

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.

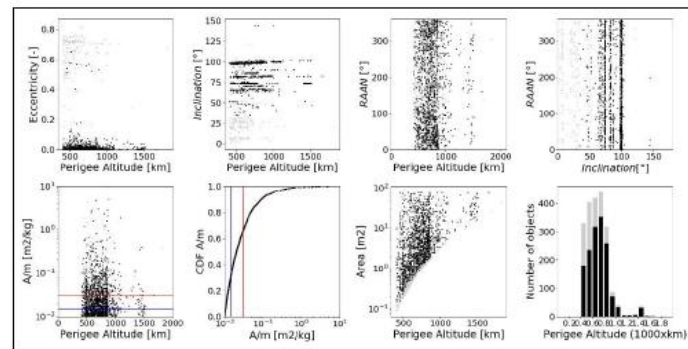


Figure 1: Object population simulated by **Ssdsim**

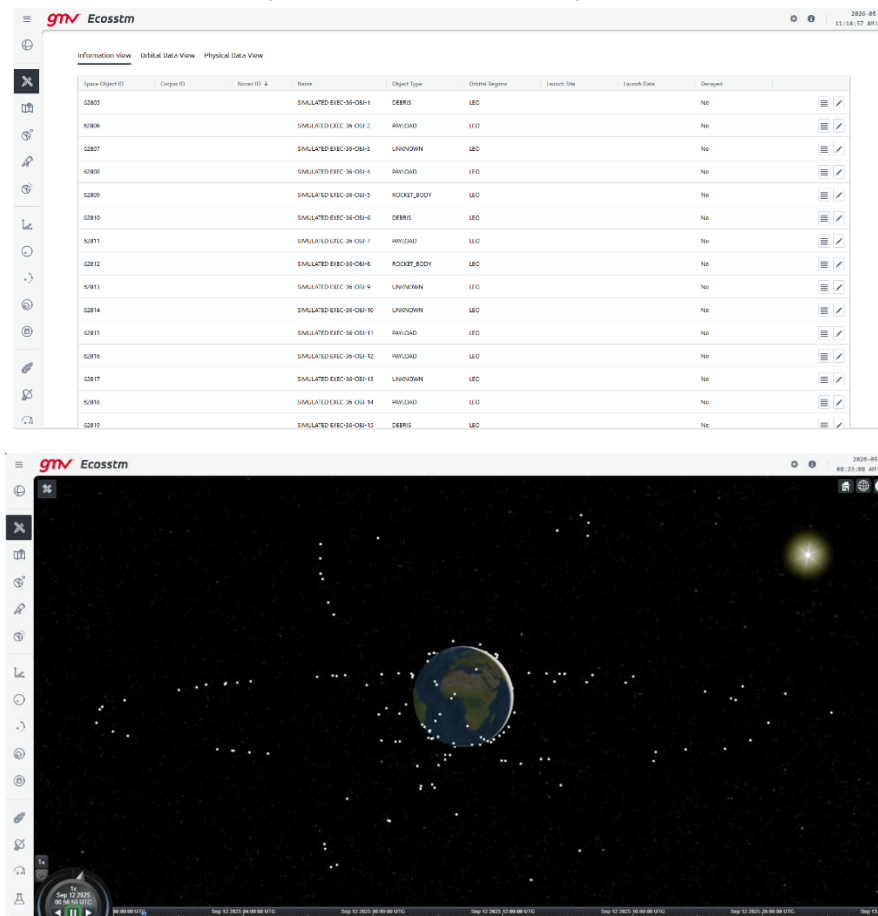


Figure 2: Object population simulated by **Ssdsim** (up: table of simulated objects, down: 3D visualization)



- 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.

