Internal Light Source-Mode Distribution

-ModeDistributionAnalyzerCmd.pyc

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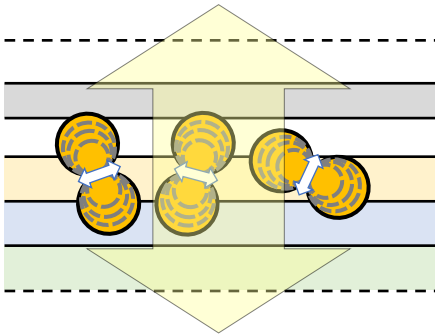


Objective

- For optical simulation in planar stacking structure, in this chapter, we'll show you how to construct the structure in the following simulation section and we'll also show you the schedule system in this software.

How to execute the calculator

python: windows
python3: mac, linux

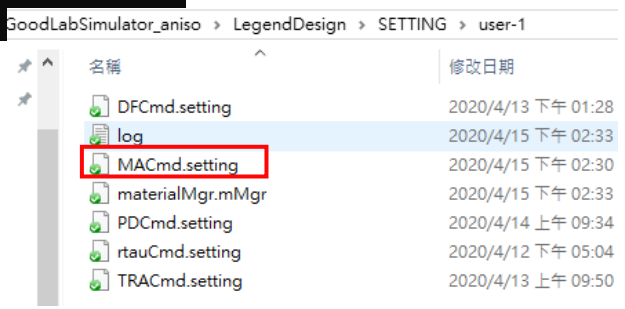
```
>python ModeDistributionAnalyzerCmd.py
```

Execution file

```
>>> Please insert username : user-1
```

Type user name

```
Mode Analyzer Setting is not built in ../../SETTING/user-1
Now saving the default mode analyzer setting.
>>> ?
```

