Stereotactic Breast Biopsy Systems Physics Evaluations

A "no hands hands-on" session

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Disclosures Thomas P. Aufdemberge, M.S., DABR

> Financial Disclosures:

- ≻Medical Physics Consultants, Inc.
 - > 27+ years experience
 - Vice-President, WI operations

FDA Disclosures: None

Stereotactic Breast Biopsy Systems Physics Evaluations

Objective: Learn how to perform medical physicist evaluations of the four commonly available systems:

- Fischer/Siemens MammoTest
 - Moved into Appendix (same tests as MultiCare Platinum, plus light field/x-ray alignment)
- Lorad MultiCare Platinum
- Hologic Affirm Prone
- Hologic Affirm Upright Add-on



Stereotactic Breast Biopsy Systems Physics Evaluations

Annual Physics Evaluation – consists of 10 tests

1) Localization in Air	2) Localization "in vitro"
3) Artifact Evaluation	4) Spatial Resolution
5) Collimation	6) Compression Force
7) AEC	8) Image Uniformity
9) Generator Tests	10) Phantom Image Quality

And one calculation – AGD

Followed with Technologist QC review



Stereotactic Breast Biopsy Systems Localization Accuracy in Air Lorad Multiview Platinum 1) Set breast support at 4.5 cm

2) Install 5 cm spacer (hollow acrylic cylinder)



5

Stereotactic Breast Biopsy Systems Localization Accuracy in Air Lorad Multiview Platinum 3) Compress to ~47.5 mm 4) Install holder and secure test needle with tape



Stereotactic Breast Biopsy Systems Localization Accuracy in Air Lorad Multiview Platinum 5) Drive stage to Zero Position (hold two buttons) 6) Manually advance needle to touch paddle



Stereotactic Breast Biopsy Systems Localization Accuracy in Air Lorad Multiview Platinum 7) Z-zero 8) Move needle to Z = 0.5 mm, re-Zero



Stereotactic Breast Biopsy Systems Localization Accuracy in Air Lorad Multiview Platinum 9) Move the needle to X=10, Y=20, Z=30 mm 10) 512 Stereotactic localization on ball



Stereotactic Breast Biopsy Systems Localization Accuracy in Air

Lorad Multiview Platinum



Stereotactic Breast Biopsy Systems Localization Accuracy in Air

Lorad Multiview Platinum



Stereotactic Breast Biopsy Systems Localization Accuracy in Air Lorad Multiview Platinum



Stereotactic Breast Biopsy Systems Localization Accuracy in Air Lorad Multiview Platinum

Start Stereo Targeting: Use the mouse to move the box until it is centered over the ball in the left image Use the mouse to move the box until it is centered over the ball in the right image





Stereotactic Breast Biopsy Systems Localization Accuracy in Air Lorad Multiview Platinum



Stereotactic Breast Biopsy Systems Localization Accuracy in Air

Hologic Affirm (Prone)

- 1) Hologic, Physicist / Login (password="physicist")
- 2) Admin / QAS



Stereotactic Breast Biopsy Systems Localization Accuracy in Air Hologic Affirm (Prone)

3) Install the QAS needle (really, cross-hairs)



Stereotactic Breast Biopsy Systems Localization Accuracy in Air Hologic Affirm (Upright) 1) Mount the Affirm mechanism (Tomo shield) 2) Login (password= "physicist") / Admin / QAS



Stereotactic Breast Biopsy Systems Localization Accuracy in Air Hologic Affirm (Upright) 3) Install the QAS needle (really, cross-hairs)



Stereotactic Breast Biopsy Systems Localization Accuracy in Air

Hologic Affirm (both Upright and Prone)



Stereotactic Breast Biopsy Systems Localization Accuracy in Air Hologic Affirm (both Upright and Prone) 4) Make the QAS exposures (2 exposures, don't lift) 5) Accept the 2 images



