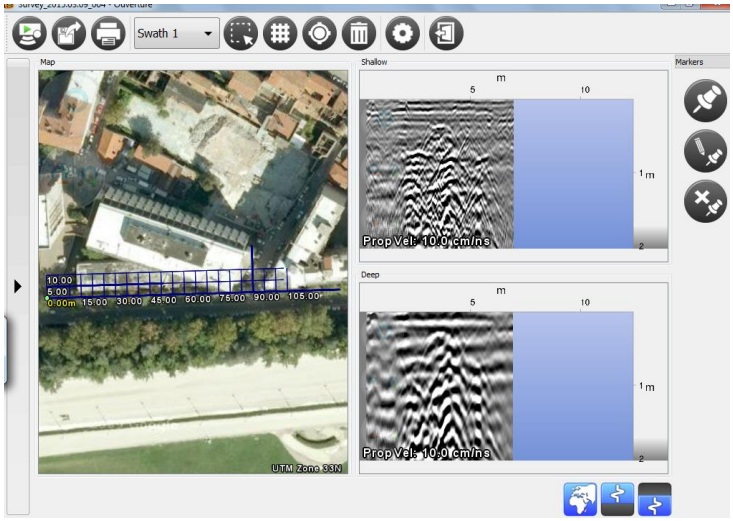
- PRO/010/M1 Rev 5 -

Rev. 1.1

N°doc: MN/2014/060

Config.: OUVERTURE - PRCS-OUT-MN

OUVERTURE



Ouverture v. 01.02 – User Manual

Pisa, October, 2015

KEYWORDS GEORADAR, OUVERTURE, RADAR DETECTION, TARGET.

SUMMARY This manual contains a complete description of the Ouverture software.

Document Evolution		
Revision	Date	Reason of change
Rev. 1.0	December 2014	First Edition
Rev. 1.1	October 2015	Disclaimer, Warranty Conditions, Updated for Ouverture 01.02: Changes in paragraphs 1.4.1, 2.2, 2.3, 2.4, 2.5, 2.6 and 2.7.

Document Change Record (Log)		
RNC	*Reference*	*Modification Description*
201505063	F. Boscagli	Internet connection is no longer required

SW Versions covered by this document
Ouverture 01.02

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a. Use of IDS Products outside its limitation of use, without proper and adequate scientific/technical knowledge or without specific training.

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d. Unauthorized changes and additions to the Products.
e. Use of the Products connected to suspected non-working equipment or with equipment (mainly PC) having characteristics non in compliance with the required specifications of IDS on not expressly authorized by IDS.
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    a. the parameters introduced by the operator/s.
    b. the particular environmental conditions: (even though the radar technology employed by IBIS, is deemed among the most reliable for the monitoring of "instable slopes).
iii. Therefore, when IBIS Products are used in "Critical Monitoring for safety purposes" applications, like real time monitoring of unstable slopes including Opencast Mining, User must be aware that the "the assessment of the stability conditions of the observed targets" must be tasked to skilled and certified operator/s able to understand data supplied by either IBIS or other equipment employed to such purpose; only operators officially trained and regularly updated by IDS (holding an "IBIS User Certificate" thereof) are allowed to use IBIS products.
iv. IDS assumes no liability for any direct, indirect special, incidental or consequential damages or injuries caused by such reliance or for the use of IBIS Products by operator not holding an "IBIS User Certificate" issued by IDS. Any Buyer or User that completely relies on information obtained from the automated data processing/analysis tools only does so at his own risk and possible damages caused to IBIS products during operations performed by not-certified operators are not covered by the applicable Warranty Terms in force.

Warranty Conditions

A. Standard Warranty Conditions

1. IDS Ingegneria dei Sistemi S.p.A, (hereinafter referred to as IDS or Seller), warrants that its products shall be free from defects in material and workmanship, for a period of 12 months from the delivery date duly registered and certified ("Effective Date") in the "Warranty Registration Form" enclosed hereto. IDS shall repair or replace Products or parts thereof found faulty (the "Faulty Parts") which are returned to IDS, and which, at IDS's judgment, were defective or became defective during its normal use. Seller's obligations shall not apply to Faulty Parts that:
   (a) Buyer do not properly store, install, use, or maintain;
   (b) Buyer modify, or perform tests which are not approved in writing by the Seller;
   (c) Buyer have subjected to any kind of misuse, detrimental exposure beyond its intended purpose or damaged in an accident or by natural disaster or calamities.
   (d) Are repaired by other than IDS personnel; in which have been installed HW/SW accessories not supplied by IDS; are integrated or connected to equipment different from the ones supplied by IDS (except the PC data Logger conform to IDS specifications);
   (e) Whose operational software was not installed as per IDS instruction (see IDS User's Guide for the Data Acquisition Software);
2. Seller's Products may include specific "Operational" software with automatic data processing and analysis tools (SW) supplied under a License agreement (EULA). While every effort is made to ensure the accuracy of the information/results provided by these tools, they must not be intended as a substitute for people analysis; rather, they have to be intended as an advisor and the user must not completely rely on the results provided by them. Under no circumstances does IDS warrant that the SW will operate uninterrupted or error free The SW is provided "as is" without warranty of any kind. IDS warrants for a period of sixty (60) days from the Effective date that, under normal use, the SW support media will be free of defects in material and workmanship; in such case the provisions of above point a) apply
3. Any different warranty, granted by the Buyer to its retailers and clients, even as final consumers, pursuant to the European Union law in force regarding the rights of the consumers, does not engage IDS in anyway.
4. The above mentioned warranty excludes any other remedies and it has to be considered the only and exclusive remedy foreseen for the Buyer and its retailers and clients, with reference to IDS Products purchase, being, expressively understood that any kind of limitation and/or discharge of responsibility provided by the present warranty is referred to both (I) the responsibility as against any third parties, pursuant to the legislation regarding the producer responsibility and (II) the warranty provided by the law in force.

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1. To proceed in the application of warranty terms, Buyer shall have to contact IDS Customer Care Office to get the clearance to return the Faulty Parts.

2. The Faulty Parts once received by IDS will be inspected to verify they are eligible for repair or replacement..

3. Buyer is responsible for ensuring that the Faulty Parts be returned to IDS with a suitable packing (it is recommended that the original packing be saved for a better understand of the failure cause); IDS will not be obliged to repair or replace Faulty Parts damaged from abuse, misuse, negligence, accident loss or damage in transit.

4. The Shipping costs for Products returned during the warranty period, are as follows:
   (f) From Buyer Site to Seller site ➔ shipping costs, as per Incoterms CIP, are borne by Buyer
   (g) From Seller Site to Buyer site ➔ shipping cost, as per Incoterms CIP, are borne by Seller

5. The warranty period on the repaired or replaced Faulty Parts is 6 (six) months or the unexpired portion of warranty on such Faulty Parts whichever date comes later.

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Without prejudice to the Warranty terms defined in the above Clauses A and B, the following special conditions apply to the IBIS products.

1. IDS offers to the Buyer, optionally, special Support and Maintenance Plans to be performed along the life of the equipment. These plans set forth special Warranty conditions which are detailed in the relevant options purchased.

2. IBIS Product Family is subject to export/import regulations as per EU export control regime Council Regulation (EC) No. 428/2009 and successive amendments. The category of exportation for IBIS F product family is 6A008.d. Buyer warrants that the IBIS Products to be purchased: a) shall not be re-exported, directly or indirectly, outside Buyer's country in violation of any law or regulation or to embargoed or otherwise restricted countries, b) shall not be used, in the design, development, production or use of chemical, biological, nuclear ballistic weapons. It is Buyer's responsibility to know the law pertaining to export/import procedures in the country of destination of the Products. Buyer will defend, indemnify and hold Seller harmless against any liability (including attorney's fees) arising out of Buyer's failure to comply with the terms of this article. Should the Authorities issue an export restriction which leads to the cancellation of a purchase order already accepted by IDS, IDS only liability shall be to return to Buyer any account paid without interests. Buyer shall comply with the laws and procedures in force in the country of destination of the Products.

3. IBIS can be used in Critical Monitoring for safety purposes applications, like real time monitoring of unstable slopes including Opencast Mining. Buyer shall be aware and agree that the assessment of the stability conditions of the observed target must be tasked to skilled and certified operator/s able to understand data supplied by either IBIS or others. The performance of IBIS can be, in fact, influenced either by the parameters introduced by the operator/s or by particular environmental conditions which may distort its outcomes, thus giving rise to false or missing alarms.

4. IDS assumes no liability for any direct, indirect special, incidental or consequential damages or injuries caused by such reliance

or for the use of IBIS Products by operator who have not achieved a training course certified by IDS. Any person or entity that completely relies on information obtained from the automated data processing/analysis tools only or by operators who have not achieved a training course certified by IDS, does so at his own risk

D. Limited Liability

Without prejudice to the exclusion of liability stated at the above Clause C.

1. Seller's sole obligation and liability under this Agreement shall be limited to the repair or replacement of the Product, or the refund of the purchase price at the Seller's sole option. This Article sets forth the sole and exclusive remedies for claims based upon defects or nonconformity of the Products, whether the claim is on contract, warranty, tort (including negligence), strict liability, or otherwise.

The cumulative liability of Seller, including its subcontractors or suppliers, for any and all claims, including but not limited to claims based on Seller's negligence of any degree, strict liability, breach of contract, warranty, reliance on the accuracy, reliability, or timeliness of the information provided by the SW, patents or otherwise, shall not exceed the sums cashed by IDS for the purchased Products, which give rise to the claim, and any such liability shall terminate upon the expiration of the warranty period.

Contacts

IDS Ingegneria dei Sistemi S.p.A. – GeoRadar Division
Via Enrica Calabresi, 24 – Loc. Montacchiello
56121 PISA - ITALY
Tel: +39.050.312411
Fax: +39.050.3124205
inforis@idscorporation.com

Customer Care department:
customercare.gpr@idscorporation.com
Tel.: +39.050.3124356

Sales & Marketing department:
sales.gpr@idscorporation.com
Tel.: +39.050.3124352

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1. INTRODUCTION

1.1 Purpose

This manual explains how to use Ouverture software in all its parts.

1.2 Application

This software is dedicated to radar detection and mapping of underground utilities and can be used only with Detector Duo and Opera Duo systems.

1.3 Trademarks

Windows 7 and Windows 8 are owned by the Microsoft Corporation.

Google is owned by Google Inc.

1.4 Acronyms and Definitions

1.4.1 Acronyms

RADAR:	RAdio Detection And Ranging
USB:	Universal Serial Bus
GPR:	Ground Penetrating Radar
HDOP:	Horizontal Dilution Of Precision
RTK:	Real Time Kinematic
LAN:	Local Area Network
GPS:	Global Positioning System
NMEA:	National Marine Electronics Association
CORS:	Continuously Operating Reference Station
UHF:	Ultra High Frequency
GSM:	Global System for Mobile communications
WMS:	Web Map Service
DXF:	Digital eXchange Format
KML:	Keyhole Markup Language
GIS:	Geographic Information System

1.4.2 Definitions

Raw data: unprocessed data obtained during a field survey.

Maps: graphics showing the change in received radar signal with respect to the scanning direction.

Survey: the name given to a collection of acquisitions, which together cover all the areas of a large investigation: typically an entire town or a large urban area.

Scan: a single movement of the antenna trolley from the beginning to the end of a pre-established path.

Setup: initialization of a piece of equipment or a software process.

Encoder: a distance measurement device which constantly signals the distance travelled from the start of the scan back to the Control Unit .

Transmitter: part of the antenna dedicated to emitting the radar signals.

Receiver: part of the antenna dedicated to detecting the radar signals.

Utilities: the objects the Detector Duo searches for, i.e. pipes supplying gas and water, electricity cables, etc.

2. OUVERTURE SOFTWARE GUIDE

Ouverture software manages the acquisition and storage of data acquired with the Opera Duo and Detector Duo radar systems.

2.1 System requirement

The only requirement to use Ouverture software is about performance of Laptop.
Usually IDS furnishes its instrumentations with laptop Panasonic CF-H2 (see Fig. 2.1), but users are free to choose other type of personal computer which has, at least, the following system requirements:

- Processor: i3 1.7 GHz
- RAM: 1 GB
- Graphic adapter compatible with Open GL 2 or newer
- Operative system: Windows 7
- Ethernet port

However, for an optimal performance we recommend the following requirements:

- Processor: i5 1.7 GHz
- RAM: 2GB
- Graphic adapter compatible with Open GL 2 or newer
- Screen resolution: 1024 X 786
- Operative system: Windows 7
- Hard disk: 40 GB shock proof
- Serial port RE 232 (only used with the GPS)
- USB port
- Ethernet port

Fig. 2.1 - Panasonic CF-H2 furnished by IDS

Prior to the software installation the user should be sure that the drivers of the graphic adapter are updated to the latest version.
For example for Intel graphic adapter those steps can be followed:

1. Connect the laptop to internet (the user should set the IP address to dynamic for this operation);
2. Open an internet browser and go to http://www.intel.com/p/en_US/support/detect;
3. Install the updated drivers;
4. Change again the IP address to the original one.

2.2 Software installation

Prior to the software installation the user must be sure that the graphic adapter drivers are updated as explained in paragraph 2.1.

To install the software the user has to launch Ouverture-x.x.x.exe file (where x.x.x is the version number) and follow the screen's instruction.

Click a single time with right mouse button on Ouverture installer and choose the option *Run as administrator* (Fig. 2.2).

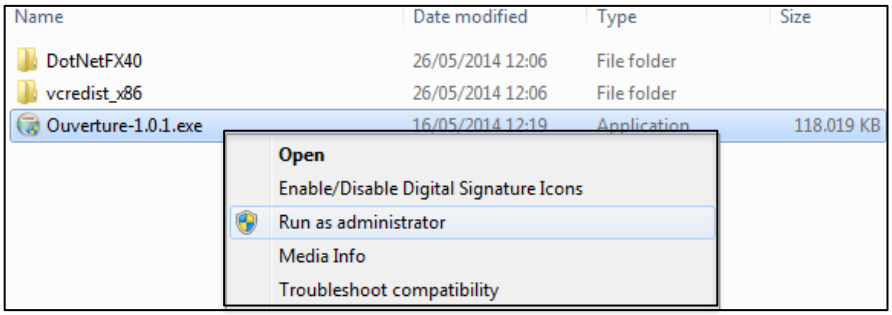


Fig. 2.2 - Ouverture software installation

A new window as the one showed in Fig. 2.3 opens. Select the first option and click on *Next*.

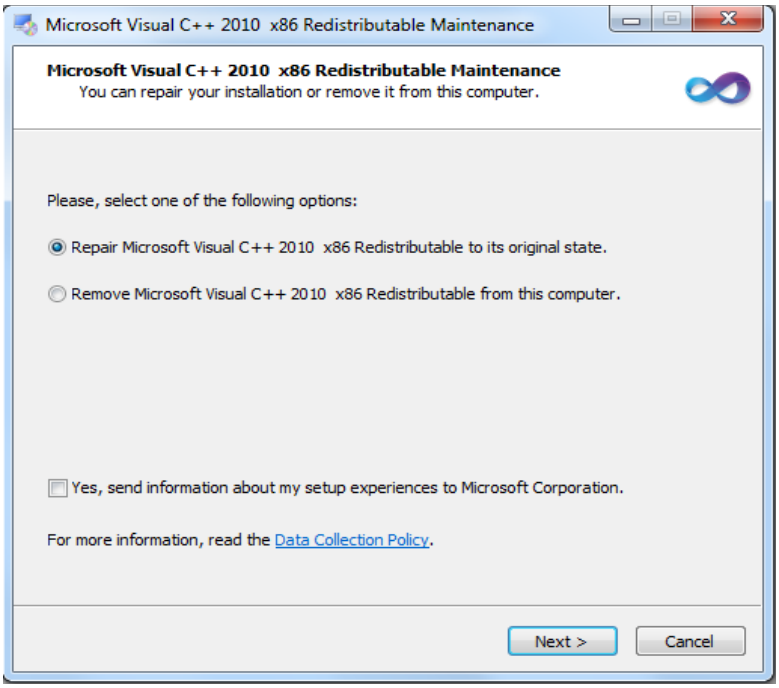


Fig. 2.3 – Microsoft Visual C ++ 2010

When the process for installation of Microsoft Visual C ++ is over, click on *Finish* and begin the installation of Ouverture software selecting *Next* (Fig. 2.4).

