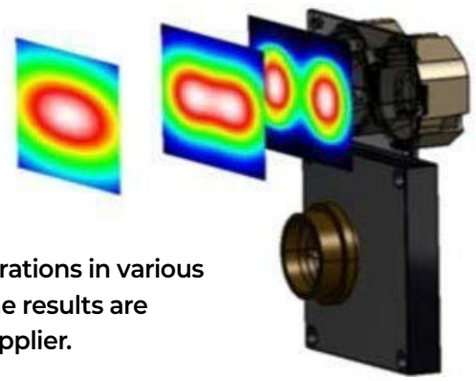
OPTICAL

Ansys SPEOS Optical Sensor Test Add-On

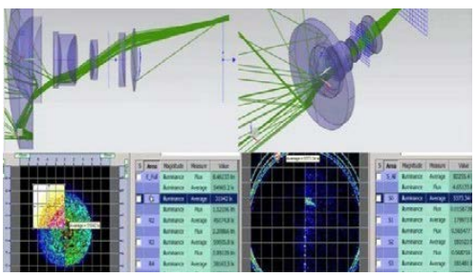
Assess camera and lidar raw signals in their integrated environment, apply electronic post-processing and evaluate sensor layouts on vehicles.



The Ansys SPEOS Optical Sensor Test provides a built-in environment for easily evaluating the impact of different design versions (low/high-end) on sensor perception and global product compliance early in the design phase. Starting from a digital mock-up, including the sensor layout, the surrounding geometries and targets, you can physically model lidar, ultrasonic and camera systems. Integrated into Ansys SPEOS, you can access the data acquired by a sensor system, considering its characteristics and constraints. The Optical Sensor Test enables you to simply perform complete analyses for different sensor configurations in various scenarios in approximately 15 minutes, without the need for manual operations. The results are insightful and help to determine the expected performance of a specific sensor supplier.

/ User-Centered Design

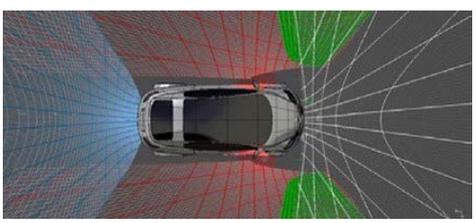
SPEOS offers intuitive 3D modeling capabilities in a comprehensive user interface, making it accessible to any optical expert or non-expert alike. Thanks to the simplified user experience, based on direct modeling, it is easy to create, experience, optimize and validate any optical system with just a few clicks in a rapid iterative process.



/ Connection with Multiphysics Simulations

The integration of SPEOS into Ansys multiphysics solutions enables you to perform related thermal and mechanical simulations in addition to optical simulation. You can check the impact of heat and deformations on optical performance to certify the compliance of any system in a comprehensive usage context.

/ Field of View

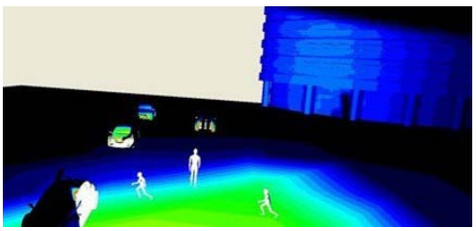


The SPEOS Optical Sensor Test enables you to perform studies of the perception field of detection systems. These studies let you specify the right sensor performance in terms of resolution and field of view. The field of view study is essential to assess sensor specifications and layout. A 3D display of the final detected image, with color scale, enables a quick and easy field of view analysis. By using input data (point cloud), you can also perform advanced studies for further detection quality. The global detection performance and sensor array can be validated early in the process, well before it can be tested on a physical prototype.

The field of view module displays a 3D projected grid representing sensor vision according to the environment. It enables you to improve the performance of the detection system in case of object occlusion by improving global tracking and recognition for increased detection safety. Based on object depth information, field of view lets you check the pixels that impact the visibility of further objects to ensure good image recognition.

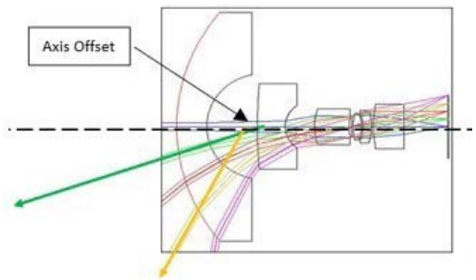
You can also use the export sensor grid as a geometry feature to create and adjust a geometry directly from the sensor view.

/ Camera Sensor



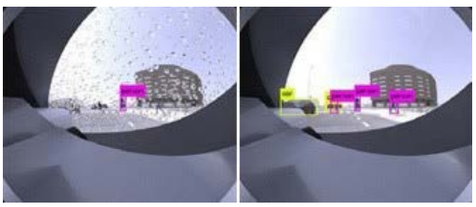
The SPEOS Optical Sensor Test simulates camera vision based on the field of view, resolution, spectral sensitivity and distortion. It includes the visualization of camera sensors, allowing you to qualify the camera system's perception.

