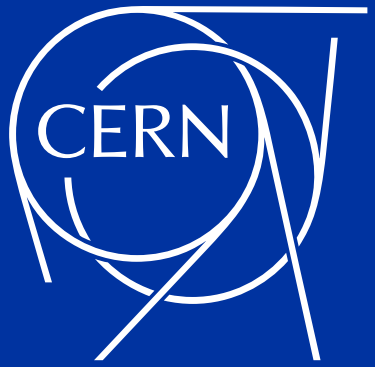
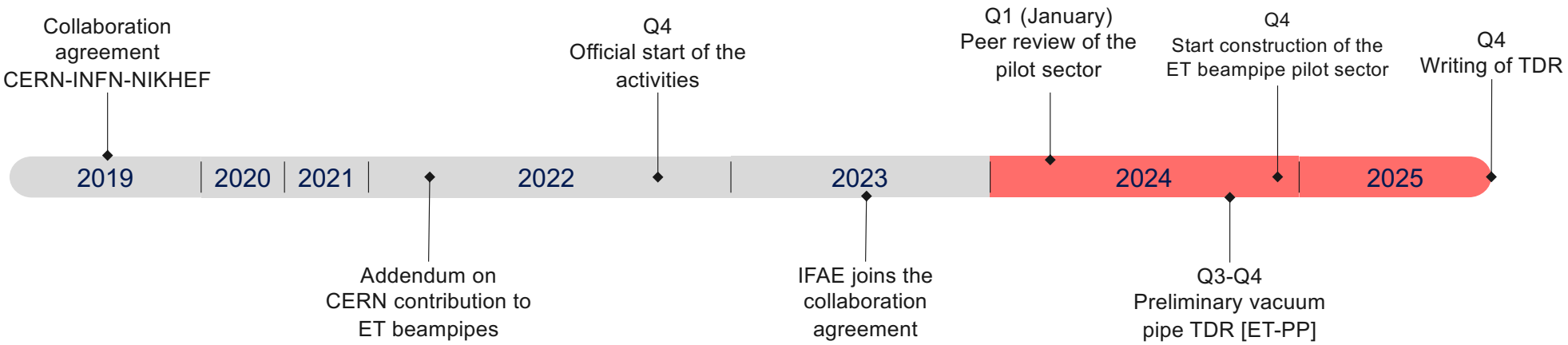


Progress on ET Pilot Sector and its future ET – CERN collaboration

Luigi SCIBILE on behalf of the ET-CERN Collaboration

XIV ET Symposium, Maastricht, 06-10 May 2024

CERN activities on ET beampipe vacuum



The main objectives are:

- **Coordinate the contributions** of all parties involved in the study of ET beampipes.
- Design, manufacture, assemble, and test a **pilot sector** of the selected ET beampipe vacuum systems.
- Preparing and writing the '**Technical Design Report**' for the vacuum systems of the ET's arms, including cost estimations.
- Contact and sharing of information with the **Cosmic Explorer community**.

Courtesy of Carlo Scarcia

ET pilot sector

The pilot sector aims to **test the design, fabrication, installation and commissioning** of the proposed **beampipes and support system**. It also aims to compare the feasibility of a selected number of technical choices.

Q1 2024 (January)

Project peer reviewed (international experts panel) with recommendations.

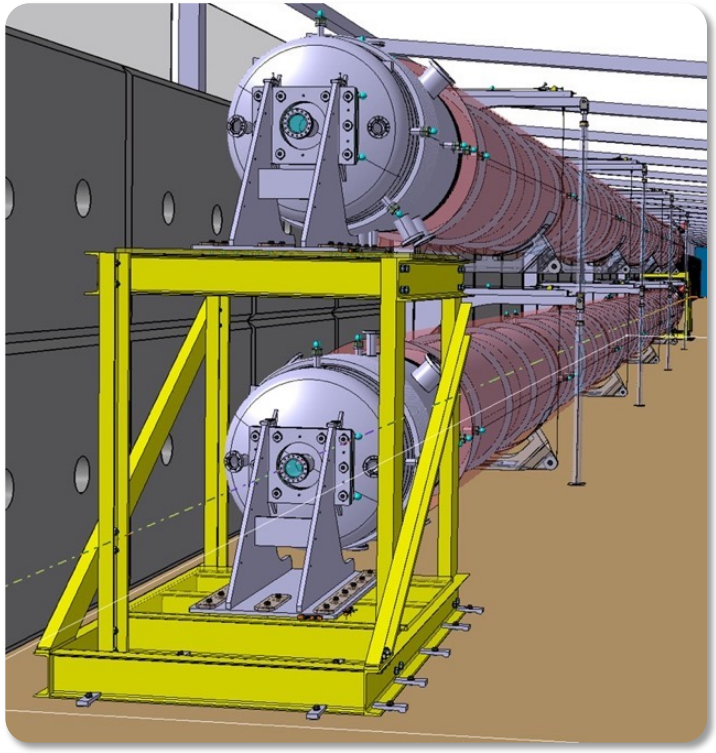
Q2-Q4 2024

Manufacturing and **procurement** of the **ancillary** components/equipment.

