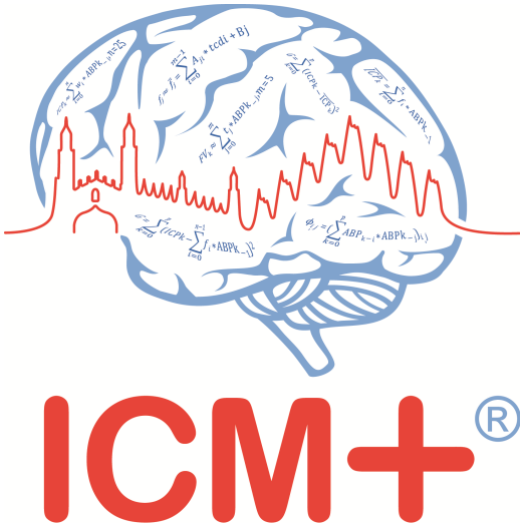
ICM+ Standard of Procedures



Getting started

May 2025

http://icmplus.neurosurg.cam.ac.uk

Table of Contents

Prerequisites

1. **A laptop (or a PC) with the latest ICM+** and the required monitor modules (e.g. GE Carescape) installed

2. **Appropriate cables** – connection to the monitor will differ depending on the monitor make and model. Most of the time it will be a serial null-modem cable connecting the serial port on the monitors with the serial (RS232) port on the laptop with ICM+. However, there may be variations, a straight modem cable might be needed instead for example. Also, for some monitors, like GE Carescape or Integra Cerelink, a specific USB-Serial adapter supported by the manufacturer will be required. These will need to be established on individual basis – please contact ICM+ support for details.

3. **Serial port available in the laptop** - If no serial port is available on the laptop an appropriate USB-Serial adapter must be used (eg https://www.startech.com/en-gb/cards-adapters/icusb232pro). However, if also a null modem connection is needed a cable that combines both is a better choice: https://www.startech.com/en-gb/cards-adapters/icusb232ftn

4. Optional file server, for archiving the data.

Locking and unlocking ICM+

ICM+ includes a simple system of user based permissions, which allows it to be used safely in a clinical environment, also by people with minimal training, ensuring that the vital data collection process is not inadvertently interrupted or disturbed.

If your ICM+ is correctly configured when the program is run it will automatically initialize with the default user 'Nurse'. There are three other users already configured in ICM+, the Administrator, the Manager and the Operator. The users have been configured with progressively decreasing operational rights.

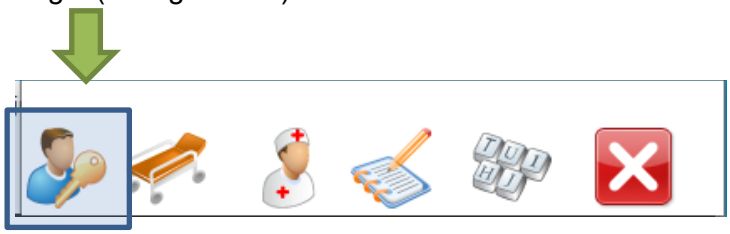
The **Nurse** is the user with the fewest rights in the software, effectively only being able to insert clinical events, browse the charts and starting new sessions, without any possibility to disrupt the data collection procedure. Please refer to the 'How to use the events form' for more details. After 3 minutes of inactivity, ICM+ automatically logs in as a Nurse.

The **Administrator** is the user that will have full access to the full features of the application.

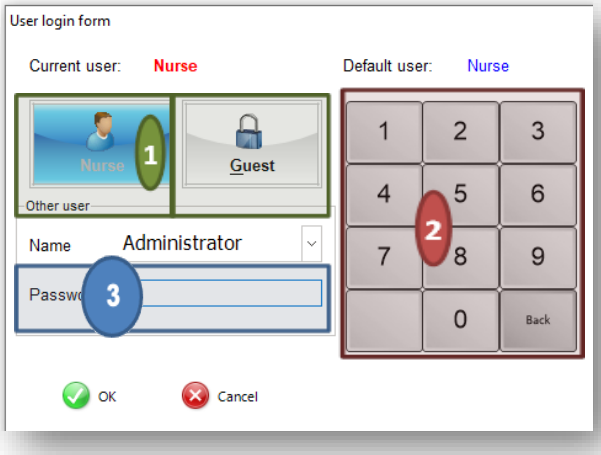
The **Manager** will have the same privileges but will not be able to manage user accounts.

The **Operator** will only be capable of starting new Recording sessions with available profiles, browsing data, inserting clinical information, display configuration as well as, importantly, pausing the session, moving beds or discharging the patient (closing the session).

Login (change users) form is accessible via a button on the tool bar/main menu bar.



When the Login button is pressed, the User login form will appear.

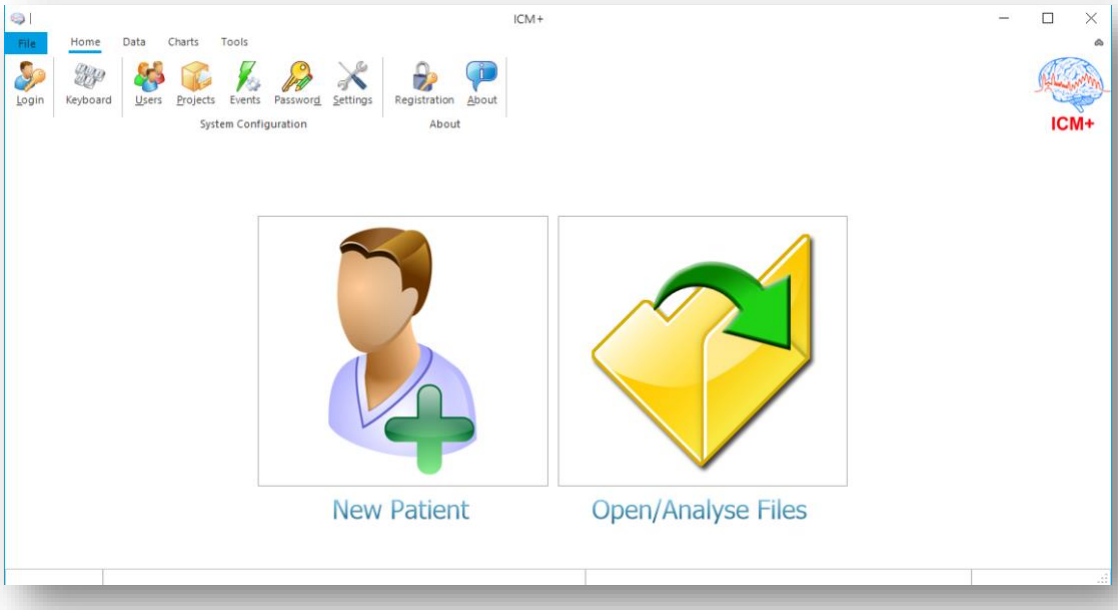


In this form you will find:

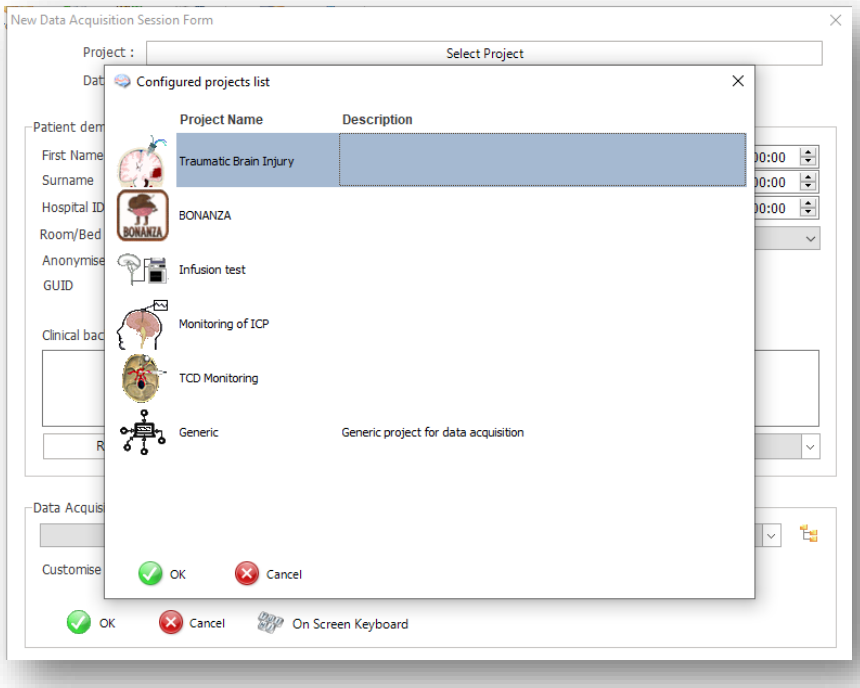
1. A button to the Default user and a button to lock the application so that nothing but the login button is accessible.
2. A key pad to insert the Password for a given use.
3. And a Drop-Down menu to select the user to Login as

