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TELESCOPES AND INSTRUMENTATION

News from the VLT

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During the last months, the work at ESO's Very Large Telescope (VLT) project, both at the Paranal Observatory and in Europe, progressed very well. On the following pages is a brief description of the recent achievements and the activities that will take place in the next months.

Figure 1: From the window of a commercial airplane on a flight from Santiago to Antofagasta, G. Wayne Van Citters from NSF took this dramatic photo of the Atacama desert. In the isolation of the mountain desert the constructions of the Paranal Observatory resemble a "mirage".

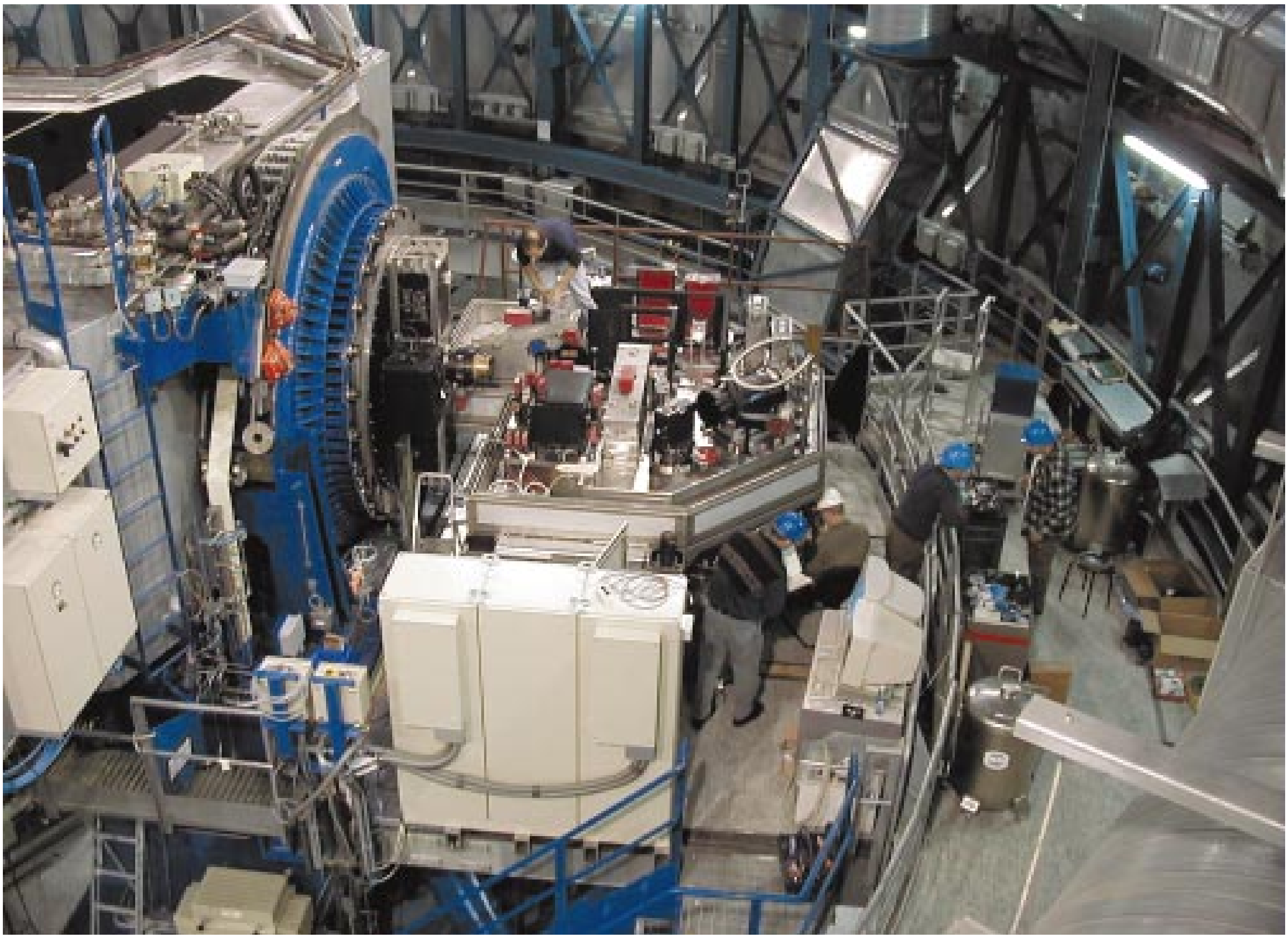


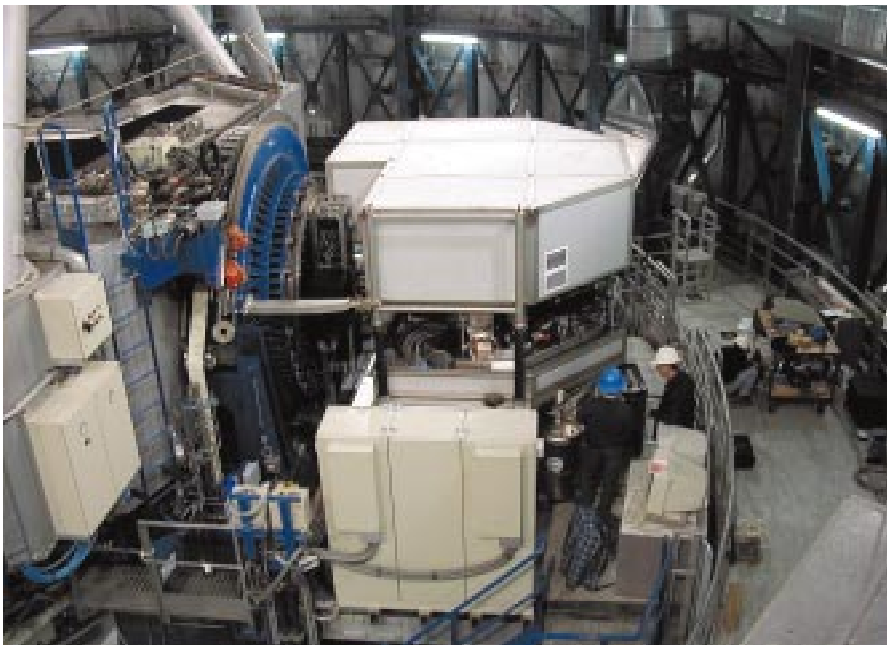
Figure 2: UVES. General view from above the KUEYEN Nasmyth platform where the high-resolution UVES spectrograph is being installed. The rotator-adapter is to the left, within the blue-painted support. (This digital photo was obtained on September 2, 1999.)

ANTU (UT1)

It is now half a year since 1st April when the first 8.2-m VLT Unit Telescope (ANTU) was handed over to the astronomers and it started to deliver excellent observational data. More than 35,000 scientific frames have been obtained so far with FORS and ISAAC. Many of the images have a seeing better than 0.4 arcsec. Several research projects for which time was allocated during the past months have reported very good and even spectacular results. In some cases, the data were fully reduced and the astronomers involved are now in the final stages