

# ET in Europe

## „Project“ status



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102  
1004

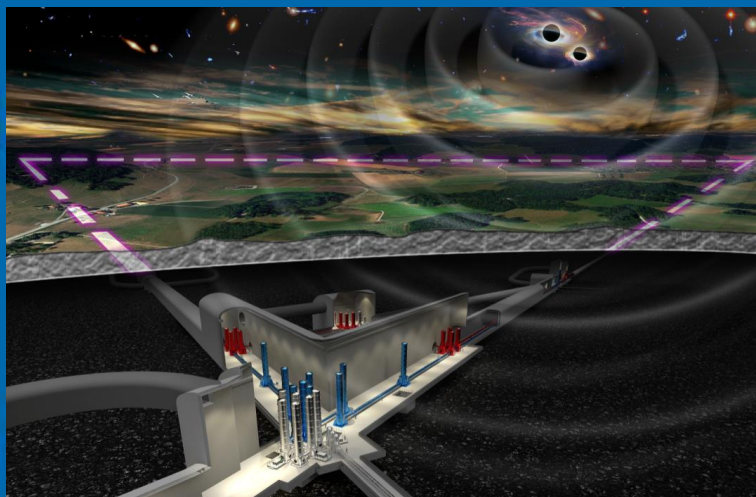


Harald Lück  
AEI Hannover  
Max-Planck Institute  
for Gravitational physics  
Leibniz Universität Hannover,  
Institute for Gravitational physics

Einstein Telescope  
German Community Meeting  
15.9.2021



<https://www.et-gw.eu/>



Project submitted by:

- **Italy** (Lead Country)
- Netherlands
- Belgium
- Spain
- Poland

30/06/2021:

**ET is on the  
ESFRI roadmap!**

## ET Consortium

- ET CA signed by 41 institutions
- INFN and Nikhef are the coordinators of the consortium
- Funding expected in the next months by the governments in the frontline
- EU funding for the Preparatory Phase in 2022



## New RIs for Roadmap 2021 announced

Strategy Report on Research Infrastructures  
**ROADMAP 2021**

ESFRI

<https://www.esfri.eu/latest-esfri-news/new-ris-roadmap-2021>

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## ESFRI announces new RIs for Roadmap 2021

30.06.2021

### PRESS RELEASE

ESFRI announces the **11 new Research Infrastructures to be included in its Roadmap 2021**

**€4.1 billion investment in excellent science contributing to address European challenges**

After two years of hard work, following a thorough evaluation and selection procedure, ESFRI proudly announces the **11 proposals** that have been scored high for their science case and maturity for implementation and will be included as new Projects in the **ESFRI 2021 Roadmap Update**.

The new ESFRI Projects are:

- **EBRAINS** - European Brain ReseArch INfrastructureS, a distributed digital infrastructure at the interface of neuroscience, computing and technology, offering scientists and developers advanced tools and services for brain research.
- **EIRENE RI** - Research Infrastructure for EnviRonnemental Exposure assessment in Europe, the first EU infrastructure on human exposome (environmental determinants of health).
- **ET** - Einstein Telescope, the first and most advanced third-generation gravitational-wave observatory, with unprecedented sensitivity that will put Europe at the forefront of the Gravitation Waves research.
- **EuPRAXIA** - European Plasma Research Accelerator with Excellence in

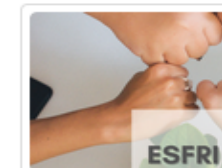
### Related files

Press Release-New Roadmap 2021

### Latest news



03.08.2021  
**ESFRI offers co  
loss of Profess**



29.07.2021  
**Join now ESFRI  
the new initiati**

### Latest ESFRI tw

3  
#Research  
#European

- OPEN CALL FOR PROPOSALS – 25.9.2019 ✓
- SUBMISSION OF PROPOSALS – 9.9.2020 ✓
- CRITICAL QUESTIONS & INVITATION TO HEARINGS – February-March 2021 ✓
- HEARING – April 14 2021 ✓
- ESFRI FORUM DECISION - June-September 2021 ✓
- ESFRI ROADMAP LAUNCH - October - November 2021

# Success of the ESFRI proposal



- The ESFRI evaluation has been a complex affair
  - From our side we formed a panel of informal referees to prepare our defence
  - Ministries have formed an “informal” committee of delegates of the interested governments (ET-5 + Germany and UK) and of the leading institutions
  - 3 delegates (M.Punturo, M. Branchesi and J.v.d.Brand) defended the proposal in front of the ESFRI panel in a very formal interview
  - The 30/06/2021 the projects in the updated ESFRI roadmap have been announced and ET is in the list
    - ET is by about one order of magnitude the largest project approved in this round
    - With the approval, we received a list of recommendations to be fulfilled in the preparatory phase
    - As expected, the ESFRI approval boosted the ET activities at the governments level

## Why is it important to be on the ESFRI roadmap?

- ESFRI does not have any funds
- But:
  - It is a **quality stamp** certifying the readiness of the project to start the preparation phase
  - It allows to access (small) specific **financial support from the European Commission**
  - It allows to **access (large) regional and national funds**
  - It facilitates the **coordination in Europe at government level**