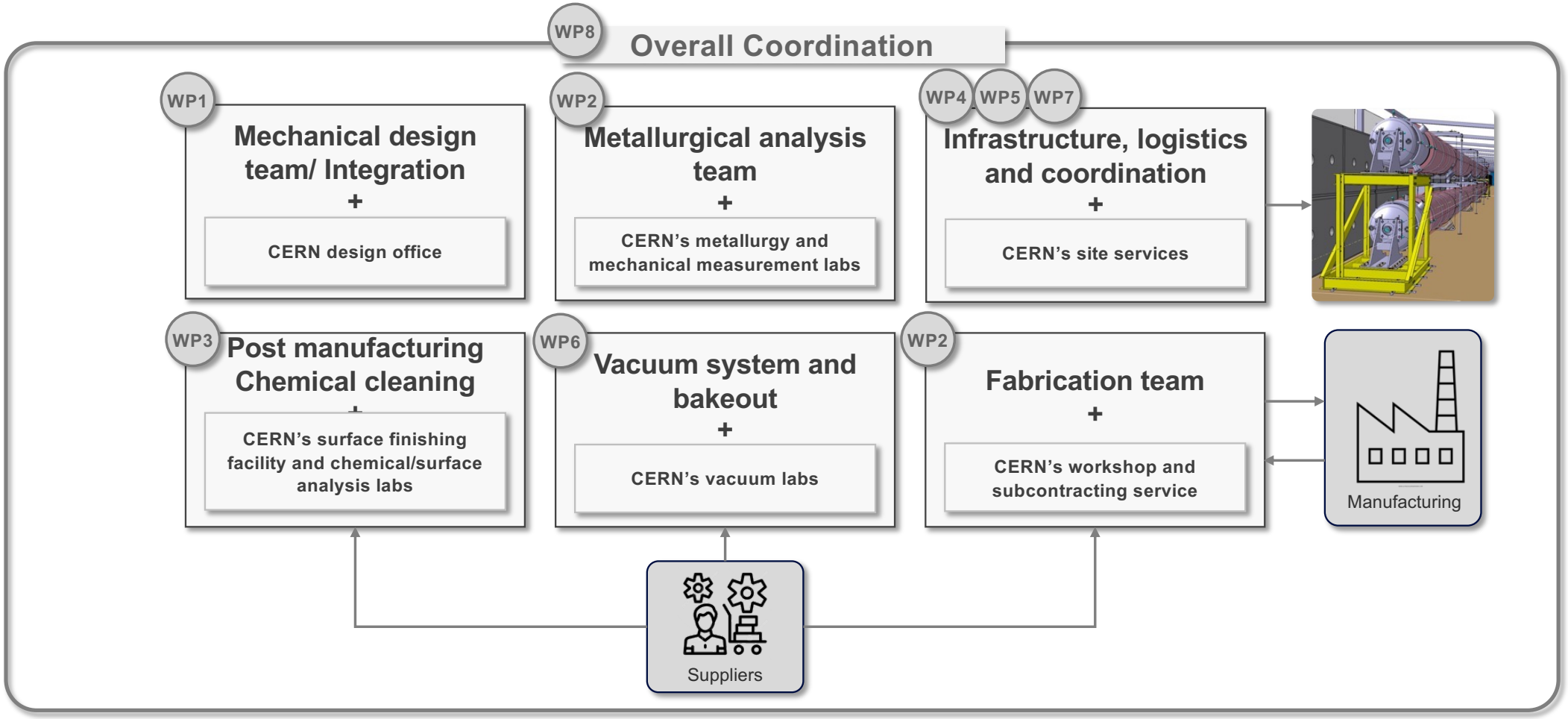
From Q4 2024/Q1 2025

Start of installation of a
AISI 441 VIRGO-like pipe **Ø 1.08 m x 4 mm x 36 m**

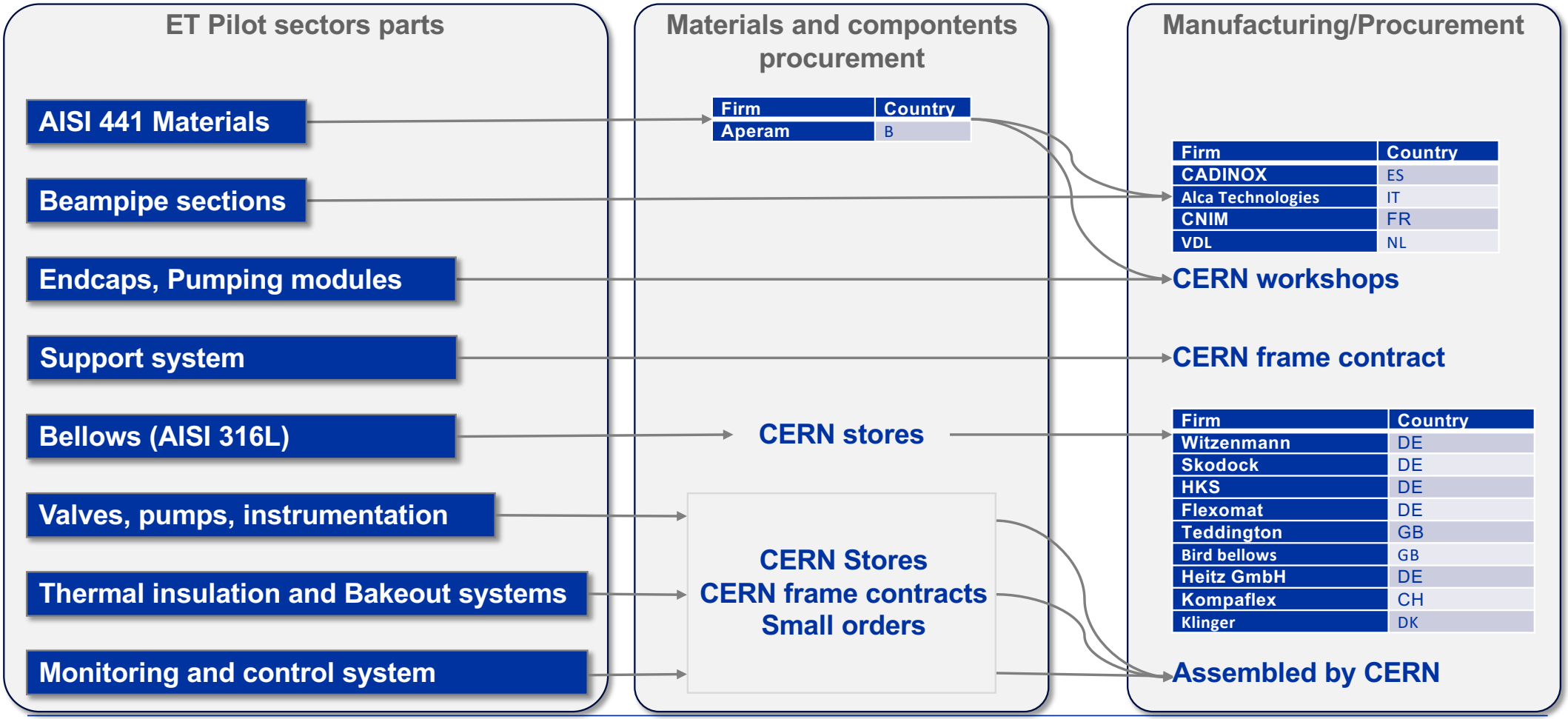
Courtesy of Carlo Scarcia



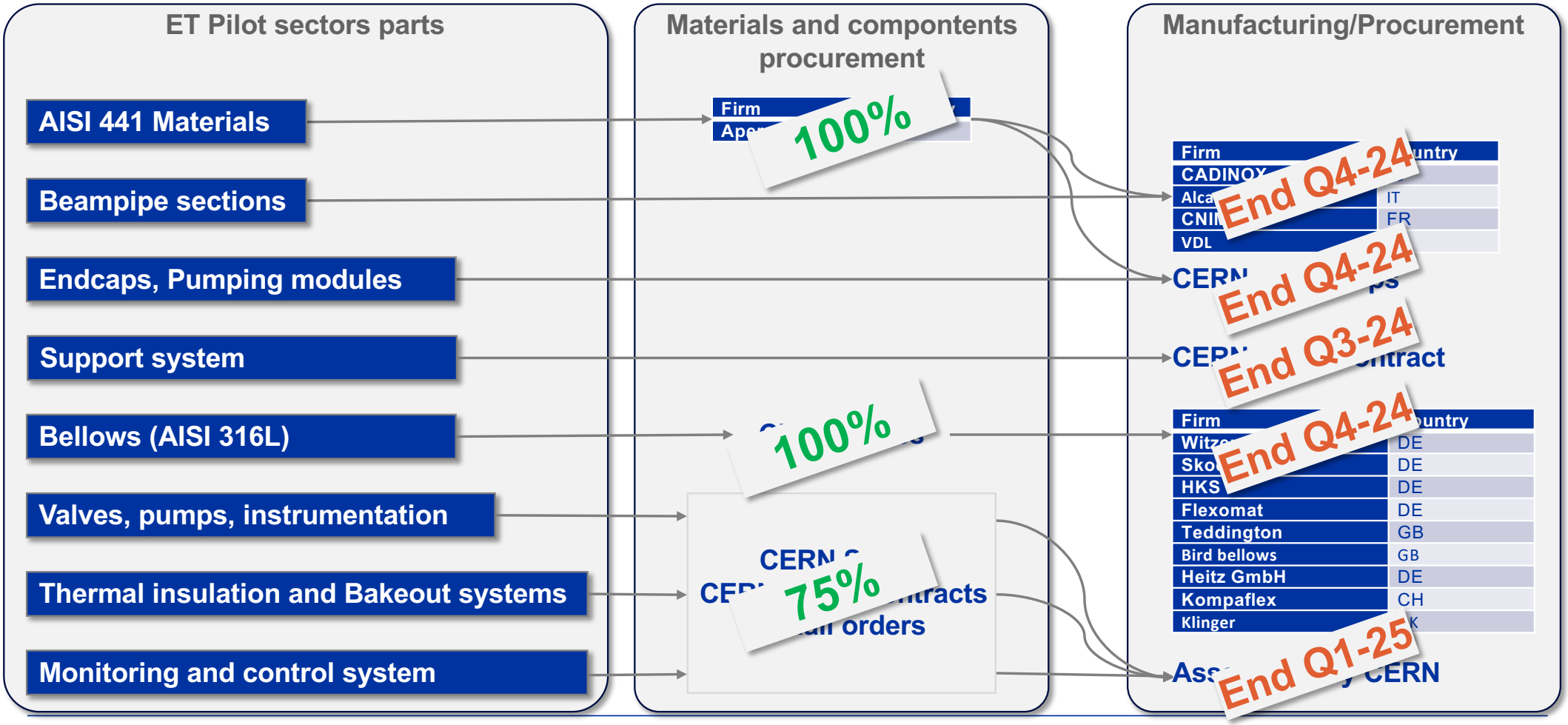
ET Pilot sector - Organisation



ET pilot sector – Procurement and manufacturing



ET pilot sector – Procurement and manufacturing



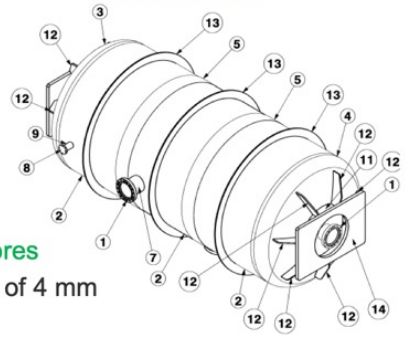
ET pilot sector – Procurement and manufacturing

ET Pilot sectors parts

- AISI 441 Materials
- **Beampipe sections**
- Endcaps, Pumping modules
- Support system
- Bellows (AISI 316L)
- Valves, pumps, instrumentation
- Thermal insulation and Bakeout systems
- Monitoring and control system

Mock-up Ø850 mm

