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Virgo Progress Report Nov. 2001

1. Management and organization

Presently all efforts are devoted to operate a smooth transition from the Virgo Project to EGO and the Virgo Collaboration.

2. Infrastructure

2.1 Central area

Small improvements and maintenance works continue to be undertaken in the central area. After completion of the arms and of the new extension, there will be still important works to be realized for the final arrangement of the premises. These include the realization of parking lots, internal roads, green spaces, reconfiguring the tubes assembly buildings, installation of a security system, etc..
These works will be carried over by EGO over the next 3 to 5 years.
The construction of the office extension is proceeding albeit with a considerable delay due to a late receipt of authorizations.
Recently a number of problems were encountered with the electrical installations due to defective work and components used for the central area. It will be necessary to undertake an upgrading plan to guarantee the reliability that Virgo requires.

2.2 Clean areas

The clean rooms in the central area are operating regularly.
The washing machine for the preparation of the clean elements has already been installed and a class 1 box ordered for the final preparation of mirrors (gluing of magnets and spacers).
Some important repair and improvement works have to be undertaken before the upgrade to Virgo:

- repairing of the lower gallery floor,
- thorough cleaning and painting of floors and ceilings,
- separation of the laser room air feed from the clean room one
- installation of super clean local working area for the assembly of mirror suspensions.

The contract for the realization of the clean rooms of the terminal buildings is about to be signed. The installation should be on schedule.

2.3 Arms and terminal buildings

The work is now progressing at a satisfying rate.
The North and west tunnels as well as the assembly buildings are achieved and in operation.
The North terminal building is expected to be delivered for the end of November and the West building for February.

North building on October 10th, 2001

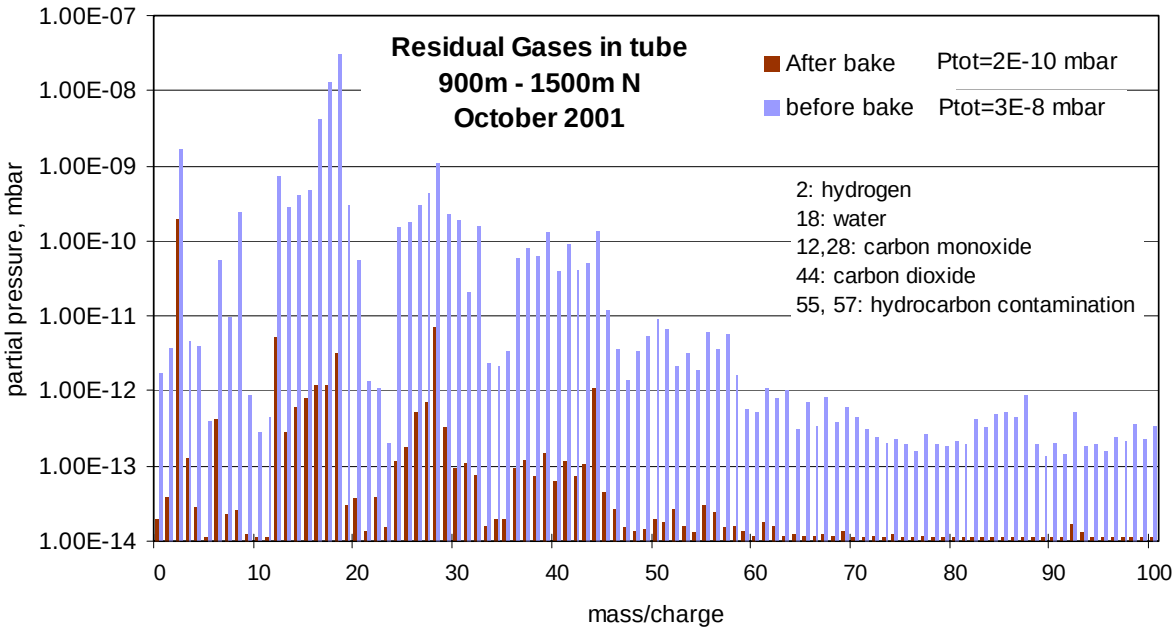
West building on October 10th, 2001

The arrival of the rainy season will probably not allow to fully completing the external surroundings. Some works such as the fencing may have to be postponed until late spring and for this reason they might be removed from the main contract and done through separate contracts.
The North assembly building will be partially converted into laboratories and storage place upon completion of the North tube. The workshop, vacuum laboratory and electrical workshop will be moved there and will occupy about half of the available space.
Generators and local UPS have been bought for the pumping stations along the arms and for the assembly and terminal buildings.
The project of the final arrangement of the site (parking lots, roads, green areas, etc...) with the areas for possible new buildings, including the area of the computing building, is ready. The request for the administrative authorization is going to be made and we expect to receive the authorization in 6 months.

3. Vacuum

3.1 Tube

The module production is progressing regularly and approaching to the end (February 2002). Our troubles with Toulon-Mantova module transport are not finished. As soon as the second truck was available the first one had an accident and it is not yet back on the road. We are now using railway transports to recover the module overflow at CNIM and the lack of modules at Belleli.
Tube assembly is well advanced on site. At present there are 3 sections (300+600+600m) of the North tube under vacuum, leak tested and baked (see figure).



The best result is continuously improving (5x10-11 mbar). 2000 more meters are installed and welded, ready for evacuation. Hence the North arm is completely installed together with 500m of the West tube.
West tube assembly is expected to be completed in May 2002.
Power supply and control system for tube bake-out are running regularly.

3.2 Large valves

The first two valves have been installed in Cascina.

3.3 Towers

The last two towers will be installed as soon as the relevant buildings will be ready to receive them. North terminal in December 2001, West terminal in February 2002.

3.4 Pumping system

The tube pumping system and its control system are being installed progressively and are expected to be completed in due time.

4. Interferometer

4.1 Injection System

The high power injection locked Nd:YAG laser is running quasi-continuously since the end of 1999. The high-bandwidth analog servo loops for injection-locking, frequency control, and amplitude stabilization of the laser are operating reliably, and fulfil the Virgo specifications.
As concerns the changes to be done between the CITF commissioning and Virgo:
The first 20 W laser should operate in Nice before the end of October 2001. This is a Nd:YVO4 laser, end-pumped by only 2 high-power diodes and injected by a Nd:YAG master laser. It will be mounted on a new laser bench, which will be delivered next year in Cascina.
The pre-mode-cleaner (necessary to reduce the high frequency laser noise, as long as the Virgo modulation frequency remains lower than 10 MHz), has been designed and will be procured in the next few months.
Electronics (hard and soft) for the automatic alignment of the injection bench onto the Virgo North arm have to be implemented.
In order to avoid as much as possible entering the laser lab, we may choose to add some remote tuning knobs in the control room, that an operator would have to adjust once a month or so.
Except for a new telescope (to match the 2-cm Virgo beam radius), and for the possible change in loop topology, which would request a small change in the beam path, it is not foreseen to modify the injection bench
The bench suspension wires may have to be changed, if they do contribute to the high noise level. That remains to be confirmed.

4.2 Detection bench

The detection bench is installed at Cascina since September 1999.
Pre-commissioning was completed at the beginning of this year. Since last spring the detection bench is used for the CITF commissioning.
The photodiodes signals have been used to lock the interferometer on the dark fringe. The output mode-cleaner has been locked on the interferometer dark fringe beam. All the slow controls have been extensively used during commissioning.
The detection bench upgrades required for VIRGO started last spring. The electronics for the photodiodes amplification and demodulation has to be changed in order to adjust it to the final modulation frequency (6.25MHz). Several of the new components have been already selected.
A prototype for the new pre-amplifier has been realized and is currently being tested.
The output bench optics upgrade started with the study of the final telescope. The simulation program used for VIRGO is now installed also in Annecy. The study of the optical isolator to be installed after the output mode cleaner will start soon.
The installation of the final bench is actually foreseen during summer 2002.

