

This file presents a procedure to test PyRFTL installation https://gitlab.unistra.fr/opm_tools/pyrftl

As detailed in the installation procedure, it is possible to modify the opticalglass package to access more Schott materials. The case in which this package is modified is referred to as *Schott.py is modified*, and the other case as *Schott.py is not modified*.

The test directory contains:

- This pdf file
- *lensesTest* directory, which contains lenses files in CodeV .seq format. These lenses do not exist.
- *analysis_noschottmodification_sysI* which are the results of system I analysis for lenses of lensesTest, when Schott.py is not modified
- *analysis_schottchange_sysI* which are the results of system I analysis for lenses of lensesTest, when Schott.py is modified
- *more test* which contains other test results (see below)

Please notice that a small difference in the last digits on numbers with a high number of significant digits can exist and is not a problem.

csv files can be opened with several software for easy reading, like Excel, LibreOffice, OnlyOffice or the Python Pandas package.

Table of contents

Initial test	2
Additional tests	5

Initial test

Lenses for the test are in **lensesTest** directory

Installation without Schott.py modification in opticalglass package:
Remove **test_oldschott.seq** lens from the folder

Run **gui_main.py**

On home page, select **pair selector**

Fill parameters as follow:

The screenshot shows the PyRFTL GUI with the 'Pair Selector' window active. The window title is 'PyRFTL gui'. The main title is 'Pair Selector' with a subtitle 'please fill parameters'. There are several sections for parameter input:

- Lenses import parameters:** A text box for 'Select lenses directory' is set to 'C:/example/lensesTest'. An arrow points to this box with the label 'Path of lensesTest folder'.
- Effective focal length and diameter parameters:** Fields for 'Diameter min [mm]', 'Diameter max [mm]', 'Effective focal length min [mm]', and 'Effective focal length max [mm]' are present. There is also an 'Advanced parameters' toggle.
- Select below effective focal length, entrance pupil diameter and cut-off angle parameters for the tube lens:** This section has three tabs: 'define parameters manually' (selected), 'remote refocus', and 'only one infinity corrected objective'. Fields for 'Desire effective focal length [mm]' (162.4), 'Desire entrance pupil diameter [mm]' (6.5), and 'Cut-off angle [°]' (4.2) are shown.
- Select here wavelengths to use in the analysis:** A list of wavelengths (486.1327 nm, 587.5618 nm, 656.2725 nm) with checkboxes for 'ref' and 'Remove' buttons.
- Select here configurations of lenses orientations to use:** A list of configurations (Config A, B, C, D) with checkboxes and labels like 'inf () img'.
- Define here distances between main surfaces of pairs:** Fields for 'Minimal distance between lenses [mm]', 'Maximal distance between lenses [mm]', 'Minimal distance ffp -> pair [mm]', 'Maximal distance ffp -> pair [mm]', 'Minimal back focal distance [mm]', and 'Maximal back focal distance [mm]'.
- Save results parameters:** A 'Select save directory' field is set to 'C:/example'. An arrow points to this box with the label 'Path of the directory where results should be returned'.
- Analysis name:** A text box containing 'PyRFTL_date_time'.
- Advanced export parameters** and **Advanced computing settings** toggles are at the bottom.
- A 'Start analysis' button is at the bottom left.

Select **Start analysis**

Wait until computations are done.

A result page is displayed at the end of computations.

PyRFTL gui

PyRFTL UI Scaling: 100% Appearance Mode: Light cancel transparency

Results are exported in :
C:/[redacted]analysis_oldschott

pair : 0_2_A : test_newschott.seq -> test_ohara_2.seq config A
cut-off angle : 8.6° rms grid 64 : 0.0466 waves

Change pair

List sequential model :

	r	t	medium	mode	zdr	sd
Obj:	0.000000	1.000000e+10	air		1	0.0000
Stop:	0.000000	0.000000	air		1	3.2500
2:	0.000000	77.6561	air		1	3.2500
3:	400.000000	4.000000	SF2		1	25.0000
4:	90.000000	11.0000	N-BK7		1	25.0000
Test:	-100.000000	132.792	air		1	25.0000
6:	400.000000	4.000000	S-TIM22		1	25.0000
7:	100.000000	9.000000	S-BL7		1	25.0000
Test:	-170.000000	39.5049	air		1	25.0000
Img:	0.000000	0.000000			1	0.15357

wavelengths information :
central wavelength= 587.5618 nm
wavelength (weight) = 587.5618 (1.000)*, 486.1327 (1.000), 656.2725 (1.000)

