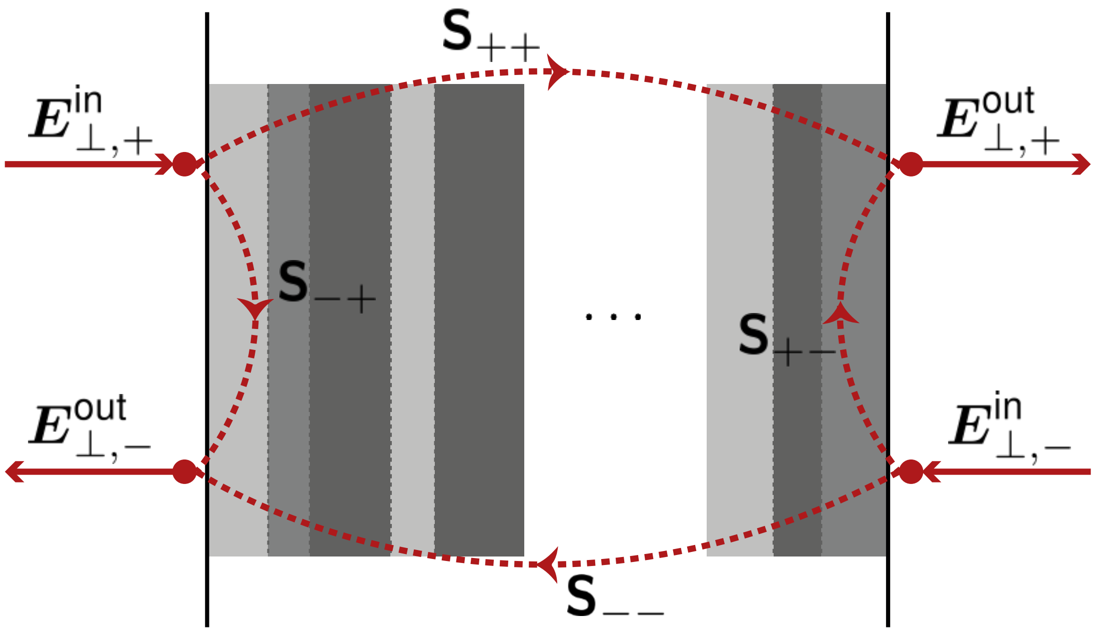
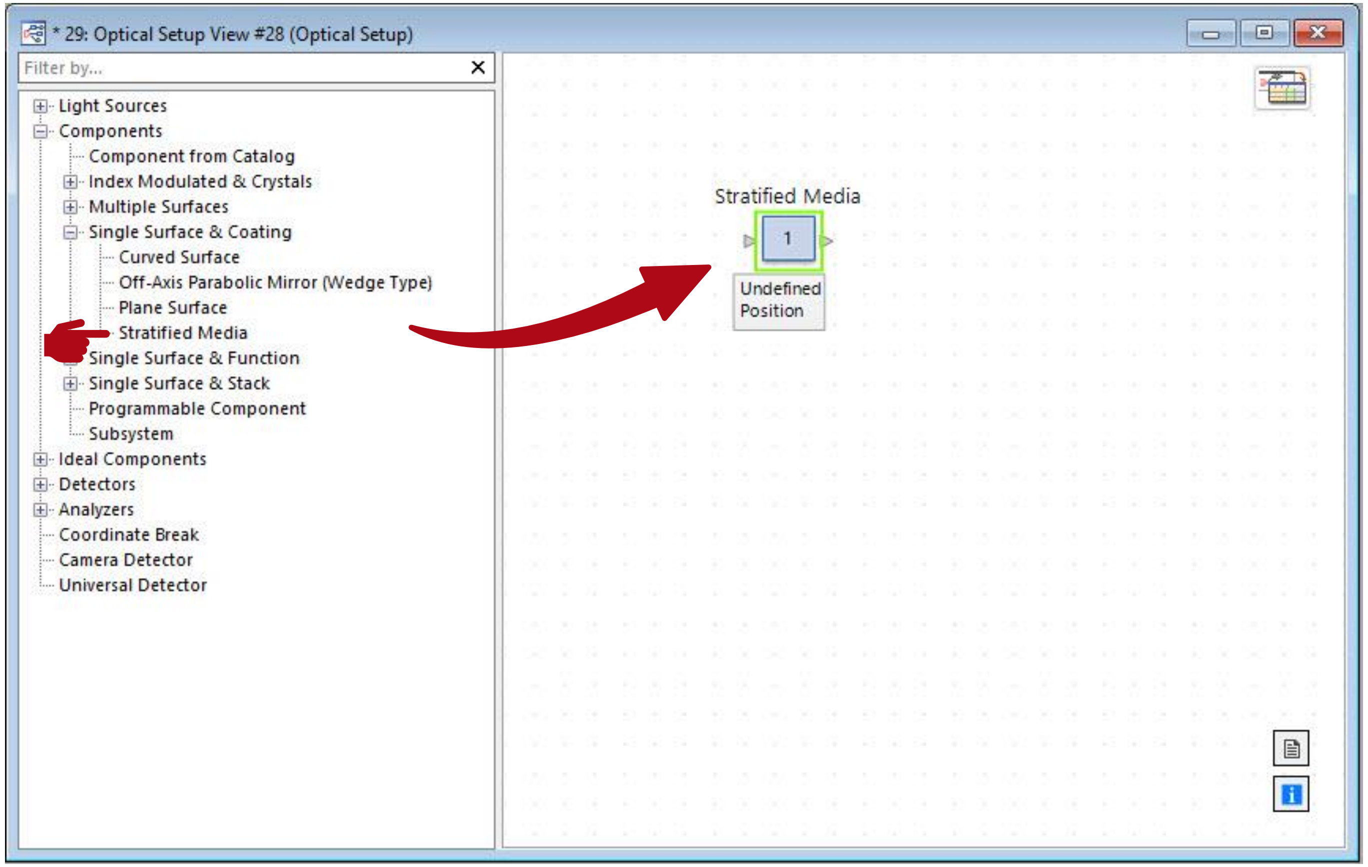
Stratified Media Component

