Example 1. To construct a forest scene

Purpose: Following this manual, you can construct a 3D forest scene based on the given 3D tree model. You can find a file named "birch.obj", which is a 3D tree model with the "obj" type.

1. Open the LESS, and the main window appears (**Figure 1**).

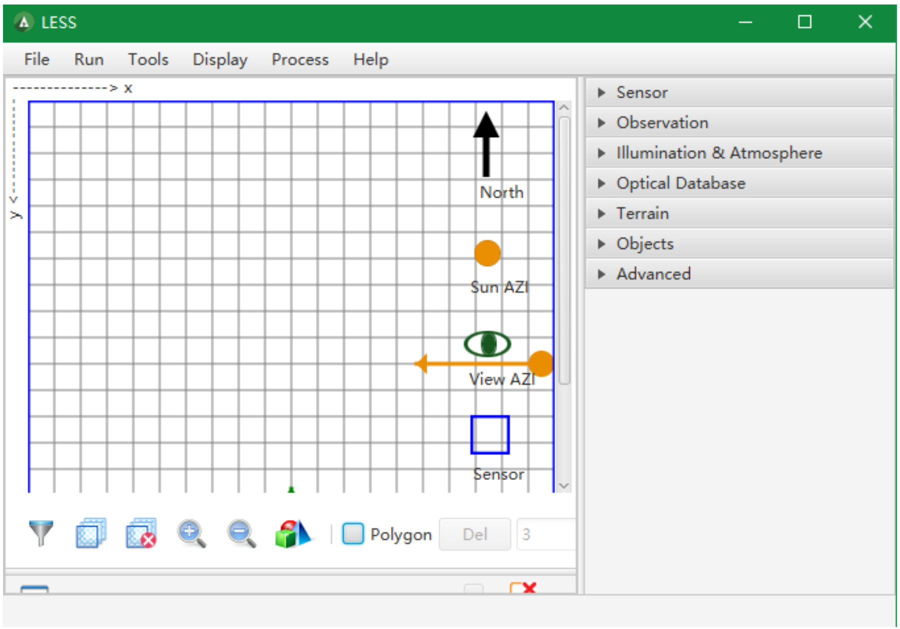


Figure 1. Main window

2. Create a new simulation by choosing [File] -> [New Simulation], then create new folder and select it. If create a simulation successfully, you can see "Succeed: 'save path'" in Progress Panel (**Figure 2**).