Starting a new data collection session

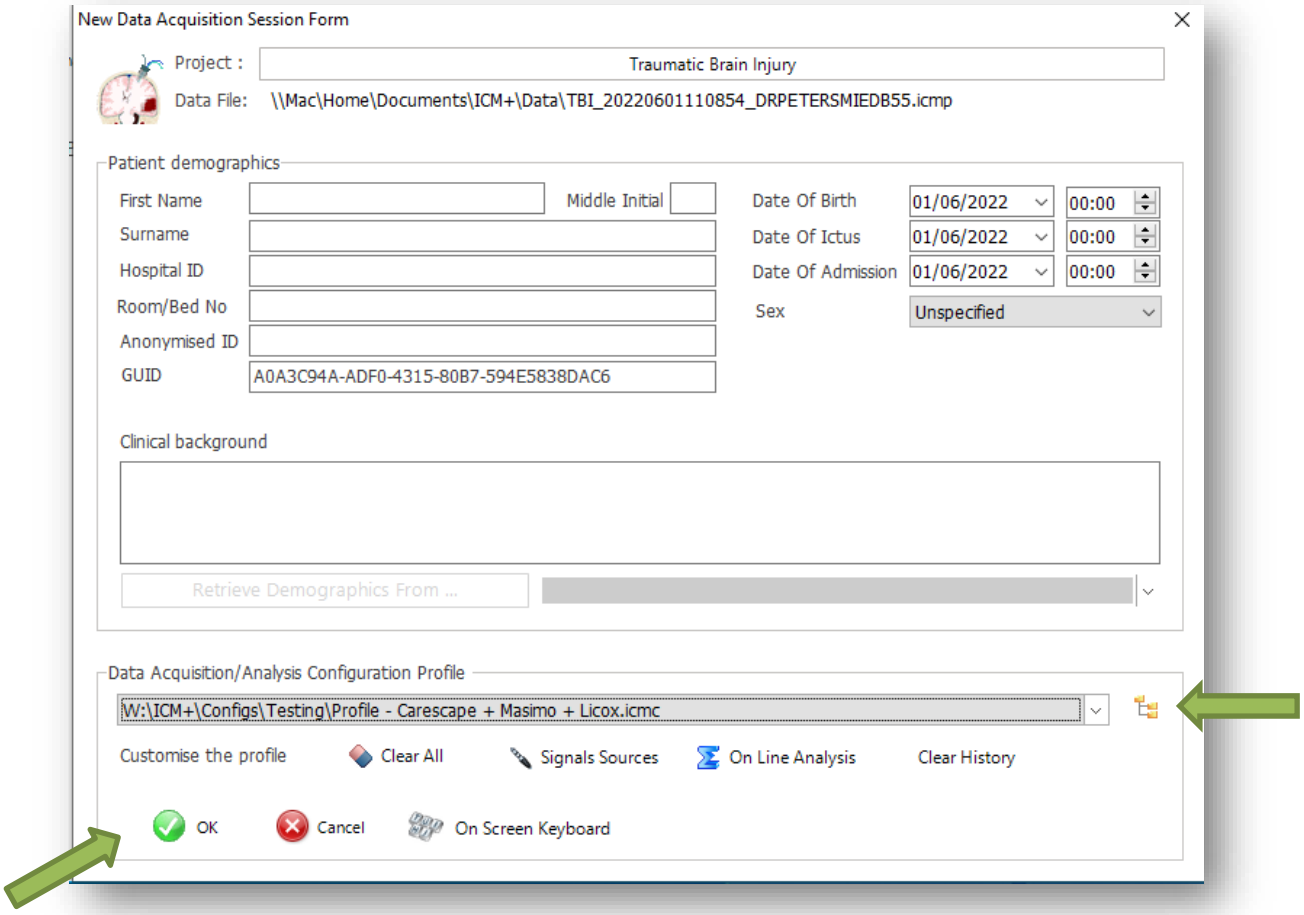
To create a new data acquisition session click on the New Patient button.



Clicking on New Patient will open a Project Selection form, where preconfigured projects will be listed:

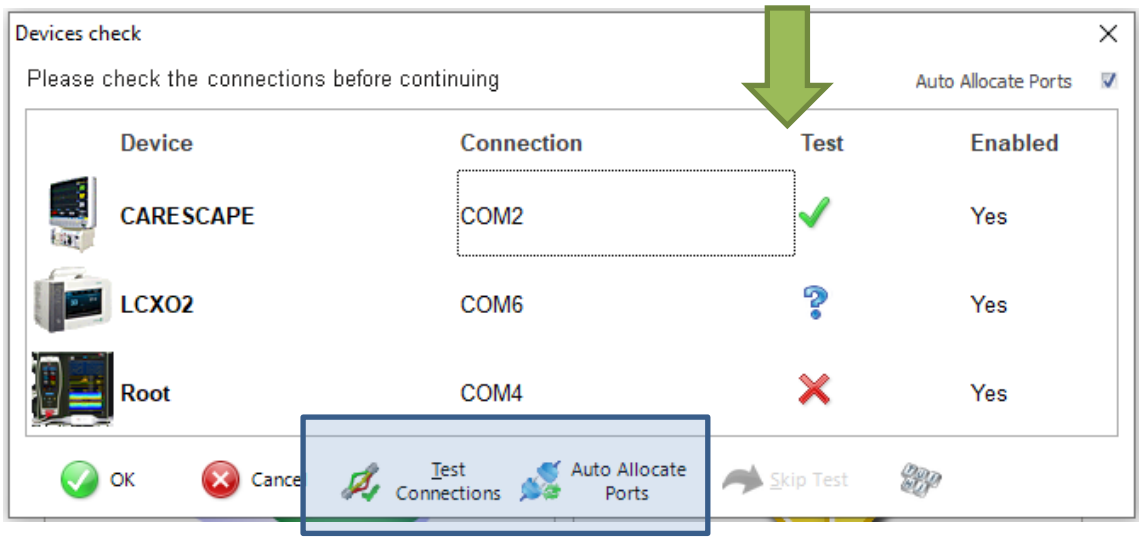


Choose a relevant project. This will bring up a new form:



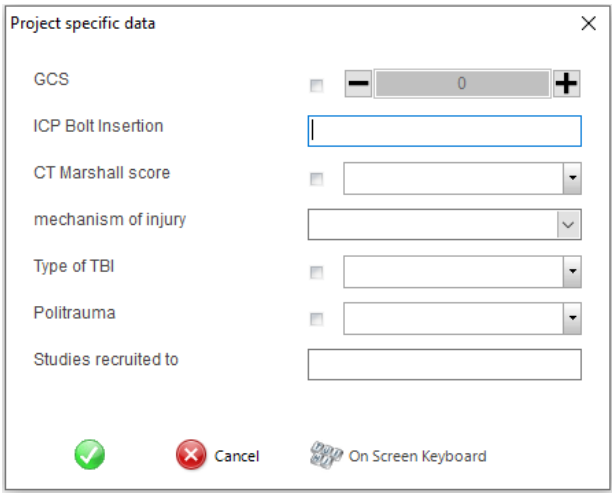
More importantly a data acquisition/analysis profile (configuration) file should be selected, either from the history list box or loaded from the file system. These can then be modified, if necessary, using Signal Sources editor (describe below), and/or On Line Analysis editor.

After the OK button is clicked, the Devices check dialogue is presented.



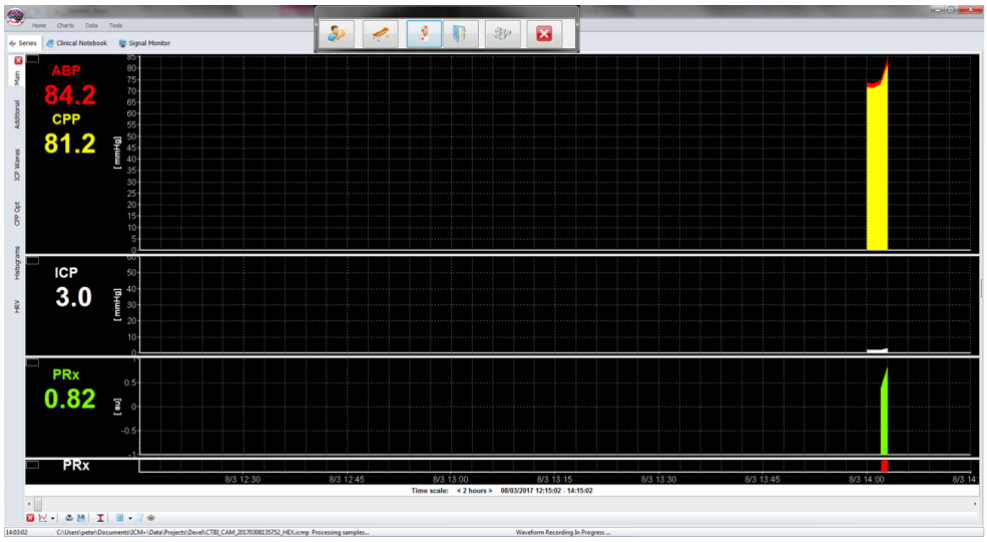
This dialogue is used to test the communication between the ICM+ and the monitor (the ‘Test connections’ button) and it is also accessible from the Data manu tab later.

This form can also be used to modify the connection port (if it is a serial connection) or an IP address (in case of a network interface). For serial connections, the button ‘Auto allocate ports’ can be used to initiate the process of scanning and testing all the available ports for automatic port allocation.

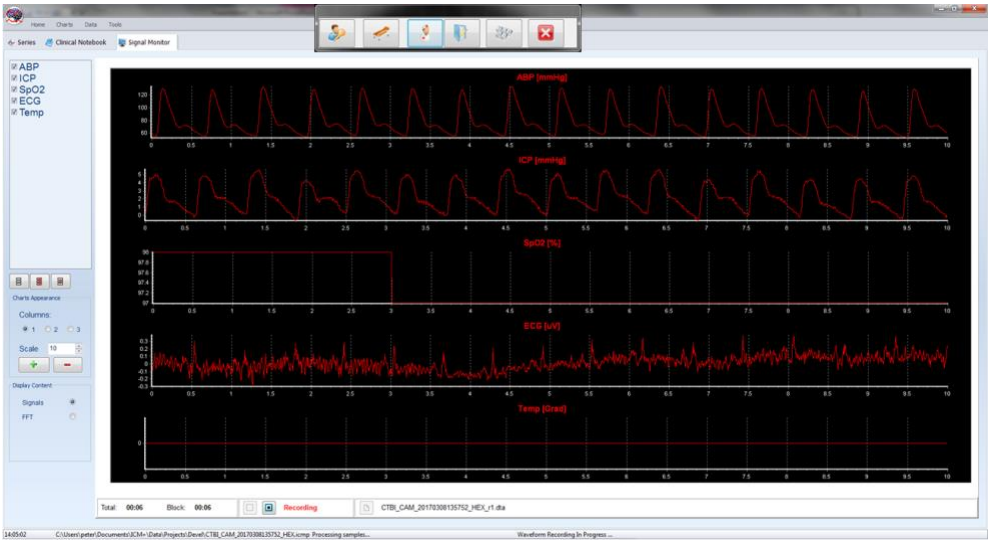


Just before the session starts, the user is prompted to insert some additional information about the patient, if configured, via the Project Specific data dialogue. This form is also accessible from the Patient Notebook tab but it is highly recommended that it is filled in, as much as possible and practical to do, at the start of the session.

After this dialogue, ICM+ main chart display is presented and the session begins recording automatically, if this behaviour is configured in the used project. Otherwise use Start button to start data acquisition (see below). The charts with configured calculated parameters will get updated with the rate specified in the configuration profile. In order to see the raw data as it comes in from the monitor(s) click on the Signal Monitor tab, or the Monitor button is the tab is not available yet (see below).

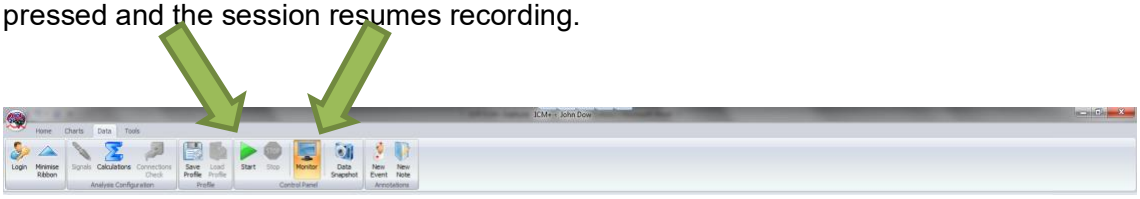


Data analysis, main, display (as configured in the loaded profile). The charts can be modified using Charts top menu tools.



