



EULER M1 CLEANING

Technical report

This technical report describes the
cleaning of M1 performed on
26.5.2021

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This document reports the M1 cleaning done on 26.5.2021; special thanks go to Gregorio and Gerardo for their kind help and to La Silla logistics for providing the missing items. Many thanks also to Bruno Chazelas and to Luc Weber for their availability even at impossible hours.

This procedure comes from a mixture of two cleaning manuals and some on the spot creativity and it documents the first time this was attempted at the Swiss telescope.

For safety and practical reasons, this procedure should never be attempted by a single person: another one should always be present to assist/help.

1.1 Shopping list

To clean the M1 without dismounting it from the tube, you will need:

- Vacuum cleaner with a round brush
- Grey rubber tubes (located in the box labelled “Boudins d’isolation type SIKA”) on the ground floor of the dome
- Two sponges which have been especially prepared: they are in two transparent plastic bags, located in the box shown in Fig. 1
- “Savon d’orvu” (same box)
- One clean bucket (same box)
- Small plastic pipe (same box, see Fig. 8)
- 2 sprayers (one in the maintenance room, another one from the bodega ESO, left in the maintenance room)
- 5- 7l of distilled water
- 3-4l of demineralized water
- 1-3l of drinking/mineral water (NOT from the tap)
- Water resistant tape (in the “Papeterie” closet near the control room)
- Two-three clean black rubbish sacks (large and small, can be found in the kitchen)
- One blue large plastic sheet (can be found in the box labelled “Baches” in the ground floor of the dome)
- A large wooden stack (15cm width) to put on the raising table on the dome (in the same box shown in Fig. 1)
- One-two white rubber foam sheets to put on top of the wooden stack
- Optical cleaning material, located in the closet with a label “Maintenance”: these will be in a plastic box named “Optical maintenance”
- Air pipe and filter. I used an extension located in the mechanical workshop and brought the pipe up to the dome floor, see Fig. 2.
- White overall, caps, gloves and shoe covers. In the “Maintenance” closet, or in the box of Fig. 1
- Clean paper cloths from the mechanical workshop, see Fig. 4
- A reflectometer (the La Silla staff lent it).



Fig. 1. Box where all the delicate (and not so delicate) items for mirror cleaning are located. Please take care of leaving things clean!!

Here you will find the sponges, the special soap, the pipe and the compressed air pistol, the wooden block and the white foam to lower the telescope on, the mixer for the cleaning solution, the bucket and the small plastic pipe.



Fig. 2. Left hand panel: compressed air intake and filter, located just below the telescope floor; the pipe needs to be connected on the right hand side.

Right hand panel: air compressed pistol and extension to be used for drying the mirror; a larger pipe extension can be found in the mechanical workshop.

1.2 Preparing the telescope and cleaning M1

The telescope was quite dirty: the minimum cleaning consisted of dusting off the top part, the floor below the telescope and the inside of the tube. To do so, the telescope was lowered on the elevating table located in the dome floor and placed on top of the wooden

stack, covered by a protective white foam sheet to avoid scratching the paint on the tube; the angle with the ground was $\sim 5-10$ degrees, see Fig. 3.

