

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 opticalglass package to access to more Schott materials. The case in which this package is modify is refered as Schott.py is modified and the other case as Schott.py is not modify.

The test directory contains:

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

Please notice that a small difference in 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 softwares for easy reading, like Excel, LibreOffice, OnlyOffice or Python Pandas package.

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Initial test

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

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

Launch **gui_main.py**

On home page, select **pair selector**

Fill parameters as follow:

The screenshot shows the PyRFTL GUI with the following configuration details:

- UI Scaling:** 100%
- Appearance Mode:** Light
- cancel transparency** button
- Pair Selector** section: please fill parameters
- Lenses import parameters:** Lenses can be in format Zemax .zmx, CodeV .seq or RayOptics .roa
- Select lenses directory:** C:/example/lensesTest (indicated by an arrow and the label "Path of lensesTest folder")
- Diameter min [mm]:** float
- Diameter max [mm]:** float
- Effective focal length min [mm]:** float
- Effective focal length max [mm]:** float
- Advanced parameters:** (toggle off)
- 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]:** 162.4
 - Desire entrance pupil diameter [mm]:** 6.5
 - Cut-off angle [°]:** 4.2
- Select here wavelengths to use in the analysis:**
 - Wavelength to add [nm]:** float
 - 486.1327 nm ref **Remove**
 - 587.5618 nm ref **Remove**
 - 656.2725 nm ref **Remove**
 - Add wavelength** button
- 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:** (toggle off)
- Save results parameters:**
 - Select save directory:** C:/example (indicated by an arrow and the label "Path of the directory where results should be returned")
 - Analysis name:** PyRFTL_date_time
 - Advanced export parameters:** (toggle off)
 - Advanced computing settings:** (toggle off)
- Start analysis** button

Select **Start analysis**

Wait until computations are done.

A result page is displayed at the end of computations

The screenshot shows the PyRFTL GUI interface. At the top, there are settings for 'UI Scaling' (100%) and 'Appearance Mode' (Light). A 'cancel transparency' button is visible on the right. The main content area displays the following information:

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-BSL 7		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
pp1	162.4
bfl	39.5
ppk	-122.9
pp_sep	-46.85
f/#	3.78

At the bottom, there are three buttons: 'Ray diagram', 'Wavefront', and 'Save pair .roa'.

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

The screenshot shows the 'WavefrontConfig' dialog box. It contains the following settings:

Please select parameters for wavefront.

Field angle [°]

Grid side size

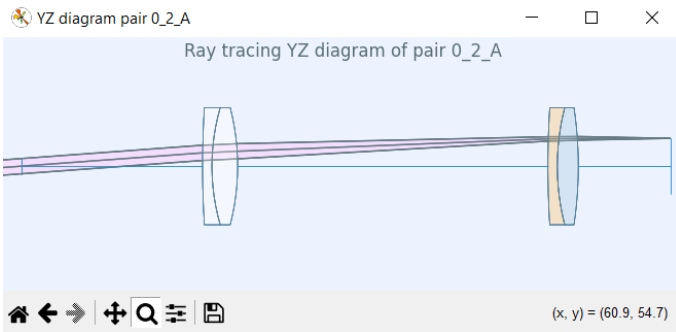
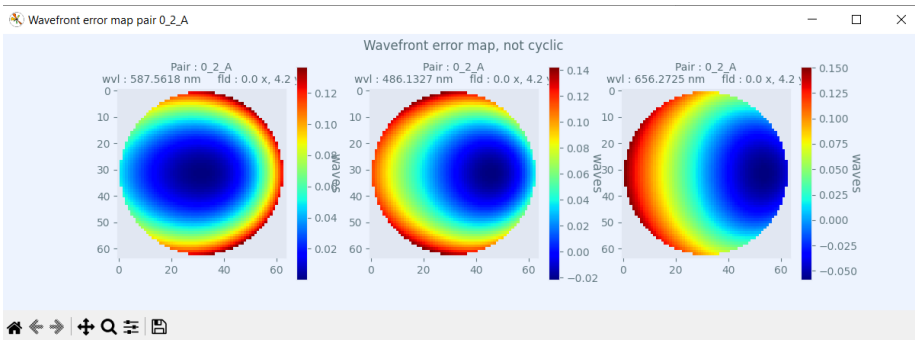
Display cyclic 1 wave

Best RMS focus for angle [°]

Best focus polychromatic

Polychromatic RMS formula

Start



Installation without Schott.py modification in opticalglass package:

Compare the returned csv file with `analysis_noschottmodification_sysl/analysis_noschottmodification_sysl.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:\[redacted]\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	5.00000	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	5.00000	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	0.00000	air		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/a 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_sysI/analysis_schottchange_sysI.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 lens. With parameters of system VI (see next page), and with lenses of lensesTest. Then compare with results depending if Schott package is changed or not, respectively in **more test/analysis_schottchange_sysVI** and **more test/analysis_noschottmodification_sysVI**

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 VI in B configuration with Thorlabs lenses. Remove thin lens pre-filter in *Advanced computing settings* tab.

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

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

Finite distance specification

Save results parameters. ?

Select save directory C:/example

Analysis name : sysVI

Advanced export parameters

Advanced computing settings

Start analysis