

INTRODUCTION

In general, the VR technology is extremely helpful for the design of astronomical instrumentation. The possibility to enter in the environment permits to facilitate several aspects like:

Improve design aspects

- Test the maintenance procedure in advance
- Collect quantitative data and not only qualitative ones
- Simplify a lot the reporting work and facilitate reviews

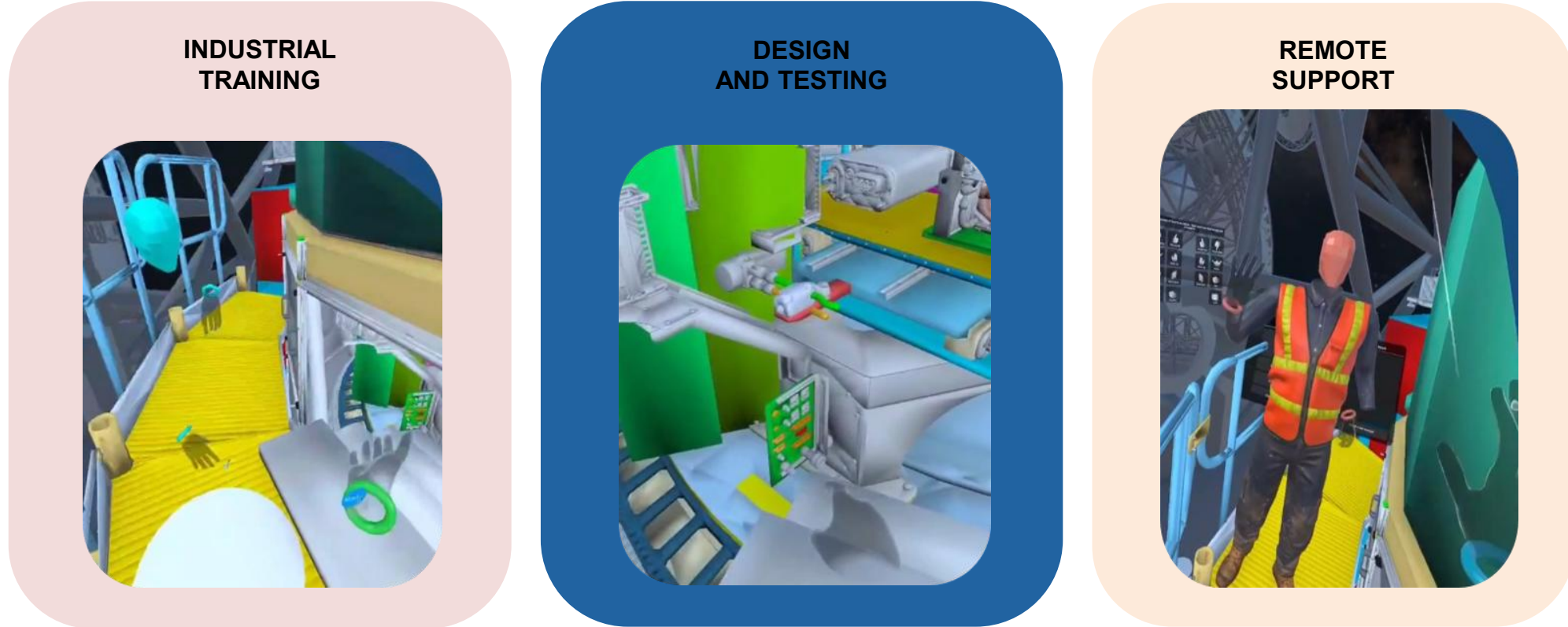


Figure 1, Some of the possibilities that can be explored using the VR technology

Implementation of the procedures

The first procedure that was implemented in the virtual word was the maintenance of FREDA; the camera is on the MORFEO's LOR subsystem enclosed by the MICADO cover and the SCAO bench. The real possibility to access the camera without installing huge structure around MICADO permits to limit the down time of the instrument and be able to fix any problem on the beck of the LOR bench.

The activity was done to evaluate this procedure, but this concept can be easily extended to other critical procedure or design.

