SYNOPSYS®

Digital Image Prediction using Image Simulation Software

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October 9, 2024

EPIC Technology Meeting on Photonics for Computer Vision Systems and Applications at VISION
Stuttgart, Germany

37 Years of Advancing Chip Design

Leading electronic design automation tools and services

Broadest portfolio of foundation, interface, security and processor IP

Pioneer in electronics systems solutions and AI-powered EDA

#12 global software company by revenue

* Excluding SIG

Synopsys' Global Presence

CANADA

US

CHILE

EUROPE

ARMENIA

ISRAEL

INDIA

CHINA

VIETNAM

S. KOREA

JAPAN

TAIWAN

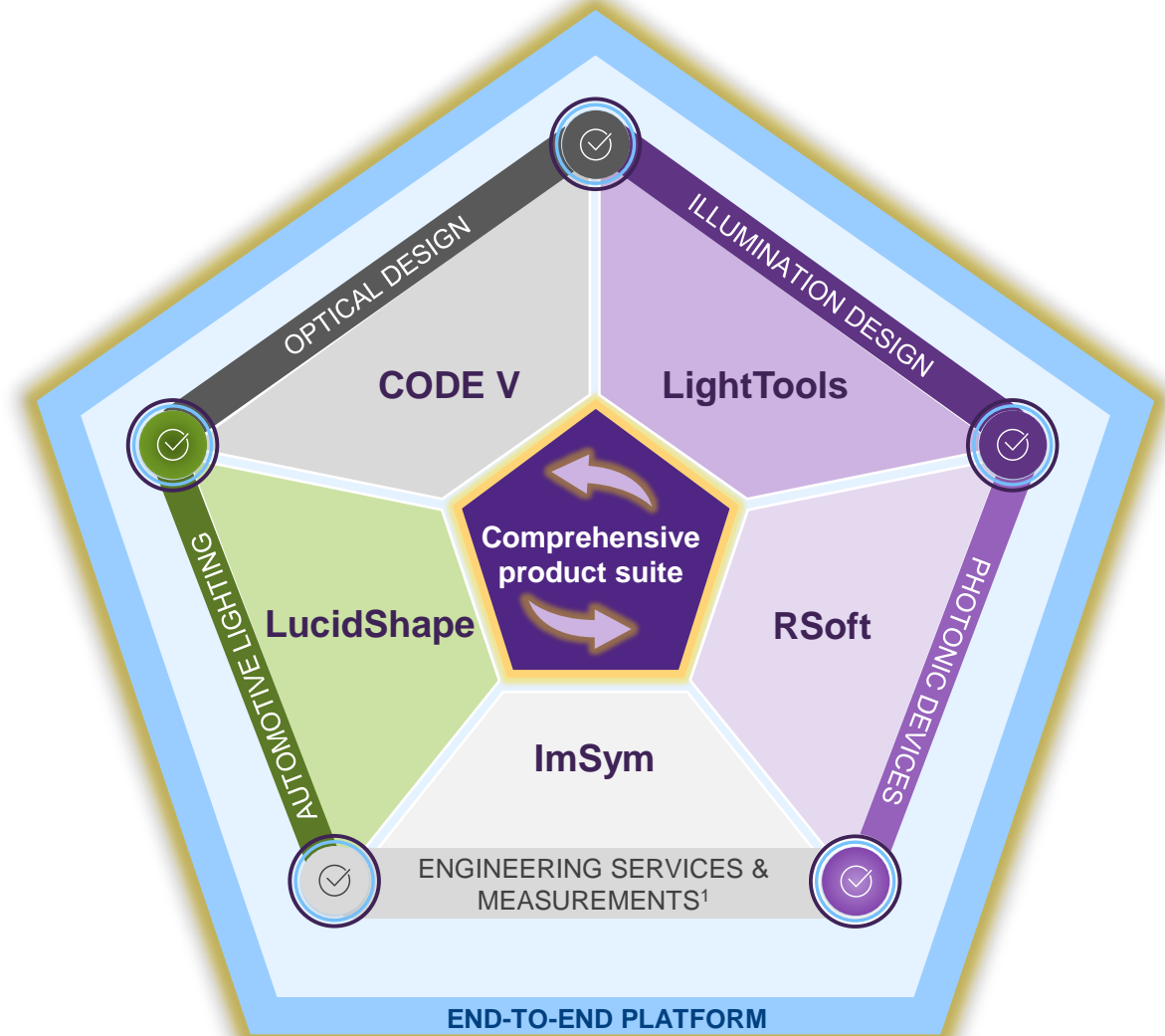| $5.96B* Revenue (TTM) | ~19K* Employees | 3,407 Patents | 27% R&D Investment |

