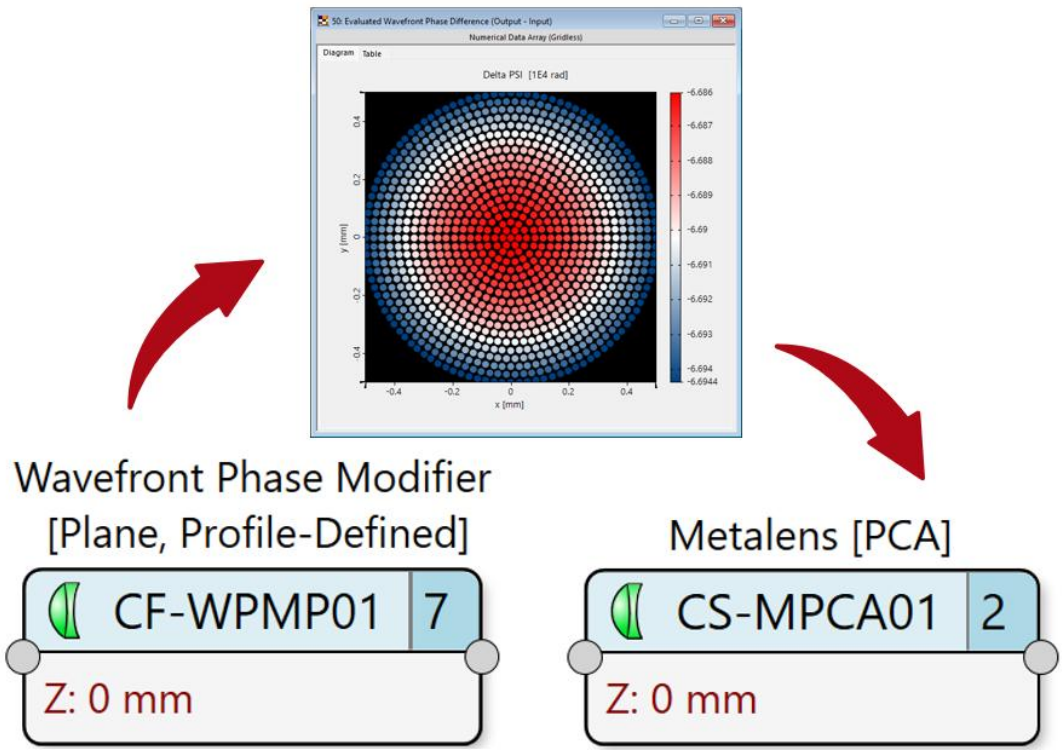
Transfer Wavefront Phase to a Metalens

Test an ideal wavefront phase first, then transfer it to a metalens to simulate the corresponding real metasurface structure.

