File and Data Manager - FIDAM
Software Manual

Radiometer Physics
A Rohde & Schwarz Company

Document Change Log

Date	Issue/Rev	Change
11.05.2021	01/01	Initial release
07.062021	01/02	Minor modifications of wording

Table of Contents

1 Introduction

Radiometer Physics GmbH (further referred as RPG) has a radar product line intended for meteorological use. The radars operate at millimetre-wavelength and – depending on the configuration – can have Doppler, polarimetric, scanning, and multifrequency capabilities. The radars provide high spatial, temporal, and Doppler resolution. This leads to a huge data volume. In the standard mode with data compression enabled, a single frequency RPG radar produces on average 1.5 Gb of spectral data per day. Therefore, handling a long-term radar dataset is not a trivial task. Typically, quicklooks of the moment data (reflectivity, mean Doppler velocity, spectral width, etc.) are used for a preselection of cases for an analysis. An analysis of spectral data, however, is often very inconvenient. In order to visualize a radar spectrogram, one needs to browse through daily quicklooks to find an interesting case. Then, the corresponding binary file with spectral data has to be located in the data archive. The binary file has to be read to RAM (or converted to other formats like netcdf). Afterwards, the spectral data from the RPG radar must be mapped on a homogeneous velocity-range grid. Conversion and mapping are often done for the whole file and using only a single CPU core, which makes the process relatively slow. Not till then, the spectral data within the single file can be browsed through. For dual-frequency radars, the procedure has to be repeated twice, since two separate files need to be processed. And, if the located spectrogram is not what the data analyst is interested in, the whole procedure has to be repeated from the very beginning.

In order to make the analysis of the radar data simpler, RPG has developed a software package called File and Data Manager (hereafter FIDAM). FIDAM's main tasks are the following:

1. Automatic file check and transfer to an archive
2. Database handling of archives
3. Fast visualization of the data including spectrograms and polarimetry
4. Coupling databases of different instrumentation
5. Optional extended functionality (e.g. calibration checks and microphysical retrievals)

2 System description

The default radar system consists of two PC units (3 for a dual-frequency radar system). The radar operation and data processing are handled by an embedded PC with Windows 10 OS (**Radar PC** hereafter).

Note, that in the case of the dual frequency system, both W- and Ka-band radars have separate embedded PCs.

The radar control requires a separate PC (denoted as **Host PC**). The Host PC is a Windows 10 based machine operated by the user to change operational settings, control the measurements and to monitor the radar status. The standard application installed on the host PC for radar control, is further denoted as the Host Software. The radar PC(s) process(es) the radar data and generate(s) binary files with spectra (denoted as **Level 0**) and moments (**Level 1**). When the LAN connection between the radar PC and the host PC is established, the radar PC transfers the files to the host PC. The exact folder on the Host PC, where the data is stored, can be configured in the Host Software (see the Operation and Software Manual). The structure of the default radar system is schematically shown in Fig. 2.1:

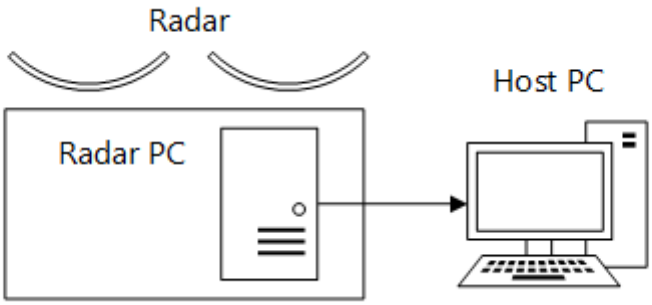

Figure 2.1. The default structure for the single frequency radar operation. The arrow indicates the data flow.

The FIDAM consists of two applications. One application manages files. This application is further called **File Manager**. Another application is used for the data visualization – hereafter called **Visualizer**. Both applications must be run under 64-bit Windows 7 or 10. FIDAM software can be used in different system configurations. In the simplest case, both File Manager and Visualizer are executed on the Host PC:

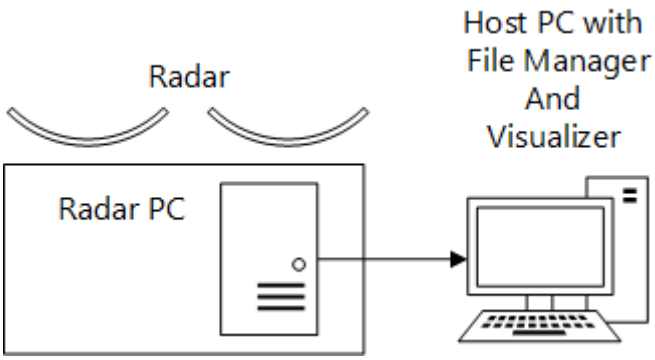

Figure 2.2. The simplest configuration for FIDAM. The arrow indicates the data flow.
The File Manager and Visualizer can be also executed on different machines:

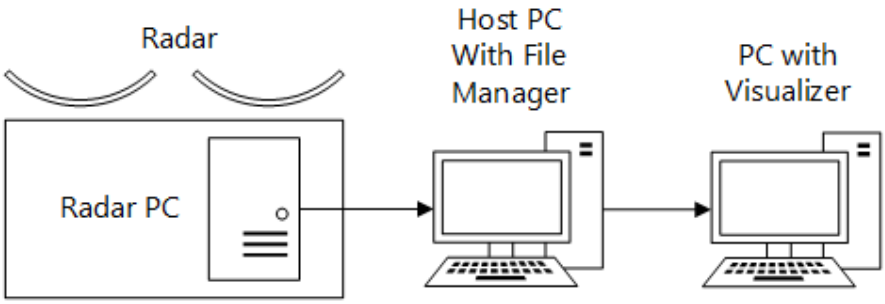

Figure 2.3. The configuration for executing the File Manager and Visualizer on different PCs. The arrows indicate the data flow.

In the configurations shown in Figs. 2.2 and 2.3, the data are stored on the Host PC, which is not suitable for long term datasets. It is a good practice to store the measurement data on a professional NAS server. As it will be shown later, the File Manager can automatically transfer files to a Network Drive. This functionality was introduced to pass the data from the Host PC to a NAS server.
Sometimes it is also beneficial having data access from different PCs. In this case, the Visualizer can be installed on several machines. All the instances of the Visualizer can have simultaneous access to the data. An advanced system configuration with a NAS server and several PCs with installed Visualizer is shown in Fig. 2.4.

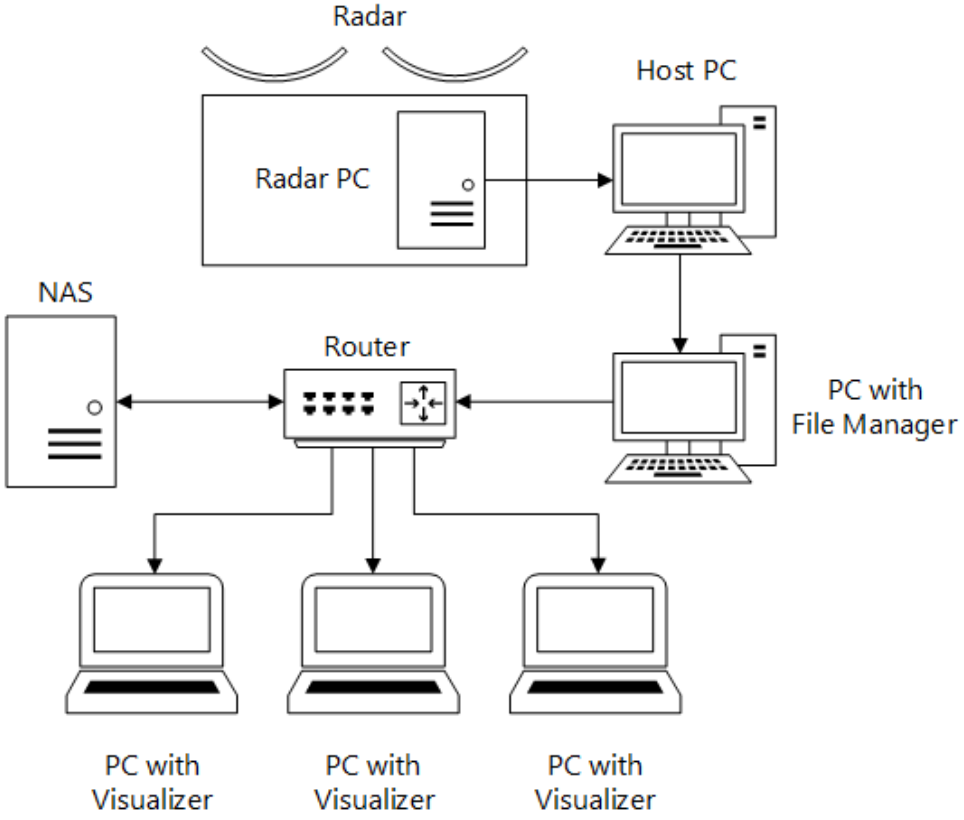

Figure 2.4. The recommended configuration for FIDAM usage for several clients. The arrows indicate the data flow.

The FIDAM software operates with the following terms:

Source Folder is a folder (local or remote) with original binary files e.g. the folder, where the Host Software stores the radar data.

Target Folder is a local/or remote folder, where data and supplementary files are stored by the File Manager, e.g. on a NAS server. The Visualizer works with Target Folders.

Archive is a collection of data and supplementary (i.e. database file, quicklooks, etc.) files for a single instrument. An Archive has a single unique Target Folder which also serves as the name of the Archive. The Target Folder of an Archive is fixed and cannot be changed. An Archive can have 0 to 2 Source folders. The Source Folders can be changed any time. The File Manager is capable of handling multiple Archives, e.g. it is possible to create different archives for different measurement campaigns. Dual frequency radars have individual archives for W- and Ka-band radars.

Database is a SQLite3 file containing metadata for each file in an Archive. Each Archive has its own Database. The File Manager creates a local copy for each processed Archive (hereafter called **local Database**). Once the processing has been done, the File Manager creates a special copy of the Database in the Target Folder (hereafter called **remote Database**). The remote Database is used by the Visualizer.

3 Licensing

The FIDAM software is protected against unauthorized distribution by a licence. The licence file is issued by RPG for each instance of FIDAM. The given license is tied to the user PC hardware and is not valid for any other PC. The given license is also tied to the user radar(s). The licensing procedure contains several steps:

1. A cryptographic hash file is created on the PC(s) intended for the FIDAM software. The SHA256 hashing algorithm is implemented. In order to generate the cryptographic hash file, please run the File Manager or Visualizer application on the machines intended for the File Manager and Visualizer usage, respectively. Because a clean copy of the File Manager and Visualizer does not include licenses, the applications will ask for a permission to create the cryptographic hash file. The cryptographic hash file does not contain any private data or passwords. It contains the types of hardware units installed on the PC (e.g. the user PC has one CPU, one Motherboard, one Network adapter, and one hard drive) and for each unit it has a cryptographic hash of the unit information. Note that, by definition of the cryptographic hash function, RPG can check if the PC, where the application is being launched, is the same as the one where the cryptographic hash was created or not. RPG cannot, however, infer any information about the hardware units or any other user related data.

Before making the cryptographic hash files, make sure that all non-permanent devices (USB sticks, external hard drives, USB adapters etc) are detached from the PC. Otherwise, the license may not be valid when one of the non-permanent devices is detached later on.

2. The hash file ForFileManager.hsh can be found in the same application folder containing RadarDBManager.exe. The hash file ForVisualizer.hsh can be found in the same application folder containing DataReader.exe. The user sends two cryptographic hash files (ForFileManager.hsh and ForVisualizer.hsh) to remotesensing-sales@radiometer-physics.de

By sending the hash files to RPG, the user agrees to transfer the knowledge about the unit types and cryptographic hashes of the unit information. RPG guarantees, that – beside the mentioned types of hardware units – no data, personal information, passwords, or their equivalents are incorporated into the hash files.

3. Based on the received cryptographic hash files, RPG issues licence files (ForFileManager.lic and ForVisualizer.lic), which are send to the user by email.
4. The user copies the licence files to the folders with the corresponding application executables (ForFileManager.lic for RadarDBManager.exe / ForVisualizer.lic for DataReader.exe).
5. The applications check the license files automatically, no further actions are required.

4 File Manager

The clean copy of the File Manager contains only a single file – RadarDBManager.exe. Since the application will create supplementary files, it is recommended to store the executable in a separate empty folder before launching.

Because the application needs to create/modify/delete files, it must have permissions to read/write/delete files in its folder and subfolders. The application must also have read/write/delete permissions for Source and Target folders.

The File Manager application performs the following tasks:

1. Creating Archives
2. Accessing data in a Source folder (e.g. the folder, where the Host Software stores the radar data)
3. Consistency checking of all Level 0 files in the Source folder including subfolders
4. Copying Level 0 files having passed the consistency check to the specified Target Folder (a local/or remote folder where all the files will be stored, e.g. on a NAS server)
5. Optional erasing of the transferred files from the Source folder.
6. Level 1 postprocessing of all Level 0 files in the Target Folder
7. Generation of daily quicklooks
8. Filling the Database
9. Database backup
10. Optional retrieval of microphysical properties of clouds and precipitation

The File Manager can be run on a PC having an access to the Source Folder with original Level 0 binary files and to the Target Folder where the consistency checked files are copied to. This can be the Host PC or any other PC.

If the Source Folder and/or Target Folder are not on the same PC where the File Manager is running, the Source and/or Target Folders must be mapped as a Network drive to the PC with the File Manager (see APPENDIX A Basics of mapping a folder as a network drive in Windows).

The File Manager can also be used to work with the Target Folder only; in this case no Source Folder is required. Only files existing in the Target folder are processed and no new files are added to the Target Folder. This is implemented to post-process previously collected data.

4.1 Creating an Archive

Before creating an Archive, please make sure that either the Source Folder or the Target Folder contain at least one Level 0 file.

An Archive creation is a 4-step procedure. In order to start it, click the **Add Archive** button. The button is only available, if no processing is taking place. Otherwise, click the **Stop** button.

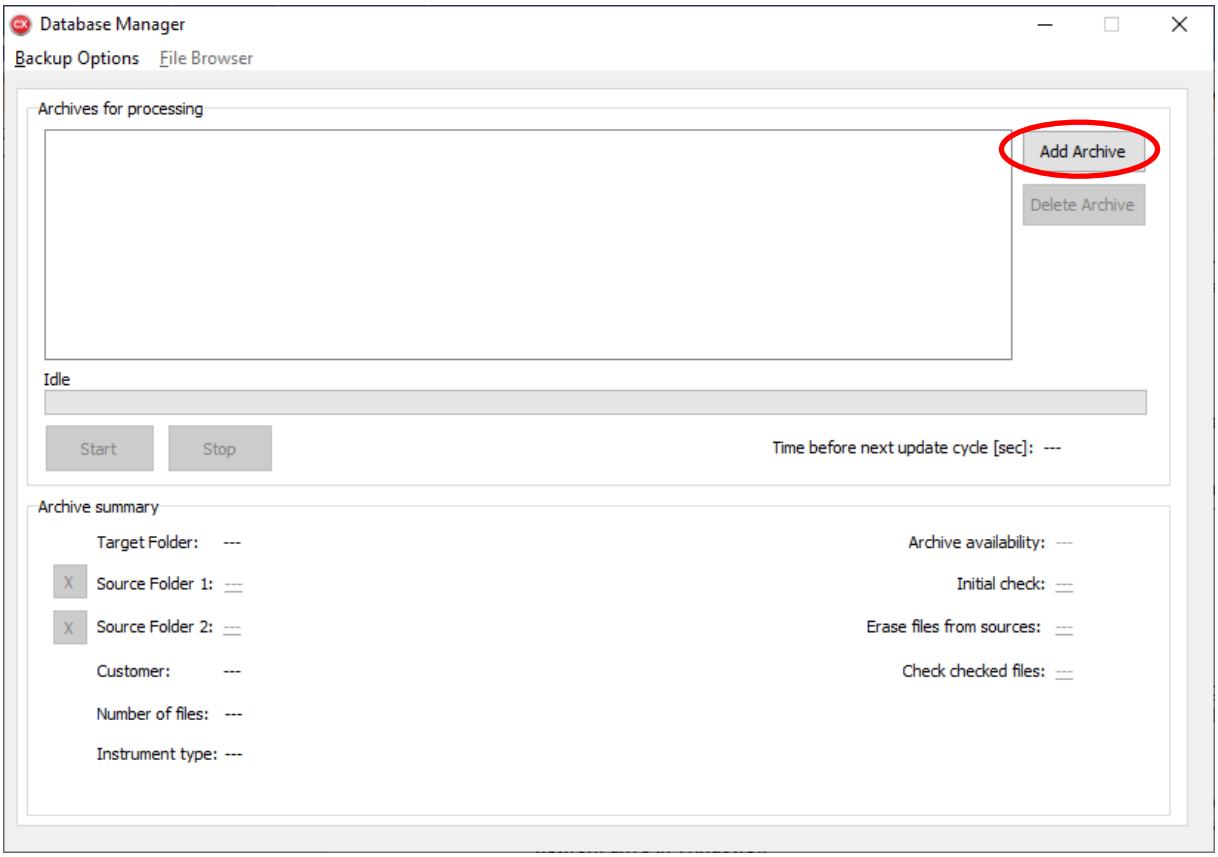

Figure 4.1. To start Archive creation, click the Add Archive button.