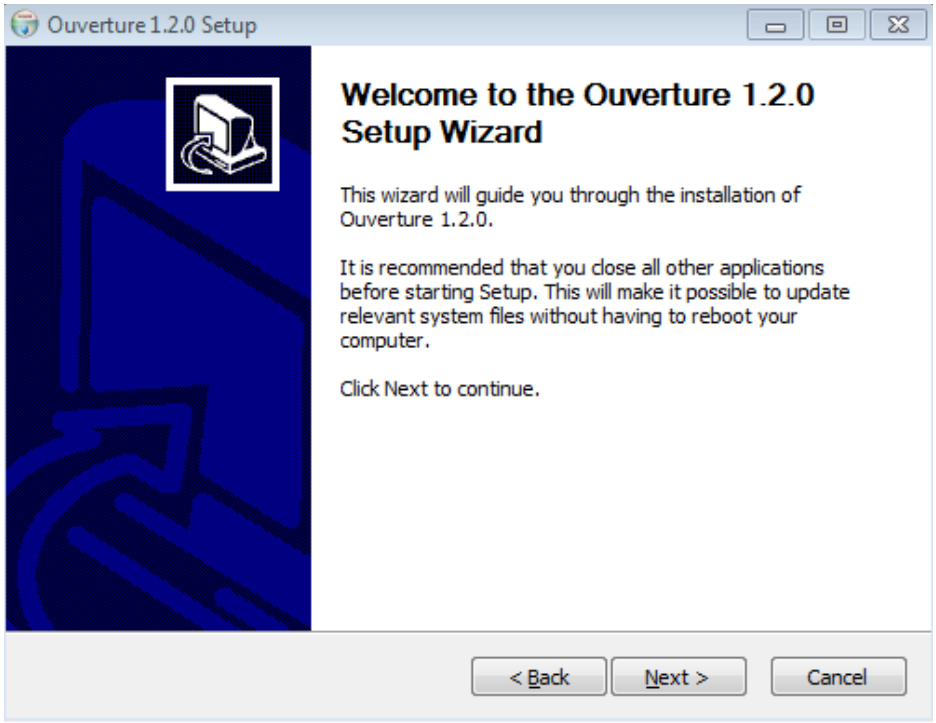


Fig. 2.4 - Install Ouverture software

Agree to the License clicking on *I Agree* button (Fig. 2.5).

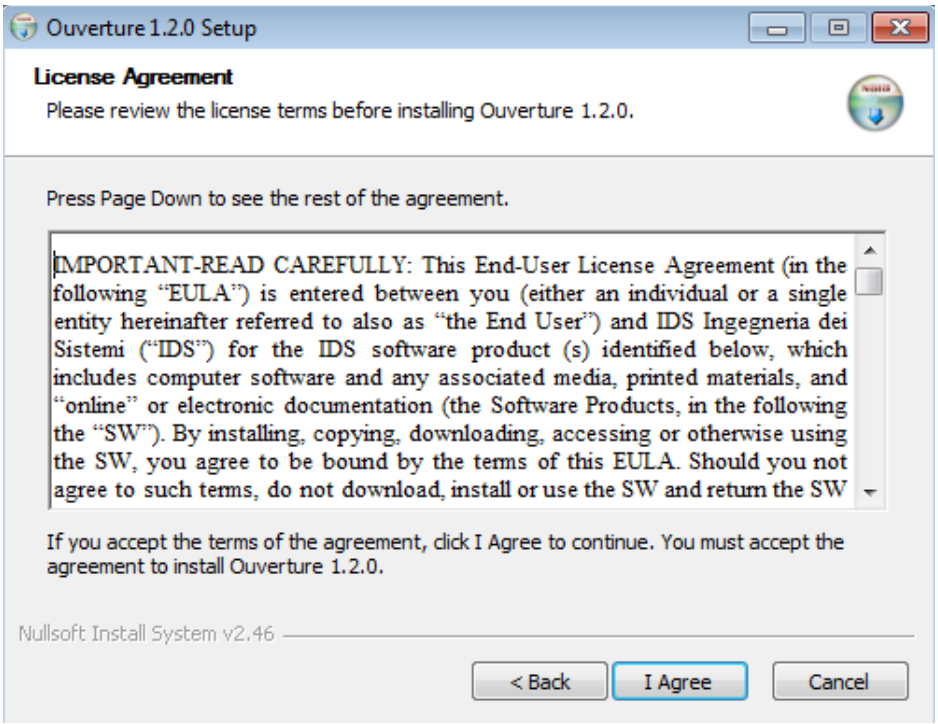


Fig. 2.5 - License Agreement

Choose Destination Folder where the software has to be saved (Fig. 2.6).

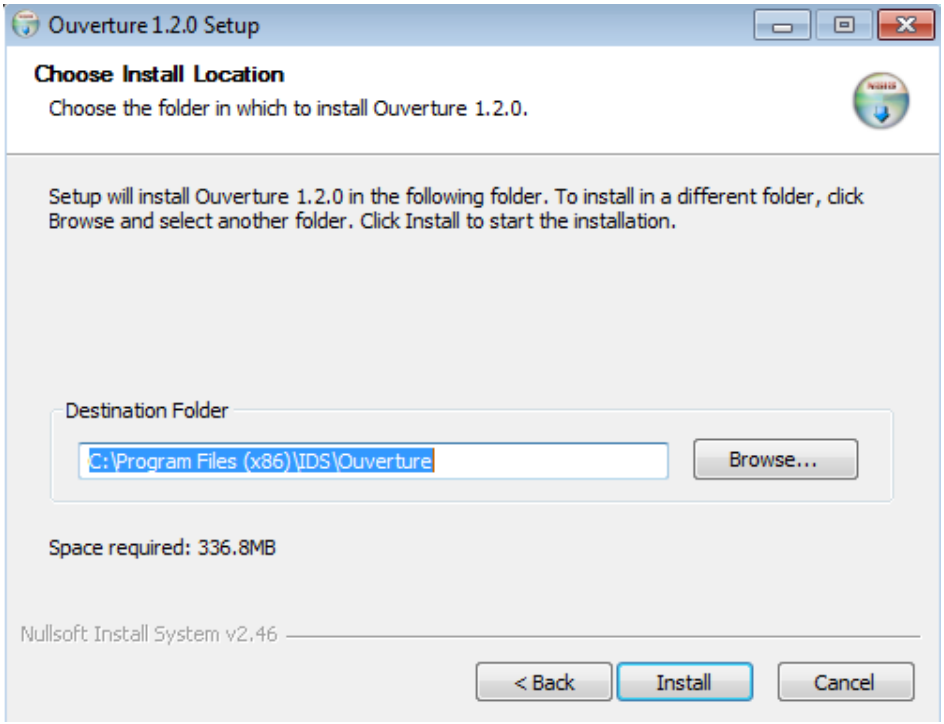


Fig. 2.6 – Choose Destination Folder

The software installing starts when green horizontal bar starts to move (Fig. 2.7).

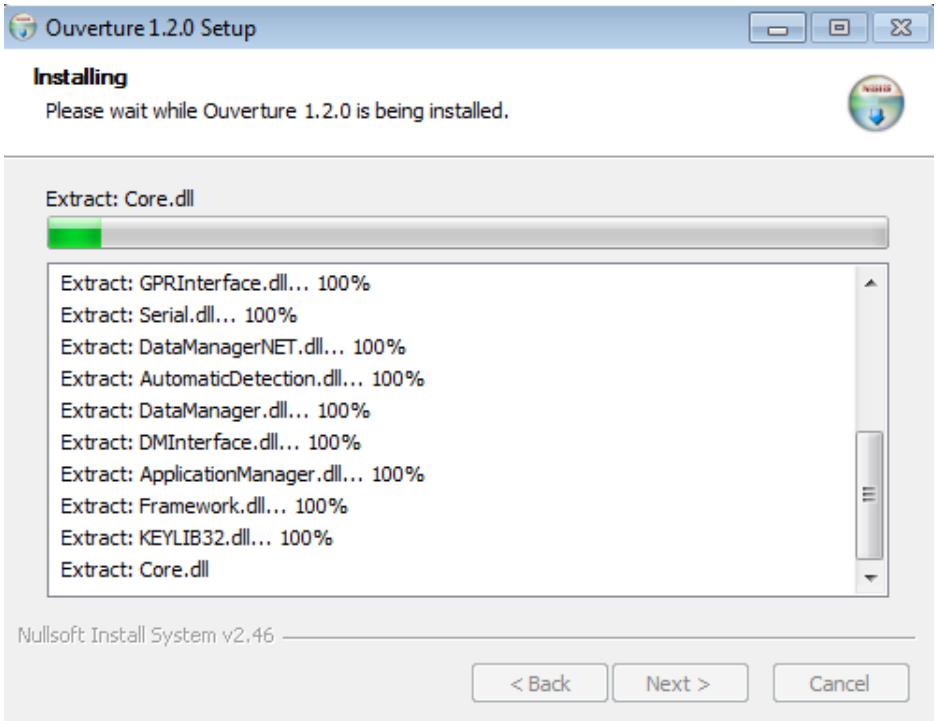


Fig. 2.7 - Installing phase

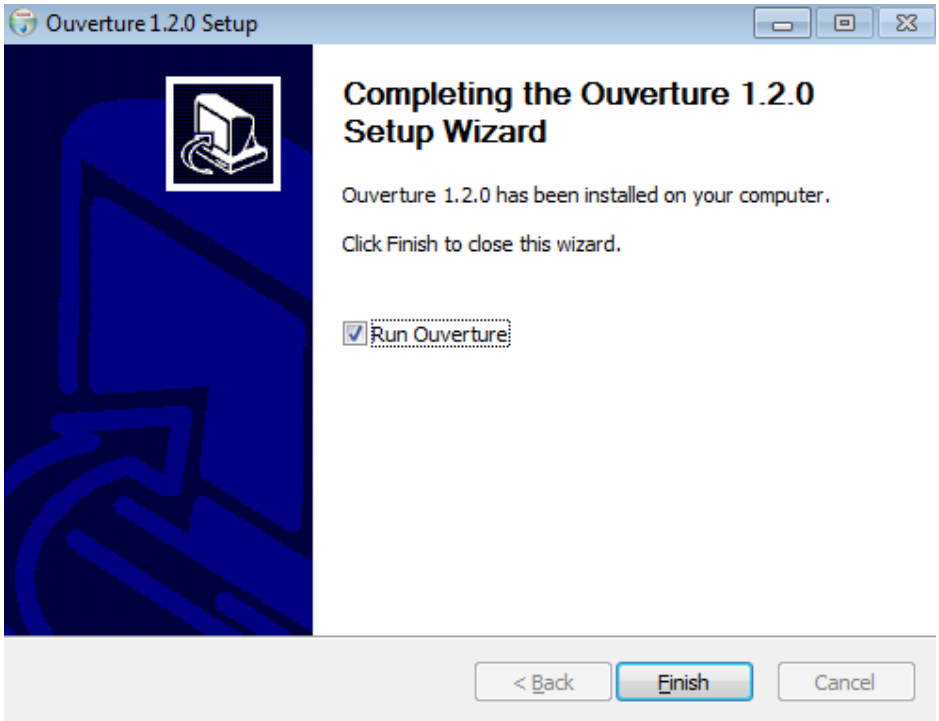


Fig. 2.8 – Software installation is completed

Click on *Finish* button (Fig. 2.8). Now Ouverture is installed on your computer.

If you leave a tick on Run Ouverture 01.01.00, automatically a new window with Main Menu of Ouverture, as the one in Fig. 2.9, opens.

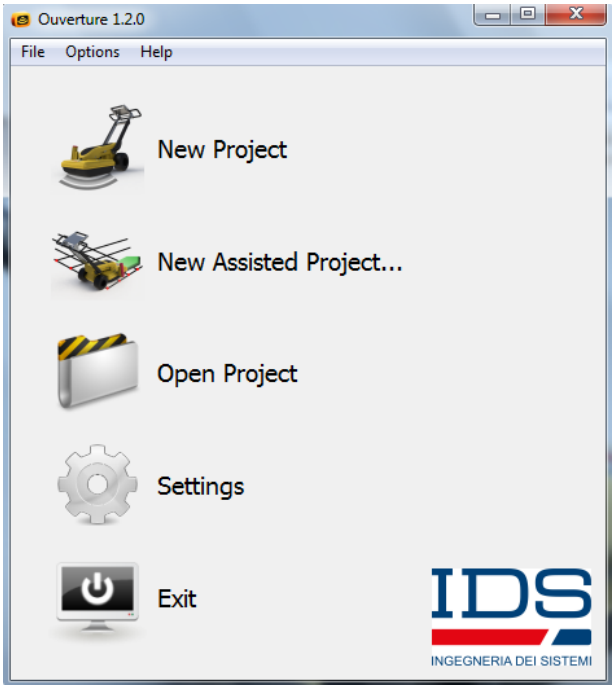


Fig. 2.9 – Main Menu

2.3 Main Menu

The Ouverture main menu contains 5 commands (Fig. 2.9):

1. New Project (see paragraph 2.4)
2. New Assisted Project (see paragraph 2.5)
3. Open Project (see paragraph 2.6)
4. Settings (see paragraph 2.7)
5. Exit

In the Menu bar at the top of the screen the user can select the following command:

1. File:
   -  New Project: select this button when you work acquiring a radar scan without using a base line and/or using GPS;
   -  New Assisted Project: this command gives the opportunity to draw a Reference Line and acquire radar maps following a grid;
   -  Open Project: to review radar scans;
   -  Exit: to quit the software.
2. Options:
   -  Settings: from this button the user can modify Survey, Hardware and International Settings.

3. Help:

-  Legacy Equipment: this command is very important only for users who use Ouverture with a Detector Duo System. The first time that you press this button, Ouverture, in order to function, requests software license (Fig. 2.10).

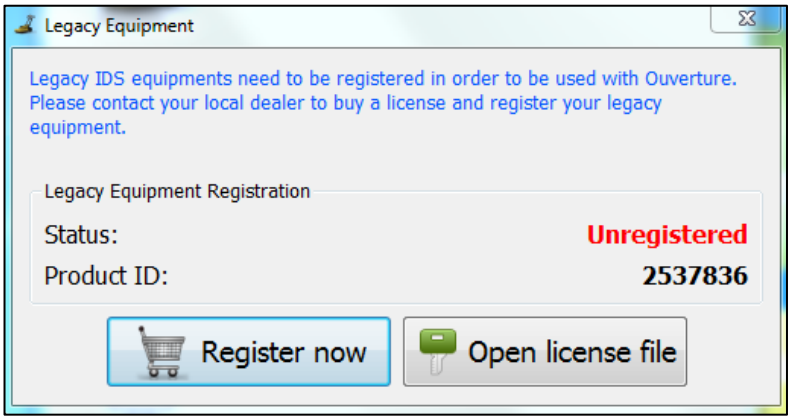


Fig. 2.10 - Legacy Equipment

The user have to click on Register now, fill white spaces (Fig. 2.11) and choose if Send () immediately the registration form to IDS Customer Care, using an internet connection, or Save () and send it later.

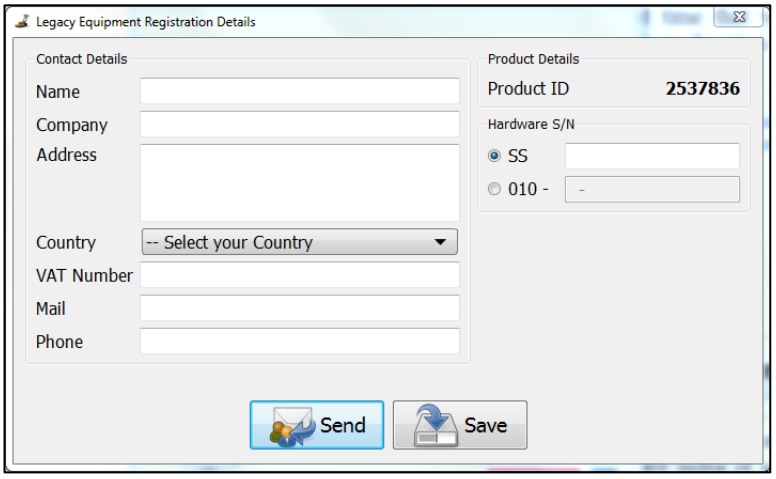


Fig. 2.11 - Registration form

Once you receive the license you have to save it on your laptop. Only the first time, the user has to select Open License file button and load it on Ouverture. If all is done correctly in Legacy Equipment window appear the Status Registered.

-  About Ouverture reports software version number and IDS Customer Care contact as visible in Fig. 2.12.

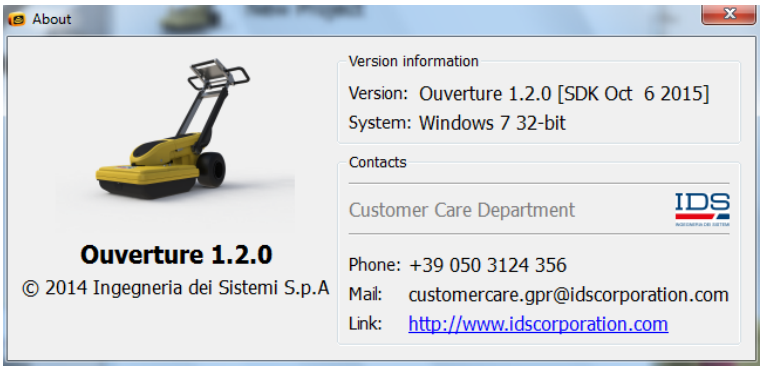


Fig. 2.12 – Software version number and contact information

2.4 New Project

Clicking the **New Project** button in the main menu (Fig. 2.9), the software calibrates the radar and in Fig. 2.13 is shown when the calibration is completed.

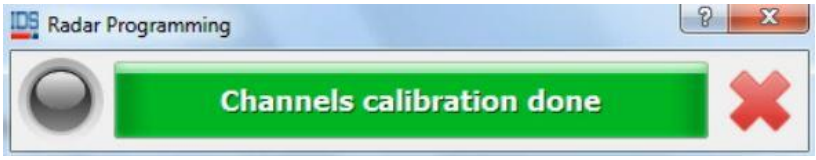


Fig. 2.13 – Radar calibration completion

If the radar fails to calibrate (Fig. 2.14), the user should check if the LAN cable is properly connected to the laptop and the DAD is turned on; if the problem persists contact the IDS customer care.

If one of the channels is not working, a calibration error appears with the faulty channel indicated.

