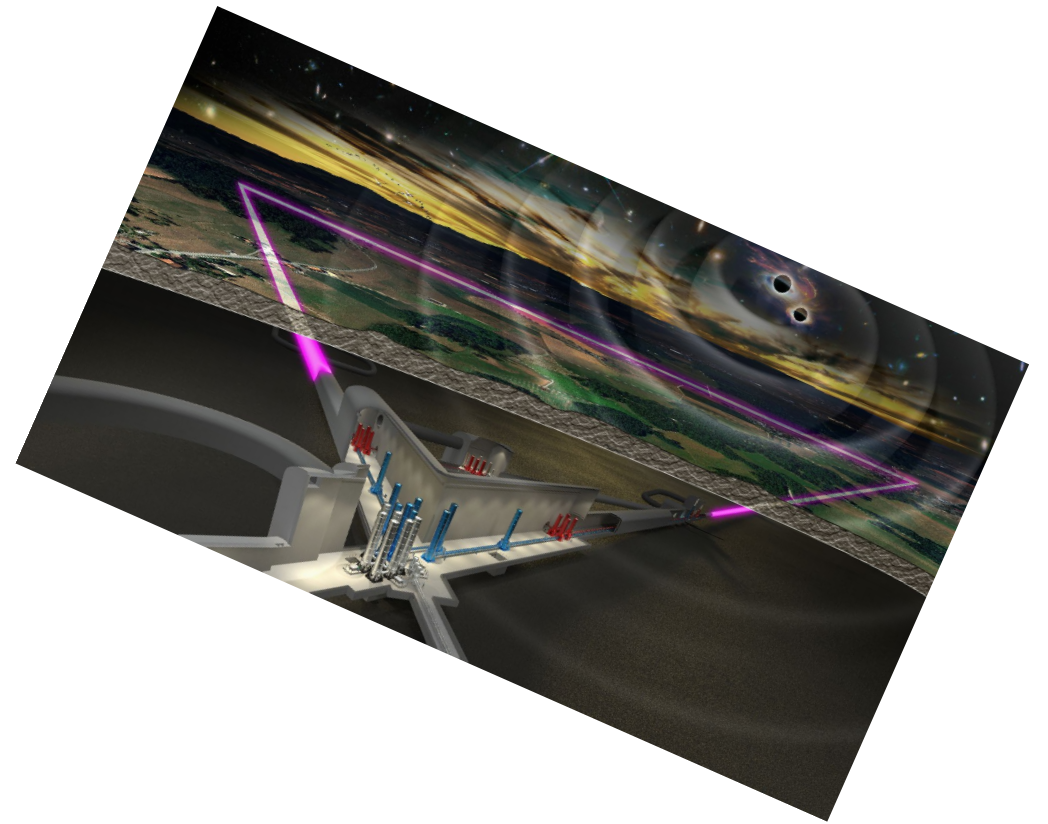


ETO Engineering Department

Patrick Werneke

