EGO Council meeting

Massimo Carpinelli
EGO Director

18-12-2023

Outline

- Administration and Budget
- Status of the infrastructure
- Post O4

Budget 2023

- 2023 budget will be closed in balance, 2022 was not.
- The results has been obtained thanks to:
  - A utilities bill better then expected
  - Postponed maintenance
  - Very limited recruitment
  - Careful control of expenses in all EGO Departments

Budget 2024

- We expect a 2024 budget in balance thanks to an increase of contribution from EGO funding members.
- Start an extraordinary maintenance
- Start a recruitment plan
- Increase the mission contribution to CNRS and INFN
- Restart a fellowship program and contribution for Visiting
- Increase the contribution to LMA

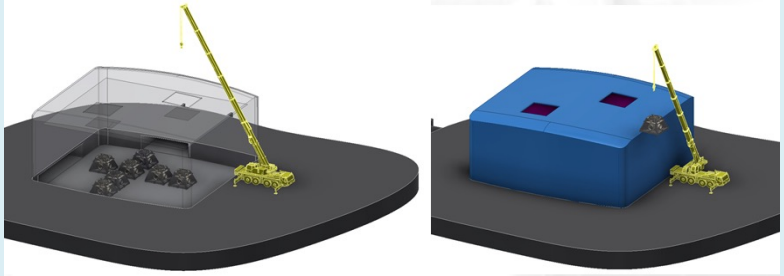
Administration Department

- New set of procedures for procurements, aligned with those of Italian Public Administrations id now routinely used.
- Purchases and contracts are going much smoother, but we need additional personnel committed to it.
- Contract with services supplier have been rewritten optimizing the overall cost.
- External consultants have been changed, requiring higher professional standard. We saved money and gained competences.
- Renewal of the contract is under discussion with Unions and Personnel representative. A consensus has not been reached so far.
- A reorganization of the Department is under study.

V&M Department

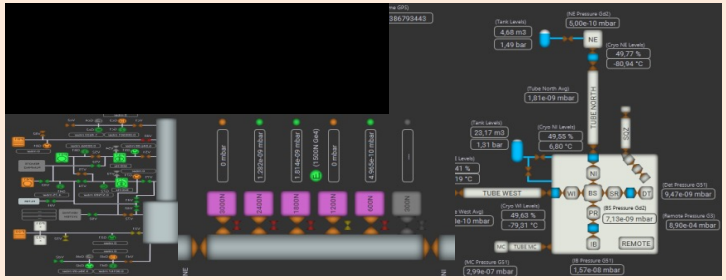
Contribution to 'Stable Cavities' design

***'Short' version**: study of design options*



***'Long' version:** vacuum system costing and scheduling*

Running Vacuum system to support O4



Lab activities

- Testing New Pumps for AdV+II on large chambers
- Characterizing dust in vacuum chambers
- Outgassing tests

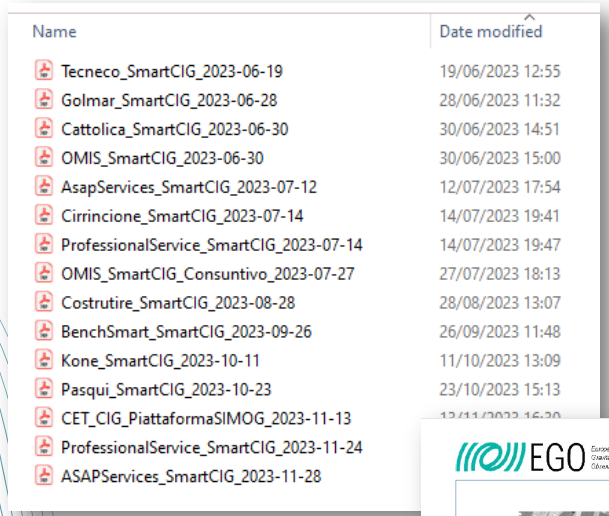
In collaboration with Virgo teams : CAEN, INFN_GE, INFN_PG, Valencia, …

