VIRGO

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Memorandum : A summary of the optics introduction scenario.

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Abstract: This is a summary of all the discussions concerning the handling of the optical payloads and baffles to be introduced in the mirror towers. A detailed scenario is presented, starting at the coater and ending in the tower. Sharing of responsibilities in the tool construction is presented.

The mirror introduction has been tested at LAPP starting from the point where the payload was already prepared in a clean room laboratory. Now it becomes interresting to fix a complete procedure starting at the coater and ending in the tower.

1.From the coater to Cascina

As the mirror cannot be cleaned on the Cascina site, it has to be transported 'clean' from Lyon to Cascina. Other components are cleaned on the site.

During coating operations, the mirror is handled using vacuum depletion in a bell resting over a 40 mm wide ring on the mirror circumference. At Annecy we interrogate the effective cleanness of such a procedure. However, if we dont exclude it in a class 1 environment, it will be more risky in a class 100 laboratory. Anyway, the procedure has to be qualified.

We dont imagine to transport the mirror under vacuum. Any leak would be the source of a pollution. Transportation has thus to be done at atmospheric pressure, in a class 1 environment.

Today we see two solutions to the problem:

Solution 1:

1. to install mirror and vacuum bell in a dedicated transportation box, in which mirror and bell are fixed.
2. to return to Pa in the bell, opening a valve, but letting the bell resting tightly on the mirror circumference. A clean leak is allowed.
3. to protect the transportation box with plastic films and transport it to Cascina.
4. take away the plastic, open the box in the class 100 laboratory, evacuate the bell: the mirror is again ready to be handled with its vacuum bell.

Solution 2:

One forgets the vacuum bell and designs dedicated lids solidly fixed on the mirror. These lids would be used for protection during long distance transportation, handling the mirror from transportation box to assembly system and last but not least to fix the mirror on the payload transfer system.

2. From factory to cleaning station.

The payload components are produced as standard mechanical objects. Before entering the ultra high vacuum (UHV) they have to be cleaned as UHV components and as class 100 clean room components.

The VIRGO UHV cleaning procedure is a standard (?) one. It has to be specified in each tender concerning a vacuum component. The procedure specified in the LAPP papers has been established with LAL. However, given our hydrocarbon partial pressure specifications, the payload components need to be baked at 150 C. Such a baking could be achieved in a dedicated installation or postponed to the tower baking.

The VIRGO Class 100 dust cleaning procedure should follow the UHV cleaning. Lets suppose for the time being that the payload components can be efficiently processed through the locale lavaggio. The components are listed in table I

Component	Size	weight
Marionetta		
Reference mass		
Mirror		
Lower cover		
Suspension wires		
Payload transfer system		
Payload shielding lids		
Payload supporting cage		
glass screens		

However, as the locale lavaggio is only a class 1000 clean room the washing machine installed there may be adequate for the suspension components but not for the payload. We will however start the payload assembly with this installation

3. From the cleaning station to the assembly lab.

At the exit of the equipment SAS, the components have to be handed to the payload mounting facility. Cranes, motors are prohibited. Clean components can only be slowly moved from below with dedicated tools.

1. The marionetta is hanged to a hook fixed at the center of the laminar flow.

2. The payload transfer system is installed below it and brought into contact sitting on a elevator chariot. The marionetta rests now on the transfer system. Mirror and reference mass suspension wires are fixed.

3. The payload transfer system is equiped with a translation mechanisms allowing to load the mirror or the reference mass outside its cage. An elevation mechanism allows then to lift the introduced object at its right level.

4. The protected mirror is put by hand on the translation mechanism.

5. Mirror suspension wires are put in place using the elevator available on the transfer system. The miror is fixed to the transfer system using its protection lid. Its suspension wires are tuned final.

6. The reference mass is moved on the translation mechanism using a « chevre »
The rear protection lid is removed from the mirror (magnet side) and the reference mass is translated in place. Its suspension wires are tuned final.

7. For transport, it rests on the transfer system elevator.

8. The transfer system is closed with its protection lids.
Several nylon veils are added to that protection.

9. Baffles are cleaned and protected for transportation with nylon veils.
Do they need a dedicated transport which would be heavy or can they be added to the payload transport?

