The AXIS110 ILS Localiser simulation software

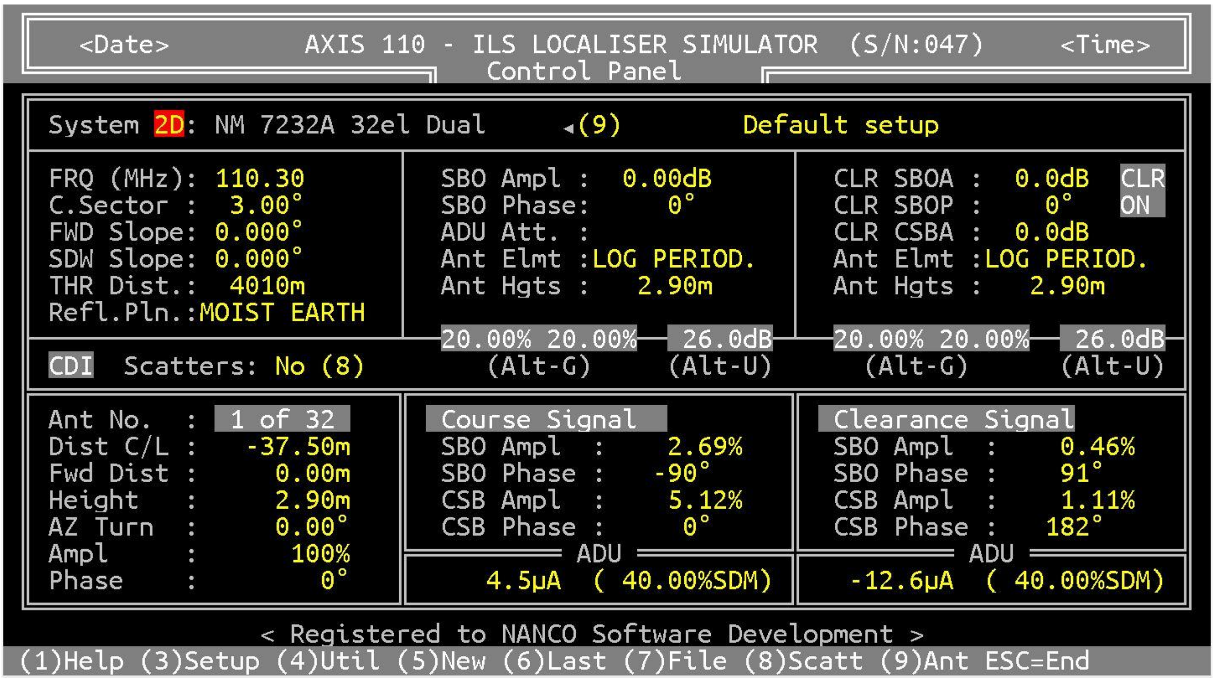

Figure 1. The Control Panel setting up the localiser system basic parameters

A basic system among a number of generally available systems can be found pressing “9” on the keyboard. The user can easily change the frequency, runway length and other parameters in order to match the site. From this page, pressing “Enter” will open the menu where you may run the simulation in five different ways.

The AXIS110 is designed for use in six areas

1 Setting-up guidance
The Control Panel shows all physical and electrical settings together with readings from sample probes in the Antenna Distribution Unit (ADU) to guide in correct ground setup & phasing in order to minimize flight inspection time at the commissioning of the installation.

2 Prediction of signal quality
The influence on the signal quality from the planned buildings or constructions on the airport area can be predicted by modelling the constructions.

3 Finding optimum antenna system
Simulation of specific installations in a given airport model to compare the theoretical signal quality with the achieved Flight Inspection results. By adjusting the model so the simulations resemble the actual results, one gets control and understanding of the model performance and behaviour. When a model is established, the simulator can find the optimum antenna system or adjustment settings to obtain the best possible signal quality.

4 Determine sensitive areas
Establish sensitive areas for a simulated aircraft tailfin, vehicle or construction crane with a given size and orientation. The object will be moved around and optionally rotated to the worst-case orientation to find the border of the sensitive area where this object will produce a specified bend amplitude at a selected receiver location or flight path. The objective is to obtain qualified restrictions for the movement of various aircraft and vehicle types as well as erecting buildings on the airport.

5 Simulating the drifting of system parameters
Stability testing by introducing changes in both course and clearance antenna feeds and their mechanical positions to learn what impact this will have on both nearfield and farfield signals. This is important in order to specify maintenance limits for the system in order to set the proper alarm limits in the monitors as well as finding the signal response at the ground measurement points on specific installations.

6 Training
Learn how the ILS Localiser system really works under all possible and impossible situations. A nearly unlimited “theory book” that adds neatly into any ILS theory course to supply the instructor with an animation and demonstration tool.

The menu for running different modes

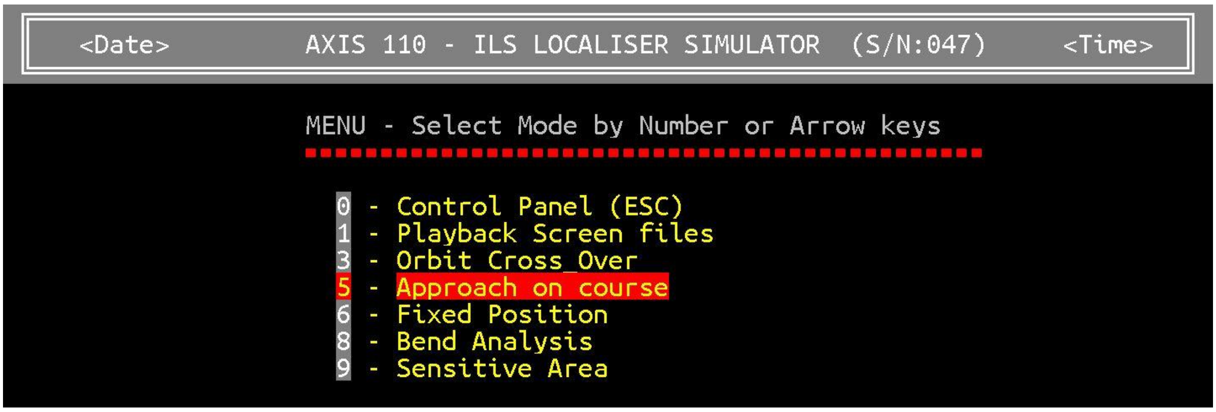

Figure 2. The menu gives access to five different modes.

