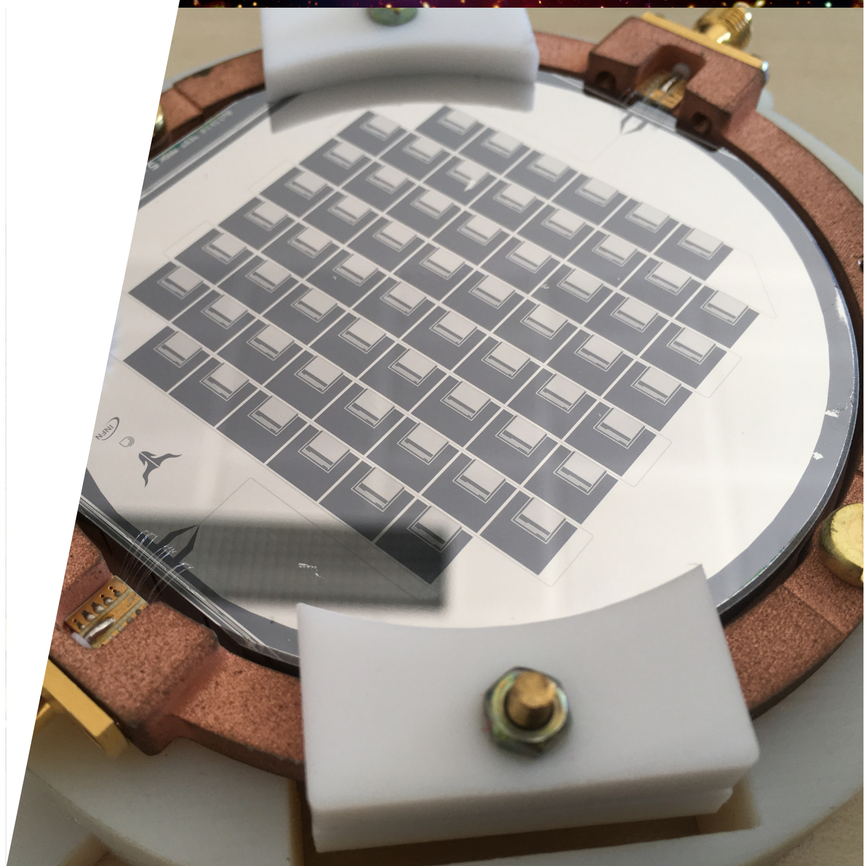
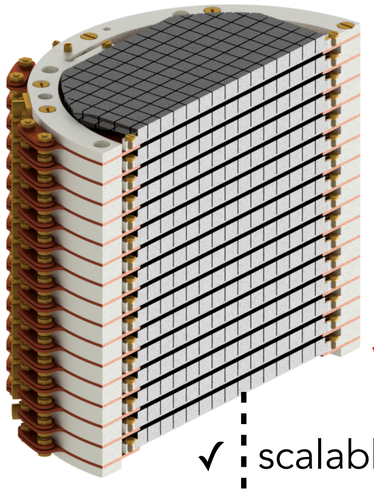
INFN
LNGS
Istituto Nazionale di Fisica Nucleare
Laboratori Nazionali del Gran Sasso

LNGS updates



Antonio D'Addabbo (LNGS-INFN)
Collaboration Meeting, Ferrara, 01 July 2025

Overview (@last general meeting)