The stability of the payload assembly has to be field proven before final installation.

4.From assembly lab. to tower

The payload has to stand all the vibrations due to transportation and handling (there will be no way to perform any fine tuning inside the tower).

A dedicated transfer chariot is used to transfer the payload from the assembly hooke to the « botola ». There, we may use a crane to transfer the payload to the gallery elevator. The gallery elevator is equipped with an x-y-z fine positioning device which allows to tune the introduction of the payload between thebechers. This device sits below an elevating cage on which one fixes the payload.

This x-y-z positioning device and the elevating cage have to be carefully protected with some veil when they are in the gallery. Veils are removed below the tower. New veils are used for each operation.

As the introduction tools enter the tower, their cleanness has to reach the same level as any object to be introduced in the tower.

Dedicated clothes are used for the different operations. One set is reserved to the clean room work, another to move the payloads from assembly laboratory to tower access, a third to enter the tower.

The scenario is now as follows:

1. The galery elevator, equiped with the fine positioning table and the telescopic cage, is used to remove the lower tower access tower.

2. The cover is taken away by an electric engine and stored in the gallery.

3. An operator, specially dressed below the tower, is introduced in the tower.

4. The gallery chariot is rolled and pushed with the electric engine to the gallery entrance.

5. The payload is fixed on the telescopic cage.

6. The telescopic cage is contracted for the transfer to the tower.

7. The gallery chariot is rolled and pushed with the electric engine to the open tower

8. Below the tower, the payload and the elevator are unveiled.

9. Two further operators wait until a class 10 is achieved below the tower and dress accordingly

10. The payload is introduced, rised by the elevating cage and by thegallery chariot. Part of the protection of the payload (around the marionetta) is removed.

11. The fine positioning table is used to guide the payload between the pots,

12. A slow motion elevator rises slowly the elevating cage plateau to the right height, The top of the transfer system is compatible with the becher geometry.

13. Once at the right level, the protecting covers are removed downwards, the mirror fixation lid is removed, the reference mass is freed: the payload is ready to be hanged.
14. The suspension wire, which was pretensioned on the intermediate vacuum chamber, is attached to the payload and the pretensioning is released: the payload should stay positioned at the right height, i.e. inside a very few mms.

15. Some baffles could be handed inside the tower and installed by the operator before leaving.

16. The tower operator lives the tower in the telescopic cage (safety cage).

17. Baffles could be put by an operator staying below the access cover.

18. The access cover is searched with the electrical engine and put in place

Dust particles are permanently monitored during the introduction. Si wafers are used to characterize the tower and its access before and over the operations. A SI sample is attached to the marionetta until the last minute to characterize the payload assembly procedure. After each motion one waits for dust particle settlement.

The entire procedure should be set up with a fake payload on the site .

5.Summary for toolings.

Several tools have to be procured. For drawings, see the FD edition january 97.

The LYON vacuum bell	??????
The mirror protection , handling and fixation lids.	Rome (design
The tool called Chevre to be used in the optical laboratory.	LAPP (purchase
Small elevating charriot for the assembly lab	LAPP (available
The payload transfer system	Rome (construction
The elevating cage with its slow lift	LAPP (march 97
The x-y-z fine positioning table	LAPP (march 97
The electrical engine to move the gallery elevator and the lower cover	LAPP (in purchase
The gallery elevator chariot .	LAPP (in purchase
Some spacers to catch the access cover or the detection bench...	LAPP (march 97

6. Management of the longterm of payload introductions.

All these procedures have been defined after many discussions between interested people. As seen in the preceeding paragraph, the construction or definition of the different items is shared between different laboratories.
Today, the responsibility of the clean room operation is clearly at Pisa. There is some know how on cleanness at LAPP, Rome, Perugia and Lyon.

In principle, best results are obtained when concerned people take care of their proper introduction, i.e.when each payload is introduced by the responsible people. Such a scenario becomes easy to practice as soon as a technician aware of cleanness is available on the site..