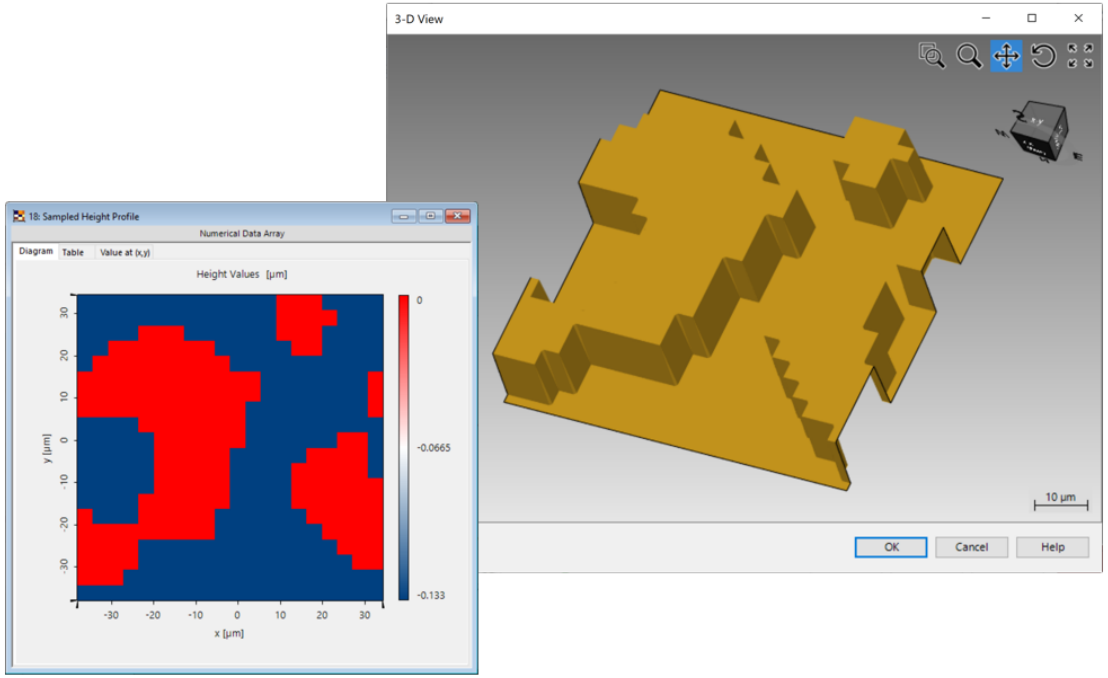
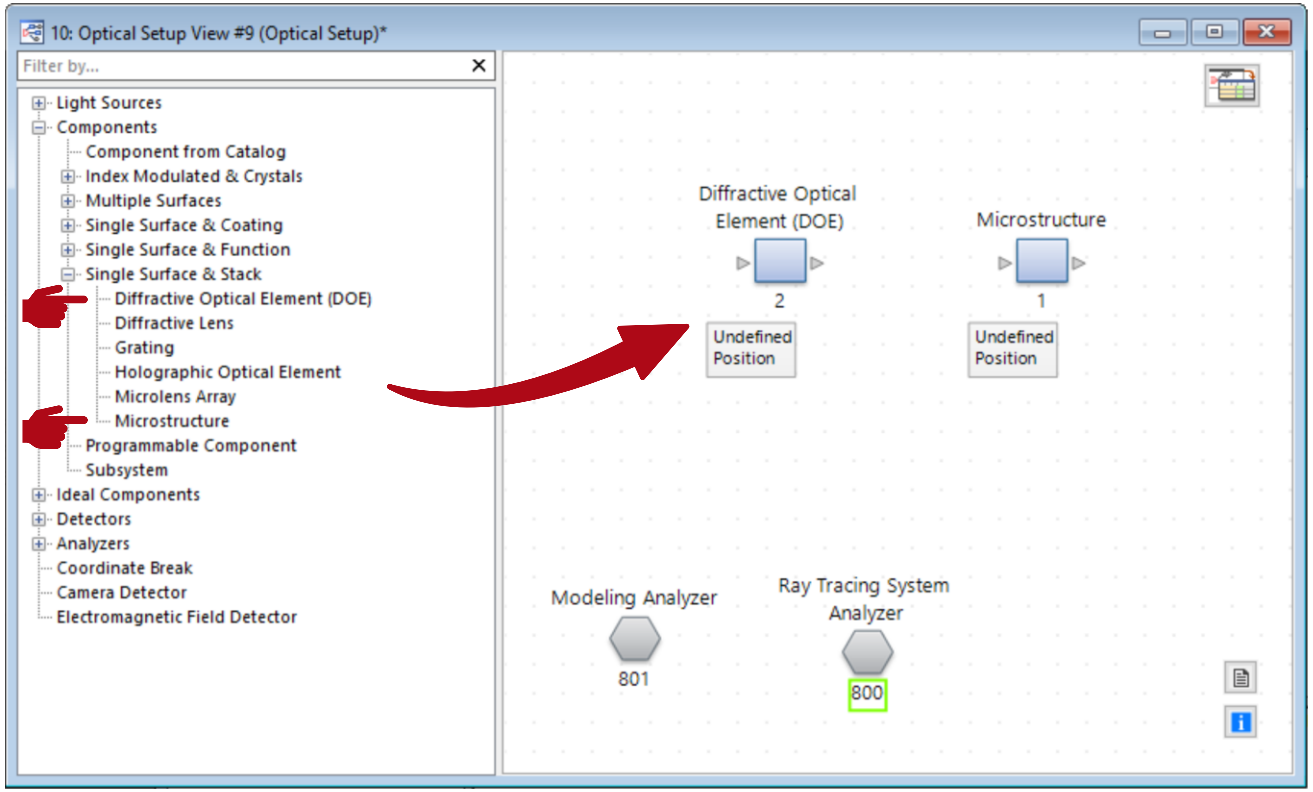
Diffractive Optical Element (DOE) & Microstructure Component

