



FRASCATI WORKSHOP FACILITY

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Outline:

1. **Area of the IR mockup within the LNF**
2. **Overall dimensions of the SIM workshop and IR mockup hall**
3. **Layout of the IR mockup hall (SIM metrology laboratory)**
4. **Measuring instruments**
5. **Machining equipment - Tools for handling and lifting**
6. **Systems**
7. **What is missing - Future upgrades**

The area for R&D of the IR mockup: it's identified within the mechanical engineering service (SIM) workshop, located in building 5/a (fig. 1).

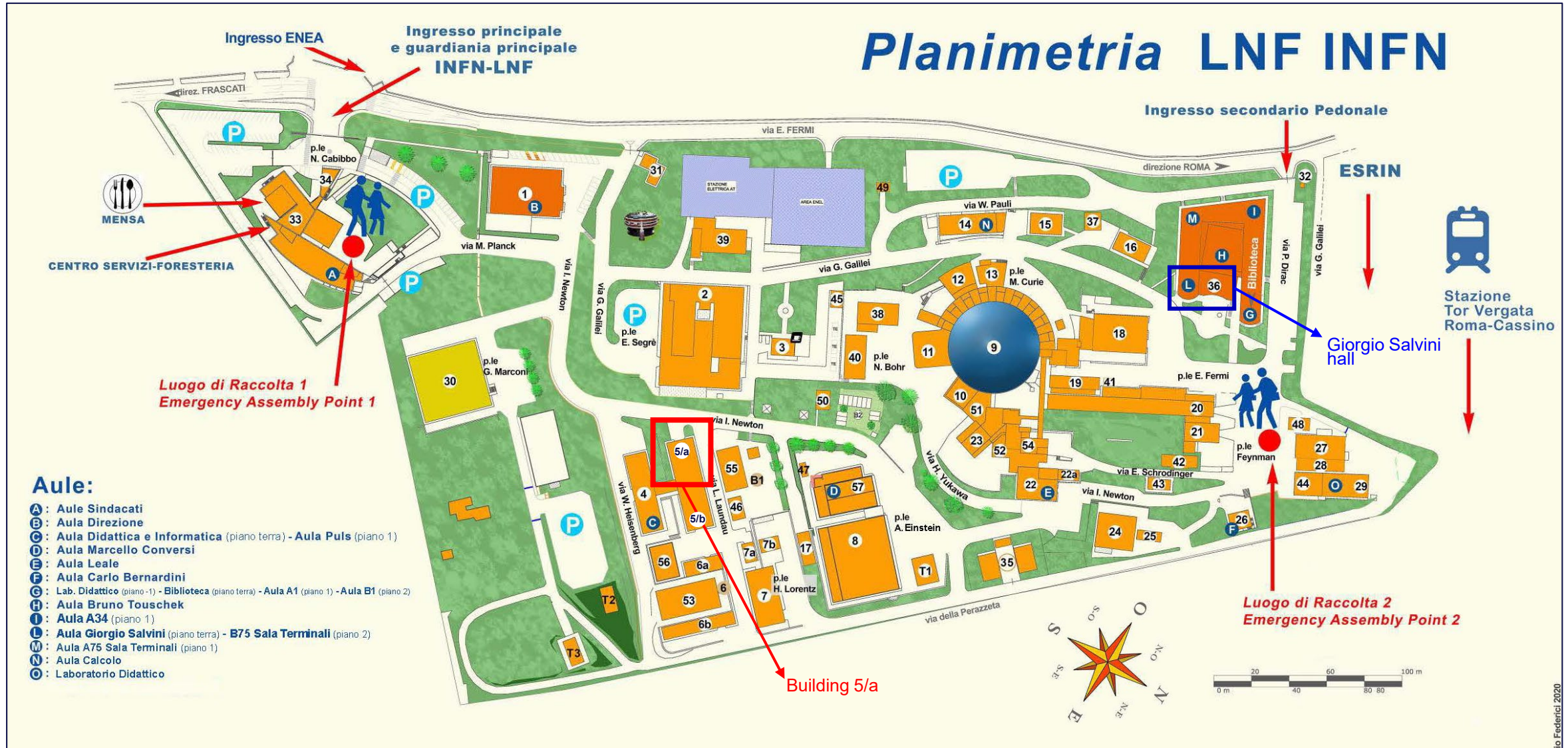


Fig.1) LNF floor plan and location of building 5/a

