Proceq GPR

Ground Penetrating Radar

User Manual

Document Information

Document Revision:	4.0
Revision Date:	Feb 12, 2026
Document State:	Released
Company:	Proceq SA Ringstrasse 2 CH-8603 Schwerzenbach Switzerland
Classification:	Technical Manual

Revision History

Rev	Date	Author, Comments
1.0	July 4, 2024	PEGG, HELG
1.1	June 1, 2024	HELG
2.0	Sept 30, 2024	GP8000 Lite release
3.0	Dec 1, 2025	AI Auto tagging release
4.0	Feb, 12 2026	Legal notice, technical specifications updates, new demo file

Content

Legal Notice

This document contains important information on the safety, use and maintenance of Proceq products. Read through this document carefully before the first use of the instrument. Observe the safety and warning notes in this documentation and on the product. This is a prerequisite for safe working and trouble-free operation.

Symbols used

This icon signals important information, specifications, proper working procedure and to avoid data loss, damage or destruction of the instrument.

This note signifies a warning about dangers to life and limb if the apparatus is handled improperly. Observe these notes and be particularly careful in these cases. Also inform other users on all safety notes. Besides the notes in this instruction manual the generally applicable safety instructions and regulations for prevention of accidents must be observed.

Limitation of use

The instrument is only to be used for its designated purpose as described herein.

- Replace faulty components only with original replacement parts from Proceq.
- Accessories should only be installed or connected to the instrument if they are expressly authorized by Proceq. If other accessories are installed or connected to the instrument then Proceq will accept no liability and the product guarantee is forfeited.

Liability

Our “General Terms and Conditions of Sales and Delivery” apply in all cases. Warranty and liability claims arising from personal injury and damage to property cannot be upheld if they are due to one or more of the following causes:

- Failure to use the instrument in accordance with its designated use as described in the product documentation.
- Incorrect performance check for operation and maintenance of the instrument and its components.
- Failure to adhere to the instructions dealing with the performance check, operation and maintenance of the instrument and its components.
- Unauthorized modifications to the instrument and its components.
- Serious damage resulting from the effects of foreign bodies, accidents, vandalism and force majeure. All information contained in this documentation is presented in good faith and believed to be correct. Proceq AG makes no warranties and excludes all liability as to the completeness and/or accuracy of the information.

Warranty Coverage During the Warranty Period

During the warranty period, all costs for preventive and remedial maintenance covered under the official Proceq SA warranty policy will be borne by Proceq SA, provided that the equipment is used, operated, and maintained strictly according to the instructions in the official User Manual and product documentation.
The User Manual, which must be provided with the equipment, contains clear instructions necessary to maintain warranty validity. Any maintenance or repairs outside the scope of the warranty policy remain the responsibility of the user.

Safety Instructions

The equipment is not allowed to be operated by children or anyone under the influence of alcohol, drugs or pharmaceutical preparations. Anyone who is not familiar with the instrument must be supervised when using the equipment.

Reserved Rights

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- Unauthorized modifications and changes of the product are not permitted.

Damages during carriage

On receipt of the goods, check for any visible damage on the packaging. If it is undamaged you may sign the receipt of the goods. If you do suspect by visual inspection that damage has occurred, make a note of the visible damage on the delivery receipt and request the courier to countersign it. Moreover, the courier service must be held responsible for the damage in writing.

If a hidden damage is discovered while unpacking, you have to inform and hold the courier liable immediately in the following way: “When opening the parcel we had to notice that … etc.“ This superficial checking of the goods has to be done within the time limit set by the carrier, which is normally 7 days. However, the period could vary depending on the courier. Hence, it is recommended to check the exact time limit when receiving the goods.

If there are any damages also inform your authorized Proceq agent or **Proceq SA** immediately.

Shipment

Should the device be transported again, it must be packaged properly. Preferably use the original packaging for later shipments. Additionally, use filling material in the package to protect the device from any shock during carriage.

Safety notes and hints

- All maintenance and repair work which is not explicitly permitted and described in the present manual shall only be carried out by **Proceq SA** or your authorized service center, failure to comply voids warranty.
- **Proceq SA** refuses all warranty and liability claims for damages caused by usage of the product in combination with **non-original accessories**, or accessories from 3rd party suppliers.
- Never immerse the device in water or other liquids: **Danger of short circuit!**
- Never leave the product under direct sun exposure. Always store the product in its carrying case.

For the operation of the product all local safety regulations apply.

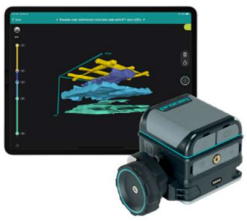
1 Introduction

The Proceq GPR family are high quality handheld ground penetrating radar (GPR) instruments used to detect various objects in concrete structures such as rebar, post-tensioning duct, pipes, voids & conduits.

The Proceq GPR family offers 3 powerful versions for all application needs:

GP8000

GP8800



GP8100

The product consists of

- The GP8000 or GP8800 or GP8100 high-performance sensor
- the GP iOS app
- and the Screening Eagle Workspace platform.

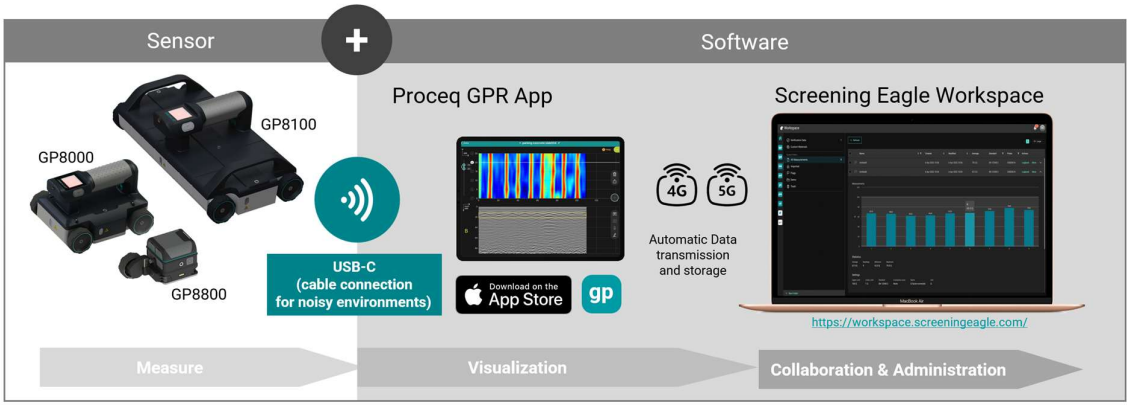


Figure 1: Proceq GPR System

1.1 Scope of this document

This document is the user manual for all products of the Proceq GPR Product family. Therefore, some pictures or functional descriptions may differ from your model.

1.2 Product versions

To be able to use the functionality of the GP app, a software license is required. The following licenses are available and offer different functionality.

Please refer to the table below for the supported features of the respective licenses:

	GP8000 Lite	GP8000	GP8800	GP8100
Sensor radar technology	Stepped-frequency continuous-wave (SFCW) GPR			
Antenna	1		1 (w. cross-polarization set)	6 (array)
Modulated frequency range	200 – 4000 MHz		400 – 6000 MHz	400 – 4000 MHz
Penetration depth[1]	Up to 80 cm / 32 in	Up to 150 cm / 60 in	Up to 65 cm / 26 in	Up to 80 cm / 32 in
Measurement Modes	Line Scan Area Scan (60cmx60cm, 24 in x 24 in)	Line Scan Area Scan up to 16m^2	Line Scan Area Scan up to 16m^2	Superline Scan Line Scan Area Scan up to 100m^2
View modes	A-scan (incl. envelope) Radargram view Migrated view Fixed time-slice view Live Wire	A-scan (incl. envelope) Radargram view Migrated view Time-slice view 3D view Augmented Reality (AR) Live Wire	A-scan (incl. envelope) Radargram view Migrated view Time-slice view 3D view Augmented Reality (AR)	A-scan (incl. envelope) Radargram view Migrated view Split view Unidirectional time-slice view Time-slice view 3D view Augmented Reality (AR) Live Wire
Image processing	Auto-gain Linear Gain Time Gain Compensation Noise Cancellation Dielectric constant Hyperbola fitting Live Wire Threshold level Markers Tags	Auto-gain Linear Gain Time Gain Compensation Noise Cancellation Background removal Depth/Time window Dielectric constant Hyperbola fitting Live Wire Threshold level Markers Tags Annotation	Auto-gain Linear Gain Time Gain Compensation Noise Cancellation Background removal Dielectric constant Hyperbola fitting Markers Tags Annotation	Auto-gain Linear Gain Time Gain Compensation Noise Cancellation Background removal Dielectric constant Hyperbola fitting Live Wire Threshold level Markers Tags Annotation
Artificial Intelligence assistance	None	AI Tag	AI Tag	AI Tag
Logbook	Measurements data, Instrument Information, Pictures, Geolocation, text notes, audio notes, configuration log	Measurements data, Instrument Information, Pictures, Geolocation, text notes, audio notes, configuration log	Measurements data, Instrument Information, Pictures, Geolocation, text notes, audio notes, configuration log	Measurements data, Instrument Information, Pictures, Geolocation, text notes, audio notes, configuration log
Data Sharing	None	URL exchange	URL exchange	URL exchange
Data Exporting	Snapshot with iPad	Snapshot with iPad HTML JPG (Snapshot) SEGY DOCX XLSX (with AI Tag)	Snapshot with iPad HTML JPG (Snapshot) SEGY DOCX XLSX (with AI Tag)	Snapshot with iPad HTML JPG (Snapshot) SEGY DOCX XLSX (with AI Tag)
Data Synchronization	None	Workspace	Workspace	Workspace

[1] For dielectric constant concrete (permittivity) < or= 7, and with low rebar density

1.3 Product applications

Each sensor is suitable for different applications & conditions as described in Figure 2.

GP8000

Clean & deep data
Multi-usage
Ideal for long line walls & tunnels

GP8800

Superior resolution
For small & congested areas
Ideal for curved surfaces

GP8100

High data density & productivity
For large areas
Ideal for bridge deck & parking slab

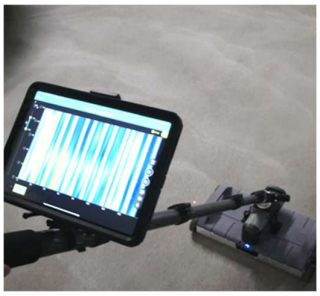


Figure 2: Proceq GPR applications

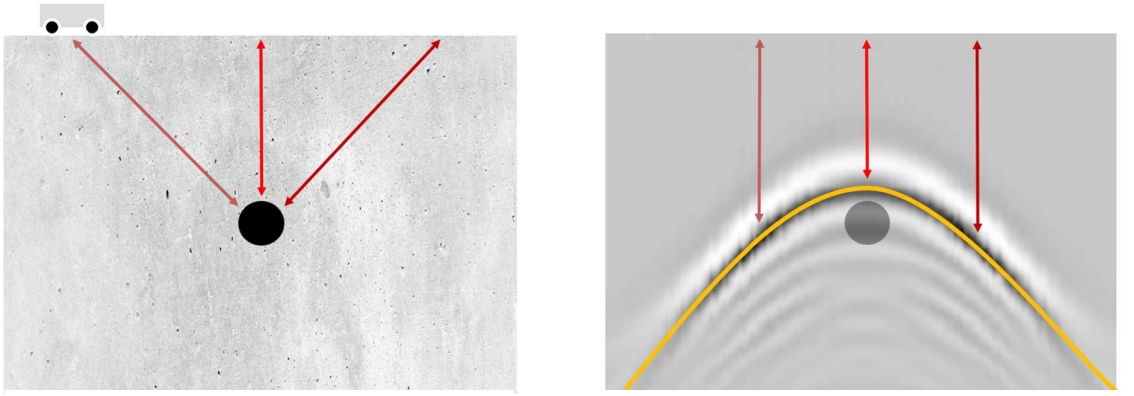
2 Scope of Delivery

Please refer to the Quick Start Guide provided in the standard delivery and available in download section of the product webpage:

SET-GP8X00-QSG-200x140-240408-digital.pdf (screeningeagle.com)

3 Measurement Principle

GPR is the acronym for **G**round **P**enetrating **R**adar, also known as Georadar, Ground Penetration Radar, or Ground Probing Radar. Proceq GPR is a compact device that scans the subsurface nondestructively to locate objects embedded in and below the surface. Visual depth penetration is based on concrete conditions and antenna characteristics.



Handheld antenna (transmitter, receiver & encoder) emits waves into concrete

The wave is reflected by an object forming a hyperbola

Figure 3: Measurement principle

Proceq GPR devices use stepped-frequency-continuous-wave (SFCW) technology. Pulsed-GPR broadcasting has a signal centered around one frequency resulting in a trade-off between resolution and depth for inspecting. SFCW has an advantage as it broadcasts an ultra wide-band range of modulated frequencies. The combination of all frequency response enables detection of objects from shallow to deep in one scan while maintaining resolution.

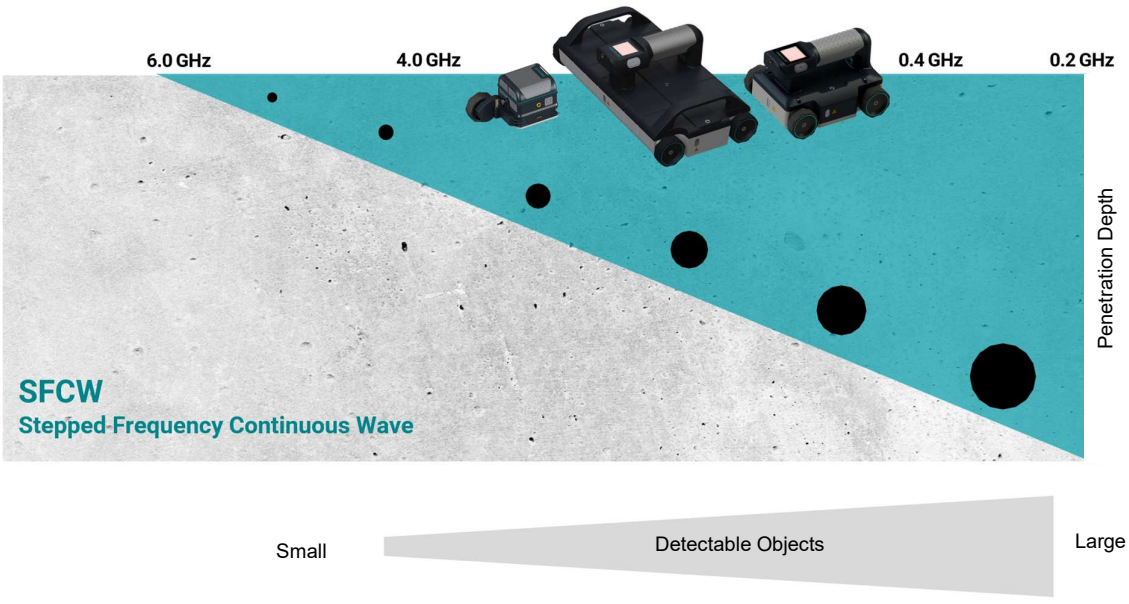


Figure 4: Stepped-Frequency-Continuous-Wave principle

The antenna (transmitter & receiver) above the concrete produces a trace called **A-scan** based on the wave trajectory across air, concrete, and reflection on objects, every material has different properties characterized by the dielectric permittivity ε. The reflection is strong on metallic objects (99% of the wave is reflected). The amplitude of A-scan (generally negative for metallic objects, positive for non-metallic objects) indicates the change of material and therefore location of objects at the peak of the amplitude.

When the antenna moves, multiple A-scans are collected along the scan to produce a **B-scan** radargram view. The colorful **migrated view** is a more intuitive way view to identify objects; it is produced from a processing radargram.

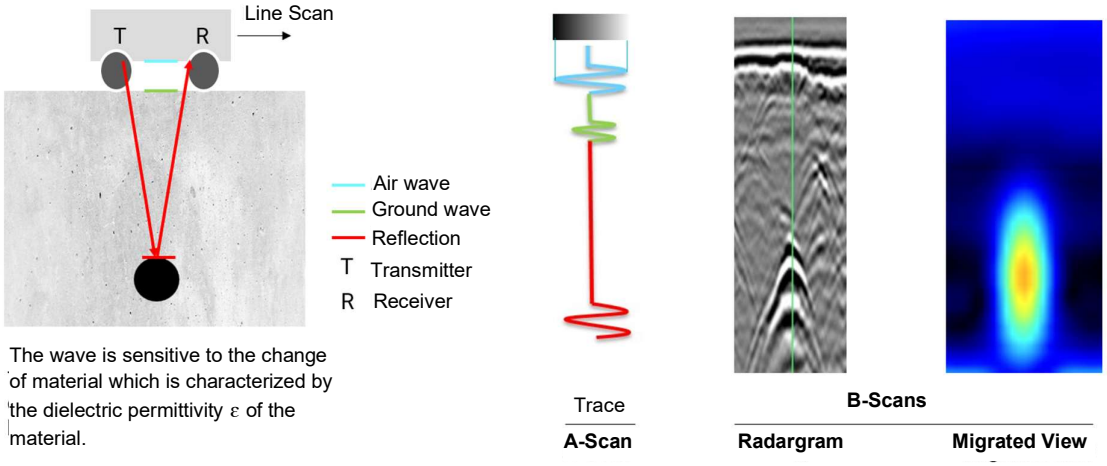


Figure 5 : A-scan, B-scan & migrated views principles

4 Sensor Overview

4.1 Getting Started

Please refer to the Quick Start Guide (included in standard delivery) for first steps with your GP8000, GP8800, or GP8100. The Quick Start Guide is also available in the download section of the product webpage:

SET-GP8X00-QSG-200x140-240408-digital.pdf (screeningeagle.com)

4.2 Buttons' function

4.2.1 Switch on/off

For GP8000 & GP8100:

- Turn on: long press 1 second the switch on/off button on the back (see Figure 6)
- Turn off: long press 1 second the switch on/off button on the back (see Figure 6)

Figure 6: GP8000 & GP8100 Switch on/off button

For GP8800:

- Turn on: long press 1 second one of the two buttons on each side (see Figure 7)
- Turn off: long press 4 seconds one of the two buttons on each side (see Figure 7)

Figure 7: GP8800 Buttons on each side

4.2.2 Start/Stop measurement

Start/Stop measurement can be also implemented from the software GP iOS app, downloadable from iOS App store. For more information, please watch tutorial videos available in GP app or YouTube (Screening Eagle Technologies channel).

For GP8000 & GP8100

There are two ways to start/stop measurements:

- Start/stop: short press one of the two buttons on the handle (see Figure 8).

Figure 8: GP8000 & GP8100 Action buttons on each side

- Start/stop: short press touchscreen following Figure 9

Figure 9 : GP8000 & GP8100 Touchscreen functions

For GP8800

Start/stop: short press one of the two buttons on each side (see Figure 10).

Figure 10: GP8800 Buttons on each side

4.2.3 Set marker

Marking digitally identified objects on the iPad screen can be also implemented from the software GP iOS app. For more information, please watch tutorial videos available in GP app or YouTube (Screening Eagle Technologies channel).

For GP8000 & GP8100

By default, “backward marking mode” is activated:

- IF device position is at front line, short press one button on side or touchscreen THEN STOP
- IF device is in back position, short press one button on side or touchscreen THEN MARK

When selected by the user, “forward marking mode”:

- IF device position is at front line, short press one button on side or touchscreen THEN MARK
- IF device is at any position and user double-pushes one button on side or touchscreen THEN STOP

For GP8800

By default, “backward marking mode” is activated:

- IF device position is at front line, short press one button on side THEN STOP
- IF device is in back position, short press one button on side THEN MARK

When selected by the user, “forward marking mode”:

- IF device position is at front line, short press one button on side THEN MARK
- IF device is at any position and user double-pushes one button on side THEN STOP

4.3 Laser functions (GP8000 & GP8100)

The GP8000 & GP8100 are equipped with a laser to indicate the scan direction & the measurement center point.

Figure 11: GP8000 & GP8100 Laser

4.4 Flexible wheel mounting (GP8800)

The GP8800 single encoder wheel can be mounted on each side for different purposes:

- To adapt to scanning conditions (ex: congested space).
- To turn the antenna at 90°in cross-polarization mode (see section 5.6)

Figure 12 : GP8800 flexible wheel mounting

4.5 Multiline (GP8100)

The GP8100 is a GPR array scanner. This means the device scans 6 lines (A, B, C, D, E, F) in only one scan called **Superline scan** (see section 5.7). It is equipped with a LED to facilitate data visualization on the iPad display when the user wishes to focus on one line scan view.

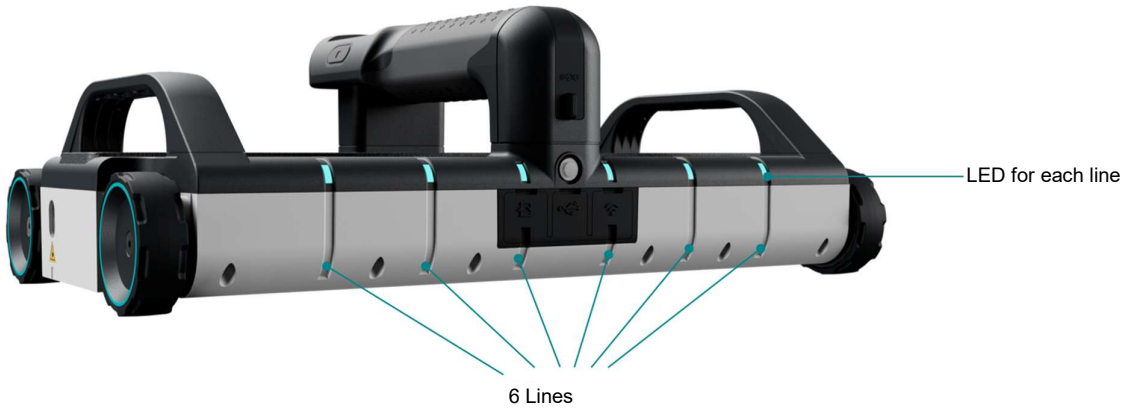


Figure 13: GP8100 array - 6 lines scan

5 Software overview

The GP app software enables visualization of any scan measurement such as line scan & area scan views with manual zoom. In addition, there is a logbook providing traceability of each measurement: time, operator, position and instrument information, pictures (with iPad camera), and written or voice notes.

Given mobile data connectivity (Wi-Fi or mobile network), the GP app automatically and safely stores all measurements on the Screening Eagle Workspace by synchronizing with the iPad. Reporting can be done from the Screening Eagle Workspace or the app.

All measurements, settings and image processing tasks are described in tutorial videos available in GP app or YouTube (Screening Eagle Technologies channel).

5.1 Connect the sensor to the GP app

Please refer to the Quick Start Guide provided in the standard delivery and available in download section of the product webpage:

SET-GP8X00-QSG-200x140-240408-digital.pdf (screeningeagle.com)

5.2 Creating a new measurement

The first step before collecting any data with the GP8x00 sensors is to create a new measurement. To do so;

1. Press on the button **Create New** for a measurement creation, or
2. Press on the **Data** tile to do the process in multiple steps

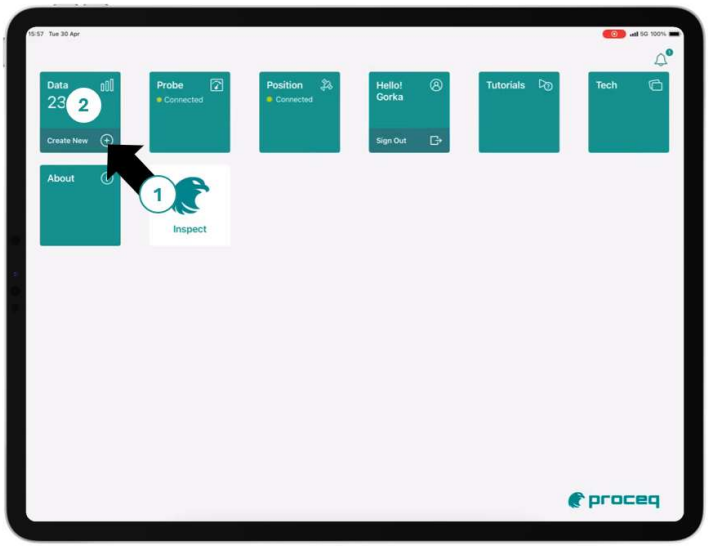


Figure 14: Creating a new measurement in the selected Screening Eagle ID account

The quick new measurement creation is not available if the GP8x00 probe is not connected.

5.2.1 Creating a folder for multiple measurements

It is possible to organize measurements in folders. To do so, once in the Data menu:

1. Press the icon **new folder**; give it a name
2. Press the icon **new measurement**

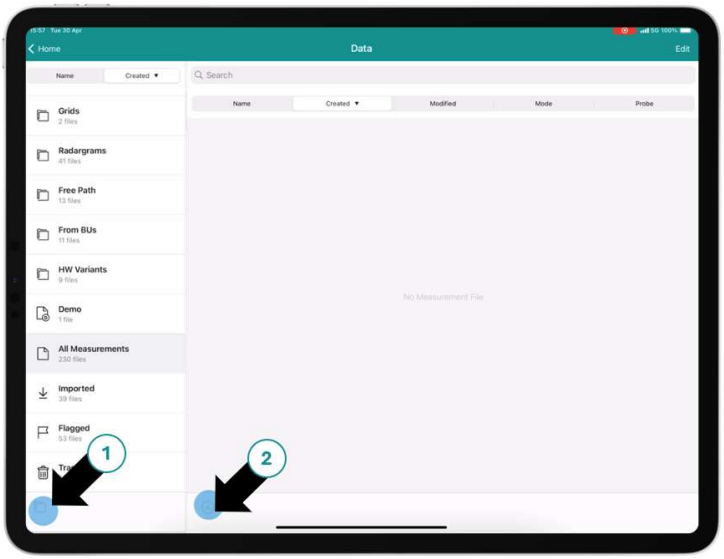


Figure 15: Creating a new folder and placing a new measurement inside it

5.2.2 Data management

By swiping with a gesture on any measurement in the list, it is possible to:

- **Delete** the measurement
- **Flag** the measurement so that it appears highlighted in the list
- Move it to a different folder (press the button **More**)
- Rename the measurement (press the button **More**)
- Share the measurement (press the button **More**)

Figure 16: Data management options for any recorded measurement

5.3 User Interface

Whether in data collection or review time, the interface presented to the user consists of four main elements: 1. **Data visualization** area 2. **Function** buttons 3**. Settings** menu 4. **Status** bar

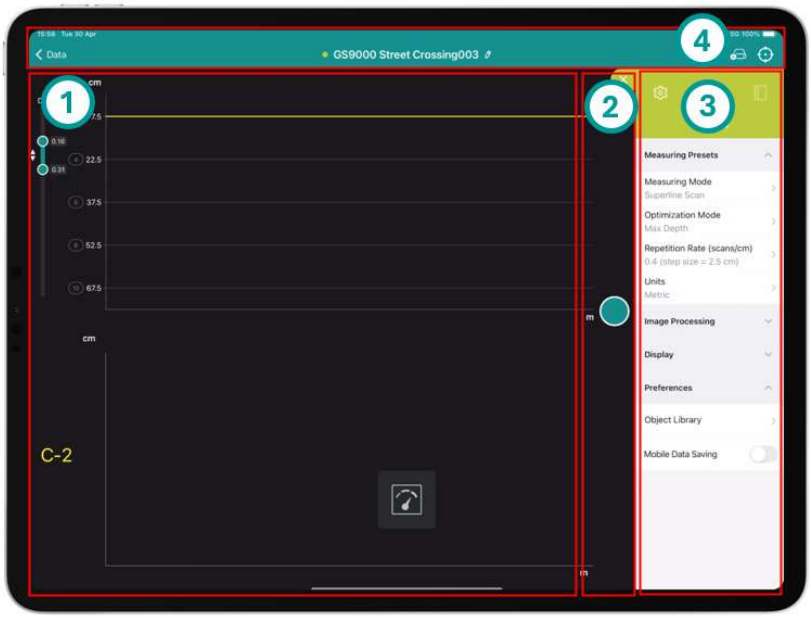


Figure 17 Main elements of the GP app user interface

While using the app, the common gestures that apply to iPads are usable:

https://support.apple.com/guide/ipad/learn-basic-gestures-ipad2c09c4d4/ipados

Symbol	Gesture
	Tap. Briefly touch an item on the screen with one finger. For example, to open an app, tap its icon on the Home Screen.
	Touch and hold. Press an item on the screen until something happens. For example, if you touch and hold the wallpaper of the Home Screen, the app icons begin to jiggle.
	Swipe. Move one finger across the screen quickly. For example, swipe left on the Home Screen to see more apps.
	Scroll. Move one finger across the screen without lifting. For example, in Photos, you can drag a list up or down to see more. Swipe to scroll quickly; touch the screen to stop scrolling.
	Zoom. Place two fingers on the screen near each other. Spread them apart to zoom in, or move them toward each other to zoom out. You can also double-tap a photo or webpage to zoom in, and double-tap again to zoom out. In Maps, double-tap and hold, then drag up to zoom in or drag down to zoom out.

5.3.1 Pressing function buttons

All function buttons are activated with a brief touch or **Tap**.

5.3.2 Selecting graphical items

To create, select or delete graphical items, such as tags, points of interest or linework, generally a gesture of **Touch & hold** will apply.

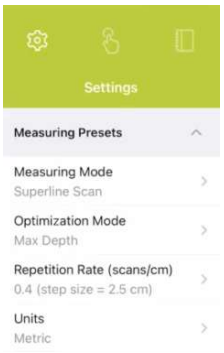
5.3.3 Zooming in and out

In any graphical view, the option to zoom in and out can be activated with a two-finger pinch gesture. On radargrams, this pinch movement is typically horizontal or vertical.

5.3.4 Switching between views

A quick two-finger swipe on the main screen allows you to switch between views.

5.4 Measuring presets



Prior to any measurement, a few parameters need to be preset to indicate the system how to perform the measurements.

These are fixed settings, which cannot be changed after data collection has finished.

Below is a list of Measuring presets:

Field	Options	Description
Measuring mode	Line Scan	Marking objects, rebar locator Long distance inspection
	Area Scan	Detailed inspection of areas
Resolution	Max. Depth	Increases depth, requires scanning slower
	Max. Speed	Decreases depth, for productive tasks
Repetition rate	0.5 scans/cm	For big measurements where resolution does not matter
	1.0 scans/cm	Standard use
	2.0 scans/cm	High resolution for locating objects
Units	Metric	Depths and distances represented in meters
	Imperial	Depths and distances represented in feet and inch

5.5 Line scan

5.5.1 Starting a measurement

When the GP8000 is rolled, the distance measured by the encoder is applied on the radargram, moving towards the left on top of data already collected. A yellow indicator represents the current position, so that the user can determine precisely when located on top of an object.

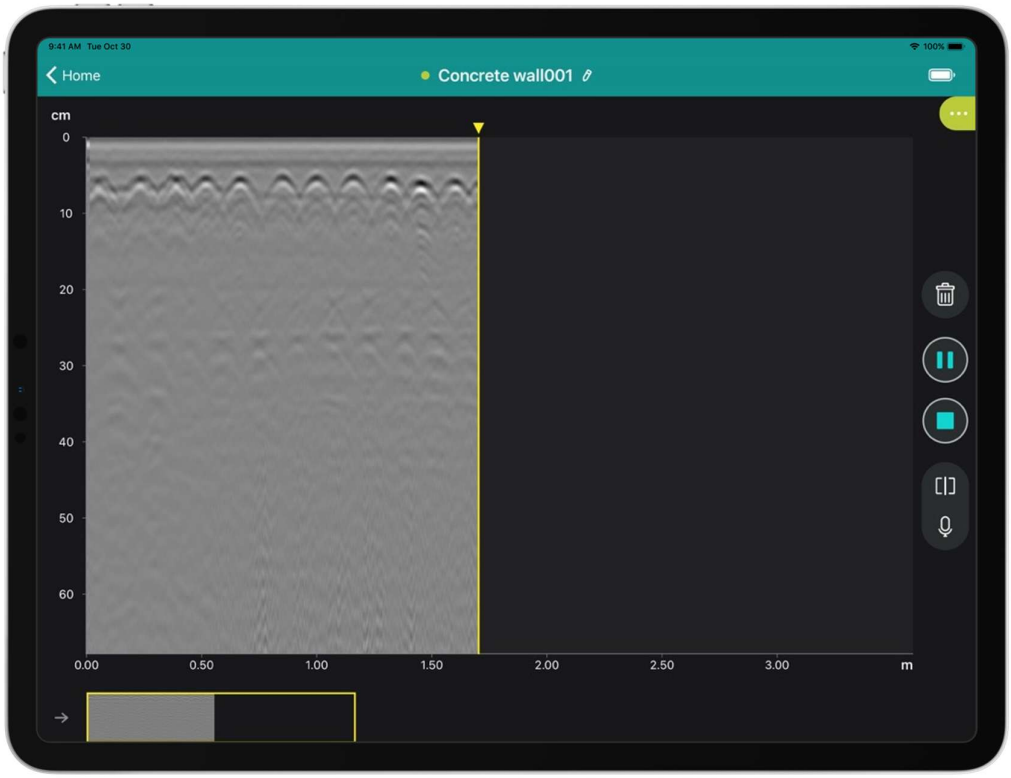


Figure 18: Current position indicator cursor in line scan measurement

When moving over a distance where data has already been collected, data is not overwritten. At least the same distance as the one rolled back needs to be walked so that new data is collected.

When the function button **Pause** is pressed, no data is collected. The user can move to any new location and press **Start** again. New data will appear in the same radargram.

When the function button **Stop** is pressed, no data is collected and the current line gets closed. The user can move to any new location and press **Start** twice. A new line with an empty set of radargrams will start to be collected again.

Figure 19: Measuring a line scan

5.5.2 Review mode

GP app software provides a **line scan** measurement view with A-scan on the left, radargram view & migrated view in the center and drop-down menu on the right.

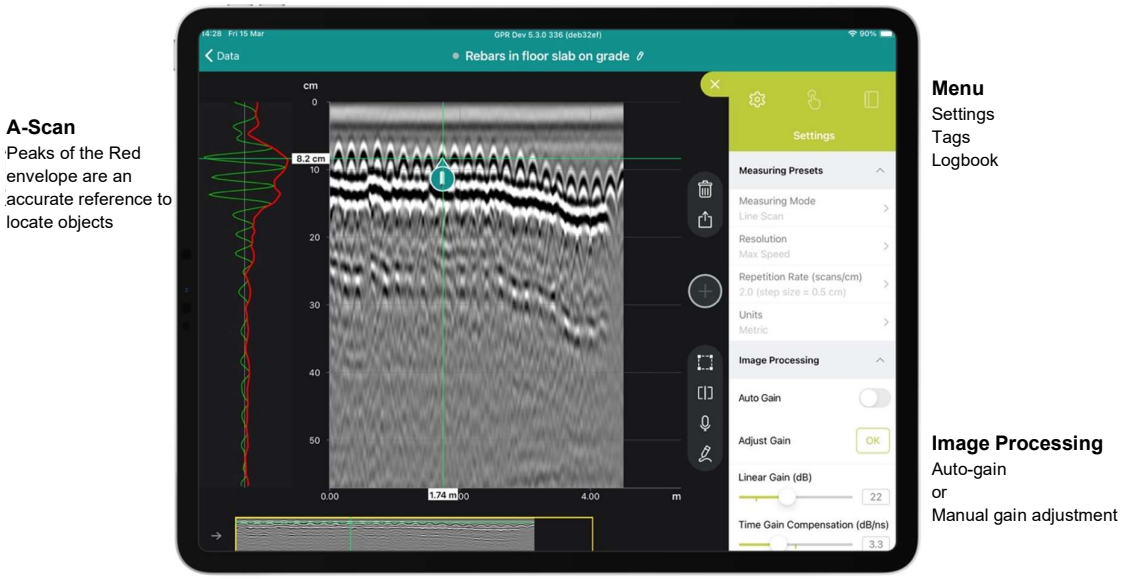


Figure 20: GP app software line scan raw data view

Single finger swipe left-right to display the A-scan. Can also be pushed away in the same manner.

