

# Accu-Gold 3

- User Guide

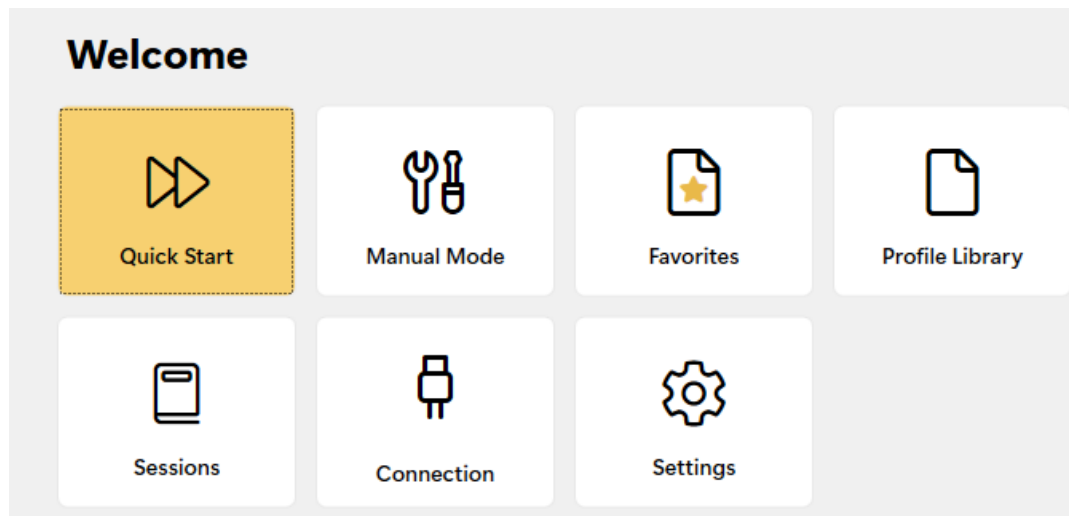


Radcal Accu-Gold 3 is a state-of-the-art radiation quality control software designed to provide accurate and reliable measurements for a wide range of applications. This instruction manual is designed to guide you through the features and functions of the software, so you can make the most of its capabilities.

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

<a href="#">4 - Hardware Introduction/Minimum Requirements</a>	
<a href="#">5 - Getting Started</a>	
<a href="#">6 - Setting up the Hardware</a>	
<a href="#">7 - Software Introduction</a>	
<a href="#">8 - Quick Start</a>	
- <a href="#">11 - Make you first measurement ...</a>	
- <a href="#">12 - Sessions</a>	
- <a href="#">14 - Contact us</a>	
- <a href="#">15 - The Main Menu</a>	
- <a href="#">16 - Manual Mode</a>	
<a href="#">18 - Profiles</a>	
- <a href="#">19 - Profile Library</a>	
- <a href="#">23 - Favorites</a>	
<a href="#">24 - Measurements</a>	
- <a href="#">26 - Initialization Cycle</a>	
- <a href="#">26 - End of Exposure Delay</a>	
- <a href="#">27 - Fluoro Measurements</a>	
- <a href="#">28 - Combo Measurement</a>	
- <a href="#">30 - Background Measurements</a>	
- <a href="#">31 - Waveforms</a>	
- <a href="#">33 - Free Run</a>	
- <a href="#">34 - Measurement limitations</a>	
- <a href="#">35 - Using the 3CT chamber</a>	
<a href="#">36 - Exporting Data</a>	
- <a href="#">37 - Exporting data to Excel</a>	
- <a href="#">38 - Exporting data in list view</a>	
- <a href="#">39 - List View</a>	
<a href="#">40 - Companion Mode</a>	
<a href="#">46 - Reanalyze</a>	
<a href="#">50 - Connection</a>	
<a href="#">53 - Settings</a>	
<a href="#">55 - Appendix A - AG3 Installation and Setup</a>	
<a href="#">56 - Appendix B - AG3 vs. AG2</a>	
<a href="#">57 - Appendix C - Custom Profiles</a>	
<a href="#">58 - Appendix D - Debugging</a>	
<a href="#">60 - Appendix E - Software Limitations</a>	
<a href="#">61 - Appendix F - Warranties and Disclosures</a>	
<a href="#">62 - Specifications/Declarations</a>	

## 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		

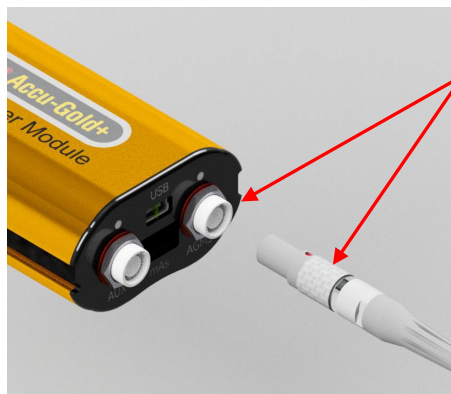
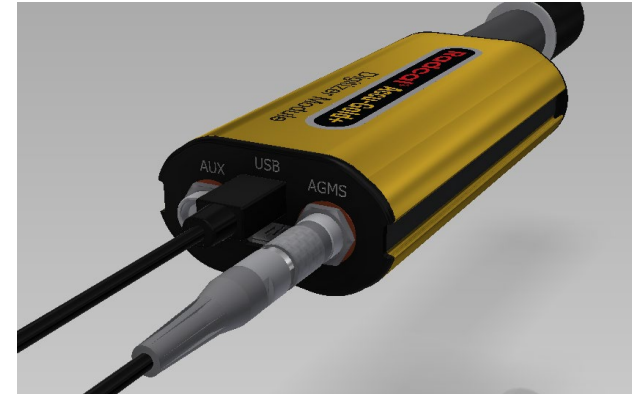
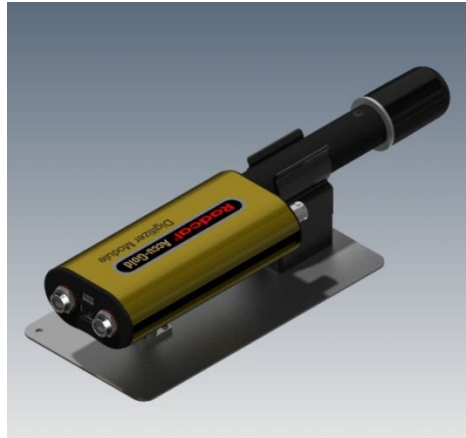
## Setting up the Hardware

To set up the Accu-Gold hardware

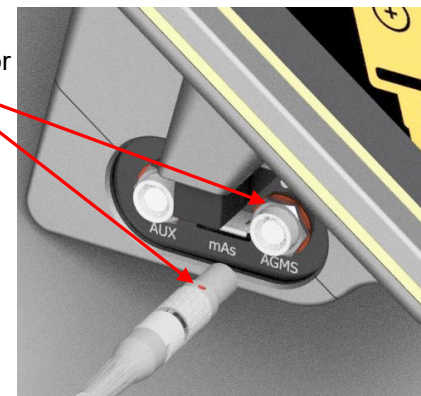
- Connect the sensor(s) to the digitizer. Connect the USB cable to the digitizer and then the computer
- Position the sensor to make a measurement.

**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](mailto: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.

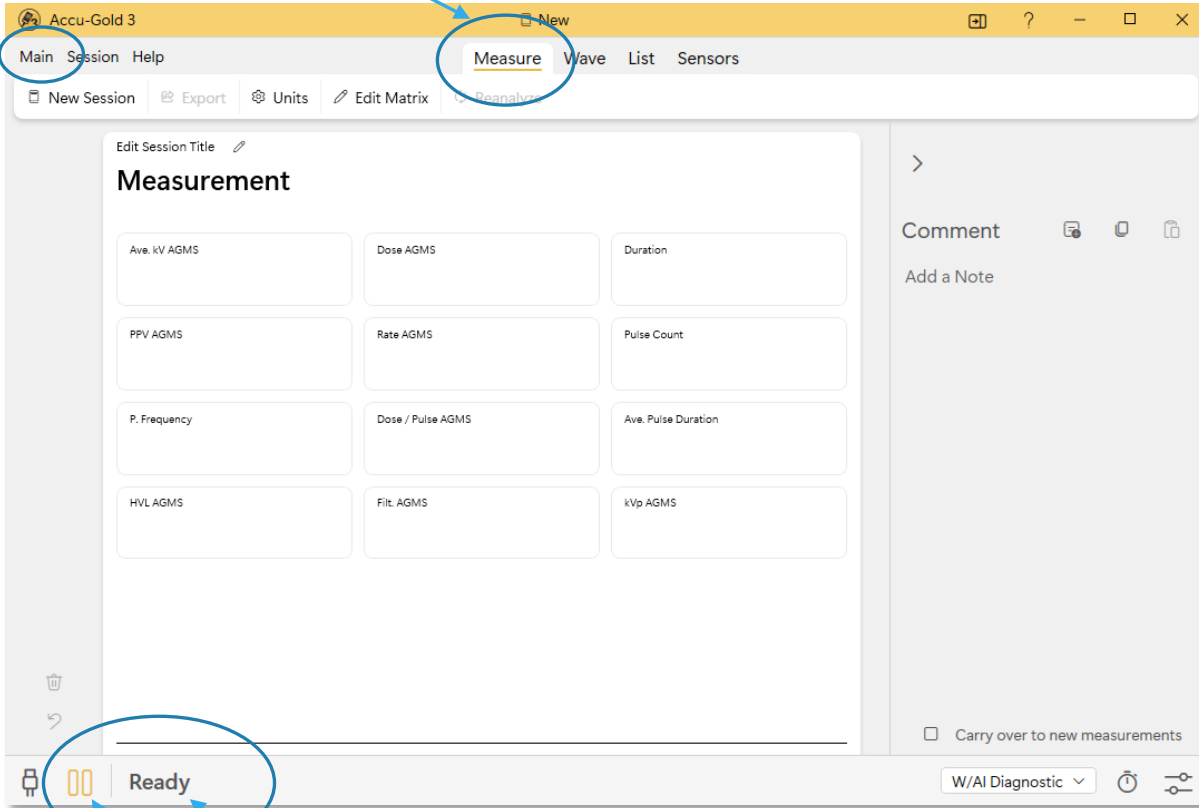


# Quick Start

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

You are here

Opens the Main menu



The screenshot shows the Accu-Gold 3 software window. The title bar is yellow and contains the text 'Accu-Gold 3' and a 'New' button. Below the title bar is a menu bar with 'Main', 'Session', and 'Help'. A blue circle highlights the 'Main' menu item, with an arrow pointing to it from the text 'Opens the Main menu'. To the right of the menu bar is a toolbar with icons for 'New Session', 'Export', 'Units', 'Edit Matrix', and 'Reanalyze'. A blue circle highlights the 'Measure' button in the toolbar, with an arrow pointing to it from the text 'You are here'. Below the toolbar is a large area labeled 'Measurement' with a grid of input fields for various parameters: 'Ave. kV AGMS', 'Dose AGMS', 'Duration', 'PPV AGMS', 'Rate AGMS', 'Pulse Count', 'P. Frequency', 'Dose / Pulse AGMS', 'Ave. Pulse Duration', 'HVL AGMS', 'Fit. AGMS', and 'kVp AGMS'. To the right of the measurement area is a 'Comment' section with a text area and icons for saving, deleting, and printing. At the bottom of the window is a status bar. A blue circle highlights the status bar area, which contains a 'Ready' label and a 'W/AI Diagnostic' dropdown. An arrow points from the text 'Indicates system is Ready to make a measurement.' to the 'Ready' label. Another arrow points from the text 'Press Pause if changing or repositioning the sensor' to the status bar area.

Indicates system is Ready to make a measurement.

