



AVxcelerate

Headlamp Simulation Overview

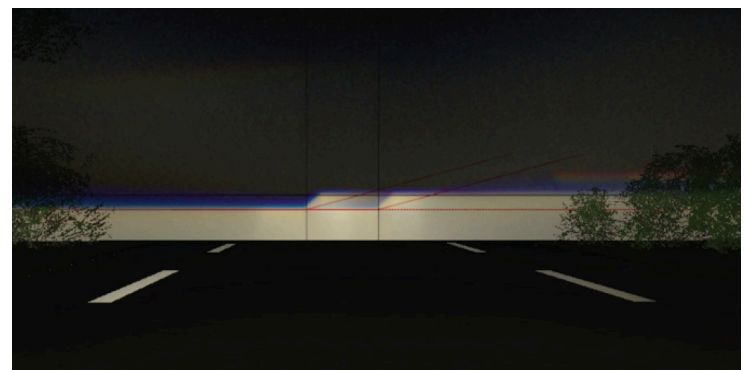
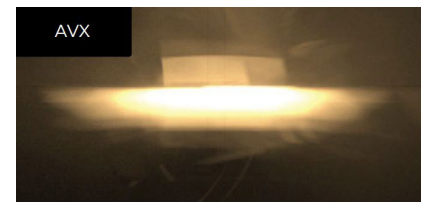
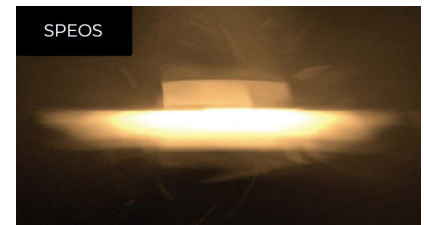
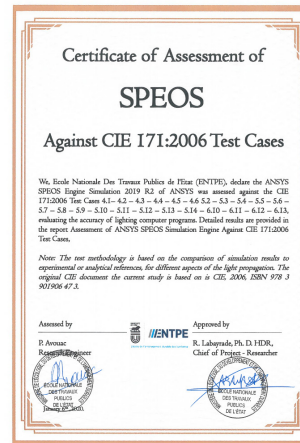
Ansys AVxcelerate provides tools to test and validate headlamp performance with a complete physics-based simulation in a dynamic virtual driving environment. It reduces the need for night road tests by virtually assessing headlamp performance in real-time. It extends testing for intelligent lighting (AFS, ADB, matrix and pixel beam) and control law models to assess IHS/CAISI ratings. .

/ Headlamp Simulation

With this real-time and physics-based solution, users can simulate virtual prototypes of headlamps in real-time with a physically accurate simulation. Simulation considers optical properties of material and light sources to simulate propagation from the headlamp and other light sources. The physically accurate results produced by AVxcelerate Headlamp, allows users to perform trustable reviews if the lighting system performances and make reliable decisions before the physical prototyping phase. Simulations are validated in comparison to those of CIE certified Ansys SPEOS light simulation tools. Real-time simulation allows users to include test drivers within the decision loop.

Headlight simulation – Simulate and test vehicle headlights during night driving conditions, without having to wait for the actual nighttime. Light distribution of the headlight system is based on beam distribution that is measured or simulated IES (Illumination Engineering Society) files, which are standard digital files in ASCII format that measure the distribution of light, in other words the intensity of the light and its shape, based on the designed optical system. Using Speos simulation, headlamps light distribution can be simulated in a proprietary format named XMP that includes the spectrum of light to simulate chromatic aberrations caused by the projector lens at the low beam cut-off area. Intelligent lighting systems such as matrix beam (up to 250 cells per side) and pixel beam can be simulated as well. Simulation can be deployed on multiple screens to provide a wide immersive environment for human-in-the-loop simulation or quality review.

Digital mock-Up allows users to import vehicle shapes, used as masks, from CAD software in 3DXML to offer an assessment of the visibility when driving a specific vehicle.



/ Environment Simulation

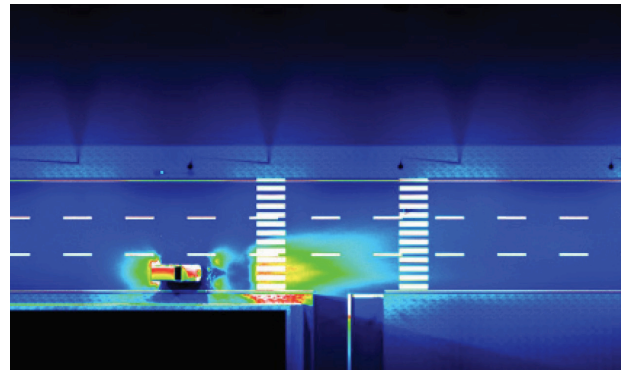
Driving scenarios allow users to create and simulate simple driving scenario that can include several vehicles. To test matrix beam and pixel beam system in situation, traffic vehicles can be added to the simulation. This allows users to generate scenarios, such as following a car, taking over or crossing car in parallel. Each vehicle included in the scenario can be static or automatic. Static mode allows users to perform static evaluation at a specific points of interest. Automatic mode enables users to drive along a predefined trajectory while the operator stays focused on lighting system behavior and performances. A basic vehicle dynamic simulation can be used to manually drive ego vehicles. This allows users to test simple driving situations using either a keyboard or a Logitech® Steering Wheel.

