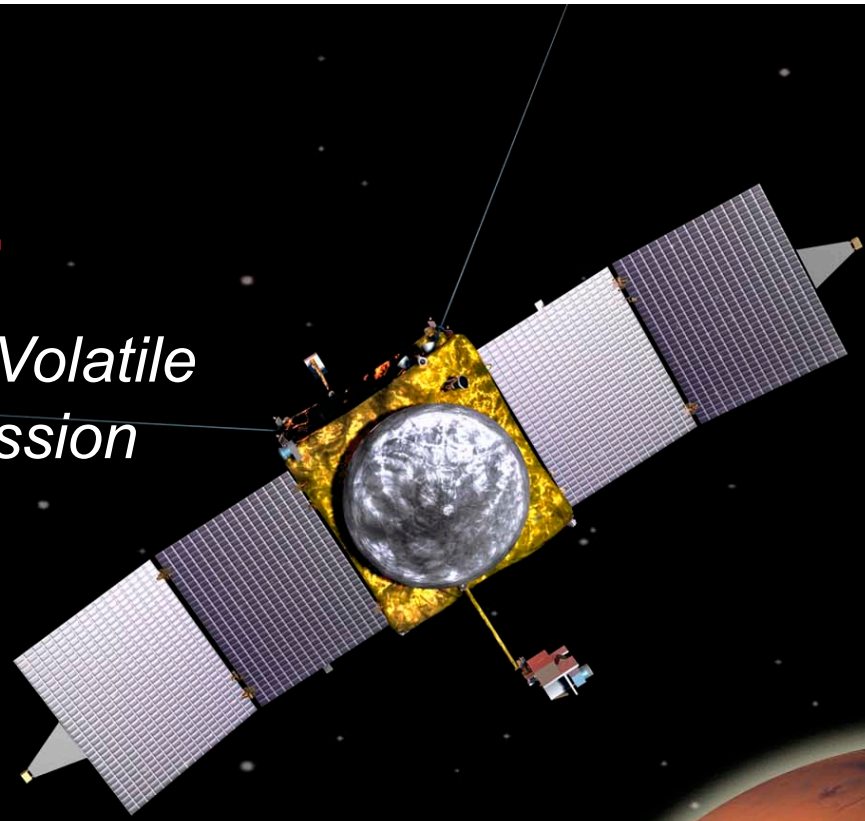


Mars Atmosphere and Volatile EvolutioN (MAVEN) Mission

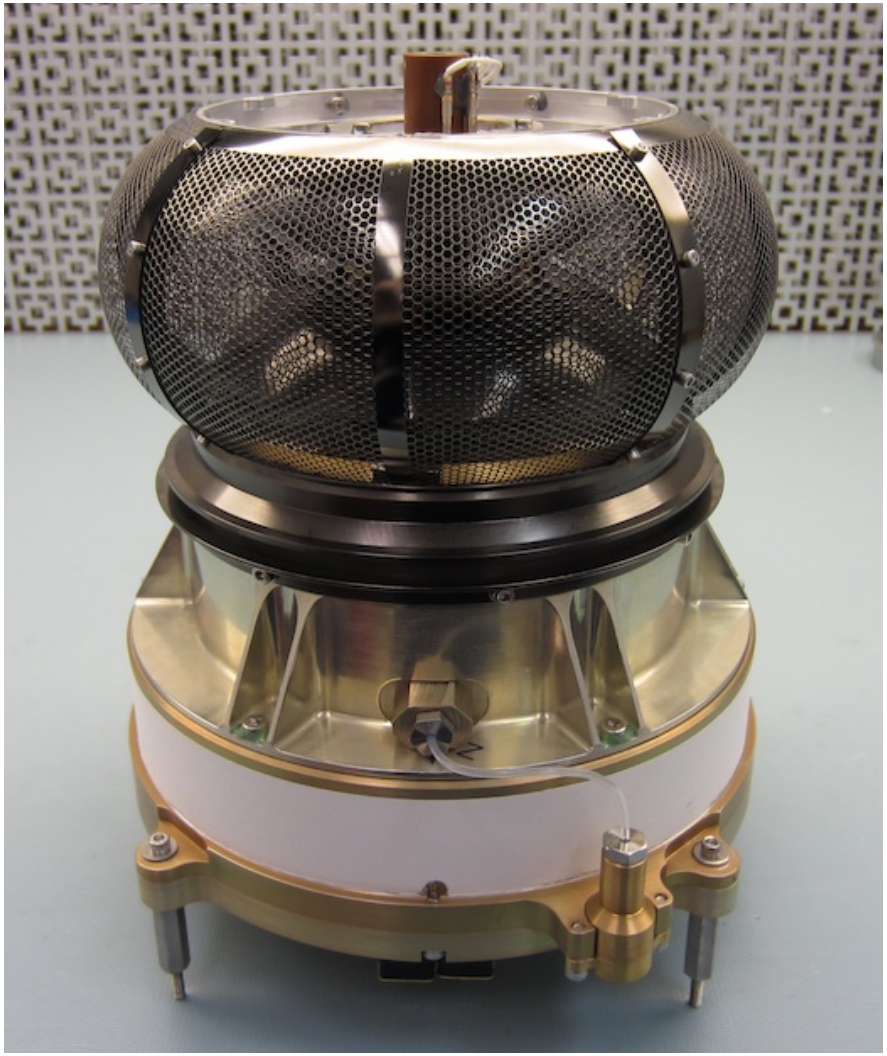
Solar Wind Electron Analyzer (SWEA)

