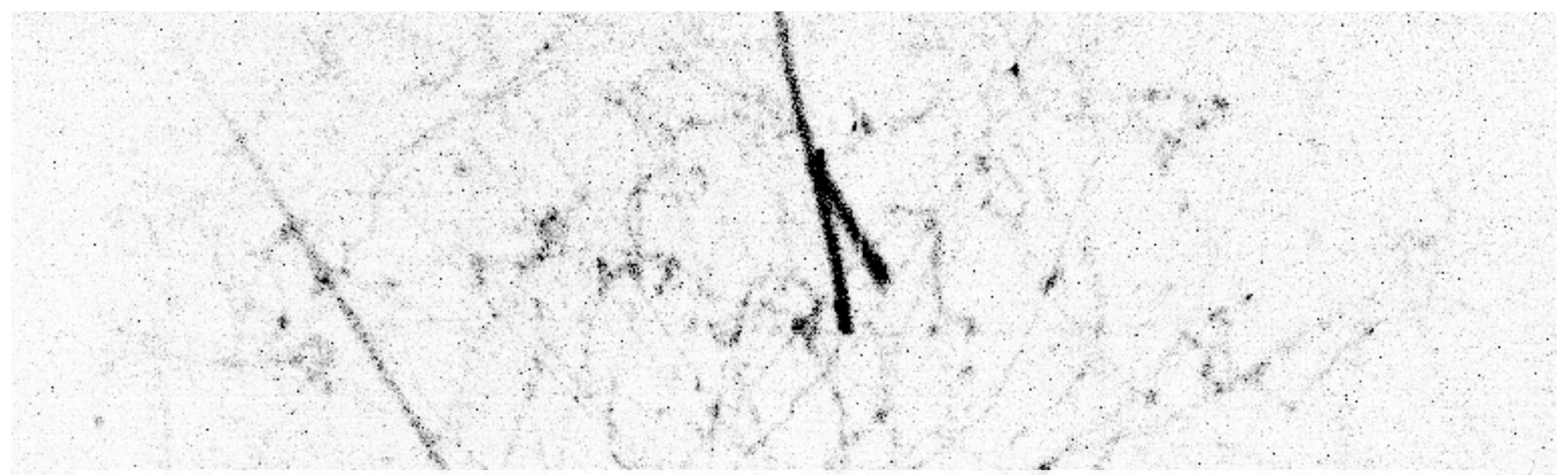


CYGNO Experiment

CYGNO status and plans
Feb 2025

INFN · Sapienza Università di Roma · GSSI · Roma Tre Università degli Studi · ENEA · The University Of Sheffield. · UFJF Universidade Federal de Juiz de Fora · UNICAMP · Universidade de Coimbra · CBPF · European Research Council Established by the European Commission

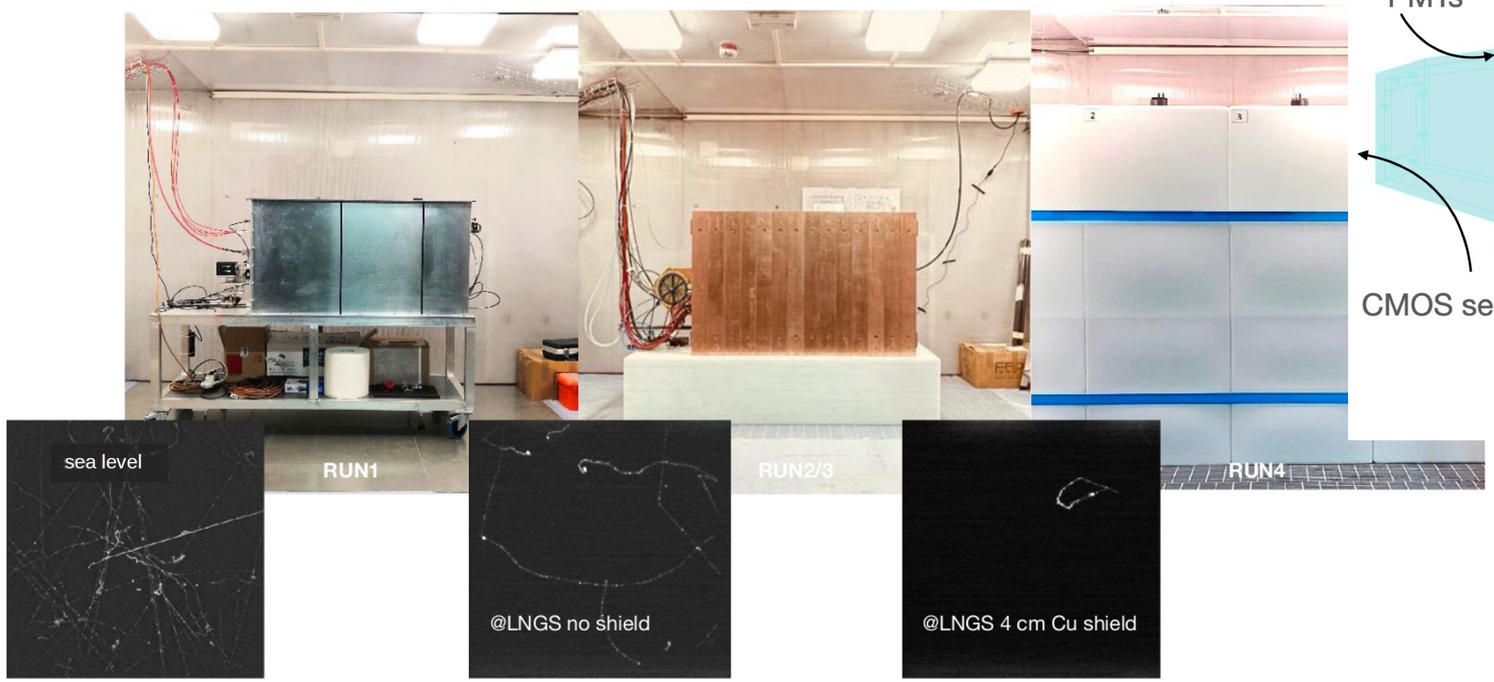
Collaboration Meeting 2024

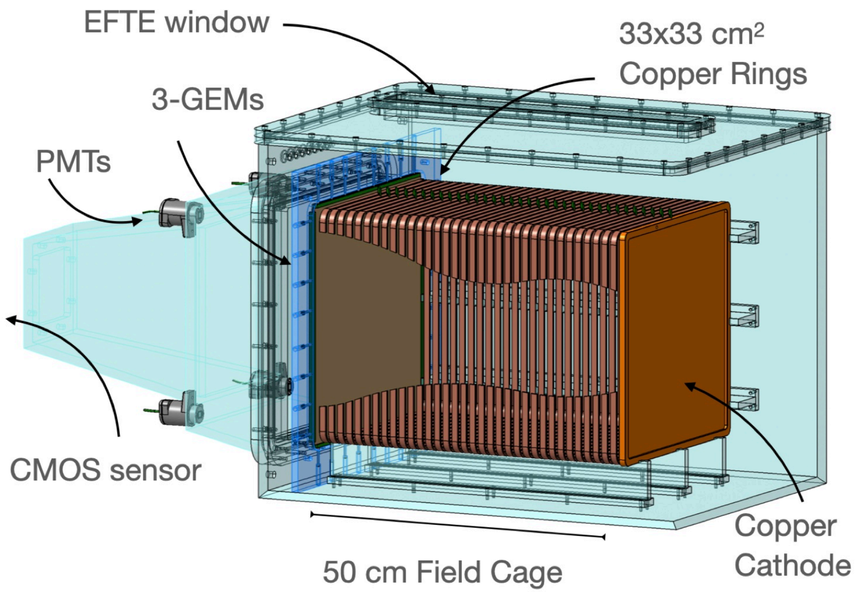
CYGNO Collaboration Meeting 2024

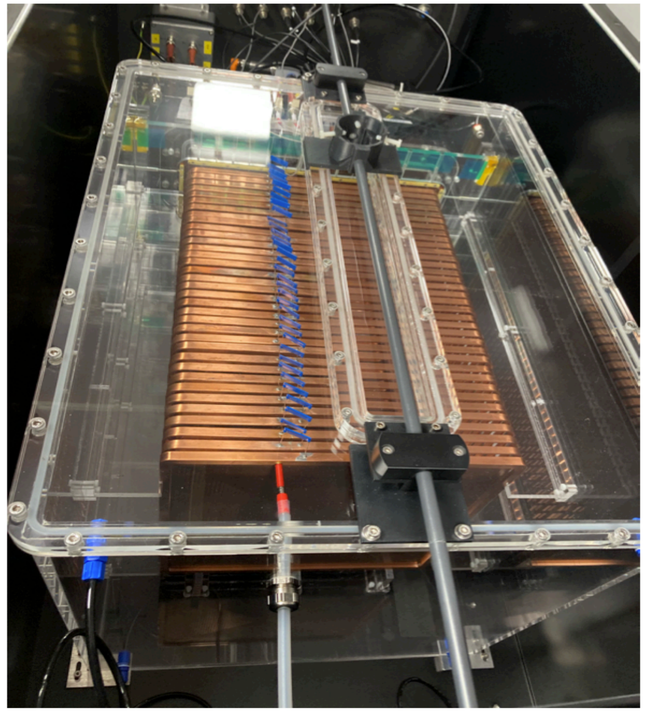
Three days of discussion about status and plans of:

- LIME Data **acquisition** and **analysis**;
- CYGNO04 **drawing** and **simulation**;
- Component **validation**;
- Project management and **financial status**;

LIME: RUNs 1-5







- testing and optimisation of **ancillary systems** (HV, Gas, Slow Control, DAQ, Reco, Monitoring);
- development and optimisations of data **analysis algorithms** and performance study;
- development and validation of **detector** and **background simulation**;

LIME: RUNs 1-5

	Time slot	Number of pictures	Event rate	Number of events
RUN 1: No-shielding	3 Nov 2023 - 15 Dec 2023	4 10^5	35 Hz	4 10^6
RUN 2: 4 cm Cu shielding	15 Feb 2023 - 15 March 2023	4.5 10^5	3.5 Hz	5 10^5
RUN 3: 10 cm Cu shielding	5 May 2023 - 16 Nov 2023	1.6 10^6	1.5 Hz	7.3 10^5
RUN 4: 10 cm Cu + 40 cm water shielding	30 Nov 2023 - 31 March 2024	2 10^6	1.0 Hz	6 10^5
RUN 5: 10 cm Cu shielding (neutron flux measurements)	17 May 2024 - 1 Dec 2024	12 10^6	1.5 Hz	5.4 10^6

Special data takings

AmBe for Nuclear Recoils	2-4 Aug 2023	2 10^5	0.04 Hz of NR	2.5 10^3 NR
^{241}Am for Electron Recoils	7-16 Nov 2023	7 10^5	50 Hz	10^6
AmBe for Nuclear Recoils	5-15 Dec 2024	6 10^5	0.04 Hz of NR	7.0 10^3 NR