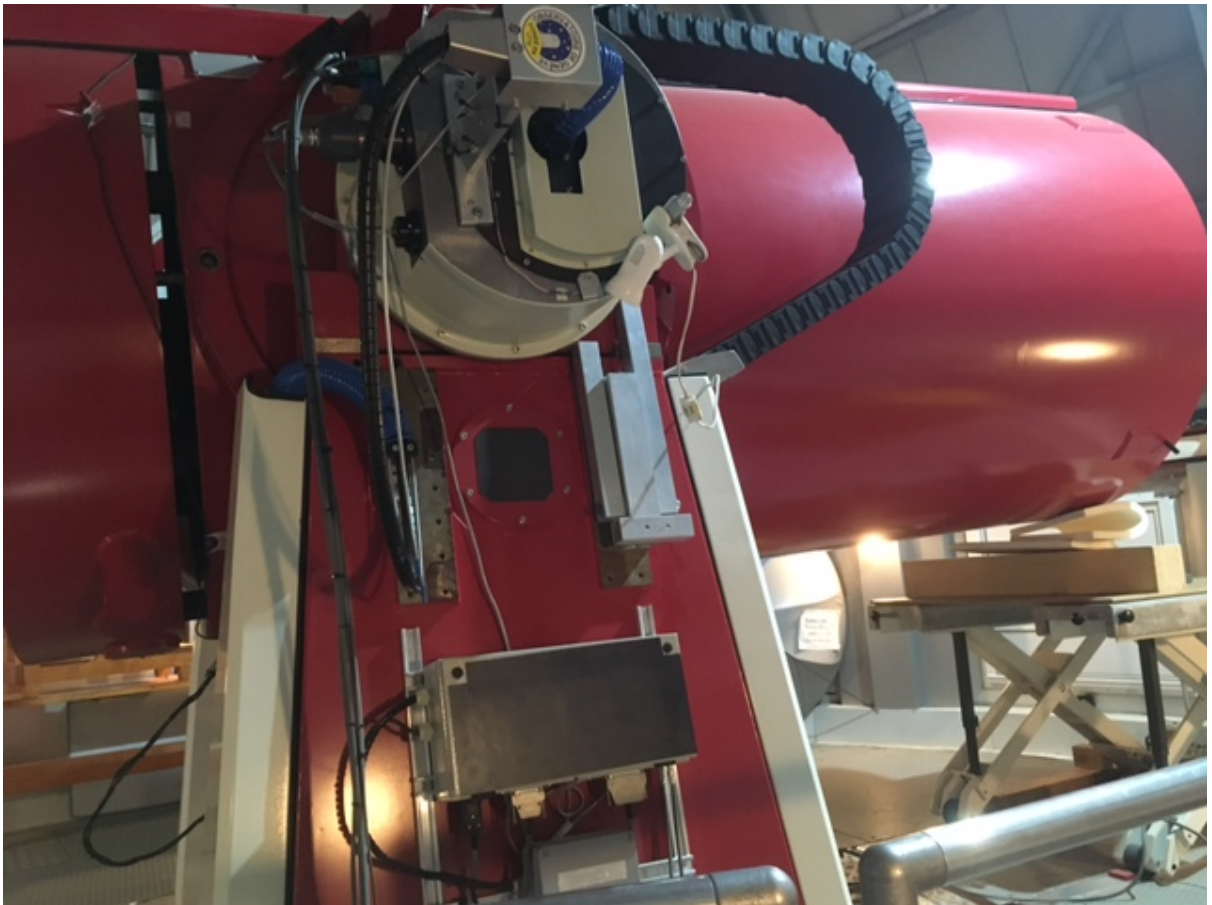


Fig. 3. The telescope is being lowered to the elevating table and the tube will go on top of the white foam visible above the wooden block. The height of the table can be adjusted with the handle located to its left.

Once the telescope is in position the emergency stop was pushed, and the preparation started. The vacuum cleaner was used to clean the external part of the tube and the top of the M2 cell and spiders. **Caution:** the brush is quite worn out, so it is useful only for first pass cleaning. After the first pass with the vacuum cleaner, a box of paper cloths located in the mechanical workshop and a sprayer filled with mineral water was used, see Fig. 4: water was sprayed on the cloth and I start to gently clean the dust off; for large surfaces and on safe location, water was sprayed directly on the parts, then cleaned immediately with the cloth. The tube and the M2 cell and spiders were very dirty, see Fig. 5: a double and in some cases a triple pass with vacuum cleaner and water+cloths was necessary. The floor below the telescope is sticky with oil, so it is was cleaned using the paper cloths and some water; using a vacuum cleaner will only dirty the cleaner without succeeding in cleaning.

Once the external cleaning is done, the floor and PISCO had to be protected from getting wet: a blue plastic sheet was placed below the telescope on the cleaned floor. Then the wires from PISCO were fixed on the upper body of the telescope tube and PISCO and the dangling wires were covered using a clean rubbish sack, see Fig. 6



Fig. 4. Paper cloths and sprayer filled with drinkable water. They are located in the mechanical workshop

After this, the water drip from M1 was directed into a defined place: using a white plastic sheet, and a water resistant tape (alias packaging tape), the lower half of the space between the tube and M1 cell was closed, see Fig. 7. An hole in the plastic sheet at the minimum height was practiced and the pipe shown in Fig. 8 was taped in; it is important to be sure that the outlet of the pipe is level with the plastic sheet, otherwise the water will not get out (check from the inside of the tube). A clean bucket was placed below to collect the water and soap from the pipe.

Following this, the cleaning solution was prepared by mixing ~3-4l of warm demineralized water and about two small shots of "savon d'orvu", which was also warmed up in advance; the mixture was checked for the right "feeling", i.e. it must glide between the fingers, and placed in the garden sprayer of Fig. 9. The container will be operated by someone outside the tube (Gregorio) and the pipe will be passed in the upper space between the M1 cell and the telescope tube.