Abstract



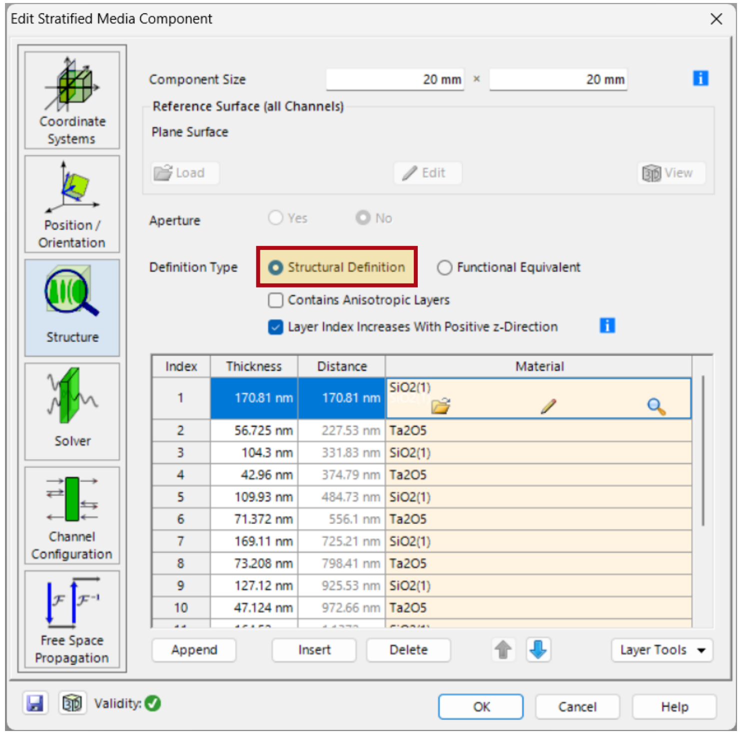
The Stratified Media component is intended for the functional description as well as the rigorous and fast analysis of a sequence of plane layers of homogeneous (isotropic or anisotropic) media. Such configurations are of particular interest in e.g. coating applications. In this use case we show how such structures can be defined in VirtualLab Fusion and provide an in-depth look into its features.

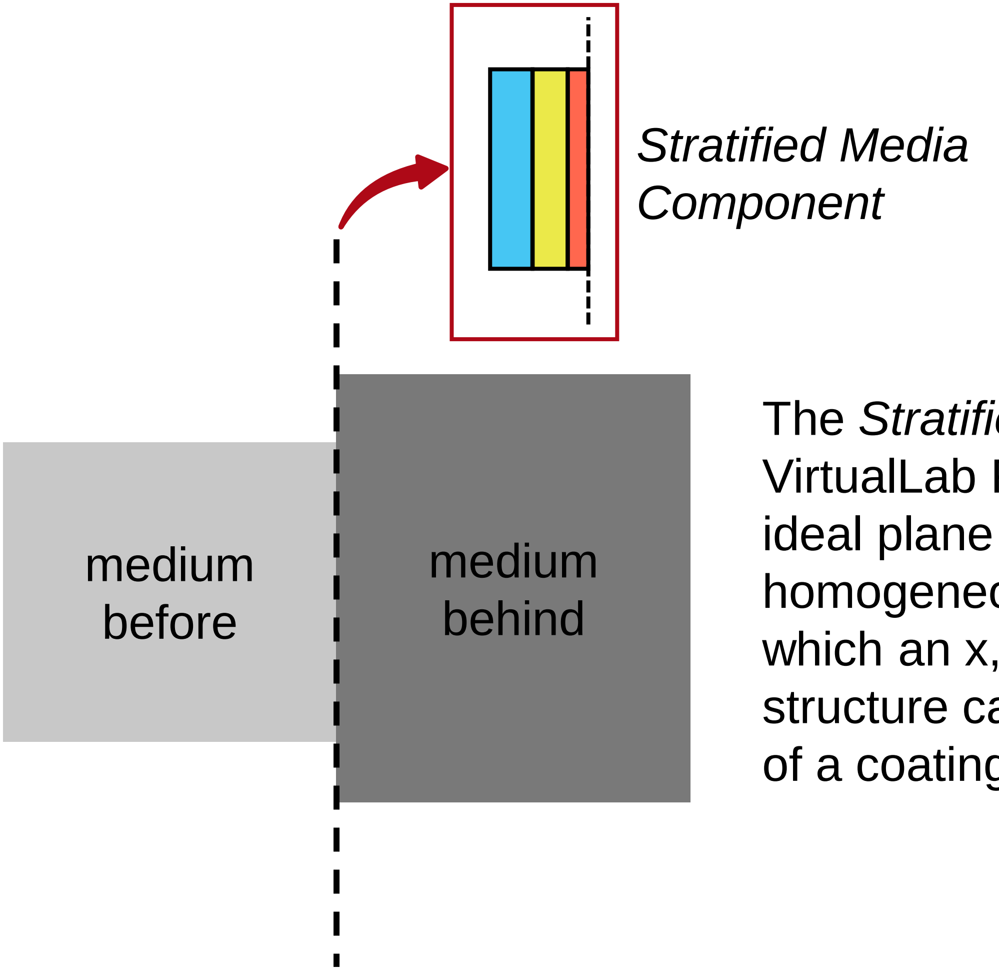
Where to Find the Component?