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Overall dimensions of the SIM workshop: it's approximately 24 meters long and 14 meters wide (fig. 2). The main entrance is a door 4 meters wide and 4 meters high, suitable for truck entry. Inside there is a room with SIM (alignment group) uses as a metrology laboratory, and for precision mechanical assemblies as well. Its dimensions are approximately 8.5 meters long and 5 meters wide (fig. 3). In this area will take place the R&D activities of the IR mockup.

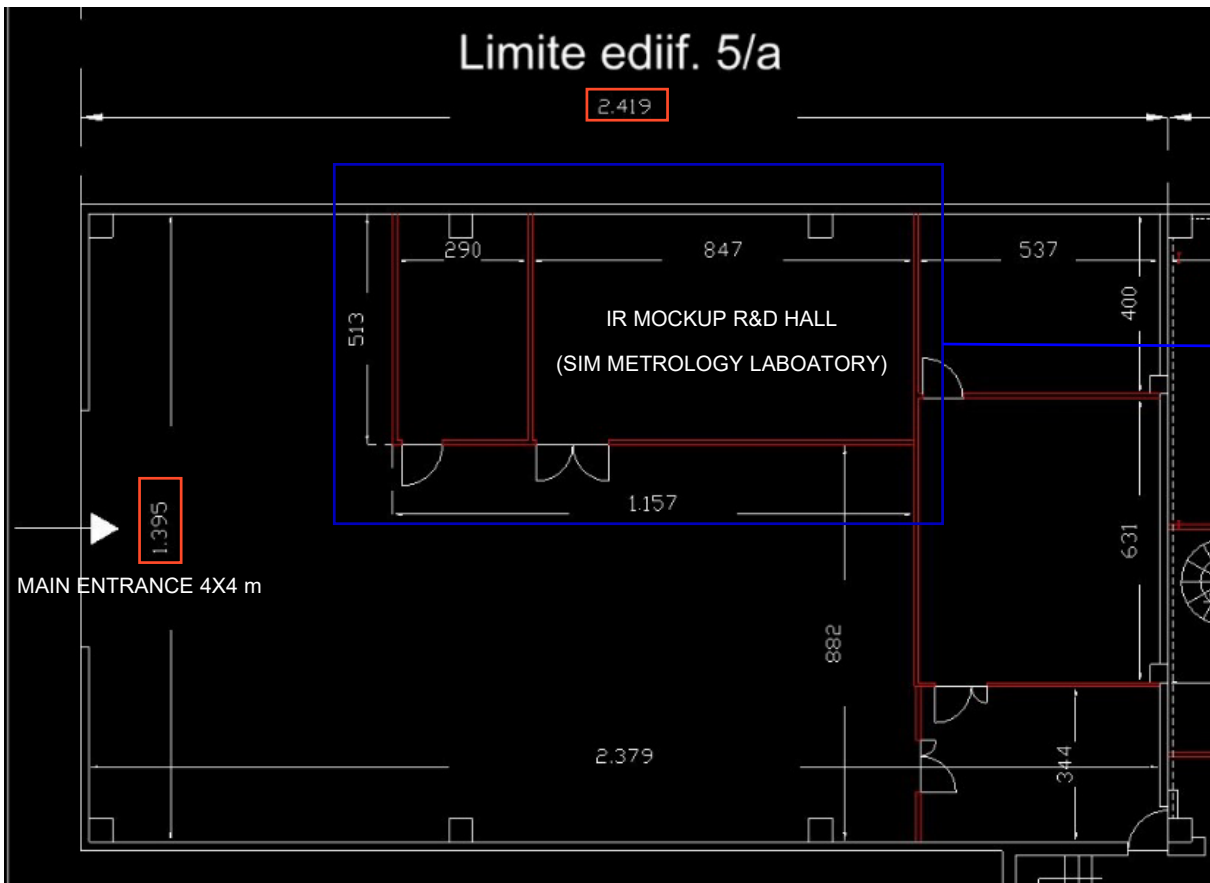


Fig.2) Building 5/a overall dimensions (cm)