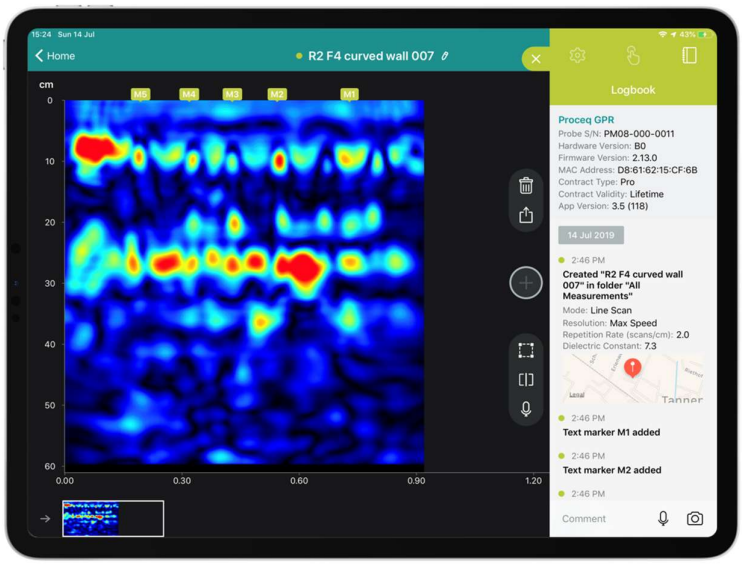
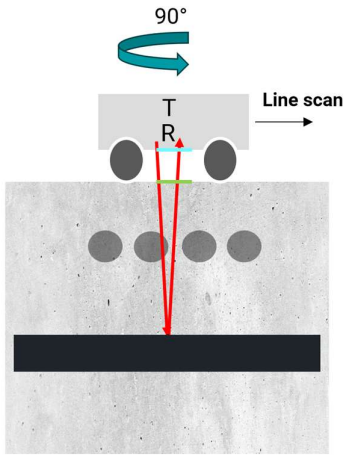


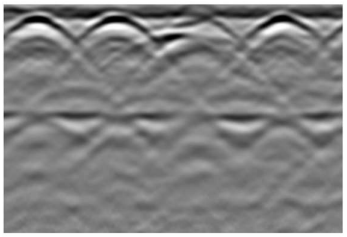
Figure 21 : GP app software line scan migrated view

5.6 Cross polarized line scan (GP8800)

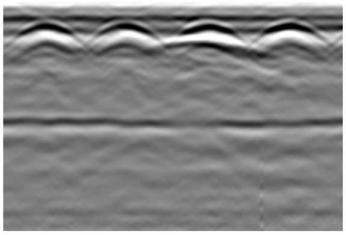
By aligning the receiver and the transmitter, which means rotating the antenna by a 90° angle, the detection of deeper objects shadowed by shallow objects (especially longitudinal targets such as ramping pipes or ducts) becomes easier as shown in Figure 22.



Cross-polarization: changing the antenna orientation eases the detection of targets shadowed by shallow objects.



Normal Line scan



Cross-polarized line scan

Figure 22: Cross polarization principle

The GP8800 is equipped with an antenna with the ability to be cross-polarized changing the orientation (90° rotation as per Figure 23) and the encoder wheel mounting (see Figure 12). The cross-polarized line scan may unveil the presence of deeper/hidden objects.

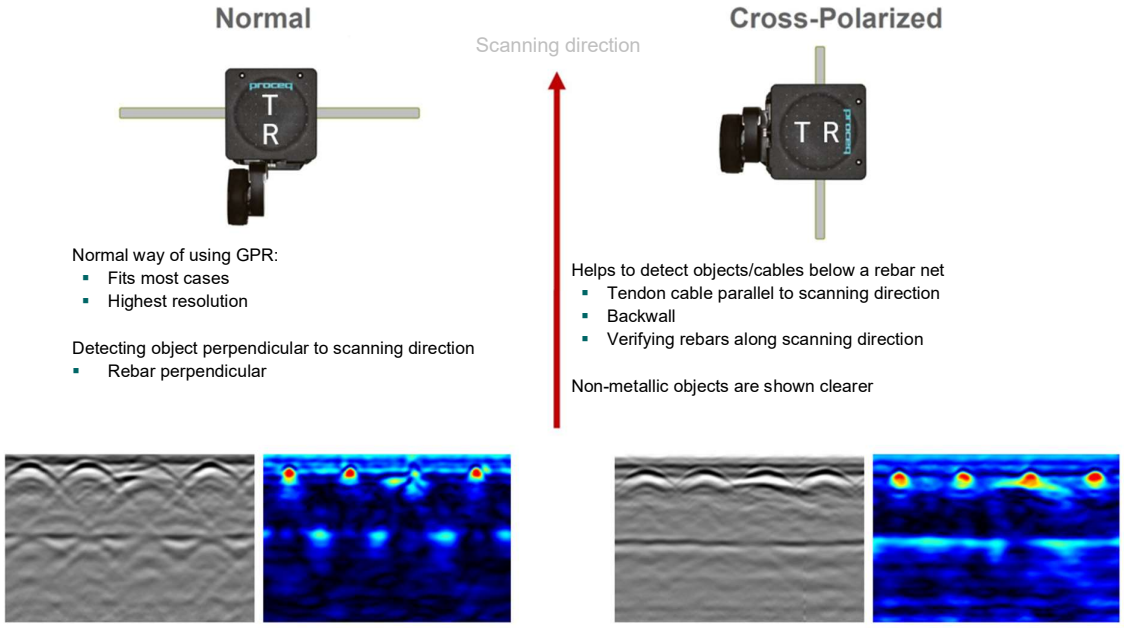


Figure 23: GP8800 Cross polarization setting

5.7 Superline scan (GP8100)

As explained in section 4.5, the GP8100 array is equipped with 6 antennas, allowing it to simultaneously measure 6 scan lines. The plan view generated from these 6 lines (A,B,C,D,E,F) is referred to as a **Superline scan**.

Each alphabetic line scan can be selected and viewed in the split view, either during or after the measurement process. During measurement, a green LED will illuminate when a line scan is selected for viewing.

The Superline scan (see Figure 24) produces a time-slice view of all objects perpendicular to the scanning direction. The user can adjust the slice thickness and create a dynamic plan view from top to bottom by moving the left slider.

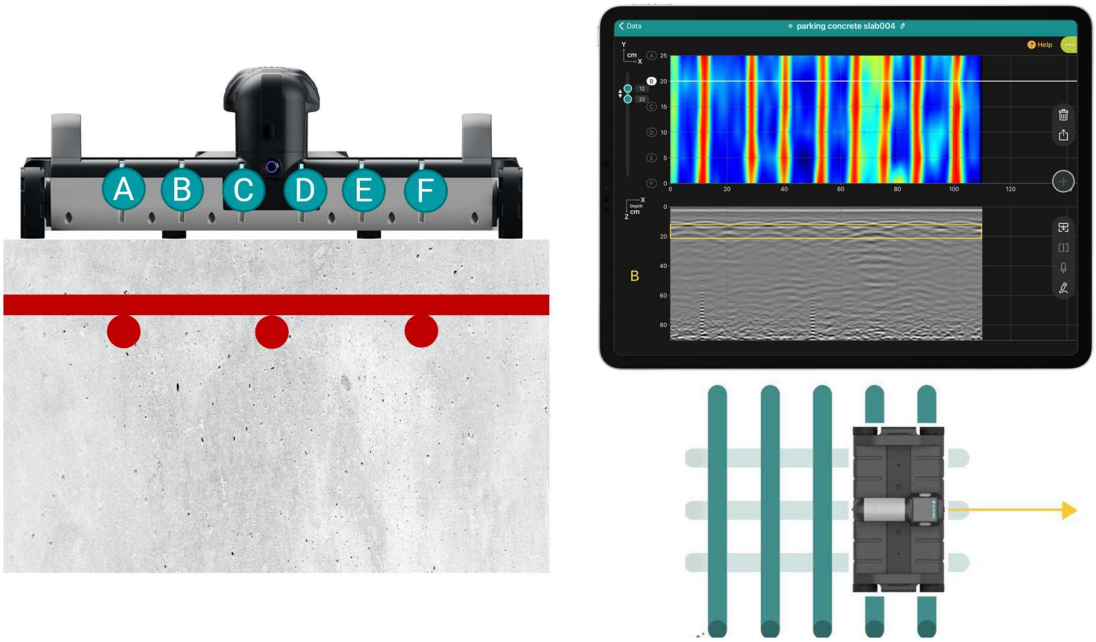


Figure 24: GP8100 Superline scan

5.8 Area scan

An **area scan**, also called **C-scan**, can be generated from the combination of different line scans in each direction (X & Y) as described in Figure 25.

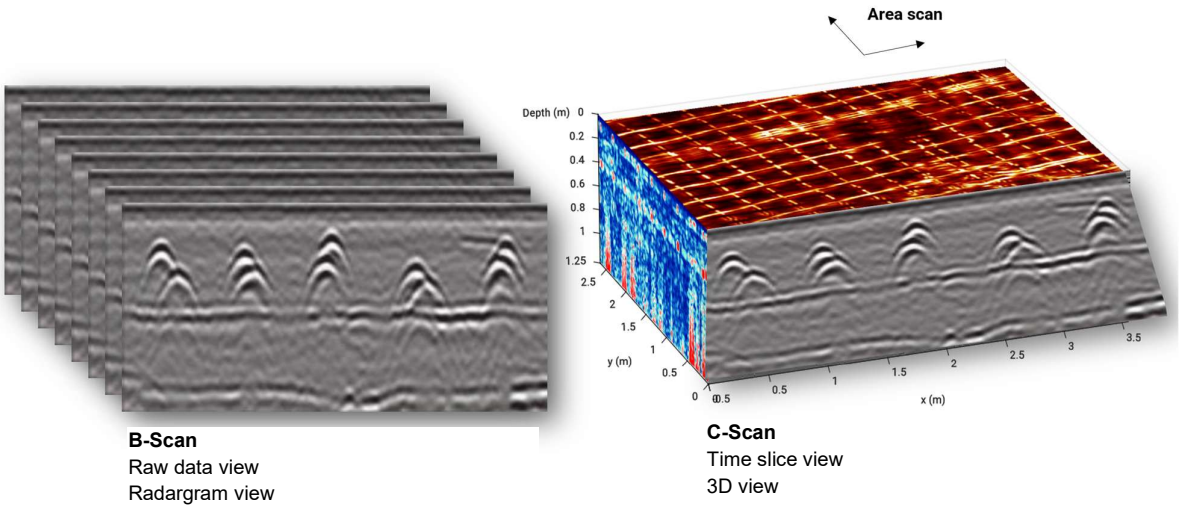


Figure 25: Area scan, 3D view & time slice view principle

GP app software provides an **area scan** measurement view (see Figure 29).

5.8.1 Starting a measurement

Grid papers are provided with the sensor kit to facilitate area scan measurement. Grid paper must be fixed to the ground or floor with tapes or similar.

For larger areas, it is recommended to mark manually all the lines in advance for getting a good quality area scan measurement.

Figure 26: Grid papers

After creating a measurement and selecting measuring mode “area scan”, there are 2 options:

- Maintain the grid paper dimensions by setting the resolution corresponding to match the grid paper (1).
  Or
- Use the flexible grid by adjusting the dimensions with your finger or by tapping (2) then setting the resolution to match the grid (1).

Once the area scan dimensions are set, proceed to scan line by line in sequence until the measurement is complete.

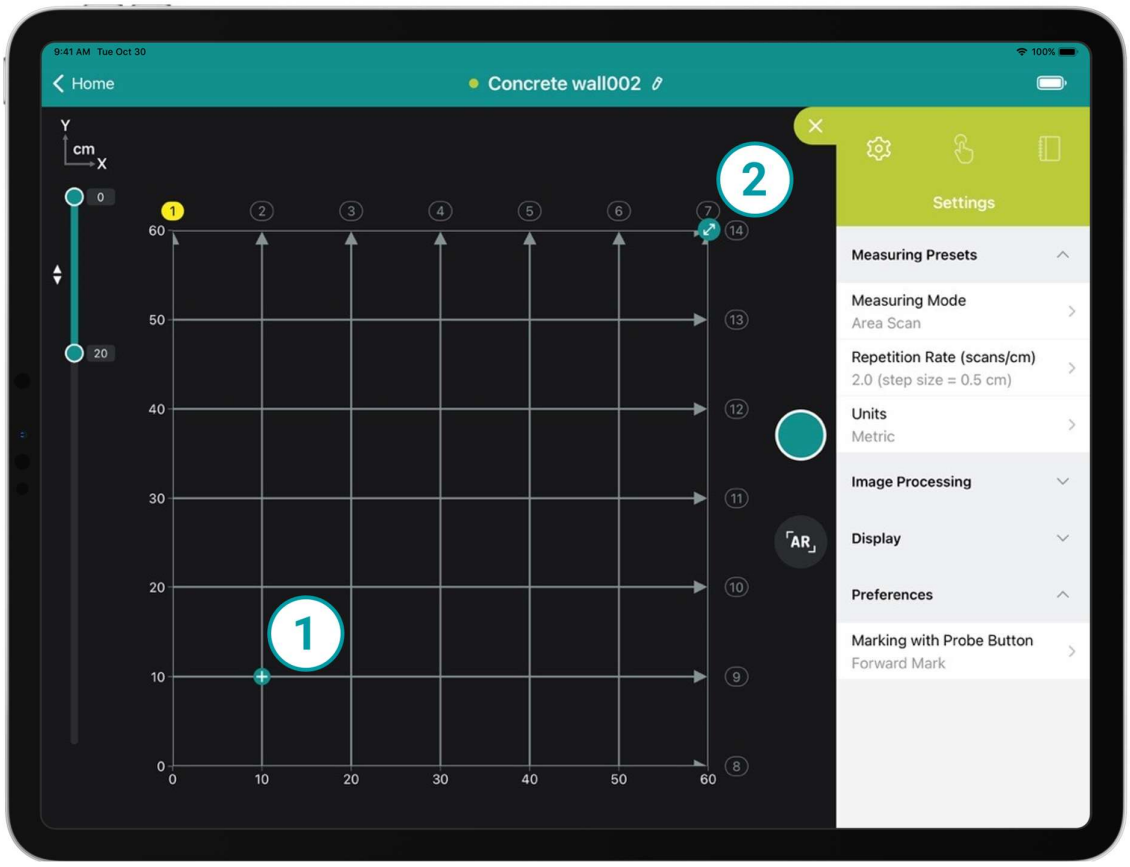


Figure 27: Area scan measurement grid

Figure 28: Scanning with grid paper

5.8.2 Time slice view

The GP app software generates a **time slice view** (as shown in Figure 29) that enhances comprehension for locating targets. Users can adjust the slice thickness and obtain a dynamic top-to-bottom plan view by moving the left depth slider.

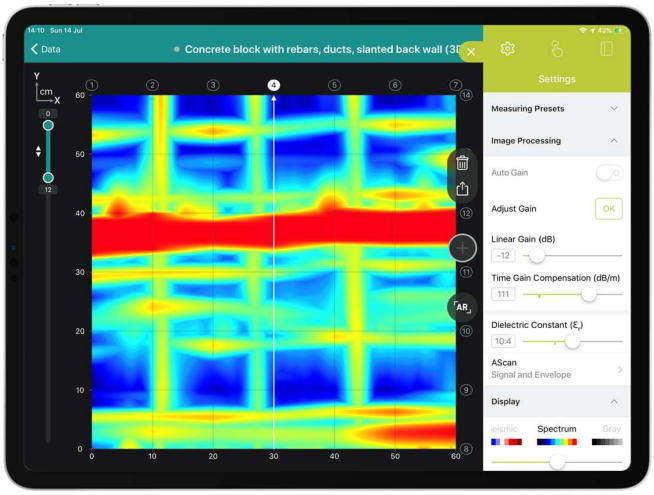


Figure 29: GP app software area scan & time slice view

5.8.3 3D view

The GP app software provides a 3D view that enhances target location comprehension. Users can easily adjust the colors of each depth interval to distinguish objects by moving the left slider.

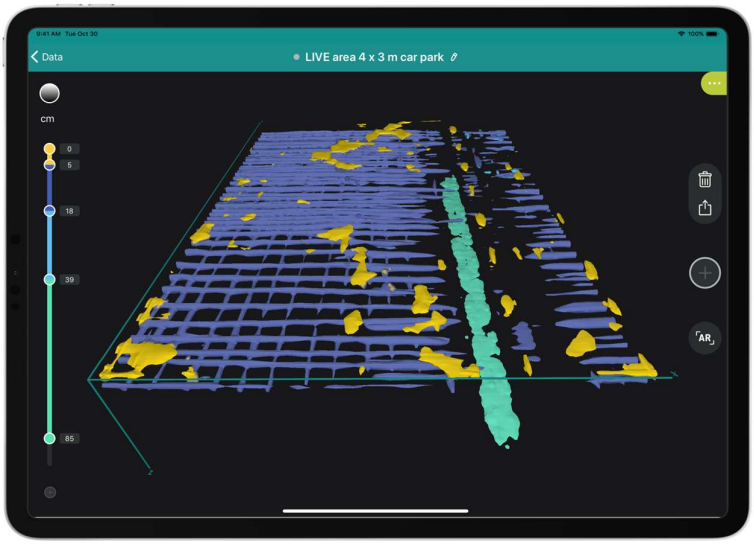


Figure 30: GP app software 3D view

5.8.4 Augmented reality (AR)

GP app software produces an **Augmented reality (AR) view** of time slice view & 3D views. Screenshots of AR view help to enrich reporting.

An augmented reality marker is included with the GP8100 sensor kit or in the grid papers provided with the GP8000/GP8800 sensor kits. This marker serves as the reference point (center = 0,0) that is placed on the surface to project the image onto the iPad.

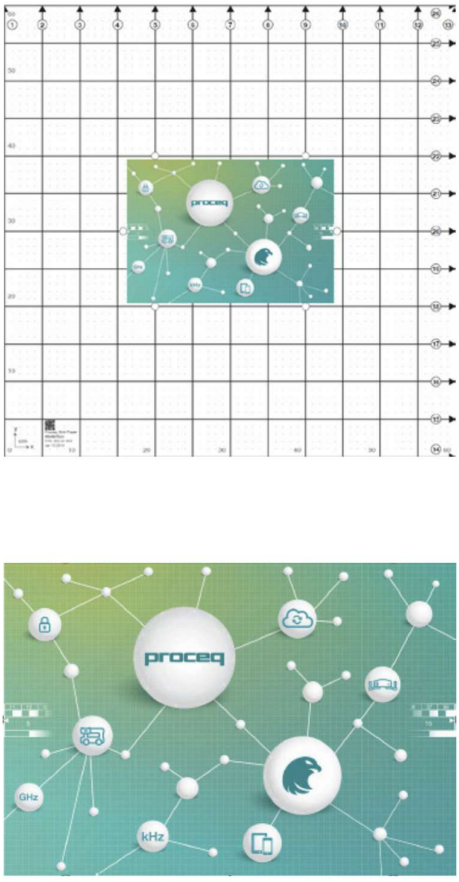


Figure 31: Augmented Reality marker

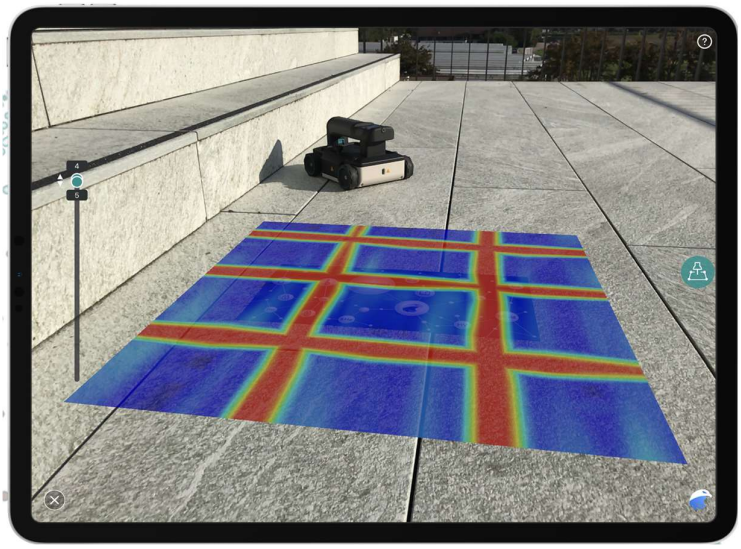


Figure 32: GP app software Augmented Reality view

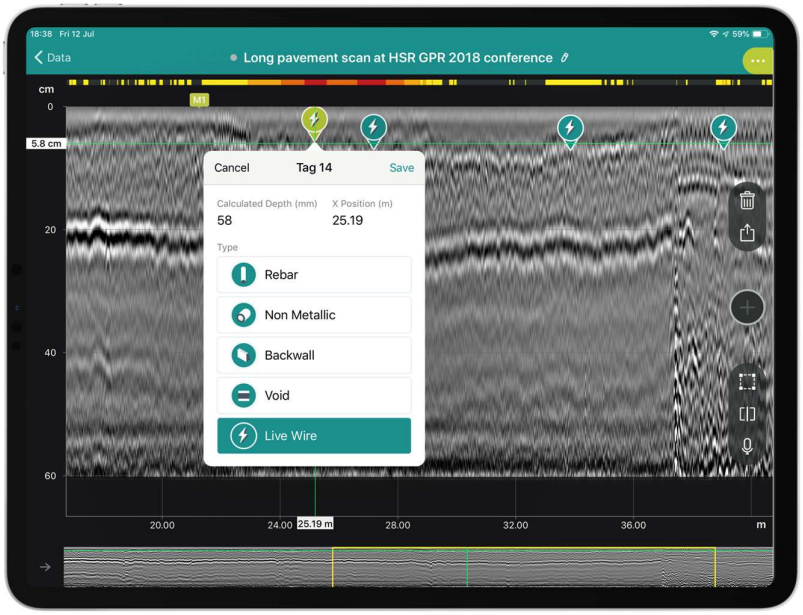
- Swipe right/left to increase or decrease the time slice view transparency.
- Swipe up/down with 2 fingers for switching between 3D view and time slice view
- Swipe up/down with 1 finger to move up/down the 3D view

5.9 Tags & Live wire detection

The **Tag menu** on the right enables the user to tag identified targets such as rebar, live wire, void, backwall or defined objects (like post-tension ducts).

GP8000 & GP8100 provide live wire detection (on top of the screen) based on signal strength color intensity that can be adjusted in image processing settings.

- It is recommended to use the A-scan (peak of the red envelope) to place tags on detected objects.
- The live wire intensity can be adjusted using the threshold slider in the Display settings.



Live wire
Signal strength
(not a measurement)

Tags
Choose from a library of predefined and user-defined tags to mark objects

Figure 33: GP app software Tags & Live wire detection

5.10 Image processing

The **Settings menu** offers a unique wide range of image processing, significantly improving the data quality and the clarity of different views.

5.10.1 Gain

Due to GPR energy attenuation in concrete, some objects may appear weak or invisible. By increasing energy through gain, the image can be improved with targets being more visible.

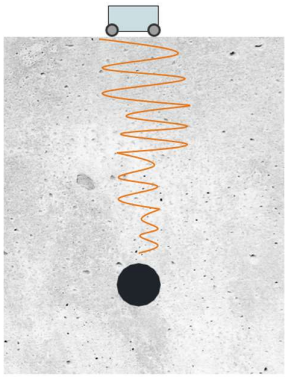
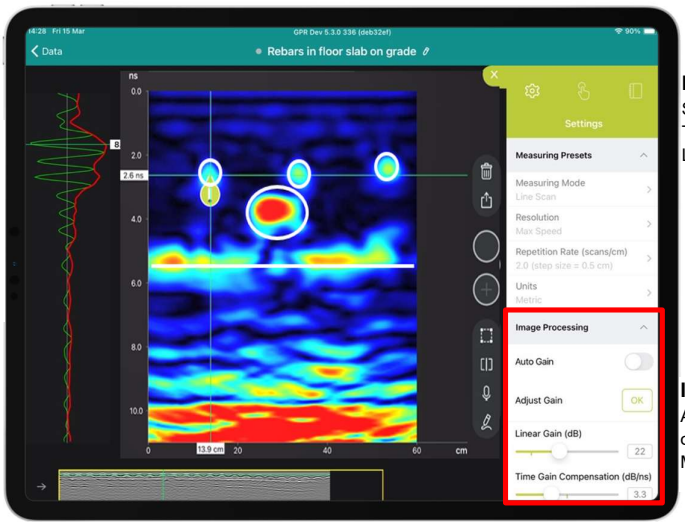


Figure 34: GPR ground wave's energy attenuation

GP app software provides in image processing dropdown menu an automatic gain called "**Auto-Gain**" which automatically adjusts the gain and amplifies the signal to improve the image quality. However, it is possible to adjust manually the gain with "**Linear Gain**" & "**Time Gain Compensation**" settings.

A-Scan
Peaks of the Red envelope are an accurate reference to locate objects



Menu
Settings
Tags
Logbook

Image Processing
Auto-gain
or
Manual gain adjustment

Figure 35: GP app software image processing auto-gain or manual gain adjustment

5.10.2 Noise cancellation

Interfering noise from close electronics devices, Wi-Fi routers, or smartphones may affect the data quality with “typical scare pattern” appearing on measurement views.

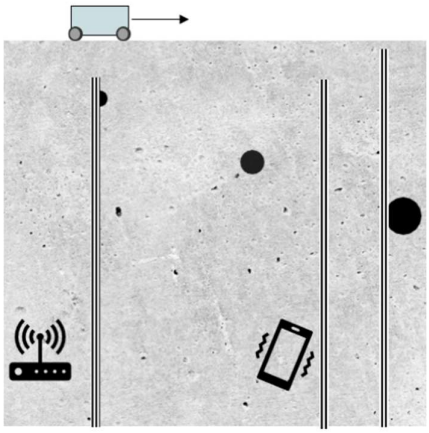
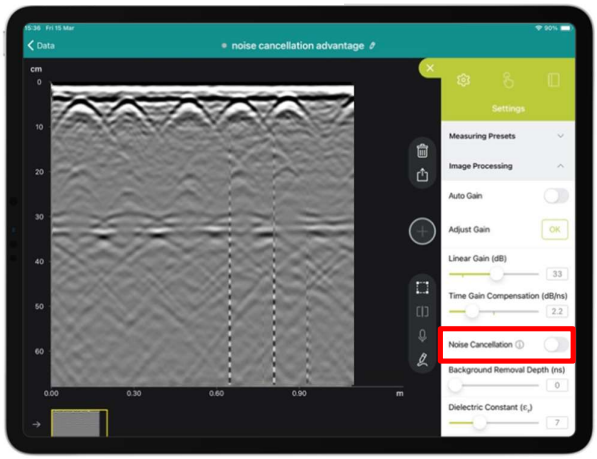


Figure 36: Noise affecting GPR object detection

GP app software provides in image processing dropdown menu: the “N**oise Cancellation**” setting which, when activated, will remove noise and improve data clarity (Figure 37).

Image processing

Noise cancellation off



Noise cancellation on

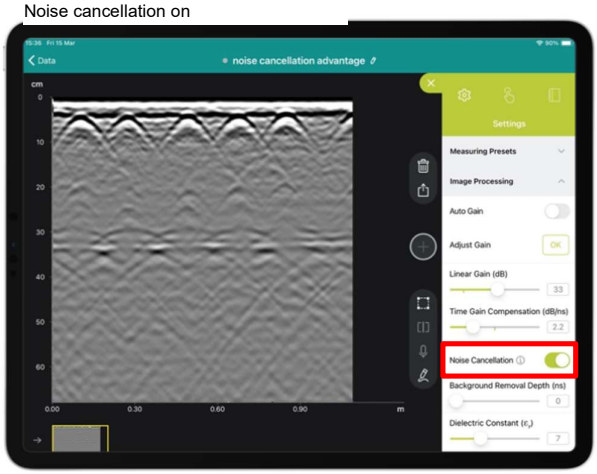


Figure 37: GP app software image processing noise cancellation

5.10.3 Background removal

In some circumstances, GPR waves from the transmitter are received by the receiver without penetrating the concrete. This creates a disturbance called “background” (visual longitudinal strip) which affects the data quality and may hide shallow targets.

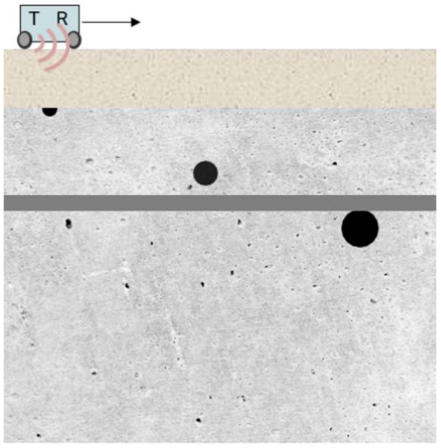
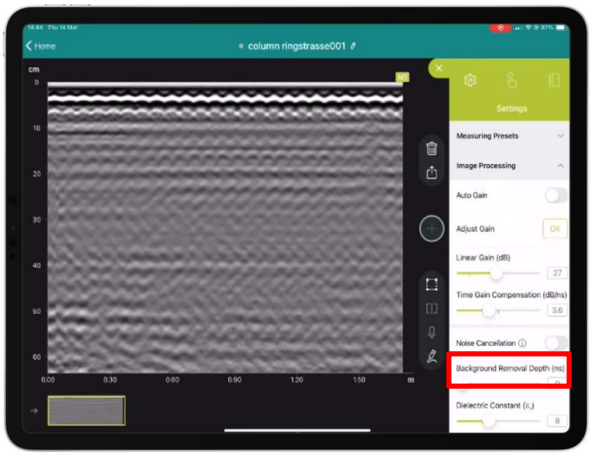


Figure 38: Background affecting GPR object detection

GP app software provides in image processing dropdown menu: the “**Background Removal**” setting which, when activated, removes the background, and makes shallow objects easier to see such as rebar as shown in Figure 39.

Image processing

Background removal off



Background removal at maximum level

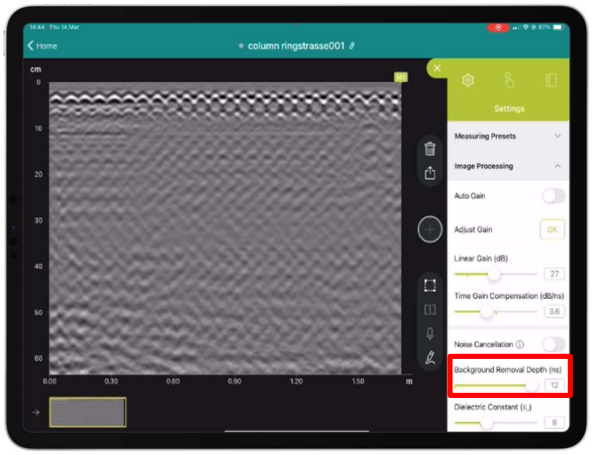


Figure 39: GP app software image processing background removal

- Use with caution, background removal may remove desired targets.
- When first viewing a GPR radargram (B Scan), it is advisable to set background removal to zero so as not to remove legitimate linear features from the data.

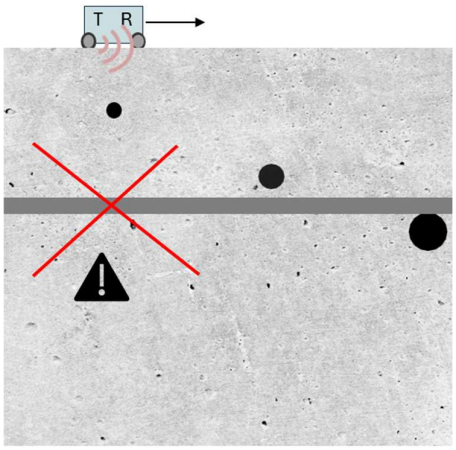


Figure 40: Background removal warning on longitudinal objects

5.10.4 Dielectric constant

The concrete material characterized by the dielectric ε (permittivity) influences hugely the measurement.

- When concrete is dry (ε<5), GPR waves are less attenuated and can penetrate deeper resulting in more prominent signals/hyperbolas.
- When concrete is wet (ε>9), GPR waves are heavily attenuated by the presence of water resulting in less prominent signals/hyperbolas.

The standard concrete usually has a dielectric (ε) between 6.5 and 7.5.

The dielectric constant of concrete can vary widely not only due to moisture content, but also factors such as the composition of the concrete mix, types of aggregates, and the presence of

air voids. As the dielectric constant is influencing the propagation of the electromagnetic waves in the material, it will influence the shown depth and object size. This is why it is critical to set ε when considering depth and objects' size accuracy.

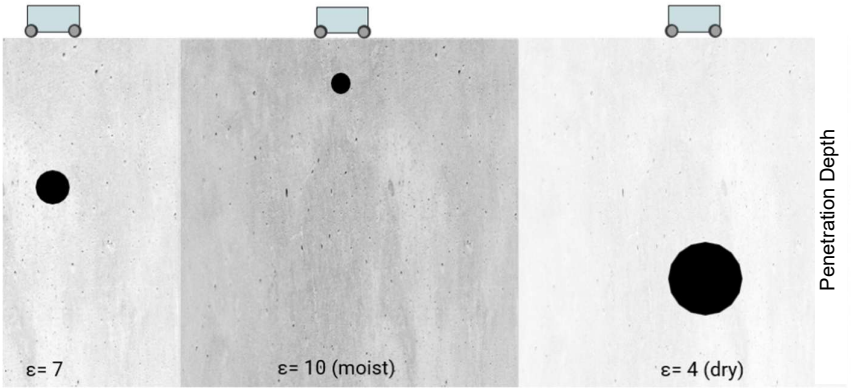


Figure 41: Concrete dielectric ε principle

GP app software provides different solutions to adjust the concrete dielectric.

5.10.4.1 Manual setting of dielectric value

When the concrete dielectric (ε) is known, then the dielectric value can be entered manually in the image processing menu (see Figure 42).

5.10.4.2 Hyperbola fitting dielectric estimation

In case the concrete dielectric (ε) is unknown, then the dielectric can be estimated with the "Hyperbola fitting" feature. By adjusting the dielectric value in image processing menu, the user must fit the new appearing yellow hyperbola on any clean hyperbola of existing object in the raw data view (B-scan) as shown in Figure 42.

Make sure the yellow hyperbola precisely covers-up the object's hyperbola. Use clean hyperbolas that are collected at a 90° orientation to the object. Compare several hyperbolas to confirm the fit.

Image Processing
Manual dielectric adjustment
or
Hyperbola fitting

Figure 42: GP app software image processing manual input or hyperbola fitting for estimation of Concrete dielectric ε

5.10.4.3 Tag object set depth dielectric calibration

When the concrete dielectric (ε) is unknown, but one object's depth (such as rebar) is precisely known from a cover meter or inspection hole then the dielectric can be calibrated by setting the depth of the object using a tag in "tag setting input depth as shown in Figure 43.

We recommend the use of cover meters such as Profometer PM8000 to precisely estimate the depth of rebar in shallow layers. Cover meter technology (eddy-current) is not influenced by the concrete dielectric.

Image processing
Dielectric adjustment with an Eddy current cover meter

GPR Rebar depth:
+/- 5mm error margin after adjustment

Eddy current Rebar depth:
+/- 1mm error margin (independent of concrete characteristics

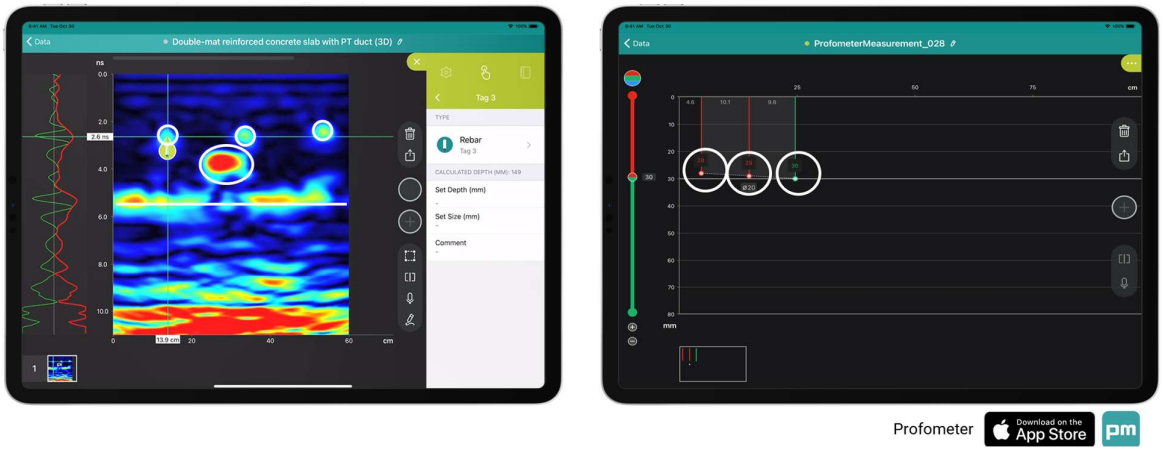


Figure 43: GP app software tag object set depth for calibration of concrete dielectric (ε)

5.10.5 Adjustable Time window (GP8000)

The time window is the time that the antenna's receiver spends listening to the GPR signals reflected from objects (reflectors) embedded in concrete (see Figure 44). Most handheld antennas have a fixed time window. Therefore, they are not suited to receive reflected signals from deeper objects (provided an adequate range of low frequencies) and only focus on shallow layers.

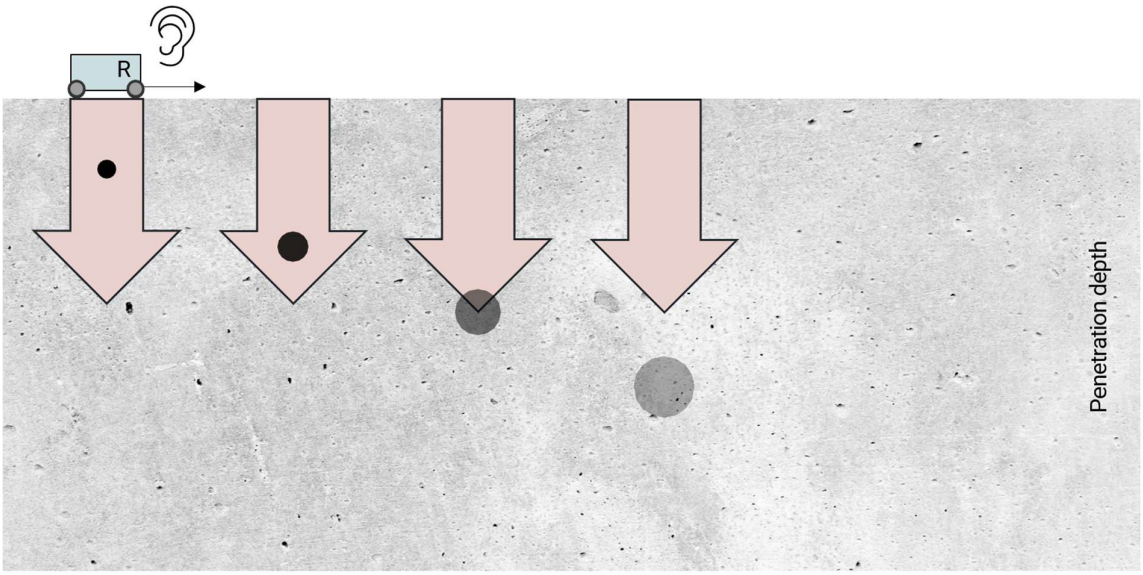


Figure 44: Time window principle

In the **Image processing** menu of GP app software (only with GP8000) the "**Depth/Time Window**" can be set. By adjusting the time window from 10 ns (shallow) to 24 ns (deep), the user can either focus on shallow objects or extend the depth to the maximum (150cm / 60in penetration depth for standard concrete).

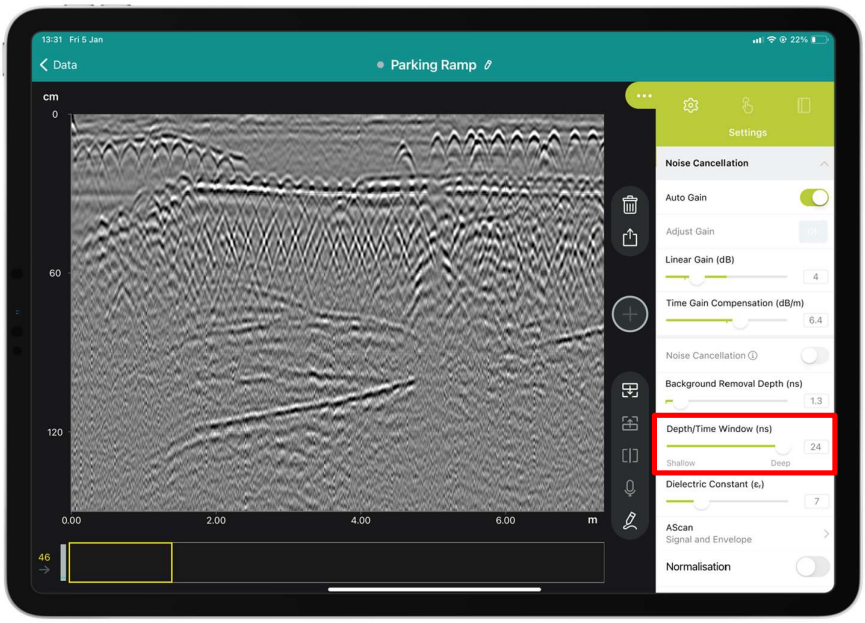


Image Processing
Adjustable time window

From 10 ns (shallow)
To 24 ns (deep)

Figure 45: GP app software image processing adjustable time window

5.11 Display & preferences

5.11.1 Color setting

Display in menu provides a wide range of color settings for the different views.

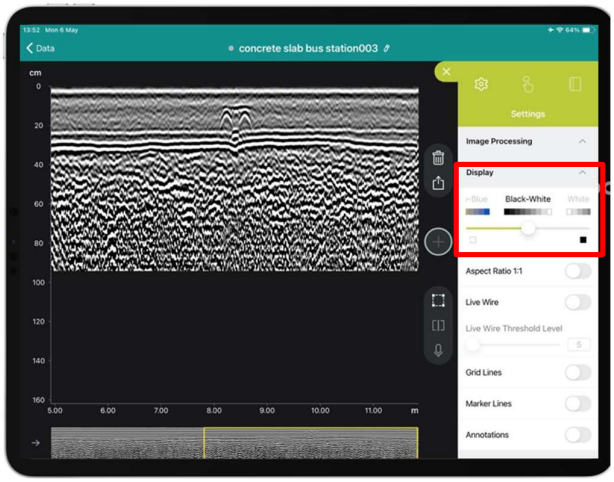
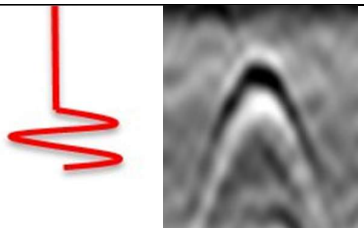
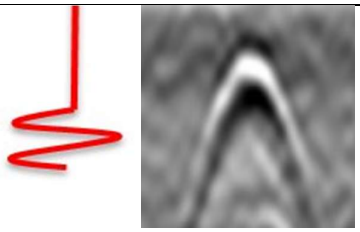
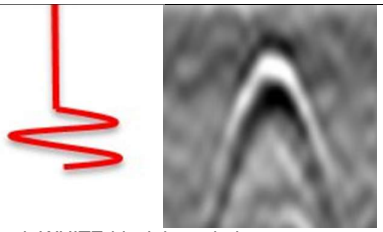
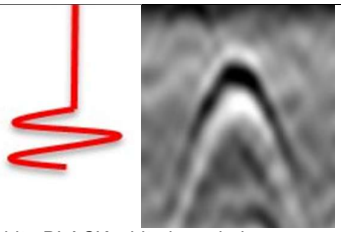


Figure 46: GP app software color display setting

By default, **Raw Data view** is in “Black-white” color scheme. This means, where the A-scan amplitude is negative (typically a metal target in concrete), the B-scan generates a main centered black color at the rebar position. Conversely, where the A-scan amplitude is positive in concrete (typically air or plastic) the B-scan generates a main centered white color. However, be aware that the opposite is “White-black” color scheme setting!

Raw data view (B-scan) Color display setting	**Metal** or **water** target in concrete A-scan with negative amplitude From Concrete to Metal or water Depending on dielectric differences!	**Plastic** or **air** target in concrete A-scan with positive amplitude From Concrete to Plastic or air Depending on dielectric differences!
Black-white (by default)	 white-BLACK-white hyperbola	 black-WHITE-black hyperbola
White-black	 black-WHITE-black hyperbola	 white-BLACK-white hyperbola

5.11.2 Marking preference

The GP app proposes two alternatives for setting markers in “**Marking with Probe Button**” setting in drop down menu.

- Back Mark: Marking by scanning backward
- Forward Mark: Marking by scanning forward

See section 4.2.3 to learn more about the marking button functionality.

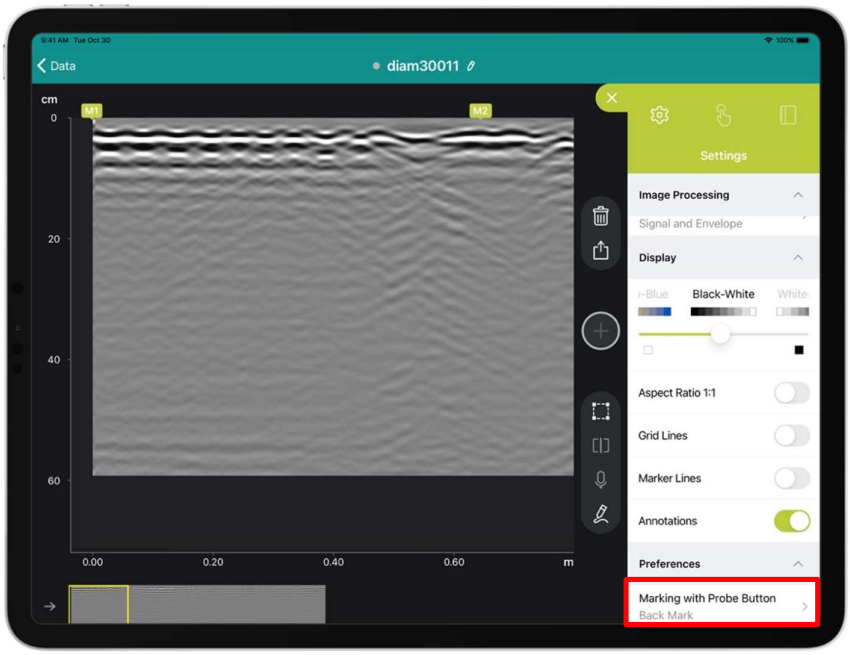


Figure 47: GP app software Marking with Probe button setting

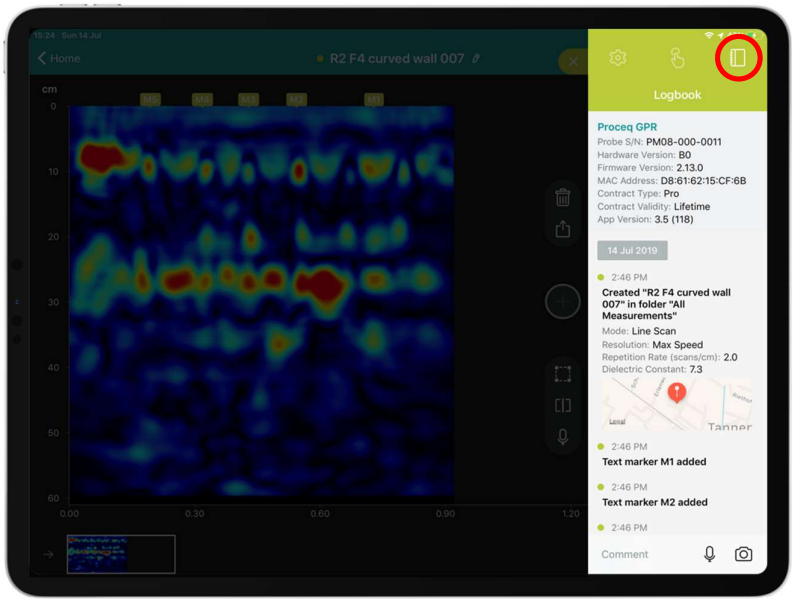
5.12 Logbook & Workspace

The GP app automatically collects meta-data to each measurement and stores it in the logbook of the measurement file. This is shown in the menu bar when the logbook item is selected (see Figure 48):

- Sensor serial number
- Software license owner
- Geolocation
- Measurement setting changes

Additional information can be stored in the logbook by the user:

- Pictures of the site
- Relevant snapshots
- Text & voice notes



Logbook
Probe Information
Measurement Settings
Geolocation (Position)
Markers/Tags
Photos
Text & Voice notes

Figure 48: GP app software logbook

5.13 Data storage, reading, archiving, sharing & reporting

Screening Eagle Workspace is an online platform where all measurements are stored automatically as soon as there is data connectivity (Wi-Fi or mobile network) allowing synchronization of the iPad. Reading and reporting (pdf printing of tab) is possible from anywhere at any time. The tabs provide all the screenshot views & logbook information. Sharing from workspace is possible with different formats such as DOCX, XLSX, SEGY, or JPG.

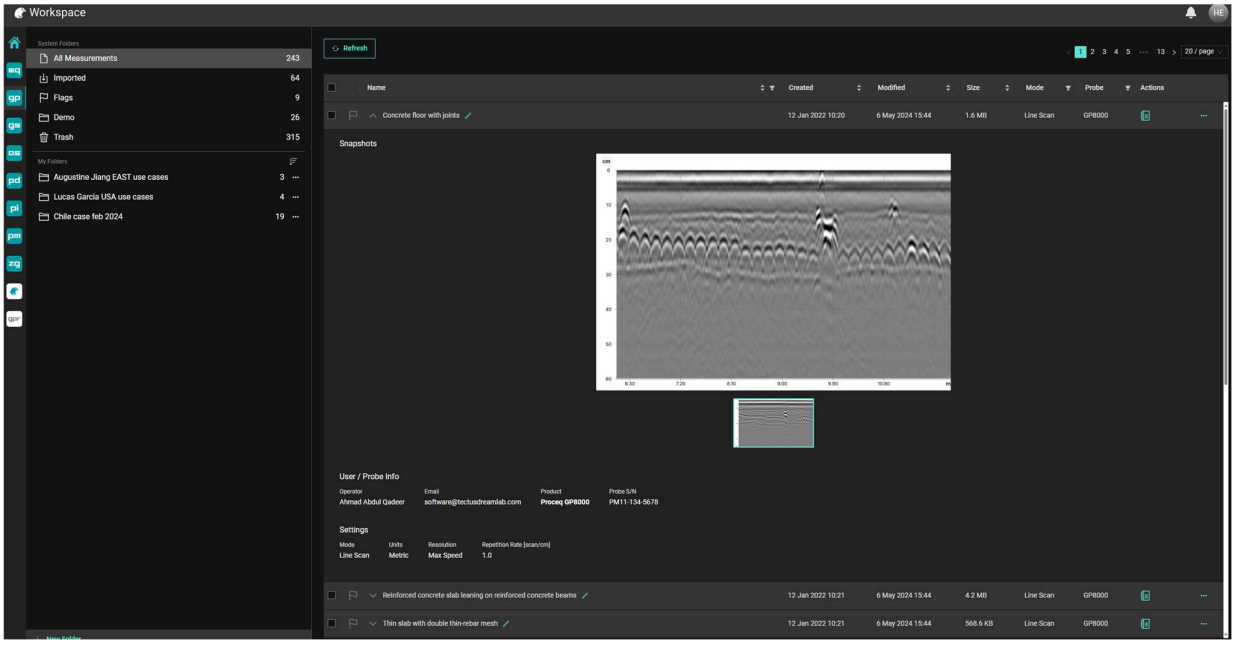
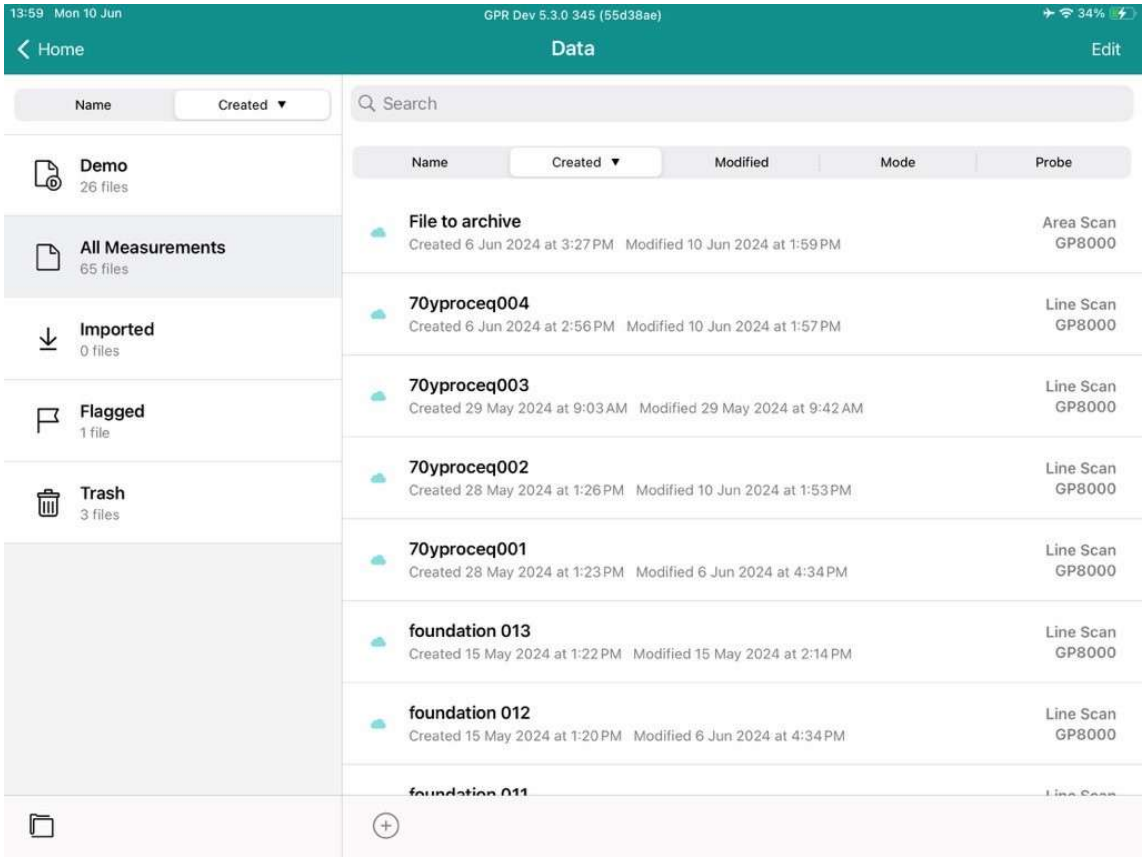


Figure 49: Screening Eagle Workspace

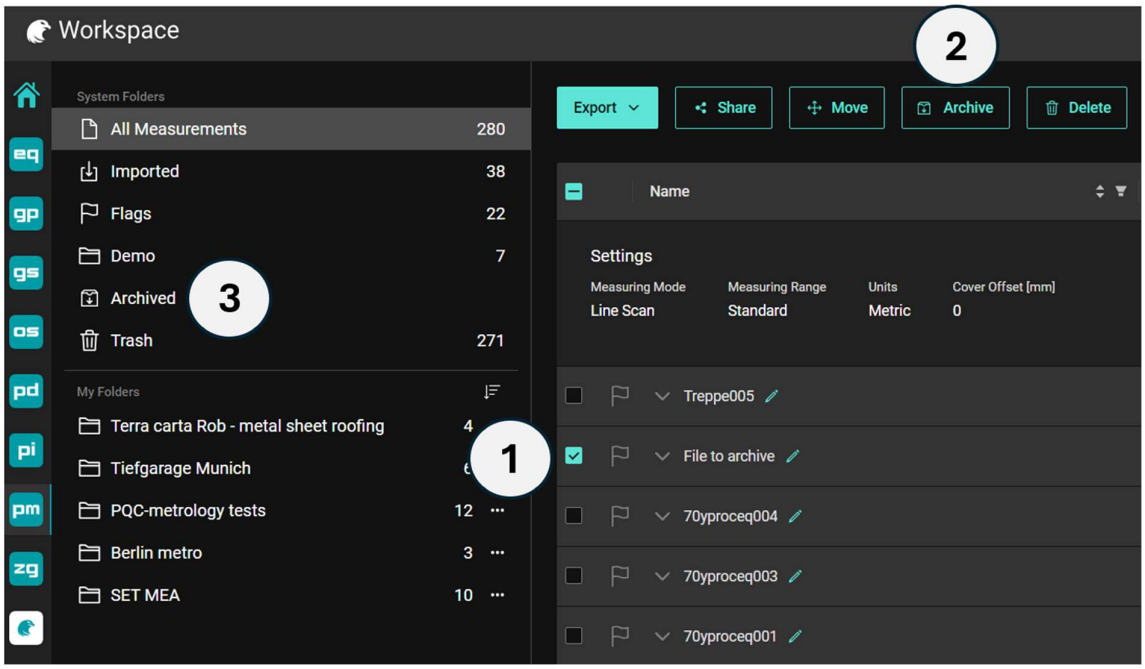
How does archive work?

All measurements recorded in a Screening Eagle user account are synchronized automatically to the iPad in use (this is represented with a colored cloud) once logged into the app with those ID credentials:

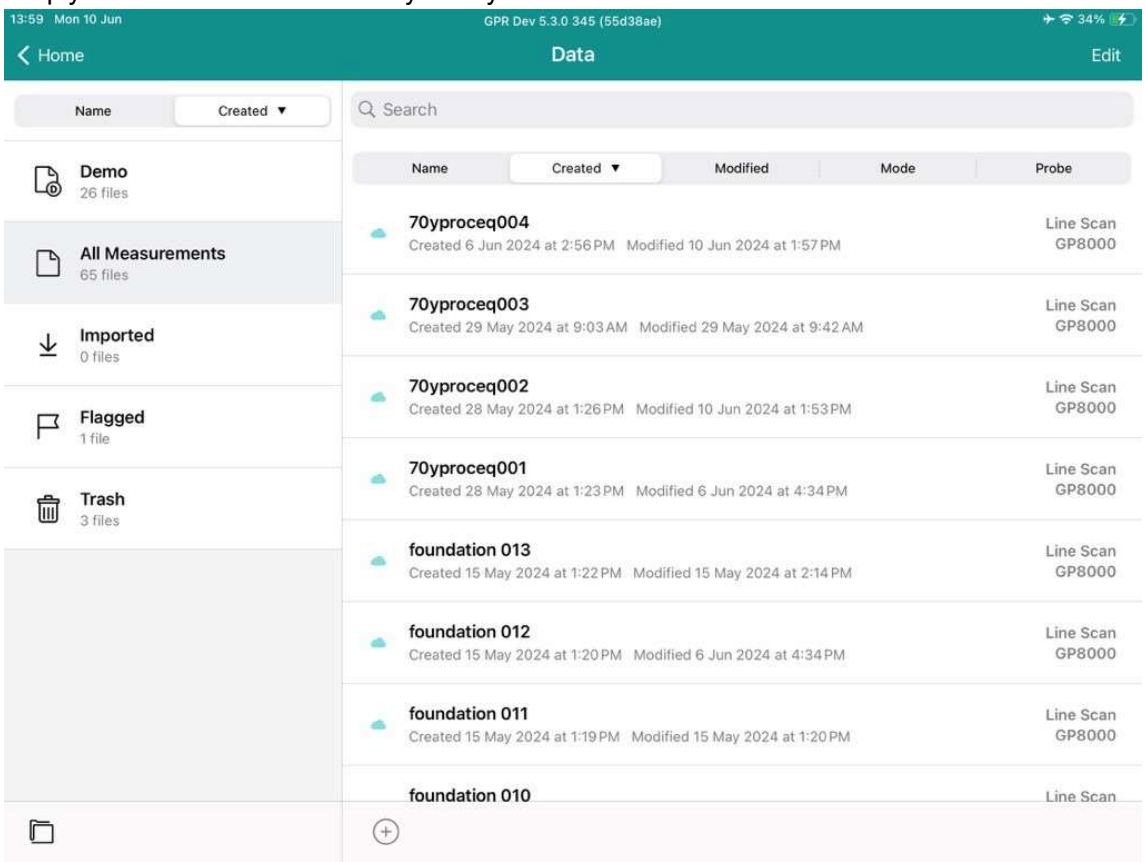


When accessing **Workspace**, it is possible to archive one or multiple measurements. To do so:

1. Select the measurement to be archived
2. Press the button Archive
3. The file will be automatically moved from the “All Measurements” to “Archive” folder



When the app is accessed next time (if app already running, please force a refresh by sliding up the list on the “All Measurements” screen), the archived measurement will simply not be listed and will not sync anymore to the iPad:



Is archiving irreversible?

No. An archived measurement can always be restored.

To do so, in Workspace, select the Archived folder, select the measurement to restore, and press Restore:

The measurement will move to the “All Measurements” folder again, and the app will recognize it in the next login or refresh, by synchronizing it again, provided there is local space in the iPad.

6 Artificial intelligence (AI) features

Any AI feature is provided strictly as an assistance tool. While it can support analysis and decision-making, it may generate inaccurate, incomplete, or misleading outputs. All results must be reviewed and validated by qualified professionals. The AI feature should not be relied upon as a sole source of truth.

6.1 AI Tag

AI Tag helps save time by automatically identifying and tagging most of hyperbolas in shallow layers. This feature is particularly useful for rebar cover, spacing, and pitch assessments, similar to cover meter outputs. An Excel report can be generated with basic statistics like average, minimum, and maximum cover.

Limitations of AI Tag

- Surface condition: Performance decreases on concrete covered with additional layers such as asphalt or plaster. Best results are achieved on bare concrete.
- Object density: Performance decreases as object density at different layers increases.
- Detection accuracy: AI Tag does not guarantee 100% hyperbola detection or tagging. Accuracy will continue to improve with future app updates and training.
- User validation required: Users must always review the results and adjust as needed by removing false positives or adding missing tags.

How to use AI Tag?

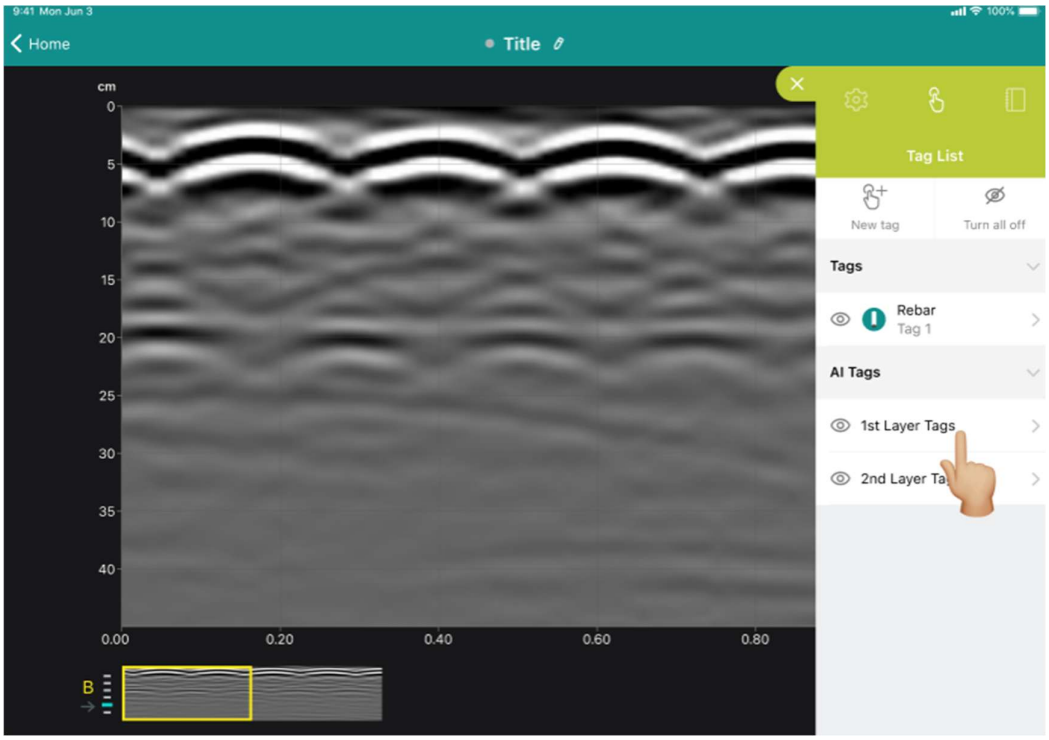
Step 1:

For best results:

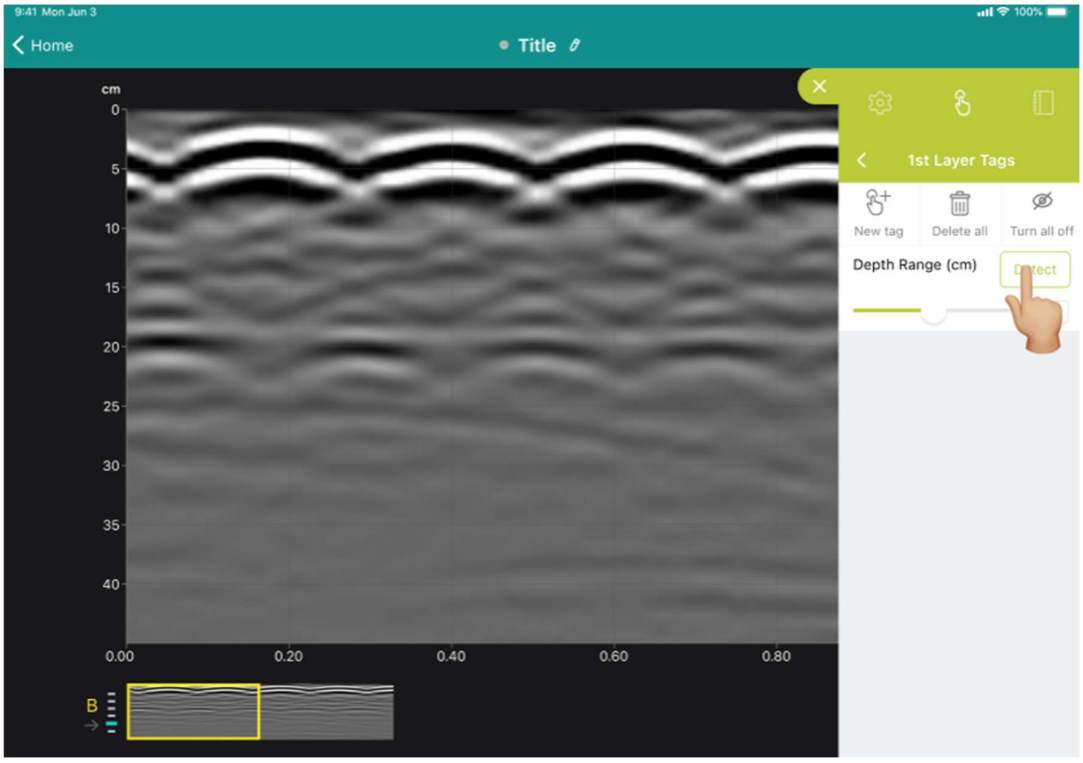
- Turn on Auto Gain!
- Calibrate Dielectric Constant
- Keep Background removal level at 0
- For GP8000, Keep time window at medium level (16ns)

All of these can be changed again after running AI Tagging.

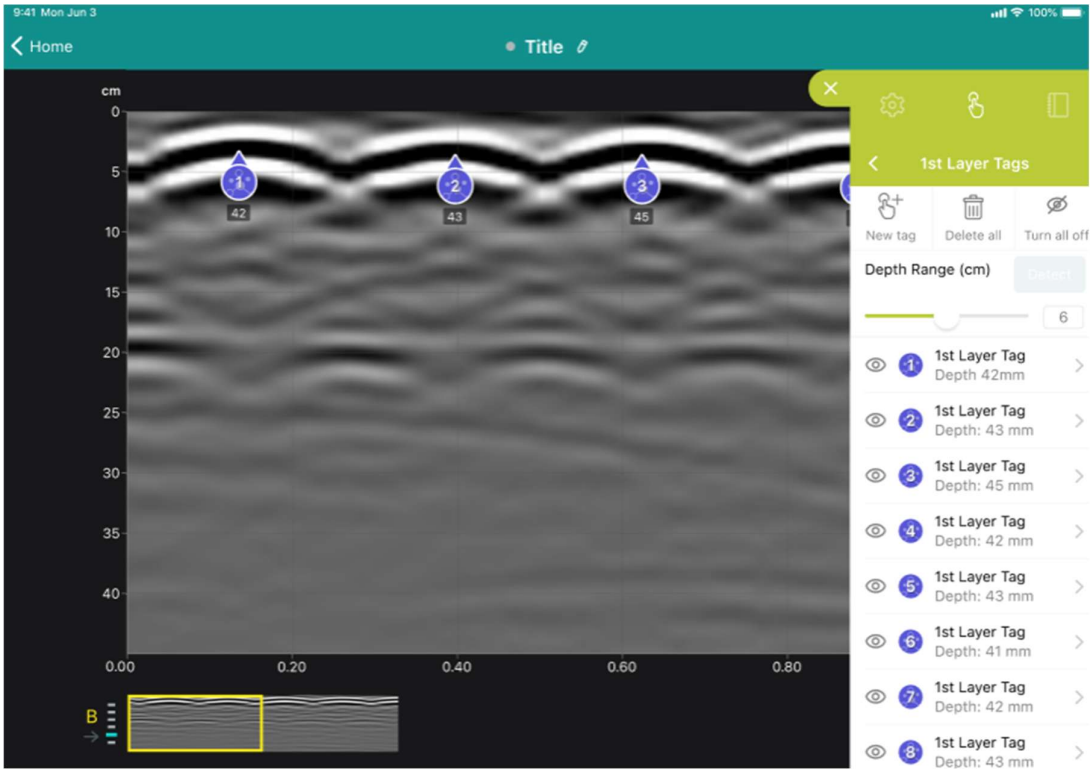
Step 2: Go to Tag List, then select AI Tags.



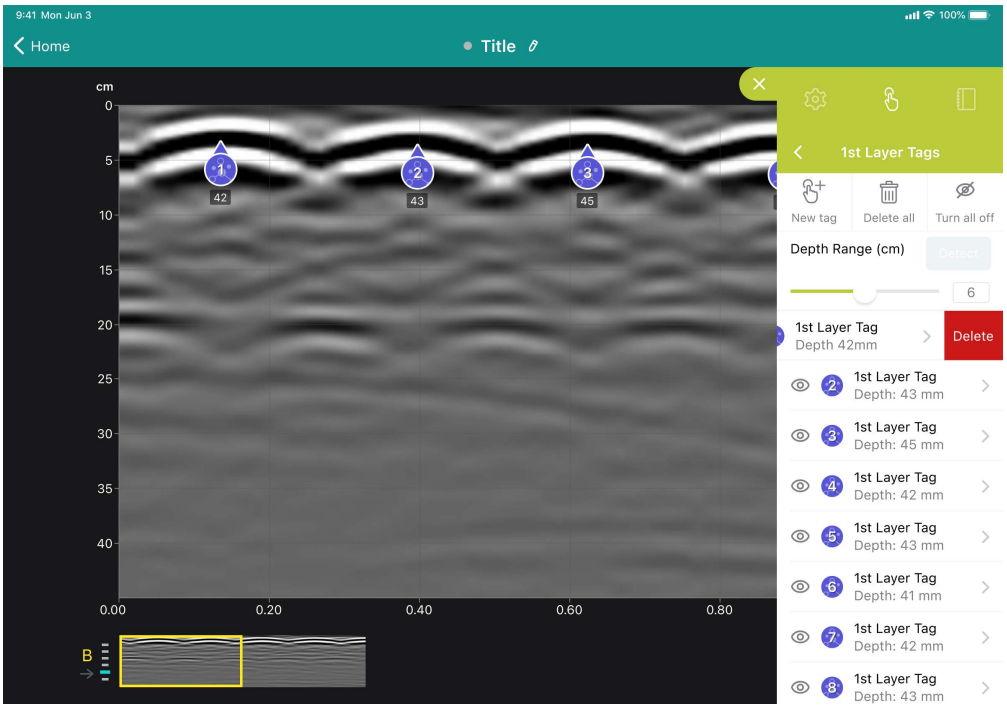
Step 3: Adjust the depth range, then press Detect



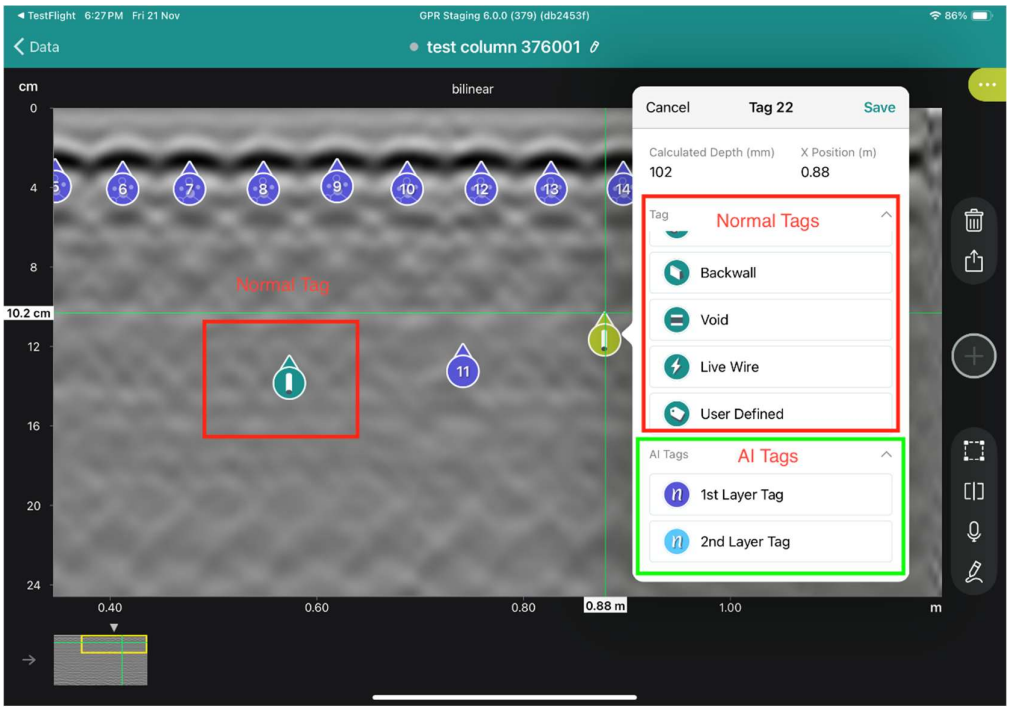
Step 4: In suitable conditions and within the feature's limitations, tags are automatically generated and placed at the apex of most hyperbolas. In the A-scan view, these tags should appear on or near the red peak envelope (A-scan is explained in section 5.5.2).



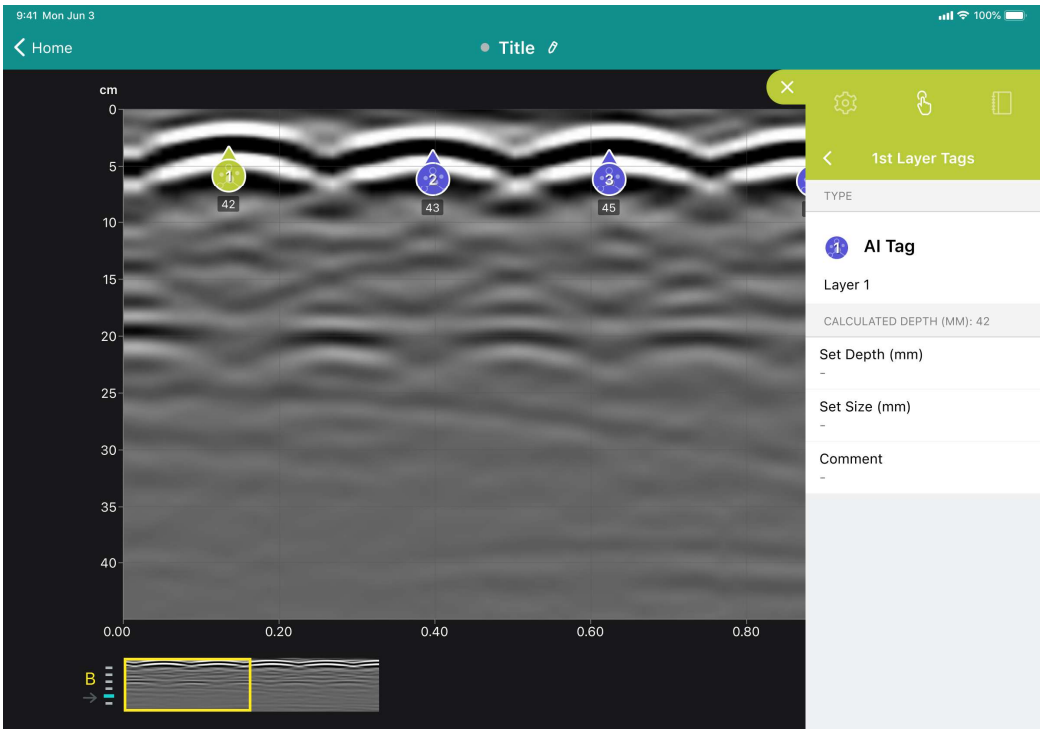
Step 5: Review the tags. If you find any false positives, delete them directly from the list or by long pressing the tag.



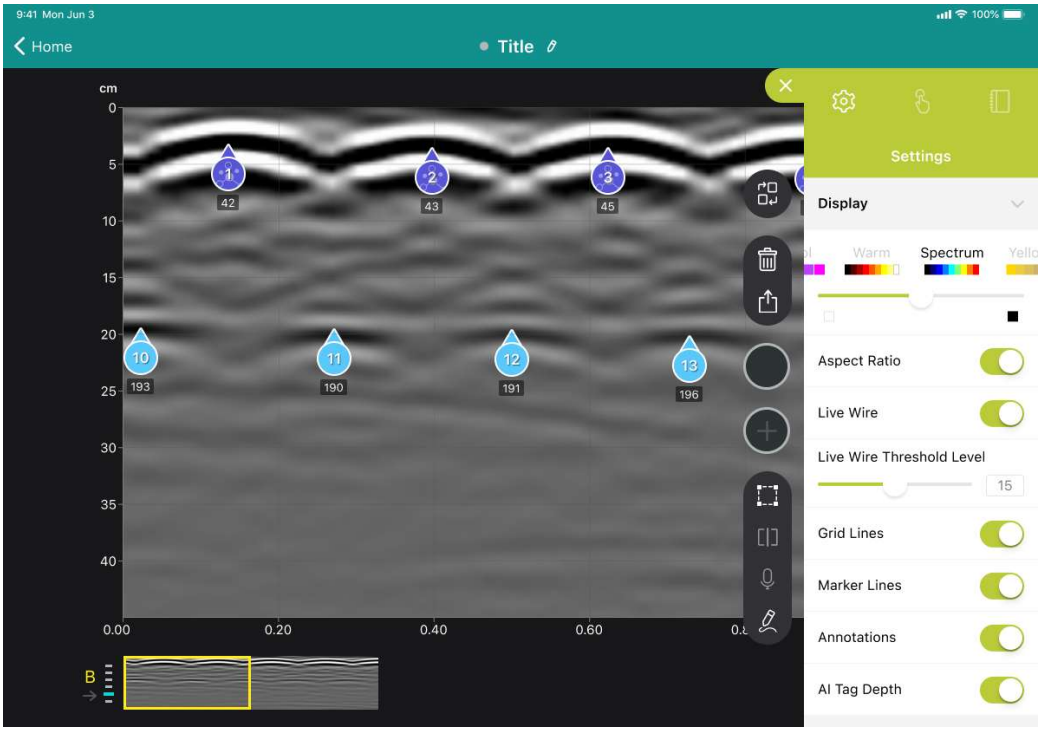
Step 6: If certain hyperbolas are not tagged, manually create the missing tags using the AI first- or second-layer tag lists. These tags are shown with distinct patterns and colors for each layer. Note that the AI Tag feature does not operate on the second layer.
Only manual tags created from the AI Tag lists include depth values and are exported in the Excel report; Normal manual tags will not appear in the Excel report.



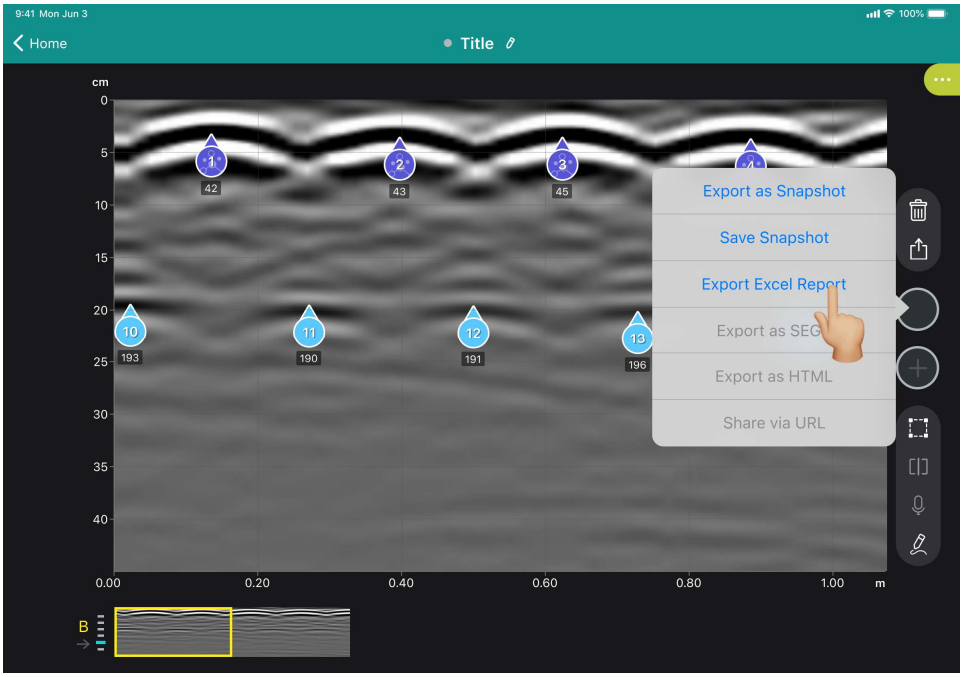
Step 7: If the depth of an object is known (for example, rebar depth from an inspection hole), you can set the depth of the corresponding AI tag by clicking on it to view and edit its information. This adjustment fine-tunes the concrete dielectric constant estimated by the hyperbola fitting.

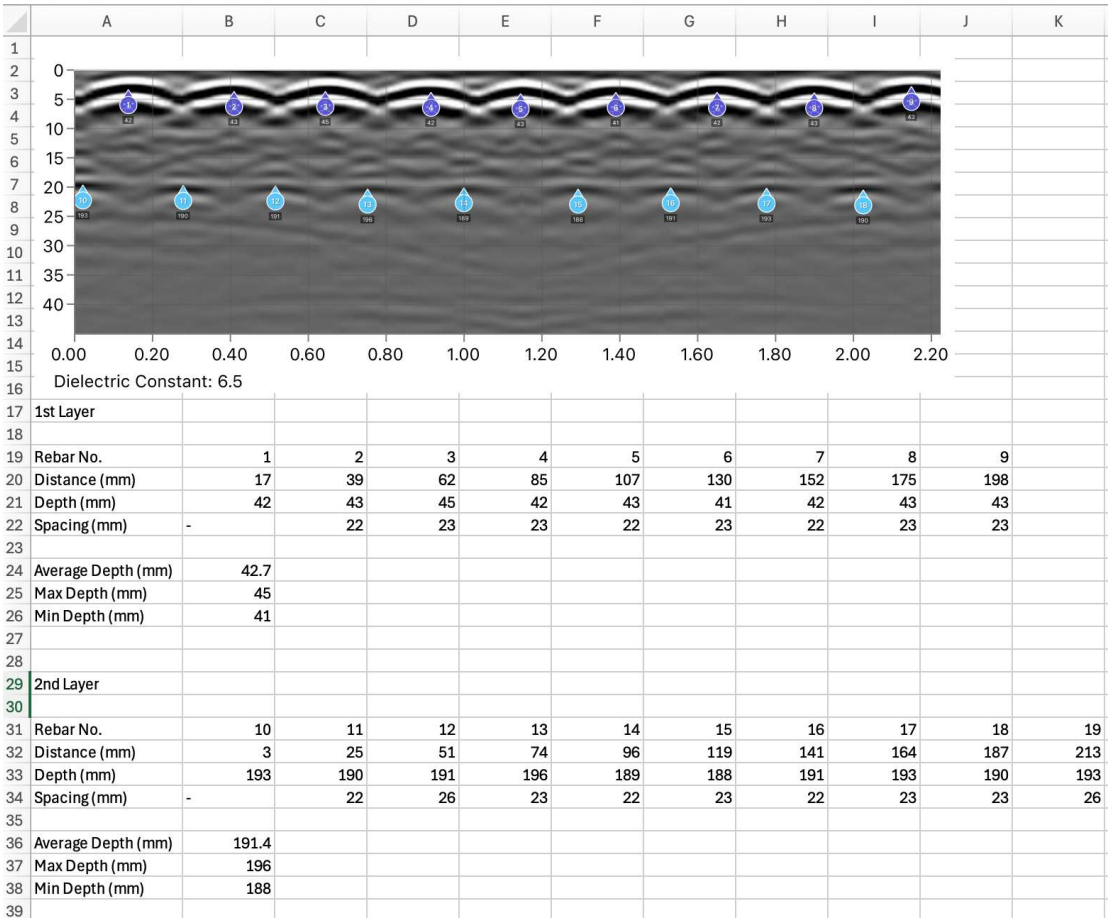


Step 8: To display tag depth, activate the ‘AI Tag Depth’ setting.



Step 9: Once your review is finished, you can export the report as an Excel file directly from the GP app or the cloud-based Workspace platform. Report contains a full-length image, a list of all AI and manual tags under the AI Tag list, and basic statistics.





	A	B	C	D	E	F	G	H	I	J	K
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16	Dielectric Constant: 6.5										
17	1st Layer										
18											
19	Rebar No.	1	2	3	4	5	6	7	8	9	
20	Distance (mm)	17	39	62	85	107	130	152	175	198	
21	Depth (mm)	42	43	45	42	43	41	42	43	43	
22	Spacing (mm)	-	22	23	23	22	23	22	23	23	
23											
24	Average Depth (mm)	42.7									
25	Max Depth (mm)	45									
26	Min Depth (mm)	41									
27											
28											
29	2nd Layer										
30											
31	Rebar No.	10	11	12	13	14	15	16	17	18	19
32	Distance (mm)	3	25	51	74	96	119	141	164	187	213
33	Depth (mm)	193	190	191	196	189	188	191	193	190	193
34	Spacing (mm)	-	22	26	23	22	23	22	23	23	26
35											
36	Average Depth (mm)	191.4									
37	Max Depth (mm)	196									
38	Min Depth (mm)	188									
39											

7 Applications

The scan views shown in this section are provided for informational and educational purposes only. The GP app software offers powerful visualization and image-processing tools to support data interpretation; however, the final interpretation and all related decisions remain the sole responsibility of the user.

7.1 Concrete floor with joints

Measurement Mode: Line scan, perpendicularly to rebar & joints

The raw data and migrated views can locate and verify the irregular depth of top rebar and the position of different construction joints.

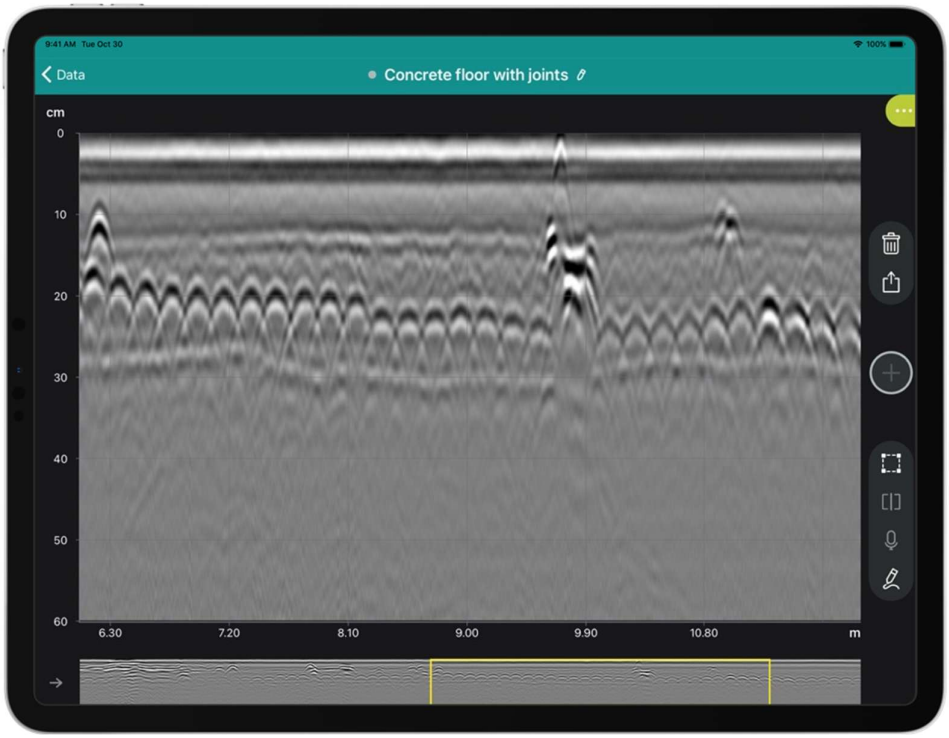


Figure 50: GP app software migrated view concrete floor with joints application

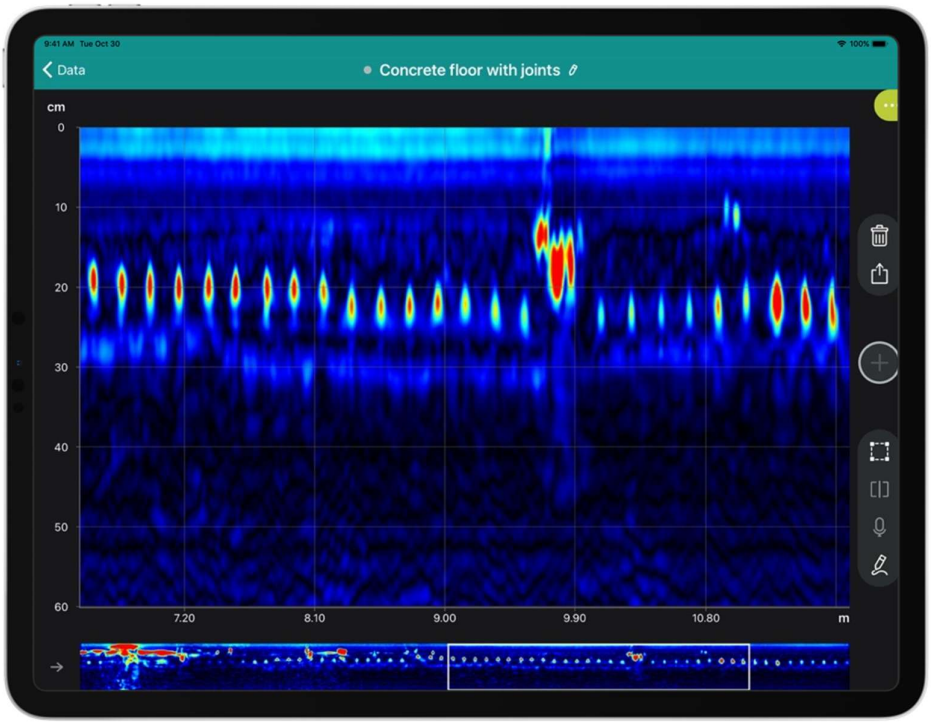


Figure 51: GP app software migrated view concrete floor with joints application.

7.2 Concrete slab with post-tensioned beam

Measurement Mode: Line scan with tags, perpendicular to beams

The raw data view shows top rebar and the PT beam bearing the slab.

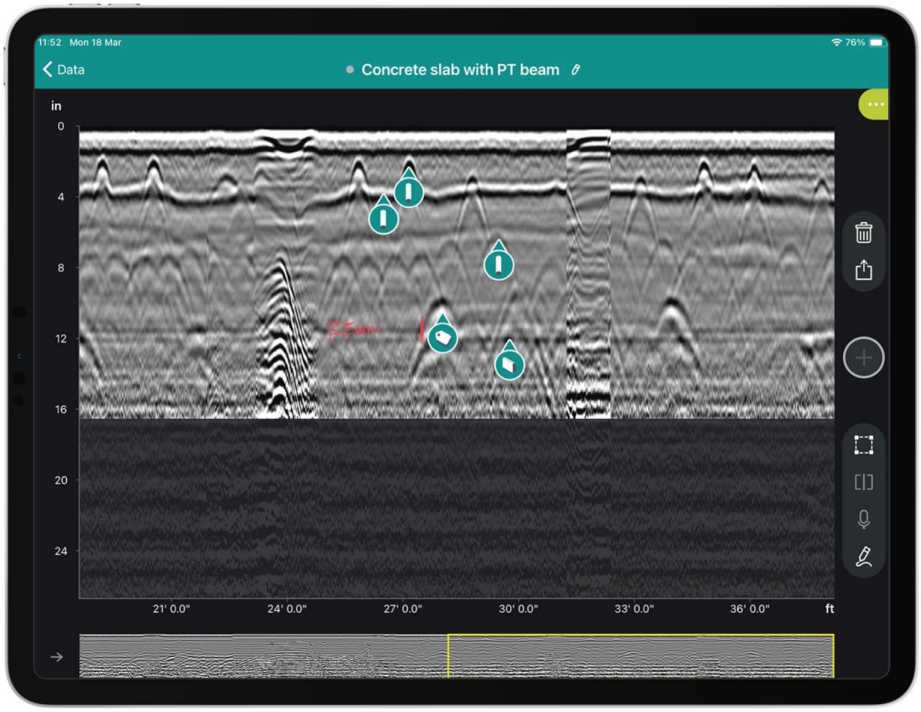


Figure 52: GP app software raw data view concrete slab with PT beam application

7.3 Hollow core concrete slab

Measurement Mode: Line scan with annotations, perpendicular to longitudinal hollow cores

The raw data view indicates the presence of hollow cores filled with air; the hyperbolas in black-WHITE-black suggests the presence of air in concrete (as explained in section 5.11).

Note that prestressed cable reflection inverts as the wave travels through air.

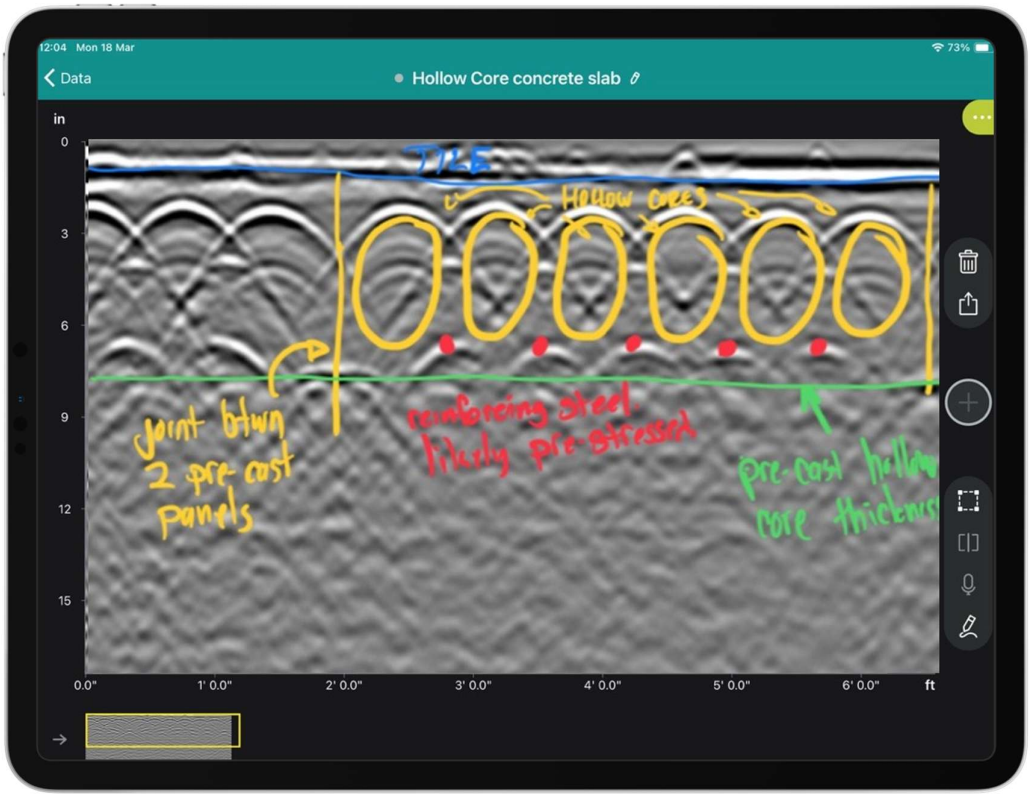


Figure 53: GP app software raw data view hollow core concrete slab application

7.4 Concrete slab with corrosion

Measurement Mode: Line scan with annotations, perpendicularly to top rebar

The raw data view indicates the presence of clean good signal targets but also low signal targets (see Figure 54). This can indicate the presence of corroded rebar.

Corroded rebar dissipates GPR waves and returns less energy than healthy steel rebar.

Proceq GPR helps to find out the potential presence of corroded rebar, however it is strongly recommended to use other tools & sensors such as GPR Insights post processing software or half-cell potential technology (Profometer PM8500) to strengthen the analysis. In any case, an inspection hole is necessary to confirm the presence of corrosion.

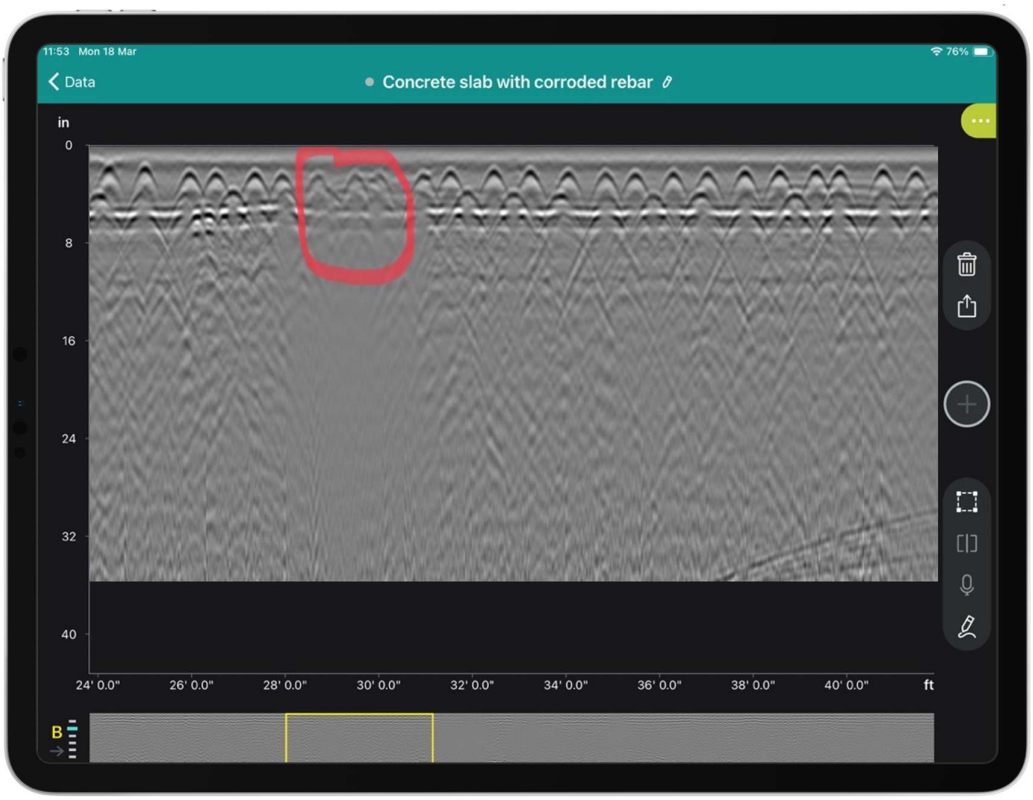


Figure 54: GP app software raw data view concrete corrosion application

7.5 Post-tensioned concrete slab

Measurement Mode: Area scan

The time slice view reveals at a certain depth all the PT duct layout and few rebar.

The B-scan and superline scan in split view confirm the presence of the PT ducts underneath the rebar.

Figure 55: GP app software area scan PT concrete slab application

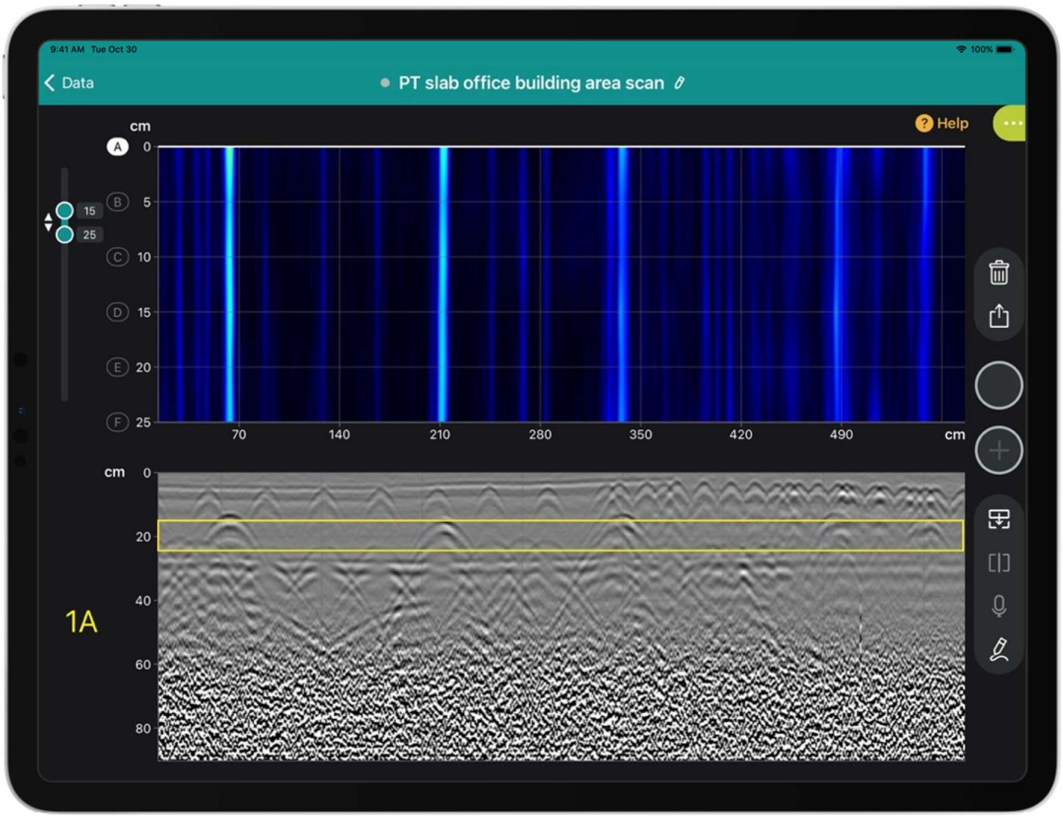


Figure 56: GP app software raw data view PT concrete slab application

7.6 Rebar Mesh with Radiant Tubing (Demo file)

Measurement Mode: Area scan with GP8100

The time slice reveals a rebar mesh and radiant tubing in a single slab.
Demo file available in GP app: “Rebar Mesh with Radiant Tubing by GPR USA”

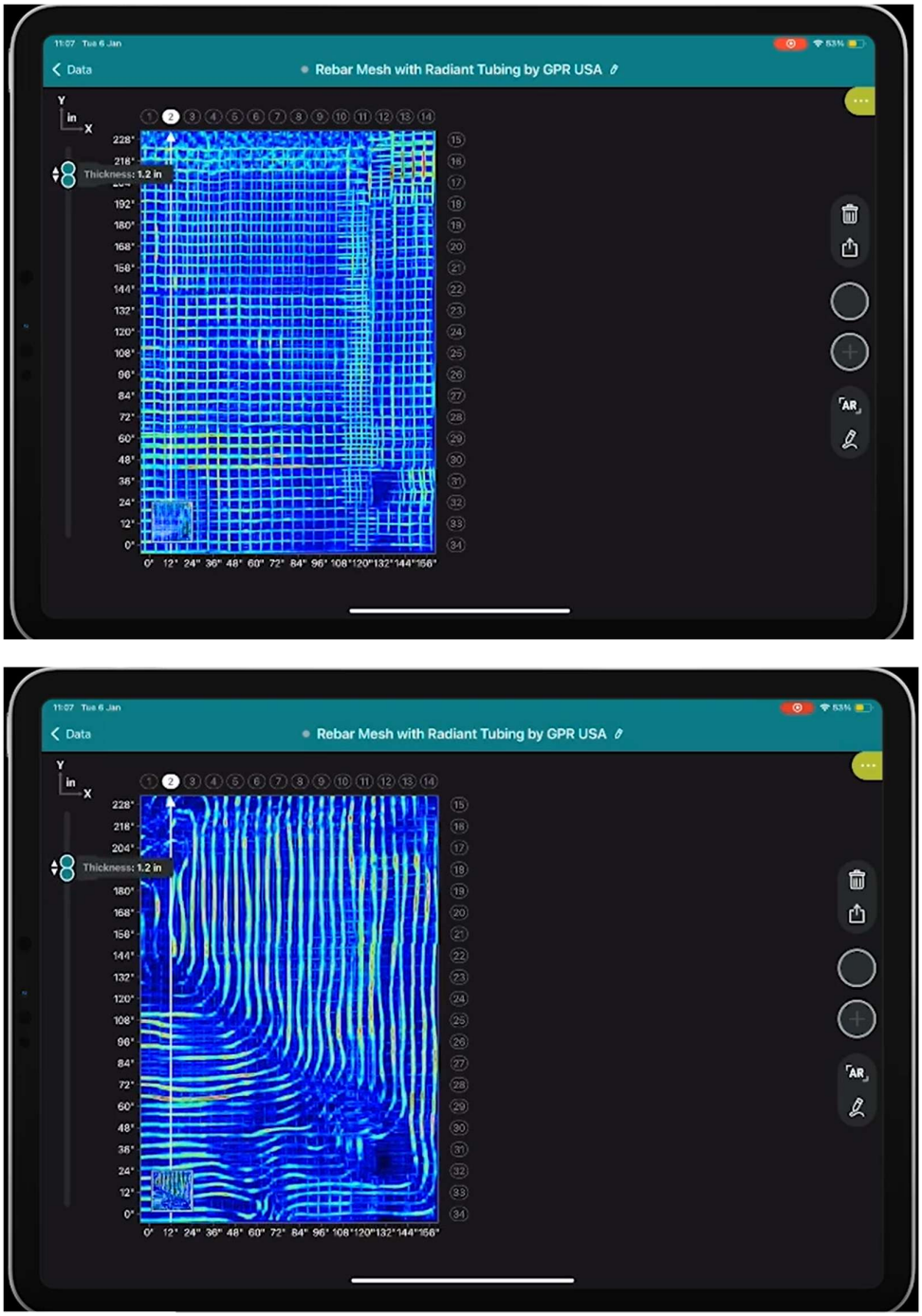


Figure 57: GP app software time slice of rebar mesh and radiant tubing in a single slab

8 Technical Specification

Measurement Principle	Stepped-frequency continuous-wave (SFCW) GPR
Regulatory compliance	CE, IC, FCC, UKCA and RoHS
Connectivity	Wi-Fi (802.11n) to display unit (iPad) USB-C to iPad for Wi-Fi restricted areas (GP8100 & GP8800 only)
Warranty	Up to 2 years
Operating Temperature*	−20 °C to +50 °C / -4°F to 122°F
Qualification/test Temperature*	−25 °C to +55 °C / -13°F to 131°F
Storage Temperature*	-10°C to +60°C / 15°F to 140°F
Relative humidity	up to 85 %, non condensing
Depth accuracy	± 5 mm / 0.2 in (upon direct dielectric calibration!)
Distance accuracy	<2% error on distance
Distance accuracy between objects (like rebars)	**GP8000 or GP8100:** 4 cm / 1.6 in **GP8800:** 3cm / 1.2 in **Note:** valid for objects in the 5 cm / 2 in depth

(*) Temperature range applies to the Proceq GPR sensor only, not the iPad.

The English version of the content remains the official version. All translated content should bear an appropriate notice to this effect.

For safety and liability information, please download at

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