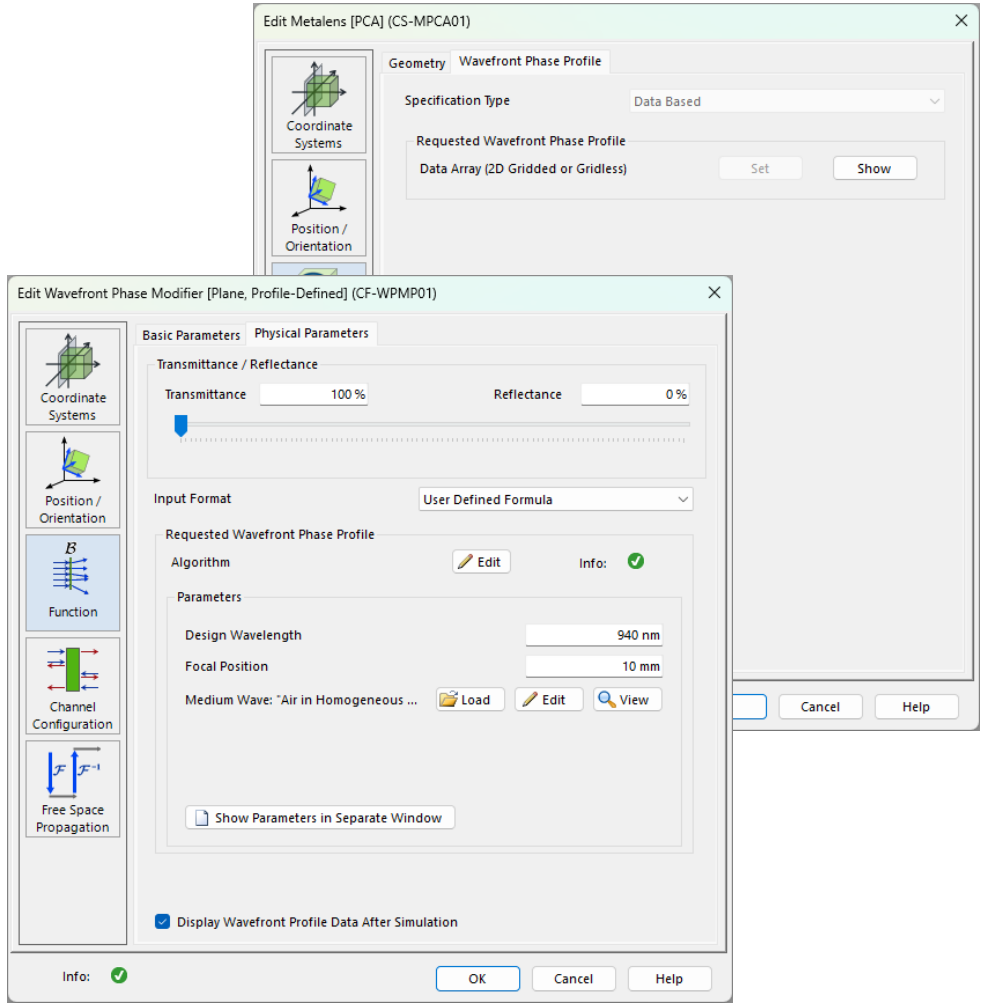
Document ID:	FD-META-TRANSFER
Version:	1.0
Date:	July 15, 2026
Author:	LightTrans International GmbH
Version:	2026.2
Package:	Flat Lens Package



What Can It Be Used For?

From Ideal Phase to Real Structure

- A *Wavefront Phase Modifier* applies a defined phase function directly to the incoming wavefront.
- A *Metalens* component uses a specified wavefront phase profile to automatically design a metasurface structure.
- The new workflow connects both steps: first define and test the desired phase response, then reuse the same phase profile for the metalens design.



For a deep dive into our Wavefront Phase Modifier twins, see:

Wavefront Phase Modifier

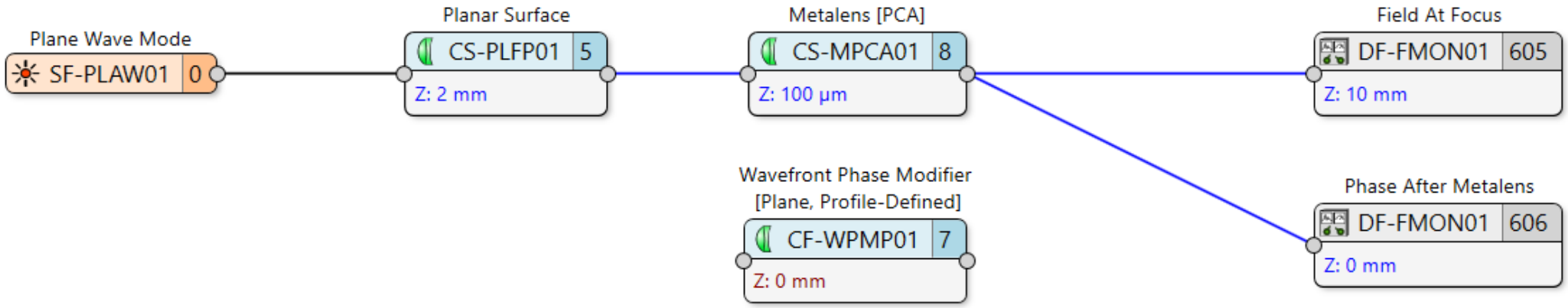
Demonstration Example

Demonstrated Optical Setup

Component	Specification
Source	Plane wave, 940 nm, 2 mm size
Metalens-Type	Nanopillars
Metalens-Function	Focussing Lens (10 mm focal length)
Detector behind Metalens	Phase of the field
Detector in Focus	EM-field

Please find the surrogate model in the corresponding files as:

- *Example_WavefrontPhaseModifier.os* (With the Wavefront Phase Modifer active.)
- *Example_Metalens.os* (With the Metalens [PCA] active.)



Comparison Between two Twins

Main Observation

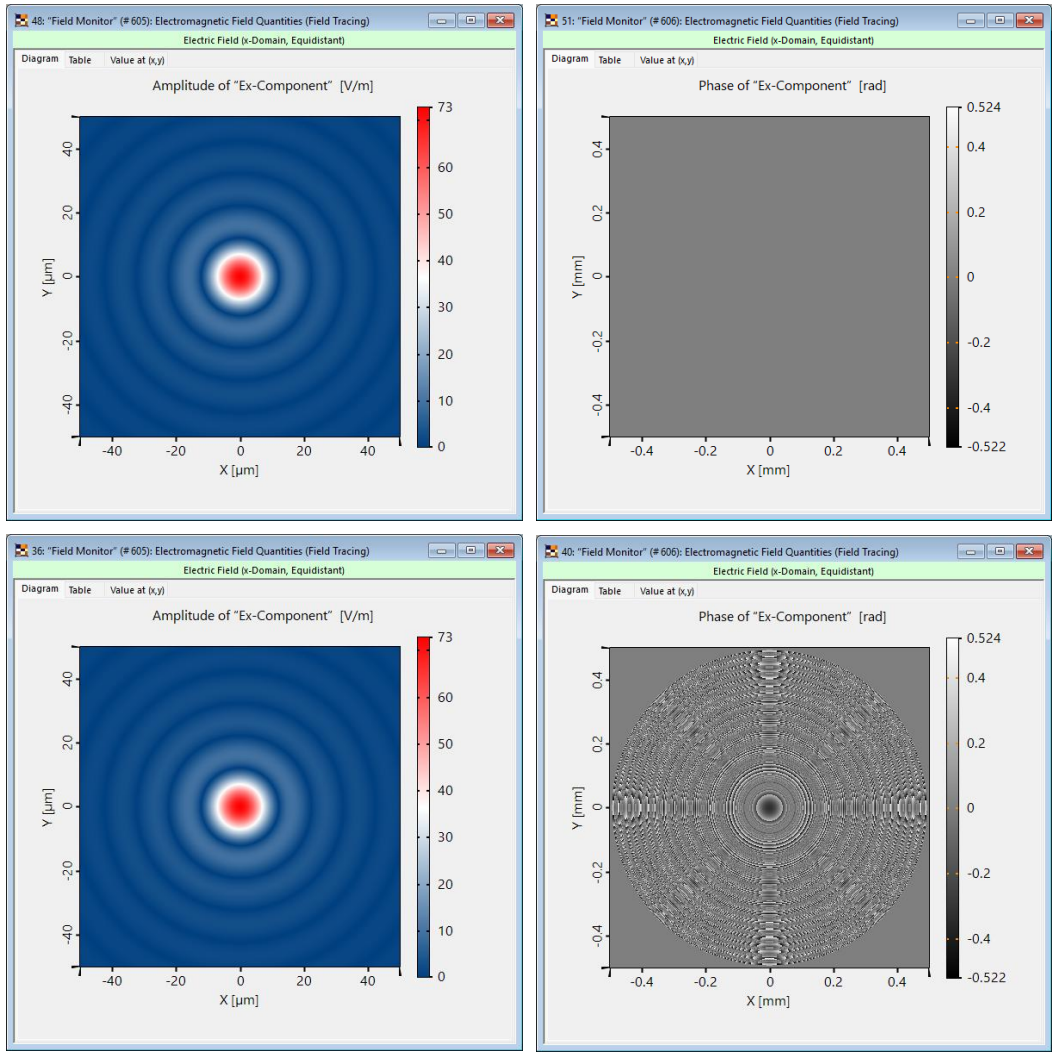
- The ideal wavefront phase modifier and the generated metalens produce the same focusing behavior.
- The focal positions and focal shapes agree well in the comparison.
- Directly behind the real metalens, additional structured phase effects caused by the quantized metalens structure are visible.