4.3 Mirrors

Since June, we have:

- completed the installation of the building equipment (production of de--ionized water, installation of the last cleaning tools);
- completed the construction of the large coater (automatic shutters and masks);
- completed the installation of optical metrology devices (wavefront measurement of 300 mm diameter areas by “stitching” together 150mm areas : precision < 1 nm);
- started R&D in collaboration with LIGO (step A of the program has been completed);
- ordered spare substrates for Virgo (the order is accepted by Heraeus, there remains some administrative obstacle before it gets fully accepted by CNRS-IN2P3).

The first results obtained with the large coater are good, as concerns coating homogeneity and absorption.
We are confident that the first Virgo end mirror will be produced before the end of the year, as planned.

4.4 Suspensions

All the seven suspensions of the VIRGO central interferometer are in operation since about one year. Three short suspensions are used for the optical benches, while four long ones are used for the interferometer mirrors.
All the building elements of the suspensions for the terminal towers are ready and are being preassembled and tuned. The suspensions will be installed starting at end 2001, as soon as the terminal buildings will be ready.
Studies and prototyping for the monolithic last stage are progressing in Perugia and in Rome. A decision about the use of this solution for Virgo will be taken in early 2002.

5. Electronics and software

The reorganization of the Electronics & Software System is going on as scheduled. This system is going to face with large structural changes that are being implemented trying to have minimal perturbation to the CITF Commissioning.
We remind that the main goals of such reorganization are passing through a clear differentiation of roles of the Cascina Staff and the Virgo Collaboration. In fact, the Cascina staff has now a relevant role in the E&S organization especially for the part related to the on-site management and takes part to the technical decisions, while the Virgo collaboration focuses more and more the attention to the physics of the experiment and to the technically related problems. According to this view, the Virgo collaboration is now adiabatically transferring the technical know how to the Cascina Staff that is assuming the control of the technical operations on the site, giving to the physicists all the needed support and leaving them the possibility of focusing their attention to the physical aspects of the problems, making the CITF Commissioning more efficient.
It is necessary to underline also in this report that the electronics management in Cascina is in large delay, mainly because there is no Cascina staff devoted to this problem. This is now becoming very critical for keeping the efficiency and working in a proper way. The first real need of electronics management is the creation of an equivalent of the software management group, starting to provide the Cascina staff with an Electronics Manager. The standardization of the electronics is an important step that must be performed as soon as possible, otherwise problems will arise that may involve and delay Virgo.

As anticipated in the previous report, a strong effort is being produced by the Virgo collaboration in order to produce a global plan which homogenize the on-line and off-line sections (E&S and Data Analysis). These efforts are being finalized in a document (Virgo Computing Plan) that will be submitted to the VEC at the November meeting and will constitute the reference plan for data acquisition, archiving, access and analysis of the VIRGO antenna for gravitational waves detection. It provides a detailed explanation of the adopted philosophy and an exhaustive description of the functionality, the interconnection and requirements of all the involved systems, already planned in the VIRGO Final Design or defined for the first time in this document. Great care is given in this document to the definition of the requirements and of the boundary between the on-line and off-line tasks of VIRGO, as well as to the planned and/or possible connections with external computing facilities, that are already part or are going to become part of this architecture. Adequate detail is given to the definition of the computing resources needed to handle the different programs of physics of VIRGO and to the identification of the different places in the VIRGO Collaboration where data analysis will be performed. Finally, a plan for the software and hardware implementation of a realistic on-line and off-line VIRGO Computing Plan is given taking into account the time scale of the VIRGO start-up (data production) by mid of 2003. This document will update the VIRGO Computing Model document.
In September an Engineering Run (E0) has been performed and the results are being analyzed both at the physical and technical level. Although deeper analysis and discussions are needed to interpret the results, what emerged in a clear way is the lack of hardware (computing power, etc.) for Virgo debugging and data analysis in Cascina. In particular, there is a lack of disk space for keeping the data on-line for Virgo debugging and data analysis and the Virgo collaboration is working very close to an emergency situation. Moreover, it is more than a year since it has been stated that Virgo needs a Cascina Computing Facility, necessary both to provide Virgo people with the necessary computing power for debugging the instrument and for the definition of the requirements and the architecture of the on-line facilities, like the 300 Gflop machine, for on-line analysis of coalescing binaries. There is a dramatic delay due to administrative problems that should be solved as soon as possible. Meanwhile, tests of data transmission and storage between Virgo and the computing centers of Lyon and Bologna are going on in order to test the software and to define the requirements on the connection. After the first tests and taking into account that the Virgo data flow is already now close to 4 Mbyte/s, we think that it is already urgent to upgrade the network up to 155 Mbit/s between Cascina and Lyon and Bologna.
Finally, the Software management Document and the Security Policy for Virgo Computer System are slowly but continuously put in practice due to the need of avoiding any perturbation of the CITF Commissioning.
The next steps that we are planning are:

- Software Libraries standardization (in connection with the Data Analysis Group);
- Definition of test for software validation;
- Definition of a global strategy for the Electronics Management;
- Analysis and upgrade of the on-line part in order to take into full account the results of the CITF Commissioning.

5.1 Control

The Michelson locking performed in June has allowed an extensive use of the various actors involved in the Virgo controls: local controls, suspension control, global control and photodiode readout. Some bugs have been found and all sub-subsystems

have been quickly improved in order to match the experimental constraints. The fast implementation of new ideas has shown the flexibility of the different components of the Virgo control and the choice of digital servo-loops instead of analogic ones is fully validated.
During the Engineering Run (E0), the dark fringe control has been insured during three days and the lock has been involuntarily lost only three times.
As a conclusion, the last six months have seen the first interaction between all sub-systems involved in the Virgo control and this interaction has been successful at all levels.

5.2 Data Acquisition

The full DAQ line is permanently running to support the commissioning activities. It was successfully used during the 3 days of the first engineering run. All the processes are reliable in stable conditions. Work is in progress to improve the monitoring tools and the reliability when the configuration is changing.
A graphical client showing the status of each DAQ server is available. The DAQ servers are on the way to be integrated in the Supervisor scheme.
The dataDisplay, widely used, has been upgraded to provide better graphics capabilities (using ROOT) and to improve its speed, functionality and robustness. Further work is in progress to better match the need of the users.
Based on the same architecture as the DAQ, some tools for online processing exist and have been used successfully to run online several monitoring algorithms during the E0 run. Improvements are still needed and planned, as well as algorithms to be tested.

5.3 Supervisor

The integration of the sub-systems (except Beam Source, Global Control and Vacuum which were already integrated) is still under progress.

5.4 System & Network administration

The upgrade and synchronization of the control workstations has completed, and the system is more stable. The twin file servers for the workstations and RIO cpus have been patched also, solving the problems of NFS hangings when the services are passed between the two.
The local scratch disks on the workstations have been rearranged to provide 200GB for the DAQ raw data buffer.
The network has been extended to the north arm and to the first half of the west arm.
The Internet connection is being upgraded up to 12 Mbps by bonding 6 2Mbps serial lines.
The small-scale test computing system is being built. Two storage nodes of 1.5TB each (raw) have been installed and used for storing and analyzing 1TB of data produced during the first engineering run on September. Many problems have occurred due to bugs in the hardware and firmware which are directing us to revert to different vendors for the next storage purchasing. The data have been stored on DLT tapes too.
A single node for the PC farm has been installed and is used for computing tests.
The call for tender for the components is closing and the proposals are being selected.
Connections with the remote data repositories in Bologna and Lyon have being set up to test the data transfer procedures.