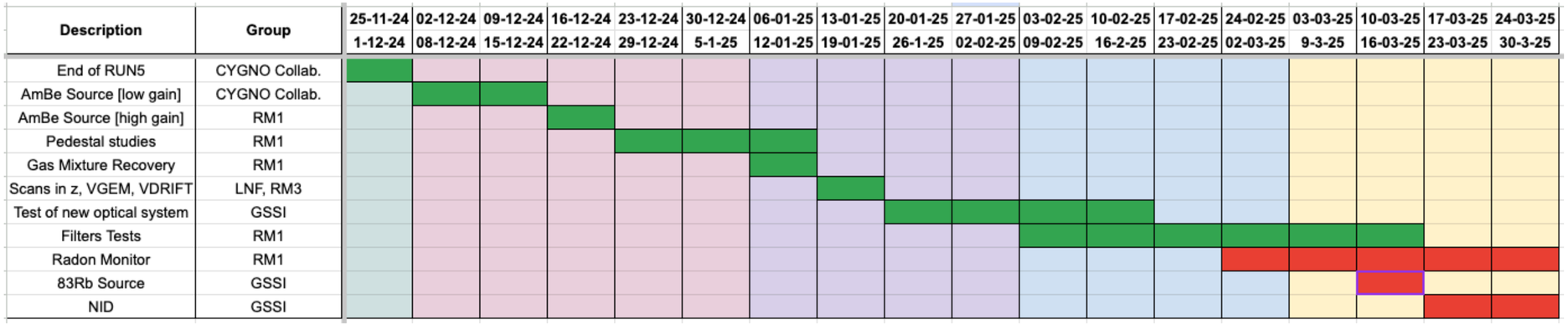
LIME PLANS

With the **end of RUN4** in March 2024, LIME data taking for **PHASE_0 is considered closed** with **3 months delay** (including the delayed start due to civil works) in over **27 months of operations**;

The water shielding was then removed and in **May 2024** and **RUN5** has been taken for 6 months to measure the **flux of underground neutrons**, in the framework of **PRIN "Zero Radioactivity on future experiments";**

Good exercise to **tune and test simulation and analysis algorithms** for **NR**, propaedeutical to DM search;

In **December 2024** a 10 days long **AmBe campaign** was performed



Description	Group	25-11-24 1-12-24	02-12-24 08-12-24	09-12-24 15-12-24	16-12-24 22-12-24	23-12-24 29-12-24	30-12-24 5-1-25	06-01-25 12-01-25	13-01-25 19-01-25	20-01-25 26-1-25	27-01-25 02-02-25	03-02-25 09-02-25	10-02-25 16-2-25	17-02-25 23-02-25	24-02-25 02-03-25	03-03-25 9-3-25	10-03-25 16-03-25	17-03-25 23-03-25	24-03-25 30-3-25
End of RUN5	CYGNO Collab.																		
AmBe Source [low gain]	CYGNO Collab.																		
AmBe Source [high gain]	RM1																		
Pedestal studies	RM1																		
Gas Mixture Recovery	RM1																		
Scans in z, VGEM, VDRIFT	LNF, RM3																		
Test of new optical system	GSSI																		
Filters Tests	RM1																		
Radon Monitor	RM1																		
83Rb Source	GSSI																		
NID	GSSI																		

From **January 2025** we are taking **technical runs** intended as **pre-commissioning** of sub-parts of **CYGNO04: new camera + lens, gas filters, new calibration source;**

A **Negative Ion Drift** run is foreseen before the closure**;**

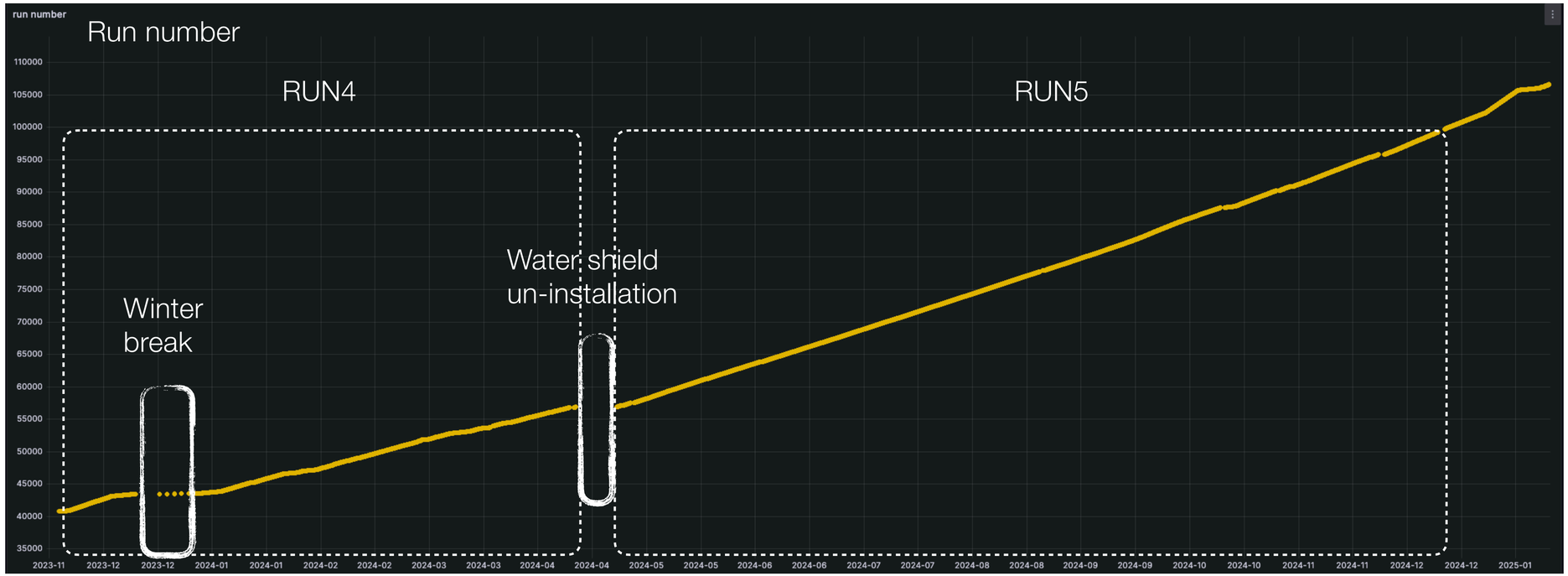
No shifts are required to collaboration, only sub-groups are responsible for these data taking;

LIME DATA TAKING SUMMARY

Ancillary systems: DAQ, Slow control

Data taking started in October 2023 never stopped;

More than **7x10^4 runs** have been taken for a total of **28 x 10^6 pictures**;



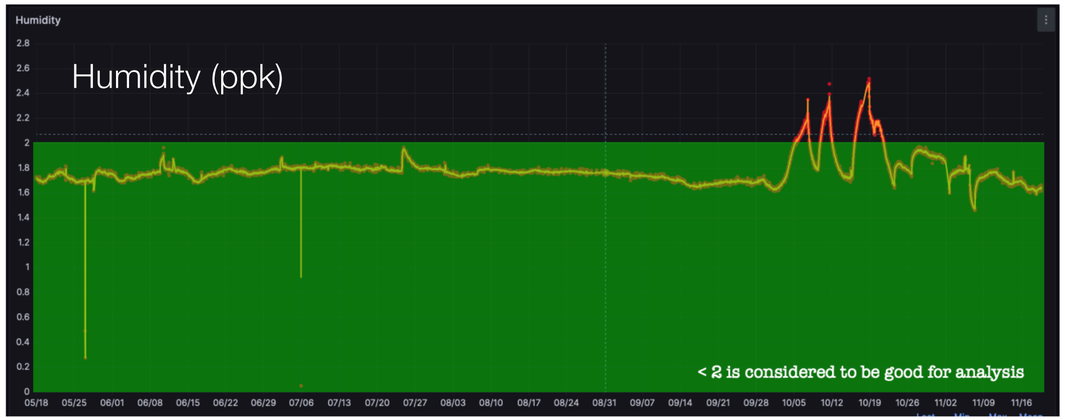
All of them have been **promptly transferred** on the INFN-Cloud and **reconstructed**;

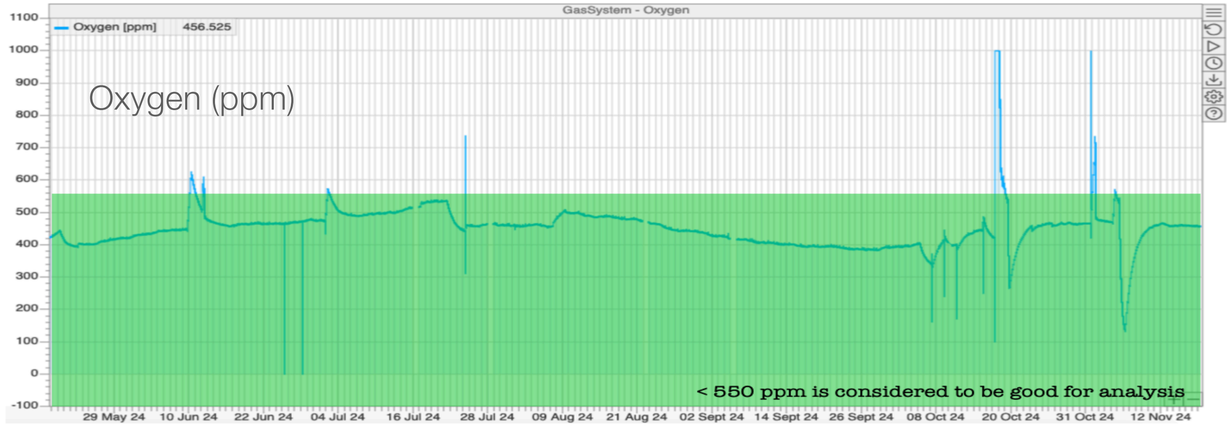
Reco-files are made available to the CYGNO users **few minutes after** the run was taken;

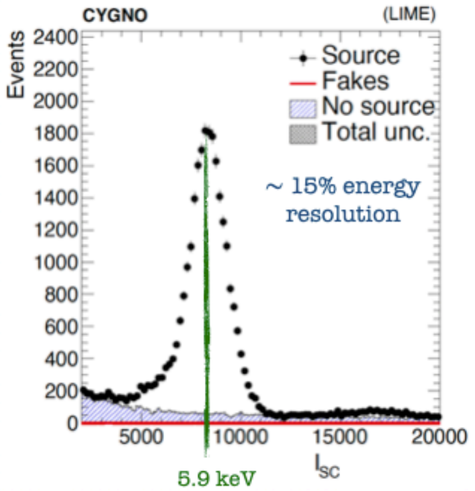
Ancillary systems: Gas and HV

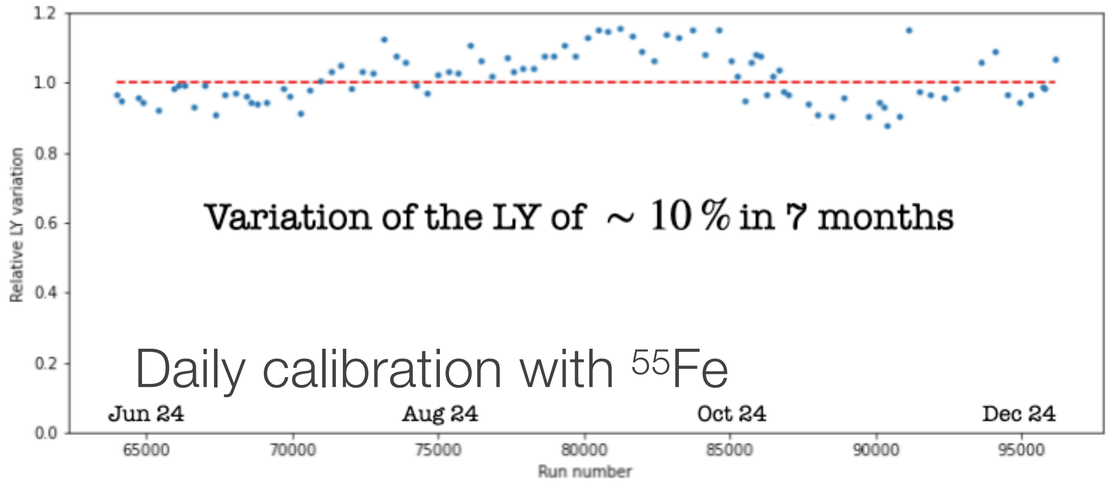
Less than one **spark-**like every 3 days was recorded in 2024 (12 times lesser than previous best limit …)

