The AXIS330 ILS Glide Path simulation software

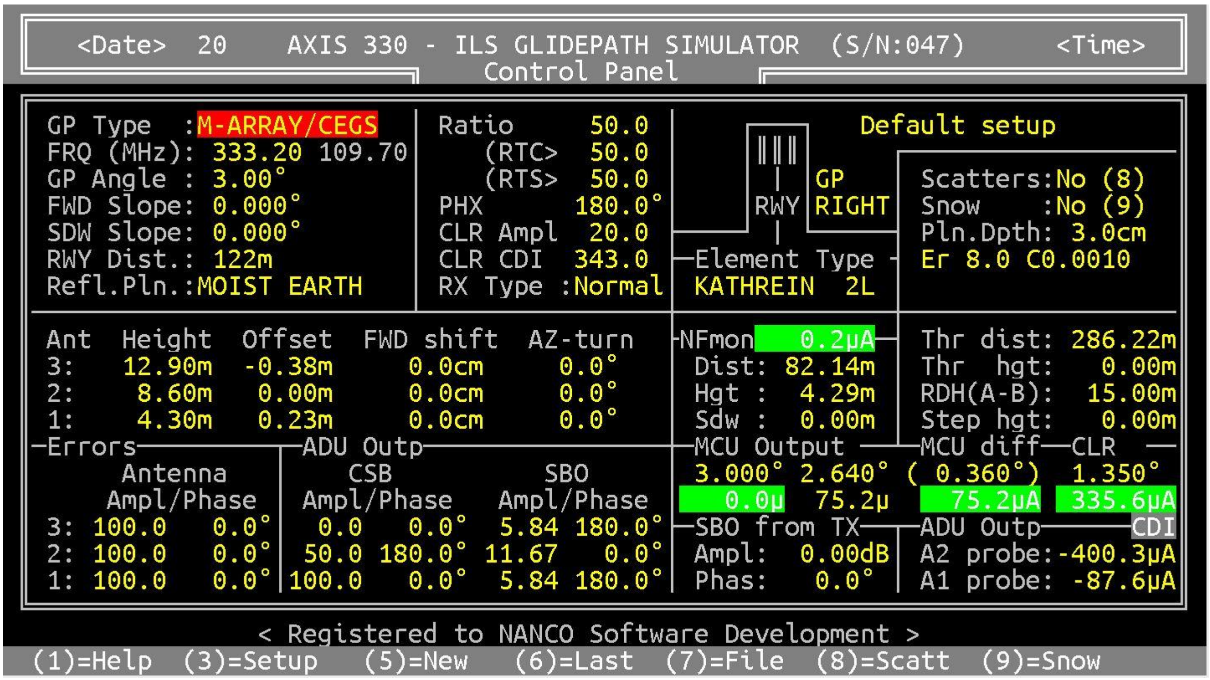

Figure 1. The Control Panel setting up the glide path system basic parameters

The user can easily change the antenna system (Null Reference, Sideband Reference and M-ARRAY, frequency, glide path angle and lots of other parameters in order to match the site. From the Control Panel pressing “Enter” will open the menu where you may run the simulation in eight different modes.

The AXIS330 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. This will 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 planned buildings or constructions at or near the airport area can be predicted by modelling. Experience in site modelling helps prediction of planned GP system performance.

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 until the simulations resemble the actual results, one gets control and understanding of the GP-system performance and behaviour. When the model is established, the simulator can find the optimum adjustment settings to obtain the best possible signal quality.

4 Determine sensitive areas
Establish sensitive areas for aircraft, vehicle movements on taxiways and roads near the GP antennas by simulating the surfaces using rectangular conducting sheets with given sizes and orientations. 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.

5 Simulating the drifting of system parameters

Stability testing by introducing changes in antenna feeds and their mechanical alignment as well as reflection plane slopes to learn what impact this will have on both nearfield and farfield signals within the coverage limits. 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

To learn how the ILS Glide Path 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

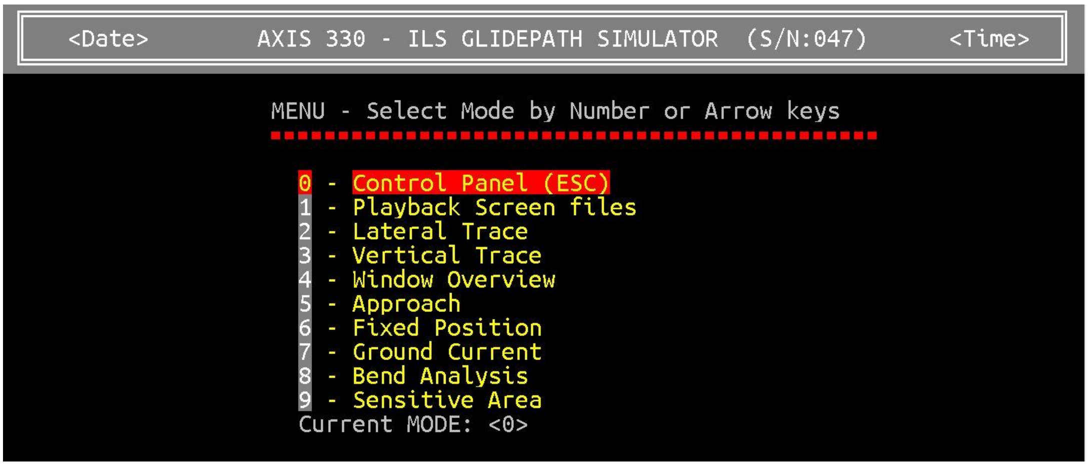

Figure 2. The menu gives access to eight different modes.

The different menu lines show keywords for how the mode works, and more details will follow in the subsequent text. Item (1) Playback Screen Files can be used to play back saved screen in the modes to follow. Often used for demonstration or comparison purposes.

Lateral Trace

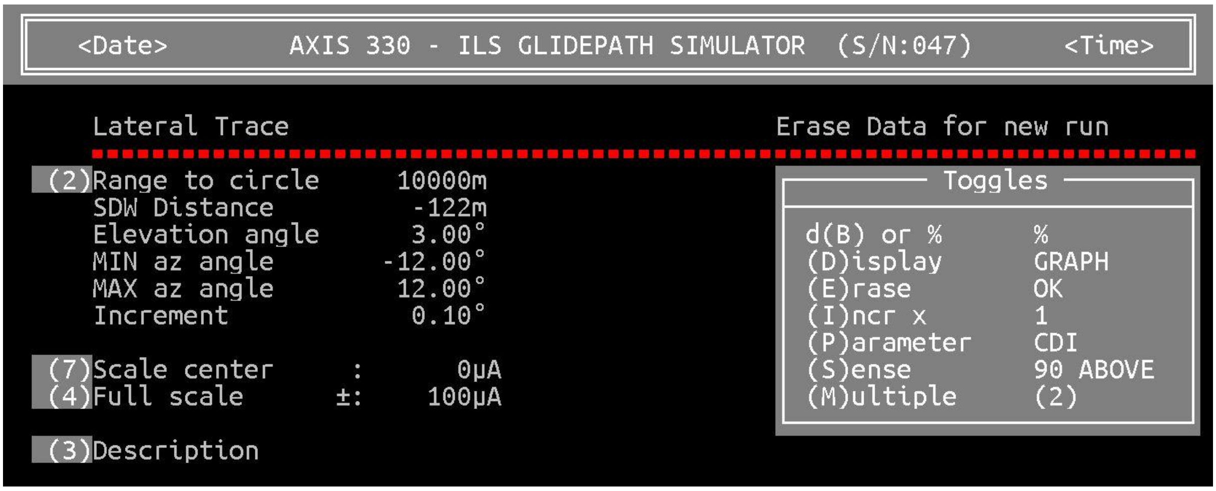

Figure 3. Lateral Trace mode (2) simulates a horizontal flight across the coverage sector.

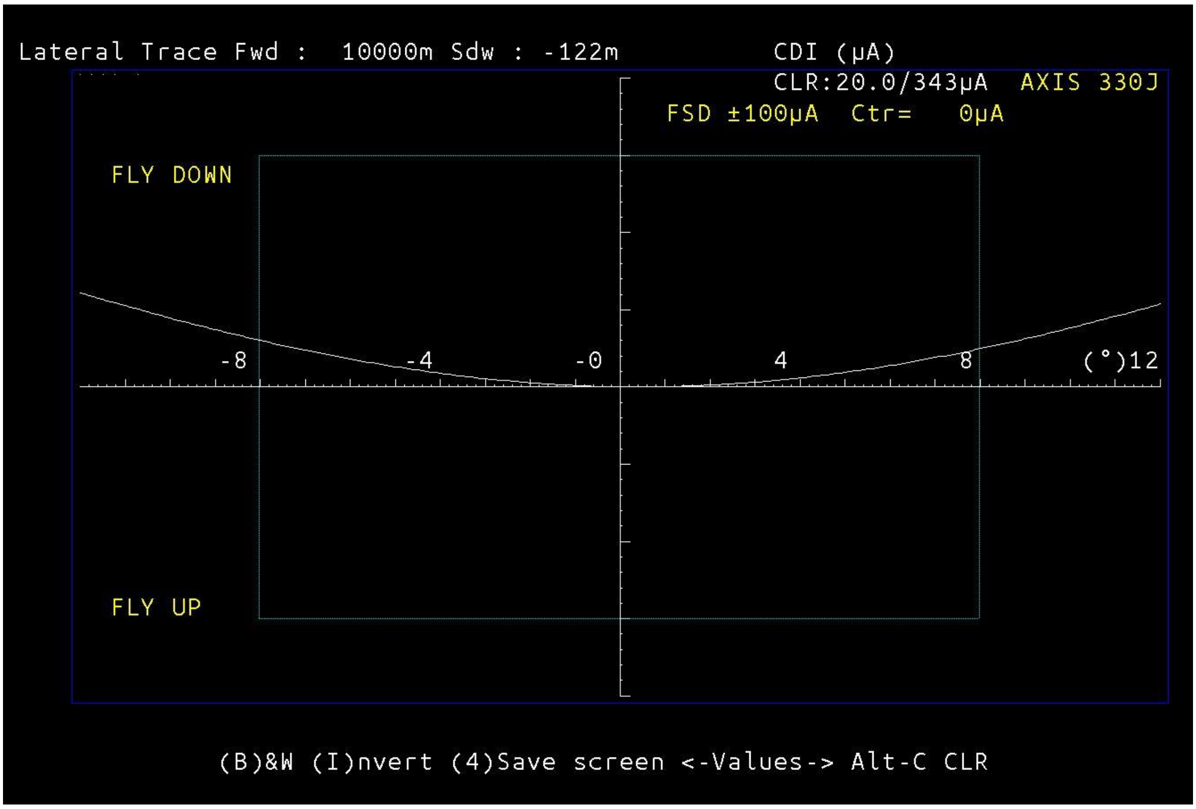

Figure 4. The CDI mode shows the CDI or % DDM as selected at the glide path angle across the 8 degrees coverage sector.

Vertical Trace

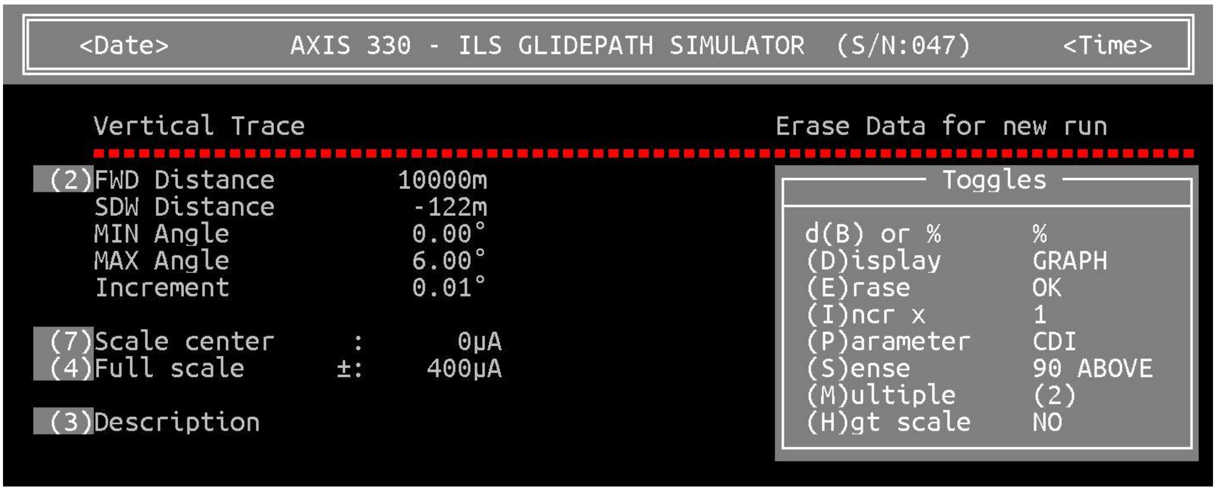

Figure 5. The vertical Trace mode (3) simulates a vertical line above a point on the ground.

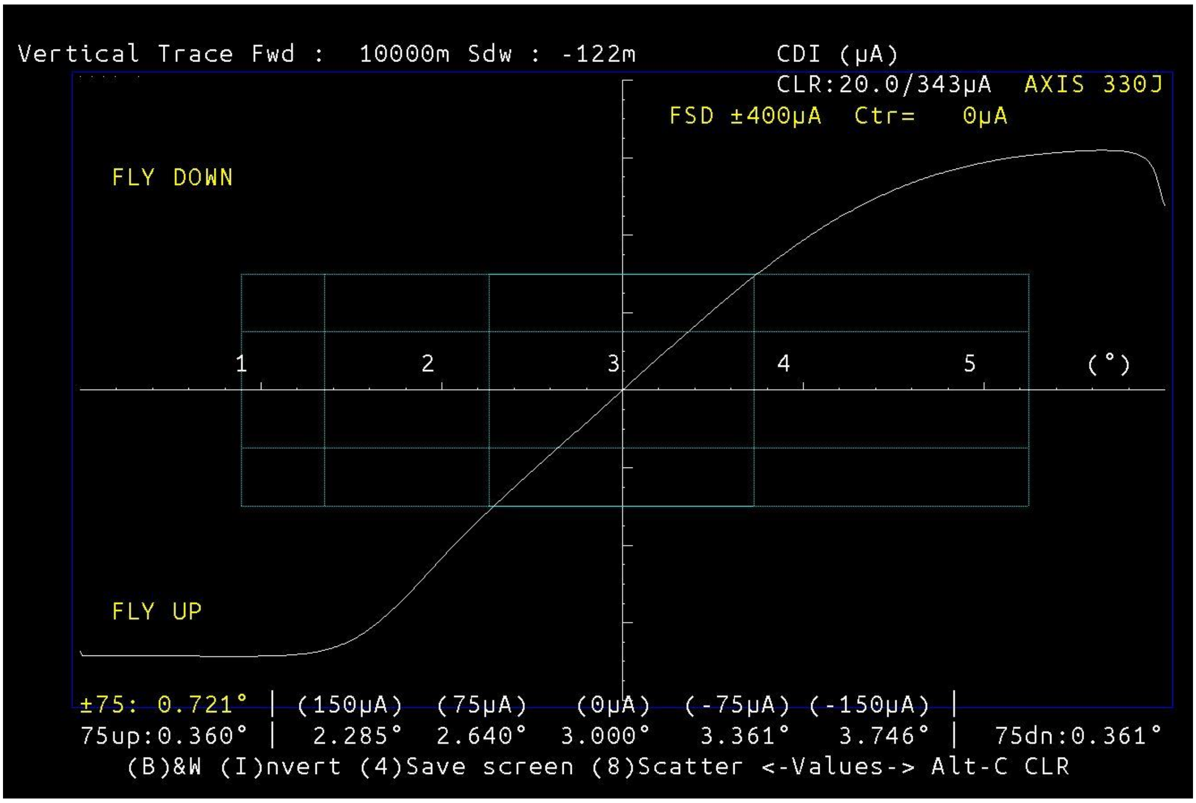

Figure 6. The CDI mode shows the CDI (or % DDM as selected) along a vertical line from 0 to twice the glide path angle.

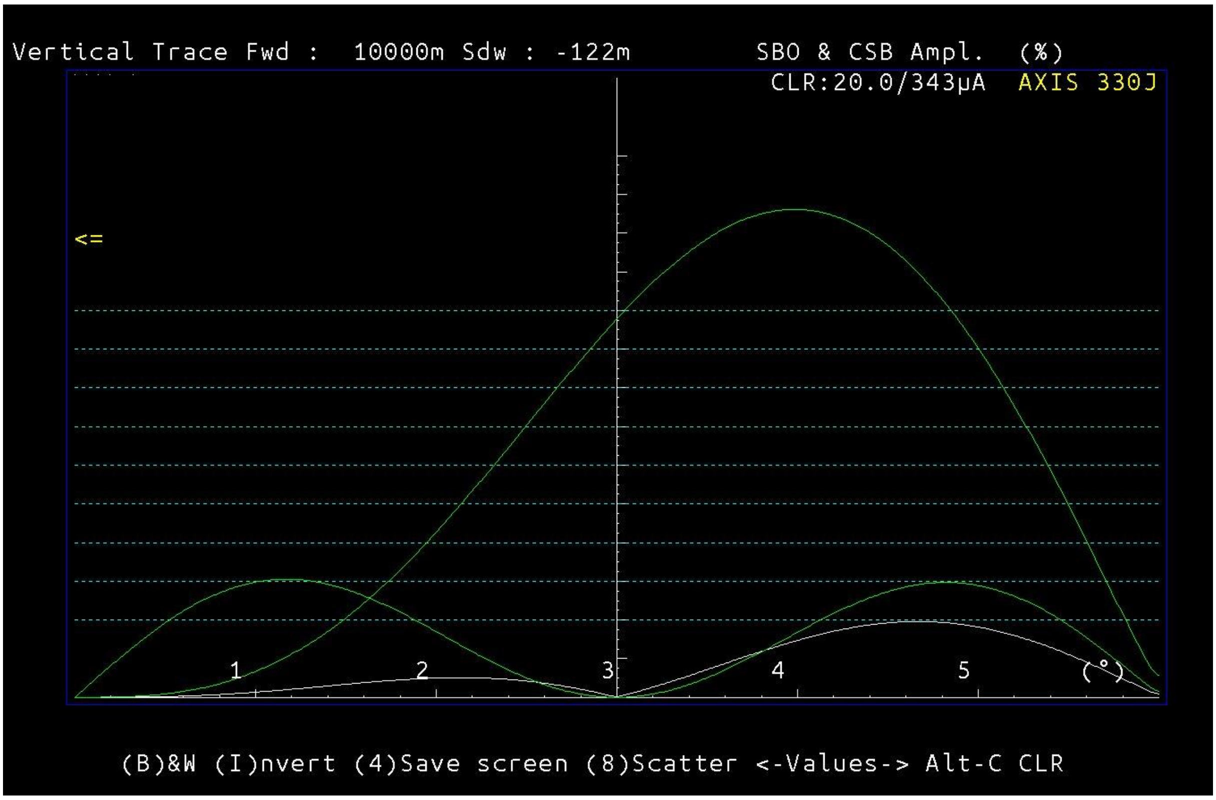

Figure 7. The amplitude of the course SBO, CSB and clearance can be shown in dB or % relative to the peak course CSB level. A cursor can be moved to read details along the curve.

The Windows mode

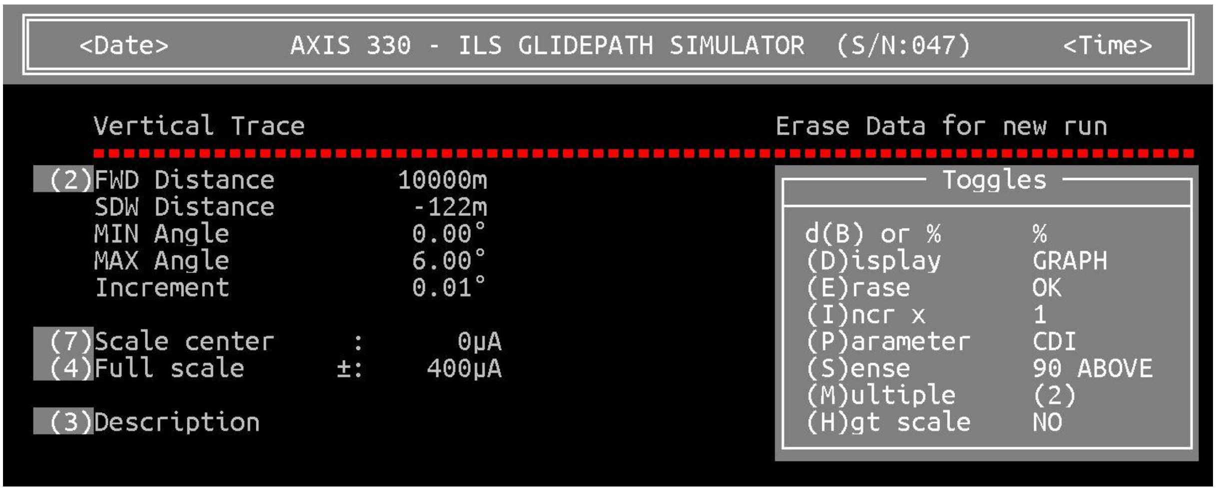

Figure 8. The Windows Mode (4) menu sets all variables desired for controlling and displaying the CDI/DDM and clearance values in the entire glide path coverage sector.

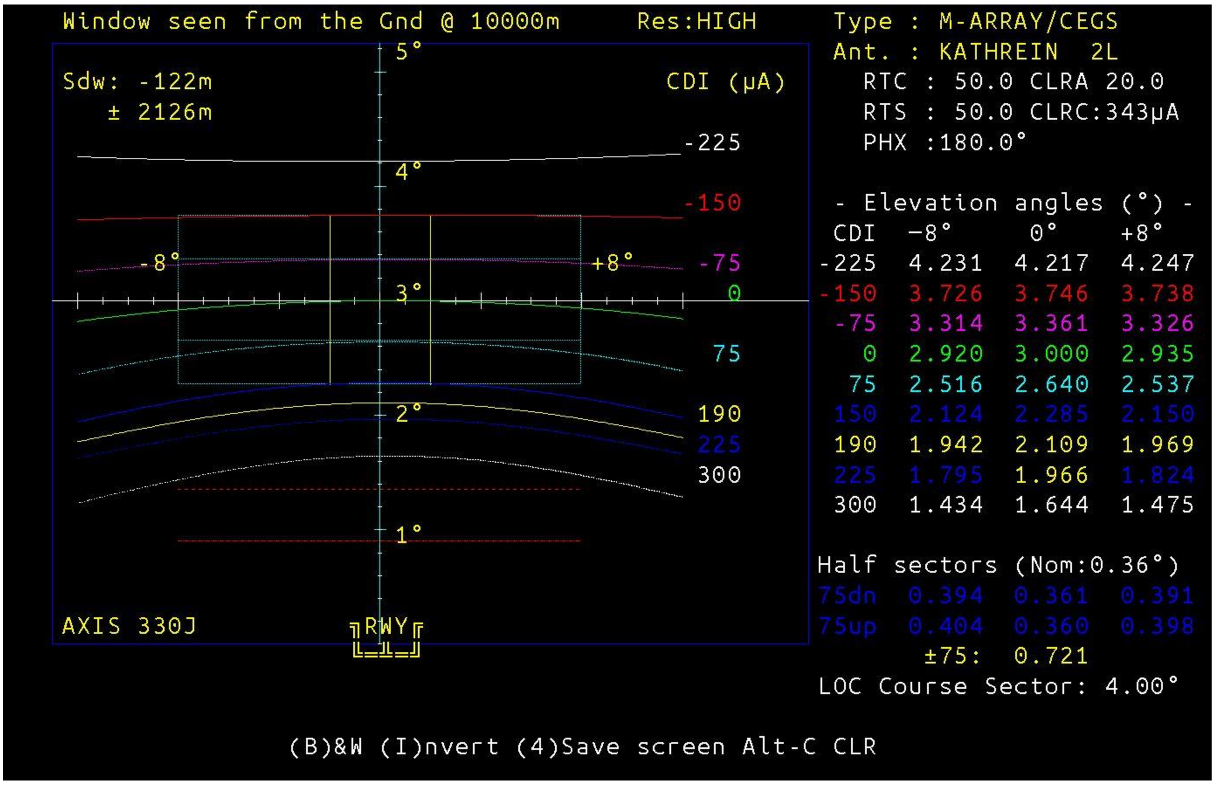

Figure 9. This shows a "window" across the approach sector where each CDI value in 75uA steps are shown in different colours.

The table on the right hand side shows at which elevation angle the lines are crossing given azimuth angles. In this example -8, 0 and +8 degrees, but these angles can be set to different values.

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

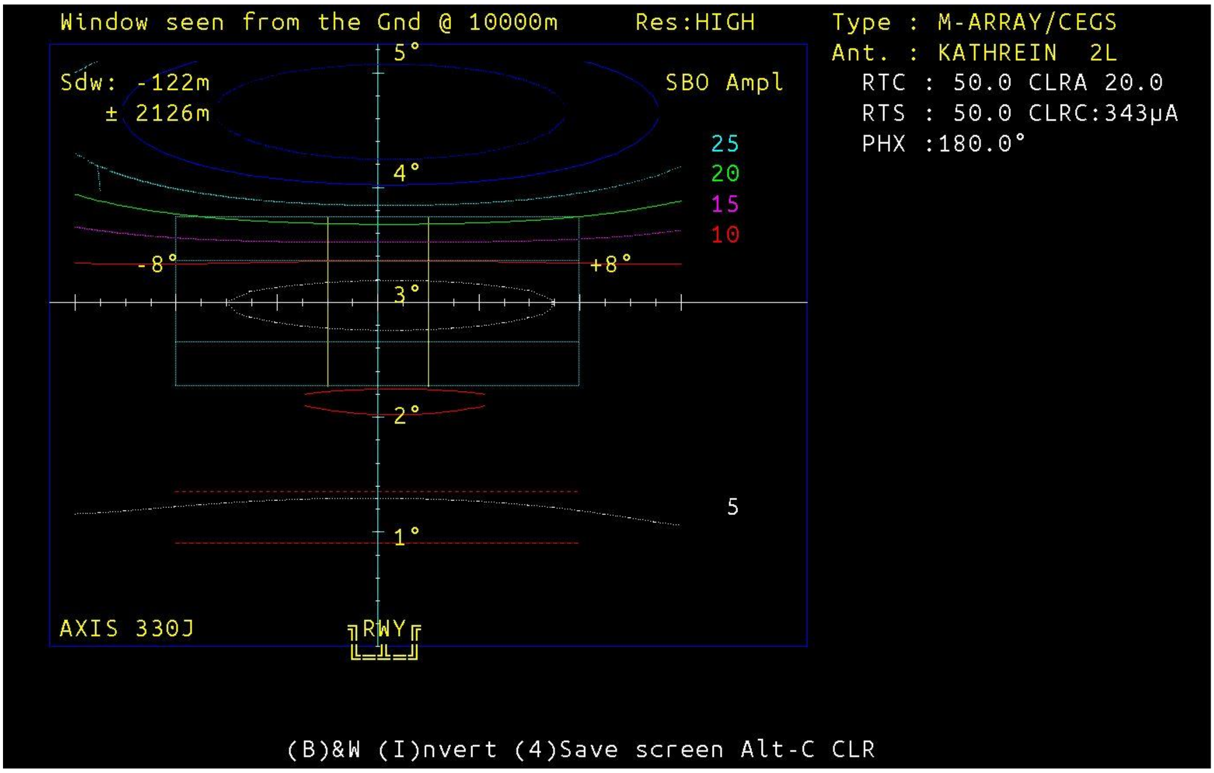

Figure 10. The window can also show amplitude values across the entire window, which is useful information when optimizing an M-ARRAY glide path to an adverse site.

Approach mode

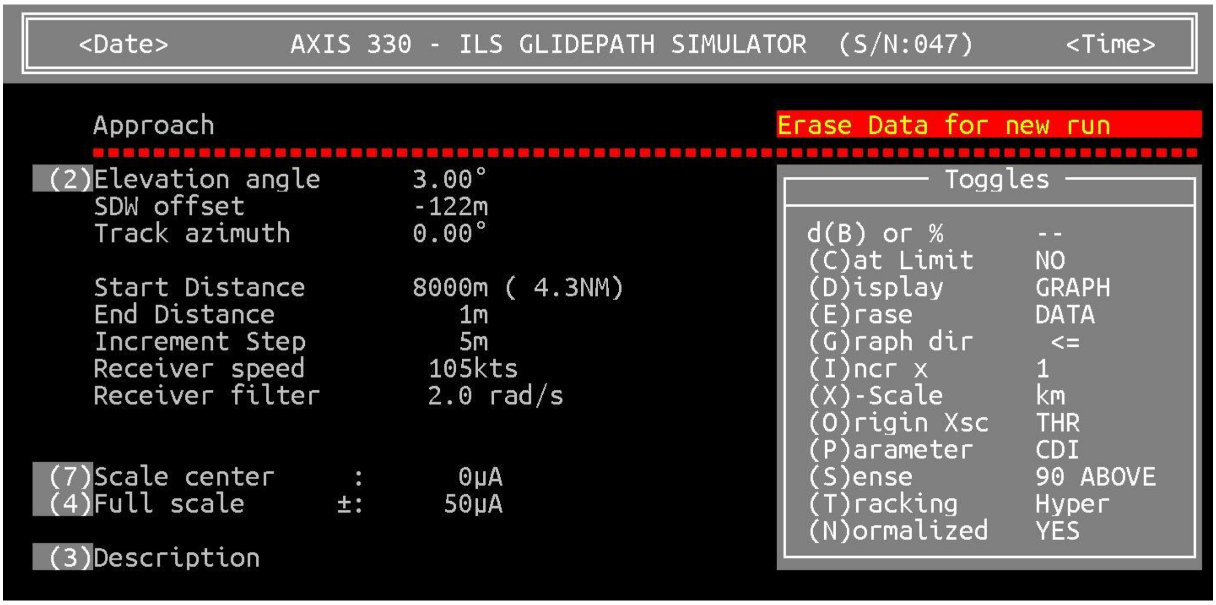

Figure 11. The Approach Mode (5) menu sets all variables desired for controlling and displaying the Fly Down along the glide path angle along the runway centre line.

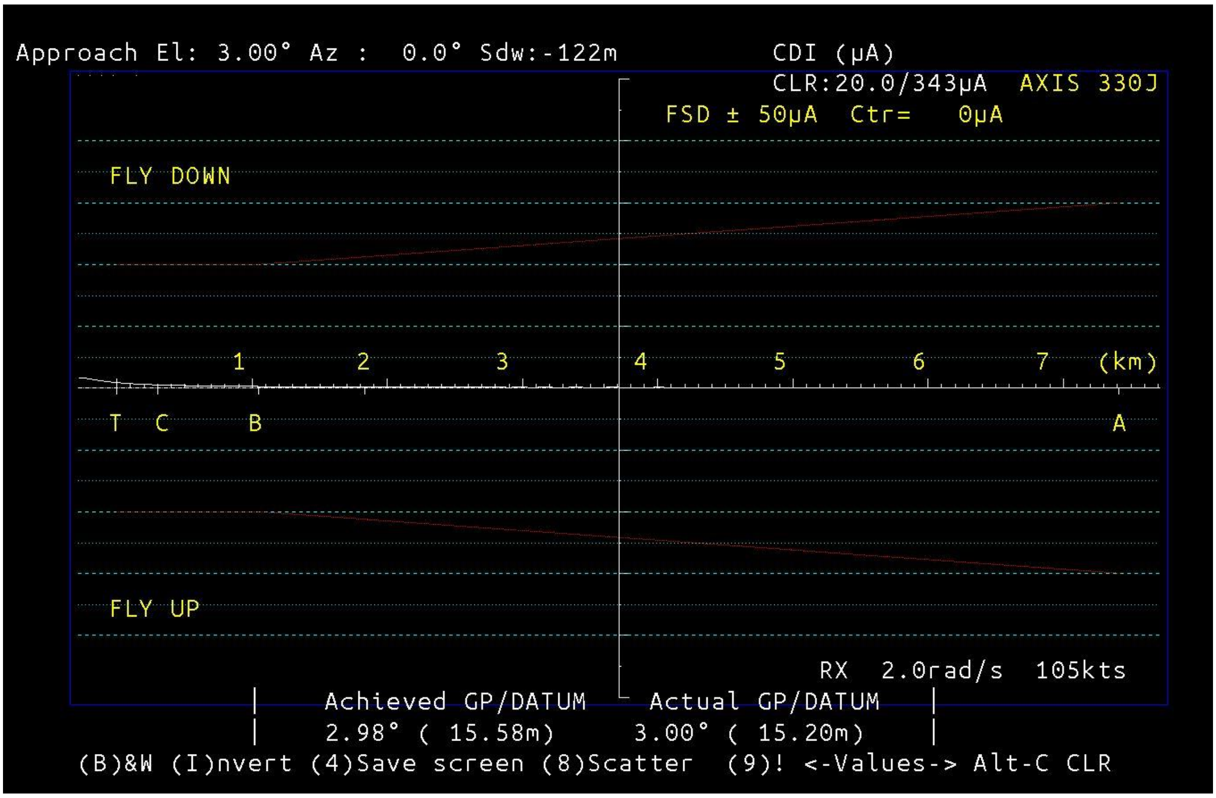

Figure 12. The approach mode shows a nearly straight line when following the hyperbolic curve (selected by (T)racking in the menu) where the CDI/DDM is zero all the way in.

If one or more scattering object are modelled the curve is likely to show disturbances due to reflections or diffractions from the said objects.

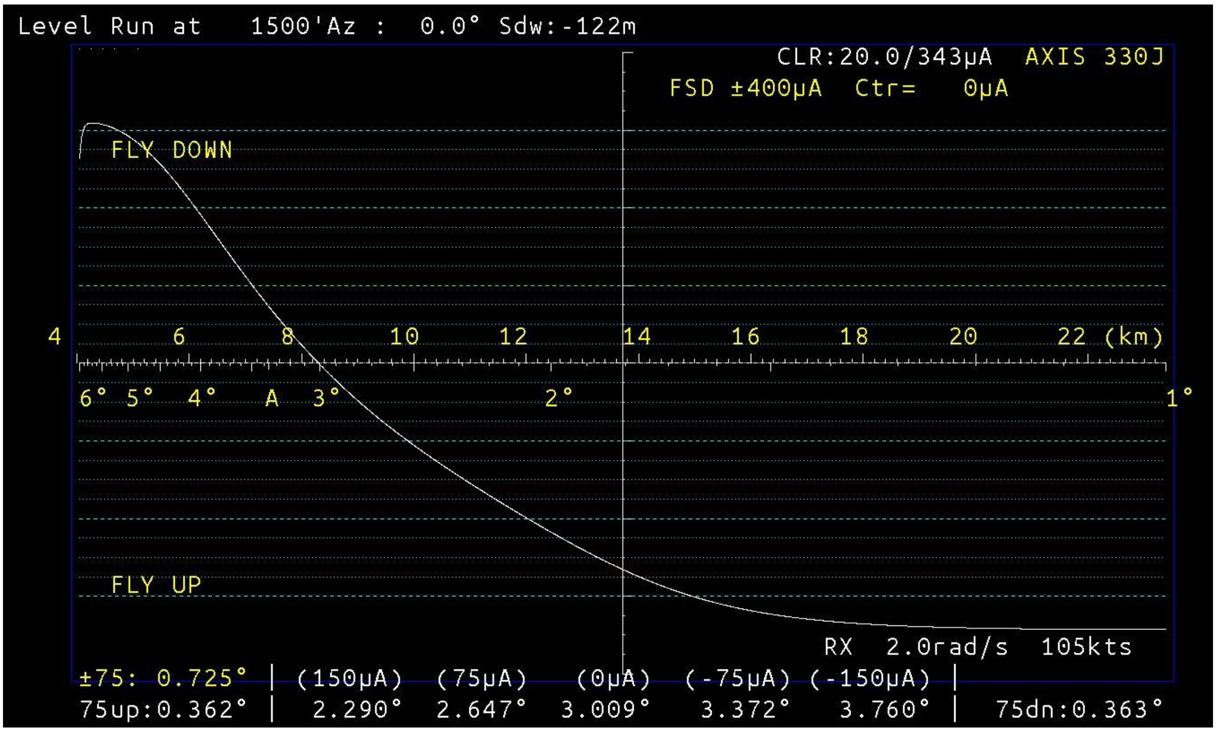

Figure 13. By choosing Level run with the (T)racking key, the curve will be like this.

The level run is flown as a horizontal flight at a constant height.

Fixed Position mode

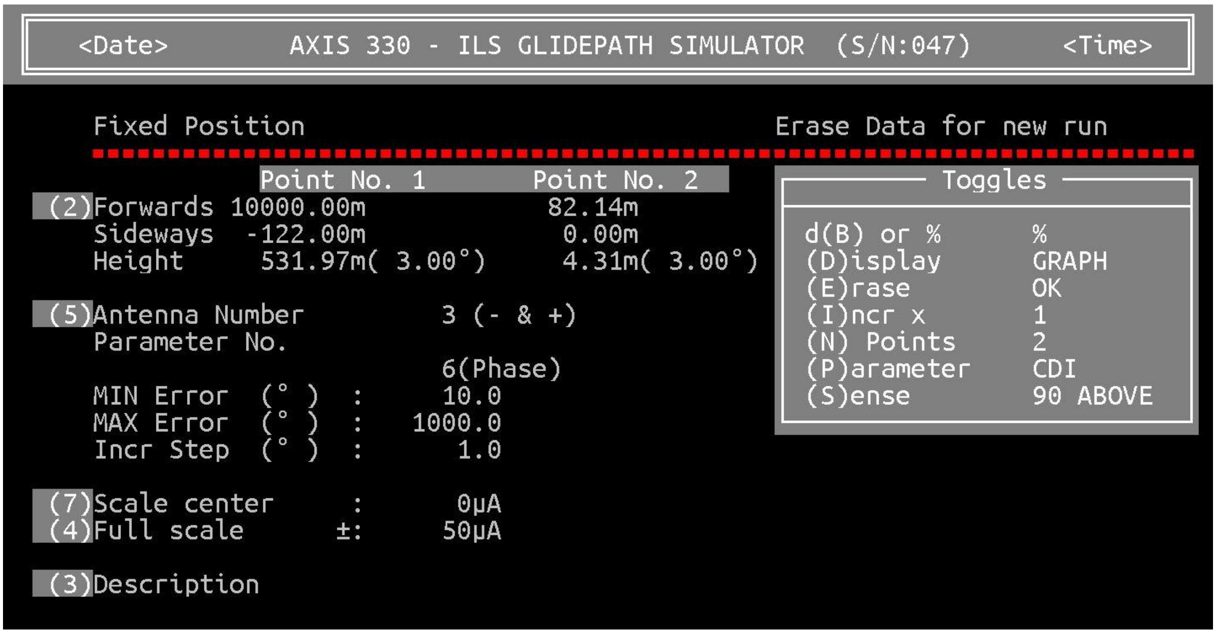

Figure 14. The Fixed Position mode (6) compares the variations in the signal parameters simultaneously in two different physical positions.

Here position 1 is 10,000m away in the far field, and position 2 is the NF monitor 82m directly in front of the antenna system.

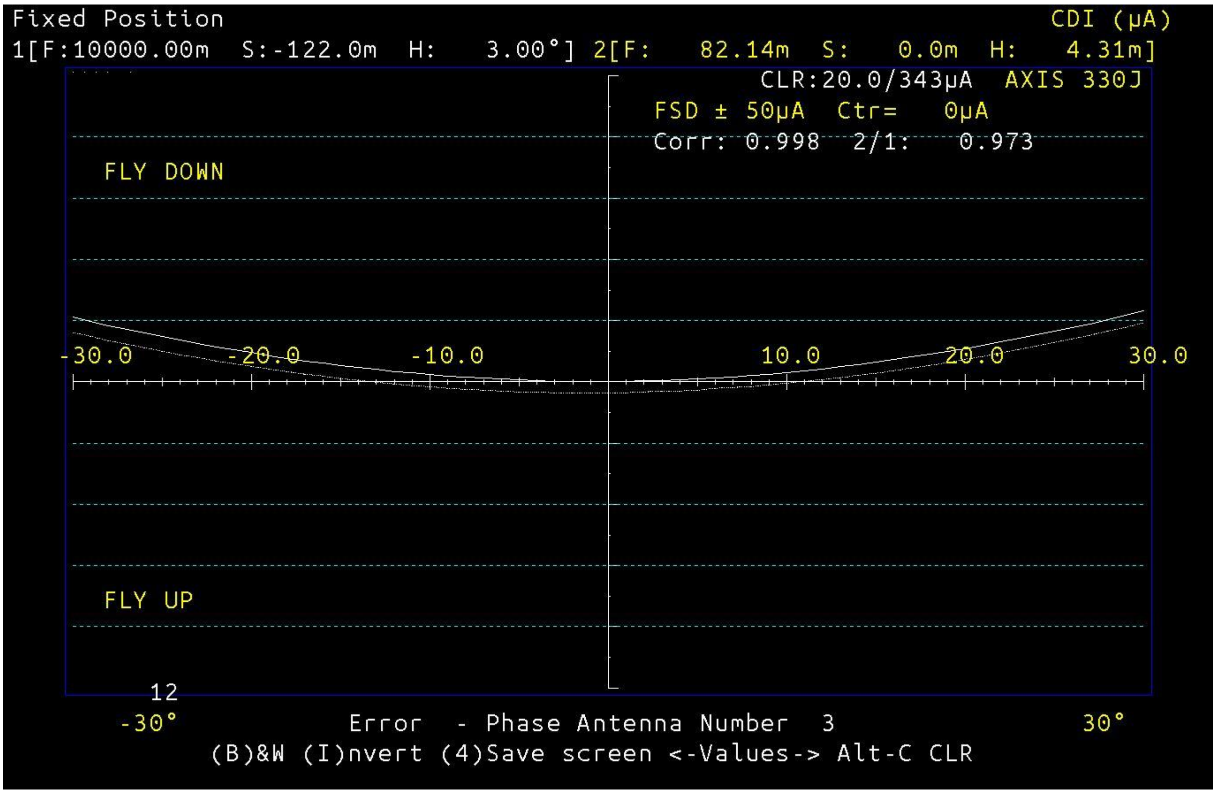

Figure 15. The reaction in the far field and at the near field monitor are quite similar when antenna number 3 (the upper one in the M-ARRAY) is dephased +/- 30 degrees.

The Bend analysis mode

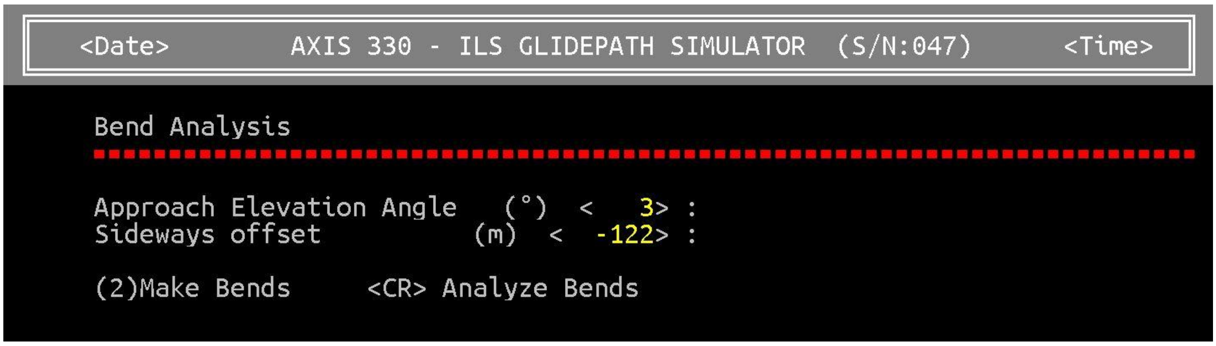

Figure 16. The Bend Analysis mode (8) entry choice.

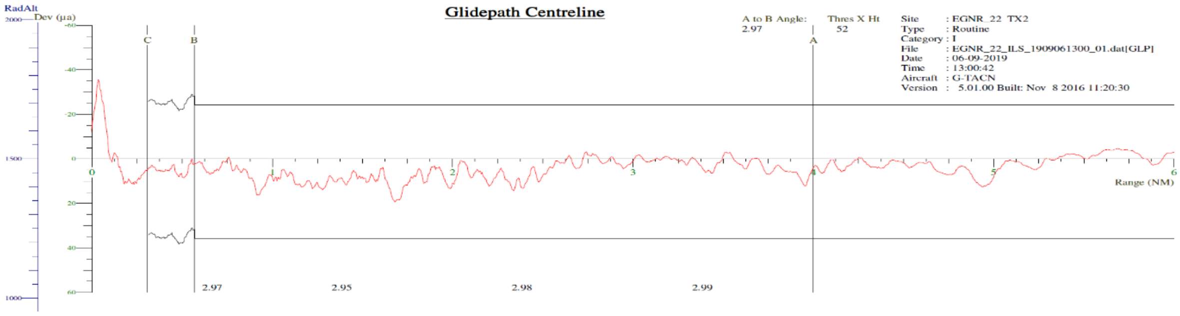

Figure 17. An example of an original curve where smooth looking bend lengths along the curve can be entered and checked for physical the origin of the main scattering object.

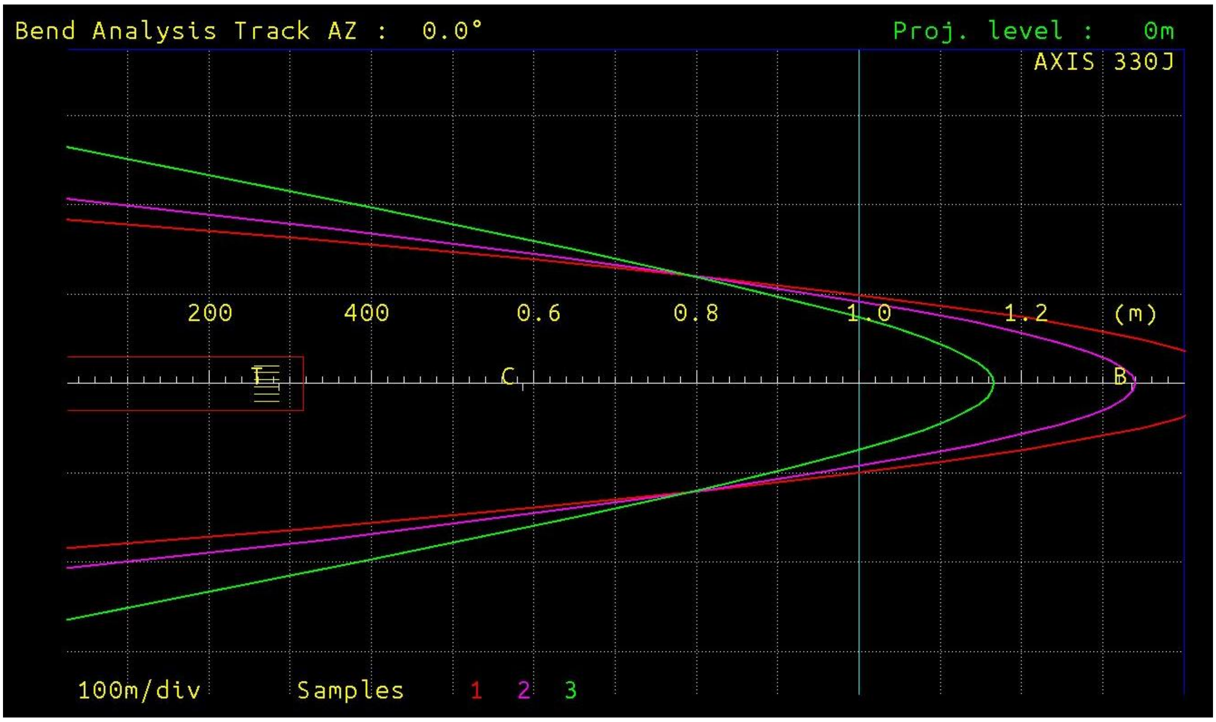

Figure 18. If the extract of bend lengths and distance is done exactly, the physical location of the dominating scattering object could be indicated by crossing hyperbolic lines.

The Sensitive Area mode

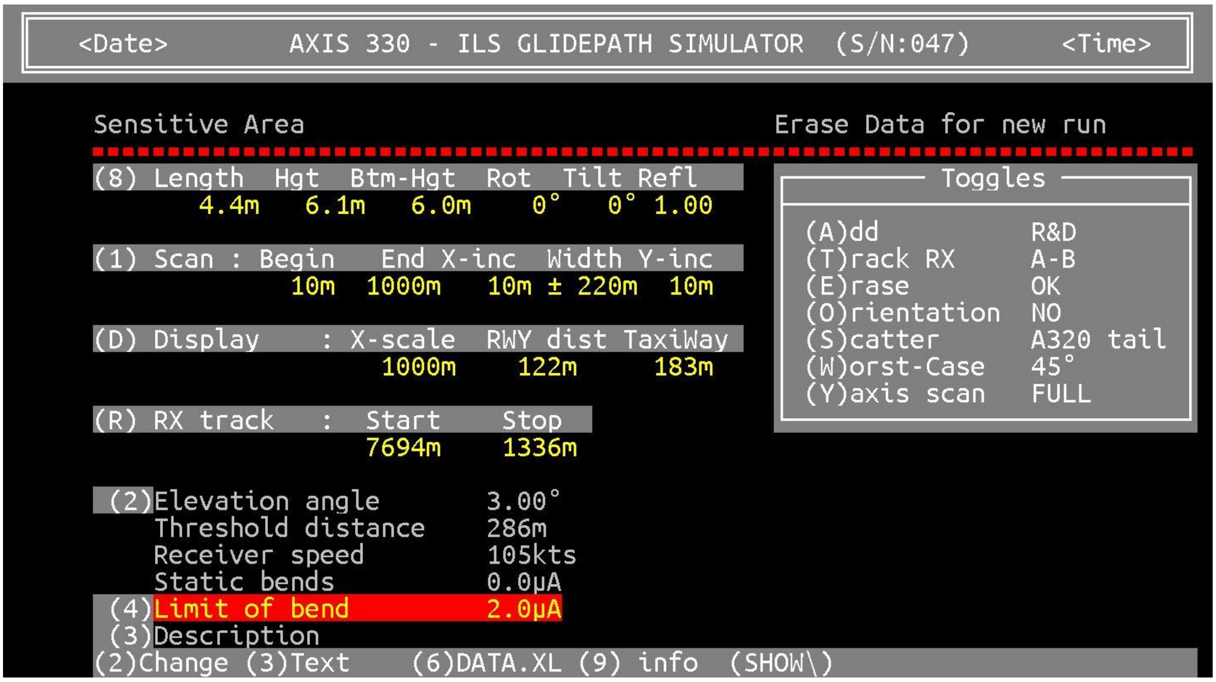

Figure 19. The Sensitive Area mode (9) will show the dimensions of the area where a given aircraft or vehicle will disturb the glide path signal for incoming aircrafts.

A number of parameters can be set up in this page, and this function should be used with caution if the user is not experienced with this type of analysis.

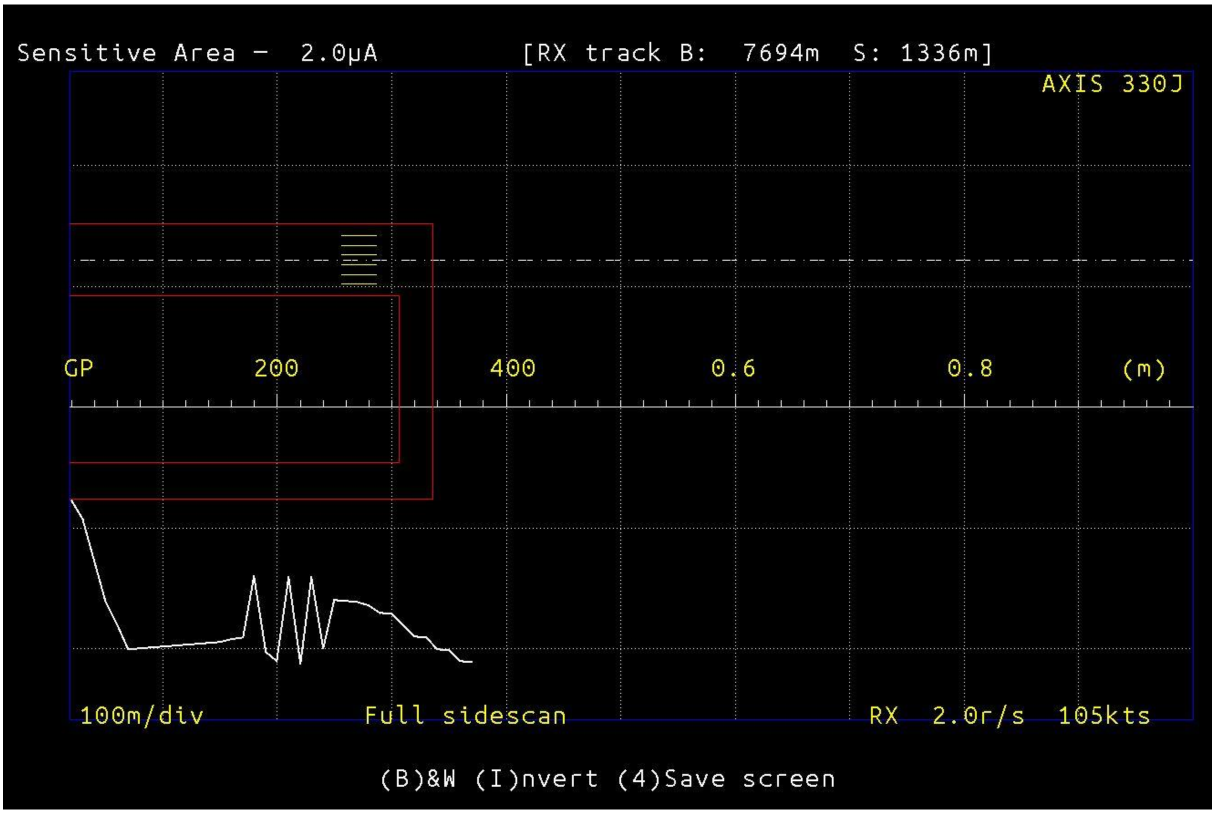

Figure 20. The resulting sensitive area for a tailfin only. In this case the fuselage should also be modelled and run separately.

Scattering objects

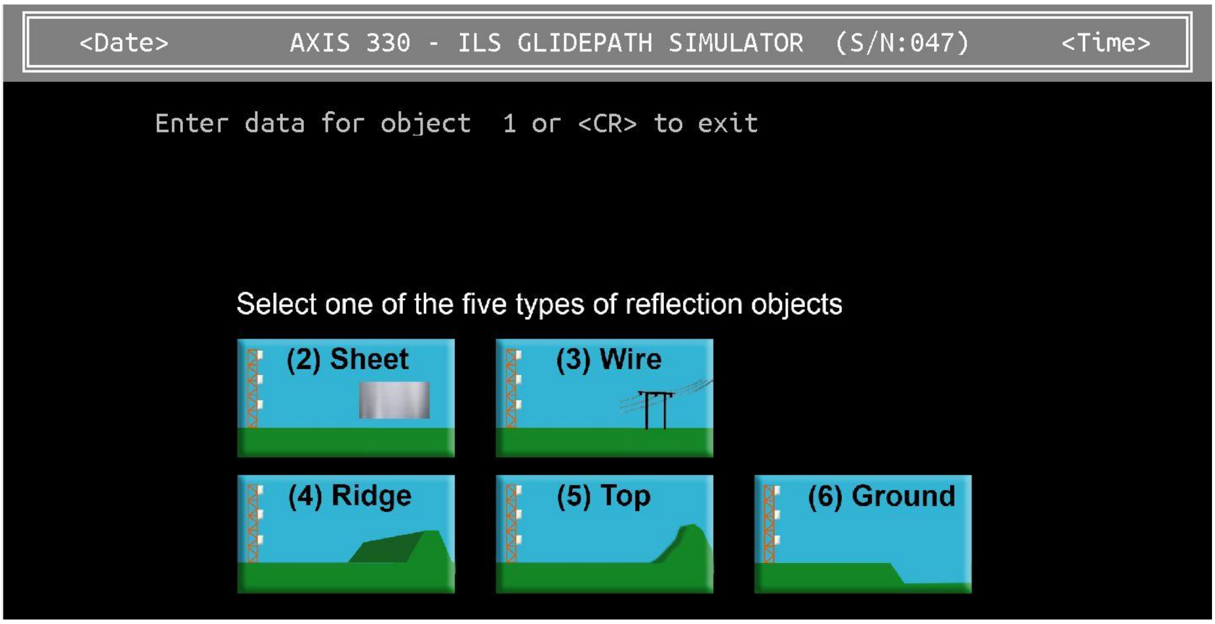

Figure 21. Pressing the "8" key will open up for modelling five types of scattering objects.

The **Sheet** will represent a building wall, a vehicle, a mast or a fence section.

Wires are often hight tension lines near the airport, and **Ridges** are often noise reducing embankments built around part of the airport.

An often used type is **Top** as it represents a single point, and can handle the illumination directly to that point in a very useful way. This is of importance for those working on optimizing the signal quality, trying to reduce illumination of identified scattering objects.

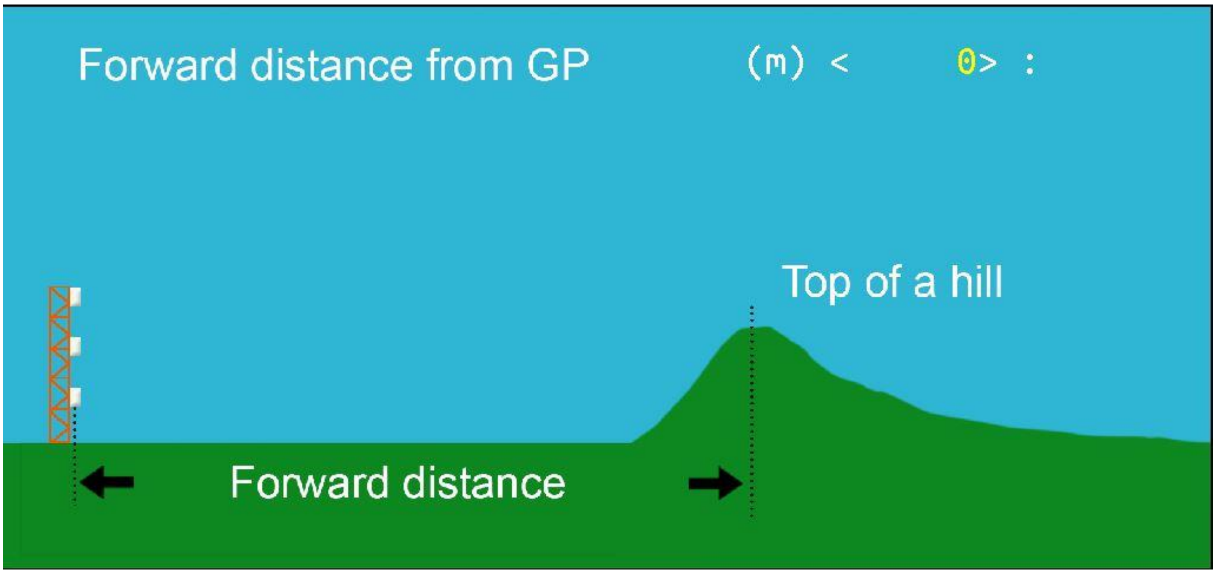

Figure 22. Figures like this will assist in setting up the model for each object.

Ground is only shown as an option first time you select an object, and is used when there is a short ground plane ending in an edge, and maybe a secondary lower reflection plane beyond the edge.

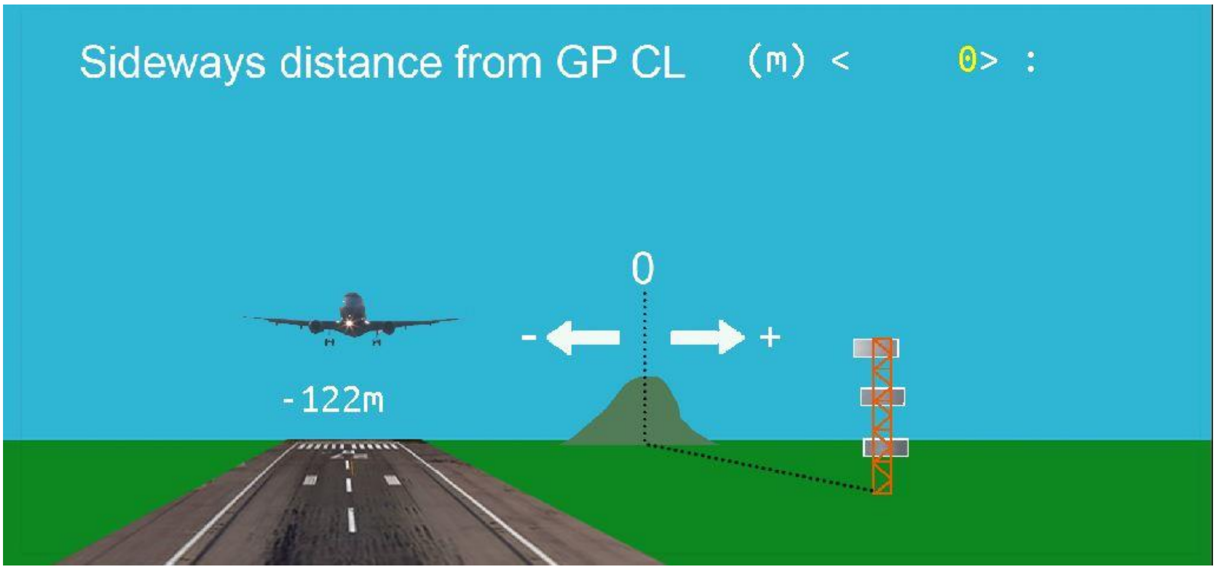

Figure 23. Example of guidance to enter the sideways distance to a Top at a distance in front of the glide path antenna system.

Optimizing the M-ARRAY

The M-ARRAY system can be optimized in order to reduce the bends and scattering when installed in adverse terrain. The AXIS 330 has the capability to automatically optimize the antenna feeds to minimize the bends due to an identified scattering object or insufficient ground reflection plane.

This is a safe and well proven method, and has "straighten out" a large number of poor quality M-ARRAY glide path signals by using this optimizing technique.

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

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