Global Explorer 2 Application Note

Global Explorer 2 (GE2) is the extended system of Global Explorer (GE) which is implemented into OSLO to utilize an "Escape Function Global Optimization" invented by Dr. Masaki Isshiki. Global Explorer 2 (GW2) has been implemented into OSLO Premium (Release 7.0.2) as a set of CCL routines.

Capability of GE2

- "Angle" operands can be added on the existing error function and the optimization process on Escape Function with "Angle" operand can be executed.
- "Angle" operand is defined as the RMS of the incident and refractive angles of the chief and marginal rays for axial field and edge field at every surface in a rotationally optical system.
- "Angle" operand can be considered for every configuration (zoom position) of the optical system.

CCL files for Global Explore 2

Two CCL files are included to run GE2:
Angle_Rms.ccl ･･･ "Angle" command is included. "Angle" command adds an "Angle" operand to the existing error function.
Optim_ge2.ccl ･･･ "GE2"command is included. "GE2"command executes the optimization process of the Escape Function for a user-defined set of global optimizations on the system selected.

Installation

1) First copy the two provided CCL files, Angle_RMS.ccl and Optim_g2.ccl files into the **c:\Program Files (X86)\OSLO 7 Premium/PrivateFolderMasterCopy\private\ccl** folder of OSLO Premium (7.0.2). You will need Administrator privilege to copy the files.

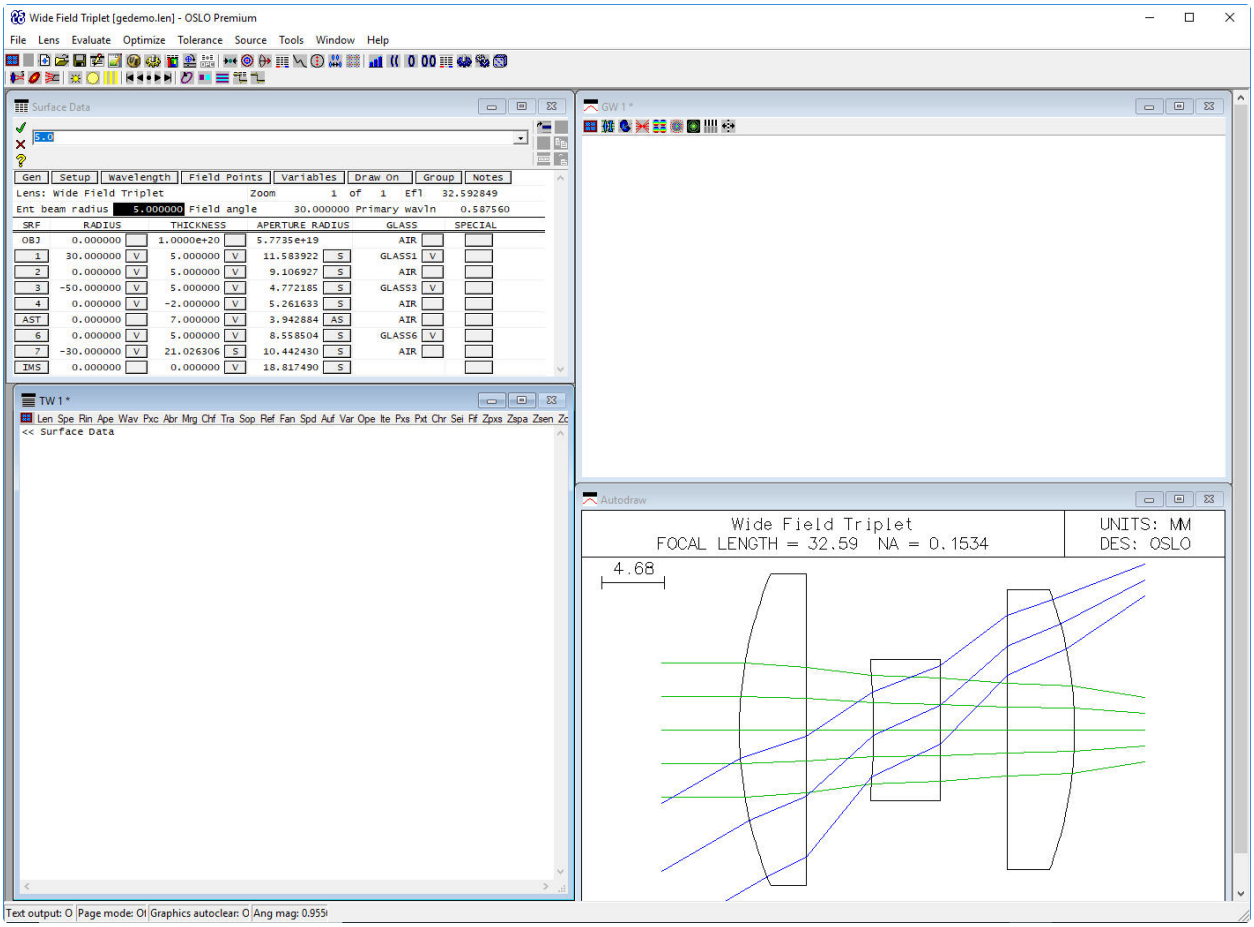
2) Start an OSLO session if it is not currently running.