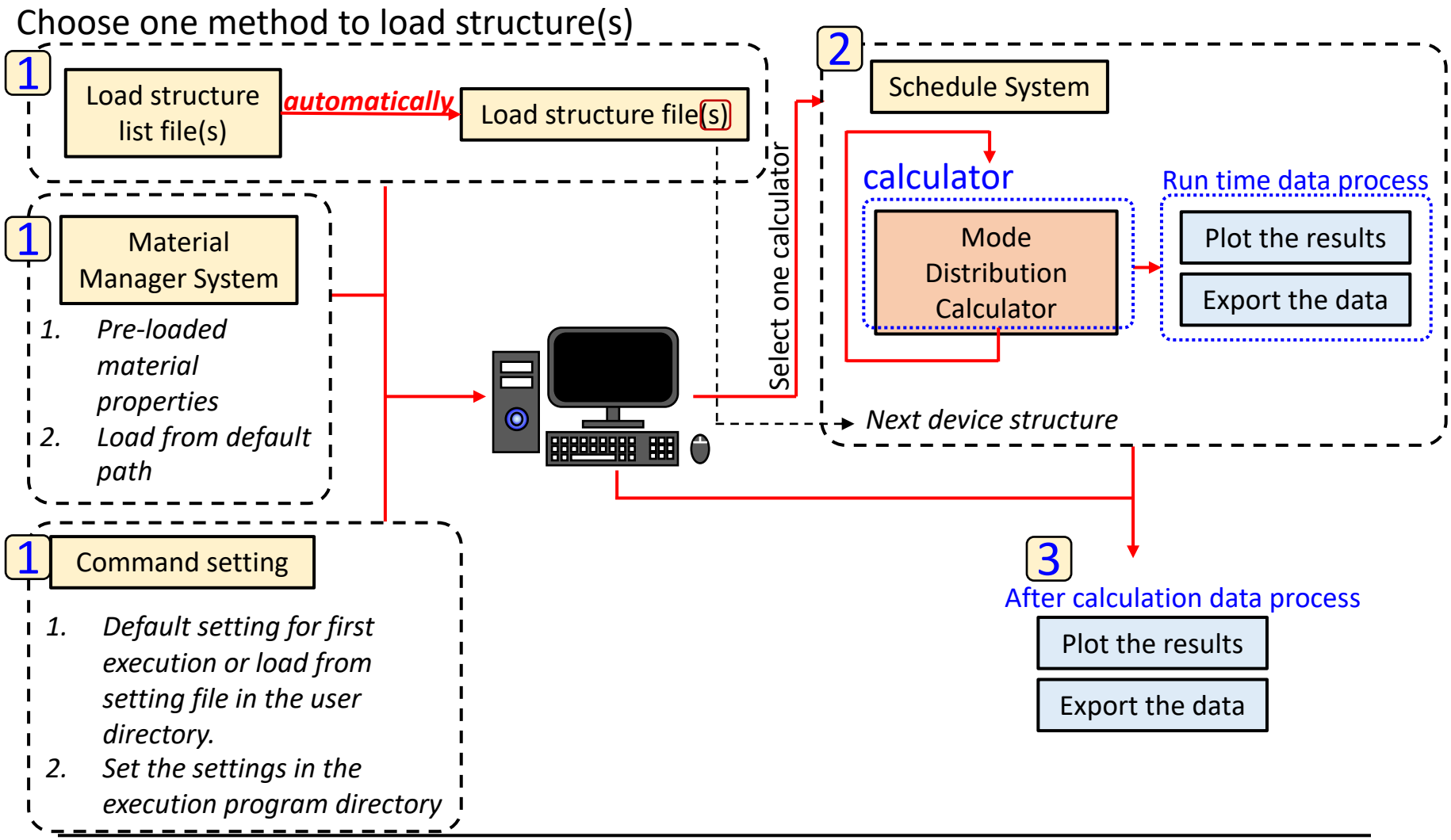


Help

```
>>> ?

User Control Command
=====================================
1. Settting Command:
changeUser              exit

Material Manager Command
=====================================
1. Settting Command:
printMgr                saveMgr

Structure/Structure List Command
=====================================
1. Structure List Command:
ReadStructListPath      ReadStructListName
SaveStructListPath      SaveStructListName
readStructList          saveStructList

2. Structure Command:
ReadStructPath          ReadStructName
SaveFilePath            SaveFileName
readStruct              deleteStruct

3. Print Information Command:
printStructInfo         printStructSettingInfo
printListInfo

4. Result Command:
ResultFilePath          ResultFileName
deleteResult
save_run_time_result_Bool
resetSN
```

```
Mode Distribution Analyzer Command
**** Check the integration parameters !!!
=====================================
1. Settting Command:
SettingFilePath         SettingFileName
setDefaultSetting       printMAInfo
loadMASETTING           saveMASETTING

2. Reference Purcell Factor Command:
ReferencePurcellFactorFilePath
ReferencePurcellFactorFileName
readRefPurcellFactor

3. Integration Parameters:
kkomax
tol                     recursivelimit
ptstart
printIntegrationInformation

4. Mode Distribution Calculation Function:
calModeDistribution

5. Plot Bool:
changefigshowBool

6. Run Time Bool:
runtime_plot

7. Mode Distribution Bool:
calStateVectorBool      writeSeparatePointsBool
writePurcellFactorQeffBool
writeModeRatioBool
writeStateVectorBool
calWVPurcellFactor      plotWVPurcellFactor
```

Calculating Workflow



Default Setting

```
>>> printMAInfo

Setting file path : ../../SETTING/user-1
Setting file name : MACmd.setting
The upper bound of kx/ko, ky/ko and kt/ko : 8.0
The integral tolerance : 0.001
The recursive limit of integral : 50
The inital points number when integration : 100
Reference Purcell factor file path : D:\Dropbox\GoodLabSimulator_aniso\LegendDesign\ori_src\Uptics\WaveUptics\SourceUptics\Data
Reference Purcell factor file name : AirPurcellFactor
Calculate state vector: False
Write separate points bool    : True
Write Purcell factor and qeff : True
Write Detailed mode ratio     : True
Write state vector            : True
Print integration information : False
Save Run Time Result  : True
Run Time Plot         : False

Figure Show Bool : True
```