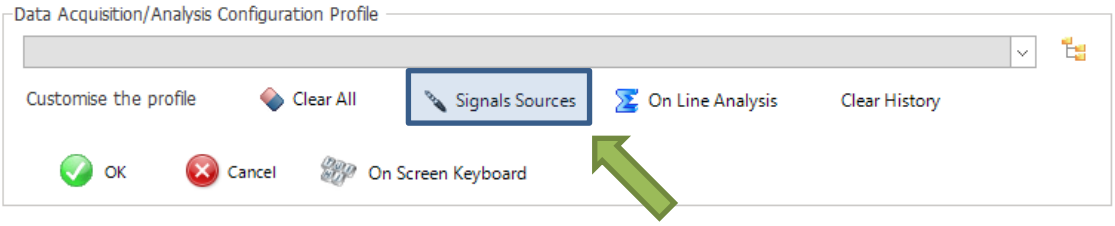
The raw signal monitor, showing all the data as it comes in. Please note that the raw data is stored in a separate file (or files if the one grows too large) with the name shown at the bottom of the monitor signals panel (file extension *.dta).

If ICM+ **shuts down during a recording session** the next time it is run, the previous session is automatically restored, but here the user must first verify that all the signals are being received correctly in the Monitor button. After this the Start button must be pressed and the session resumes recording.

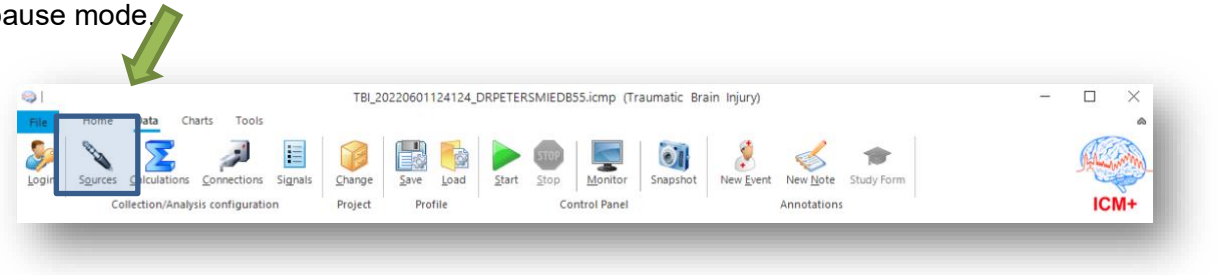


Manually configuring data collection

If there is no prepared profile available that includes desired data collection from the monitor or if there is a need to modify or add parameters downloaded from the monitor Signal Sources option needs to be used. This can be done in the New Data Acquisition Form:



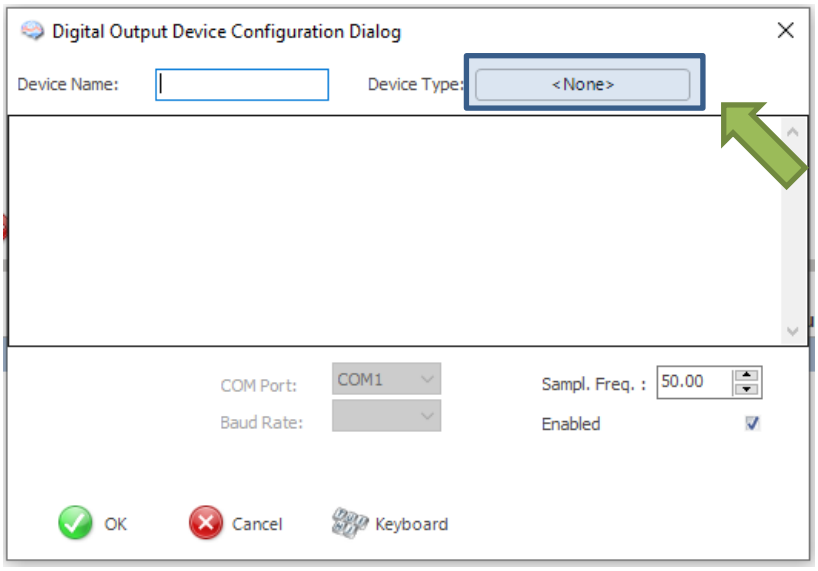
Or using Signals button in the main Menu (Data Section), with the data acquisition in pause mode.



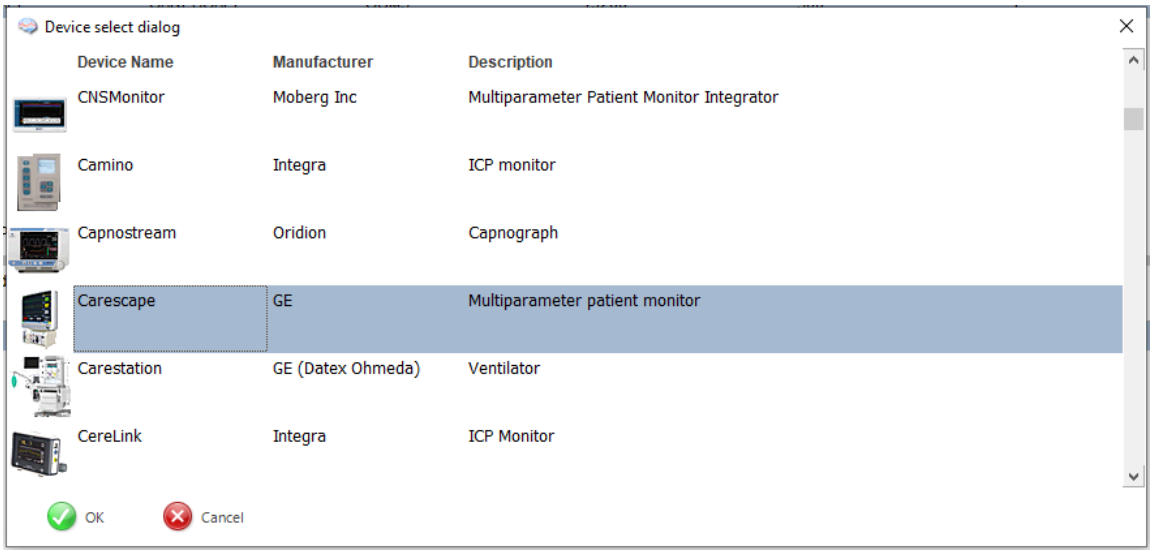
This brings up the Sampler Configuration form:

Clicking on Add button in the upper part (Digital Output devices tab) opens a Device Configuration dialog.

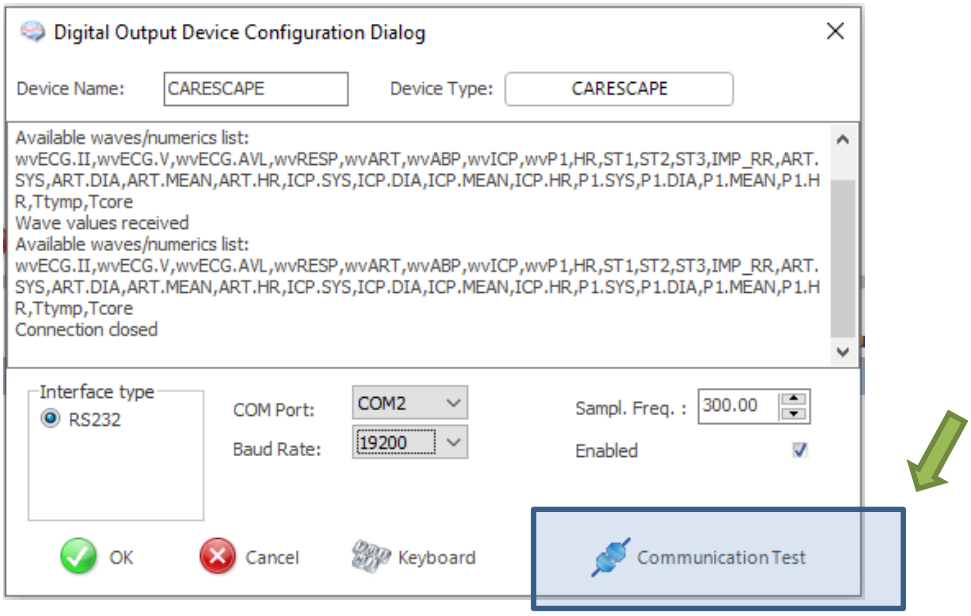
Here, one can select the monitor module from the list of available (installed) interfaces, as well as specify the serial port (real or virtual, when using USB-RS232 adapter) and its baud rate to match the one configured/offered by the device.



Clicking on the Device type button a list of available, installed, monitor modules will be available to choose from:

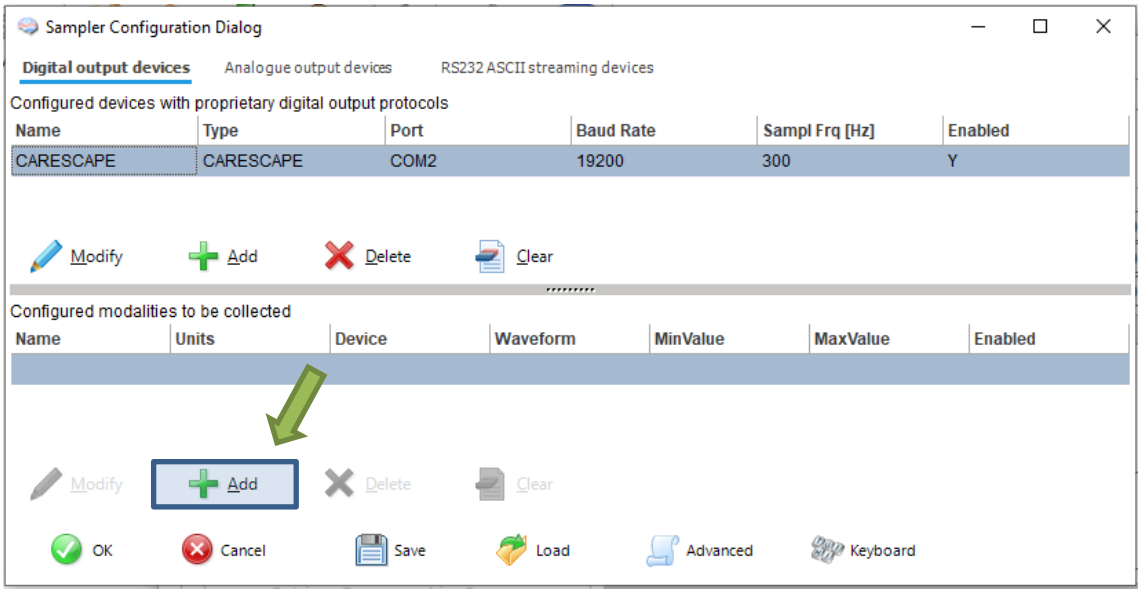


When the correct interface module, the COM port and the baud rate is chosen, clicking on ‘Communication Test’ will try to establish communication with the monitor and the log of that communication is printed in the memo box, listing also all the parameters that are available to download from the monitor .

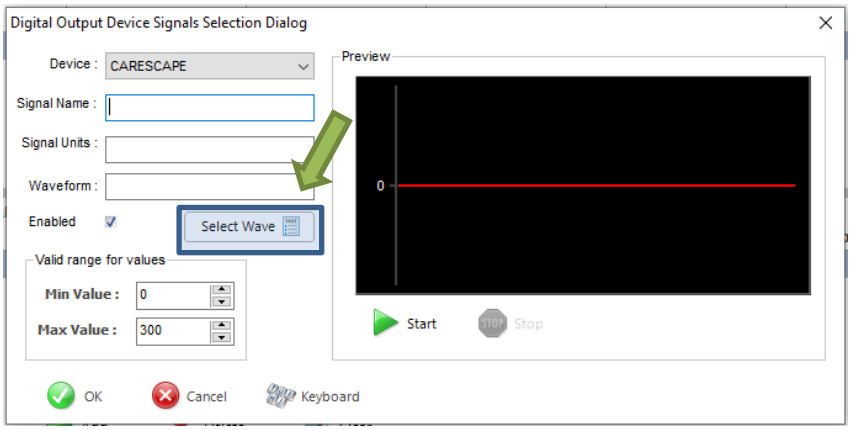


When the connectivity is confirmed the dialog can now be closed, which causes the device to be added to the data collection configuration.

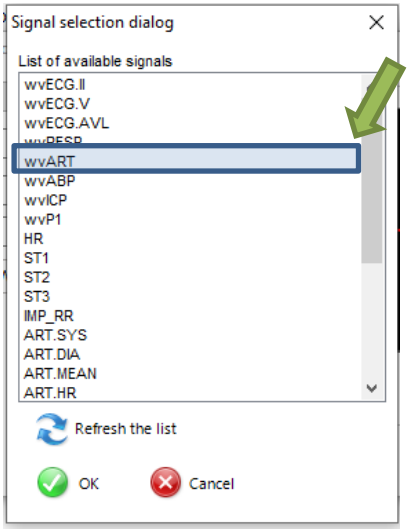
What remains to complete the configuration is adding to the configuration all the desired parameters to be downloaded. This can be achieved by using the Add button in the lower part of the Sampler Configuration dialog.



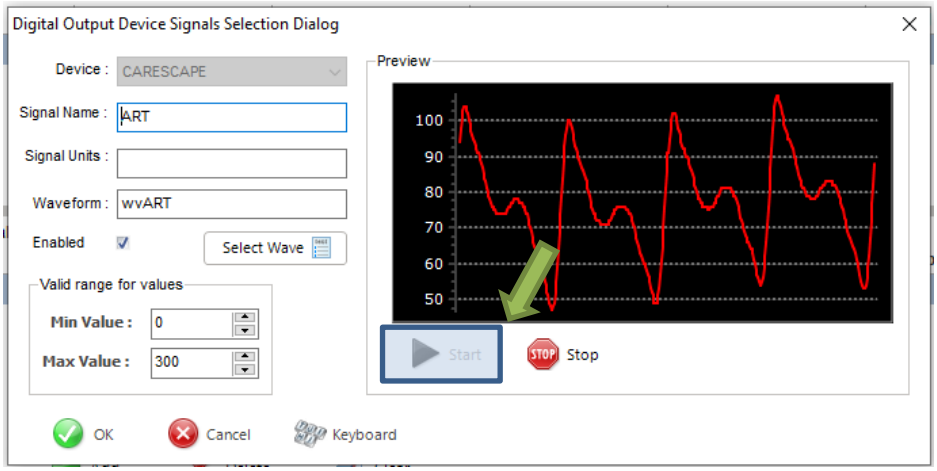
This opens a signal selection dialog:



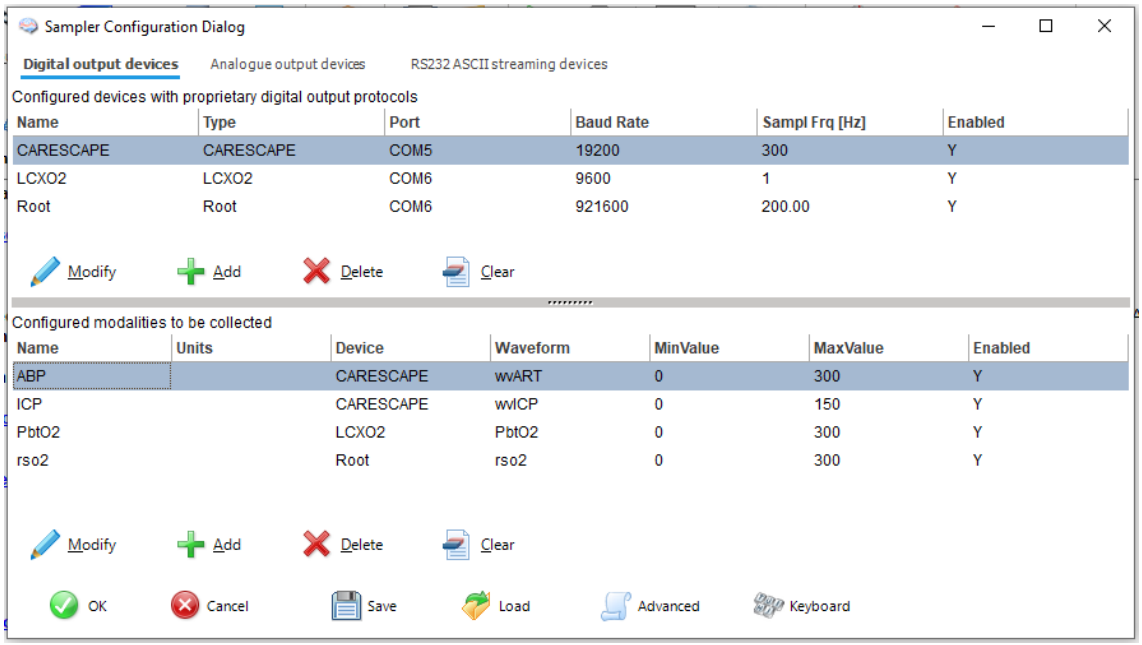
Using the 'Select Wave' button one can select available signal, one at a time.



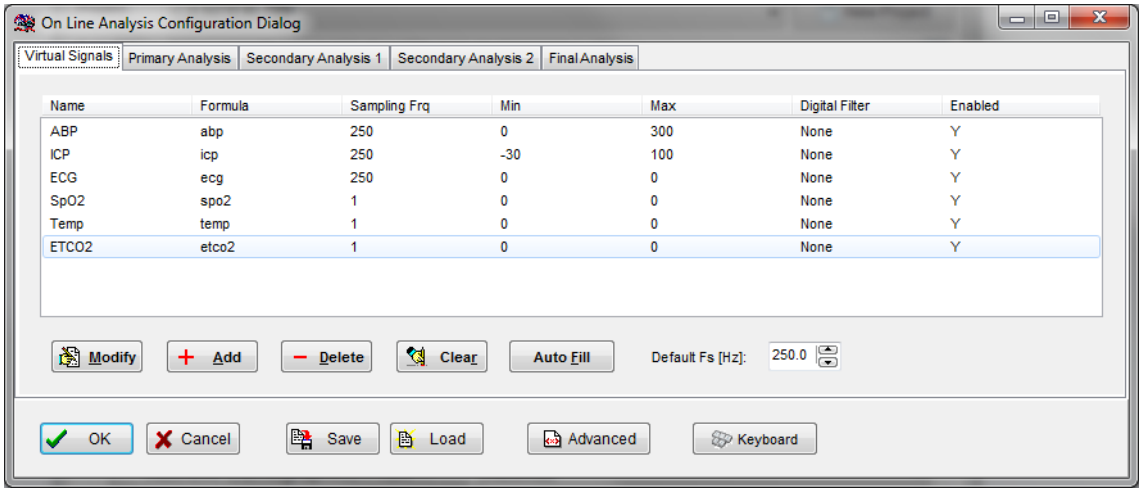
When a parameter is selected one can test if the data is coming in as expected by using the Start button



This process can be repeated as many times as it is needed putting together the complete list of parameters to be collected, which complete the data acquisition configuration procedure.



Please note, that adding parameters/signals to the data collection will make ICM+ show and record the data through the Signal Monitor window but the trends charts will not automatically get configured to show them. This is because the trend charts only show results of calculations, not the raw data. So to display even just a mean trend of a newly added variable collected from the monitor ICM+ this needs to be configured first in the analysis section, as in picture below, and then the new trend added to the charts.



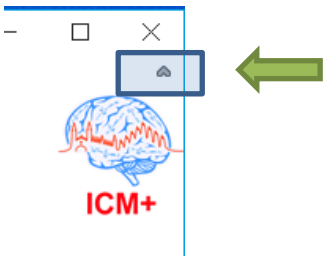
Annotating clinical events

As soon as the acquisition of data starts the main menu tool bar will get minimised and in its place a small, ‘data acquisition essentials’, tool bar will open, as below.