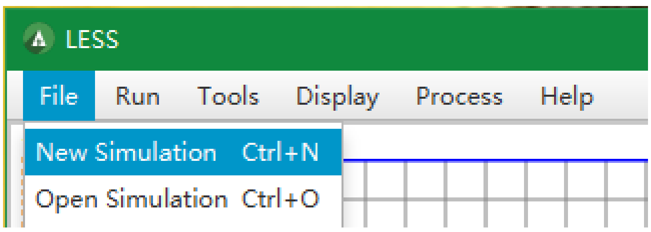


Figure 2. Create a new simulation

3. Define optical models in [Optical Database] in Parameter Control Panel (**Figure 3**).

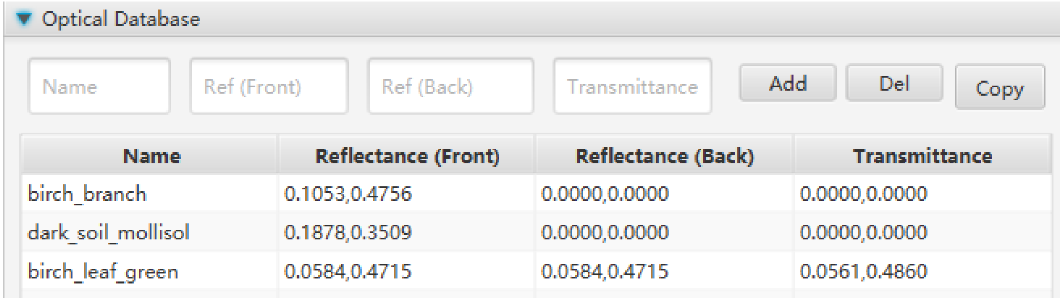


Figure 3. Define optical models

4. Set terrain parameters by default in [Terrain] in Parameter Control Panel (**Figure 4**).

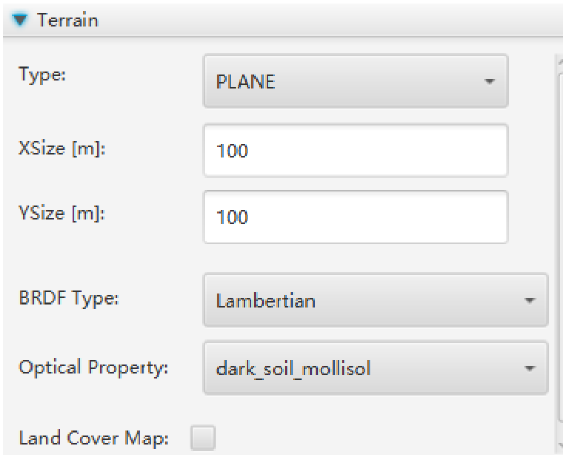


Figure 4. Set terrain parameters

5. Input tree models and define their positions in [Objects] in Parameter Control Panel.

   5.1 Input tree models by clicking [Define Object],

      5.1.1 Enter the name of tree object in the pop-up window, such as "birch". After clicking [Add] button, "birch" will appear in the Objects list (**Figure 5**).

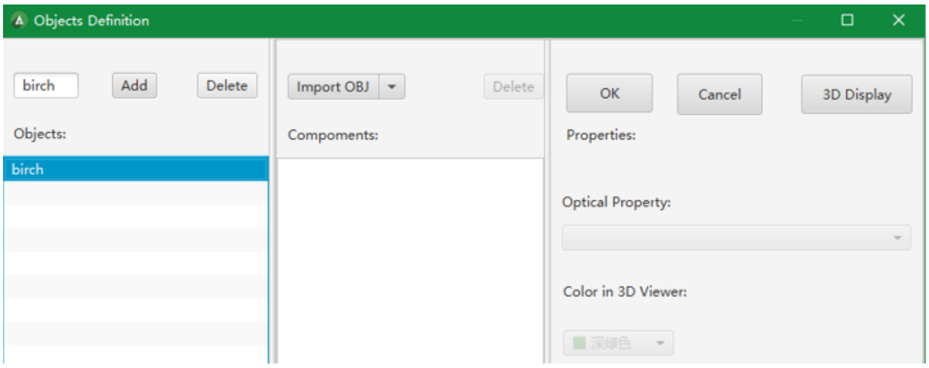


Figure 5. Name the obj

5.1.2 Selecting the name we write in "Objects" area, the button [Import OBJ] is activated. Click the [Import OBJ], then choose the obj file in the pop-up window and input it as the object. the units of the model is saved as "m", so the scale should be 1.00.

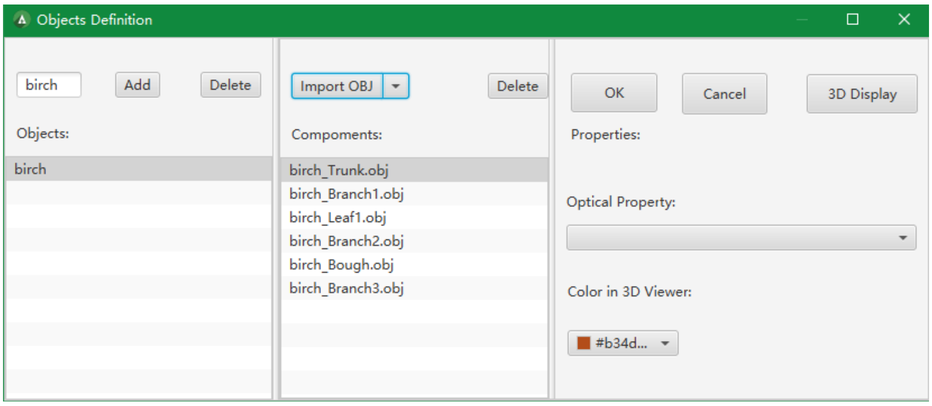


Figure 6. Input the obj

5.1.3 Select one of the components to active [Optical Property], then choose an optical property for the selected component.

