

FIRST HAND EXPERIENCE IN IMPLEMENTING THE NEW ACR QC MANUAL

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Outline

- Should we adopt ACR QC or not?
- Implementation Plan
- Challenges and Solutions
- Key take home points



Should we adopt the ACR Mammography QC Manual?

- Does it make sense to adopt the manual?
 - Yes since we have a mix of vendor mammo units
 - This is not just a physicist decision. You need the whole mammography team to be on board with the idea
 - Highlight Radiologist Involvement!
- We pitched the idea to the whole team by making a presentation (using ACR and our slides) and pointing out advantages and disadvantages

Why should we switch?

Every day efficiency

- Fewer QC tests than mfr QC
- Lower frequency of QC tests
- Less total time spent on QC tests
- No more "baselines" in any tests
- No more calculations of any sort
- All results are read or scored directly from the Acquisition Monitor
- 2D and Tomo are both included
- Forms can be either paper or electronic (both provided by the ACR)

... yet, QC tests are more useful, more relevant, more helpful, and provide a better quality evaluation of your system!

Why else should we switch?

Life is easier with standardization

- Expect cleaner MQSA inspections
- Standardization reduces errors
- No more chasing mfr QC manual versions
- Current edition & future revisions will be provided by ACR
- QC forms will be provided by the ACR (paper or electronic)

CONS

- New phantoms (4 in total) to be purchased
 - \$995 each
 - 2 needed at SCCA – Total \$1990
 - 1 each at Roosevelt and ESC – Total \$1990
 - See next slide for contact info for [Gammex](#)
- Transition plan will take time
- Change for all but to a better QC program
- Include manufacturer calibration tests if any



Implementation Timeline

TRANSITION PLAN- SCCA

Buy 2 ACR Mammo Phantoms – Need to buy ASAP

TRIAL PERIOD – Tech practices ACR QC with physicist help

Room 1

Room 2

Room 3

Mobile

Hologic Affirm

Annual testing
– Feb 6th
delay to
March 7, 2019

Annual testing -
May 22,
2019

Annual testing -
March 27,
2019

Annual testing -
July 18,
2019

Annual testing -
October 30,
2019

ACR TECH QC implement

TRANSITION PLAN - DISPLAY

Buy 2 ACR Mammo Phantoms – Need to buy ASAP

TRIAL PERIOD – Tech practices ACR DISPLAY QC (AW and RW) with physicist help

ALL DISPLAY DEVICES (AW and RW) TESTED USING ACR QC IN MARCH, 2019

ACR TECH DISPLAY QC implement



QC Tests

Test	Imaging Modes to Test			
	System Used for Both 2D and DBT Acquisition			System Used for DBT Acquisition Only
	2D	2D w/Add-on DBT Device	DBT	DBT
Technologist Tests				
1. ACR DM Phantom Image Quality	✓*	✓	✓	✓ & 2D*
2. Computed Radiography Cassette Erasure (if applicable)	✓*			
3. Compression Thickness Indicator	✓*	✓*		✓*
4. Visual Checklist	✓*	✓	✓	✓
5. Acquisition Workstation Monitor QC	✓*			✓*
6. Radiologist Workstation Monitor QC	✓*			✓*
7. Film Printer QC (if applicable)	✓*			✓*
8. Viewbox Cleanliness (if applicable)	✓*			✓*
9. Facility QC Review	✓*	✓	✓	✓
10. Compression Force	✓*	✓*		✓*
11. Manufacturer Calibrations (if applicable)	✓*	✓	✓	✓



Challenges – TECH QC

- Remember we were early adopters and implemented ACR QC a year ago so were new to the process, not many of the issues were worked out at that time.
- TECH buy in and understanding of QC is very important!
- Understanding the ACR QC forms – important to review what your techs need to use or remove – example CR Cassette Erasure sheet



Challenges – TECH QC

- Every site is unique and so are techs. Different issues/concerns may come up and so be prepared to respond. As physicists, we are teaching them and are responsible for their understanding.
- Implementing QC online since the forms are fillable – some techs are comfortable, some not. Hard to have consistency across sites
- The new ACR phantom – techs need to get used to this phantom
- Remove the review workstation forms (common) from individual unit spreadsheet – segregate that sheet out



Solutions – TECH QC

- Questions that came up
 - If we do combo mode usually (2D+3D), can we use those images for 2D and 3D QC? Why do we need to acquire 2D first and then take combo for 3D to analyze?
 - Yes can use.
 - What goes in the ACR Technique and Procedure (TP) Summaries sheet?
 - The objective is for the MP to acquire the phantom in the clinical mode used most frequently (Hologic would be Auto-Filter, GE might be Std) then replicate this setup on the TP sheet so the Tech can replicate for their weekly.
 - What is facility review? How often? Does everyone need to be physically present during review?
 - Radiologist reviews QC quarterly with tech. Physicist not necessary?



