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Main Structure: Progress and First Test Results

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The assembly of the main structure is progressing very fast in Milan, and the telescope will finally be completed and functional at the end of September. At this stage of the mounting, one can say that the tasks which were considered the most difficult, from the assembly point of view, have been carried out by AES's crew under the supervision of Mr.

Figure 1: The M1/M3 concrete dummy is positioned on the fork.

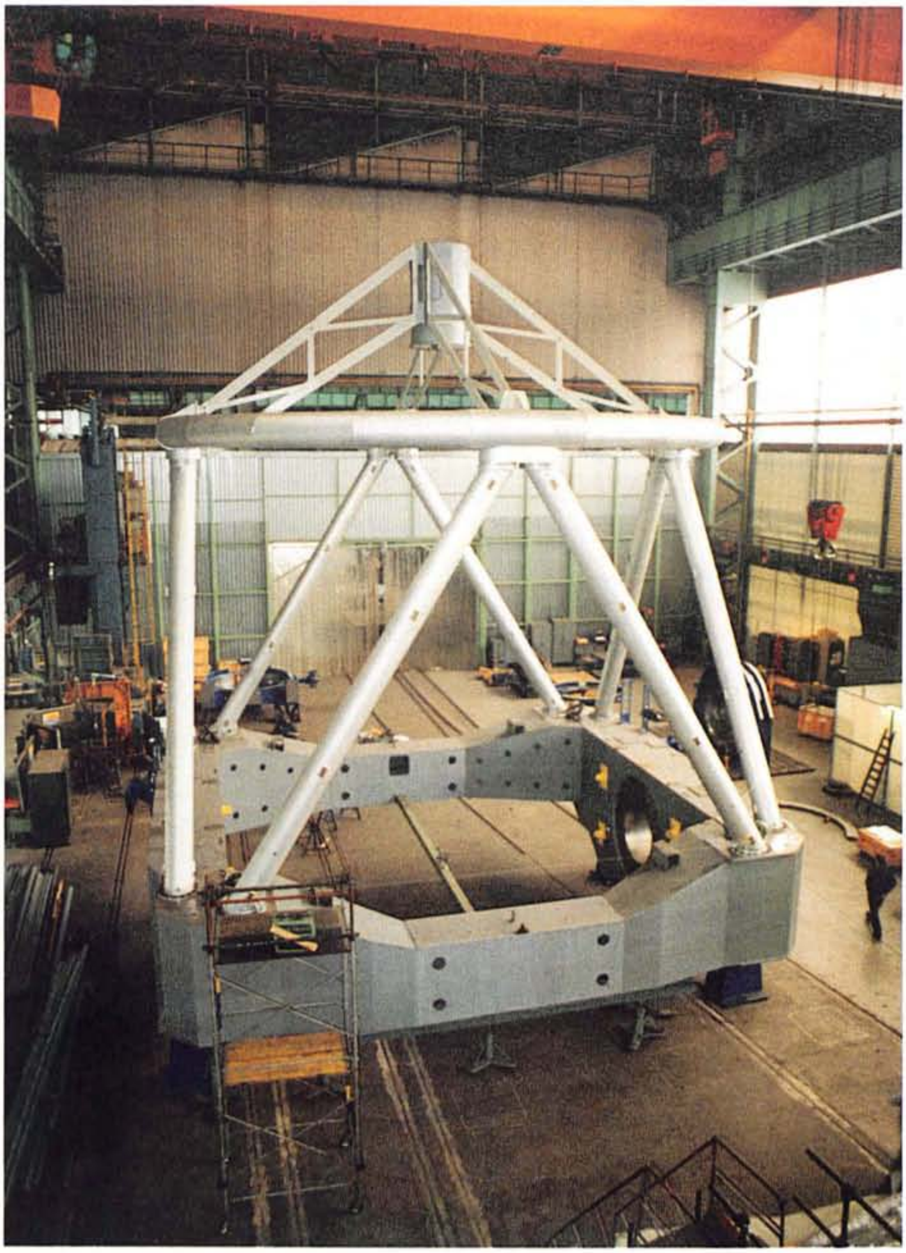

Figure 2: The tube is placed on supports for the Top Unit dynamic test. ◀

Bartolamei, obtaining far better results than specified and eliminating all the concerns that these operations had caused the designer.

