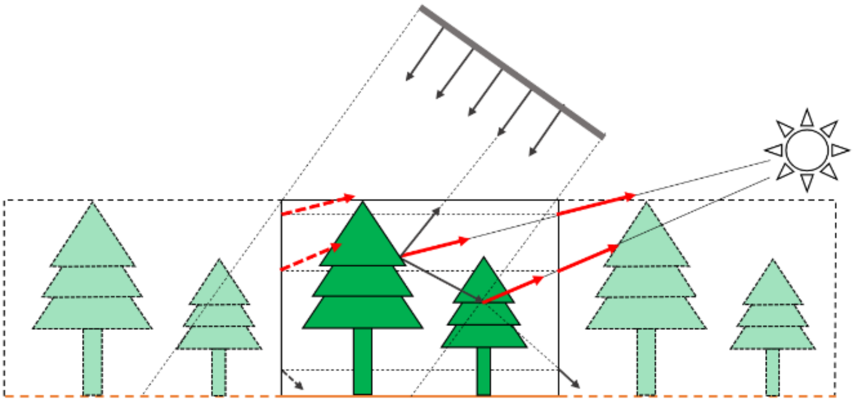
LESS Example Document

Version 1.8.8



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Example 0. Forest scene construction

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**).

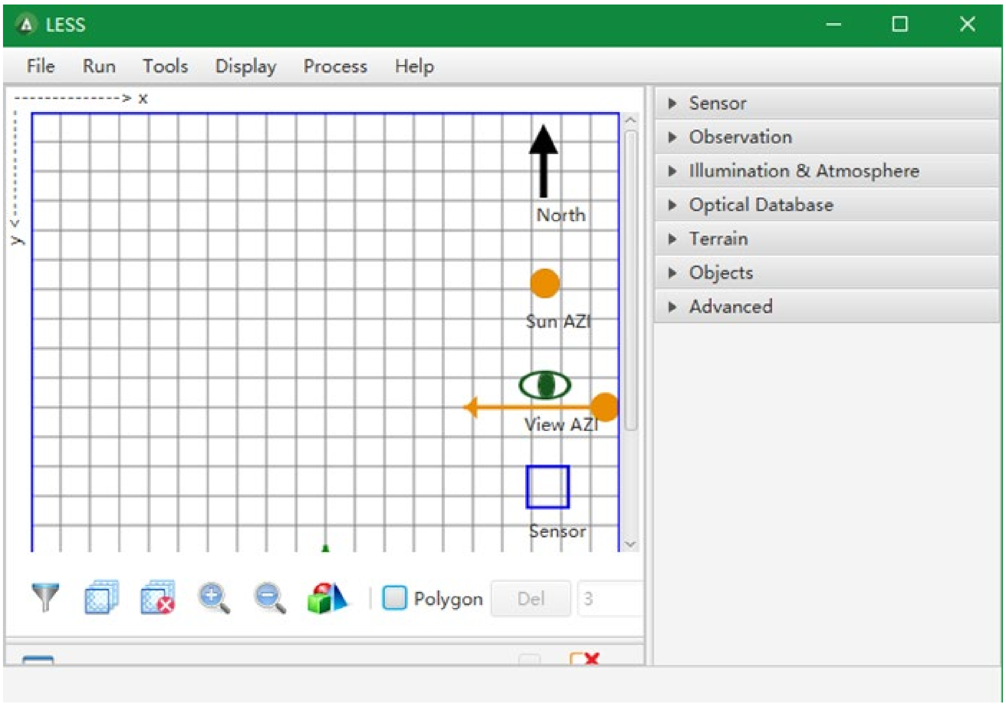


Figure 1. Main window

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**).

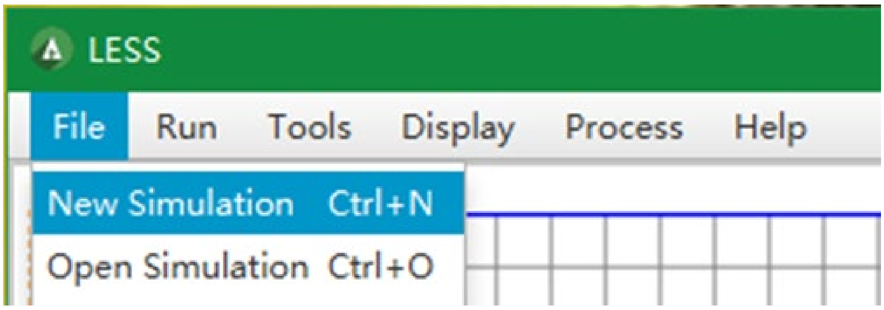


Figure 2. Create a new simulation

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

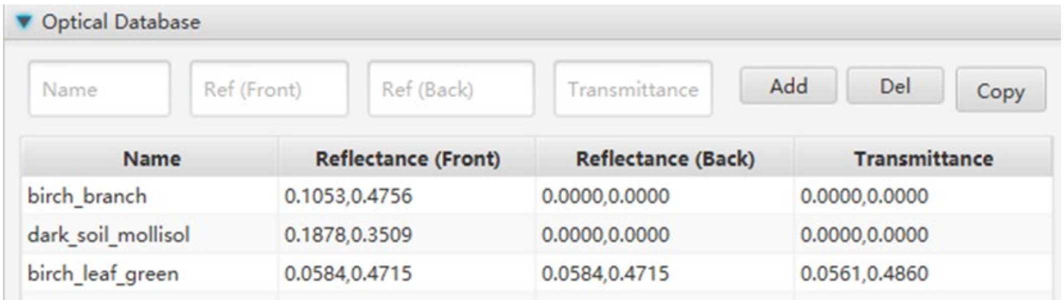


Figure 3. Define optical models

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

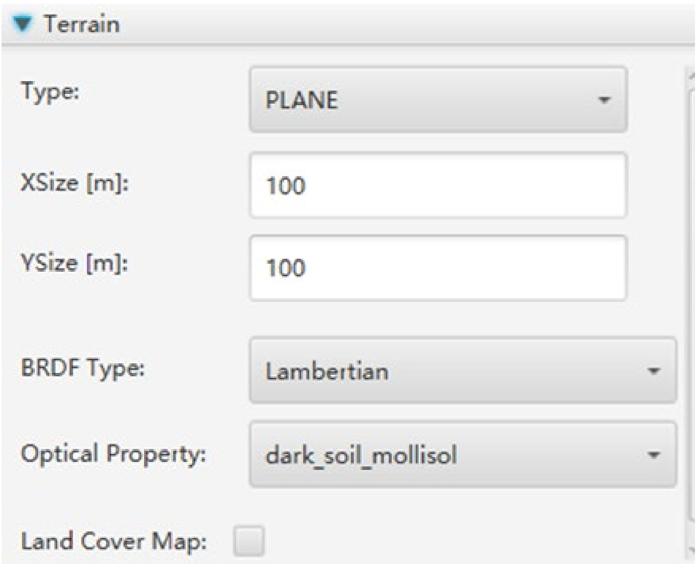


Figure 4. Set terrain parameters

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**).

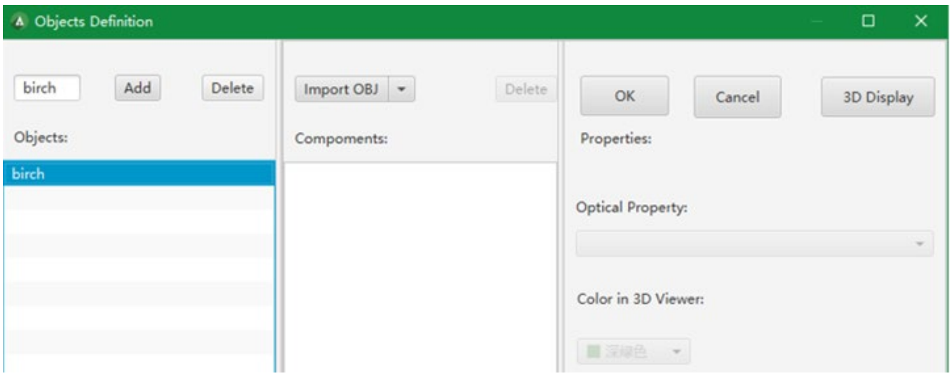


Figure 5. Name the obj

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 (**Figure 6**). The units of the model is saved as "m", so the scale should be 1.00.

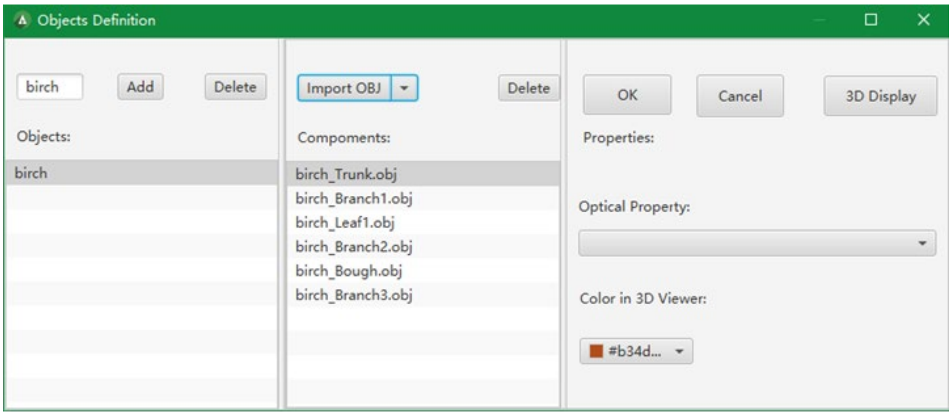


Figure 6. Input the obj

5.1.3 Select one of the components to active [Optical Property], then choose an optical property for the selected component (**Figure 7**).

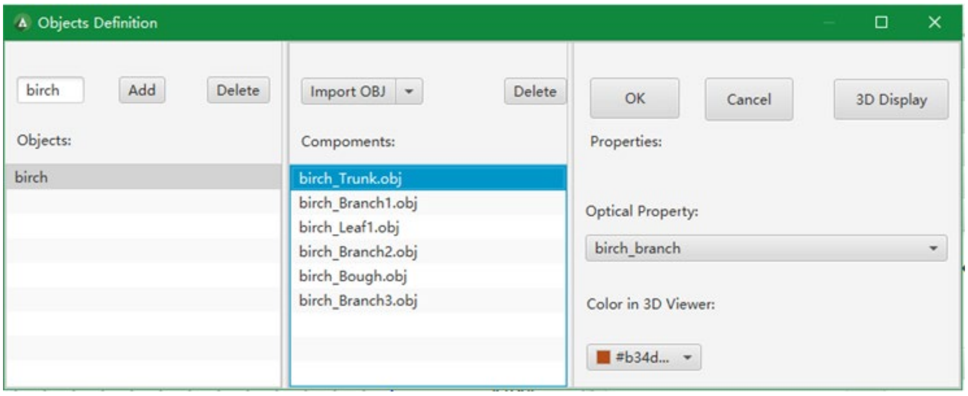


Figure 7. Choose optical properties

5.2 Define positions of tree model

Choose the tree models, then click [Random]. Enter "5" in [minimum distance], click [OK] (错误!未找到引用源。). The positions of the model will display in Preview Panel (**Figure 9**).

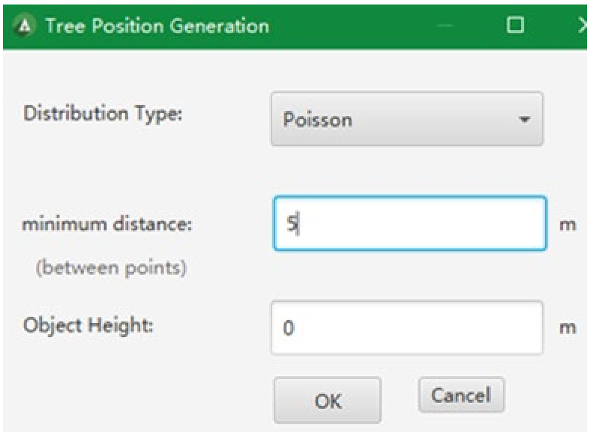


Figure 8. Define the position of obj

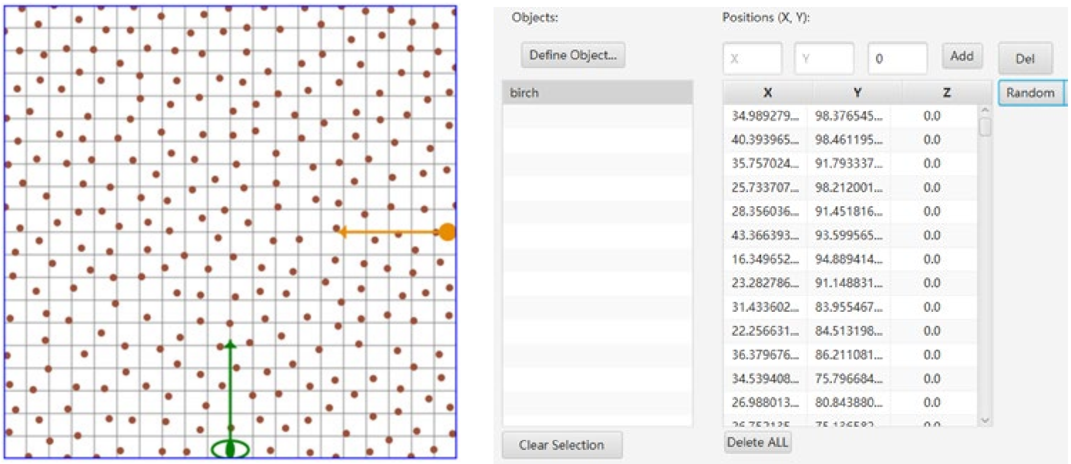


Figure 9, Show the position

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

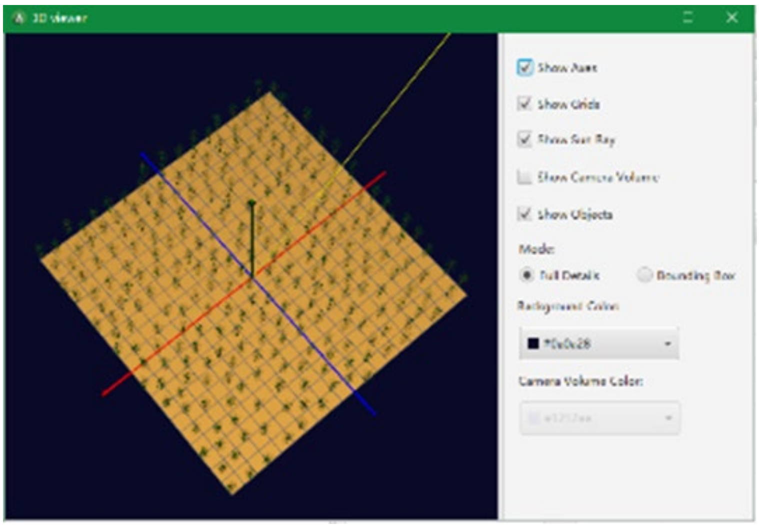


Figure 10. 3D scene

Example 1. 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.

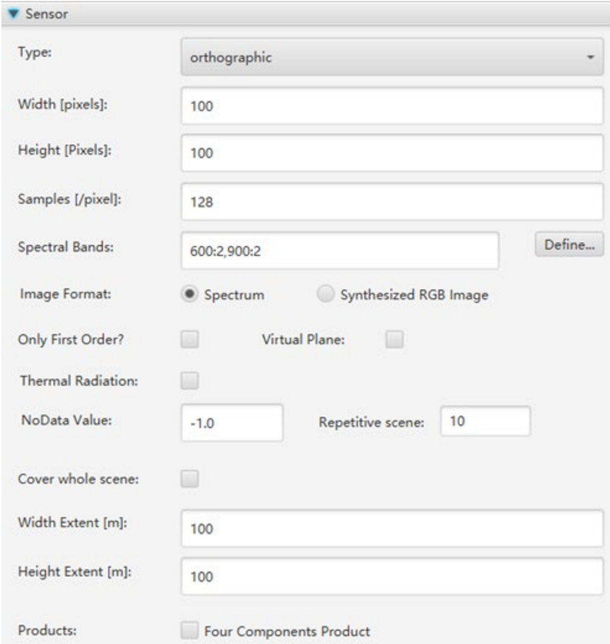


Figure 11. Sensor parameter

2. [Observation] and [Illumination & Atmosphere] are set according your requirement.

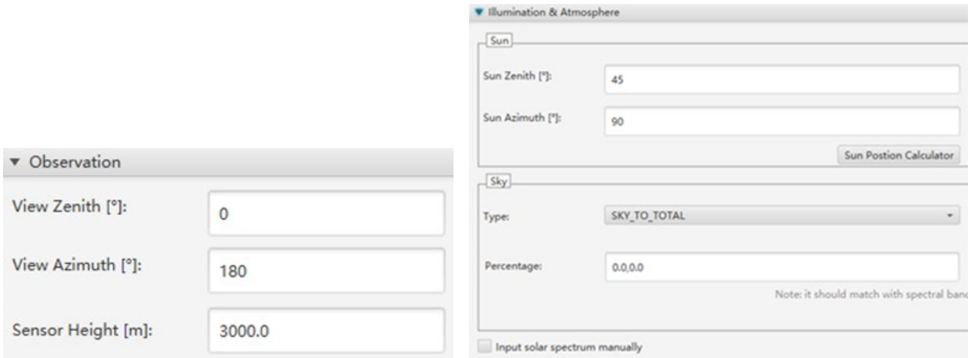


Figure 12. Observation and illumination &atmosphere setting

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

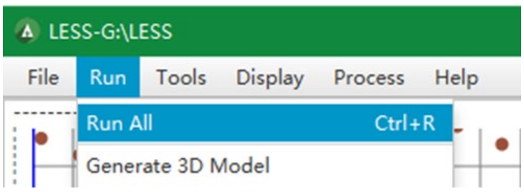


Figure 13. Run the program

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

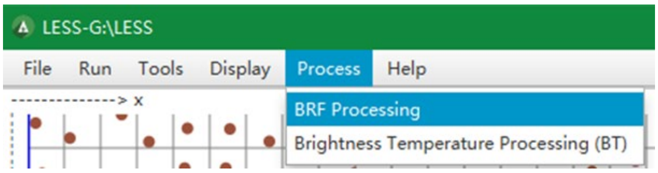


Figure 14. Generate BRF image

5. View the generated results by choosing [Tools] -> [Open Results Folder] (**Figure 15**). 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 (**Figure 16**). You can open them by ENVI.

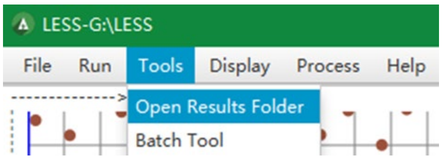


Figure 15. Find the generated results

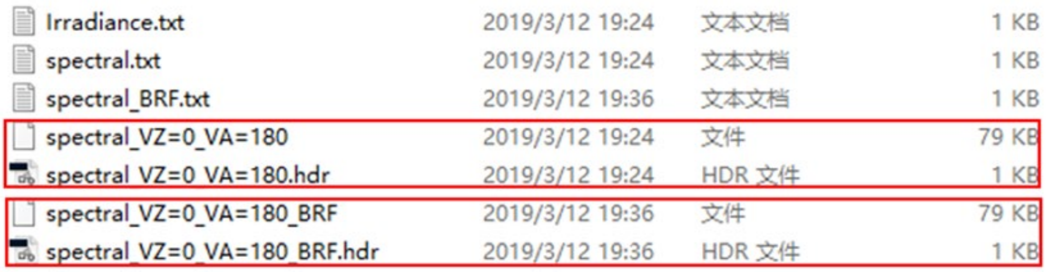


Figure 16. Results

Example 2. 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 17**).

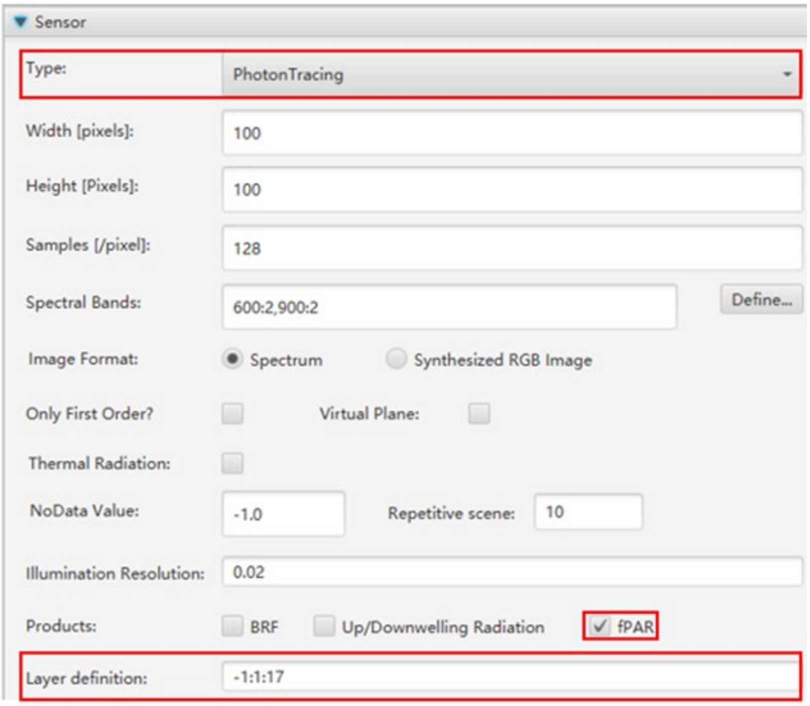


Figure 17. Sensor parameter

2. [Observation] and [Illumination & Atmosphere] are set according your requirement (**Figure 18**).

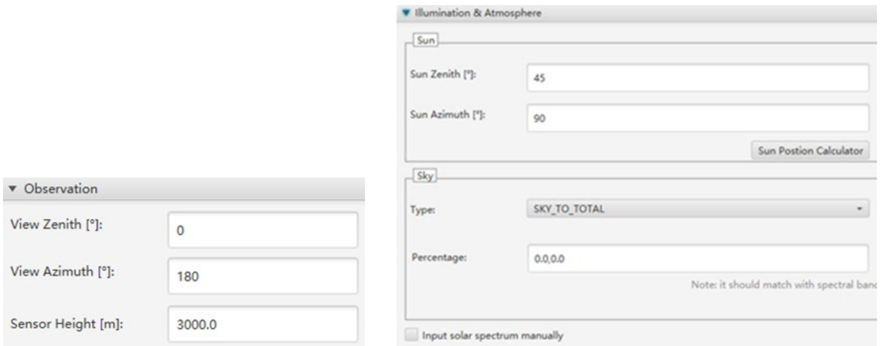


Figure 18. Observation and illumination &atmosphere setting

3. Run this program by choosing Run -> Run all (**Figure 19**).

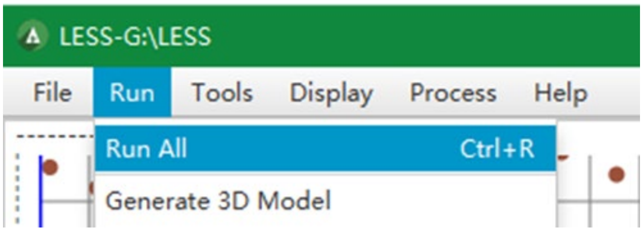


Figure 19. Run the program

4. View the generated results by choosing [Tools] -> [Open Results Folder] (**Figure 20**). The file named "photontracing_0_02_Layer_fPAR.txt" is the fPAR in different height layers and component (**Figure 21**). **Figure 22** shows the result of fPAR..

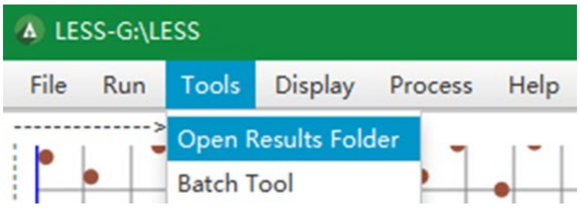
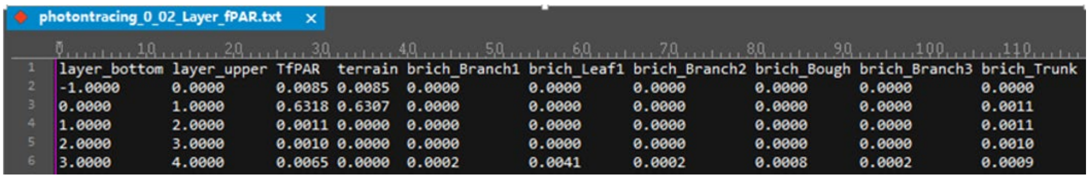


Figure 20. Open results folder

Figure 21. Results


photontracing_0_02_Layer_fPAR.txt

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

Figure 22. The result of fPAR

Example 3. To calculate the albedo

1. Set sensor parameters. Change [Type] to "PhotonTracing". Check [BRF] in [Products] (**Figure 23**).

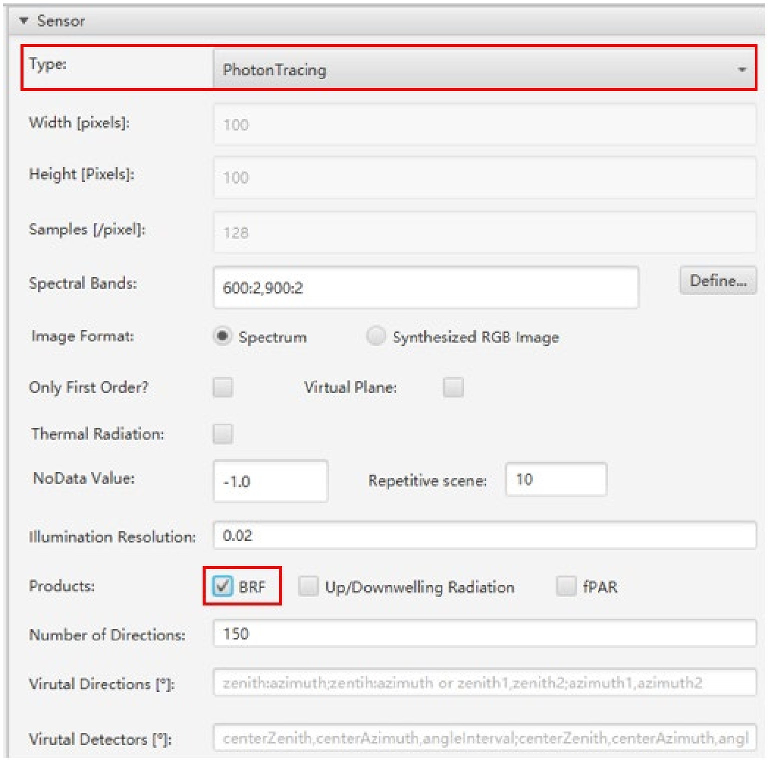


Figure 23. Sensor parameter

2. [Observation] and [Illumination & Atmosphere] are set according your requirement (**Figure 24**).

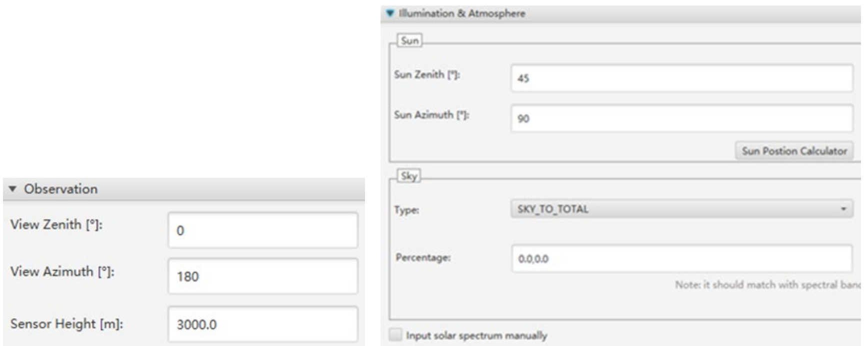


Figure 24. Observation and illumination &atmosphere setting

3. Run this program by choosing Run -> Run all (**Figure 25**).

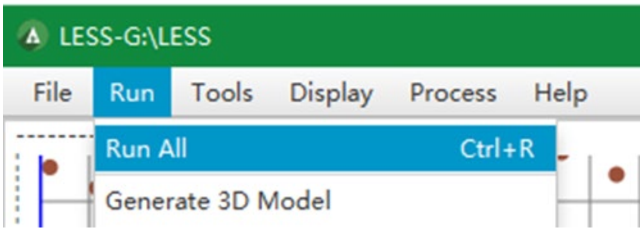


Figure 25. Run the program

4. View the generated results by choosing [Tools] -> [Open Results Folder] (**Figure 26**). The file named "photontracing_0_02_LESS.txt" is the albedo results (**Figure 27**). **Figure 28** shows the result of albedo.

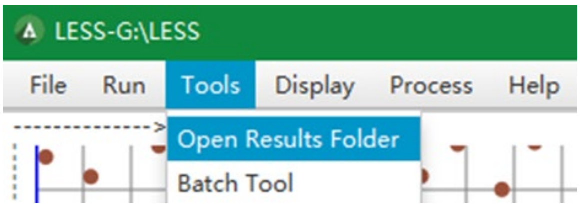


Figure 26. Open results folder

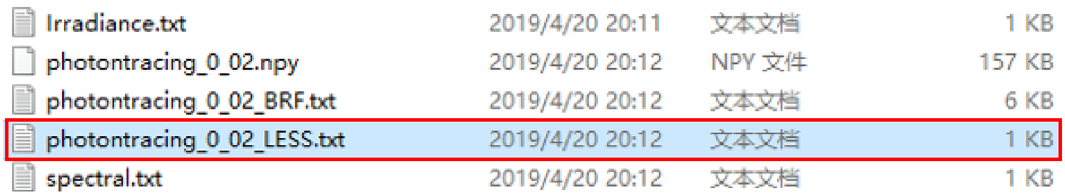


Figure 27. Results

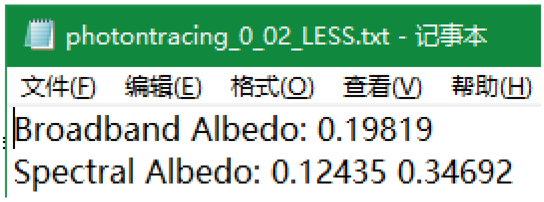


Figure 28. Albedo results

Example 4. To calculate the directional gap probability

1. Set sensor parameters. Keep [Type] to “orthographic”. Set [width] and [Height] to make sure that the spatial resolution is higher than 0.05 meters. The value of [Sample] must higher than 32. The number of [Spectral Bands] must more than 5. Check [Only First Order] & [Virtual Plane]. Set [NoData Value] to -1. Set [XSzie] and [YSzie] in [Size] according to the size of scene. Check [Four Components Product] in [Product].

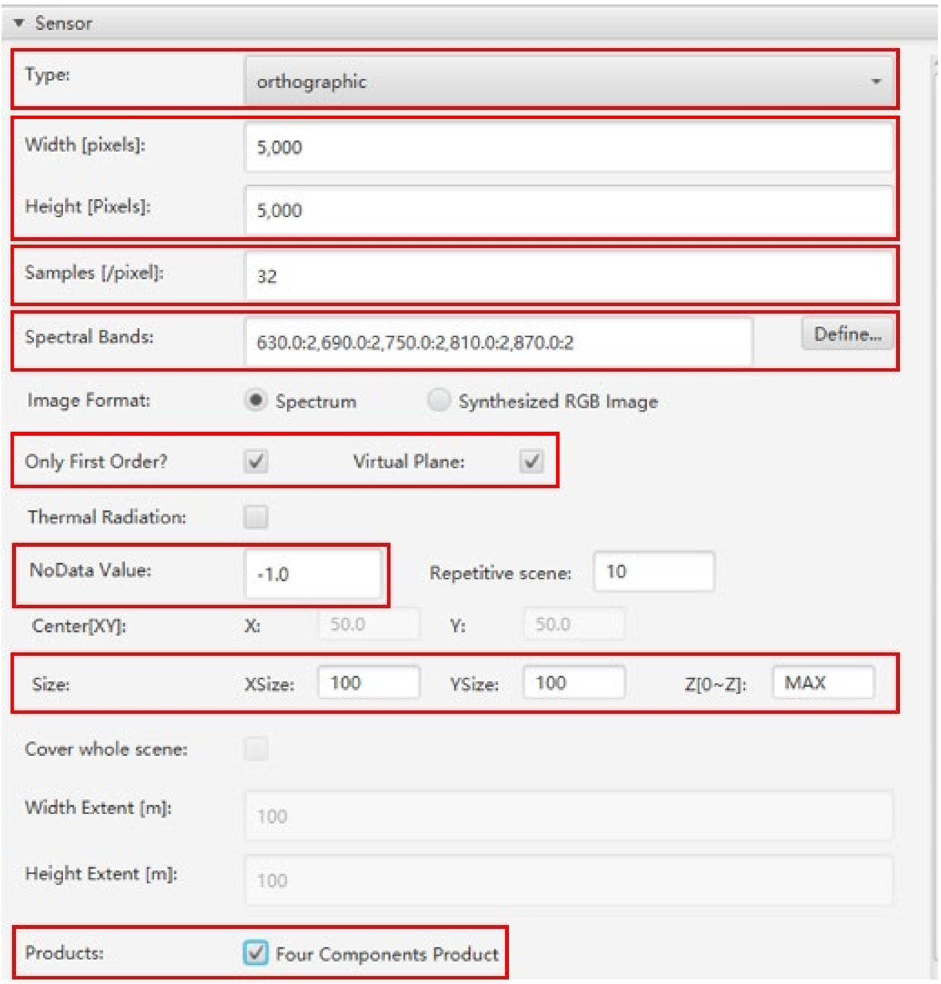


Figure 29. Sensor parameter

2. [Observation] and [Illumination & Atmosphere] are set according your requirement.

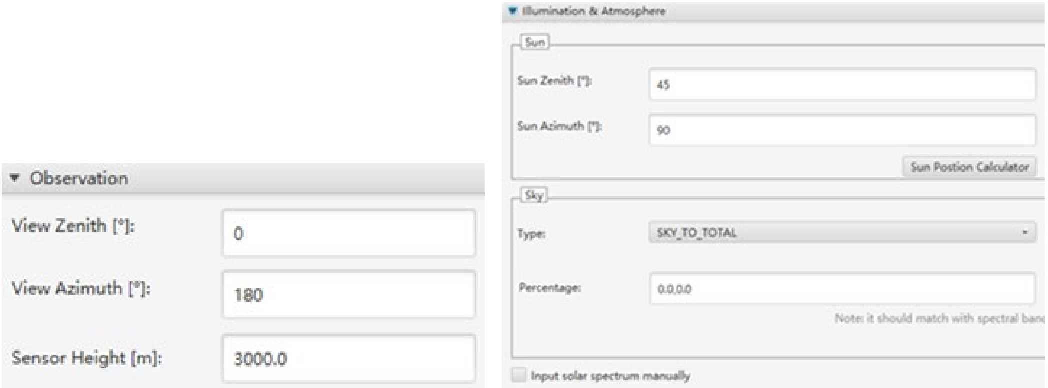


Figure 30. Observation and illumination &atmosphere setting

3. Run this program by choosing Run -> Run all (**Figure 31**).

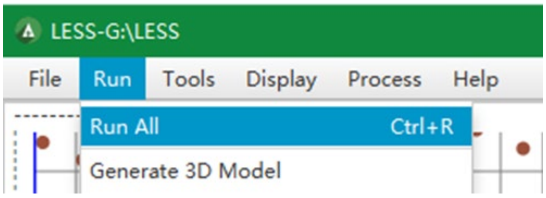


Figure 31. Run the program

4. View the generated results by choosing [Tools] -> [Open Results Folder] (**Figure 32**). The file named "spectral_VZ=0_VA=180_4Components" is the results (**Figure 33**).

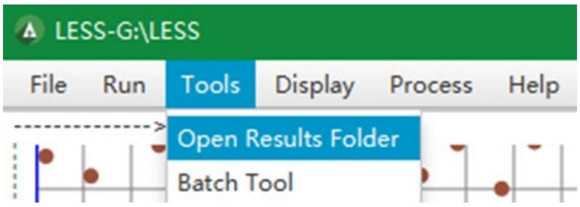


Figure 32. Open results folder

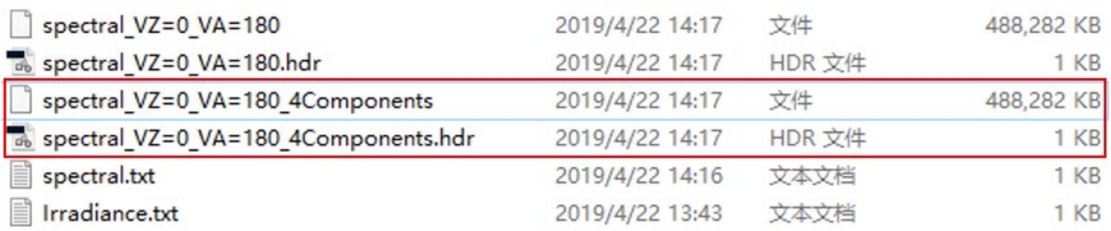


Figure 33. Results

5. **Figure 34** shows the result opened by ENVI. Band one is the four component result.

   The pixel value of band 1 represents the category of pixels (1 means the pixel type is sunlit soil. 2 means the pixel type is sunlit plant. 3 means the pixel type is shaded soil. 4 means the pixel type is shaded plant.). The pixel value of band 2, band 3, band 4, band 5 is the proportion of the corresponding component in the pixel (band 2 is sunlit soil, band 3 is sunlit plant, band 4 is shaded soil, band 5 is shaded plant).

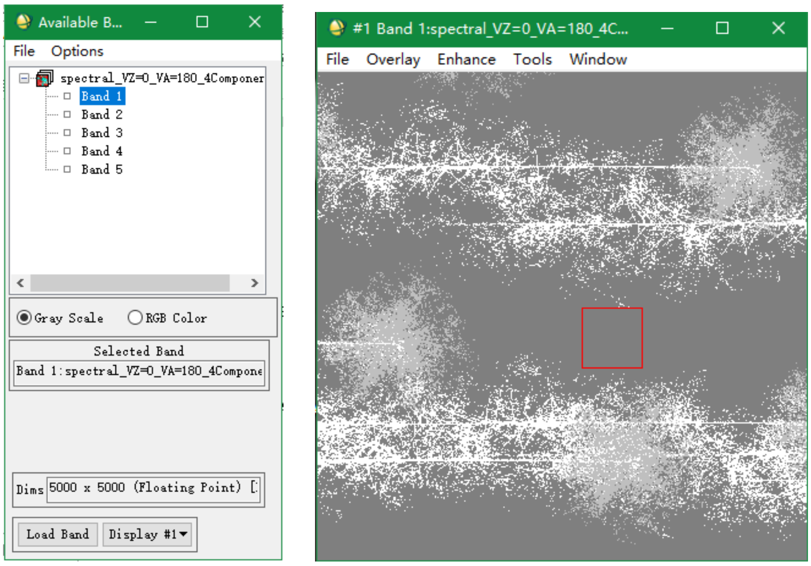


Figure 34

6. Calculate the directional gap probability

   The directional gap probability can be calculated by: mean(b2+b4)