sions with E. Swinnen and G. Ihle, we eventually managed to obtain a more accurate picture of the 3.6-m thermal problem.

For the measurements I want to acknowledge: A. Gilliotte, T. Höög, M. Maugis, A. Pizarro and G. Timmermann. Special thanks go to C. Perrier who took the data with SHARP presented here.

References

1. Le Poole, 1990, final report: "Minimising the man-made deterioration of the seeing at the 3.6-m telescope at La Silla".
2. M. Faucherre, 1995, Internal ESO report: "3.6-m Seeing Improvement Project".
3. M. Faucherre, 1994–1995, Internal memorandae # 3.6-m/seeing-2, -11, -17 and -21.

M. Faucherre
e-mail: mfaucher@eso.org

CAT/CES NEWS

L. PASQUINI, L. KAPER, ESO

During the last week of March, a new CCD was tested on the Coudé Echelle Spectrograph's Long Camera. This CCD, ESO#38, is a LORAL/LESSER 2688 × 512 thinned, backside illuminated device (pixel size 15 × 15 μm) with anti-reflection coating. The quantum efficiency is about 80% throughout the visible wavelength range (350–800 nm) with a peak value of 90% at 700 nm. The values are better by a factor of 5 in the blue to 2 in the red than CCD#34 which is presently in use on the Long Camera (see Table 1). The high QE is obtained after flooding the CCD with intense UV light. In normal operations, it is expected that the CCD will need to be UV flooded once every month. The new chip is mounted in a continuous flow cryostat, with a hold time of about one week.

Efficiency tests were carried out which confirmed the high sensitivity of the CCD. We were, however, confronted with a degradation in resolution at high resolving powers. Specifically, a slit setting to yield a resolution of 100,000 resulted in an actual resolving power of about 70,000. The details are given in Table 2. According to the CCD detector group, the degradation in resolution is expected especially in the UV with backside illuminated devices. Due to a *field-free* region inside the device, photon-generated electrons spread to adjacent pixels, thus increasing the effective pixel size. This effect is more pronounced in the blue than in the red.

Given the above results it was decided not to offer CCD #38 to the ESO community at the start of the current period 55. For the moment, the Short Camera with CCD #9 and the Long Camera with CCD #34 are available. The stability of the UV-flooding of CCD #38 will be further tested and a solution has to be found for the degradation in resolution. Due to the very high performance of this chip, we plan to offer CCD #38 with the Long Camera starting in August 1995 after the "idle" period of the CAT telescope. The Short Camera and CCD #9 will be decommissioned and CCD #38 offered to the observers requiring a resolving power up to R = 70,000. For programmes requiring higher resolution CCD #34 will be retained. A new version of the CAT+CES Operating Manual containing the characteristics of the new configuration will also be distributed. The high QE, the low read-out noise (8 e/pixel), and the large size of CCD #38 would be a significant improvement in the performance of the CAT/CES spectrograph if a procedure for recovering the expected spectral resolution can be developed.

Some details of the characteristics of CCD #38 are provided in Tables 1 and 2.

L. Pasquini
e-mail: lpasquin@eso.org

TABLE 1: OVERALL CAT+CES LONG CAMERA EFFICIENCY IN PERCENT

λ(Ångström)	CCD #38	CCD #34
3500	0.8	0.15
3589	2.3	0.47
4035	5.4	1.4
4435	6.9	1.1
5400	9.2	3.8
6450	10.4	5.2
8092	5.88	3.7

TABLE 2: CES LONG CAMERA + CCD #38 MEASURED RESOLUTION VS NOMINAL RESOLUTION AT 4435 Å

Nominal	FWHM (Pixels)	Measured	Meas/Nominal
40,000	5.8	39,300	0.98
50,000	4.9	46,500	0.93
60,000	4.1	55,660	0.92
70,000	3.75	60,800	0.87
80,000	3.6	63,300	0.79
90,000	3.35	68,000	0.76
100,000	3.18	71,800	0.72
110,000	3.0	76,000	0.69
120,000	2.96	77,000	0.64

The FORS Focal Reducers for the VLT – a Status Report

G. RUPPRECHT, ESO-Garching

Introduction

The FORS1 and FORS2 *FO*cal *R*educer/low dispersion *S*pectrographs are expected to be something like the workhorses of the VLT since they will offer a variety of observing modes in the visual and near ultraviolet wavelength range, namely

1. direct imaging (2 image scales)
2. low-dispersion grism spectroscopy
3. multi-object spectroscopy (MOS; up to 19 objects)
4. polarimetry (FORS1 only).