General Infrastructure Dep. Activity

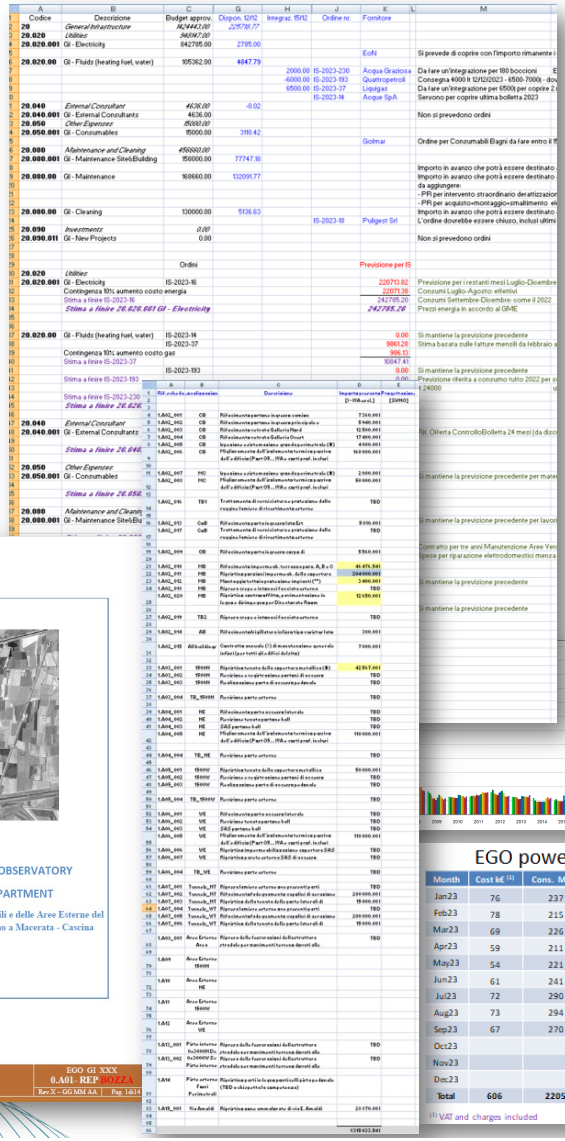
2nd half-year 2023

EGO VIRGO

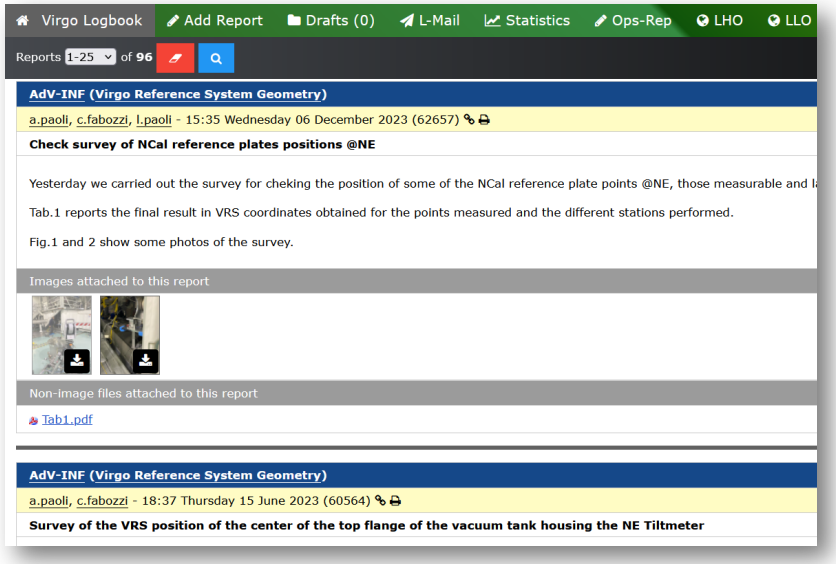
Ordinary activity and Procurement procedures



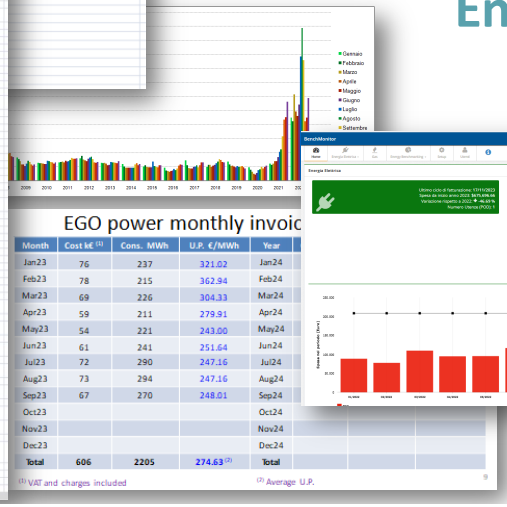
Budget Control

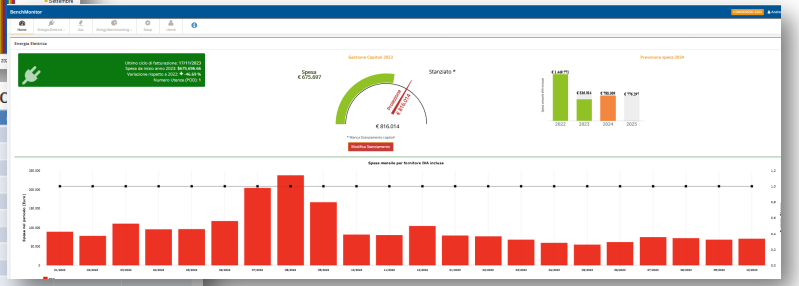


Survey Engineering activity



Energy Consumption Monitoring





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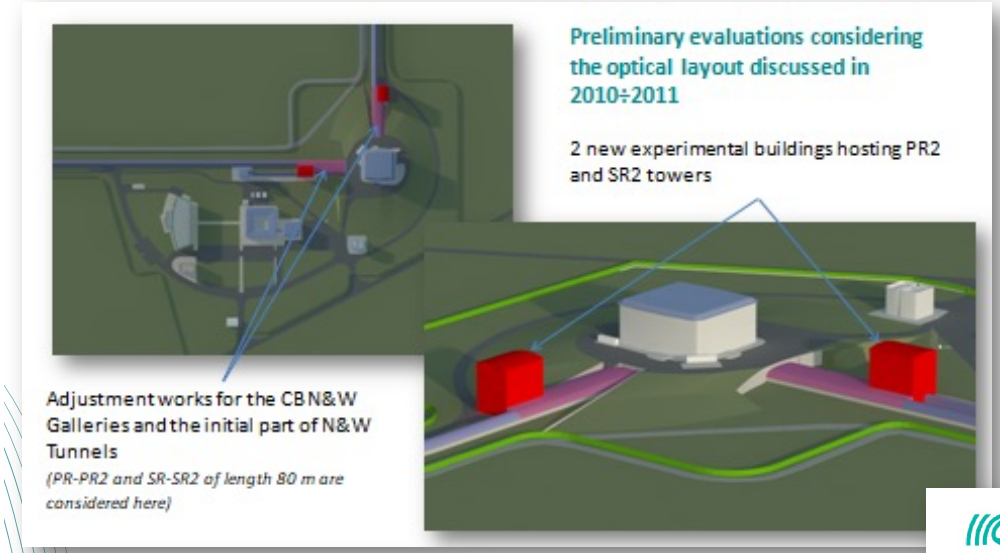
Stable Recycling Cavities Design