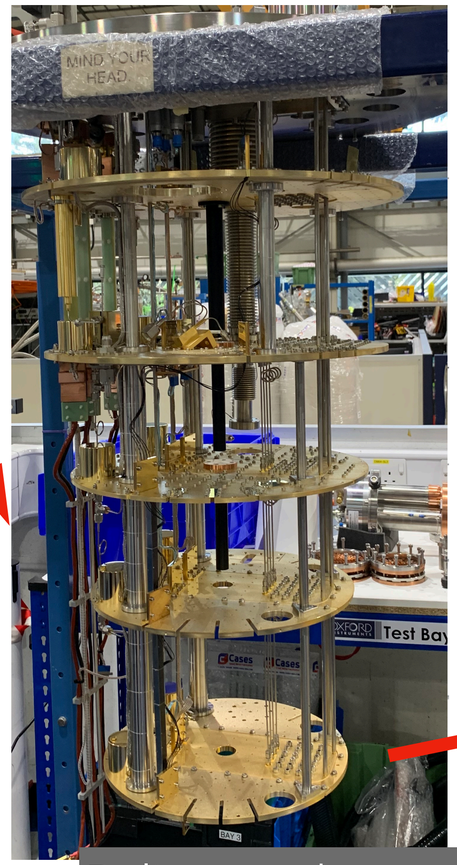


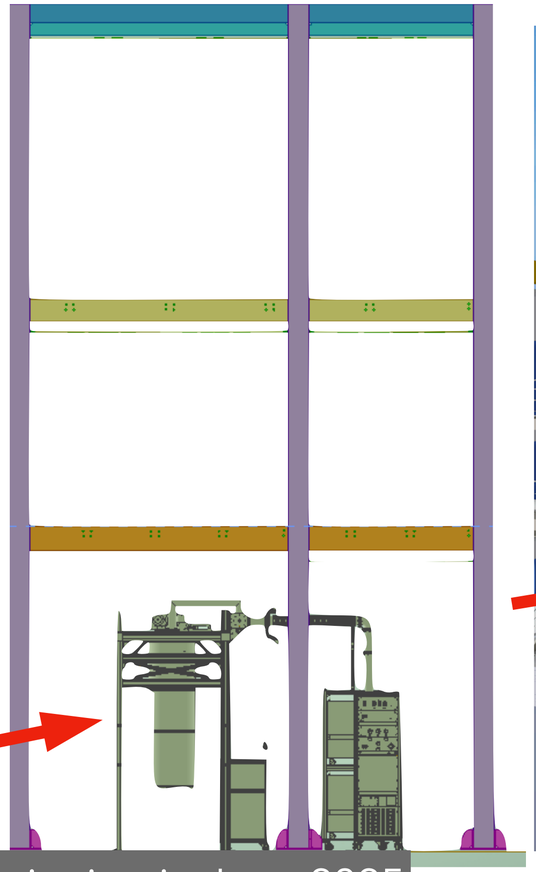
✓ scalable

Detector

- ✓ 800 g of silicon target
- ✓ 2300 detector units (dice)
- ✓ No inert material in detector vol
- ✓ fully active
- ✓ fiducialization (600 g)

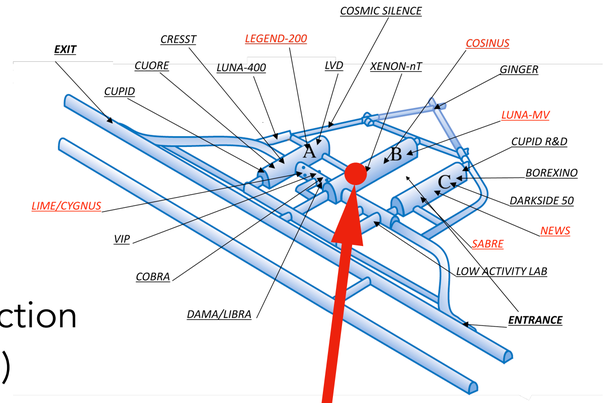
ProteoxMX dilution cryostat
by Oxford Instruments





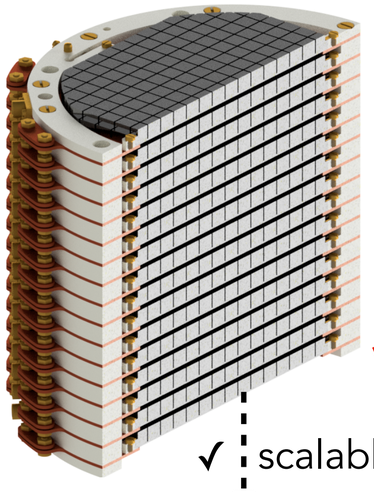
Delivery and commissioning in June 2025

Cryo-Platform facility under construction
in the LNGS underground (Hall-B)



Ready by fall 2025

Overview (updated)