These modes can be combined e.g. to allow imaging polarimetry or spectropo-

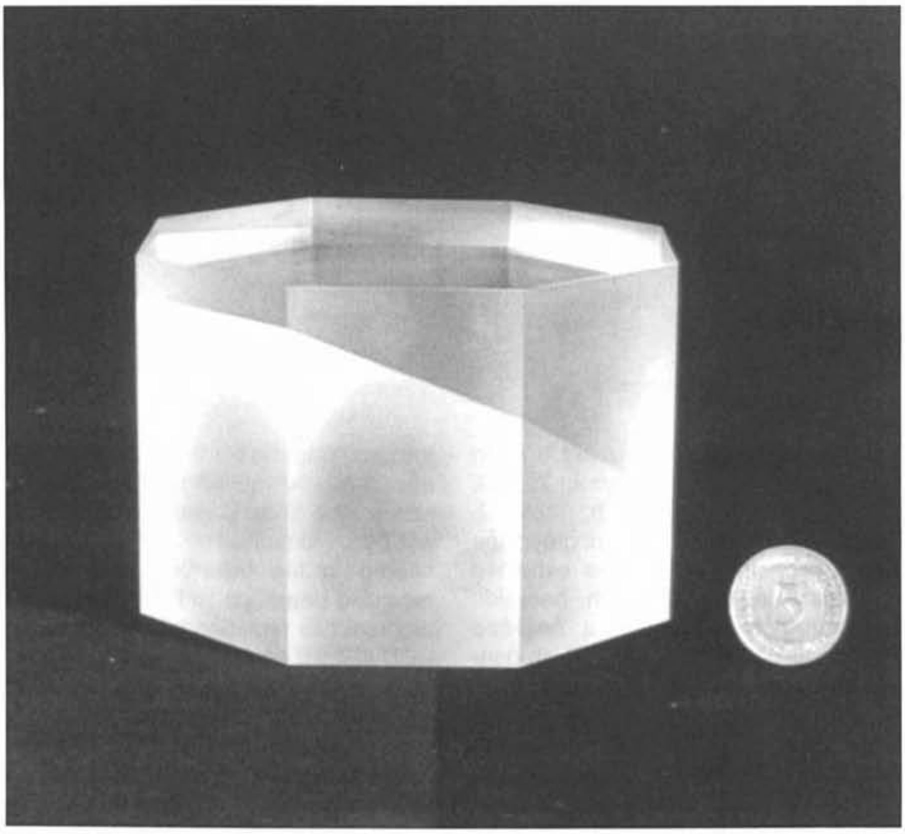

Figure 1: *The FORS Wollaston prism; note the enormous size!*

larimetry. In addition, a mode offering higher dispersion (possibly up to $R \sim 5000$) is envisaged for FORS2 which will therefore not be equipped with polarimetric optics. An overview of the FORS project can be found in [1]. A more comprehensive description of the expected instrument performance is given in [2] and [3] and more technical descriptions in [4] and [5].

Status of the Project

Work is progressing well at the three institutes (Landessternwarte Heidelberg, Universitäts-Sternwarte Göttingen, Universitäts-Sternwarte München) collaborating in a consortium. Already in April 1992 the Preliminary Design Review (PDR) was held, and in February 1994 the Final Design Review (FDR) followed for the instrument mechanics, electronics, the assembly, integration and test procedures, for handling and maintenance aspects and for safety and management issues. No serious problems were identified, so immediately afterwards the consortium began to transform the approved design into hardware.