Abstract



Diffractive optical elements (DOEs) and micro structured surfaces enable a hugh variety of optical functions, such as beam splitters, beam shapers and diffusers. Due to the diffractive approach, these elements are usually thinner and lighter than most refractive elements, while providing unique and powerful options for many applications in optics. In this Use Case, we demonstrate how such components can be defined in VirtualLab Fusion using the Microstructure- and Diffractive Optical Element (DOE) components.

Where to find the Components?

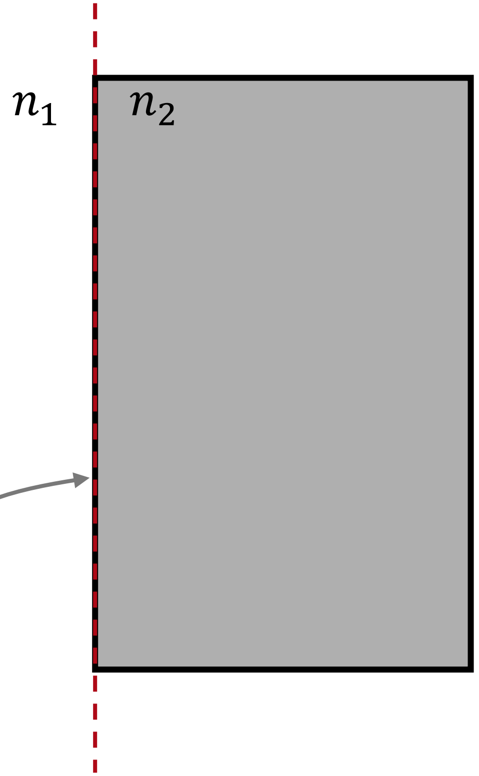


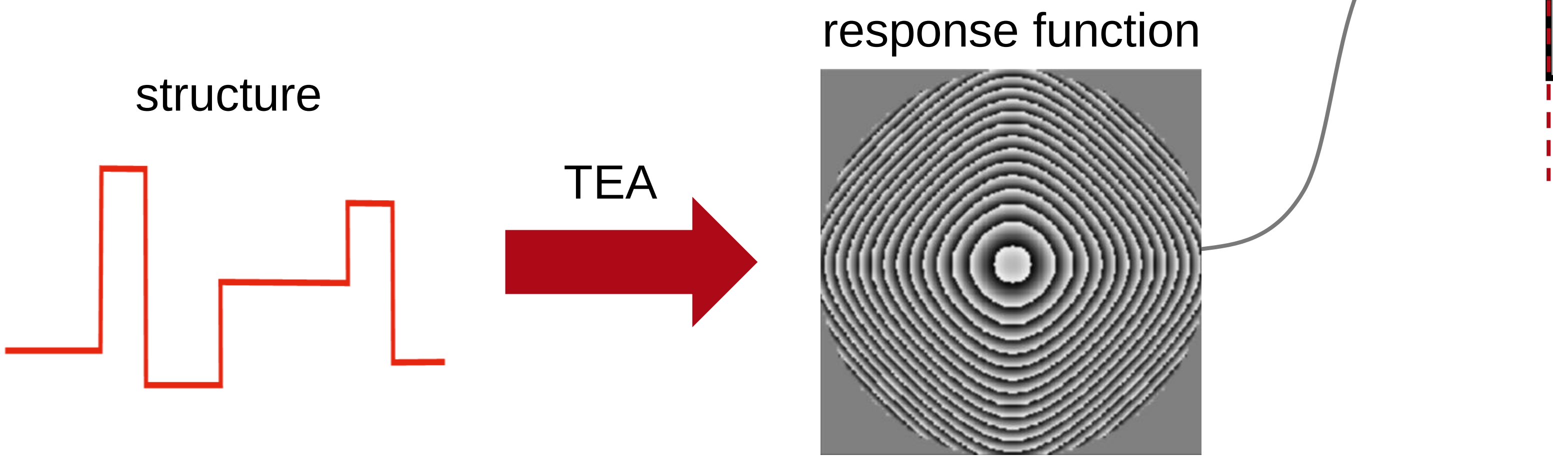
The *Diffractive Optical Element (DOE)* component and the *Microstructure* component can be found under *Components > Single Surface & Stack.*

Both components use the same internal solver and only have different names for the ease of recognition and application. In this Use Case we will show the *Microstructure* component, but everything can analogously be applied to the *Diffractive Optical Element (DOE)* component.