Fig. 2.14 – Calibration error

After the calibration, the acquisition main window automatically opens (Fig. 2.15).

Fig. 2.15 – Acquisition main window

The main window is composed by the following sections:

1. Map layer list (paragraph 2.4.1)
2. Area map and radargrams (paragraph 2.4.2)
3. Acquisition commands (paragraph 2.4.3)
4. Target commands (paragraph 2.4.4)
5. Acquisition menu (paragraph 2.4.5)
6. System status (paragraph 2.4.6)
7. Map visualization buttons (paragraph 2.4.7)

2.4.1 Map layer list

The user can load one or more maps from a saved file or from the internet to visualize the scan lines and the targets on them.

To load a raster map use the  button; the types of file format that can be loaded are .tif, .tiff. Be sure to load a map containing the area you are currently scanning.

To load a vector map use the  button; the type of file format that can be loaded are .shp, .kml, .dxf.

To load a map from internet use the  button; the layers that can be downloaded are shown in Fig. 2.16.

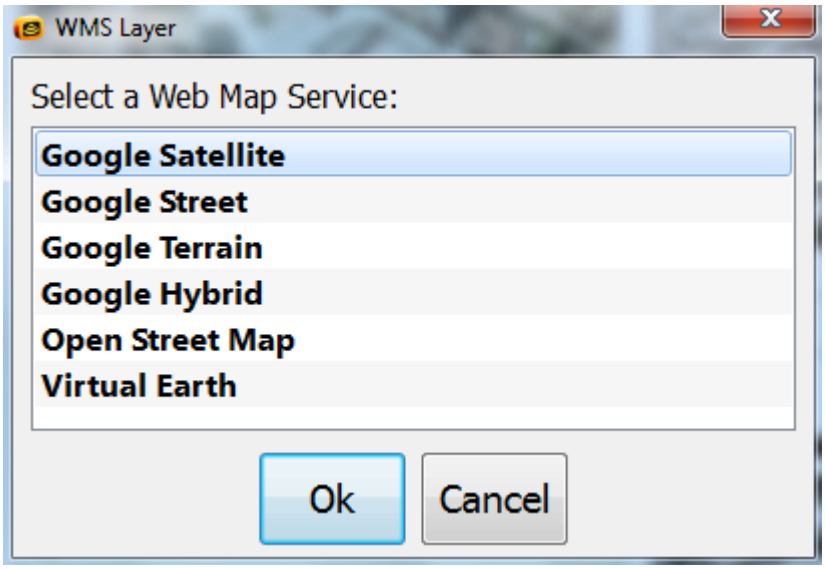


Fig. 2.16 – Downloadable map layers

Each layer can be removed from the list using the  button, turned off by clicking the  button and made more transparent using the slider  .

The layers are visualized in the Area map (see paragraph 2.4.2).

2.4.2 Area map and radargram

This section is divided in 3 parts:

1. Area map (see paragraph 2.4.2.1)
2. 700 MHz radargram (see paragraph 2.4.2.2)
3. 250 MHz radargram (see paragraph 2.4.2.2)

2.4.2.1 Area map

This map shows the loaded map layers (see paragraph 2.4.1), a compass  , the scan trajectory and the inserted targets (Fig. 2.17). The current position of the radar is represented as a yellow icon  .

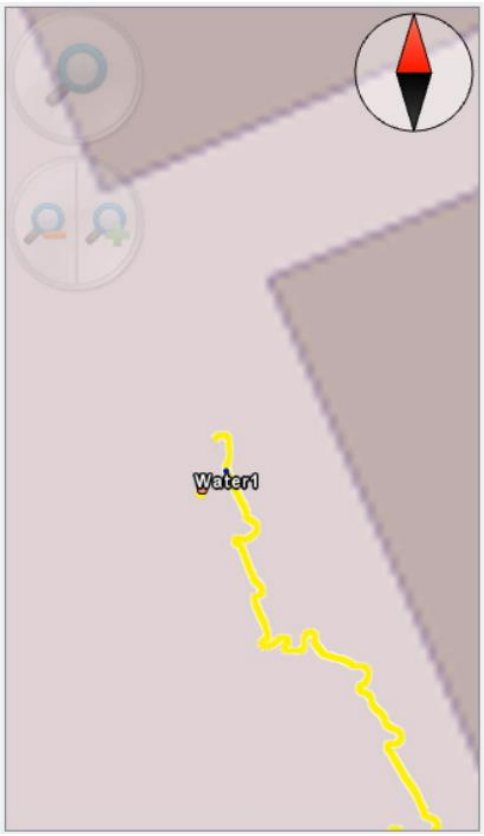


Fig. 2.17 – Area map

The user can zoom to the entire extent of the scan with the  button and zoom in/out with the  button.

2.4.2.2 700 and 250 radargrams

This map shows the two radargrams in real time, complete with horizontal scale (distance travelled) and vertical scale (depth), see Fig. 2.18; In the lower part of the map the last propagation velocity select is shown, if no propagation velocity is yet selected the software will use the default one (10 cm/ns).

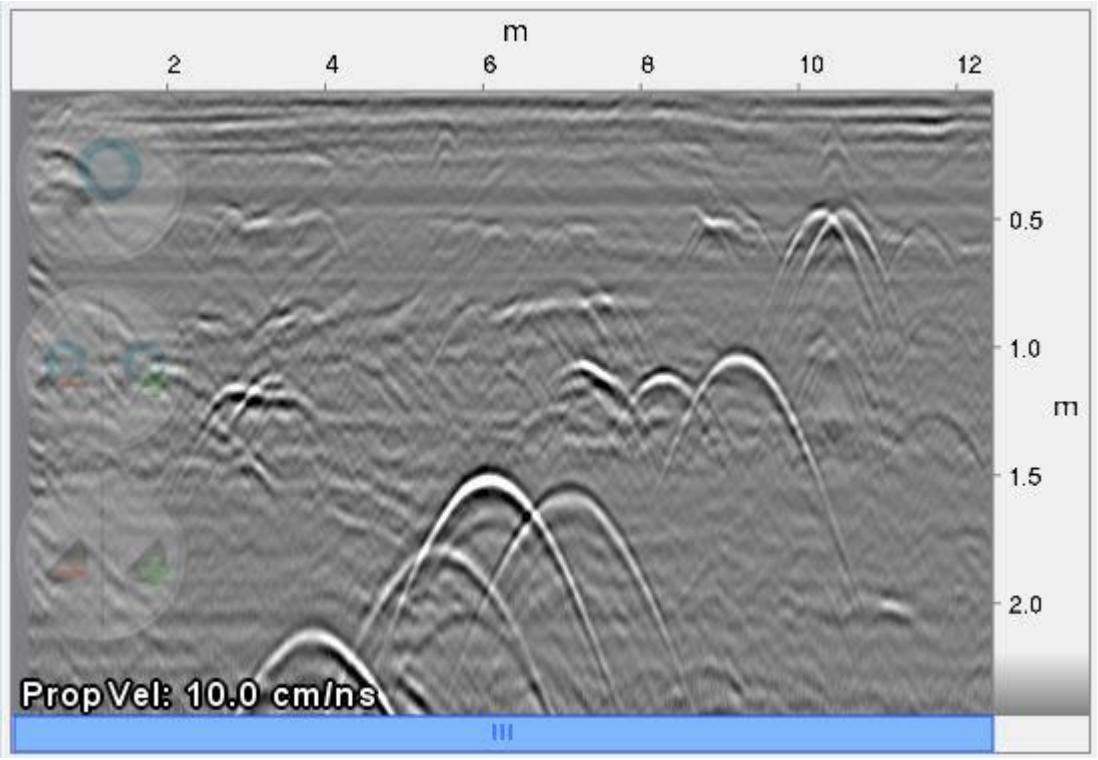


Fig. 2.18 – Radargram

If the map is too long for it to be displayed at the selected zoom level, the user can scroll it using the blue bar below it (see Fig. 2.18), please note that the scrolling is synchronized between the two radar maps.

The same zoom commands can be found here as for the Area map section, (see paragraph 2.4.2.1), please note that zoom is synchronized between the two radar maps; in addition the user can adjust the contrast of each map with the  command.

2.4.3 Acquisition commands

Before starting an acquisition, the user can chose the scan direction (forward or backward) using the  button, in order to push or pull the radar (shortcut F2).

To start an acquisition, click the  button; after that the button changes into the  button that needs to be clicked to stop and save the acquisition. At the same way to Start and Stop the acquisition you can press shortcut F1.

During the first scan, the software uses a very short part of the radar scan (about half a meter) to evaluate soil characteristics and to calculate the best graphic settings for the visualization of radargrams. Following this, the software continuously adjusts those settings.

If a sudden change in the soil condition is encountered, the software won't be able to adjust the graphic settings properly. The user should click the button to reset the map filtering based on the acquired data. Please note that by doing this any previous calibration data will be lost (see Fig. 2.19).

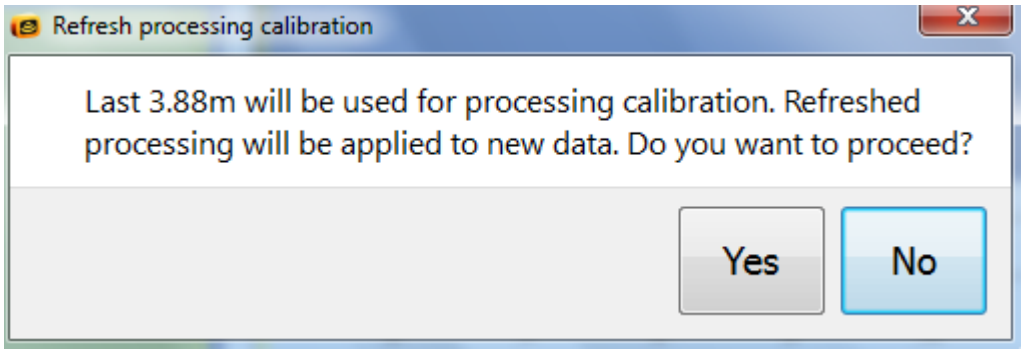


Fig. 2.19 – Recalibration warning

2.4.4 Target commands

To insert a marker click the button and then click directly on the anomaly seen on the radargram: this opens the **Place/Modify Target** window (see paragraph 2.4.4.1).

To delete a marker click the button then select the marker to be deleted using the mouse.

To modify an existing marker click the button then select the marker to be edited on the radargram; this opens the **Place/Modify Target** window (see paragraph 2.4.4.1)

If the Spray Support is installed and connected, the user can click the button to mark the target on the ground (see Fig. 2.20) or press F5.

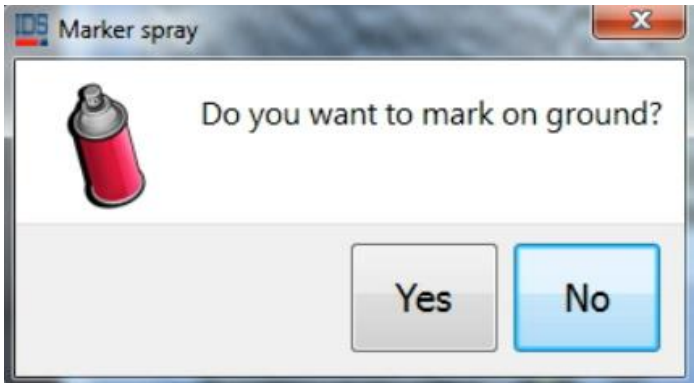


Fig. 2.20 – Marker Spray

Place Target ( ) button can be used only with Opera Duo systems and not with Detector Duo systems; in this last case the command is disabled.

2.4.4.1 Place/Modify Target Window

This window opens after a marker has been placed on the radargram using the button, or a marker is selected to be modified using the button. In the left part of this window (see Fig. 2.21) the user can edit the inserted marker, defining:

- Target type (Fig. 2.22);
- Name: a list of the previous inserted targets is available. A default name is proposed based on the selected target typology;
- Colour: default colour is defined according to the target typology;
- Notes.

If two markers are inserted using the same name, the software connects them with a line in the map, forming a so-called “Target”.

The details of the target (position, depth, swath number and channel number) can also be seen in this window, the first two parameters can be modified to refine the target positioning.

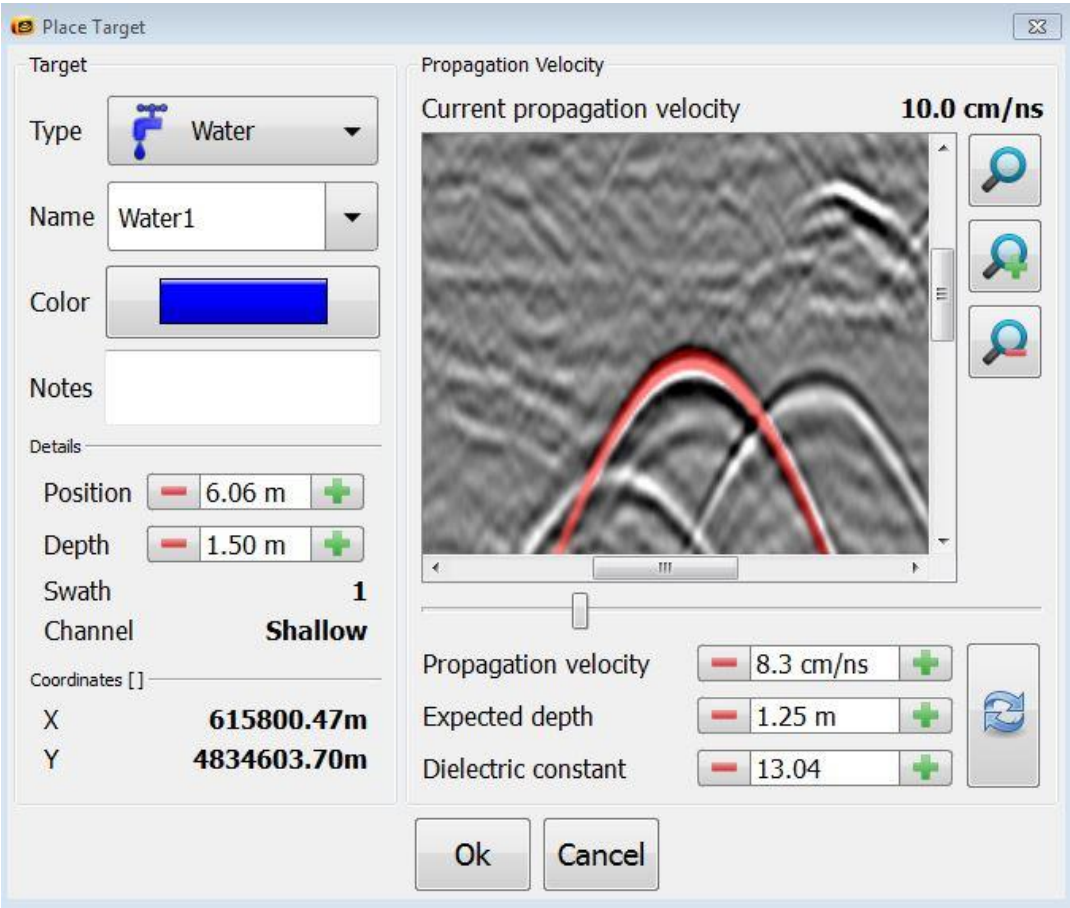


Fig. 2.21 – Place/Modify Target window

Fig. 2.22 – Target type

The right part of the **Place/Modify Target** window is used for the propagation velocity estimation: the user can superimpose the red hyperbola on the radargram using the slider below the map or modifying one of the three values below the slider (Fig. 2.23). All these parameters are bound by a relationship. At the same time the user can modify dielectric constant or expected depth in order to find the best propagation velocity.

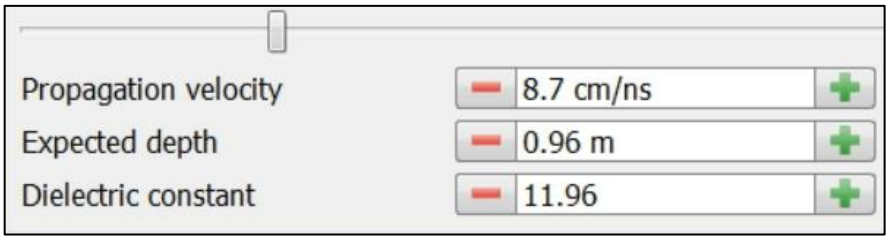


Fig. 2.23 – Propagation velocity, expected depth and dielectric constant evaluation

With the  button the user can reset the propagation velocity to the last confirmed value.

On the right of the radargram the zoom buttons  ,  and  . can be found.

To confirm the insertion of the marker click the **OK** button, otherwise click **Cancel**.

2.4.5 Acquisition menu

This bar contains a series of buttons to manage various functions.

By clicking the  button, the Create Report window opens, see paragraph 2.4.5.1.

With the  button, the grid on the radargrams can be turned on and off.

The  button can be used to delete the last acquired scan (Fig. 2.24).