The *Stratified Media* component can be found under *Components > Single Surface & Coating.*

Configuration of the Structure

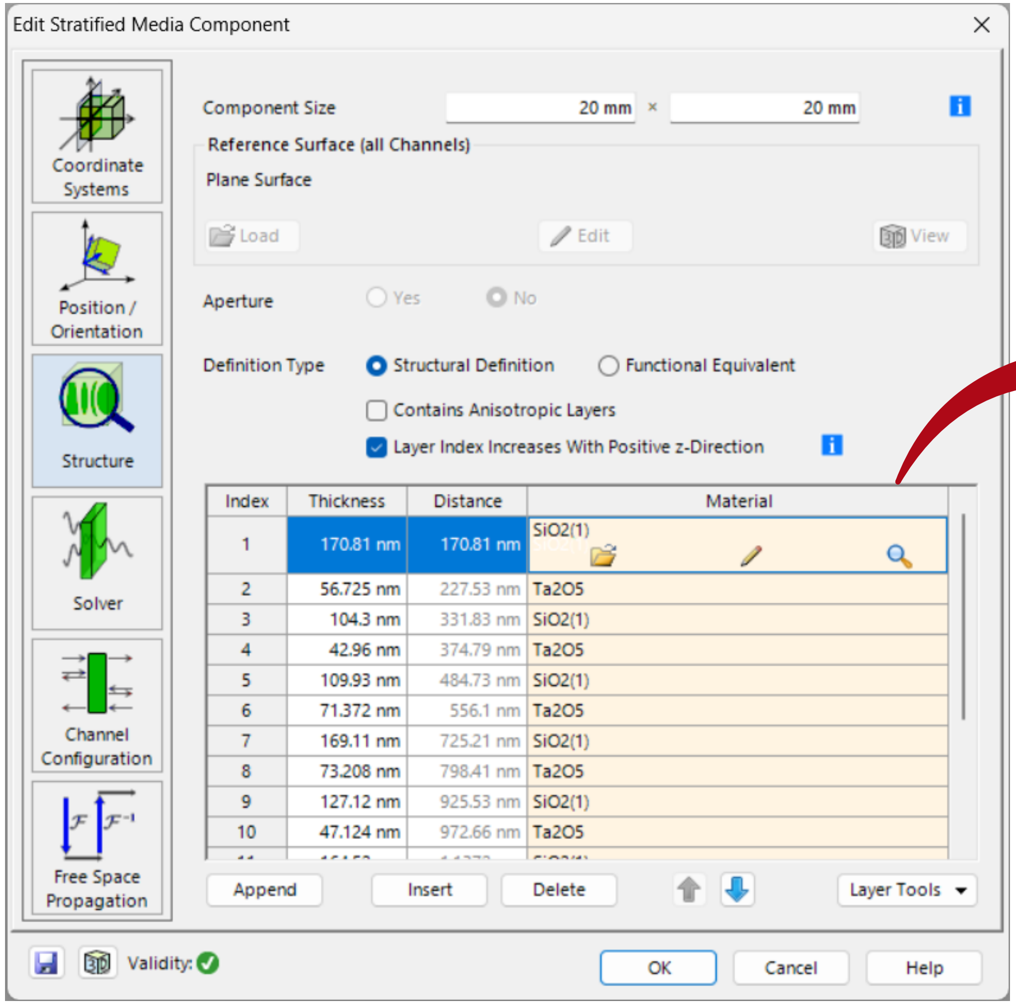




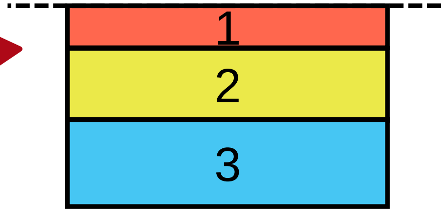
The *Stratified Media Component* in VirtualLab Fusion is defined as an ideal plane surface separating two homogeneous isotropic media, on which an x, y-invariant layered structure can be applied in the form of a coating stack.

