# ICM+ Standard of Procedures



## **Mindray Benevision monitors**

11 July 2018

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

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#### **Prerequisites**

- 1. A laptop (or a PC) with the latest ICM+ (version 8.4.4.1) and its Mindray Benevision module installed
- 2. Mindray Benevision N-Series monitor.

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			50 ° 0 ° ····
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😂 🛃 🛱 🕹 40 Nove Alam Rept Ande Fance Privacy Node Zena			() <b>4</b> 0 I⊟ noby Volane Setup Menu
	mindray		

3. Network connectivity – ICM+ can be installed on a separate laptop computer or on the PC integrated into the Benevision monitor. In either case the computer's and the monitor's network connection have to be configured so that they are both on the same network. If there is a wireless network available both, the monitor and the laptop/PC can be hooked up to it, but the laptop should, if possible, be allocated a static IP address (or at least reserved one on the router, so it does not change on reboot). Alternatively the two can be connected with a network cable (the port marked in red in the figures below) and then both the monitor and the laptop need to be configured with a static IP addresses, for example 192.169.1.1 (for the monitor) and 192.168.1.2 (for the laptop). In N17 series the integrated computer network is shown on the right, marked blue.



4. Optional file server, for archiving the data.

#### Monitor configuration for data export

The monitor data export has to be activated to send out data using HL7 protocol. This can be done via Maintenance menu as described in this modified extract from the BeneVision documentation:

You can send the realtime data, waveforms, and alarms from the monitor to the hospital servers via HL7 protocol. To do so, follow this procedure:

- 1. Select the Main Menu quick key  $\rightarrow$  from the System column select Maintenance  $\rightarrow$  input the required
- 2. password  $\rightarrow$  select .
- 3. Select the Network Setup tab  $\rightarrow$  HL7 Configuration tab.
- 4. Switch on Send Data, Send Waveform.
- 5. From the Data + Waveforms column, set Destination IP and Port for the server receiving the realtime data and waveform. The destination has to be the IP address of the ICM+ laptop and the port number is configured in the ICM+ Benevision configuration ini file:

c:\Program Files (x86)\University of Cambridge\ICM+\Monitors\Mindray\BeneVision\BeneVision.ini

#### It is set in the module by default to 11000

- 6. Set Data Interval. This has to be set to the fastest, 10sec
- 7. This page also display the server connection status.

#### 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 and display configuration.

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

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#### Starting a new data collection session

Real Chatte Data Task		ICM+	- 🗇 🗙
Home Charts Data Tools			
Login Minimise Show Users Projects Events Password Se Ribbon Keyboard Config Change	ttings Registration About		
System Configuration	Help		
	New Patient	Open/Analyse Old Files	

To create a new data acquisition session hit New Patient button.

#### This will bring up a new form:

Project :	Traumatic B	rain Injury		~	New F	Project
Data File:	C:\Users\ps100\Do	ocuments\ICM+\Data\TBI_2018042311	2151_NEWTON.icmp			
Patient's	information					
First N	ame	Middle Initial	Date Of Birth	23/04/2018	00:00	
Surnar	ne		Date Of Ictus	23/04/2018		
Hospit	al ID		Date Of Admission	23/04/2018	00:00	
Room/	Bed No		Gender	● Male 〇	Female	
Anonyr	mised ID					
Clinica	I background					_
Clinica	I background		_			
		graphics From Ber	neVision			~
F	Retrieve Demo	graphics From Ber	neVision			~
F Data Acc	Retrieve Demo	Configuration Profile	neVision			- -
F Data Acc C:\.\P	Retrieve Demo quisition/Analysis (	Configuration Profile (TBLiCMC		Line Analysis	Clear H	

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.

