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Deliver Engineering-Grade Light Simulation to Studio Designers

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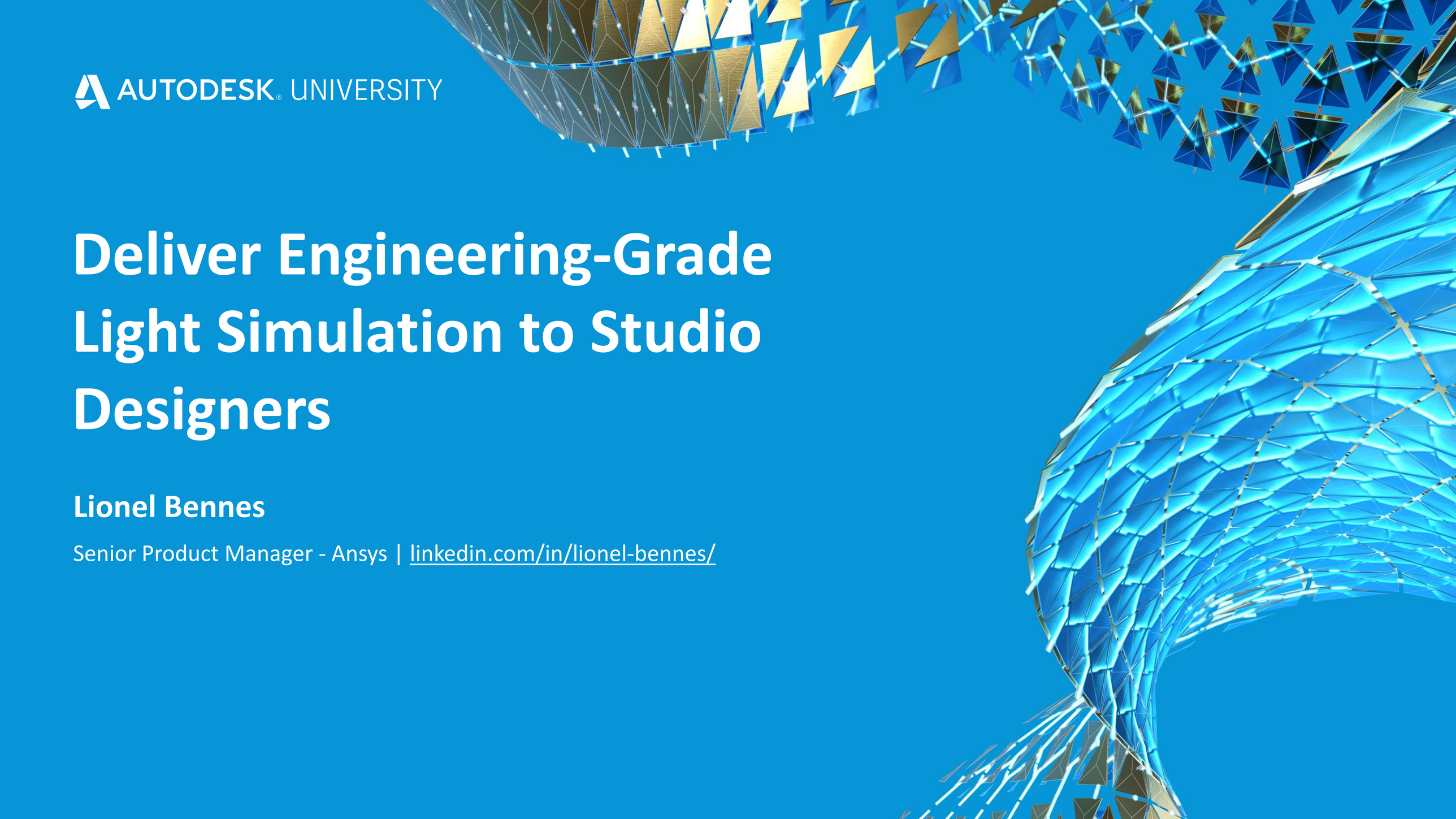


Agenda

- Ansys & Autodesk Partnership
- Workflow with Autodesk VRED & Ansys VRXPERIENCE Light Simulation
- Practical case of making the Aurora Concept car lighting an engineering reality
- Behind the scenes – « How to »
- Key takeaways

Ansys & Autodesk Partnership : Spur Innovation for the Automotive Industry

Ansys + Autodesk - Spur Innovation for the Automotive Industry

- Combine leading software solutions to **drive revolutionary design advancements**.
- Unique Solution enabling automakers to **complement hyper-realistic visualizations of vehicle interiors and exteriors with highly accurate lighting simulation.**
- Deliver engineering grade light simulation to studio designers in a **single, self-sustaining workflow**.

“Light is the new chrome”

New trends will further drive the demand for lighting, and the need to create designs while keeping in mind their impact on lighting

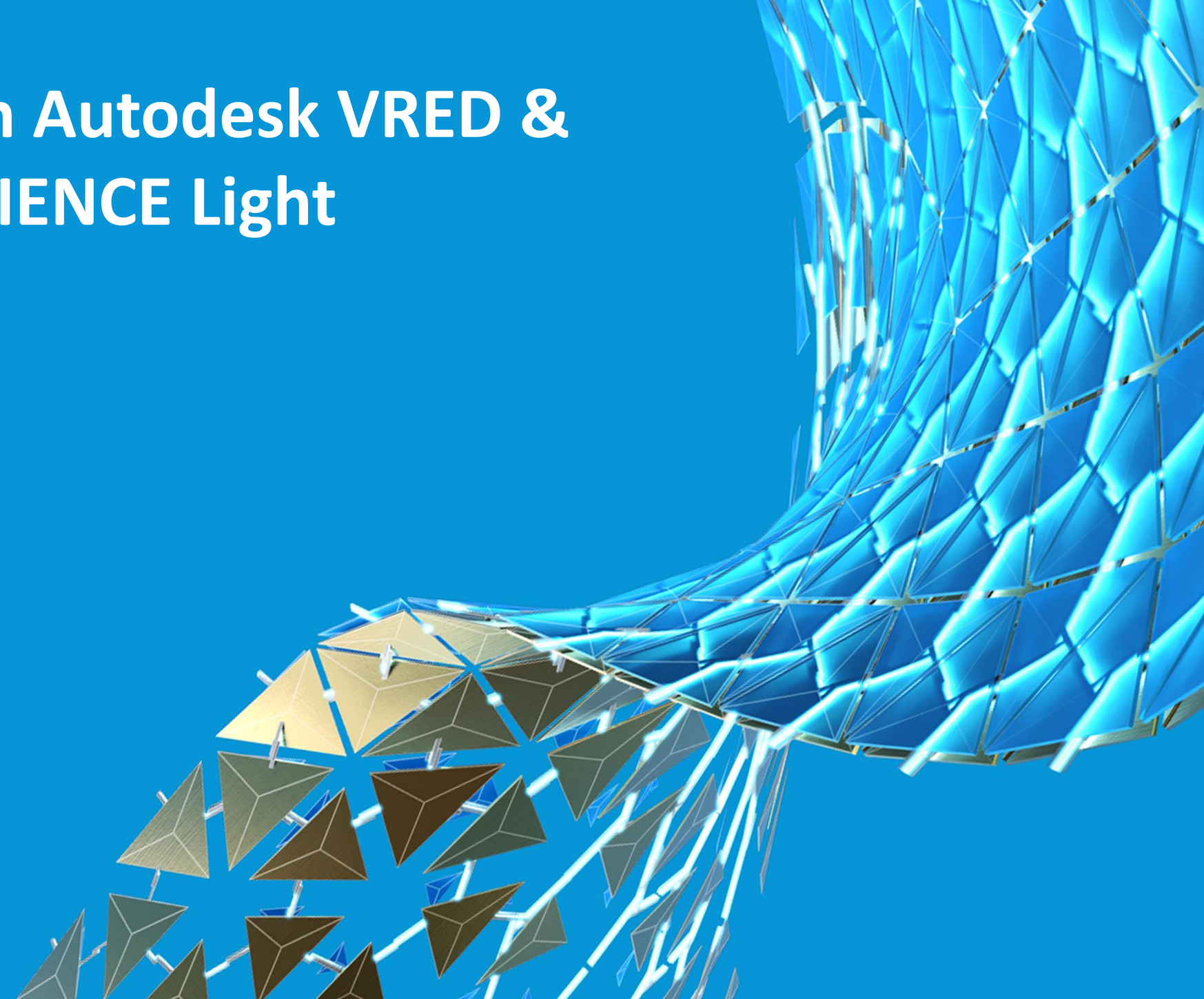
For automotive companies, lighting is *“The new competition arena”*
- Dr. W. Huhn, Audi AG, Lighting & Vision director