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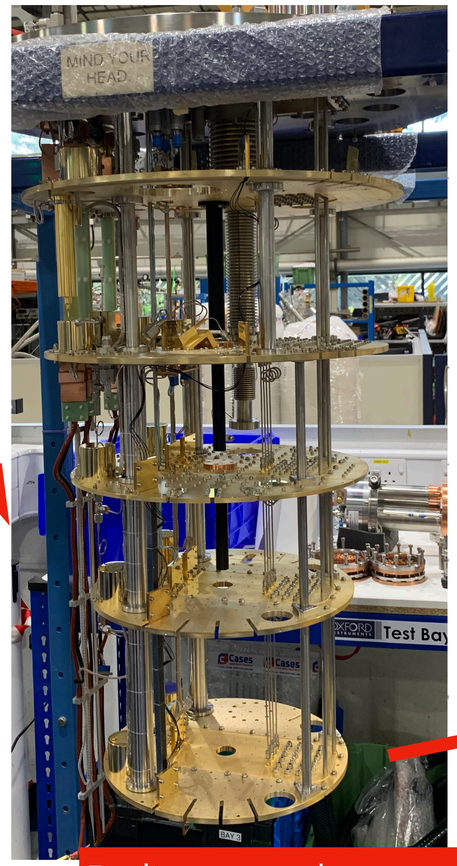

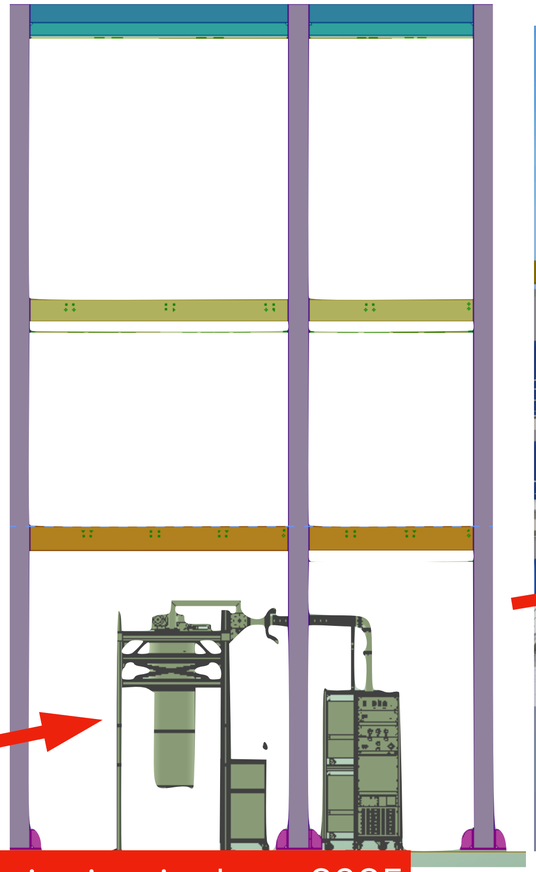

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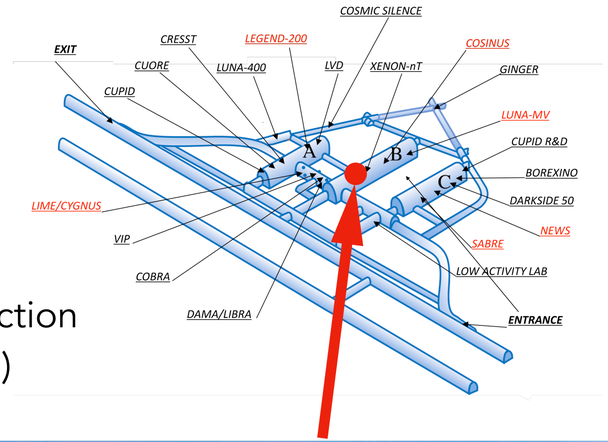
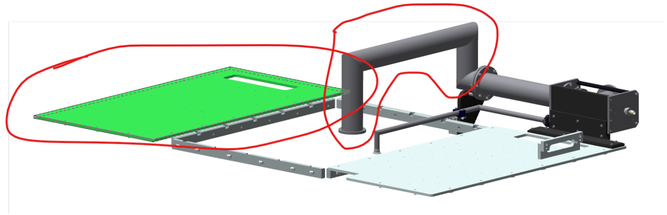


