EP2 Plasma Propulsion Laboratory

XTT Vacuum chamber

The 200 m^2 laboratory hosts, among other facilities, a large stainless steel vacuum chamber built and certified by Leybold Oerlikon and optimized for the testing of low-mid power Hall effect, gridded ion, and RF thrusters (helicon, ECR) up to about 2 kW and 100 sccm:

- Chamber dimensions: 1.5 m inner diameter, 3.5 m long
- Vacuum performance:
  - Continuous operation at $< 2 \cdot 10^{-5}$ mbar @ 20 sccm of Ar or Xe for > 5 days
  - Total pumping speed > 37000 l/s Xe
  - Ultimate vacuum pressure $< 10^{-7}$ mbar
- Fully oil-free vacuum system:
  - Rough vacuum dry pump, Leyvac LV80 ($80\ \mathrm{m}^3$/h)
  - 2 magnetically levitated Turbomolecular pumps, MAGW2.200iP (2000 l/s each)
  - 3 Cryopanels, Leyvac 140 T-V (adaptable to Xe or Ar)
- Accurate pressure sensors in the full range ($5 \cdot 10^{-10}$ mbar – 1 atm)
- Great optical and mechanical accessibility:
  - Multiple interchangeable DN250 ISO-F windows and flanges at different locations
  - Two full-diameter access doors
  - Several fluidic / electric feedthroughs
- Fully automated control interface
- Easily extensible in length and in pumping capacity. Possibility to add a thruster prechamber (hatch)

Ancillary hardware:

- Leybold L300i leak detector (minimum threshold of leak detection $5 \cdot 10^{-12}$ mbar l/s)
- 200 amu Residual Gas Analyzer (Hiden HALO201)
- 3-degree-of-freedom translational stage system (automatic) for 3D scanning
- 5 A hollow cathode
- 2 kW 13.56 MHz RF generator and automatic matching network
- Advanced electrometer (Keithley 6517B)
- Multiple voltage and current sources (FUG, up to 2 kV and SORENSEN, up to 75 A)
- State-of-the-art Osciloscopes (Keysight), DAQ (National Instruments), function generators

Future capabilities:

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

Contact:

- Eng. Jaume Navarro (jaume.navarro@uc3m.es)
- Dr. Pablo Fajardo (pablo.fajardo@uc3m.es)
- Dr. Mario Merino (mario.merino@uc3m.es)
- Prof. Eduardo Ahedo (eduardo.ahedo@uc3m.es)
- More information on: http://ep2.uc3m.es

Plasma diagnostic systems

Electrostatic probes

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