



LISA Mission Status & Performance

ESA-LISA-EST-MIS-HO-0015

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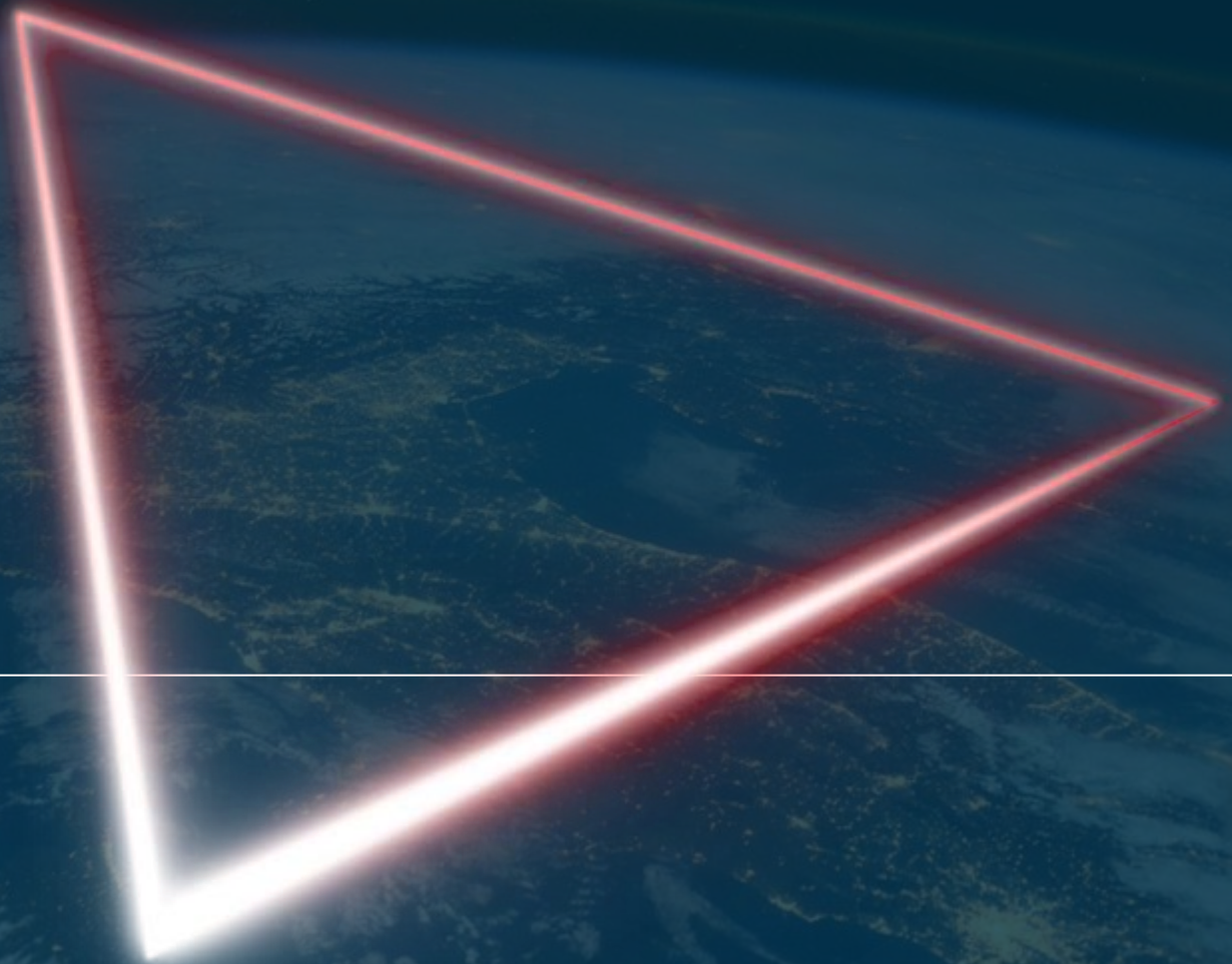


