

SE-RAY-EM

Simulation

Electromagnetic

Software

Prediction



Analyse

**Compute reliable electromagnetic fields
and radar signature**

Advanced Electromagnetic Scene Generation Tool

SE-RAY-EM main features:

RF models validated by ONERA in France FOI in Sweden and FGAN in Germany

« Forward » ray-tracing method

« Asymptotic » electromagnetic model for radio wave propagation, reflection, scattering, diffraction and transmission

Dedicated models for clutter materials including speckle effects

Can deal with almost all popular CAD formats thanks to its associated 3DS max plug-in

Scenarios creation and management tools SE-SCENARIO

Mobile elements and mobile sensors handling in the scene

« Phase textures » to simulate local rough surfaces

Multi-platforms distributed computation under development

SE-RAY-EM takes advantage of the recent improvements in the field of 3D graphics to compute very efficiently the RF fields in a synthetic environment whose 3D mock-up can be made of several millions polygons, including very complex objects and targets.

Shooting and bouncing forward ray technique & RF asymptotic technique (GO, PO, PTD, ECM) are well adapted to compute complete electromagnetic models including propagation, scattering, reflection and edge diffraction.

Physical model features

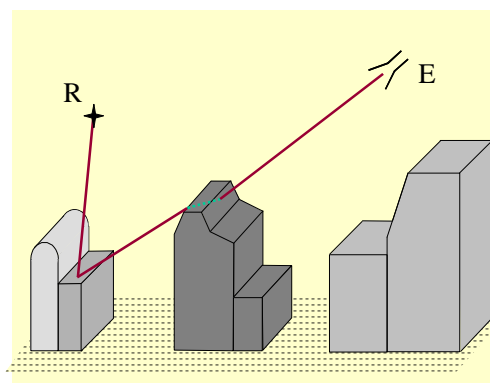
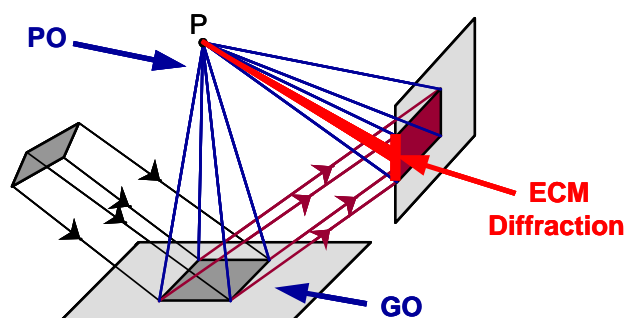
- Association of ray technique (ray tracing) & electromagnetic asymptotic formulations
- Scattering computation using Physical Optics
- Multiple reflections computation using Geometrical Optics
- Edge diffraction computation using the Equivalent Current Method of Michaeli extended to targets covered by dielectric materials
- Geometrical divergence in GO reflection computation
- Reflection and scattering on multilayer dielectric materials

Specials features

- Computation of atmospheric effects:
 - Atmospheric attenuation, depending on the height, the site, the path length, the frequency and hygrometric conditions
 - Backscattering volume depends on the height, the site, the path length and the rain clutter volume for every radar « distance ranges » (volume and terrain intersection is taken into account)
- Modeling of the radar antenna diagram both in transmitting/receiving modes
- Bump-mapping and roughness management
- Radar modeling (transfer function and wave form)
- Results exploitation based on individual « Contributor » saving

Manipulated files

File extension	File description
scn (ASCII)	SE-RAY-EM scenario file
scnx (XML)	A complete scenario refers to: one or several objects (.bdd), one or several sensors (.cpt), one or several paths (.trj or .trjx).
bdd (ASCII)	Description of objects (including the environment)
cpt (ASCII)	Sensor configuration file A sensor configuration file is required for each sensor of SE-RAY-EM scenario.
trj (ASCII)	Path file. A path is in SDM format.



SE-RAY-EM

A technological rupture

Very efficient computation kernel, even for very complex scenes, including very complex objects, described by several millions polygons CAD models

Calculation time nearly independent of the number of polygons

Number of rays optimized using « adaptive antialiasing »

Can compute dielectric objects, including diffraction by their edges

Unified approach for 3D targets and the environment

Handles the target / environment coupling effects

Unified calculation method for near and far fields

Can take Doppler effects into account

Benefits:

- Fast and modular ray-tracing
- A complete and well documented validation process
- Well documented physical formulations

System requirements :

