Wavefront Phase Modifier [Plane, Output-Defined]

Digital Twin Specification Sheet | Version 1.0 | CF-WPMP02

Specification identity

Twin Code:	`CF-WPMP02`
Twin Name:	Wavefront Phase Modifier [Plane, Output-Defined]
Twin Family:	Wavefront Phase Modifier
Family Role:	Computes and applies a phase profile from a desired output phase on a plane
Category:	Component
Type:	Function-Based
Operation Type:	Pointwise wavefront phase modifier
Operator Domain:	x-domain
Package:	Platform

1 Purpose

The **Wavefront Phase Modifier [Plane, Output-Defined]** computes the required wavefront phase profile from a specified desired output wavefront phase, and then applies it to the incoming field on a plane reference surface.

Mathematically, the required profile is determined by:

$$\Delta\psi^{\mathrm{prf}}(x,y) = \psi^{\mathrm{out}}(x,y) - \psi^{\mathrm{in}}(x,y). \tag{1}$$

The resulting profile is then applied in the same way as for the Profile-Defined variant. This twin is useful when the target output wavefront is known, but the required phase profile is not immediately obvious.

2 Geometric Support

This twin is defined on a plane reference surface. The reference surface is fixed to a plane; the user cannot select a different surface type.

3 Supported Channels

This twin supports illumination from the front side only. The user selects either the transmission (T) or reflection (R) channel as the active output channel. The selected channel is the only generated output; the opposite channel is not generated. The requested output phase is defined for the selected channel.

4 Simulation Model

This is a function-based optical digital twin with an in-built design capability. It computes the required wavefront phase profile from the requested output wavefront phase and the incoming wavefront phase, then applies the computed profile.

The twin includes an aperture option: the user can select whether the component is used as *Single Function without Aperture* or *Single Function with Aperture*. If the aperture option is selected, the user can define the aperture size, shape, and edge width.

Model context: output-defined design

This twin is useful when the desired output wavefront is known but the required phase profile is not obvious. For example, when the incoming wavefront is aberrated and the goal is a specific output wavefront shape.

5 Parameters Where This Sheet Adds Guidance

The complete parameter documentation is available in the VirtualLab Fusion manual and from the twin via `Help`. This sheet only lists parameters for which additional modeling interpretation, usage guidance, or cross-twin selection advice is useful.

Requested Output Wavefront Phase

Role: Specifies the desired output wavefront phase ψ^{out}.

Spec-sheet insight: Three input formats are available: Even Order Radial Polynomial, User-Defined Formula, and Data Based. The component internally computes the required profile. For Zemax users, coefficients can be imported directly from a Zemax file.

Flip Output Phase Sign

Role: Inverts the sign of the specified output wavefront phase.

Spec-sheet insight: Use this to correct a wrong sign setting without redefining the desired output. A wrong sign setting simply conjugates the result.

Selected Output Channel

Role: Selects the active output channel: Transmission or Reflection.

Spec-sheet insight: The requested output phase is defined for the selected channel. Only the selected channel is generated.

Consider Phase Effect Only

Role: Ignores amplitude and polarization effects from energy conservation.

Spec-sheet insight: Use this for studying the pure phase effect in isolation. In production simulations, energy conservation should normally be enabled.

Display Wavefront Profile Data After Simulation

Role: Outputs the internally computed wavefront phase profile.

Spec-sheet insight: The displayed data shows the profile that was applied, not the requested output phase. This is useful for verification and for reusing the profile in other contexts.

Aperture Size and Shape

Role: Defines the aperture truncation applied to the field before the phase modification.

Spec-sheet insight: This is a modeling parameter that affects the field support. Use the aperture variant when the finite extent of the component is physically relevant.

6 Recommended Usage

- Use this twin when the desired output wavefront is known, and you want the component to compute the required profile automatically.
- Use the *Even Order Radial Polynomial* format for rotationally symmetric output phases, such as spherical wavefronts.
- Use the *Data Based* format for output phases from measurements or external simulations.
- Use the *Import from Zemax OpticStudio System* button to import coefficients directly from a Zemax file.
- Use the *Display Wavefront Profile Data After Simulation* option to verify the internally computed profile.
- Use the *Consider Phase Effect Only* flag for pure phase studies.

7 Related Twins

Related twins belong to the same function-based family or to closely neighboring function-based variants.

Related twin	Main distinction
Wavefront Phase Modifier [Plane, Profile-Defined]	Same plane geometry; profile is supplied directly.
Wavefront Phase Modifier [Surface, Profile-Defined]	Profile-defined concept on a curved surface.
Wavefront Phase Modifier [Surface, Output-Defined]	Output-defined concept on a curved surface.

8 Possible Replacement Twins

Replacement twins provide another modeling route for the same design intention.

Possible replacement twin	When it replaces this twin
Wavefront Phase Modifier [Plane, Profile-Defined]	Use when the required profile is already known and can be supplied directly.
Metalens Twin	Use when the phase profile should be realized by a metasurface structure.
Holographic Optical Element (HOE) Twin	Use when the phase profile should be realized by a diffractive structure.

9 Further Reading

For complete software parameter documentation, see the VirtualLab Fusion manual, Sec. 69.7, *Wavefront Phase Modifier [Plane, Output-Defined]*.

For the theoretical foundations of the Wavefront Phase Modifier family see the white paper on From Phase to Structure: A Two-Step Design Workflow with Wavefront Phase Modifier Twins (LightTrans Document ID: WP-WPM-PUB).