tions were announced for this four-day conference, which took place just before the ESO-Conference on "Very Large Telescopes and their Instrumentation".

In addition, a one-day tutorial was arranged the day before the conference to teach scientists, researchers and students new in this area about the theory and experimental techniques of interferometry in optical astronomy. About 100 persons participated.

The conference itself was attended by 183 participants (including 24 from ESO and the ST-ECF). They came from more than 15 countries. The United States was represented by 46, followed by France with 41, and the Federal Republic of Germany with 26 scientists. A total of 20 invited talks, 97 contributed presentations (63 talks and 34 posters) and 1 special talk were given during the conference.

The programme was composed of papers covering the scientific needs for high angular resolution and interferometry, single aperture interferometry including speckle interferometry, pupil-plane interferometry, the Know-Thompson method, triple correlation methods, phase-closure methods and others, and multiple aperture interferometry with presentations on existing and future projects for long-baseline interferometers and related technologies. A special talk illustrated the progress of radio interferometry during the last decades and the way interferometry at infrared and visible wavelengths still has to go.

A large number of excellent and novel scientific and technical results were presented during this conference. The highlights included spectacular scientific results, improved algorithms and reconstructed images, advanced experimental set-ups, instruments and interferometers and plans and proposals for the next generation of interferometric equipment. The Proceedings, which will give a comprehensive overview of the area of high resolution imaging by interferometry in astronomy, are expected by end of July 1988.

The next ESO/NOAO meeting – on "Infrared Array Detectors" – will take place in Tucson in September or October 1989.

F. MERKLE, ESO

VLT NEWS

The VLT Adaptive Optics Prototype System: Status May 1988

F. MERKLE, ESO

In 1987 ESO decided to develop and construct an adaptive optics prototype system. This initial step into the field of adaptive optics at ESO has been taken in collaboration with the French three institutions ONERA, CGE-Laboratoires de Marcoussis, and the Observatoire de Paris-Meudon (DESPA). The system is dimensioned for F/8 focus of the ESO 3.6-m telescope and the 1.52-m telescope of the Observatoire de Haute-Provence. It operates as a polychromatic adaptive system (see Fig. 1), i.e. it is equipped with an infrared camera for image detection in the 3 to 5 μm range while its wavefront sensor works in the visible. It uses a deformable mirror with 19 actuators while the wavefront is sensed at 10×10 subapertures. It serves as a testbench for the various elements of an adaptive system and the modal control algorithms.

The construction of the main elements of this adaptive optical system is basically finished and the first functional tests have already started. These elements are:

- the deformable mirror,
- the wavefront sensor, and
- the control computer.

For this prototype system a thin faceplate (0.7 mm) deformable mirror had been selected. It was developed at CGE-Laboratoires de Marcoussis in France (see Fig. 2). The 19 piezoelectric actuators are distributed over a circular area with 65 mm in diameter in a hexagon arrangement. The total diameter of the mirror is 130 mm. The maximum actuator stroke is in the range of $\pm$ 7.5 μm for a voltage of $\pm$ 1,500 V. The mirror itself is made of silicon which has been polished to better than half an interference fringe at the HE-NE-laser wavelength and is coated with silver.

For adaptive optics a Shack-Hartmann sensor seems to be the most adequate wavefront sensor. The lenticular arrays which are the key-components of Shack-Hartmann sensors have been

