User's manual

LiDAR II CIMEL Software

27 mars 2017

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II. GENERAL INTRODUCTION

1. Objectives and general framework of use

The user's manual of LiDAR II presents the possibilities and the functionalities of the software, and describes its implementation methods in order to allow a quick handling.

It is recognized that the user of the program is trained in the Microsoft Windows operating system and has mastered the various interfaces and associated peripherals.

LiDAR II implements the acquisition and display of real-time LiDAR data for an instrument.

2. Software architecture

The application consists of an active main window, with several buttons and tabs to open windows corresponding to software options. The content of LiDAR II and its possibilities are defined in detail in section VI. Functions / Software options.

3. Computer Requirements

LiDAR II must be installed on a microcomputer, operating under a Windows 32 or 64-bit operating system (Windows XP or later) of Microsoft Corporation. On Windows 7, it is advisable to connect the Lidar to a USB2 port, the USB3 is not supported by the operating system and can cause software malfunctions.

The minimum requirements are as follows:

- PC under Windows 7 or later,
- with Core2 duo 2 GHz or better,
- 2 GB of RAM,
- 100 GB of free disk space,
- Screen with a resolution of 1280x768.

Space is mainly used for recording data.

For installation, the user must have administrator rights to the computer.

III. SOFTWARE INSTALLATION

The LiDAR II software is supplied on a USB key or available on the Cimel website (http://support.cimel.fr/photo/lidar.htm).

The user can directly run the installer of the software, using the .exe file, as well as the installation of USB drivers. The installation of the USB driver is mandatory to allow the use of the LiDAR software.

1. Internet installation

Simply click on the LIDAR 2 link to download the lidar2.exe executable file. The installation is simple and fast (see Appendix 1).

2. USB key installation

Cimel Electronique provides a USB flash drive with the instrument that includes:

- A Cimel brochure and presentations of LiDAR and photometers (pdf files)
- A folder for installing Drivers
- A folder containing a Setup.exe executable for installing the LiDAR II software (see Appendix 1)

3. Comments

Pour une mise à jour d'une version LiDAR II déjà installée sur le micro-ordinateur PC par une version plus récente (des mises à jour sont faites régulièrement, avec à disposition un fichier récapitulatif des améliorations) : il suffit d'utiliser le logiciel CimelUpdate pour procéder normalement à l'installation de la nouvelle version.

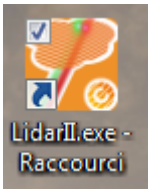
It is recommended that you accept the default options offered by the installer.

For ease, it is recommended to make a shortcut on the desktop of the executable.

For update LiDAR II already installed on the PC by a newer version (updates are made regularly, with a summary file of improvements available): just use the software CimelUpdate to proceed with the installation of the new version.

IV. PROGRAMME START

1. Application start



The program starts by double-clicking on the LiDAR II icon displayed on the desktop of the computer (or in the installation folder if the user did not create a shortcut on the desktop). The program opens on its main sheet, which consists of the main menu bar, which manages the various functionalities offered by the software, a graphical interface (profile and quicklook) configured for the most complete LiDAR (4 channels) and the monitoring band.

When the type of configuration for the LiDAR used has been defined (cf. 2. Configuration settings for LiDAR), the program will open automatically with the appropriate graphic window taking into account the configurations of the user.

2. Configuration settings for the LiDAR

For the first using of LiDAR II, the program configuration must be chosen according to the LiDAR used; In the *Lidar* tab of the main menu bar, then *Lidar Model*. The same procedure should be followed when changing the lidar model. A definition file (.def extension) is supplied with the software for each type of instrument and is essential for the operation of the soft. This is saved in C: / Lidar / LidConf.

In the C: / Lidar / LidConf folder, copy the calibration folder **CAL_% serial number% .zip** provided with the instrument.

The various parameters of definition can be modified at the request of the user, during the later uses of the software.

In version 2.05 of the software, the possible configuration changes are limited:

- when the default data is switched on and off
- whether or not in "Debug" mode
- the choice of scales for the Quicklook graph and the profile
- to the recording path of the different data
- to the data export file (duration, information)

The following other configuration options are required in version 2.03 of LiDAR II:

- Language of use: English
- Blocking the sleep mode when **Power** is active
- Generating a .lid2 file per hour with all data
- Default options (described in Section VI): *Show Profile*, *Additionnal Information*, *Afterpulse Correction*

3. Files generated by the application

A new .lid2 file is generated per time in the **DIR_%serialnumber%** type folder, which is stored in C: / Lidar / LidData. These files can be replayed with the software (File → Open).

When the data export option is chosen, the data is presented in a .txt file, saved by default in the C: / Lidar / ExportData folder.

It is possible to change the place of recording in Tools → Configurations → Folders (see section VI.2.c).

V. OPERATION OF LIDAR WITH SOFT

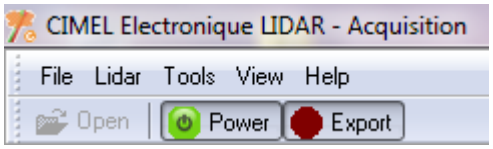
LiDAR II makes it possible to use the instrument in the best conditions, it controls the lighting and the extinction of the laser as well as the acquisitions of data LiDAR and monitoring.

In the next chapter, all options are listed and detailed. This section introduces the LiDAR to operate the instrument.

1. Switch on

To turn on the LiDAR, you must:

1. Run the LiDAR II software (the type of instrument used has been entered)
2. Connect the LiDAR to the PC and turn on the instrument (front panel switch)
4. Press the **Power** button to turn on the laser and begin acquiring the LiDAR data



2. Data export

If exporting data is requested, the **Export** button is used to export the data in .txt files at regular intervals (to be defined in the configurations, see section VI.2.c).

To stop exporting data, deactivating the **Export** button will stop the generation of the text files.

3. Switch off

To turn off the laser and stop data acquisition, press the **Power** button.

VI. SOFTWARE FUNCTIONS / OPTIONS

In this chapter we will take one by one the elements available in the software.

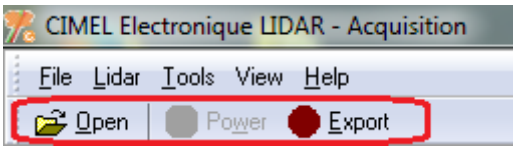
1. Active window

The active window gives important visual information when operating the instrument. Several elements are visible:

- the buttons for starting the LiDAR,
- LiDAR data processed in real time,
- informations on instrument and laser connection and monitoring data.

When the software is in acquisition mode, the LiDAR serial number is displayed (figure below). The same is true in lid2 file replay mode.

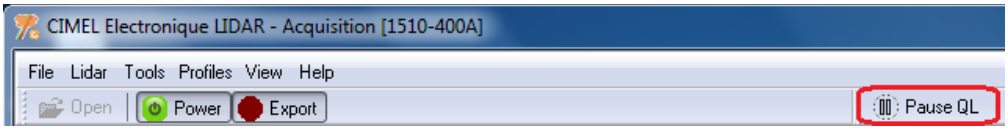
a. Shortcut buttons



There are three shortcut buttons (at the top left of the window) that provide quick access to the main functions of LiDAR II:

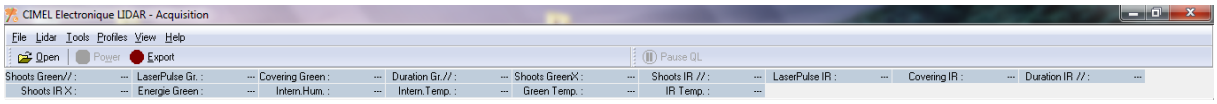
- *Open*: Open a file
- *Power*: Turn on the laser and start data acquisition (counting card is powered).
- *Export*: Export data

A fourth button is visible: *Pause QL*. It allows to stop the graphic renewal of the quicklook during the acquisitions. This allows you to view an event or a zoom in for example without being disturbed by window refreshing.



When the functionality of these buttons is not accessible, they are grayed out.

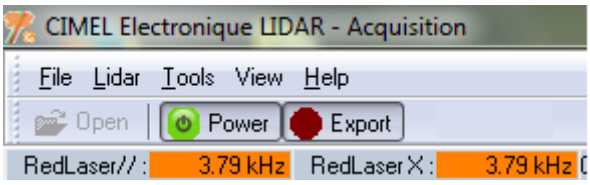
b. Monitoring band



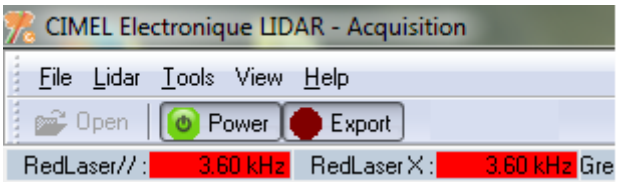
The monitoring strip (the full width at the top of the window) gives the information provided by the monitoring card and counting card inside the LiDAR. Each LiDAR model has its own information.

- The repetition rate of the laser (s) given by the counting card for each receiving channel
- Information on laser shots (duration, covering ...)
- Number of laser shots per acquisition, vesting period.
- The laser energy on emission 532 nm measured by the energy measurement photodiode (characterized by Cimel and given value in Volt)
- Room and laser (s) temperature and humidity
- Position information if an inertial unit is used

For each instrument, limit values are imposed in the LiDAR definition file; especially for the repetition rate of the laser (s). If the values ollected by the software are out of specification, a warning (error percentages previously defined in the instrument definition file) or an error may occur.



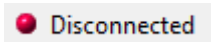
A warning is recognized thanks to the orange color which appears on the value out of limit but always in the specifications. The LiDAR is still in operation.



An off-specification value must be red but the instrument still continues to acquire data. In this case, restart the LiDAR instrument. If the problem persists, contact Cimel Support.

c. LiDAR Status Information

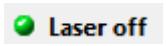
The real-time information on LiDAR communication with the PC is displayed at the bottom right of the main window. Several views can be encountered:



With fixed red LED: no instrument is connected to the software. During an attempt to reconnect after disconnection.

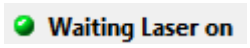
(ou Disconnect) With the orange LED blinking: the software cannot connect; No instrument is connected to the PC.

→ Connect the instrument to the PC.

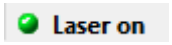


With the green LED fixed: the LiDAR is connected and the laser ready to emit.

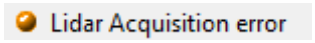
→ Press the *Power* button to turn on the laser



With the green LED fixed: the software has sent the command for the lighting of the laser and waits for a response from the instrument or the laser heating time.

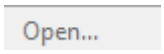


With the green LED fixed: the laser emits and the acquisition works.



With the orange LED blinking: a communication problem is present and acquisitions cannot be made.

→ Turn the LiDAR off and on again. If the problem persists, use the *Communication details* option (see Chapter VI.2.a) to see where the communication problem is.



(Open button ... grayed out) This information is usually present just before an acquisition problem in the communication between the software and the LiDAR is not done correctly or not fast enough.

d. Profile et Quicklook

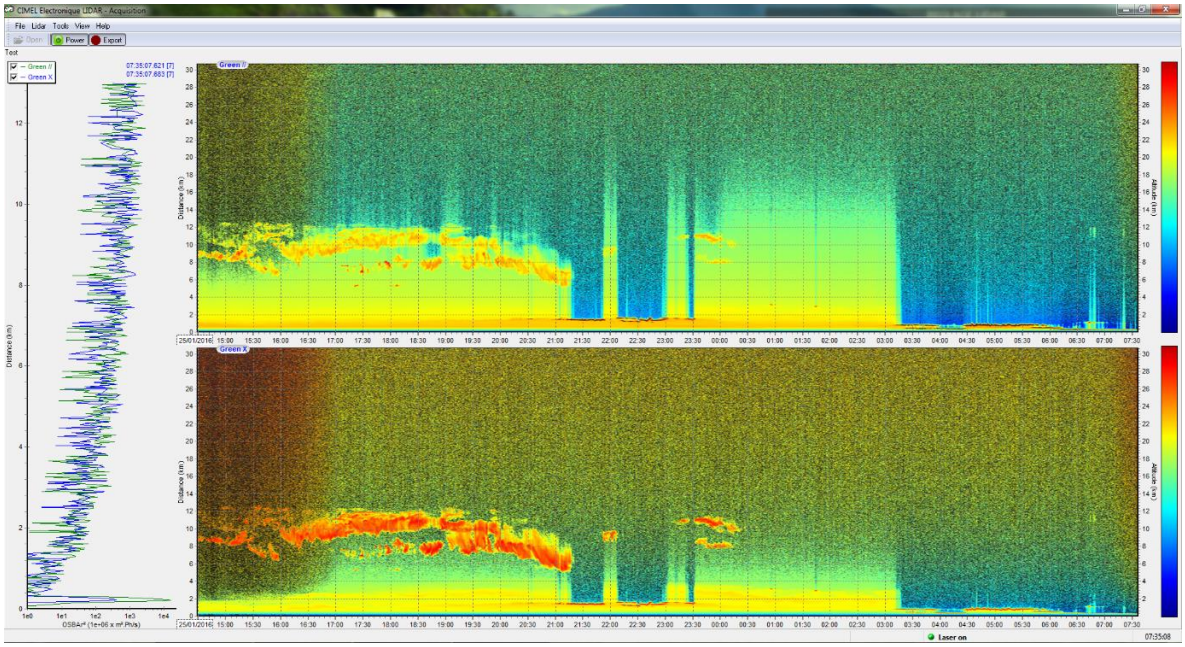


FIGURE 1 : EXAMPLE OF PROFILES + QUICKLOOKS FOR A POLARIZED GREEN LIDAR (TWO CHANNELS)

