Chamber system for consistent residual gas analyser to provide high-quality measurements for vacuum acceptance tests

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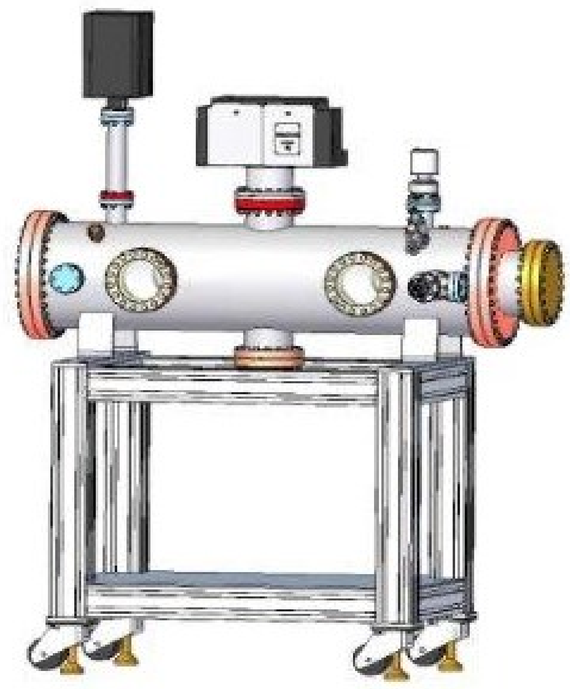
Requirements for vacuum components

The conditions of UHV (ultrahigh vacuum) components for X-ray beam transport systems at the European XFEL facility have to conform to the UHV specifications that are documented in the X-ray FEL vacuum guidelines. This means that UHV components must be free of hydrocarbons and reach a certain pressure level in a definite time and that their outgassing rate must be low.

To perform the appropriate proofs of a component, a test chamber with a pumping system and a sufficiently sensitive residual gas analyser (RGA) is used, usually equipped with a secondary electron multiplier (SEM).

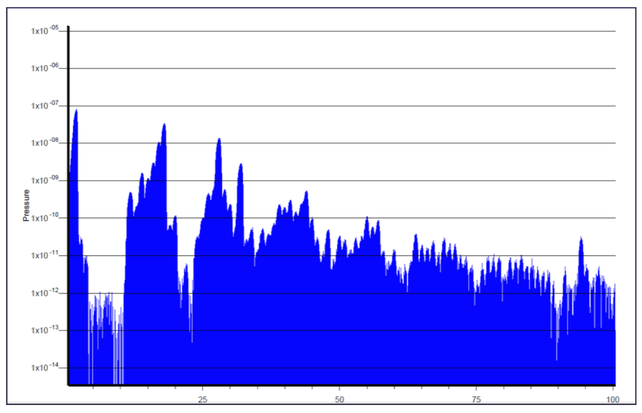
Chamber to test UHV parts

The system requirement for an RGA measurement of a sample is a clean chamber, i.e. free of particles and hydrocarbons. This is accomplished by an oil-free pump system attached to the chamber. A bake-out jacket can increase the outgas of the material for best vacuum results. The chamber is mounted on a cart to move it easy, if needed. Various ports from CF16 to CF250 allow the mounting of components for a test.



System

- Tube 1020 mm length
- 250 mm diameter
- Ports for CF16, CF40, CF100, CF160, CF250
- Window flanges
- 75 l/s Ion pump
- RGA with quadrupole mass analyser 0–200 amu
- Pressure gauge
- Angle valve to attach a pumpcart
- Bake out jacket



