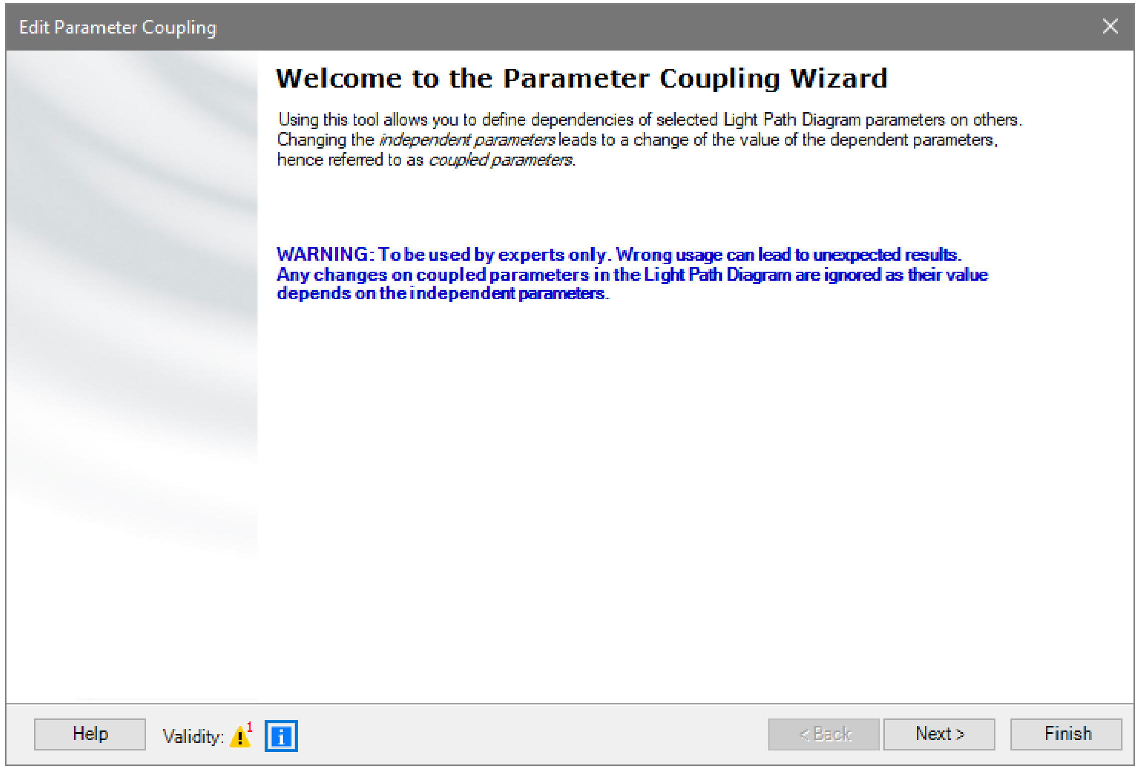
Coupling of Parameters in VirtualLab Fusion

Abstract



Welcome to the Parameter Coupling Wizard

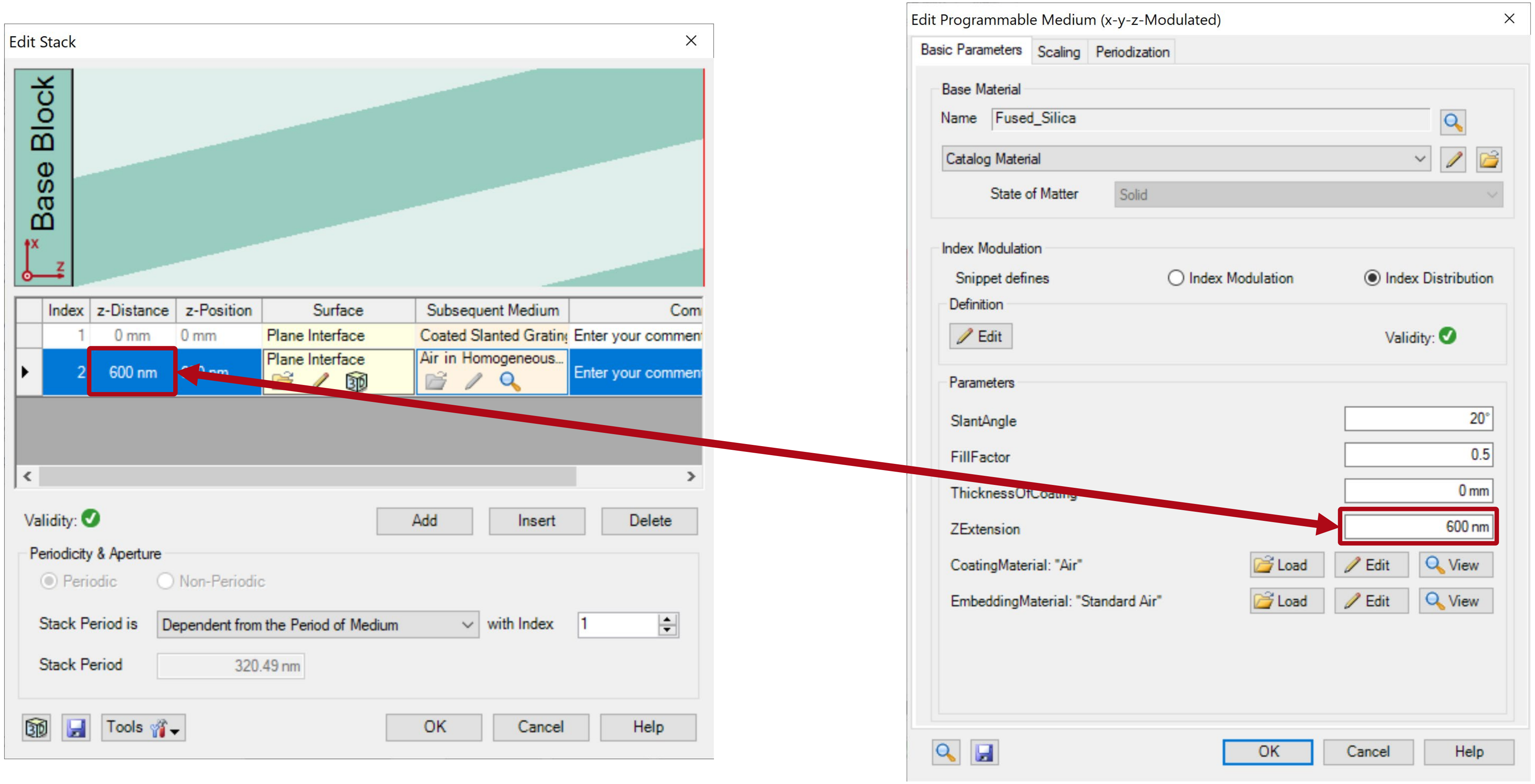
Using this tool allows you to define dependencies of selected Light Path Diagram parameters on others. Changing the *independent parameters* leads to a change of the value of the dependent parameters, hence referred to as *coupled parameters*.

