



Standard Mode – PV Placement

Field Logic, Inc.

Version 1.0

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1. Introduction

About This Document (Tutorial)

HelioBase® is an application that predicts the generated output of a photovoltaic system.

This document describes how to place a PV module and how to place on the 3D object.

The goal of this tutorial is to allow the user to apply the knowledge gained from this document to place a PV module according to the environment in which a simulation is performed.

◇NOTE◇

Data file used:

The following data file is used in this document.

- ① Tutorial02.stl :STL data file of the architecture model
- ② Tutorial-pv.pvx: It is a sample obtained by performing this tutorial.

2. Place the PV module in a 3D object plane

Before start

Open the sample PVX file to prepare same conditions as this document.

- ① Start HelioBase®.

Prepare a 3D object

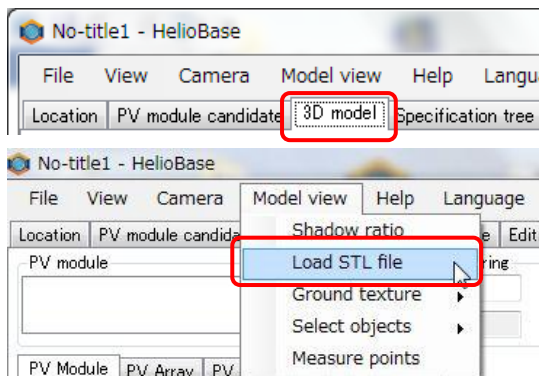
There are the following methods in using 3D object by HelioBase®.

- Importing an external file.
- Using the function of [solid generation (Boundary line)].

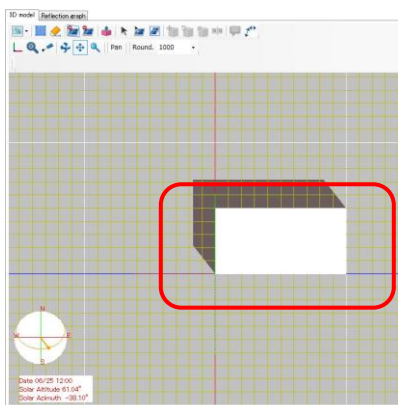
Importing an external file

Operation: Import a 3D object (e.g., a building generated by another application) and display it in the 3D drawing.

- ① Open the [3D model] tab. From the menu, select [Model view] – [Load STL file].



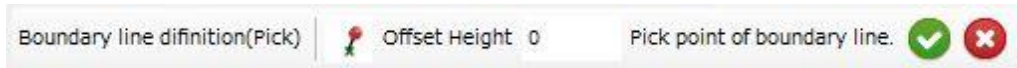
- ② The [Open STL File] dialog box appears. Select the 3D object file and open it.
Next, select and open the following file: C:\temp\Tutorial02.stl
- ③ The imported 3D object is displayed in the center of the 3D drawing as shown below.



Using the function of [Solid generation (Boundary line)]

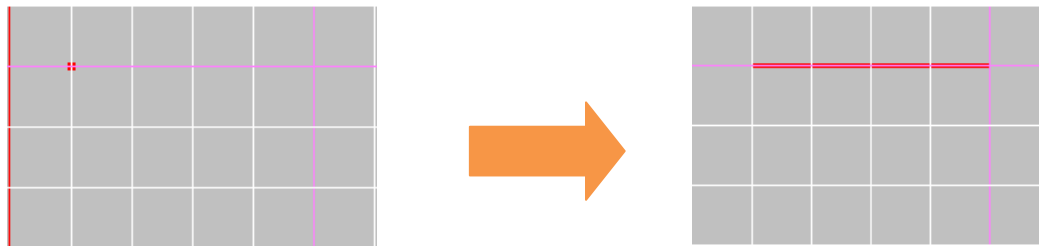
Operation: Make a 3D object by using the function of [Solid generation (Boundary line)] on the 3D drawing.

- ① Click the [Boundary line definition (Pick)] icon  on the 3D model toolbar.



- ② Click a location in the 3D drawing.


- ③ Click the second location. The 1st location and the second location are connected by a red line.

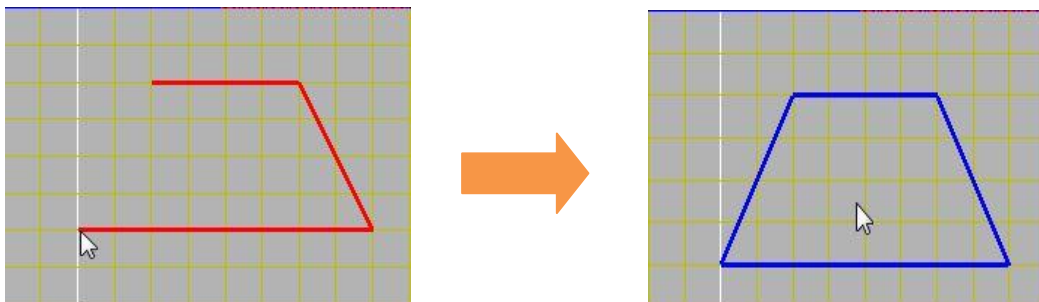



◇NOTE◇

Pressing the [BackSpace] key deletes the last location specified.

- ④ Then, addition of the point is repeated so that it may become a form of an object to create.

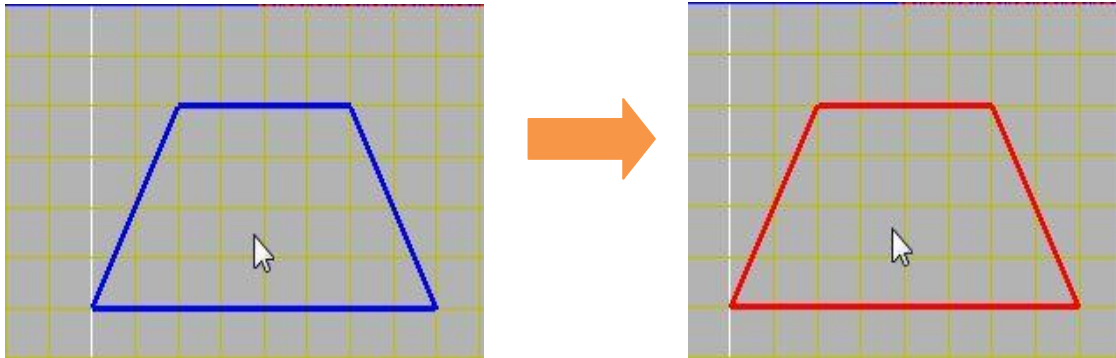
If the enter key is pressed or the [Execution] button  is pushed, the starting point and a terminal point will be combined, a joint line changes to blue, and the [Boundary line definition(Pick)] mode is canceled.




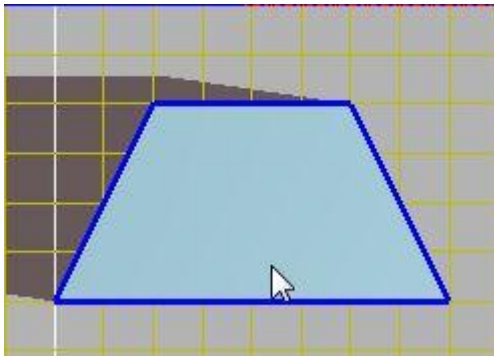
- ⑤ Click the [Solid generation (Boundary line)] icon  on 3D model tool bar. Then, [Solid gen.(Boundary line)] command toolbar will be displayed.



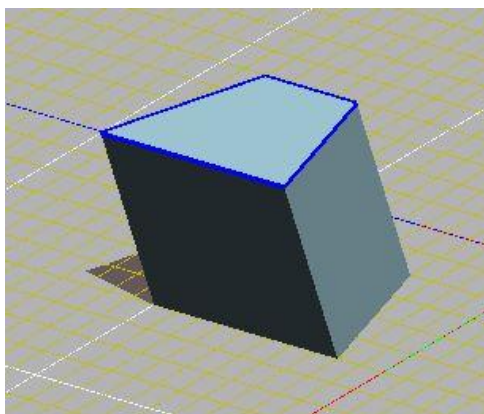
⑥ If it clicks the inside of the created boundary line, a boundary line will be changed into red and will become active.



⑦ If the [Execution]  button is clicked or it presses the enter key, a 3D model whose height is specified by [Sweep height] will be generated.

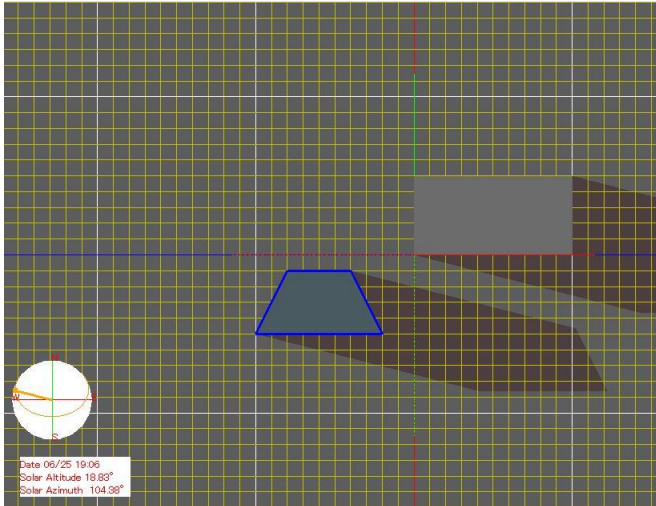


※ If camera mode is set as [Orbit] and the viewpoint is changed, it will be easy to check the 3D model.