Integration parameters

Reference Purcell Factor File

AirPurcellFactor.txt

	wavelength	PurcellFactor
2	0	1
3	10000	1

Calculate Power Density

Bottom-emitting OLED

sfile-1.txt

```
          MATERIAL                                  THICKNESS(nm)
               air                                          X
                Al                                   120.000000
               LiF                                     1.000000
           B3PYMPM                                          50
               CBP                                  20.000000
              TAPC                                          50
              cito                                          80
             glass                                          X

wavelength(nm) : 480.0:10.0:600.0
EML :
    Layerno                    : 5
    Position(nm)               : 10.000000
    ratio                      : 1.000000
    QY                         : 1.000000
    Fluorescence               : cbp_irppy2acac
    DOF                        : cbp_irppy2acac
```

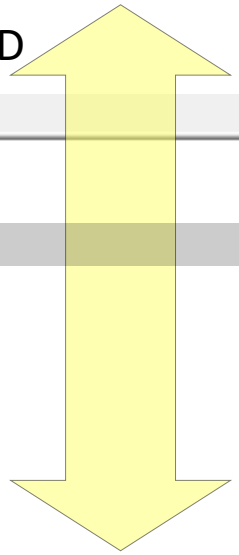
Thick metal

Integration wavelength

```
Name readfilename                readfilepath          savefilename                                savefile
 #s1  sfile-1-air.txt      ./Example/structure/Convention          sfile-1      ../../Example/MACmd/Convention/Conver
```

Calculate Power Density

Transparent/ Double-emitting OLED



sfile-1.txt | sfile-1.txt

```
          MATERIAL                    THICKNESS(nm)
               air                              X
                Al                        10:5:20
               LiF                       1.000000
            B3PYMPM                             50
               CBP                      20.000000
              TAPC                              20
              cito                              50
             glass                              X

wavelength(nm)  : 450:10:650.0
EML :
    Layerno                 : 5
    Position(nm)            : 10.000000
    ratio                   : 1.000000
    QY                      : 1.000000
    Fluorescence            : cbp_irppy2acac
    DOF                     : cbp_irppy2acac
```

Thin metal

Integration wavelength

Name	readfilename	readfilepath	savefilename	savefile
#Ts1	sfile-1-air.txt	./Example/structure/Transparent	sfile-1	../../Example/MACmd/Transpare

Calculate Mode Distribution

```
>>> changefigshowBool F

*** Unknown syntax: changefigshowBool F
>>> save_run_time_result_Bool F

>>> ReadStructListPath  ./Example/structure/Convention

>>> ReadStructListName  structureList-ModeAnalyzerCmd.txt

>>> readStructList

Now reading structure list file ./Example/structure/Convention\structureList-ModeAnalyzerCmd.txt
  No./Name         filename        savefilename  CommandID  Check                    readfilepath
-------------------------------------------------------------------------------------------------------------------
       #s1  sfile-1-air.txt             sfile-1        0.0      X  ./Example/structure/Convention  ../../Example/MACmd/Conv


Structure file reading...
-------------------------------------------------------------------------------------------
Now reading structure file ./Example/structure/Convention\sfile-1-air.txt

>>> ReadStructListPath  ./Example/structure/Transparent

>>> ReadStructListName  structureList-ModeAnalyzerCmd.txt

>>> readStructList

Now reading structure list file ./Example/structure/Transparent\structureList-ModeAnalyzerCmd.txt
  No./Name         filename        savefilename  CommandID  Check                    readfilepath
-------------------------------------------------------------------------------------------------------------------
      #Ts1  sfile-1-air.txt             sfile-1        0.0      X  ./Example/structure/Transparent  ../../Example/MACmd/Tra


Structure file reading...
-------------------------------------------------------------------------------------------
Now reading structure file ./Example/structure/Transparent\sfile-1-air.txt

>>> calStateVectorBool T
```

