CCTV coverage

Release number v2.0
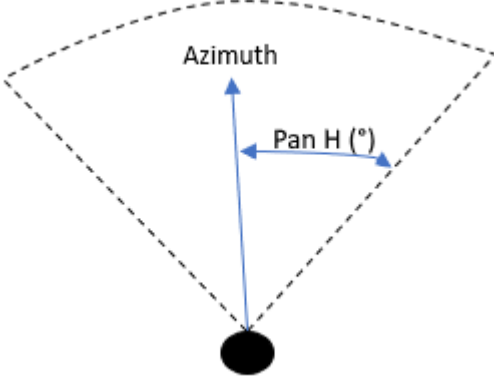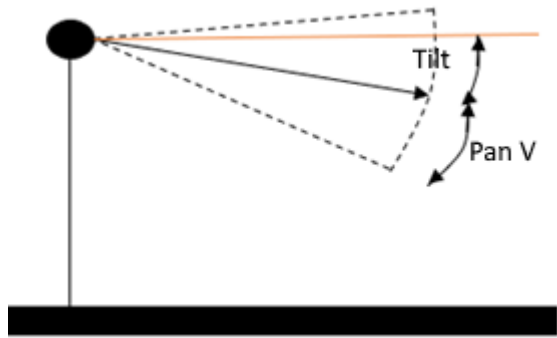
1.   Introduction

This document entails instructions on how to model, plan, simulate and analyze CCTV cameras in HTZ tool.

2.   CCTV object

To add CCTV object to the map:

1- Right-click anywhere on the map.
2- Select "Add station".
3- Select "CCTV".

Main parameters:

CCTV object parameters

Pan H parameter (top view)

Pan V parameters (side view)

- Mast height: Height of the camera above ground level.
- Azimuth [0 to 359]: Orientation of the camera's center of view relative to true North.
- Tilt [-90 to +90]: Tilting of the camera with -ve being towards the ground.
- Pan H (+-deg): That is in fact ½ of the maximum Horizontal range of angles. For example, if the camera specs specify 160° horizontal range of angles, user must divide this number by 2 and set it to 80°.

- Pan V (+-deg): That is in fact ½ of the maximum Vertical range of angles. For example, if the camera specs specify 46° vertical range of angles, user must divide this number by 2 and set it to 23°.

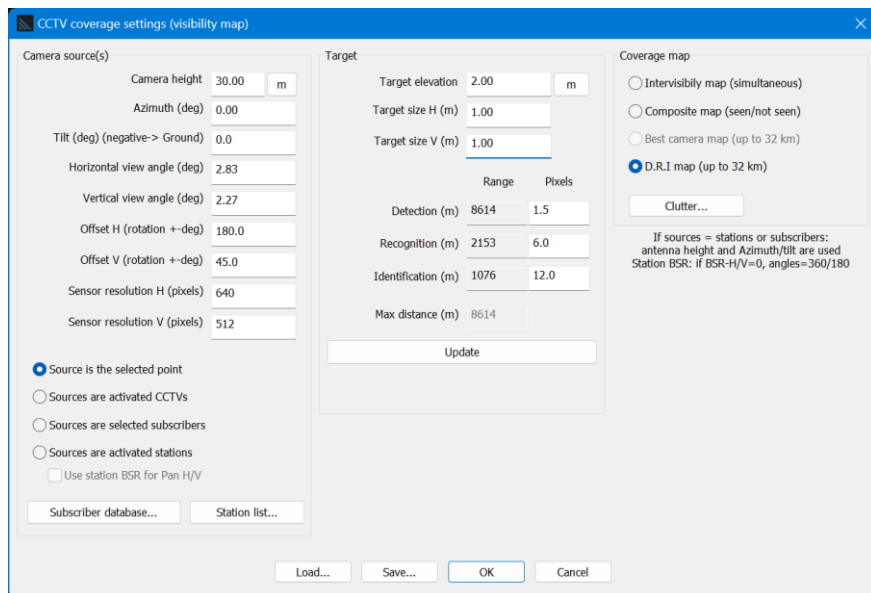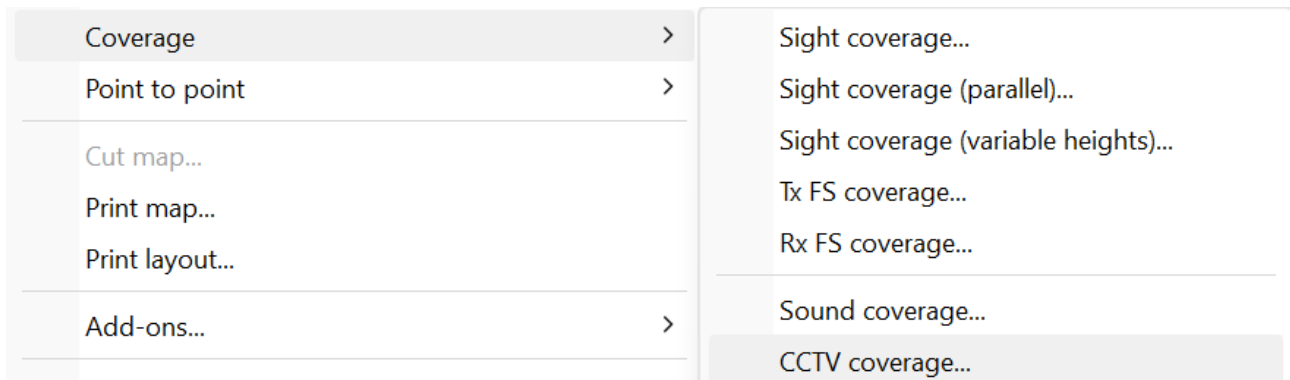Ranges for horizontal angles = From Azimuth - Pan H to Azimuth + Pan H.
Ranges for vertical angles = From Tilt - Pan V to Tilt + Pan V.

