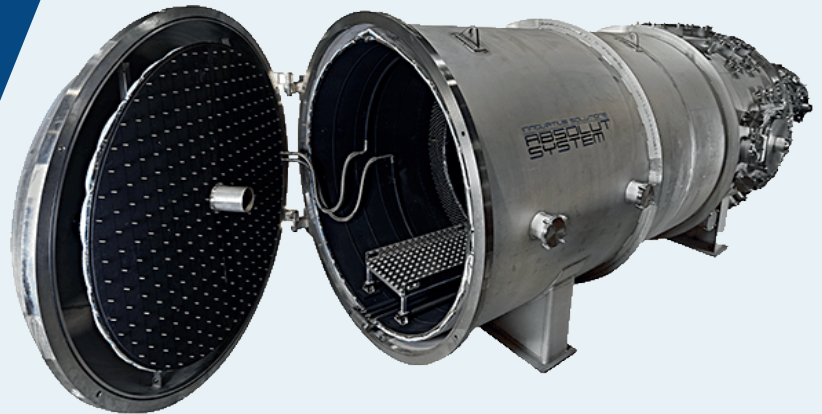


Vacuum test benches

*Characterization of satellite
thrusters appendix:
helium loop cryopumping*



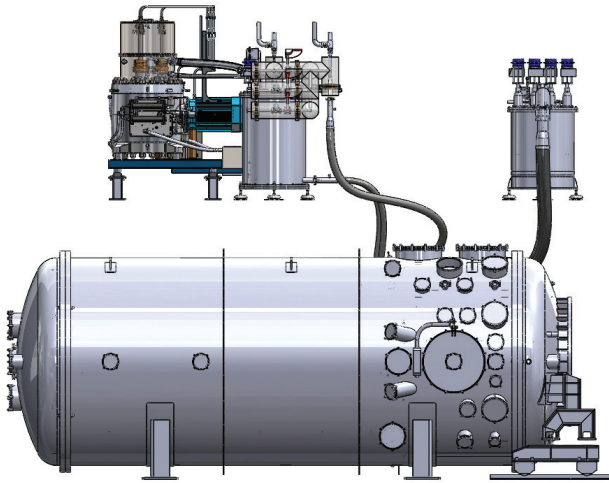
Absolut System develops specific test benches to characterize and optimize electric thrusters, using cryogenics to maintain an adequate level of high vacuum or ultra-high vacuum.

The vacuum chamber recreates the environment of the satellite in orbit, enabling us to test the performance and lifetime of the motors under study, as closely as possible to actual operating conditions. Absolut System's cryogenic traps maintain the vacuum despite the expulsion of particles generated by the engine's plasma propulsion. The cold captures and freezes the molecules as they are released, ensuring optimum conditions throughout the weeks of testing.

Cooling of the chamber's radiative screens, are cooled via a closed liquid nitrogen circuit, using a recondensation loop. The system is equipped with a CRYOMECH cold head and a 40 K helium cryostat.

A few customers:

- CNRS
- ONERA
- SAFRAN ...



- **Self-contained closed circuit with liquid nitrogen**
- **20K - 40 K helium cooling loop with cryogenic circulator**
- **Highly dynamic xenon pumping capacity for engine firing**
- **Test box isolation valve**
- **Removable walkways and pedestals**
- **Adding cold spots at 4K-20K with cryomachines for residual gas trapping**

Configuration examples

Vacuum chamber (Ø = 2m)	6 m ² of 40 K panels cooled by a single chiller Gifford-McMahon chiller. Specific configuration: LN2 reservoir/phase separator connected to a 100 K baffle
	6m ² of panels cooled by a helium gas circulation loop (between 20 K and 40 K). Specific configuration: PTC1000 nitrogen liquefier/recondenser + custom-designed nitrogen tank cryostat.
Vacuum chamber: small size (Ø = 0.8m)	Disk at 40 K (Ø=0.6m) cooled with a cooler. Specific configuration: The screen is made from MLI mattresses.

Technical information

100% customized configuration

- ▶ Protection: Graphite plate
- ▶ Walkway: Aluminium
- ▶ Closed circuit Nitrogen and/or Helium

Absolut System's engineering department designs tailor-made systems, adapted to the needs of each customer.

- ▶ Absolut System has developed tools to model and optimize the cryopumping system to obtain optimum results for complex geometries.

This tool includes the following steps:

- ▶ Macroscopic analysis of the cryopump using empirical methods.
- ▶ A finite element radiative thermal analysis (elaborate modeling of radiative exchanges) to help select cryogenic coolers.
- ▶ Molecular Monte Carlo analysis to validate the pumping capacity of the specific geometry.