Accu-Gold 3

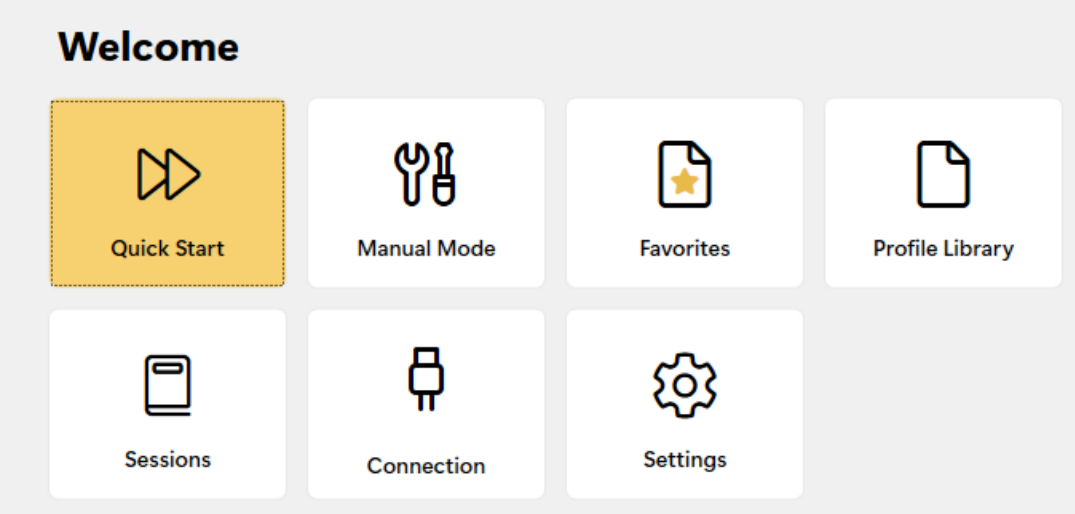
- User Guide

Radcal Accu-Gold 3 is a state-of-the-art radiation quality control software designed to provide accurate and reliable measurements for a wide range of applications. This instruction manual is designed to guide you through the features and functions of the software, so you can make the most of its capabilities.

With its advanced algorithms and sophisticated sensors, it is capable of making measurements in real-time, and provides a range of tools for data management and analysis. Additionally, its ability to connect to other devices and systems makes it an ideal tool for researchers and scientists who need to collect, analyze, and share data from multiple sources. With its user-friendly interface, Accu-Gold 3 is easy to use and understand, making it the perfect tool for anyone working with radiation.

Simply Powerful

AG3



Radcal Accu-Gold 3 is a powerful tool for radiation quality control that can be used in a variety of settings, including medical facilities, research labs, and industrial environments. It is capable of making measurements in a wide range of radiation environments.

AG3's strength is the ability to fully utilize the multi-function capabilities of the Accu-Gold digitizer via Profiles in ways heretofore not possible. Profiles are able to control all aspects of a measurement application including the triggering sensor's level, anode/filter selection, region(s) of interest as well as many other unique capabilities of the Accu-Gold system.

Table of Contents

Hardware Introduction

Accu-Gold 3 (AG3) is the next generation X-ray measurement system at the heart of which is a compact multi-function digitizer module and powerful, intuitive software. Accu-Gold 3 transforms your computer into a compact, cost effective, and multi-function X-ray analyzer and uses the latest technology in solid state sensors, gold standard ion chambers, mA, and light sensors.

(Please comment on this software and report any bugs that you may find. Accu-Gold 3 software provides the ability to save all of your measurements as session files. You should save session files because they are extremely valuable when solving application issues. In addition, saving raw data is invaluable in debugging any issues that come up.)

Computer System Minimum Requirements

The specified performance requires a computer with the following minimum specifications:
Operating system:
•Windows 7
•Windows 8
•Windows 10
•Windows 11

Processor: 800 MHz (Intel, AMD or VIA)
Screen Resolution of 1024 x 600
RAM: 150 MB free system memory to run application
Program storage: 10 MB for application and 50 MB for Framework.
Additional storage, greater than 50 MB, is recommended for storing measurement session files.
USB 2.0 Full-speed port for connection to the Accu-Gold Digitizer Module.
Excel 2007 or later is recommended for Excel data reports.

Getting Started

Hardware Overview

The Accu-Gold system consists of a digitizer module, sensor(s) and a display. AG3 is only compatible with Accu-Gold 'plus' hardware.

Connect the digitizer to the computer using a USB cable with a mini connector or connect the internal digitizer from a T3-Pro using a USB cable with a micro connector. Put the sensor in beam and start the software.

Accu-Gold Hardware setup video

System Configuration Options and Capabilities

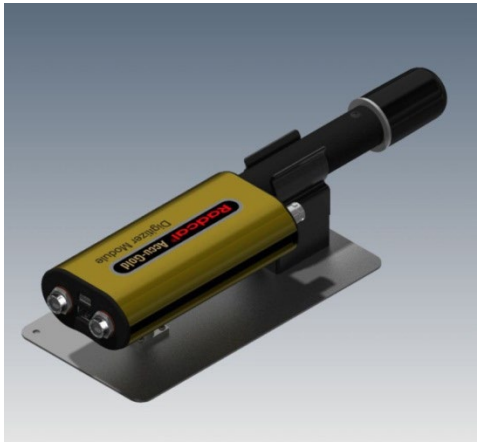
System	Accu-Gold	Rapid-Gold	Accu-Dose
Digitizer Model Number	AGDM+	RGDM+	ADDM+
T3 Pro Model Number	AGT3-P-AG	AGT3-P-RG	AGT3-P-AD
Sensor Options			
AGMS-D+ AGMS-M+ AGMS-DM+	X	X	
Ion Chambers	X		X
Dose Diode	X	X	X
mAs Sensor	X	X	
Light Sensor	X		

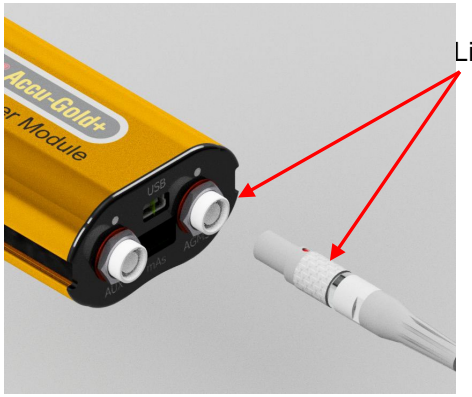
Setting up the Hardware

To set up the Accu-Gold hardware

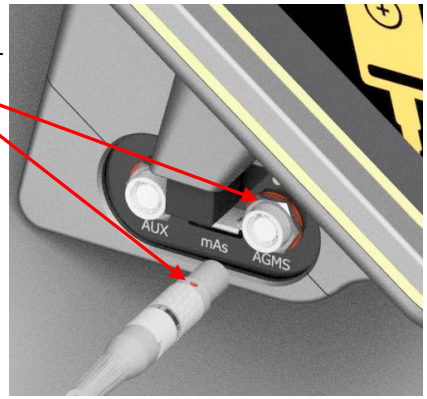
•Connect the sensor(s) to the digitizer. Connect the USB cable to the digitizer and then the computer
•Position the sensor to make a measurement.

Note: Position the sensor before clicking the **Play** button.
Moving the sensor or cable after clicking the **Play** button may trigger a false measurement.





Line up red dot with top of connector
Do NOT rotate



Software Introduction

- This software provides a user-friendly interface, making it easy to navigate and understand. The interface is intuitive, with clear and simple instructions that guide users through the measurement process.
- At AG3's core is the usage of profiles. Profiles are used to define the measurement process. They spell out trigger parameters, filtration requirements, the breakdown of the measurement (such as having a scout pulse) and the end of the pulse. Special calibrations are built into the profiles eliminating the need to install calibration files. Profiles allow you to specify different techniques for special measurements rather than relying on across-the-board catch-all techniques.
- When special needs arise, the profiles can make the measurement when nothing else can. Radcal is poised to help you by making special profiles as needed. If you feel that you need a special profile, contact customer support at cust_sup@radcal.com or call (626)357-7921, ext 123.
- Note - AG3 exclusively accommodates 'plus' digitizers paired with corresponding 'plus' sensors. If you currently utilize legacy Accu-Gold equipment and you want to take advantage of AG3, we recommend contacting your sales representative. They will be happy to assist you in exploring the possibility of a trade-in. Thank you for your understanding and cooperation.
- …*And much more*… Stay tuned to receive improvements and features.

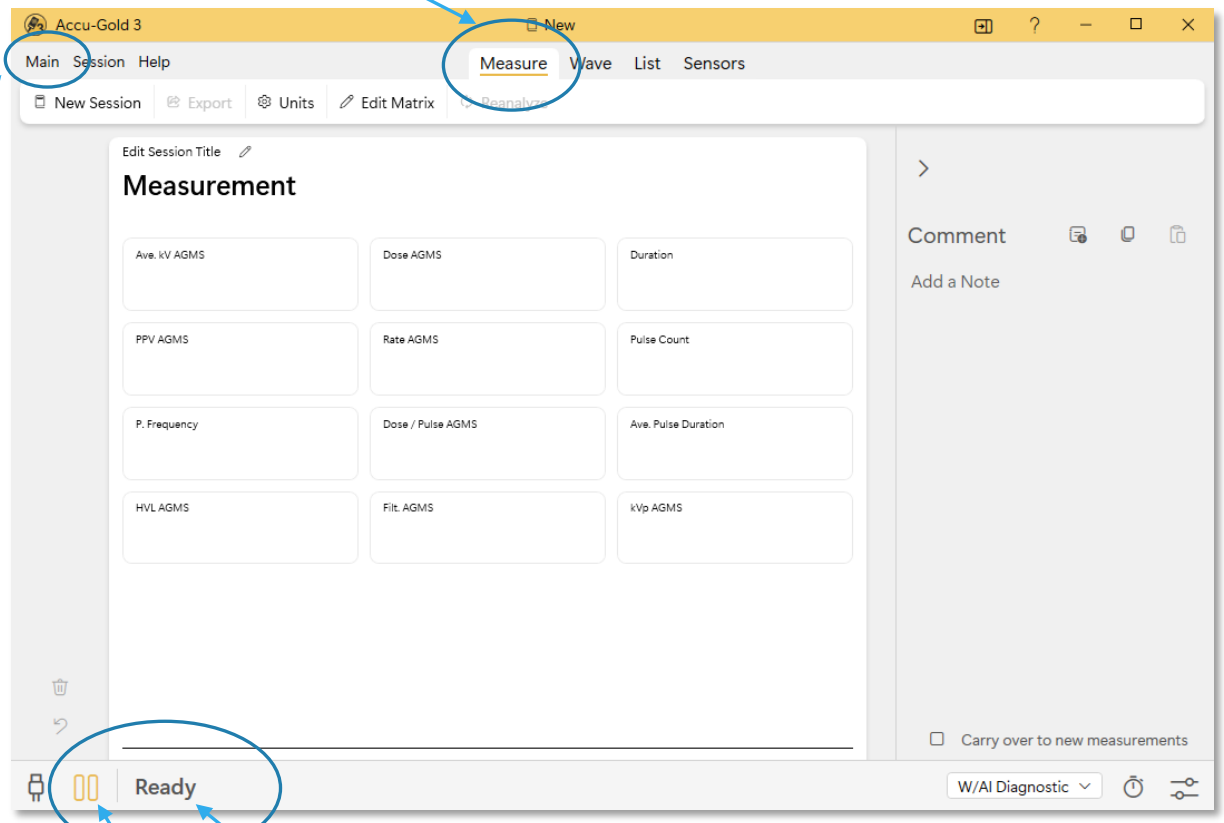
(See appendix A for installation instructions)

Quick Start

The software will automatically recognize your sensors once they are connected.

Quick Start

Plug in your sensors, launch the program - you are ready to make measurements …

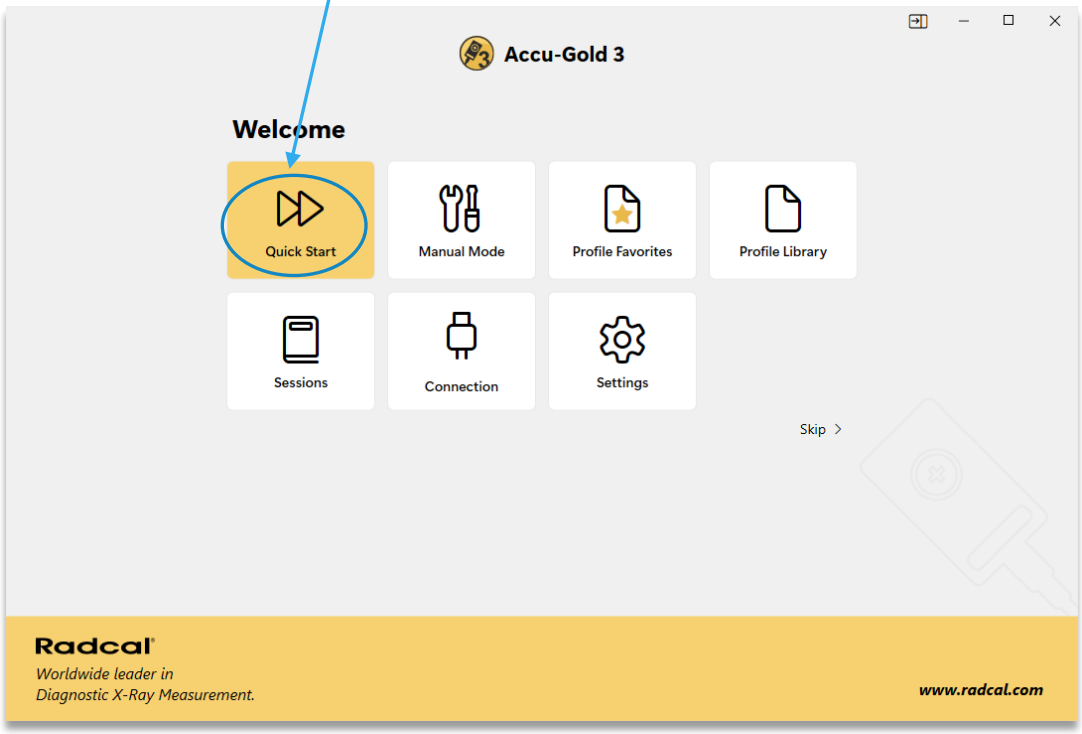


If you attach sensors after the program is open …

Click on the *Quick Start* box and the program will go straight to measure.

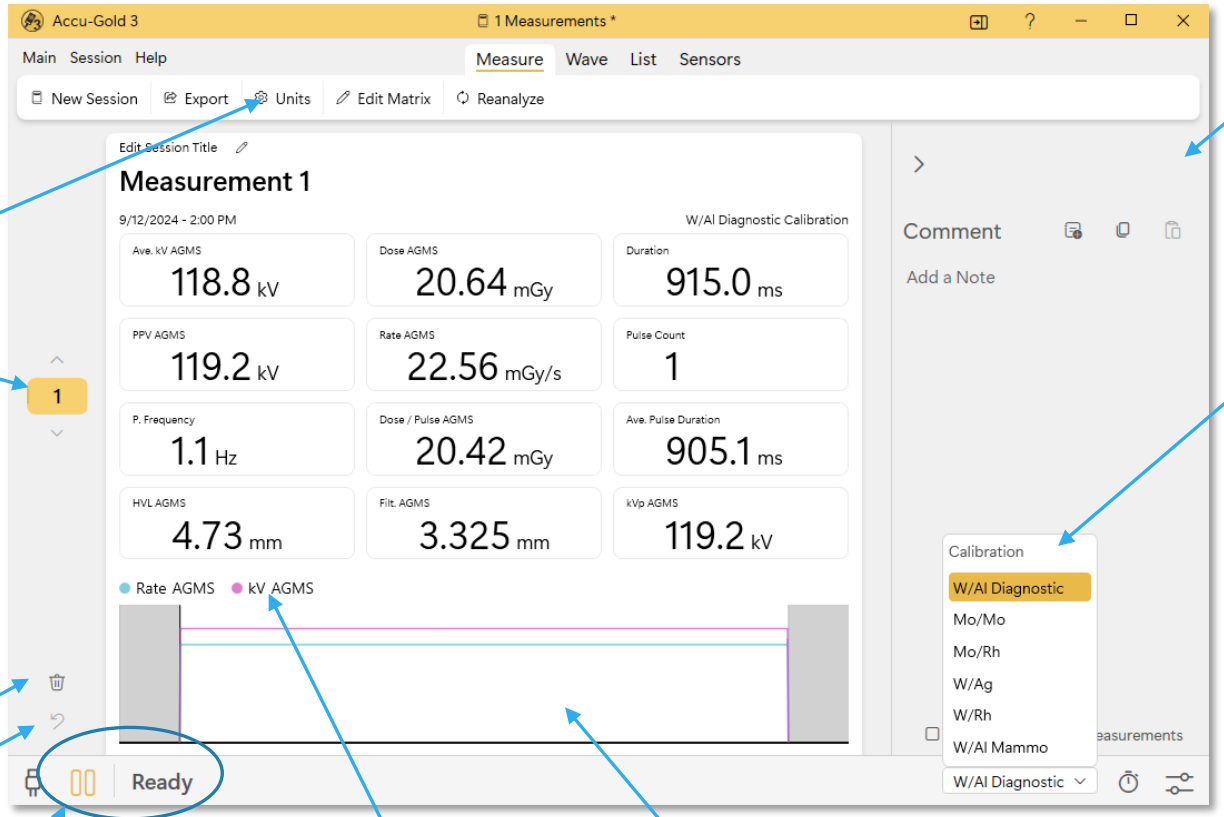
If the choices made by Quick-Start are not appropriate* for the measurements you are making, choose Manual Mode or select a profile from the Profile Library.

This is the *Main* menu



*Quick-Start will look to see what sensors are attached and will automatically choose the appropriate profile. Note: when using the DM sensor, it will choose the W-Al diagnostic calibration as the default. If you are making Mammo measurements, you will have to choose the appropriate anode-filter manually.

Make your first measurement …



Change from Gy to mR or use seconds vs. hours, etc if necessary

Measurement number. You can scroll thru each measurement you have captured using the up and down arrows

Delete measurement

Undo delete

You can continue making measurements when it says *Ready*

Waveform legend

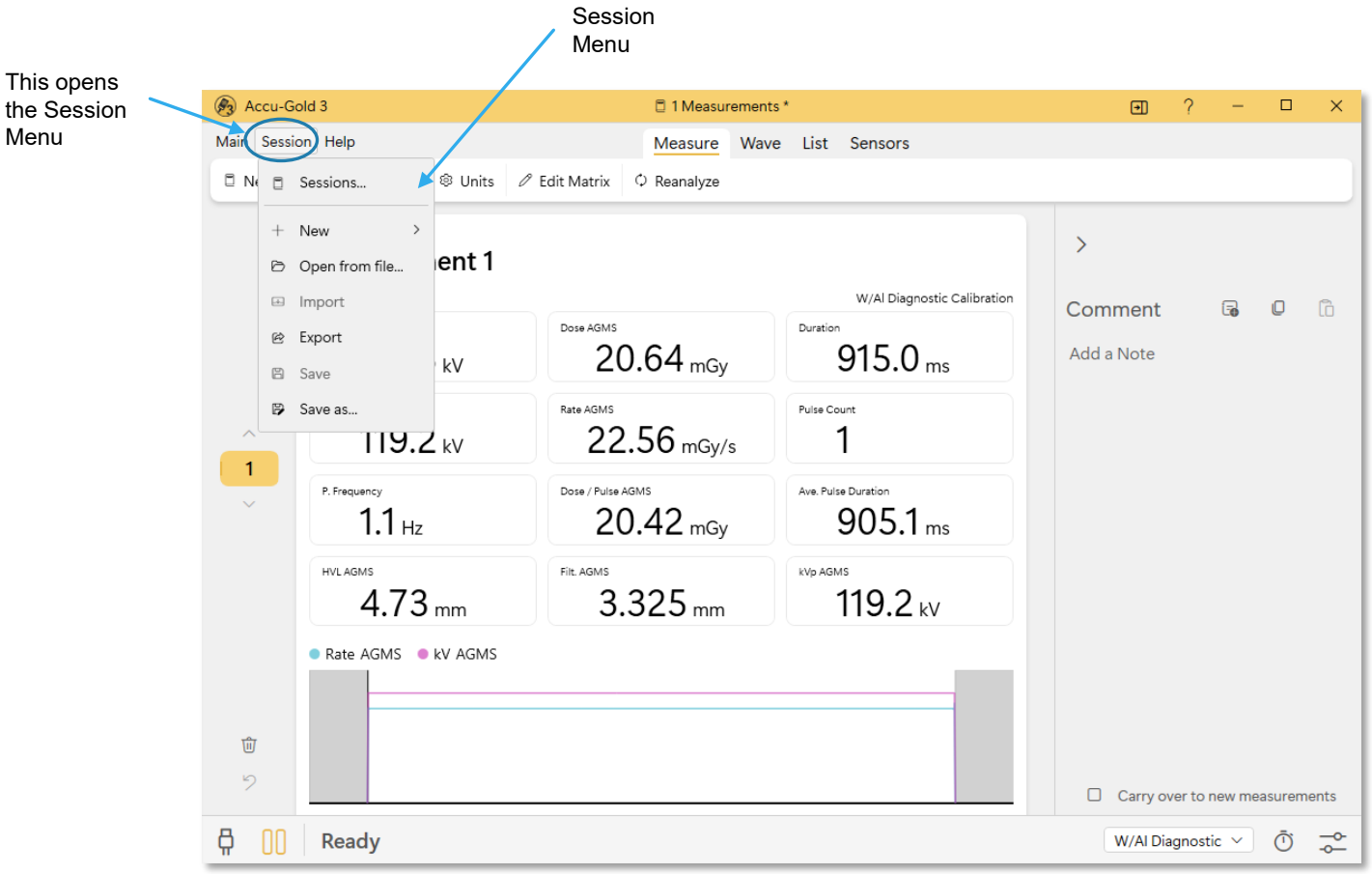
Click on the waveform to expand it or choose the *Wave* tab (See measurement section for more information)

Expand to enter comments (Described later)

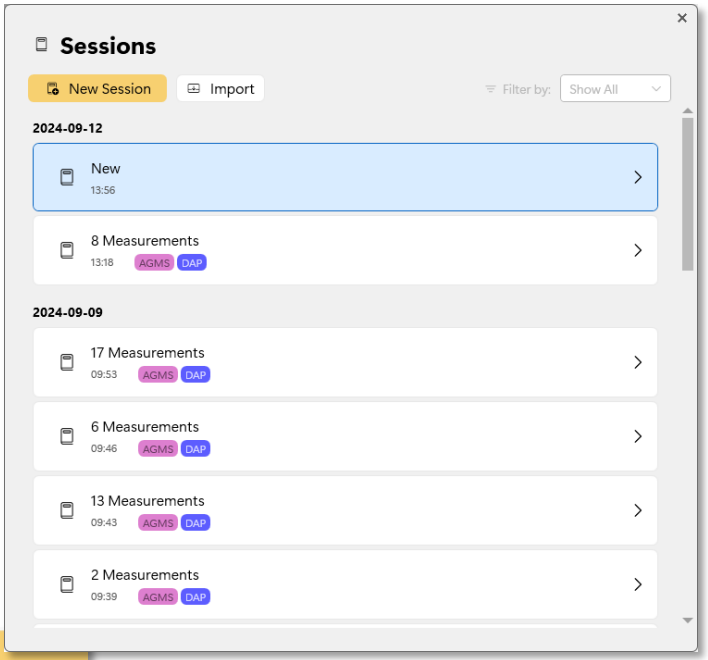
Choose the appropriate anode-filter to use from the DM+ sensor.

