the same CCD # 3 was used with dewar windows made of two different types of fused silica when on CASPEC or EFOSC (see Table 1). Event rates in RCA CCDs are relatively constant and a factor of 3–4 higher than in GEC and TEK CCDs. As the dewars are the same for all CCD types, the high rates are probably related to some radioactive component in the RCA CCD package, the support glass being the most likely candidate. It is not clear whether the difference between GEC and TEK is significant. The count rates in GEC CCDs may have been slightly affected by electronic noise which can imitate radiation events.

The values are very close to the low limits quoted by C.D. Mac Kay in his review article in the 1986 Annual Review of *Astronomy and Astrophysics*. The question remains open as to whether a fraction of these counts observed in GEC and TEK CCDs is still of local origin, and further tests are planned in the near future.

Astronomers who have measured or suspect that the event rates in their CCD exposures are significantly different from the values given in Table 1 are strongly encouraged to send their data to ESO for further analysis. It would be of particular interest to measure using the same algorithm rates from CCDs of different types and/or located at other Observatories.

S. D'Odorico and S. Deiries

New Technology Telescope Taking Shape

M. TARENGHI, ESO

As an intermediate step towards a very large telescope (VLT), ESO decided to design and build a New Technology Telescope (NTT) with a mirror measuring 3.5 m in diameter. This telescope will help reduce demand on the 3.6 m telescope and will offer an opportunity for practical testing of new ideas for telescope design.

The NTT project includes a number of innovations:

(i) thin primary mirror with active optical control of the mirror geometry,
(ii) active control of the collimation and of the focusing of the secondary mirror,
(iii) maximum exposure of the telescope to the external environment during observations (better seeing),
(iv) fast switching of the light beam between two different instruments,
(v) alt-azimuth mount with high pointing and tracking accuracy,
(vi) flexible and easy control system,
(vii) remote control,
(viii) rotating compact building.

The optical system is a Ritchey-Chretien type. The primary M1 as well as the M2 and M3 mirrors consist of Zerodur glass ceramic manufactured by Schott Glaswerke, Mainz, FRG. The meniscus shape and the diameter-to-thickness ratio of only 15 of the primary mirror is thinner than that of any other large optical telescope built in recent years.

The optical figuring is now being carried out by Carl Zeiss, Oberkochen, FRG. The optical quality specification to the manufacturer for the combined optical train (Nasmyth image) is 80 % of the geometrical optical energy within 0.4 arcsec. However, after correction with the ESO active optics support, the optics should maintain an image quality of 80 % of the geometrical optical energy within 0.15 arcsec.

The telescope mechanics is made of box-shaped parts in order to achieve high stiffness with low mass. The NTT is expected to have an eigenfrequency of about 8 Hz. The result is a structure with the turning part weighing approximately 110 tons. The manufacturing of the main steel structure and the assembly in Europe of the complete telescope is being carried out by Innocenti-Santeustacchio, INNSE, Brescia, Italy.

The azimuth axis is mounted on an axial multipad hydrostatic bearing of 3.5 metre diameter. The radial location is defined by an axially pre-loaded angular contact ball bearing. The altitude axis is mounted on large self-aligning internally pre-loaded ball bearings.

The function of the azimuth axial hydrostatic bearing system is to provide a stiff support and to allow the accurate and low-friction rotation of the telescope fork on the supporting ring. This is accomplished by using an oil low-pressure, multipad (24), hydrostatic bearing with a large carrying surface. In addition to the low-pressure design of the hydrostatic supports, which allows for a low consumption of oil and a limited temperature increase of the oil in the pads, an active, high-acccuracy oil temperature control system avoids major exchanges of heat between oil, telescope structure and environment.

The two axes of the telescope are both controlled by a group of four servodrives. The altitude drive system is composed of two toothed wheels, one