WARNING: To be used by experts only. Wrong usage can lead to unexpected results. Any changes on coupled parameters in the Light Path Diagram are ignored as their value depends on the independent parameters.

The parameter coupling feature of VirtualLab Fusion enables the coupling of parameters in an optical setup. The values can also be used to re-calculate other parameters of the system, so that a certain relationship between them is automatically maintained. Hence, this feature allows the user to instate complex dependencies for these parameters. For instance, in this example we use the Parameter Coupling to ensure that the z extension of a user-programmed slanted grating medium coincides with the thickness of the structured layer where it is contained.

Task

We wish to link two parameters of an optical system, so that they automatically take the same value. For this purpose, VirtualLab's Parameter Coupling feature is used.



Edit Stack

	Index	z-Distance	z-Position	Surface	Subsequent Medium	Com
	1	0 mm	0 mm	Plane Interface	Coated Slanted Grating	Enter your comment
▶	2	600 nm	600 nm	Plane Interface	Air in Homogeneous...	Enter your comment

Validity: ✓

Periodicity & Aperture

◉ Periodic ○ Non-Periodic

Stack Period is: Dependent from the Period of Medium with Index 1

Stack Period: 320.49 nm

Edit Programmable Medium (x-y-z-Modulated)

Base Material

Name: Fused_Silica

Catalog Material

State of Matter: Solid

Index Modulation

Snippet defines ○ Index Modulation ● Index Distribution

Definition

Validity: ✓

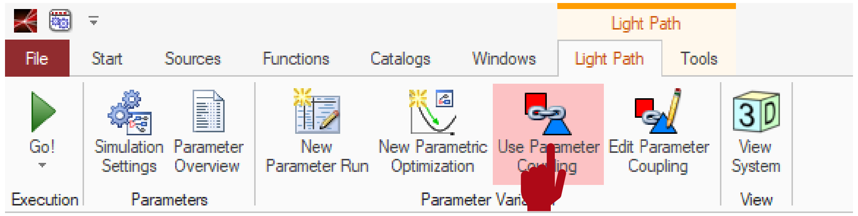
Parameters

SlantAngle	20°
FillFactor	0.5
ThicknessOfCoating	0 mm
ZExtension	600 nm

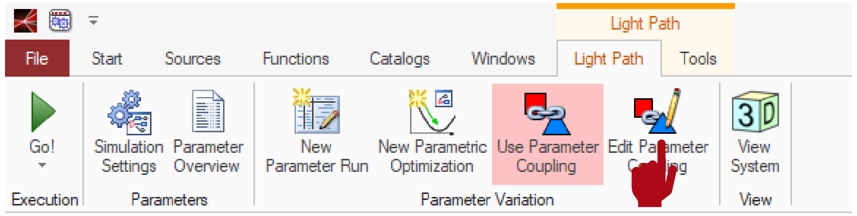
CoatingMaterial: "Air"

EmbeddingMaterial: "Standard Air"

Set Up Parameter Coupling

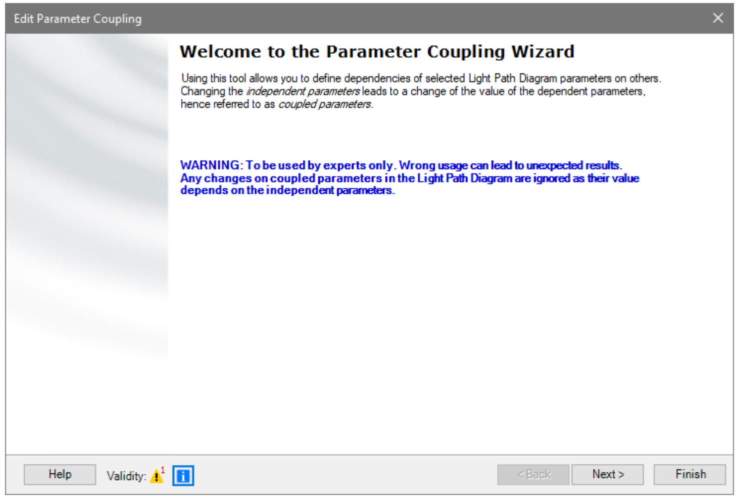


In order to use the parameter coupling feature of VirtualLab Fusion activate the option “*Use Parameter Coupling*” for the optical setup in question.



Afterwards, the “*Edit Parameter Coupling*” button is available.

Clicking on the “*Edit Parameter Coupling*” button causes the parameter coupling wizard to appear.


