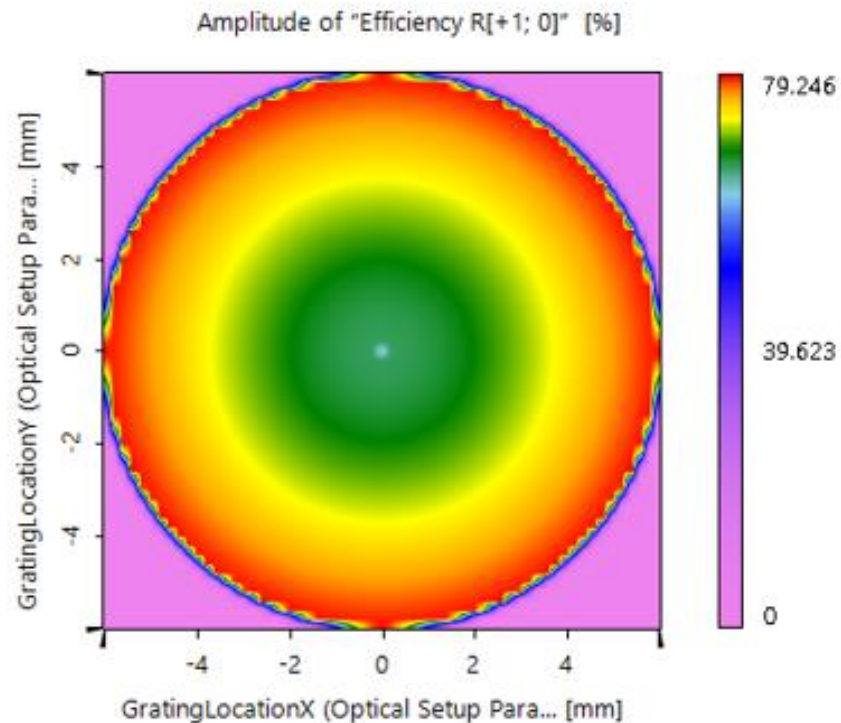


Calculation of Diffraction Efficiency for a Reflective Volume Holographic Grating generated by a Spherical Wave

Abstract



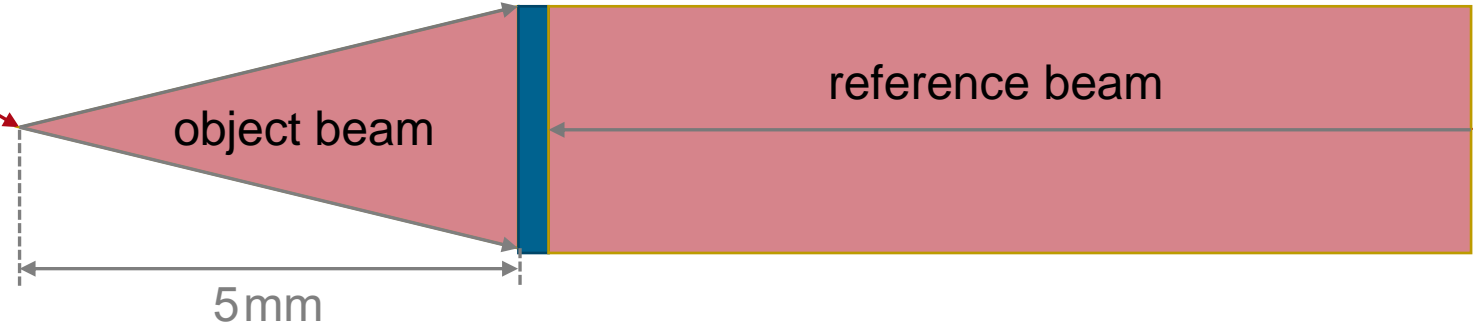
In this Demo the diffraction efficiency of a volume holographic grating is investigated, which was generated by an impinging spherical and plane wave. The rigorous modeling solver FMM (RCWA) is applied for accurate calculation of the efficiencies. The rotation-symmetry of the setup is exploited, in order to significantly reduce the calculation time.

