Ssdsim

SST SENSOR DATA SIMULATION

GMV's ***Ssdsim*** COTS software is a software application for the **simulation of SST data** from a customizable network of sensors, including radars, telescopes, satellite laser ranging stations and passive ranging stations. To do so, ***Ssdsim*** runs a processing chain that performs the following tasks:

1) Object **population simulation**: starting from input TLE, OMM or Master catalogues, the software generates a realistic object population by assigning mass, area, and other properties (i.e., drag coefficient and SRP coefficient) to each object following statistical distributions defined according to the objects' altitudes.

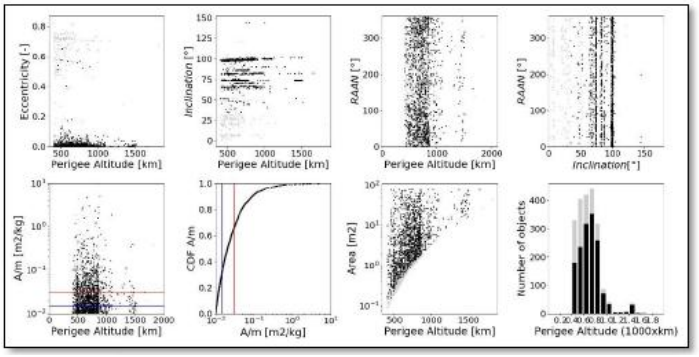

Figure 1: Object population simulated by ***Ssdsim***

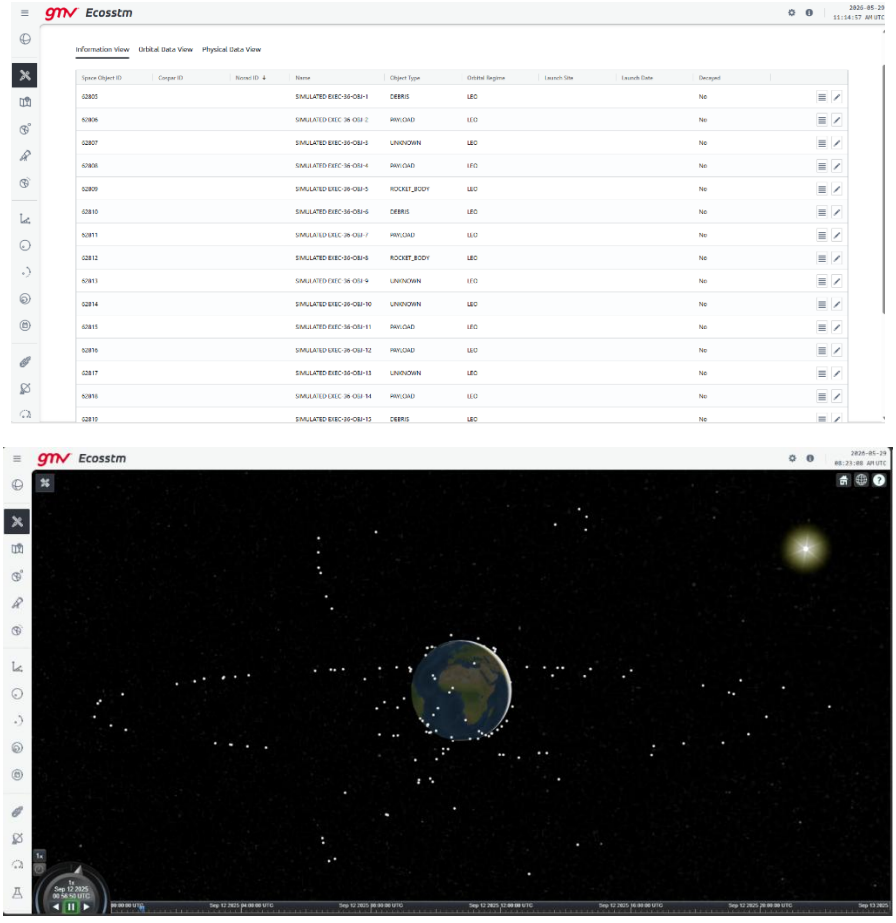

Figure 2: Object population simulated by ***Ssdsim*** (up: table of simulated objects, down: 3D visualization)

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2) **Orbit propagation** of the simulated population: the generated population is propagated via a customizable dynamical model (e.g., gravity degree and order, atmospheric forces, solar radiation pressures and more precise perturbations relevant for SST purposes).

3) Generation of the **observation plan**. According to the type of simulated sensor and its defined task (survey/tracking), the software can either:
   a. Ingest and process a **planned schedule** for each sensor devoted to tracking activities (telescopes, radars, satellite laser ranging stations), which includes the definition each tracking task (with its start time, stop time and object of interest).
   b. Determine the best **surveillance law** for survey telescopes, considering relevant physical constraints (e.g., night periods, presence of the moon and distance to the galactic plane) and trying to maximize the visibility of the whole population.
   c. Generate a plan for **passive ranging** links (defined by a primary and a secondary station) by customizing the number of observation cycles, the number of slots for each object, the duration of each slot and other additional parameters.