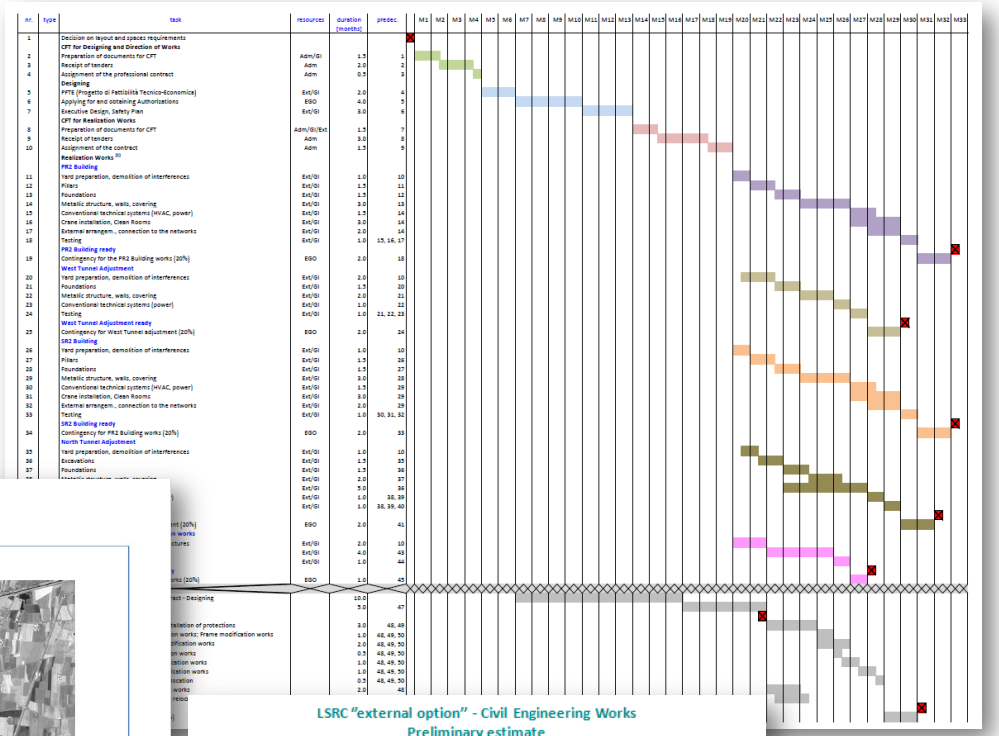


Preliminary evaluations considering the optical layout discussed in 2010÷2011

2 new experimental buildings hosting PR2 and SR2 towers

Adjustment works for the CB N&W Galleries and the initial part of N&W Tunnels

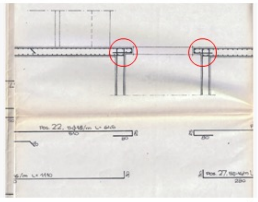
(PR-PR2 and SR-SR2 of length 80 m are considered here)



SSRC: holes below INJ and DET Tower

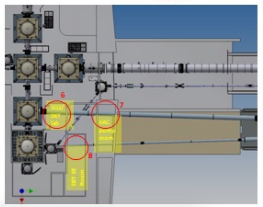
After the decision on the optical layout and the financing of the project:

1. Link to current reinforced concrete slab: need to carefully choose the structural solution and effective designing;
2. Current concrete slab structural load q = 1500 daN/m²;
3. Need to define straightness requirements.



SR-LSRC: interferences with CB structures

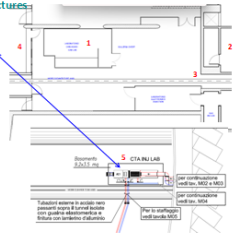
NORTH



6. SQZ DET lab: r.c.-light walls;
7. SQZ pump room should be replaced; reinforced concrete walls passages;
8. DET EE Room: light walls

PR-LSRC: interferences with CB structures

1. Cabling Lab: replacement of the Lab from the current position in West Gallery;
2. EE Room: realization of the passages in both reinforced concrete and light walls;
3. Interference of the vacuum tube with structural should be verified near INJ Lab: depending to the vacuum tubes layout;
4. Modification of the West Gallery glass window
5. Displacement of INJ Lab Air Handler Unit and redesign of air the distribution ducts



EGO European Gravitational Observatory

EGO - EUROPEAN GRAVITATIONAL OBSERVATORY

GENERAL INFRASTRUCTURE DEPARTMENT

"Relazione Illustrativa su: Quadro Procedurale-Tempi-Stima preliminare dei costi-per le Opere Civili della configurazione Post O5-V_nEXT dell'interferometro (Long Stable Recycling Cavities) del Progetto Virgo in località S. Stefano a Macerata - Cascina

EGO GI 004
7.A.01- REP Rel1
Rev: 1 – 07 09 23 | Pag: 1di12

LSRC "external option" - Civil Engineering Works
Preliminary estimate

- Professional costs considered: based on official Italian Law (D.M. 17/06/2016: "Regolamento recante le modalità per la determinazione dei corrispettivi a base di gara per l'affidamento dei contratti pubblici di servizi attinenti all'architettura e all'ingegneria");

Base of calculation	5805 k€
PFTE	116.10 k€
Executive Design	145.13 k€
Direction of Works	174.15 k€
Safety Coordination	58.05 k€
Official Testing	29.03 k€
Safety Costs (non bid costs)	174.15 k€
Additional Charges	58.05 k€
Total Professional Costs	**755 k€**

Type of works	
PR2 Building	1900 k€
West Tunnel Adjustment	520 k€
SR2 Building	1900 k€
North Tunnel Adjustment	640 k€
CB structural modification works	228 k€
External arrangements	620 k€
Total Works	**5805 k€**

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Interferometer Technology Department Report

[Electronics team]
[ELE&HVAC team]
[ITF Services team]
[Noise&Control team]
[Optics team]

EGO VIRGO

Activities in the second half of 2023

Virgo

- Coordination of INJ , ISC
- Contribution to ALS, PAY, SLC, DET, SAT, INF, VAC, EMS, QNR and PSL subsystems
- Commissioning and operations of INJ, ISC, ALS, PSL
- Study of technical noises of viewports scattered light
- Study of magnetic shield for the DET Fast Shutter and the Faraday Isolators (phase II)
- Study and investigation of site noises that might affect the ITF (trains magnetic noise, photovoltaic noise,…)
- RAM (Residual Amplitude Modulation) servo electronics tests and validation on the ITF
- Conceptual studies for INJ and ISC phase II (included Stable Cavities scenario)
- Characterization of stray light control materials
- Operator Service: 14 shifts/wk (8am-4pm and 3pm-11pm)
- Maintenance of DMS
- Contribution to Outreach activities (site visits)
- Support to Collaboration Groups for Optics and Electronics issues
- Management of Detector Maintenance Budget
- Post-O5 document contribution
- Tutoring of internship students and of master students

Activities in the second half of 2023

EU

•Mobile sensor array (EU project AHEAD WP15)

ET

•Co-chairing of "Optical design and sensing and control LF" package
•Co-chairing of "Inter platform noise suppression" package
•Co-chairing of "Magnetic Noise" package
•Co-chairing of "Newtonian Noise " package
•Contribution to MaNET project

EGO

•Running and maintenance of HVAC, Compressed Air and Electrical systems
•Extraordinary maintenance and upgrades of ordinary and emergency electrical systems started
•Renewal of plant maintenance contracts with the various companies (13 companies) for the years 2024-2025 according to the new procurement rules of EGO
•Definition and proposal of possible scenarios photovoltaic systems at EGO
•Procurement and refill of Clean Areas consumables
•Management of the cleaning of the experimental areas
•IMMS sensor network extension and maintenance
•Energy saving campaign

EGO VIRGO

Photovoltaic @ EGO

Initial photovoltaic system for the production of electricity installed in March 2023 on the roof of the Office Building (power: 20kWp, energy production: 24MWh/year).