“25% of brand signature” comes from lighting
- Oliver Wyman Consultants

LIGHT GUIDE / DIFFUSIVE PLASTIC

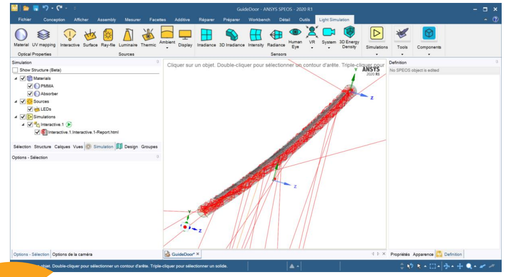
OLED / CONTROLLABLE EMITTING SURFACES

Workflow with Autodesk VRED & Ansys VRXPERIENCE Light Simulation



Lighting Design Process

Ansys / SPEOS



Early design phase → Design & Styling ⇄ Engineering Design → Marketing & Sales

AUTODESK®
VRED™ PROFESSIONAL

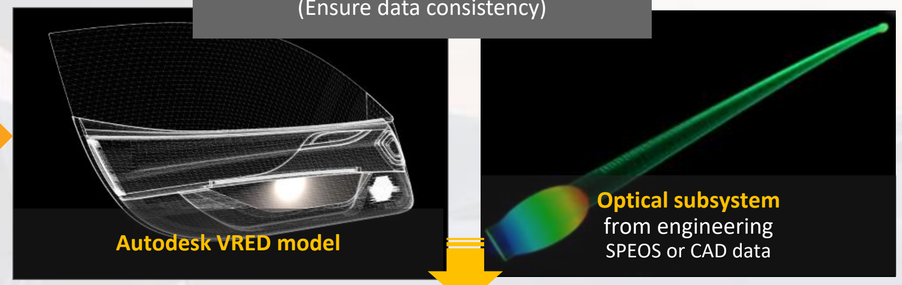
The challenge of closing the gap between design studio and engineering

How to validate design intent preservation based on engineering input?

- **Lighting uniformity**
- **Light leakage**
- **Lit appearance**

EXPORT
Data

COMBINE
(Ensure data consistency)



AUTODESK®
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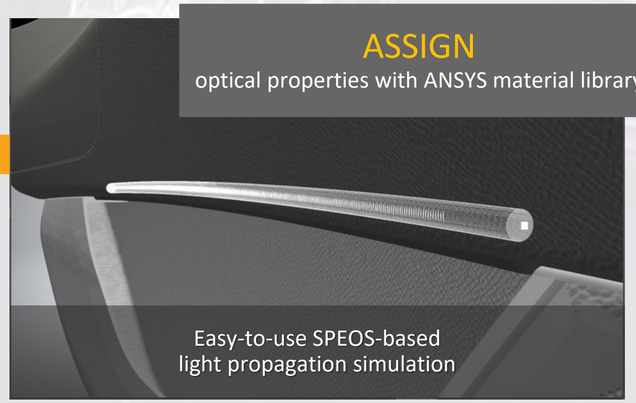
Delivers engineering-grade light simulation to studio engineers

Ansys / VRXPERIENCE Light Simulation

EXPORT
Rayfiles results to VRED

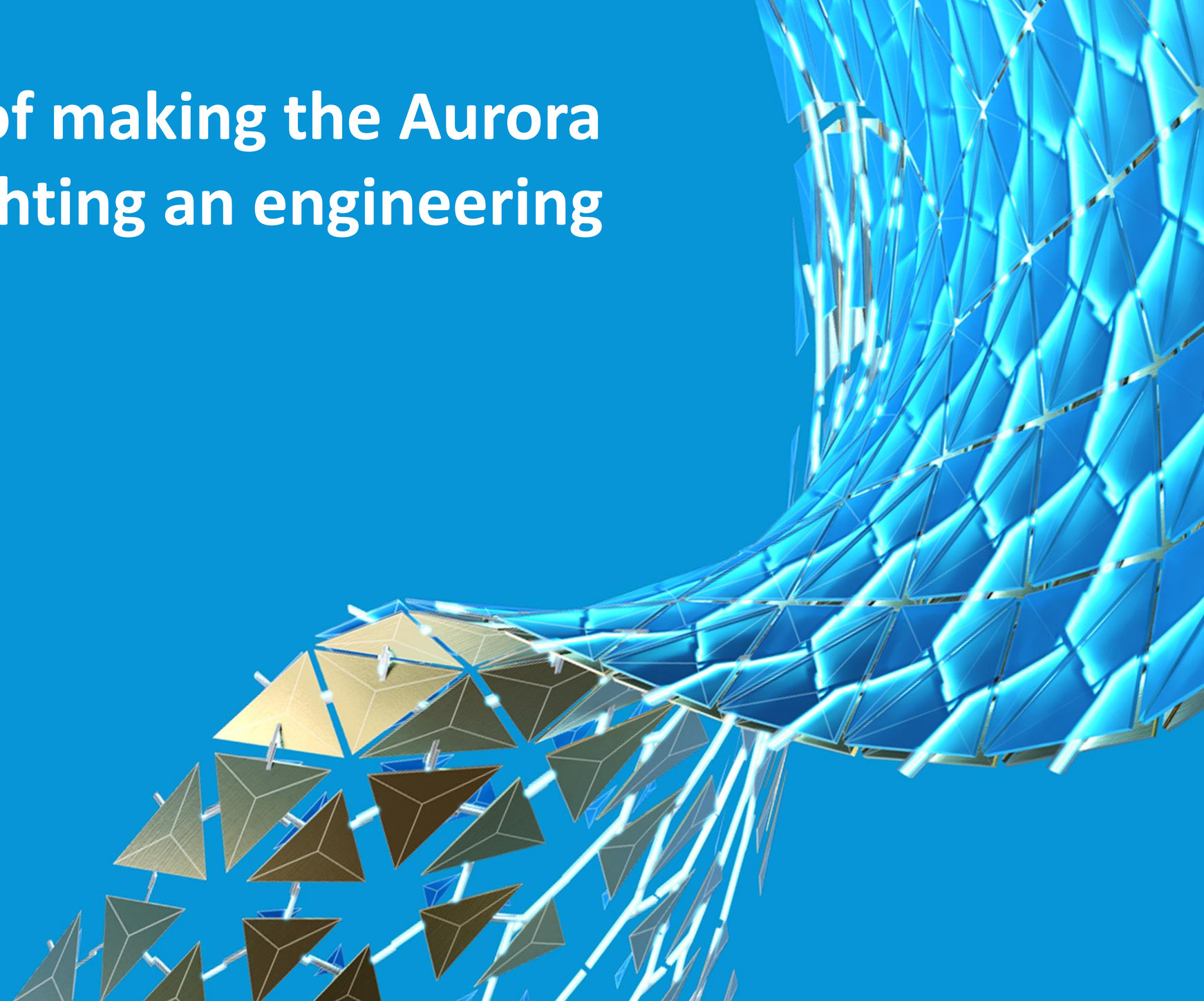
ASSIGN
optical properties with ANSYS material library



VRED / VRXPERIENCE workflow

The combination of VRED & Optical Engineering data in VRXPERIENCE Light Simulation empowers the design studio with physics-based lighting simulation results, on demand. Resulting in a better collaboration, better quality and in time- and cost-savings.

