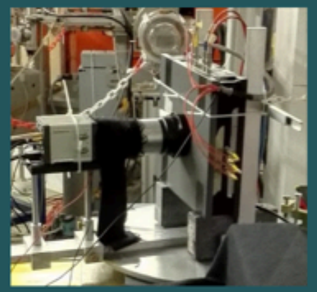
The CYGNO project timeline

PHASE 0: R&D and prototypes

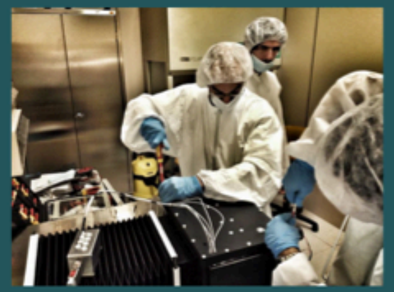
2015/16 ROMA1 → ORANGE

- 1 cm drift



2017/18 LNF → LEMON

- 3D printing
- 20 cm drift

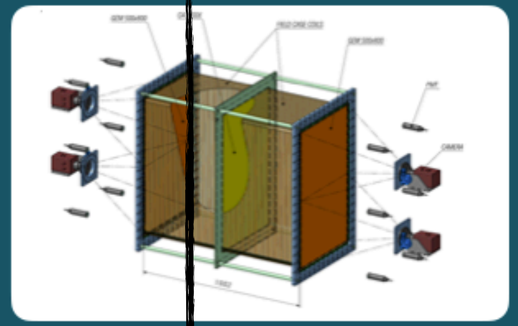


2019/22 LNF/LNGS → LIME

- 50 cm drift
- underground tests
- shielding

PHASE 1: 1 m³ Demonstrator

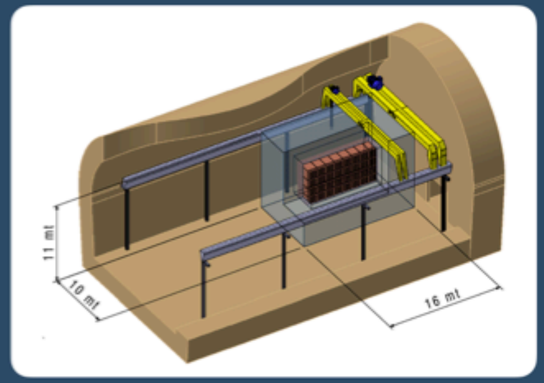
2022/27 LNF/LNGS → CYGNO_04



- background
- materials test, gas purification
- scalability

PHASE 2: 30 m³ Experiment

2027… LNGS → CYGNO_30



- Physics research

we are here

CYGNO: TDR - GANTT 2023

PROJECT TITLE		NAME	INFN		
PROJECT MANAGER		ATE	30/6/22		
WBS ID	TASK	DESIGN and PROCUREMENT (2023)			
		1-4	5-8	9-12	
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				M3.
3.2	Montecarlo for PHASE 1				
3.3	estimation for PHASE 2				
WP4	**Detector Design and Constructio**				
4.1	executive layout infrastructure	M4.1			
4.2	executive layout of the detector			M4.2	
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	D5.1			
5.2	validating DAQ v0				M5.
5.3	validating DAQ v1				
WP6	**Research and Development**				
6.1	validating large GEM			M6.1	
6.2	validating sensors and lens				
6.3	validating field cage component				
6.4	validating R&D for PHASE 2				
WP7	**Management**				
7.1	ERC-FRP3			M7.1	
7.2	ERC-FRP4				
7.3	CSN2 Progress Report		M7.3		
7.4	ERC-SRP2				
7.5	CSN2 Final Report				

1. **LIME data taking** will go on in 2023 **analysis** will be **focused** on LIME data
2. **a complete Data/MC comparison** is expected by the end of 2023
3. validate **gas system** by April 2023 and **DAQ system** by the end of 2023

