

StructureScan™ Optical

Quick Start Guide

A Fast Check List for Field Operation

Introduction	1
Section 1: Startup System	2
Section 2: ConcreteScan Data Collection	3
Section 3: ConcreteScan Data Playback and Review	8
Section 4: StructureScan Optical Collection	9
Section 5: C-Scan Display of StructureScan Data	14
Section 6: Using the Save Image Function	19
Section 7: Data Transfer to a PC	21
Appendix A: Survey Wheel Calibration	23
Appendix B: Figuring out the Correct Dielectric Value	24
Appendix C: How to Put Your System Together	26
Section 8: Data Processing Setup with RADAN 7	31
Section 9: Processing StructureScan Grid Files for C-Scan (or Depth Slices) in RADAN 7	32
Section 10: StructureScan Super 3D	35



Please Note:

Your StructureScan Optical System is equipped with a "deadman switch." The red grip on the minicart handle must be fully depressed at all times in order for your system to function properly.

Because of this feature it is legal to operate this system on all surfaces including walls.

Introduction

This Quick Start guide will help you with the field operation of the two main modes of the StructureScan™ Optical system: ConcreteScan and StructureScan. This is meant as a supplement for the SIR® 3000 manual that was also included with your system. Be sure to read through both this document and the main manual before starting work.

- Use **ConcreteScan** with the 2.6 GHz, 2.0 GHz Palm, 1.5/1.6 GHz, 1 GHz or 900 MHz antennas. ConcreteScan is for a quick linescan into a concrete slab. You will use it to note the location of a rebar, conduit, PT cable, etc., in real time so that you can mark its location on the slab. ConcreteScan data is not intended for processing in RADAN™. Sections 2 and 3 of this guide will focus on ConcreteScan.
- Use **StructureScan** with only the 2.6 GHz, 1.6 GHz or 1.5 GHz antenna, the optical minicart, and the bar coded paper mats. StructureScan will allow you to collect 3D data that can be quickly and easily imaged directly on the SIR 3000 or processed and examined in RADAN. StructureScan is best for those times when you either have complicated layouts or dangerous materials in the slab and you need that added confidence of seeing the whole picture before you cut or core. Sections 4 and 5 of this guide focus on StructureScan Optical operation.

Section 1: Startup System

1 Connect the antenna to the SIR 3000.

- If you are using the 900 MHz antenna, attach the survey wheel assembly to the antenna. Connect the antenna to the system with the control cable.
- If you are using the 2.6 GHz, 1.5/1.6 GHz or 1.0 GHz antenna, velcro the antenna into the minicart. Make sure that the lead from the minicart (short, black cable) is connected to the antenna's electronics box. Plug the serial cable into the back of the SIR 3000. Tighten down the serial cable thumbscrews to secure.
- If you are using the Palm antenna, plug the cable from the Palm directly into the SIR 3000.

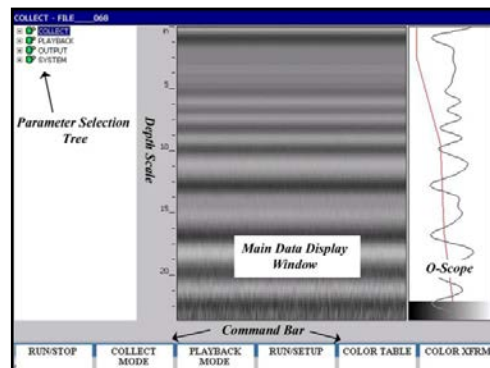
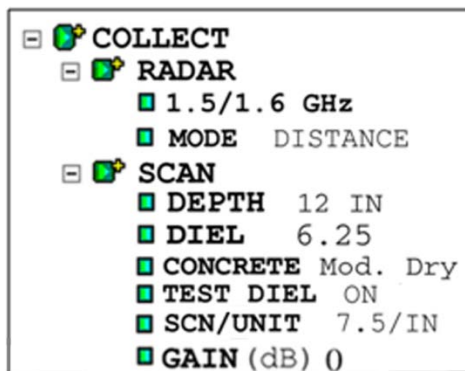
2 Plug the SIR 3000 into external power or insert a battery and push the green power button to turn the system on.

3 After the system boots-up, hold down the deadman switch and then push the ConcreteScan or the StructureScan function key.

Helpful Hint: Detailed hardware setup information can be found in Appendix B: How to Put Your System Together.

Section 2: ConcreteScan Data Collection

After the antenna initializes, the screen will be split into three windows. You will see the menu tree at left, a linescan display in the center, and a single scan in the O-scope display on the right. The six function keys will be displayed in a bar at the bottom.



- 1 Press the Down arrow once to activate the menu tree and highlight the Collect menu, then press Right to open that menu.
- 2 **Reload Setup:** Under the System menu at the bottom of the parameter tree, select Setup and then Recall. Choose the correct setup for your antenna and cart configuration. For example, if you have the 1.6 GHz antenna and the blue metal cart, pick the 1600BlueCart. This will cause the antenna to re-initialize. You will see the blue bar at the lower left scroll twice, and data will begin to move across the screen. *Be sure to hold down the deadman switch.*

3 Check Collection Mode: Ensure Mode is set to Distance.

- If not, press Enter, select Distance, then press Right to enter and accept. This will bring up a survey wheel calibration box.
- Check that the number is 102.4 for English, and 40.3 for Metric.
If not, click the Mark button to highlight the bottom window, and then Up/Down to set the appropriate digit. If you have a keyboard connected, you can also type in this number. Click Right to enter and accept.
- If you need to calibrate your survey wheel because you are on unusually rough terrain, see Appendix A. Otherwise, it is fine to leave it on the factory default

4 Set Depth: Under the Scan submenu, highlight Depth and press Enter. Choose your maximum depth of interest from the list. Always choose a depth that is deeper than the targets you are trying to image.

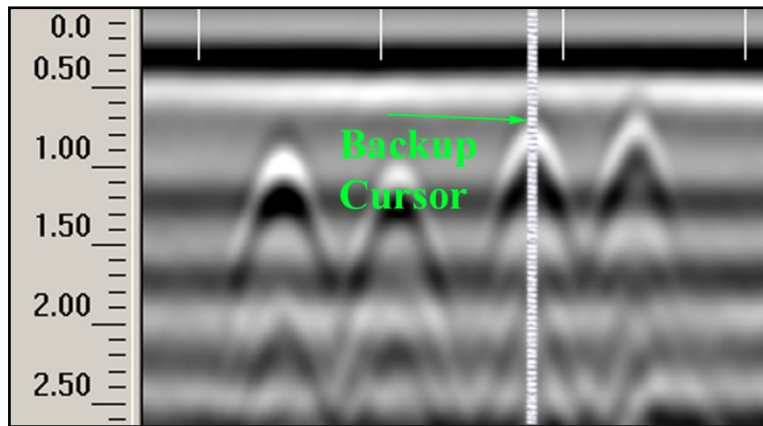
- If you are using the 1.5/1.6 GHz, it is usually best to choose 18 inches. Once you are sure that you are scanning to the proper depth, you can reset it to a shallower depth.
- If you do not think that you need the extra penetration, setting the depth to 6 or 12 inches will allow you to scan faster.
- Click Right to enter and accept.

