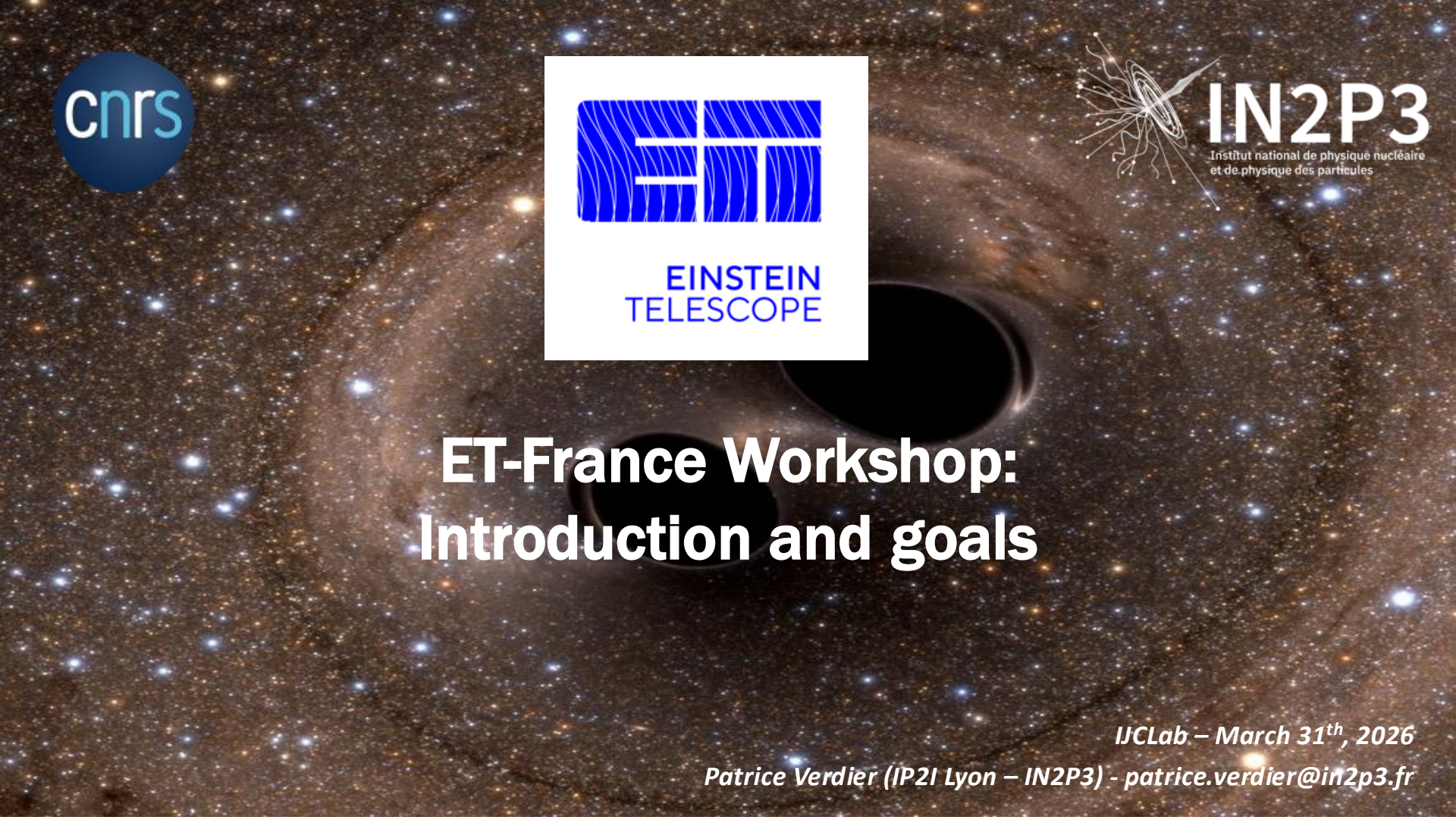


ET-France Workshop: Introduction and goals

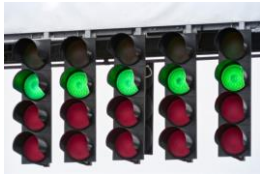
IJCLab – March 31th, 2026

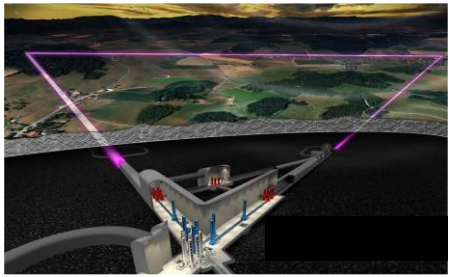
Patrice Verdier (IP2I Lyon – IN2P3) - patrice.verdier@in2p3.fr

Einstein Telescope

ET pioneered the idea of 3rd generation GW observatory:

- A new infrastructure for >50 years
- Sensitivity at least 10 times better than 2nd generation
- Huge improvement in sensitivity at low frequency (a few Hz to 10 Hz)
- Essential French contribution since the initial studies