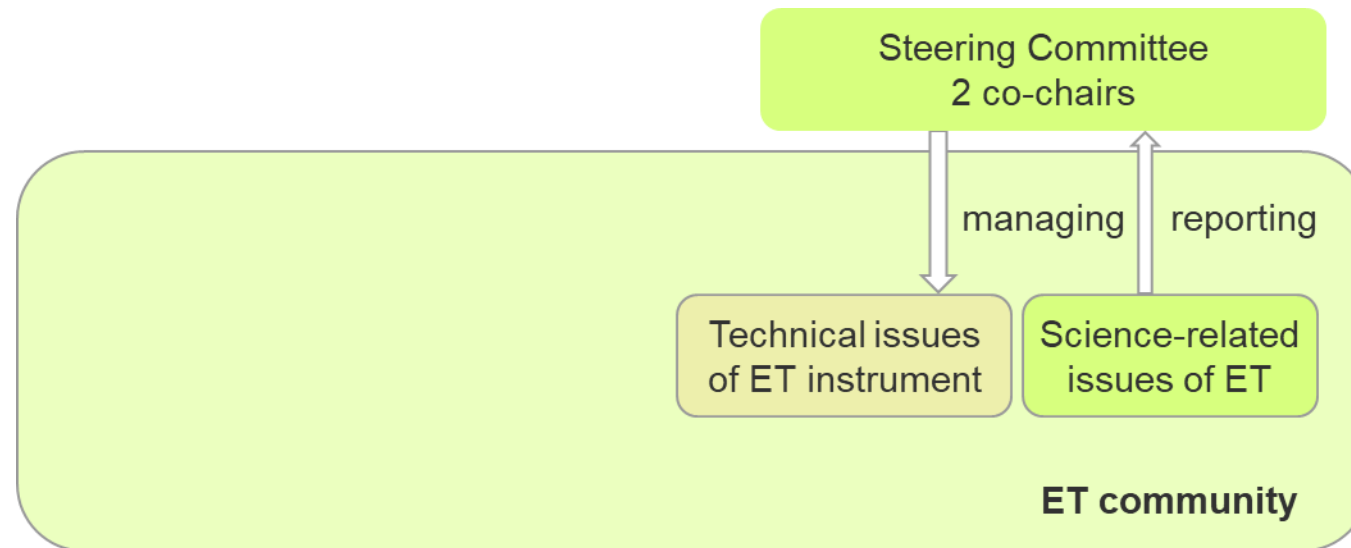
# Key content of the ESFRI Proposal

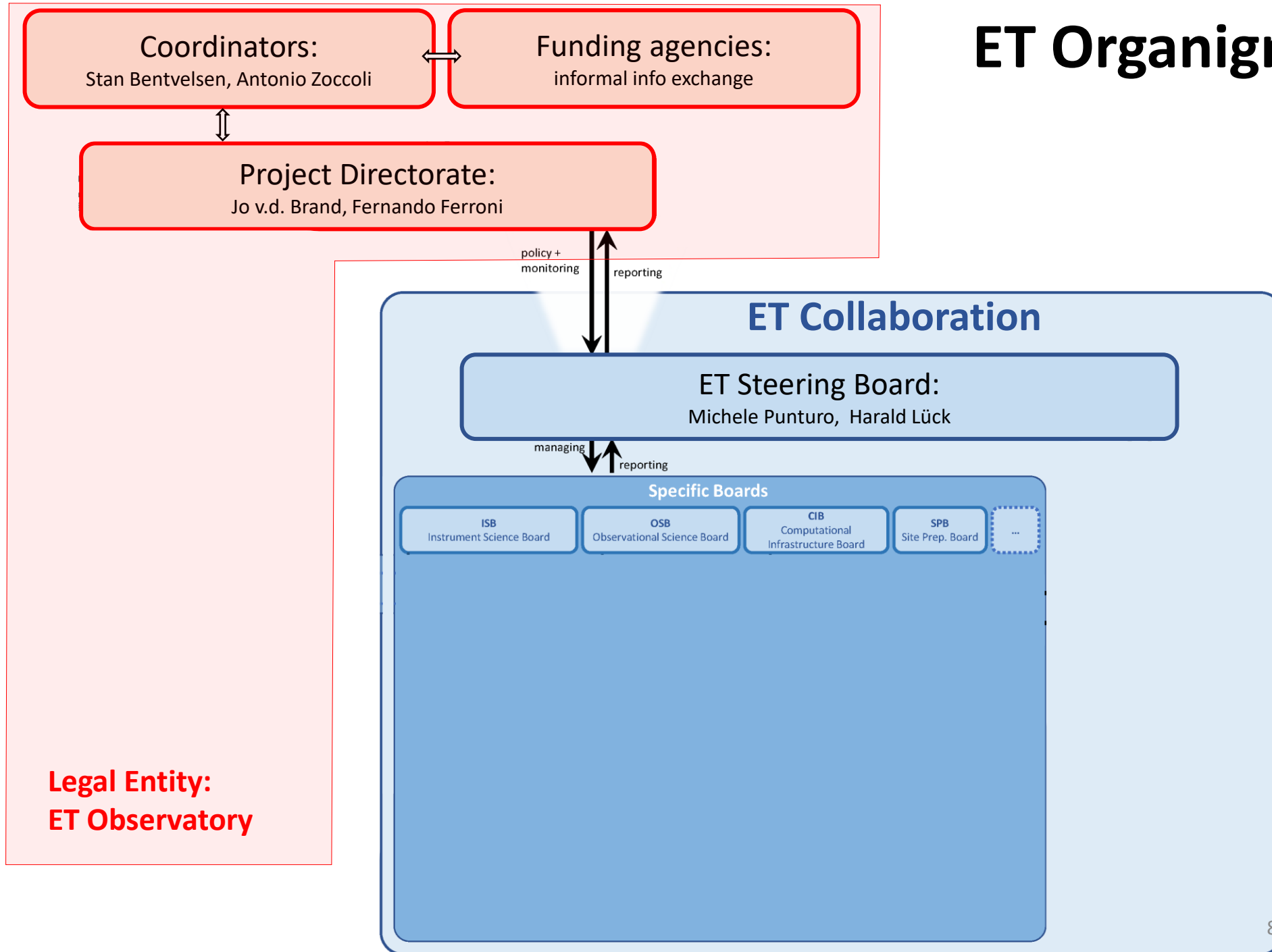
- Five governments
- 41 entities signed the consortium (national agencies, institutes, universities)
- We submitted
  - ET proposal questionnaire
  - ET Cost Book through the evaluation of two external companies for the excavation costs
  - ET Science<sup>1</sup> and Technology<sup>2</sup>
  - ET services and communities
  - (Very) draft governance scheme
  - ET planning including site selection milestone
  - ...

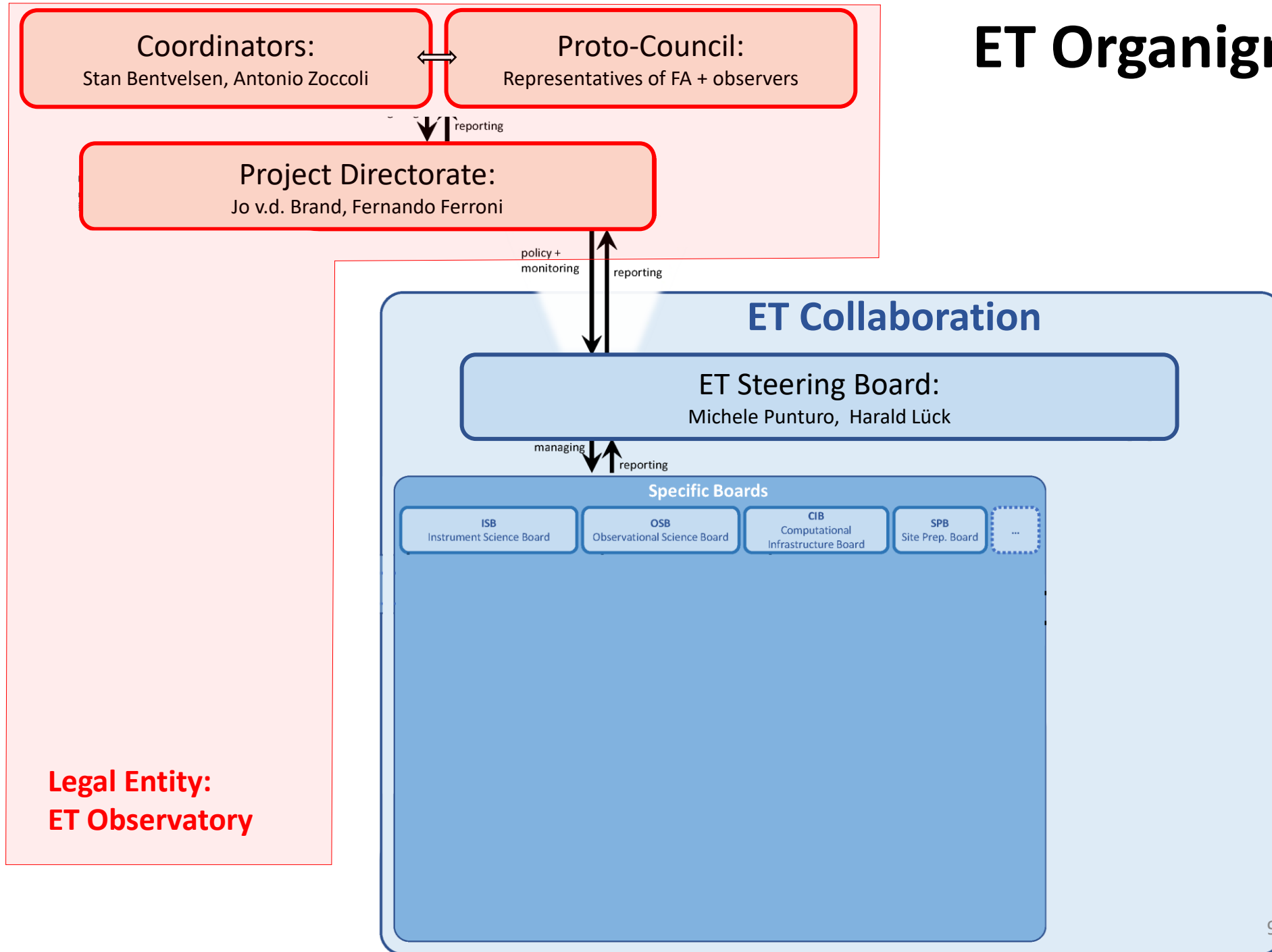
<sup>1</sup> Michele Maggiore et al JCAP03(2020)050