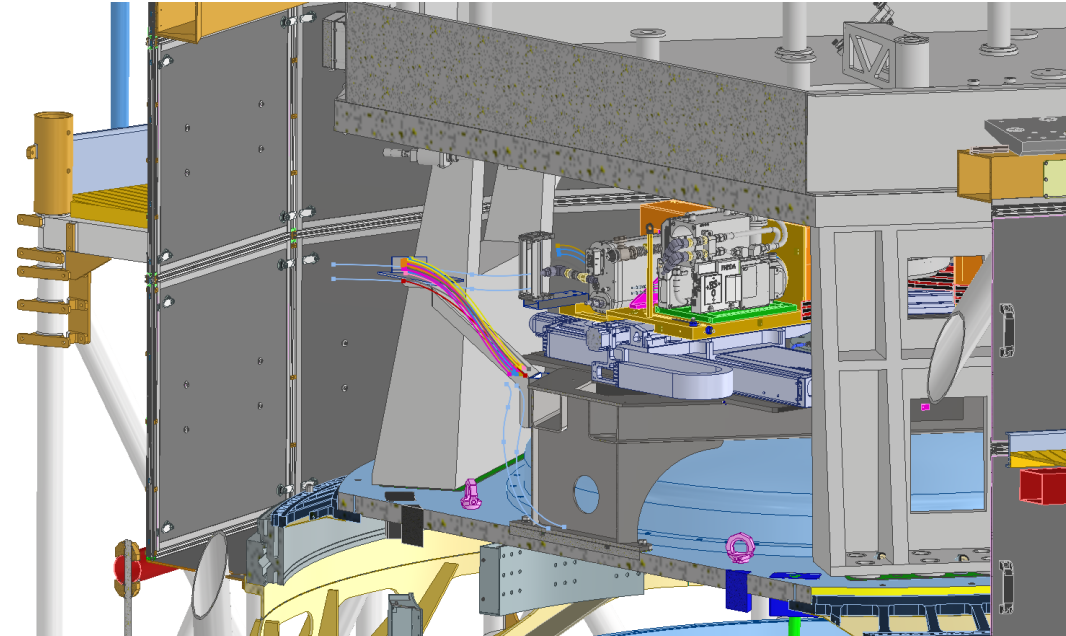


Figure 2, The operator can follow the procedure implemented and have a quantitate and qualitative data

ACKNOWLEDGEMENTS

Many thanks are due to the productive collaboration with the VR group in the Department of Mechanical Engineering of Politecnico di Milano, which contributed greatly to the implementation of the procedures

