PRODUCT BROCHURE

Keysight Optical Simulation Solutions

Everything you need to enable innovation in optical design

KEYSIGHT

Table of Contents

Everything You Need to Enable Innovation in Optical Design

CODE V: Must-have lens design software

Supports optimization, analysis, tolerance analysis, and manufacturing-related analysis in lens systems.

LightTools: Complete illumination design software

User-friendly tools help you speed illumination design, increase your success rate, and reduce prototyping time.

LucidShape: Optical design software developed exclusively for automotive engineers

LucidShape products help optical engineers explore the future of automotive lighting designs.

RSoft Photonic Device Tools: Empowering photonic innovations

Industry's largest portfolio of simulators and optimizers to design nanoscale passive and active photonic and optoelectronic devices.

Optical engineering services: Custom optical design consulting services

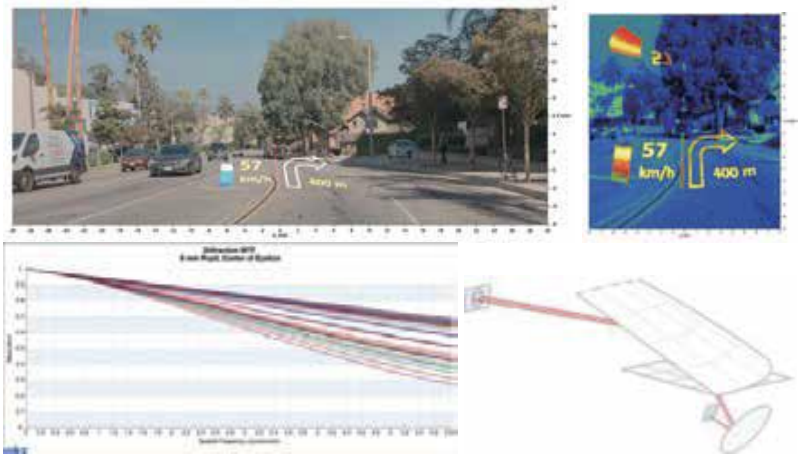
Experts from Keysight provide imaging, lighting, and systems engineering services to help you with your optical design challenges.

Optical scattering measurement equipment and services: Accurate, highly efficient optical scattering data

Equipment to measure optical samples and import customized data into Keysight optical software tools to enhance your product research and development.

Automotive Optical Solutions

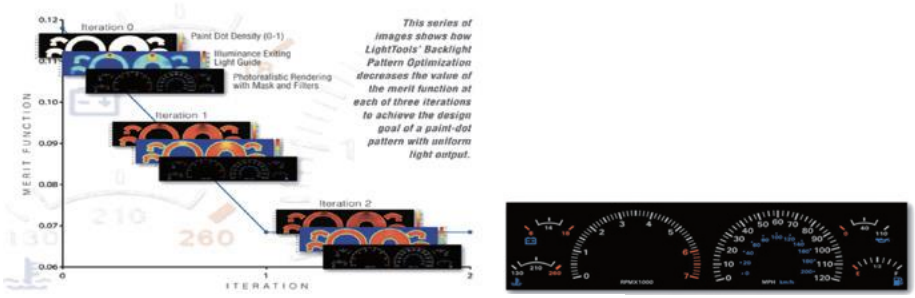
1. **Head-up display (HUD): Code V/LightTools/RSoft**
   - Import the windshield model into CODE V and design HUD freeform surface
   - Utilize LightTools for overall system performance and visualization analysis
   - Design diffractive optical elements by RSoft such as reflective gratings

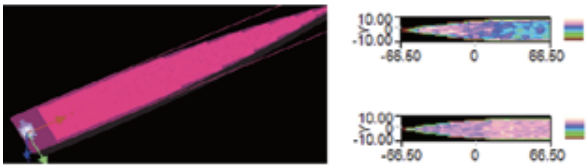


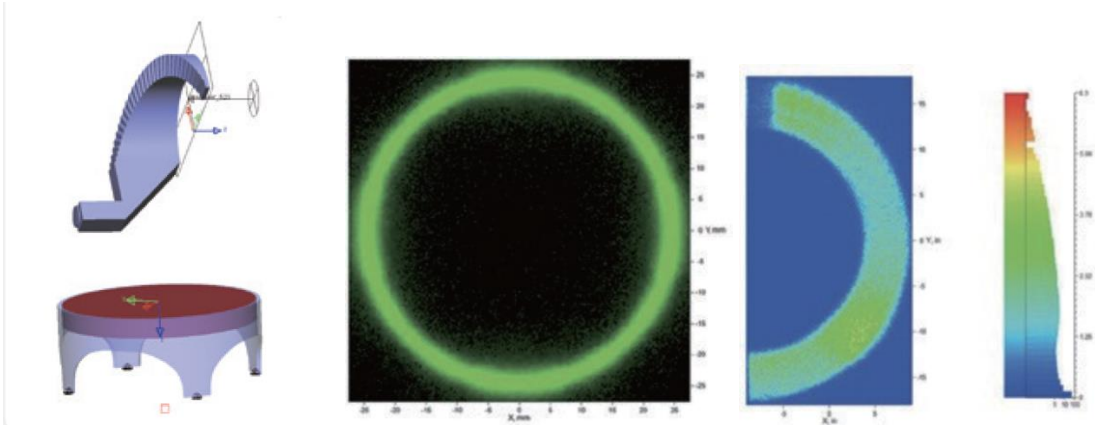
2. **Automotive interior display: LightTools**
   - Design of mini-LED display
   - Design of curved backlight module

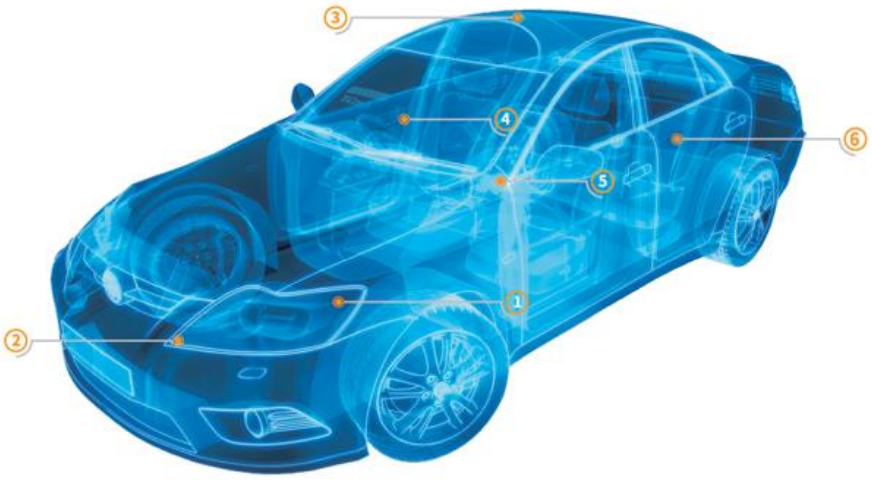
3. Dashboard and light guide design: LightTools

- Optimization for dashboard backlight patterns
- Uniformity design for light guide

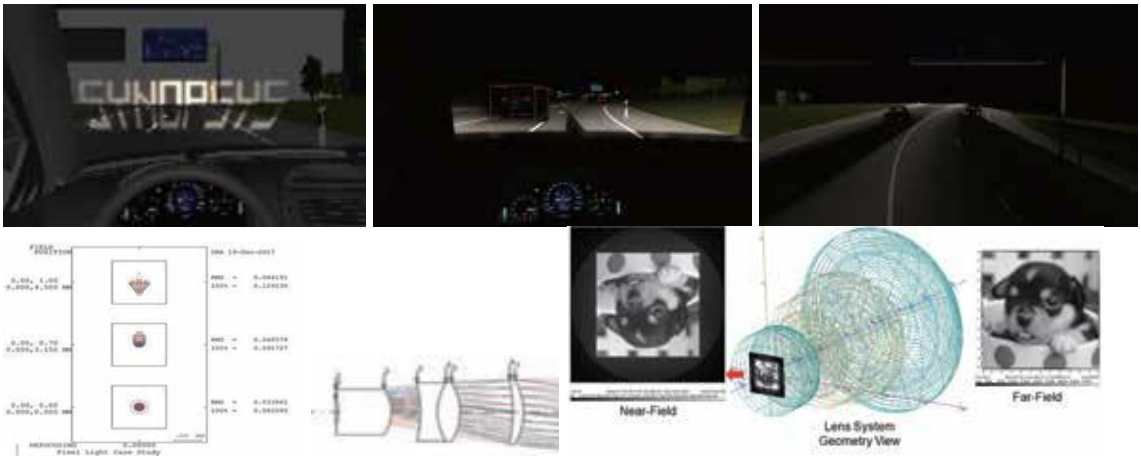




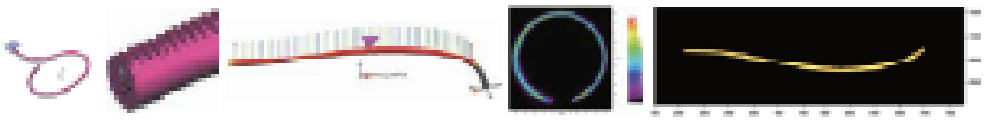


- 

1. **Design of pixel headlight: CODE V/LucidShape/LucidDrive**
    - Projection system lens design by CODE V
    - Lighting simulation and analysis of the overall system conducted by LucidShape
    - Night driving simulation by LucidDrive