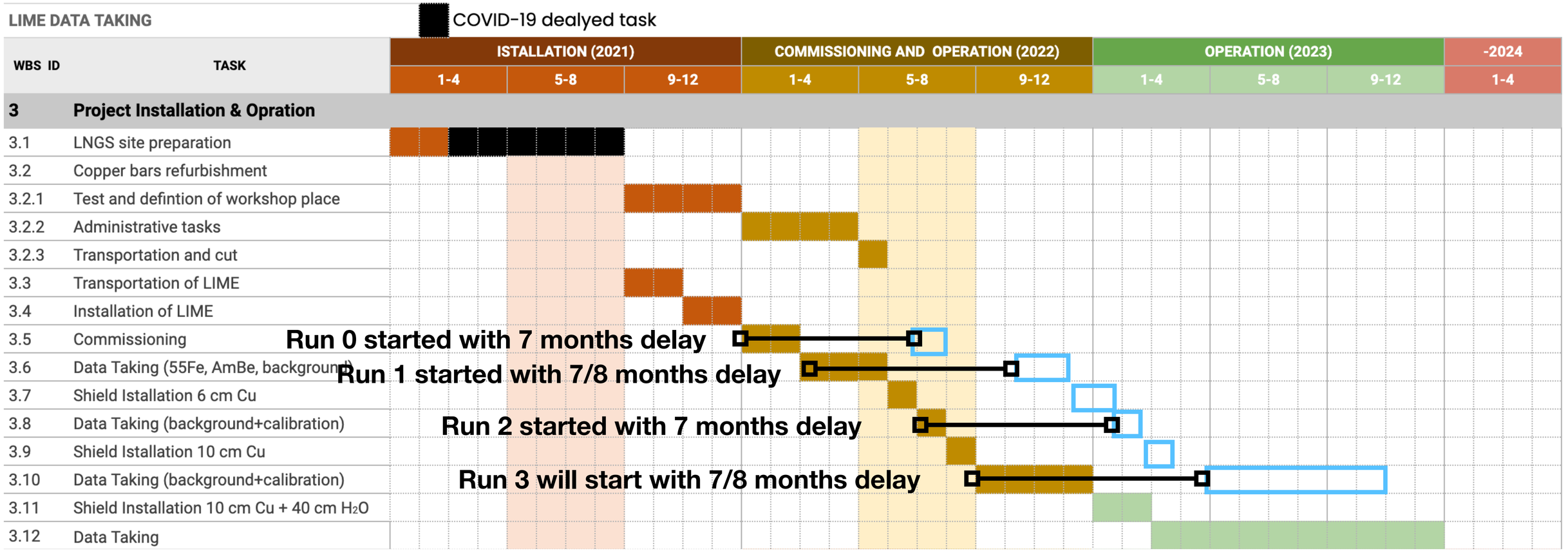
Main LIME outcomes

4. **infrastructure designs** are expected to be ready by April 2023 and then **detector design**
5. **test on GEM, cathode and field cage** will be carried on, to freeze detector **construction procedures**

CYGNO_04 preparation

1-LIME: Long Imaging ModulE

1-LIME: GANTT

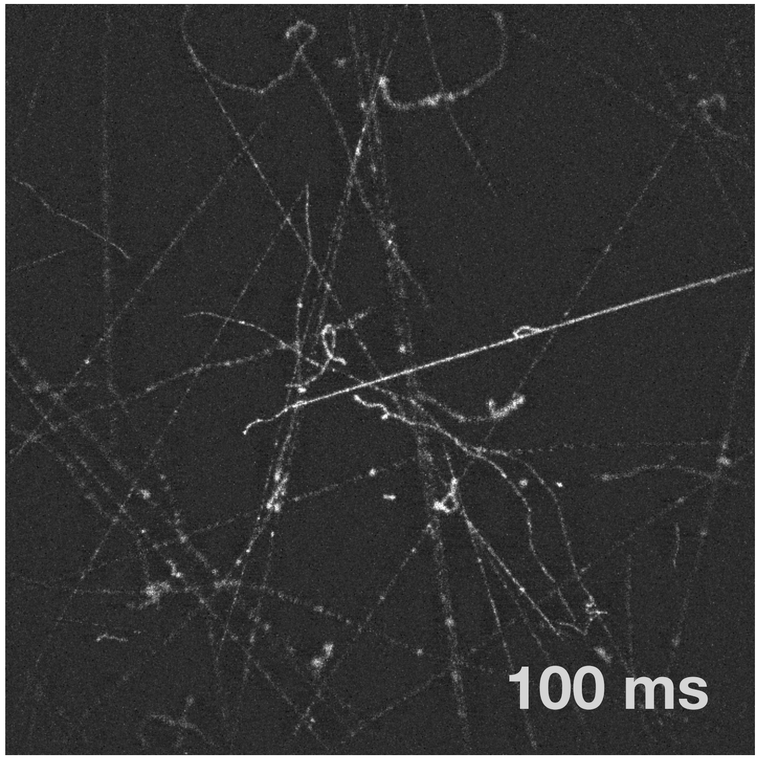


Run0 started 6-7 months later than planned in 2020 due to delays in the construction work for site preparation (not dependent on us). **No more** significant **delays** were **accumulated**.
We are preparing for **Run3** which should start by the end of **April**.