Edit Parameter Coupling

Welcome to the Parameter Coupling Wizard

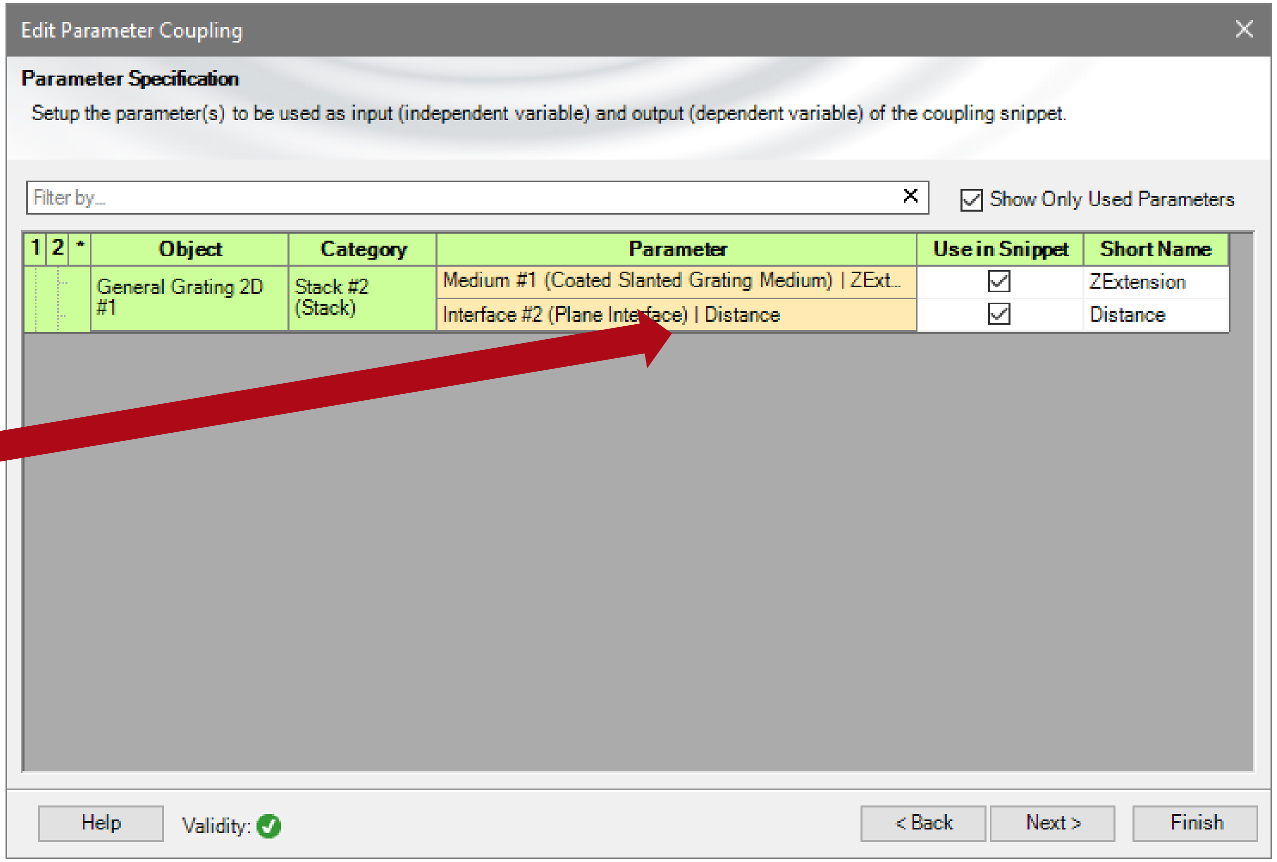
Using this tool allows you to define dependencies of selected Light Path Diagram parameters on others. Changing the *independent parameters* leads to a change of the value of the dependent parameters, hence referred to as *coupled parameters*.

WARNING: To be used by experts only. Wrong usage can lead to unexpected results. Any changes on coupled parameters in the Light Path Diagram are ignored as their value depends on the independent parameters.

Choose Parameters Involved

By clicking “*Next*”, a table is shown which contains all parameters of the current optical setup.

Please select all the parameters which are relevant for the coupling and necessary calculation. For instance, the parameters “*ZExtension*” and “*Distance*” are chosen in this case.



Edit Parameter Coupling

Parameter Specification

Setup the parameter(s) to be used as input (independent variable) and output (dependent variable) of the coupling snippet.

Filter by...