There, from left to right the following functions are accessible:

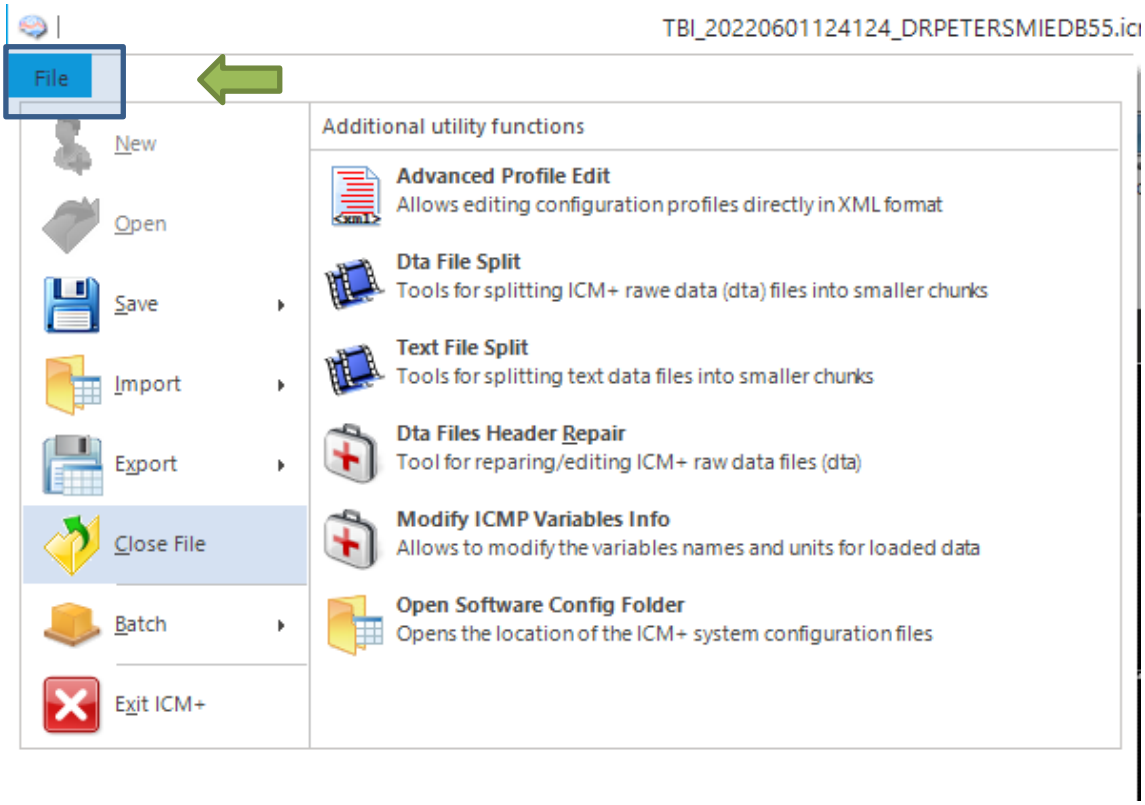
1. Log-in/Log-off form – to change the user (ie privileges)
2. Patient Discharge/Bed change button
3. Event annotation form
4. Free textual annotations form
5. An on-screen keyboard
6. The last button closes this tool bar and unfolds the main men toolbars

The toolbar can also be open or hidden using a little arrow button in the top right corner:

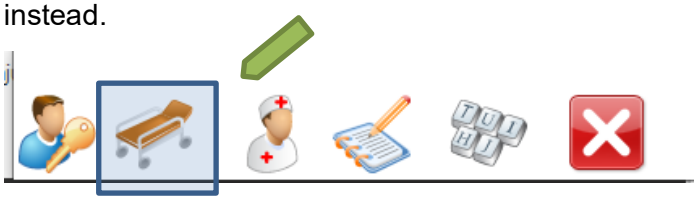


Terminating the data collection session and uploading the data

When the data acquisition process is finished (patient discharged) the recording session can be closed using the Close button present in the ICM+ button. This will initialize a cascade of forms that will eventually lead to the sealing of the file and subsequent archiving the data to the file server, if required.

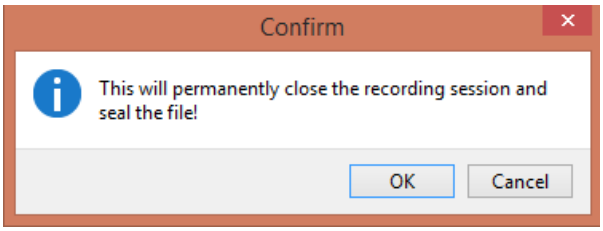


If the data acquisition tool bar is opened, click on the Discharge/Bed transfer button instead.

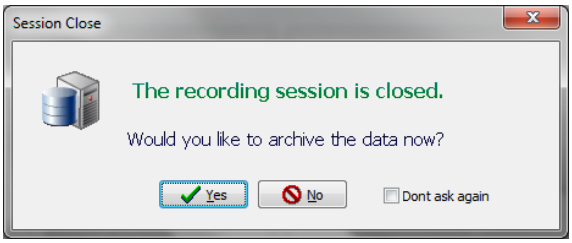


Closing a session is different from closing the program. To close the ICM+ application you need to press the red cross present on the upside corner of the right side of the screen. If ICM+ is closed (Exited) using this button or if the computer shuts down, the next time it is run, the recording session will be resumed with the same configurations it had at the moment of shutdown.

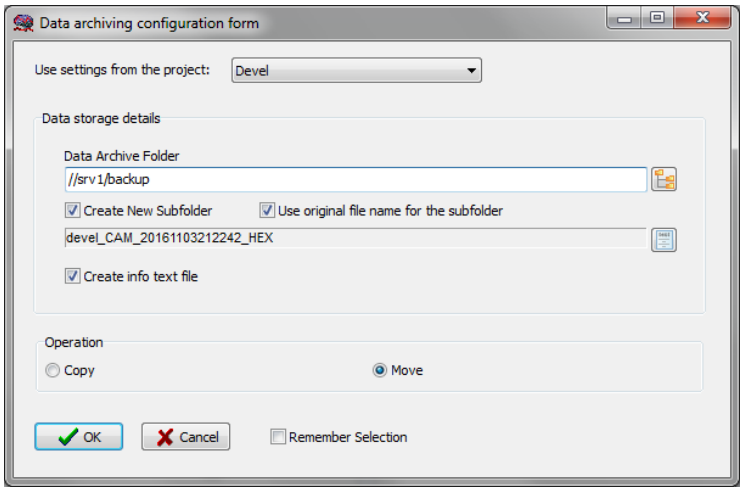
When this Close/Discharge button is pressed a dialogue is presented prompting the user to confirm the closure of the recording session:



After confirming the end of the recording session another dialogue is presented prompting the user to archive the data:



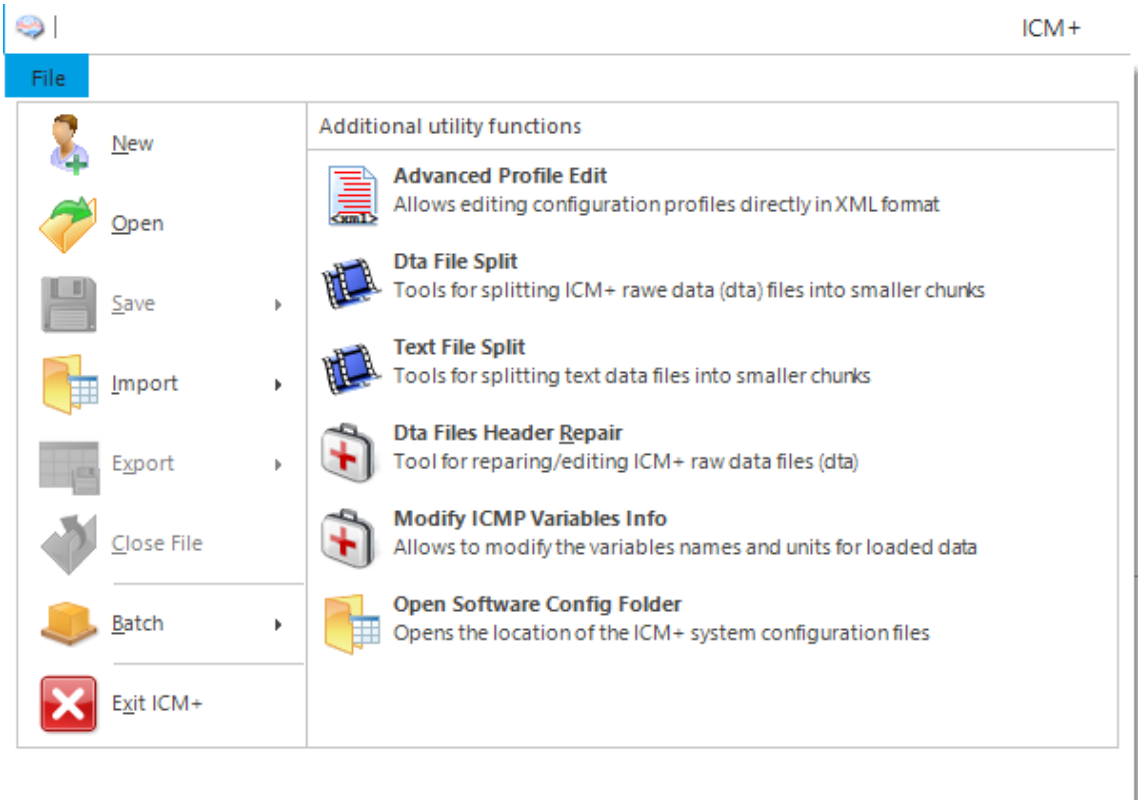
After confirming this dialogue the Data Archiving Form is presented, where the user can specify/confirm the location of the server and its share to use:



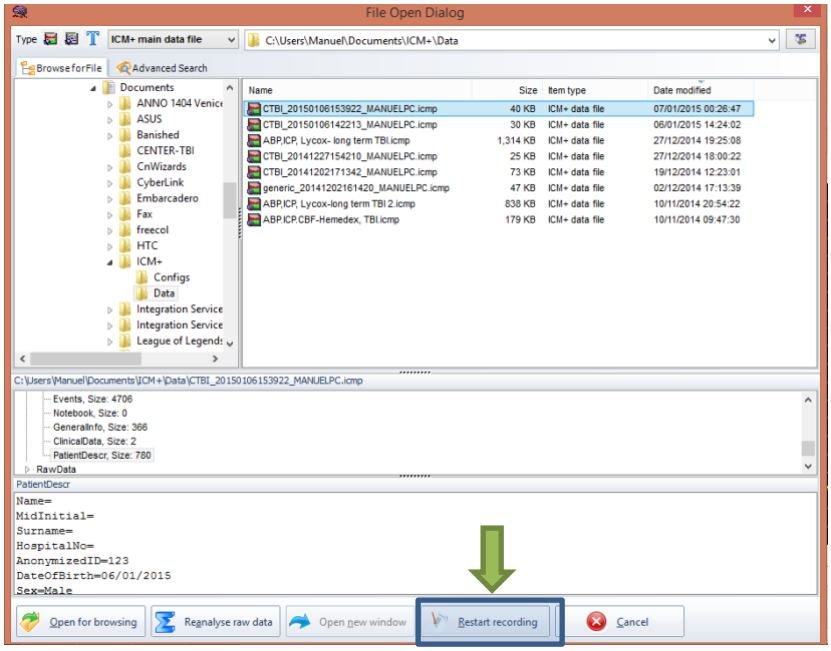
Restoring a closed data collection session

If a session was for some reason closed and a recording needs to be restored again the button open can be pressed.

The dialog that opens can be used to reopen the file in order to upload the data to our servers or to restore the recording session.