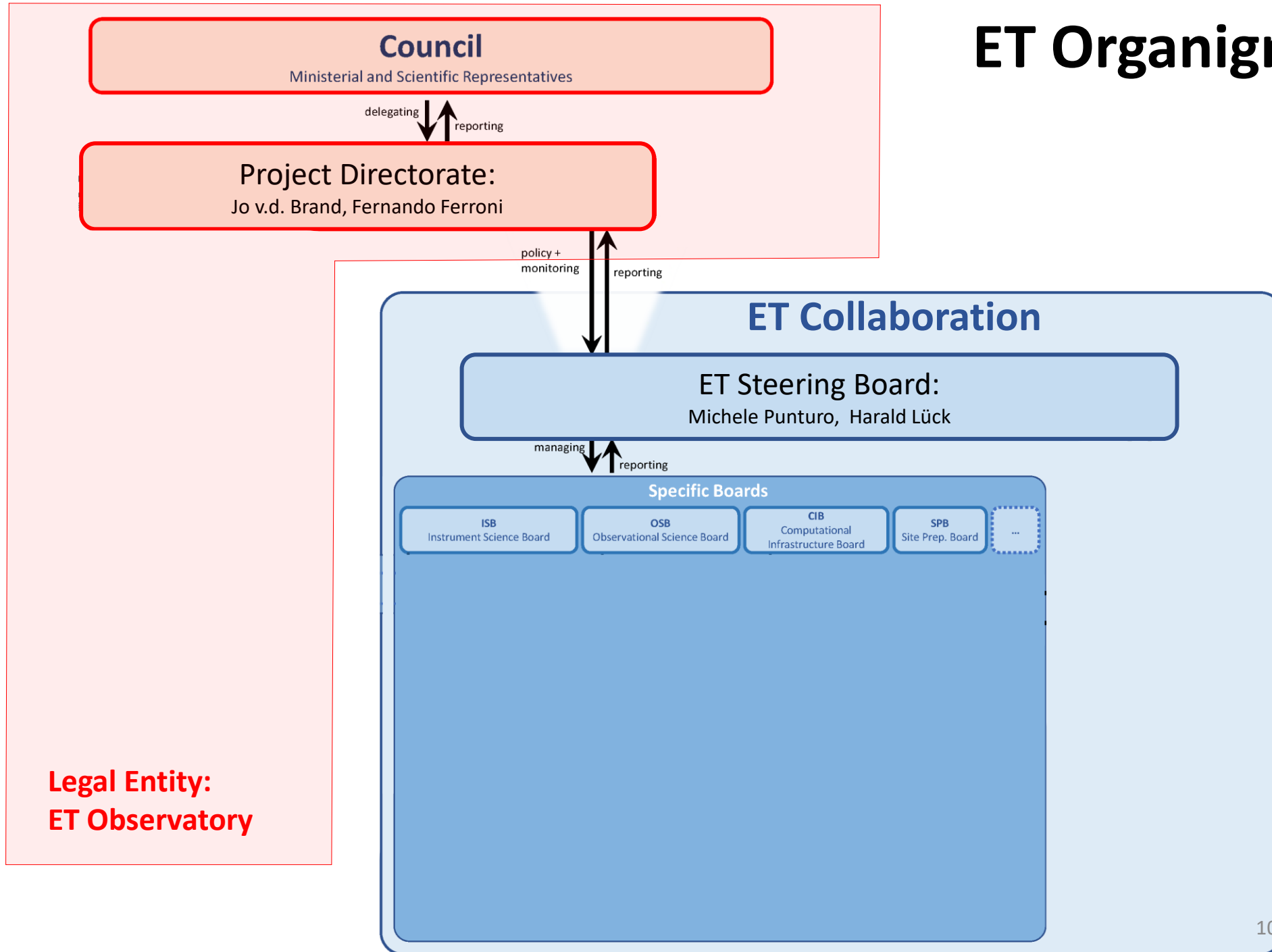
<sup>2</sup> ET-0004A-20, <https://apps.et-gw.eu/tds/ql/?c=15284>

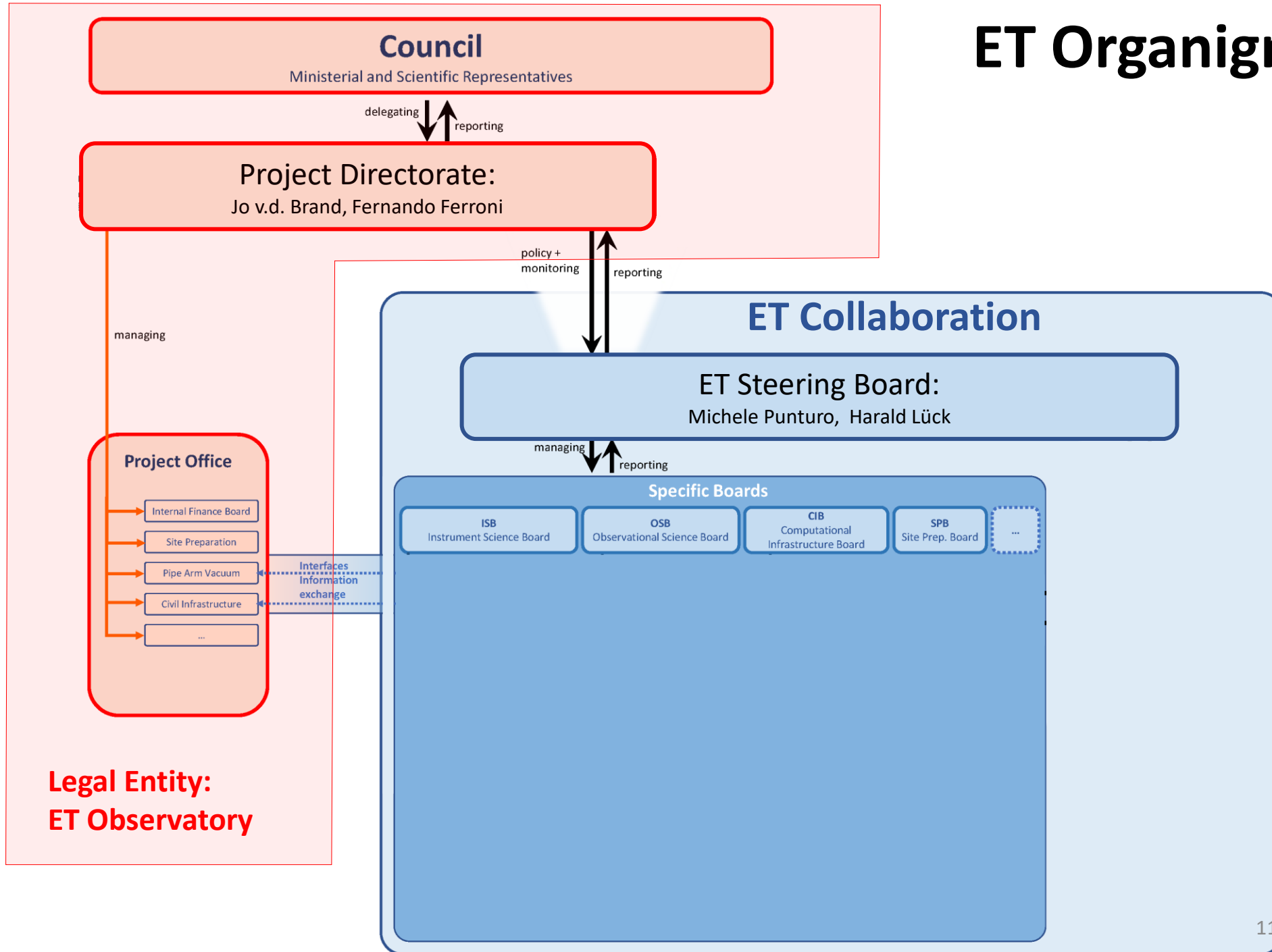
- Until now: A broad ET scientific community;