☑ Show Only Used Parameters

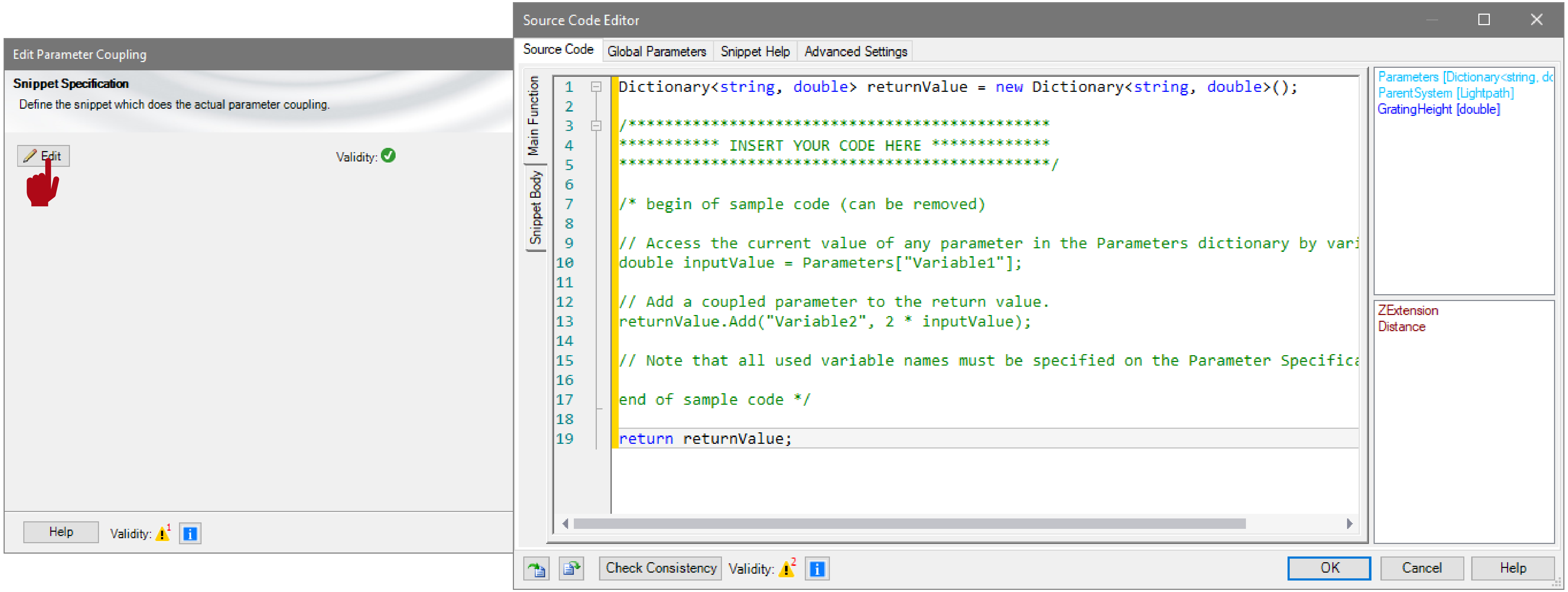
1	2	*	Object	Category	Parameter	Use in Snippet	Short Name
			General Grating 2D #1	Stack #2 (Stack)	Medium #1 (Coated Slanted Grating Medium) | ZExt...	☑	ZExtension
					Interface #2 (Plane Interface) | Distance	☑	Distance

Validity: ✓

Configure the Coupling of the Parameters

After choosing the parameters, the snippet which controls the coupling has to be set.

By clicking on “*Edit*” the source code editor opens.



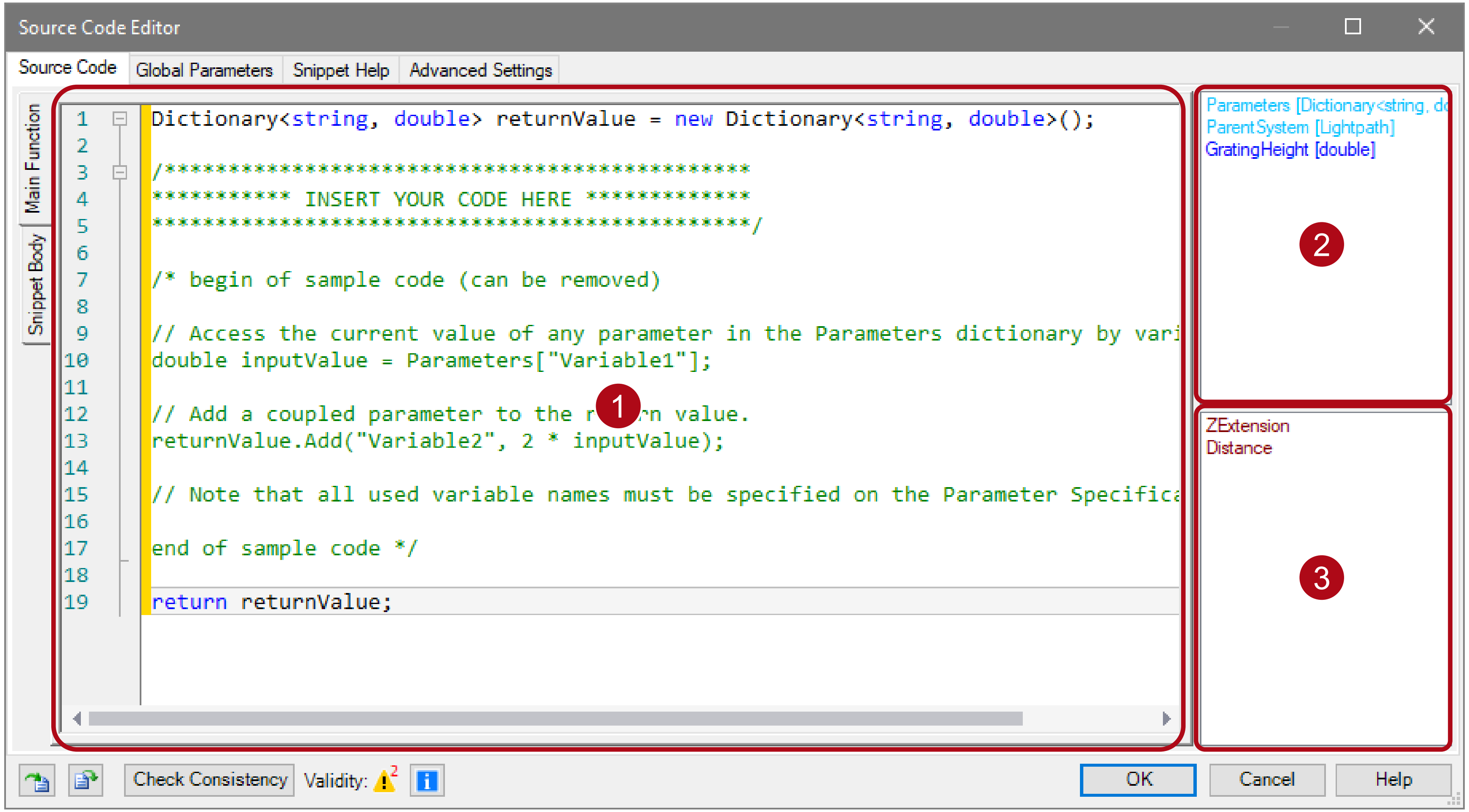
Define the snippet which does the actual parameter coupling.

```
Dictionary<string, double> returnValue = new Dictionary<string, double>();

/*********************************************
*********** INSERT YOUR CODE HERE *************
**********************************************/

/* begin of sample code (can be removed)

// Access the current value of any parameter in the Parameters dictionary by vari
double inputValue = Parameters["Variable1"];

// Add a coupled parameter to the return value.
returnValue.Add("Variable2", 2 * inputValue);

// Note that all used variable names must be specified on the Parameter Specifica

end of sample code */

return returnValue;
```