Synopsys Optical Solutions
Industry-leading product suite addressing the needs of optical design teams

1 A **comprehensive portfolio** backed by world-class optical experts known for advanced skills and continuous innovation

2 **Proprietary optimization engines** that leverage HPC to deliver best quality, accuracy, and time to results

3 **Specialized services** that optimize the design-to-build process

OPTICAL DESIGN — CODE V

ILLUMINATION DESIGN — LightTools

Comprehensive product suite

AUTOMOTIVE LIGHTING — LucidShape

PHOTONIC DEVICES — RSoft

ImSym

ENGINEERING SERVICES & MEASUREMENTS[1]

END-TO-END PLATFORM

1. Includes Optical Engineering Services and Optical Scattering Measurements & Equipment

ImSym – Imaging System Simulator

Provides an end-to-end model of an imaging system including lenses, sensors, and ISPs before it is sent to manufacturing.

- Industry-first imaging virtual prototyping platform
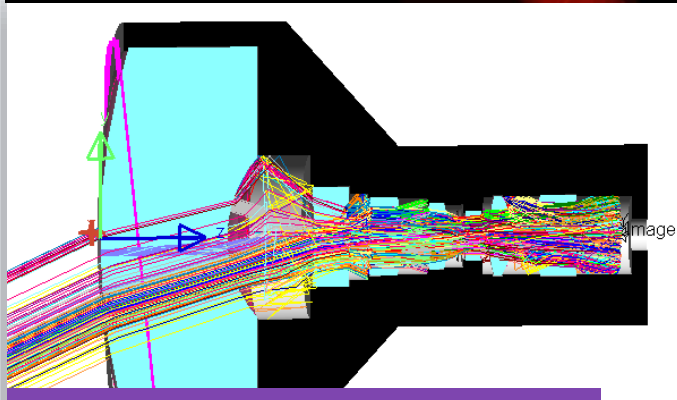- Integrates trusted accuracy of CODE V and LightTools

