SPENVIS Tutorial: mission concept

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Last and near-future SPENVIS features

- 4.6.1 (June 2009)
  - RB: IGE2006/POLE (e^- geostationary orbit)
  - SEP: Rosenqvist et al. update of JPL-91
  - GCR: ISO-15390, Nymmik et al 1996
  - Surface charging: Burke's equation, Auroral environment
  - DICTAT v3
  - Orbit generator: Martian and Jovian orbit
  - Jovian Radiation belts
- 4.6.2 (December 2009)
  - java-based geometry definition tool → Laszlo H.
  - ECSS space environment standard ← Eamonn D.
  - SPENVIS Kernel, Help pages (broken links)

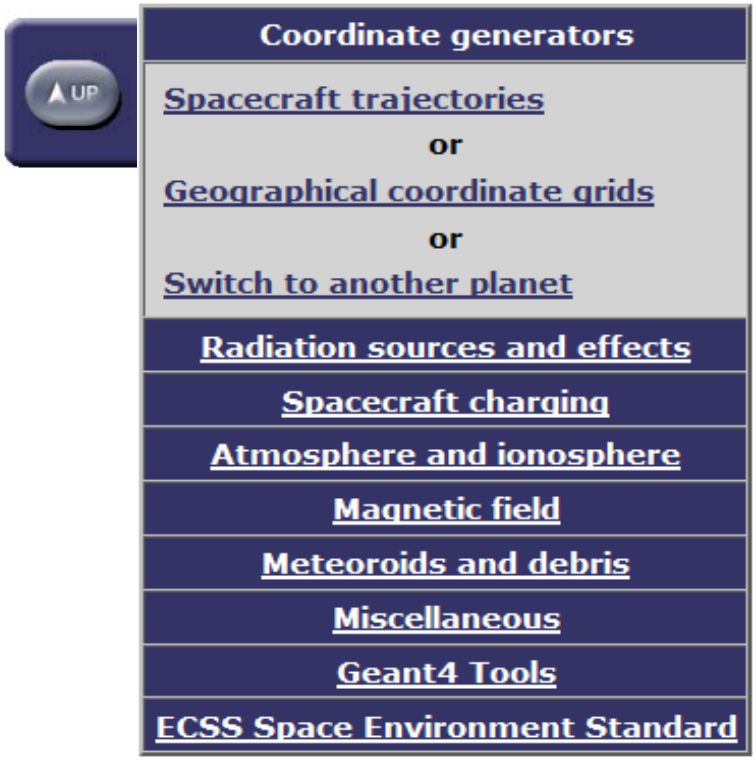
Last and near-future SPENVIS features

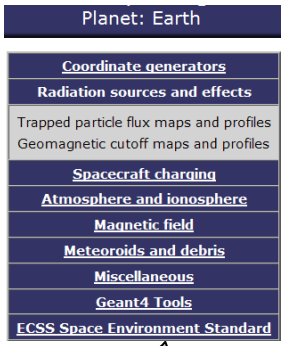
- 4.6.3 (February 2010)
  - Mars Energetic Radiation Environment Models → Wednesday
  - Relative Damage Coefficient converter (Tada et al 1982)
  - Magnetocosmics and Planetocosmics → Neophytos M.
  - Ionospheric NeQuick model
  - PSYCHIC model (Solar Energetic Particle)
  - MC-SCREAM model for solar cell degradation **(???)**
  - Upgrade of Single Event upset rates → Erwin DD.
  - Geant4 tools (user interface) → Neophytos M.
  - index page (help), Result export facility

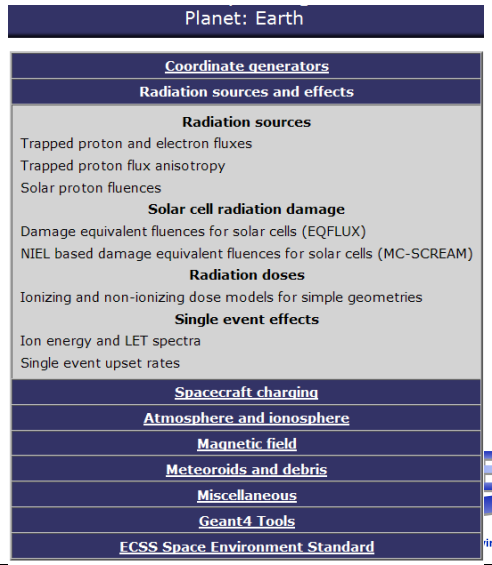
- Near future (4.6.4, 4.6.5)
  - Spacecraft trajectory: new upload, hyperbolic
  - SEP flux and GCR fluence separated from LETORB → Erwin DD.
  - SEP & GCR for other planets → Erwin DD.
  - Update of magnetic shielding based on Magnetocosmics
  - Outgasing contamination analysis tool
  - ODI, JoveRem → Wednesday

