

A New Low Limit in the Read-Out Noise of ESO CCDs

In the framework of the EMMI tuning before it started regular operation, a special effort was made last October to optimize the read-out noise of the two 1024^2 pixels, Thomson TH31156 CCDs now in operation at the red and blue arm of the instrument with two ESO-built VME-based controllers. Due to higher tolerances in the line voltage at La Silla the main power suppliers of the CCD controllers had to be modified to suppress pick-up noise. Further adjustment of the CCD clock's timing further improved the rejection of spurious noise.

It was finally possible to reach at the telescope values around 3 e^-/pix rms in both the blue- and the red-arm CCDs. This is the lowest instrumental noise ever achieved at ESO and a wide range of astronomical observations (essentially those which are not source or sky photon noise limited) will benefit from the improvement.

S. D'ODORICO and R. REISS, ESO

Results on the Testing of Ford Aerospace and Tektronix CCDs

In the second half of 1990, two new types of CCDs were tested in the detector laboratory in Garching. ESO received 6 2048^2-front-illuminated CCDs from Ford Aerospace (15-micron pixels). The actual testing was carried out in collaboration by ESO staff and Martin Roth of the Munich University Observatory. The best devices of the lot have QE curves typical of thick devices with a peak value of 42% at 700 nm and read-out noise of about 10 e^- without any optimization effort. They have also 3–4 hot columns or major traps. Test of three additional devices delivered by Ford is going on with a view to select one CCD for astronomical tests at the telescope in 1991. In relation to the introduction of the large CCDs at the telescope, an upgraded software on the CCD controllers has also been tested. It makes possible to freely define windows of interests in the CCD image. Undesired pixels are skipped already during CCD read-out and therefore the read and transfer time is reduced. A windowed format, when possible, also makes the use of the IHAP data reduction system much faster.

ESO has also received three back-illuminated 512^2-Tektronix CCDs with 27-micron pixels. These CCDs are of very good cosmetic quality and of high efficiency over the useful spectral range (40% at 400 nm, 60% at 600 nm and 10% at 1000 nm). A read-out noise of 13 e^- has been measured in the first laboratory tests. The La Silla staff is currently preparing the installation of one of these CCDs at the CASPEC spectrograph.

S. DEIRIES, S. D'ODORICO and R. REISS, ESO

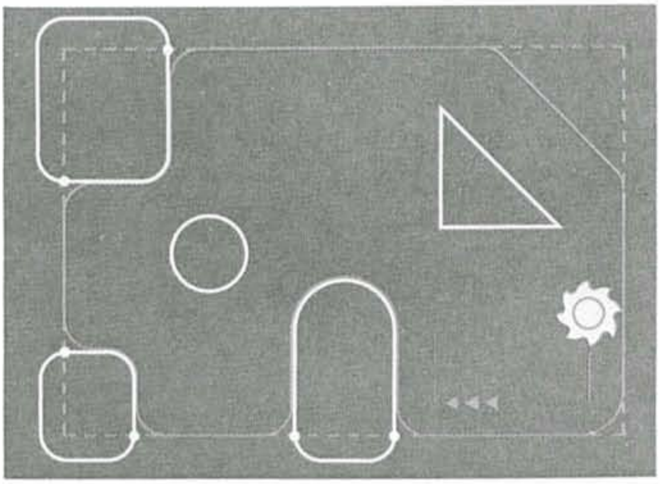
Celestial Mechanics

S.A. BALON, ESO

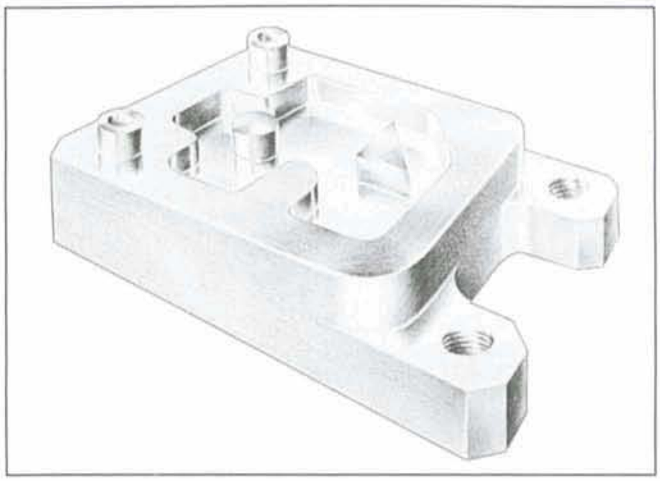
At the beginning of this year I had the pleasure of installing the first Mikron milling computerized machine in the Astroworkshop on La Silla.

We had already made Optopus plates with this machine for a long time in the mechanical workshop at Garching Headquarters (see *The Messenger* No. 31, March 1983, and No. 43, March 1986), and during the long period of testing the machine has demonstrated its good qualities.

