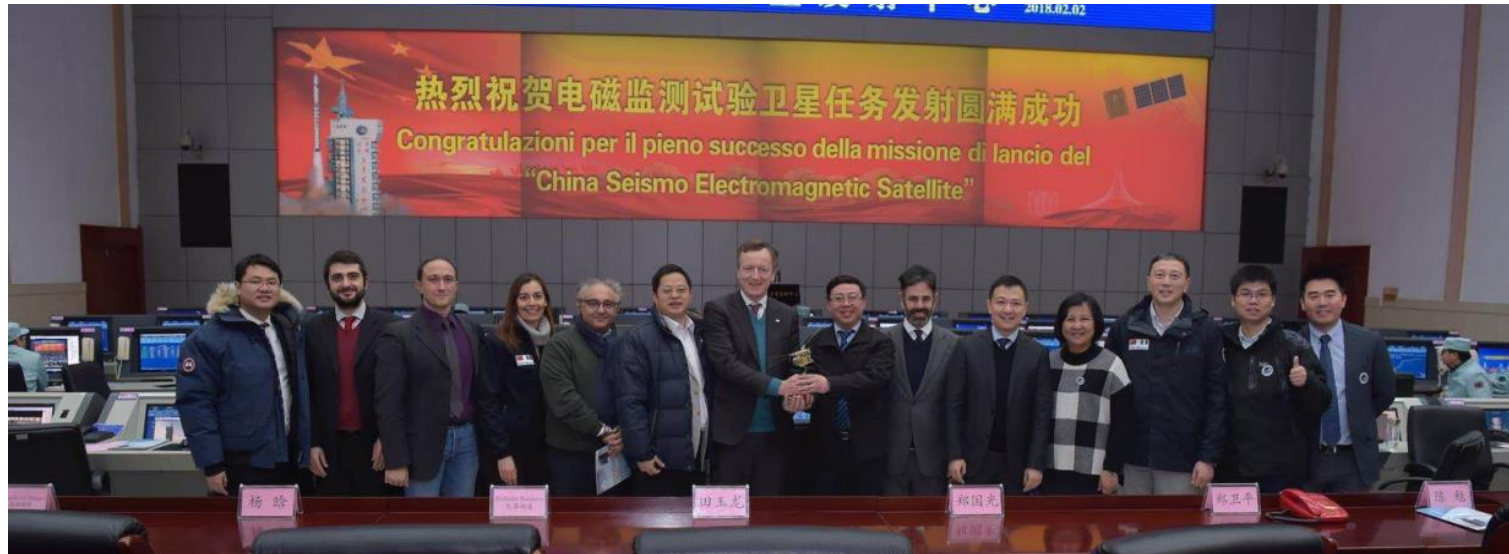
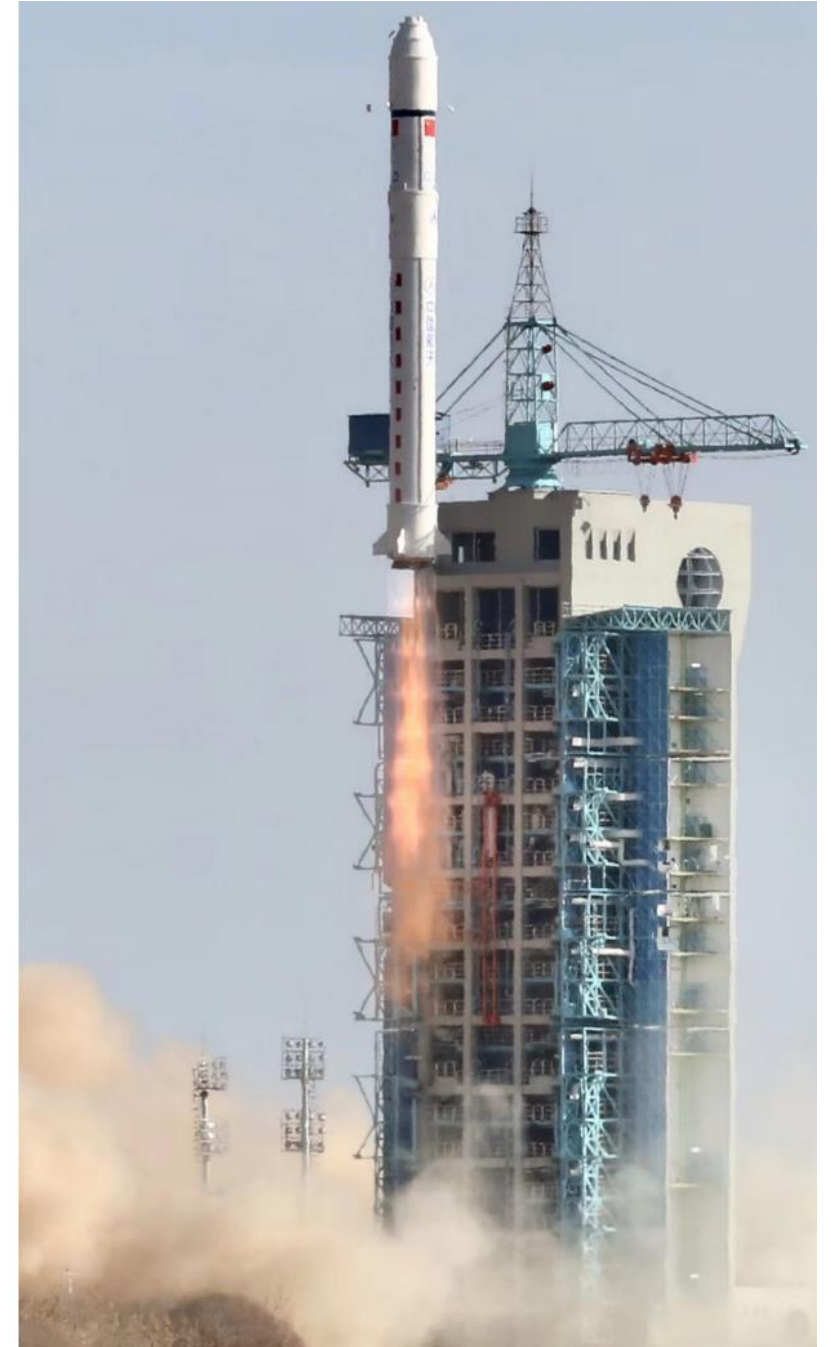
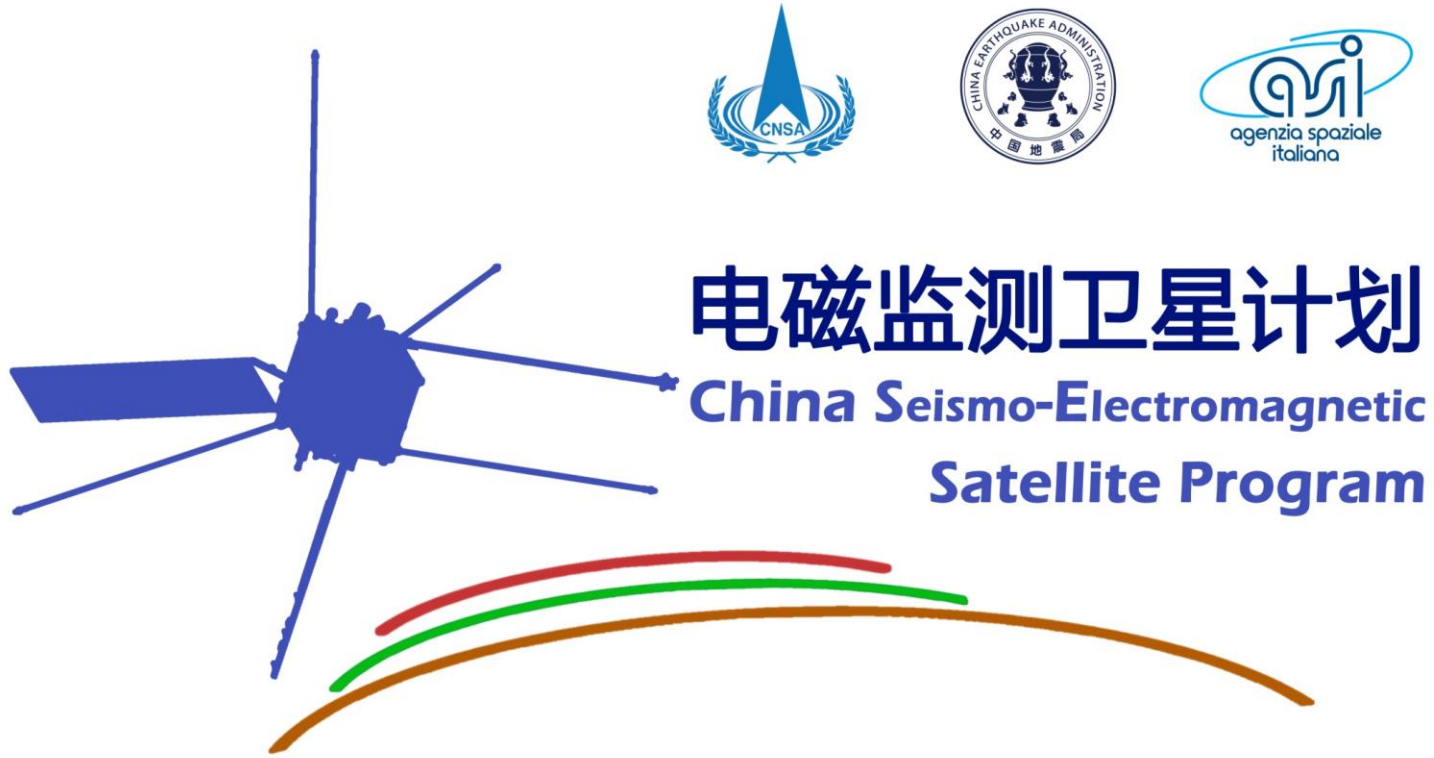