3) Re-compile the private ccl library by clicking on the  icon on the OSLO main toolbar.

4) The following message is printed if the above compilation is successfully ended.
*CCL COMPILATION MESSAGES:
No errors detected

An example of using GE2

1) Open the lens “gedemo.len” from the Public\len\demo\premium folder.

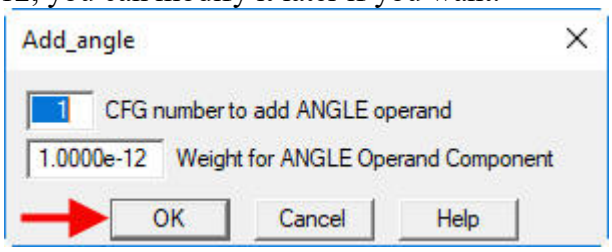


2) Now issue an “OPE” command on the command line to confirm the current error function as follows.

>> ope

```
*OPERANDS
 OP   MODE   WGT      NAME          VALUE   %CNTRB DEFINITION
O  7   M    0.250000 Yrms1        0.028588    0.21 RMS
O 16   M    0.500000 Xrms2        0.201845   20.47 RMS
O 25   M    0.500000 Yrms2        0.287626   41.57 RMS
O 34   M    0.125000 Xrms3        0.277410    9.67 RMS
O 43   M    0.125000 Yrms3        0.454192   25.92 RMS
O 50   M    0.125000 CHRrms1      0.041813    0.22 RMS
O 59   M    0.500000 CHRrms2      0.038057    0.73 RMS
O 68   M    0.125000 CHRrms3      0.028267    0.10 RMS
O 72 M        --                  7.070081     --  PL(4,20,1,5)+PL(4,20,1,6)
O 79 M        --                  6.322051     --  PL(4,21,1,5)+PL(4,21,1,6)
O 83 M    10.000000               -0.010533    1.12 PU+0.142875
MIN RMS ERROR:      0.027429
```

3) Run the “Angle” CCL Command by entering Angle in the command line and hitting the enter key, this will execute the Angle CCL. The Add Angle Menu dialog should now be displayed and you can specify the CFG number, enter a 1 as shown below. ‘Weight’ may be left as the default 1e-12, you can modify it later if you want.



If you click the **[OK]** button in the dialog, the “Angle” operand is added to the existing error function. In the text window, you can see the ray data which is used to calculate the “Angle” operand.