Practical case of making the Aurora Concept car lighting an engineering reality



Engineering Aurora Model Interior Lighting

- **From the initial design intent:**
  - Engineer interior lighting systems
  - Identify failures and iterate
  - Make Aurora an engineering reality

1. **Focus on indirect light guide in door pocket**
2. **Focus on direct sight light guide in the central console**

1. Focus on indirect light guide in door pocket

- **Design intent**
  - Perfectly uniform lighting of the door pocket
  - No light leakage

1. Door Pocket / Step 1: Initial Engineering proposition

- **Lack of longitudinal lighting uniformity**
  - Due to regular prism angle all along the light guide, not optimized to drive light far enough in the guide.
- **Light leakage and weak lighting level**
  - Due to LED light source faulty coupling with the guide.
  - Only 45° of the light source output is sent into the guide, the rest is leaked.
- **Clear cover lens**
  - Visible stripes from the internal structure of the guide are not soften by a diffusing cover lens

- **Back to engineering for light guide modifications**
- **Explore other cover lens material.**

1. Door Pocket / Step 2: Milky cover lens

- **Improved lighting homogeneity by using**
  - Variable prism angle
  - A more diffusing material for the cover lens (milky material)

- **Improved lighting homogeneity by using a more diffusing material for the cover lens (milky material)**

➢ **Reduce Light Leakage.**

1. Door Pocket / Step 3: Light source optimization

- **Leakage reduced and improved lighting level by adding a lens to couple more light inside of the guide.**

➢ **Acceptable result regarding initial design intent**

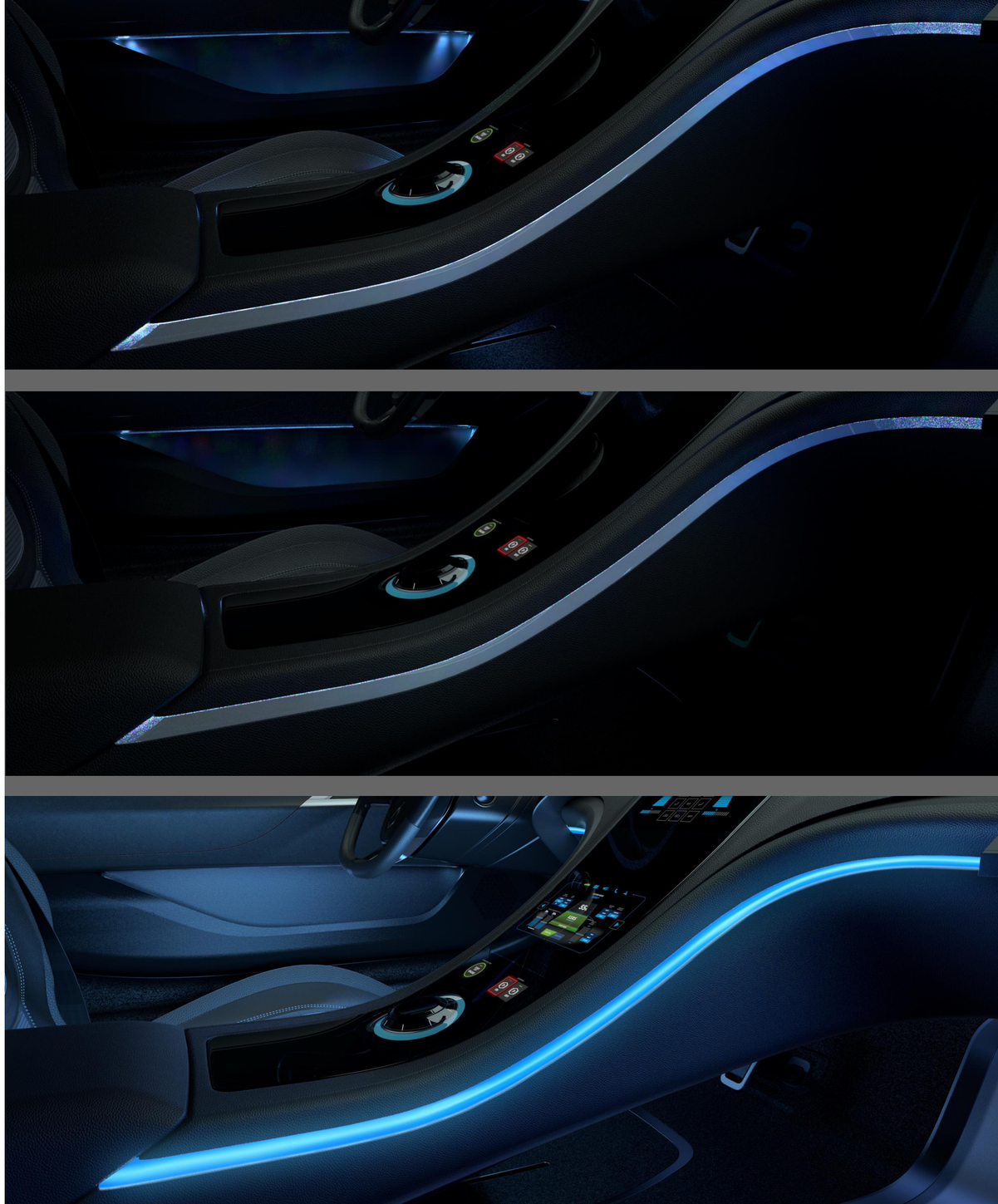
2. Focus on direct sight light guide in the central console

- **Design intent**
  - Light guide with direct sight intent
  - Uniform lighting
  - Perfectly diffuse lighting (uniform from all sight directions)

2. Focus on direct sight light guide in the central console

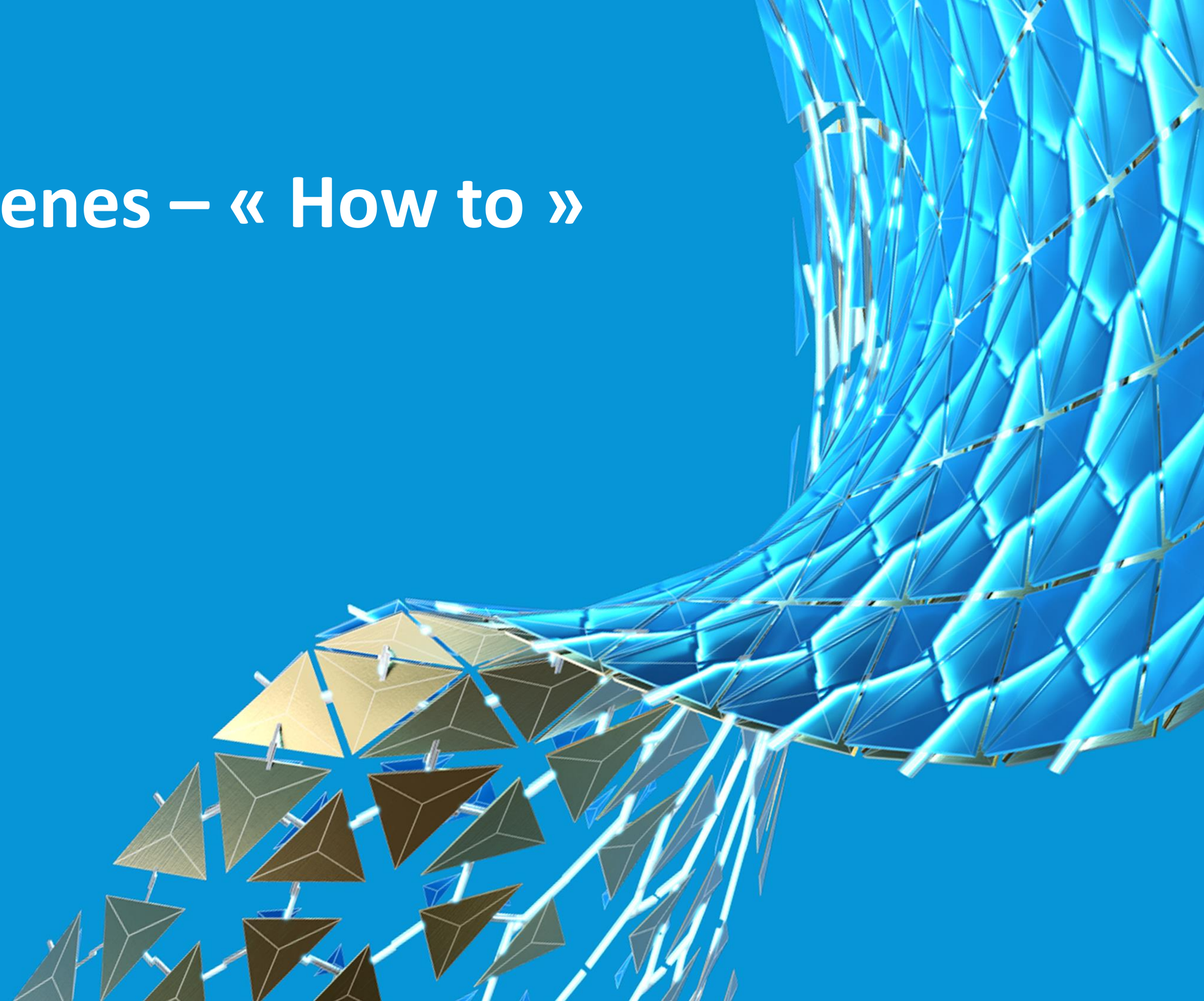
- **Light guide based on light stripes, individual reflectors and a cover lens.**
  - **Step 1** : chrome mirror reflector, unpolished/frosted translucent glass cover lens
  - **Step 2** : Diffuse white reflector, unpolished/frosted translucent glass cover lens
  - **Step 3** : Diffuse white reflector, white milky material cover lens