CSES Mission: Italy and China in Space

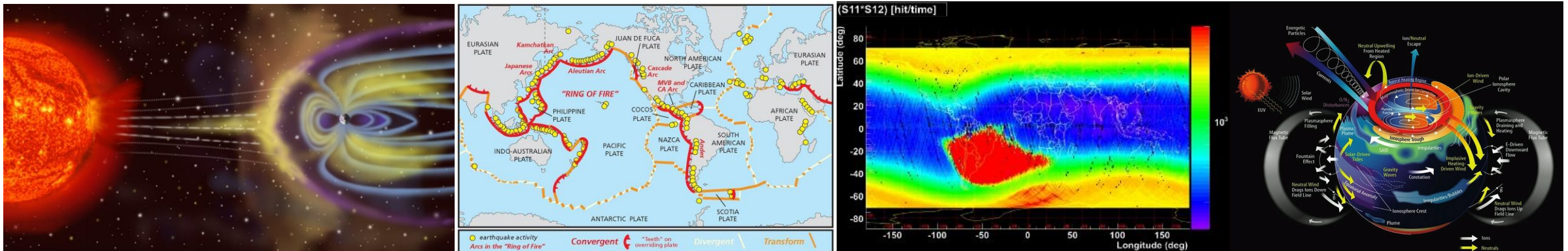
S. Zoffoli – Italian Space Agency

Vienna, 56th Session STSC, 12/01/2019

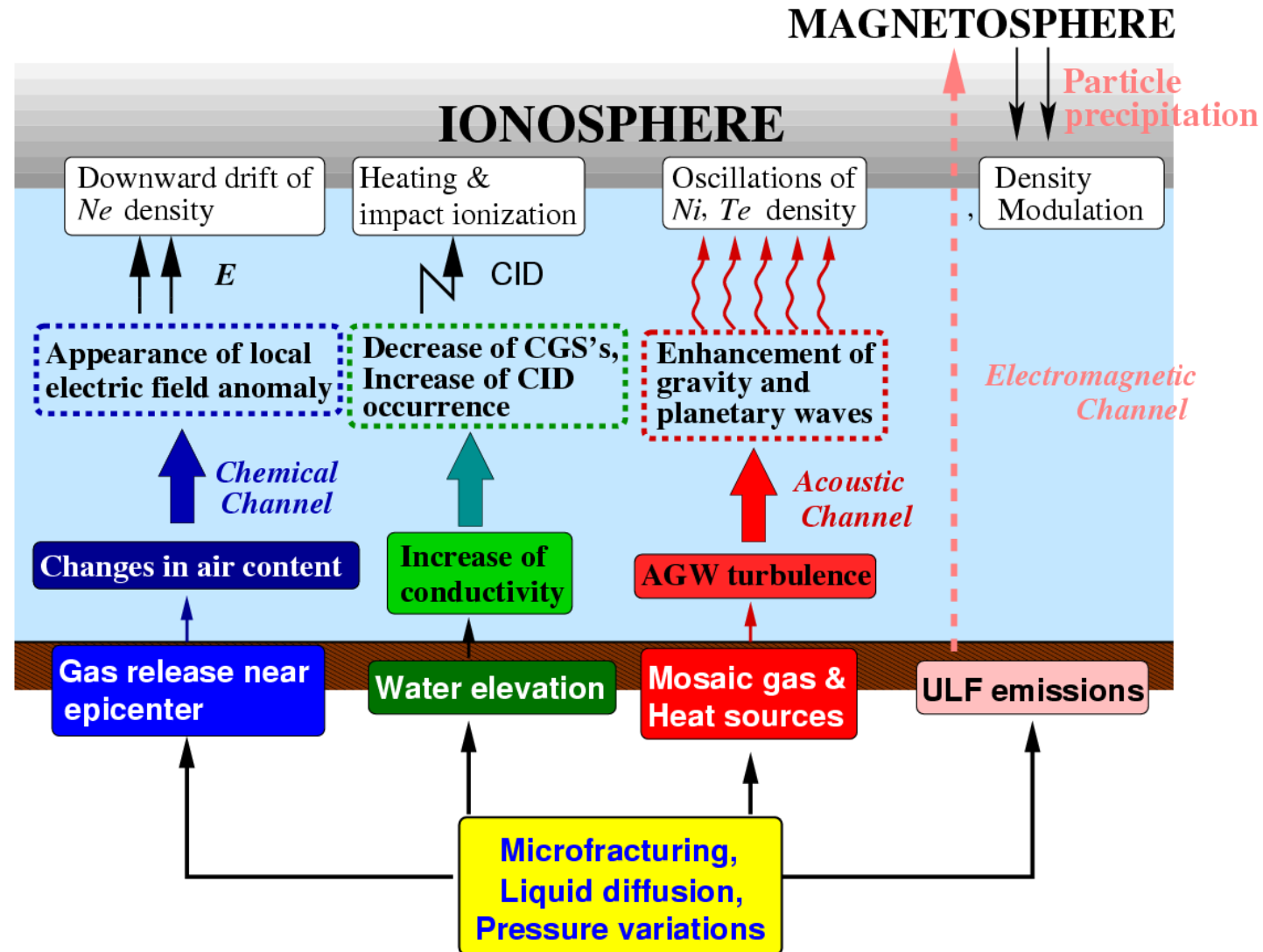


Mission scientific objectives

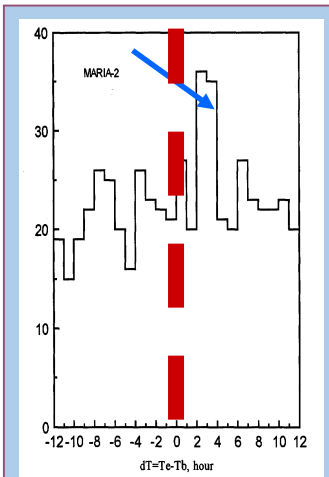
- monitoring **electromagnetic field and waves, plasma and particles perturbations** induced in the ionosphere and magnetosphere
- study **possible spatial and temporal correlation** between electromagnetic disturbances in the top side ionosphere and the occurrence of **seismic and volcanic events**
- study **solar physics**
- monitor **space weather phenomena**



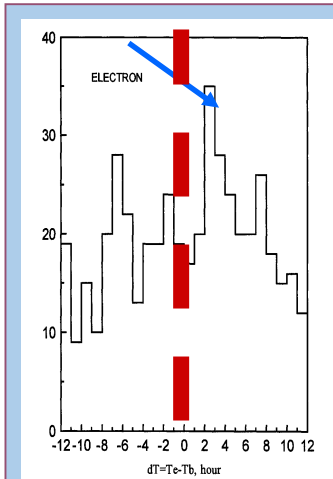
Litosphere-Ionosphere-Magnetosphere Coupling



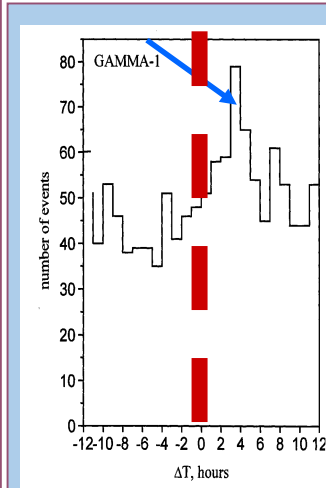
Electro-Magnetic Disturbances



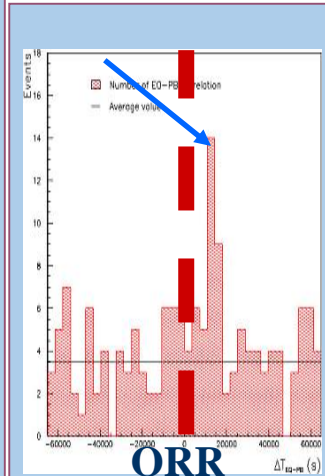
MIR mission
1985-2000
Altitude: 400 km
Inclination: 51°
 E_e : 20 ÷ 200 MeV
 E_p : 20 ÷ 200 MeV



METEOR-3
1985-1986
Altitude: 1250 km
Inclination: 82°
 E_e : ≤ 30 MeV



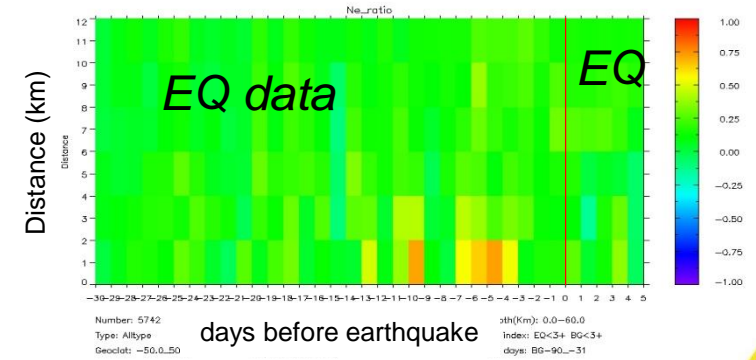
GAMMA-1
1990-1992
Altitude: 350km
Inclination: 51°
 E_e : > 50 MeV



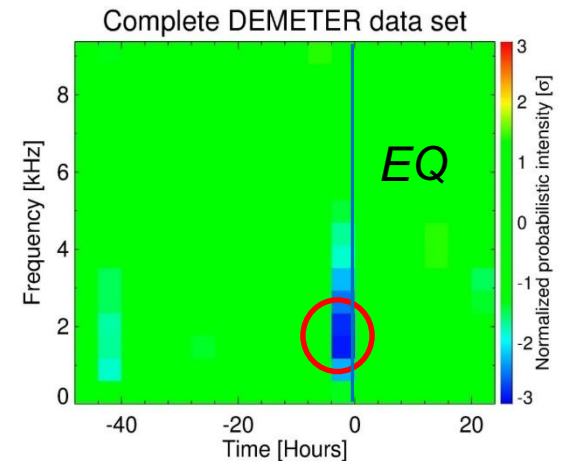
(Orbit Rate Rotation;
July 1992 - May 1994)
SAMPEX/PET
1992-1999
Altitude:
520÷740km
Inclination: 82°
 $4 \leq E_e \leq 15$ MeV