◇NOTE◇

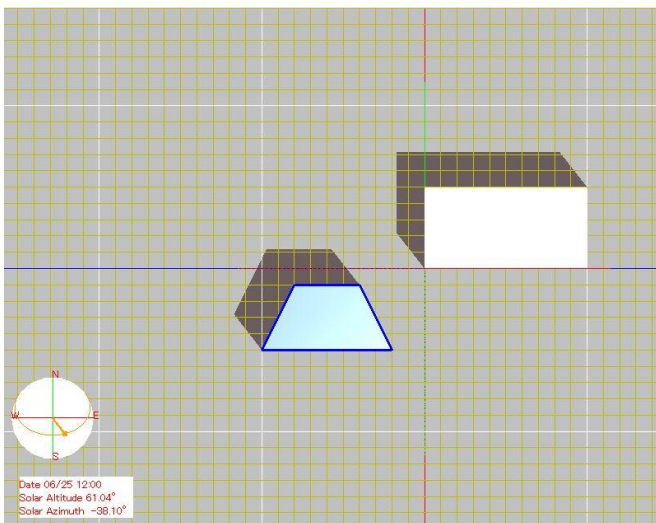
When *HelioBase®* is activated, the time shown in the 3D drawing is set to the time of the activation of *HelioBase®* as the default. If *HelioBase®* is activated early in the morning, evening or night, the object in the 3D drawing may not be visible. If this is the case, click the [Noon] button in the time box at the lower left of the [3D model] tab. The time of the drawing is set to noon.



If the drawing is dark, select the [Noon] button.



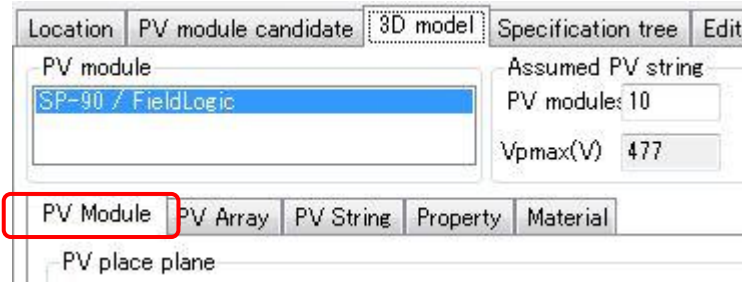
The time of the drawing is changed and the object is displayed clearly.



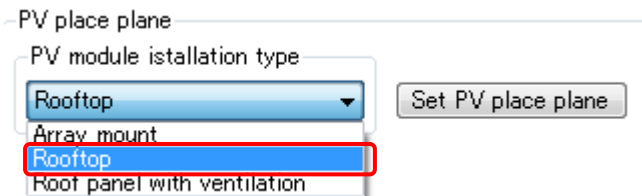
Set the PV placement plane (surface to paste the PV module)

Operation: Set a surface of the imported 3D object as the PV placement plane.

- ① Open the [PV module placement] tab.



- ② In the [PV module installation type] list box, select the method to place the PV module. Here, select [Rooftop].



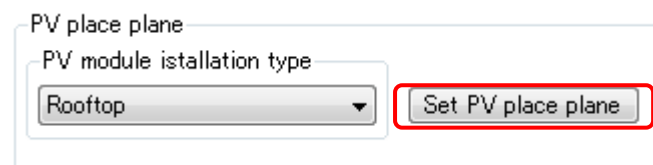
◇NOTE◇

Method to place the PV module

A method to place the PV module can be set for each surface. Depending on the placement method, the calculation coefficient of the PV module's temperature in the simulation changes. One of the following three methods can be selected:

- [Array mount]
- [Rooftop]
- [Roof panel with ventilation]

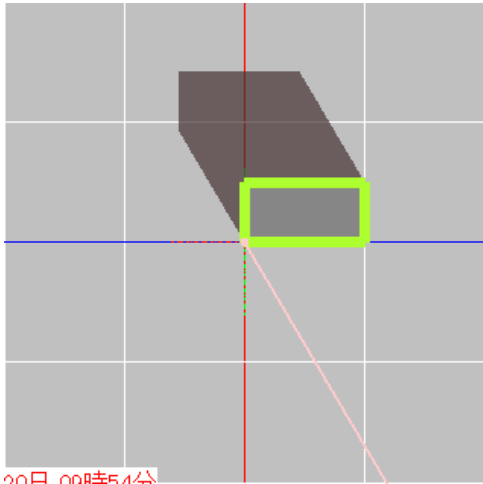
- ③ Click the [Set PV place plane] button.



The operation mode (top of the 3D drawing) changes to the [Set PV place plane] mode.



- ④ Click a surface on the 3D object previously placed in the 3D drawing.




The clicked surface is highlighted with bold lines as shown above and set as [PV placement plane]. Clicking the highlighted surface again deselects [PV placement plane].

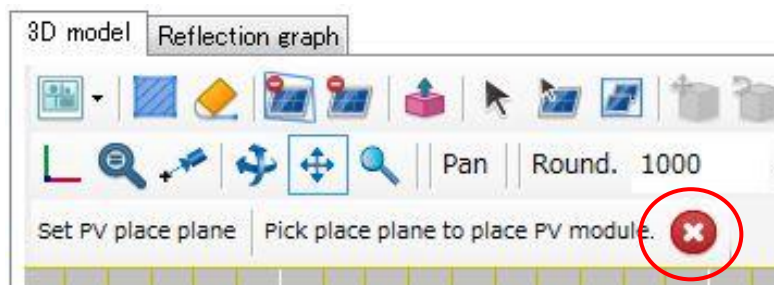
According to the method to place the PV module, the bold line changes the color:

[Array mount] - Yellow

[Rooftop] – Yellow green

[Roof panel with ventilation] - Blue

- ⑤ After specifying the particular plane to place the object, click the [Cancel] icon  (top of the 3D drawing). The [Set PV placement plane] mode is terminated.

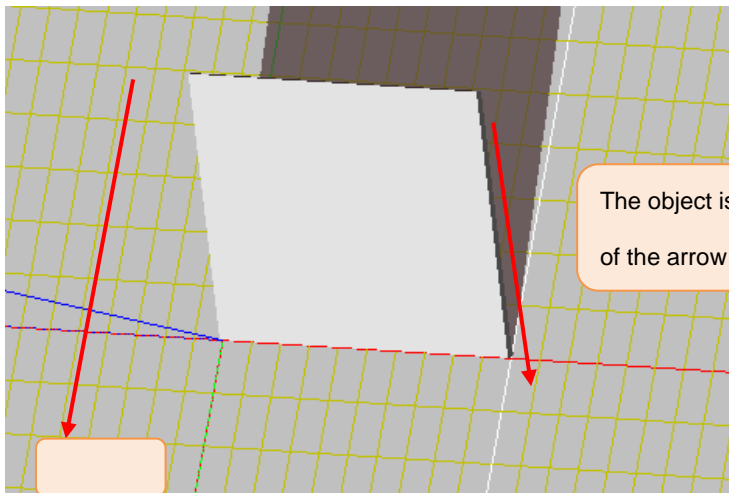


◇NOTE◇

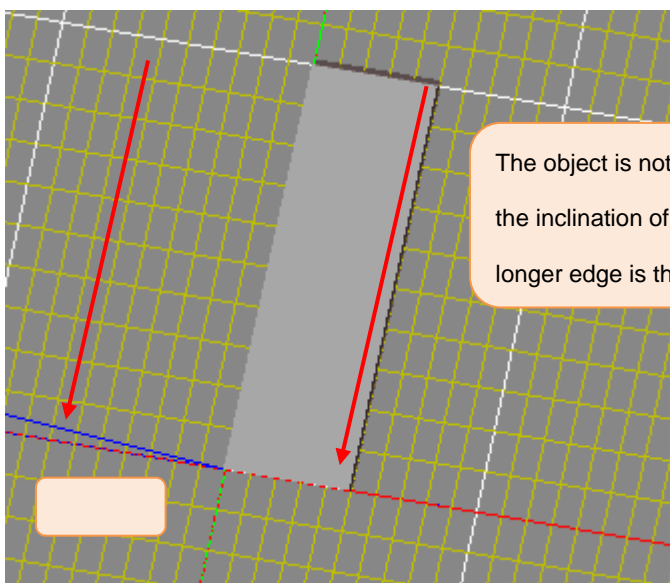
PV placement plane – Vertical/Horizontal directions

Depending on the length of the edges of the PV placement plane and the inclination of the edges to the horizontal plane, the vertical and horizontal directions on the PV placement plane are determined as shown below. The vertical/horizontal directions of the PV placement plane affect the direction of the placement of the PV module if some restrictions are applied in vertical placement or horizontal placement.

The direction of the edge with the steeper inclination is the vertical direction.



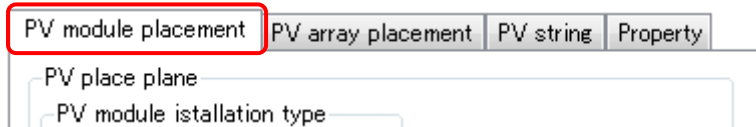
If the inclination of the edges is the same, the side with the longer edge is the vertical direction.