Configure the Coupling of Parameters

The source code tab contains three areas:

1. the source code (center area)
2. global variables/parameters (upper right area)
3. chosen system parameters (lower right)



```
Dictionary<string, double> returnValue = new Dictionary<string, double>();

/*********************************************
*********** INSERT YOUR CODE HERE *************
*********************************************/

/* begin of sample code (can be removed)

// Access the current value of any parameter in the Parameters dictionary by vari
double inputValue = Parameters["Variable1"];

// Add a coupled parameter to the return value.
returnValue.Add("Variable2", 2 * inputValue);

// Note that all used variable names must be specified on the Parameter Specifica

end of sample code */

return returnValue;
```

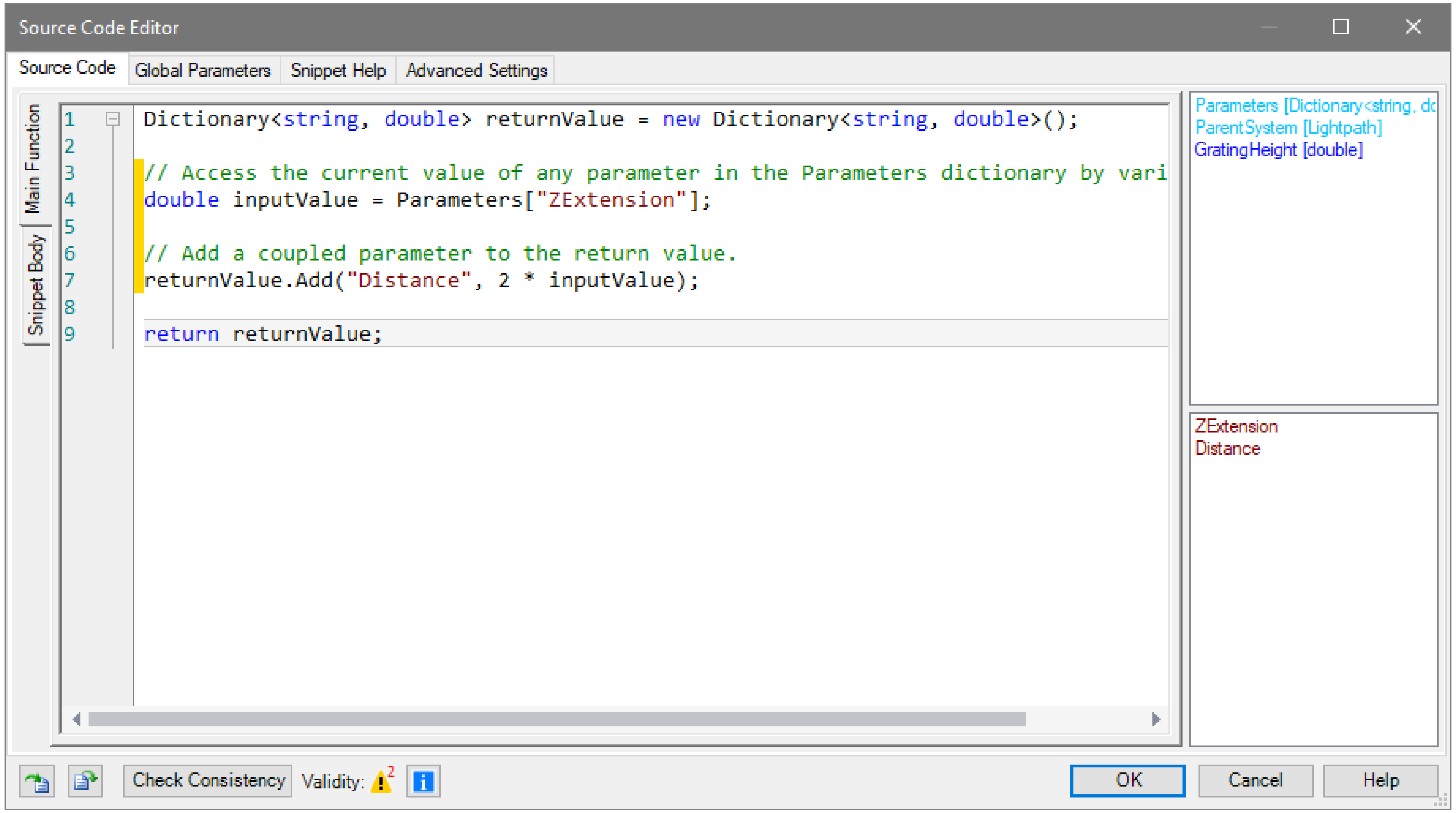
Parameters [Dictionary<string, d
ParentSystem [Lightpath]
GratingHeight [double]

ZExtension
Distance

General Example of Parameter Coupling

- In general, the chosen parameters have to be read from the dictionary and saved to a variable (line 4).

- Afterwards, that value can be used as output for another parameter, or play a role in its calculation, e.g. be doubled (line 7).



