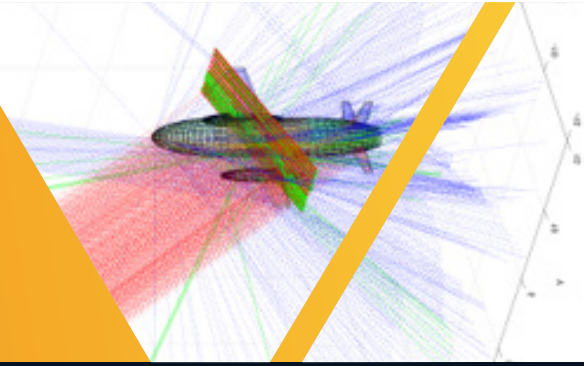


# Axient Capability Highlight: Electro-Optical/Infra-Red (EO/IR) & High-Energy Laser (HEL)



## Core Capacity

PULSE EO/IR federate features (SPIRIT):

- Construct IR scene of principal objects, debris, clusters, plumes, and wakes.
- Consolidate thermal IR signatures generated separately from MSLRAD, OSC, DebrisSim, and PIDS etc.
- Simulate multispectral IR sensors with fixed positions or with time varying position and orientation.
- Evaluate interceptor performance using precalculated IR data and the sensor's kinematic states.
- Provide simple to complex IR scenes for investigating realistic threat scenarios.
- Export IR signatures combined with RFdata for object tracking and identification ML/AI algorithm.

PULSE HEL for DE Applications (MIRORS)

- Calculate HEL propagation efficiency through turbulent atmosphere for DEW lethality assessment.
- Use LEEDR to calculate environmental parameters for laser propagation.
- Use laser profile on targets to calculate HEL reflectance signatures for object detection and identification.
- Calculate sensor responses to produce HEL scene of the threat scenario.
- Emulate fast laser steering mirror beam control systems to scan objects over long distance.
- Synthesize HEL time sequence returned signals into extended images.
- Construct targets with simple geometry solids or with CAD facet models.
- Use physics-based or empirical models to calculate the reflectance of laser from the target.
- Combined with passive thermal IR to improve object identification capability.

## OVERVIEW

EO/IR scene is a new feature of SEG's flagship simulation software, Physics Unlimited Scalable Simulation Environment (PULSE). Passive thermal IR signatures of hardbody and operational debris are generated by Scene Projection IR Imaging Tool (SPIRIT), whereas signatures of laser-based active scanning of principal objects are simulated by Multispectral InfraRed/Optical Reflection Simulation (MIRORS).

SPIRIT is an IR scene constructor for principal objects and debris. SPIRIT uses the principal object thermal radiance calculated by Missile Radiance (MSLRAD) or by Optical Signatures Code (OSC) combined with the thermal radiance of operational debris from Debris Simulation (DebrisSim), and Post Intercept Debris Simulation (PIDS) to generate fused IR scenes. SPIRIT allows users to place sensors at time varying positions to emulate different type sensors.

MIRORS uses high energy laser (HEL) to generate HEL signatures by scanning the object. MIRORS uses the laser parameters computed by High Energy Laser End-to-End Operational Simulation (HELEEOS) code to generate HEL scene under various geological and climatic conditions. MIRORS renders the laser reflected signature using either empirical models of bidirectional reflectance distribution function (BRDF) or theoretical values optical properties, and surface roughness data.



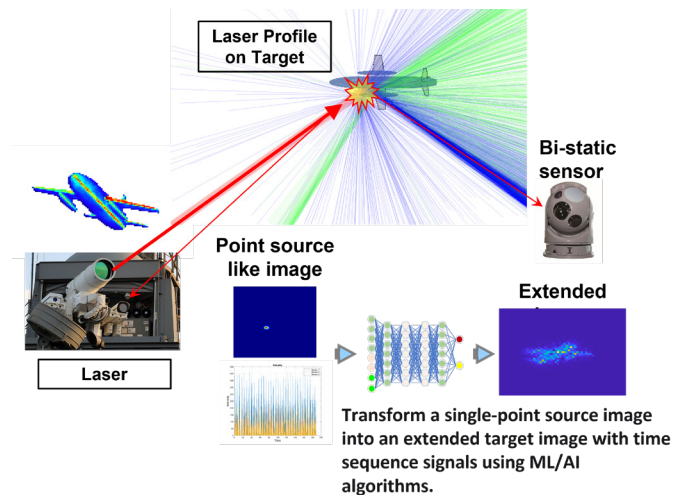
## About 3rd Party GFI Apps

PULSE unites the following GFI Apps in the EO/IR and HEL signatures and scene generations:

- MSLRAD, Missile Radiance, Applied Physics Laboratory: principal object IR signatures.
- OSC, Optical Signatures Code, Teledyne Brown Engineering, Inc.: principal object IR signatures.
- HELEEOS, High Energy Laser End-to-End Operational Simulation, Air Force Institute of Technology: laser optics, and laser propagation in turbulent atmosphere.
- LEEDR, Laser Environmental Effects Definition and Reference, Air Force Institute of Technology: laser environmental parameters.
- MODTRAN, Moderate resolution atmospheric Transmission, Spectral Sciences Inc.: IR environmental parameters.

## Summary

Axient provides several new capabilities in PULSE: passive thermal IR scene construction, performance of high energy laser propagation in turbulent ambient for directed energy weapon system lethality assessment, and active high energy laser scanning for object tracking and identification. The new passive and active EO/IR scene construction feature is benefited from many Axient internal programs such as DebrisSim, GPI, CCIR. SPIRIT provides thermal IR images whereas MIRORS injects complementary unique bandwidth signatures into the scene. SPIRIT is fully integrated into PULSE. MIRORS requires additional efforts to include HELEEOS and LEEDR to be a part of PULSE federates. The main goal of MIRORS is to predict HEL performance as a part of the fire control assessment and to use HEL active scanning for PULSE multispectral object identification purpose.



## About Axient

With over 2,200 employees, Axient is headquartered in Huntsville, Alabama and has provided premier services and solutions to the Federal Government for more than three decades. Axient's customers include the U.S. Army, U.S. Navy, Missile Defense Agency, U.S. Air Force, U.S. Space Force, and NASA. Axient is certified in the following: ISO 9001:2015, AS9100 Rev D, CMMIDEV Maturity Level 3, and has a DCMA Purchasing System, DCMA Property System, and DCAA Accounting System.