5.5 Software management

In the previous report, we said that an important operation was in progress: the homogenization of the operating system and compiler levels on all the workstations. This operation did take place in May, and we took advantage of it to proceed to a massive recompilation of the Virgo software, according to policy which was agreed upon some time before. This gives us a good homogeneity also on the application software point of view.
In the previous report, we also mentioned the importance of the "runs" to come to test and "stress" the software packages in real conditions. The first run took place recently and we were able to acquire continuously instrument data for three days (at 3.5 Mbytes/s). This proves the robustness of this software. Moreover we were able to keep the lock during 54 hours just controlling the instrument by software means. This proves the reliability of this software. A major improvement was the integration of the "root" software in the data display tool. This allows doing some analysis while displaying the data. This widely used tool is now much more efficient and user-friendly.

One of the major pieces of our infrastructure software is our communications library (Cm). Thanks to a large collaborative effort, the robustness of this software has greatly increased recently.
The run has shown that there is still room for improvements on the quality of the control and acquisition software, and this is the present objective.
As we are more confident about software for acquiring data, an important work to come now will be about software for analyzing the data.

5.6 Electronics Laboratory (VELAB)

Continuous electronics components supply service and technical support is given to all the groups of the Virgo Collaboration. Anyway, it is necessary to enlarge the lab in order to make it more efficient.

6. Assembly, Integration and Commissioning

6.1 Injection System precommissioning

The automatic alignment servo systems for the mode-cleaner and for the reference cavity are operating: the error signals have the expected shape (with some offsets, to be understood), and the servo loops are stable.
The digital control electronics (hard and soft) are nearly completed, and progressively debugged.
The whole system can run for long time periods (longest run 20h, intentionally interrupted), but it is sometimes difficult to start-up, and it happens to unlock, for unknown reasons.
During the first engineering run, six “unlock” events have been detected, and are investigated.
Another priority is to understand excess noise in the length fluctuations of the mode-cleaner: the measured noise level is higher than the Virgo specification, and not yet understood. If that could not be solved, it would still be possible to recover, through a change in the servo-loops topology. But this “safe” topology does not make use of all the good properties of the mode-cleaner (low pass noise filtering)
Presently, there is some uncertainty as concerns the finesse of the mode-cleaner: its value is slightly **higher** than expected from the metrology of the components and from simulation runs. This looks incompatible with the fact that the mirrors don’t seem perfectly clean. They should have extra losses, which should result in a **lower** finesse.

The mode-cleaner transmission is not yet calibrated: the measurement is made through a high reflectivity mirror, whose transmission needs to be checked.
A very positive result is that the finesse and the transmission did not decrease since the first measurements, more than six months ago: the losses are stable, there is no aging or pollution of the coatings, once the mirrors are under vacuum.
New mirrors, and a spare wedge, are being manufactured for the mode-cleaner. They will be delivered at the beginning of 2002.

6.2 Suspension System precommissioning

The Inertial Damping loop, designed to reduce the rms displacements of the suspension point, has been implemented on all towers. The rms horizontal displacements of the chain suspension points have been reduced down to a fraction of micron on time scales of ten seconds and more. Even if this result is in agreement with the VIRGO specifications, some improvements have been recently achieved. Indeed the suspension point horizontal motion between 10 mHz and a few tenths of mHz (providing the main contribution to the residual mirror rms) have been reduced by about one order of magnitude.
The software of the four mirror cameras has been improved, increasing the robustness and the sensitivity of the monitoring. The camera monitors the mirror position in all six degrees of freedom. It is used in a local control loop where the four marionetta coil-magnet actuators are involved. The loop reduces the rms angular displacements of the mirror (about the vertical axis and about the horizontal one perpendicular to the beam) down to less than one microradian on time-scales of tens of seconds. This result is in agreement with the VIRGO specification. A similar technique is used to perform a damping of the motion of the mirror along the beam during the locking procedures.
The transfer functions connecting the eight coil-magnet actuators assembled on the last stage and the mirror displacements have been accurately measured by using a local interferometer. The measurements have been performed on the Beam Splitter towers and on the West Input one, obtaining very similar results. The angular motion along the two degrees of freedom mentioned above and the translations along the beam have been damped measuring the mirror displacements with respect to the local interferometer. This has been achieved by using the coil-magnet systems assembled on the optical payload. This result have proved for the first time that it is possible to control the mirror position by using actuators assembled on the Superattenuator items (and thus isolated from seismic vibrations). The information obtained by these local measurements made possible the locking of the central interferometer.
A few problems on the digital cards (ADC, DAC, DSP), developed ad hoc for the Suspension control, have been fixed and solved. However, some spurious numbers can still be detected in the 10 kHz sampled data coming from Suspension DSP cards. These spurious events, whose number is decreasing, are due to software and hardware problems in the lines connecting the DSPs to the Frame Builder, via Digital Optical Link.
All the software processes concerning Suspensions are massively used since many months without any trouble. A new graphical interface client for the main server (managing the download of feedback digital filters on the DSP cards) has been recently prepared and tested. The final test concerning the integration of the entire suspension software to the VIRGO Supervisor is scheduled on November. The Global Control signals are read by Suspension DSPs without any trouble.

6.3 CITF commissioning

6.3.1 Last period activities

CITF commissioning is going on since the end of March using the auxiliary laser as light source.

The alignment of the Michelson interferometer was completed in May with the alignment of the WI mirror.

In June the Michelson interferometer was locked on the dark fringe. Locking was achieved by acting on the WI mirror trough the reference mass. The lock was quite robust. Locking periods of more than 12h were easily attained. The locking of the Michelson interferometer allowed testing the whole control chain including the photodiodes read-out system, the global control crate and the suspension actuators control. This was an important milestone since it demonstrates that it is possible to finely control the mirror position using actuators suspended to the super-attenuator and a fully digital control chain.

At the end of June the output mode-cleaner was locked using the interferometer dark fringe beam as input beam. Lock was very robust. Lost of locking occurred only if the interferometer lock was lost.

First half of July was dedicated to the alignment of the power recycling mirror. When correctly aligned the recycling mirror allows increasing the light impinging on the beam-splitter by a factor of 60.

First trials to lock the full interferometer (recycling cavity at resonance plus Michelson on the dark fringe) were performed at the end of July. The locking trials performed in July showed that several improvement were needed on the mirror suspensions and on their control system.

In August the site was not accessible due to electric maintenance and the commissioning activity was stopped.

Several improvements to the suspensions and to their control were performed in September. Different aspects of the local control were improved in order to improve the reliability and to improve the damping speed performances. The last stage suspension was also improved by gluing the spacers. Various bugs on the power recycling suspension were detected and solved. Some of these improvements are still in progress.

Meanwhile the low finesse cavity formed by the recycling mirror and the north mirror (with the west input mirror not aligned) has been reliably locked at the resonance. The data collected during the recycling cavity alignment and the locking trials are currently being used off-line and compared to the simulation in order to better understand the locking acquisition procedure for the full interferometer.

Commissioning activity allowed testing the data acquisition system. This system is now running in a configuration very near to the final one. Trend data and undersampled data at 50 Hz are produced on-line.

The data storage system is still not available. Since the data archiving and data distribution systems are not working, data are currently stored on one of the scratch disk used for the interferometer control. This is currently limiting the data buffer to 16 hours. Setting-up a reliable data archiving system is one of the priority.

6.3.2 First engineering run (E0)

The first CITF engineering run was performed from September 21st to September 24th. The goal was to collect a 'long' and 'clean' stream of data with the interferometer in well defined conditions. Then use the data collected to help the detector characterization and to start a real data analysis exercise using real data.