Full body tracking with cooperative mode

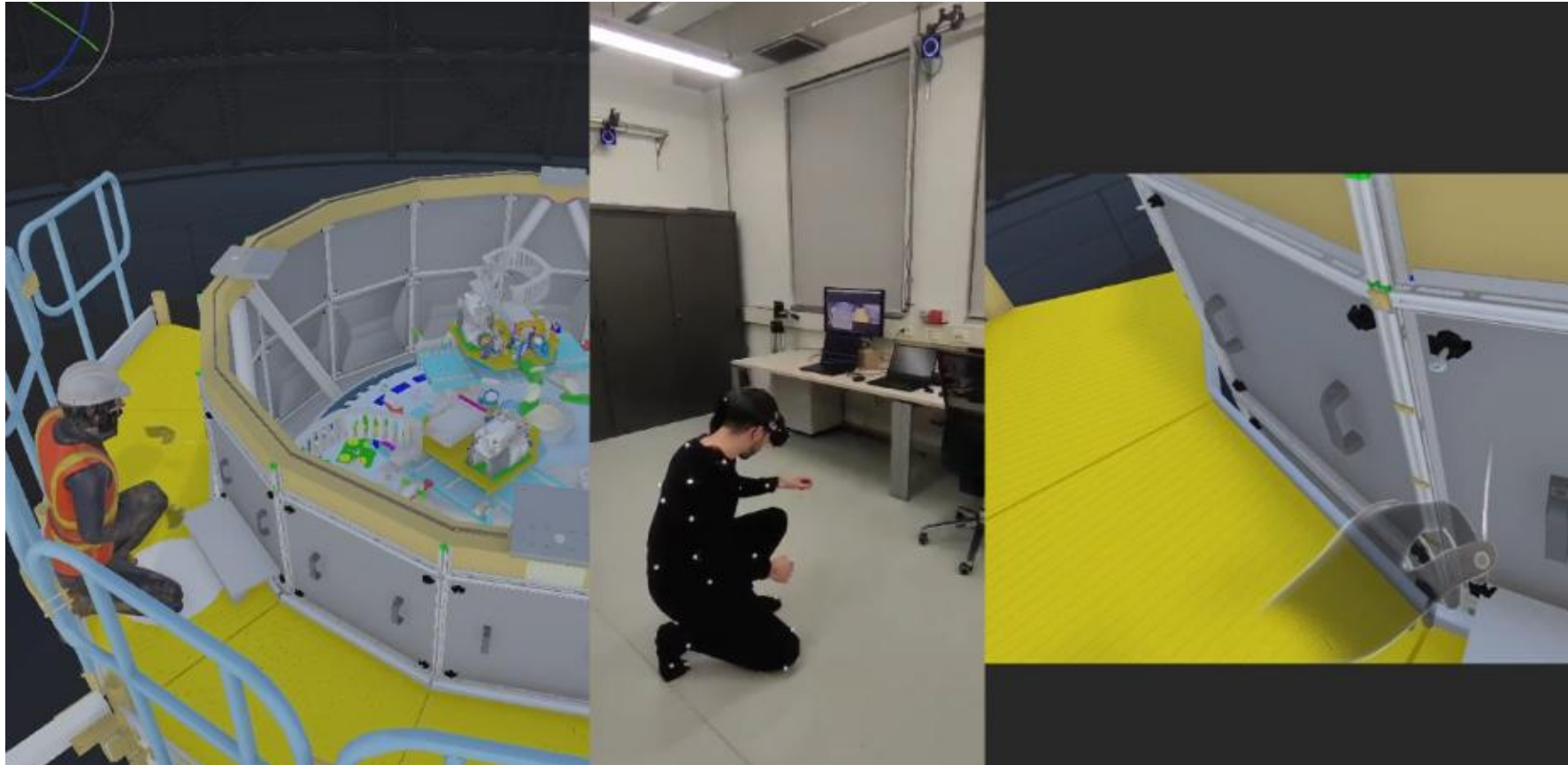


Figure 3, left View of the colleague, centre: real word, Right: view of the main actor

Several features can be implemented in the virtual word, in figure 2 is reported an example, like a full body tracking system in a cooperative mode. The full body tracking system can track not only the ergonomics but also the best procedure to use to be able to implement the needed tasks. The cooperative work can be used to teach or to learn the activity performed by the main actor on the scene.