Sessions

When done making measurements, open the ***Session*** menu. Sessions are saved automatically but here you can start a new session, export, import or save the session with a meaningful name of your choice or leave the default name. You can also do session maintenance from the ***Main*** menu



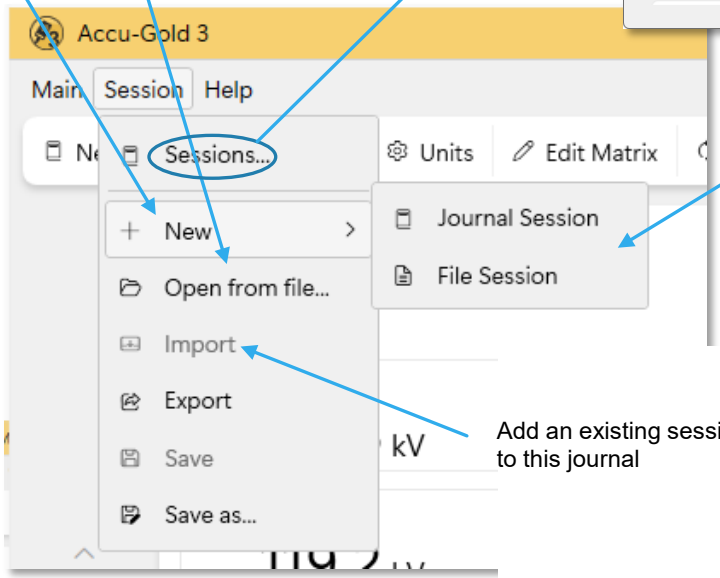
Sessions (cont)



This brings up a list of the sessions in the Journal

Open an existing session (including AG2 sessions)

If you have a session open, it will close it first then start a new session



A *Journal Session* saves data in the program space automatically.
A *File Session* saves data to a file independent of the Journal that is part of the program space.

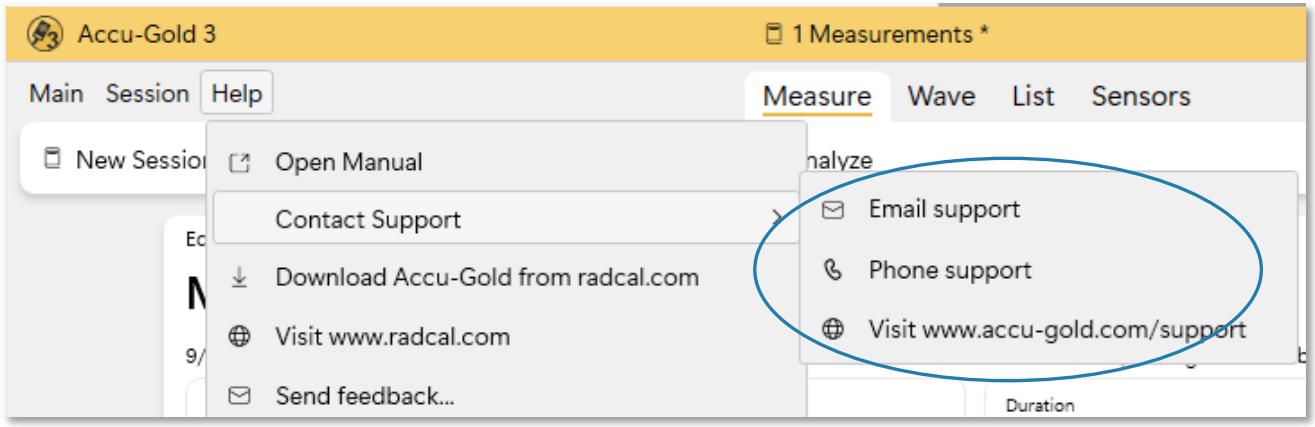
Add an existing session to this journal

Quick Start should always be method of choice for all standard diagnostic x-ray measurements except mammography and CT. If you don't get the desired result, a suitable Profile may be available based on the Modality. For example; you might want the end values for a Pulsed Fluoro exposure, not the averages, so select Pulsed Fluoro with a 1s ROI. The same goes for low dose rate continuous fluoro.

AG3 provides tools for Radcal to quickly solve your measurement issues If you do not get the desired result, you are encouraged to contact Radcal. Save the session and contact Radcal tech support to see if a special Profile can meet your measurement needs.

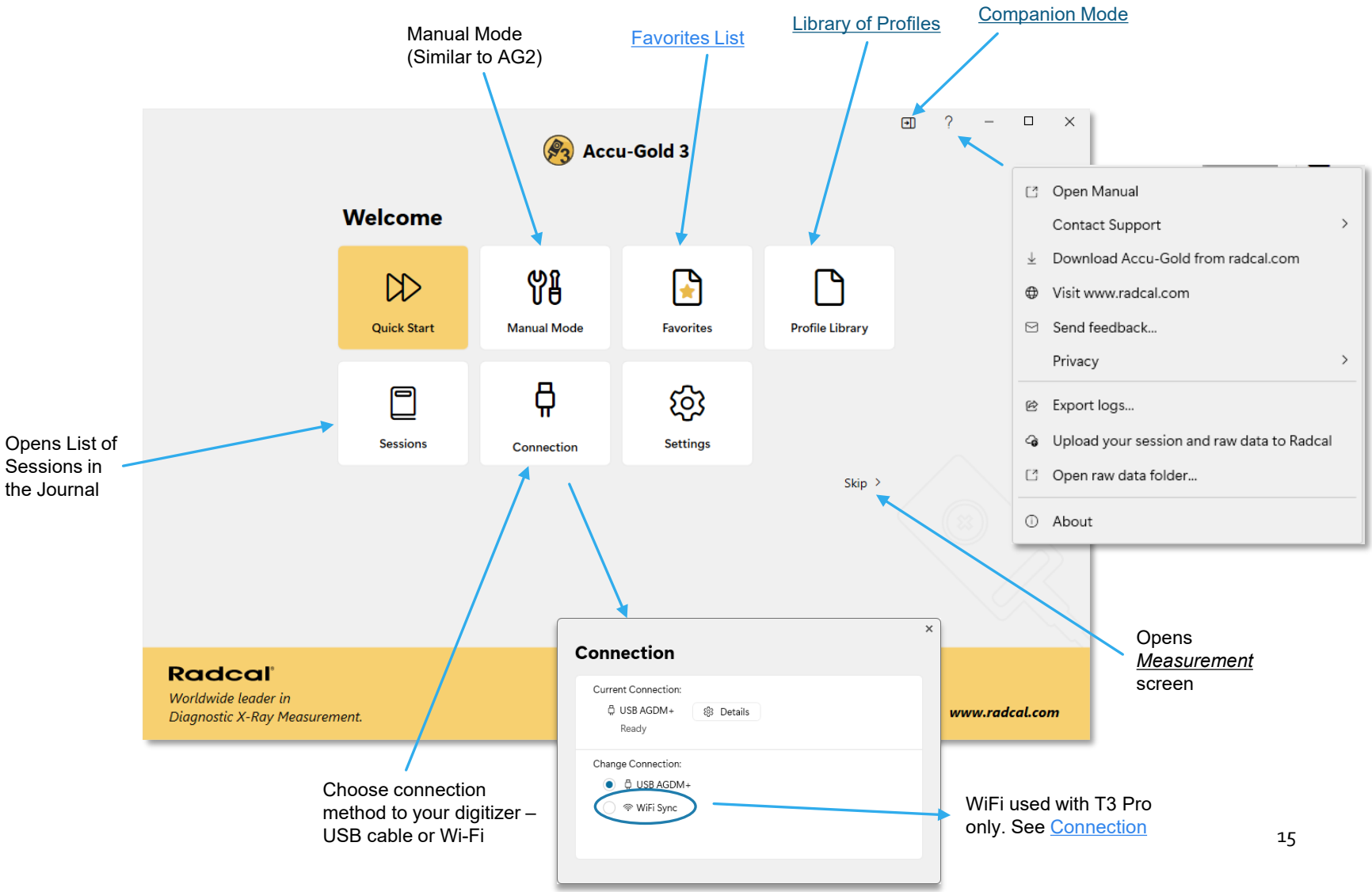
Contact us …

Click on ***Help***



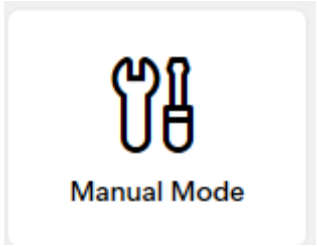
The Main Menu

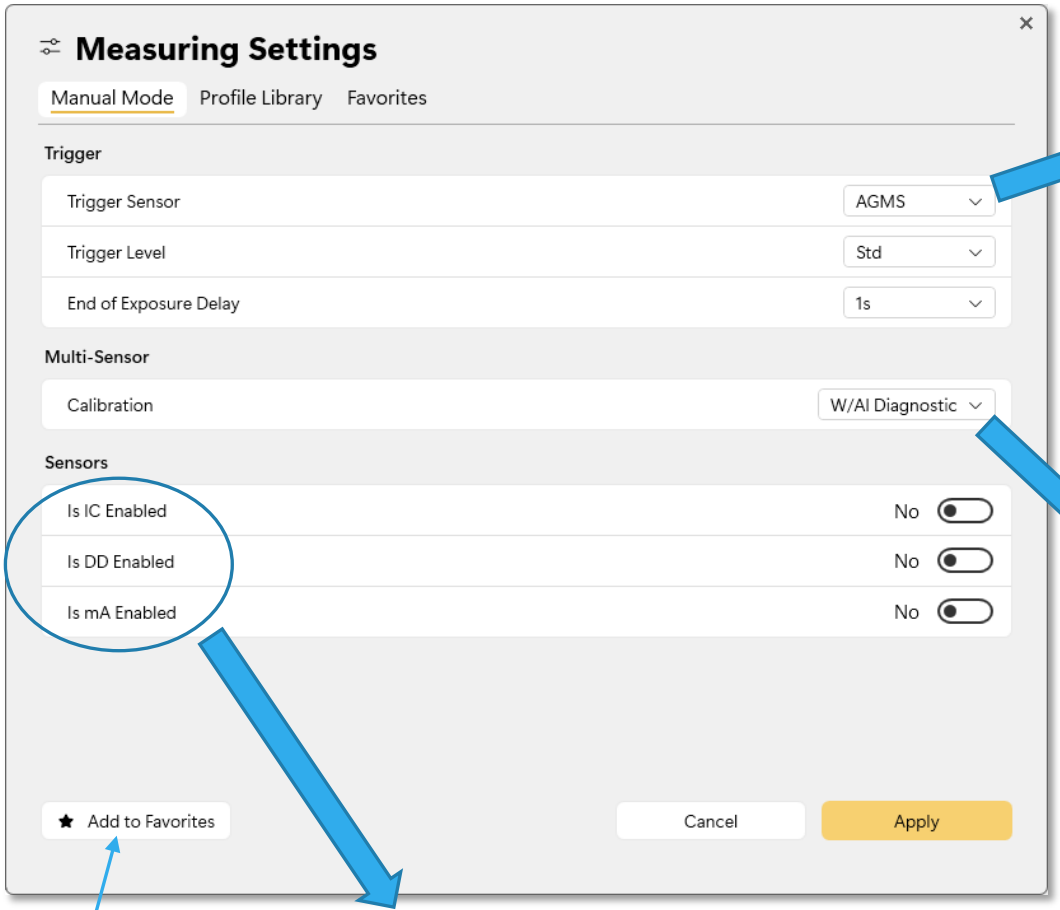
Start here

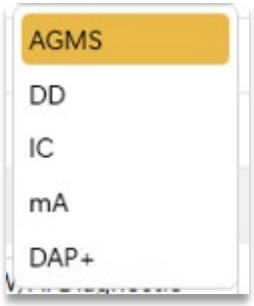


Manual Mode

Choose *Manual Mode* from the *Main* menu







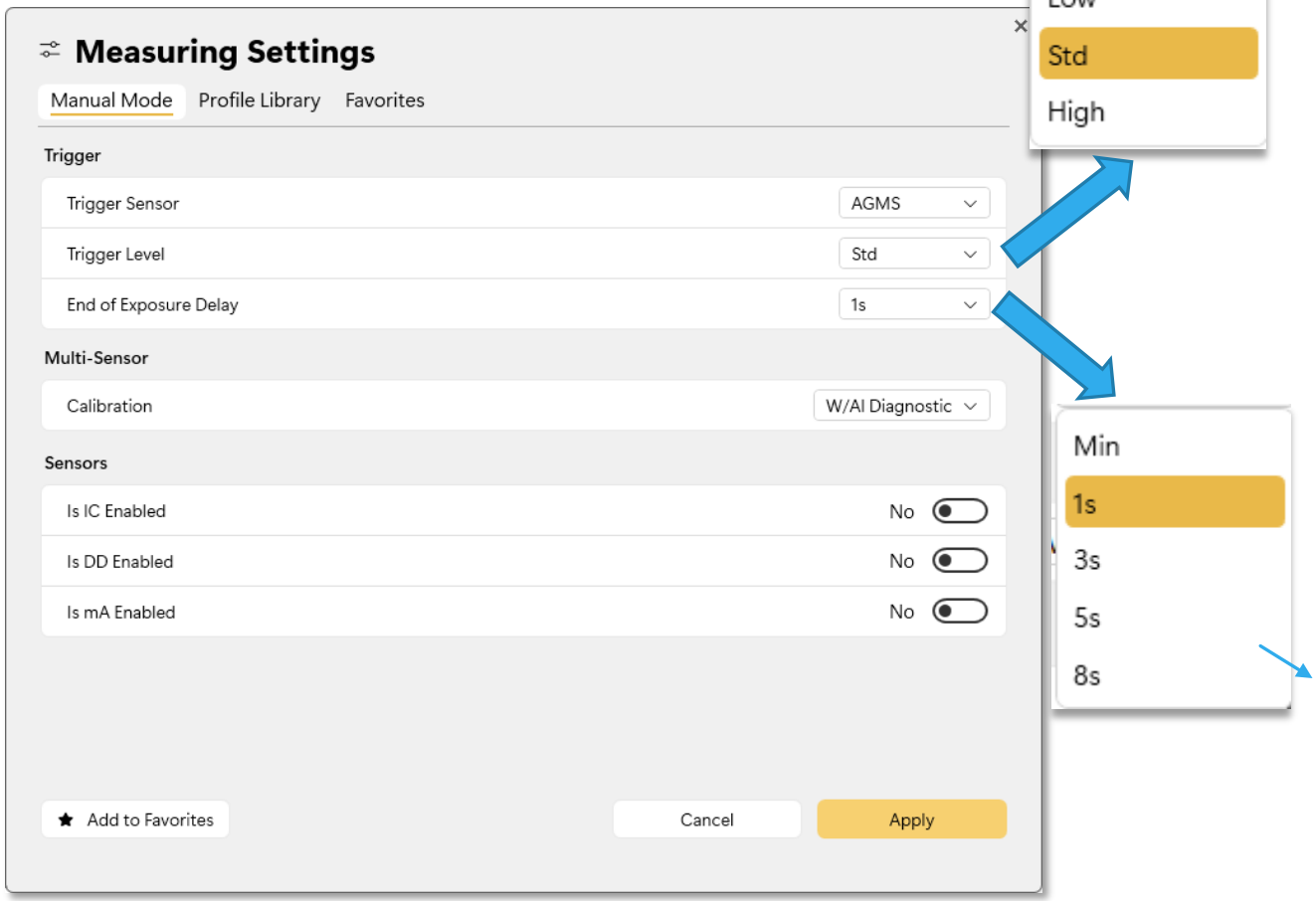
Choose the sensor to be the trigger source

Before making an exposure, make sure to choose the Anode/Filter combination that matches the machine being measured.

The Accu-Gold Digitizer Module (AGDM) allows you to simultaneously collect data from multiple sensors.

A combination that is used often can be saved by adding it to the *Favorites* menu.

Manual Mode (cont)



Std - *Std* trigger sensitivity is recommended.

Low - Select if Std is not low enough. *Low* may allow smaller signals to be captured, but may also result in false triggers.

High – Select if *Std* causes false triggering.

Note: If noise or false triggers prevent reliable ion chamber measurements and grounding the system has not improved the experience, connect a Multi-sensor or Dose Diode and locate it somewhere in the radiation beam so that it can serve as a trigger source.

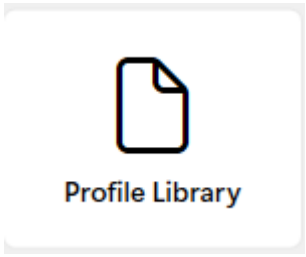
If you have a strong, noise free signal, selecting *High* will minimize the time the system measures a background zero in between measurements allowing you to make continuous measurements rapidly. A new zero will be recalculated every 5 minutes..

Many x-ray feature scout exposures which may introduce gaps of several seconds or more in the radiation output. The default end of exposure timing in some instances will not be long enough and Accu-Gold may attempt to display the exposure results while the generator is finishing the exposure. If this situation is encountered, you may select an end of exposure delay of up to 8 seconds. *Min* allows one to make successive measurements quickly. In between measurements, zeroing is skipped and therefore use *Min* with large signals only where zeroing in between measurements is not important – use with “High Threshold”.

NOTE: Do not make sensitive measurements when the computer is hooked up to a charger unless the charger has a 3-wire AC cord (and the AC outlet is properly grounded).

Profiles

You have three ways to select a profile yourself: Favorites, Manual Mode or Profile Library. Since there are no Favorites in the beginning, use Manual Mode (which is also a way of selecting a profile) to try it out, then explore the Library to see what else you can do.

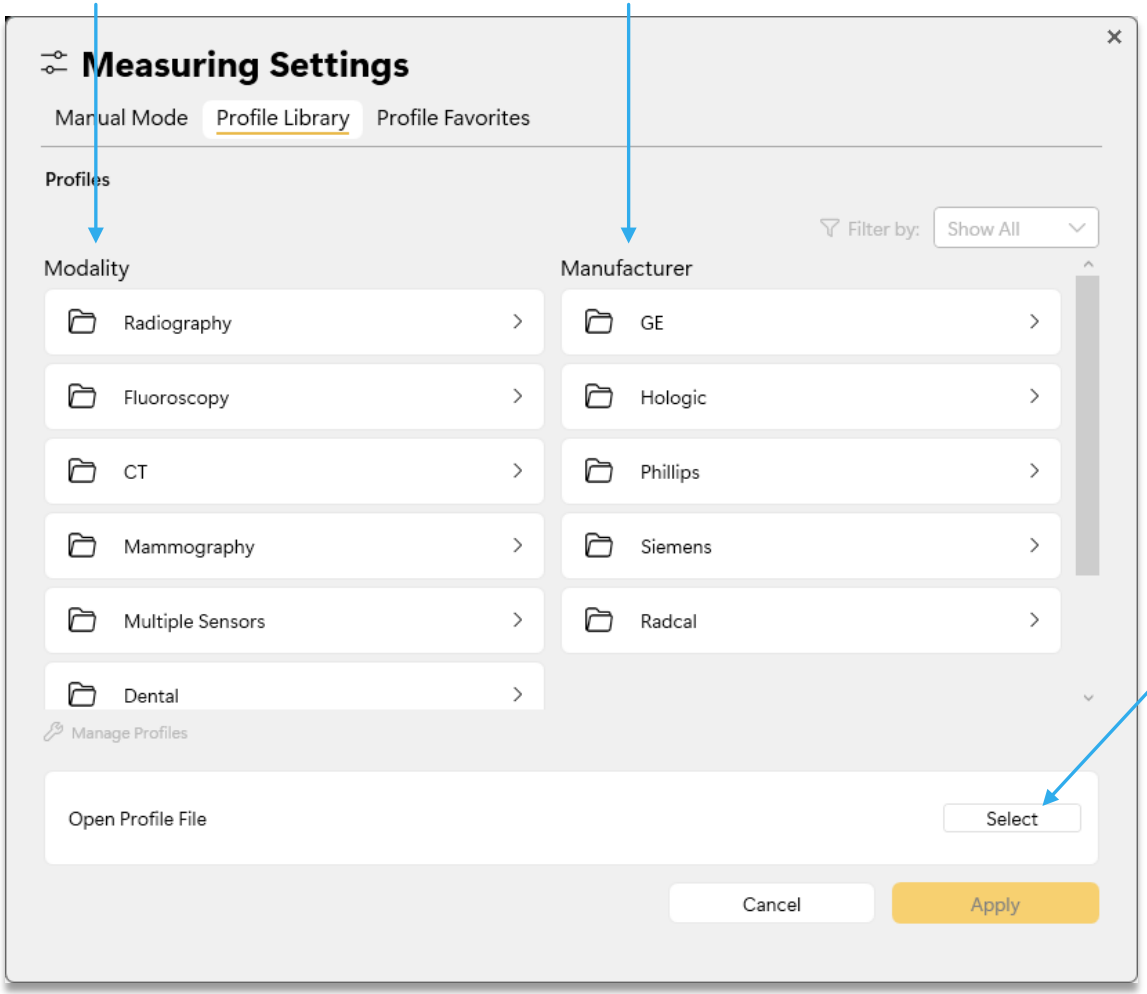


Profile Library

When a user doesn't get the desired result using Manual Mode, a suitable profile might be available based on Modality or Manufacturer.

