

WP 4.2 Ultra-High Vacuum components

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FWO IRI Workshop – 8/6/2026

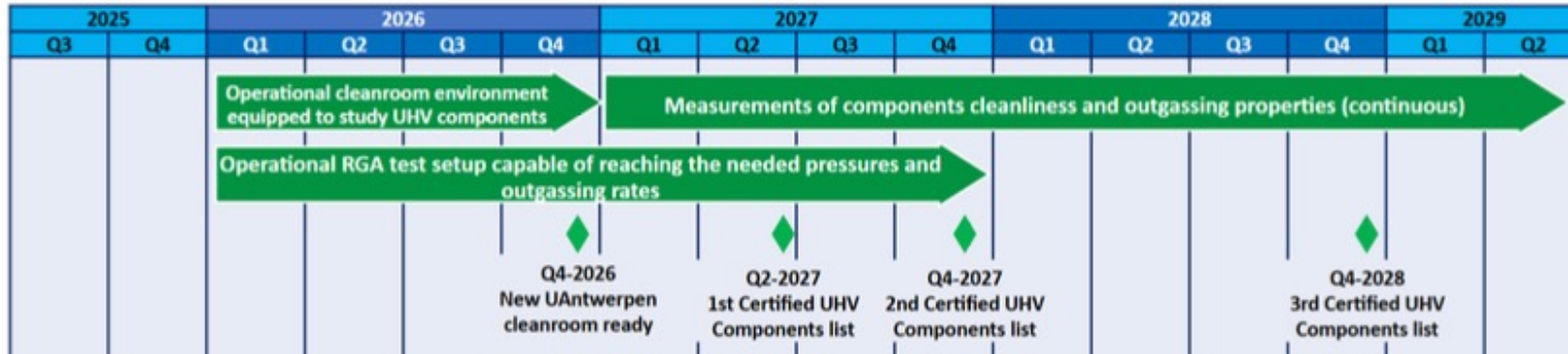
Overview

- Vacuum Requirement for GW Observatories: Third-generation GW observatories require an ultra-high vacuum (UHV) environment with a hydrogen total residual pressure of 10^{-10} mbar and a hydrocarbon total partial pressure of 10^{-14} mbar.
- Cleanliness Requirements for UHV: Achieving UHV necessitates strict cleanliness standards for all components, including specific manufacturing procedures, ultrasonic cleaning, and vacuum bake-outs.
- Cleanroom Infrastructure at UAntwerpen: A cleanroom infrastructure will be constructed at UAntwerpen to study the effect of different manufacturing processes, UHV cleaning, and baking steps on material outgassing. It includes a vacuum system to perform Residual Gas Analysis measurements to check the cleanliness of components.
- Provide research infrastructure to bake-out components for ETpathfinder/Virgo, and facilitate small hardware experiments (e.g. for AdV+ Phase 2 the calibration upgrade project in WP3.1).
- It will increase our knowledge on UHV manufacturing and cleaning in Flanders, potentially opening collaborations with industry.

Budget: Cleanroom, Ultra High Vacuum RGA and bake-out system, Operational costs, Postdoc (3 years)

Initial timeline

Planning and Key Performance Indicators for this Work Package



KPI 1 - Q3/2026: set of requirements defined for UHV vacuum components for the ET.

KPI 2 - Q4/2026: class 7 cleanroom built out in UAntwerpen with class 5 work benches (targeting class 4).

KPI 2 - Q2/2027: initial set of certified UHV compatible components published, covering alloys and assemblies (e.g. sensors).

KPI 4 - Q2/2027: publication of certified list of cleaning procedures for UHV compatibility, with specification of “required and sufficient” processes, e.g. covering levels of temperatures and timings for sufficient outgassing of dedicated components for the ET.

KPI 5 - Q4/2028: standard list of components for ET that have been tested, published.

KPI 6 - Q4/2028: standards for cleaning of smaller components for the ET published, excluding larger components, e.g. beampipe or vacuum tower elements.

Cleanroom at BlueApp

- Construct a ~45m² cleanroom of ISO Class 7 at BlueApp: casco's 41-42 on third floor.
- Equip with cleaning infrastructure: ultrasonic baths, dry-oven, flow bench
- Install the Ultra High Vacuum RGA and bake-out system for cleanliness studies, and small experiments
- European tender published 12/5/2026; deadline 6/7/2026.