1. Preparing for implementation
2. Performance & Operations





Mission Status

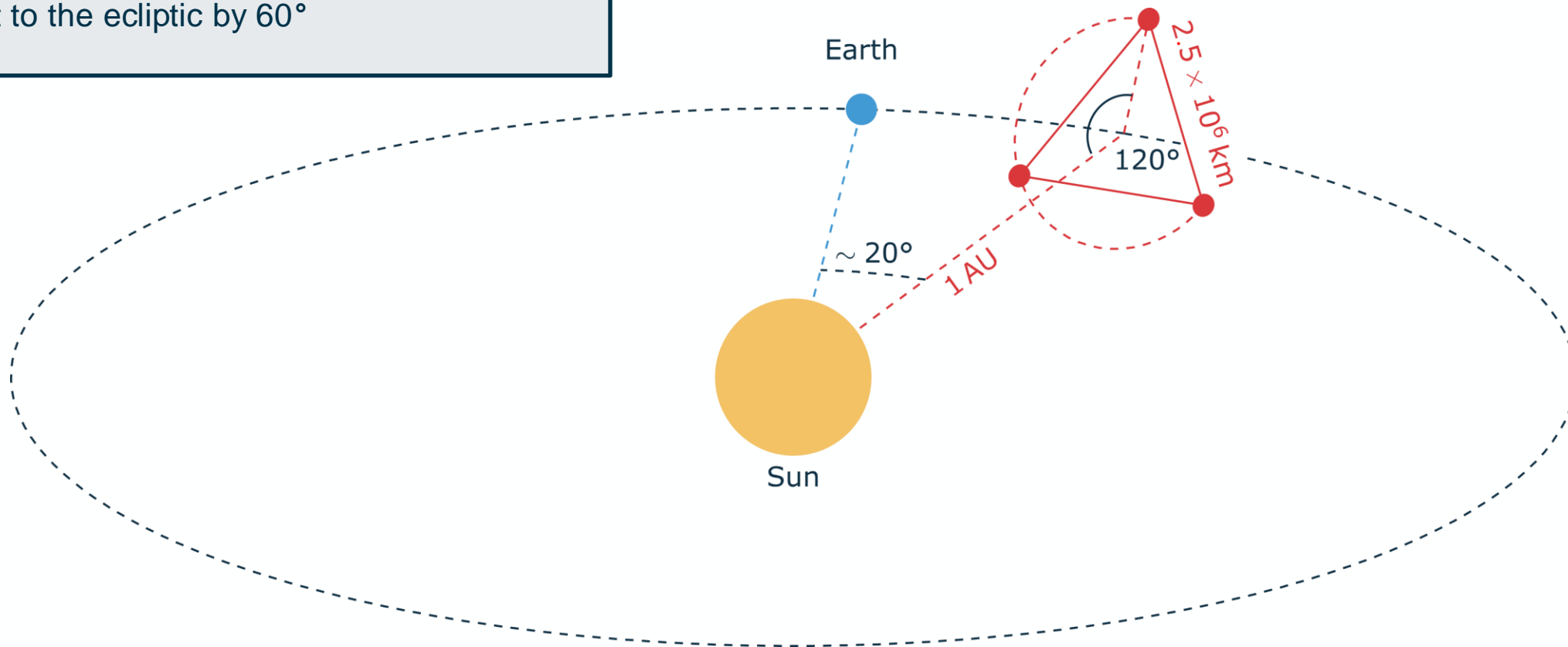




LISA Mission Concept

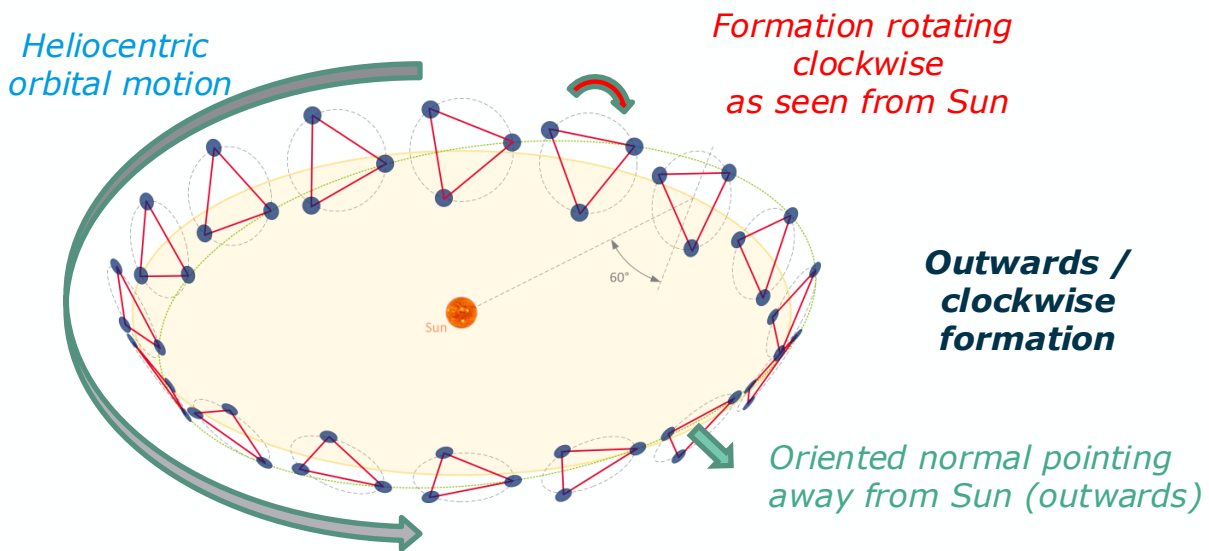


Cluster of **3 spacecraft** in heliocentric orbit
Trailing or Leading the Earth by 20° (50 million kilometres)
Equilateral **triangle** with 2.5 million kilometres arm length
Inclined with respect to the ecliptic by 60°





LISA Mission Concept



Pre-Launch	LEOP, NECR, Transfer	Commissioning	NSP	Disposal
	1.5 year	3 months	4.5 years	1 week

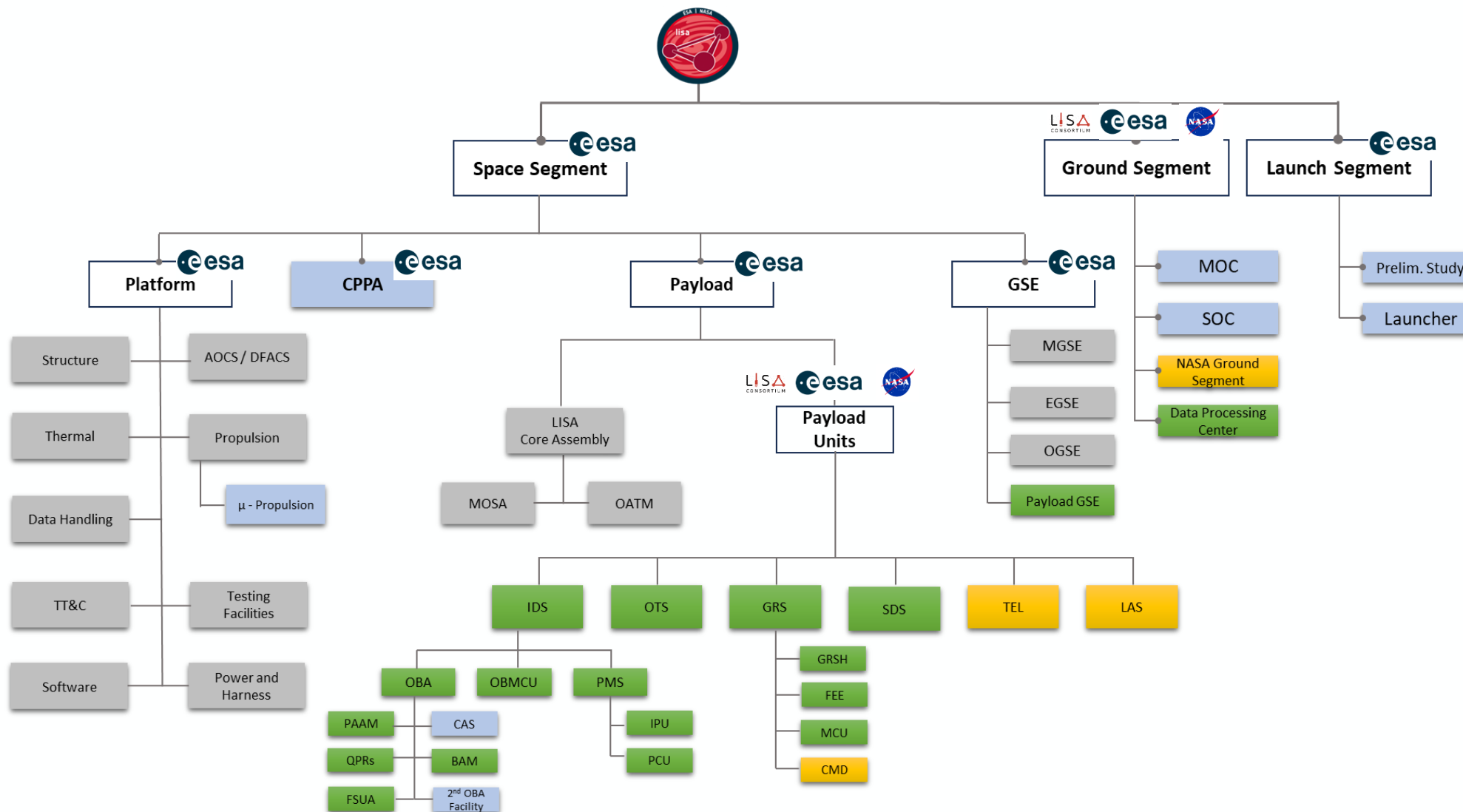
6,25 years

POWER	~2.3 kW in Science Mode Bus voltage @ 28V
MASS	~8300 Kg Launch Mass 2400 kg dry mass per spacecraft (plus adapter / dispenser and propellant)
COMMUNICATION	~270 kbits/s data rate X band (deep space) via steerable HGA 8 hour/day to 35m ESA Ground Stations
PROPULSION (TRANSFER)	1.5 kW Hall-Effect Xenon Thrusters
DRAG FREE AND ATTITUDE CONTROL	Cold gas (Nitrogen) micro-Newton thrusters (heritage GAIA, LPF, Microscope, Euclid) 3-axis stabilized