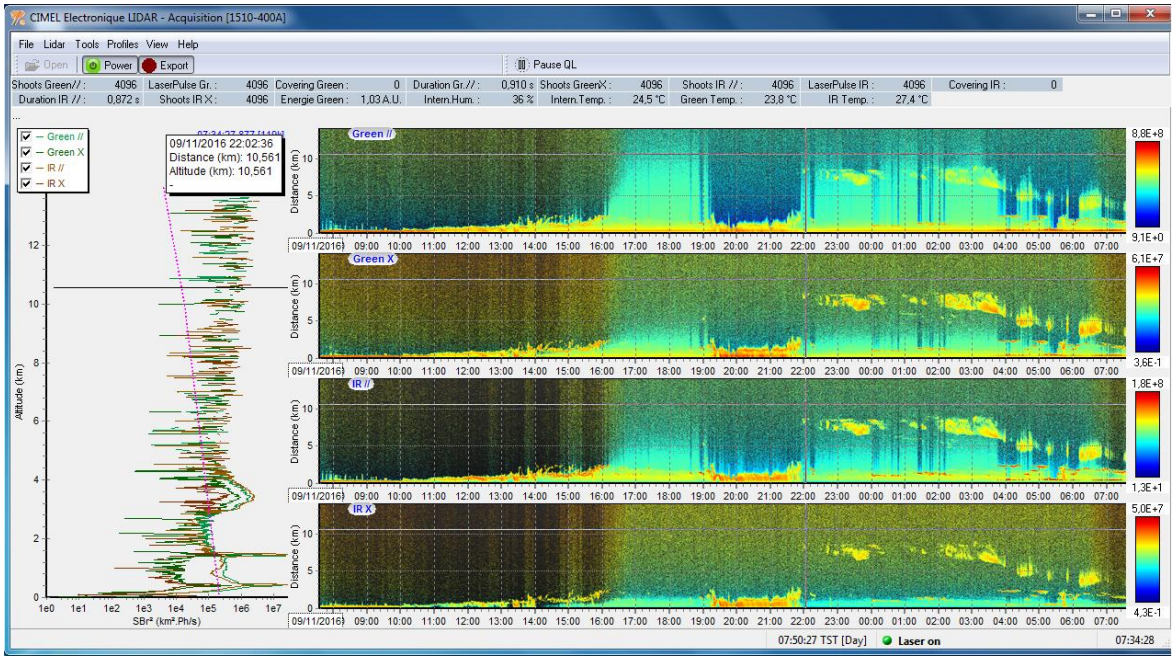
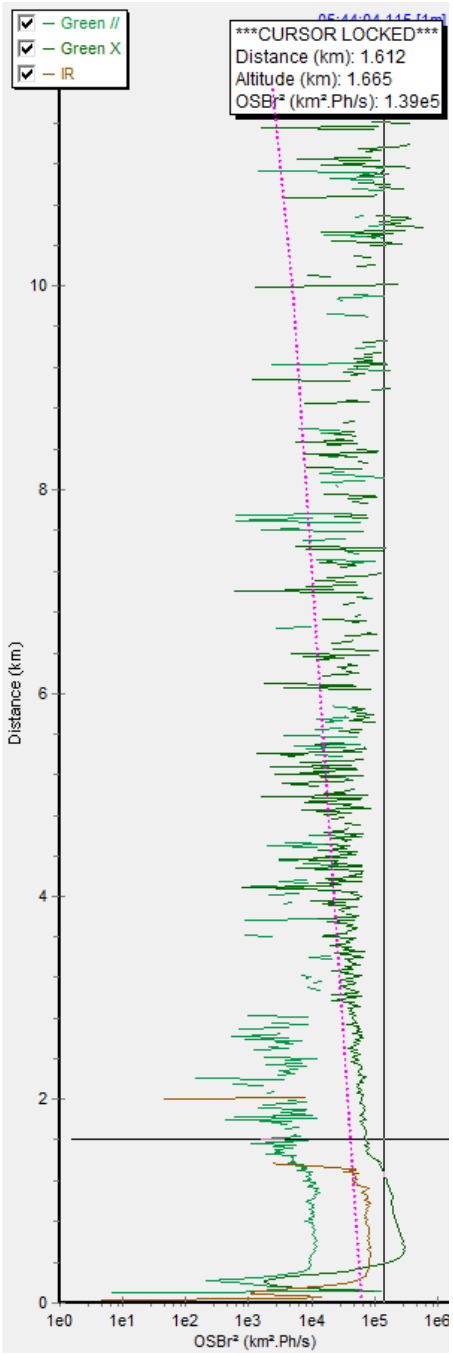


FIGURE 2 : EXAMPLE OF PROFILES + QUICKLOOKS FOR A BI POLARIZÉD (4 CHANNELS)

The profile (s) (depending on the instrument) are visible on the left side of the window in real time. On the right, the quicklook (s) according to the configuration of the LiDAR (from 1 to n channels) are also displayed at the same time.

A cursor is displayed when you move the mouse on the main window; it gives the precise information of the axes (distance and signal). This cursor can be fixed to a position by the user by pressing the space key on the keyboard: *** CURSOR LOCKED *** appears in the cursor window (figure below).



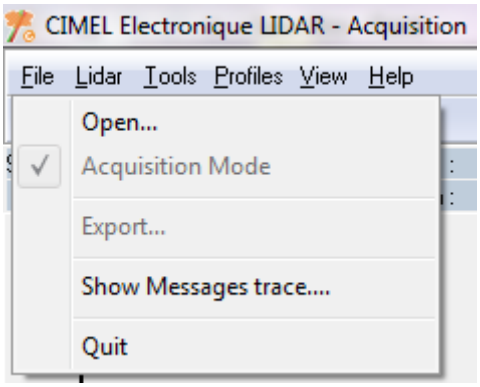
e. Hour

At the bottom right of the main window, the UTC time is displayed. All data (raw, processed and exported) is sorted and named according to this schedule.

2. Tabs

There are five main tabs in the active window:

a. File



Two gray elements can be seen; this means that they are not yet accessible to the user because the instrument is only connected and does not acquire. "Acquisition Mode" is active when the Power button is lit; "Export" is active when the button with the same name is activated.

The *File* tab includes the "Open" button to open the previously saved .lid and .lid2 files and the "Quit" button that closes the application. The software cannot read the .lid files from the previous version of the Lidar software.

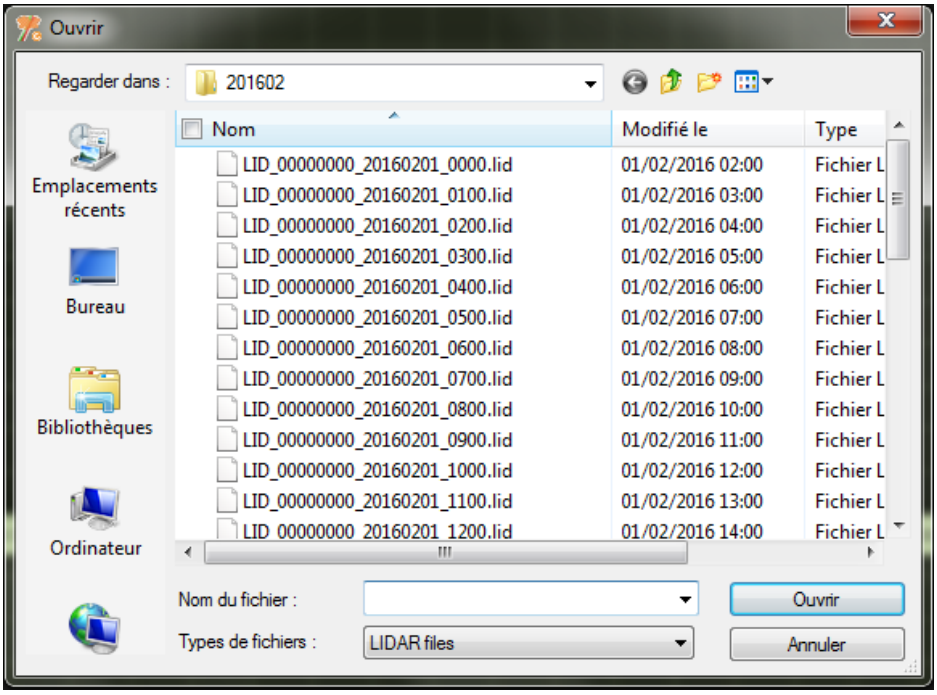
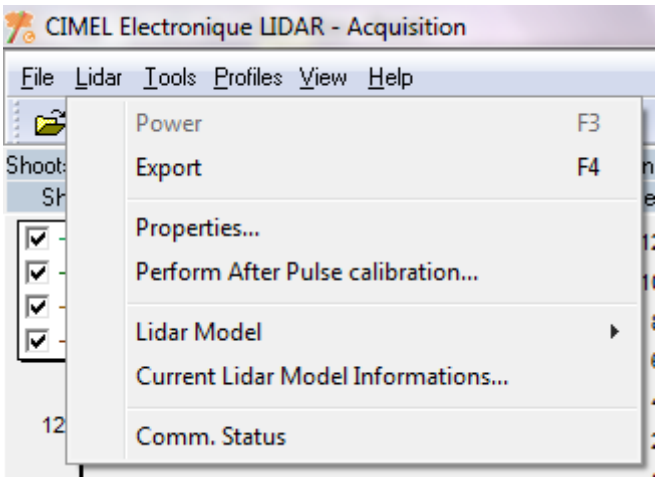


FIGURE 3 : WINDOW FOR CHOOSING A FILE .LID TO OPEN

In the *File* tab, information about USB connection, communication and possible errors are available via "Show Messages trace ...".

"Show Messages trace ..." opens a file that lists errors that occurred during measurements.

b. Lidar



The *Lidar* tab includes actions to communicate with the instrument.

The shortcut buttons present on the active window are: "Power" to turn on the laser, "Export" to export the data.

"Properties ..." lists the LiDAR serial number in operation. It is possible to enter its location and altitude if necessary in the *Localization / Altitude* tab. The altitude and attitude of the instrument are used to calculate and adjust the altitude information of the profiles according to the inclination of the instrument.

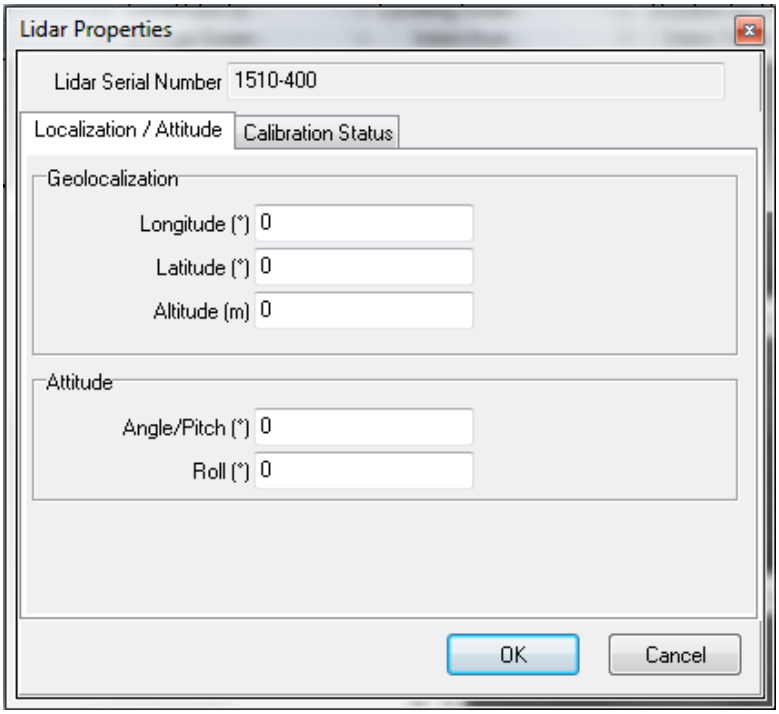


FIGURE 4 : EXAMPLE OF WINDOW PROPERTIES WITH THE LIDAR SERIAL NUMBER

In the second *Calibration Status* tab, information about the calibration of the instrument per channel is entered. Three colors allow to know the status of the calibration:

- Green: file present and used during the acquisition
- Orange: file present but not used (usually when the instrument is not in operation)
- Red: file not present in the calibration folder (type **CAL_% serial number%**)

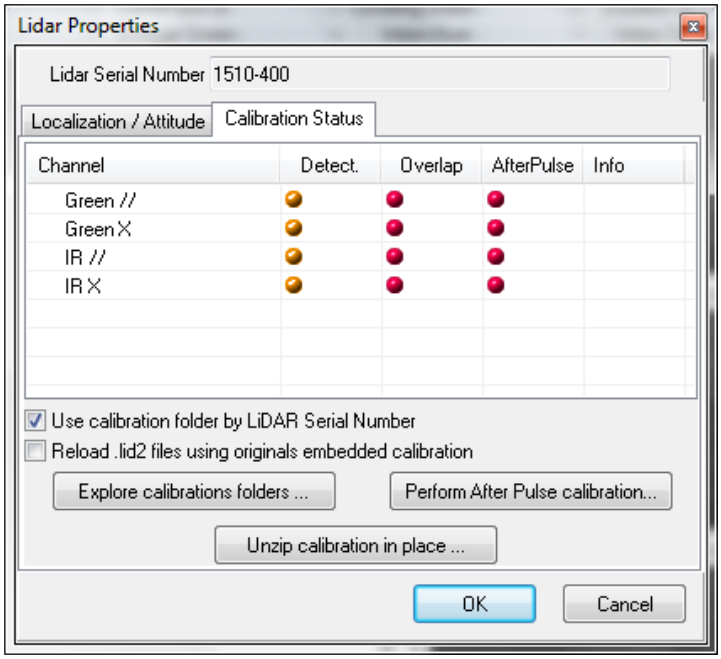
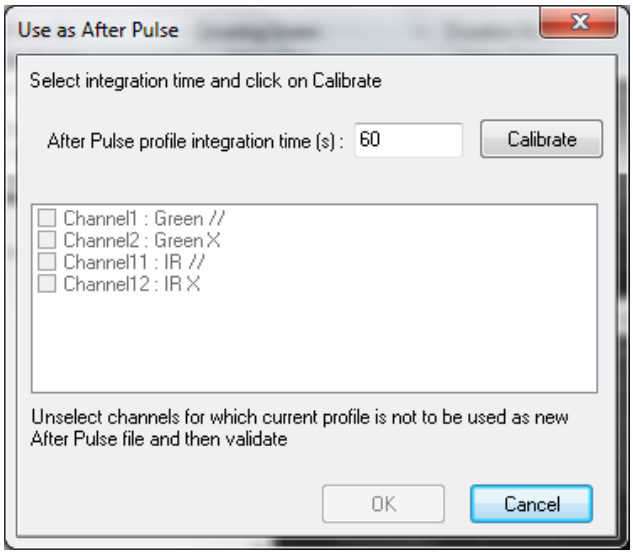


FIGURE 5 : EXAMPLE OF CALIBRATION ONLY OF DETECTORS

The software allows to create an afterpulse .txt file with "Perform After Pulse calibration ...". A window opens allowing you to set the duration of the afterpulse profile. When this profile is made, it is necessary to choose for which channel it is useful. When the afterpulse is enabled, the software directly saves the corresponding file in the calibration folder.



The choice of the definition file of the instrument is made in "Lidar Model". By default the software offers a choice of different Cimel instruments; It is enough to choose the file corresponding to your LiDAR (this information is generally given on the LiDAR delivery note).

In some cases, it is possible to name the instrument definition file by the name of the project in which it participates (as shown in Figure 6).

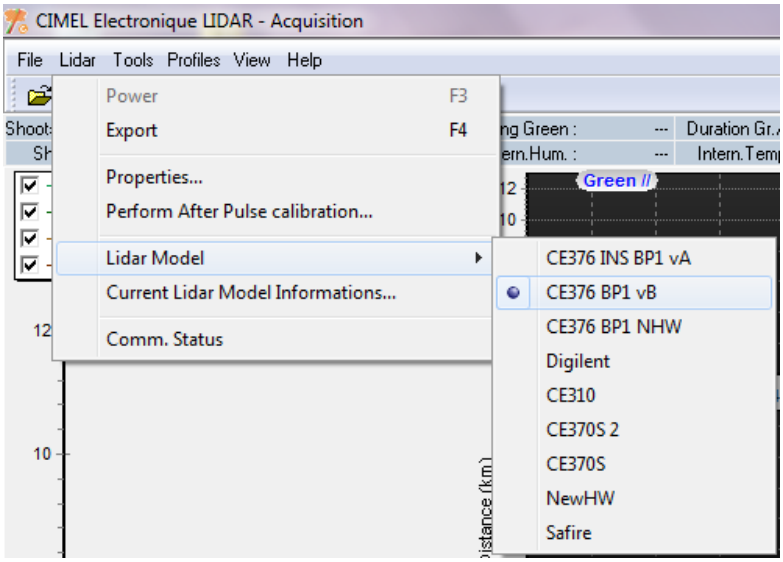


FIGURE 6 : EXAMPLE OF CHOICE OF DEFINITION FILE FOR 4 CHANNELS LIDAR

"Current Lidar Model Information ..." shows the information used by the software in the configuration file for the selected model.