3. CCTV coverage

Step 1: Right click anywhere on the map
Step 2: Go down to Coverage
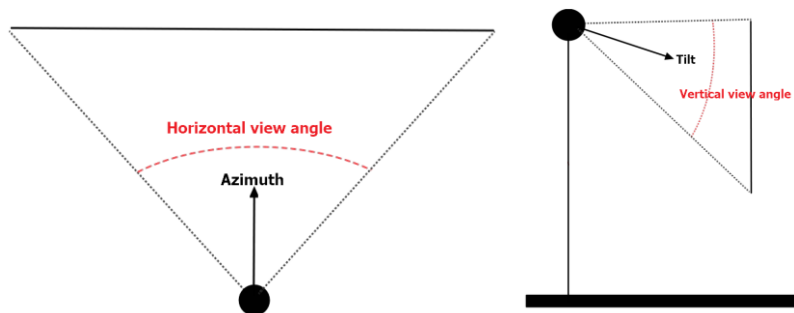**Step 3: Select "CCTV coverage…"**

Step 4: Select the camera source.

- Common parameters whatever the selected source:

| Horizontal view angle (deg) | 2.83 | | Sensor resolution H (pixels) | 640 |
| Vertical view angle (deg) | 2.27 | | Sensor resolution V (pixels) | 512 |

Horizontal view angle (deg): For a given azimuth of the camera, this is the total range of horizontal angles that can be seen from the camera.

Vertical view angle (deg): For a given tilt of the camera, this is the total range of vertical angles that can be seen from the camera.

Sensor resolution H (pixels): Number of pixels on the image captured by the camera in the horizontal plane.

Sensor resolution V (pixels): Number of pixels on the image captured by the camera in the vertical plane.

- Source is the selected point: This option allows to model one camera only. It will enable the following settings:
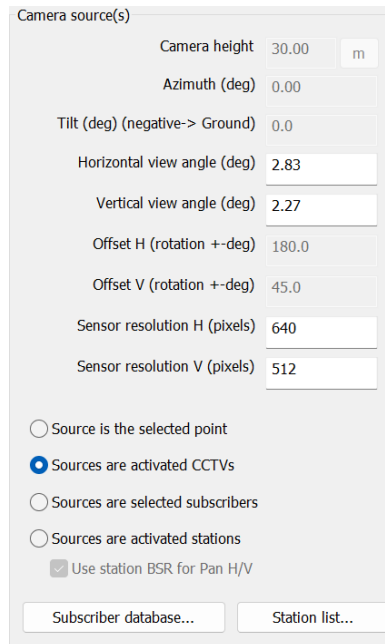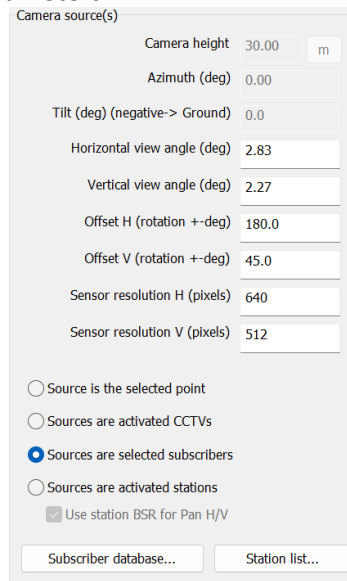

- Camera height.
- Azimuth.
- Tilt.
- Offset H (rotation +-deg): That is in fact ½ of the maximum Horizontal range of angles.
- Offset V (rotation +-deg): That is in fact ½ of the maximum Vertical range of angles.

