

Siradel Planner User Guide

Version 3.7

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- **Introduction**
- Main menu overview
- Map data management
- Network settings wizard
- Network element creation
- Automatic cell selection
- Coverage prediction
- Automatic cell planning
- Access auto assignment
- Link analysis
- Annex – additional information

Introduction

Software Siradel Planner is a radio planning tool for the design of

- Outdoor & Indoor mobile networks
- FWA (Fixed Wireless Access)
- IOT (LoRaWAN) networks

Two modes of Siradel Planner are available

- Standalone (Desktop): compatible with Windows 10 and 11, and Windows Server 2019
- SaaS: remote connection to Siradel's SaaS server with login information

Main Features and Scope

Coverage simulation : coverage and capacity simulations for outdoor, indoor, outdoor-to-indoor and indoor-to-outdoor scenarios.

Automatic cell selection : identify optimal locations for new sites, whether it's for greenfield deployments or network densification.

Automatic cell planning : optimize the antenna configurations (tilt, azimuth, transmit power, etc.) to reach network planning objectives.

3D coverage simulation and visualization : offer 3D views of buildings to illustrate their indoor penetration and facade coverage.

Point to Point and Point to Multiple Points simulation: model radio links either between two defined locations (Point-to-Point) or from a single transmitter to multiple receivers (Point-to-Multipoint). It generates vertical path profiles for each link and provides detailed input parameters, link budget calculations, and performance results, including link reliability and capacity estimates for each simulated path.

Fixed Wireless Access network planning : determine available service levels before signing up new FWA subscribers and use location data and radio access network insights to optimize cell selection.

Backhaul network planning and simulation : point-to-point and point-to-multipoint analysis and automatic planning.

Multiple technologies and multiple frequency bands :

LTE/5G, LoRa, Wifi and non-standard technologies

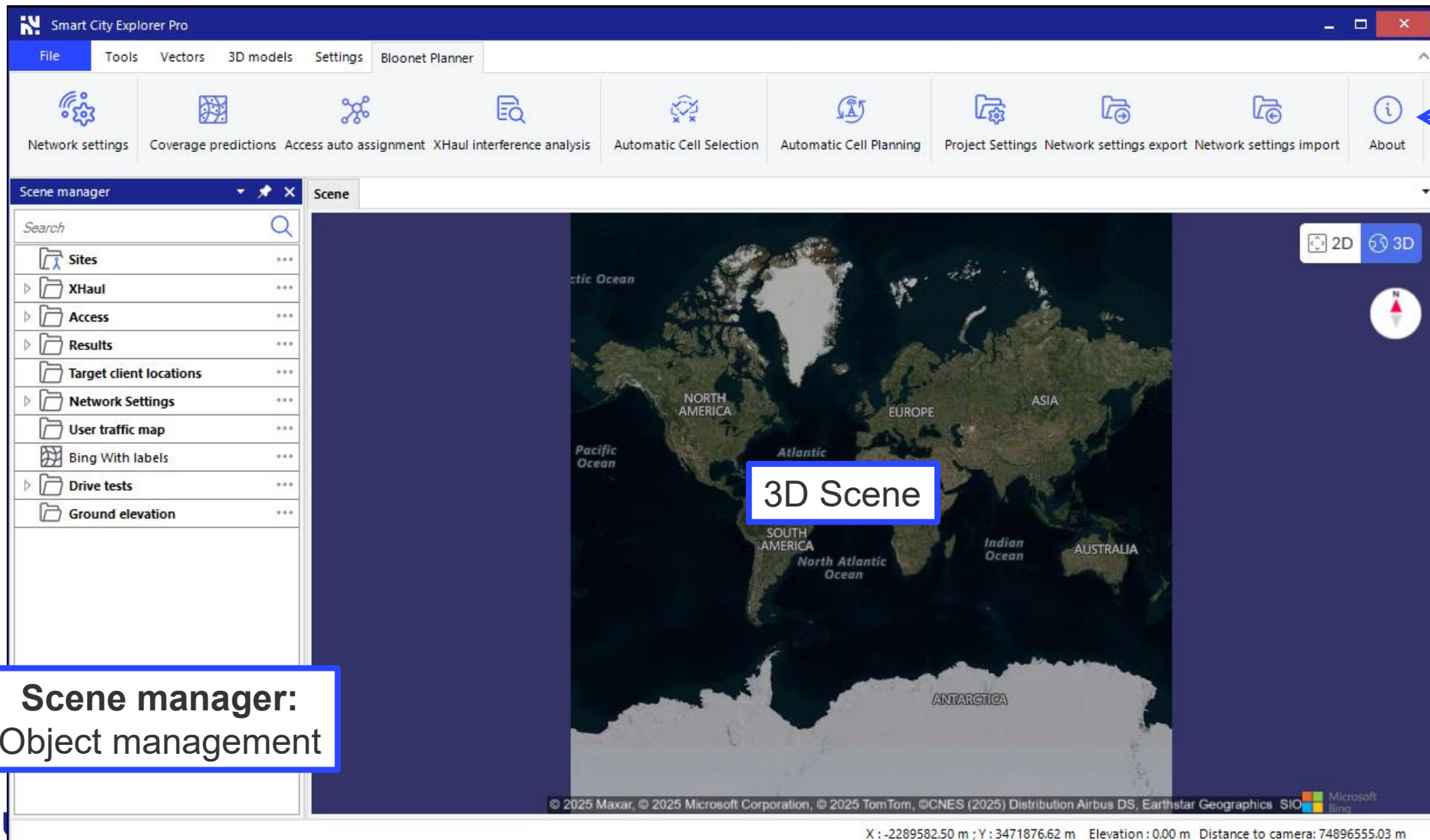
Sub-6 GHz, mmWave bands

Vector editor : create and edit polygons in the LOD1 environment.

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Main Windows

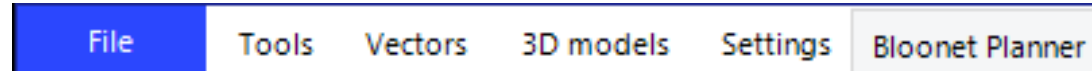


Menu Bar

Scene manager:
Object management

3D Scene

Menu Bar : main items



Tools

- Address search
- Bing Maps display
- Ruler
- **Add zones**
- Clipping
- Viewpoints
- Screenshot
- **GIS select/extract**
- **Projection**
- **Point mapping**
- Terrain colorization options
- Resize

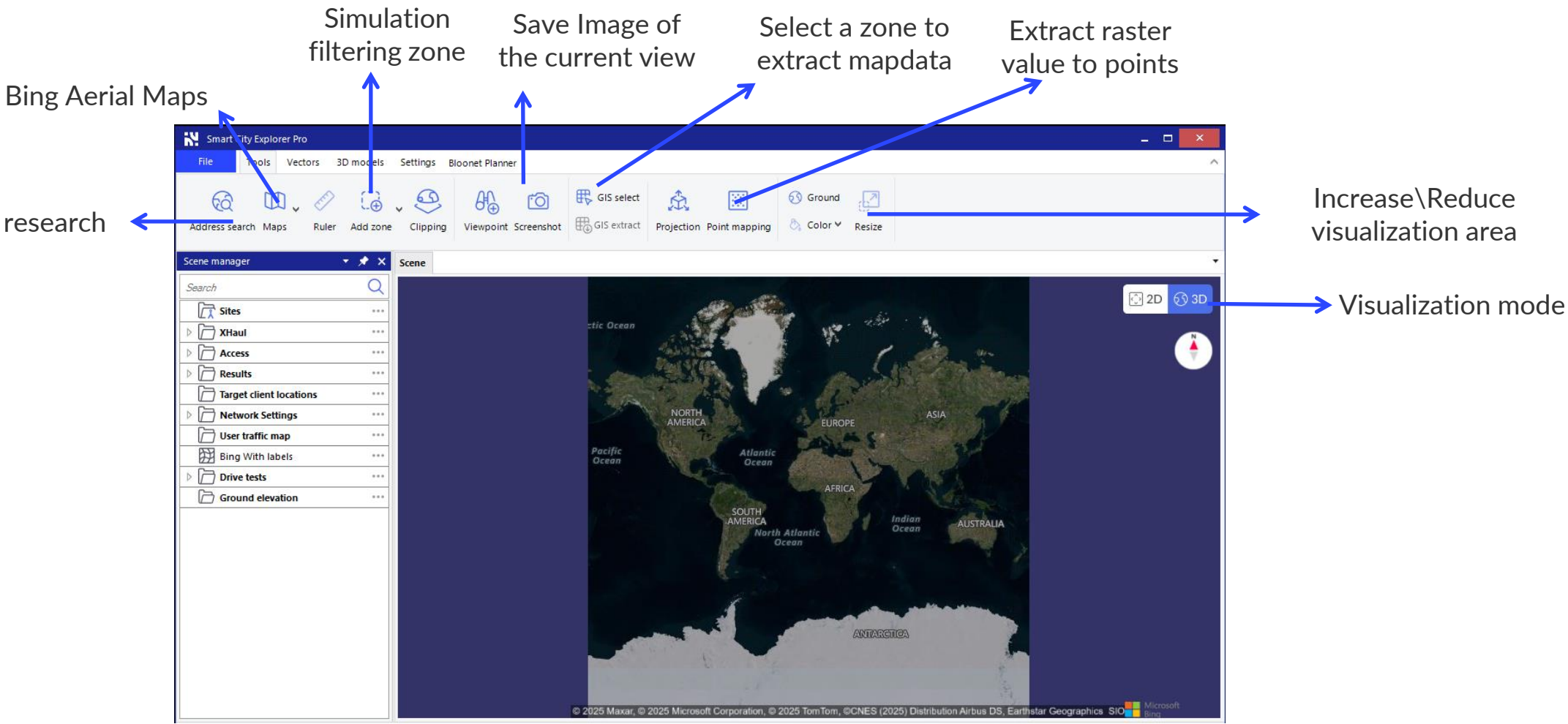
Settings

- Display
 - Compass
 - Windows → **Windows**
 - Full screen
 - Plugins
- Animation editor
 - Legend
 - Logs
 - Palette editor
 - Properties
 - Scene manager

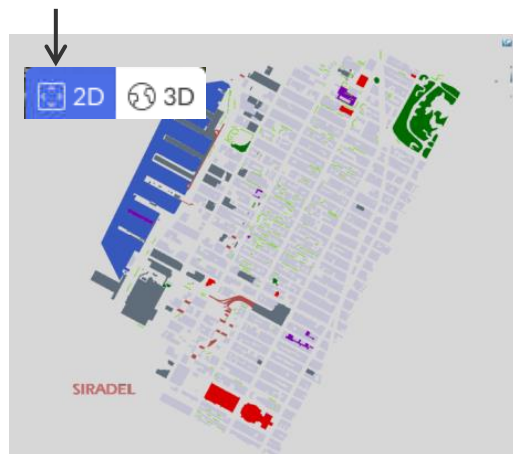
Bloonet Planner

- Network settings (Create/Export/Import)
- Shortcut for Coverage predictions
- Shortcut for Access auto assignment
- Shortcut for XHaul Interference analysis
- Shortcut for Automated Cell Selection
- Project Settings
- About

GUI Overview - Tools

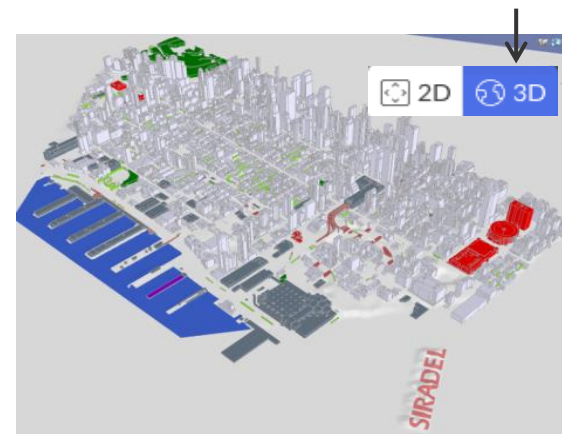


Visualization and navigation tips



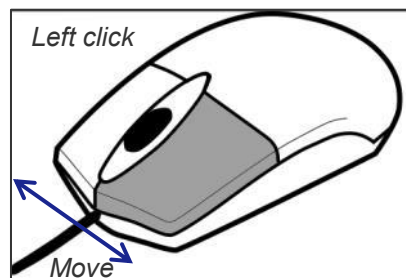
2D view

- Equivalent to the 3D view with the camera positioned in top view
- Camera rotation is blocked

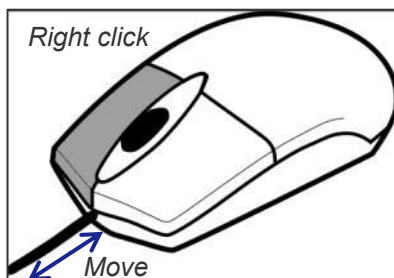


3D view

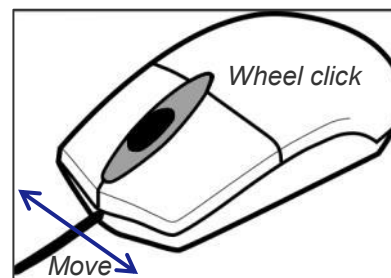
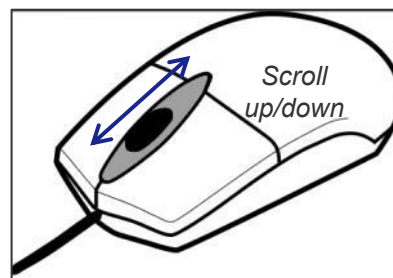
- Movement of the camera possible in the 3 axes with a left click + movement of the mouse and the wheel
- Rotation of the camera possible in 2 axes with a wheel click + mouse movement



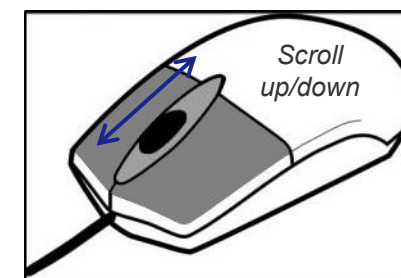
Move map



Zoom in/out



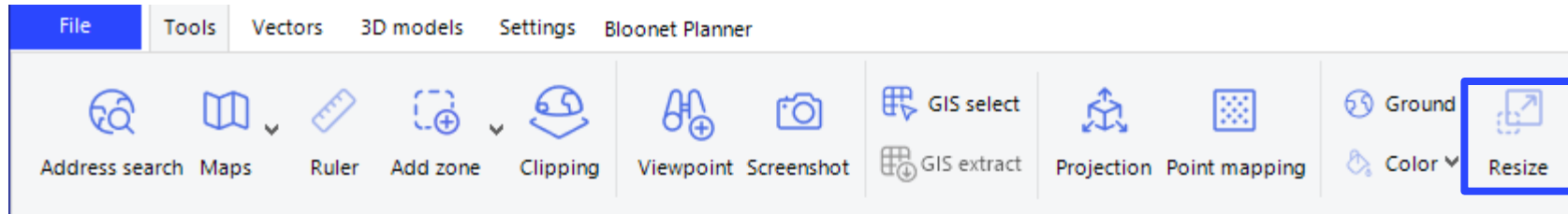
Move around



Change viewpoint

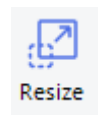
Use left and right clicks to move around with mouse without scrolls

Resize

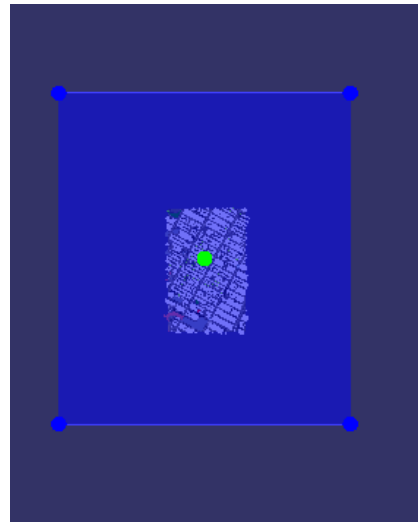


Resize enables to increase or reduce the working area that the user can visualize in the scene

- 1, Click on Resize to select the geographical area
- 2, Click again on Resize to validate



1



2

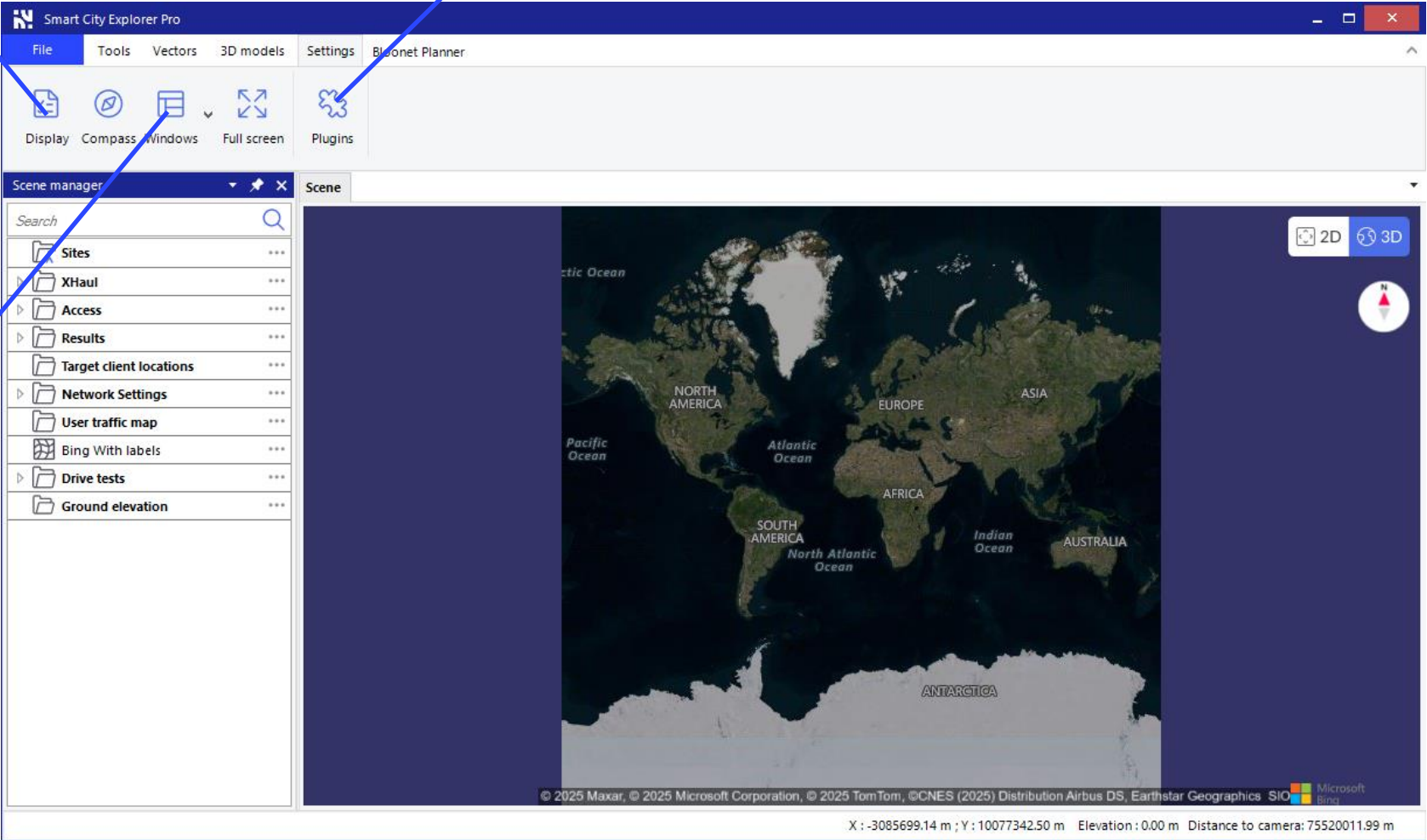


GUI Overview - Settings

Display properties
(e.g. switch from Metric to Imperial system)

Siradel tool plug-ins (Bloonet Planner, InoWave, Building Creator.)

Animation Editor	Alt+A
Clipping	Alt+C
Legend	Alt+L
Logs	Alt+D
Palette Editor	
Properties	Alt+P
☒ Scene Manager	Alt+T
☒ Viewpoints	Alt+V



GUI Overview - Bloonet Planner

Network setting (Create)

Network simulations and analysis

Automatic Site Selection and Cell Planning

Project level Computation related parameter settings

Network settings export/import

Scene manager

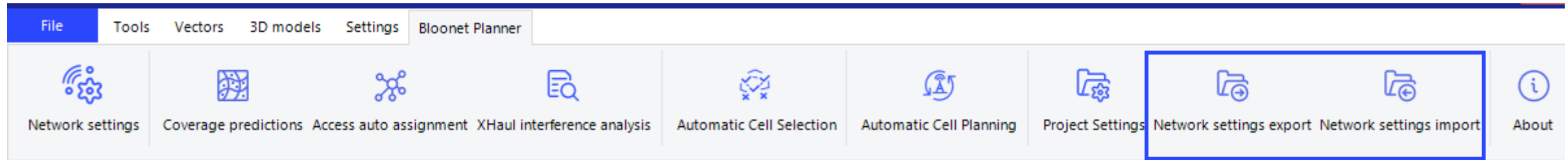
- Network settings
- Network element management
- Simulation results

Scene

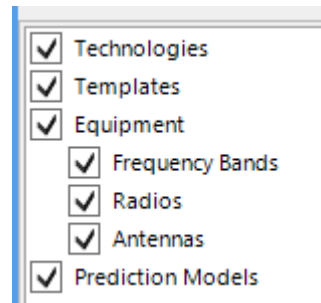
- Map data visualization
- Network elements visualization
- Coverage maps visualization

The screenshot shows the Bloonet Planner interface. At the top is a menu bar with 'File', 'Tools', 'Vectors', '3D models', 'Settings', and 'Bloonet Planner'. Below the menu bar is a toolbar with icons for 'Network settings', 'Coverage predictions', 'Access auto assignment', 'XHaul interference analysis', 'Automatic Cell Selection', 'Automatic Cell Planning', 'Project Settings', 'Network settings export', 'Network settings import', and 'About'. The main window is divided into two panes. The left pane is the 'Scene manager' with a search bar and a list of items: 'Sites', 'XHaul', 'Access', 'Results', 'Target client locations', 'Network Settings', 'User traffic map', 'Bing With labels', 'Drive tests', and 'Ground elevation'. The right pane is the 'Scene' view, which displays a world map. The map is currently in 2D view, as indicated by the '2D' button being selected. The map shows the continents and oceans. At the bottom of the window, there is a status bar with the text: 'X : -2289582.50 m ; Y : 3471876.62 m Elevation : 0.00 m Distance to camera: 74896555.03 m'.

Network settings Import / Export



- **Network Settings Export** allows to export the entire network settings in a XML file
- XML files can be imported with **Network Settings Import**.
- During the import process, it is possible to select the categories of network settings to import.



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Map data format overview

This section introduces the **Outdoor** LoD1 outdoor map data import.

LoD1 is the first level of 3D building modeling, used for large-scale urban planning and basic simulation needs. It represents buildings as **simple blocks** without any roof shapes, facade details, or interior structures.

For **Indoor** or **Hybrid** environments (outdoor + indoor), accurate simulations may require creating a **3D model** of the environment. This detailed 3D model is referred to as **LoD4** (Level of Detail 4).

Bloonet Planner supports **LoD4** models in **DXF** format. For **Indoor** or **Hybrid** environments modeling and other related information, please refer to [Indoor & Outdoor/Indoor Hybrid Scenario](#).

LoD1 Outdoor Map data import

Layer		Planet format	Asset format	Bil format	Mapinfo format	Shape format
DTM	Map data files	*.bin	*.bin	*.bil, *.hdr	*.tab, *.grd	NA
	Volcano required files	index	index.txt	index.xml	index	
	Siradel Planner Import file	index	index.txt	*.bil	*.grd	
DLU	Map data files	*.bin	*.bin	*.bil, *.hdr	*.tab, *.grc	
	Volcano required files	index menu	index.txt menu.txt	index.xml menu	index menu	
	Siradel Planner Import file	index	index.txt	*.bil	*.grc	
DHM	VoMap data files	*.bin	*.bin	*.bil, *.hdr	*.tab, *.grd	
	Volcano required files	index	index.txt	index.xml	index	
	Siradel Planner Import file	index	index.txt	*.bil	*.grd	
Vector	Map data files	*.txt	*.txt	NA	*.dat, *.id, *.map, *.tab	*.shp, *.shx, *.prj, *.dbf, *.cpg
	Volcano required files	index menu	index.txt menu.txt	NA	index.xml menu.dat	index.xml menu.vol
	Siradel Planner Import file	index	index.txt	NA	*.tab	*.shp

Import vector data data

Vector data are imported using a “drag and drop” of the suitable file in the visualization scene or use the **File - import** from the menu , then select the **Vector & Linear** layer type.

Files to be imported vary according to the map data format, refer to the previous page for more information.

To select a **projection system**, use the **Search** field to enter the name or code of the projection system corresponding to the map data you want to import. If the desired projection system does not appear in the initial list, enable the **Display all CRS** option to view the complete list of available coordinate reference systems.

Select your coordinate reference systems

Projection:

Search: 32631

Recently used coordinate reference systems:

Name	EPSG
WGS 84 / UTM zone 31N	32631

Coordinate reference systems: Display all CRS ☒

Name	EPSG
WGS 84 / UTM zone 31N	32631

Selected CRS informations:

☐ Use this projection for following imports

OK Cancel

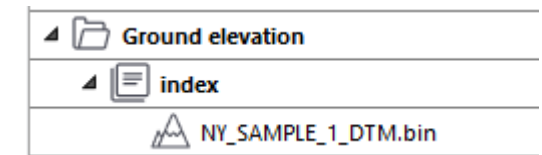
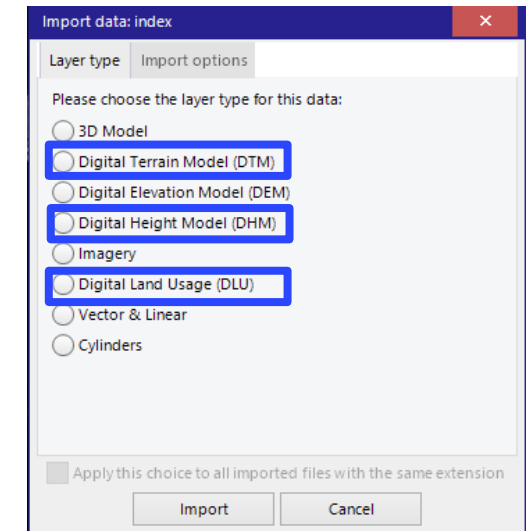
Import raster Map data(DTM/DLU/DHM)

Raster data are imported using a "drag and drop" of the suitable file in the visualization scene or use the File - import from the menu, then select the corresponding layer type.

Files to be imported vary according to the map data format, refer to the previous page for more information.

To select a **projection system**, use the **Search** field to enter the name or code of the projection system corresponding to the map data you want to import. If the desired projection system does not appear in the initial list, enable the **Display all CRS** option to view the complete list of available coordinate reference systems.

After import, DTM and DHM layers can be found in the **Ground elevation** folder in the Scene Manager window, and DLU layers can be found at the top of the Scene Manager window.

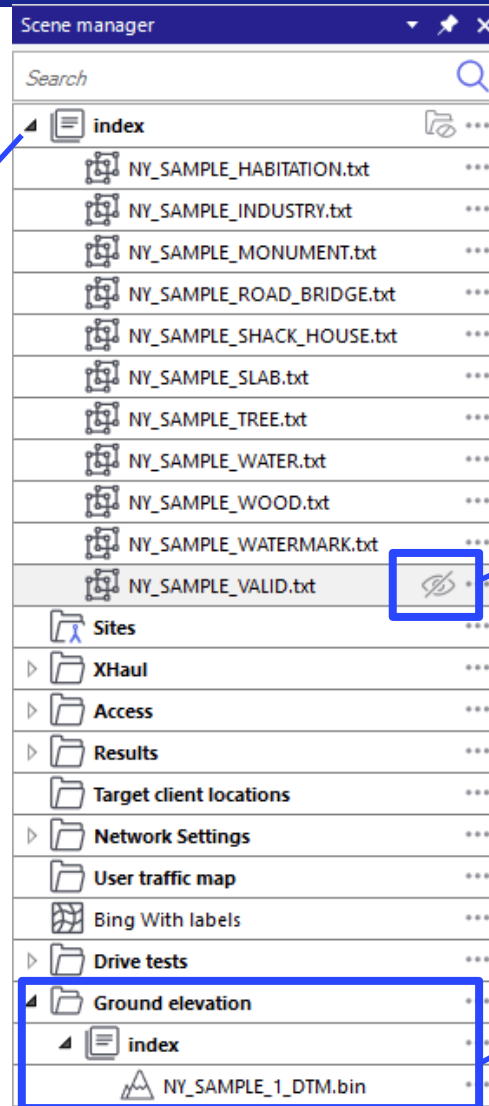
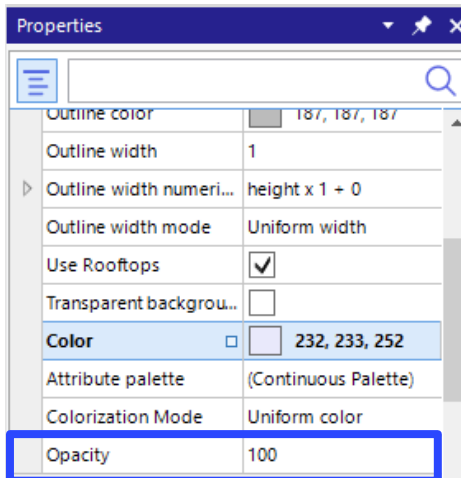


Map data visualisation

The higher layer in the Scene manager has higher priority in Scene display.

Click on the triangle icon at the left side of a folder to extend or fold the layers

Select a folder or a layer and use Properties window (Settings – Windows – Properties) to adjust **Opacity** of the layer. It works the same way for the coverage simulation results.

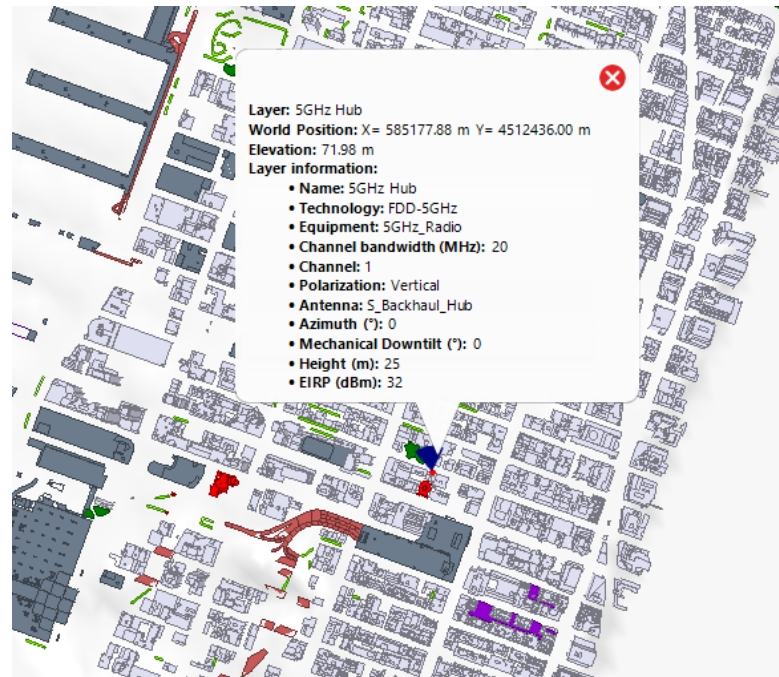


Click on the eye icon at the right side of a folder or a layer to hide or show

Ground elevation folder: **DTM** (Digital Terrain Model) and DHM (Digital Height Model) data

Layer Information

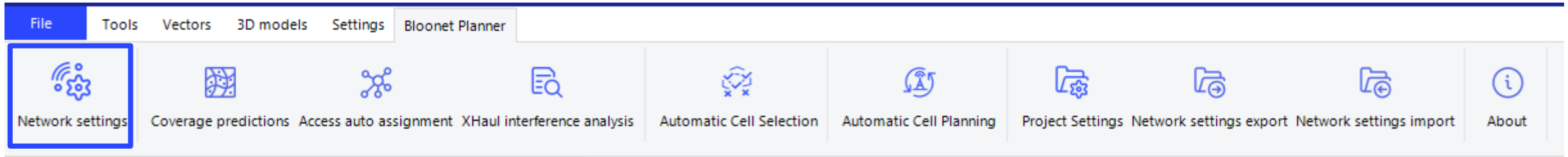
The user can access information about any layers (Map data, coverage maps, network elements...) directly in the scene by **left-click + Ctrl** on any point of the layer.



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Network settings - Overview



Before adding new network elements, use the **Network Settings wizard** which will take you step by step to configure some important information for the target **radio (access)** network, which includes:

- Frequency band
- Technology
- Radio equipment (gNodeB, Gateway, AP, and UE device characteristics)
- Deployment-related parameters (number of sectors, cable loss, etc.)

The Network settings wizard does not cover the XHaul network settings. To configure the XHaul network elements, use the Network settings menu in the Scene manager.

Technology types and active technology type

Technology types

Multiple technologies are proposed to the user depending on the use cases to be addressed.

To differentiate from the different technologies for the same technology type, here we use the term **Technology type** to represent the 3 technology types inside the tool:

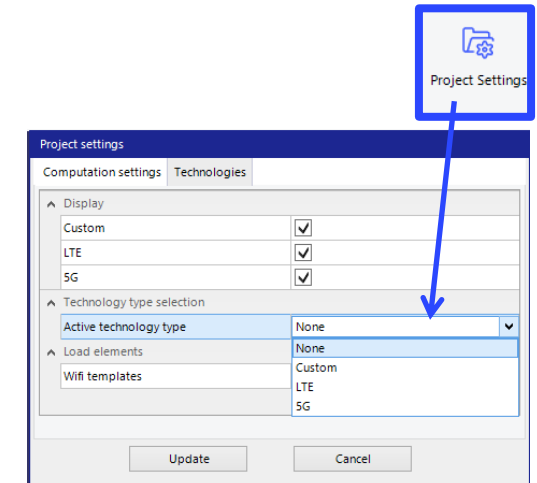
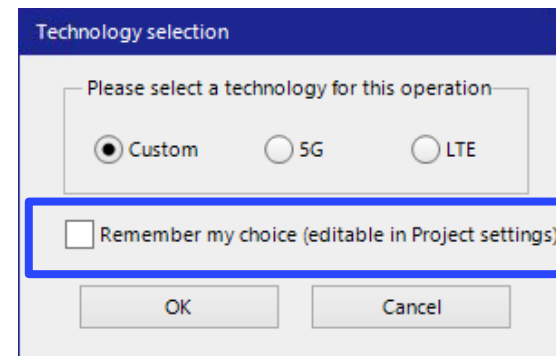
- Custom: High flexibility for the user to define a proprietary technology (typically non-3GPP)
- 5G-NR: Technology parameters to support 5G-NR simulations
- LTE: Technology parameters to support LTE simulations

Each technology type has different output metrics and specific formulas, while the workflows remain the same for all three technology types.

Active technology type

When users open a new project and run Network settings or other simulation workflows (such as coverage prediction or automatic cell selection) for the first time, a **Technology selection** window appears, prompting users to select a technology type from Custom, 5G, or LTE.

- Users can check the '**Remember my choice**' option to save the selected technology type as the active technology type. In this case, the tool will remember the users' choice and will not prompt them again for each new simulation.
- Users can later modify their choice in the **Project settings – Technologies** window by changing the **Active technology type** parameter. They can reset their choice or set it to None, then click the **Update** button to apply the changes.

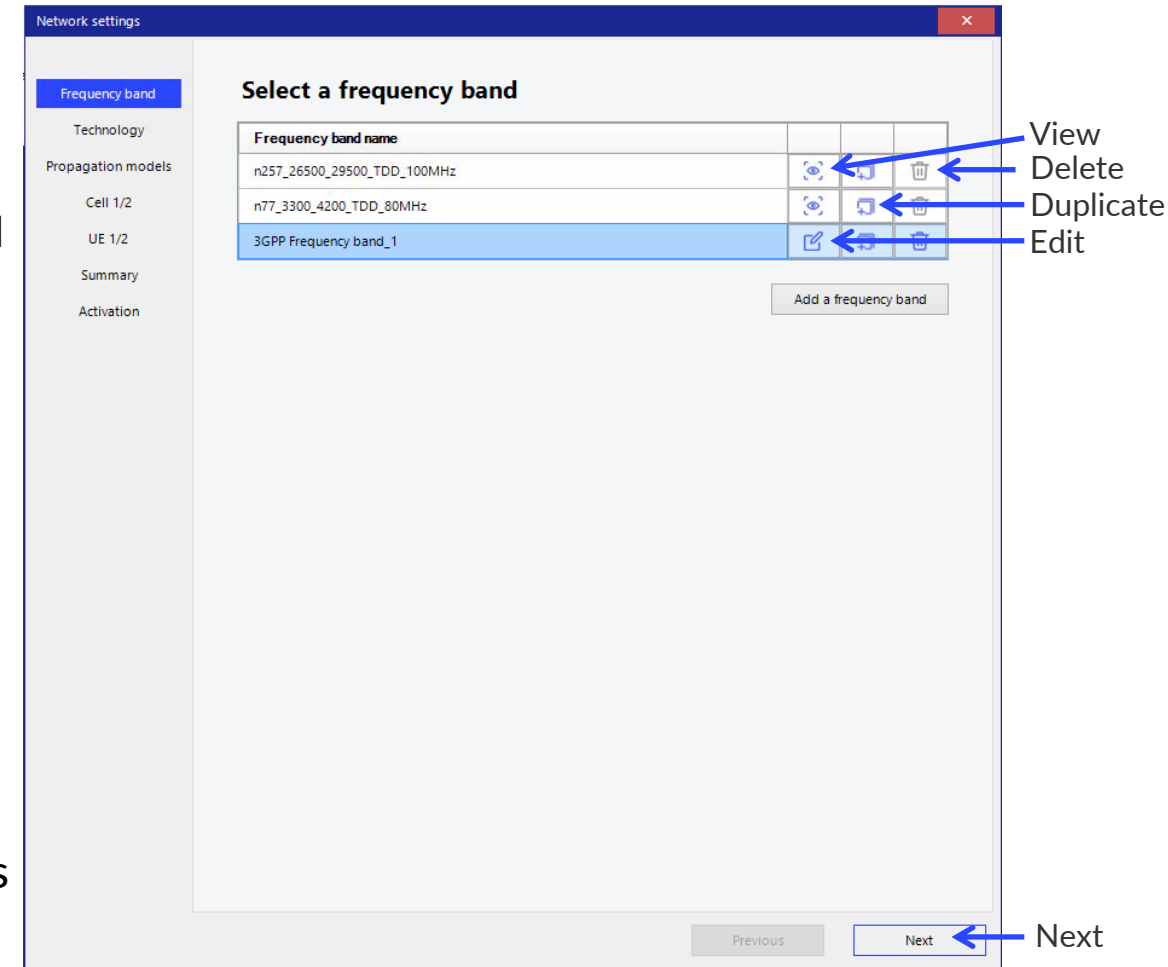


Network settings wizard - principles

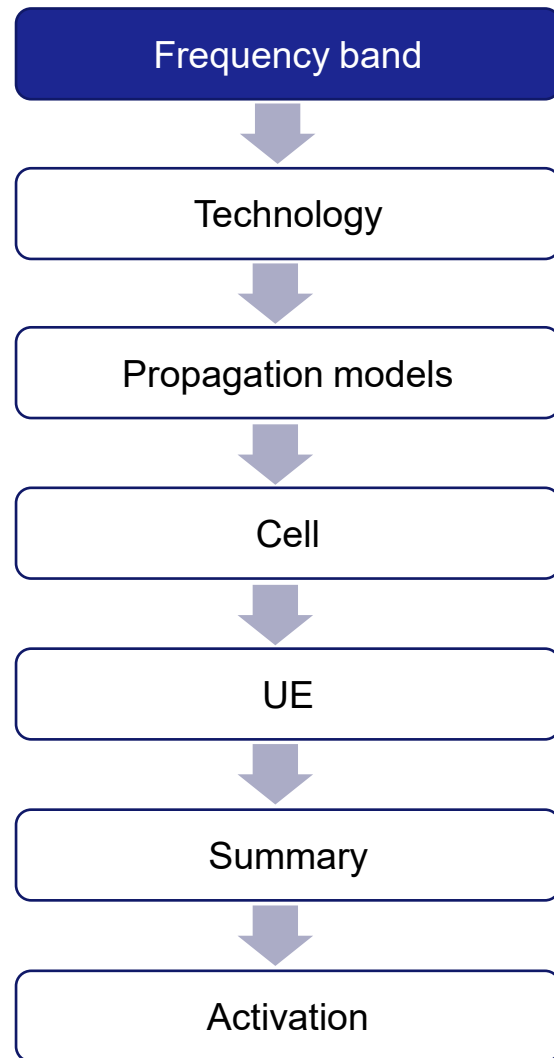
The Network Settings wizard offers a step-by-step guide for users to configure network settings parameters.