The communication statuses are given in the "Comm. Status "in a visual way with color dots for each communicating element. Three colors can be seen: green (ok), orange (limit value) and red (problem). When errors occur, they appear in red with a number and designation (Figure 9).

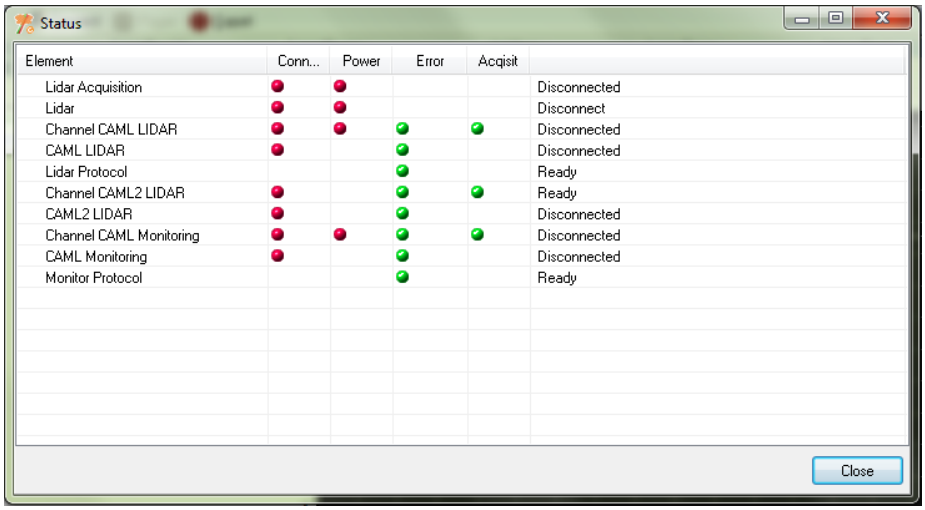


FIGURE 7 : EXAMPLE OF STATUTES FOR A 2 CHANNELS LIDAR

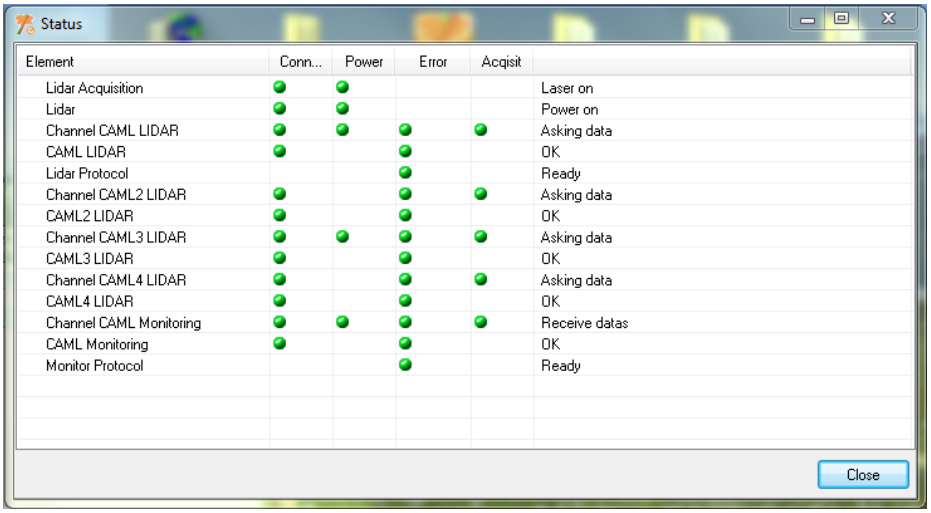
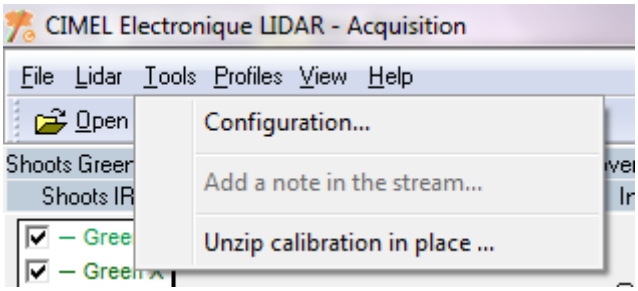


FIGURE 8 : EXAMPLE OF STATUTES FOR A 4 CHANNELS LIDAR IN OPERATION

FIGURE 9 : EXAMPLE OF STATUTES FOR A 4 CHANNELS LIDAR HAVING USB PROBLEMS

c. Tools



The general configuration of the software is done in the *Tools* tab and then "Configuration ...". The window that opens has four tabs:

- "General" (Figure 10): Default setting is whether the laser will start up when the software is started (provided the LiDAR is turned on), as well as data export and **debug** mode (cf. section 3.Debug mode). An option for degrading graphics quality is also available for low-powered PCs; this does not change the quality of the data acquired.

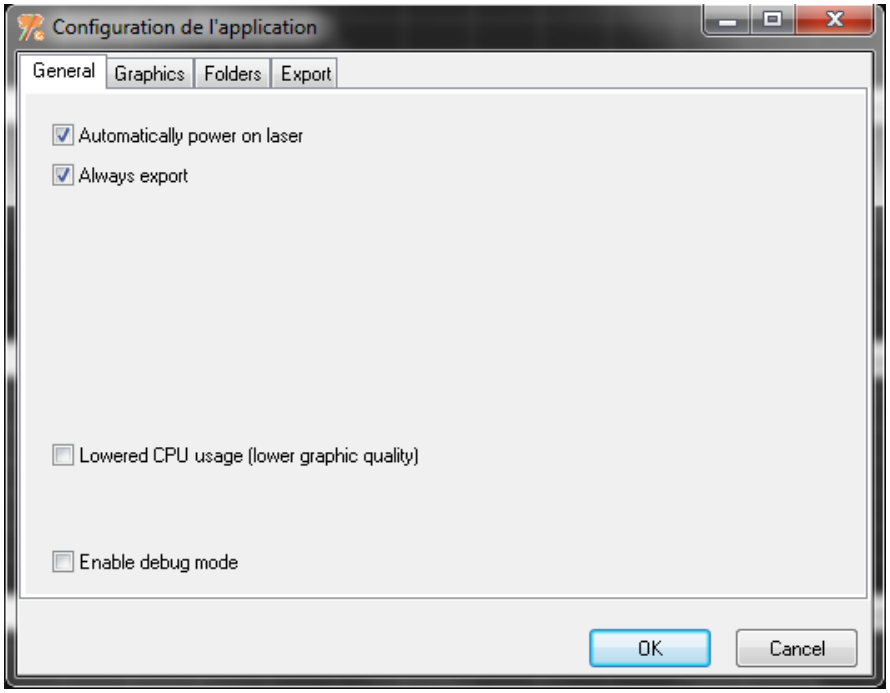


FIGURE 10 : CONFIGURATION, GENERAL TAB

- "Graphics" (figure 11): in this tab, graphic elements are defined such as axis scales, profile time... Scales can be directly modified by clicking on the profile axes in the main window of the application. The simplified Rayleigh curve can be displayed on the profiles or not. To make it coincide with a profile just right click on the desired curve.

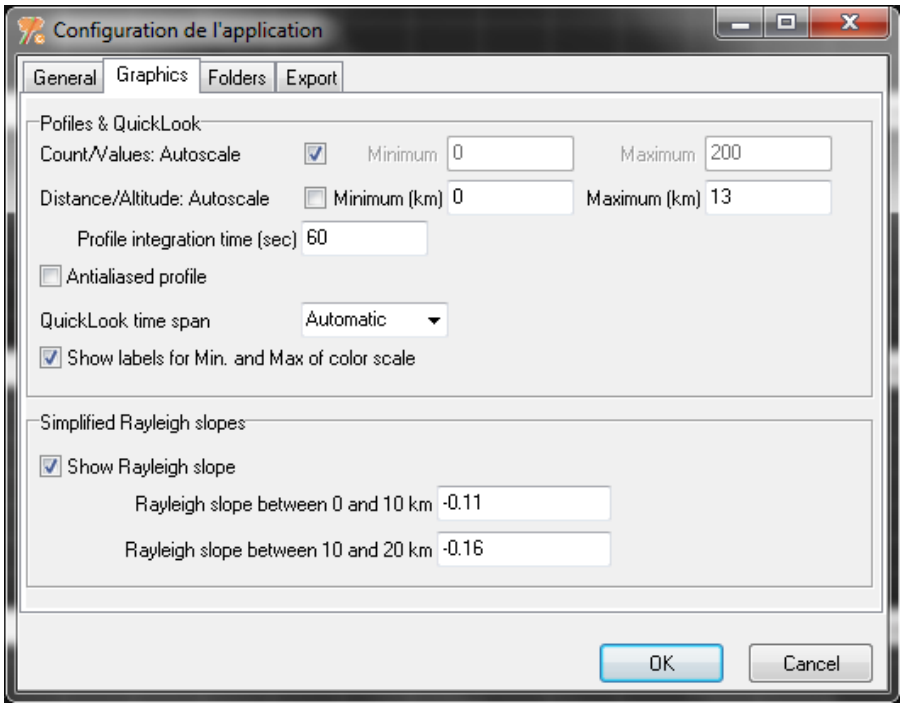


FIGURE 11 : CONFIGURATION, GRAPHICS TAB

- "Folders" (Figure 12): The default paths of saved items are entered in this tab. The user can of course change these paths at his convenience.

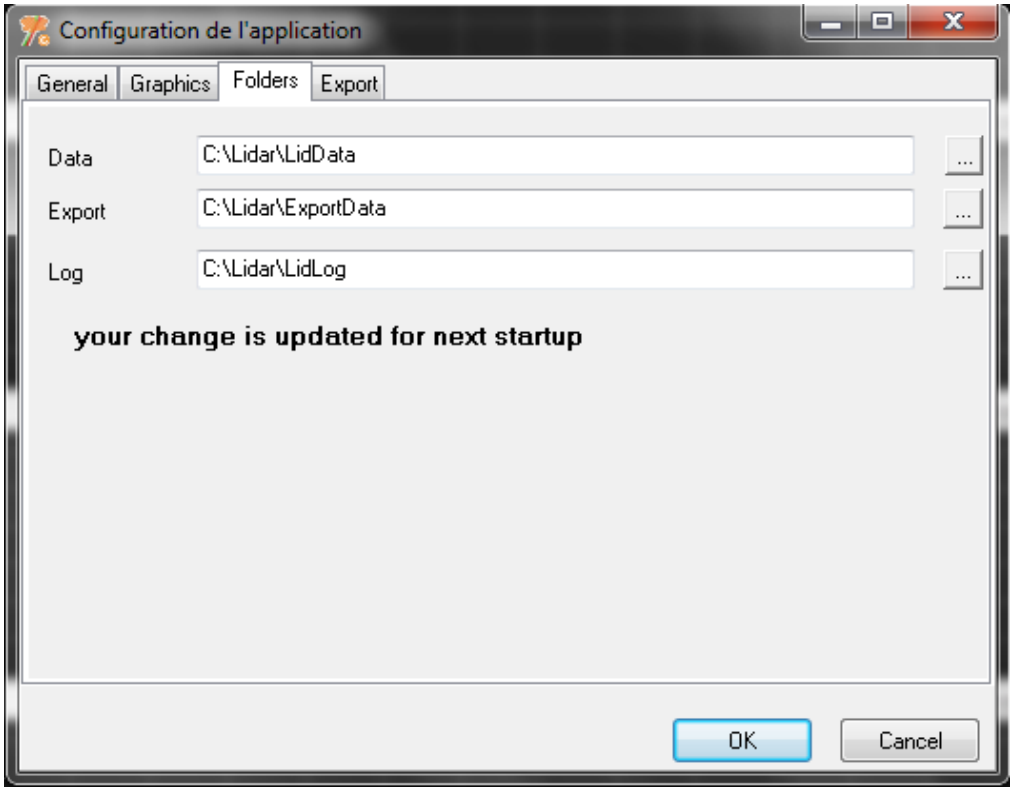


FIGURE 12 : CONFIGURATION, FOLDERS TAB

- "Export" (figure 13): inside this tab, we define the information of the export file such as its name, size, data type ...

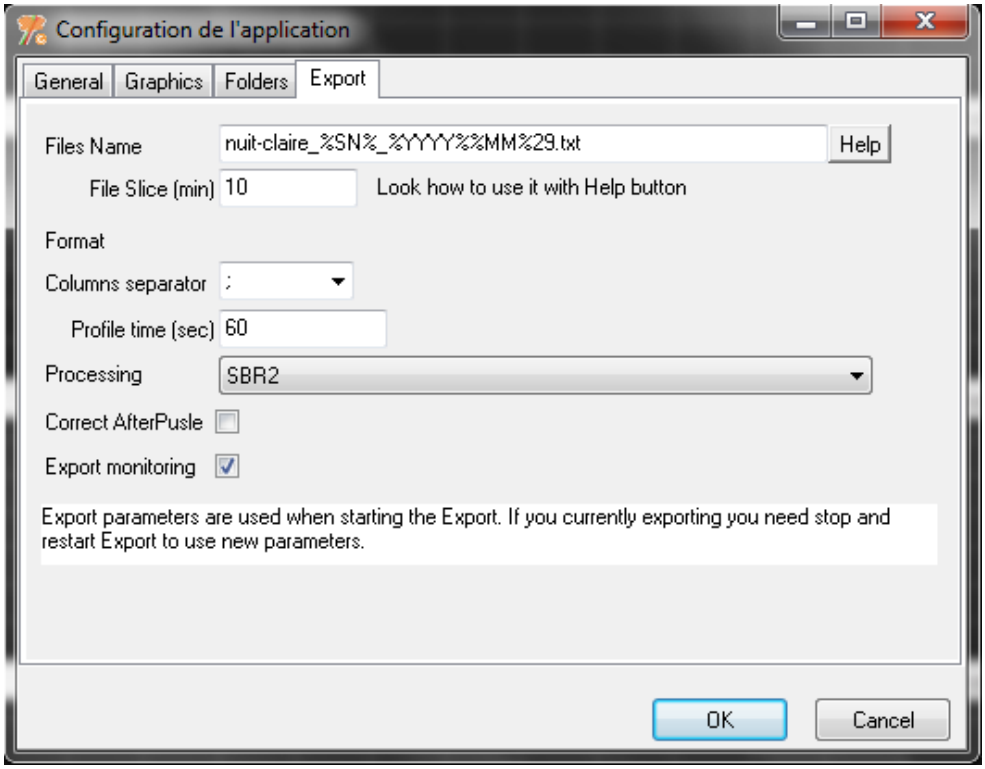


FIGURE 13 : CONFIGURATION, EXPORT TAB WITH EXAMPLE FOR A FILE POUR UN FICHIER TOUTES ALL 10 MINUTES

To understand how information about exporting data, the Help button is very useful:

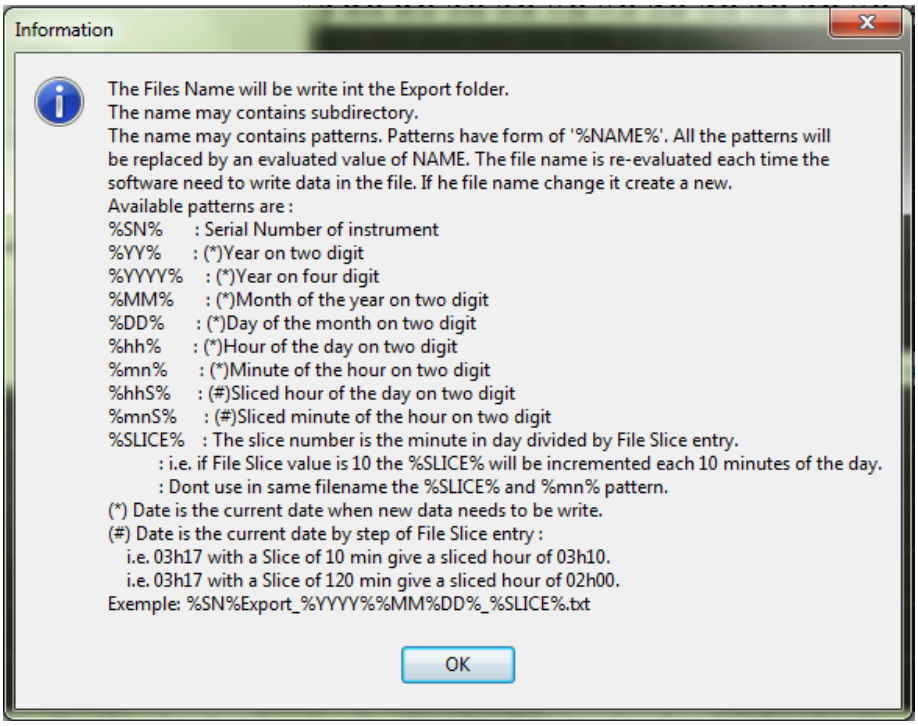


FIGURE 14 : HELP BOUTON FOR DATA EXPORTS

- "Airins" (nly for instruments intended for with a specific definition in the configuration file, figure 15): This tab is only necessary when using an Airin type inertial control unit, for airborne applications, for example. IP address and port information must be filled in by the user. In the case of a static use of the LiDAR, make sure that the "Enable Airins" box is unchecked.

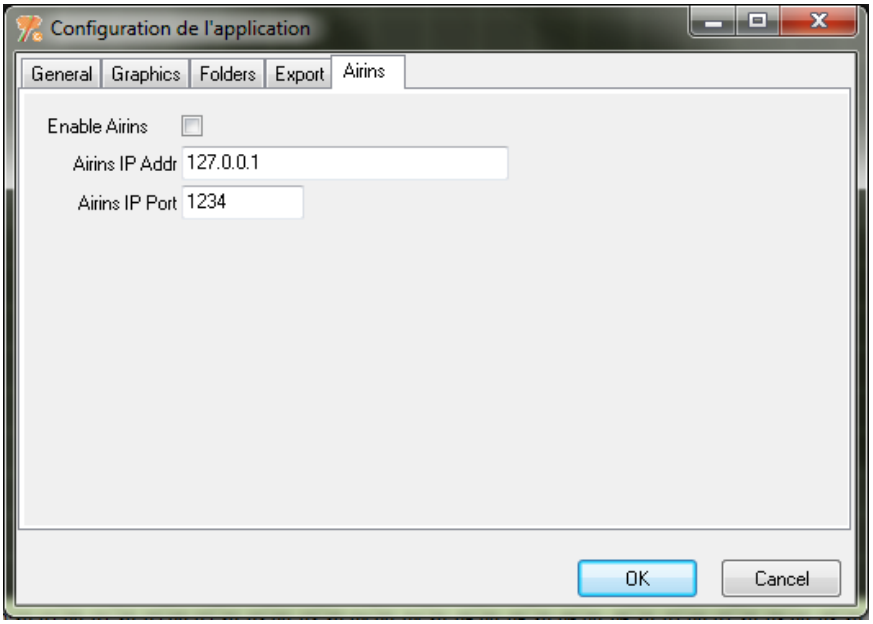
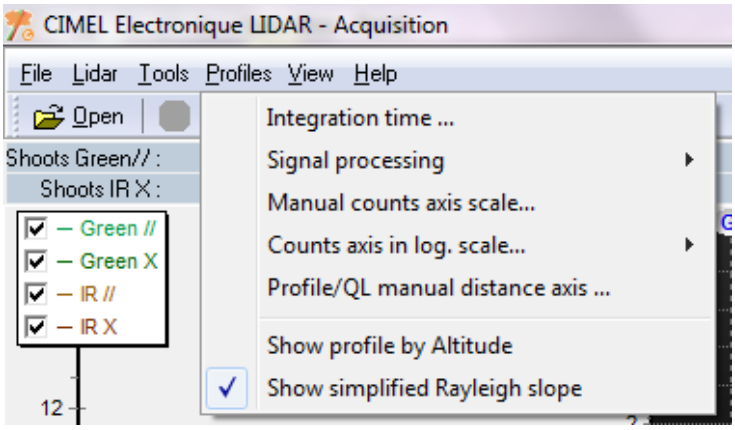


FIGURE 15 : CONFIGURATION, AIRINS TAB

It is possible to insert comments to note a particular event during measurement acquisitions with "Add a note in the stream ...".

Each instrument uses detectors for each channel. For data processing, it is preferable to fill in the calibration files for these detectors. When delivering the LiDAR, a .zip file is provided with a folder for each channel containing a .txt file for the detector, afterpulse, and overlap. To load this folder into the software, we use "Unzip calibration in place ...".

d. Profiles



As its name suggests *Profiles* allows you to modify information about LiDAR profiles.

"Integration Time" is used to define the length of a profile depending on the user.

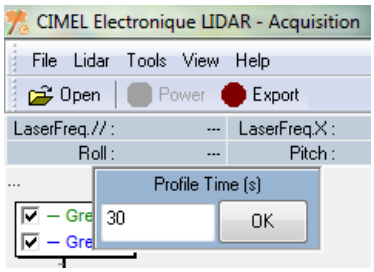


FIGURE 16 : PROFILE TIME OPTION

LiDAR data can be viewed with different corrections on the profile:

- Raw Signal [R]: raw data (in electronic count)
- Number of Photons / s [S]: raw data after correction of the detector (Ph / s)
- Background Corrected [SB]: Detector and background corrected data (Ph / s)
- Photons / s Range corrected [SBr²]: corrected detector, background and solid angle (km².Ph/s)
- Overlap correction [OSB]: data taking into account correction of the overlap function in addition to the detector and the background (Ph / s)
- Lidar Signal [OSBr²]: data summing all the corrections listed above (km².Ph / s)

The afterpulse correction is left for each display if it is enabled.

This choice is made with "Profile signal processing", as shown in Figure 17 below.

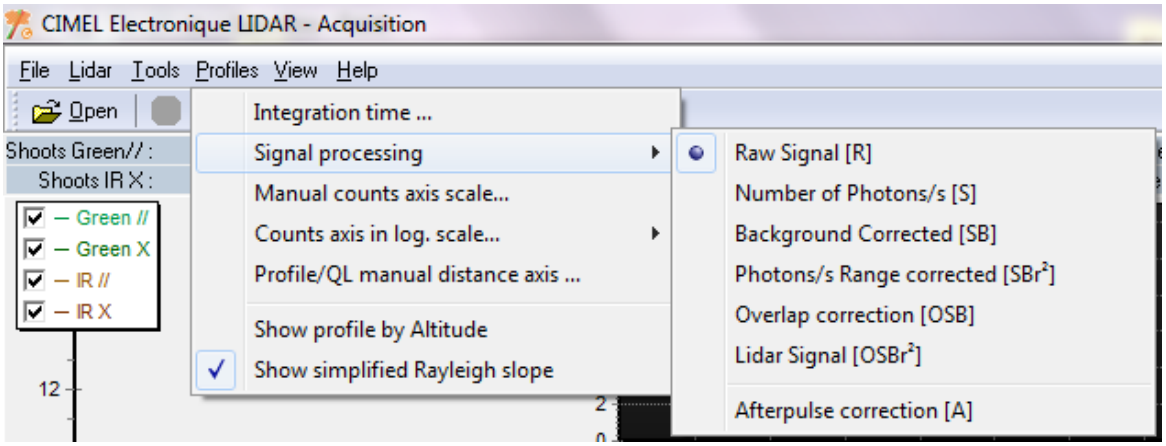


FIGURE 17 : PROFILE SIGNAL PROCESSING OPTION

"Manual counts axis scale ..." and "Profile / QL manual distance axis ..." allow to define the axes of the profile (s): they can be in automatic mode or the user can impose a value (abscissa axis) Distance (ordinate axis) maximum.

FIGURE 18 : MANUAL COUNTS AXIS SCALE ET PROFILE/QL MANUAL DISTANCE AXIS OPTIONS

With the option "Counts axis in log. Scale ... ", the user can display the abscissa axis in a linear or logarithmic scale.

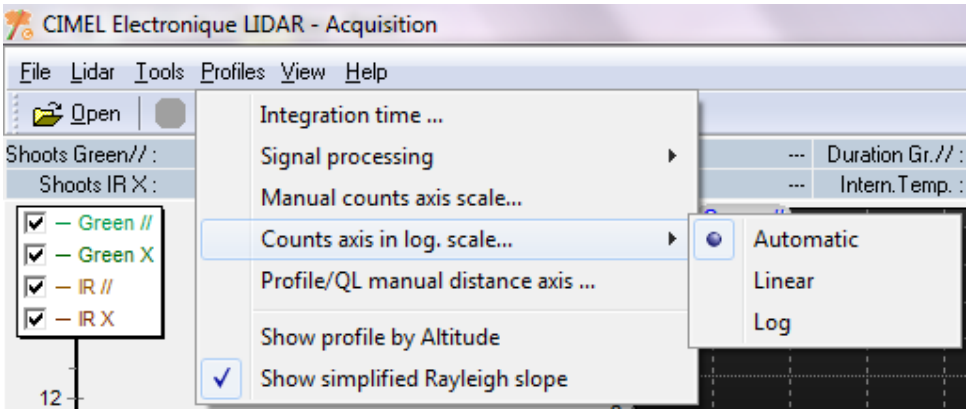
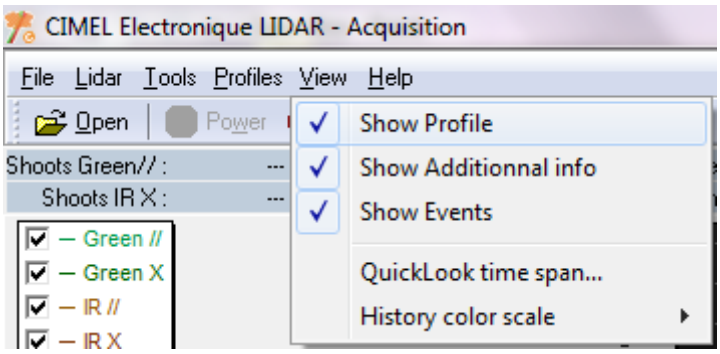


FIGURE 19 : PROFILE COUNTS SCALE LOG. MODE OPTION

The user can view the profile (s) according to altitude or distance in km; This is made possible with the function "Show profile by Altitude" (in case of inclined instrument or airborne use).

Similarly, the simplified Rayleigh slope may or may not be visible with the "Show simplified Rayleigh slope" function.

e. View



View, as the name suggests, brings together all the visualization features of the data.

The user can choose to display the profile (s) in real time in the active window with the "Show Profile" function.

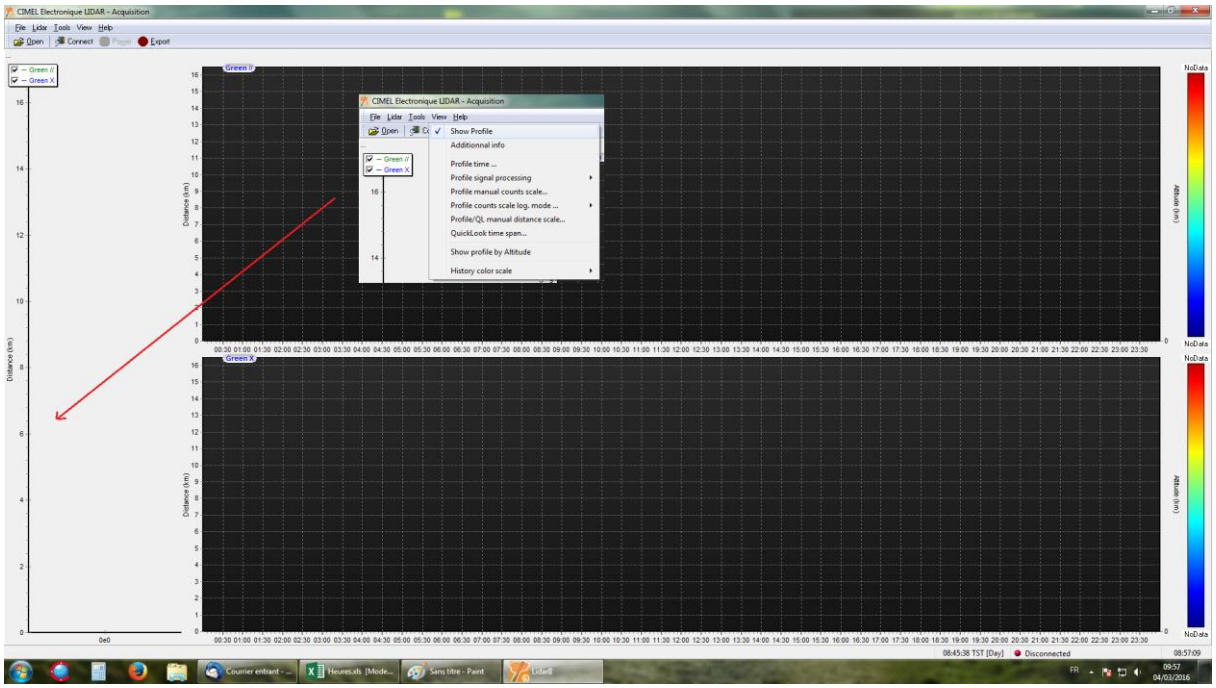


FIGURE 20 : SHOW PROFILE OPTION CHECKED TO VISUALIZE THE PROFILE

In the same way, the user can decide whether to have the monitoring information or not on the main window with the "Additionnal info" function.