AI and Reporting

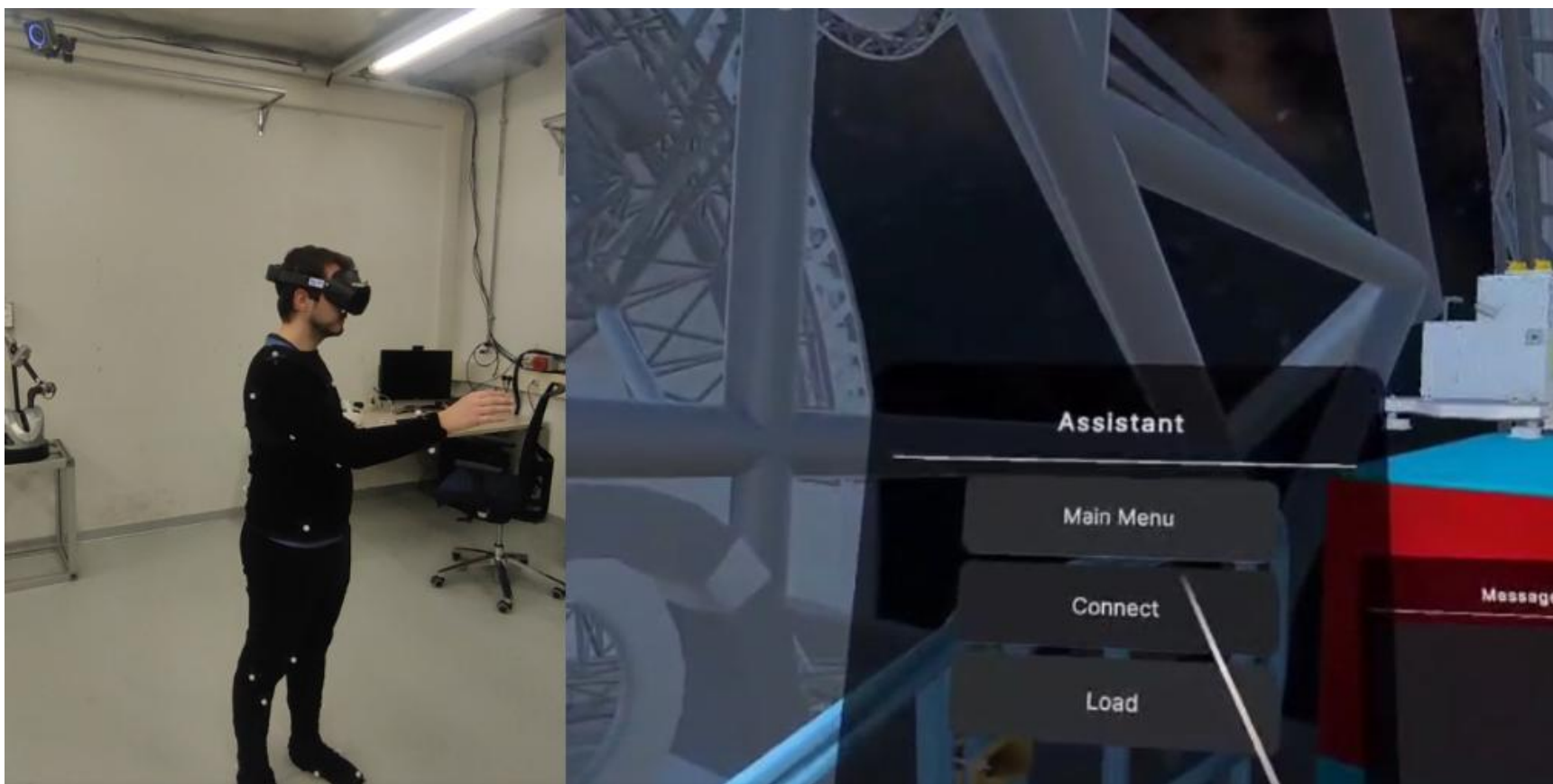
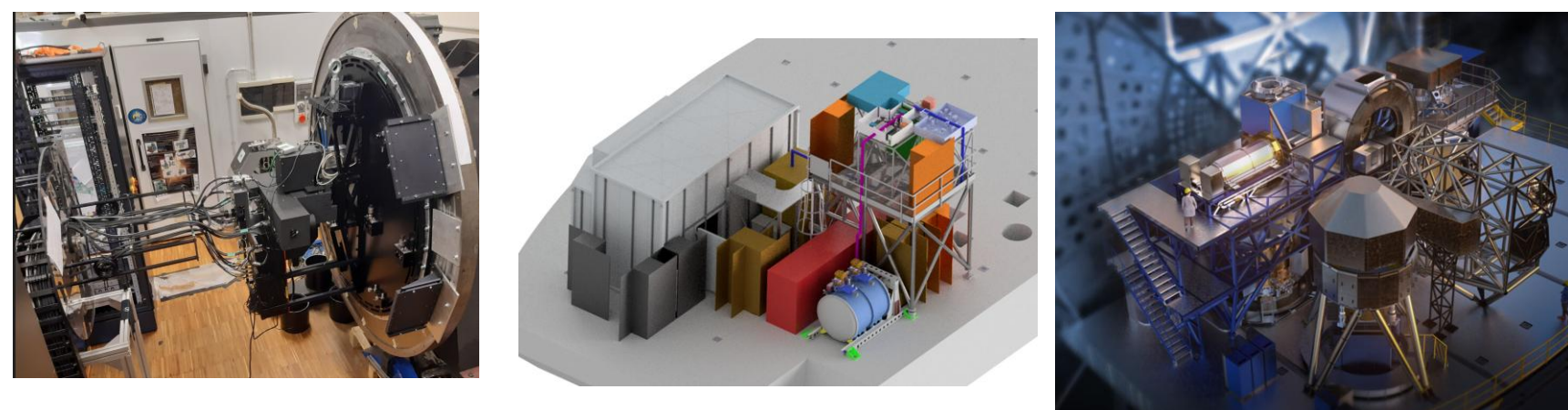


Figure 4, Operator interacts with the assistant

Implementation of a Large Language Model permits during the design and the test of procedure to have thousand of tests those permit to find the best way to access, but also to realize a document full of details effortless.

FUTURE WORK

The number of projects requiring VR is already large, and together with the increasing size of telescopes, the complexity of operations is also growing. VR technology will soon be implemented not only for dissemination purposes but also for technical aspects, as already mentioned. A list of projects that will integrate VR includes:



Review Mode

The VR can be used to review the project, implementing different scenarios to be validated with the operators or reviewers that during the test of the procedure they can acquire:

- Screenshots
- Comments
- Move object
- Call external equipment

Everything is recorded and then post processed by an AI agent that summarize alle the session in a document

Design Review Summary Report: M7 Mirror and Panel Maintenance Procedure

Milano, January 23rd, 2026 h 15:52

Participants:

Type of review:
Maintenance Procedure
Review

Academic year
2025 - 2026

4 Critical Action Items

Issue

Improper sequence for adjusting the mirror handling tool's center of gravity (COG) relative to detachment from the crane, posing a risk of mirror slippage.

