SenSim™

**λ JRM** ∿∿∿⟶ *Real Physics • Real Sensors • Real-time*

EO/IR Sensor Effects SDK & Real-Time Library

SenSim is an image-processing SDK and run-time library for real-time sensor effects simulation of EO and IR sensors, including visible CCD, NVG and FLIR. It runs in real-time on Commercial Off-The-Shelf (COTS) PC graphics cards, and provides engineering-level modeling of optics, detector, electronics and display components, simulating Modulation Transfer Functions (MTFs), detector sampling, 1/f and white noise, image intensification, and displays. SenSim can use your fundamental sensor component specifications to provide realistic sensor display visualizations, and is available for both Windows and Linux OS.

SenSim is an optical sensor modeling and effects package that supports sensor design, visualization and analysis studies, and runs in real-time on COTS PC graphics hardware. Users simply enter typical or known sensor specifications like f/#, NET and detector pitch, and dynamically view the resulting image effects. SenSim models the basic sensor components: optics, detector sub-assembly, signal processing and display system.

SenSim Modeling
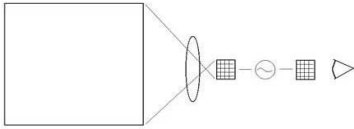
Optics and Detector Sampling
- Nyquist up-sampling
- Motion MTF
- Lens transmittance
- Diffraction Optics
- Design optics blur
- 3rd order Optical Aberrations
- Detector MTF & sampling
- Platform Jitter Blur

Detector Noise Injection
- Detector IFOV sampling
- Detector pitch
- Spectral response/efficiency
- Scanning effects, TDI *
- NET-calibrated (1/f)^n, Poisson, & white noise
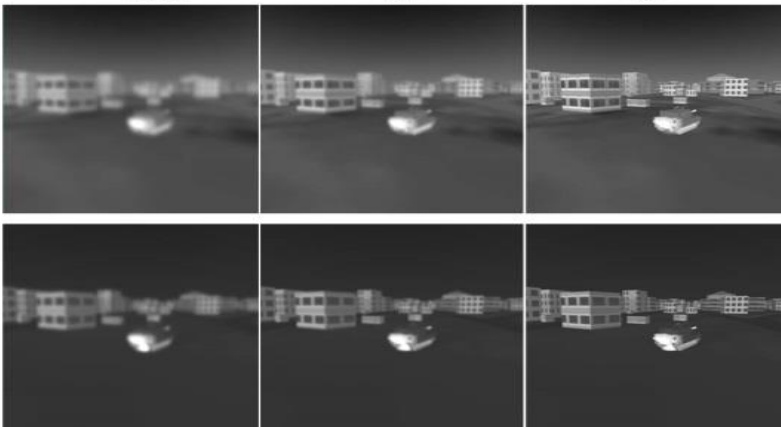- Detector non-uniformity
- Dead-pixels

Post Filtering
- Pre-amplifier
- Display MTF
- AGC/Gain-Level
- Real-time display

Example Diffraction Analysis

### Engineering-Level Modeling of Optics, Detector, Electronics and Display

- Geometrical/Design Blur & Diffraction MTFs
- 3rd order Optical Aberrations
- Aero-optical effects
- Transmittance/emittance
- Detector array/IFOV sampling
- Detector pitch
- Detector Spectral response/efficiency
- $(1/f)^n$, Poisson, thermal, & fixed-pattern noise
- Detector non-uniformity (high & low frequency)
- Scanning non-uniformity
- Dead pixels / Fill factor
- Pre-amplifiers
- Display MTF/sampling
- Platform Jitter Blur
- Gain-Level/ AGC
- Real-time displays
- Physically-correct NVG light point haloing
- Custom MTF and QE Curve support
- Customizable Color Mapping modes

Example Noise Analysis
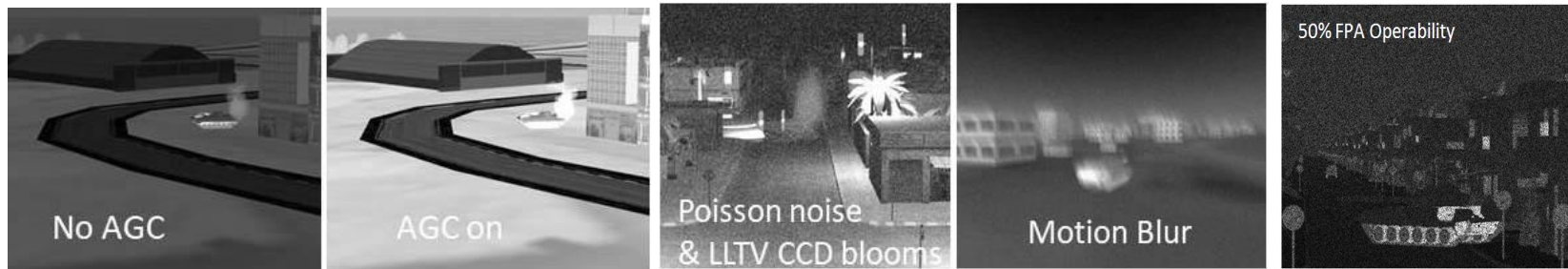
SenSim™

SenSim is an advanced optical sensor modeling and real-time effects solution suite consisting of two component technologies: SenSimMT, the Sensor Design Modeling Tool, and SenSimRT, the real-time Sensor Effects Post-Processor Library.