Calculate Mode Distribution

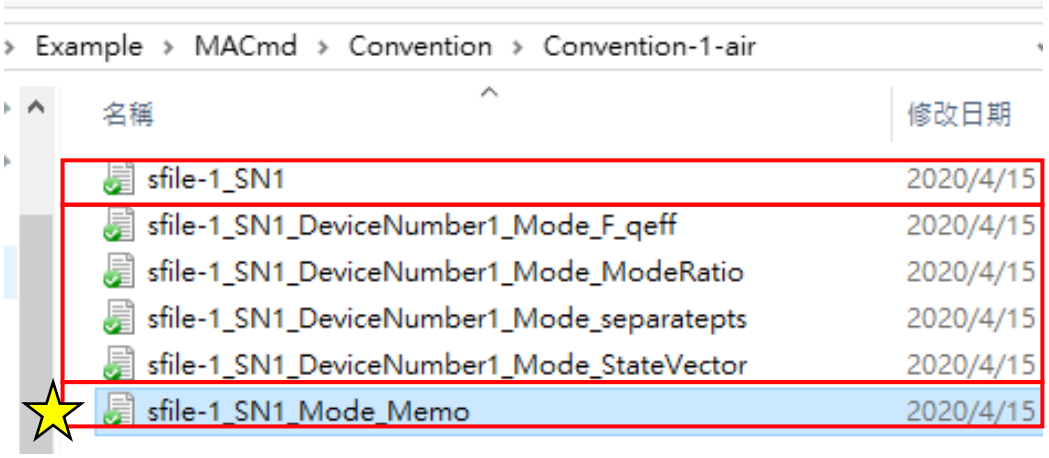
This would cost a lot of time for calculation.

```
>>> calStateVectorBool T
>>> printStructInfo

****************************************
Name: #s1
[#]   Material            Thickness(nm)
----------------------------------------
[1]   air                 X
[2]   Al                  120.0
[3]   LiF                 1.0
[4]   B3PYMPM             50.0
[5]   CBP                 20.0
[6]   TAPC                50.0
[7]   cito                80.0
[8]   glass               X
[9]   air                 X

wavelength(nm) : 480.00000:10.00000:600.00000

EML   Fluorescence    DOF             Position(nm)    PLQY            Ratio
-------------------------------------------------------------------------------
[5]   cbp_irppy2acac  cbp_irppy2acac  10.0            1.0             1.0
Device number : 1


****************************************
Name: #Ts1
[#]   Material            Thickness(nm)
----------------------------------------
[1]   air                 X
[2]   Al                  10.00000:5.00000:20.00000
[3]   LiF                 1.0
[4]   B3PYMPM             50.0
[5]   CBP                 20.0
[6]   TAPC                20.0
[7]   cito                50.0
[8]   glass               X
[9]   air                 X

wavelength(nm) : 450.00000:10.00000:650.00000

EML   Fluorescence    DOF             Position(nm)    PLQY            Ratio
-------------------------------------------------------------------------------
[5]   cbp_irppy2acac  cbp_irppy2acac  10.0            1.0             1.0
Device number : 3
```

Calculate Mode Distribution

```
>>> calModeDistribution

Now running structure (#1/#2) #s1 ...
Memo file exists. The simulation will continues
The number starts from 1.
¦Device-#1/#1¦(100%)>>>>>>>>>>>>>>>>>>>>¦Elapsed:0day(s)/0hr(s)/2min(s)/0sec(s)
Now running structure (#2/#2) #Ts1 ...
¦Device-#3/#3¦(100%)>>>>>>>>>>>>>>>>>>>>¦Elapsed:0day(s)/0hr(s)/10min(s)/11sec(s)
```