End-to-End Simulation Pipeline

Light Source

Scene

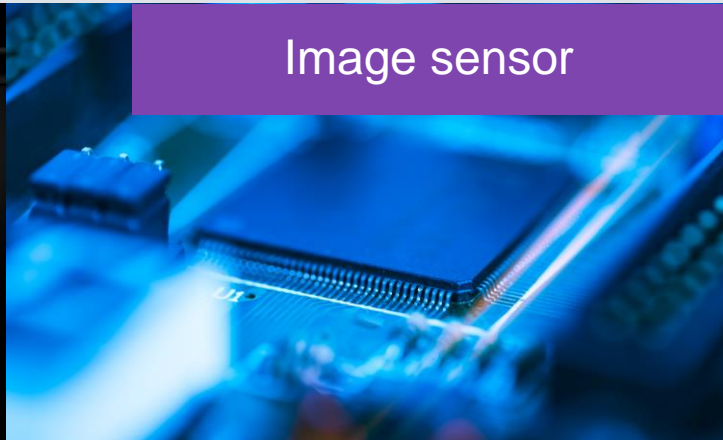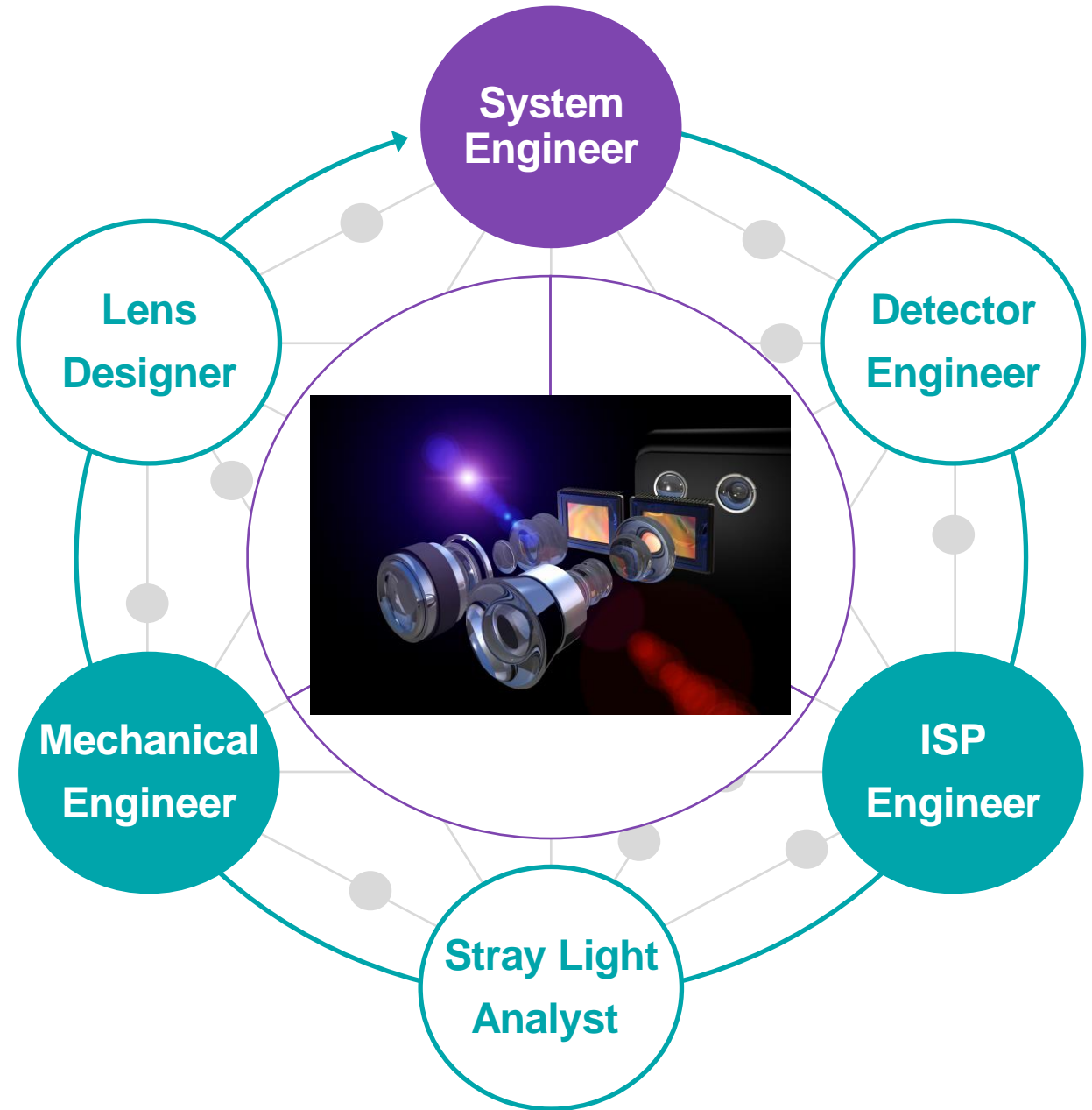Optical Design

Opto-mechanical parts

Image sensor

Image Signal Processing

Image

Team collaboration

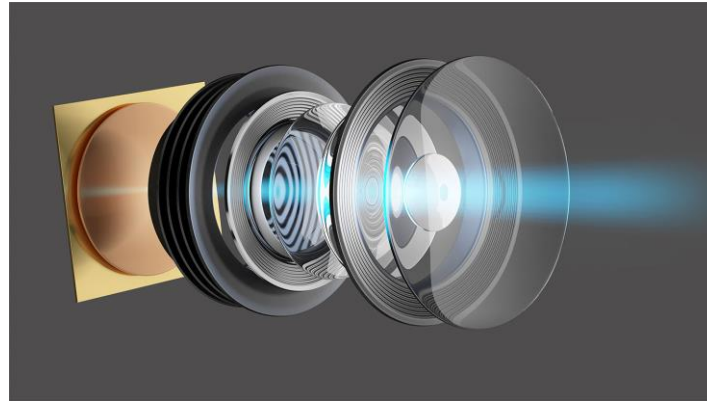During the design of a new imaging product, there are several domain experts involved.