- Sources are activated CCTVs: This option will make use of the CCTV object(s) defined by the user on the map. This option is ideal if user wishes to model multiple cameras added on the map and produce combined analysis.
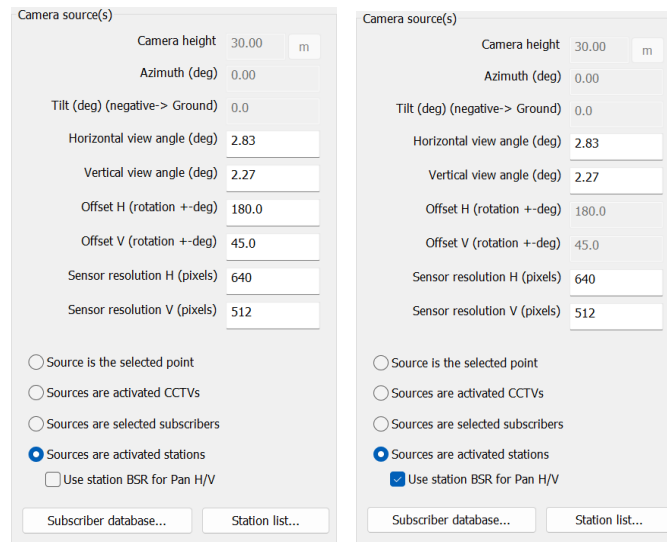

- o Camera height: Extracted from the parameters of each CCTV object (Mast height).
- o Azimuth: Extracted from the parameters of each CCTV object.
- o Tilt: Extracted from the parameters of each CCTV object.
- o Offset H (rotation +-deg): Extracted from each CCTV object (Pan H).
- o Offset V (rotation +-deg): Extracted from each CCTV object (Pan V).

- Sources are selected subscribers: In this case, transmitting antenna heights and Azimuths/Tilts are extracted from subscribers parameters.
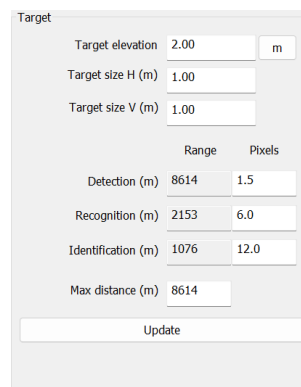

- o Camera height: Extracted from the parameters of each subscriber (Antenna height).
- o Azimuth: Extracted from the parameters of each subscriber.
- o Tilt: Extracted from the parameters of each subscriber.

- o Offset H (rotation +-deg): That is in fact ½ of the maximum Horizontal range of angles.
  - o Offset V (rotation +-deg): That is in fact ½ of the maximum Vertical range of angles.

- Sources are activated stations: This is used if user prefers to make use of standard Tx/Rx objects. In this case, transmitting antenna heights and Azimuths/Tilts are extracted from each station parameters. If the "Use station BSR for PanH/V" option is selected, Horizontal and Vertical view angles are computed according to station Beam Steering Range (BSR) values set in each station parameters.

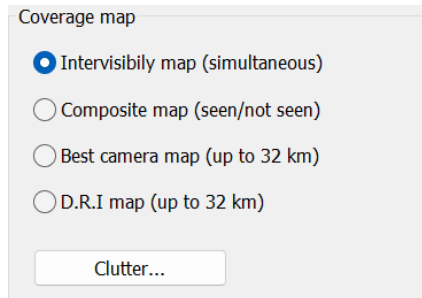**Step 5: Configure the target and calculation ranges**

- Target elevation: This is the height of the object (AGL m) being targeted. For example, a person can be estimated to 1 meter. If it's a drone – then the expected height of the drone to be used.
- Target size H (m): Size of the target in the horizontal plane. Used to compute the maximum range(s).
- Target size V (m): Size of the target in the Vertical plane. Used to compute the maximum range(s).
- Ranges (limited to 32km)
  - o The Detection, Recognition and Identification ranges (D.R.I) are computed according to the corresponding minimum number of pixels to be present on the image.
  - o Max distance: This is greyed out if the "D.R.I map" option is selected. By default, it is set to the maximum value computed for D.R.I. ranges. It can be also user defined.

o The "Update" button will update the ranges according to the target sizes and the number of pixels required.