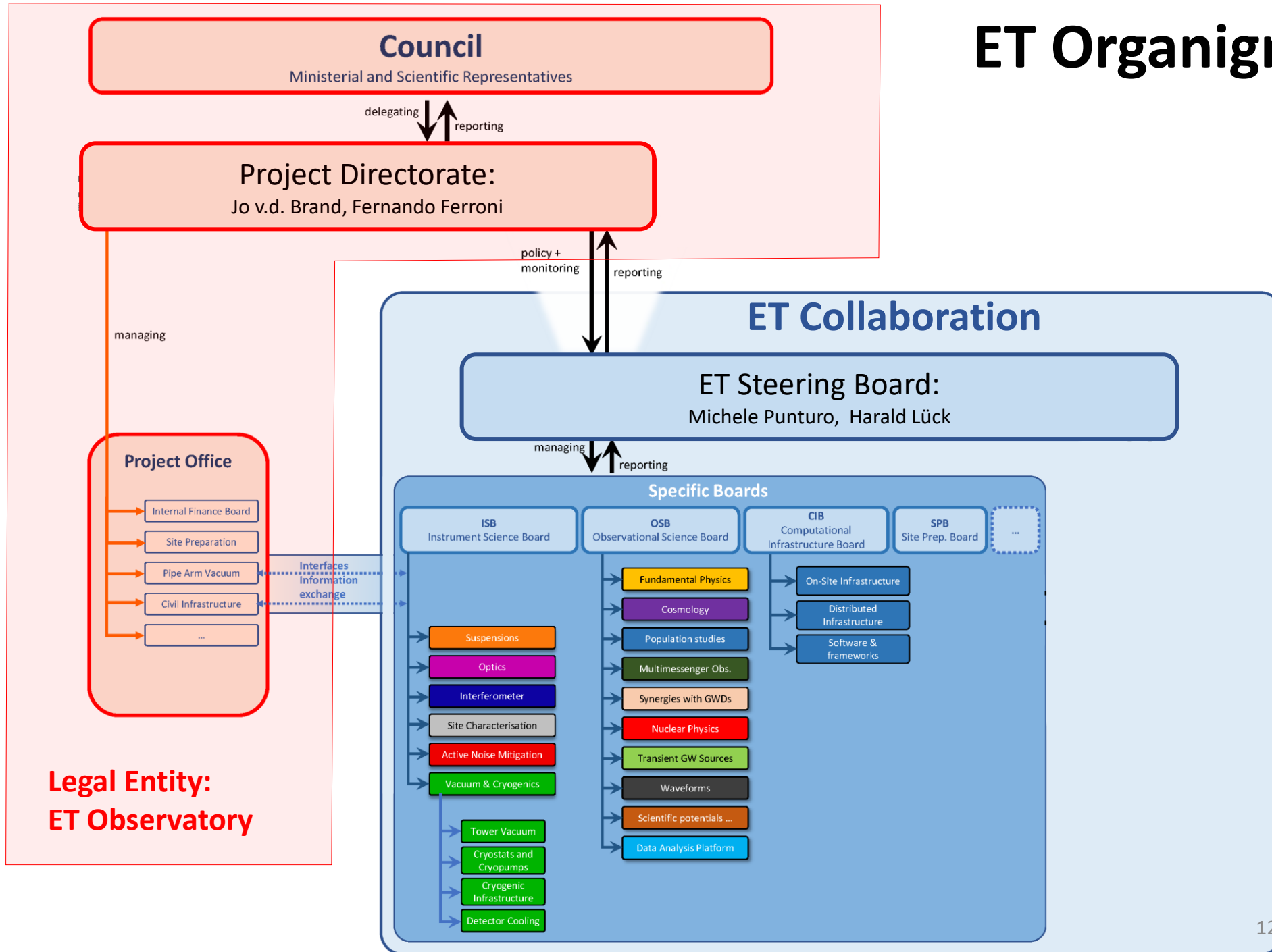


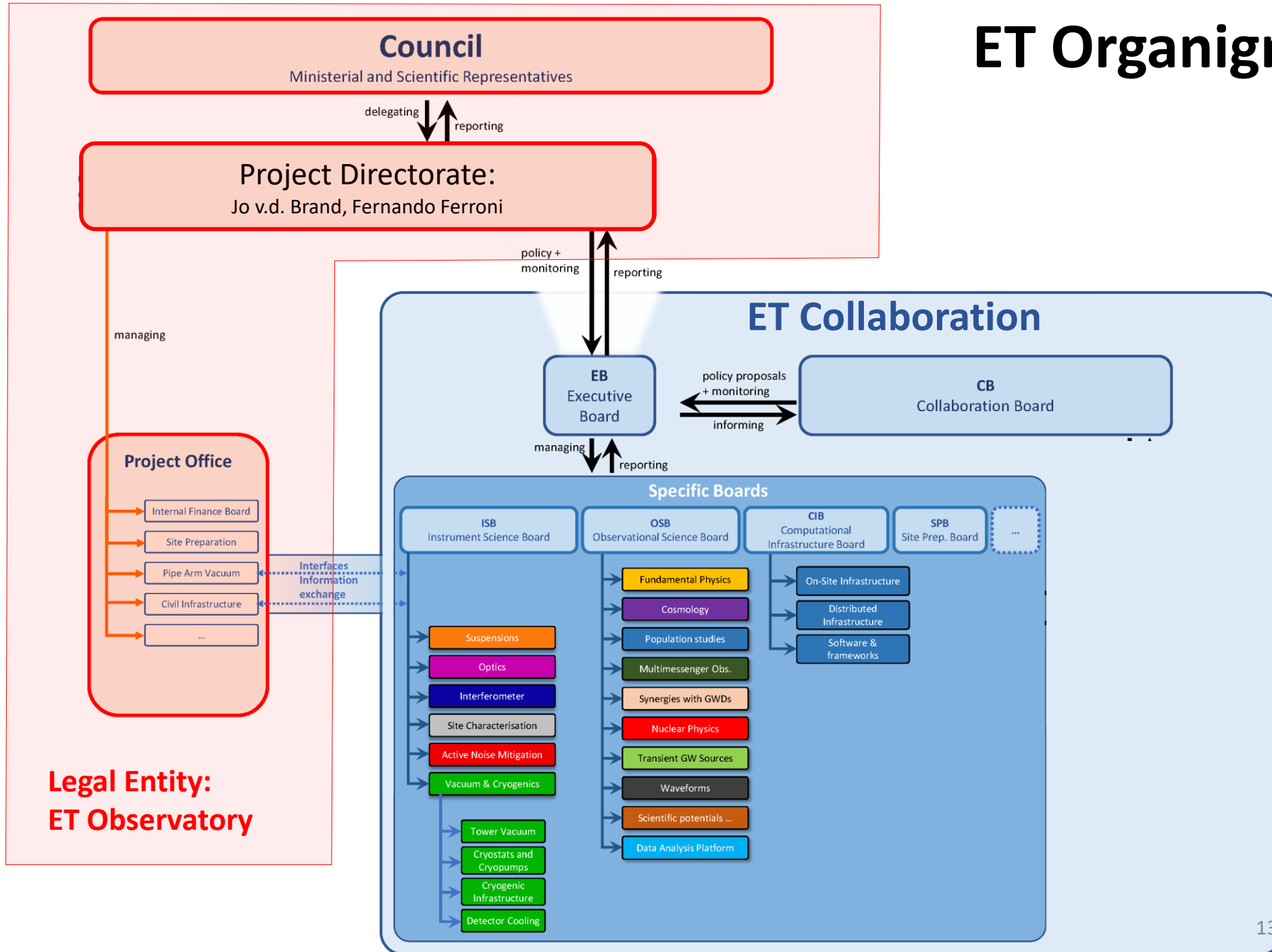


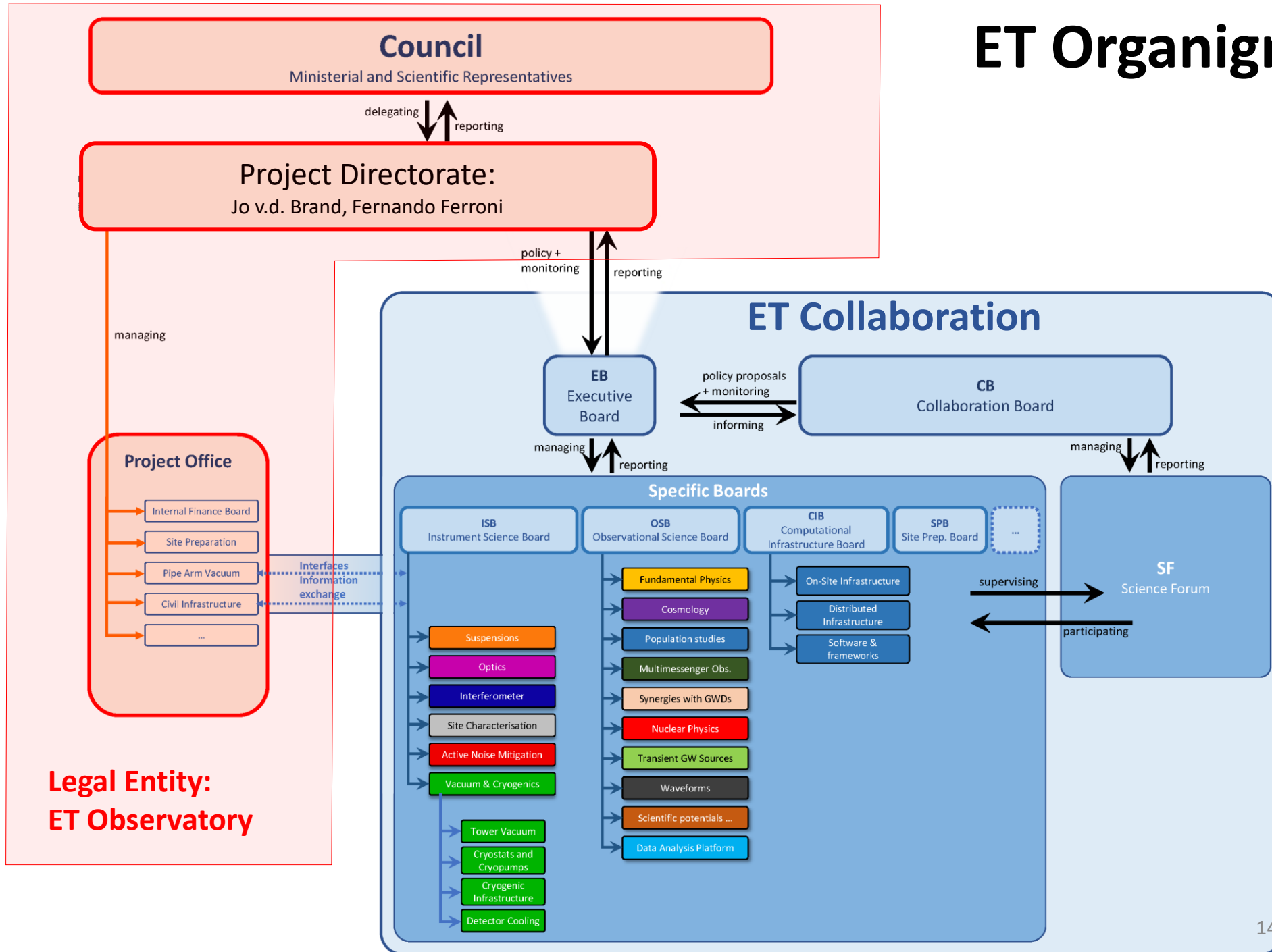


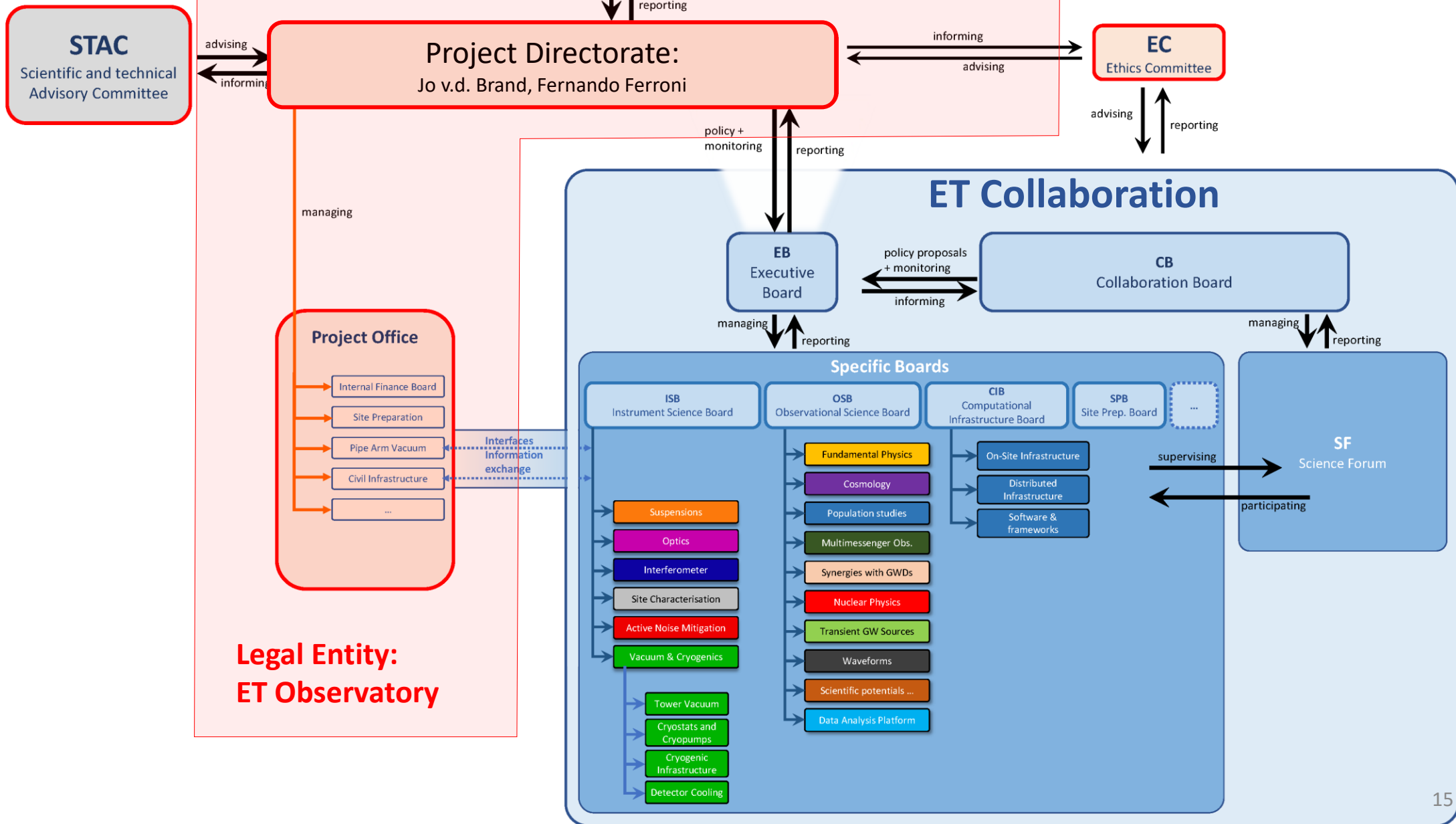












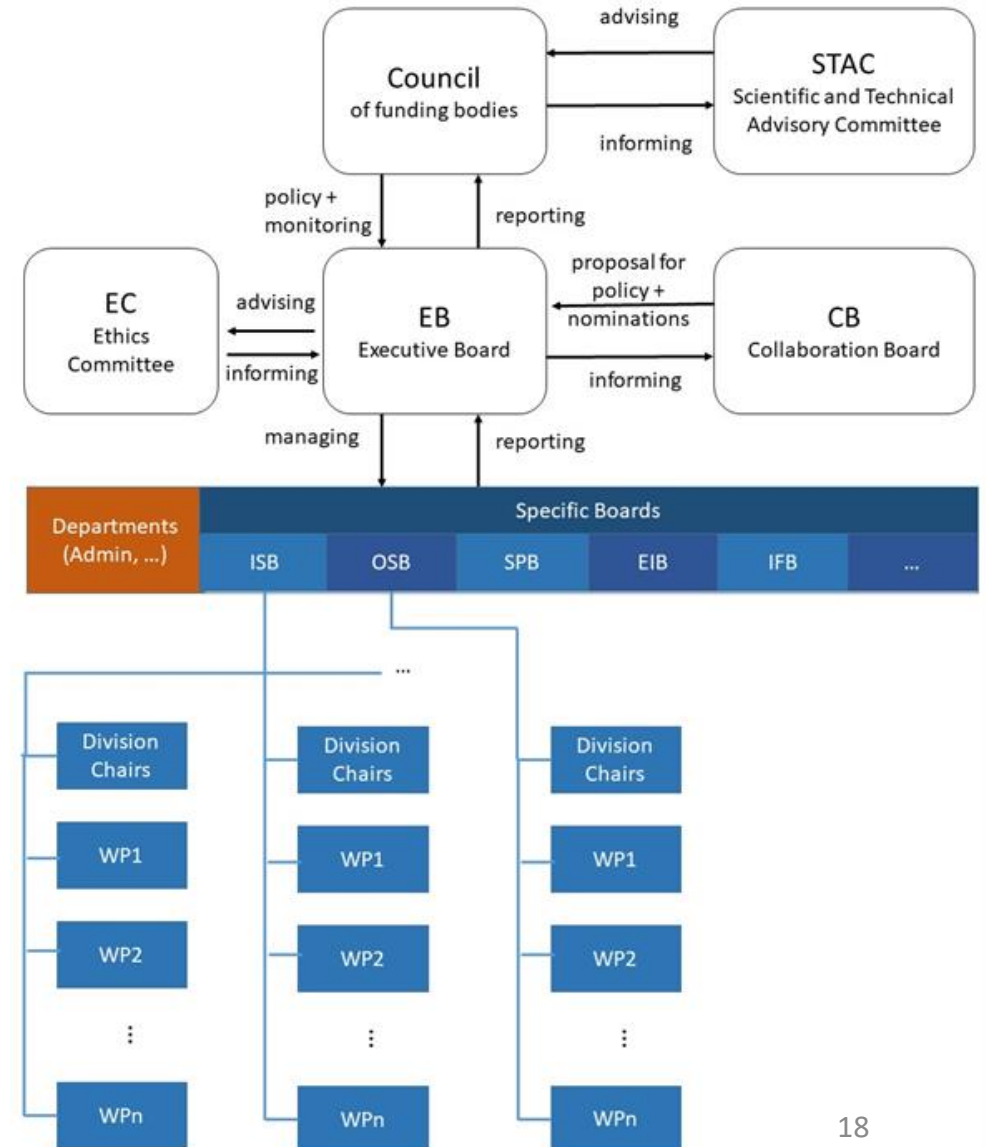
# Comments on the international project governance

- **INFN and Nikhef** had a proactive role as ESFRI **consortium coordinators role** (and due to the site candidatures)
- Now there is an international **pressure to form at least a proto-Council**, with (at least) the scientific representative of the ET-5 countries:
  - Discussion ongoing with other EU countries
  - Progresses in these days
- Evolution also of the **Project Directorate**, to have a **larger team** of delegated persons and to form a **Project Office**.