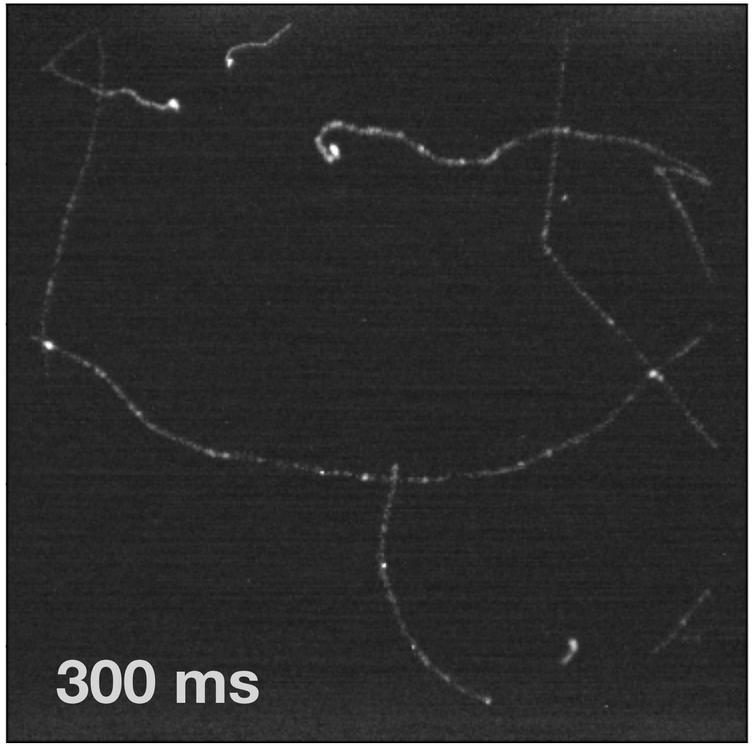
No interferences with CYGNO_04 activities up to **January 2025**.