Now it is time to get in: donning a white protective overall, cap and shoe covers (actually it is much more practical to go in without shoes) and bringing in the paper cloths and the sprinkler shown in Fig. 4 filled with mineral water, one must clean inside the tube while moving in (clean first, THEN move in). It is advisable to do it with ease, the position is not the most comfortable and in the first leg the space is shared with the M2 cell, while in the last leg one must wrap oneself around M3 (and clean the baffle). It is important to be very careful there, as M3 is quite exposed.

Once the inside of the tube is clean, another white plastic sheet, some tape, a couple of the larger grey tubes ("Boudins d'isolation type SIKA") and the blue plastic tape located in the same box as the cleaning sponges were brought in. The white plastic sheet was put on top

of the PISCO hole below M3 baffle (it is impossible to see it from the outside) and sealed with tape. The blue plastic tape was placed around the lower part of M1 and kept in place using the grey tubes: this is a delicate balance because the M1 support were not removed and it took some time to find a good adjustment. Be patient, it is possible.



Fig. 5. From top left to top right and bottom left: M2 spider with bird droppings and dust and a view of the M1 and the inside of the telescope tube before the cleaning

Finally Gregorio was asked to pass through the upper space between M1 and the tube the cleaning hose and the air compressed pistol, see Fig. 10. Handled with care to avoid touching M1.

The reflectometer was brought in and a first measure of the M1 reflectivity was done:

$$R(\%)= 70.87$$

$$R(\text{\AA})= 152.3$$



Fig. 6. Left hand panel: PISCO inside the clean rubbish bag; another bag has been used to insulate the dangling wires.

Right hand panel: fixing PISCO wires to the upper part of the telescope

Following this, a sprinkler filled with distilled water and another one filled with mineral water were brought in and a decision was taken which half of the mirror would be washed first: due to the M3 baffle it is very difficult to reach all M1 in the same position, so the washing needs to be done in two halves, see Fig. 11.

A small part of M1 toward the bottom part was selected for the washing test: it was sprinkled with mineral water first, taking away the dust; following this, the soapy solution was generously sprinkled on the same part, then it was touched uniformly with one sponge and finally generously sprinkled with distilled water until no soap could be seen. A second sponge was used to gently touch the watered surface, followed by drying with compressed air.

The result seemed satisfactory (read: the mirror looked cleaner), so the procedure was repeated twice for the first half of M1. Following this, the second half of the M1 was washed: again twice and finally dried with compressed air.



Fig. 7. Closing the lower half of the space between M1 cell and the tube in an attempt to control the direction of the water flow from M1 washing...and to avoid having water inside M1 cell.

Once all the mirror is dry, the reflectivity measure was repeated:

$R(\%) = 89.65$

$R(\text{Å}) = 48.6$

The measurement shows a definite improvement on M1.

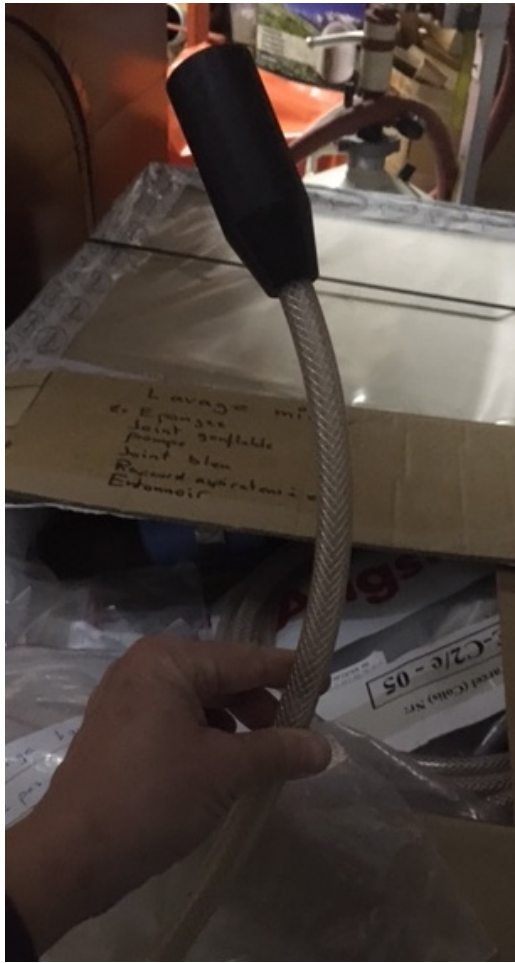


Fig. 8. The small pipe used to collect at the bottom of M1



Fig 9. The container used for the cleaning mixture



Fig. 10. Here is visible the compressed air pipe (blue one) inside the tube and (barely visible) the grey tube used around M1. Below it, there is the pipe and sprinkler for the cleaning solution