5 Set Concrete Type: This sets the dielectric constant and is important for an accurate depth calculation. After making your choice, click Right to enter and accept. If you are unsure, set this to Mod.Dry. If you know your dielectric value from previous work on the concrete, change this to Custom and enter that value under the DIEL option.

- 6 Set SCN/UNIT:** This is the number of scans per inch (or cm) that you are collecting. The default here is 5/in (2/cm). Possible choices are 5/7.5/10 per inch and 2/3/4 per cm. It may be easier to resolve closely spaced targets with a higher number of scans per unit. The trade off is that if you set this higher, you will need to move the cart more slowly.
- 7 Set Test Dielectric:** This function allows you to test out the assumed dielectric of the concrete. This is important because if your dielectric is correct, then you know that you actually are scanning to the depth that you specify in Step 4. Highlight this choice and click Enter to bring up a pop-up menu. You will notice that data has stopped scrolling across the screen. With that pop-up menu on the screen, collect a profile of at least 6 feet in length. This profile must go over known targets and must cut across those targets at a right angle. You will now use the Up and Down arrows to adjust the dielectric value so that those hyperbolas collapse to points. After selecting a dielectric value, press Enter to see that take effect. For more information about collapsing hyperbolas, see Appendix B. This step is optional, but recommended.
- 8 Apply Display Gain (dB) if needed:** It may be helpful to increase the gain to make weaker reflections brighter. Select the appropriate positive gain value (one that brightens the screen but doesn't saturate) from the list.
- Helpful Hint:** If you believe the gains are set too low (everything looks gray) and the contrast of the linescan is too low to see targets, hold your antenna so that it points up into the air and press Run/Stop to pause the data, then press it again. This will cause the system to re-initialize the gains and may help visibility.

Collecting Data

- 1 Start Collection:** Click Run/Setup to begin collecting a data file. The data file's name will appear in the top left corner of the screen. The SIR 3000 will beep twice when it is ready to record the data. Data only gets collected when you move the cart forward.
- 2 Locating Targets:** After you see a hyperbola on the screen, pull the antenna straight back along your survey line. You will see a vertical line (the backup cursor) scroll along your data. When that vertical line is right in the center of the hyperbola, the center of the antenna is over that target.
 - If you look on the side of the antenna (orange box) you will see an indented vertical line. That is the center of the antenna and when you have that backup cursor on top of your target, that is where you should mark.
 - After marking the location on the ground, push the cart straight forward. No data will be collected until you have passed the spot where you started to reverse.



3 Figuring out the Depth: To get the most accurate depth calibration, you need to find a target in your data and drill down to that target and measure how deep it is. When you have finished collecting that file, click Run/Stop to halt data collection and bring up the crosshairs. Now drill to get that depth measurement.

- Use the arrow keys to move the crosshairs to the middle of the first positive (white in color table 4, color transform 2) peak of the hyperbolas from your measured target. Click the Depth button to bring up the depth dialog, enter the number and click Right. The vertical scale is updated and a better depth estimation based on ground-truth data for all of your targets is displayed. Click Run/Stop again to save the file. This depth calculation is good for any target in the whole area as long as it is the same material.

Helpful Hint: Make a sketch map of your survey area with immovable objects (columns, electrical boxes, etc.) as reference points. Sketch in your survey files, note the start and stop points, direction of travel, and file name on the map. This will make it much easier to relocate your targets after the survey.

Helpful Hint: The top of a target is the middle of the first positive peak for metal targets (rebar, PT, cable in PVC).

- If you are working in a grayscale color table, the positives are white.
- If the PVC is air or gas filled (empty PVC) the top of the target is the middle of the first negative peak (black).
- The back of a wall or suspended slab will always show a negative (black) peak first.

Section 3: ConcreteScan Data Playback and Review

The Playback menu provides several tools to help you interpret your data on the systems. None of these functions are required to get interpretable data, they are simply meant to help you in visualizing difficult data. These functions do not permanently change your data, or affect your saved data in any way. All of these changes must be done in Playback Setup (3 windows). More intensive processing can be done in RADAN.

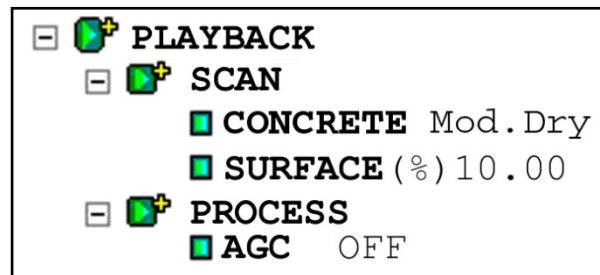
Under the Scan submenu, you can change Concrete type and SURFACE (%) if necessary. For a detailed discussion of the Surface %, see the SIR 3000 user manual. Changing the concrete type will change the dielectric and change your depth calculation.

1 Recall Data: From the Collect Setup (3 windows) screen, click Playback Mode to bring up the list of saved files. Highlight the profile and click Enter to put a 'check' in the box next to it. Click Right to load the file.

2 Review Data: Click Run/Setup. The data will scroll until the file ends and then crosshairs will appear. These can be moved with the arrow keys to get the coordinates of any target. Also check to see if you can easily interpret your data or if it needs any processing.

3 Automatic Gain Control (AGC): Set this to 5. This is the number of points along your vertical scan where the system is automatically adding gain to try to make targets more visible. If your data is weak-looking deeper down, this may help you to see those deeper targets.

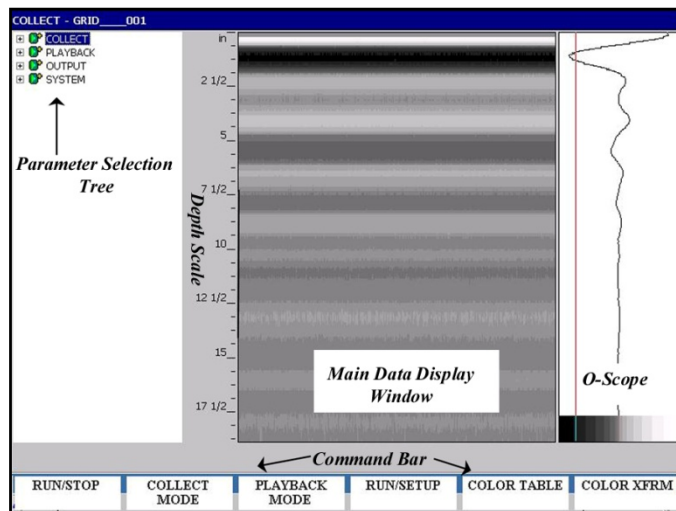
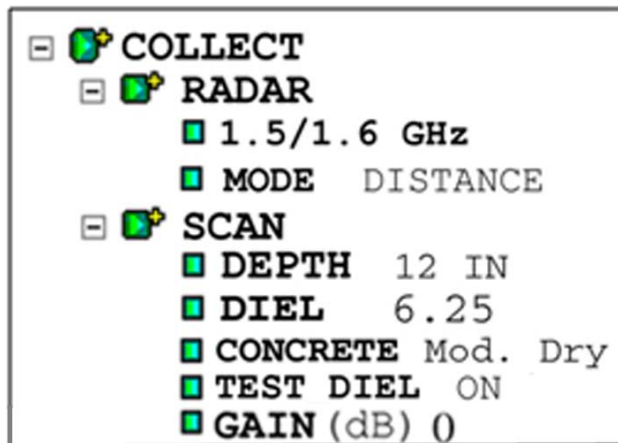
4 Collect More Data: To return to data collection mode, click the Collect Mode button.