Stereotactic Breast Biopsy Systems Localization Accuracy in Air Hologic Affirm (both Upright and Prone) 6) Accept the calculation 7) Verify X, Y, Z are within 1.0 mm of set position



Stereotactic Breast Biopsy Systems Localization Accuracy in Air Hologic Affirm (both Upright and Prone) 8) Repeat for Tomo Biopsy QAS, starting with step 4





Stereotactic Breast Biopsy Systems Localization in "Phantom"

All SBB systems:

This is a test of the technologist's competency in performing clinical SBB – only required by ACR-SBB. Nonetheless, hints:

- Tissue = Braunschweiger (extras are delicious), Bologna (not so much)
- Calcifications = 1-2 mm shards of paper clip
- Targeting aim next to "calcification"



Lorad Multiview Platinum

- 1) Compress 4 cm of acrylic
- 2) Acquire 512 scout, using Auto-time at 28 kVp



Lorad Multiview Platinum

- 3) Left-click to accept W/L setting
- 4) Right-click, choose Zoom-In, evaluate the full screen image



Hologic Affirm (Prone)

1) Clinical Stereo Scout image with W/Ag, AEC



Hologic Affirm (Prone)

2) 4 cm acrylic block in paddle

3) Expose, accept, view full resolution image



Hologic Affirm (Prone)

4) Evaluate image for artifacts (non-uniformities, white specks, black specks, fine lines, etc.)



Hopefully, it will look like this.



Hologic Affirm (Prone and Upright)

5) To get exposure technique factors, Tools / Face



Hologic Affirm (Prone)

7) Repeat for Tomo with W/Al at 30 kVp





Hologic Affirm (Prone)

8) View projections (look at first, center, and last)







Hologic Affirm (Upright)

Use the artifact evaluation results from the 2D/3D screening mammography physics evaluation – DONE!



Lorad Multiview Platinum – 512 image

- 1) Compress 1-5 lp/mm test tool on 4.5 cm acrylic
- 2) Orient bars perpendicular to anode-cathode axis

3) Expose at 28 kVp, 80 mAs





Lorad Multiview Platinum – 512 image

4) Window & Level, Zoom-In to see the smallest possible set of 5 black bars (expect 3.5 lp/mm)

5) Repeat with test object rotated 90°



Lorad Multiview Platinum – 1024 image

- 1) Compress mammo resolution test tool with 4.5 cm acrylic
- 2) Expose at 28 kVp, 160 mAs







Lorad Multiview Platinum – 1024 image

3) Window & Level, (will already be Zoom-In'd) to see the smallest possible set of 5 white bars (expect 7 lp/mm, both parallel and perpendicular)




Stereotactic Breast Biopsy Systems Compressed Breast Thickness Indicator Lorad Multiview Platinum After 1024 resolution test, while here, record Indicated Compressed Breast Thickness – expect error to be ±5 mm



Hologic Affirm (Prone) stereo

- Tape mammo res pattern at 45° to chest wall with
 4.5 cm acrylic
- 2) Expose Stereo Scout at 28 kVp, 120 mAs.





Stereotactic Breast Biopsy Systems Spatial Resolution Hologic Affirm (Prone) stereo notes Must unlock stage to use powered compression.

Must lock stage to allow exposures.





Hologic Affirm (Prone) stereo

3) Window & Level and Zoom to see smallest possible set of 5 white lines (expect to see 8 lp/mm).



Hologic Affirm (Prone) tomo

- Compress 1-5 lp/mm pattern at 45° to chest wall with 4 or 4.5 cm acrylic.
- Expose Tomo Scout at 30 kVp, 50 mAs.







Hologic Affirm (Prone) stereo

3) Scroll to sharpest image, Window & Level and Zoom to see smallest possible set of 5 black bars (expect to see 3.5 lp/mm).





