PRODUCT BROCHURE

Keysight Sim3D

Realistic Multipath and Obscuration Simulation — Simulating the Impact of the Local Environment on GNSS Signals

KEYSIGHT

Verify Positioning Performance in a True-to-Life Synthetic Environment

Obscuration, as well as the reflection and diffraction of signals known as multipath, can be one of the main sources of error in a GNSS receiver. Multipath errors can vary from a few meters to hundreds of meters according to satellite geometry and the receiver environment. The characterization and study of multipath is complex but important, as its effects need to be compensated for in most positioning, navigation, or timing solutions.

Sim3D is an innovative real-time system that enables the reproduction of an authentic multipath environment. The system combines a state-of-the-art GNSS simulator and an advanced GNSS propagation model. The propagation model relies on a 3D scene of the environment, which is used to generate the multipath and obscuration signature that strictly depends on the location of the receiver's antenna — whether static or dynamic.

Sim3D enables testing in fully customizable environments, ranging from deep urban to dense forest to highway. With a wide range of models available, and the ability to build and introduce true-to-life buildings, cars, pedestrians, and trees, the level of detail is completely in your control.

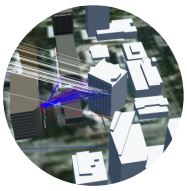
Working in conjunction with Keysight's PNT X, GSS7000, and GSS9000 simulators, and our industry leading positioning software platform, Sim3D enables testing using a broad range of signals.

Users working in the development, integration, or verification of the full range of GNSS-enabled products are able to verify product performance under controlled, repeatable, and true-to-life conditions.

Features

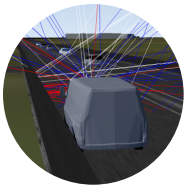
- Supports all constellations, frequencies, and codes currently simulated by Keysight
- The signal code, carrier, and power are manipulated based on interaction with the environment
- Supports static and dynamic scenarios
- Up to 31 multipath signals per line of sight (LOS) simulated
- Up to 6 reflections per multipath computed
- Ability to generate your own 3D models
- Import externally generated models and objects
- Multiple 3D models are included
- Dynamic trajectory generation
- Support for a scene size of up to 5km 2 — or greater for highway scenes
- Unprecedented level of control
  - Obscuration mode on/off
  - Multipath on/off
  - Number of reflections per multipath signal
- User-defined filtering algorithms to simulate only multipath in chosen delay/power ranges
- Visualize the multipath direction of arrival
- Building and object materials are modelled and taken into account during the computation
- Support for hardware-in-the-loop setups — integrates with Keysight SimHIL
- Generate GNSS reception heat maps for mission planning
- Import user antenna patterns — with RHCP/LHCP polarization
- Indoor modeling of signals
- Over-the-air mode for anechoic/zoned chambers

Benefits



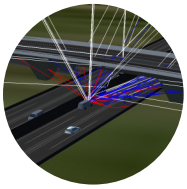
Realistic Multipath and Obscuration Simulation

Multipath and obscuration is simulated based on a synthetic 3D model. Real-life locations can be regenerated and used in simulation to recreate the multipath signature of that location. In addition, traffic, crowd, and other objects are used in the simulation to provide a level of realism not available in any other product in the market.



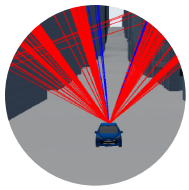
Ability to Simulate Real-Life Applications

Define your antenna carrier as a vehicle or pedestrian, then position your antenna relative to the carrier center of gravity. The multipath and obscuration are computed considering the antenna carrier position and motion. This provides valuable insight for optimizing the location of the antenna for optimum performance.



Better Level of Control and Analysis

Sim3D provides a level of control not available in any other multipath/obscuration simulation approaches. Choose which constellations to simulate, the number of satellites to simulate, the minimum satellite elevation, and much more.

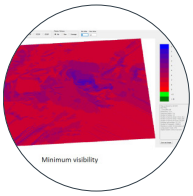


Fully Verified with Real-Life Data

The performance of Sim3D simulation relative to field data has been exhaustively assessed, with good indicative results shown.

Full Level of Customization

Sim3D enables you to create your own 3D models with the level of accuracy desired. Many generic 3D model formats are supported using provided convertors, meaning existing or purchased models can be easily imported.



Ability to Generate Heat Maps

Improve mission planning and productivity by identifying areas of compromised GNSS reception in modeled environments.

PosApp sends in real-time at each epoch:

- Satellite and signal information
- Vehicle/antenna location
- Vehicle/antenna attitude

The Sim3D GNSS propagation model computes in real time:

- Signal power (LOS/NLOS)
- Code offset (NLOS)
- Carrier offset (NLOS)
- Azimuth and elevation (NLOS)

PosApp controls multipath channels and output RF to the DUT according to the provided data (see Figure 1).