3 segments of 850 mm diameter, 500 mm length
(rolled & welded cylinders)



Manufacturing progress

- Fabrication expected to be completed mid-July
- Base material (4 mm thickness) received at CERN
- 2x End Cups successfully manufactured
- Sleeves material (2 mm thickness) received at CERN
- Stiffeners material (304L square bars) available in CERN Stores
- Welding developments on-going → Plasma and TIG welding of 4 mm

Courtesy of M. Dakshinamurthy and A. T. Pérez

ET pilot sector – Procurement and manufacturing

ET Pilot sectors parts

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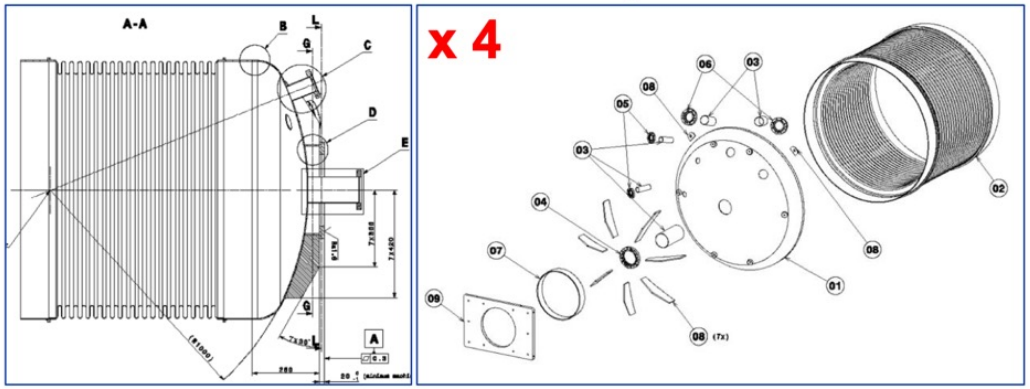
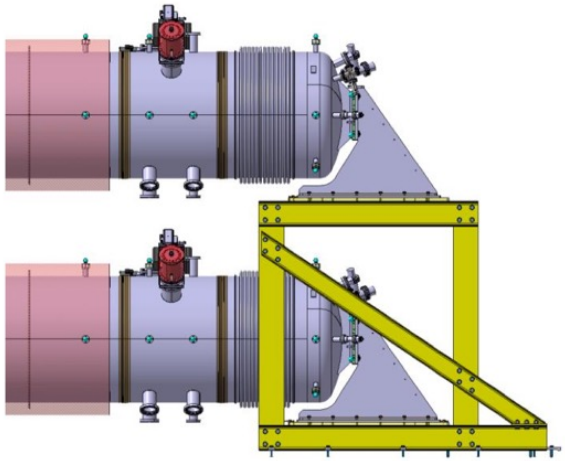
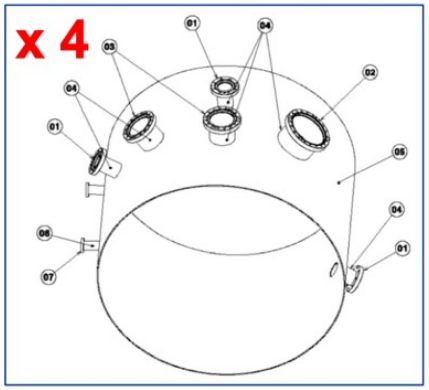
End-Cap module