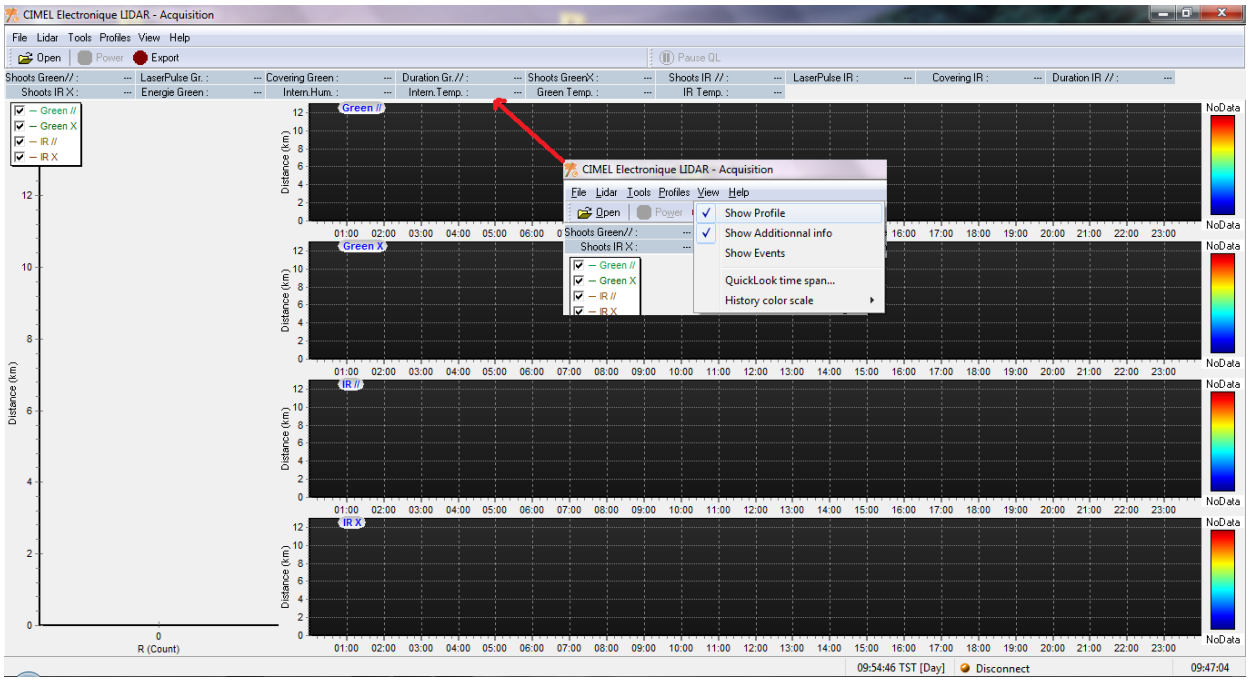


FIGURE 21 : ADDITIONNAL INFO OPTION TO VISUALIZE MONITORING INFORMATIONS

"Show Events" allows to visualize the events on the quicklook in the form of small white triangles (one for the beginning and one to mark the end). The events can be an afterpulse and/or a comment for example.

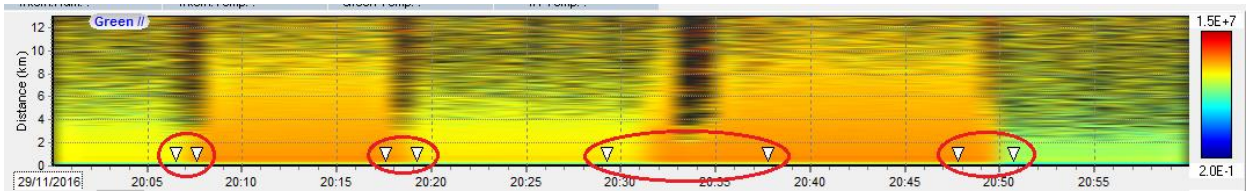


FIGURE 22 : FOUR VISIBLE EVENTS ON THIS QUICKLOOK WITH THE SHOW EVENTS FUNCTION

The "Quicklook time span" option, also available from Tools → Configuration → Graphics, gives you the ability to view the quicklook over a dynamic or fixed duration that can range from 10 minutes to 24 hours.

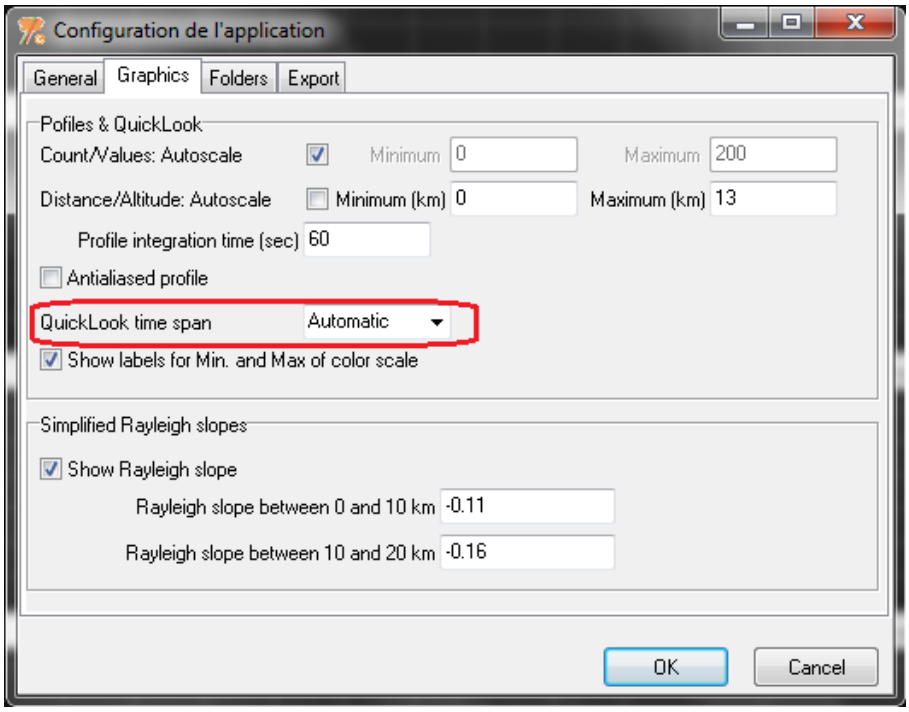
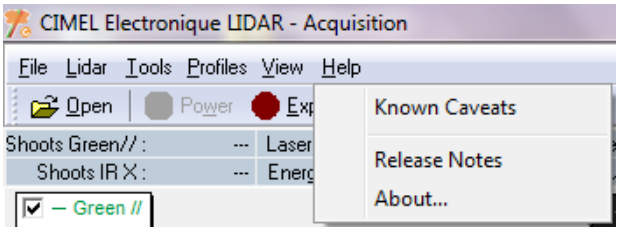


FIGURE 23 : QUICKLOOK TIME SPAN OPTION

The color scales of the quicklook are available in "History color scale" in several gradients according to the tastes of the user for each channel, the most common being Jet.

f. Help



The help allows to know the weak points known and that are being improved (*Known Caveats)*, the changes made and to come since the last update listed in a .html file (Release Notes) and finally the general information of the software and its origin (*About* ..., Figure 28).

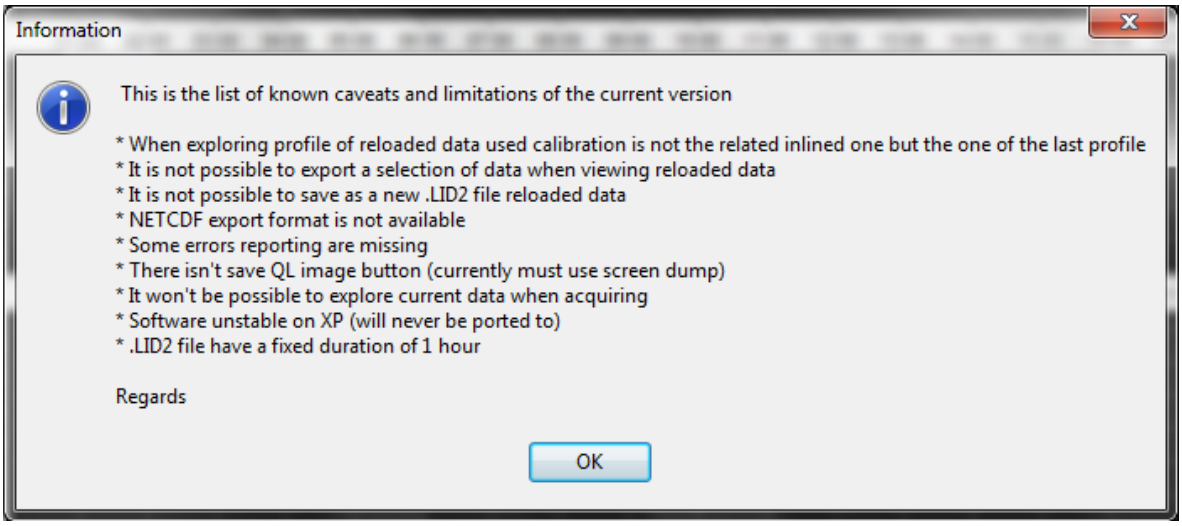
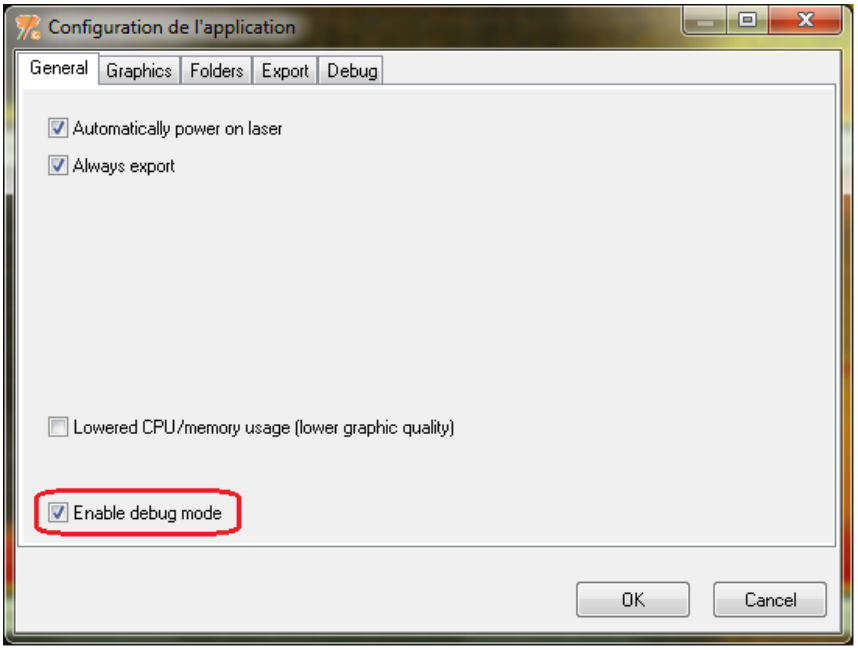


FIGURE 24 : KNOWN CAVEATS WINDOW

3. Debug mode

The Debug mode allows access to additional information or functionality (used mainly by Cimel to validate the instrument). This feature is enabled by checking Enable debug mode in Tools → Configuration…



Once the box is checked, a new Debug tab appears in the configuration window.

Enable auto connect allows you to enable or disable the LiDAR auto-connect function in case of unexpected disconnection. However, this function only applies if the disconnection is not due to a failure of the instrument but to a passenger element (micro-power failure for example).

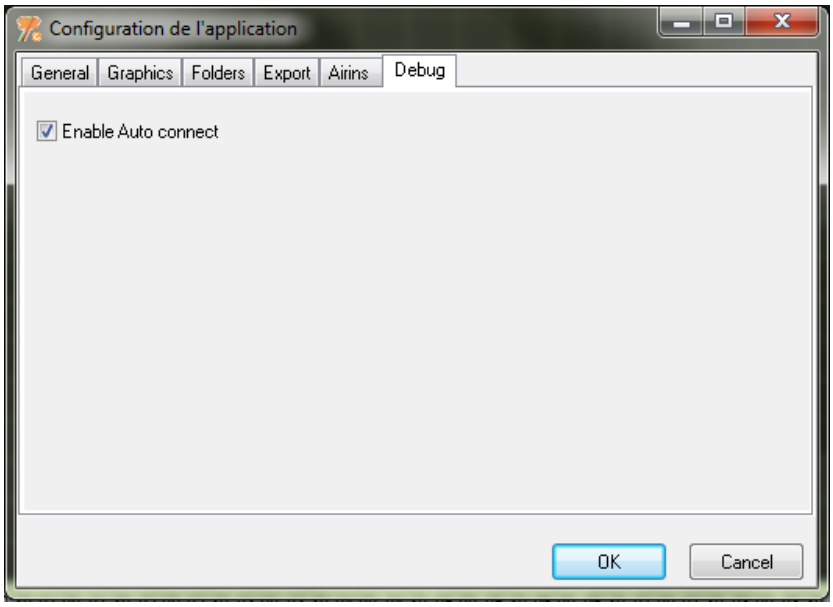
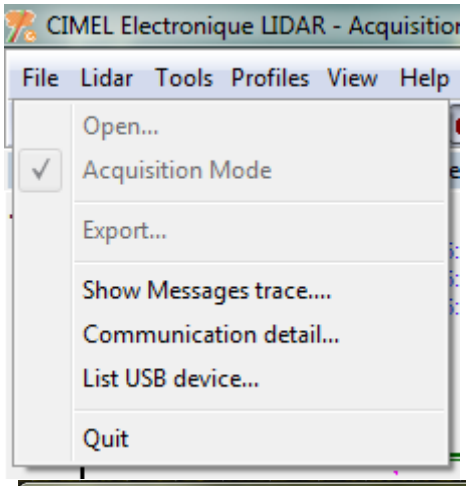


FIGURE 25 : CONFIGURATION, DEBUG TAB

a. File (debug)



The *File* tab now includes two additional functions.

The real-time communication information is visible in the "Communication details" window for each counting and monitoring card. We can choose to see the communication elements of the channels we want and also save this data in a file (Log to file bottom left).