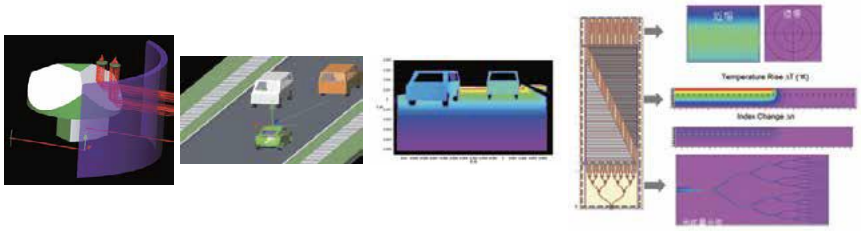


2. **Design of daytime running light: LightTools/LucidShape CAA V5 Based (2)**
    - Support various types of daytime running lights
    - Light extractors of light guide
    - Uniformity simulation of multi-viewing angle luminance



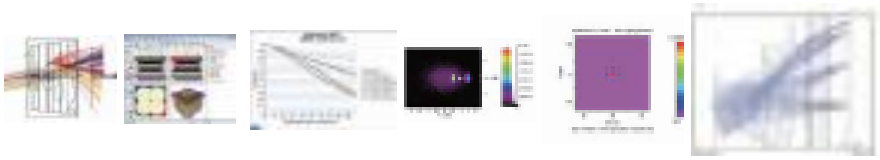
3. LiDAR: LightTools/CODE V/RSoft

- Modeling and design of mechanical LiDAR
- Atmosphere interference analysis
- On-chip LiDAR modeling and design



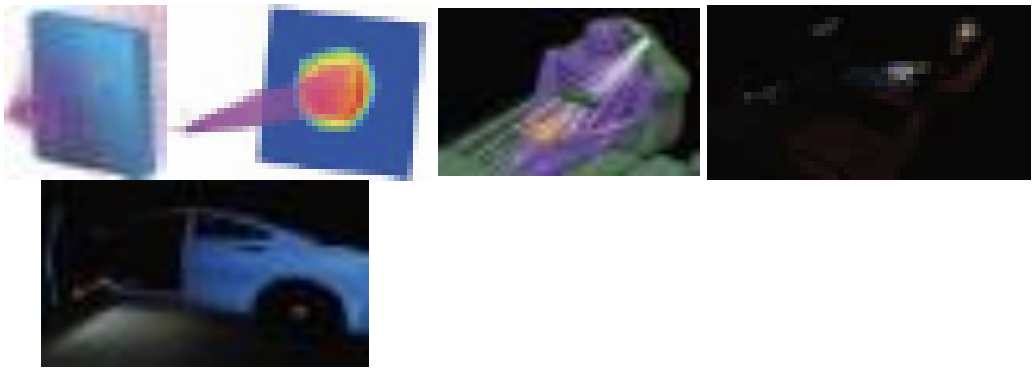
4. Automotive lens: LightTools/RSoft/CODE V

- Lens for dashboard camera
- Lens for auxiliary monitoring
- Night vision auxiliary lens
- Wide-angle lens
- Stray light analysis for lens
- Diffracted stray light simulation of CMOS image sensor



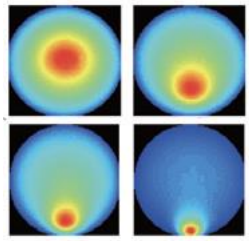
5. Automotive interior lighting: LightTools

- Reading light
- Puddle light
- Interior light
- Ambient light



6. Surface BSDF scattering measurements: Synopsys Optical Measurement Equipment

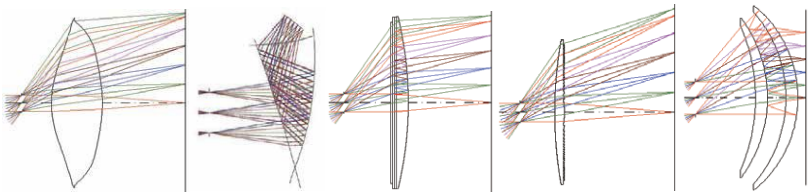
BSDF data can be measured by the equipment and applied in simulation software to improve simulation accuracy



VR/AR/MR

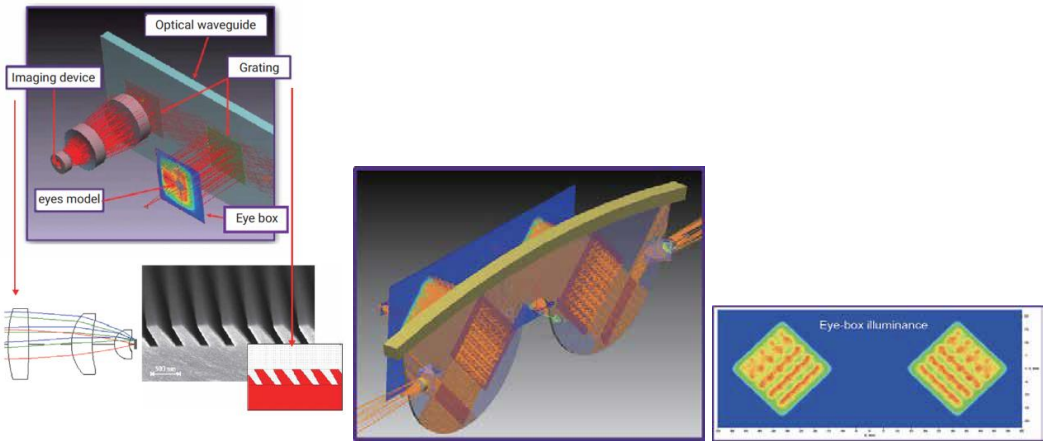
Lens designs: CODE V

A wide range of lenses including aspheric lenses, Fresnel lenses, freeform lenses, DOEs, and pancake lenses can be designed with CODE V.



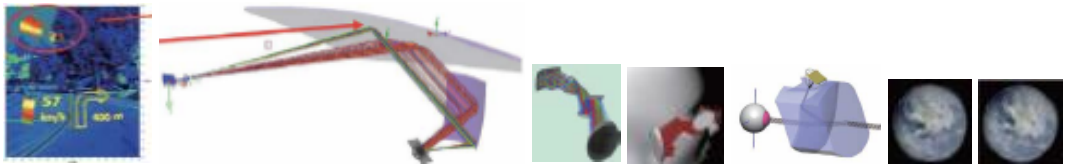
Waveguide and diffracted gratings: LightTools/RSoft/CODE V

AR design of diffracted grating and waveguide includes CODE V for imaging design and RSoft for gratings design. System analysis can be performed when both results are imported into LightTools. For multi-grating design, the parameters in the RSoft BSDF files can be integrated and optimized in LightTools.