Devices check						
Please check the connections before continuing:						
Device	Connection	Test	Enabled			
BeneVision	brphys.2	<ul> <li>✓</li> </ul>	Yes			
V OK X Cance	Test Connections	cate Ports	<u>S</u> kip			

This dialogue is used to test the communication between the ICM+ and the monitor (the 'Test connections' button). If the test is successful the OK button can be pressed.

This form can also be used to modify the connection address. In case of Benevision monitors the connection string has to match the location configured in the monitor, as in this picture (the location string is composed of Room no and/or Bed no strings, separated by a '.' Character, if both set, in this case amounting to brphys.2).

- VinV	-vv			/	
	and the second	Ма	intenance		×
Device Locat	ion Patient Man	agement	Alarm	CAA	« »
Device ID	00-0F-14-04-9B-0B-	70-4C	Location		
Monitor Name		Demo	O Unfixed	• Fixe	ed
Facility			Room No		brphys
Department		Neurosci	Bed No		2
Wlan Mac	00.17.00.50.05.05	Neurosci			
	00:17:23:E0:8E:9E				
an Mac	00:0F:14:0B:70:4C				

Before continuing with starting the session the user is asked to confirm the bed location, to receive the data from.

Confirm	>	<
1	Please confirm the monitor location : brphys.2	
	<u>Y</u> es <u>N</u> o	

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.

Project specific data					
GCS	5	~			
CT Marshall score	IV	~			
Type of TBI	Diffuse brain injury	~			
Politrauma	Abdominal	~			

After this dialogue, ICM+ main 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.

Home Charts Data rries 🥂 Clinical Noteb	n tok ok y Synd Monter
BP CP 5pO2 CG Temp	
	spc2 [14]
S Appearance	
olumns:	a os i is 2 25 2 25 4 45 6 65 2 75 6 85 9 95 10
ale 10 ÷	Man from phylored person from the market was from the mark the second and the sec
gnals @	43
т О	Temp [Grad]
	Total: 00.06 Block: 00.06 Block

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:

Customise the profile	ar All	Signals Sources	🔀 On Line Analysis
✓ OK X Canc	el	😂 On Screen Key.	

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

		ICN	/+ - CTBI_CAM_20161223145142_HEX.icr	np	
$\sim$	Home Charts Data Tools				
	b 🔺 🔪 🔀 🔎		<b>STOP STOP</b>	2	
Lo	gin Minimise Signals Calculations Connections Ribbon Check	Save Load Profile Profile	Start Stop Monitor Data Snapshot	New New Event Note	
	Analysis Configuration	Profile	Control Panel	Annotations	

This brings up the Sampler Configuration form:

2	👷 Sampler Configur	ation Dialog							
Γ	Digital output devices	Analogue output device	RS232 ASC	Il streaming devices					
	Name	Туре	Port	Baud	Sampi Frq	Enabled			
	🕅 Modify	Modify Delete Clear							
	Name Units Device Waveform Min V Max Enabled								

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.

Device Name:	BeneVision	Device Type:	BeneVision	~
			BeneVision BIS Camino Capnostream CARESCAPE CerOx cFlow CNSMonitor	~ ~
Interface type	Re Address:	efresh bed list	Sampl. Freq. 500.00 Enabled:	

When the correct interface module is chosen (BeneVision), 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. **Please note that it may take up to 20 seconds to receive all the info from the monitor** though the connection message should appear within 10 seconds.

🧠 Digital Output D	evice Configuratio	n Dialog		×
Device Name: Ber	neVision	Device Type:	BeneVision	~
\$1.7.6.131336,wv\$1 \$1.7.6.131334,wv\$1 \$1.1.12.150084,wv\$	ceived. d herics list: l,wvECG_l,wvART, .7.6.131332,wv\$1 .7.6.131391,wv\$1 1.9.1.152040,wv\$	.7.6.131390,wv\$ .7.6.131331,wv\$ 1.9.1.151908,wv	D2,wvVentVol,wvPleth,wv 1.7.6.131392,wv\$1.7.6.131 1.7.6.131333,wv\$1.1.11.15 \$1.9.1.152048,wv\$1.11.2.1 12.1.288.2,wv\$1.12.1.288,v	0032,wv 51764,wv
Interface type		resh bed list brphys.2	Sampl. Freq. 500 Enable V Stop	
🗸 ок	X Cancel	> Keyboard		

If the Address is cleared clicking on the Communication will collect the available monitor lists (their location) and then clicking on 'Refresh bed list' will populate the address drop down list box with the monitors locations available.