On the first step, the user is requested to select an instrument type

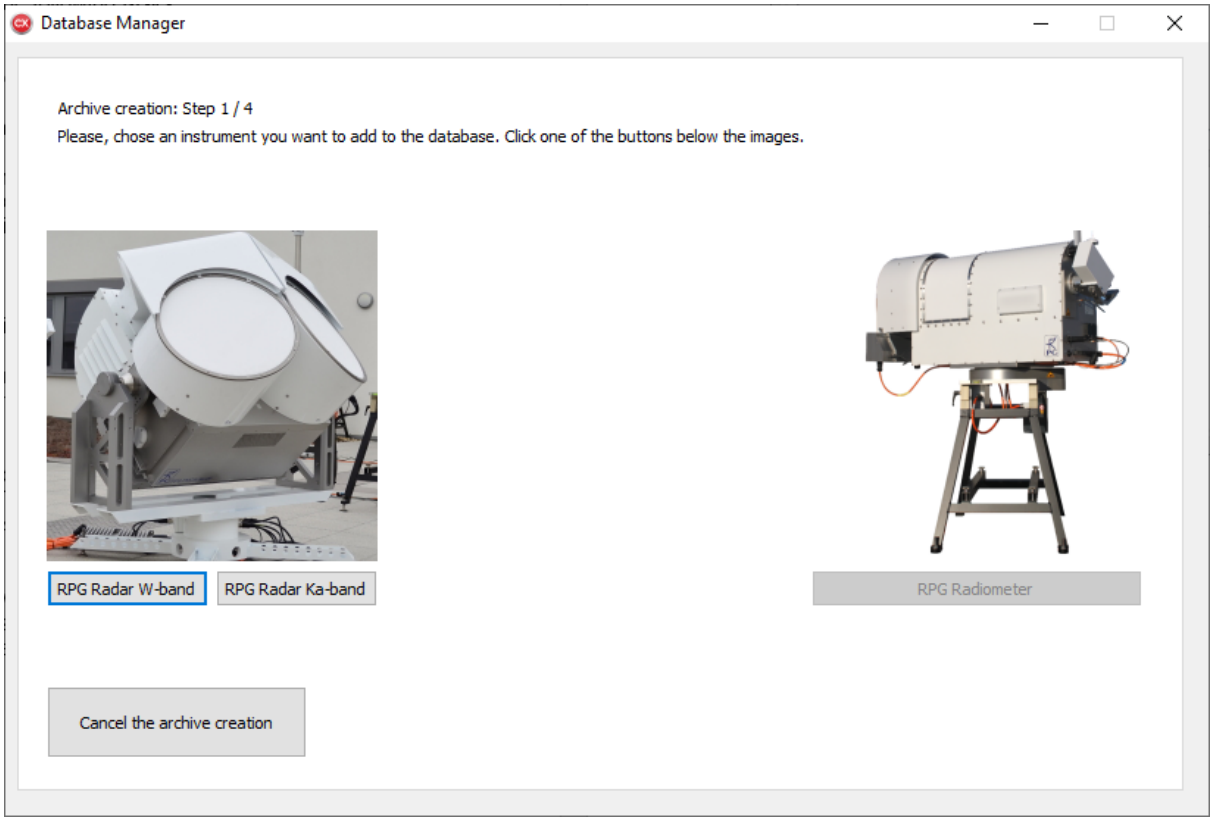

Figure 4.2. To select an instrument, click the corresponding button.

On the second step, the user needs to specify the Target Folder. Click the button **Select Target Folder**. In the appearing dialog window, select the Target Folder and click **OK**. In order to avoid possible confusions between Target and Source Folders, a Target Folder name must start with 'T_' characters. The application has an internal check for this convention. In the case of missing 'T_' the following warning message is given:

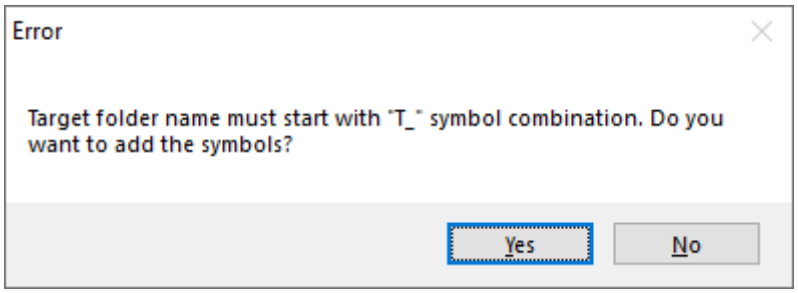

Figure 4.3. Target Folder warning message.

Please double check whether the correct folder has been selected. If so, you may allow the application to add the missing 'T_' characters to the folder name by clicking the **Yes** button.

Mixing up Target and Source Folders may lead to unwanted data movements, database changes and loss of data files. In the case of the warning message shown above, please carefully check, if the Target Folder is correct or not.

At this step, the application checks for files in the Target Folder. If a Level 0 binary file is present, the application checks, whether the instrument type chosen in the previous step fits to the one in the file header. If the instrument types are not the same, the application shows an error message.

If a Level 0 file has been found, the application also extracts the customer name from the file header and **assigns** it to the Archive. In this case, the customer name is displayed in the lower part of the window as shown in Fig. 4.4.

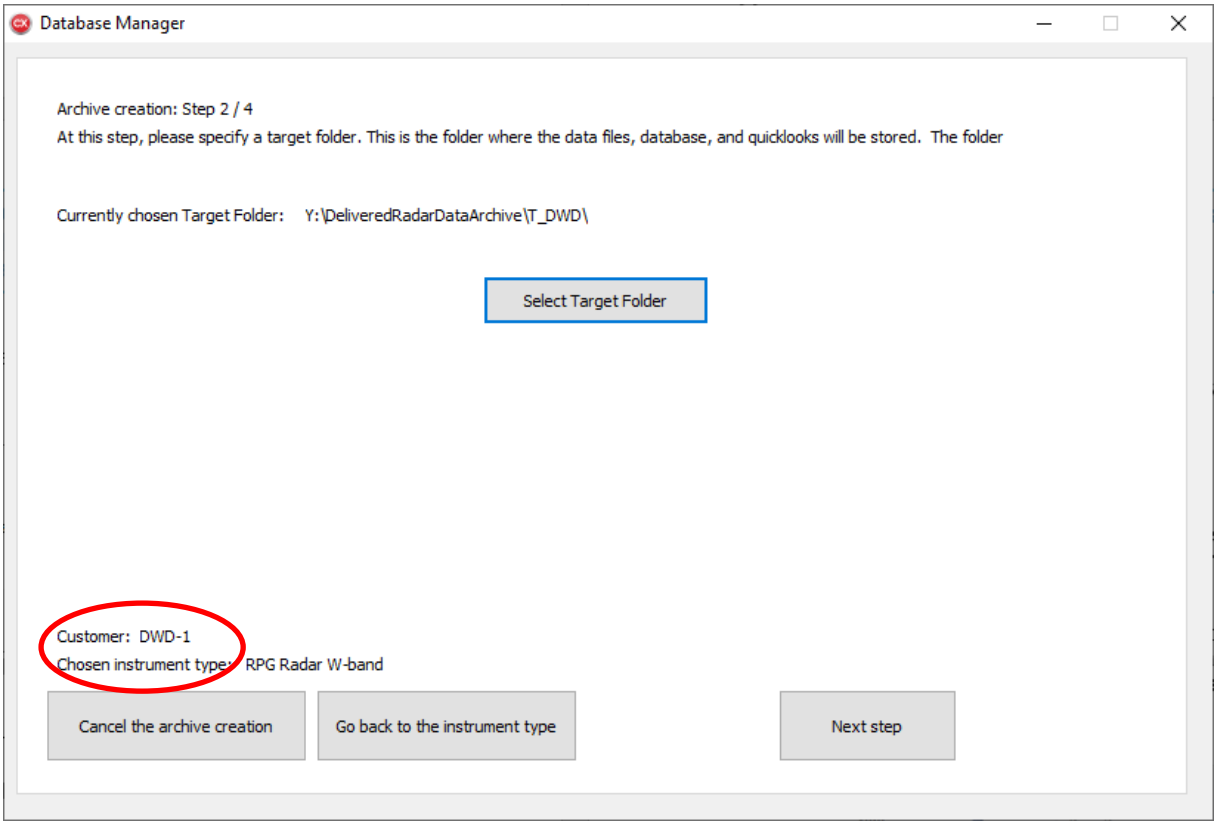

Figure 4.4. If a measurement file is located in the Target Folder, the application indicates the customer name.

Level 0 files in the Source Folder, having a customer name different from the customer name of the Archive, are not added to the Archive.

When the Target Folder is selected and all the checks are passed, the **Next step** button becomes enabled. Please click it to proceed.

On the third step, the user is requested to specify up to two Source Folders. In order to add a Source Folder, click the **Select Source Folder 1** button. In the dialog window select a folder and click **OK**. The application performs the following checks:

- The Source Folder path must differ from the Target Folder path
- If no Level 0 files were found in the Target Folder on the previous step, the application searches for a Level 0 file in the specified Source Folder. If a file has been found, the

instrument type must be the same as the one selected on the step 1. The application also extracts the customer name.

When all checks are passed, the user can optionally add an additional Source Folder by clicking the button **Select Source Folder 2**. The Application gives a warning, if the **Source Folder 1** and the **Source Folder 2** are the same.

If an existing data archive shall be post-processed, it is selected as the Target Folder on the previous step and no Source Folders are required. In this case, the user should skip the third step by clicking the button **Skip this step.**

The Source Folder settings can be modified after the Archive is created.

During the processing, the File Manager searches for Level 0 files in the specified Source Folders including subfolders.

On the fourth step, the user may activate the following options:

- Automatic erasing of the Level 0 files in the Source Folder (-s) after they have been checked, copied, and added to the Database. When this option is set, Level 0 files are automatically erased from the Source Folder(s) once checked, copied to the Target Folder and added to the Database. Without the flag, files are not erased from the Source Folder(s). In this case, there will be two copies of Level 0 files, one in the Target Folder and another one in the Source Folder.
- Force a consistency checks of already checked files. The consistency checked files have a different file code. By default, the consistency checking for already checked files is not foreseen. In order to enforce this, activate the option **Check checked files.**

It is possible to modify these options after the Archive is created.

At this step the user has a possibility to double check all Archive parameters. They are shown in the lower left part of the application window. The Archive creation process is finished by clicking the button **Create Archive.**

When clicking **Create Archive**, the application searches for an existing Database in the Target Folder. When a database is present, the application shows the following warning message:

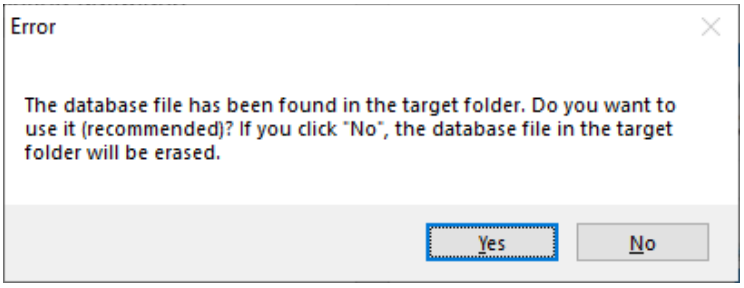

Figure 4.5. Existing Database warning message.

The application can use the found Database. This option is selected by clicking the **Yes** button. If the existing Database has to be erased, then the button **No** should be clicked.

With the **No** option, the application erases only the existing remote Database file (fileinfo.dbc). It is then replaced by an empty one. Please note, that processing of an Archive with a long-term measurement from scratch may take a lot of time. Therefore, consider carefully, whether or not you want to erase the existing Database file. The data files are not erased if the **No** button is clicked.

Once the Archive is created, it is shows up in the **List Box** in the upper part of the application window:

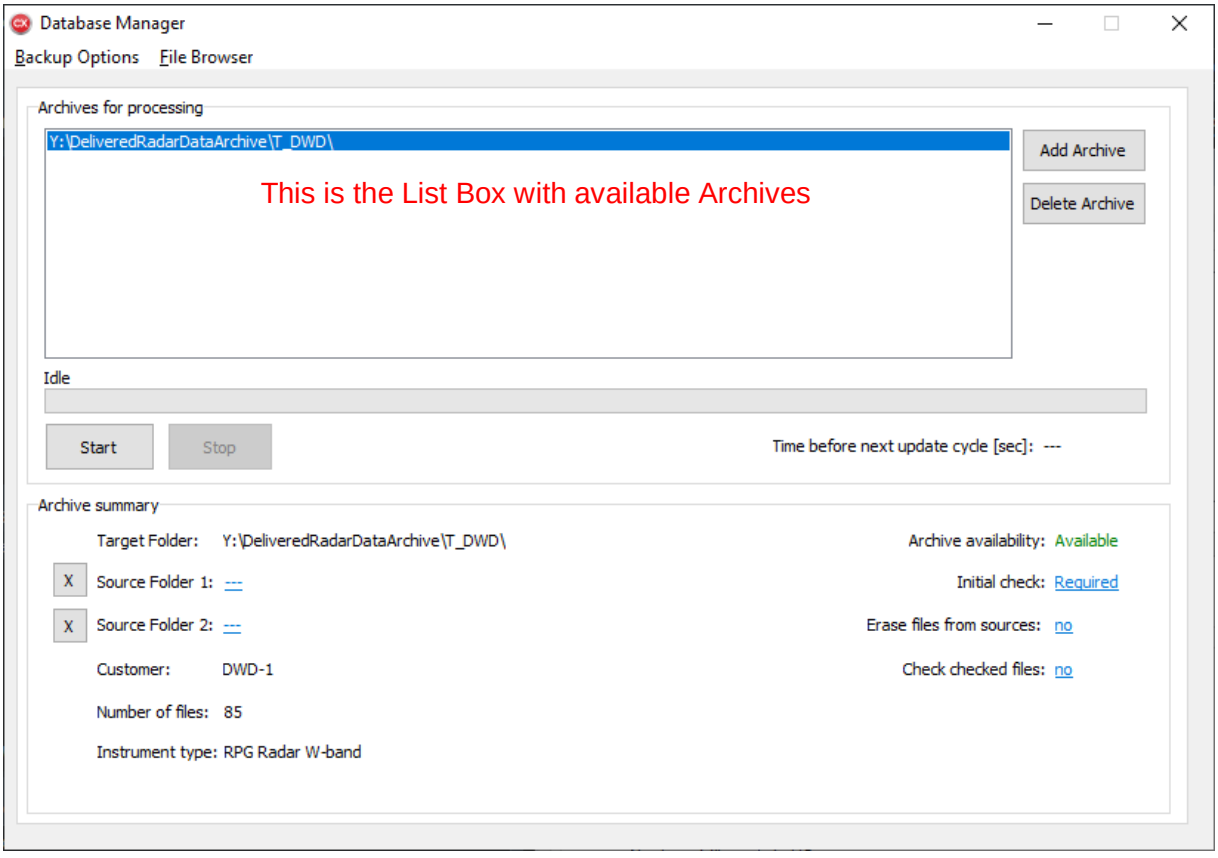

Figure 4.6. The added Archive shown in the List Box.