Some principles of the wizard:

- The existing elements in the project can be viewed by users, but they cannot be modified.
- Users can click the **Add** button (e.g. **Add a frequency band**) to add a new element. During the network settings workflow, users can edit these new elements.
- Users can click the **Duplicate** button to duplicate an existing element, then use Edit to modify the new element.
- During the network settings workflow, users have the option to delete a newly added element by clicking the **Delete** button.
- The selected (highlighted) element will be utilized for the configuration inputs in the subsequent steps. Users can also choose another element if required.
- After configuring all required parameters, click the **Next** button to proceed to the next step in the Network settings wizard.



Network settings – Frequency band (5G/LTE)



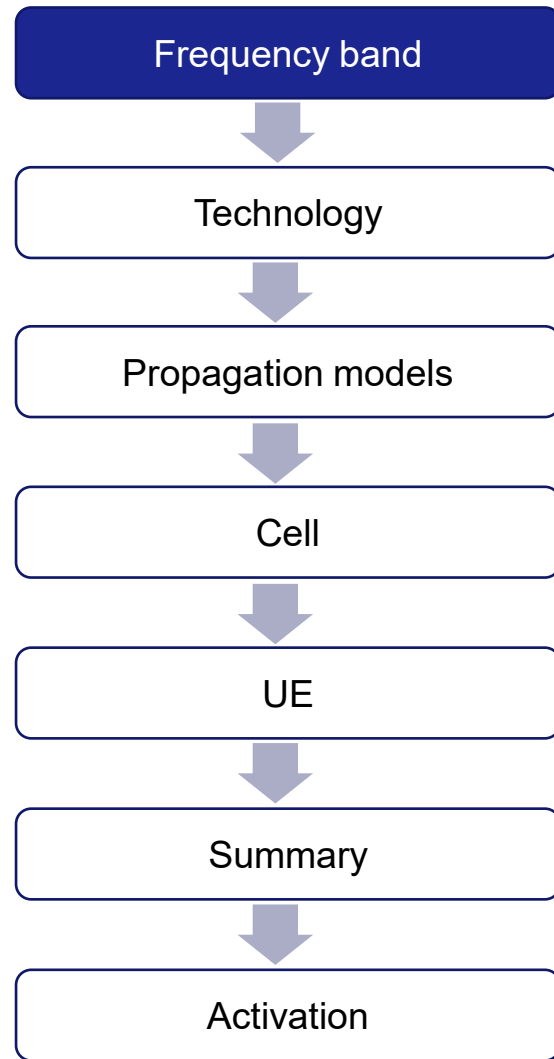
The definition of Frequency Band for 5G-NR or LTE in Siradel Planner is based on a list of pre-defined standard frequency bands following 3GPP TS 38.104 Release 16 specification.

The following window prompts when you click on **Add a frequency band** of 5G or LTE technology type or the **Edit** icon of a 5G or LTE frequency band.

The screenshot shows the 'Edit frequency band' dialog box. The 'Name' field is set to '3GPP Frequency band_1'. A list of pre-defined standard frequency bands is shown, with 'n20_UL_832_862_DL_791_821_FDD' selected. The 'Min frequency (MHz)' is 3300 and the 'Max frequency (MHz)' is 4200. The 'Division duplex mode' is set to 'TDD'. The 'Channel bandwidth (MHz)' is set to 80.0. The 'Multi-channel' checkbox is unchecked. The 'Central frequency (MHz)' is 3500.0. The 'OK' button is highlighted.

- name the frequency band
- Select a pre-defined standard frequency band
- Select a channel bandwidth
- Multi-channel option
- Configure the central frequency(ies)
- Click **OK** to save the configured parameters and return to the wizard

Network settings – Frequency band (Custom)



For Custom technology, multiple bandwidths can be set. Follow the steps to **Add a frequency band** of Custom technology type, select the division duplex mode and define a list of channels, grouped by their bandwidth:

1 Add channel bandwidth

2 Set the signal bandwidth. Several different signal bandwidths can be added. Finish the first signal bandwidth editing workflow, then start the next one.

3 OK

4 Click Edit icon to configure channels.

5 If the target channels are consecutive, use **Auto fill** to add them automatically. Otherwise, add the channels manually.

6 Configure the starting frequency and the number of channels of this signal bandwidth.

7 Auto-fill

8 OK

Channel list

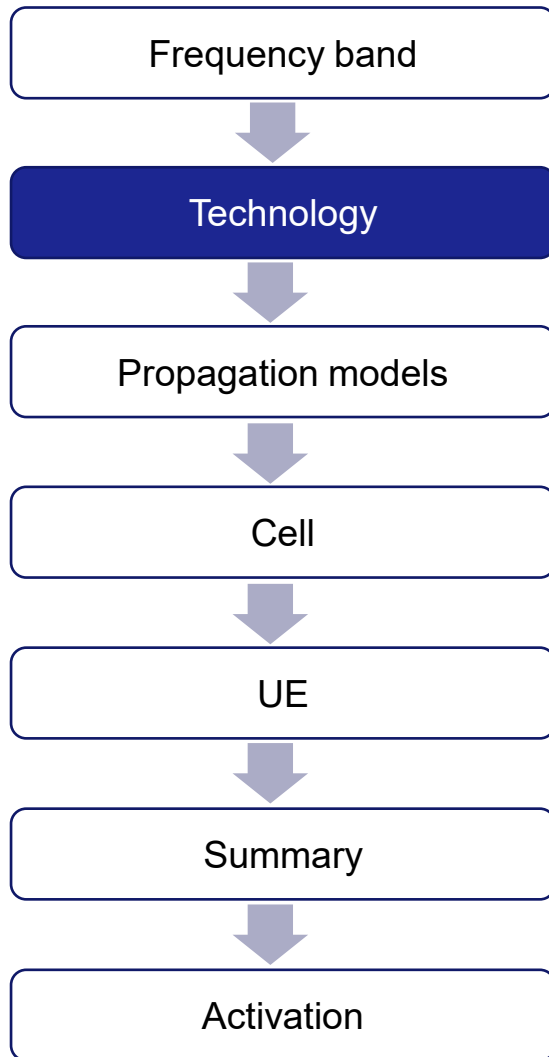
ID	Channel bandwidth (MHz)	Number of channels
1	10	5

Channel auto-fill

Start frequency (MHz): 2700.0

Number of channels: 5

Network settings – Technology (5G/LTE)



The 5G/LTE technology settings allow users to:

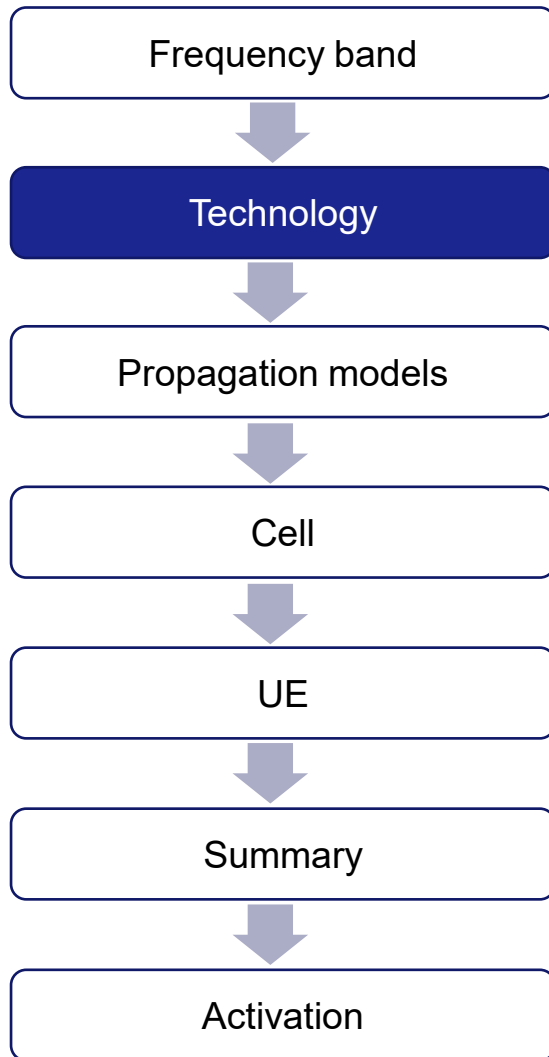
- Select the frequency band defined from the standard frequency bands.
- Select the **numerology** (i.e. subcarrier spacing) to cover specific service and usage
 - SS/PBCH (Synchronization Signal/Physical Broadcast Channel) block
 - Traffic channels in DL (i.e. PDSCH and CSI-RS)
 - Traffic channels in UL (i.e. PUSCH)
- Select the DL & UL **active bandwidth** for traffic channels (number of PRBs $\times$ SCS $\times$ 12).
- Set the **Downlink/Uplink ratio** (TDD only), i.e. the time spent by the network to transmit DL data and the time spent by the network to transmit UL data
- State if the deterministic computation of interferences in DL (from Cells other than the best-server to the UE) is activated

The screenshot shows the 'Network settings' dialog box with the 'Technology' tab selected. The 'Edit technology' section contains the following settings:

Parameter	Value
Name	Technology_1
Frequency band	3GPP Frequency band_1
DL numerology	1
DL Subcarrier spacing	30 kHz
UL numerology	1
UL Subcarrier spacing	30 kHz
SS/PBCH numerology	1
SS/PBCH subcarrier spacing	30 kHz
DL active bandwidth per channel (PRBs number)	152
UL active bandwidth per channel (PRBs number)	137
DL / UL ratio	1 : 1
Deterministic interferences activated	☒

Buttons at the bottom: Cancel, OK, Previous, Next.

Network settings – Technology (Custom)



The Custom technology settings allow users to:

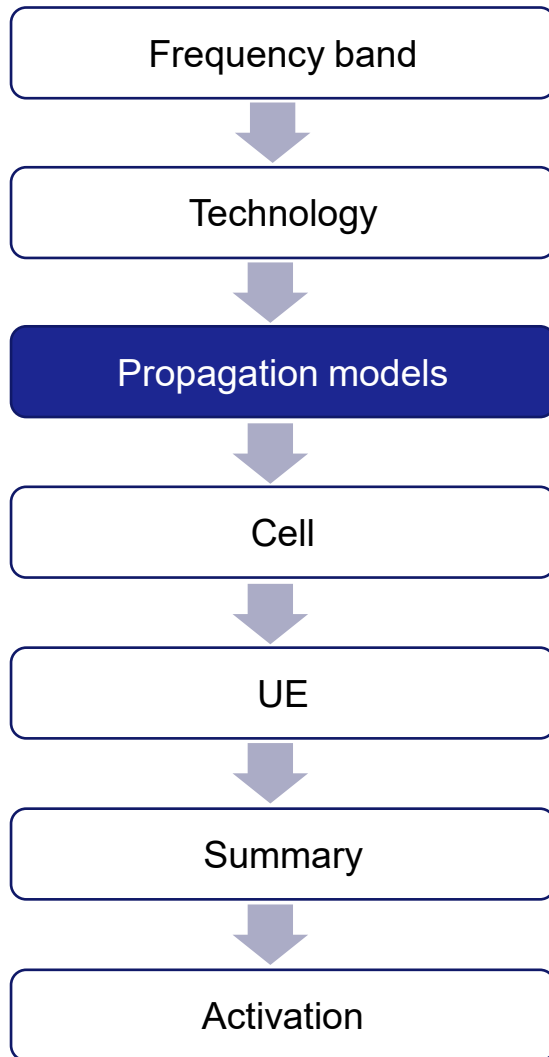
- Select the frequency band defined from the custom frequency bands.
- Set the Downlink/Uplink ratio (TDD only), i.e. the time spent by the network to transmit DL data and the time spent by the network to transmit UL data
- State if the deterministic computation of interferences in DL (from Cells other than the best-server to the UE) is activated

The screenshot shows a software window titled 'Network settings' with a sidebar on the left and a main content area. The sidebar contains a list of settings: 'Frequency band', 'Technology' (selected), 'Propagation models', 'Cell 1/2', 'UE 1/2', 'Summary', and 'Activation'. The main content area is titled 'Edit technology' and contains the following fields:

- Name:** A text input field containing 'Technology_1'.
- Frequency band:** A dropdown menu showing 'Frequency band_1'.
- DL / UL ratio:** Two input fields, both containing '1', separated by a colon.
- Deterministic interferences activated:** An unchecked checkbox.

At the bottom right of the main content area are 'Cancel' and 'OK' buttons. At the bottom of the window are 'Previous' and 'Next' buttons.

Network settings – Propagation model



Prediction models gather the various simulation and propagation settings considered during a computation.

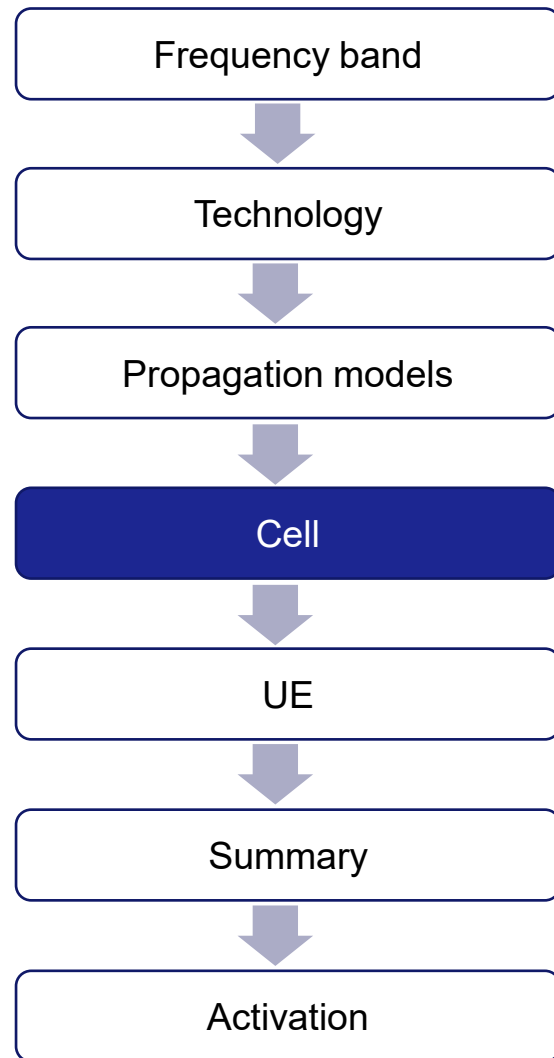
- A prediction model is associated to a Cell.
- Several propagation models can be added in the project, when creating a new cell, users can use a specific propagation model to assign to the cell.
- Refer to [Volcano Propagation Model](#) for more details concerning the propagation model settings.
- In the absence of a specific context, the default prediction model can be used. Click **Next** to continue.

The screenshot shows the 'Network settings' dialog box with a sidebar on the left and a main content area. The sidebar lists the following options: Frequency band, Technology, Propagation models (selected), Cell 1/2, UE 1/2, Summary, and Activation. The main content area is titled 'Select a propagation model' and features a table with the following structure:

Propagation model name			
Prediction Model			

Below the table is a button labeled 'Add a propagation model'. At the bottom of the dialog box, there are two buttons: 'Previous' and 'Next'.

Network settings – Cell



There are two sub-steps for configuring Cells in Network settings :

Cell 1/2

Cell equipment defines parameters that are strongly associated with a base station or access point, including transmit power, receiver noise figure, number of antenna ports and uplink mapping tables that translate a given SINR into throughput value through spectrum efficiency.

Cell 2/2

Cell template defines element characteristics used for the deployment of cells, including number of sectors that enables the automatic creation of multi-sectorized cells, antenna install height, cable loss, traffic load and propagation model used for predictions.

The screenshot shows the 'Select a cell equipment' dialog in the 'Network settings' window. The left sidebar has 'Cell 1/2' selected. The main area has a table with two rows: 'BaseStation_5GHz' and 'BaseStation_60GHz'. Each row has icons for edit, refresh, and delete. Below the table is an 'Add a cell equipment' button. At the bottom, there is a 'Previous' button and a 'Next' button. A help icon and text are at the bottom of the main area.

Cell equipment name			
BaseStation_5GHz			
BaseStation_60GHz			

Buttons: Add a cell equipment, Previous, Next

Help text: Cell equipment defines parameters that are strongly associated with a base station or access point, including transmit power, receiver noise figure, number of antenna ports and uplink mapping tables that translate a given SINR into throughput value through spectrum efficiency.

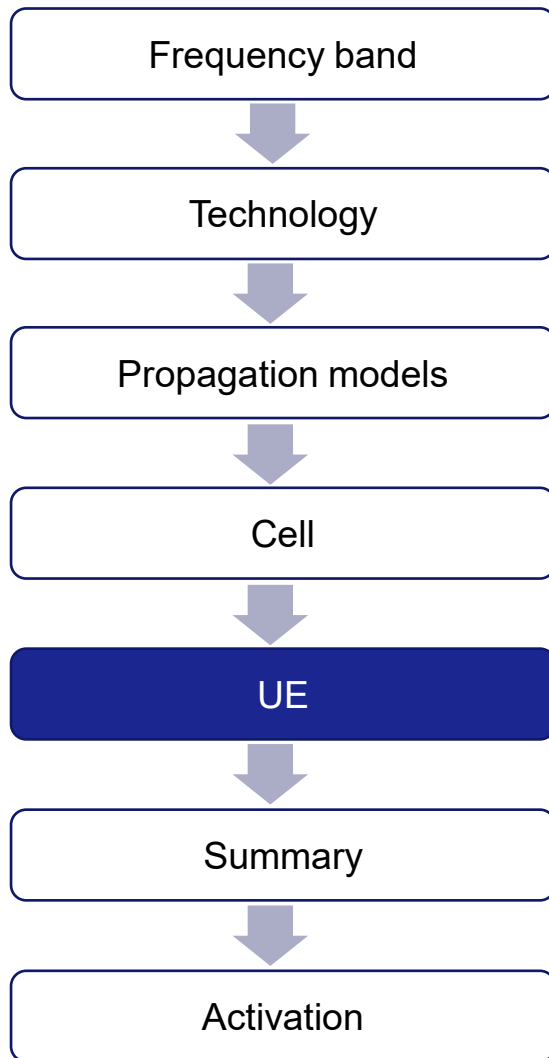
The screenshot shows the 'Select a cell template' dialog in the 'Network settings' window. The left sidebar has 'Cell 2/2' selected. The main area has a table with two rows: '5GHz Cell' and '60GHz Cell'. Each row has icons for edit, refresh, and delete. Below the table is an 'Add a cell template' button. At the bottom, there is a 'Previous' button and a 'Next' button. A help icon and text are at the bottom of the main area.

Cell template name			
5GHz Cell			
60GHz Cell			

Buttons: Add a cell template, Previous, Next

Help text: Cell template defines element characteristics used for the deployment of cells, including number of sectors that enables the automatic creation of multi - sectorized cells, antenna install height, cable loss, traffic load and propagation model used for predictions.

Network settings – UE



There are two sub-steps for configuring UEs in Network settings :

UE 1/2

UE equipment defines parameters that are strongly associated with the UE (User Equipment), including maximum and minimum transmit power, receiver noise figure, number of antenna ports and downlink mapping tables that translate a given SINR into throughput value through spectrum efficiency.

UE 2/2

UE template defines element characteristics to be used for the receiver profile, such as the height of the receiver.

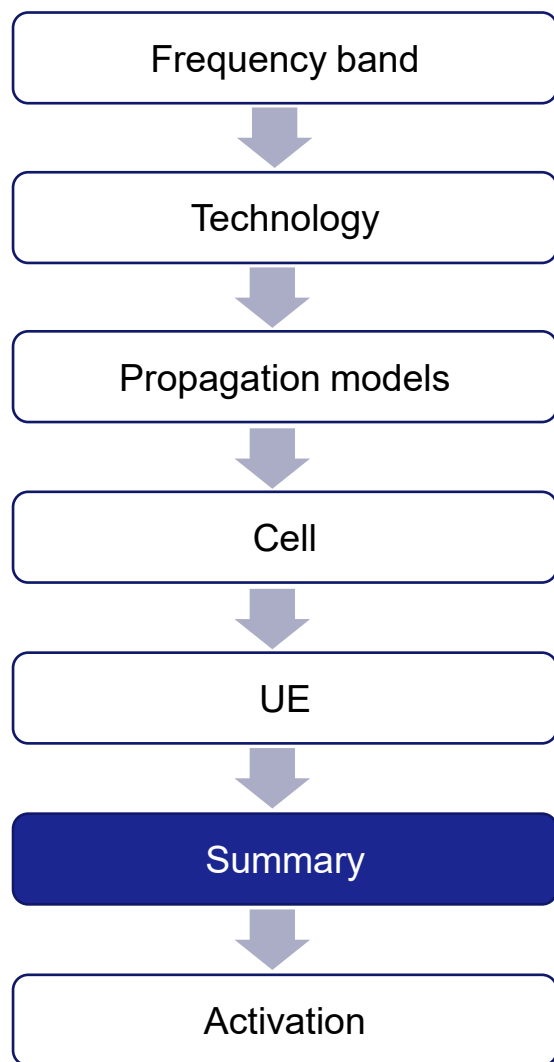
The screenshot shows the 'Network settings' window with the 'UE 1/2' sub-step selected. The main area is titled 'Select an UE equipment'. It contains a table with two rows: 'UERadio_5GHz' and 'UERadio_60GHz'. Each row has three icons: a blue square with a white 'X', a blue square with a white 'Y', and a trash icon. Below the table is a button labeled 'Add an UE equipment'. At the bottom, there are 'Previous' and 'Next' buttons. A small information icon (i) is present next to a descriptive text block.

UE equipment name			
UERadio_5GHz			
UERadio_60GHz			

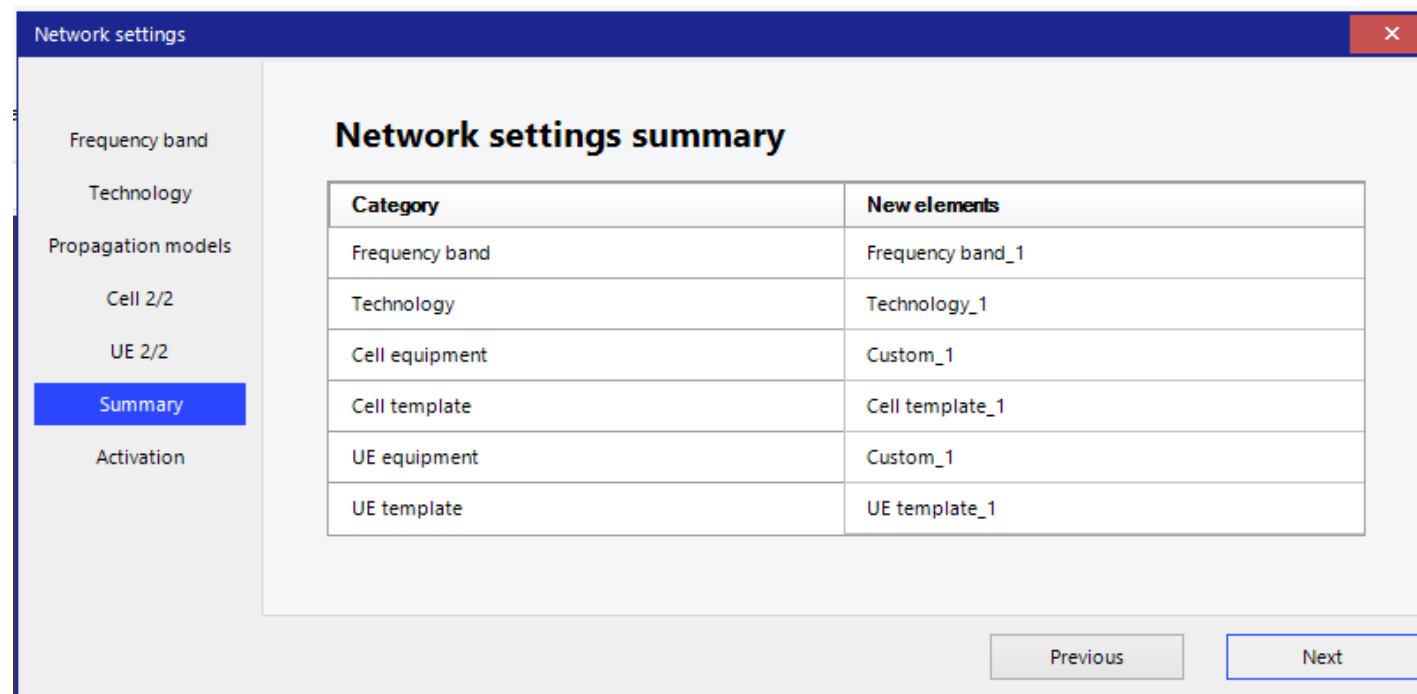
The screenshot shows the 'Network settings' window with the 'UE 2/2' sub-step selected. The main area is titled 'Select an UE template'. It contains a table with two rows: '5GHz UE' and '60GHz UE'. Each row has three icons: a blue square with a white 'X', a blue square with a white 'Y', and a trash icon. Below the table is a button labeled 'Add an UE template'. At the bottom, there are 'Previous' and 'Next' buttons. A small information icon (i) is present next to a descriptive text block.

UE template name			
5GHz UE			
60GHz UE			

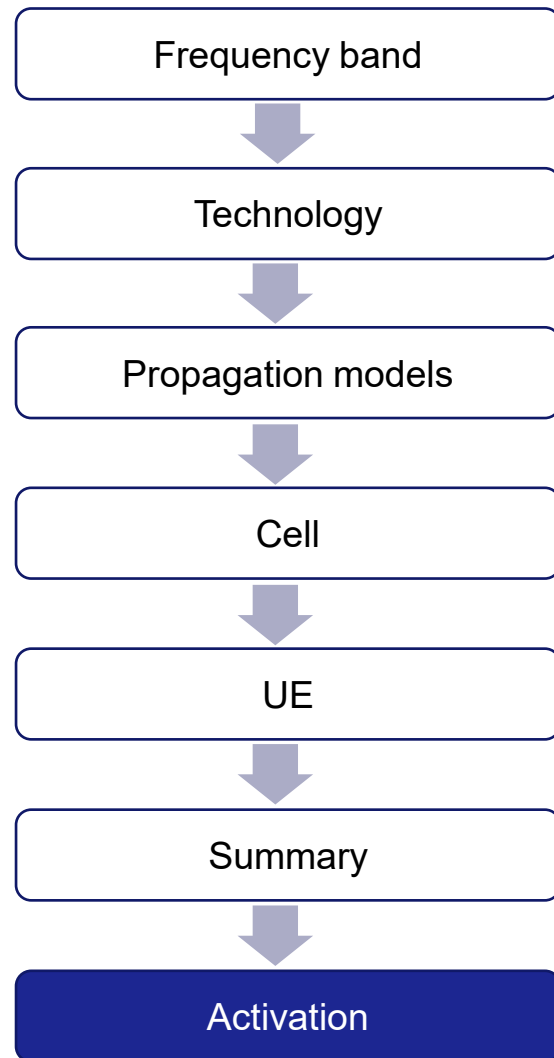
Network settings – Summary



The **Summary** step displays all the new elements added during the network settings wizard process. This step is informational only; users cannot make direct edits in this GUI. However, users can return to previous steps to modify some elements or parameters.

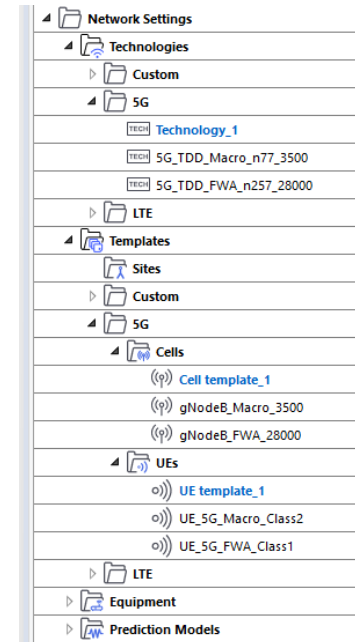
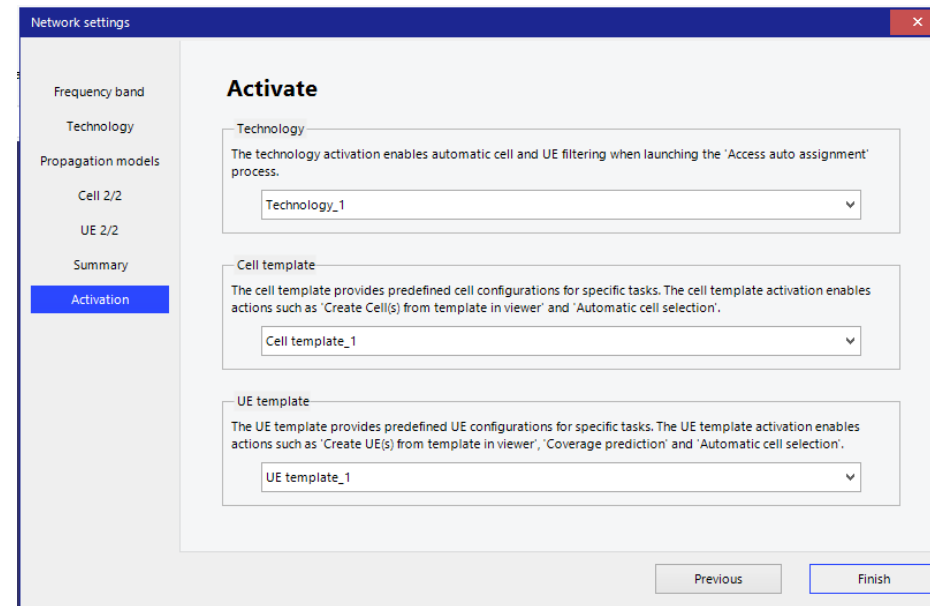


Network settings – Activation



The Activation is the last step of Network settings wizard. There are 3 elements to be set as active:

- **Technology** (not Technology Type): The technology activation enables automatic Cell and UE filtering when launching the 'Access auto assignment' process (and 'Automatic Cell Selection' process in the 3.7 and later versions)
- **Cell template**: The cell template provides predefined cell configurations for specific tasks. The cell template activation enables actions such as 'Create Cell(s) from template in viewer' and 'Automatic cell selection'.
- **UE template**: The UE template provides predefined UE configurations for specific tasks. The UE template activation enables actions such as 'Create Cell(s) from template in viewer', 'Coverage prediction' and 'Automatic cell selection'.



Once all parameter settings are verified, users can click the **Finish** button to complete the network settings wizard. All new elements will be added to the project, and the elements selected in the **Activation** step will be activated in the scene manager under Network settings.

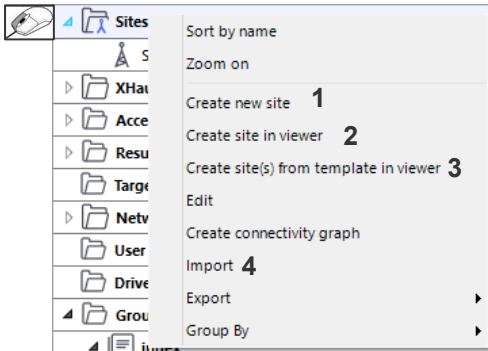
CONTENT

- Introduction
- Main menu overview
- Map data management
- Network settings wizard
- **Network element creation**
- Automatic cell selection
- Coverage prediction
- Automatic cell planning
- Access auto assignment
- Link analysis
- Indoor/Hybrid scenarios
- Annex – additional information

Network element – Sites

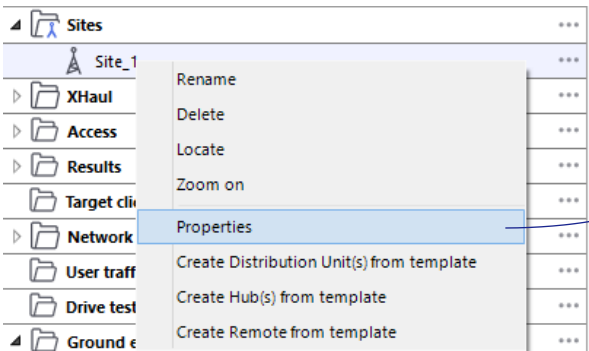
Site creation process main options :

- 1. Create new site from coordinates
- 2. Create site in viewer (To create sites, **right-click** in the scene after choosing this action)
- 3. Create site from template in viewer (characteristics of the **active template** is considered. To create sites, **right-click** in the scene after choosing this action). Please refer to [Active templates](#) for more details.
- 4. Import from CSV file (Please refer to [Network Elements Import \ Export](#) for more details)



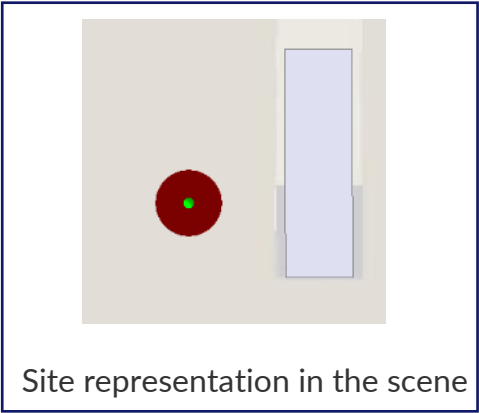
Right-click “Sites” to access its actions

i Sites define the location of Cells and UEs within the project. A site is described by its X/Y Metric or Lat/Long coordinates, defined in same metric coordinate system as the Geo data.