Required Action

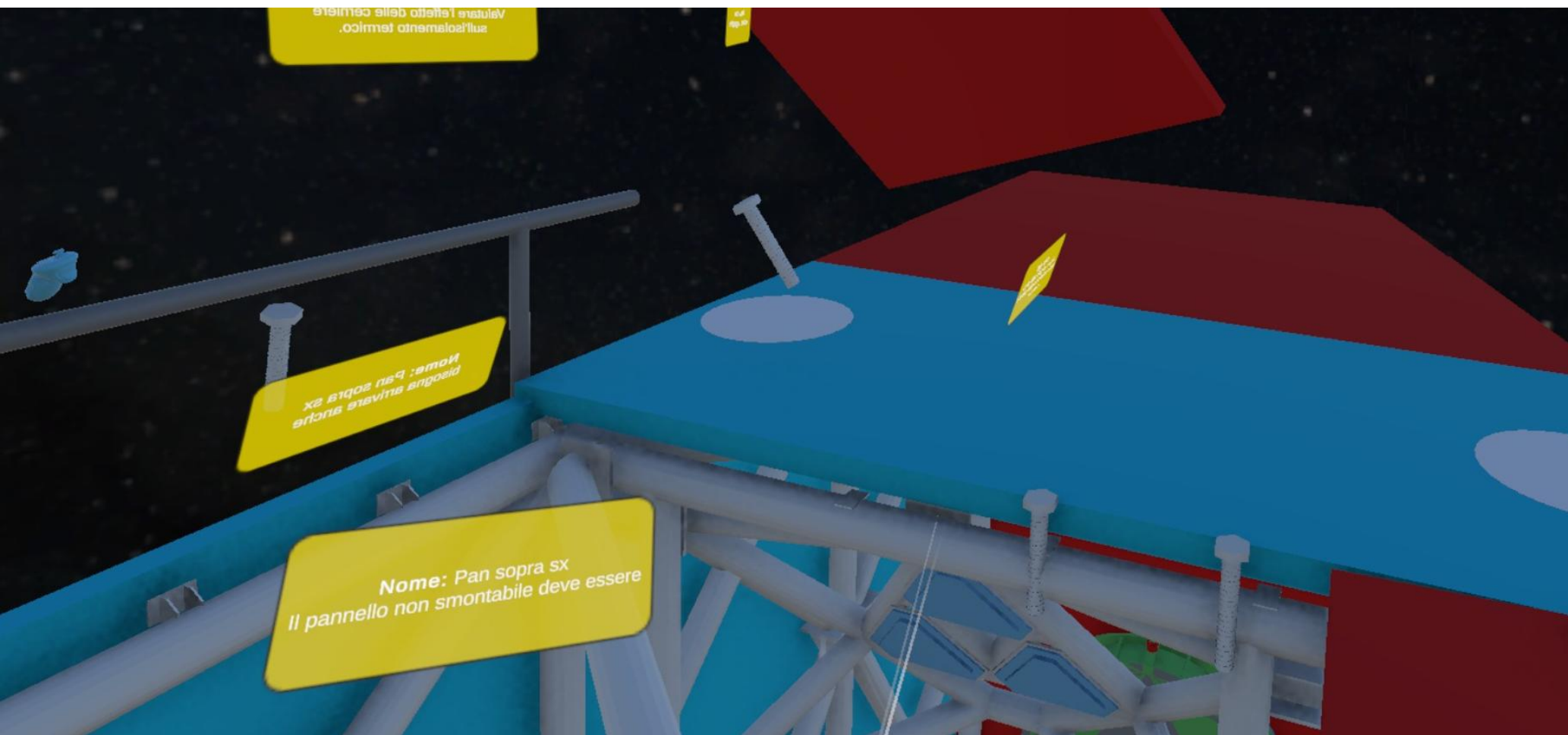
Establish and enforce a strict procedural step to adjust the handling tool's COG before unhooking the mirror from the crane, as explicitly noted (Note: Lens, 15:59:22, INAF) (Note: Lens, 15:59:29, INAF).