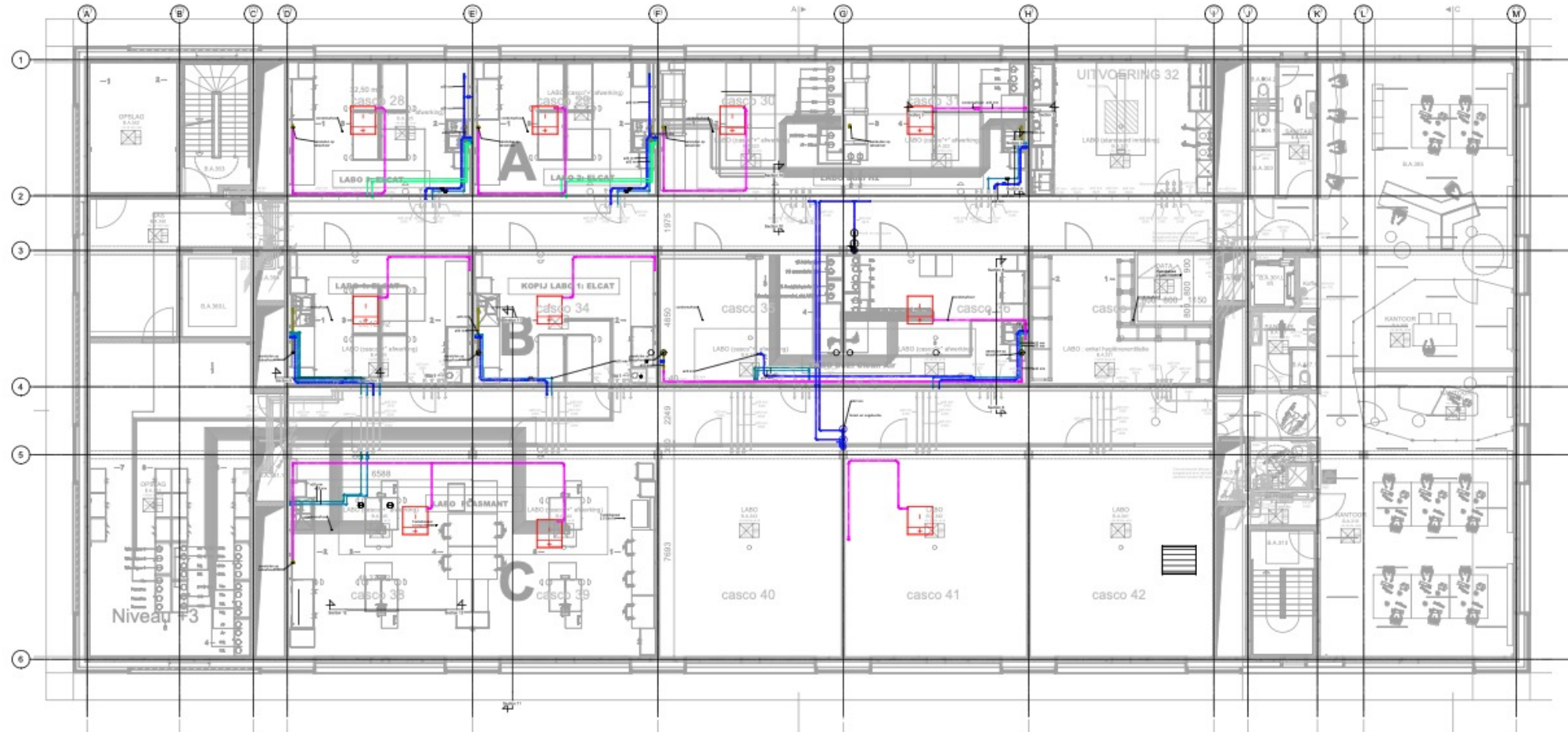
National link: [BOSA – eProcurement](#)

European link: [324248-2026 - Competition – TED](#)

Already two interested parties (ABN, Jansen), feel free to forward tender to other potential candidates...
Aim for delivery Q4 2026 – Q1 2027.