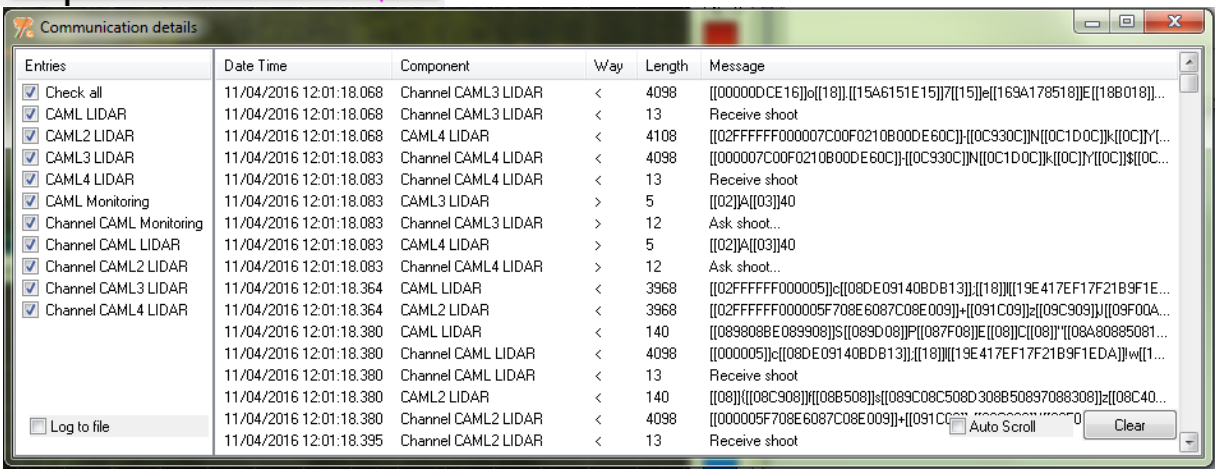
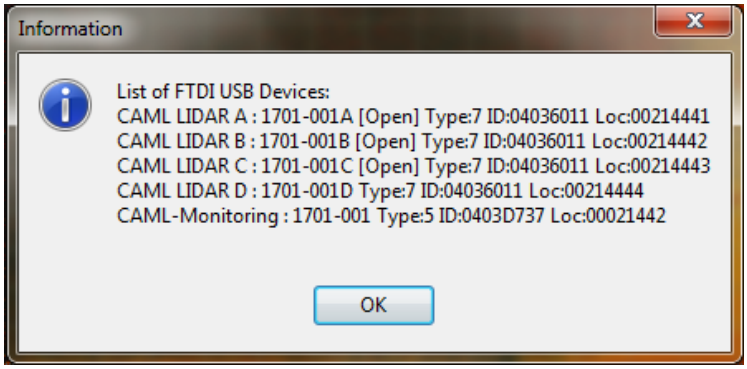


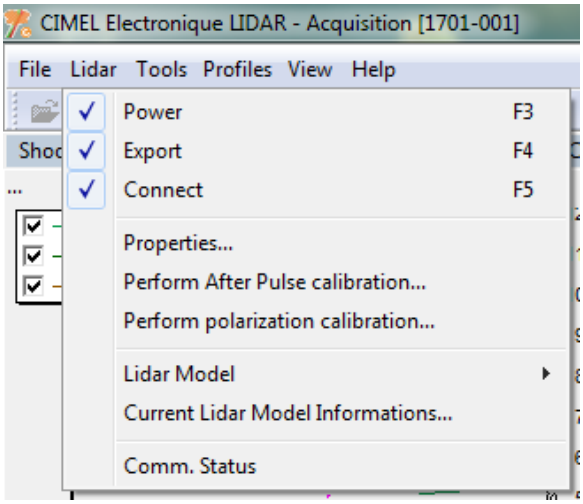
FIGURE 26 : EXAMPLE OF COMMUNICATION ELEMENTS FOR A 4 CHANNELS LIDAR IN OPERATION

The statuses of the communications are also available interactively in Lidar → Comm. Status (see paragraph VI.2.b).

"List USB device" displays the list of USB read by the software.



a. Lidar (debug)

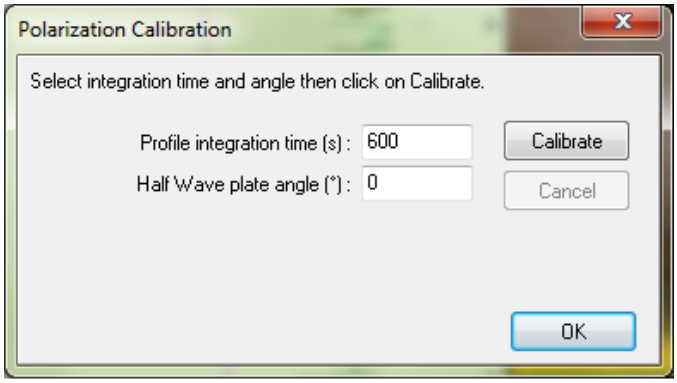


The *Lidar* tab now includes the function for recording the polarization calibration data of the instrument.

The shortcut "Connect" button on the active window is found here; it allows to manage the connection of the instrument.

« Perform polarization calibration… » allows to record the events in the data relating to the calibration in polarization of the instrument, in particular the change of angle. The calibration most often performed is the measurement of LiDAR data for 0 °, 45 °, 90 ° and -45 ° angles.

The data to be filled in are the integration time of the profile for a given angle of the half wave plate (in reception).



When the Calibrate button is pressed, an event is created (visible on the quicklook as a white triangle). Once the finished profile the event ends (new triangle on the quicklook); if the user cancels his measurement, this also appears as a triangle (figure 27).

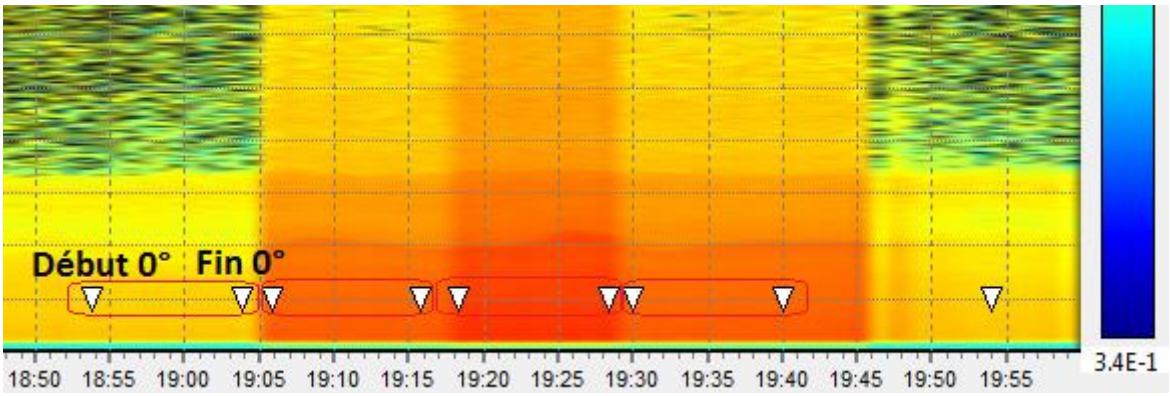
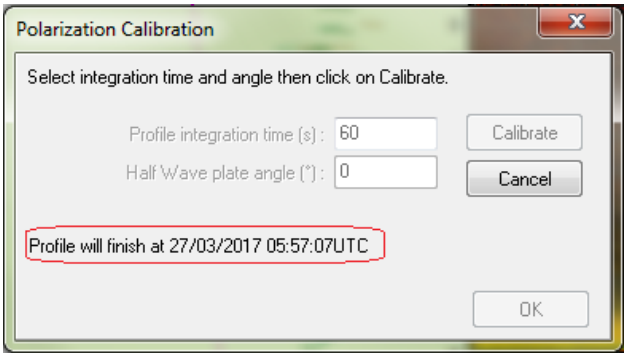
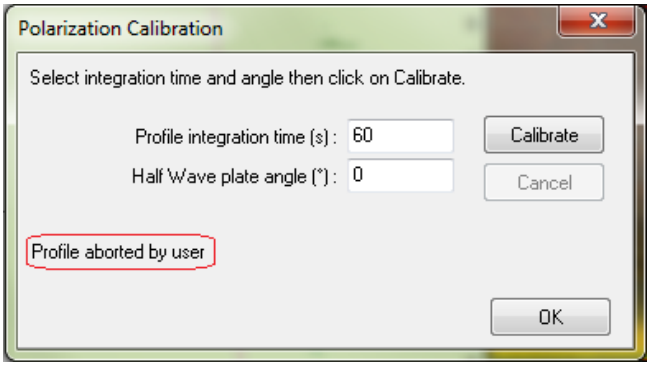


FIGURE 27 : EVENT DURING THE POLARIZATION CALIBRATION OF A LIDAR



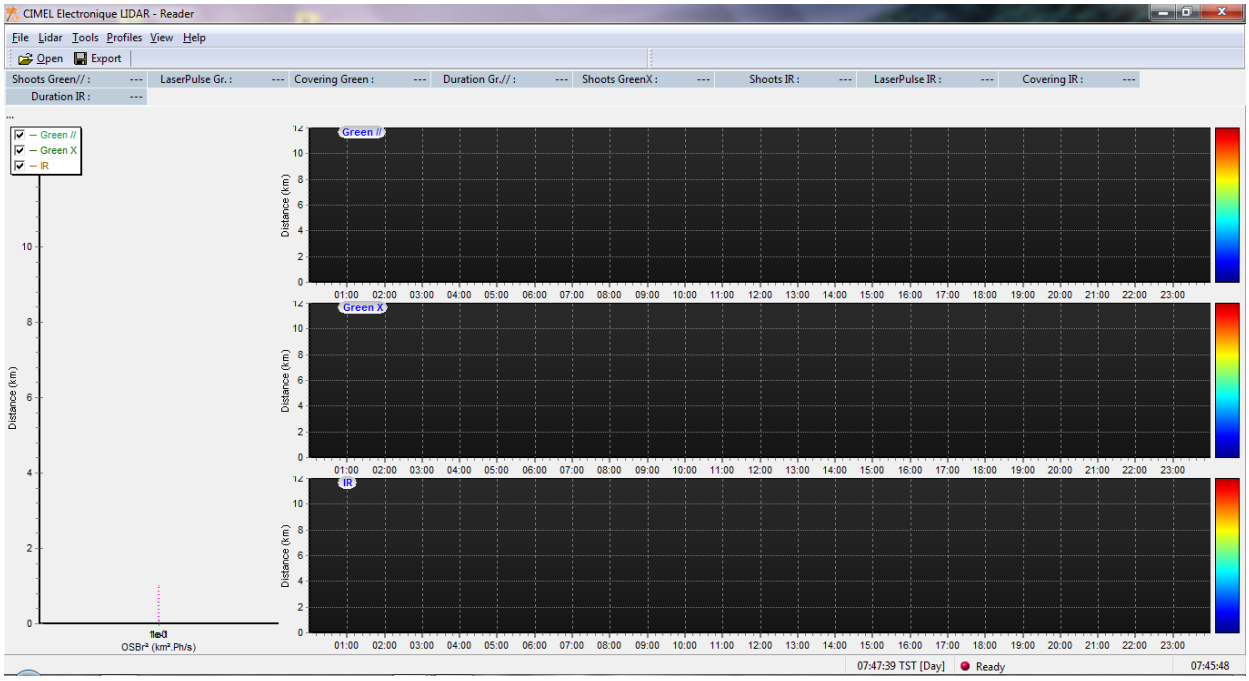
The information of the end of the measurement is displayed in the window. As can be seen in the figure opposite, all the elements are grayed out (except the Cancel button) to avoid any manipulation which could disturb the measurement.

If the user decides to cancel the mesure, the information appears in the window and it becomes active again.



4. LiDAR Reader

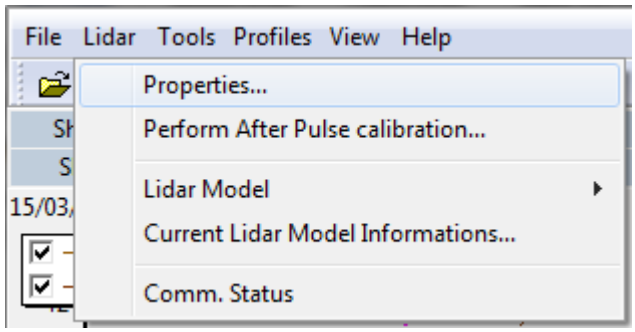
The LiDAR software allows you to re-read one or more .lid2 files even when an acquisition is being made. Simply double click on the desktop shortcut and a CIMEL Electronic LIDAR - Reader window opens:



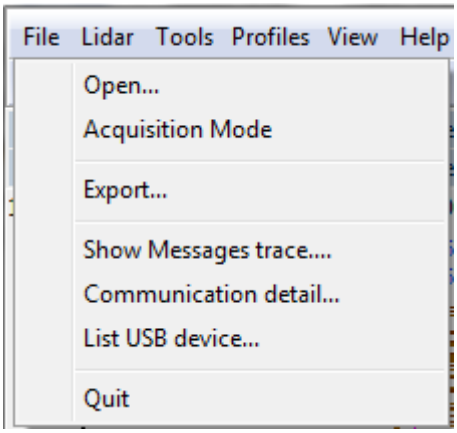
In the main window, the six tabs are present but only two buttons are visible: *Open* and *Export*.

The *Help*, *View*, *Profiles*, *Tools* tabs have the same functions as in the main window of the acquisition mode (see section VI.2).

The *Lidar* tab is largely reduced as shown in the figure below:



The most useful function of this tab is "Lidar Model"; In fact, the choice of the LiDAR is also made before opening the corresponding files to have an optimum data display.



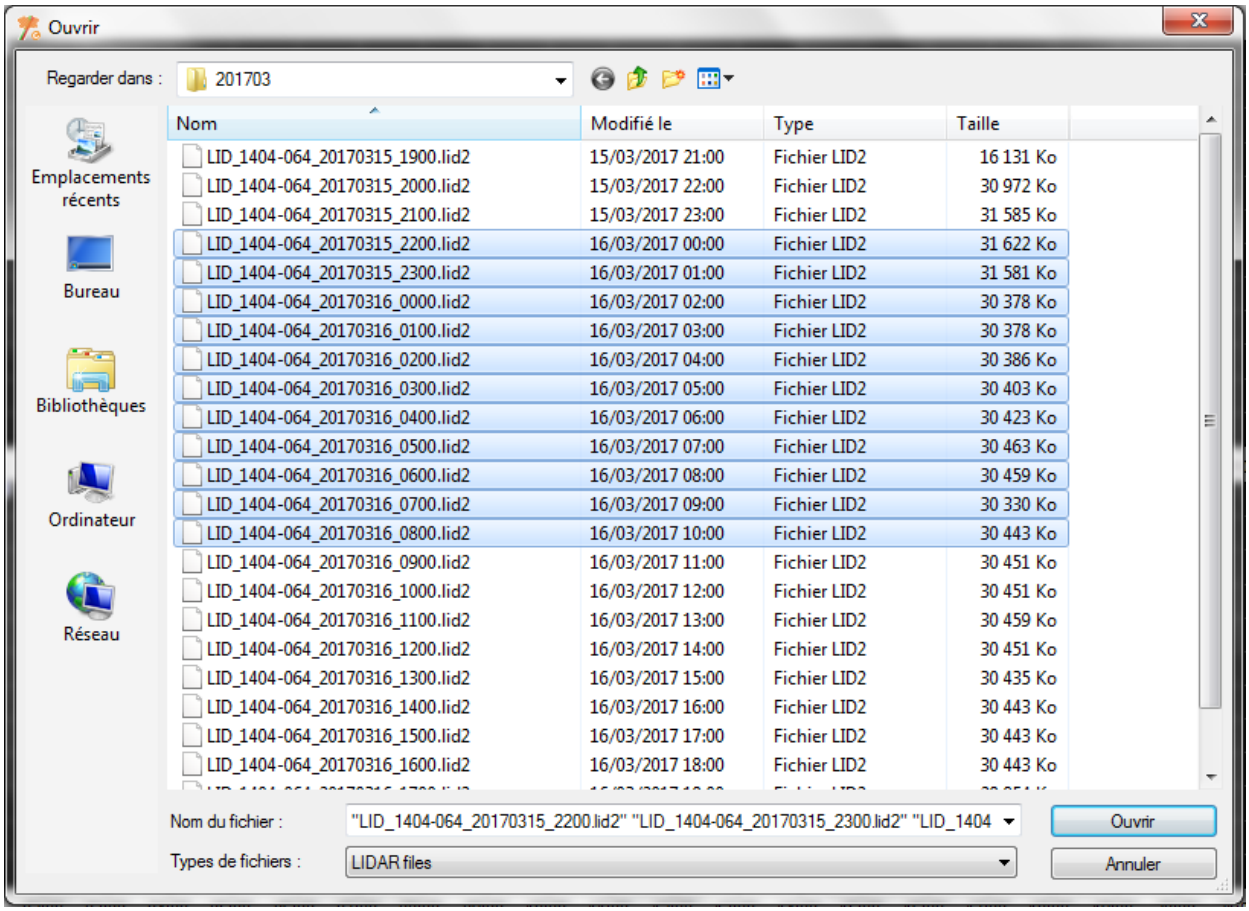
The *File* tab keeps the same characteristics for two purposes: "Acquisition mode" is not checked and the "Export" option is available.