Configuration of the Structure

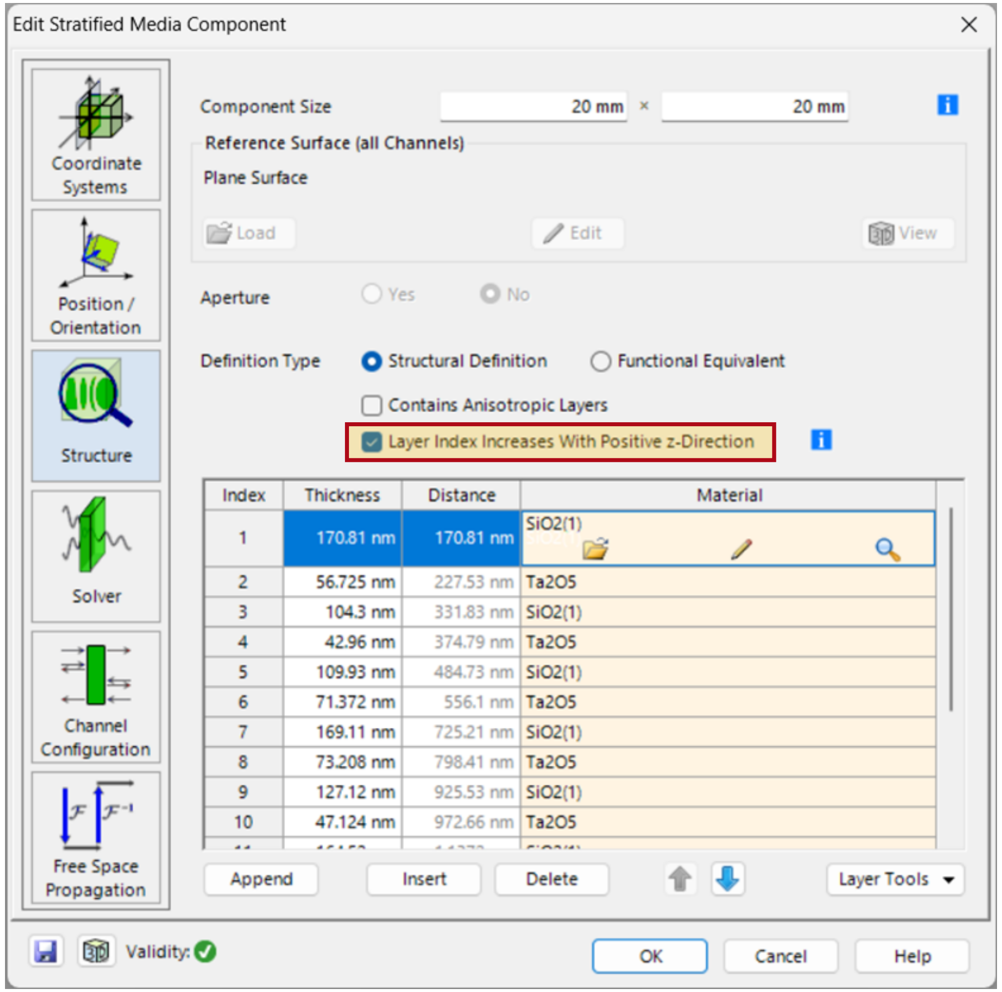
The user can configure their own stratified medium. Here a coating of a polarizing beamsplitter is presented.

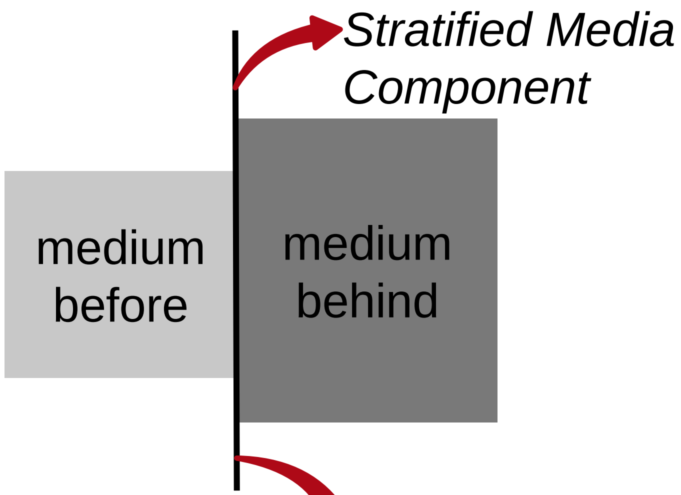


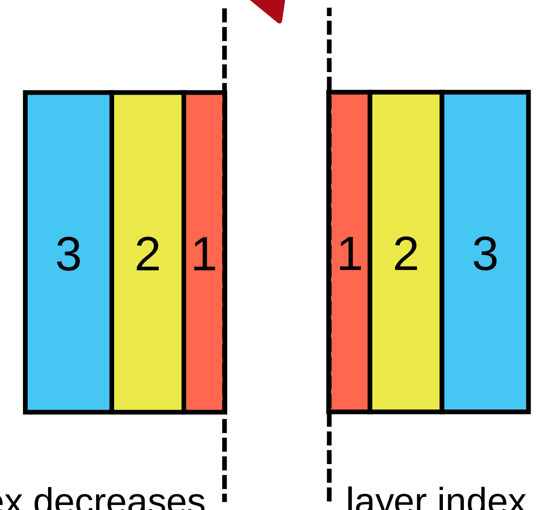
The user can set the material and thickness of each individual layer here.



Orientation of the Layer Sequence







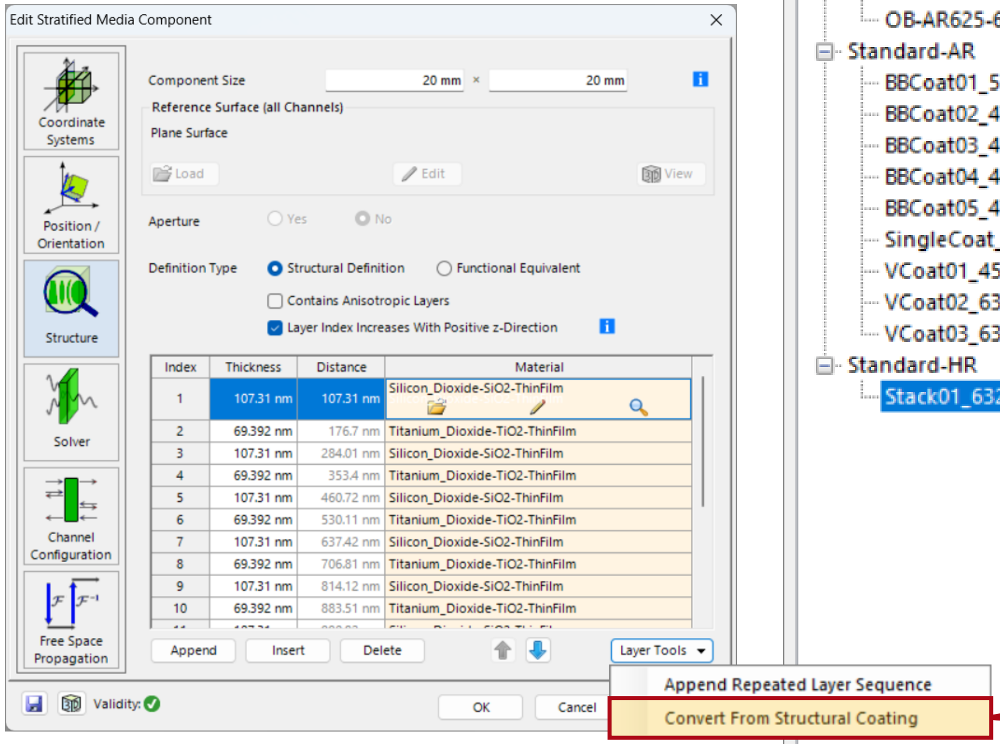
The layer index of the coating can either increases or decreases with positive z-direction of the reference plane. Here the reference plane is marked with a dashed line.

