4. STC

The Scientific Technical Committee also met recently and evaluated the scientific technical aspects of the ESO operations at La Silla. The STC again underlined that science must be the driver of all ESO activities and expressed the opinion that there are currently too many tasks for the astronomical/technical staff at La Silla. Reductions will be necessary, probably by the closure of some of the telescopes, or by transferring the operational responsibility to national groups.

The STC strongly supported the view that the VLTI must be re-introduced in the VLT as soon as possible since it is a unique feature of this telescope. The STC endorsed the new, smaller interferometry programme which was presented by ESO. It costs 30 % less and also further reduces the annual cost, since it will be stretched over twice the period earlier envisaged. In this connection, the interest of our Australian colleagues in VLT interferometry and the possibility of using in addition to the MPG/CNRS and ESO contributions the entry fee by Australia for this purpose, if and when it becomes a full member of ESO, is indeed very exciting.

5. Scientific Visiting Committee

This Committee has now delivered its report about the science carried out at La Silla and at the Headquarters. It is the intention to continue to rely upon its services as an Advisory Body for these questions. Certain problems were remarked on, in particular that more attention should be given to the involvement of ESO scientists in the development of new instrumental facilities, communications between the scientists inside and outside ESO and also the personnel policy of the Organization of which certain aspects, for instance salaries, are in the state of an undesirable lack of definition.

It is obvious that we must attempt to define better what we are really trying to do in the personnel area, but also that we must do everything possible to attract and keep the staff with the best qualifications. For this reason, special measures may become necessary during the period until the personnel policy has become better defined. The issue of a system based on merit is still open, but it is particularly important that the staff gets a feeling of fairness in the judgement of their performance. It will be my task to try to convince the Finance Committee and Council of what our "fair market value" really is. This will become much clearer after the termination of the current comparative study of employment conditions (including salaries) at ESO and other national and private organizations.

6. Budget

I am happy to report that Finance Committee and Council approved the budget for 1994 as well as the forecast for 1995–1997. They also approved various management tools in connection with the cash flow, etc. which will facilitate the financial administration during the next years of heavy VLT expenditures.

7. Conclusions

In conclusion, I am glad to state that I do not see any real show-stoppers for ESO and its VLT project at this moment. We will surely be able to carry through successfully this great project but it is also true that we must improve ourselves in terms of management techniques and internal communication. There may still be some "cultural" problems within ESO, but I think that good will and enthusiasm for the common cause will make it possible to overcome these difficulties. *R. GIACCONI*

TELESCOPES AND INSTRUMENTATION

Work Starts on the VLT M2 Units

D. ENARD, ESO

The development and construction of the 4 VLT secondary mirror units is going to be carried out by Matra Marconi Systems together with REOSC, SFIM and MAN. The kick-off meeting was held on April 20 and 21 and the design work is already proceeding.

One of the basic features of the VLT is that there is only one secondary mirror to serve the different observing modes. The switch from Cassegrain to the Nasmyth and coudé foci is achieved by moving the tertiary mirror into different positions rather than – as is traditional – by exchanging the secondary mirror unit. There are important operational and cost-saving advantages in this approach. It gives a unique opportunity to change at any time of observing mode, reduces maintenance and significantly simplifies the operation software as well as the adapters. This secondary mirror has a diameter of about 1.2 metre for the nominal aperture of F/15 at the Nasmyth focus. Because the VLT is largely optimized for the IR, the secondary mirror also defines the pupil which is slightly undersized with respect to the beam defined by the primary mirror outer diameter. This approach sets however a number of tough requirements on the M2 unit since alle the requirements which traditionally are distributed on several mirror units of different sizes are concentrated into one single unit.

As part of the active optics scheme, the secondary mirror must be able to maintain the telescope geometry with respect to the primary mirror. To this effect, the secondary mirror can be positioned in three coordinates to correct for focusing and centring as it is already the case for the NTT as well as for most modern telescopes.

In addition, the VLT secondary mirrors can be controlled in tilt around a point close to the vertex to correct for fast guiding errors. This mode is called field stabilization and was introduced at a very early stage of the project and was driven by the important wind loads to which the structure would have been subjected with the retractable enclosure originally foreseen. The later decision to revert to a conventional enclosure – essentially in order to better protect the primary mirror from wind loads – did not remove that need. As a matter of fact, numerical and wind tunnel simulations have shown that the enclosure did not contribute much to reduce the dynamic part of the wind loads and that, considering the strong winds at Cerro Paranal, a fast guiding would be necessary if the very ambitious image quality goals were to be attained.