➢ **No change in the engineering data, only material exploration performed by the design studio.**



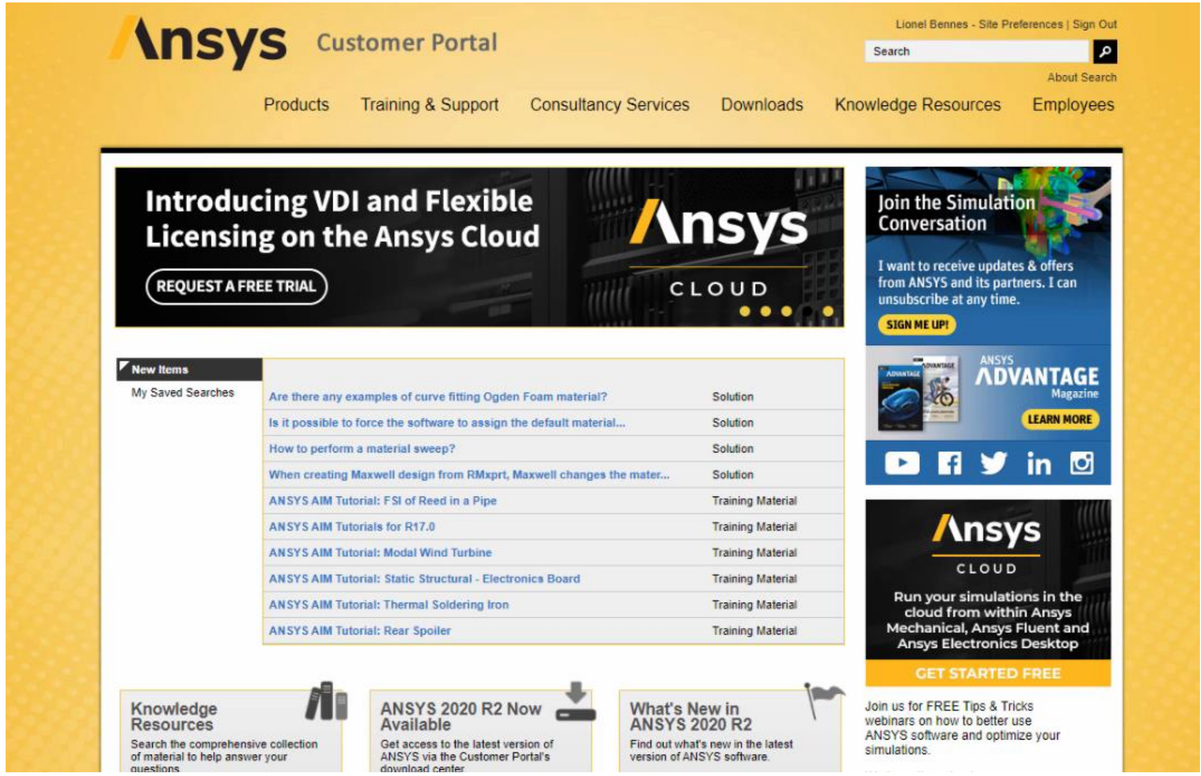
End result is acceptable in regard with the initial design intent

Behind the scenes – « How to »



Setting up Ansys VRXPERIENCE Light Simulation

- **Once granted, access to Ansys customer portal to download the software:**
  - https://support.ansys.com/portal/site/AnsysCustomerPortal

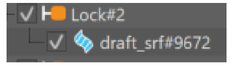


- **Run the installer and select « VRXPERIENCE Light Simulation »**

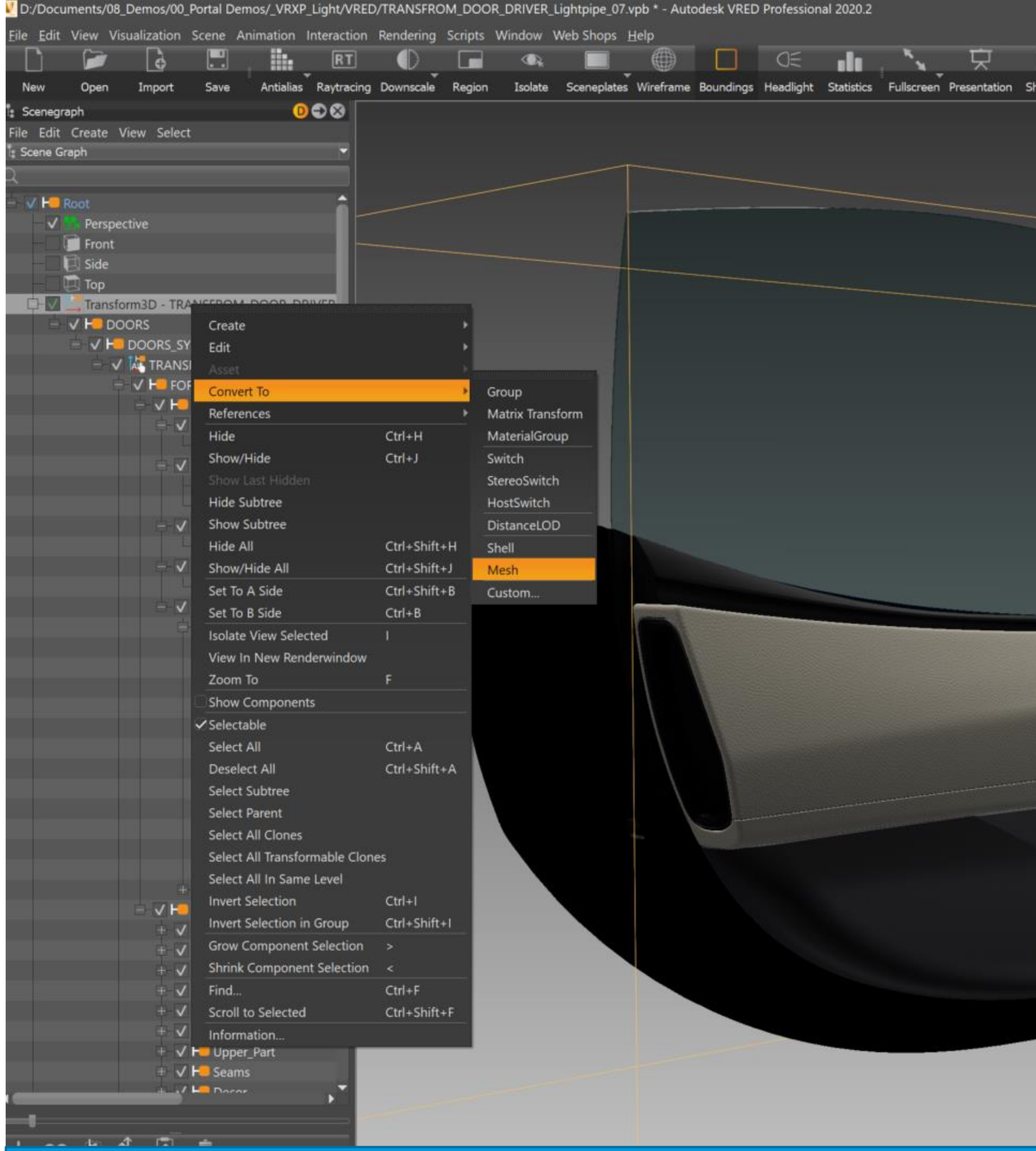
Export Design Data from Autodesk VRED

- **Pre-requisite : Models need to be meshed to be used in VRXPERIENCE.**
  - Un-reversible operation, make sure to keep a NURBS based version on the side if needed.
- **In VRED :**
  - Convert model to Mesh
    - Save a project copy.
    - Covert to mesh, right click in the scenegraph top node, convert to, mesh.
  - Export to FBX format for import in VRXPERIENCE
    - File/Export
    - Select Fbx format
- **Alternatively, user can export only a part of the VRED:**
  - Select data to export
  - File / Export Selected...
  - Fbx format