Data



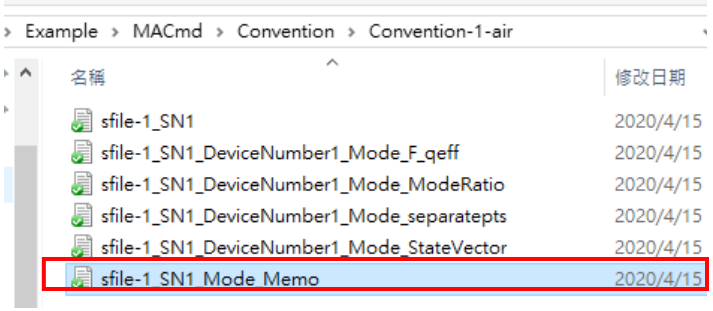
Copied Structure File

Detailed Data of Each Scan Parameter

Summarization File

Data

Bottom-emitting OLED



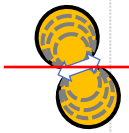
Structure

sfile-1_SN1_Mode_Memo - 記事本

檔案(F) 編輯(E) 格式(O) 檢視(V) 說明

Number	(1)air(nm)	(2)Al(nm)	(3)LiF(nm)	(4)B3PYMPM(nm)	(5)CBP(nm)	(6)TAPC(nm)	(7)cito(nm)	(8)glass(nm)	(9)air(nm)	Ave
1	X	120.00000	1.00000	50.00000	20.00000	50.00000	80.00000	X	X	2.08

MATERIAL	THICKNESS(nm)
air	X
Al	120.000000
LiF	1.000000
B3PYMPM	50
CBP	20.000000
TAPC	50
cito	80
glass	X
air	X



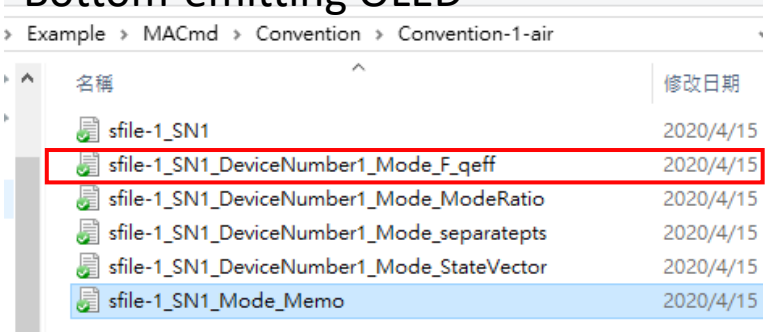
Important Simulation Results

Ave(F)	Ave(qeff)	OCpQY	OCnQY	Radiation	Substrate	Waveguided	SPP
2.08375	1.00000	0.00000	0.30744	0.30744	0.56063	0.40049	0.03888

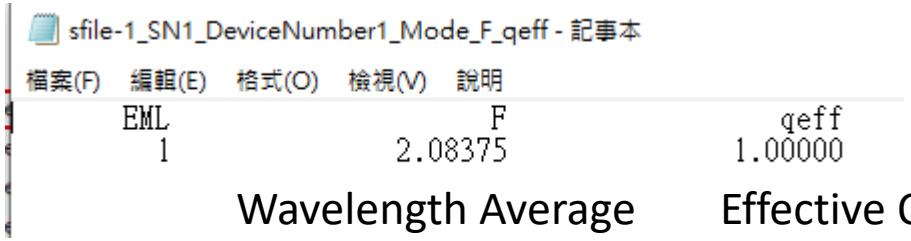
Wavelength Average Purcell Factor	Effective Quantum Efficiency	Outcoupling efficiency in the 1st semi-infinite material	Outcoupling efficiency in the last semi-infinite material	Total radiation efficiency. (OCpQY+ OCnQY)	Efficiency confined in the substrate /incoherence region.	Efficiency confined in the waveguide mode.	Efficiency confined in the surface plasma mode.