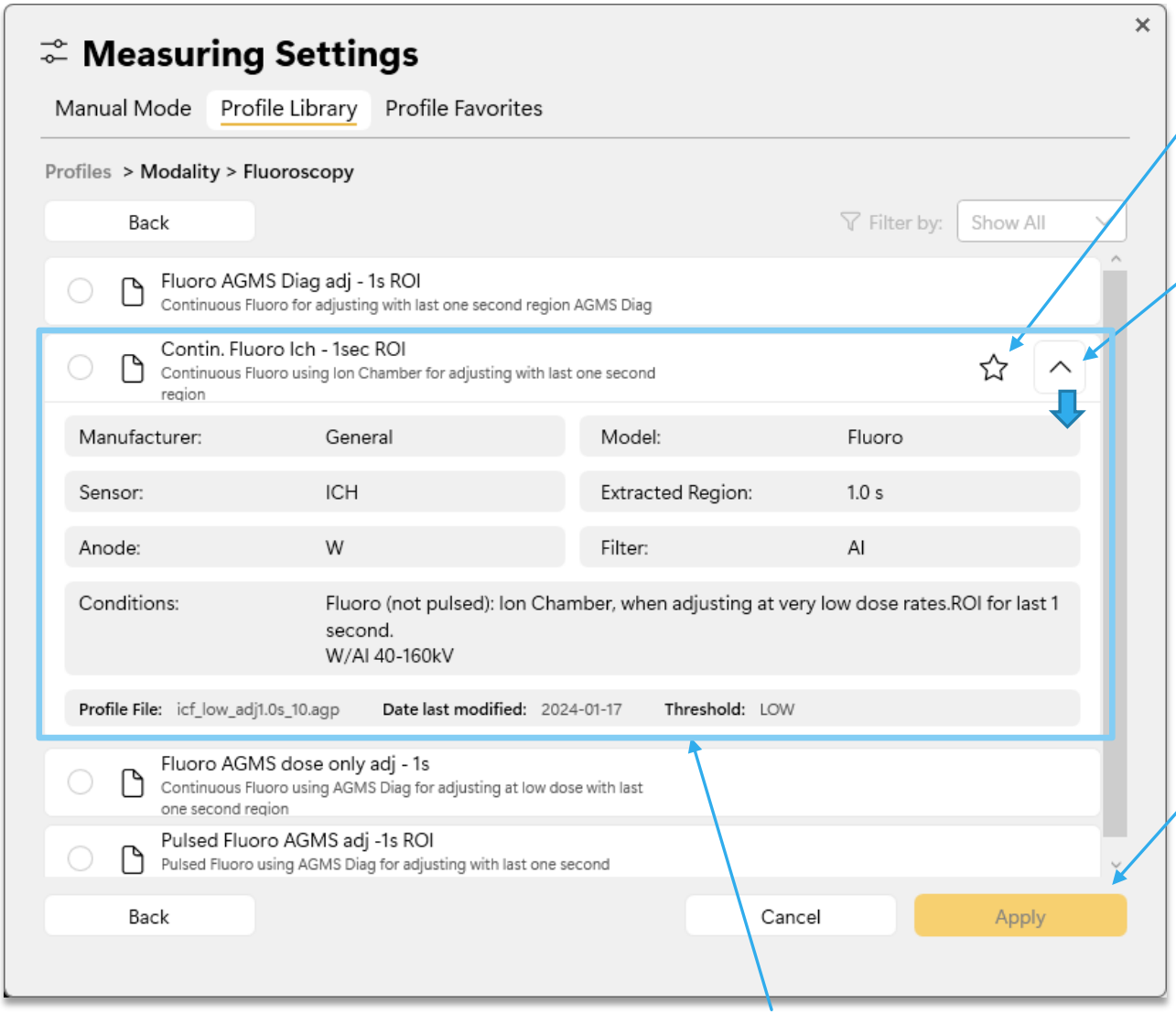
By Modality

By Manufacturer



Use this if a custom profile has been supplied to you. See Appendix

Profile Library (cont)



Select to make it a favorite

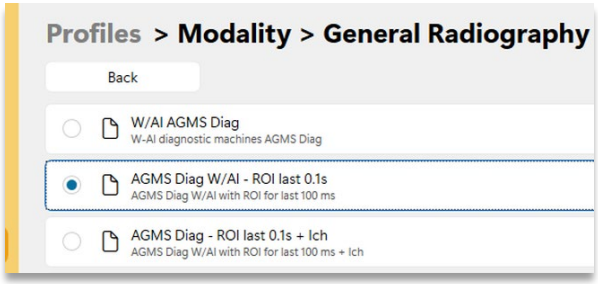
Click to expand/contract

Click Apply to use

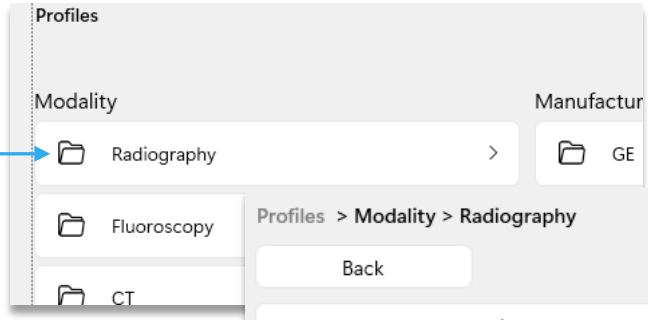
Application information

Example -

I want to make a measurement using a W-AI diagnostic x-ray machine and I am interested in examining the last 100 milliseconds of the waveform which would be useful where the generator needs time to stabilize and the initial kVp & dose rate undershoot or overshoot

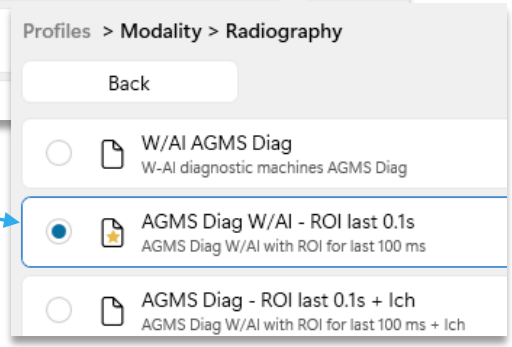


Choose Radiography

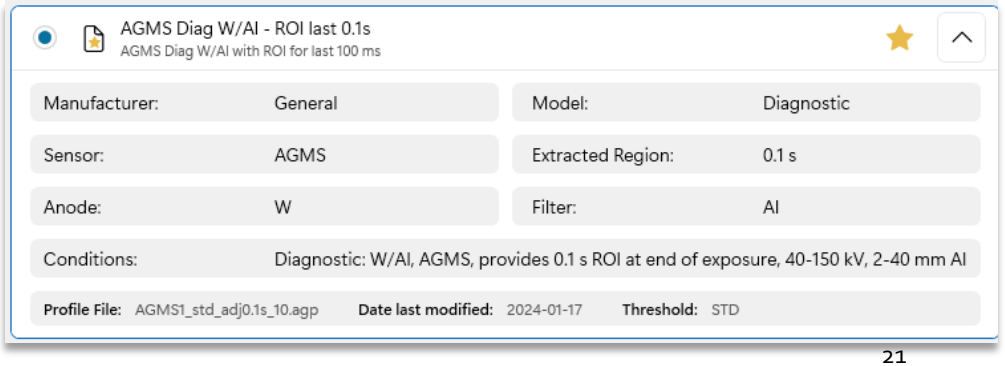


ⓘ

Then choose using a multisensor profile that gives a region of interest of 100 msec
AGMS with ROI 100 ms



Click the star to make it a favorite

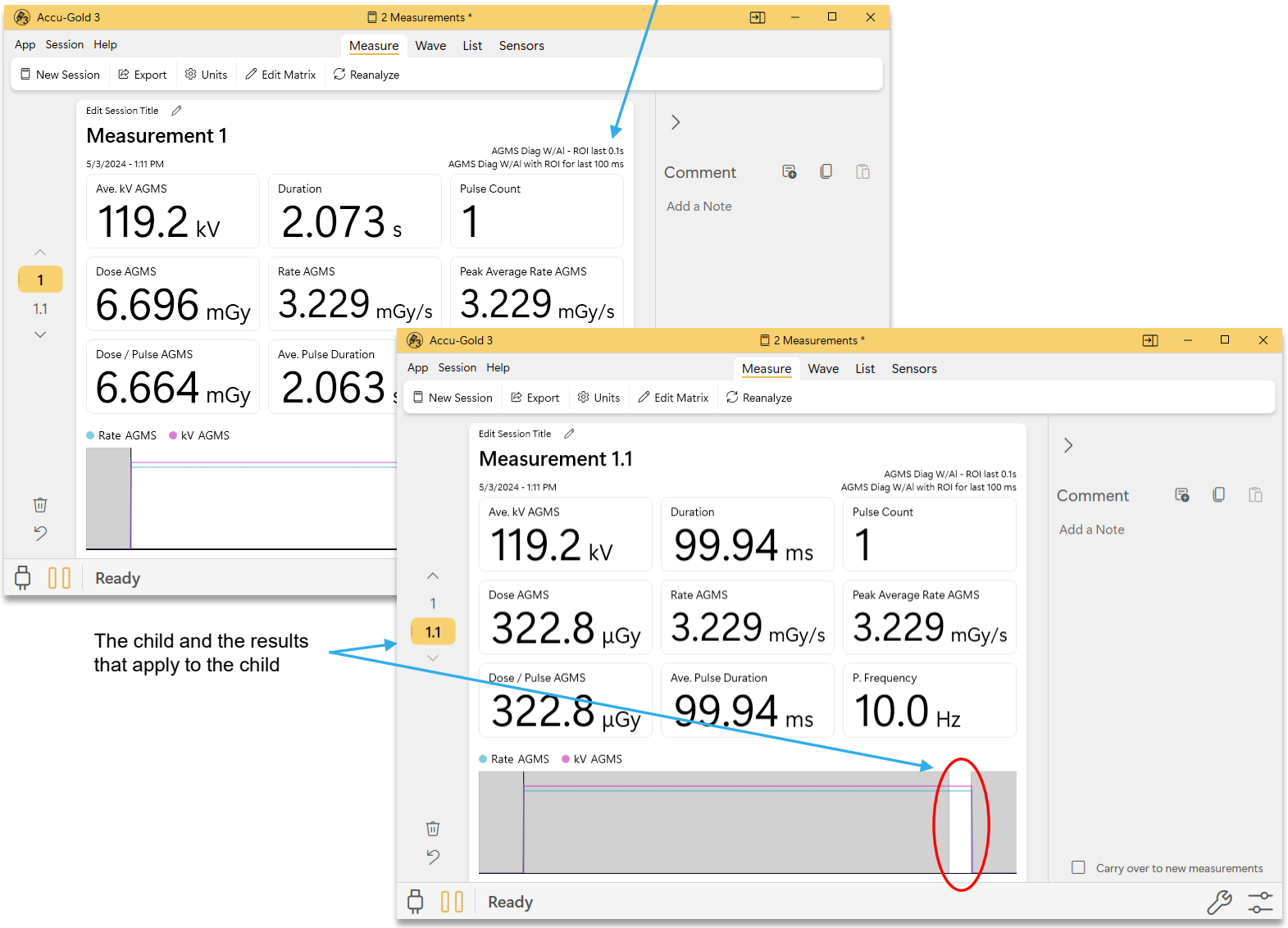


Clicking the ⓘ button will expand the information about the profile and will describe the application it was intended for.

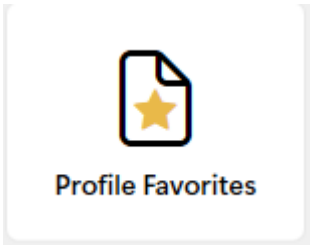
(continued)

Click *Apply* and make a measurement

The profile name

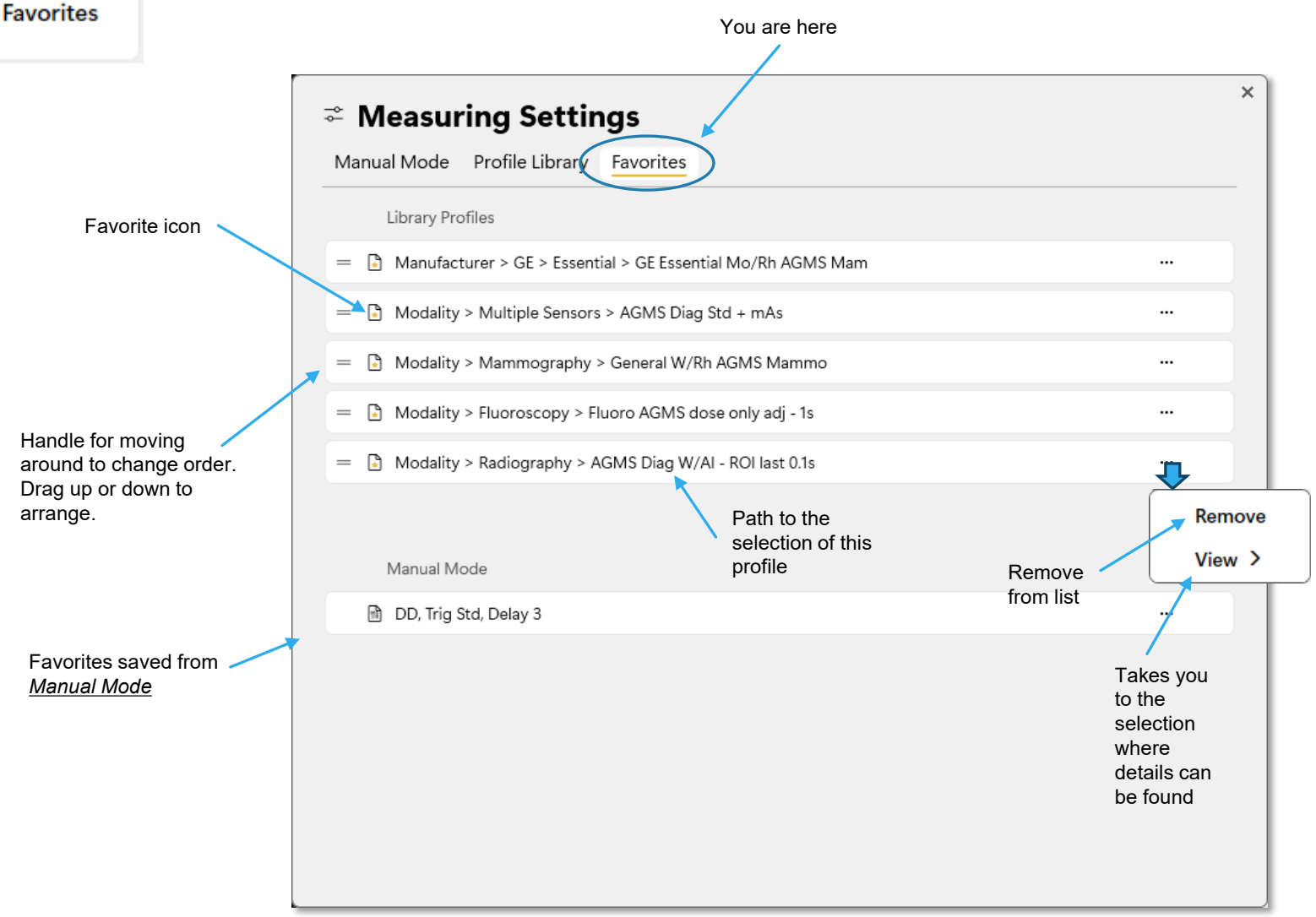


The child and the results that apply to the child



Profile Favorites

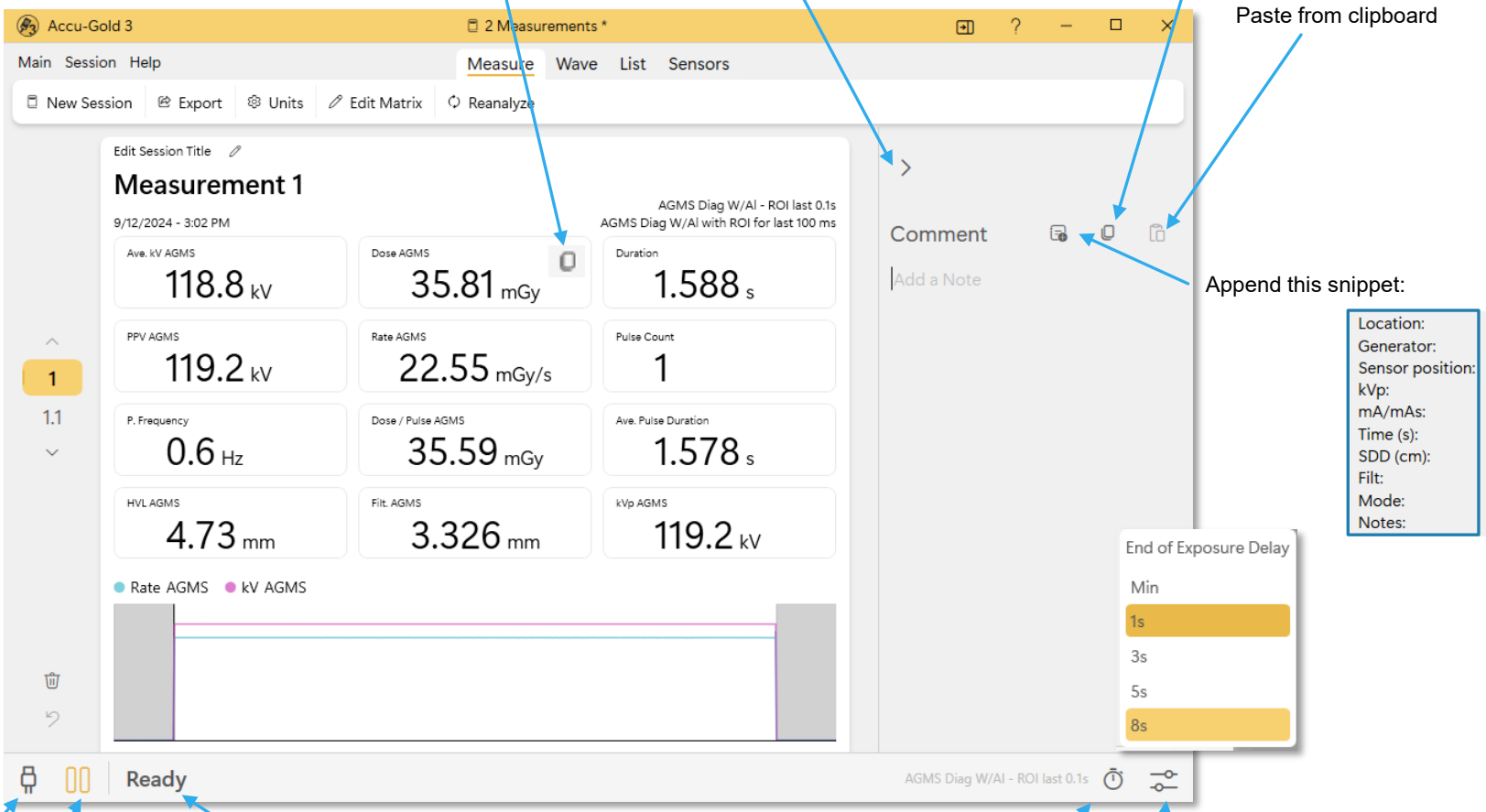
Selecting Profile Favorites lets you manage the Favorites. You can change the order, remove, or examine what you have:



Measurements

Quick-Start is generic and is sufficient to make basic measurements. With special requirements, profiles will be required.

Making Measurements and Copying data



Expand or contract comment area

Click on icon to copy to clipboard or drag-and-drop value straight to Excel

Copy entire comment to clipboard

Paste from clipboard

Append this snippet:

Location:
Generator:
Sensor position:
kVp:
mA/mAs:
Time (s):
SDD (cm):
Filt:
Mode:
Notes:

Connection type = USB

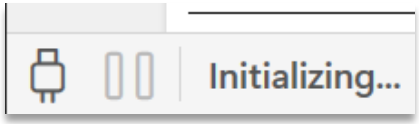
Click when ready to start the next measurement
Click again to pause

Measurement status - When *Ready* is shown, start the exposure

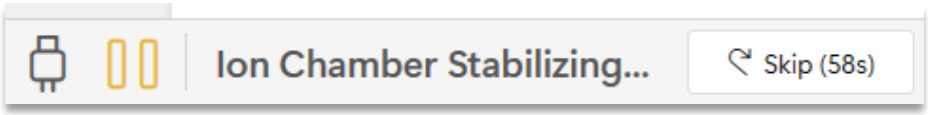
Click to bring up option to change delay

Returns to profile selection area or where you were last

Initialization Cycle

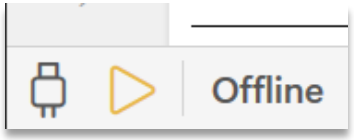


The software starts by connecting to the digitizer and initializing the electronics

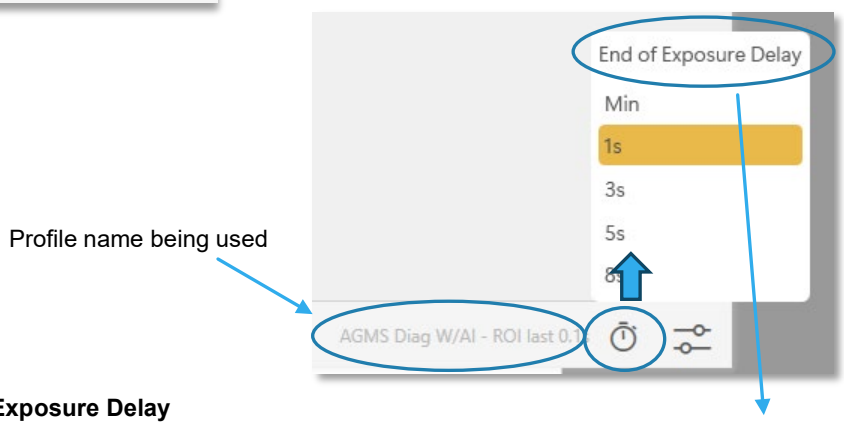


If an ion chamber is connected, the bias supply starts and the software waits for it to stabilize.