Instrumentation module

Courtesy of G. Favre

ET pilot sector – Procurement and manufacturing

ET Pilot sectors parts

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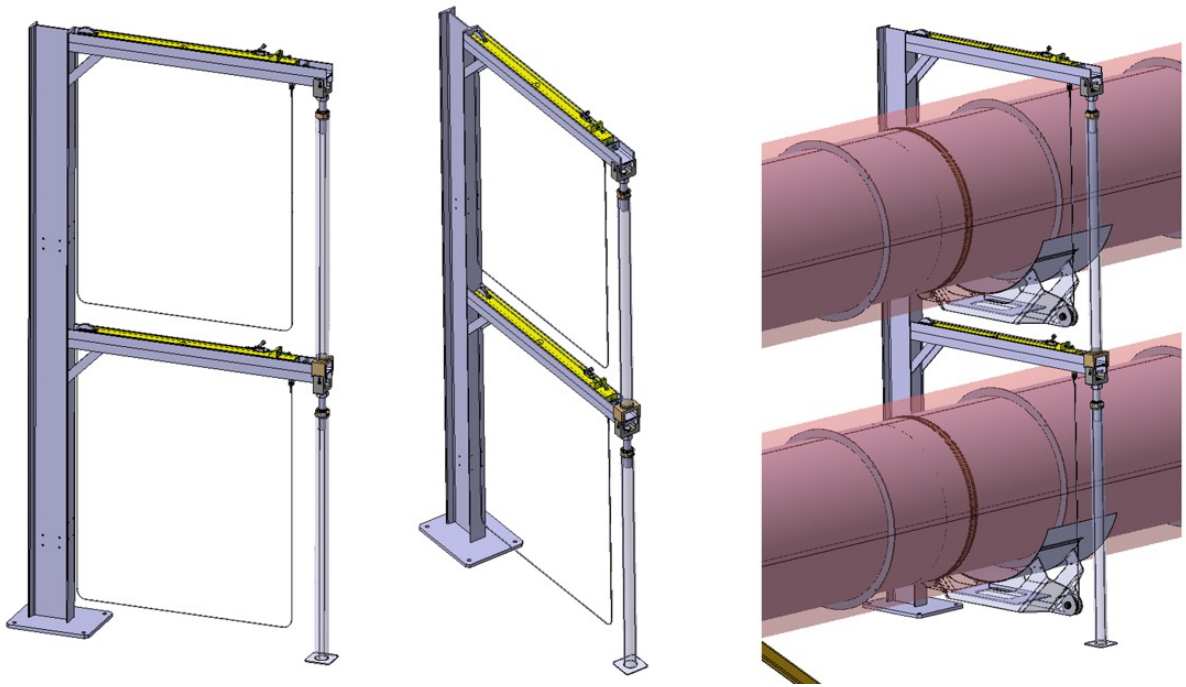

Courtesy of C. Garion, L. Gentini

ET pilot sector – Procurement and manufacturing

ET Pilot sectors parts

- AISI 441 Materials
- Beampipe sections
- Endcaps, Pumping modules
- Support system
- **Bellows (AISI 316L)**
- Valves, pumps, instrumentation
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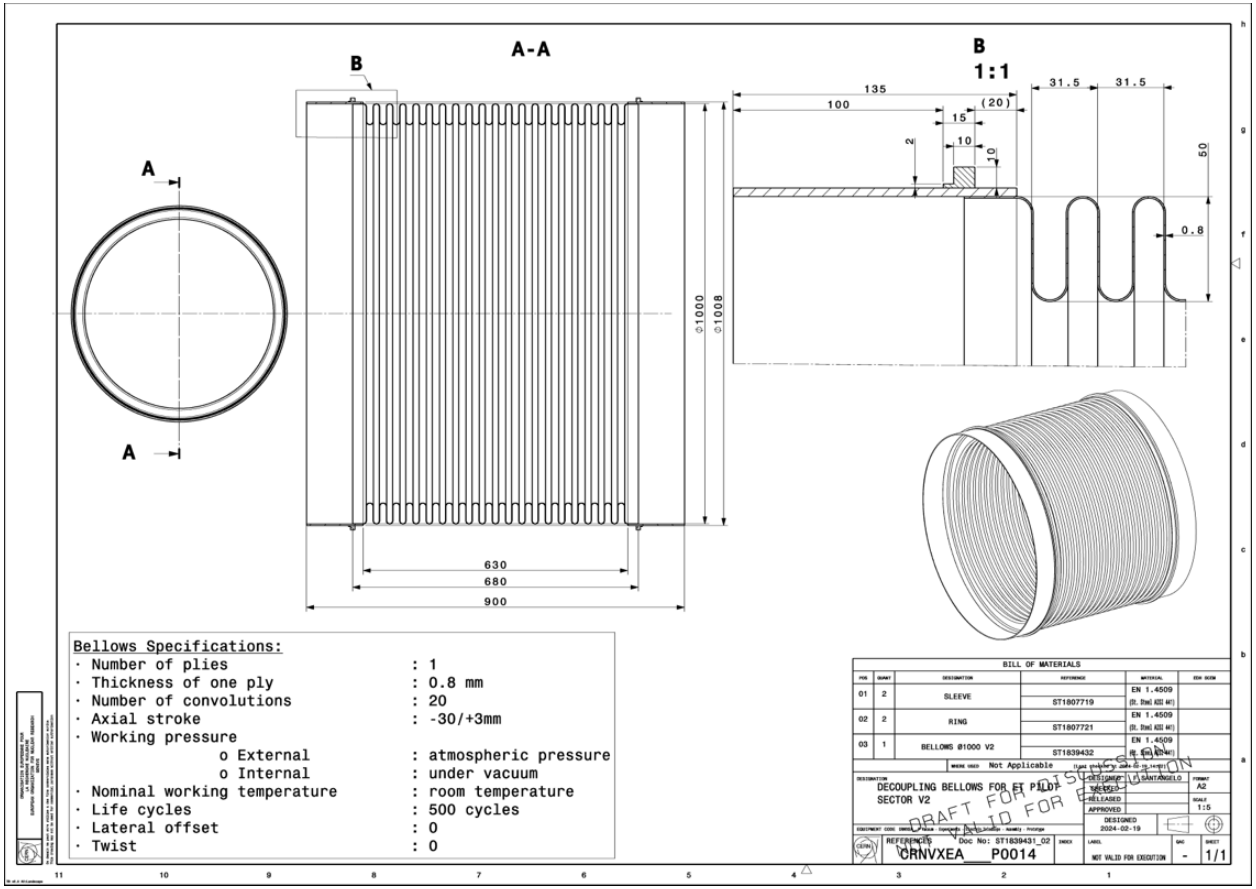


