

# Upgrade Coordinator Report

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INFN Roma Tor Vergata

VIR-0586A-24

# Outline

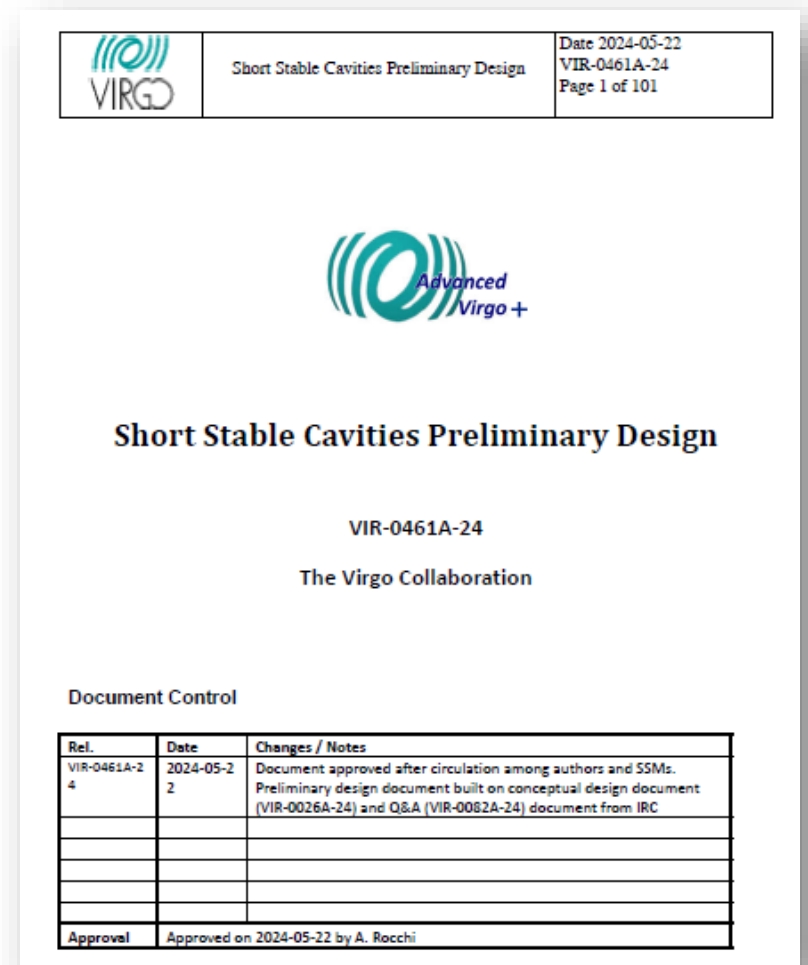
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- Stable recycling cavities
- Upgrade Plans for O5
  - Baseline configuration (Plan A)
  - Emergency plan (Plan B)
- Project Management

# Stable Recycling Cavities

# Preliminary Design Document

- The Conceptual Design Document ([VIR-0026A-24](#)), delivered for Internal Review Committee, has been updated with the answers provided in the “Q&A document” ([VIR-0082A-24](#));
- We consider the recently released document ([VIR-0461A-24](#)) as a **Preliminary Design Document** for the implementation of the Short Stable Recycling Cavities in view of O5
- This document (together with others – see next slide) has been shared with the ERC