As soon as the 'Ready' message is displayed at the bottom of the screen, you can make a measurement.



Press the 'Pause' when moving, changing or adding sensors. Pressing the 'Play' again starts the initialization and re-zeroing again.



Profile name being used

End of Exposure Delay

Many modern x-ray generators now feature scout exposures which may introduce gaps of several seconds or more in the radiation output. The default end of exposure timing for Accu-Gold is 1 second for Diagnostic and Mammographic sensors. In some instances, this is not long enough and Accu-Gold may attempt to display the exposure results while the generator is finishing the exposure. If this situation is encountered, you may select an end of exposure delay of up to 8 seconds. 'Min' allows one to make successive measurements quickly. In between measurements, zeroing is skipped therefore use 'Min' with large signals only where zeroing in between measurements is not important – use with "High Threshold". The End of Exposure Delay in the profile or that selected in Manual mode can be overridden here.

Fluoro Measurements

Fluoro measurements can normally be made by using Quick-Start which will use the profile for W-Al diagnostic. Certain modes of Fluoro measurements may require more specialized profiles:

Pulsed-Fluoro Measurements

Calibration of pulsed-fluoroscopy machines is facilitated through use of the real-time display. When a fluoroscopy exposure is initiated, the dose rate will be measured and displayed in real-time *without the need to select a special mode*. The value of dose rate is updated at a rate of once per second making Accu-Gold an ideal instrument for tracking dose rate changes as fluoroscopy machine settings such as mA (current) are continuously adjusted. Previous Radcal products required selection of the pulse rate in advance in order to obtain accurate real-time measurements. This is no longer required as the Accu-Gold system automatically identifies individual pulses and pulse rate on the fly providing a stable accurate reading regardless of kV, pulse rate, and mA.

Continuous Low Dose Fluoro Measurements

Making Low Dose Measurements with a Multi-Sensor

The AGMS Multi-Sensor operates by measuring the x-ray intensity through several sensing elements equipped with increasing levels of internal filtration. As the dose decreases below certain levels that are anode/filter-specific, measures of the spectral quantities (kV, HVL, and Filtration) cannot be made. Dose and Dose Rate remain reliable and are reported along with the note *Dose Only Mode*.

Making Low Dose Measurements with Ion Chambers

When making low dose measurements using an ion chamber (in the range of 10 times the minimum rated range), it is important to eliminate all sources of noise including noise induced by changing temperatures of the surroundings and the electronics. Position the ion chamber. Set the threshold to low and wait 3 minutes. Do not touch the cable or digitizer. For changing environments, allow 10 minutes for every 10 C difference for the sensor/electronics to equilibrate. Grounding the system to eliminate interference may be warranted.

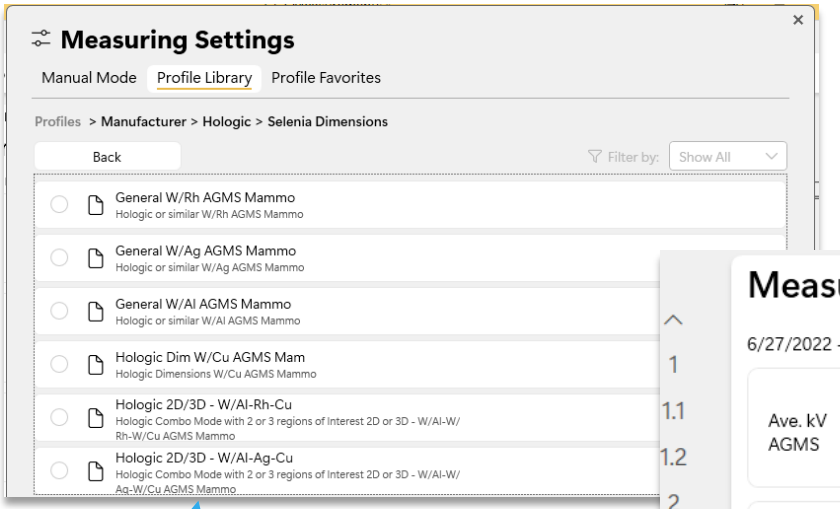
Several profiles are provided to assist in making adjustments to a fluoro system which require adjusting the kV down to some level. These profiles will save the kV value at the end of the adjustment.

Combination Measurements

Mammography machines are increasingly supporting multi-mode or combination mode exposures in which multiple modalities such as 2D, Tomographic 3D, and High Contrast are incorporated in a single exposure (see below). Radcal's Accu-Gold instruments support these modes in a number of ways.

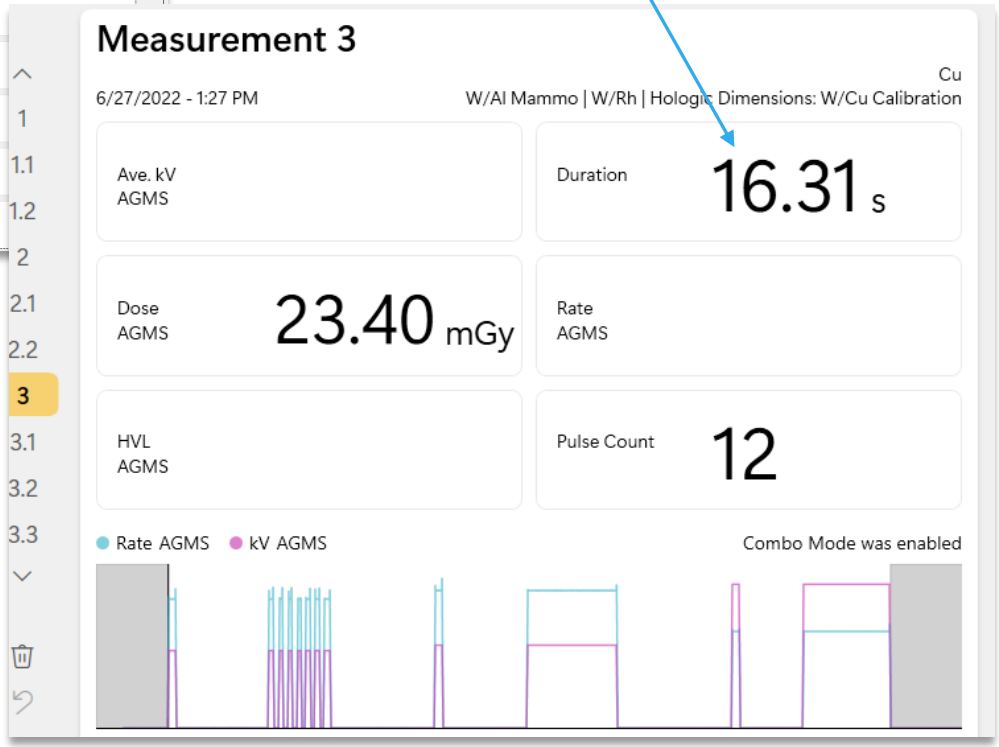
Radcal's 10X6-6M ion chamber has excellent energy uniformity and provides accurate dose measurements for all mammography beam qualities. As a result, this sensor is an excellent solution for reliable dose measurement for combination modes.

Radcal's AGMS multi-sensors also support accurate dose measurements for a number of combination mode systems. In particular, the Hologic Dimensions systems are well characterized by the AGMS sensors. Simply select the Hologic Selenia Combo mode profile, as shown below, for the 2D+3D Tomographic combination mode.



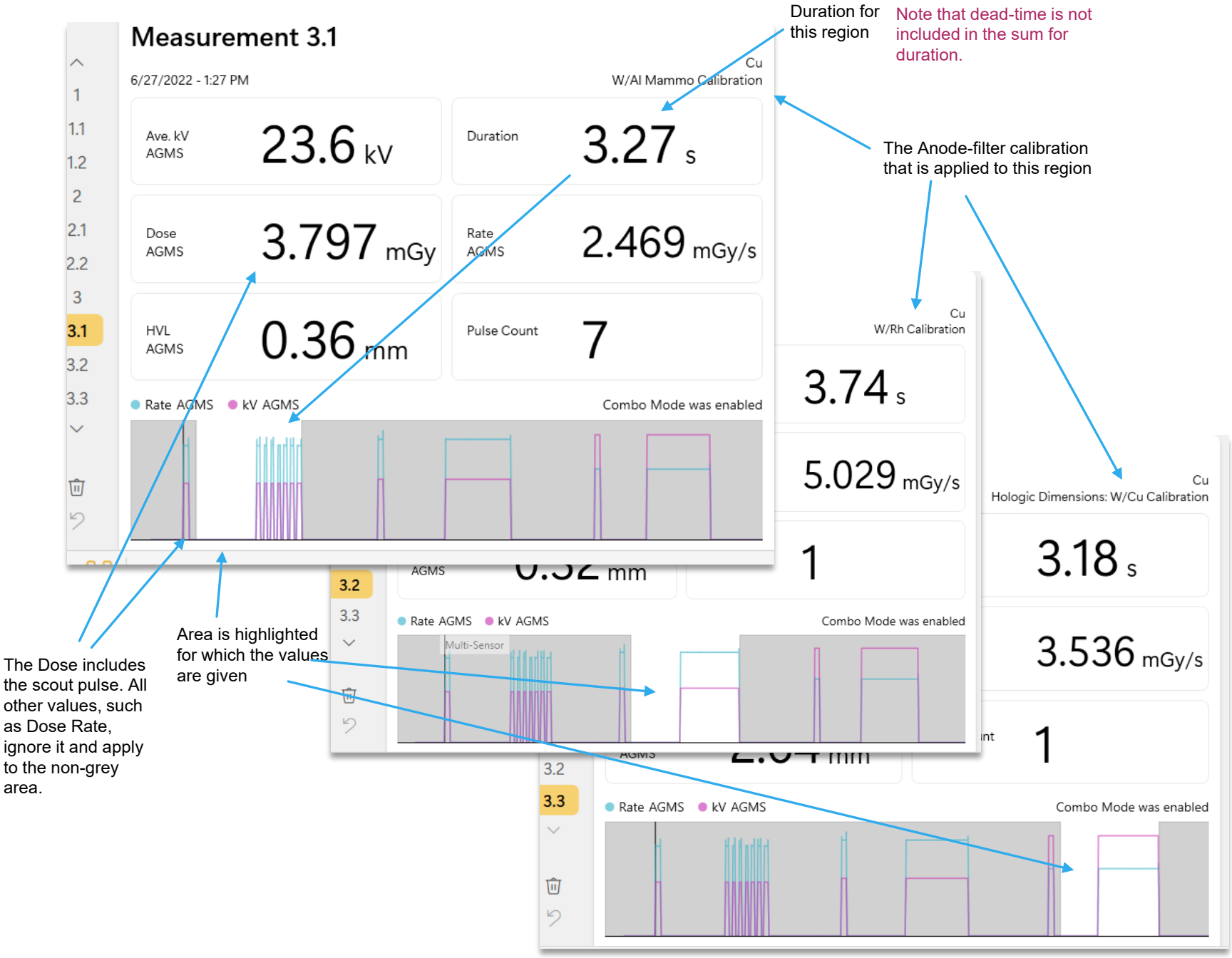
Hologic Combo Mode measurement

Total Duration



3 Child measurements

(continued)


Duration for this region
Note that dead-time is not included in the sum for duration.
The Anode-filter calibration that is applied to this region
Measurement 3.1
6/27/2022 - 1:27 PM
Cu
W/Al Mammo Calibration
Ave. kV AGMS
23.6 kV
Duration
3.27 s
Dose AGMS
3.797 mGy
Rate AGMS
2.469 mGy/s
HVL AGMS
0.36 mm
Pulse Count
7
Rate AGMS
kV AGMS
Combo Mode was enabled
Cu
W/Rh Calibration
3.74 s
5.029 mGy/s
1
Cu
Hologic Dimensions: W/Cu Calibration
3.18 s
3.536 mGy/s
1
Multi-Sensor
The Dose includes the scout pulse. All other values, such as Dose Rate, ignore it and apply to the non-grey area.
Area is highlighted for which the values are given

Background Measurements

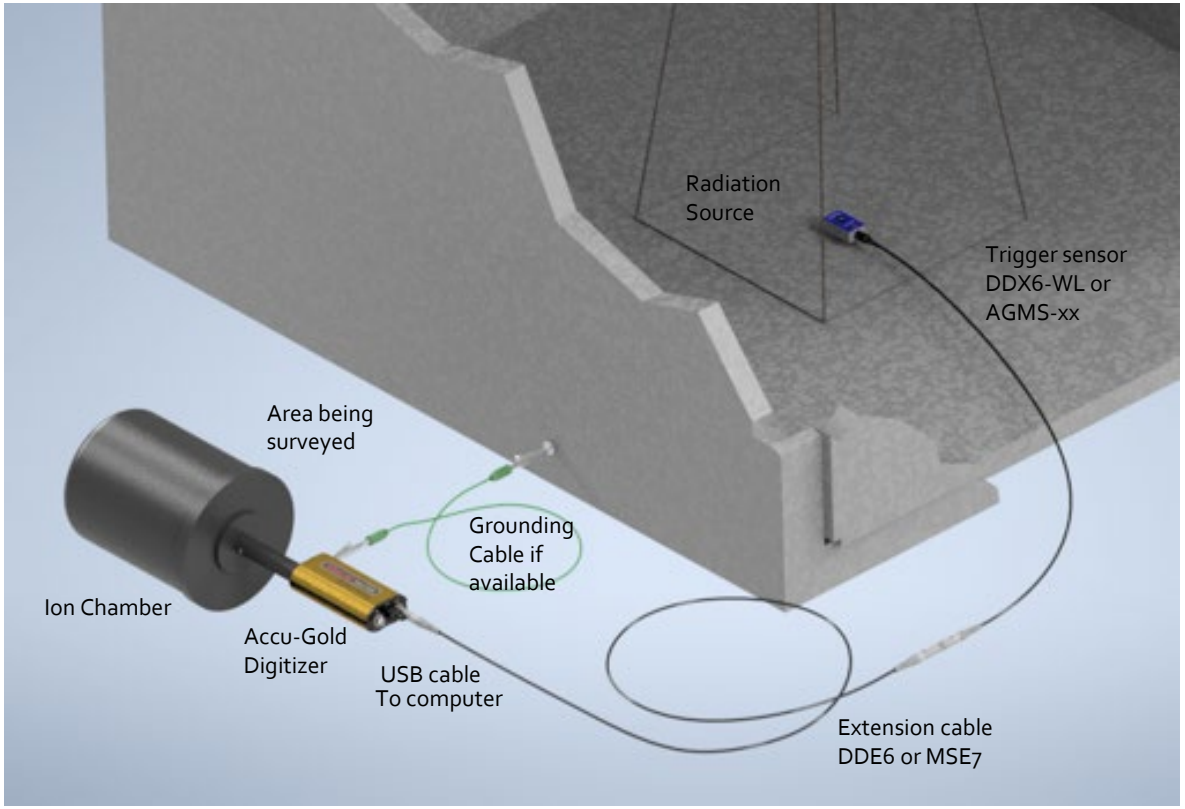
The technique and radiation levels to be detected will determine the best sensor suited for your evaluation. A 180cc, 500cc, or 1800cc chamber may be used, but while the 180 Ionization Chamber is excellent for detecting direct leakage with its 100cm^2 area, it is not practical for scatter measurements. The 1800 Ionization Chamber, for instance, allows 360° detection.

Several methods are available for making these measurements. See AN1007 for additional details.

Triggering with a Multi-Sensor/Dose Diode

When making scatter or leakage measurements, the readings may be too low to trigger a measurement. In that case a second sensor placed in the beam can be used to trigger the measurement which will guarantee that the ion chamber's signal is captured during the triggering period of that sensor. We recommend that you use AGMS-DM+ or DDX6-WL as the trigger source.

This can be done by placing the trigger sensor in the primary beam using an extension cable as necessary to connect it to the digitizer, and the Ionization Chamber in a fixed position (tripod, clamp, etc.) in the areas of choice. (See figure) If additional distance is necessary, the USB connection can be extended using active USB extensions or even USB-over-Ethernet.



Waveforms

Opens Excel and exports all data related to the current waveform

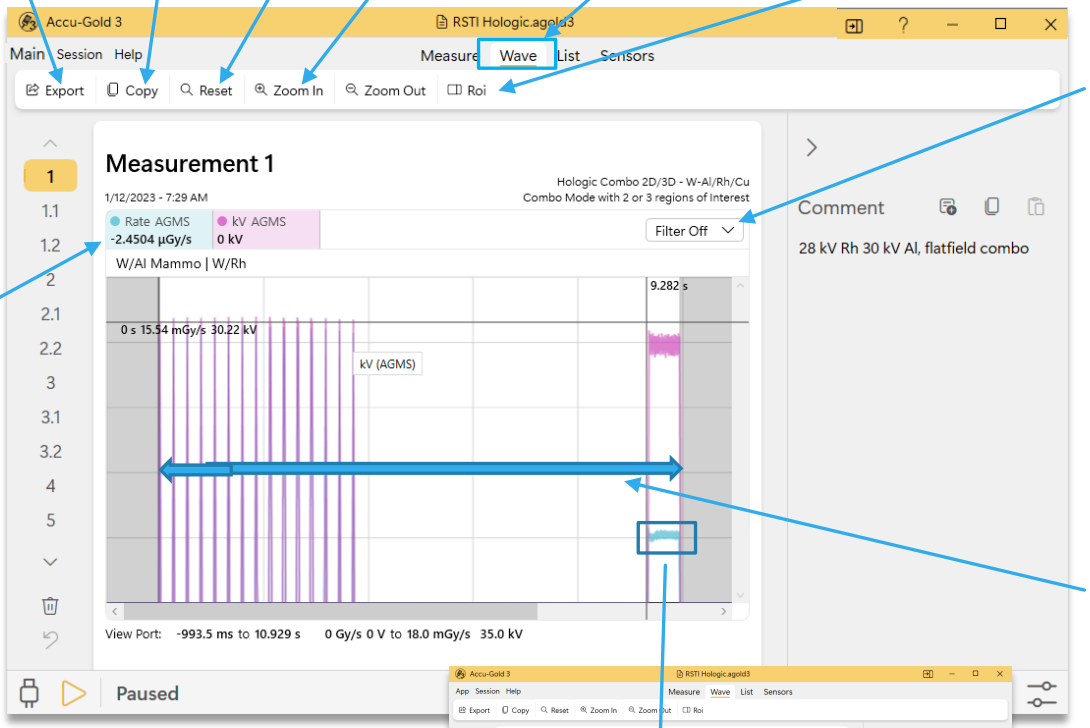
Copies the data for the waveform to the clipboard

Resets the waveform back after any magnifying or manipulation

Magnifies the waveform

You are here

Generates a Region of Interest for the last 15% of the waveform

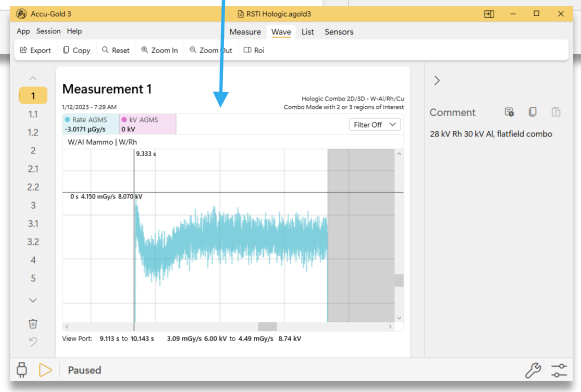


Measurements made with low-level signals (e.g. low mA, fluoro, scatter & small ion chambers) may display noisy waveforms that obscure important details. This provides a dropdown selection to apply a “Low-pass Bandwidth Filter” to the waveform.