Section 4: StructureScan Optical Collection

After the antenna initializes, the screen will be split into three windows. You will see the menu tree at left, a linescan display in the center, and a single scan in the O-scope display on the right. The six command bar keys will be displayed in a bar at the bottom.

Please Note: You can only use this mode with the 1.5, 1.6, or 2.6 GHz antenna, the bar code minicart, and the bar coded paper sheets.



Setting the System for Data Collection

- 1** Press the Down arrow once to activate the menu tree and highlight the Collect menu, then press Right to open that menu.
- 2 Set Depth:** Under the Scan submenu, highlight Depth. This sets the system's scan depth. This, and your target depths, are only truly accurate if you have the concrete type figured correctly. The system will automatically collect some additional depth anyway as a safety measure, but set this deeper than you need to scan. For example if you have a 6 inch slab, set this to 12 inches so that you are sure you penetrate deeply enough. Possible choices are 6, 12, and 18 inches for English, or 15, 30, and 50 cm for Metric.

Helpful Hint: Selecting a 12 inch depth will allow you to scan much faster than an 18 inch depth. Reserve the 18 inch setting for deeper applications.

- 3 Set Test Dielectric:** This function allows you to test out the assumed dielectric of the concrete. This is important because if your dielectric is correct, then you know that you actually are scanning to the depth that you specify in Step 2. Highlight this choice and click Enter to bring up a pop-up menu. You will notice that data has stopped scrolling across the screen. With that pop-up menu on the screen, collect at profile of at least 6 feet in length. This profile must go over known targets and must cut across those targets at a right angle. You will now use the Up and Down arrows to adjust the dielectric value so that those hyperbolas collapse to points. After selecting a dielectric value, press Enter to see that take effect. For more information about collapsing hyperbolas, see Appendix B. This step is optional, but recommended.

- 4 Reinitialize Antenna:** Hold the antenna pointed up, with no obstructions and click the Run/Stop button. The SIR 3000 will beep twice. Wait 3 seconds, then click again (keep holding the antenna up). The system will reinitialize, and then beep once.

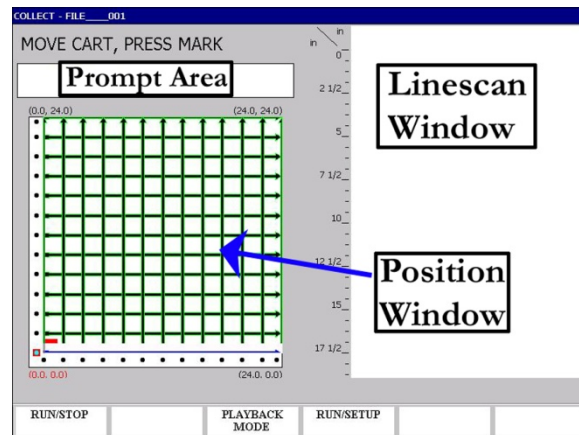
- 5** Now go on to the next section: **Collecting a Pad of Data.**

Important Note: StructureScan Optical can collect pad data with the antenna cross-polarized (turned 90 degrees in the minicart). If you want to collect data this way, turn the antenna 90 degrees and make sure that the long axis of the antenna is aligned with the rear-most set of white lines on the minicart. You must then select 1.5GHZx from the Collect>Radar submenu. *Do not forget to reset it back to 1.5GHZ when you have the antenna in its normal configuration.*

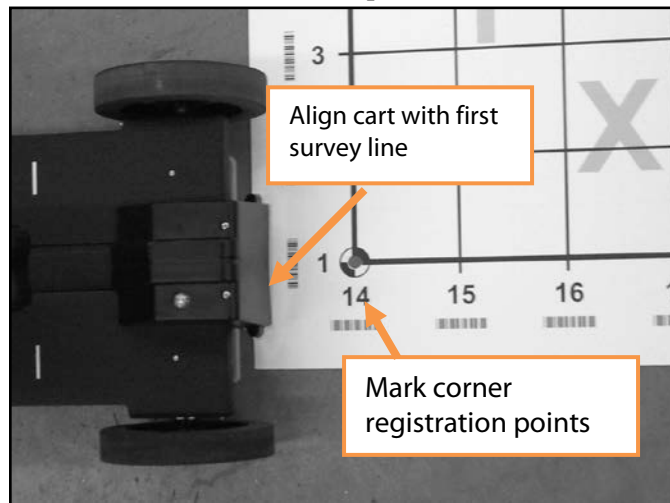
Collecting a Pad of Data

Structure Scan Optical has a specially designed scan pad that works with the bar code minicart and the RADAN software to provide accurate location of and depth to features through a plan view display either on the SIR 3000 or on your PC running RADAN.

- 1** Tape your pad to your survey surface. Mark **Registration Points** for each corner. We recommend marking the 0, 0 corner with a different color than the other corners, or mark the survey surface designating direction of first transect collected.
- 2 Press Run/Setup:** You will have to scan the barcode at the corner of the pad. This tells the system the size of the pad.



- 3** You will see a split screen like the one above. At the right is the Linescan Window, which shows the 2D data. The Position window shows the survey lines and their direction. These lines will be replaced with data as you collect. The Prompt Area is located at the top left and gives current position information and instructions during data collection.
- 4** With the minicart aligned at the beginning of your first profile, press the Mark button on the minicart. (thumb button). The SIR 3000 will beep once and you will see the wording “SCAN LINE ID” in the Prompt Area.
- 5** Move the minicart slowly forward until the barcode at the beginning of the line is read. The green light on the minicart will flash once and the SIR 3000 will beep once.
- 6 Scan the line:** The system will beep once when the center of the antenna crosses the beginning of the line. If you are going too fast, the SIR 3000 will beep to tell you. If the system has beeped, finish the line and scan it again. When you get to the end of the line (the center of the antenna is at the far edge of the paper pad), the system will beep twice to tell you that it has saved the profile. After that signal, reposition the minicart at the beginning of the next line, make sure you see the words “MOVE CART, PRESS MARK,” and go back to Step 4.
- 7** Once you have finished the last line, press Run/Setup to stop data collection and save your file.