Gas **humidity, oxygen** and other **contaminants** were **under control** for the whole **2024**







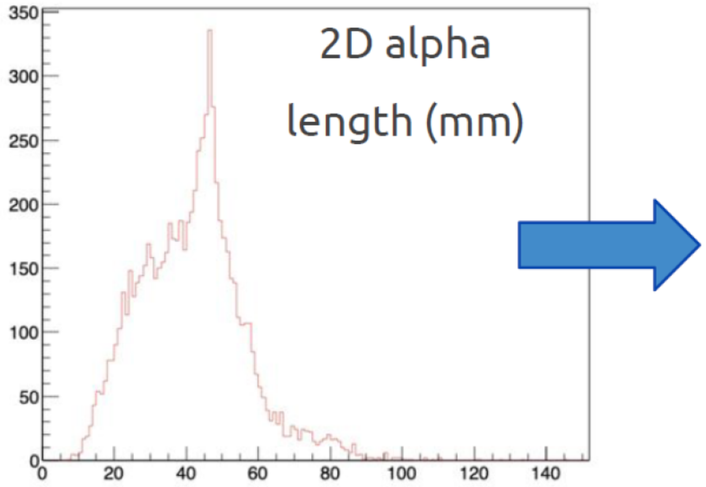


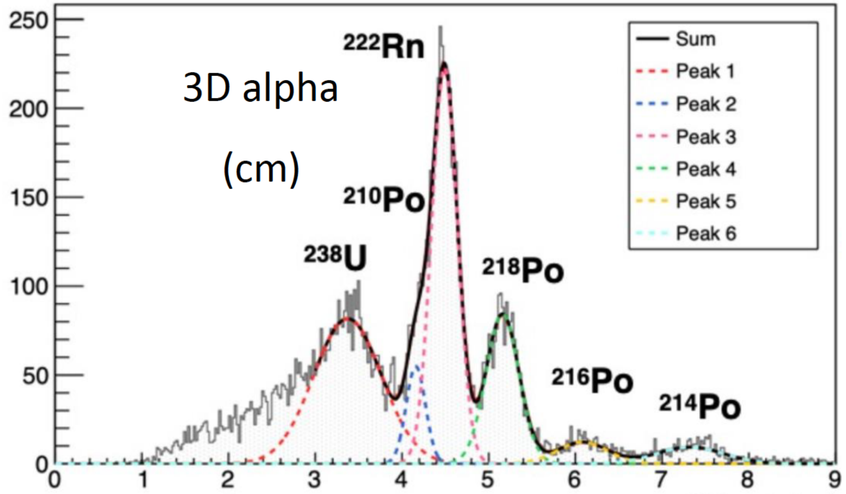
Detector calibration with **^{55}Fe** is now a **completely automated** procedure and showed a **stability with 7% RMS** over 6 months

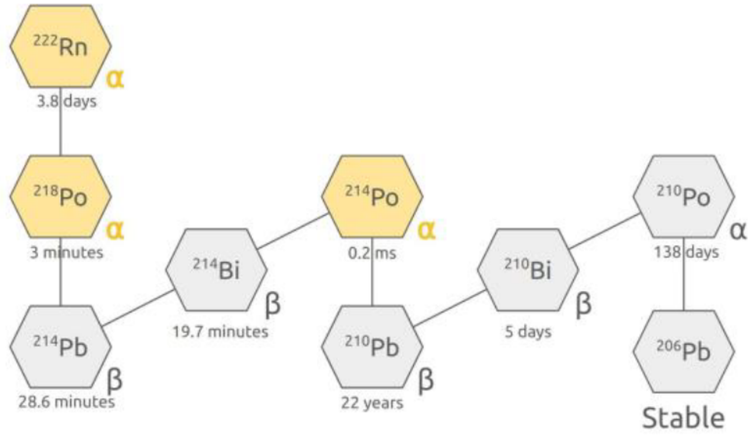
LIME DATA ANALYSIS SUMMARY

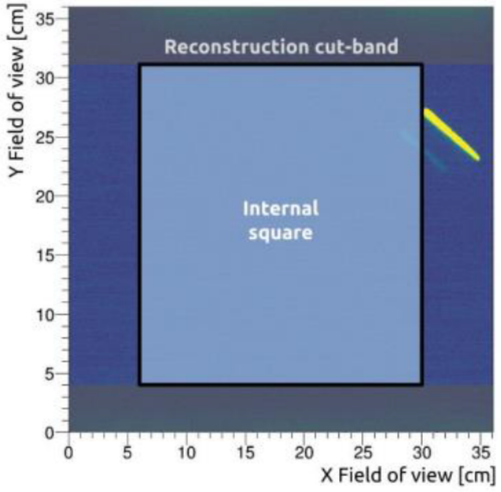
3D and Radon

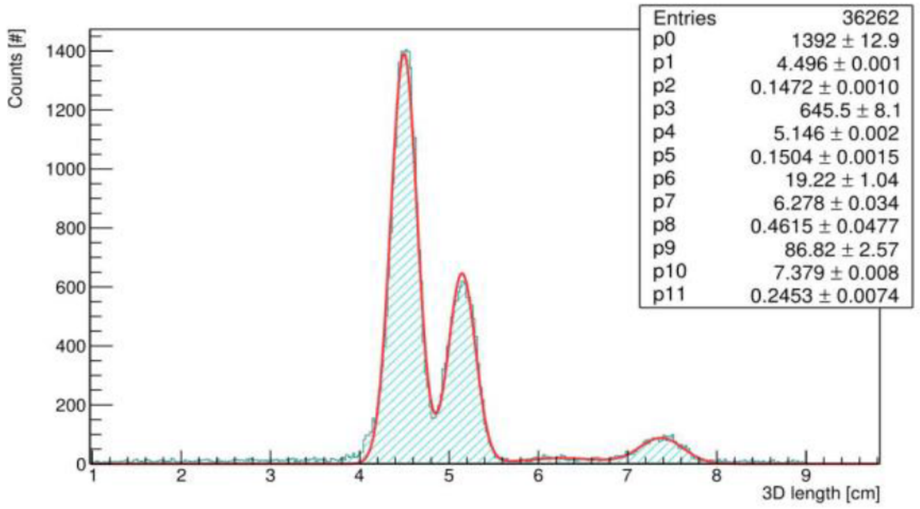
3D reconstruction allowed a precise measurement of the length of the alpha tracks with a consequent assessment of their energies









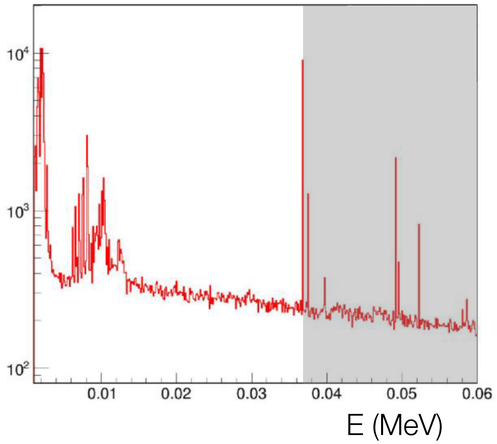


Isotope	Energy (MeV)	Expected length (mm)	Measured length (mm)
^{222}Rn	5,50	45,7	44,3
^{218}Po	6,00	51,0	51,2
^{214}Po	6,79	71,0	72,3

^{222}Rn contamination **confirmed**

3D and Radon

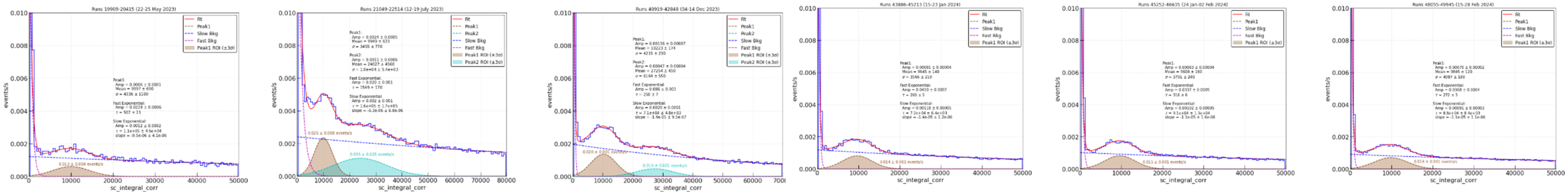
Is there any correlation between the ^{222}Rn quantity (evaluable from the rate of the high energy tracks) and the low energy part of the spectrum?