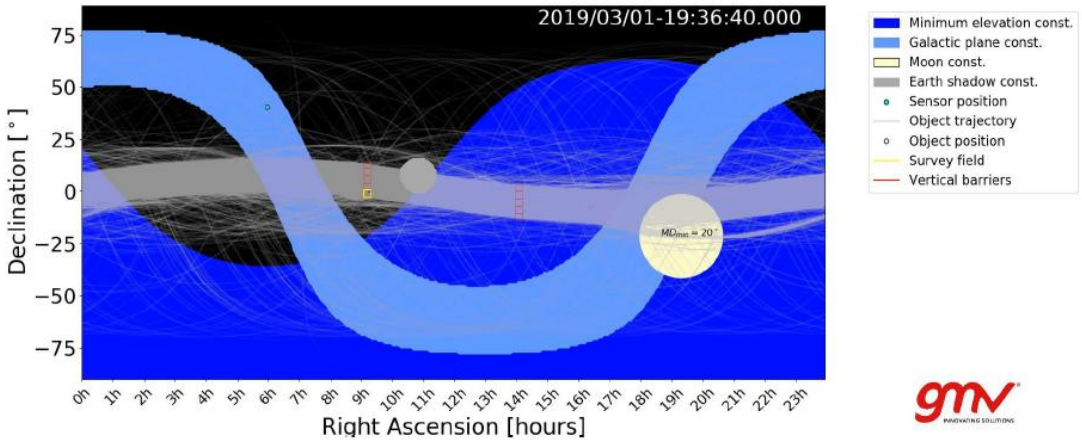

Figure 3: Survey strategy optimization for a survey telescope with two vertical barriers by ***Ssdsim***

4) Computation of **survey visibilities** and **tracking opportunities** for each object, according to the type of simulated sensors.

5) Generation of **measurements** adding **noise models** and including various effects:

   a. Annual, diurnal, or annual + diurnal **aberration** for telescopes.
   b. **Tropospheric refraction** (several models available, such as IRI-2016 or NEQUICK) for radars.
   c. **Ionospheric refraction** (several models available, such as Saastamoinen or Marini) for radars.

As products, ***Ssdsim*** provides the generated **measurements** (in TDM format or binary format), the simulated **initial state vectors** of the population (in OPM format) and mean elements set of the population (in OMM format), the **propagated orbits** (in OEM format) and the survey **visibilities** or tracking **opportunities.**

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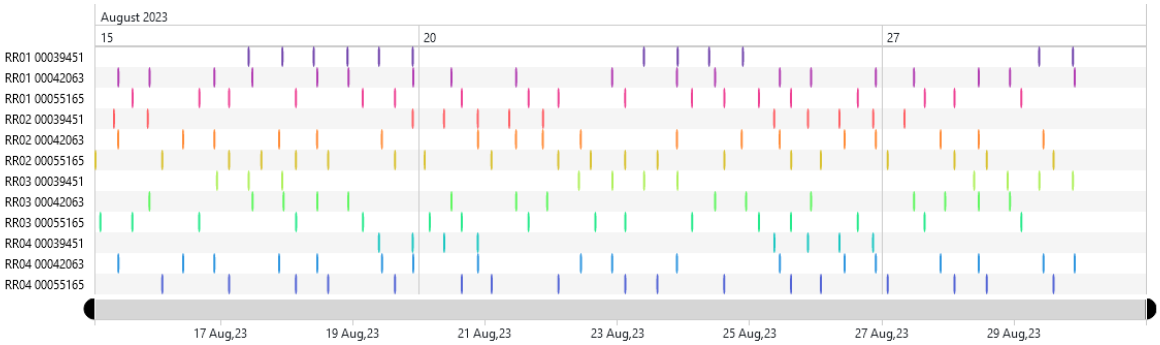

Figure 4: Survey visibilities for a radar as computed by ***Ssdsim***

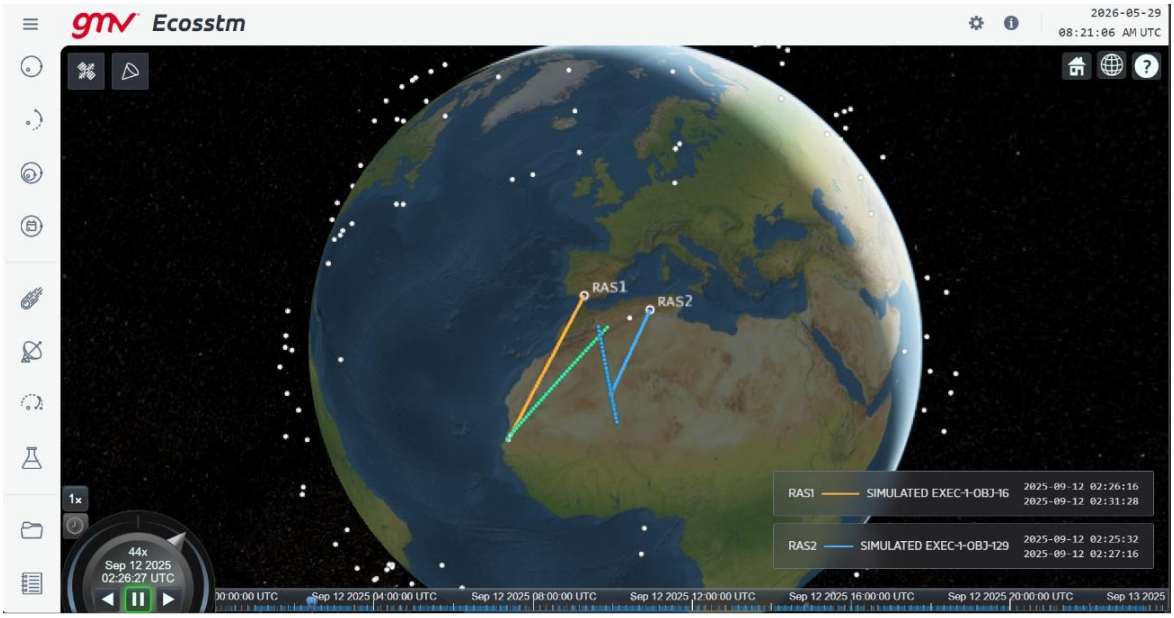

Figure 5: Measurements for two survey radars as computed by ***Ssdsim***

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