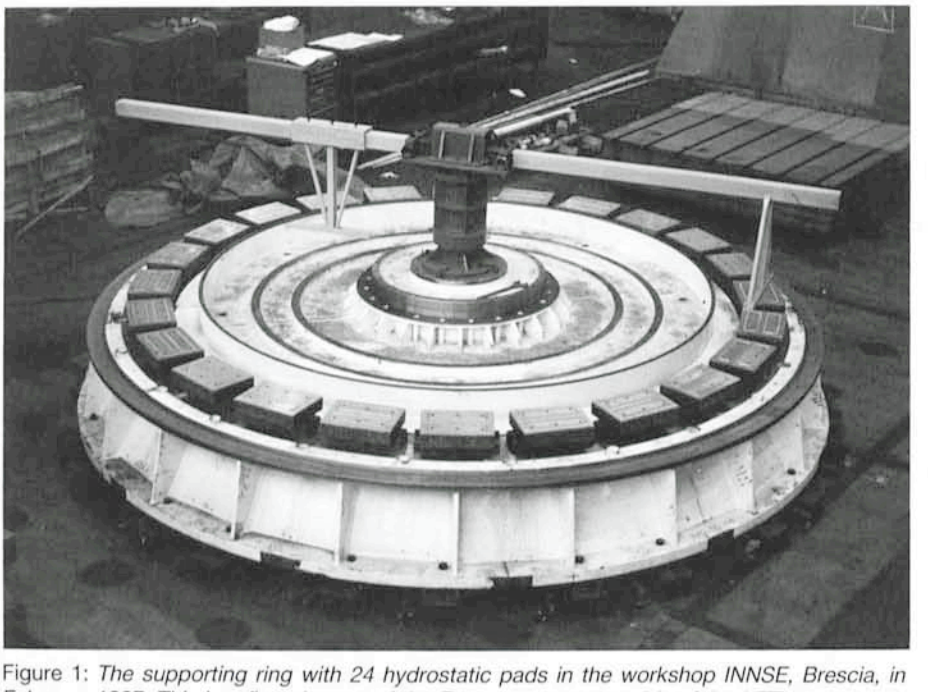

Figure 1: *The supporting ring with 24 hydrostatic pads in the workshop INNSE, Brescia, in February 1987. This is a first element of the European pre-assembly of the NTT.*

Figure 2: *The fork arms on the reference plane. The seats (holes) for the drive units and for the big ball-bearing of the elevation axis are clearly visible.*

at each end of the altitude axis, each driven by two servodrives via two pinions. The azimuth drive system consists of a stationary toothed wheel on which four pinions, one for each servodrive, are engaged.

The absolute position of the telescope is measured by two directly coupled absolute encoders. The tracking is controlled by two friction-driven incremental encoders. Each axis is provided with one absolute and one incremental encoder.

An important aspect in the design is the maximum exposure of the telescope to the external environment during observation. This approach has been selected in order to provide maximum ventilation to the structure, thus allowing for thermal stabilization of the telescope to night conditions and avoiding the trapping of layers of air at different temperatures in the path of the optical beam, which would cause blurring of the image. The building floor is actively cooled, as are all heat sources located on the telescope.

The mobile part of the building is octagonal, has three storeys and rotates on a cylindrical concrete base.

The instrument rooms are on both sides of the telescope behind the side walls of the telescope room. The control equipment occupies a separate lower floor. At this level is also a room for the technical services of the building.

In order to keep high pointing and tracking accuracies with good ventilation at the same time, the telescope is protected at the front and back by permeable wind-screens which control the wind speed in the chamber where the Telescope tube sits.

The temperature in the telescope room and in the instrument rooms is maintained at the level of the outside temperature at night, achieved by means of an appropriate thermal insulation and air conditioning system.

NTT Control/Acquisition Software

G. RAFFI, ESO

In these months, while the main mechanical and optical components are being prepared for the NTT, the control software has also to meet its first deadlines. In a few months, members of the Electronics Group will be testing the main telescope movements at INNSE in Brescia.

This will be the first result of a preparatory work, which started a couple of years ago. The present description should highlight new aspects of the NTT software with respect to the control/acquisition systems presently in use at La Silla.

The NTT control system design in general (electronics and software) was designed by the TP Electronics Group. People who are specifically working at the NTT software (some part-time or for a limited period of time due to other ongoing projects) are P. Biereichel, B. Gilli, B. Gustafsson, J. Marchand, G. Raffi, K. Wirenstrand from the Electronics Group and L. Noethe from the NTT Group.

In this issue of the *Messenger* the general structure of the NTT control/acquisition system is summarized. In future issues some areas will be expanded more in detail, like: user interface; pool: parameter data base; microprocessor software, and acctive optics software.

Computers

Figure 1 shows the NTT control computer configuration. As the control electronics of the NTT was designed to be distributed, in order to reduce cabling and therefore increase reliability, a number of crates (based on the VME standard) are used for the telescope control functions. The VME crates incorporate microprocessors of the Motorola 68000 family and are all linked via a Local Area Network (LAN) of the Ethernet type.

The control computer of the NTT is a Hewlett Packard A900, which has the function of coordinating the distributed control system, perform data acquisition, accommodate user interface and image processing and support remote control. The A900 minicomputer is the newest member of the HP1000 family based on newer and more compact technology and with computational performances a factor of two better than HP1000 F computers.

Software

Software control and data acquisition systems serve the purpose of managing telescope, instrument, detector, image processing operation in a way which has to be comprehensive and clear for the user. The need for a data acquisition system has been recognized and implemented at La Silla already some years ago. The NTT, however, is the first case where a comprehensive system design has been done right from the beginning.

The main requirements of the NTT system were to accommodate distributed control electronics and two instruments which will be permanently connected. This in turn led to specify that the software should allow multi-instrument operation and multi-user operation (or multi-station) as a consequence of the simultaneous use of more than one instrument and of remote control.

Additional needs, which had a large impact on the design, were remote control and user interface. Finally, during the whole design phase of the NTT system, much attention was payed to see that the present design work could also be used for the VLT and thus represent a first test bench for this instrument.

Altogether the NTT control/acquisition system can be characterized in the following way:

– *Distributed system:* Programmes can be either on the A900 or on any