Helpful Hint: If you need to end a profile before the end of the pad, press and hold the Mark button on the minicart to close that profile. You will hear a tone. Continue to hold the marker switch until the tone stops. Once the system has finished the profile, collect the next profile normally. The system will write in dummy values for the areas you did not scan.

To Sum Up:

- 1** From the Setup Screen, Press Run/Setup.
- 2** Scan corner barcode (**BEEP**).
- 3** Position cart at start of line, press Mark (**BEEP**).
- 4** Move forward to read barcode (**BEEP**).
- 5** Scan line. Center of antenna crosses start line (**BEEP**).
- 6** Center of antenna crosses end of line (**BEEP BEEP**). Line is finished. Move on to the next one. Make sure you see the MOVE CART PRESS MARK note before pressing the marker button.
- 7** After the last line is scanned, press Run/Setup to save the data and return to the Setup window.

Go on to the next section for a discussion of the C-Scan window.

Note: The only way that the system knows where to start scanning at the beginning of each line is by tracking survey wheel distance after you scan the barcode. This means that if you scan the barcode by waving the cart at it, or pick up the cart after you scan the barcode, your position will be wrong. DO NOT let the back wheels of the cart leave the surface after you scan the barcode. The only correct way to scan the barcode is to roll the cart over it.

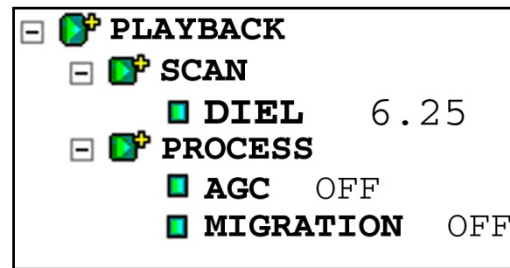
Section 5: C-Scan Display of StructureScan Data

This section will explain how to generate a C-Scan (top-down, sliceable view of your data).

Steps to Generate a C-Scan

- 1 From the setup screen (3 windows) press the Playback Mode button on the Command Bar. Choose the Grid file that you want to Playback.
- 2 You will be in the Setup screen (3 windows) and will see the files scrolling across in succession.
- 3 You need to set the proper dielectric value for the concrete under the DIEL choice in the Scan submenu and Migrate the data. Under the Process submenu, turn Migration on. You will then need to change the dielectric value under DIEL.
 - Highlight DIEL and press Enter to open the DIEL pop-up window.
 - Use the Up/Down arrow keys to scroll to a different number and then press Enter. You will see the change take effect on the data.

The goal is to choose a value that causes the hyperbolas to collapse to points. See Appendix B for information on choosing the correct dielectric.
- 4 Once you have chosen the correct value, press Run/Setup to generate the image. Depending on the size of the pad you scanned, it can take up to several minutes for the system to process the data and generate the image. Be patient.



Understanding the C-Scan Display

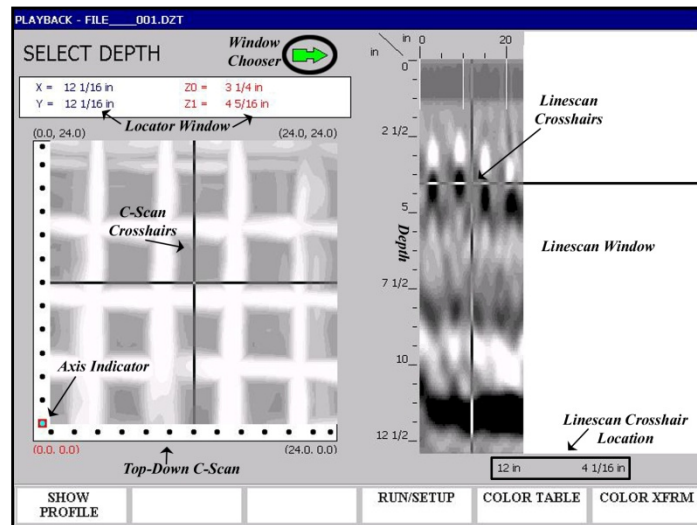
Once you get to this display you can toggle to different color tables or transforms by using the Command Bar buttons, or go back to the Setup (3 windows) screen by clicking Run/Setup.

The C-Scan display window is split into 3 important areas.

- At the right is the Linescan window which shows a 2D vertical profile. Depth is shown on the vertical axis and distance along the survey profile is shown on the horizontal. Underneath this display are two coordinates. The first is distance, and the second is depth.
- At the left is the Top-Down C-Scan map. This map shows the location of targets as if you were standing above your survey area and looking straight down. At the lower left corner is 0,0.

The “X” axis is horizontal and the “Y” is vertical. The black dots along two of the sides are the locations of profiles. You will also see a red box (Axis Indicator) covering one of the dots. That is the currently selected profile and the one that will be displayed in the linescan window if you press Show Profile.

- Above the C-Scan window is the Locator Window. This window gives positioning information for the C-Scan crosshairs and also shows the highest (Z0) and lowest (Z1) points of the depth slice shown in the C-Scan.



Working with the C-Scan Display

The C-Scan display has three main functions: Select Depth, Select Profile, and Select X/Y Position. You toggle between each one by clicking Enter. When you click Enter, the window chooser arrow changes. This arrow shows you which window (Linescan or C-Scan) to browse with the arrow keys.

- For example, if you click Enter until the “Select X/Y Position” wording appears, you will notice that the window chooser arrow points down to the C-Scan window. Now if you click the arrow keys, you will notice that the C-Scan crosshairs move and you will get location information in the Locator Window.
- You may also see the first number change in the Linescan Crosshair locator, but the locator window information is more accurate. Each of the modes are explained below.



Select X/Y Position: This mode allows you to find the horizontal location of targets or clear areas to drill. The window chooser arrow will point down to the C-Scan window, telling you that you should only work with this window to make decisions.

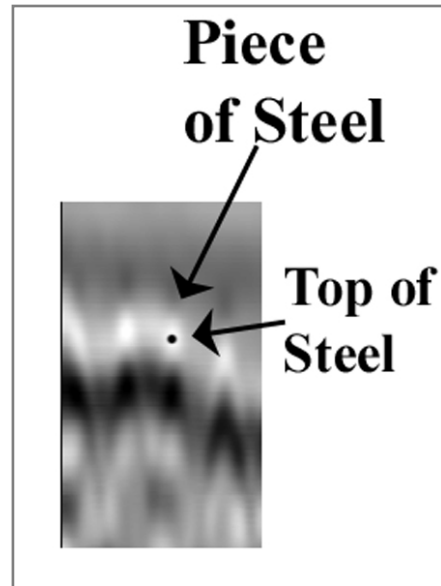
- You can move the C-Scan crosshairs around with the arrow keys to get locations on anything you see in the data.
- You will also notice that the vertical crosshair on the Linescan Window is also moving and that it is giving a location below that window (right above the Color Table button). That location is not as accurate as the one on the C-Scan window. You should always read X/Y coordinates from the C-Scan Locator Window.