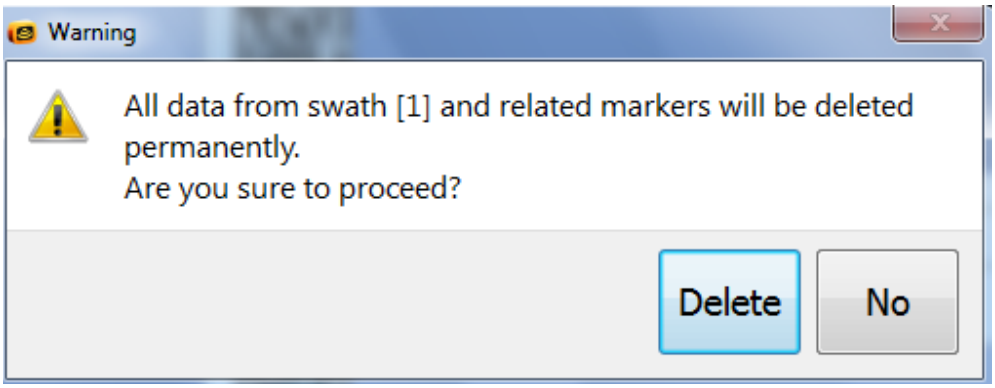


Fig. 2.24 – Delete last scan

The user can click the button to access the **Settings** menu, see paragraph 2.7; please note that the settings window during a project is only for the visualization, to change the settings the user must access the window using the main menu, see paragraph 2.3.

To stop the current Project and go back to the main menu (see paragraph 2.1) click the button.

2.4.5.1 Create Report

In the **Create Report** window the user can manage the options for the survey report generation (Fig. 2.25).

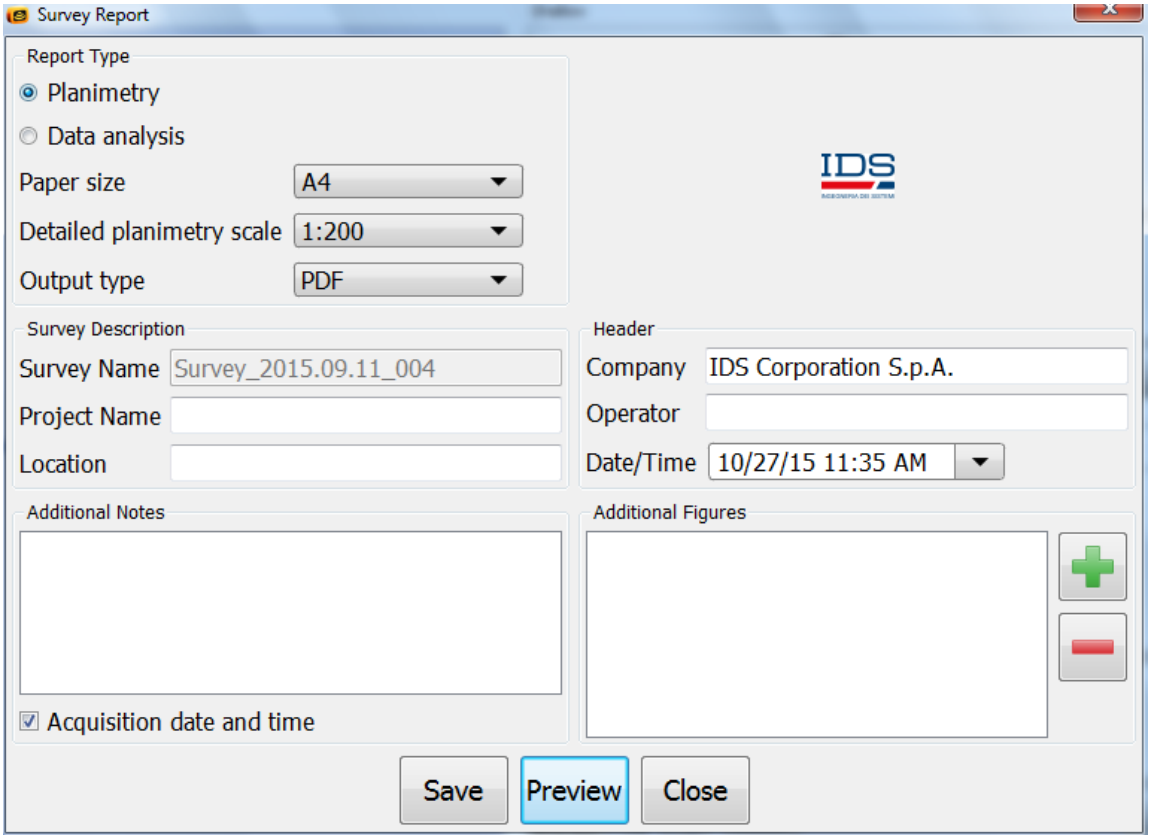


Fig. 2.25 – Create Report

In the **Report Type** section the user can choose to create a Planimetry Report (formed by target maps and tables) or Data Analysis Report (formed by radar maps with inserted targets), the user can also switch between different Paper sizes (A3 or A4), Planimetry scales (from 1:50 to 1:1000) and Output types (PDF or HTML).

In the **Survey Description** section the user can see the Survey name, and can insert the Project name and the job Location.

In the **Header** section the Company and Operator name and the Date/Time can be inserted; the user can also insert a Logo to be printed in the report, clicking in the upper right section of the window.

In the lower left part of the windows additional notes can be inserted, as also the acquisition date and time.

The lower right part of the window can be used to insert (or remove) additional figures, as also captions for them (see Fig. 2.26).

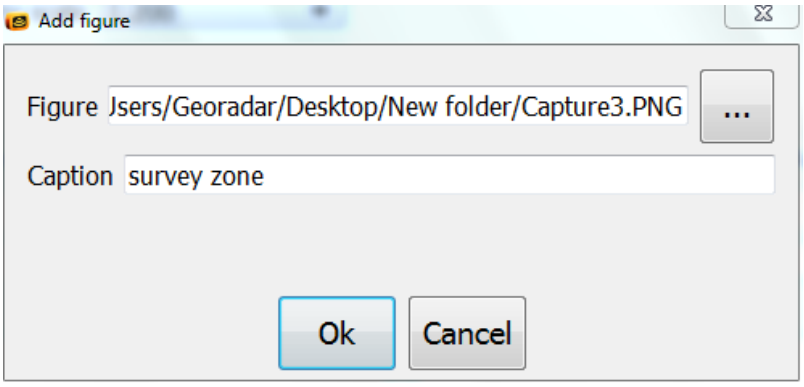


Fig. 2.26 – Add Figure to Report

Click **Save** to generate the report, select **Preview** to visualize it before saving and click **Cancel** to avoid saving the report.

2.4.6 System status

The status of the radar  , the GPS  , and the battery  can be checked in this section.

The user can verify the status of the system by clicking on one of these buttons (see Fig. 2.27).

If the number of satellites seen by the GPS is low the window in Fig. 2.28 will be shown.

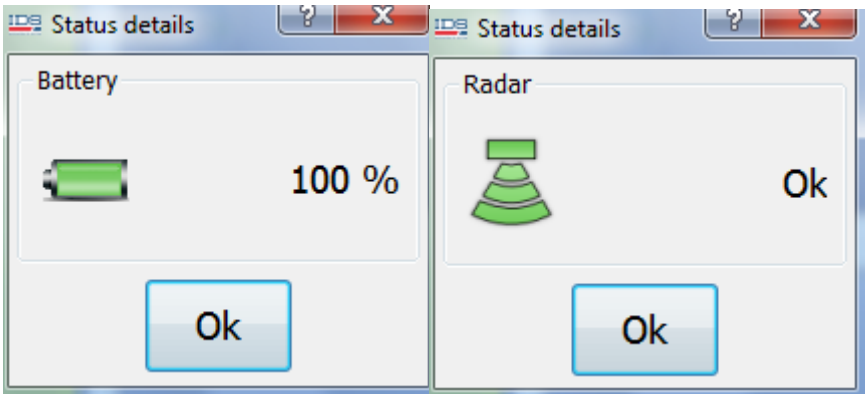


Fig. 2.27 – Status details

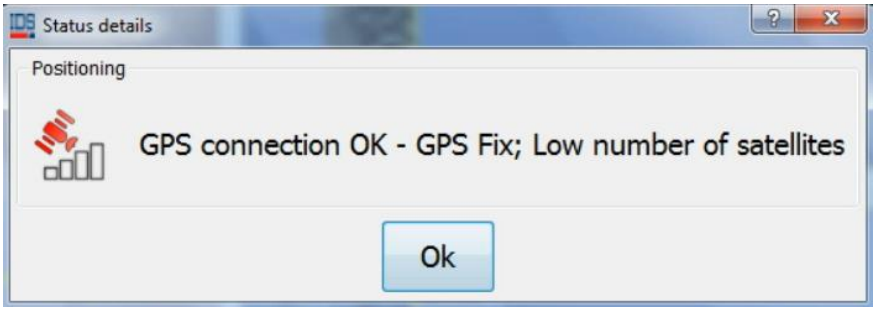


Fig. 2.28 – Low number of satellites

2.4.7 Map visualization menu

The user can turn on and off the Area map  , the "shallow" channel  and the "deep" channel  .

Shortcut	Associated command
Press **F1**	Start and Stop acquisition
Press **F2**	Push or Pull the radar
Press **F3**	Start wheel calibration
Press **F5**	Mark the target

Tab. 2.1 - Shortcut to use during the acquisition

2.5 New Assisted Project

2.5.1 Assisted Project Setup

When the **Assisted Project** button is clicked in the main menu (Fig. 2.9), the software opens the **Assisted Project Setup** window (Fig. 2.29); here the user must setup the measurement grid.

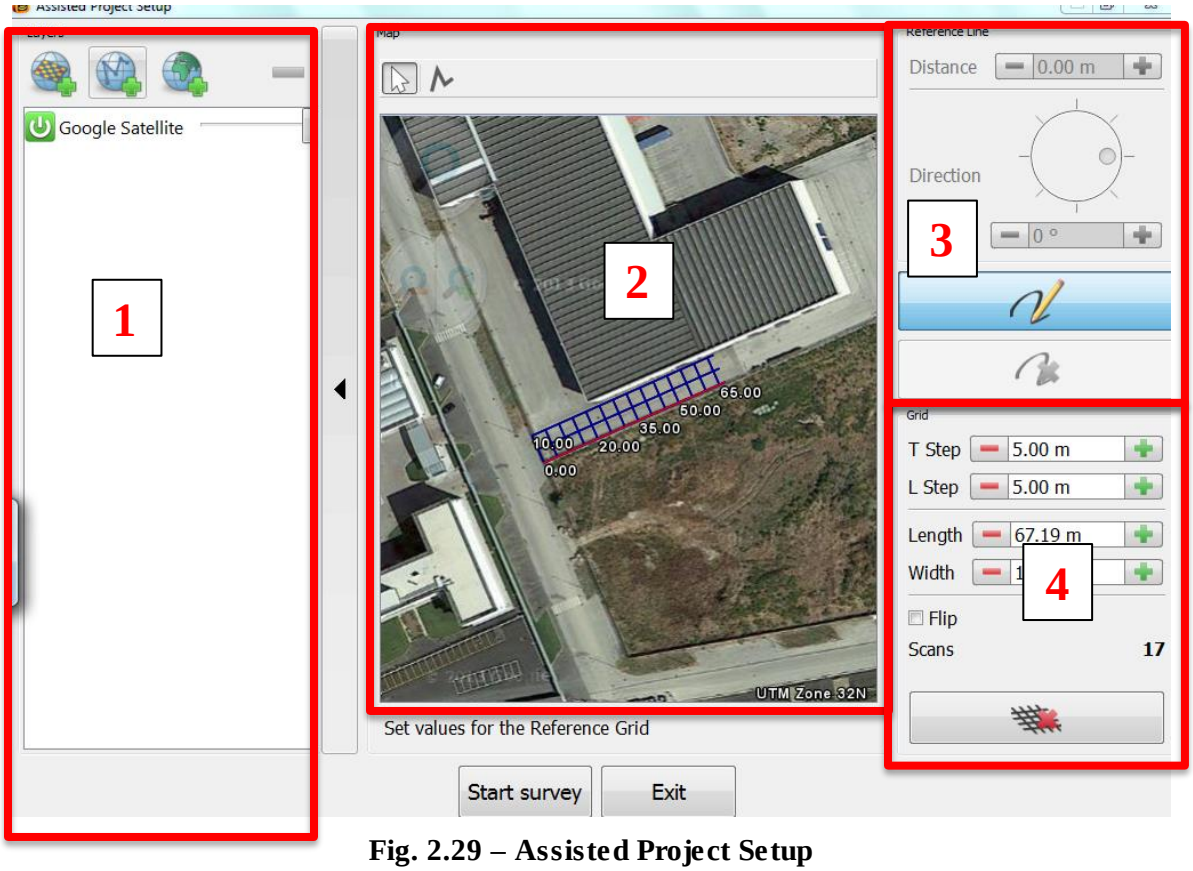


Fig. 2.29 – Assisted Project Setup

The **Setup** window is composed by the following parts:

1. Map layers list (paragraph 2.4.1)
2. Area map (paragraph 2.5.1.1)
3. Reference Line commands (paragraph 2.5.1.2)
4. Grid Settings (paragraph 0)

When the grid is complete the user must click Start survey to begin the acquisition, or Cancel to go back to the main menu.

2.5.1.1 Area map

This section contains the loaded map layers and the grid sketch superimposed on each other.

The user can zoom to the entire extent of the grid with the  button and zoom in/out with the  button.

To draw the grid reference line the user must click  and then click on the map to place two or more points (Fig. 2.30).

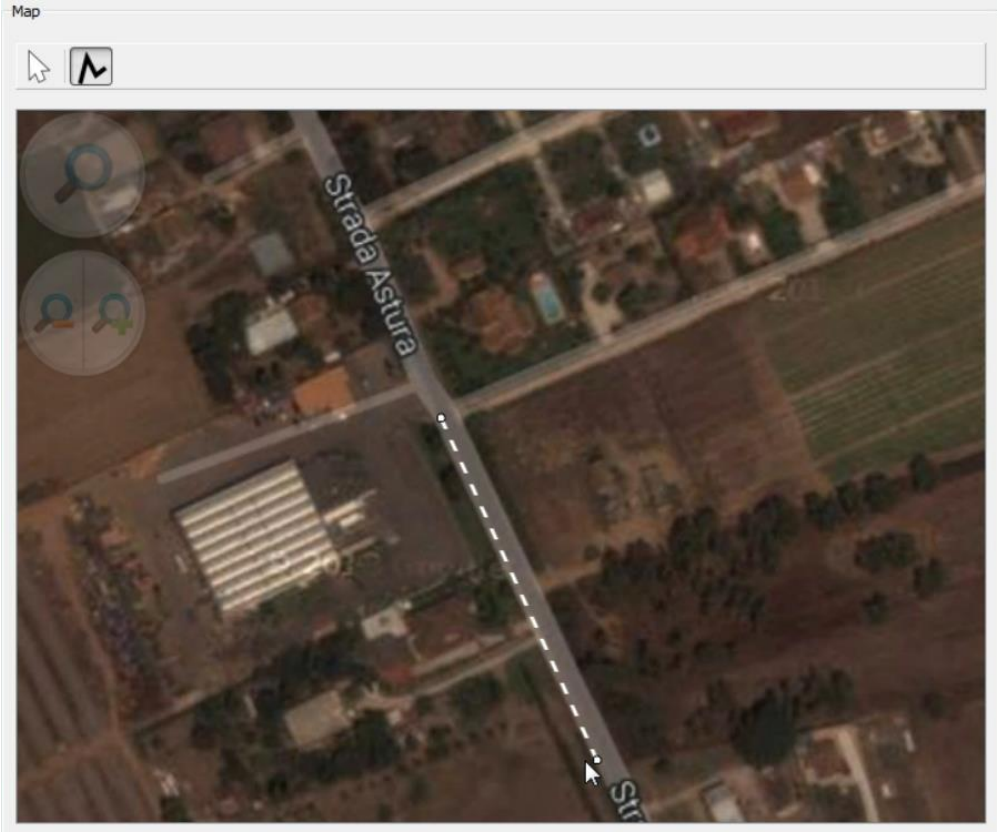


Fig. 2.30 – Reference Line

To pan the map click the  button, then click and drag the mouse.

2.5.1.2 Reference Line Commands

When the drawing of the reference line is finished, the user can click  .

The reference line can be modified if the button  is clicked again.

The user can delete the reference line with the  button.

Selecting one of the points of the reference line the user can change the distance from the previous point and the angle relative to the previous segment of the line (Fig. 2.31).

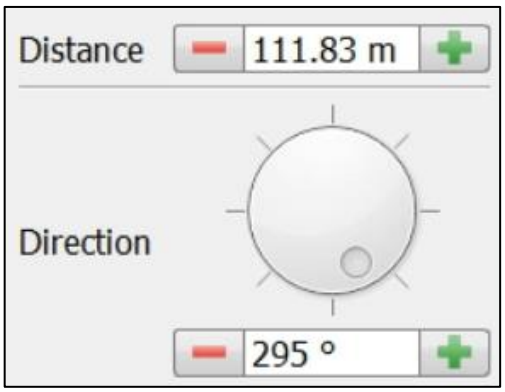


Fig. 2.31 – Reference Line point setup

2.5.1.3 Grid Settings

In this section the user can change the dimension and the step of the grid in the T and L directions. There is also the option to flip the grid 180°. The total number of scans needed to complete the survey is also shown here (Fig. 2.32).

The T axis is the starting point of the transversal scans while the L axis is the starting point of the longitudinal scans.

Fig. 2.32 – Grid dimension

The grid can be deleted using the  button.

2.5.2 Assisted Project Acquisition window

The **Acquisition** window is the same as the one explained in paragraph 2.4, but has two new available commands.