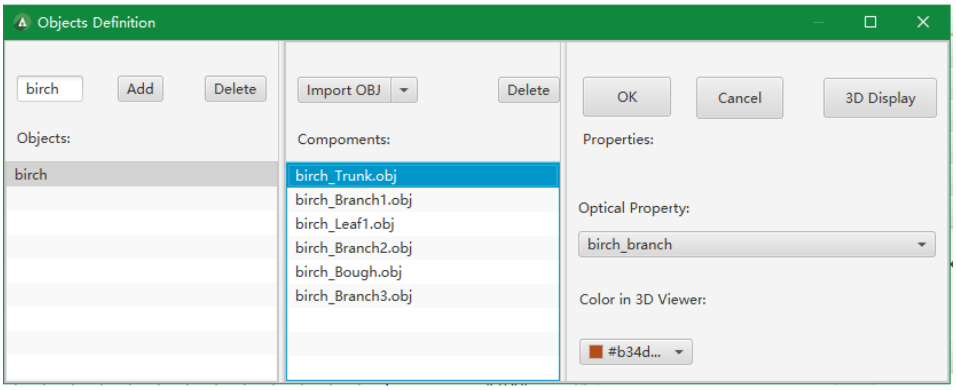


Figure 7. Choose optical properties

5.2 Define positions of tree model

Choose the tree models, then click [Random]. Enter "5" in [minimum distance], click [OK] (**Figure 8**). The positions of the model will display in Preview Panel (**Figure 9**).