For a detailed discussion of the field effects introduced by the quantized metalens, see:

Collimation with a Metalens Based on Nanopillars

Focal Spot

Phase after lens



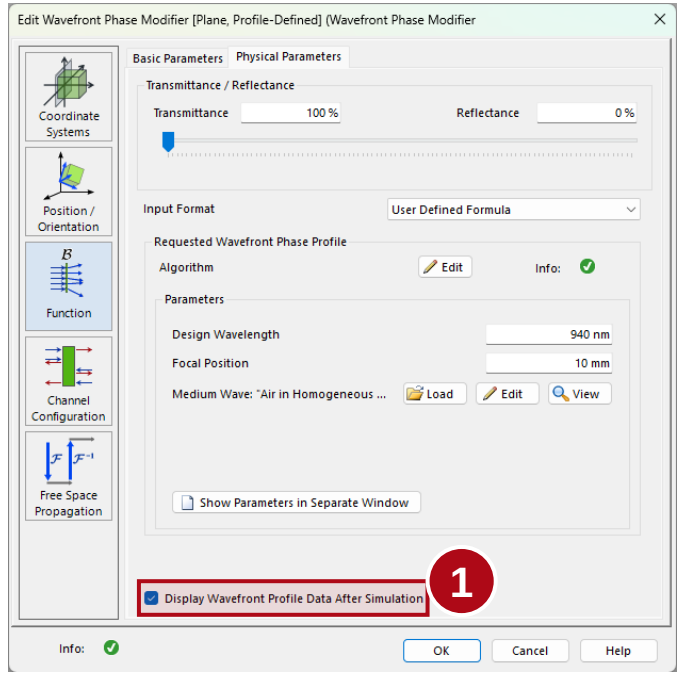
Wavefront Phase Modifier component

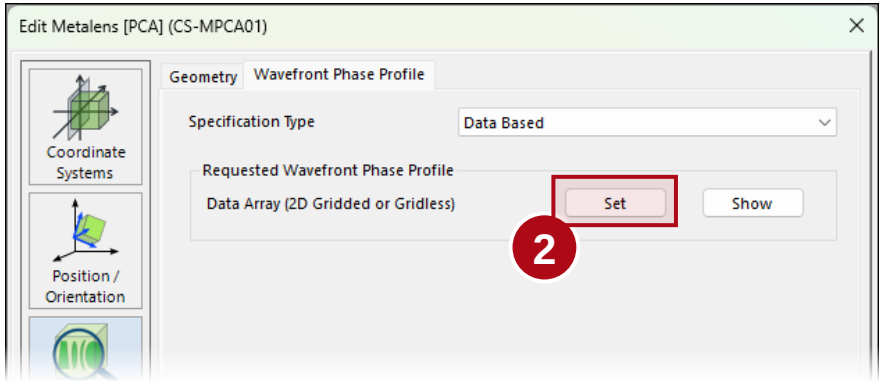
Metalens [PCA] component

Workflow

What the User Does

1. Define the desired wavefront phase response in the *Wavefront Phase Modifier*.
2. Activate *Display Wavefront Profile Data After Simulation*.
3. Start the simulation. You will receive a wavefront phase profile.
4. Load the phase profile into the *Metalens* component using *Data Based* input format.
5. Run the simulation again with the generated metasurface structure.
6. Compare the ideal phase-function result with the metalens result





