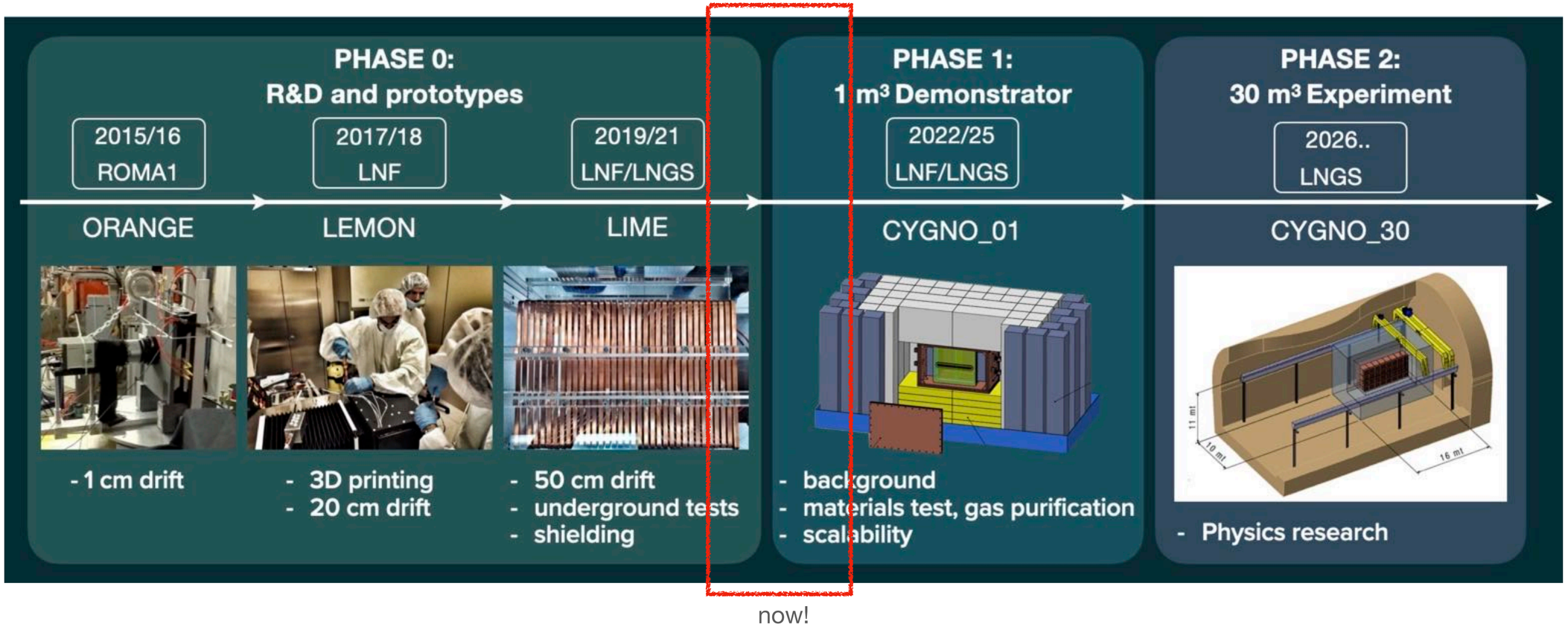
CYGN0-04 project status & prospectives the phase1

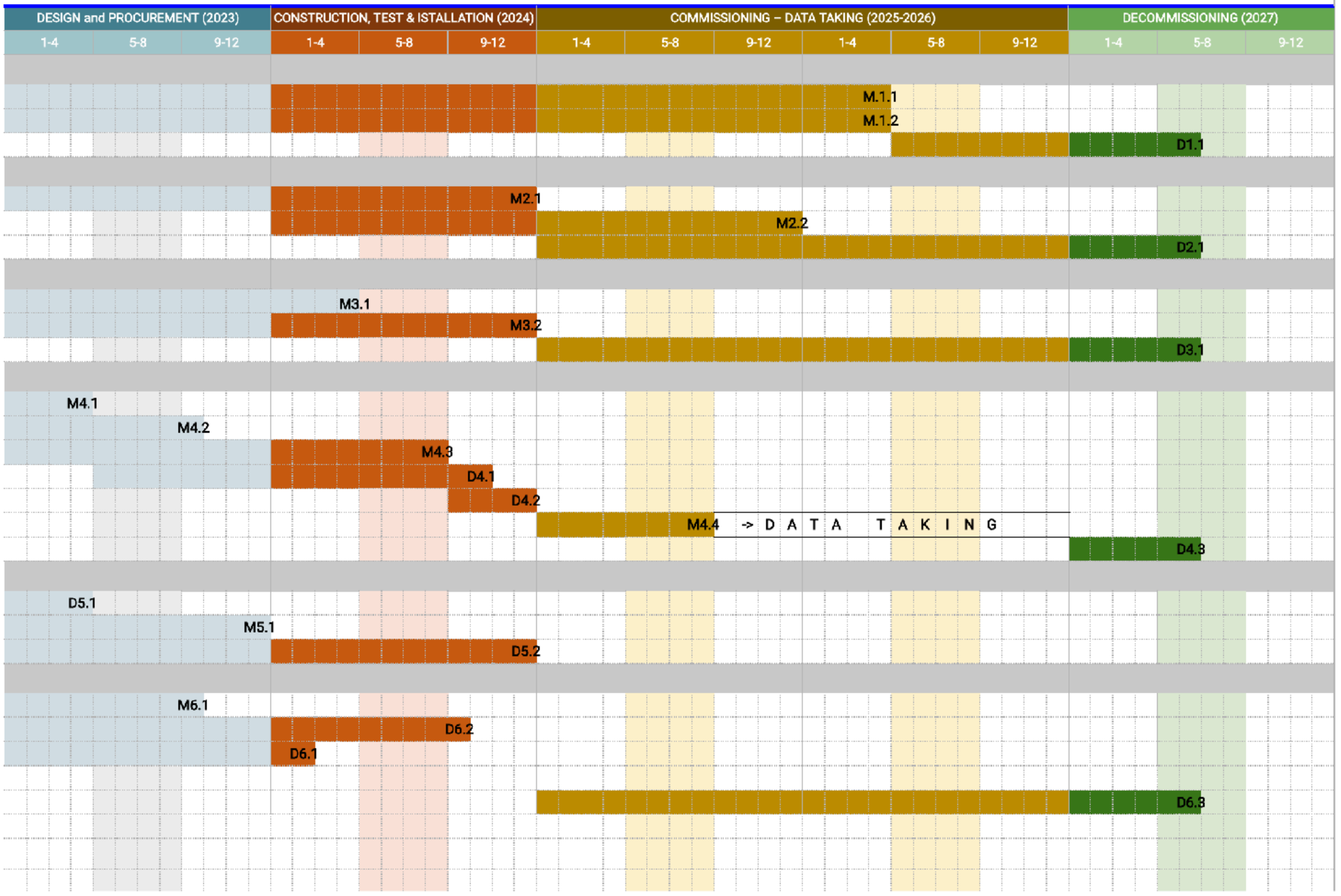


now!

G. Mazzitelli CYGNO annual meeting 4/6-12-2023

CYGNO/INITIUM

WBS ID	TASK
WP1	**Physics**
1,1	solar neutrino sensitivity
1,2	dark matter sensitivity
1,3	physical parameters PHASE 2
WP2	**Data Analysis**
2,1	reconstruc/background v0
2,2	reconstruc/background v1
2,3	detector analisys PHASE 1
WP3	**Detector Simulation**
3,1	valdete PHASE 0 results
3,2	Montecarlo for PHASE 1
3,3	estimation for PHASE 2
WP4	**Detector Design and Construction**
4,1	executive layout infrastructure
4,2	executive layout of the detector
4,3	procurements of components
4,4	install infrastructure
4,5	install detector
4,6	commissioning & calibration
4,8	decommissioning
WP5	**Auxiliary Services**
5,1	validating gas system
5,2	validating DAQ v0
5,3	validating DAQ v1
WP6	**Research and Development**
6,1	validating large GEM
6,2	validating sensors and lens
6,3	validating field cage component
6,4	validating cathode power distribution
6,5	validating R&D for PHASE 2
6,6	validation of materials
6,7	Materials radioactivity measurements and log



CYGNO/INITIUM

now

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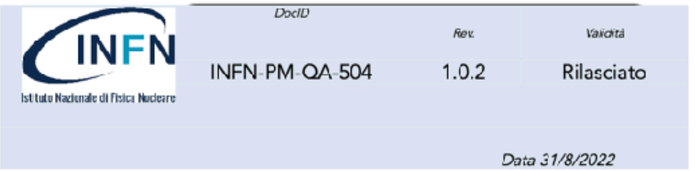
DESIGN and PROCUREMENT (2023) | CONSTRUCTION, TEST & ISTALLATION (2024) | COMMISSIONING – DATA TAKING (2025-2026) | DECOMMISSIONING (2027)

1-4 5-8 9-12 | 1-4 5-8 9-12 | 1-4 5-8 9-12 1-4 5-8 9-12 | 1-4 5-8 9-12

M.1.1
M.1.2
D1.1
M2.1 in progress
M2.2
D2.1
M3.1 in progress
M3.2 ???
D3.1
M4.1 done
M4.2 in progress
M4.3 ???
D4.1 in progress/done (hopefully anticipated)
D4.2 ???
M4.4 -> D A T A T A K I N G
D4.3
D5.1 in progress/done???
M5.1 in progress/done???
D5.2
M6.1 in progress
D6.2 in progress
D6.1 in progress
D6.3
forget items
started..... ???
started

guidelines for phase1

- **follow tasks addressed** in the TDR and it's amendment coming form the SC
- use WP structure defined in the WP in order to **better monitor milestone and deliverables**
- the g**eneral meeting** must be address to have a report of any WP
- **WP meeting must** be the report of any task of the WP and need to be addressed not only to the competition of the detector but also taking in to account the milestones/deliverables of the project



INFN
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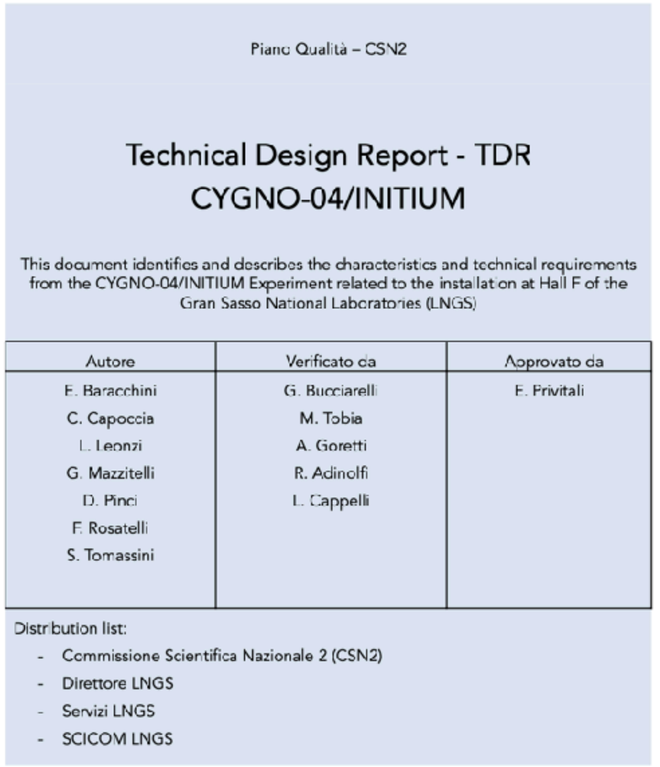
DocID	Rev.	Validità
INFN-PM-QA-504	1.0.2	Rilasciato