Function of the Microstructure Component

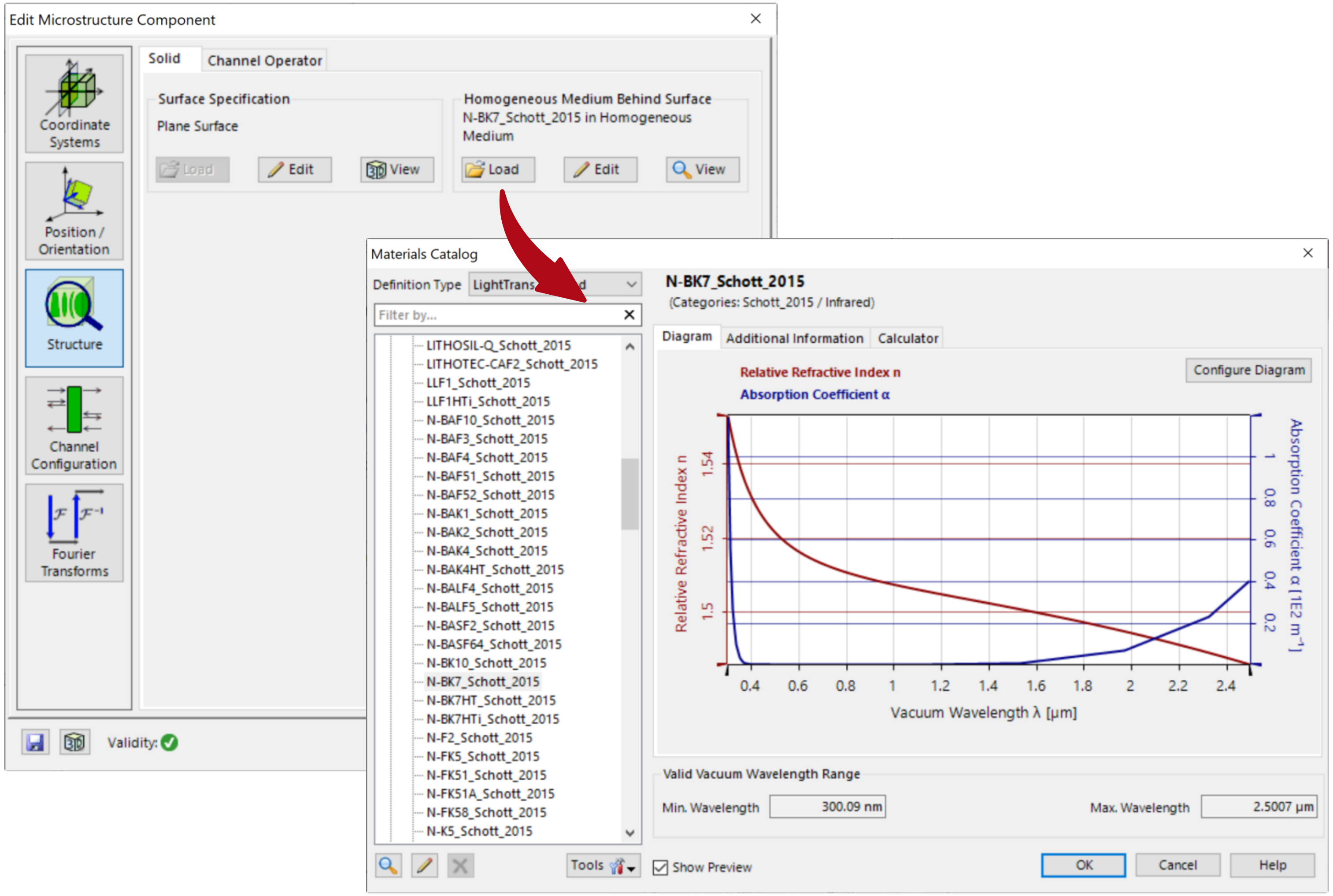
For the propagation of light through a desired microstructure, the *Microstructure Component* applies a *Complex Surface Response* – meaning a response function for amplitude and phase for all field components – to the impinging light. This response function can be either defined directly as a transmission function or can be calculated for a given height profile by applying *Thin Element Approximation* (TEA).





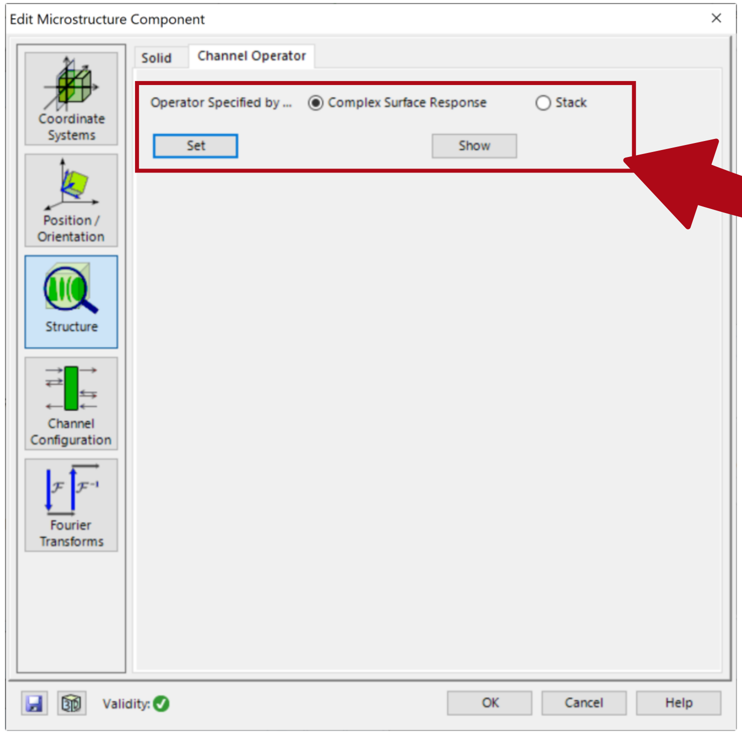
Base Interface

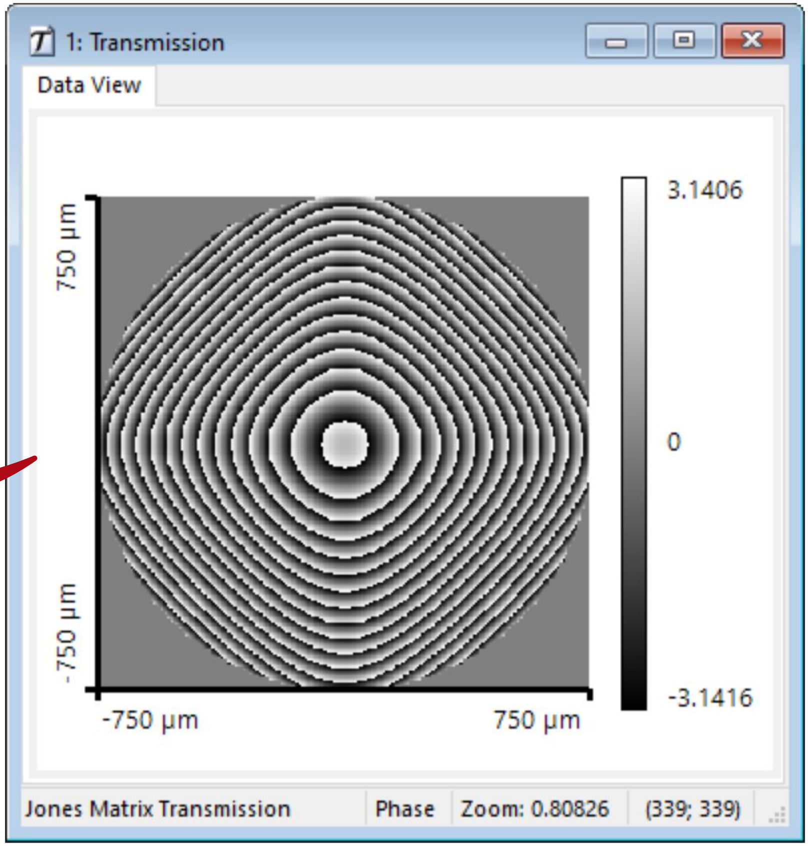
On the *Solid* tab, general parameters are defined, such as the media behind the particular surface, where the intended structure is located. The user can utilize an extended library of different materials to choose from or define own materials using dispersion formulas e.g. Sellmeier-Equation.



Definition as Complex Surface Response

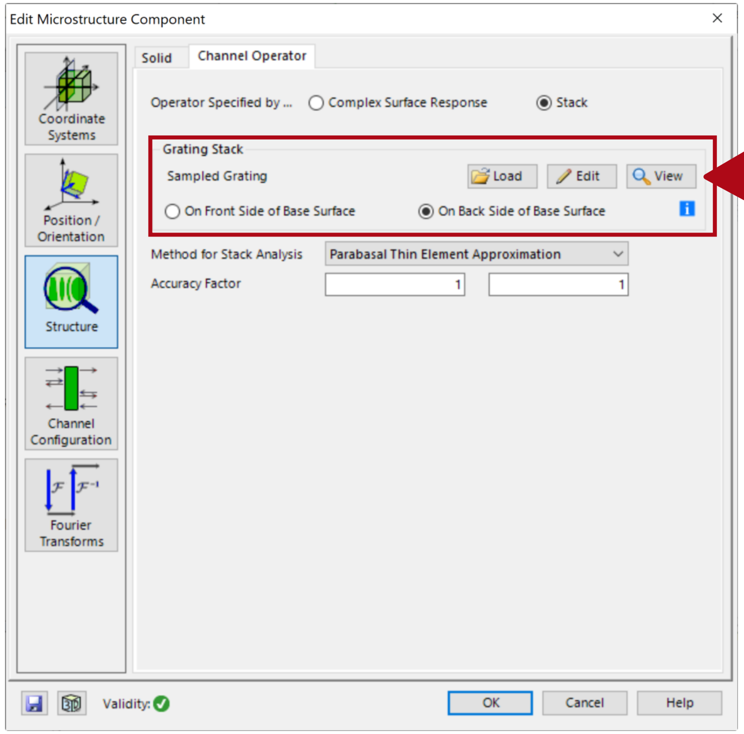
On the *Channel Operator* tab, the Complex Surface Response of the desired DOE can be defined either by setting a complex transmission function…