Solutions – TECH QC

- Questions that came up
 - Do we need to do printer QC if being used only for wire localizations?
 - If mammography images are going to be printed and used for final interpretation or comparison than printer QC must be performed under MQSA.
 - That being said MQSA currently exempts interventional procedures. However, from a technologist point of view, if a needle localization is being performed on a non-maintained processor and they are going after calcifications, processor “stuff” could certainly mask the real calcifications.
 - Review workstation QC – Manual does not specify if we need to send 2D or 3D phantom image to RWS for QC. Does it matter?
 - If you perform 2D and 3D imaging, then, both a 2D and 3D image should be evaluated on the AWS and RWS.



QC Tests

Test	Imaging Modes to Test			
	System Used for Both 2D and DBT Acquisition			System Used for DBT Acquisition Only
	2D	2D w/Add-on DBT Device	DBT	DBT

Medical Physicist Tests				
1. Mammography Equipment Evaluation (MEE)	✓*			✓*
2. ACR DM Phantom Image Quality	✓*	✓	✓	✓ & 2D*
3. DBT Z Resolution			✓	✓
4. Spatial Resolution	✓*	✓	✓	✓
5. DBT Volume Coverage			✓	✓
6. Automatic Exposure Control System Performance	✓*	✓	✓	✓
7. Average Glandular Dose	✓*	✓	✓	✓
8. Unit Checklist	✓*	✓	✓	✓
9. Computed Radiography (<i>if applicable</i>)	✓*			
10. Acquisition Workstation Monitor QC	✓*			✓*
11. Radiologist Workstation Monitor QC	✓*			✓*
12. Film Printer QC (<i>if applicable</i>)	✓*			✓*
13. Evaluation of Site's Technologist QC Program	✓*	✓	✓	✓
14. Evaluation of Display Device Technologist QC Program	✓*			✓*
15. Manufacturer Calibrations (<i>if applicable</i>)	✓*	✓	✓	✓
16. Collimation Assessment	✓*	✓*	✓	✓
MEE or Troubleshooting - Beam Quality (Half-Value Layer [HVL]) Assessment	✓* ^{TF}			✓* ^{TF}
MEE or Troubleshooting - kVp Accuracy and Reproducibility	✓* ^{TF}			✓* ^{TF}

*Follow the procedures and frequency outlined for 2D QC

^{TF}HVL and kVp tests must include kVp, target, and filter combinations used for DBT



Challenges – PHYSICIST QC

- ACR DBT – 2D+DBT or DBT only, that’s the question
 - Since all new patients also need a 2D, we do all 2D + DBT tests
- ACR Image Quality
 - Make sure you are looking at phantom for artifacts as well which is different from previous methods – where you only used to score (flat field previously)
 - Distance measurement in Mag Mode
 - Rotate phantom – see FAQs
- FOR AEC test - $SNR \geq 40$ for DBT – no criteria even though manual suggests there is
 - <https://www.acraccreditation.org/-/media/ACRAccreditation/Documents/Resources/DMQC/DMQCFAQs.pdf?l=a=en>



Challenges – PHYSICT QC

- For the DBT Z-Resolution
- ROI tool not giving any data on the GE Seno Iris (RWS) – had to do analysis offline at first. GE eventually updated software to get ROI data.

