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The INAF/IAPS Plasma Chamber for ionospheric simulation experiment

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The plasma chamber is particularly suitable to perform studies for the following applications:
- plasma compatibility and functional tests on payloads envisioned to operate in the ionosphere (e.g. sensors onboard satellites, exposed to the external plasma environment);
- calibration/testing of plasma diagnostic sensors;
- characterization and compatibility tests on components for space applications (e.g. optical elements, harness, satellite paints, photo-voltaic cells, etc.);
- experiments on satellite charging in a space plasma environment;
- tests on active experiments which use ion, electron or plasma sources (ion thrusters, hollow cathodes, field effect emitters, plasma contactors, etc.);
- possible studies relevant to fundamental space plasma physics.
The facility consists of a large volume vacuum tank (a cylinder of length 4.5 m and diameter 1.7 m) equipped with a Kaufman type plasma source, operating with Argon gas, capable to generate a plasma beam with parameters (i.e. density and electron temperature) close to the values encountered in the ionosphere at F layer altitudes. The plasma beam (A+ ions and electrons) is accelerated into the chamber at a velocity that reproduces the relative motion between an orbiting satellite and the ionosphere ($\approx$ 8 km/s).
This feature, in particular, allows laboratory simulations of the actual compression and depletion phenomena which take place in the ram and wake regions around satellites moving through the ionosphere. The reproduced plasma environment is monitored using Langmuir Probes (LP) and Retarding Potential Analyzers (RPA). These sensors can be automatically moved within the experimental space using a sled mechanism. Such a feature allows the acquisition of the plasma parameters all around the space payload installed into the chamber for testing.
The facility is currently in use to test the payloads of CSES satellite (Chinese Seismic Electromagnetic Satellite) devoted to plasma parameters and electric field measurements in a polar orbit at 500 km altitude.