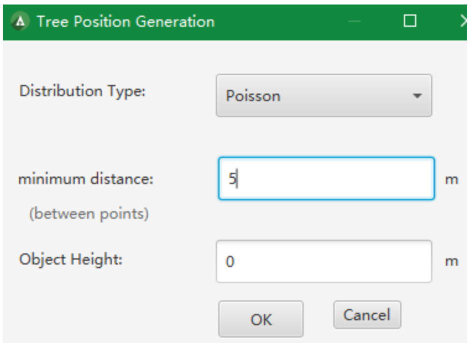


Figure 8. Define the position of obj

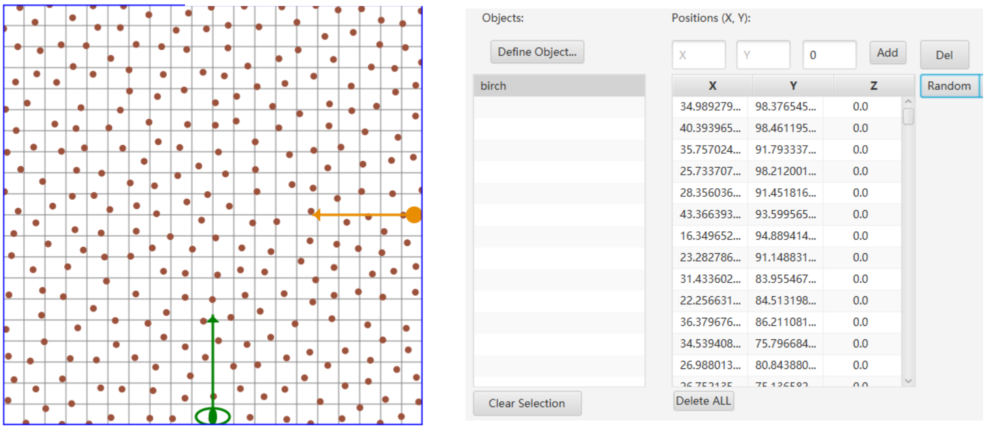


Figure 9. Show the position

6. View and check the 3D scene. Click [] in the back of Preview Panel.

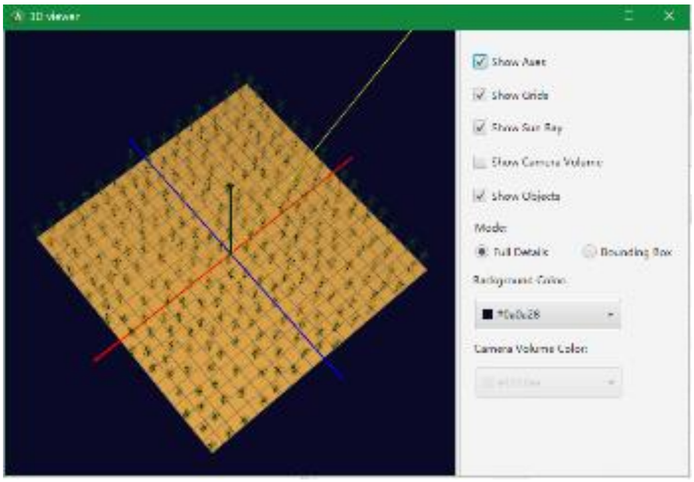


Figure 10. 3D scene

Example 2. To simulate BRF of the scene

Purpose: BRF of the scene can be simulated based on the constructed 3D scene using the LESS

1. Set sensor parameters by default in [Sensor] in Parameter Control Panel.

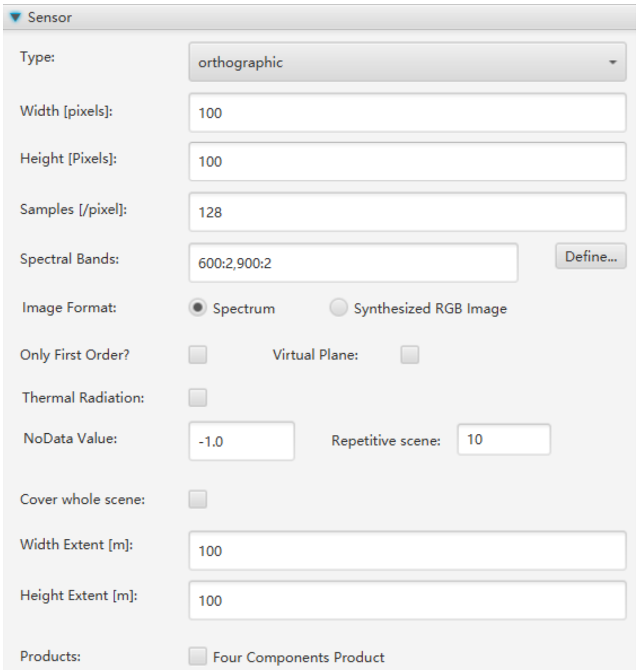


Figure 11. Sensor parameter

2. [Observation] and [Illumination & Atmosphere] settings remain the default.

