Radio Technologies for Planetary Exploration

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- Jupiter and its moons
- UML Space Technologies
- Planetary Advance Radio Sounder

Jupiter

Distance from the Sun

5.2 A.U.

Mean Equatorial Radius

11.2 Re

Spin Period

0.41354 day

Orbit Period

11.862615 sidereal years

Mean Temperature at Solid Surface

288 to 293 K

Major Atmospheric Constituents

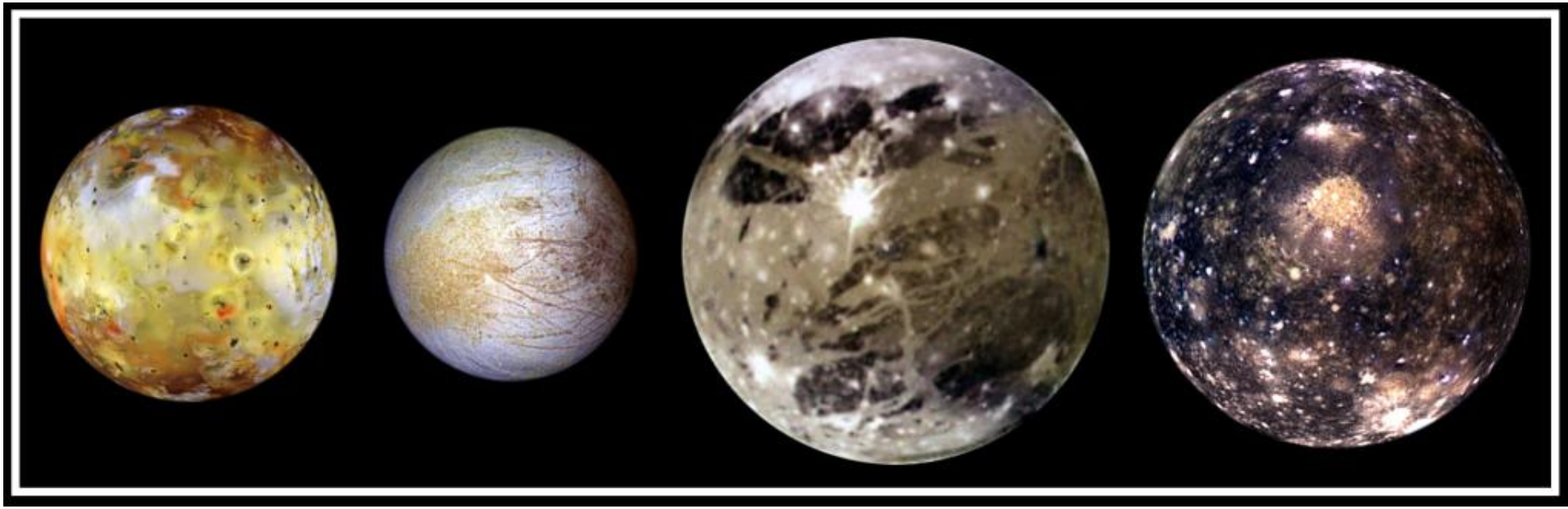
H_2, He

Strong Internal Magnetic Field

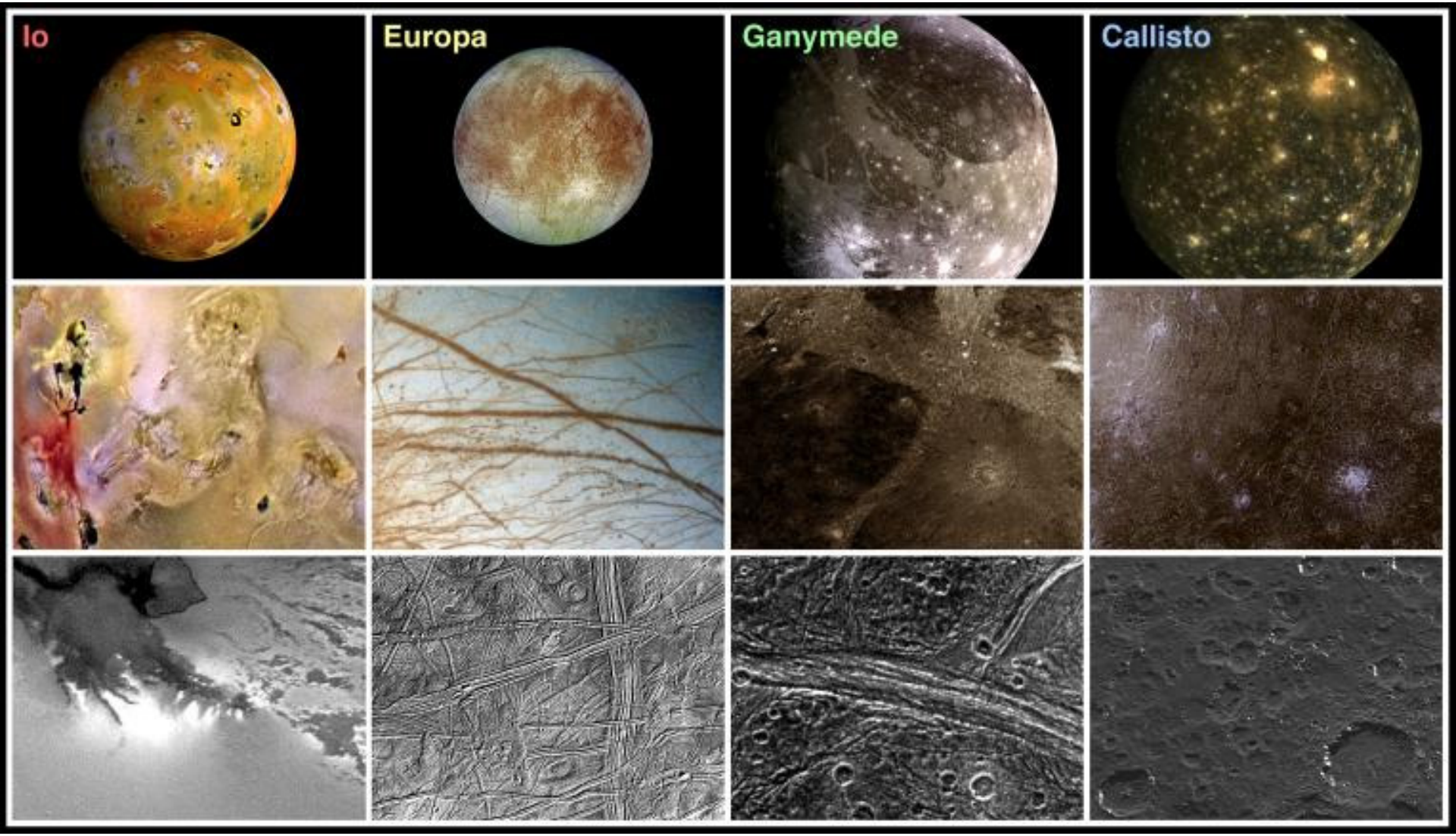
Magnetosphere 100 Rj

Jupiter Moons

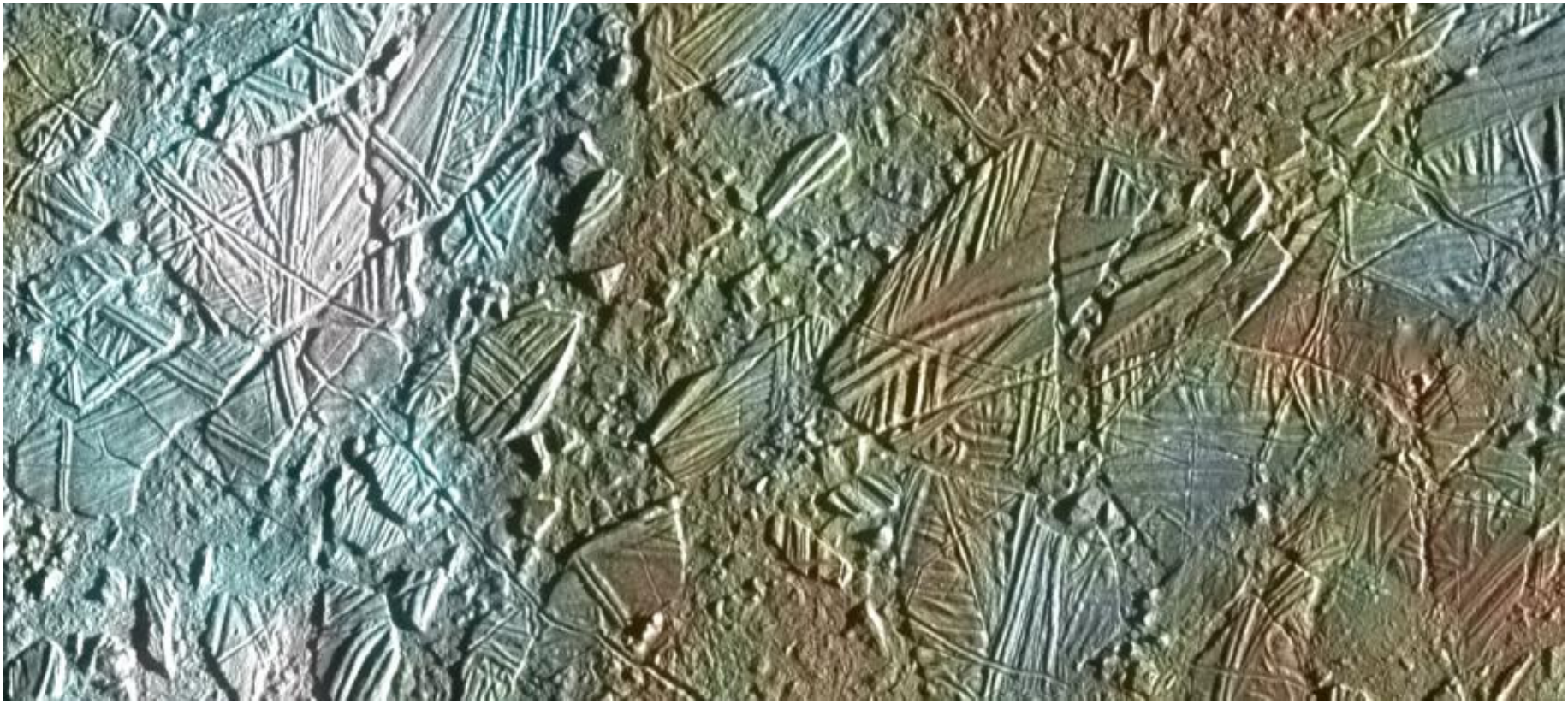
- Io (5.9 Rj),
- Europa (9.5 Rj),
- Ganymede (15.1 Rj),
- Callisto (26.6 Rj)



