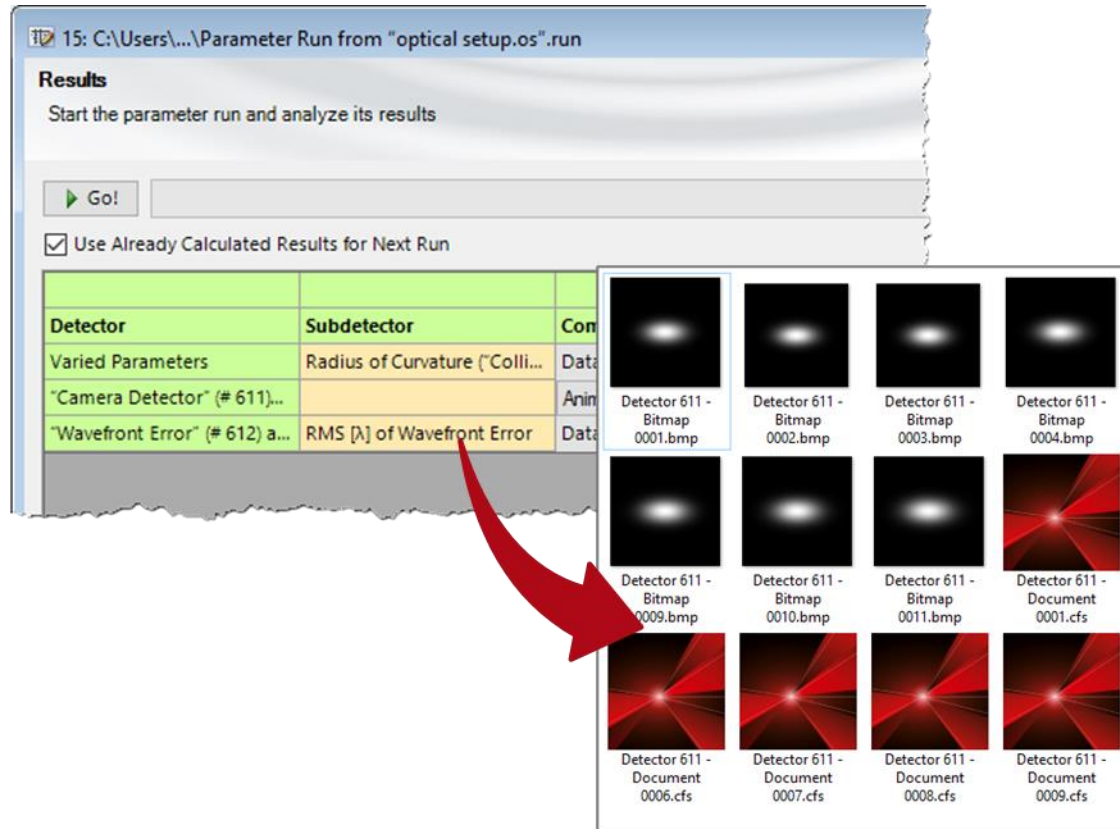


Export of Results of a Parameter Run

Abstract



Being able to vary the parameters of an optical system is required for the detailed analysis of its functionality and capabilities. For this purpose, the Parameter Run of VirtualLab Fusion, which provides versatile options and different variation strategies, can be applied. The results of the different iterations are provided, in a convenient and compact way, all together in the Parameter Run document. In this use case we present a possible workflow to export the results of the Parameter Run.

This Use Case Shows...

... how to use a C# module to export results from a *Parameter Run* document to a specific location on the hard disk.

15: C:\Users\...\Parameter Run from "optical setup.os".run

Results
Start the parameter run and analyze its results

Go!