System Engineer

Detector Engineer

Lens Designer

ISP Engineer

Mechanical Engineer

Stray Light Analyst

ImSym – Imaging System Simulator

Facilitates seamless collaboration across development team

Enables testing and validation before manufacturing

Helps your product get to market faster

SYNOPSYS®

# Traditionally, a **hardware prototype** iteration approach is used to converge upon a final product.

Software

Design

Physical Prototype

Manufacture and Tuning

Hardware
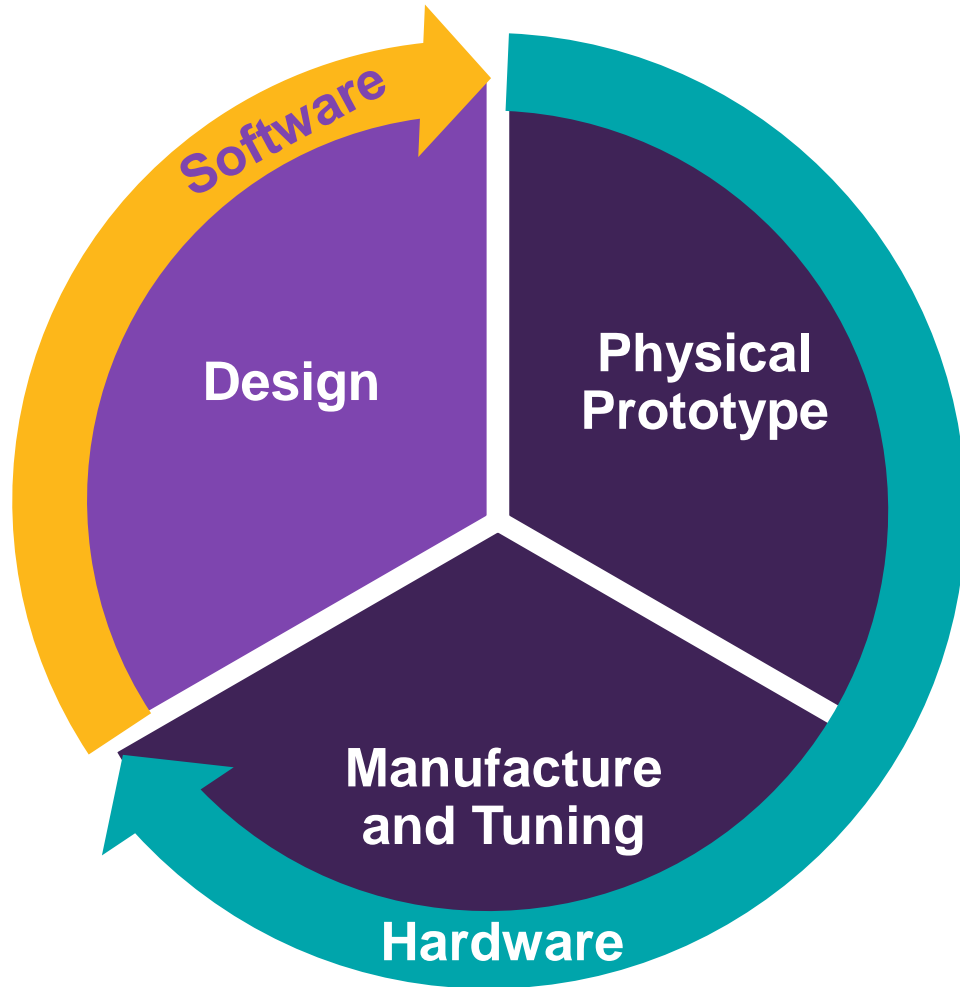
Design challenges

Reliance on physical prototypes to assess image quality

Difficulties in imaging system complexity

Barriers to collaborate between designers, manufacturers, OEMs, and partners.

ImSym left-shifts the majority of image system development into virtual prototyping