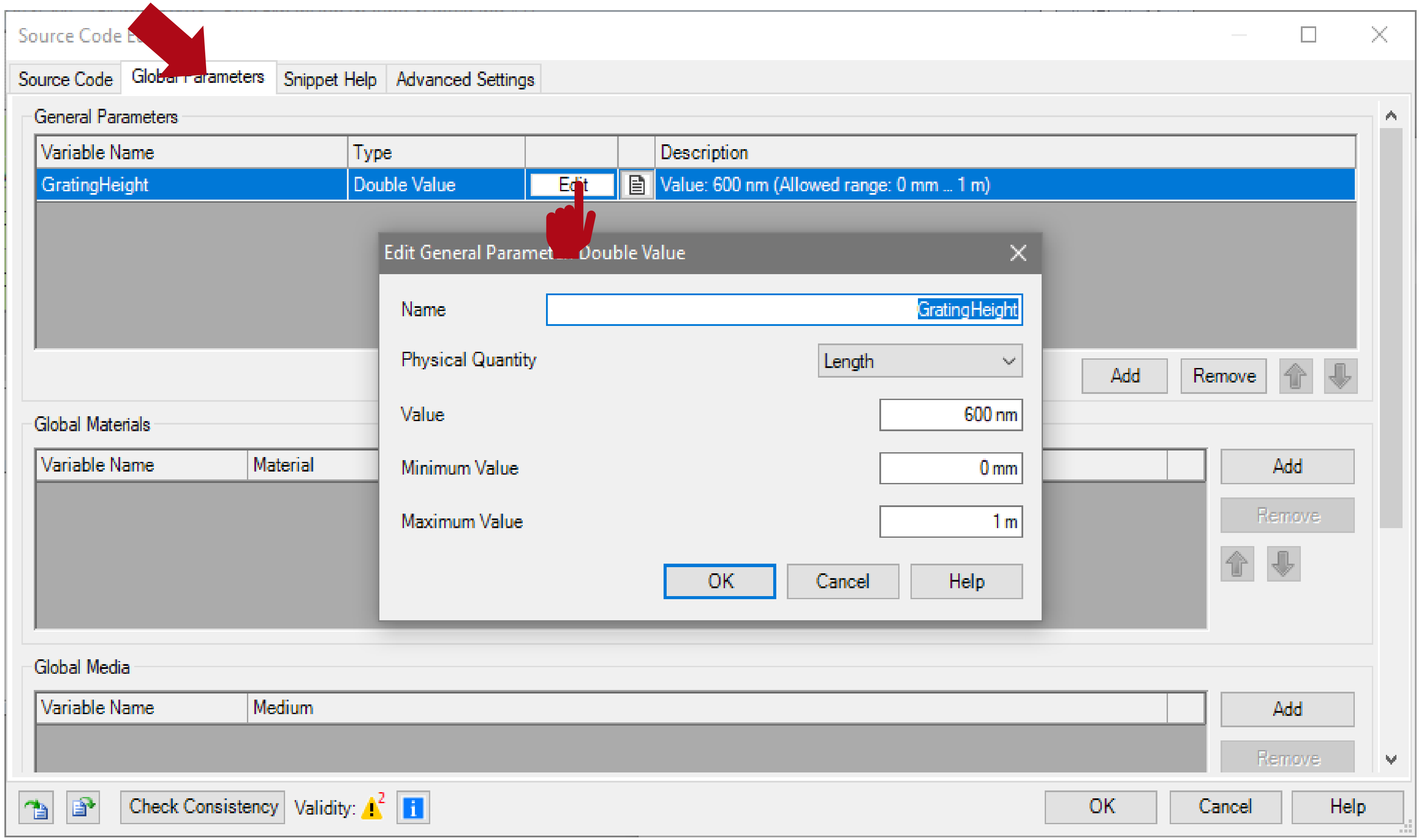
```
1  Dictionary<string, double> returnValue = new Dictionary<string, double>();
2
3  // Access the current value of any parameter in the Parameters dictionary by vari
4  double inputValue = Parameters["ZExtension"];
5
6  // Add a coupled parameter to the return value.
7  returnValue.Add("Distance", 2 * inputValue);
8
9  return returnValue;
```

Definition of Global Parameters

- In this particular example, it is helpful to define a new global variable, which later appears on the parameter coupling window.

- This can be done in the "*Global Parameters*" tab.

- The variable can be of different types and have different physical quantities attached.



Variable Name	Type			Description
GratingHeight	Double Value	Edit		Value: 600 nm (Allowed range: 0 mm ... 1 m)

Edit General Paramet... Double Value

Name	GratingHeight
Physical Quantity	Length
Value	600 nm
Minimum Value	0 mm
Maximum Value	1 m