~~Ready by fall 2025~~

Still pipe issue and new plan

Initial installation/commissioning
at LNGS planned 16-27 June

Oxford Instruments delayed the
LNGS commissioning on short notice



Shortage of key elements at Oxford Instruments (Still pipe)

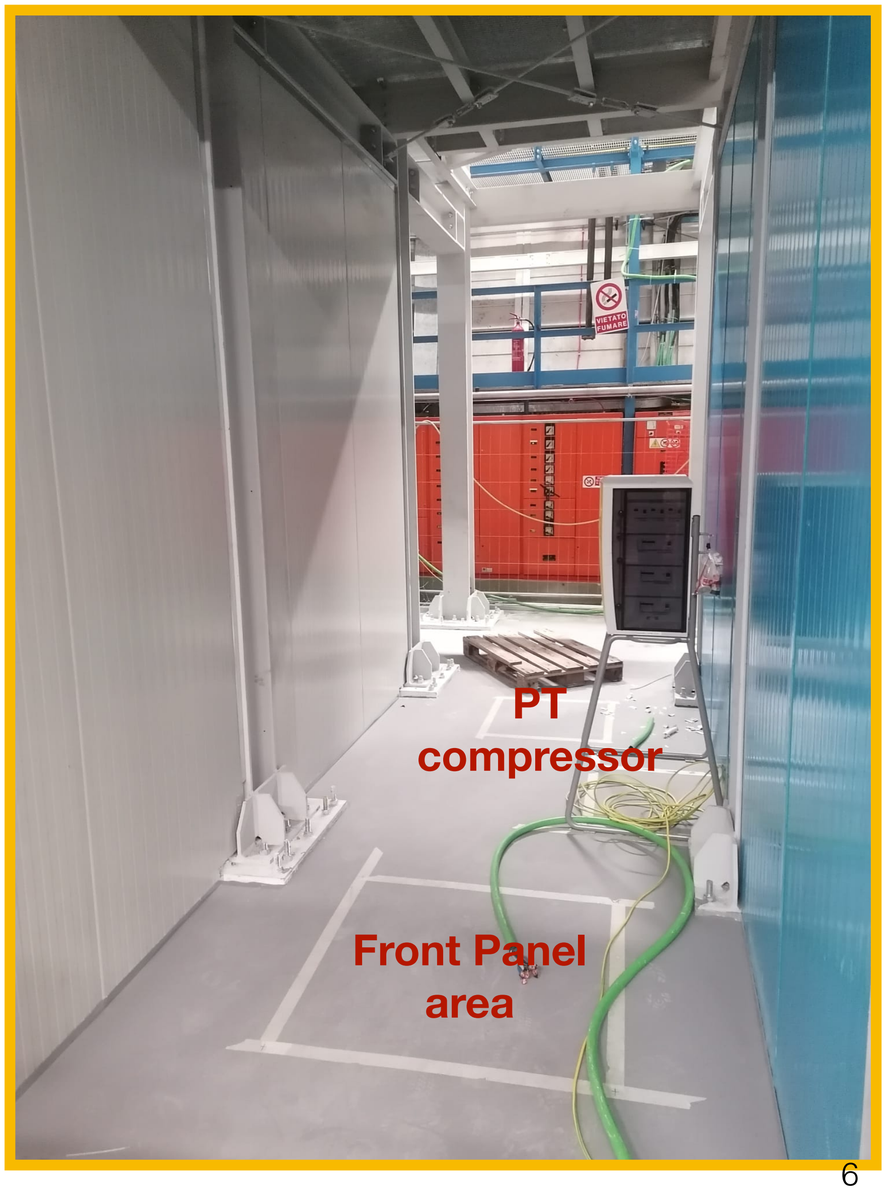
Managed to fix and
reschedule the LNGS
commissioning promptly