Within SPEOS 3D view, the camera sensor module provides a built-in environment for easily evaluating the impact of different design variations, from low-end to high-end, on camera perception and product compliance early in the design stage — much earlier than waiting for a physical prototype. As early as the conceptual design phase, you can ensure that your cameras will comply with rear visibility tests.



Variable entrance pupil position

Starting from a digital mock-up including surrounding geometries, sensor layout and surrounding targets, the camera sensor module can physically model natural and artificial lights and real camera systems, and gather the virtual information that the camera will perceive.



You can analyze the image acquired by the camera system, considering the objective characteristics, the imager properties and the image's encoding and compression. The camera sensor module performs a complete analysis for different configurations of the sensor in approximately 15 minutes, without the need for manual operations. The module delivers the optical signal just before its conversion to an electronic signal by the sensor. These results are useful to assess the expected performance of a specific camera.

The camera sensor module also includes a parametric model of distortion, simulating a fisheye lens system up to 270° in real time. This model enables you to simulate the surrounding view, covering 360°. Usual camera defects associated with the sensor system, such as the impact of variable EPP car parts, the depth of field and vignetting are taken into account, to optimize the efficiency of the global system. This tool is particularly suitable in testing the autonomous parking function. In addition to this, the camera takes into account the spectral irradiance information reaching the opto-electronic sensor. You can evaluate the post-processing algorithm at the sensor level, for elements such as white balance, gain, or signal perturbation, to increase the accuracy of the simulation.

/ Lidar Sensor

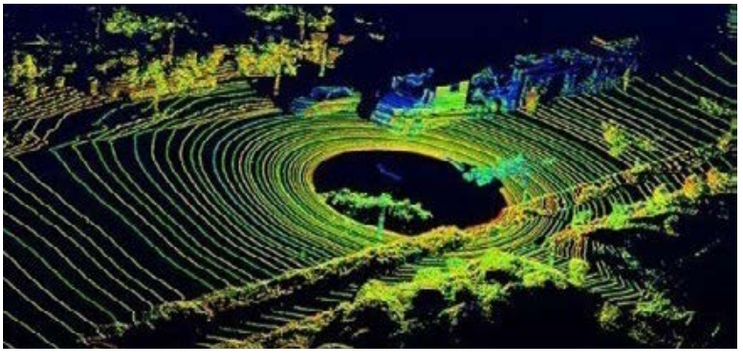
The SPEOS Optical Sensor Test includes the simulation of static, rotating and scanning lidar sensors so you can qualify the quality of lidar system perception. The lidar sensor module provides a built-in environment for easily evaluating the impact of different lidar design variations, from low-end to high-end. Thanks to this feature, the perception of the environment by lidar systems and the testing of product compliance can be performed earlier in the development process, even before physical prototypes are available. Typically, the SPEOS Optical Sensor Test can be used at the conceptual design stage to compare different lidar packaging options and evaluate the impact of surrounding geometries on signal quality.

From a digital mock-up, including the surrounding geometries and targets as well as the sensor layout, the lidar sensor module provides functionalities to model and simulate the interaction between the solid state lidar sensor and the surrounding world.

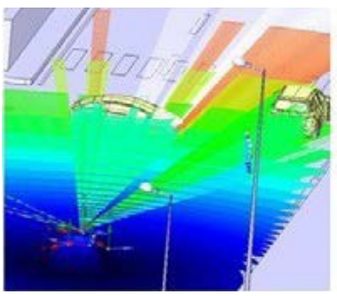
The module performs a complete simulation of the sensor in approximately 5 minutes, without the need for manual operations. The output is a distance map, as delivered by a lidar system and interpreted from the optical signal acquired by a lidar system. The map takes into account the emitter quality, the receiver characteristics and the surrounding world properties.

More than just an interpreted map, the SPEOS Optical Sensor Test provides the optical time-of-flight (ToF) signal received by each channel of the receiver just before its processing as an electronic signal. This enables you to do specific post-processing analyses based on the raw signal to develop more robust detection algorithms.

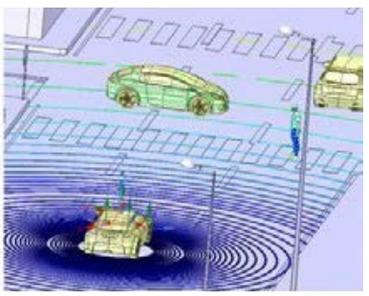
Additionally, the SPEOS Optical Sensor Test visualizes the field of view of sensors. The field of view tool is used for describing the installed performance of a sensor. For instance, when a lidar is placed behind a protective lens like a windshield or a headlamp lens, it distorts the signal detected. The SPEOS Optical Sensor Test simulates these distortions and the multiple ghost detection induced by multi-reflections inside the lens. Thus, the lidar placement can be optimized to guarantee higher performance and safety.