2005

ILIAS FP6
Ideas on 3rd gen. GW interferometers

2010

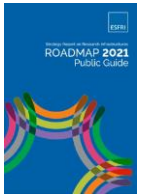
ET FP7
Conceptual Design Study

2015

ET R&D funded by **ASPERA-2**

2020

2021 ESFRI roadmap



June 2022
The Einstein Telescope Collaboration is established

2025

Infradev : ET Preparatory Phase
2023-2026

Pre-TDR for RI and detector
Computing Model
Science Book

Feb. 2023
Mandate for the Einstein Telescope Organization

Sept. 2023
France Joins the ET BGR

2030

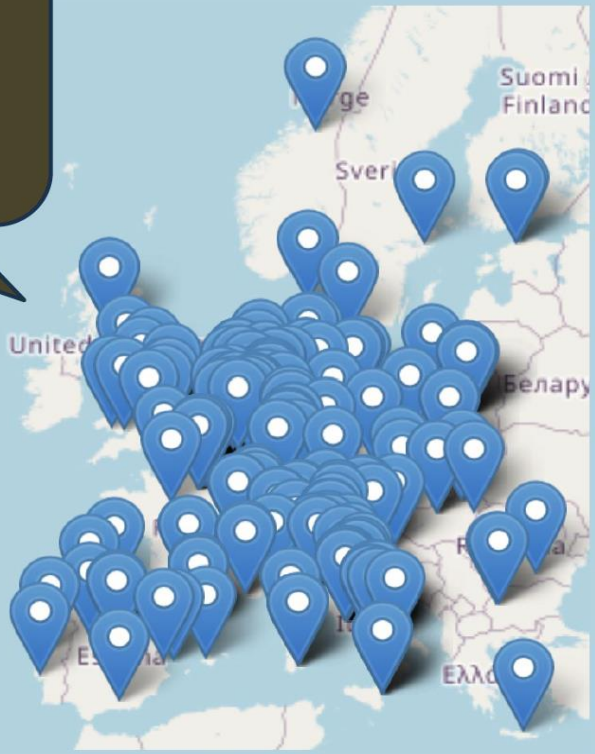
The Einstein Telescope Collaboration

- **97 Research Units**
- **2005 members (05/03/2026)**
- **Total: 291 Institutions in 34 Countries**

+ **FZU**: Institute of Physics of the Czech Academy of Science
+ **TNO**: Dutch Organisation for Applied Scientific Research
+ **Tallinn:** National Institute of Chemical Physics and Biophysics
+**Queen Mary Univ**, London

ET Member's affiliation map

- **ET member database**



Who we are? A complementary team

Candidate spokesperson:
Michele Maggiore

- Theorist
  - Co-chair of the Observation Science Board (OSB) since 2020
  - Co-coordinator of the Blue Book (The Science of the Einstein Telescope)
- Long experience in gravitational wave experiments since the mid-1990s
- I created and led the Research Unit of the Geneva group (Switzerland)
- Member of the ET Steering Committee and then Executive Board since 2019
- …

Candidate deputy spokesperson:
Angélique Lartaux

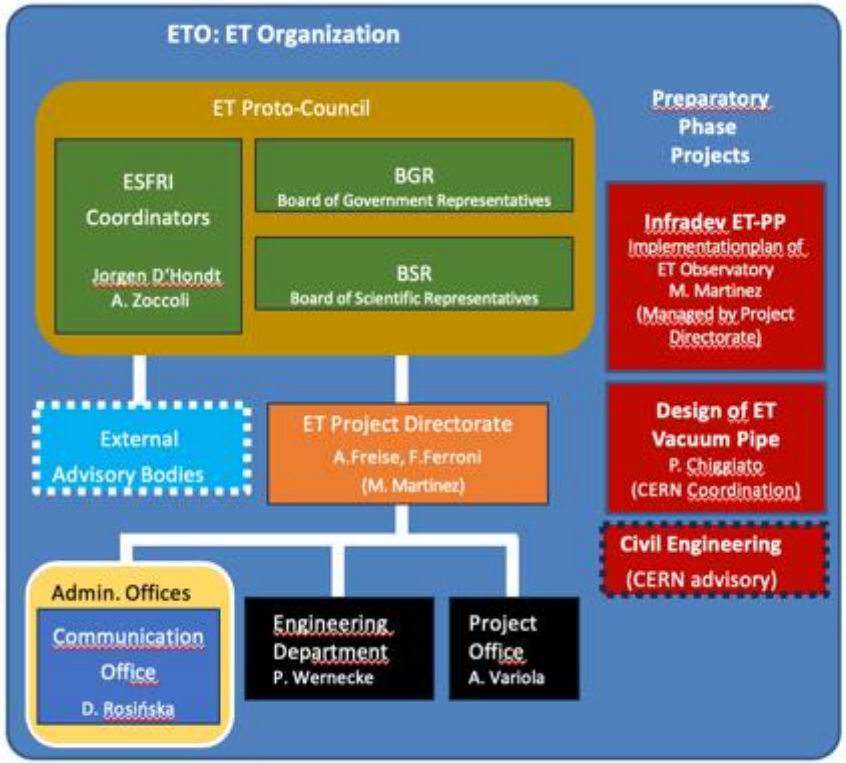
- Instrumentalist
  - Co-chair of Squeezed Light Working group since 2025
  - Contributor of the pre-TDR (preliminary Detector Technical Design Report)
- Experience in gravitational wave experiments since the mid-2010s
- Research Unit Leader of the IJCLab group (France) since 2022
- Member of the Early Career Support Committee since 2024
- …