NURBS

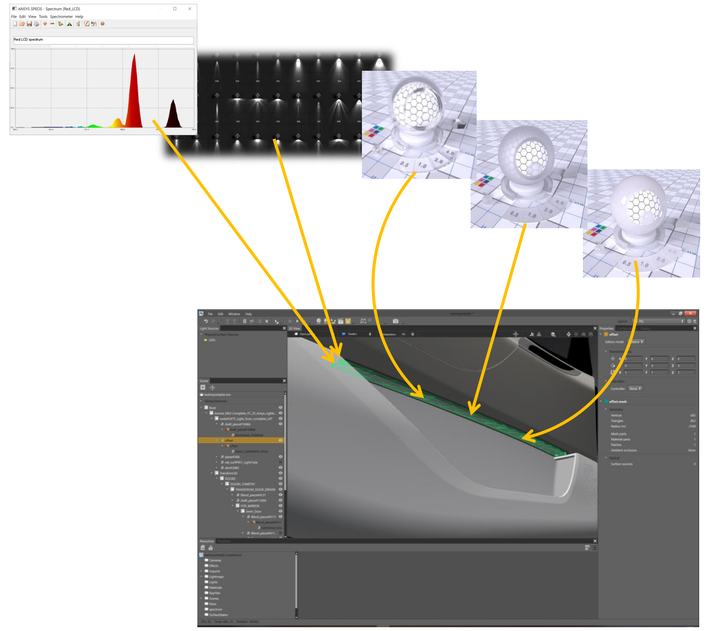


MESH



Warning :
Export selected = import back ray files at the level of export !

Asking for the proper data to the engineering team



- **If the engineering team (supplier) is using SPEOS**
  - Ask for an SV5 export of the optical system – optical properties will be preserved
  - Ask for the available optical properties to be used in the project
    - Light sources properties
      - Light intensity files (.ies) for light sources illumination patterns
      - Spectrum files (.spectrum) for light sources emissive properties
    - Material
      - BRDF files for surface state properties of opaque material
      - Volumic optical properties (.material) for diffusers or translucent material

- **If the engineering team is not using SPEOS**
  - Ask for optical system CAD data
  - You can pick optical properties from the Ansys optical library, from the main optical material suppliers

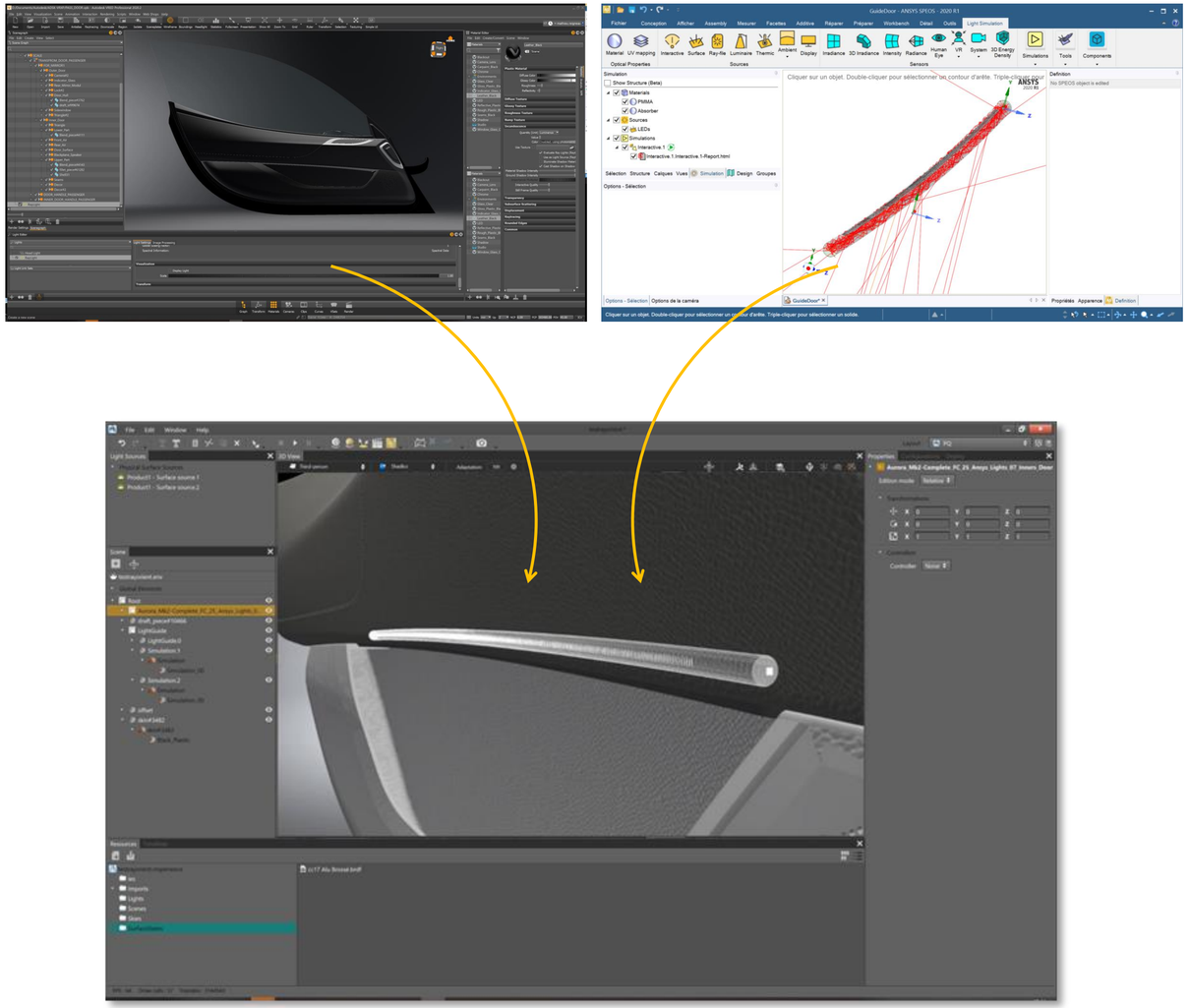
Import all data in VRXPERIENCE

- **In VRXPERIENCE, combine design studio inputs (VRED export) and engineering data (SPEOS export – or CAD) to create a single consistent data source to run the optical simulation:**

  - Import VRED data via fbx (keep default options).
  - Import SPEOS or CAD data via SV5 or native CAD data (standard VRXPERIENCE import).
    - When using SPEOS data (SV5), optical properties are preserved.

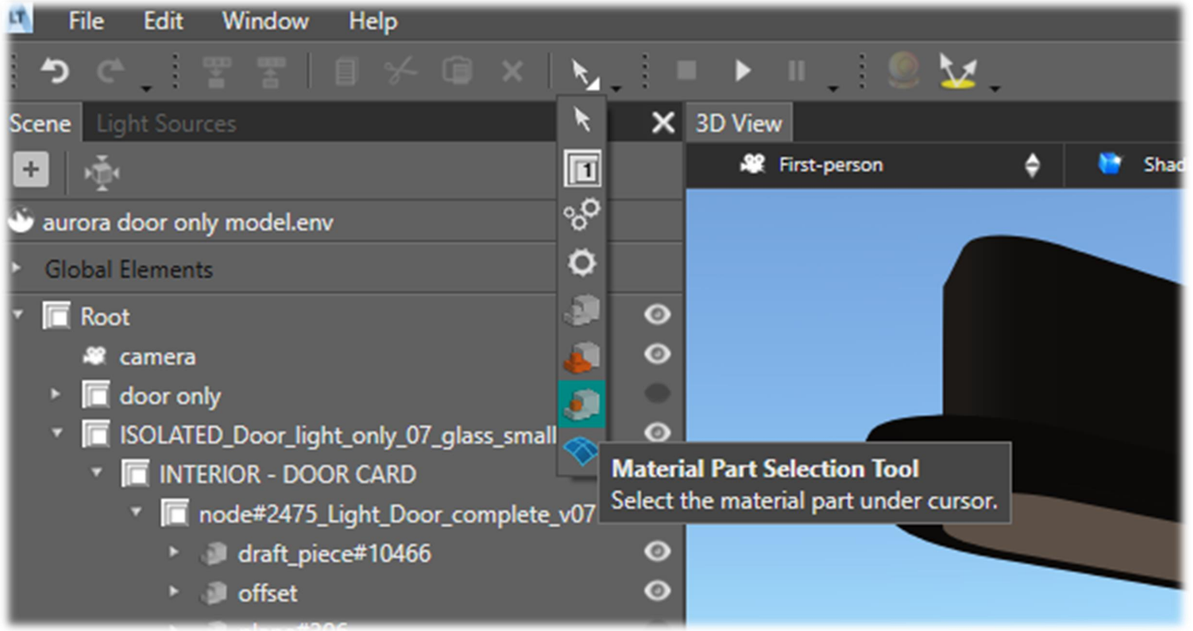
  - Warning: Final results are to be reviewed in VRED, so engineering data are to be aligned (position, orientation) on the design studio data, and not the opposite!