Lack of clear visual indicators for correct panel orientation during reassembly, particularly for square panels, which could lead to incorrect mounting.

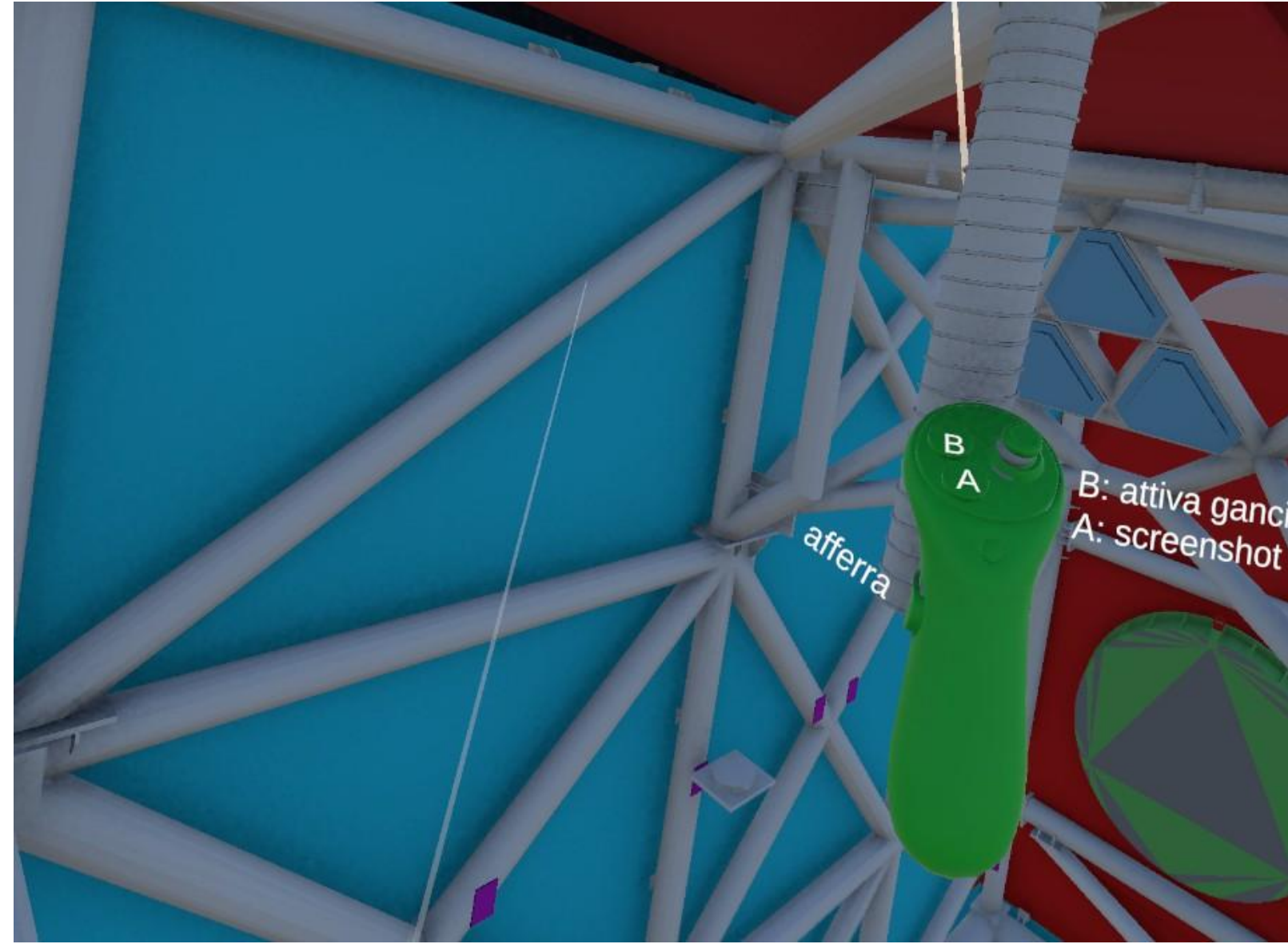
Implement clear and evident markings on panels to guide their correct orientation during mounting, as noted (Note: Pann sotto corto, 16:06:18, INAF).