An International Co-operation



ESA Responsibility

LISA Cons. Responsibility

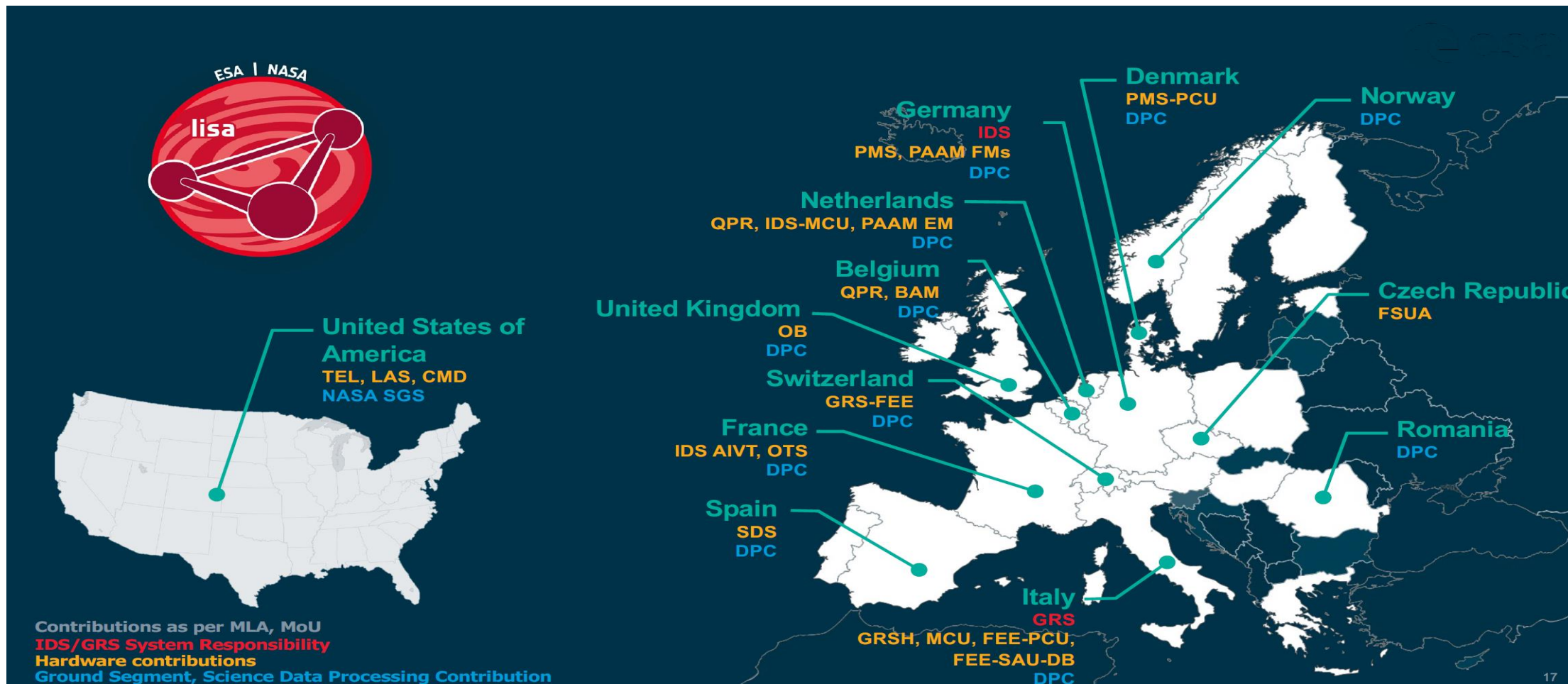
NASA Responsibility

- ESA Procurement
- Prime (ESA Procurement)
- NASA
- Member States





12 Member States and NASA





From Adoption to Build-up of LISA project



Mission Adopted

25/01/24

Proposals Evaluation for selection of Industrial Consortium

Aug/Oct 24

Negotiation and Industrial Contract Kick-off

Dec 24 / Jan 25

System Requirements Review

Q3 25

28/03/24

Invitation to Tender published

Q3 24 (start) to Q1 2025 (end)