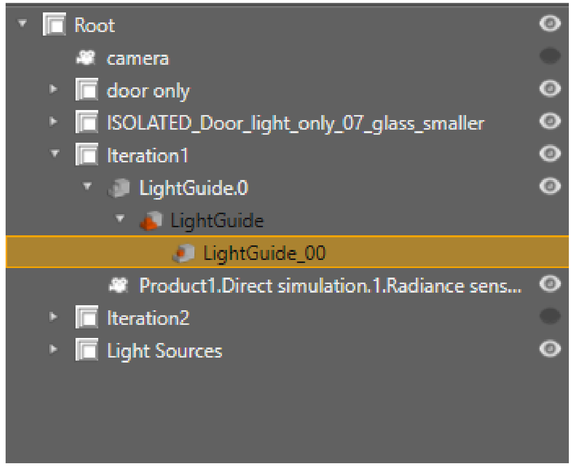
  - Advice: isolate the optical system (design+engineering) in order to focus the lighting simulation on the optical system output.
    - For example: in the door pocket data, isolate:
      - Light guide geometry & light source (SPEOS)
      - Cover lens and surrounding case (VRED)

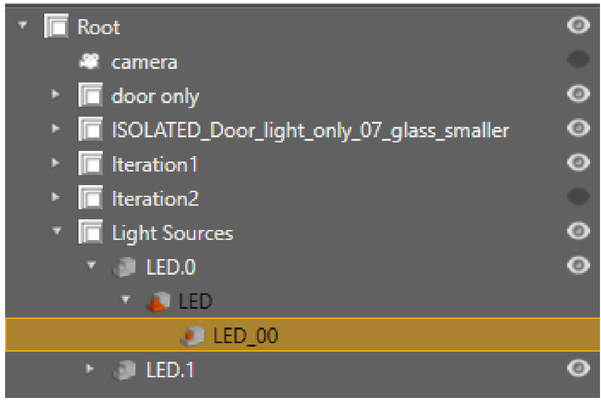


Apply Optical Properties

- **In VRXPERIENCE, optical properties are applied at the “material part” level.**
  - Use the dedicated 3D view picker for direct access
  - Or use the lower hierarchy level from the graph explorer.
- **Optical engineers often use “surface sources” (emissive surface) to represent light sources**
  - In VRXPERIENCE, surface sources are managed at the “material part level” in complement of the optical properties of the part.

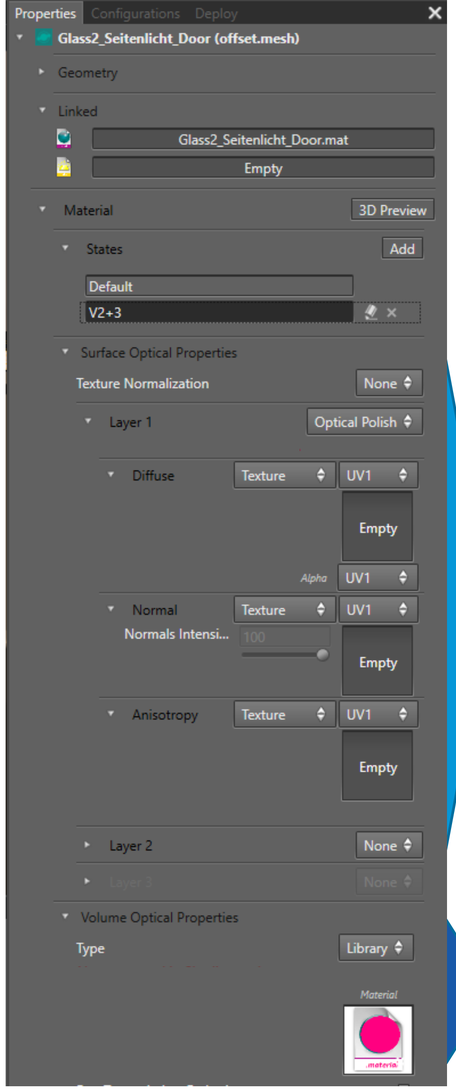


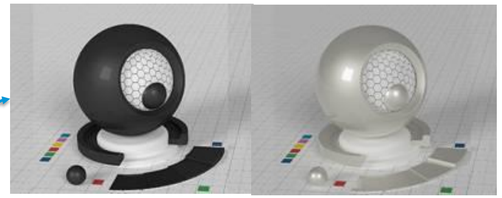


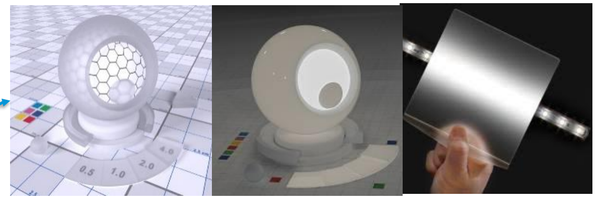


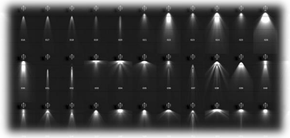
Apply Optical Properties

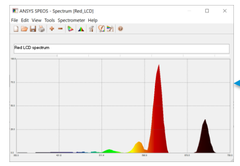
- **Brief explanation of material properties**
  - Surface Optical Properties
    - Combination of optical properties describing how light is reflected at an opaque surface (BRDF) with a surface variation driven by textures.
    - Multi-layer capability to define multi-material surfaces
    - Library or parametric description for simple behaviors (Lambertian, Optical Polish)
  - Volume Optical Properties
    - Optical properties describing the behavior of the light as it goes through a transparent or diffusive volume.
    - Layers and interfaces of several volumes can be considered.
    - Library or parametric description for simple behaviors
- **Light source optical properties**
  - Intensity defining power and intensity profile (parametric or IES)
  - Spectrum definition (wavelength or spectrum file)