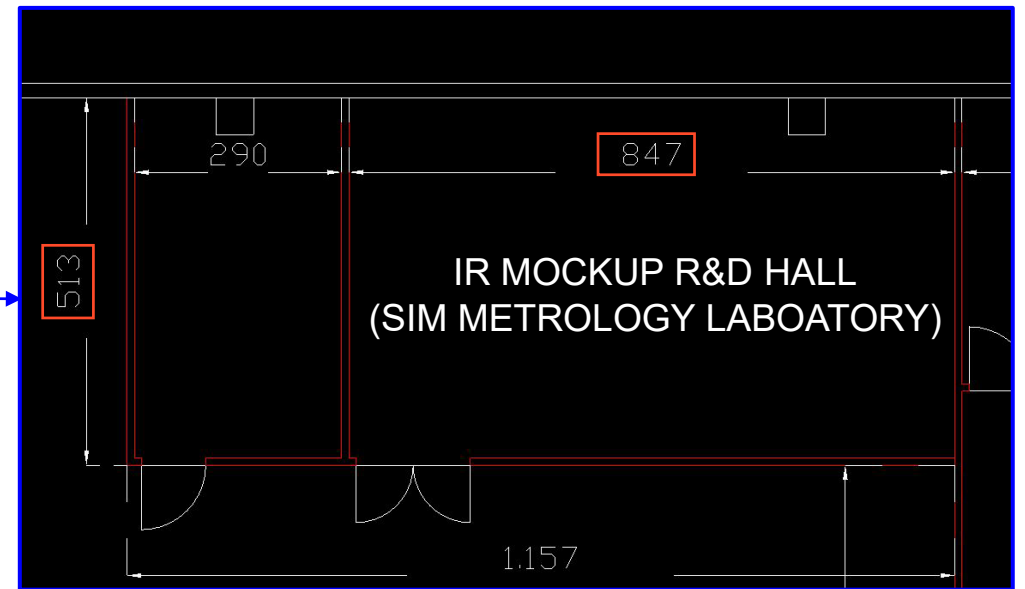


Fig.3) IR mockup hall overall dimensions (cm)

On the right side of the building, there are all the machines for mechanical processing (fig. 5), on the left side the office and the room for the mockup (fig. 6).