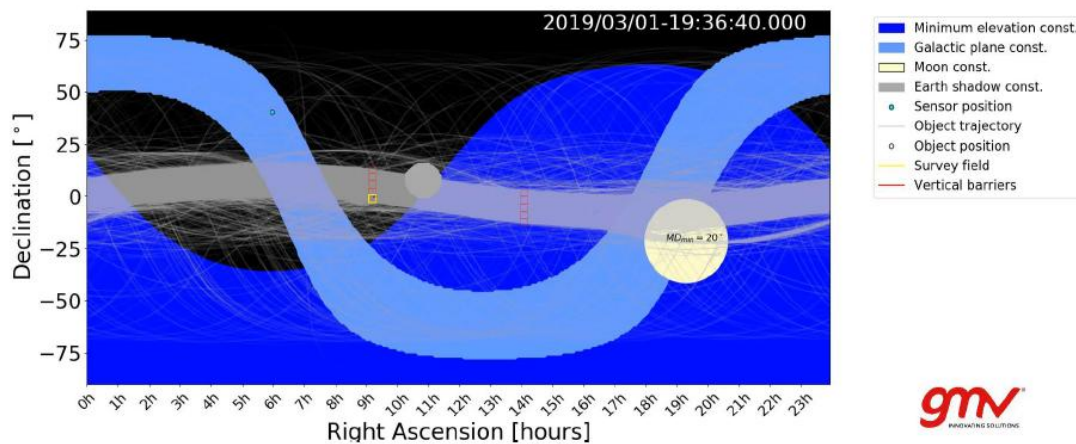


Figure 3: Survey strategy optimization for a survey telescope with two vertical barriers by *Sdsim*

- 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, *Sdsim* 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**.

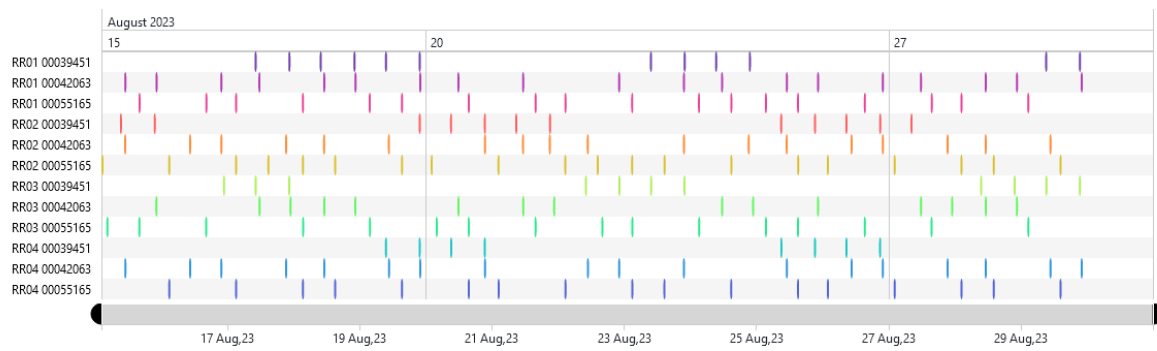


Figure 4: Survey visibilities for a radar as computed by Ssdsim

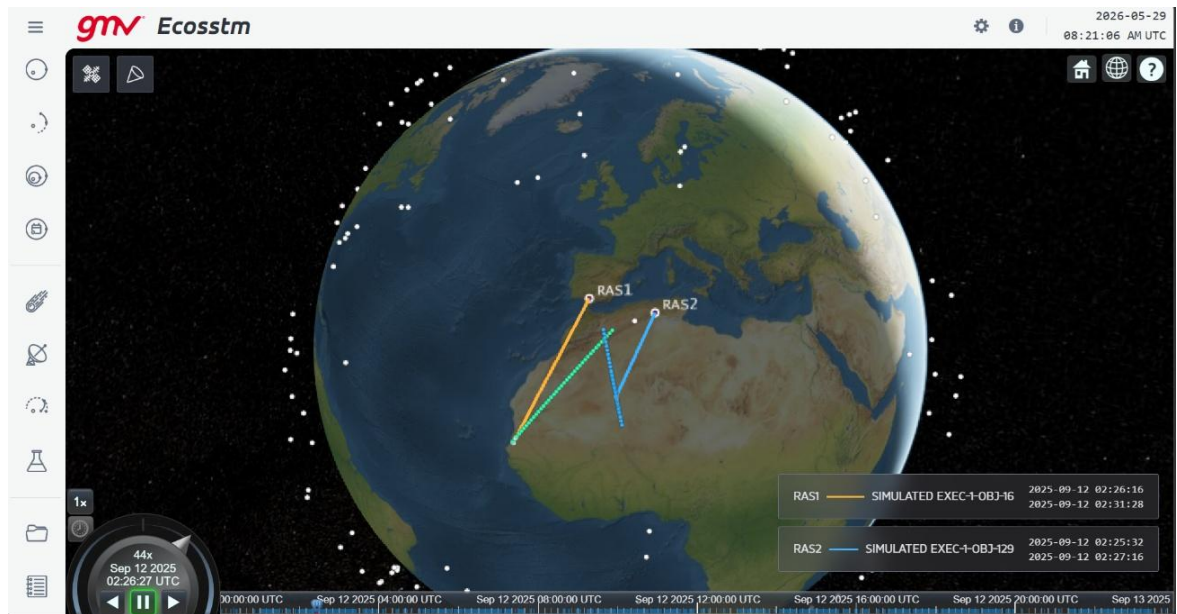


Figure 5: Measurements for two survey radars as computed by Ssdsim