Cryostat delivered to LNGS on July 7th

Installation 7-11 July, then commissioning 14-18 July

Cryo-platform readiness

Cryo-platform readiness



Cryo-platform readiness

Additional purchases

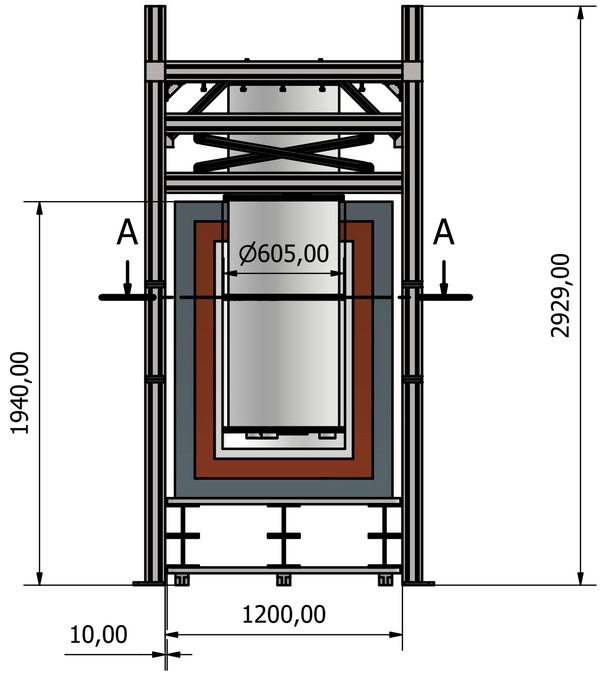
More than 300 k€ of add-ons purchased

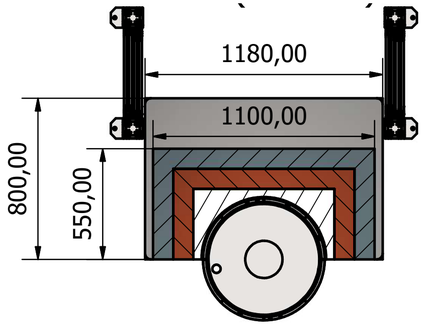
- 18 litres stp of 3He
- Double LN2 trap for 3He/4He with bypass
- Additional RF lines
- Wiring for power supply of top to 8 LNA (2 already bought)
- 2 additional optical fibers
- Support package essential
- Ancillaries

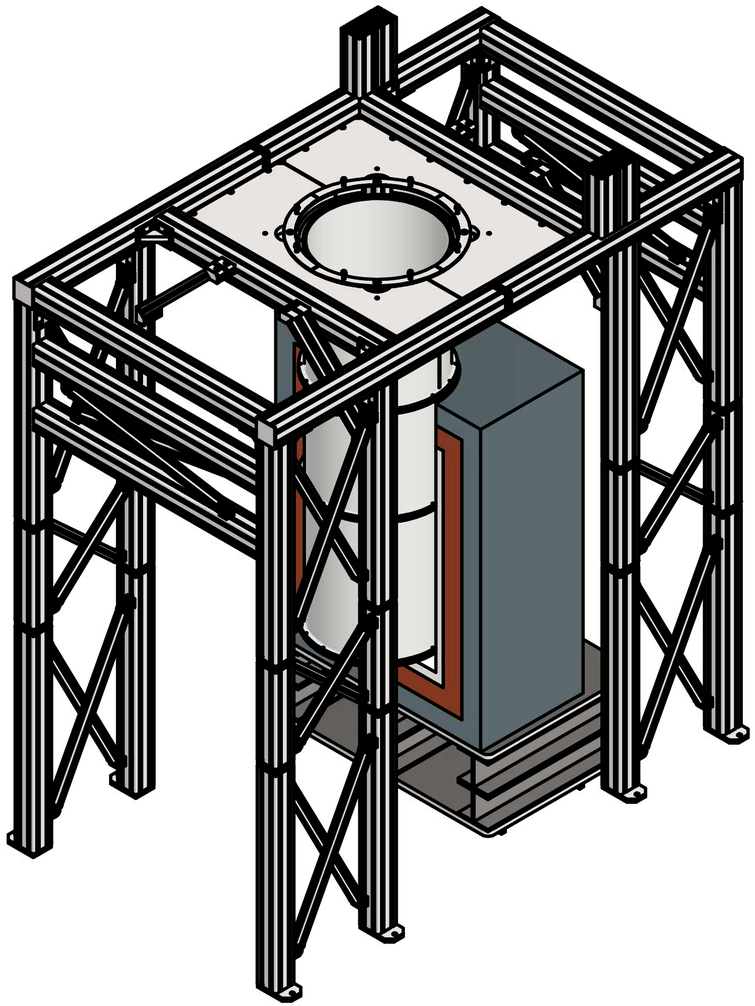
Room temperature shields

Preliminary design completed

- Two “L-shaped” halves
- “Hat” shield
- footprint: 1100 mm x 1100 mm
- height: 1500 mm
- No more top shield



