

SE-RAY-IR: Virtual Reality in IR and IL

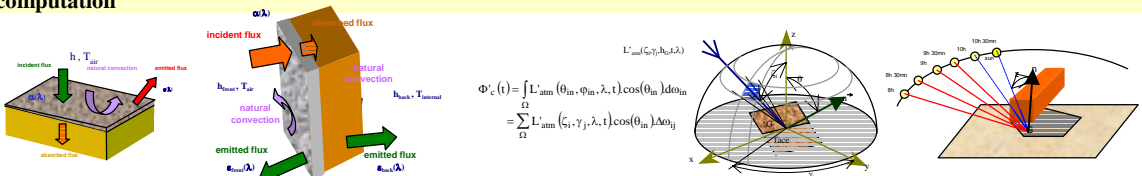
Optronic simulation must take advantage of current improvements in the field of 3D graphics (growing geometrical complexity of 3D databases)

OKTAL SYNTHETIC ENVIRONMENT SE-AGETIM™, SE-ATMOSPHERE™, SE-PHYSICAL-MODELER™, SE-CLASSIFICATION™, SE-THERMAL™, terrain, atmosphere and thermal modelling tools enable to automatically generate 3D virtual mock-ups, very detailed at geometrical level, and natively enhanced with physical attributes in the IR spectral domain. These 3D databases associate terrain meshing, vegetation infrastructures, building superstructures and moving objects considered as potential targets for the assessed optronic sensor (infrared, intensification of light and visible).



Shooting and bouncing ray technique and thermal heat equation solving are well adapted to compute complete thermal models which include propagation and reflection. The generated hyperspectral images are very accurate and validated in infrared, intensification of light and visible.

Principle of the heat equation solving computation **Absorbed flux and thermal shadow**



The software **SE-RAY-IR™** benefits from many years of development and validations. The main performances of **SE-RAY-IR™** in terms of physical accuracy are the following:

- Accurate management of atmospheric conditions and effects (for each ray, direct access to LOWTRAN, MODTRAN or empiric tables)
- Accurate representation of thermal and cast shadows (taking into account the thermal effects)
- Thermal software (**SE-THERMAL™**) based on accurate computation of atmospheric incident flux
- Simulation of directional effects (angular dependences of the BRDF)
- Simulation of multiple reflections effects
- Spectral modelling (wavelength by wavelength)

A validation process based on theory and experiments

The **SE-RAY-IR™** software is delivered with its validation dossier and the documentation of the internal equations and their software implementation. The code has been validated based on heat theory:

- Physical radiative model, atmospheric model and thermal model accurate description,
- Simple tests cases with existing analytical solution,
- Comparison of Real Time (**SE-FAST-IR™**) & Non Real Time results (**SE-RAY-IR™**)

In addition, validation processes based on experiment have been made in the frame of missile seeker programs:

- **Storm Shadow** & **SCALP EG** missiles application (French MoD & MBDA)
- **2ASM** missile application (French MoD & SAGEM)

SE-RAY-IR

Application domains

Defence

IR seeker and auto directors for missiles: study, validation and qualification

Infrared countermeasure studies

Infrared signature and propagation studies

Detection/Identification infrared image training

Intensification of light image recognition training

Night vision goggle training and assessment

Hardware in the loop seeker head validation

Data fusion with visible data

Image and target recognition algorithms development, tuning and validation

Aeronautics

Human compatibility studies

Infrared image recognition training

All weather flying conditions studies

Night vision system design and qualification

Sensor information data fusion studies

Automotive

Obstacle detection through data fusion of lidar, infrared and radar sensors

Obstacle avoidance in driving vehicle

Human compatibility studies