1-LIME: Underground data so far

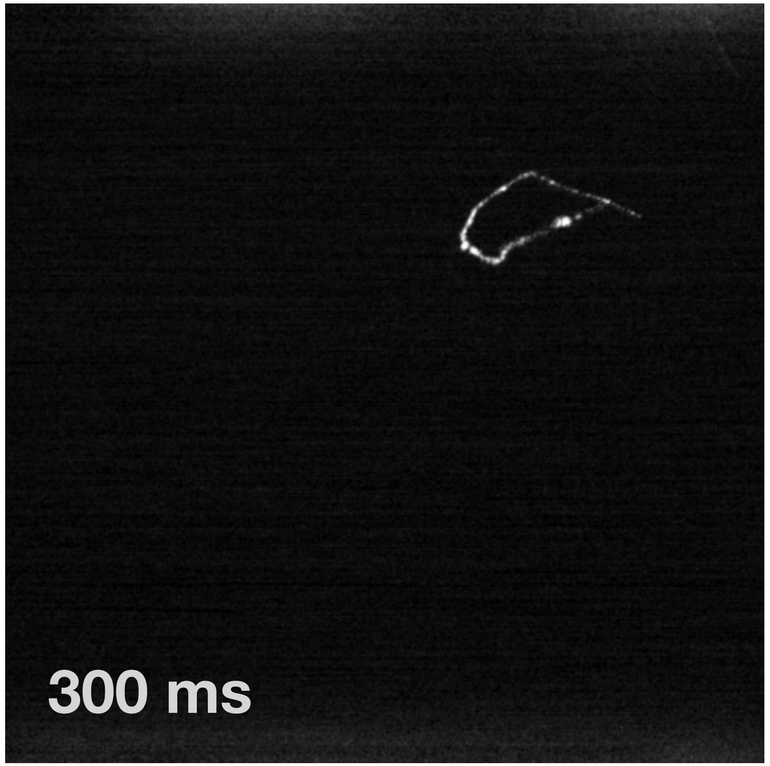
LNF: overground



RUN 1: No-shielding

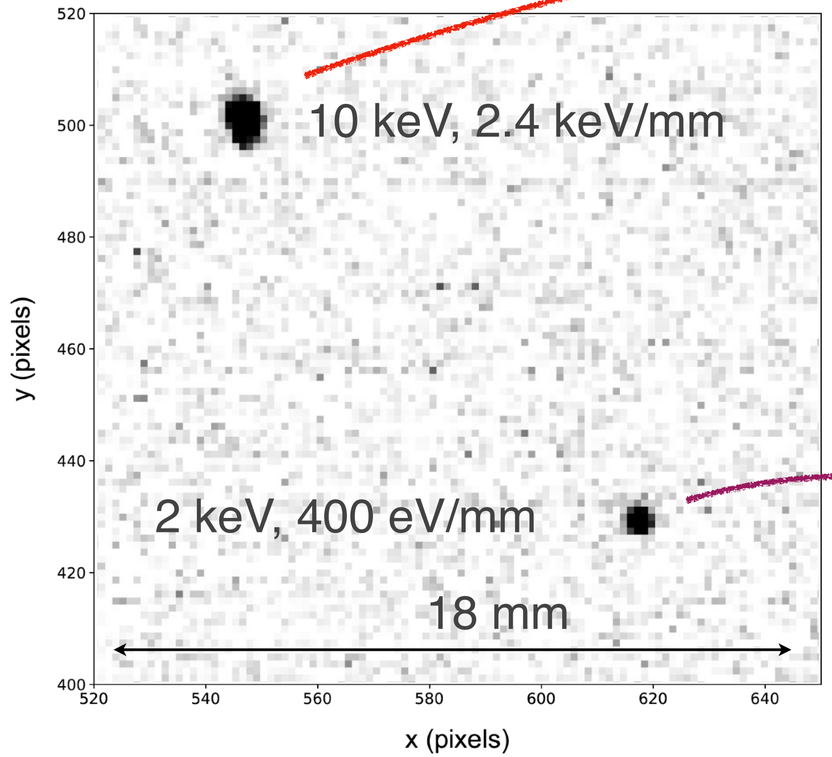


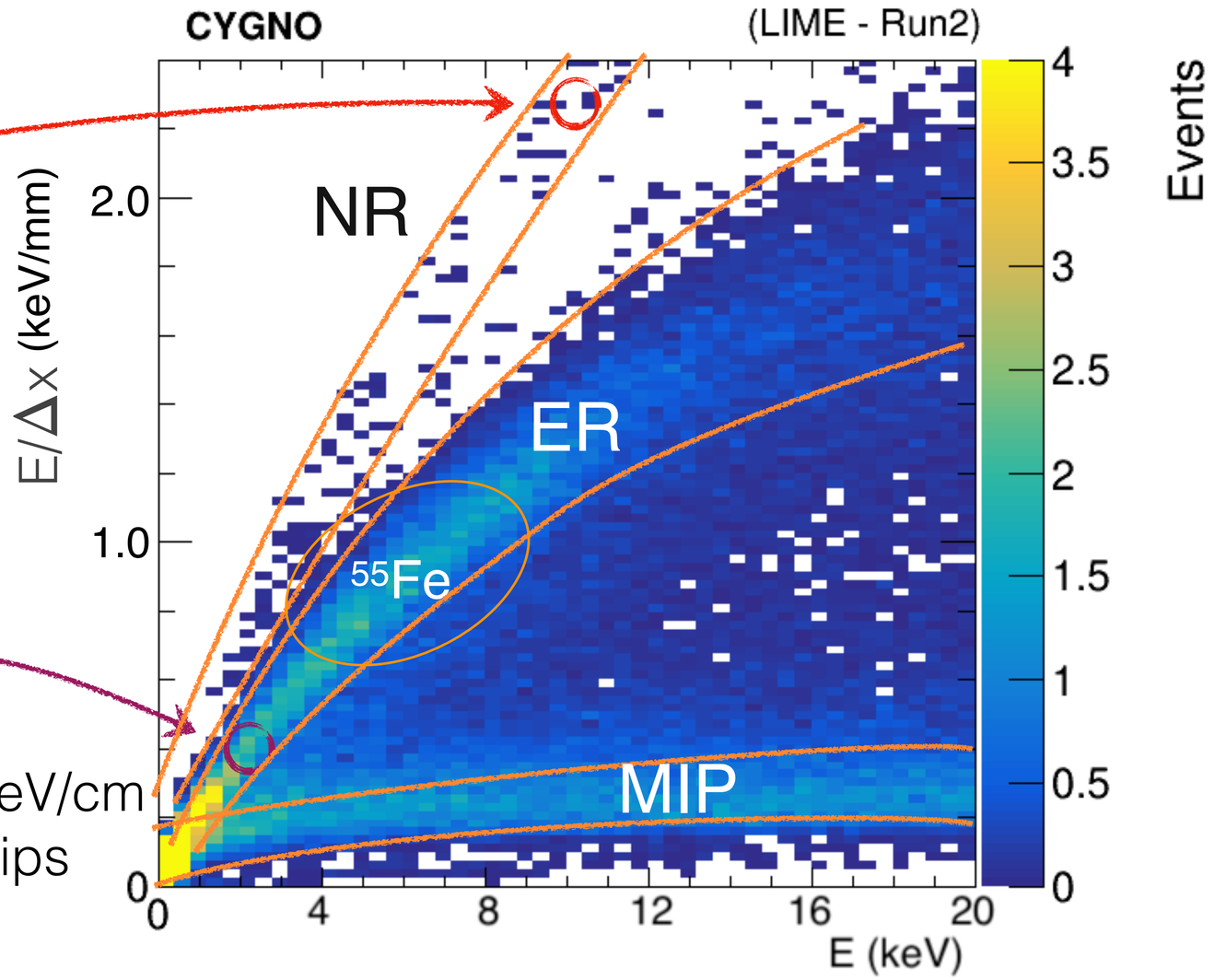
RUN 2: 4 cm Cu shielding



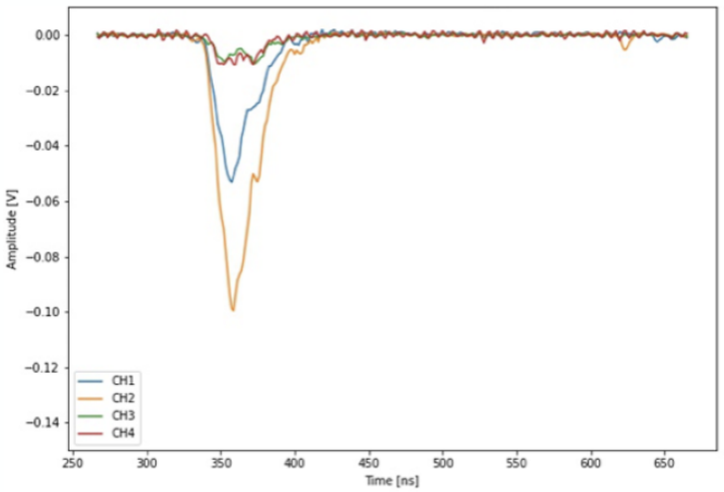
1-LIME: First look to the discrimination