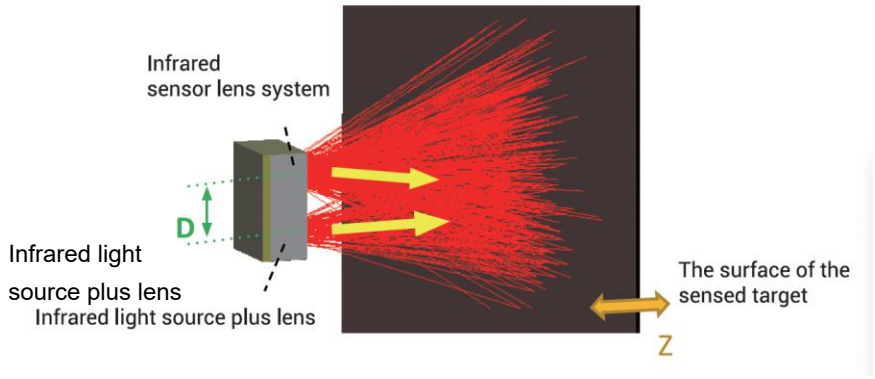
Optical path design and moiré pattern/stray light analysis: LightTools/CODE V

Optical path design and stray light analysis for various types of devices can be performed by CODE V and LightTools.



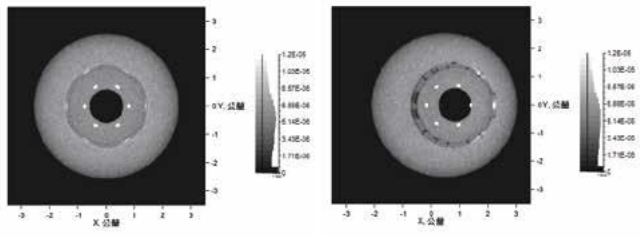
Infrared distance sensor: LightTools

Analyze the detected power with different surfaces and different distances. Design lenses to enhance light collection efficiency.



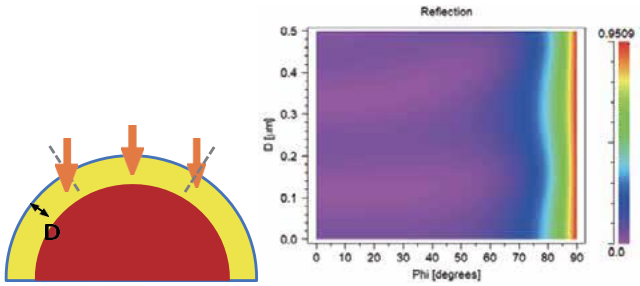
Eye tracking system: LightTools

Use LightTools to create and simulate eye tracking system models.



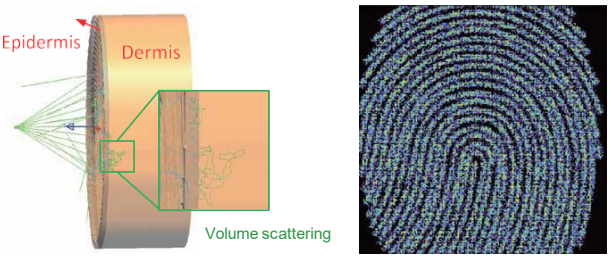
Coating design: LightTools/RSoft

LightTools integrates RSoft BSDF for optimization, fully presenting the influence of surface shape on coating performance.

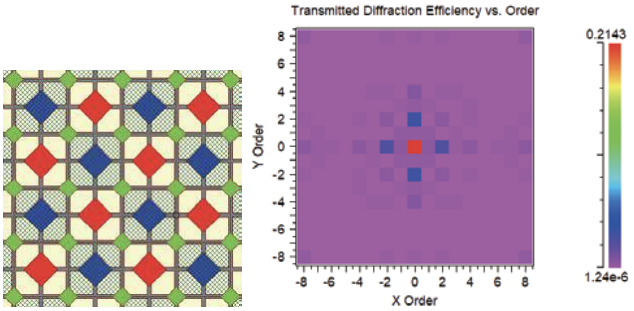


Mobile Devices

1. **In-display fingerprint: LightTools/RSoft/CODE V**
    - Biological tissue modeling
    - Fingerprint image simulation

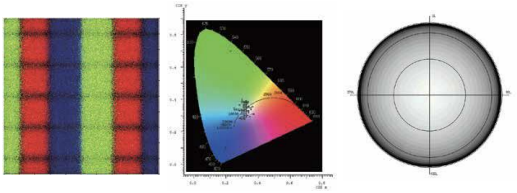


- Diffraction effects by display panels

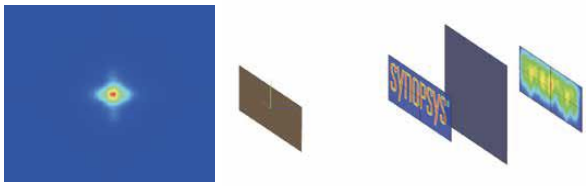


2. OLED panel: LightTools/Volume-scattering measurement

- Color simulations

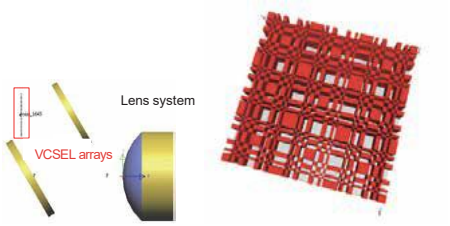


- Scattering measurement and simulation verification of OLED panels

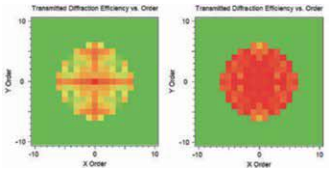


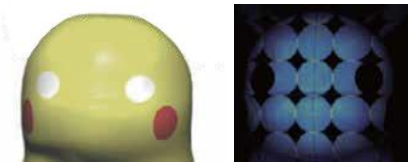
3. Structured light sensing: LightTools/RSoft/CODE V

- Diffraction efficiency analysis for DOE

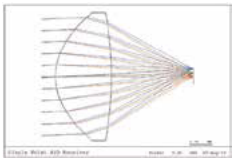


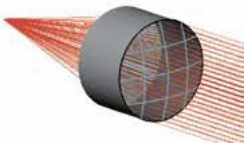
DOE structure



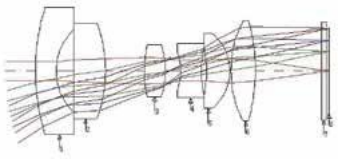


4. **LiDAR: LightTools/CODE V**
   - Transceiver lens design
   - Real-scene sensing

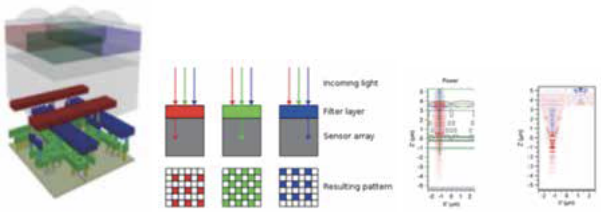




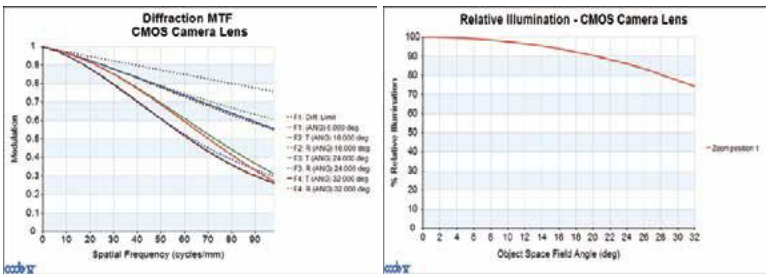
5. **Cell phone lens, stray light analysis, and CIS: LightTools/CODE V/RSoft**
   - Lens design



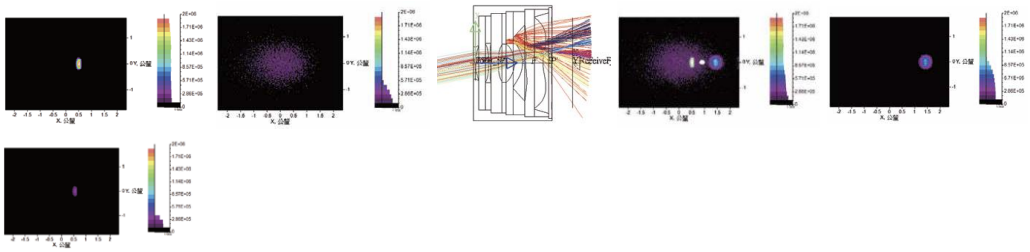
   - CMOS image sensor



- Image performance analysis



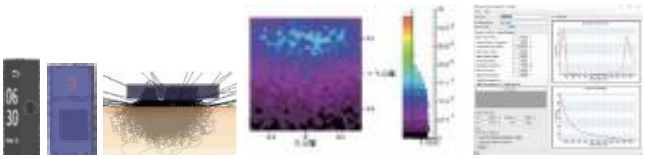
- Stray light analysis



Medical and Health Management

Design of photoplethysmogram sensor: LightTools

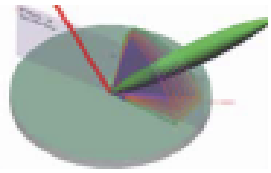
Provide biological tissue database and human tissue utility, which can simulate skin tissue with the Henyey Greenstein scattering model