Table 1: Critical Action Items

Examples of figures and text extracted during the internal VR review



Review Mode



5 Configuration Status

5.1 Key Design Changes

The review identified a need for fundamental changes in panel design, including making certain panels load-bearing, re-evaluating panel dimensions ('Pan sopra dx' smaller, 'Pan sopra sx' larger), incorporating hinges for 'Pan sopra sx', and ensuring fasteners are fully accessible. The procedure for beam removal was defined, involving two operators and a crane. Additional safety features like railings were also specified.

The Ai tool extract conversations, comments, notes, and extract useful information for the report

Table 13: Note 2026-01-23-15-41-53

Note	2026-01-23-15-42-34
Object Name	Pan sopra sx
Username	INAF1
Position	(-0.55, 7.30, 12.82)
Content	Il pannello non smontabile deve essere

Table 14: Note 2026-01-23-15-42-34

Note	2026-01-23-15-43-24
Object Name	NoteSpawn(Clone)
Username	INAF3
Position	(-0.23, 7.86, 13.23)
Content	Valutare l'effetto delle cerniere sull'isolamento termico.

Table 15: Note 2026-01-23-15-43-24

Note	2026-01-23-15-45-27
Object Name	Pan sopra dx
Username	INAF1
Position	(-0.35, 7.33, 11.44)
Content	questo pannello deve essere piA' piccolo

Table 16: Note 2026-01-23-15-45-27

Note	2026-01-23-15-45-32
Object Name	Pan sopra sx
Username	INAF1
Position	(1.22, 8.47, 12.06)
Content	questo pannello deve essere piA' grande