Related Documents

White Papers

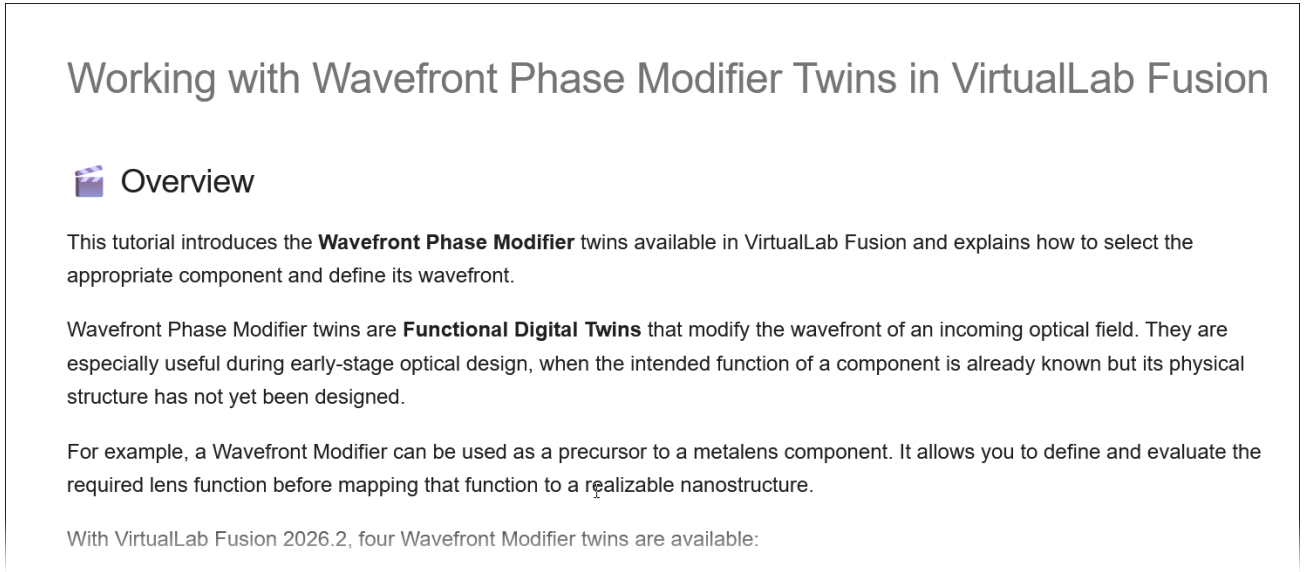
- WP-META-SURROGATE — Surrogate Modeling: Enabling Practical Metalens Design and Simulation
- WP-META-PHASE — Designing and Analyzing the Phase Response of Metasurfaces

Use Cases

- Collimation with a Metalens Based on Nanopillars
- Aberration Control via Metalens

Tutorials

- Wavefront Phase Modifier
- Designing a Metalens in VirtualLab Fusion



Working with Wavefront Phase Modifier Twins in VirtualLab Fusion

Overview

This tutorial introduces the **Wavefront Phase Modifier** twins available in VirtualLab Fusion and explains how to select the appropriate component and define its wavefront.

Wavefront Phase Modifier twins are **Functional Digital Twins** that modify the wavefront of an incoming optical field. They are especially useful during early-stage optical design, when the intended function of a component is already known but its physical structure has not yet been designed.

For example, a Wavefront Modifier can be used as a precursor to a metalens component. It allows you to define and evaluate the required lens function before mapping that function to a realizable nanostructure.

With VirtualLab Fusion 2026.2, four Wavefront Modifier twins are available: