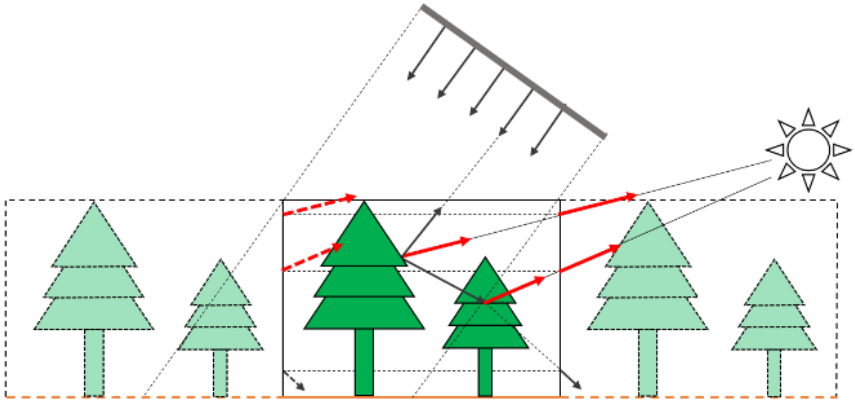
LESS Example Document

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**).

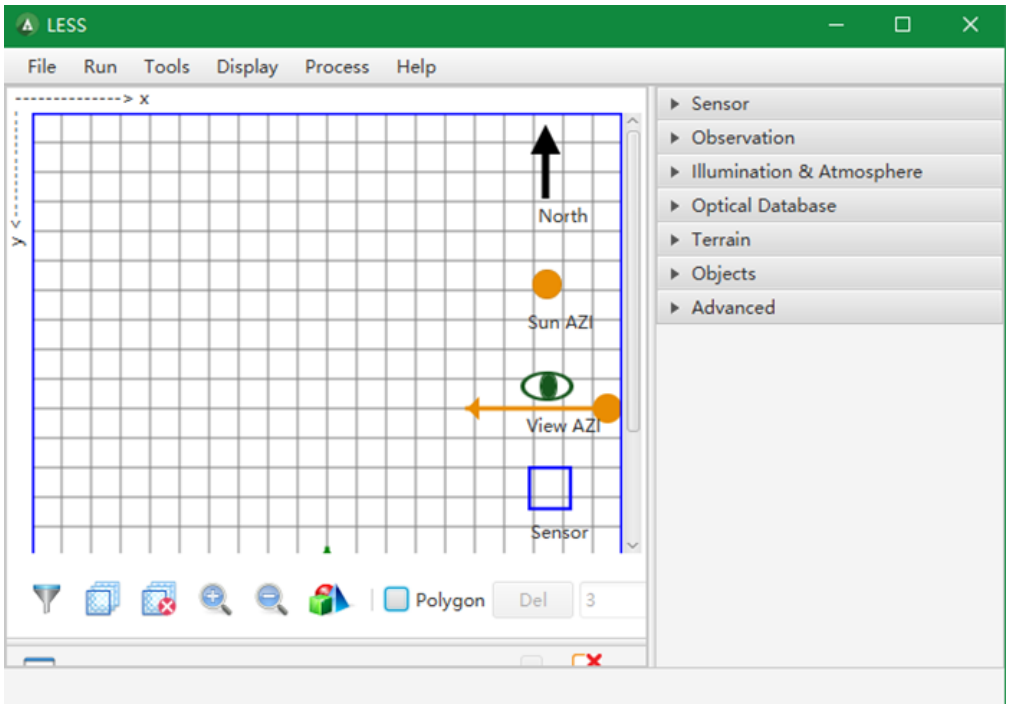

Figure 1. Main window

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**).

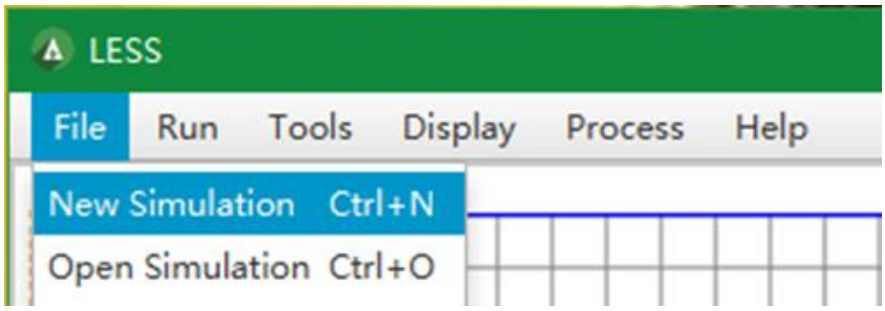

Figure 2. Create a new simulation

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

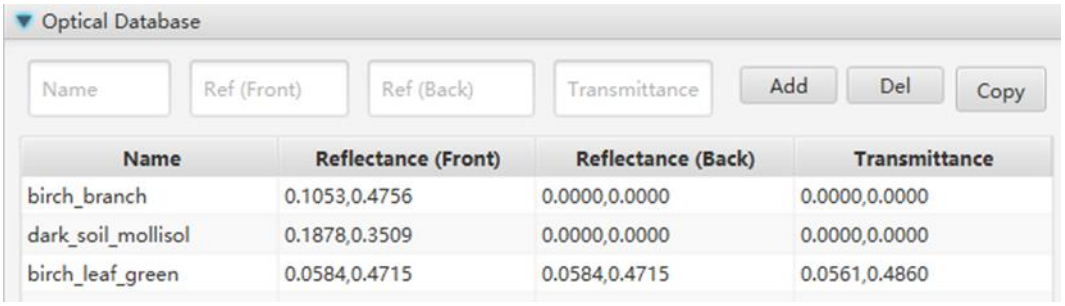

Figure 3. Define optical models

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

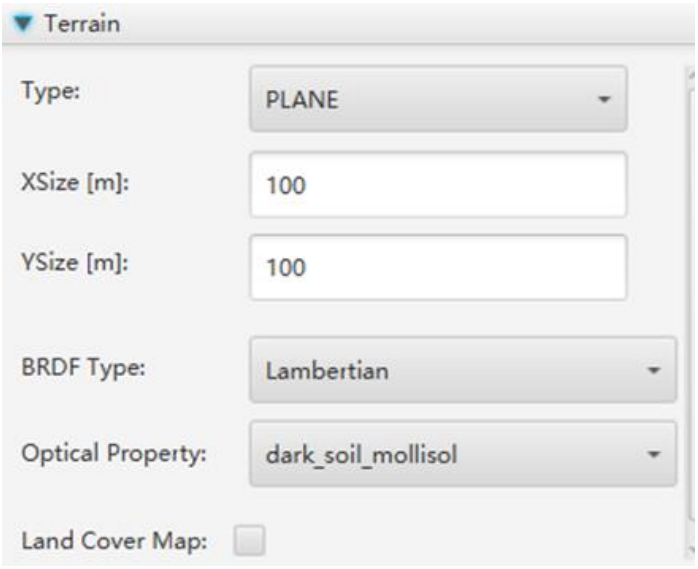

Figure 4. Set terrain parameters

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**).

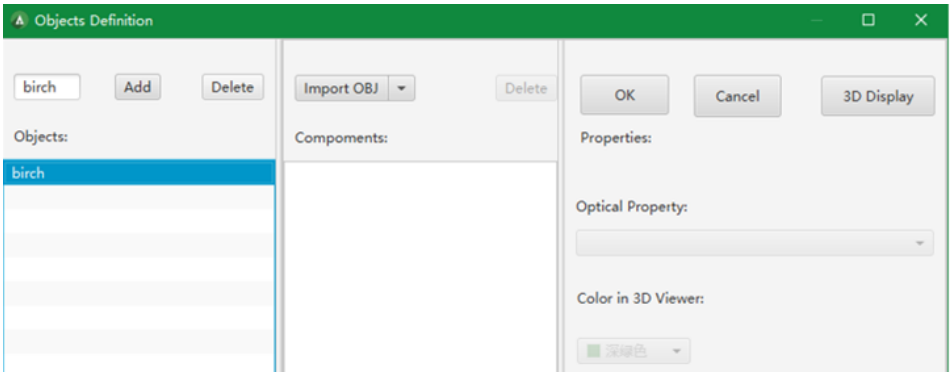

Figure 5. Name the obj

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.

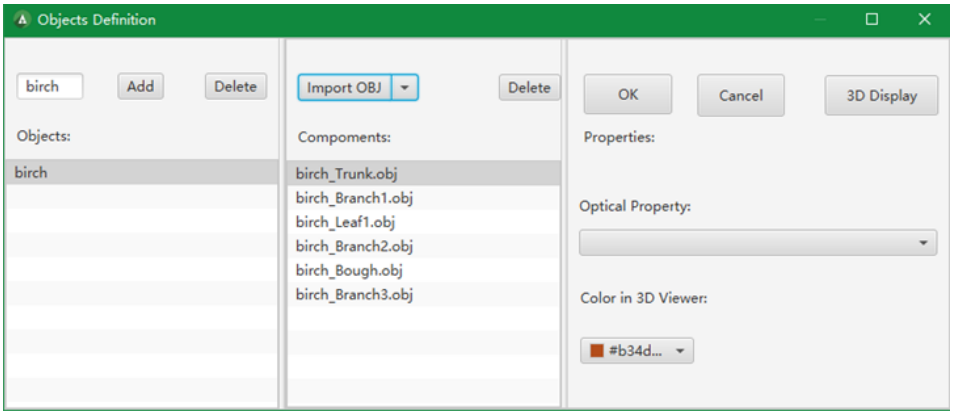

Figure 6. Input the obj

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

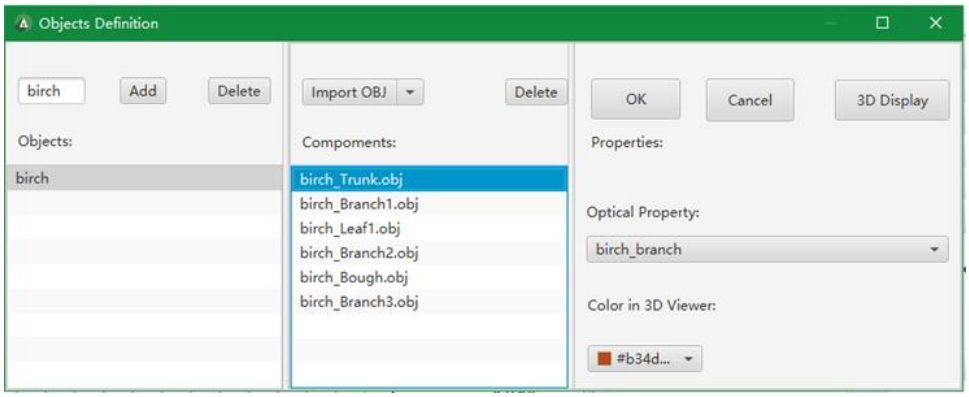

Figure 7. Choose optical properties

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**).

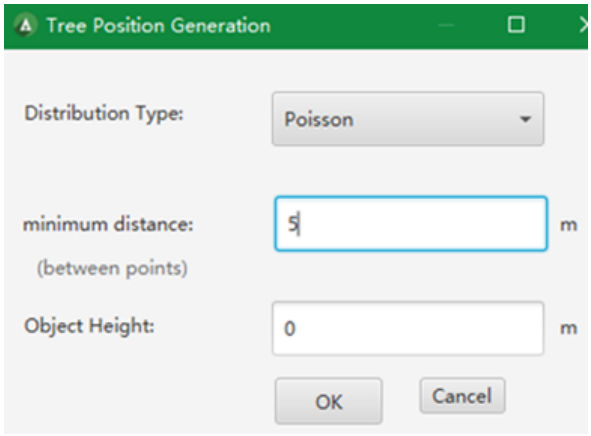

Figure 8. Define the position of obj

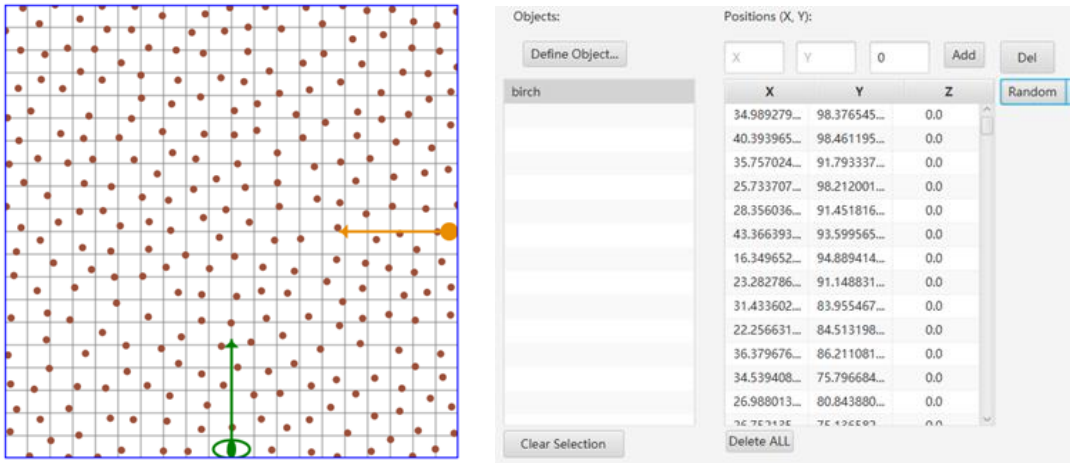

Figure 9, Show the position

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

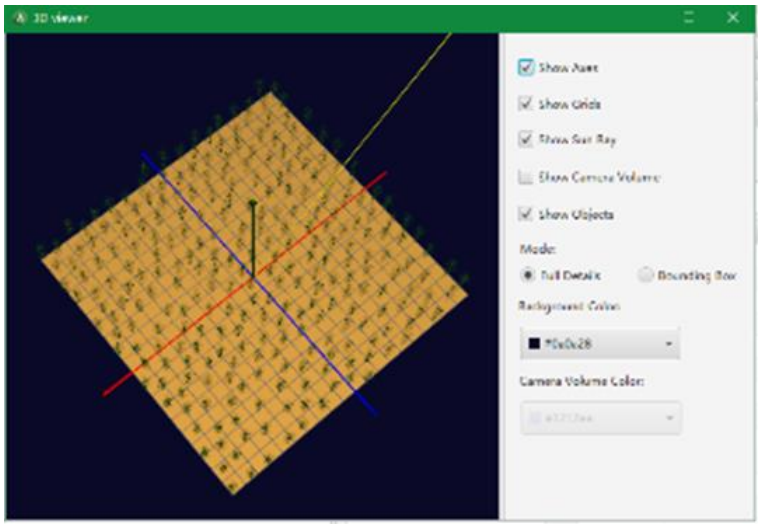

Figure 10. 3D scene

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.

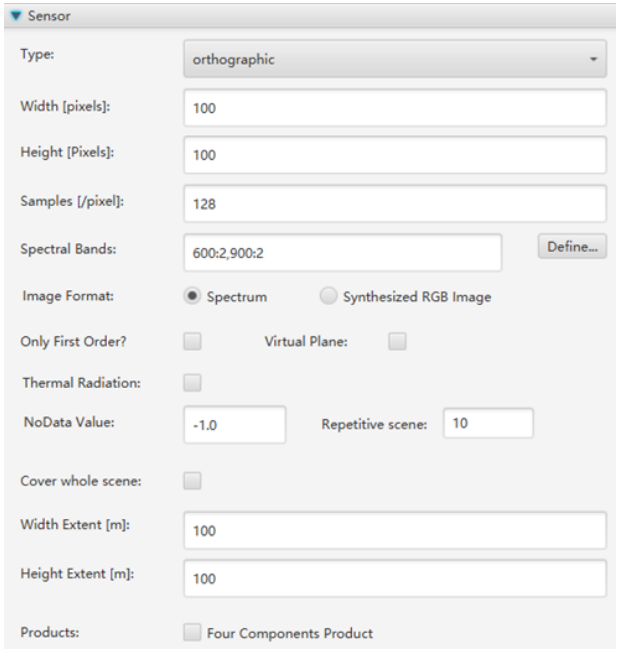

Figure 11. Sensor parameter

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

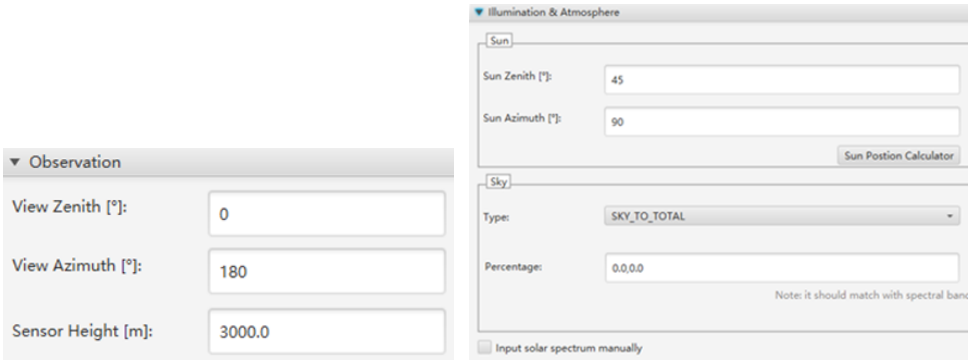

Figure 12. Observation and illumination &atmosphere setting

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

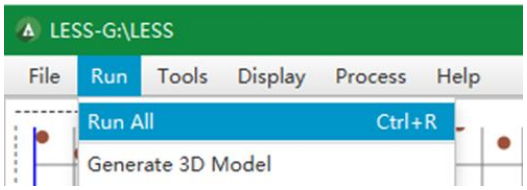

Figure 13. Run the program

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

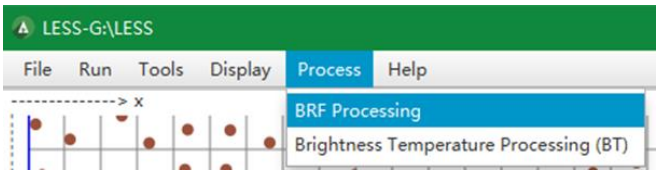

Figure 14. Generate BRF image

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.

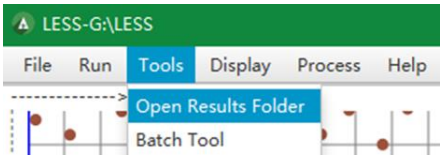

Figure 15. Find the generated results

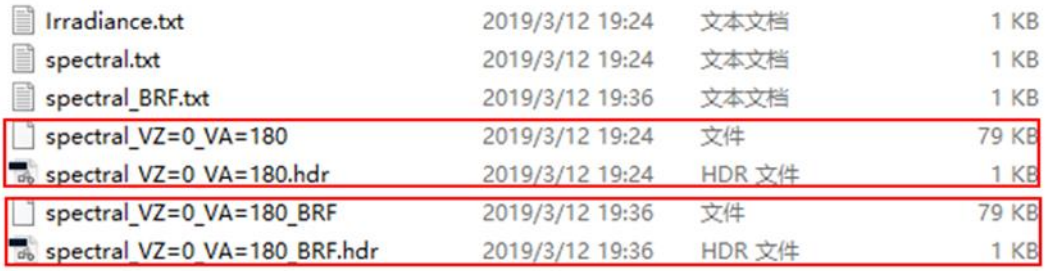

Figure 16. Results

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**).

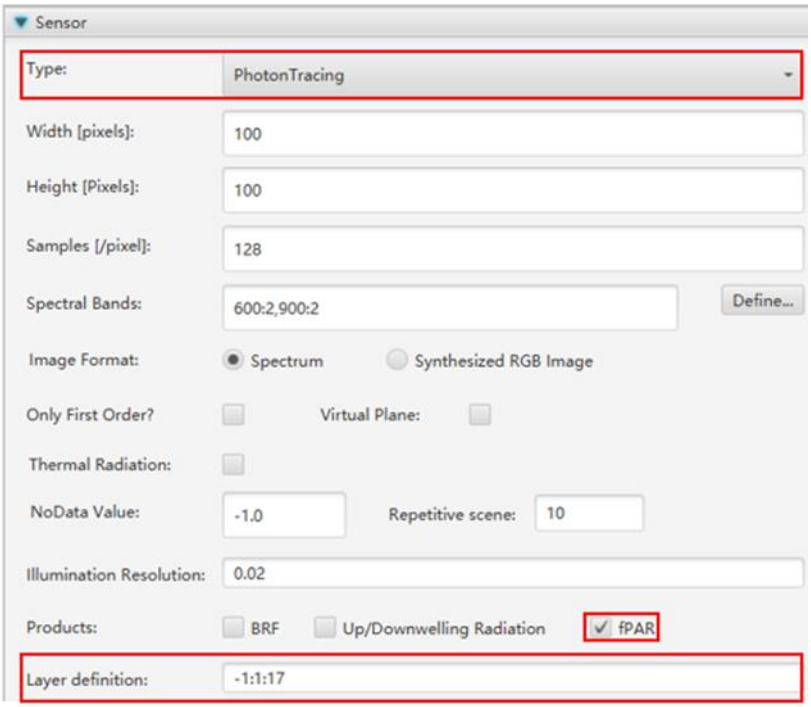

Figure 17. Sensor parameter

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

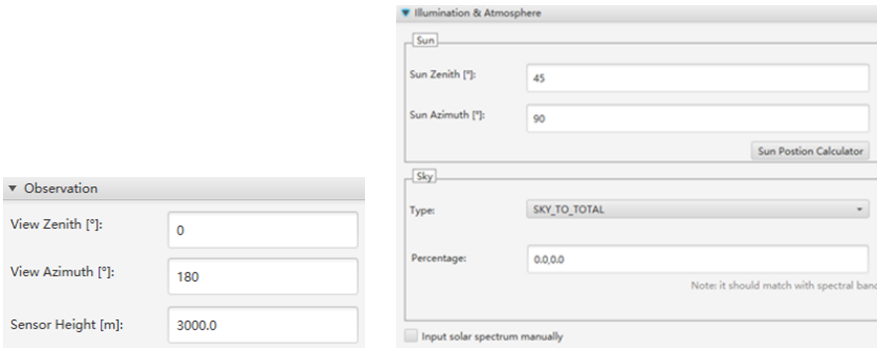

Figure 18. Observation and illumination &atmosphere setting

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

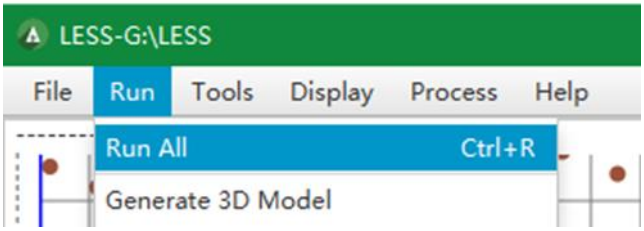

Figure 19. Run the program

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..

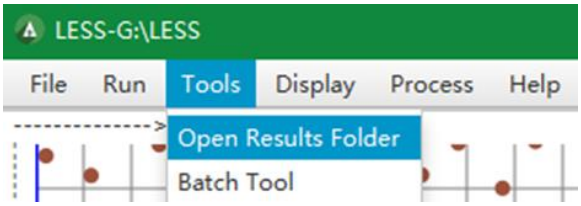

Figure 20. Open results folder

Figure 21. Results

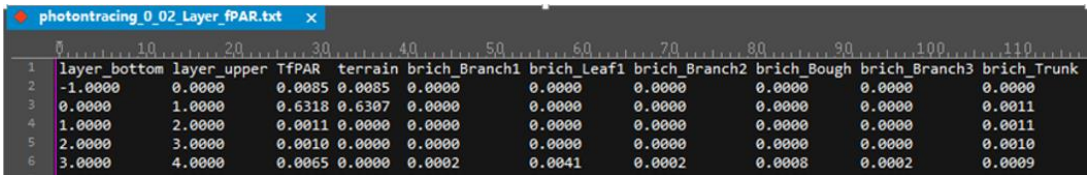

Figure 22. The result of fPAR

Example 3. To calculate the albedo

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

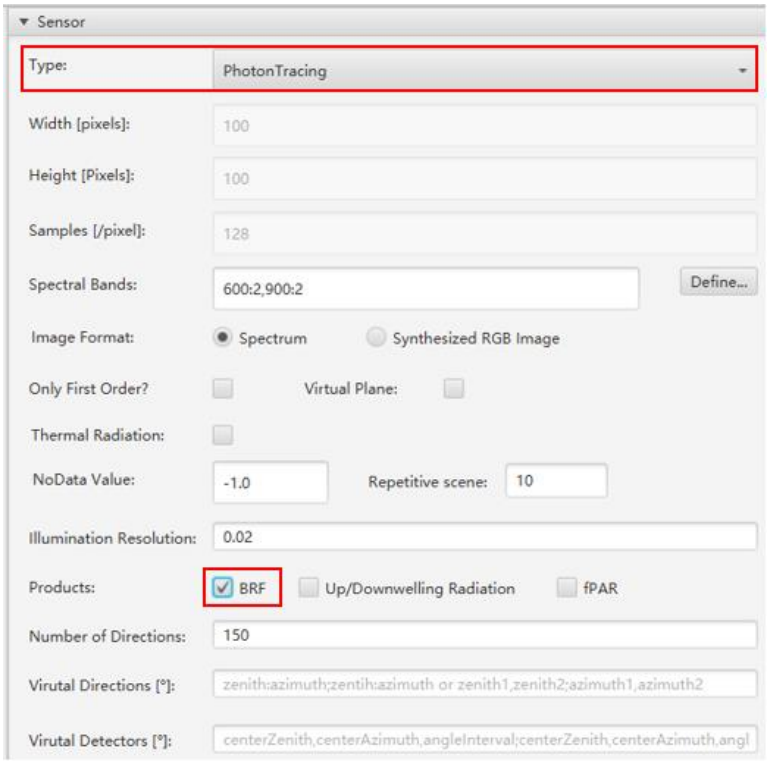

Figure 23. Sensor parameter

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

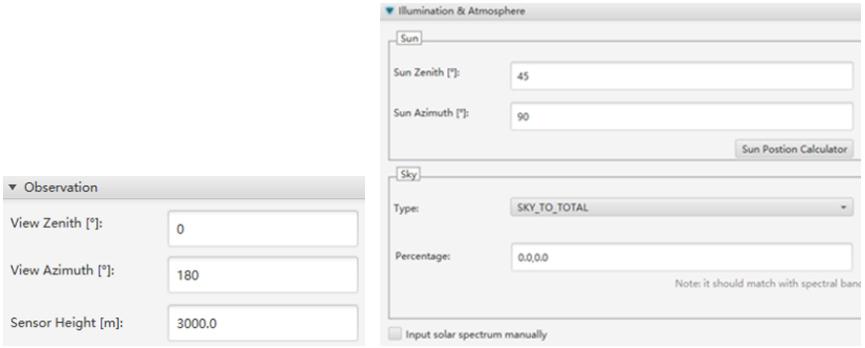

Figure 24. Observation and illumination &atmosphere setting

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

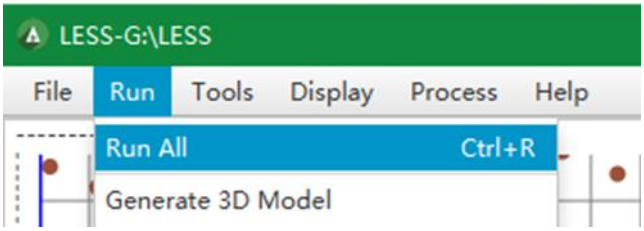

Figure 25. Run the program

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.

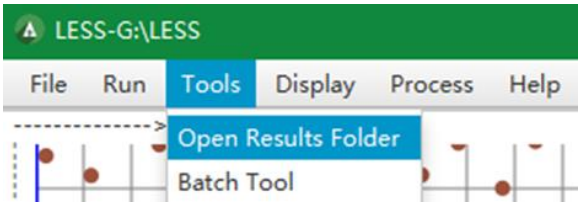

Figure 26. Open results folder

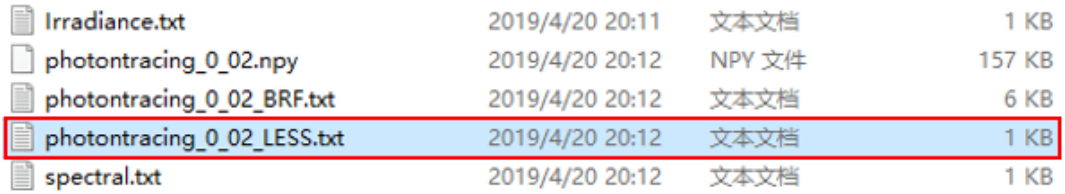

Figure 27. Results

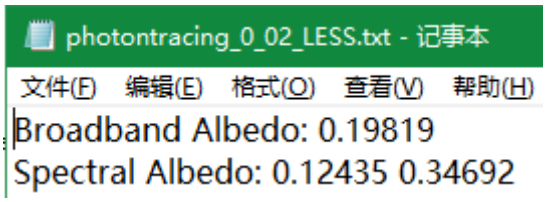

Figure 28. Albedo results

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].

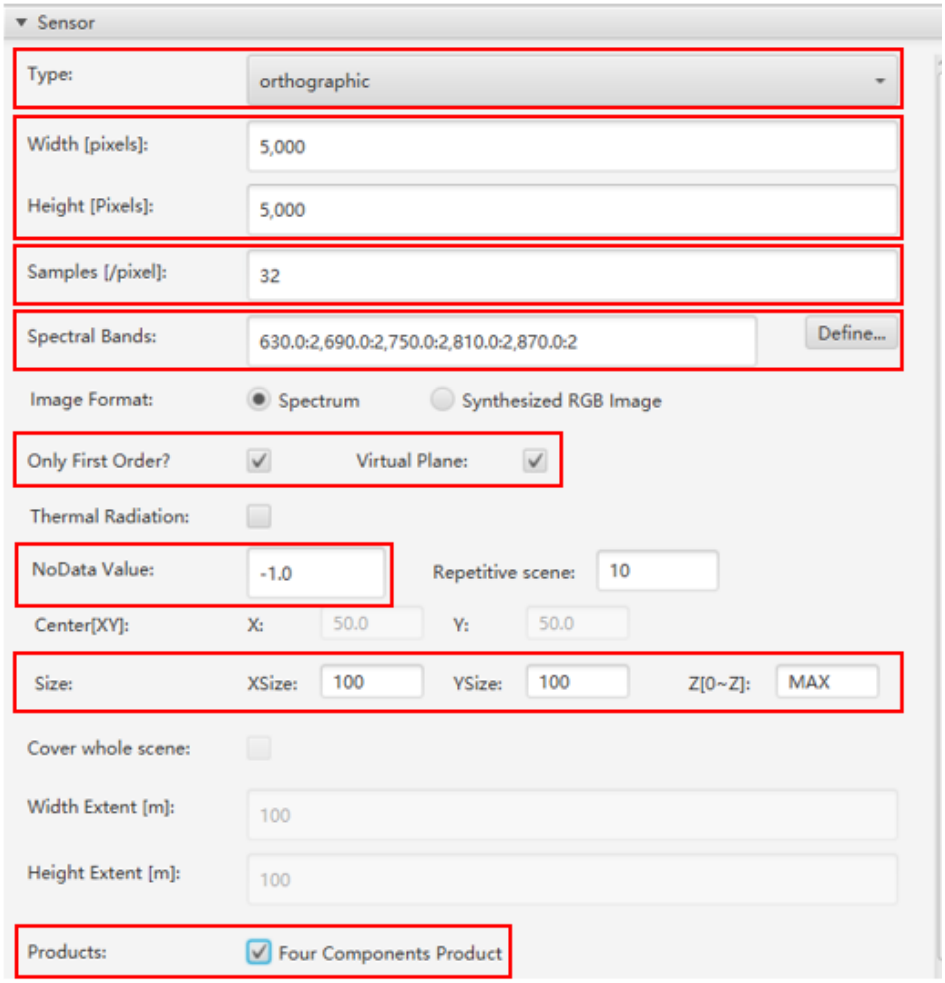

Figure 29. Sensor parameter

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

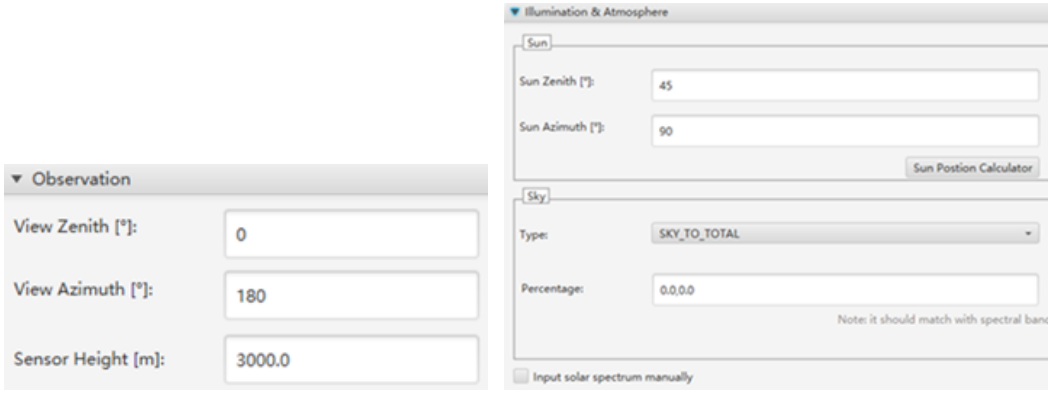

Figure 30. Observation and illumination &atmosphere setting

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

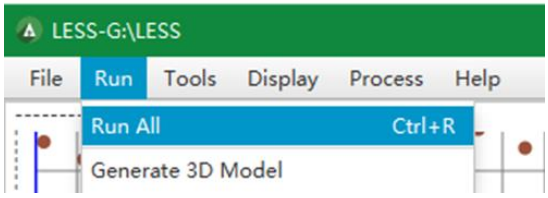

Figure 31. Run the program

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**).

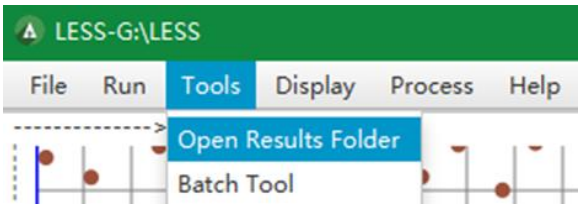

Figure 32. Open results folder

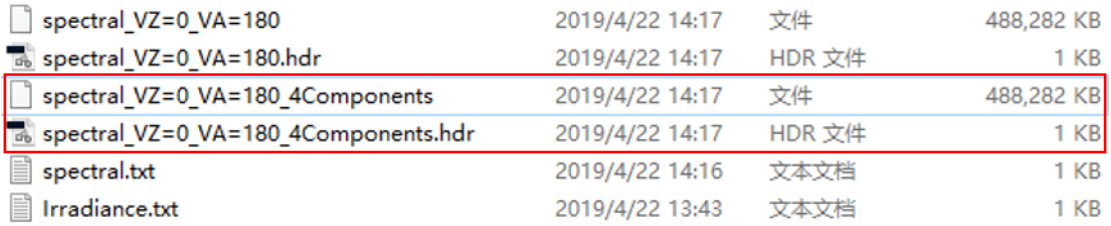

Figure 33. Results

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).

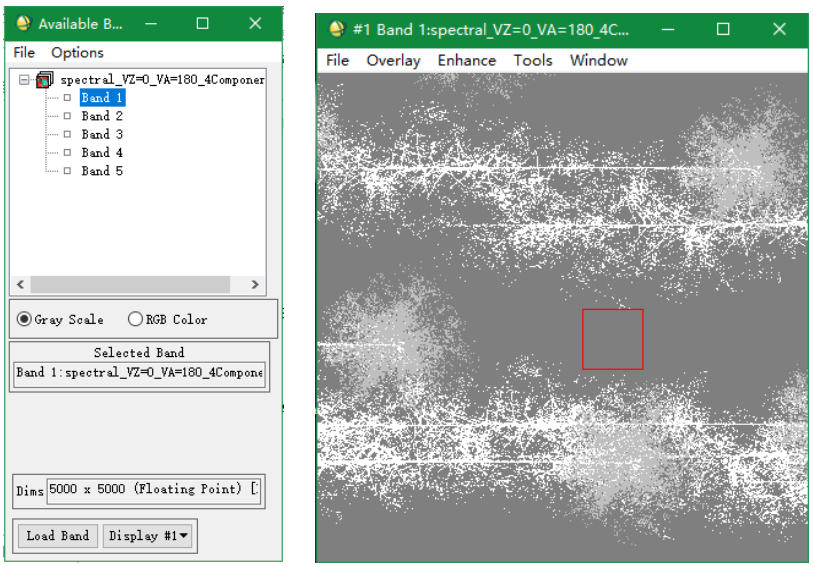

Figure 34

6. Calculate the directional gap probability

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

Example 5. To generate fisheye images

1. Set sensor parameters. Change [Type] to “CircularFisheye”. Set [Spectral Bands] by click [Define] (**Figure 36**). [From] is modified to 380, and [To] is modified to 830,and [BandNum] is modified to 40. Check [Synthesized RGB Image] (**Figure 35**).

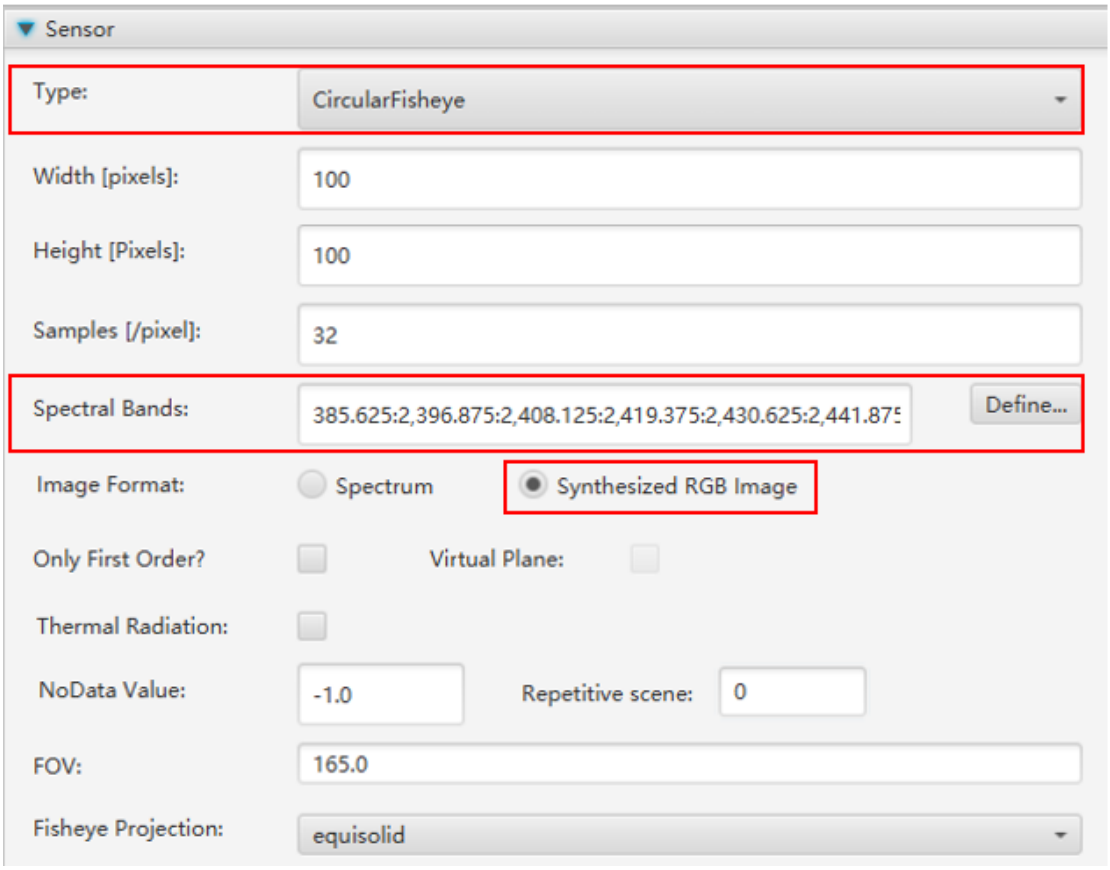

Figure 35. Sensor parameter

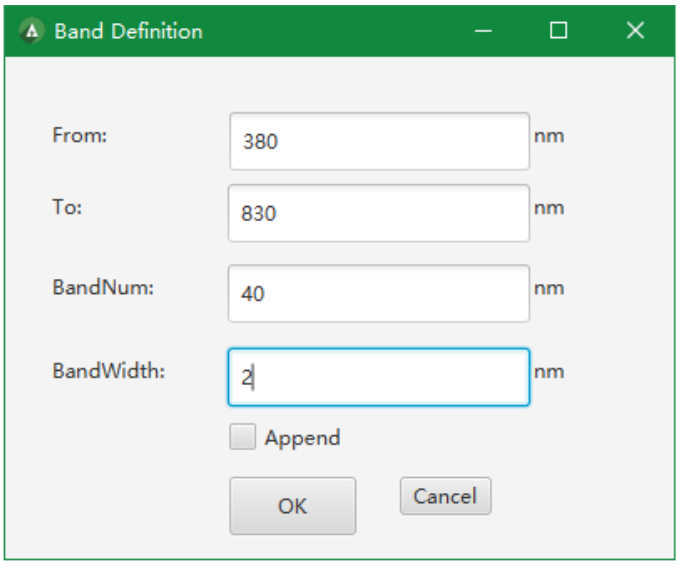

Figure 36. Define spectral bands

2. Set the position and direction of camera in [Observation]. The [Camera Position] and [Target] construct a vector of view (**Figure 37**).

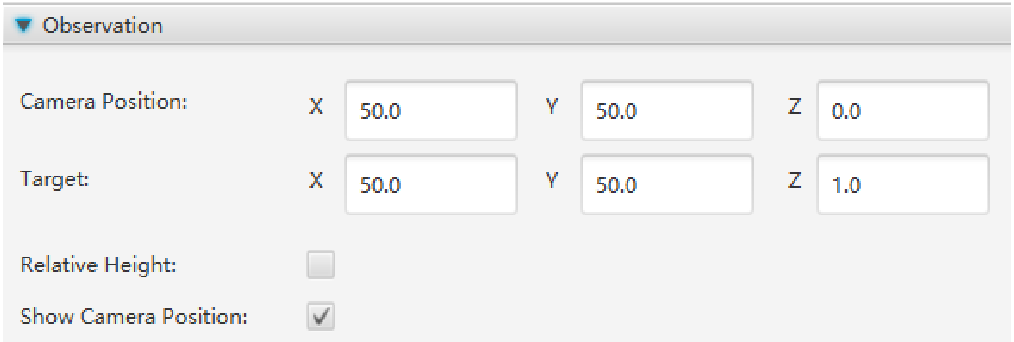

Figure 37. Set the Observation

3. [Illumination & Atmosphere] are set according your requirement (**Figure 38**).

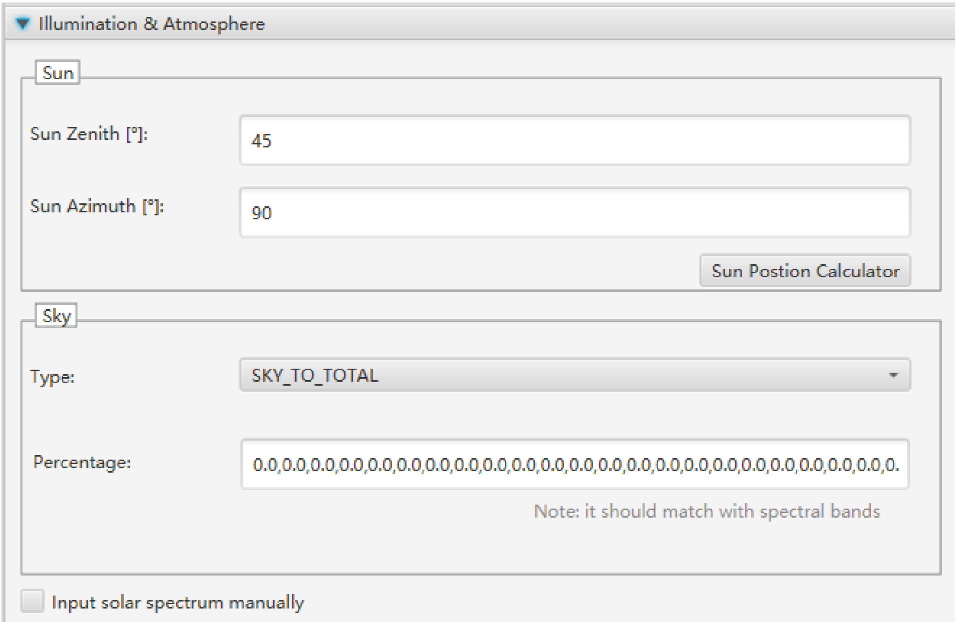

Figure 38. Illumination & Atmosphere

4. Run this program by choosing Run -> Run all (**Figure 39**).

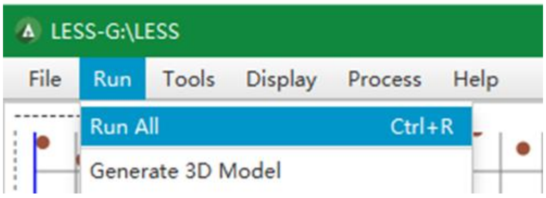

Figure 39. Run the program

5. View the generated results by choosing [Tools] -> [Open Results Folder] (**Figure 40**).The file named “spectral_ox=50_00_oy=50_00_oz=0_00_tx=50_00_ty=50_00_tz=1_00.png” is the results (**Figure 41**). **Figure 42** shows the result of fisheye image.

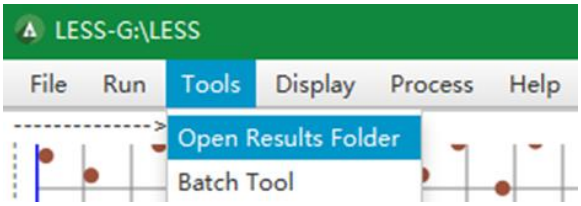

Figure 40. Open results folder

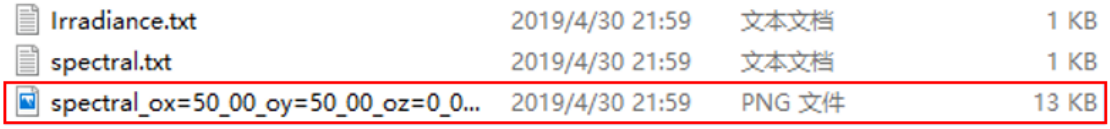

Figure 41. Results

Figure 42. Fisheye image