Stereotactic Breast Biopsy Systems
Compressed Breast Thickness Indicator
Hologic Affirm (Prone)
After resolution test, while here, record Indicated
Compressed Breast Thickness
- expect error to be ± 5 mm



Hologic Affirm (Upright)

Use the resolution test results from the 2D/3D screening mammography physics evaluation – DONE!



Lorad Multiview Platinum (no light field)

1) Tape doubled large paperclips into biopsy window



Lorad Multiview Platinum (no light field)

2) Compress with 4 cm acrylic

3) Tape GAF chromatic strip \perp to chest wall





Lorad Multiview Platinum

- 4) Expose at 28 kVp, 300 mAs
- 5) Compare image to paperclips
- 6) Verify image is fully exposed
- Expect window to be 3-5 mm larger than image at all edges.



8) Measure x-ray beam/chest wall extension (0-6 mm)

- should be able to see paperclip shadow.





Hologic Affirm (Prone)

- No light field, no idea of where the beam is
- Can only test x-ray chest-wall overlap with paperclip and GAF strip taped to paddle





Hologic Affirm (Prone)

- Thinking about it
 - Could tape 2 GAF strips on leaded ruler on top of 4 cm artifact phantom with ~8 cm gap between them
 - Expose twice at 28 kVp, 280 mAs.
 - Compare x-ray beam to image (detector)
 - Repeat, rotated 90°



Hologic Affirm (Prone) - Criteria

- Beam must fully expose the biopsy window
- Beam must not extend into the chest wall by more than 1% of SID
- Beam must not extend beyond any edge of the detector by more than 2% of the SID



Hologic Affirm (Upright)
1) Draw a line with a fine Sharpie on 4
GAFchromatic strips
2) Place these 4 strips with line on light fine

2) Place those 4 strips with line on light field edge



Cover the always on light with your finger to see the collimator light field.



Hologic Affirm (Upright)

3) Align the outside of the doubled large paperclips parallel to the line on each GAFchromatic strip



Cover the always on light with your finger to see the collimator light field.



Hologic Affirm (Upright)4) Make the first 28 kVp, 280 mAs exposure, reject and repeat.





Hologic Affirm (Upright)

Light field to X-ray beam alignment:

Use ruler to measure exposed region of GAFchromatic strip. If beyond the line, positive value, if inside the line, negative value.

Criteria: $\leq 2\%$ of the SID which is 63.5 cm (70 –

1.5 - 4 = 63.5 cm)

Example = +2 mm



Hologic Affirm (Upright)5) Don't panic, view full field.



Hologic Affirm (Upright)

6) Analysis: (Clip = 10 mm, wire = 1 mm)

Judge how much clip is missing, then add to that edge's light-field difference.







Hologic Affirm (Upright) - Criteria

- Beam must fully expose the biopsy window
- Beam must not extend beyond the image receptor by more than 2% of SID (still 63.5 cm) on each edge.
- Light field to x-ray <= 2% of SID each dimension



Stereotactic Breast Biopsy Systems Compressed Breast Thickness Indicator Hologic Affirm (Upright) Compressed Breast Thickness Indicator 4.5 cm phantom compressed to ~25 lbs. – expect error to be ±5 mm



Stereotactic Breast Biopsy Systems Compression Paddle Edge Hologic Affirm (Upright) Compression Paddle Edge Location: Paperclip supported / taped at inside edge of compression paddle (Criteria <= 1% of SID)



Lorad Multiview Platinum

- 1) Compress "scale" with power compression
 - expect 10 to 15 pounds







Lorad Multiview Platinum

- 2) Compress "scale" with manual compression
 - verify it can reach and hold at 40 pounds







Hologic Affirm (Prone)

 Compress "scale" with power compression – expect ~ 10 - 15 pounds



Hologic Affirm (Prone)

2) Compress "scale" with manual compression – verify that it can achieve and hold > 40 pounds







Hologic Affirm (Upright)

Use the compression force test results from the 2D/3D screening mammography physics evaluation – DONE!