Software

Design

Virtual Prototype

Manufacture and Tuning

Hardware
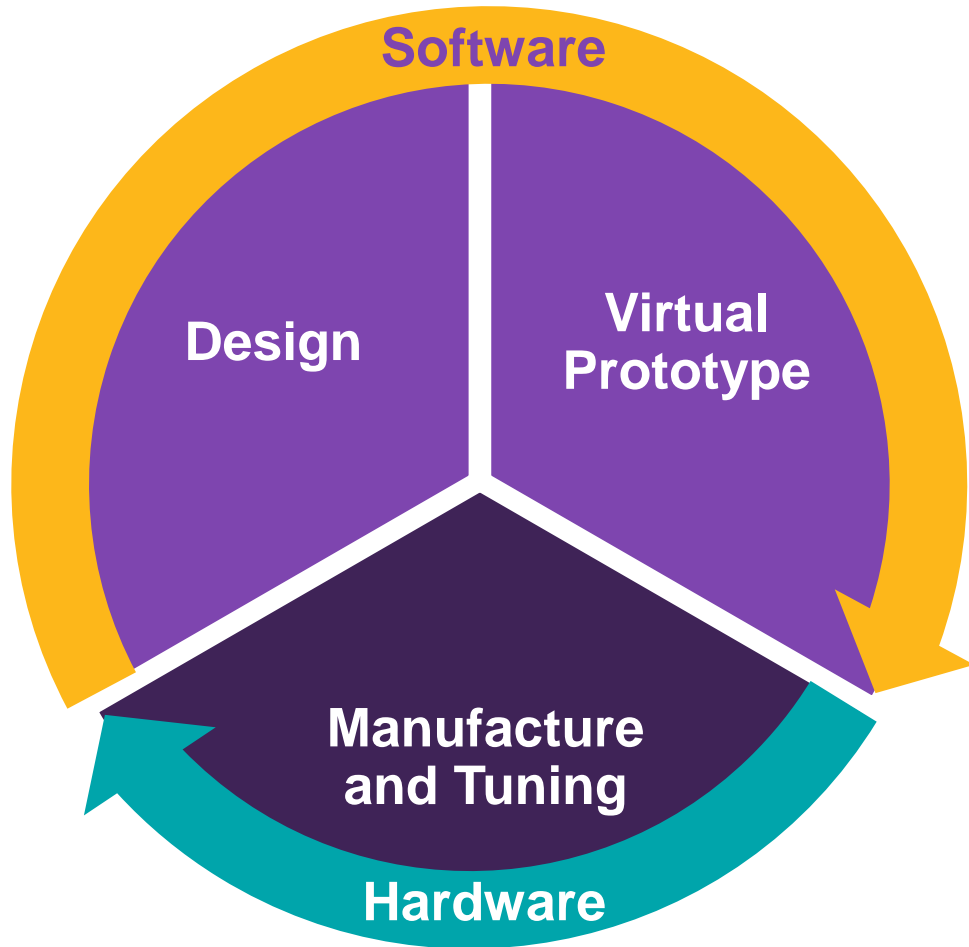
ImSym

Accelerates imaging design cycles

Enhances team collaboration

Mitigates development risk

Reduces cost by considering overall performance
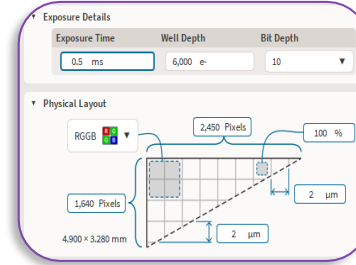
ImSym Platform

Modular, Collaborative, and Easy to Use
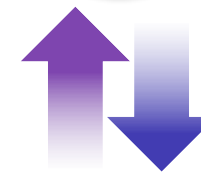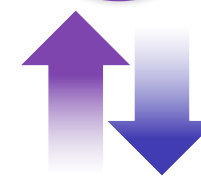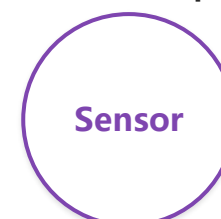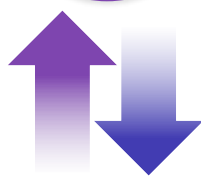

Quantitative Scene
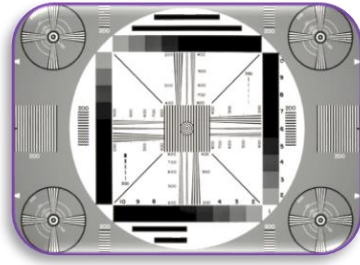
Optics Performance

Ghosting & Flare

Noise & Response

Tunning & Detection

Input Scene

Lens System

Stray Light

Sensor

ISP
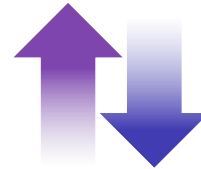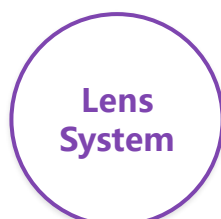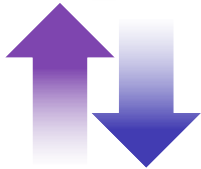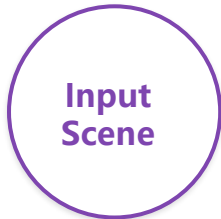
ImSym Platform