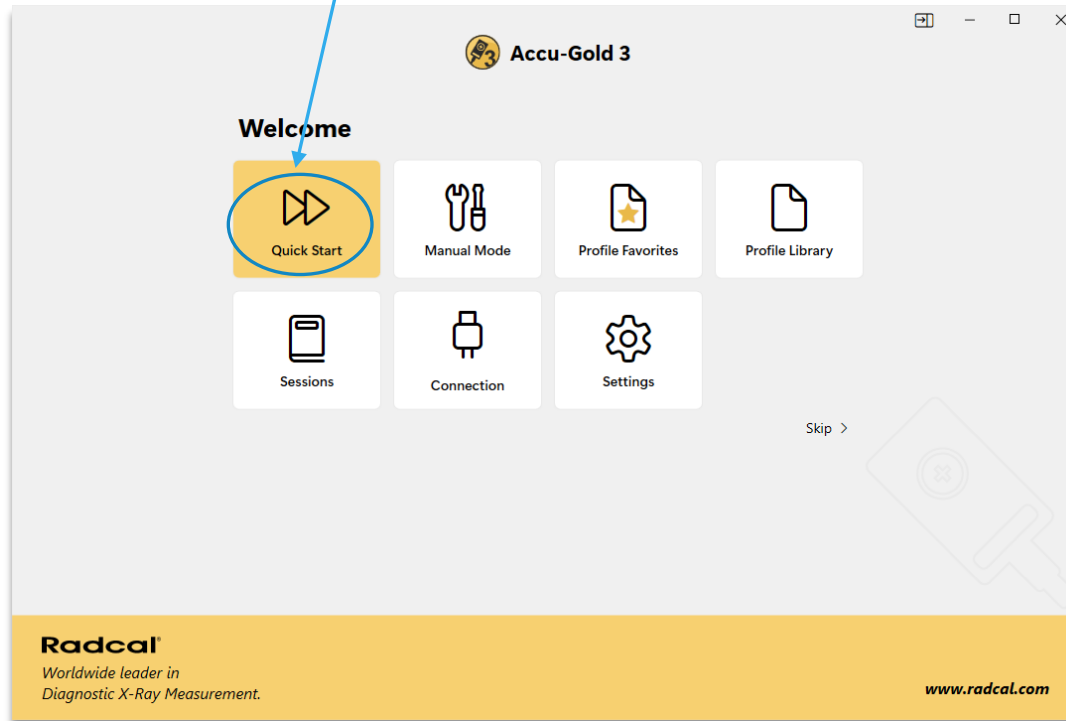
Press Pause if changing or repositioning the sensor

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-AI 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 ...

The screenshot displays the Accu-Gold 3 software interface with the following components and annotations:

- Top Bar:** Contains the title "Accu-Gold 3" and "1 Measurements \*". The menu bar includes "Main", "Session", and "Help". The "Measure" tab is selected, with other tabs being "Wave", "List", and "Sensors".
- Toolbar:** Includes icons for "New Session", "Export", "Units", "Edit Matrix", and "Reanalyze".
- Measurement Data:** A grid of 12 data points for "Measurement 1" (dated 9/12/2024 - 2:00 PM) under the "W/AI Diagnostic Calibration" mode.

Parameter	Value
Ave. kV AGMS	118.8 kV
Dose AGMS	20.64 mGy
Duration	915.0 ms
PPV AGMS	119.2 kV
Rate AGMS	22.56 mGy/s
Pulse Count	1
P. Frequency	1.1 Hz
Dose / Pulse AGMS	20.42 mGy
Ave. Pulse Duration	905.1 ms
HVL AGMS	4.73 mm
Filt. AGMS	3.325 mm
kVp AGMS	119.2 kV
- Waveform:** A graph at the bottom shows "Rate AGMS" (cyan line) and "kV AGMS" (magenta line). A legend above the graph identifies these series.
- Right Panel:** A "Comment" section with an "Add a Note" button and a list of calibration options: "W/AI Diagnostic" (selected), "Mo/Mo", "Mo/Rh", "W/Ag", "W/Rh", "W/AI Mammo", and "W/AI Diagnostic".
- Bottom Bar:** Features a "Ready" status indicator and a "Delete" button.

Annotations with arrows point to specific features:

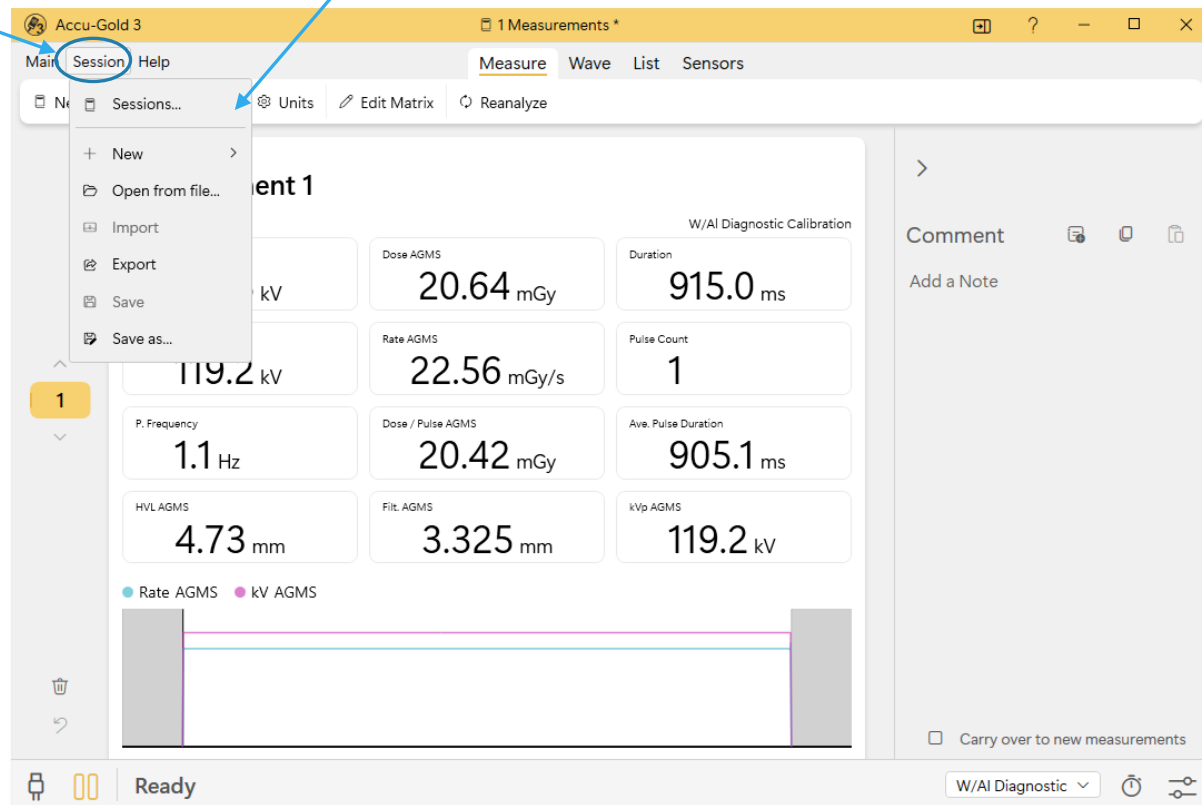
- "Change from Gy to mR or use seconds vs. hours, etc if necessary" points to the "Units" button in the toolbar.
- "Measurement number. You can scroll thru each measurement you have captured using the up and down arrows" points to the measurement number "1" in the left sidebar.
- "Delete measurement" points to the "Delete" button in the bottom bar.
- "Undo delete" points to the "Undo" button in the bottom bar.
- "You can continue making measurements when it says Ready" points to the "Ready" status indicator.
- "Waveform legend" points to the legend above the waveform graph.
- "Click on the waveform to expand it or choose the Wave tab (See [measurement](#) section for more information)" points to the waveform graph area.
- "Expand to enter comments ([Described later](#))" points to the "Comment" section on the right.
- "Choose the appropriate anode-filter to use from the DM+ sensor." points to the calibration dropdown menu.

# Sessions

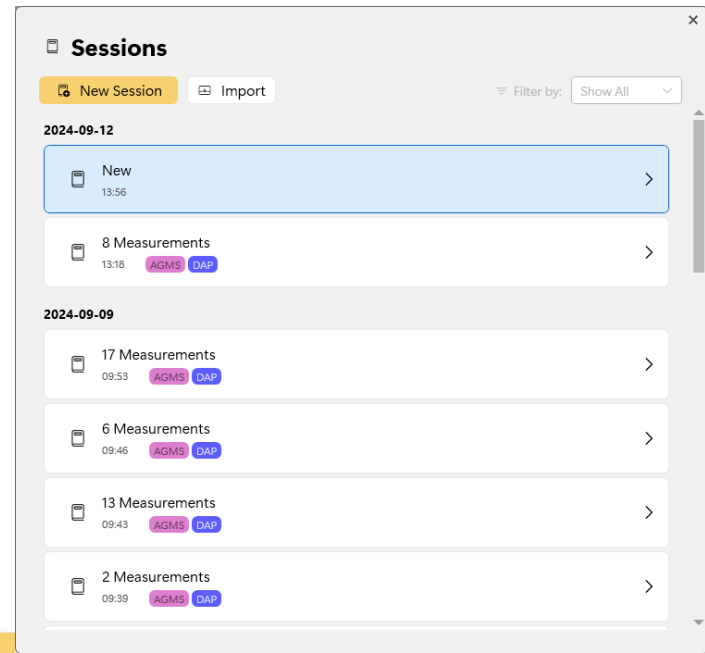
When done making measurements, open the Session menu. Sessions are saved automatically but here you can start a new session, export, import or save the session with a meaningful name of your choice or leave the default name. You can also do session maintenance from the Main menu

This opens  
the Session  
Menu

Session  
Menu



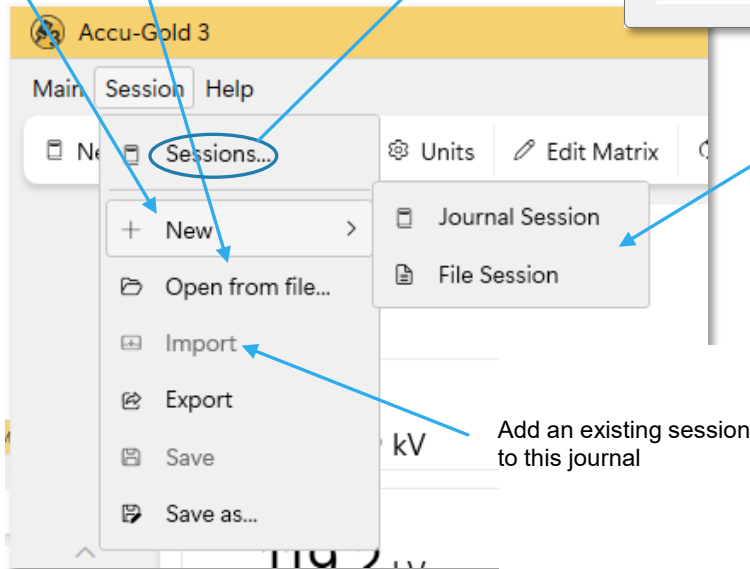
# Sessions (cont)



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

Open an existing session (including AG2 sessions)

This brings up a list of the sessions in the Journal



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.

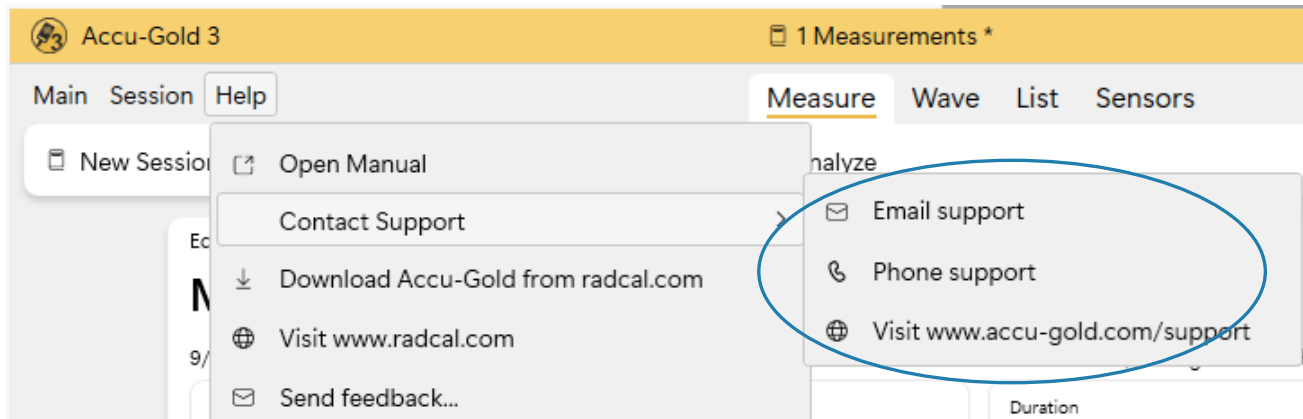
Add an existing session to this journal

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

The screenshot shows the main menu of the Accu-Gold 3 software. At the top, it says "Accu-Gold 3". Below this is a "Welcome" section with a grid of icons: "Quick Start", "Manual Mode", "Favorites", "Profile Library", "Sessions", "Connection", and "Settings". A "Skip >" button is located to the right of the "Connection" icon. At the bottom, there is a yellow banner with the "Radcal" logo and the text "Worldwide leader in Diagnostic X-Ray Measurement." and "www.radcal.com".