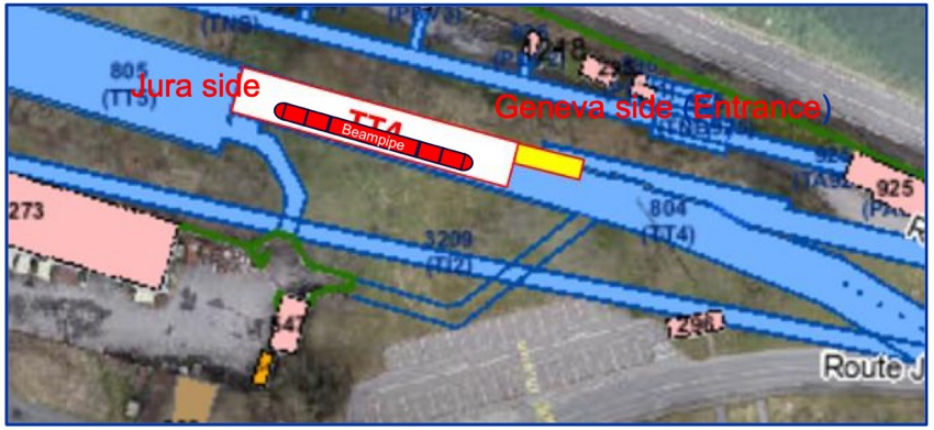
Courtesy of C. Garion

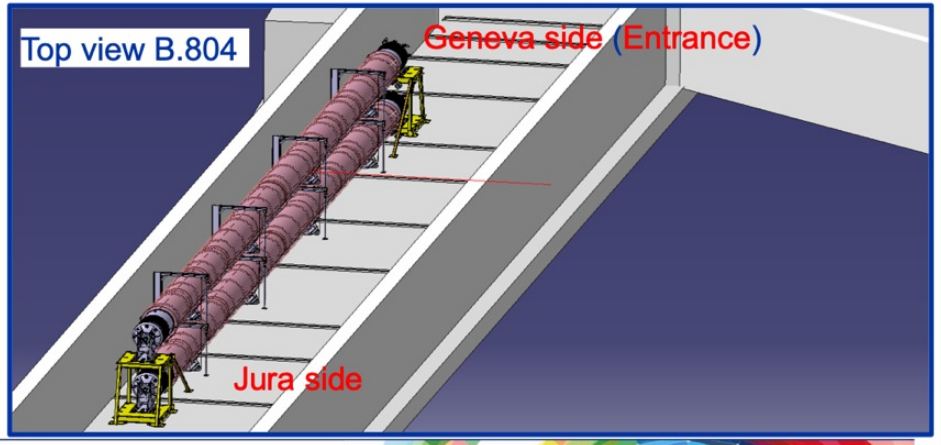
ET pilot sector – Logistics

Place of Installation

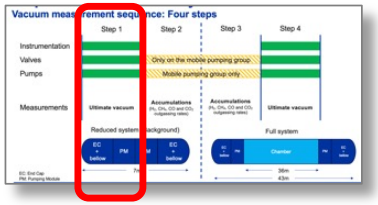
Courtesy of J. Hansen

- Building B973 old base line
- New base line is TT4 (B804)





ET pilot sector – Logistics for step 1



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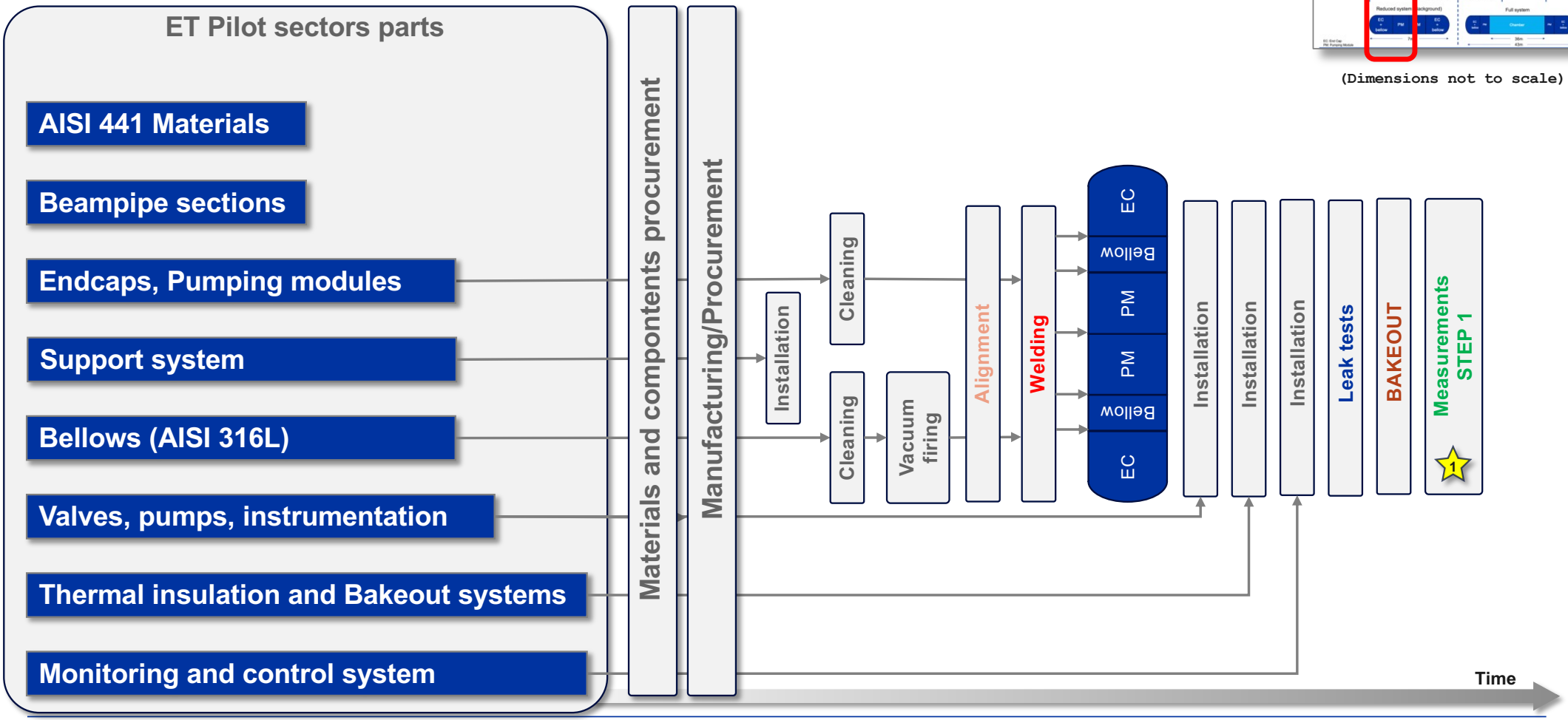
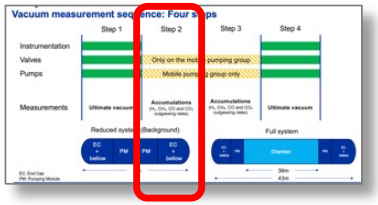


ET pilot sector – Logistics for STEP 2



(Dimensions not to scale)

ET Pilot sectors parts

- AISI 441 Materials
- Beampipe sections
- Endcaps, Pumping modules
- Support system
- Bellows (AISI 316L)
- Valves, pumps, instrumentation
- Thermal insulation and Bakeout systems
- Monitoring and control system

Materials and compontents procurement

Manufacturing/Procurement

EC | Bellow | PM | PM | Bellow | EC

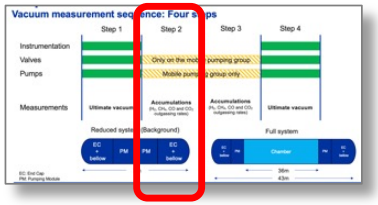
De-install instrumentation, valves and pumps

Measurements STEP 2

2

Time

ET pilot sector – Logistics for STEP 3/4



(Dimensions not to scale)

ET Pilot sectors parts

- AISI 441 Materials
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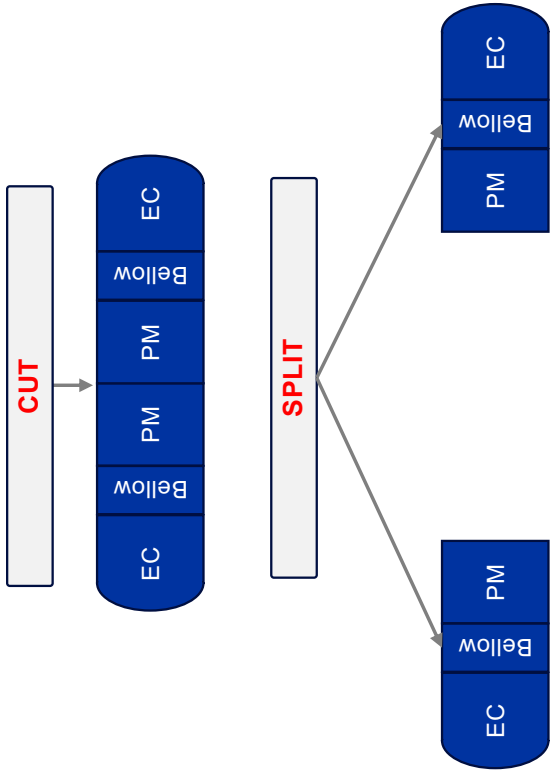
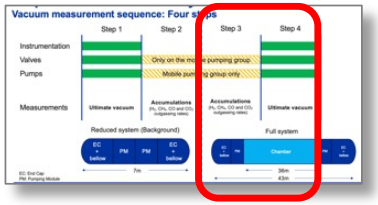
Materials and compontents procurement

