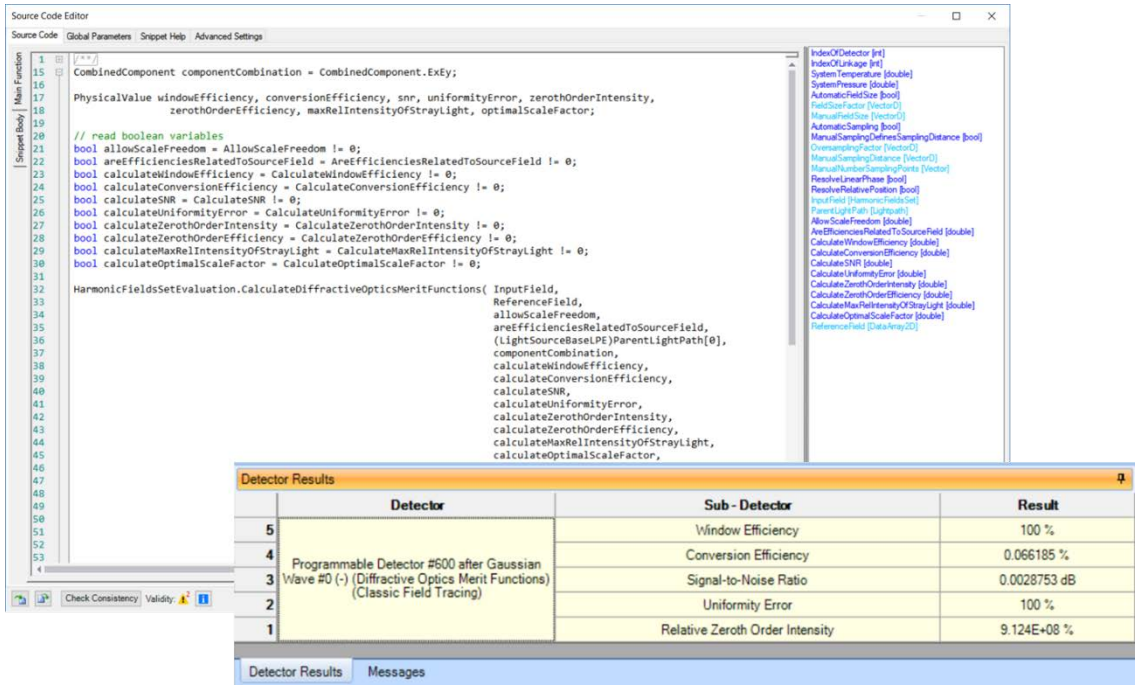
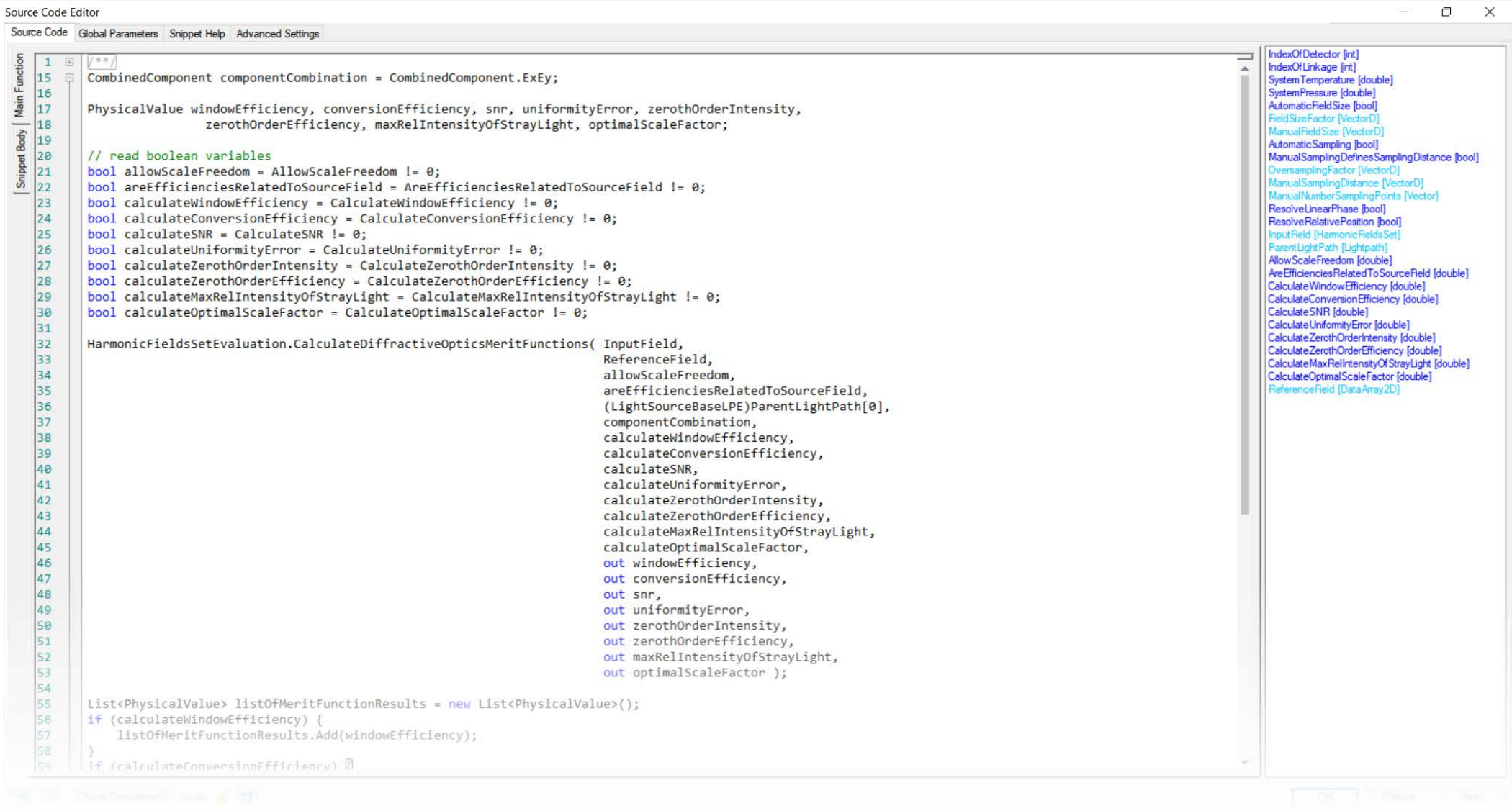
Programming a Detector for Diffractive Optics Merit Functions Calculation