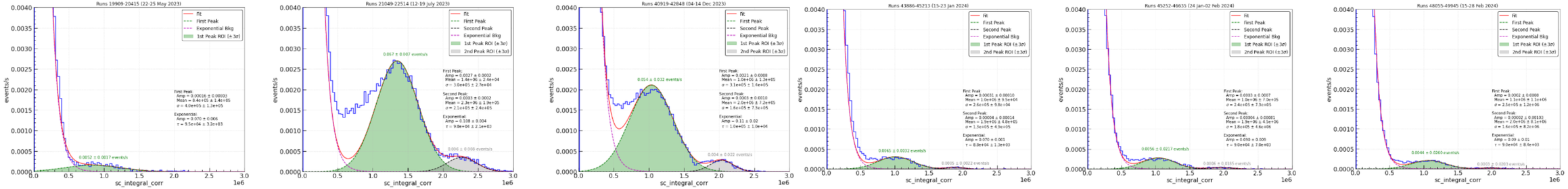
Energy deposits from ^{222}Rn chain GEANT

RUN3: May 2023 only fresh gas | **RUN3: July 2023 high contamination** | **RUN4: Dec 2023 part-unfiltered** | **RUN4: Jan 2024 filtered** | **RUN4: Feb 2024 filtered** | **RUN4: Feb 2024 filtered**

low energy



high energy

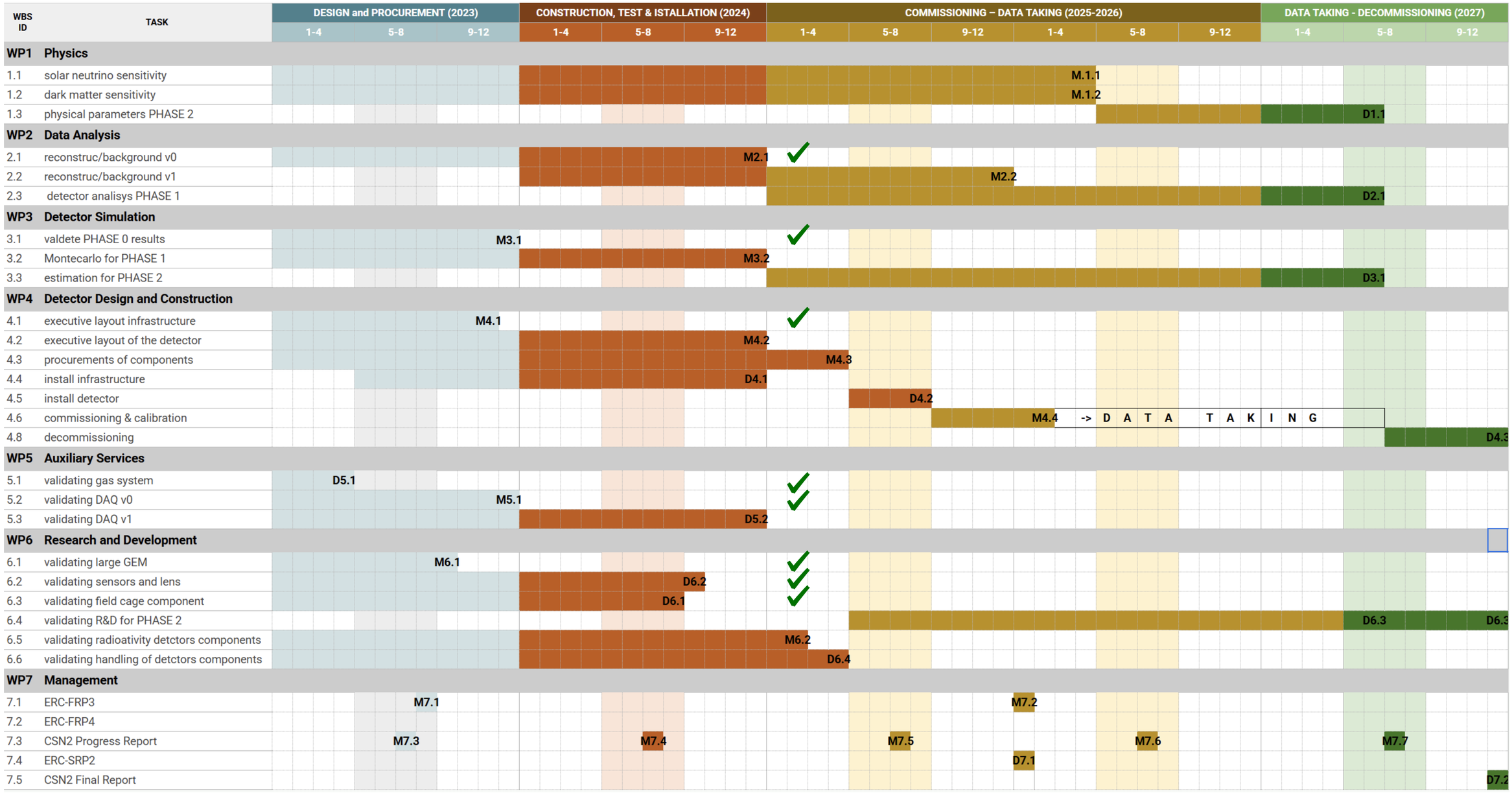


A **quantitative** study on the **correlation** between the two regions is **under study**;

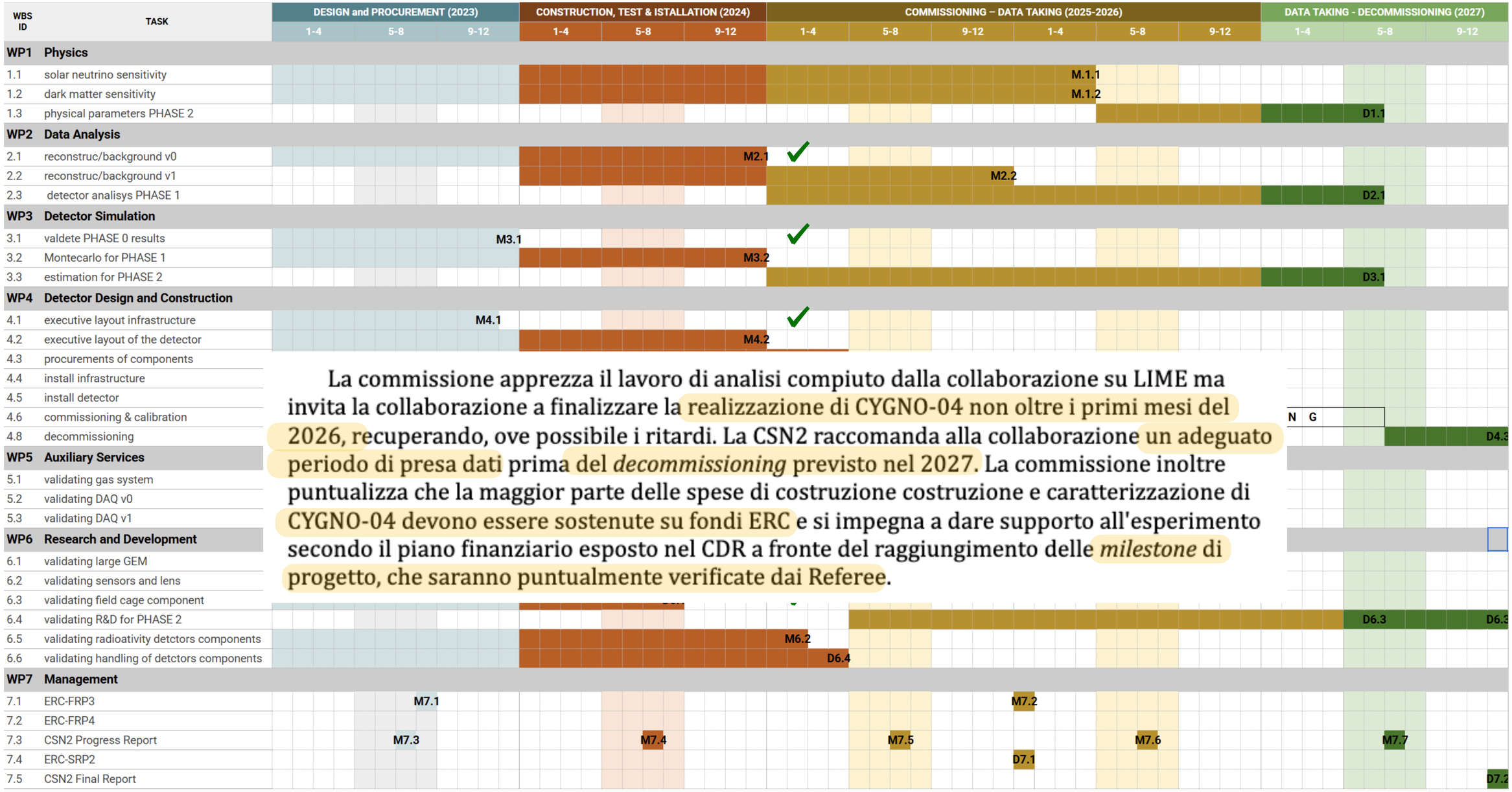
Measurement campaign with a new **radon-meter** will start in 10 days;

CYGNO04

CYGNO04 GANTT Progress Report 2024



CYGNO04 GANTT Progress Report 2024



La commissione apprezza il lavoro di analisi compiuto dalla collaborazione su LIME ma invita la collaborazione a finalizzare la realizzazione di CYGNO-04 non oltre i primi mesi del 2026, recuperando, ove possibile i ritardi. La CSN2 raccomanda alla collaborazione un adeguato periodo di presa dati prima del *decommissioning* previsto nel 2027. La commissione inoltre puntualizza che la maggior parte delle spese di costruzione costruzione e caratterizzazione di CYGNO-04 devono essere sostenute su fondi ERC e si impegna a dare supporto all'esperimento secondo il piano finanziario esposto nel CDR a fronte del raggiungimento delle *milestone* di progetto, che saranno puntualmente verificate dai Referee.

CYGNO Management

In Nov 2024 **Davide Fiorina** (GSSI) was appointed as Technical Coordinator for CYGNO, 6 months later Giovanni Mazzitelli resignation;

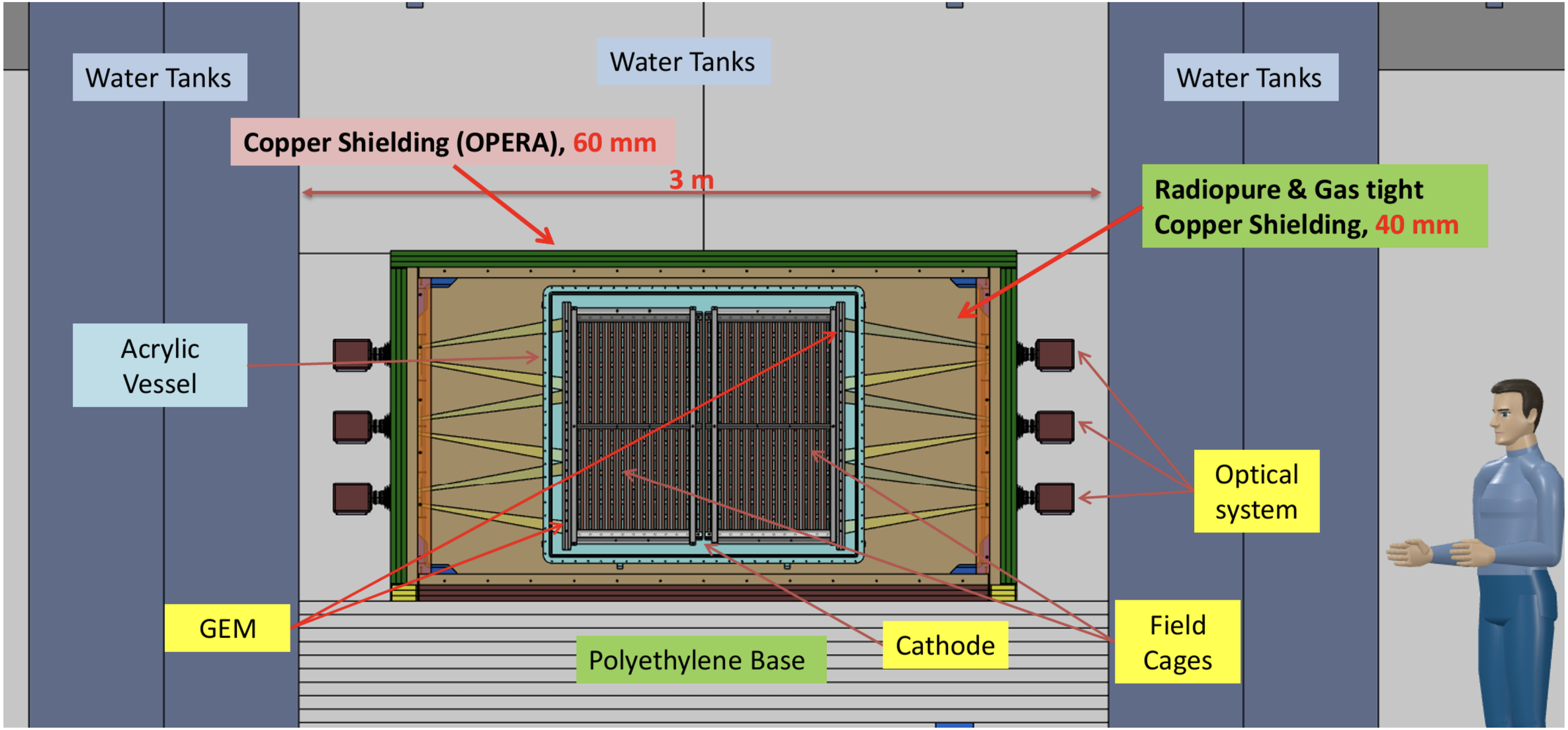
With the new year and a stabilised situation, it became clear that the **delay** in producing the **executive drawings for CYGNO04** was unrecoverable by relying solely on the forces available to LNF's Design Dervice