The interferometer was run in the simple Michelson configuration for three days 24 hours a day. More than 30 people, coming from most of the VIRGO labs, spent a part of their weekend on shift at Cascina.
The interferometer was kept locked on the dark fringe for most of the time. Only three losses of locking occurred between Friday evening and Saturday morning (but two of these were generated by human activity). Starting from Saturday morning the Michelson interferometer was kept locked on the dark fringe until the end of the run (more than 51 hours). Most of the software for interferometer control and data collection/storage performed well. Several strange interesting behaviors have been detected and are being studied.
More than 1 TB of raw data was produced. Unfortunately the raw data archiving system did not work correctly and some data were corrupted while writing on disk. This was particularly unfortunate since the raw data archiving on tape is not working on-line and thus the data were not backed-up while they were produced. Some work will be necessary in order to make this sub-system working as well as the others.
Trend data were produced online. Post-processing to produce 50 Hz rate frames has just been completed. A list of investigations to be performed using this data and a list of people on charge for each of this investigations have been set up.
More information about the engineering run can be found at:
http://wwwcascina.virgo.infn.it/commissioning/E0 .

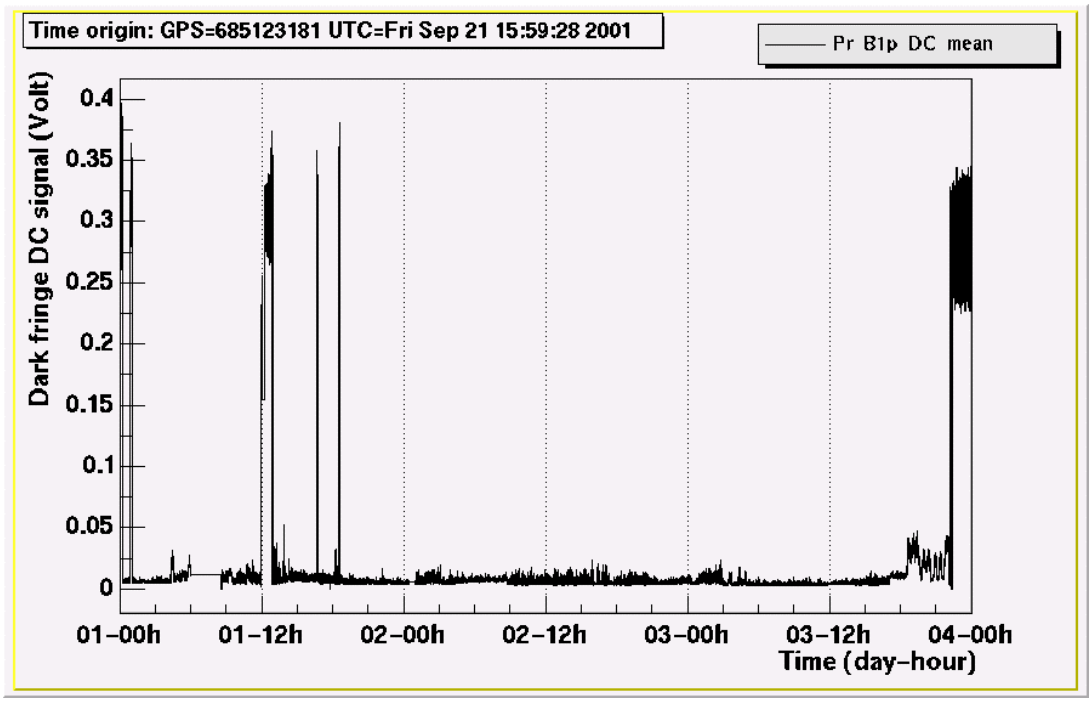


Fig. 1: Dark fringe power measured over three days during the E0 run.
The Michelson is kept locked on the dark fringe for more than 51 hours.

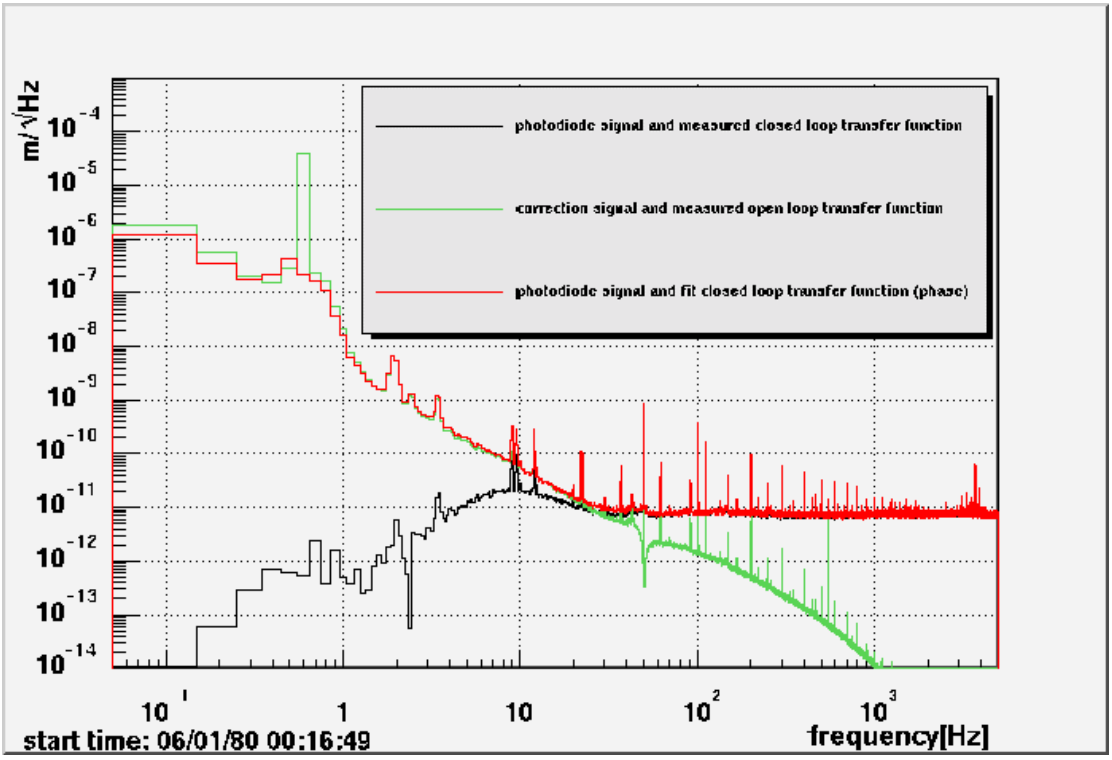


Fig. 2: CITF displacement noise spectrum measured during the E0 run using the auxiliary laser.

6.3.3 Organization

Since the beginning of the year shifts were settled up for data acquisition and for suspensions in order to support the commissioning activity at the site. Since last springs shifts have been extended to most of the critical subsystems. At present regular shifts are organized for suspensions, data acquisition, global control, detection, environmental monitoring and vacuum.

As the various subsystems evolve a considerable effort is made in order to define written procedures available on-line to the people on shift (http://wwwcascina.virgo.infn.it/commissioning/procedures).

The commissioning activity is discussed regularly on a weekly base each Tuesday afternoon. An agenda for the meeting is sent to all the collaboration the day before. Some of the VIRGO labs regularly participate to the meeting via telephone. Short daily meeting have been organized but they are not regular enough yet.

The commissioning activity on a longer time scale is discussed at the VTMT each one or two months. Even if this meeting is open to all the people who want to participate, the discussion remains limited to a small number of people. Furthermore, since this is a half-day meeting where other important issues are also discussed, it is difficult to diffuse all the knowledge gained during the commissioning across the collaboration. The need to have real collaboration meetings is becoming more and more evident.