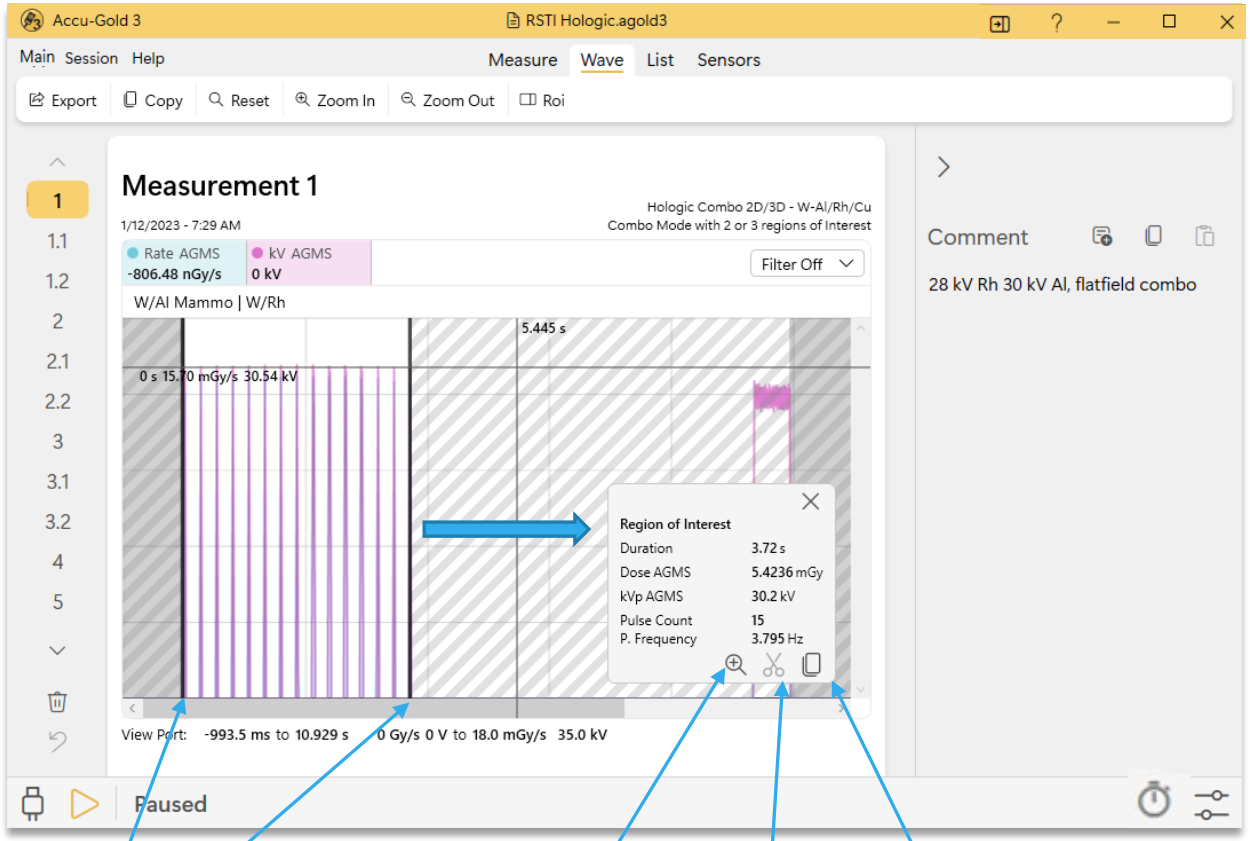
Click to turn off that particular waveform

Measured area

Expand the wave view by clicking and dragging a box over the region to be expanded. To return to the normal view, click on ***Reset***



Creating a region of interest



Click start of area

Then end of area

Zooms to defined area

Extracts area as a new region of interest

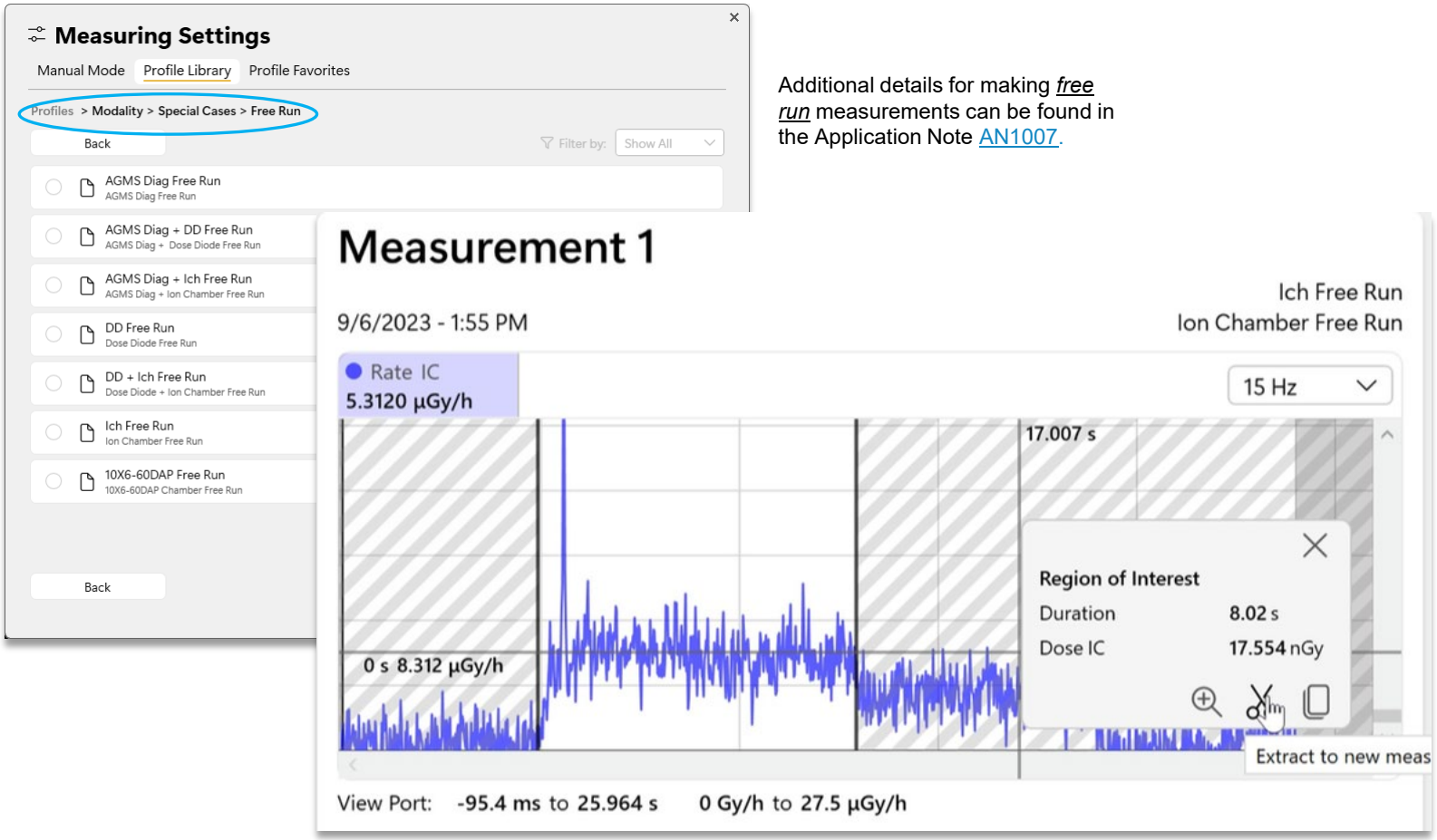
Copies information about the region to the clipboard

Free Run

For Free Run, no trigger is required. Free Run is useful for doing background measurements, surveys, sources and any other application that does not have a signal that can trigger the exposure reliably. Free Run starts measuring as soon as you hit play.

Free Run - No Trigger –

If the system did not trigger even at the low trigger setting, ‘free’ trigger level may be used. Ready the generator for an exposure, select a ‘Free Run’ profile (and press ‘Apply’. The system will initialize immediately. Make an exposure and then stop the measurement. Select the wave tab and the appropriate filter. Use either cursor or ROI methods to determine the peak or average dose rates.



Additional details for making ***free run*** measurements can be found in the Application Note AN1007.

Measurement Limitations

The Radcal AGMS Series of Multi-Sensors are highly capable instruments that will generally provide a comprehensive set of measurements throughout a wide range of diagnostic x-ray applications. However, there are some conditions under which the sensor will provide a more restricted set of measurements. These conditions are described here:

Filtration/kV Out of Range

In instances where filtration exceeds the operating range and/or kV is out of range, the spectral characteristics provide accurate measurements of Dose and Dose Rate only. Under these circumstances kV, HVL, and Filtration are not reported and the following warning is displayed:

Filtration for AGMS is out of range!
kV for AGMS is out of range!

Low Dose

The AGMS Multi-Sensor operates by measuring the x-ray intensity through several sensing elements equipped with increasing levels of internal filtration. As the dose decreases below certain levels that are anode/filter-specific measures of the spectral quantities (kV, HVL, and Filtration) cannot be made reliably. However, Dose and Dose Rate remain reliable and are reported along with the warning:

Low Dose Mode

Insufficient Dose

Under certain circumstances such as very low kV, excess filtration, and/or large source to sensor distance there are insufficient x-rays for an accurate measurement or any of the beam properties. Under these circumstances, no values are reported and the following warning is displayed:

Insufficient Dose

Making Low Dose Measurements with Ion Chambers

When making low dose measurements using an ion chamber (in the range of 10 times the minimum rated range), it is important to eliminate all sources of noise including noise induced by changing temperatures of the surroundings and the electronics. Position the ion chamber. Set the threshold to low and wait 3 minutes. Do not touch the cable or digitizer. For changing environments, allow 10 minutes for every 10 C difference for the sensor/electronics to equilibrate. Grounding the system to eliminate interference may be warranted.

When making background or scatter measurements, the readings may be too low to trigger a measurement. In that case a second sensor placed in the beam can be used to trigger the measurement which will guarantee that the ion chamber's signal is captured during the triggering period of that sensor.

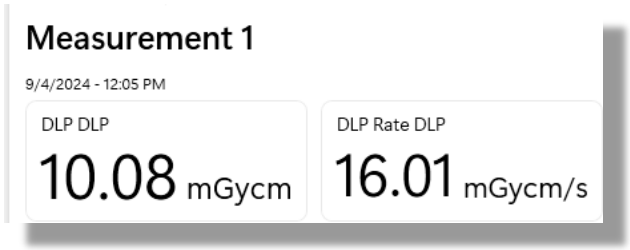
Using the 3CT chamber

The 10X6-3CT chamber, sometimes known as a pencil chamber, has a volume of 3cc and a length of 10cm. It can be used as an ion chamber for CTDI measurements or as a DLP chamber.

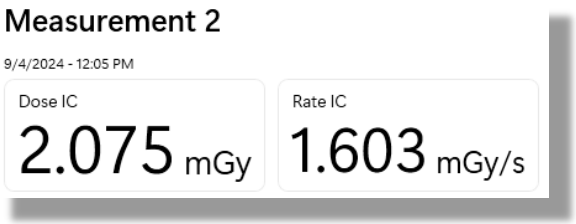
When used as an ion chamber, the entire chamber must be exposed. When used as a DLP chamber, it can be partially exposed and the values displayed are DLP values. Example: Dose is given as Gycm. To get the correct dose value you must multiply the DLP dose by the width exposed.

When the 3CT chamber is used in QuickStart, the values will be DLP values. When the 3CT chamber is used in Manual Mode or with a profile, the values will be displayed as ion chamber values, i.e. it assumes that you have exposed the entire chamber.

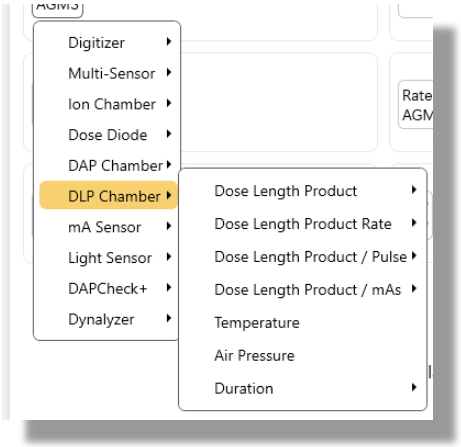
When used as DLP (QS)



When used as ion chamber
(Manual Mode or Profile)



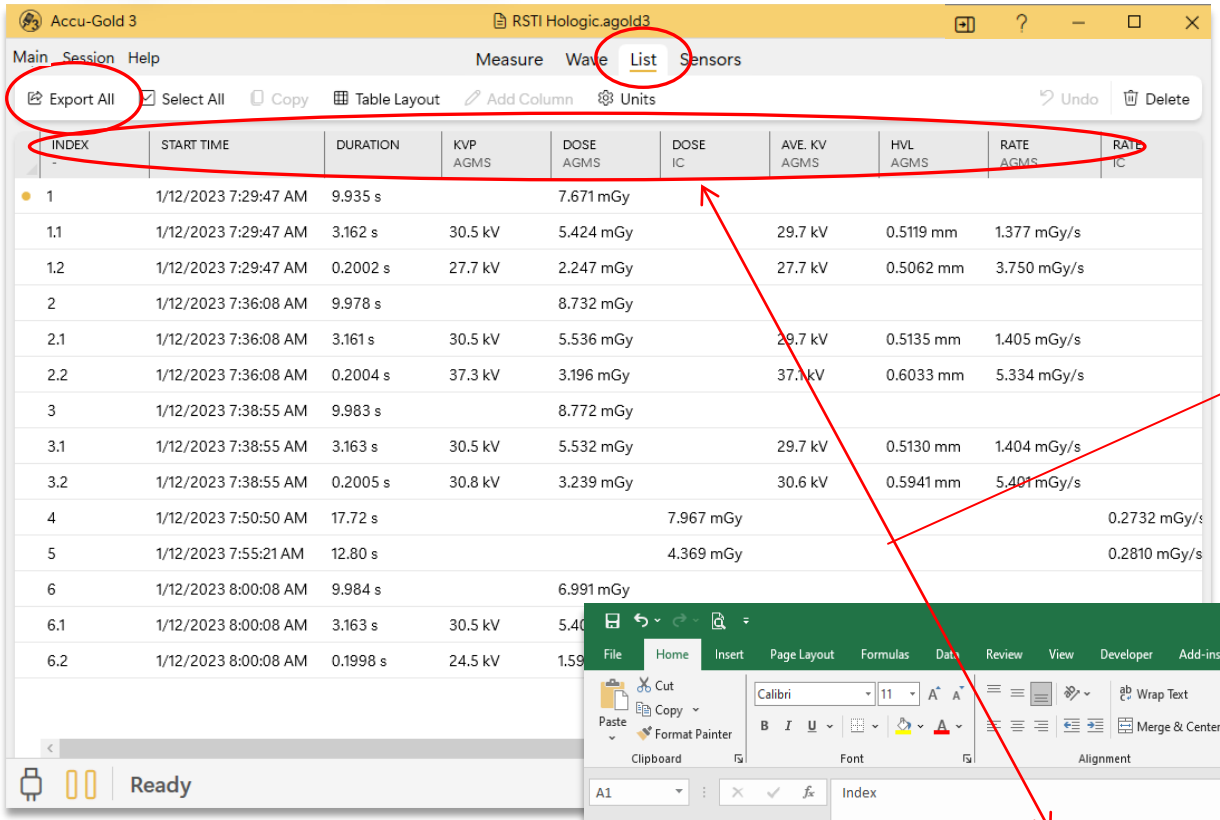
You can also use DLP mode values by customizing the measurement window. DLP measurement units can be selected under DLP Chamber:

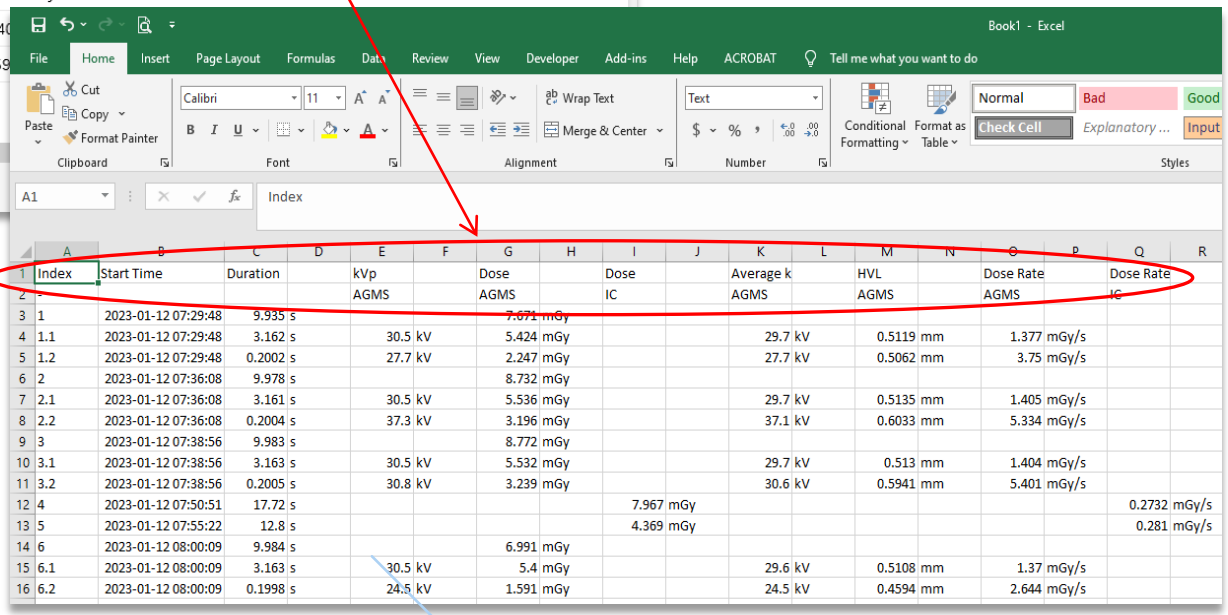


Exporting Data

Data collected by AG3 can be exported to Excel as well as a text editor. The collection of this data can be automated to fill out procedural templates by way of Companion mode.

Export All to Excel



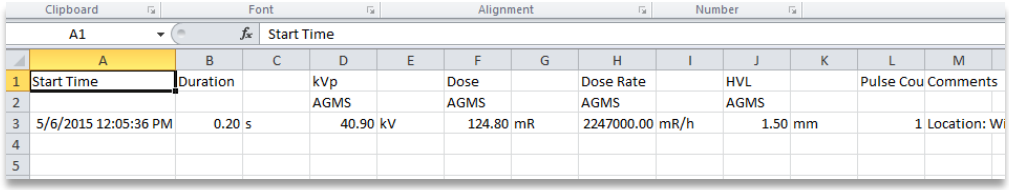


On the list view tab you will find *Export All*
Clicking on the icon will export the data from the active columns

The columns will match what you have set up in AG3.

Exporting Data in List View

Select List View. ***Export all*** – opens a new instance of Excel and exports all of the measurements in the format that had been selected.

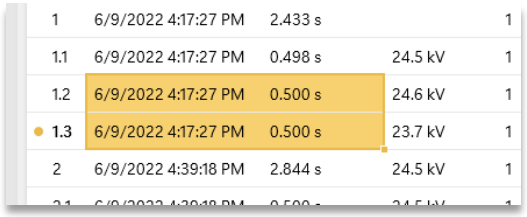


	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Start Time	Duration		kVp		Dose		Dose Rate		HVL		Pulse Cou	Comments
2				AGMS		AGMS		AGMS		AGMS			
3	5/6/2015 12:05:36 PM	0.20	s	40.90	kV	124.80	mR	2247000.00	mR/h	1.50	mm	1	Location: Wi
4													
5													

The units used can be changed in the ***Units*** menu before exporting to Excel.

Part of ***Units*** setting menu:

The columns included in the export and the order they are displayed can be selected. When exporting the data, the units will occupy a separate column. If the Unit Position is set to ***Include in header***, the data will be exported using the same number of columns as displayed. This allows one to grab large groups of data and paste them into an Excel template.



1	6/9/2022 4:17:27 PM	2.433 s		1
1.1	6/9/2022 4:17:27 PM	0.498 s	24.5 kV	1
1.2	6/9/2022 4:17:27 PM	0.500 s	24.6 kV	1
1.3	6/9/2022 4:17:27 PM	0.500 s	23.7 kV	1
2	6/9/2022 4:39:18 PM	2.844 s	24.5 kV	1

Individual measurements can be selected instead of ***Select All*** by choosing the measurement number on the left. Drag the selection down or hold the control key down to select more than one.

All of the columns will be copied based on which columns you have showing.

Individual cells or groups of cells can be selected by highlighting the cells of interest then click on ***Copy*** , press Ctrl-C or use the Windows right-click menu. Paste in the destination by pressing Ctrl-V or using the Windows right-click menu.

List View

You can select individual measurements or *Select All* to copy all of the rows

When you click *Export All*, all of those columns associated with the Table Layout format that you chose here will be included.

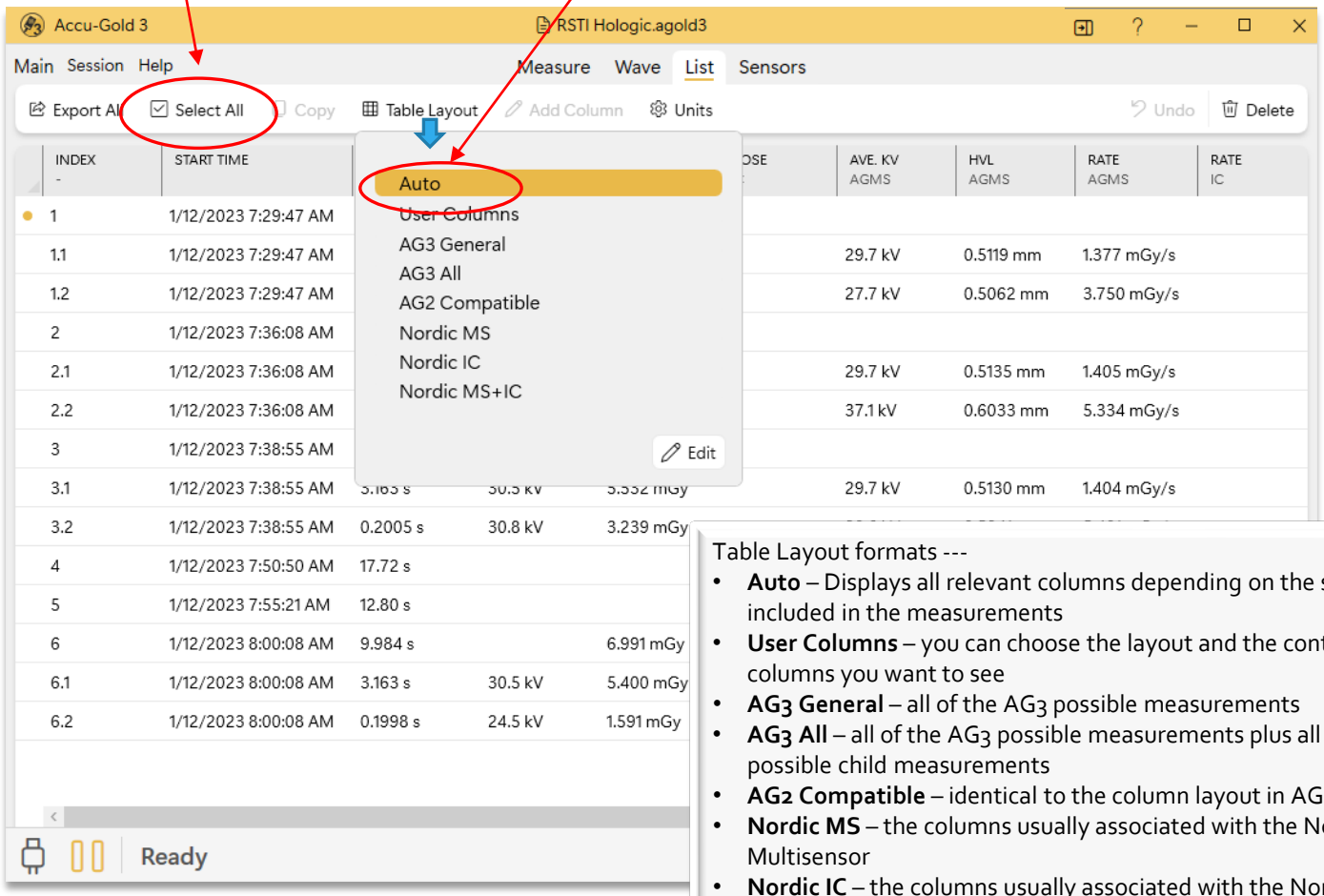


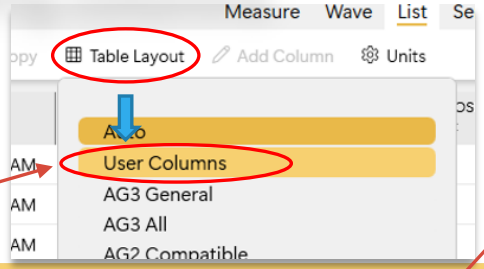
Table Layout formats ---

- **Auto** – Displays all relevant columns depending on the sensors included in the measurements
- **User Columns** – you can choose the layout and the contents for the columns you want to see
- **AG3 General** – all of the AG3 possible measurements
- **AG3 All** – all of the AG3 possible measurements plus all of the possible child measurements
- **AG2 Compatible** – identical to the column layout in AG2
- **Nordic MS** – the columns usually associated with the Nordic Multisensor
- **Nordic IC** – the columns usually associated with the Nordic Ion Chamber
- **Nordic MS+IC** – A fusion of the two Nordic versions