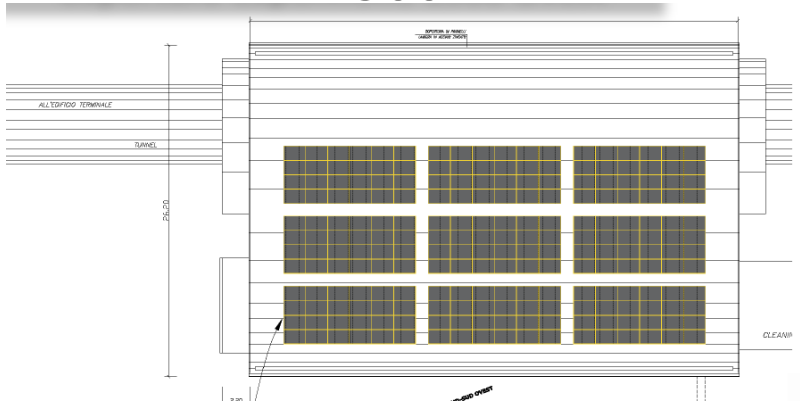
Verified that the aforementioned system did not introduce any disturbance or noise in the IPS network and in the ITF (EGO-REP-INF-295)

We are now proceeding with the realization of 2 further plants:
- plant on Main Building roof (power: 50kWp, energy production: 63MWh/year).
- plant on 1500W Building roof (power: 100kWp, energy production: 123MWh/year).

The executive design and the procurement of the components are in progress

Total cost for the investment for 150 kWp is around 120kE, that will be recovered in about 3 years of operation

1500W



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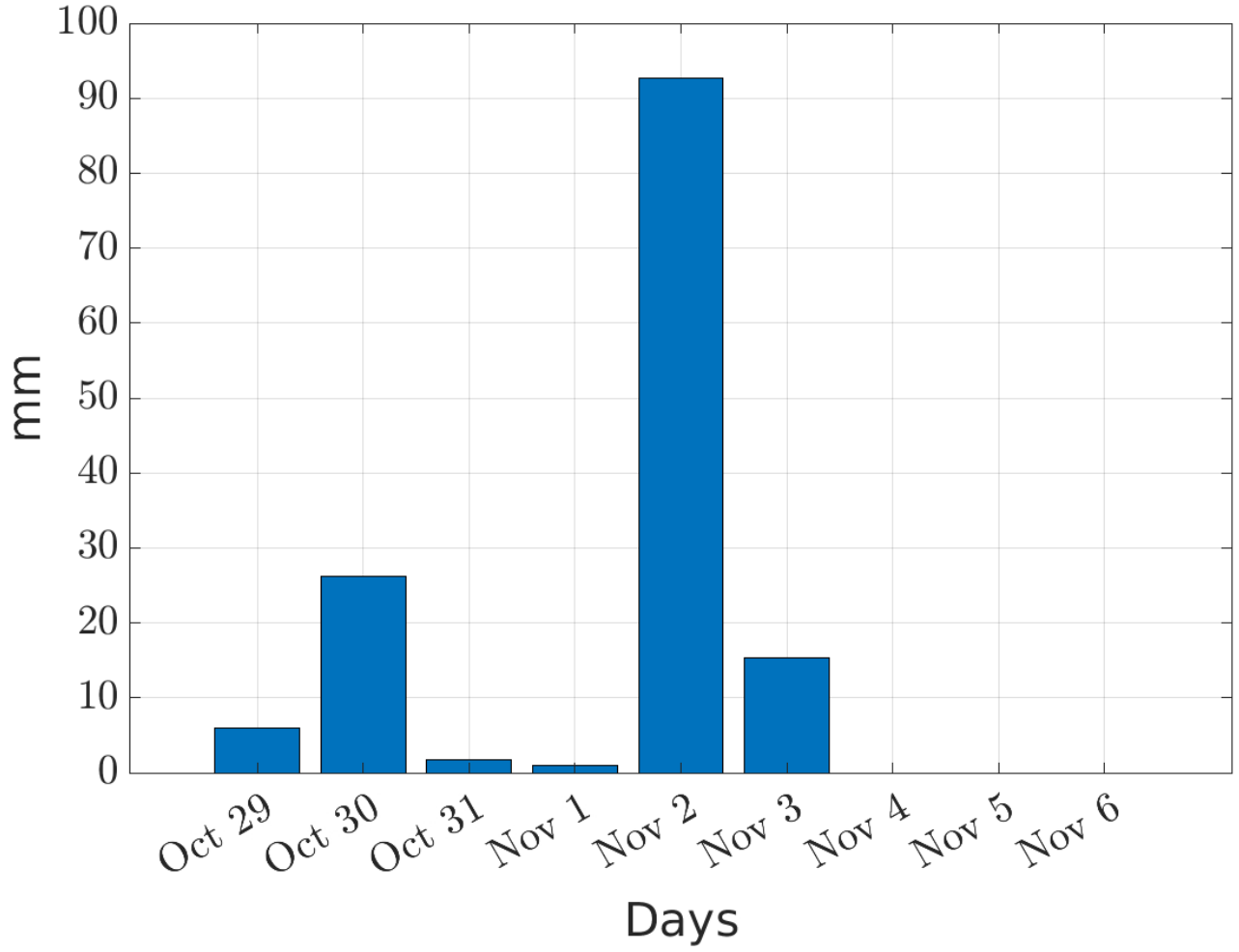
Exceptional storm, November 2


100
90
80
70
60
50
40
30
20
10
0
mm
Oct 29
Oct 30
Oct 31
Nov 1
Nov 2
Nov 3
Nov 4
Nov 5
Nov 6
Days


Scolmatore, Sr206 Emilia (Radio)
15:45 , oggi
114 cm
CSV
Condividere
SMS
Altezza
Portata
450 cm
360 cm
270 cm
180 cm
90 cm
Nov 2020
Altezza: 118 cm
Nov 2020
Feb 2021
May 2021
Aug 2021
Nov 2021
Feb 2022
May 2022
Aug 2022
Nov 2022
Feb 2023
May 2023
Aug 2023
Nov 2023
LAE
LAA
1 giorno
7 giorni
30 giorni
Storico