The VLT uses as a main criterion for image quality the Central Intensity Ratio which characterizes the peak intensity degradation induced by the telescope. The CIR is a direct indication of the telescope efficiency and is very sensitive to random image motion. As an example, a random image motion of 0.05 arcsecond will produce a CIR loss of about 10 % for a seeing of 0.4 arcsecond.

Atmospheric image motion can also be corrected by the tip/tilt secondary mirror within the limit of the isoplanatic field and if an appropriate detection scheme is used.

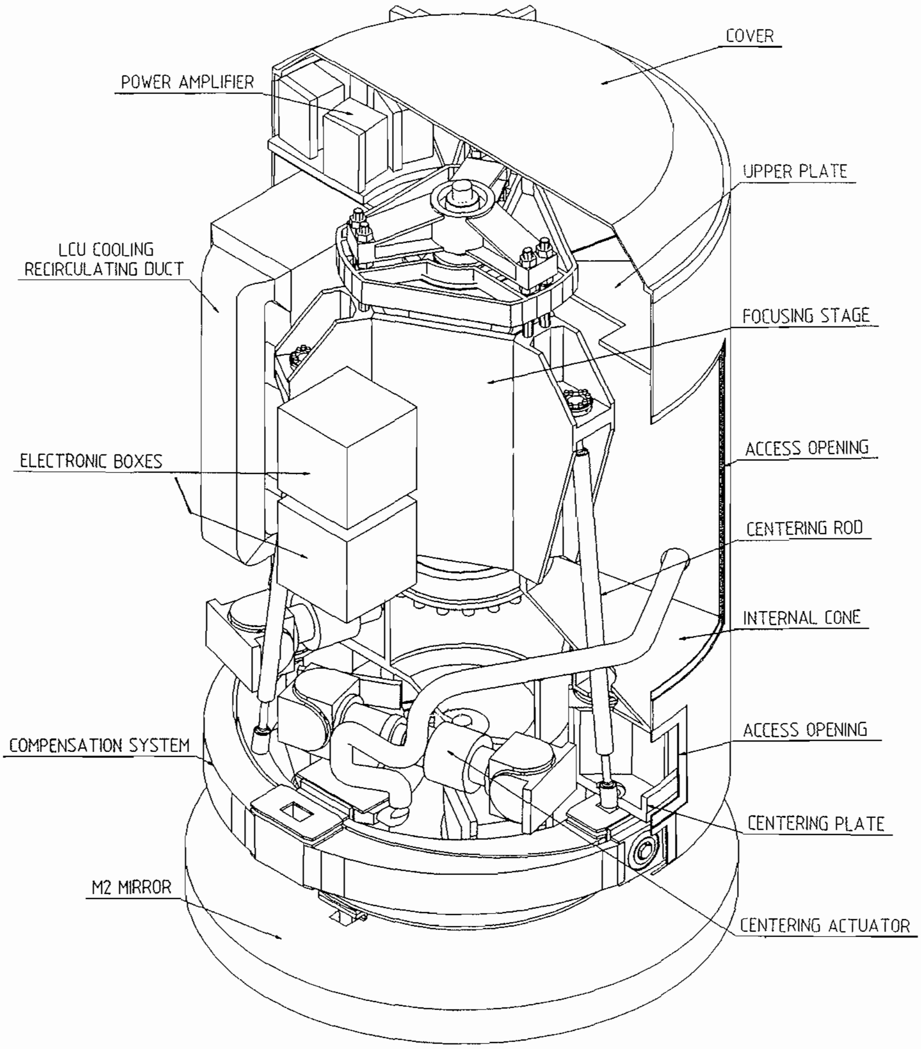
The accuracy requirement for field stabilization is 0.05 arcsecond which corresponds to about 0.01 arcsecond in sky coordinates. The correction bandwidth has been fixed to 10 Hertz which has been found adequate to correct for telescope guiding errors as well as for atmospheric image motion.

The third requirement for the secondary mirrors is square wave chopping for observing in the IR. The amazing development of IR detectors in the last 10 years has however much reduced the use of chopping which seems now limited to the longer wavelength range (10 and 20 μ). The requirements on frequency and tilt amplitude have been thoroughly analysed using the existing IR instruments. Though they have been considerably reduced with respect to what they were 10 or 15 years ago, they remain in terms of mirror bandwidth far above those necessary for the field stabilization mode and represent a technical challenge considering the relatively large size of the secondary mirror. The maximum chopping frequency is 5 Hertz for an amplitude of 2 arcminutes.