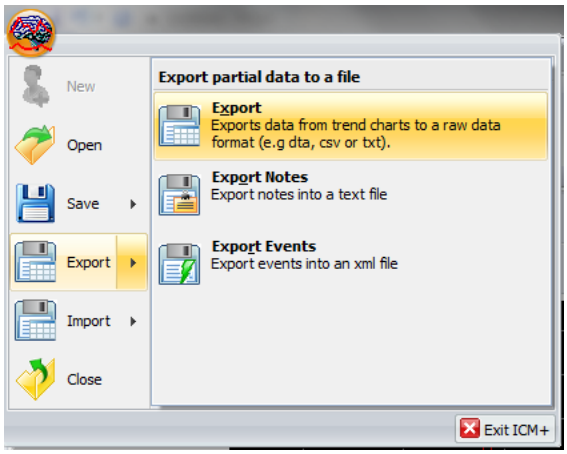
To reopen a file for inspection or to upload it is only necessary to double-click the desired file.



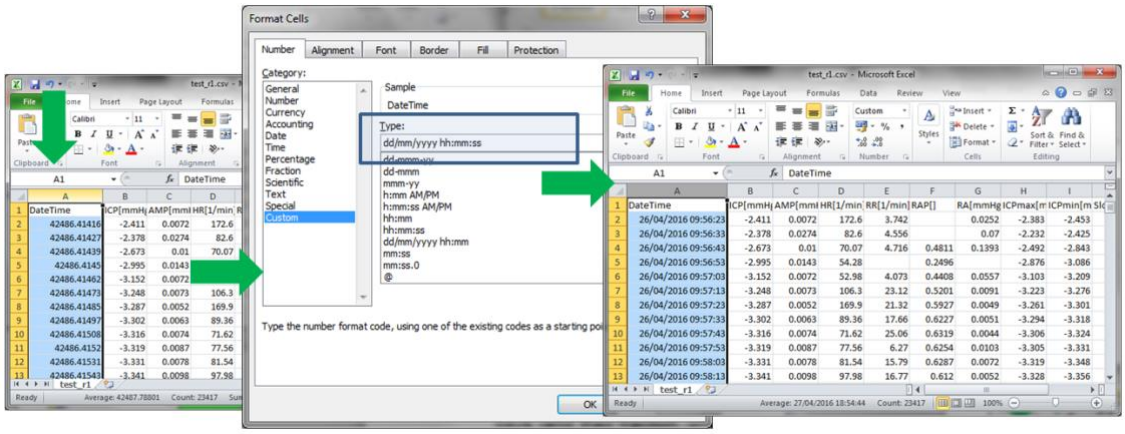
To restore the recording session, the highlighted button must be pressed and the recording resumes using the same profile as when it was closed.

Exporting data to a csv (Excel) format

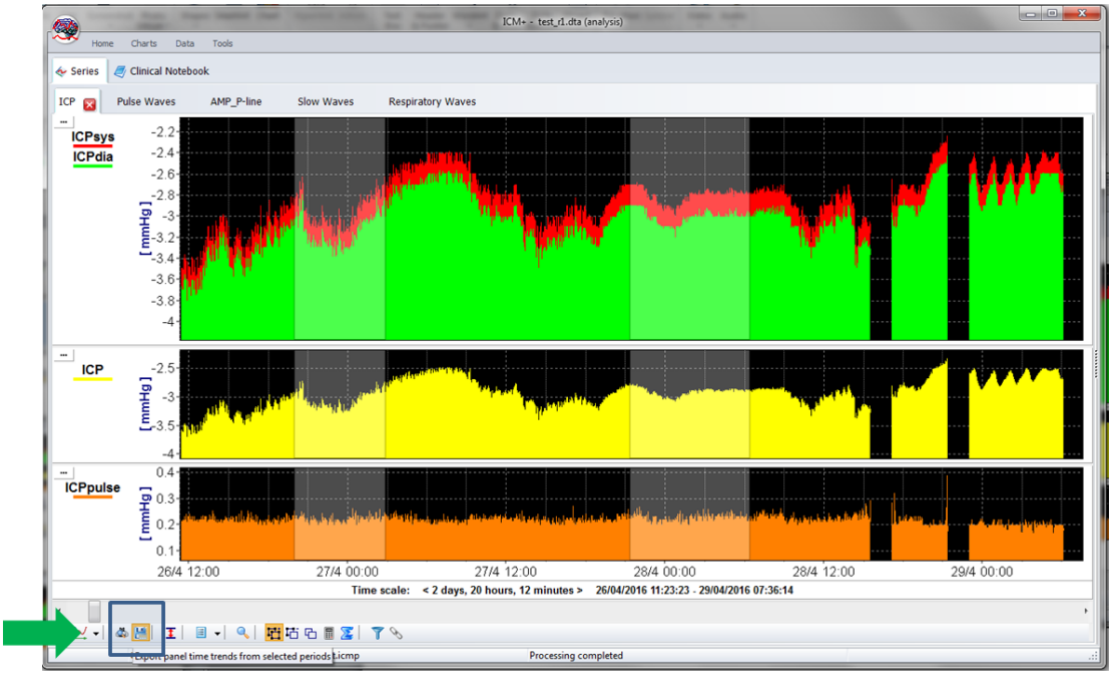
There are two ways the data can be exported from ICM+. One way is to select Export option in the main menu (the Brain icon).



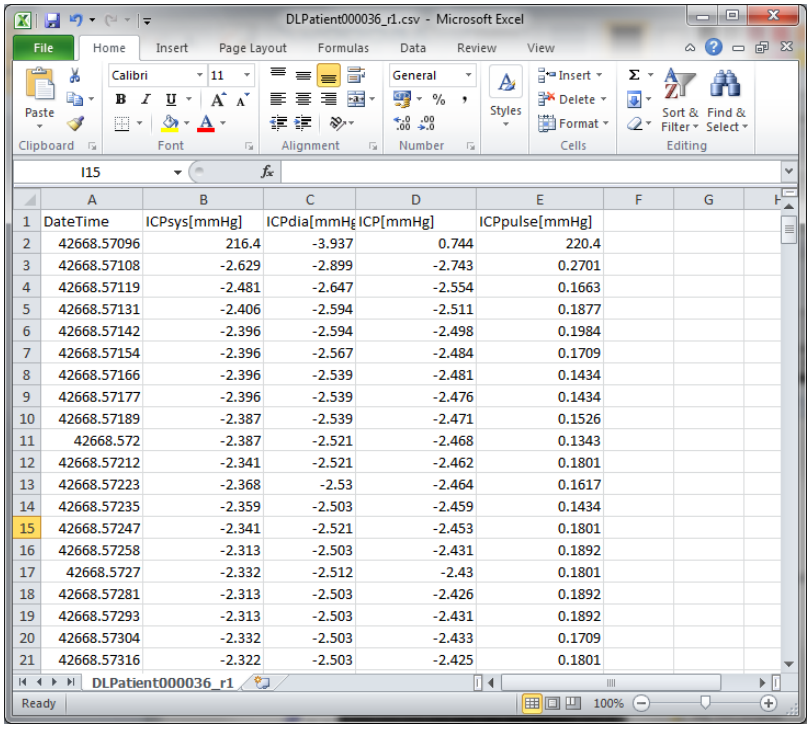
This will export all the trend data from the memory, all the variables, in commas separated columns of values, with the first column containing the time stamps, in the internal Windows DateTime format. The DateTime format is essentially a number of days (and their fraction, which translate into time) since 31/12/1899. Imported into Excel it will initially showed up as those numbers, but if date or time (or combined) cell formatting is requested for that column the data and or time will be shown.



The second way of exporting data is to use the data export chart tool, located at the bottom of each charting vertical panel:



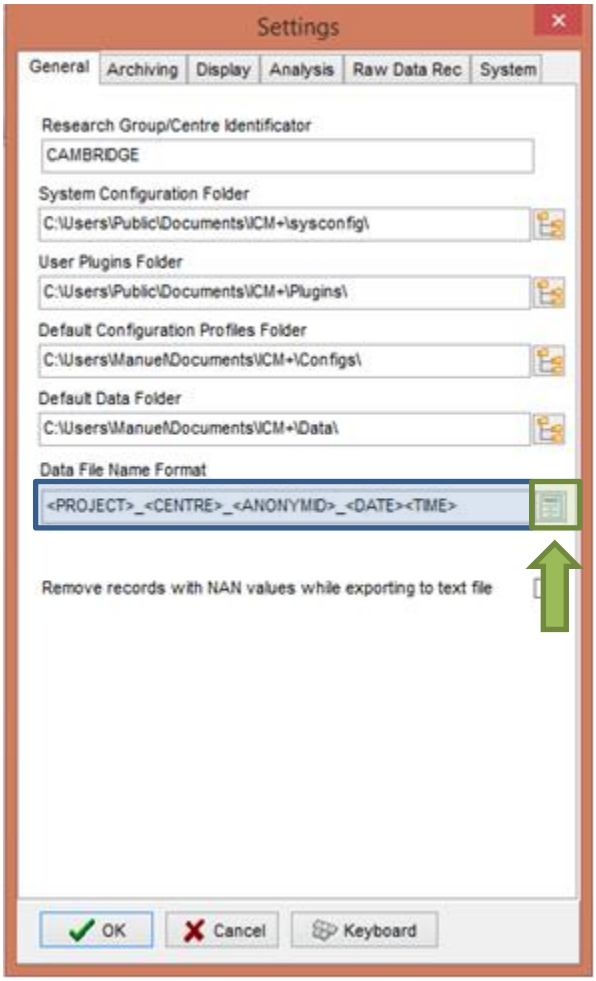
This will export data only from the variables plotted in the panel corresponding to the button toolbar, in this case it will be ICPsys, ICPdia, ICP and ICPpulse only, and only from selected time periods, if the selection tool is used, or the whole recording time, if not.



Appendix 1: Configuring ICM+ system options

Most of the programmable behaviours of the software can adjusted via the Settings menu. This menu can be found by clicking the Home tab and the Settings button.

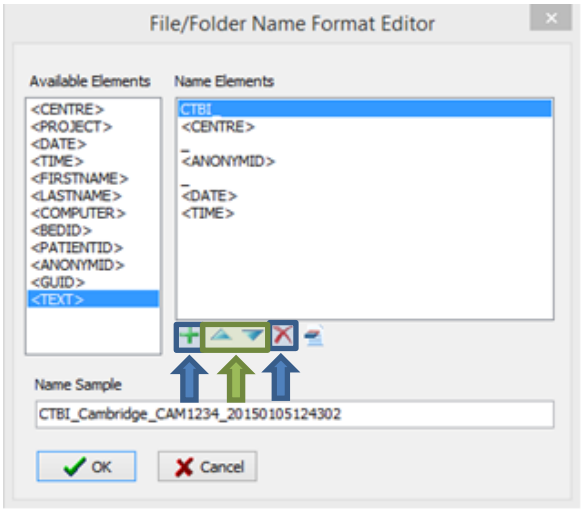
In the Settings menu you will find many system-wide configurations.