4.2 Archive Deletion

In order to delete an Archive, select it in the **List box** and click the **Delete Archive** button. The button is only enabled, if no processing is taking place. When processing is running, click the **Stop** button.

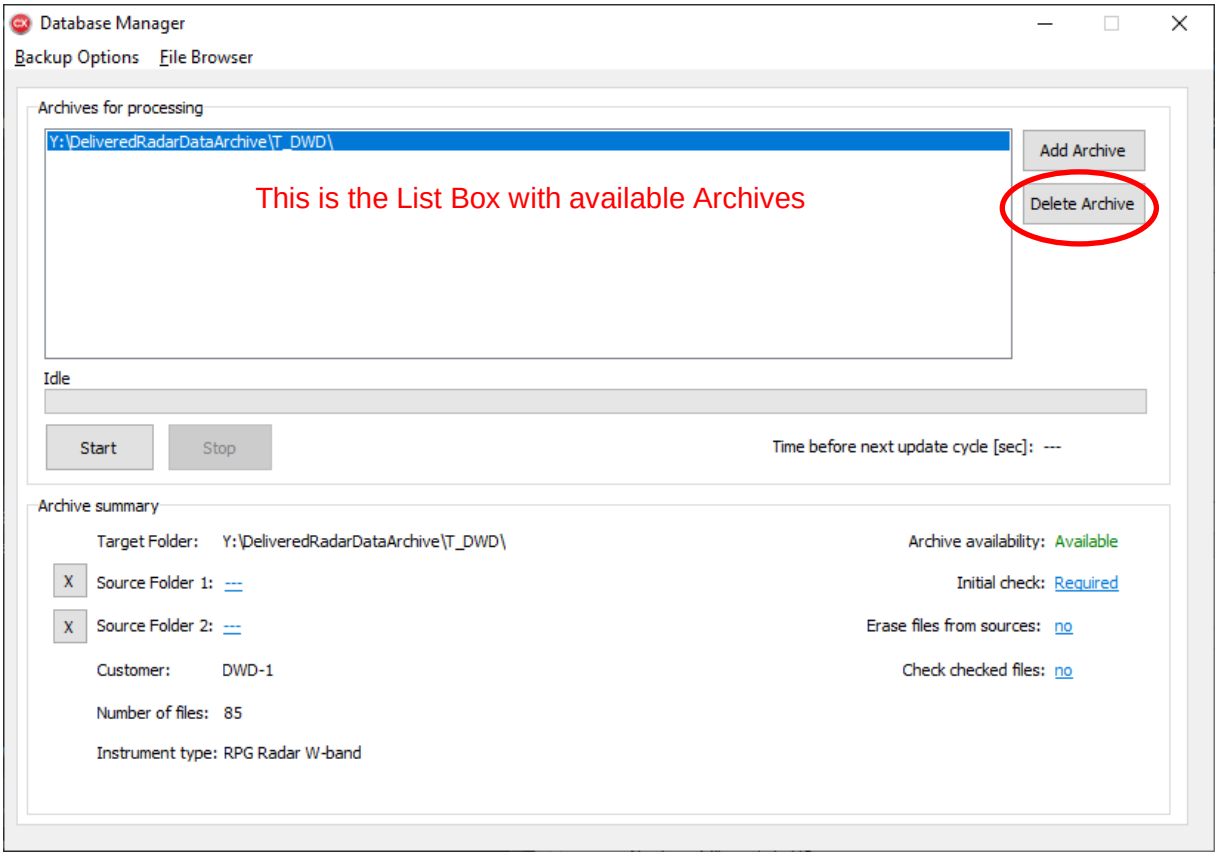

Figure 4.7. In order to delete the selected Archive, click the Delete Archive button.

When an Archive is deleted from the File Manager, the local Database is removed. The remote Database, however, is not erased.

4.3 Modification of Archive Settings

The modification is only available, when no processing is running. Otherwise, click the **Stop** button. In order to modify a setting, select the Archive in the list box. The current settings of the selected Archive are displayed in the lower part of the application window. The following Archive settings can be modified:

- Source Folder 1: To change the path, click the blue label right next to the **Source Folder 1:** label. To erase the Source Folder 1, click the **X** button on the left side relative to the **Source Folder 1:** label.
- Source Folder 2: To change the path, click the blue label right next to the **Source Folder 2:** label. To erase the Source Folder 2, click the **X** button on the left side relative to the **Source Folder 2:** label.
- Initial check: If the flag is set to **Required,** the Target Folder is processed when processing is activated. If the flag is set to **Done**, the Target Folder is not processed. The application sets the flag to **Required** for newly created Archives. After a processing cycle, the flag is automatically changed to **Done**.
- Erase files from sources: If this flag is set to **yes**, the Level 0 files are automatically erased from the Source Folder(s), once they are checked, copied to the Target Folder, and added to the Database. If the flag is set to **no**, the files are not erased from the Source Folder(s). In this case, there will be two copies of Level 0 files, one in the Target Folder and another one in the Source Folder.
- Check checked files: If the flag is **yes**, the application performs consistency checks of files which have been already checked. If the flag is **no,** the consistency checked files are not checked again.

4.4 File browser

In order to inspect files in an Archive, click the **File Browser** button.

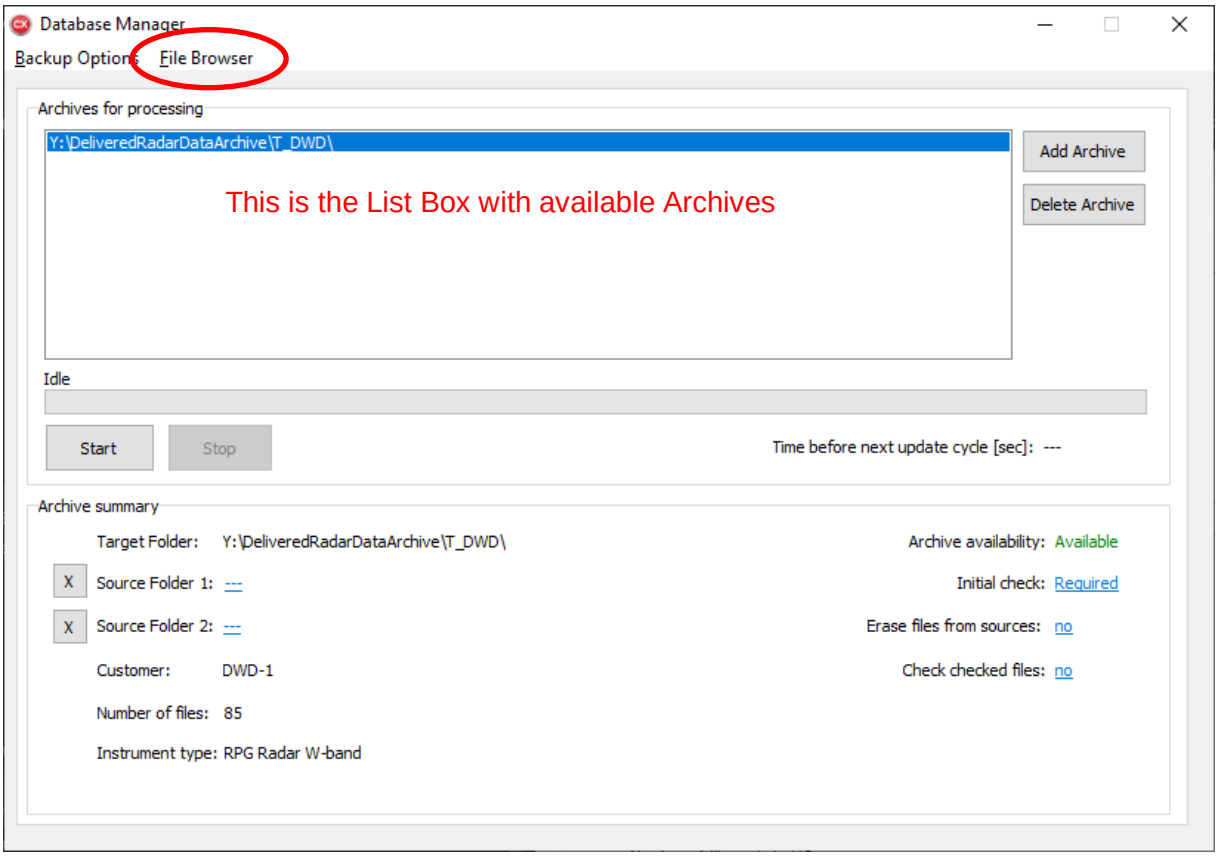

Figure 4.8. Click the File Browser button to inspect files in an Archive

The File Browser has 4 sections:

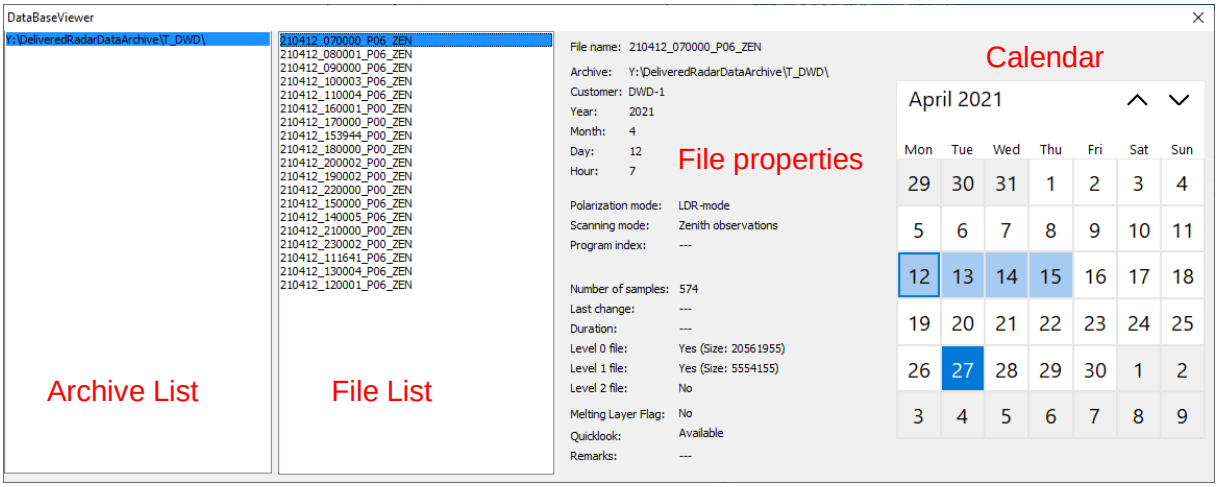

Figure 4.9. File Browser window.

In order to check files in the Archive, select the Archive in the Archive List. Then select a date of interest in the **Calendar**. The calendar is the standard Windows tool and supports several

views. By default, the monthly view is shown. To switch to yearly view, click on the month (November 2020 in the example above). To switch to the decade view, click on the selected year in the yearly view. The decades/years/months/days with available data are shown in light-blue color. To get a list of files on a certain date, click on the date in the calendar. Available files are listed in the File List. Clicking on a file in the File List displays its properties.

4.5 Database backup

Even though the FIDAM software uses an optimized and high performance SQLite3 library for handling databases, there is always a small chance of a database file becoming corrupted in the case of power loss during input/output operation. Therefore, the File Manager has a backup possibility. With the backup activated, the File Manager creates copies of remote database files after each processing cycle. The copies are stored to the Target Folder into a directory called **database\backup.** Database copies have the extension *.fbb. The backup filename indicates the date on which the backup file was created.

Database backup settings can only be modified when no processing is running. Otherwise, click the **Stop** button. Use **Backup Options** to open the window with backup settings.

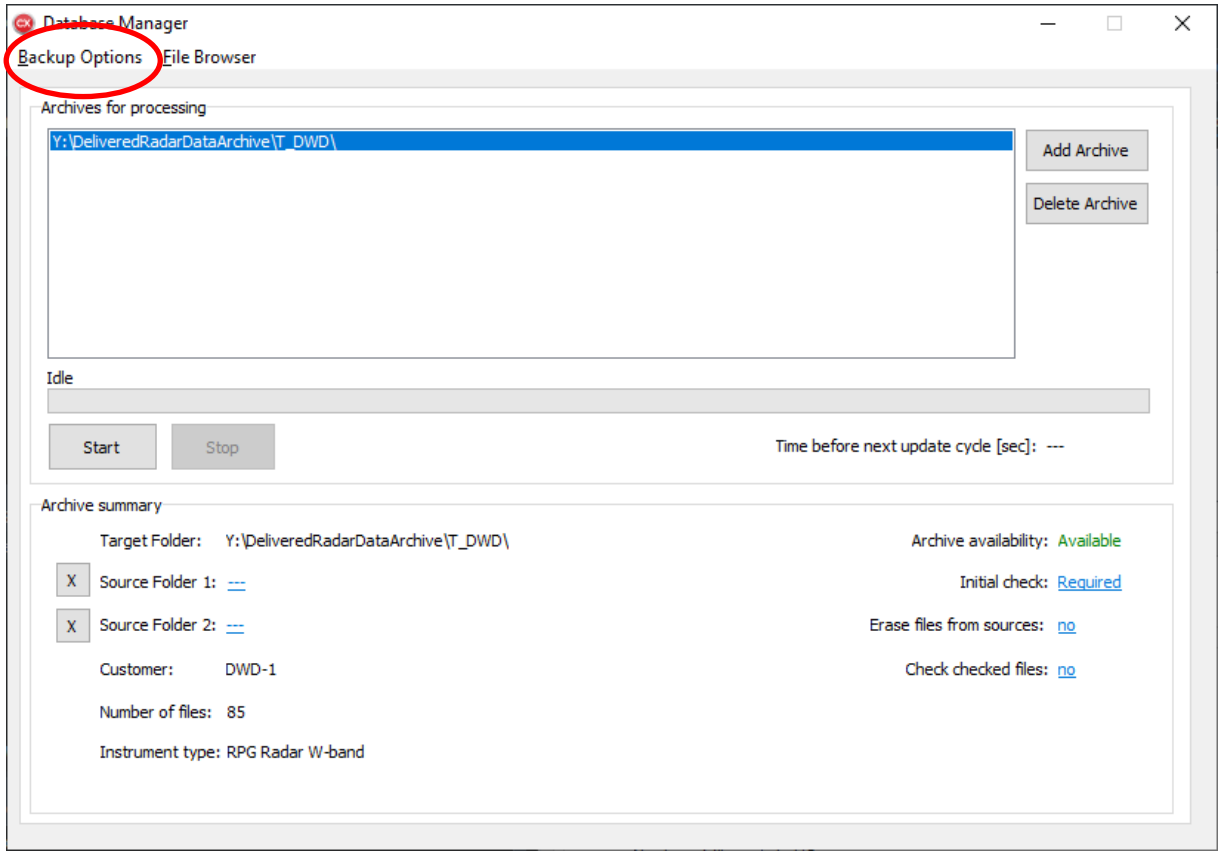

Figure 4.10. To change backup settings, click the Backup options button.

Activate the backup by checking **Backup Active** in the **Backup Options** window. It is possible to automatically erase old backup files. To do so, choose from the available options in the lower part of the **Backup Options** window. If the **Do not erase** option is activated, the backup files will never be erased.