ImSym Platform
Input Scene

Spectral Radiance and Discrete Wavelengths
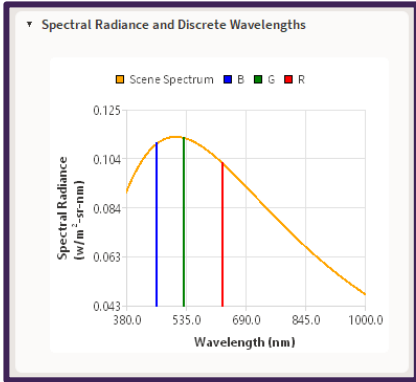
- Radiometric accuracy
- User-defined radiance
- User-defined spectral weighting

Process

- Select any desired scene object to suite the application.
- Set the radiance level.
- Set scene spectral properties.

Sunny day with one car in field of view

Indoor garage with fluorescent lamp

Nighttime driving with single car.

Scene generated by Synopsys LucidDrive

Scene Object Properties

▼ Bitmap File

Half Field of View	33 °
Bitmap File	Garage-1_1Mp.bmp
Bitmap File Gamma	sRGB

▼ Spectrum Definition

Spectral Profile	5,700 Kelvin
In-Band Scene Radiance	54 W/m²-sr

Channel Name	Wavelength (nm)
<Shortest wavelength>	380
B Channel	460
G Channel	530
R Channel	630
<Longest wavelength>	1,000

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ImSym Platform
Lens System

The lens system modeling is done in CODE V. All the heritage and power of CODE V is available for ImSym simulations.

Principal Image

ImSym
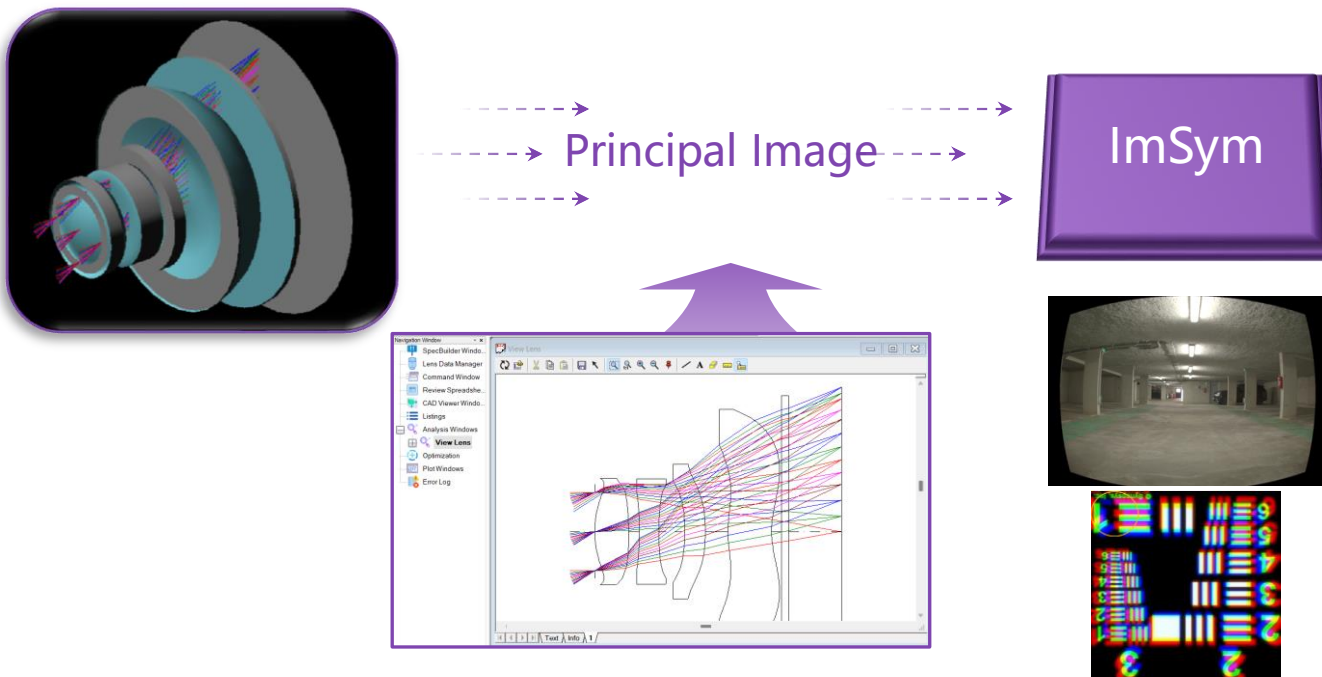
Process

- Select CODE V lens file.
- Select Principal Image modeling parameters as done in CODE V.
- Modeling includes:
    Aberration
    Distortion
    Chromatic Effects
    Relative Illumination
    Diffraction