Important Note: You MUST pay close attention to the Z0 and Z1 numbers on the C-Scan Locator Window. The C-Scan is only showing targets within that depth range. For example, in the screenshot on Page 14, that map is of targets between 3 ¼ and 4 5/16 only. Anything above or below that depth is not being displayed.



Select Depth: This mode allows you to find out how deep something is and to change the display depth of the C-Scan window. You will notice that the Window Chooser arrow is pointed to the Linescan Window on the right.

- If your scan is 12" (or up to 50 cm) deep, then it will be divided into 12 equal slices.
- If it is deeper than this, then it will be divided into 15 slices.
- You will use the Up/Down arrow to move the horizontal crosshair on the Linescan Window up and down. That will give you depth information which will be displayed below the Linescan Window (above the Color Xform button).
- Remember that the top of a piece of metal (rebar, conduit, PT) is the middle of the first bright white part of the target. In the example on the right, the black dot is at the middle of the white target which is the location of the top edge of the metal target. To get the depth of that you should set the horizontal linescan crosshair at that location.



- If you scroll to the top or the bottom of the image, you will get a C-Scan display of the full depth range. The image is displaying strongest targets in the full range. If you look at the C-Scan Locator Window, you will see that Z0 is set to 0 and that Z1 shows the maximum depth.
- Otherwise as you scroll up and down the profile, these numbers will change once the horizontal crosshair on the Linescan Window crosses a distance threshold. The C-Scan will then change to show the new slice data and the Z0 and Z1 will update to give you the new depth range.



Select Profile: This mode lets you display individual profiles in the Linescan Window at the right. You would do this to show a target that you can then find the depth of by using the Select Depth mode. You will notice that the window chooser arrow is now pointing down to the C-Scan window.

- You can select the X profiles by clicking Up/Down and the Y profiles by clicking Left/Right. The profile line number will be displayed in the C-Scan Locator Window.
- Once you have selected your profile, click the Show Profile button on the Command Bar to display it in the Linescan Window. Each profile begins at the red box and ends at the tip of the arrow. In the Linescan Window, the profiles read from left to right with the beginning (red box location) being at the left.

Section 6: Using the Save Image Function

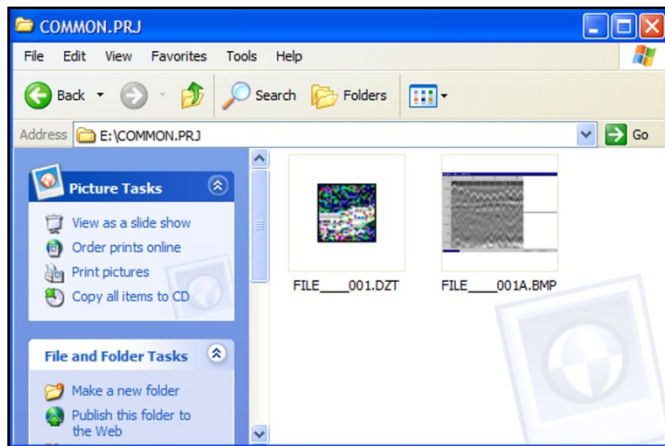
The SIR 3000 has the capability to save the displayed image as a bitmap (.BMP). Bitmaps can be printed or emailed and can be viewed on any Windows or Mac computer. The image is stored on the SIR 3000's internal compact flash card and will automatically be transferred to your computer when you transfer the data file. If you had a removable compact flash card inserted when you powered up the system, then the image will get saved to the removable card.

Only the section of the data file that is shown on the screen will be saved.

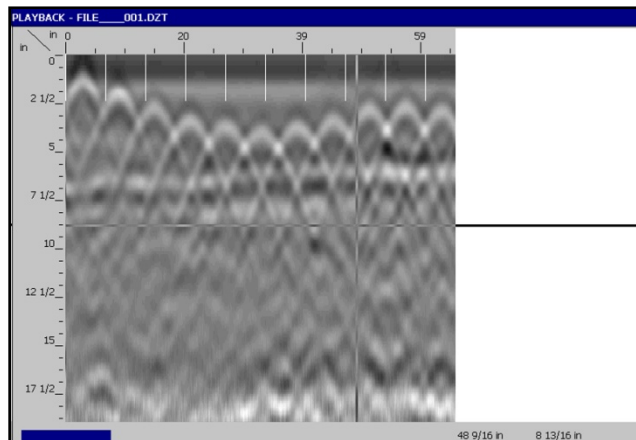
The Save Image function is only available in Playback. In Playback Run mode, the Command Bar will look like this:

RUN/STOP	SAVE	PLAYBACK	RUN/SETUP	DISPLAY	DEPTH
	IMAGE	MODE			

- 1** With the section of data that you want to save displayed on the screen, press Save Image. You will see a blue wait bar scroll across the bottom section of the screen. The Playback crosshairs and their coordinates will be saved as well. The file will be saved with the same name as your datafile, but it will have an "A" after the number. For example, if the filename was FILE___001.DZT, the image is saved as FILE___001A.BMP.
- 2** If you want to save another section of the data file, scroll left or right until you see that portion and repeat the first step. If the datafile name is the same, it will have a "B" after the number.
- 3** Transfer the data onto your computer for emailing or printing. You do not need to open the bitmap image in RADAN.



The image will appear in the Common folder. It will share the same name as the radar data file.



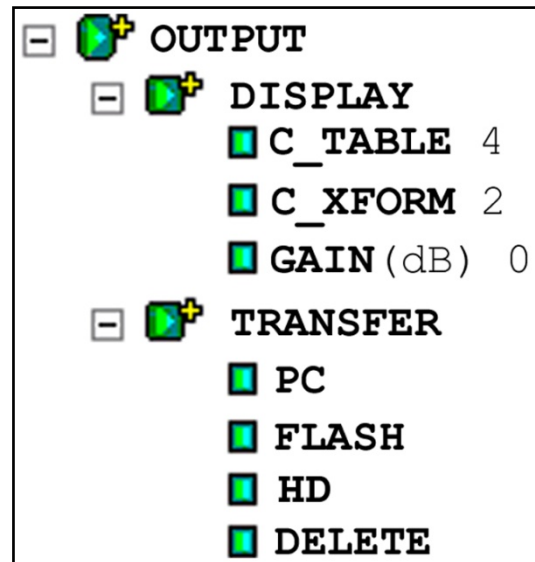
The saved image will be a copy of the SIR 3000 screen without the Command Bar buttons at the bottom.

Section 7: Data Transfer to a PC

The data that you collect with StructureScan can easily be transferred to a PC for either intensive processing of pad data in RADAN, or permanent storage on a CD. Follow the steps below.

Please Note: If you left the memory card inserted in the SIR 3000 and then turned on the system and collected data, the data were automatically stored to the removable card, so there is no need to transfer.