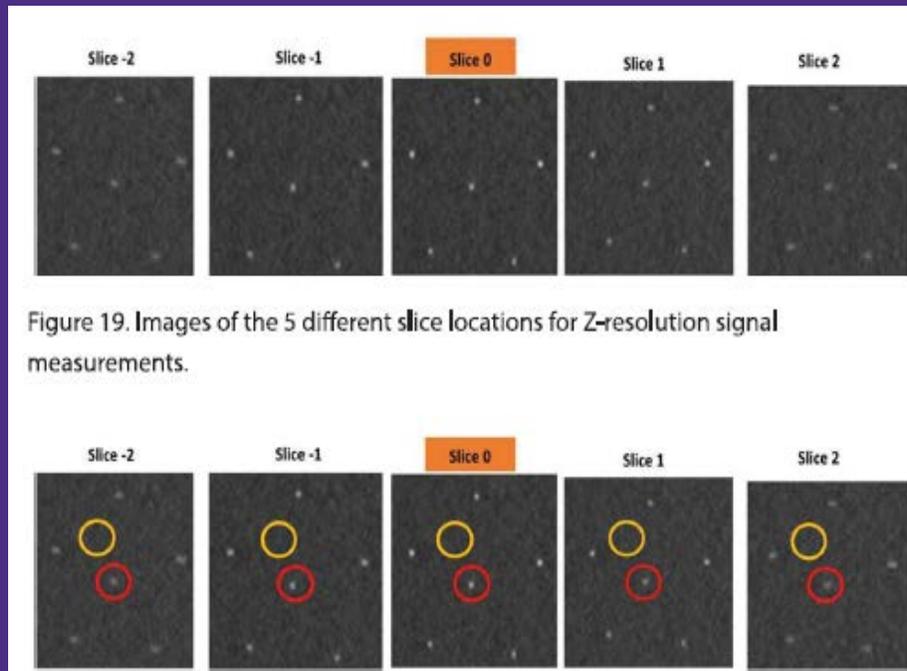
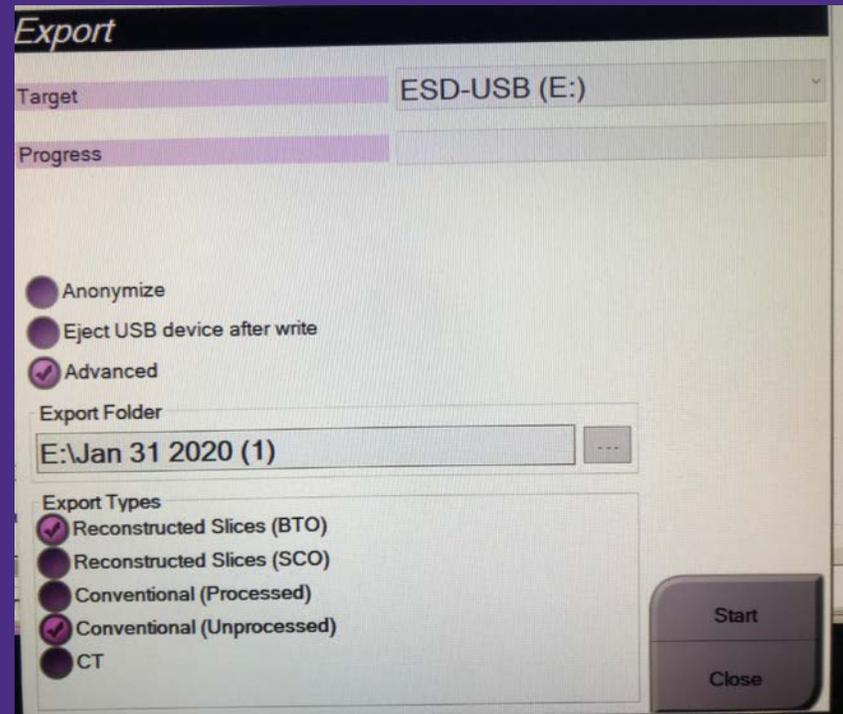
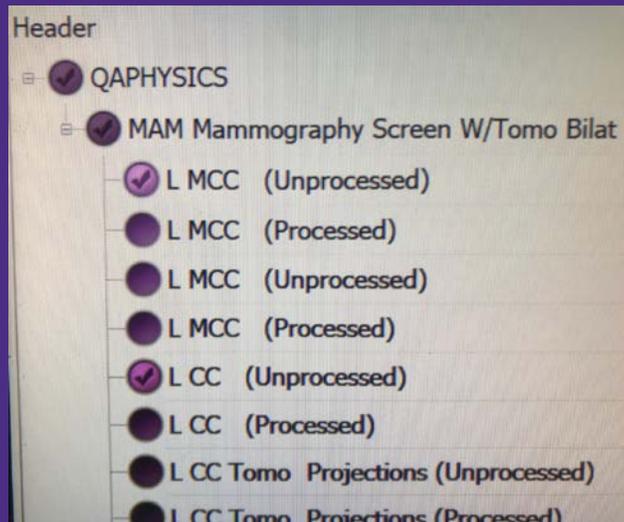


Figure 19. Images of the 5 different slice locations for Z-resolution signal measurements.