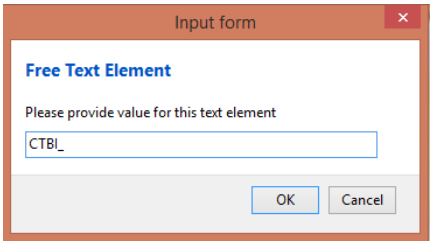
- Note that many of these settings will be overridden by Project settings, if a specific project is chosen for the Data Collection session. If a Generic project is chosen the system-wide settings will be used.

- The **Data File Name Format** is used to configure the format of the filename as the filenames are automatically generated at the start of a new Data Acquisition session.

To build the **Data File Name Format** you will need to click the highlighted button and the following form will appear:

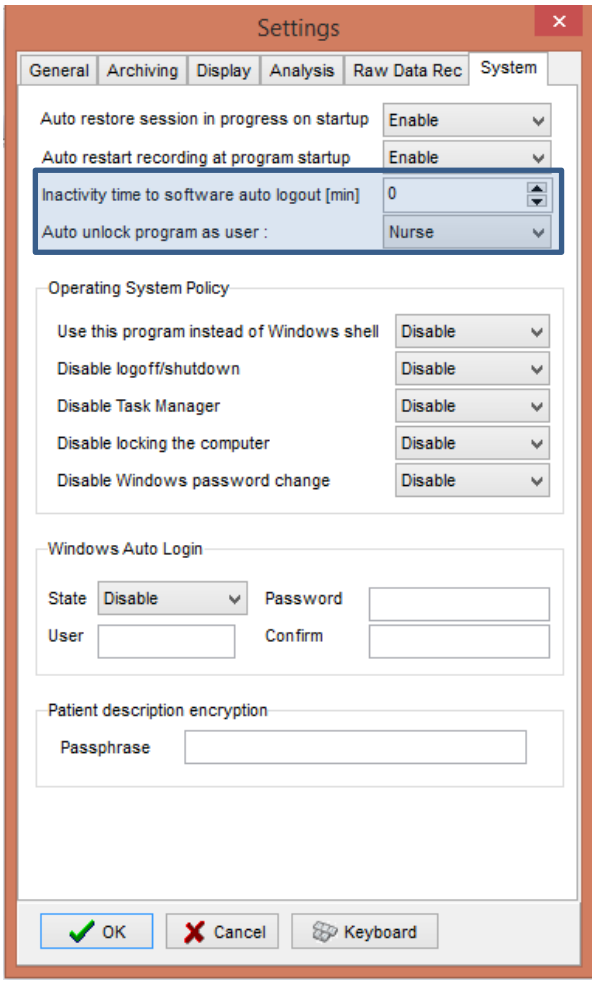


In this form it is possible to add/remove any name element present in the Available Elements menu.



The '_' and any additional static text can be inserted by using the element '<text>' and inserting the text to be added manually.

- On the System tab



For laptop used for Data Collection it is **recommended** to set the **'Auto unlock program as user'** to **Nurse**. Setting the inactivity time to a value greater than 0, eg 10 min, will cause the software to auto log-in as that default user following a selected period of time without interaction with the software (this will only happen of course if the program was unlocked as another user)

Appendix 2: ICM+ configuration folders and files

ICM+ uses two locations (configurable via the Settings form) to store all its configuration files:

Location 1: **C:\Users\<username>\Documents\ICM+**.

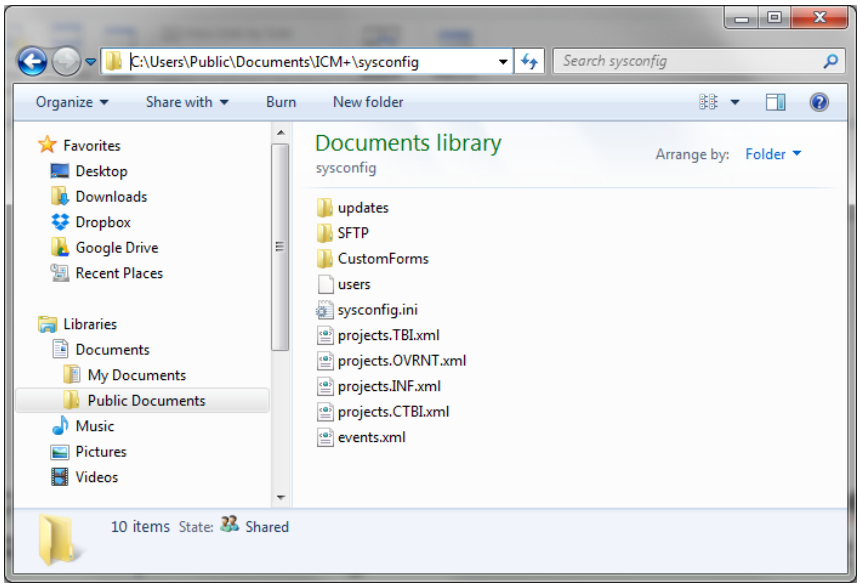
There are two subfolders here:

'**Data'** folder, where all the data recorded during the acquisition process is stored, and

'**Configs'** folder, used to store the data collection and analysis configuration 'profile' files, as in the figure below.

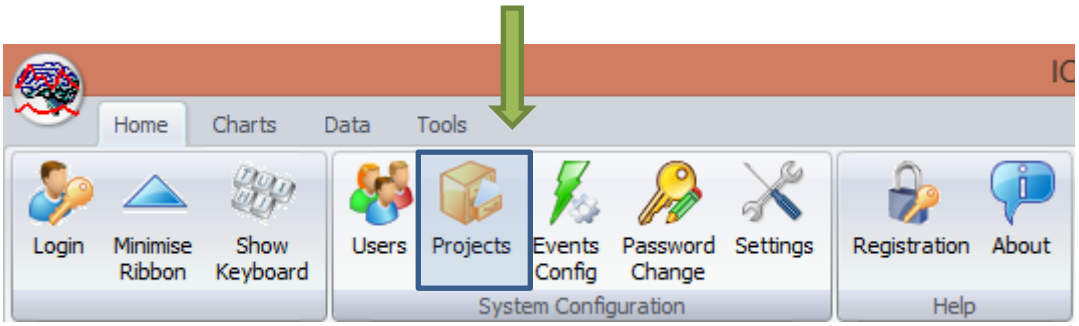
Location 2: **C:\Users\Public\Documents\ICM+**

Here all the environment configurations/settings are stored. This location contains a folder called **Plugins**, where 3rd party function libraries reside, a folder called **TxtFilters**, containing parsing definitions for different text format data files, and a folder called **sysconfig** containing all the settings of the software, except the data collection and analysis profiles which are store in the Location 1 (as above). Although these files could be edited directly using a text editor ICM+ has specific user interface forms to edit all aspects of the program functionality.

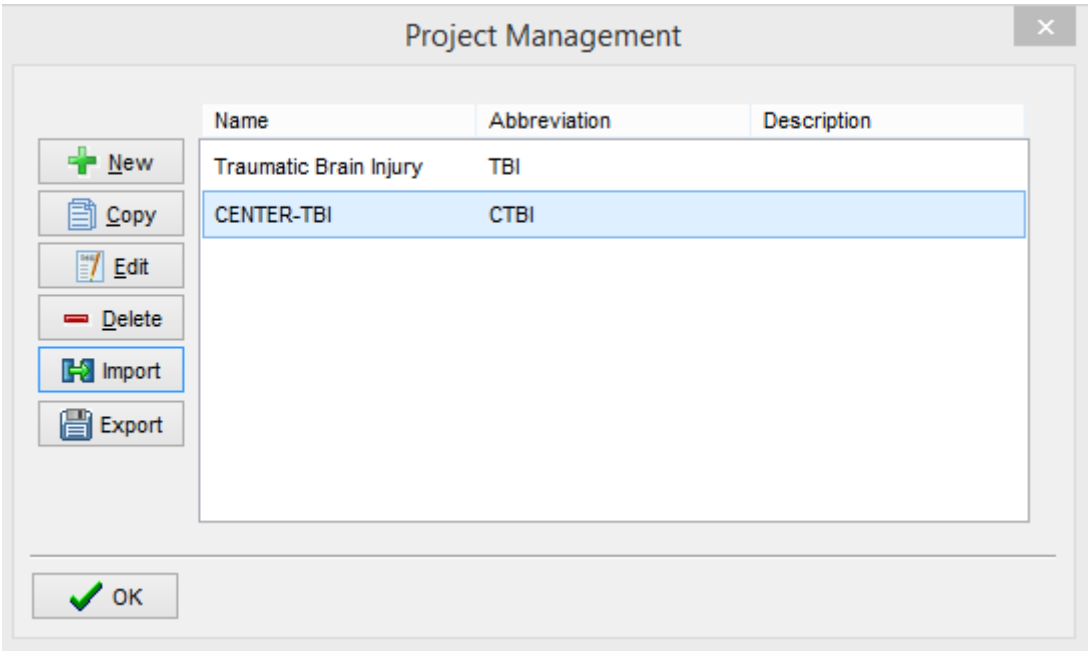


Appendix 3: Editing ICM+ Projects

Projects contain various configurations specific to a particular research project. These can be edited using **Projects** button in the main menu tool bar.

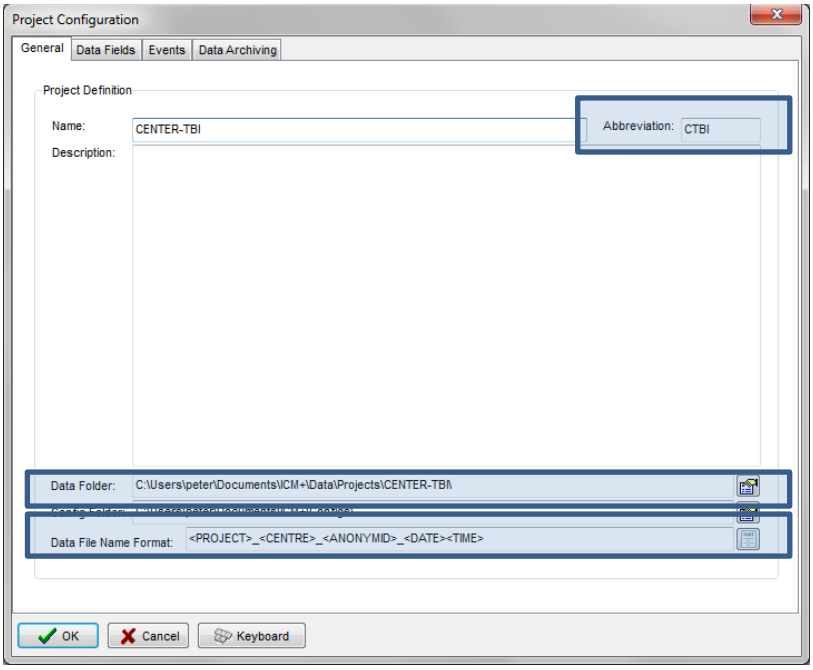


Clicking this button will open the Project Management dialogue, where you create, copy, edit, delete, export/import selected projects to/from a file.