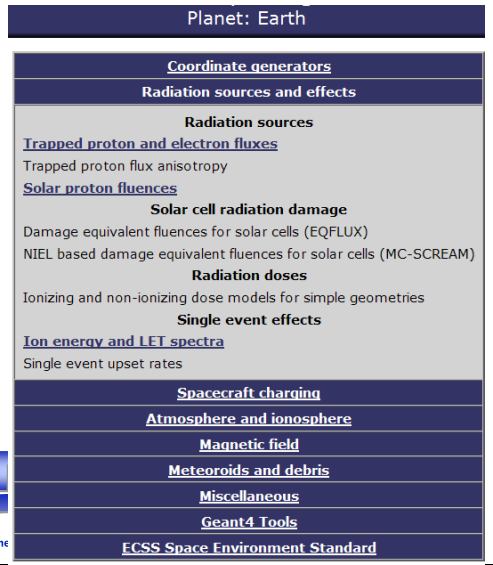
Models in SPENVIS

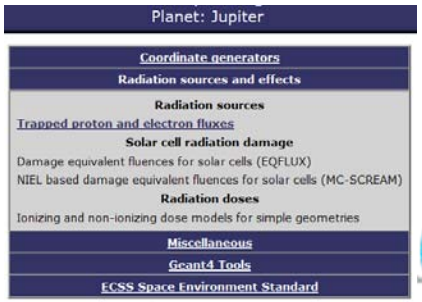
- Grouped by packages
- Grouped by planets
- Grouped by types
  - Spacecraft trajectories
  - Coordinate grids (single point, profile, maps)
  - Other
- Model dependencies