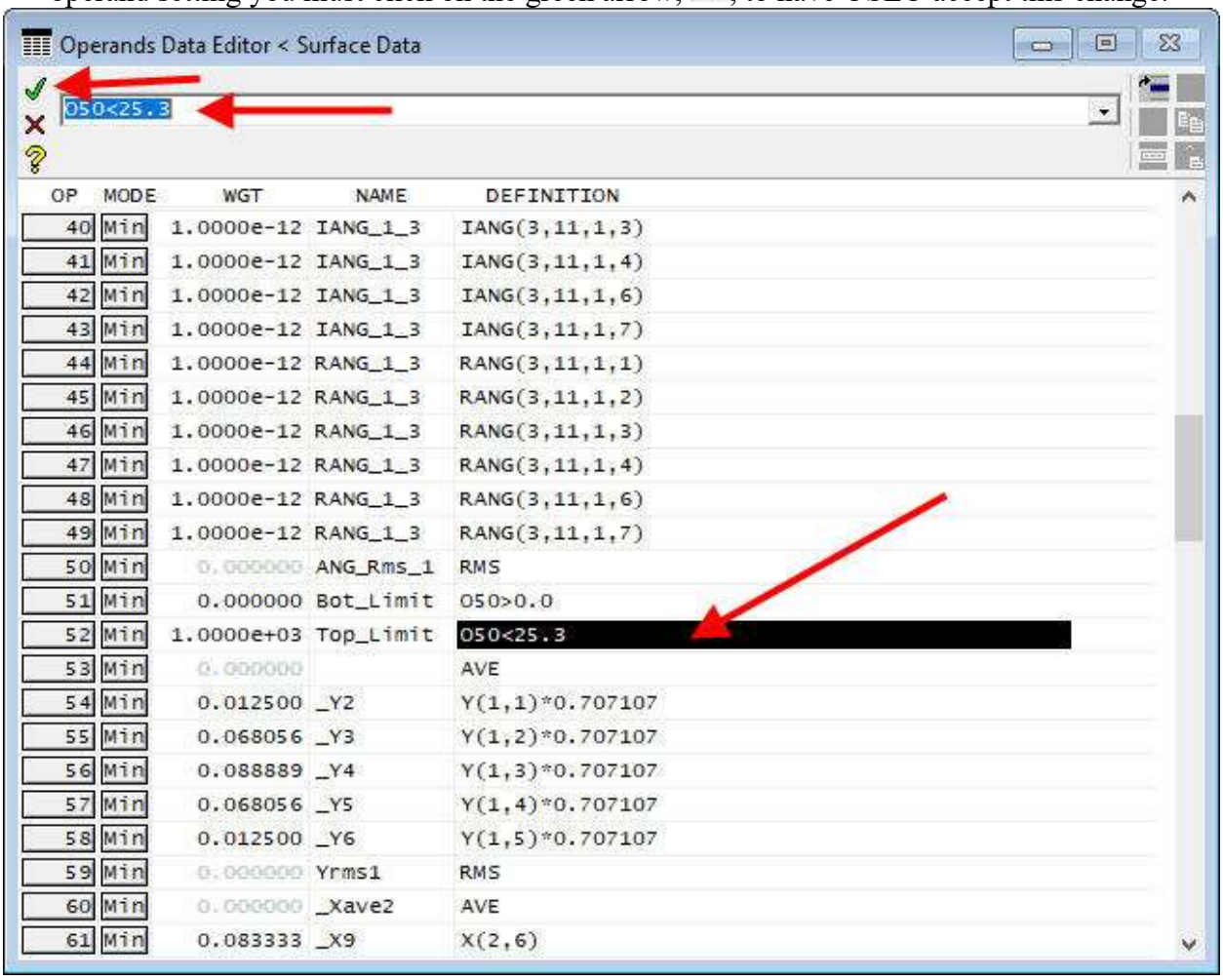
```
*** Selected On-Axis Fpt ***
 FPT   CFG   FBY   FBX       FY1       FY2       FX1       FX2
   1     0  0.00  0.00  -1.00000   1.00000  -1.00000   1.00000
*** Selected On-Axis Ray ***
 Ray    TYP         FY        FX
R  5  Ordinary   1.00000   0.00000

*** Selected Off-Axis Fpt ***
 FPT   CFG   FBY   FBX       FY1       FY2       FX1       FX2
   3     0  1.00  0.00  -0.80000   0.80000  -0.80000   0.80000
*** Selected Off-Axis Ray ***
 Ray    TYP         FY        FX
R  5  Ordinary   1.00000   0.00000
R 11  Ordinary   0.00000   1.00000
R 12  Ordinary  -1.00000   0.00000
]
```

4) You can confirm the ANGLE operand by using the “ope” command.