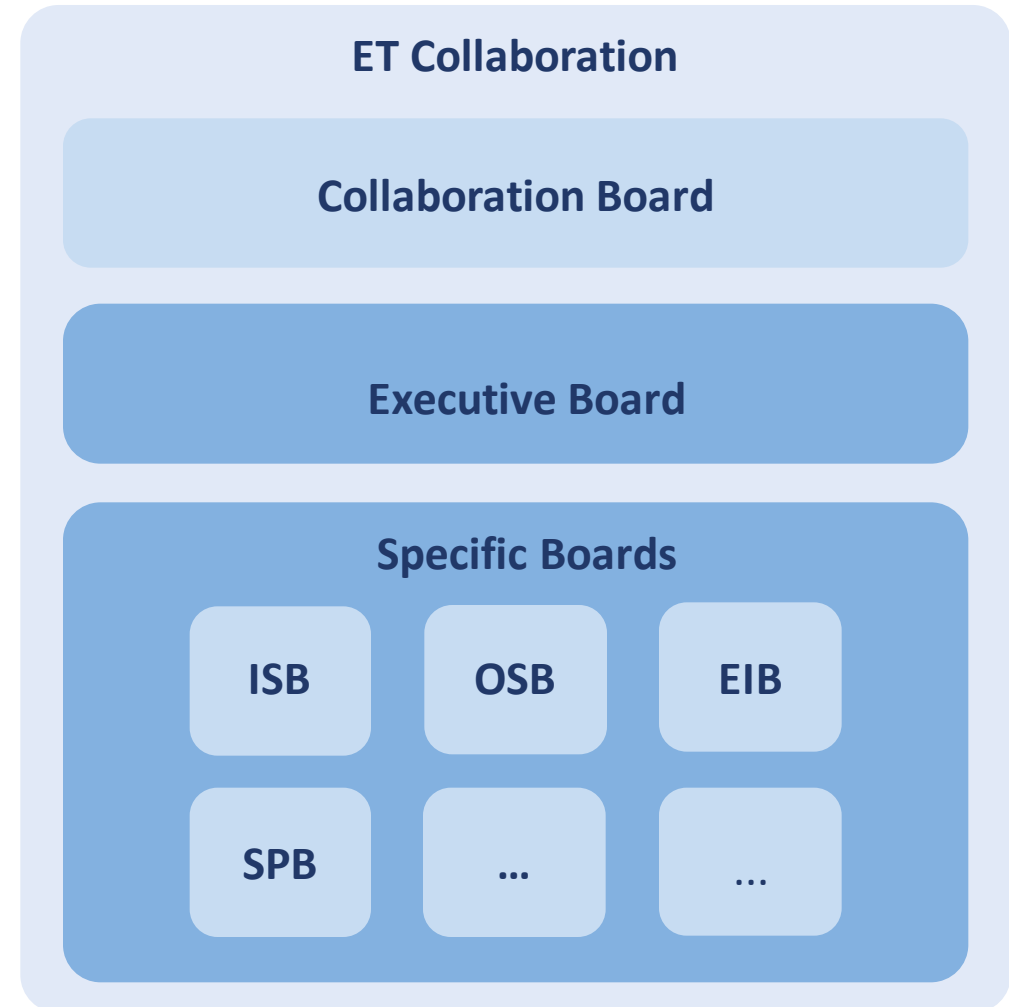
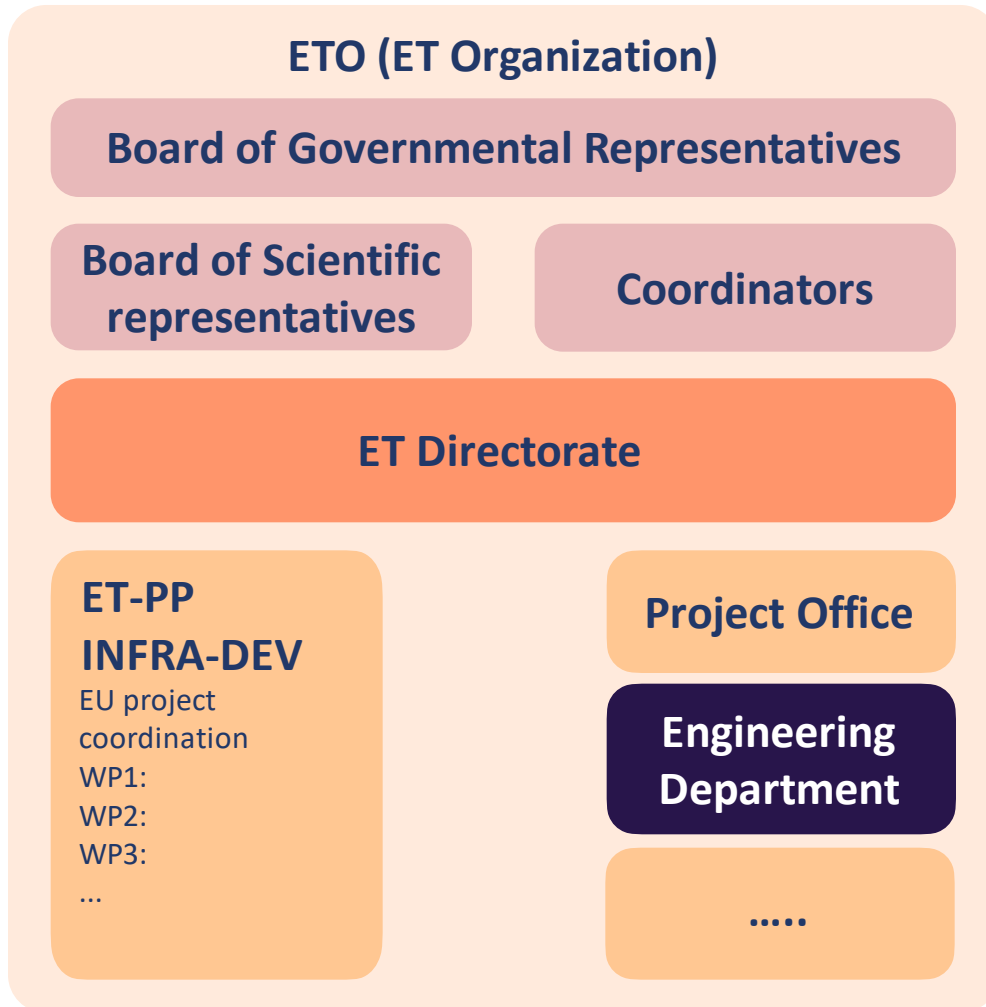
2nd Einstein Telescope Annual Meeting