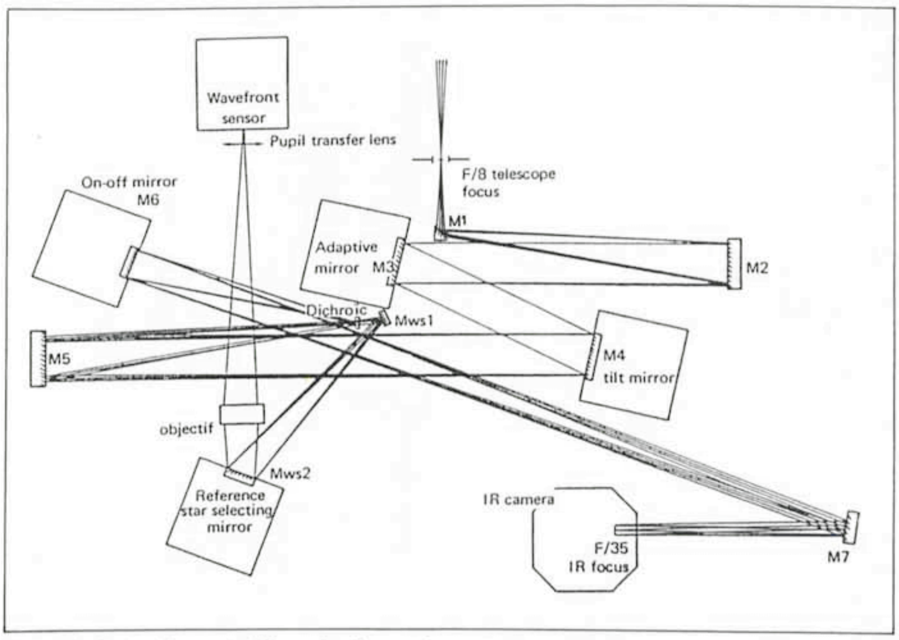

Figure 1: *Optical lay-out of the adaptive optics prototype system.*

Figure 2: *Deformable mirror developed at CGE-Laboratoires de Marcoussis with 19 piezoelectric actuators.*

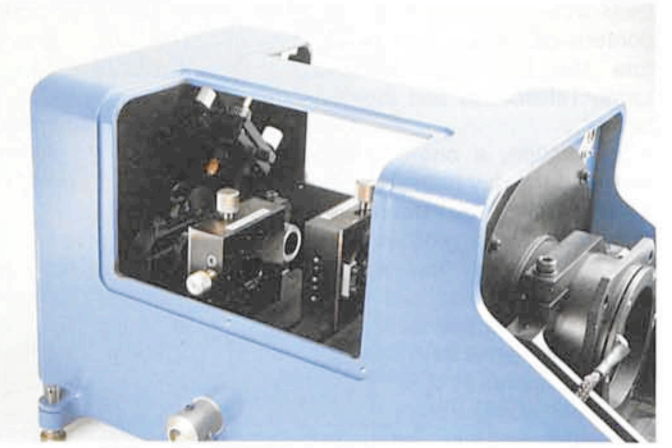

Figure 3: *Picture of the fast Shack-Hartmann sensor developed at ESO which is equipped with an intensified 100 × 100 Reticon array detector.*

developed at ESO already for the NTT. The individual lenses (in total 1,600) are 1 × 1 mm and have a focal length of 170 mm. They are manufactured by a replication technique using two crossed arrays of cylindrical lenses. A Reticon type array is used as detector to sense the position of the individual foci for the calculation of the centres of gravity within the subpupils. Combining the beam to be analysed with a reference beam, representing a plane wavefront, allows a self-calibration even during observation.

Figure 3 shows a picture of the fast ESO Shack-Hartmann sensor equipped with a 100 × 100 Reticon array detector. The spot pattern is intensified by a two stage proximity focus intensifier (Proxitronic). The intensifiers and the Reticon are coupled together by fiber plates. Two optical configurations can be selected, either 10 × 10 or 5 × 5 subapertures with 10 × 10 or 20 × 20 pixels, respectively. The maximum frame rate is 500 frames per second but in typical operation conditions it is limited to 200.

All slope-measuring wavefront sensors require a reconstruction of the wavefront itself. Normally, two orthogonal wavefront slope measurements are made for each subaperture. The reconstruction algorithms require very high computation powers in order to meet the temporal and spatial requirements. With special dedicated hardware or hybrid systems this problem is successfully approachable.

The prototype system is based on special hardware developments going on at ONERA and CGE in France. These systems use microprogrammable parallel structures, controlled by a general purpose host processor. The maximum pixel rate of the detector of the wavefront sensor is currently limited to 2 Megapixels per second which sets the maximum control loop rate to 200 cy-

Figure 4: *Wavefront computer developed at ONERA.*

cles per second due to the 10,000 pixels of the detector. The expected OdB-bandwidth of the system is approximately 30 Hz. This will allow a full correction for wavelengths greater 2.2 μm. At this wavelength the typical atmospheric correlation time is 35 ms.

The integration of the optomechanical system is planned for October and November. In December system tests with closed-loop operation will begin. First light is scheduled for March 1989 at OHP and at the 3.6-meter telescope later next year.

This development programme is carried out within the frame of the VLT project. It is intended to equip each individual VLT telescope with independent active and adaptive optical systems. The active optics will be used for the figure compensation of the telescope optics. The atmospheric compensation is foreseen in a separate adaptive optical system which will be installed in the Coudé beam. Active and adaptive optics will have separate wavefront sensors, due to the different isoplanatic angles and the different time constants for the corrections. At the moment, an adaptive system with 100 to 200 subapertures and 50 to 100 Hz operational frequency is the target for future investigations. By extrapolating currently available technology with piezoelectric material for the 100 to 200 actuators the diameter of this mirror will be approximately 300 mm. Future developments in mirror technology and special control electronics may lead to much more complex systems. It is envisaged to incorporate these developments after availability into the concept.