The *Pause* button has disappeared from the main window.

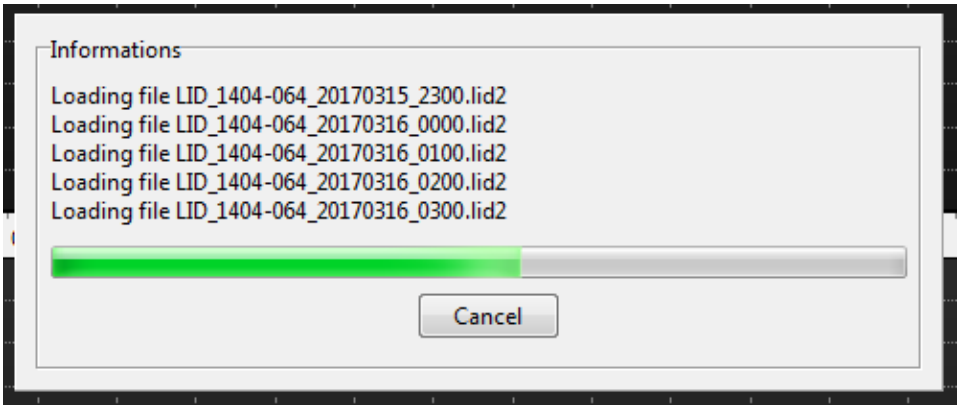
All the display functions (zoom for example) remain unchanged compared to the acquisition mode.

a. Open

The *Open* button opens a window that allows you to search for .lid2 files to read.



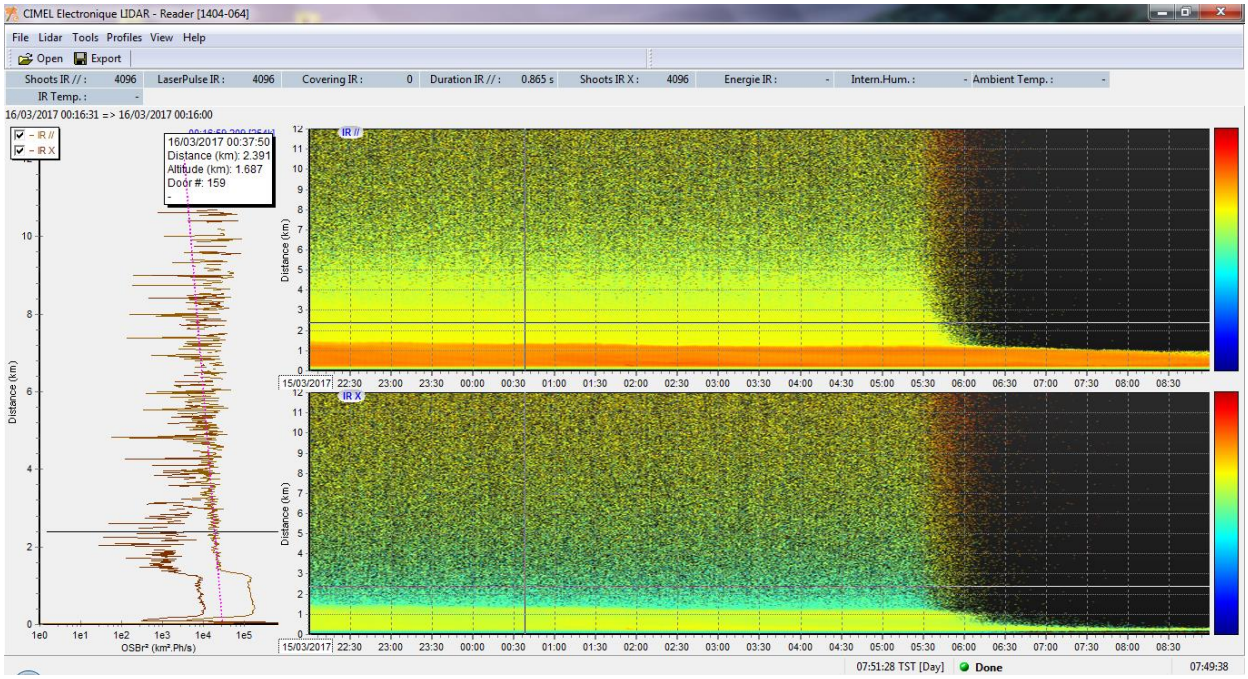
Once the choice of the files is made, a window of the software makes it possible to show the progress of the loading of the files.



At the bottom of the window is a message “Loading Files” that blinks orange:

When opening files, the serial number of the corresponding instrument is displayed at the top left of the software bar.

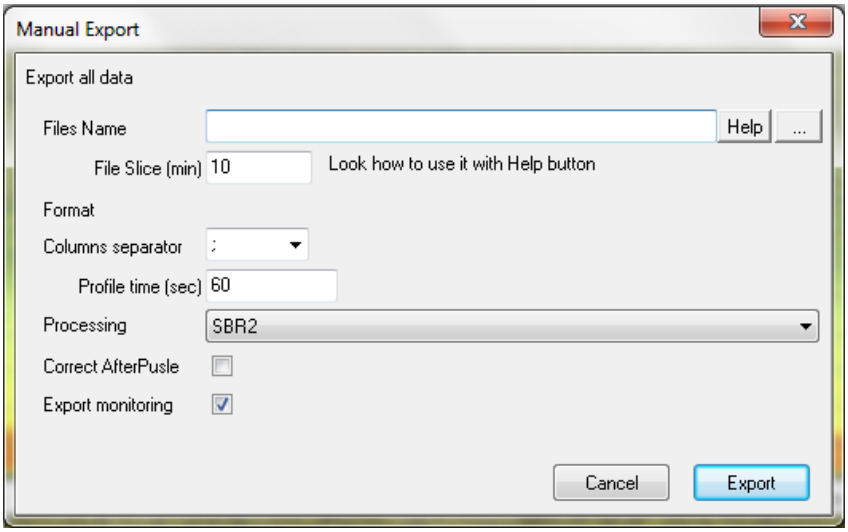
Data are displayed in the quicklooks and when you click on it you will see the corresponding profile(s).



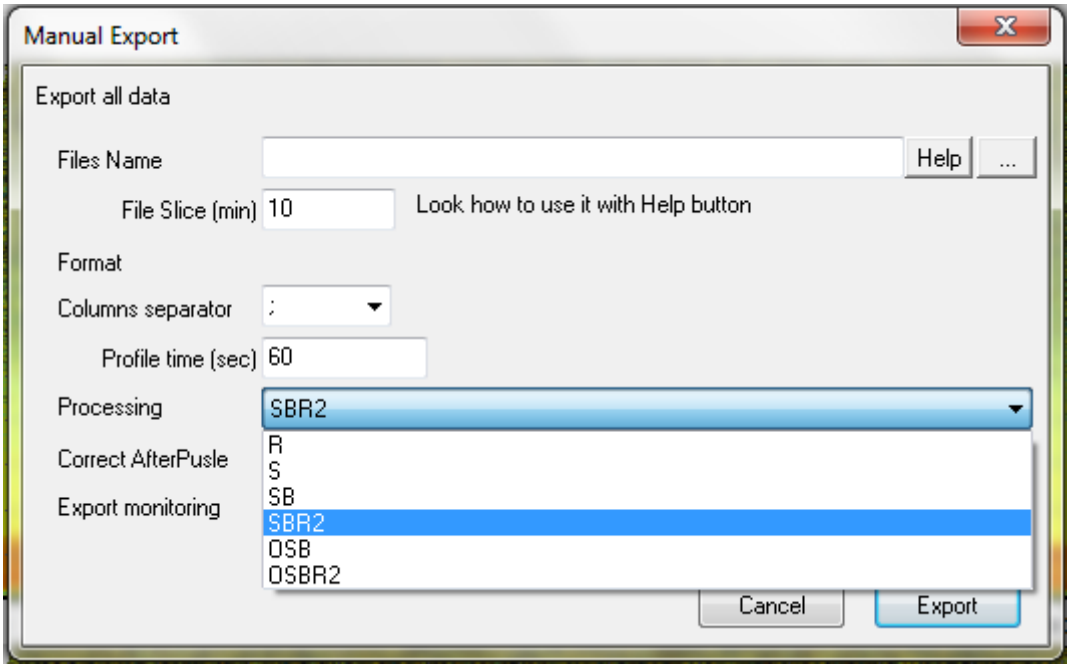
b. Export

The *Export* button is used to export the read data to .txt files. This is very useful if you want to highlight a phenomenon and then process it.

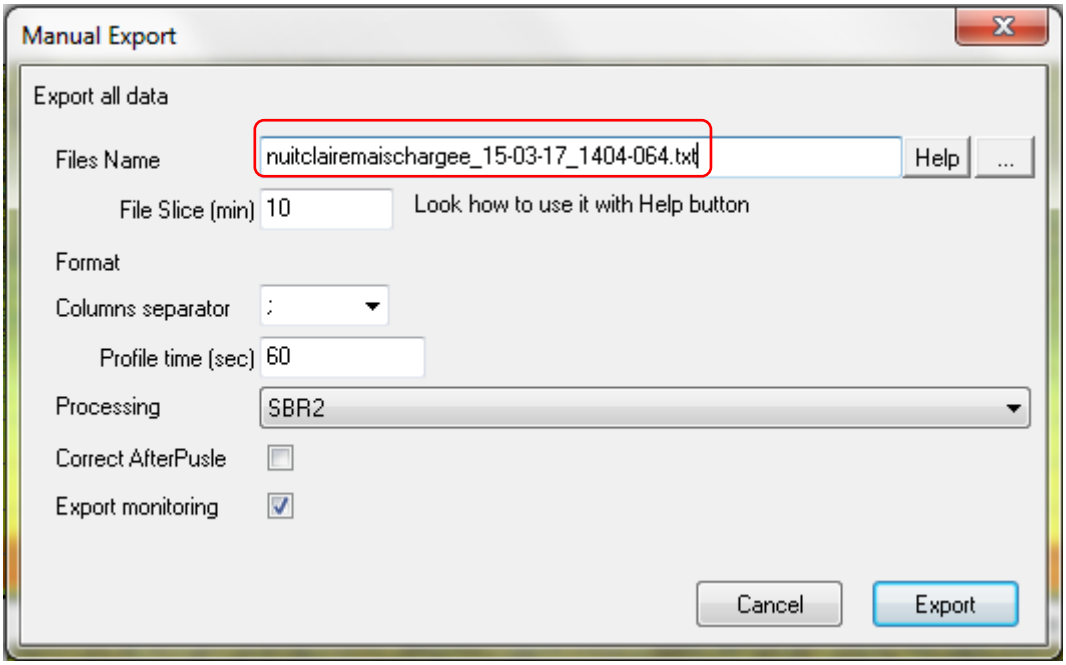
A "Manual export" window opens:



The choice of the data format to be exported is available in the Processing drop-down list (see section VI.2.d.Profiles to see what each acronym stands for).

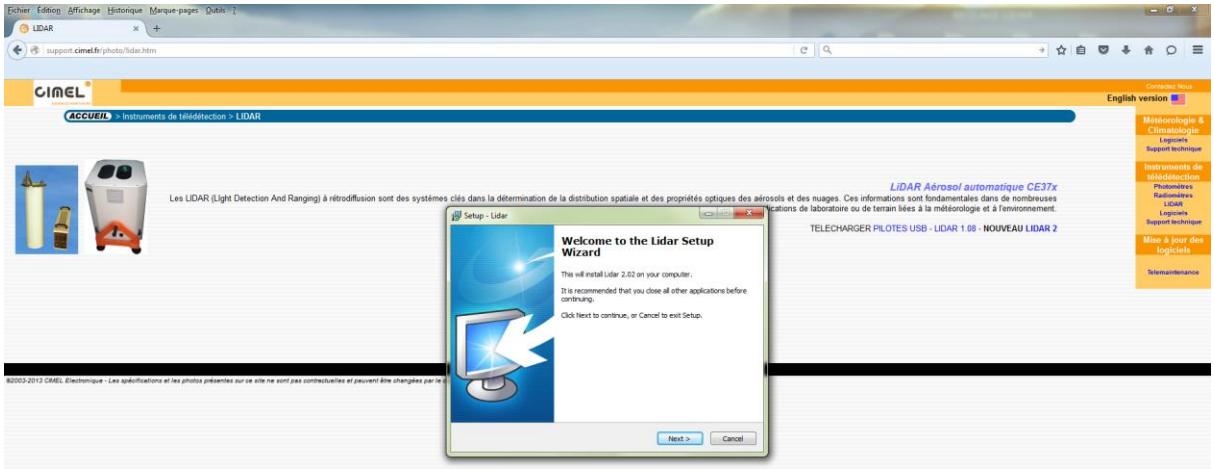


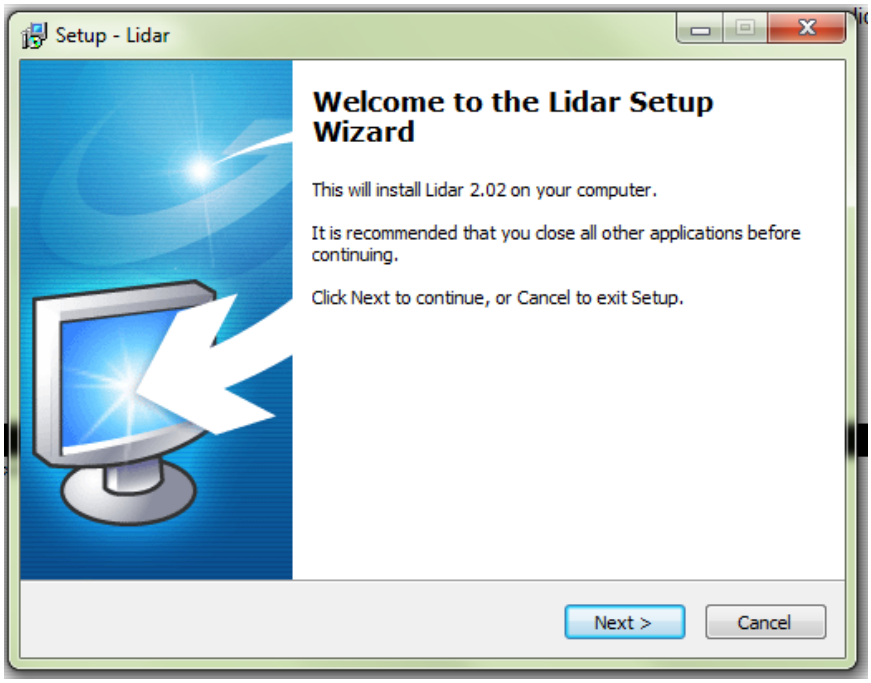
To export to a .txt file, do not forget to put the extension at the end of the file name.