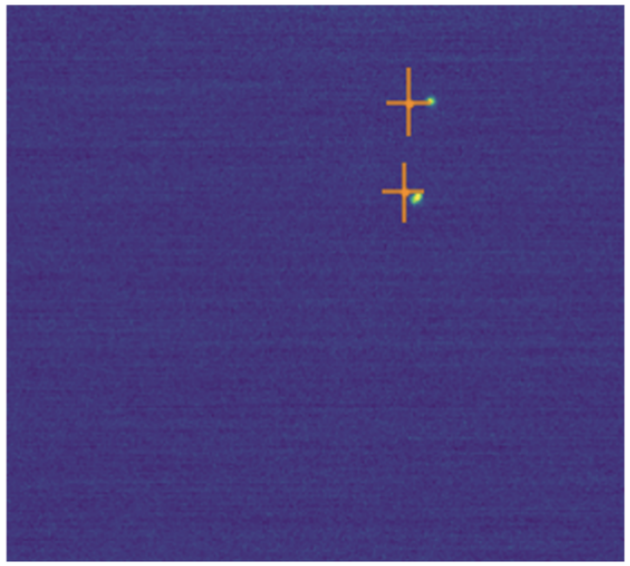
E/Δx variable can be used to have a first look to discrimination power

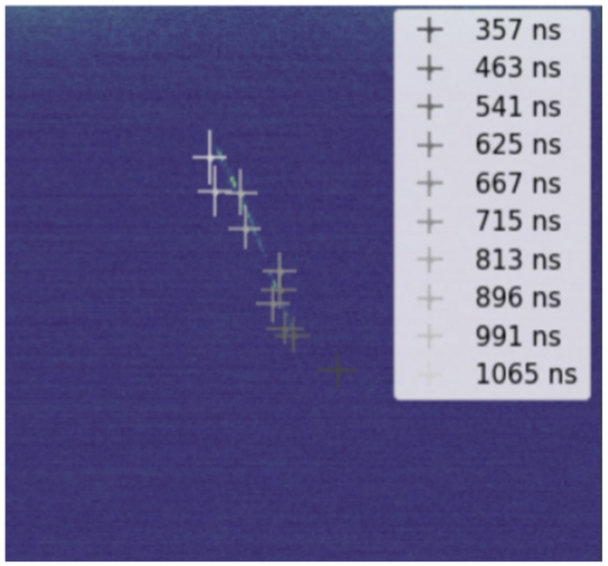




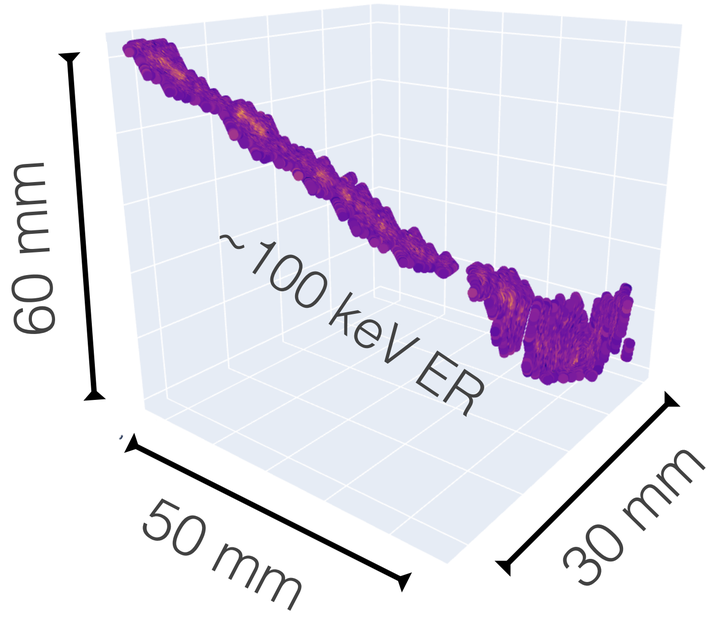
1-LIME: Preliminary analysis from PMTs



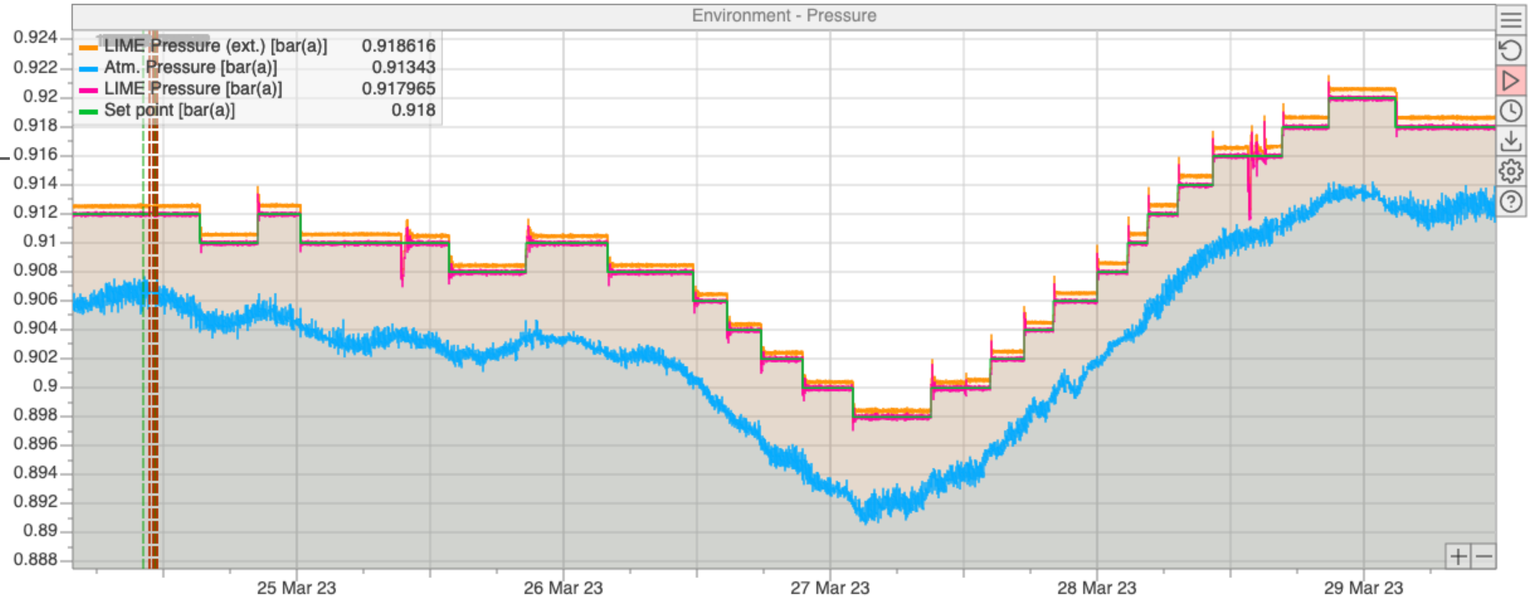




- **First attempts** are encouraging, but still a lot of **work to do,** especially on long tracks