🧠 Digital Outpu	t Device Configuratio	n Dialog		×
Device Name:	BeneVision	Device Type:	BeneVision	$\sim$
Waiting for a Con Connection estat Monitors/beds lis		om the monitor		^
				~
Interface type	Ref	resh bed list	Sampl. Freq. 250.00	
Network	Address:		Enabled: 🗹	
✔ ОК	X Cancel	🖗 Keyboard		

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.

igital output devices	Analogue ou	tput devices	RS232	ASCII streaming	devices				
Configured devices	with proprietar	y digital outp	ut protoco	ols					
Name	Туре		Port	t.	Baud	Sampl Frq	Enabled		
BeneVision	BeneV	ision	brph	hys.2	0	250	Y		
Modify	+ Add	<u> </u>	elete	😫 Clear					
Configured modalities	s to be collecte	ed							
Name	Units	Device		Waveform I	Min V Max	Enabled			
		17							
		//							
	,	Π							
	,	1							
Modify	+ Add		elete	Ciear					
Modify	+ Add		elete	전: Ciear					
(Modify	+ Add		elete	<u>ির</u> Clear					
	+ Add		Bave	Clear		dvanced	Se Keyboard		

This opens a signal selection dialog:

Digital Output Device Signals Selection Dialog	×
Device : BeneVision  Signal Name : Signal Units : Uaveform : Enabled Physiological Values Range Min Value : 0 Start	Stop
VOK X Cancel 🛞 Keyboard	

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

	Signal selection dialog	×
Device : BeneVision	List of available signals	
Signal Name :	wvECG_II wvECG_II	
Signal Units :	wvART	
Waveform :	wvCvP wvGasC02 wvVentVol	
Enabled 🗸	wvPleth wv\$1.7.6.131336	
Physiological Values Range	wv\$1.7.6.131332 wv\$1.7.6.131390	
Min Value : 0 Max Value : 300	wv\$1.7.6.131392	▼ Stop
300	Refresh the list	
	✓ ОК X Сан	ncel

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

Digital Output Device Signals Selection	n Dialog	Х
Device : BeneVision Signal Name : ART Signal Units : Waveform : wvART Enabled Physiological Values Range Min Value : 0 Max Value : 300	Preview	
VOK X Cancel	V Keyboard	

Please note that it will take up to 10 seconds or so for the data to start coming through.

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.

		t protocols						
Name								
BeneVision		Port	Baud	. Sampl	Frq	Enabled		
	BeneVision I	orphys.2	0	250		Y		
Modify +			Clea <u>r</u>				 	
Name Uni	ts Device	Waveform	Min V	Max	Enabled			
ABP	BeneVision	WVART	0	300	Υ			
ECG	BeneVision	wvECG_II	0	10	Y			
ICP	BeneVision	WVICP	0	300	Υ			
EtCO2	BeneVision	EtCO2	0	100	Y			
SpO2	BeneVision	SpO2	0	100	Y			
Modify +	- <u>A</u> dd — <u>D</u> e	elete	Clea <u>r</u>					

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.