The different menu lines show keywords indicating how the mode works, and more details will be given in the subsequent text.

Item (1) Playback Screen files are used for showing saved screens in the following modes, mainly for demonstration or comparison purposes.

The Orbit Crossover mode

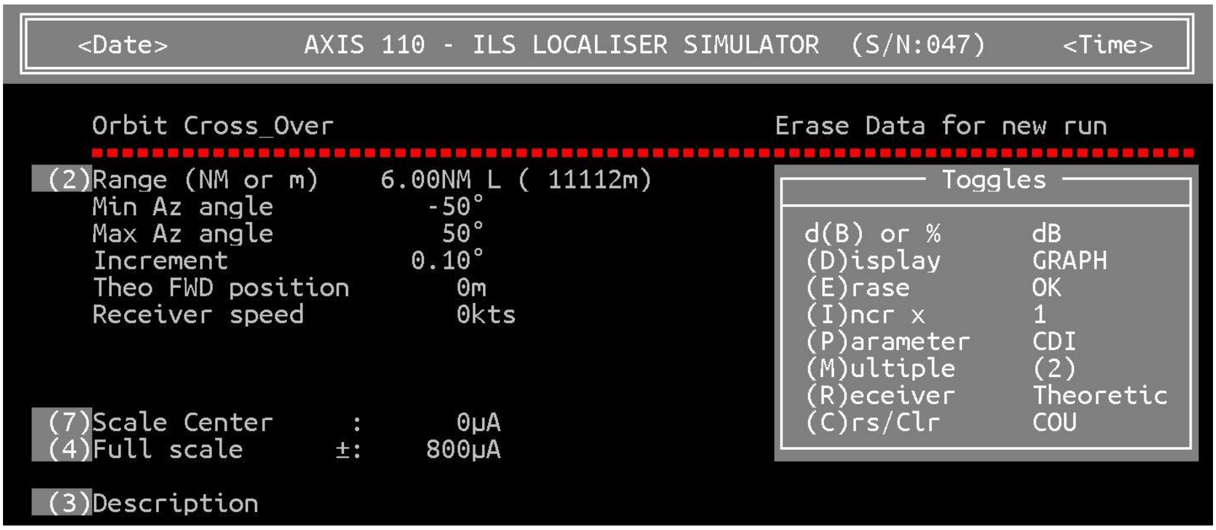

Figure 3. The Orbit Cross over mode (3) simulates a horizontal flight across the LOC sector.

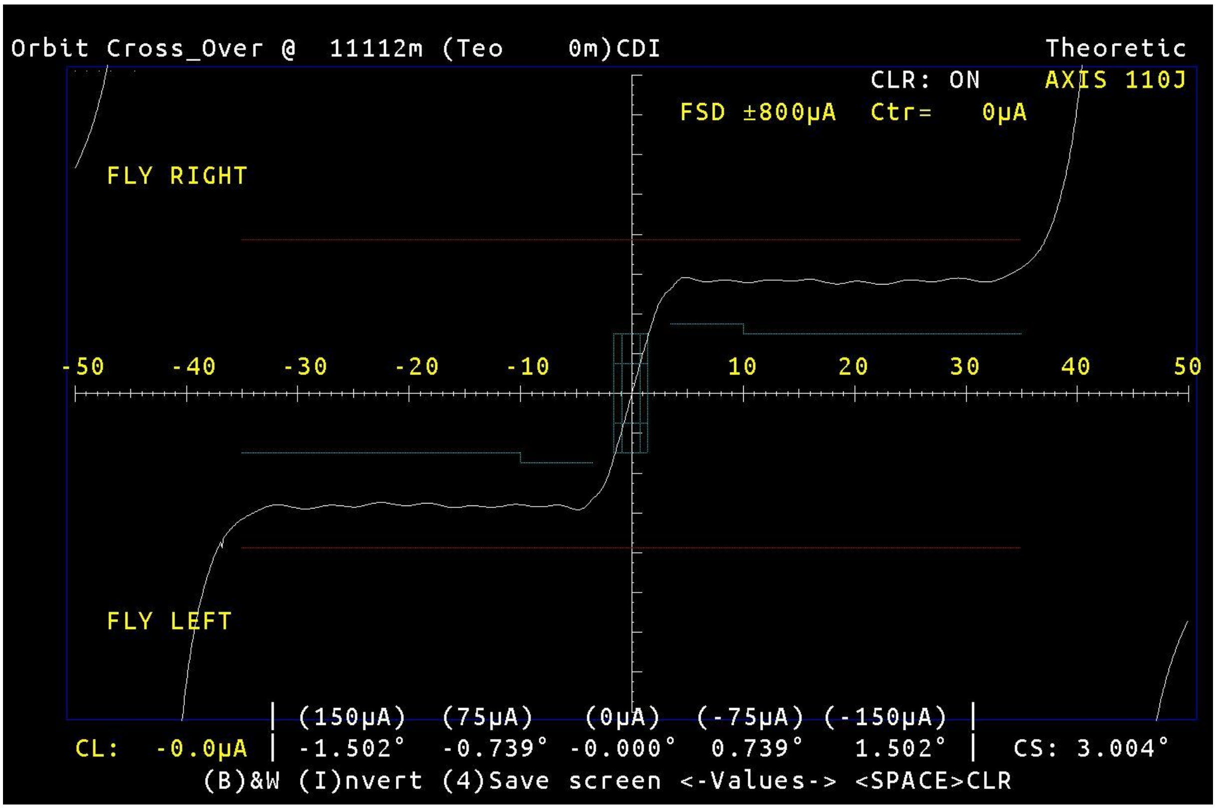

Figure 4. The CDI mode shows the CDI or % DDM as selected across the coverage sector. The red and blue lines show the limits for the signal according to the specifications given in ICAO Annex 10.

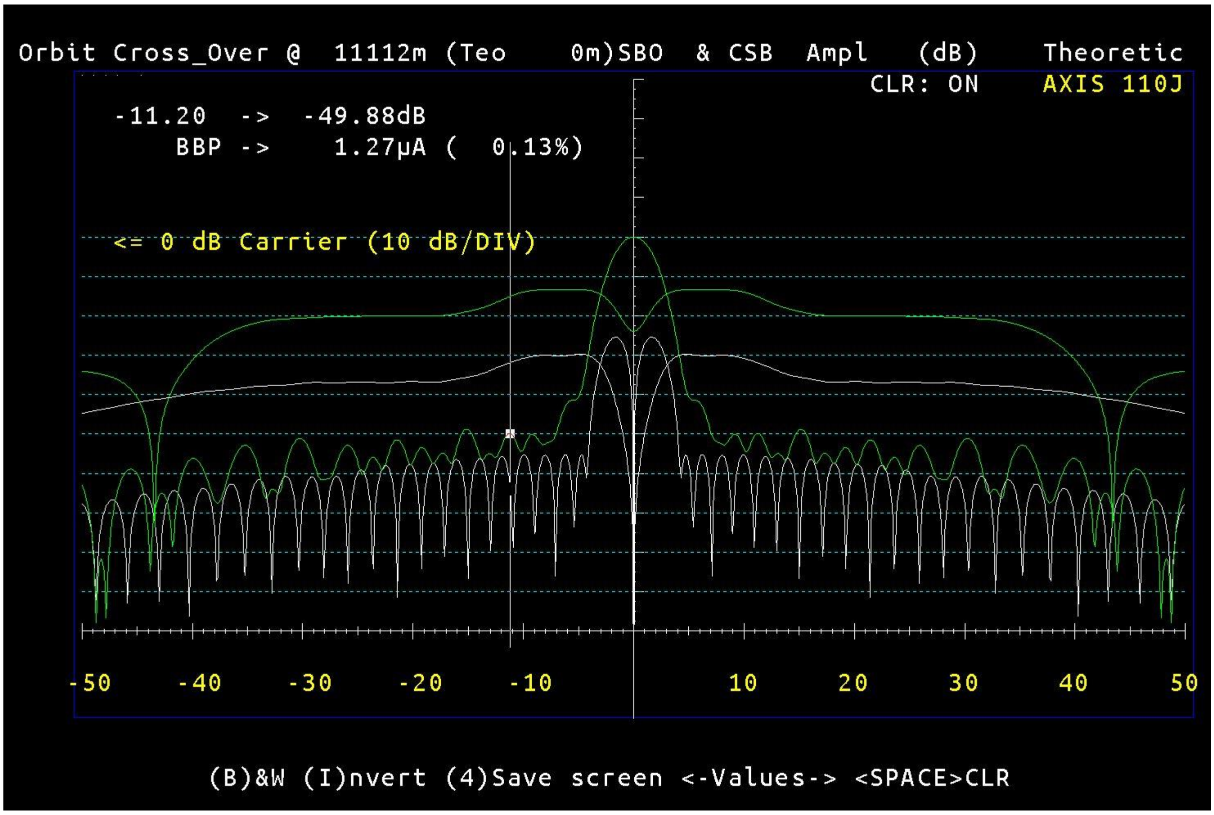

Figure 5. The amplitude of the course and clearance SBO and CSB can be shown in dB or % relative to the peak course CSB level. A cursor can be moved to read details along the curve.

The Approach on Course mode

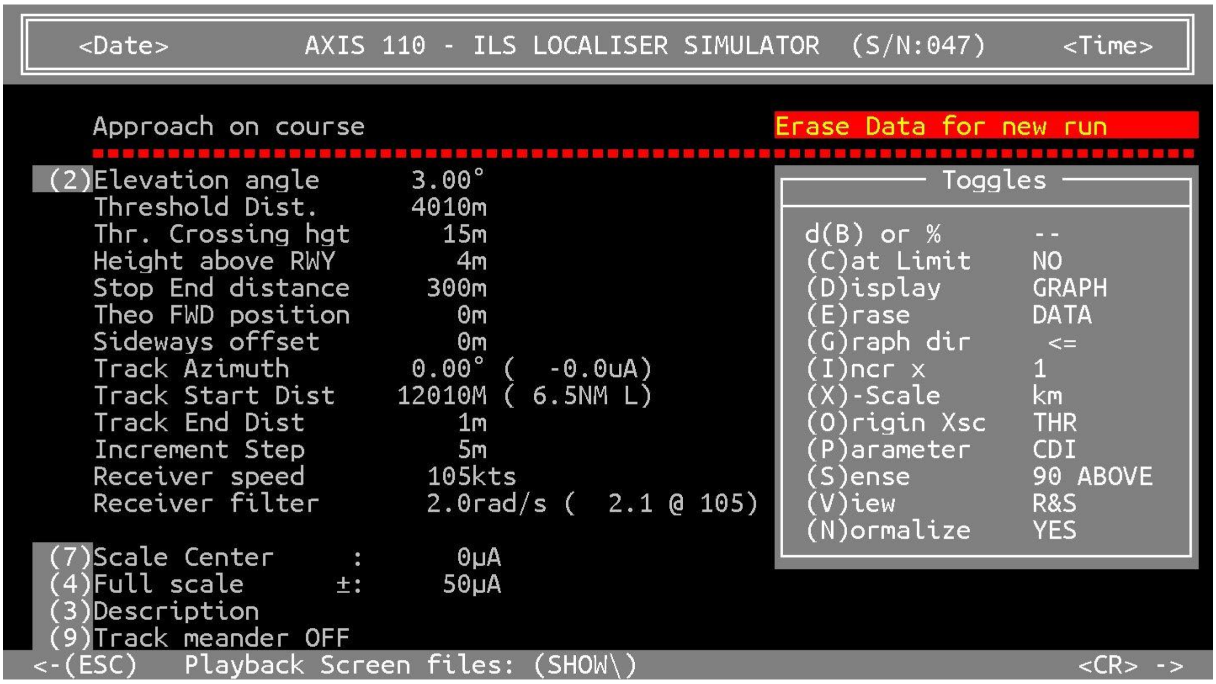

Figure 6. The Approach Mode (5) menu sets all variables desired for controlling and displaying the Fly Down along the course line along a chose glide path angle.

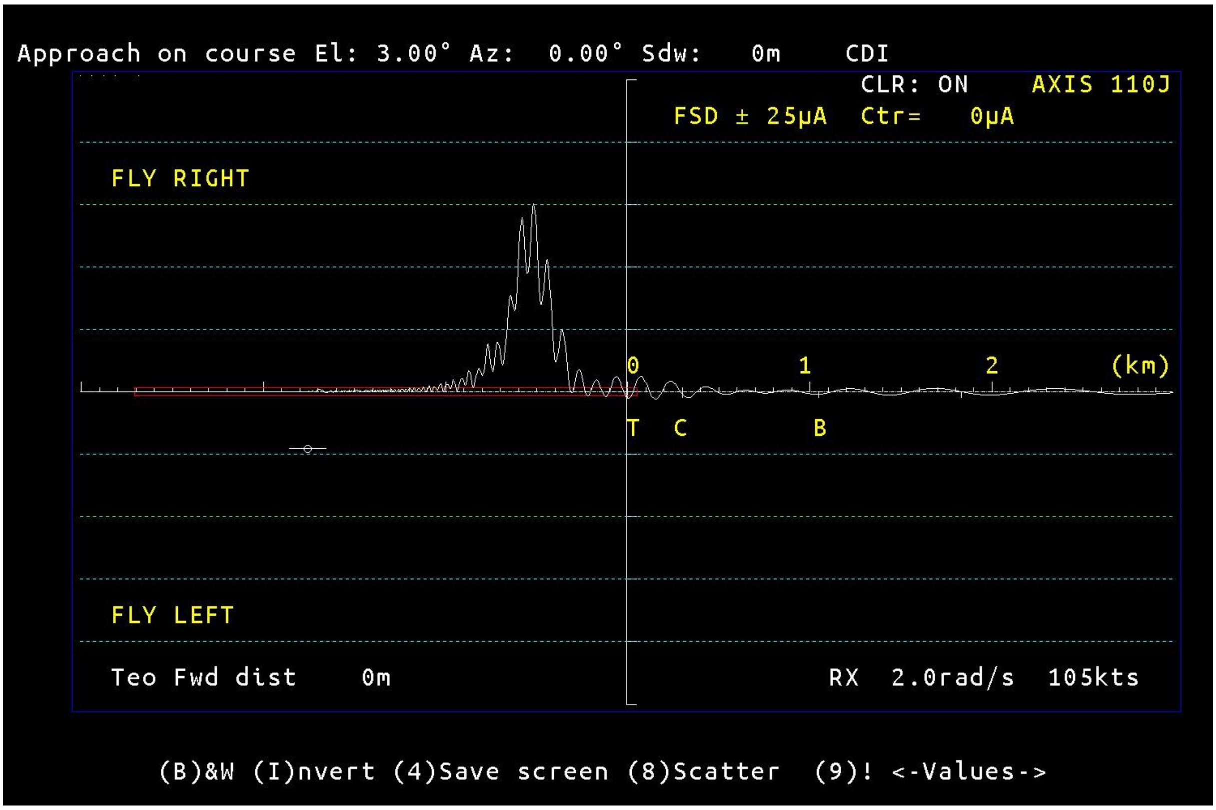

Figure 7. Introducing a sheet or plate beside the runway may result in disturbance on the course lone along the runway.

This picture shows the resulting disturbance when the course and clearance signal are reflected and cross the runway after the threshold.

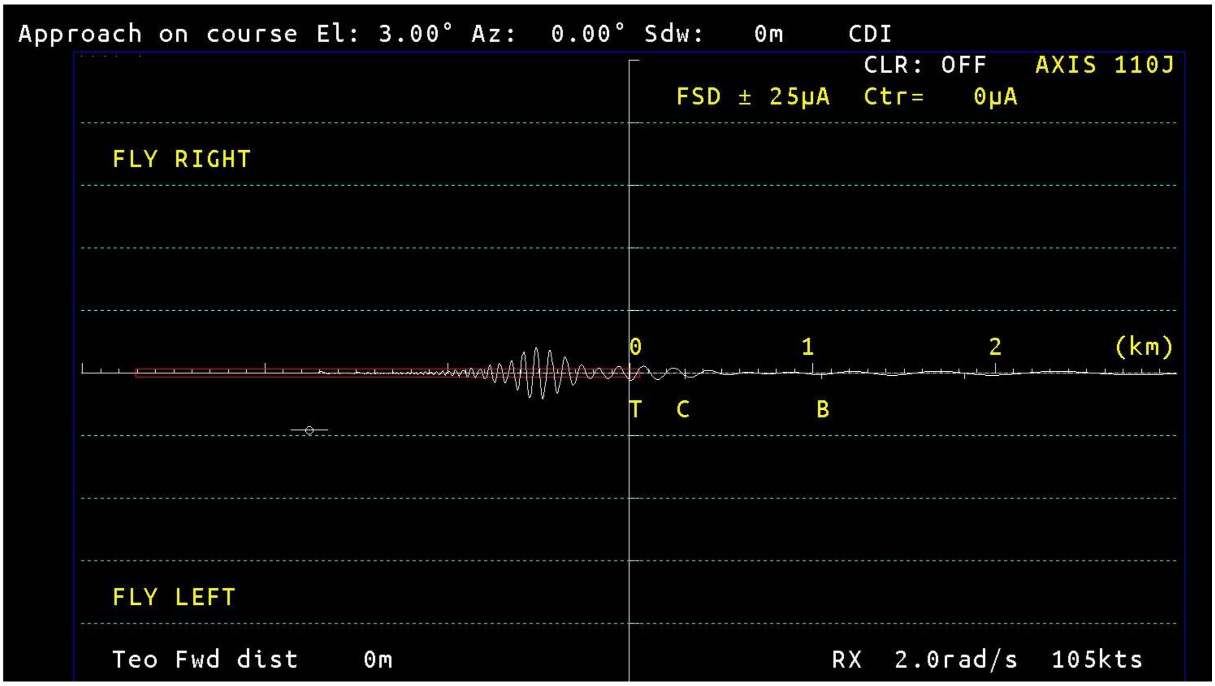

Figure 8. Same situation as in the previous picture, but by switching the clearance off using Alt-C key combination.

The curve shows a different and symmetrical pattern which is typical for a course-course signal disturbance.

The Fixed Position mode

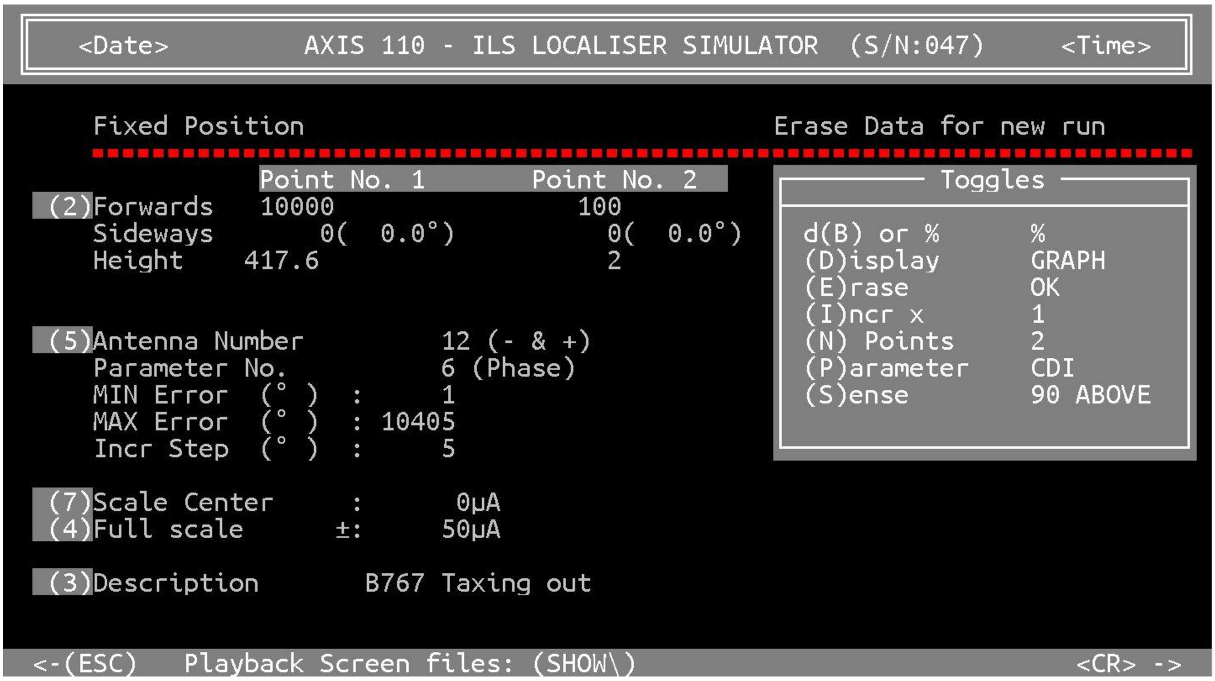

Figure 9. The Fixed Position mode (6) compares the variations in the signal parameters simultaneously in two different physical positions.

Here position 1 is 10,000m away while position 2 is 100m in front of the antenna system.

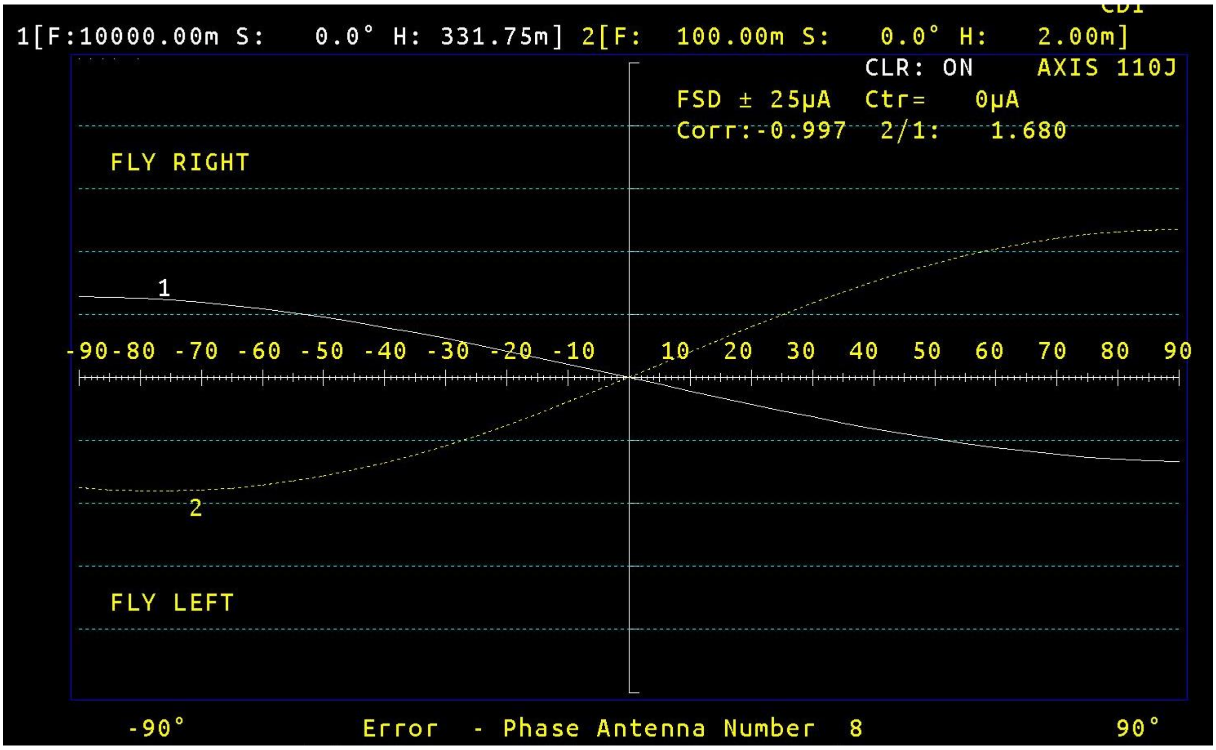

Figure 10. The reaction in these two points for a large aperture antenna system when antenna number 8 (from left when looking form behind) is dephased +/- 90 degrees.

The Bend Analysis mode

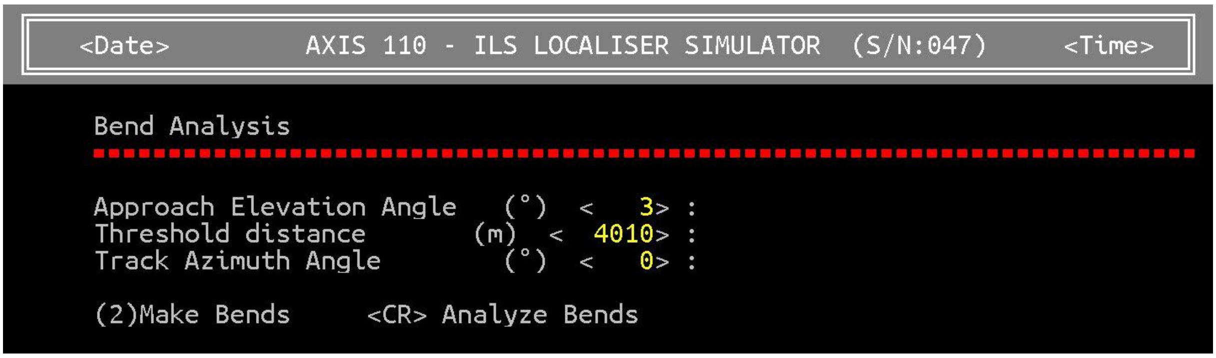

Figure 11. The Bend Analysis mode (8) entry choice.

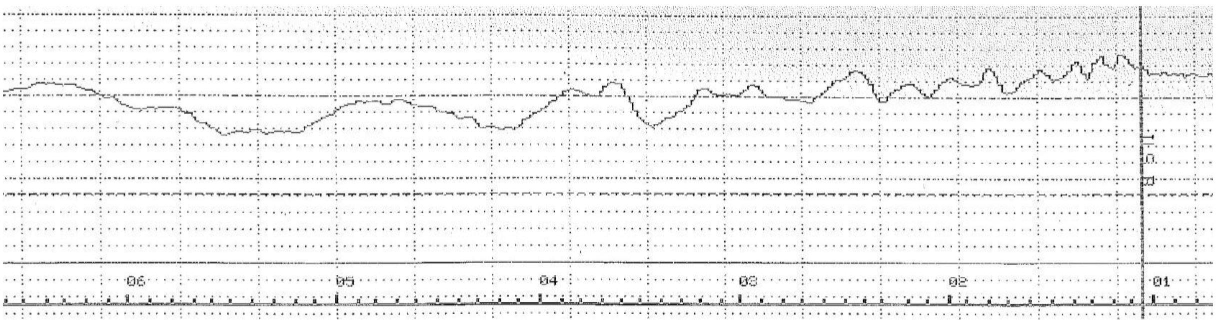

Figure 12. An example of an original curve where smooth looking bend lengths along the curve can be entered and checked for physical the origin of the main scattering object.

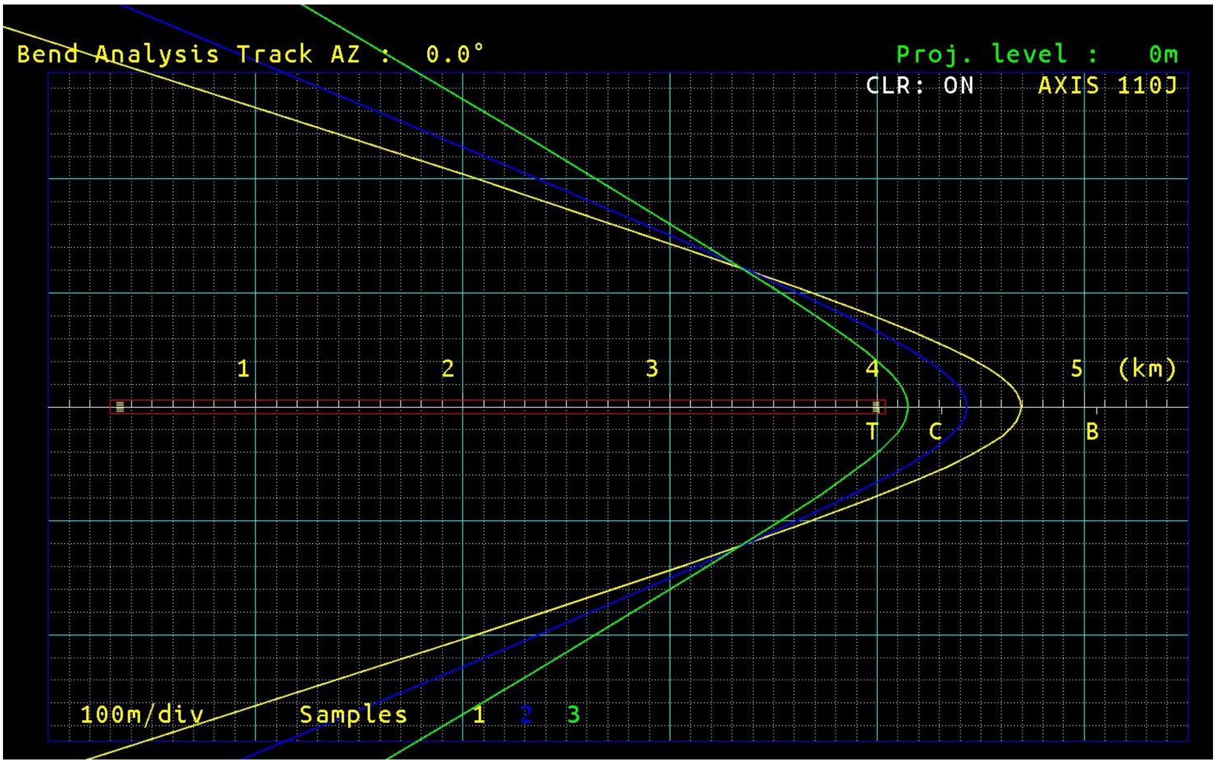

Figure 13. If the extract of bend lengths and distance is done exactly, the physical location of the dominating scattering object could be indicated by crossing hyperbolic lines.

The Sensitive Area mode

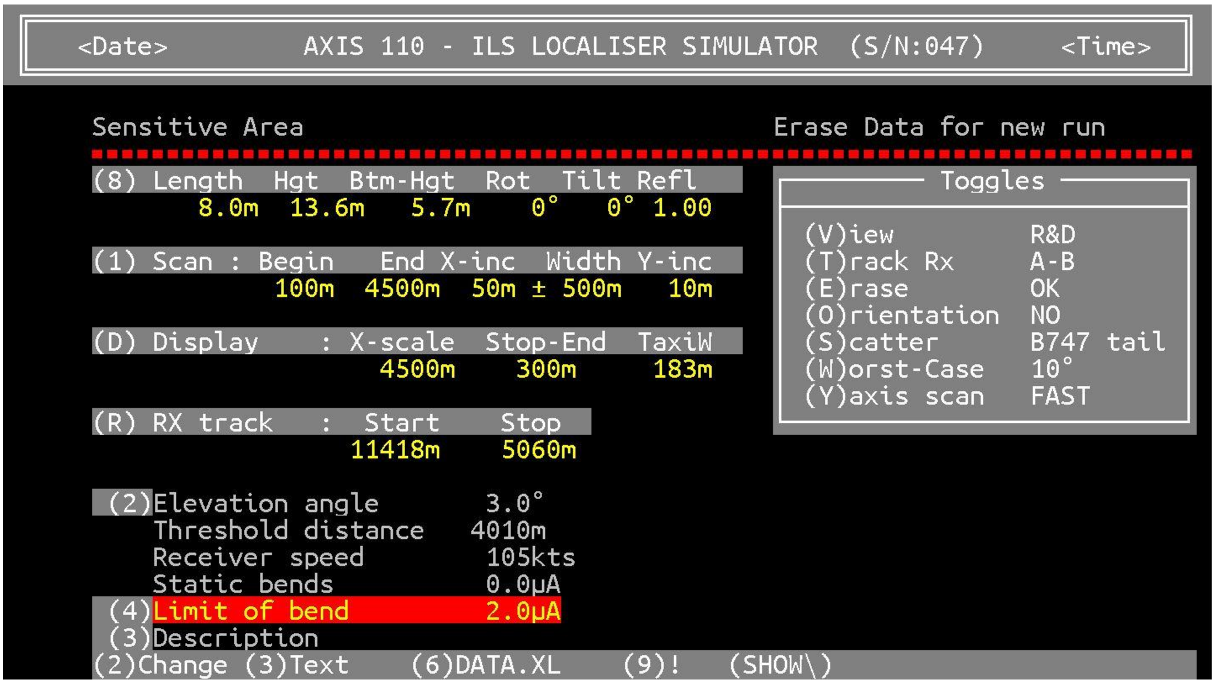

Figure 14. The Sensitive Area mode (9) will show the dimensions of the area where a tailfin of a given aircraft will disturb the next incoming aircraft when exiting the runway after landing.

A number of parameters can be set up in this page, both antenna system, runway length, aircraft type and scanning density.

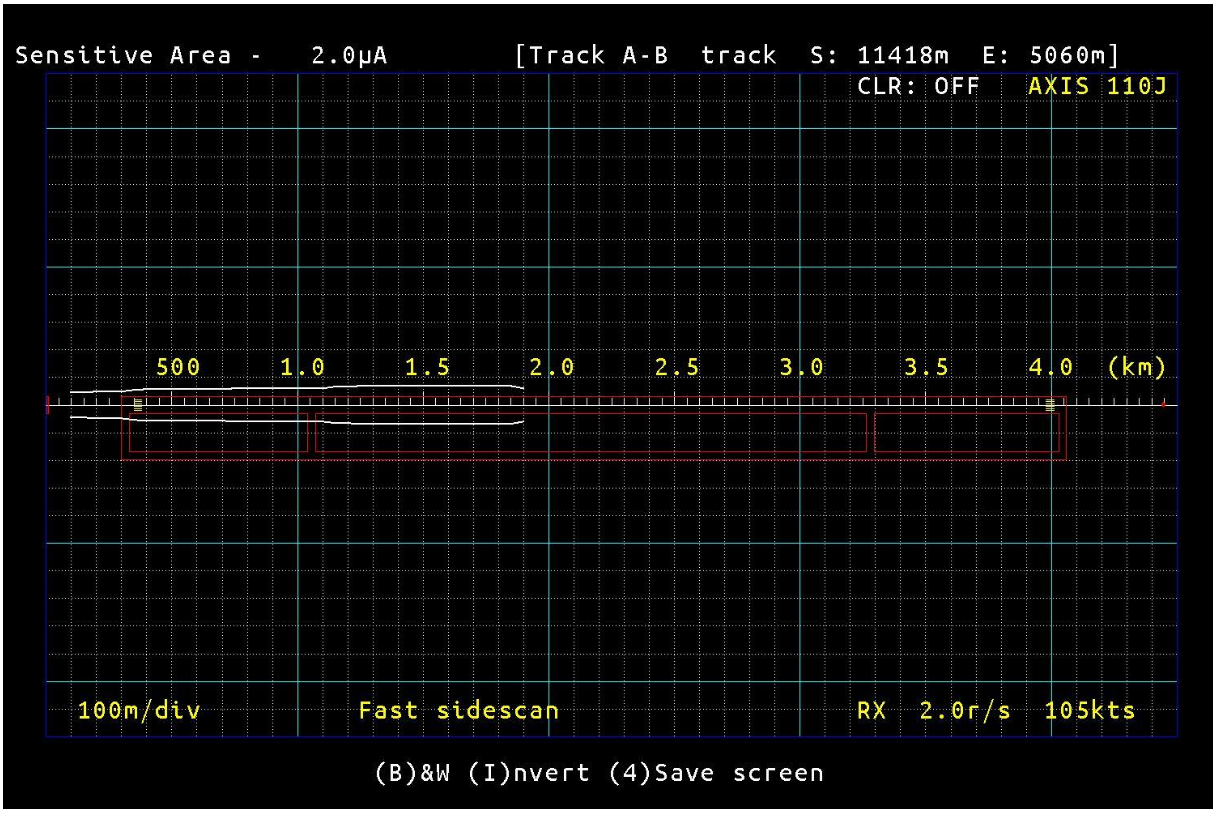

Figure 15. The resulting sensitive area for a Boeing 747 at a 32 elements localiser.

The runway threshold is located 4,000 meters in front of the antenna system, and the limit for accepted disturbance is set to 2uA bend amplitude. There is 100m per square and a table can be printed out to show the exact distance of the curve from the centreline in 50 m intervals.

This mode is highly valuable in order to protect the airport from disturbances due to taxing aircrafts near the runway.

Utilities

Figure 16. An antenna designer is found below the control Panel as item “4”.

The antenna designer is a training mode for learning and understanding the anatomy of a linear wide aperture array. Enter how many antennas there should be in the design, and the desired side lobe level.