14.11.2023



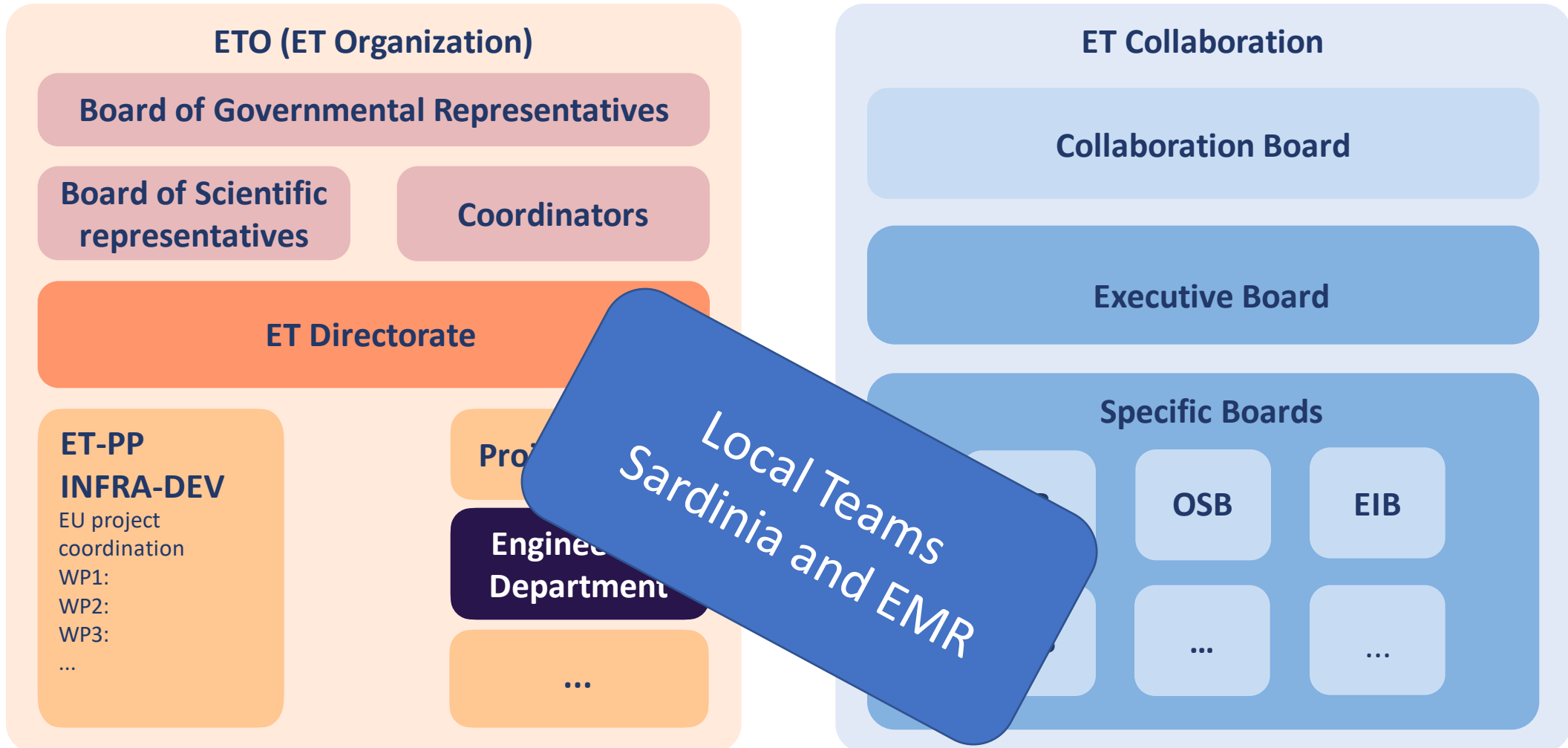
Towards ET Dual Organizational Structure

1) project organization (towards legal entity) and 2) scientific collaboration



Towards ET Dual Organizational Structure

1) project organization (towards legal entity) and 2) scientific collaboration



Engineering Department: mandate

The Engineering Department will **design, procure, install, commission, operate, maintain and eventually, dismantle:**

1. **The technical infrastructure systems** needed to host the gravitational wave detector (e.g. civil engineering, technical Infrastructures).

and

2. **The special systems** needed to operate the gravitational wave detector (e.g. vacuum, cryo, monitoring & survey).