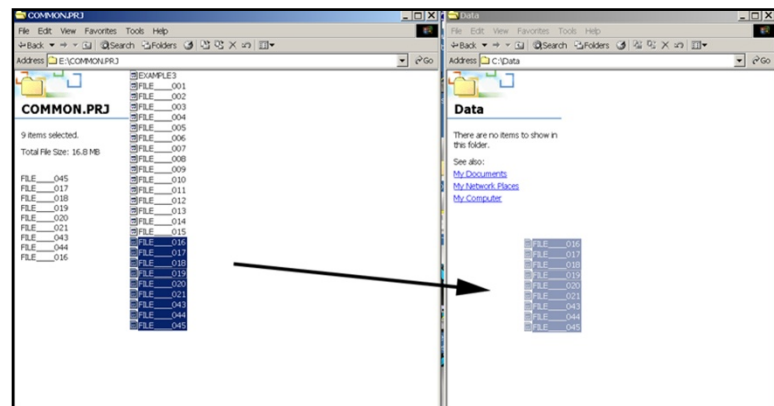
- 1 Turn on the SIR 3000:** Connect a battery or AC power and push the green power button to turn on the system. Select any of the collection modes. You do not need to have an antenna connected.
- 2 Plug in Memory Card:** Remove the black plastic cover above the antenna connector and find the slot for the Compact Flash memory card. Insert the card into the slot and push gently until the square plastic button next to the slot pops up. There is only one right way for it to go in, so do not force it.
- 3 Open Transfer submenu:** In the Output menu, highlight Transfer and click Right. Highlight Flash and click Enter. You will see a box that says “Select Files to Copy,” and it will show the file name, size in KB, and date it was collected.



- 4 Select Files and Transfer:** Highlight each file you want to transfer and press Enter to put a check in the box next to the file name. Press Right to transfer files. This moves each file from the internal memory to the memory card. When the transfer is complete, remove the power from the SIR 3000. Each of your Structure Scan Optical Files will say: “GRID__001, GRID__002, and so on.”
- 5 Turn off the SIR 3000:** Remove the AC power or the battery.
- 6 Eject Memory Card and Plug into PC:** Gently push the black plastic button next to the card slot. The card will pop out slightly. Plug a USB card reader into your PC. These are available at very low cost from any computer store. Your PC will automatically find it. It will show up as “Removable Disk.” Insert the card into the reader. Click on the “My Computer” icon and then “Removable Disk.”
- 7 Copy Data to PC:** You will see a folder on the memory card called COMMON.PRJ. This is where your data is. Double click on that folder to open it, and “drag and drop” your data to a folder on your PC.

Helpful Hint: After you have transferred your data, delete the data off of your memory card from your PC. This is much easier and faster than deleting data through the SIR 3000.

Helpful Hint: Create different folders on your computer to hold data from different jobs. This will help you keep things organized.



Appendix A: Survey Wheel Calibration

Survey Wheel Calibration is run to calibrate the survey wheel to different survey surfaces. The Survey Wheel controls the data collection rate necessary for optimal data collection.

- 1** Under the Radar submenu of the Collect menu, highlight Mode and press Enter.
- 2** Highlight Time and press Enter. Then highlight Mode again and press Enter.
- 3** Highlight Distance and press Right. A dialogue window will come up.
- 4** Measure a distance on the surface you will be surveying. Put that number in under Distance.
- 5** Push Enter and move the antenna along that distance. The start and finish line must be on the same spot on the antenna. When you get to the end, click Enter.
- 6** The system is now paused, click Run/Stop to un-pause.
 - The proper survey calibration values for flat, smooth surfaces are 102.4/inch or 40.3/cm.

This graphic does not mean that the survey wheel needs 102.4 ticks to go 10 inches. 10 inches is only a calibration distance number. It can be set to whatever you want if you are doing a calibration. You could set this to 1000 inches and, if the terrain surface is smooth, still come up with 102.4 per inch. This has nothing to do with scans per inch, it is solely to tell the computer how many ticks (an internal parameter) the SW has to count before it knows it has gone 1 inch.

CALIBRATE SW

1. Select calibration distance
2. Position Antenna on the Start mark
3. Click ENTER button

0

Distance (IN) 10

Calibration Value

Saved 102.4

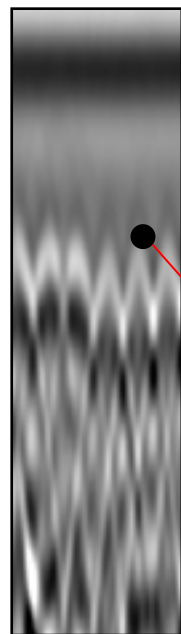
New 102.4

Appendix B: Figuring out the Correct Dielectric Value

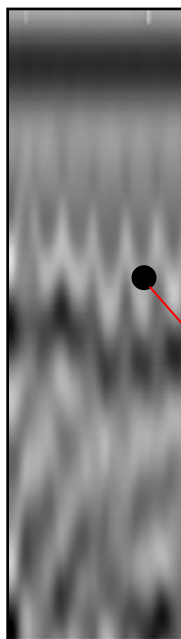
The StructureScan Optical system has built into it a very powerful tool to enable you to find the correct dielectric value. It is important to get that value because the dielectric number is related to the speed that the radar energy can move through the concrete. If we know the speed, (the GPR is recording elapsed time for the reflection) then we know the distance (depth) of the target. It turns out that that the shape of the hyperbola is caused by the dielectric of material. The TEST_DIEL function of StructureScan Optical allows you to set different dielectric values and see the outcome on the data. Through trial and error you can get the correct value and be very accurate on your depth calculation.

You can also set the Dielectric value after collection and before Playback imaging of the C-Scan. Once you load the data to playback, under Playback>Scan>Process, turn on the Migration function and toggle the DIEL value under the Playback>Scan menu, and skip the first two steps of the list below.

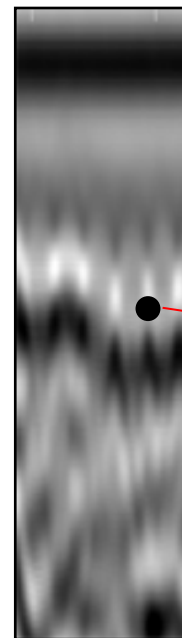
- 1** Under the Scan submenu of the Collect menu, highlight TEST_DIEL and press Enter. Toggle the test function to On and press the Right arrow.
- 2** Scan at least 6 feet of data. You must scan over some targets and you **MUST** cut across those at a right angle.
- 3** Using the Up/Down arrows, change the dielectric value to a new number, then press Enter to see it take effect. Continue to vary the number until the hyperbolas have collapsed to points. (see below). If you find that the value is too low or too high, change it in 0.25 increments until you have found the proper number. Please note that if you are used to working with other StructureScan products, we are asking for Dielectric here, not velocity.
- 4** Once you have gotten the proper number, click the Right arrow to accept and continue with data collection.

**DIEL too HIGH**

Hyperbolas have not collapsed into points. Still are shaped like hyperbolas. Need to reset DIEL to a lower number.