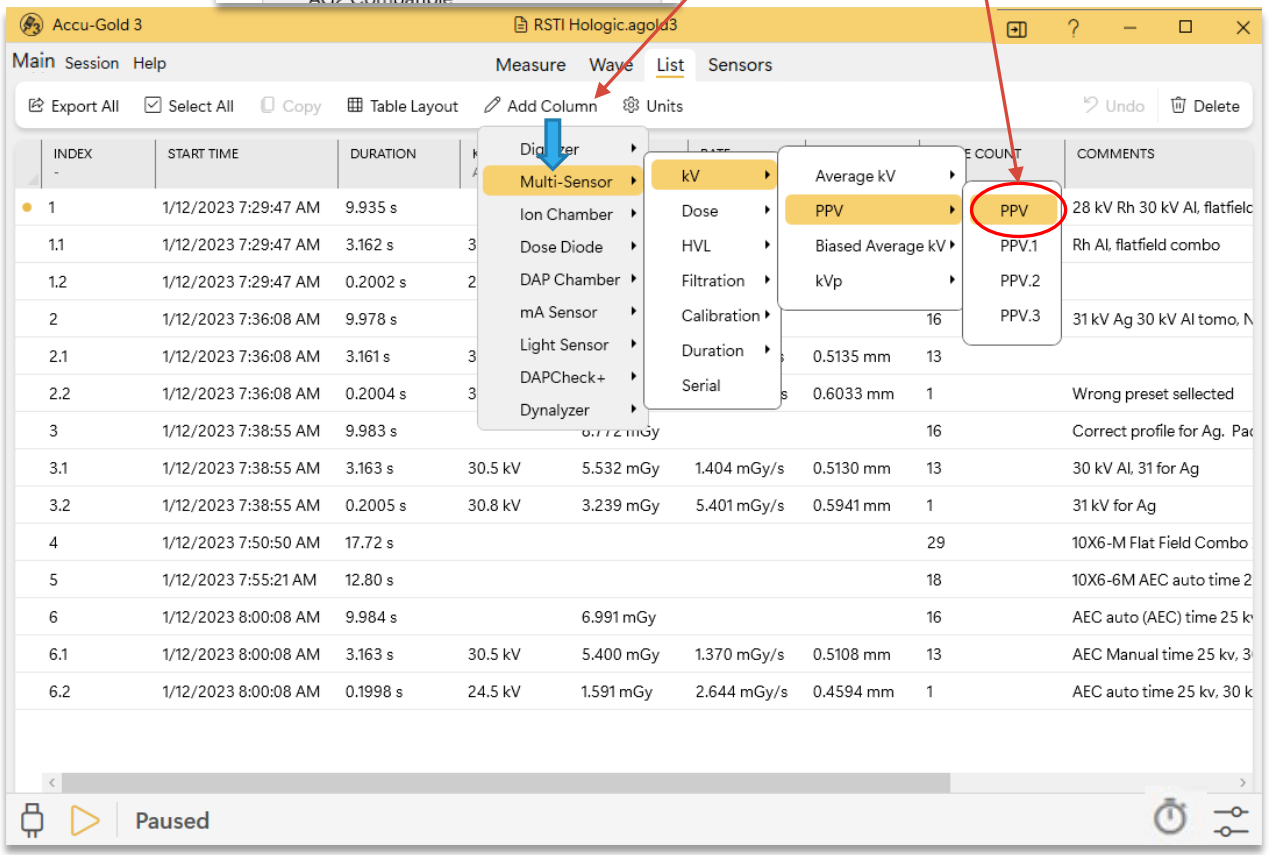
Note that when you click on *Export All* it will open a new Excel book with the data starting in cell A1.

List View – changing columns

On the list view screen you can change the parameter being shown by choosing *Table Layout* then *User Columns*



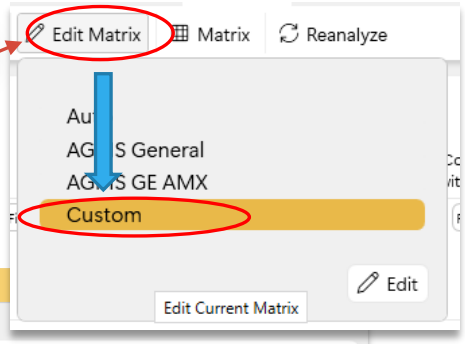
You can then add a column by choosing the parameter you want to see. (The value may be blank if it wasn't measured.)

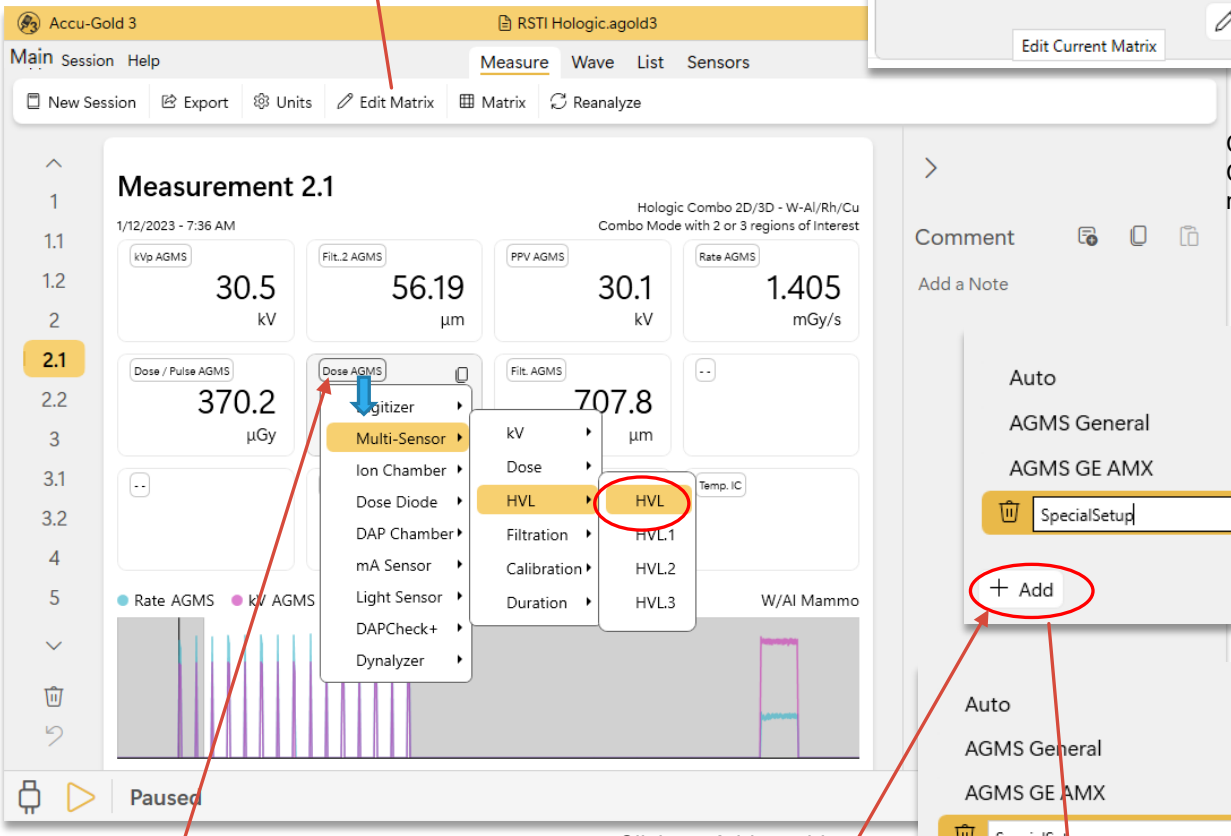


INDEX	START TIME	DURATION						COMMENTS
1	1/12/2023 7:29:47 AM	9.935 s						28 kV Rh 30 kV Al, flatfield
1.1	1/12/2023 7:29:47 AM	3.162 s						Rh Al, flatfield combo
1.2	1/12/2023 7:29:47 AM	0.2002 s						
2	1/12/2023 7:36:08 AM	9.978 s					16	31 kV Ag 30 kV Al tomo, N
2.1	1/12/2023 7:36:08 AM	3.161 s				0.5135 mm	13	
2.2	1/12/2023 7:36:08 AM	0.2004 s				0.6033 mm	1	Wrong preset sellected
3	1/12/2023 7:38:55 AM	9.983 s					16	Correct profile for Ag. Pa
3.1	1/12/2023 7:38:55 AM	3.163 s	30.5 kV	5.532 mGy	1.404 mGy/s	0.5130 mm	13	30 kV Al, 31 for Ag
3.2	1/12/2023 7:38:55 AM	0.2005 s	30.8 kV	3.239 mGy	5.401 mGy/s	0.5941 mm	1	31 kV for Ag
4	1/12/2023 7:50:50 AM	17.72 s					29	10X6-M Flat Field Combo
5	1/12/2023 7:55:21 AM	12.80 s					18	10X6-6M AEC auto time 2
6	1/12/2023 8:00:08 AM	9.984 s		6.991 mGy			16	AEC auto (AEC) time 25 k
6.1	1/12/2023 8:00:08 AM	3.163 s	30.5 kV	5.400 mGy	1.370 mGy/s	0.5108 mm	13	AEC Manual time 25 kv, 3
6.2	1/12/2023 8:00:08 AM	0.1998 s	24.5 kV	1.591 mGy	2.644 mGy/s	0.4594 mm	1	AEC auto time 25 kv, 30 k

Measure View – changing result values

On the measurement screen you can change the parameter being shown by choosing *Edit Matrix* then *Custom*



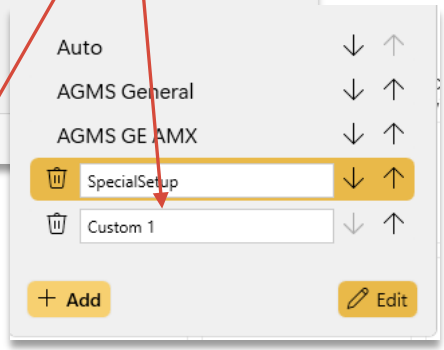


Click on *Edit* so the Custom setup can be renamed.

Click on the arrows to rearrange the order.

After choosing *Custom*, you can click on the label. This expands the pull-downs so you can find the result value you want to see.

Click on *Add* to add another custom setup.

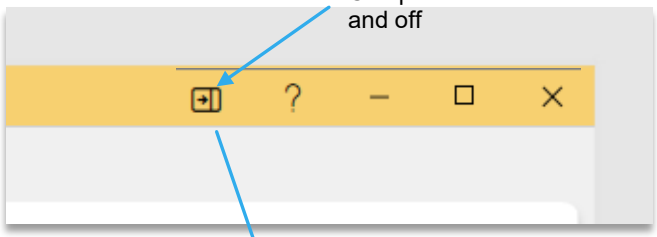


Companion Mode

Companion mode offers a way to automate data collection. An Excel template is automatically filled in as measurements are made in real time significantly reducing the time and improving accuracy when running test procedures.

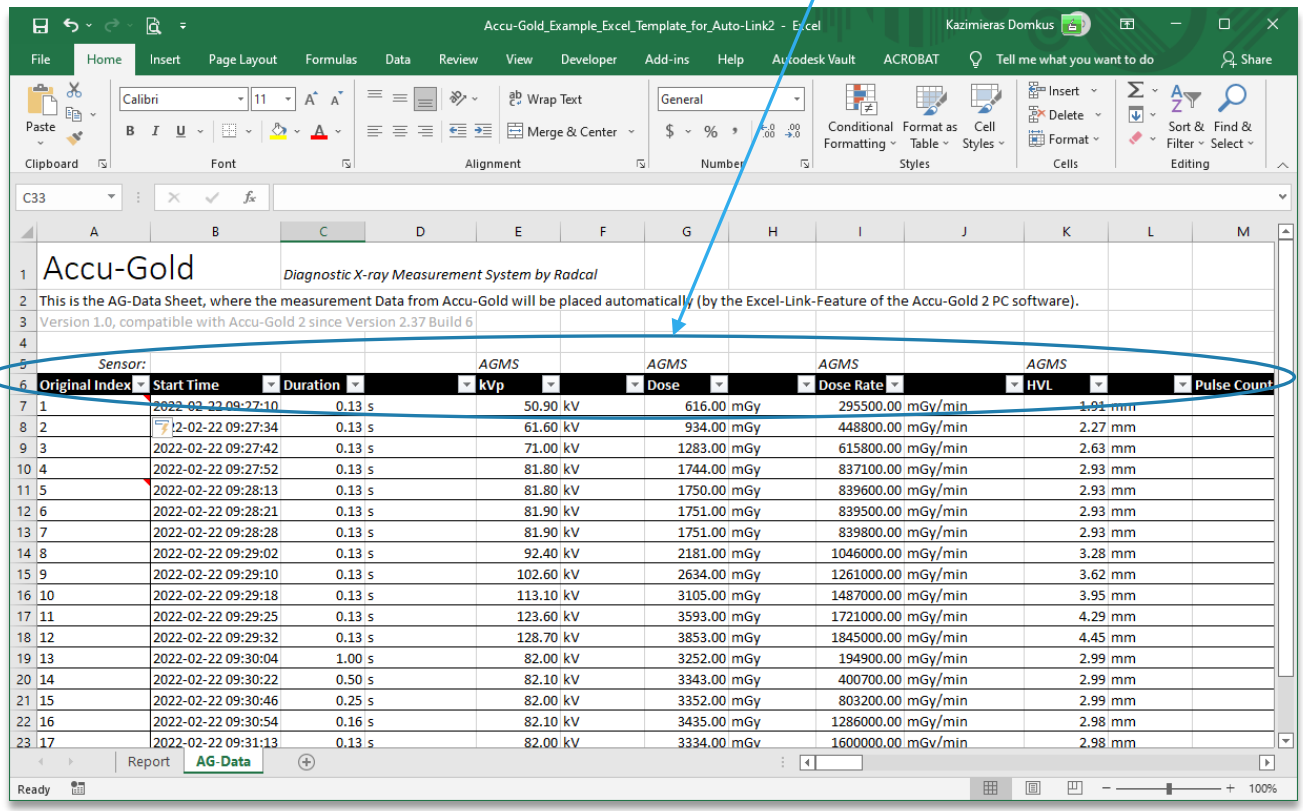
Companion-Mode

Use this icon to turn Companion-Mode on and off



If you already have a template that you want to link to, open it first.

When you click on the Companion mode icon, it will open a blank workbook with the columns formatted with the name of the value that will be exported. The default is AG3 General Format. However, you can choose other column formats (see Companion Mode Options)



Accu-Gold_Example_Excel_Template_for_Auto-Link2 - Excel

Accu-Gold *Diagnostic X-ray Measurement System by Radcal*

This is the AG-Data Sheet, where the measurement Data from Accu-Gold will be placed automatically (by the Excel-Link-Feature of the Accu-Gold 2 PC software).

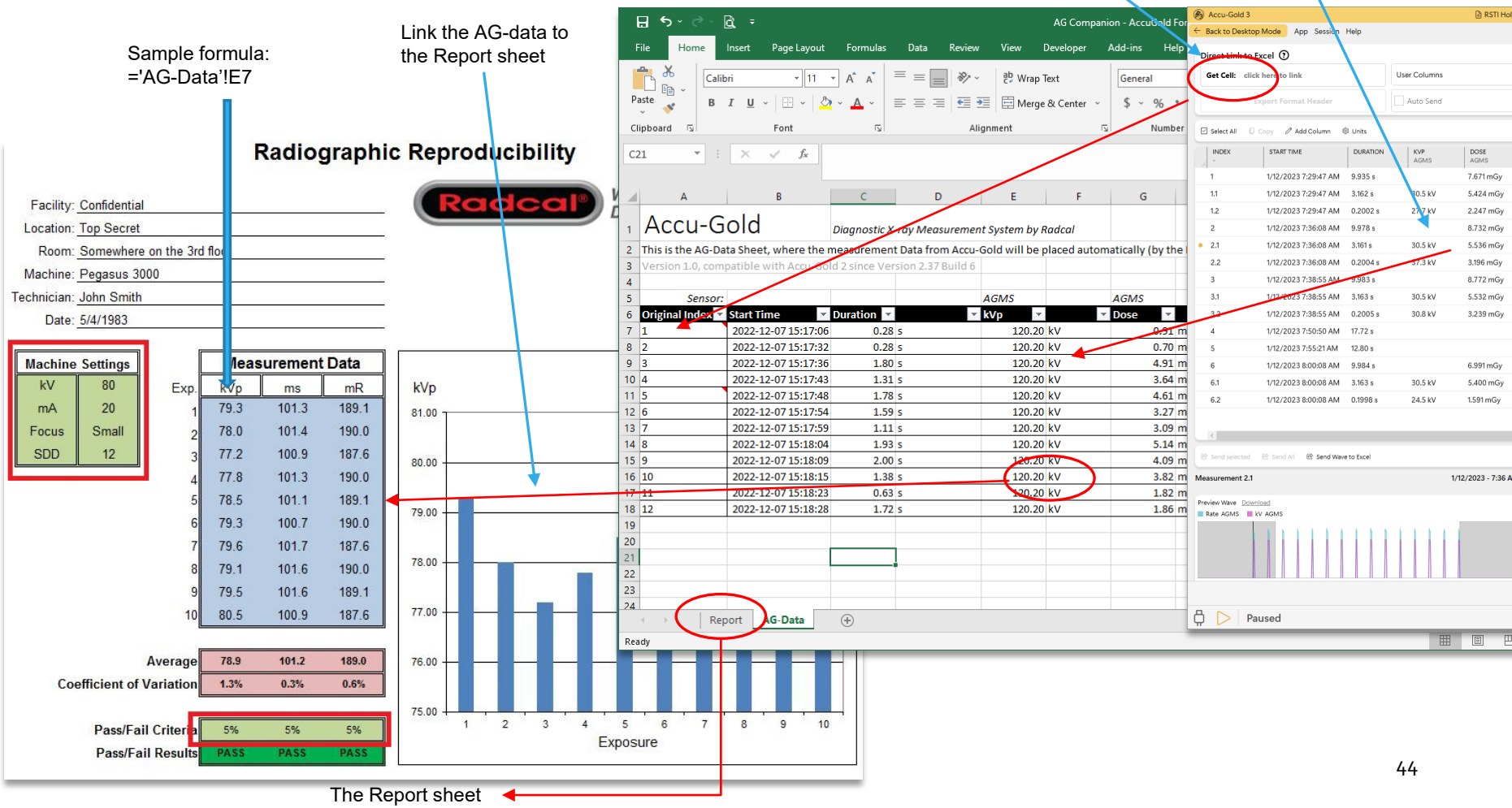
Version 1.0, compatible with Accu-Gold 2 since Version 2.37 Build 6

	Sensor:			AGMS		AGMS		AGMS		AGMS		
	Original Index	Start Time	Duration	kVp		Dose		Dose Rate		HVL		Pulse Count
1	1	2022-02-22 09:27:10	0.13 s	50.90	kV	616.00	mGy	295500.00	mGy/min	1.91	mm	
2	2	2022-02-22 09:27:34	0.13 s	61.60	kV	934.00	mGy	448800.00	mGy/min	2.27	mm	
3	3	2022-02-22 09:27:42	0.13 s	71.00	kV	1283.00	mGy	615800.00	mGy/min	2.63	mm	
4	4	2022-02-22 09:27:52	0.13 s	81.80	kV	1744.00	mGy	837100.00	mGy/min	2.93	mm	
5	5	2022-02-22 09:28:13	0.13 s	81.80	kV	1750.00	mGy	839600.00	mGy/min	2.93	mm	
6	6	2022-02-22 09:28:21	0.13 s	81.90	kV	1751.00	mGy	839500.00	mGy/min	2.93	mm	
7	7	2022-02-22 09:28:28	0.13 s	81.90	kV	1751.00	mGy	839800.00	mGy/min	2.93	mm	
8	8	2022-02-22 09:29:02	0.13 s	92.40	kV	2181.00	mGy	1046000.00	mGy/min	3.28	mm	
9	9	2022-02-22 09:29:10	0.13 s	102.60	kV	2634.00	mGy	1261000.00	mGy/min	3.62	mm	
10	10	2022-02-22 09:29:18	0.13 s	113.10	kV	3105.00	mGy	1487000.00	mGy/min	3.95	mm	
11	11	2022-02-22 09:29:25	0.13 s	123.60	kV	3593.00	mGy	1721000.00	mGy/min	4.29	mm	
12	12	2022-02-22 09:29:32	0.13 s	128.70	kV	3853.00	mGy	1845000.00	mGy/min	4.45	mm	
13	13	2022-02-22 09:30:04	1.00 s	82.00	kV	3252.00	mGy	194900.00	mGy/min	2.99	mm	
14	14	2022-02-22 09:30:22	0.50 s	82.10	kV	3343.00	mGy	400700.00	mGy/min	2.99	mm	
15	15	2022-02-22 09:30:46	0.25 s	82.00	kV	3352.00	mGy	803200.00	mGy/min	2.99	mm	
16	16	2022-02-22 09:30:54	0.16 s	82.10	kV	3435.00	mGy	1286000.00	mGy/min	2.98	mm	
17	17	2022-02-22 09:31:13	0.13 s	82.00	kV	3334.00	mGy	1600000.00	mGy/min	2.98	mm	