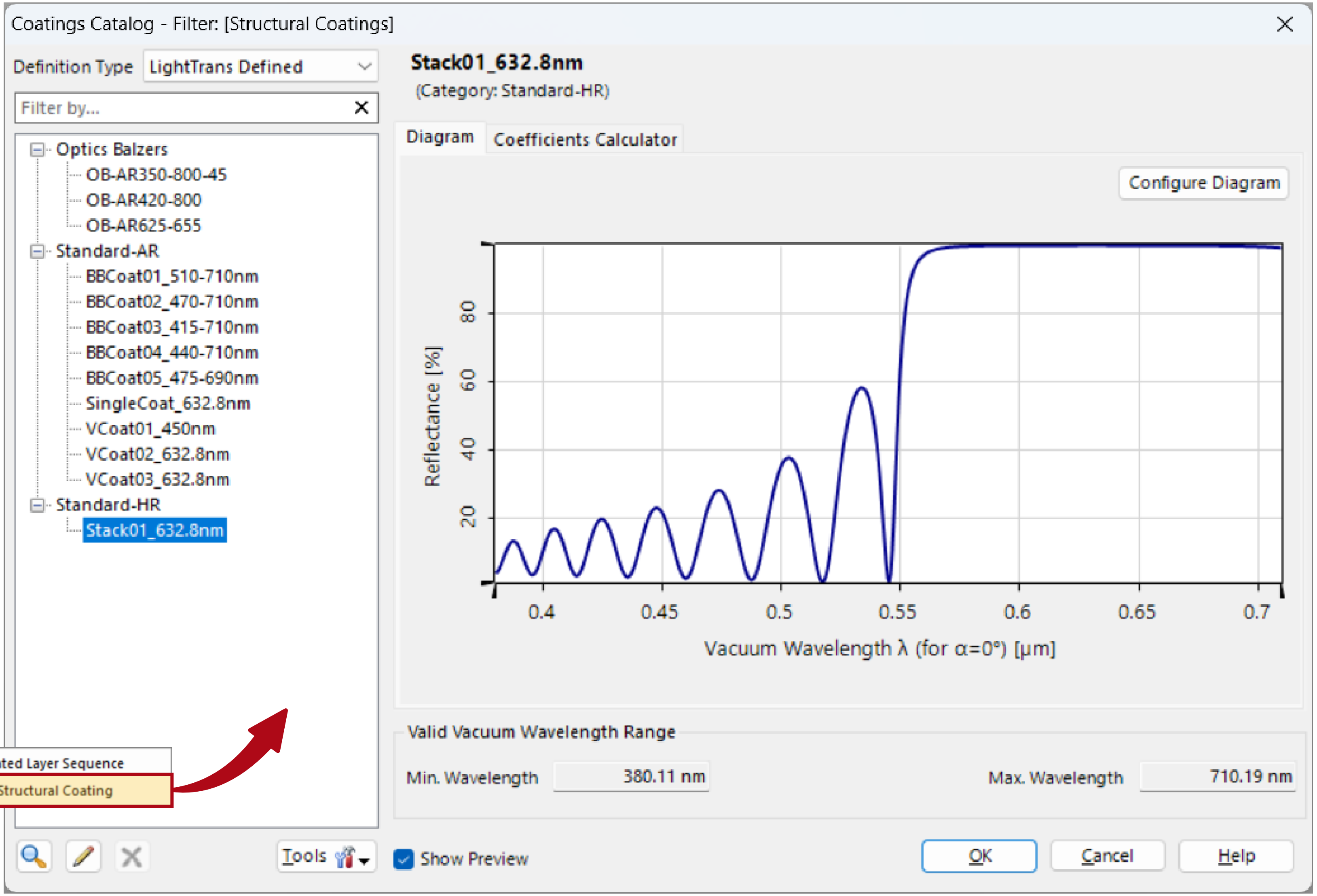
layer index decreases with positive z-direction

layer index increases with positive z-direction

Coating Import

The user can also employ our in-built off-the-shelf coatings from the catalog.