Data

Bottom-emitting OLED



Purcell Factor & Effective Quantum Efficiency

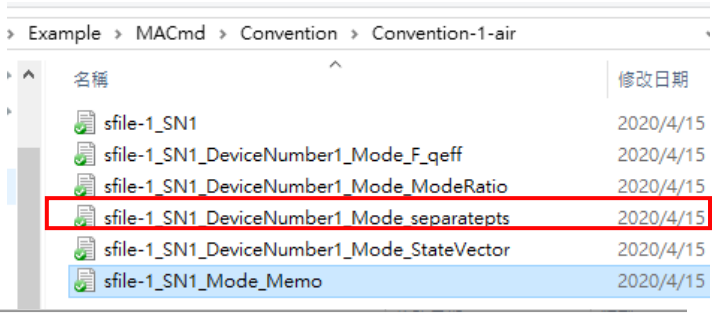


Wavelength Average Purcell Factor

Effective Quantum Efficiency

Data

Bottom-emitting OLED

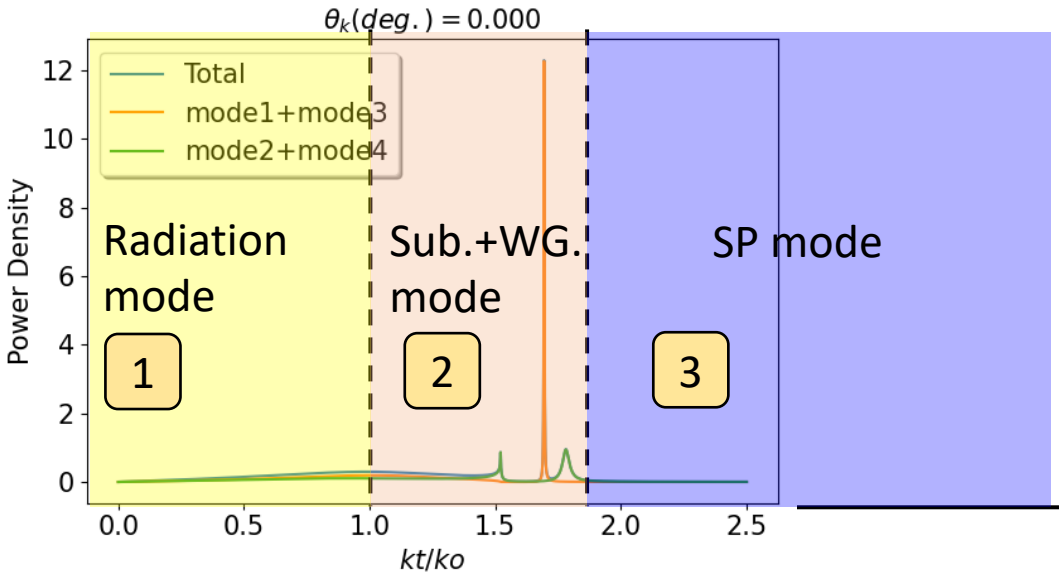


Integration Region

sfile-1_SN1_DeviceNumber1_Mode_separatepts - 記事本

檔案(F) 編輯(E) 格式(O) 檢視(V) 說明

wavelength(nm)		1		2		3	
480.000000	0.000000		1.000000		1.829914		8.000000
490.000000	0.000000		1.000000		1.823893		8.000000
500.000000	0.000000		1.000000		1.818632		8.000000
510.000000	0.000000		1.000000		1.813369		8.000000
520.000000	0.000000		1.000000		1.808530		8.000000
530.000000	0.000000		1.000000		1.804135		8.000000
540.000000	0.000000		1.000000		1.799954		8.000000
550.000000	0.000000		1.000000		1.795886		8.000000
560.000000	0.000000		1.000000		1.792143		8.000000
570.000000	0.000000		1.000000		1.788692		8.000000
580.000000	0.000000		1.000000		1.785700		8.000000
590.000000	0.000000		1.000000		1.782984		8.000000
600.000000	0.000000		1.000000		1.779276		8.000000



The integration area would correspond to the power of the mode.

Data

Bottom-emitting OLED

Example › MACmd › Convention › Convention-1-air

名稱	修改日期
sfile-1_SN1	2020/4/15
sfile-1_SN1_DeviceNumber1_Mode_F_qeff	2020/4/15
sfile-1_SN1_DeviceNumber1_Mode_ModeRatio	2020/4/15
sfile-1_SN1_DeviceNumber1_Mode_separatepts	2020/4/15
iceNumber1_Mode_StateVector	2020/4/15
de_Memo	2020/4/15

Mode TE TM

EML

Mode	Total	plus	minus	mode1+mode3	mode2+mode4
Total	1.00000	0.42139	0.55284	0.44078	0.55922
1	0.33050	0.10980	0.22072	0.17958	0.15092
2	0.62720	0.30501	0.32437	0.25778	0.36942
3	0.04230	0.00659	0.00774	0.00342	0.03888

