Spherical EUV and Plasma Spectrometer (SEPS)

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What are the applications and scientific topics?

The primary goal is to study the impact of solar activity events (space weather) as well as subsequent reactions of the ionospheric / thermospheric system on for example GPS navigation signals.

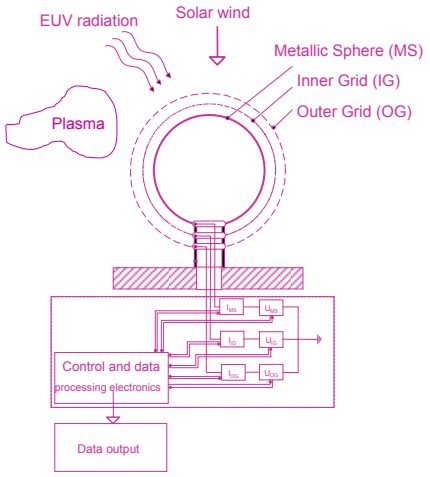
The analysis of disturbances by solar activity should be investigated in more detail to study the impact on communication signals.

Parameters to be measured

- ***Spectral solar EUV irradiance*** (18-200 nm)
- ***Plasma parameters***
  electron energies
  electron temperature
  electron density
  ion density
  ion composition
- ***Charging of satellites***

SEPS-sensor

Schematic representation of the SEPS-sensor.

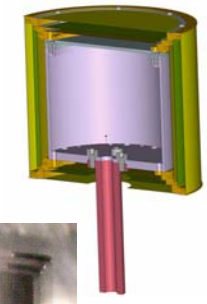


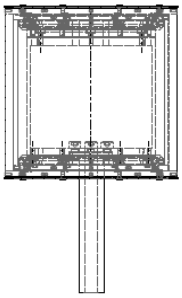
SEPS measurement modes

	Voltage		
Mode	**sphere**	**inner grid**	**outer grid**
Langmuir	+8…-8	+8…-8	+8…-8
Shielded Langmuir	+20…-70	0	0
Plasma shielded Langmuir	+20…-70	V_{pl}	V_{pl}
RPA electron	+20	+10…-70	0
RPA plasma electron	+20	+10…-70	V_{pl}
RPA ion	-20	+70…-10	0
RPA plasma ion	-20	+70…-10	V_{pl}
EUV	+70…-70	-50	+50
Calibration	0	-70	+70

SEPS-sensor (Mock-Up II)

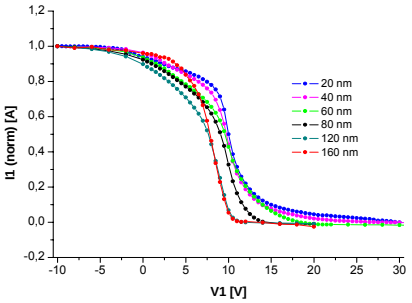
Schematic representation of the simplified cylindric SEPS-sensor for first measurements.
(For plasma measurements the cylindric form is representative)





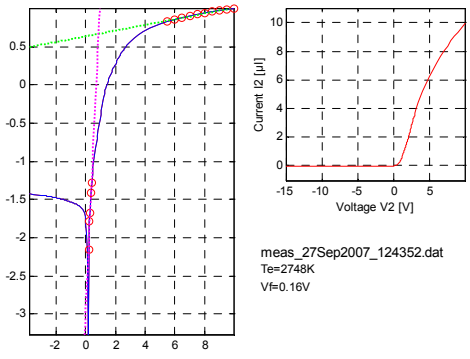
SEPS measurements - EUV

Measurement of photoelectrons generated by the absorption of EUV photons in the cylinder.
The electrons are collected by I1 while sweeping the potential V1.
Potential inner grid V2 = +10V.



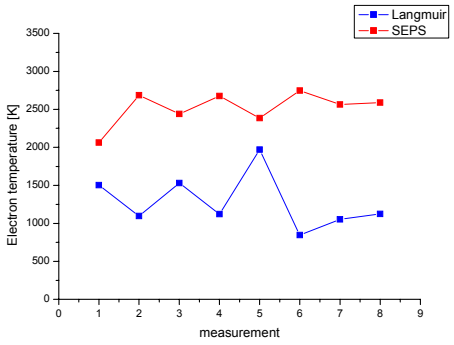
SEPS measurements - T_e

Determination of electron temperature by shielded Langmuir mode

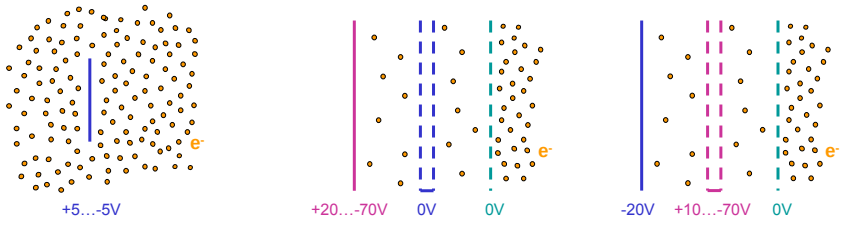


SEPS measurements

Comparison of derived electron temperatures from SEPS-sensor and a standard Langmuir probe.



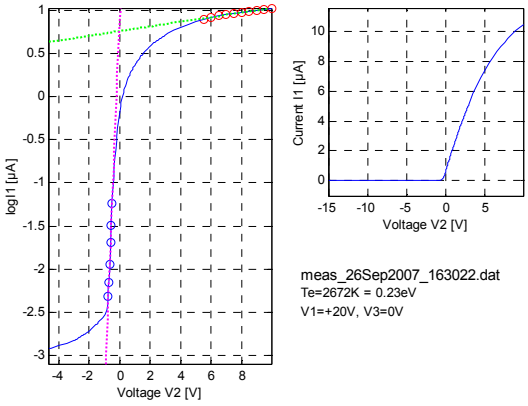
Langmuir mode – shielded Langmuir mode



Langmuir mode | Shielded Langmuir mode | RPA electron mode

SEPS measurements - T_e

Measurement of electron temperature by RPA electron mode.



meas_26Sep2007_163022.dat
Te=2672K = 0.23eV
V1=+20V, V3=0V

Outlook

- Further evaluation of plasma temperature determination and development of algorithms for EUV spectra measurements
- Flight model design of SEPS-sensor will be finished by March 2009 in close cooperation with EADS/Astrium Friedrichshafen
- Flight model could be available by end of 2009 (if funding is clarified until end of 2008)
- Possibilities for in orbit verifications are under discussion

Spherical EUV and Plasma Spectrometer (SEPS)

Thanks
to
ESA/ESTEC
for technical support and the facilities
realising the plasma measurements

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Interfaces

Sensor
Outer diameter of the sensor: 80 mm
Weight: 300 g

Electronics
Weight 2.5 kg
Data rate: < 8 kbit/s
Energy: 8 W

SEPS measurements

Measurement of photoelectrons generated by the absorption of EUV photons in the sphere.
Sweeps for different voltages at inner and outer grid. If U_{IG}= U_{OG}= 0V the current I1 results from plasma electrons from the light source and photo electrons from inner and outer grid. • shows the effect after the plasma electrons are extracted by a potential of +50V (compare with ■). In the case that U_{IG}= -20V and U_{OG}= +20V only photo electrons from inner grid will contribute to I1. If the potential of MS is below -20V, I1 is dominated by photo electrons from the sphere.