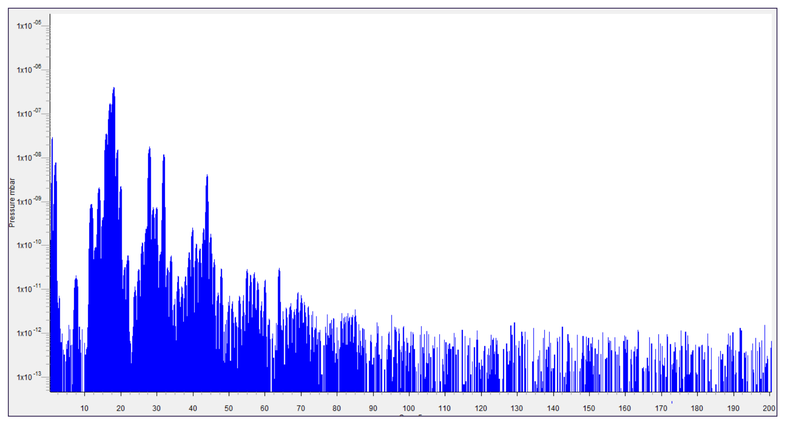
Measurement result shows a bad spectrum with a lot of hydrocarbons, which are caused by a dirty sample.

Test procedure

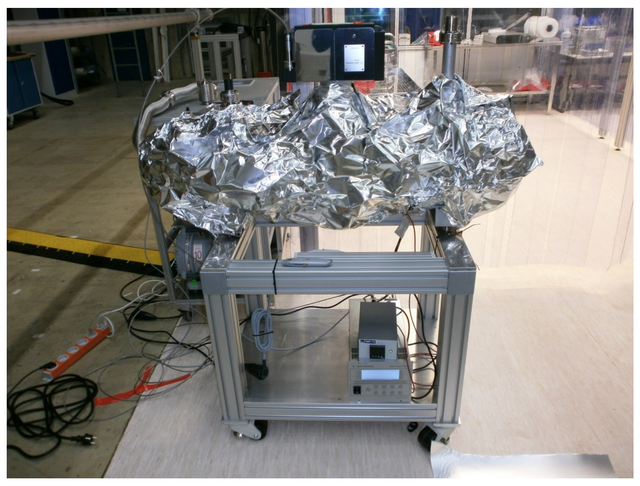
The test procedure means that two RGA measurements with the same parameters must be performed and documented for testing a sample.

A measurement of the empty test chamber is a reference and a measurement of the test chamber with the sample inside. Both the reference and sample measurement results are evaluated independently and also compared.

All data will be stored as text files in the cloud.

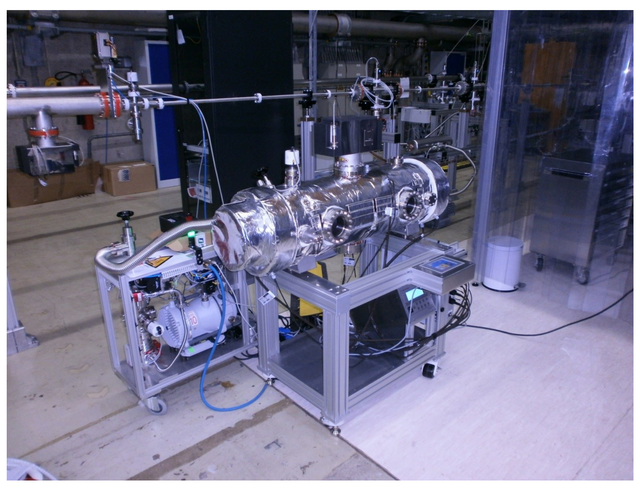


Measurement result shows an acceptable spectrum with a low level of hydrocarbons.



First test setup

- Mass analyser 0–100 amu
- Aluminium foil isolated bake-out
- Oil-free pump cart



Upgrade

- Professional bake-out jacket
- PLC control
- Mass analyser for 200 amu

Results

The chamber system provides the ability to perform high-quality measurements for consistent residual gas analysis for UHV acceptance tests. Many parts and assemblies have been tested already. If samples do not pass the UHV specification, this system enables us to find out why.

The RGA test system is used for quality control and to ensure compliance with required standards according to the UHV Guidelines for X-Ray Beam Transport Systems at the European XFEL.