Fig.4) Building 5/a, main entrance



Fig.5) Building 5/a, right side, machines for machining

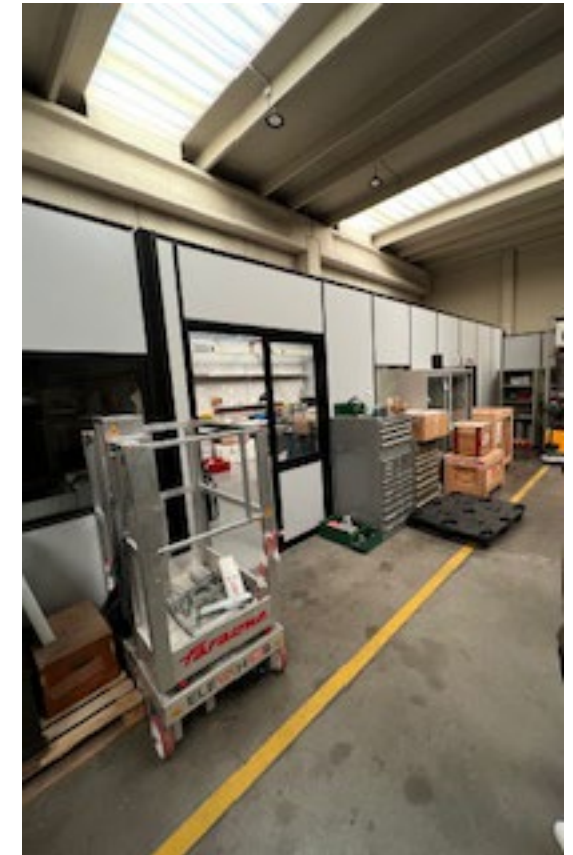


Fig.6) Building 5/a, left side, office and IR mockup hall

IR mockup room: at this moment there are a granite table, where the mockup will be set, and all the equipment for precision mechanical assembly and for mechanical measurements (fig. 7 and 8). In the workshop there is an additional optical table of the same dimensions.



Fig.7) Metrology laboratory - IR mockup hall



Fig.8) Metrology laboratory - IR mockup hall

Layout of the IR mockup hall (SIM metrology laboratory): main dimensions are 8,4 m of length and 5 m in width. The granite table is 3 m long and 1,5 m wide, height is 85 cm from the floor. There is a clearance for service, within the table and the walls, in a range of 2,2 m up to 2,5 m (fig. 9).