of preparing the associated scientific reports and papers. Our scientific operation team guided by R. Gilmozzi gained enormous experience both in the service and visitor modes. Now it is time to transfer the telescopes and instruments to the others. A fundamental contribution was given by the Garching front end and back end operations teams led by D. Silva and B. Leibundgut that interact with the community in the preparation of the observation and the support of the VLT archive.

KUEYEN (UT2)

Following "First Light" in March this year, the commissioning work for the second Unit Telescope successfully reached a milestone when instruments could be integrated at the different



▶ *Figure 3: UVES. When the UVES cover is put in place, it protects the sensitive inner parts of the instrument from unwanted light and dust. (This digital photo was obtained on September 16, 1999.)*

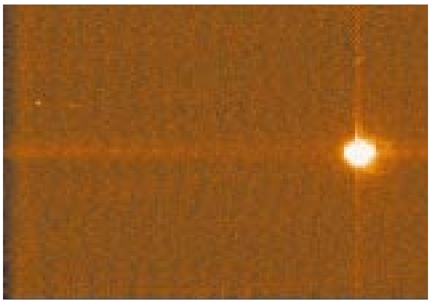


Figure 4: UT3 first pointing. First image of a star obtained with the CCD camera at the 20-cm guide telescope on MELIPAL, at the beginning of pointing and tracking tests.

telescope foci. The KUEYEN Commission Team, led by Jason Spyromilio, tuned the telescope control system in such a way that the pointing tests are proceeding extremely well. During a series of 145 test stars just completed and covering the entire operating range of the telescope, on no occasion was the star out of the patch. From the real performance measurements, the overall RMS value was found to be only 0.85 arcsec and no stars were rejected during the test. This is an excellent result for any telescope.