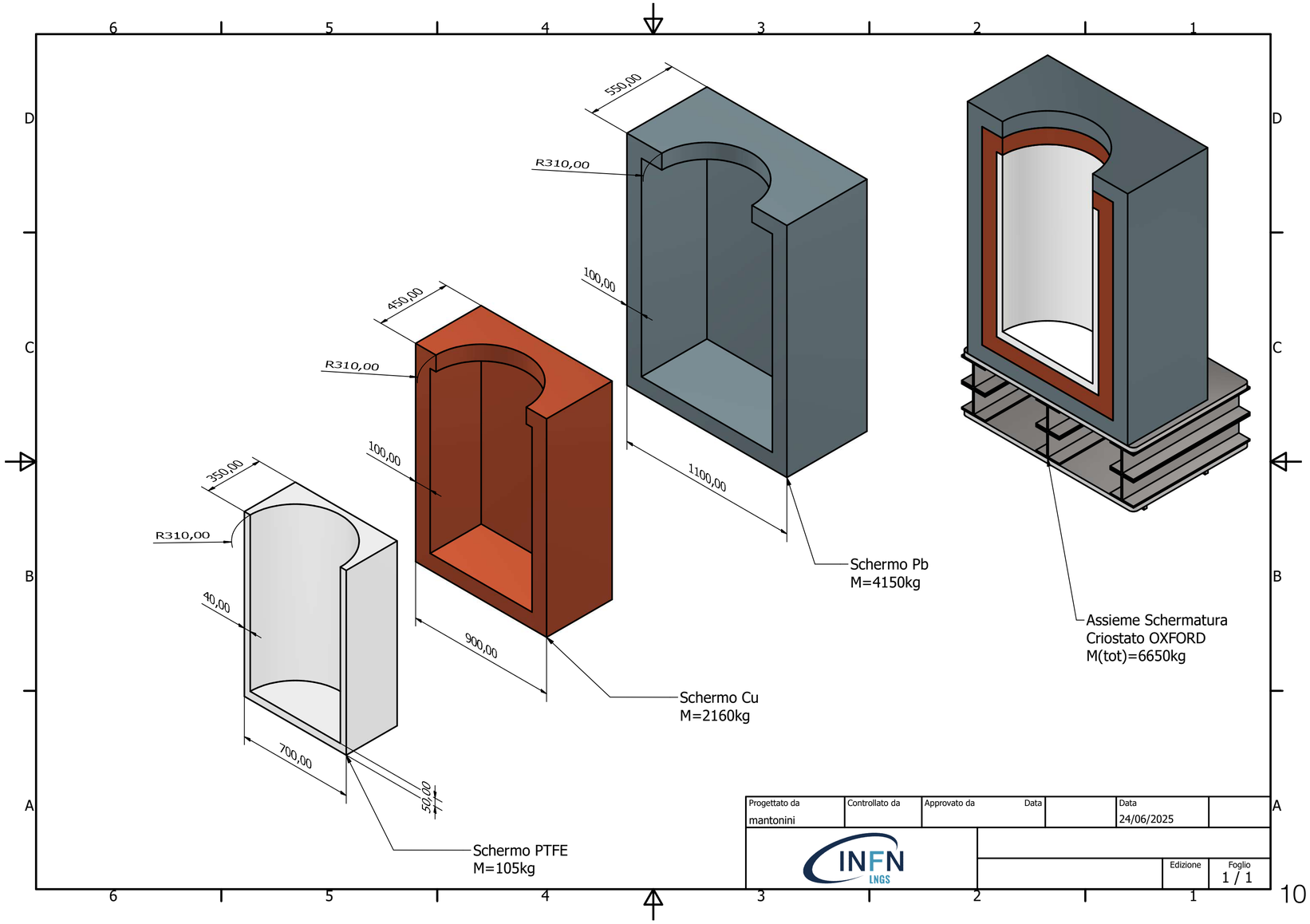




Room temperature shields

Preliminary design completed

- 10 cm lead (8300 kg)
  - bricks (20x10x5 cm^3)
  - purchase @LNGS to recast OPERA lead sheets
- 10 cm copper (4320 kg)
  - single plates, purchase @LNGS (see next slide)