Right-click a network element to access its actions

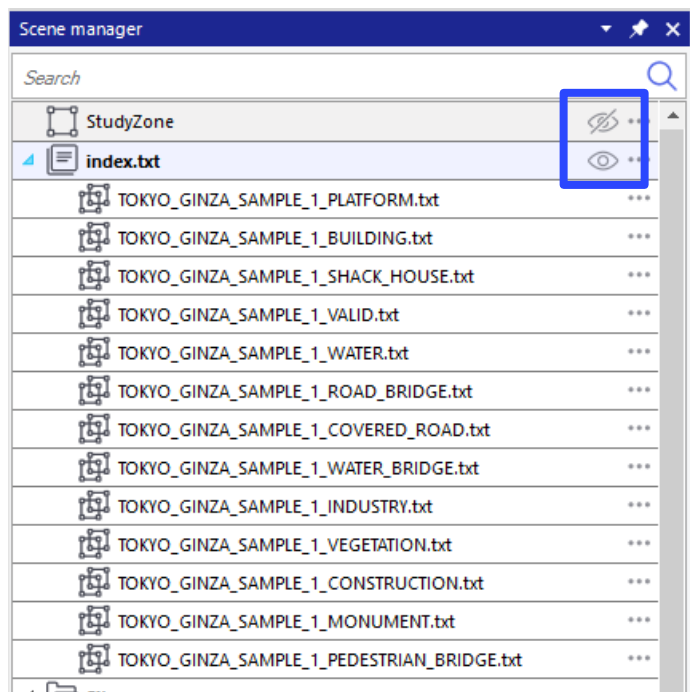
Optional information



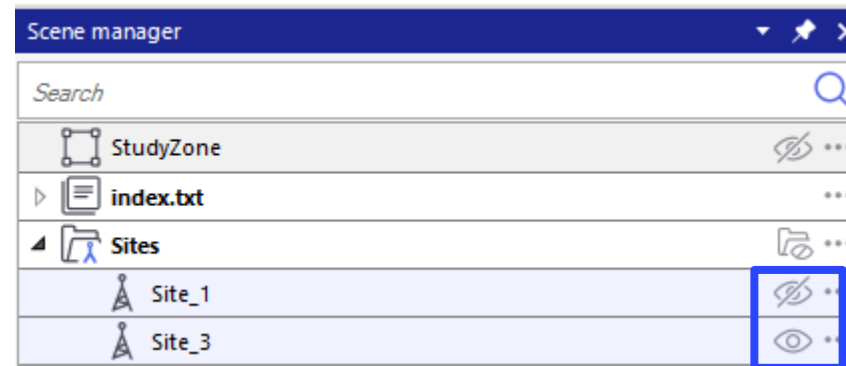
Site representation in the scene

Display / Hide Elements in Scene

Display or hide a whole layer (or folder)

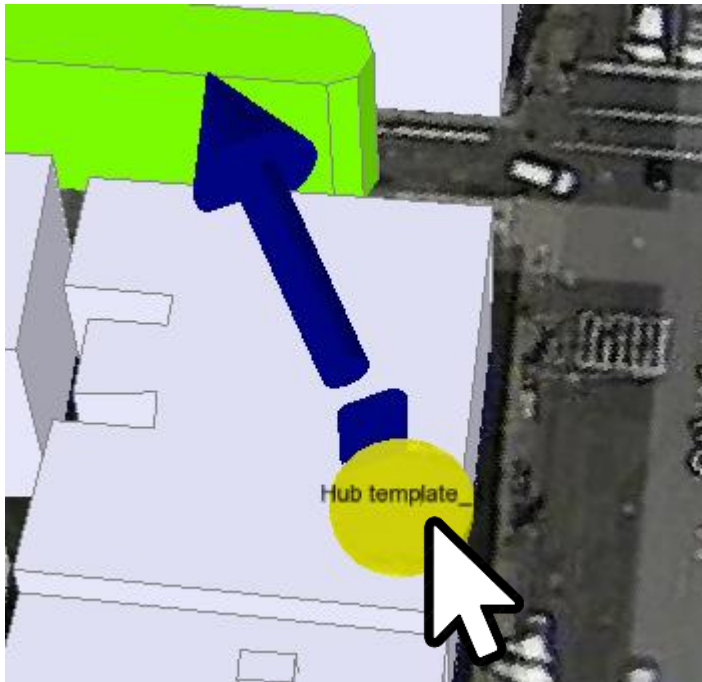


Display or hide one element

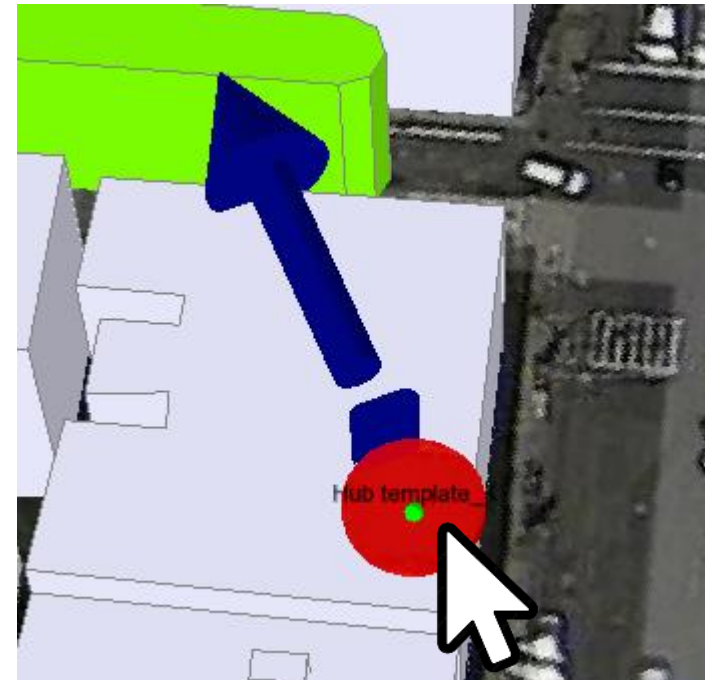


Move a Site

Sites can be moved manually in the scene



The Site highlights when cursor is located on it

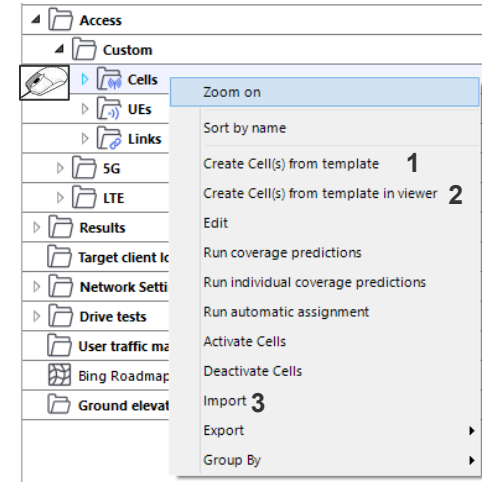


Press on the Ctrl button
Left click on the Site to select it and move
green point by holding the left click

Network element : Access \ Cells creation

Cell creation process main options :

1. Create Cell(s) from template (characteristics of the active template is considered)
2. Create Cell(s) from template in viewer (characteristics of the **active template** is considered. To create Cells, **right-click** in the scene after choosing this action). Please refer to [Active templates](#) for more details.
3. Import from CSV file (Please refer to [Network Elements Import \ Export](#) for more details)
 - Mandatory information in the CSV files are:
 - Name
 - X \ Y location
 - All other parameters are optional.
 - Cell template information are considered when no parameters is provided during import

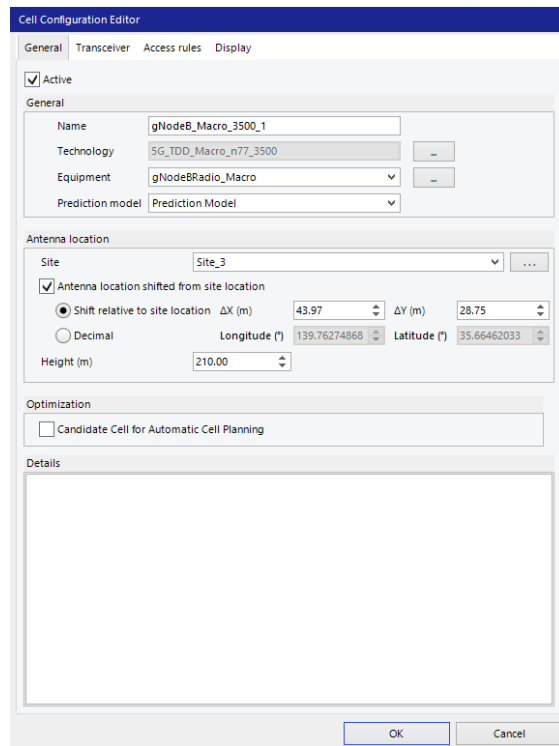


Right-click a network element to access its actions

- i** Cell export files (CSV) can be open with XLS to perform table operations. Importing the CSV file will create new Cells and update existing Cells
- i** If Cell height above rooftop is unknown and no information is available during import, then [Bloonet Planner will automatically set the Cells above rooftop when located on a building](#)

Network element : Access \ Cells properties

- A Cell consists an antenna, an equipment (mandatory), radio characteristics and information about the interference and attachment ranges
- Cells can be deployed on rooftops or at street-level



Cell Configuration Editor

General Transceiver Access rules Display

☒ Active

General

Name: gNodeB_Macro_3500_1

Technology: 5G_TDD_Macro_n77_3500

Equipment: gNodeBRadio_Macro

Prediction model: Prediction Model

Antenna location

Site: Site_3

☒ Antenna location shifted from site location

☒ Shift relative to site location ΔX (m): 43.97 ΔY (m): 28.75

☐ Decimal Longitude (°): 139.76274868 Latitude (°): 35.66462033

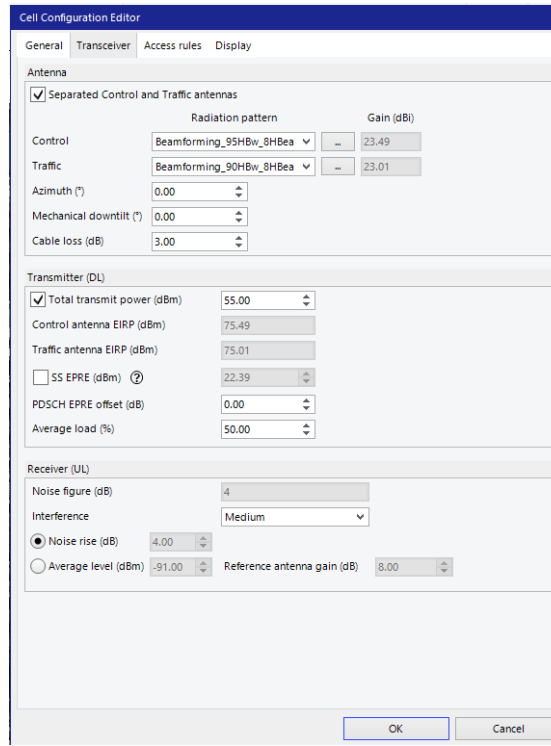
Height (m): 210.00

Optimization

☐ Candidate Cell for Automatic Cell Planning

Details

OK Cancel



Cell Configuration Editor

General Transceiver Access rules Display

Antenna

☒ Separated Control and Traffic antennas

Radiation pattern Gain (dBi)

Control: Beamforming_95HBw_8HBea 23.49

Traffic: Beamforming_90HBw_8HBea 23.01

Azimuth (°): 0.00

Mechanical downtilt (°): 0.00

Cable loss (dB): 3.00

Transmitter (DL)

☒ Total transmit power (dBm): 55.00

Control antenna EIRP (dBm): 75.49

Traffic antenna EIRP (dBm): 75.01

☐ SS EPRE (dBm): 22.39

PDSCH EPRE offset (dB): 0.00

Average load (%): 50.00

Receiver (UL)

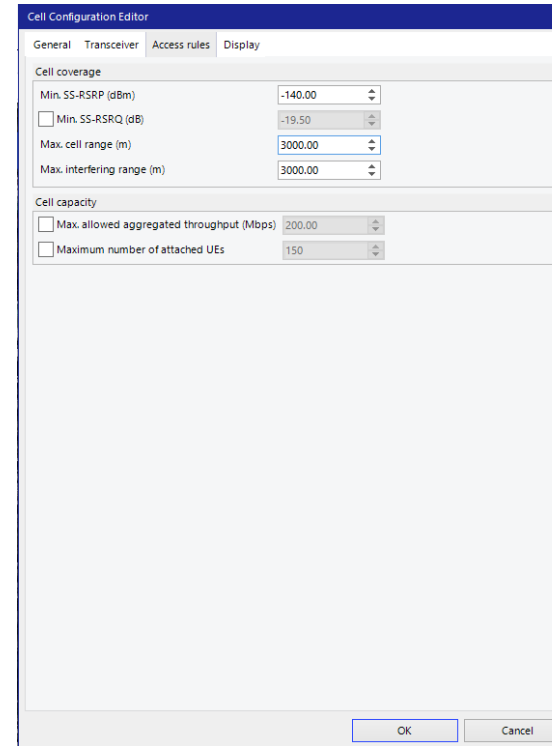
Noise figure (dB): 4

Interference: Medium

☒ Noise rise (dB): 4.00

☐ Average level (dBm): -91.00 Reference antenna gain (dB): 8.00

OK Cancel



Cell Configuration Editor

General Transceiver Access rules Display

Cell coverage

Min. SS-RSRP (dBm): -140.00

☐ Min. SS-RSRQ (dB): -19.50

Max. cell range (m): 3000.00

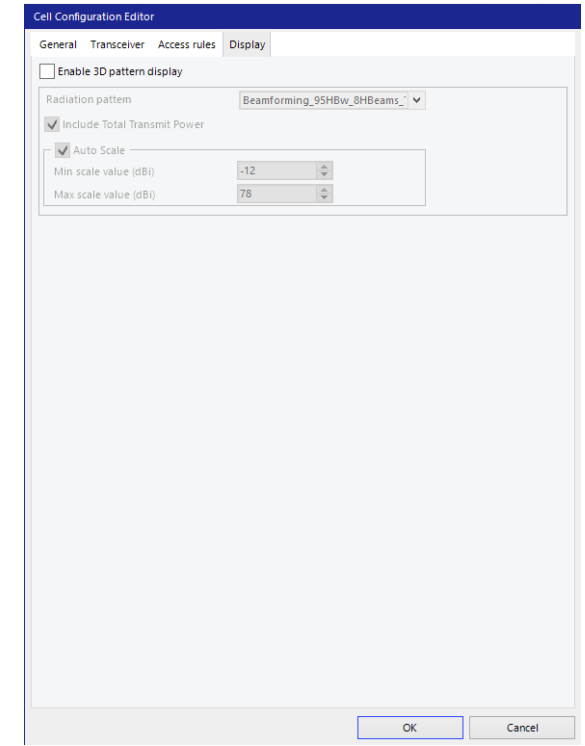
Max. interfering range (m): 3000.00

Cell capacity

☐ Max. allowed aggregated throughput (Mbps): 200.00

☐ Maximum number of attached UEs: 150

OK Cancel



Cell Configuration Editor

General Transceiver Access rules Display

☐ Enable 3D pattern display

Radiation pattern: Beamforming_95HBw_8HBeams

☒ Include Total Transmit Power

☒ Auto Scale

Min scale value (dBi): -12

Max scale value (dBi): 78

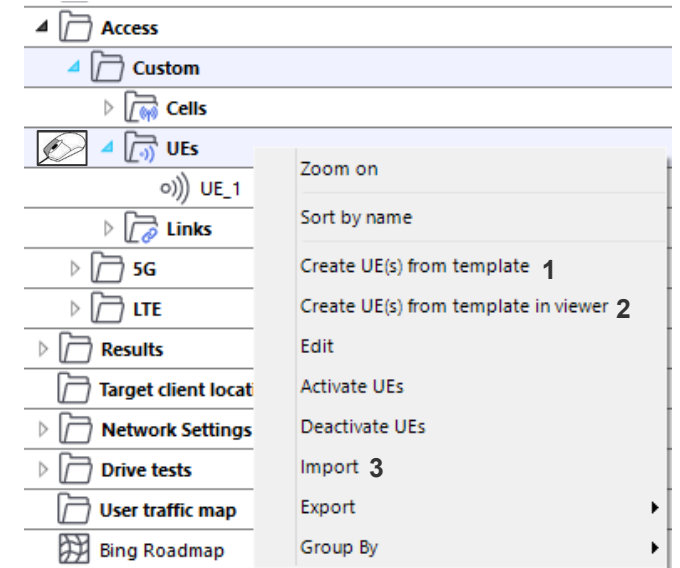
OK Cancel

Network element : Access \ UEs creation

UEs creation process main options

1. Create UE from template (characteristics of the active template is considered)
2. Create UE from template in viewer (characteristics of the **active template** is considered. To create Cells, **right-click** in the scene after choosing this action). Please refer to [Active templates](#) for more details.
3. Import from CSV file (Please refer to [Network Elements Import \ Export](#) for more details)
 - Mandatory information in the CSV files are:
 - Name
 - X \ Y location
 - All other parameters are optional. UE template information are considered when no parameters is provided during import

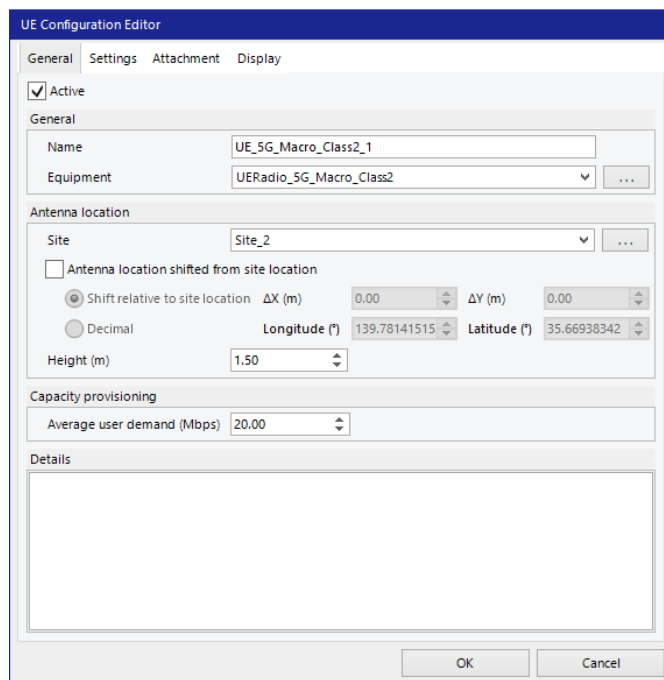
- i** UE export files (CSV) can be open with XLS to perform table operations. Importing the CSV file will create new Cells and update existing Cells.
- i** If UE height above rooftop is unknown and no information is available during import, then [Bloonet Planner](#) will automatically set the UE above rooftop when located on a building.



Right-click a network element to access its actions

Network element: Access \ UEs properties

- A UE is a UE which consists an antenna, an equipment (mandatory), radio characteristics and information about the Cell attachment
- UEs can be deployed on rooftops or at the street-level



UE Configuration Editor

General Settings Attachment Display

☒ Active

General

Name: UE_5G_Macro_Class2_1

Equipment: UERadio_5G_Macro_Class2

Antenna location

Site: Site_2

☐ Antenna location shifted from site location

☒ Shift relative to site location ΔX (m): 0.00 ΔY (m): 0.00

☐ Decimal Longitude (°): 139.78141515 Latitude (°): 35.66938342

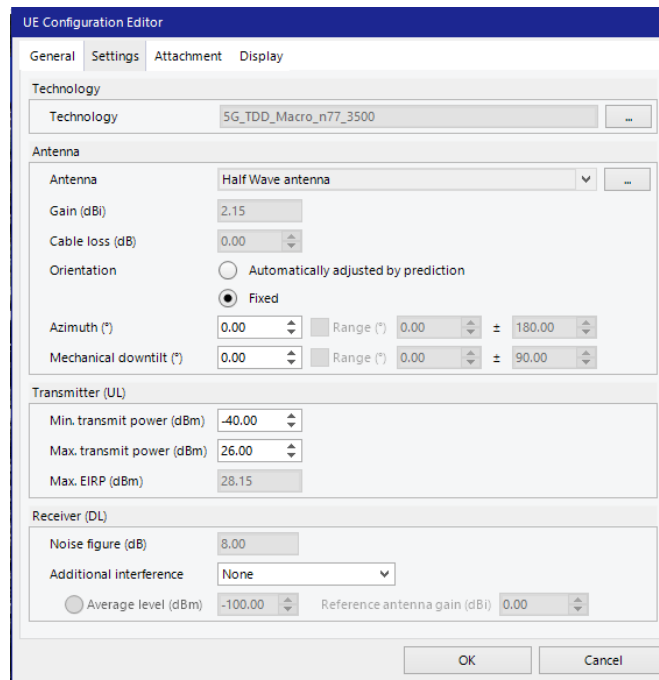
Height (m): 1.50

Capacity provisioning

Average user demand (Mbps): 20.00

Details

OK Cancel



UE Configuration Editor

General Settings Attachment Display

Technology

Technology: 5G_TDD_Macro_n77_3500

Antenna

Antenna: Half Wave antenna

Gain (dBi): 2.15

Cable loss (dB): 0.00

Orientation

☐ Automatically adjusted by prediction

☒ Fixed

Azimuth (°): 0.00 Range (°): 0.00 ± 180.00

Mechanical downtilt (°): 0.00 Range (°): 0.00 ± 90.00

Transmitter (UL)

Min. transmit power (dBm): -40.00

Max. transmit power (dBm): 26.00

Max. EIRP (dBm): 28.15

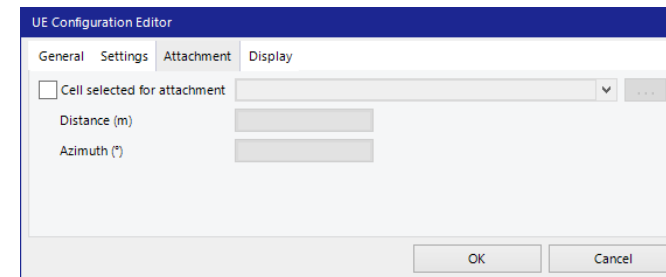
Receiver (DL)

Noise figure (dB): 8.00

Additional interference: None

☐ Average level (dBm): -100.00 Reference antenna gain (dBi): 0.00

OK Cancel



UE Configuration Editor

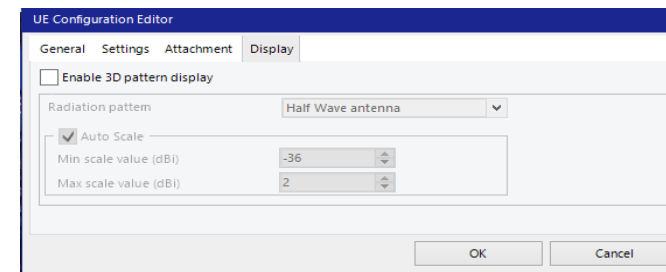
General Settings Attachment Display

☐ Cell selected for attachment

Distance (m):

Azimuth (°):

OK Cancel



UE Configuration Editor

General Settings Attachment Display

☐ Enable 3D pattern display

Radiation pattern: Half Wave antenna

☒ Auto Scale

Min scale value (dBi): -36

Max scale value (dBi): 2

OK Cancel

Network Elements Import \ Export

- Sites, Cells and UEs can be imported to the project through CSV files

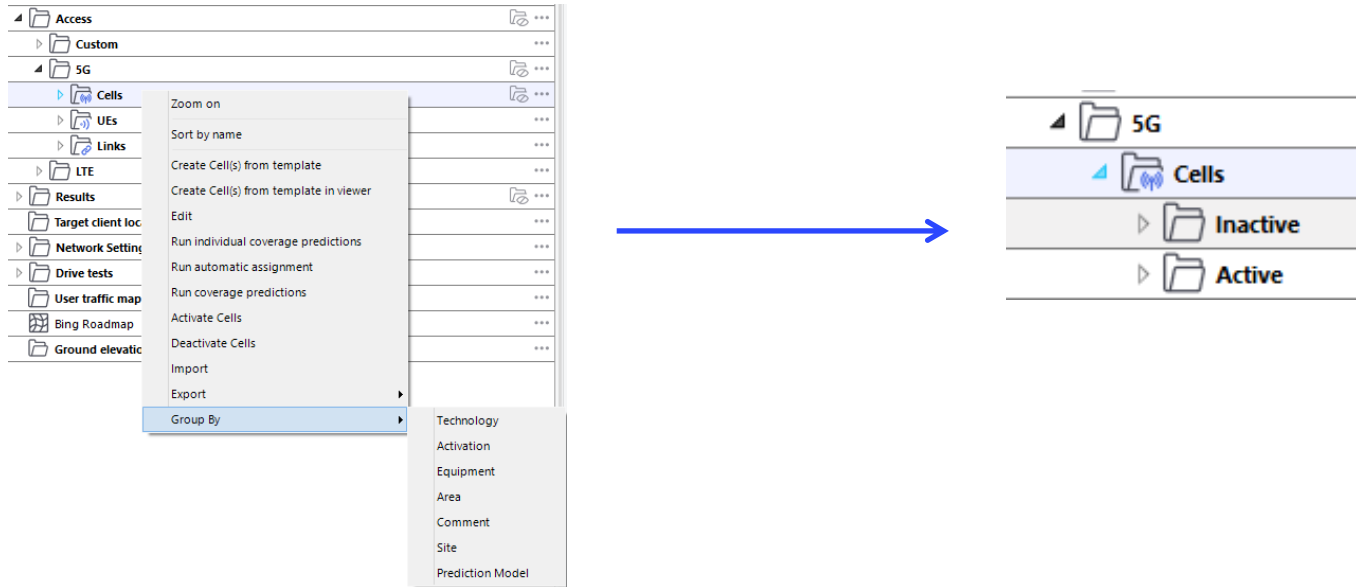
Name	Technology	Equipment	Site	Site X (m)/Long (°)	Site Y (m)/Lat (°)	Height (m)	DeltaX (m)	DeltaY (m)	Antenna X (m)/Long (°)	Antenna Y (m)/Lat (°)	Channel Bandwith (MHz)	Channel	Polarization	Antenna
Hub1	Techno1	Equip1	Site_1	586884.943	2852719.726	11.69	0	0	586884.943	2852719.726	20	1	Vertical	Antenna1
Hub2	Techno1	Equip1	Site_2	586908.9876	2852614.937	25	0	0	586908.9876	2852614.937	20	1	Vertical	Antenna1
Hub3	Techno1	Equip1	Site_3	586888.9408	2852616.635	21.52	0	0	586888.9408	2852616.635	20	1	Vertical	Antenna1
Hub4	Techno1	Equip1	Site_4	586892.6433	2852243.332	28.1	44.46569567	410.5230519	586937.109	2852653.855	20	1	Vertical	Antenna1

i It is possible to import Cells or UEs with their own Lat/Long coordinates (different from their site coordinates)

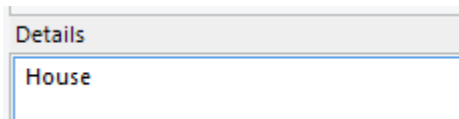
- Mandatory information in the CSV files are:
 - Name
 - X \ Y location
 - All other parameters are optional.
 - If optional parameters are defined in the CSV file, they are considered during import
 - If optional parameters are not defined, **active template parameters are considered during import**
- i** Exporting existing network elements to a file allows the user to access to the CSV format structure.

Group By

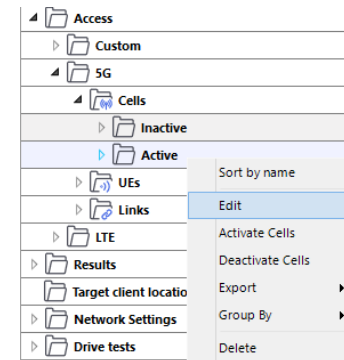
- Cells and UEs can be organized in different folders with the option “Group by”



- Adding a comment in the details window (general tab) for Cells and UEs is a convenient way to sort Cells and UEs in different folders

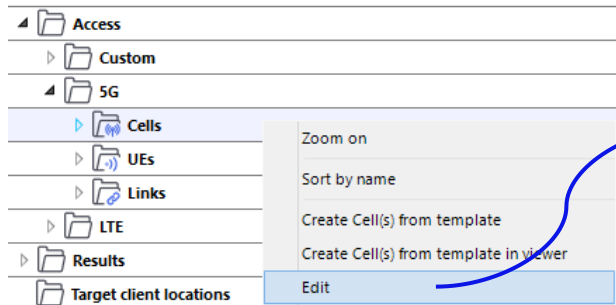


- Table element edition can be open on sub-folders



Tabular Editor

- Tabular edition is available for Cells, UEs and Distribution units from the element folder



Name	Technology	Equipment	Site	X (m)	Y (m)	Height (m)	Use X/Y shift	ΔX (m)	ΔY (m)
5GHz Hub_1	FDD-5GHz	5GHz_Radio	Site_1	332694.16	4693787	12.47	☐	0	0
5GHz Hub_2	FDD-5GHz	5GHz_Radio	Site_2	330423.94	4692087	41.61	☐	0	0
5GHz Hub_3	FDD-5GHz	5GHz_Radio	Site_3	330180.19	4692508	51.07	☐	0	0
5GHz Hub_4	FDD-5GHz	5GHz_Radio	Site_4	330602.53	4692593	14.66	☐	0	0

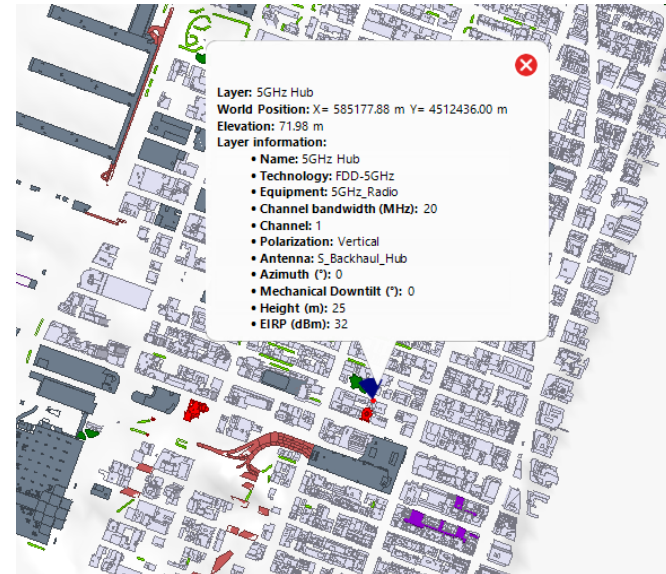
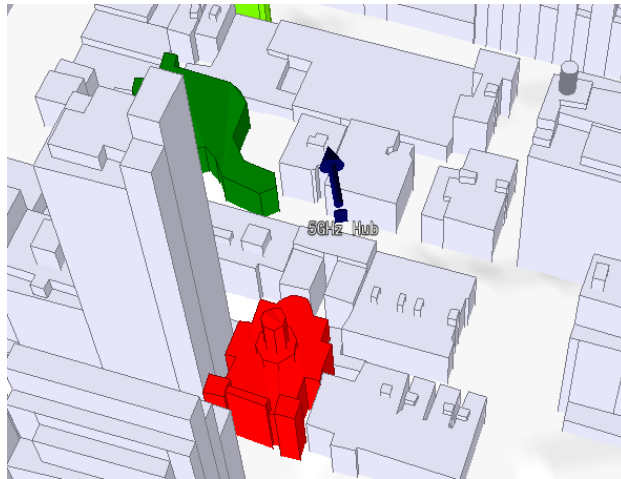
Use filter field to filter values in the table

- Copy/paste in the table are allowed (from XLS for instance) and the following shortcuts allows an easy edition of the Cells and UEs parameters
 - Ctrl + A – Selection of the entire table
 - Ctrl + C/V – Copy/paste element
 - Ctrl + D – Select the first element of a column and apply the value for the entire column
 - Ctrl + Z – Reverse modifications
 - Ctrl + F – Research elements in the table

i Table editor is available on sub-folders when grouped by

Site / Cell / UE Visualization

- Two visualization modes are proposed in Bloonet Planner
 - When zooming close to an element, a 3D model of the radio element is displayed in the scene. The user can click on it to move the element in the scene
 - When zooming out, the 3D model switches to a 2D model to visualize the entire network



- For both visualization modes, the user can left-clicking + ctrl on the 2D or 3D icon to get detailed information

CONTENT

- Introduction
- Main menu overview
- Map data management
- Network settings wizard
- Network element creation
- **Automatic cell selection**
- Coverage prediction
- Automatic cell planning
- Access auto assignment
- Link analysis
- Indoor/Hybrid scenarios
- Annex – additional information

Automatic Cell Selection

Automatic Cell Selection feature aims at determining the best locations to deploy Cells (Transmitters) to reach **Access coverage objectives**

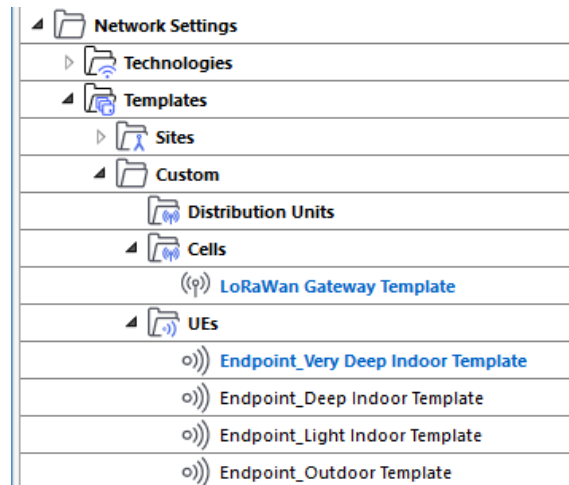
The ACS focuses on selecting sites with minimum cost needed to reach specific coverage targets.

Bloonet Planner provides different simulation modes within the ACP

- **Access only – The study objective is to deploy Cells on site candidates to reach the coverage objectives** (This part will focus on Access Only scenario).
- X-Haul only – The study objective is to deploy Distribution Units to connect active Cells in the study area.
- Joint Access + X-Haul – The study objective is to deploy both Cells to reach coverage targets as well as Distribution Units to provide backhaul connectivity.

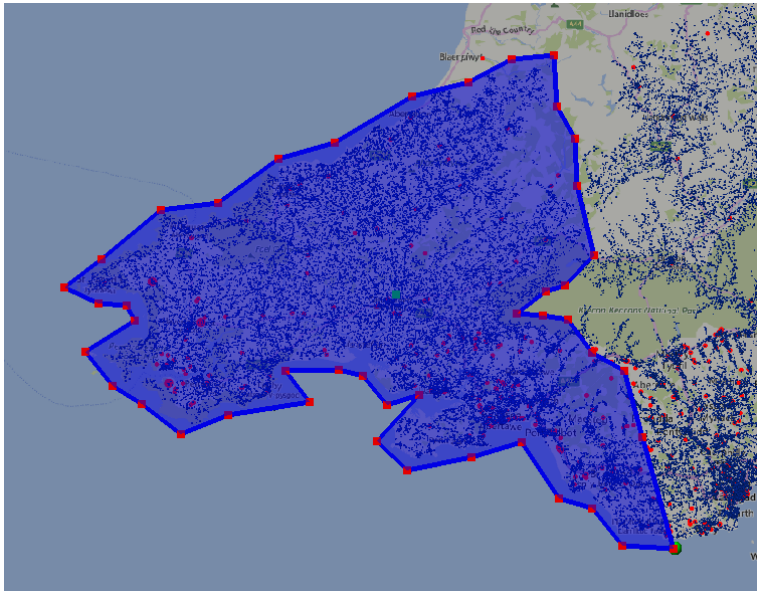
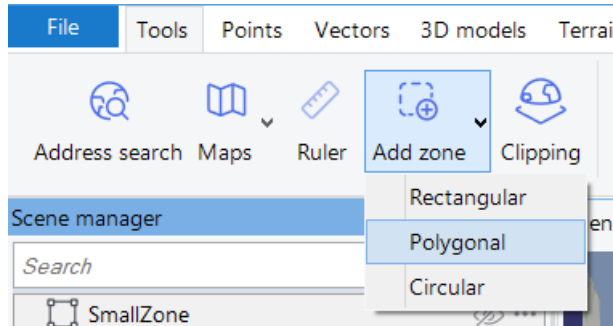
Study initialization 1/3

- Define the simulation settings to be considered
 - Cell Template – Defines characteristics of Base Stations (Cells) to be deployed
 - UE Template – Defines characteristics of the receivers (UEs) during the simulation



- Define a study area by creating a rectangular or polygonal zone (**Tools – Add zone**)
 - The area will be used to calculate the coverage statistics as well as selecting the network elements to be included in the simulation

Study Zone Creation

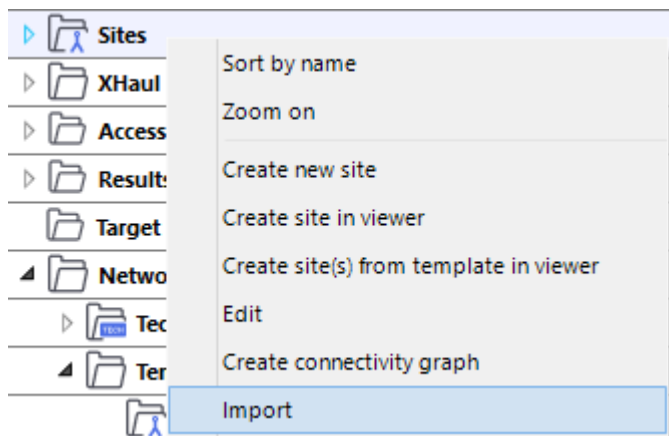


- **Study zone:** predictions will be computed at all pixels inside the study zone, base stations outside of the zone will still be considered for those pixels in its coverage range.
- 3 forms possible for a study zone:
 - Rectangular:
 - Polygonal
 - Circular
- Polygonal zone edition:
 - Ctrl + double-click to edit the zone
 - In edit mode, click any point of the polygone, when the point turns into blue, drag it to extend to the target location

Study initialization 2/3

- Define **candidate sites** and characteristics

Import a list of sites and define which sites are candidates to an automatic deployment as well as additional characteristics that will be considered during the study



Candidate status activation for consideration in the simulation process

Installation height defines the preferred deployment height at this site. If no value, default template values will be considered

A screenshot of the 'Site' configuration form. The form is divided into several sections: 'Name' (Site1), 'Address' (Street, House number, City, Post code, State, Country), 'Owner' (Name, Phone number), 'Details' (Type, Misc, Site acquisition cost), 'Coordinates' (Metric, DMS, Decimal), 'Site capacity' (Existing core network connectivity, Maximum capacity), 'Site deployment' (Site candidate for Automatic Cell Selection, Installation height, Reference layer). The 'Site acquisition cost' field is set to 1, and the 'Installation height' field is set to 0.00. A blue arrow points from the text 'When the site acquisition cost is set as 0, the site will be forced into selection.)' to the 'Site acquisition cost' field. Another blue arrow points from the text 'Installation height defines the preferred deployment height at this site. If no value, default template values will be considered' to the 'Installation height' field.

Cost associated to the deployment of Cells on this site.

When the site acquisition cost is set as 0, the site will be forced into selection.)

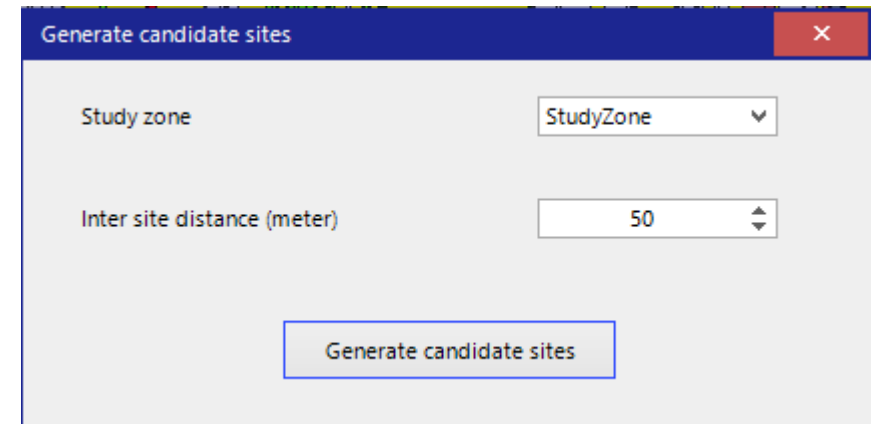
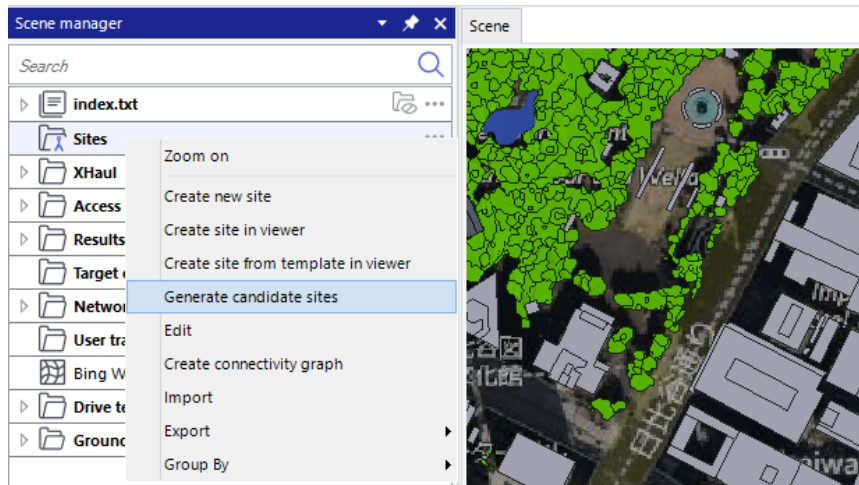
Study initialization 3/3

- Candidate sites auto-generation

If there is no candidate list available for the study, Bloonet Planner proposes to automatically generate candidate sites by right-clicking **Scene manager – Sites** and choosing “Generate candidate sites”.