Preliminary Design Reviews of CFIs Subsystems

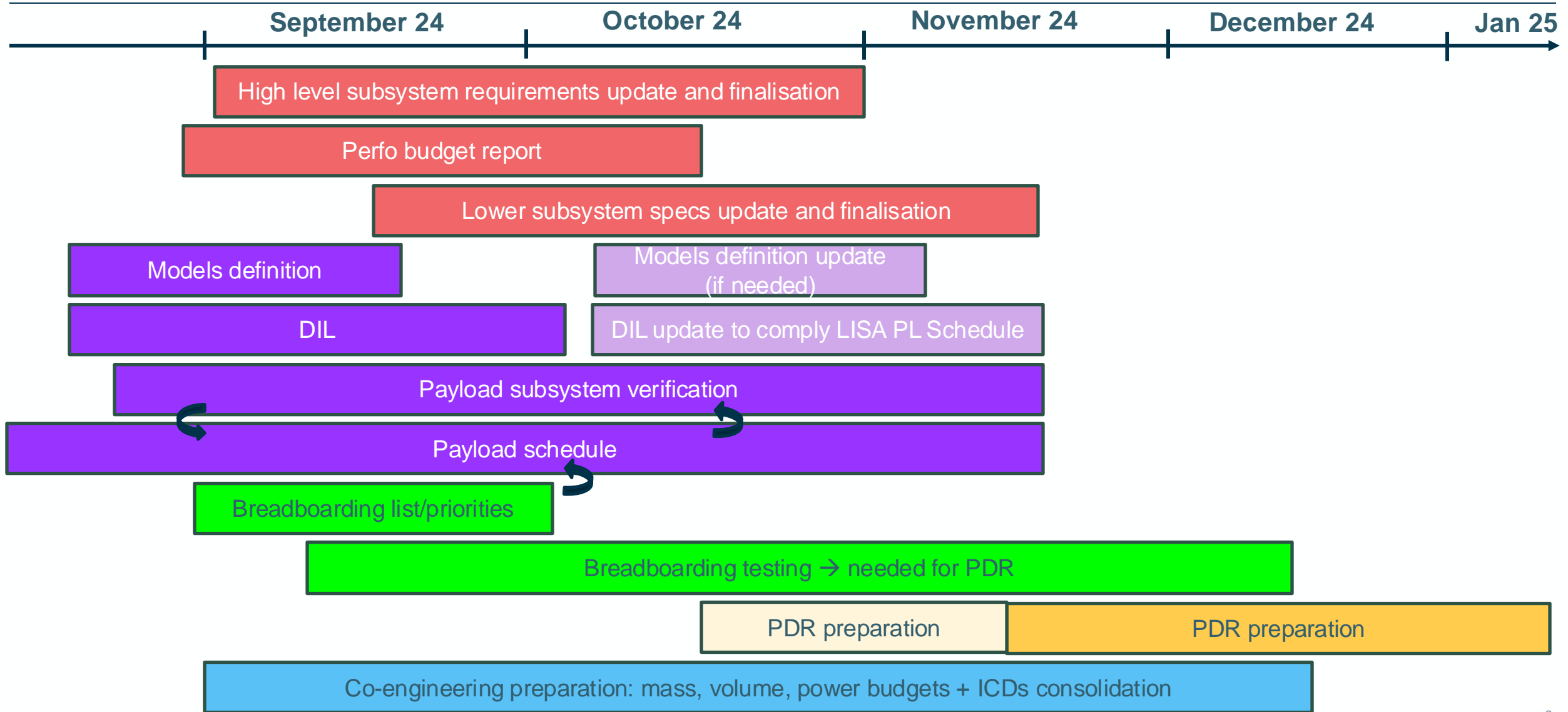
Jan 25 to Apr 25

Co-engineering Phase with Industrial Team and CFI Teams





LISA Payload Short-Term Plan





LISA Project team

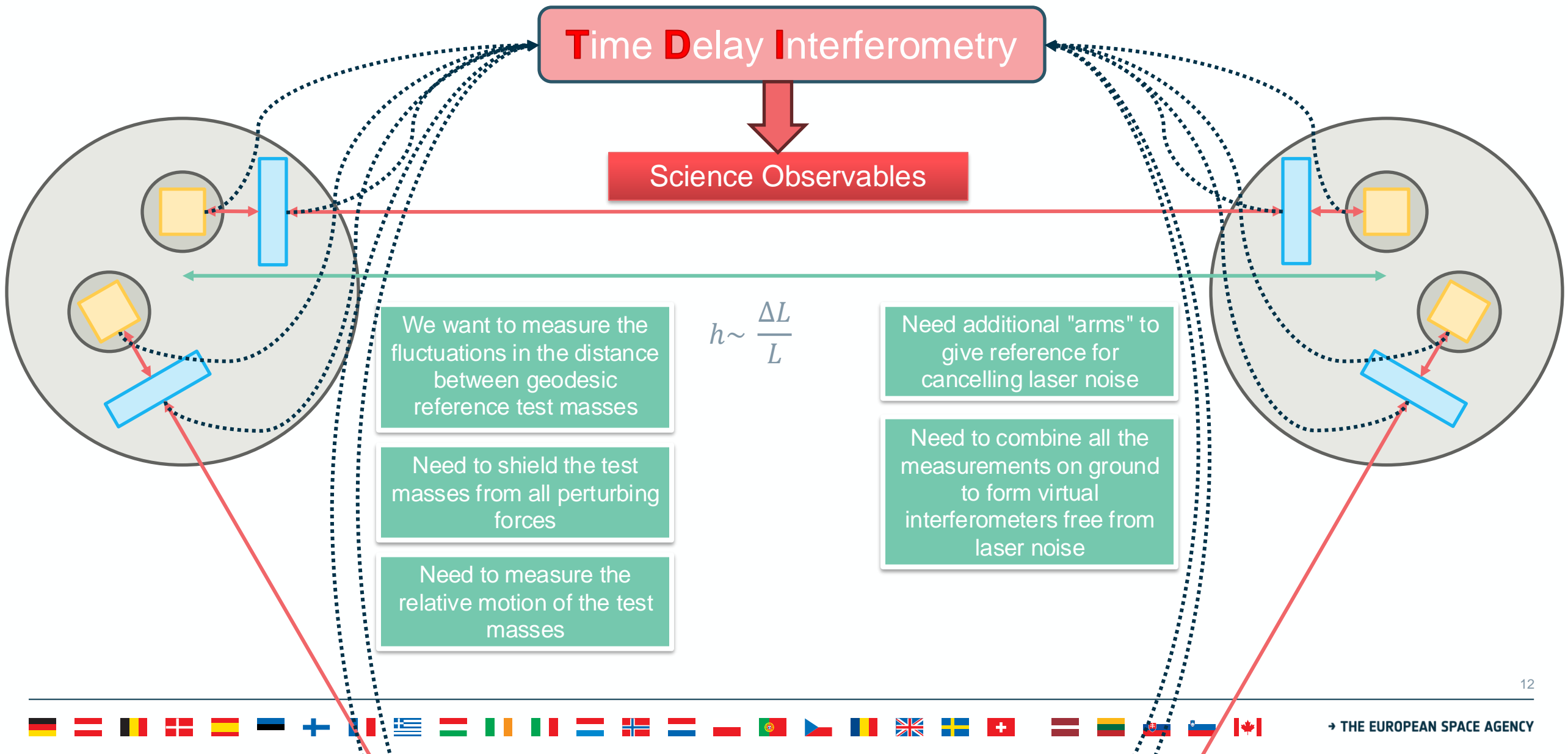




LISA Performance – Status

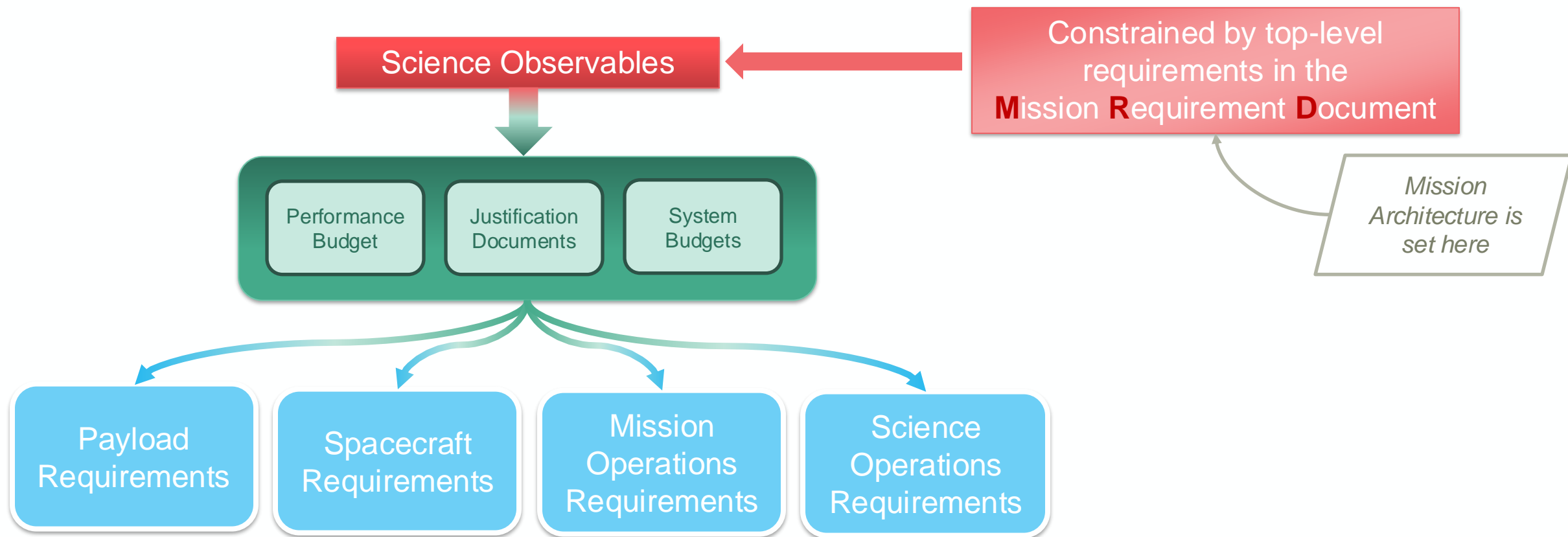


LISA: Key features and measurement principle





Ensuring Performance: requirements flow-down

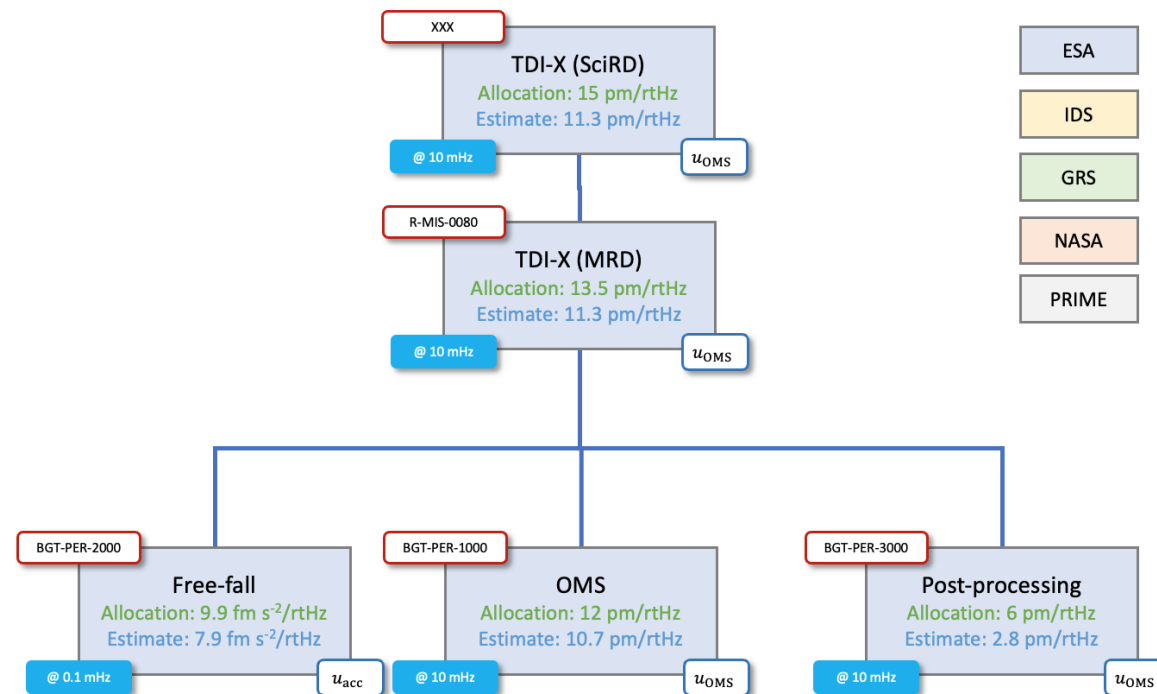




Top-level performance break-down



- Performance contributors are grouped in three main areas:
- Optical Metrology Noises
 - “Local” noise in interferometers, mostly driven by IDS hardware
- Test Mass Residual Free-Fall noises
 - Noises local to a single SC that disturb the TM in its free-fall
- Post-processing Residuals
 - Couplings of system noises that couple when we form the constellation in post-processing