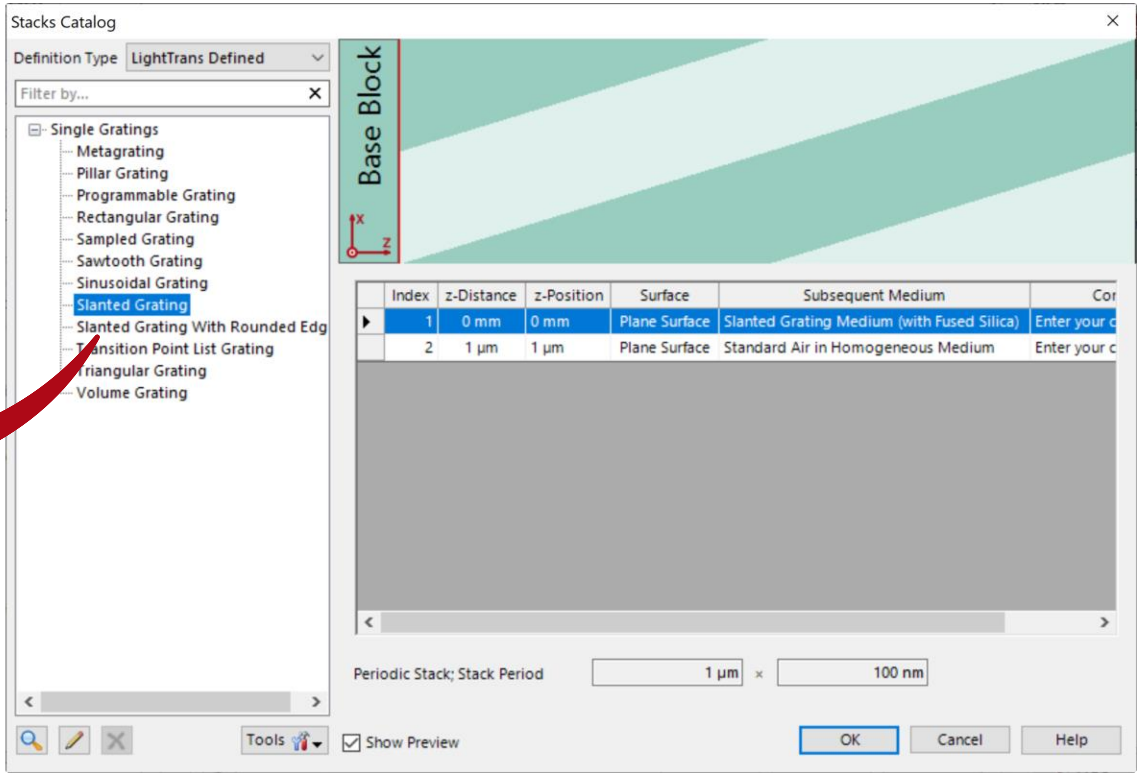




Definition as Stack – Real Height Profile

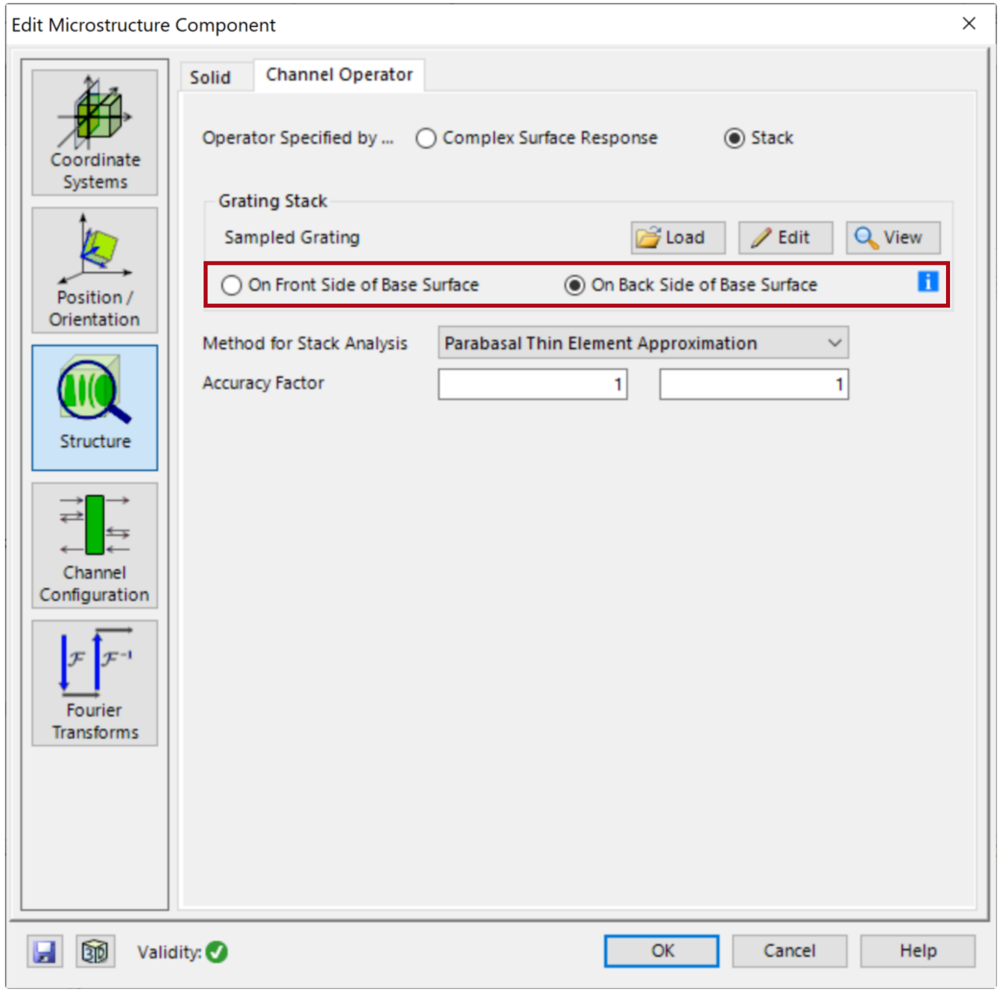
…or by configuring the real height profile in a so-called *Stack.*