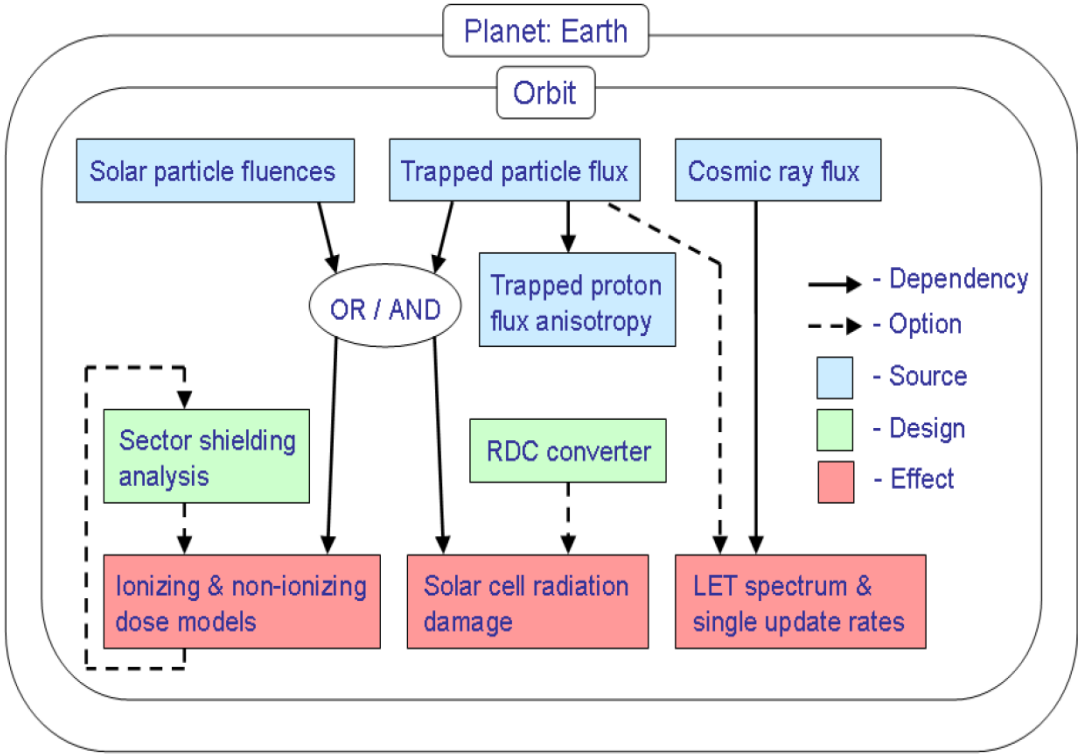




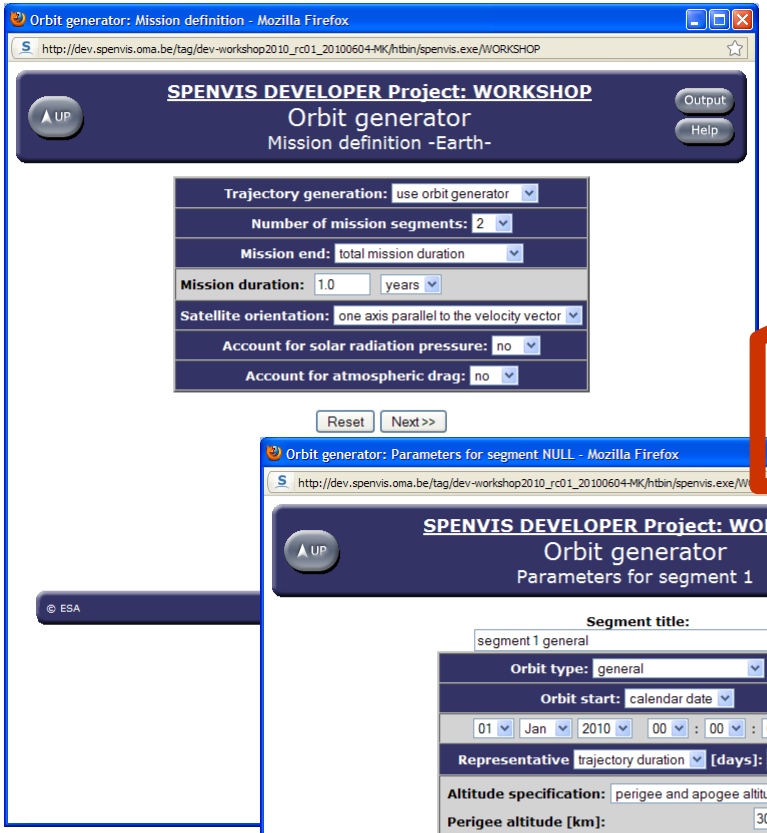


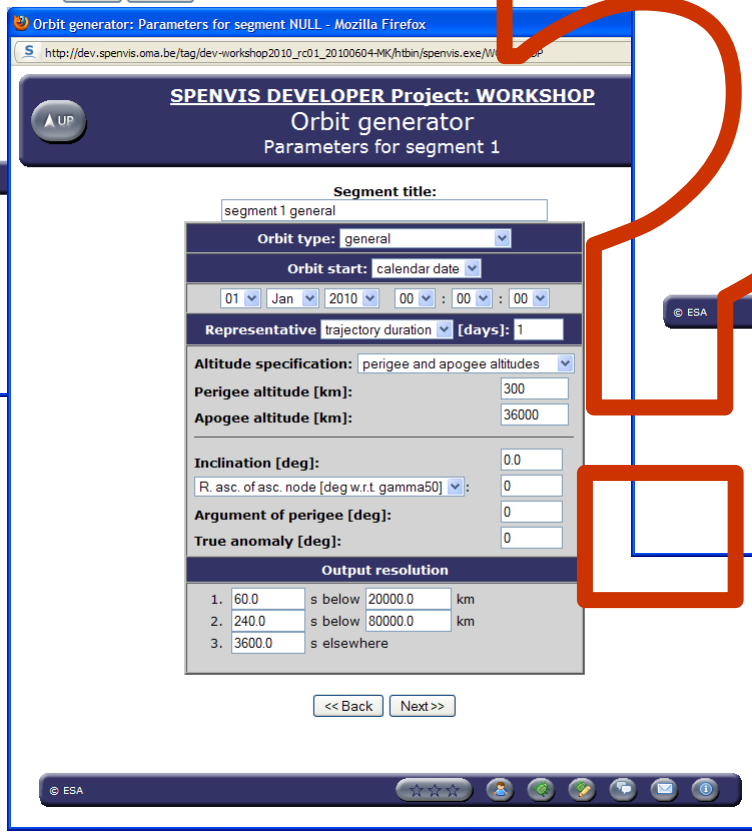
Model dependencies

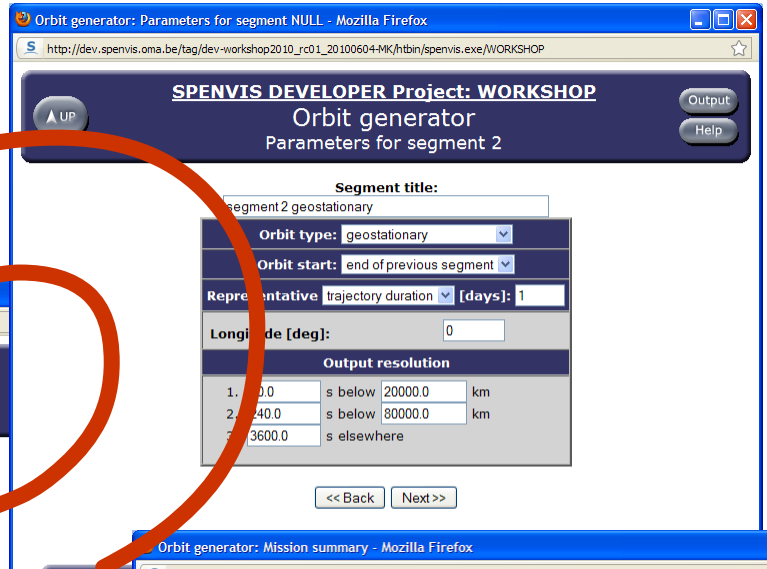
- Type:
  spacecraft trajectories
- Logic of
  the dependencies:
  1. Orbit generator
  2. Space environment
  3. Design (optional)
  4. Environment effects
- First step