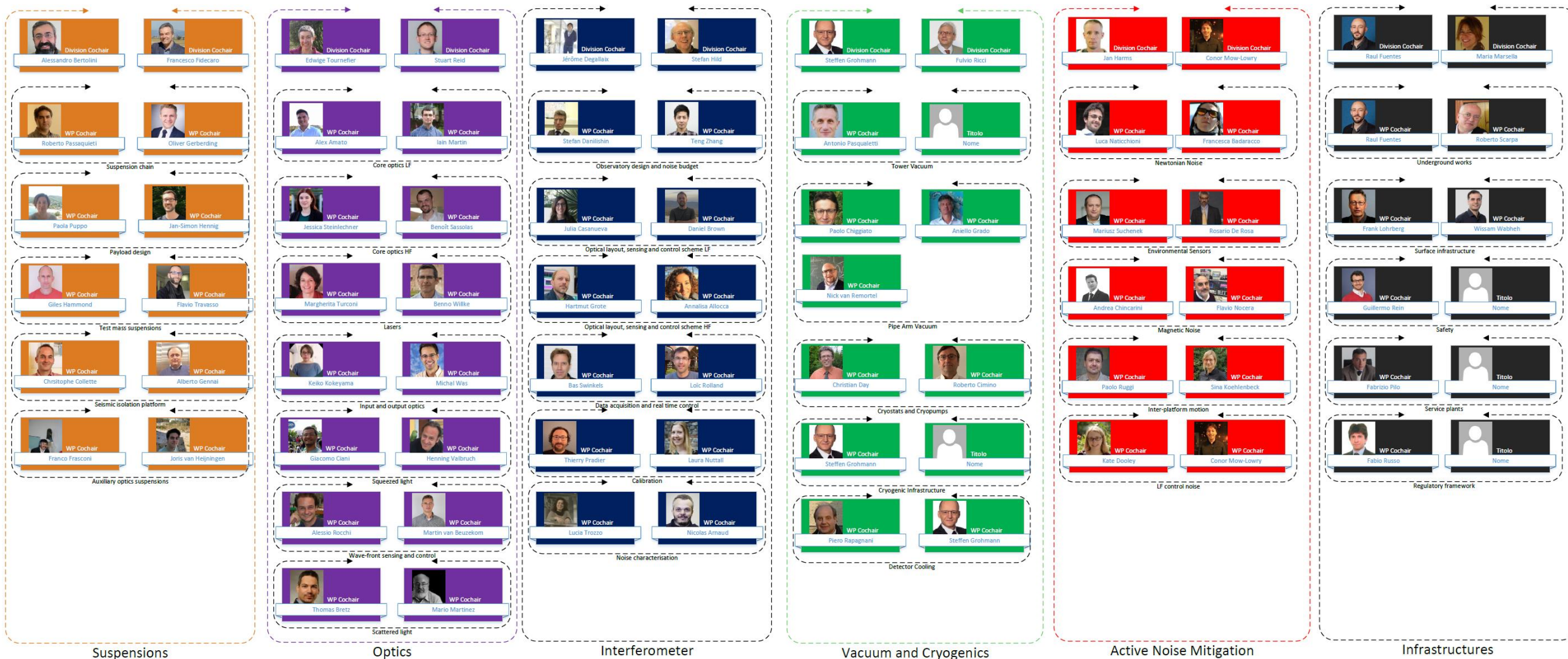
# ET Scientific Collaboration



- In the last 3 years the Steering Committee has effectively been the management body of ET.
- It has an informal structure and is lacking a formal definition of the ET collaboration.
- We are starting to formalise the ET collaboration:
  - Membership rules
  - Publication rules
  - Possible common funds
- The initial idea has evolved:
- Within 2022 we have to find the right way to place the ET collaboration within the framework of the ET project



ET Instrument Science Board (ISB) Organigram (ET-0033A-21)



Suspensions

Optics

Interferometer

Vacuum and Cryogenics

Active Noise Mitigation

Infrastructures

# The ISB mandate (from ET-085A-20)

Boosted by financial  
availabilities at national level

- The first objective of the team is to deliver the ET Technical Design Report (ET-TDR) of the infrastructure and of the detectors starting from the ET Conceptual Design Report (ET-CDR). The ET TDR production will be an iterative process and will go through intermediate steps:
  - **Q3 2022: Pre-engineering definition of the Research Infrastructure** (including an updated costs evaluation).
  - **Q4 2022: Pre-engineering definition of the detector** (including an updated costs evaluation).
- The level of detail of the design must be sufficient to allow the customization of the design for the two different sites, in order to prepare the site bids.
  - **Q4 2025: RI operative TDR full engineering** (including costs evaluation). This activity will probably be transferred to (or shared with) an external company.
  - **Q2 2026: Detector operative TDR** (including costs evaluations).
- Further intermediate internal release of the TDR will be needed in order, for example, to inform external agencies or committees.
- The second objective of the whole team is to identify the missing technologies and suggest a plan for R&D activities. This must be a living plan, regularly updated.
  - The first delivering of this plan is expected in **March 2022**.

Boosted by grant possibilities  
at European level in 2022

# ISB Workshop activities

<https://indico.in2p3.fr/event/24903/>



## ET-LF wavelength workshop (Day 1)

Friday 3 Sep 2021, 09:00 → 12:00 Europe/Paris

Zoom

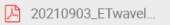
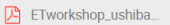
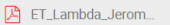

Edwige Tournefier (CNRS) , Stuart Reid

### Description

The aim of this workshop is to collect and discuss all the available information for the possible wavelengths which could be used for ET-LF (state of the art of the technologies, impact on the design for all Divisions, impact on the sensitivity, needed R&D and associated timelines for R&D, impact on the cost,...) and draw the path towards a decision.

The workshop will be held on Zoom. Instructions for connecting can be found on the workshop [Wiki page](#).

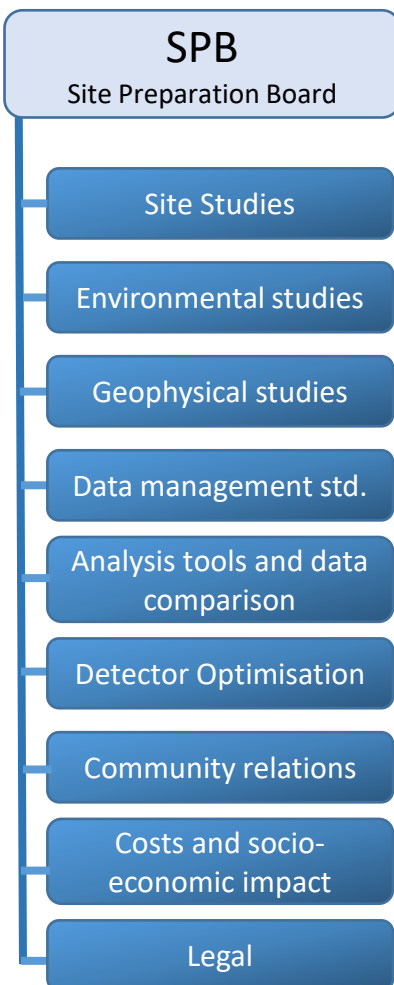
The agenda of the second half day of the workshop (on September 16th) can be found on <https://indico.in2p3.fr/event/24932/>

09:00	→ 09:10	<b>Introduction</b> Speaker: Stuart Reid	🕒 10m
09:10	→ 09:25	<b>KAGRA's experience with sapphire mirrors</b> Speaker: Matteo Leonardi 	🕒 15m
09:35	→ 09:50	<b>KAGRA's experience: icing issues and cryogenic suspensions</b> Speaker: Takafumi Ushiba 	🕒 15m
10:00	→ 10:20	<b>ET-LF Core optics: overview on wavelength considerations</b> Speaker: Jessica Steinlechner, Ilan Martin, Alex Amato, Benoit Sassolas	🕒 20m
10:30	→ 11:00	<b>Wavelength considerations for ET Optics workpackages</b> Speaker: Margherita Turconi, Benno Willke, Keiko Kokeyama, Michal Was, Thomas Bretz, Mario Martinez, Giacomo Ciani, Henning Valbruch, Alessio Rocchi, Martin van Beuzekom	🕒 30m
11:00	→ 11:10	<b>Overview of optical layout, pros and cons for each wavelength</b> Speaker: Jérôme Degallaix 	🕒 10m
11:10	→ 11:25	<b>Noise budget vs wavelength</b> Speaker: Teng Zhang 	🕒 15m
11:35	→ 11:40	<b>Overview of large diameter silicon</b> Speaker: Margot Hennig	🕒 5m

- Second day of ET-LF  $\lambda$  workshop scheduled for September 16, 4pm
- Other workshops in scheduling.

