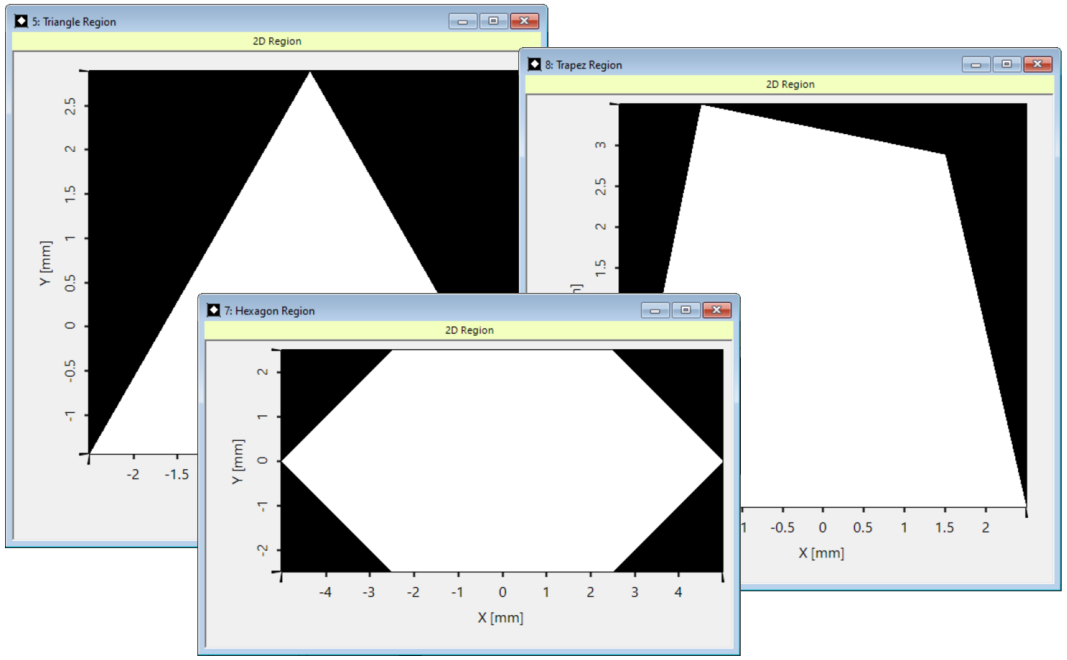
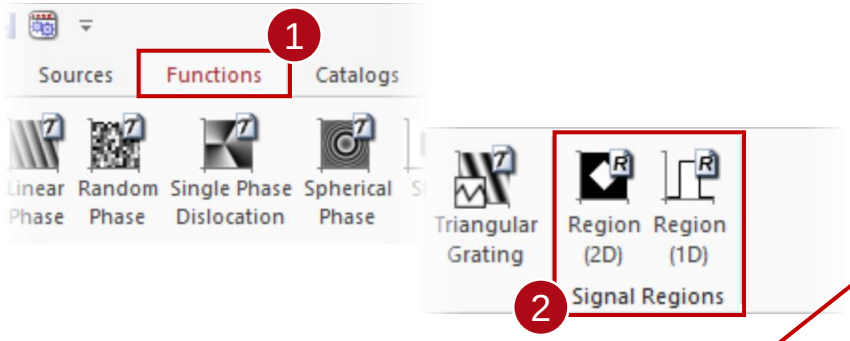
Flexible Region Definition

Abstract

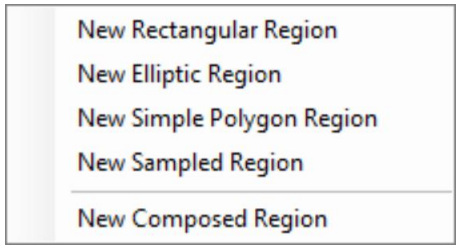


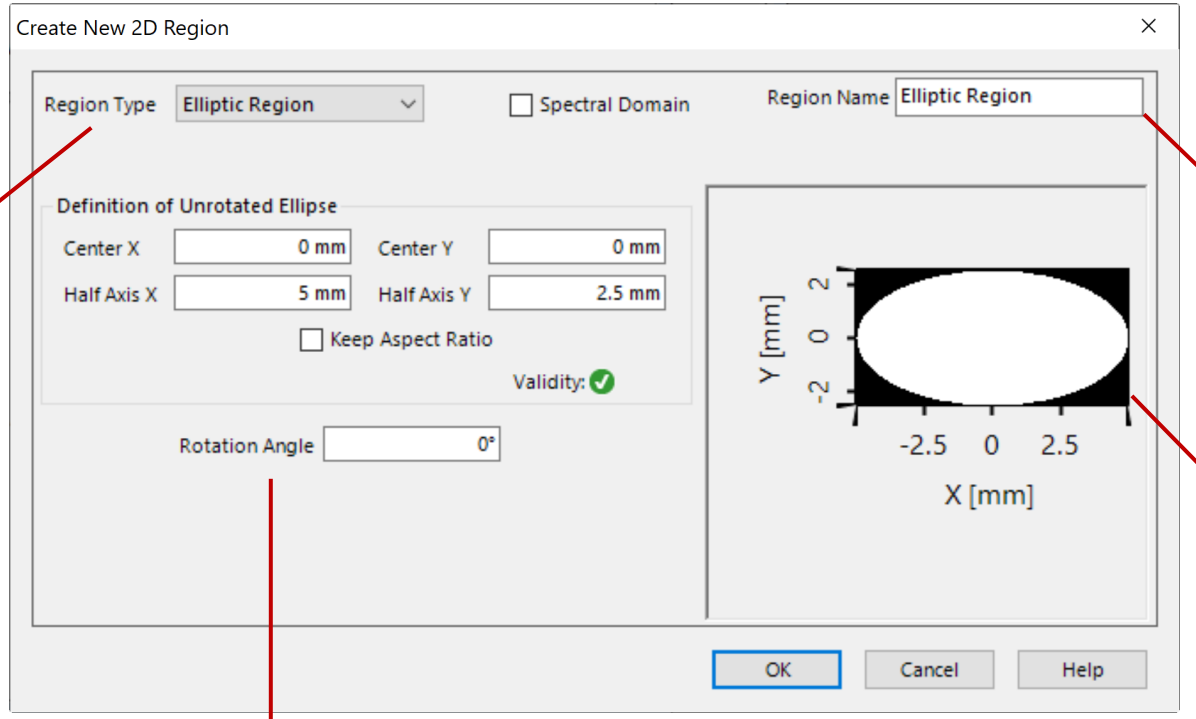
In VirtualLab Fusion, the concept of “region” (understood as a finite area defined on a plane, occasionally also 1D) is used for several purposes across the software: to determine the desired optimization region for the IFTA or the evaluation area for the Diffractive Optics Merit Functions detector, but also to define grating regions on the surfaces of light guides to perform the function, for instance, of couplers. To cover all of the above without restricting our users, the configuration of regions in VirtualLab Fusion is extremely flexible, with several off-the-shelf options as well as importing capabilities. In this use case we go over the process of region configuration in detail.

Region Definition



There are multiple different templates for new regions.





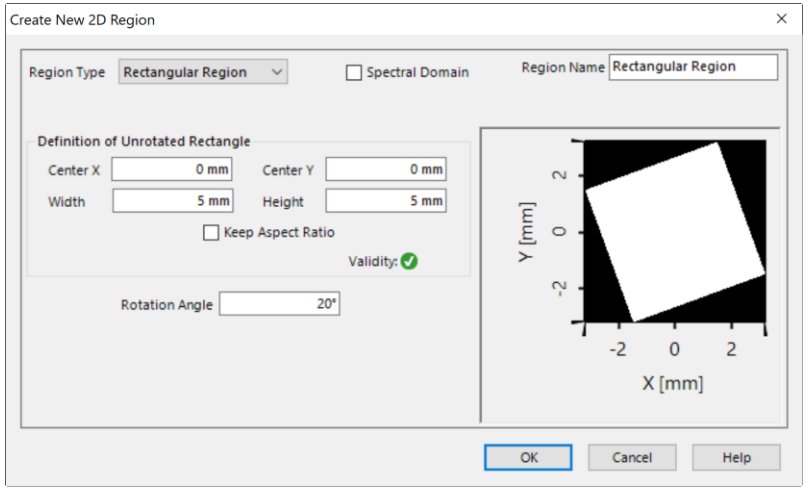
Name of the region (editable)

A preview according to the current settings is displayed here.

