

Ion and Neutral Mass and Energy Imaging Spectrometer INMEIS



**F. Leblanc¹, F. Cipriani², J.J. Berthelier¹
et al.**

¹ LATMOS/IPSL, France

² ESTEC/ESA

INMEIS Scientific Objectives

How did solar wind sputtering / photon desorption / MIV weather the asteroid upper surface?

Characterization of the exospheric species of the NEO

Approach: high sensitive mass spectrometer

Objective: exospheric composition

⇒ **Towards an optimized surface characterization**

Characterization of their mechanisms of ejection:

Approach: mass and energy distribution measurements

Objective: maturation of the asteroid upper surface

⇒ **Towards an optimized analysis of the returned samples**

Characterization of the exospheric spatial distribution:

Approach: high temporal resolution

Objective: “active” regions of the asteroid

⇒ **Representativeness of the collected samples**

INMEIS Performances

A neutral and ion mass and energy spectrometer

Ion species: 0 eV to ~1 keV Neutral species: 0 to ~100 eV
mass range 0 to 500 amu

With high sensitivity: able to measure density down to
 10^{-2} ion particles/cm⁻³ 10 neutral particles/cm⁻³

With a high mass resolution mode:

$M/\Delta M \sim 300$

With a low mass and energy resolution mode:

$M/\Delta M \sim 60$ and $E/\Delta E \sim 20$

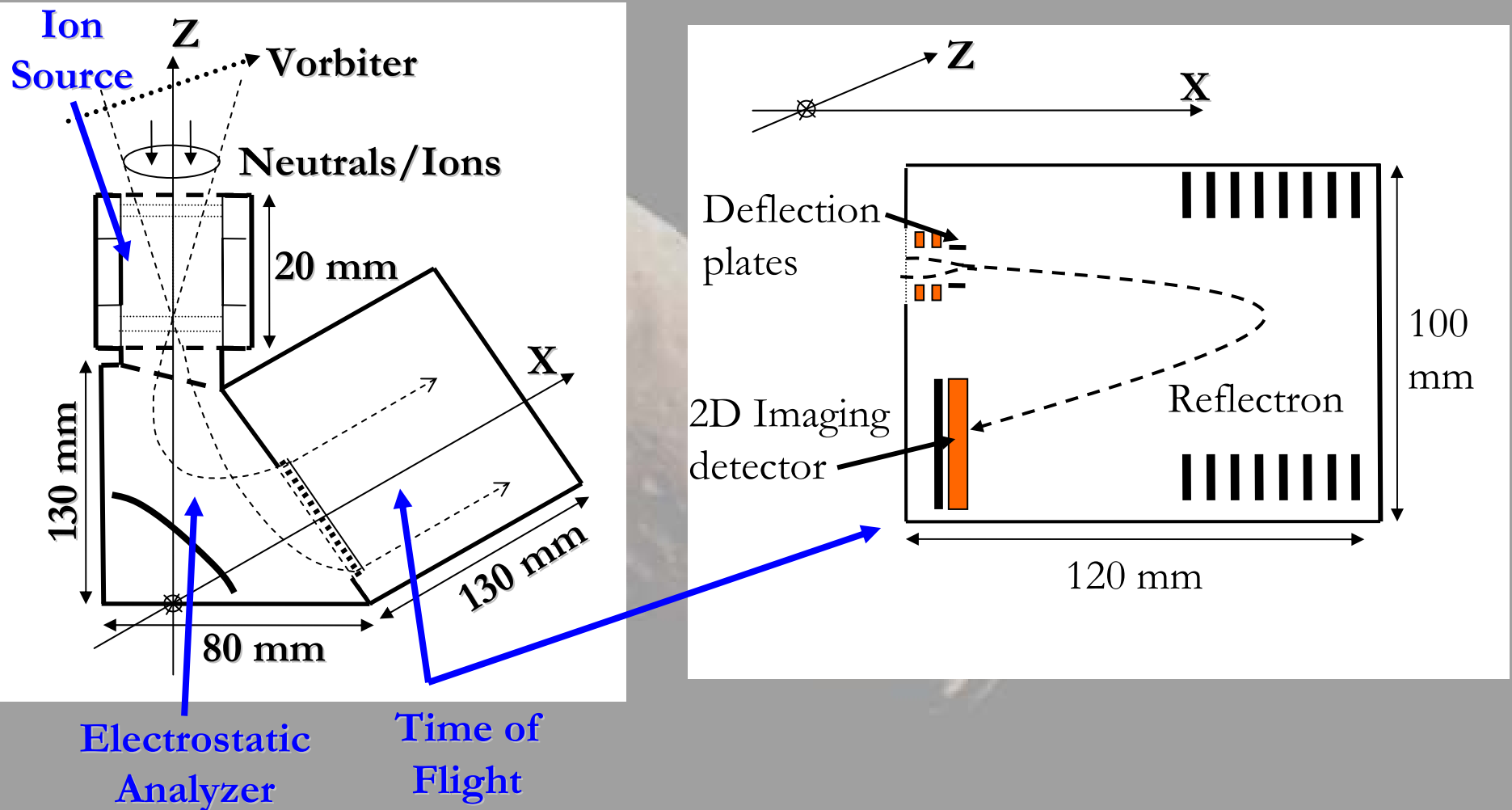
With high temporal resolution on given energy window:

Continuous and simultaneous measurement

With an angular Field of View and resolution:

20°x20°

INMEIS Concept



The electrostatic analyzer disperses in energy at TOF entrance
The TOF measures the start (either by gating or by electric field deflection) and the stop at 2D detector (1D= energy & 1D=mass)

INMEIS Ressources

		Weight (g)	Margin (20%)
INMEIS	Detector - Electronics	400	80
	Structure	800	160
	TOF - Optics	400	80
	Ion Source	350	70
	Total	1950	380
TOTAL With Margin (20%)		2330 g	

Volume: 15×20×10 cm³

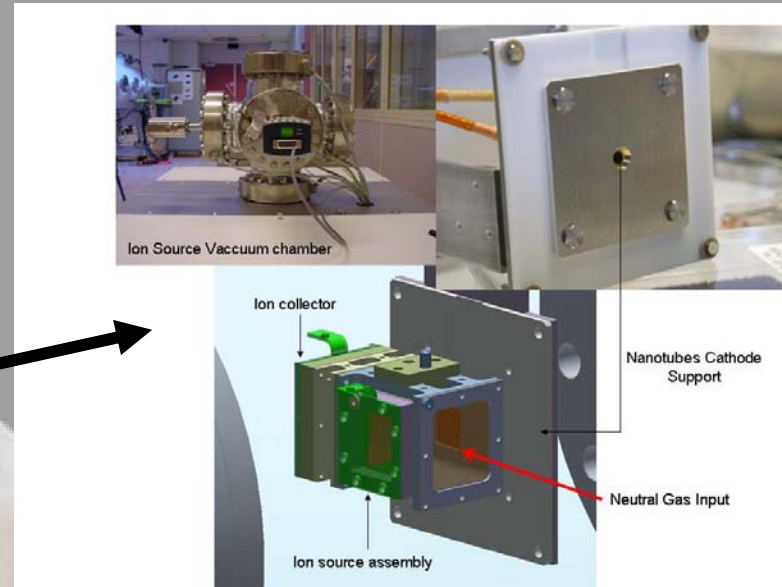
Telemetry: Average about 1kbit/s

Power: 4.5 W with 30% margin: 5.8 W

INMEIS Heritage

Ion source:

- Similar to the one of COPS/ROSINA
- CNES R&T of emitters based on micro-tips emitter and carbon nano-tube (Cipriani, PhD, 2006).
- Laboratory tests and studies at ESA/ESTEC on first prototype using carbon nano-tube.

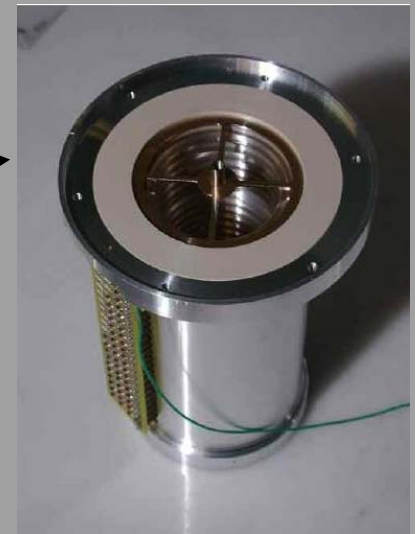


Electrostatic Analyzer:

- Similar as on NMS/Giotto

Time of flight:

- Start time: gating from PICAM/Bepi Colombo
- Reflectron derived from PALOMA (R&T).
- Imaging detector: developed in the frame of PICAM/Bepi-Colombo (Phase C/D).



INMEIS Working Plans

From July 2009, R&T study (under funds of CNES)

Approach: design, building and test of INMEIS prototype

Objective: demonstration of a TRL 5 by beginning of 2011.

First step (6 months starting in July 2009):

- Complete numerical design of the instrument

Second step (12 months starting in October 2009)

- Full mechanical and electronic designs
- Building of the prototype and of a test bench

Third step (6 months starting in November 2010):

- Test of the instrument and evaluation of its performance