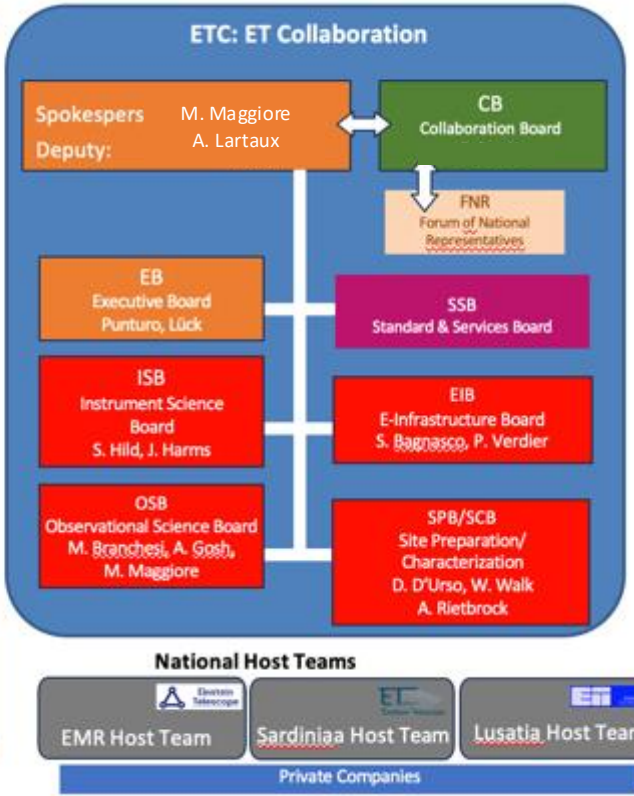
ET Organization and ET Collaboration

The EU supports the creation of the ET infrastructure (ETO) through the financing of Infradev projects:

Einstein Telescope Preparatory Phase ET-PP 2023-2026

Implementation Phase ET-COMPASS 2027-2028





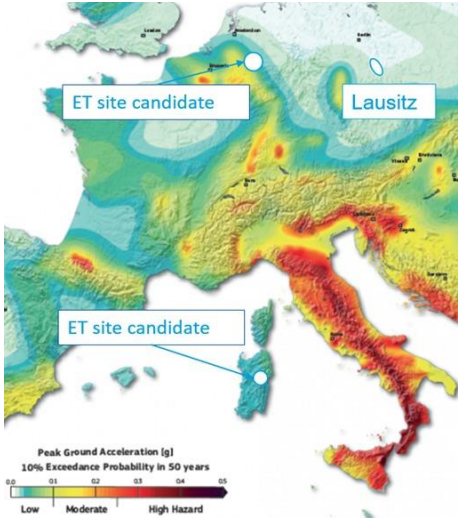
R&D Facilities in Europe

From the XIII ET symposium, an incomplete selection of the presented large facilities

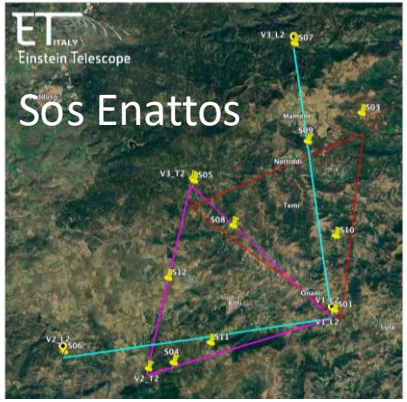
ET Funding Agencies are about to launch an ET R&D roadmap exercise

Site(s) and geometry

- **Three candidate sites** candidates to host ET: **EMR**, **Sardignia**, and **Lusastia**
  - Italy and the Netherlands have pledged to cover nearly half of the cost if their proposed sites are selected
  - Important budget in Italy (50M€), The Netherlands (42M€), and Germany(~90M€) to support **site characterizations** (boreholes, seismometer, environmental studies), **civil engineering studies** (tunnels and caverns), **Instrumental &D and physics studies**
  - **All 3 are underground :**
    - **Seismic noise attenuates with depth**
    - **Newtonian noise is less significant and NN cancelation system can be developed to reach sensitivity below 10 Hz**



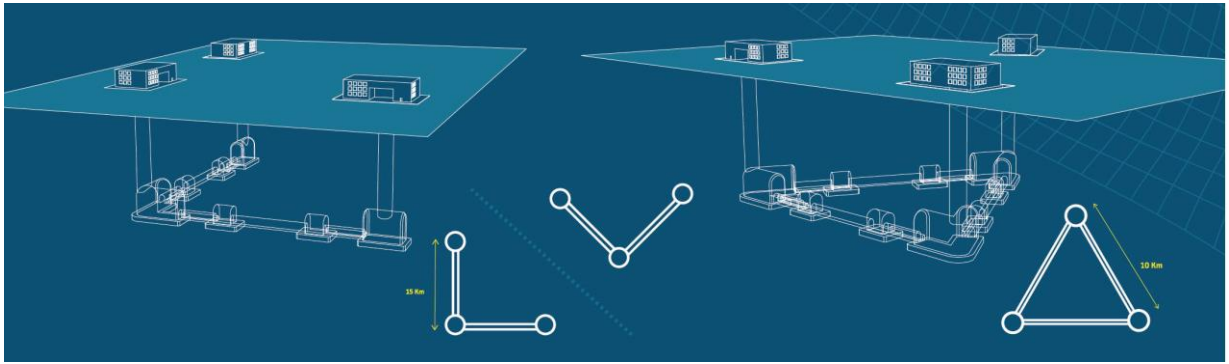
- **Geometry:**
  - Studies of physics potential has led to two geometry possibilities which are jointly evaluated: "2L 15 km" is generally better (45° orientation) and less risky than the triangle
  - Site Selection Criteria Committee will provide recommendations to BGR in 2026