Manufacturing/Procurement



ET pilot sector – Logistics for STEP 3&4



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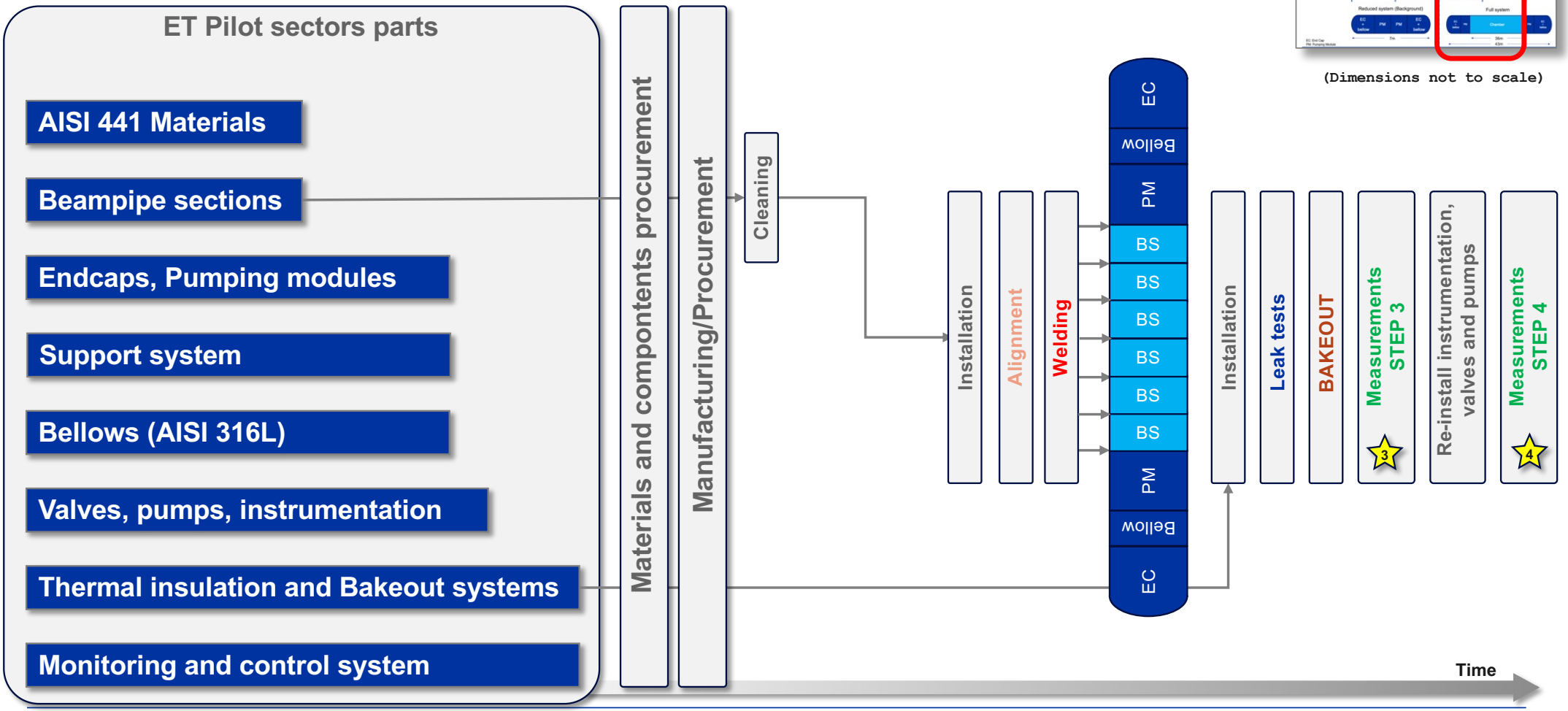
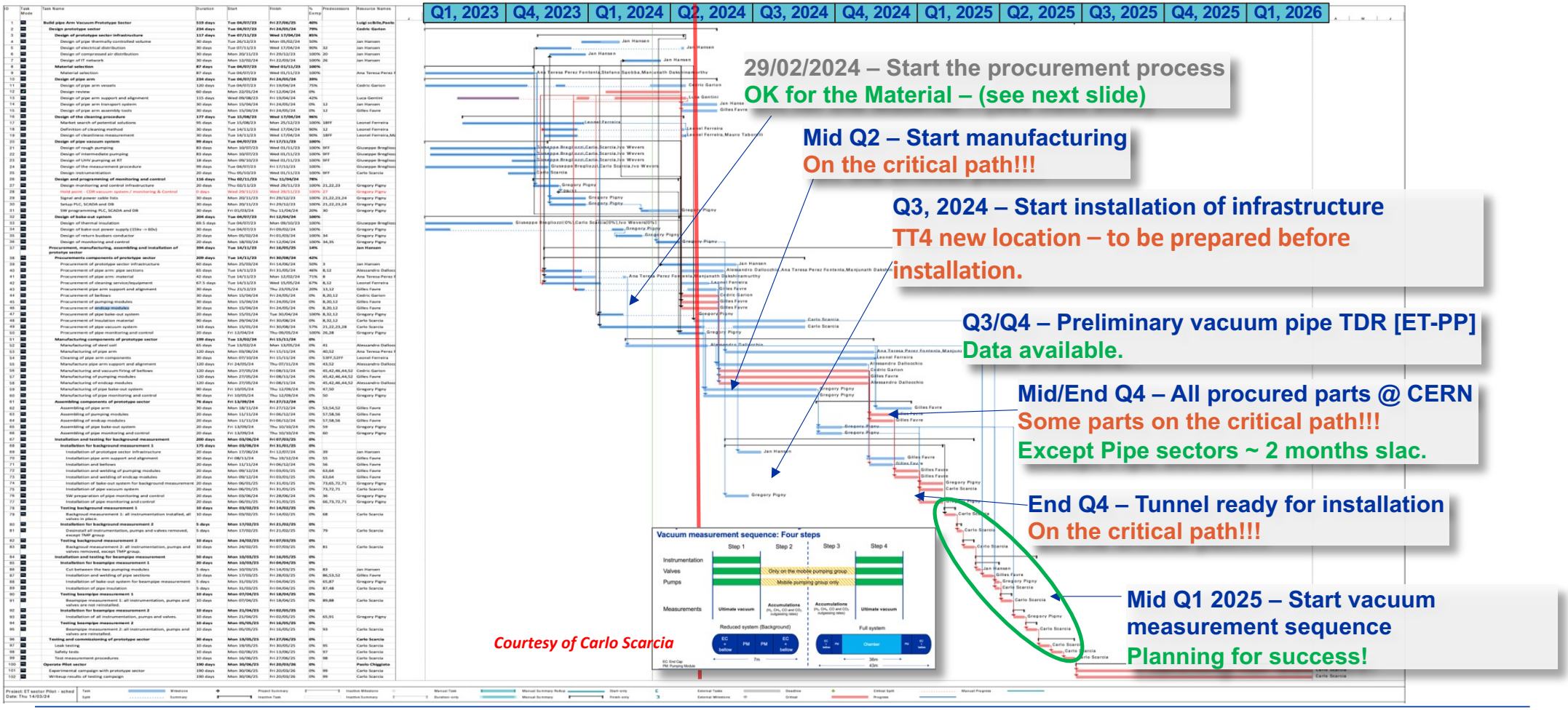
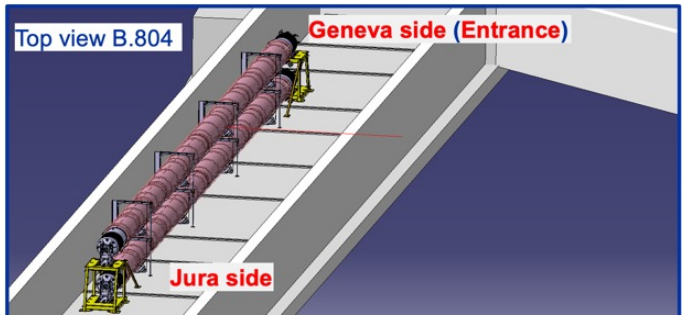