- space for 4 cm PTFE (210 kg
- bottom structure to hold and raise the shielding



The copper shield

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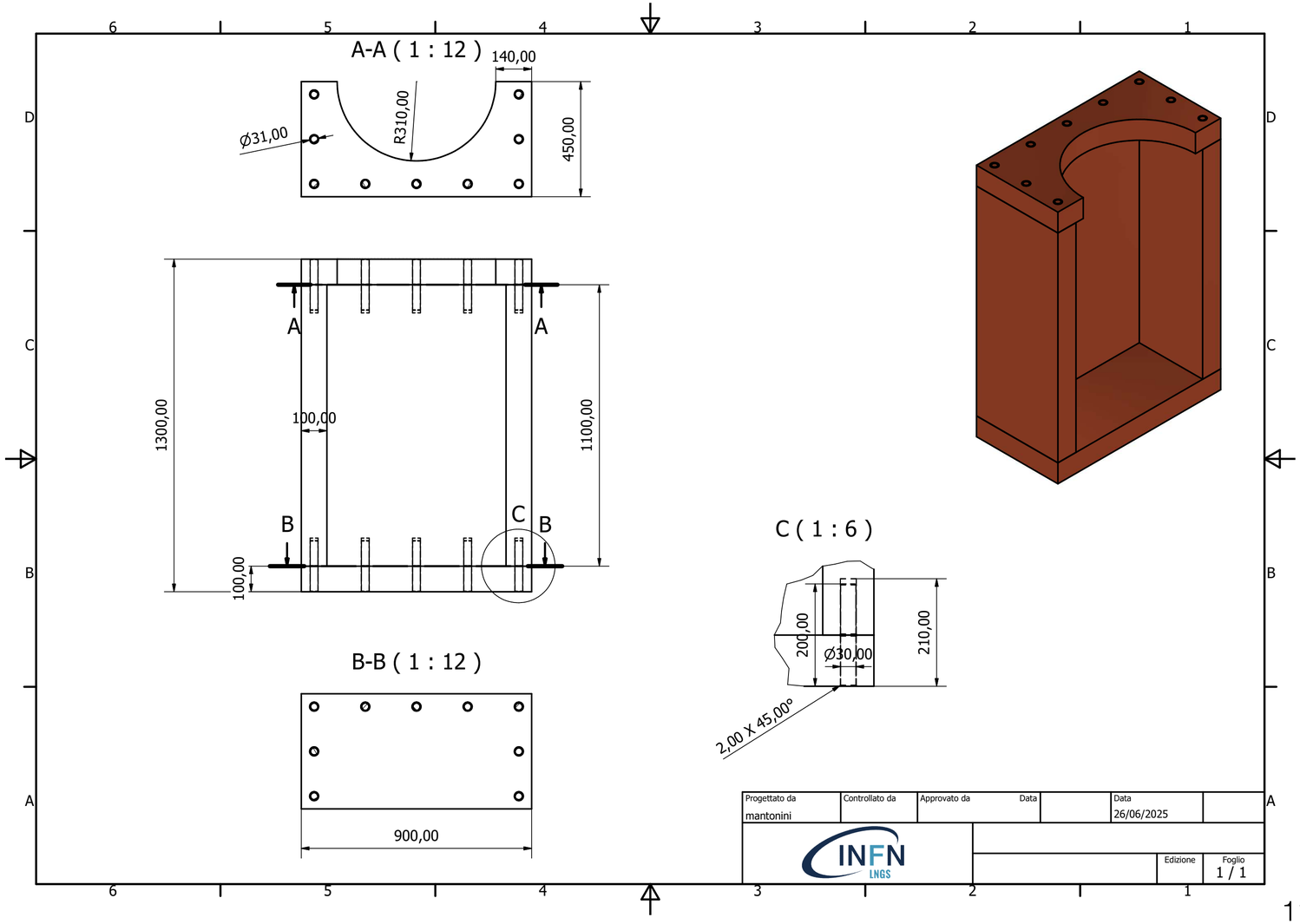
Preliminary design completed