The use of logbook has been improved a lot since last year but it is still insufficient. People on shift do not use it regularly yet. This has to be improved.

A first version of a 'CITF operation plan' (http://wwwcascina.virgo.infn.it/commissioning) was edited and presented to the VTMT last June. It was also sent to the VEC but, unfortunately, it has not been discussed yet.

6.3.4 Next period activity

The locking of the recycling cavity is the next milestone. The first trials were unsuccessful since a very well defined procedure was not available. A better defined strategy is being studied with the help of the simulation and of the data collected during the first trials. The possibility to increase the actuators maximum force in order to make the locking simpler is also being investigated. The improvements performed on the suspension and on its control system should also help the recycling locking acquisition.

Once the locking will be acquired the next step will be to start operating the linear alignment system in order to help maintaining the lock on a longer time scale. This will conclude the first phase of the commissioning.

The following step foreseen will be to improve the control reliability using the various actuators available on the suspension. This work has been already started. Feedback at low frequency using the mirror position measurement and acting at the top of the suspension has already been implemented.

The use of the real laser is another important milestone. After discussion it has been decided to continue to work in parallel on the CITF and on the injection system and to start using the injection system for the CITF once the input mode-cleaner control reliability and its length noise will be understood (see injection system report for details). The exact date is not defined yet.

6.3.5 Concerns

1) The data archiving system and the data distribution system which were built for VIRGO are not working at a level such that they can be used. For this reason we suffered from storage space problem last summer.

Recently two disks of 1.5 TB were purchased and made available for the engineering run. Unfortunately they became available only few days before the run started and they showed several failures. At this moment the disks are not available for standard commissioning data taking yet.

Having a reliable data storage and data distribution system is a real concern.

2) Computing resources for on-line and off-line analysis are also becoming critical at the site. With the exception of Windows PC's no purchase of new computers has been done since nearly two years. In the past this activity was organized and managed in the frame of the electronic & software system. This is not the case anymore.

A long-term computing plan, dedicated to the preparation of the analysis of the data VIRGO will provide once it will work, has been discussed several times in the collaboration, but the short-term and mid-term plan have not been sufficiently considered.

3) The commitment of the laboratories with the commissioning activity at the site could be improved. R&D for future generation of VIRGO seems to attract many physicist inside the VIRGO collaboration. This is positive but it may slow down the commissioning of the first generation.

4) Exchange of information and discussion inside the collaboration is crucial for the progress of the commissioning. A way to improve this would be to have regular collaboration meetings were people working on different aspects of the experiment (commissioning, data analysis, software and R&D) have the opportunity to meet, to exchange information and to have an overall view on the experiment.

5) Commissioning activity is producing a quite big amount of data which could be more widely used for understanding different aspects of the detector and for improving the simulation. This requires investing more in the off-line analysis work. It also requires the development of standard data analysis tools for data access and

data processing. Some tools have been developed by several different people but the results are still not proportional to the effort done. Some better coordination could improve the situation.

7. Data Analysis

Since May 2001, a work in common with system 5000 is to elaborate the Virgo Computing Plan (VCP), a document which describes the whole Virgo computing architecture. This has pushed all the responsibles of data analysis activities to define precisely their future work, in order to establish solid requirements for the computing architecture. These requirements and the recommendations from the "Computing panel" allow us to define an improved computing architecture, which allows for evolutions in the technology and of the data analysis activity.

The VCP document will be finalized at the beginning of November.

During the first engineering run, more than 2 TBytes of data have been stored, in the frame format, and are presently being analyzed: we are performing statistical studies, noise analyses, burst searches, etc…

Together with LIGO, we have started some network analysis of environment data: seismic and temperature data are exchanged, more signals (seismic, electromagnetic) will soon be exchanged. There was a meeting in Cascina (Sept.29-30) where future exchanges were discussed with LIGO, GEO, and the bar groups. See http://wwwcascina.virgo.infn.it/otherDetectors/NdasStatus.html for details.

A new processor (Itanium) is presently tested in Rome for the analysis of periodic sources, to which it looks well adapted.

Using small Beowulf machines in Perugia, Napoli, and Firenze, we are learning about the optimization of parallel processing for the detection of coalescing binaries. A larger machine (the "small scale" machine) will soon be available in Cascina.

The search for stochastic background(s) is going to develop, in collaboration with LIGO.

8. Planning Report

The North tunnel is finished and the tube installed. Vacuum tests are progressing.

The first 1500m of the **West tunnel** and the assembly building have been delivered. The tube assembly is proceeding. The second part of the west tunnel is close to completion. Therefore the civil engineering is not any more a driver for the tube. Following the severe accident of the truck transporting the tubes and the subsequent difficulties created by the authorities, a considerable delay has been accumulated in the transport of modules to Mantova. At the present time the authorization for the truck to resume transport has not been received and to circumvent this problem a train transport was organized and is being used for removing the backlog of modules at CNIM.

The overall planning for Virgo is still constrained by the delivery of the **two end buildings.** The North building is close to completion while about 60% of the concrete structure of the West building has been achieved.

We expect to have the essential works (those that are necessary for starting the towers assembly) achieved by December for the North building and by February for the West. The present planning is based on this assumption.

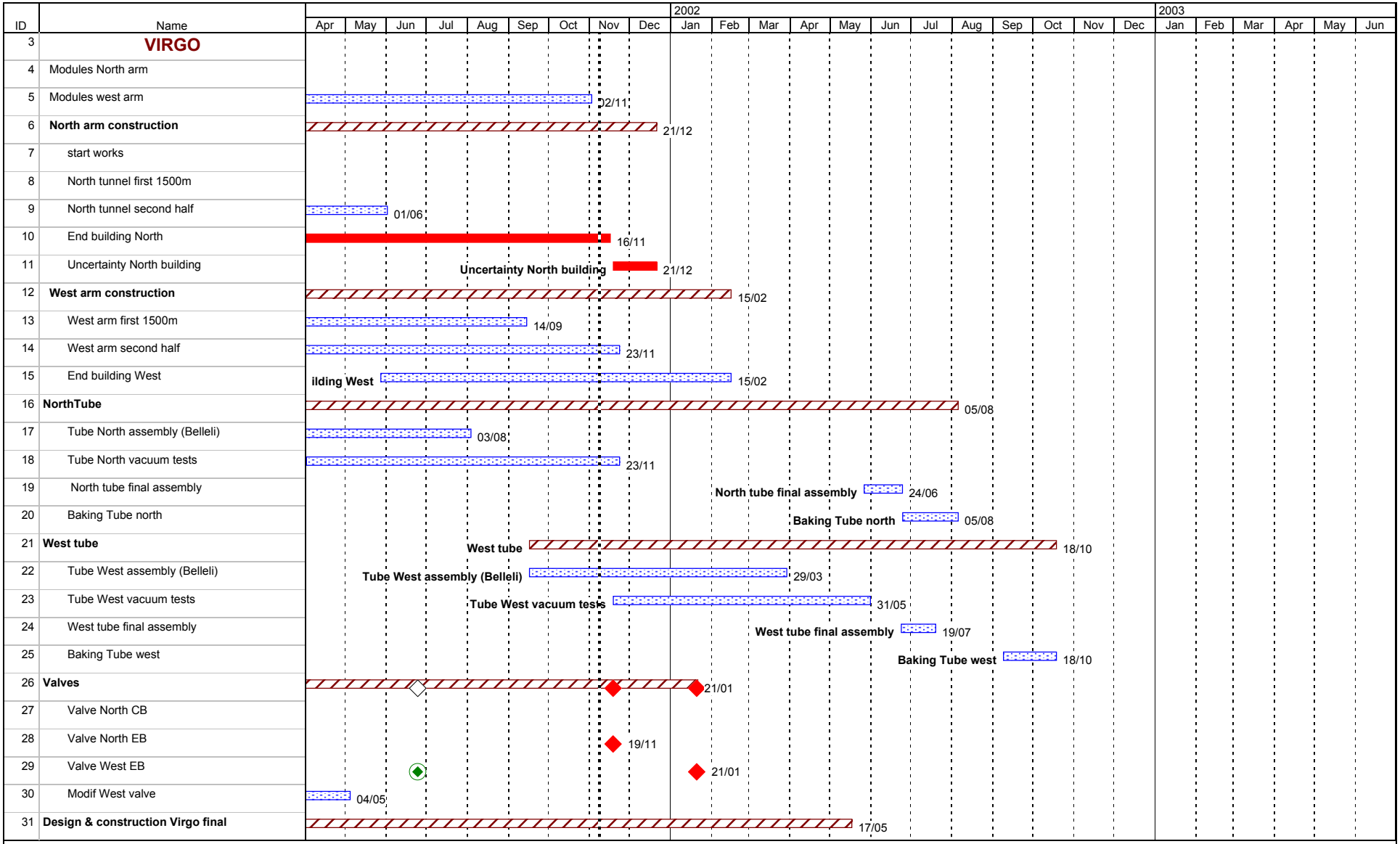
The mirror polishing is progressing well and no delay is expected with respect to the original schedule as it was feared some time ago. A first set of polished substrates have been delivered and will be coated in the coming months.