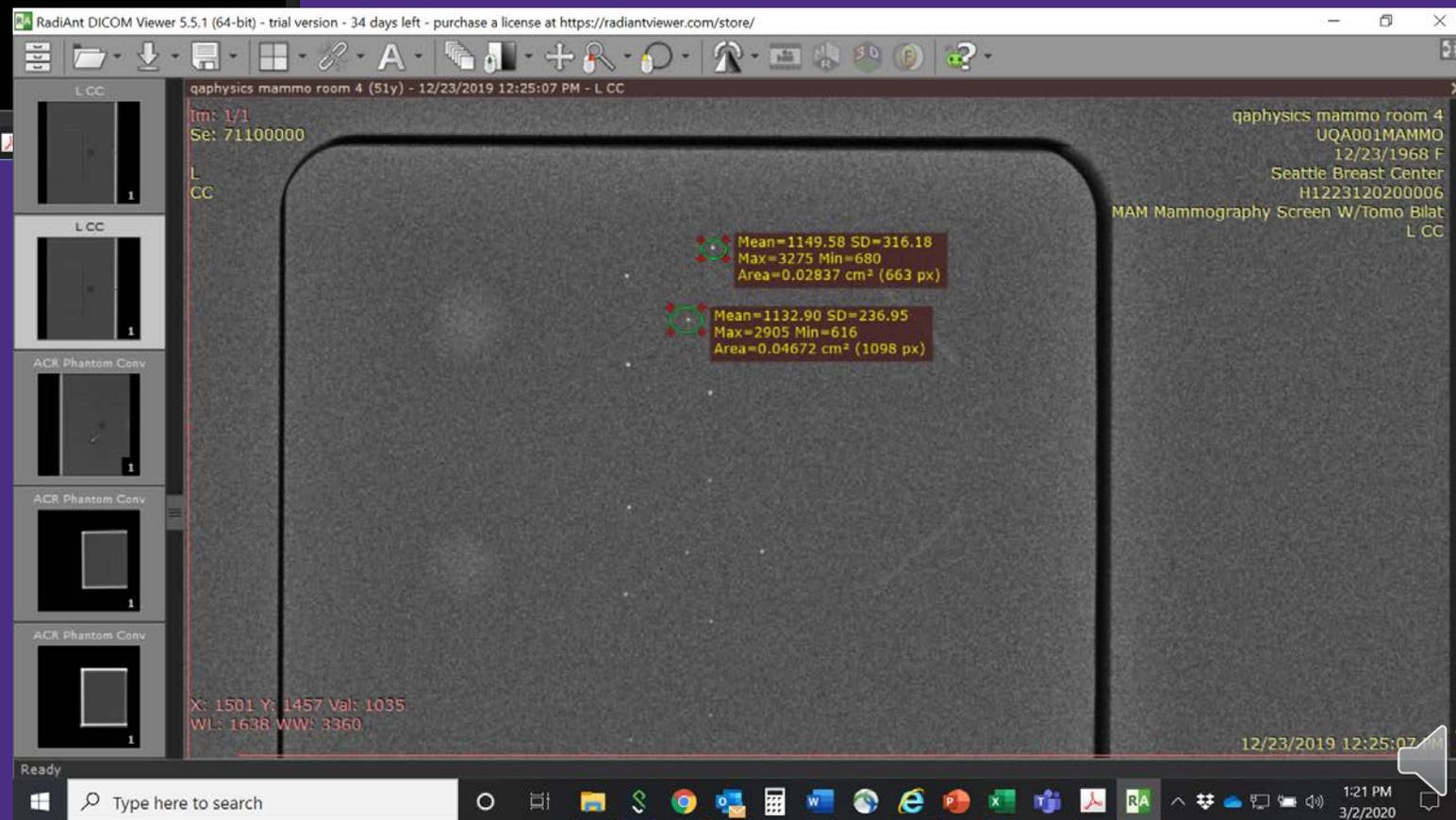
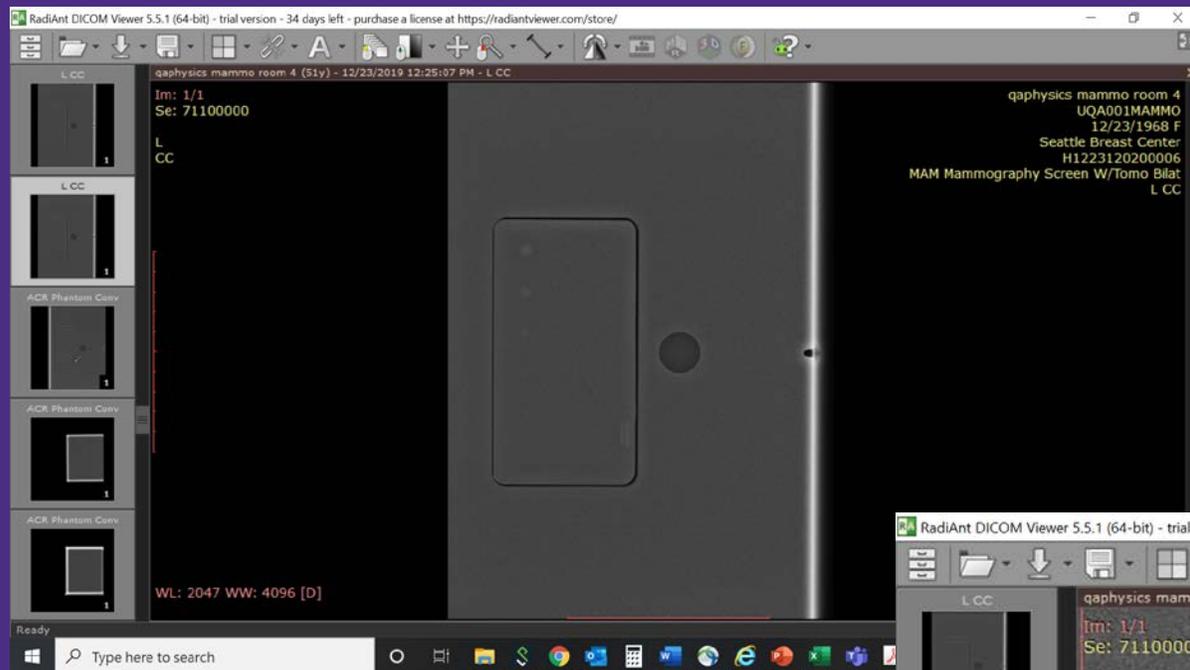