After having received our instructions, the personnel at the Astroworkshop on La Silla is now able to take over this work from us. According to G. Avila who



Milling cycles for variable contour pockets.



follows closely the functioning of Optopus, the results continue to be as impressive as before.

At the mechanical workshop in Garching we obviously had to replace the previous machine with a new Mikron in order to ensure compatibility and permit the possibility of an exchange of programmes between Garching and La Silla. As the mechanical workshop in Garching has only one milling machine, we have chosen one with a greater capacity than the previous one, which allows us displacements by 700 mm in X, 500 mm in Y and 500 mm in Z, thus enabling the manufacture of larger parts. The capabilities of this Mikron WF51D "TNC 355" machine are identical to its predecessor with a few new features:

- Programme input during machining
- Programming of chamfers
- Helical interpolation (enabling manufacture of larger diameter, external or internal screw threads)
- The standard cycles which already existed are retained (Heidenhain) but we have cycles unique to Mikron
- Milling of pockets with varied contours allowing us to retain the islands
- Scaling factor 0 to 100 enabling us to enlarge or reduce the forms or figures of geometrically identical holes.
- The control enlarges or reduces shapes or drilling patterns of similar geometry by a scaling factor.
- Shifts from point zero, but also coordinates system rotation, a feature which did not exist on the previous machine. If the milling or drilling patterns are repeated at shifted positions, there is no need for reprogramming, you only specify the offset. If a milling or drilling pattern is rotated on a circular arc, you programme a coordinate system rotation.
- Programme test: programming assurance through test run without machine movement

Jöran Ramberg (1906–1990)

Already in 1933, Jöran Ramberg joined as Research Assistant the newly established Stockholm Observatory in Saltsjöbaden – at the time an institution under the Royal Swedish Academy of Sciences. He remained at the Observatory at different posts – from 1948 as Associate Professor and from 1960 as Professor – until 1963, when he took up duty as Assistant Director of the European Southern Observatory. In 1968, he became the Technical Director of ESO and remained in this position until his retirement in 1971. Through this, Ramberg very actively contributed to the first development of ESO.

Jöran Ramberg's research in astronomy mainly dealt with the structure of the Milky Way system. The method he used is based on the determination of the distances of stars through a combination of spectral analysis and photometry. As both the observing and the data reduction were very time consuming, Ramberg's work had to be limited to deep surveys (as far as the telescopes in Saltsjöbaden could reach) in selected areas. In his thesis, Ramberg controlled and calibrated this method by observing the two nearby star clusters, the *Hyades* and *Praesepe*.

As a side-result, he discovered two white dwarf stars in the Hyades. This was the first time that these extremely compact objects, which represent the end phase of the development of a star, had been found in a star cluster – a discovery important in determining the ages of these stars. The deep surveys also required observations from the Southern Hemisphere; these were made at the Harvard Observatory Branch in Bloemfontein in South Africa. Ramberg's investigations reached a distance of 6000 light-years and are still unsurpassed. They showed that the stars, also those at a relatively high age, are strongly concentrated to the spiral arms that are lined up of gas and dust in the Milky Way. This result is remarkable because it cannot be fully explained by existing theories for the origin of spiral arms in rotating stellar systems.

All of us who have had the pleasure of knowing Jöran Ramberg as friend and colleague, have admired his untiring energy and deep engagement, his meticulousness in both research and instrument construction, and his self-sacrificing work making astronomy and its achievements known to the public. We have always enjoyed his perfect readiness to share his knowledge and his experience. His demise leaves big emptiness behind.

P. O. LINDBLAD

- Programme checking with graphics, simulation of the machining:
  (a) display of blank
  (b) views in three planes
  (c) plan view with depth display
  (d) 3D view
  (e) magnify.

The Mikron machines on La Silla and Garching have demonstrated excellent performance and this has enabled us to manufacture not only the Optopus but also to participate in the manufacture of "EMMI", the extraordinary instrument mechanically designed by H. Kotzlowski and described by S. D'Odorico (see *The Messenger* No. 61, September 1990) and with which R. Buettinghaus and myself have been working for almost one and a half years in the Garching Mechanical Workshop.

As the dawn of the VLT approaches, we are well equipped to deal with the instrumentation of tomorrow.

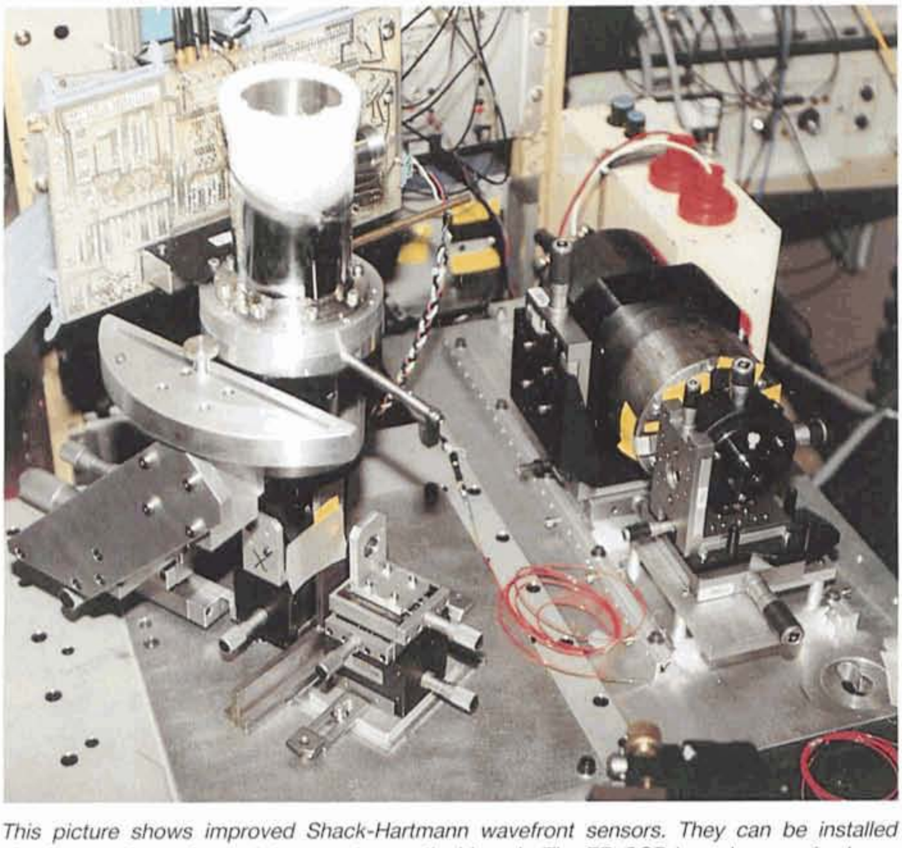
News About Adaptive Optics

After the successful initial test of the adaptive optics prototype system on the 3.6-m telescope (see *The Messenger* No. 60), a second test run was performed from September 26 to October 2, 1990. The aim of this run was to test two improved Shack-Hartmann wavefront sensor configurations, a sensor for the visible wavelength range, equipped with an electron bombarded CCD (EB-CCD), and an infrared wavefront sensor.

The EB-CCD sensor was developed by the Observatoire de Paris. The EB-CCD, which is still in a prototype phase, was manufactured by LEP (Philips) in France and allowed to push the limiting magnitude for wavefront sensing in the visible to approximately m_v = 11.5, a substantial gain compared to the old sensor which was based on an intensified Reticon and only reached m_v = 8.5. The new sensor appears to be quantum noise limited.

In a second test an infrared wavefront sensor was applied to the adaptive system. This sensor was built by the Observatoire de Paris and LETI-LIR in Grenoble, where the 64 by 64 InSb detector array has been developed with a read-out noise of 450 electrons. Although the system transmission was not yet fully optimized, the servo system, locked on a star of m_K = 2.5, offers very good prospects for the future. For this sensor, the limiting magnitude still has to be determined, but it has already proven to be suitable in the closed-loop system.

The above-mentioned test run was aimed at purely technical features and fine-tuning of the prototype system. A science-devoted run with the adaptive optics system followed from October 24 to November 5. For the first time, 6 nights have been exclusively devoted to the scientific exploration of adaptive optics. The set-up and activation of the system has now become a nearly routine operation, and for the team of astronomers from Observatoire de Paris-Meudon it was possible to concentrate fully on the science aspects of their observations.



This picture shows improved Shack-Hartmann wavefront sensors. They can be installed simultaneously on the prototype system optical bench. The EB-CCD based sensor is shown on the right side with the lens array mounted in the alignment stage in front of the cylindrical detector housing. The infrared sensor with its small cryostat is shown on the left. Here the light enters from below via a relay lens and a folding mirror.

A second similar science-devoted run is planned for January 1991 before the system will undergo a major upgrade. In early 1992 it will be available again with a deformable mirror with approximately 50 actuators and an increased bandwidth of 25 Hz to possibly 40 Hz (at 0 dB). This will allow diffraction-limited observations at the 3.6-m telescope in the K-Band and possibly the H-band with good seeing. Although it will still be a prototype, we will attempt to make it more "user-friendly". It may then be offered to the ESO community in late 1992 for a limited number of programmes.

F. MERKLE, ESO
F. RIGAUT, Observatoire de Meudon

MIDAS Memo

ESO Image Processing Group

1. Application Developments – Graphics

The MIDAS graphics package has been subject to a number of questions during the course of this year. Although in principle one can obtain all important information from the MIDAS User Guide (Volume A, Chapter 6), we would like to summarize here briefly the available functionality.

The MIDAS graphics sub-system enables you to visualize (plot) all data structures in MIDAS: frames, tables, descriptors and keywords. To do so, obviously named plot and overplot commands have been implemented. In general these commands have a well defined syntax.