- Windows™ XP, 2000
- Linux RHE4

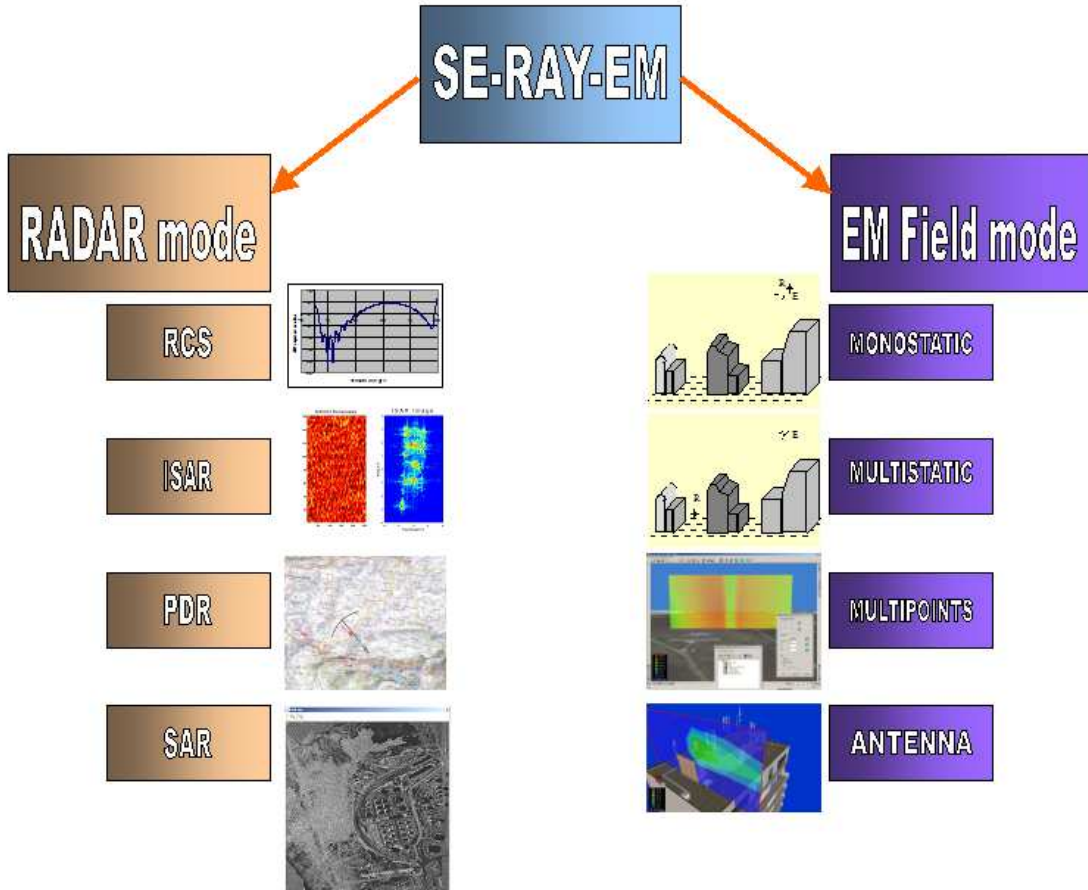
An original approach in RF simulation

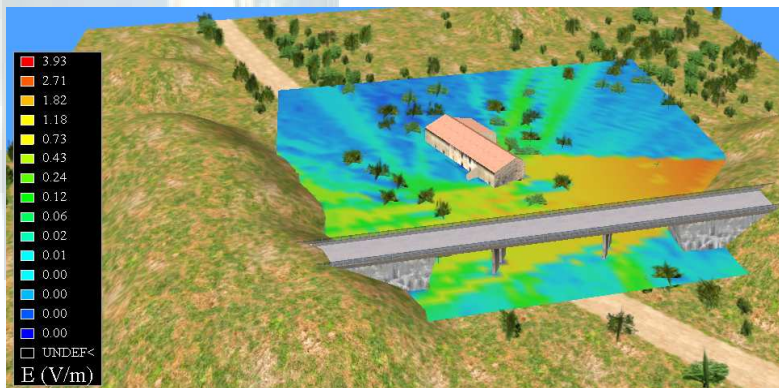
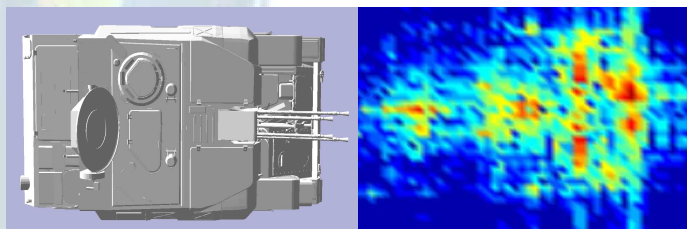
SE-RAY-EM associates the “shooting ray” technique, or “forward ray tracing” technique and the high frequency electromagnetic scattering formulations. A set of rays representing the incident plane wave is shot toward the observed area made of objects tessellated with triangles. More specifically, from an emission point, this area is included in a pyramid in which elementary tubes of four rays are launched. Every tube is defined so that its intersection with the object constitutes a planar surface.



A very complete simulation tool

SE-RAY-EM performs direct computation of the EM waves interactions with involved targets and the 3D environment. Targets are defined using real CAD files so SE-RAY-EM evaluates target and clutter contributions in the same process. SE-RAY-EM naturally takes into account geometrical effects of these interactions: masking and shadowing, “speckle”, dihedrals configuration (from terrain, vegetation and superstructures respectively such as cliffs, wood edges, buildings, target/clutter coupling), multiple paths phenomena including transmission.





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