tual Signals	Primary Analysis	Secondary Analysis 1	Secondary Analysis 2	Final Analysis		
Name	Formu	la Sampi	ng Frq Min	Max	Digital Filter	Enabled
ABP	abp	250	0	300	None	Y
ICP	icp	250	-30	100	None	Y
ECG	ecg	250	0	0	None	Υ
SpO2	spo2	1	0	0	None	Y
Temp	temp	1	0	0	None	Y
ETCO2	etco2	1	0	0	None	Y
Modi	fy <mark>+ A</mark> dd	- Delete	Ciear A	uto <u>F</u> ill Default Fs (H	z]: 250.0 💌	
🗸 ок	X Cancel	📴 Save	🚯 Load	Advanced 🚳	Keyboard	

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## **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. Event annotation form
- 3. Free textual annotations form
- 4. An on-screen keyboard
- 5. The last button closes this tool bar and unfolds the main men toolbars

# Terminating the data collection session and uploading the data

When the data acquisition process is finished 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.

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 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:

🔵 Data archiving configuration	on form	
Use settings from the project:	Devel	
Data storage details		
Data Archive Folder		
//srv1/backup		<b>E</b>
Create New Subfolder	Use original file name for the subfolder	
devel_CAM_2016110321	2242_HEX	
☑ Create info text file		
Operation		
🔘 Сору	Move	
V OK X Cance	el Remember Selection	

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#### 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.

<b>.</b>	File Open Dialog					×
Type 🛃 🔯 🍸 ICM+ main data file 🗸	C:\Users\Manuel\Documents\ICM+\Data				~	35
Browse for File						
Documents ANNO 1404 Venice ANNO 1404 Venice Banished CENTER-TBI CENTER-TBI CENTER-TBI CENTER-TBI CENTER-TBI Fax: Fax: Fax: Config: Data	Name CTBI_20150106153922_MANUELPC.icmp CTBI_20150106142213_MANUELPC.icmp CTBI_20141227154210_MANUELPC.icmp CTBI_20141227154210_MANUELPC.icmp CTBI_20141227154210_MANUELPC.icmp generic_20141202161420_MANUELPC.icmp ABP.ICP.CBF-Hemedex, TBI.cmp ABP.ICP.CBF-Hemedex, TBI.cmp	Size 40 KB 30 KB 1,314 KB 25 KB 73 KB 47 KB 838 KB 179 KB	Item type ICM+ data file ICM+ data file	Date modified 0701/2015 00.284/7 06/01/2015 14:24.02 2711/22014 19:25.08 2711/22014 18:00.22 191/22014 12:23.01 02/12/2014 17:13.39 10111/2014 09:47:30		
Integration Service     Integration Service     Lasgue of Legent:      C:\Uses\Wanuel\Documents\UCH+Data(CTBL_20150)     Events, Size: 4706     Hotebook, Size: 0     Generainfo, Size: 386	106153922_MANUELPC.iomp					^
ClinicalData, Size: 2 PatientDescr, Size: 780 RawData						~
PatenDesr Name= Nidlnitial= Surname= HospitalNo= AnonymizedID=123 DateOFBirb=06/01/2015 Sex=Male		Û				
Open for browsing Reanalyse rav	w data 🧼 Open <u>n</u> ew window 🖹 🕅 <u>R</u> e	start recording	ء 🔕	ancel		

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.