MAVEN Science Community Workshop

Dec 02, 2011

David L. Mitchell SWEA Lead

IRAP / UCB-SSL Collaboration

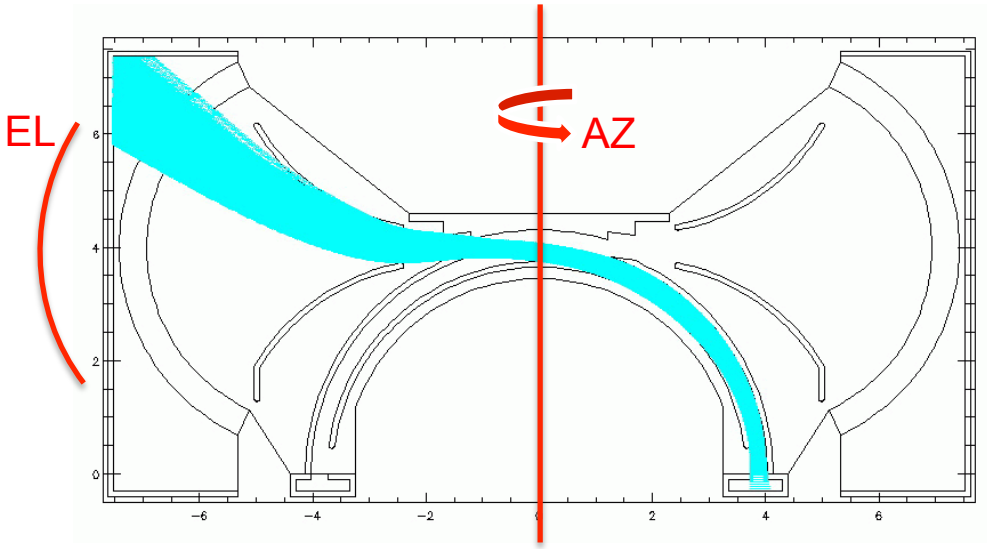


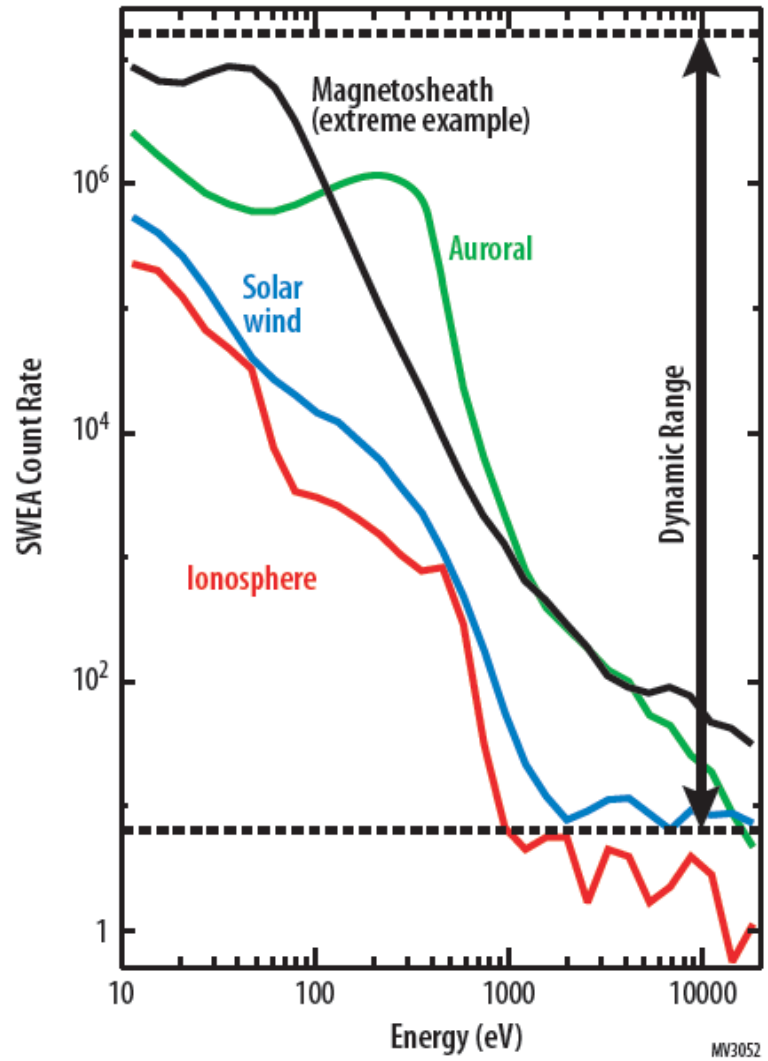
IRAP, Toulouse
- Analyzer
- MCP
- Anode
- HVPS

SSL, Berkeley
- Pedestal
- Digital / FPGA
- LVPS

(same as for STEREO)

Instrument Performance





- **Energy range:** 5 eV to 5 keV
- **FOV:** 360° x 120° for energies up to 1.6 keV
- **Angular resolution:** 22.5° x 20°
- **Energy resolution (ΔE/E):** 12% below 50 eV, increasing to 18%
- **Geometric factor:** 0.009 cm^2 ster eV/eV
- **Energy fluxes:** 10^3 to 10^9 eV/cm^2-s-ster-eV

Variation of Energy Resolution

$\Delta E/E$ of the sensor at low energy can be controlled by varying the voltage bias U_0 between the internal and external grids:

$$\Delta E/E_{inc} = (\Delta E/E)_{or} / (1 + U_0/E_{inc})$$

where $(\Delta E/E)_{or}$ is the energy resolution for zero bias (0.18)
and E_{inc} is the incident energy of the electron