**DIEL too LOW**

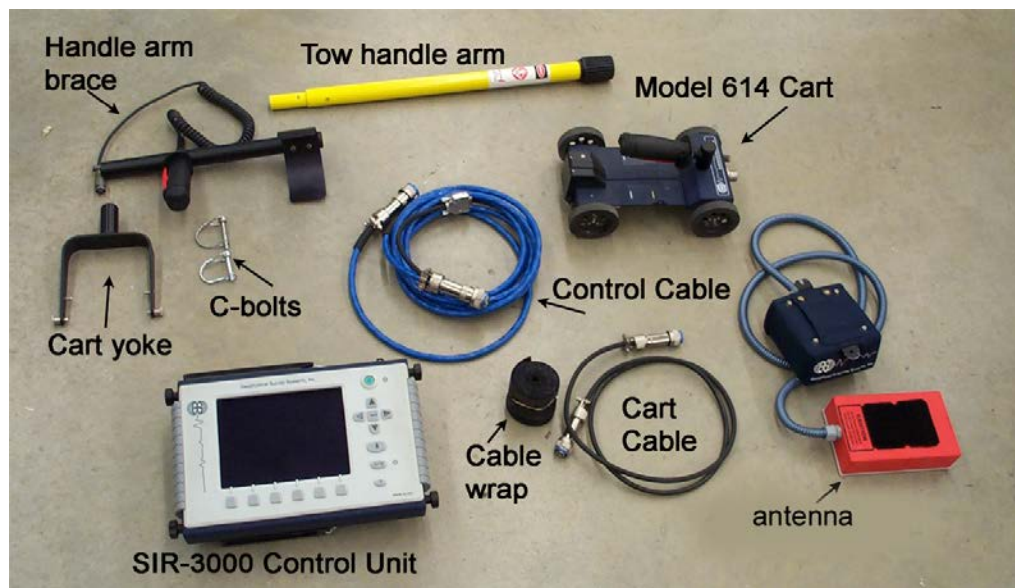
Hyperbola tails have turned upward into 'smiles.' Need to reset DIEL to a higher number.

**DIEL just RIGHT**

Hyperbolas have collapsed into narrow targets. Correct DIEL value.



Appendix C: How to Put Your System Together



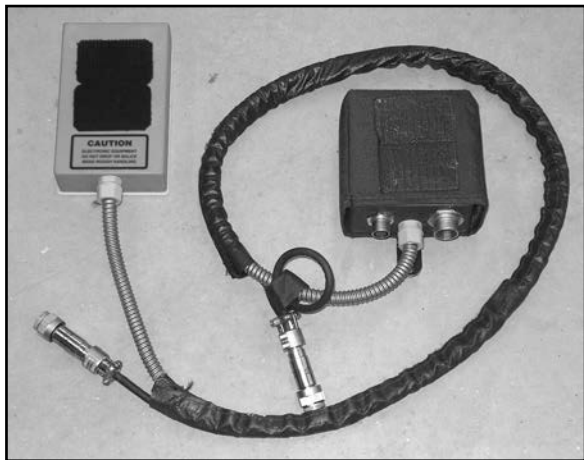
Aside from the parts pictured here, you will also have 2 batteries and a charger.

Your selection of StructureScan Optical paper scan pads is available for an additional purchase.

Do not attempt to detach the orange box of the antenna from the padded electronics box of the antenna. Doing so will void your warranty.

Step 1:

Unroll the Velcro cable wrap and use it to gather the cart cable and the blue cable on the 1.5/1.6 GHz antenna together.



Step 2:

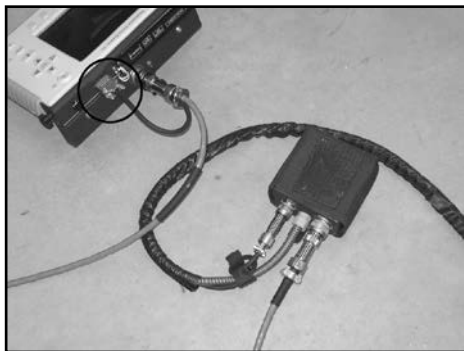
Velcro the orange box of the 1.5/1.6 GHz antenna into the bottom of the minicart. Make sure that the white plate on the orange antenna box is pointing down.



Next connect one end of the cart cable to the back of the minicart, and connect the other end to the blue padded antenna electronics box. Make sure all connections are snugged down.

Step 3:

Connect one end of the Control Cable to the blue padded antenna electronics box and connect the other end to the SIR 3000 control cable connector. Make sure that the red lines on the connectors are completely covered by the control cable collar. Connections should be hand tightened only. Once the antenna is connected, you can power-up the SIR 3000. You must also connect the serial lead from the control cable to the back of the SIR 3000. You may need to remove a small black plastic cover on the back of the SIR 3000.



Step 4:

Slide the cart yoke into the tow handle arm and secure with a c-bolt. Then attach the handle arm brace to the tow handle arm and secure with a c-bolt. Connect the marker switch lead from the handle arm brace to the connector at the back of the minicart and connect the cart yoke to the minicart. The antenna electronics box connects to the back of the handle arm brace.

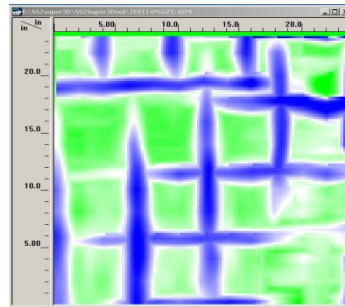


StructureScan™ Optical

Data Processing with RADAN™ 7

Quick Start Guide

Section 8: Data Processing Setup.....	31
StructureScan Data Processing Buttons	31
Section 9: Processing StructureScan Grid Files for C-Scan (or Depth Slices) in RADAN 7	32
Section 10: StructureScan Super 3D	35
To create a StructureScan Optical Super 3D File	35



Section 8: Data Processing Setup

StructureScan Data Processing Options

- 1 Open RADAN. In the Properties Pane > Global Parameters.

Auto Save File:

- True: Automatically save a processed file (GSSI naming convention) in a folder called “Proc” within the Source folder. See Appendix A in the GSSI’s RADAN 7 Manual for the GSSI naming convention.
- False: User is prompted to save a processed file and you name the file.

Source Directory: Select the folder where the source (original data is located).

Output Directory: Select the folder where all processed data will be located. This is displayed ONLY if Auto Save File is set to False.

- 2 Open data file.

- 3 Because of StructureScan data collection settings, the display gain will initially be very weak.

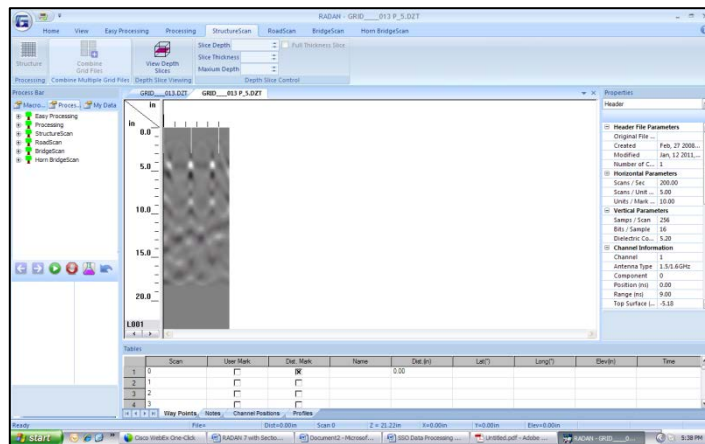
- To **increase** the display gain to better view data, right-click in data window and increase gain.

