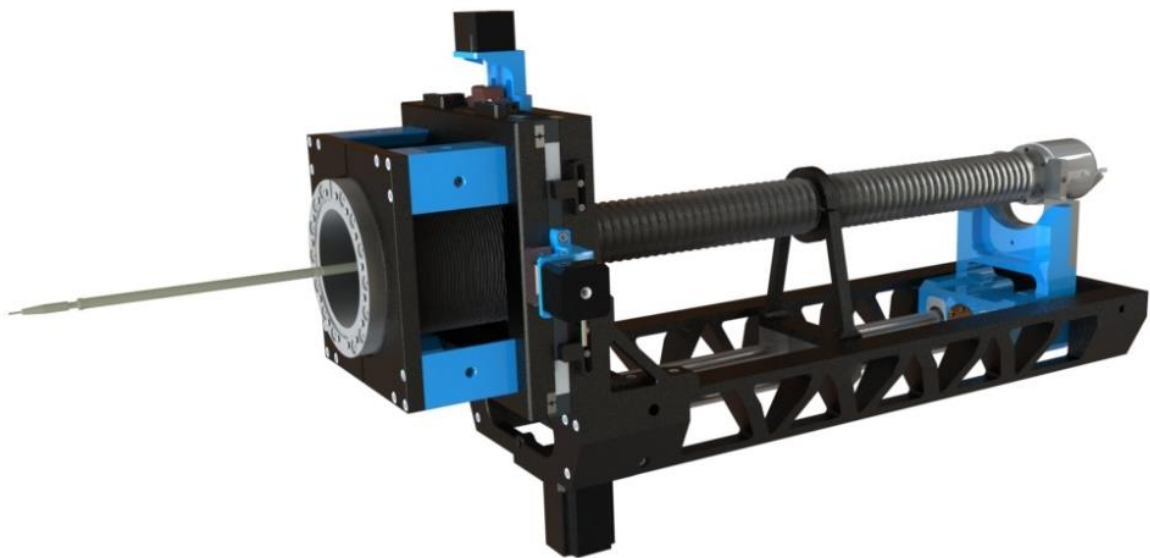


Automated 3D plasma mapping with Hiden *ESPION* Langmuir probe

The CRYOSCAN plasma
probing solution



CRYOSCAN proposes a solution for automated plasma mapping thanks to manipulators equipped with a Langmuir Probe from Hiden Analytical. The robustness of the design together with the quality of the mechanical parts insure a great accuracy in the positioning of the probe, thus allowing the creation of 3D representations of the different plasma physical parameters (potential, densities, electron temperature).

The solution includes a software suite that allows for the programming of several thousands of probe positions as well as the automatic recording of probe current-voltage characteristics. Tested in low pressure plasmas, the solution is compatible with most of the laboratory plasma conditions.



Hidden ESPION Langmuir Probe

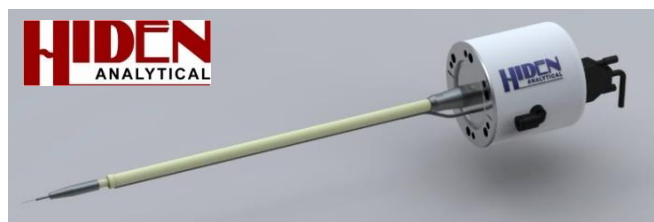
Probes available for both RF and DC plasmas.

More than 20 tip materials available. Different probe tips are proposed (Cylindrical, planar, ...).

Ion and electron densities in the range 10^{14} to 10^{19} m^{-3} can be investigated

Electron temperature up to 10 eV

Self-cleaning cycle to limit probe tip contamination



3D Manipulator and Software

Developed for Ultra-High Vacuum environments, manipulators are compatible with all laboratory plasma pressure conditions and baking procedures up to 150°C. Installation in either horizontal or vertical direction.

Three independent linear translations (stepper motors):

Direction	Course range	Positioning
Perpendicular	+/- 50mm*	5 μm
Longitudinal	300 to 1200 mm*	5 μm

1D only manipulators available

* other courses available on demand

Software

Automatic recording of several thousands of points IV characteristics. Basic probe data analysis available (OML, ...) but subject to plasma conditions.

Technical description

Manipulator:

UHV Ready

Interface: 160 CF Flange

Courses: XY Table* : 100mm** (+/-50mm)

Longitudinal: 300 – 1200 mm**

Dimensions: W335 x H500 mm

Installation: Vertical or Horizontal

* 1D Manipulators available ** other courses on demand

Software:

Manipulator and probe controls

Probe: Ethernet communication

Manipulator: USB port (serial communication)

Data:

Recording of full IV characteristics and probe position

Data exported as HDF5 or text files

Database of experiment parameters available

Examples of 3D Radio-Frequency plasma scans

The automated solution proposed has been originally designed for studying the interaction between a low pressure plasma and a RF antenna. It has been extensively used to map plasma characteristics in the vicinity of the antenna in Argon and Helium plasmas.

Floating and plasma potentials, as well as electron temperature, are usually straightforward to derived from I-V curves and the procedure can usually be done automatically. Ion and electron densities are not so straightforward to determine and need manual checking,

Results derived from these measurements have been presented in different plasma conferences [1,2] and published in a peer-reviewed journal[3,4].

[1] S.Devaux *et al.*, 22nd PSI Conference, Rome, 2016

[2] S.Devaux *et al.*, 44th EPS Conference, Belfast, 201

[3] E.Faudot *et al.*, *Review of Scientific Instrumentation* **86**, 2016, 063502

[4] S.Devaux *et al.*, *Nuclear Material and Energy* **12**, 2017, 908