The commissioning of the CITF is making steady progress. Many problems have been understood and this should facilitate the commissioning of Virgo.

The upgrade to the final Virgo is expected to start in July and should end in December 2002. This is a very tight schedule with no margin and which will necessitate a mobilization of the collaboration.

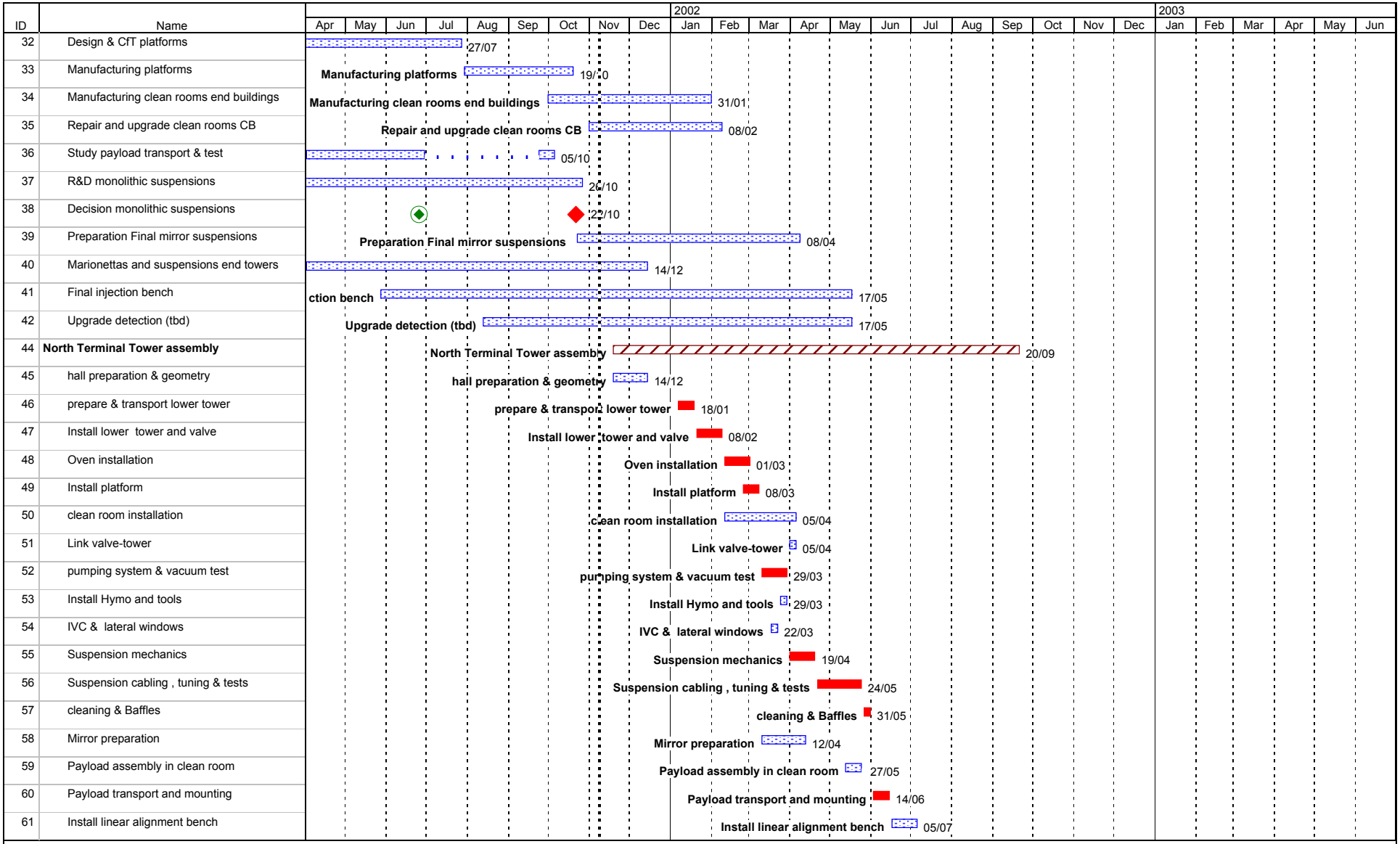
The key end dates remain unchanged:

Virgo upgrade integration	December 2002
Virgo commissioning	June 2003



VIRGO GENERAL PLAN
Date: Thu 08/11/01
PlanningSept2001v6-1.mpp

Critical	Baseline	Rolled Up Critical	Rolled Up Baseline
Critical Split	Baseline Split	Rolled Up Critical Split	Rolled Up Baseline Milestone
Critical Progress	Baseline Milestone	Rolled Up Critical Progress	Rolled Up Milestone
Task	Milestone	Rolled Up Task	External Tasks
Split	Summary Progress	Rolled Up Split	Project Summary
Task Progress	Summary	Rolled Up Task Progress	