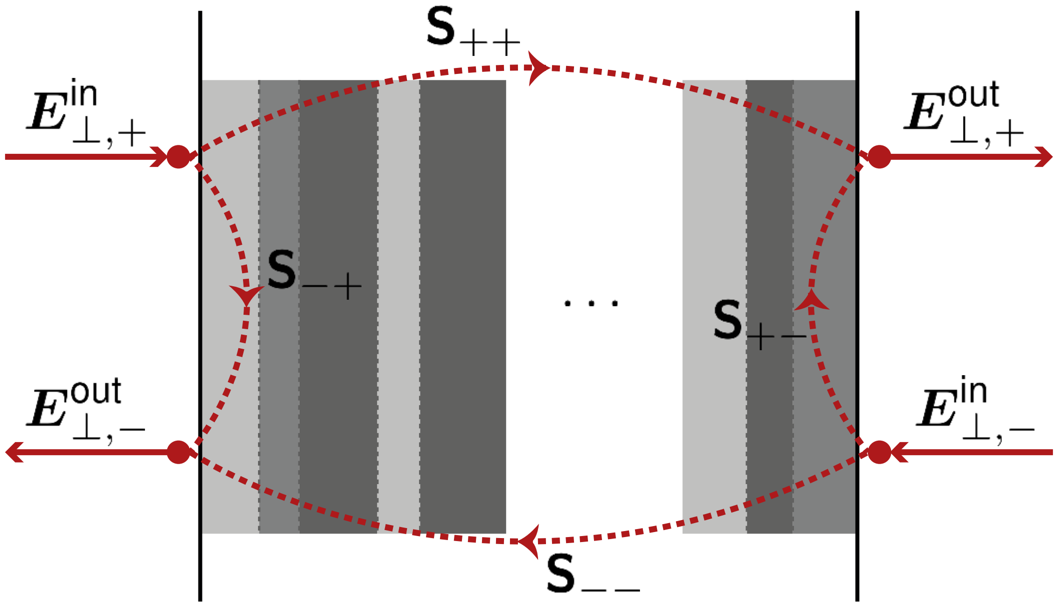


Layer Matrix Solver

The *Stratified Media Component* uses the layer matrix electromagnetic field solver. This solver works in the spatial frequency domain (**k domain**). It consists of

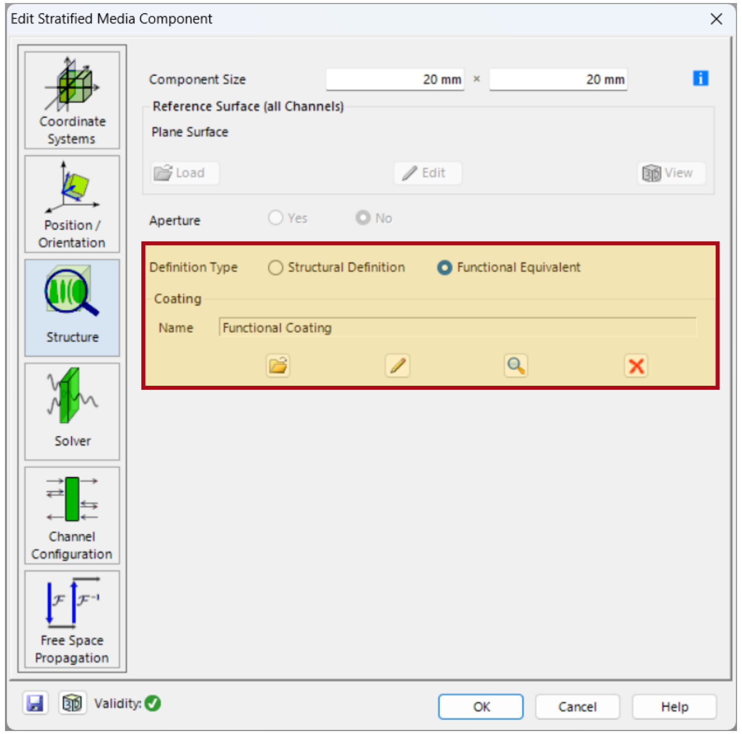
1. an eigenmode solver for each homogeneous layer and
2. an S-matrix for matching the boundary conditions at all the interfaces.

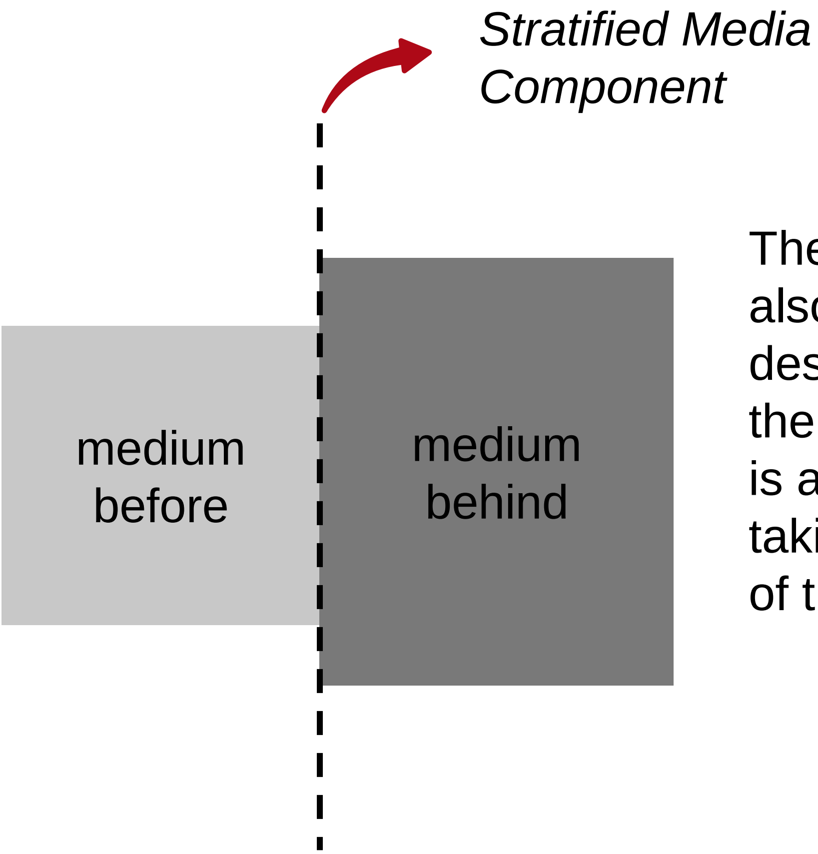
The eigenmode solver computes the field solution in the k-domain for the homogeneous medium in each layer. The S-matrix algorithm calculates the response of the whole layer system by matching the boundary conditions in a recursive manner. This is a method well-known for its unconditional numerical stability since, unlike the traditional transfer matrix, it avoids the exponentially growing functions in the calculation steps.