Each secondary mirror unit is composed of a mirror assembly and of an electro-mechanical assembly.

The electro-mechanical assembly is composed of three independent stages: the focusing, centring and tilt/chopping stages. The mirror assembly is fixed to the tilt and chopping stage which itself is attached to the centring stage and to the focusing stage which provides the final attachment to the M2 unit structure.

The Focusing Stage consists of a servo-controlled electro-mechanical actuator generating a movement of the M2 mirror along the telescope optical axis. The same focusing system is used when changing between the Nasmyth and the Cassegrain foci which requires a change of mirror position of about 30 mm.



Architecture of the VLT M2 unit.

The Centring Stage is used to keep the lateral alignment of the M2 mirror with respect to the primary mirror. It is designed in such a way that the mirror vertex rotates around the mirror centre of curvature. This has the advantage of not modifying the telescope pointing so that only coma is corrected. The effective movement is achieved by three servo-controlled actuators acting on the mirror tilt and chopping stage which itself is attached to the focusing stage through a three legs pantograph.

The Tilt/Chopping Stage tilts the mirror around a point ideally located at the mirror vertex. This stage is equipped with a dynamically balancing system, intended to compensate the reaction forces which could cause oscillation of the electro-mechanical assembly.

The Control System consists of the Local Control Unit (LCU) and of all the electrical and electronic hardware used to control the operation of all the systems inside the M2 Unit. Except for the power supplies which are fixed on the telescope structure, the control system is physically integrated inside the M2 Unit.

All heat sources inside the M2 Unit are cooled in order to maintain the outer surface close to the ambient air temperature.

The M2 units are also equipped with a deployable Sky Baffle, which is used to obstruct an annular region of the sky immediately around the M2 Unit for particular observations.

The Mirror Assembly

The 1.2-metre diameter secondary mirrors are lightweighted convex hyperbolic mirrors made of Silicon Carbide. This material is together with Beryllium the most suitable for extreme lightweight structures. The Silicon Carbide has however the great advantage over Beryllium to be cheaper and probably more stable in the long term. The particular technology selected by Matra for the mirror substrate is the Reaction Bonded Silicon Carbide known as CERASTAR and produced by CARBORUNDUM. The weight of the finished mirror will be about 33 kg and its first eigenfrequency about 800 Hz. The mass is about 10 % of that of a traditional glass mirror.

The optical surface will be generated by replication from a concave master. The development of a replication process applicable to astronomical large and highly accurate mirrors has been carried out for several years at the Observatory of Côte D'Azur with the financial support of INSU and ESO. Excellent replicas of a 1-metre concave mirror have been recently achieved, which gives confidence that the M2 mirrors can be successfully replicated. In case of difficulties however, conventional polishing is foreseen as back-up. Replication is particularly suited for convex surfaces which, with conventional polishing, are much more difficult to produce and to test than concave surfaces. The mould to be used for replication is concave and can be tested quite easily. The mould can also be oversized which gives the possibility to attain an excellent optical quality up to the very edge of the mirror which is hardly possible with traditional polishing. The main advantages of replica are therefore a lower cost, a shorter lead time and a better optical quality.

With the scheme proposed by Matra, the first unit is expected to be delivered well in time for the integration on the first Unit Telescope.

Hunting the Bad Vibes at Paranal!

B. KOEHLER, ESO

1. Introduction

It is well known that interferometric devices are extremely sensitive to vibrations. The VLT, in its interferometric mode (VLTI), is not an exception to this rule. Indeed, vibrations which generate relative displacement of the optical element of the interferometer at sub-micron level may blur the fringe pattern and result in a significant decrease of the fringe contrast, that is one of the prime observables of a stellar interferometer. Among many other sources of fringe contrast decrease, the vibrations coming from the ground (referred to as microseismic noise) are especially critical and require particular attention during the design and development phase of the project. As a matter of fact, an important specificity of the VLTI with respect to laboratory interferometers is that the optical elements of the interferometer are firmly fixed to the ground and not isolated from the ground. This requires, therefore, a high dynamic stability of the ground itself. The reasons for which the optical elements cannot be isolated from the ground are: (i) the site extension does not allow to place the complete interferometer on a single bench, (ii) individual isolation systems, because of their intrinsic low stiffness, would be incompatible with other requirements such as high tracking accuracy of the telescope under wind load and could, in some cases, deteriorate even more the fringe contrast because of their free relative motion at the support resonance.