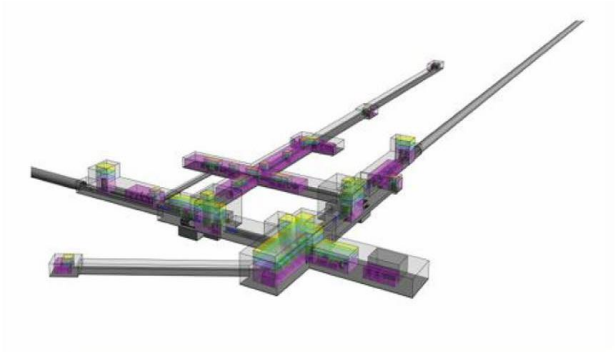


Decisions on site and geometry are expect in 2026-2027

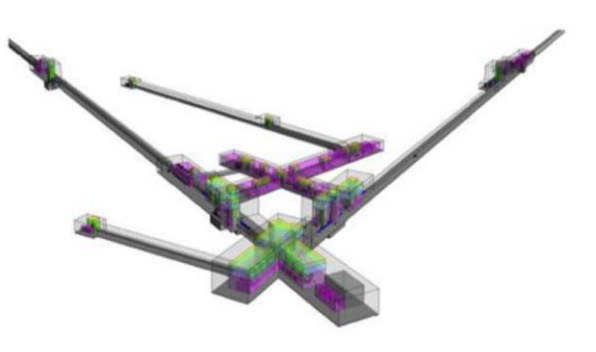
French Position in preparation: preference for the 2L 15km geometry

Optical Design Layout





- 2L, Task Force baseline



- Triangle, Task Force baseline

Significant work :

- "The ET Baseline Detector Layout", 78 pages
- "Supporting Document for the ET Baseline Detector Layout", 205 pages

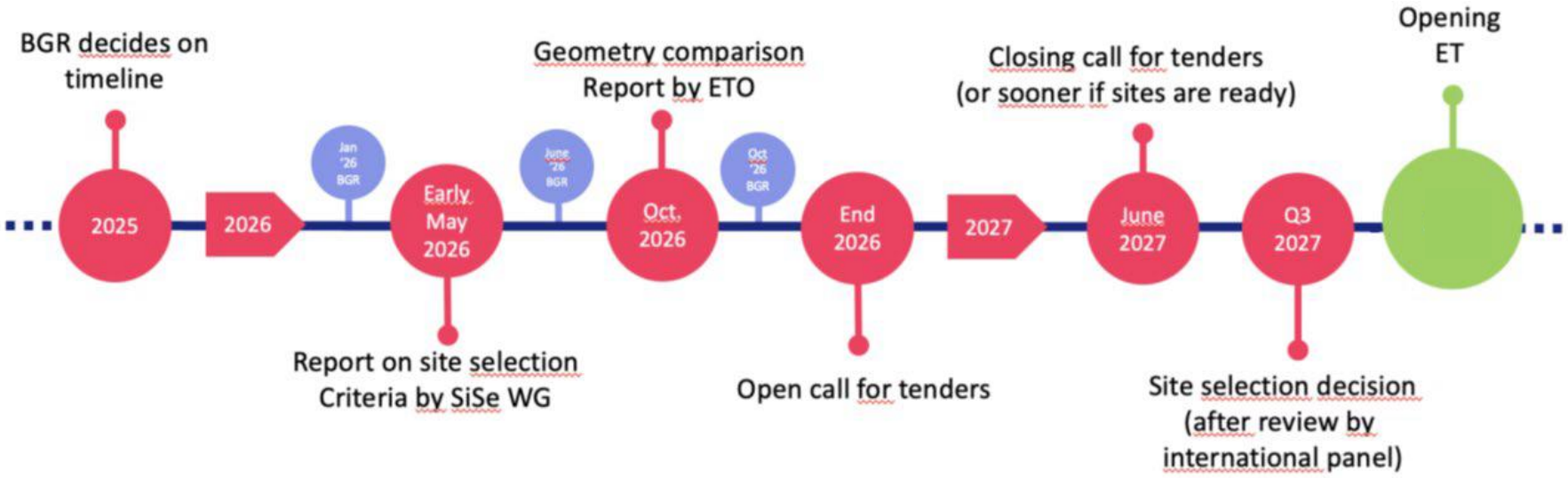
Some key outcomes:

- Filter cavity in the main tunnel
- Reduced Input Mode Cleaner length
- Reshuffling of central interferometer
- Reduction of benches footprint and tower height

Volume reduced by ~25% from 2024 reference layout (both triangle & 2L)

Better definition of technical infrastructure (cryogenics, clean rooms, noisy rooms)

ET Decision Timeline



Site Selection WG

@A. Harrisson

4 subgroups have been set up, with agreed scope and terms of reference and all but 1 (SG4) have started work: it proved challenging to find Chairs for some SGs, but this has now been resolved

SG areas	
1	Scientific and technical requirements of the detector
2	Civil works, environment and geology
3	Contextual factors: ecosystem, community and connectivity
4	Overall costings and finance