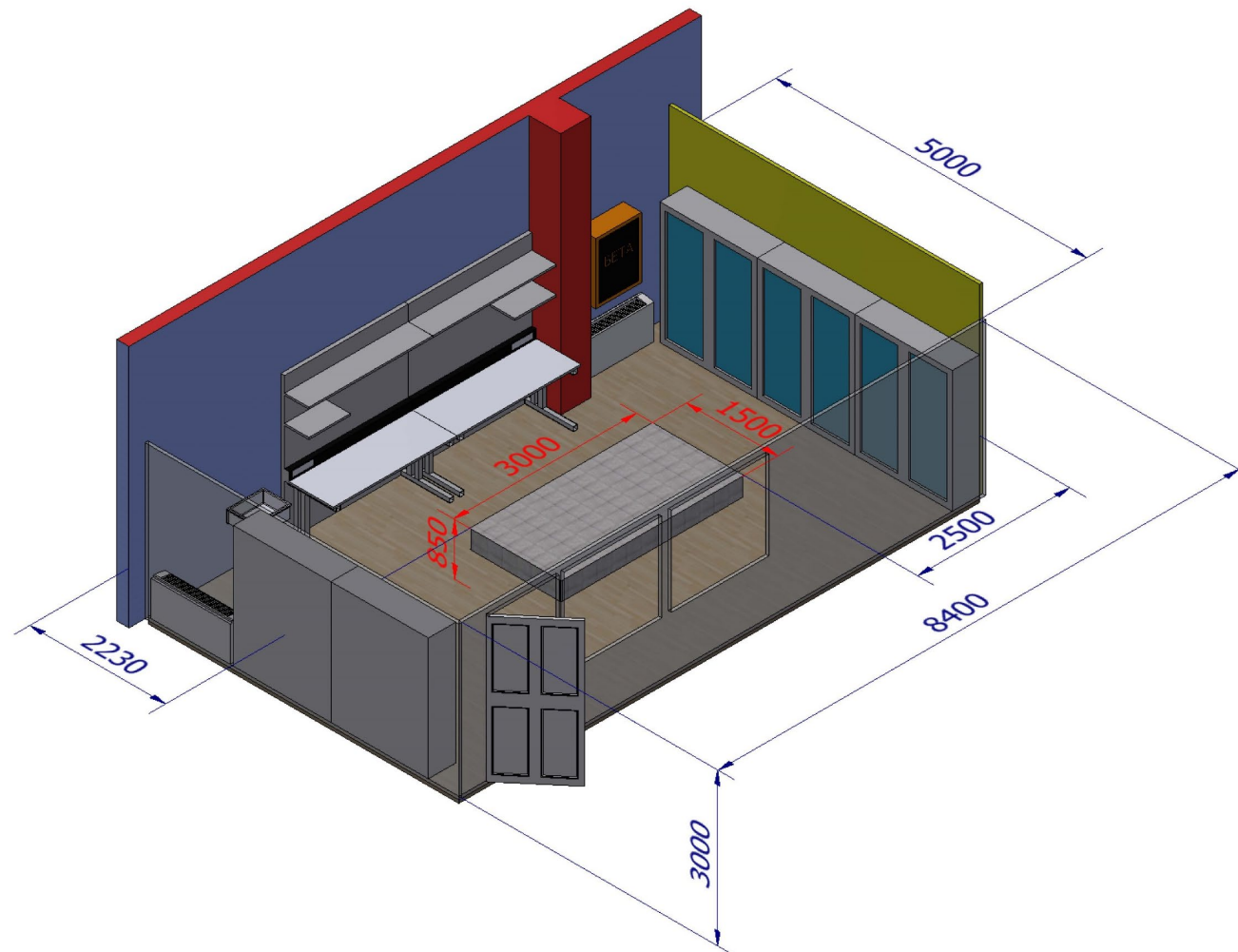


Fig.9) IR mockup hall layout

In fig. 10 and 11 a screenshot from the 3D model of the set up of the IR mockup in the room is shown . You can find and manage the 3D model directly from your browser at following link: <https://autode.sk/3MF8zhK> (Autodesk Viewer).