# Stable Recycling Cavities: ERC documents

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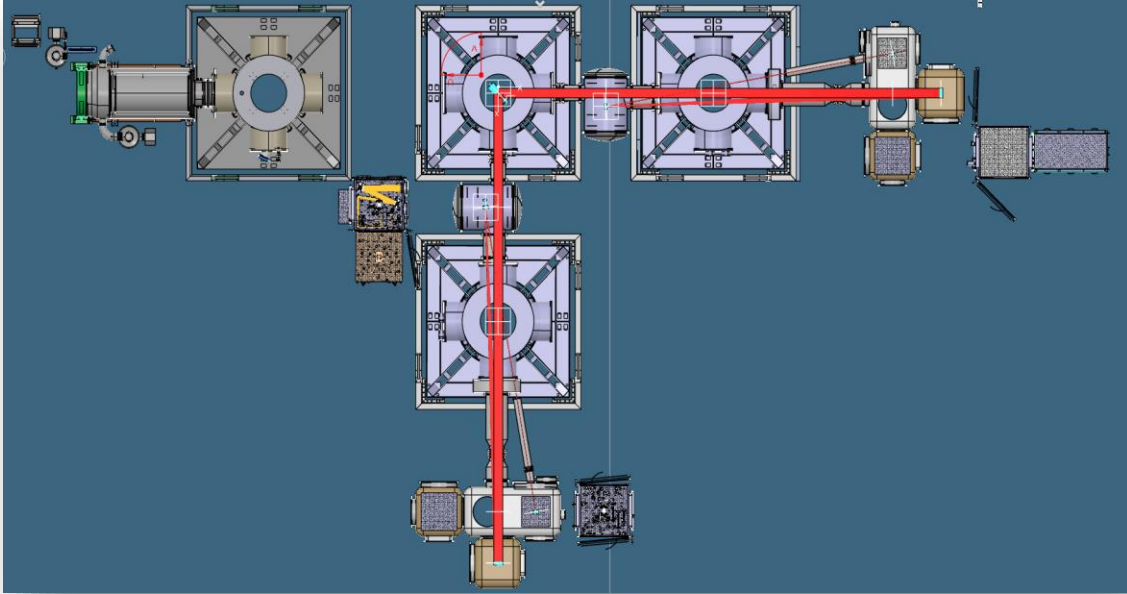
- Conceptual Design document: [VIR-0026A-24](#)
- Q&A Internal Review document: [VIR-0082A-24](#)
- Note on thermal effects evaluation (40 and 80 W): [VIR-0031A-24](#)
- Note on residual motion of the recycling cavity mirrors: [VIR-0314A-24](#)
- Results of Risk Analysis: [VIR-0063B-24](#)
  - Selection criteria document: [VIR-1088B-23](#)
  - Current Risk Management Plan: [VIR-1060C-23](#)
- Internal Review Committee Report: [VIR-0325A-24](#)
- Preliminary Design Document: [VIR-0461B-24](#)
  
- All documents made available to the ERC on a Google Shared Folder

# Seismic Isolation system

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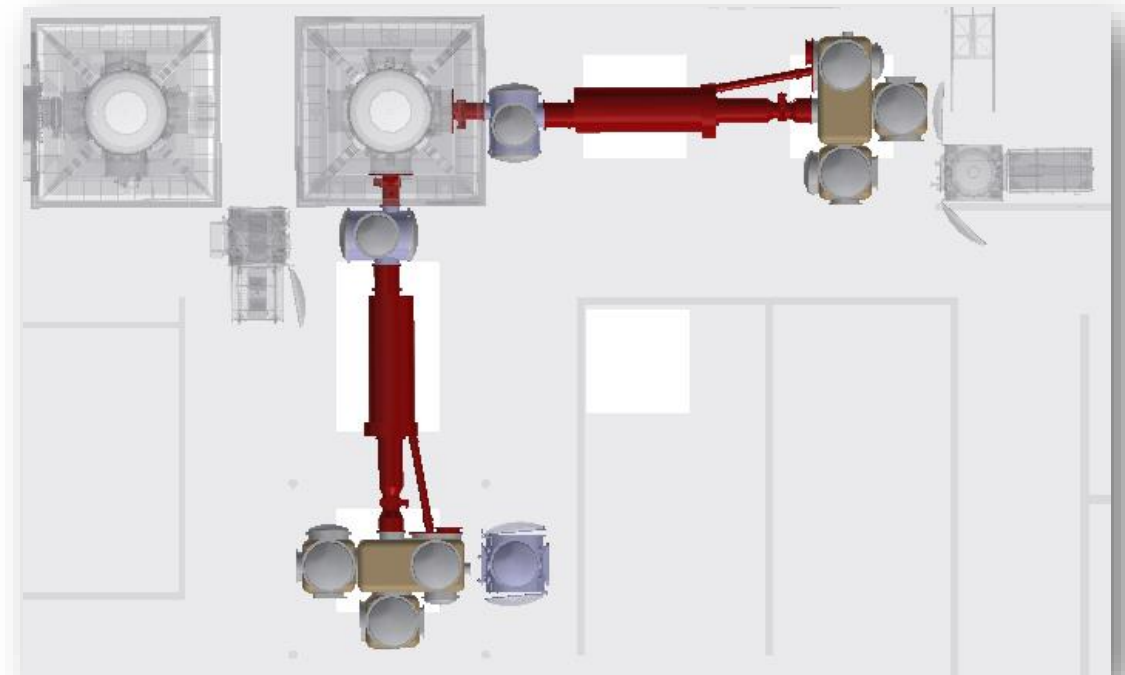
- Needed suspensions for the recycling cavities optics
  - PRM3/SRM3 (12 kg)
  - PRM2/SRM2 (3 kg)
  - PRM1/SRM1 (1.3 kg)
    - Mirror suspended on top of suspended bench
    - For SRM1, keep the possibility to install Homodyne Balanced Detection (in our VnEXT plans – in O5 LIGO plans)
  - Two seismic isolators for the injection and detection benches
    - IMC flat mirrors
    - Output mode-cleaner
- To finalize the design of the suspensions, a working group has been formed, comprising members from: EGO, Nikhef, Perugia, Pisa and Sapienza
- Information available on dedicated Wiki page: <https://wiki.virgo-gw.eu/AdvancedVirgoPlus/SuspensionsWG>