3- The GAS system



Gas system is performing well, ensuring the operation with proper mixture and the right **overpressure with respect to atmospheric one**

Gas **leakages** lower than **0.5 litres/h**

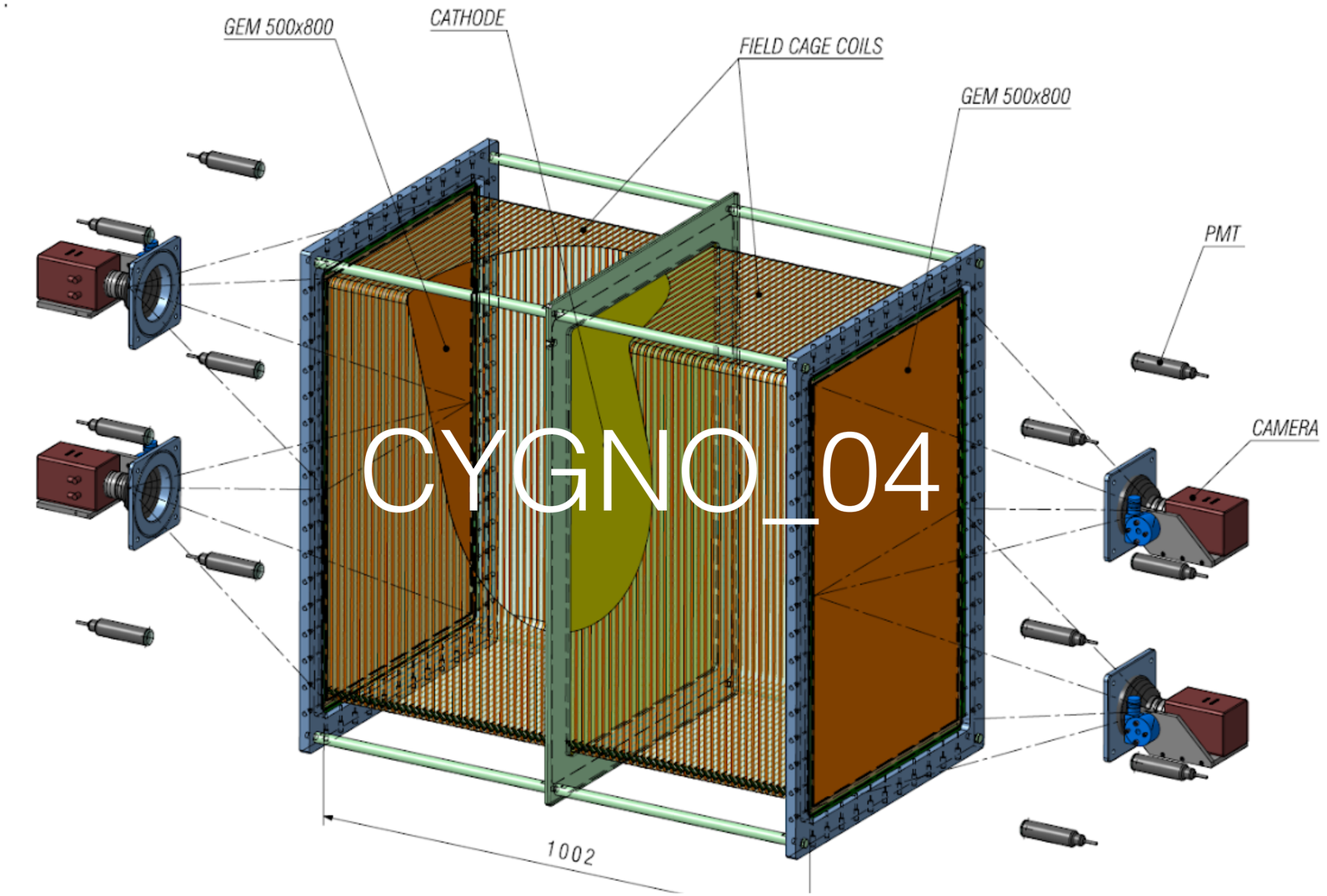
Recovery procedure of exhausted gas properly started