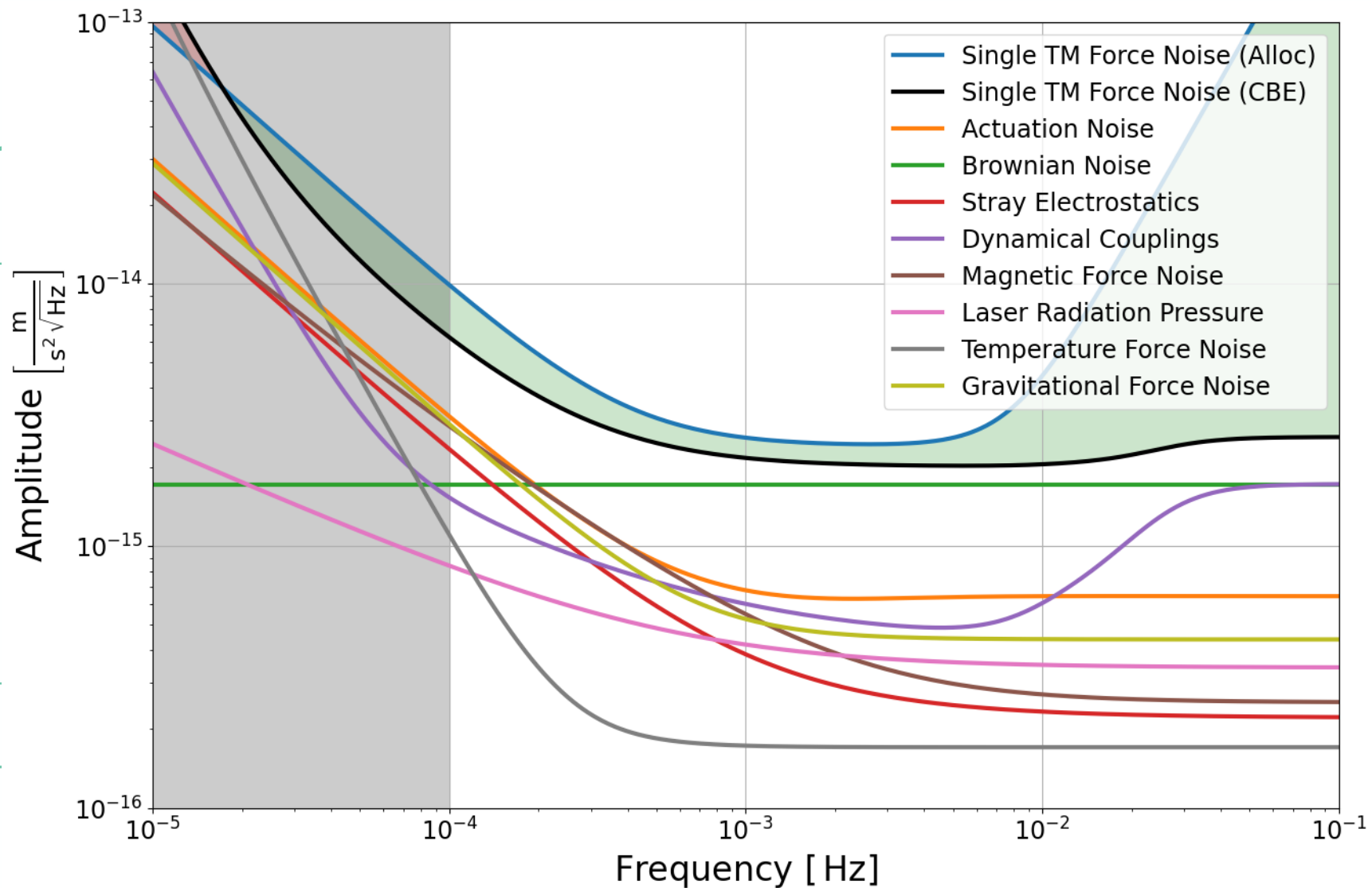
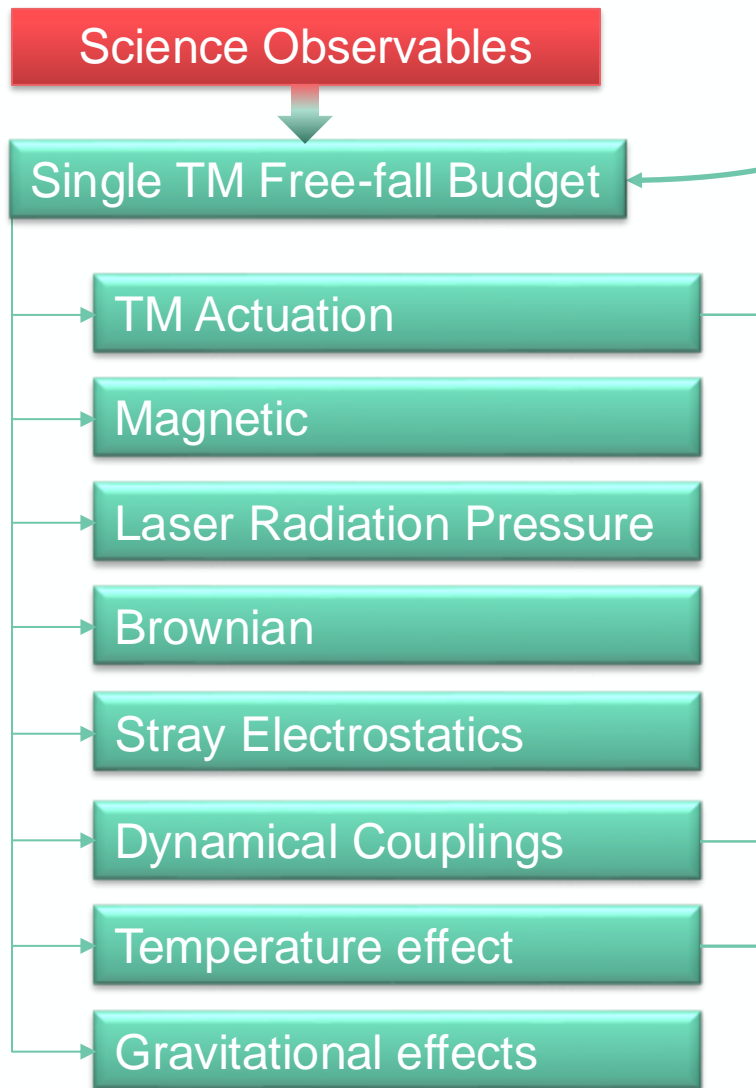


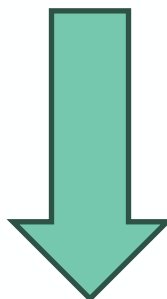
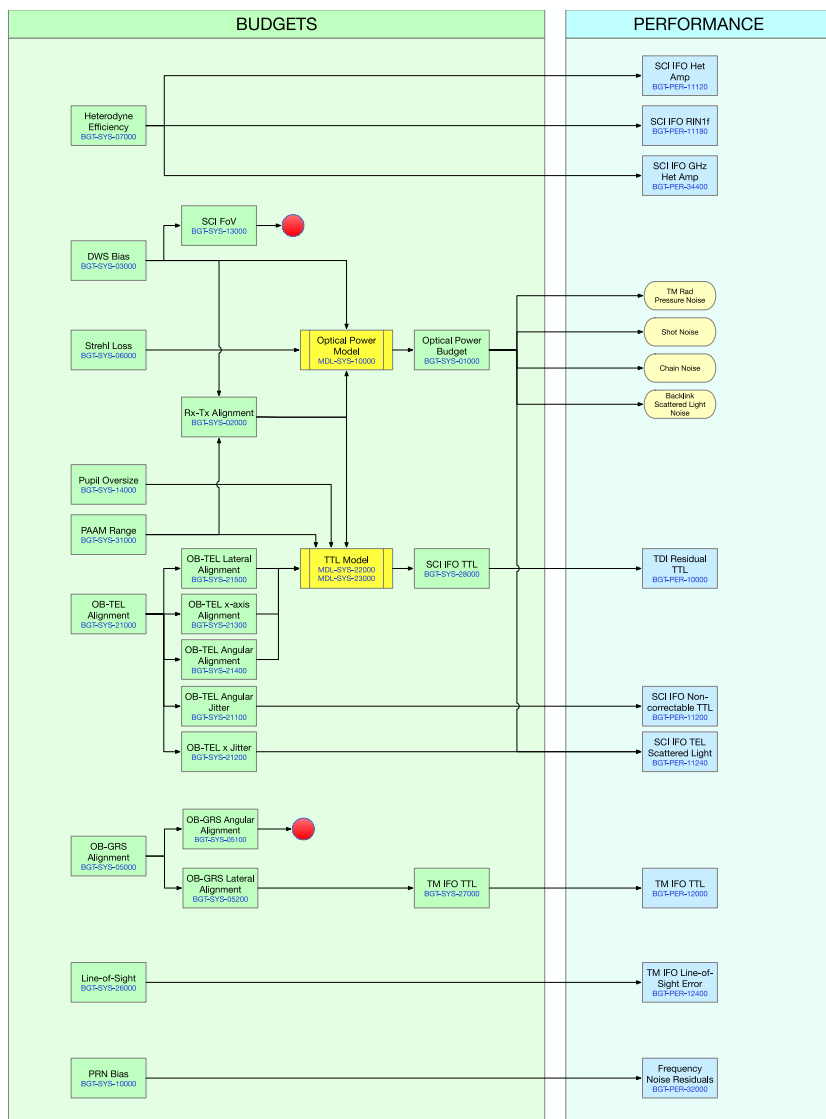
10000 OMS	20000 Free-Fall	30000 Post-processing
11000 SCI IFO	21000 Actuation	31000 Residual TTL
12000 TM IFO	22000 Magnetics	32000 Frequency Noise Residuals
13000 REF IFO	23000 Stray Electrostatics	33000 MOSA Longitudinal Jitter
14000 TM-REF IFO	24000 TM-SC/MOSA Couplings	34000 Timing Noise Residuals
15000 Thermo-mechanical OPL	25000 Temperature	
16000 TTL	26000 Gravitational	
	27000 Brownian Noise	
	28000 Laser Radiation Pressure	



