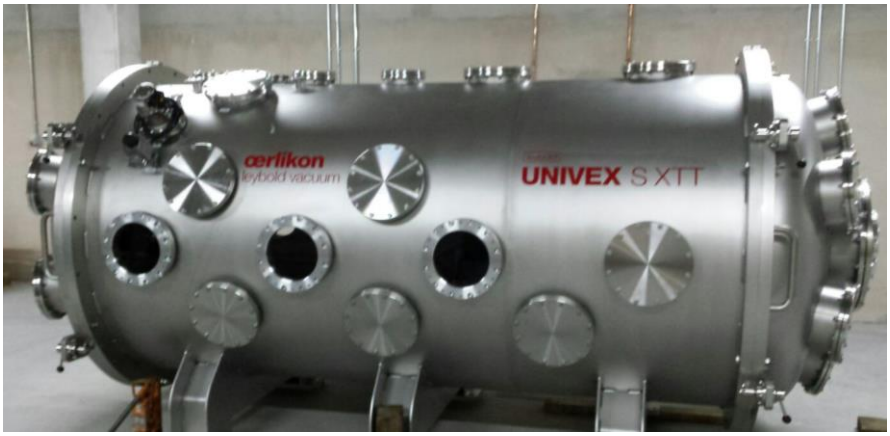
EP2 Plasma Propulsion Laboratory

XTT Vacuum chamber



- Optimized for the testing of low-mid power Hall effect, gridded ion, and RF thrusters (helicon, ECR) up to approx. 2 kW
- Dimensions: 1.5 m inner diameter, 3.5 m long.
- Vessel made of stainless steel 304.
- Great optical and mechanical accessibility: multiple interchangeable DN250CF windows and flanges at different locations; two full diameter access doors.
- Easily expansible in length and in pumping capacity
- *Vacuum performances*[1]*:*
  - Continuous operation with 20 sccm of Ar or Xe @ $2 \cdot 10^{-5}$ mbar for 5 days.
  - Ultimate vacuum pressure$< 10^{-8}$ mbar.
- *Vacuum technology:*
  - Fully oil-free vacuum system
  - Rough/vacuum mechanical dry pump, Leyvac LV80 (80 m^3/h).
  - 2 magnetically levitated Turbomolecular pumps, MAGW2.200iP (2000 l/s each).
  - 3 Cryopanels, Leyvac 140 T-V (combined pumping speed 30,000 l/s Xe).
  - Full-range pressure sensors, Ionvac ($5 \cdot 10^{-10} - 1000$ mbar)
- High-accuracy calibrated mass flow controllers for two independent lines of Ar and Xe
- Leak detector Leybold L300i (minimum threshold of leak detection $5 \cdot 10^{-12}$ mbar l/s).

Turbomolecular pump MAGW2.200iP and cryohead 140 T-V with cryopanel.

[1] Performances certified by *Oerlikon Leybold*.

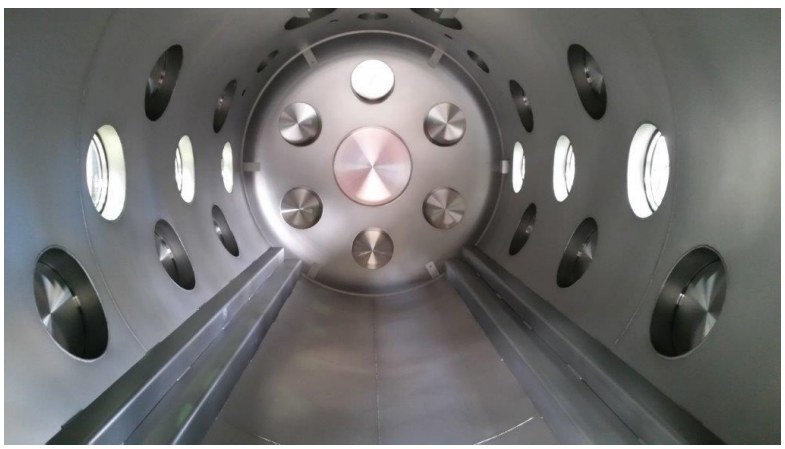
Plasma diagnostic systems

Probe diagnostics

Diagnostic system	Equipment	Performance
Langmuir probes (RF-compensated), Emissive probes, Double probes.	Advanced Keithley electrometer, State-of-the-art NI DAQ system and Keysight Oscilloscopes In-house developed diagnosis analysis tools	3D Mapping plasma density, potential, ion current, and electron temperature EEDF in DC and RF plasmas. Multiple probe dimension and geometry options. Current measurements with up to pA accuracy
Retarding potential analyzer (RPA)	Semion MultiSensor System (Impedans)	IEDF resolution 1eV, range 0-2000eV Time averaged measurements (100kHz-80Mhz) Time resolved measurements (0Hz-100kHz)
Faraday cup array	(currently under development)	

Optical diagnostics

Diagnostic system	**Equipment**	**Performance**
Optical Emission Spectroscopy	Ocean Optic Spectrometer HR4000	Emission spectra in the 200-1100 nm range (UV, visible, near-IR) with 1 nm spectral resolution
High speed imaging	Photron FASTCAM Mini UX50	1.3 Megapixel image resolution at 2,000fps rate and up to 160,000fps rate at reduced image resolution



Additional equipment and facilities

- 3-degree-of-freedom translational stage system (automatic) for 3D Scanning, configurable 3D scanning with probes, optic fiber, etc. (under development)
- 3-axis Magnetic B-probe (Lakeshore 460 Hall effect Gaussmeter)
- 200 amu RGA (Hiden HALO201)
- Multiple current and voltage power sources (FUG; up to 2 kV and SORENSEN; up to 75 A)
- 2kW 13.56 MHz RF generator plus generic matching network
- 5 A hollow cathode (with heater) and associated control unit
- State-of-the-art Osciloscopes (Keysight), DAQ (National Instruments), function generators

Future capabilities:

- Under construction: mN thrust balance
- Additional 1.5 m diameter x 1 m length steel vacuum chamber (to be refurbished)

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