There is a **dispute** with **AirLiquid** over the efficiency of a **booster** and **recovery valves** that do not seem to behave properly (likely because of a wrong part installed by them).

We tested the effectiveness of **filters** for the **humidity** in **LNF** now **installed** on **LIME**;

A first test performed last week showed **one line ok** and **one line bad. Intervention foreseen for next week;**

If no issues arise, **validation** of **GAS system** expected by the end April of 2023


GEM 500x800
CATHODE
FIELD CAGE COILS
GEM 500x800
PMT
CAMERA
CYGNO_04
1002

4-CYGNO_04: Site preparation

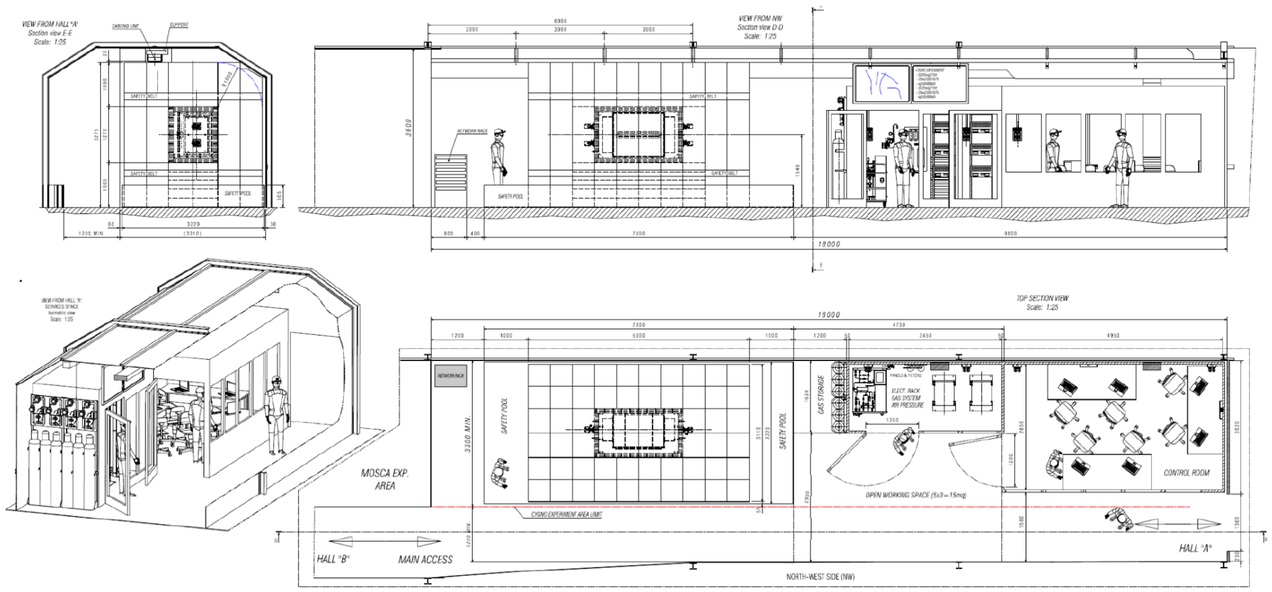
The **site layout** was submitted to **LNGS** technical **services**:

- evaluation of the environmental impact of CYGNO-04 (**VINCA**) has been carried out

- the **Fire Department** experts just **approved CYGNO-04 infrastructure** design in terms of fire hazards without the need of additional safety measurements.