Data 31/8/2022



Piano Qualità – CSN2

Technical Design Report - TDR
CYGNO-04/INITIUM

This document identifies and describes the characteristics and technical requirements from the CYGNO-04/INITIUM Experiment related to the installation at Hall F of the Gran Sasso National Laboratories (LNGS)

Autore	Verificato da	Approvato da
E. Baracchini C. Capoccia L. Leonzi G. Mazzitelli D. Pinci F. Rosatelli S. Tomassini	G. Bucciarelli M. Tobia A. Goretti R. Adinolfi L. Cappelli	E. Privitali

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- Direttore LNGS
- Servizi LNGS
- SCICOM LNGS

guidelines for phase1
WP

- WP1 - Physics (meeting missed, report missed)
- WP2 - Analysis (biweekly meeting, report missed)
- WP3 - Simulation (biweekly meeting, report missed)
- WP4 - Design and Construction (weekly meeting and report)
- WP5 - Auxiliary service (biweekly meeting - DAQ only, report missed)
- WP6 - R&D (meeting missed, partially discussed in WP4 meeting for items belonging to WP4)

guidelines for phase1

- report is ! slides:

- it must be not a narration of what is going on (slides are there)
- it have to be a list of task/activities and decision taken (bullet, one sentence)
- possibly report “who” is in charge of it
- it have to be share with experiments spokesperson, TM, SC leader
- it have to be archived somewhere

guidelines for phase1

example of weekly report of WP4

LNGS
- tutto pronto per il rompimento
- ma problema sul sistema di gas, come se non arrivare gas sul rivelatore. Probabilmente i bidoni hanno “pinzato" il tubo, o tubo che si e’ sfilato.
- martedì ricontrollo e re-check della linea
- martedì Daniele, Roberto ok (mattina gas, riempimento bidone per la mattina di mercoledì)
- mercoledì roberto, Cesidio (possibile supporto di RM1) riempimento acqua.
- giovedì (Danile, Roberto, Cesidio) fine riempimento
- aggiorniamo a domai pranzo per i passi successivi.

GIN:
- sostituzione GIN1/GIN2, problemi di scarica sulla FC e di umidità nel gas.
- il sistema gas senza GIN ha umidità 0. Quindi ancora GIN perde. Procediamo quindi a fare ulteriori test con le viti di plastica.

MANGO:
- test in corso con il flusso.

CYGNO04
- ordine infrastruttura, prioritario trovare una soluzione.
- disegno di CYGNO04
- lanciata misura meccanica sulle GEM 80*50, misura in analisi.

if you use mailing list to send the notes the log is automatic https://lists.lnf.infn.it/sympa/arc/cygno_lnf/2023-11/

safety and radio-protection
communication as GLIMOS and RAE

I want to remind you to strictly follow the protocols you have learned in the safety and radiation protection courses. I don't know who left the source like in the picture below (not in the locker in the control room) without the internal parts and the notice, but this is only part of the issue because I often find similar situations.

In particular:

- **you must wear personal protective equipment (DPI).**
- **the workplace must be kept clean and tidy.**
- **the use of any unauthorized liquids or materials is not permitted.**
- **furthermore, all waste materials must be handled and disposed of correctly.**

Last but not least, nobody is authorized to undertake any task involving **risks not previously declared and for witch you are trained**." These changes should make your message more precise and easier to understand.

PS By the way, only Samuele and Betta are allowed, to the best of my knowledge, to install and remove the source. In particular, technicians should not be asked to do this. If you have undergone the necessary training at your institution to be authorized to handle the source, **you must provide your radiation protection documentation to LNGS Radioprotezioni Service**. Otherwise, these individuals cannot install or remove the source. To be clear, the personnel in RM1 are not permitted to install or remove the source, even if they have completed the training, unless they provide their radiation protection documentation to LNGS.

you are strongly invited to read documentation available for safety and environmental items

IT @ LNGS

Dear XXX YYY,
your access to LNGS IT resources will expire in 30 days.

This may be due to the fact that this is the date that the IT representative of your experiment or project chose for the expiration of your account, or because two years passed since it was requested.
If appropriate, ask the IT representative of your experiment or project to extend your account duration.

Please make sure that she/he indicates rita.antonietti@roma3.infn.it as your e-mail address.
If you would like to change your contact e-mail please write to calcolo@lngs.infn.it.

Thanks, the Computing and Network Service at LNGS.

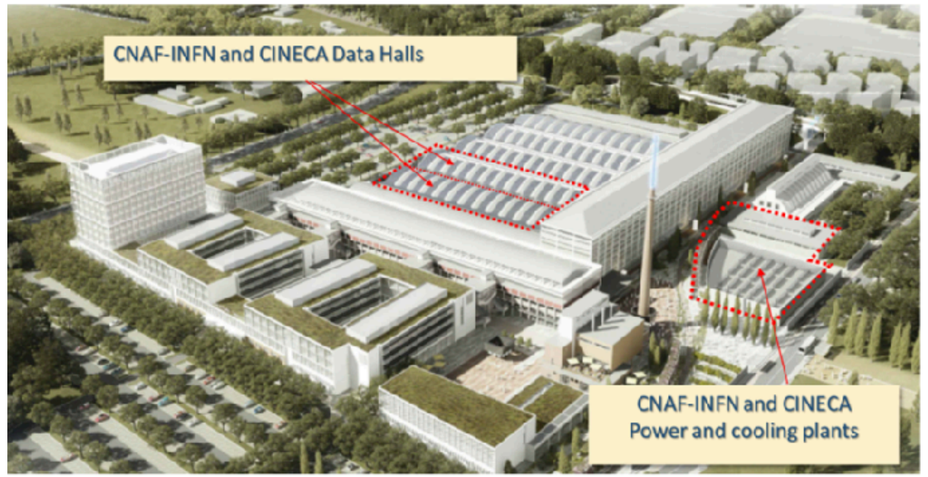
Just sed me an email to extend the account duration!

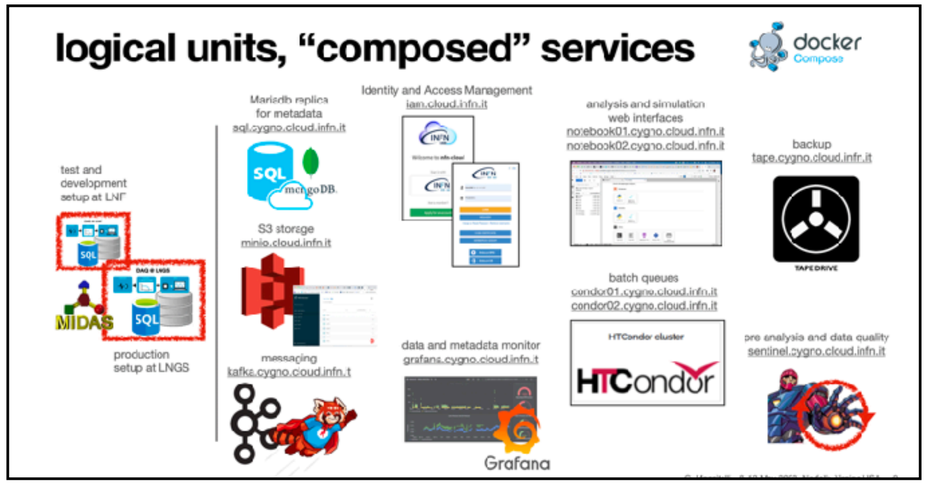
remember that this is valid for any interaction about computing with LNGS

IT infrastructure

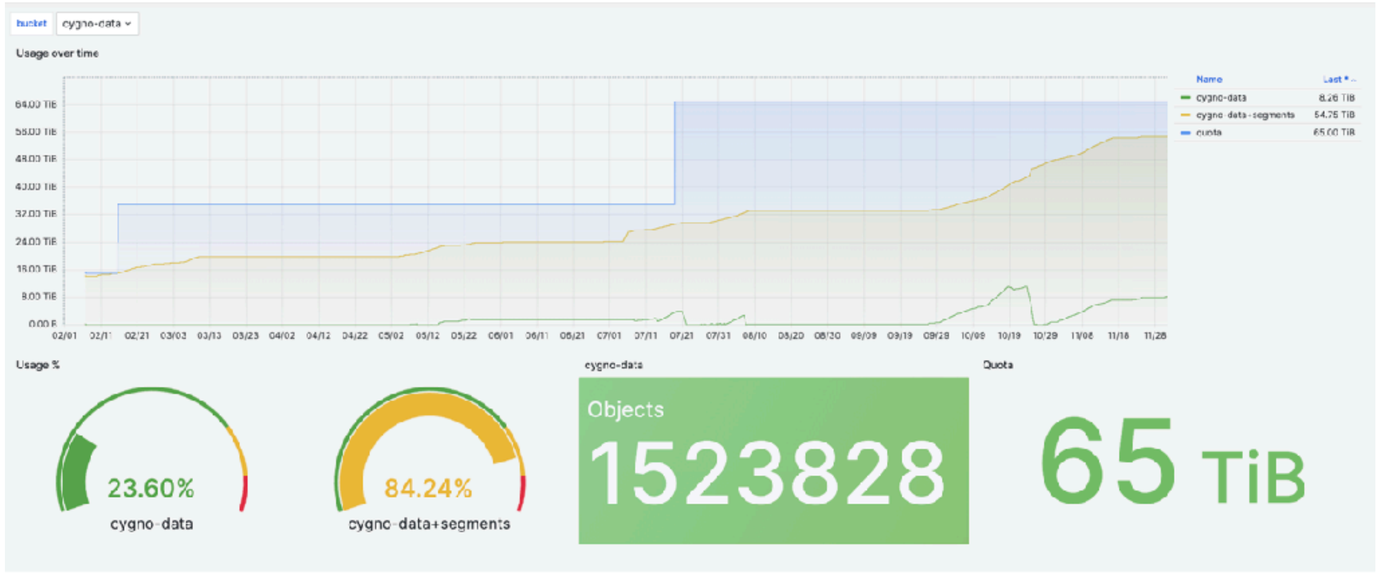
@ CLOUD-CANF (CNAF migration to new site)

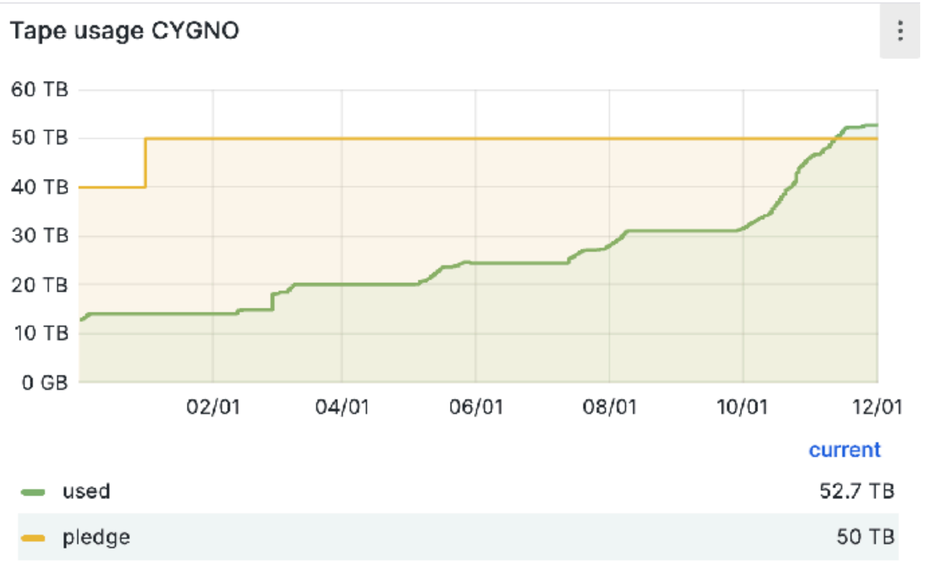
- queue migration (done)
- services migration (in progress) some malfunctioning or service interruption its foressen
- documentation on git is always update (in progress)
- we are running over pledge (apart for CPU), but in pledge 2024:
  - CPU +2800 tot 5000 HS06 + 130%
  - DISK +125, tot 180 TB +230%
  - TAPE +150 TB, tot 200 TB +130%
- because of a problem with the tender of all INFN disks resources, we have to take care of it with attention