In the **Generate candidate sites** window:

- Select a **Study zone** that predefined in the project
- Complete **Inter site distance**
- Click **OK** to generate candidate sites



Automatic Site Selection: General settings

Access Technology:

Define the technology to be studied

The screenshot shows the 'Automatic Cell Selection' dialog box with the 'General' tab selected. The 'Access Technology' dropdown is set to 'LoRaWan'. The 'Study Area' dropdown is set to 'StudyZone.shp'. The 'ACS Target' dropdown is set to 'Access-only'. The 'Output selection' button is visible on the right. Blue arrows point from the text annotations to the 'Access Technology', 'Study Area', 'ACS Target', and 'Output selection' fields.

Field	Value
Study Name	OptimizationStudy_1
ACS Target	Access-only
Study Area	StudyZone.shp
Access Technology	LoRaWan

Area: Study zone is mandatory, if target area is the map data area, a zone can be created to cover the whole area.

ACS Target:

Access only – The study objective is to deploy Cells on site candidates to reach the coverage objectives (This document will focus on Access Only scenario).

X-Haul only – The study objective is to deploy Distribution Units to connect active Cells in the study area.

Joint Access + X-Haul – The study objective is to deploy both Cells to reach coverage targets as well as Distribution Units to provide backhaul connectivity.

Output selection:

After the ACS process, a coverage prediction will be run with the selected sites, here select the simulation output metrics of this final coverage prediction.

Automatic Site Selection: Study settings

Automatic Cell Selection

General
Access
X-Haul
Simulation

Network Parameters Advanced settings

☒ Existing Access Cells
☒ Active Access Cells
☐ All Access Cells

Site selection strategy ☐ Forced ☒ Candidates

Candidates
☒ Candidate Access sites Access Cells template LoRaWan Gateway Template

Receiver
Template Endpoint_Outdoor Template
Location ☒ Above ground ☐ Above buildings

Coverage target
Resolution (m) 50
☐ Surface
☐ Traffic map
☐ Buildings footprint
☒ Target locations End_point_sample_lambert2.txt

Previous Next

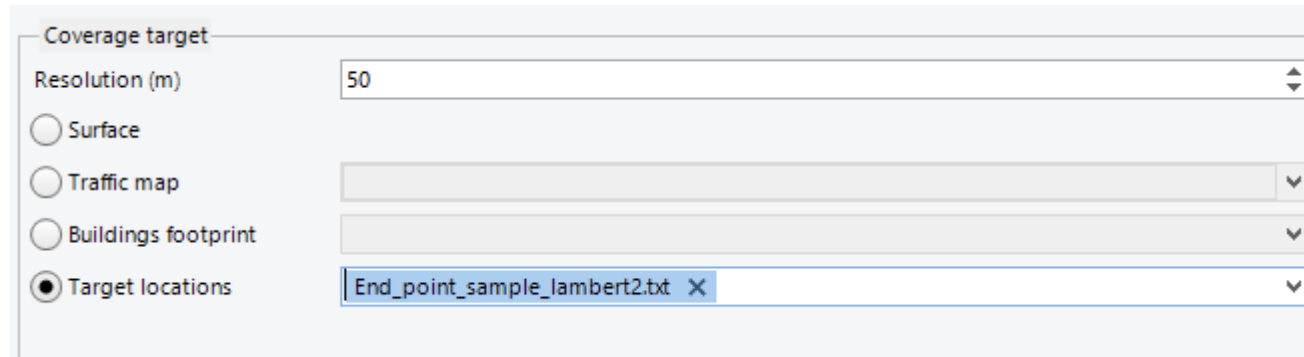
Existing Cells in the project can be candidates to the selection or forced in the selection

Define the characteristics of the Access Cells to be deployed.

Defines the characteristics of the receiver

Defines the coverage resolution for the propagation simulation

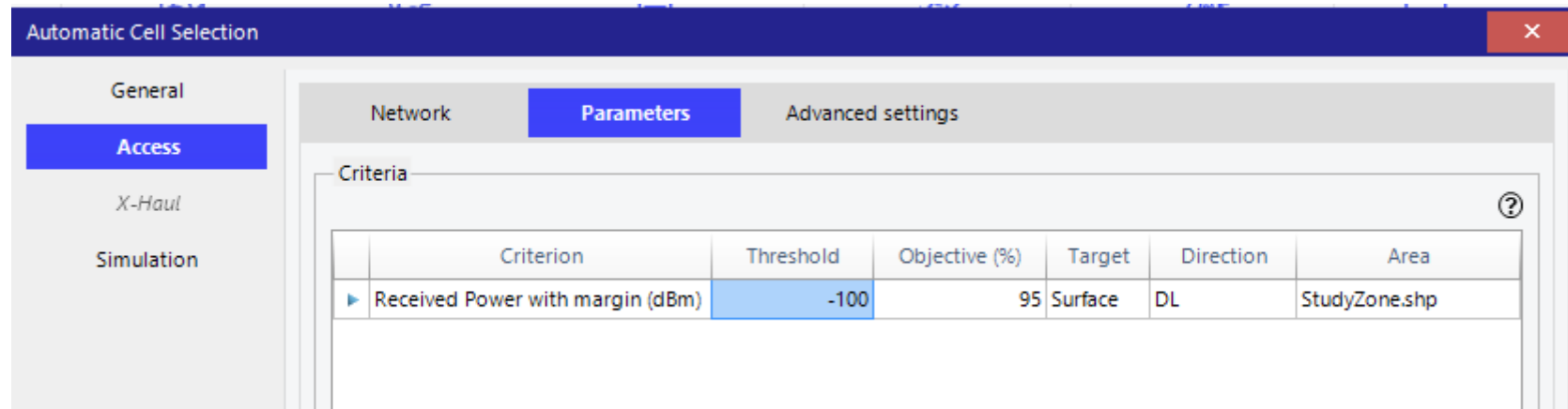
Automatic Site Selection: Coverage target settings



The screenshot shows a software interface for setting coverage targets. It features a title bar 'Coverage target' and a 'Resolution (m)' input field set to '50'. Below this are four radio button options: 'Surface', 'Traffic map', 'Buildings footprint', and 'Target locations'. The 'Target locations' option is selected. To the right of each radio button is a corresponding input field: a dropdown for 'Surface', a dropdown for 'Traffic map', a dropdown for 'Buildings footprint', and a text field for 'Target locations' containing the file path 'End_point_sample_lambert2.txt' with a small 'X' icon to its right.

- **Surface** : % surface covered within the study area
 - The total surface is the sum of the simulated pixels (that are non-excluded) in the study area
 - If location is above rooftop, the % is the ratio between covered building surface and total building surface
- **Traffic map** : % population covered within the study area
 - A user traffic map needs to be imported in the project
- **Building footprint** : % buildings covered within the selected layer(s) within the study area
 - A building is considered as covered as soon as a one pixel in a building footprint is above the defined threshold
- **Target locations** : % points covered within the study area

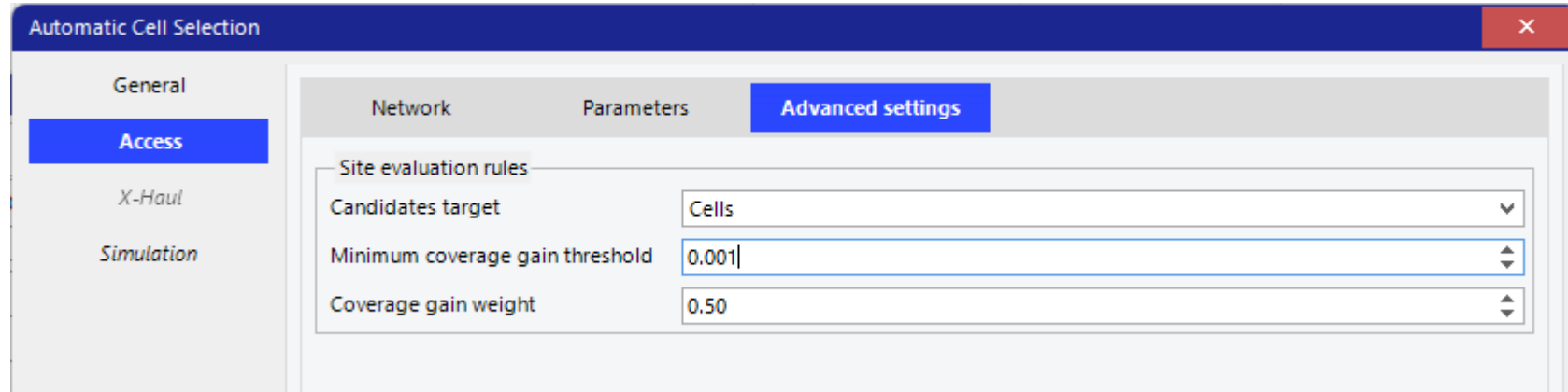
Automatic Site Selection: Criteria definition



Define the criteria for the computation:

- **Criterion** : metric that will be utilized to determine the most effective sites to achieve the objective.
- **Threshold** : minimum value of the chosen metric. Points with results equal or above the threshold will be considered as covered or qualified capacity.
- **Objective (%)** : percentage of points that are considered as covered or qualified capacity within study area.
- **Target**: indicative, referring to the coverage location target which is defined in the previous step.
- **Direction**: DL or UL, only indicative for the direction-specific metrics.
- **Area**: indicative, referring to the Study area chosen in General settings

Automatic Site Selection: Advanced settings

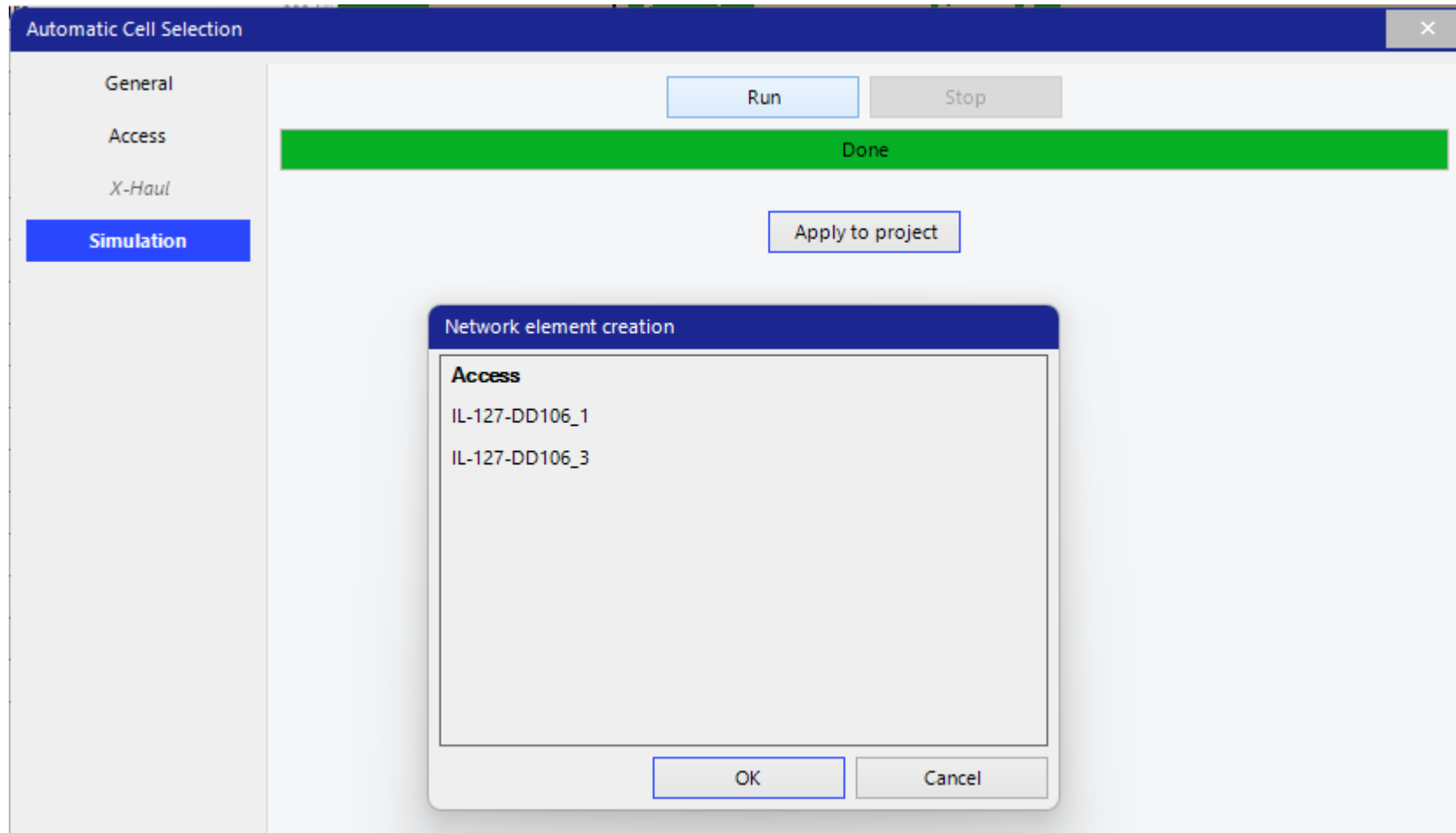


The screenshot shows a software window titled "Automatic Cell Selection" with a red close button in the top right corner. On the left is a sidebar with four tabs: "General", "Access" (highlighted in blue), "X-Haul", and "Simulation". The main area has three sub-tabs: "Network", "Parameters", and "Advanced settings" (highlighted in blue). Under the "Advanced settings" tab, there is a section titled "Site evaluation rules" containing three parameters:

Parameter	Value
Candidates target	Cells
Minimum coverage gain threshold	0.001
Coverage gain weight	0.50

- **Candidates target:** This parameter provides two options: Sites (default) and Cells. The Sites option enables Automatic Site Selection at the site level, assuming all sites share the same cell configuration (for example, the same number of sectors per site). The Cells option enables ACS at the individual cell level.
- **Minimum coverage gain threshold:** Defines the minimum percentage of coverage contribution required for a candidate site to be considered. For example, a value of 0.01 corresponds to a 1% minimum coverage contribution.
- **Coverage gain weight:** Adjusts the relative importance of coverage gain versus total site cost (including acquisition and equipment costs). A higher value increases the influence of coverage gain in the site selection process, while reducing the weight of cost considerations.

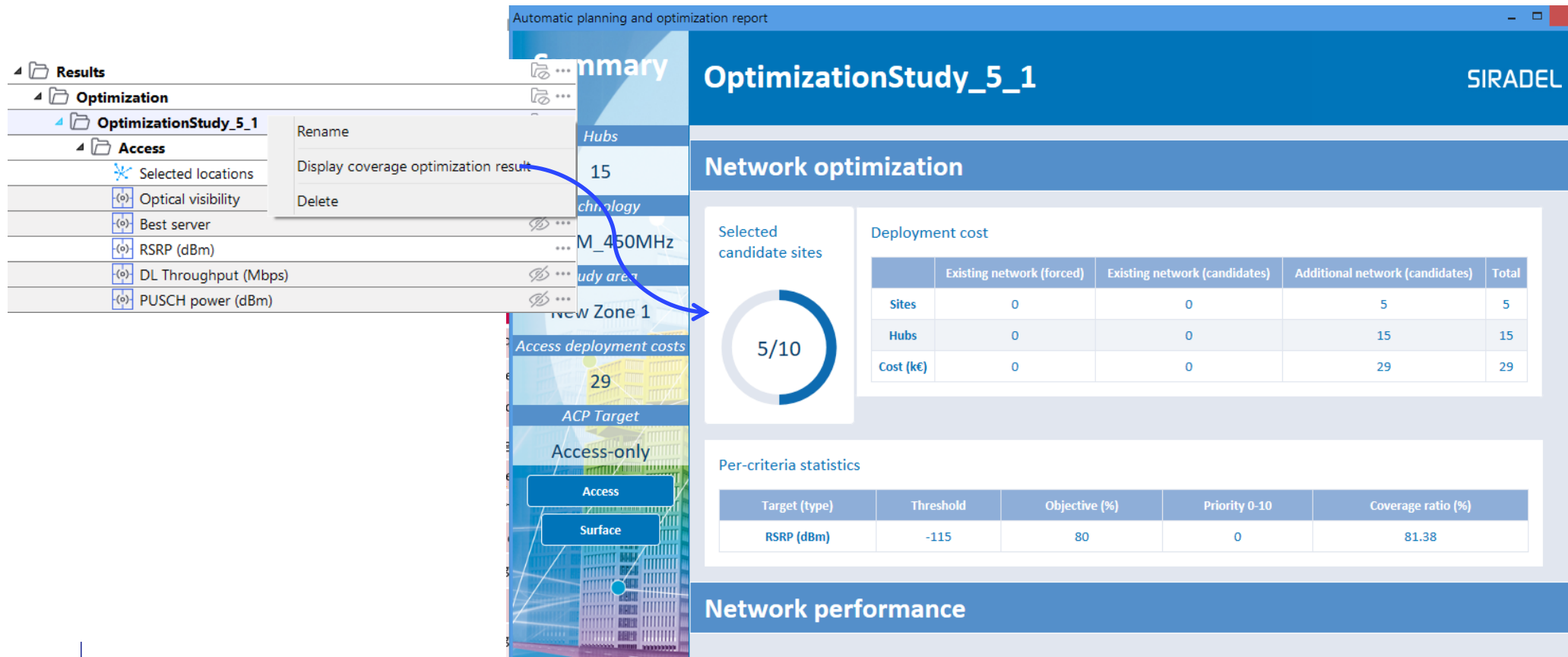
Automatic Site Selection: Simulation Run



- Apply to project will create new selected Cells and update activation state based on the analysis result

Automatic Site Selection: Result and Report

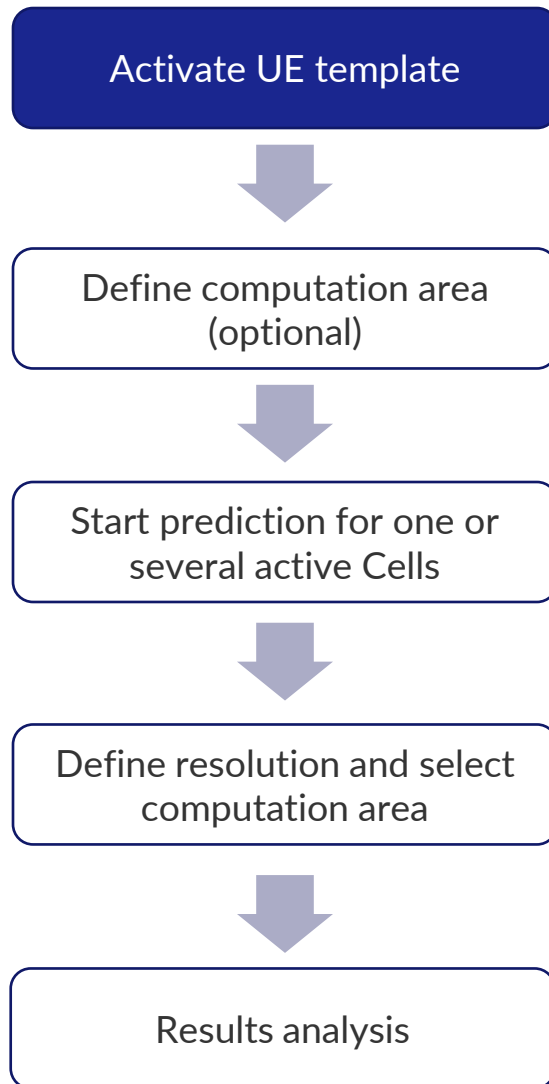
- Once the simulation process is performed, a report is generated providing an overview of the selected network as well as a description of the selected Cells
- Coverage maps generated with the selected network are available in the result folder



CONTENT

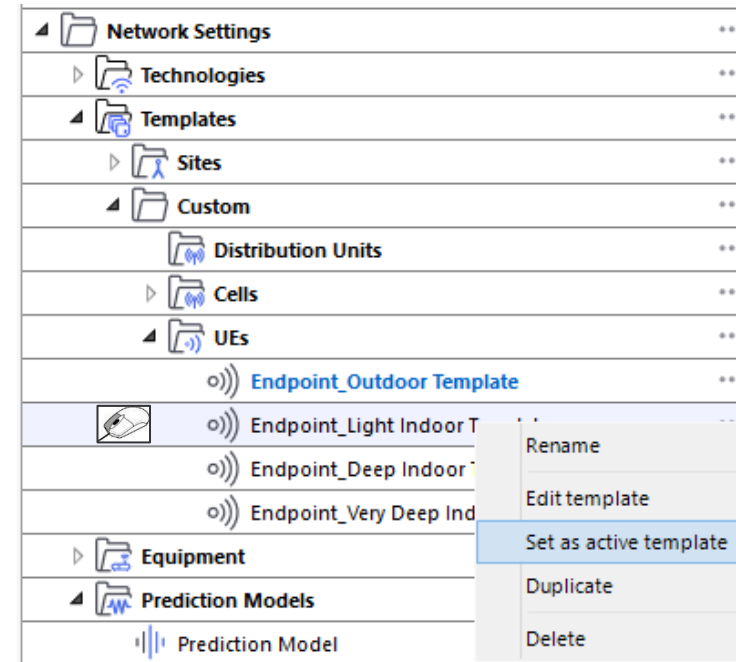
- Introduction
- Main menu overview
- Map data management
- Network settings wizard
- Network element creation
- Automatic cell selection
- **Coverage prediction**
- Automatic cell planning
- Access auto assignment
- Link analysis
- Indoor/Hybrid scenarios
- Annex – additional information

Coverage Prediction Workflow

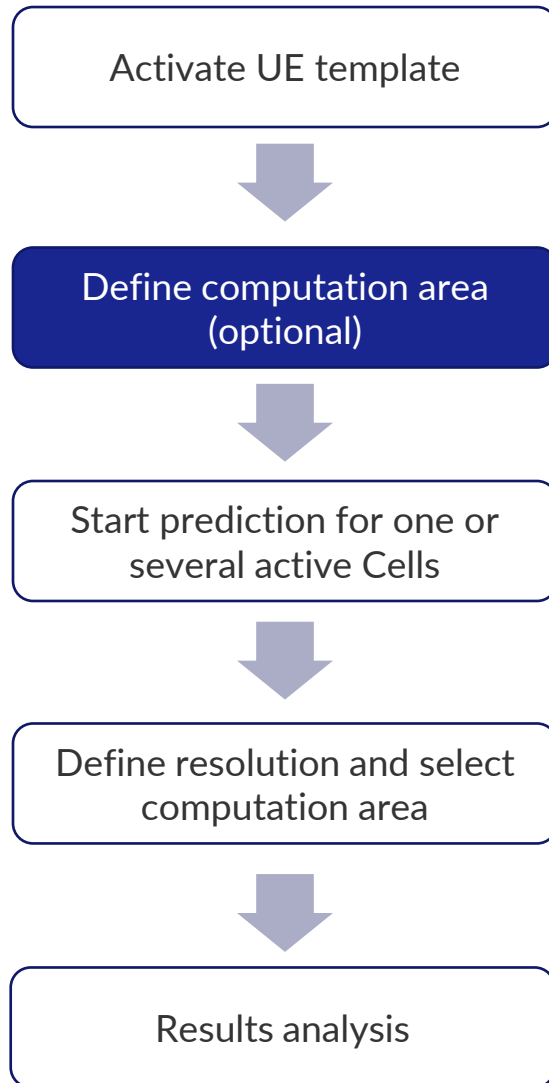


UE template gathers all **receiver characteristics** to run the coverage map:

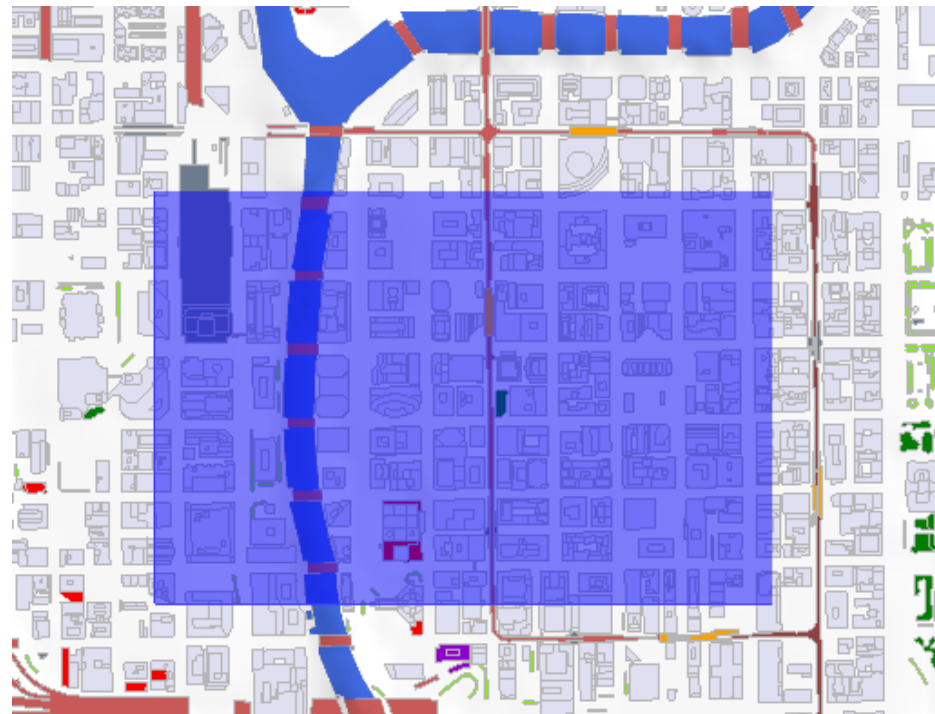
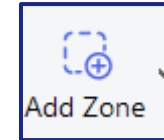
- UE Height
- UE Antenna and Orientation strategy
- Technology
- ...



Coverage Prediction Workflow

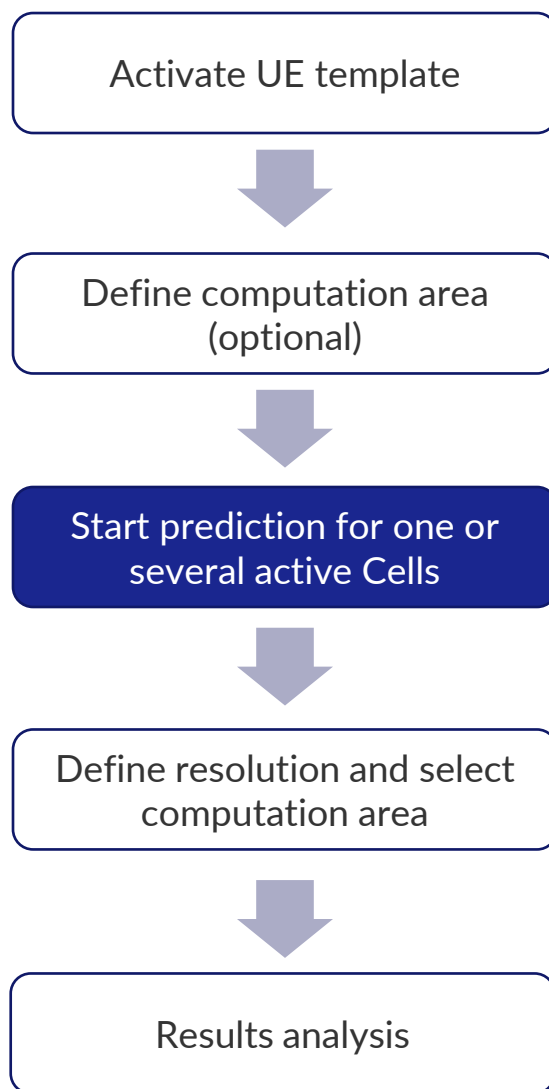


Tools – Add zone

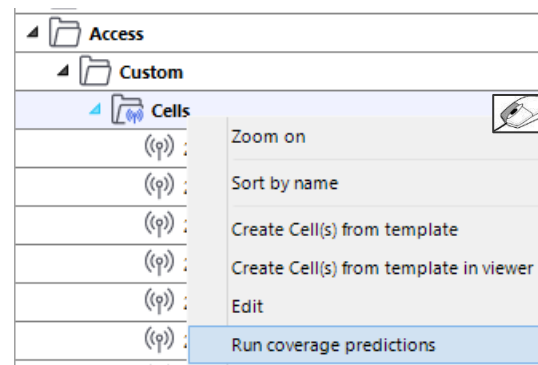


More details: [Study zone creation](#)

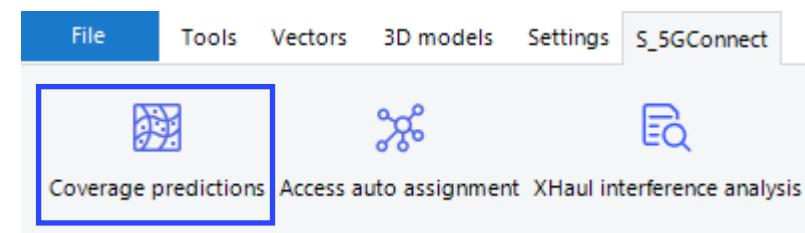
Coverage Prediction Workflow



Run coverage for all active Cells of a technology

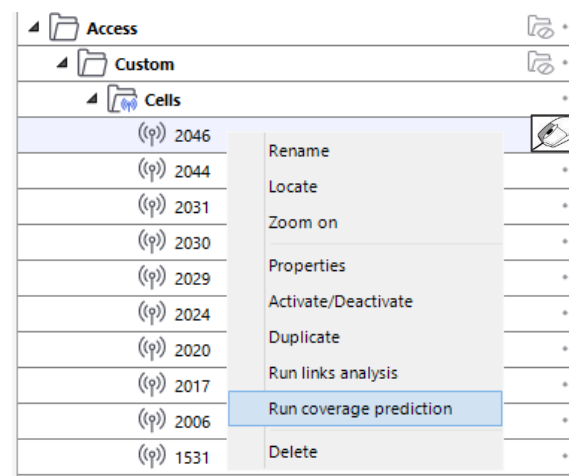


Or

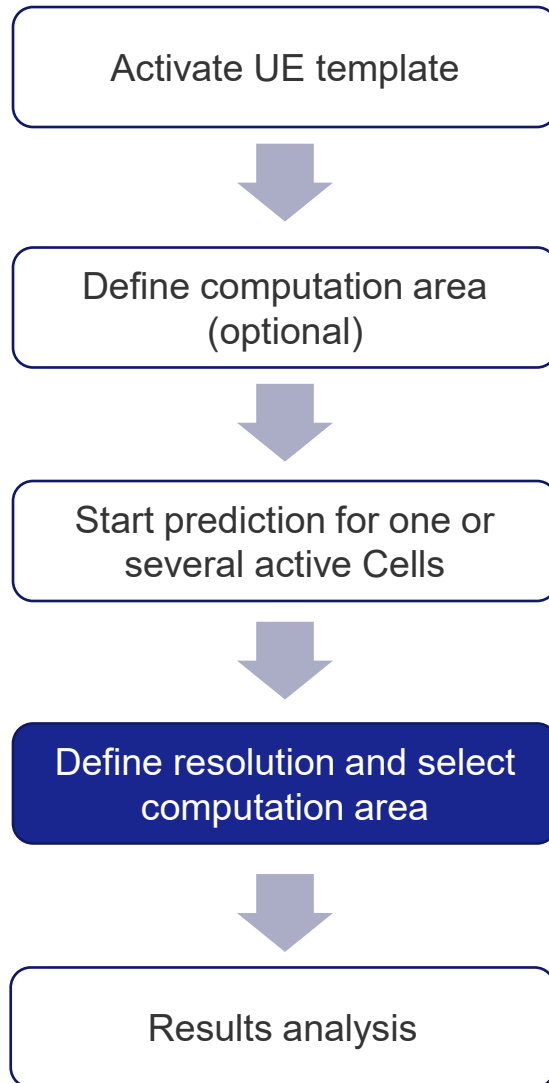


After click « Coverage predictions », select the target technology type (from Custom/5G/LTE)

Run coverage for a single Cell (the Cell technology is selected for the prediction provided that the same technology is defined for the active UE template).



Coverage Prediction Workflow



Override prediction radius defined at the Cell level

Study Area:
To be selected among the different existing areas

Cell coverage

Study name: 5G_TDD_Macro_n77_3500_Study_1

Study Area: New Zone 0

Technology: 5G_TDD_Macro_n77_3500

Receiver template definition: UE_5G_Macro_Class2

Resolution (m): 10.00

☐ Force cells prediction radius (m): 1000.00

Coverage target:

- ☒ Surface
- ☐ Traffic map
- ☐ Target client locations

Propagation model: VolcanoUrban

Receiver location:

- ☒ Above ground
- ☐ Above building rooftops
- ☐ Hybrid (above ground/rooftop)
- ☐ 3D Outdoor

Multi-floor heights: ☐

Computation progress: Not Started

Buttons: Close, Run, Stop

Output selection
Select coverage layers to be generated

Coverage study settings

Computation settings | Output selection

- ☒ Neutral coverage maps
 - ☐ Optical visibility
 - ☒ Best server
 - ☐ 2nd Best server
 - ☐ Clearance
- ☒ Downlink coverage maps
 - ☐ Mean Rx power
 - ☐ 2nd Best server mean Rx power
 - ☒ Rx power with margins
 - ☐ 2nd Best server Rx power with margins
 - ☐ Mean SINR
 - ☒ SINR with margins
 - ☒ Throughput
 - ☐ Interference
 - ☐ EMF
 - ☐ Exposure state
 - ☐ Mean total field
 - ☐ Total field with margins
- ☒ Uplink coverage maps
 - ☐ Mean Rx power
 - ☒ Rx power with margins
 - ☐ Mean SINR

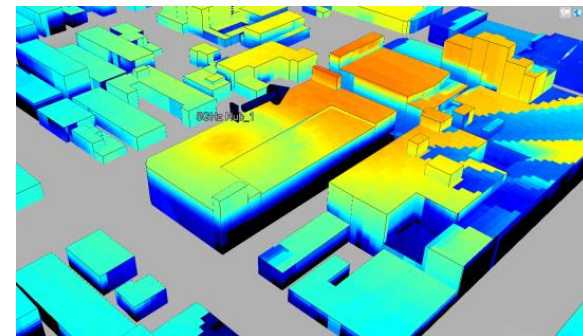
Buttons: OK, Cancel

Resolution (m): Computation resolution

Coverage Prediction Workflow - 3D simulations

3D simulations are performed on building polygons, providing either coverage on building external facades in **Outdoor** mode or coverage inside buildings (internal facades and different floors) in **Indoor** mode, with computations based on multiple heights defined in the active Remote template.

During first 3D computation, a textured model is automatically created, there is color and value smoothing applied between two floors. (Currently there is no smoothing applied between the rooftop and last floor.)