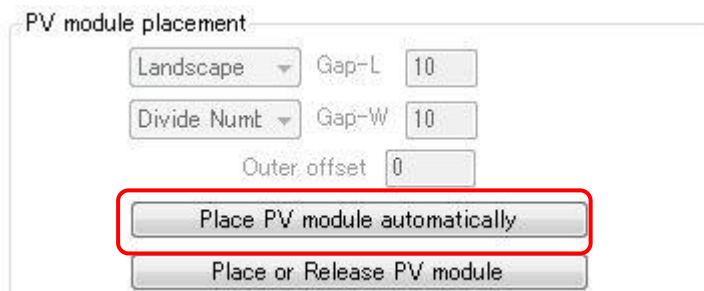
Place the PV modules filling the PV placement plane

Operation: Place the PV modules in the specified PV placement plane using the [Automatic] function.

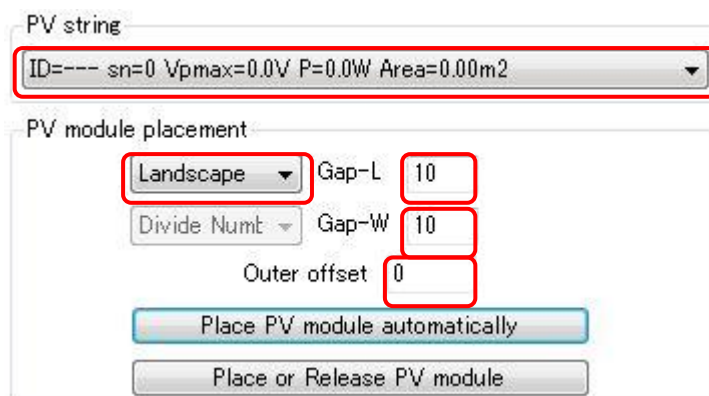
- ① Open the [PV module placement] tab.



- ② Click the [Place PV module automatically] button.



- ③ Specify the parameters to place the PV modules filling the specified plane.

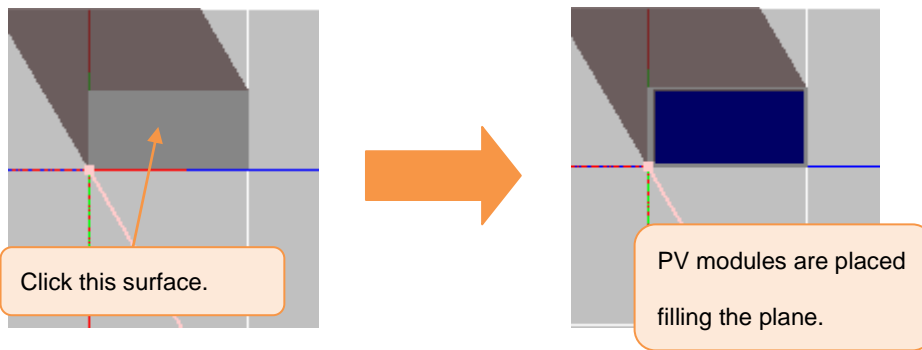


[PV string] list box]: Specify the PV string to which the PV module belongs.

[PV module placement] box

- [Landscape] list box: Set up the install direction of PV module. [Landscape] or [Portrait] can be selected. If PV module have a limit of rotation and set up this ,
- [Divide Numt] list box: Specify the number of divisions of the PV modules placed to move the PV modules. The details are described later.
- [Gap-L]: Specifies the gap (horizontal) between the PV modules to be placed. (Unit: mm)
- [Gap-W]: Specifies the gap (vertical) between the PV modules to be placed. (Unit: mm)
- [Outer offset]: Specify the minimum outer offset when the PV modules are placed automatically filling the PV module placement plane. (Unit: mm)

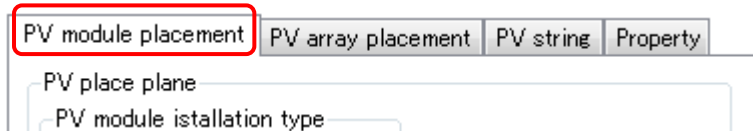
- ④ In the 3D drawing, click the PV module placement plane to fill the PV modules.



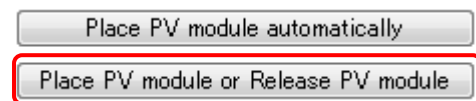
Delete all PV modules placed in the PV placement plane

Operation: Delete all PV modules placed in the PV placement plane.

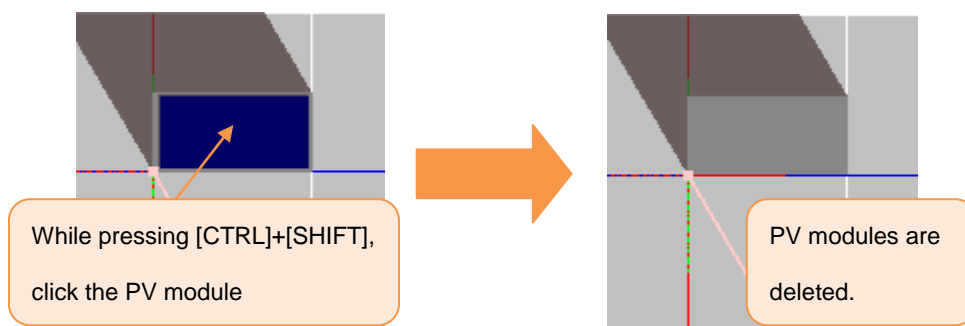
- ① Open the [PV module placement] tab.




- ② Click the [Place PV module or Release PV module] button. The [Place PV module or Release PV module] mode is enabled.



- ③ While pressing down the [CTRL] and [SHIFT] keys, click and delete the PV module in the 3D drawing.
- ④ All PV modules placed in the same plane of the clicked PV module are deleted.

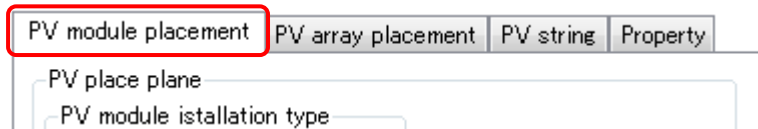


- ⑤ Click the [Cancel] icon  above the 3D drawing to terminate the [Place PV module or Release PV module] mode.

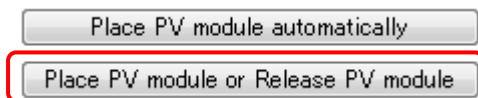
Place one PV module at a time in the PV placement plane

Operation: Place one PV module at a time in the PV placement plane.

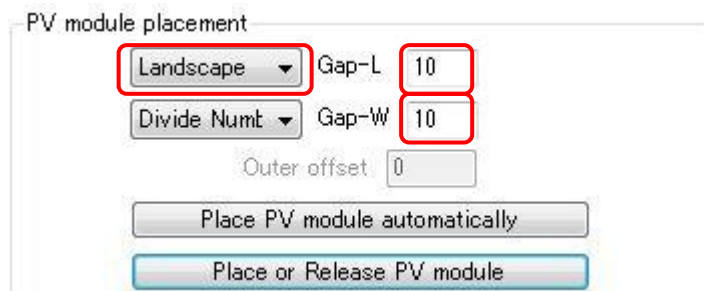
- ① Open the [PV module placement] tab.



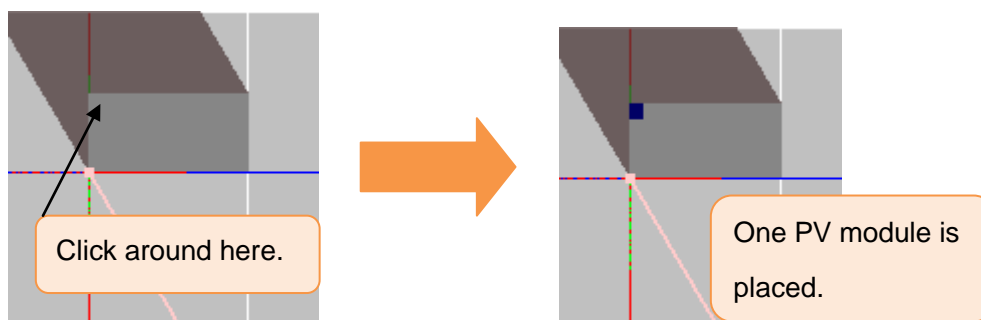
- ② Click the [Place PV module or Release PV module] button. The [Place PV module or Release PV module] mode is enabled.