ET pilot sector – Main milestones



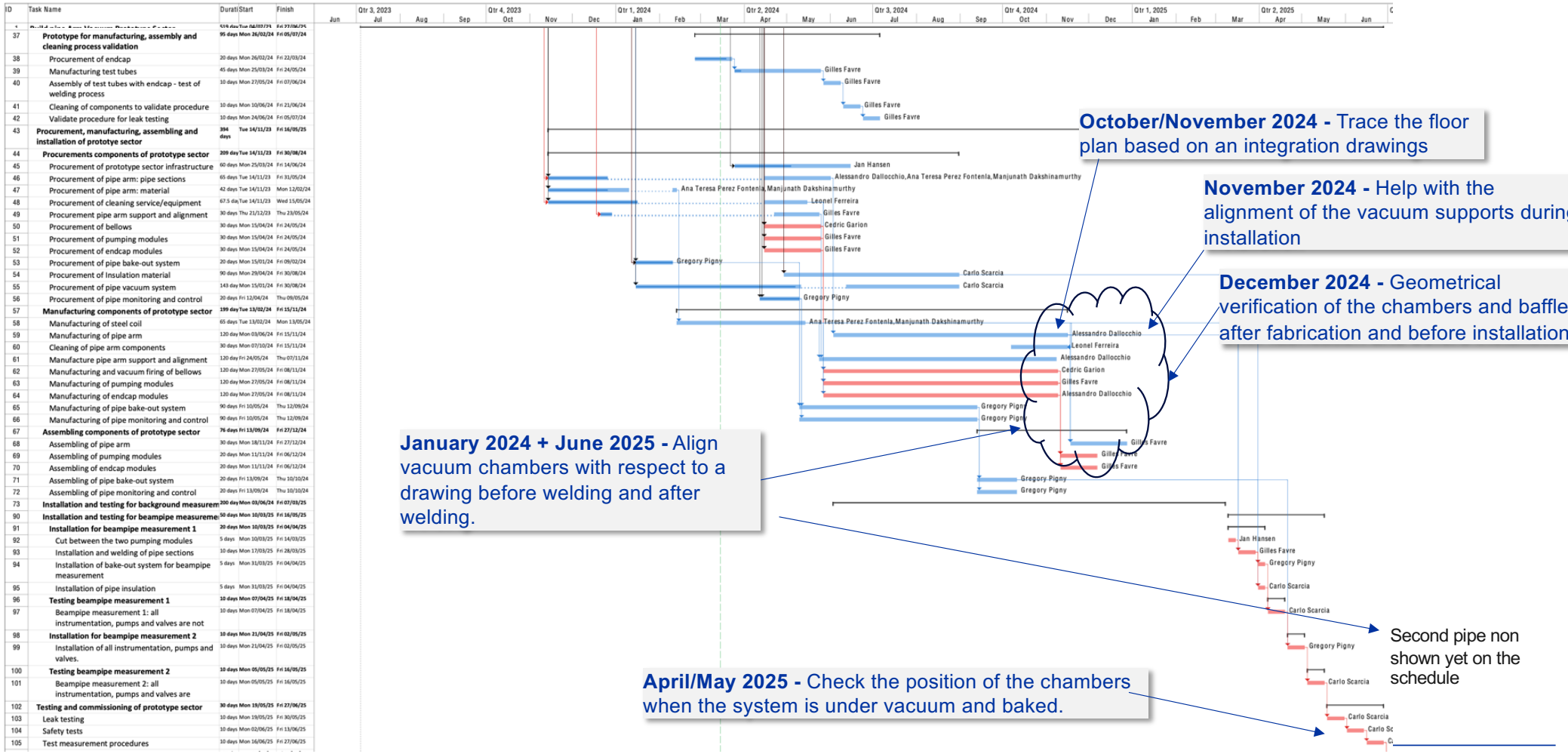
ET pilot sector – Alignment

- Contact established with **CERN alignment and survey services**.
- Request for support during the installation sequence in TT4 (see also next slide):
  - Trace the floor plan before installation of the supports
  - Help with the alignment of the vacuum supports during installation
  - Help with the alignment of vacuum chambers with respect to the end supports before welding.
  - Check the position of the chambers when the system is under vacuum.



- Started discussions for the **alignment techniques for the 10km installation**.

ET pilot sector – Alignment planning



October/November 2024 - Trace the floor plan based on an integration drawings

November 2024 - Help with the alignment of the vacuum supports during installation

December 2024 - Geometrical verification of the chambers and baffles after fabrication and before installation.

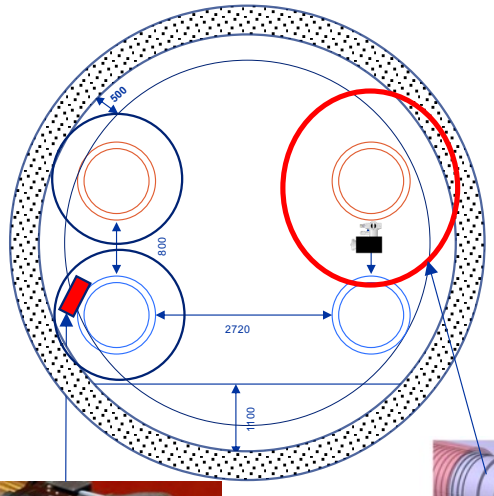
January 2024 + June 2025 - Align vacuum chambers with respect to a drawing before welding and after welding.

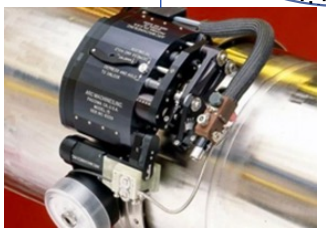
Second pipe non shown yet on the schedule

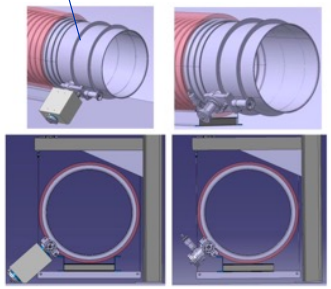
April/May 2025 - Check the position of the chambers when the system is under vacuum and baked.