Optics

In Heidelberg, the design of the imaging optics has been finished and the lenses (FORS is an all-dioptric focal reducer) are presently being polished by FISBA. Delivery is expected later this year. The optics for the polarimetric mode, which consist of a Wollaston prism of 132 mm (!) free diameter (Fig. 1) and two 3 × 3 mosaics with 135 mm free diameter of superachromatic retarder plates, have already been delivered to the consortium (by Halle). The standard set of grisms has also been designed and is presently being procured. The broadband and interference filters which will be provided with FORS are being defined in collaboration with the Instrument Science Team.

Since it became clear that atmospheric dispersion would significantly degrade the image quality of FORS, ESO decided to install atmospheric dispersion correctors (ADCs) in unit telescopes UT1 and UT3. A novel design called "Longitudinal ADC" consisting of two silica prisms with variable distance will be used. A paper giving full details is currently in preparation.

Mechanics

For reasons of economy, instrument components procured externally are always bought simultaneously for FORS1 and FORS2. The Göttingen workshop is therefore presently busy with the incoming inspections of the major mechanical components produced by industry. So far, the cylindrical housings for the instruments have been received (Fig. 2) as well as the focusing units made of cast aluminium and the mechanical components (spindles, linear bearings) for the multi-object spectroscopy units; also, a significant part of the manufacturing is done in Göttingen.

Electronics and Software

This part of the project is performed in Munich. Most electromechanical units

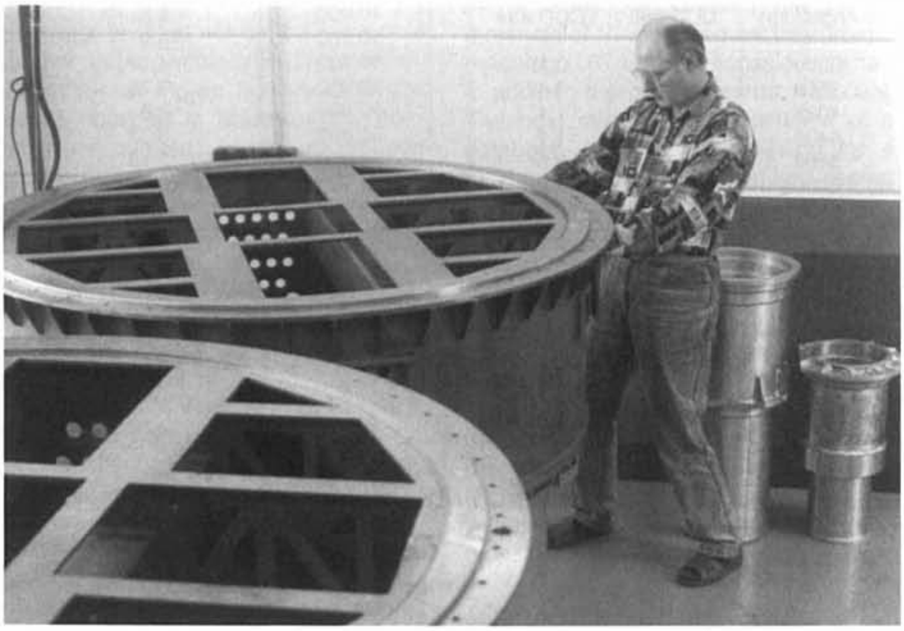

Figure 2: *Incoming inspection of the FORS1 and FORS2 top sections; they will house the multi-object spectroscopy units. At right are the tubes of the collimators for FORS1 needed to change the image scale.*

(motors and encoders) have been procured.

In September 1994 the FDR for some of the instrument control software modules was held and coding started immediately afterwards.

Data reduction software for FORS specific instrument modes (mainly MOS and polarimetry) is being implemented in Heidelberg. The first finished context (MOS) will be included in the 95NOV release of MIDAS.

Auxiliary Devices

Several auxiliary devices are under construction for FORS. The most important ones for the construction and test phase are the star simulator for the optics tests, which is partly finished, and the telescope simulator to be used mainly for the flexure tests of the integrated instruments; this one is under construction.

Another important device will be the transport carriage. It turned out that the requirements for handling the FORS instruments at the telescope are very similar to those of the Cassegrain adapters/rotators, e.g. weight to be transported, lifting height and mounting accuracy. In order to simplify maintenance procedures and to reduce the diversity of ancillary equipment at the VLT, the carriage is therefore being designed to accommodate both; two copies will be procured in 1995.