This article provides an overview of the approach followed by ESO to investigate the effect of microseismic noise on the VLTI and describes, more particularly, two measurement campaigns recently performed at Paranal to support this investigation. These activities are part of the more general system engineering effort undertaken to verify and regularly update the VLTI

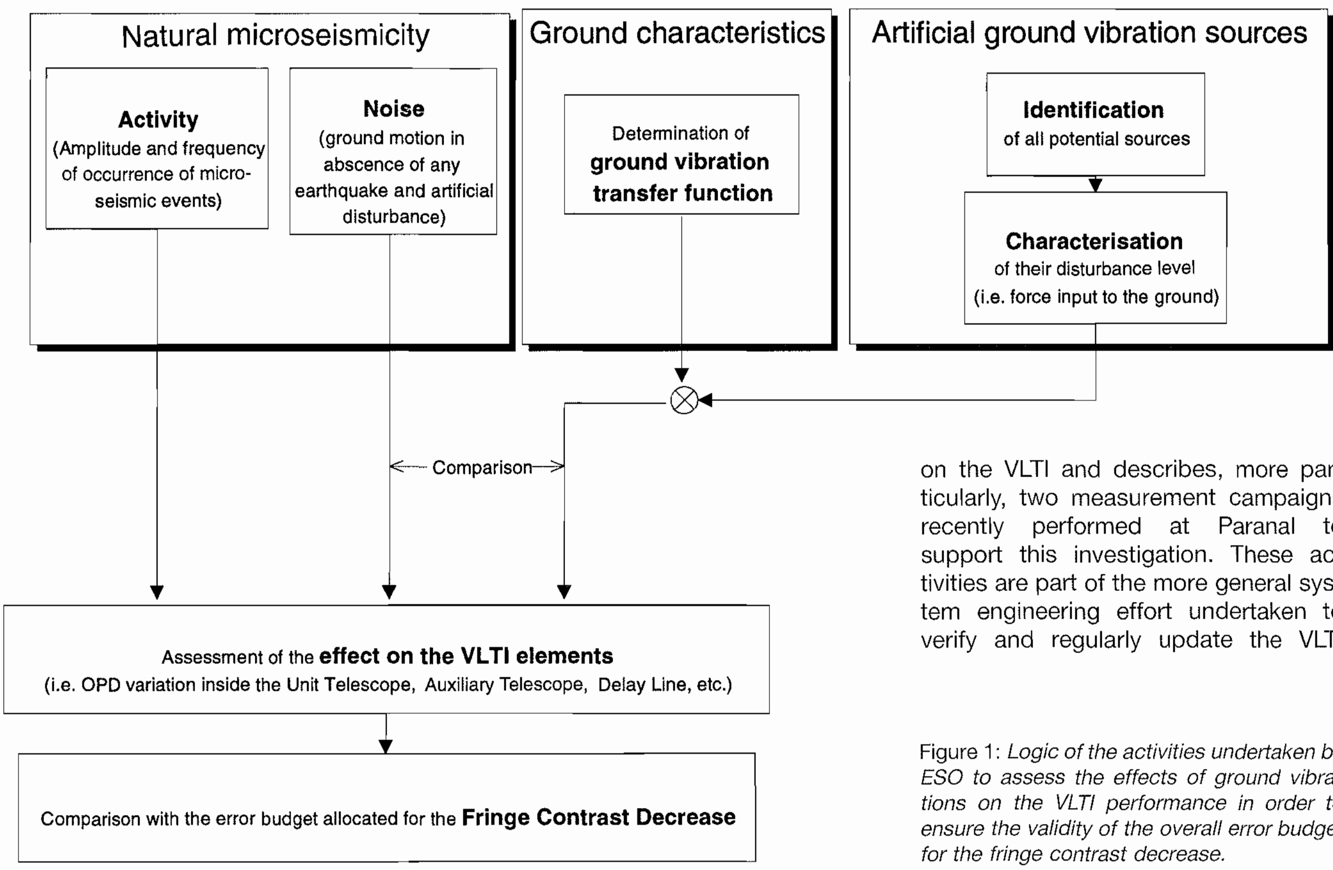


Figure 1: *Logic of the activities undertaken by ESO to assess the effects of ground vibrations on the VLTI performance in order to ensure the validity of the overall error budget for the fringe contrast decrease.*