Scope of SG work

- Refine drafted criteria, develop definitions and propose initial weightings/minimum conditions to be met
- Define the information or evidence to be gathered for bidbooks, including the methodology to be used, assessment of risks and uncertainties where relevant, and the nature of any validation processes required

Sub Groups 3 and 4: outline scopes

Contextual factors: ecosystem, community and connectivity

- **'Deliverability' by the local team**
- **Ecosystem and socio-economic impact**
- **Human/social issues**
- **Connectivity and accessibility for construction and operations**
- **Costs**

Overall costs and financing

- **Overall cost of the ET-project for delivery, drawing on SG1, SG2 and SG3 inputs with methodology to determine costs, risks and contingency in a manner acceptable to all potential Members**
- **Financial terms offered by the potential host(s)**

Sub Groups 1 and 2: scopes

Scientific and technical requirements of the detector

- **Noise**
  Maximum admissible levels to ensure compliance with ET sensitivity requirements
  - Seismic noise:
  - Newtonian noise:
  - Magnetic noise:
  - Other relevant environmental/anthropogenic source
  - Geological and geophysical characteristics
- **E-Infrastructure**
  Include infrastructure for low-latency data processing on or near the site of the detector and also for connections with equipment for later-stage data analysis.
- **Costings**

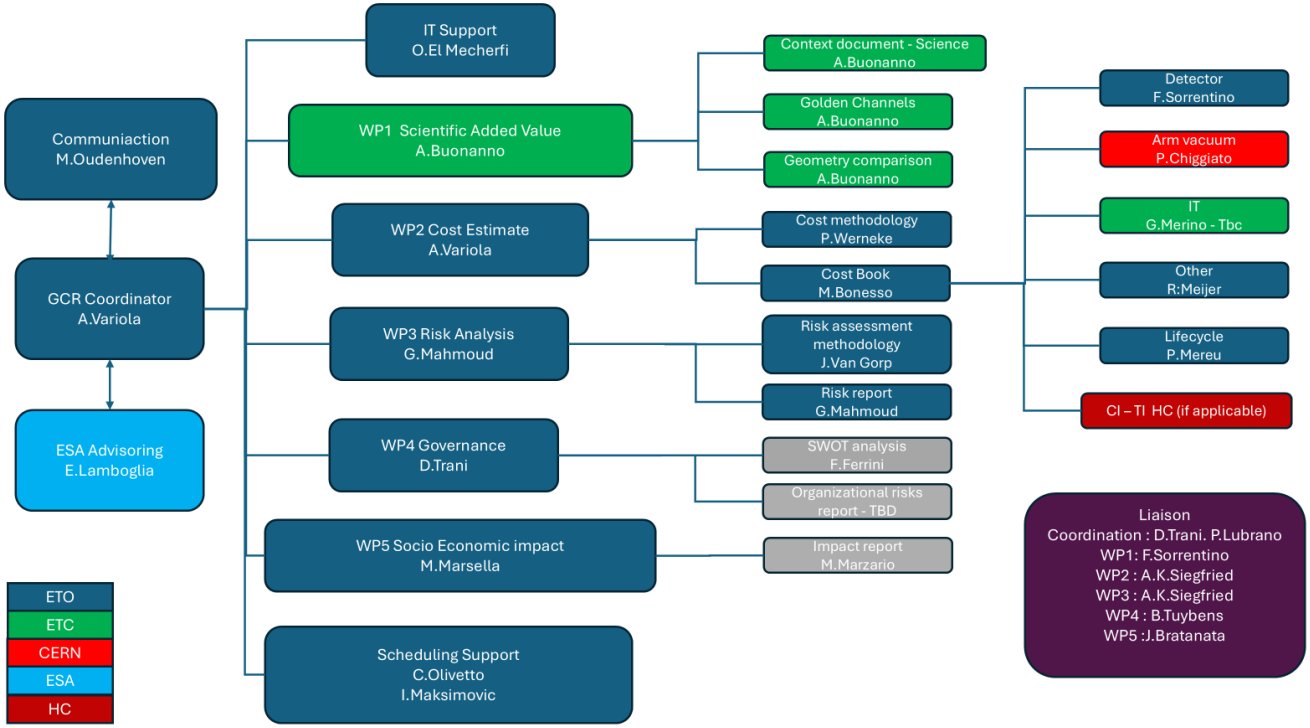
Civil works, environment and geology

- **Reliability and stability of the underground environment hosting the infrastructure**
- **Construction methods and the achievable level of functionality and performance of the infrastructure**
- **Authorization issues**
- **Costs, timelines and implementation methods for construction**
- **Expected environmental impacts due to construction**

Next steps

1. SGs to report back on their criteria, including definitions/methodology, acceptable ranges and validation methods where relevant, and weighting scheme, noting that the methodology for the last of these is still an open question — May-June 2026
2. The decision procedure, including timeframe and intermediate steps. — May-June 2026
3. Overall report to be put together for submission to the BGR — August 2026

Geometry Comparison Report



Work towards GCR structured as a project to deliver documents providing an analysis of:

- Scientific added value
- Costs and their lifecycle
- Risks
- Governance
- Socio-economic impact.

