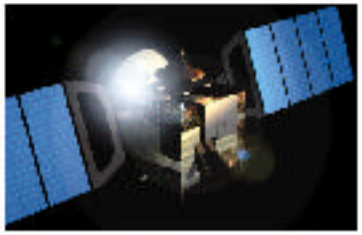


Initial Results from the Mars Express ASPERA-3 Experiment

R. Lundin, J. R. Sharber, S. Barabash,
J. D. Winningham, R. A. Frahm
and the ASPERA-3 Team

Presented at the 35th Lunar and Planetary Science Conference (LPSC),
Clear Lake, Texas, March, 2004.

ASPERA-3

The Analyzer of Space Plasmas and Energetic Atoms

Imaging plasma and energetic neutral atoms near Mars

Rickard Lundin, Stanislav Barabash + ASPERA-team

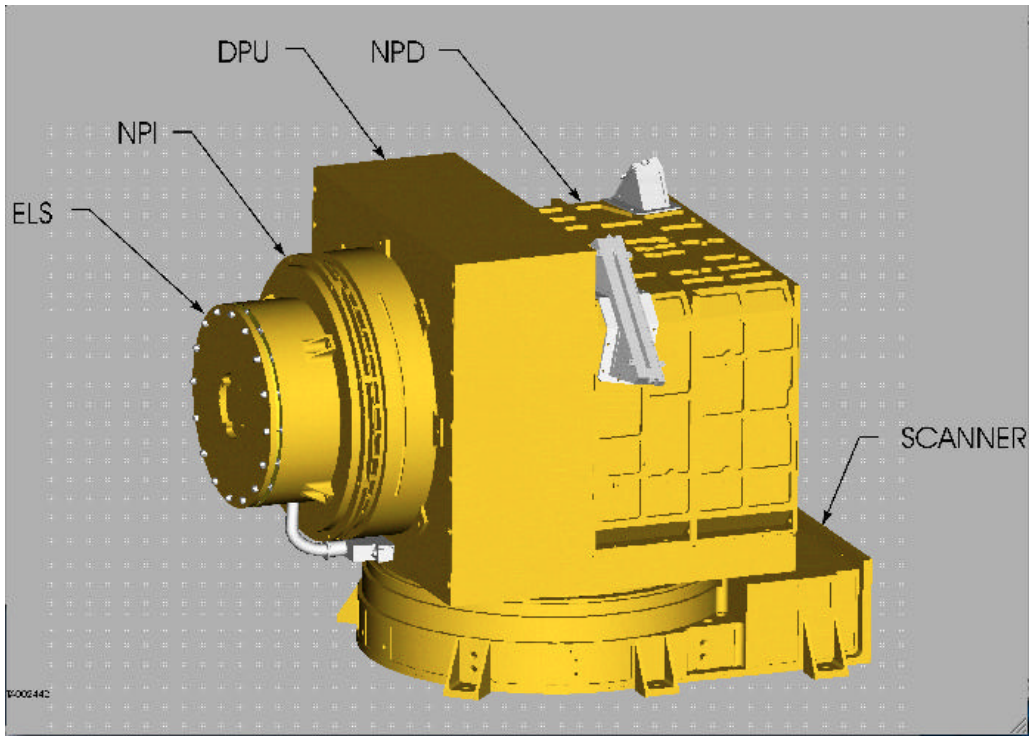
Swedish Institute of Space Physics + 14 teams from Finland, France, Japan, Germany, Ireland, Italy, Russia, Switzerland, UK, and USA

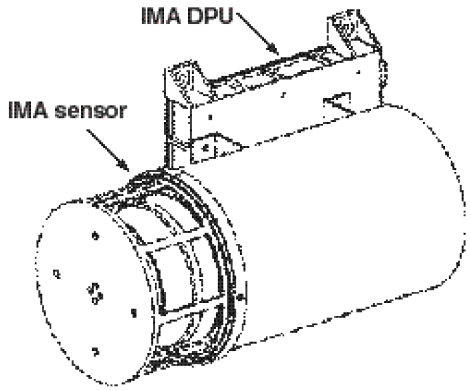
***Question*:** **Is the solar wind erosion the prime reason for the present lack of water on Mars?**