Comparison of the moons



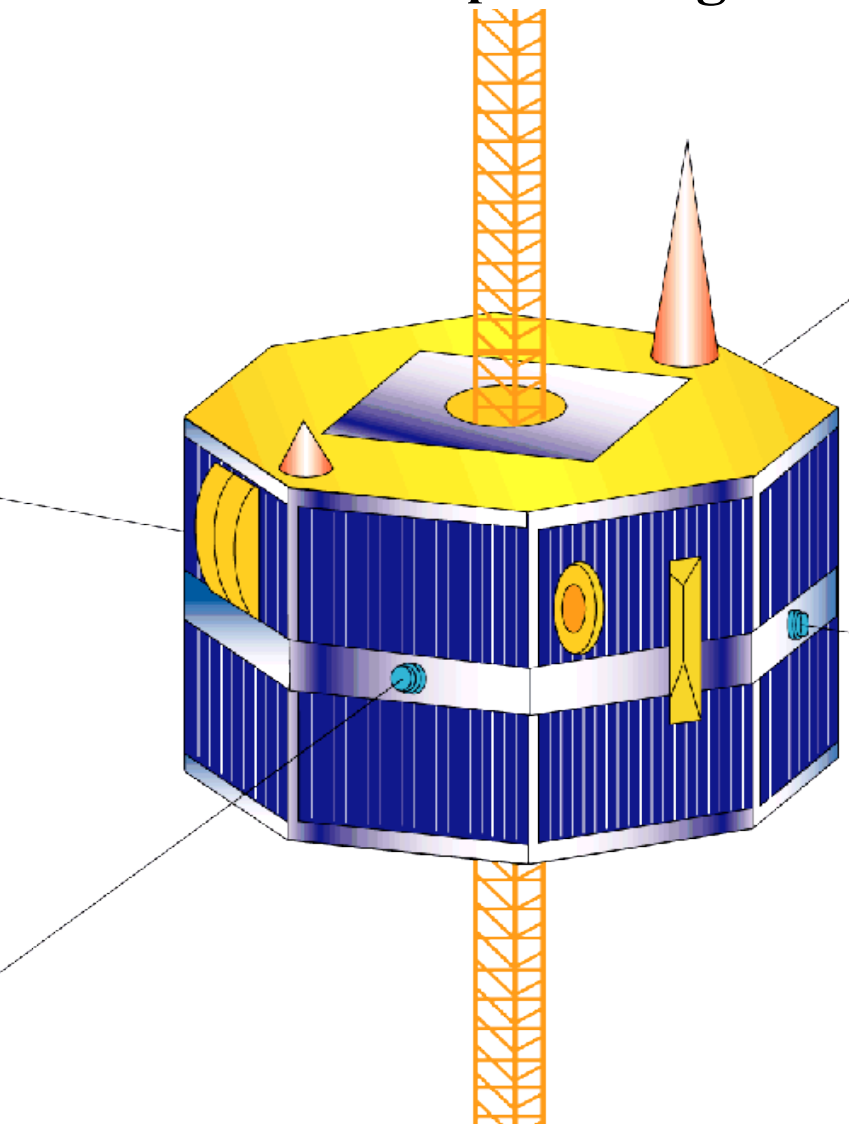
Europa Surface

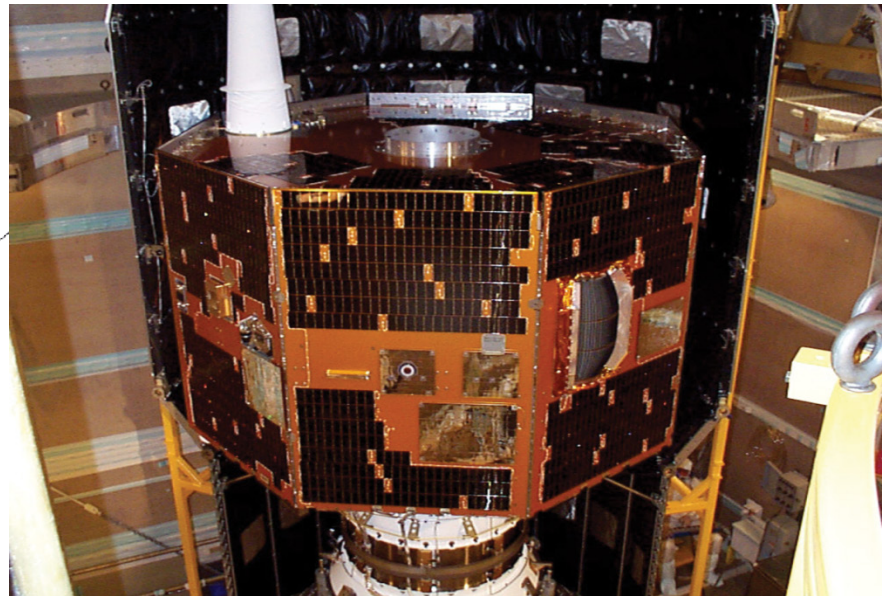


Possible internal structures of icy moons

IMAGE Spacecraft

20-m dipole along z