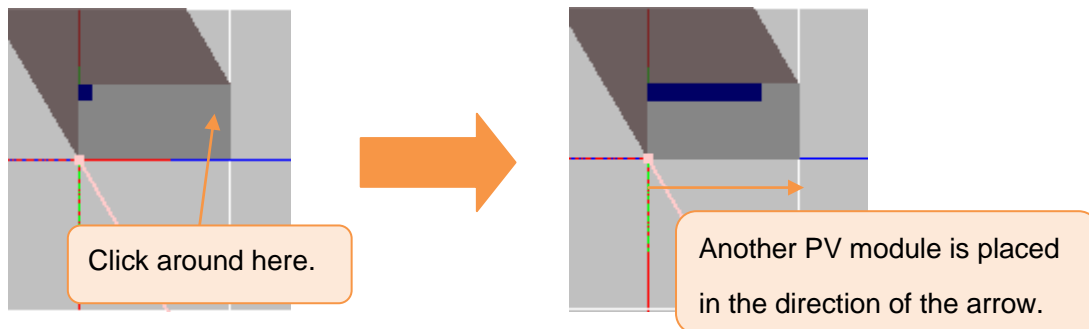
- ③ Enter the necessary data in [Gap-L] and [Gap-W] in [PV module Placement]. Enter the correct value for the PV module to be placed.




- ④ Click a location in the PV placement plane (selected earlier) in the 3D drawing.
- ⑤ The PV module is placed at the corner near the clicked location in the PV placement plane.



- ⑥ Click another location in the PV placement plane. Another PV module is placed in the direction of the clicked location from the PV module that has been already placed.

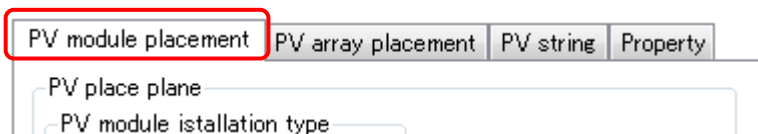


- ⑦ After placing all PV modules, click the [Cancel] icon  above the 3D drawing to terminate the [Place PV module or Release PV module] mode.

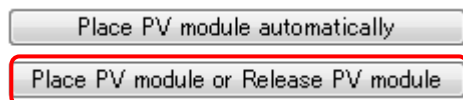
Move the placed PV module

Operation: Move one PV module placed in the PV placement plane.

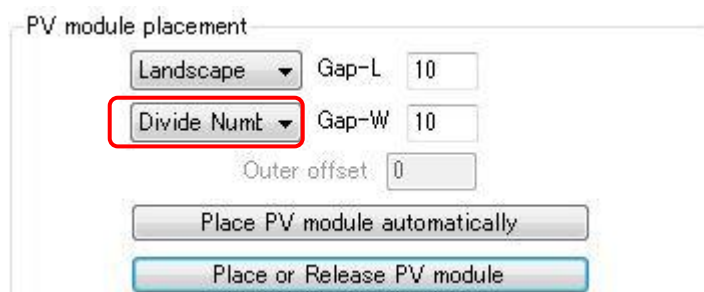
- ① Open the [PV module placement] tab.



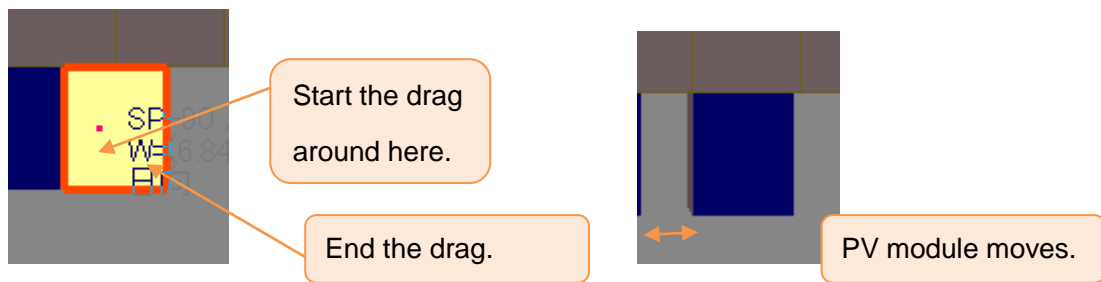
- ② Click the [Place PV module or Release PV module] button. The [Place PV module or Release PV module] mode is enabled.




- ③ Select the value (distance to move) in the [Divide Numt] list box. Here, use the default ([No. of divisions = 2]).



- ④ Click the PV module to be moved in the 3D drawing, and drag and drop the PV module.



- ⑤ Repeat the above steps and move the PV modules to the desired locations.

- ⑥ After moving all PV modules, click the [Cancel] icon  above the 3D drawing to terminate the [Place PV module or Release PV module] mode.

◇NOTE◇

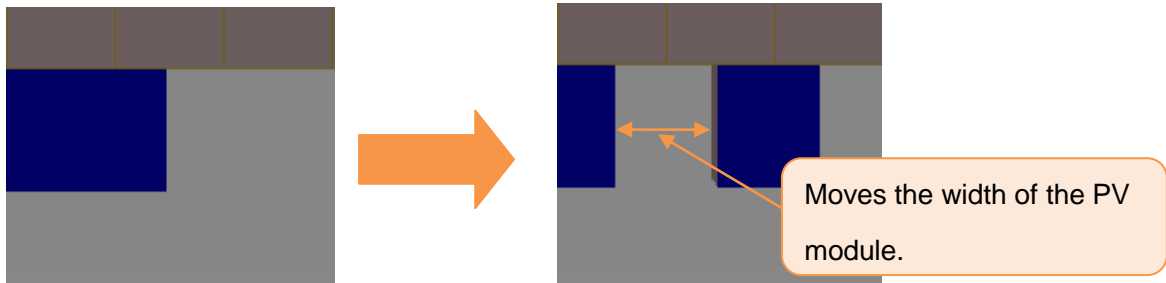
[Divide Num] parameter

Specify the following in this parameter:

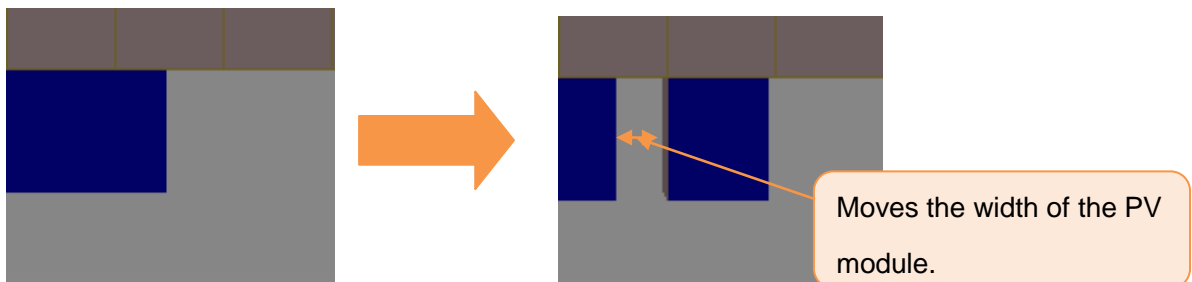
- The distance to move the PV module one time.

The following shows how the PV module is moved by changing the value (No. of divisions) in this parameter.

[No. of divisions: 1] = [Moving distance (1 time): Horizontal] : [Target PV module width] , [Vertical: Height]



[No. of divisions: 2] = [Moving distance (1 time): Horizontal] : [Target PV module width: 1/2], [Vertical: 1/2 of the height]

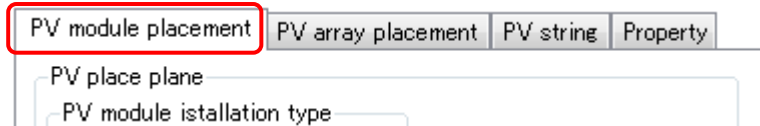


If the number of divisions is 3 or more, the moving distance is 1/3, 1/4...

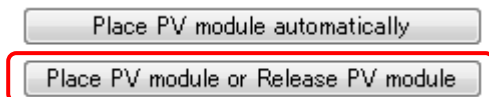
Delete the placed PV modules one by one

Operation: Delete the placed PV modules one by one

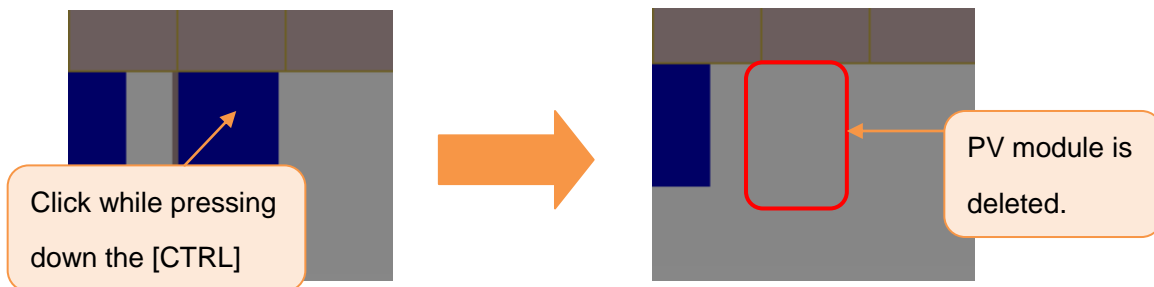
- ① Open the [PV module placement] tab.




- ② Click the [Place PV module or Release PV module] button. The [Place PV module or Release PV module] mode is enabled.



- ③ While pressing down the [CTRL] key, click any PV module already placed in the 3D drawing.
- ④ The placed PV module at the clicked location is deleted.




- ⑤ After deleting the PV module, click the [Cancel] icon  above the 3D drawing to terminate the [Place PV module or Release PV module] mode.