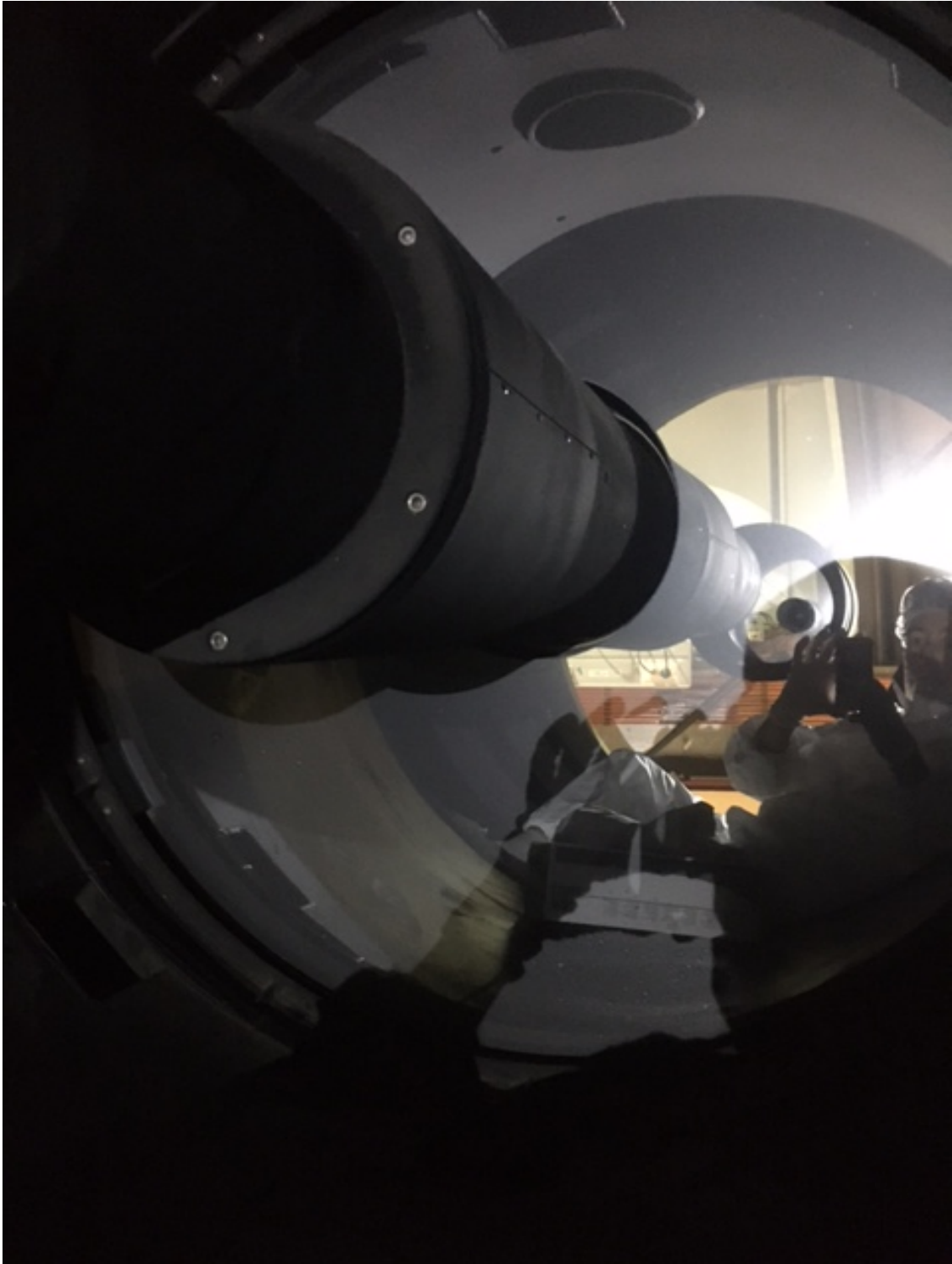


Fig. 11. Inside the tube..

1.3 Final considerations

- M1 looked much better after the cleaning; however several small spots are still visible on it; a bird dropping was clearly visible in the upper right part, luckily close to the edge. It was possible to remove most of it, but the shadow is still visible on the mirror surface.
- It may be worth to resume the regular CO cleaning, to keep the mirror clean.

- During the cleaning it may be worth to consider wearing an head mounted lamp, since space is limited and finding a good position for a self-standing lamp is not trivial.
- Some water, albeit little, managed to find its way below M1 and could be seen dripping down from the bottom of the telescope once this was returned to the park position. This has to be expected, because it is impossible to mount the M1 seal inside the tube and the plastics placed in its place are not hermetic. The flaps in the dome were opened around 4pm, which guaranteed a faster drying; no problems were reported during the night.