500-m dipoles in spin plane

RPI:
<10 W radiated power
3 kHz – 3 MHz
300 Hz bandwidth

Launched on 25 Mar 2000

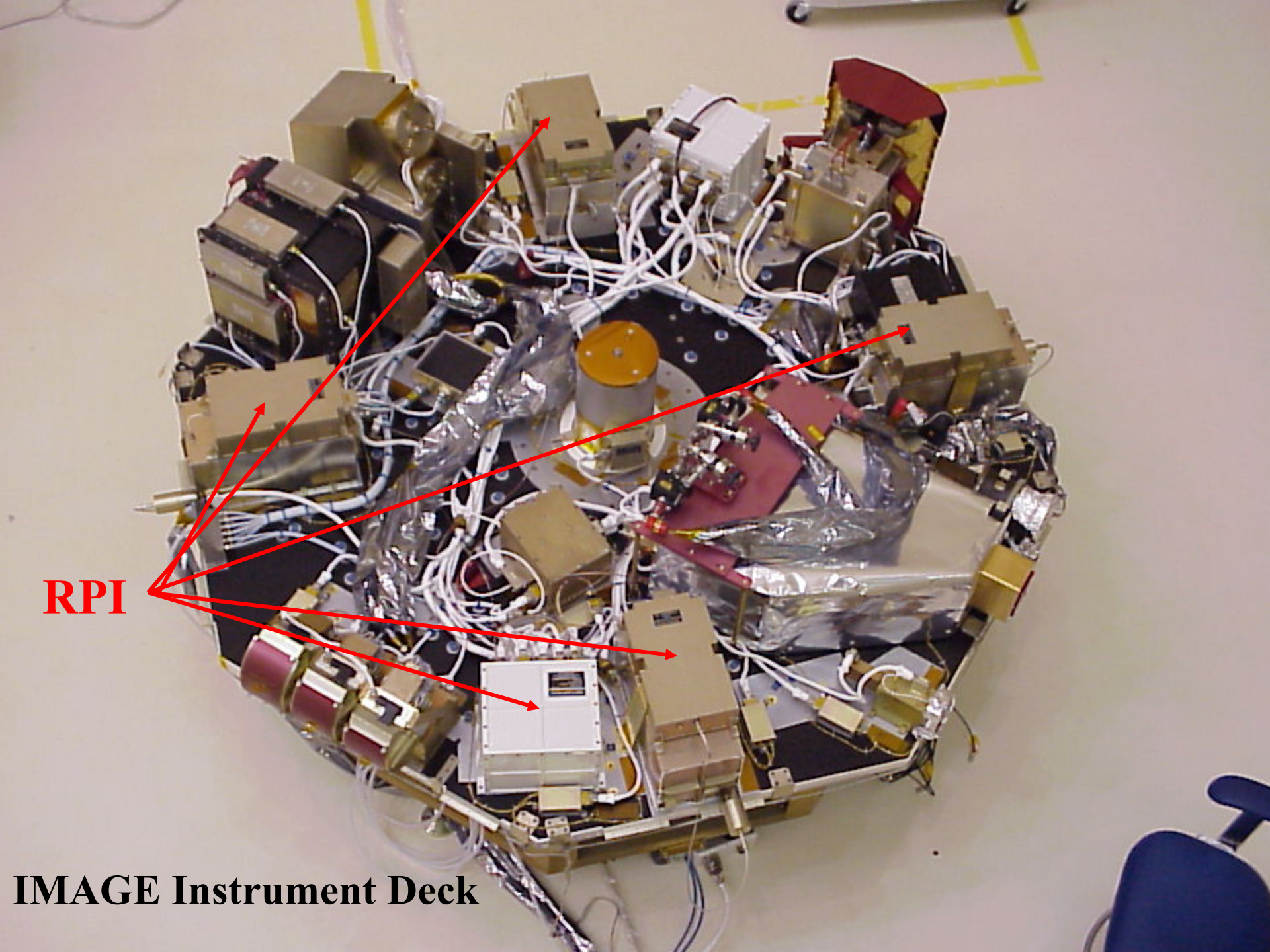
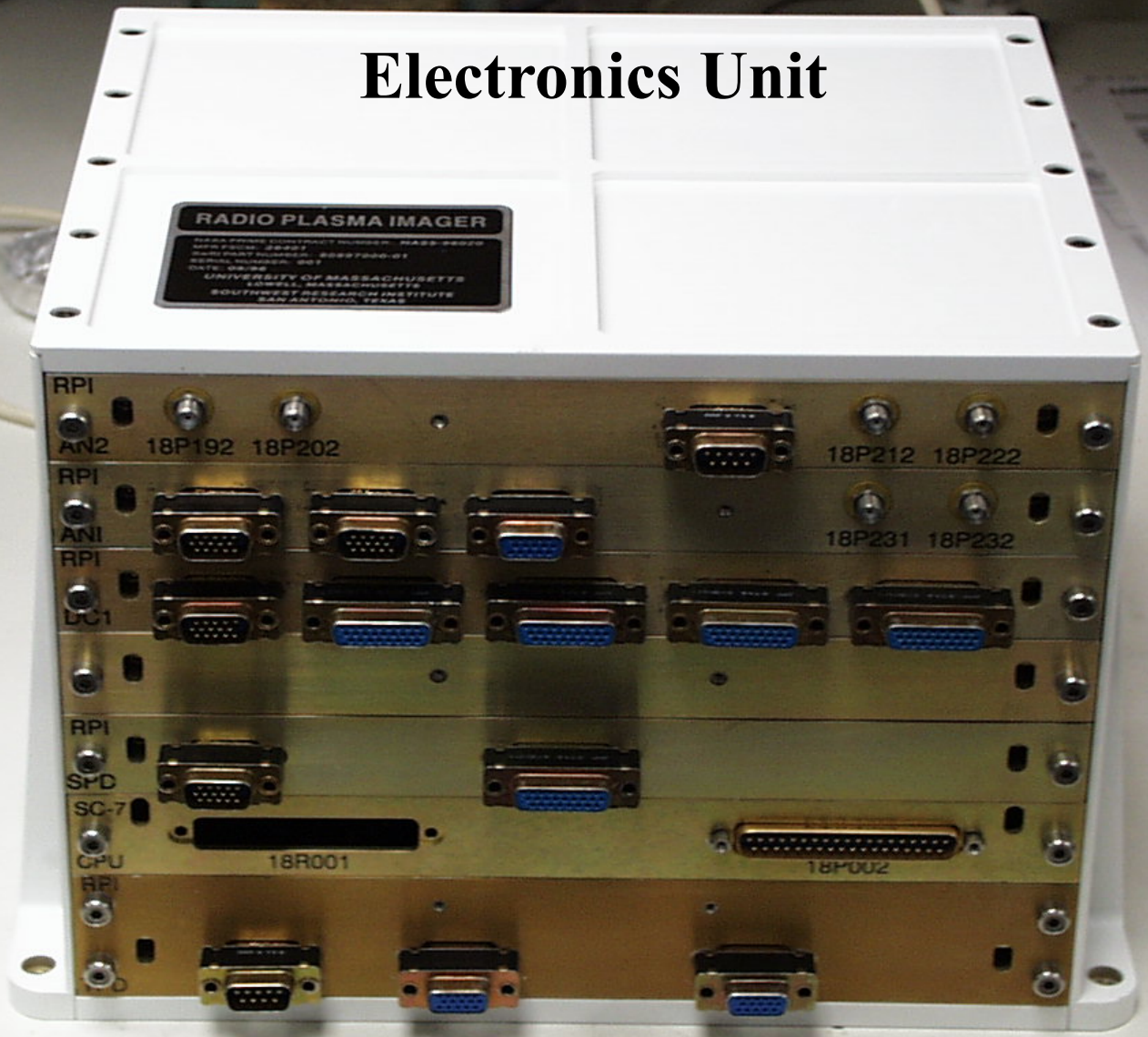


