The Relativistic Proton Spectrometer (RPS) On-Line Data Products

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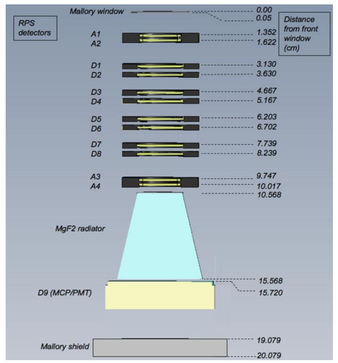
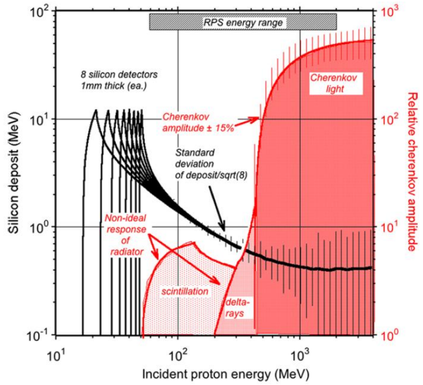
What is RPS?

- RPS measures 60 MeV to >1 GeV protons on NASA's Radiation Belt Storm Probes
- RPS consists of a stack of 12 coaxial silicon solid state detectors (SSDs) followed by a MgF_2 Cherenkov radiator
- Fast coincidence is used to eliminate particles outside the field of view
- Energy deposits in 8 of the SSDs and photons generated in the radiator are pulse-height analyzed to assist in energy/species/direction determination
- The field of view is perpendicular to the spin axis, so RPS obtains angular distributions by analyzing event arrival in the time domain
- Mazur et al. 2012, Space Sci. Rev., http://dx.doi.org/10.1007/s11214-012-9926-9
- The RPS Science Operations Center (SOC) is at The Aerospace Corporation http://rbsp.aerospace.org





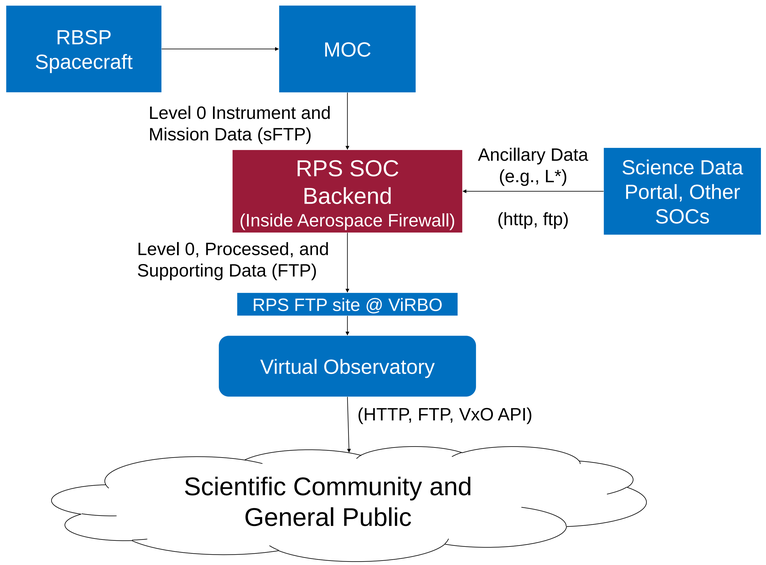
Telemetry Description

- Rate and Housekeeping packet
  - Produced every second
  - Contains singles, coincidence rates, dead time
  - PEN rate reflects coincidence in all active SSDs
  - CHE rate reflects coincidence in SSDs and Cherenkov radiator
- Direct Event packet
  - Produced every second or absent
  - Contains fine time (1/64-second) and pulseheights for D1-D9 (10 bits/ea)
  - Number of PEN and CHE events limited by quotas
- Event quotas change with L shell to optimized telemetry usage
  - Very low quotas near apogee – GCR and solar energetic particles
  - Highest quotas in the inner belt – trapped protons