>> ope

```
*OPERANDS
 OP  MODE    WGT        NAME          VALUE     %CNTRB   DEFINITION
O 50  M   4.8000e-11   ANG_Rms_1    25.499454    0.00   RMS
O 51  M      --        Bot_Limit        --        --    O50>0.0
O 52  M   1.0000e+03   Top_Limit        --        --    O50<90.0
O 59  M   0.250000     Yrms1          0.028588    0.21   RMS
O 68  M   0.500000     Xrms2          0.201845   20.47   RMS
O 77  M   0.500000     Yrms2          0.287626   41.57   RMS
O 86  M   0.125000     Xrms3          0.277410    9.67   RMS
O 95  M   0.125000     Yrms3          0.454192   25.92   RMS
O 102 M   0.125000     CHRrms1        0.041813    0.22   RMS
O 111 M   0.500000     CHRrms2        0.038057    0.73   RMS
O 120 M   0.125000     CHRrms3        0.028267    0.10   RMS
O 124 M     --                       7.070081     --   PL(4,20,1,5)+PL(4,20,1,6)
O 131 M     --                       6.322051     --   PL(4,21,1,5)+PL(4,21,1,6)
O 135 M  10.000000                  -0.010533    1.12  PU+0.142875
MIN RMS ERROR:     0.009374
```

5) Click the  icon on the main tool bar. The Operand Data Editor will open, you can now modify the target value, weight etc... For example, you can modify the "Top_Limit" operand (O50) to the value <25.3 as shown in the screen capture below. After you enter the new operand setting you must click on the green arrow,  , to have OSLO accept this change.



OP	MODE	WGT	NAME	DEFINITION
40	Min	1.0000e-12	IANG_1_3	IANG(3,11,1,3)
41	Min	1.0000e-12	IANG_1_3	IANG(3,11,1,4)
42	Min	1.0000e-12	IANG_1_3	IANG(3,11,1,6)
43	Min	1.0000e-12	IANG_1_3	IANG(3,11,1,7)
44	Min	1.0000e-12	RANG_1_3	RANG(3,11,1,1)
45	Min	1.0000e-12	RANG_1_3	RANG(3,11,1,2)
46	Min	1.0000e-12	RANG_1_3	RANG(3,11,1,3)
47	Min	1.0000e-12	RANG_1_3	RANG(3,11,1,4)
48	Min	1.0000e-12	RANG_1_3	RANG(3,11,1,6)
49	Min	1.0000e-12	RANG_1_3	RANG(3,11,1,7)
50	Min	0.000000	ANG_Rms_1	RMS
51	Min	0.000000	Bot_Limit	O50>0.0
52	Min	1.0000e+03	Top_Limit	O50<25.3
53	Min	0.000000		AVE
54	Min	0.012500	_Y2	Y(1,1)*0.707107
55	Min	0.068056	_Y3	Y(1,2)*0.707107
56	Min	0.088889	_Y4	Y(1,3)*0.707107
57	Min	0.068056	_Y5	Y(1,4)*0.707107
58	Min	0.012500	_Y6	Y(1,5)*0.707107
59	Min	0.000000	Yrms1	RMS
60	Min	0.000000	_Xave2	AVE
61	Min	0.083333	_X9	X(2,6)

6) Now enter an "Ope" command in the command window to verify that the (o52) has been changed to 25.3.