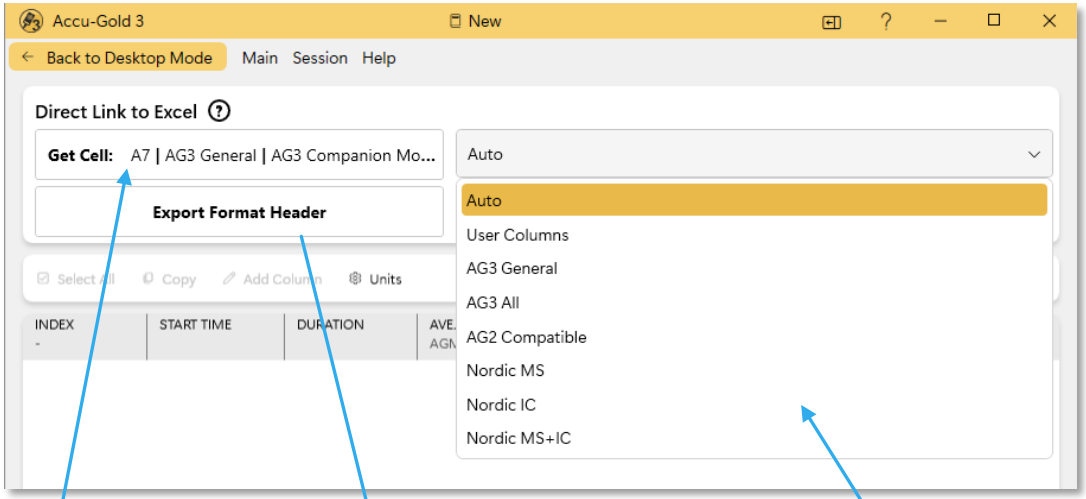
Report AG-Data

Ready

We recommend using Companion-Mode and the AG3 General format so that it exports data to a separate worksheet. The data on that worksheet then links to the report section of your template. For example:



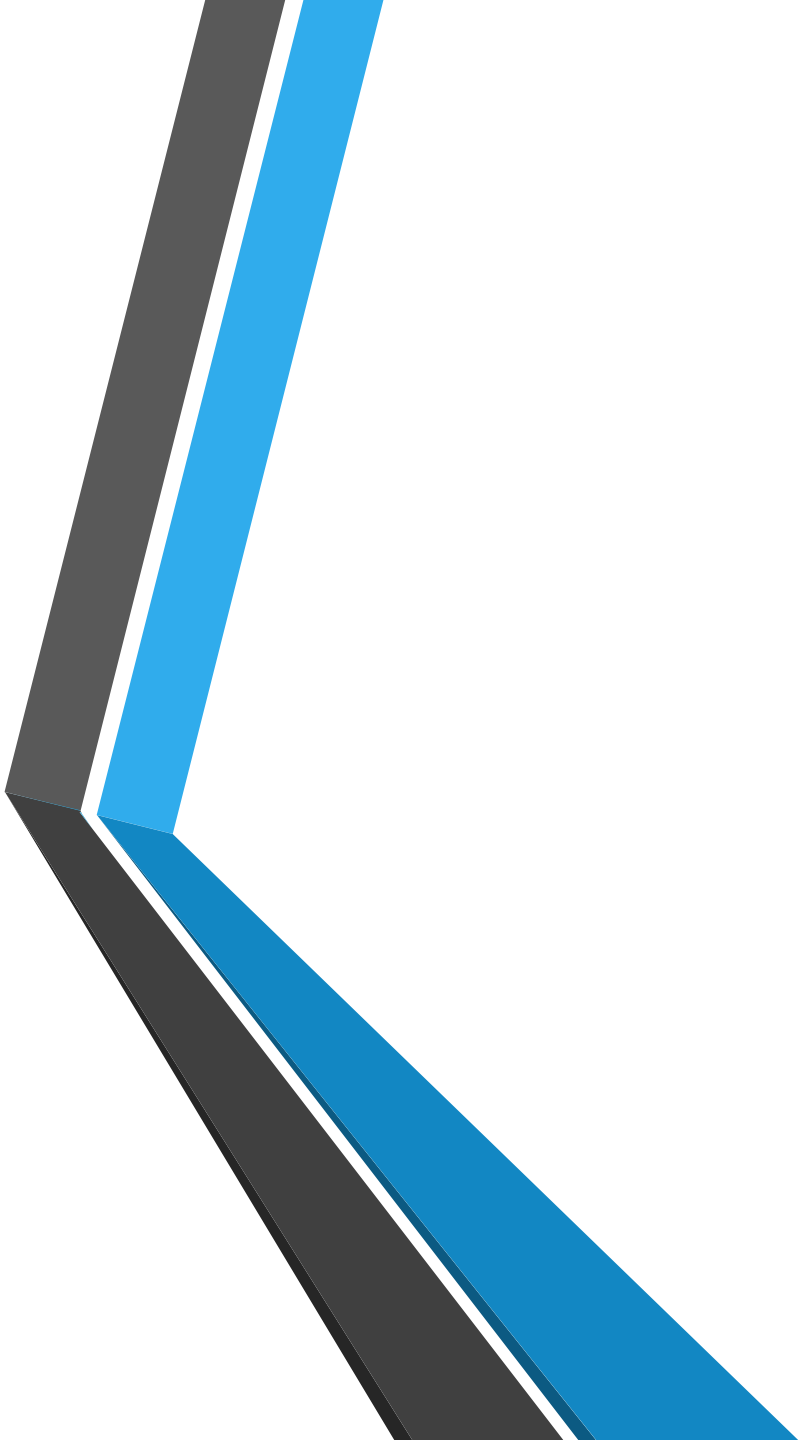
Companion-Mode options



Select the Excel cell where you want the output to start then click here to 'Get' the cell number.

This will put out 2 rows with the column headings that will match the data output

You can choose the column format for the Excel template. These formats are the same as the list view column options (see list view).



Reanalyze

Salvaging work

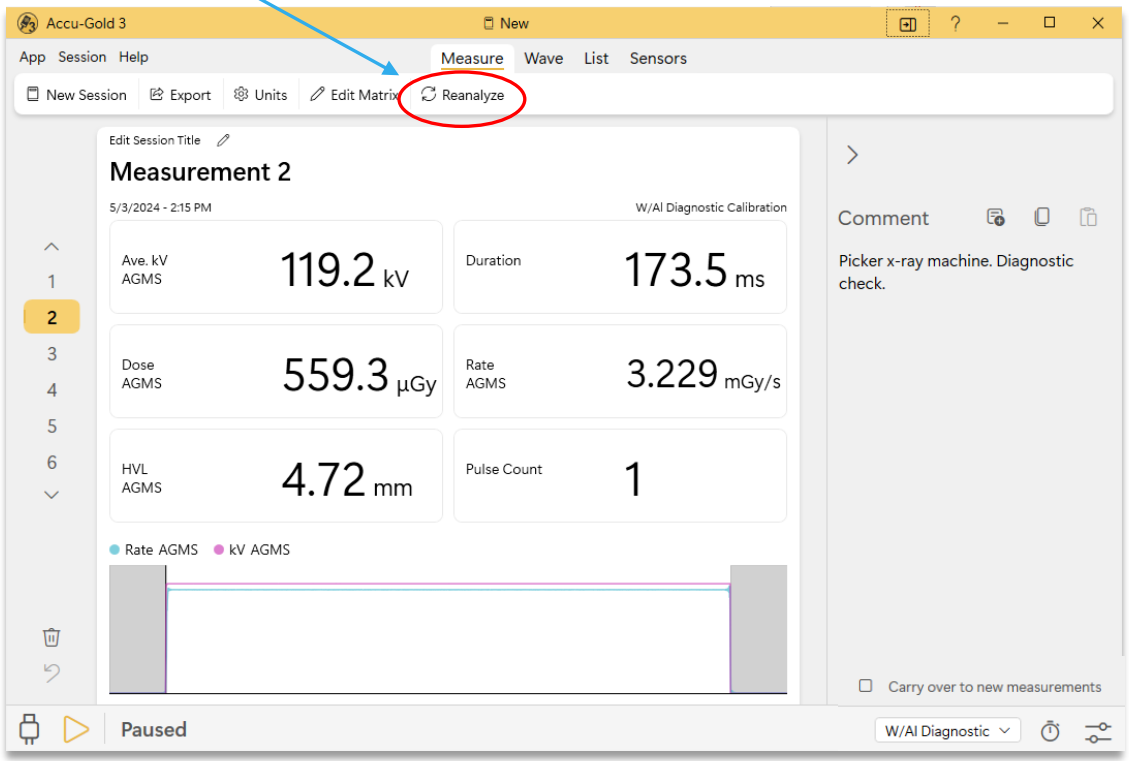
Reanalyze

The original preprocessed sensor data of a measurement is saved as “raw data” on your computer. The processing of this data is directed by the profiles used by AG3. This allows AG3 to reprocess the data at a later time using a different profile (within limits).

Example: You used the Hologic Combo mode profile for the Hologic Selenia that uses a tungsten anode and Al, Rh and Cu as filters during its measurement modes. Sometime later, you discover that it was the model that uses Al, Ag and Cu filters. Instead of having to repeat the measurement, you can re-analyze the data with the correct profile.

Bring up the session that has the incorrect profile. Click on Reanalyze, then choose the new profile and follow instructions from there. If the data is not available, it will give you an error message.

Note that you will need to connect a digitizer and multisensor to the computer and the sensor has to be the original sensor that was used for that measurement. (See the serial number(s) under the Sensors tab.)

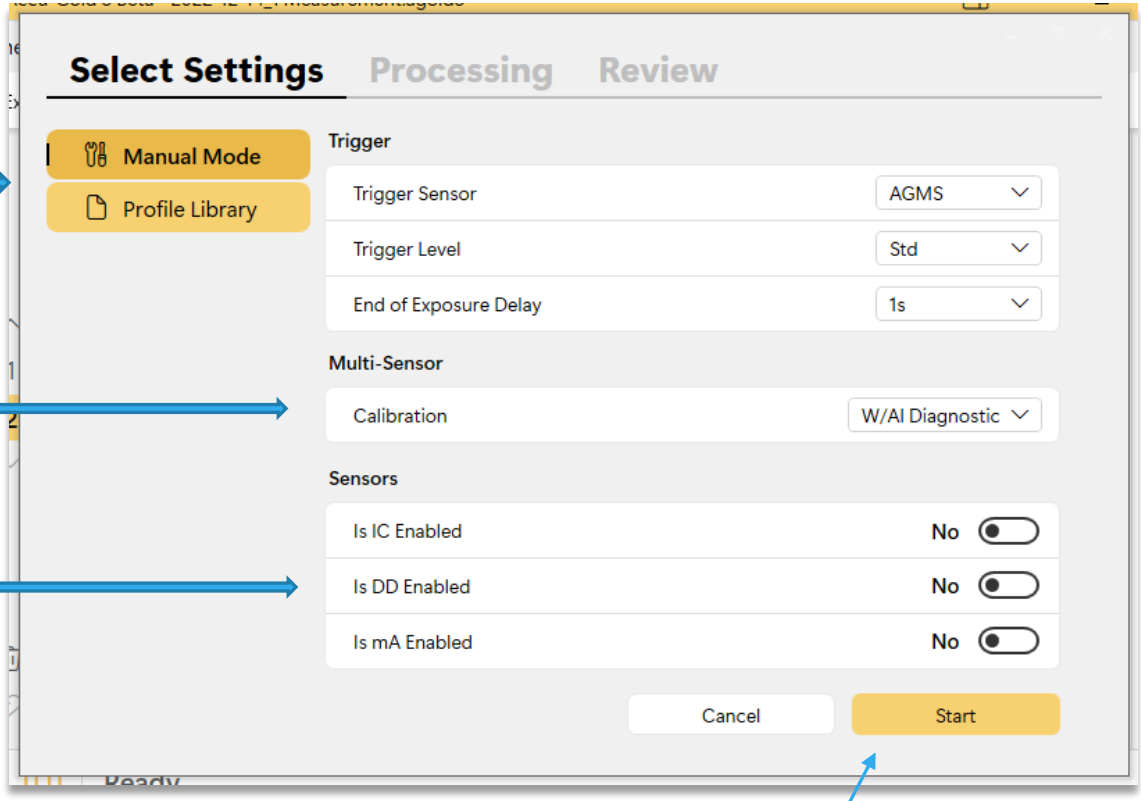


Selecting Reanalyze brings up this menu:

You can chose a new profile from either the Manual Mode or the library

Select the correct calibration if applicable

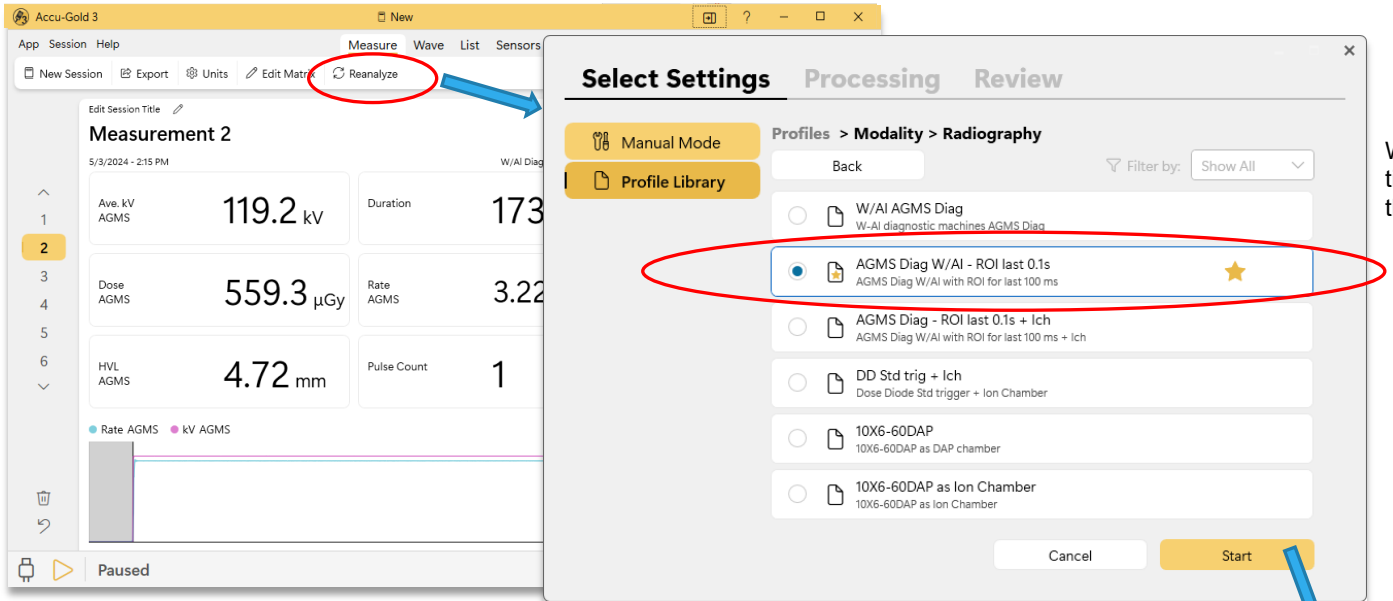
This cannot be changed



Selecting *Start* will bring up a review screen which you would then *Accept*

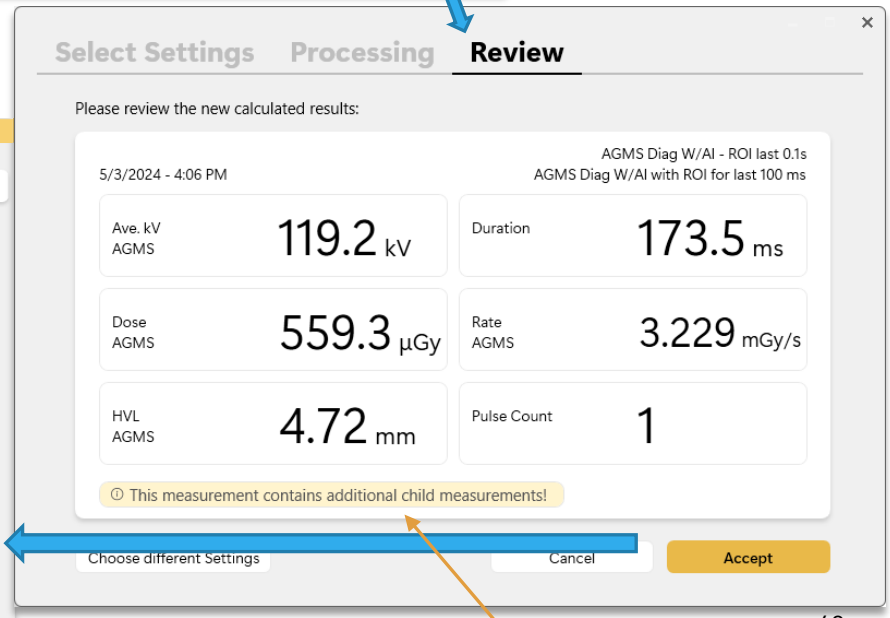
See the following example -

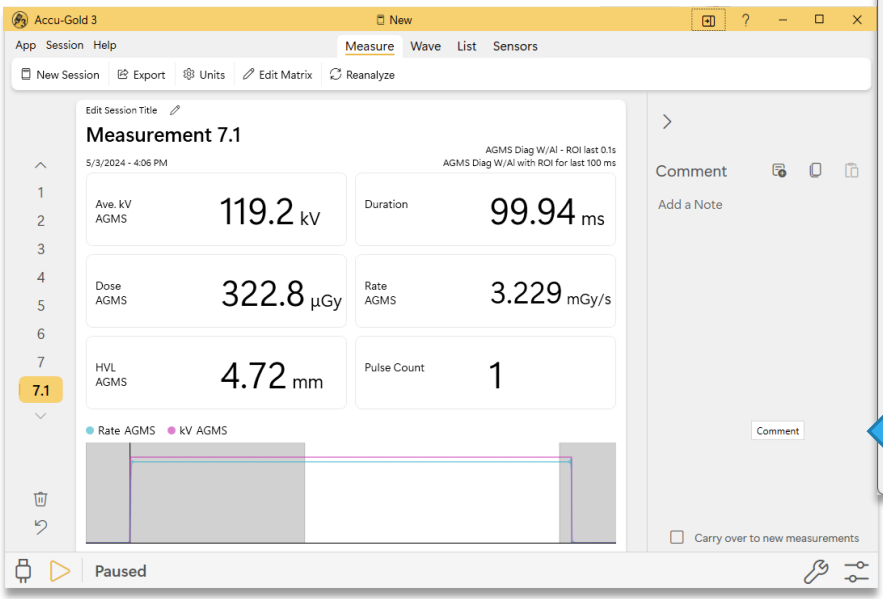
We made a measurement using W/AI Diagnostic-



We choose *Reanalyze* and this time we choose a profile from the library, then hit *Start*

We get a review screen. Everything looks reasonable so we click on *Accept*.





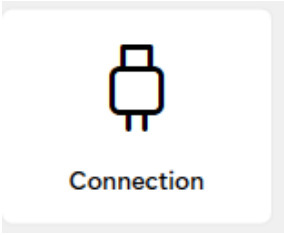
This time, though, we have data for the last 100 ms of the exposure

(This message implies that the result will have a child even though the review screen doesn't show one.)

Connection

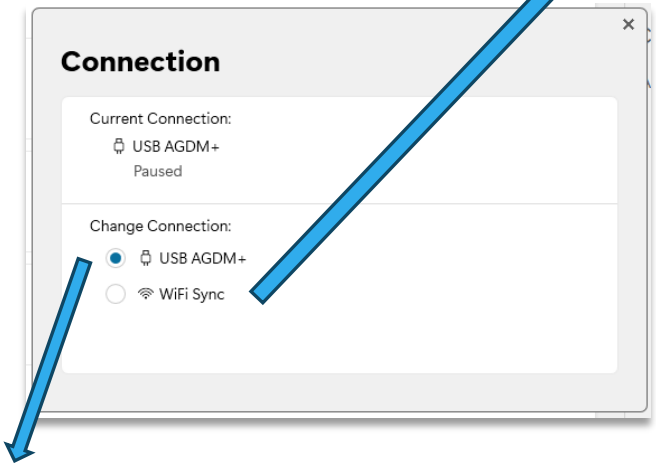
USB Mode

WiFi Sync Mode



Connection

Choose *Connection* from the *Main* menu:



USB Mode

USB Mode is when a digitizer is connected to the computer's USB connector directly or when it is connected to a digitizer thru a Touch (Touch or T3) using a USB cable. A direct connection will require a USB cable with a mini-USB connector. A Touch will require a micro-USB connector. In either case, AG3 will operate the same.

WiFi Mode

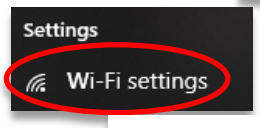
WiFi Mode requires a T3 that is connected wirelessly to your computer.
Turn on the T3, select Settings/Connections then turn on WiFi

In Windows*

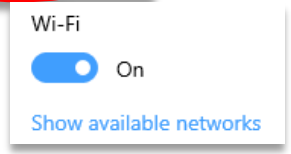
Start by telling your PC how to connect to the T3:

Press the Windows key and start to type 'WiFi settings'.

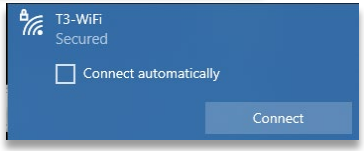
Then select 'WiFi settings'.



Make sure Wi-Fi is 'On' on your computer then select 'Show available networks'



You will then see 'T3_56-xxxx' with the serial number of your T3 unit in the list. Click 'Connect' and enter 12345678 as the password.

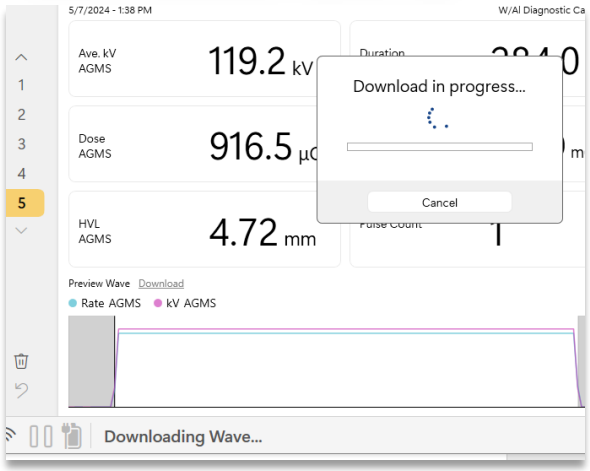


Now go to AG3 and select *WiFi Sync*, then *Connect.*
You will see the status bar change to this:

Connect your sensor(s) to the T3 and touch the play button. The battery icon shows the charge status of the battery of the T3. On the Connection dialog when you selected WiFi, you will see a Details button which will give additional information.