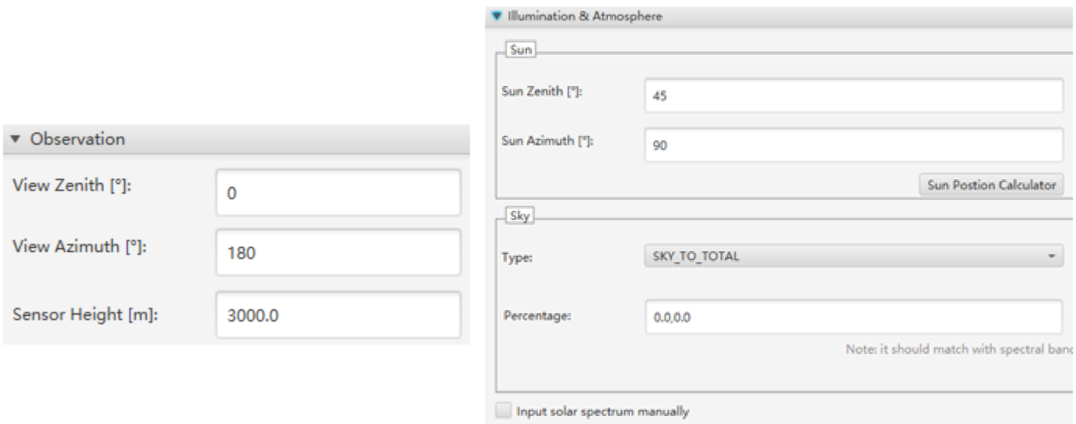


Figure 12. Observation and illumination &atmosphere setting

3. Run this program by choosing [Run] -> [Run all]. The result is radiance image.

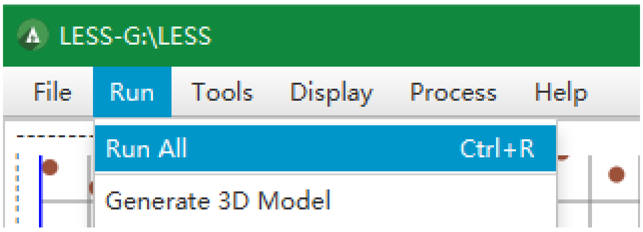


Figure 13. Run the program

4. Generate BRF image by choosing [Process] -> [BRF Processing].

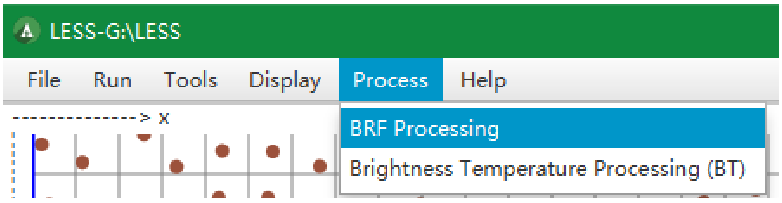


Figure 14. Generate BRF image

5. View the generated results by choosing [Tools] -> [Open Results Folder] (**Figure 14**). The file named "spectral_VZ=0_VA=180" is the radiance image. And the file named "spectral_VZ=0_VA=180_BRF" is the BRF image. You can open them by ENVI.

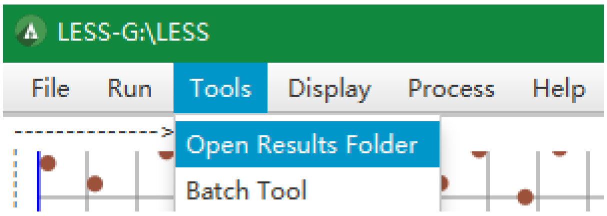


Figure 15. Open results folder

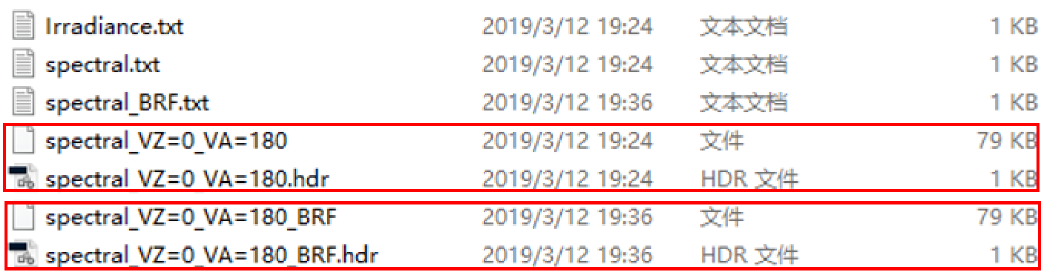


Figure 15. Results

Example 3. To calculate the layered FPAR

Purpose: the layered FPAR of the forest scene can be calculated based on the constructed 3D forest scene using the LESS.

1. Set sensor parameters. Change [Type] to "PhotonTracing". Check [Fpar] in [Products]. Input the initial position and end positions of height layers and width of each layer in [Layer definition].