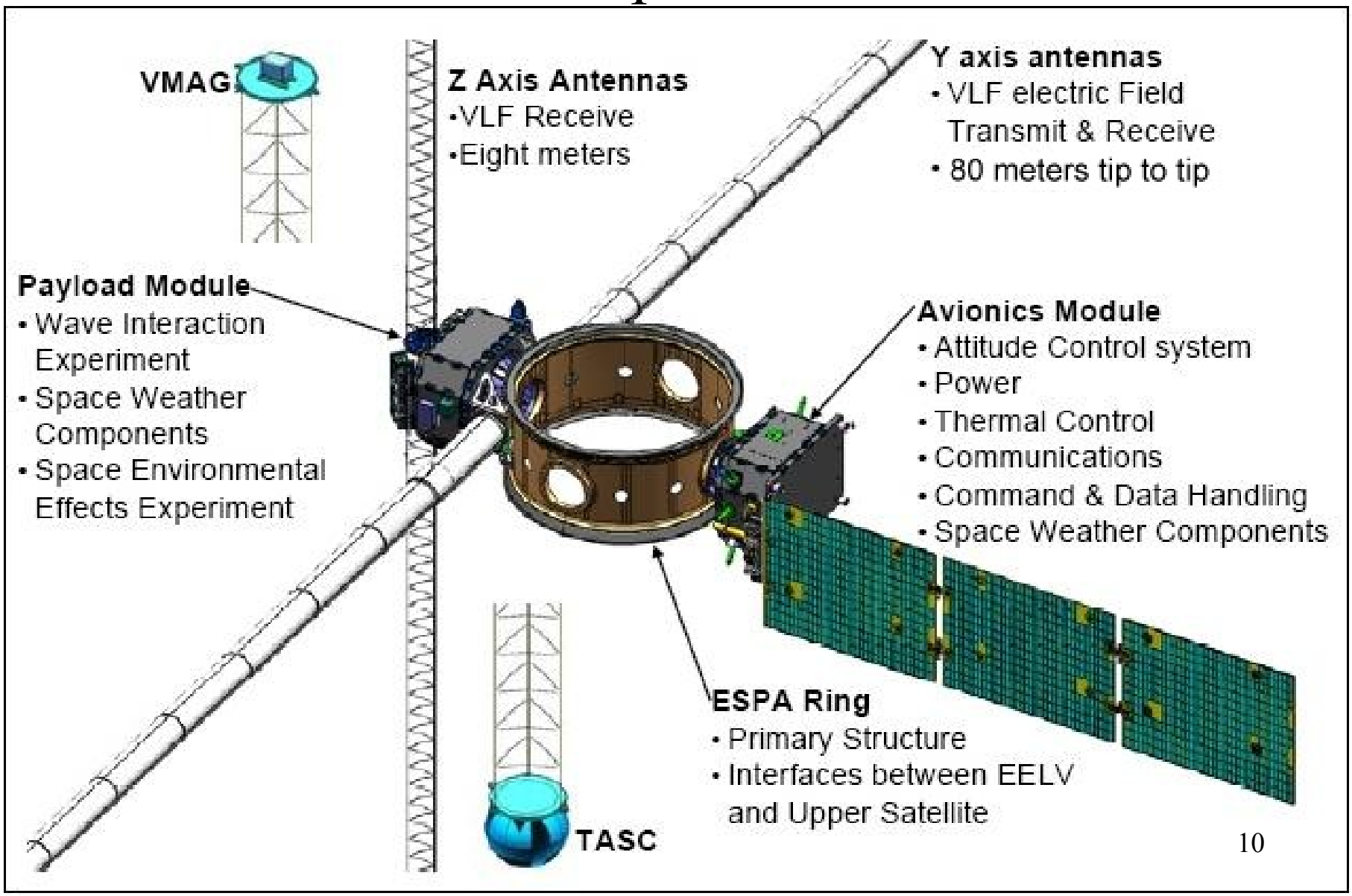
IMAGE Instrument Deck

RPI on IMAGE

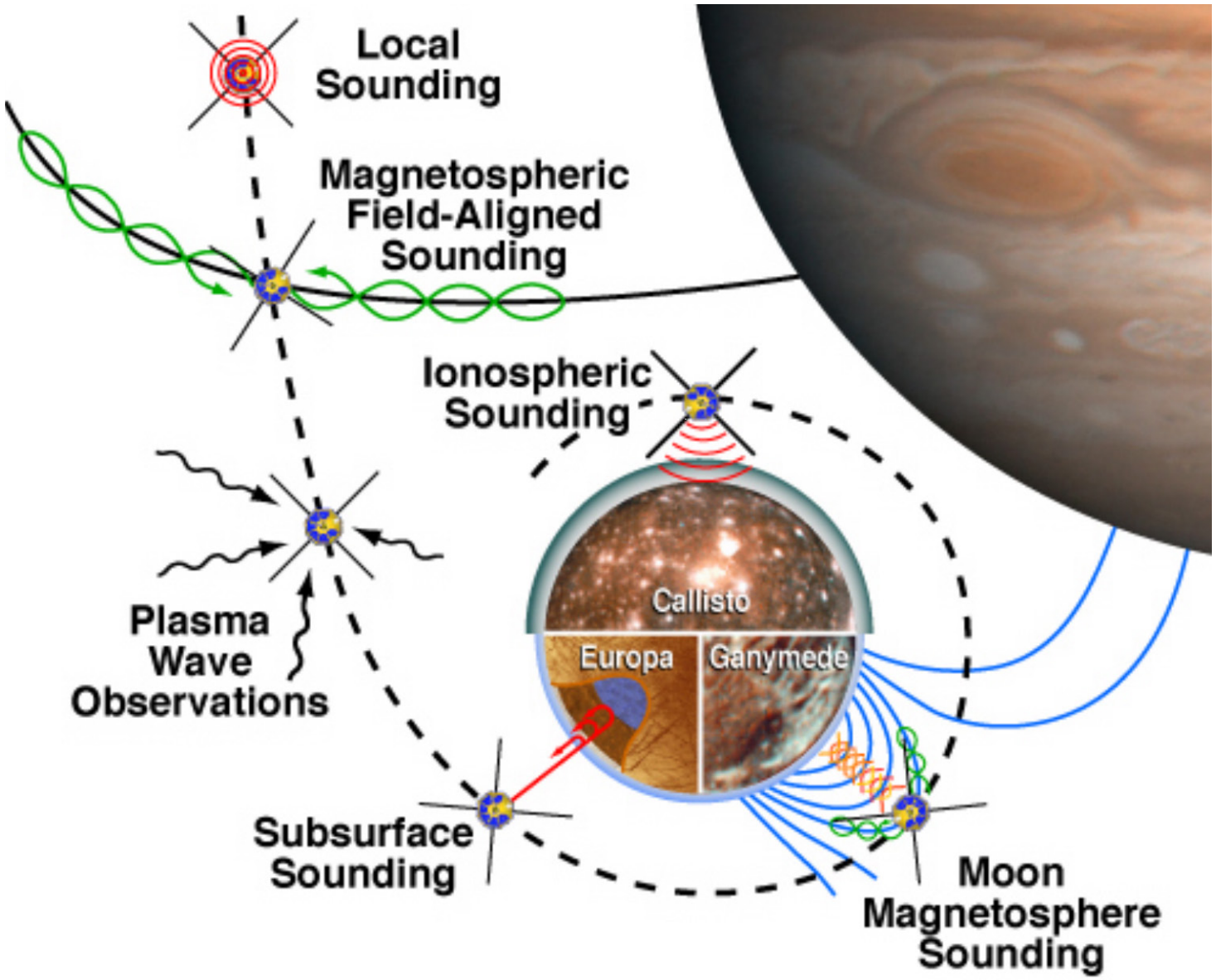
Electronics Unit



Space Transmission
DSX Spacecraft