Simulation of UV sterilization: LightTools

Simulation of UV light distribution in bathroom space

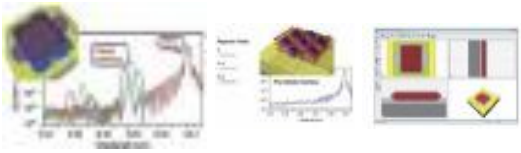
Scattering measurement of surface properties



- Synopsys Mini-Diff V2
- Synopsys Mini-Diff VPRO
- Synopsys REFLET 180S

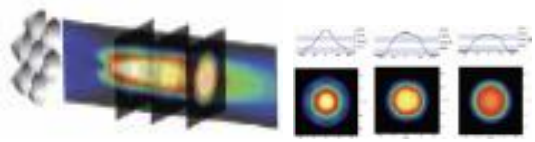
Biological sensing chip: RSoft

- Analysis of optical properties of biological samples
- Design of biosensing chips
- Analysis of photonic crystal samples



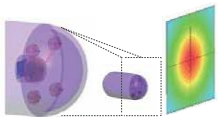
Design solutions for surgical lights: LightTools

Design reflector cups to abide by the regulation of illuminance distribution



Applications of general endoscopy and capsule endoscopy: LightTools/CODE V/RSoft

- LED lighting analysis for endoscopes



- Design endoscope lenses and analyze image quality by CODE V

- Design metalens of endoscopes with RSoft

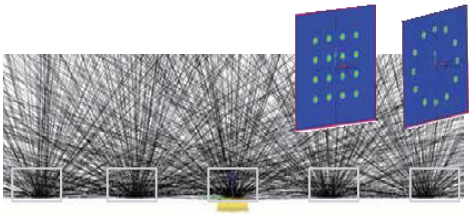
Design of inspection lens

CODE V

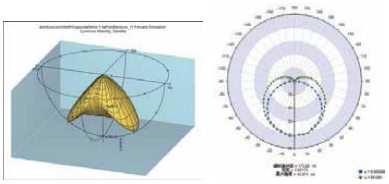
Please refer to the Imaging Lenses Design section for the lens design

Illumination design for inspection system: LightTools

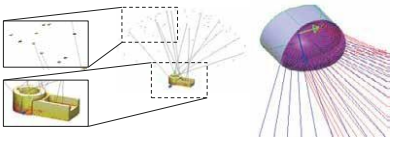
- Design of light source array



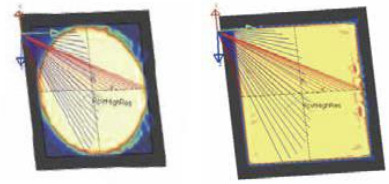
- Intensity distribution analysis of luminaires



- Object inspection

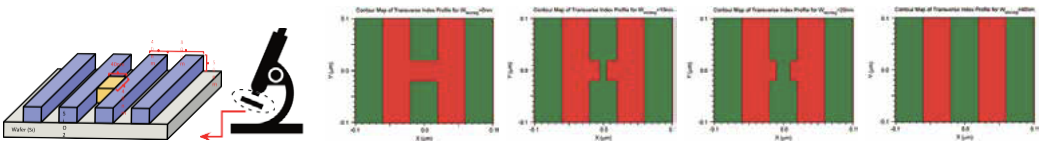


- Design of the special light shaping

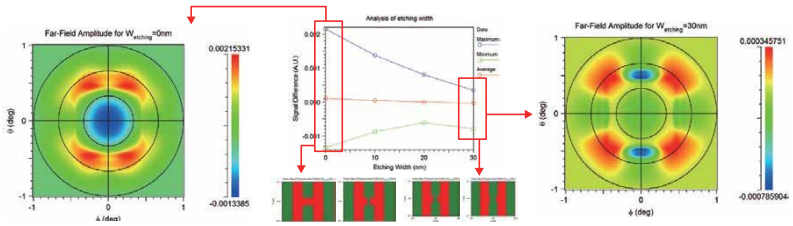


Wafer defect simulation: RSoft

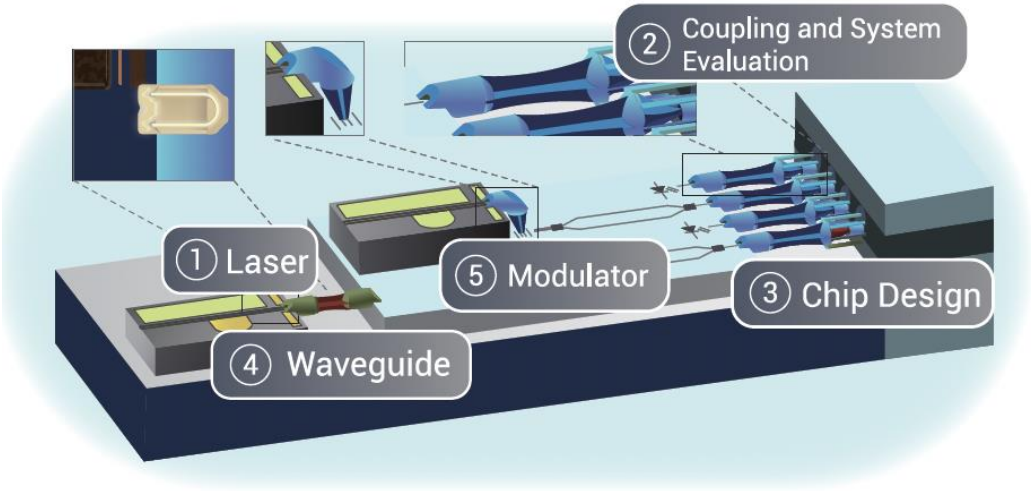
- Defect modeling



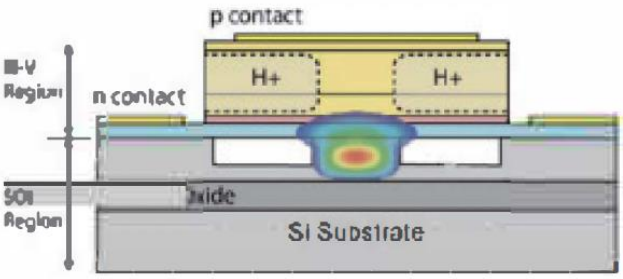
- Analyze simulation results for different defect conditions

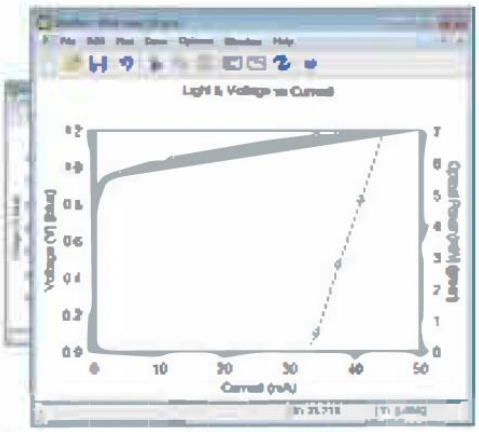


Silicon Photonics Components and Systems



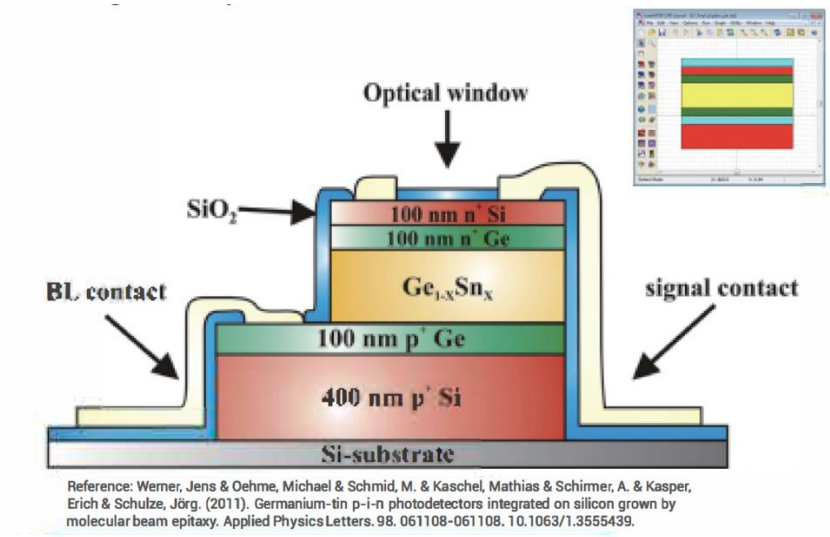
1. **Analysis and design of semiconductor laser: RSoft**
   - Design of VCSEL, DFB, DBR, and FP laser
   - Analysis of tapered laser





