

Field Phase Removal

Digital Twin Specification

Twin Code:	CF-FPRC01
Twin Name:	Field Phase Removal
Category:	Component
Type:	Function-Based
Version:	1.0
VLF Package:	Platform
Last Updated:	2026-05-28

Description

Structure-based optical components - such as metalenses, diffractive optical elements, or spatial light modulators - often introduce small phase errors alongside their intended wavefront shaping function. These errors may arise from quantization, discretization, or material inhomogeneities. While they typically do not alter the smooth, designed wavefront phase, they contribute a residual phase component that can affect the propagated field (e.g., through scattering or reduced focusing efficiency).

This component removes the residual phase from the incoming field, leaving only the smooth, intended wavefront phase. This enables direct comparison between a real (non-ideal) component and its ideal reference, helping users quantify the impact of phase errors on system performance.

Simulation Model

The component processes the incoming complex field as follows:

1. **Retrieve Residual Phase:** The residual phase map is obtained from the input field. This represents the non-ideal part of the wavefront (quantization errors, fabrication artifacts, etc.).
2. **Phase Manipulation:** The residual phase is set to 0.
3. **Output:** The resulting field contains only the smooth, intended wavefront phase — representing an ideal reference version of the real component.

Model Parameters

The Field Phase Removal Component has no configurable parameters.

Recommended Usage

1. **Adding the Component:** From the Digital Twin Hub, add "Field Phase Removal (FPRC01)" component to your optical system. Position it after the component whose residual phase you wish to remove.
2. **Running the Simulation:** Simulate with Field Tracing.
3. **Comparing Results:** Simulate once with the component and once without to quantify the impact of phase errors.

Typical Use Cases

- **Metalens Quantization Analysis:** A metalens with 2-level phase quantization produces a residual phase error. Use this component to remove that error and compare the focused spot with that of an ideal continuous-phase metalens.
- **Ideal vs. Real Comparison:** Propagate both the real field and the idealized field (after residual removal) through the same optical system to isolate performance degradation caused solely by residual phase errors.

Author:	LightTrans International GmbH
Contact:	support@lighttrans.com
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