Engineering Department

The **activities** of the Engineering Department are in the following fields:

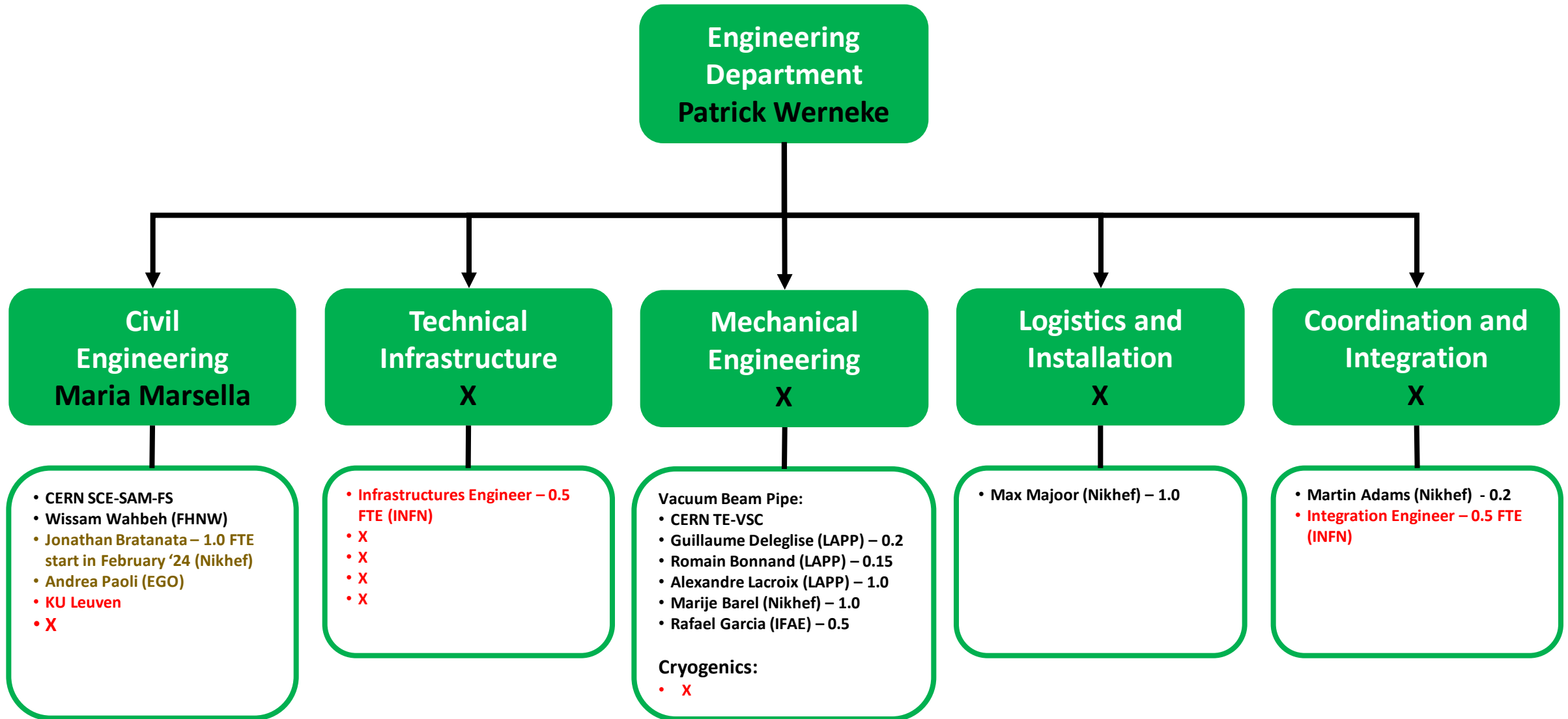
- **Civil Engineering:**
 - Underground shafts, caverns and tunnels
 - Surface buildings, roads, landscaping,
- **Technical Infrastructure:**
 - Cooling & ventilation, electricity, access and alarms, water management,
- **Mechanical Engineering:**
 - The technical systems associated with the gravitational wave detector: vacuum, cryogenics, survey, materials

Engineering Department

The **activities** of the Engineering Department are in the following fields:

- **Installation and operation:**
 - Logistics, transport, handling and lifting
 - Responsible for clean operations
- **Coordination and integration (In close collaboration with the Project Office):**
 - Information management: lifecycle management, CAD, visualization
 - Integration studies and maintenance of the engineering documentation
 - Organization and scheduling of the installation and interventions
 - Coordination of the activities for installation, interventions and changes
 - Coordination of safety in the field
- **Giving technical support to the ET collaboration and local teams**

Engineering Department



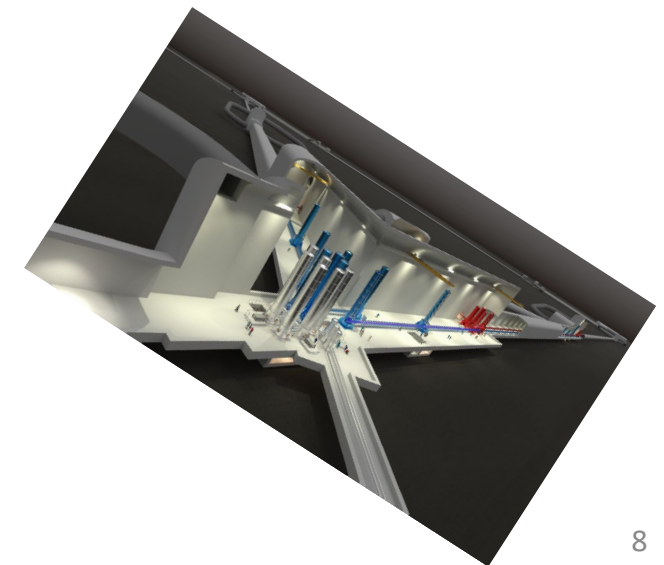
Draft version of the ED organizational chart

Engineering Department: ET Phases and deliverables

ET is currently in **Phase I** of a **Design and Preparation Phase**, which ends with the **selection of a site** for ET.

Deliverables for Phase 1 - for Δ and 2L:

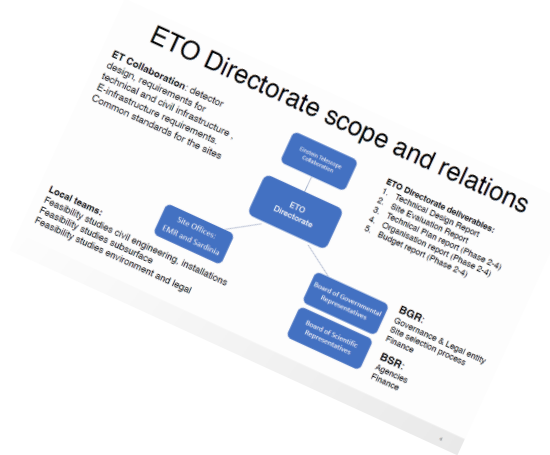
- (Preliminary) Technical Design Report
- Cost report of the research infrastructure (Phase 2 + following phases)
- Planning report (Phase 2 + following phases)
- Organizational report (Phase 2 + following phases)
- Site evaluation report



Engineering Department: ET Phases and deliverables

For the deliverables ETO needs to work closely with the ET Collaboration and Local Teams.

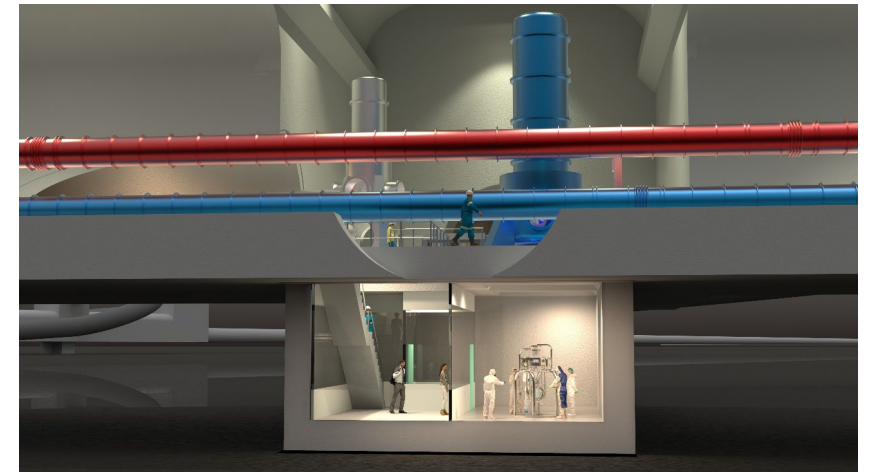
- The ET Collaboration is responsible, amongst others, for the interferometer design and requirements.
- The Local Teams will conduct , amongst others, site feasibility studies.