# Site Preparation Board

- The SPB has the mandate to characterise, qualify and compare the two sites.
- The global reorganisation of the ET project has partially disturbed and delayed its formal definition, but the technical activities are progressing at full speed
  - Characterisation at the sites
  - Definition of common tools and methods
    - SPB Workshop



## SPB Workshop

### ET - Site Studies and Characterization

18 Oct 2021, 09:00 → 21 Oct 2021, 19:00 Europe/Rome  
 Domenico D'Urso (University of Sassari and INFN-LNS) , Frank LINDE (Nikhef - APPEC)

MONDAY, 18 OCTOBER

09:00 → 13:00 Site Status and Future Plans

15:00 → 19:00 Analysis Status

TUESDAY, 19 OCTOBER

09:00 → 13:00 Newton Noise Studies

15:00 → 19:00 Hands-on Session

WEDNESDAY, 20 OCTOBER

09:00 → 13:00 Drilling and Measurement Campaign and equipment

Share of experience got it during drilling, sensor deployment and decommissioning and so on

14:00 → 20:00 Visit to Sos Enattos

THURSDAY, 21 OCTOBER

09:00 → 13:00 Agree on Site Parameters

15:00 → 16:30 Summary and Final Conclusion

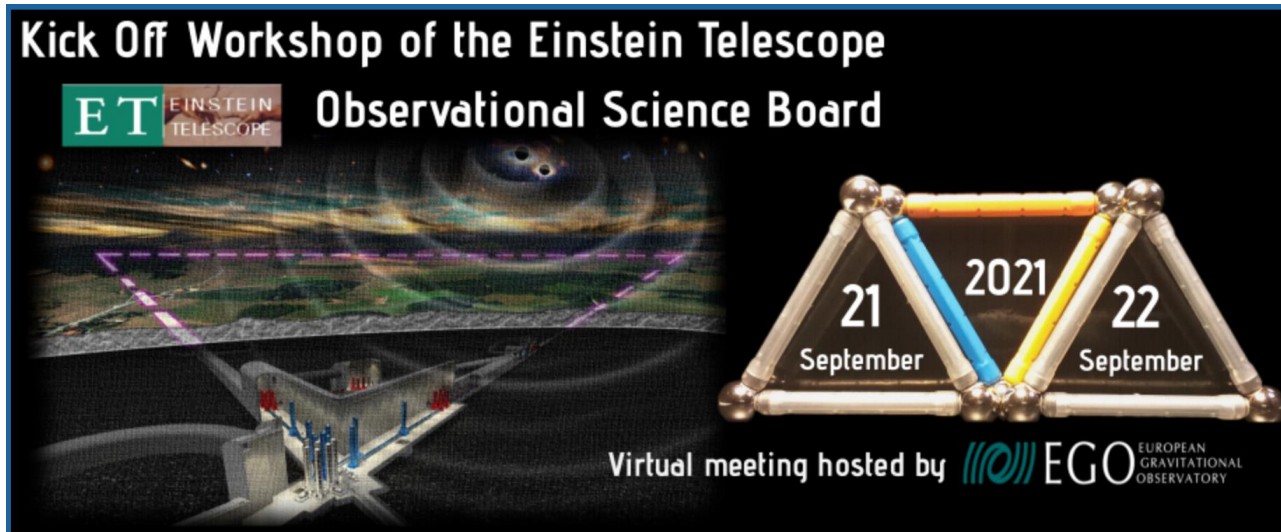
<https://agenda.infn.it/event/28070/>

# OSB: Observation Science Board

Marica Branchesi - Michele Maggiore - Ed Porter

Fundamental physics	Cosmology	Population Studies	MM observations	Synergies w. other GW observ.	Nuclear physics	Transient GW Sources	Waveforms	Science Potential	DA platform
Physics near BH horizons	Dark Energy	Predictions of population of astrophysical origin	ET / high-energy	Synergies with 2G+ detector	EoS of NSs in isolated systems	Predictions for Supernovae	Waveforms relevant for ET	Science potential for various detector configurations	DA platform
Tests of GR	Dark matter	Predictions of primordial BHs	ET / optical	Synergies with CE, 3G	EoS in NSs in binary systems	Predictions for magnetars	Improvement of waveforms for BBH	Common tools	
Exotic compact objects	Estimation of cosmological parameters	Stochastic backgrounds of astrophysical origin	ET / radio	Synergies with LISA	Nucleo-synthesis in BNS mergers	Predictions for cosmic string bursts	Improvement of waveforms for NSBH		
	Modifications of gravity at cosmological scales		ET / neutrinos				Improvement of waveforms for BNS		
	Stochastic background of cosmological origin								

# OSB Kick-off workshop



<https://indico.ego-gw.it/event/240/>

- The Einstein Telescope Gravitational Wave Observatory has recently reached an important milestone;
  - it has been included in the European Strategy Forum on Research Infrastructures (ESFRI).
- This is a starting point for the realisation of ET. The next months, years will see an increase in activities to finalize the ET technical design, to select the ET site, to further define its science as a single observatory and within a network of gravitational-wave and multi-messenger detectors, to develop and optimize the data analysis.
- During the last year a board, called Observational Science Board (OSB) has been structured with the goals to develop the ET science case, to build the scientific community around it, and to bring it to a scientific maturity to exploit the data taken when ET will start operation.
- **The OSB kick-off meeting aims at presenting the organization, activities, and policy of this board, inviting participation of the community interested in ET science exploitation. The meeting will be structured remotely in two days with large space for questions and answers.**

# SPB: ET sites under characterisation

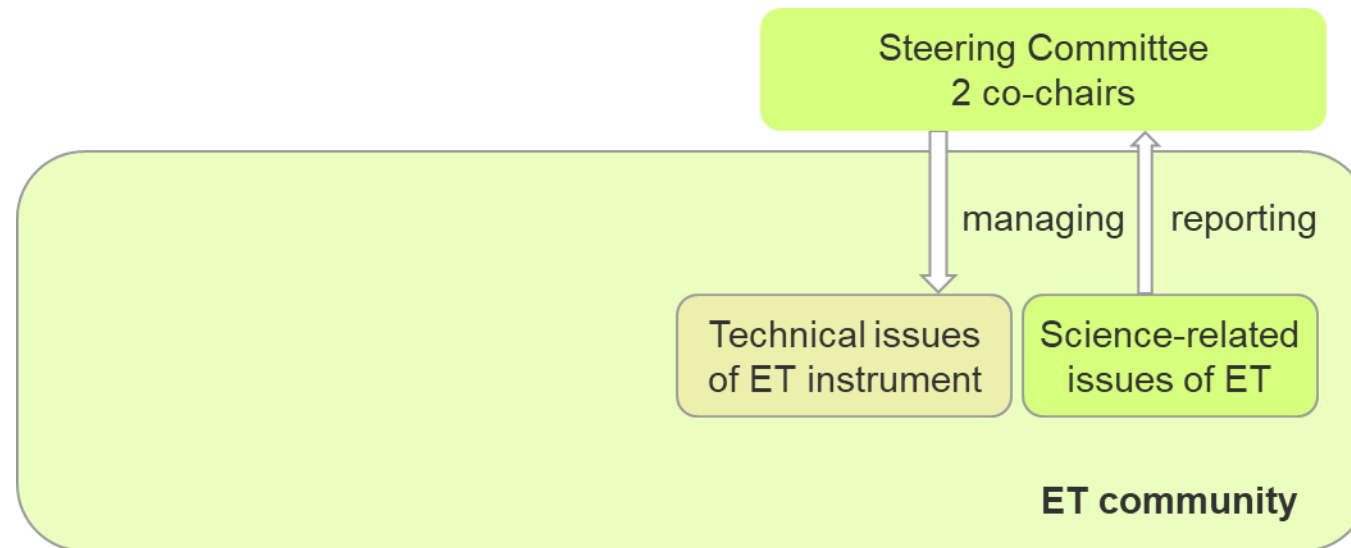
## Euregio Meuse-Rhine

- A 250-m deep borehole has been excavated and equipped
  - Seismic data under acquisition and analysis
- 3-5 other boreholes expected
- Extensive active and passive site characterisation with sensor arrays in 2021
- Good seismic noise attenuation given by the particular geological structure
- ET pathfinder centre under construction
- ~30M€ funding through Interreg grants

## Sardinia

- Long standing characterisation of the mine in one of the corners continuing
  - Seismic, magnetic and acoustic noise characterisation ongoing at different depth in the mine
- Underground laboratory under construction (SarGrav)
- Two ~290m boreholes have been excavated and they will be equipped in the next weeks
- Intense & international surface investigations programme in Summer/Fall 2021
- ~30M€ funding through national and regional funds

- Until now: A broad ET scientific community;