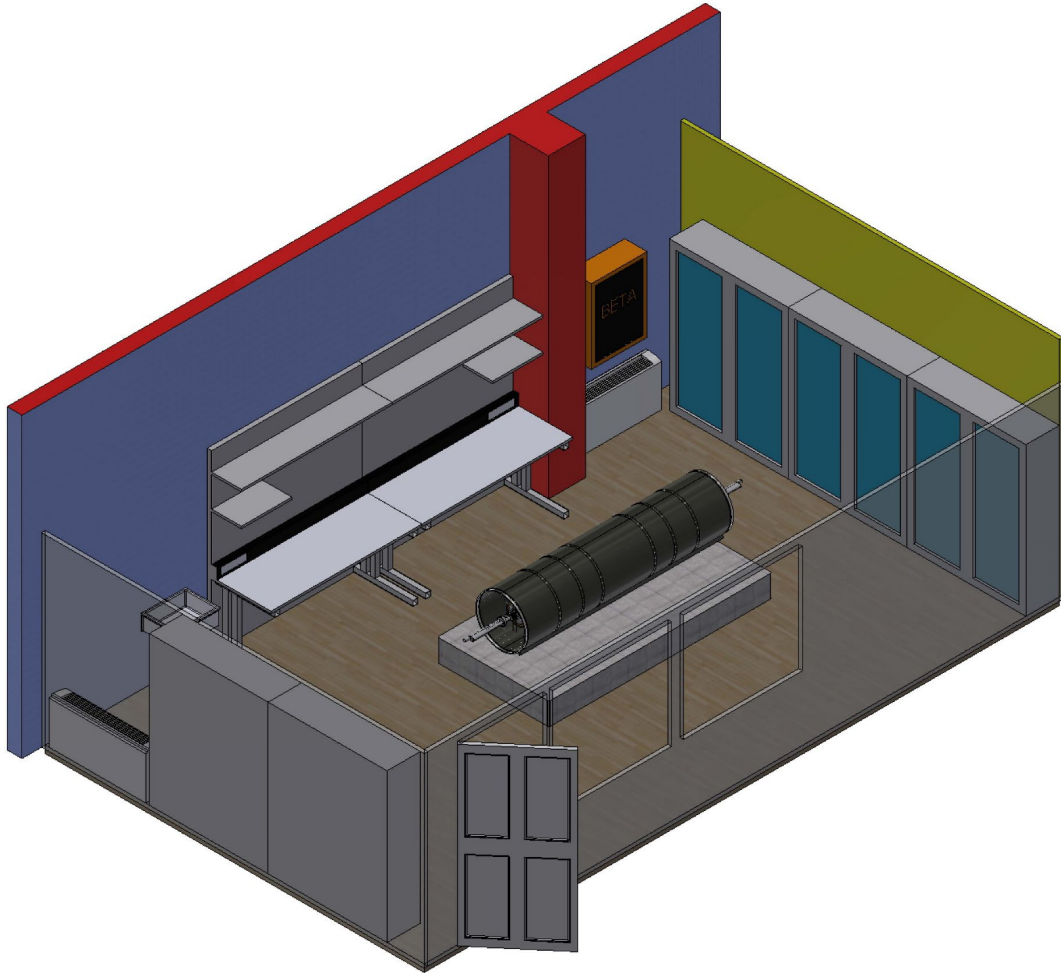


Fig.10) IR mockup set up, orthogonal view

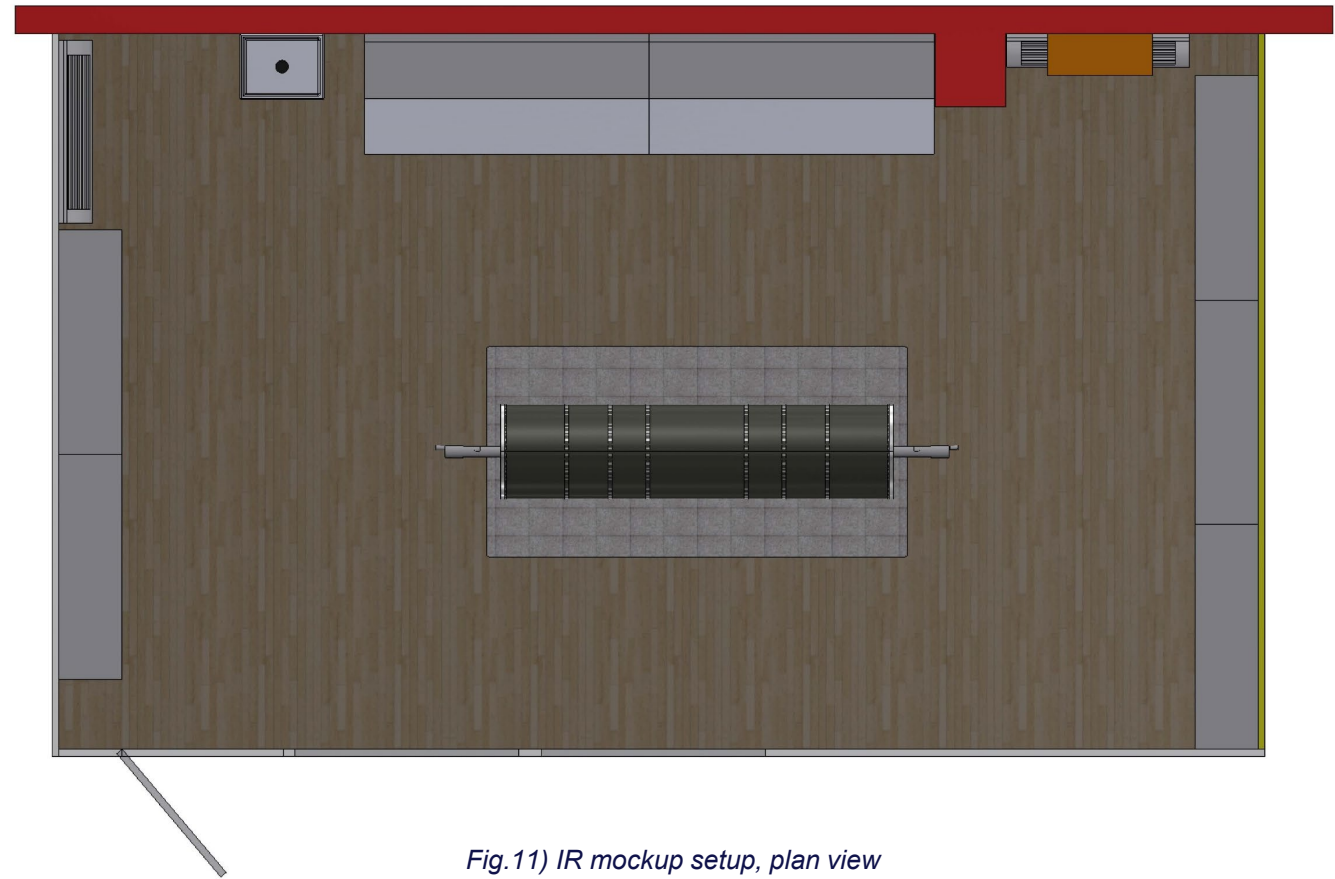


Fig.11) IR mockup setup, plan view

Measuring instruments: the metrology laboratory is equipped with a series of measuring instruments, such as the laser tracker and a portable CMM (portable measuring arms) that can also be used for laser scanning (scan arm - measurements and reverse engineering). In fig. 12 e fig. 13 both instruments are reported, with a part of their technical data.

Leica Absolute Tracker AT960

The Leica Absolute Tracker integrates interferometer and absolute distance meter in a single instrument for distance measurement and two very high precision angular encoders that measure elevation angle and azimuth.



Tracking

Transversal tracking speed > 4 m/s

Radial tracking speed > 6 m/s

Acceleration > 2 g

360° horizontal measurement sectors

Vertical measurement sectors +/- 145°

Measuring volume 80 m.

Precision

Angular resolution 0.14 arcsec

Coordinated repeatability $\pm 7.5 \mu\text{m} + 3 \mu\text{m/m}$

Accuracy relative to full range $\pm 15 \mu\text{m} + 6 \mu\text{m/m}$

Volume accuracy of $2.5 \times 5 \times 10 \text{ m} \pm 10 \mu\text{m} + 5 \mu\text{m/m}$

Absolute Interferometer (AIFM)

Interferometer distance resolution 0.32 μm

Interferometer distance accuracy $\pm 0.5 \mu\text{m/m}$

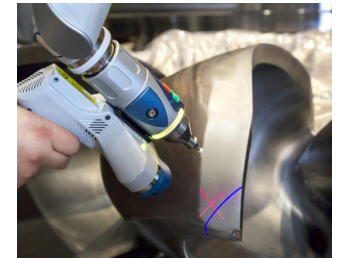
Dynamic locking precision $\pm 10 \mu\text{m}$

Wavelength 633 nm / 795 nm (visible / IR)

Typical operating range of docking 1 – 80 m

