

# Radial Wavefront Phase Detector

## Digital Twin Specification

<b>Twin Code:</b>	DF-RWPD01
<b>Twin Name:</b>	Radial Wavefront Phase Detector
<b>Category:</b>	Detector
<b>Type:</b>	Function-Based
<b>Version:</b>	1.0
<b>VLF Package:</b>	Platform
<b>Last Updated:</b>	2026-05-28

## Description

Analyzing radially symmetric wavefronts is a common task in optical design, particularly in the context of metalenses, aspheric lenses, and other rotationally symmetric optical elements. This detector twin extracts the radial phase profile from an incoming electromagnetic field and provides it as a 1D function of the radial coordinate  $r = \sqrt{x^2 + y^2}$ . The extracted radial phase profile can then be used as an input to other components—for example, to negate an input wavefront in a Metalens [PCA] component or to generate complementary phase profiles for wavefront correction.

Please be aware that this detector logically only provides meaningful results for radially symmetric wavefronts.

## Measured Quantity

The detector outputs a 1D radial phase profile:

- **Radial Wavefront Phase  $\phi(r)$ :** The wavefront phase of the electromagnetic field as a function of the radial coordinate, extracted from the 2D complex field.

The output is typically used as a data source for other components e.g., as an input to a Metalens [PCA] phase definition snippet "Negate Input Wavefront".

## Model Parameters

The Radial Wavefront Phase Detector itself has no configurable parameters beyond the standard detector properties (size and sampling).

- **Detector Window Size:** The size of the detector in (x,y). Can be defined manually or by scaling factor.
- **Detector Grid Resolution:** Used number of sampling points to resolve the field. Can be defined via grid points or scaling factor

## Recommended Usage

1. **Adding the Detector:** From the Digital Twin Hub, add the "Radial Wavefront Phase Detector" (RWPD01) to your optical system. Position it at the plane where you want to analyze the wavefront phase.
2. **Running the Simulation:** Execute the field tracing. The detector analyzes the field at its designated plane and extracts the radial phase profile.

## Typical Use Cases

- **Metalens Wavefront Negation:** Extract the incoming wavefront phase and use it in a Metalens [PCA] component with the "Negate Input Wavefront Phase" snippet to create a correction plate that flattens the wavefront.
- **Wavefront Phase Verification:** After performing wavefront phase retrieval from the electromagnetic field, verify that the retrieved phase is how it is supposed to be.

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