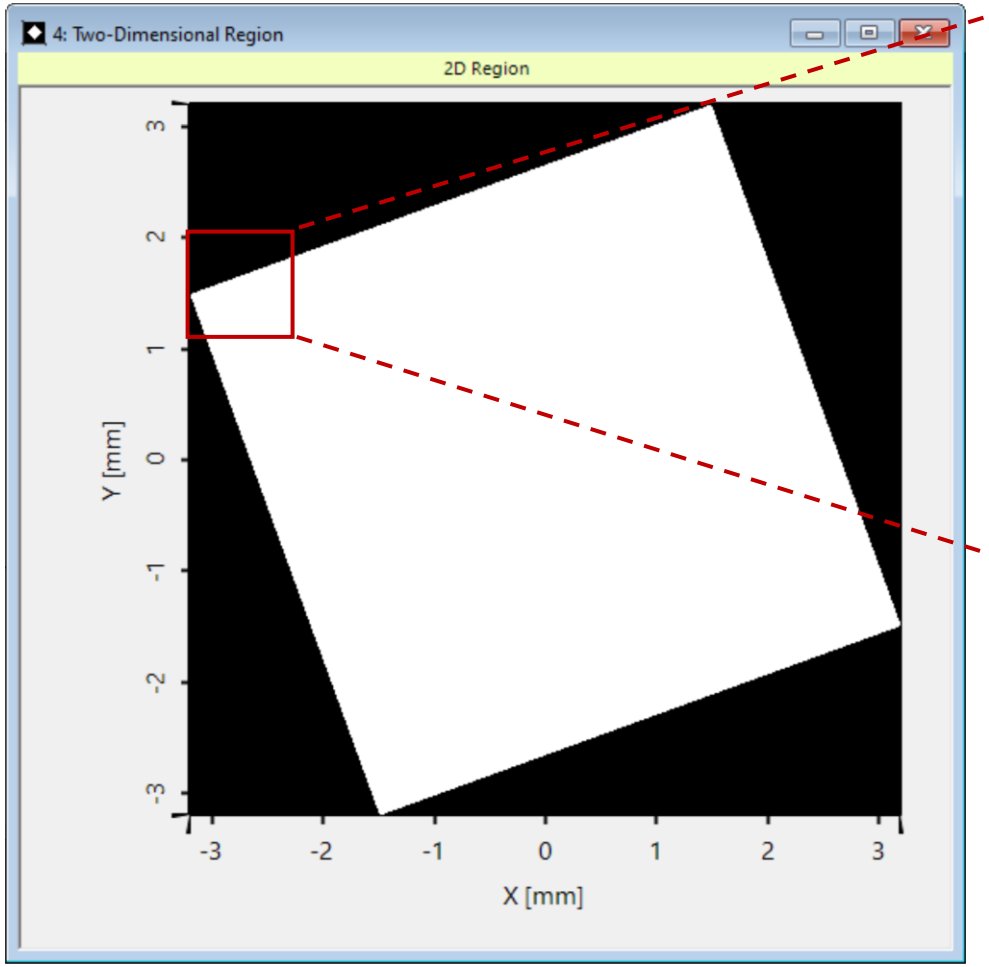
The actual parameters of the region

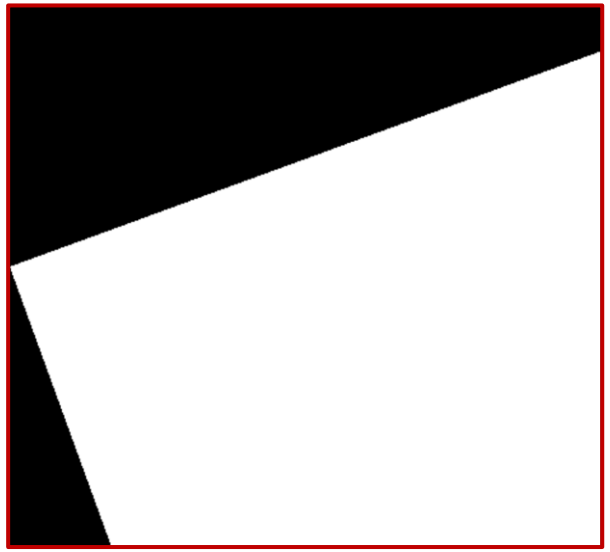
Note: In the Light Guide *component it is possible to generate and configure the regions directly in the component itself.*

Simple Regions



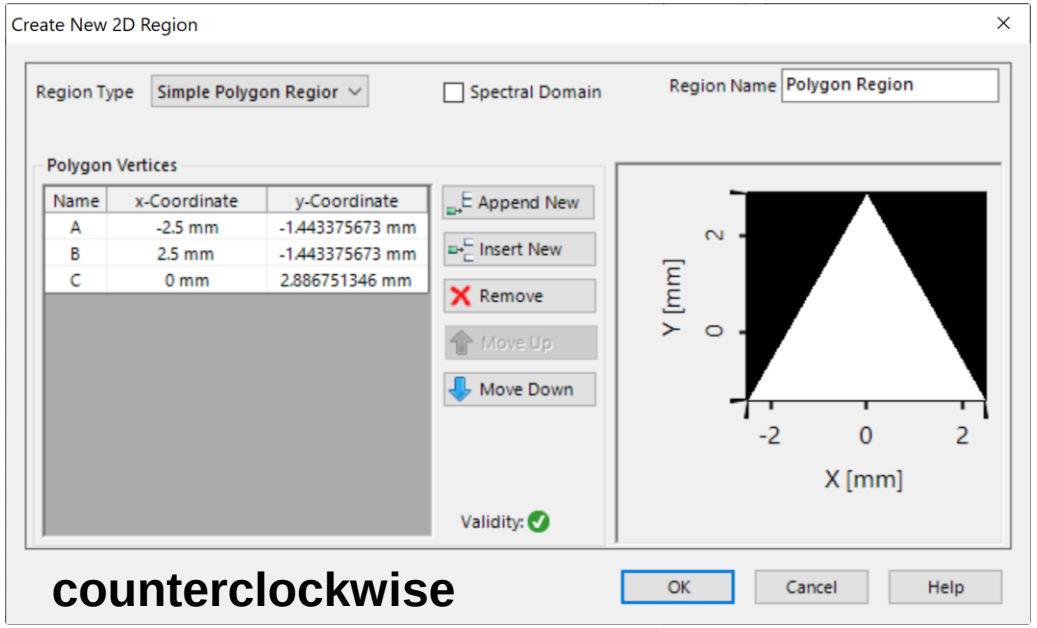
Simple rectangular and elliptical regions can be directly defined from the template.



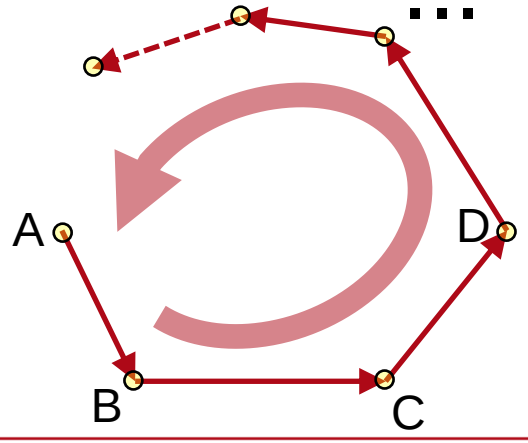


Rectangular, elliptical and polygonal regions are defined analytically through their parameters, and can thus be zoomed arbitrarily without pixelation. But they also can be converted to sampled data instead.