Challenges – PHYSICT QC

- For Hologic – not possible to do measurements on the Barco workstations so had to transfer image to USB and use RADIAnt or other software to make measurements.
- You have to press Advanced button and then click on BTO (breast tomosynthesis object) format as SCO (secondary capture object) is Hologic proprietary.



RADIant



Challenges – PHYSICT QC

- For the AGD measurement in DBT, I assume we are allowed to use the 'fixed' tomographic mode (all shots taken at 0 degrees) - our solid state dosimeter has a slight angular dependence. Can we use the combo mode to measure the 2D and 3D exposures for AGD or do we have to do a separate 2D only shot?
- We did our measurements both ways to see what the angular dependence looked like. We do 2D and 3D dose measurement separately. In combo mode – meter does not respond quickly enough to get the 2 measurements.
- Characterize with your meter to understand measurement conditions



Challenges – PHYSICT QC

- For collimation, there is no guidance on what paddle to use- just want to make sure we only have to measure paddle edge to chest wall for one paddle and not all of them, and can use the same paddle for multiple field sizes.
- Use the paddle which is used most clinically



Challenges – PHYSICT QC

- Also, you have to be careful with the $g\text{-factor} \times c\text{-factor} \times 8.76 \text{ mGy/R}$ calculator (table) on the right. This spreadsheet automatically pulls the HVL from cell R21 on the form. If you are measuring different modes with different target/filters you have to pay attention and manually change it each time.
- Make sure you are checking Excel calculations if you add anything not included in the spreadsheet



ACR QC bottom-line!

- It has been a challenging experience adopting but now that we have, we are happy we made the decision to go to ACR QC!
- We have consistency across different vendor units in terms of QC now
- Vendor specific QC and therefore familiarity/history with QC is gone! Need to understand trends and pass/fail criteria with ACR QC to develop confidence.
- Techs are happy!
- Physicists are happy!



Take home points

- Mammo Team buy-in to adopt the ACR QC manual – include radiologist
- Have patience with technologist as they learn to navigate the new QC
- Do some “test” QC to ensure you (physicist) understand and get desired results
- By now most of the issues with physicist QC have been resolved but for us early adopters, it was challenging initially to implement



Thank You

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