Use Already Calculated Results for Next Run

Detector	Subdetector	Combined Output	Iteration Step				
			4	5	6	7	
Varied Parameters	Radius of Curvature ("Colli...	Data Array	-6.4 mm	-6.6 mm	-6.8 mm	-7 mm	-7.2 n
"Camera Detector" (# 611)...		Animation	Chromatic Fields Set	Chromatic Fields Set	Chromatic Fields Set	Chromatic Fields Set	Chromatic Fields
"Wavefront Error" (# 612) a...	RMS [Å] of Wavefront Error	Data Array	6.669317826	3.107056209	1.2414616	4.283805457	7.075140

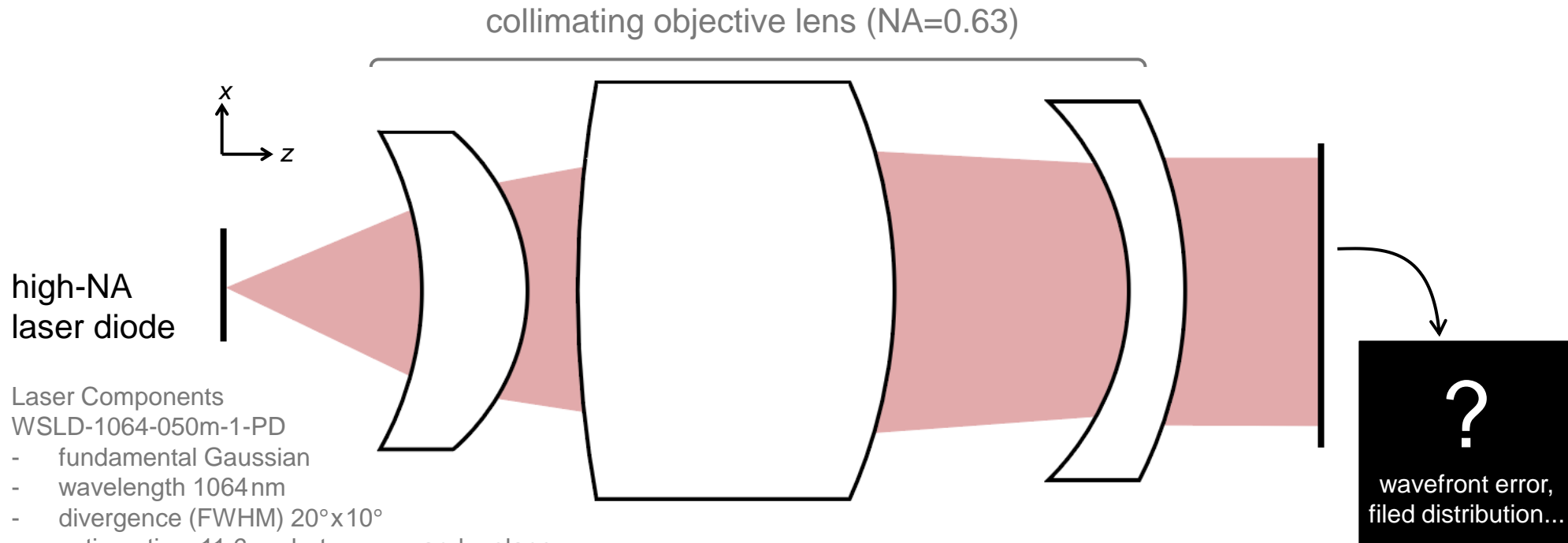
Create Output from Selection

< Back Next > Show ▾

The results of a *Parameter Run* are provided in a table. They can be of different types, e.g.:

- 2D field or energy density distribution
- numerical values of physical quantities

Example: Collimation of Astigmatic Diode Laser Beam

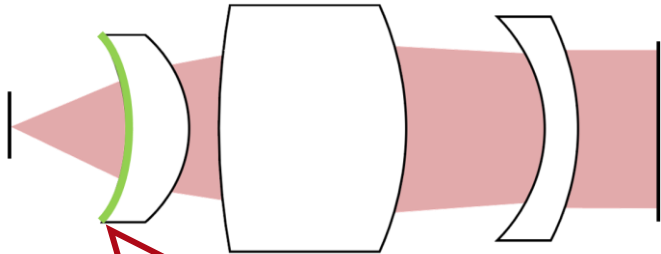


What is the wavefront error and field distribution of the collimated beam on the detector plane with varying surface parameter?

See the full Use Case:

[!\[\]\(e78f798d4ea5c530c9db49e7d26e6b95_img.jpg\) Collimation of Astigmatic Diode Laser Beam by Objective Lens](#)

Example: Collimation of Astigmatic Diode Laser Beam



For demonstration purposes, we take a closer look at the effect of the radius of curvature of the first surface of the lens, when it varies between -5.8 mm and -7.8 mm.