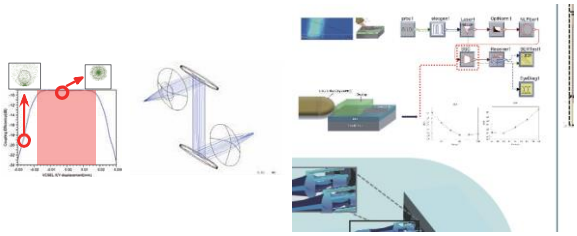
Reference: Matthew N. Sysak. Hyundal Park, Alexander W. Fang, John E. Bowers, Richard Jones, Oded Cohen, Omri Raday, and Mario Paniccia, "Experimental and theoretical thermal analysis of a Hybrid Silicon Evanescent Laser," Opt. Express 15, 15041-15046 (2007)

1. **Analysis and Design of Receiver: RSoft**
   - Design and analysis of APD and PIN structure

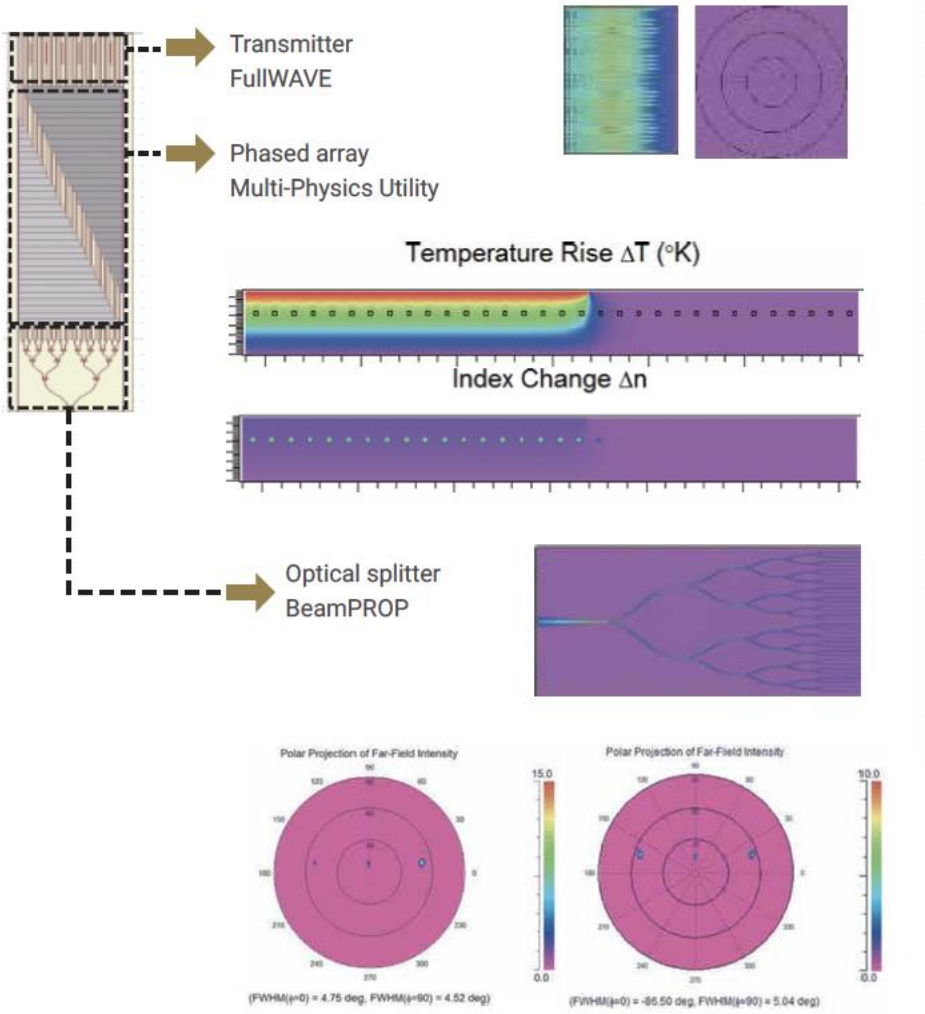


Reference: Werner, Jens & Oehme, Michael & Schmid, M. & Kaschel, Mathias & Schirmer, A. & Kasper, Erich & Schulze, Jörg. (2011). Germanium-tin p-i-n photodetectors integrated on silicon grown by molecular beam epitaxy. Applied Physics Letters. 98. 061108-061108. 10.1063/1.3555439.

2. **Design and optimization of fiber coupling: LightTools/CODE V/RSoft**
   - Fiber/waveguide Coupling
   - Coupler design
   - Coupling lens design
   - Mechanism stray light analysis
   - Evaluation of component

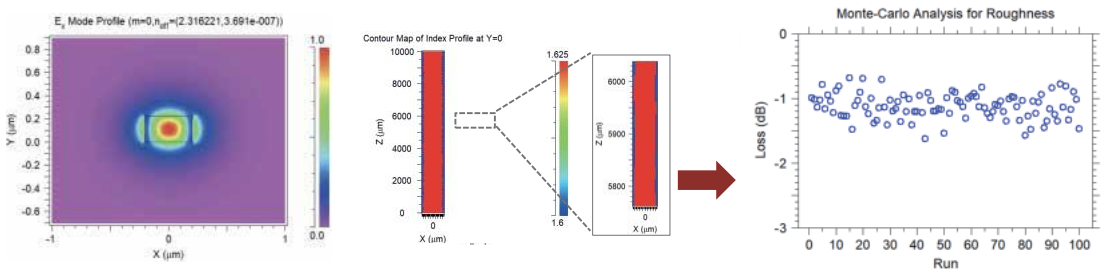


3. LiDAR on-chip: RSoft



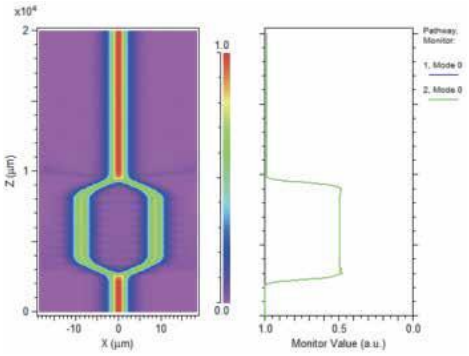
4. Analysis and design of waveguide: RSoft

- Modal analysis of light propagation
- Calculation of bending loss
- Analysis of tolerance

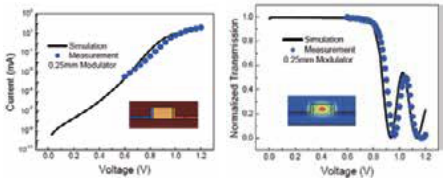


5. Analysis and design of modulator: RSoft

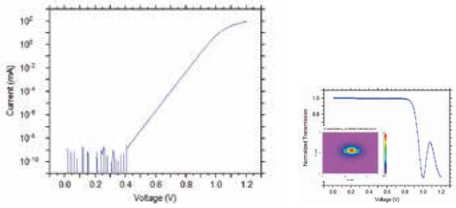
- Electro-optic modulator
- Thermo-optic modulator
- Carrier modulator
- EAM analysis



- Simulation and experiments of S-Device



- RSoft simulation



Domains	Applications	Tools
Active/passive device	Fiber optics, waveguides, and laser modulators	RSoft Photonic Device Tools
Wafer level simulation	Integrated optics/circuit Communication	
Mechanism analysis	Coupling lenses Mechanism stray light analysis	CODE V, LightTools

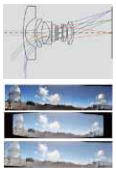
Imaging Lenses Design

1. Specification definition and evaluation: CODE V

Designers can quickly build a complete set of project specifications and goals for optical design and monitor them at any time.