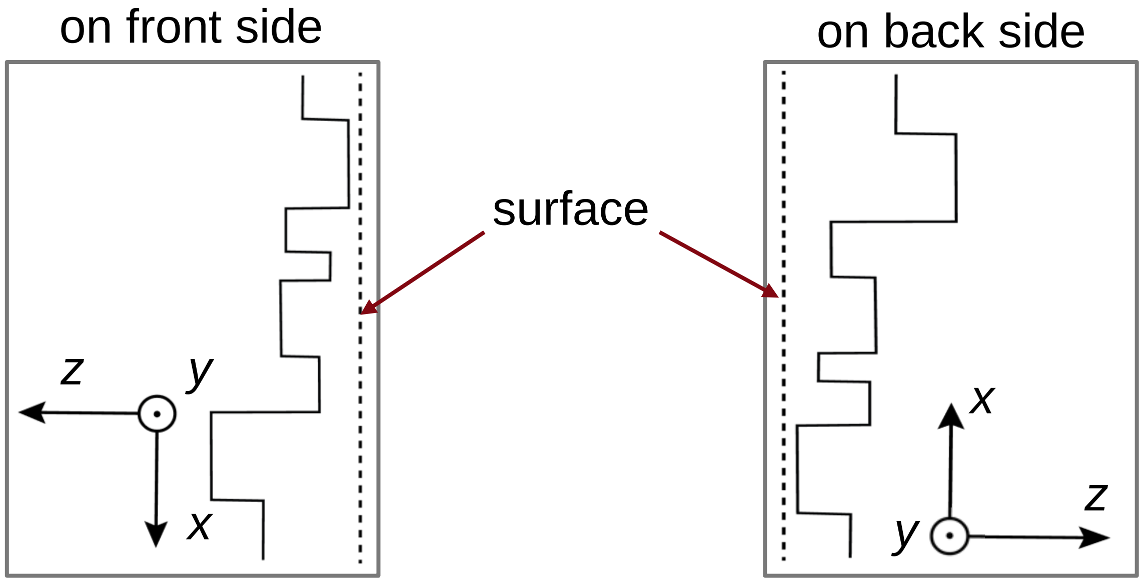




If the microstructure is defined by a *Stack*, the user can use predefined templates from our catalogues, including different grating types as well as sampled or programmable structures to configure the intended height profile.