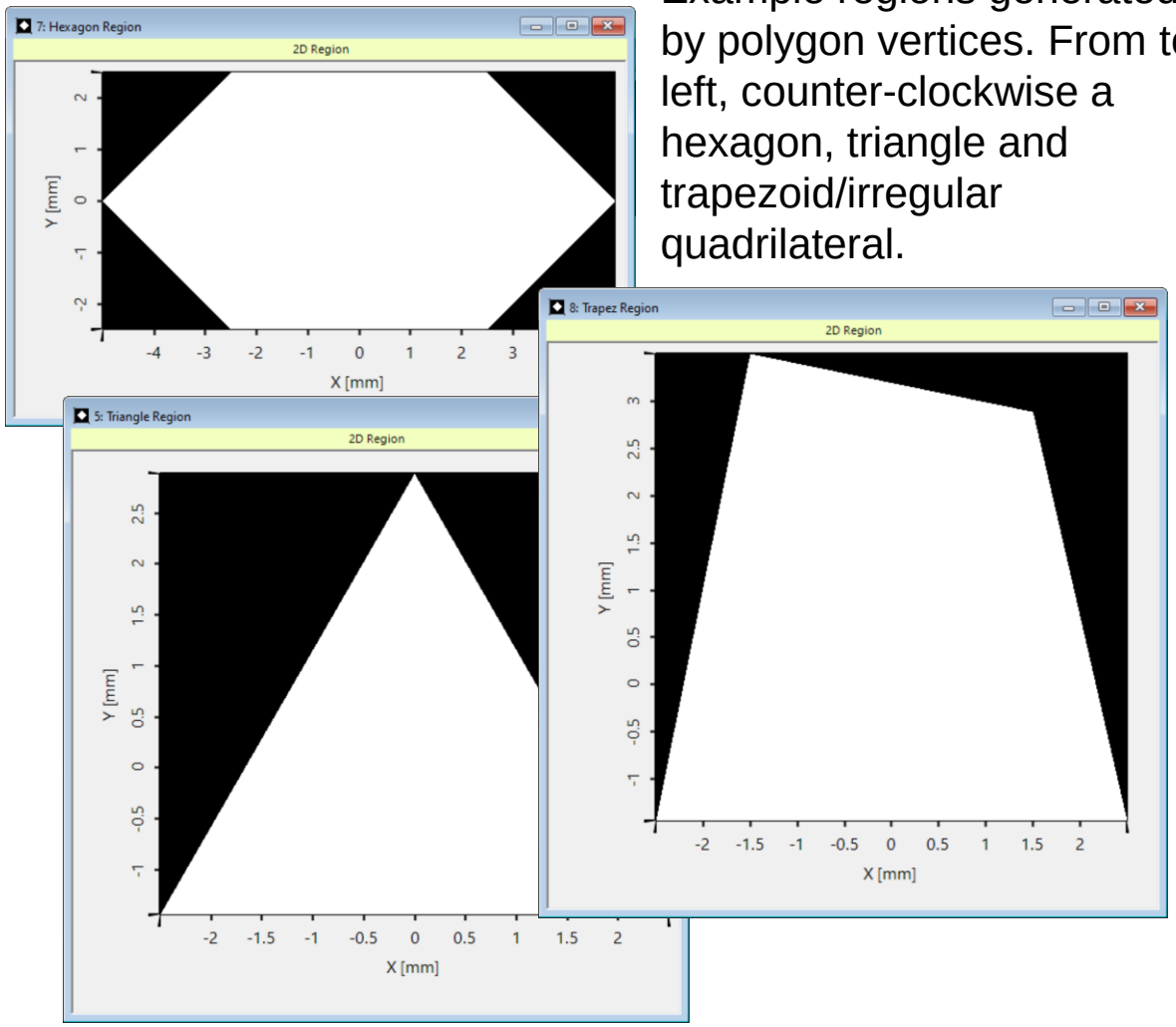
Polygon Regions



counterclockwise definition

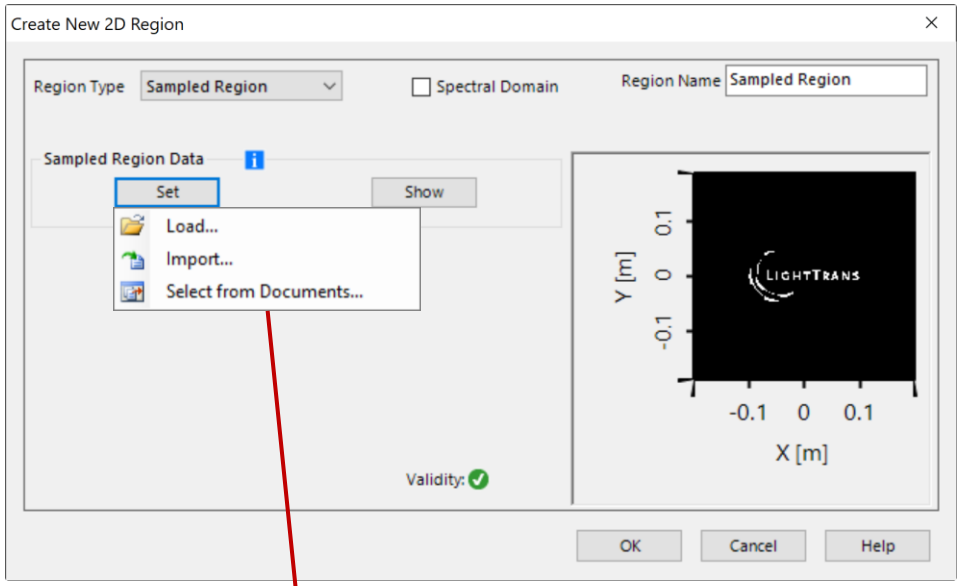


Type in positions of polygon vertices in successive sequence to construct simple polygon regions. Vertices are defined counter-clockwise.