SenSimMT – Sensor Design Analysis Tool

SenSimMT is a powerful tool for sensor design and analysis studies. It ingests either a static sensor image or synthesizes a tactical scene on-the-fly with a target model at-range based on user-specified inputs. Users simply enter typical or known sensor specifications, and dynamically view the effect as would be seen on an actual sensor display. When the right sensor "look-and-feel" has been achieved, SenSimMT can output run-time data constructs to be used by SenSimRT for real-time GPU-based sensor effects implementation.

SenSimRT – GPU real-time sensors

SenSimRT implements sensor modeling on COTS PC graphics cards in real-time. Efficient floating-point GPU algorithms apply the effects to at-aperture imagery in the frame-buffer with minimal impact on scene rendering performance. The result is high-performance, high-dynamic-range sensor effects at real-time frame rates on low cost PC-based hardware. SenSimRT can also simulate realistic physics based NVG haloing of tens of thousands of light points at 60Hz or better. SenSimRT additionally supports user defined MTF data for specific sensor blur model customizations.

At-aperture Frame-buffer Inputs
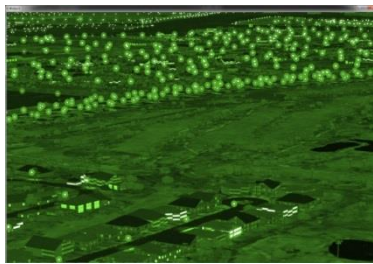
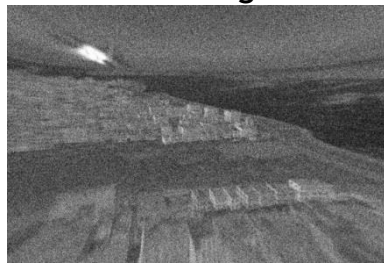T38a Plume   Air to Air   Tactical

SenSimRT Sensor Effect Outputs
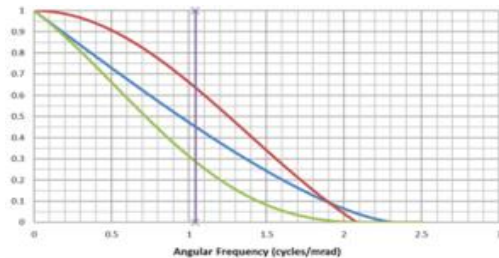
T38a Plume   Air to Air   Tactical
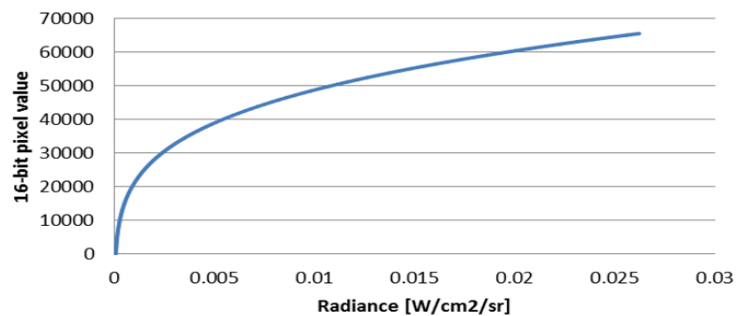

User defined Aero Heating and non uniformity

Color-Mapping modes for 16/24-bit High-Dynamic-Range Applications

Real-time GPU CCD and PMT Haloing

3rd order aberration Modeling

User defined MTF support

Angular Frequency (cycles/mrad)
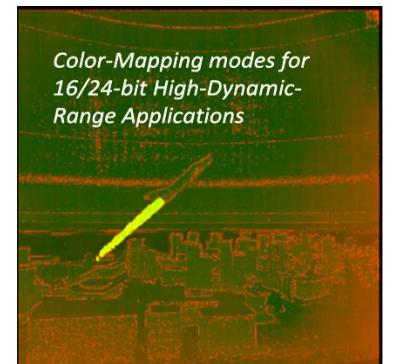
User-defined Nonlinear Radiance-to-PixelCount curves

16-bit pixel value — Radiance [W/cm2/sr]

*Product contains no defense articles, classified, or export controlled (ITAR) data.

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