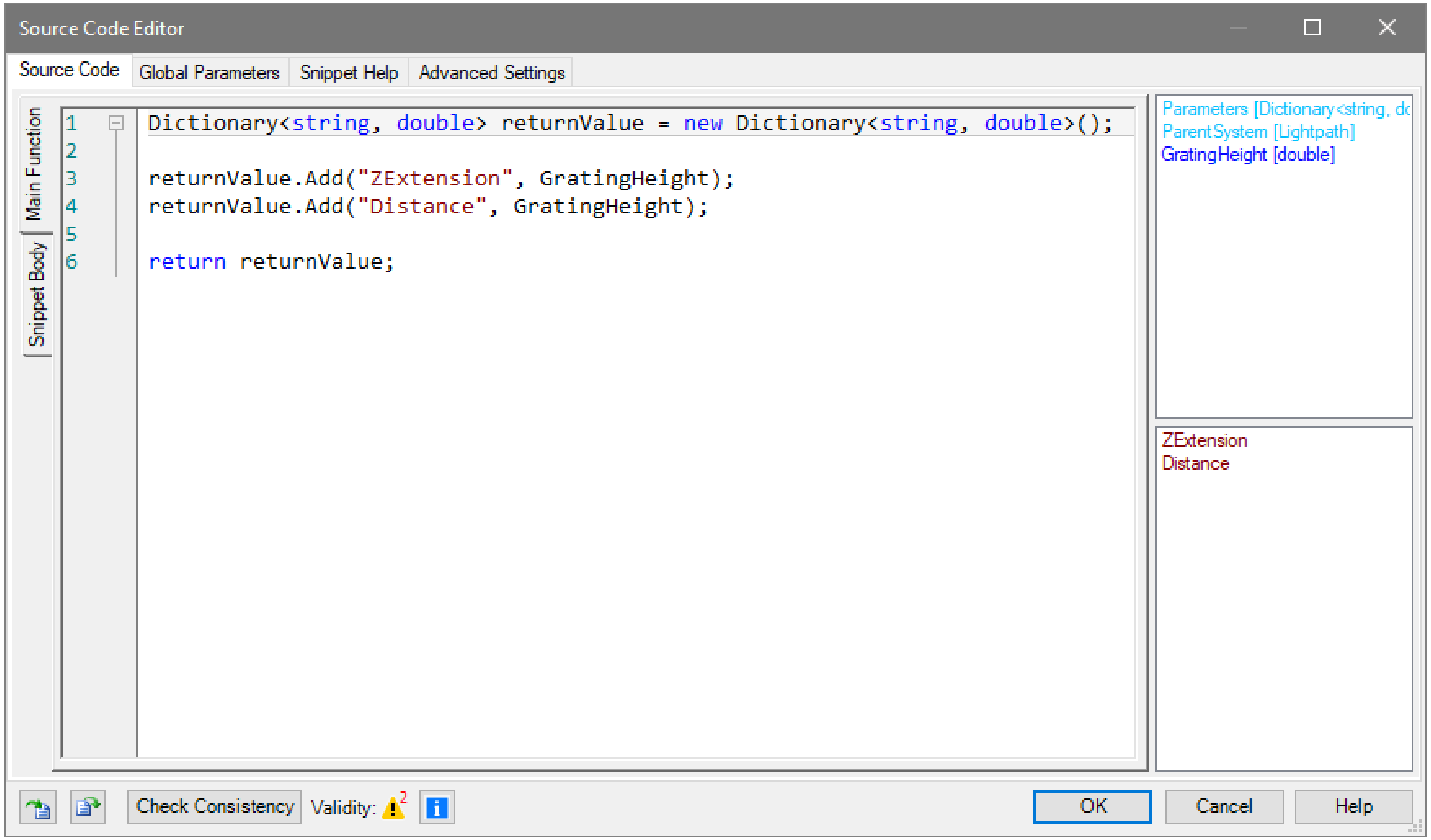
Variable Name	Material

Variable Name	Medium

Particular Example of Parameter Coupling

- In this example, the global variable is used to return its value to both chosen parameters of the system.

- Thus, no parameter has to be read from the dictionary or re-calculated.



```
Dictionary<string, double> returnValue = new Dictionary<string, double>();

returnValue.Add("ZExtension", GratingHeight);
returnValue.Add("Distance", GratingHeight);

return returnValue;
```

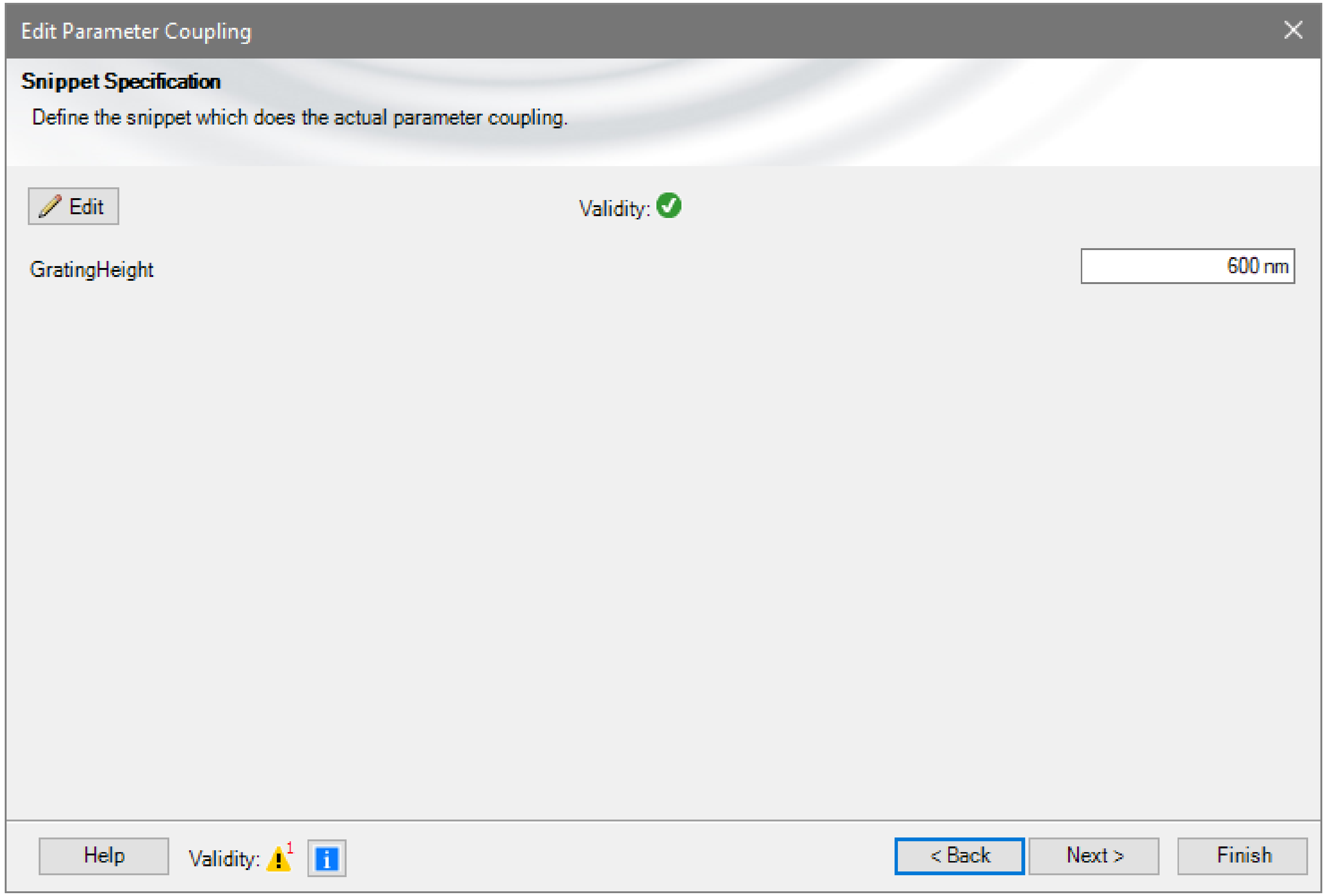
Parameters [Dictionary<string, dc
ParentSystem [Lightpath]
GratingHeight [double]