The next major activity, currently underway, is the mounting of the large, high-dispersion spectrograph UVES onto one of the Nasmyth platforms (see Figs. 2 and 3). UVES is the second major VLT instrument to be built at ESO. It is also one of the heaviest and most complex ones at this astronomical facility. This delicate work includes the installation and exceedingly accurate alignment of the many optical components on the heavy base plate, necessary to ensure the highest optical quality during the forthcoming observations. The moment of “UVES First Light” with the first test observations of spectra of celestial objects is expected the last week of September.

Figure 5: Mirror cell for UT4. The fourth M1 Cell (for YEPUN) in its protective cover arrives at Paranal, after a safe passage from Europe. (This digital photo was obtained on August 23, 1999).

Work on the assembly of FORS2 continued at the Integration Laboratory in the Mirror Maintenance Building (MMB) and the first tests were made. This instrument will be installed at the Cassegrain focus of KUEYEN in late October 1999.

MELIPAL (UT3)

The dummy M1 mirror cell was removed in early August from the third Unit Telescope (MELIPAL) and the real Mirror Cell (the third “M1 Cell”), although still with a concrete (dummy) mirror, was installed at the telescope. With a dummy M2 Unit in place at the top of the telescope frame, pointing and tracking tests were initiated. The first image with the 20-cm guide telescope mounted on the centrepiece and used for these tests was obtained in late August (see Fig. 4). As was the case for the first two Unit Telescopes, the mechanical quality of MELIPAL was found to be excellent and the pointing has now been tuned to a few arcsec over the entire sky. The tracking is also very good. Following these tests, the M1 Cell was again taken down to the MMB at the Base Camp and the dummy concrete mirror was removed. The M1 Cell was moved back up the mountain and stored under the MELIPAL structure until the (third) 8.2-m Zerodur mirror is installed in mid-November. “First light” with the VLT Test Camera at the Cassegrain focus of this telescope is planned for February 2000.

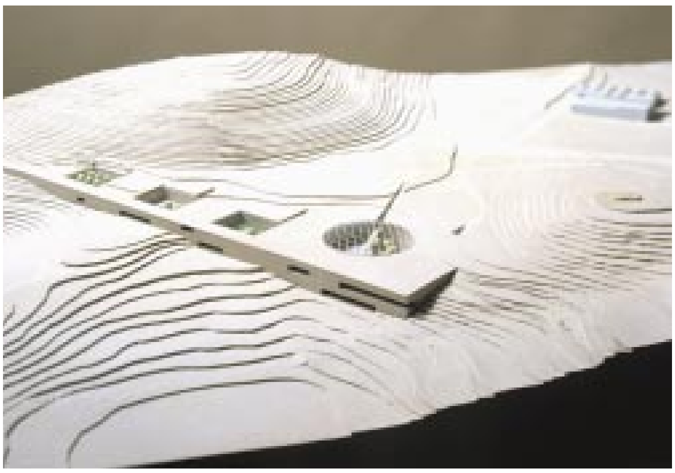


Figure 6: “Residencia” model. Photo of the architect's model of the Paranal Residencia and Offices. The building is fully integrated into the landscape. Its southern and western facades emerge from the ground, providing a view from the bedrooms, offices and restaurant towards the Pacific Ocean.

Figure 7: Start of construction. View of the building site where the first part of the new Paranal Residencia and Offices are now under construction.

YEPUN (UT4)

The fourth Unit Telescope (YEPUN) is now in the final phase of mechanical assembly. Acceptance tests with the supplier will start soon, after which the construction of the four telescope structures will have been finished. The fourth M1 Cell arrived at Paranal in late August (Fig. 5). "First Light" for YEPUN is scheduled for July 2000.

VLTI

In Europe, major achievements occurred in the area of the VLT Interferometer (VLTI) construction. The two siderostats are being tested on the cloudy European sky (see article by F. Derie et al. in this issue). ESO concluded a contract with REOSC (France) for delivery of all mirrors to equip the four VLT Unit Telescopes with coudé foci optics. An important milestone was reached with the completion of the polishing of the optics for the first delay line for the VLTI at REOSC. The integration of the cat's eye will be done at TNO (Netherlands) and this part will then be integrated into the delay line at Fokker Aerospace (The Netherlands). Shipment to Chile will take place immediately afterwards. In addition, the 1.8-m primary mirror for the first VLTI Auxiliary Telescope has reached the final stage of the light-weighting process and the optical polishing will soon begin at AMOS (Belgium). The already manufactured optics (null correctors, M2 matrix) have shown excellent optical quality results. A contract for the purchasing of the Auxiliary Telescope number 3 was concluded with AMOS.