Acknowledgements

The author's thanks are due to many colleagues contributing to ESO's activities in the field of adaptive optics, particularly J.C. Fontanella (ONERA), J.P. Gaffard (CGE), P. Kern (Obs. de Meudon), P. Léna (Obs. de Meudon), J.C. de Miscault (CGE), G. Rousset (ONERA), and to many colleagues at ESO for stimulating discussions.

Latest Studies Lead to Revised Design of the VLT Enclosure

L. ZAGO, ESO

Like for many other systems of such an innovative project as the VLT, the design process of the enclosure is necessarily iterative. Those who have followed the evolution of the project from its beginning will remember the first concept which presented the arrangement of the four telescopes observing in the open air, behind a large wind shield and with mobile shelters for daytime and weather protection. Then inflatable domes were proposed: the resulting enclosure was certainly much lighter, more elegant and above all cheaper.

Now, in view of the latest studies and developments on both telescope and dome, we are coming to a further iteration (possibly not the last one) in the definition of the VLT enclosure. This is well illustrated by the latest model of the VLT, first shown at the Large Telescopes Conference of last March.

The new model shows one unit telescope of the VLT array, which is enclosed by a circular service platform supporting the inflatable dome. The telescope pillar is lower than in the previous designs, as measurements of atmospheric properties in the near ground layer at La Silla have shown that there is no advantage in having the opening of a telescope higher than 15 metres above the ground. While this conclusion may be revised for other sites, it has been included in the present baseline project. It is therefore now more convenient to base the gantry crane on tracks at ground level than to make a continuous

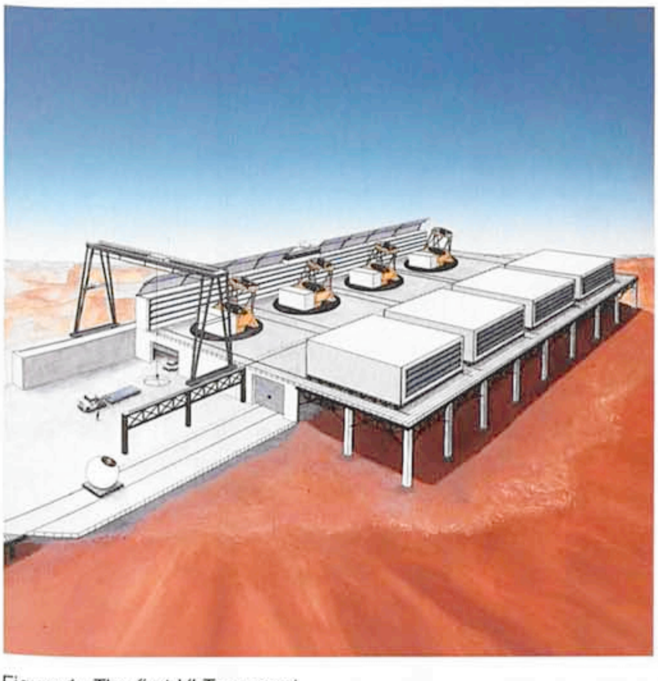

Figure 1: *The first VLT concept.*

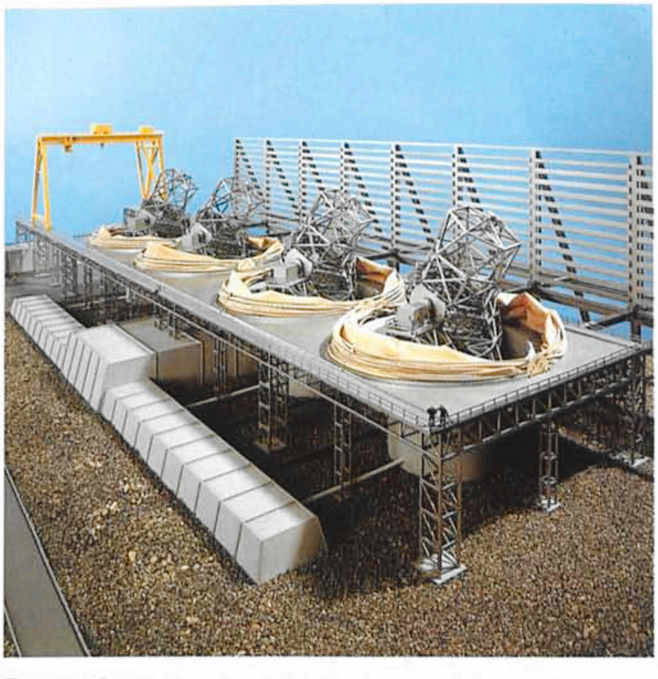

Figure 2: *Second iteration: inflatable domes, a lighter platform.*