Task: Efficiency Calculation for a Volume Holographic Grating

object: point source
position = (0,0,0) mm
wavelength: 550nm

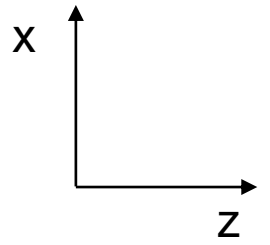
photosensitive volume
material

reference beam:
plane wave
wavelength: 550nm



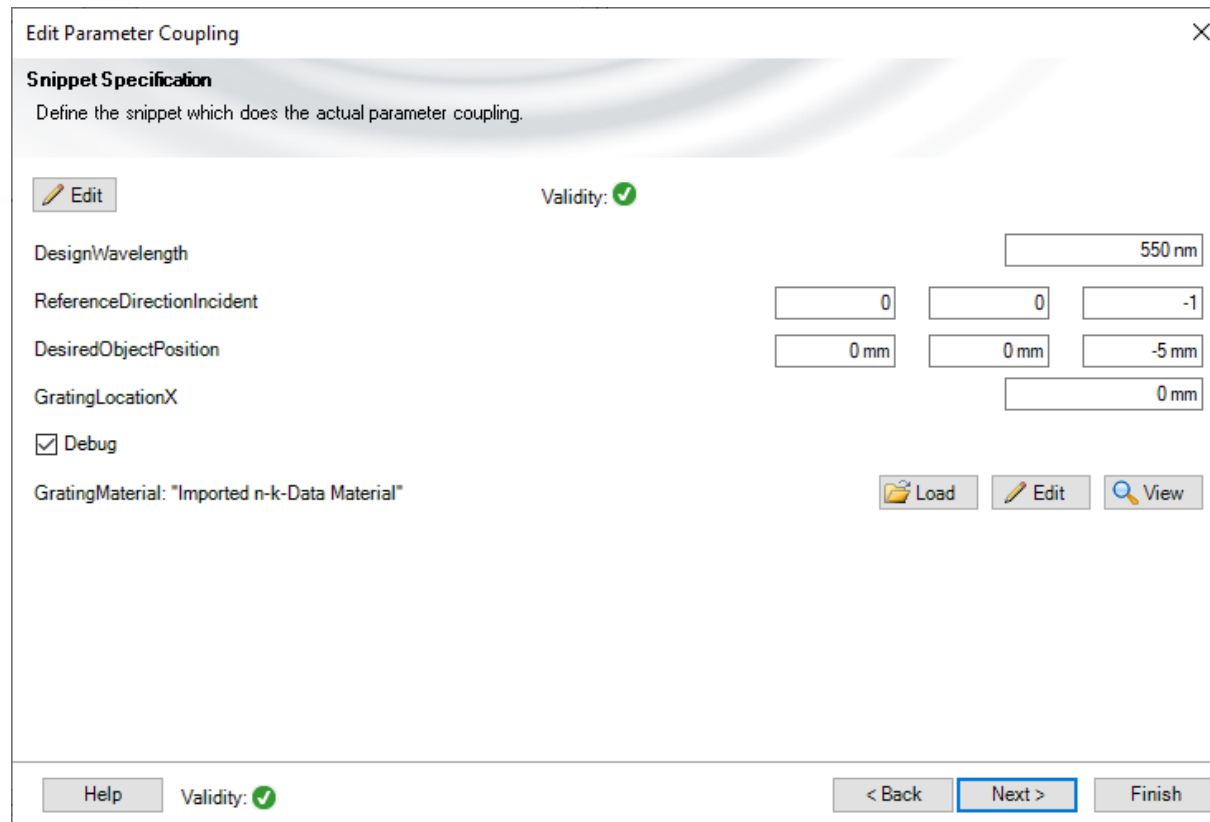
photosensitive volume
material parameters:

- thickness: 10 and 20 μ m
- refractive index: 1.4599
- index modulation: 0.02

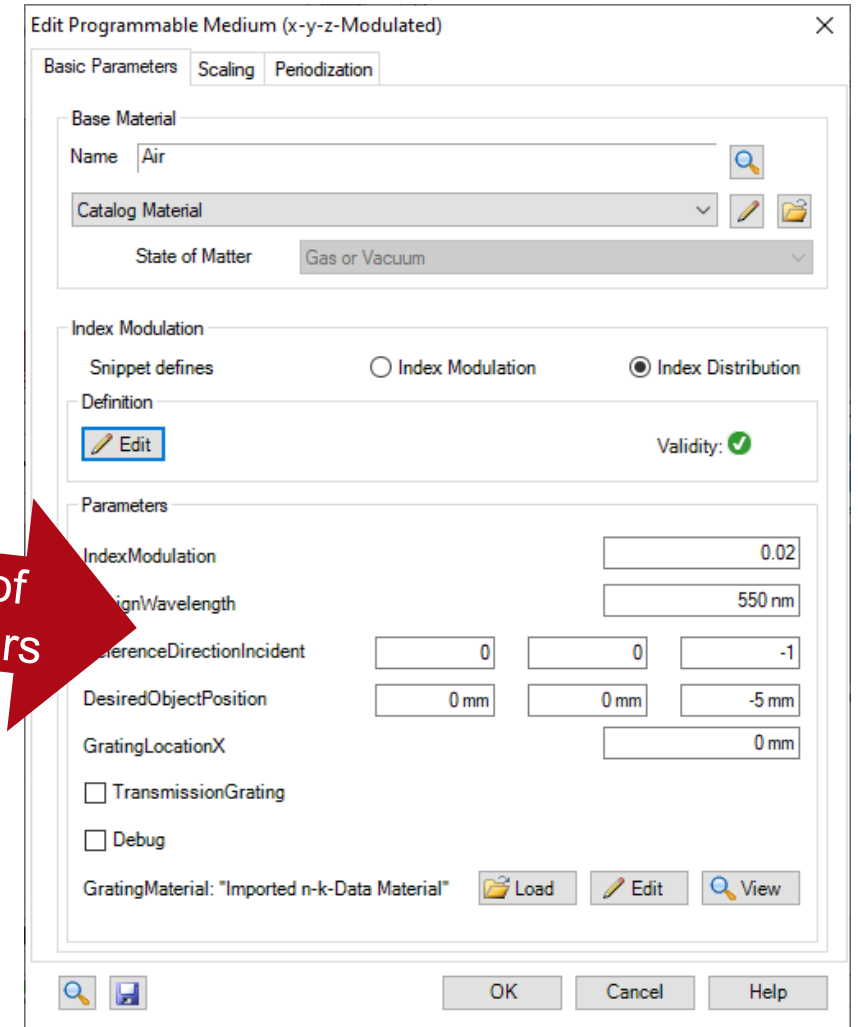


Modeling Strategy

- Take advantage of the rotational symmetry of the volume hologram, thus just the calculation along the radius has to be done
- Local linear grating (LLGA) is assumed and realized by a combination of programmable medium and parameter coupling

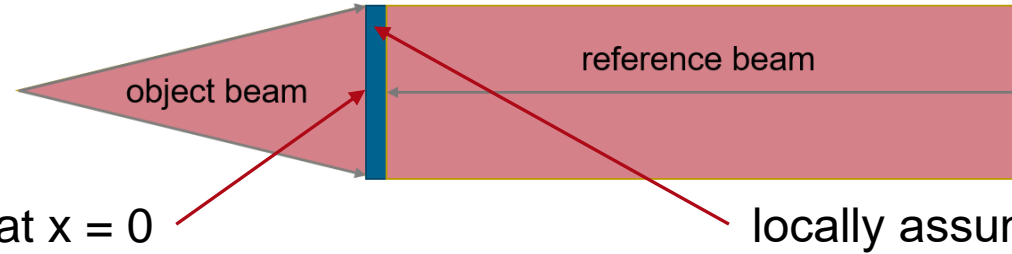


control of parameters



Modeling Strategy

Local linear grating (LLGA) is assumed and realized by a combination of programmable medium and parameter coupling



locally assumed grating at $x = 0$

locally assumed grating at $x = 5\text{ mm}$

Edit Stack

Index	z-Distance	z-Position	Interface	Subsequent Medium	Com
1	0 mm	0 mm	Plane Interface	Programmable Medium	Enter your commen
2	10 μm	10 μm	Plane Interface	Non-Dispersive Mat...	Enter your commen

Validity: 1

Period

Stack Period is with Index

Stack Period

OK Cancel Help

Edit Stack

Index	z-Distance	z-Position	Interface	Subsequent Medium	Com
1	0 mm	0 mm	Plane Interface	Programmable Medium	Enter your commen
2	10 μm	10 μm	Plane Interface	Non-Dispersive Mat...	Enter your commen

Validity:

Period

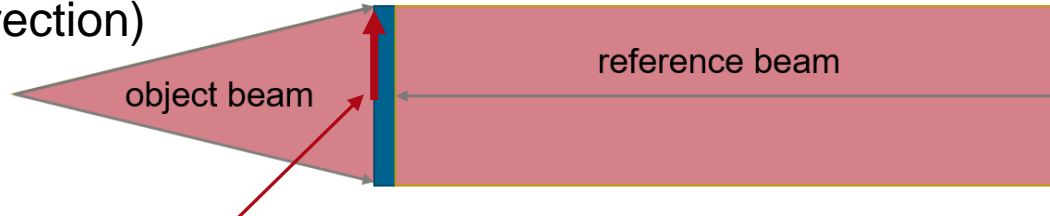
Stack Period is with Index

Stack Period

OK Cancel Help

Modeling Strategy

Further, a parameter run is used to scan the positions of the holographic medium along the radius (e.g. in x-direction)



4: Parameter Run along x-Position

Results
Start the parameter run and analyze its results

Go!