We therefore asked the **LNGS Design Service** for support: merging and sharing their resources with LNF’s one can be the **opportunity to finalise the work** done so far in a reasonable time interval;

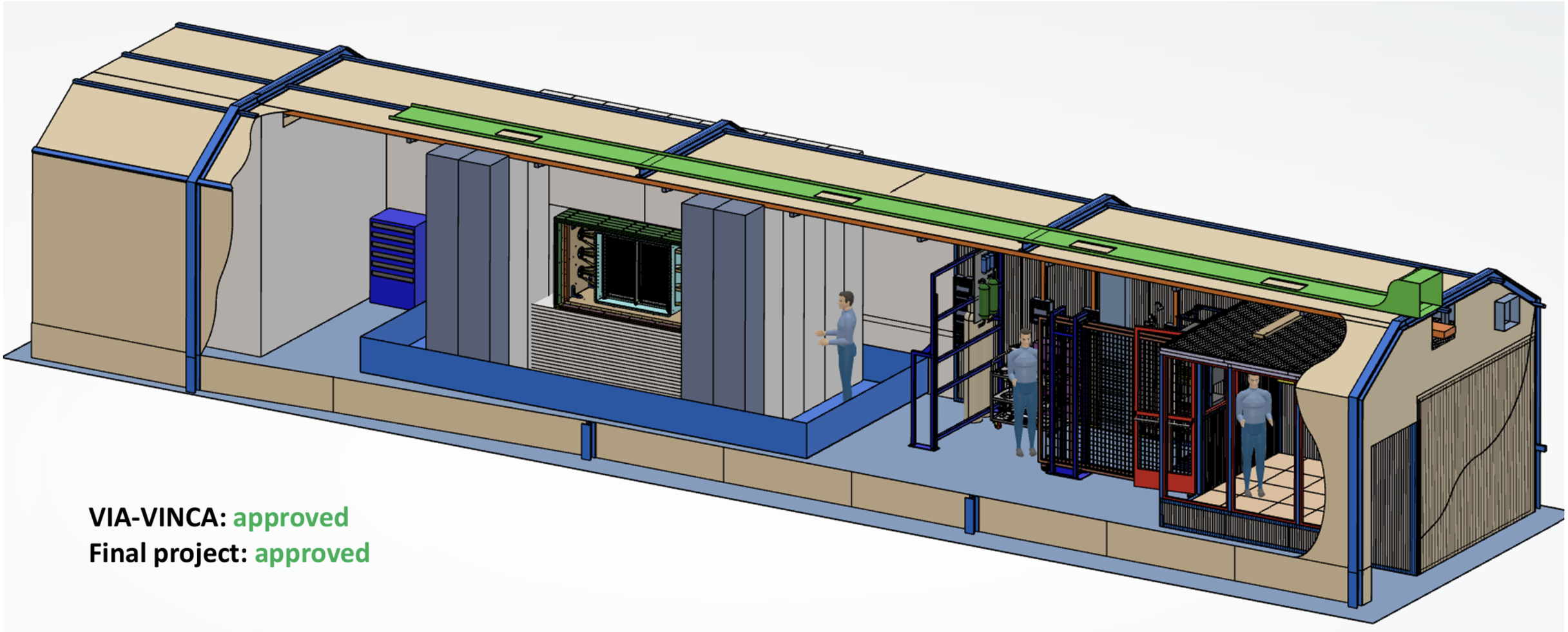
In order to reach this aim, the proposal issued by the LNGS+LNF Services is the creation of a **task force** including:

- **a designer** with the supervision of the **heads of the Services** from **both** the labs;
- having as **direct link to CYGNO** Collaboration the **Technical Coordinator** supported by Davide Pinci as CYGNO spokesperson;
- We are now on the correct path to deliver the detector in the **first trimester of 2026**

CYGNO04

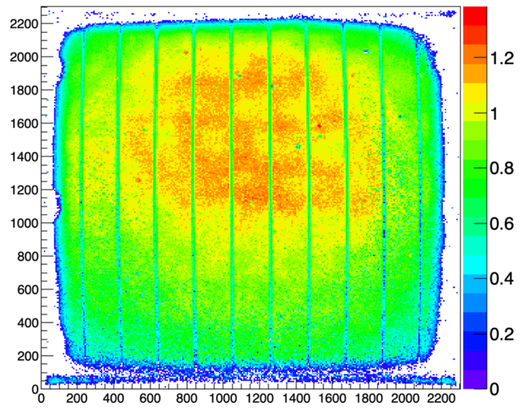

Water Tanks
Water Tanks
Water Tanks
Copper Shielding (OPERA), 60 mm
3 m
Radiopure & Gas tight
Copper Shielding, 40 mm
Acrylic
Vessel
Optical
system
GEM
Polyethylene Base
Cathode
Field
Cages

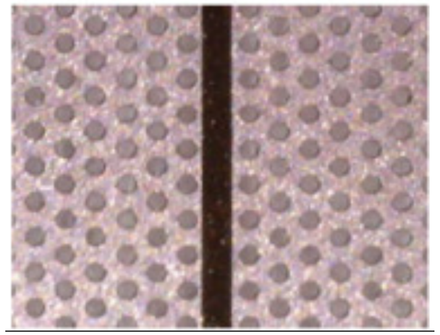
Hall-F Infrastructure

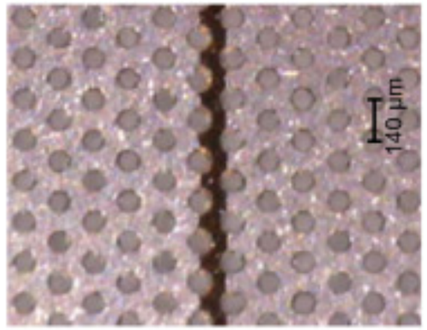


- Civil works **started** this week and **delivery** expected **end of February**;
- In accordance with the CYGNO04 timeline;

Component Validation - GEM

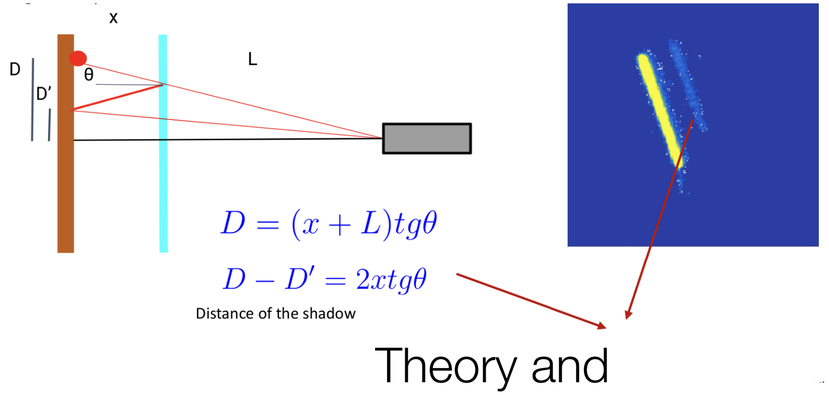




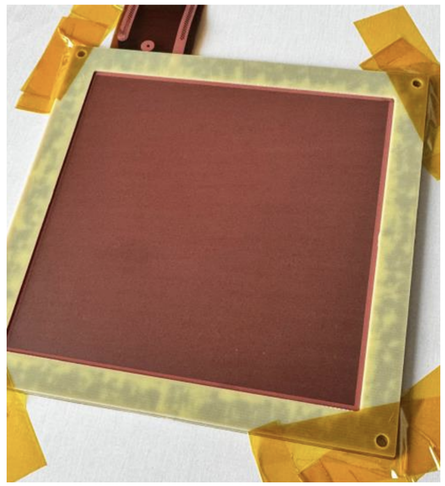


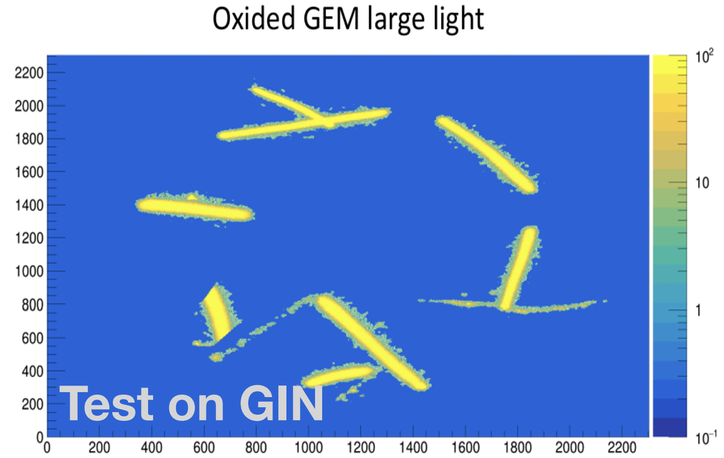
Random **segmentation** should reduce the dead area while keeping the operational stability (tested by CMS-GEM)

Oxidised GEM **avoiding reflection** of large light emission on the PMMA window as observed in LIME