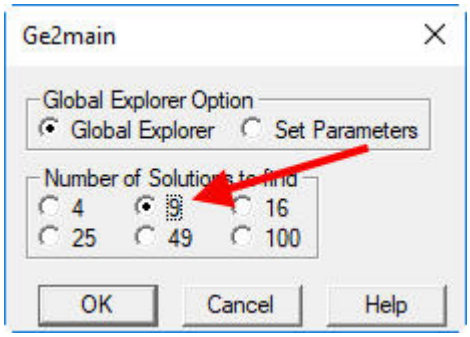
>> ope

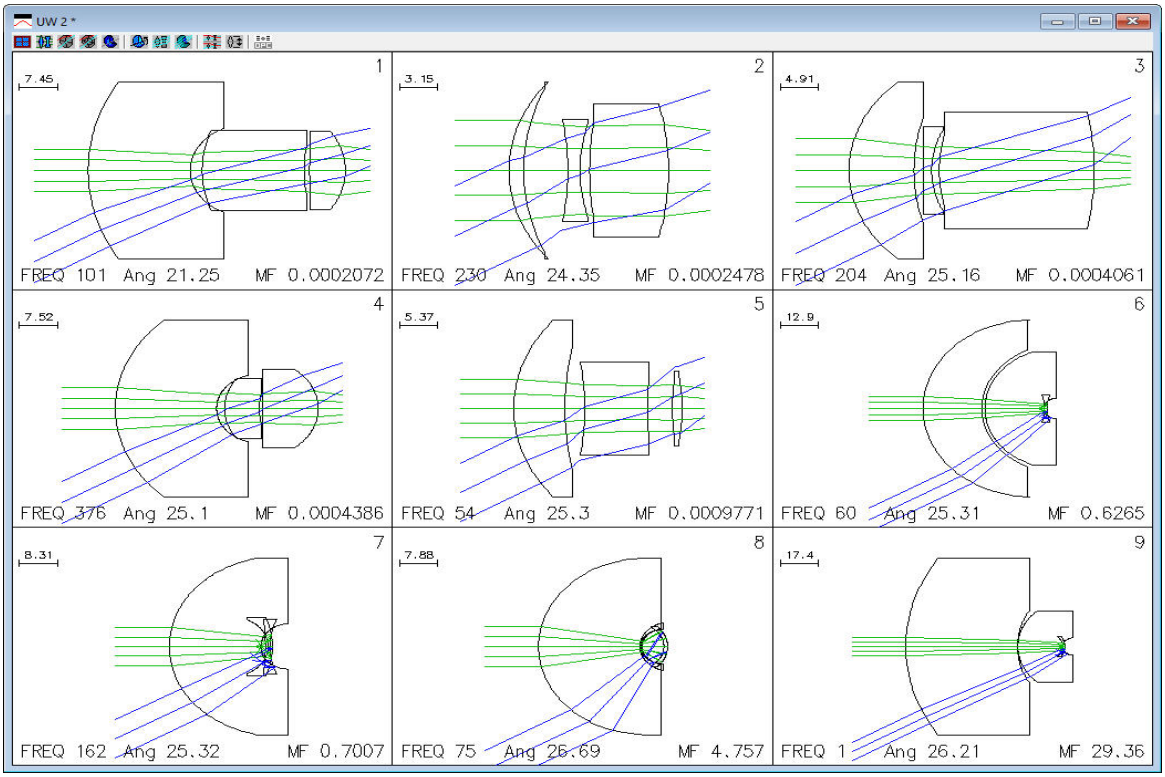
```
*OPERANDS
 OP   MODE     WGT        NAME          VALUE   %CNTRB DEFINITION
O 50   M     4.8000e-11 ANG_Rms_1   25.499454    0.00 RMS
O 51   M       --       Bot_Limit        --       --  O50>0.0
O 52   M     1.0000e+03 Top_Limit    0.199454   99.75 O50<25.3
O 59   M     0.250000   Yrms1        0.028588    0.00 RMS
O 68   M     0.500000   Xrms2        0.201845    0.05 RMS
O 77   M     0.500000   Yrms2        0.287626    0.10 RMS
O 86   M     0.125000   Xrms3        0.277410    0.02 RMS
O 95   M     0.125000   Yrms3        0.454192    0.06 RMS
O 102  M     0.125000   CHRrms1      0.041813    0.00 RMS
O 111  M     0.500000   CHRrms2      0.038057    0.00 RMS
```

```
O 120 M     0.125000    CHRrms3      0.028267    0.00 RMS
O 124 M     --                       7.070081     --  PL(4,20,1,5)+PL(4,20,1,6)
O 131 M     --                       6.322051     --  PL(4,21,1,5)+PL(4,21,1,6)
O 135 M    10.000000                -0.010533    0.00 PU+0.142875
MIN RMS ERROR:      0.187678
```

7) **Run "GE2" command.**

To run the Global Explorer 2, enter GE2 in the command line. The G2main dialog will appear. Select the number of solutions to find, 9 is a good start and click on the [OK] button to start the optimization process. Results are displayed in the Lens spread sheet and graphics window, it may take some time to find all 9 results so do not expect immediate answers especially when selecting higher number of solutions above 16.





The GE2 user guide was originally authored by Dr. Seiichi Kaneko and Dr. Masaki Isshiki, it has been updated to the OSLO 7.0.2 revision by Lambda Research Corporation.