Location

Height above ground (m) 1.50

Height above rooftop (m) 2.00

Height above reference layer (m) 0.50

Multi-floor heights

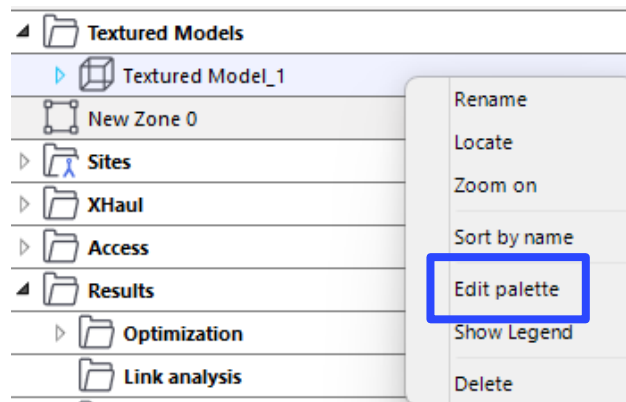
☒ 1.5;10.5;20.5

☐ Min 1.5

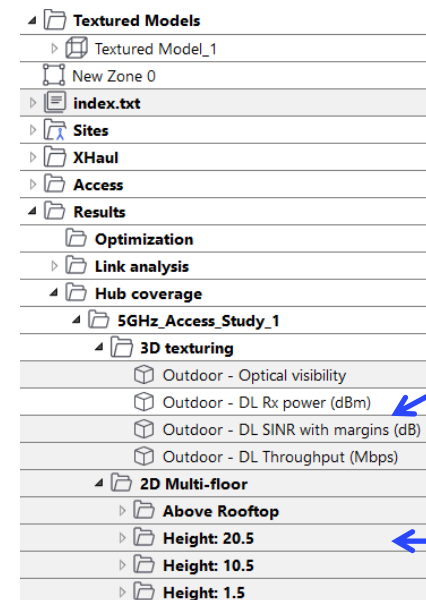
Nb floors 3

Floor height (m) 10.0

3D Simulations are performed on multi-heights based on the heights provided in the active Remote template (under Network settings – Templates – Custom/5G/LTE – Ues)



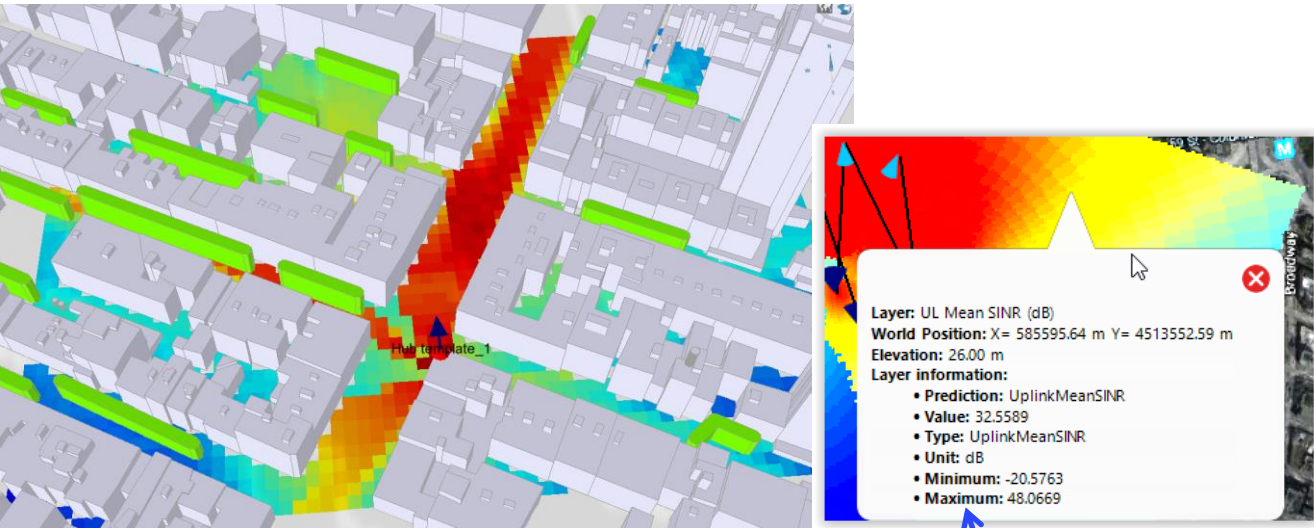
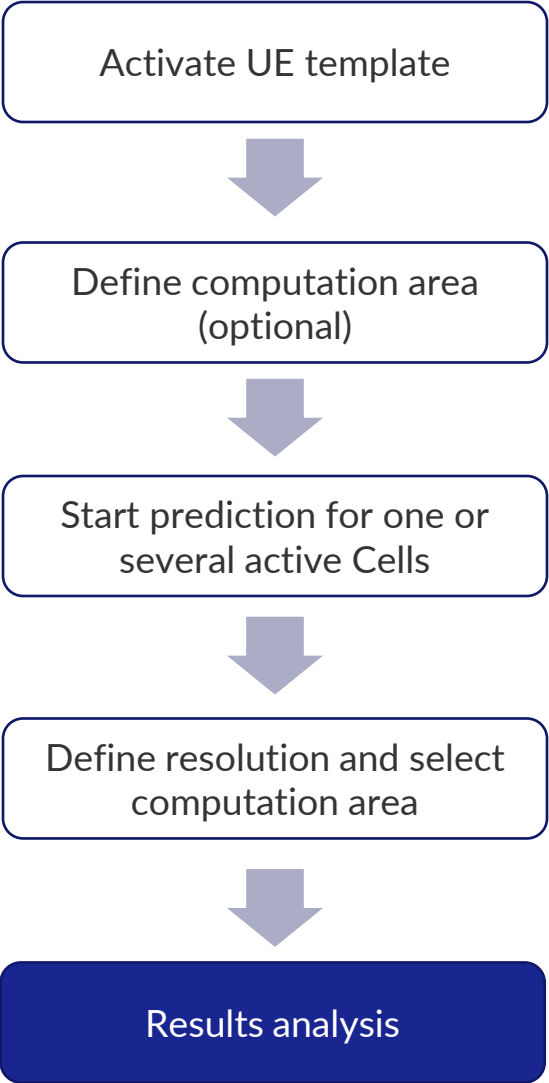
To modify the color palette of textured 3D simulation result, right-click the **textured model** and select **Edit palette**



3D texturing simulations are available in the Scene manager under Results (linked to the textured model)

2D multi-heights Volcano results used in input of the texturing are also available

Coverage Prediction Workflow



Results	...
Optimization	...
Link analysis	...
Cell coverage	...
LoRaWan_Study_10m	...
Best server	...
DL Rx power with margins (dBm)	...
DL SINR with margins (dB)	...
DL Throughput (Mbps)	...
UL Rx power with margins (dBm)	...
UL SINR with margins (dB)	...
UL Throughput (Mbps)	...

Left click + ctrl opens a tooltip to read coverage values at a specific location

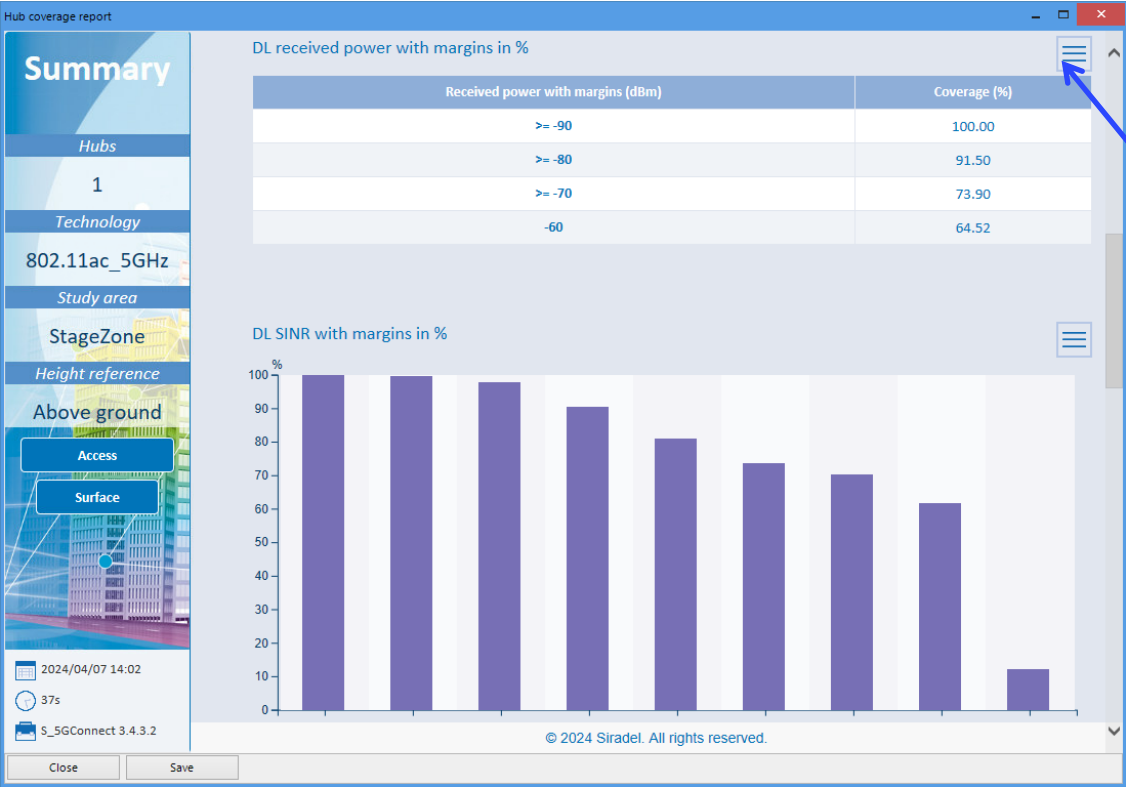
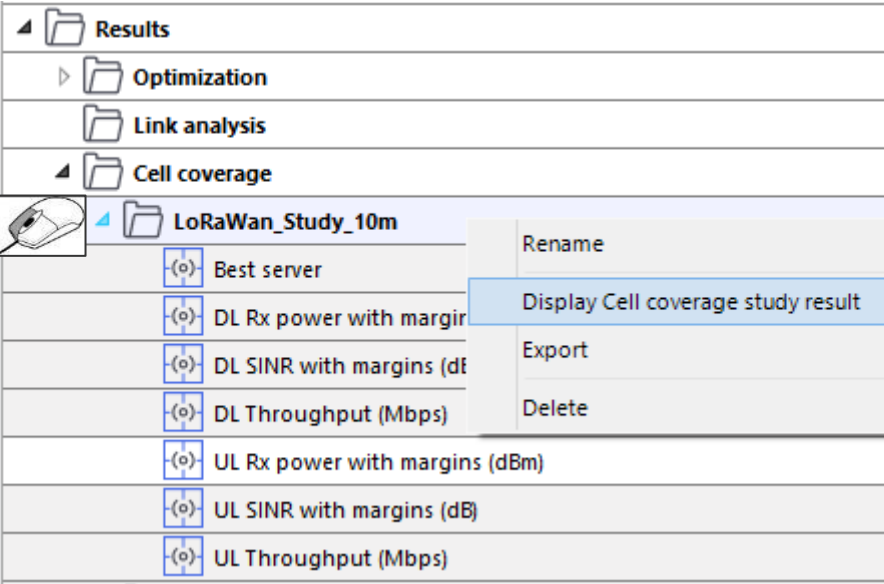
Display/Hide results by clicking on the « Eye »

Coverage results available in the Scene manager under **Results**

Coverage Prediction Workflow - Report

The report provides a detailed overview of the simulated metrics (Throughput, SINR, Received power, Best Server, Visibility) as well as a comprehensive summary of the simulation input data.

For indoor or 3D simulation scenario, the coverage report is located at the receiver floor level. **Right-click** “Results – Cell coverage – (Simulation name) – 2D multi-floor – Height: (receiver height)” and select “Display Cell coverage study result” option to display the study report.



Switch view between chart and table

Coverage map: palette (legend) configuration

To modify the legend of a coverage map, right-click on a coverage map layer, select **Edit palette**.

There are two ways to modify the coverage map palette:

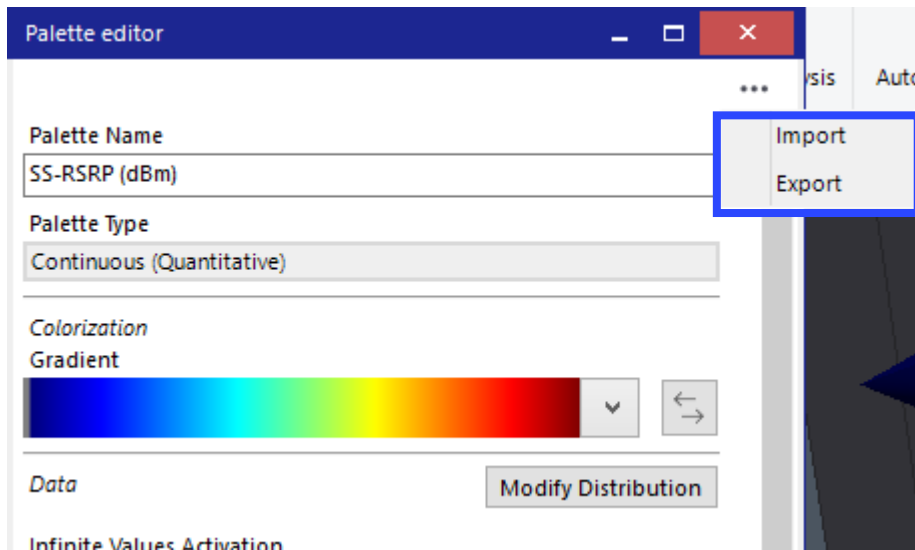
- Use **Gradient** and **Modify Distribution** function, to configure and generate automatically the legend.
- Click the ... button to Add or Remove step and click on the color block to change the color of the step.

The screenshot illustrates the workflow for editing a coverage map palette. It shows the 'Results' tree, the 'Cell coverage' folder, and the '5G_TDD_Macro_n77_3500_Study' layer. The 'Edit palette' option is selected in the context menu. The 'Palette editor' dialog is open, showing the 'Colorization' dropdown set to 'Gradient'. The 'Data Distribution' dialog is also open, showing the 'Min. Value' and 'Max. Value' fields, 'Step Number' and 'Classification' dropdowns, and 'Apply', 'Save', and 'Close' buttons. The 'Color dialog' is open at the bottom left, showing a color selection interface. The 'Palette editor' dialog has a 'Data' section with a table of values and a 'Legend' section showing the resulting color scale. A blue arrow points from the 'Edit palette' menu item to the 'Palette editor' dialog. Another blue arrow points from the 'Modify Distribution' button in the 'Palette editor' to the 'Data Distribution' dialog. A third blue arrow points from the 'Add Step Before' button in the 'Data Distribution' dialog to the 'Data' table in the 'Palette editor'.

Color	Value	Legend Label
Blue	-200	***
Dark Blue	-160.0000000000001	***
Dark Blue	-160	***
Dark Blue	-159	***
Dark Blue	-158	***
Dark Blue	-157	***
Dark Blue	-156	***
Dark Blue	-155	***
Dark Blue	-154	***
Dark Blue	-153	***
Dark Blue	-152	***

Coverage map: palette (legend) – Export and Import

Click on the ... button on left top of the Palette editor window to export or import palette configuration file.
The palette configuration file is in XML format, which can be edited directly.



```
<?xml version="1.0" encoding="UTF-8" ?>
<ResultPalette xmlns:i="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://schemas.datacontract.org/2004/07/System.Drawing">
  <ExtendToNegativeInfinity>false</ExtendToNegativeInfinity>
  <ExtendToPositiveInfinity>true</ExtendToPositiveInfinity>
  <Markers>
    <Marker>
      <Color xmlns:d4pl="http://schemas.datacontract.org/2004/07/System.Drawing">
        <d4pl:knownColor>0</d4pl:knownColor>
        <d4pl:name i:nil="true" />
        <d4pl:state>2</d4pl:state>
        <d4pl:value>4278190080</d4pl:value>
      </Color>
      <Label></Label>
      <Value>-120</Value>
    </Marker>
    <Marker>
      <Color xmlns:d4pl="http://schemas.datacontract.org/2004/07/System.Drawing">
        <d4pl:knownColor>0</d4pl:knownColor>
        <d4pl:name i:nil="true" />
        <d4pl:state>2</d4pl:state>
        <d4pl:value>4282123268</d4pl:value>
      </Color>
      <Label></Label>
      <Value>-119</Value>
    </Marker>
    <Marker>
      <Color xmlns:d4pl="http://schemas.datacontract.org/2004/07/System.Drawing">
        <d4pl:knownColor>0</d4pl:knownColor>
        <d4pl:name i:nil="true" />
        <d4pl:state>2</d4pl:state>
        <d4pl:value>4283828738</d4pl:value>
      </Color>
      <Label></Label>
      <Value>-118</Value>
    </Marker>
    <Marker>
      <Color xmlns:d4pl="http://schemas.datacontract.org/2004/07/System.Drawing">
        <d4pl:knownColor>0</d4pl:knownColor>
        <d4pl:name i:nil="true" />
        <d4pl:state>2</d4pl:state>
        <d4pl:value>4287698441</d4pl:value>
      </Color>
      <Label></Label>
      <Value>-117</Value>
    </Marker>
  </Markers>
</ResultPalette>
```

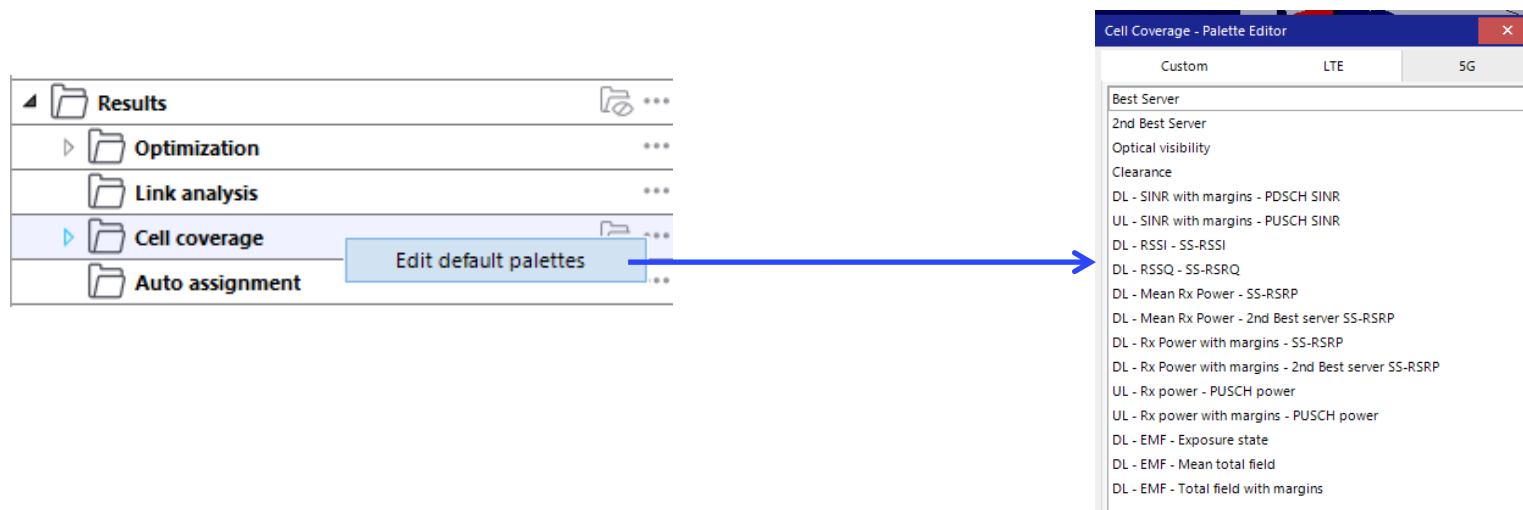
Coverage map: default palette (legend) configuration

Bloonet Planner provides default palettes for different metrics.

There are two levels of default setting modification :

Project level: all users (SaaS and Desktop users) can right-click (or click on the ... button at the right) on **Results – Cell coverage**, click on **Edit default palettes** button. Select the metric and click **Edit Palette** button to edit the default palette of selected metric. All simulations run after this will be based on the new palette of this metric. This is limited in the project.

Application level: Desktop users can follow the palette configuration and export steps to create their own palettes. Replace the default palettes that are located at C:\Program Files\Siradel\SmartCityExplorer\bin\plugins\S_5GConnect\Resources\Palettes if the default installation path is used. The default palettes will be rewritten upon new version installation. Please ensure the backup before upgrading Bloonet Planner to a new release. (This option is not available for SaaS users.)

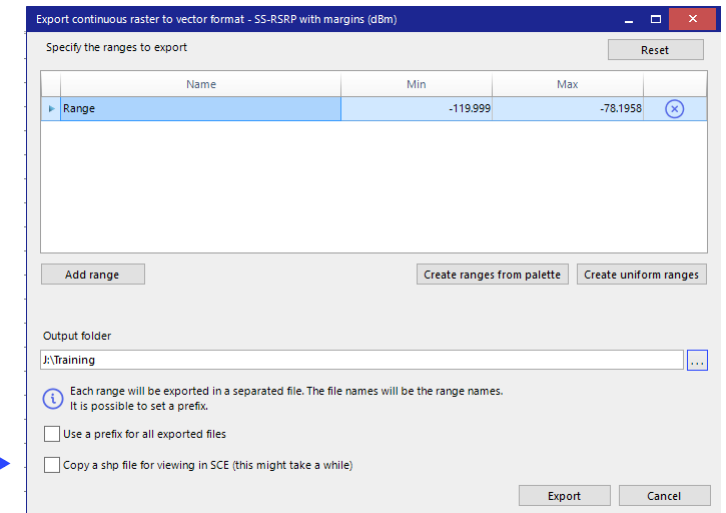
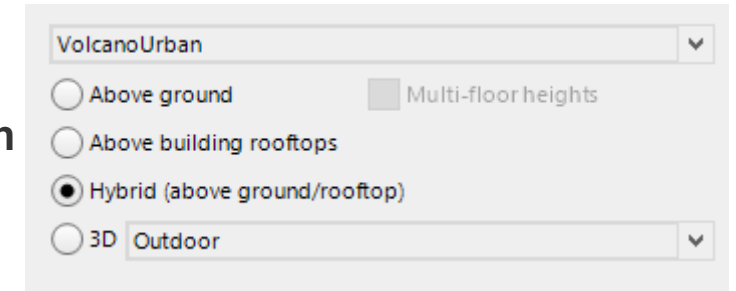
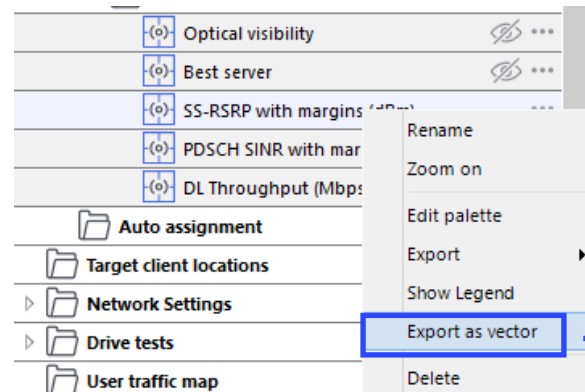
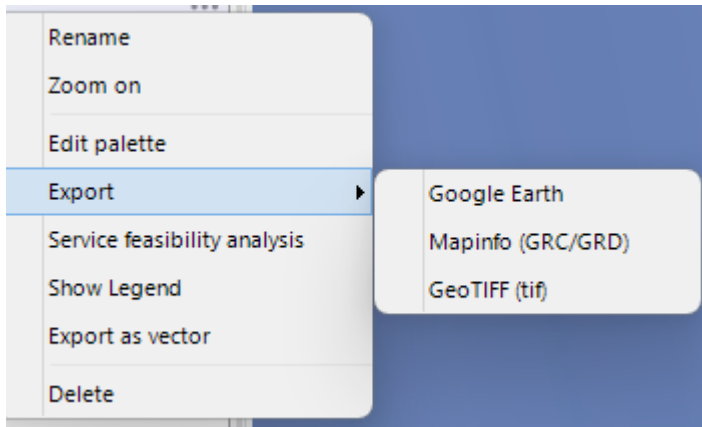


2D Coverage map: export options

2D coverage map refers to the simulation results when the receiver location is Above ground, Above building rooftops or Hybrid (above ground/rooftop).

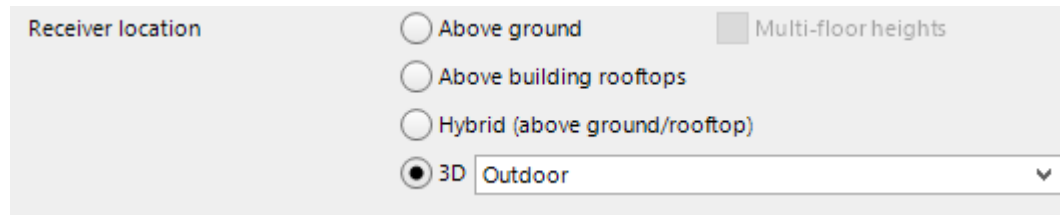
There are 4 options to export 2D coverage simulation results:

- **Google earth (KMZ)** : Right-click a simulation result, select **Export – Google Earth**
- **Mapinfo (GRC/GRD)** : Right-click a simulation result, select **Export – Mapinfo**
- **GeoTIF (tif)** : Right-click a simulation result, select **Export – GeoTIFF**
- **Vector (Shape format)** : Right-click a simulation result, choose **Export as vector**, configure the parameters in the pop-up window, and export the results as a Shapefile vector format. The exported files provide coverage area contours where metric values fall within the specified range.



3D Coverage map export

3D coverage map refers to the simulation results when the receiver location is 3D (Outdoor or Indoor).



Receiver location

☐ Above ground ☐ Multi-floor heights

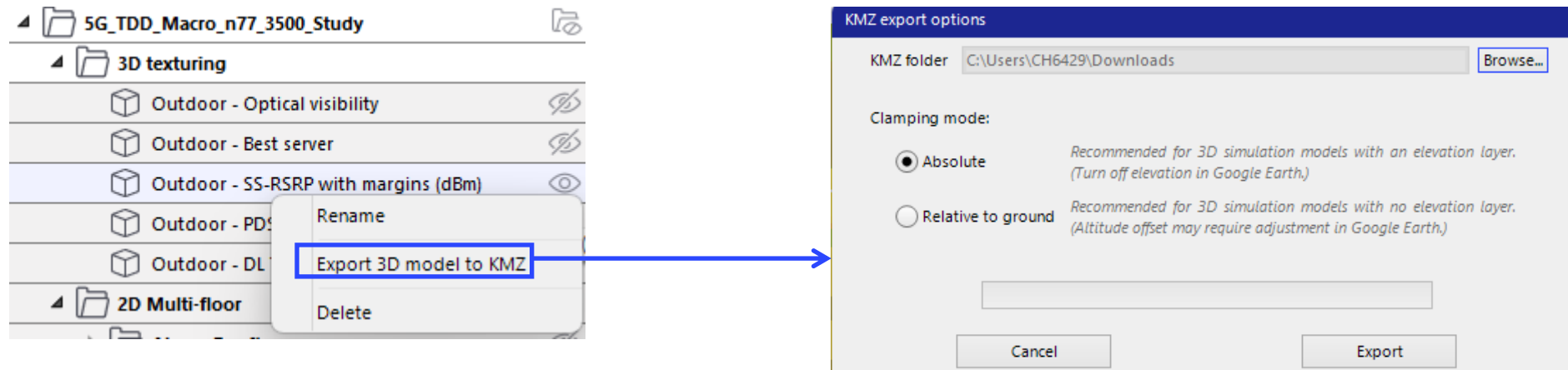
☐ Above building rooftops

☐ Hybrid (above ground/rooftop)

☒ 3D

Right-click a simulation result under 3D texturing and select Export 3D model to KMZ (Google Earth format), two clamping modes are proposed:

- Relative to ground: Recommended mode for 3D coverage map export.
- Absolute: Terrain option in Google Earth Pro needs to be deactivated.



CONTENT

- Introduction
- Main menu overview
- Map data management
- Network settings wizard
- Network element creation
- Automatic cell selection
- Coverage prediction
- **Automatic cell planning**
- Access auto assignment
- Link analysis
- Indoor/Hybrid scenarios
- Annex – additional information

Automatic cell planning - introduction

Automatic cell planning feature is a workflow that helps the users to automate the process of optimizing the cell configurations. It uses optimization algorithms to determine the optimal cell configuration based on given objective.

This workflow can be used either at the network design phase, before the actual deployment of the base stations or gateways, or at the continuous network optimization phase, after the network deployment.

Together with the [Automatic Cell Selection](#) workflow, Automatic Cell Planning offers several significant benefits :

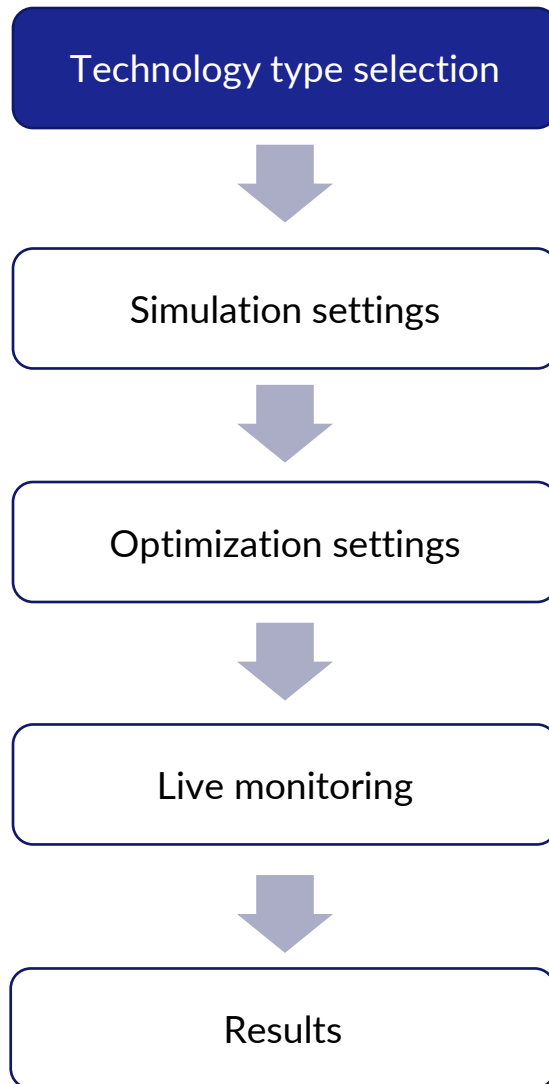
- Improvement of network coverage by strategically placing cell sites and proposing the optimal configurations to minimize coverage holes.
- Cost-efficiency as it reduces the need for manual planning, saving both time and resources.
- Enhanced service quality by minimizing interference and optimizing signal strength.

Automatic cell planning – pre-requisites

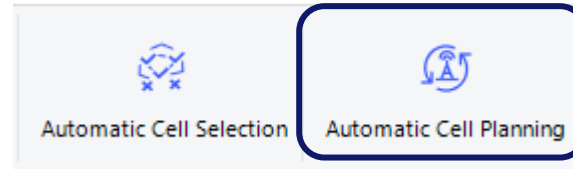
Before starting Automatic cell planning workflow, there are some pre-requisites to respect:

- **Cells** to be optimized have been already created in the project
- **UE equipment** (under “Network settings – Equipments – Radios – Custom/5G/LTE – UEs” in the Scene manager) has been well configured, gathering the target receiver equipment’s characteristics : transmission power, noise figure, mapping tables that translate a given SINR into throughput value through spectrum efficiency, antenna pattern, etc.
- **UE template** (under “Network settings – Templates – Custom/5G/LTE – UEs” in the Scene manager) has been well configured, gathering target UE’s initial configuration information : UE equipment, receiver height, antenna related parameters, additional interference, etc.
- **Study Area** (menu **Tools – Add zone** in the tool bar) has been created. The study area specifies a zone where the simulation will be run.
- **Optimization Area** (menu **Tools – Add zone** in the tool bar) has been created. The optimization area specifies a zone where the candidate cells are to be optimized.

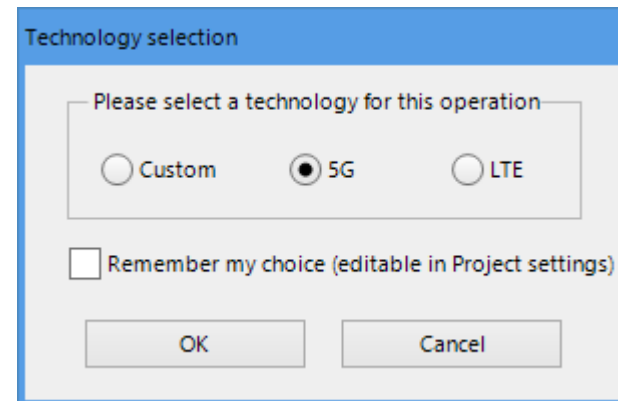
Automatic Cell Planning Workflow : Technology type selection



Select the **Automatic Cell Planning** button in the tool bar to launch Automatic Cell Planning workflow.

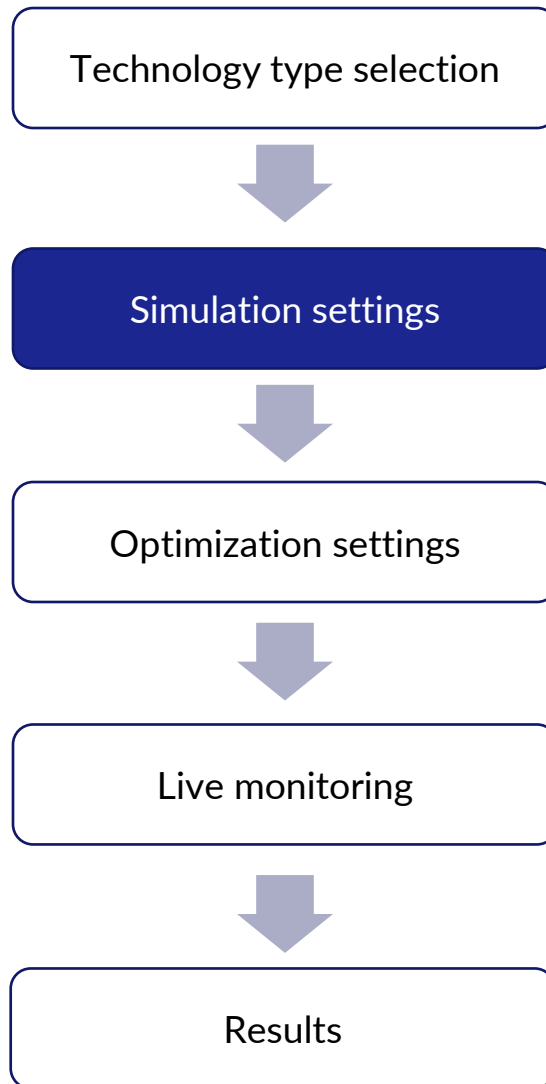


Select the **Technology Type** in the pop-up window:



If previously the **Remember my choice** option has been activated, this window will not be shown. You can select the **Project settings** button in the tool bar, then **Technologies** tab to change the **Active technology type**.

Automatic Cell Planning Workflow : Simulation settings



This step has similar parameters as in coverage prediction. It defines prediction related parameters.

The screenshot shows the 'Automatic Cell Planning' software interface, specifically the 'Simulation settings' tab. The window is divided into a left sidebar with 'Simulation settings', 'ACP settings', and 'Run' options, and a main configuration area. The 'Simulation settings' section includes the following parameters:

- Study name:** 5G_TDD_Macro_n77_3500_Study_1
- Study Area:** CampusZone
- Technology:** 5G_TDD_Macro_n77_3500
- Receiver template definition:** UE_5G_Macro_Class2
- Resolution (m):** 1.00
- Force cells prediction radius (m):** 1000.00 (with an unchecked checkbox)
- Coverage target:** Includes checkboxes for 'Surface' (checked), 'Traffic map', and 'Target client locations'.
- Propagation model:** VolcanoUrban
- Receiver location:** Includes radio buttons for 'Above ground' (selected), 'Above building rooftops', and '3D', along with a 'Multi-floor heights' checkbox and an 'Outdoor' dropdown menu.

Blue arrows point from descriptive text on the right to specific fields in the window: 'Study Area' points to the 'CampusZone' dropdown, 'Receiver template' points to the 'UE_5G_Macro_Class2' dropdown, 'Output selection' points to the 'Output selection' button, 'Resolution (m)' points to the '1.00' input field, and 'Override prediction radius' points to the 'Force cells prediction radius' checkbox and its value.

Study Area:

Select the Study zone prepared in advance, as stated in the pre-requisites page

Receiver template:

Select the UE template prepared in advance, as stated in the pre-requisites page

Output selection

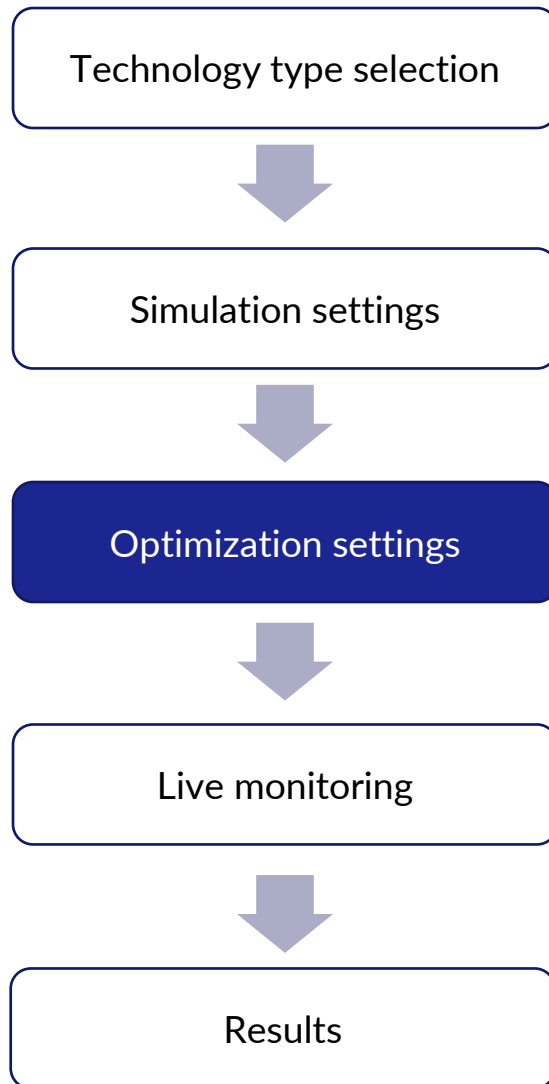
Select metrics results to be generated **with the proposed cell configuration**

Resolution (m):

Computation resolution

Override prediction radius defined at the cell level

Automatic Cell Planning Workflow: Optimization settings 1/2



The screenshot shows the 'Automatic Cell Planning' software interface. The 'ACP settings' tab is active. The 'Objective' is set to 'Maximize SS-RSRP coverage'. The 'Threshold (dBm)' is set to -90.00. The 'Optimization area' is checked, and the 'OptimZone' is selected. The 'Degrees of Freedom' section includes 'Transmitted DL Power (dBm)', 'Azimuth (°)', and 'Downtilt (°)', all of which are checked. Each of these has a 'Reconfiguration cost' of 0.00 and a 'Range configuration' set to 'Relative range'. The 'gNodeB control antenna' is unchecked. The 'List of candidate antennas' is empty. The 'Previous' and 'Next' buttons are at the bottom.

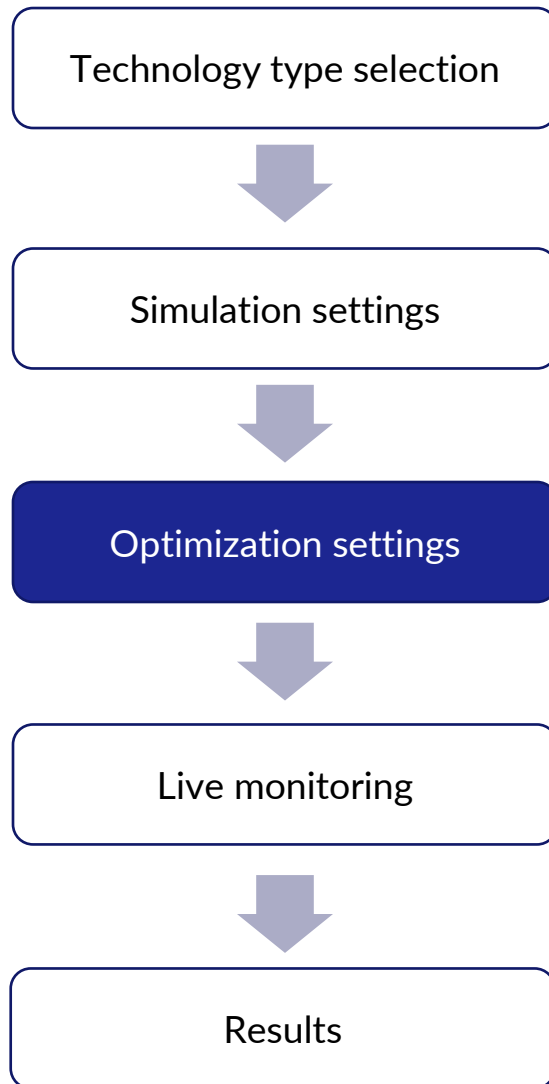
Objective: metric that will be utilized to determine the most effective configuration to achieve the objective.

Threshold : minimum value of the chosen metric. Points with results equal or above the threshold will be considered as covered or qualified capacity.

Target:

- **Coverage:** percentage of points that are considered as covered within study area.
- **SINR:** the average SINR of all the points in the study area
- **Not selected:** the algorithm will try to find the maximum value possible. In this case, it is recommended to set a "**Maximum optimization duration**" value in the live monitoring step.