# Vacuum modifications



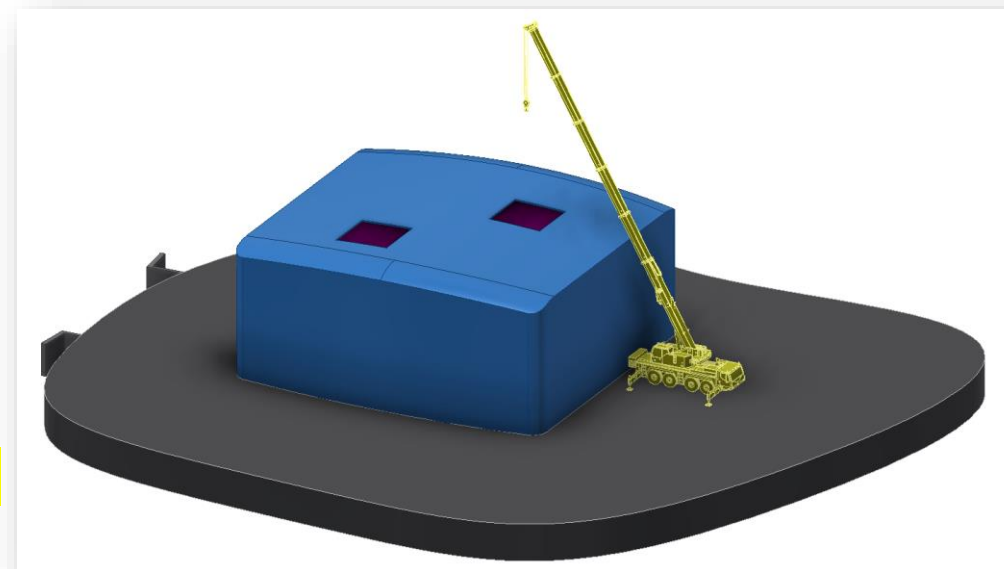
- Baseline configuration: DET and INJ towers only removed

- New configuration being considered: removal also of the PR and SR towers;
- Would free more space in the CEB;
- Would allow for larger clean areas around the new towers.



# Vacuum modifications

- To remove the two (or four) tower bases, two solutions are under study:
  1. **Open the roof of the building** to remove the entire tower bases. In this case, removing the four towers **will be faster** than in the second solution. Possibly, this option could allow tanks of similar size and weight to be inserted in same way.
    - The **EGO INF Dept.** is in the process to assign a feasibility study to an external company to assess the cost, duration and needed bureaucracy for this intervention;
  2. Enclose the towers in a structure to **cut with plasma** one tower base into 8 pieces (of masses less than 3 tons or 5 tons if the unit load of the trolleys is increased), then remove the structure and remove the pieces using the two trolleys of the main building crane. This solution preserves the integrity of the building, **but it is dirtier and requires more time to complete.**