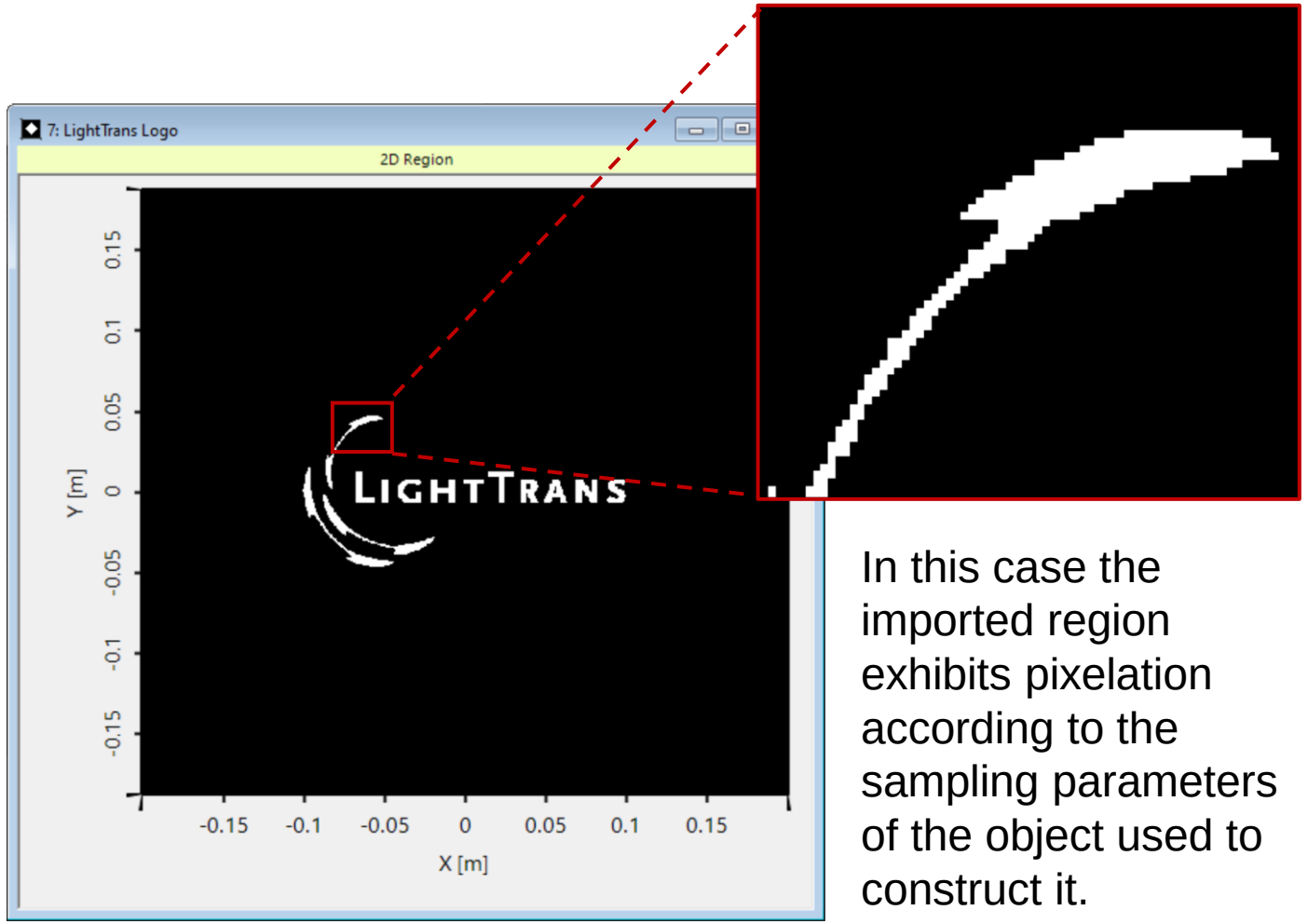


Example regions generated by polygon vertices. From top left, counter-clockwise a hexagon, triangle and trapezoid/irregular quadrilateral.

Sampled Region

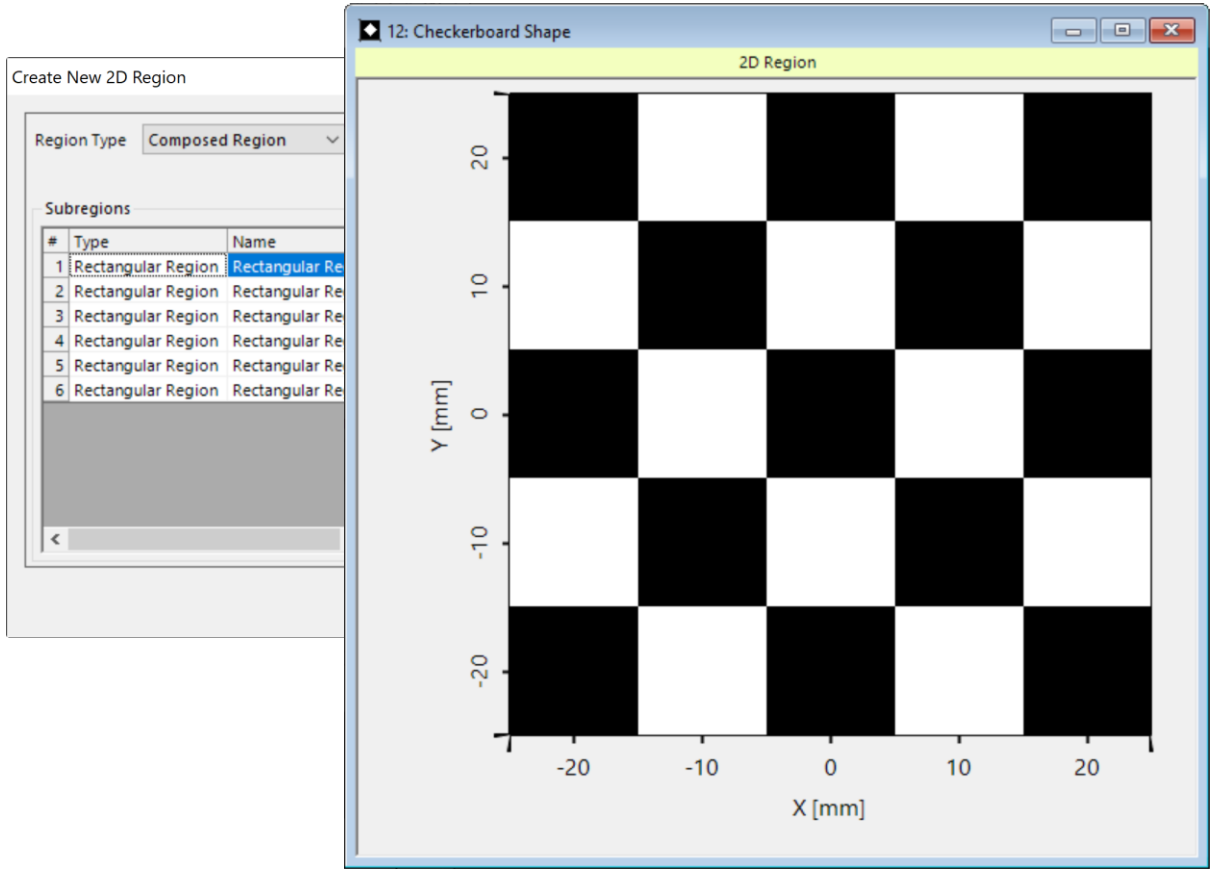


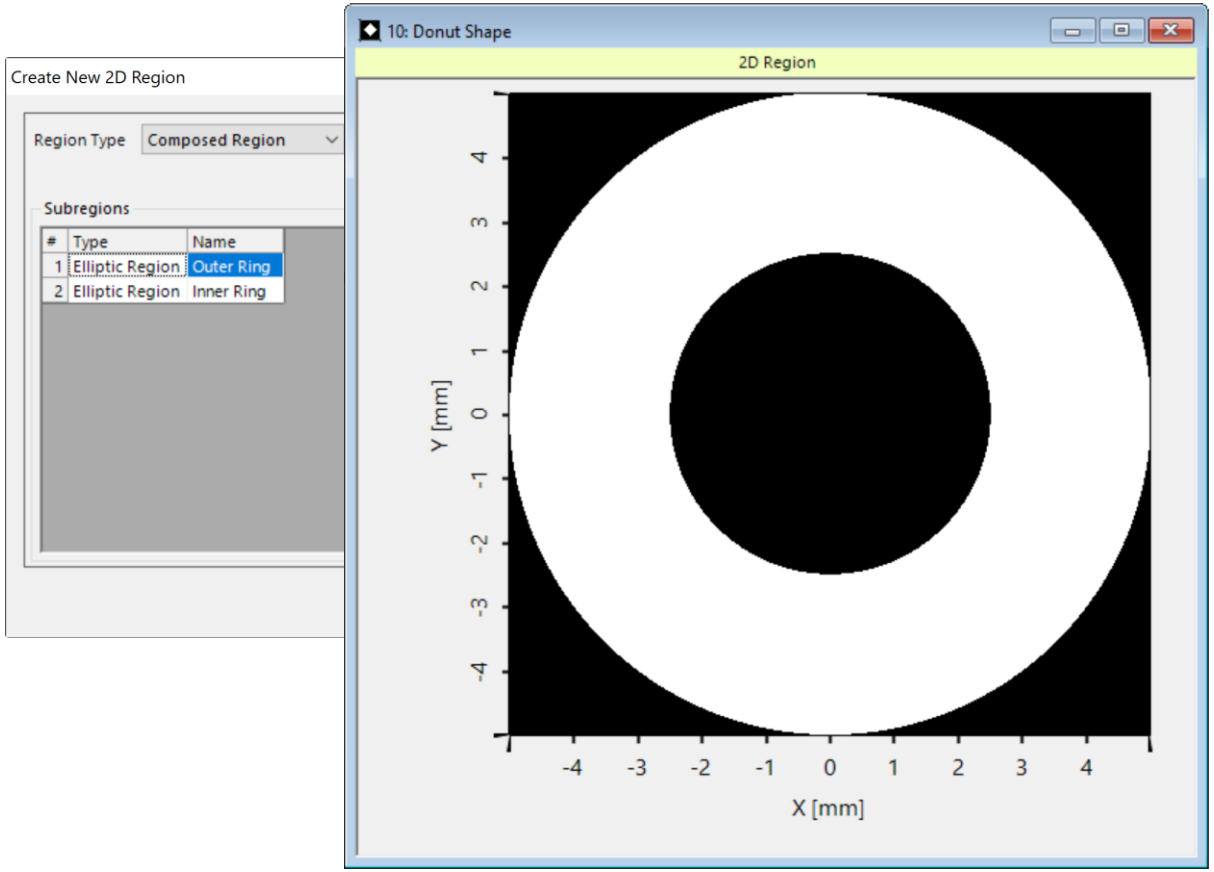
Real-valued data arrays containing a single data set can be selected from among the open documents or otherwise imported to construct specific regions. Bitmaps can also be used after conversion into data arrays. Please note that region definition uses a binary criterion (a given point is either inside or outside the region) so, for non-binary data, values equal to zero are assumed to be outside the region, all others, inside.