***Objective*:** **To measure solar wind scavenging: The slow escape of volatiles (atmosphere, hydrosphere) from Mars.**

LPSC, March 2004

Instrument Arrangement



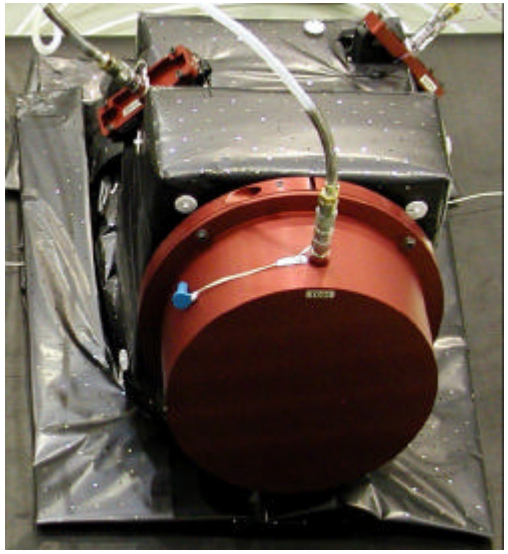


Ion Mass Analyzer (IMA)

Main Unit:

- Neutral particle imagers (NPI, NPD)
- Electron spectrometer (ELS)
- Data processing unit
- Mechanical scanner

Instrumentation



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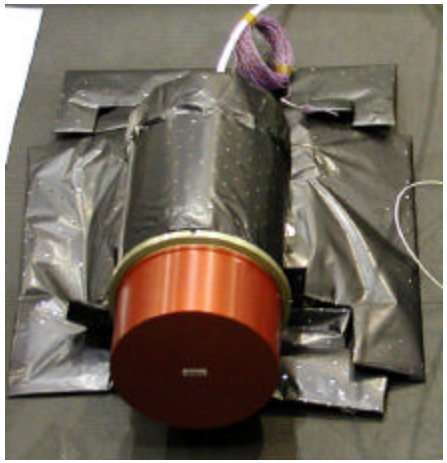
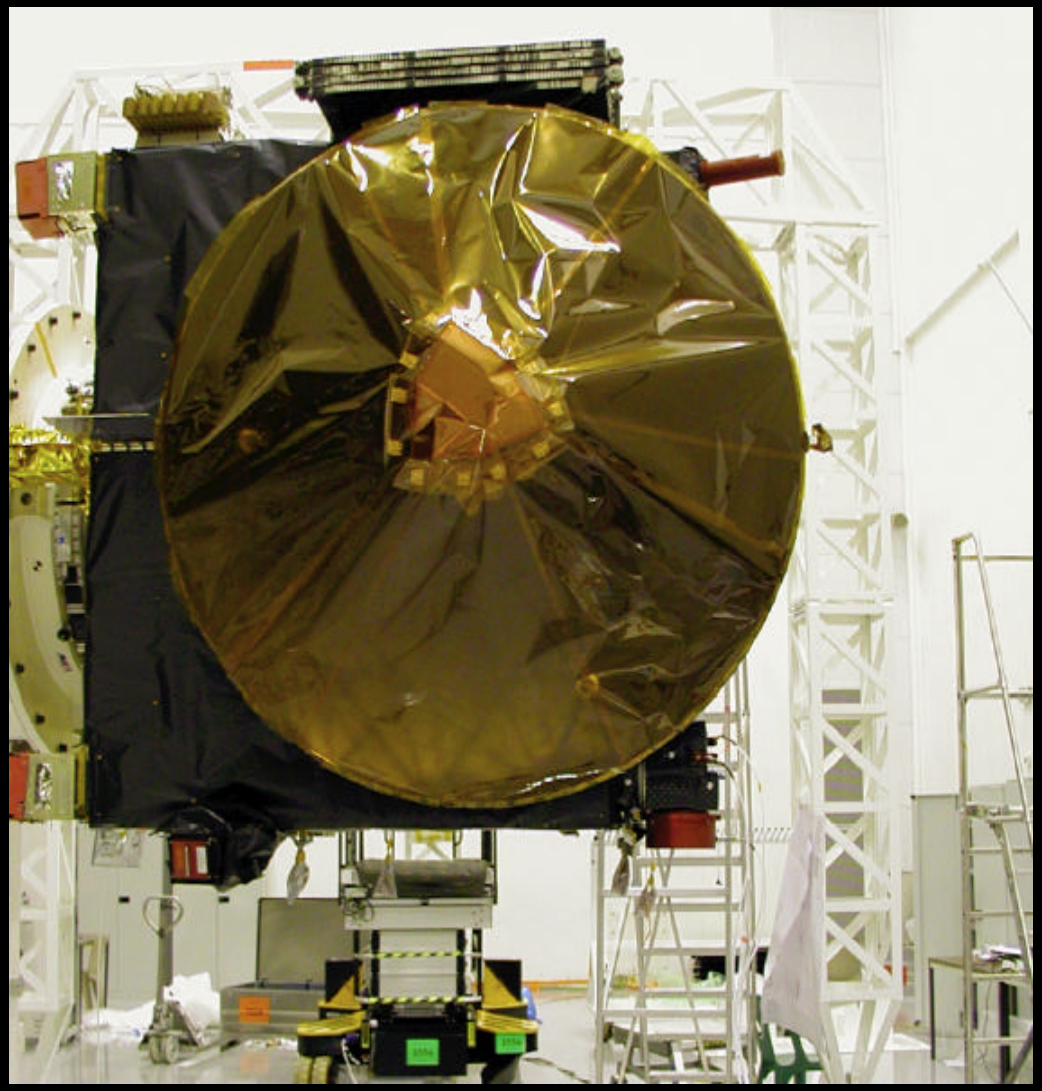
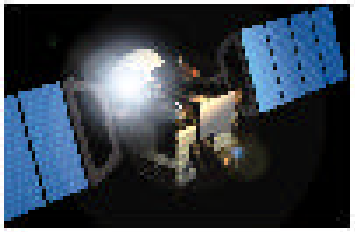


- **Ion Mass Analyzer**

Location on S/C





Measurement Objectives

Remote Measurements of Energetic Neutral Atoms (ENA)

- Investigate the interaction between the solar wind and Martian atmosphere
- Characterize quantitatively the impact of plasma processes on atmospheric evolution
- Obtain the global plasma and neutral gas distributions in the near-Mars environment

***In Situ* Measurements of Ions and Electrons**

- Complement the ENA images (electrons and multipli-charged ions cannot be imaged)
- Study local characteristics of plasma
  - dynamics and structure of boundaries
- Provide solar wind parameters necessary for interpretation of ENA images

Ion Mass Analyzer (IMA)

This instrument consists of an electrostatic analyzer section followed by a mass analysis section employing a cylindrical magnetic field.

The acceptance geometry is 16 sectors of 22.5° each around 360°

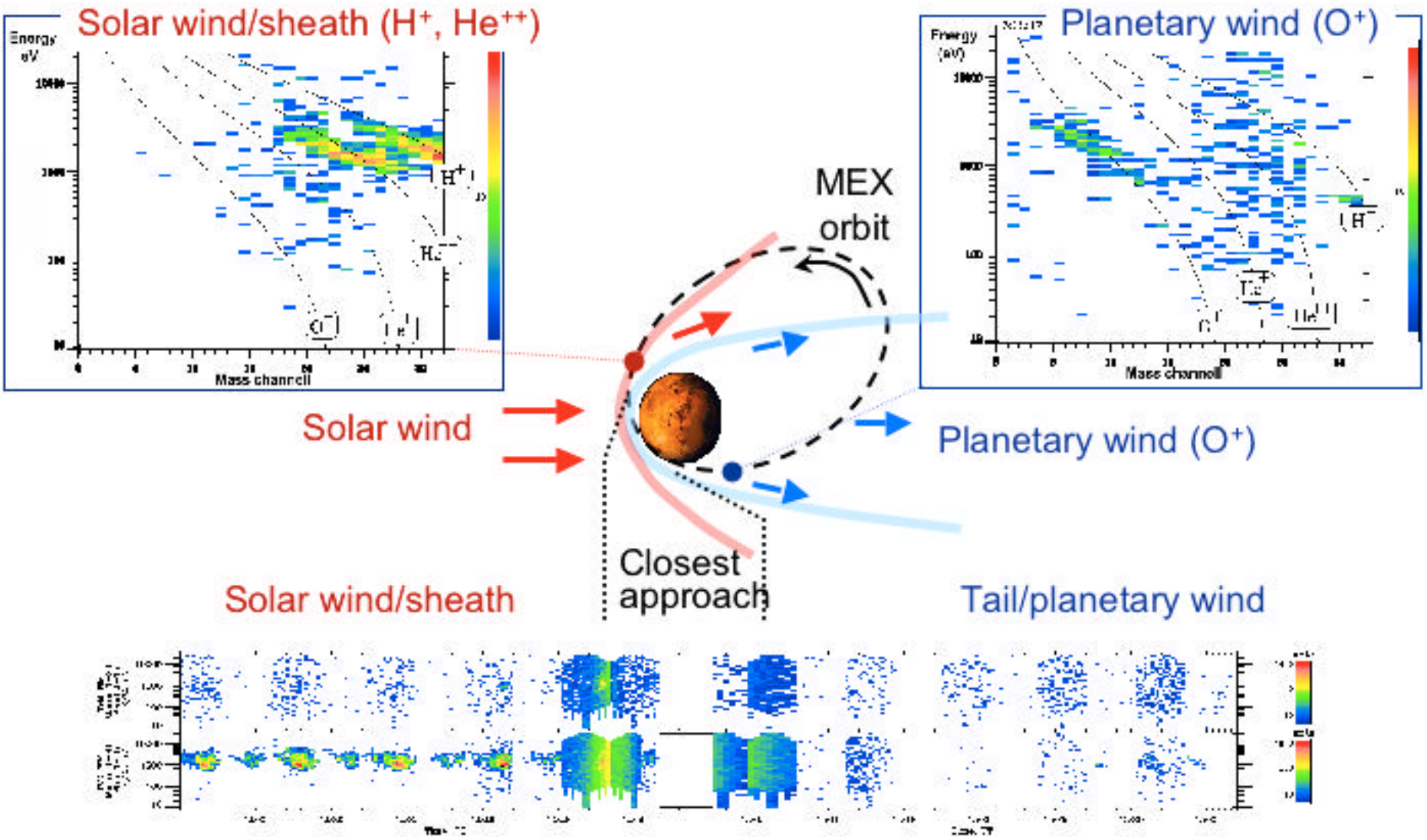
Energy resolution is 7%.

Mass resolution: M/?M ~6.

Geometric factor (per sector): 3.5 x 10 (-4) cm2 sr.

ASPERA-3 — Early results (IMA)

Confirmation of the planetary wind - O^+ and molecular ions



Electron Spectrometer (ELS)

The Electron Spectrometer (ELS) sensor is a light-weight, low-power, spherical top-hat electrostatic analyzer with collimation, detection, and readout system.

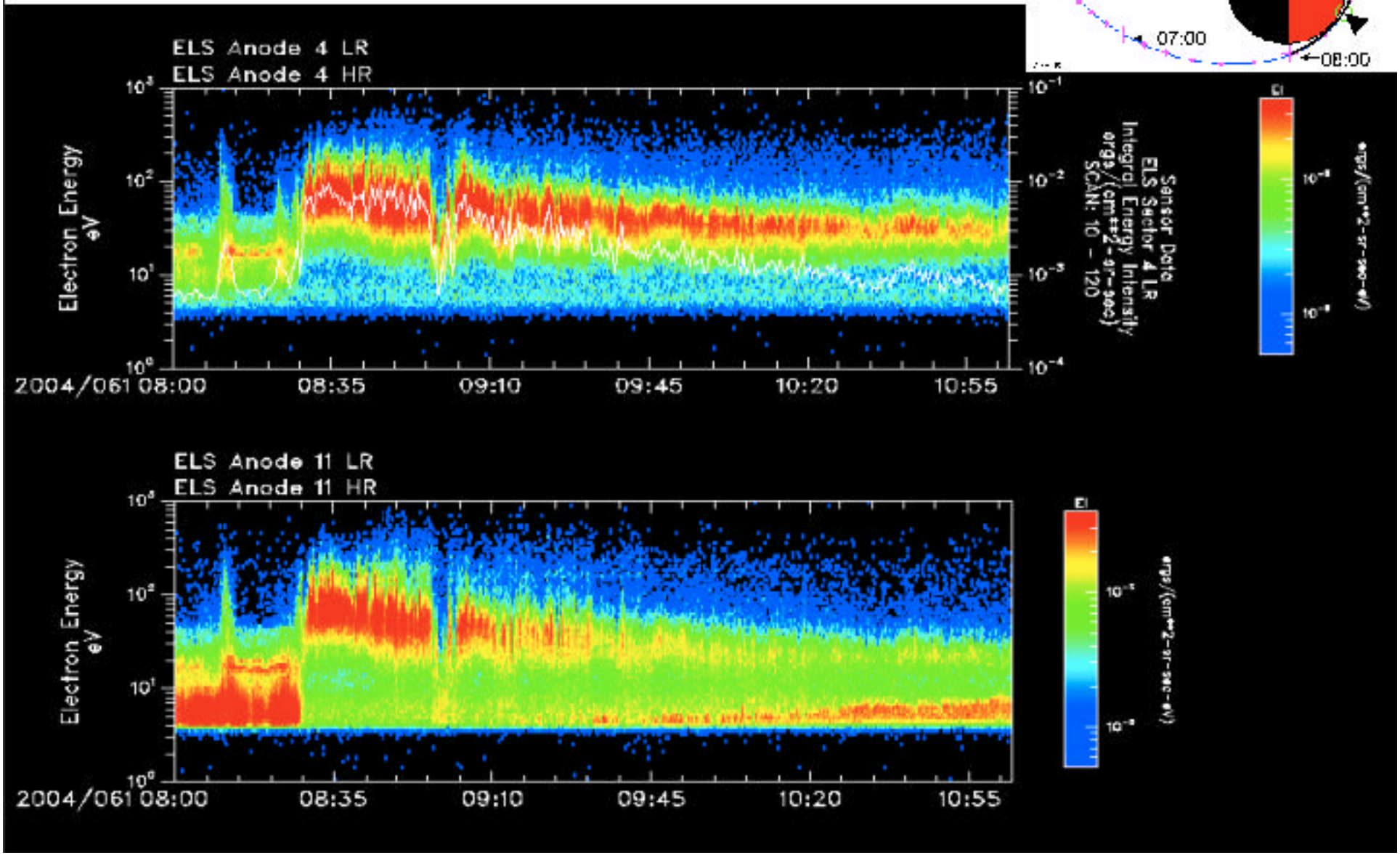
Energy resolution is 7%.

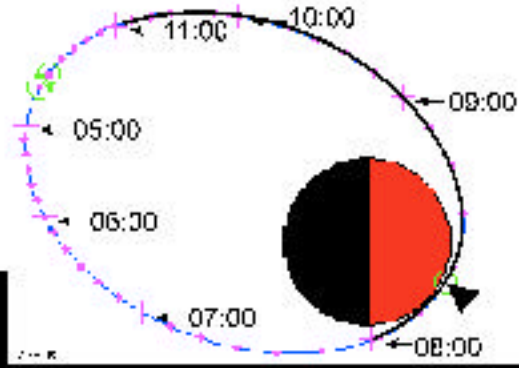
Energy range: 1 eV/q to 20 keV/q, one energy sweep per four seconds.

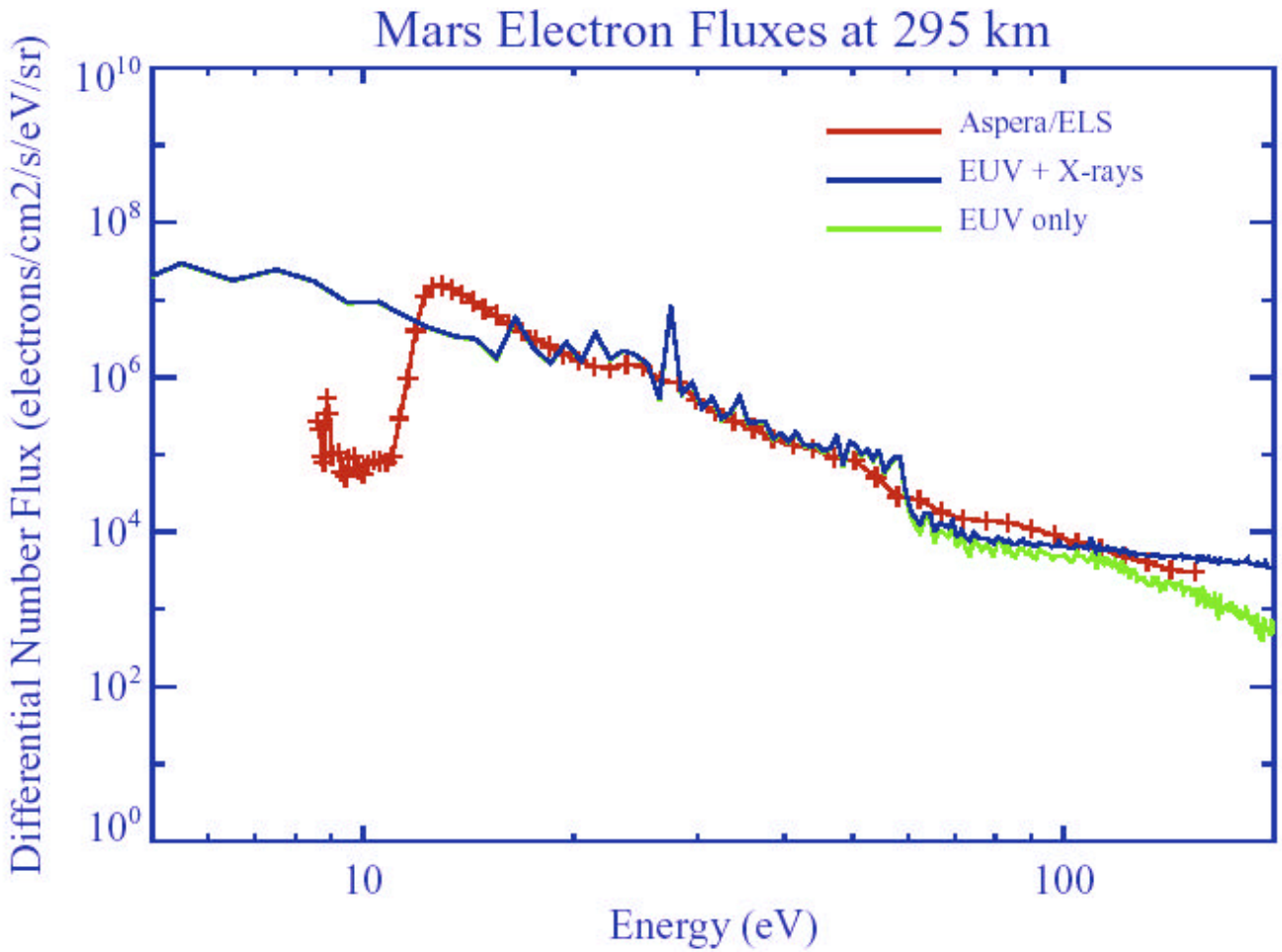
There are 16 anodes around a 360° fov, each defining a 22.5 ° sector.

Geometric factor (per sector) is 7.5 x 10 -5 cm2 sr

ELS Mar 1, 2004







The calculation of photoelectron fluxes at Mars uses a Boltzmann transport code based on Link (1992).

BACK-UPS

Boltzmann Electron Transport Code Calculations

A Boltzmann electron transport code, based on Link [1992], has been developed to analyze Mars photoelectron fluxes and precipitation of solar wind electrons into the Mars atmosphere. The present calculations cover the energy region 0.5 eV - 4 KeV, and include K-shell photoionization and Auger electron ejection for the primary Mars gases CO2, N2, and O.

Expected Mars Photoelectron Spectrum at 145 km

from the ASPERA-3 Electron Plasma (ELS) Instrument

Instrument Response, Instrument Threshold (2 count), and Poisson Errors