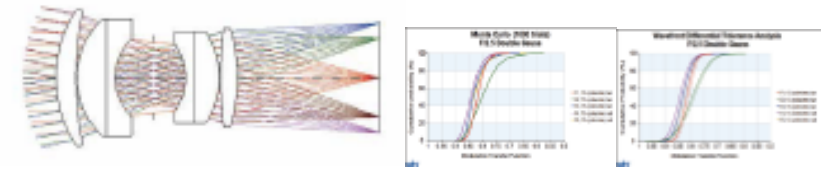
2. Lens design: CODE V/RSoft

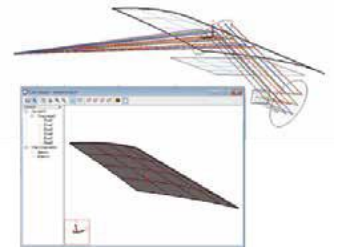
- Wide-angle design



3. Fastest tolerance analysis: CODE V

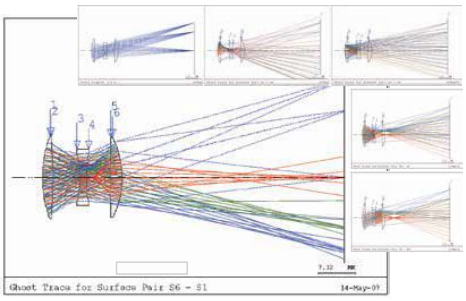
Tolerance can be directly applied into the optimization, which can significantly shorten the time of trial production adjustment.





4. Ghost analysis: CODE V

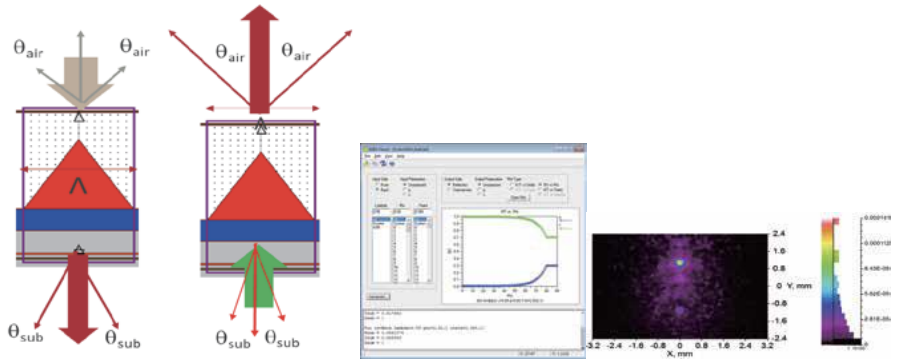
CODE V can simulate ghost images that are caused by total internal reflections.



5. Crosstalk analysis of detector: RSoft

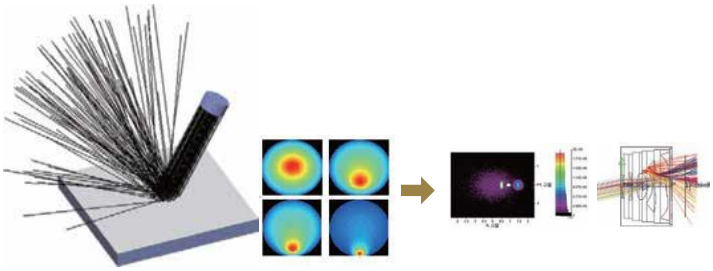
- Optical simulation of microlens
- Use CODE V output light field as the light source to process crosstalk analysis of detector

6. Coating design: RSoft

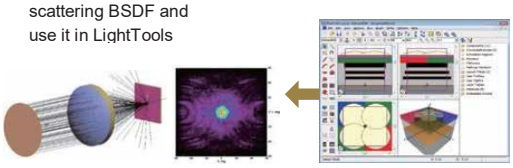


7. Stray light analysis: LightTools/RSoft

- Synopsys Mini-Diff V2
- Synopsys Mini-Diff VPRO
- Synopsys REFLET 180S



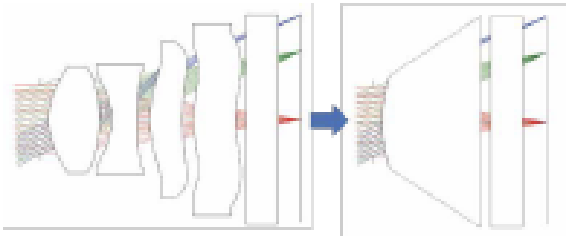
Measure surface scattering BSDF and use it in LightTools

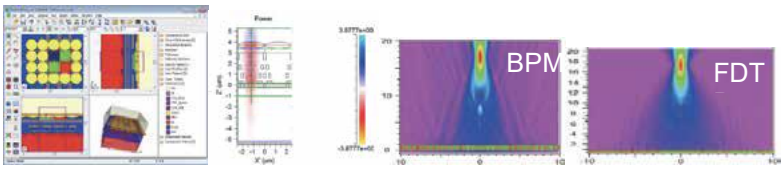


Analyze stray light by integrating reflective scattering/diffraction resulting from the sensor into LightTools

8. Powerful hidden lens module: CODE V

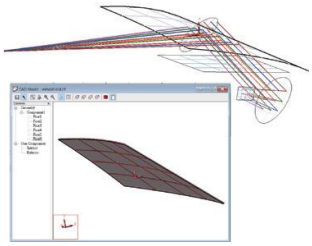
Hide the parameters of the surface perfectly and deliver the design without revealing its details





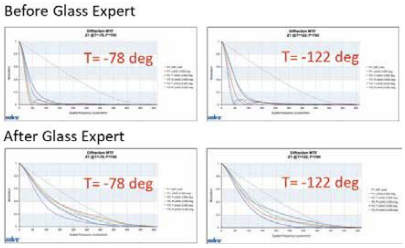
Importing CAD: CODE V

Use CAD models directly for display and ray tracing

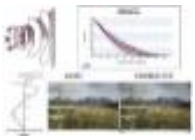


Thermal analysis and optimization: CODE V

Simultaneously generate and optimize multiple structures with different temperatures and pressure time

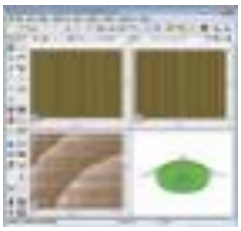


- Lens design and optical performance analysis

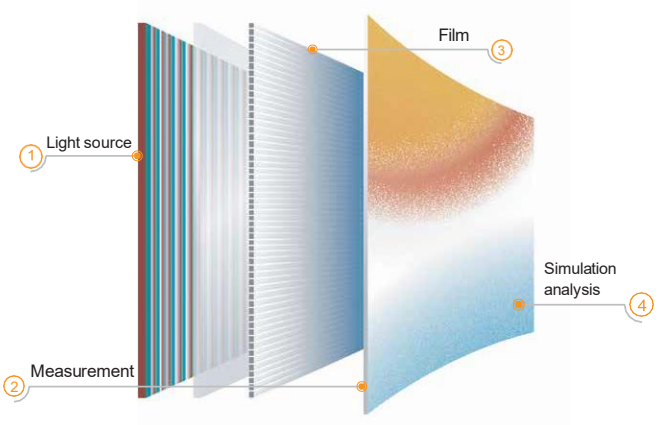


- Powerful global optimization: Get multiple solutions that all meet required constraints, or confirm that the final design is the best one

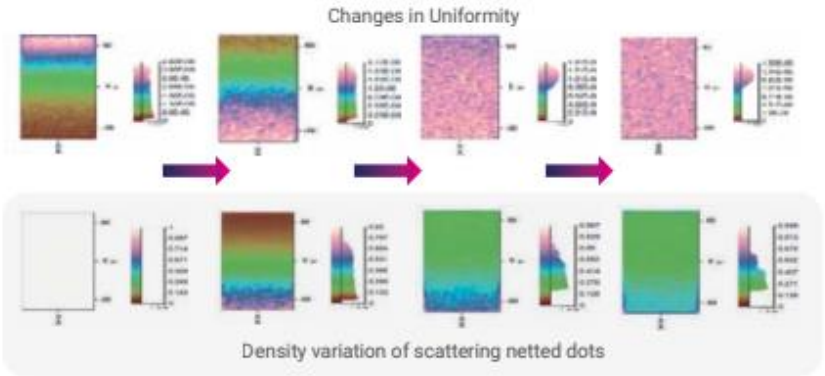
- Metalens design and simulation



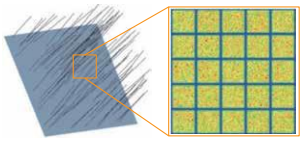
Displays



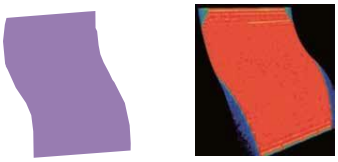
1. **Backlight/design of active light source: LightTools**
   - Optimization of backlight texture of side emitting backlight