In this case the imported region exhibits pixelation according to the sampling parameters of the object used to construct it.

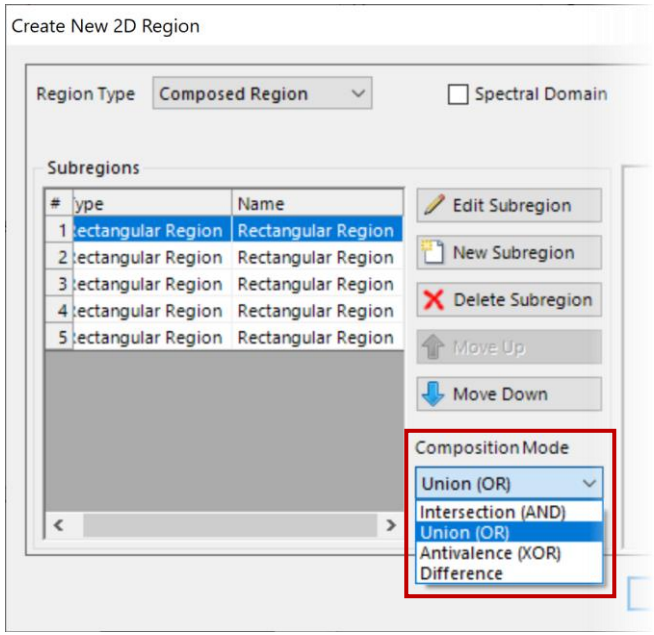
Composed Regions





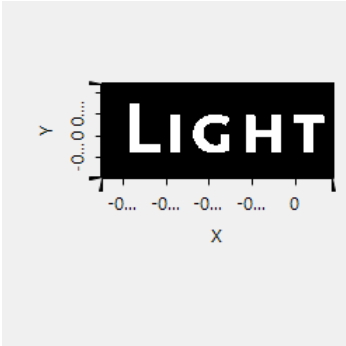
More complex shapes like a donut-like or checkerboard region can be generated using the *Compound Region* type, which combines multiple individual regions according using logical operators.

Regions Composed Using Different Logical Operators

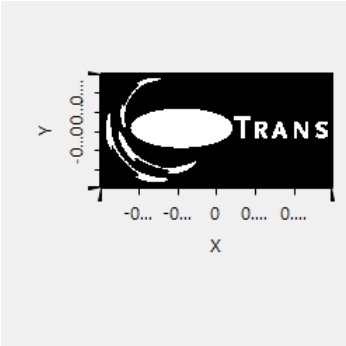


We demonstrate the effect of different operators on the combination of an (analytically defined) ellipse and a sampled region representing the LightTrans logo:

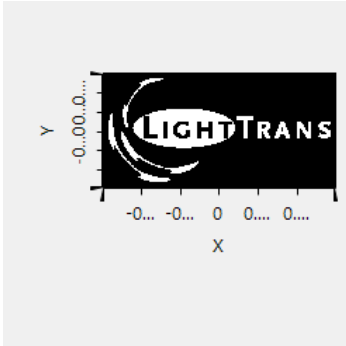
Intersection (AND)



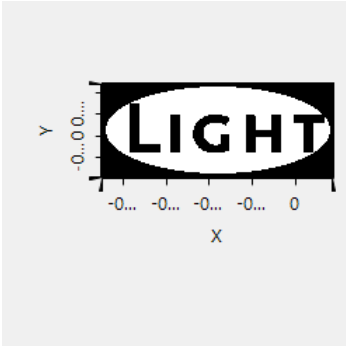
Union (OR)



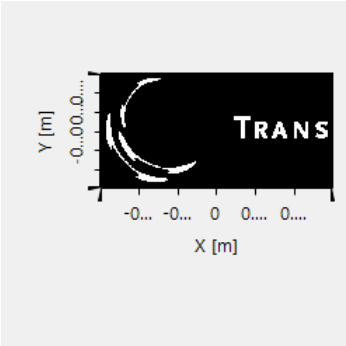
Antivalence (XOR)