Running over disk space





- analysis (55%/3TB) and simulation (80%/7TB) are running close to the limit
- info: https://github.com/CYGNUS-RD/cygno/blob/main/infrastructure.md

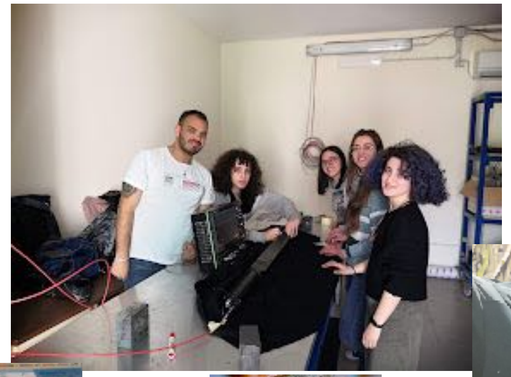
Design & Construction

WP4 & LNF task in WP6

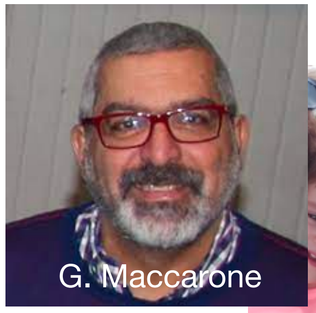
G. Mazzitelli CYGNO annual meeting 4/6-12-2023

D&C team!

and more



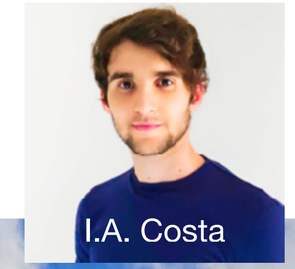
+ Saviano e Caponero …



G. Maccarone

D. Pierlugi et al

I. F. Pains



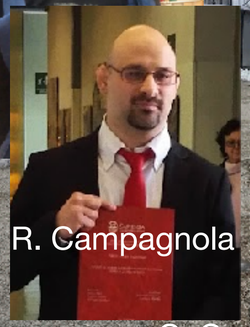
I.A. Costa

A. Russo

L. Leonzi et al.

F. Rosatelli

E. Paoletti



R. Campagnola

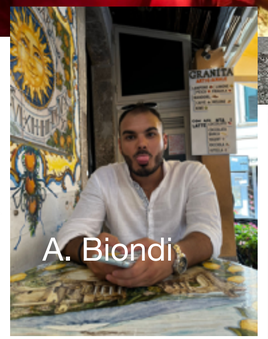
C. Capoccia, L. Passamonti, R. Tesauro

L. Benussi

A. Calanca

J. Lee Bo

A. Rodano



A. Biondi

G Dho

N. Piretti

S. Tommasini

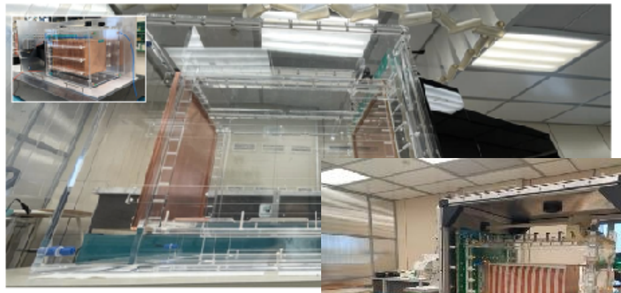
LNF echosystem (WP2-WP4-WP5-WP6)

Design and Contraction

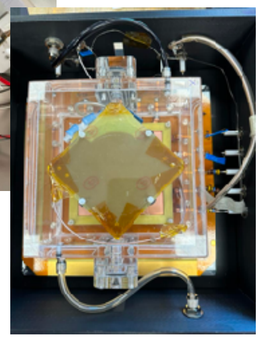
IT infrastructure and Services
and now also Analysis

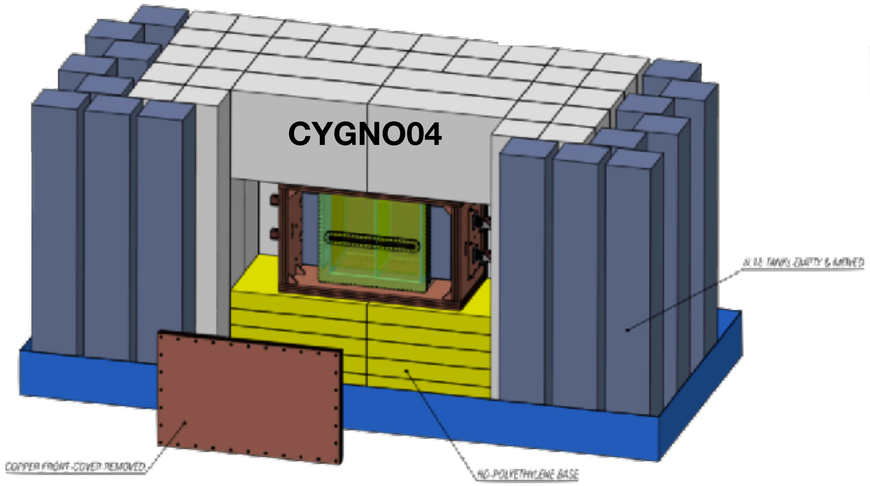
LIME,
Gas System
& equipment

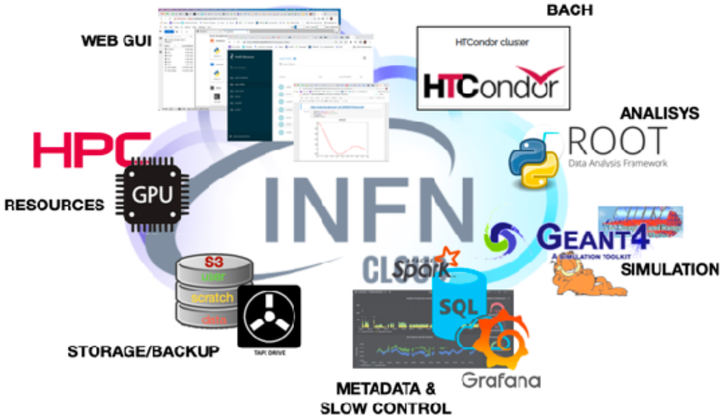
LIME2/GIN



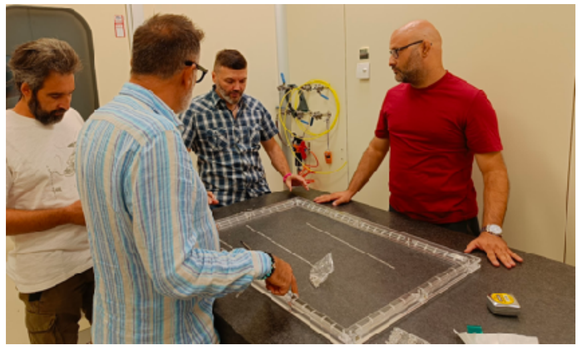
MANGO





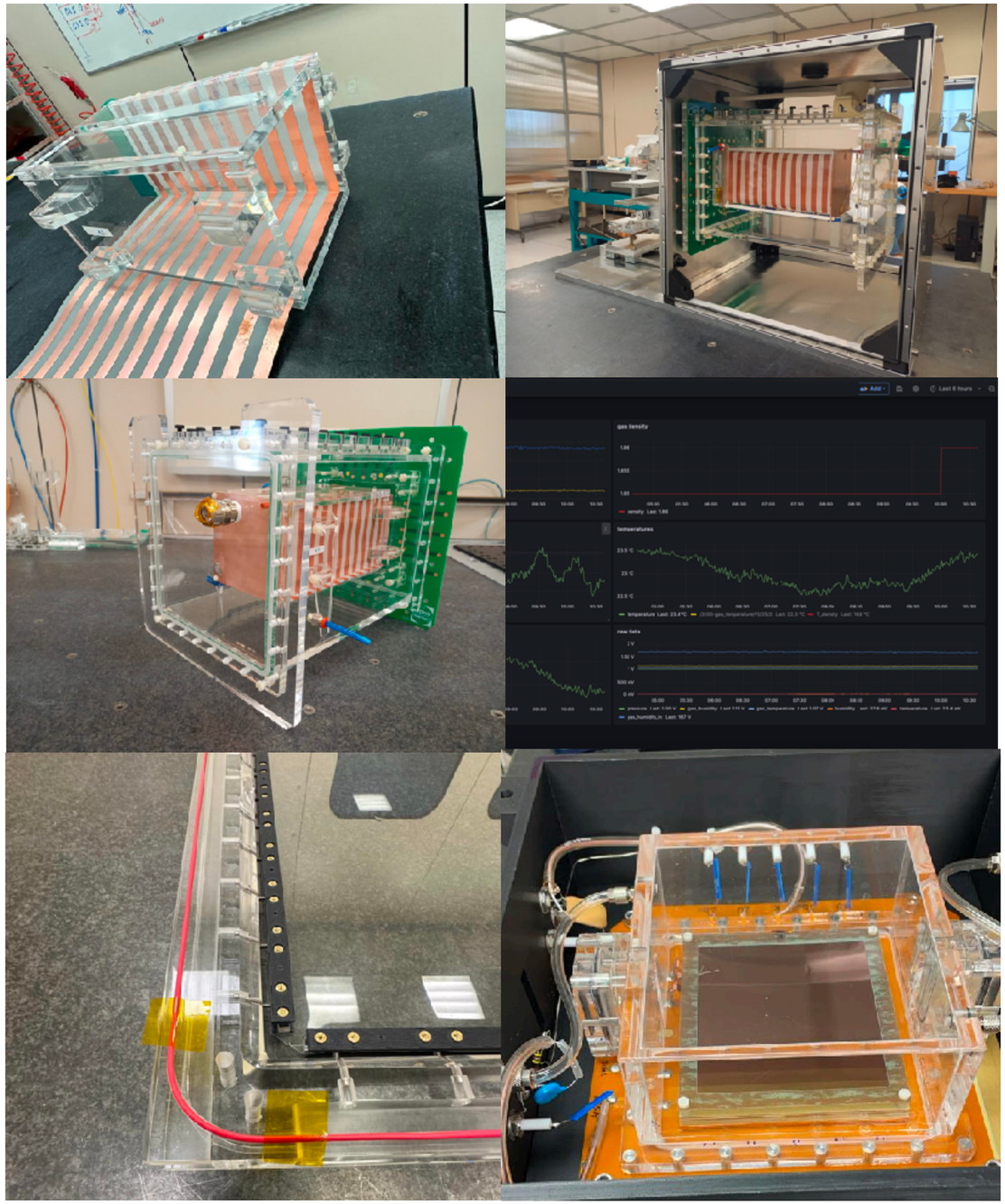


GEM/FC ecc



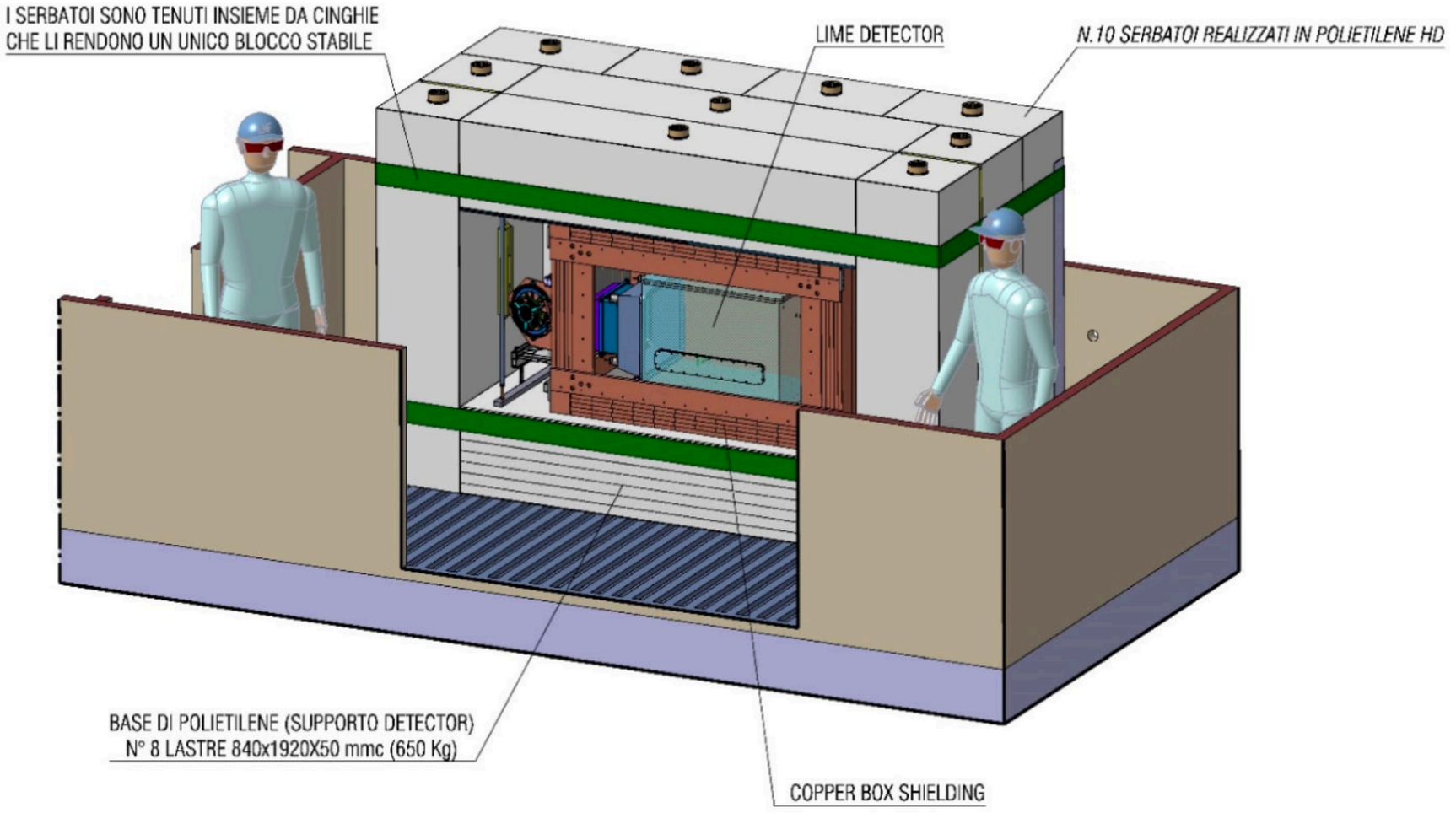
WP5-WP6 tasks

- ended tests on LIME2 (KFC/tape FC/gas)
- D6.1 tests of GIN (printed circuit FC/ Cathode/gas in progress, critical
- M6.1 validating large GEMs in progress. although partially in late but is not critical.
- support to gas system, filter test and D5.1, critical and in late



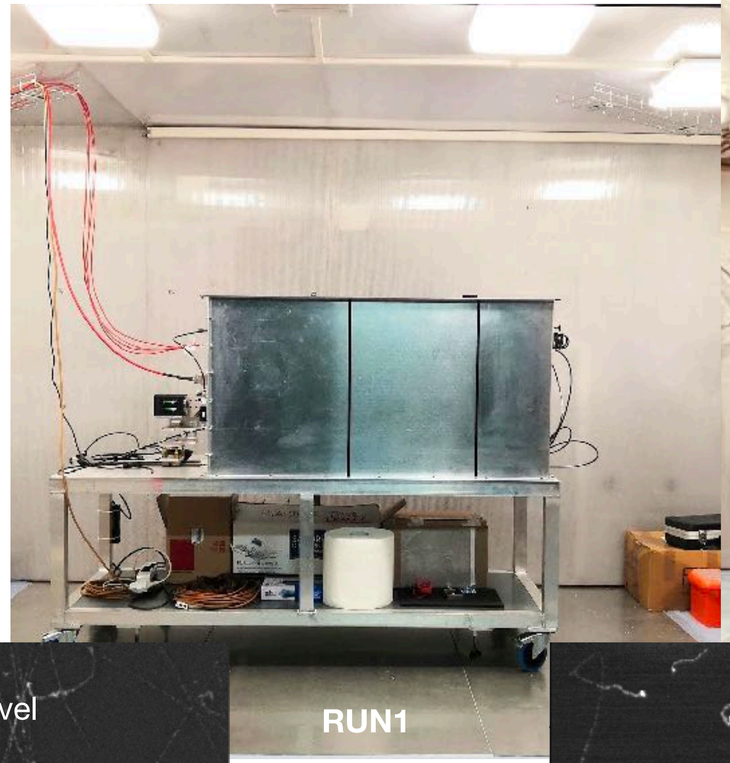
LIME RUN1->RUN4

phase0



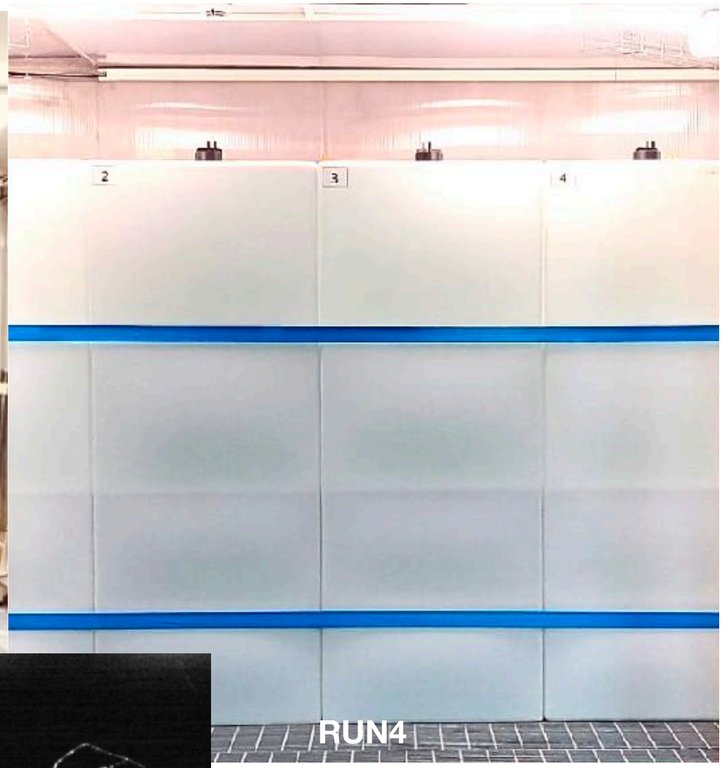
LIME RUN1->RUN4

phase0 - M3.1 validating montecarlo

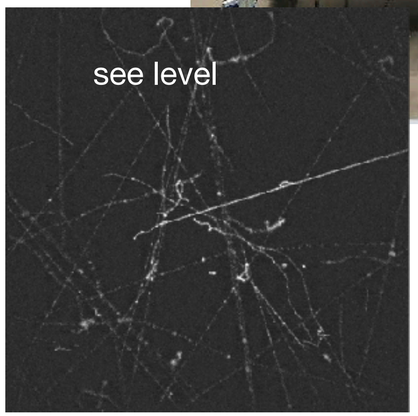


RUN1

RUN2/3

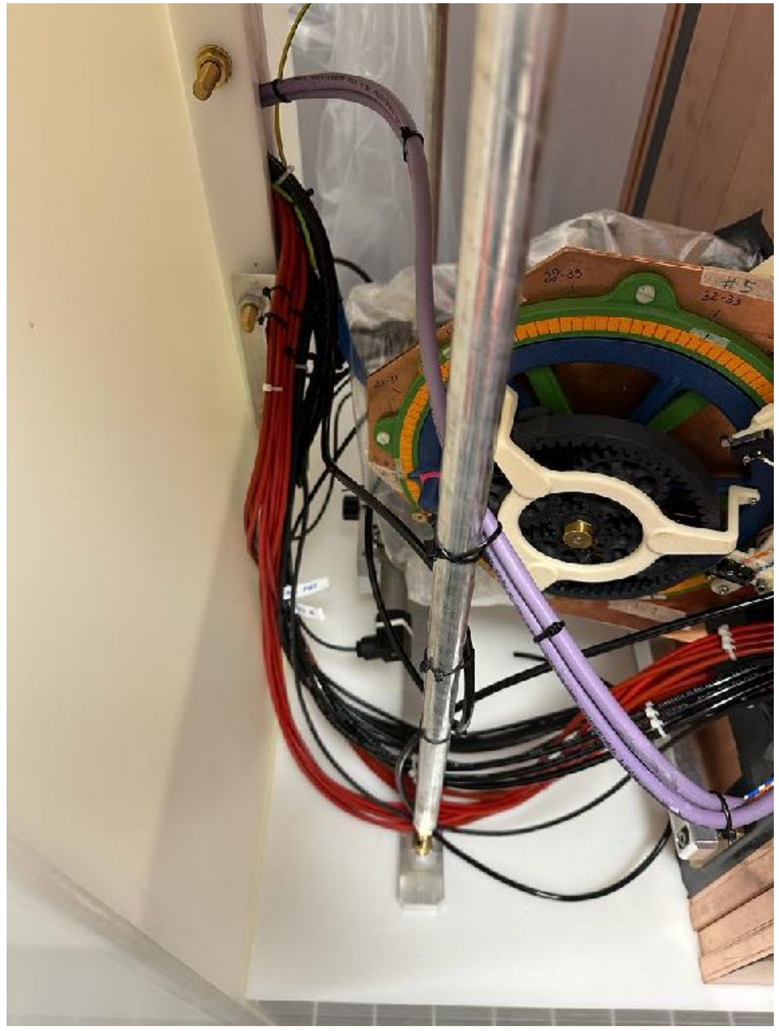


RUN4



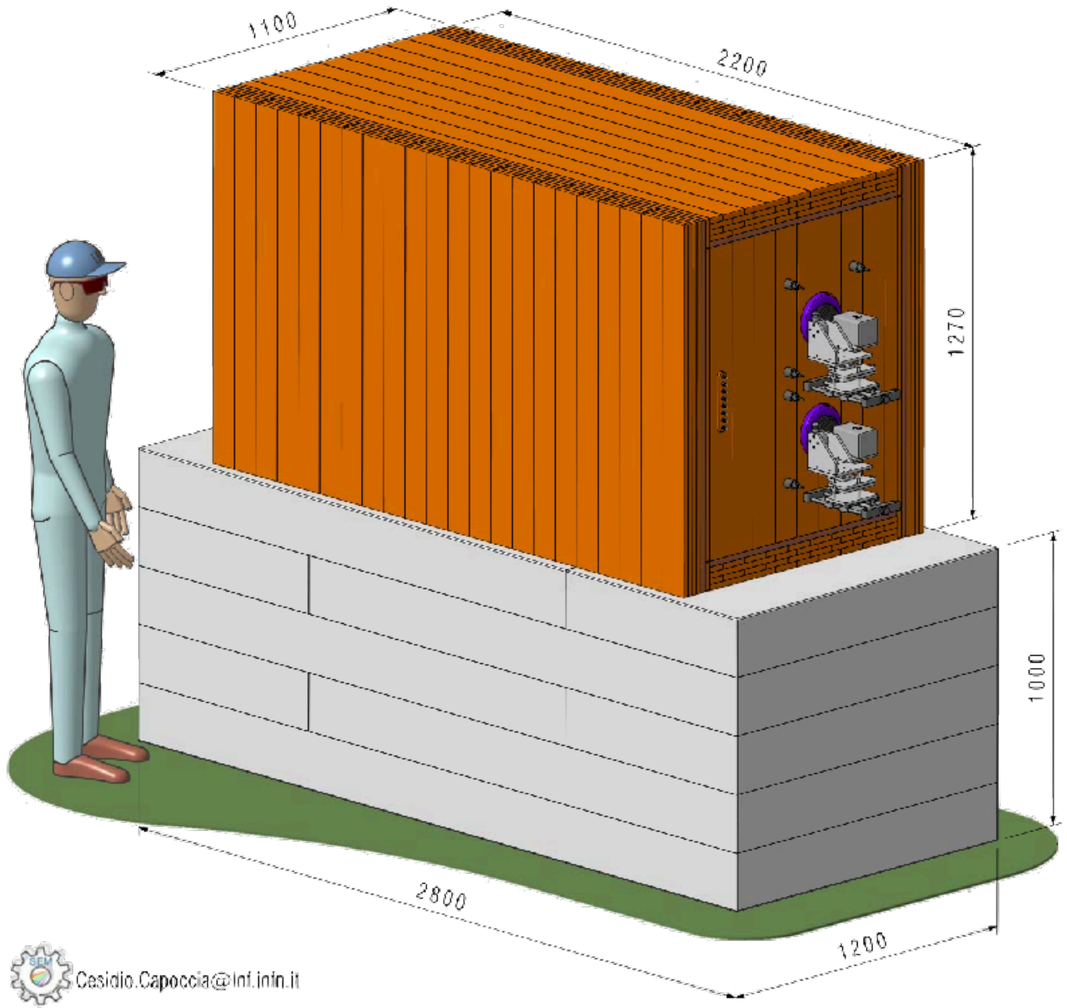
LIME RUN4 setup

last step of phase0



CYGNO-04

phase1



G. Mazzitelli CYGNO annual meeting 4/6-12-2023

phase 1 - CYGNO-04

Hall F - LNGS May 2022

INFN Istituto Nazionale di Fisica Nucleare	DocID	Rev.	Validità
	INFN-PM-QA-504	1.0.1	Rilasciato

Data 29/6/2022

Piano Qualità – CSN2

Technical Design Report - TDR
CYGNO-04/INITIUM

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Autore	Verificato da	Approvato da
E. Baracchini C. Capoccia L. Leonzi G. Mazzitelli D. Pinci F. Rosatelli S. Tomassini		

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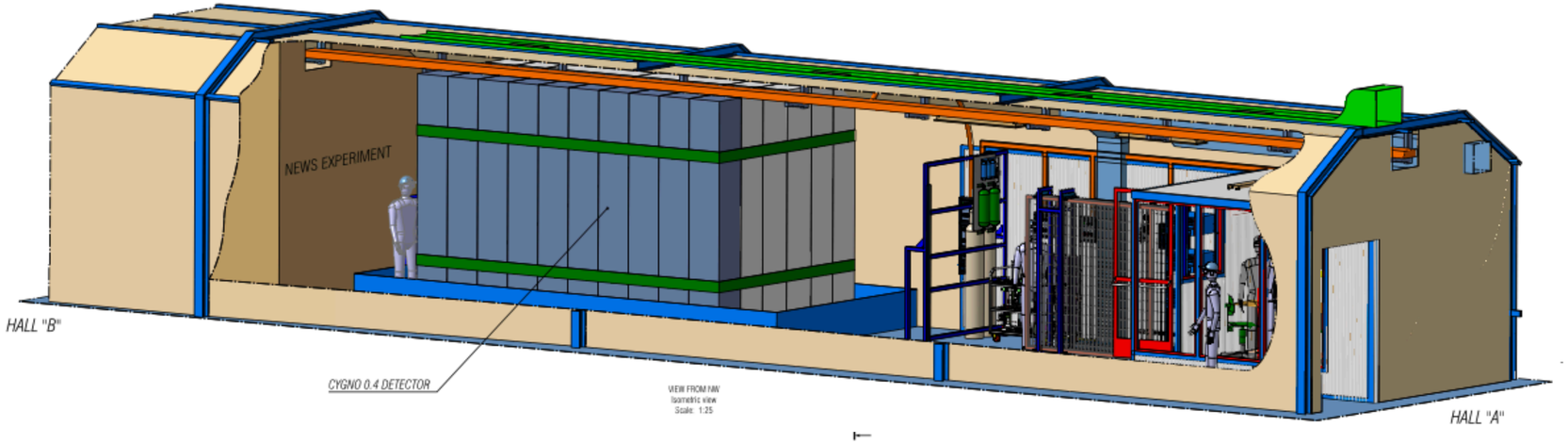
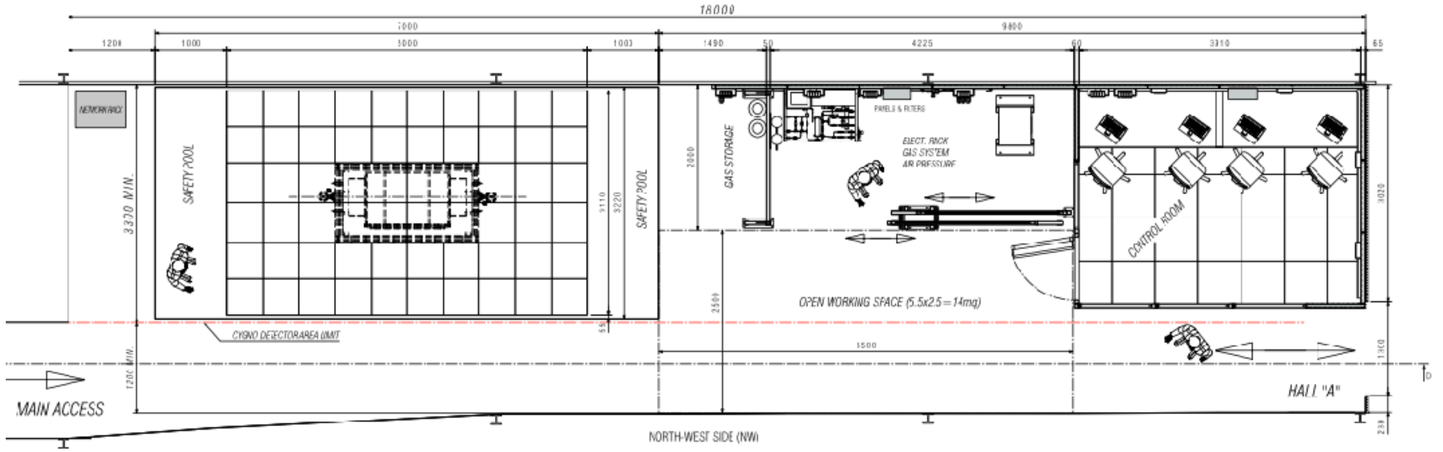
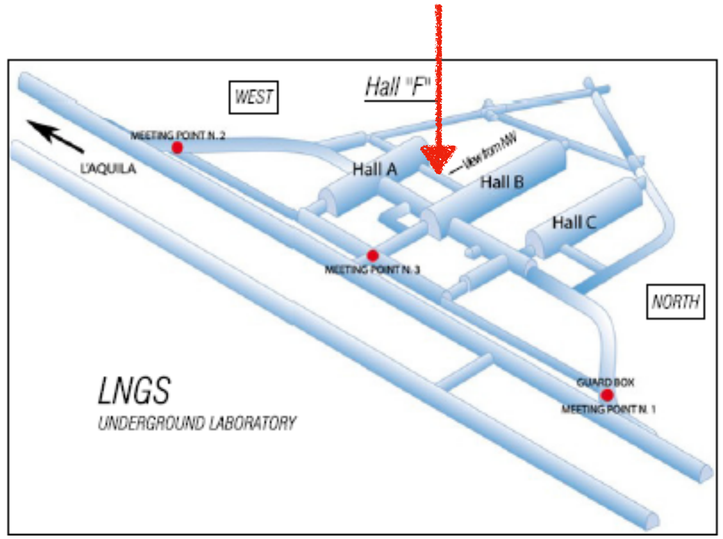
https://drive.google.com/file/d/1yd6EspIiOAMvgfTMFM2LOPHIjzyzQVpP/view?usp=sharing

phase 1 - CYGNO-04

hall F setup

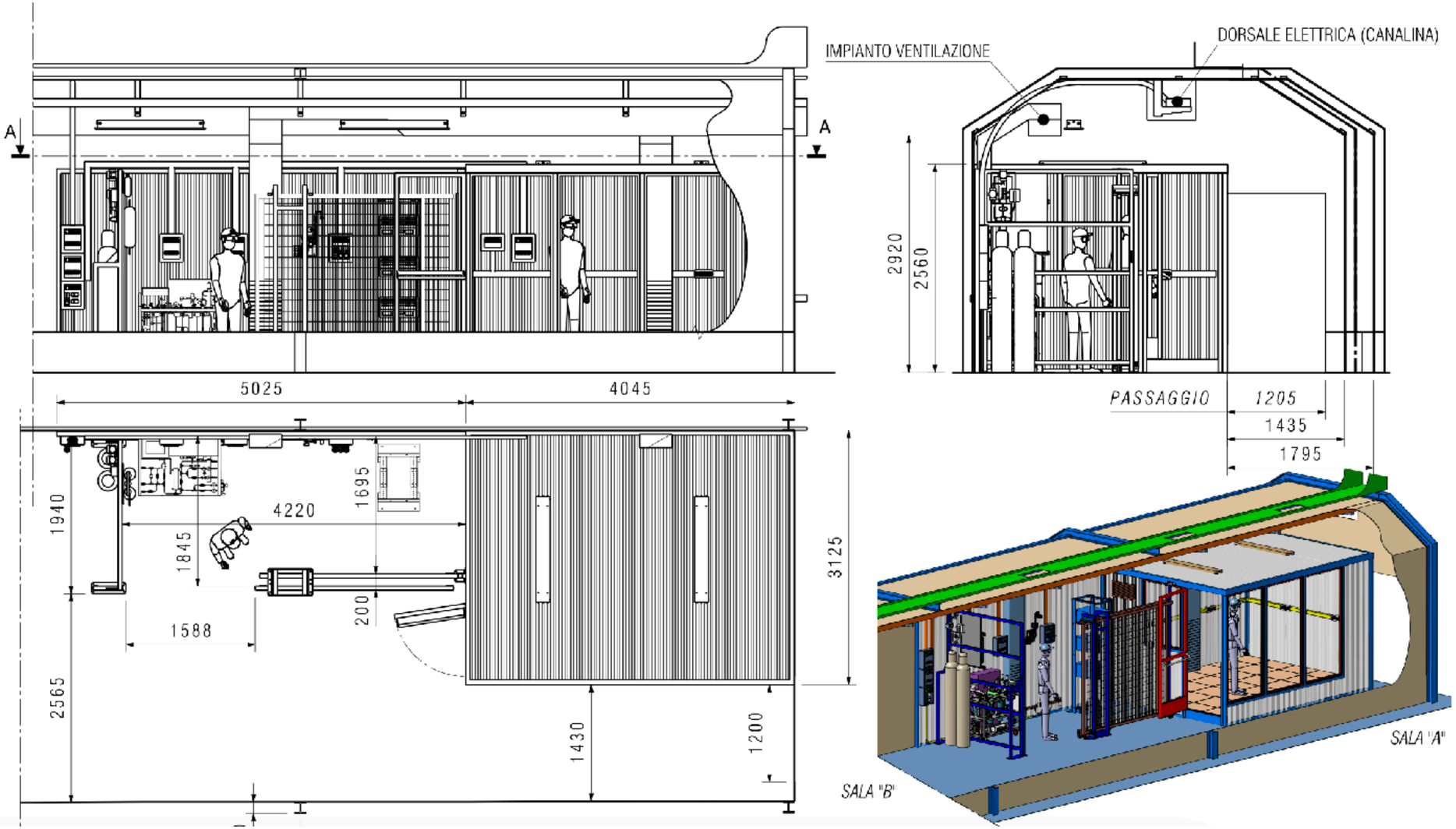






M4.1 executive layout of infrastructure

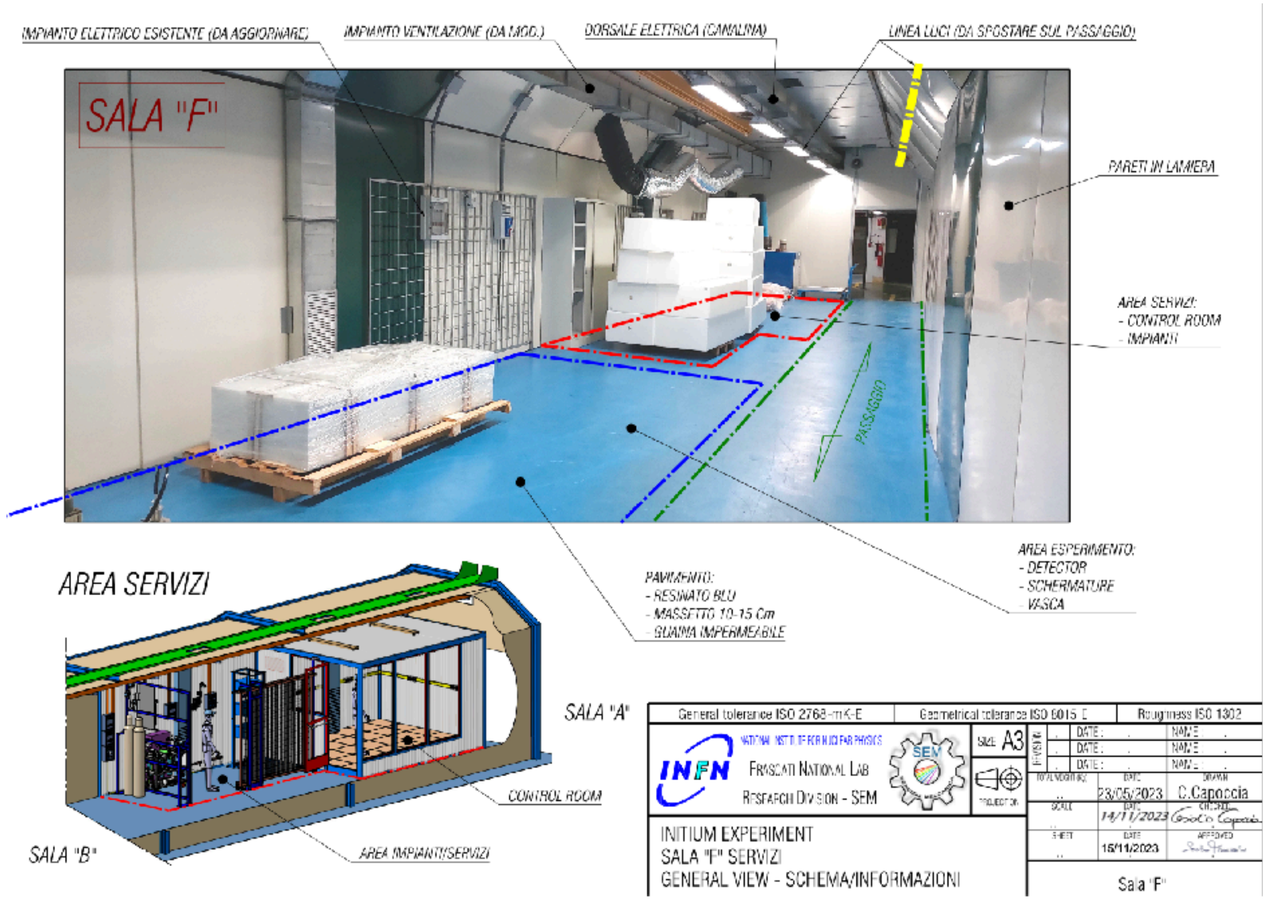
phase1 - Apr 23 - completed



D4.1 installation of the infrastructure

phase1 - Nov 24 in progress - hopefully Feb. 24

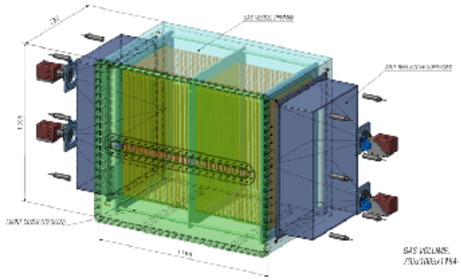
- the **tender** as been assigned we are waiting for GSSI formalisation of the procurements
- the **installation** have to be done between Gen-Feb. 24 because of critical overlap with PNRR
- the design and tender **includes** power distribution, air distribution, compressed air, ecc. ecc.