First order properties :

efl	162.4
f	162.4
f'	162.4
ffl	-2.842e-14
ppl	162.4
bfl	39.5
ppk	-122.9
pp_sep	-46.85
E/#	24.00

Ray diagram Wavefront Save pair .roa

Check that you can display wavefront and ray tracing diagrams (depending on your Python IDE configuration, results can be in the Figure tab instead or in new windows):

WavefrontConfig

Please select parameters for wavefront.

Field angle [°] 4.2

Grid side size 64

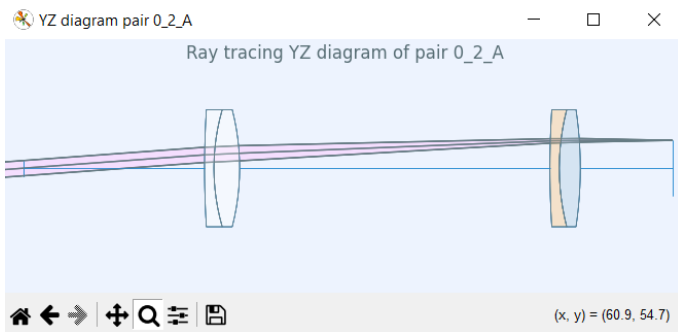
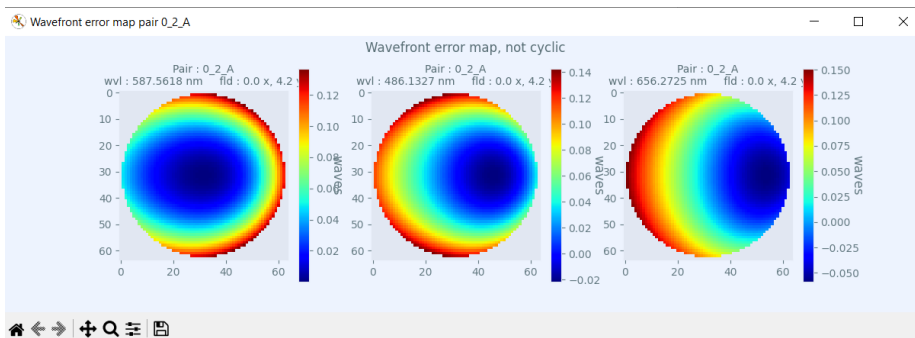
☐ Display cyclic 1 wave

☒ Best RMS focus for angle [°] 0

Best focus polychromatic reference wavelength

Polychromatic RMS formula rms

Start



Installation without Schott.py modification in opticalglass package:

Compare the returned csv file with **analysis_noschottmodification/analysis_noschottmodification.csv**

Installation with Schott.py modification in opticalglass package:

Use **change_pair** button to observe a pair with **test_oldschott.seq** lens. Pair short name can be found in the returned csv file.

For example, if **3_3_A** is **test_oldschott->test_oldschott_config_A** we get:

PyRFTL gui

PyRFTL UI Scaling: 100% Appearance Mode: Light cancel transparency

Results are exported in : C:\analysis_oldschott

pair : 3_3_A : test_oldschott.seq -> test_oldschott.seq config A

cut-off angle : 8.1° rms grid 64 : 0.0691 waves

Change pair

List sequential model :

	r	t	medium	mode	zdr	sd
Obj:	0.000000	1.000000e+10	air		1	0.0000
Stop:	0.000000	0.000000	air		1	3.2500
2:	0.000000	100.032	air		1	3.2500
3:	500.000000	5.000000	F3		1	25.0000
4:	100.000000	10.0000	BK7		1	25.0000
Test:	-150.000000	80.4417	air		1	25.0000
6:	500.000000	5.000000	F3		1	25.0000
7:	100.000000	10.0000	BK7		1	25.0000
Test:	-150.000000	106.776	air		1	25.0000
Img:	0.000000	0.000000			1	0.10342

wavelengths information :
central wavelength= 587.5618 nm
wavelength (weight) = 587.5618 (1.000)*, 486.1327 (1.000), 656.2725 (1.000)