Difference A-B



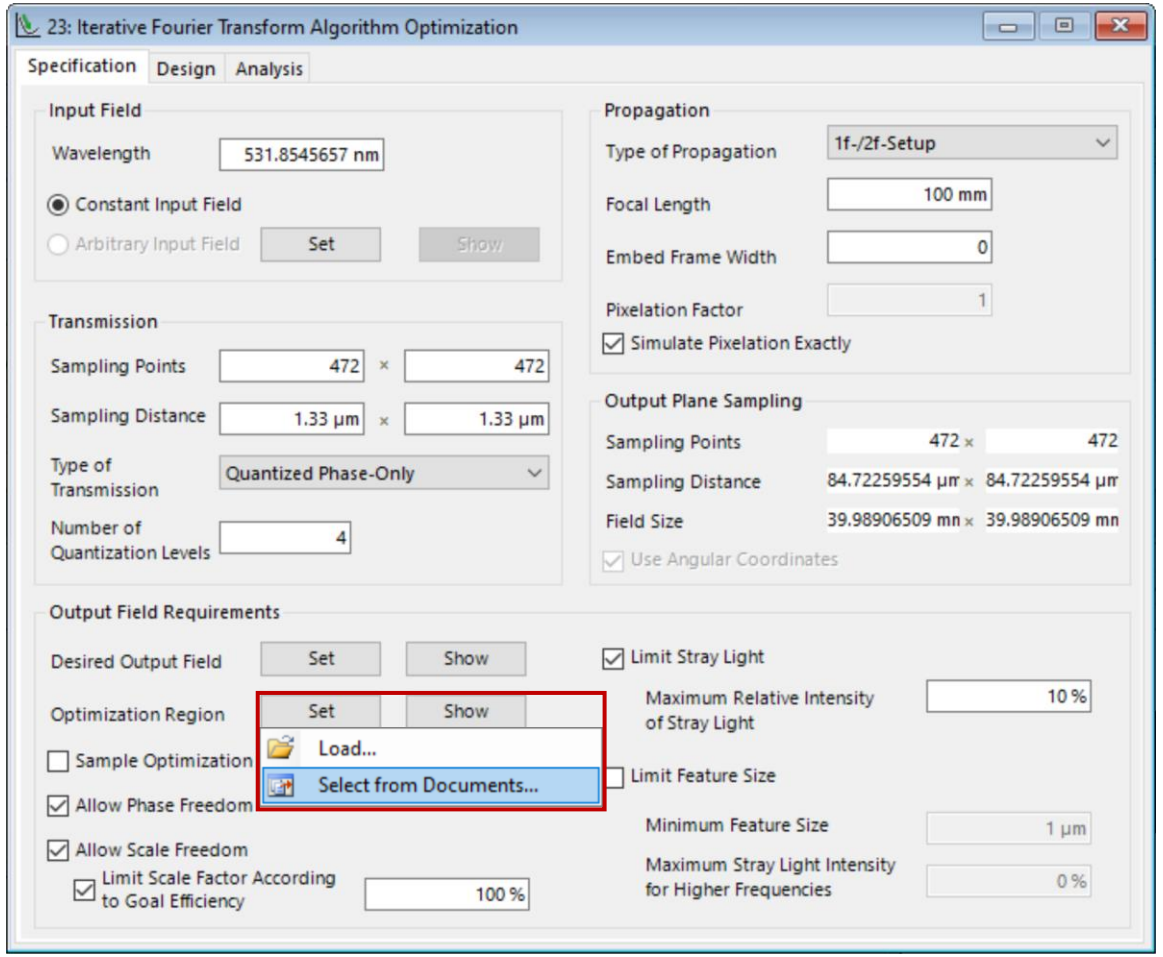
Difference B-A



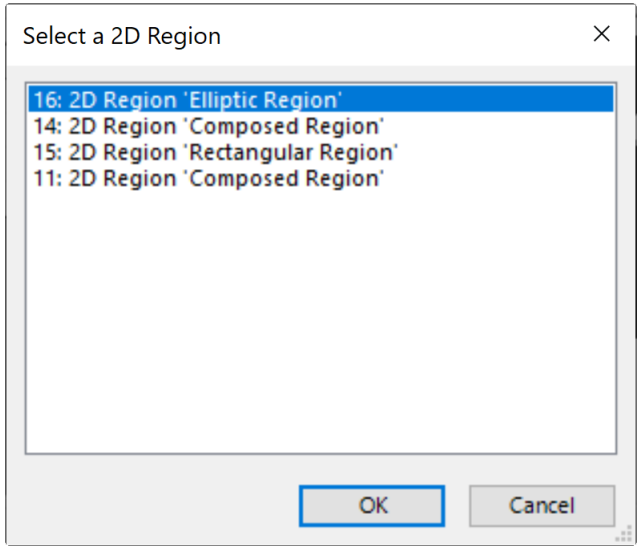
The result of the *Difference* mode depends on the order of the subregions, which can be adjusted using *Move Up* and *Move Down*

Used as Optimization Region

Regions can be used in any *Iterative Fourier Transform Algorithm* (IFTA) *Optimization* to define the *Optimization Region.*

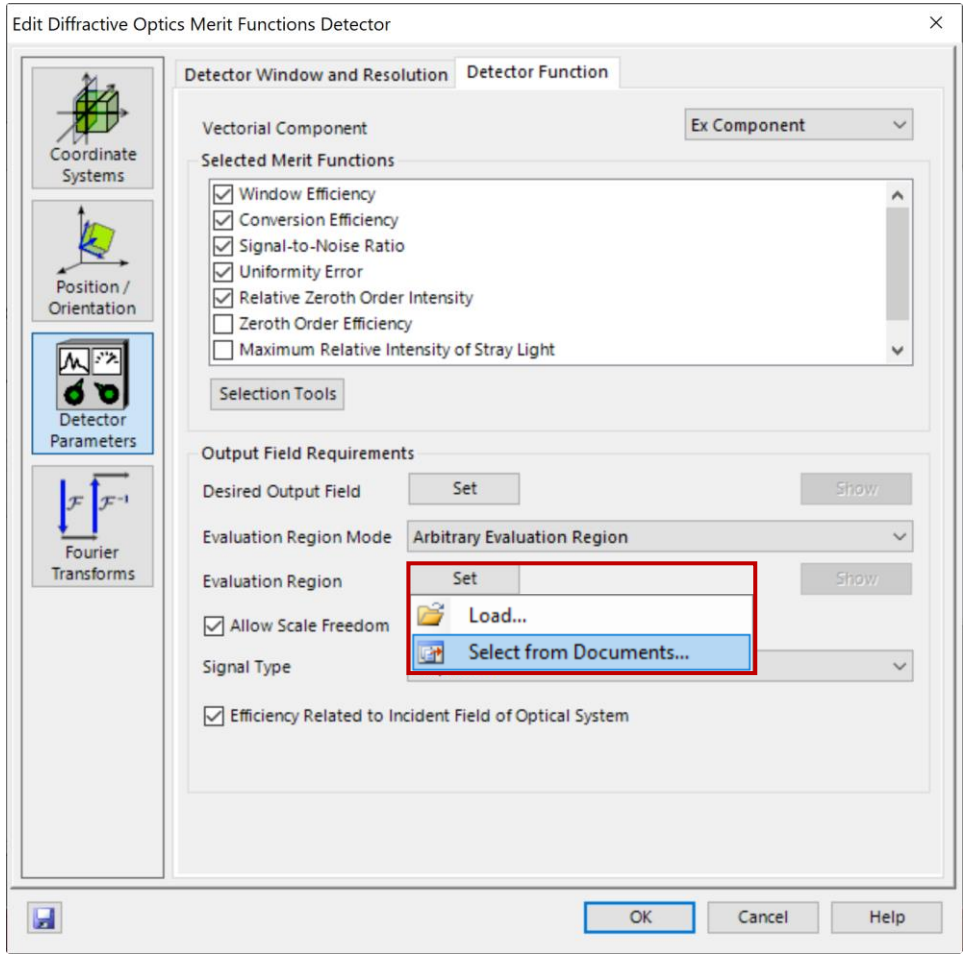


Open region documents can be selected as the *Optimization Region* for the design.