The  button lets the user select a scan line on the defined grid (see 0); to do this click and drag the selection over the desired lines, alternatively the user can just click on the line he wishes to select. This function is available before starting a scan.

Clicking  opens the **Starting Point Editor** window, from which the user can modify the starting position of the next scan with respect to the defined grid (see paragraph 2.5.2.1). This function is available before starting a scan.

2.5.2.1 Starting Point Editor

From this window the user can modify the Starting Point of the scan (with respect to the 0 point of the grid) and the Displacement of the selected line (with respect to the expected starting point of that line). Another thing that can be modified in this window is the scan direction (Forward or Backward). The radar picture is interactive, green arrows can be clicked to modify the values of the in-line and lateral displacements. The radar icon on the Map is positioned on the pre-defined grid according to the parameters set in this window.

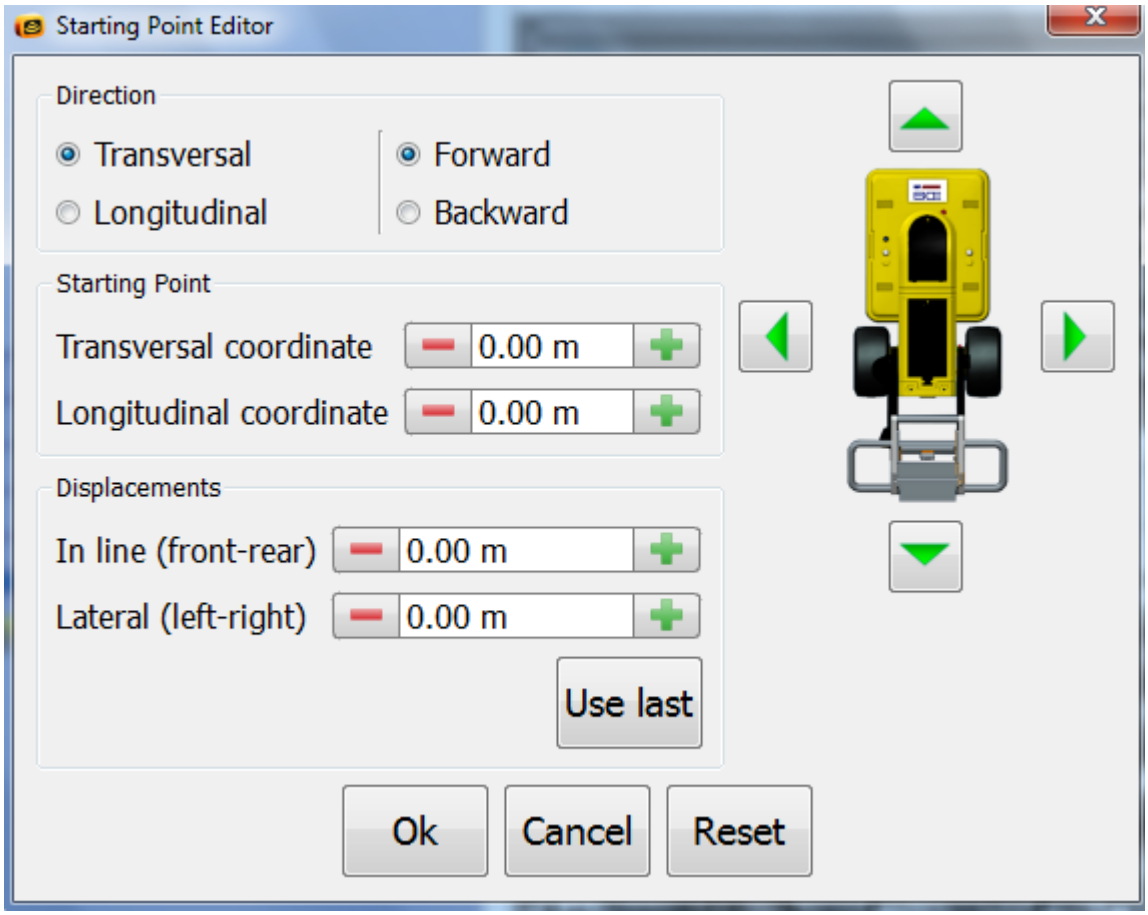


Fig. 2.33 - Starting Point Editor

2.6 Open Project

The **Open Project** button in the main menu (Fig. 2.9) is used to open an existing project select the .xml file found inside the survey folder, this opens the **Review Acquisition** window (Fig. 2.34).

Fig. 2.34 – Review Acquisition Window

The **Review Acquisition** window is composed by the following parts:

1. Area map and radargrams (paragraph2.4.2)
2. Target Commands (paragraph 2.6.1)
3. Map visualization buttons (paragraph 2.4.7)
4. Review Acquisition menu (paragraph 2.6.2)

2.6.1 Target Commands

These commands are the same as the ones explained in paragraph 2.4.4, except the  button is not present.

2.6.2 Review Acquisition menu

This bar contains the commands to manage various software functions.

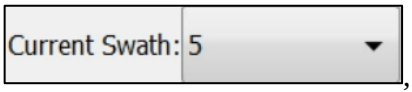
The  ,  ,  and  functions are explained in paragraph 2.4.5.

The  and  functions is described in paragraph 2.5.2.

Clicking the  button the user can resume the saved Survey and proceed with data acquisition (for example, for completion with missing lines).

With the  command the targets are exported to an external files in one of the following formats:

1. IDS Geomap (see chapter 3)
2. ESRI Shapefile;
3. AutoDesk DXF;
4. OpenGIS KML.

Using the **Scroll** menu 

, the user can switch between the various scans.

2.7 Settings

The Settings menu, is accessible using the **Settings** button of the main menu (Fig. 2.9), is subdivided in three tabs:

1. Survey Settings (see paragraph 2.7.1)
2. Hardware Settings (see paragraph 2.7.2)
3. Graphics Settings (see paragraph 0)
4. International Settings (see paragraph 0)

2.7.1 Survey Settings

In the **Survey Settings** menu the user can (see Fig. 2.35):

1. Modify the project name and saving folder;
2. Turn on and off the GPS and access the Positioning Settings (see Paragraph 2.7.1.1).

With the  button the user can go back to the initial settings.

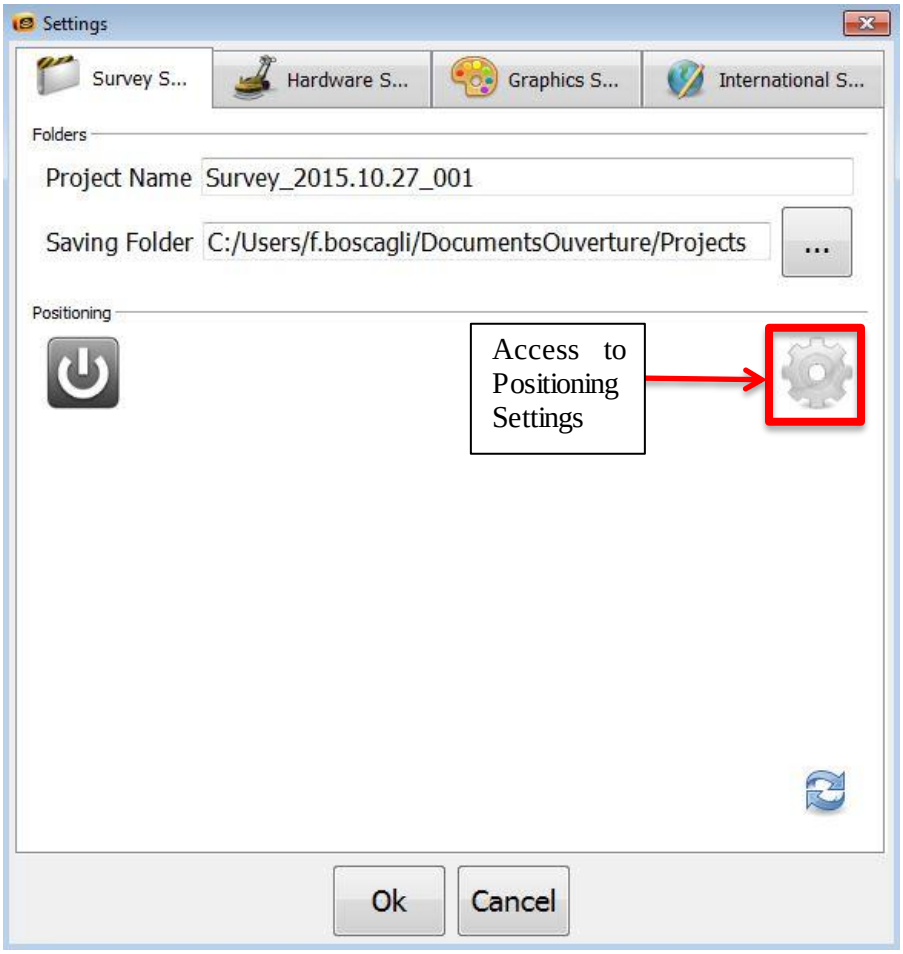


Fig. 2.35 – Survey settings

2.7.1.1 Positioning Settings

The **Positioning Settings** menu contains two tabs:

1. COM Port Settings (Fig. 2.36)
2. Positioning System (Fig. 2.37)

In addition, the status of the GPS and the incoming NMEA strings can be found in the same window.

In the **COM Port Settings** the user must insert the same value used for the setting of the GPS (refer to the GPS user manual).

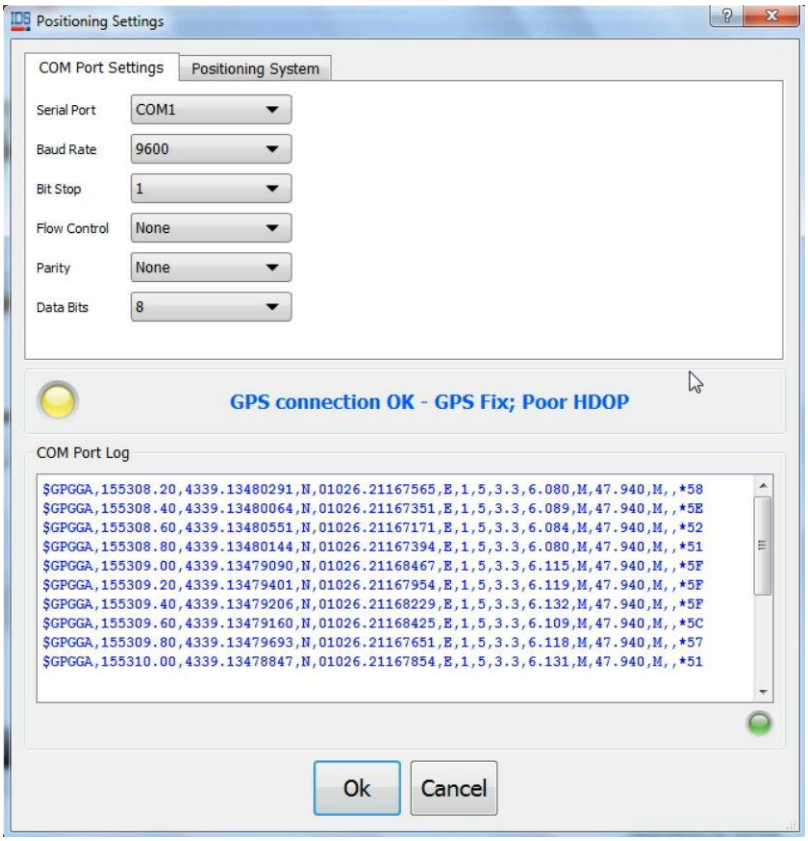


Fig. 2.36 – COM Port Settings

In the **Positioning System** menu contains a **Status** section displaying the following information:

1. Satellites: indicates the number of satellites from which the GPS is receiving data, for a good signal at least 5 satellites are required.
2. HDOP: Horizontal Dilution of Precision, the lower this number is, the better accuracy is achieved; for a good positioning this value should be no greater than 2.
3. Fix: indicates the Real Time Kinematic status, the value can be GPS Fix (without RTK) or RTK Fix (with RTK); if the value is RTK Float it means that the connection with the base station is lost.

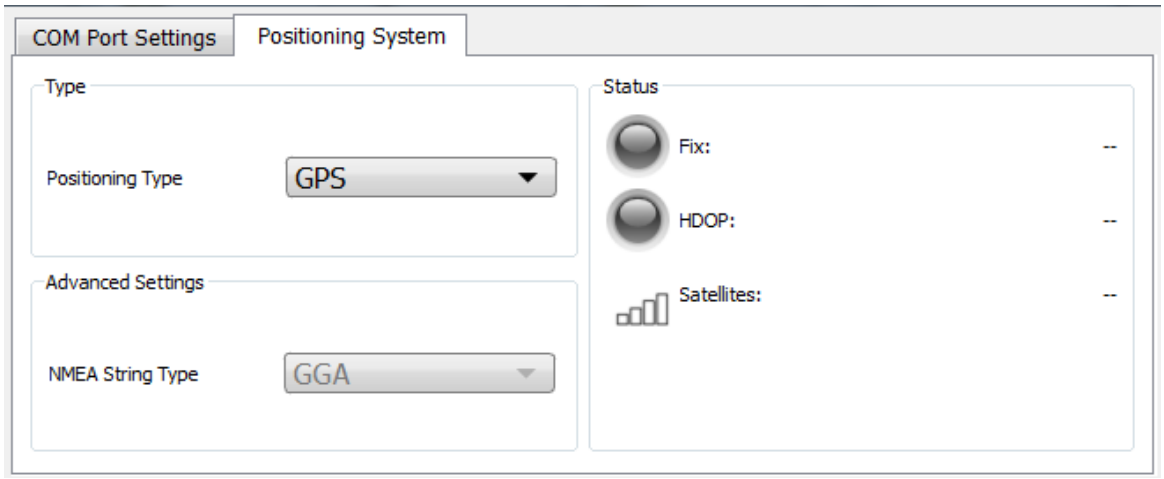


Fig. 2.37 – Positioning System menu

2.7.2 Hardware Settings

The **Hardware Settings** menu is used for:

1. Modifying the radar depth range (in ns);
2. Modify the number of samples per scan;
3. Modify the performance of the instrument, choosing for a higher maximum speed or a greater penetration;
4. Selecting the scan step (please note that changing the scan step will result in a different hyperbola shape);
5. Calibrate the encoder with the button (see paragraph 0.).

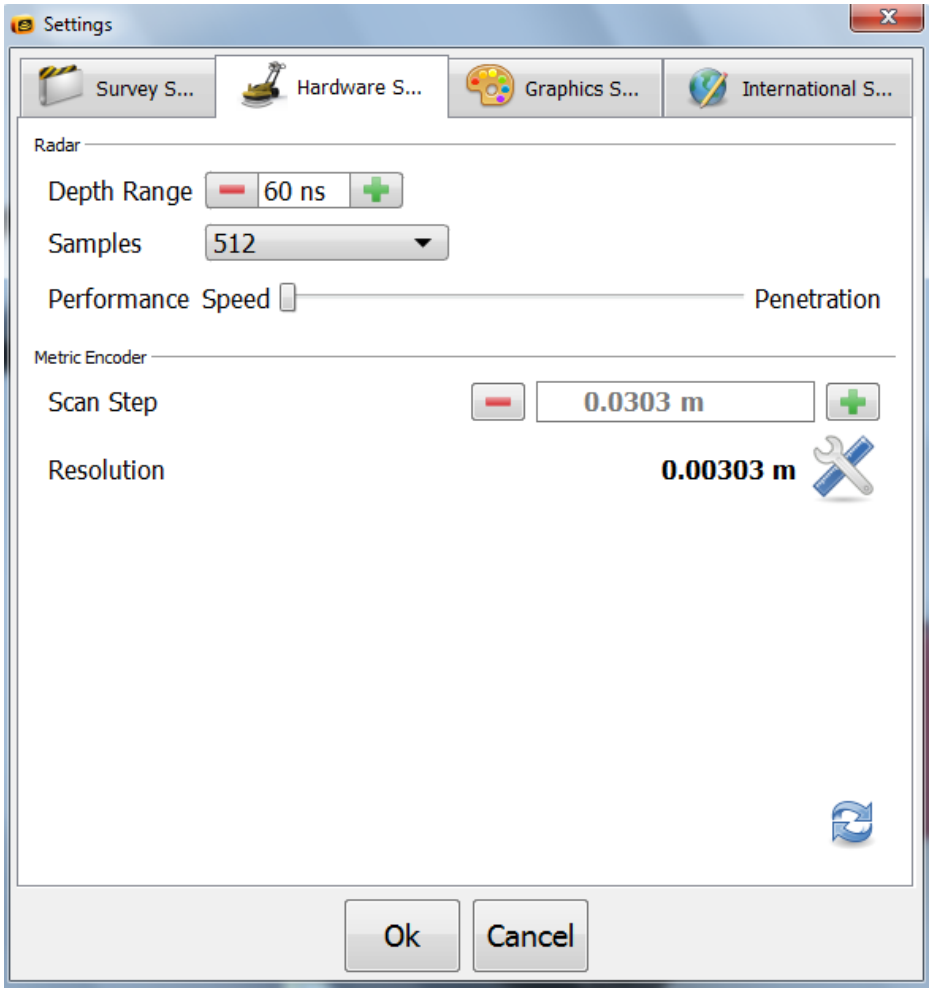


Fig. 2.38 – Hardware Settings

2.7.2.1 Wheel calibration

The user must click Calibrate (Shortcut F3) to start the wheel calibration, see Fig. 2.39, and then click the **Start** button  in the encoder calibration window, see Fig. 2.40.