General Infrastructure Building Damage Report

EGO VIRGO

1500N Area

Photo 1

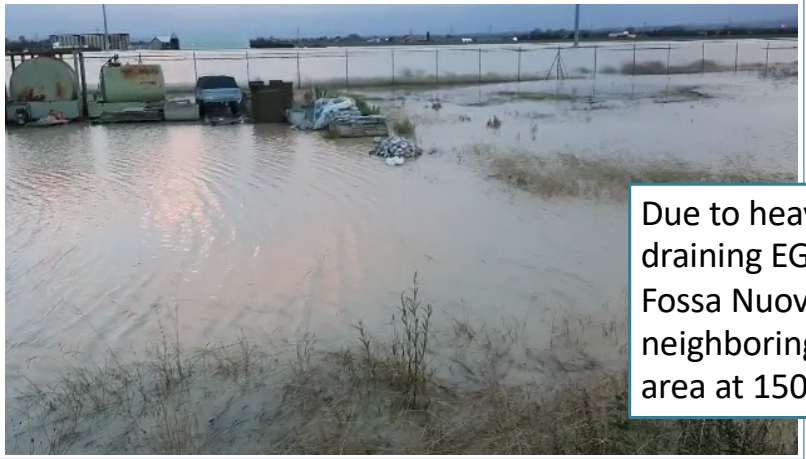
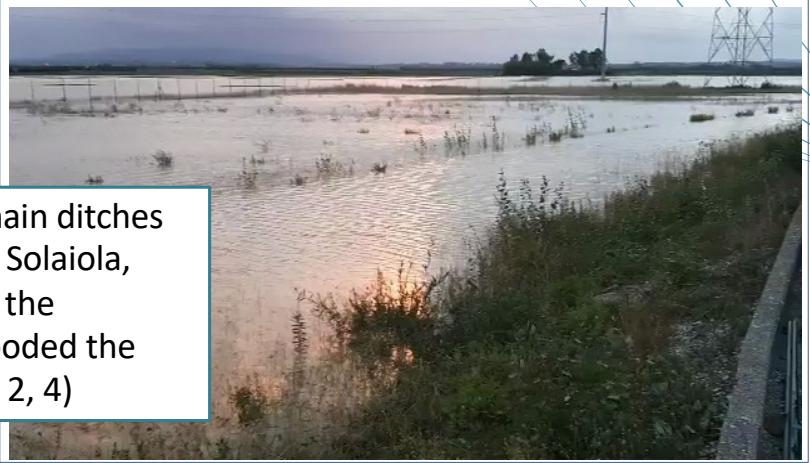


Photo 2



Due to heavy rains, the main ditches draining EGO Area (Fosso Solaiola, Fossa Nuova) overflowed the neighboring fields and flooded the area at 1500 N (photos 1, 2, 4)

Photo 3

The technical rooms at 1500N were affected

Photo 4

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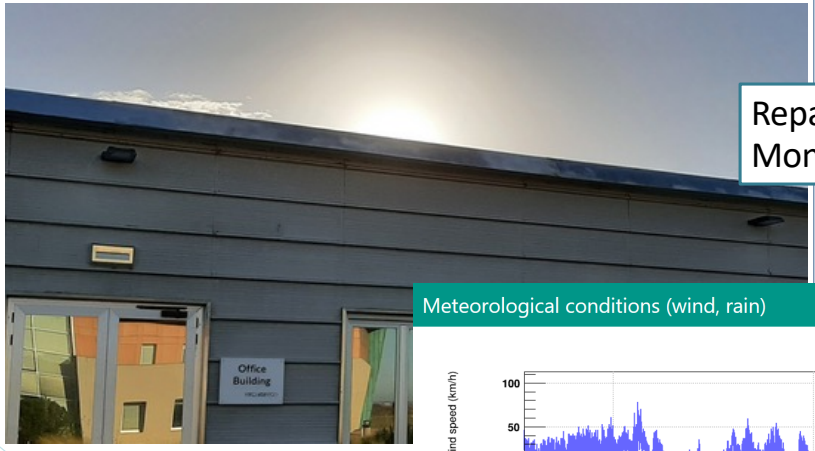
Office Building

Photo 5

Strong wind gusts caused the detachment of part of the building's eaves on the west side facade