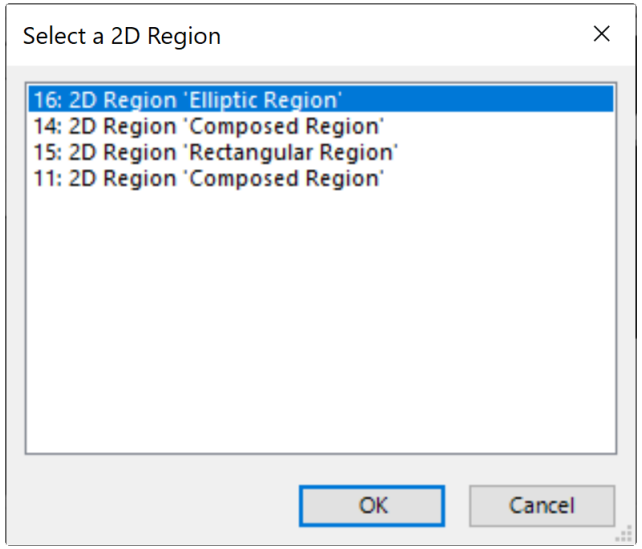


Used as Evaluation Region

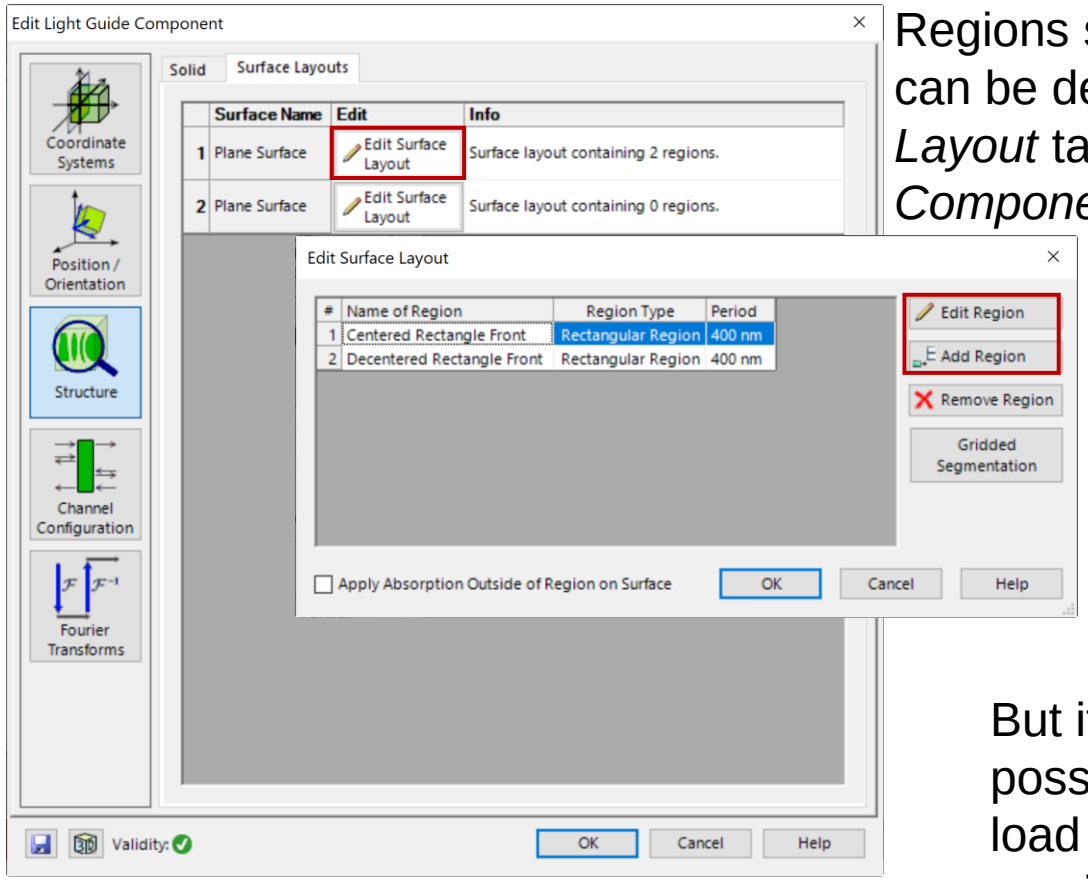
The *Diffractive Optics Merit Functions Detector* can also use a custom region as its *Evaluation Region* used for the calculation of the merit functions.



Open region documents can be selected as the *Evaluation Region* for the design.

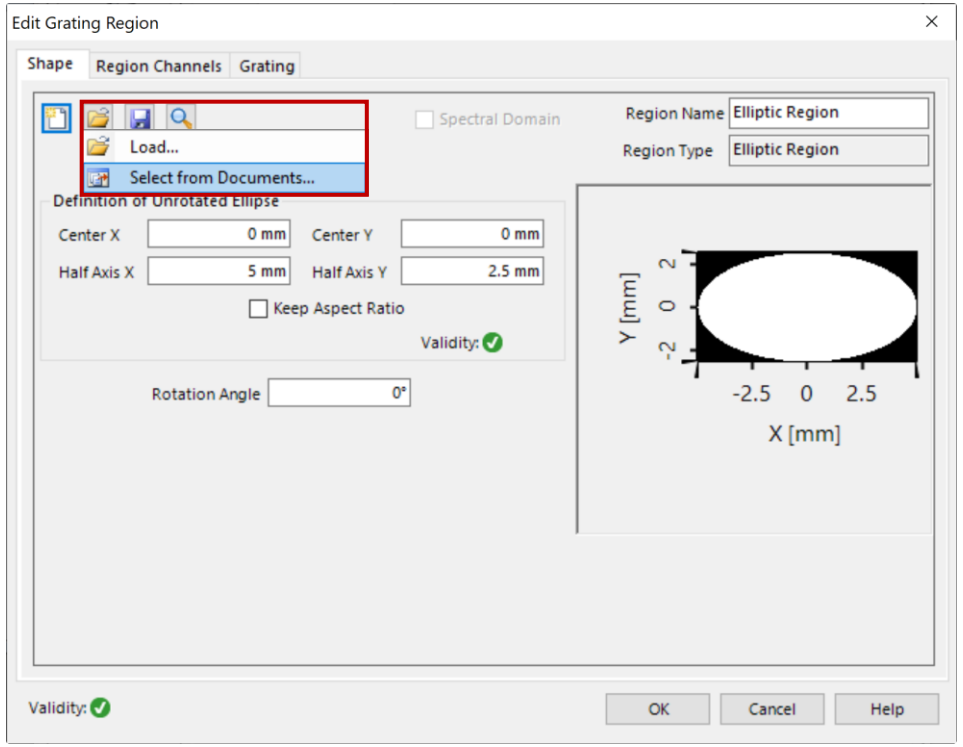


Used in Light Guide Component

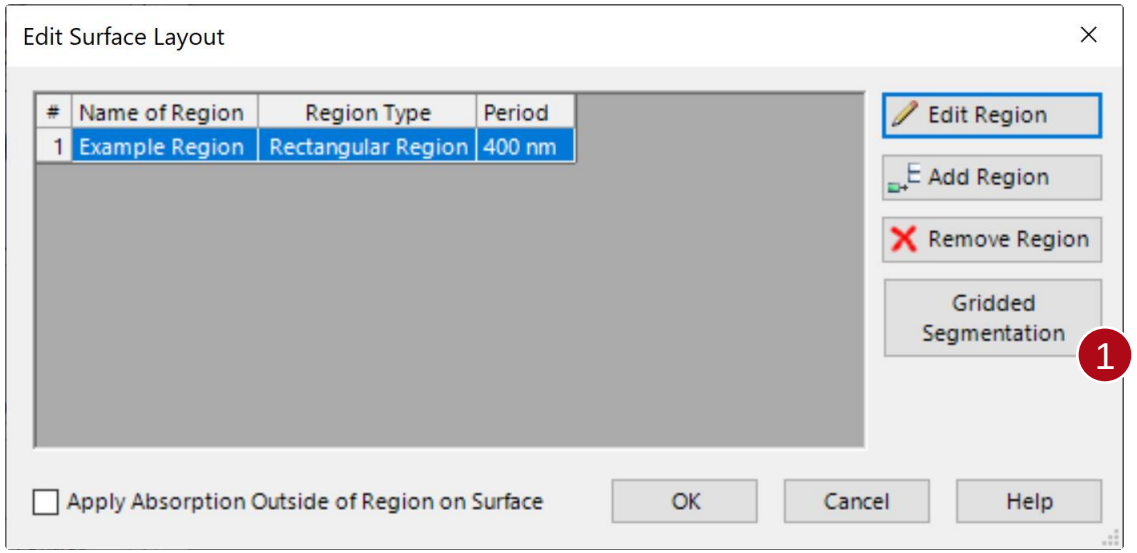


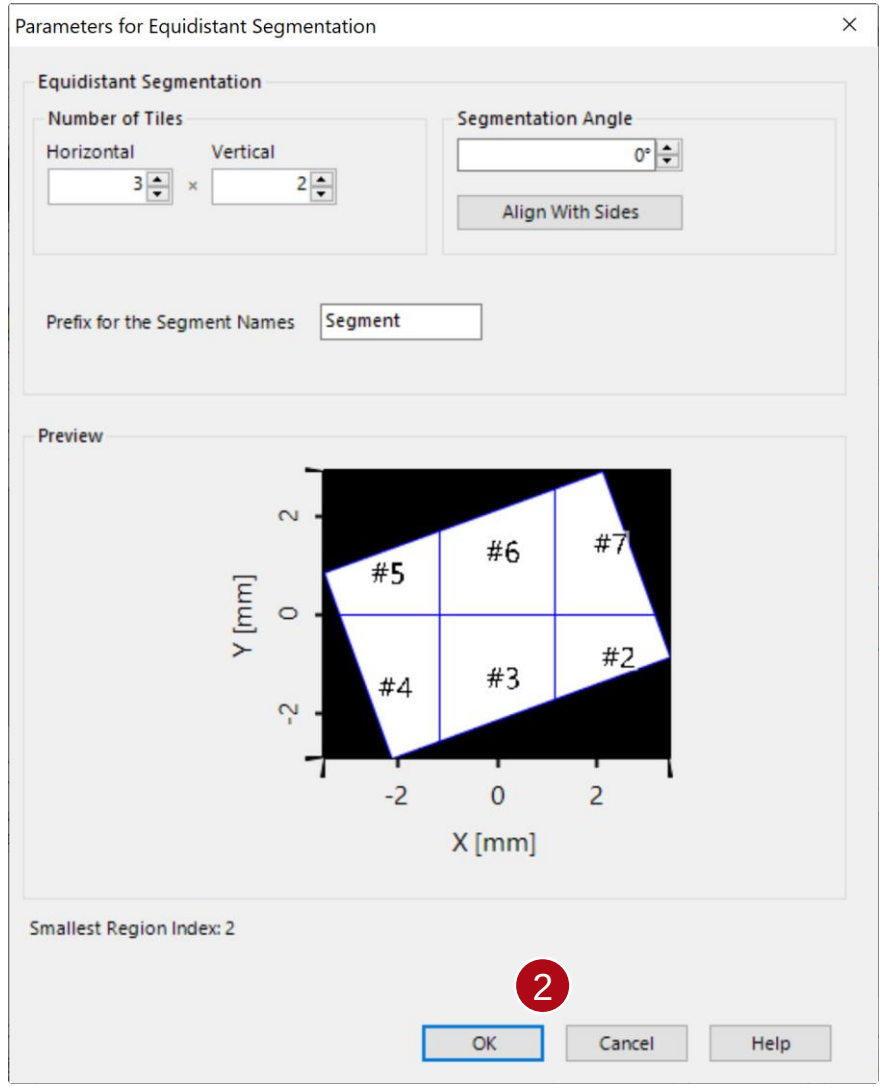
Regions specifically for light guides can be defined inside the *Surface Layout* tab of the *Light Guide Component*.