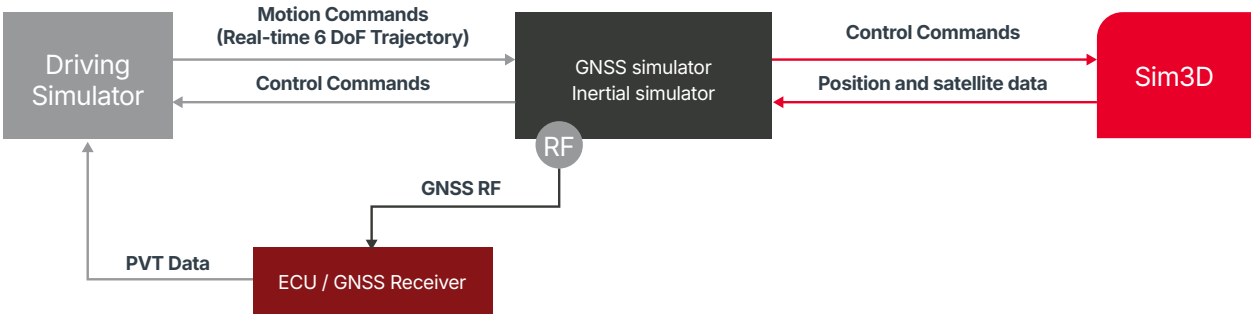


Figure 1. Sim3D introduces realistic multipath into an automotive hardware-in-the-loop test setup

True-to-Life Validation

To establish the true value of Sim3D over the existing multipath testing methodologies, Keysight carried out extensive validation testing. The failure of older technologies is the inability to recreate a truly realistic environment, so overcoming this was the benchmark we set.

We collected field data from San Jose and San Francisco, California, and then recreated the environments in Sim3D. Signals simulated in the virtual environment were then compared to the recorded field data, demonstrating strong indicative results, and even close correlation in many cases (see Figure 2).

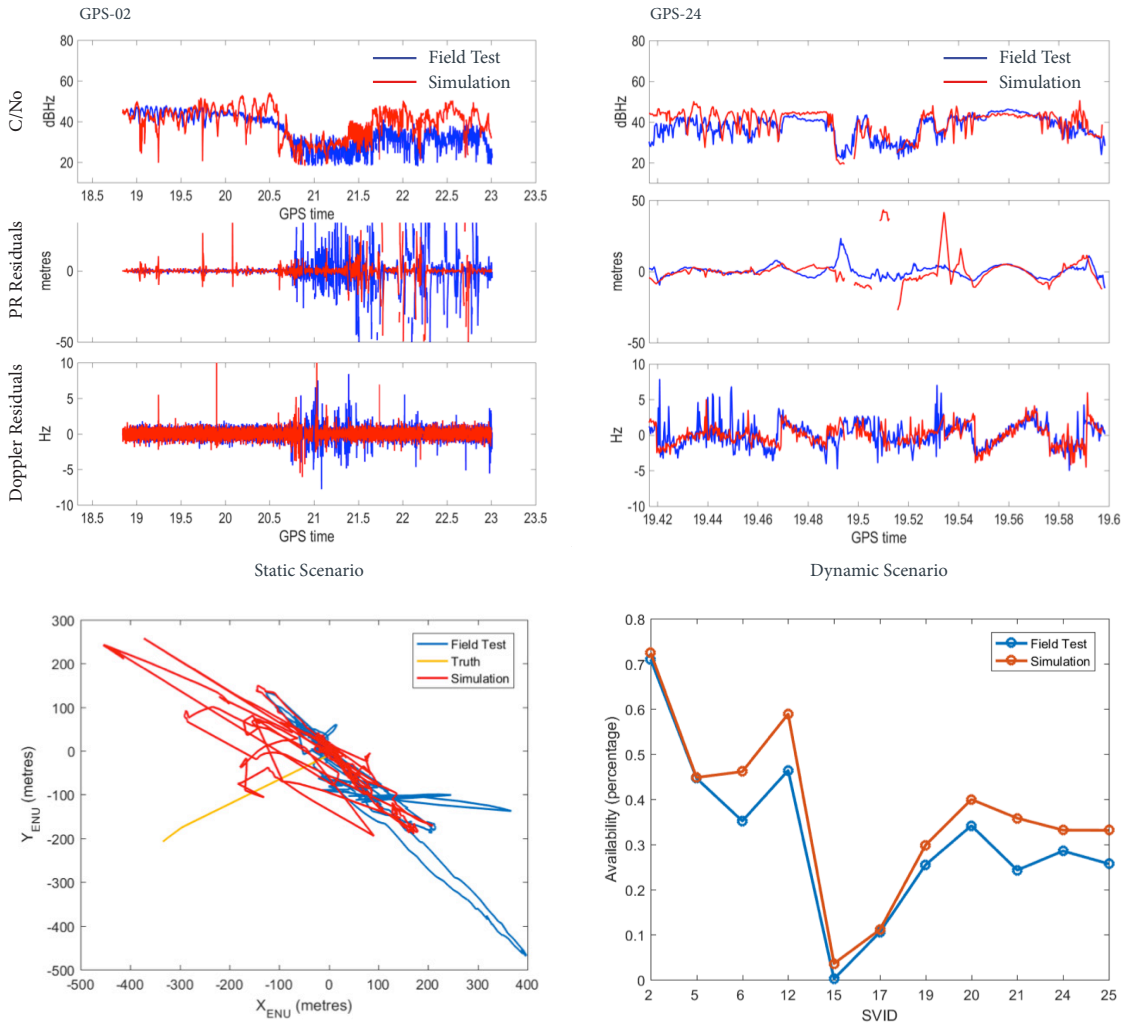


Figure 2. Comparative receiver output analysis of real-world drive testing in San Francisco vs. corresponding simulated scene in Sim3D

Keysight enables innovators to push the boundaries of engineering by quickly solving design, emulation, and test challenges to create the best product experiences. Start your innovation journey at www.keysight.com.

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