Annotations and links:

- Manual Mode (Similar to AG2)**: Points to the "Manual Mode" icon.
- Favorites List**: Points to the "Favorites" icon.
- Library of Profiles**: Points to the "Profile Library" icon.
- Companion Mode**: Points to the "Connection" icon.
- Opens List of Sessions in the Journal**: Points to the "Sessions" icon.
- Choose connection method to your digitizer – USB cable or Wi-Fi**: Points to the "Connection" icon.
- Opens Measurement screen**: Points to the "Skip >" button.
- WiFi used with T3 Pro only. See [Connection](#)**: Points to the "WiFi Sync" option in the "Change Connection" section of the "Connection" dialog.

The "Connection" dialog box is open, showing the following options:

- Current Connection:** USB AGDM+ (Ready) [Details]
- Change Connection:**
  - ☒ USB AGDM+
  - ☐ WiFi Sync

The "About" menu is also visible, containing the following items:

- Open Manual
- Contact Support >
- Download Accu-Gold from radcal.com
- Visit www.radcal.com
- Send feedback...
- Privacy >
- Export logs...
- Upload your session and raw data to Radcal
- Open raw data folder...
- About

# Manual Mode

Choose Manual Mode from the Main menu



Manual Mode

**Measuring Settings**

Manual Mode | Profile Library | Favorites

**Trigger**

Trigger Sensor: AGMS

Trigger Level: Std

End of Exposure Delay: 1s

**Multi-Sensor**

Calibration: W/AI Diagnostic

**Sensors**

Is IC Enabled: No

Is DD Enabled: No

Is mA Enabled: No

★ Add to Favorites

Cancel Apply

AGMS

DD

IC

mA

DAP+

Choose the sensor to be the trigger source

W/AI Diagnostic

Mo/Mo

Mo/Rh

W/Ag

W/Rh

W/AI Mammo

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

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

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



# Manual Mode (cont)

**Measuring Settings**

Manual Mode Profile Library Favorites

**Trigger**

Trigger Sensor AGMS

Trigger Level Std

End of Exposure Delay 1s

**Multi-Sensor**

Calibration W/AI Diagnostic

**Sensors**

Is IC Enabled No

Is DD Enabled No

Is mA Enabled No

★ Add to Favorites Cancel Apply

Low  
**Std**  
High

**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..

Min  
**1s**  
3s  
5s  
8s

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

# 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

**Measuring Settings**

Manual Mode Profile Library Profile Favorites

Profiles

Filter by: Show All

Modality	Manufacturer
Radiography >	GE >
Fluoroscopy >	Hologic >
CT >	Phillips >
Mammography >	Siemens >
Multiple Sensors >	Radcal >
Dental >	

Manage Profiles

Open Profile File

Select

Cancel Apply

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

# Profile Library (cont)

The screenshot shows the 'Measuring Settings' window with the 'Profile Library' tab selected. The breadcrumb path is 'Profiles > Modality > Fluoroscopy'. A 'Filter by: Show All' dropdown is present. A list of profiles is shown, with the second profile, 'Contin. Fluoro Ich - 1sec ROI', highlighted by a blue box. This profile's details are expanded, showing fields for Manufacturer (General), Model (Fluoro), Sensor (ICH), Extracted Region (1.0 s), Anode (W), Filter (AI), and Conditions (Fluoro (not pulsed): Ion Chamber, when adjusting at very low dose rates. ROI for last 1 second. W/AI 40-160kV). At the bottom of the details box, it shows 'Profile File: icf\_low\_adj1.0s\_10.agp', 'Date last modified: 2024-01-17', and 'Threshold: LOW'. Below the details box, more profiles are listed. At the bottom of the window are 'Back', 'Cancel', and 'Apply' buttons. Four blue arrows with text labels point to specific UI elements: 'Select to make it a favorite' points to a star icon; 'Click to expand/contract' points to a chevron icon; 'Click Apply to use' points to the 'Apply' button; and 'Application information' points to the profile details box.

**Measuring Settings**

Manual Mode Profile Library Profile Favorites

Profiles > Modality > Fluoroscopy

Back Filter by: Show All

☐ Fluoro AGMS Diag adj - 1s ROI  
Continuous Fluoro for adjusting with last one second region AGMS Diag

☐ **Contin. Fluoro Ich - 1sec ROI**  
Continuous Fluoro using Ion Chamber for adjusting with last one second region

Manufacturer: General Model: Fluoro

Sensor: ICH Extracted Region: 1.0 s

Anode: W Filter: AI

Conditions: Fluoro (not pulsed): Ion Chamber, when adjusting at very low dose rates. ROI for last 1 second. W/AI 40-160kV

Profile File: icf\_low\_adj1.0s\_10.agp Date last modified: 2024-01-17 Threshold: LOW

☐ Fluoro AGMS dose only adj - 1s  
Continuous Fluoro using AGMS Diag for adjusting at low dose with last one second region

☐ Pulsed Fluoro AGMS adj -1s ROI  
Pulsed Fluoro using AGMS Diag for adjusting with last one second

Back Cancel Apply

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

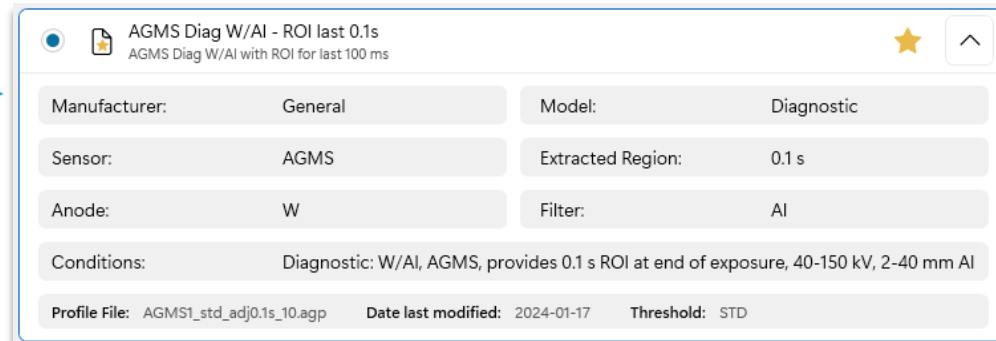
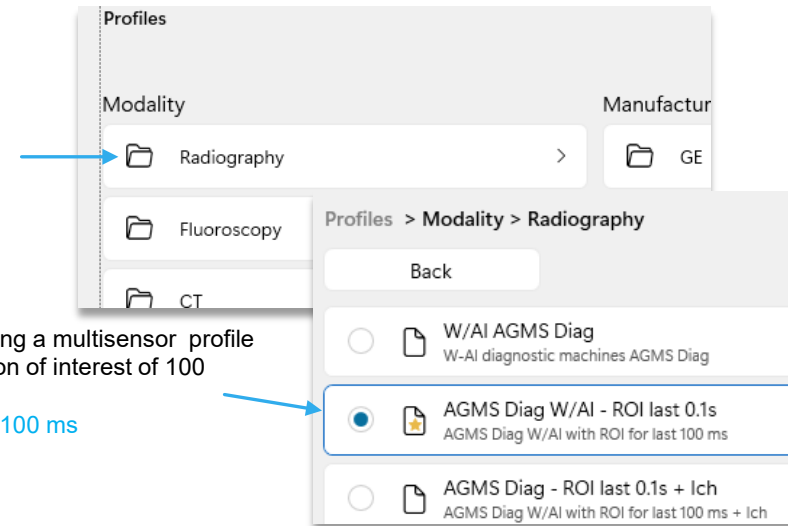
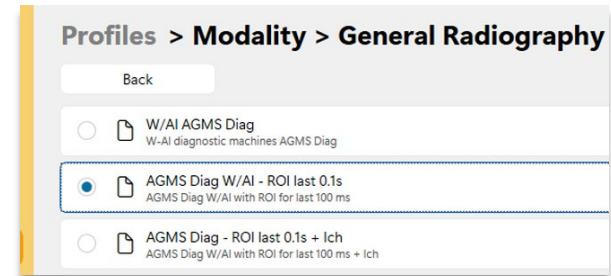
①

Choose  
Radiography

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

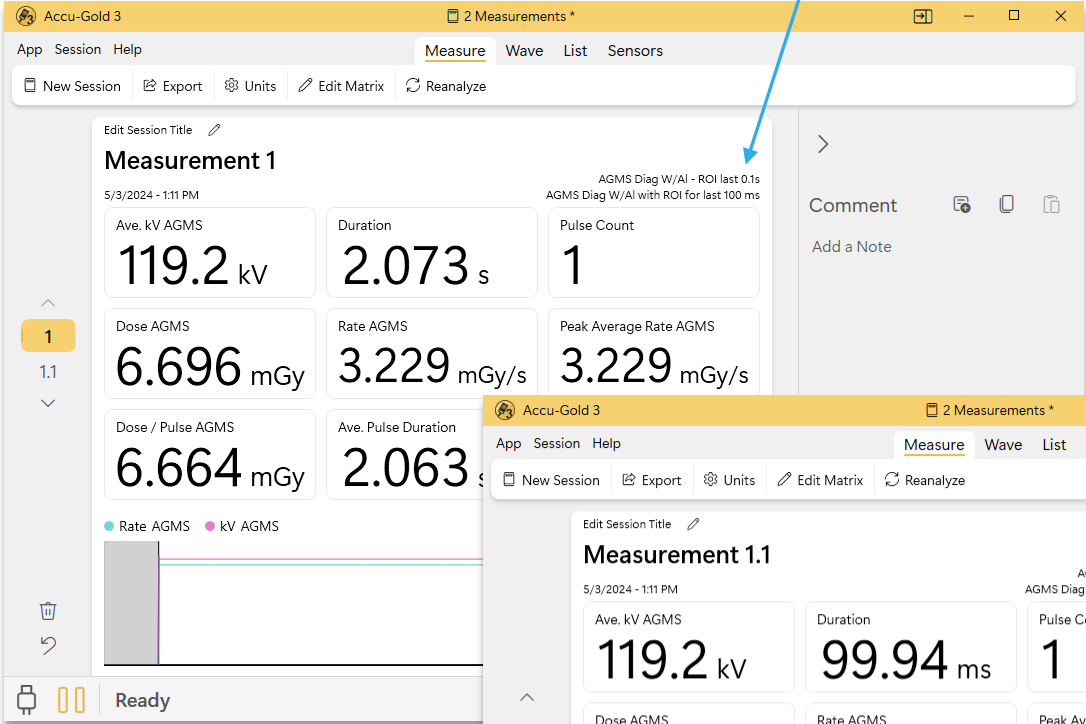
Click the star to  
make it a favorite

Clicking the ① button will expand the  
information about the profile and will  
describe the application it was intended for.

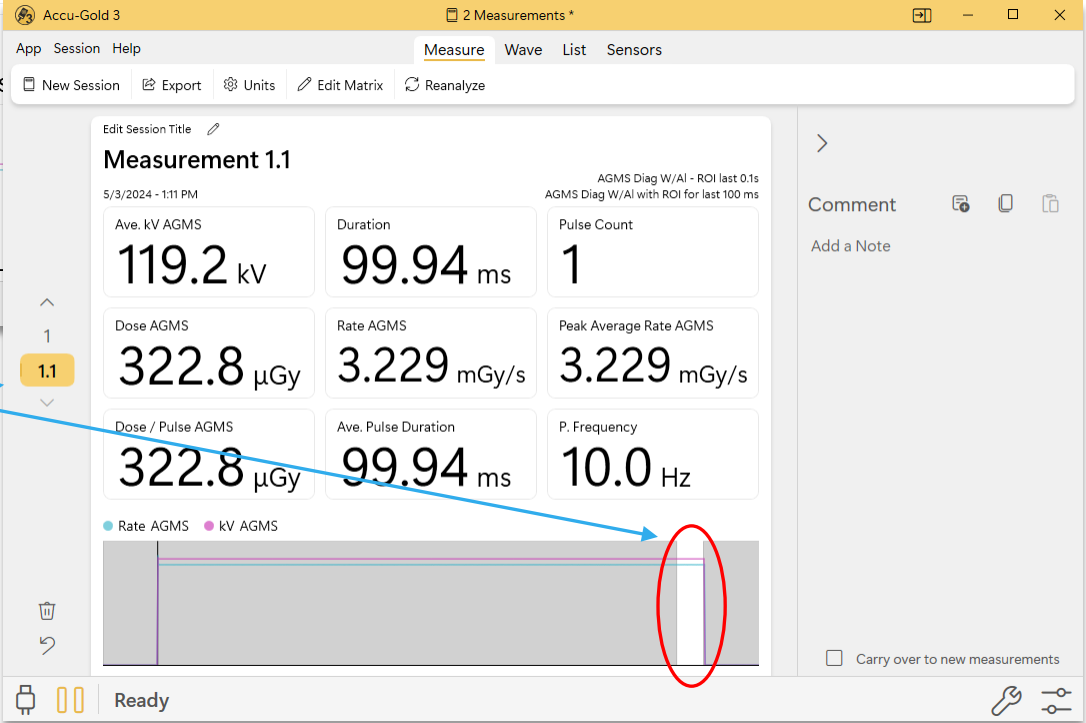


Click Apply and make a measurement

The profile name



The child and the results that apply to the child





## Profile Favorites

# Profile Favorites

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

You are here

Favorite icon

Handle for moving around to change order. Drag up or down to arrange.