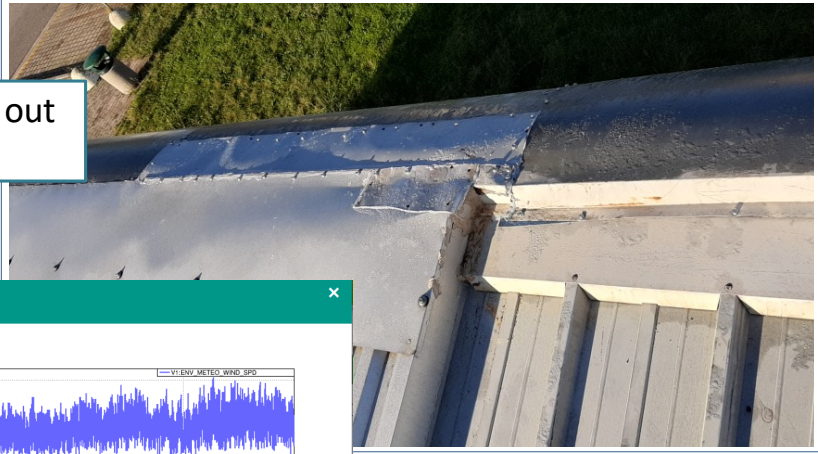
Photo 6

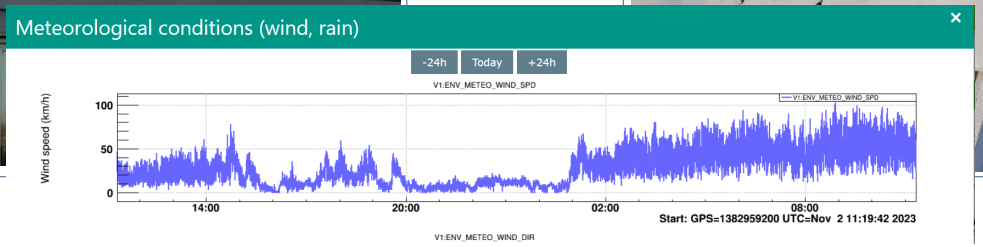
Photo 7



Repair was carried out Monday, Nov 6

Photo 8





Central Building – Mode Cleaner - Access Building – West End Building

Photo 9

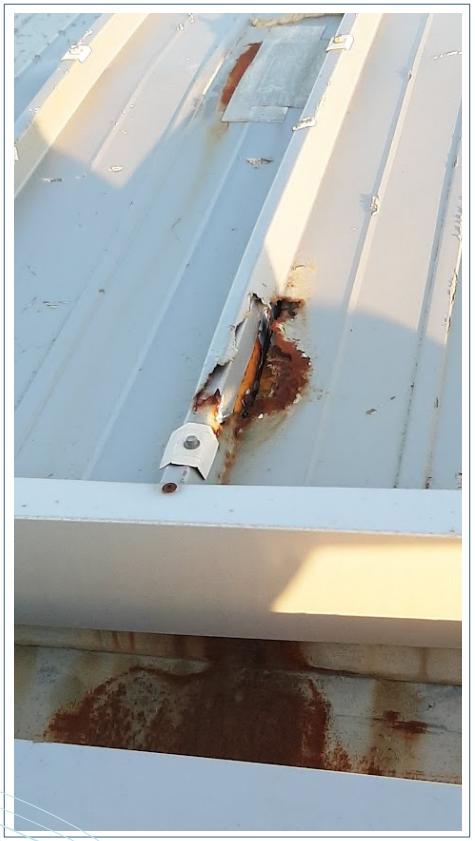


Photo 10

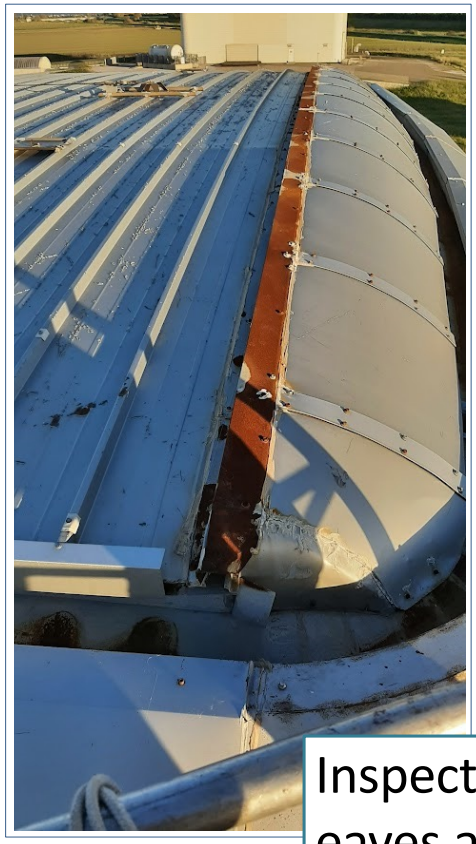


Photo 11

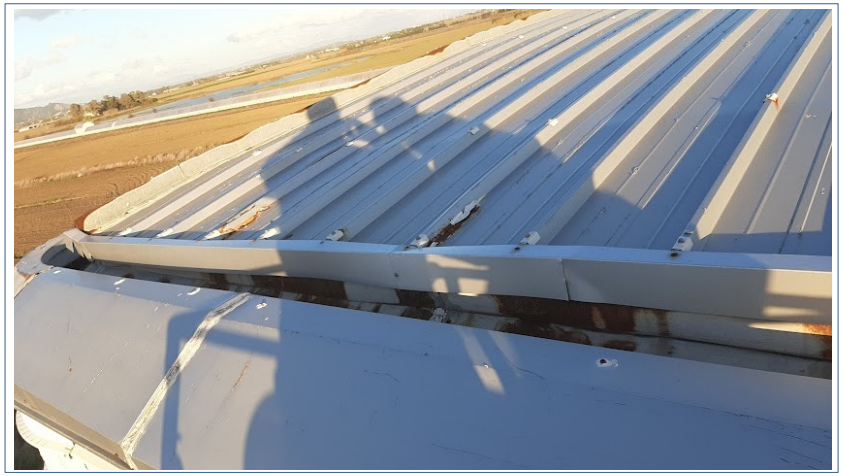


Photo 12

Inspection of the roofs and eaves and first restorations

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Central Building – Mode Cleaner - Access Building – West End Building

Photo 13

Photo 14

Photo 15

Photo 16

Repairs were carried out Tuesday, Nov 7 (photos 14, 15, 16)

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Interferometer Damage Report

EGO VIRGO

Damage of the MCB UPS

Thursday 2nd evening

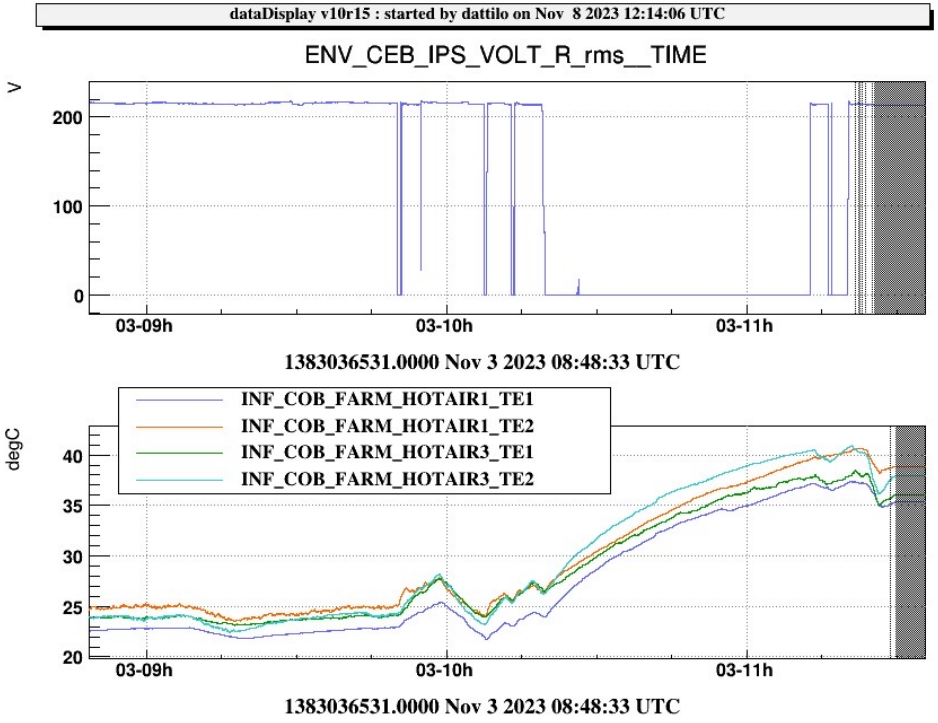
- At around 18:30 UTC the DMS notified a problem on the MCB UPS
- M. D'Andrea quickly intervened
- He found that one of the two UPSs in parallel (2 x 10 kVA) had suffered water leaks coming from the roof of the building;
- The water caused a fault on the output board towards the load so both UPSs were affected by the fault.
- This caused a load shutdown