Automatic Cell Planning Workflow: Optimization settings 1/2



The screenshot shows the 'Automatic Cell Planning' window with the 'ACP settings' tab selected. The 'Run' button is visible. The settings are organized into sections: Objective, Threshold (dBm), Target SS-RSRP coverage (%), Optimization area, Only candidates Cells, Degrees of Freedom, Transmitted DL Power (dBm), Reconfiguration cost, Range configuration, Azimuth (*), Downtilt (*), and gNodeB control antenna. The 'Optimization area' checkbox is checked, and the 'Degrees of Freedom' section is expanded, showing 'Transmitted DL Power (dBm)' and 'Azimuth (*)' settings. The 'Reconfiguration cost' is set to 0.00. The 'Range configuration' is set to 'Relative range' with 'Min. offset' at 0.00, 'Max. offset' at 10.00, and 'Step' at 2.00. The 'Azimuth (*)' section is also expanded, showing 'Reconfiguration cost' at 0.00, 'Range configuration' set to 'Relative range', 'Min. offset' at -5.00, 'Max. offset' at 5.00, and 'Step' at 1.00. The 'Downtilt (*)' section is expanded, showing 'Reconfiguration cost' at 0.00, 'Range configuration' set to 'Relative range', 'Min. offset' at 0.00, 'Max. offset' at 5.00, and 'Step' at 1.00. The 'gNodeB control antenna' section is collapsed, showing 'Reconfiguration cost' at 0.00. The 'List of candidate antennas' is empty. The 'Previous' and 'Next' buttons are at the bottom.

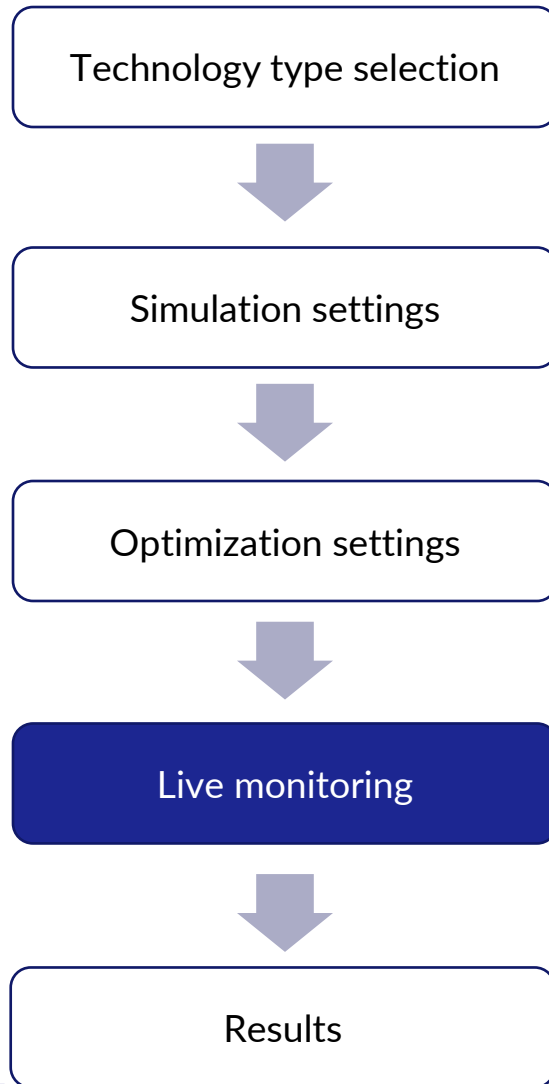
Optimization area : the zone where the candidate cells are to be optimized. If not activated, the study area selected in the simulation settings will be used.

Only candidate cells : if this option is activated, only the cells configured in the cell properties as **Candidate cell for Optimization Cell Planning** will be optimized.

Degrees of freedom: the cell parameters that are subject to optimization. The range of optimization can be set as absolute value or relative range to the initial value.

Reconfiguration cost: the total reconfiguration cost will appear in the ACP report.

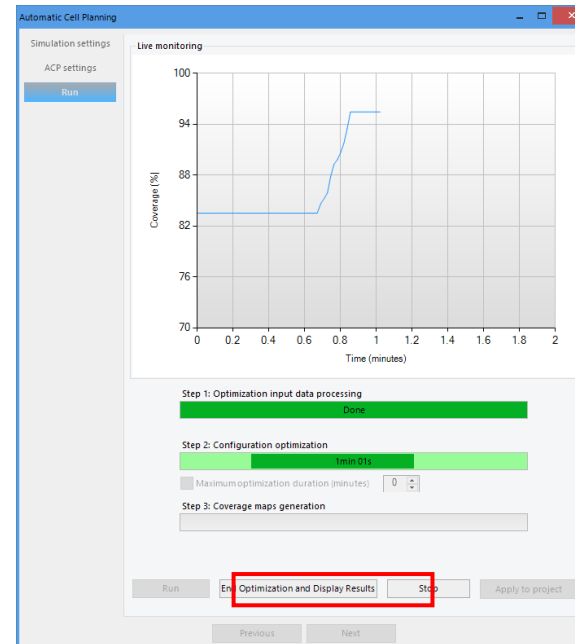
Automatic Cell Planning Workflow



During the Run phase, live monitoring is shown to actively track the optimization process. This allows users to be informed of the current status and make decisions about when to halt the optimization, particularly as the results begin to converge.

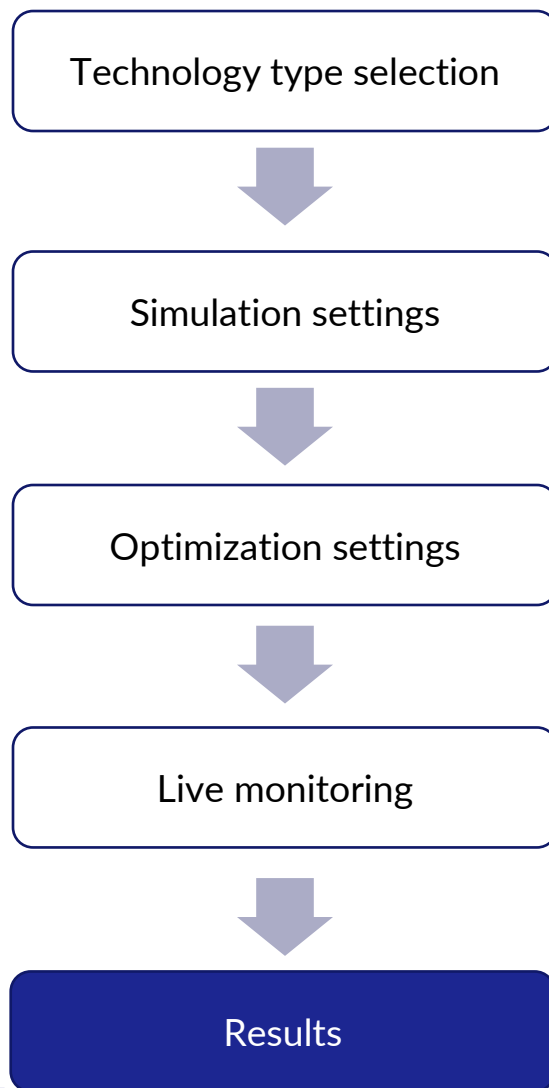
There are 3 triggers to stop the optimization process and show the results:

- 1, **End Optimization and Display Results** button is pressed by the user: this button can be used by users to end the optimization process if they believe the result is satisfactory.
- 2, **Maximum optimization duration** is reached: this setting allows users to specify a limit for the optimization duration. In networks with a large number of cells and several configuration parameters (Degrees of freedom), the number of possible combinations can be vast. As a result, the optimization could continue for an extended period, often yielding marginal improvements after a certain threshold. By setting the Maximum optimization duration, users can ensure they achieve an optimal configuration within a desired timeframe.
- 3, The objective that was set in the previous step has been achieved.

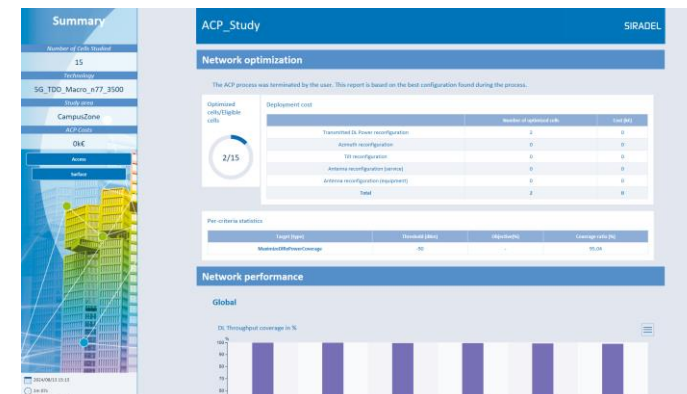
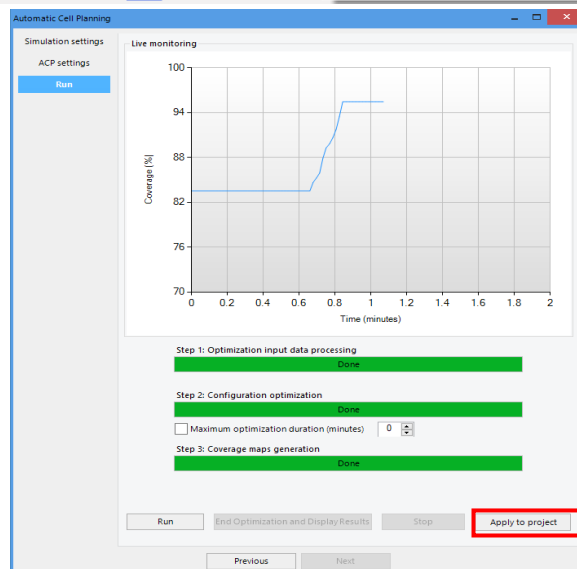
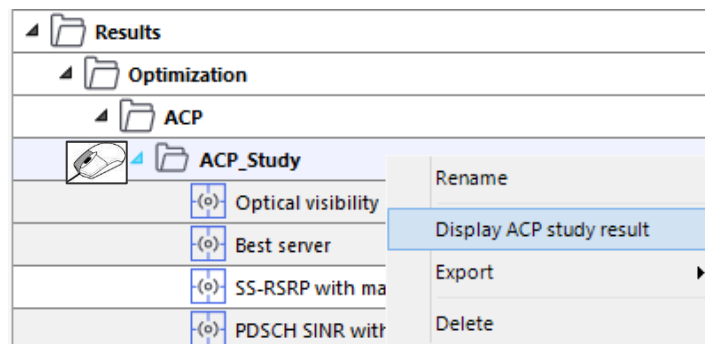


The screenshot shows the configuration settings form for the Automatic Cell Planning software. It includes three steps: Step 1: Optimization input data processing, Step 2: Configuration optimization, and Step 3: Coverage maps generation. The 'Maximum optimization duration (minutes)' field is highlighted with a red box, showing a value of 60 minutes.

Automatic Cell Planning Workflow



Upon completion of the ACP process, an ACP report will be generated, summarizing the results. Users may then click the **Apply to Project** button to implement the suggested configuration within the project.



Cell name	Height (m)	Transmitted DL Power (dBm)		Azimuth (deg)		DownTilt (deg)	
		Before	After	Before	After	Before	After
Site_44_3	25	17.39	17.39	245	245	0	0
Site_44_2	25	27.39	27.39	120	120	0	0
Site_44_1	25	17.39	17.39	5	5	0	0
Site_43_3	25	17.39	17.39	240	240	0	0
Site_43_2	25	17.39	17.39	126	126	2	2
Site_43_1	25	27.39	27.39	0	0	5	5
Site_39_3	25	27.39	27.39	240	240	0	0
Site_39_2	25	17.39	17.39	115	115	0	0
Site_39_1	25	17.39	17.39	0	0	5	5
Site_38_3	25	27.39	27.39	235	235	0	0
Site_38_2	25	27.39	27.39	125	125	5	5
Site_38_1	25	27.39	27.39	0	0	0	0
Site_33_3	25	17.39	17.39	245	245	0	0
Site_33_2	25	27.39	27.39	125	125	0	0
Site_33_1	25	17.39	17.39	5	5	0	0

Only Cells eligible for optimization are listed in this table. Reconfigured parameters are marked in red.

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- Annex – additional information

Access Auto Assignment

The Access Auto Assignment aims at automatically assigning UEs (or CPE : Customer Premises Equipment) to Cells. The feature simplifies the process of assigning Cells and UEs for users designing a Fixed Wireless Access network.

Access Auto Assignment

Start Access Auto Assignment



General settings



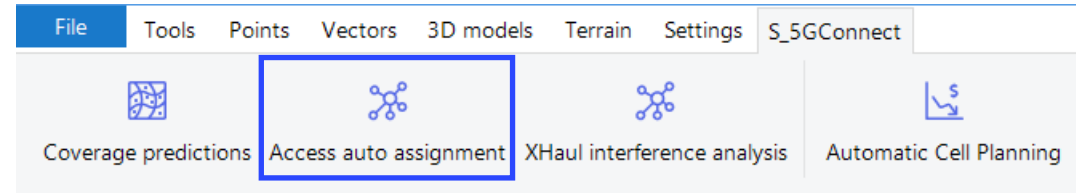
Manually adjust study configuration (optional)



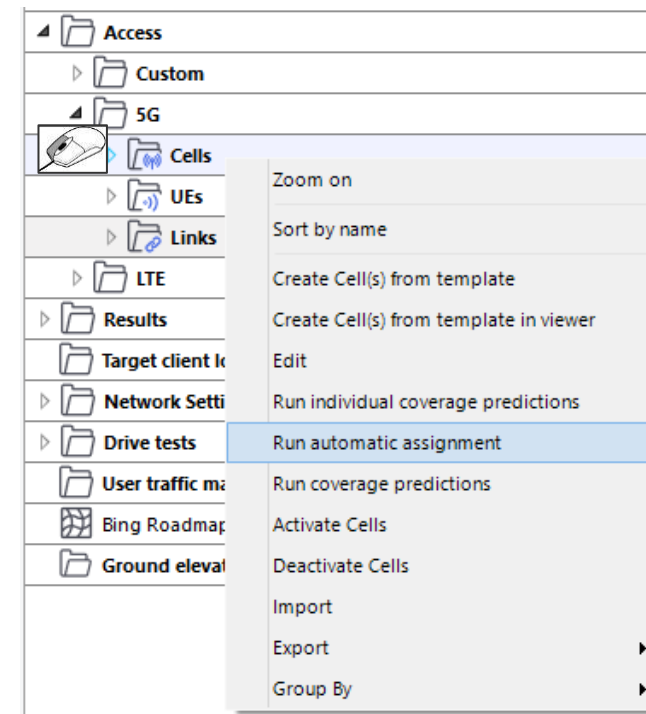
Run



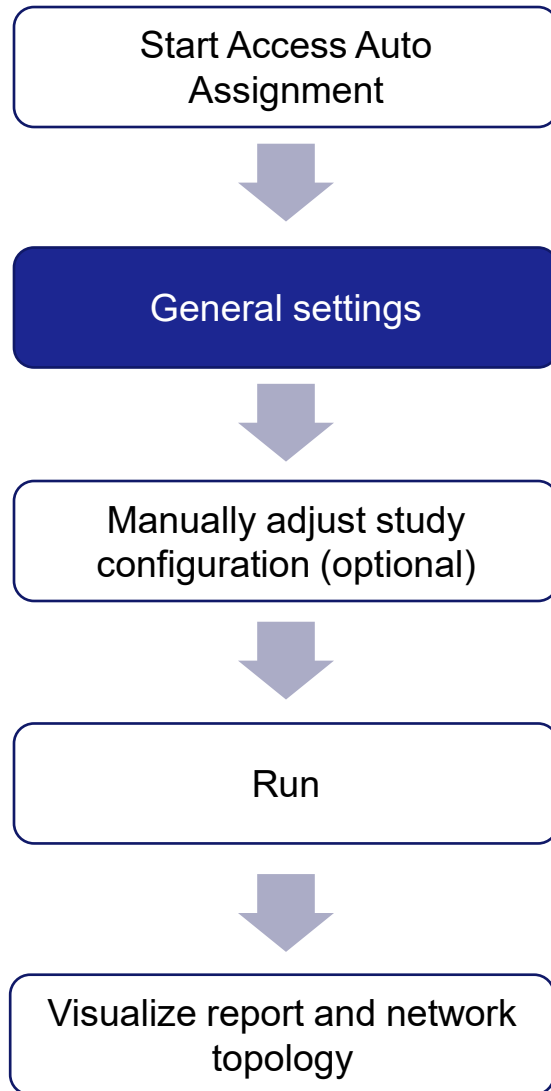
Visualize report and network topology



Or



Access Auto Assignment



The screenshot shows the 'Design Criteria' dialog box. It has a 'General settings' section at the top with fields for 'Study name' (Analysis), 'Study area' (No study area), 'Design criteria' (with an 'Edit' button), and 'Remote assignment' (with 'Auto' and 'Remote settings' buttons). Below this is the 'Design Criteria' section, which includes 'Network Settings' and 'Design targets'. 'Network Settings' has checkboxes for 'Force automatic orientation for all Cells', 'Maximum number of UEs assigned per Cell', 'Maximum Cell attachment range (m)', 'Maximum Cell aggregated throughput demand (Mbps)', 'UE throughput demand (Mbps)', and 'Deactivate deterministic interferences simulation'. 'Design targets' has checkboxes for 'Cell/UE LOS visibility only' and 'Minimum link throughput DL & UL (Mbps)'. The dialog also has 'OK' and 'Cancel' buttons at the bottom. Blue arrows point from the 'Auto' button in the 'General settings' section to the 'Design Criteria' dialog box and from the 'Remote settings' button to the 'UE Settings' list.

General settings

Study name: Analysis Design criteria: Edit

Study area: No study area Remote assignment: Auto Remote settings

Design Criteria

Network Settings

- ☐ Force automatic orientation for all Cells Azimuth and mechanical
- ☐ Maximum number of UEs assigned per Cell 1
- ☐ Maximum Cell attachment range (m) 2000.00
- ☐ Maximum Cell aggregated throughput demand (Mbps) 100.00
- ☐ UE throughput demand (Mbps) 20.00
- ☐ Deactivate deterministic interferences simulation

Design targets

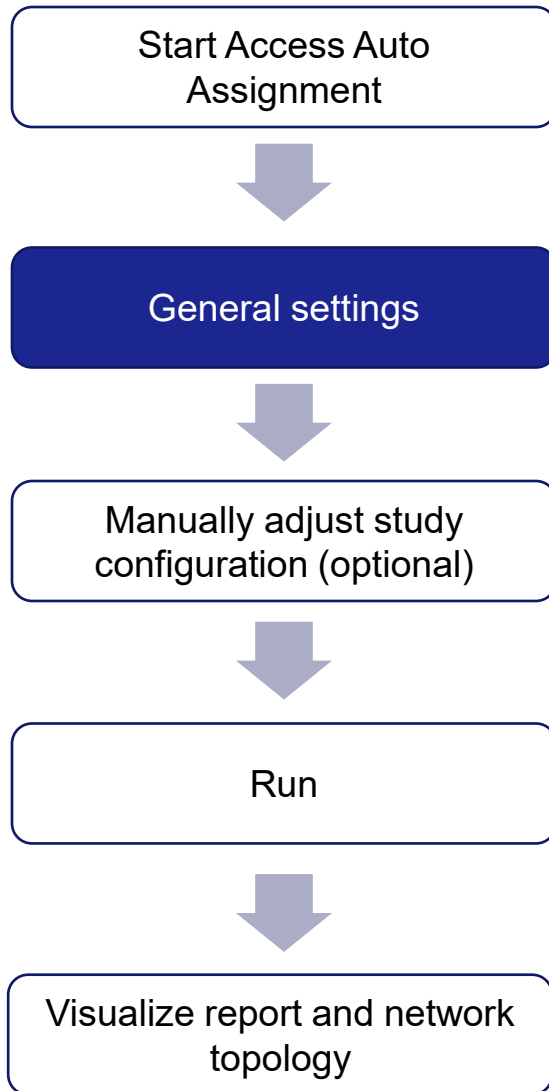
- ☐ Cell/UE LOS visibility only
- ☐ Minimum link throughput DL & UL (Mbps) 0.00

OK Cancel

- Auto: All UEs in the list are eligible for assignment.
- UE Settings: UEs that are already assigned to Cells will be excluded from the AAA simulation.

Design Criteria enables to easily overwrite network settings for quick evaluation of different deployment scenarios.

Access Auto Assignment



The screenshot shows the 'Cells loading' and 'UEs loading' sections of the software interface. In the 'Cells loading' section, the 'From Project' radio button is selected, and the 'Cell template' dropdown is set to 'Cell_template_3.5GHz_Channel_1'. In the 'UEs loading' section, the 'From target client locations' radio button is selected, and the 'UE template' dropdown is set to 'UE template_3.5GHz'. A text input field below the 'UEs loading' section contains 'TCL list.csv'.

- Cells loading:
 - **From Project:** the active cells of the corresponding technology in the project will be considered for the AAA simulation.
 - **From Cell list:** users need to select a csv format file which contains the available Cells for the AAA simulation.
- UEs loading:
 - **From Project:** the active UEs of the corresponding technology in the project will be considered for the AAA simulation.
 - **From UE list:** users need to select a csv format file which contains the UEs for the AAA simulation. If a study area is selected, only the UEs within the study area will be considered.
 - **From target client locations:** the dropdown list include all target client location lists imported under Target client locations in the Scene manager. The target client location file includes at least 4 columns: Name;X;Y;Height

Access Auto Assignment

Start Access Auto Assignment

General settings

Manually adjust study configuration (optional)

Run

Visualize report and network topology

List of Cells to be considered in the study as potential donors

Links study		Site; Height(m); Antenna; Orientation("); Demand(Mbps); EIRP(dBm)	Orientation	Discarded
Cell_template_3.5GHz_Channel_1_1	Site_14; 25.00; 3GHz_Compact_R0; Az. 0 Tilt 0; -; 49.70		Orientation	X
Cell_template_3.5GHz_Channel_1_2	Site_14; 25.00; 3GHz_Compact_R0; Az. 120 Tilt 0; -; 49.70		Orientation	X
Cell_template_3.5GHz_Channel_1_3	Site_14; 25.00; 3GHz_Compact_R0; Az. 240 Tilt 0; -; 49.70		Orientation	X
SFO-00471_1	SFO-00471; 29.27; 3GHz_Compact_R0; Az. 0 Tilt 0; -; 49.70		Orientation	X

Unassigned UEs		Site; Height(m); Antenna; Orientation("); Demand(Mbps); EIRP(dBm)	Orientation	Discarded
UE template_3.5GHz_1	Site_16; 2.00; S_Backhaul_UE; Auto; 10.00; 28.00			X
UE template_3.5GHz_10	Site_13; 2.00; S_Backhaul_UE; Auto; 10.00; 28.00			X

Computation progress: Not Started

☒ Import per-UE performance in 3D scene

Simulation output for display: DL Rx power (dBm)

Buttons: Reset, Stop, Run, Apply to project

Force manually the attachment of some UEs to specific Cells

Import per-UE performance in 3D scene:
When this option is enabled, a 3D point layer representing the selected simulation output per point will be generated and displayed in the Scene window. The 3D display of the point layer requires that height information is included in the target client location file.

List of UEs to be assigned to the potential donors (Cells)
(The UE list is visible if **From target client locations** option is selected for Ues loading.)

Access Auto Assignment

Start Access Auto Assignment



General settings



Manually adjust study configuration (optional)



Run



Visualize report and network topology

Click the **Run** button to launch the AAA simulation.

Automatic assignment

General settings

Study name: Analysis Design criteria: Edit

Study area: No study area Remote assignment: Auto Remote settings

Study definition

Study configuration

Links study	Site: Height(m); Control Antenna; Max Throughput (Mbps) ; Demand(Mbps)		
Site_Candidate_5_1	Site_Candidate_5; 18.95; SSB 3.5GHz; -;	Orientat...	✗
Site_Candidate_5_2	Site_Candidate_5; 18.95; SSB 3.5GHz; -;	Orientat...	✗
Site_Candidate_5_3	Site_Candidate_5; 18.95; SSB 3.5GHz; -;	Orientat...	✗
Site_Candidate_6_1	Site_Candidate_6; 12.27; SSB 3.5GHz; -;	Orientat...	✗
Site_Candidate_6_2	Site_Candidate_6; 12.27; SSB 3.5GHz; -;	Orientat...	✗
Site_Candidate_6_3	Site_Candidate_6; 12.27; SSB 3.5GHz; -;	Orientat...	✗
Site_Candidate_8_3	Site_Candidate_8; 61.86; SSB 3.5GHz; -;	Orientat...	✗
Site_Candidate_8_2	Site_Candidate_8; 61.86; SSB 3.5GHz; -;	Orientat...	✗
Site_Candidate_8_1	Site_Candidate_8; 61.86; SSB 3.5GHz; -;	Orientat...	✗

Unassigned UEs

	Site; Height(m); Control Antenna; -; Demand(Mbps)		
House10	House_10; 8.88; Isotropic; -; 100.00	↑	✗
House104	House_104; 15.27; Isotropic; -; 20.00	↑	✗
House114	House_114; 15.06; Isotropic; -; 20.00	↑	✗
House13	House_13; 16.12; Isotropic; -; 100.00	↑	✗
House153	House_153; 9.90; Isotropic; -; 20.00	↑	✗
House168	House_168; 7.82; Isotropic; -; 20.00	↑	✗
House179	House_179; 12.06; Isotropic; -; 20.00	↑	✗

Discarded Hubs

...

Discarded Remotes

...

Computation progress

Running (24%)

Close Run Stop Reset Apply to project

The « **Apply to project** » button will be available after the computation. Clicking on it will enable the automatic generation of the assignment links in the report.

Access Auto Assignment

Start Access Auto Assignment



General settings



Manually adjust study configuration (optional)

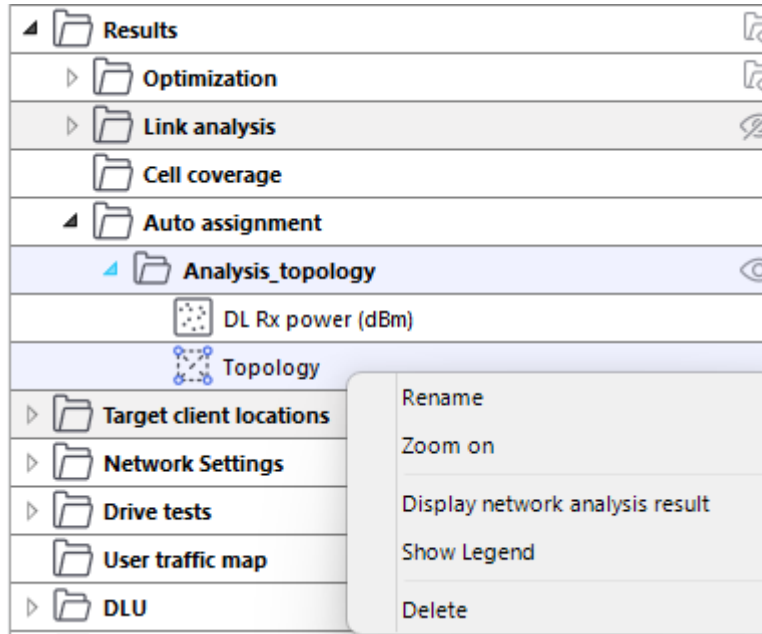


Run



Visualize report and network topology

Right-click the **Topology** layer under the AAA result folder to display the AAA report.



If **Import per-UE performance in 3D scene** option on the Automatic assignment GUI is selected, a point layer will be also generated under the AAA result folder with the simulation output as the layer name (e.g. DL Rx power with margins (dBm)).

Access Auto Assignment

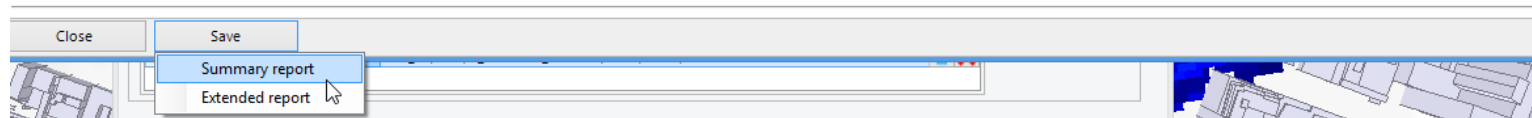
Two reports are available :

Summary report (HTML): The report provides the optimal network configuration connecting each UE to Cells and respecting the constraints set by the user

Extended report : The extended report provides the complete list of Cells that can possibly connect to each UE, available in two formats: CSV and Excel formats. The extended report menu will not be accessible if the **Maximum number of attached UEs option** is deactivated (not checked) for all Cells.

Per-Remote Performance

Remote	Hub	LOS/NLOS	Distance (m)	DL SINR (dB)	UL SINR (dB)	DL Throughput (Mbps)	UL Throughput (Mbps)	Hi-Res GIS	Azimuth (deg)	Downtilt (deg)
5GHz Remote_1	5GHz Hub_1	NLOS	36.82	32.63	32.63	104	104	True	14.42	-7.12
5GHz Remote_2	5GHz Hub_4	LOS	194.68	19.42	19.42	96	96	True	36.24	-4.87
5GHz Remote_3	5GHz Hub	NLOS	219.6	3.43	3.43	22	22	True	170.45	-44.87
5GHz Remote_4	5GHz Hub_2	NLOS	126.29	4.94	4.94	22	22	True	101.86	-14.38
5GHz Remote_5	5GHz Hub_3	NLOS	108.45	15.43	15.43	72	72	True	269.49	-5.17



Information about best server ranking is available if Cell orientation is fixed and interferences inactive

Extended report

Remote	Hub	Distance	Optical vis	DL SINR (dB)	UL SINR (dB)	DL Throughput (Mbps)	UL Throughput (Mbps)	DL Rx Power (dBm)	UL Rx Power (dBm)	3D GIS	Remote A	Remote D	Hub Az (deg)	Hub Downtilt (deg)	Direct Path (dBm)	Direct Path (dBm)	Algorithm	Server ranking
UE_1	Hubs_33_0	837.4081	NLOS Veg	4.848767	37.62877	55.47675	0.059991	-122.128	-86.3475	LR	336.564	-2.403	0	0	156.564	-2.403	1	4
UE_1	Hubs_33_120	837.4081	NLOS Veg	26.03142	58.81142	299.9535	0.059991	-100.945	-65.1649	LR	336.564	-2.403	0	0	156.564	-2.403	0	1
UE_1	Hubs_33_240	837.4081	NLOS Veg	6.317235	39.09724	71.613	0.059991	-120.659	-84.8791	LR	336.564	-2.403	0	0	156.564	-2.403	0	3
UE_1	Hubs_46_120	1346.295	NLOS Veg	18.31799	51.09799	194.9063	0.059991	-108.658	-72.8783	LR	336.564	-2.403	0	0	79.063	-1.495	0	2

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Link Analysis Workflow

Select Cell



Select UEs to be simulated



Define Cell antenna
orientation strategy

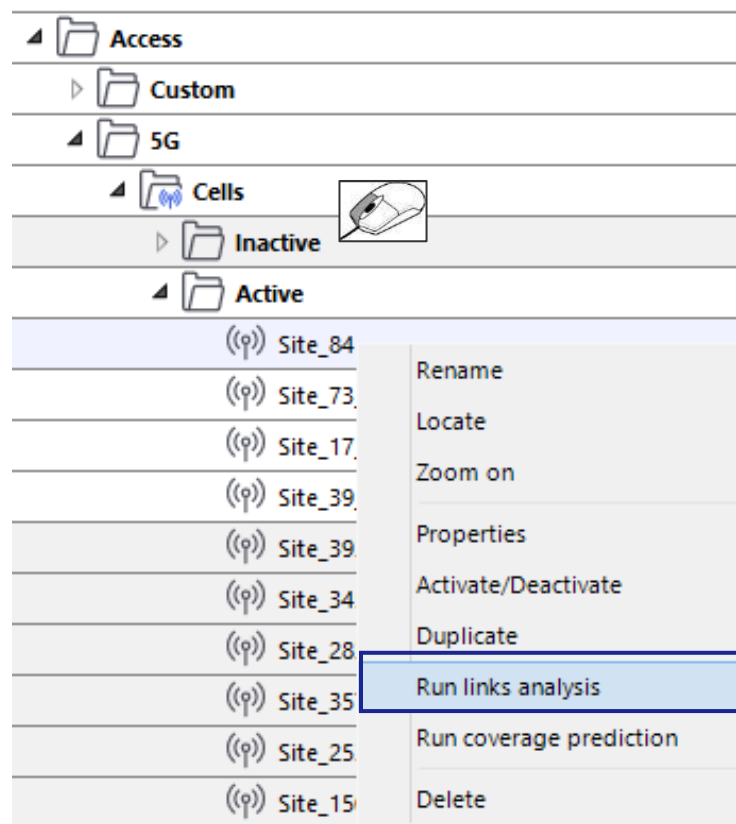


Run simulations and analyze
results

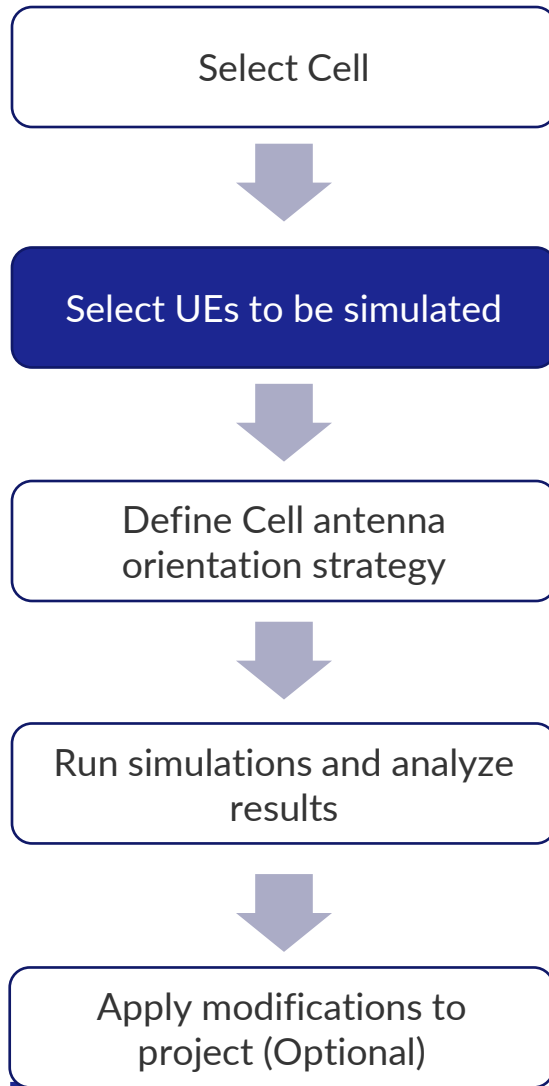


Apply modifications to
project (Optional)

Link analysis simulation refers to **Point-to-Point** or **Point-to-Multiple Points** simulations. Right-click a Cell and select the **Run links analysis** action to launch the link analysis simulation.



Link Analysis Workflow



Filter UE list based on azimuth range criteria

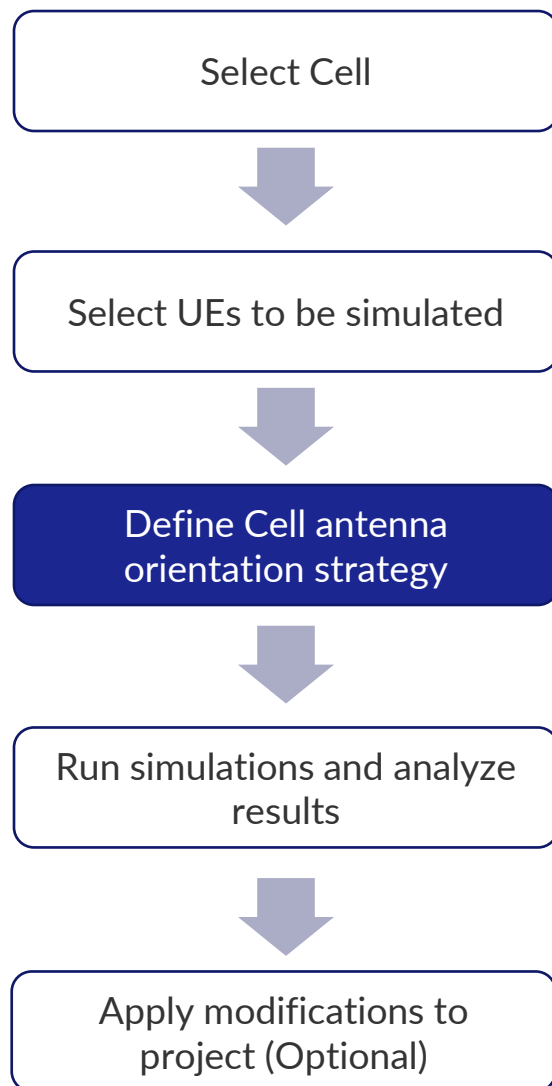
The screenshot shows the 'Links analysis' software interface. The 'Study settings' tab is active, showing the study name 'Site_84 links study'. Under 'UEs selection', the option 'UEs attached to this cell' is selected. The 'UEs filter' section shows a checkbox for 'UEs in the cell azimuth range (°)' which is checked, with a range of ± 180. Below this is a table of 'Active UEs' with columns for UE name and site details. The table lists several UEs (House1, House10, House100, House101, House102, House103, House104) and their corresponding site information. At the bottom of the table, there are up and down arrow buttons for selecting UEs. Below the table is the 'Study configuration' section, which shows the 'Links study' configuration for 'Site_84'. The 'Computation progress' bar at the bottom indicates 'Not Started'.