15: C:\Users\...\Parameter Run from "optical setup.os".run

Results
Start the parameter run and analyze its results

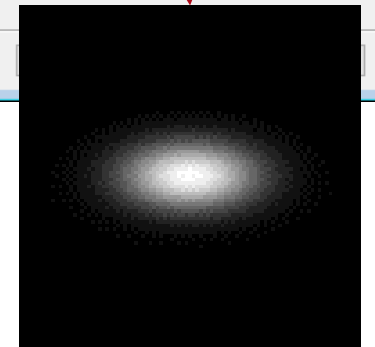
Go!

Use Already Calculated Results for Next Run

Detector	Subdetector	Combined Output	Iteration Step				
			4	5	6	7	
Varied Parameters	Radius of Curvature ("Colli...	Data Array	-6.4 mm	-6.6 mm	-6.8 mm	-7 mm	-7.2 mm
"Camera Detector" (# 611)...		Animation	Chromatic Fields Set	Chromatic Fields Set	Chromatic Fields Set	Chromatic Fields Set	Chromatic Fields Set
"Wavefront Error" (# 612) a...	RMS [λ] of Wavefront Error	Data Array	6.669317826	3.107056209	1.2414616	4.283805457	7.075140...

In this example, the resulting outputs are:

- energy density data as *Chromatic Field Set* (to be exported as bitmap – file)
- *RMS of Wavefront Error* (to be exported as text – file)



More information on the *Parameter Run* document:

[Usage of the Parameter Run Document](#)

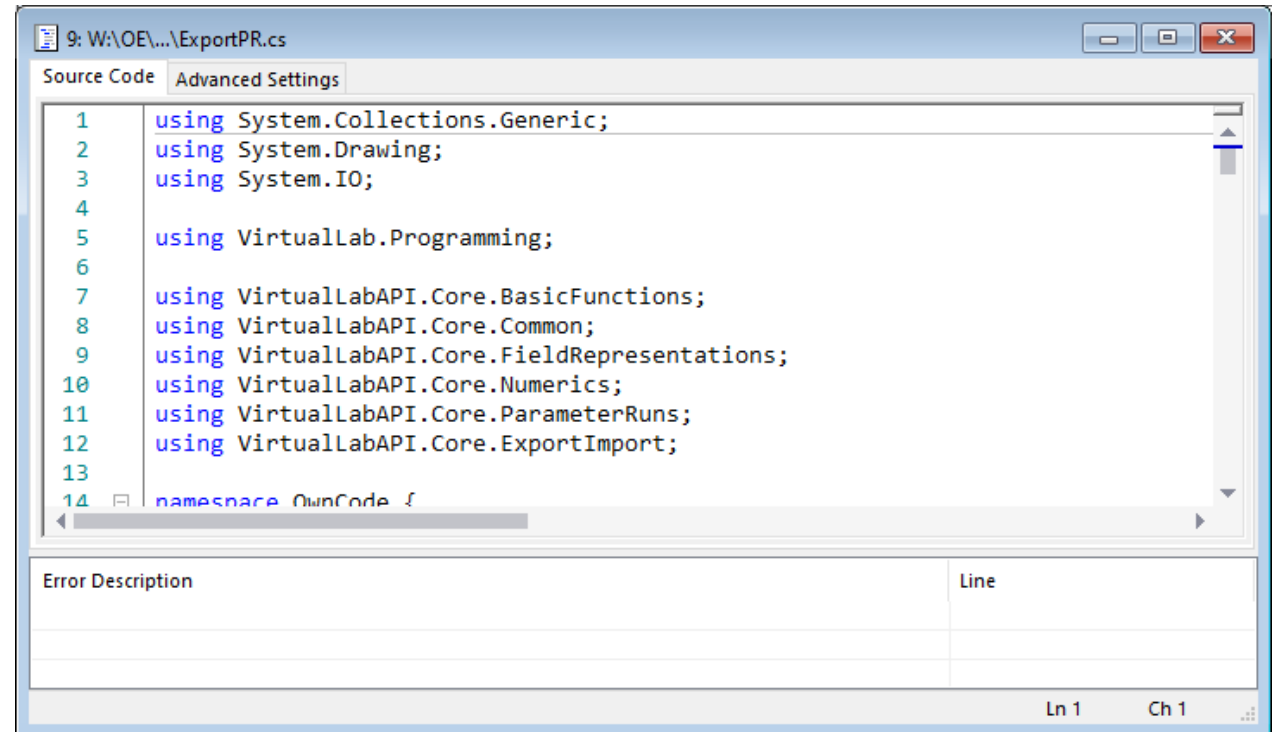
Export of Data

Due to the flexible programming capabilities of VirtualLab Fusion, a module can be used in order to export the data from the Parameter Run into the desired file format, such as:

- VirtualLab Fusion documents
- bitmap files
- text files

For a detailed look at the operation of modules, see:

[➔ How to Work with the C# Module and Example](#)



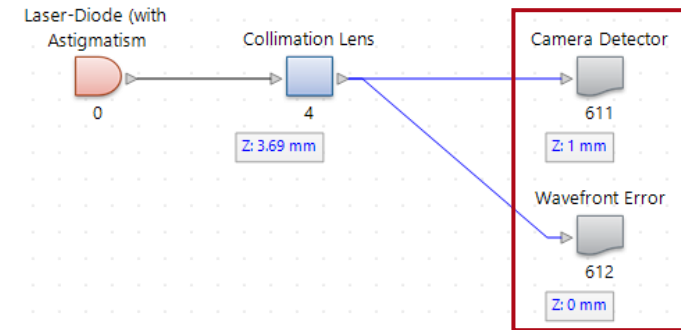
The screenshot shows a code editor window titled '9: W:\OE\...\ExportPR.cs'. The code is as follows:

```
1 using System.Collections.Generic;
2 using System.Drawing;
3 using System.IO;
4
5 using VirtualLab.Programming;
6
7 using VirtualLabAPI.Core.BasicFunctions;
8 using VirtualLabAPI.Core.Common;
9 using VirtualLabAPI.Core.FieldRepresentations;
10 using VirtualLabAPI.Core.Numerics;
11 using VirtualLabAPI.Core.ParameterRuns;
12 using VirtualLabAPI.Core.ExportImport;
13
14 namespace OwnCode {
```

Below the code editor is an 'Error Description' table with a 'Line' column. The table is currently empty. At the bottom right of the window, it shows 'Ln 1 Ch 1'.

Note: Inside the module, some settings require a few adaptations in order to customize the code with regards to the particular Parameter Run in question, as shown in the next slide.

Module Adaptation



1. The indices of the desired detectors need to be entered (line 26 and 27). E.g., in this case, #611 (*Camera Detector*) and #612 (*Wavefront Error* detector).
2. In case of a detector which provides one or more numerical values, the name of the desired value (“sub-detector”) must be specified (line 28).
3. The user can specify a path for the saved files (line 31).

```
9: W:\OE\...\ExportPR.cs
Source Code  Advanced Settings
20  /// • Version: 3.0a, Date: 2022-03-17
21  /// • Tested with VirtualLab 2021.1.
22  /// • License: CC-BY 3.0
23  /// </remarks>
24  public class VLModule {
25      //enter the indices of the desired detectors:
26      int indexCameraDetector = 611;
27      int indexValueDetector = 612;
28      string subdetectorValue = "RMS [λ] of Wavefront Error";
29
30      //enter the desired directory for export:
31      string directory = @"C:\Temp\Results\";
32
33      /// <summary>
34      /// Main function
35      ...