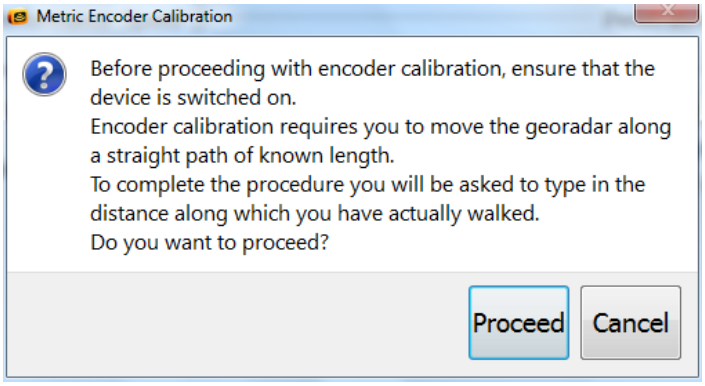


Fig. 2.39 – Calibration start

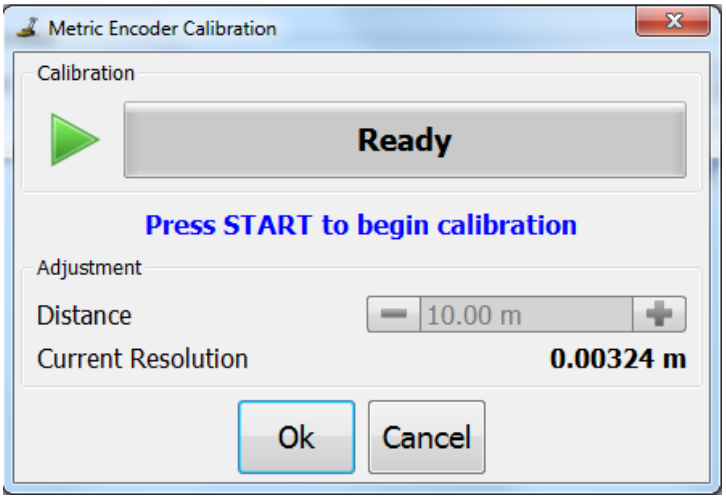


Fig. 2.40 – Encoder calibration

Once enough distance is travelled the reen bar will be completely filled and the word "Done!" will be displayed; at this point the user must click the **Stop** button  (Fig. 2.41), write the travelled distance and click the **OK** button, see Fig. 2.42.

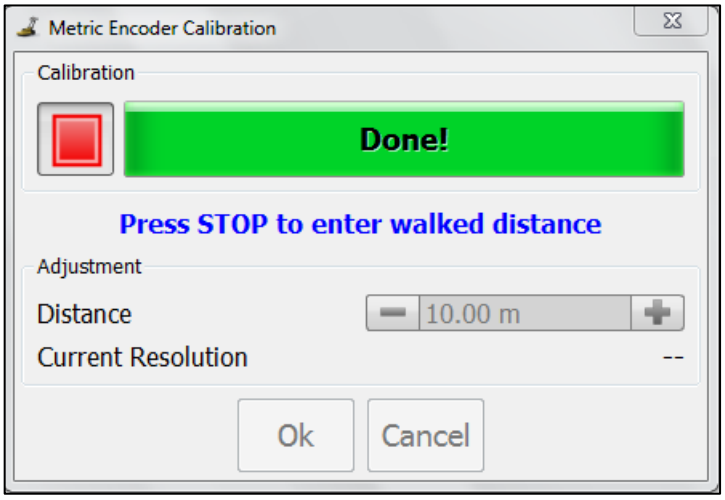


Fig. 2.41 - Calibration phase

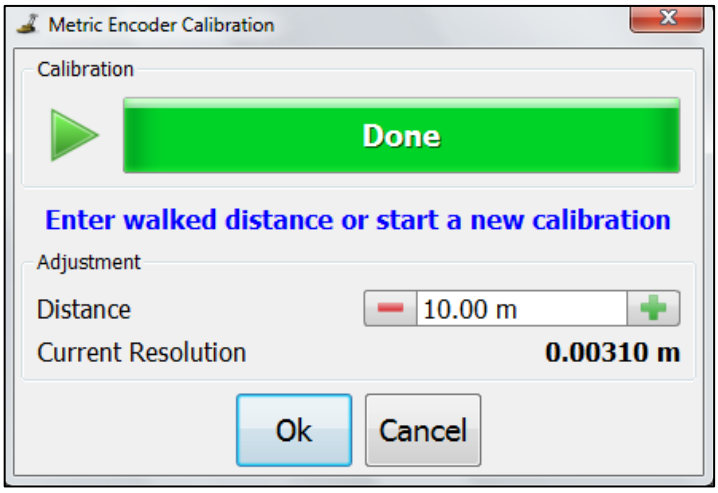


Fig. 2.42 - Calibration finished

In the last row of the Fig. 2.42 you may read the new spatial resolution value (i.e. 0.00310 m).
To be sure that the measured distance is right the user should repeat the calibration every 30 days.

2.7.3 Graphics Settings

In the Graphic Settings tab the user can choose between various colour palettes for the radar maps (see Fig. 2.43).

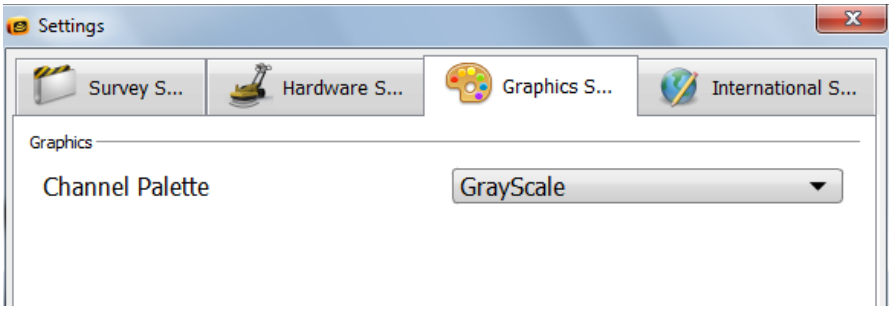


Fig. 2.43 – Graphics Settings

2.7.4 International settings

The international Settings menu allows the user to choose the language, the measurement system and units (Fig. 2.44).

Fig. 2.44 – International Settings

The available units of measurement for distance are meters, feet and yards; for depth the user can choose between meters, centimetres, inches or feet.

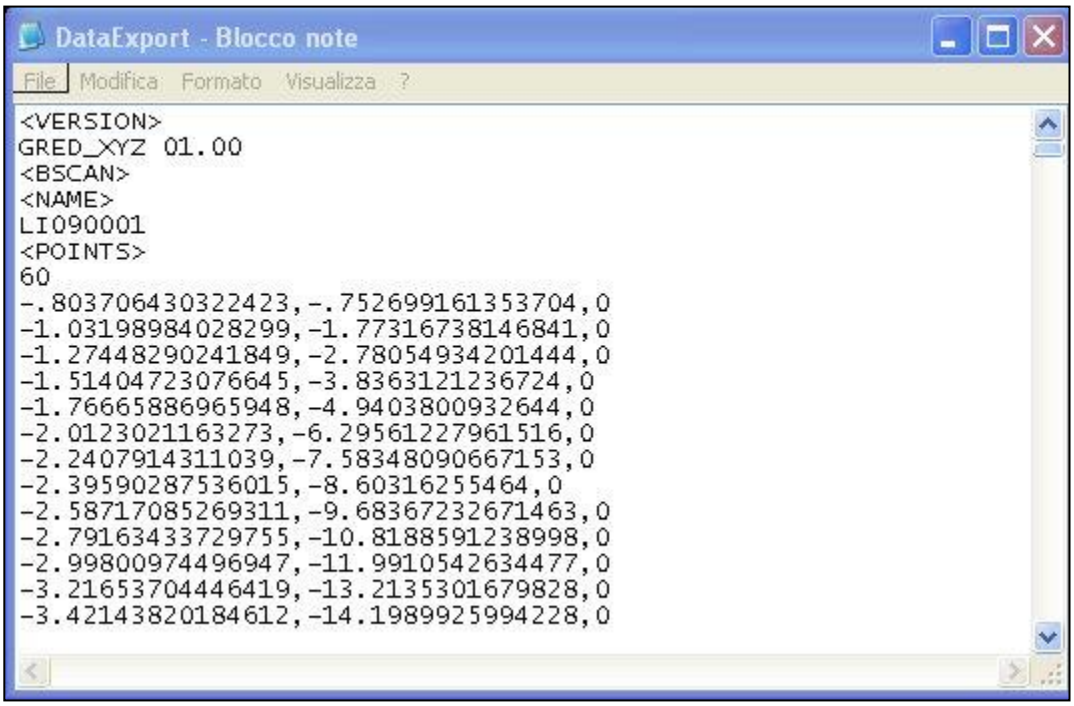
3. IDS GEOMAP GUIDE

The CAD module is an additional tool that, optionally, you can add to the BASIC module, or to the 3D module, or to the BRIDGE module. The main function of this module is to permit the user to export data (scans and targets inserted) to AutoCad environment. The AutoCad Full Version compatible with the GRED HD software are: 2007-2008-2009-2010-2011-2012. The platform must be anyway Windows XP Professional or Windows 7 (32 bits or 64 bits).

3.1 The command Export to IdsGeomap

The user can follow two ways to export data on AutoCad:

The first one is by clicking the Save button  , directly on Ouverture both for New and Assisted Project. Here you save a file in ASCII format with the list of coordinates of all radar sections and the targets extracted, as shown in Fig. 3.1.