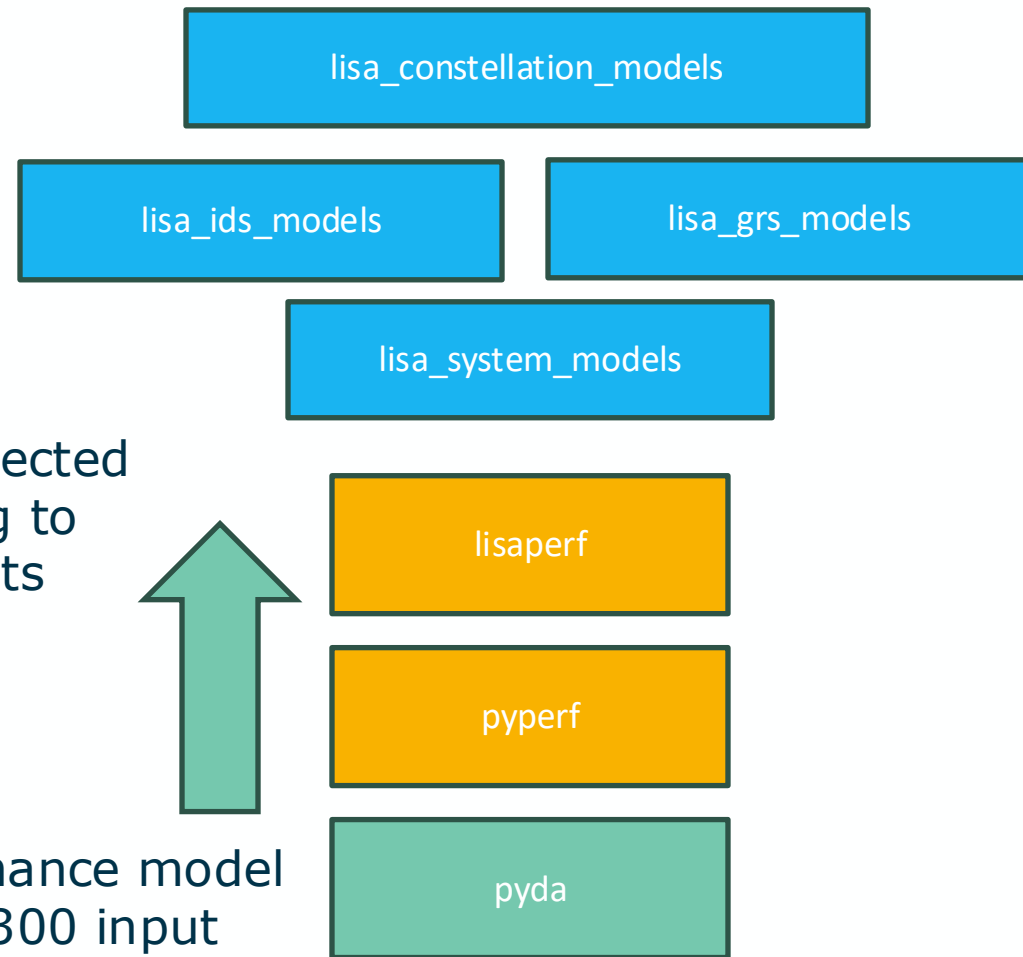


Free-fall budget and requirements





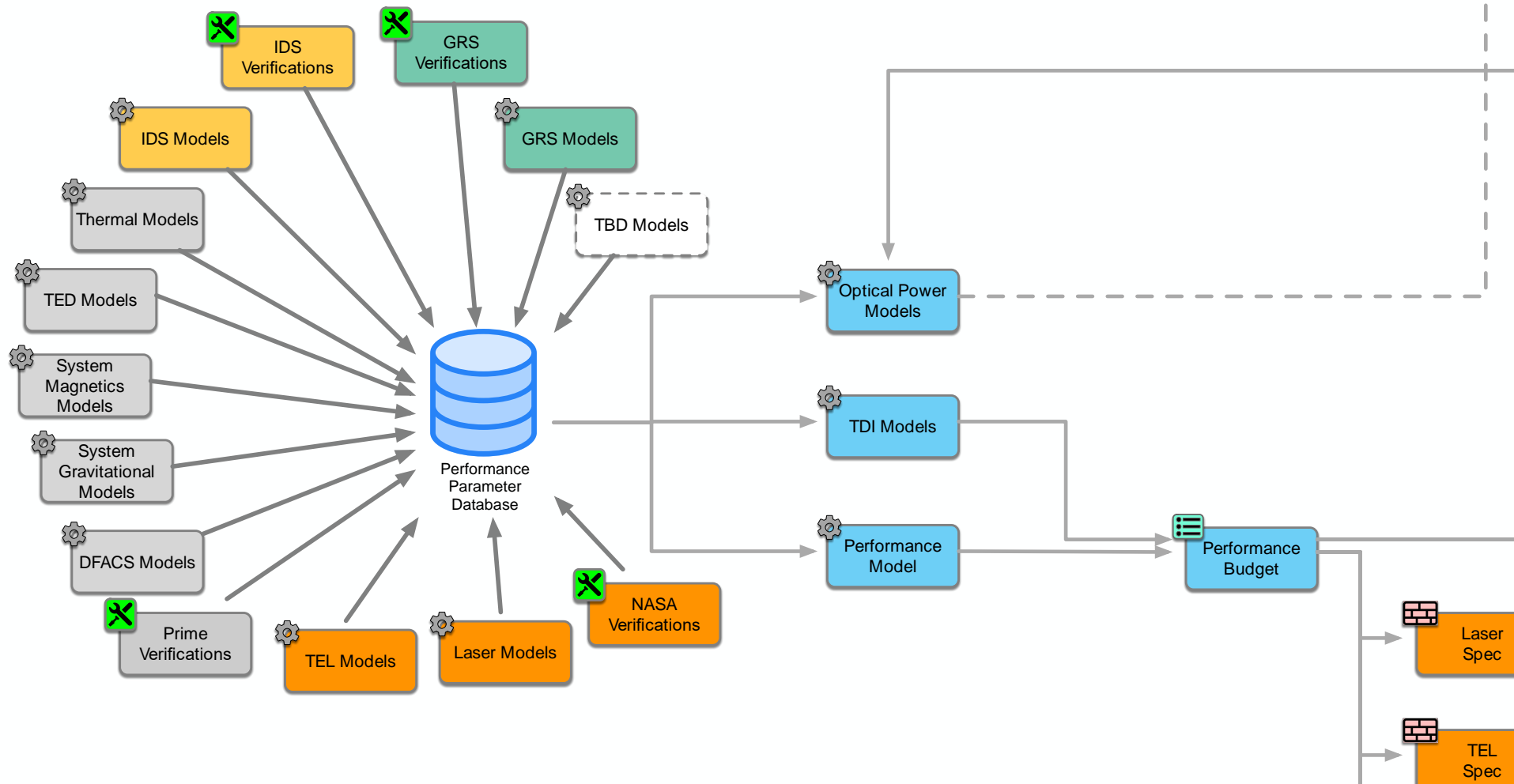
700 budget entries collected over 28 budgets linking to requirements documents



~375 performance model nodes with ~300 input parameters build up Constellation model



Setting and updating performance budgets





Exercise in information management!