These are **part of the development of milestones M4.1** towards the executive layout of the infrastructure;

We are now preparing the **tender specifications** for the **realization** of the containers

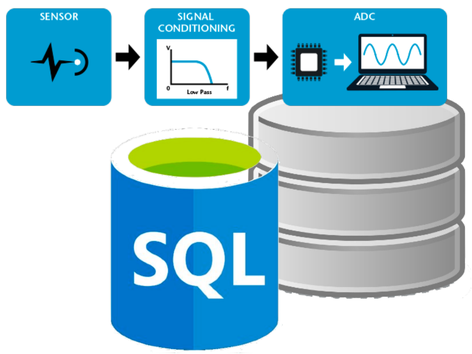


LNF technical services foresees to construct the **infrastructure** by the **end** of **2023**

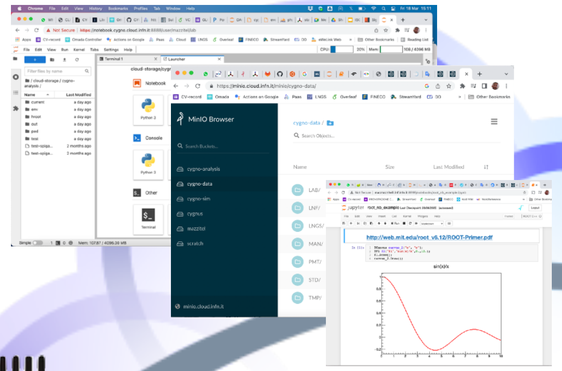
CYGNO/CSN2… computing model

LNGS/LNF/…

DAQ



WEB GUI

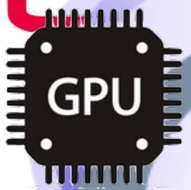


BACH

ANALISYS

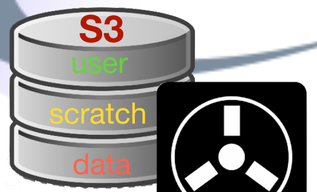
HPC

RESOURCES



INFN CLOUD

SIMULATION



TAPE DRIVE

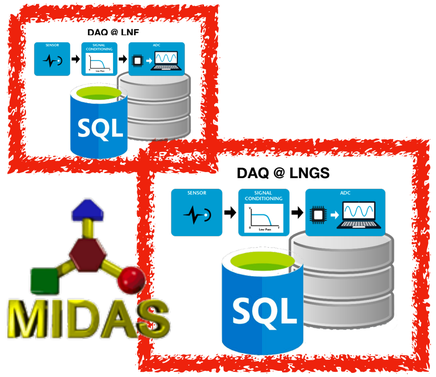
STORAGE/BACKUP

METADATA &
SLOW CONTROL

logical units, “composed” services

docker Compose

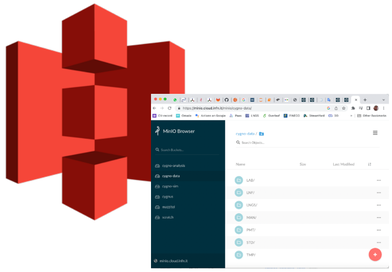
test and development setup at LNF



production setup at LNGS

Mariadb replica for metadata
sql.cygno.cloud.infn.it

S3 storage
minio.cloud.infn.it

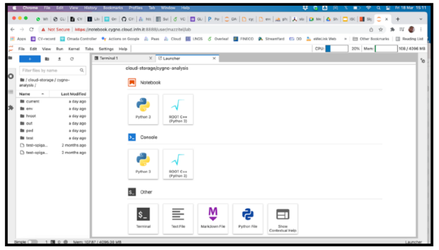


messaging
kafka.cygno.cloud.infn.it

Identity and Access Management
iam.cloud.infn.it

data and metadata monitor
grafana.cygno.cloud.infn.it

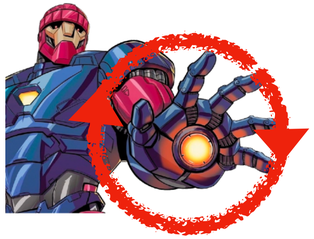
analysis and simulation web interfaces
notebook01.cygno.cloud.infn.it
notebook02.cygno.cloud.infn.it



batch queues
condor01.cygno.cloud.infn.it
condor02.cygno.cloud.infn.it

backup
tape.cygno.cloud.infn.it

pre analysis and data quality
sentinel.cygno.cloud.infn.it



PNRR - spoke 2-WP3.4

Pipeline optimization for space and ground based experiments

- generalise CYGNO/QUAX computing model for medium/small astropaticle experiments
- set up a common queue for reconstruction/simulation/analysis for medium/small astropaticle experiments
- integrate local resources in common interface
- define roles to access the common resources