Database files for long datasets can reach >100 MB in size. Since backup files are just copies of the database file, the backup files may occupy a lot of space when the **Do not erase** option is activated. It is then up to the user to take care of the available space in the Target Folder.

If **Erase backup older than 1 week** is selected, the backup database files older than 1 week are automatically erased. If **Erase backup older than 1 month** is activated, the backup database files older than 1 month ago are automatically erased.

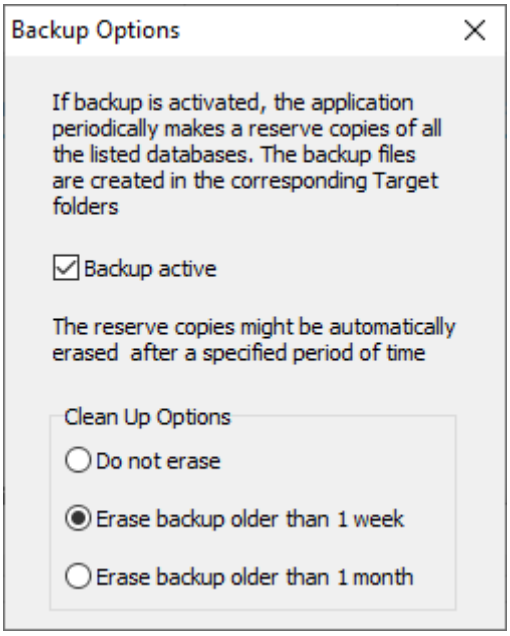

Figure 4.11. The Backup Options window.

Backup settings are the same for all Archives being processed.

4.6 Start / Stop processing

Once all required Archives are created, the processing is started by clicking the **Start** button.

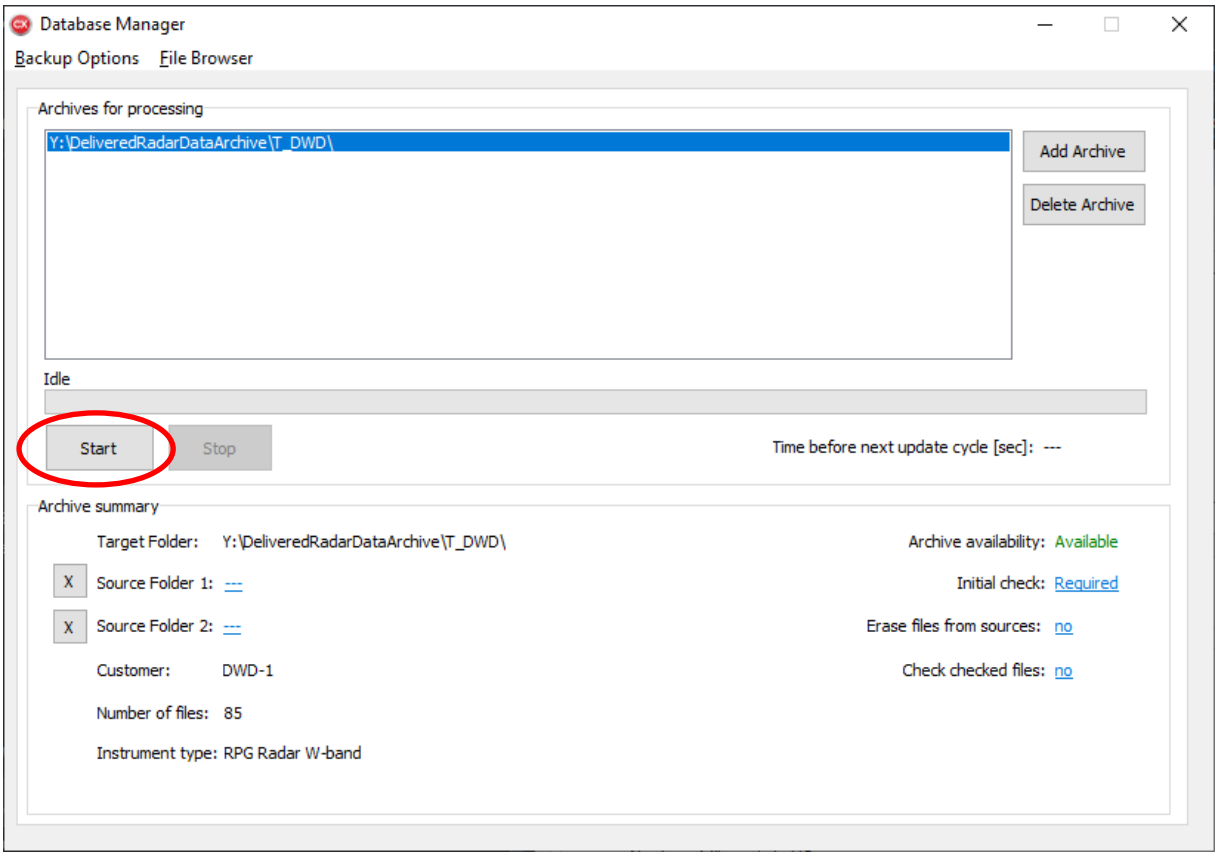

Figure 4.12. Click the Start button for processing.

During processing, all interface control components except for the **Stop** button are disabled. To stop the processing, click the **Stop** button.

Always stop the processing and wait until all the control units of the interface become available before closing the application.

Archives are processed sequentially. For each Archive the processing includes the following steps:

1. If **Initial check** is set to **Required**, the software searches for Level 0 files, located in the Target Folder but not included in the database.
2. Found Level 0 files are checked for consistency. Consistency means, that the files can be opened by the Visualizer without crashing it. For instance, values of a variable which are out of the expected range are not necessarily considered to be critical. But a negative value, which is supposed to be shown in logarithmic units by the Visualizer is not consistent. Both critical and non-critical inconsistencies are shown in the log file (rdbm_log.txt) of the File Manager, which can be found in the application folder. The extension of Level 0 files with critical inconsistencies is changed to *._LV0. The file code (see Operation and Software Manual for the RPG radars) of Level 0 files without critical inconsistences is changed to 1889346. If **Check checked files** flag is set to **no**, the Level 0 files with the file code 1889346 are not checked again.

3. Level 0 files without critical inconsistencies are copied to the Target Folder. The file structure is YAAAA\MBB\DCC, where AAAA, BB, and CC are the year, month index, and day index of the creation time of the measurement file, respectively.
4. In the case of the Initial check of the Target Folder, the **Erase files from sources** has no effect. Files are never deleted from the Target Folder.
5. Metadata of each new Level 0 file in the Target Folder is added to the local Database.
6. For each new Level 0 file in the Target Folder, a Level 1 file with radar moments is generated. The generated Level 1 files are checked for consistency. If the consistency check has passed, the Level 1 flag is set in the database.
7. The File Manager creates/updates daily quicklooks for days with new LV0 files. The quicklooks are stored in the Target Folder in the directory **database\quicklooks**. On success the quicklook flag is set in the database for all files within the day.
8. The content of the local Database is copied to the remote Database.
9. Steps 2 to 8 are repeated for the Source Folder 1 (if specified). On the step 4, the original files are erased from the Source Folder if the **Erase files from sources** is set to **yes**. Before erasing, the File Manager checks, whether or not the file sizes in the Source and the Target Folders are the same. Only when the sizes are the same, the Level 0 file is erased from the Source Folder.
10. Steps 2 to 8 are repeated for the Source Folder 2 (if specified). On step 4, the original files are erased from the Source Folder, if the **Erase files from sources** is set to **yes**. Before erasing, the File Manager checks, whether or not the file sizes in the Source and the Target Folders are the same. Only when the sizes are the same, the Level 0 file is erased from the Source Folder.

After a full processing cycle the File Manager waits for 5 minutes and repeats the cycle.

5 Visualizer

In order to install the Visualizer, please store the executable and the **Languages** folder to an empty directory and run the executable. The licensing will be done according to section 3 of this manual. When the application is launched, the **Title Page** is shown.

The size of the application window is automatically adjusted to the screen resolution. The minimum required screen resolution is 1360 x 768 pixels. The recommended screen resolution for the Visualizer operation is at least 1900 x 1080 pixels.

The screen resolutions given above are for the scale factor (specified in the display settings of windows) of 100%. For a larger scale factor (e.g. 125 %) the effective screen resolution is lower.

Some visual functionality of the Visualizer may be limited at screen resolutions lower than the recommended values.

Because the application needs to create/modify/delete files, it must have permissions to read/write/delete files in its folder and subfolders. The application must also have reading permissions for the Target Folders.

If the Target Folder is not on the same PC where the Visualizer is running, the Target Folder must be mapped as a Network drive to the PC with the Visualizer (see section Basics of mapping a folder as a network drive in Windows).

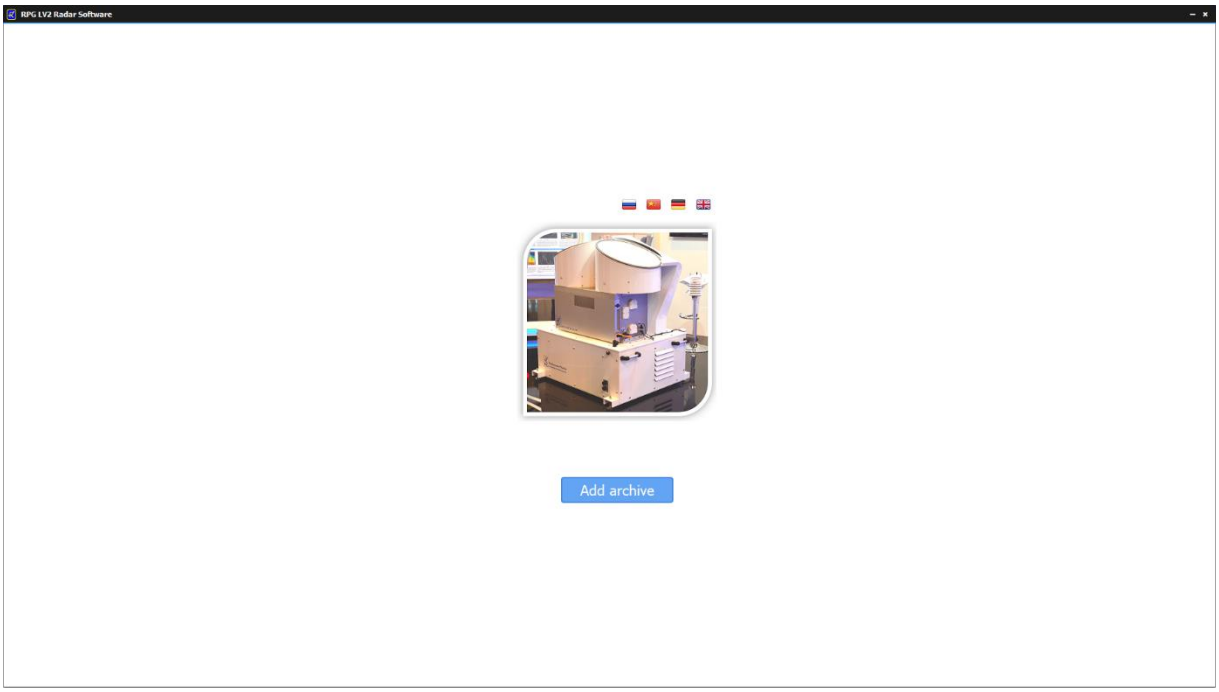

Figure 5.1. Title page of the Visualizer window at first start with the valid license.

5.1 Adding Archives

If there are no archives added to the Visualizer, an Archive can be added by clicking the button **Add Archive** on the **Title Page** of the Visualizer.

When at least one Archive has been already added, to add another Archive, click the **Change archive** label on the **Title Page** to switch to the **Archive Browser Page**. Then click the **Add archive** menu item in the upper left part of the window.

In the dialog window **Browse For Folder,** select the Target Folder (starting with 'T_' characters) and click **OK**. If the chosen folder contains the proper Database file, the Archive is shown as a panel in the Visualizer window. The panel contains the shortened name of the Archive path, customer name, time stamps of the first and the last samples, and a number of Level 0 files in the Archive.

In order to see the full path of the Archive, put the mouse pointer over the shortened Archive name.

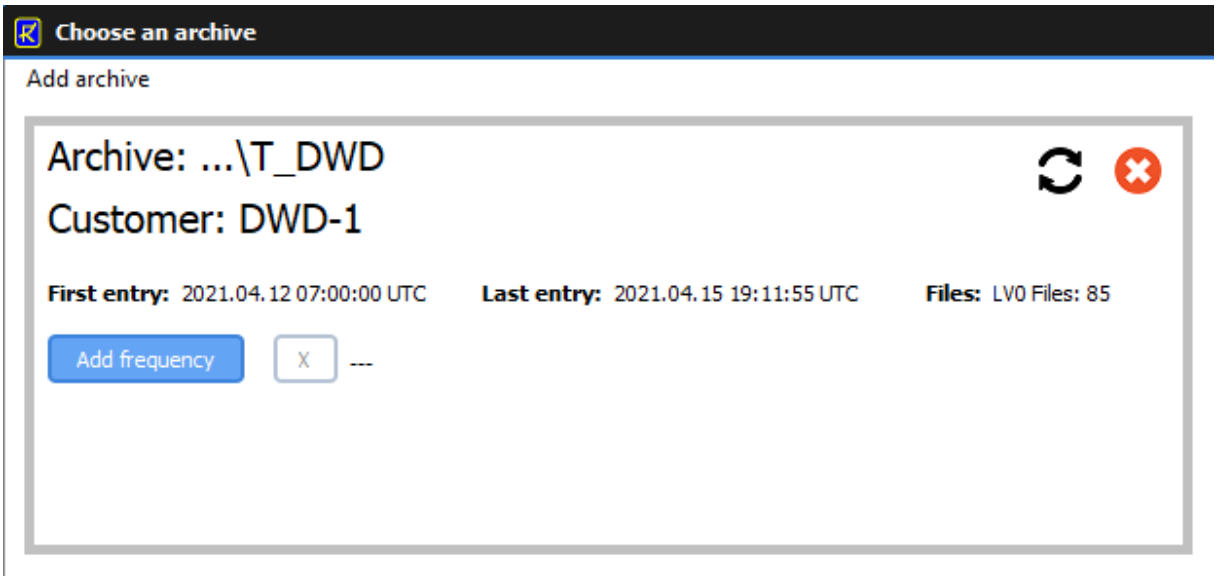

Figure 5.2. The panel of an added Archive.

5.2 Updating Archive

During measurements, the File Manager adds new files to the remote database. The Visualizer does not update its version of the database automatically. This has to be triggered manually.

To do so, click the **Update** button on any archive panel. All the databases are updated, regardless on which panel the **Update** button is clicked.

5.3 Archive unloading

In order to unload an Archive from the Visualizer click the **Unload** button on the Archive panel.

5.4 Coupling W- and Ka-band radars

For dual frequency radars, it is possible to couple Archives of the W- and Ka-band radars. This allows to display dual-frequency products (e.g. dual frequency ratio). In order to couple the two Archives, first add individual W-band and the corresponding Ka-band Archives following section 5.1.

Then click the button **Add frequency** on the W-band Archive panel. All panels with instruments other than Ka-band radars will disappear. Please click on the Ka-band Archive to couple it to the W-band Archive.