UE	Site; Height(m); Control Antenna; ; Demand(Mbps)
House1	House_1; 15.57; Isotropic; -; 100.00
House10	House_10; 8.88; Isotropic; -; 100.00
House100	House_100; 12.97; Isotropic; -; 20.00
House101	House_101; 13.05; Isotropic; -; 20.00
House102	House_102; 10.46; Isotropic; -; 20.00
House103	House_103; 10.50; Isotropic; -; 20.00
House104	House_104; 15.27; Isotropic; -; 20.00

Links study	Site; Height(m); Control Antenna; Max Throughput (Mbps) ; Demand(Mbps)	Orientation
Site_84	Site_84; 61.77; Dir_H65_V6_tilt4_PoIV_20dBi; -	

- Up\Down arrows to select UEs to be simulated
- Select one UE for Point-to-Point or several UEs for Point-to-MultiPoint simulations

Link Analysis Workflow



Study configuration				
	Links study	Site; Height(m); Control Antenna; Max Throughput (Mbps) ; Demand(Mbps)		
▶ Site_84		Site_84; 61.77; Dir_H65_V6_tilt4_PoIV_20dBi; -; -		Orientation

The Cell configuration dialog box shows the following settings:

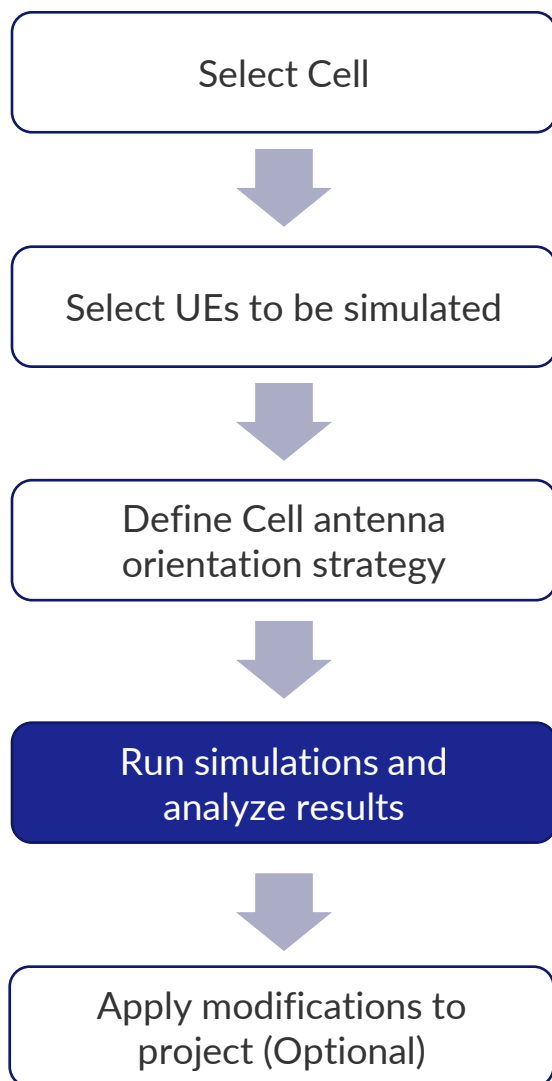
- Cell Orientation: ☒ Fixed
- Azimuth (°): 0.00
- Mechanical Downtilt (°): 0.00
- ☐ Automatically adjusted by prediction
- Azimuth and mechanical downtilt: [Dropdown menu]
- Buttons: OK, Cancel

4 modes*

- Fixed (Consider Azimuth\Tilt defined in the project)
- Automatic Azimuth orientation
- Automatic Mechanical tilt orientation
- Automatic Azimuth\Tilt orientation

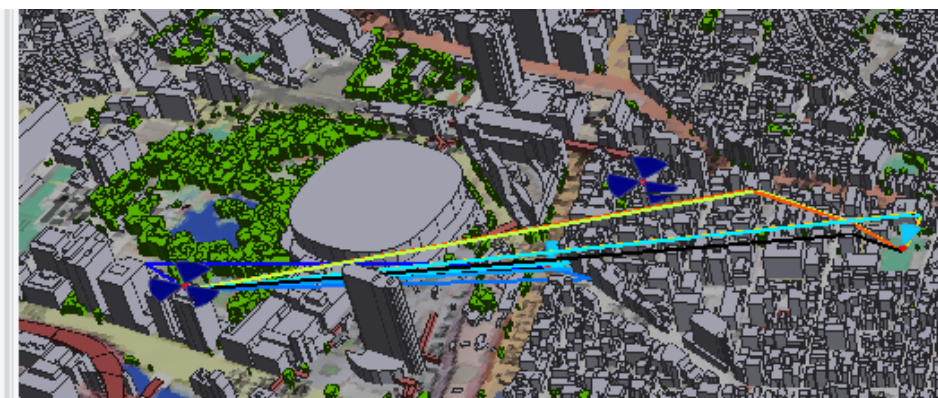
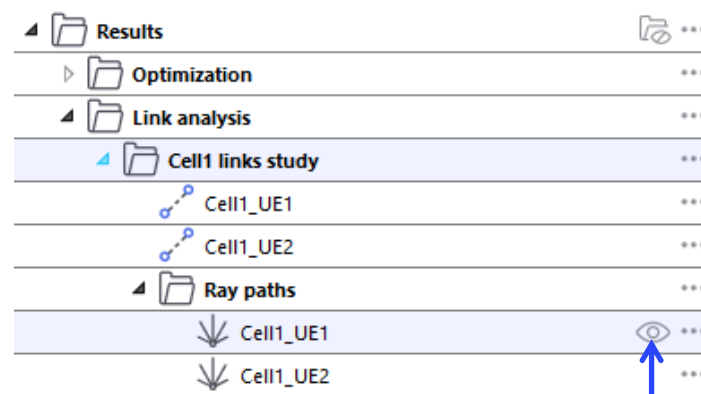
Important: This step is only relevant for backhaul design and is supported exclusively with **Custom** technology type.

Link Analysis Workflow



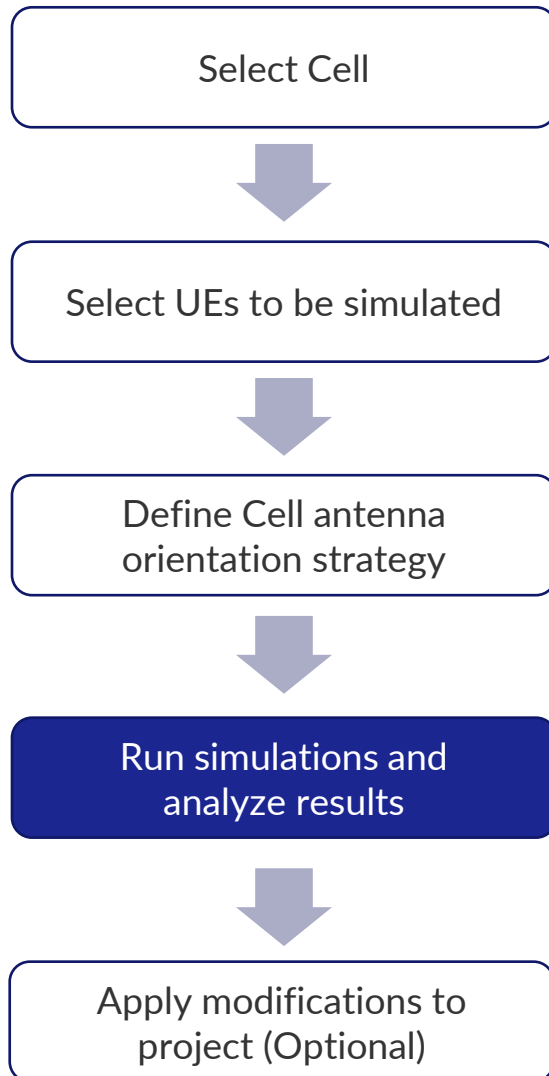
After running the simulation, a link analysis result section is created under **Results - Link analysis - Link study name** in the **Scene manger**, providing :

- a P2P simulation result per link, and
- a **Ray paths** sub-section, with detailed ray tracing visualization, which is only relevant when there are vector map data layers in the project. By default, the Ray paths sub-section is hidden, click on the Eye icon to display the ray paths.



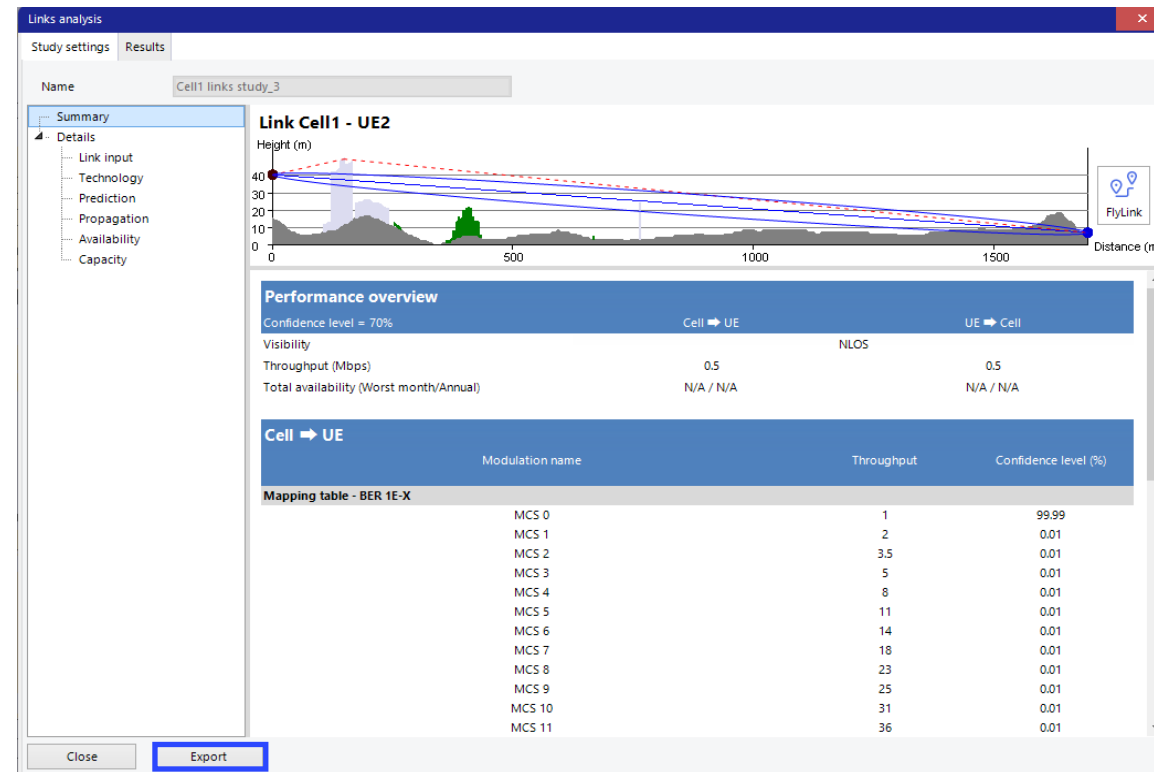
Ray-paths visualization

Link Analysis Workflow – Point-to-Point (P2P) report



After running the simulation, a **Results** tab appears. For **P2P** simulation, the report is divided into two sections :

- Summary: provides a vertical profile of the P2P link, an overall performance overview, and a mapping of modulation schemes to throughput and confidence levels.
- Details: presents comprehensive information on inputs, propagation characteristics, availability, and capacity.



XLS Export

Link Analysis Workflow – Point-to-MultiPoint (P2MP) report

Select Cell



Select UEs to be simulated



Define Cell antenna orientation strategy



Run simulations and analyze results

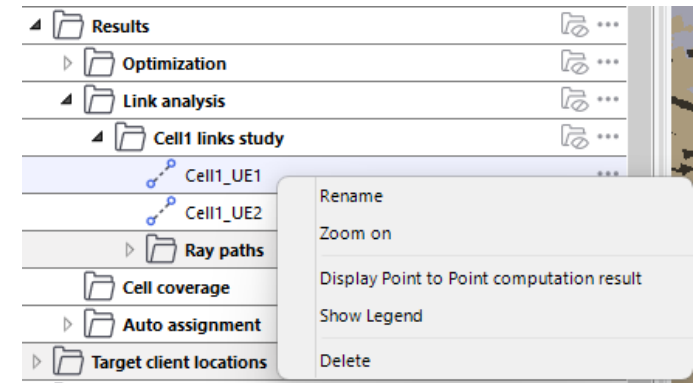


Apply modifications to project (Optional)

After running the simulation, a **Results** tab appears. For **P2MP** simulation, the report includes the Summary sections providing the Cell settings and Link performance information.

Links analysis			
Study settings			
Name: Cell1 links study_1			
Links summary			
Links analysis			
Cell settings			
Technology	Technology_3.5GHz		
Cell	Cell1		
Total requested throughput (Mbps)	20		
Cell traffic load (%)	5333.33		
Link performance			
	Cell → UE	UE → Cell	
UE2			
Visibility	NLOS		
Throughput (Mbps)	0.5	0.5	
UE1			
Visibility	NLOS		
Throughput (Mbps)	0.5	0.5	

To view the detailed report of each P2P link, right-click the P2P link under **Results - Link analysis - Link study name** in the **Scene manger** and select **Display Point to Point computation result** action.



Link Analysis Workflow

Select Cell



Select UEs to be simulated



Define Cell antenna orientation strategy



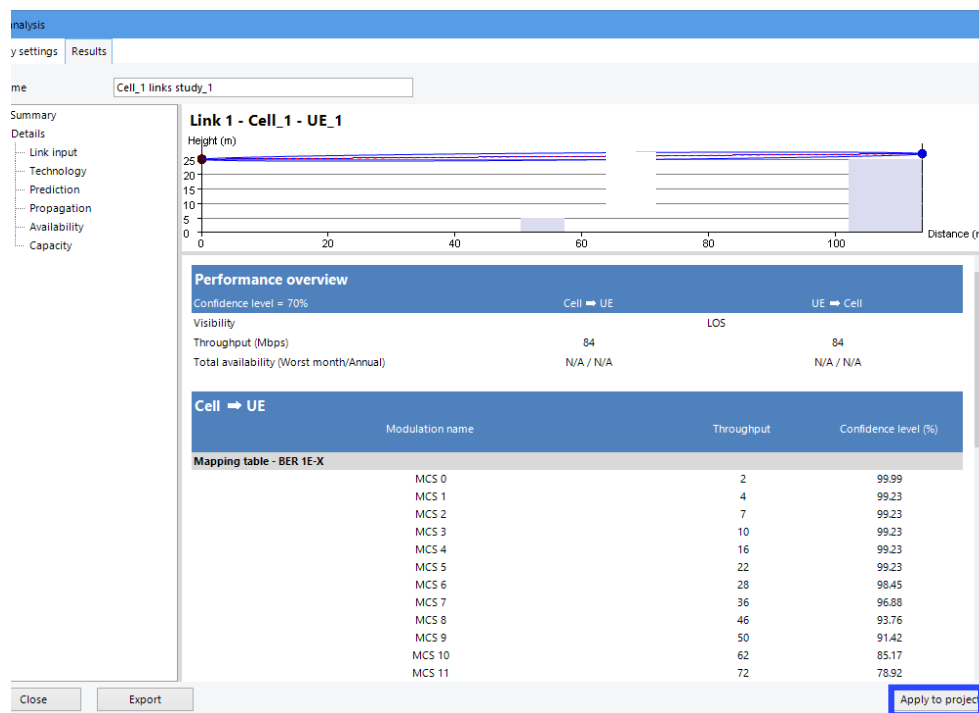
Run simulations and analyze results



Apply modifications to project (Optional)

For **Customer technology type**, users have the option to apply modifications to project so that parameters automatically set during the predictions are set in the project properties:

- Cell azimuth
- Cell mechanical Tilt
- Cell assignment list for link creation



Cells assignments

☒ Cells orientation ☒ Set Cells orientation mode to fixed ☒ Network element creation

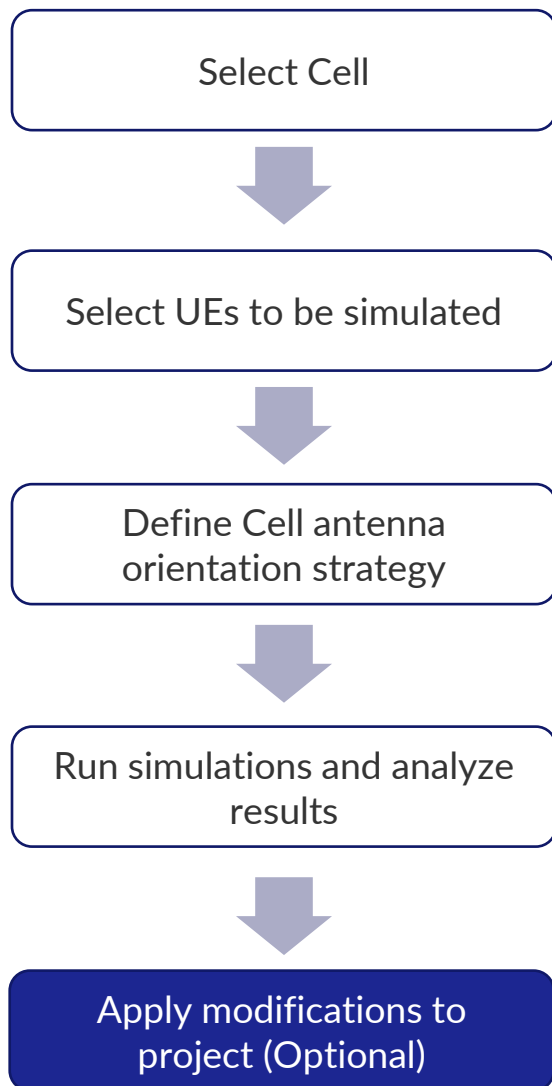
Cell_2

Azimuth 0°-> 198°

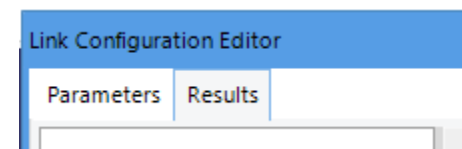
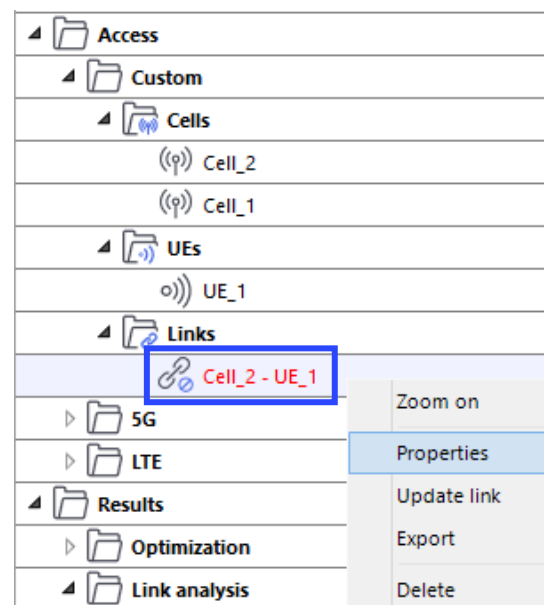
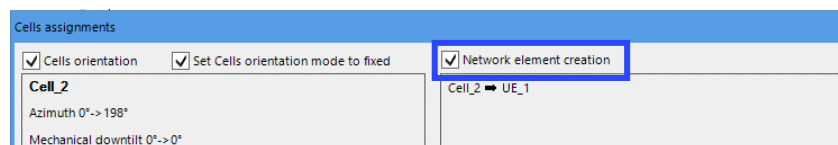
Mechanical downtilt 0°-> 0°

Cell_2 → UE_1

Link Analysis Workflow



If a link is created when applying the modifications, then link results are also available under **Access – Custom/5G/LTE – Links** in the **Scene manger**



Detailed Link report

The link report provides a detailed description of the link performance.

Link input section summarizes computation input data.

Link		
	Cell	UE
Longitude (°)	139.74510613	139.74457648
Latitude (°)	35.65961432	35.65781015
Height above ground (m)	25.07	26.91
Radio equipment	BaseStation_5GHz_Access	UE_5GHz_Access
Antenna	S_Backhaul_Hub	S_Backhaul_Remote
Antenna gain (dBi)	12	8
Cable loss (dB)	0	0
Connector loss (dB)	0	0
Orientation	Az. And Tilt set by prediction	Automatically adjusted
Azimuth (°)	198	14.2
Mechanical downtilt (°)	0	0
Transmitter		
Number of active antenna ports	2	2
Total transmit power (dBm)	20	20
EIRP (dBm)	32	28
Receiver		
Number of active antenna ports	2	2
Noise figure (dB)	4	4
Point to Point equipment settings		
Channel Bandwidth (MHz)	20	
Channel	1	
Central Frequency (MHz)	5810	5790
Polarization	Vertical	

Capacity		
	Cell → UE	UE → Cell
Inputs		
Number of Tx antennas	2	2
Number of Rx antennas	2	2
Intra-system interference	Disabled	Disabled
Average background interference (dBm)	Disabled	Disabled
Results		
Rx power (dBm)	-61.39	-61.39
Rx power with margins (dBm)	-63.49	-63.49
Interference (dBm)	-	-
Mean SINR (dB)	38.58	38.58
SINR with margins (dB)	34.91	36.48
Transmission mode	Mapping table	Mapping table
MCS	MCS 14	MCS 14
Throughput (Mbps)	104	104

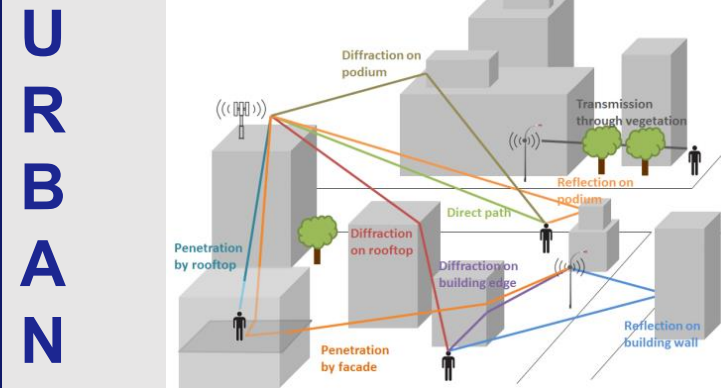
CONTENT

- Introduction
- Main menu overview
- Map data management
- Network settings wizard
- Network element creation
- Automatic cell selection
- Coverage prediction
- Automatic cell planning
- Access auto assignment
- Link analysis
- **Indoor/Hybrid scenarios**
- Annex – additional information

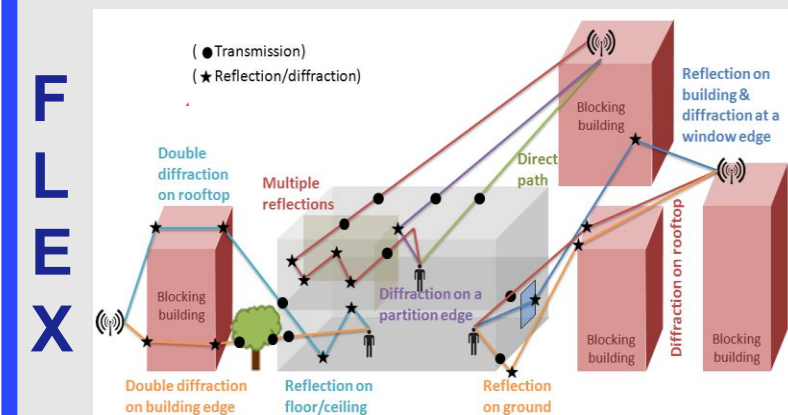
Volcano Urban & Flex

In Siradel Planner, two propagation models are available, each corresponding to specific data model formats :

- Volcano Urban : Designed for outdoor environments using LOD1 (Level of Detail 1) map data.
- Volcano Flex : Supports the **DXF** format data model, enabling the modeling of indoor environments with LOD4 map data, as well as hybrid configurations that combine LOD1 and LOD4.



- **Large-scale scenarios:** 3D propagation, Large multi-BS coverage maps
- **Environments:** Outdoor, Outdoor-to-Indoor (statistical)
- **Geo data:** 3D City (LOD1), LiDAR point cloud
- **Multi-paths:** Reflection, Diffraction, Scattering, Penetration Loss

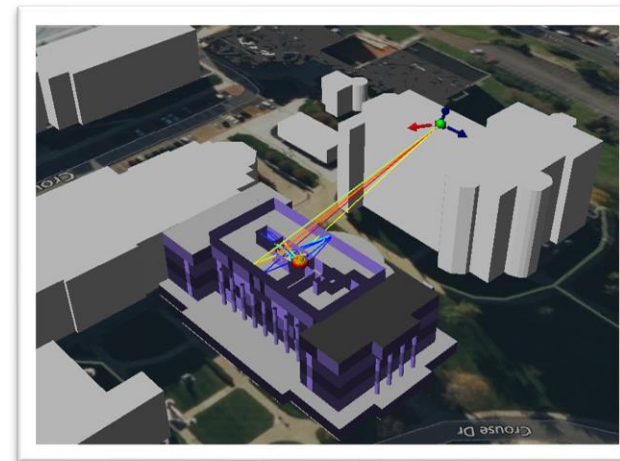
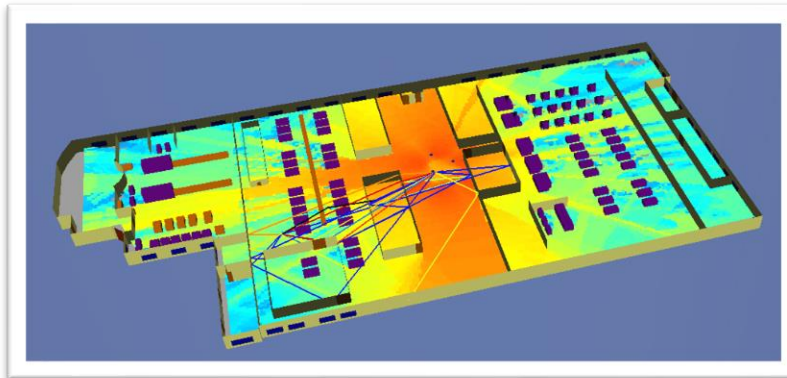


- **Small-scale scenarios:** 3D propagation, From indoor to small district areas
- **Environments:** Indoor, O2I , Outdoor
- **Geo data:** 3D building model in LOD4 (DXF format), possibly completed with 3D City LOD1
- **Multi-paths:** Reflection, Diffraction, Scattering, Penetration Loss

Volcano Flex – Geo Data Modeling

Volcano Flex supports two types of geographical data to address various propagation scenarios including outdoor, indoor and outdoor-indoor:

- Outdoor (LoD1 – Level of Detail 1): Buildings and vegetation could be represented in LOD1 data, i.e. described by their footprint and height. The top of LOD1 buildings and vegetation blocks is plane. This representation is regularly employed to model a group of buildings or a district.
 - Volcano Flex considers LOD1 buildings as opaque obstacles, without any possible transmission.
 - Transmission through LOD1 vegetation is permitted with a loss depending on the in-vegetation distance of propagation.
- Indoor (LoD4 – Level of Detail 4) Modelling of detailed building is obtained from a group of surfaces that describe walls, windows, doors, floors, etc. Some objects can also be represented, e.g. metallic armchairs, machines, when significant impact on propagation is expected.



Volcano Flex for Indoor or Hybrid Simulations

For Volcano Flex to operate, two file components are required :

1.DXF File – Represents the 3D geographical environment of the target area.

- To create a DXF 3D model, it is recommended to use third-party tools such as **Blender** – an open-source software for 3D modeling, animation, and rendering.
- Siradel provides a series of tutorials to help users create **Siradel Planner-compliant** 3D models using Blender.

2.DBM File – An XML file containing information about different layers, including materials, propagation types, and other parameters.

- The **DBM file** is generated using the Siradel tool **Building Creator**, which allows you to configure the necessary parameters and automatically create the file.
- Ensure that the DXF file path defined in the DBM XML file is expressed as a relative path, based on the location of the DBM XML file. This practice guarantees file portability and usability when the project is shared.

Importing into Siradel Planner:

The 3D model can be imported into Siradel Planner by either:

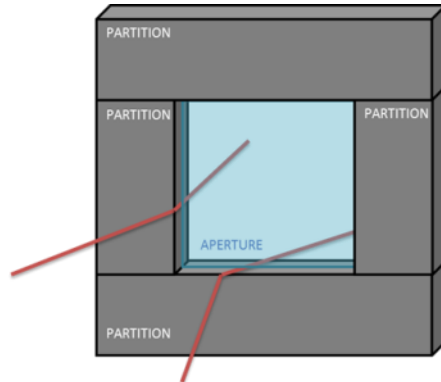
- Dragging and dropping the DXF file into the 3D scene, or
- Using the **File → Import** option from the menu to import the DXF file.

Volcano Flex – Multi path prediction

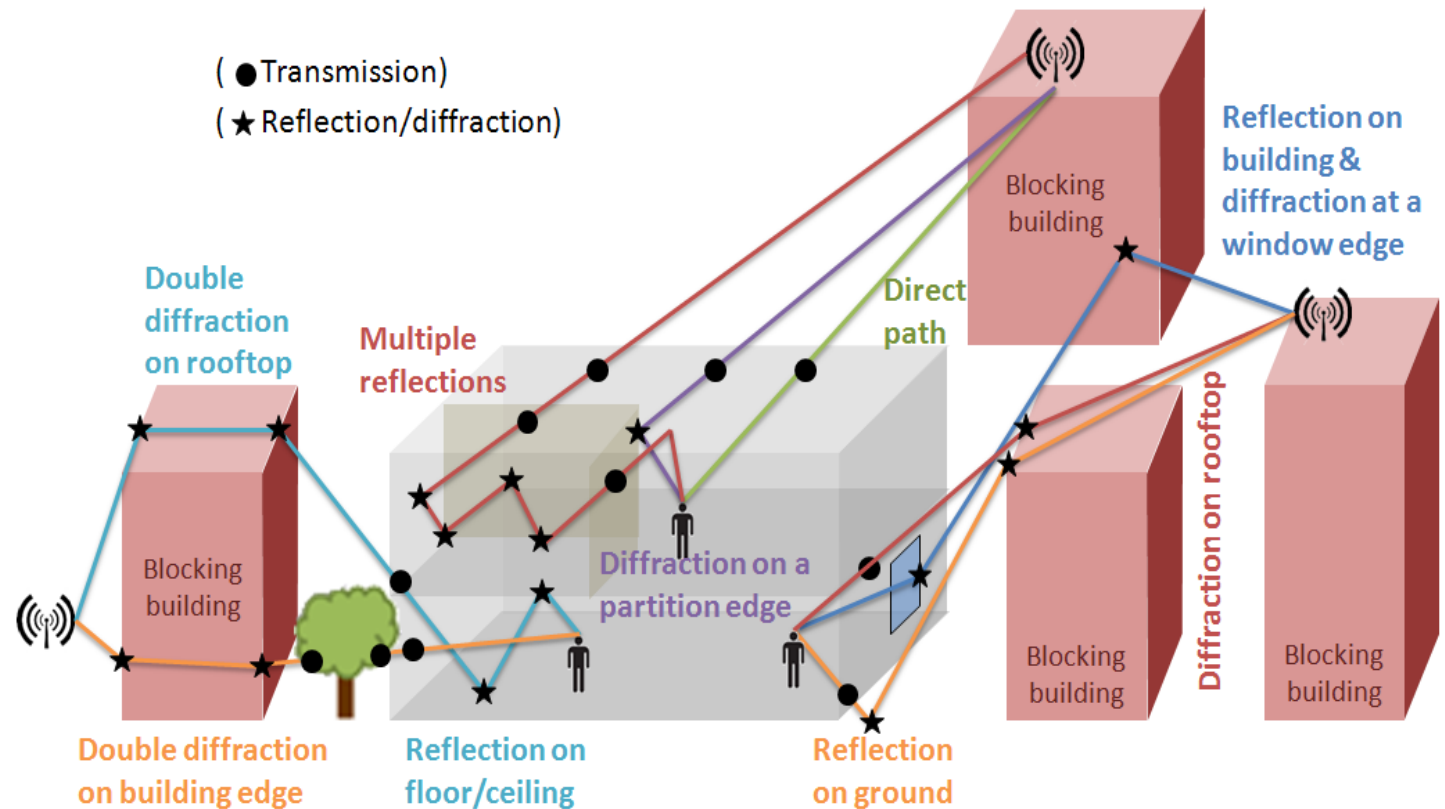
Volcano Flex can simulate in-building coverage with detailed map (CAD map)

- Reflections
- Diffractions
- Transmissions through walls and floors
- Transmissions through objects (e.g., tables)

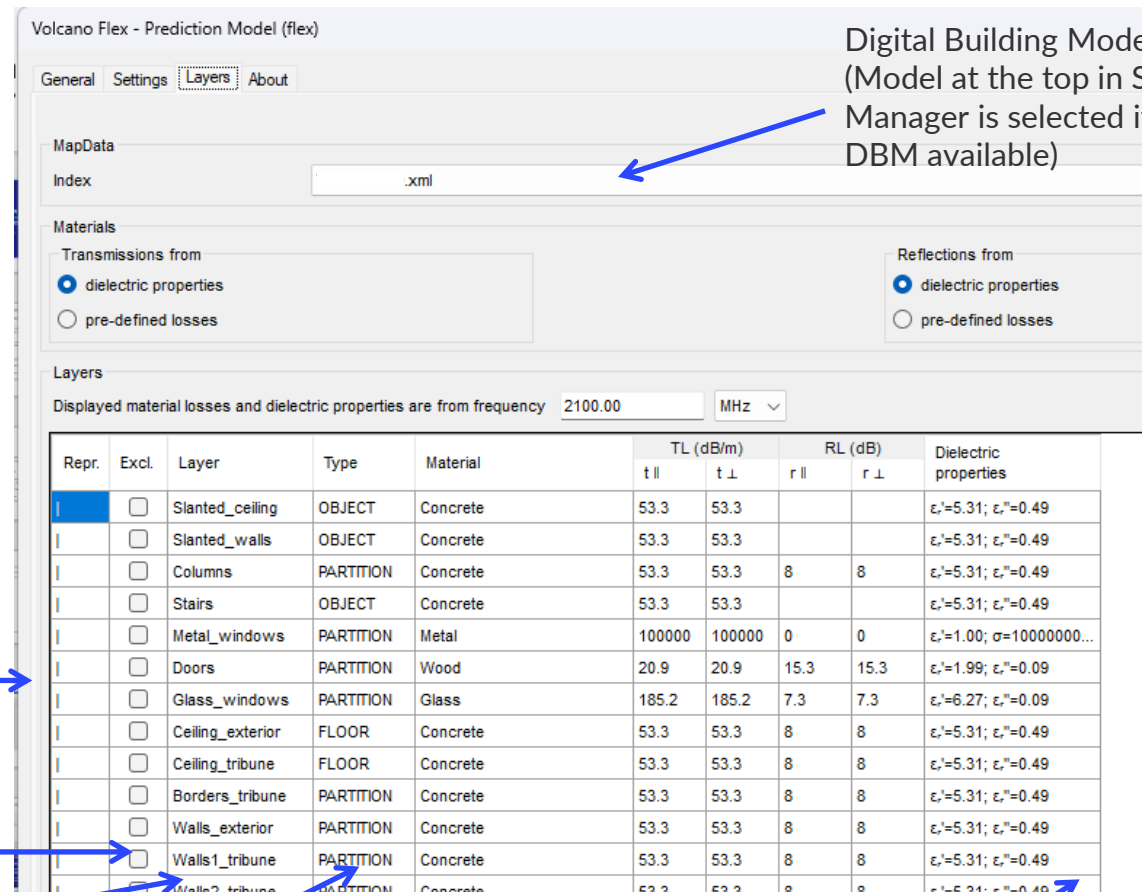
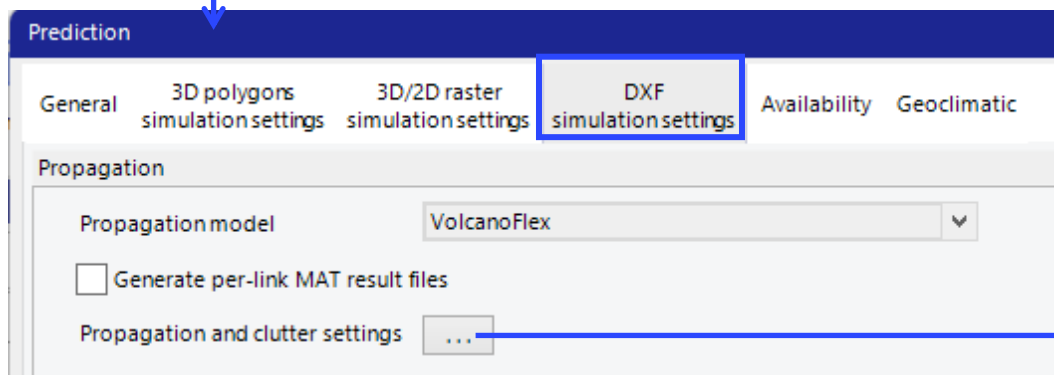
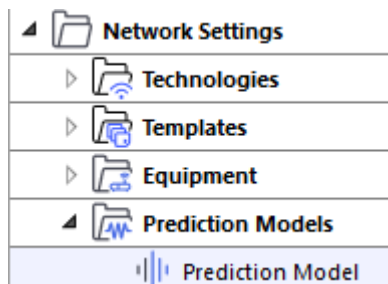
- *Diffraction at the window vertical and horizontal edges:
- Leading to fine simulation of the outdoor-indoor propagation mechanisms



Diffractions by window/wall edge



Volcano Flex - Layers settings



Layer Exclusion from prediction

3D model layers

Types:
See next page

Dielectric properties are selected according to material and frequency. Materials and properties can be edited at installation folder for desktop users (By default: C:\Program Files\Siradel\SmartCityExplorer\bin\plugins\S_5GConnect\data\core_data\building_materials.xml).

Volcano Flex - Layer Type Properties

Type / Category	Description	Geometry	Propagation
#BUILDING	LOD1 B-buildings (no indoor modeling)	Cuboid	Reflections, diffractions and diffuse scattering. No indoor penetration.
#GROUND	Outdoor ground floor	Horizontal or slightly slanted faces	Reflections and diffuse scattering
#FOLIAGE	Foliage	Cuboid	Transmission and diffraction on top/bottom.
#OBJECT	Any indoor and outdoor objects or transmission-only layers	Any geometry	Transmissions
#PARTITION	D-building indoor walls	Vertical faces	Reflections, diffractions, diffuse scattering and transmissions
#APERTURE	D-building windows and doors	Vertical faces	Reflections, diffuse scattering, diffraction on the aperture edges and transmissions
#FLOOR	D-building floors/ceilings	Horizontal or slightly slanted faces	Reflections, diffuse scattering and transmissions

If technically relevant, the layer type (Category) can be adjusted in the DBM XML file.

```

106 <layer>
107   <name>Ceiling_tribune</name>
108   <representation>face</representation>
109   <material>Concrete</material>
110   <category>FLOOR</category>
111   <width>0.100</width>
112 </layer>
113 <layer>
114   <name>Borders_tribune</name>
115   <representation>face</representation>
116   <material>Concrete</material>
117   <category>PARTITION</category>
118   <width>0.100</width>
119 </layer>
120 <layer>
121   <name>Walls_exterior</name>
122   <representation>face</representation>
123   <material>Concrete</material>
124   <category>PARTITION</category>
125   <width>0.100</width>
126 </layer>
127 <layer>
128   <name>Walls1_tribune</name>
129   <representation>face</representation>
130   <material>Concrete</material>
131   <category>PARTITION</category>
132   <width>0.100</width>
133 </layer>
134 <layer>
135   <name>Walls2_tribune</name>
136   <representation>face</representation>
137   <material>Concrete</material>
138   <category>PARTITION</category>
139   <width>0.100</width>
140 </layer>
141 <layer>
142   <name>Walls3_tribune</name>
143   <representation>face</representation>
144   <material>Concrete</material>
145   <category>PARTITION</category>
146   <width>0.100</width>
147 </layer>

```

Propagation Parameters Settings

The **Max. number of reflections** and **Max. number of diffractions** parameters set the maximum number of specular lateral interactions allowed along a ray-path.