Radiation
Sub+WG
SP

EMLp

Mode	Total	plus	minus	mode1+mode3	mode2+mode4
Total	0.43361	2.79777	-2.39041	0.15254	0.28106
1	0.01701	0.12158	-0.10457	0.00863	0.00838
2	0.37864	2.66843	-2.28473	0.14054	0.23809
3	0.03796	0.00776	-0.00111	0.00337	0.03459

EMLn

Mode	Total	plus	minus	mode1+mode3	mode2+mode4
Total	0.56639	-2.37638	2.94325	0.28823	0.27816
1	0.31349	-0.01179	0.32529	0.17095	0.14254
2	0.24857	-2.36343	2.60910	0.11724	0.13133
3	0.00434	-0.00117	0.00885	0.00005	0.00429

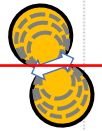
Semip

Mode	Total	plus	minus	mode1+mode3	mode2+mode4
Total	0.00000	0.00000	0.00000	0.00000	0.00000
1	0.00000	0.00000	0.00000	0.00000	0.00000
2	0.00000	0.00000	0.00000	0.00000	0.00000
3	0.00000	0.00000	0.00000	0.00000	0.00000

Semin

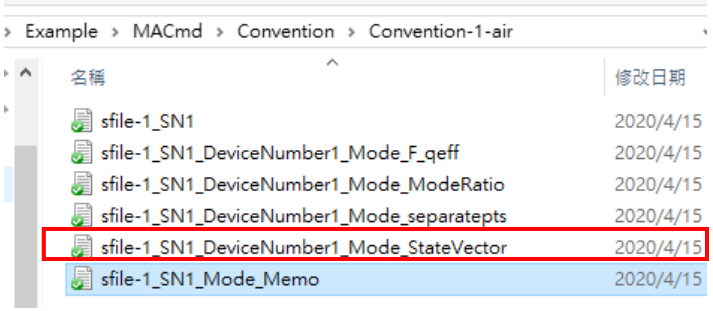
Mode	Total	plus		2+mode4
Total	0.56063	0.00000		0.27355
1	0.31343	0.00000		0.14252
2	0.24720	0.00000		0.13104
3	0.00000	0.00000		0.00000

MATERIAL	THICKNESS(nm)
air	X
Al	120.000000
LiF	1.000000
B3PYMPM	50
CBP	20.000000
TAPC	50
cito	80
glass	X
air	X



Data

Bottom-emitting OLED



sfile-1_SN1_DeviceNumber1_Mode_StateVector - 記事本

檔案(F) 編輯(E) 格式(O) 檢視(V) 說明

1 2 3

Total

LayerNum	1	2	3
1	0.30780	0.00000	0.00000
2	0.30780	-0.00000	0.00000
3	0.00000	0.00000	0.00000

plus

LayerNum	1	2	3
1	0.00000	0.00000	0.00000
2	-0.04075	-2.62183	0.00000
3	0.00000	0.00000	0.00000

minus

LayerNum	1	2	3
1	0.30780	0.00000	0.00000
2	0.34856	2.62183	0.00000
3	0.00000	0.00000	0.00000

TE

mode1+mode3

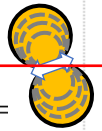
LayerNum	1	2	3
1	0.16638	0.00000	0.00000
2	0.16638	-0.00000	0.00000
3	0.00000	0.00000	0.00000

TM

mode2+mode4

LayerNum	1	2	3
1	0.14142	0.00000	0.00000
2	0.14142	0.00000	0.00000
3	0.00000	0.00000	0.00000

MATERIAL	THICKNESS(nm)
air	X
Al	120.000000
LiF	1.000000
B3PYMPM	50
CBP	20.000000
TAPC	50
cito	80
glass	X
air	X



Exit

Exit the material manager system.
*** The material manager system would be automatically saved into the user's setting directory.

```
>>> exit
------------------------------------------------------------------------------------------
End running GOODLAB anisotropic simulator ver1.0 Wed Apr 15 15:13:45 2020
Elapsed time : 0 day(s)/ 0 hr(s)/ 12 min(s)/ 11.903586149215698 sec(s)
------------------------------------------------------------------------------------------
```