▼ Principal Image Generation Settings

| Default Settings | Advanced Settings |

PSF Computation Parameters

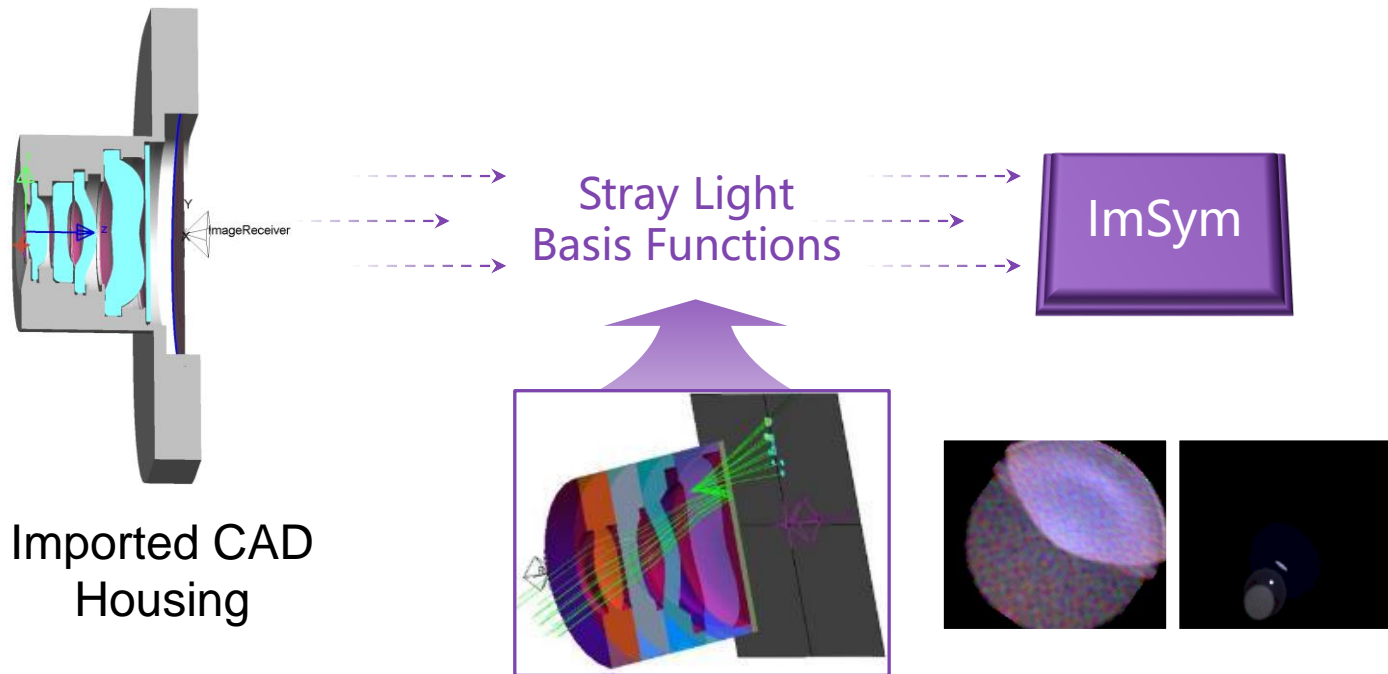| FFT Grid Size | 256 ▼ |
| Number of Rays Across Diameter | 128 Rays |

PSF Field Sampling

| Number of Samples in X | 7 |
| Number of Samples in Y | 7 |

ImSym Platform
Stray Light

User-specified stray light basis functions calculated in LightTools. Any feature available in LightTools is available to ImSym analysis.