```

Error Description
Module started
Thread finished normally

15: C:\Users\...\Parameter Run from "optical setup.os".run

Results
Start the parameter run and analyze its results

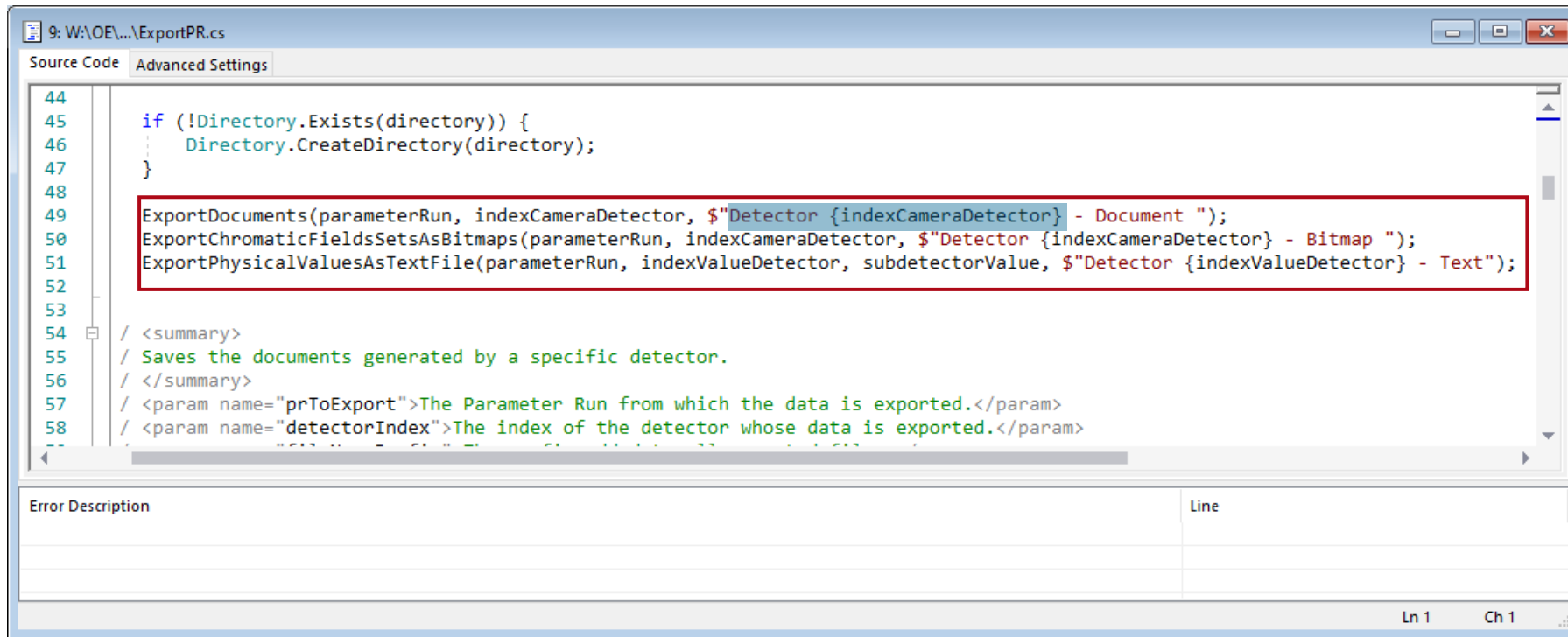
Go!

Use Already Calculated Results for Next Run

Detector	Subdetector	Combined Output	
Varied Parameters	Radius of Curvature ("Colli...	Data Array	-6.4 m
"Camera Detector" (# 611)...		Animation	Chromatic Fields 9
"Wavefront Error" (# 612) a...	RMS [λ] of Wavefront Error	Data Array	6.6693178

Module Adaptation

- By default, both the 2D output data and the numerical data can be exported (line 49, 50 and 51).
- If only one of the two data types is desired as output, the unwanted export commands can be commented out or deleted.
- The naming consists of a string clarifying the detector index and the number of each iteration step of the parameter run (marked below in blue).