Correlations between EQ & ps: Δ TEQ-PB distributions

Ionospheric Electronic Density



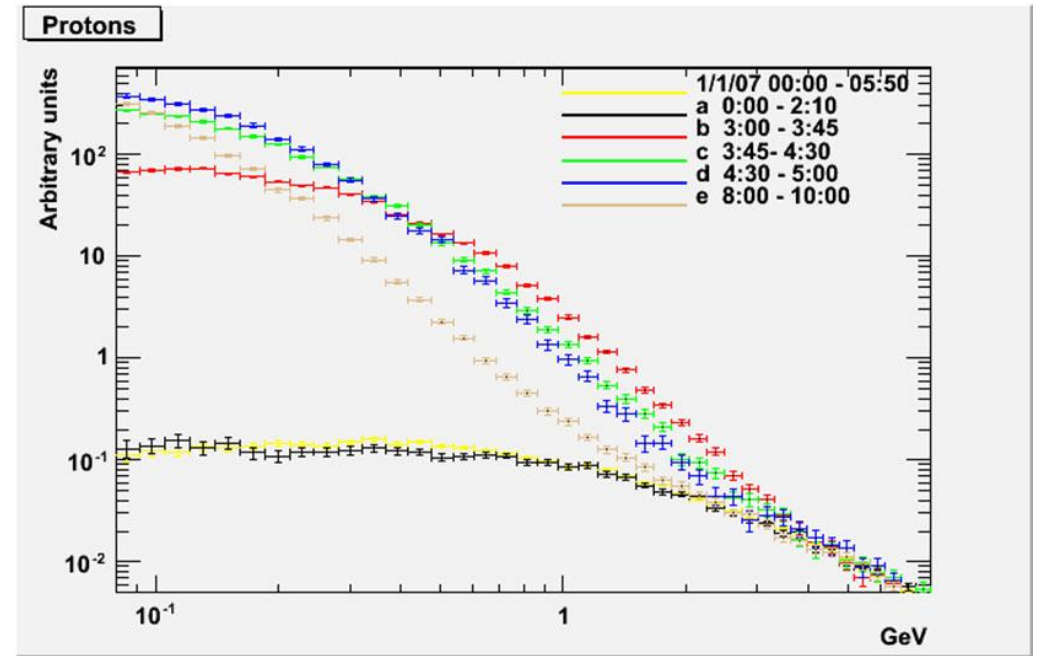
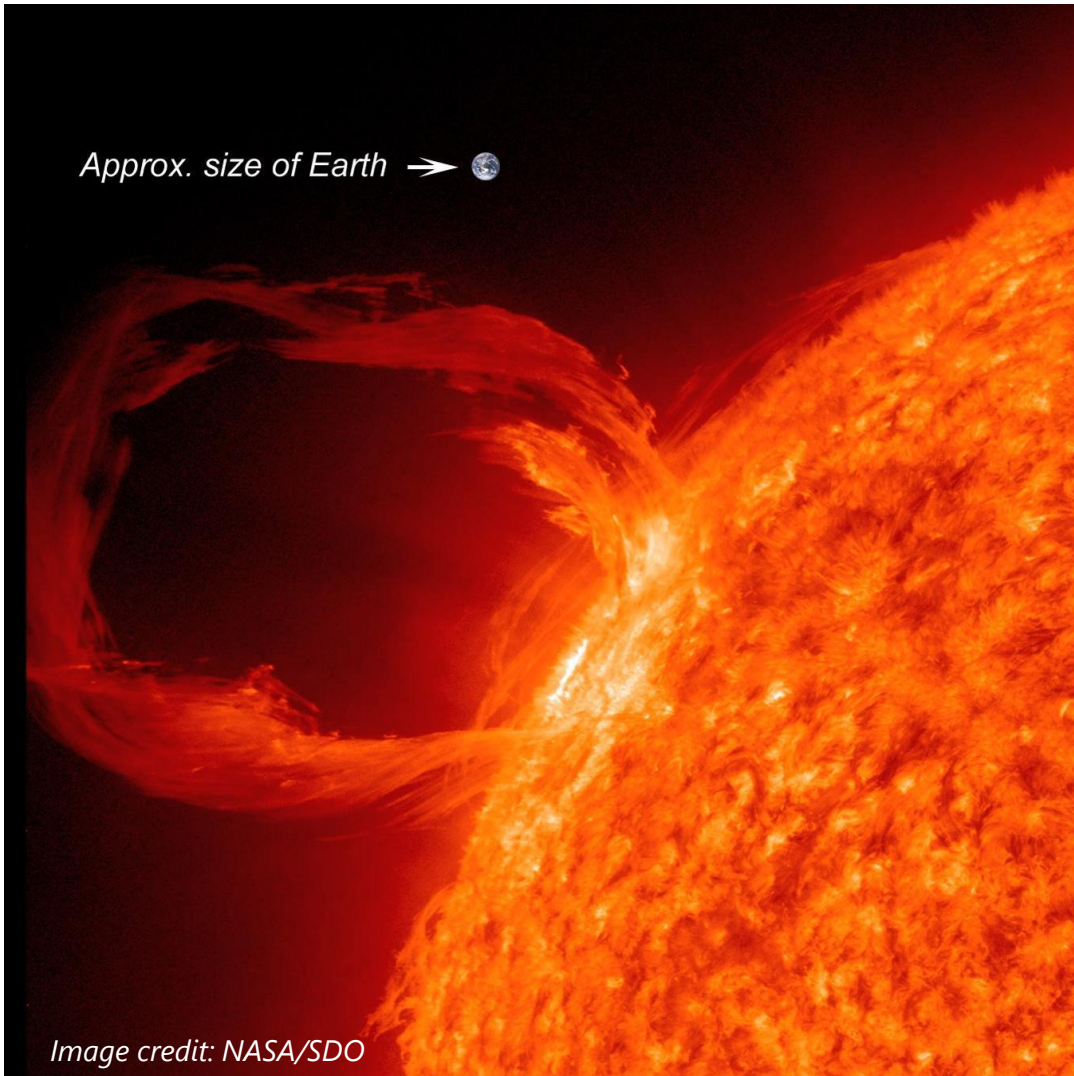
Night time VLF
Electric field Attenuation at ~1.7kHz



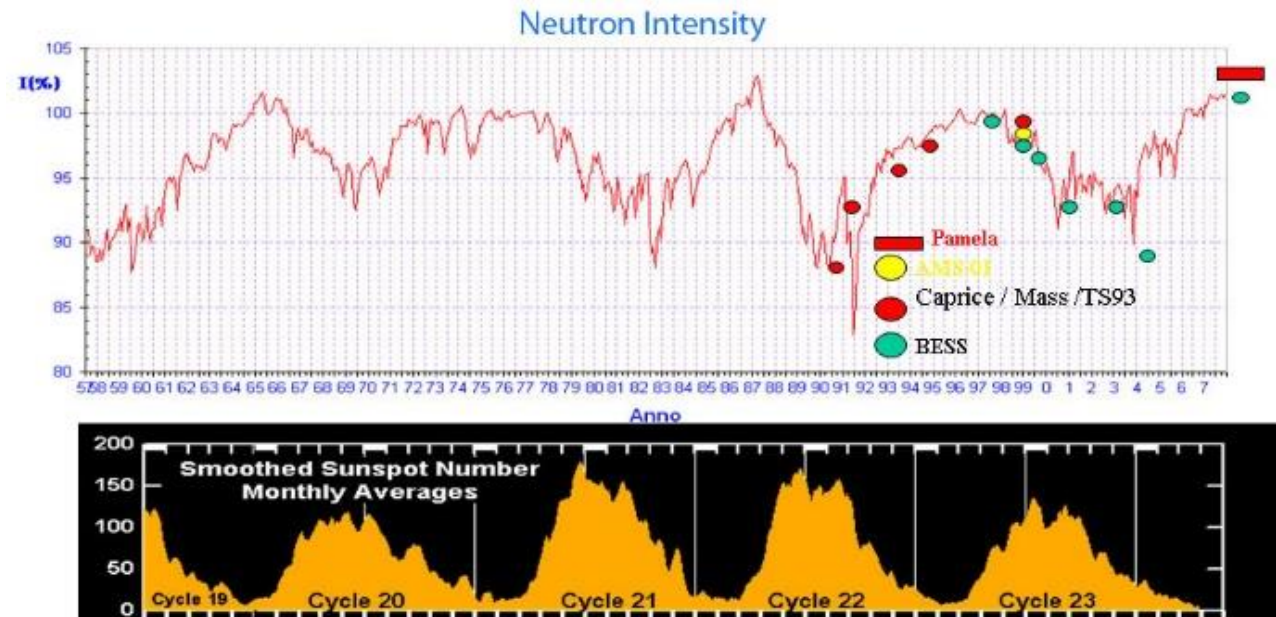
Li & Parrot 2013

Pisa et al. (2012, 2013)