Theory and measurement agree

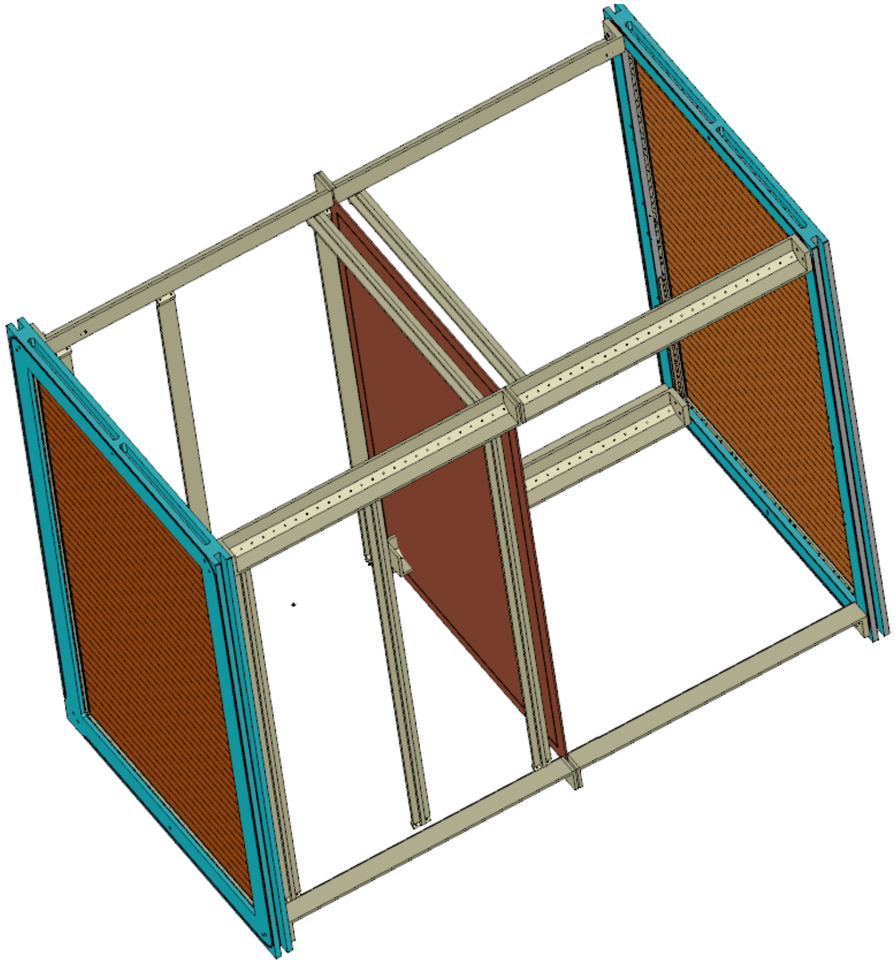


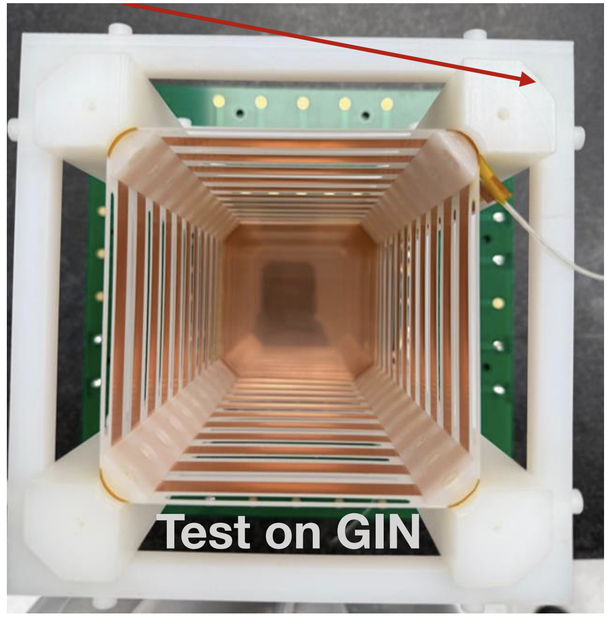


Done!

Studies and developments **funded** by CSN2 in past years

Component Validation - Field Cage





Field Cage **Structure in Nylon66**

- Field rings made by copper strips on Kapton (PET as backup)
- Resistors soldered on one side

The cathode **will be a Kapton foil copper clad on both sides**

- Backup solution, full copper plate

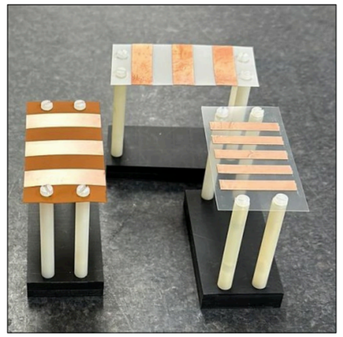
Done!

Studies and developments **funded** by CSN2 in past years

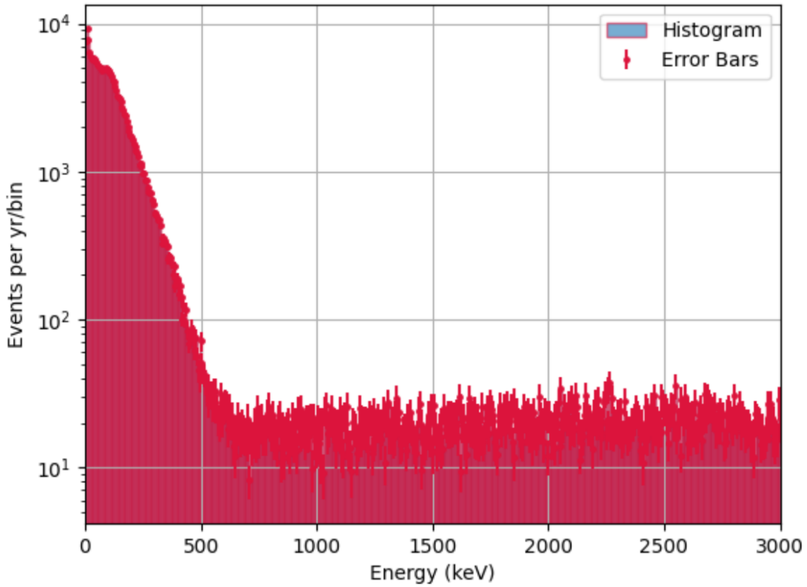
Component Validation - Field Cage

Field Cage Foils

- Three different field cage foils:
  - **PET+Cu with glue**: a polyethylene foil with Cu strips glued by spreading the adhesive over the entire foil
  - **PET+Cu with no glue**: a polyethylene foil with Cu strips glued by applying the adhesive only between the strips and the foil
  - **Kapton+Cu:** a kapton foil with Cu strips
- The foils were measured at LNGS



Sample Name	in measure	measured	analysed
FC-kapton+Cu	no	yes	yes
FC-PET+Cu	no	yes	yes
FC-PET+Cu no glue	no	yes	yes
nylon6	no	yes	on-going
GEM foil	no	yes	on-going
nylon screws	no	yes	on-going
steel screws	no	yes	on-going
SMD resistors	no	yes	on-going
CMOS camera	no	yes	yes
PMMA	yes	no	no

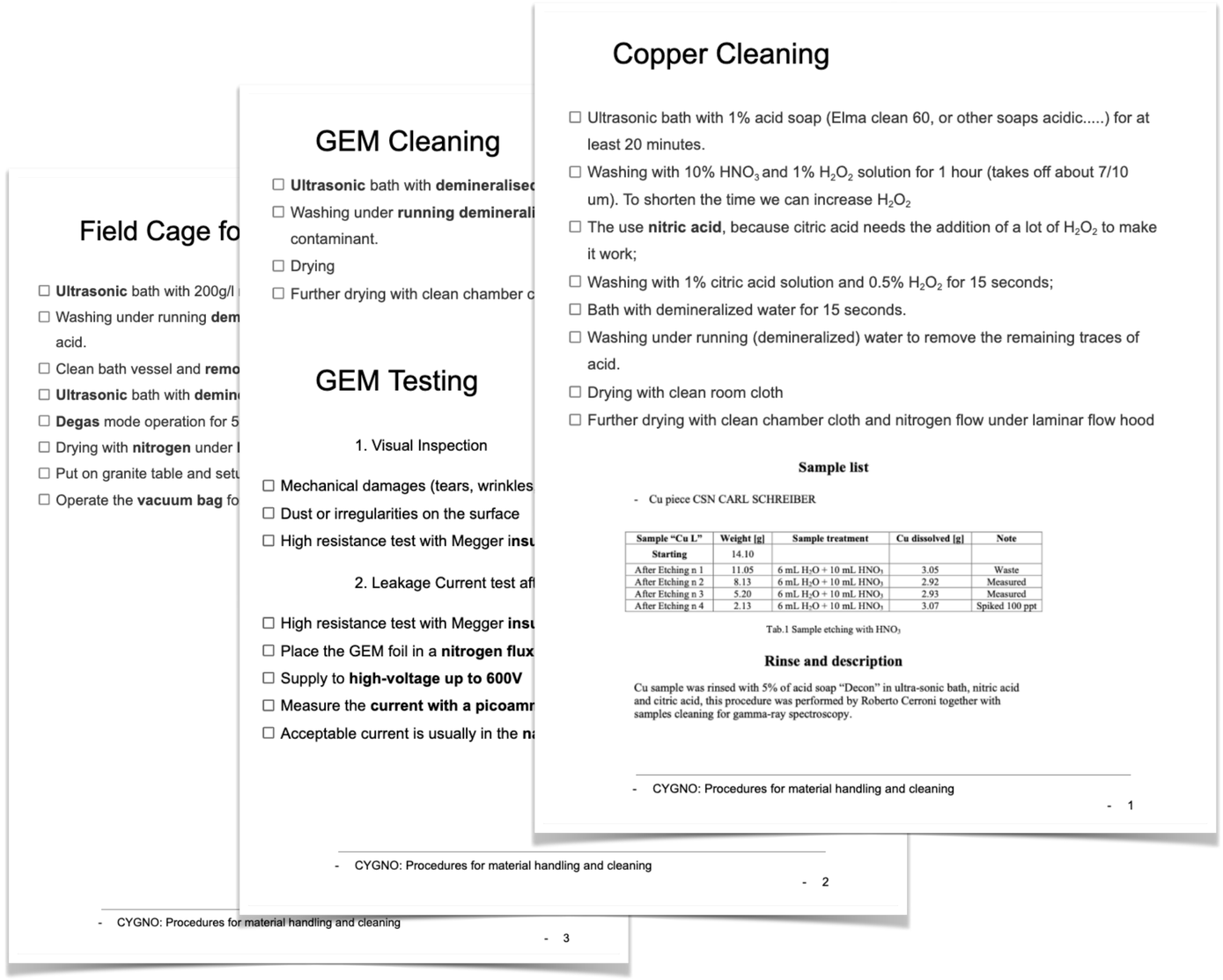


In the low energy range (1-20 keV):

- **(1.56 ± 0.01) 10^5** evt/year;
- **(1.20 ± 0.08) 10^3** NR evt/year;

Done!