VIRGO GENERAL PLAN
Date: Thu 08/11/01
PlanningSeptiul2001v6-1.mpp

Critical	Baseline	Rolled Up Critical	Rolled Up Baseline
Critical Split	Baseline Split	Rolled Up Critical Split	Rolled Up Baseline Milestone
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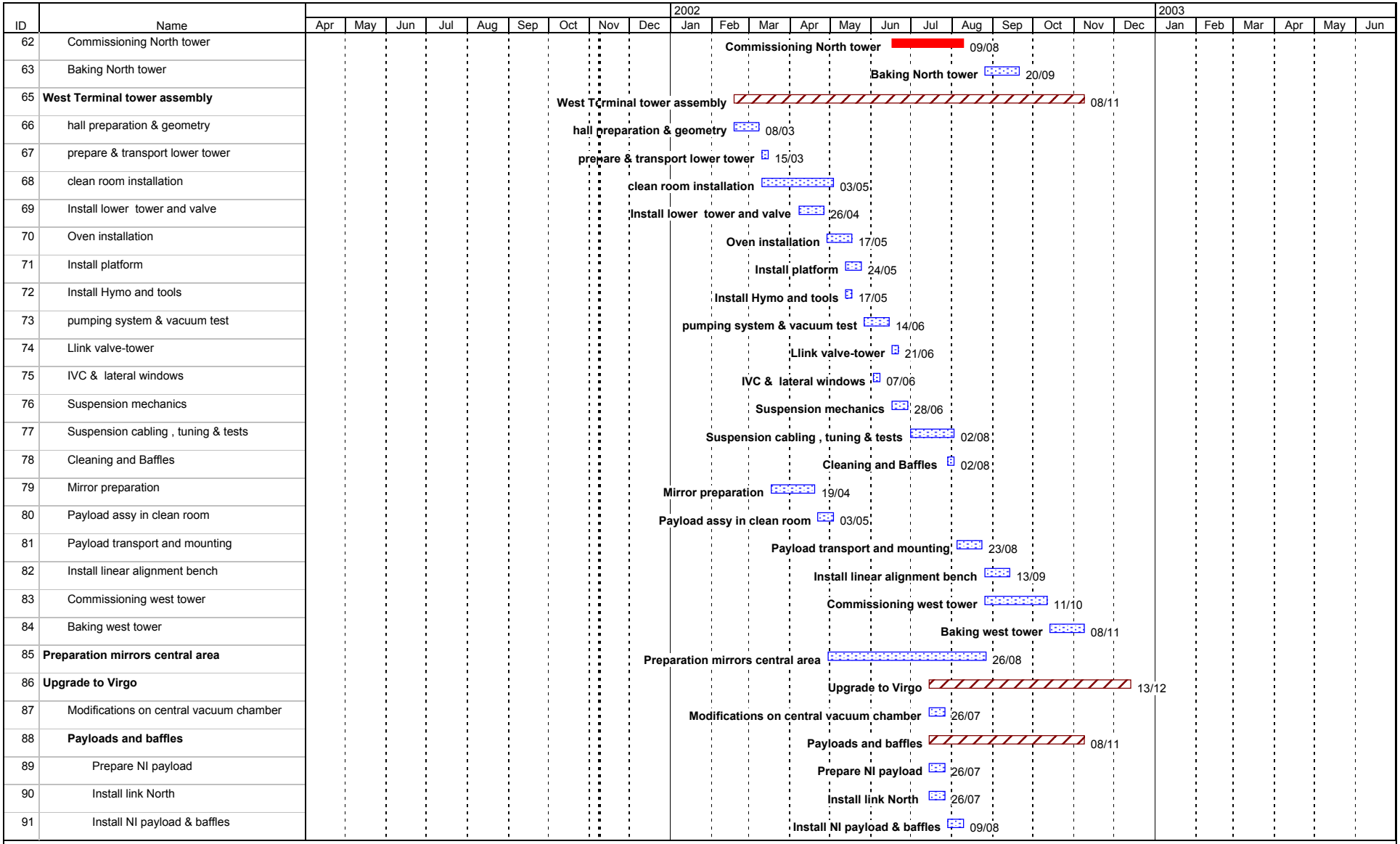
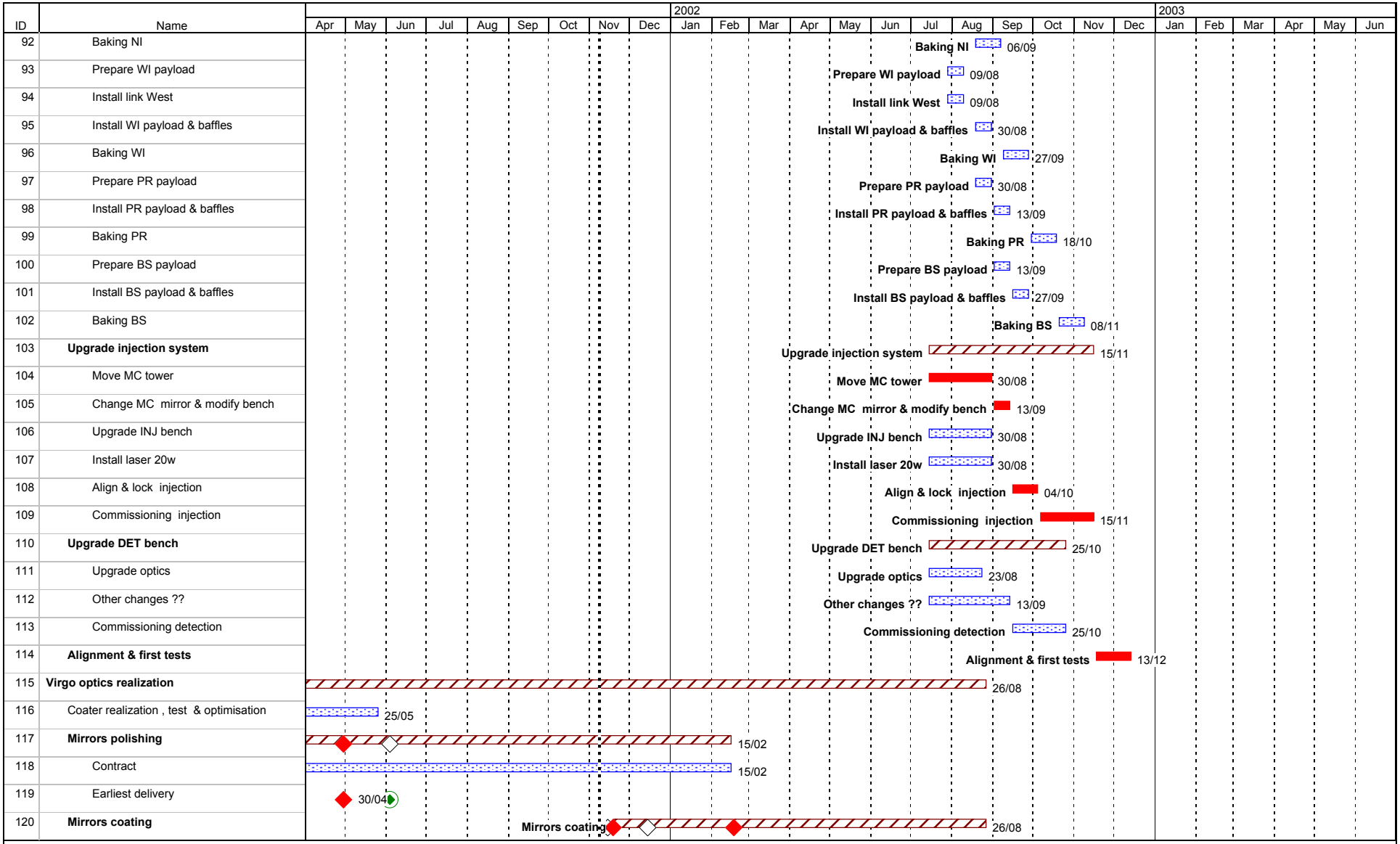


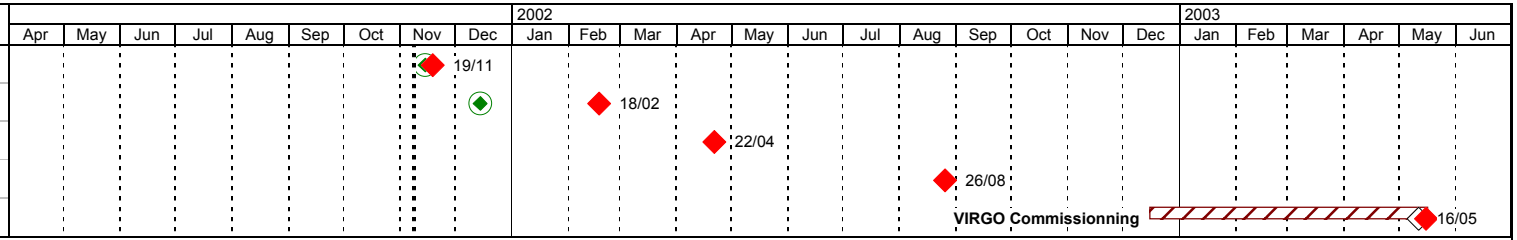
PlanningSeniri2001v6.1.mpp
VIRGO GENERAL PLAN
Date: Thu 08/11/01