As a matter of fact, even though during the conceptual and final design phases all the difficulties related to the machining and alignment of large pieces had been thoroughly investigated, the designers were waiting for the real operation to test on the field that the assumptions used would have given the foreseen results.

In fact, the major concerns which accompanied us during the phases of assembly were related to the alignment precision and its stability in time, both required to meet the final specified alignment of the axes of the telescope. The concrete foundations long-term stability would have played a major role in the overall long-time stability of the telescope, also impacting on the functionality of the hydrostatic bearing system which needs plane journals to work at its best performance. Also the encoders could have been affected by instability of the mounting due, for instance, to temperature gradients in the mechanics, and this would have influenced the repeatability of the system degrading the final performances.

All these concerns have now been ruled out by the results obtained in Milan. The precision of alignment of the azimuth bearing journals, both positioning and run-out, as well as planarity, have been met better than specified, as already mentioned in previous articles. Their stability has proved to be so good that during all the surveying time until now (and it will continue until the dismounting of the main structure) no modifications have been detected, and the azimuth hydrostatic bearing system runs in a smooth and stable manner.

The positioning and alignment of the large mechanics have been carried out with outstanding precision and reproducibility even after multiple dismounting and mounting. The reference pinning of the different pieces has made it feasible and will make the assembling of the structure in Chile faster and "easier".

The altitude encoder has been completely assembled in a laboratory built on purpose next to the telescope, and its mounting stability is kept under control. It shows that no modifications of the relative position of the measuring elements take place due to temperature cycling or micro-vibration induced into the system

Figure 3: Altitude hydrostatic bearing pads and locking pin support. ▶

Figure 4: Altitude drive pre-assembling. ▶

by the "dirty" industrial environment (one should not forget that heavy tool machines are operated in the same building).

After a first assembling of the tube on the main structure to perform a number of alignments, the telescope has again been taken apart as one can see in Fig. 1 and 2. This operation was necessary to carry out a modification of the altitude hydrostatic pads to facilitate the maintenance (mainly to make accessible pressure transducers and check valves as seen in Figure 3) and perform the final alignment of the altitude axis. At the same time the M1/M3 unit concrete dummy has been placed on the fork and centred with respect to the azimuth axis (Fig. 1), ready now to be bolted on the tube structure.

At the same time the altitude drives (2.8 m diameter) are being pre-assembled ready to be lifted on the Nasmyth platform (Fig. 4).

Now the tube structure has been repositioned on the fork, and the dummy has been mounted, making the main structure ready to undergo the dynamic tests during week 22.

The first test results though have been obtained during the month of March 1996. In fact, one of the reason to dismount the tube from the fork and place it on supports was precisely to test the dynamic performance of the M2 dummy, which forms with top ring and spider the so-called telescope Top Unit.

The eigenfrequencies of the M2 along the optical axis and around the axis perpendicular to it will define the performance of the M2 unit under the wind action (important for the Optical Path Variation in the interferometric mode) and while