**Consortium**

Stan Bentvelsen  
Antonio Zoccoli

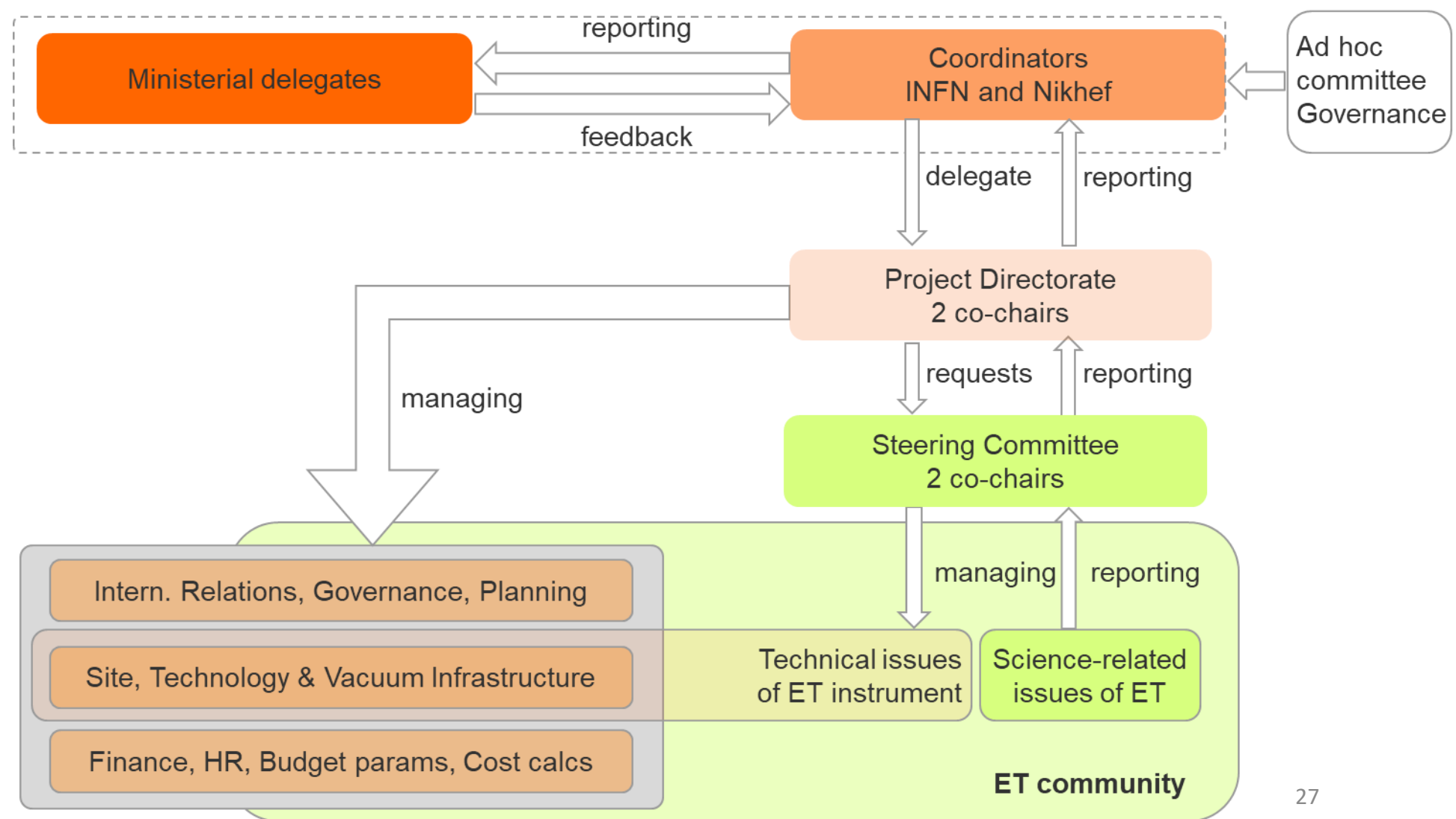
**Project directorate**

Jo v.d. Brand  
Fernando Ferroni

**ET Collaboration**

Michele Punturo  
Harald Lück

An interim structure for the ET project organization until establishment of a Council



## Structure during Implementation phase

### Council

Assisted by several bodies (*e.g.* STAC)

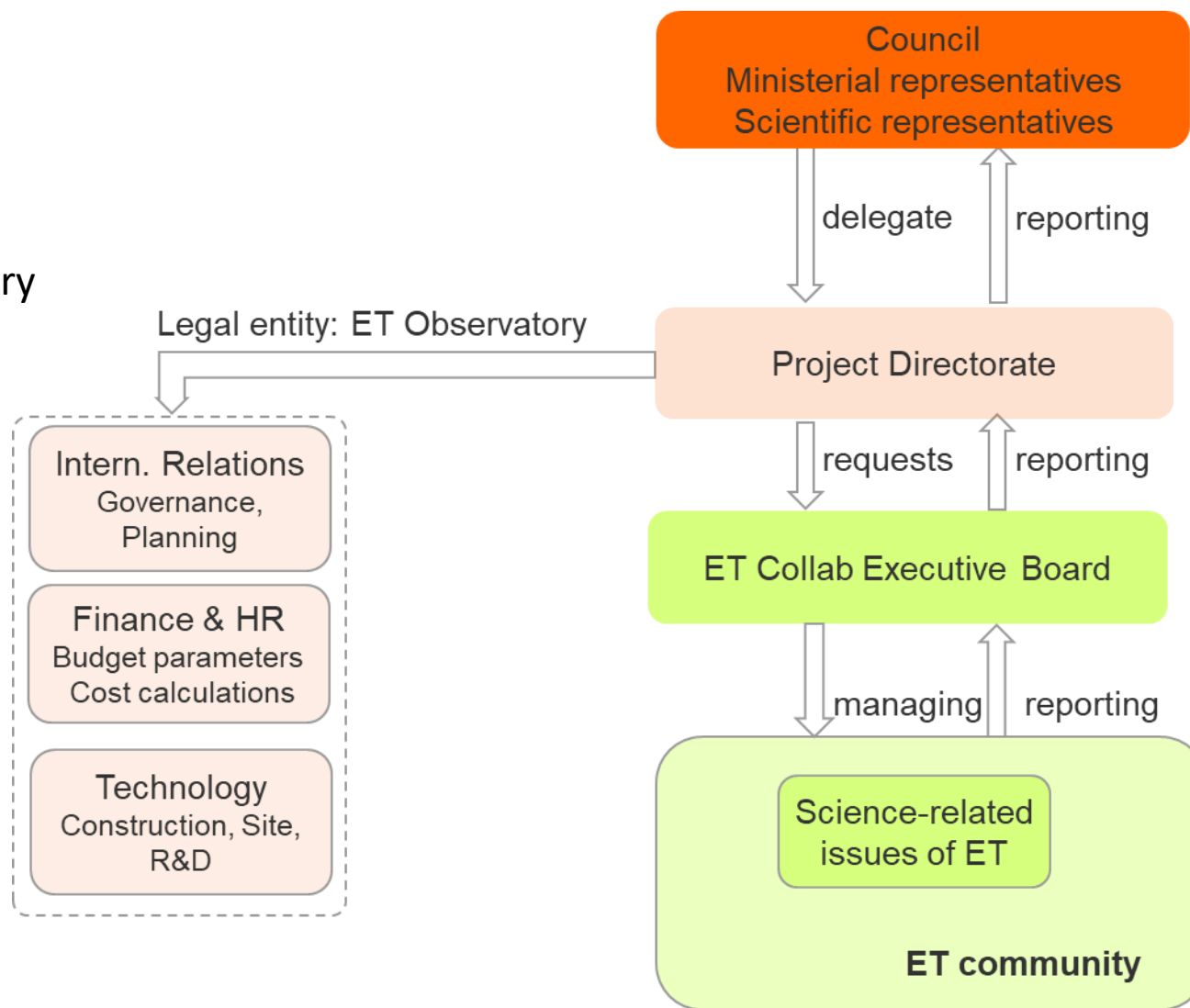
### Project Directorate

evolves into Einstein Telescope Observatory

### ET Observatory will be a legal entity

and will have significant staff

Verify by expert panel on  
governance and project  
organization



- **TOPIC ID: HORIZON-INFRA-2021-DEV-02-01**

- Dedicated to the preparatory phase of ESFRI projects
- HORIZON-CSA HORIZON **Coordination and Support Actions**
  - aimed at the organisation & governance of ESFRI projects
  - Coordinators + Project Directorate will prepare the proposal

- **TOPIC ID: HORIZON-INFRA-2022-TECH-01-01**

- Next generation of scientific instrumentation, tools and methods (April 2022)
- HORIZON-RIA HORIZON **Research and Innovation Actions**
- Consortia must be built around a leading core of **at least 3 world-class research infrastructures**, being ESFRI infrastructures, European Research Infrastructures Consortia (ERICs) and/or other world-class research infrastructures of European interest
  - ET collaboration will prepare the proposal

# Summary

- ET is now an ESFRI project
- Important and increasing support from national governments
- Perspective of EU funding for specific activities
- Agencies and institutions are working to define the ET project governance
- The ET collaboration is moving toward its formalisation
- Huge amount of technical, scientific, political and financial activities is progressing

What are **you** doing?

ET Wants You!