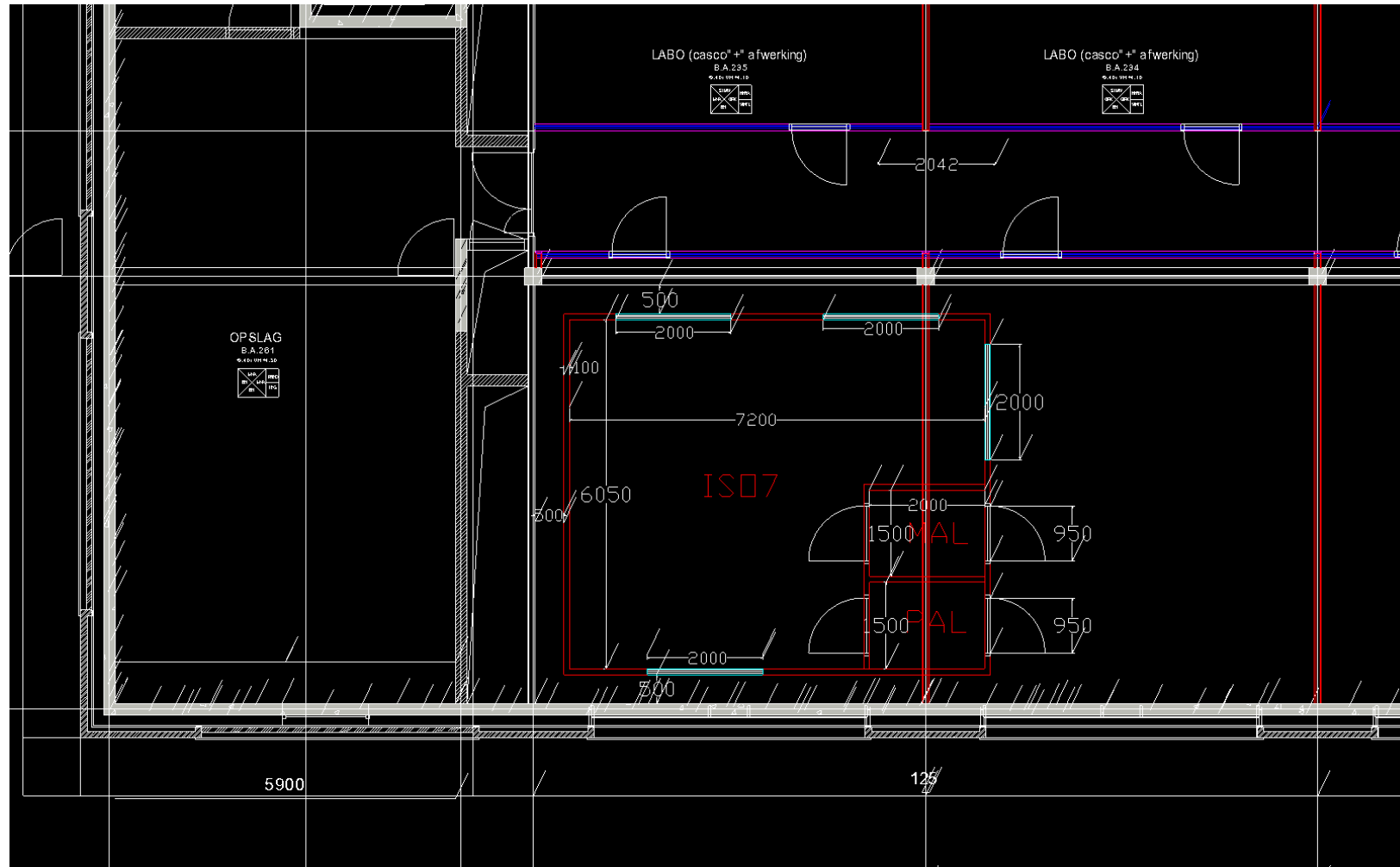
Cleanroom at BlueApp

- Location:



Cleanroom at BlueApp

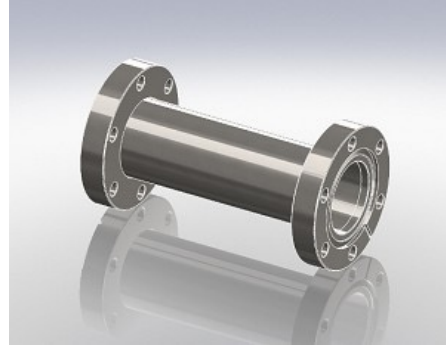
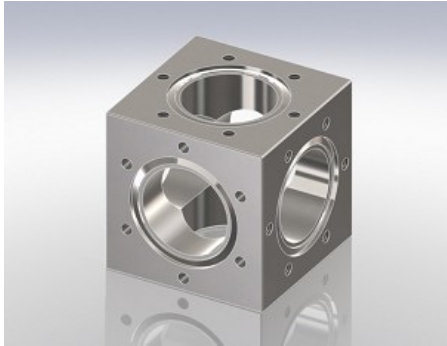
- Preliminary design concept:



Ultra High Vacuum RGA and bake-out system

Design of the system ongoing:

- Based on available system ETpathfinder
- Bigger volume of vacuum chambers, include viewport for e.g. optics experiments
- Same baseline of pumps, RGA spectrometer, sensors



Pfeiffer Turbo Pump ATH-M HP300M CF



Pfeiffer QMG 250 M1 PrismaPro
PT M16 112 211

Set up system using Hositrad components

Collecting list of all parts, acquiring pricing, quotes,...

Outlook

- Cleanroom tender published: start review and negotiations after 6/7/2026
→ aim for construction Q4 2026 – Q1 2027
- Hire requested postdoc to work on cleanliness requirements and RGA vacuum system, and commission cleanroom once ready.
- Additional budget acquired to complete infrastructure and hire a technician (2 years) for lab management and further cleanroom lab commissioning.
- Finish design of the RGA vacuum system and purchase all components