Favorites saved from Manual Mode

Path to the selection of this profile

Remove from list

Takes you to the selection where details can be found



# Measurements

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



# Making Measurements and Copying data

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

Expand or contract comment area

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

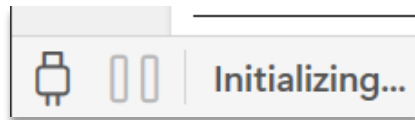
Returns to profile selection area or where you were last

The screenshot displays the Accu-Gold 3 software interface. The top menu bar includes 'Main', 'Session', and 'Help'. Below it, a toolbar contains 'New Session', 'Export', 'Units', 'Edit Matrix', and 'Reanalyze'. The main display area is titled 'Measurement 1' and shows various AGMS (Automatic Gain Measurement System) parameters. A table of these parameters is as follows:

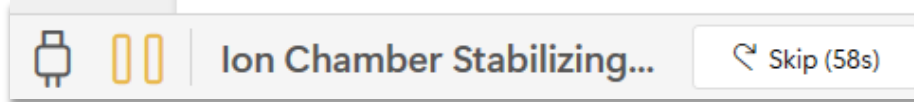
Parameter	Value
Ave. kV AGMS	118.8 kV
Dose AGMS	35.81 mGy
Duration	1.588 s
PPV AGMS	119.2 kV
Rate AGMS	22.55 mGy/s
Pulse Count	1
P. Frequency	0.6 Hz
Dose / Pulse AGMS	35.59 mGy
Ave. Pulse Duration	1.578 s
HVL AGMS	4.73 mm
Filt. AGMS	3.326 mm
kVp AGMS	119.2 kV

Below the table is a graph showing 'Rate AGMS' (cyan line) and 'kV AGMS' (magenta line) over time. To the right of the main display is a 'Comment' section with a text input field and a 'Paste from clipboard' button. A 'Ready' status indicator is shown at the bottom left, with a 'Click when ready to start the next measurement' and 'Click again to pause' instruction. A 'Connection type = USB' label points to the USB icon. A 'Click to bring up option to change delay' label points to a clock icon. A 'Returns to profile selection area or where you were last' label points to a gear icon. A 'Click on icon to copy to clipboard or drag-and-drop value straight to Excel' label points to a copy icon. An 'Expand or contract comment area' label points to a plus/minus icon. A 'Copy entire comment to clipboard' label points to a copy icon. A 'Paste from clipboard' label points to a paste icon. A 'Append this snippet:' label points to a snippet box containing a list of parameters to be copied.

## Initialization Cycle



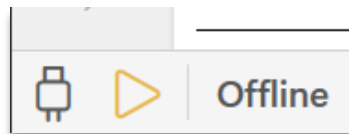
The software starts by connecting to the digitizer and initializing the electronics



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

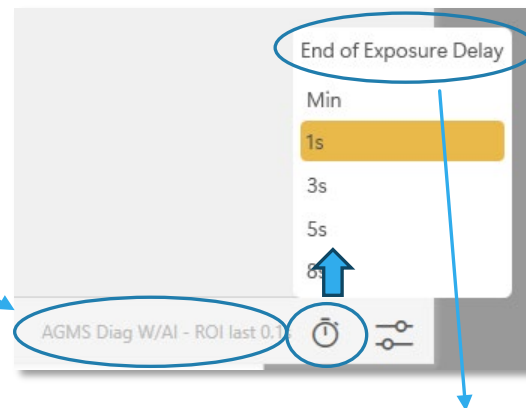


As soon as the 'Ready' message is displayed at the bottom of the screen, you can make a measurement.



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-AI 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.

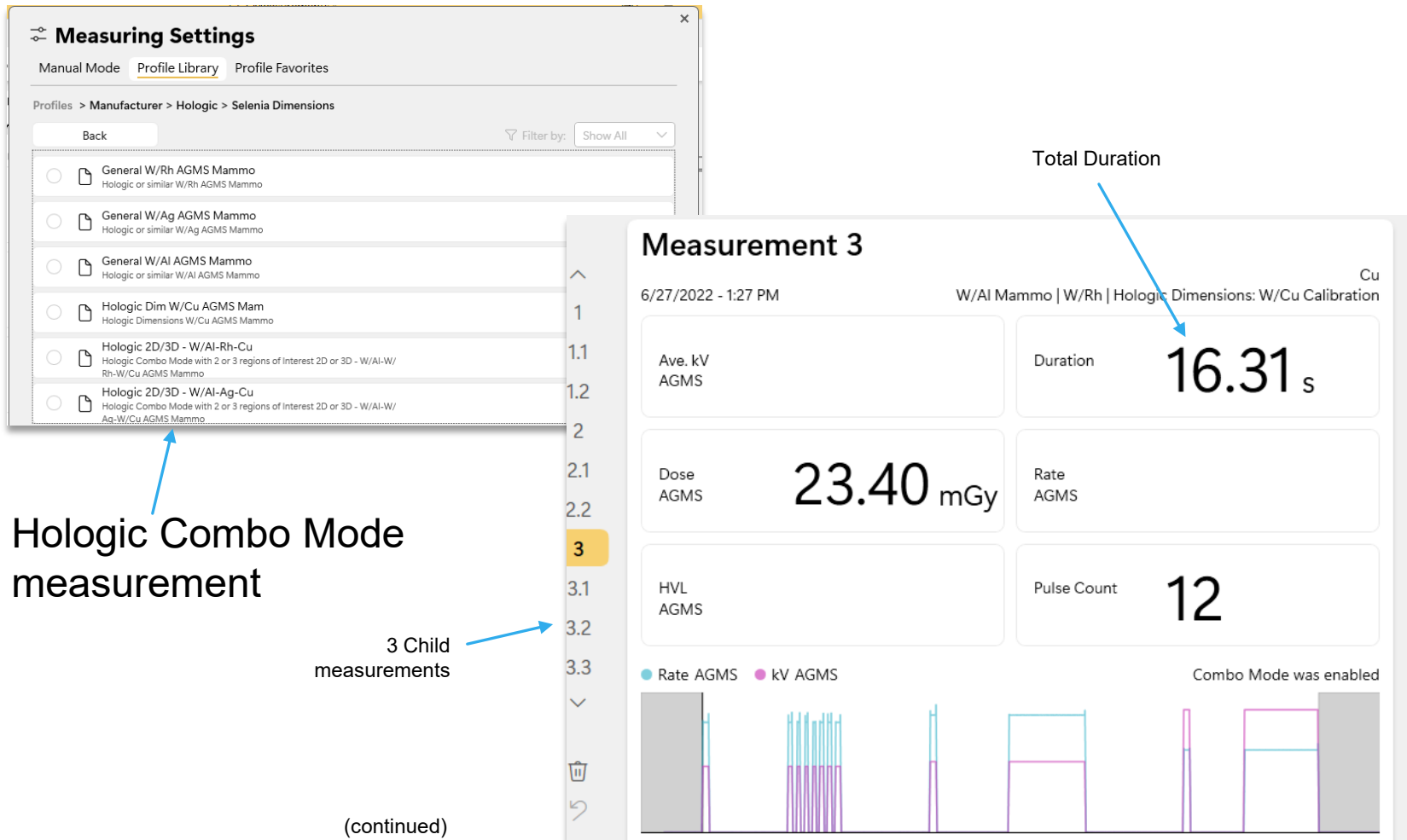
Several profiles are provided to assist in making adjustments to a fluoro system which require adjusting the kV down to some level. These profiles will save the kV value at the end of the adjustment.

# 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.



## Measurement 3.1

6/27/2022 - 1:27 PM

Ave. kV  
AGMS

23.6 kV

Duration

3.27 s

Dose  
AGMS

3.797 mGy

Rate  
AGMS

2.469 mGy/s

HVL  
AGMS

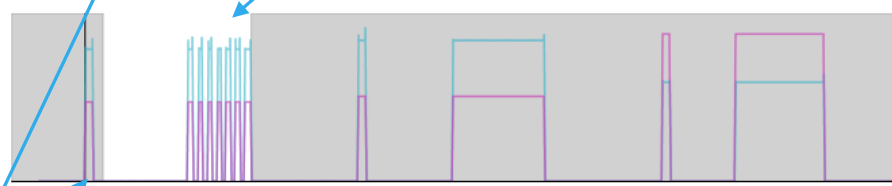
0.36 mm

Pulse Count

7

● Rate AGMS ● kV AGMS

Combo Mode was enabled



Area is highlighted  
for which the values  
are given

The Dose includes  
the scout pulse. All  
other values, such  
as Dose Rate,  
ignore it and apply  
to the non-grey  
area.

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

Cu  
W/Rh Calibration

3.74 s

5.029 mGy/s

Cu  
Hologic Dimensions: W/Cu Calibration

3.18 s

3.536 mGy/s

1

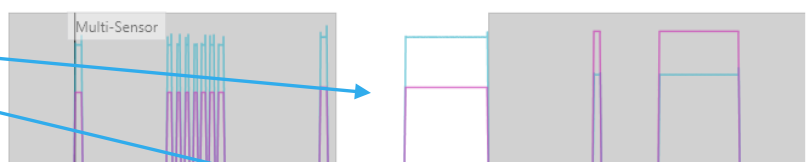
3.2

AGMS

0.32 mm

● Rate AGMS ● kV AGMS

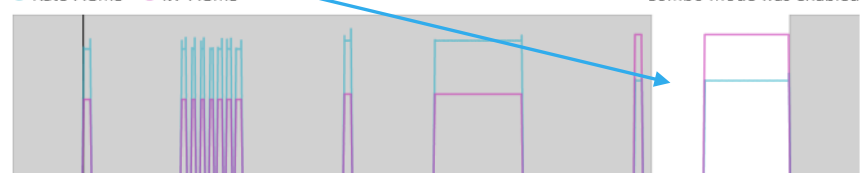
Combo Mode was enabled



3.3

● Rate AGMS ● kV AGMS

Combo Mode was enabled



# Background Measurements

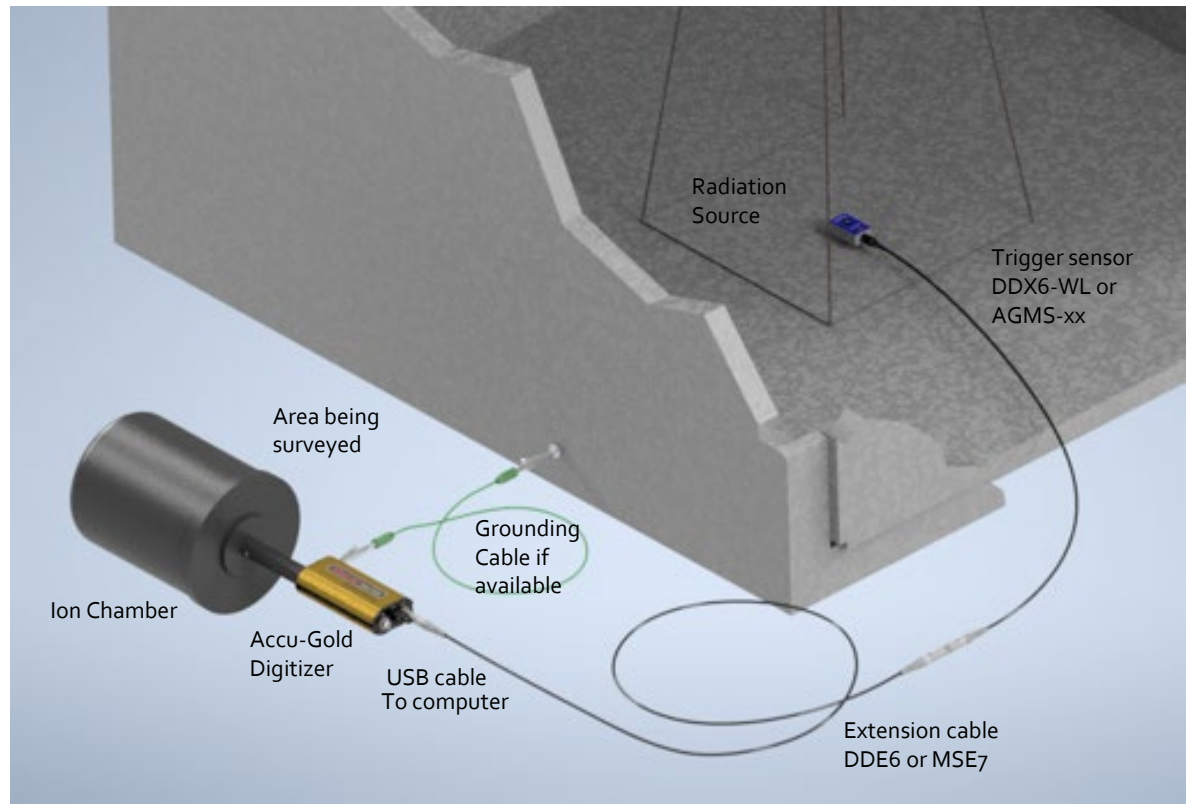
The technique and radiation levels to be detected will determine the best sensor suited for your evaluation. A 180cc, 500cc, or 1800cc chamber may be used, but while the 180 Ionization Chamber is excellent for detecting direct leakage with its 100cm<sup>2</sup> area, it is not practical for scatter measurements.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