Solar activity

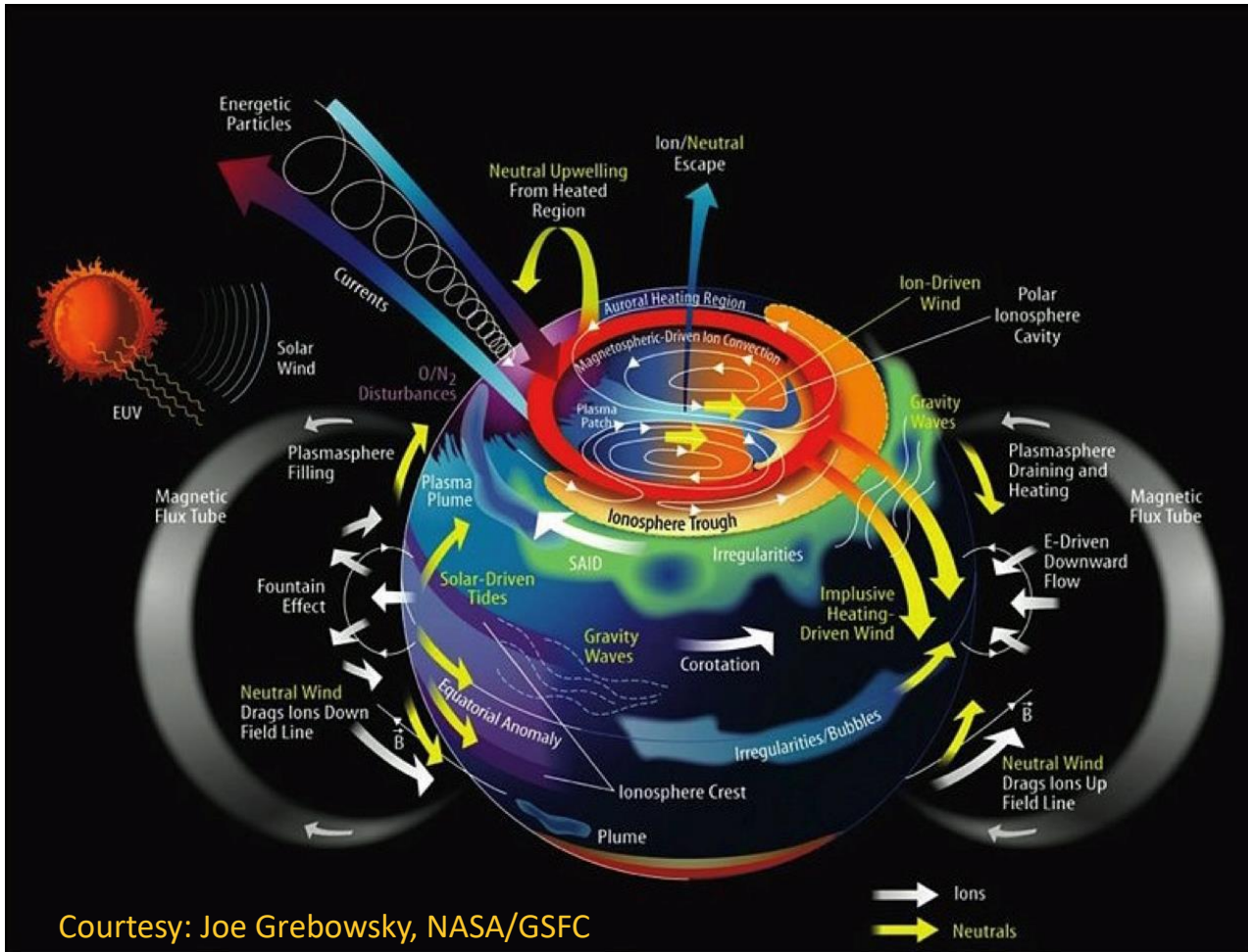


Proton fluxes vs energy - Solar Flare December 13th, 2006



Solar Modulation of Galactic Cosmic Rays

Space Weather



Courtesy: Joe Grebowsky, NASA/GSFC

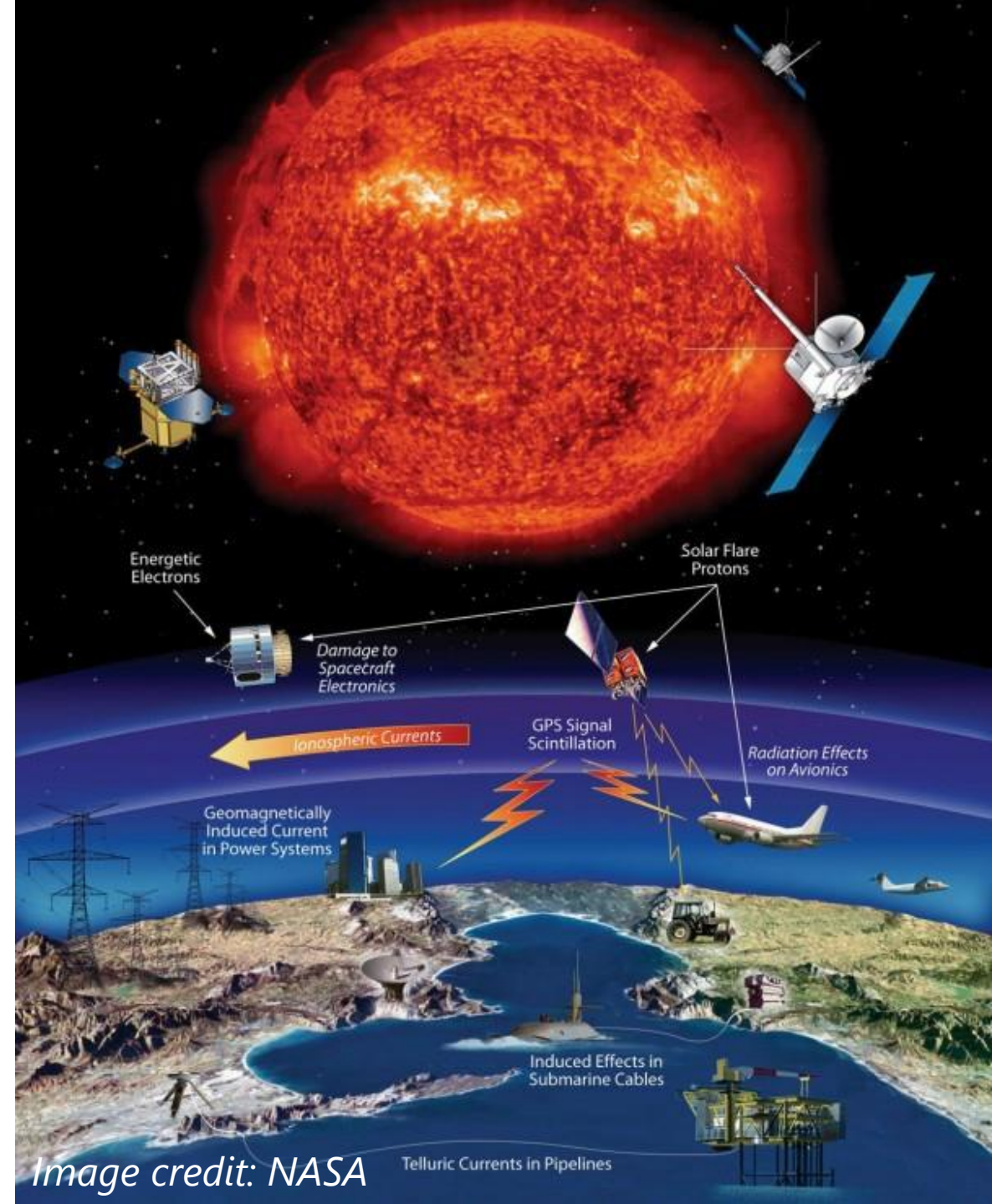
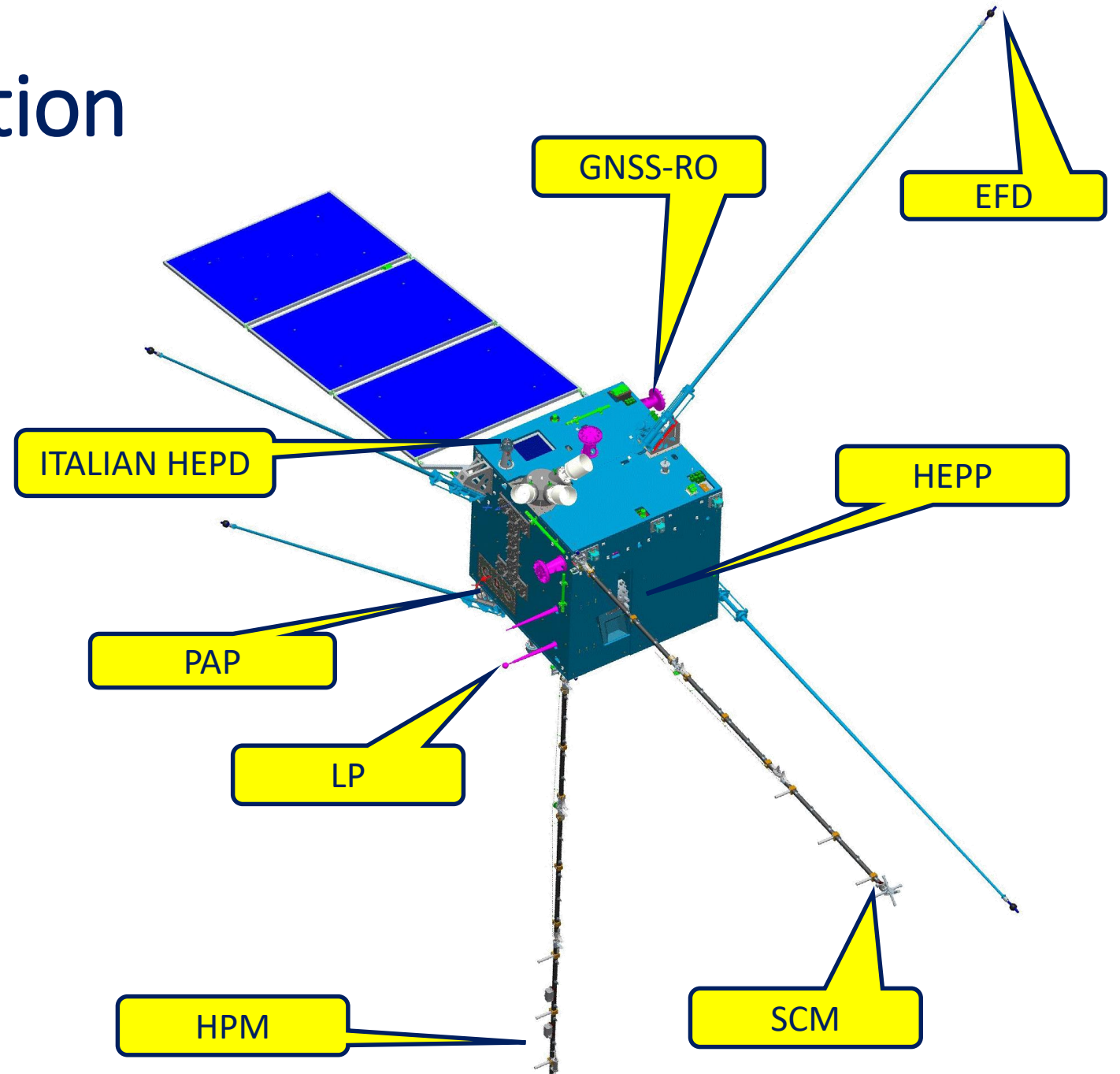
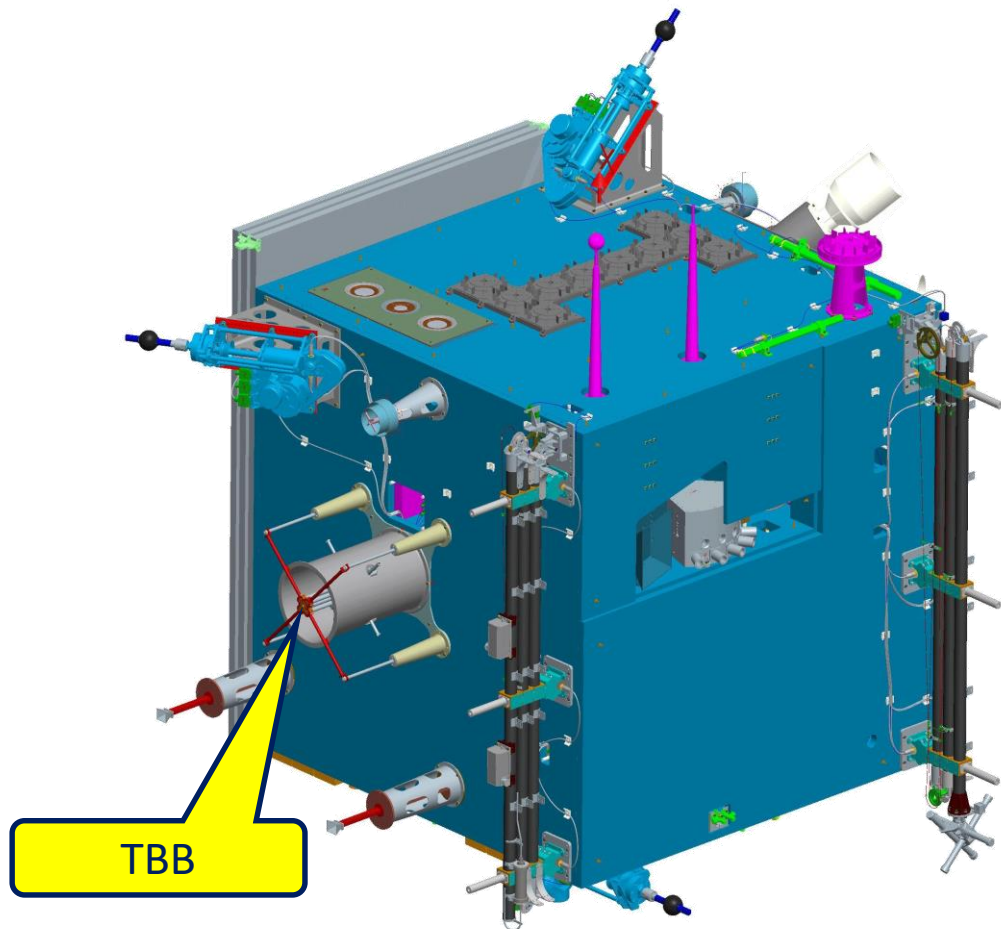
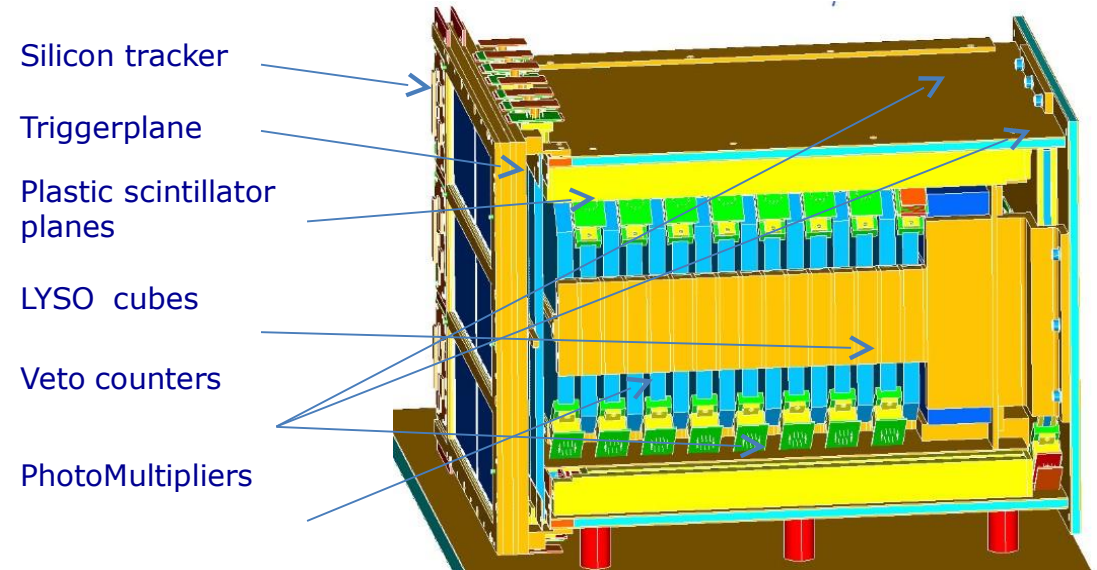
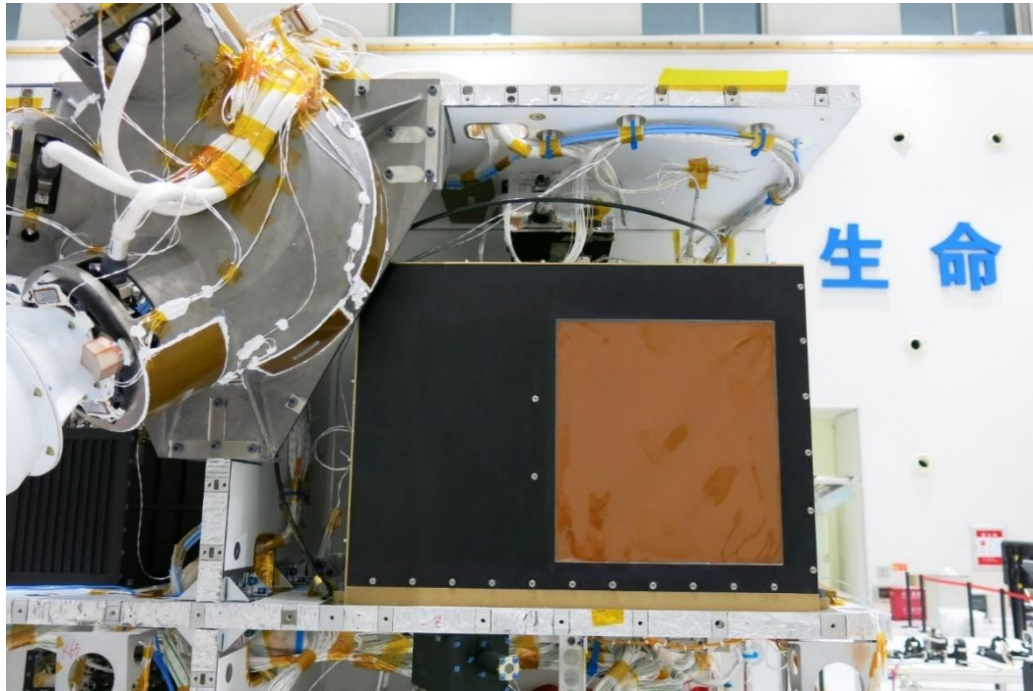


Image credit: NASA

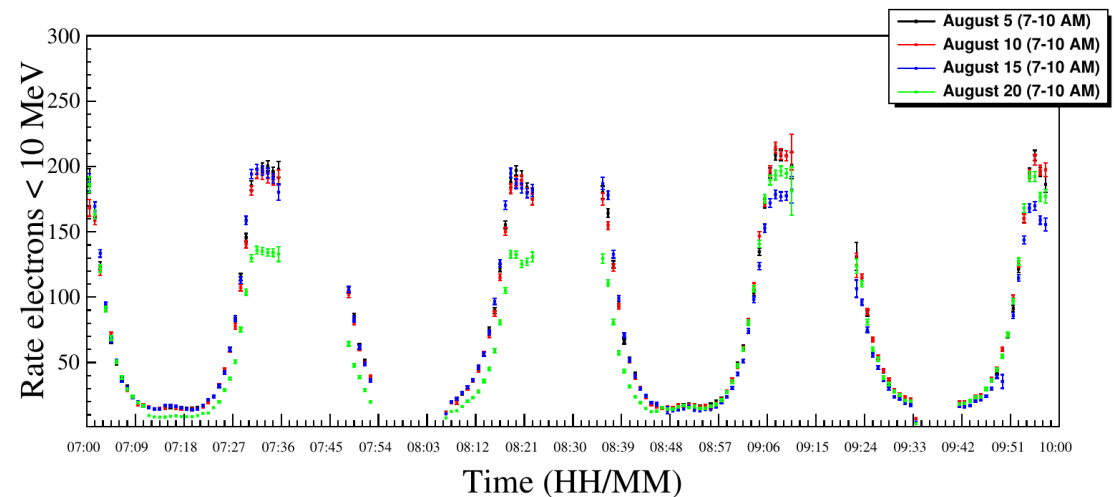
CSES-01 Configuration



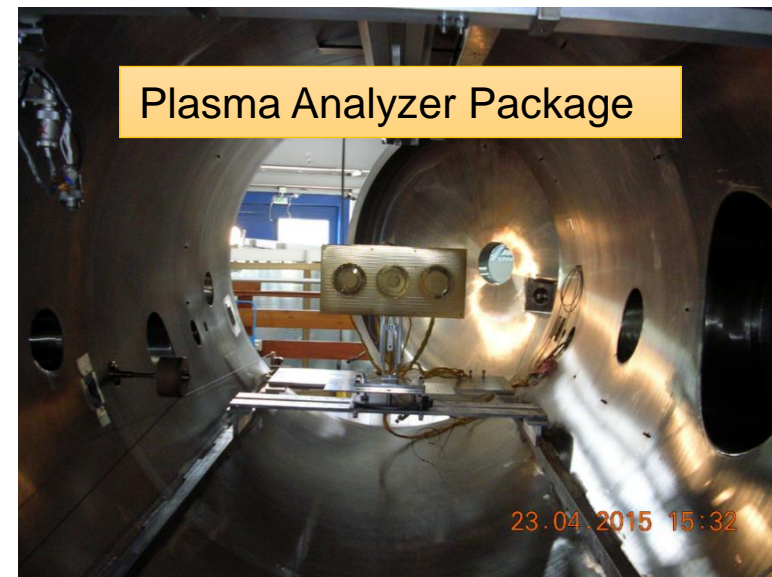
HEPD- High-Energy Particle Detector



- **Energy range**
 - ✓ *Electron: 3 MeV~100 MeV*
 - ✓ *Proton: 30 MeV~200 MeV*
- **Angular resolution** $< 8^\circ$ @ 5 MeV
- **Energy resolution** $< 10\%$ @ 5 MeV
- **Particle Identification** $> 90\%$