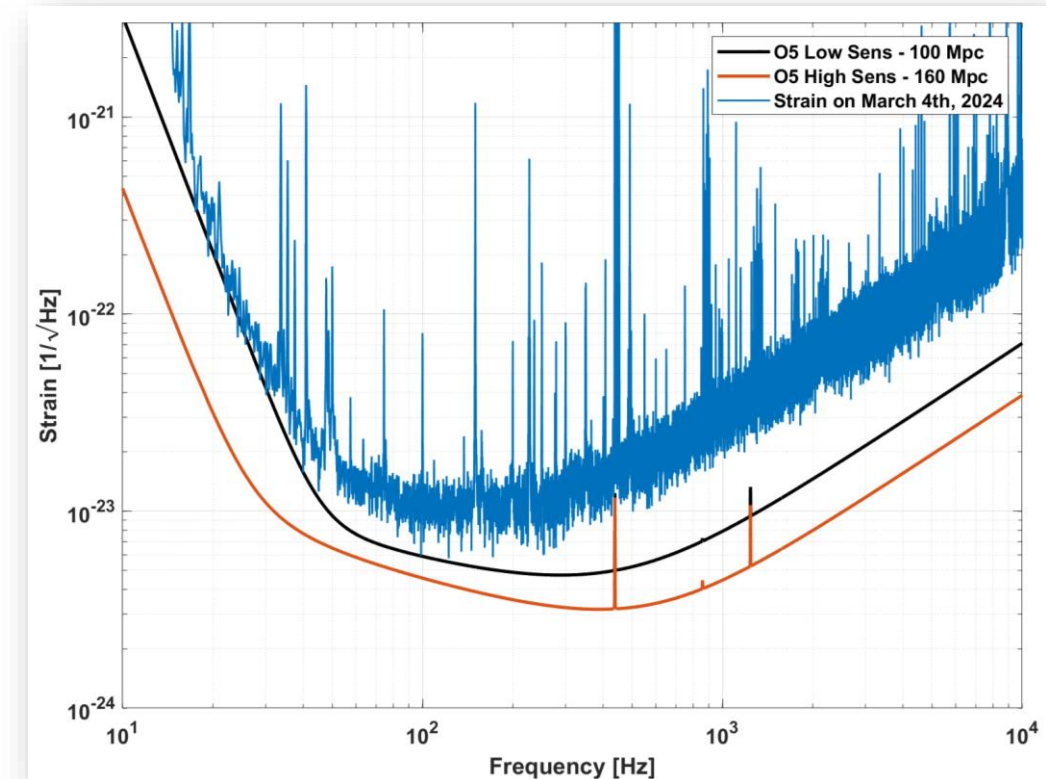


# Other upgrades for O5

# AdV+ in O5 – baseline (Plan A)

1. Short Stable Recycling Cavities
2. NO Large ETMs
3. Other Phase II upgrades not connected to LMs (from [VIR-1179C-19](#))
4. Other upgrades coming from commissioning experience ([VIR-0532A-24](#))

Parameter	O5 «Low sensitivity»	O5 «High sensitivity»
Recycling cavity	Stable	Stable
FP cavity power	190 kW	380 kW
SQZ measured	4.5 dB	6.0 dB
Coating thermal noise	1	0.7
Low Freq. Tech. noise	High	Low
BNS range	100 Mpc	160 Mpc
BBH range	1 Gpc	1.42 Gpc



PSDs on the TDS: [VIR-0218A-24](#)