The "Residencia"

It has always been ESO's intention to provide better quarters and living facilities at Paranal. Plans for the design and construction of the "Facilities for Offices, Board and Lodging", also known as the Paranal Residencia and Offices, were therefore begun some years ago. The project was developed by Auer and Weber Freie Architekten from Munich (Germany). Their design was selected among eight proposals from European and Chilean architects.

The unusual conceptual design is structured as an L-shaped building, located downhill from the Paranal access road on the southwest side of the present Base Camp. The building is fully integrated into the landscape, essentially underground with its southern and western facades emerging from the ground, providing a view from the bedrooms, offices and restaurant towards the Pacific Ocean. The common facilities, restaurant, offices, library, reception and meeting rooms are articulated around the corner of the building, while the hotel rooms are distributed along the wings of the L-shape. A circular hall, 35 m wide and four floors deep – covered with a dome emerging at ground level – is the building's focal point with natural light. At the floor of the hall there is an oasis of vegetation with a swimming pool. Special protection against light pollution is foreseen. To a large extent, the ventilation is with natural airflow through remotely controlled air in outlets.

The Chilean firm Vial y Vives won the construction tender. Work on the first part of the building began on July 1, 1999, and is scheduled to be completed within two years. The excavation work for the Paranal Residencia is proceeding according to schedule, with the first concrete to be cast shortly.

Performance of the VLT Mirror Coating Unit

E. ETTLINGER (LINDE), P. GIORDANO and M. SCHNEERMANN (ESO)

In August 1995 ESO signed a contract with LINDE AG to supply the coating unit for the mirrors of the Very Large Telescope. The coating unit was first erected and tested in Germany and then disassembled, packed and shipped to Chile. After integration into the Main Maintenance Building on Paranal, the first mirror was coated on May 20, 1998 ("First Light" on May 25–26, 1998). The final runs for provisional acceptance were performed in January 1999.

The Coating Unit

The Coating Unit encloses the following main components (see Fig. 1):

• the vacuum chamber with a diameter of more than 9 m and an inner volume of 122 m^3

• the roughing pump system and the high vacuum pumping system, consisting of 8 cryo pumps and a Meissner trap

• the mirror support system, a whiffle tree structure with lateral and axial pads to support the glass mirror during coating

• the mirror rotary device including a ferrofluidic vacuum feedthrough, to rotate the mirror underneath the magnetron during coating

• the coating cart, enclosing an air cushion system to drive the lower chamber section and a lifting device, to close the vacuum chamber after mirror loading

• the magnetron sputter source with a water-cooled shutter system and cryogenic shields

• the glow discharge cleaning device, to heat up and clean the mirror surface prior to coating.

Thin Film Deposition Equipment

The main component for the coating process is the thin film deposition equipment of the Coating Unit comprising the following components:

• sputter source for aluminium including power supply

• shields to trim the aluminium coating deposited

• shutter panels

• cryo panels attached to the shutters

• Glow Discharge Cleaning Device (GDCD) including power supplies

The DC Planar Magnetron Source consists of the target 99.995% pure aluminium cathode bonded to a water-cooled backing plate to reduce the heat radiated to the mirror. The discharge is produced by the use of an inert gas (Argon) to support the flow of current between cathode and anode. The planar magnetron source uses magnetic fields to focus electrons in the region of the sputtering target.

Stainless steel trim shields, which are placed below the cathode to trim the deposition of the sputtered aluminium, ensure that the mirror is evenly coated with a uniform thickness of aluminium.

The shutter panels are stainless steel sheet box constructions, which are cooled by water, fed through the panels under pressure. There are two shutters, one to form the leading edge of the coating, and one to form the trailing edge. Both shutters are pivoted about the centre of the mirror, and at the beginning of a coating run both shutters are closed together along the line of the joint band.

Below the shutter panels, copper cryo panels are suspended, filled with liquid nitrogen.

Their purpose is to provide an area of high purity and homogeneity between the shutter opening below the magnetron and hence aid and improve the quality of the reflectance of the aluminium deposited onto the mirror.

The GDCD consists of two aluminium electrodes, shaped to give the required profile. The glow discharge electrodes are water-cooled and are suspended from a dark space shield, which is also made of aluminium. The purpose of the GDCD is to reduce adsorbed water molecules from the mirror, the inner surfaces of the chamber and all components mounted inside the chamber. The