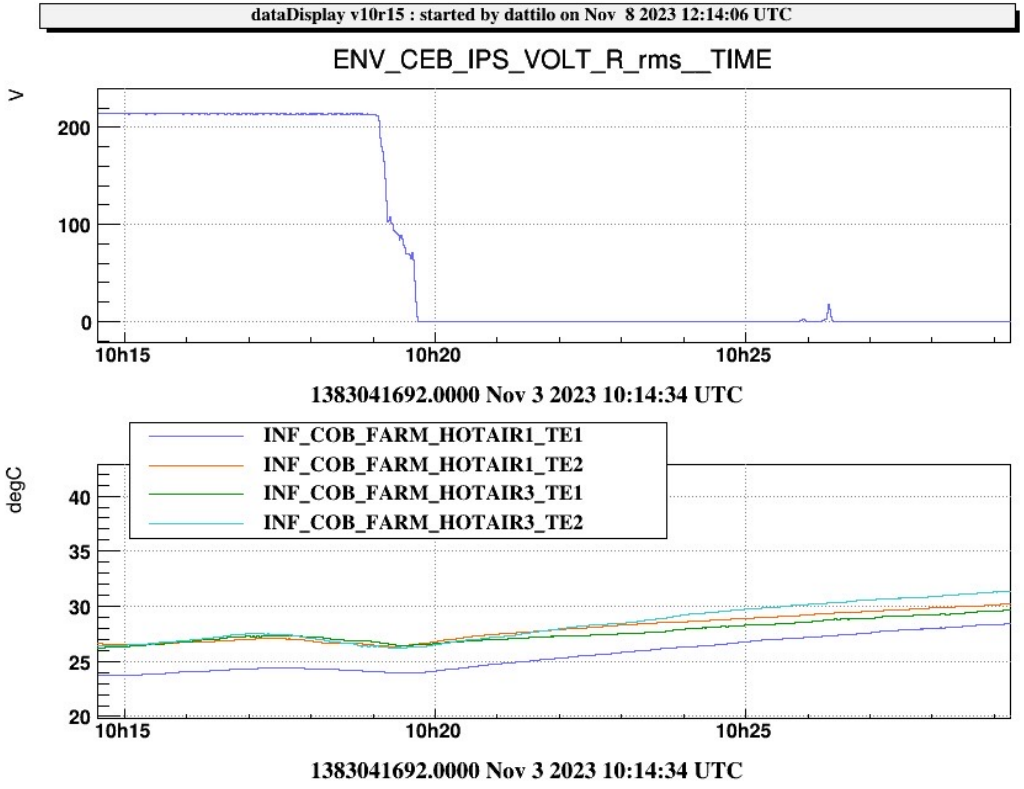
Friday 3rd morning

- Isolated (electrical disconnection) the faulty machine
- At around 07:50 UTC, MCB powered by a single UPS
- Restart of the MCB devices started

Situation Nov 9th

- one UPS in operation
- the other one to be repaired
- MCB roof needs to be repaired to avoid future water leakage


dataDisplay v10r15 : started by dattilo on Nov 8 2023 12:14:06 UTC
ENV_CEB_IPS_VOLT_R_rms__TIME
V
200
100
0
03-09h
03-10h
03-11h
1383036531.0000 Nov 3 2023 08:48:33 UTC
INF_COB_FARM_HOTAIR1_TE1
INF_COB_FARM_HOTAIR1_TE2
INF_COB_FARM_HOTAIR3_TE1
INF_COB_FARM_HOTAIR3_TE2
degC
40
35
30
25
20
03-09h
03-10h
03-11h
1383036531.0000 Nov 3 2023 08:48:33 UTC


dataDisplay v10r15 : started by dattilo on Nov 8 2023 12:14:06 UTC
ENV_CEB_IPS_VOLT_R_rms__TIME
V
200
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0
10h15
10h20
10h25
1383041692.0000 Nov 3 2023 10:14:34 UTC
INF_COB_FARM_HOTAIR1_TE1
INF_COB_FARM_HOTAIR1_TE2
INF_COB_FARM_HOTAIR3_TE1
INF_COB_FARM_HOTAIR3_TE2
degC
40
35
30
25
20
10h15
10h20
10h25
1383041692.0000 Nov 3 2023 10:14:34 UTC

Damage of the TEB1 electrical generators 1/2

Friday 3rd

- From ~10:00 to 17:45 UTC ENEL blackout
- Our generators started regularly, but after a few minutes the 2 generators (2 x 500kVA) of TEB1 that serves the Central Area, went into forced stop by the engine safety systems, due to the presence of water in the fuel
- The combination of large amounts of rain in recent days (143 mm) and strong winds (up to 100km/h) have caused water infiltrations into the underground diesel tank that serves the generators
- Due to the simultaneous failure of the ENEL supply and the 2 generators, the CEB, MCB and Computing Centre remained powered only by the UPS batteries, with limited autonomy (2-3 hours). Thus we had to proceed to a controlled shutdown of the ITF and of the Computing.

Damage of the TEB1 electrical generators 2/2

Recovery activity

- On Friday we have made a new emergency connection on a new diesel tank to supply clean fuel to the generators, after attempting to purge the polluted fuel from the generators' power circuits, but the restart attempt failed. Failed attempt also on Saturday morning.
- On Monday 6th, with the help of an external company, an internal cleaning of the machines was been carried out, and finally the generators have returned to regular service.
- On Tuesday morning, a stress test has been successfully carried out, with ENEL supply disconnected for 15 minutes and the entire load under generators.