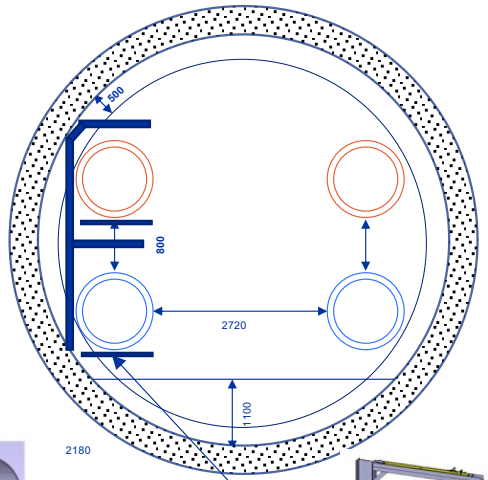
Interfaces/Interferences between the beampipe and the tunnel: cross section

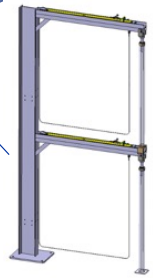
- Space required for the supporting structure, for welding and future inspections (min 500mm), for gate valves, for pumping modules and related control units (depending on design installation).

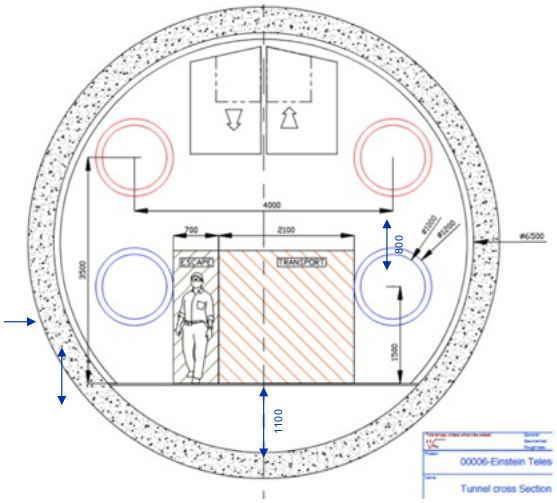








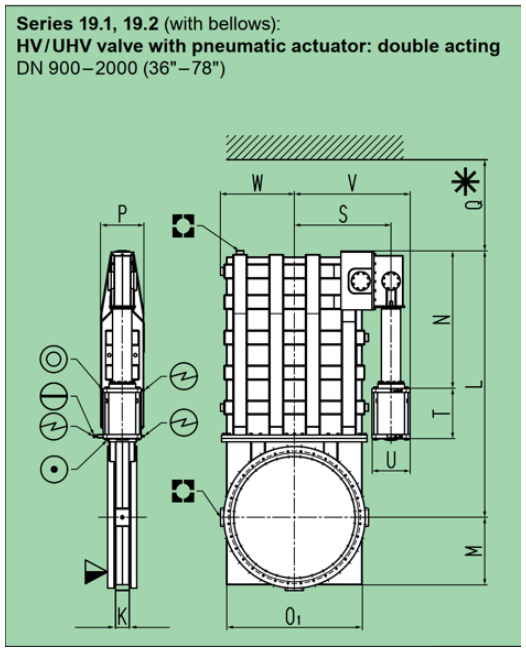




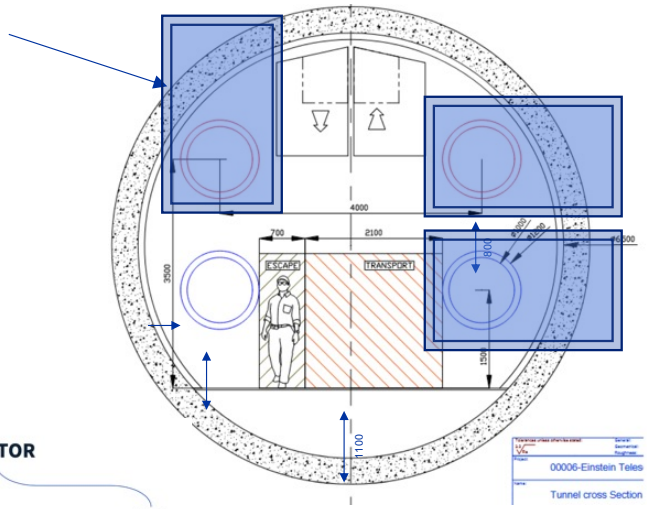
- **Fire fighting** equipment (water - DN200 pipe?)
- **Cable trays** for communication equipment?
- **Ventilation and smoke extraction**?
- Presence of **alcoves/enlargements**?
- **Minimum safety distance** between tubes and wall?

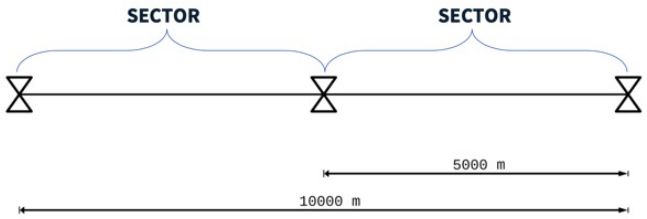
Interfaces/Interferences between the beampipe and the tunnel: cross section

Space required for sectional gate valves (DN1000)



1565 (W+V) x 2751 (L +M) x 356 (P) mm
+ 140 mm (Q)





ET – CERN to be proposed future scope extension

- Test of beampipe other than AISI 441 4mm VIRGO-like.
- Prepare the framework for other beampipe solutions to be tested in the same environment.
- Purchase a gate valve and carry out the mechanical integration studies, the UHV caracterization inclusing the conditioning and outgassing rate measurements.
- Workout the detailed integration with the civil engineering.
- Study alignment techniques for the 10km assembly and installation and eventual optimisations of the support system.
- Design of leak detection systems for the manufacturing, installation and final system.
- Design the detailed procedures for the installation and commissioning in the final ET tunnel design.
- Study for the control of dust during all assembly and installation processes.
- Carry out the baffle material outgassing studies and its integration and alignment in the ET final tubes.
- Open to discuss, via ETO, the possibility to carry out other type of tests.
- Update the TDR and costing in line with general ET timeline.

ET pilot sector: peer review recommendations

Recommendation	Action
Investigation on corrosion resistance of ferritic stainless steels (tunnel environmental conditions)	Contract with UGhent to be launched for comparative corrosion studies
Use pilot sector as testbed for extrapolation of ET leak detection	Methodologies and tooling under investigation
ET pilot sector to be used to test different insulation materials and solutions (installation, removal)	Contact with companies started
Implementation of large gate valves (DN1000+) to test thermal cycling, stroke cycling, treatments etc.	**Planned in the extension of ET-CERN scope**
Implementation of temperature control systems in selected building	**ET pilot sector moved to TT4 tunnel – stable temperature.**
Consider launching a parallel test on a corrugated chamber (perhaps through external contribution)	**Planned in the extension of ET-CERN scope**

See Carlo's Presentation

home.cern