For further information:
[Layer Matrix [S-Matrix]]

Configuration of the Functional Coating

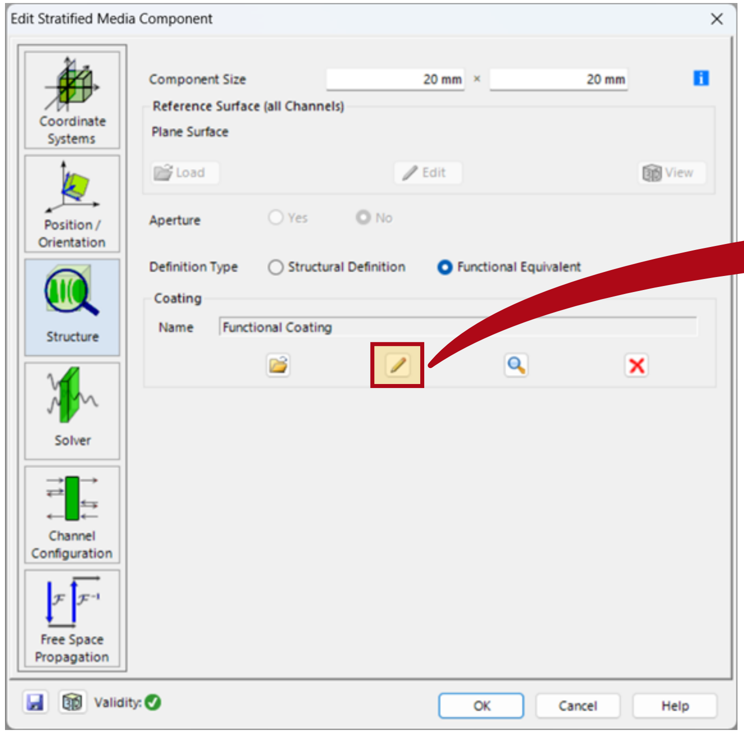


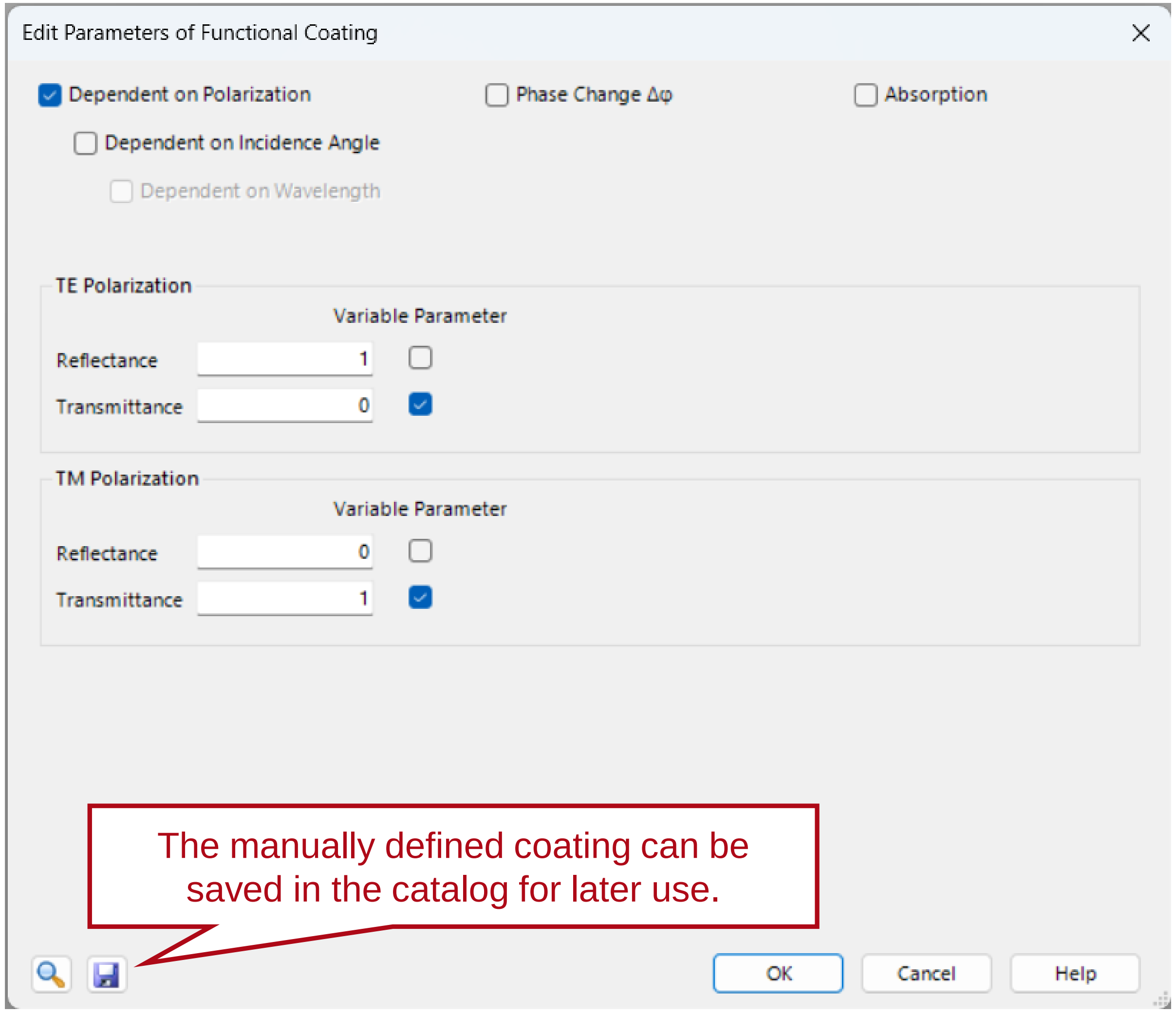


The *Stratified Media Component* also enables the functional description of a coating. In this way the desired response of the coating is applied to the input field, without taking the actual physical structure of the coating into account.