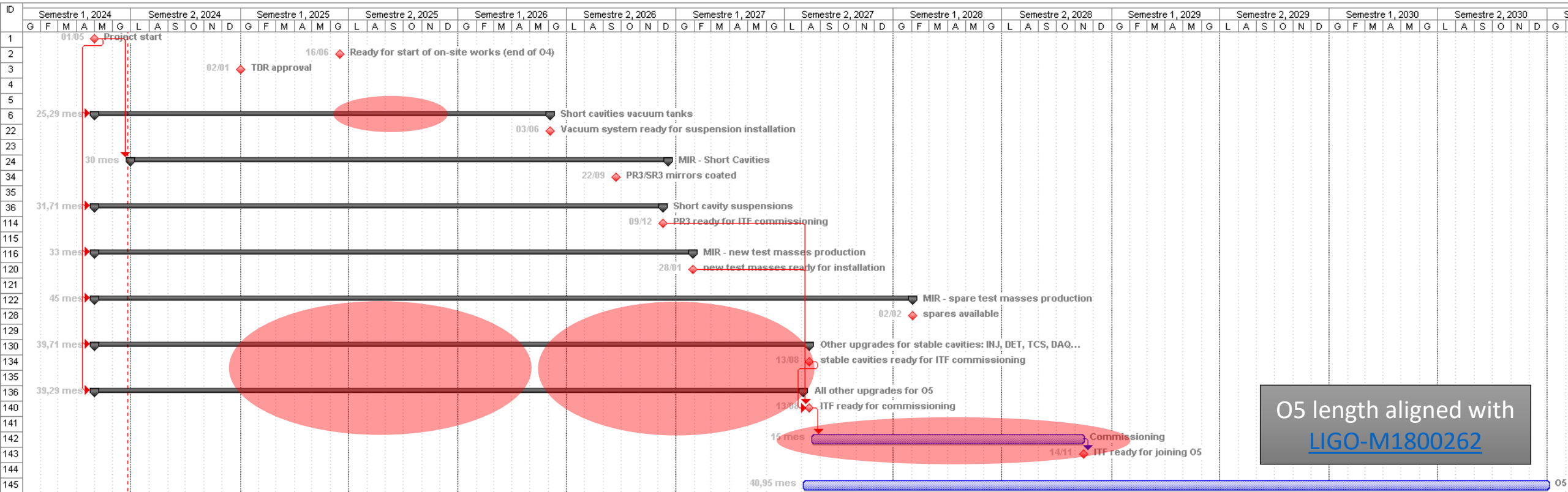
Available to DA colleagues for simulations

# Preliminary global planning

Uncertainty on start and duration of infrastructure interventions in CEB

Uncertainty on the procurement phase due to the load on the EGO administration (mostly coming from bureaucracy)

Installation and commissioning planning to be refined

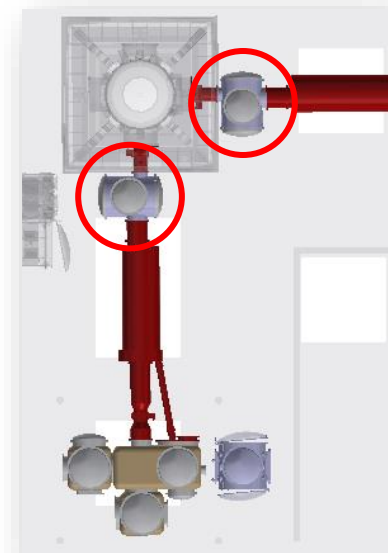


O5 length aligned with [LIGO-M1800262](#)

# Urgent expenses

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- Current schedule relies on the possibility to anticipate some urgent expenses (mostly related to stable cavities) before the delivery of the TDR
- Urgent expenses for 2024:
  - 1.5 M€ for recycling cavity mirrors (convention with LMA needed – EGO not allowed for this kind of CfTs)
  - 0.4 M€ for suspensions prototyping
  - 0.1 M€ for SAT control electronics development (internally reviewed)
  - 0.4 M€ for PR2/SR2 vacuum chambers (standard design)
- A decision is needed at this time

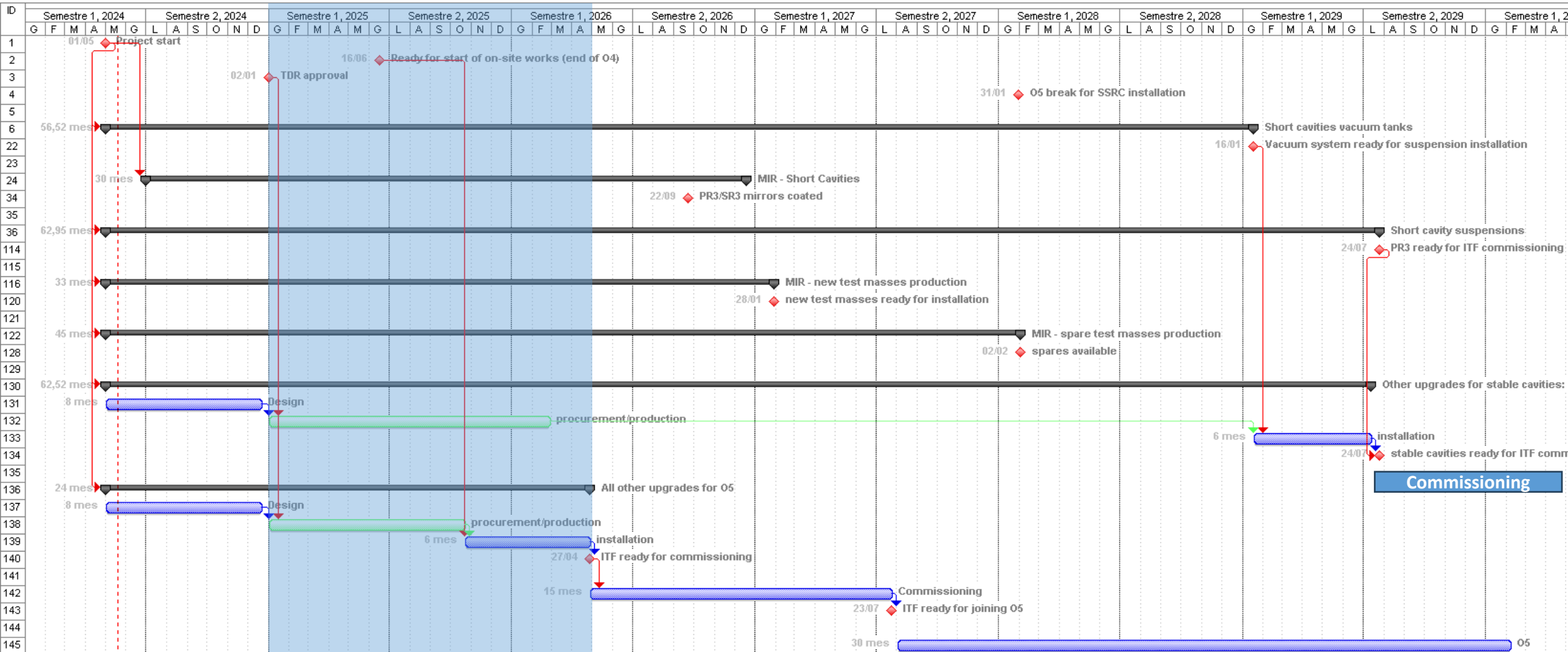


# The Plan B (emergency plan)

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- Proceed with stable cavities production, but defer installation to the future (start after end of O5) → keep unstable cavities in O5
- Replace PRM and North CP (major sources of optical aberrations)
- Install some upgrades coming from Phase II ([VIR-1179C-19](#)) and commissioning experience ([VIR-0532A-24](#))
- Open points:
  - **Replacement of TMs**
  - What **input power** (or how much power in the arms)
  - **Squeezing** effectiveness with high SRC losses
- Very difficult to make projections on achievable sensitivity, likely in the 60-80 Mpc range
- **Might** allow to join O5 from the beginning
  - Plan B planning has same uncertainty level as Plan A planning

# The Plan B (emergency plan)



# Project Management

# Project Management Structure

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- New structure of the AdV+ Project Office since February 2024:
  - Upgrade Coordinator (A. Rocchi)
  - Technical Manager (H. Heitmann)
  - Configuration Manager (H. Heitmann – ad interim)
  - System Engineer (F. Carbognani)
  - QA/QC Manager (---) → in the EGO recruitment plan
  - Risk Manager (F. Sorrentino – ad interim)
  - On-site Integration Manager (---) → in the EGO recruitment plan
  - Liaison to Commissioning (M. Was)
  - Liaison to V\_nEXT (V. Fafone)



# AdV+ PO description document



- Document released to describe structure of the AdV+ Project Office:
  - Description of the roles of the members (Technical Manager, Configuration Manager, System Engineer, Quality & Risk Manager, On-site Integration Manager)
  - Focuses on integration phase of the project
  - Available on the TDS: [VIR-0390A-24](#)
- Used to test new infrastructure for Document Lifecycle Management
  - Document approval process managed through Google environment with authentication
  - Approved document automatically uploaded on the TDS on a specific series
- It will be extended to SSs documents



Series ?