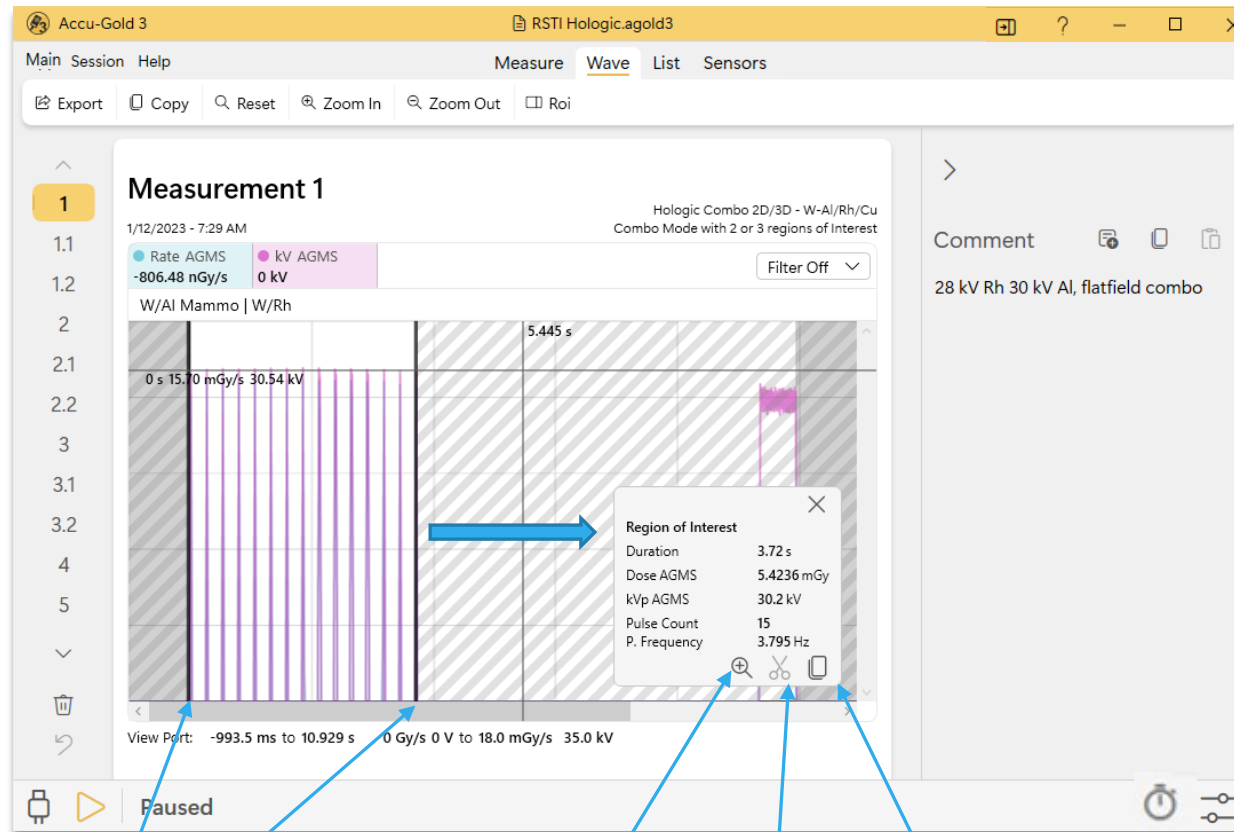
Click to turn off that particular waveform

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.

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

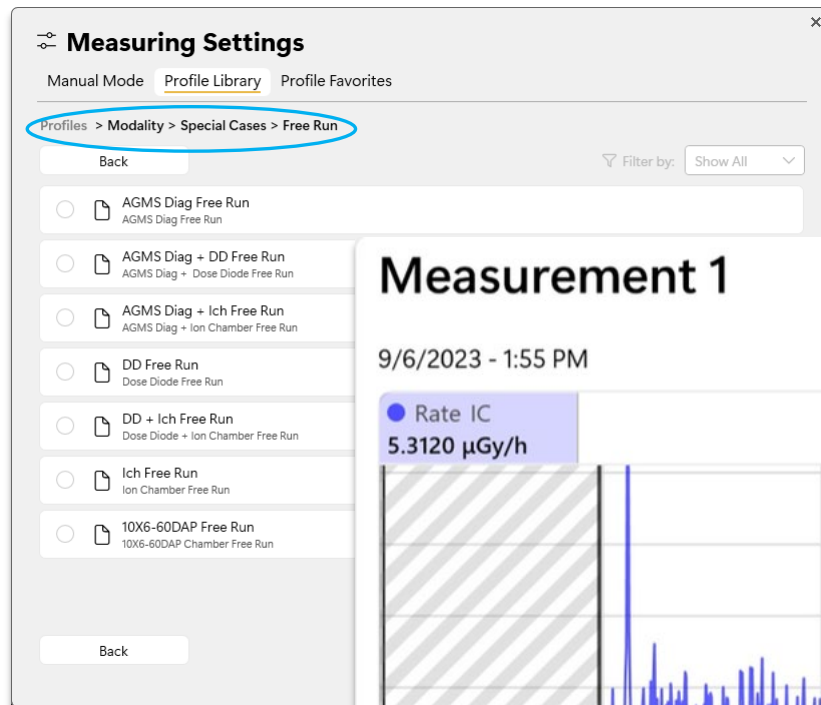


# Free Run

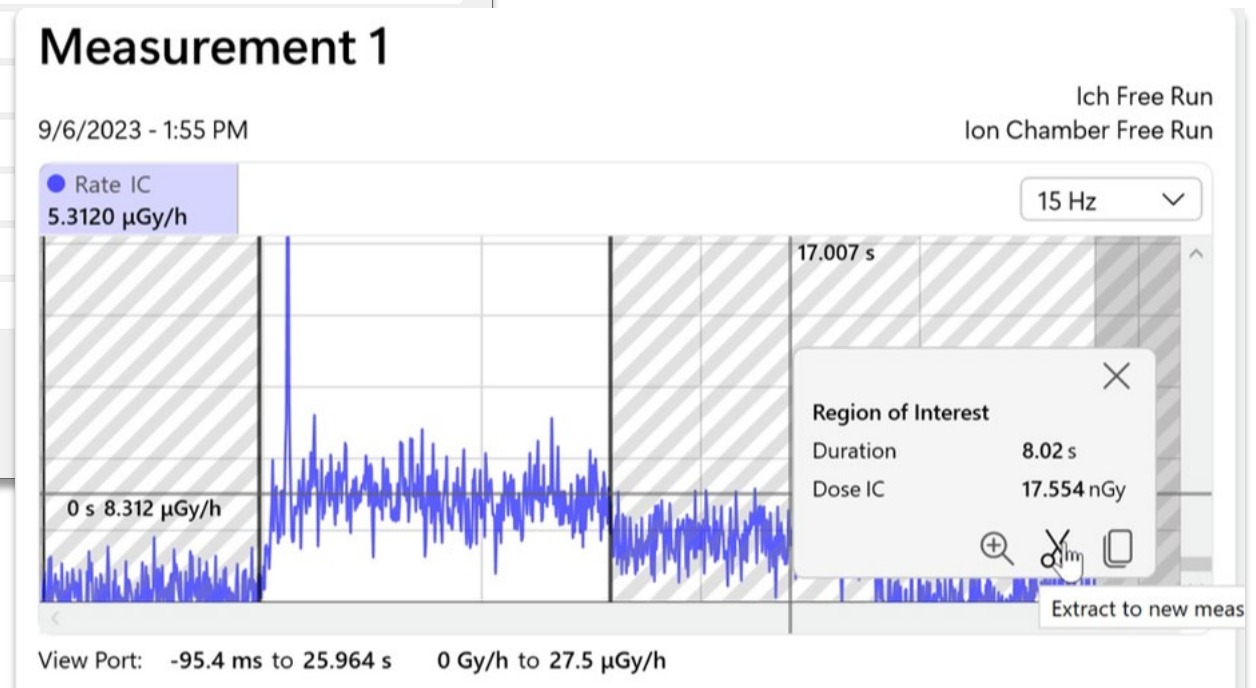
For Free Run, no trigger is required. Free Run is useful for doing background measurements, surveys, sources and any other application that does not have a signal that can trigger the exposure reliably. Free Run starts measuring as soon as you hit play.

## 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.

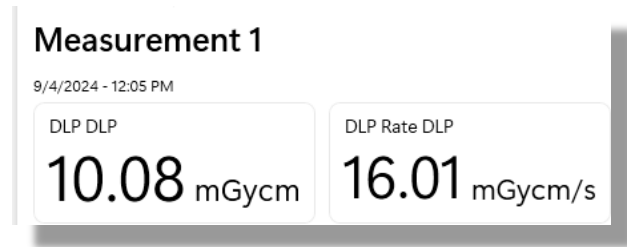
# Using the 3CT chamber

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 Gy<sub>cm</sub>. 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.

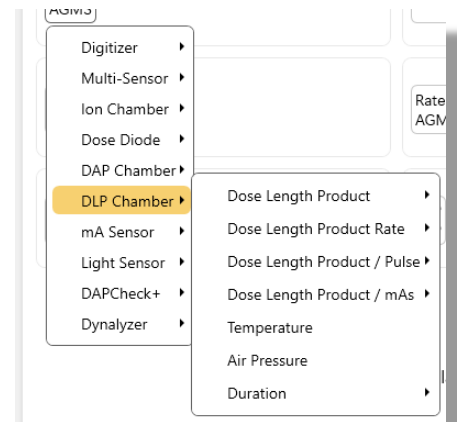
## When used as DLP (QS)



## 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

Accu-Gold 3 RSTI Hologic.agold3

Main Session Help Measure Wave **List** Sensors

**Export All** Select All Copy Table Layout Add Column Units Undo Delete

INDEX	START TIME	DURATION	KVP AGMS	DOSE AGMS	DOSE IC	AVE. KV AGMS	HVL AGMS	RATE AGMS	RATE IC
1	1/12/2023 7:29:47 AM	9.935 s		7.671 mGy					
1.1	1/12/2023 7:29:47 AM	3.162 s	30.5 kV	5.424 mGy		29.7 kV	0.5119 mm	1.377 mGy/s	
1.2	1/12/2023 7:29:47 AM	0.2002 s	27.7 kV	2.247 mGy		27.7 kV	0.5062 mm	3.750 mGy/s	
2	1/12/2023 7:36:08 AM	9.978 s		8.732 mGy					
2.1	1/12/2023 7:36:08 AM	3.161 s	30.5 kV	5.536 mGy		29.7 kV	0.5135 mm	1.405 mGy/s	
2.2	1/12/2023 7:36:08 AM	0.2004 s	37.3 kV	3.196 mGy		37.1 kV	0.6033 mm	5.334 mGy/s	
3	1/12/2023 7:38:55 AM	9.983 s		8.772 mGy					
3.1	1/12/2023 7:38:55 AM	3.163 s	30.5 kV	5.532 mGy		29.7 kV	0.5130 mm	1.404 mGy/s	
3.2	1/12/2023 7:38:55 AM	0.2005 s	30.8 kV	3.239 mGy		30.6 kV	0.5941 mm	5.401 mGy/s	
4	1/12/2023 7:50:50 AM	17.72 s			7.967 mGy				0.2732 mGy/s
5	1/12/2023 7:55:21 AM	12.80 s			4.369 mGy				0.2810 mGy/s
6	1/12/2023 8:00:08 AM	9.984 s		6.991 mGy					
6.1	1/12/2023 8:00:08 AM	3.163 s	30.5 kV	5.401 mGy					
6.2	1/12/2023 8:00:08 AM	0.1998 s	24.5 kV	1.591 mGy					

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.