		22								
	Number Alignment Font Border Fill Protection			_			-	_		. <b>0</b> _ x
	Category: General Sample	X	<b>1 1 1 1 1 1 1 1 1 1</b>	-	test_r1.csv	- Microsoft Exce	ы			
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	Currency		🗎 🔏 Calibri	~ 11 ~ <sup>3</sup>	= 😑 📑	Custom -	A i	• Insert •	Σ · Α	A
	Accounting <u>Type</u> :		🛄 • в I Ц •	A' A' I		- % ·	3	Delete -	3 - ZI	
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	Percentage	Cli	pboard 🕼 Font		Alignment 15	Number 5		Cells	Editin	g
	Fraction dd-mmm		A1 • (	- f <sub>x</sub>	DateTime					
ria de la deletime	Scientific mmm-yy		Δ	B	C D	F	F	G	н	1
A B C D	Text h:mm AM/PM Special h:mm:ss AM/PM	1	DateTime		MP[mmi HR[1/		RAPI		ICPmax[mIC	Pminfm
ICP[mmH; AMP[mmi HR[1/min]R	Custom hh:mm	2	26/04/2016 09:56:23	-2.411		72.6 3.742	in the	0.0252	-2.383	-2.453
42486.41416 -2.411 0.0072 172.6 42486.41427 -2.378 0.0274 82.6	hh:mm:ss	3	26/04/2016 09:56:33	-2.378		82.6 4.556		0.07	-2.232	-2.425
42486.41427 -2.378 0.0274 82.8	dd/mm/yyyy hh:mm	4	26/04/2016 09:56:43	-2.673	0.01 7	0.07 4.716	0.4811	0.1393	-2.492	-2.843
42486.41459 -2.995 0.0143	mm:ss mm:ss.0	5	26/04/2016 09:56:53	-2.995	0.0143 5	4.28	0.2496		-2.876	-3.086
42486.41462 -3.152 0.0072	@	6	26/04/2016 09:57:03	-3.152	0.0072 5	2.98 4.073	0.4408	0.0557	-3.103	-3.209
42486.41473 -3.248 0.0073 106.3		7	26/04/2016 09:57:13	-3.248	0.0073 1	06.3 23.12	0.5201	0.0091	-3.223	-3.276
42486.41485 -3.287 0.0052 169.9		8	26/04/2016 09:57:23	-3.287	0.0052 1	59.9 21.32	0.5927	0.0049	-3.261	-3.301
42486.41497 -3.302 0.0063 89.36	Type the number format code, using one of the existing codes as a	9	26/04/2016 09:57:33	-3.302	0.0063 8	9.36 17.66	0.6227	0.0051	-3.294	-3.318
42486.41508 -3.316 0.0074 71.62	Type the number format code, using the of the existing codes as a :	10	26/04/2016 09:57:43	-3.316	0.0074 7	1.62 25.06	0.6319	0.0044	-3.306	-3.324
42486.4152 -3.319 0.0087 77.56		11	26/04/2016 09:57:53	-3.319	0.0087 7	7.56 6.27	0.6254	0.0103	-3.305	-3.331
42486.41531 -3.331 0.0078 81.54		12	26/04/2016 09:58:03	-3.331	0.0078 8	1.54 15.79	0.6287	0.0072	-3.319	-3.348
42486.41543 -3.341 0.0098 97.98		13	26/04/2016 09:58:13	-3.341	0.0098 9	7.98 16.77	0.612	0.0052	-3.328	-3.356
Average: 42487.78801 Count: 23417 Sun		14	( ) H test_r1				4			) b

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.

X	<b>9</b> • (* •	-	DLPatient0000	36_r1.csv - Micros	oft Excel	-		
Fi	ile Home	Insert Page Lay	yout Formulas	s Data Rev	iew View		ے 😮 ۵	φ Σ
	📜 👗 🛛 Calibr	ri - 11 -	= = = =	General 🔹	A ansert ◄	Σ -	A	
		<u></u>		- 🕎 - % ,	🕂 Delete			
Pas	te 🍼 👘 🗸	3 - A -	₹ ₹ ≫,-	.00 .00 .00 ⇒.0	Styles		Sort & Find & Filter ▼ Select `	
Clip	board 🗔	Font G	Alignment	G Number G	Cells		Editing	
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2	42668.57096	216.4	-3.937	0.744	220.4			
3	42668.57108	-2.629	-2.899	-2.743	0.2701			
4	42668.57119	-2.481	-2.647	-2.554	0.1663			
5	42668.57131	-2.406	-2.594	-2.511	0.1877			
6	42668.57142	-2.396	-2.594	-2.498	0.1984			
7	42668.57154	-2.396	-2.567	-2.484	0.1709			
8	42668.57166	-2.396	-2.539	-2.481	0.1434			
9	42668.57177	-2.396	-2.539	-2.476	0.1434			
10	42668.57189	-2.387	-2.539	-2.471	0.1526			
11	42668.572	-2.387	-2.521	-2.468	0.1343			
12	42668.57212	-2.341	-2.521	-2.462	0.1801			
13	42668.57223	-2.368	-2.53	-2.464	0.1617			
14	42668.57235	-2.359	-2.503	-2.459	0.1434			
15	42668.57247	-2.341	-2.521	-2.453	0.1801			
16	42668.57258	-2.313	-2.503	-2.431	0.1892			
17	42668.5727	-2.332	-2.512	-2.43	0.1801			
18	42668.57281	-2.313	-2.503	-2.426	0.1892			
19	42668.57293	-2.313	-2.503	-2.431	0.1892			
20	42668.57304	-2.332	-2.503	-2.433	0.1709			
21	42668.57316	-2.322	-2.503	-2.425	0.1801			
4 4	▶ ► DLPatie	nt000036_r1 🥂	2/					▶ ] —(+)

#### **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 need to configure several things:

• On the General tab:

seneral	Archiving D	isplay	Analysis	Raw Data Rec	System
Resear	ch Group/Cent	re ident	ificator		
CAMB	RIDGE				
System	Configuration	Folder			
C:\Use	s\Public\Docur	ments\X	M+\syscor	nfig\	ť
User Pl	gins Folder				
C:\Use	s\Public\Docur	ments\K	M+\Plugins	1	1
Default	Configuration F	Profiles	Folder		
particular and a second	sManuelDocu			251	-
	Data Folder			-1 ° 594	1.4
	sManuelDocu	imente)	CM+)Date)		1
Charles and					
Data Fi	e Name Format	t			_
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Remov	e records with	NAN vi	alues while	exporting to text	file [

- The Research Group/Centre identification will be a unique name in the project that will identify the centre. This name should be fully inserted in capitals (ex. CAMBRIDGE).
- The Data File Name Format will be used to configure the structure to be used on the construction of the name of each data file. As each file generated in the study must have a unique identifier we agreed in using

a structure that uses the format highlighted in the picture. A description on how to build this File Name format is presented further down in this appendix.

• On the Archiving tab:

Archive Root Folder Location Archive Folder Name Format PROJECT>_ <centre>_<anonymid>_<date><time> Upload to a remote destination Default Destination: CENTER TBI</time></date></anonymid></centre>				Settings			×
Automatic Data Archiving at the recording session end: Ask Create text info files for archived data Delete original data after archiving Archive Root Folder Location Archive Folder Name Format <project>_<centre>_<anonymid>_<date><time> Upload to a remote destination Default Destination: CENTER TBI</time></date></anonymid></centre></project>	General	Archiving	Display	Analysis	Raw Data Re	c System	n
Create text info files for archived data Delete original data after archiving Archive Root Folder Location  Archive Eolder Name Format  PROJECT>_ <centre>_<anonymid>_<date><time>  Upload to a remote destination  Default Destination:  CENTER TBI</time></date></anonymid></centre>	Local an	chiving					
Delete original data after archiving Archive Root Folder Location Archive Folder Name Format PROJECT>_ <centre>_<anonymd>_<date><time> Upload to a remote destination Default Destination: CENTER TBI</time></date></anonymd></centre>	Automat	ic Data Arch	iving at th	e recording	session end:	Ask	~
Archive Root Folder Location Archive Ender Name Format PROJECT>_ <centre>_<anonymd>_<date><time> Upload to a remote destination Default Destination: CENTER TBI</time></date></anonymd></centre>	Create t	ext info files	for archiv	ved data		1	
Archive Folder Name Format PROJECT>_ <centre>_<anonymd>_<date><time> Upload to a remote destination Default Destination:</time></date></anonymd></centre>	Delete o	riginal data a	after archi	iving		1	-
<project>_<centre>_<anonymd>_<date><time> Upload to a remote destination Default Destination:</time></date></anonymd></centre></project>	Archive	Root Folder	Location				
<project>_<centre>_<anonymd>_<date><time> Upload to a remote destination Default Destination:</time></date></anonymd></centre></project>							Es
Upload to a remote destination Default Destination:	Archive	Folder Name	Format				-
Defaut Destination:	<proje< td=""><td>CT&gt;_<cent< td=""><td>RE&gt;_<an< td=""><td>ONYMD&gt;_</td><td><date><time></time></date></td><td></td><td></td></an<></td></cent<></td></proje<>	CT>_ <cent< td=""><td>RE&gt;_<an< td=""><td>ONYMD&gt;_</td><td><date><time></time></date></td><td></td><td></td></an<></td></cent<>	RE>_ <an< td=""><td>ONYMD&gt;_</td><td><date><time></time></date></td><td></td><td></td></an<>	ONYMD>_	<date><time></time></date>		
Defaut Destination:							
	Upload t	o a remote d	estination				
	Defau# 1	Destination	CEN	TER TBI			7
	5.50 (A)		(house				1121
V OK X Cancel 🛞 Keyboard	1	ок	X Cance	H SP	Keyboard		

- The Archive Folder Name Format will follow the same structure as the Data File Name Format. This setting is used for organising local archival storage of the data files.
- The remote server Upload (accessible via the upload function) default Destination can be selected here but it is the matching setting in the Project configuration that will ultimately take precedence.

• On the Raw Data Rec tab:



 The Use 'Start' button to control Raw Signals Recording must be checked if you are using ICM+ to record any data directly from bed side monitors • On the System tab:

Settings								
General	Archiving	Display	Analysis	Rav	v Data Rec	System		
Auto res	store sessio	n in progr	ess on star	tup	Enable			
Auto re	start record	ing at pro	gram startu	p	Enable			
Inactivit	y time to sof	tware au	to logout (m	in]	0			
Auto unlock program as user : Nurse V								
Operat	Operating System Policy							
Use t	Use this program instead of Windows shell Disable 🗸 🗸							
Disab	le logoff/shu	ıtdown			Disable		•	
Disab	le Task Man	ager			Disable		•	
Disab	le locking th	e compute	er		Disable		•	
Disab	le Windows	passwor	d change		Disable			
Window	ws Auto Log	jin						
State	Disable	~	Password					
User			Confirm					
	Patient description encryption Passphrase							
<ul> <li>✓</li> </ul>	ок	🗙 Cance	el 🔊	Keyb	oard			

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

OK Cancel

<centre></centre>	Name Elements	Input form
<pre><project> <date> <time> <time> <firstname> <lastname> <computer> <bedid> <patientid> <anonymid></anonymid></patientid></bedid></computer></lastname></firstname></time></time></date></project></pre>	<centre> <anonymid> <date> <time></time></date></anonymid></centre>	Free Text Element Please provide value for this text element CTBI_
<guid> <text></text></guid>	CAM1234_20150105124302	

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.

#### **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 3<sup>rd</sup> 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.

	Proje	ect Management		×
	Name	Abbreviation	Description	
<u> </u>	Traumatic Brain Injury	тві		
<u>С</u> ору	CENTER-TBI	СТВІ		
🝸 Edit				
💻 Delete				
🛃 Import				
Export				
🗸 ок				

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.

Project Co	onfiguration									x
General	Data Fields	Events	Data Archiving							
Proje	ct Definition-						_			
Nar	me:	CENTER-T	BI				 Abb	reviation:	стві	
Des	scription:									
			eter\Documents\I		jects\CENTE	ER-TBN				ן
Dat	a File Name F	ormat:	<pre>«PROJECT&gt;_<cei< pre=""></cei<></pre>	NTRE>_ <ano< td=""><td>NYMID&gt;_<d< td=""><td>)ATE&gt;<time></time></td><td></td><td></td><td></td><td></td></d<></td></ano<>	NYMID>_ <d< td=""><td>)ATE&gt;<time></time></td><td></td><td></td><td></td><td></td></d<>	)ATE> <time></time>				
<b>~</b> 0	к 🗙	Cancel	🛞 Keyboar	d						

## 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.

eral Data Field	is Events Data	Archiving		
ata Fields Defin	itions			
	Name	Caption	Туре	Description
🛉 Add	GCS	GCS	Category	Glasgow Coma Score at admission
🔰 Edit	СТ	CT Marshall score	Category	CT Marshall score at admission
X Remove	ТуреТВІ	Type of TBI	Category	General type of brain trauma
Move Up	Politrauma	Politrauma	Category	Other significant injury
👆 Move Dn				

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.

Project Configuration	
General Data Fields Events Data Archiving	
Use Custom Events Form: 📝 Custom Form:	CENTER-TBI
Event Groups	***************************************
Complications	All selected (checked) events
Е СТВІ С	VasoprUP (Vasopress/Inotropes UP) CTBI VasoprDown (Vasopress/Inotropes DOWN) CTBI
Diagnostics F	Fluid (Fluid Bolus) CTBI Suction CTBI Physio (Physio/movement) CTBI
Diagnostics NPH	Osmo (Osmotheraphy) CTBI SedUp (Sedation UP) CTBI
Fluid infusion	SedDown (Sedation DOWN) CTBI SedBolus (Sedation Bolus) CTBI
ICP control	
Intervention Other	·
Intervention Surgical	
Measurements	
Medication Barbiturates	
Medication Bolus	
Medication Infusion	
🕨 🗮 🕂 🔌 🗙 💆	7
OK X Cancel & Keyboard	

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.

Project Configuration	×
General Data Fields Events Data Archiving	
Show data packaging prompt at the recording session end	
Data Archive Folder	
Create New Subfolder	
Create info text file	
Reset to defaults	
Remote upload server	
Data Snapshots	
Show data snapshots reminders	
Snapshot length [minutes] 60	
List of timepoints for data snapshots [hours] 2,12,24,48,72,96	
2,12,24,70,72,30	
VK Cancel By Keyboard	

Here one can define the location and format of data archives as well as, essentially for CENTER-TBI:

- This should be ticked in order for you to be prompted to convert the file to HDF5 at the end of the recording session
- 2. the destination of the remote server for data uploads,
- 3. the data snapshot length and the data snapshot reminders

#### **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 and here you will have to press the Copy Details.

nstallCode:	Please quote this code for a 485ACBC6D289	any further assistance
Username:	ICMadmin	
Institution:	Institution Name	
Computer:	CTBI-Copenh2	
	Copy Details	📨 Email Details
Register Nov		

This will let you paste the details anywhere you want. You will then have email those details to Dr Peter Smielewski (<u>ps10011@cam.ac.uk</u>) or Manuel Cabeleira (<u>mc916@cam.ac.uk</u>) so that we can generate your product key and send it to you.

You will then have to paste the Key to the highlighted space and click Register now. If you are successful you will see the Registration successful dialogue.

ICM+	×
Registration was sucessful	
	ОК

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

		4.9		
ICM+ Registration Status		<b></b>	3rd Party Plugins	
Registered To: ICMadmin		т		
Institution:				
Registration Valid Until: 31/12/2016				
Registered Features				
Data Acquisition And Real-time Analysis	1			
Customisable Analysis Configuration	1			
Raw Signals Recording	1			
Off-line Analysis of Raw Signals	1			
CSF Dynamics Tools	1			
Cerebrovascular Reactivity Tools				
P Register New Key				
Installed Monitor Modules				
Simulator				
	-			

#### **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.

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