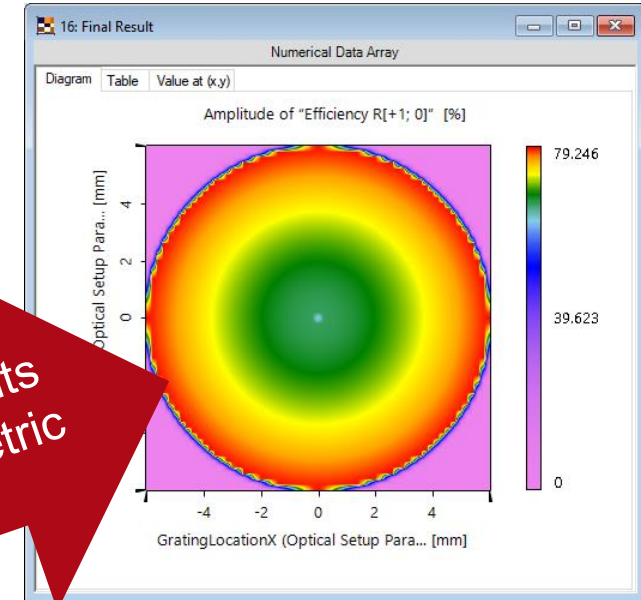
Use Already Calculated Results for Next Run

Detector	Subdetector	Combined Output	Iteration Step				
			1	2	3	4	5
Varied Parameters			0 mm	200 μ m	400 μ m	600 μ m	800 μ m
	Constant Refractive Index (...)	Data Array	1.4599	1.4599	1.4599	1.4599	1.4599
	DesignWavelength (Volume...)	Data Array	550 nm	550 nm	550 nm	550 nm	550 nm
	DesiredObjectPosition X (...)	Data Array	0 mm	0 mm	0 mm	0 mm	0 mm
	DesiredObjectPosition Y (...)	Data Array	0 mm	0 mm	0 mm	0 mm	0 mm
	DesiredObjectPosition Z (V...)	Data Array	-5 mm	-5 mm	-5 mm	-5 mm	-5 mm
Coupled Parameters			0 mm	200 μ m	400 μ m	600 μ m	800 μ m
	GratingLocationX (Volume...)	Data Array	0 mm	200 μ m	400 μ m	600 μ m	800 μ m
	Period x-Direction (Volume...)	Data Array	+inf mm	9.426 μ m	4.7243 μ m	3.162 μ m	2.3846 μ m
	Period y-Direction (Volume...)	Data Array	+inf mm	+inf mm	+inf mm	+inf mm	+inf mm
	Period z-Direction (Volume...)	Data Array	188.37 nm	188.44 nm	188.67 nm	189.04 nm	189.56 nm
	ReferenceDirectionIncident...	Data Array	0	0	0	0	0

Create Output from Selection

< Back Next > Show ▾

combination of results into rotation symmetric distribution



11: C:\Users\...Extract Rotational Symmetric Distribution from PR.cs

```

Source Code  Advanced Settings
23 using VirtualLabAPI.Core.ParameterRuns;
24
25 namespace OwnCode {
26     public class VLModule {
27
28         string nameOfDetector = "Grating Order Analyzer #800\r\n(Results for Individual Order";
29         string nameOfSubDetectorZero = "Efficiency R[0; 0]";
30         string nameOfSubDetector = "Efficiency R[+1; 0]";
31         InterpolationMethod usedInterpolation = InterpolationMethod.Linear_RealAndImaginaryP;
32
33         public void Run() {
34             ParameterRun run = Globals.ActiveDocumentHistory.BrowseLastDocuments(DocumentFil;
35             ParameterRunResultMatrix resultMatrix = run.ResultMatrix;
36
37             List<Double> values = resultMatrix.GetValueList();
38         }
39     }
40 }