—Project —Advanced Virgo Plus —MAN —Sys Eng and QA —Document Approved

# Project Management Structure



## AdV+ Project Management Team

**AdV+ Project Office**  
 Upgrade Coordinator: A. Rocchi  
 Technical Manager: H. Heitmann  
 System Engineer: F. Carbognani  
 QA/QC Manager: TBD  
 Risk Manager: F. Sorrentino – ad interim  
 On-site Integration Manager: TBD  
 Configuration Control Manager: H. Heitmann – ad interim  
 Liaison to Commissioning: M. Was  
 Liaison to Virgo\_nEXT: V. Fafone

## AdV+ Project Technical Committee

<b>OSD</b> S. Steinlechner	<b>SBE</b> H. Bulten	<b>CRD</b> M. Bazzan	<b>NNC</b> J. Harms	<b>SGD</b> M. Vardaro
<b>PSL</b> W. Chaibi	<b>MIR</b> L. Pinard	<b>ISC</b> J. Casanueva	<b>INF</b> A. Paoli	<b>SVS</b> M. De Laurentis
<b>INJ</b> M. Gosselin	<b>TCS</b> I. Nardecchia	<b>ALS</b> A. van de Walle	<b>VAC</b> A. Pasqualetti	<b>SIN</b> R. Bonnand
<b>SLC</b> L-M. Mir	<b>PAY</b> E. Majorana	<b>DAQ</b> N. Letendre	<b>EMS</b> R. De Rosa	<b>FLT</b> A. Bertolini
<b>DET</b> R. Gouaty	<b>SAT</b> V. Boschi	<b>CAL</b> L. Rolland		

# Next steps

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1. Finalization of the PBS (list of deliverables) for O5
2. Production of the TDR
  - **New** chapters for **new** deliverables from Stable Cavities and O4 commissioning
  - **Old** chapters for **old** deliverables
  - **Reviewed** chapters for **old** deliverables
  - including costs, person-power, **new risk register** (see later), **new requirements register**, interfaces
  - Internal Design Reviews of chapters (next slide)
3. Production of the WBS: new WBS for new deliverables, review existing WBS for existing deliverables.
4. Assemble global planning for production, installation and commissioning for O5

Planned delivery date of TDR to the ERC: **October 2024**

# Design Reviews



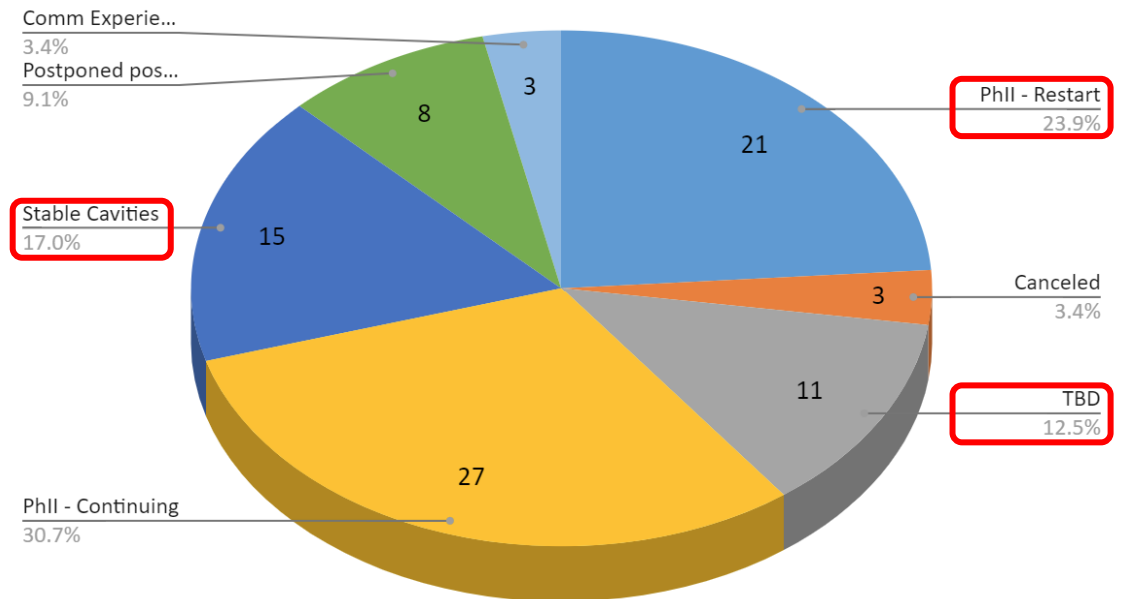
## AdV+ Phase II - O5 System Engineering Top Page