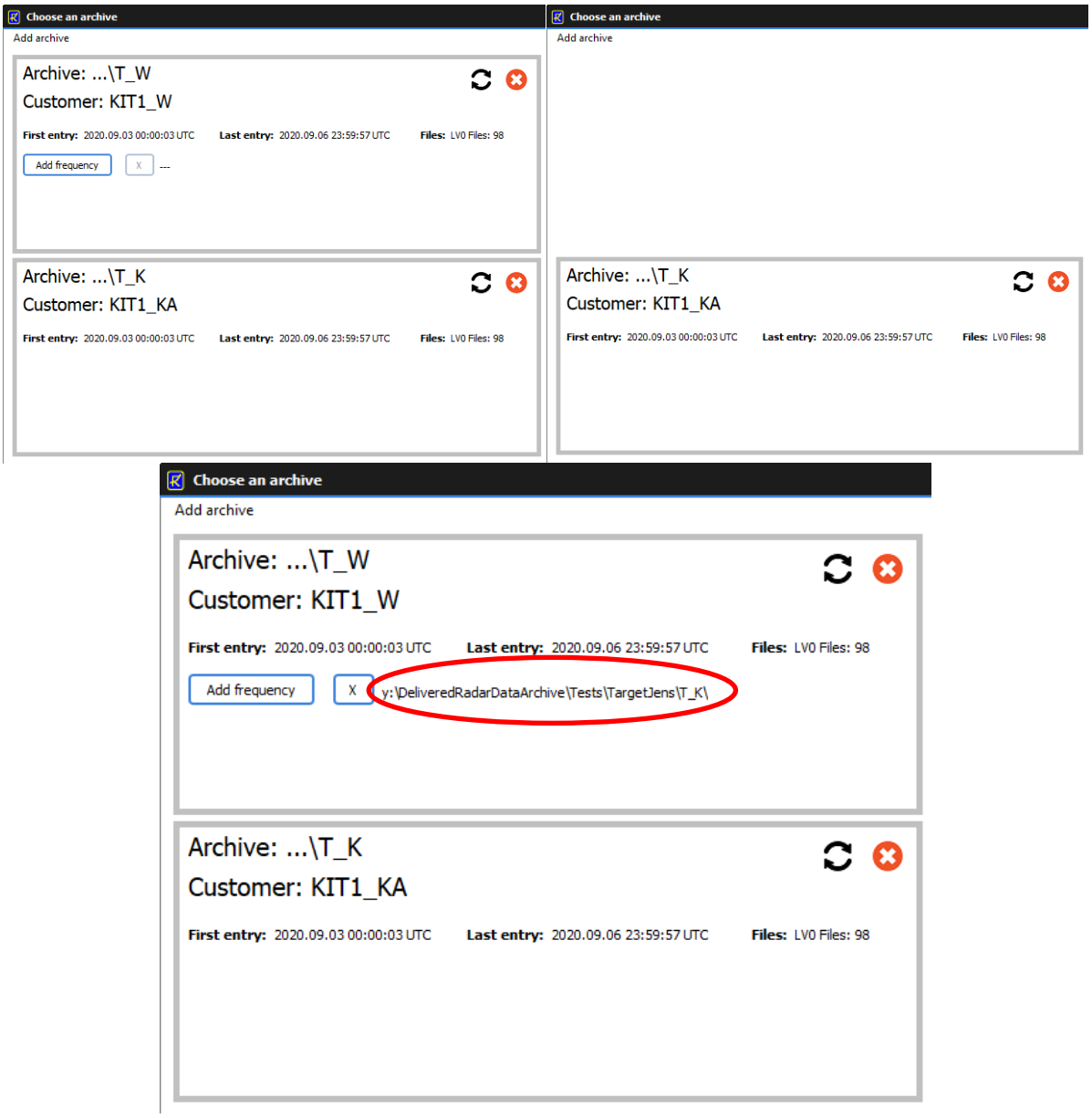

Figure 5.3. Coupling two frequencies.

The coupled Ka-band Archive will be shown on the W-band panel.

The W-band Archive is always the master and, therefore, the Ka-band archive must be coupled to it. It is not required (and not possible) to couple a W-band archive to a Ka-band Archive.

5.5 Decoupling W- and Ka-band radars

In order to decouple the Ka-band Archive, click the **X** button on the left side of the Ka-band path on the W-band panel.

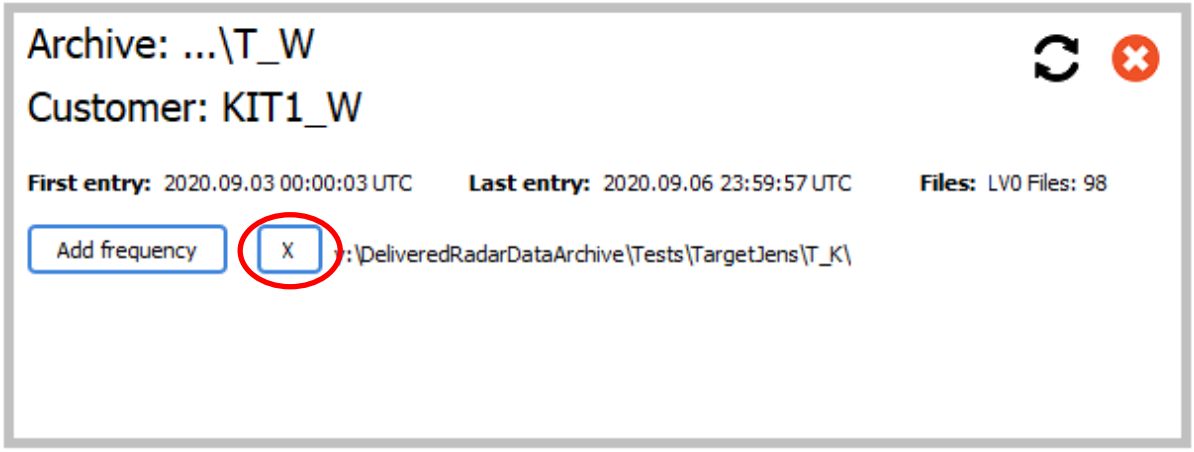

Figure 5.4. Decoupling two frequencies.

5.6 Archive selection

In order to select an Archive for the analysis, move the mouse pointer on it (the border of the Archive panel becomes black) and click.

Make sure that the mouse pointer is NOT positioned over a control unit (e.g. button or label).

When an Archive is selected, the Visualizer switches to the **Title Page.**

5.7 Layout creation

When an archive has been added to the newly installed Visualizer, the button **Create layout** appears on the **Title Page**. Note that, once the layout has been created, this button will not be shown any more.

When the button **Create layout** is clicked, the Visualizer switches to the **Layout Page**. On this page the user needs to add and arrange the positions of panels.

In order to add a panel, click the **Add Panel** menu item in the upper left corner of the window. A sliding panel will appear on the left side of the window. The **Layout Page** also displays the grid.

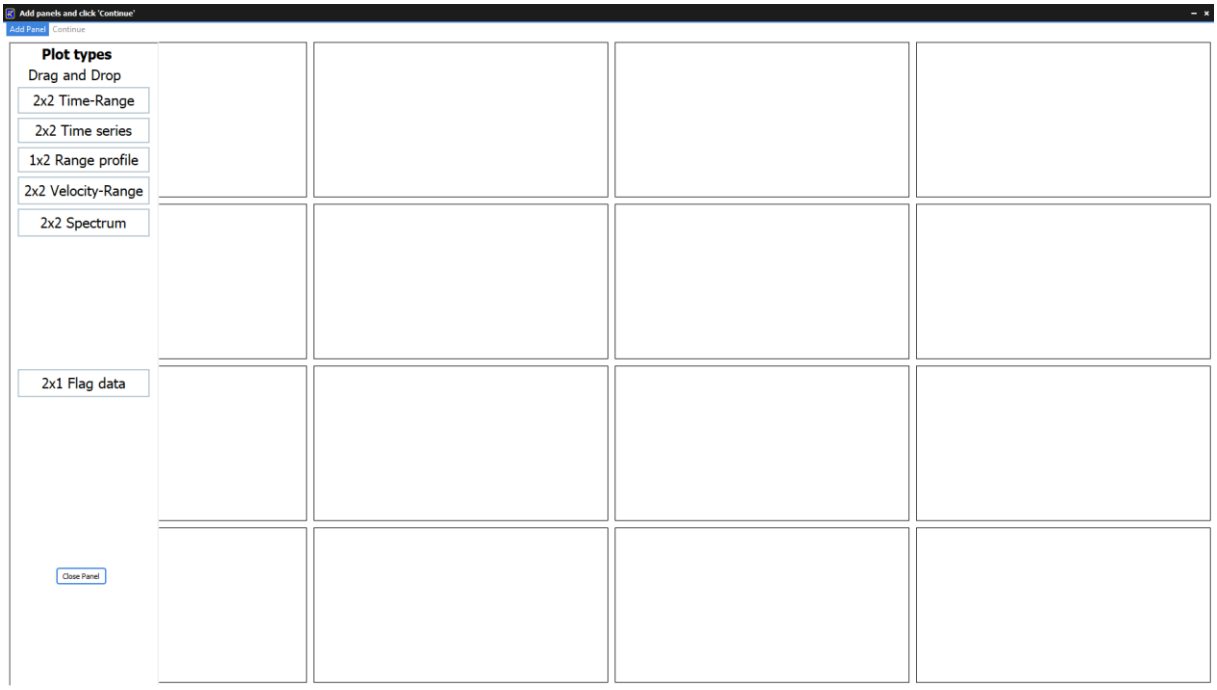

Figure 5.5. Sliding panel and the grid on the Layout Page.

The sliding panel contains different types of panels corresponding to different types of plots (i.e. Time-Range, Time series etc). The panel names contain two numbers indicating the panel size on the grid. For instance, 1x2 means 1 column and 2 rows.

To add a panel, left-click and hold the button corresponding to the type to add. Drag the mouse pointer to the grid. When the position is suitable for adding the chosen panel, the area for the panel is colored in green. If it is not possible to add the panel, the area is colored in red.

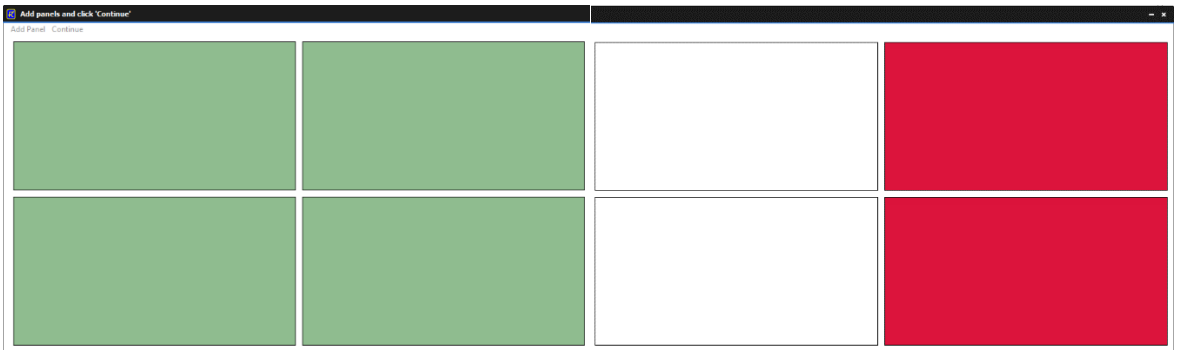

Figure 5.6. Green color means the panel can be placed here, red means the panel does not fit.

Release the mouse button to place the panel.

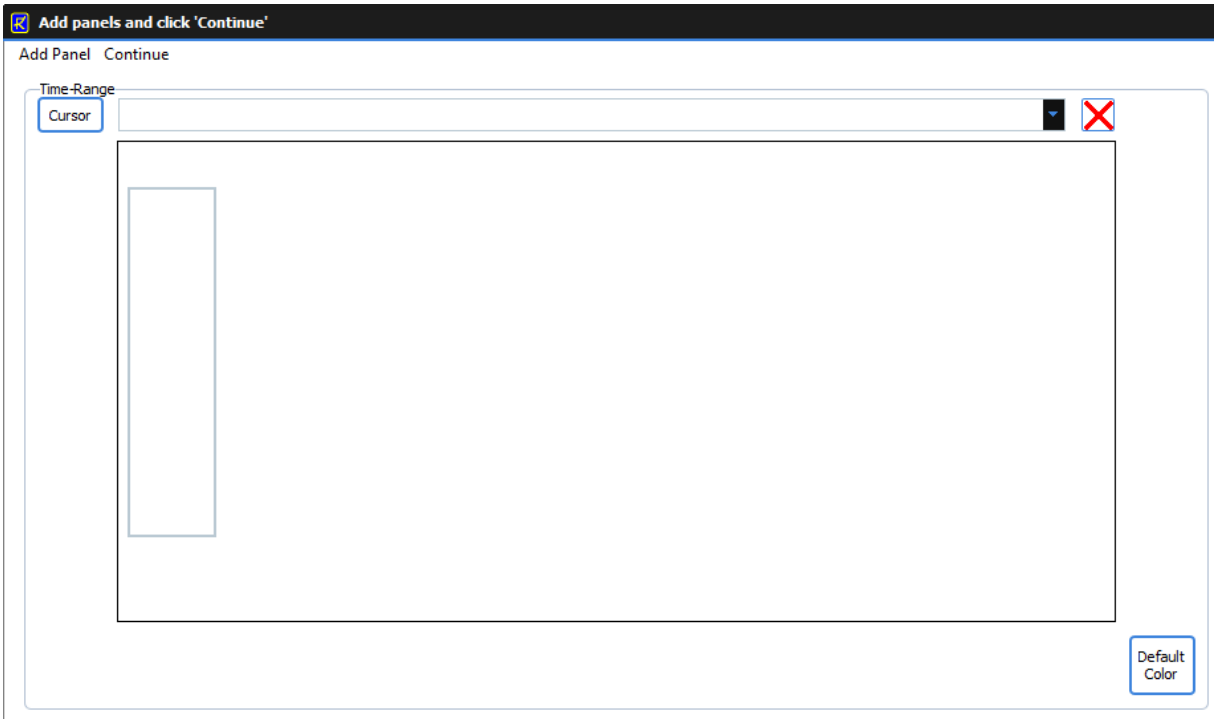

Figure 5.7. Example of an added panel.

In order to delete a panel, click the button ☒ on the panel.

The layout can contain as many panels as fit into the grid. Several panels of the same type are allowed.

When at least one panel has been added, the **Continue** menu item in the upper left corner of the windows becomes available. The layout can be modified later on. Clicking the Continue menu item switches the Visualizer to the **Calendar Page.**

5.8 Calendar Page

The Calendar Page provides a convenient interface to find a day for analysis. The calendar control unit on this page can be used to browse the dates. The calendar is the standard Windows tool and supports several views. By default, the monthly view is shown. To switch to yearly view, click on the month (September 2020 in the example below). To switch to the decade view, click on the selected year in the yearly view. The decades/years/months/days with available data are shown in light-blue color.

When the mouse pointer is located over a date with available measurements, the daily quicklook corresponding to the date is displayed. A number of files and total measurement time for the day are shown below the calendar.

In order to select a data for analysis, move the mouse pointer over it and click. The button **Open <Date> for analysis** becomes available. This button switches to the **Measurement Page** for the detailed analysis of the radar measurements on the chosen day.

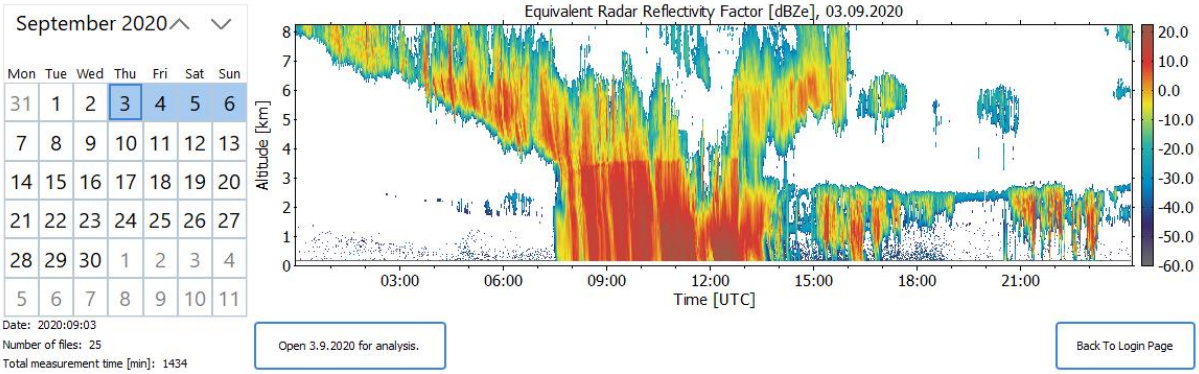

Figure 5.8. An example of the Calendar Page.