Book1 - Excel

File Home Insert Page Layout Formulas Data Review View Developer Add-ins Help ACROBAT Tell me what you want to do

Clipboard Font Alignment Number Styles

A1 Index

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
	Index	Start Time	Duration	kVp AGMS			Dose AGMS		Dose IC		Average k AGMS		HVL AGMS		Dose Rate AGMS		Dose Rate IC	
3	1	2023-01-12 07:29:48	9.935 s				7.671 mGy											
4	1.1	2023-01-12 07:29:48	3.162 s	30.5 kV			5.424 mGy				29.7 kV		0.5119 mm		1.377 mGy/s			
5	1.2	2023-01-12 07:29:48	0.2002 s	27.7 kV			2.247 mGy				27.7 kV		0.5062 mm		3.75 mGy/s			
6	2	2023-01-12 07:36:08	9.978 s				8.732 mGy											
7	2.1	2023-01-12 07:36:08	3.161 s	30.5 kV			5.536 mGy				29.7 kV		0.5135 mm		1.405 mGy/s			
8	2.2	2023-01-12 07:36:08	0.2004 s	37.3 kV			3.196 mGy				37.1 kV		0.6033 mm		5.334 mGy/s			
9	3	2023-01-12 07:38:56	9.983 s				8.772 mGy											
10	3.1	2023-01-12 07:38:56	3.163 s	30.5 kV			5.532 mGy				29.7 kV		0.513 mm		1.404 mGy/s			
11	3.2	2023-01-12 07:38:56	0.2005 s	30.8 kV			3.239 mGy				30.6 kV		0.5941 mm		5.401 mGy/s			
12	4	2023-01-12 07:50:51	17.72 s						7.967 mGy								0.2732 mGy/s	
13	5	2023-01-12 07:55:22	12.8 s						4.369 mGy								0.281 mGy/s	
14	6	2023-01-12 08:00:09	9.984 s				6.991 mGy											
15	6.1	2023-01-12 08:00:09	3.163 s	30.5 kV			5.4 mGy				29.6 kV		0.5108 mm		1.37 mGy/s			
16	6.2	2023-01-12 08:00:09	0.1998 s	24.5 kV			1.591 mGy				24.5 kV		0.4594 mm		2.644 mGy/s			

# 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:

Change Table Settings

Dose Scaling: Milli

Unit Position: Next to value

Include in header

Next to value

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
3.1	6/9/2022 4:39:18 PM	0.500 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.

The screenshot shows the Accu-Gold 3 software interface. The 'Main' menu is open, and the 'List' tab is selected. The 'Export All' button is highlighted with a red circle and an arrow. The 'Table Layout' dropdown menu is open, showing the 'Auto' option selected, also highlighted with a red circle and an arrow. The main data table displays a list of measurements with columns for INDEX, START TIME, and various measurement parameters.

INDEX	START TIME	AVE. KV AGMS	HVL AGMS	RATE AGMS	RATE IC
1	1/12/2023 7:29:47 AM				
1.1	1/12/2023 7:29:47 AM	29.7 kV	0.5119 mm	1.377 mGy/s	
1.2	1/12/2023 7:29:47 AM	27.7 kV	0.5062 mm	3.750 mGy/s	
2	1/12/2023 7:36:08 AM				
2.1	1/12/2023 7:36:08 AM	29.7 kV	0.5135 mm	1.405 mGy/s	
2.2	1/12/2023 7:36:08 AM	37.1 kV	0.6033 mm	5.334 mGy/s	
3	1/12/2023 7:38:55 AM				
3.1	1/12/2023 7:38:55 AM	29.7 kV	0.5130 mm	1.404 mGy/s	
3.2	1/12/2023 7:38:55 AM				
4	1/12/2023 7:50:50 AM				
5	1/12/2023 7:55:21 AM				
6	1/12/2023 8:00:08 AM				
6.1	1/12/2023 8:00:08 AM	30.5 kV		5.400 mGy	
6.2	1/12/2023 8:00:08 AM	24.5 kV		1.591 mGy	

## 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 ROI** – 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

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

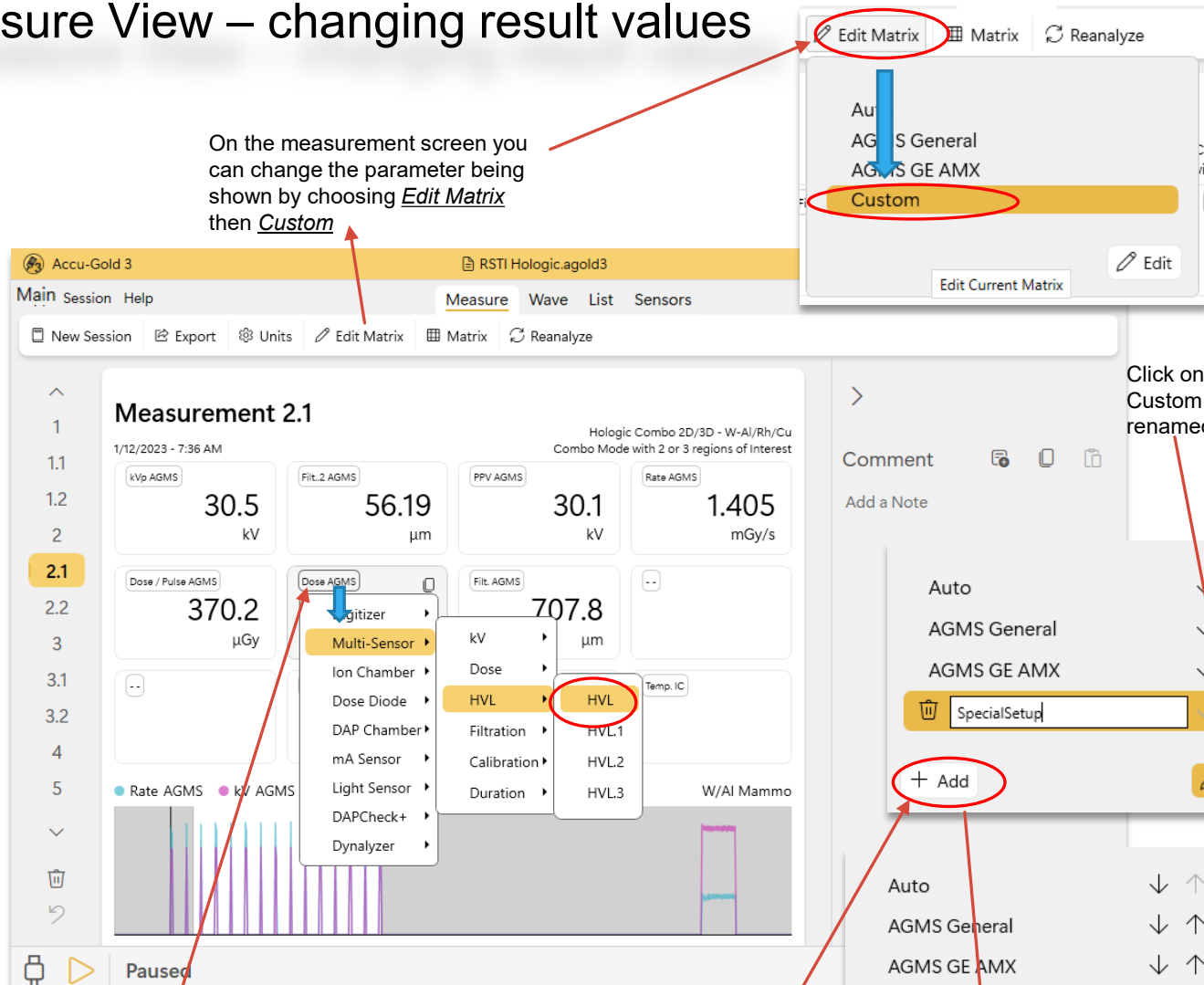
You can then add a column by choosing the parameter you want to see. (The value may be blank if it wasn't measured.)

INDEX	START TIME	DURATION	kV	Dose	HVL	Filtration	Calibration	Duration	Serial	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								31 kV Ag 30 kV Al tomo, N
2.1	1/12/2023 7:36:08 AM	3.161 s								
2.2	1/12/2023 7:36:08 AM	0.2004 s								Wrong preset selected
3	1/12/2023 7:38:55 AM	9.983 s								Correct profile for Ag. Pac
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								10X6-M Flat Field Combo
5	1/12/2023 7:55:21 AM	12.80 s								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 



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.

Click on Edit so the Custom setup can be renamed.

Click on the arrows to rearrange the order.

Auto  
AGMS General  
AGMS GE AMX

+ Add

Auto

AGMS General

AGMS GE AMX

SpecialSetup

Custom

+ Add

 Edit

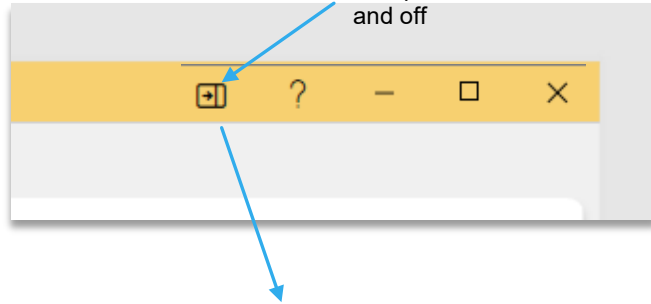


# Companion Mode

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

Kazimieras Domkus

File Home Insert Page Layout Formulas Data Review View Developer Add-ins Help Autodesk Vault ACROBAT Tell me what you want to do Share

Clipboard Font Alignment Number Styles Cells Editing

C33

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

Report AG-Data

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:

Sample formula:  
='AG-Data'!E7

Link the AG-data to the Report sheet

## Radiographic Reproducibility



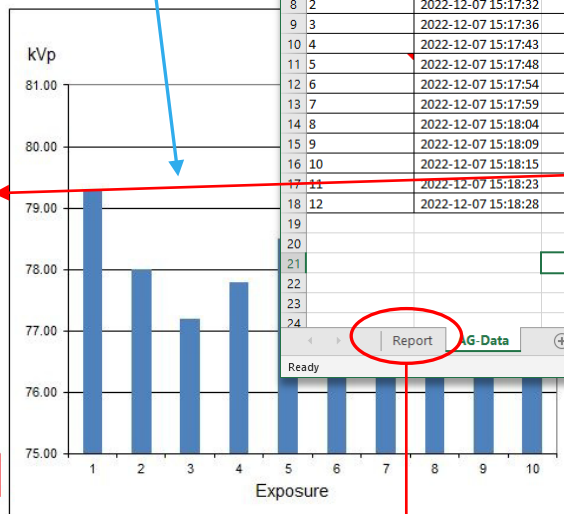
Facility: Confidential  
Location: Top Secret  
Room: Somewhere on the 3rd floor  
Machine: Pegasus 3000  
Technician: John Smith  
Date: 5/4/1983

Machine Settings	
kV	80
mA	20
Focus	Small
SDD	12

Exp.	Measurement Data		
	kVp	ms	mR
1	79.3	101.3	189.1
2	78.0	101.4	190.0
3	77.2	100.9	187.6
4	77.8	101.3	190.0
5	78.5	101.1	189.1
6	79.3	100.7	190.0
7	79.6	101.7	187.6
8	79.1	101.6	190.0
9	79.5	101.6	189.1
10	80.5	100.9	187.6