Co-Simulation more advanced scenario and vehicle dynamics can be addressed in co-simulation with driving simulators. A connector to IPG Automotive CarMaker is provided.

/ Lighting System Development

Interactive Virtual measurement features include tools dedicated to beam assessment and regulation check. It offers a wide set of analysis tools to detect, measure and compare any defects in the beam pattern. Real time visualization in luminance, illuminance, iso-lines or iso-areas facilitates the comparisons between different behaviors and light sources - Halogen, Xenon or LED. Measurement grids ease the assessment of homogeneity of light distribution. The aiming wall allow users to check the conformity of the cut-off according to regional regulation (such as ECE markers).

Intelligent lighting systems – AVxcelerate Headlamp includes advanced features dedicated to the development of dynamic and intelligent lighting systems. It addresses: Cornering light, Adaptive Front Lighting System, Dynamic Bending Light, Adaptive Driving Beam, Matrix Beam and Pixel Light. Functions to modify lighting modules orientation and cells power are available through C++ API, Ansys SCADE connector or MATLAB Simulink. In addition, the solution offers pixel beam control through a mask application to the lighting system to simulate the behavior of DMD or LCD in real time.

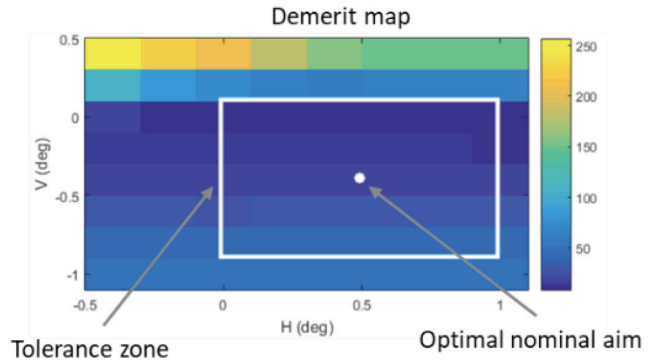


/ Performance Assessment

The purpose of developing a matrix beam or any type of intelligent lighting system is to put as much light as possible on the road to optimize driver safety without creating dangerous or distracting glare for other drivers. This is the **Glare-Free High Beam** feature. The product feature enables users to measure the discomfort of the glare generated by the other vehicle headlamp from a driver's perspective. It comes with a visual gauge to objectively measure the discomfort of the glare on the De Boer Scale. A corresponding visual effect is also added to the rendering view to graphically show the glare impact. Measures are available through C++ API, Ansys SCADE connector or MATLAB Simulink toolbox, to allow quantified detailed analysis on several lighting configurations and scenarios.



AVxcelerate Headlamp enables users to virtually evaluate and optimize the rating of the headlamp according to virtual measurement devices and a digital twin of **IIHS – Insurance Institute for Highway Safety** – test track or **C-IASI** one. The vehicle under test automatically drives on the defined trajectories where virtual illuminance sensors are positioned. It considers vehicle dynamics and intelligent lighting control laws. A PDF report is produced that takes into consideration the 5 lux detection threshold. Batching mode allows users to evaluate several headlamp positioning tolerances.



Custom test environments can be created by positioning individual illuminance sensors in the tracks or in vehicles. Users can create their own custom performances reports to assess their own KPIs.

FMVSS 108 ADB Virtual Regulation

With FMVSS 108 regulation, Adaptive driving beam headlights are now permitted in US. AVxcelerate now has the capability to provide a digital twin of the test track to help test the requirements needed for compliance. Evaluation glare reduction in opposite or same direction scenario and accuracy of traffic lighting system are now possible. A final report is generated with detailed illuminance plots for each test section, and a summary highlighting PASS or FAIL for each test scenario. Virtual regulation can help save time, cost and improve the efficiency of the ADB system.

Ansys AVxcelerate Headlamp Simulation			Add-ons		Bundle	
	Prepost	Solve	Headlamp	Driver View	Premium	Enterprise
Headlamp capabilities						
Real-time physics-based lighting			●		●	●
Smart camera			●		●	●
Lamp control			●		●	●
Glare			●		●	●
IIHS/C-IASI / FMVSS 108 regulation validation			●		●	●
Solve capabilities						
Basic driving scenario		●			●	●
Co-Simulation		●			●	●
Prep/Post tools						
Interactive Virtual measurement	●				●	●

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

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