Abstract



VirtualLab Fusion provides maximum versatility for your optical simulations. Based on the full field information, those typically used merit functions in diffractive optics, like the window efficiency, can be calculated according to their definitions. In this example, we realize the standard diffractive optics merit functions which has been defined in VirtualLab, but by using a Programmable Detector for illustration. In a similar manner, one can define their own merit functions for specific applications with full flexibility.

Main Function



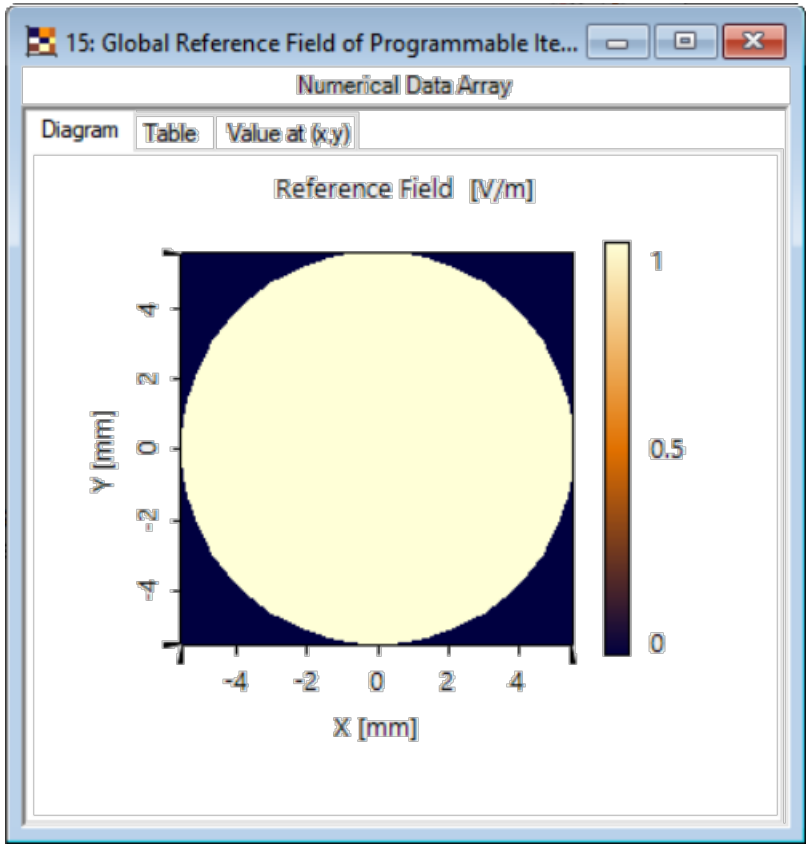
Main Function

```
                                                    out zerothOrderIntensity,
                                                    out zerothOrderEfficiency,
                                                    out maxRelIntensityOfStrayLight,
                                                    out optimalScaleFactor );

List<PhysicalValue> listOfMeritFunctionResults = new List<PhysicalValue>();
if (calculateWindowEfficiency) {
    listOfMeritFunctionResults.Add(windowEfficiency);
}
if (calculateConversionEfficiency) {
    listOfMeritFunctionResults.Add(conversionEfficiency);
}
if (calculateSNR) {
    listOfMeritFunctionResults.Add(snr);
}
if (calculateUniformityError) {
    listOfMeritFunctionResults.Add(uniformityError);
}
if (calculateZerothOrderIntensity) {
    listOfMeritFunctionResults.Add(zerothOrderIntensity);
}
if (calculateZerothOrderEfficiency) {
    listOfMeritFunctionResults.Add(zerothOrderEfficiency);
}
if (calculateMaxRelIntensityOfStrayLight) {
    listOfMeritFunctionResults.Add(maxRelIntensityOfStrayLight);
}
if (calculateOptimalScaleFactor) {
    listOfMeritFunctionResults.Add(optimalScaleFactor);
}

return new DetectorResultObject[]{new DetectorResultObject(listOfMeritFunctionResults, "Diffractive Optics Merit Functions")};
```