```

Error Description

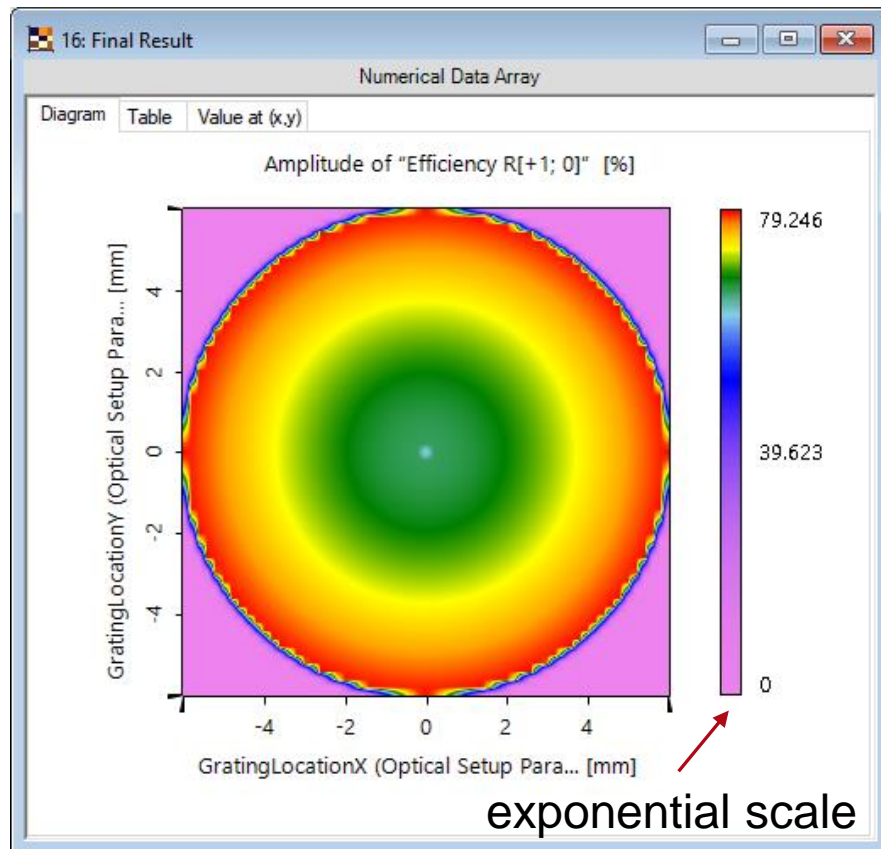
Module started

Thread finished normally

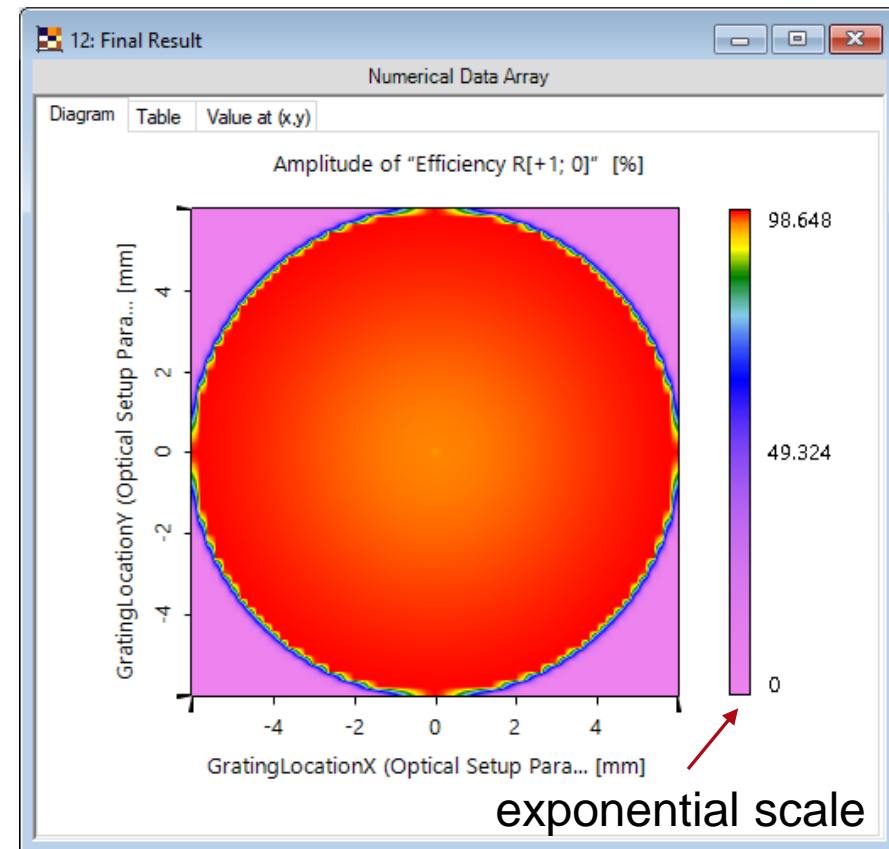
Ln 1 Ch 1

Result for 10 μm & 20 μm Thick of Holographic Material

10 μm holographic grating



20 μm holographic grating



Document Information

title	Volume Holographic Grating with Spherical Wave
document code	Demo.xx
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VL version used for simulations	VirtualLab Fusion Spring Release 2020
category	Demo
further reading	