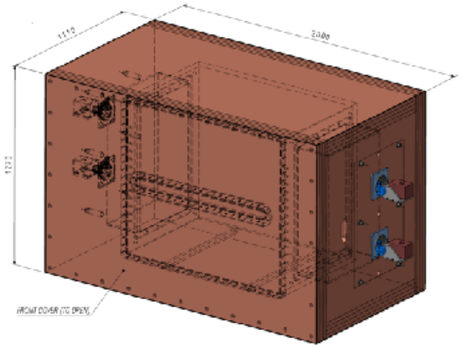
M4.2 executive layout of detector

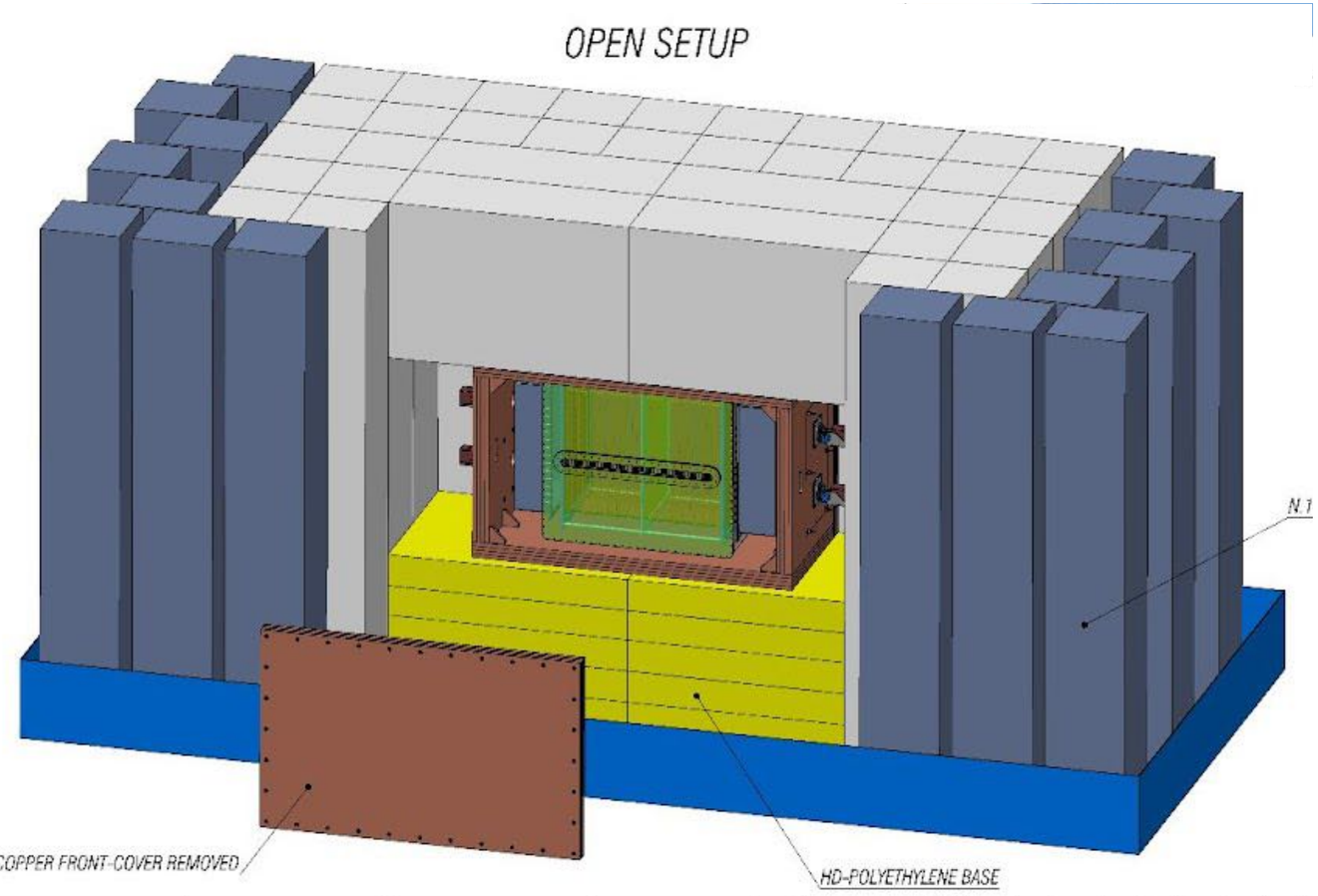
TDR preliminary design

gas vessel & readout



detractor &
copper shield





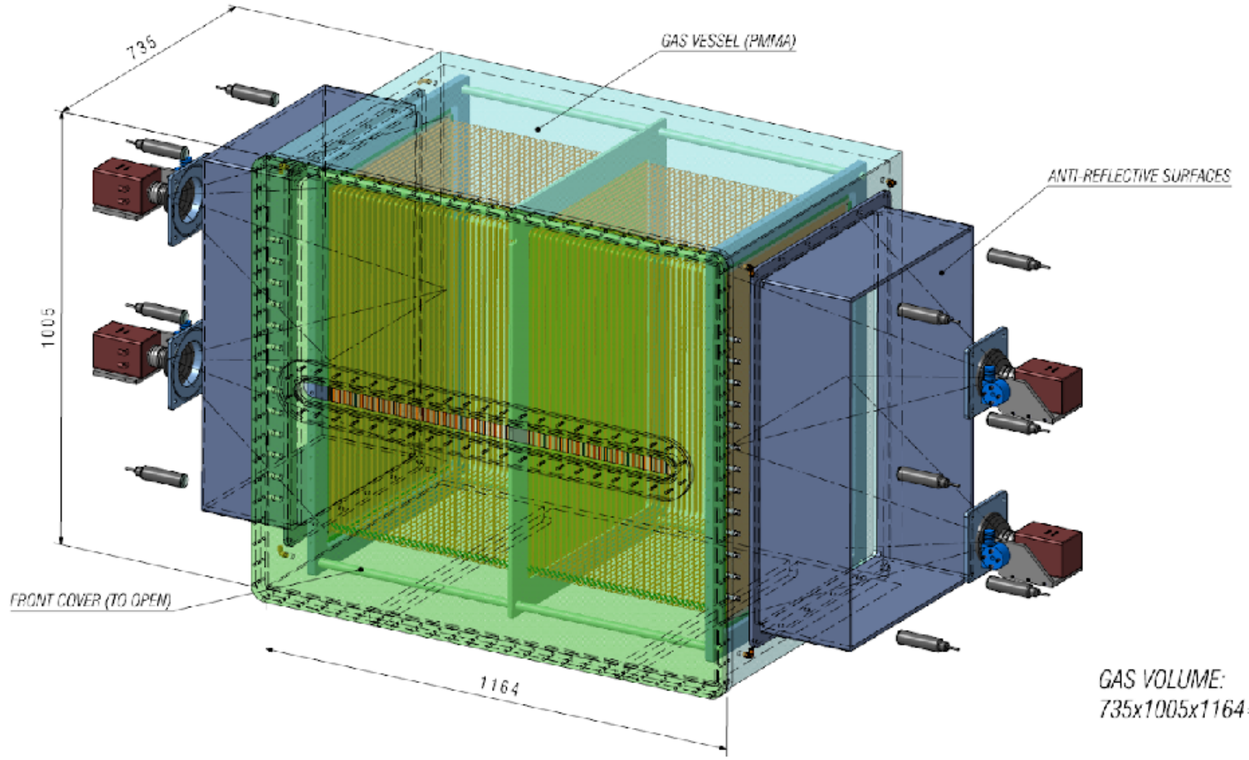
full detector shielded (Cu+water)

M4.2 executive layout of detector

FC/Cathode/GEM/camera setup

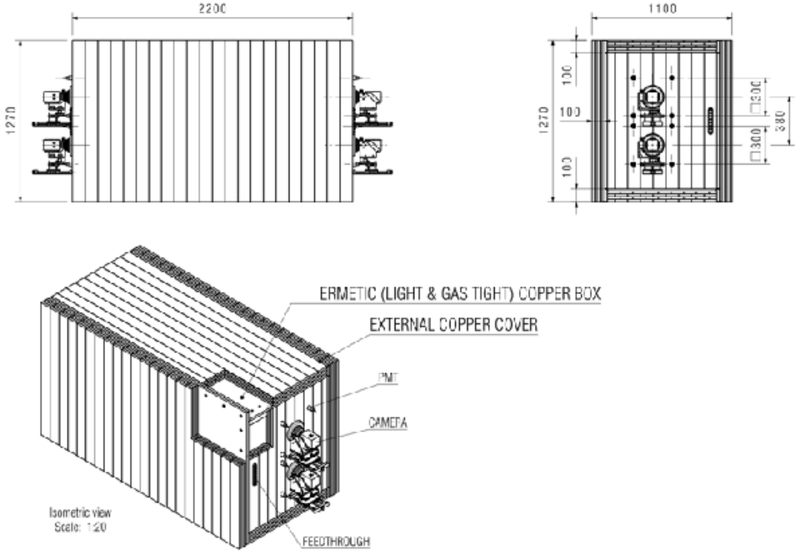
- because no different solutions came from the R&D-WP6 and what we learned from LIME/GIN, we choose to implement **best compromise** from letterature ints and our knowledge.

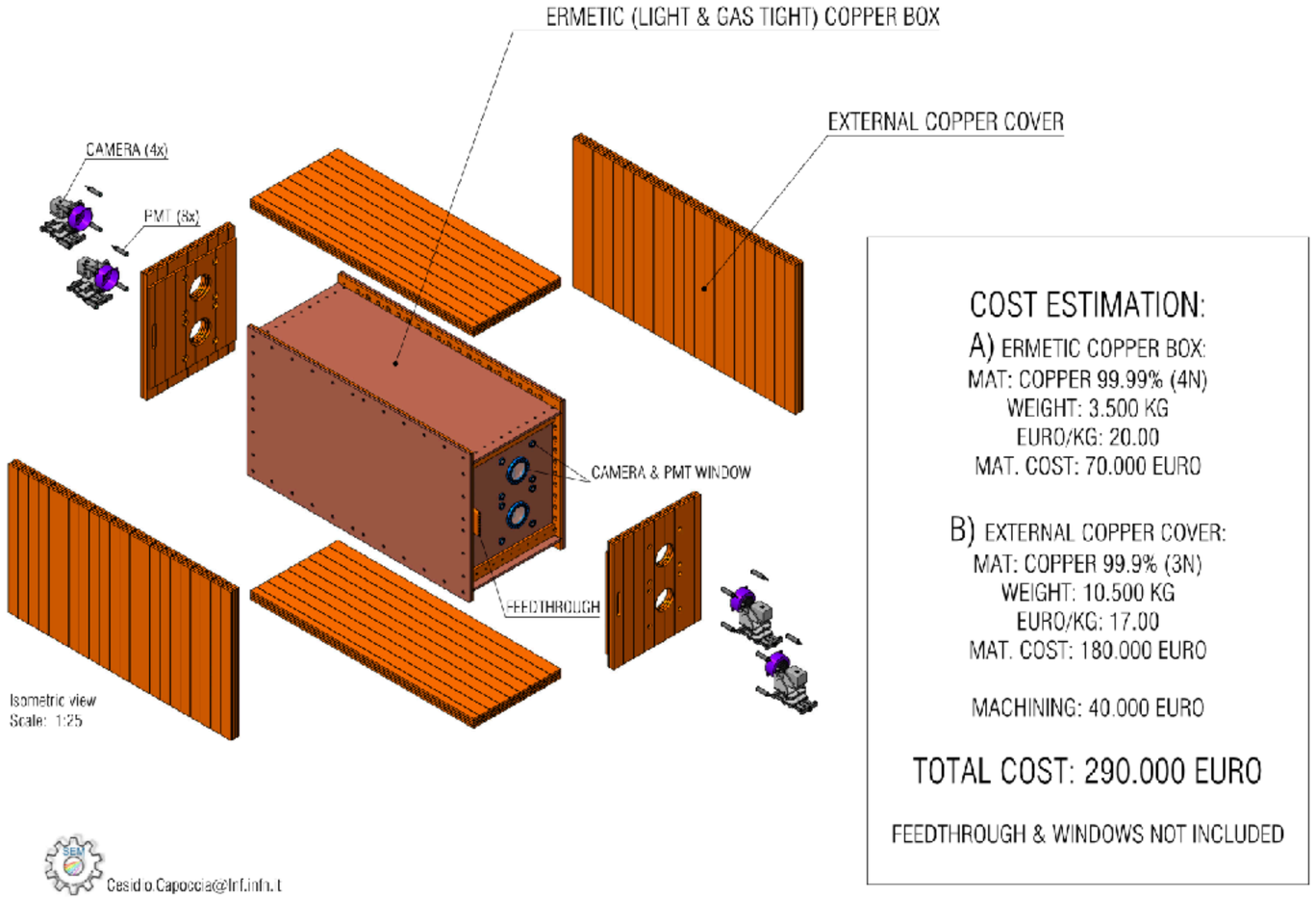
- This probably is not the best detector we can build, finding optimal solution for saturation, radioactivity etc, etc, but **is the only way to realise the project in time to exploit the ERC founds**



M4.2 executive layout of detector

phase1 - Sep 23 started (in late)





COST ESTIMATION:

A) ERMETIC COPPER BOX:
MAT: COPPER 99.99% (4N)
WEIGHT: 3.500 KG
EURO/KG: 20.00
MAT. COST: 70.000 EURO

B) EXTERNAL COPPER COVER:
MAT: COPPER 99.9% (3N)
WEIGHT: 10.500 KG
EURO/KG: 17.00
MAT. COST: 180.000 EURO

MACHINING: 40.000 EURO

TOTAL COST: 290.000 EURO

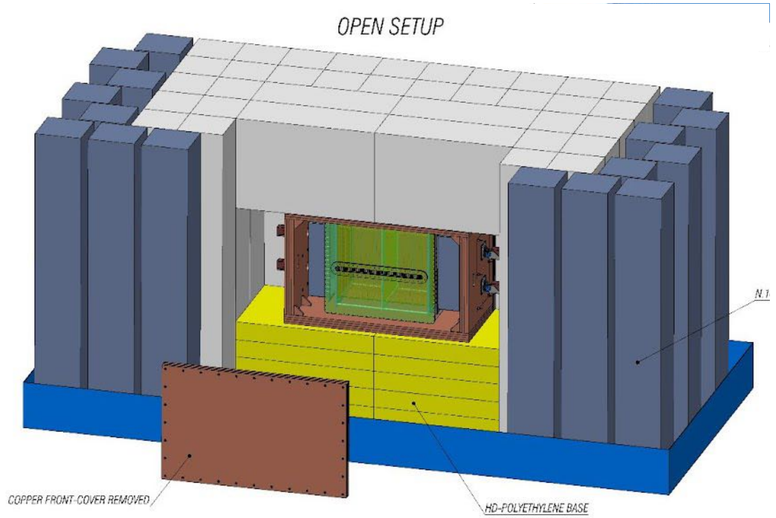
FEEDTHROUGH & WINDOWS NOT INCLUDED

we decided to confirm an **hermetic solution**, different from the path chosen for LIME, in order to avoid issue related to **gas tightness, lower materials** inside and allows maximum **physics application** range

M4.2 executive layout of detector

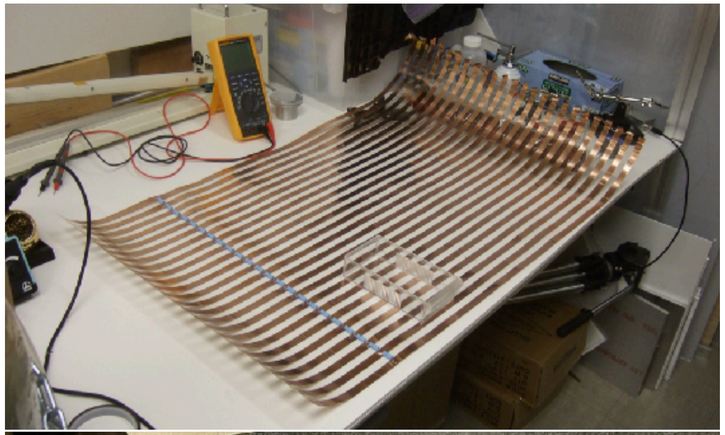
phase1 - Sep 23 started (in late)