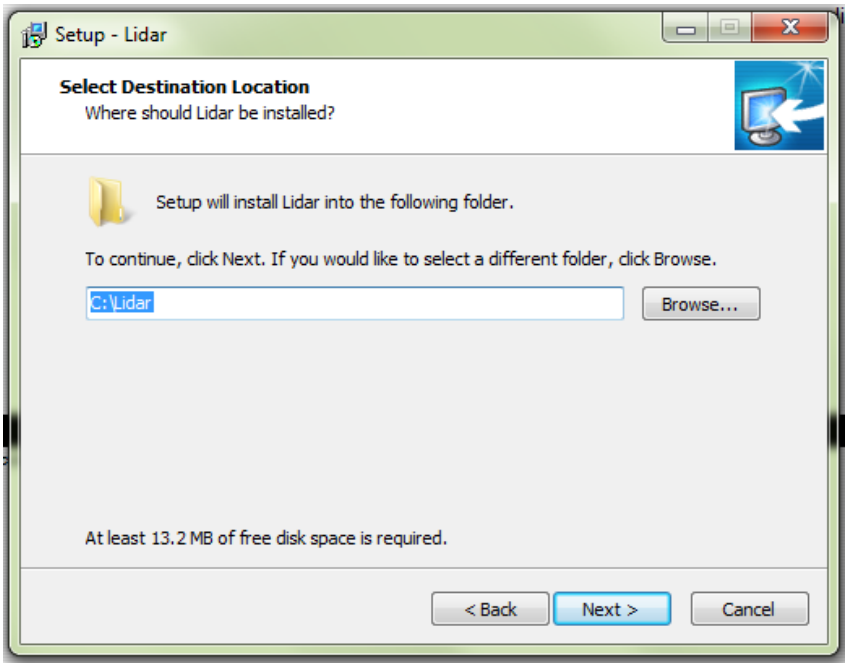


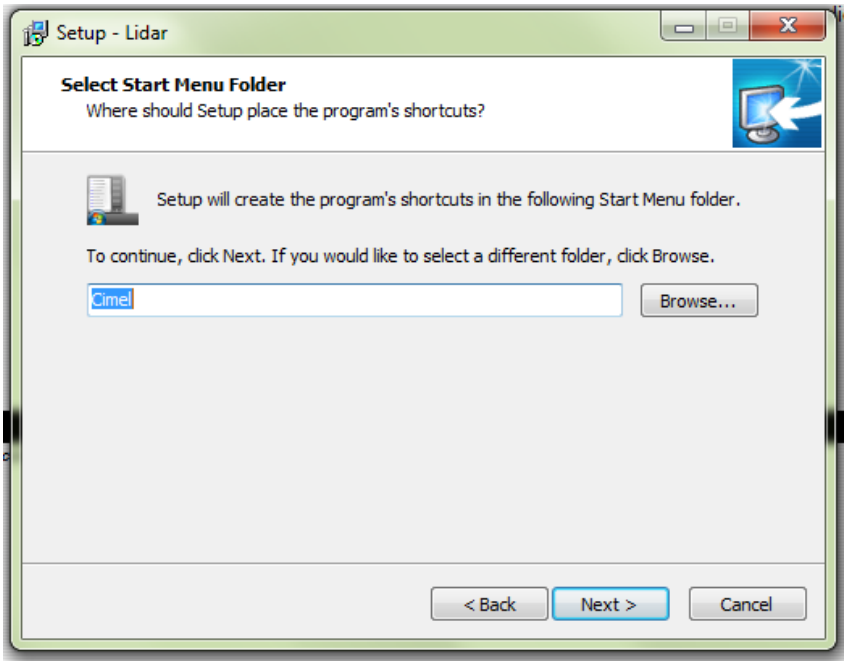
VII. APPENDIX

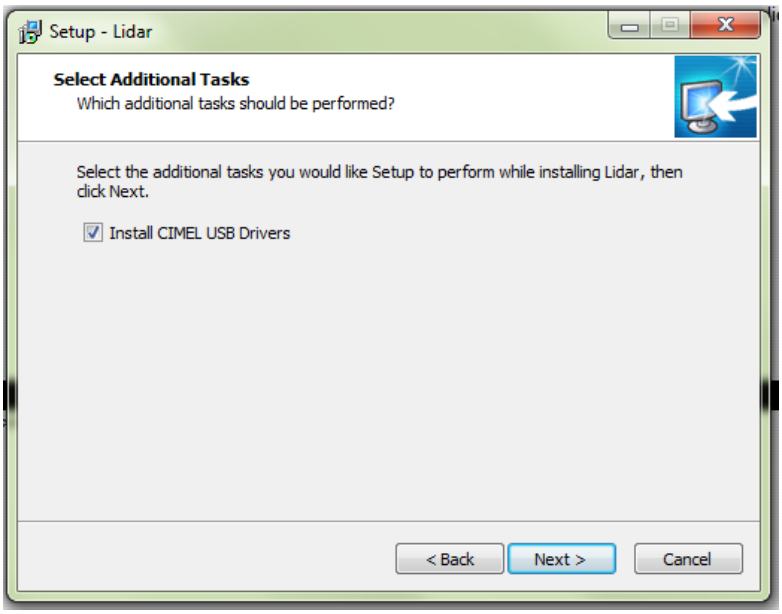
1. LiDAR II Software installation

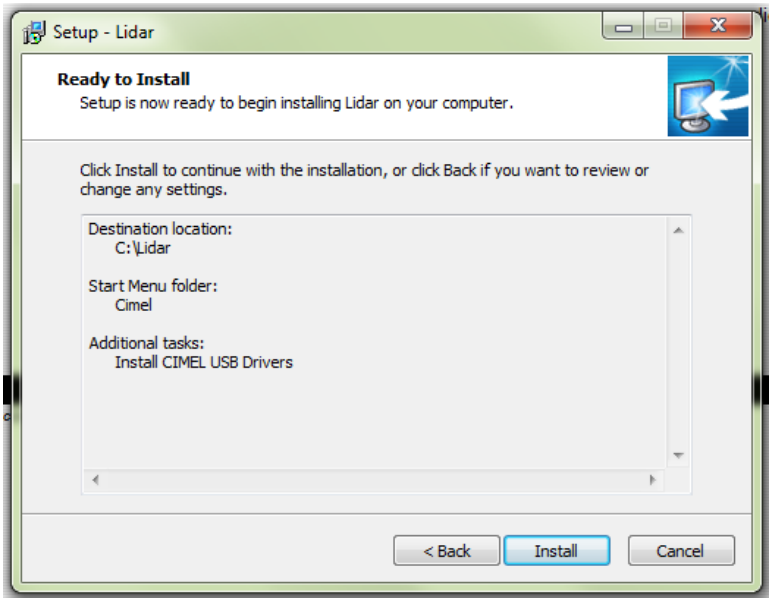


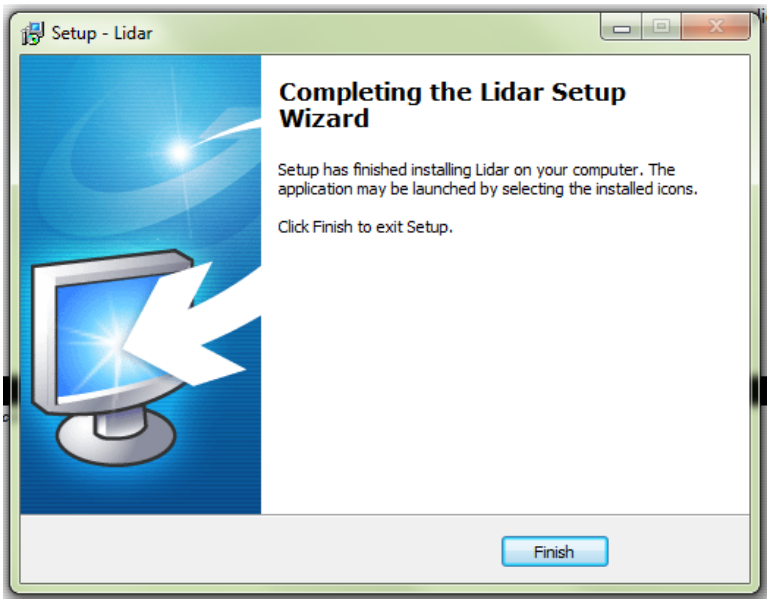



Setup - Lidar
Select Destination Location
Where should Lidar be installed?
Setup will install Lidar into the following folder.
To continue, click Next. If you would like to select a different folder, click Browse.
C:\Lidar
Browse...
At least 13.2 MB of free disk space is required.
< Back
Next >
Cancel


Setup - Lidar
Select Start Menu Folder
Where should Setup place the program's shortcuts?
Setup will create the program's shortcuts in the following Start Menu folder.
To continue, click Next. If you would like to select a different folder, click Browse.
Cimel
Browse...
< Back
Next >
Cancel


Setup - Lidar
Select Additional Tasks
Which additional tasks should be performed?
Select the additional tasks you would like Setup to perform while installing Lidar, then click Next.
Install CIMEL USB Drivers
< Back
Next >
Cancel

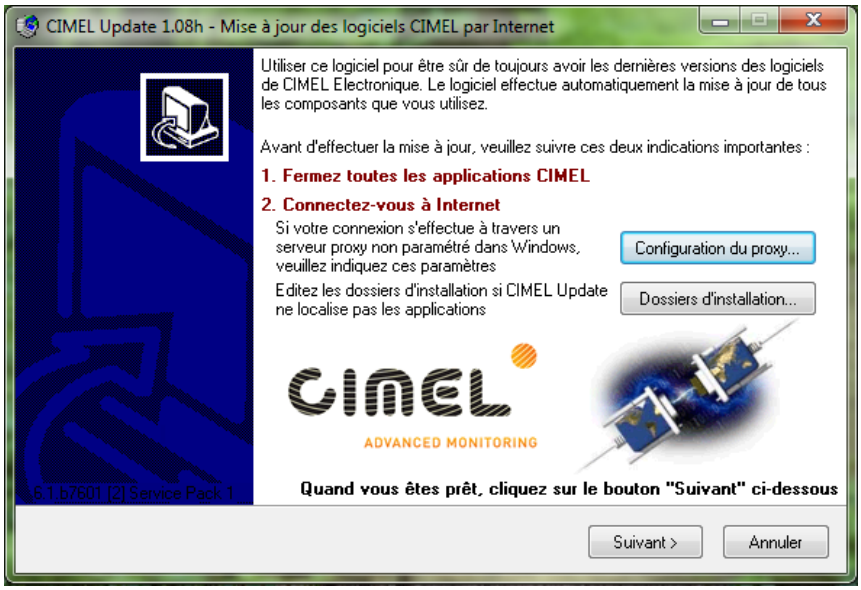

Setup - Lidar
Ready to Install
Setup is now ready to begin installing Lidar on your computer.
Click Install to continue with the installation, or click Back if you want to review or change any settings.
Destination location:
C:\Lidar
Start Menu folder:
Cimel
Additional tasks:
Install CIMEL USB Drivers
< Back
Install
Cancel

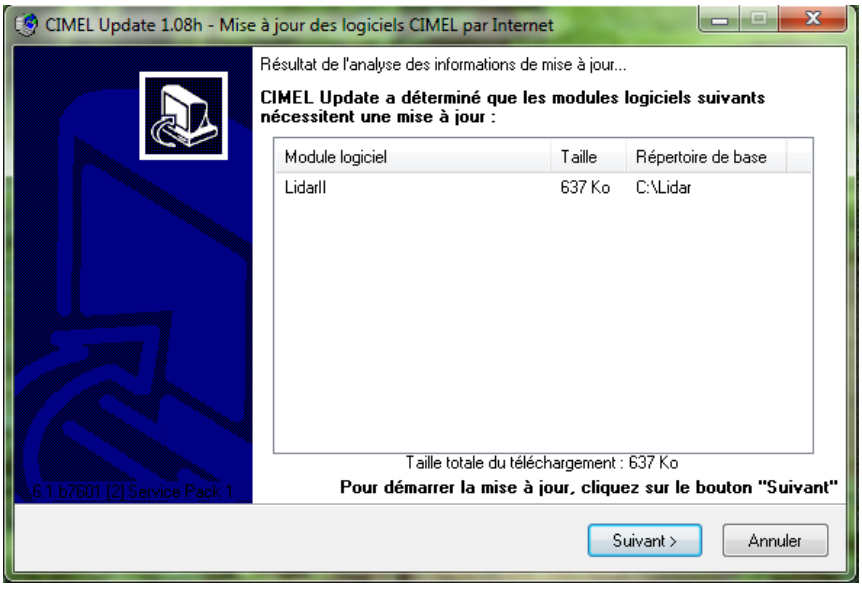

Setup - Lidar
Completing the Lidar Setup Wizard
Setup has finished installing Lidar on your computer. The application may be launched by selecting the installed icons.
Click Finish to exit Setup.
Finish

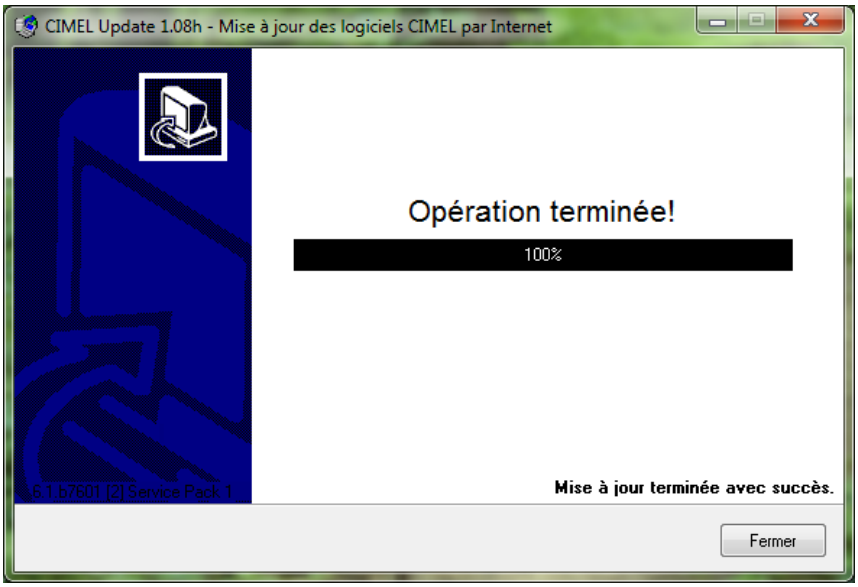
2. Software update

The new software is still being upgraded; So there are regular updates from the designer. To upgrade your software, just use CimelUpdate.exe, which will offer new updates for all your Cimel products software.

After you run CimelUpdate.exe, follow the instructions to update your Cimel software.







CimelUpdate may need to update itself, in which case it will restart automatically after its own update.

3. Contacts

If you have any questions, issues to raise for the improvement of the program, bugs in the software, do not hesitate to contact us:

FIGURE 28 : ABOUT WINDOW

4. Reviews

Date	Soft Version	Author	Changes
10/10/2016	From 2.03	S. Meunier	• Add document review • Additional information on blocking the PC standby mode.
03/2017	From 2.04	S. Meunier	• Add document review • Improved calibration procedures