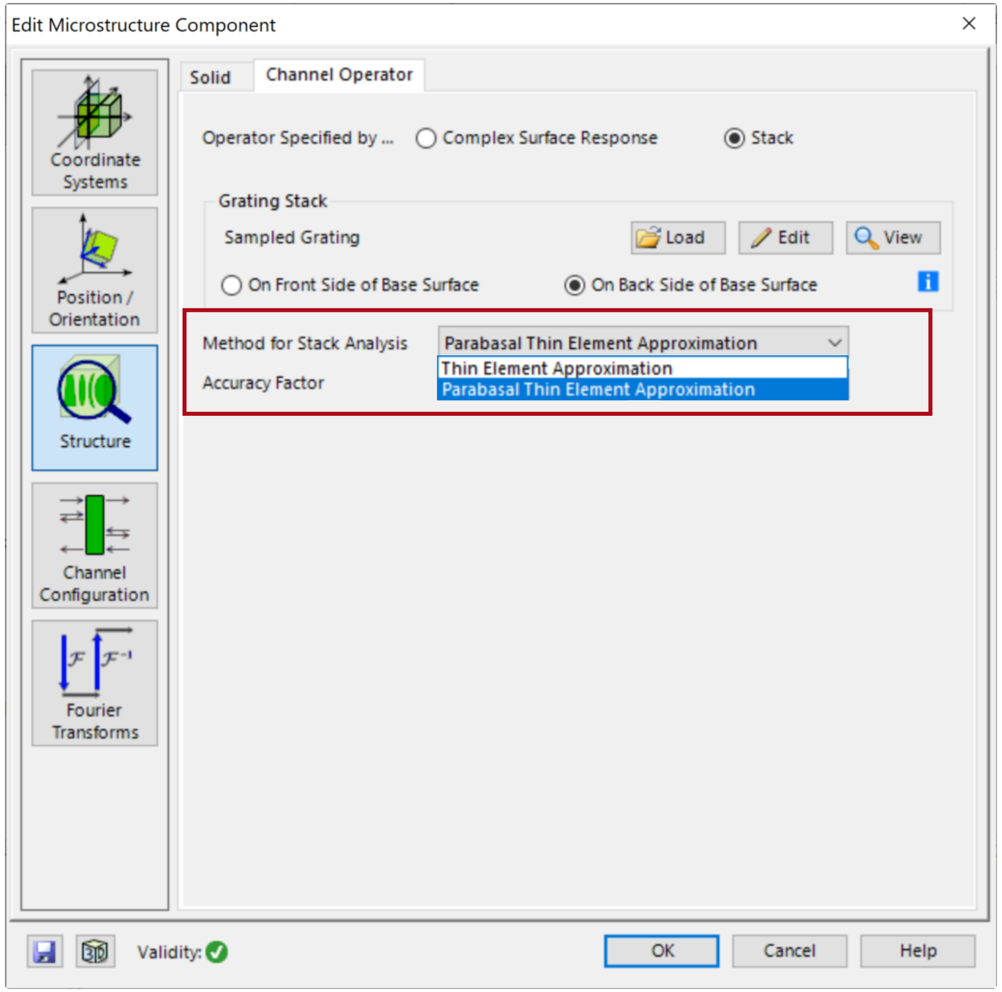
Orientation of the Microstructure





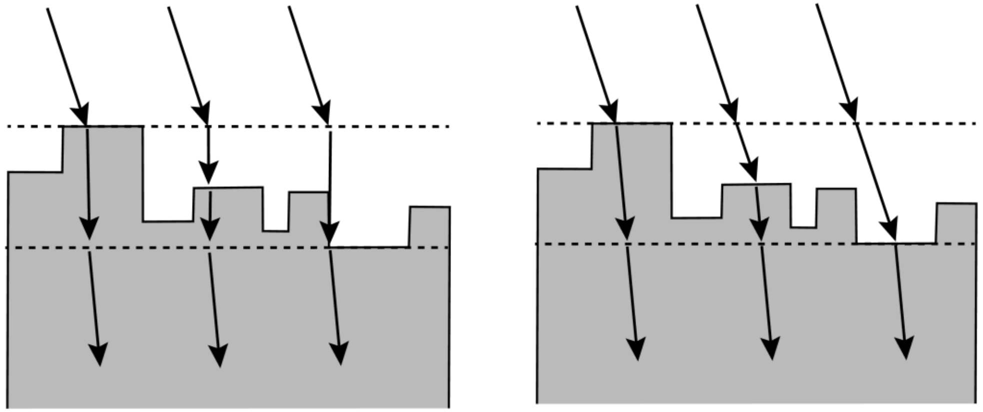
The orientation of the *Stack* can be specified to either be applied on the front side of the surface (defined in the Solid tab) or on its back side. Please note that the stack will be rotated by 180 degrees if positioned on front side, what influences the internal coordinate system of the used *Stack* and needs to be considered during the definition of the height profile, eventually.

Applied Solver



The component offers two solvering algorithms, namely (paraxial) *Thin Element Approximation* and *Parabasal Thin Element Approximation*.

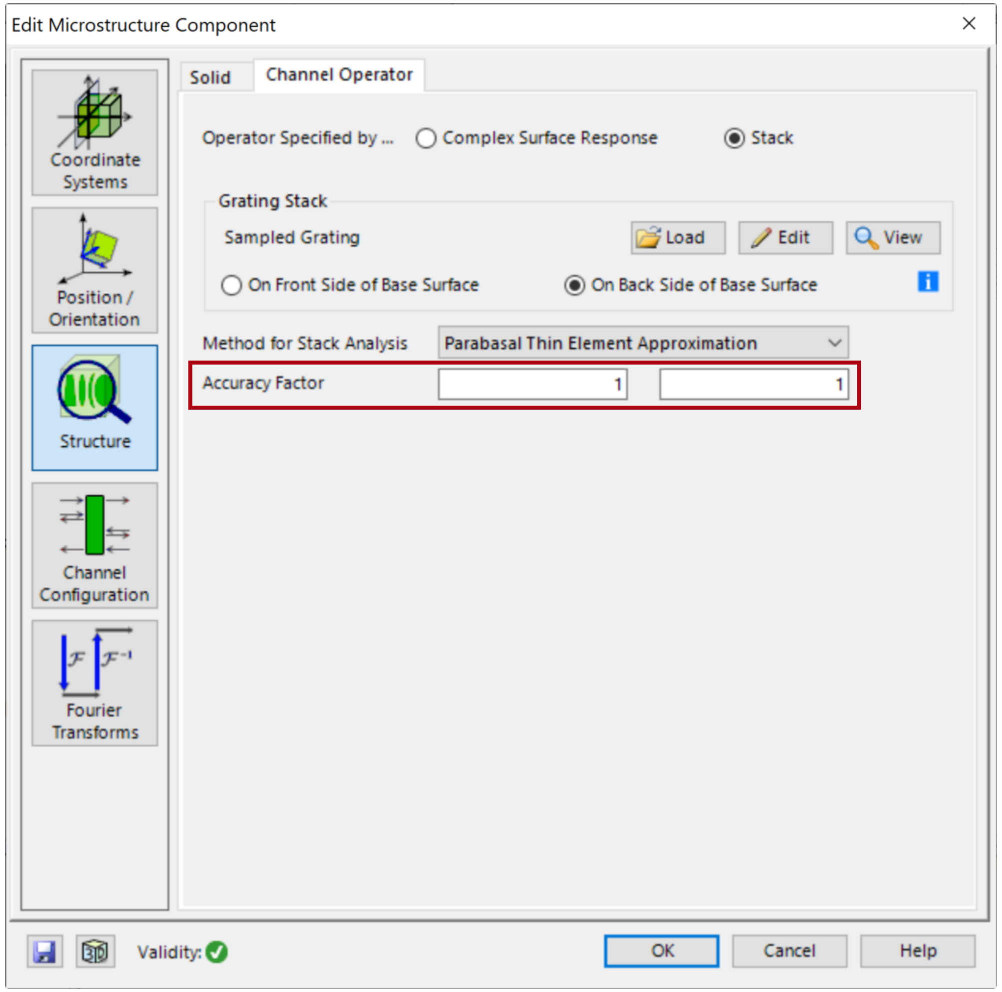
The first solver assumes the incident light is perpendicular to the underlying *Plane Surface* (defined in the Solid tab). For the parabasal solver, the local direction of the incident light is considered in addition by using linear phase fitting algorithms.

