



Why VirtualLab Fusion?

The Digital Twin Platform for Light

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VirtualLab Fusion – Your Virtual Lab, Unified

To predict how an optical system will behave before you assemble it, you first need to create a virtual representation—and that is why we gave our software the name VirtualLab. And because we combine the diversity of simulation concepts known in optics literature into one unified simulation environment, we call it VirtualLab Fusion.

The Logic You Already Know

When you choose a software product, you choose a simulation concept—for example, ray tracing. That is how it works. For the simulation of many optical systems, that is perfectly fine.

But when your system includes assets that require different simulation concepts, you end up in tool-hopping. And you know how painful that is.

Or worse: sometimes no software product provides a simulation model for an asset at all.

We are not here to replace what works. We are here for the cases where your current approach reaches its limits.

The solution is logical: the software does not enforce a single simulation concept on all assets. It uses the best one for each asset. That is what we do.

A. The Demand: Simulation of Modern Optical Systems

Modern optical systems are built from diverse assets. Different assets demand different modeling approaches. A lens, a grating, a metalens, a waveguide, a detector—each has its own physics. Each requires its own balance of accuracy and speed. Traditional software, built around a single dominant method, cannot deliver this in a unified way. It forces all assets into one modeling box, regardless of whether it fits.

The consequence is painful **tool-hopping**: users must switch between different software products to simulate their full system. This is time-consuming, error-prone, and forces users to learn multiple products with different user interfaces. Moreover, connecting these products—each built around different modeling concepts—lacks a clear foundation in optical theory.

So the demand is clear: you need a platform that can use different modeling concepts for different assets, and connect them seamlessly.

B. The Solution: Optical Digital Twins

VirtualLab Fusion delivers exactly that.

We take inspiration from working in a real optical lab and transfer that concept into simulation. In VirtualLab Fusion, real lab assets—such as sources, components, objects in the light path, and detectors—are replaced by optical digital twins.

Each digital twin represents a parametric class of an optical asset. For example, a Gaussian beam source twin defines the class of Gaussian beams and allows you to adjust parameters like wavelength and beam radius and also the order of the beam, to define the exact source for your simulation. In the same way, you configure other twins to match your specific optical setup. Each twin provides an interface for this configuration and simulates the optical behavior using a tailored, built-in simulation model.

Key point: Each twin comes with its own simulation model, chosen to optimize the balance between accuracy and speed. These models may draw on any theoretical concept in optics—

including geometrical optics, scalar optics, paraxial optics, Fourier optics, physical optics, and electromagnetic optics, as well as their modifications and combinations.

You build your system from these twins. Running a simulation means propagating light non-sequentially from source twins through component twins to detector twins—connecting all the different simulation models in a unified environment.

This gives you the diversity of models needed to simulate the full range of optical sources, components, and detectors—while you enjoy a unified simulation experience. The platform maintains the speed of geometrical optics where appropriate, for example in traditional lenses, and seamlessly connects with other modeling concepts, such as electromagnetic simulation for gratings and metalenses, wherever needed.

To use the platform and its existing twins, you do not need to be an expert in each simulation model. The expertise is built into the twins. The user interface focuses on the parameters for asset and system configuration.

This approach makes high-end simulation technology accessible and flattens the learning curve. You can concentrate on building your system and running simulations, rather than studying different modeling concepts and user interfaces for each product and each concept.

Summary

To simulate modern optical systems, different modeling concepts are needed for different assets—and they must be connected. Software products that offer only one dominant modeling approach must be connected externally, which is technically challenging and conceptually weak.

VirtualLab Fusion solves this challenge at its core: suitable simulation models are built into the optical digital twins that represent the assets and are seamlessly connected in system simulation.

What You Get with VirtualLab Fusion

- A unified simulation environment based on a solid physical foundation
- Optical Digital Twins with built-in, tailored models
- Seamless connection of simulation concepts ranging from geometrical to electromagnetic optics

"Understand Scenario. Select Twins and Tools. Simulate and Design."