Maximum number of reflections and diffractions are respectively 4 and 2. Diffraction above buildings can be activated independently.

Volcano Flex - Prediction Model (flex)

General Settings Layers About

Inside building interactions Restricted

Max. number of reflections 2

Max. number of diffractions 0

Diffraction above buildings ☐

Vertical-plane ray-tracing mode

☐ For all horizontal-plane paths

☐ For horizontal-plane direct and reflected paths

☒ For horizontal-plane direct path

Advanced

The **Inside building interactions** parameter allows to reduce calculation time by filtering some ray interactions.

This setting option only applies for outdoor base stations. It can be set to 'Restricted' or 'Full' :

- **Restricted** -> Some interactions are not considered in the calculation to drastically reduce the calculation time. This causes a slight loss of precision in received power results as only transmissions (+ diffractions on the edges of outside windows) are authorized inside the DXF building.
- **Full** -> No ray filtering

The **Vertical-plane ray-tracing mode** parameter offers a trade-off between computation time and prediction accuracy by limiting the combinations of interactions in the horizontal plane and interactions in the vertical plane.

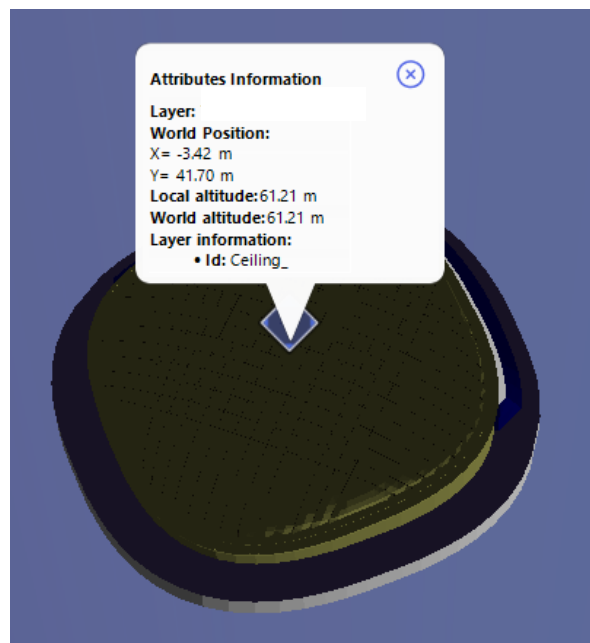
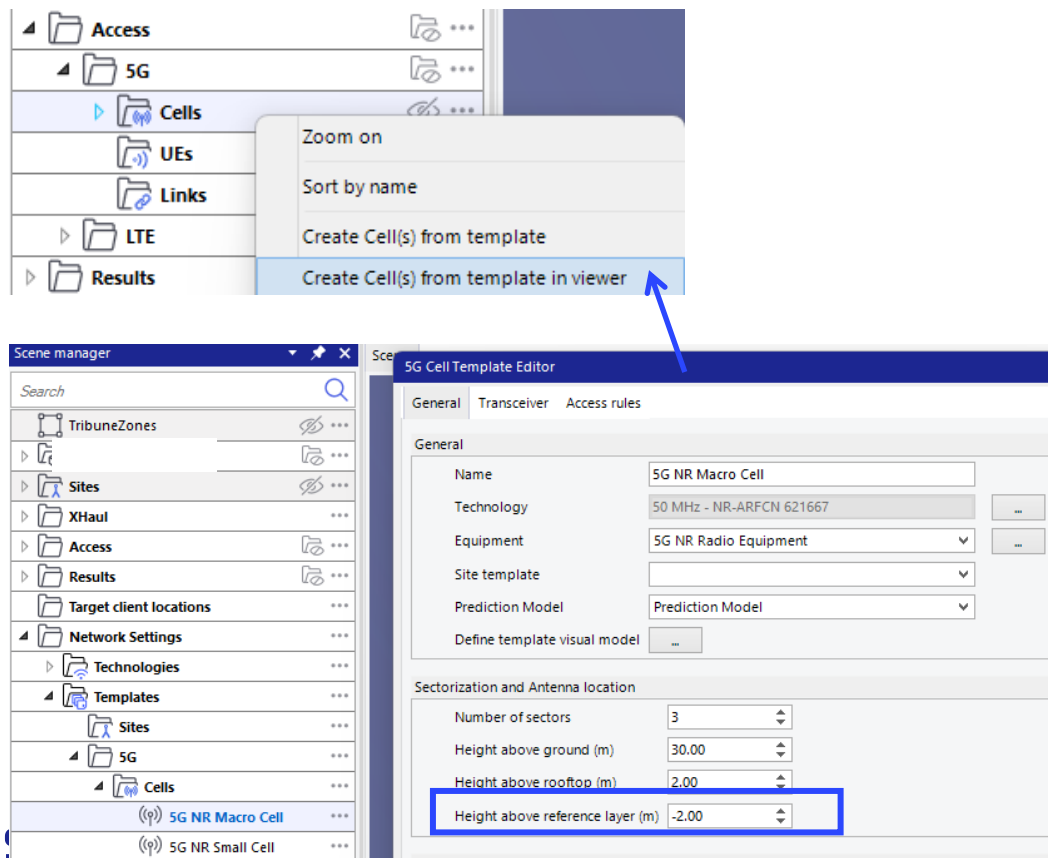
3 levels of algorithm complexity exist:

- **For all horizontal-plane paths:** ray-launching in vertical plane is performed for all propagation paths found in horizontal plane.
- **For horizontal-plane direct and reflected paths** -> ray-launching in the vertical plane is performed for only direct and reflected paths found in the horizontal plane.
- **For horizontal-plane direct path** -> ray-launching in the vertical plane is performed for only the direct-path between the terminal antennas, delivering an approximate received power for outdoor-only and indoor-only pre-design scenarios with about 90% gain in computation time.

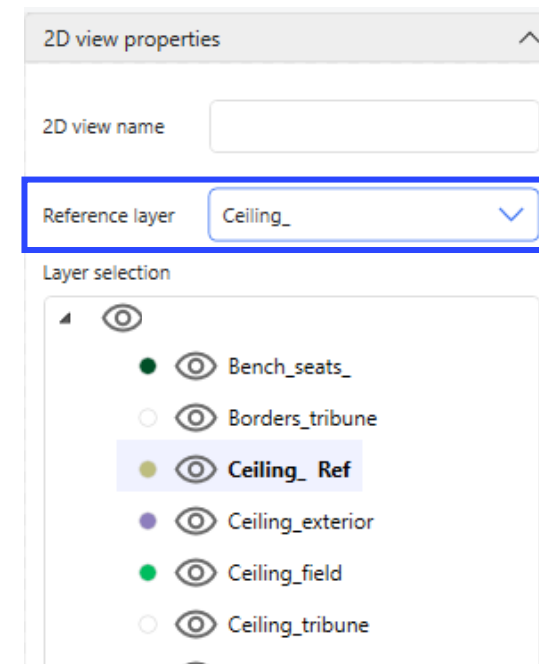
Network Element Creation in 3D Scene

When creating a new network element (Cell or UE) **from template in viewer**, the **Height above reference layer** value defined in Cell/UE template will be used to determine the antenna installation height of the network element :

- In 3D Scene: installation height = layer height at the click point + **Height above reference layer** value.
- In 2D View: installation height = height of the selected reference layer at the click point + **Height above reference layer** value.



3D Scene



2D View

Above layer: Coverage Prediction Configuration

There are three options for the *Receiver Location* parameter in the **Coverage Predictions** window:

1.Layer – The receiver height is defined relative to the selected layer(s). The relative height value is set by the *Height Above Reference Layer* parameter. Multiple layers can be selected, and each selected layer will produce a separate simulation result displayed in the results section.

2.DXF Model – Works similarly to the *Layer* option, but the simulation results are generated per DXF model. For the receiver height of a given point, if multiple layers share the same horizontal coordinates (same X, Y), the highest Z value among those layers will be used.

3.Height – Uses fixed receiver heights, defined in the *Multi-Floor Heights* parameter. Multiple heights can be specified, with each height generating a separate simulation result displayed in the results section.

Part of Active remote template GUI

Location

Height above ground (m) 1.50

Height above rooftop (m) 2.00

Height above reference layer (m) 0.50

Multi-floor heights

☒ 1.5;10;20

☐ Min 1.5

Nb floors 3

Floor height (m) 10.0

Part of Coverage predictions (Cell coverage) GUI

Propagation model VolcanoFlex

Receiver location

Simulation by

☒ Layer

☐ DXF model

☐ Height

Layer selection

☒ Factory

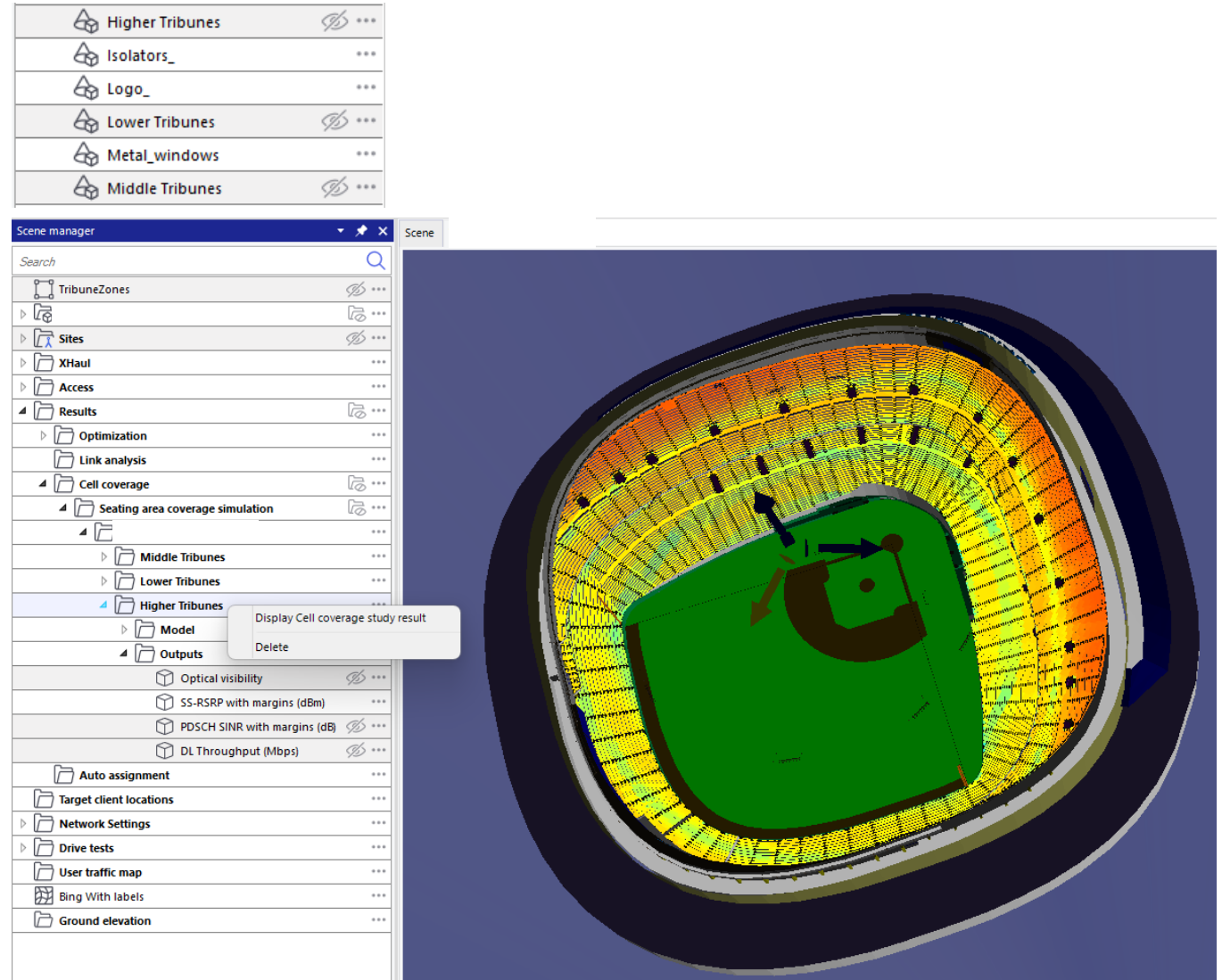
☐ CEILING

☐ COLUMNS

☐ COLUMNS Extra

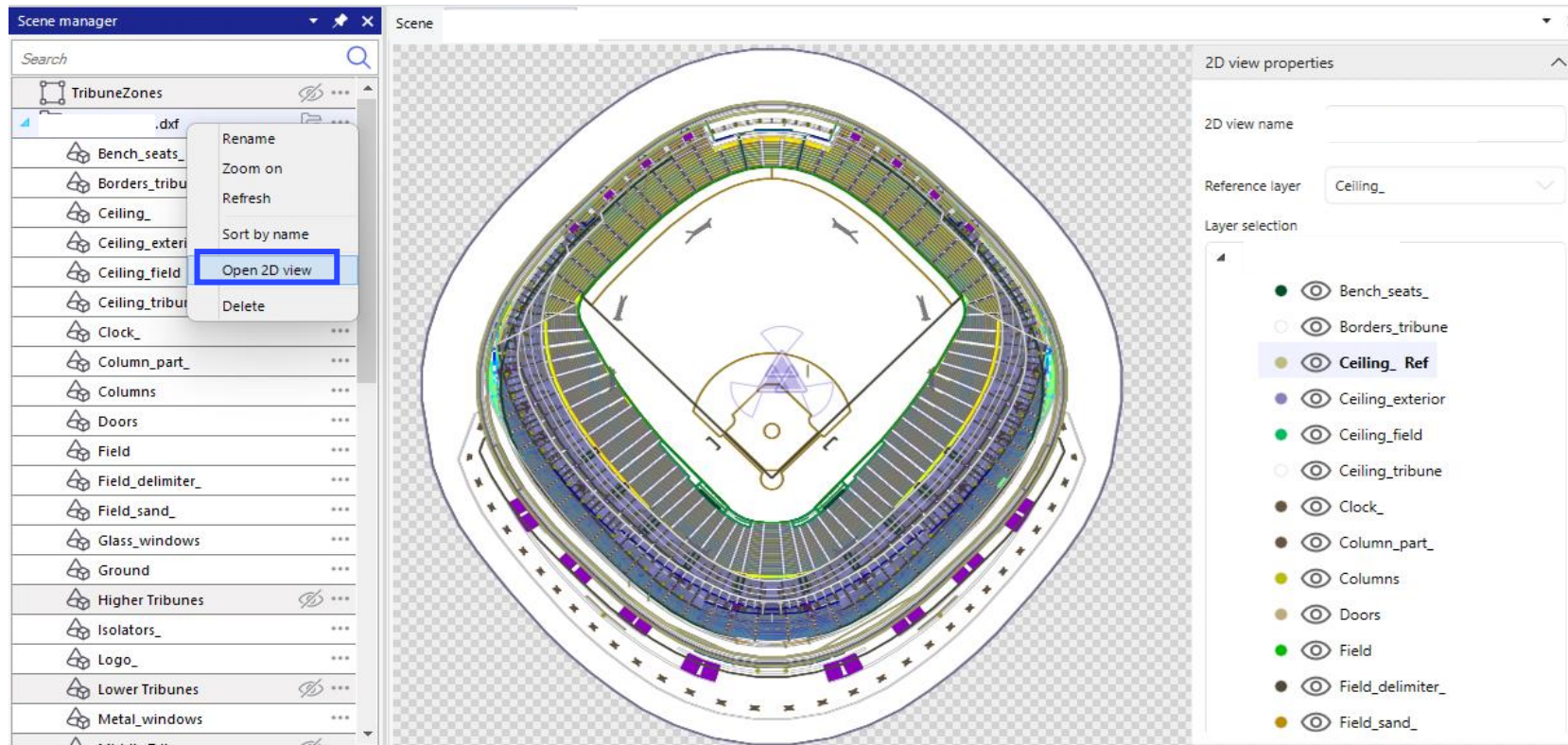
Above layer: Simulation Results

- The **Above Layer** simulation results are organized by Layer or DXF model depending on the user's selection in *Coverage predictions* GUI.
- **To view the simulation report:** right-click the Layer name node and select **Display Cell coverage study result**.
- The simulation results can have conflicts in visualization with the DXF data layers, hide data layer in DXF model to show simulation results.
- **To show or hide a result or a data layer:** click the Eye icon.
- **To adjust palettes:** the simulation result palette can be modified, exported, or imported. Desktop users can also replace the default palettes located in the installation directory (C:\Program Files\Siradel\SmartCityExplorer\bin\plugins\S_5GConnect\Resources\Palettes).
- **To access GeoTIFF output:** right-click simulation result and select GeoTIFF export action.



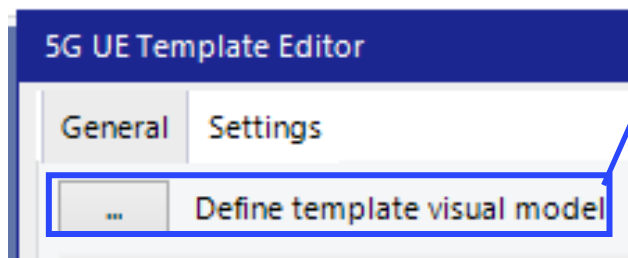
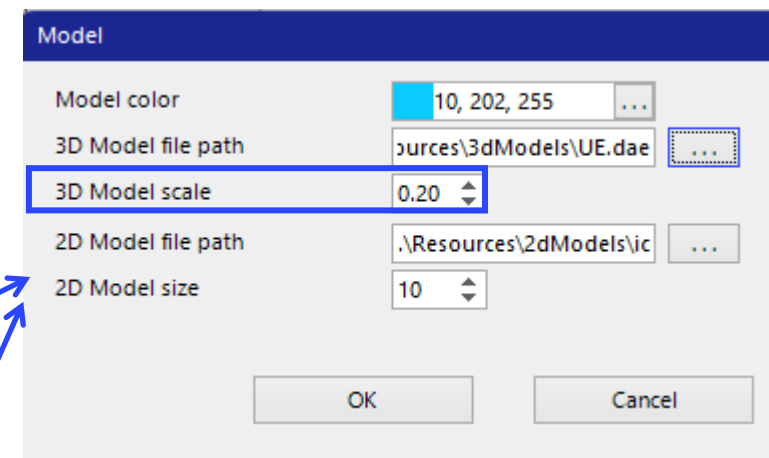
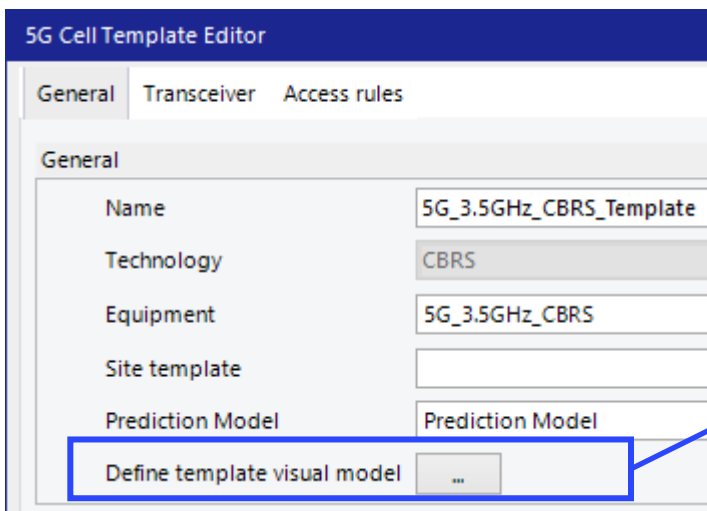
2D View

- Right-click the DXF model and select **Open 2D view** to open it in a new Scene tab.
- The **Eye** icons for DXF model layers in the Scene Manager are synchronized with the **Eye** icons in the **Layer selection** panel of the 2D view.
- Network elements can be added directly in the 2D view.
- Coverage maps are displayed in the 2D view associated with the corresponding DXF model.



Some recommendations for Indoor simulation

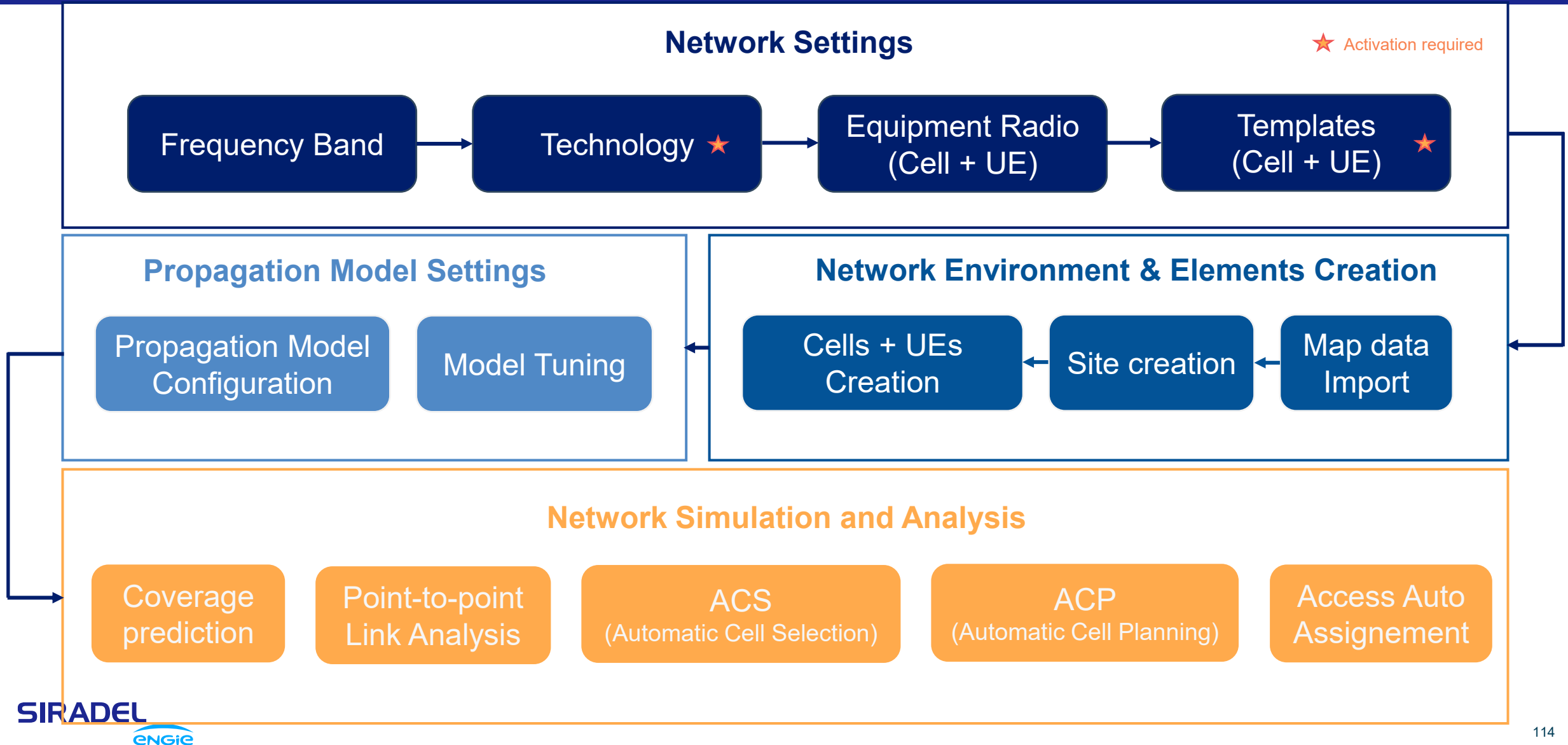
Adjust the Cell/UE icon size for in-building configuration. Default template visual model can be edited. Recommendation is to use 3D model scale at 0.1-0.25 for in-building configurations.



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- Indoor/Hybrid scenarios
- **Annex – additional information**

Siradel Planner Workflow Overview



Key Terminology in Siradel Planner

- **Cell** represents Base Stations, transmitter, GateWay, Access Point, ...
- **UE** represents User equipment or End point in IOT scenario
- **3 Technology types** are defined in the tool: 5G, LTE, and custom. The custom technology type provides high flexibility for users to mobilize different elements, and can be used for all technologies other than 5G and LTE.
- **Technology** defines parameters like bandwidth, DL/UL ratio, etc
- **Radio equipment** defines parameters that are strongly associated with the base station equipment or UE (user equipment or device), including mapping tables that translate a given SINR into throughput value through spectrum efficiency.
- **Template** defines element characteristics to be used for the creation of Sites, Cells and UEs. Refer to [Zoom on Templates](#) for more detailed information.
- **Propagation models** gather the various simulation and propagation settings considered during a computation. Each Cell can be associated to a propagation model.

Network settings: zoom on Templates

Active templates aim at defining element characteristics to be used for the creation of Sites, Cells and UEs.

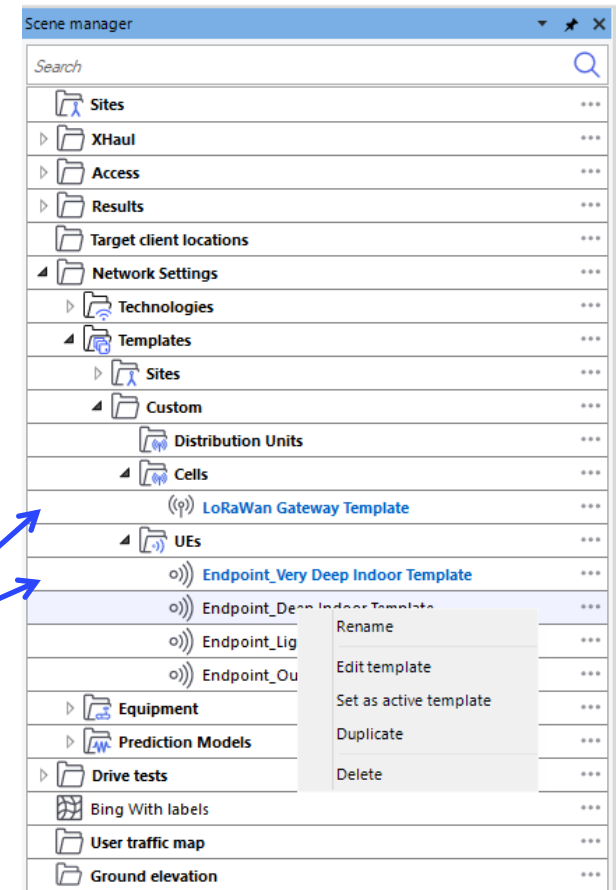
Template-specific parameters

- Number of sectors enables to automatically create multi-sectorized Cells
- Height in street (m) aims at defining the default height for element creation in the street
- Height above rooftop (m) aims at defining the default height for element creation on rooftops

The active UE template is also used to determine the characteristics of the user equipment when running coverage predictions

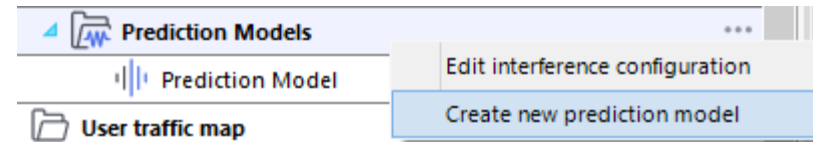
All templates have been already properly configured for the UX/UI exploration.

- Active templates are highlighted in Blue
- Right-click a template and select "Set as active template" to activate it



Volcano Propagation Model

- The prediction models aim at defining the **propagation parameters** as well as the **reliability** and **availability** parameters considered for **margins and link performance evaluation**.
- A standard prediction model is available with any new project and embeds Siradel recommended parameters when no measurements are available to perform a model tuning
 - Model tuning is possible in Siradel Planner
- New prediction models can be created and edited by the user



Volcano Propagation Model: 3 Mapdata Types

- **3D polygons simulation settings**
Outdoor environment simulations with HR (High-Resolution) map data (3D Vector layer)
- **3D/2D raster simulation settings**
 - Outdoor environment simulations with 3D raster map data (DTM+DLU+DHM)
 - Outdoor environment simulations with 2D raster map data (DTM+DLU)
- **DXF simulation settings**
 - Indoor or Outdoor+Indoor environment simulations with DXF format map data
- Mapdata priority level: 3D polygons > 3D/2D raster > DXF
 - Siradel Planner selects automatically the mapdata layer and its related propagation model according to this order.

The screenshot shows a software window titled "Prediction". It has a tabbed interface with five tabs: "General", "3D polygons simulation settings", "3D/2D raster simulation settings", "DXF simulation settings", and "Availability Geoclimatic". The "General" tab is currently selected. Inside the "General" tab, there is a "Name" label followed by a text input field containing the text "Prediction Model". Below this, there is a section labeled "Details" which contains a large, empty rectangular area. At the bottom right of the window, there are two buttons: "OK" and "Cancel".

Project Settings

Project Settings allows to set some project level parameters. It includes two types of settings:

- Computation settings: computation related parameters can be set here.
- Technologies:
 - Custom is by default selected
 - LTE/5G can be activated if the licenses are granted.
 - When Wifi templates option is checked, Wifi related templates will be imported into the project.

The screenshot displays the Smart City Explorer Pro software interface. The top menu bar includes 'File', 'Tools', 'Vectors', '3D models', 'Settings', and 'Bloonet Planner'. Below the menu is a toolbar with icons for various functions. The 'Project Settings' icon, which shows a folder with a gear, is highlighted with a blue rectangle. Below the toolbar, two screenshots of the 'Project settings' dialog box are shown side-by-side.

Project settings dialog box (left):

- Tab: Computation settings
- Interference calculation settings
 - Interference combination method: Basic
- Prediction margin settings
 - Confidence level: 70
 - Standard deviation of SINR error (dB): 7
 - Additional margin: 0
- EMF settings
 - Threshold exposure EMF (V/m): 61
- Buttons: Update, Cancel

Project settings dialog box (right):

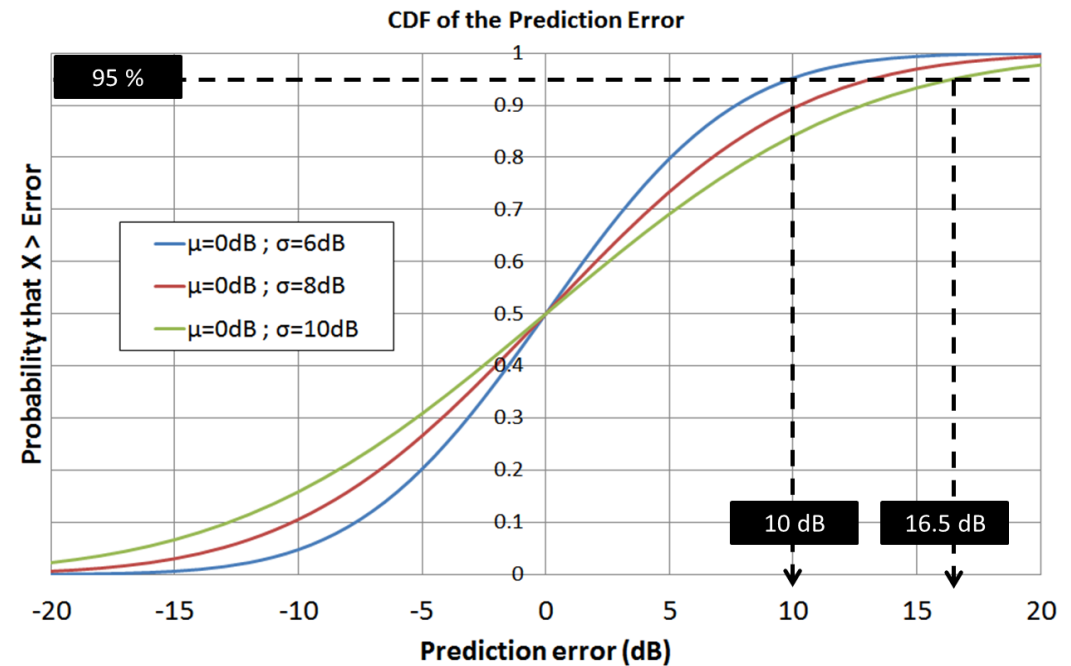
- Tab: Technologies
- Display
 - Custom: ☒
 - LTE: ☒
 - 5G: ☒
- Technology type selection
 - Active technology type: None
- Load elements
 - Wifi templates: ☐
- Buttons: Update, Cancel

Shadowing margin vs Confidence level

- The prediction error is characterized by a lognormal distribution with a standard deviation σ . A margin is defined to guarantee that the predicted signal with margins is achieved with a confidence level of X%
- For instance, for a link between a Cell and a UE, a margin of 10dB will enable to achieve 95% level of confidence for a model standard deviation of 6dB

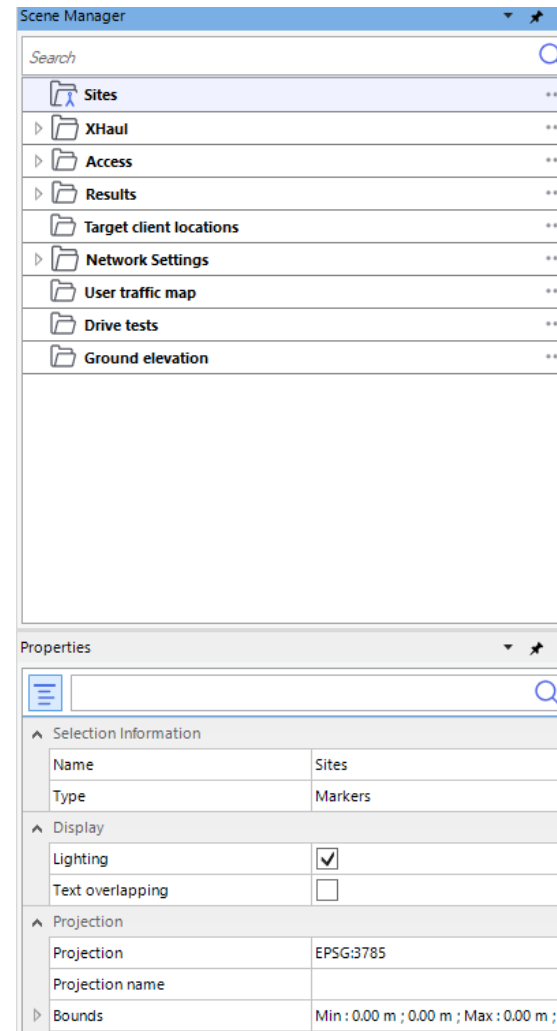
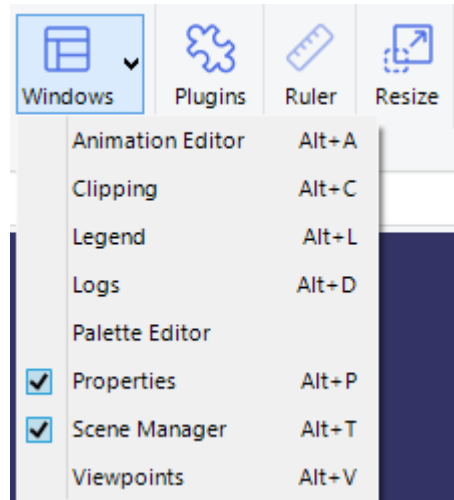
Prediction margin

Standard deviation error on propagation loss	LOS (dB)	4.00	} Confidence Level (%)	50.00
	NLOS (dB)	6.00		
☐ Additional margin (dB)		0.00		



Visual properties

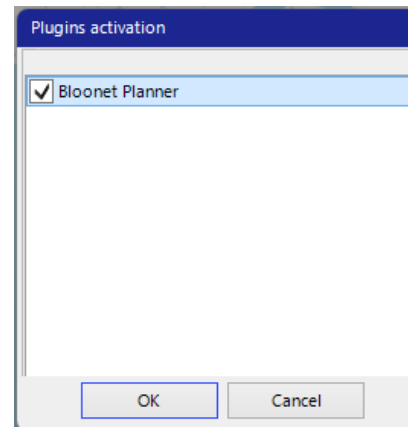
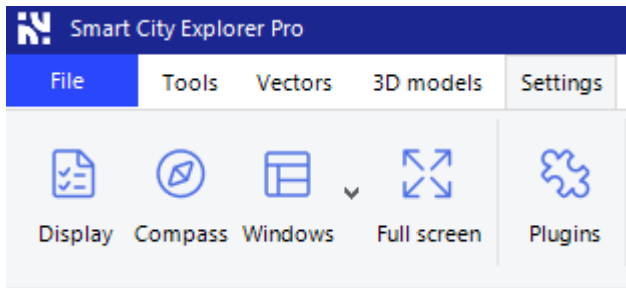
- Properties window (Alt+P) allows the user to modify the visual properties of elements imported in the tool (text, color, 3D/2D model, etc.)



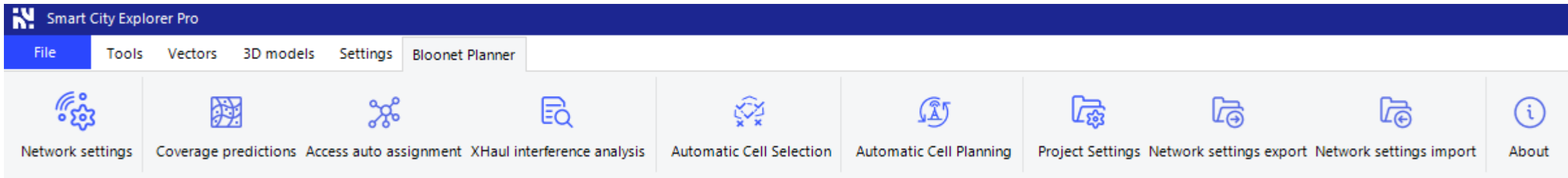
Register Plugins

- Bloonet Planner is a plugin integrated in Smart City Explorer Pro. The plugin is automatically activated when Bloonet Planner is installed.
- If the plugin is unregistered at some point (usual Bloonet Planner related folders and the “Bloonet Planner” tab do not appear anymore), the plugin can be activated with the **Plugins activation** option.

Without plugin activated



With Bloonet Planner plugin activated :





THANKS