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<VERSION>
GRED_XYZ 01.00
<BSCAN>
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LI090001
<POINTS>
60
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-1.03198984028299,-1.77316738146841,0
-1.27448290241849,-2.78054934201444,0
-1.51404723076645,-3.8363121236724,0
-1.76665886965948,-4.9403800932644,0
-2.0123021163273,-6.29561227961516,0
-2.2407914311039,-7.58348090667153,0
-2.39590287536015,-8.60316255464,0
-2.58717085269311,-9.68367232671463,0
-2.79163433729755,-10.8188591238998,0
-2.99800974496947,-11.9910542634477,0
-3.21653704446419,-13.2135301679828,0
-3.42143820184612,-14.1989925994228,0
```

Fig. 3.1 – Example of a file in ASCII format

3.2 Ids_gcad_xyz application

Once AutoCad application icon is launched, the *Ids_gcad_xyz* toolbar, Fig. 3.2, will appear on AutoCad workspace.

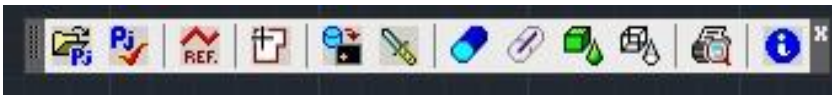

Fig. 3.2 – Ids_gcad_xyz toolbar

3.2.1 GPR and GPS data export

1. To Open a project  on AutoCad select the first button of Ids_gcad_xyz toolbar and choose the folder where the project is contained; press OPEN.

2. Now press *Load from radar export*  , fifth button of *Ids_gcad_xyz* toolbar. The data will be automatically represented on the drawing and georeferenced respect to the present GPS system of the hardware used.

3. *Current project*  allows you to manage more than one project on the same CAD design. The procedure is:

   - Repeat step 1 & 2 for each new project you want to export in CAD (remember that GRED HD SW creates a different ASCII file for each project inside its directory). The user will choose the current project among the ones contained in the list.

4. Once you have selected the project, click on *Objects creation*  button from the *Ids_gcad_xyz* toolbar (fourth button). This button opens the *New object* window where you can choose between a: Point, Line/Pipe, Cover, Box or a Solid.

5. *Make Section*  allows you to automatically obtain schematic longitudinal, traversal, horizontal and diagonal sections of the cartography imported from the Data Base. Activating this button the window in Fig. 3.3 will appear in which you can decide which section perform. To create a section you must edit the following fields:

   - *Section name:* insert the name of the section
   - *Vertical Limits:* insert the min & max depth of the vertical section
   - *Grid* : insert the X-step & Y-step of your reference grid
   - *Vertical Scale Factor:* select the scale relation in vertical direction.

   After having completed the setting phase, press *Create Section*.

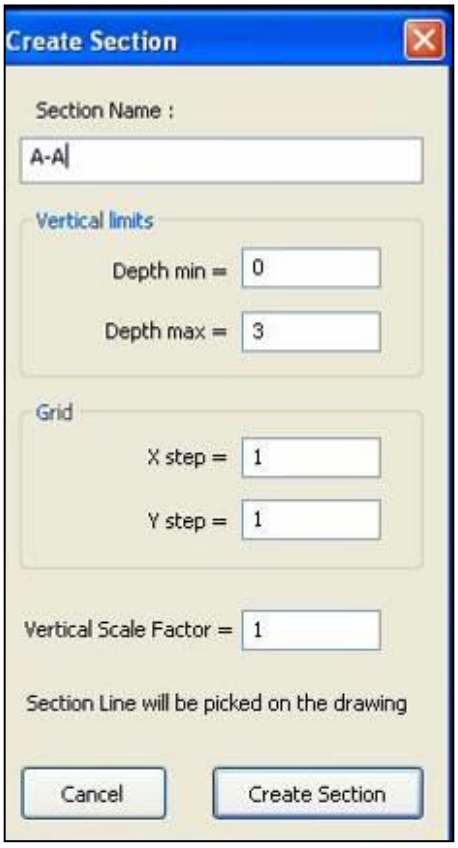

Fig. 3.3 - Dialog window parameter section parameters

To create a new section you have to:

- selecting two or more points with left mouse button on Main Window;
- stopping the selection pressing right mouse button;
- choosing where place the new section in the AutoCad's workspace. There you can visualize the name of the section, intersected targets, grid's step, length and the depth of the section.

In Fig. 3.4 you can see a section NE – SW oriented that intersects targets (3) Est – West oriented; in the following image (Fig. 3.5) you visualize a XY map with all targets located in the area.

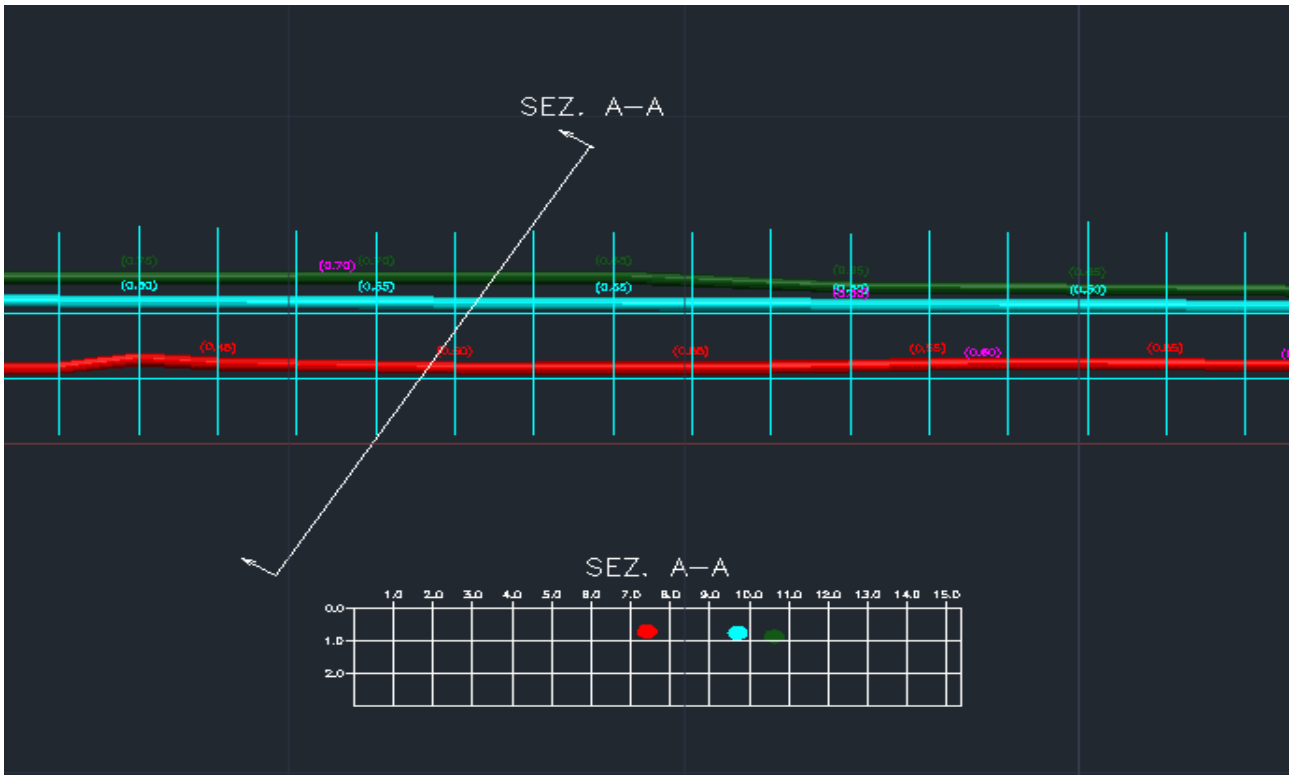

Fig. 3.4 - A-A Section across three horizontal targets

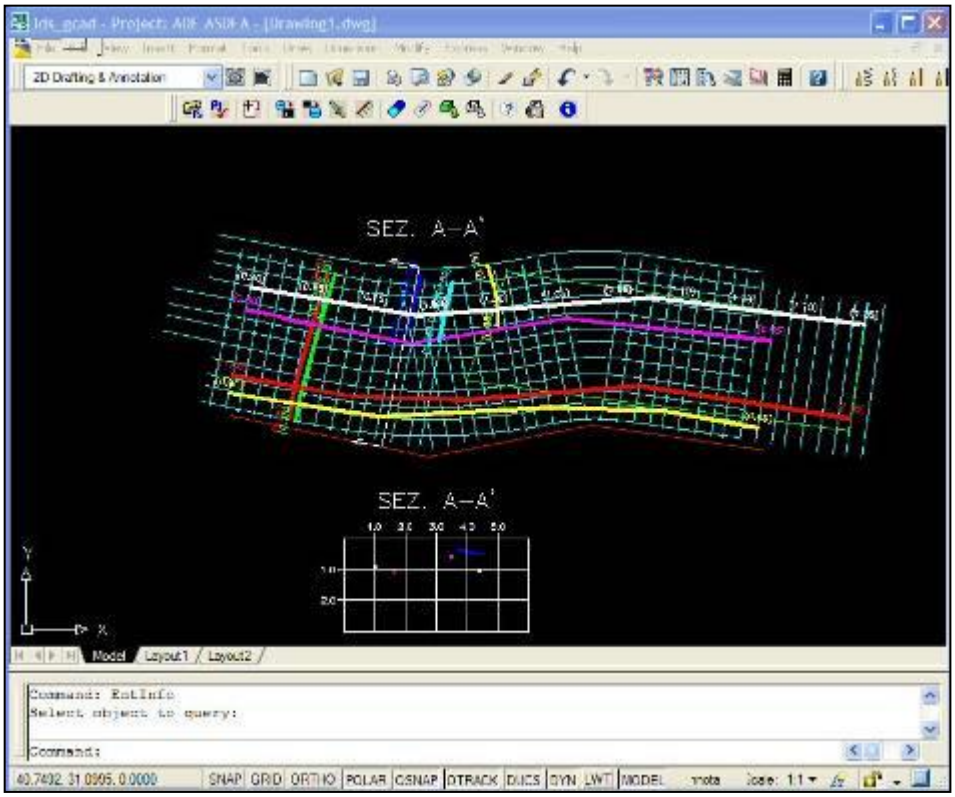

Fig. 3.5 – XY representation of targets

6. *Dress Pipe*  allows you to "dress" the pipes, creating around the pipe axis the vectors of a cylinder. This type of viewing gives the pipe a so-called "iron wire" look. After activating the *Dress pipe*, the curser becomes a small square which you use to select the pipes to "dress".

7. *Undress Pipe*  allows you to "undress" the pipes, highlighting the pipe axis. This command allows you to reduce the pipe in a poly-line, and may be modified using normal AutoCad tools.

8. *Shade 3D Objects*  automatically executes a "rendering" of all the 3D elements in the AutoCad file see Fig. 3.6.

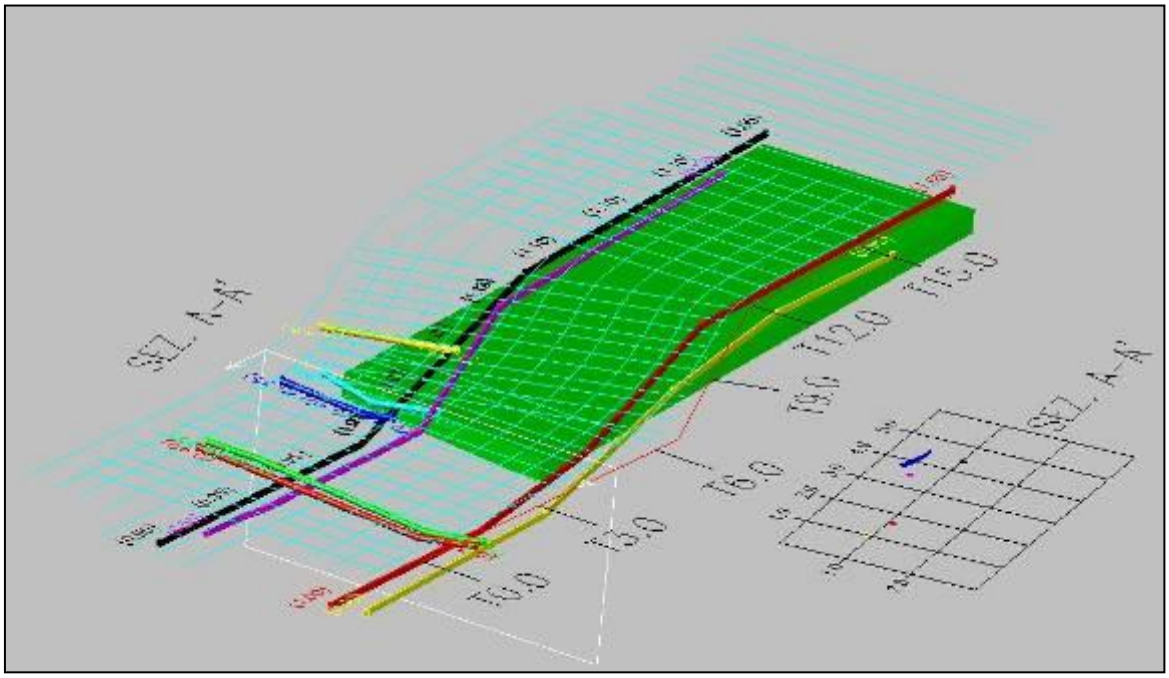

Fig. 3.6 – 3D View with rendering activated

9. *Unshade 3D Objects*  allows you to view the 3D elements in the so-called "iron wire" view Fig. 3.7.

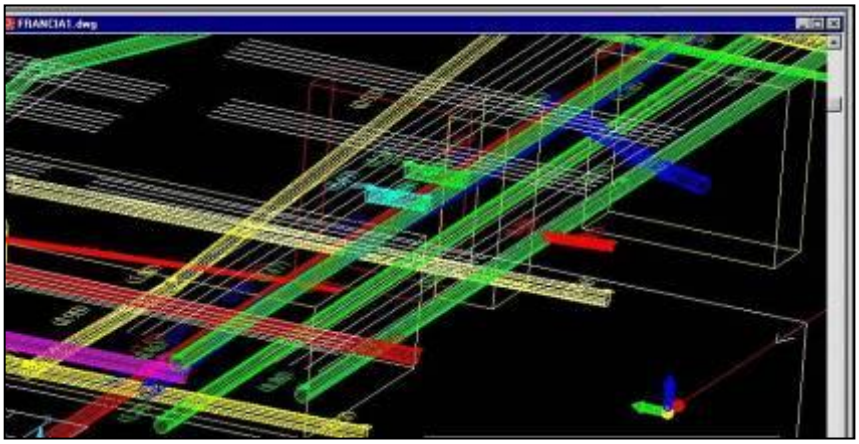

Fig. 3.7 – 3D View in iron wire mode

10. *Layout Manager*  activates the window in Fig. 3.8 that manages the creation of the various printing Layouts.

In the window in Fig. 3.8 you can select the following fields:

- Select *Paper Size* (from A0 sheet to A4 sheet);
- Define *Output Scale*;
- Click on *Insert Frame*;
- On the main window select one or more frames to represent in final layouts (Click one time with left mouse button for each frame; to end the process press right mouse button);
- Press *Make all Layouts* command (create various printing layouts).
- Select *Visible frames when closing*: view printing boarders in AutoCad design.

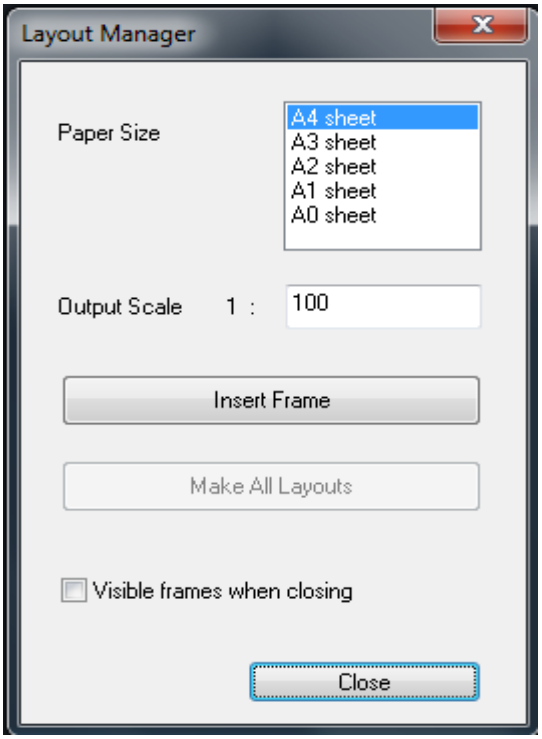

Fig. 3.8 - Layout Manager window

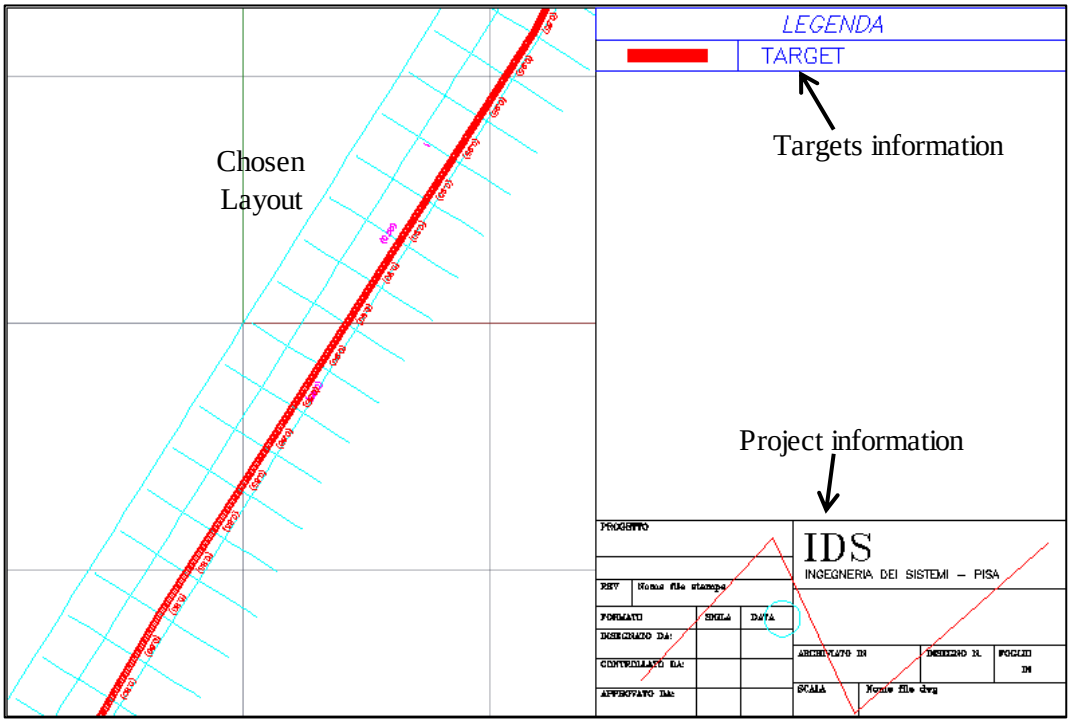

Fig. 3.9 - Example of Layout

If you wish to cancel a layout, you must repeat the insertion using *Make All Layouts* in Fig. 3.8, in this case the *Ids_gcad_xyz SW* will present a video message, Fig. 3.10, if you press Yes you except creating new printing layouts substituting the ones previously created.

Fig. 3.10 – Frame creation confirmation window

11. *Object Information* transforms the AutoCad cursor into a white square; you can click on the desired item and the window in Fig. 3.11 will appear. This window will view all the general information regarding the Project and Zone and regarding information about the selected object, for example, type of plot R-PIPE and the name PIPE-01 (see Fig. 3.11).

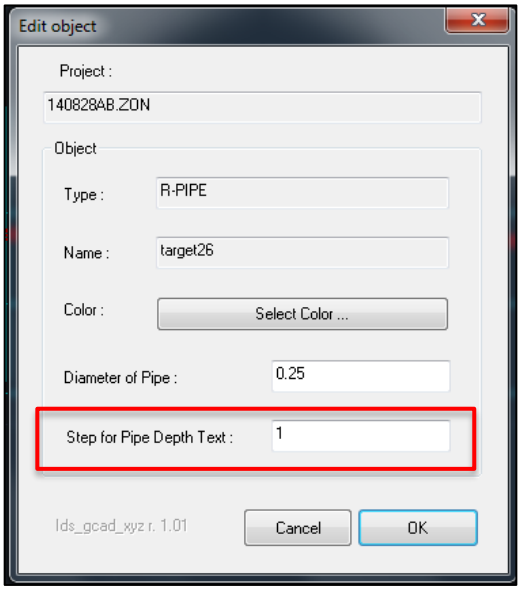

Fig. 3.11 - Information command window

The following fields may also be edited:

- *Colour:* activating *Select Colour* you may choose from the palette of AutoCad colours the colour you want to associate to the selected element.
- *Diameter of Pipe*: change pipe diameter.
- *Step for Pipe Depth Text:* select the distance interval of the fields associated to each pipe (red rectangle in Fig. 3.11). In this way you can read the depth at which you find the target in respect to reference surface (XY Plane).

4. PRELIMINARY JOBSITE INVESTIGATION

4.1 Jobsite features

The first fundamental phase for any field survey consists in understanding the features of the jobsite: the scope is to acquire all the necessary information for the logistics of the operation, taking into account the objectives to be performed.

In the specific case of a GPR investigation for underground utilities detection, the first thing to consider is the accessibility of the site, in terms of the space available for the passage of the GPR equipment and any architectural features that could cause an obstacle to the data acquisition phase. Often, in fact, the investigation is performed in streets, squares and on pavements with a relatively high level of urban traffic, and above all, in the presence of randomly parked cars.

The main points to be considered during this phase are described below:

- Specific permission must be obtained (access to pedestrian zones, permission to interrupt the traffic flow, etc.);
- Any difficulties in accessing the site must be considered;
- The space available;
- The presence of parked cars;
- The level of traffic.

It is the task of the user to take these points into consideration when planning the survey.

4.2 Technical maps

Technical maps of the existing utilities are produced by the various utilities companies.

These give general indications in a schematic way about the type and position of the utilities that are managed and/or have been constructed by them.

These maps can be requested by faxing or writing to the cartographic or planning office of the companies, specifying clearly the streets and areas of interest.

The most important types of utilities (which may be managed by different agencies) to be considered are:

- Public Street Lighting
- Low, Medium and High Voltage Electricity Cables
- Water supply
- Gas
- Telephone Cables
- Sewers

Even though they may be very generic, these maps represent an important support during the extraction and data interpretation phases, since they give the user a first idea, if not an exhaustive one, of the utilities that are present.

For this reason, it is important that the user activates the procedures for obtaining these maps well in advance to make sure that they are available during the data extraction phase.