  = Orbit generator

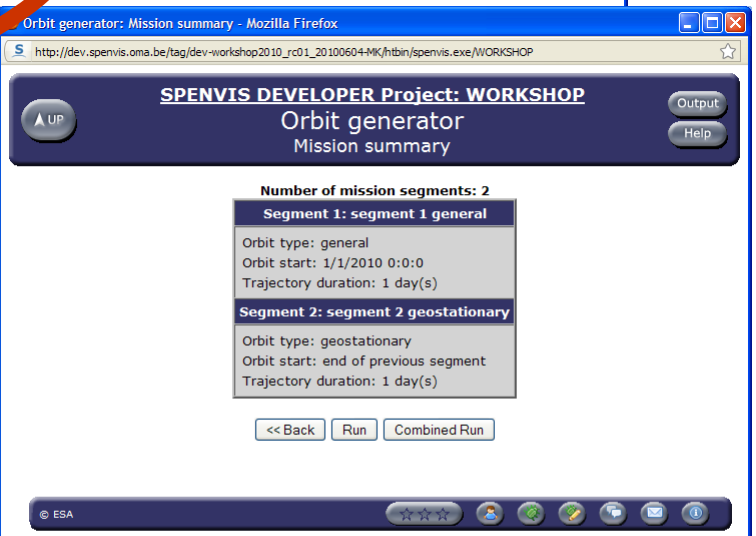


Orbit generator









SPENVIS
The Space Environment Information System

SPENVIS User's Workshop

aeronomie.be

SPENVIS Mission concept

- Number of mission segments
- Mission duration

For each segment

- Orbit start
- Orbit duration
- Segment duration (implicit)

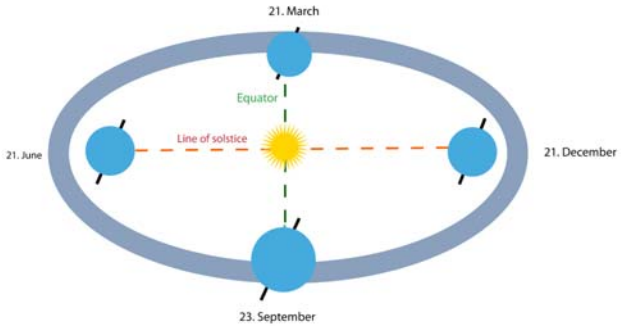
Why?