3. Automatically Place the PV Array in the Specified Area in the 3D Drawing

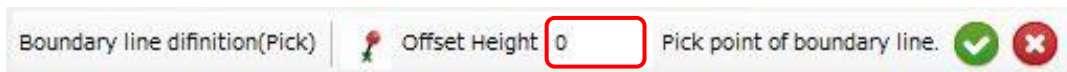
Set the area to place the PV array

Operation: Set the area to place the PV array in the 3D drawing.

- ① Click [Boundary definition (Pick)]  in the toolbar in the 3D drawing to enable the [Boundary definition (Pick)] mode.



- ② Set the [Offset Height] parameter. Here, enter "0".

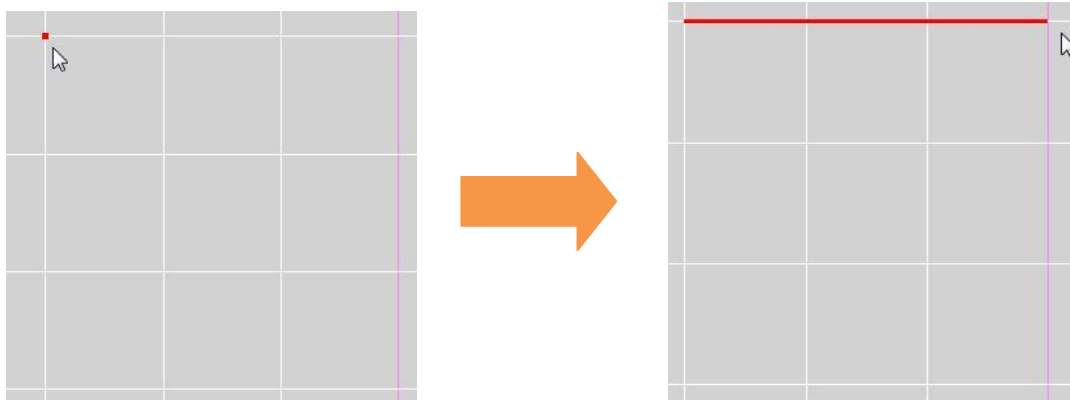


◇NOTE◇

[Offset Height] parameter

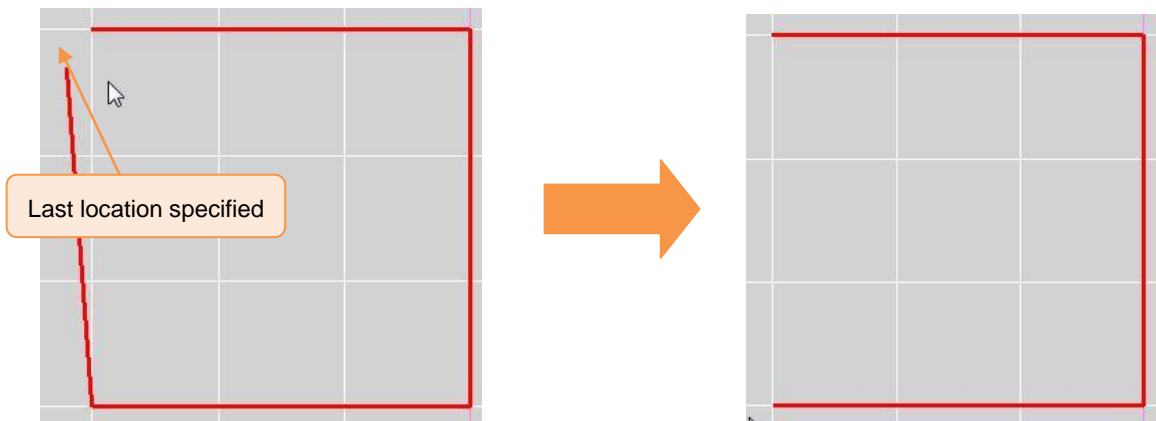
Setting "0" or more in the [Offset Height] parameter raises the placement area to the specified height (Unit: mm) specified.

- ③ Click a location in the 3D drawing.
④ Click the second location. The 1st location and the second location are connected by a red line.



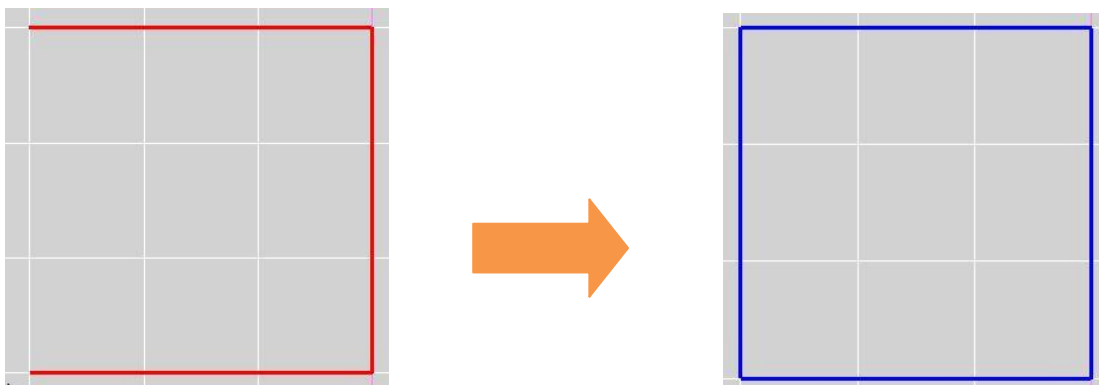
◇NOTE◇

Pressing the [BackSpace] key deletes the last location specified.



- ⑤ Click the 3rd location. When 3 locations are specified, pressing the [Enter] key or clicking [OK]

✓ in the toolbar defines the area (where the 1st location and the last location are connected) as the PV placement area and the area is drawn by blue lines instead of red lines when the locations are connected. The [Boundary definition (Pick)] mode is terminated.

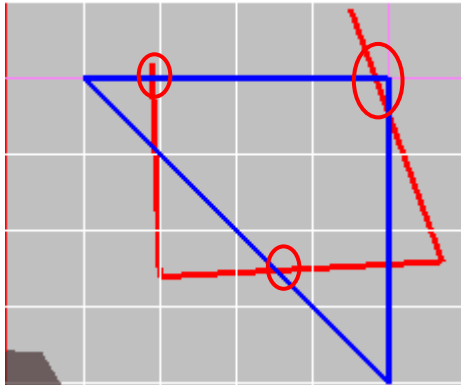


◇NOTE◇

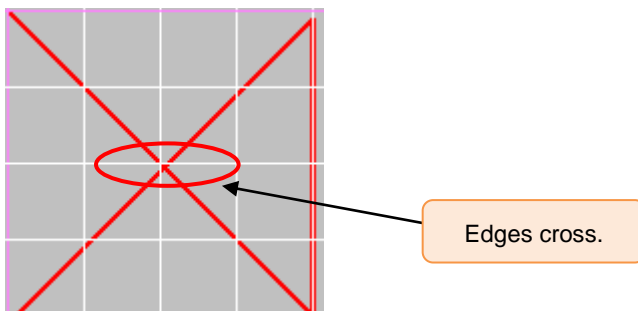
Invalid placement area (geometry) (area that cannot be set as the placement area).

Up to 99 locations can be set to define a placement area. However, a placement area cannot be defined if the location specification is invalid as shown below.

Locations interfere with another placement area.




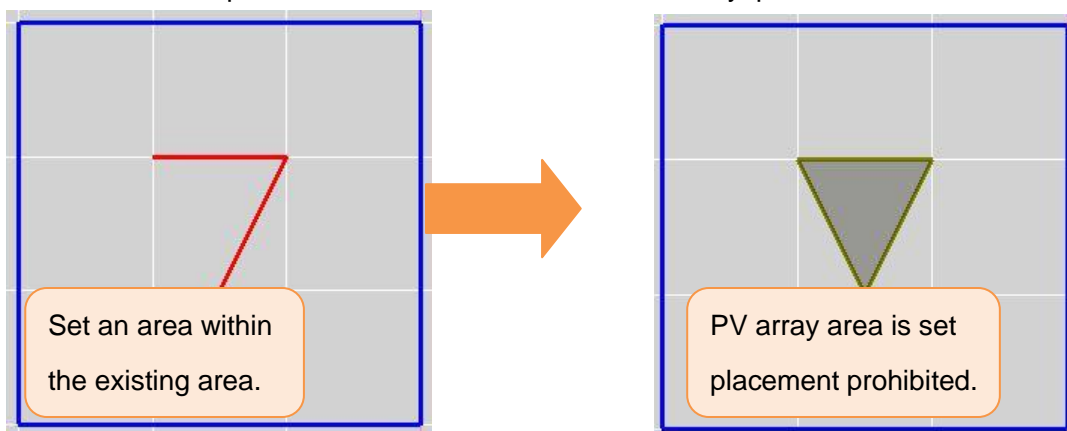
Locations interfere with themselves.



Set "Placement prohibited area " in the placement area

Operation: Set a "Placement prohibited area" in placement area.

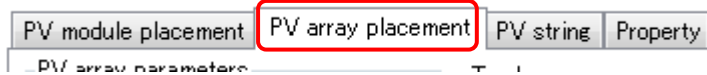
- ① Click [Boundary definition (Pick)]  in the toolbar icons in the 3D drawing to enable the [Boundary definition (Pick)] mode.
- ② Set an area in the same way that placement area is set in the existing PV array placement area.
- ③ The "Placement prohibited area" is set in the PV array placement area as shown below.