4.3 Opening manholes

This phase is normally performed once the acquisition phase has been completed, and consists in opening the manholes present in the investigated site.

The data regarding the depth, diameter, and direction of the utility should be saved on the work sheet: this provides the user with further reference data during the interpretation phase, and allows propagation velocity estimates to be performed in order to calculate the depth of the identified utility as precisely as possible.

5. FIELD WORKING PROCEDURE

5.1 Job setup

Prior to departure to the jobsite be sure that the laptop and radar batteries are fully charged.

For a correct acquisition follow the instruction in paragraph 5.2, depending on the purpose of the job and the available tools.

5.2 On site target mark-out

The acquisition procedure is:

1. Turn on the laptop;
2. Start up the Ouverture software;
3. Click the **New Project** button (because a grid is not needed in this situation, see paragraphs 2.4);
4. After the radar calibration, check the radar and battery status (see paragraph 2.4.6);
5. For a better visualization of the radargrams, the area map can be turned off (see paragraph 2.4.7);
6. Choose the movement mode, pulling or pushing the instrument (see paragraph 2.4.3) and position the instrument at the start of a line to be scanned;
7. Start the acquisition (see paragraph 2.4.3) and start moving;
8. When a target is found stop and go back until the vertical yellow line in the radargrams is on top of the target;
9. Insert the target and estimate the correct depth (see paragraph 2.4.4.1);
10. If a Spray Support is present, use the proper command to mark the ground (see paragraph 2.4.4);
11. When a line is finished stop the acquisition (see paragraph 2.4.3) and position the instrument at the start of a new line;
12. Repeat the steps from 7 to 11 until the jobsite is covered.

5.3 Utilities mapping without GPS

If the purpose of the job is to obtain a map, but a GPS is not available, the user must setup an acquisition grid following these steps:

1. Turn on the laptop;
2. Start up the Ouverture software;
3. Click on the **New Assisted Project** button (see paragraphs 2.5);
4. If an internet connection or a cartographic file is available, the user can download a map layer to be underlayed with the scan lines and targets (see paragraph 2.4.1);
5. Setup the acquisition grid (see paragraphs 0);
6. After the radar calibration check the radar and battery status (see paragraph 2.4.6);
7. Choose the movement mode, pulling or pushing the instrument (see paragraph 2.4.3);
8. Position the instrument on the first line to be scanned, select a new line in case the one suggested by the software is to be skipped; the starting position and movement direction can also be modified;
9. Start the acquisition (see paragraph 2.4.3) and start moving;
10. When a target is found stop and insert it estimating the correct depth (see paragraph 2.4.4.1);
11. If a Spray support is present go back on top of the target and mark it on the ground (see paragraph 2.4.4);
12. When a line is finished, stop the acquisition (see paragraph 2.4.3) and position the instrument at the start of a new line. The user can modify the starting point and movement direction or select a different line;
13. Repeat the steps from 7 to 10 until the entire grid is covered; after concluding, save the **Survey report** (see paragraph 2.4.5.1) and exit the acquisition phase.
14. The Acquisition can be reviewed using the **Open Project** button (see paragraph 2.6);
15. The data can be also exported to IDS Geomap to be edited in AutoCad (see paragraph 3.1.

5.4 Utilities mapping with GPS

If a GPS is present a georeferenced map of the targets can be created, following these steps:

1. Turn on the laptop;
2. Start up the Ouverture software;
3. Connect and configure the GPS using the **Settings** menu (see paragraph 2.2 and 2.7.1);
4. Click on the **New Project** button because a grid is not required in this situation (see paragraphs 2.4);
5. After the radar calibration check the radar, GPS and battery status (see paragraph 2.4.6);
6. If an internet connection or a cartographic file is available, the user can download a map layer to be underlayed with the scan lines and targets;
7. Choose the movement mode, pulling or pushing the instrument (see paragraph 2.4.3) and position the instrument at the start of a line to be scanned;
8. Start the acquisition (see paragraph 2.4.3) and start moving;
9. When a target is found stop and insert it estimating the correct depth;
10. If a Spray support is present go back on top of the target and mark it on the ground;
11. When a line is finished stop the acquisition (see paragraph 2.4.3) and position the instrument at the start of a new line;
12. Repeat the steps from 8 to 11 until the entire area is covered; after concluding, save the **Survey report** (see paragraph 2.4.5.1) and exit the acquisition phase.
13. The Acquisition can be reviewed using the **Open Project** button (see paragraph 2.2);
14. The data can be also exported to IDS Geomap for editing in AutoCad.

6. GPS REQUIREMENTS

The Opera Duo system can be used with a GPS to position the scans in real time without the need of creating a grid.

The requirement of such GPS are:

1. Dual frequency (L1+L2);
2. Positioning update greater than 5 Hz;
3. RTK: connection to a base station via radio link (UHF or GSM) or connection to a Continuously Operating Reference Station (CORS) via internet;
4. NMEA output;
5. Serial cable (RS232) is required, alternatively the GPS can be connected to the laptop via Bluetooth.

7. IDS ON-LINE ASSISTANCE

7.1 Download area

The Georadar section of the IDS website has a download area accessible from the customer to get the latest update of software, manuals, guides and other useful tools.

To do this the first step is to fill the registration form, accessible from https://www.idscorporation.com/georadar/more-information/georadar-customer-area-logged/request-an-account (Fig. 7.1).

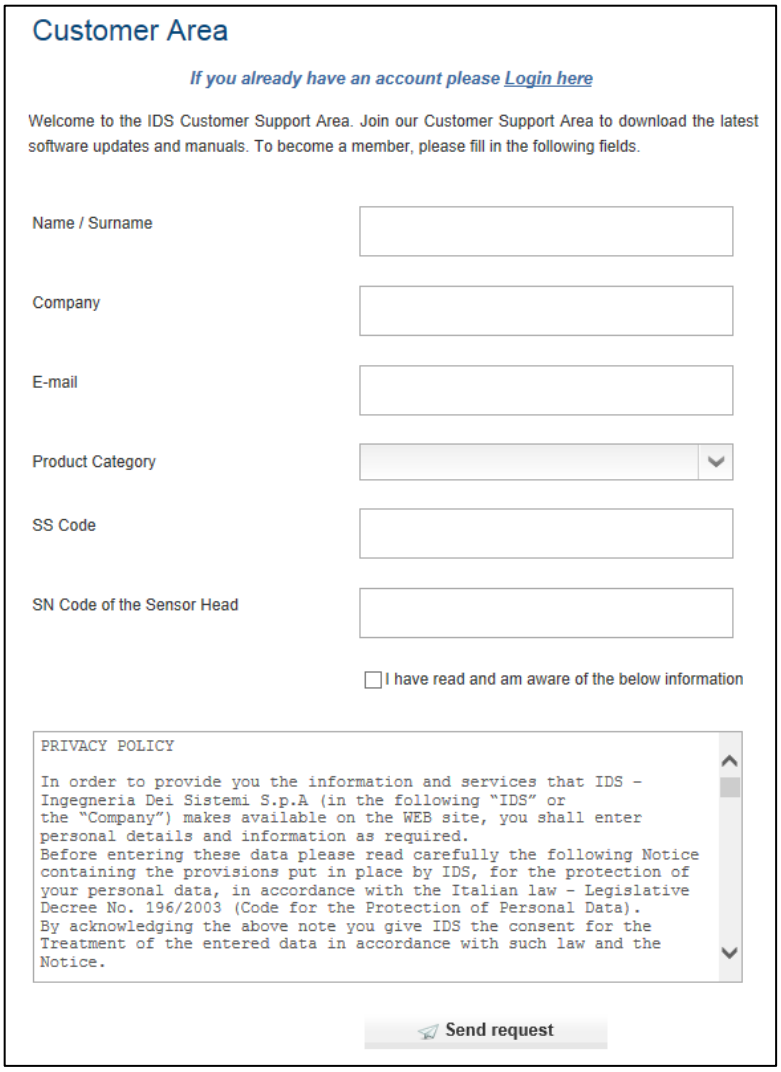

Fig. 7.1 – Registration form

The request will be handled by the Customer Care of IDS; the user will receive an email with its credentials to access the download area, that he has to enter in https://www.idscorporation.com/georadar/more-information/georadar-customer-area-logged/customer-area-login.

7.2 Remote assistance using Webex Support Center

The Webex Support Center is a service that allows the activation of a two host session, making an application or the desktop available to the other user or letting the user capture another remote desktop.

It can be used to perform web conferences and presentations.

It is easy to use thanks to a simple and intuitive interface.

Since there are no firewalls or other types of network configurations, it is a fast and secure means of reaching any client host in any part of the world. In fact, the client only has to accept to download a small plug used to permit the service authentication and function.

7.2.1 How to use the Webex service

The user will receive an email from IDS Customer Care containing a link to the support session (see Fig. 7.1).

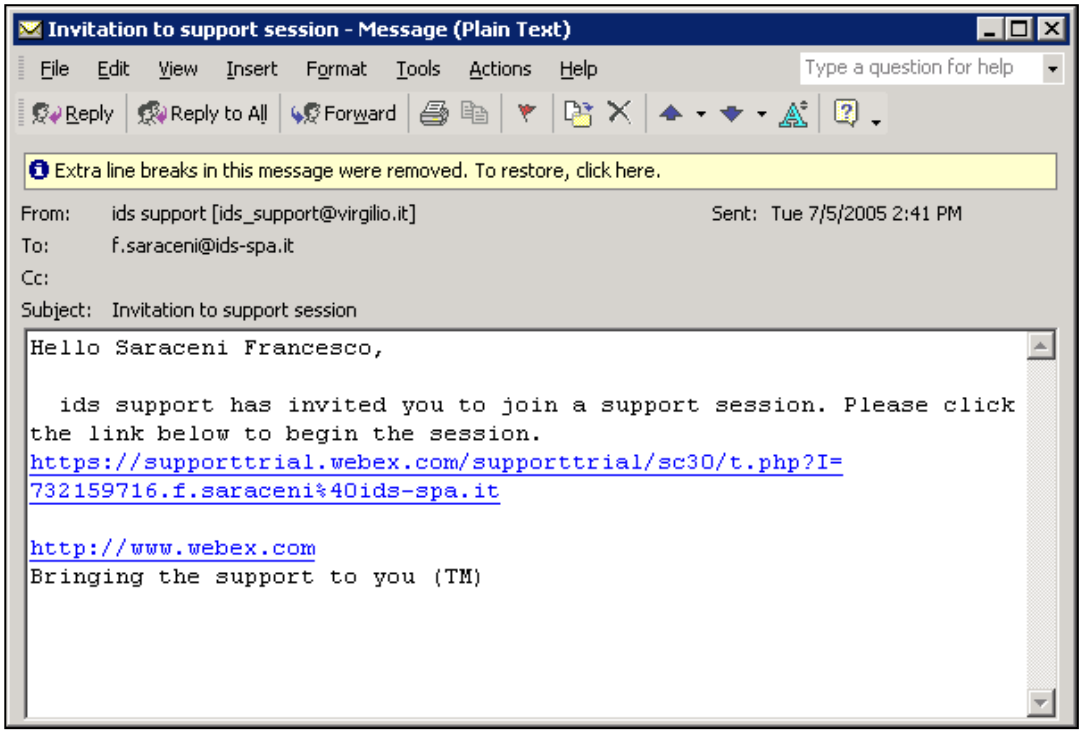

Fig. 7.2 – IDS e-mail sent to the client

Clicking on the link in the email, the following window appears. Insert the user data into the form (see Fig. 7.2).

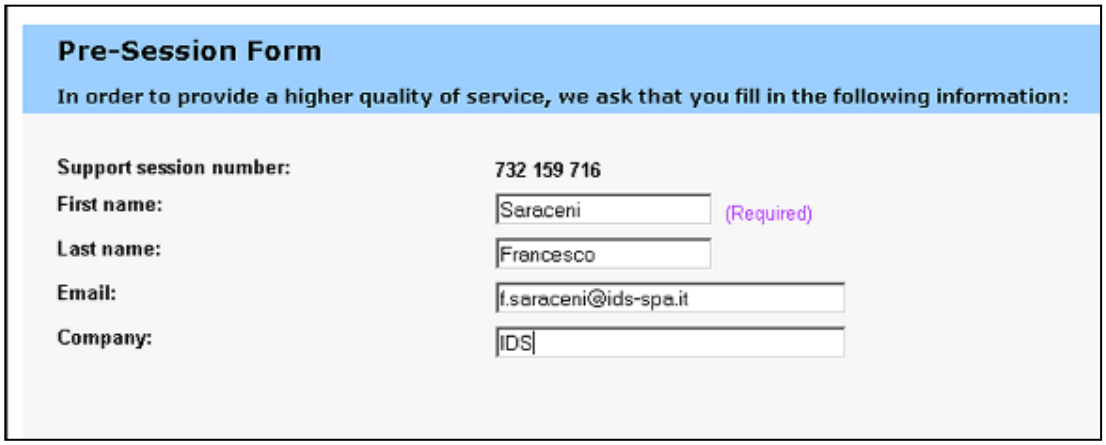

Fig. 7.3 – Client data insertion form

Clicking **Submit,** the following page appears showing a downloading bar. The session starts as soon as the download is complete. (see Fig. 7.3).

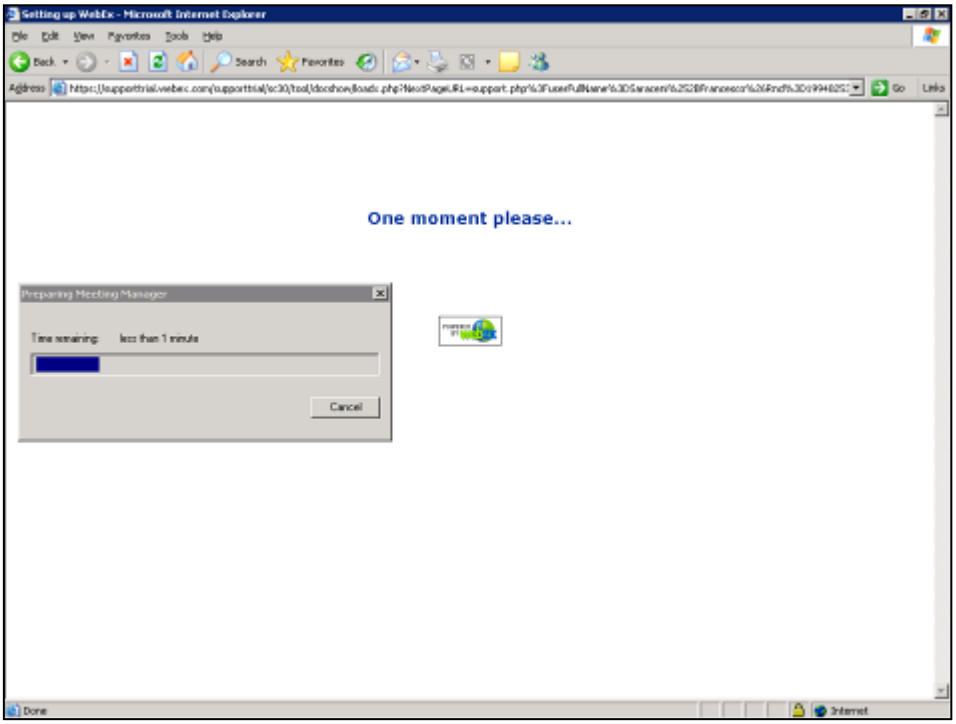

Fig. 7.4 – Webex Set up window

As shown in the following screen (see Fig. 7.5) the user is given a console, containing the **Chat**, **Video** and **Leave Session** commands.

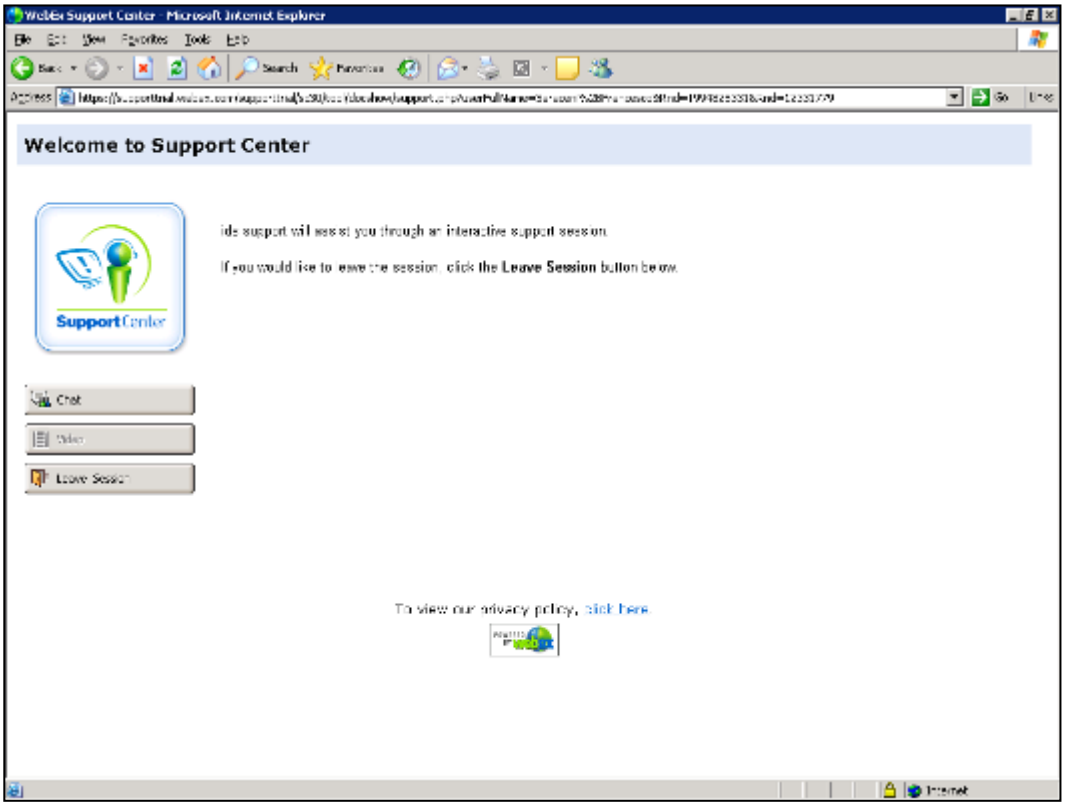

Fig. 7.5 - Welcome to Webex Support Center window

At this point, IDS Customer Care can perform a range of operations on the user desktop:

- Request control of the desktop using the Request Control command;
- Give the user control of the IDS desktop using the Share Control command;
- Request to display the remote desktop using Request View;
- Share the visualization of the IDS desktop using Share View.

Before each command is activated, the user is asked for confirmation through the window shown in Fig. 7.6.

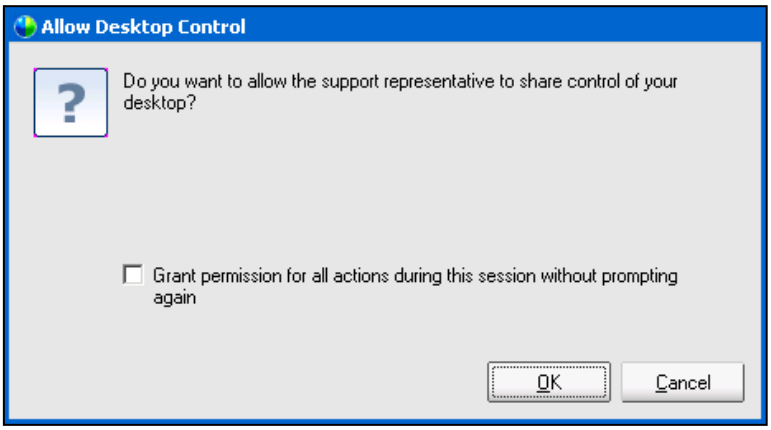

Fig. 7.6 – Command acceptance window