In order to return to the **Title Page** click the button **Back To Title Page**.

5.9 Measurement Page

With **Open <Date> for analysis** on the **Calendar Page**, the Visualizer accesses the data in the Target Folder and generates plots for each panel in the layout. The progress bar in the upper part of each panel indicates the processing progress. In the case of coupled dual-frequency measurements, the processing is performed separately for each radar and consequently, the progress bar is filled twice.

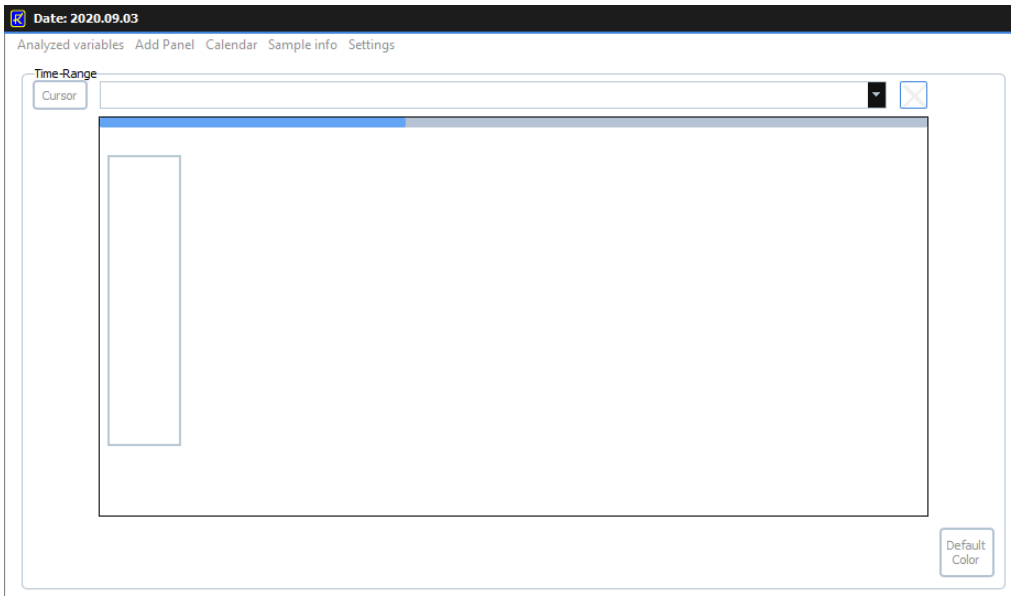

Figure 5.9. Data processing progress.

Once the processing has been finished, the data products are visualized.

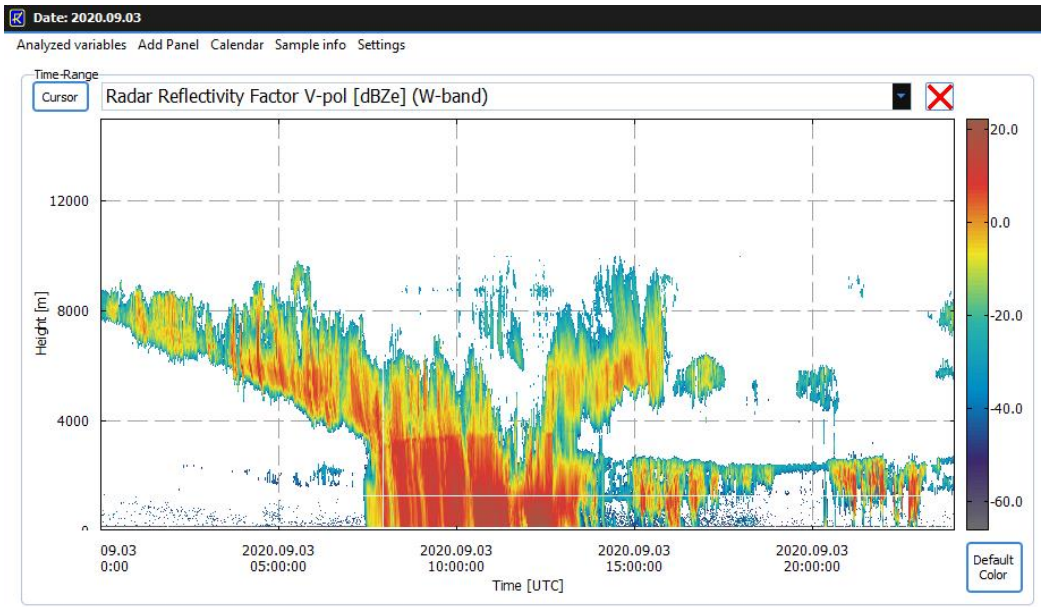

Figure 5.10. An example of the visualized data.

5.9.1 Analyzed Variables

Each panel can visualize a number of variables. By default, only a few variables are activated. In order to activate/deactivate variables, click the **Analyzed variables** menu item in the upper left corner of the window.

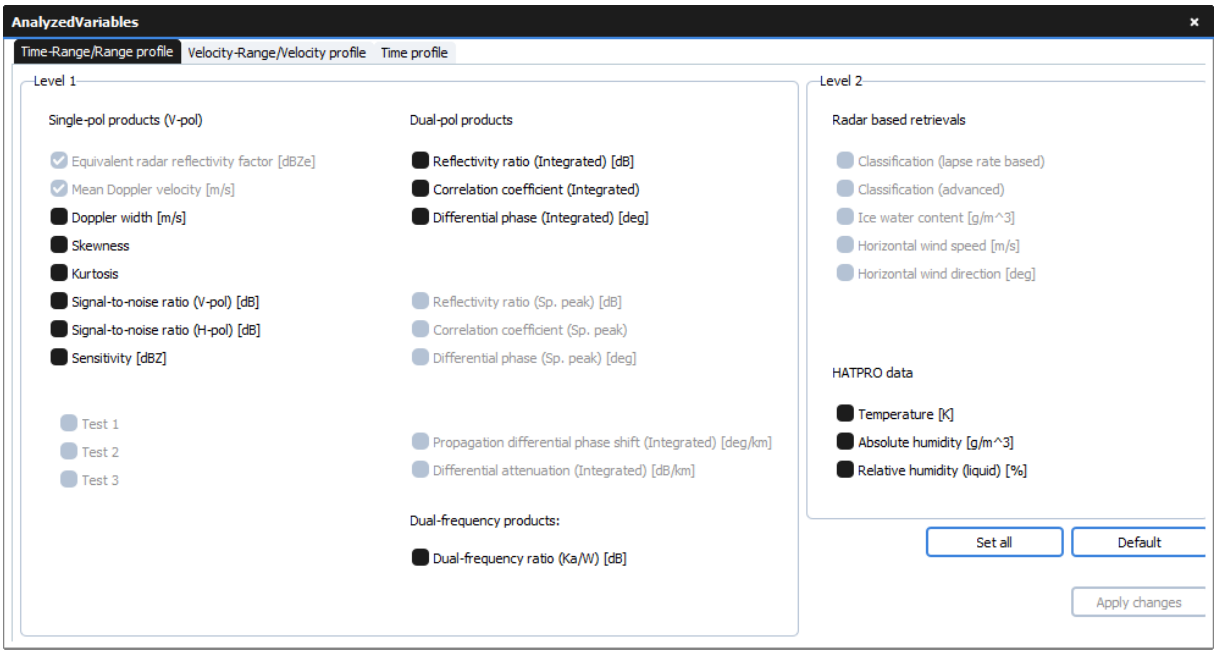

Figure 5.11. Data processing progress.

There are three tabs in the dialog window. The names of the tabs show, which panel types are affected by the tab. In order to activate/deactivate variables, set/reset corresponding check boxes. Note that disabled checkboxes cannot be modified by the user. To enable all available products, click the button **Set all**. To reset all the products, except for the default ones, click the button **Default**. Note, that **Set all** and **Default** buttons change only the currently shown tab.

To apply the introduced changes, click the button **Apply changes.** This button will store the changes on all the tabs. In order to discard the changes, close the dialog window.

The configuration of the **Analyzed Variables** window is stored in a special file in the application folder. Therefore, the settings will not be reset after the application restart.

For dual-frequency archives, the selected variables are available for both frequencies, i.e. there is no need to activate the variables for two frequencies individually.

5.9.2 Modification of Layout

A panel can be removed any time by clicking the button ☒ in the right upper corner of the panel. In order to add a panel, click the menu item **Add Panel** in the upper left corner of the application window. The procedure of adding a Panel is the same as in the section 5.7 (Layout Creation).

5.9.3 Changing the date within the chosen Archive

In order to open another date in the same Archive, click the menu item **Calendar**. Then follow the section 5.8 (Calendar Page).

5.9.4 Changing / Updating Archives

To change the Archive, click the menu item **Calendar**. On the **Calendar Page,** click the button **Back To Title Page.** On the **Title Page** click the label **Change Archive**. Follow the sections 5.1 – 5.6 to handle Archives.

5.9.5 Getting info about current sample

To get information about the chosen sample, click the menu item **Sample Info.** In the shown window the information from the file header is displayed. In the case of a dual-frequency Archive, the radars can be selected in the right upper corner of the window.

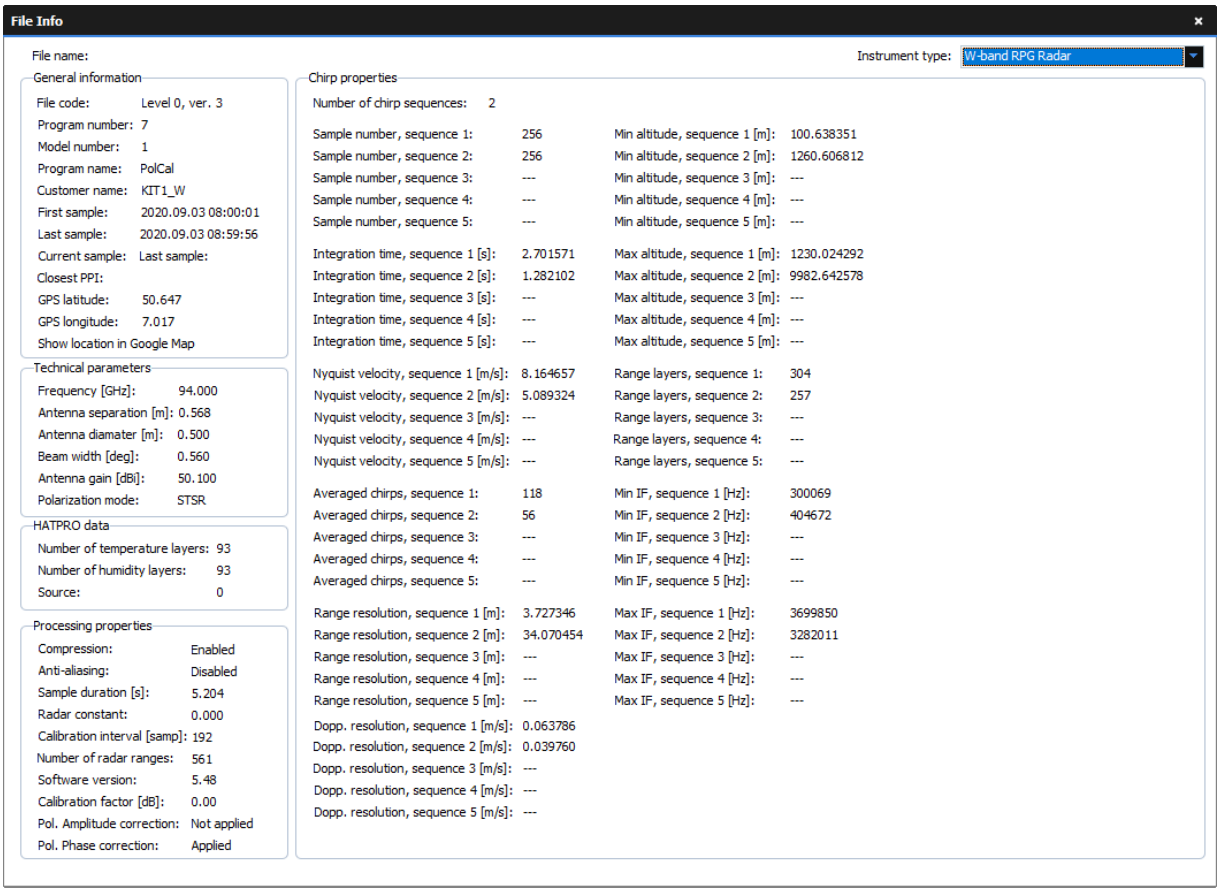

Figure 5.12. The Sample Info window.

5.9.6 Other settings

In order to get access to other settings, click the **Settings** menu item. Currently the following settings are available:

Calculate LV1 products from LV0: By default, this setting is disabled. When disabled, the daily images of the data are obtained using Level 1 files in the Target Folder. These files are generated by the File Manager from Level 0 files. Level 1 files are several orders of magnitude smaller than corresponding Level 0 files. The access to the integrated variables is much faster and the data analysis can be done even via slow network connections. Some variables, however, are not available in Level 1 files (e.g. integrated signal-to-noise ratio). Such variables are not displayed with the disabled setting. If these variables are required, the setting should be enabled. When enabled, all the variables are calculated on-the-fly from LV0 files, therefore the processing is several times slower in comparison to Level 1 files.

For fast connections (> 1 Gbit/s) to the Target Folder, the access speed reduction due to the activation of the **Calculate LV1 products from LV0** flag is not critical. For slow connections (< 100 Mbit/s) it is recommended to keep this setting disabled.

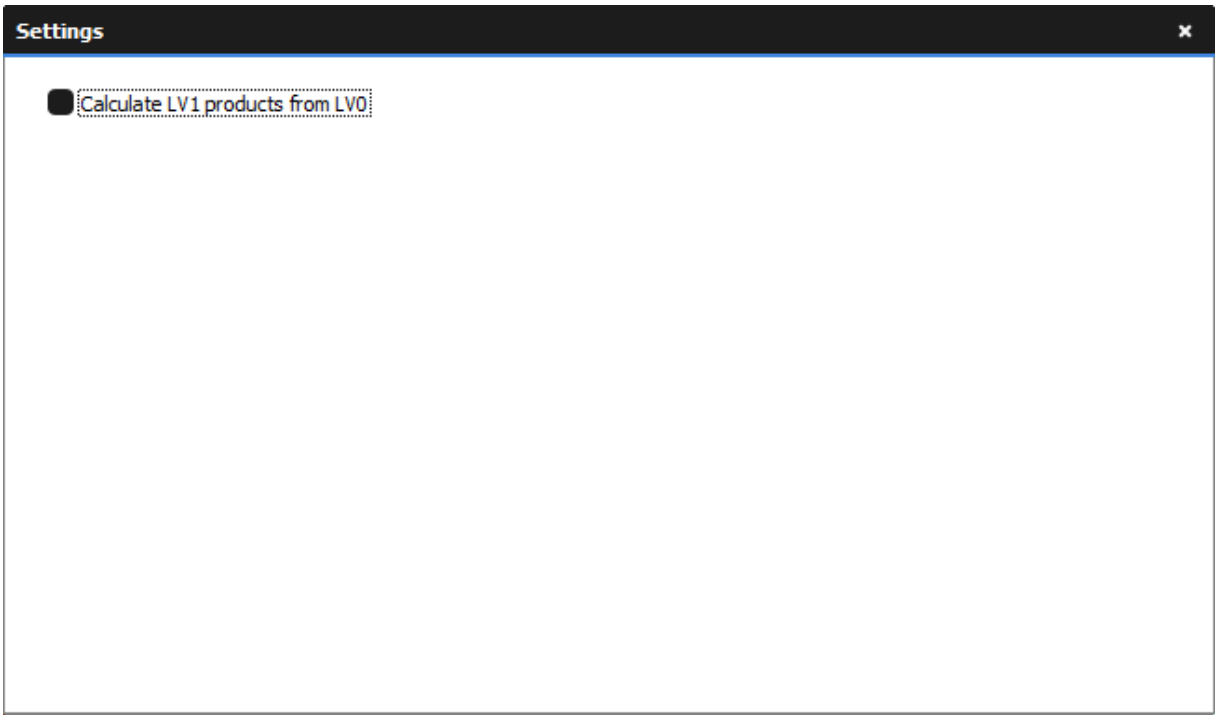

Figure 5.13. The Settings window.