Average	78.9	101.2	189.0
Coefficient of Variation	1.3%	0.3%	0.6%

Pass/Fail Criteria	5%	5%	5%
Pass/Fail Results	PASS	PASS	PASS



The Report sheet

Click on the starting cell  
then click on Get Cell.  
Click Auto Send

As data is  
measured, it gets  
automatically copied  
to the Excel sheet

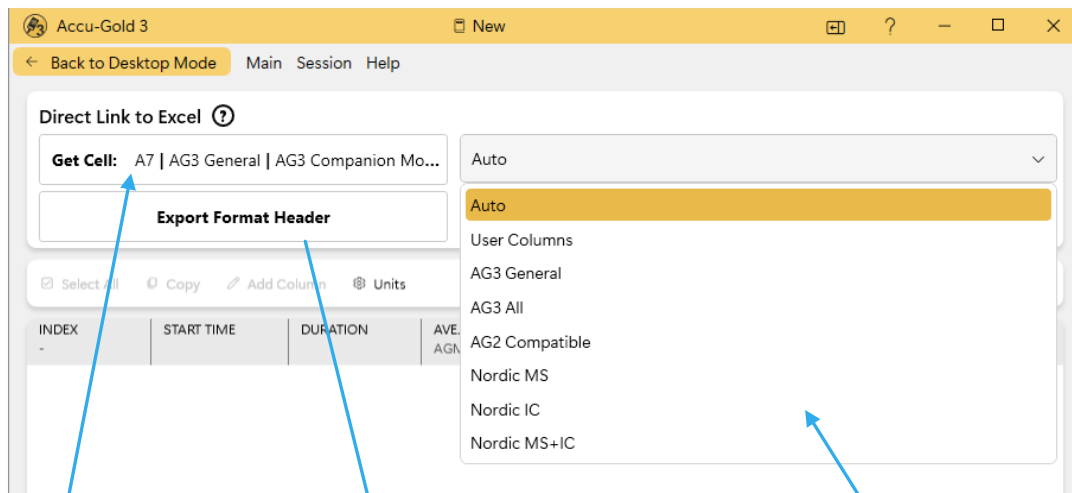
The screenshot shows the AG Companion software interface. The main window displays the AG-Data sheet, which contains a table of measurement data. The table has columns for Original Index, Start Time, Duration, kVp, and AGMS. The data is as follows:

Original Index	Start Time	Duration	kVp	AGMS
1	2022-12-07 15:17:06	0.28 s	120.20 kV	0.91 m
2	2022-12-07 15:17:32	0.28 s	120.20 kV	0.70 m
3	2022-12-07 15:17:36	1.80 s	120.20 kV	4.91 m
4	2022-12-07 15:17:43	1.31 s	120.20 kV	3.64 m
5	2022-12-07 15:17:48	1.78 s	120.20 kV	4.61 m
6	2022-12-07 15:17:54	1.59 s	120.20 kV	3.27 m
7	2022-12-07 15:17:59	1.11 s	120.20 kV	3.09 m
8	2022-12-07 15:18:04	1.93 s	120.20 kV	5.14 m
9	2022-12-07 15:18:09	2.00 s	120.20 kV	4.09 m
10	2022-12-07 15:18:15	1.38 s	120.20 kV	3.82 m
11	2022-12-07 15:18:23	0.63 s	120.20 kV	1.82 m
12	2022-12-07 15:18:28	1.72 s	120.20 kV	1.86 m

The Report sheet is visible at the bottom, showing a bar chart of kVp vs Exposure. The chart has 10 bars, each representing an exposure. The y-axis is labeled kVp and ranges from 75.00 to 81.00. The x-axis is labeled Exposure and ranges from 1 to 10. The bars show a slight upward trend in kVp over the exposures.

The interface also includes a menu bar (File, Home, Insert, Page Layout, Formulas, Data, Review, View, Developer, Add-ins, Help) and a toolbar with various icons. The status bar at the bottom shows 'Ready' and 'AG-Data'.

# 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

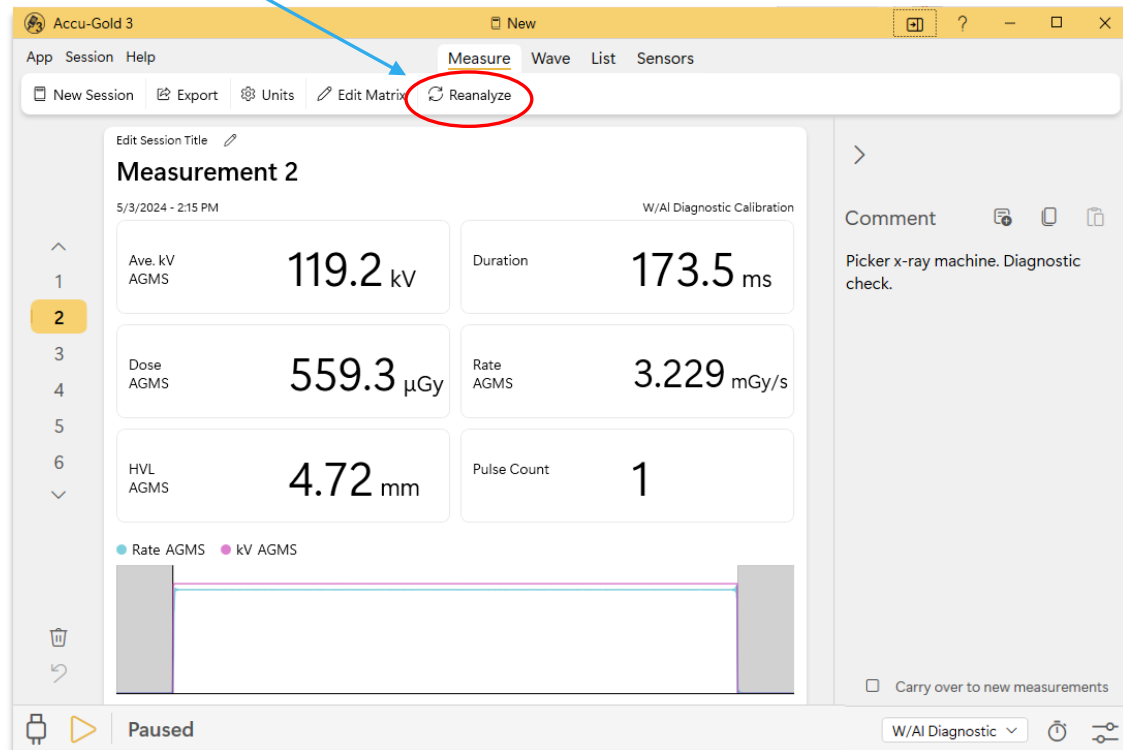
# Reanalyze

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. 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.)

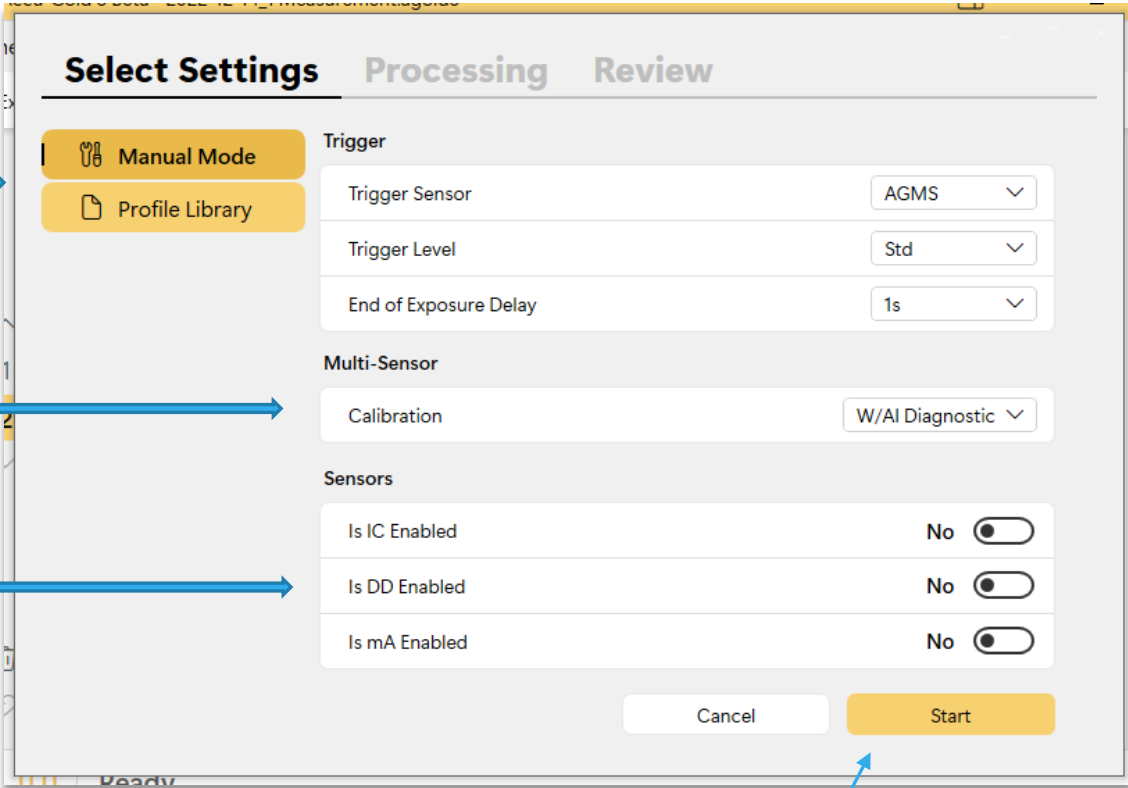


Selecting Reanalyze brings up this menu:

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

Select the correct calibration if applicable

This cannot be changed



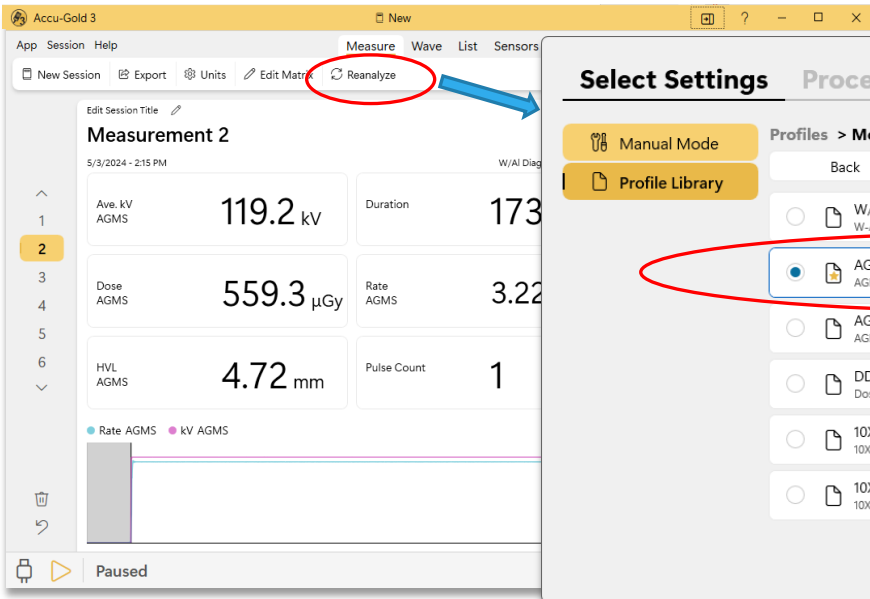
The screenshot shows a 'Select Settings' dialog box with three tabs: 'Select Settings', 'Processing', and 'Review'. The 'Select Settings' tab is active. It contains three main sections: 'Trigger', 'Multi-Sensor', and 'Sensors'. The 'Trigger' section has three dropdown menus: 'Trigger Sensor' (set to 'AGMS'), 'Trigger Level' (set to 'Std'), and 'End of Exposure Delay' (set to '1s'). The 'Multi-Sensor' section has one dropdown menu: 'Calibration' (set to 'W/AI Diagnostic'). The 'Sensors' section has three toggle switches, all set to 'No': 'Is IC Enabled', 'Is DD Enabled', and 'Is mA Enabled'. At the bottom, there are two buttons: 'Cancel' and 'Start'. Blue arrows point from the text annotations to specific elements: one to the 'Manual Mode' and 'Profile Library' buttons, one to the 'Calibration' dropdown, and one to the 'Start' button.

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-



Select Settings Processing Review

Manual Mode Profile Library

Profiles > Modality > Radiography

Back

Filter by: Show All

- ☐ W/AI AGMS Diag  
W-AI diagnostic machines AGMS Diag
- ☒ AGMS Diag W/AI - ROI last 0.1s  
AGMS Diag W/AI with ROI for last 100 ms
- ☐ AGMS Diag - ROI last 0.1s + Ich  
AGMS Diag W/AI with ROI for last 100 ms + Ich
- ☐ DD Std trig + Ich  
Dose Diode Std trigger + Ion Chamber
- ☐ 10X6-60DAP  
10X6-60DAP as DAP chamber
- ☐ 10X6-60DAP as Ion Chamber  
10X6-60DAP as Ion Chamber

Cancel Start

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.