The result will show the beam width for the course array, and the side lobe level. You can put this system on your site and see how it will handle the surroundings when you add buildings and other constructions on or near the airport.

Scattering objects

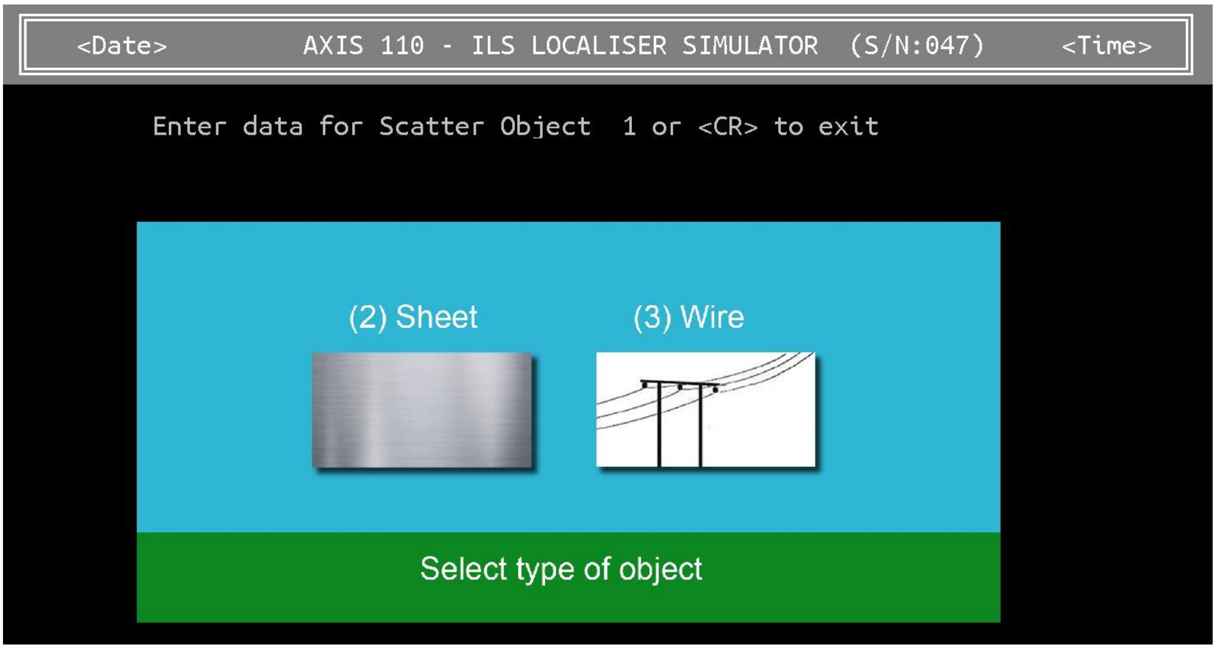

Figure 17. Pressing the “8” key will open up for modelling a sheet or a wire

The **Sheet** will represent a hangar wall visible for both the transmitter and the receiver. It can be located anywhere, and is assumed to be made of smooth metal.

For simulating an aircraft exiting the runway the tailfin is the last part to leave the sensitive area, and normally the only part needed to be modelled.

The fuselage is normally only modelled when the aircraft is entering the runway before lineup and takeoff.

The **Wire** may be high tension lines near the airport visible within the localiser horizontal coverage sector.

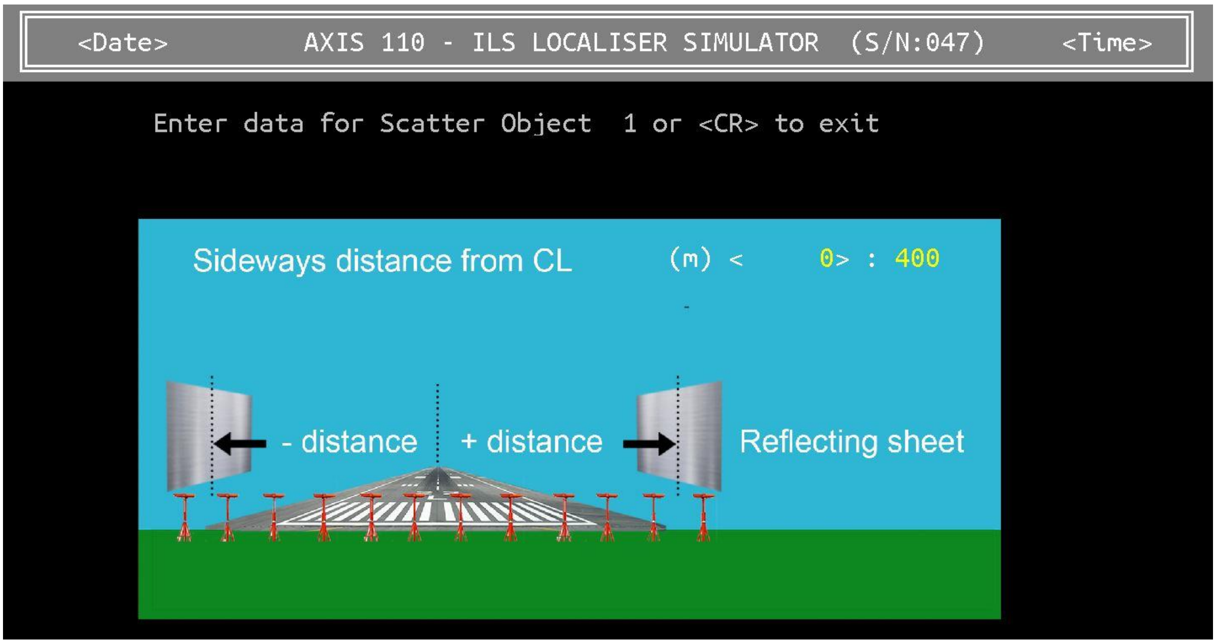

Figure 18. Figures like this will assist in setting up the model for each object.

Specifications

Software platform:	JAVA, free available at Oracle
Operating system:	Any system running JAVA
Computer:	Able to run Microsoft or similar office programs
Development:	Since 1988, and improved according to developments in theoretical understanding and antenna systems.
Customers:	Sold to more than 30 countries
Scattering model:	Physical Object and Ground Current based Diffraction model
Number of scatterers:	Maximum 11 (normally sufficient for visible parts of buildings)

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