6 Panels

There are two main types of panels:

2D Panel: plotting a parameter as a function of a single argument variable. The function is displayed as a line. Depending on the argument variable, 2D Panels can be of type **Time Series**, **Range-Profile**, or **Spectrum**. One panel can be of a single type, and it cannot be changed once the Panel has been created.

3D Panel: The second type of panels displays a parameter as a function of two argument variables. The parameter value is color-coded. A 3D Panel can be one of types **Time-Range** or **Velocity-Range**. There is also a supplementary type of panel which is used to visualize a flag parameter using color. This plot type is called **Flag Panel**.

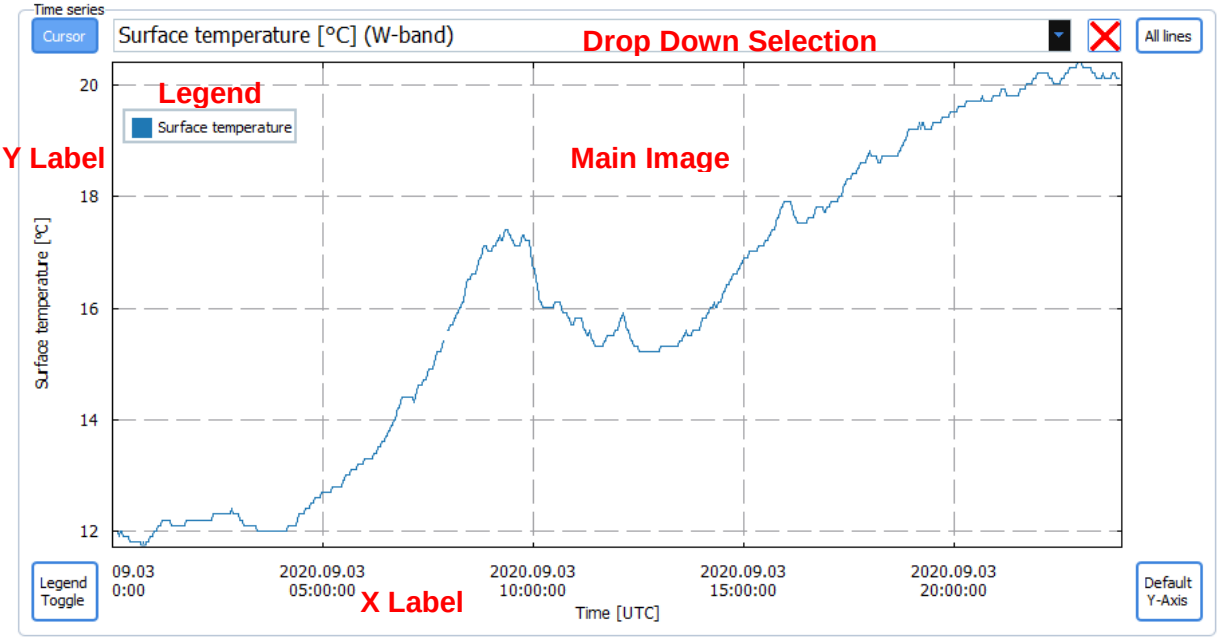

Figure 6.1. An example of the Time Series type of 2D Panel.

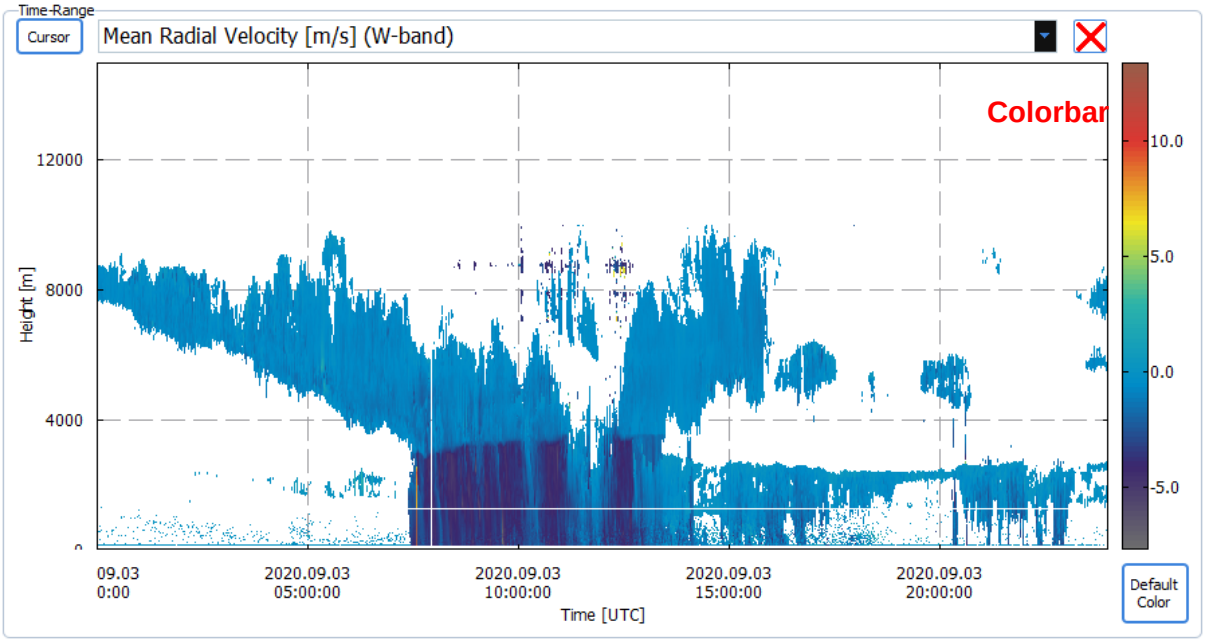

Figure 6.2. An example of the Time-Range type of 3D Panel.

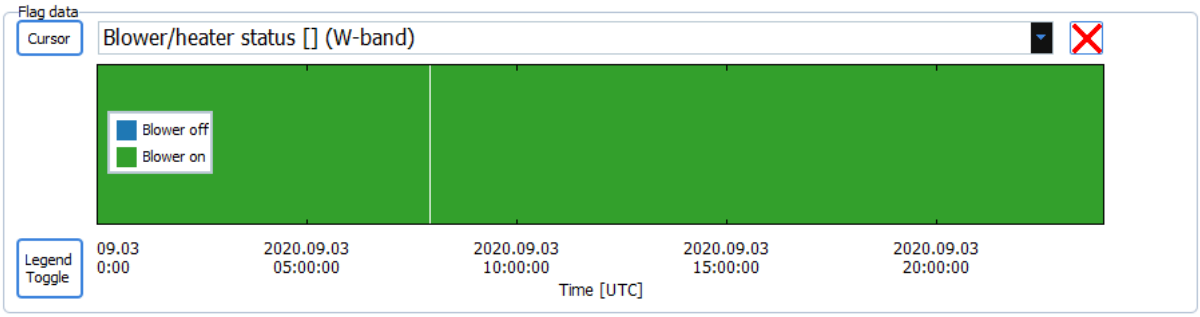

Figure 6.3. An example of the Flag Panel.

6.1 Structure of Panels

Every panel has its type (e.g. Time Series, Time-Range, etc.) indicated in the left upper corner.

All panels have a drop down selection in the upper part. The drop down selection indicates the name of the currently shown parameter. Changing the parameter is done by clicking on the drop box and by choosing the required parameter. If the required parameter is not in the list, see section 5.9.1 (Analyzed Variables) with instructions on how to activate parameters.

All panels have the button ☒ in the right upper corner. This button removes the panel.

The button **Cursor** in the left upper corner shows/hides the cursor indicating the currently chosen time sample, range, and velocity. The cursor is shown by black lines.

All panels show the image box where the chosen parameter is displayed. 2D Panels have X and Y labels. 3D panels have X and Y labels and also a color bar. Flag Panels have only the X label.

2D and Flag Panels display the button **Legend Toggle** in the lower left corner. This button shows/hides the legend.

2D Panels have the button **All Lines** in the upper right corner. This button activates the multi-line mode. In this mode, for some parameters several lines related to each other (for example temperatures of the environment, transmitter, receiver, and PC) are displayed by colored lines.

The legend can be dragged and dropped within the area of the main image. In multi-line mode, the shape of the legend can be changed to improve visibility. If the upper border of the legend touches the upper border of the main image, the legend items are arranged in a single row. If the left border of the legend touches the left border of the main image, the legend items are arranged in a single column.

6.2 Limit adjustments

All the panels allow for limit adjustments of X and Y axes and the color bar. On a 2D Panel, the adjustment of the displayed parameter indicated in the Drop Box is done by scrolling the mouse on the corresponding axis. For example, to change the temperature limits in Fig. 6.1 simply scroll the mouse on the Y-Axis. For a range profile, the scrolling should be done on the X-axis. In order to change the upper limit, the scrolling should be done in the upper (right) half of the axis. The lower limit is changed by scrolling in the lower (left) half of the axis. When scrolling is possible, the mouse cursor is shown either as a horizontal or as vertical double arrow. In order to reset the limits of the displayed parameter to the default values, click the **Default axis** button in the lower right corner of the panel.

On a 3D panel the displayed parameter is color-coded. Therefore, the limits are changed by changing the limits of the color bar. In order to change the upper limit, the scrolling should be done in the upper half of the color bar. The lower limit is changed by scrolling in the lower half of the color bar. When scrolling is possible, the mouse cursor is shown as a vertical double arrow. In order to reset the limits of the displayed parameter to the default values, click the **Default Color** button in the lower right corner of the panel.

The adjustment of argument variables (i.e. time, range, velocity) is done in a different way relative to displayed parameters (indicated in the Drop Box). When limits of an argument parameter change, the Visualizer has to access the data in the Target Folder and calculate all the products again. In order to change the limits on the argument parameters (to “zoom in”), select an area in the main image by pressing the left mouse button at the lower limits of the argument variables, moving the mouse to the upper limits of the argument variables and releasing the mouse button. During the mouse movement, the selected area is shown by a black rectangle.

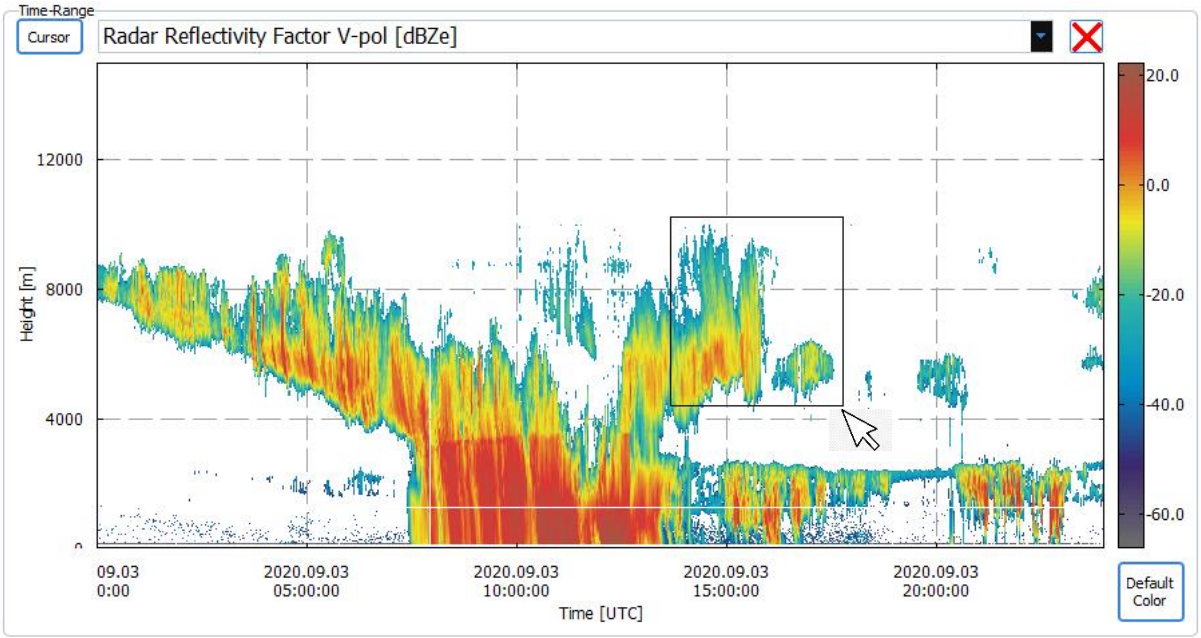

Figure 6.4. An example of adjusting time and height limits.

One of the panel features is the coupling of their argument variables. Changes in the argument variables in one panel leads to the same change in all the other panels.

In order to reset the argument variables (to “zoom out”), click on the main image with the right mouse button and select the menu item **Zoom Out**.

6.3 Selection of time / range / velocity

Some Panels such as e.g. Velocity-Range and Spectrum display data for a selected time sample and/or range. In order to change the chosen time/range/velocity, double click in the point of interest.

For instance, consider the following Time-Range Panel:

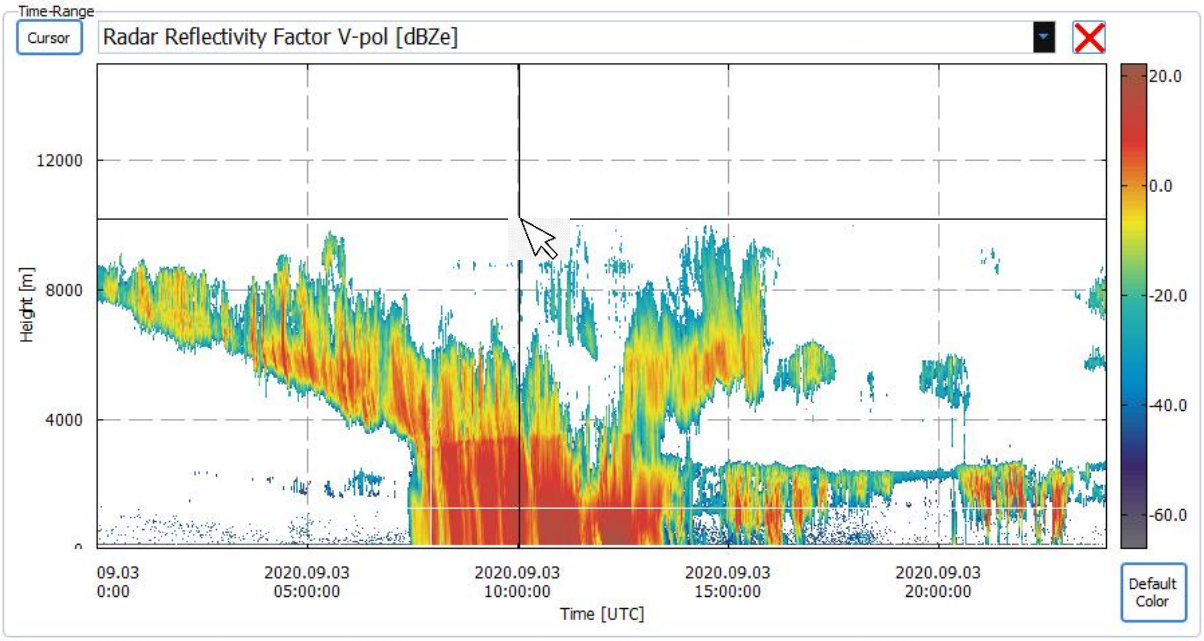

Figure 6.5. A Time-Range Panel after the double click.