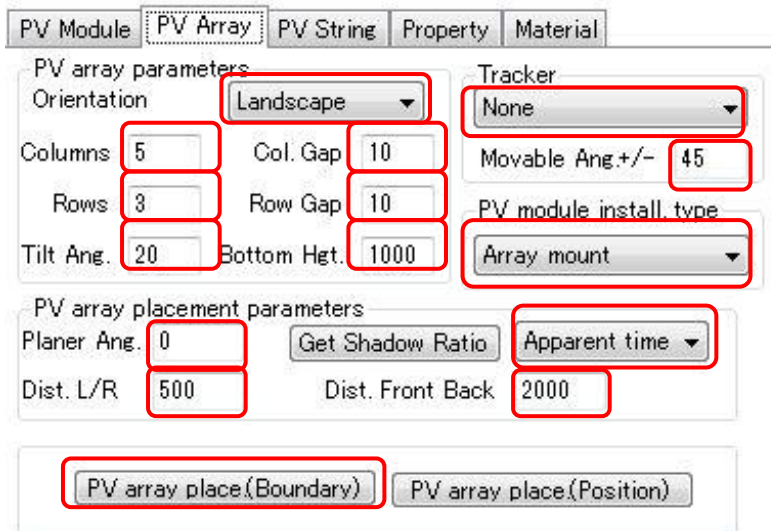
Automatically set the PV array in the area that has been set

Operation: Automatically set the PV array in the PV array placement area that has been set.

- ① Open the [PV array placement] tab.



- ② Set the parameters in the [PV array placement] tab.



[PV array placement] tab - Parameters

[PV array parameters] box

- [Orientation]: Specify the orientation of the PV modules that configure the PV array.
- [Columns]: Specify the number of PV module columns (horizontally) that configure 1 PV array.
- [Col. Gap]: Specify the gap between the PV modules (columns). (Unit: mm)
- [Rows]: Specify the number of PV module rows (vertically) that configure 1 PV array.
- [Row Gap]: Specify the gap between the PV modules (rows). (Unit: mm)
- [Tilt Ang.]: Specify the tilting angle from the horizontal plane. (Unit:°)
- [Bottom Hgt.]: Specify the height to the bottom edge of the PV array frame from place plane. (Unit: mm)

[Tracker] box

- [Tracker type] list box : Specify [None], [Horizontal 1 axis], or [Skewed 1 axis].
- [Movable Ang.]: Specify the tracker's movable angle to use the tracker.

[PV module install type] box

[Install type] list box : Specify [Array mount], [Rooftop] or [Roof panel with vent].

[PV array placement parameters] box

[Planar Ang. for South]: Specify the placement angle of the PV array (Direct south is 0 degree). (-180°~+180° counterclockwise)

[Dist. Left Right]: Specify the distance (left-right) between the PV arrays. (Unit: mm)

[Dist. Front Back]: Specify the distance (front-back) between the PV arrays. (Unit: mm)

Clicking the [Get by Shadow Ratio] button allows calculation of the distance in which the arrays are not shadowed in the time period set in advance and to set the distance in the distance parameters.

- ③ Click the [PV array place.(Boundary)] button to enable the [PV array place (Boundary)] mode.

PV array place.(Boundary) | Offset Height 0 | Outer offset 0 | No. of protruded array 0

Max. no. of array 250 | Pick boundary line to place PV arrays. [X]

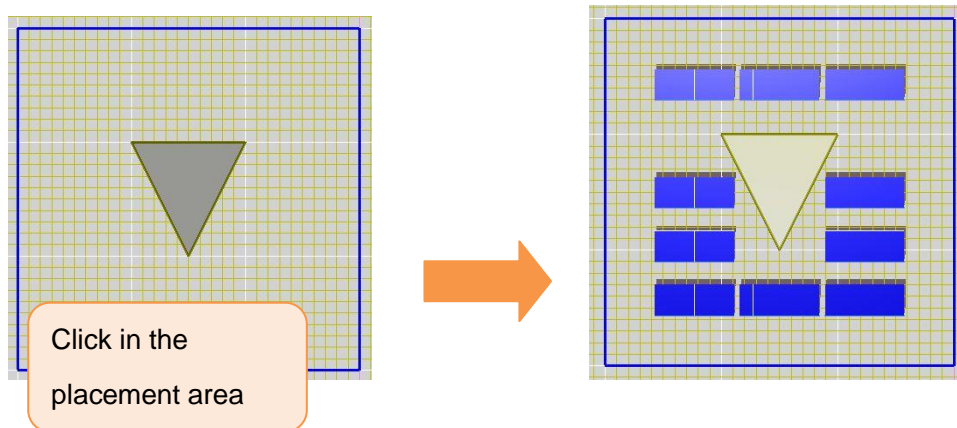
[Offset Height]: Specifies to height[mm] which floats PV array from the surface enclosed by boundary line.

[Outer offset]: Lets the range of inner side "Outer offset"[mm] from the boundary line be a placement area.

[No. of protruded array]: Specifies the number of arrays which protrudes out of the placement area.

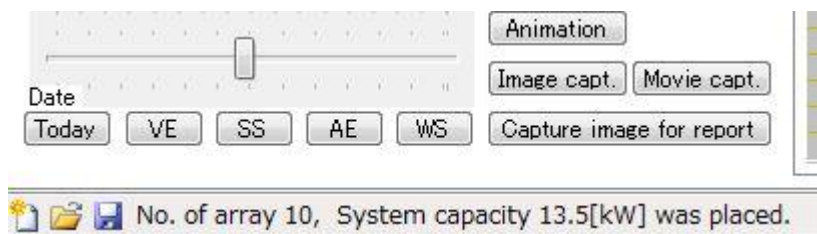
[Max. no. of array] Specifies the number of maximum PV arrays to place.

- ④ Click a location in the placement area in the 3D drawing.
- ⑤ Arrays are automatically placed until the inner side of boundary is filled or the number of arrays reaches the specified max. number of array.



◇NOTE◇

- The number of arrays depends on the configuration of offset and distance between arrays.
- The number of array and system capacity are displayed at the status bar of this application.




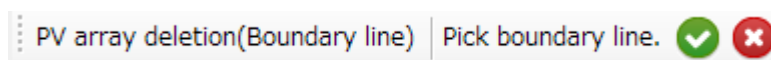
[No. of array] : The number of arrays which placed automatically

[System capacity[kW]] : The maximum system capacity of PV arrays placed automatically.

Delete the PV arrays placed in the area

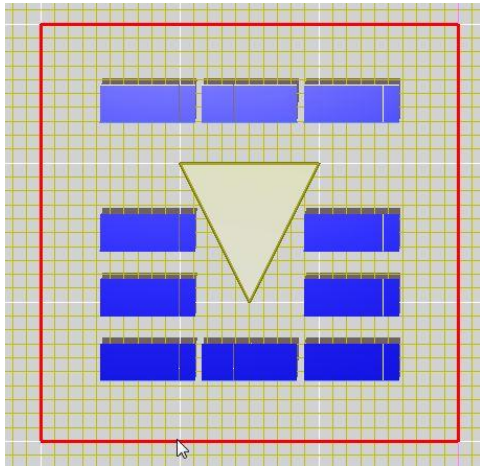
Operation: Delete all PV arrays placed in the area.

- ① Click [PV array deletion (Boundary line)]  in the toolbar icons in the 3D drawing. The [PV array deletion (Boundary line)] mode is enabled.




- ② Click the PV array placement area that includes the PV arrays to be deleted in the 3D drawing.

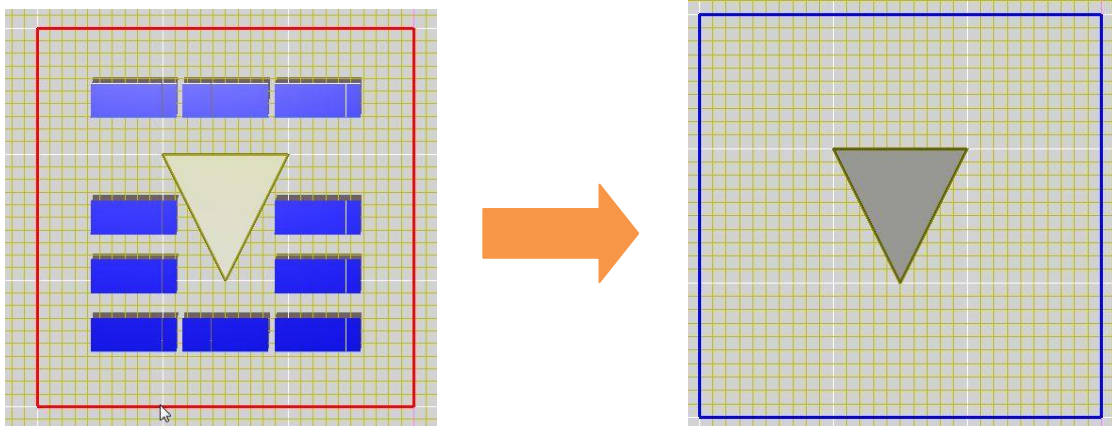
- ③ The border of the clicked PV array placement area is drawn in red and selected.



◇NOTE◇


Clicking other PV array placement areas selects multiple areas simultaneously.