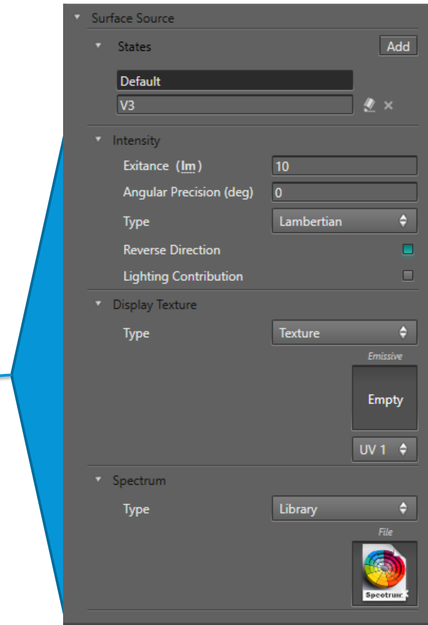






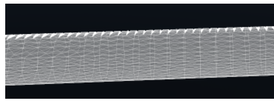


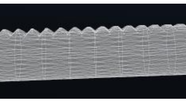


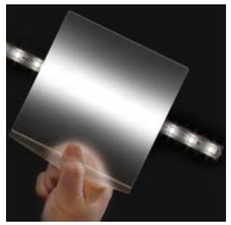


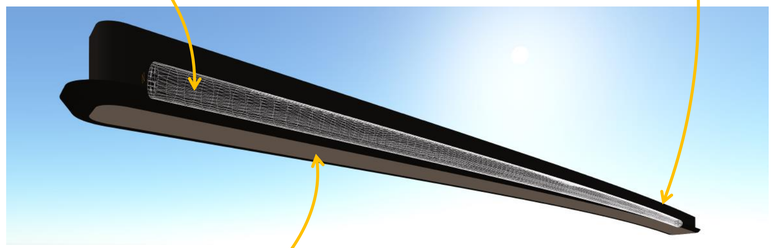
Apply Optical Properties

Plastic Black Coarse.brdf







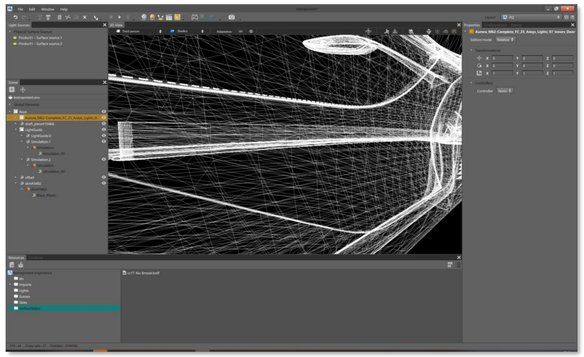


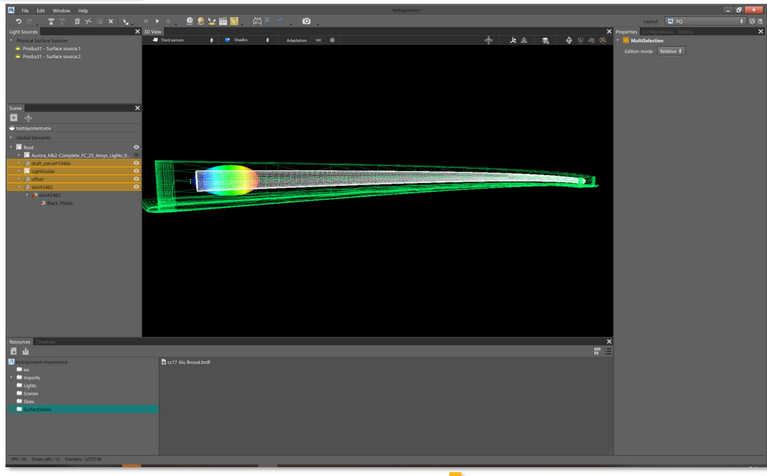
Run the Optical Simulation and Generate Rayfiles

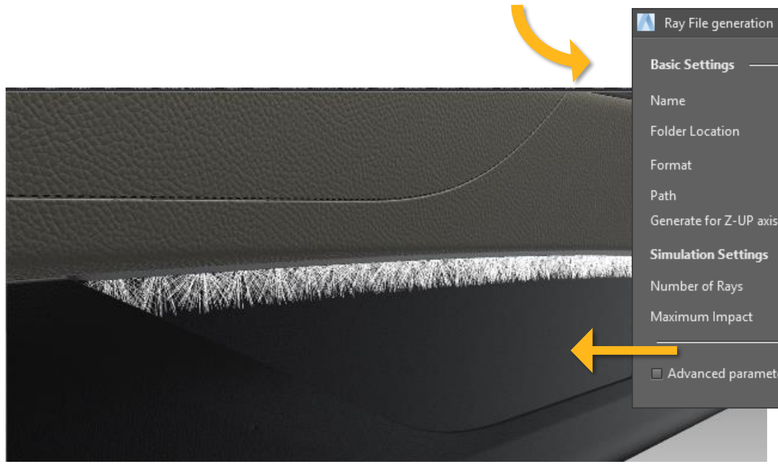
- **SPEOS Simulation facts**
  - Full spectral physically correct monte-carlo optical simulation.
  - Simulate light interaction with advanced materials like aluminum scattering reflectors, aluminum anisotropic scattering reflectors, and transparent or diffusive plastic for light guide applications.
  - SPEOS simulation core considers spectral transmission (transparent materials), spectral reflection (mirrors) and spectral diffusion (plaster) to calculate the real behavior of a complete lighting system.
  - SPEOS is traditionnally used for optical systems design, performances assesment of optical systems and regulations check.

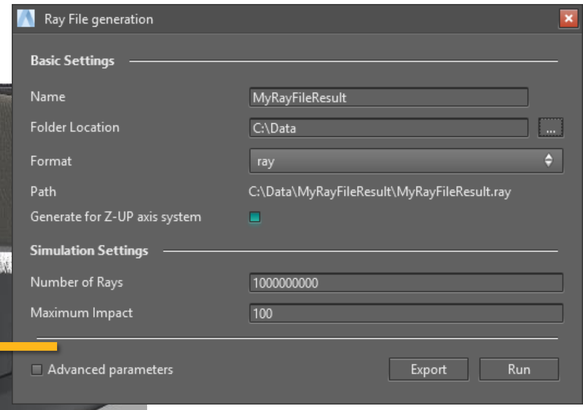
- **Easy run for optical simulation:**
  - Isolate the optical component and sources
  - Define number of impacts and generated rays according to optical complexity
  - Run on embedded solver or export to HPC

- **Metrics:**
  - 10M rays / 100 max impact will run in about 3 hours on the 4 provided cores