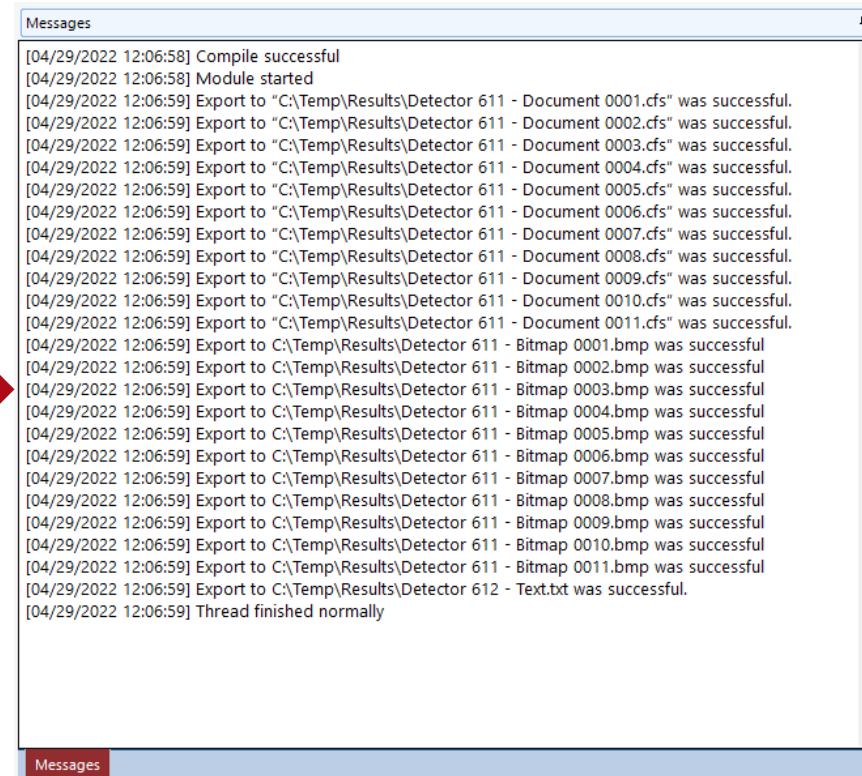
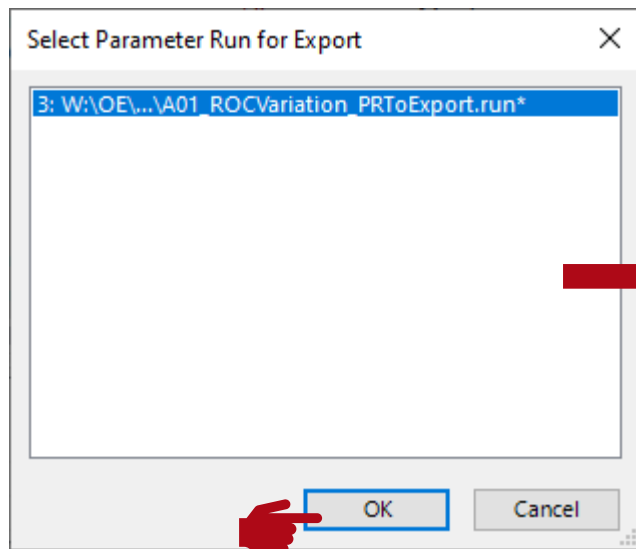
```
9: W:\OE\...\ExportPR.cs
Source Code  Advanced Settings
44
45  if (!Directory.Exists(directory)) {
46      Directory.CreateDirectory(directory);
47  }
48
49  ExportDocuments(parameterRun, indexCameraDetector, $"Detector {indexCameraDetector} - Document ");
50  ExportChromaticFieldsSetsAsBitmaps(parameterRun, indexCameraDetector, $"Detector {indexCameraDetector} - Bitmap ");
51  ExportPhysicalValuesAsTextFile(parameterRun, indexValueDetector, subdetectorValue, $"Detector {indexValueDetector} - Text");
52
53
54  / <summary>
55  / Saves the documents generated by a specific detector.
56  / </summary>
57  / <param name="prToExport">The Parameter Run from which the data is exported.</param>
58  / <param name="detectorIndex">The index of the detector whose data is exported.</param>
```