To inspect a spectrogram at 10 AM UTC, put the mouse pointer over a point on the main image corresponding to 10 AM UTC and make a double click. After the double click the cursor (crossing of two orthogonal black lines) is displayed at the clicked point. The corresponding spectrogram will be displayed on the Velocity-Range Panel (see Fig. 6.6). The cursor’s vertical line indicates the selected time sample. The horizontal line of the cursor shows the chosen range. The selected time and range are used to display the corresponding data on other panels. To select a velocity, click on a panel with the velocity being the argument variable.

If the cursor is not shown, click the button **Cursor** in the left upper corner of the panel. Note, that the cursor flag is independent for each panel.

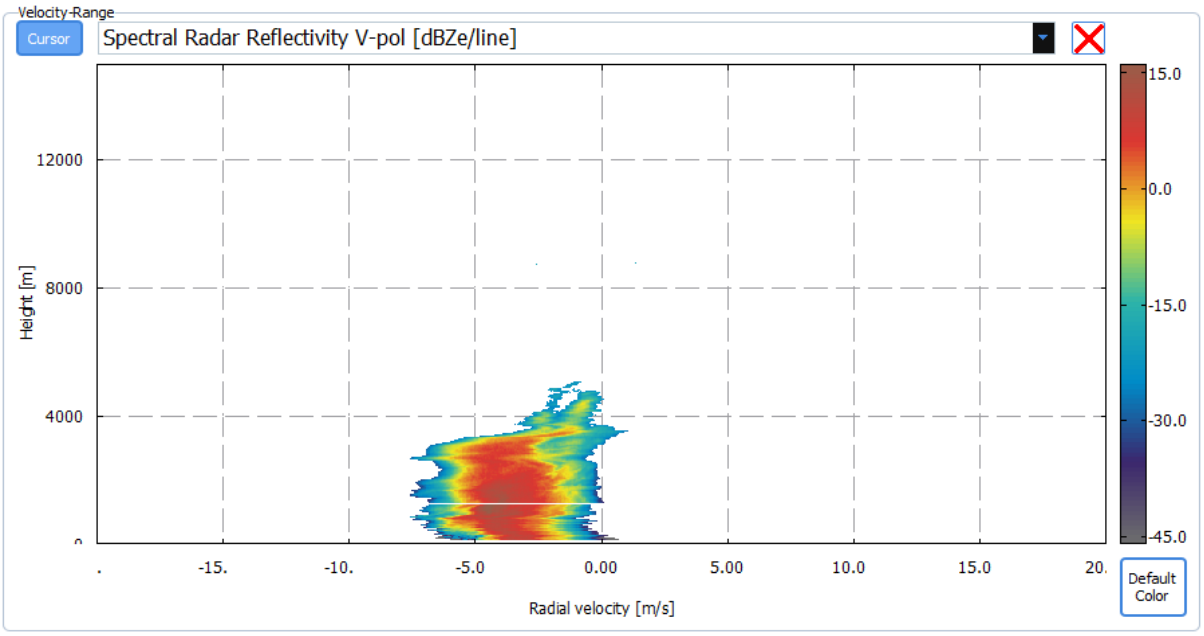

Figure 6.6. The spectrogram corresponding to the selected time sample at 10 AM UTC.

6.4 Changing the color scheme

3D Panels have an option to choose among predefined color schemes. In order to select a color scheme, click the left mouse button on the color bar. Then choose a color scheme in the menu.

APPENDIX A Basics of mapping a folder as a network drive in Windows

This manual shows a very basic approach to map the folder. Please consult with the IT department of your institution before implementing the mapping. **RPG is not responsible for any possible IT/security issues or data losses related to the folder mapping.**

In order to map a folder as a network drive, it has to be shared from the PC where it is physically located. For this open the Windows Explorer and navigate to the folder to share (in the example below C:\Work\RadarData\). Click on the **Properties** button.

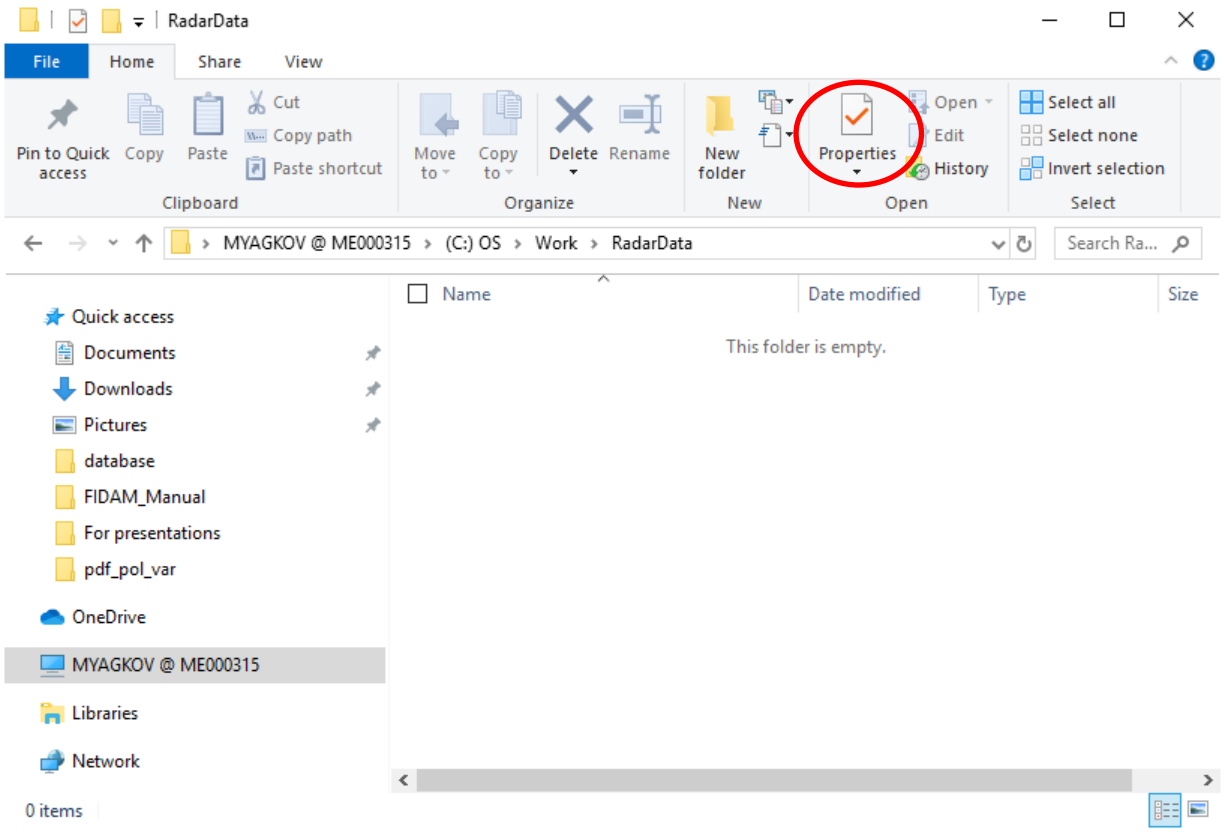

Figure A.1. Location of the Properties button.

In the dialog window go to the **Sharing** tab and click the **Advanced Sharing** button

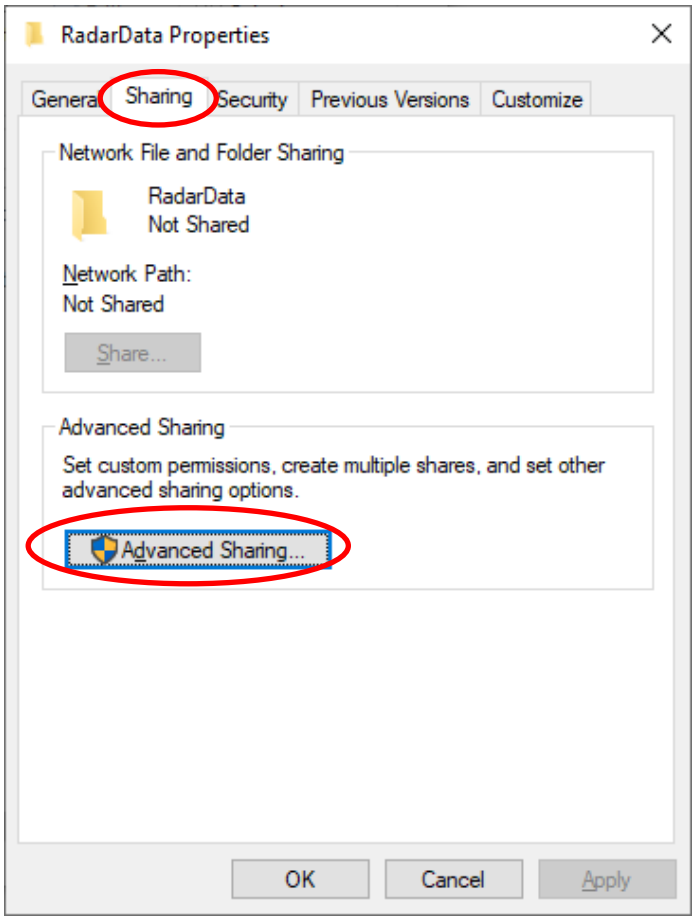

Figure A.2. Location of the Advanced Sharing button.

In the dialog window **Advanced Sharing** activate **Share this Folder**. Please write down or remember the **Share name.** It will be later required to create the Network Drive. Since the File Manager needs to create and delete files in the Source and Target folders it requires **Full Control** permissions. The permission rights can be set by clicking the **Permissions** button. Even though**,** in the example below the access is given to everyone, please follow your institutional regulations for providing the access to the folders.

Please consult the IT department of your institution to properly configure the access rights. **RPG is not responsible for any possible IT/security issues or data loss related to the permission configuration.**

The sharing is only shown for Windows OS. However, the sharing can be also made on any other OS. For sharing folders in another OS, please contact the IT department of your institution.

On the PC where the folder has to be mapped open the Windows Explorer and go to the content of the PC. Click the **Map Network Drive** button on the panel.

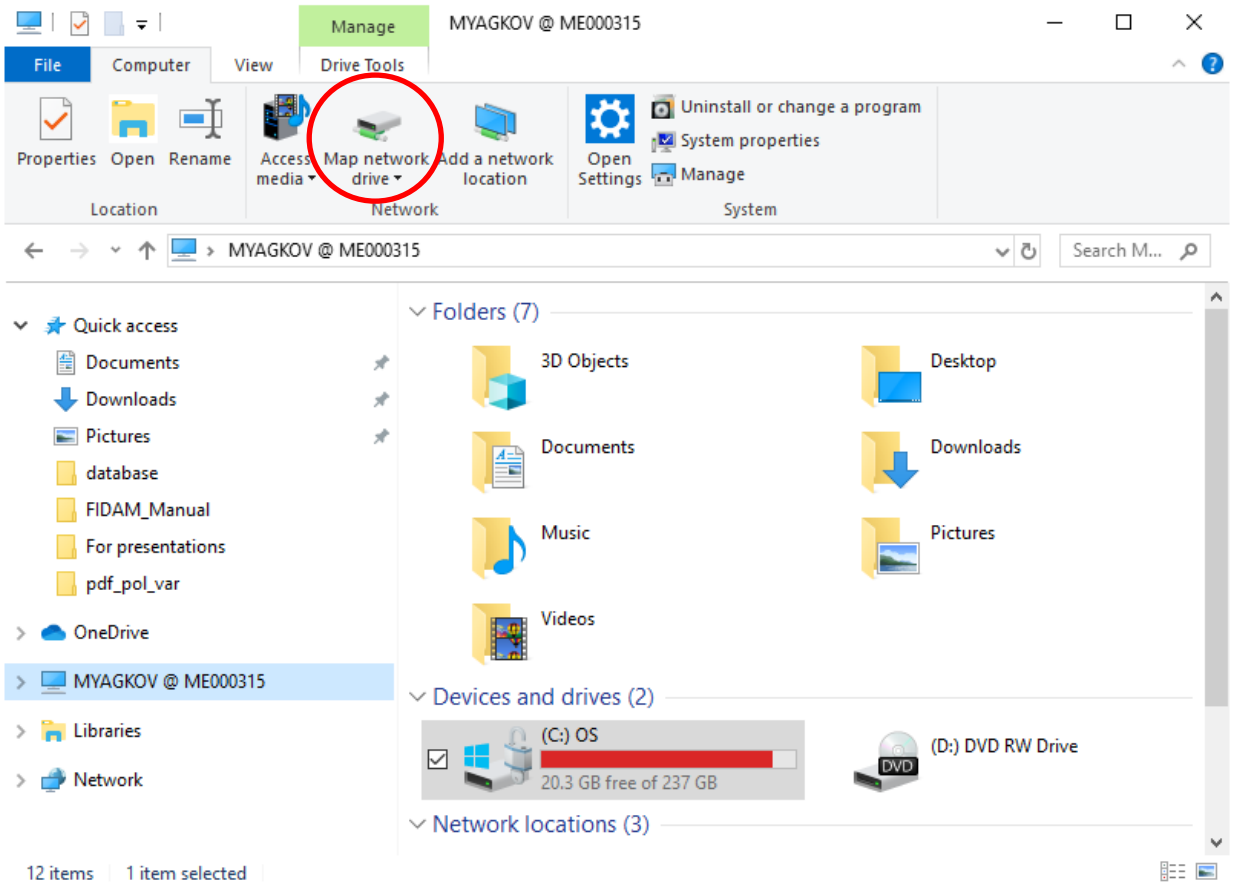

Figure A.3. Location of the *Map Network Drive* button.

In the dialog window choose an available letter for the **Drive** and type the **Folder** address.

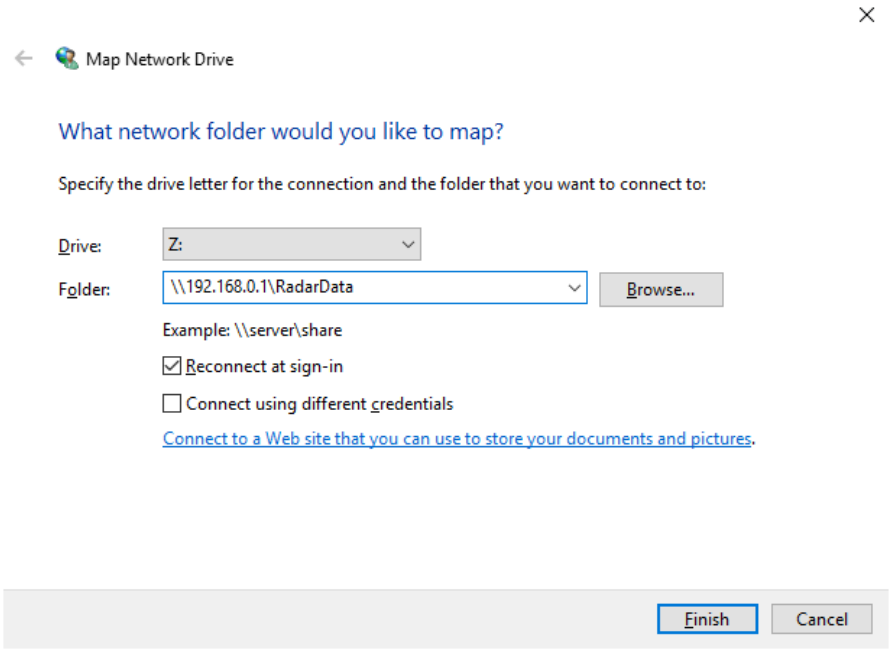

Figure A.4. Map Network Drive window.

If credentials are required to access the PC with the shared folder, please activate **Connect using different credentials**.

Click the Finish button. If credentials are required they will be requested. Upon success a window with the content of the mapped drive pops up.