Thus for 1.5x finer energy resolution (and 2x smaller GF), we apply

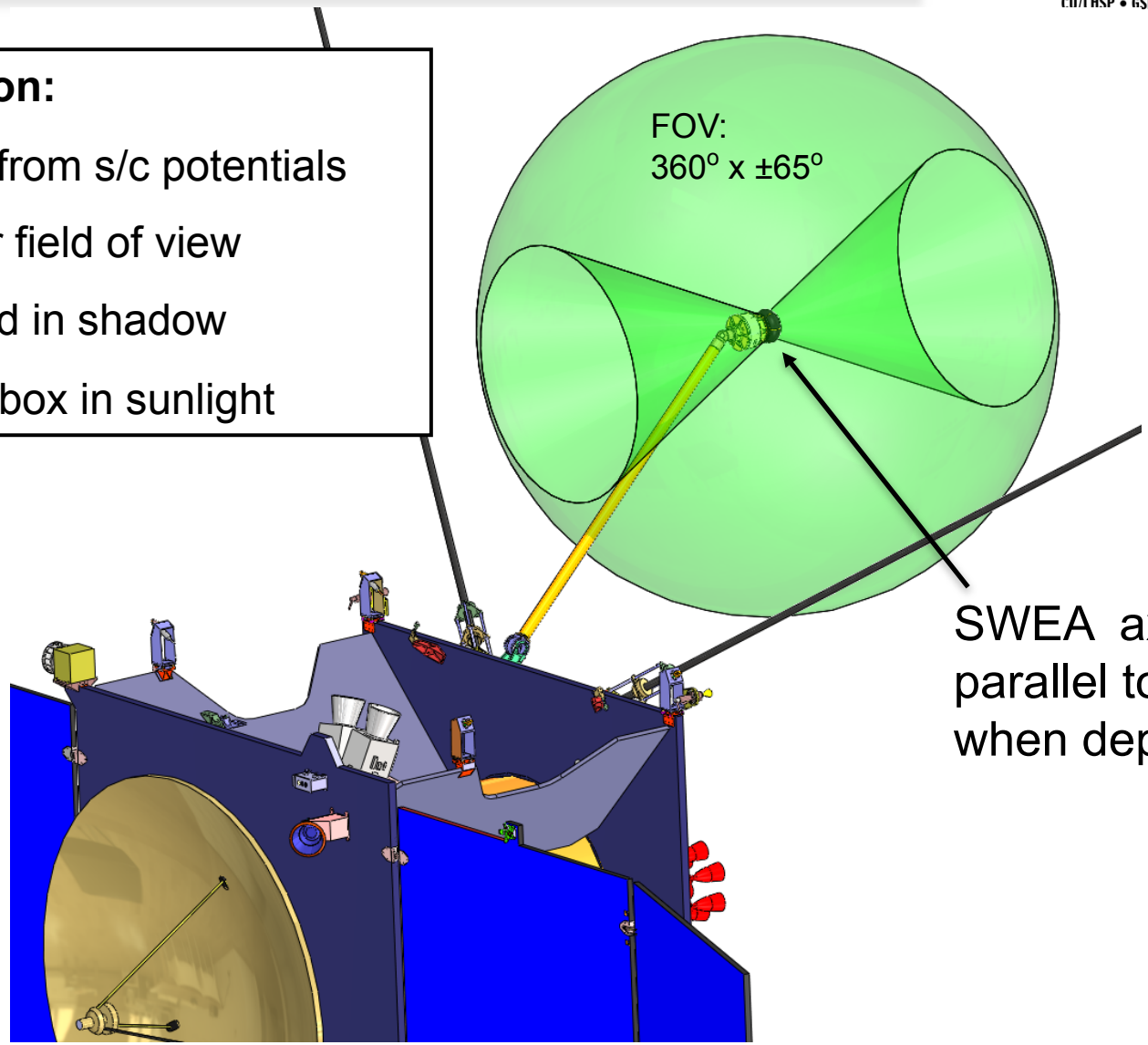
$$U_0 = E_{inc}/2$$

Works for apoapsis and side segments in all orbit scenarios.
Works for Sun-Velocity mode at periapsis (~50% of orbits).
Does not work for deep dips.

Spacecraft Accommodation

Boom location:

- Separation from s/c potentials
- Large, clear field of view
- Sensor head in shadow