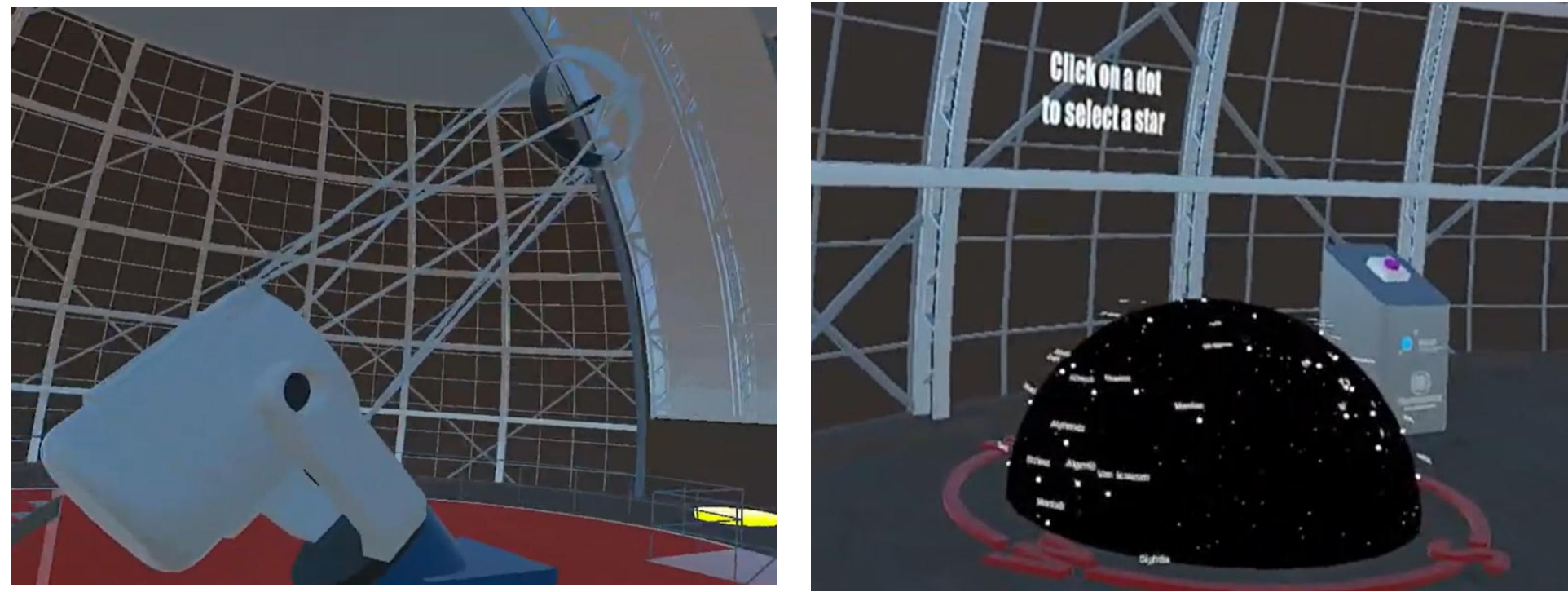
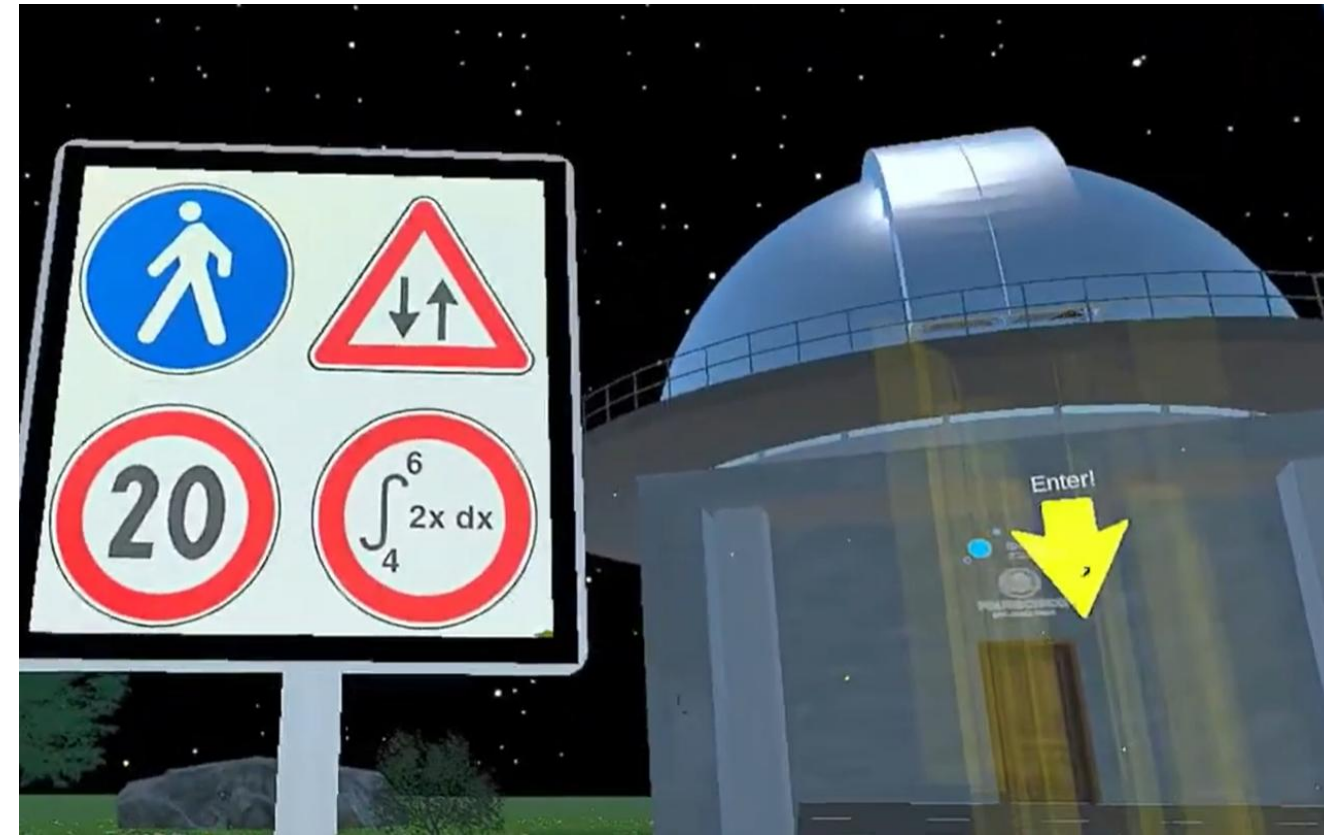
Table 17: Note 2026-01-23-15-45-32

Note	2026-01-23-15-47-01
Object Name	Figlio trav
Username	INAF1
Position	(-0.42, 7.20, 12.62)
Content	sta venendo via.

Table 18: Note 2026-01-23-15-47-01

Astronomical experience

Among the activities realized with the VR technology there is the possibility to use the device to navigate and use telescopes and instrumentations. The examples reported there are the Ruths telescope in Merate and the Boscovich telescope in Brera



Link to see the full video :<https://www.youtube.com/watch?v=UfpbYamTp08&t=3s>



Figure 5, Left: external photo of the observatory model Right: internal design of the Boscovich model



Figure 6, Left: external photo of the observatory model in VR Right: internal design in VR of the Boscovich model