Component handling procedures



Field Cage fo

- ☐ **Ultrasonic** bath with 200g/l
- ☐ Washing under running **dem** acid.
- ☐ Clean bath vessel and **remo**
- ☐ **Ultrasonic** bath with **demin**
- ☐ **Degas** mode operation for 5
- ☐ Drying with **nitrogen** under
- ☐ Put on granite table and setu
- ☐ Operate the **vacuum bag** fo

- CYGNO: Procedures for material handling and cleaning - 3

GEM Cleaning

- ☐ **Ultrasonic** bath with **demineralise**
- ☐ Washing under **running demineral** contaminant.
- ☐ Drying
- ☐ Further drying with clean chamber c

GEM Testing

1. Visual Inspection

- ☐ Mechanical damages (tears, wrinkles
- ☐ Dust or irregularities on the surface
- ☐ High resistance test with Megger **insu**

2. Leakage Current test af

- ☐ High resistance test with Megger **insu**
- ☐ Place the GEM foil in a **nitrogen flux**
- ☐ Supply to **high-voltage up to 600V**
- ☐ Measure the **current with a picoamm**
- ☐ Acceptable current is usually in the **na**

- CYGNO: Procedures for material handling and cleaning - 2

Copper Cleaning

- ☐ Ultrasonic bath with 1% acid soap (Elma clean 60, or other soaps acidic.....) for at least 20 minutes.
- ☐ Washing with 10% HNO_3 and 1% H_2O_2 solution for 1 hour (takes off about 7/10 um). To shorten the time we can increase H_2O_2
- ☐ The use **nitric acid**, because citric acid needs the addition of a lot of H_2O_2 to make it work;
- ☐ Washing with 1% citric acid solution and 0.5% H_2O_2 for 15 seconds;
- ☐ Bath with demineralized water for 15 seconds.
- ☐ Washing under running (demineralized) water to remove the remaining traces of acid.
- ☐ Drying with clean room cloth
- ☐ Further drying with clean chamber cloth and nitrogen flow under laminar flow hood

Sample list

- Cu piece CSN CARL SCHREIBER

Sample "Cu L"	Weight [g]	Sample treatment	Cu dissolved [g]	Note
Starting	14.10			
After Etching n 1	11.05	6 mL H_2O + 10 mL HNO_3	3.05	Waste
After Etching n 2	8.13	6 mL H_2O + 10 mL HNO_3	2.92	Measured
After Etching n 3	5.20	6 mL H_2O + 10 mL HNO_3	2.93	Measured
After Etching n 4	2.13	6 mL H_2O + 10 mL HNO_3	3.07	Spiked 100 ppt

Tab.1 Sample etching with HNO_3

Rinse and description

Cu sample was rinsed with 5% of acid soap "Decon" in ultra-sonic bath, nitric acid and citric acid, this procedure was performed by Roberto Cerroni together with samples cleaning for gamma-ray spectroscopy.

- CYGNO: Procedures for material handling and cleaning - 1

We are collecting all procedures materials and parts cleaning, handling, testing and quality assessment in a shared document

Component Validation - Copper Shield

Copper analysis with ICPMS

- They used the described procedure to clean it and measured the U and Th content

	Etching 2	Etching 3
	[pg * g^{-1}]	[pg * g^{-1}]
Th	9 ± 3	7 ± 2
U	5 ± 2	2 ± 1

- These were the Matthias results

```
radionuclide concentrations:

Th-232:
Ra-228:        < 0.38 mBq/kg          <==>    < 9.3 E-11 g/g
Th-228:        < 0.20 mBq/kg          <==>    < 4.9 E-11 g/g

U-238:
Ra-226         < 0.44 mBq/kg          <==>    < 3.5 E-11 g/g
Th-234         < 17 mBq/kg            <==>    < 9.3 E-10 g/g
Pa-234m        < 11 mBq/kg            <==>    < 6.5 E-10 g/g

U-235:         < 0.37 mBq/kg          <==>    < 6.5 E-10 g/g

K-40:          < 3.2 mBq/kg           <==>    < 1.0 E-7 g/g

Cs-137:        < 0.14 mBq/kg

Co-60:         < 0.12 mBq/kg

Co-58:         (0.8 +- 0.1) mBq/kg

Mn-54:         (0.12 +- 0.05) mBq/kg
```

^{58}Co has an half life of 70 days
^{54}Mn has an half life of 1 year

	October
Layer_0 (1-20 keV) [evts/yr]	14655 ± 347
Layer_1 (1-20 keV) [evts/yr]	4518 ± 176
Layer_2 (1-20 keV) [evts/yr]	10588 ± 2671
TOTAL	**29761 ± 2700**

Significant **improvement** thanks to ICP-MS measurement of Schrieber's copper

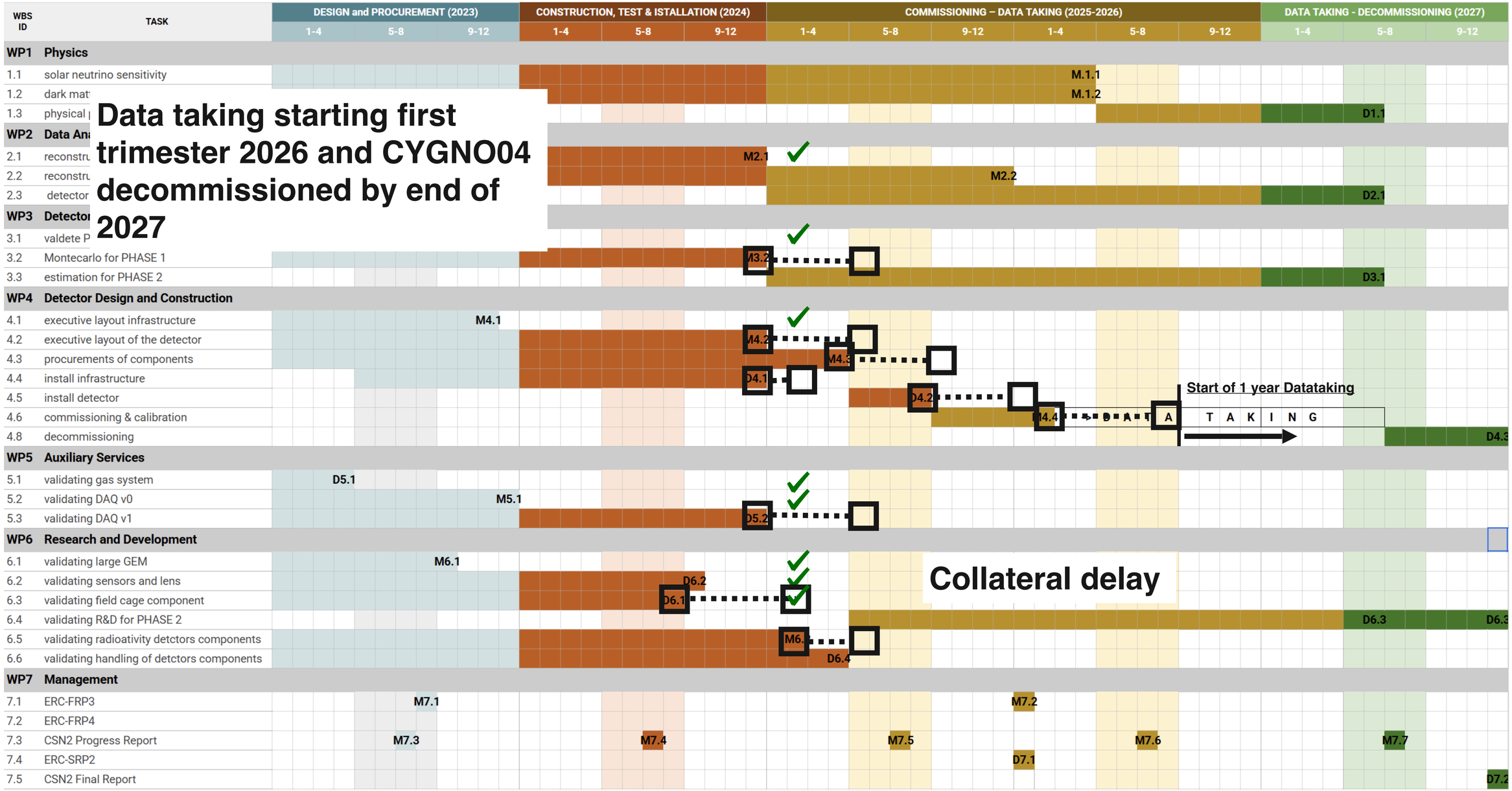
Huge statistics required to see first effects of Bi210 in OPERA's copper
→ **more storage space needed**

In light of the updated results, the most viable option is still
4 cm clean copper + 6 cm OPERA

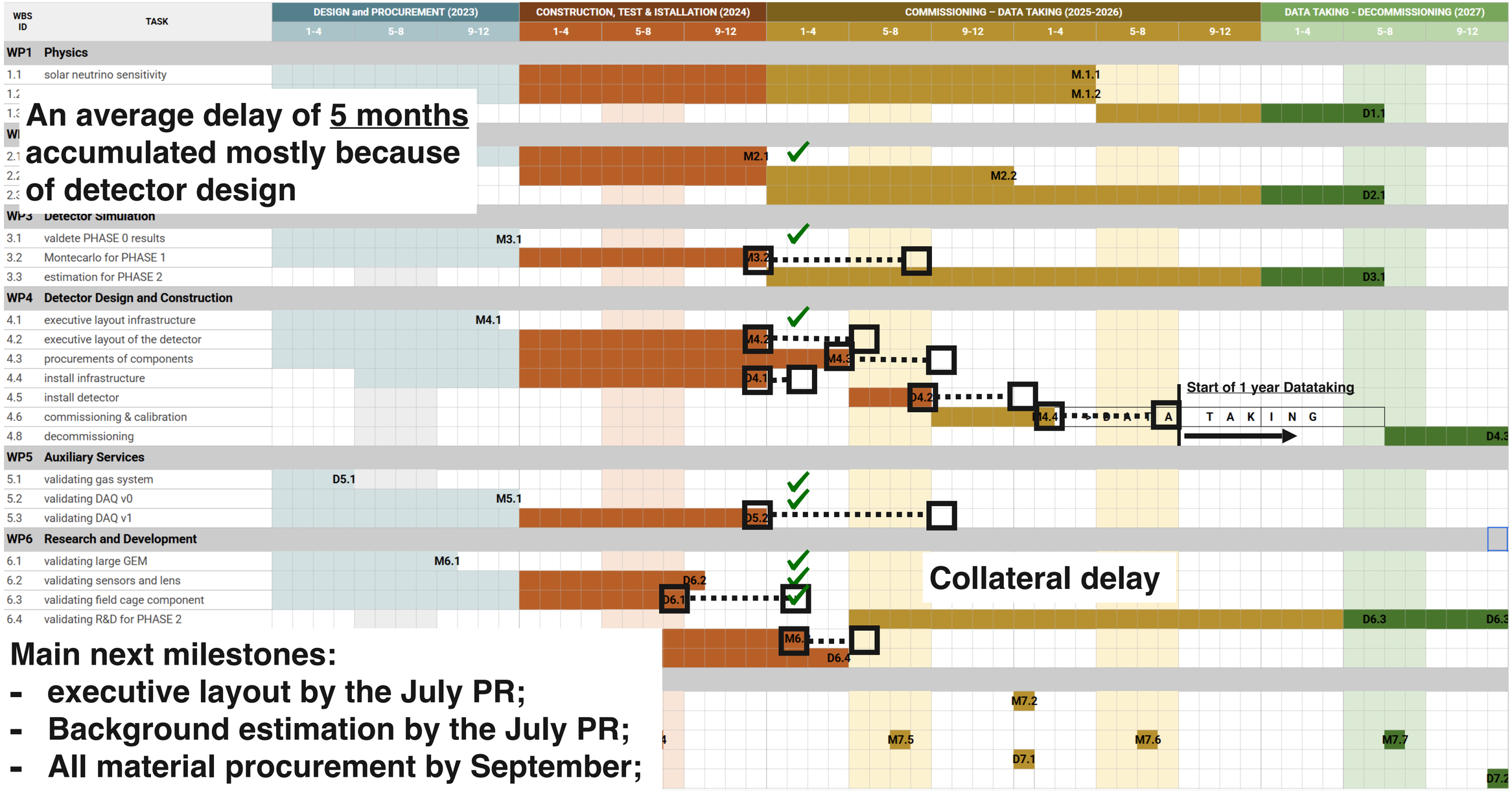
Upper limits on U and Th obtained with Germanium detector, 10 times larger than actual values