Subsystem	SSM	Code	Deliverable	TDR chapter	Interface Control	Risks Table	Verification Matrix	Actions	Review status	Priority	Del. type	C
CAL	L. Rolland	CAL.01	CAL - Newtonian calibrators	<a href="#">Google Doc</a> TDS		CAL	CAL.01	None	Approve		PhII - Continuing	C
		CAL.02	CAL - Dark fringe sensors frequency response calibrator				Approve			PhII - Continuing	C	
		CAL.03	CAL - End benches scattered light calibrators				Follow up			PhII - Restart light	C	
		CAL.04	CAL - Photon calibrators (TBC)				Completed			PhII - Restart full	C	

- Internal Design Reviews of TDR chapters

- New deliverables → new review
- Phase II continuing → no review
- Phase II restart full (light) → full (light) review (depending on the level of modification)

Del. type



# Risk Register

1. Update Risk Register to take into account Risk Impact Domain
2. Update Risk Register according to status of the corresponding deliverable

Level	Cost impact	Schedule Impact	Performance Impact
5	> 300 k€	> 4 months	Unacceptable
4	50 ... 300 k€	2 - 4 months	Doesn't meet important goals
3	25 ... 50 k€	1 - 2 months	Doesn't meet some goals
2	5 ... 25 k€	<1 month	Doesn't meet high goals
1	< 5 k€	Negligible	Negligible



## Draft plan to update AdV+ risk register

- Include risks on new deliverables
  - who: SSMs
  - when: during the review process for TDR preparation
- Set risk items on obsolete deliverables as "closed"
  - who: SSMs
  - when: after risk register is updated
- Include impact domains: technical, financial, schedule
  - who: risk manager
  - when: ASAP
- Update standard risk tables for TDR review accordingly
- Include global & interface risk items (TBD)
  - who: risk manager & SSMs, open contribution by anyone else
  - when: along TDR editing
- Prepare standard tools for risk identification (TBD)
  - who: risk manager
- No immediate actions for SSM

Risk ID	Risk manager	Name	SS / Deliverable	Phase	Risk Evaluation			Action Date (check)
					Probability	Impact	Severity	
INJ001	Antonino Chiummo	EGO Optics group overlap	INJ	I	3	3	Med	8/4/2020
INJ002	Antonino Chiummo	Marionette design drawing details	INJ	I	3	2	Med	1/31/2020



## Risk management draft work plan

- During TDR preparation
  - update risk register (see previous slide)
  - One cycle of risk analysis for each risk item
    - » identification (cause and impact domains)
    - » assessment (likelihood and severity)
    - » response definition implementation (accept/close/avoid/transfer)
    - » response definition implementation
    - » monitor and control
- During project execution
  - periodic review of risk items status: repeat risk analysis cycle for each phase and for each open risk item
    - » who: SSMs & risk manager
    - » when: TBD
  - Dedicated study on mitigation for high severity risks
    - » who: risk manager & concerned SSM
    - » when: as soon as high severity is assessed

### 3. Start Risk Management Lifecycle

# Conclusions

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## 1. Stable Recycling Cavities

- Preliminary Design Document released
- Open design options being nailed down

## 2. Plans for O5

- Detector configuration for Plan A defined
  - Increase detector robustness with short stable recycling cavities
  - Target sensitivity in the range 100-160 Mpc
  - Schedule for O5 is tight (room for planning optimization)
- Plan B being consolidated
  - Postpone installation of stable cavities to after O5
  - Very limited modifications to the detector
  - Achievable sensitivity in the 60-80 Mpc range
  - Schedule for O5 is tight

## 3. Project Management Structure

- Reviewed for a more “**rigorous project management structure**”
- Some key members to be hired
- The planned management processes starting