*Windows 10 shown. Illustrations may look different in other versions

Connection (cont)



WiFi Mode will make measurement data available 'in sync' on the T3 as well as the AG3 computer. The control of the measurement can be from either device..

After you make an exposure, the T3 will download the wave information. Depending on how long of an exposure, the download may take a while. The wave data it downloads is full resolution that allows for complete analysis of the waveform by the AG3 software.

You can change the settings to reduce the wait time but only partial data will be transferred.

In AG3, go to ***Settings***, ***General Settings:***

You can set it so that it only does a full download of 5s or 1s waveforms or never, but you will still get a waveform. This waveform will be a 'preview' version of the full waveform but will not contain the data necessary for analysis.

If you select the Wave window in AG3 you will see this:

You can go back and download the wave data that was missing as long as you are still on the same session. If you change sessions, you will lose that option.

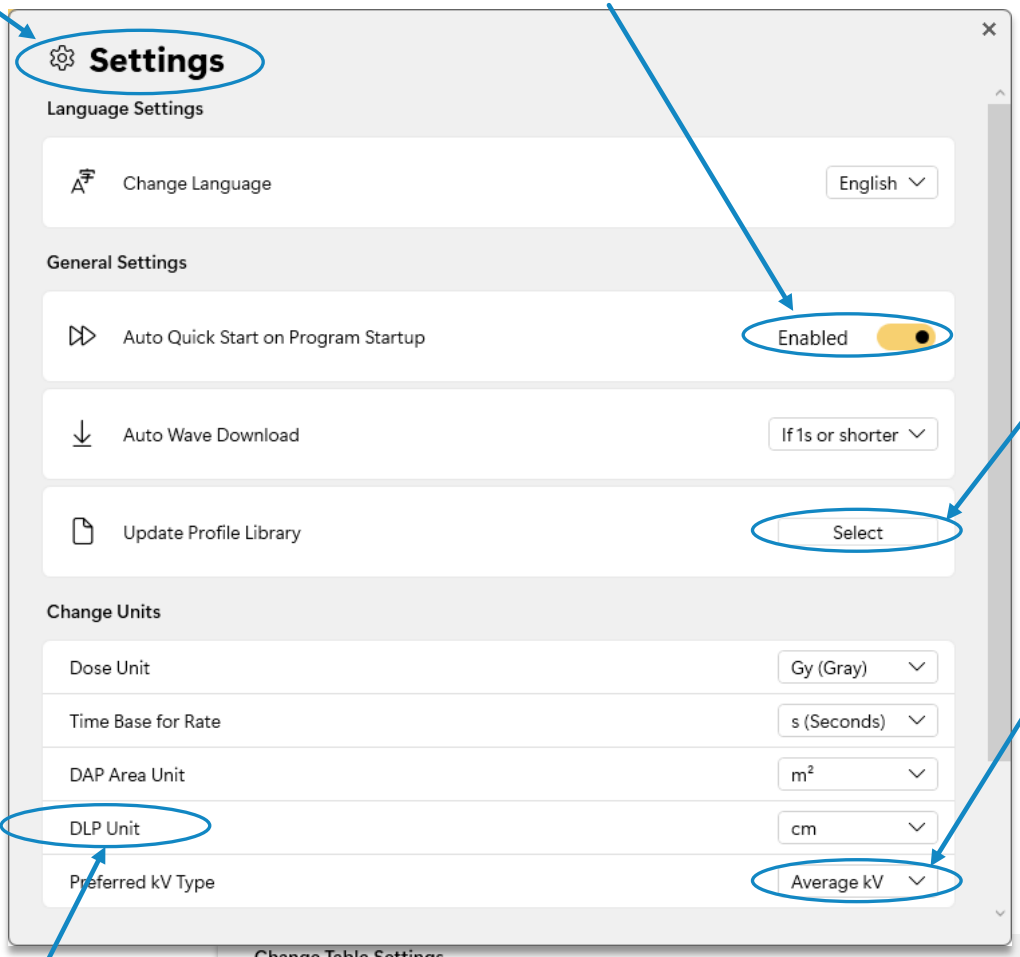
Settings

Miscellaneous settings

Settings

You are here

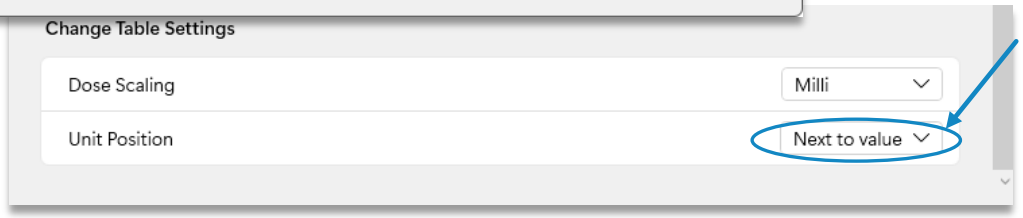
The program automatically determines the profile needed by examining the sensors connected. The 'Auto Quick Start' happens when the program opens and this can be disabled.
The program will still determine the profile needed if you click the Quick Start menu selection.



The profile Library can be updated without requiring an update to the program by selecting the .zip file that is provided to you.

The default kV measurement type. See AN1016 for more information on the different types.

Dose-Length-Product (DLP) applies to CT chamber measurements



This applies to List mode and exporting.

Appendix A

AG3 Installation and Setup

AG3 is compatible with the following hardware:

Digitizers	Touch Units (in USB or WiFi mode)
AGDM+	AGT-P-AG
ADDM+	AGT-P-AD
RGDM+	AGT-P-RG
AGDN+	

Operating system
- Windows 7
- Windows 8
- Windows 10
- Windows 11

Hardware system
- Screen resolution of 1024 x 600 min
- RAM 150MB min
- Storage 100 MB min

Misc
- USB 2.0 Full-speed port for digitizer
- Excel 2007 or later for data reports

AG3 Installation Notes:

- **Install Accu-Gold software prior to connecting the Digitizer Module.**
- Uninstalling old versions is not necessary.
- Administrator privileges are required for installation.

Installation Procedure:
- To begin Accu-Gold3 software installation, copy the Accu-Gold_Setup_3.0.zip file to your computer. **IMPORTANT:** Right-click and select '**Extract All**..'. This will expand the zip file and create a folder of the same name. Open the folder and click on the Accu-Gold_Setup_3.0.exe file.
- The "Accu-Gold_Setup" file will launch an installation dialog. You must agree to the *License terms and conditions* to continue. Click **Install**. The dotNET Framework Client version 4.0 or greater is required and will be installed if it is not already installed on your computer. An internet connection is not required.
- Click "Close" to exit the installation process.

Uninstall Procedure:
- To uninstall Radcal Accu-Gold go to Add/Remove Programs in Control Panel and select "Accu-Gold 3". Then click on Uninstall and answer Yes to the prompts. You may also run the setup program again to uninstall it. Please feel free to comment on this software and report any bugs that you may find. Please save session files since they would be most useful. Separate calibrations or license files are not required for AG3.

Appendix B

AG3 vs. AG2

Settings-

End of Exposure Delay is selectable in Ag2. In AG3, all library profiles use *Min* or *1s* as the normal delay. Other specific profiles may use longer delays as appropriate. In AG3 it is possible to override the delay used by the profile – see End of Exposure Delay.

Trigger Levels-

Most profiles use a *Trigger Level* of *Standard* unless otherwise indicated.

File Formats-

All session file formats for AG1 (file extension Agold) and AG2 (file extension AGold2), are compatible with AG3. You can use AG3 to open, analyze and add measurements to any session. If you modify the session it will still be saved in its previous version. Certain functions available in AG3 will not work with legacy data (such as Reanalyze).

You can open AG3 (file extension AGold3) files with AG2 but it will not have any of the enhancements that come with AG3.

Exporting Data-

In Companion Mode, Accu-Gold Format/AG3 General and Nordic Format are identical between AG2 and AG3.

AG3 General Format will not include child measurements except measurements labeled as End measurements which are the same as child 1 measurements.

Staying up to date is important. You can go to *Help* then *About* on the main menu to verify that AG3 is up to date. Hovering over the ⓘ next to the version number will list the library version that is installed.
As new versions of AG3 are released, you will get an automatic message when you open AG3 telling you how to update it.

Appendix C

Custom Profiles

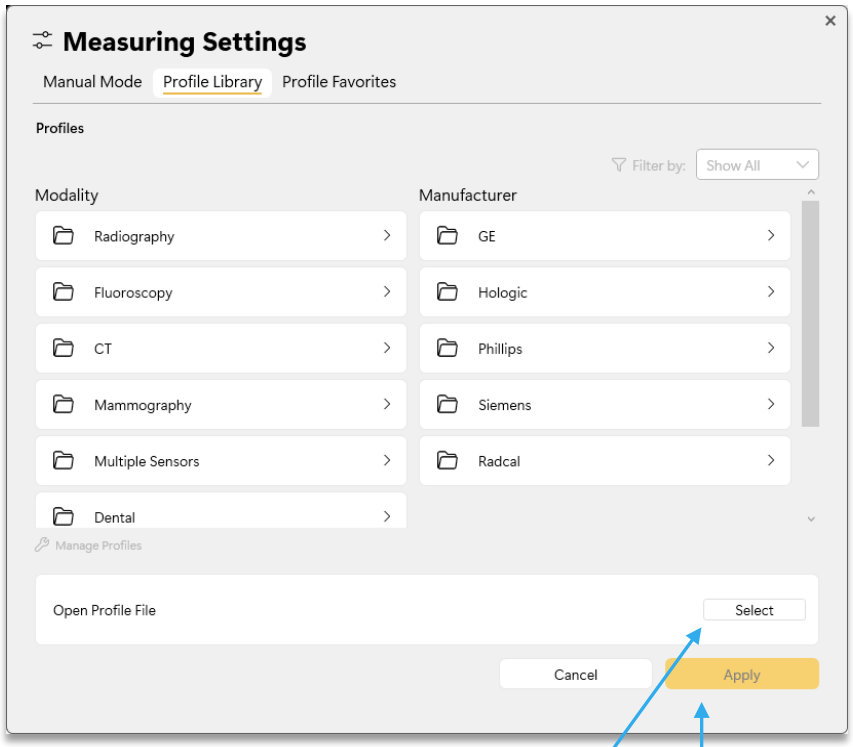
Profiles allow one to make highly technical measurements without the hassle of setting up the parameters each time. They tell the computer the calibration file to use, the timing required, the sensors to use and so on. The allow you to set a region of interest (ROI) which gives you details on certain areas of the measurement.

Combo-mode profiles allow you to quickly make the multiple measurements with a single exposure of the x-ray machine when the x-ray machine is changing anode-filters internally. This makes it possible to save precious time and hassle and gets you in and out in a hurry.

So what happens when there is no profile for what you need? Contact Radcal to discuss your needs and we will assess your situation. We will make a profile that is suited for your specific needs. If this is a general need, we will incorporate the profile in our profile library and release it in the next version of the software.

If it is a general profile that is added to the profile library, update the software and find it there. If it is a custom profile, the profile we send you will need to be loaded onto AG3 to be used.

To import the custom profile, select ***Profile Library*** from the menu and then select ***Open Profile File.***



Use Windows to find the file that was sent to you.

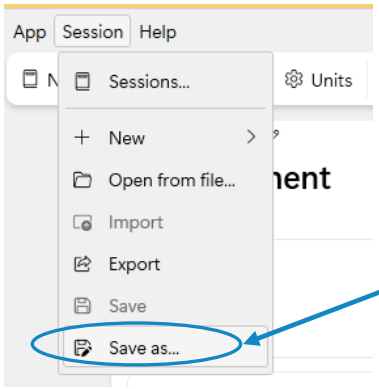
Select the profile file and then select ***Apply***

Appendix D

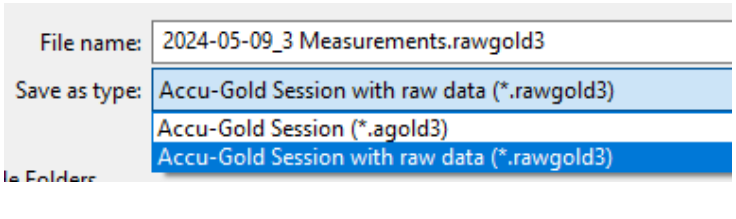
Sending AG3 Sessions to Radcal Support (including raw data)

When issues come up, when something is not working as expected, or a better fit of a profile is required, etc., please send session data that includes raw data. That allows us to recreate the issue and understand it better. Also please email it with a summary of your needs, the measurement conditions and if available, a picture or diagram of your measurement scheme.

Save session data:



Choose *Save as…*

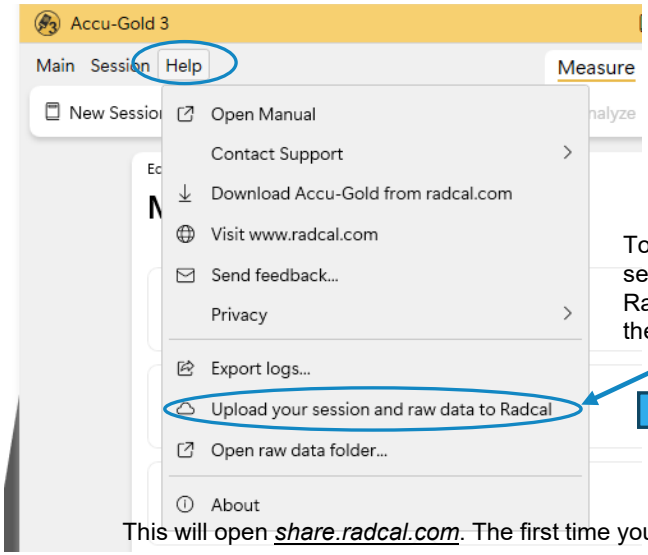


Then select filetype as *.rawgold3

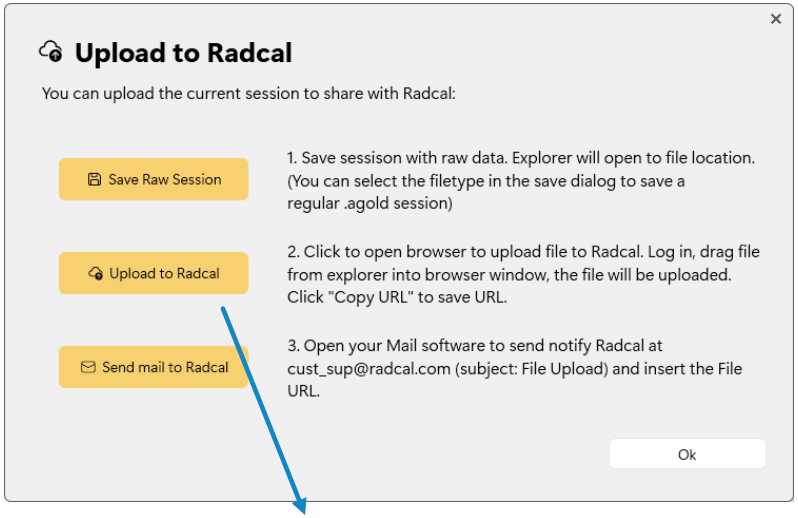
You could make the filename your company name or a problem description. Then use a file share site like *wetransfer.com* or *share.radcal.com* to upload the file and send us the link by email to *cust_sup@radcal.com*

Reference: The .rawgold3 file can be used by AG3 in a normal way to see session information. Except for it being a bigger file, it can also be used like a normal session file. Since raw data is deleted eventually so that it doesn't grow too much, you might get the message that raw data is not available. Send the session anyway. Sending the session is still more valuable that a screen-grab since it contain other valuable information.

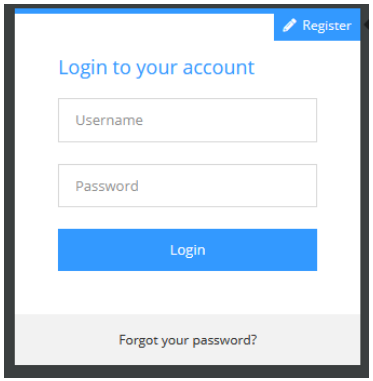
Sending AG3 Sessions to Radcal Support (continued)

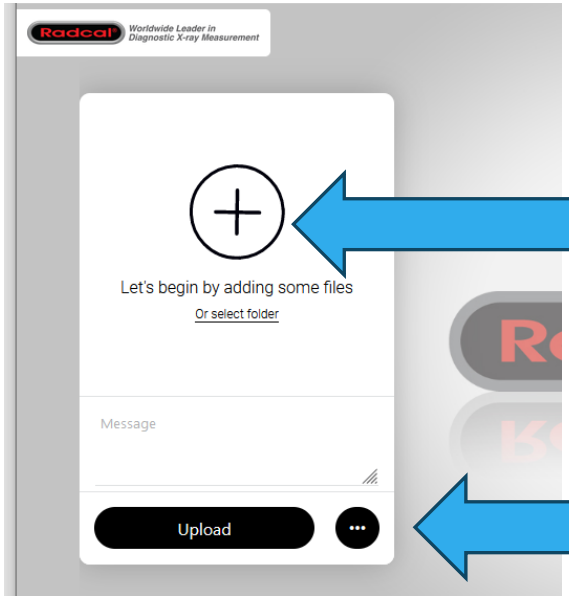


To send the session file to Radcal, go to Help then select:



This will open *share.radcal.com*. The first time you use it, create an account then log in.





Click on the '+' then find the file you saved and select 'open'.

Click on the upload.
Click on 'Copy URL'
Create an email and press Ctrl-V to paste it in the email.
Send to cust_sup@radcal.com

Appendix E

Software Limitations

- Maximum disk / flash space reserved for raw data recordings
  - AG3: **512MB** *(oldest ones will be deleted when reaching limit)*
  - T3: **128MB** *(currently disabled-future feature)*
- Maximum measurement length, due to configuration measurement profiles:
  - AG3: **120s**
  - T3: **120s**
- Maximum measurement length with wave data:
  Because of a limitation in underlying protocol code, there is a limit to the maximum amount of wave data for one exposure. When limit is reached, measurement continues but wave data is lost. This limitation is planned to be eliminated.
  - AG3: **1m with 5 channels, 5m with 1 channel**
  - T3: **2m with 5 channels, 10m with 1 channel**
  - T3 (Wi-Fi): **1m with 5 channels, 5m with 1 channel**
- Maximum measurement count per session:
  - AG3: **Unlimited (theoretically)**
  - T3: **Unlimited - but 300 measurements per session are displayed**
- Maximum session count:
  - AG3: **Depending on disk space** (ca. 150KB/Session/Measurement)
  - T3: **last 75 sessions displayable,** all others are kept on SD-Card, complete management of all sessions comes later as feature of AG3 (ca. 150KB/Session/Measurement)

Appendix F – Warranties and Disclosures

Warranty for the Accu-Gold Measurement System

Radcal warrants that, in the event that any defects in material or workmanship should develop within one year of the date of shipment, the company assumes full responsibility for servicing equipment of its manufacture without charge upon return of the equipment to Radcal, with shipping costs prepaid by the customer. Costs to return-ship to customer by ground transportation will be paid by Radcal if the repairs are warranty-applicable. This warranty excludes batteries.

Radcal shall not be held liable for damages or delays caused by defects beyond making repairs or furnishing replacement parts, nor shall Radcal be liable for any defective material replaced without Radcal's consent during the period of this warranty. Radcal reserves the right to perform warranty services at its own factory.

Non-Warranty Repairs

The calibration of this instrument was correct within specified limits when the instrument left our factory. Radcal cannot be responsible for injury or damage resulting from improper use or calibration errors which develop subsequent to our shipment of the instrument.

If Radcal determines that a fault has been caused by misuse, abnormal operating conditions, or repairs by unauthorized personnel during the warranty period, repairs and shipping costs will be billed at normal rates.

If the equipment is found to be in proper working condition, Radcal will return-ship the equipment at customer expense.

Data Loss

Although we take great effort to save your data, the customer is responsible for backing up any and all data that is stored on their computers prior to being serviced.

WEEE and RoHS

Accu-Gold meets the requirements of the *2002/06/EC (WEEE) Directive*. Radcal has implemented full compliance. Recycling manuals are available on request.

Accu-Gold/Rapid-Gold/Accu-Dose+ meets the requirements of the EU-RoHS directive for RoHS 3, *The Restriction of the Use of Certain Hazardous Substances (RoHS) in Electrical and Electronic Equipment Directive* (EU Directive 2015/863) .

The Accu-Gold/Rapid-Gold/Accu-Dose+ comply with China's requirements for RoHS Marking and EFUP pursuant to *clause* 6.2 of *SJT/11364:2006 for Electronic Information Products*.

The Accu-Gold/Rapid-Gold/Accu-Dose+ comply with the requirements of the *1907/2006 EU (REACH) Directive concerning Registration, Evaluation, Authorization of Chemicals*. The aforementioned Radcal products do not contain added substances above 0.1% weight of Substance of Very High Concern (SVHC) listed in the Annex XVII as of June 27th, 2018.

Specifications

Ion Chambers
10X6-6
10X6-6M
10X6-10
10X6-60
10X6-60DAP
10X6-3CT
10X6-180
10X6-1800
10X6-0.18
10X6-0.6
10X6-0.6CT
10X6-500

Solid State Multisensors
Specifications
Dimensions

Solid State Dose Sensor
Current Sensors
Light Sensor
DAP Calibration Sensors

Declaration of Conformity

See https://radcal.com/downloads-conformity/

Making Low Level Measurements Using Ion Chambers

When making low dose measurements using an ion chamber (in the range of 10 times the minimum rated range), it is important to eliminate all sources of noise including noise induced by changing temperatures of the surroundings and the electronics. Position the ion chamber. Set the threshold to low and wait 3 minutes. Do not touch the cable or digitizer. For changing environments, allow 10 minutes for every 10 C difference for the sensor/electronics to equilibrate. Grounding the system to eliminate interference may be warranted.

Automatic temperature and pressure compensation for the unsealed ion chambers is provided. Temperature-compensation accuracy is equivalent to 0.5°C (0.2%) between 15 and 35°C. Temperature is measured at the ion chamber connector. Pressure-compensation accuracy is equivalent to 0.5 kPa between 60 and 105 kPa. Pressure is measured in the digitizer module.

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Radcal Part # MNL/AG3
4094502 Rev: B
Software V3.29 & on
Printed: Sept 2024