Engineering Department: ET Phases

Phase 2 + following Phases:

2. Preparatory Phase 2: this phase will end with the final TDR, costing overview, risk assessment and schedule for the construction
3. Implementation Phase: this phase will end with the Einstein Telescope commissioned
4. Operation Phase
5. Termination Phase



Collaboration with CERN

- Several similarities between ET and CERN – specifically related to vacuum and underground infrastructures.
- We have an MOU with CERN for their support on technical topics.
- The MOU was setup with INFN and Nikhef. IFAE has joined as a fourth partner.
- **More partners are welcome.**

KN4657 / DG / EinsteinTelescope Collaboration Agreement

Collaboration Agreement KN4657/DG/EinsteinTelescope

Between

The European Organization for Nuclear Research
("CERN")

And

the Lead Institutes of the Einstein Telescope
Collaboration:

The Italian National Institute for Nuclear Physics
("INFN")

and

The Dutch National Institute for Subatomic Physics
("Nikhef"),

(hereinafter "Party" and collectively "Parties")

Concerning

Collaboration on the design of future gravitational wave
detection experiments

2019

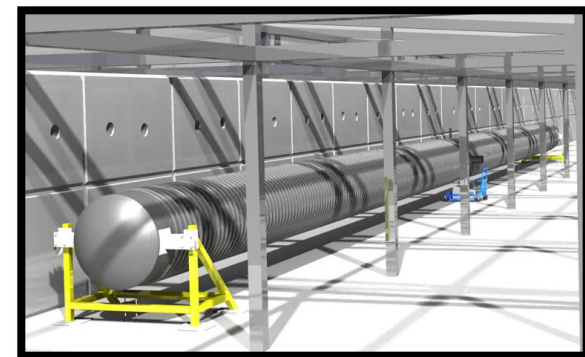
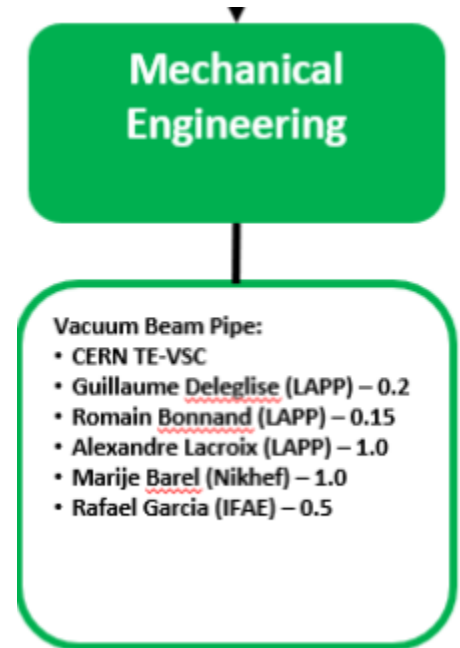
Collaboration with CERN

Vacuum Beam Pipe:

- The CERN vacuum team has the responsibility to deliver the **technical design for the ET beampipe** at the end of a three year project. MOU partners will provide financial support for related CERN fellowships.
 - **Coordinate the efforts** of the institutes that work for the ET beampipes;
 - Ensure **the link with** the vacuum community of the CE.
 - **Propose less expensive technical solutions** that fulfil the requirements
 - **Leading to a pilot sector and a TDR by end of 2025.**

See presentation from Carlo and Luigi

Note: Antwerp and Gent University are supporting TE-VSC



Collaboration with CERN

Civil Engineering:

- Recently signed a MOU with CERN CERN Civil Engineering to provide **support** towards the **technical design for the underground structure**.
- MOU partners will provide financial support for CERN fellow.
- **Goal: Preliminary TDR: Q4 2026**

Deliverable	Description of civil engineering documents to be produced by ETO and reviewed and supported by CERN	Date
D1	Work Plan explaining the roadmap to produce the TDR	Q4 2023
D2	Review and Assessment document of existing information relevant for civil engineering	Q4 2023
D3	Requirements and specific objectives for the civil engineering tender documents for consultant(s) to develop civil engineering layouts/specifications and to produce cost/schedule report and risk analysis	Q2 2024
D4	Configuration of design tools (<u>Geoprofiler</u> , GIS data, BIM model etc.)	Q4 2024
D5	Structure of the TDR	Q1 2025
D6	TDR	Q4 2026



Collaboration with CERN

Civil Engineering:

- Recently signed a MOU with CERN
CERN Civil Engineering to provide **support** towards the **technical design for the underground structure**.
- MOU partners will provide financial support for related CERN fellowships.
- **Goal: Preliminary TDR: Q4 2026**



Civil Engineering session

Wednesday parallel session 11:10 – 13:10 in Salle 101

Agenda:

- Engineering Department Mandate and organization
- Roadmap for Civil Engineering Preliminary TDR organization
- Links between special systems and civil infrastructure: lesson learnt from the beam pipe design
- SPB contributions to civil engineering roadmap
- Seed questions and future actions

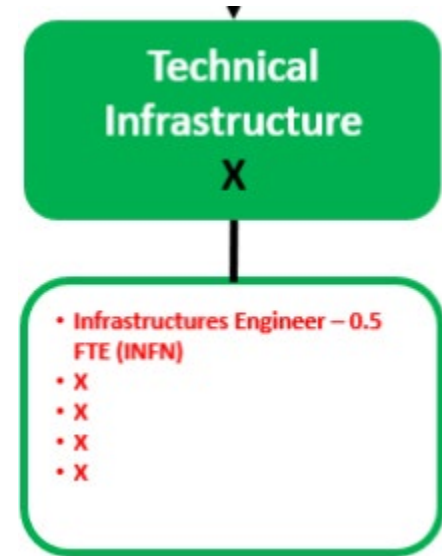


Possible collaboration with CERN

CERN Engineering Department

- Cooling and Ventilation
- Access and Safety
- Electrical Engineering
- Water Management

We are discussing support with CERN, but we also need internal “specialists” (In-kind) from ET(O) to work with CERN.



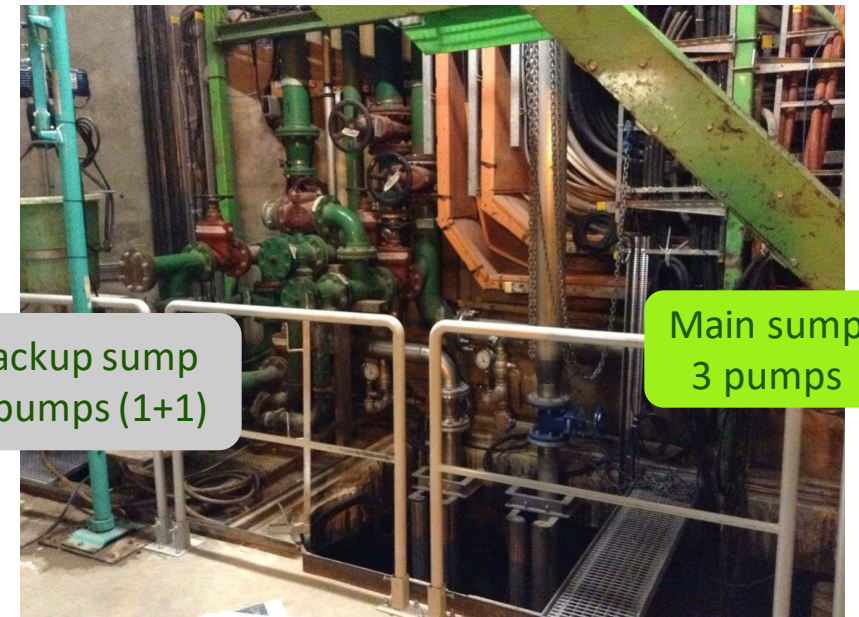
Possible collaboration with CERN

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80 m³/h underground water infiltration



Backup sump
2 pumps (1+1)

Main sump
3 pumps

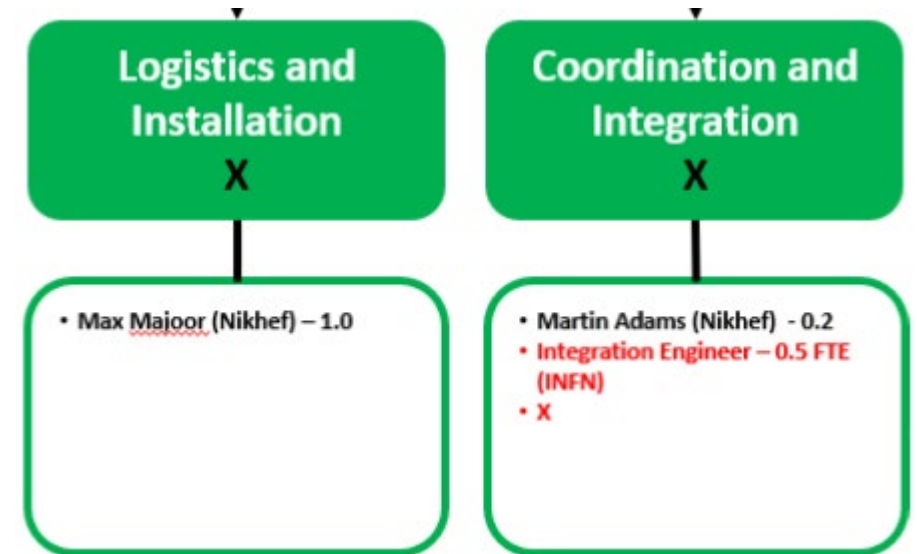
Possible collaboration with CERN

CERN Engineering Department and HSE:

- Logistics and Transport (Handling)
- Layout and Integration
- Information Management

- Occupational Health & Safety and Environment (ETO)

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Possible collaboration with CERN

CERN Engineering Department and HSE:

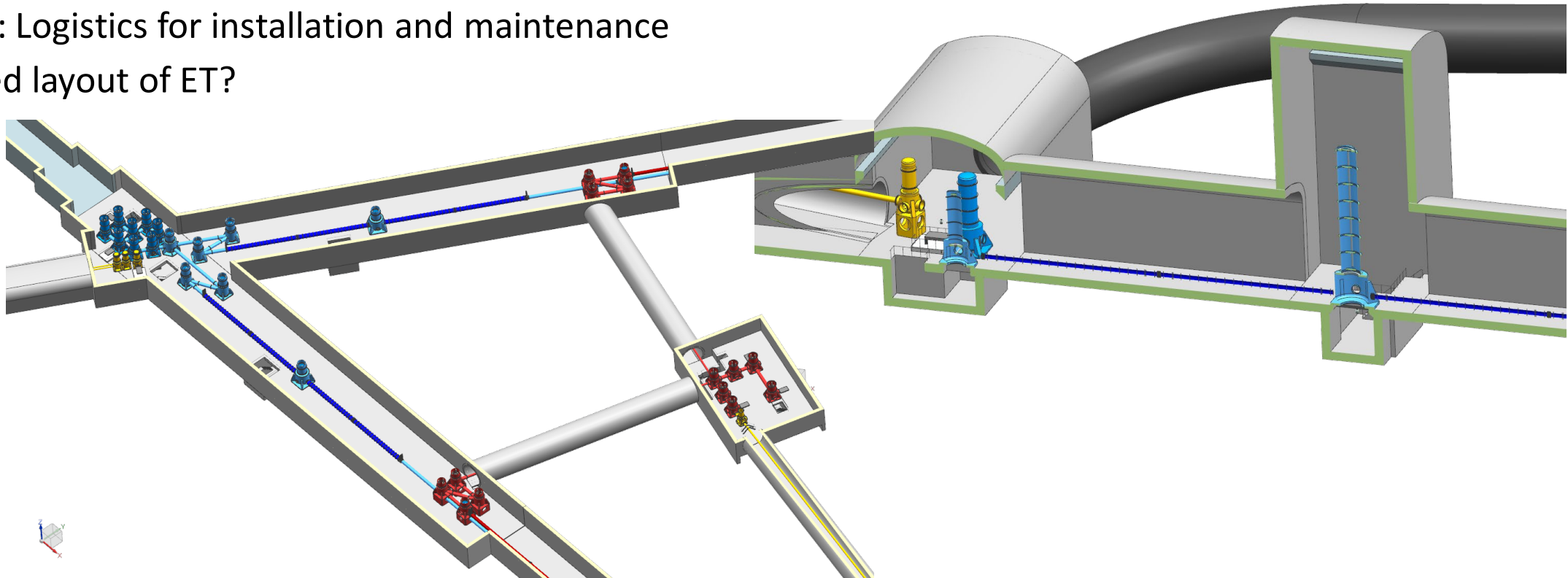
- Logistics and Transport (Handling)
- Layout and Integration
- Information Management
- Occupational Health & Safety and Environment (ETO)
- *We are discussing support with CERN, but we also need internal “specialists” (In-kind) from ET(O) to work with CERN.*



Logistics and Installation

For Civil Engineering: started the process of “remodeling” the space needed for ET: including installation and maintenance.

- Need discussions with several ISB Divisions + requirements
 - E.g.: Logistics for installation and maintenance
- Approved layout of ET?



Pictures from the ET design: ET Layout 8 (2020)

Summary

- The Engineering Department team is growing, but will need more support to fulfil our tasks for Phase 1:
 - In most teams, but specifically for Technical Infrastructures we need support
 - Recruitment process of the ET-PP resources is almost complete
- Started the work on Civil Engineering with CERN: more info in the parallel session on Wednesday
- MOU with CERN for Civil Engineering in addition to the Vacuum Beam Pipe
- Expect an MOU with the CERN Engineering Department first half 2024

End