Select Settings Processing **Review**

Please review the new calculated results:

5/3/2024 - 4:06 PM

AGMS Diag W/AI - ROI last 0.1s  
AGMS Diag W/AI with ROI for last 100 ms

Ave. kV AGMS	119.2 kV	Duration	173.5 ms
Dose AGMS	559.3 $\mu$ Gy	Rate AGMS	3.229 mGy/s
HVL AGMS	4.72 mm	Pulse Count	1

This measurement contains additional child measurements!

Choose different Settings Cancel 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

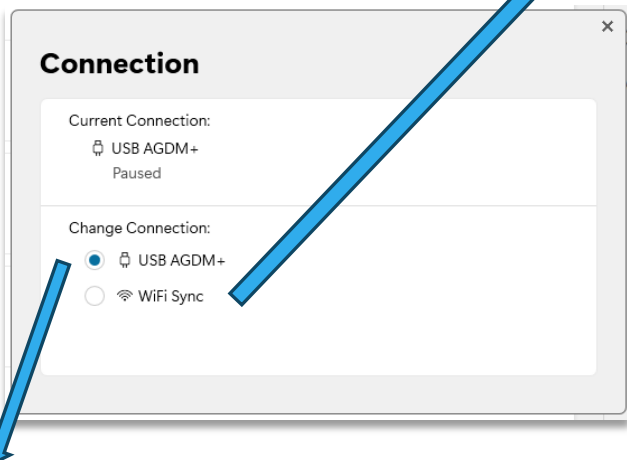
USB Mode

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

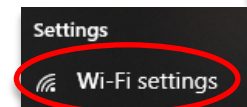
### In Windows\*

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

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



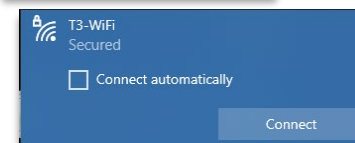
Then select 'WiFi settings'.



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.



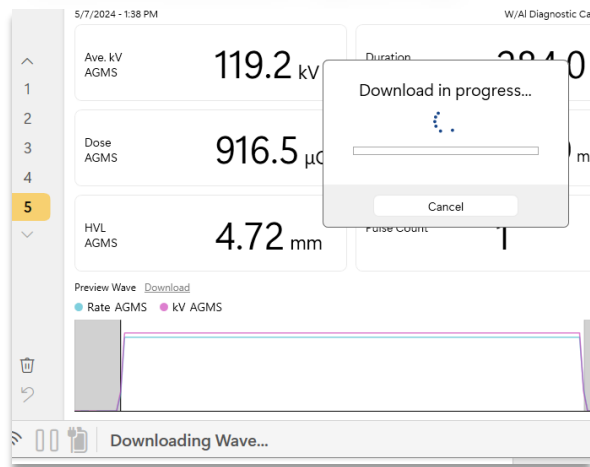
Now go to AG3 and select WiFi Sync, then Connect.  
You will see the status bar change to this:



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.

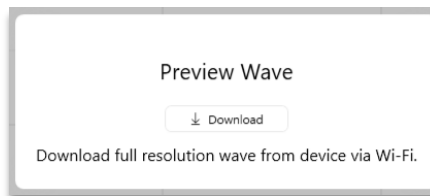
In AG3, go to Settings, General Settings:

↓ Auto Wave Download

If 1s or shorter ▾  
Always  
If 5s or shorter  
If 1s or shorter  
Never

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 screenshot shows the 'Settings' window with several sections and options. Annotations with blue arrows point to specific elements:

- Settings**: The title of the window, circled in blue.
- Language Settings**: A section containing a 'Change Language' button and a dropdown menu set to 'English'.
- General Settings**: A section containing three options:
  - Auto Quick Start on Program Startup**: A toggle switch set to 'Enabled', circled in blue.
  - Auto Wave Download**: A dropdown menu set to 'If 1s or shorter'.
  - Update Profile Library**: A button labeled 'Select', circled in blue.
- Change Units**: A section containing five dropdown menus:
  - Dose Unit**: Set to 'Gy (Gray)'.
  - Time Base for Rate**: Set to 's (Seconds)'.
  - DAP Area Unit**: Set to 'm<sup>2</sup>'.
  - DLP Unit**: Circled in blue, with an arrow pointing to the explanatory text at the bottom left.
  - Preferred kV Type**: Set to 'Average kV', circled in blue, with an arrow pointing to the explanatory text at the bottom right.

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

The screenshot shows the 'Change Table Settings' window with two options:

- Dose Scaling**: A dropdown menu set to 'Milli'.
- Unit Position**: A dropdown menu set to 'Next to value', circled in blue, with an arrow pointing to the explanatory text at the bottom right.

This applies to List mode and exporting.

# Appendix A

## AG3 Installation and Setup

AG3 is compatible with the following hardware:

### Digitizers

AGDM+  
ADDM+  
RGDM+  
AGDN+

### Touch Units (in USB or WiFi mode)

AGT-P-AG  
AGT-P-AD  
AGT-P-RG

### 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

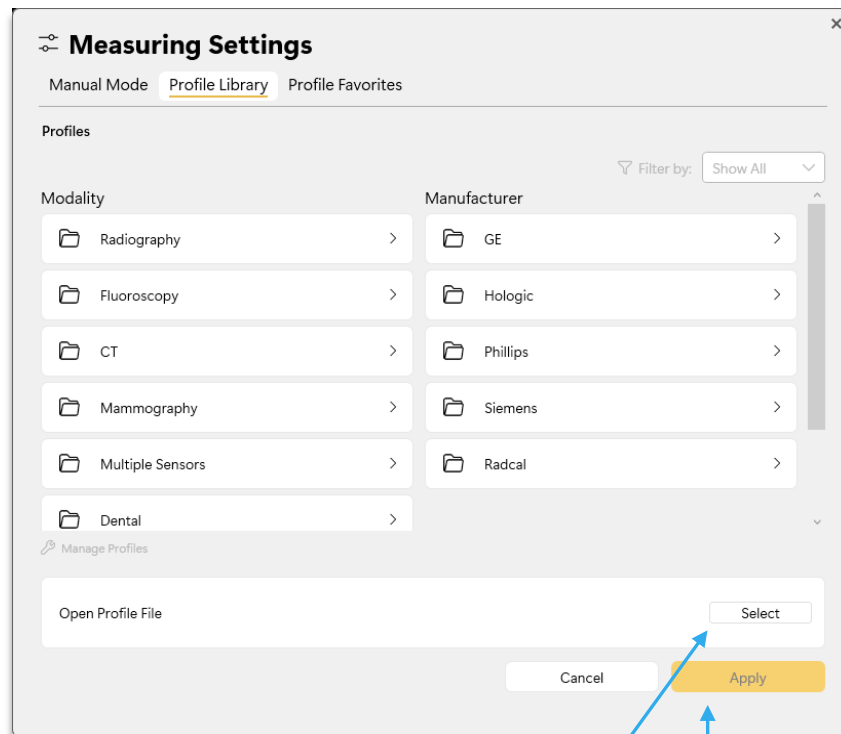
Profiles allow one to make highly technical measurements without the hassle of setting up the parameters each time. They tell the computer the calibration file to use, the timing required, the sensors to use and so on. They allow you to set a region of interest (ROI) which gives you details on certain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

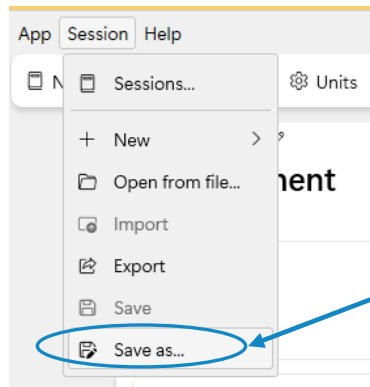
Select the profile file and then select Apply

# Appendix D

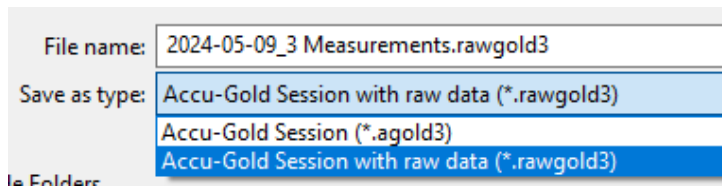
## Sending AG3 Sessions to Radcal Support (including raw data)

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...

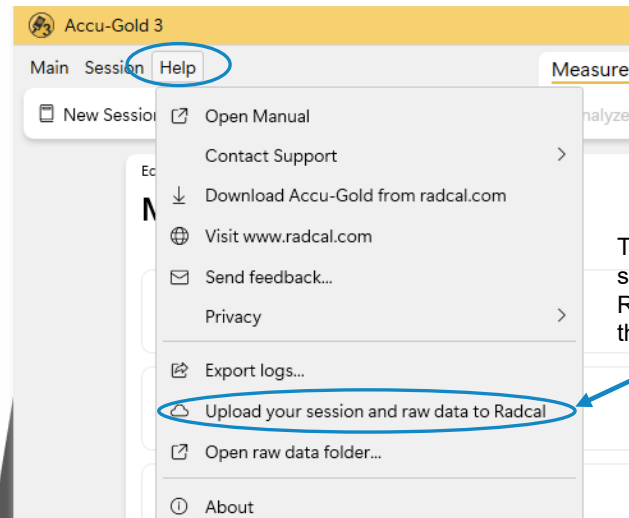


Then select filetype as  
\*.rawgold3

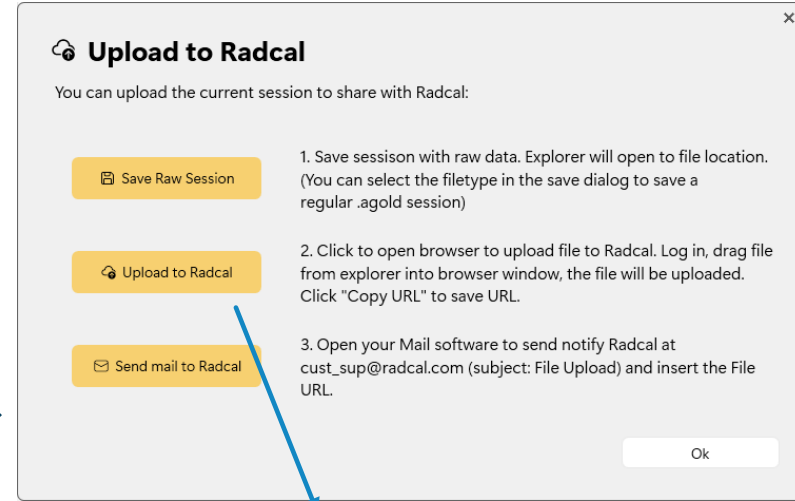
You could make the filename your company name or a problem description. Then use a file share site like [wetransfer.com](https://wetransfer.com) or [share.radcal.com](https://share.radcal.com) to upload the file and send us the link by email to [cust\\_sup@radcal.com](mailto:cust_sup@radcal.com)

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 than a screen-grab since it contains other valuable information.

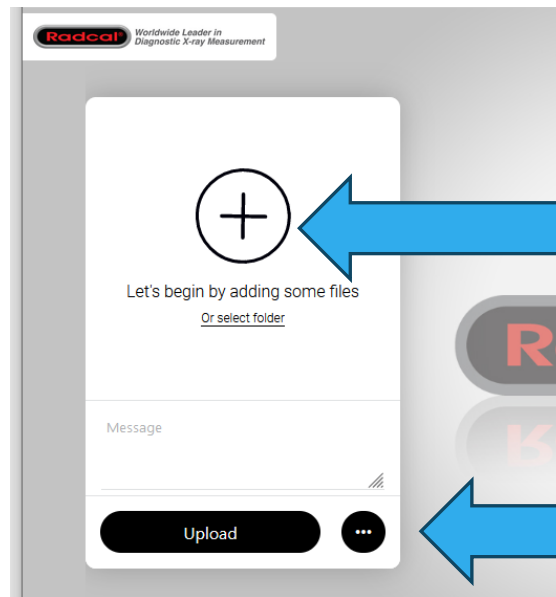
## Sending AG3 Sessions to Radcal Support (continued)



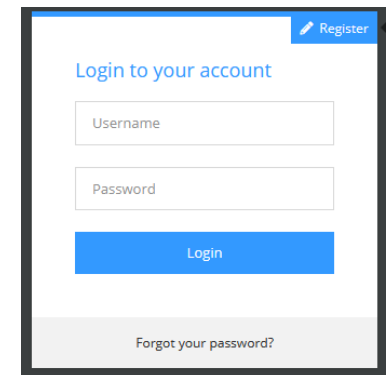
To send the session file to Radcal, go to Help then select:



This will open [share.radcal.com](https://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](#)

## [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.

## Declaration of Conformity

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



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