26 MARCH 2026

ESA and ETO partner on cost estimation methodologies

https://einsteintelescope.eu/news/esa-and-eto-partner-on-cost-estimation-methodologies

ET-PP: documents for decisions

@M. Martinez

Recent highlights

https://indico.cern.ch/e/ETSustainability2026

Very significant progress in the last months and the preparation / production of key documents

- Financial model for design and preparatory phase
- Computing model
- Environmental Impact
- C02 footprint
- Detector preliminary TDR

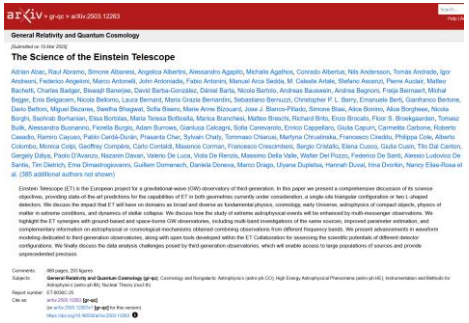
Three important workshops taking place in the framework of ET-PP industrial perspective

- Sustainability (last week @ Rome)
- Vacuum and Cryogenics. (April @ CERN)
- Computing (April @ NIKHEF)

https://indico.cern.ch/event/1605739/

https://indico.cern.ch/event/1604489/

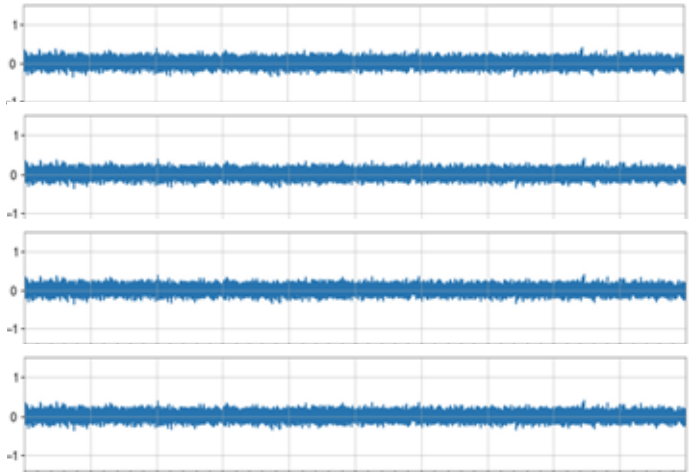
ET blue book published
https://arxiv.org/abs/2503.12263
JCAP03 (2026) 081



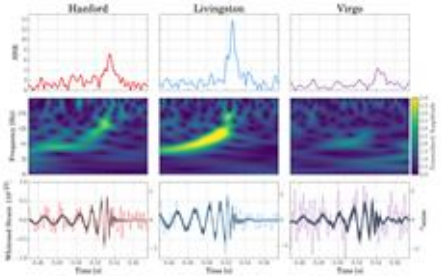
ET-PP docs available on : https://etpp.ifae.es/deliverables-milestones/

Computing & Software: From 2G to 3G

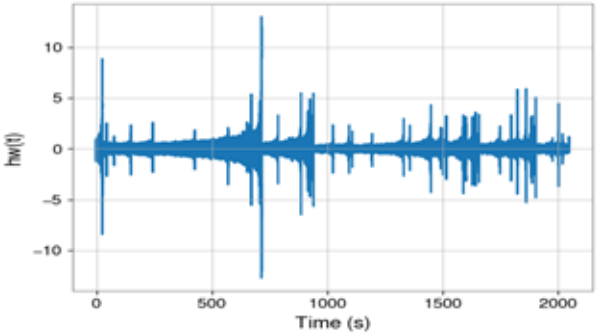
2G : LVK are dominated by backgrounds

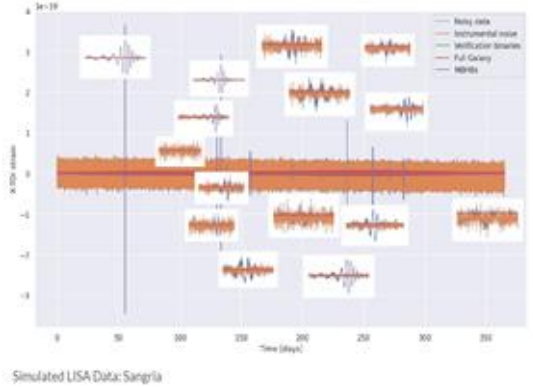


And 2-3 times per week



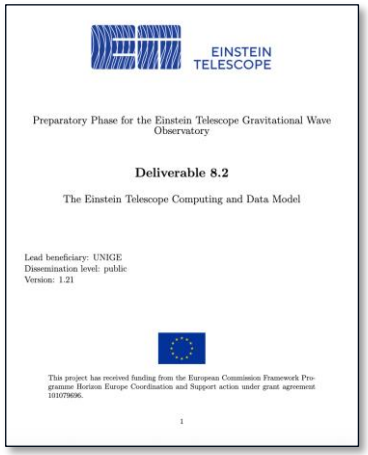
ET and LISA will be dominated by signals





Dataset size won't change so much
Complexity and computing power to reduce the data and reconstruct events will increase a lot