Error Description	Line

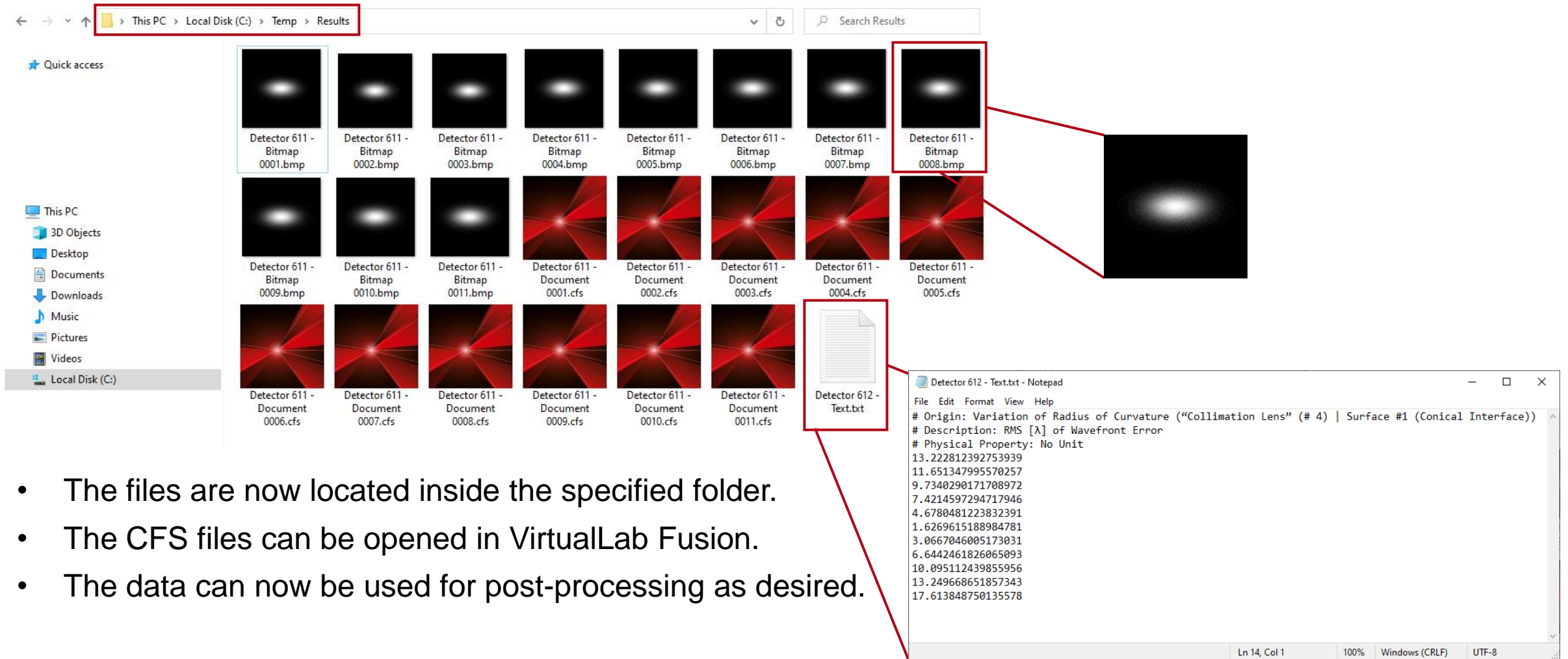
Ln 1 Ch 1

Run the Module

- After adapting the module, it can be executed (by clicking on *Go* in the *Module* tab or by pressing F5).
- In the pop-up dialog, please choose the desired Parameter Run (as shown below).
- The details of the export process are logged in the *Messages* information panel (normally at the bottom of the VirtualLab Fusion window).



Exported Results



The screenshot shows a Windows File Explorer window with the address bar set to 'This PC > Local Disk (C:) > Temp > Results'. The main area displays a grid of files. The files are organized into three rows: the first row contains eight 'Detector 611 - Bitmap' files (0001.bmp to 0008.bmp); the second row contains eight 'Detector 611 - Document' files (0009.bmp to 0011.bmp); and the third row contains six 'Detector 611 - Document' files (0006.cfs to 0011.cfs). A red box highlights the path 'This PC > Local Disk (C:) > Temp > Results'. Another red box highlights the file 'Detector 611 - Bitmap 0008.bmp', which is shown in a larger view to the right. A third red box highlights the file 'Detector 612 - Text.txt', which is shown in a Notepad window to the right. The Notepad window displays the following text:

```
# Origin: Variation of Radius of Curvature ('Collimation Lens' (# 4) | Surface #1 (Conical Interface))
# Description: RMS [λ] of Wavefront Error
# Physical Property: No Unit
13.222812392753939
11.651347995570257
9.7340290171708972
7.4214597294717946
4.6780481223832391
1.6269615188984781
3.0667046005173031
6.6442461826065093
10.095112439855956
13.249668651857343
17.613848750135578
```

- The files are now located inside the specified folder.
- The CFS files can be opened in VirtualLab Fusion.
- The data can now be used for post-processing as desired.

Document Information

title	Export of Results of a Parameter Run
document code	MISC.0064
document version	1.1
software version	2021.1 (Build 1.180)
software edition	VirtualLab Fusion Basic
category	Application Use Case
further reading	<ul style="list-style-type: none">- <u>How to Work with the C# Module and Example</u>- <u>Usage of the Parameter Run Document</u>- <u>Tolerancing with Random Distributions using the Programmable Mode of the Parameter Run</u>