Global Parameters

- The global parameter Reference Field is a 2D Numerical Data Array which describes the signal field and a corresponding signal region (with the same sampling).

- The 2D Numerical Data Array can be imported numerical as bitmap datas, or directly defined by the aperture function in VirtualLab Fusion.



Global Parameters

- The detector function has the following global parameters:

Global Parameters	Description
AllowScaleFreedom	If value is 1, the scale factor α is calculated for all merit functions calculations.
AreEfficienciesRelatedTo-SourceField	If value is 0, the input field power is assumed to be equal to the output field power. Otherwise, all efficiency calculations are related to the power of the Optical Setup source field.
CalculateWindowEfficiency	If value is 1, the window efficiency will be calculated and shown on Detector Results tab.
CalculateConversionEfficiency	If value is 1, the conversion efficiency will be calculated and shown on Detector Results tab.
CalculateSNR	If value is 1, the signal-to-noise-ratio (SNR) will be calculated and shown on Detector Results tab.

Global Parameters

Global Parameters	Description
CalculateUniformityError	If value is 1, the uniformity error will be calculated and shown on Detector Results tab.
CalculateZerothOrderIntensity	If value is 1, the zeroth order intensity will be calculated and shown on Detector Results tab.
CalculateZerothOrderEfficiency	If value is 1, the zeroth order efficiency will be calculated and shown on Detector Results tab.
CalculateMaxRelIntensityOf-StrayLight	If value is 1, the maximum relative intensity of stray light will be calculated and shown on Detector Results tab.
CalculateOptimalScaleFactor	If value is 1, the scale factor α will be calculated and shown on Detector Results tab

Field Component Combination

- Another parameter can be set in the snippet itself: Via the variable componentCombination one can control which field components are considered for squared amplitudes summation:

```
14  // additional parameters
15  CombinedComponent componentCombination = CombinedComponent.ExEy;
```

Value of component	Meaning
Combination CombinedComponent.ExEy	$\sum(\lvert E_x\rvert^2 + \lvert E_y\rvert^2)$
Combination CombinedComponent.ExEz	$\sum(\lvert E_x\rvert^2 + \lvert E_z\rvert^2)$
Combination CombinedComponent.EzEy	$\sum(\lvert E_z\rvert^2 + \lvert E_y\rvert^2)$
Combination CombinedComponent.ExEyEz	$\sum(\lvert E_x\rvert^2 + \lvert E_y\rvert^2 + \lvert E_z\rvert^2)$

Document Information

title	Programming a Detector for Diffractive Optics Merit Functions Calculation
document code	CZT.0053
version	1.0
toolbox(es)	Starter Toolbox
VL version used for simulations	7.4.0.49
category	Feature Use Case
further reading	- How to Work with the Programmable Detector and Example (Minimum and Maximum Wavelengths)