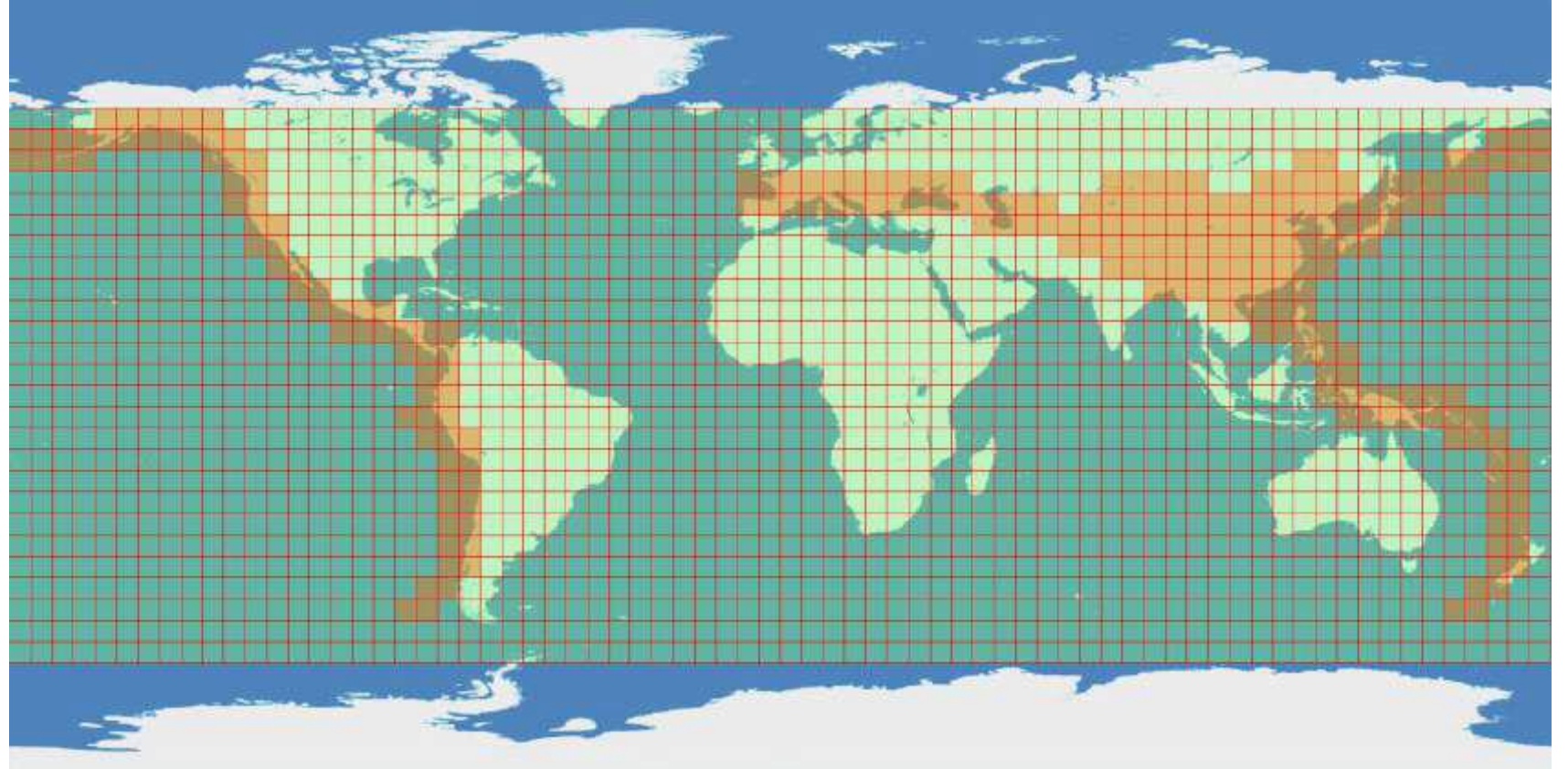


Test in Plasma Chamber @ INAF



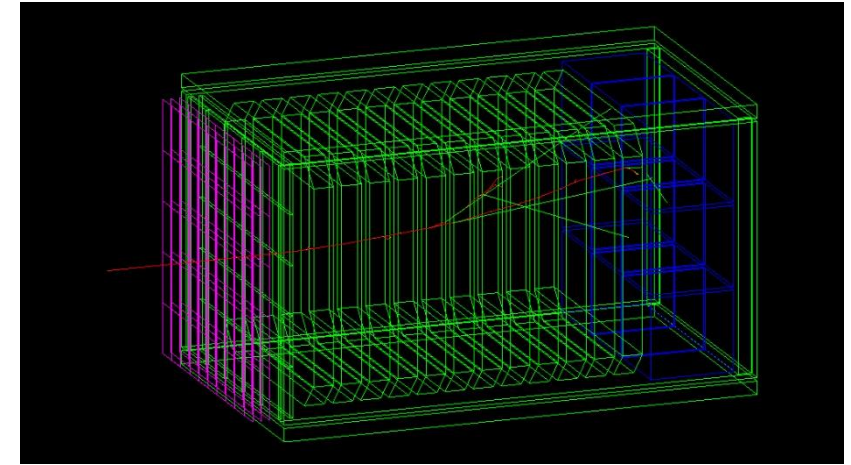
CSES-01 operating mode

- P/L operating zone covers -65° a $+65^{\circ}$
- Burst mode covers seismic belt and China mainland
- Survey mode for the others area

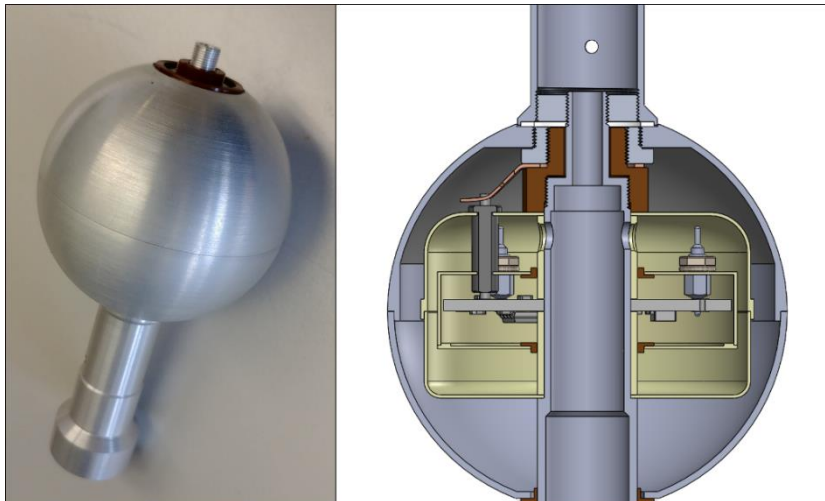


CSES-02 – IT cooperation

- The **High Energy Particle Detector (HEPD-02)** designed to provide good energy and angular resolutions for electrons in the energy range 3 to 100 MeV and for protons in the energy range 30 to 200 MeV.



GEANT4 simulation of a 60 MeV electron entering HEPD-02 from the left. Red tracks represent electrons, green tracks photons.



A probe designed for EFD-02.

- The **Electric Field Detector (EFD-02)** designed to measure electric fields from quasi-DC up to 4 MHz over four different bands (ULF, ELF, VLF and HF) with high sensitivity ($<1 \mu\text{V/m}$ in ULF)

The LIMADOU collaboration



ISTITUTO NAZIONALE DI GEOFISICA E VULCANOLOGIA