The screenshot shows the 'Properties' window in RADAN 7, with the 'Global Parameters' tab selected. The window is divided into several sections: 'File Parameters', 'View Attributes', and 'Data Attributes'. The 'File Parameters' section includes 'Auto Save File' (set to True), 'Source Directory' (C:\easthelenabr...), and 'Output Directory' (C:\easthelenabr...). The 'View Attributes' section includes 'Display Channel' (All), 'Marker Style' (Short), 'Horizontal Scale' (Show), and 'Grid Lines' (Hide). The 'Data Attributes' section includes 'Vertical Units' (ft), 'Horizontal Units' (ft), and 'GPS Units' (°).

Properties	
Global Parameters	
File Parameters	
Auto Save File	True
Source Directory	C:\easthelenabr...
Output Directory	C:\easthelenabr...
View Attributes	
Display Channel	All
Marker Style	Short
Horizontal Scale	Show
Grid Lines	Hide
Data Attributes	
Vertical Units	ft
Horizontal Units	ft
GPS Units	°

Section 9: StructureScan Grid Pad Files for C-Scan (or Depth Slices)

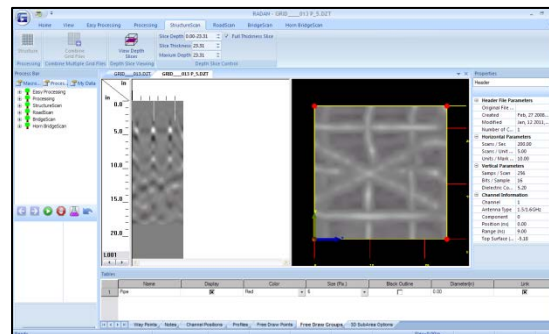
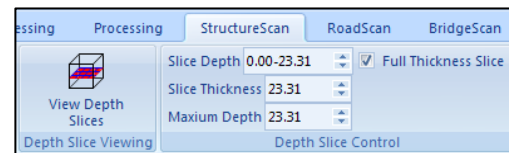
- 1 Open Grid pad file. The raw data file will appear on the screen. Increase screen gain (contrast).
- 2 Click the StructureScan Tab in the Ribbon Pane.
- 3 Click the Structure Icon located on the left side of the Ribbon. This will load a GSSI created macro in the Process Bar Pane.
- 4 Click Apply and it will automatically test three processes:
Time Zero Adjustment
Smart Background Removal
Auto Amplitude Correction (Migration)
- 5 If necessary, click Reset to make any adjustments to the three processes and click Apply again. Continue this until you have the desired results.
- 6 Click OK once you have the desired results.
(Note the surface is at the top, noise has been removed, and migration was done.)

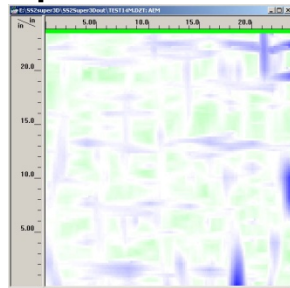
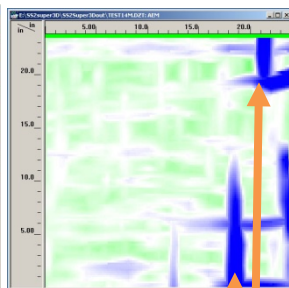
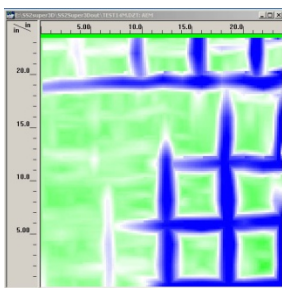
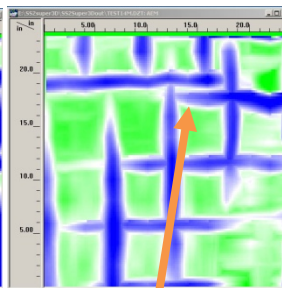


Depth Slices

If you like, you can make View Depth Slices. This view will allow you to view the data from the top and also give you the ability slice through the data.

- 1 Click the View Depth Slices Icon.
- 2 This will give you the top-down view of your data. You may make adjustments as follows:
 - **Slice Depth:** Slice the Z slice up and down. You will need to uncheck Full Thickness Slice to do this.
 - **Slice Thickness:** Adjust the thickness of the slice
 - **Maximum Depth:** Adjust the Depth of the data
 - When viewing from the very top of the data, you may have a Full Thickness Slice, or turn it off.



Depth: 2.5"-3"**3"-3.5"****3.5"-4"****4"-4.5"**

Beginning to hit the top of the wire mesh.

Following the mesh as it dips in the slab.
Note overlap in 2 pieces of mesh.

Section 10: StructureScan Super 3D

Multiple 2' x 2' grid pads can be combined into one large Depth Slice file.

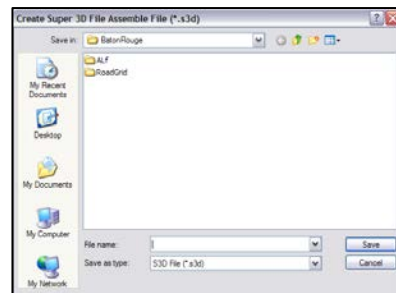
- Grid pads must be collected with corner reference points connecting
- If corner reference points do not connect, they must be on the same spatial grid as other pad data sets.

Creating a Super 3D Grid (Combining Grids)

You may combine multiple processed 3D Grids to create one “super” 3D Grid. This will create a new file with the extension .s3d.

Note: Process each grid located in the super3d folder.

- 1** Click the GSSI Button, then click Assemble.
- 2** After you select Super 3D File, enter a filename for the newly created Super 3D file (.s3d).
- 3** Click Save to save and continue.
- 4 Add File:** Click Add File to retrieve a grid.
- 5 Filename:** Click Filename >> to browse and retrieve a grid
- 6 Populate:** Populate the File Parameters window.
- 7 Starting (X,Y) Coords:** Enter the X,Y position for this grid.



- 8** If this is the first grid you are adding, the Starting (X,Y) coordinate is more likely 0,0.
- 9** If this is NOT the first grid you are adding, the Starting (X,Y) coordinate is relative to the first grid you added.
- 10** If necessary, you can Rotate, Flip Horizontally, and/or Flip Vertically, depending on how the grid was collected relative to the coordinates of the first grid you added.
- 11** Click OK when you are done.
- 12 Repeat:** If you have more grids to add, continue back to step 3.
- 13** Once you have completed adding all the grids, click OK and the system will combine all the grids and create a Super Grid file.