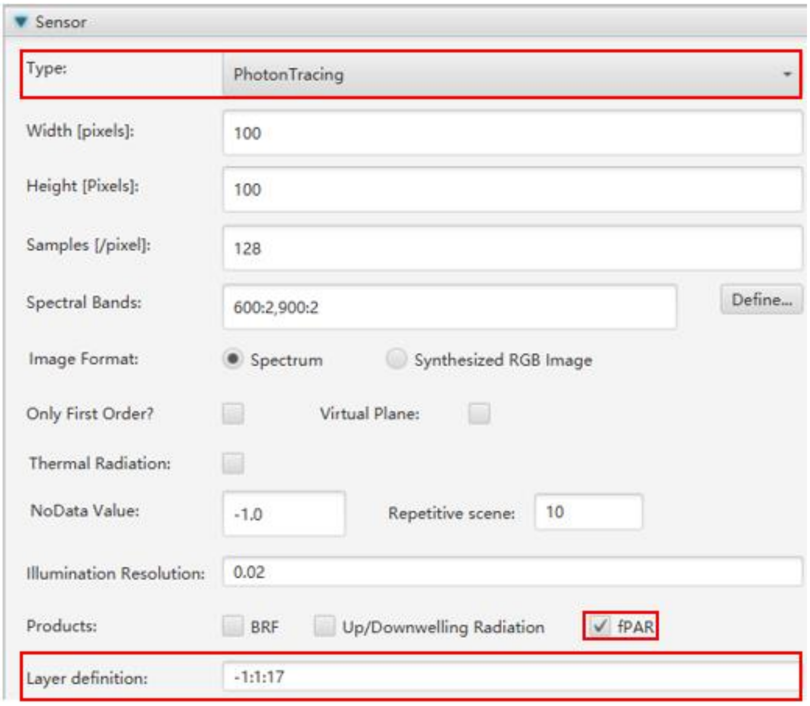
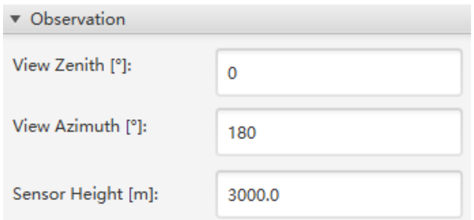


Figure 16. Sensor parameter

2. [Observation] and [Illumination & Atmosphere] settings remain the default.



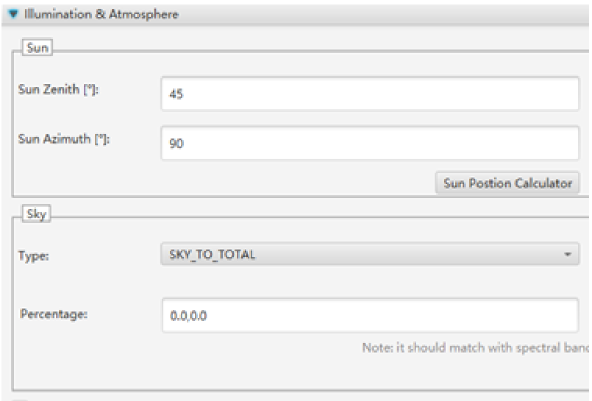


Figure 17. Observation and illumination &atmosphere setting

3. Run this program by choosing Run -> Run all.

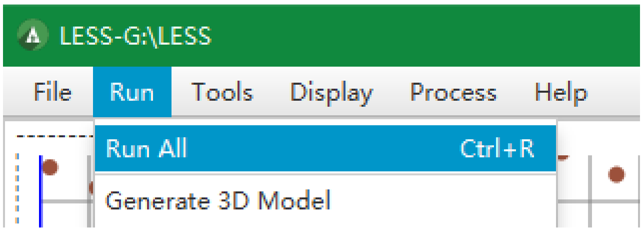


Figure 18. Run the program

4. View the generated results by choosing [Tools] -> [Open Results Folder] (**Figure 14**). The file named “photontracing_0_02_Layer_fPAR.txt” is the fPAR in different height layers and component.