- Need to cycle through everything whenever anything significant happens:
 - Test results
 - Design changes
 - Major reviews
 - Etc
- Common pool of parameters also needed for science ground segment development (simulators, etc)



Who's doing all that stuff?



LISA PERFORMANCE & OPERATIONS

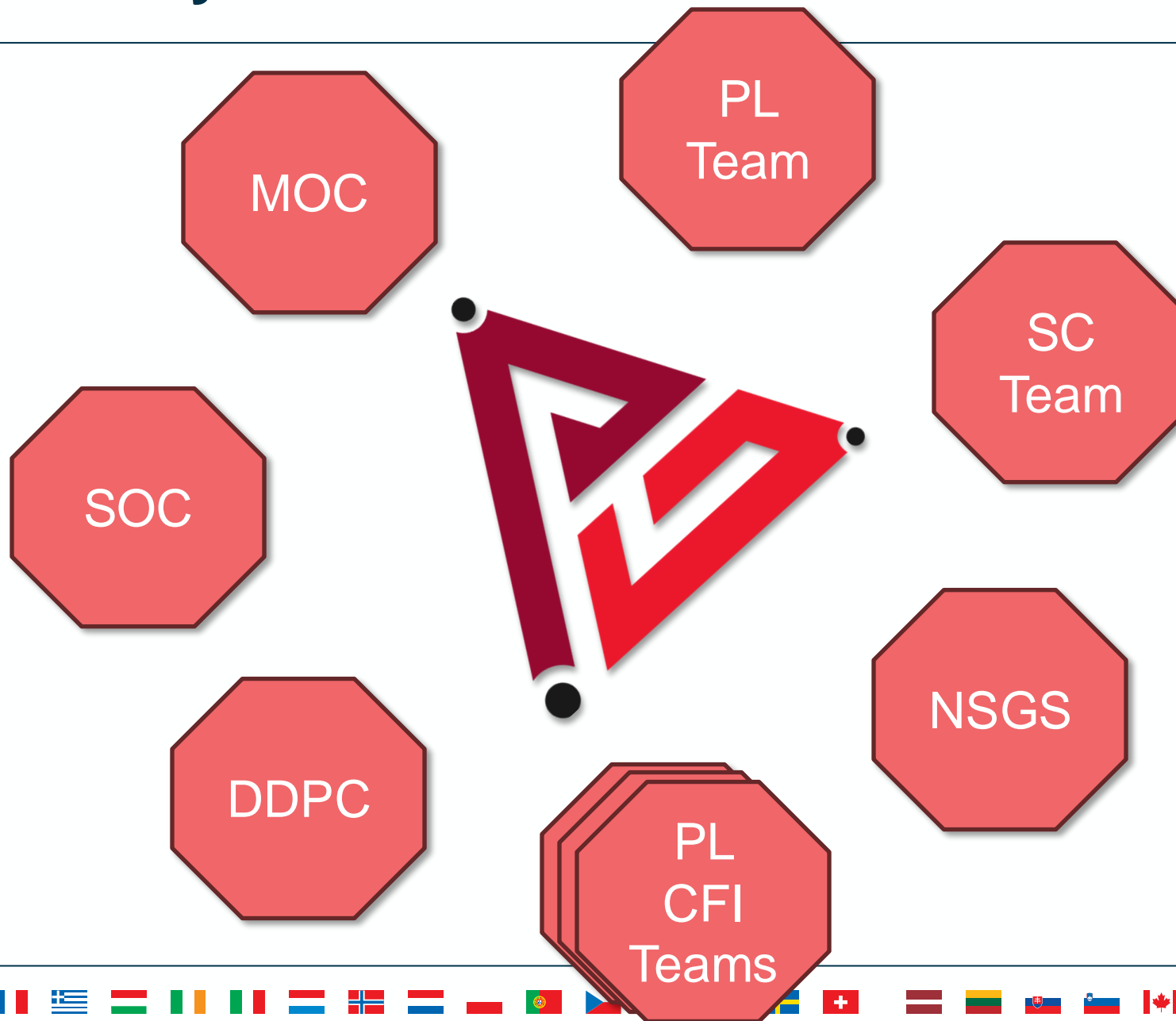
The central graphic features a semi-circular gauge labeled 'PERFORMANCE' with a needle pointing towards the right. Below the gauge are three portrait photos of team members. Surrounding this central element are logos for various partner institutions:

- cea** (red square)
- UNIVERSITÀ DEGLI STUDI DI TRENTO** (blue crest)
- SRON** Netherlands Institute for Space Research (black text)
- agenzia spaziale italiana** (blue and white logo)
- NASA** (blue and red logo)
- ETH zürich** (black text on white background)
- KU LEUVEN** (white text on blue background)
- IEEC CSIC ICE** (blue and red text)
- Science & Technology Facilities Council UK Astronomy Technology Centre** (white text on dark blue background)
- Nikhef** (red text)
- lpc Caen** (blue and orange logo)
- ETH zürich** (blue and red logo)
- ETH zürich** (red square)
- ETH zürich** (purple logo)





And who do they work with?





Core Tasks & Products

- Performance Budgets
- Performance Verification
- Requirements
- Mission Reviews
- Commissioning
- Science Operations