Notes:
- CCTV coverage settings can be saved / loaded to/from .CTV files.
- CCTV angle views can be computed (if needed) from a Web calculator such as: https://www.cctvcalculator.net/en/calculations/viewing-angle/

Step 6: Select the output map type

- Intervisibility map (simultaneous): The number of cameras simultaneously viewing each point is displayed on the map.
- Composite map (seen/not seen): The composite visibility map is displayed with Seen=1 / Not seen = 0.
- Best camera map (up to 32km): Available only for sources defined from CCTV or station objects. The nearest station number seeing each point is displayed on the map.
- D.R.I map (up to 32km): Detection / Recognition / Identification map. Please refer to the next section for more information.
- Select the clutter codes to be considered as a potential location of the target on the map.

4. D.R.I Analysis for human (1.8m x 0.5m)

A particular coverage can be performed in order to display and analyze the D.R.I coverage based on the camera's capabilities and target pixels criteria:
- D: Detection range (m)
- R: Recognition range (m)
- I: Identification range (m)

4.1. Background

50% confidence – based on a person
DRI as per 1.5 ± 0.5 pixels for **Detection** 6 ± 1.5 pixels for **Recognition** and 12± 2 pixels for **Identification** with 50% probability of achieving the objective, at the specified distance.
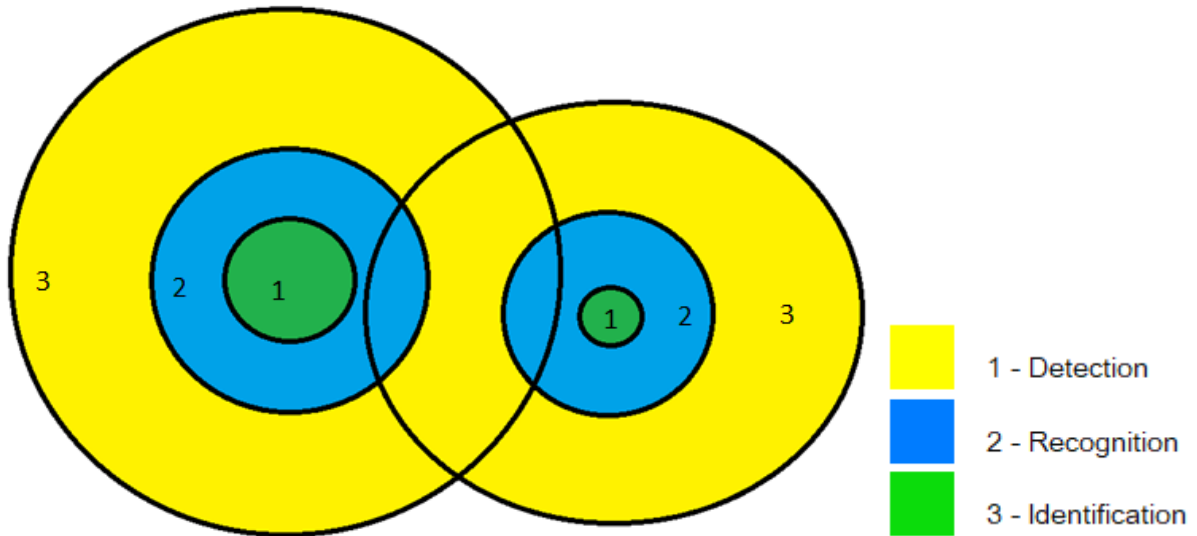**70% confidence – based on a person**
DRI as per 1.88 ± 0.5 pixels for **Detection** 7.5 ± 1.5 pixels for **Recognition** and 15± 2 pixels for **Identification** with 70% probability of achieving the objective, at the specified distance.
90% confidence – based on a person
DRI as per 2.68 ± 0.5 pixels for **Detection** 10.74 ± 1.5 pixel for **Recognition** and 21.4 ± 2 pixels for **Identification** with 90% probability of achieving the objective, at the specified distance.

Figure 1: Theoretical DRI map

4.2. D.R.I map from CCTV objects

Select the sources as activated CCTVs.

Camera sensor settings:

- Resolution: 1920x1080
- Horizontal view angle: 2.83°
- Vertical view angle: 2.27°

Configure the target.

- Target elevation: this is the height of the object (AGL m) being targeted. For example, a person can be estimated to 1 meter. If it's a drone - then the expected height of the drone to be used.
- Target size (m): 1.80 x 0.5 (m)
- Ranges: Set the minimum number of pixels required for each case and click on "Update".

Simulation outcome