Fig.12) leica absolute laser tracker

8-Axis Edge Arm e ScanArm



Scan probe specifications

Accuracy: $\pm 25 \mu\text{m}$

Repeatability: $25 \mu\text{m}, 2\sigma$

Stand Off: 115mm

Depth of field: 115mm

Effective scanning width: Minimum distance 80 mm

Maximum distance 150 mm

Points per line: 2,000 points/line

Minimum dot spacing: 40 μm

Scanning speed: 280 frames/second, 280 fps x 2,000 dots/line

= 560,000 points/second

Fig.13) CAM 2 Edge Scan Arm

Machining equipment – Tools for handling and lifting: workshop of the SIM is equipped with a series of machines for machining, such as one milling cutter (fig. 14), two lathes (fig.15), two electric saws (fig.16), two column drill (fig. 17). For handling and lifting, we are equipped with an electric pallet truck and a portable crane.



Fig.14) Milling cutter



Fig.15) Lathes



Fig.16) Electric saw



Fig.17) Column drill

Systems: building 5/a is equipped with a generalized heating/cooling system (fig. 18). There is a system for running water and a dry compressed air system (compressor that cools the outgoing air to -70 degrees Celsius).



Fig. 18) heating/cooling system

What is missing - future upgrade: in building 5/a the overhead crane is missing. This lack can be overcome by using the portable crane or, for heavier objects, by having a truck with a hydraulic arm access the building. Furthermore, the mockup room lacks the ceiling and a dedicated air conditioning system. Both will be installed in the near future.



THANK YOU FOR
YOUR ATTENTION

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