ZExtension
Distance

Particular Example of Parameter Coupling

- After closing the source code editor, the defined global variable “*GratingHeight*” appears.

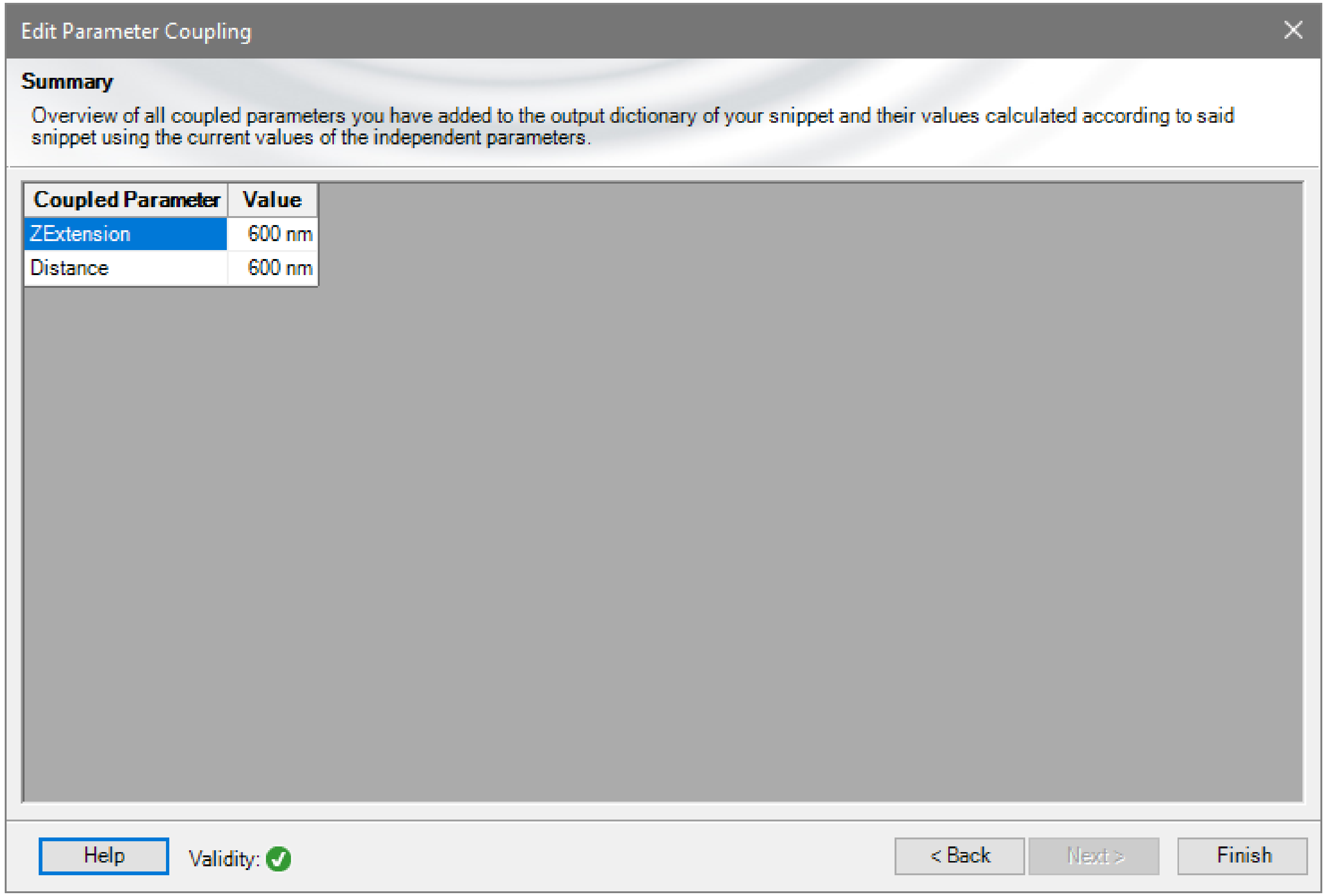
- When working with the system later on, the user will only be able to modify the value of this variable, which will in turn automatically affect the value of the system parameters. Trying to modify the value of the parameters themselves will have no effect.



GratingHeight 600 nm

Final Check of the Set-up Parameter Coupling

- On the last page of the wizard, the returned parameters and values can be checked.



Summary

Overview of all coupled parameters you have added to the output dictionary of your snippet and their values calculated according to said snippet using the current values of the independent parameters.

Coupled Parameter	Value
ZExtension	600 nm
Distance	600 nm

Validity: ✓

Document Information

title	Coupling of Parameters in VirtualLab Fusion
document code	CZT.0006
version	2.0
edition	VirtualLab Fusion Basic
software version	2020.2 (Build 2.22)
category	Feature Use Case
further reading	- Automatized Detector Positioning by using Parameter Coupling