Computing & Software


EINSTEIN TELESCOPE

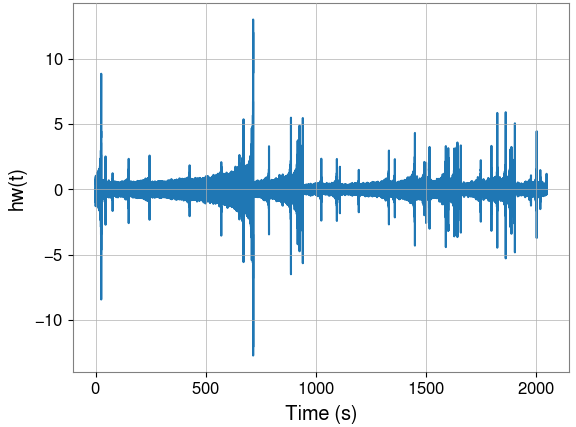
Preparatory Phase for the Einstein Telescope Gravitational Wave Observatory

Deliverable 8.2

The Einstein Telescope Computing and Data Model

Lead beneficiary: UNIGE
Dissemination level: public
Version: 1.21

This project has received funding from the European Commission Framework Programme Horizon Europe Coordination and Support action under grant agreement 101079696.



Regimbau, Suresh arXiv:2506.12237

ET with Cosmic Explorer (3G in the US) in a network for multi-messengers astrophysics

- Data format & management
- Online, low-latency, offline computing
- Simulation and MDCs
- AI/ML techniques
- Develop CC-IN2P3 usage for GW physics
- Usage of HPC resources
- Trainings
- …

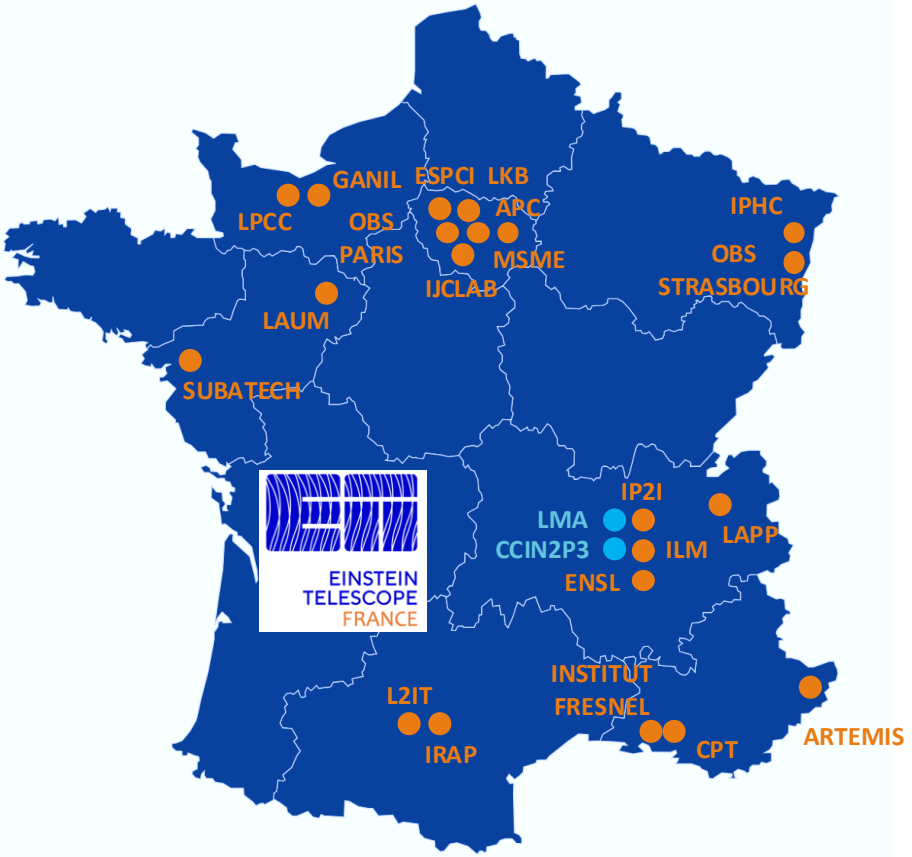
Einstein Telescope France

4 CNRS Institutes: IN2P3, INP, INSIS, INSU

ET-France web site: https://et-france.in2p3.fr

154 French collaborators officially joined the ET Collaboration
(~2/3 are also members of Virgo)

Organized in **8 Research Units** :
FTE threshold to get 1 voting voice at the ET Collaboration Board



Prospectives for 3rd Gen. GW detection

The ET project entered the ESFRI roadmap in 2021

ET is a strong priority in the French strategic plan for Nuclear, Particle, and astroparticle physics (2021)

« Participate in the 3G GW interferometer development guided by the leveraging of French Virgo expertise and facilities. »

- Almost 40% of survey **answers mentioning gravitational-waves**
- **Einstein Telescope** is the most cited experiment, followed by LISA and Virgo

- *Based on the survey, **ET stands out as the most indicated next-generation infrastructure to be included in the roadmap**.*
- *It is of interest not only to the GW community but also to a **broader range of astroparticle scientists***

European FAs are working together towards an integrated European R&D roadmap for ET

Update of the French national roadmap for RIs

Einstein Telescope is applying to enter this roadmap

- April 2025: eligibility application – OK
- July 2025: application to enter as IR
- October 2025: audition by the GT PNHE

Next steps:

End of October 2025 : WG evaluation

February 2026: decision at MESR

April 2026 : validation of the final list by CD TGIR

Final publication: September 2026

ET-France Workshop goals

Being on the French roadmap for Research Infrastructures is a mandatory step, but non sufficient to get an ET budget:

- If IR* label => ET is a budget line in French national budget
- If IR label => ET's budget will come from CNRS budget

ET-France is asked, both by CNRS and MESRE/DGRI, to provide by summer 2026 :

- Detailed information about ET-France contributions to the preparation of ET:
  - "what, who, where, how" …
  - How do ET-France exploit existing expertise/know-how, R&D and computing platforms/labs ?
  - How ET-France is connected to the French landscape: Virgo, LISA, GDR OG, AISSAI, …
- An organization chart (next slide) :
  - with identified responsibilities and people in charge
  - including governance and steering mechanisms
  - Including all mandatory transverse actions for a large RI like ET:

    Project management, Sustainability & environmental impact, Industrial partnership, communication

=> Elaboration of a document for the summer 2026 => workshop to prepare that document !!!

MESRE/DGRI

Steering committee:
(Entretien Annuel Projet)
CNRS Institutes (+ other oganisms)

Advisory Scientific Committee (?)

EINSTEIN TELESCOPE FRANCE

Responsable Scientifique — Patrice Verdier

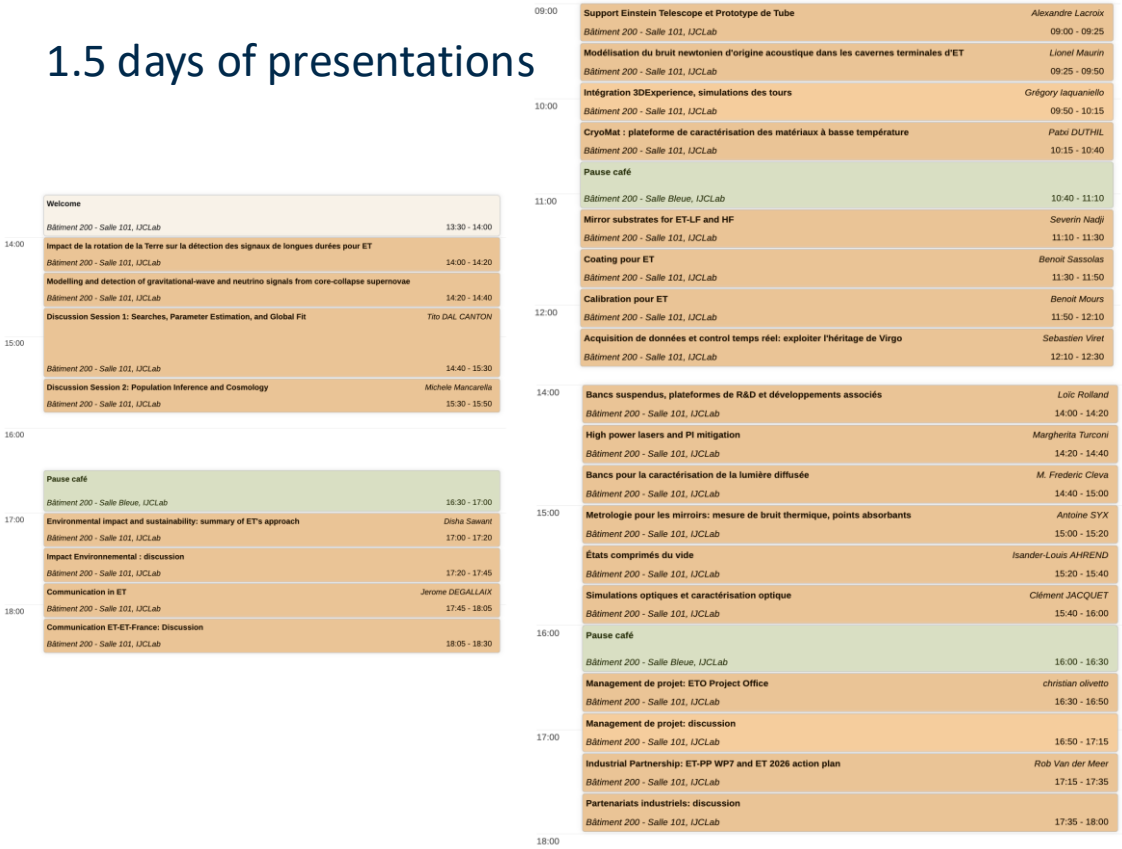
Responsable Technique — Christian Olivetto

- **Management Projet** — Gestion et suivi qualité, systèmes, risques, documentation, contractualisation, …
- **Partenariats Industriels** — Liaison entreprises françaises, lien avec ET (ILO), événements avec les industriels
- **Communication** — Stratégie de communication nationale, lien avec la com ET
- **Impact environnemental** — Stratégie et implémentation dans le plan de développement ET-France

- **Analyses, software et Computing** — Développement des pipeline d'analyse et des outils de simulation (MDC), gestion des données, management software et core-computing sur les centres de calcul nationaux
- **Détecteurs** — Miroirs: Coatings, substrat, polissage; simulations optiques, caractérisations, lumière diffusée, Squeezing, lasers, DAQ
- **Infrastructure et environnement** — Tubes à vide, enceintes/tours à vide, cryogénie, bruits environnementaux (acoustiques, magnétiques)

ET-France Workshop

1.5 days of presentations



Half a day of working session and preliminary restitution

We go back to our labs with a working plan and on organization to elaborate our ET-France document