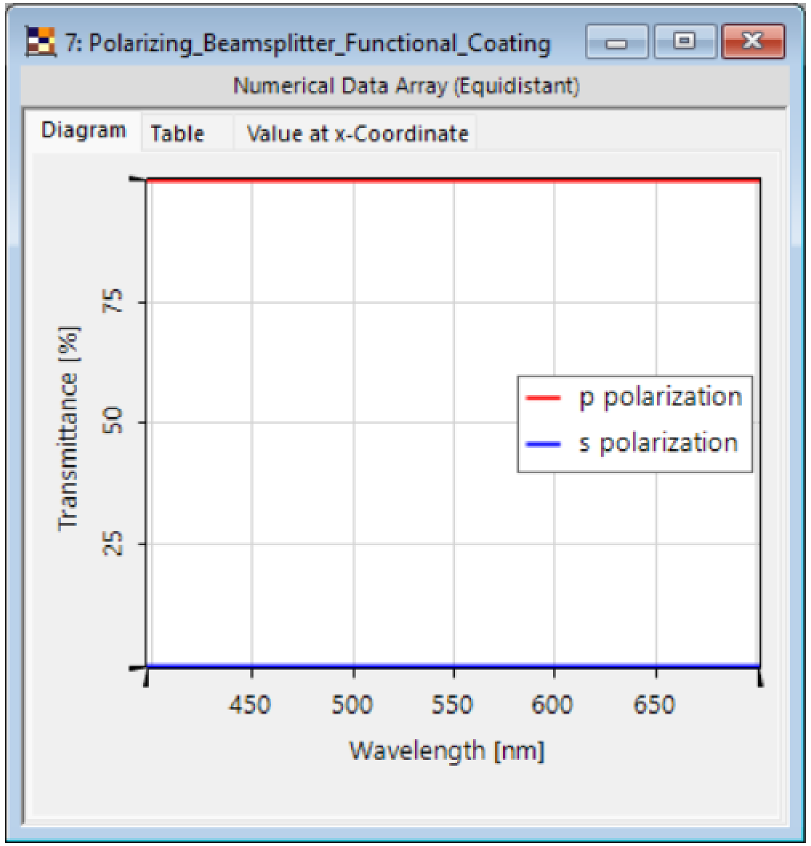
Configuration of the Functional Coating

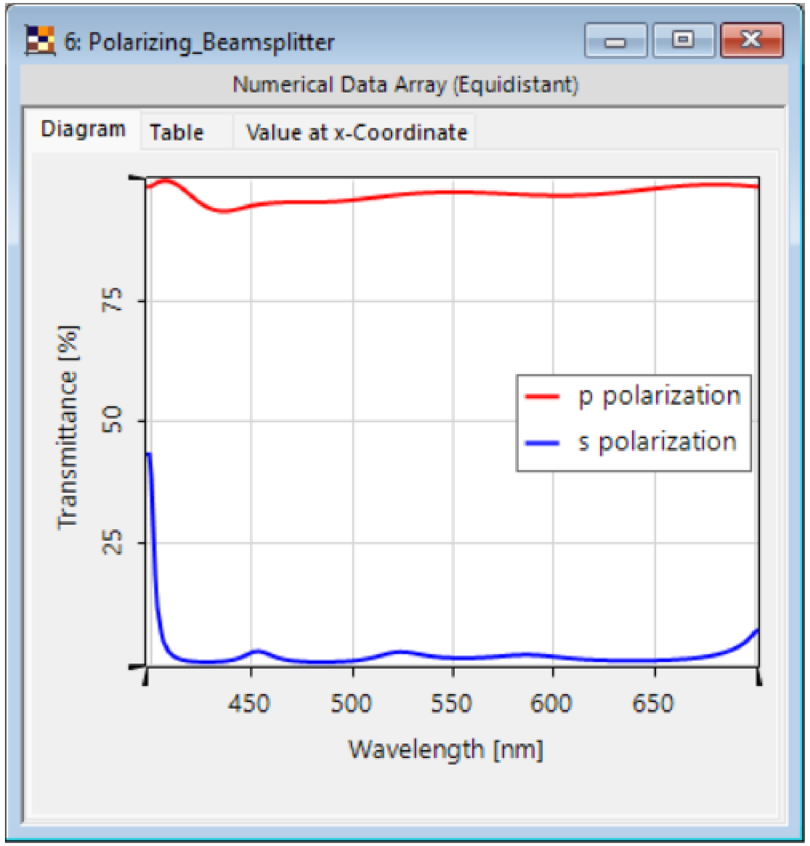
The desired transmittance and reflectance of the incident light can be directly defined. Here a functional coating of a polarizing beamsplitter is presented.





Comparison between Functional and Real Coating





We integrated the coatings of the aforementioned polarizing beamsplitter into optical setups to calculate their transmittance. We can observe that the real coating does not perfectly split the input beam into its s- and p-polarized components, whereas the functional coating represents an idealized scenario.

Document Information

title	Stratified Media Component
document code	SWF.0005
document version	1.3
software edition	VirtualLab Fusion Basic
software version	2024.1 (Build 2.30)
category	Feature Use Case
further reading	• Effects of Mirror Coating on Pulse Characteristics • Absorption in a CIGS Solar Cell