Event Identification

- The "Enigma" algorithm looks up each 9-dimensional direct event against a database of incident particles and their deposits simulated by GEANT4
- Species identification (H^+, He^{++}, e^-)
- Direction (in/out of forward FOV)
- Incident energy and error estimate

RPS Data Flow



RPS Data Products

Name	Contents	Latency	Reprocessing
Level 0 Data	Raw RPS packets (decoded in CDF, includes space weather data)	1-3 days	By MOC
Level 1 Data	Nearly all L0 data, UTC, energy/photon deposits, singles and coincidence rates, s/c location, RPS boresight vector, magnetic field vector, dead times (including quota effects), minimal OPQ coordinates	L0 + 0-1 days	Daily up to L0+7 days, and on-demand
Energy Spectra, Level 2 Data	UTC, flux versus energy spectrum (once per 5 degrees rotation), pitch-angle and full magnetic coordinates (e.g., L_m, MLT, I, B_{local}, B_{equ}, Φ) of RPS boresight in OPQ and TS models	L1+ 0-2 days	Daily up to L0+7 days and on-demand
Energy-Angle Spectra, Level 3 Data	UTC, energy-pitch angle spectrum (once per spin and once per minute), full magnetic coordinates in OPQ, and TS models	L2 + 0-2 days	Daily up to L0+7 days and on-demand
Global Maps, Level 4 Data	UTC, flux vs E/α_{eq}/L_m, flux vs E/K/Φ, PSD vs M/K/Φ maps (once per orbit leg) in multilple field models	L3 + 0-2 days	Daily up to L0+7 days and on-demand

Data Files

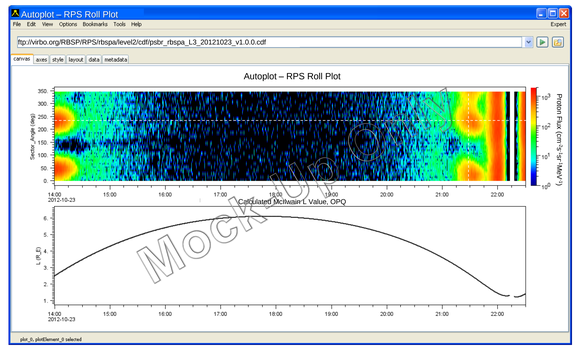
- CDF, ASCII, and HDF5 (CDF is the definitive format)
- ISTP and PRBEM compliant
- File s are versioned X.Y.Z style
  - X – Changes when variables are added, deleted, renamed
  - Y – Changes when processing codes change or other significant change in numerical values
  - Z – All other changes: new RPS data downloads, updated RBSP ephemeris, attitude, magnetic field data, etc
- Flags indicate status of data
  - No "Quick-Look" distinction
  - Most science will be done with Level 2 and higher products

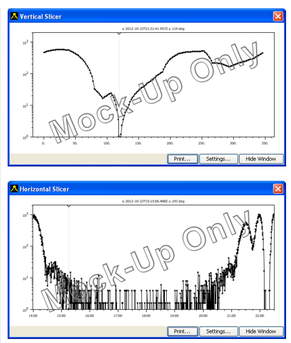
Data Access at ViRBO – Virtual Radiation Belt Observatory

- Data Only: ftp://virbo.org/RBSP/RPS
- Web/VxO Interface: http://virbo.org/RBSP/RPS

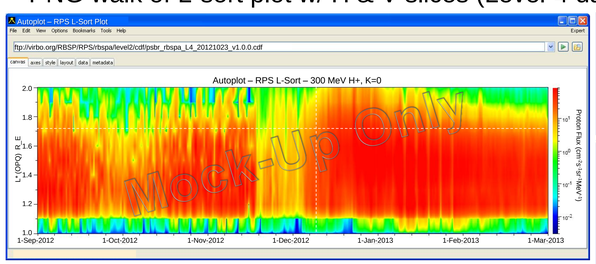
Autoplot – Interactive Browse Plots

Browse plot of pitch angle roll plots with H & V slices (Level-3 data)





PNG walk of L-sort plot w/ H & V slices (Level-4 data)



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