First order properties :

efl	162.4
f	162.4
f'	162.4
ffl	0
ppl	162.4
bfl	106.8
ppk	-55.62
pp_sep	-7.55
z/zs	na na

Ray diagram Wavefront Save pair .roa

Go down with mouse wheel and check if glass materials are correct:

```
===== LENS 1 START =====
INTERFACE 3 :
transmit
profile: Spherical
c=0.002, r=500.0
surface_od=25.0
```

```

ca: radius=25.0
ca: radius=25.0

GAP 3 :t=5.0;    medium: F3, Schott
rindex of medium for wvl 587.5618 nm is : 1.6129309887478114
rindex of medium for wvl 486.1327 nm is : 1.624612269899057
rindex of medium for wvl 656.2725 nm is : 1.608063989636603

INTERFACE 4 :
transmit
profile: Spherical
c=0.01,    r=100.0
surface_od=25.0
ca: radius=25.0
ca: radius=25.0

GAP 4 :t=10.0;    medium: BK7, Schott
rindex of medium for wvl 587.5618 nm is : 1.5168000345005885
rindex of medium for wvl 486.1327 nm is : 1.5223762897312285
rindex of medium for wvl 656.2725 nm is : 1.5143223472613747

INTERFACE 5 :
Test: transmit
profile: Spherical
c=-0.006666666666666667,    r=-150.0
surface_od=25.0
ca: radius=25.0
ca: radius=25.0
===== LENS 1 END =====

```

Installation with Schott.py modification in opticalglass package:

Compare the returned csv file with **analysis_schottchange/analysis_schottchange.csv**

Test is done.

Additional tests

If needed, additional tests can be done with more lenses. (If modify PyRFTL for example, and wanted to check with more lenses...)

A first test can be done with finite distance before the pair. With parameters of system V (see next page) and with lenses of lensesTest. Then compare the results with the ones in **more test/analysis_schottchange_sysV** and **more test/analysis_noschottmodification_sysV**, depending on whether if Schott.py is changed or not.

For additional test, lenses from https://gitlab.unistra.fr/opm_tools/lenses have to be downloaded

Results are done for system I in A configuration for OptoSigma lenses, and for system V in B configuration with Thorlabs lenses.

Results are identical with or without Schott.py modification, as lenses are with new materials.

PyRFTL
UI Scaling: 100%
Appearance Mode: Light
cancel transparency

Pair Selector

please fill parameters

Lenses import parameters

Lenses can be in format Zemax .zmx, CodeV .seq or RayOptics .roa

Select lenses directory
C:/example/lensesTest

Diameter min [mm]: float
Diameter max [mm]: float

Effective focal length min [mm]: float
Effective focal length max [mm]: float
Advanced parameters

Select below effective focal length, entrance pupil diameter and cut-off angle parameters for the tube lens.

define parameters manually
remote refocus
only one infinity corrected objective

Desire effective focal length [mm]: 180
Desire entrance pupil diameter [mm]: 6.8

Cut-off angle [°]: 4.2

Select here wavelengths to use in the analysis.

Wavelength to add [nm]: float

Add wavelength

486.1327 nm ref Remove
587.5618 nm ref Remove
656.2725 nm ref Remove

Select here configurations of lenses orientations to use.

☒ Config A
inf |) img
☒ Config B
inf | (| img
☒ Config C
inf | (| img
☒ Config D
inf | (| img

Define here distances between main surfaces of pairs.

Minimal distance between lenses [mm]: float
Maximal distance between lenses [mm]: float

Minimal distance ffp -> pair [mm]: float
Maximal distance ffp -> pair [mm]: float

Minimal back focal distance [mm]: float
Maximal back focal distance [mm]: float

Advanced distances parameters

Distance from the aperture stop to the first lens of pair.
(The entering field rotate at the aperture position).

☐ distance is -front focal length (remote refocus case)
Distance [mm]: 58

Save results parameters.

Select save directory
C:/example

Analysis name: PyRFTL_date_time

Advanced export parameters

Advanced computing settings

Start analysis

Finite distance specification