Detector

One of the most crucial components of an instrument is its detector. For FORS SITe (formerly Tektronix) 2048 × 2048 CCDs with 24 µm pixels were selected; the procurement of the CCDs including all peripherals (dewar, controller) is being done by ESO. So far we have received one CCD of grade 1 which is now awaiting full characterisation by ESO's detector laboratory.

Future Planning

Activities scheduled to happen in the near future include tests of the imaging optics and performance tests of the first MOS unit, both from a mechanical and control system point of view.

The long-term planning foresees the integration of FORS1 for 1996, system tests for 1996 and 1997, transport to the VLT Observatory in 1998 with an installation date on UT1 in the last quarter of 1998, according to the current VLT planning. FORS2 is then scheduled for an installation on UT3 in the year 2000.

References

[1] I. Appenzeller, G. Rupprecht, "FORS – The Focal Reducer for the VLT" ESO Messenger **67**, p. 18 (March 1992).

[2] G. Rupprecht, "FORS" in: Instruments for the VLT, ESO Instrumentation Department, A. Moorwood, Editor, p. 9 (1994).

[3] W. Seifert, W. Mitsch, H. Nicklas, G. Rupprecht, "FORS: A Workhorse Instrument for the ESO VLT," in: *Instrumentation in Astronomy VIII*, David. L. Crawford, Eric R. Crain, Editors, Proc. SPIE 2198, p. 213 (1994).

[4] W. Mitsch, G. Rupprecht, W. Seifert, H. Nicklas, S. Kiesewetter, "Versatile multi-object spectroscopy with FORS at the ESO Very Large Telescope," in: *Instrumentation in Astronomy VIII*, David. L. Crawford, Eric R. Crain, Editors, Proc. SPIE 2198, p. 317 (1994).

[5] H. Böhnhardt, S. Möhler, H.-J. Hess, S. Kiesewetter, H. Nicklas, "Design Benchmarks of the FORS Instrument for the ESO VLT," in: *Scientific and Engineering Frontiers for 8–10m Telescopes*, M. Iye and T. Nishimura, Editors (1995).

G. Rupprecht, ESO-Garching
e-mail: grupprec@eso.org
URL:http://vlt.usm.uni-muenchen.de:8002/home.html

UVES (UV-Visual Echelle Spectrograph) for the VLT – a Status Report

H. DEKKER, ESO Instrumentation Division

Introduction

UVES is a two-arm crossdispersed echelle spectrograph covering the wavelength range 0.3–0.5 µm (blue) and 0.42–1.1 µm (red), with a 2-pixel resolution of up to 90,000 and 120,000, respectively. It will be mounted at the Nasmyth of UT2.

Project kick-off for UVES was in spring 1992 with a plan [1] calling for two identical instruments, to go on UT2 and UT3, with a resolution of up to 70,000. An overview is given in [2]. In response to discussions on a redistribution of instruments at the foci of the VLT, it was decided in spring 1994 to build a single instrument with increased spectral resolution and versatility (by adding an Atmospheric Dispersion Compensator, an Iodine absorption cell, a depolariser and exposuremeters) [3]. The science objectives and expected performance of the upgraded instrument are given in Tables 1 and 2 and in [4].

UVES is being designed and built in-house. The instrument control and data reduction software is being developed in collaboration with the Observatory of Trieste. S. D'Odorico is the Instrument Scientist.

Status of the Project

Following the Preliminary Design Review in October 1993, UVES is now in the

TABLE 1. UVES SCIENCE OBJECTIVES

- Structure, physical conditions and abundances of interstellar and intergalactic gas at early epochs from the absorption spectra of high redshift QSO's
- Kinematics of gas and stars in galactic nuclei
- Kinematics and mass distributions of star clusters
- Composition, kinematics and physical conditions of the interstellar medium in the galaxy and in nearby systems
- Chemical composition and atmospheric models of galactic and extragalactic stars
- Substellar companions of nearby stars (high-precision radial velocity studies over long time scales)
- Stellar oscillations