- Copper shaped in thick plates: either two 50 mm or one 100 mm thick plate
- Hat shaped around the cryostat 300 K vessel
- holders to “mount” the shield
- it will be entirely funded on LNGS funds (~120 k€ estimated)



Radiopurity measurements

OFE copper (for the cryo shield)

- Cleaned in ultrasonic bath with slightly acid soap and rinsed with demineralized water

- **Measurements are ongoing** (results by late july)

- Goal sensitivity (mBq/kg):
  ^{40}K < 0.1
  ^{234}Th < 0.1
  ^{60}Co < 0.01
  ^{226}Ra < 1

Radiopurity measurements

OPERA lead (for room temperature shield)

- Cleaning ongoing in ultrasonic bath with slightly acid soap and rinsed with demineralized water
- **Measurements will start soon** (results by early september)

Radiopurity measurements

OPERA lead (for room temperature shield)

- Cleaning ongoing in ultrasonic bath with slightly acid soap and rinsed with demineralized water
- **Measurements will start soon**
- Goal: increase sensitivity w.r.t. previous measurement
  - using 240 sheets (30 kg)
  - measuring for 2 months

sample:	39 lead sheets OPERA		
weight:	5.4149 kg		
live time:	1424949 s		
detector:	GeCris		
radionuclide concentrations:			
Th-232:			
Ra-228:	< 0.18 mBq/kg	<==>	< 4.4 E-11 g/g
Th-228:	< 0.46 mBq/kg	<==>	< 1.1 E-10 g/g
U-238:			
Ra-226	< 0.12 mBq/kg	<==>	< 9.6 E-12 g/g
Th-234	< 2.5 mBq/kg	<==>	< 2.0 E-10 g/g
Pa-234m	< 8.0 mBq/kg	<==>	< 6.5 E-10 g/g
U-235:			
U-235:	< 6.7 mBq/kg	<==>	< 1.2 E-8 g/g
K-40:	< 1.8 mBq/kg	<==>	< 5.9 E-8 g/g
Cs-137:	< 0.26 mBq/kg		
Co-60:	< 10 microBq/kg		
Pb-210:	(58 +- 9) Bq/kg	@ 26-SEP-2014	

upper limits with k=1.645, uncertainties are given with k=1 (approx. 68% CL);

Ra-228 from Ac-228;
Th-228 from Pb-212 & Bi-212 & Tl-208;
Ra-226 from Pb-214 & Bi-214;
U-235 from U-235 & Ra-226/Pb-214/Bi-214
Pb-210 from Po-210

LNGS resources and personnel in 2025

LNGS collaborators registry

- Antonio D'Addabbo (technologist @LNGS) 0.3 FTE

Support from services

- Chemical 2 man-months
- Cryovac 2 man-months
- Special techniques 3 machine-months
- Mechanical 1 man-months

TOTAL: 0.3 FTE

LNGS resources and personnel in 2026

LNGS collaborators registry prevision for 2026

- Antonio D'Addabbo (technologist @LNGS) 0.5 FTE
- Federico Ferraro (researcher @LNGS) 0.2 FTE
- Shihong Fu (post-doc @LNGS) 0.5 FTE
- Dounia Helis (temp technologist @LNGS) (0.0 FTE)
- Kangkang Zhao (post-doc @GSSI) 0.3 FTE
- Jacopo Brunetti (Assistant Professor @UnivAq) 0.3 FTE
- Walter D'Ambrogio (Full Professor @UnivAq) 0.3 FTE

TOTAL: 2.1 FTE

Support from services

- Chemical 2 man-months
- Cryovac 3 man-months
- Special techniques 3 machine-months
- Mechanical 2 man-months

+1.8 FTE Cryovac +1
Mechanical +1

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Thanks