Imported CAD Housing

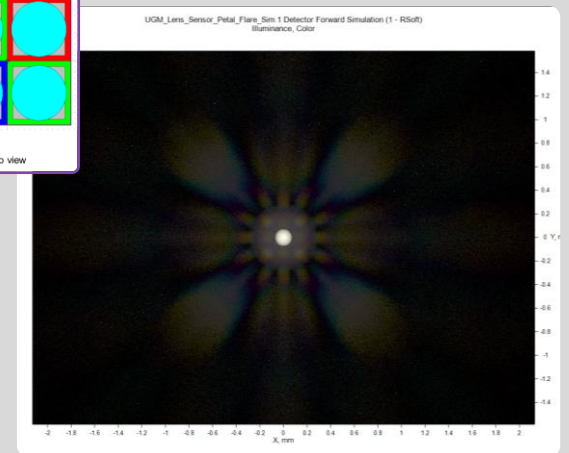Stray Light Basis Functions

ImSym

Process Options

- Select pre-calculated stray light basis function file.
- Open LightTools to load CODE V lens. Run Stray Light Scanner
- Open LightTools model. Run Stray Light Scanner.
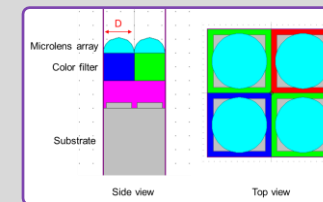
CIS model

Petal flare

ImSym Platform
Detector

Well Depth:
40k, 4k, 0.4k
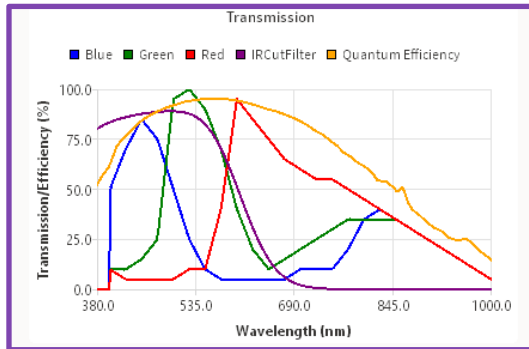

Exposure Time:
2, 20, 40 ms

Noise

Process

- Set exposure
- Set physical layout
- Enter spectral data.
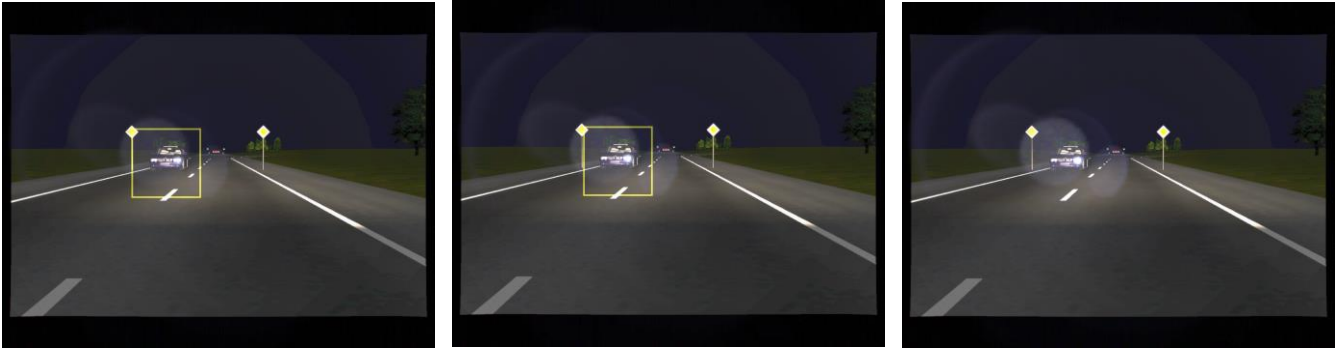- Enter noise details or select a standard detector model.

ImSym Platform
Image Signal Processing

Run basic built-in functions or custom Python functions.

	Additive Stray Light 50 W/m²	Additive Stray Light 80 W/m²	Additive Stray Light 100 W/m²
ISP	Custom ISP Detects	Custom ISP Detects	Custom ISP Fails

Scene Generated Using Synopsys LucidDrive

Process

- Enable/Disable radiometric calibration
- Perform built in ISP steps or replace individual steps with Python scripting.
  - White Balance
  - Demosaic
  - Blur/Sharpen Imagery
  - Color conversion
  - Apply Gamma
- Replace entire ISP with Python scripting.

Interested in a software demo?

Visit our Booth 10G86

SYNOPSYS®