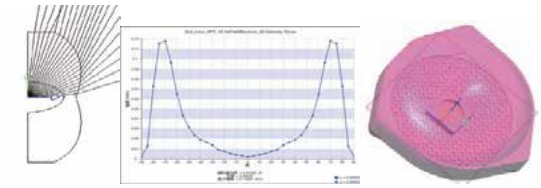
- MicroLED/OLED pixel array



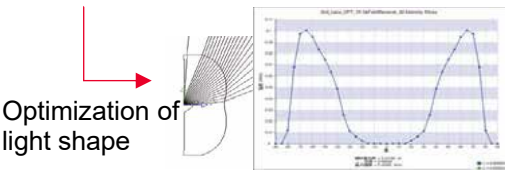
- Design of curved display



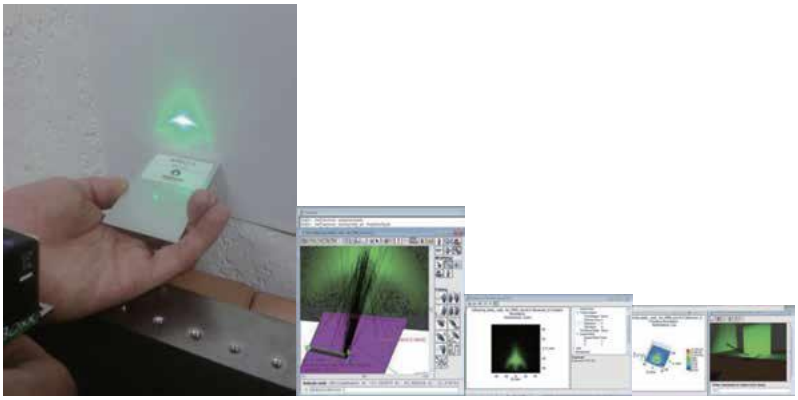
- Optimization of direct-light-type lens



Optimization of light shape



2. Scattering simulation: LightTools/Scattering measurements



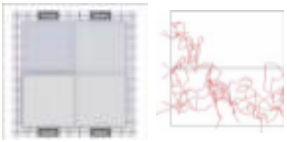
Synopsys Mini-Diff V2 Synopsys Mini-Diff VPRO Synopsys REFLET 180S

Scattering measurement data is imported into LightTools to perform simulation

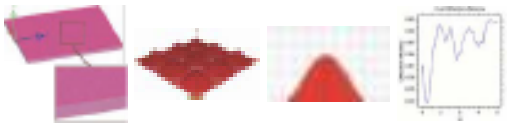
2. Viewing angle measurement: Synopsys Mini-Diff V2

3. Structure of film: LightTools x RSoft x Volume-scattering measurement service

- Volume scattering /Brightness enhancement film

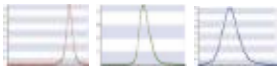


- Microstructure film



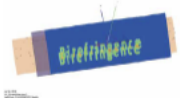
- Simulation of quantum dot and phosphor

Absorption spectum



Emission spectrum

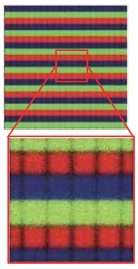
- Birefringent materials



- Color conversion films

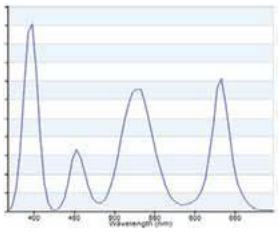
4. Simulation analysis: LightTools

- Color analysis



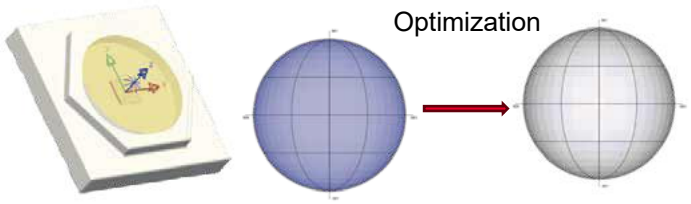
- Multipoint uniformity analysis

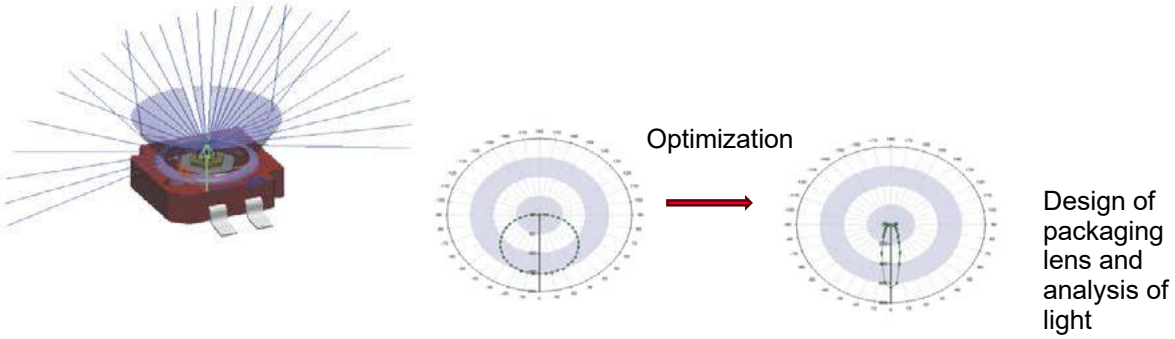
- Spectrum distribution



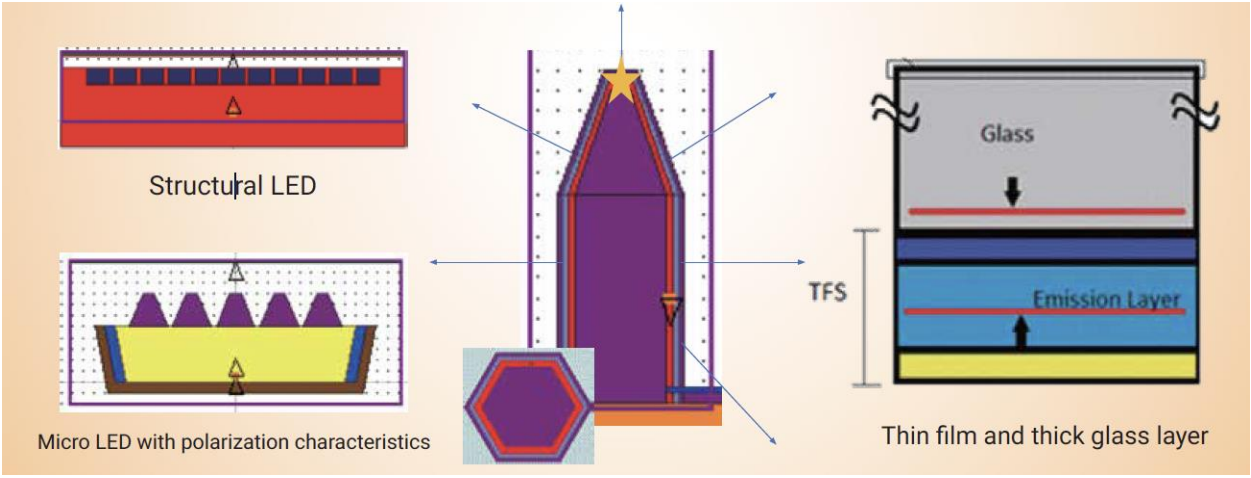
LED/OLED/Micro LED/Mini LED

Packaging design: LightTools



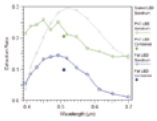


Chip design

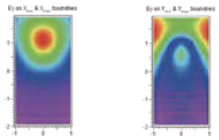


RSoft

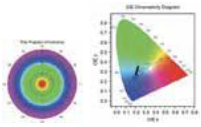
- Improve light extraction efficiency by designing and simulating microstructures
- The characteristics of light source for non-coherent and nonfixed polarization can be calculated with the LED Utility
- Calculate the light extraction profile and rate at the chip-level



Analysis of light extraction efficiency



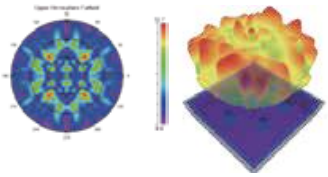
Near-field distribution in X and Y directions



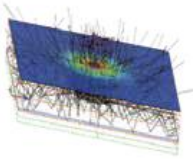
Photometric and chromaticity diagrams

RSoft/LightTools

- LED Utility calculates the characteristics of luminosity at the chip level and exports light data files into LightTools format
- Import the parameterized BSDF data into LightTools to generate large-scale coating layers to process the. optimal design



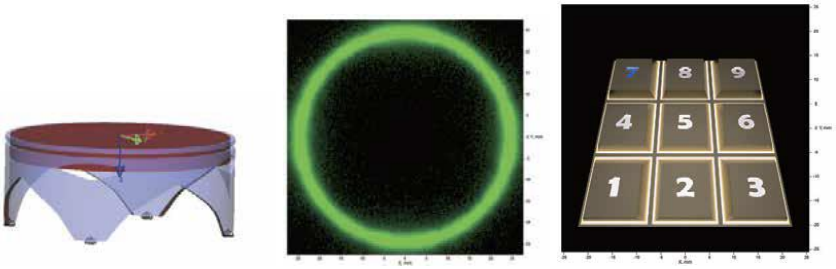
Far-field light distribution



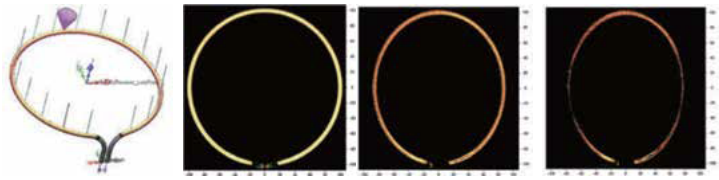
Illumination distribution

Light guide systems: LightTools

- Diversified and powerful design capabilities
- Support any type of light guide design

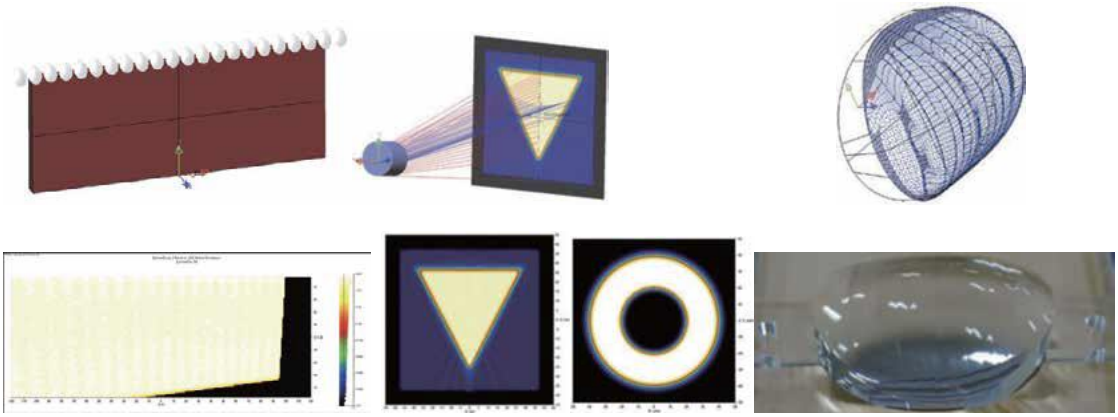


Keyboard with light guide film



Light guide pipe

Freeform lens/reflector: LightTools



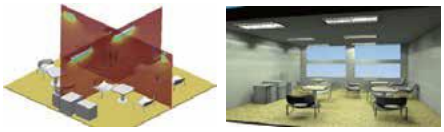
Uniformity of wall washer lights

Design of the special light distribution

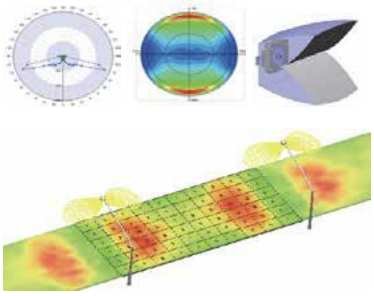
Image-based lighting

Indoor/outdoor lighting design: LightTools

Special-shaped images



Indoor illumination analysis



Street lighting

Semiconductor Active Device

Semiconductor lasers and their applications, semiconductor photodetector (RSoft)

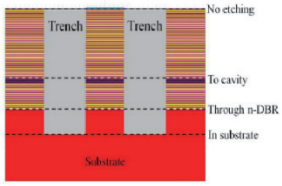
LaserMOD utilizes the fully coupled numerical method to apply the spatial quantification of the component geometry to solve the carrier transport, optical properties, as well as the electronic interactions of the charge carriers

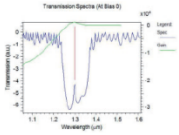
Alloy material parameters and doping concentration

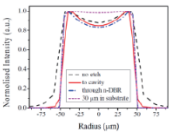
- Ternary and quaternary materials
- Band structure
- Gain
- Refractive index
- Strain compensation

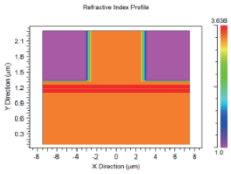
Laser cavity structure design

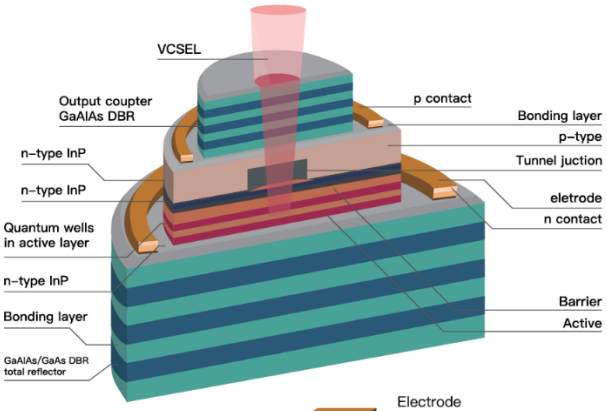
- Groove depth
- Pore size of oxidation
- MQW design
- DBR design





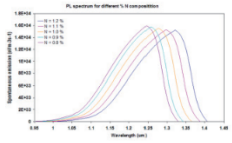


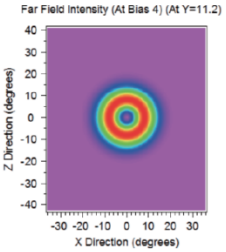


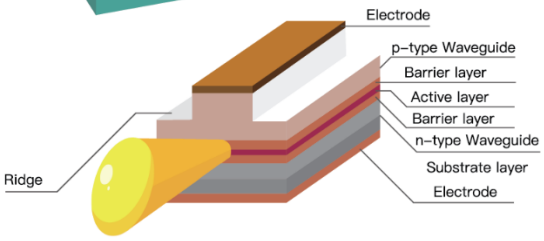


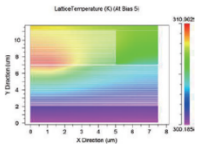
Output characteristics

- L-I-V
- Near and far field
- Temperature distribution
- Dynamic response





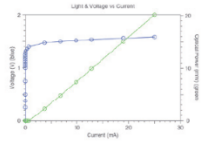




Modal calculation

- Iterated Ritz method (IRM)
- Beam propagation method (BPM)
- Finite element method (FEM)
- Transfer matrix method (TMM)

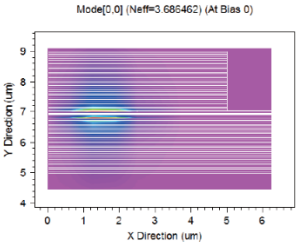
▲ Application types: Fabry-Perot, VCSEL, DFB

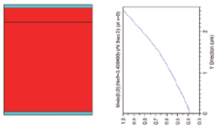


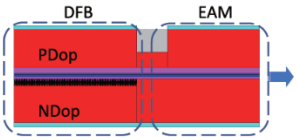
Light sensor

- Photocurrent
- Energy distribution

EML application







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