- Electronics box in sunlight



SWEA axis parallel to SC Z when deployed

Data Products

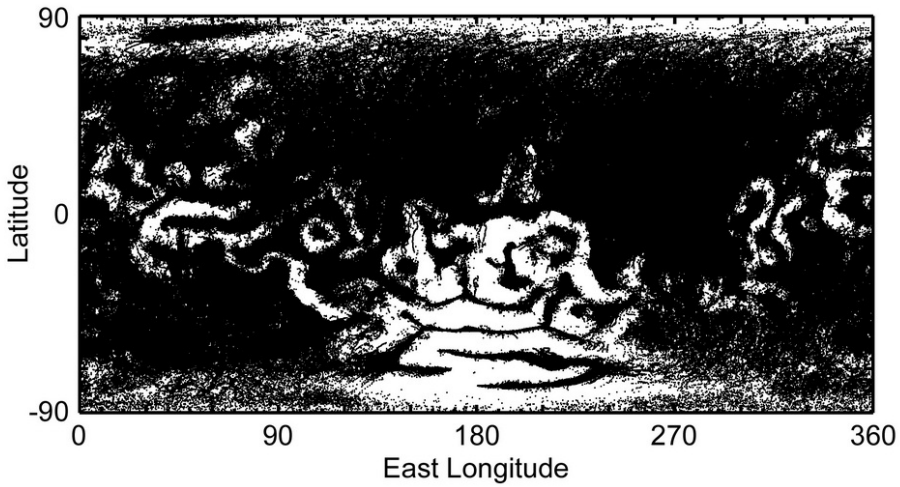
- SWEA provides a single science data product to the PFDPU
  - Counts per accumulation interval for each of the 16 anodes (as a function of analyzer and deflector sweeps)
  - Complete measurement sequence takes 2 seconds.
- PFDPU computes three data products, with cadence depending on altitude