Field Cage and **GEM** foils are now on queue for the ICPMS measurements

CYGNO04 GANTT Up to date



CYGNO04 GANTT Up to date



An average delay of 5 months accumulated mostly because of detector design

Collateral delay

Main next milestones:

- **executive layout by the July PR;**
- **Background estimation by the July PR;**
- **All material procurement by September;**

TDR CYGNO financial plan and CSN2 proposal

Financial profile for ERC and INFN from the **2022 TDR**

Year	INITIUM/ERC	CYGNO/INFN
2019	20	54
2020	201	44
2021	71	96
2022	40	96
2023	374	120
2024	302	125
2025	60	135
2026	0	95
2027	0	50
Tot 23-27	736	525
Tot	**1068**	**815**

The new situation had very negligible effects on the financial plans:

A total of **490 k€** are expected to being funded by INFN for the quinquennium 2023-2027 (**515 k€** foreseen in the **TDR)**

Financial profile for ERC and INFN from the up to date

Year	INITIUM/ERC	CYGNO/INFN
2019	20	54
2020	201	44
2021	71	96
2022	40	96
2023	164	93.5
2024	359	91.5
2025	276	145
2026	0	80
2027	0	80
Tot 23-27	799	490
Tot	**1131**	**780**

- In particular **305 k€** foreseen by INFN in 25-27;

- A total of **1131 k€** are expected to being funded by ERC for the quinquennium 2023-2027 (**1068 k€** foreseen in the **TDR)**

CYGNO04 Economic sustainability

Currently, from the ERC fundings, to cover the core costs of CYGNO04, there are a total of **300 k€** available at **INFN** and **GSSI**

Part of the equipment is being used and validated on LIME:

- high voltage system;
- gas system;
- DAQ and trigger;

According to the latest quotations received, the **other costs** expected for the **construction** of CYGNO04 is of **276 k€**, therefore an expense that can **be fully covered with ERC funds.**

Deadline for finalizing **purchases: August 2025**

The **total value** of **CYGNO04** is of about **940 k€.**

GAS VOLUME	Cone and GEM holders	5	1	5	0	1	5	35
	Vessel	30	1	30	0	1	30	
READOUT	4-GEM Set	10	2	20	2	0	0	14
	Orca Quest	26	6	156	6	0	0	
	Camera mechanics	1	6	6	0	6	6	
	Lenses	2	6	12	2	4	8	
	PMT+Socket	1	16	16	16	0	0	
CATHODE	Frame+foil+feedthrough	17	1	17	0	1	17	17
FIELD CAGE	Field Cage	13	1	13	0	1	13	13
CALIBRATION SYSTEM	Kripton-Rubidium	6	1	6	0	1	6	8
	55-Fe system	2	1	2	0	1	2	
SHIELDING	4 ton Copper Elsasser	176	1	176	1	0	0	165
	copper precision machinering	10	1	10	0	1	10	
	Opera copper refurbishing	30	1	30	0	1	30	
	High Voltage feed through	10	1	10	0	1	10	
	Optical windows	10	1	10	0	1	10	
	water tanks	65	1	65	0	1	65	
	frame	20	1	20	0	1	20	
	polietilene	20	1	20	0	1	20	
GAS SYSTEM	gas system	85	1	85	1	0	0	0
	filters	1	8	8	8	0	0	
HV SYSTEM	GEM-HV	5	1	5	1	0	0	0
	PMT-HV	3	2	6	2	0	0	
	Cathode HV	5	1	5	1	0	0	
DAQ & SLOW CONTROLS	modules	45.5	1	45.5	1	0	0	0
COMPRESSED AIR SYSTEM	filters and pipes	5	1	5	0	1	5	5
ELECTRIC SERVICES	power distribution system	10	1	10	1	0	0	0
	cables & connectors	5	1	5	1	0	0	
	UPS	5	1	5	1	0	0	
NETWORK DISTRIBUTION	network distribution system	13	1	13	1	0	0	0
COOLING and CONDITIONING	Conditioning	20	1	20	1	0	0	4
	Cameras chiller	5	1	5	1	0	0	
	PMTs flow system	2	1	2	0	1	2	
	Cables & connectors	2	1	2	0	1	2	
SAFETY (PRA-VIA)	pra+vinca	6	1	6	1	0	0	0
	fire detection	10	1	10	1	0	0	
	gas monitor	15	1	15	1	0	0	
	safety design	10	1	10	1	0	0	
CIVIL WORK	total	40	1	40	1	0	0	0
DESIGN AND DOCUMENTATION	software	5	1	5	0	1	5	15
	final audit	10	1	10	0	1	10	
			Gran Total	**941.5**			**276**	**276**

Papers in last year

Secondary scintillation yield from GEM electron avalanches in He-CF_4 and He-CF_4/butane for CYGNO – Directional Dark Matter Search with an optical TPC

Published by PLB

F.D. Amaro,[a] E. Bar… …si,[d] S. Bianco,[d] C. Capoccia,[d] M. Caponero,[d,e] D.S… …voto,[g,h] A. Corte… [b,c] L.A. Costa [i] F. Dané [d] G. Dho,[b,c] F. Di … Di Marco,[h] G. D'Imp… P. Lima Júnior,[c] C… …accarrone,[d] R.D.P. Ma… …arcelo Grego… …ues,[b,c] G. Mazzitelli,[d] A.G. M… C.M.B. M… …orega,[i] I.F. Pains,[i] E. Paoletti,[d] …si,[h] F. … …acentini,[g,h] D. Piccolo,[d] D. Pierluig… …i,[b,c] F. … …d.C. Roque,[a,2] F. Rosatelli,[d] A. Russo,… Sa… …,[n] N.J.C. Spooner,[k] R. Tesauro,[d] S. Toma…

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Prepared for submission to JINST

Charge Amplification in Low Pressure CF_4/SF_6:He Mixtures with a Multi-Mesh ThGEM for Directional Dark Matter Searches

Published on JINST

…racchini,[4,5] L. Benussi,[6] …ardoso,[10] G. Cavo… …ie,[11] E. …a,[4,5] E. Di Ma… …czeribe,[12] J.M. …orton,[6] F… …H.P. Lima Júnior,[10] …D.P. Mano,[1] R.R. Marcelo Gregorio,[1] D.J.G. Marques,[1] …n,[12,*] P. Meloni,[2,3] A. Messina,[7,8] C. M. B. Monteiro,[1] R.A. N… …Paoletti,[6] L. Passamonti,[6] S. Pelosi,[7] F. Petrucci,[2,3] S. Pia… …ierluigi,[6] D. Pinci,[7] A. Prajapati,[4,5] F. Renga,[7] R. C. P… …usso,[6] G. Saviano,[6,16] A. Scarff,[12] N.J.C. Spooner.[12] …ni,[6] S. Torelli,[4,5] and D. Tozzi[7,8]

Prepared for submission to JINST

Enhancing the light yield of He:CF_4 based gaseous detector

Fernando Domingues Amaro[1], Rita Antonietti[2,3], Elisab… …tta Baracchini[4,5], Luigi Benussi[6], Stefano Bianco[6], Rob… Campagnola[6], Cesidio Capoccia[6], Michele Capo… …lo Santos Cardoso[8], Luan Gomes Mattosinhos… Gianluca Cavoto[10,11], Igor Abritta Cost… Emiliano Dané[6], Giorgio Dho[4,6,a], F… …cista[4,5], Emanuele Di Marco[11], Melba D… …Imperio[11], Davide Fiorina[4,5], Frances… …or ul Islam[4,5], Herman Pessoa Lima … …emp[12], Giovanni Maccarrone[6], Rui … …, Robert Renz M… Gregorio[13], D… …arques[4,5], Giovanni Ma… Alasdair … …drea Messina[10,11], Pietro Cris… …Monteiro[1], Rafael Antunes N… …miliano Paoletti[6], Luciano Passar… …, Stefano Piacentini[4,5], Davide Piccol… …avide Pinci[11], Atul Prajapati[4,5], Francesco … …na da Cruz Roque[1], Filippo Rosatelli[6], Alessand… …quim Marques Ferreira dos Santos[1], Giovanna Saviano[6,14], Pedro Alberto Oliveira Costa Silva[1], Neil John Curwen Spooner[13], Roberto Tesauro[6], Sandro Tomassini[6], Samuele Torelli[4,5]

…ins-det] 4 Nov 2024

Published on EPJC

He-CF4-CH4 ternary mixtures as target gas… …e CYGNO directional dark matter ex…

R. J. da C. Roque, R. D. P. Mano, C. M. B Monteiro (… …GNO authorlist)

Under internal review

Abstract

The CYGNO collaboration … …solution optical Time Projection Chamber for directional dark matt… …neutrino spectroscopy, to be deployed at LNGS. He-40% CF_4 is h… …gas, at atmospheric pressure, and a triple-GEM cascade is being us… …of the ionization signal, being the scintillation produced in the GEM … …d out by sCMOS cameras. High sensitivity to interactions in the few k… …on event tracking and particle identification are enabled with this solution. …y the addition of 3 to 10 percent of methane to He-40%CF_4 and demonstrate …ane inclusion contributes to both the electrical stability of the TPC and to higher sc… …on output from the GEM avalanches. In spite of the sc… …e, the addition of methane increases the maximum voltage that c… …re the onset of discharges, eventually resulting in higher scintillatio… …he visible component of the gas scintillation shows that isobutan… …V photons emitted by He-CF_4. The maximum voltage that could b… …nd to be independent from the methane concentration in the st… …a hydrogen-based gas provides CYGNO with an even lighter targe… …ter detection threshold, in longer track lengths of light nuclear recoils and, thus, in a clearer direction discrimination.

Modeling the detector response of the CYGNO optical readout TPC

Under internal review

F.D. Amaro[a] R. Antonietti[b,c] E. Baracchini[d,e] … F. Borra[g,h] C. Capoccia[f] M. Caponero[f,d] D.S. Card… …Costa[b,c] E. Dané[f] G. Dho[d,e] F. Di Giambattista[d,e] E. Di Marco[h] … …ngeli[h] H.P. Lima Júnior[k] E. Kemp[f,d] G.S.P. Lopes[m] G. Maccarron… …Marcelo Gregorio[n] D.J.G. Marques[d,e] G. Mazzitelli[f] A.G. Mel… …essina[g,h] C.M.B. Monteiro[a] R.A. Nobrega[m] I.F. Pains[m] E. Pao… …S. Pelosi[h] F. Petrucci[b,c] S. Piacentini[g,h] D. Piccolo[f] D. Pierluigi[f] … …e F. Renga[h] R.J.d.C. Roque[a] F. Rosatelli[f] A. Russo[f] J.M.F. … …o[f,o] N.J.C. Spooner[n] R. Tesauro… D…

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An analytical model of the response of the optically readout GEM based TPC for the CYGNO experiment

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Under internal review


PULP FICTION
Rita Roque
Cristina Bernardes Monteiro
Fernando Jerez
Daniel Mateo
THANKS!