VIRGO GENERAL PLAN
PlanningGenInt2001v6r1.mpp
Date: Thu 08/11/01

Critical	Baseline		Rolled Up Critical	Rolled Up Baseline	
Critical Split	Baseline Split		Rolled Up Critical Split	Rolled Up Baseline Milestone	
Critical Progress	Baseline Milestone		Rolled Up Critical Progress	Rolled Up Milestone	
Task	Milestone		Rolled Up Task	External Tasks	
Split	Summary Progress		Rolled Up Split	Project Summary	
Task Progress	Summary		Rolled Up Task Progress		

ID	Name
121	North end mirror
122	West end mirror delivery
123	Central area mirrors first set
124	Central area mirrors spares
125	**VIRGO Commissionning**



VIRGO GENERAL PLAN
Date: Thu 08/11/01
PlanningGeneral2001v6r1.mpp

Critical	Baseline	Rolled Up Critical	Rolled Up Baseline
Critical Split	Baseline Split	Rolled Up Critical Split	Rolled Up Baseline Milestone
Critical Progress	Baseline Milestone	Rolled Up Critical Progress	Rolled Up Milestone
Task	Milestone	Rolled Up Task	External Tasks
Split	Summary Progress	Rolled Up Split	Project Summary
Task Progress	Summary	Rolled Up Task Progress	

ANNEX TO PROGRESS REPORT

List of documents produced by Virgo (starting from 1-1-2001)

Virgo Code	Title	IssueDate	AuthorName
VIR-BIB-PIS-1390-101	Virgo Library Thesaurus	01-Jun-01	S.Braccini and M.Coullet
VIR-CRE-OCA-7100-001	High resolution DACs for mode cleaner control	20-Feb-01	H.Heitmann
VIR-CRE-OCA-4100-001	Wires of the Injection and Mode Cleaner Benches : Change of wires and of responsabilities	20-Feb-01	F.Bondu, H.Heitmann and C.N. Man
VIR-CRE-OCA-4100-002	Local readout ADCs in laser lab for laser systems signals	20-Feb-01	F.Bondu
VIR-CRE-ROM-4700-004	Beam splitter payload geometry	10-Apr-01	P.Puppo and P.Rapagnani
VIR-CRE-LAP-3300-005	Spacers for pots of Long Towers	16-Jul-01	F.Frasconi
VIR-LIS-OCA-4100-137	Acquisition of data coming from the laser, the input bench and the mode cleaner	15-Jun-01	E. Chassande-Mottin
VIR-MAN-NAP-5800-108	Buildings Control User Manual	20-Mar-01	F.Barone, A.Eleuteri, K.Qipiani et al
VIR-MAN-NAP-5800-102	Environment monitoring parameters	28-May-01	F.Barone, A.Eleuteri, K.Qipiani et al
VIR-MAN-NAP-5800-107	Environment monitoring probes calibration	28-May-01	F.Barone, A.Eleuteri, K.Qipiani et al
VIR-MAN-OCA-4100-138	Injection system local control : camera software user's guide	03-Jul-01	H.Heitmann
VIR-NOT-OCA-1390-166	Noises produced by opto-thermal couplings in mirrors	23-Jan-01	J.Y. Vinet
VIR-NOT-LAL-1390-165	Detecting gravitational wave bursts in coincidence with interferometric detectors	23-Jan-01	N.Arnaud, M.Barsuglia, M.A. Bizouard et al
VIR-NOT-PIS-1390-167	Two degrees of freedom control of the R&D SA test mass	31-Jan-01	R.Cecchi, G.Losurdo, D.Passuello et al
VIR-NOT-LAL-1390-168	The Page Detector for detecting gravitational wave bursts	01-Feb-01	P.Hello
VIR-NOT-LAL-1390-170	Compensation for thermal effects in VIRGO mirrors	01-Feb-01	P.Hello
VIR-NOT-NAP-1390-173	First results on TF measurement and payload control on the BS suspension	24-May-01	V.Calbucci, E.Calloni, L.di Fiore et al
VIR-NOT-NAP-1390-174	TF measurement and payload control on the WI suspension	30-May-01	V.Calbucci, E.Calloni, L.di Fiore et al
VIR-NOT-OCA-1390-176	Waveforms from binary black hole coalescences and 3PN templates generation	01-Jul-01	T.Cokelaer, P.Jaranowski, J.Y.Vinet
VIR-NOT-OCA-1390-178	Comparison of two different topologies for frequency stabilisation of the laser	31-Aug-01	H.Trinquet and F.Bondu
VIR-NOT-LAL-1390-177	The Mean Filter for detecting gravitational wave bursts	01-Sep-01	N.Arnaud, M.A. Bizouard, F.Cavalier et al
VIR-PLA-TAC-6300-128	Corrispondenza tra le Codifiche dei Componenti dei Tubi a Vuoto	23-Nov-01	A.Errico
VIR-PRO-CAS-1200-116	Emergency plan	19-Jan-01	F.Richard
VIR-PRO-CAS-1200-117	Safety and cleanliness instructions	19-Jan-01	F.Richard
VIR-PRO-PIS-6300-107	Section and tube He and Vacuum testing procedure	23-Jan-01	A.Pasqualetti
VIR-REP-OCA-4400-001	Alignements du Mode Cleaner d'entrée de Virgo	10-Jan-01	T.Battistini
VIR-REP-OCA-4400-002	Alignements du Mode Cleaner d'entrée de Virgo	15-Jan-01	T.Battistini
VIR-SPE-TAC-6300-166	Vacuum Tubes Assembly Contract : Coordinates of the Reference Points in the Tunnels	01-Feb-01	L.G Nicolosi
VIR-SPE-LYO-4320-002	Mode Cleaner End Mirror	15-Feb-01	L.Pinard
VIR-SPE-ROM-4700-106	Mirrors mounted on CITF Suspensions	28-Feb-01	P.Puppo

VIR-SPE-CAS-9200-122	Realizzazione della fondazione in calcestruzzo armato per l'unità prefabbricata per l'ampliamento dell'edificio di controllo - Computo metrico e cronoprogramma	07-Mar-01	A.Paoli
VIR-SPE-CAS-9200-123	Realizzazione della fondazione in calcestruzzo edificio centrale - Progetto esecutivo - Lista delle lavorazioni e delle forniture previste per la realizzazione dell'opera	07-Mar-01	A.Paoli
VIR-SPE-CAS-9200-121	Realizzazione della fondazione in calcestruzzo armato per l'unità prefabbricata per l'ampliamento dell'edificio di controllo - Progetto esecutivo - Capitolato speciale d'appalto	07-Mar-01	A.Paoli
VIR-SPE-TAC-6300-157	Vacuum Tubes Assembly Contracts - Coordinates of the Reference Points in the Tunnels	28-Mar-01	L.G. Nicolosi
VIR-SPE-LYO-4320-001	Procès-verbal de caractérisation - Miroirs 50 mm, épaisseur 10 mm, incidence 45°.	24-Apr-01	L.Pinard
VIR-SPE-TAC-6300-157	Vacuum Tubes Assembly Contract : Coordinates of the Reference Points in the Tunnels	04-Jun-01	L.G.Nicolosi
VIR-TRE-DIR-1100-133	Evaluation of several scenarios for Data Analysis computing facilities	21-Feb-01	D.Enard
VIR-TRE-OCA-4100-134	Mode cleaner local control servo characteristics	14-Mar-01	H.Heitmann
VIR-TRE-PIS-3400-171	Conductance pipe for the VIRGO IVC	25-Jun-01	V.Dattilo