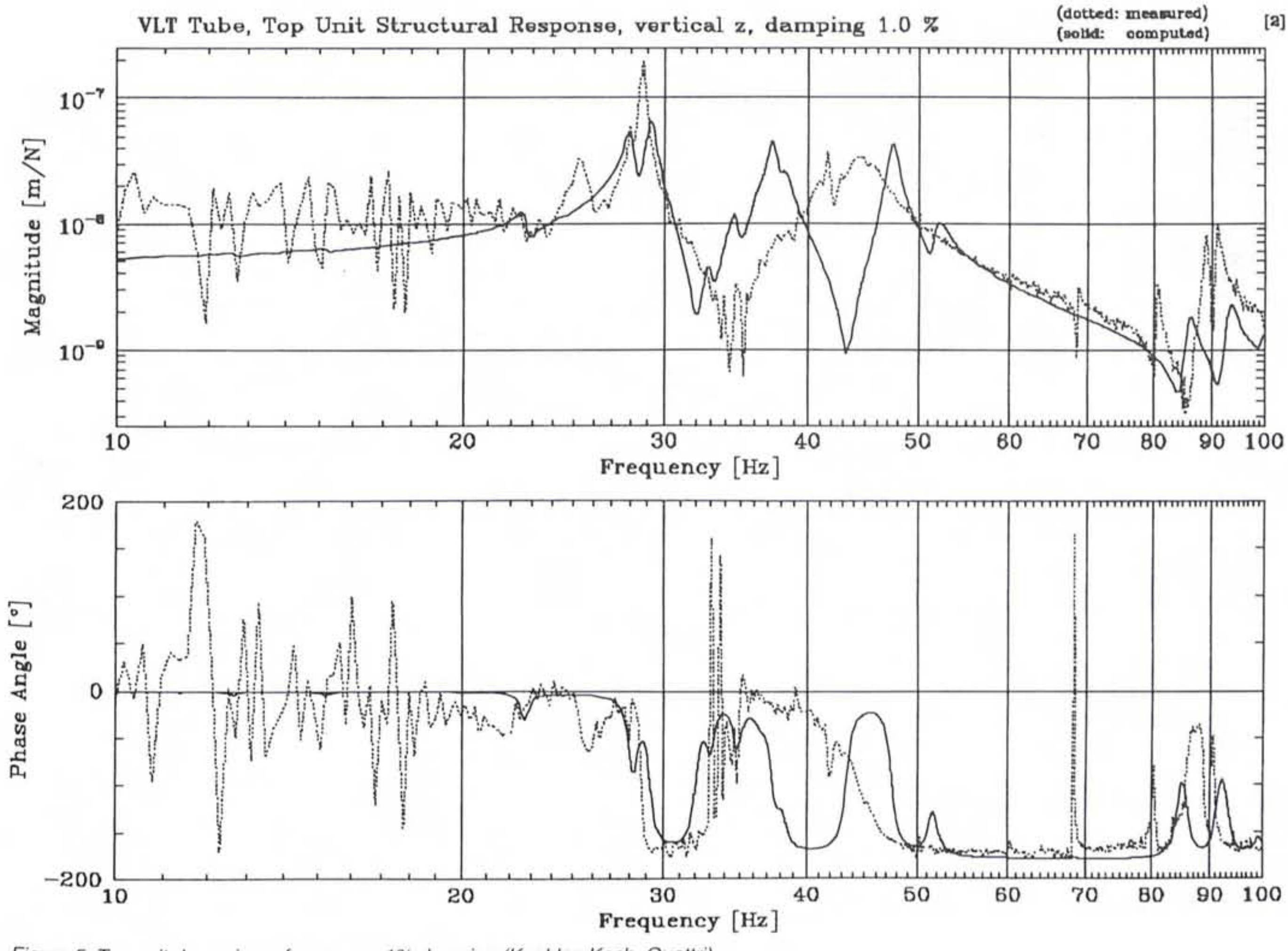

Figure 5: Top unit dynamic performances 1% damping (Koehler, Koch, Quattri).