But it is also possible to load regions previously defined in the main menu.



Segmented Gridding



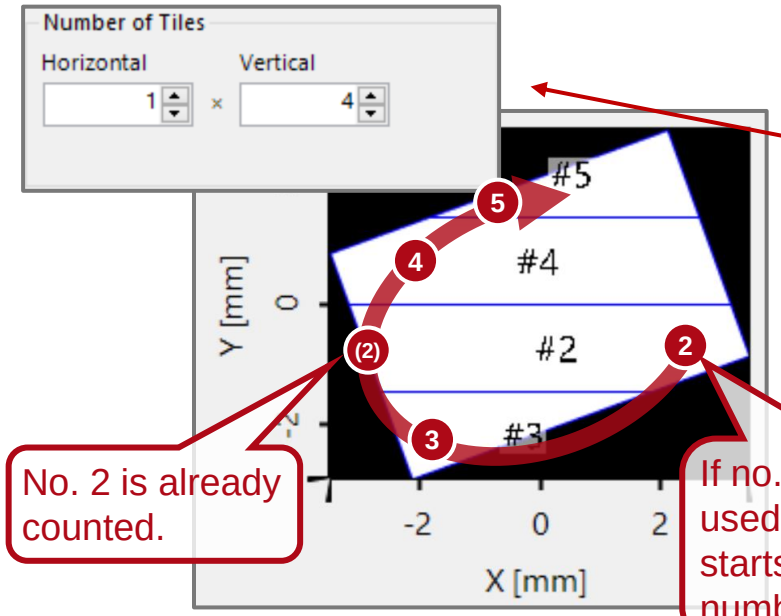


It is possible to break up a rectangular or polygonal grating region using an equidistant grid so that the grating parameters of each individual region can be modified independently from the others. **This can only be done for regions in the *Light Guide Component.***

#	Name of Region	Region Type	Period
3	Segment #3	Simple Polygon Region	400 nm
4	Segment #4	Simple Polygon Region	400 nm
5	Segment #5	Simple Polygon Region	400 nm
6	Segment #6	Simple Polygon Region	400 nm
7	Segment #7	Simple Polygon Region	400 nm
8	Segment #8	Simple Polygon Region	400 nm

3

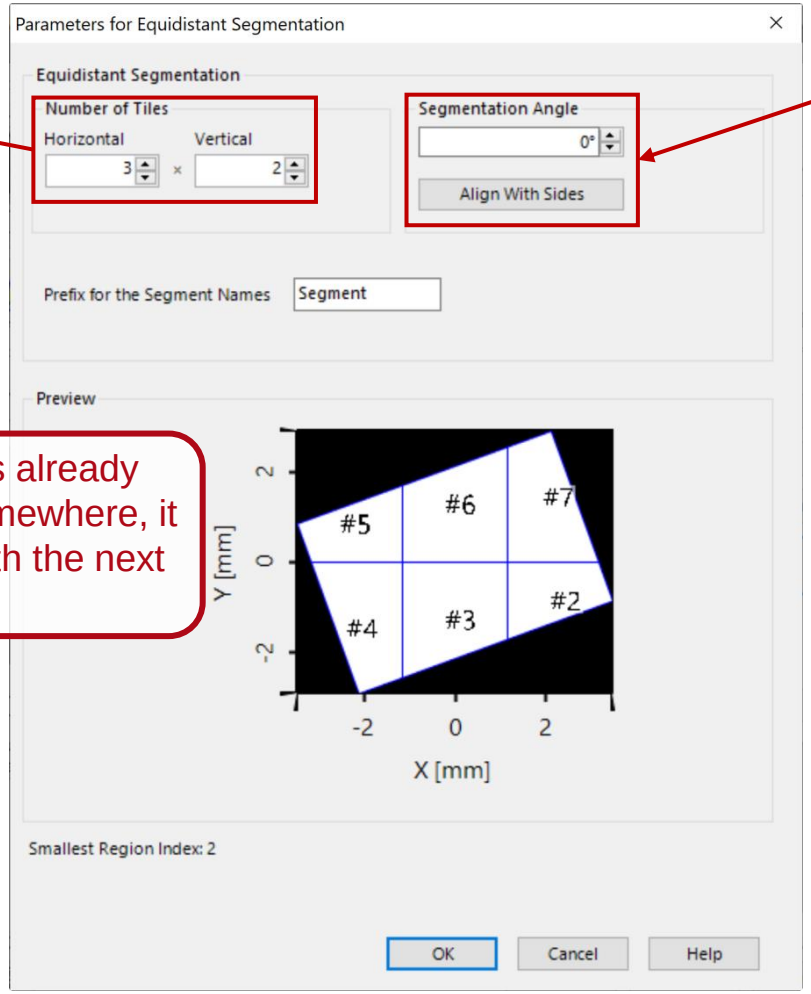
Gridded Segmentation – Options



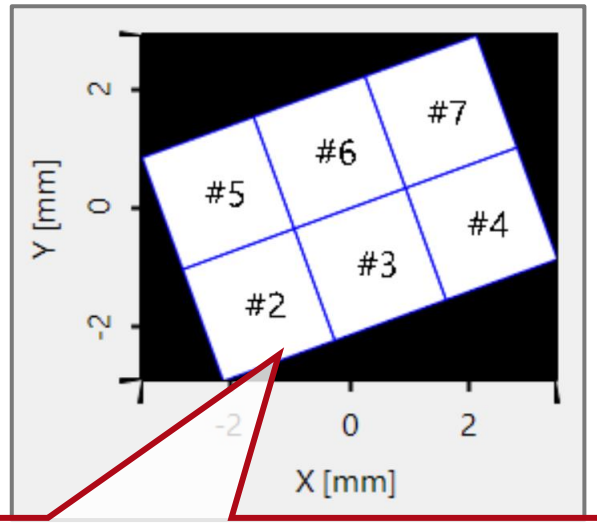
No. 2 is already counted.

If no. 1 is already used somewhere, it starts with the next number.

Number of Tiles controls the number of subdivisions in the grid. The indexes will consider previously existing regions (if 1 region is present, it starts with #2, and so on)



The angle for the segmentation is also customizable. For rectangular gratings it is possible to automatically detect and align with the rotation of the rectangle.



In case of an axially parallel segmentation of rectangles the counting order goes differently (along x- then y-coordinates).

Document Information

title	Flexible Region Definition
document code	Misc.0091
document version	1.1
software edition	• VirtualLab Fusion Basic • VirtualLab Fusion Basic with Diffractive Toolbox Silver (for IFTA) • VirtualLab Fusion Advanced (for Light Guide component)
software version	2021.1 (Build 1.180)
category	Feature Use Case
further reading	- Specification of Diffraction Orders and Efficiencies for Grating Regions