Solar Wind Mode altitude > 500 km	• Energy spectra (64E) every 8 sec • Pitch angle distr. (16A x 16E) every 8 sec • 3D distributions (80A x 16E) every 64 sec
Ionosphere Mode altitude < 500 km	• Energy spectra (64E) every 2 sec • Pitch angle distr. (16A x 16E) every 2 sec • 3D distributions (80A x 16E) every 64 sec

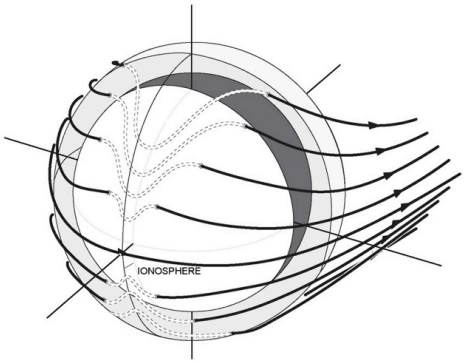
SWEA Science Goals

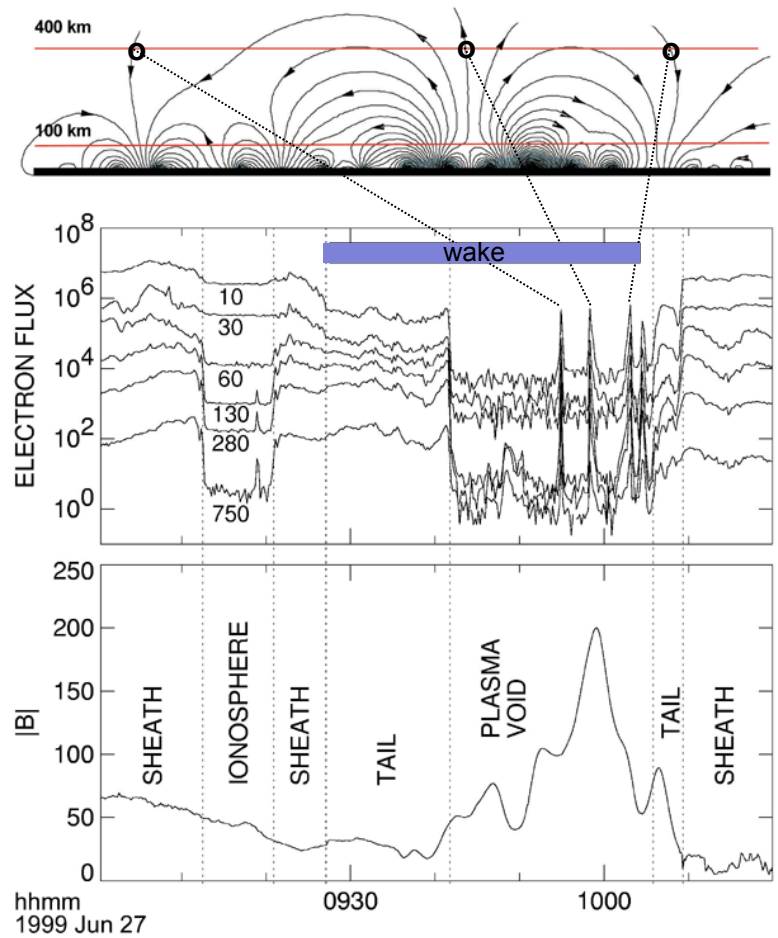
Magnetic Topology & Plasma Regime

- Crustal Magnetospheres/Cusps

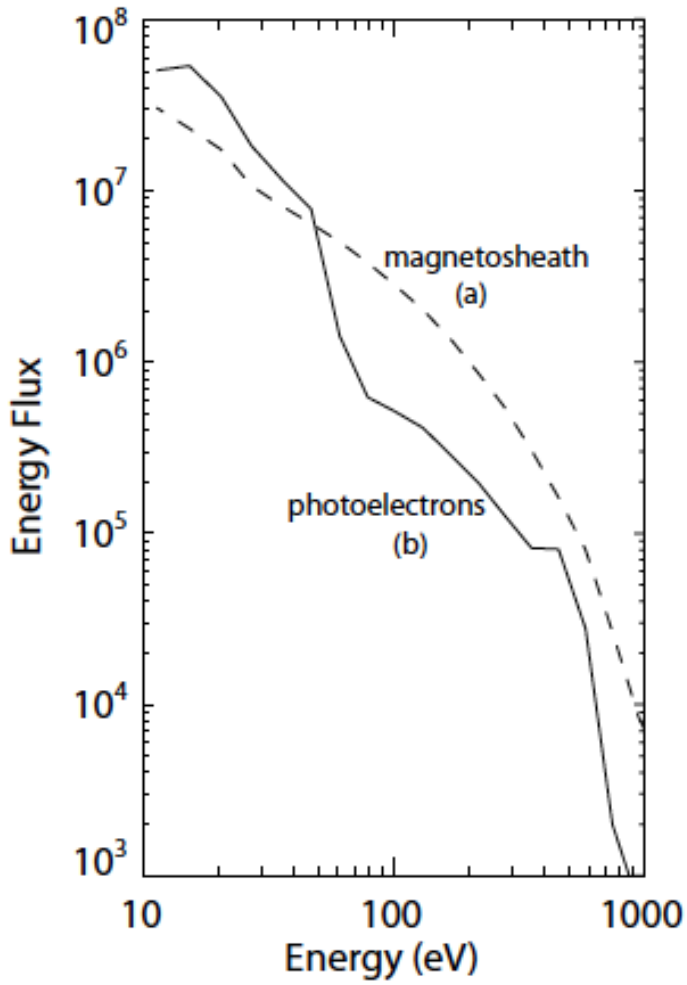


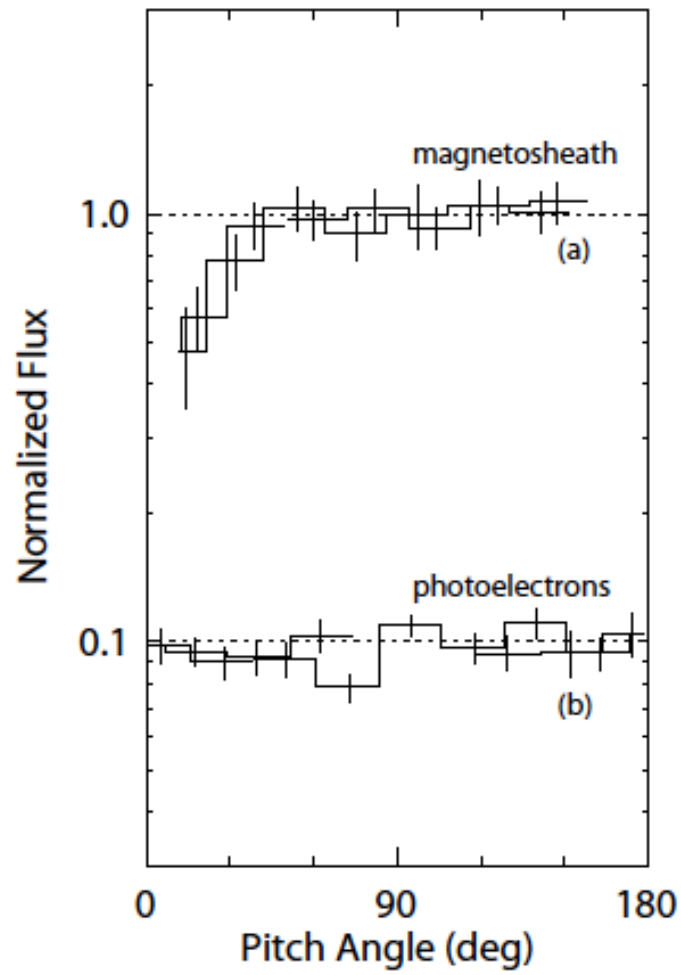
- Draped Field Lines



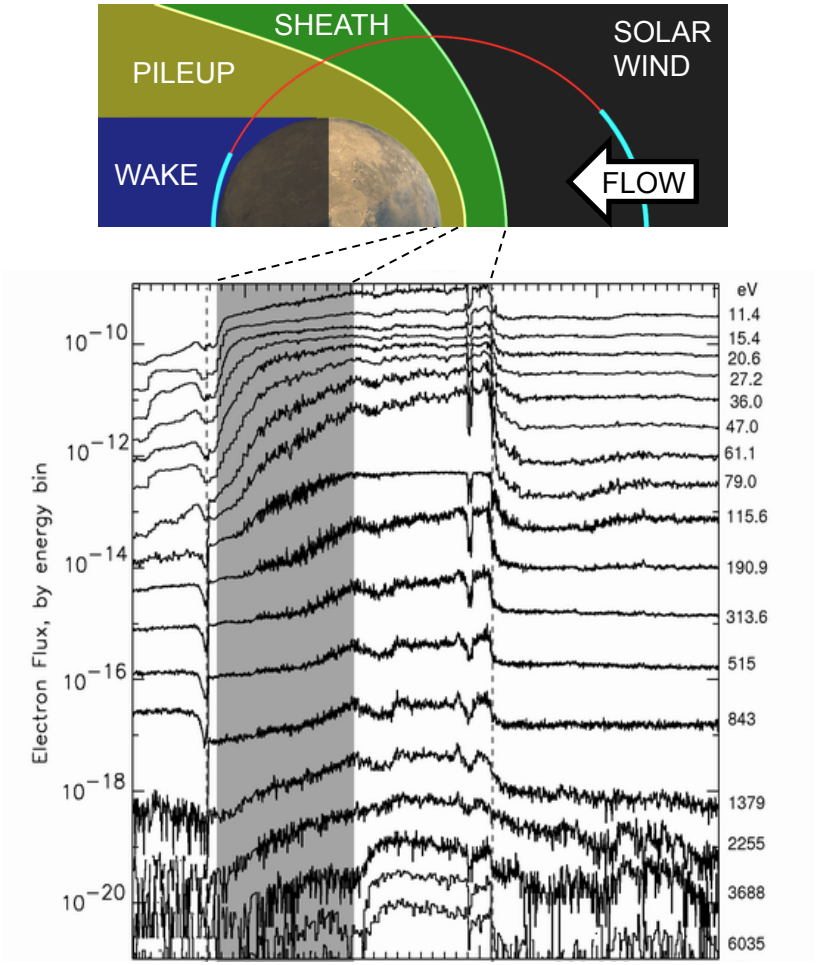


SWEA Science Goals





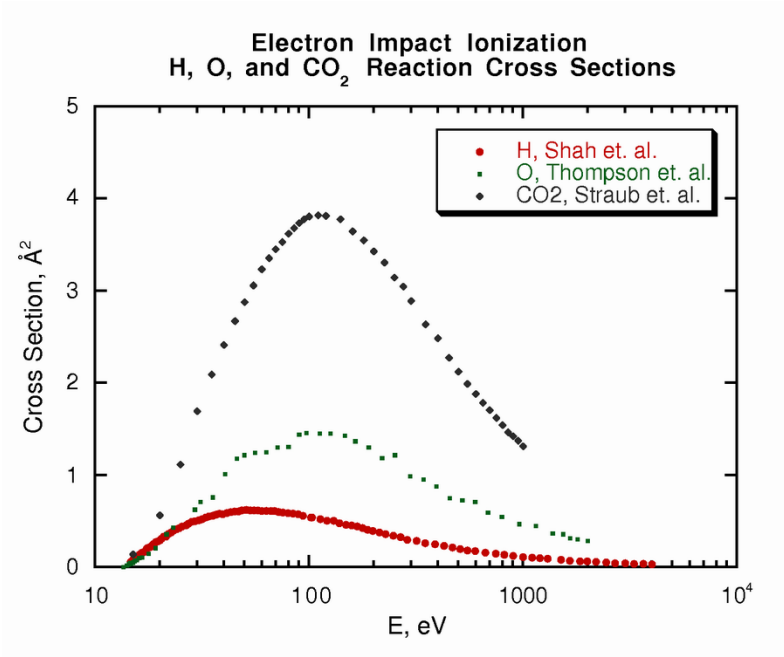
SWEA Science Goals



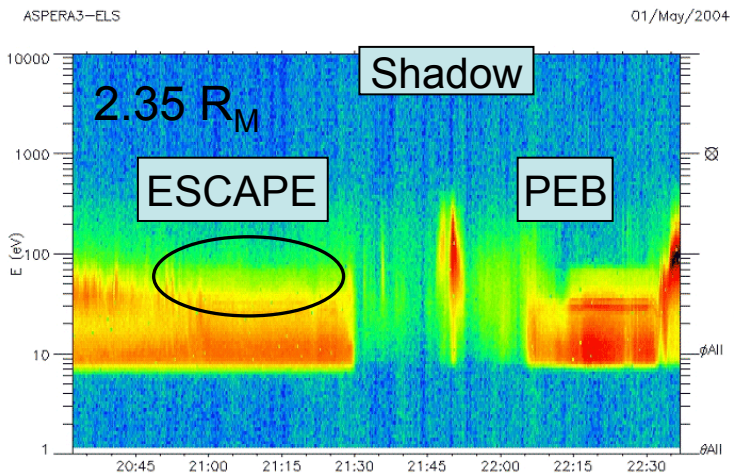
MGS MAG/ER

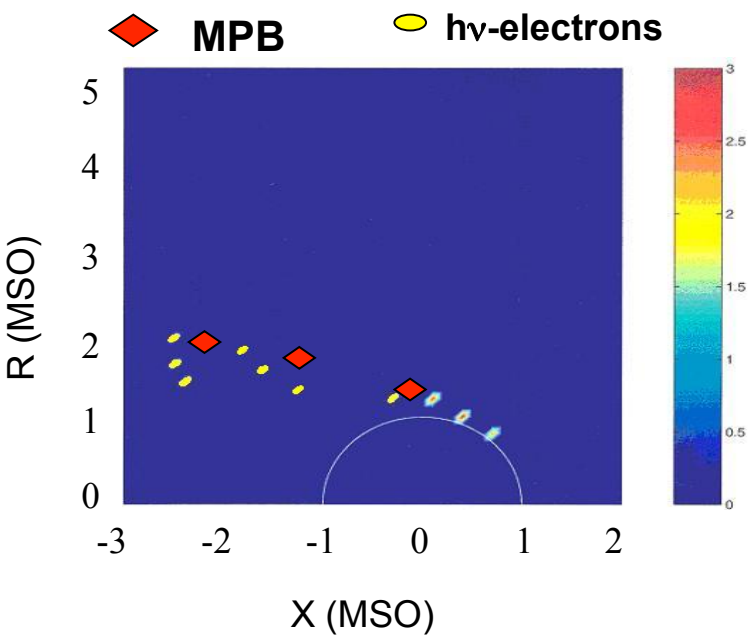
Electron Impact Ionization

- Magnetic Pileup Region
- Ionosphere



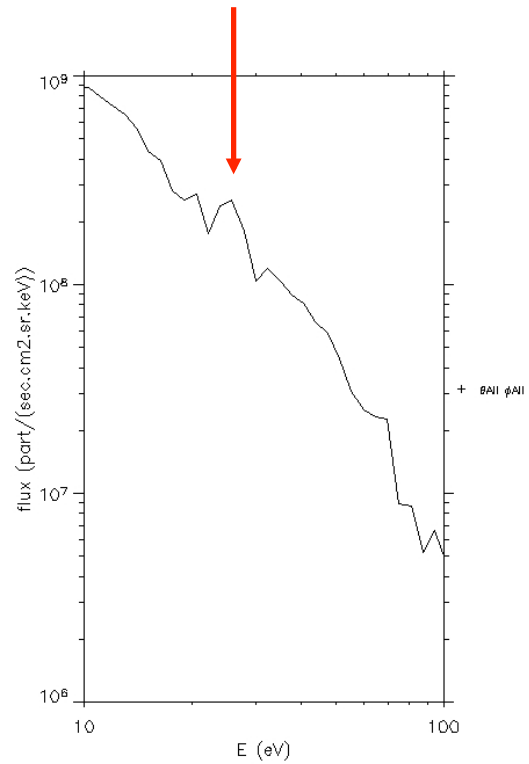
SWEA Science Goals





Mars Express

Photo-ionization of CO_2 by solar hν @ 304 Å



Escape associated with heavy ions (M > 16)