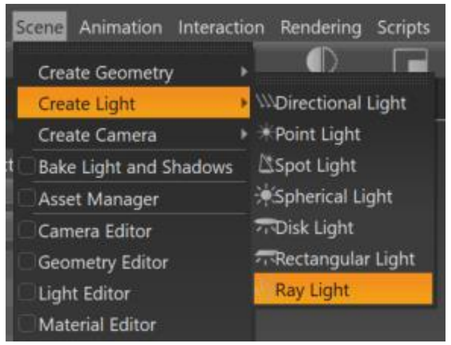


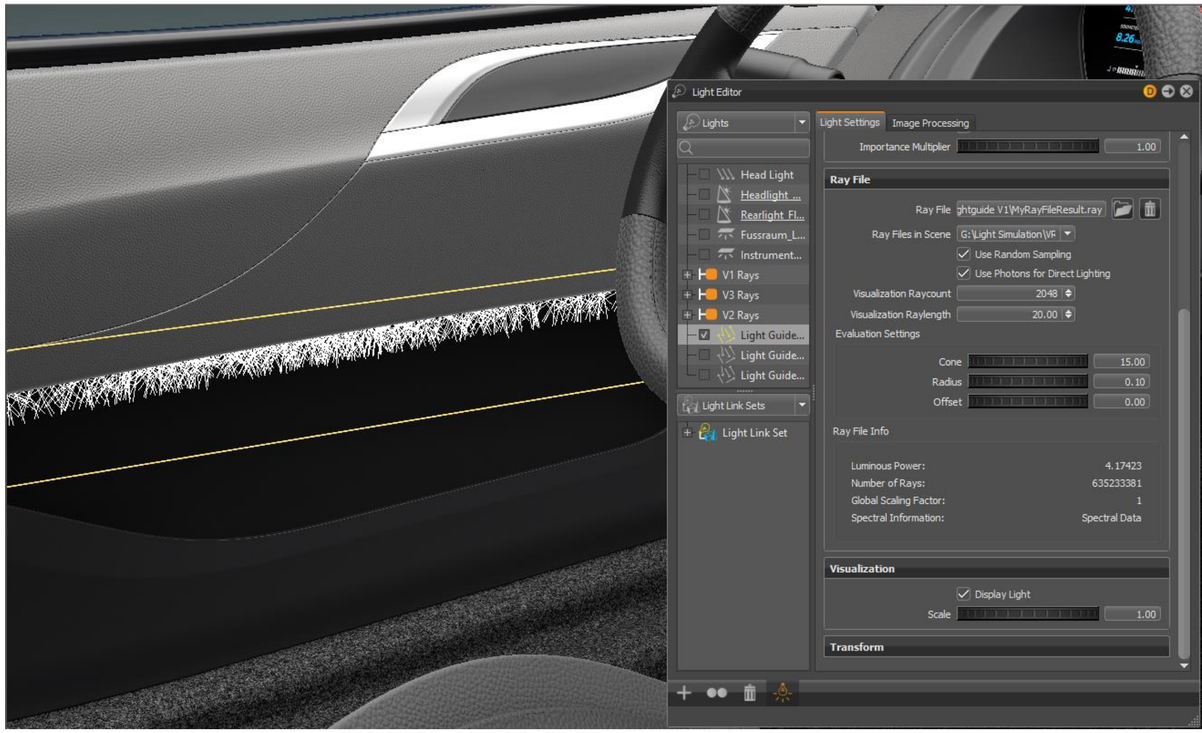


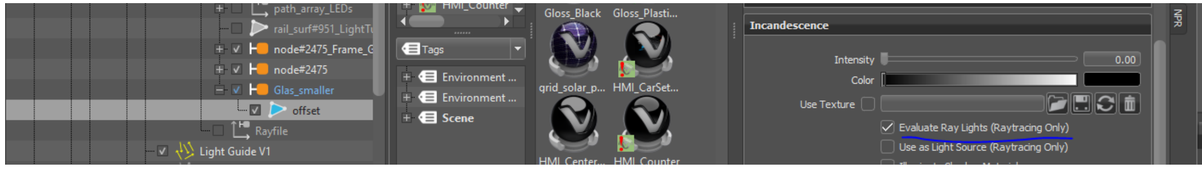


Back in VRED, propagate light and review

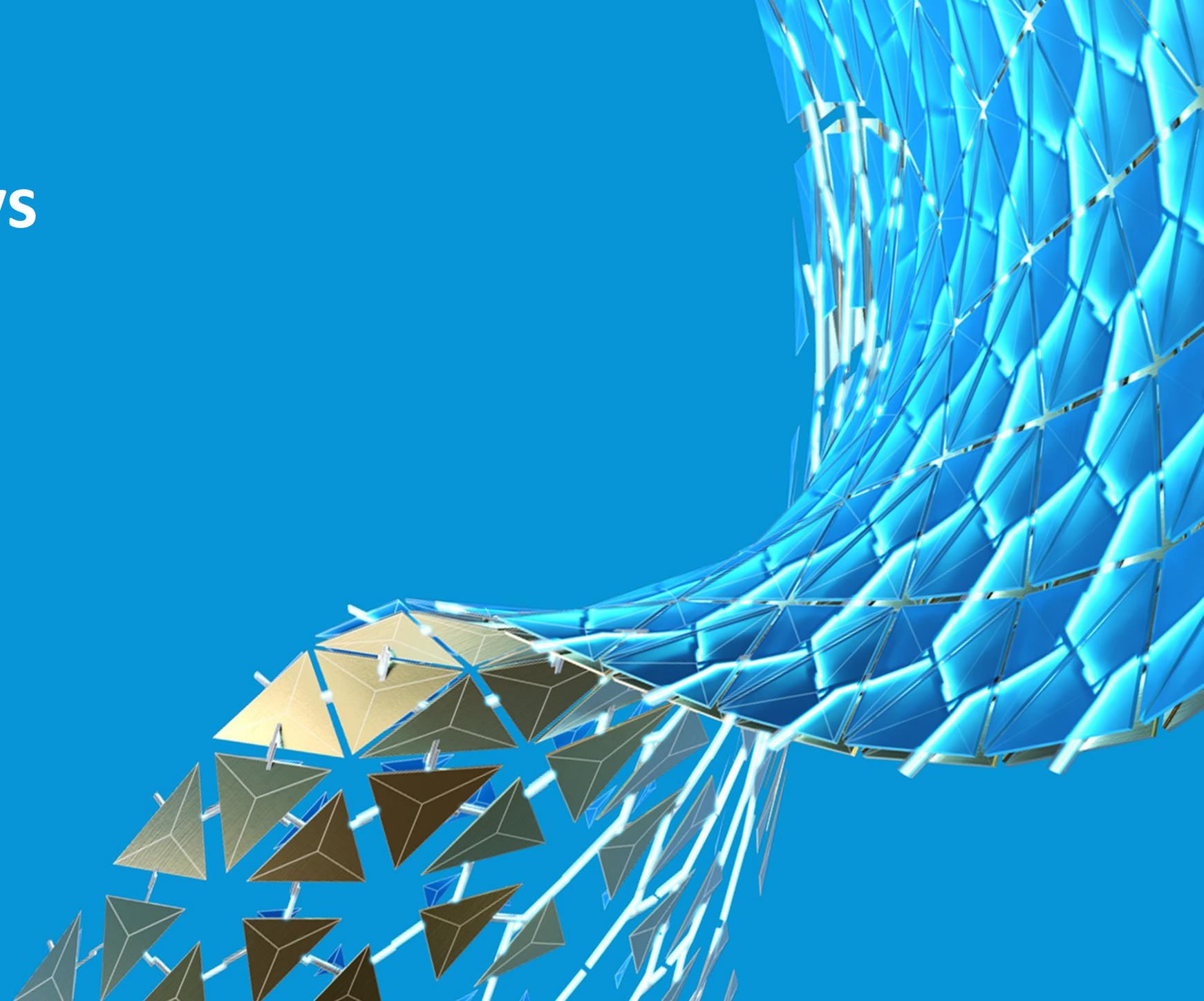
- **Import the generated rayfile inside VRED.**
  - Create Ray Light source
  - Enable “material visibility” for direct sight
- **Launch Raytracing image generation**
  - Live or Send to Cluster
- **Warning:**
  - Export selected = import back ray files at the level of export !







Key takeaways

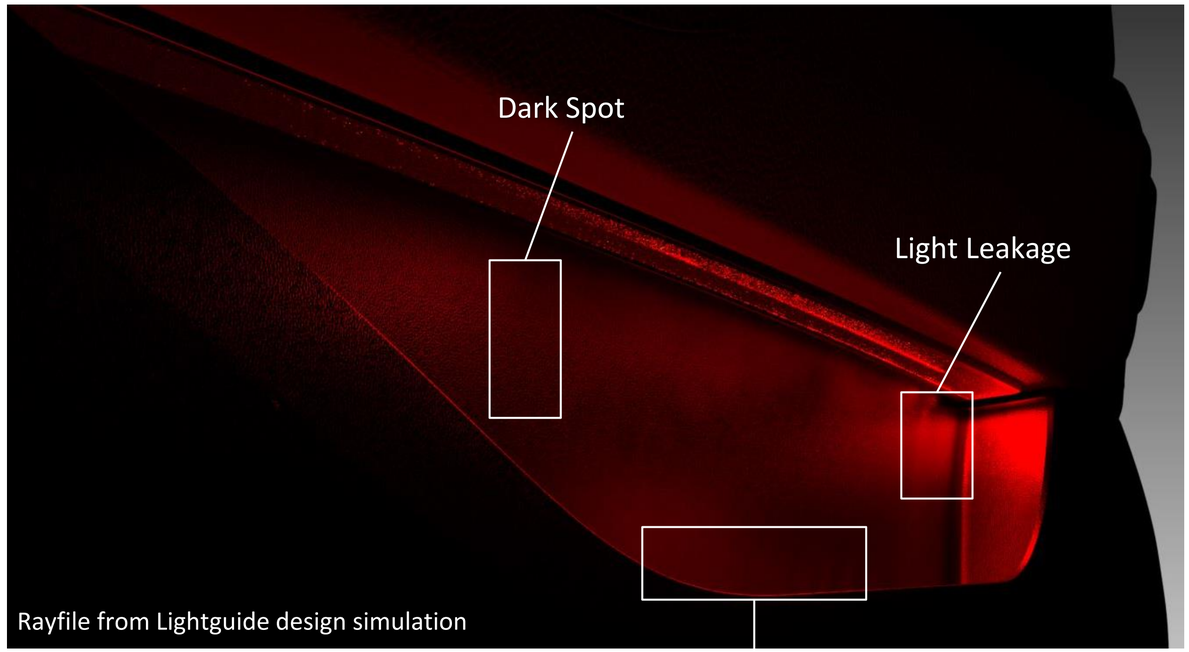


Empower Decision Making

- **Highlight defects that can be identified with VRED in combination with VRXPERIENCE Light Simulation**

AUTODESK® VRED™ PROFESSIONAL

AUTODESK® VRED™ PROFESSIONAL + Ansys / VRXPERIENCE Light Simulation



Stripe effect from LG

Benefits

CREATE POWERFUL AND
INNOVATIVE LIGHTING SYSTEMS

ESTABLISH UNIQUELY
IDENTIFIABLE LIGHT SIGNATURES

VISUALIZE FUTURE PRODUCTS
BEFORE PRODUCTION IN
AUTODESK VRED

ACCELERATE THE
DECISION-MAKING PROCESS

To Go Further

White Paper

Ansys & Autodesk Deliver Engineering

Grade Light Simulation to Studio Designers

Webinar

Ansys & Autodesk Deliver Engineering

Grade Light Simulation to Studio Designers

Infographic

Ansys & Autodesk Deliver Engineering

Grade Light Simulation to Studio Designers

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