Double clicking on a selected project or clicking on Edit will open a Project Editor where all the custom project settings can be modified.

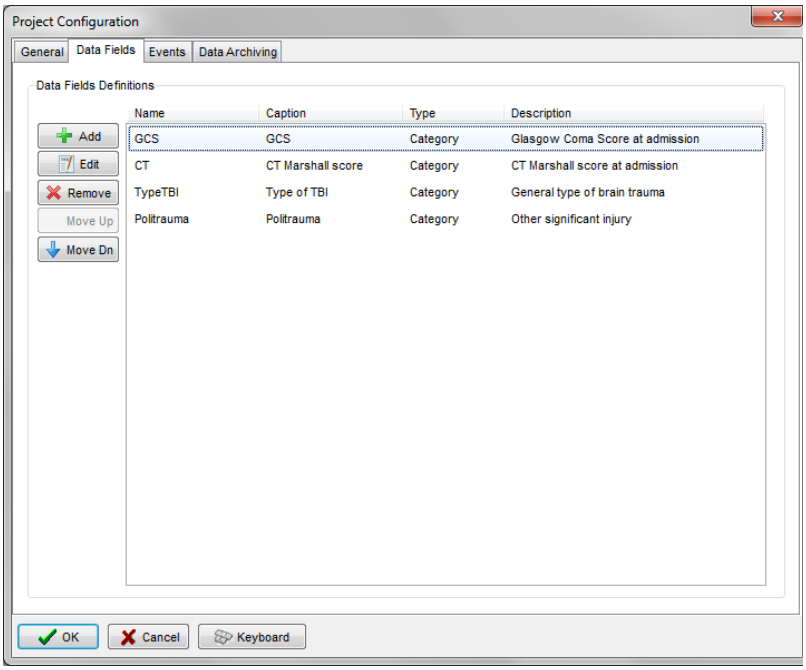
The following screen shots describe the CENTER-TBI specific settings. These settings would have already been preconfigured for you if you have copied the provided project.ctb.xml file to the ICM+ sysconfig folder, or used the Project Manager to import the settings from that file. Please do not modify those for CENTER-TBI project.



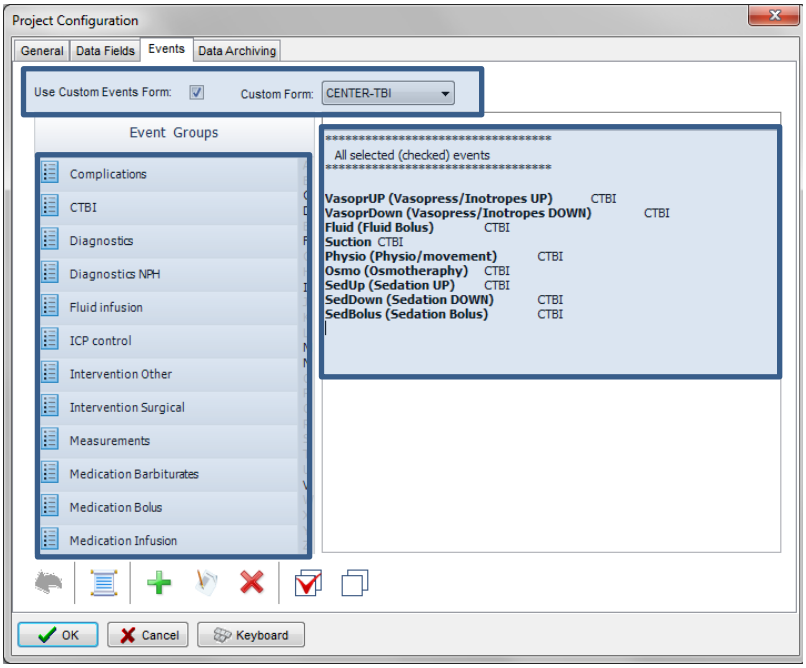
1 . The project **abbreviation** will be part of the file name

2. '**Data Folder'** is a local folder where the data collected as part of this project will be stored

3. **Data File Name Format** lists elements that will be used to create automatic file names for each new data acquisition sessions. Please note that elements listed here will have to be filled in (e.g Centre ID, or the anonymous Patient ID) at the New Data Acquisition form stage before continuing.



The data fields define placeholders for general clinical descriptors that characterise the patient at the time of admission to the critical care unit, that are useful to be kept together with the monitoring data.



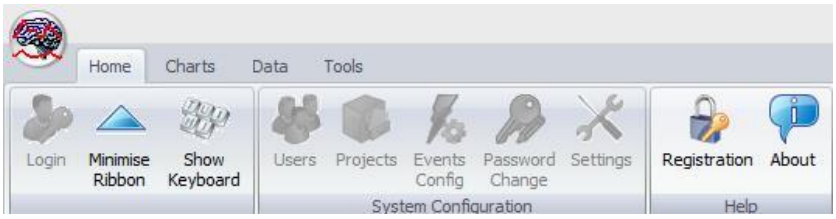
This is where events that are already defined elsewhere (in the Events form), listed in the left panel (1), can be assigned to the particular project (listed in the right panel 2.).

Please note that CENTER-TBI uses a customised event form, selected using the 'Custom Forms' list box (3). It is possible however to add more events to the project but those will only be accessible from within the 'Event List' panel, toggled from the main menu tool bar panel, Charts section.

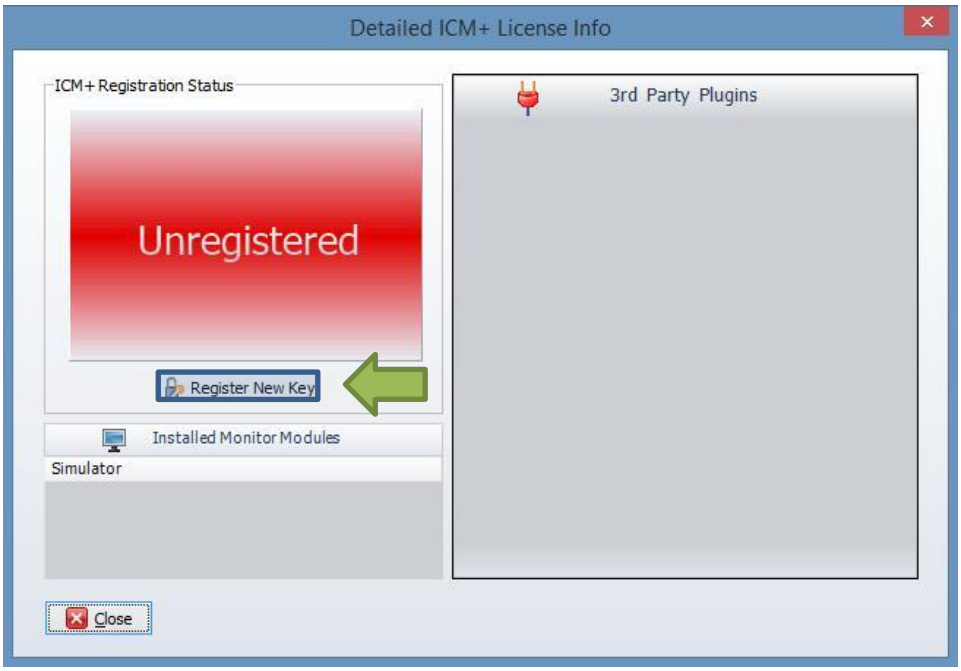
Appendix 4: Registering ICM+

When ICM+ is successfully installed for the first time in a computer it needs to be registered. This will probably already be done for you when you get the laptops, but if any major update needs to be done you will have to register it again.

To register ICM+ you need to press the Registration button on the Home tab.



This will bring up the Detailed ICM+ License Info window where you will need to press the Register New Key button.



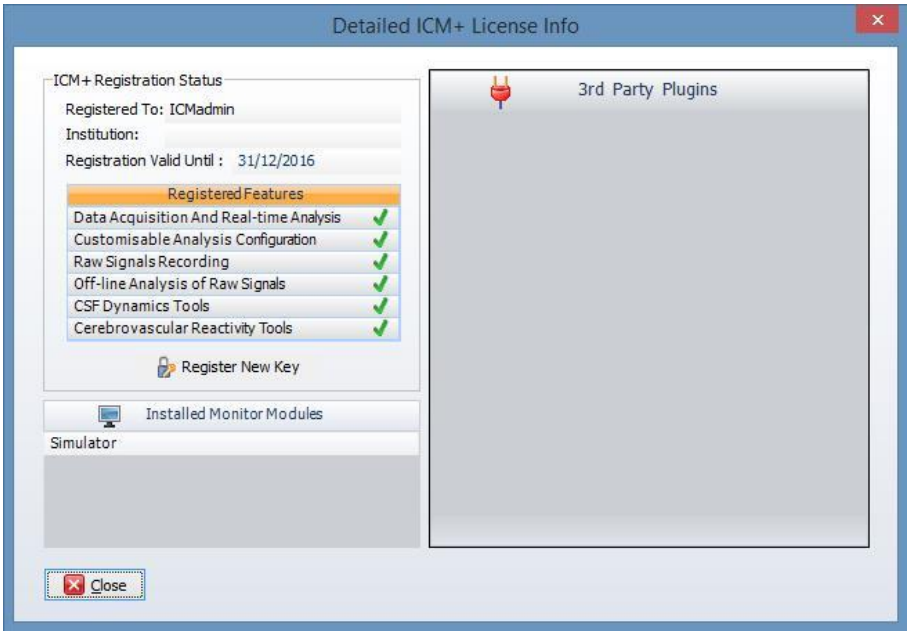
This will bring forth the ICM+ Registration Form:

Please submit these details with your Key Request via the ICM+ website, the user area:

https://icmplus.neurosurg.cam.ac.uk/user-area

Once the Key is released (you will be notified by email registered with the website) please retrieve it and enter into the Registration box, as above and click Register Now.

And your Detailed ICM+ Licence Info window should look something like this:



Appendix 5: Preconfigured users and passwords

Administrator – 2718

Manager – 1618

Operator – 3142

Nurse – 1414

The users, their passwords, and their rights are fully configurable in the software, using Users form. The default users have been chosen to fulfil the following roles:

User	Role
Administrator	Complete access to all the software configuration options, the users and passwords
Manager	Access to all the configuration options, except the users and password. This will normally be the user to do the entire configuration needed for data collection.
Operator	Control of the data collection process using preconfigured profiles, and changes to the charts layout and properties.
Nurse	Access to clinical annotations tools only. This should be normally set up as the default user kept logged-in during the data collection process, in order to prevent any inadvertent disruption to data recording but at the same time allowing and encouraging quick access to the clinical annotations.
Guest	This 'user' has no rights, making it impossible to interact with the software in any way.