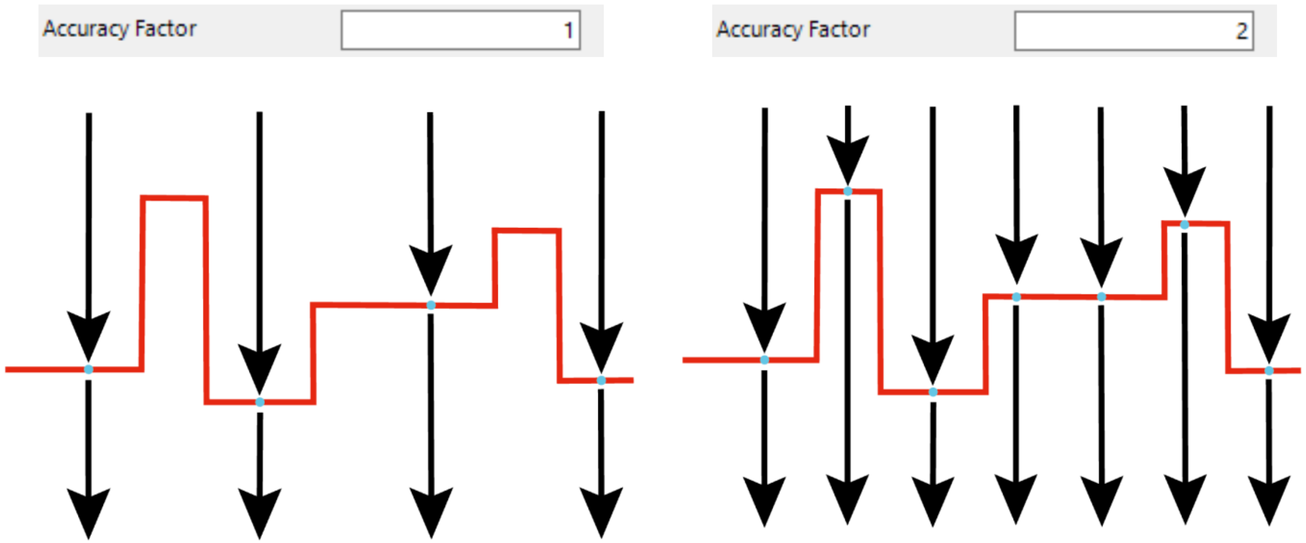


(Paraxial) TEA

Parabasal TEA

Accuracy Factor

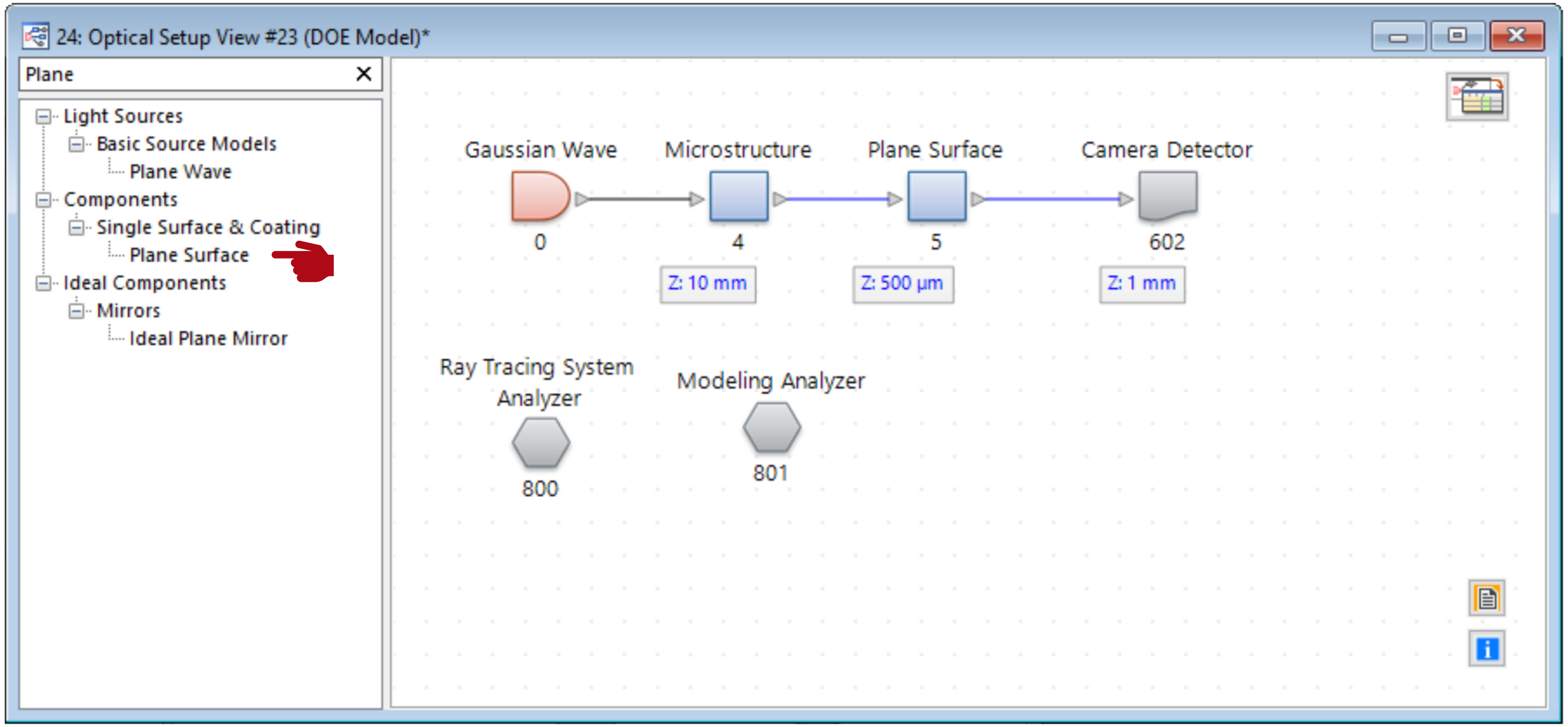




The *Accuracy Factor* enables the control of the number of sampling points, which will be used to resolve the shape of the defined height profile during the analysis by *TEA*. Especially in case of complex height profiles it may be necessary to increase this value in order to consider the microstructure accurately.

Adding a Back Surface

As the *Microstructure Component* only defines the surface where the microstructure is located, for configuring an element on a substrate a back surface is necessary.
This can be achieved by adding a *Plane Surface* under *Components > Single Surface & Coating* and configuring the proper distance (thickness of substrate) and material.



Document Information

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