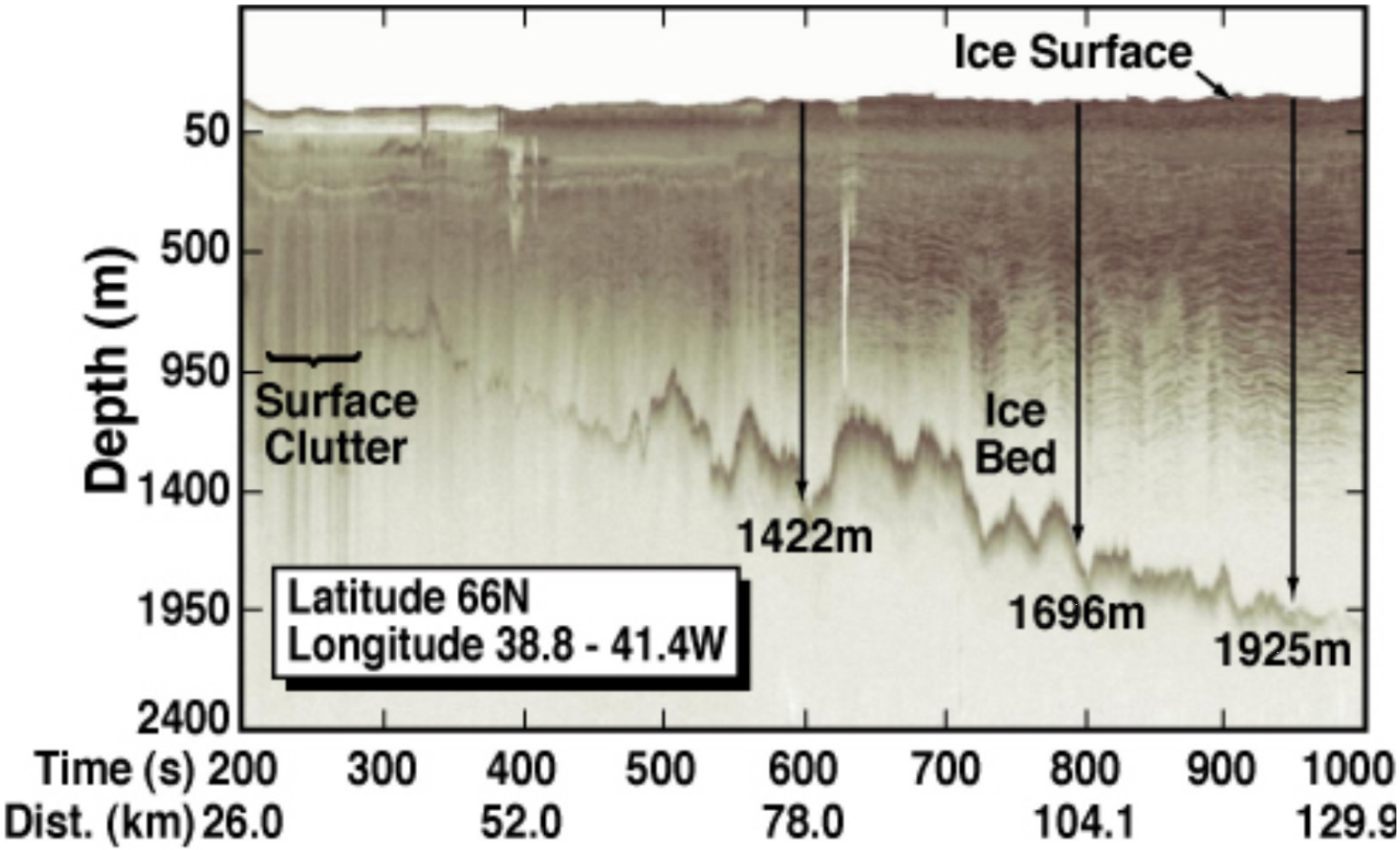


Planetary Advanced Radio Sounder: a 5-in-1 instrument



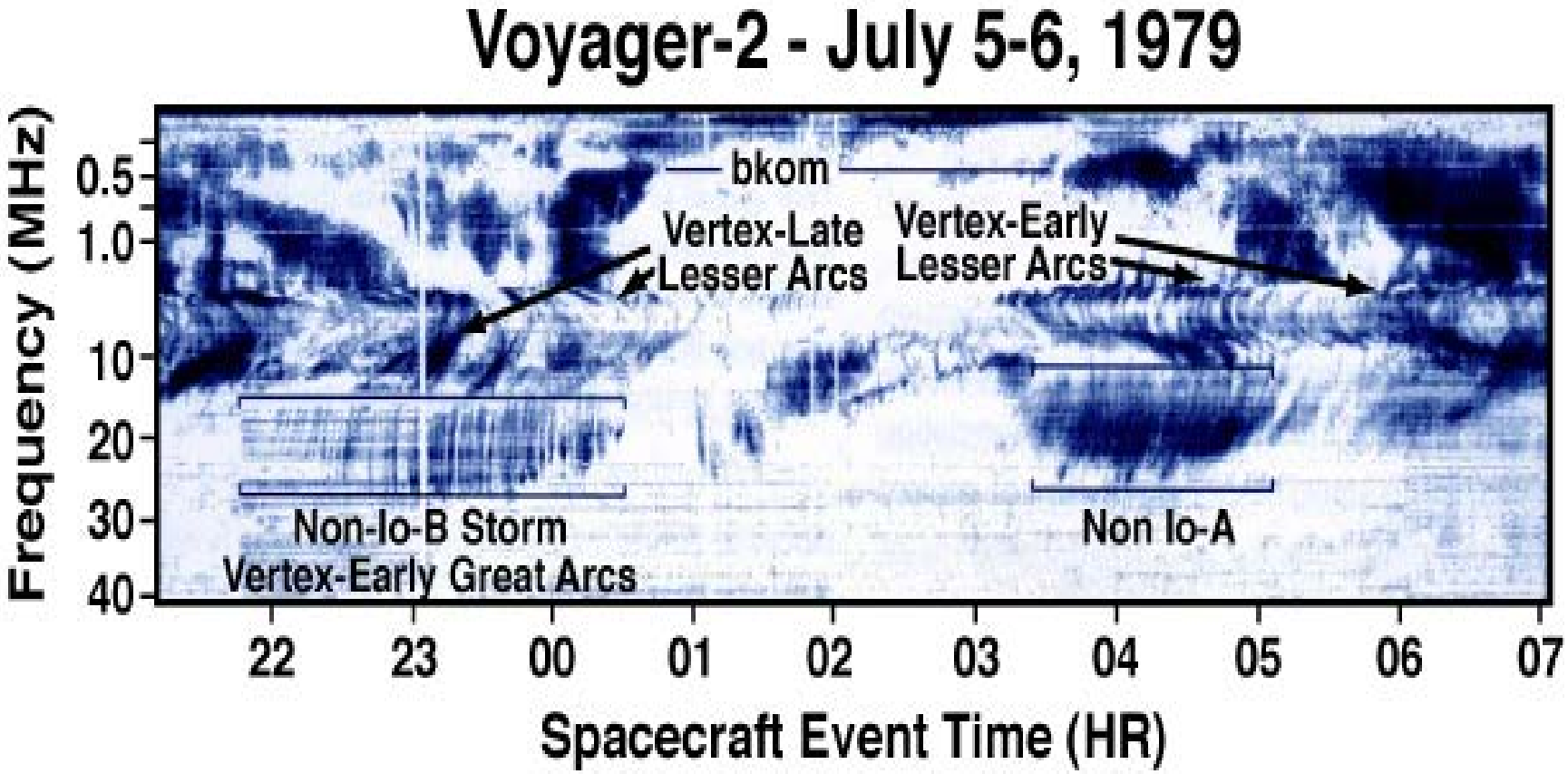
Subsurface Sounding
High-power, 10 ~ 50 MHz

Measuring the height of interfaces



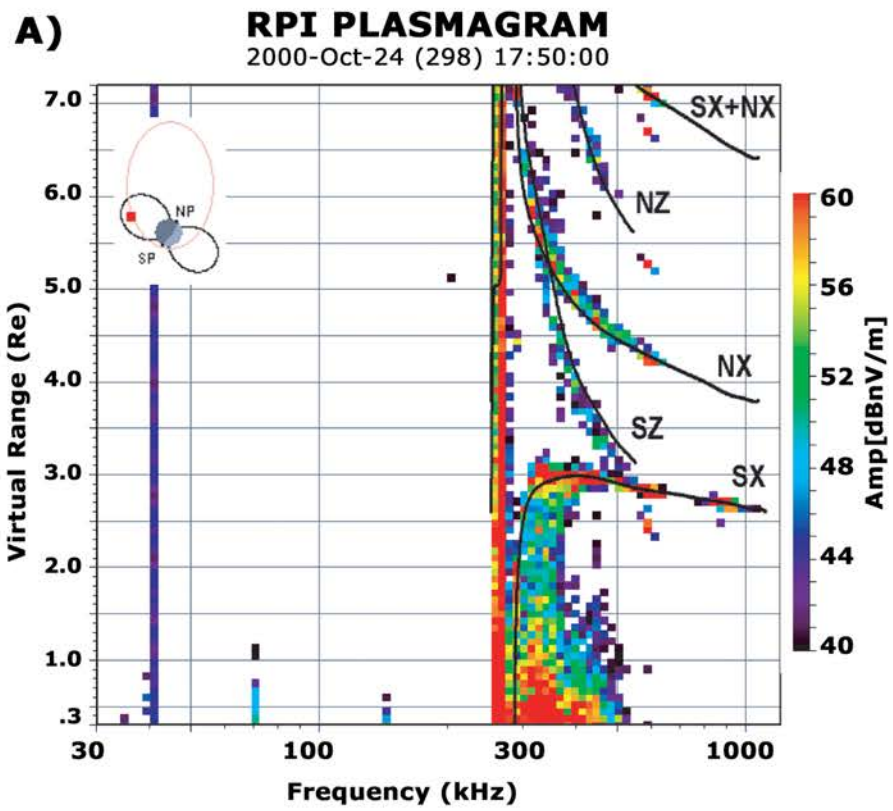
Natural Plasma Waves

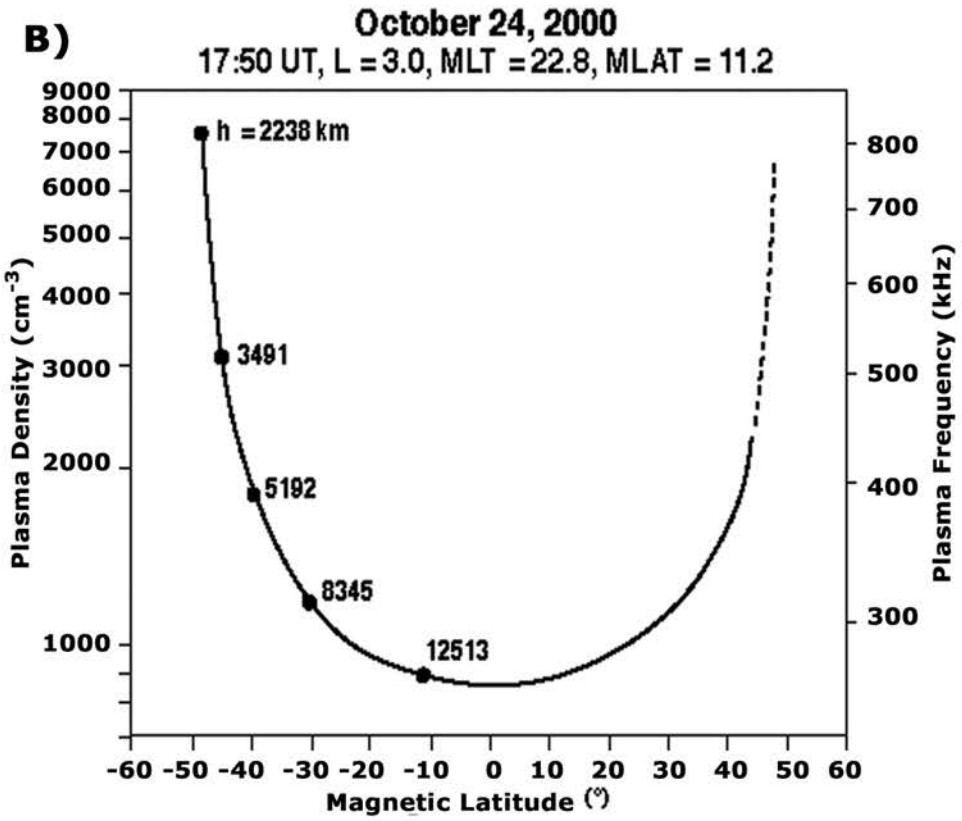
Measuring electric field perturbations at the satellite location



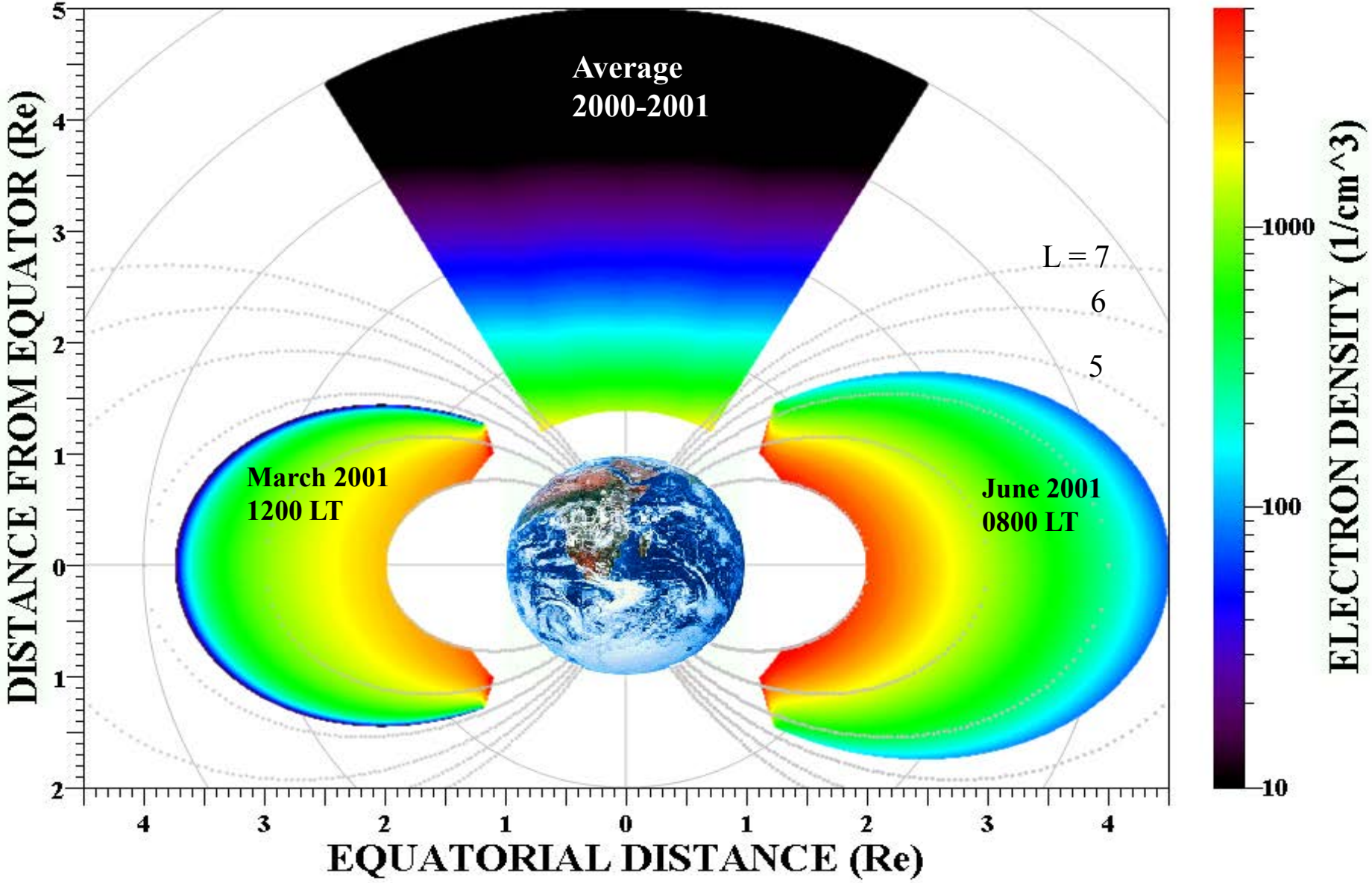
Remote Magnetospheric Sounding

Measuring electron density along the magnetic field line

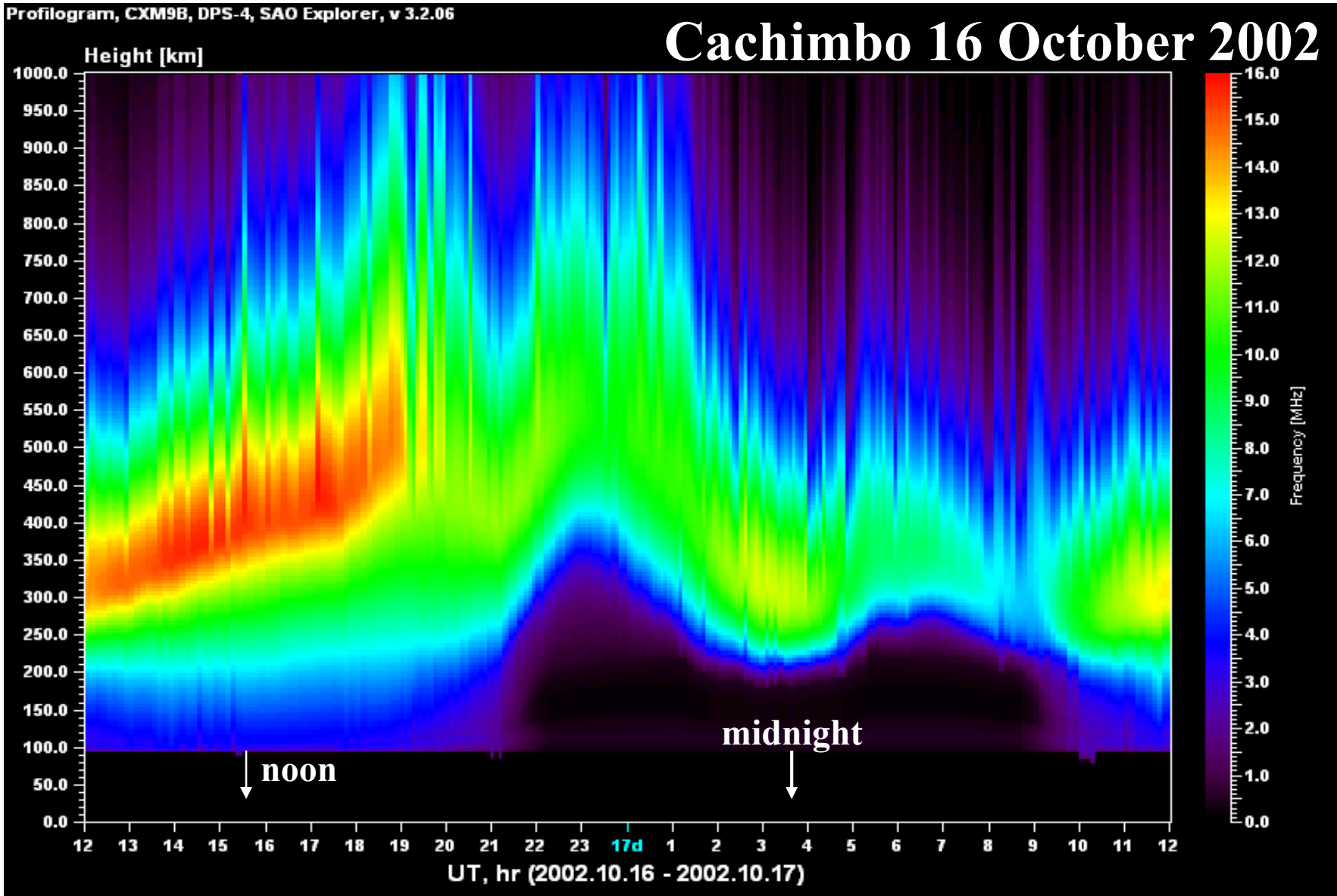




Empirical Magnetospheric Density Distribution

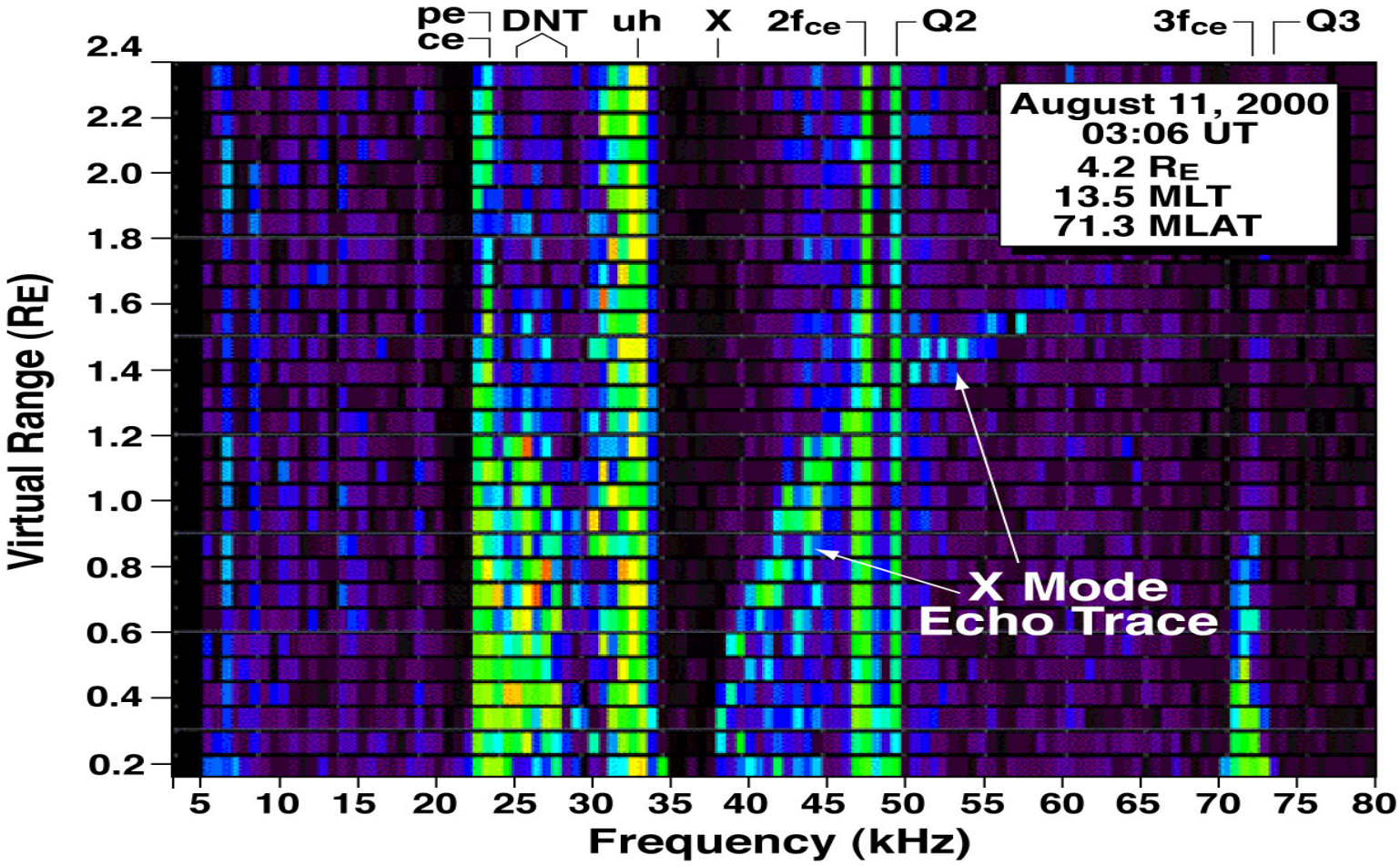


Sounding the Ionosphere



Local Sounding

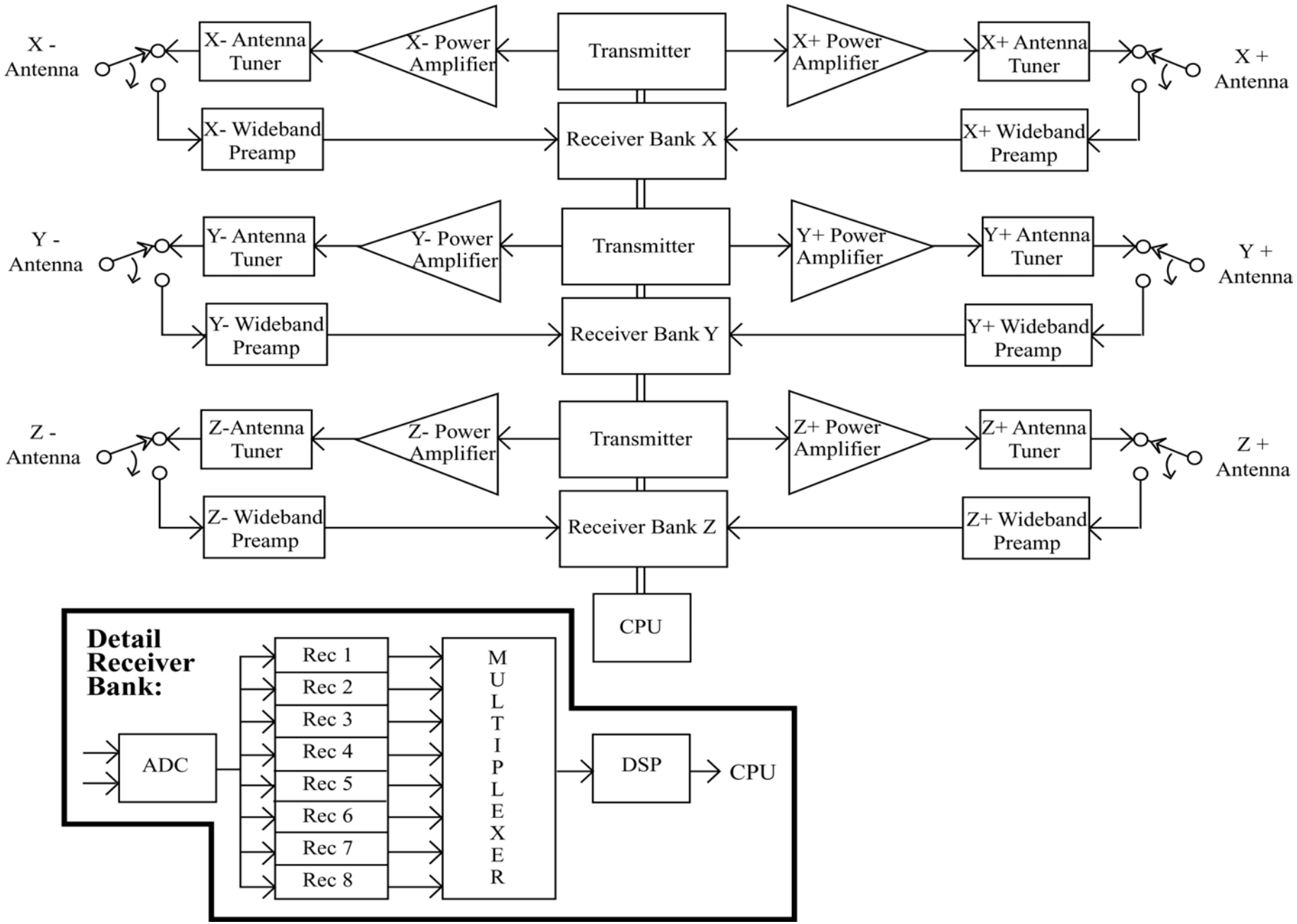
Measuring in-situ electron density and magnetic field strength



Prototype PARS

- High Power Transmission (10 kW)
  - Multiple power amplifiers (6)
  - High-voltage large-current components (<10 kV)
  - adaptive tuning
  - Nonlinear current feeding (multiple frequencies)
- High-spatial resolution and range resolution (10 m, 1 km)
  - Multiple receivers (24 or 32)
  - Dual-frequency transmission (combined with nonlinear feeding)
  - Enhanced range sampling rate (250 ns)
- Large frequency range (1kHz – 50 MHz)
- High data rate (2 Mb/s)
- Numerical modeling and experiments
  - Subsurface modeling and experiments
  - Magnetic field, ionosphere, and magnetospheric environments modeling
  - Ray tracing calculations

PARS Tri-Axis Transreceiver System



Thank You!

Questions?