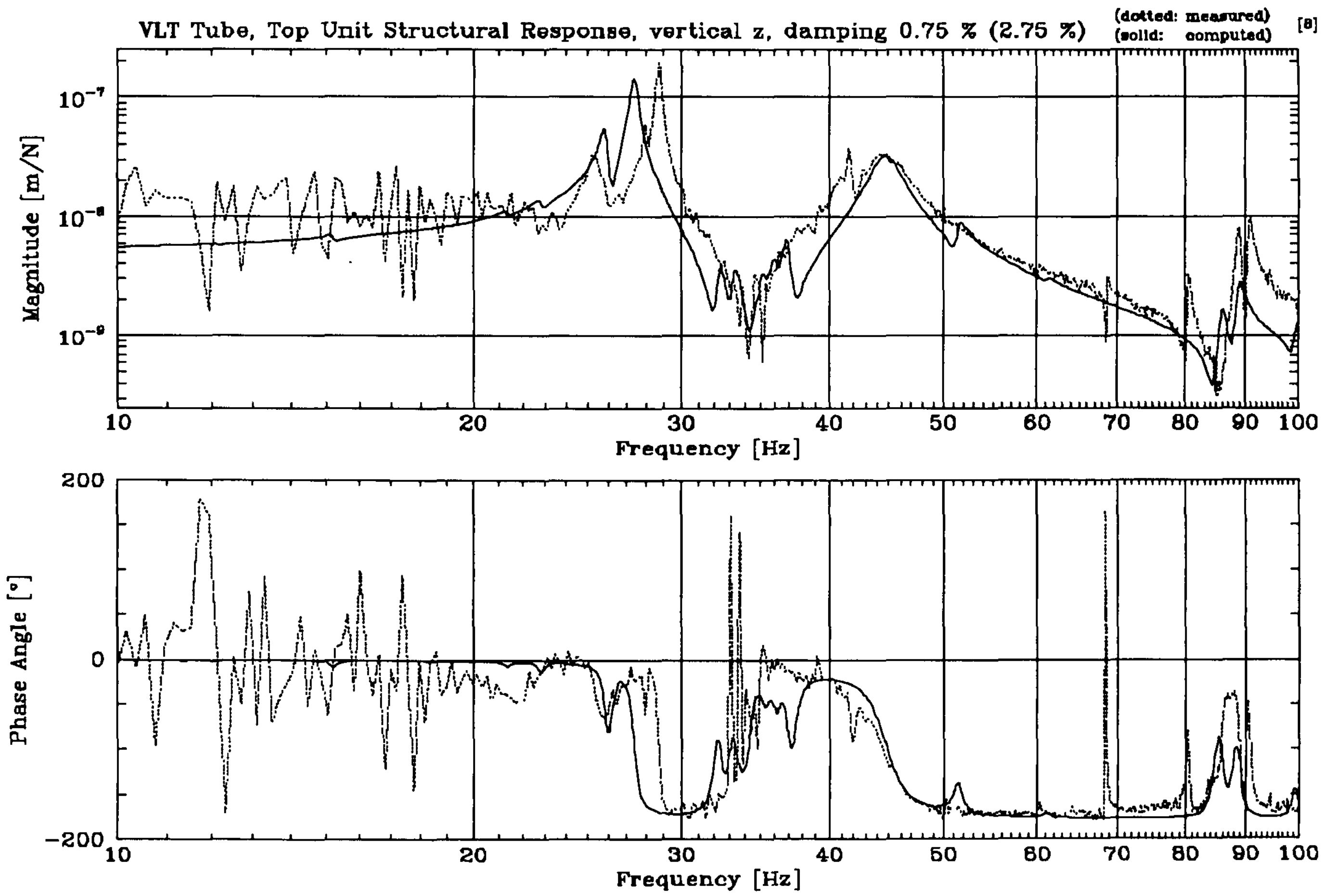

Figure 6: Top unit dynamic performance 0.75% and 2.75 % damping (Koehler, Koch, Quattri).

chopping or tip-tilting. The value specified, and determined according to the interferometric and infrared requirements, were 20 Hz along the optical axis and 26 Hz in rotation. The design calculation had shown better performances (27 and 36 Hz respectively) after the modification of the top ring using a stiffer section.

Last March the tube was equipped with accelerometers, and, using an electronic hammer, the impulsive excitation was applied to the M2 dummy both along the optical axis and the axes perpendicular to it. The results are shown in Figure 5: the dotted line shows the recorded spectrum of the displacement of the M2 dummy. B. Koehler and F. Koch have compared the experimental results with the calculated spectrum, shown in Fig. 5 with the solid line, and have found a very good agreement among the two, which tells how reliable the calculations performed by AES are.

It was very interesting to see that the curves had even a better agreement after having applied a higher damping factor to that mode in which the spiders move on the bolted attachments to the top ring (see Fig. 6).

The fact that the effective damping is the same as the one used in the analysis, and generally used for welded structures, gives an idea of how good the bolted junctions in the structure have been designed and realised. On the other hand, the fact that the vibration modes which involve bolted parts are better damped gives the feeling that the behaviour of the structure during seismic events could be better than the one calculated with the very conservative damping factor of 0.75%.

In the next months, till end of July, the main structure will be thoroughly tested in all its components, and a complete picture of its performances will be available. The start is positive and very encouraging.

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The VLT Software Review

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A Status Review of the VLT control software was held in ESO, Garching, from April 24–26, 1996. The purpose of the Review was to provide the ESO Management and the Divisions involved in using the VLT software with a quantitative report on the status of the software, close to important milestones of the VLT programme.

ESO representatives of the different "VLT software User" Groups/Divisions were present, including Instrumentation, La Silla and of course DMD and VLT (Software Engineering, NTT Upgrade, VLTI). A team of external Reviewers was appointed from the international scientific community: Drs. R. Doxsey (STSci), Chairman, A. Daneels (CERN), S. Wampler (Gemini) and T. Axelrod (MSSSO). They provided already a number of relevant comments and remarks during and at the end of the Review. A written report will also be forwarded to ESO.

The review had a dense three-day agenda, involving not only the VLT control software aspects but also the Data