Simulations
for verification



LISA
Performance
Budget



Related
technical
documentation



Related
System
Budgets



LISA
Performance
Model





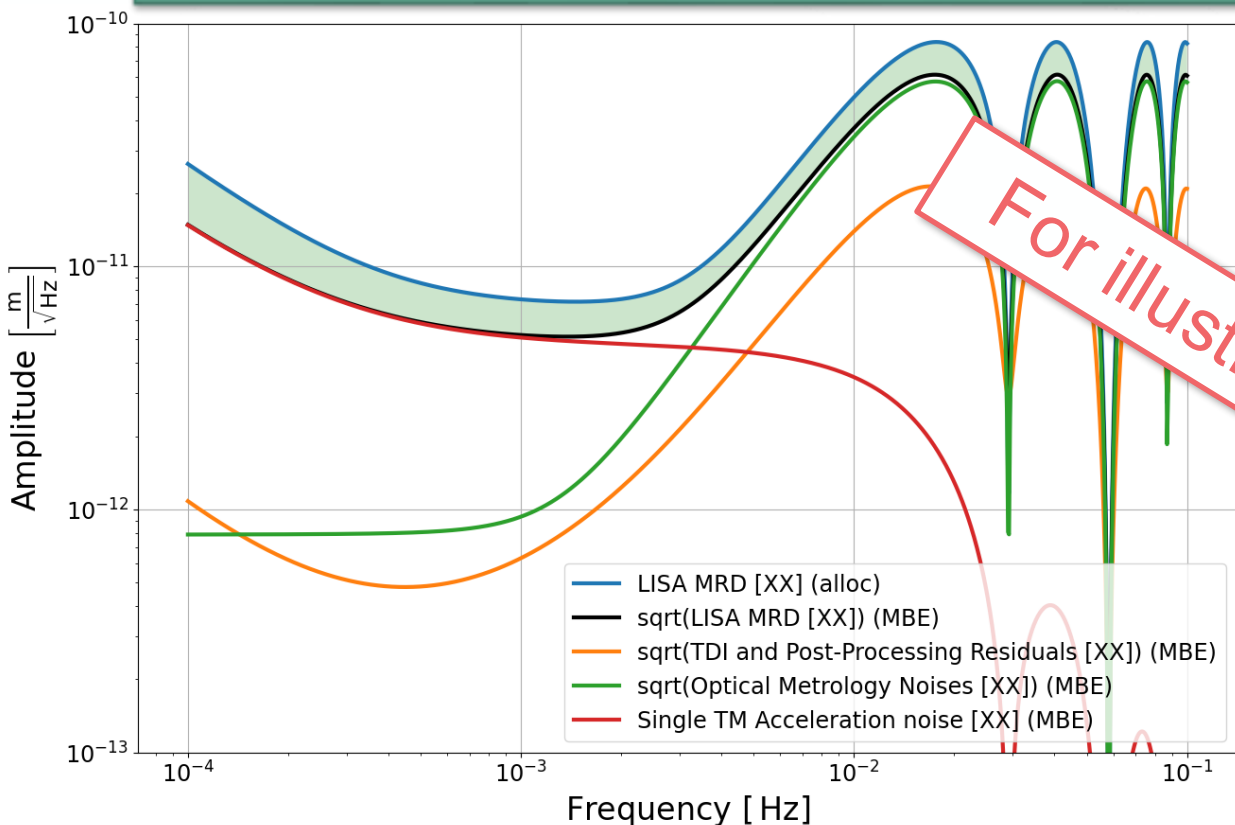
Best and Worst Case performance



- All parameters have best and worst case values tracked

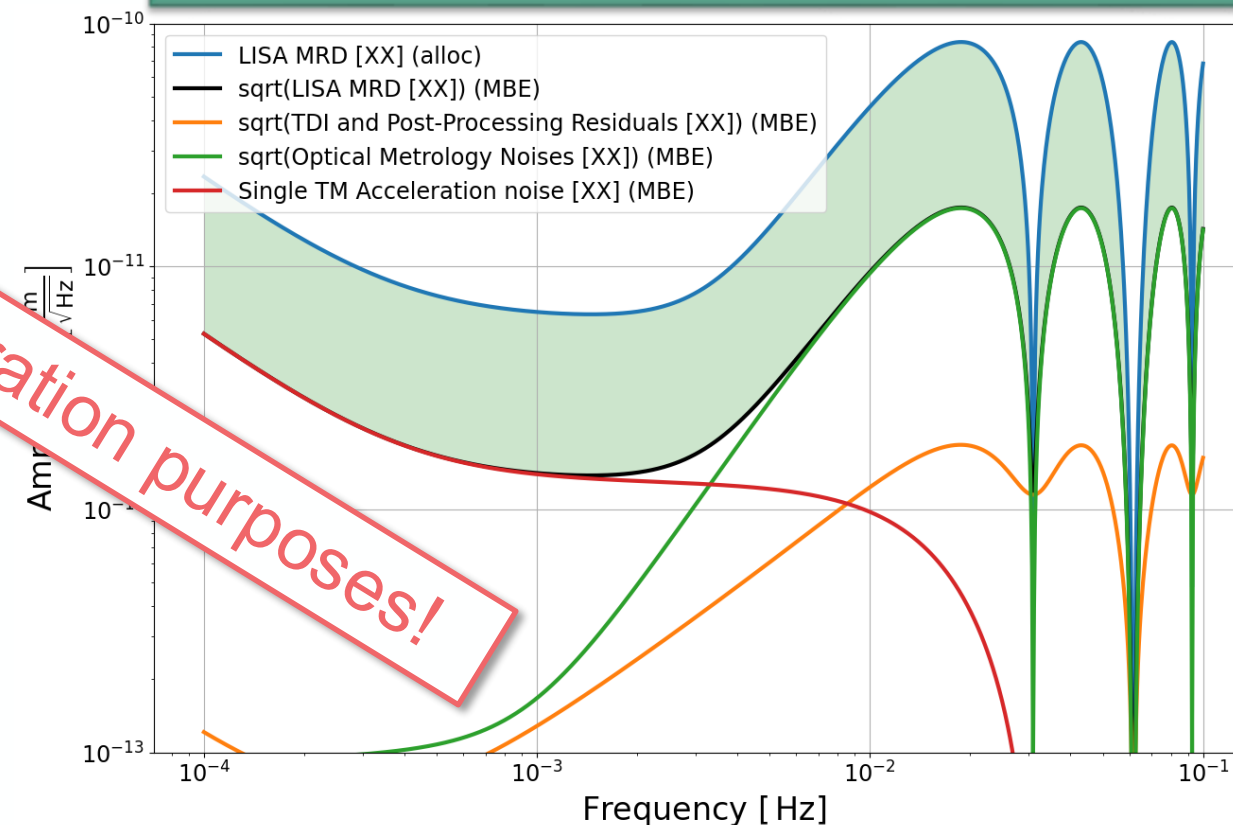
Worst Case Parameters

We are required to build this



Best Case Parameters

We will study what this might look like

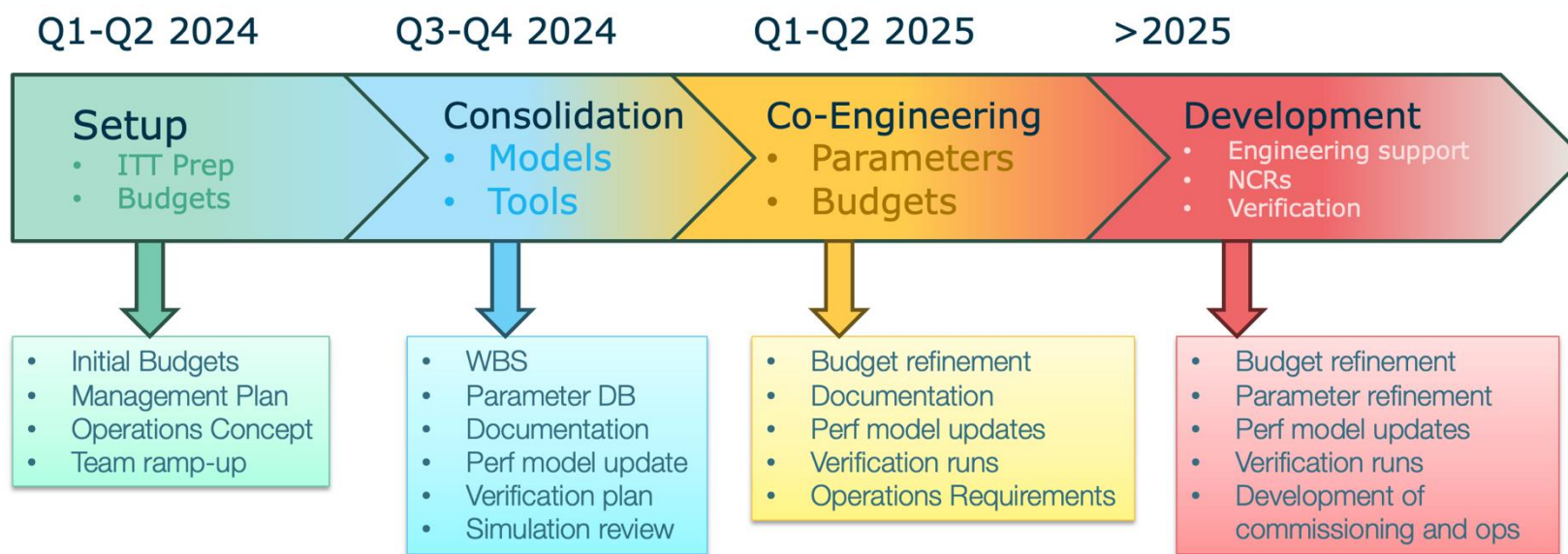




Next steps...



- Performance budget and models will undergo a project-level review at end of 2024
 - This will set the baseline to start co-engineering phase with the selected prime contractor
- As part of this we will also establish:
 - A Verification & Validation plan
 - How we will validate the models and build performance confidence through hardware verification
 - A Risk management plan
 - Configuration control plan (parameters, models, baseline releases, etc)



Thanks!

...and Go LISA!