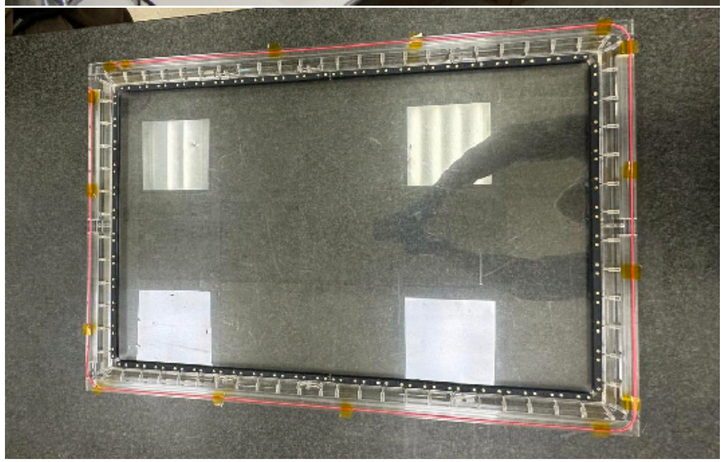
- the hermetic solution provide us the best compromise between performance/costs
- but…
  - we still don’t know witch are the optics (fix position etc), windows, and costs
  - we still don’t know how much money we have for overall project! and so if have to use Opera Cu or worst if we can do it.
  - we sill have to validate internal components with exhaustive tests, decide materials, thickens allowed, etc, etc



M4.3 procurements of components

phase1 - Sep 24 started





- **printed circuits** for FC electromechanics behaviour are under test (see Alex talk), can be relies of the dimension need and easy purchased. But we miss radio purity qualification

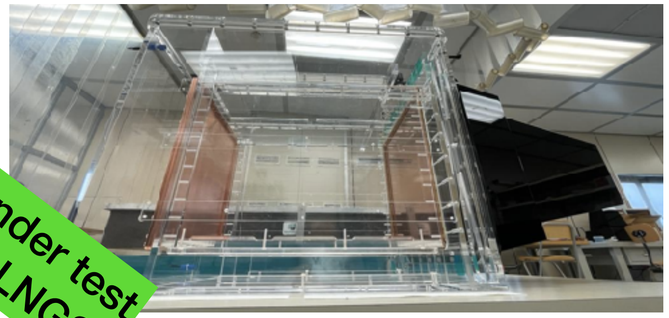
- **GEM and GEM frame** electromechanics test are ongoing (see Luigi talk), we need radio purity qualification in order to define material thickness allowed, material soft the screw, etc, etc.

- we plan to use Lomba **cathode**, we have only one sample of it, probably enough to assemble what we need. Test are in program close, but if we fail we run over of spare.

WP5-M5.2/D5.2 DAD & computing infrastructure

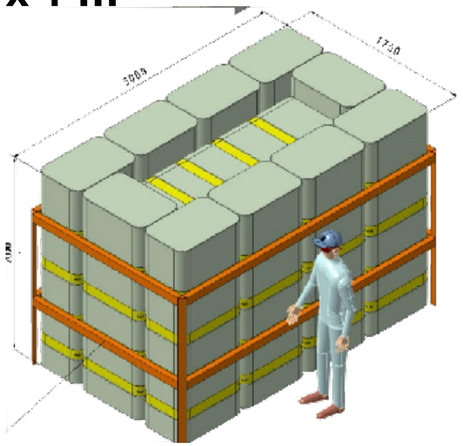
demonstrate the technique and …

LIME



under test at LNGS

x 1 …

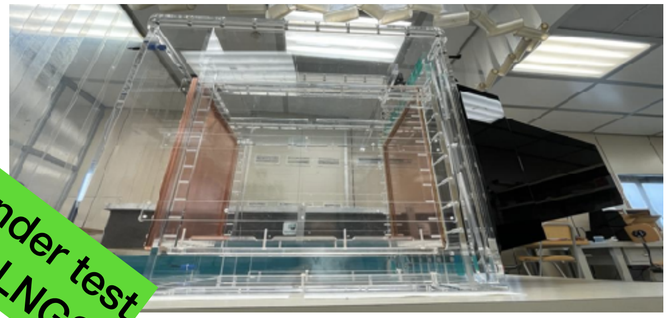


5*10 litres, 1 camera
10 MB/event 0.2—>0.01 Hz

WP5-M5.2/D5.2 DAD & computing infrastructure

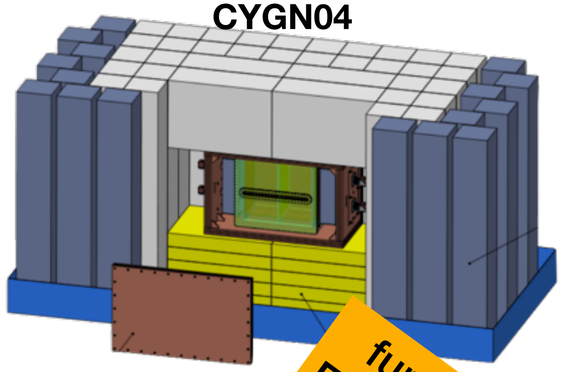
demonstrate the technique and feasibility of …

LIME



under test at LNGS

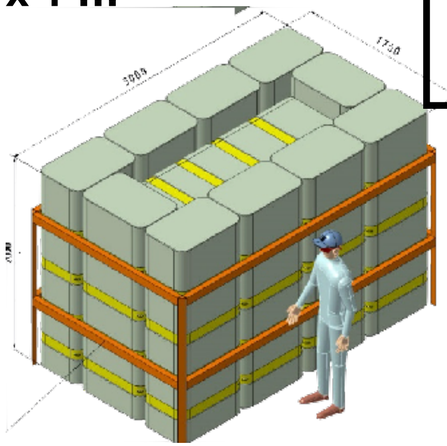
CYGN04



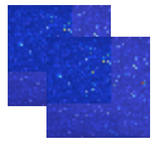
funded by ERC-INITIUM

10^7 readout channels + time signals
18 cameras monitoring 330*330 mm
each with **150 µm resolution** and a
sensitivity of ~ **1 ph / 2 eV** released in gas

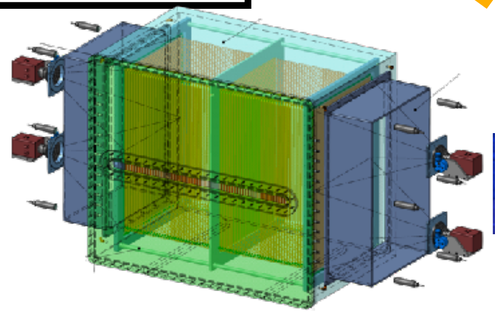
x 1 …



5*10 litres, 1 camera
10 MB/event 0.2—>0.01 Hz



x 2 …



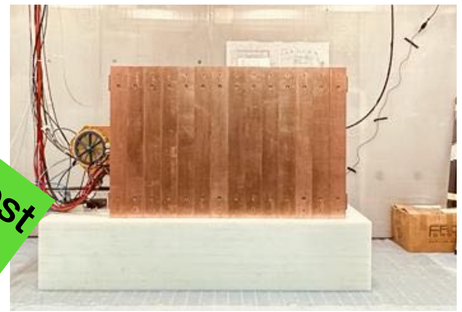
x 2 …

1*10^3 litres, 4 cameras
40 MB/event (Hz ?)

WP5-M5.2/D5.2 DAD & computing infrastructure

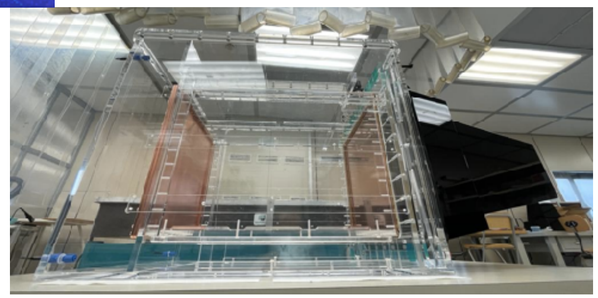
demonstrate the technique and feasibility of large scale detector

prototype



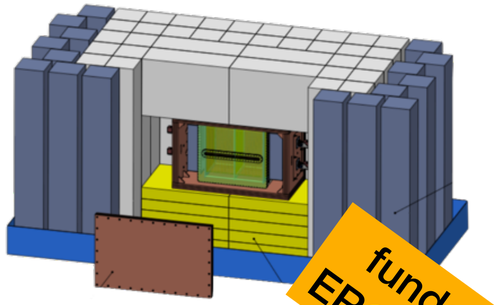
under test at LNGS

x 1 …



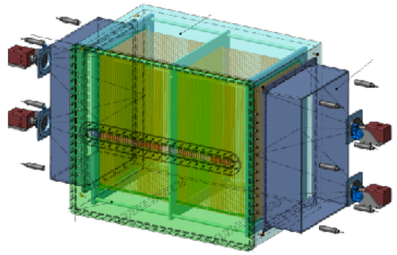
5*10 litres, 1 camera
10 MB/event 0.2—>0.01 Hz

CYGN04



funded by ERC-INITIUM

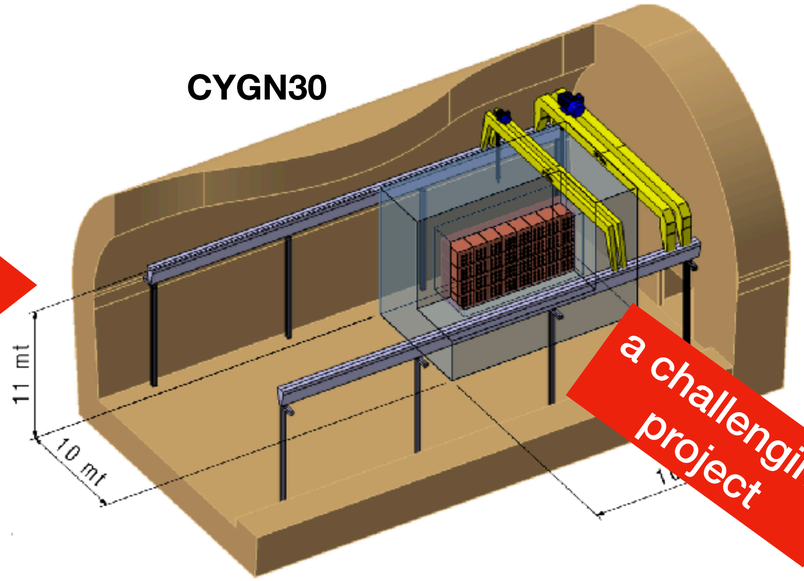
x 2 …



1*10^3 litres, 4 cameras
45 MB/event (Hz ?)

x 2 …

CYGN30



a challenging project

x N …

3*10^4 litres, > 100 cameras
4-5 GB/event (Hz ?)

D5.1 Gas System

phase1 - Apr. 23 (in late?)

- the gas system is our **single point of failure**, ti cost 80ke and we don’t have a spere;
- after about 1.5 year seems that main issue are resolved and we probably close the deliverable;
- actually the purification, part of the deliverable has never been tested. we are still running with part of the **chemical filter** and we never test the **radio cleaning one** fundamental for CYGNO-04;

conclusion

similar to last annual meeting conclusion…

- the **interference** between LIME fault and operation during the 2023 bring to a delay in some of the foreseen operations for this year starting from the WP4 duty.
- because of LIME operations the personnel in task of **WP2/WP5 and WP6 do not seems to be fully committed** to achievements of milestones/deliverable scheduled on the CYGNO-04 project.
- anyhow the most important critical points are:
  - we still do not have **fully decide how we want to build** the detector;
  - we sill don’t know if **we have the many to build it.**