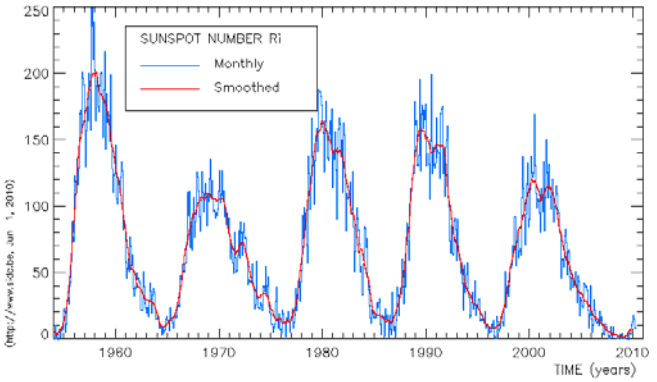
- Generate the trajectory over the full mission
  - Huge files, not real added value
- Mission = set of segments
  - Representative orbits for each segment
  - Start of segment = start of representative orbits
  - End of segment = start of next segment OR end of mission
- Durations: Mission (M), Segments (S_i), Repr. Orbits (T_i)
  - Relations: $T_i < S_i$ and $M = \sum_i S_i$
- **Orbit mean → Mission average**
  - Along orbit: $f(t)$, $F^T = \int_{T_i} f(t)\, dt$, $\langle f^T \rangle_i = F^T / T_i$
  - Mission: $\langle f^M \rangle = \sum_i \langle f^T \rangle_i S_i / M$

How many segments?

Criteria

- Spacecraft orbit change, e.g. GTO → GEO
- Precession of the orbital plane,
  e.g. SAMPEX (near-polar orbit) precession period = 6 months
- Space & time variability of the Space Environment
  - Solar cycle variation
  - Seasonal effect,
    e.g tilt of magnetic dipole
- Type of models



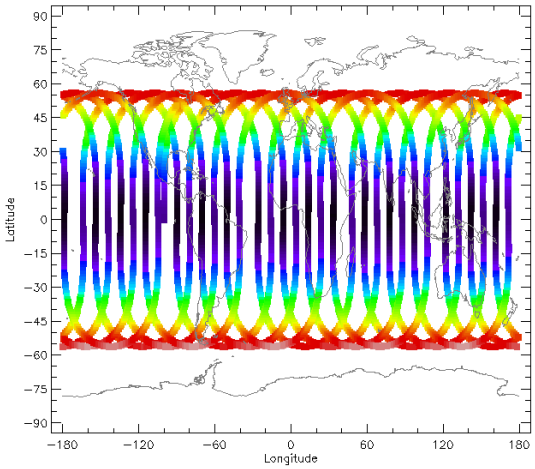


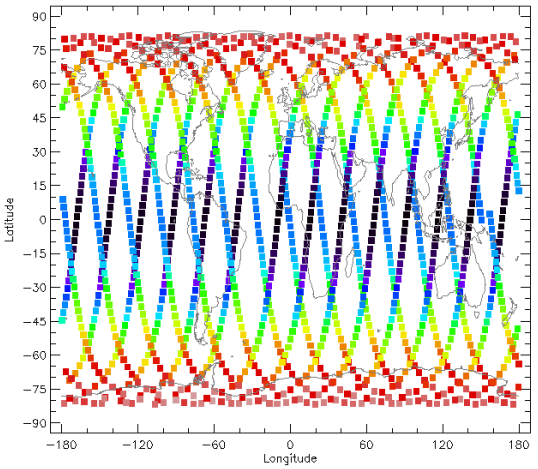
Which orbit duration?

- Too long: huge files, not real added value
- Too short: missing feature

Criteria

- Space variability of the Space Environment
  - E.g. South Atlantic Anomaly
- Warning: ascending/descending legs when not circular orbit





Conclusion: SPENVIS mission concept

Need an adequate selection of

- Mission segments
- Representative orbits

in order to catch all variability of the space environment

- SPENVIS provides the tool but its use is user's responsibility

- Type of orbits:
  - General (elliptic), GEO, sun-synchronous;
  - Upload user's trajectory (new format);
  - Earth only: hyperbolic, Two-Line Element

SPENVIS

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