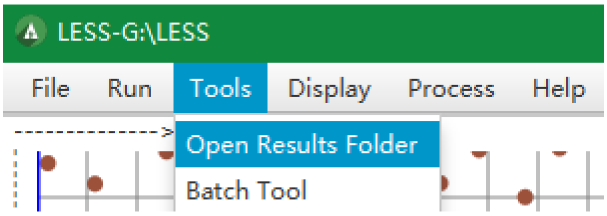
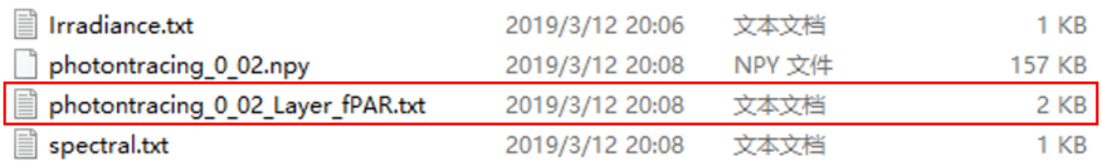
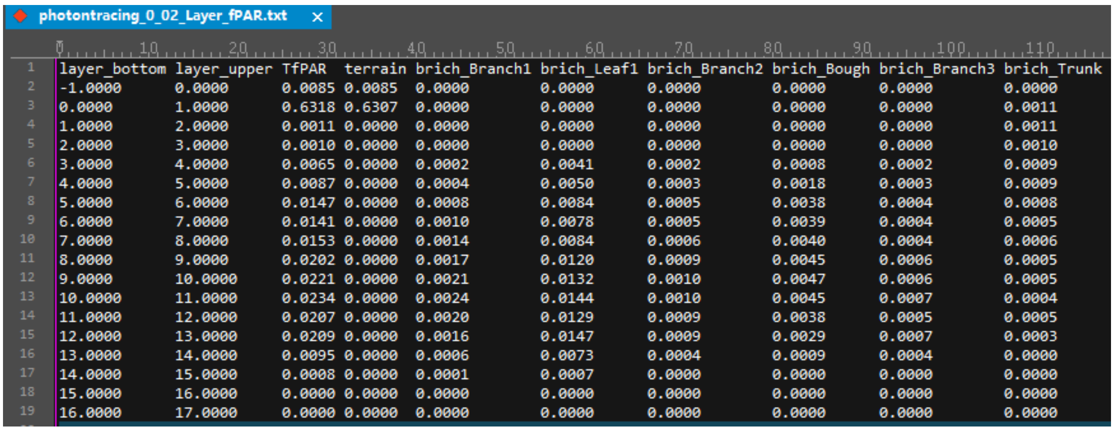


Figure 19. Open results folder



Irradiance.txt	2019/3/12 20:06	文本文档	1 KB
photontracing_0_02.npy	2019/3/12 20:08	NPY 文件	157 KB
photontracing_0_02_Layer_fPAR.txt	2019/3/12 20:08	文本文档	2 KB
spectral.txt	2019/3/12 20:08	文本文档	1 KB

Figure 20. Results



layer_bottom	layer_upper	TfPAR	terrain	brich_Branch1	brich_Leaf1	brich_Branch2	brich_Bough	brich_Branch3	brich_Trunk
-1.0000	0.0000	0.0085	0.0085	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	1.0000	0.6318	0.6307	0.0000	0.0000	0.0000	0.0000	0.0000	0.0011
1.0000	2.0000	0.0011	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0011
2.0000	3.0000	0.0010	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0010
3.0000	4.0000	0.0065	0.0000	0.0002	0.0041	0.0002	0.0008	0.0002	0.0009
4.0000	5.0000	0.0087	0.0000	0.0004	0.0050	0.0003	0.0018	0.0003	0.0009
5.0000	6.0000	0.0147	0.0000	0.0008	0.0084	0.0005	0.0038	0.0004	0.0008
6.0000	7.0000	0.0141	0.0000	0.0010	0.0078	0.0005	0.0039	0.0004	0.0005
7.0000	8.0000	0.0153	0.0000	0.0014	0.0084	0.0006	0.0040	0.0004	0.0006
8.0000	9.0000	0.0202	0.0000	0.0017	0.0120	0.0009	0.0045	0.0006	0.0005
9.0000	10.0000	0.0221	0.0000	0.0021	0.0132	0.0010	0.0047	0.0006	0.0005
10.0000	11.0000	0.0234	0.0000	0.0024	0.0144	0.0010	0.0045	0.0007	0.0004
11.0000	12.0000	0.0207	0.0000	0.0020	0.0129	0.0009	0.0038	0.0005	0.0005
12.0000	13.0000	0.0209	0.0000	0.0016	0.0147	0.0009	0.0029	0.0007	0.0003
13.0000	14.0000	0.0095	0.0000	0.0006	0.0073	0.0004	0.0009	0.0004	0.0000
14.0000	15.0000	0.0008	0.0000	0.0001	0.0007	0.0000	0.0000	0.0000	0.0000
15.0000	16.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
16.0000	17.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Figure 21. photontracing_0_02_Layer_fPAR.txt