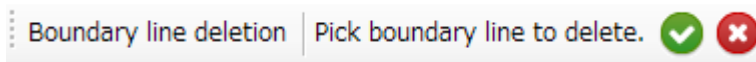
- ④ In this state, press the [Enter] key or click [OK]  in the toolbar.
- ⑤ The PV arrays in the selected PV array placement area are deleted, and the [PV array deletion (Boundary line)] mode is terminated.



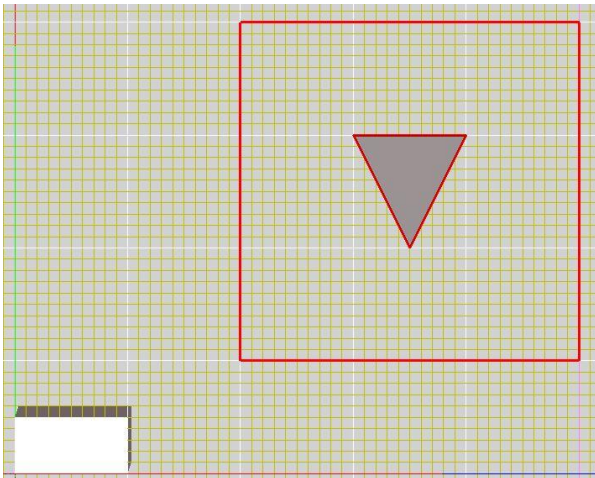
Delete the placement area that has been set

Operation: Deletes the PV array placement area that has been set.

- ① Click [Boundary line deletion]  in the toolbar icon in the 3D drawing. The [Boundary line deletion] mode is enabled.




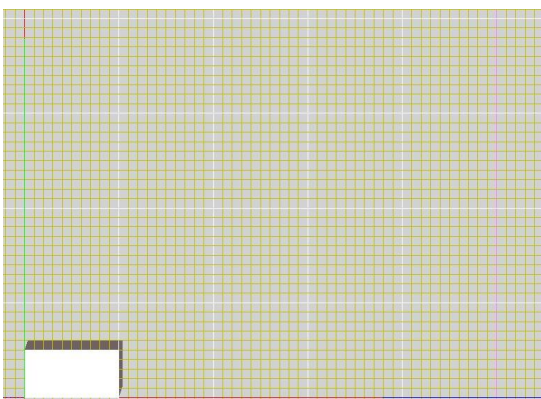
- ② Click a location inside the PV array placement area to delete in the 3D drawing.
- ③ The border of the clicked PV array placement area is drawn in red and selected.



◇NOTE◇

Clicking other PV array placement areas selects multiple areas simultaneously.

- ④ In this state, press the [Enter] key or click [OK]  in the toolbar.
- ⑤ The selected PV array placement area is deleted, and the [Boundary line deletion] mode is terminated.

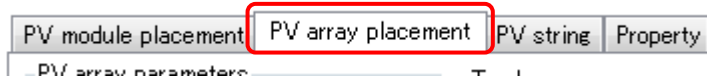


4. Place the PV array in a location in the 3D drawing

Place the PV array in a location

Operation: Place the PV array in a location in the 3D drawing.

- ① Open the [PV array placement] tab.



- ② Set the parameters in the [PV array placement] tab.

Please refer to the “Automatically set the PV array in the area that has been set” of the preceding chapter.

- ③ Set the parameters at [PV array place.(Position)] toolbar which is displayed by clicking the [PV array place.(Position)] button.

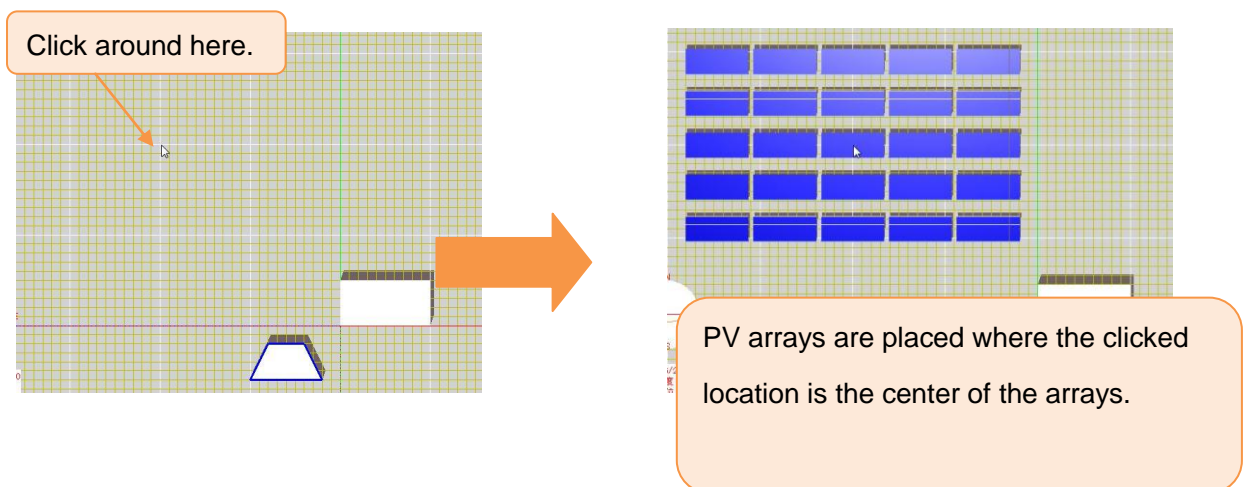


[Offset Height]: Specifies to height[mm] which floats PV array from the surface of picked point.

[No. of arrays L/R]: Specifies the number of arrays placed to a horizontal direction.


[No. of arrays F/B]: Specifies the number of arrays placed to a vertical direction.

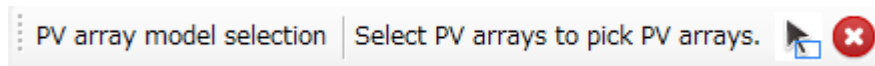
- ④ Click a location in the 3D drawing.
- ⑤ In the clicked location, the PV arrays (the number of PV arrays specified) are placed. The [Manual Placement (Pick)] mode is terminated.



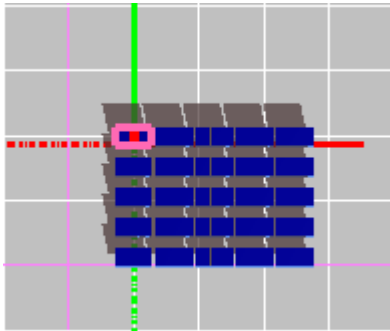
Delete the placed PV array

Operation: Delete a PV array placed in the 3D drawing.

- ① Click [Select Object/PV Array]  in the toolbar icons in the 3D drawing. The [PV array model selection] mode is enabled.




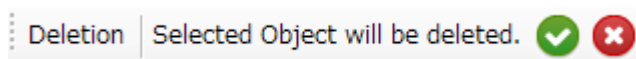
- ② Click the PV array to delete in the 3D drawing.
- ③ The clicked PV array is highlighted with a pink border as shown below.




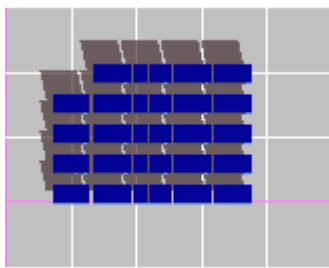
◇NOTE◇

While pressing down the [Shift] key or [CTRL] key, click and select multiple PV arrays

- ④ In this state, click [Selected Object will be deleted]  in the toolbar icons.
- ⑤ The [Selected Object will be deleted] mode is enabled and the lower row of the toolbar icons is changed to the following:



- ⑥ Click [Deletion] .
- ⑦ Selected PV arrays are deleted in the 3D drawing. The [Selected Object will be deleted] mode is terminated.



5. Splitting up the PV array

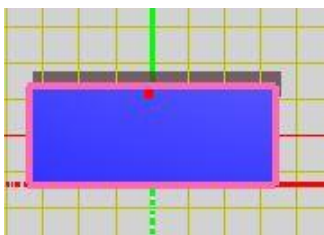
Splitting up the PV array


Operation: Splitting up a PV array

This function cannot be used if the Column number of [PV array parameters] is not even.

①Click the [PV array place.(Position)] button and Place a PV array in the arbitrary point on 3D drawing.

②Select the PV array by using [Object/PV array selection] button .

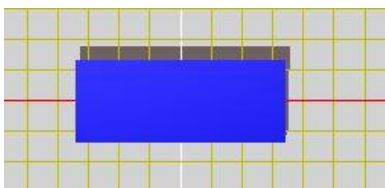


③Click the [Selected Object/PV array split] button  in this state. Then the toolbar shown in the following figure is displayed.

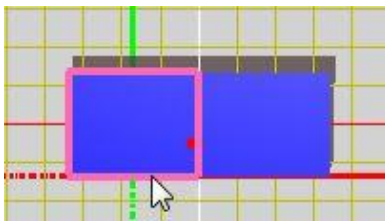


④Click the [Apply] button .

The selected PV array is split up. And the [Selected Object/PV array split] mode is canceled.



⑤Select the PV array by using [Object/PV array selection] button  again.



