Programmable Grating Analyzer
For different grating applications, one may like to access the grating diffraction properties in different manners. Besides the standard Grating Order Analyzer, VirtualLab Fusion provides a fully customizable analyzer. In this example, we show how to access the complete grating diffraction information, to display them, and to use it for further analysis or optimization. We use a pillar grating for illustration and show how to access the result of interest via Parameter Run.
Using a Programmable Grating Analyzer to access the grating diffraction information, and to display the efficiency of a specified order, as well as the efficiencies of all propagating orders as a 2D matrix/graph.

C# programming

2D data matrix of the efficiencies of all propagating orders

Efficiency of a specific order
Programmable Grating Analyzer can be found in the left pannel of Optical Setup in *Grating Toolbox.*
Basic Parameters

order information can be accessed from the two global parameters

additional using must be included here
Efficiency of a Specified Order

C# Code: get the efficiency of a specified order and display of it

```csharp
DetectorResultObject[] detectorResults = new DetectorResultObject[1];

//Get the efficiency of Order (1,1)
OrderInfo Order_11 = TransmissionResults.GetOrder(1, 1);
double Efficiency_11 = Order_11.Efficiency;

//display of efficiency of specific order
detectorResults[0] = new DetectorResultObject(new PhysicalValue(Efficiency_11, Percentage, EfficiencyProperty).Percentage, EfficiencyProperty); //property of efficiency

return detectorResults;
```

well guidance of C# code.
Efficiencies of All Grating Orders

C# Code: get the efficiency matrix

```csharp
//Get all efficiencies
ComplexField Efficiency_cf = TransmissionResults.ConvertEfficienciesToComplexField(); //Convert efficiency into a 2D matrix
```

C# Code: formulate the display matrix with setting the physical properties of x-/y- axis and efficiency

```csharp
//Calculate the index of order (OrderX_min, OrderY_min)
SamplingParameters SP = new SamplingParameters(Efficiency_cf.SamplingPoints, //order numbers
    new VectorD(1, 1)); // order index is integer, so sampling distance is 1 along both x and y direction
VectorD FirstOrderIndexXY = CoordinateTransformations.PointFromPixelToPhysicalCoordinates(new VectorD(0, 0), SP); // (OrderX_min, OrderY_min)

//2D order efficiencies matrix
DataArray2D Efficiency = new DataArray2D(new ComplexFieldArray(Efficiency_cf), Efficiency, new PhysicalProperty[][] { PhysicalProperty.Percentage }, //unit of efficiency is percentage
    new string[] { "Efficiency" }, //title of the data array
    1.0, //sampling distance of order index is 1 along x direction
    FirstOrderIndexXY.X, //OrderX_min
    PhysicalProperty.NoUnit, //index has no unit
    "Order X", //label of x-axis
    1.0, //sampling distance of order index is 1 along y direction
    FirstOrderIndexXY.Y, //OrderY_min
    PhysicalProperty.NoUnit, //index has no unit
    "Order Y")); //label of y-axis
```
Efficiencies of All Grating Orders

C# Code: display the efficiency matrix

```csharp
// Display the efficiency data array 2D
detectorResults[1] = new DetectorResultObject(Efficiency, "Grating Order Efficiency", "Programmable Grating Analyzer");
```

Efficiencies are displayed as a 2D matrix/graph.
Parameter Run – Varying Wavelength

- Varying wavelength from 300 nm to 700 nm for 11 steps
- 11 layers of 2D data matrix/graph
- Efficiency (1,1) vs. wavelength
Peek into VirtualLab

C# code in the Programmable Grating Analyzer

Parameter Run to scanning values of wavelength
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