Situation Nov 9th

- Generators active and ready to turn on in the event of an ENEL blackout
- The connection to the new diesel tank (which in the emergency was made temporarily) will have to be finalized
- the old diesel tank will be emptied and decommissioned. Since last spring we have already started a campaign to decommission all the diesel tanks on the site (there are 11 in total, for a total of 90000 litres), and replace them with new tanks that are no longer underground

Vacuum&Mechanics Report

V&M report – mains failure 03/11

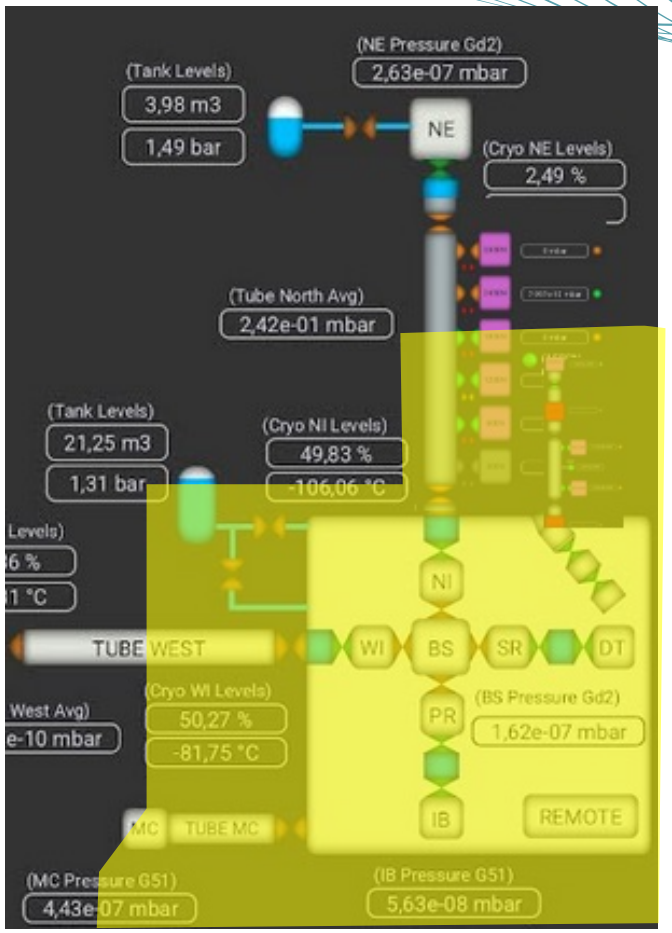
A shutdown was forced for all devices and drivers associated with the following systems:

- 7 CB towers and Tube Cryotraps
- MC tower and MC tube
- Pumping stations of both UHV arms from 0 m to 1500 m
- Squeezing systems – all stations

During the weekend, the chambers were isolated and left in static vacuum.

- At restart, some devices failed and were replaced. Spare inventory to be restored ≈ 15 kE.
- Recovery activity is underway, expected to be completed by Tue 07/11

A special case is that of cryostats: to avoid their warming up with the associated mechanical risks and longer recovery times, we kept operating the relevant refill systems. One-two persons have been on site closely following this operation.



V&M report – mains failure 03/11

Others:

- Vacum lab @ 1500N, 1500W: two tests undergoing were interrupted (NEG-ZAO vs water, ‘thick’ SS samples vs hydrogen). They can be repeated without complications.
- Mech. Shop: No consequences

Conclusions:

- Shutdown recovery was completed
- Weak points / improvements to be undertaken = spare inventory need to be increased, due to increased aging of parts, higher frequency of extreme events and generally long delivery terms.

Information Technolgy Report

EGO VIRGO

Cascina IT design and effect of power cut

- Cascina IT infrastructure centralized in 2 rooms of the Control Building

- IT was not designed to foresee any geographic nor local disaster recovery mirror (duplicating the system would entail duplicating the building facilities anyway)

- Focus put on disaster prevention for most common failures from external factors:
  - flooding: *in 2006 the network and computing infrastructure raised to the first floor*
  - fire: *halon based antifire system*
  - lightings: *avoid copper data cables crossing the building perimeter in computer room*
  - overheating: *N+1 redundant cooling equipment*
  - provider power cut: *relying on the double UPS+power-generator of the site*
  - and on redundancy of any IT component to avoid SPOF (Single Point of Failure) in normal conditions
- Consequences for the whole site:
  - LAN/phone_system/Internet/mail down: lack of communications on-site and off-site
  - working devices: only laptops and mobiles on GSM/LTE network
  - ITF to be put in safety mode beforehand

Shutdown procedures

• New or updated procedures should be provided by the Virgo Subsystem manager to make the shutdown sequence as safe as possible for apparatuses

•The event demonstrated that the combined ITF + Computing shutdown procedure is taking too long to fit the UPS autonomy:

- • A new "emergency" procedure should be defined for each subsystem and for the computing with some deviations/shortcuts from the standard procedure which has been normally followed for planned shutdowns
- •The serialization/parallelization of the ITF and Computing procedures should be reviewed

Final remarks

- We have been trough an unwanted major “stress test”.
- The test has been passed thanks to the prompt response of EGO personnel and VIRGO members.
- Electrical power line performances degraded in the last years, due to increase load (non EGO) on the line => stress on the infrastructure
- EGO infrastructure is 25 year old and need some extraordinary maintenance
- A common EGO/VIRGO procedure to respond to sudden adverse events has to be defined and a working group has been appointed jointly by VIRGO spokesperson and EGO Director

Stable Cavity – EGO Director perspective

- Extract from STAC report, November 2023
- “The magnitude and complexity of the project requires enhanced QA/QC, and EGO management should make sure that the necessary personpower for efficient and exhaustive QA/QC is available.”
- “We recommend that a new 10 year strategic plan for EGO and Virgo is prepared. This must be completed by the 2nd or 3rd quarter of 2024. The long term scientific strategy, which is linked to Virgo_nEXT, LIGO (A#), Cosmic Explorer and Einstein Telescope is not clear.”

Stable Cavity – EGO Director perspective

- I totally agree with the STAC recommendation.
- Both proposal for stable cavity will have a big impact on the infrastructure.
- We need a clear assessment of the needed person power.
- A detailed risk analysis of the needed major changes in the infrastructure, largely irreversible, is needed
- Clear set of milestones (that was not the case so far)
- A long term strategy for EGO and Virgo has to be defined

Thank you for your attention!

EGO VIRGO