It can check that the PV array is divided into two

6. Application

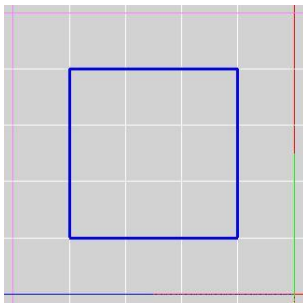
Operation: Place the PV arrays by using both the [PV array place.(Boundary)] function and [Selected Object/PV array split] function.

Preparation

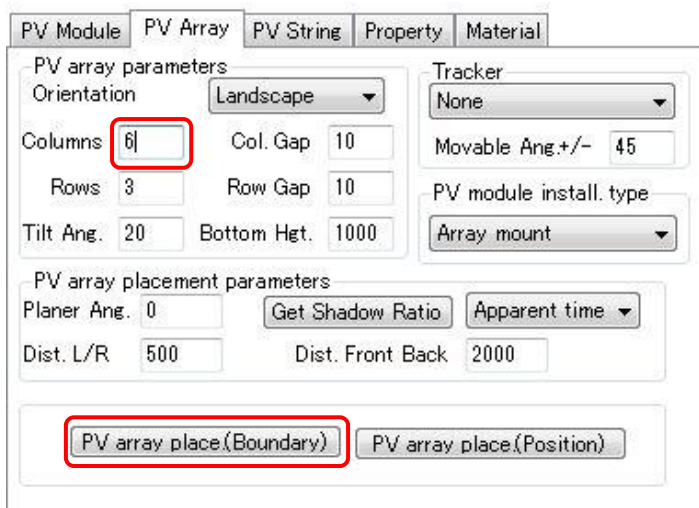
- 1) Start the HelioBase®.
- 2) Select the [PV module candidate] tab. And Select the PV module.

In this process, the PV module of SP-90 manufactured by Field Logic is used.

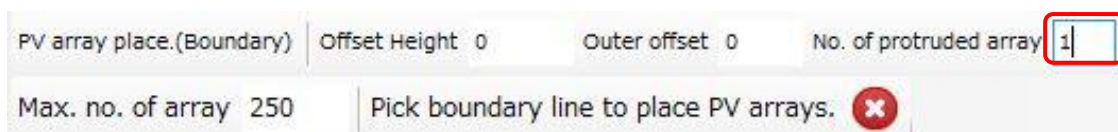
- ① Make a PV placing area by using the function of [Boundary line definition] in the [3D model] tab.



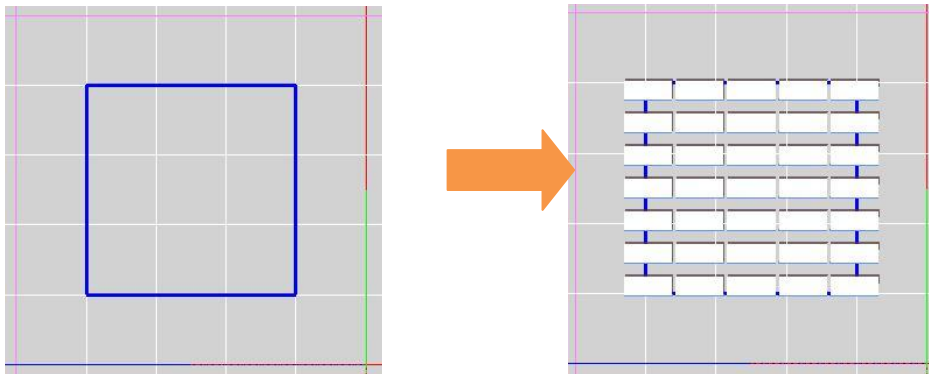
- ② Select the [PV Array] tab and set the [Columns] to “6”, and Push the [PV array place.(Boundary)] button.




- ③ Set the [No. of protruded array] to “1” in the [PV array place.(Boundary)] toolbar.



- ④ Click the inner side of PV placing area. Then the PV arrays are placed automatically.

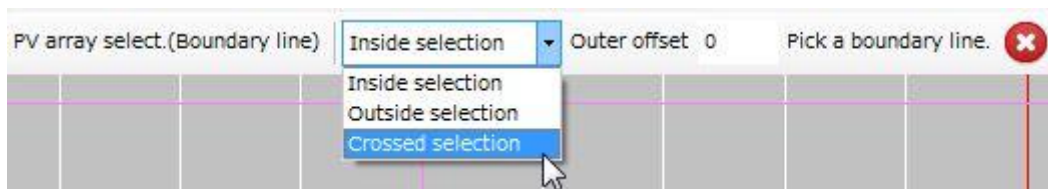


- ⑤ Click the [Object/PV array selection (Boundary line)] icon  at the toolbar.

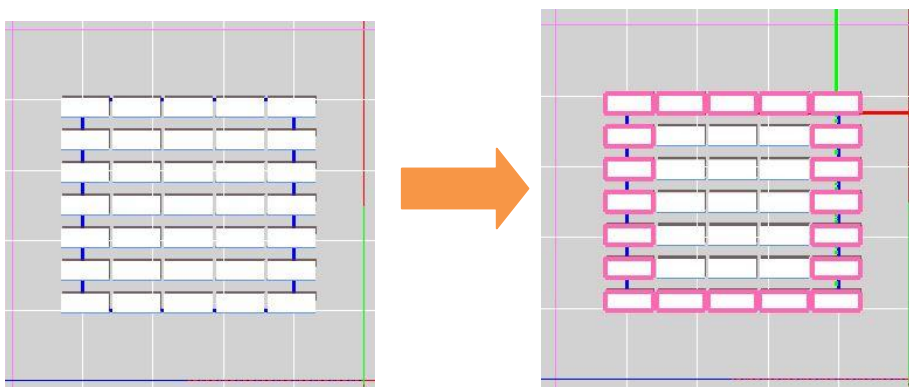
The tool bar of the following figure is displayed.



Select the [Crossed selection] in the list box.

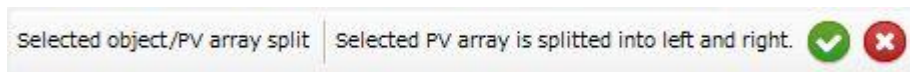


- ⑦ Click the inner side of the PV array placing area. Then the PV arrays across the boundary line are selected.



- ⑧ Click the [Selected Object/PV array split] icon .

The tool bar of the following figure is displayed.

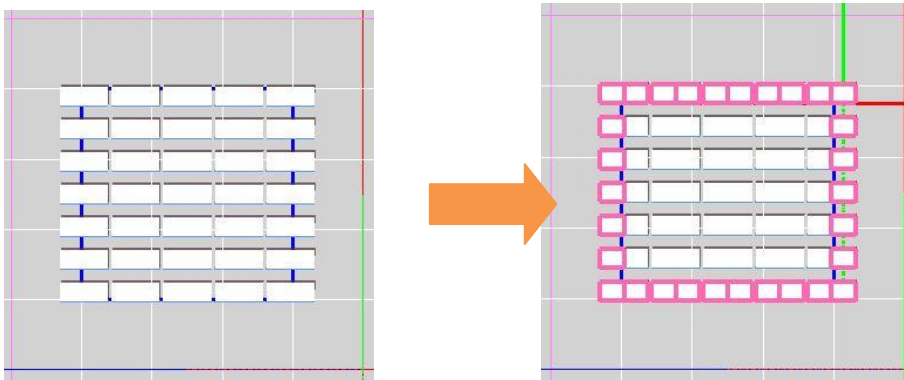


- ⑨ Click the [Apply] icon .

- ⑩ Click the [Object/PV array selection (Boundary line)] icon  at the toolbar again.

- ⑪ Select the [Crossed selection] in the list box.


- ⑫ Click the inner side of the PV array placing area. Then the PV arrays across the boundary line are selected as following figure.

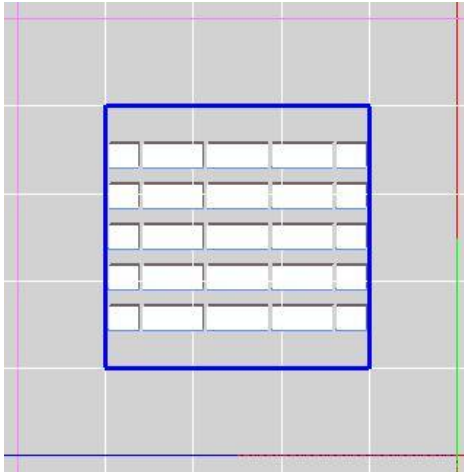


- ⑬ Click the [Selected Object/Deletion] icon .

- ⑭ The tool bar of the following figure is displayed.



⑮ Click the [Apply] icon . Then the selected PV arrays are deleted as the following figure.

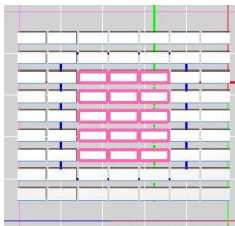


PV array can be efficiently placed in an PV array placing area by combining the specification of the number of protruded array with the function of the PV array splitting.

◇NOTE◇

About the [Object/PV array selection (Boundary)] mode.

Inside selection — Only PV arrays placed inside the boundary line is chosen.



Outside selection — PV arrays other than PV arrays placed inside a boundary line are chosen.



Crossed selection — Only PV arrays which overlap with the boundary line is chosen.