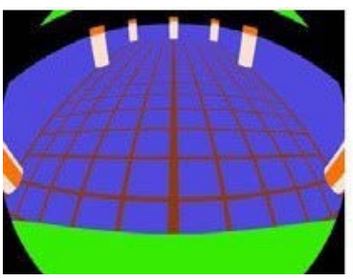
FoV output in 3D (with color scale)



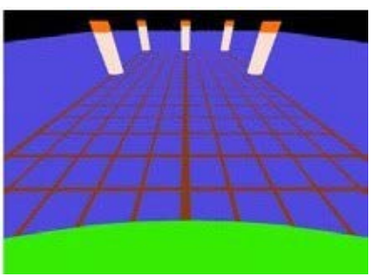
Rays



Impacts



Distorted camera view



After image post-processing

/ Camera Post-Processing

The SPEOS Optical Sensor Test performs post-processing of the camera system. Camera post-processing enables you to apply an image processing algorithm on a simulated image to test algorithm performance in various scenarios. You can thus review, early in the process, the actual legibility of the camera image displayed in the cockpit or check the compliance of the image with the rear visibility test (FMVSS 111 standard issued by the NHTSA in 2011).

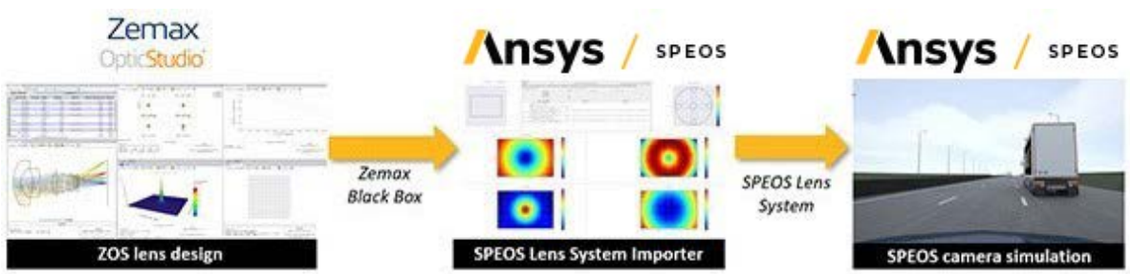
With the interoperability between camera acquisition simulation and image processing, packaging vision system designers can assess the performance and robustness of algorithms in various scenarios.

Using the plug-in mechanism, post-processing provides an image as it will be displayed to the end-user with specific acceptance criteria. Plug-ins can be developed either by SPEOS Optical Sensor Test users themselves or by Ansys engineers to achieve desired customer specifications.

The plug-in mechanism protects the intellectual property of the owner as its distribution remains under the owner's control. Numerical assessment of the optical system design can be performed in accordance with the program specification, facilitating communication between all collaborators working on a project.

/ SPEOS Lens System Importer

The SPEOS lens system importer facilitates the creation and analysis of imaging systems. It makes it possible to import any native Zemax OpticStudio optical system or any SPEOS-generated optical system into SPEOS. The imported system contains the optical data necessary to perform advanced analysis, while protecting the original system's intellectual property. Using imported systems ensures continuity throughout the development of imaging systems.



Ansys SPEOS Packaging - Synthesis		
PRODUCT	PACKAGE / ADD-ON	DESCRIPTION
Ansys SPEOS	Pro	Simulates lighting system's performance in the visible light range, evaluates photometric and colorimetric magnitude
	Premium	Evaluates materials and lighting system's performance and appearance, extends analysis to radiometry from ultraviolet to near-infrared
	Enterprise	Examines human vision, physiologically models the human eye, determines reflection visibility and information legibility
	Optical Part Design	Creates dedicated optical geometries for the design of lighting systems
	Optical Sensor Test	Assesses camera and lidar raw signals in a driving environment, applies electronic processing, enables layout of sensors on vehicles
	Far-Infrared Extension	Extends optical simulation range up to far-infrared, models thermal radiation
	HUD Design & Analysis	Head-up display (HUD) optical design. Designs automotive HUD imaging systems, tests HUD image quality against standards and specifications
	HPC	Shortens simulation times for high-quality results and enables quick evaluation of systems at extremely high resolution

To see a full list of Ansys Optical capabilities please visit Ansys SPEOS Capabilities Chart

ANSYS, Inc.
www.ansys.com
ansysinfo@ansys.com
866.267.9724