Stereotactic Breast Biopsy Systems AEC / AEC reproducibility / Image Uniformity Lorad Multiview Platinum 1) Compress 2 cm acrylic

2) Expose 512 scout at 25 kVp, Auto-Time



Stereotactic Breast Biopsy Systems AEC / AEC reproducibility / Image Uniformity Lorad Multiview Platinum 3) File / Image Statistics

- 4) Type S, D to display full information
- 5) Right-click until Box Size = 32x32



Stereotactic Breast Biopsy Systems AEC / AEC reproducibility / Image Uniformity Lorad Multiview Platinum

- 6) Record mAs and "Ave" signal for center of image
- Repeat process for 4 cm (making 4 exposures) at 28 kVp, 6 cm at 32 kVp, and 8 cm at 34 kVp.

Note that 2 images and their image statistics can be

displayed simultaneously.So, measure 4a with 4b,4c with 4d, and 6 with 8.



Stereotactic Breast Biopsy Systems AEC / AEC reproducibility / Image Uniformity Lorad Multiview Platinum 8) With the 4 cm images, record "Ave" signal for the four corners of the image 9) ROI corner positions: UL = 100, 100; UR = 400, 100



Stereotactic Breast Biopsy Systems AEC / AEC reproducibility / Image Uniformity Lorad Multiview Platinum - Criteria

- Performance < ± 20% variation from 4 cm average
- Reproducibility < 5% coefficient of variation
- Uniformity < 15% variation from center



Stereotactic Breast Biopsy Systems AEC / AEC reproducibility / Image Uniformity Hologic Affirm (Prone) 1) Admin / Quality Control

2) Automatic Exposure Control Performance Asse



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lame	Last Performed	Due Date	Sian
a Annual	6/7/2018		Mark Completed
a Al	6/7/2018		A Mark Completed
Stereotactic Breast Biopsy Unit Assembly Evalua	6/7/2018	6/4/2019	Revent
Collimation Assessment	6/7/2018	6/4/2019	Completed
Artifact Evaluation	6/7/2018	6/4/2019	
kVp Accuracy and Reproducibility	6/7/2018	6/4/2019	
Beam Quality - Half-Value Layer Measurement	6/7/2018	6/4/2019	
Focal Spot Performance and System Limiting S.	6/7/2018	6/4/2019	
Automatic Exposure Control Performance Asse.	6/7/2018	6/4/2019	
Dose and Exposure Reproducibility	6/7/2018	6/4/2019	
Image Quality Evaluation	6/7/2018	6/4/2019	
Digital Receptor Uniformity	6/7/2018	6/4/2019	
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Stereotactic Breast Biopsy Systems
AEC / AEC reproducibility / Image Uniformity
Hologic Affirm (Prone)
3) Compress 2 cm of acrylic

4) Expose Stereo Scout with default kVp, AEC







Stereotactic Breast Biopsy Systems AEC / AEC reproducibility / Image Uniformity Hologic Affirm (Prone) 4) Record kVp, mAs, Exposure Index

5) Repeat for 2 cm Tomo Scout



Add Procedu

Add View

Edit View

Output Group

6x7 STE

2.3 cm

Auto
Stereotactic Breast Biopsy Systems AEC / AEC reproducibility / Image Uniformity Hologic Affirm (Prone) 6) Repeat both 2D and 3D for 4 cm, 6 cm, and 8 cm

 Repeat 4 cm 2D three more times for reproducibility



Stereotactic Breast Biopsy Systems AEC / AEC reproducibility / Image Uniformity Hologic Affirm (Prone)

8) Measure the Mean Exposure Index in the four corners of the biopsy window as well as the center.



Stereotactic Breast Biopsy Systems AEC / AEC reproducibility / Image Uniformity Hologic Affirm (Prone) - Criteria

- Uniformity < 15% variation from center
- 2D AEC < 10% variation from average EI of 4 cm, after applying correction factors from service engineer.

Thickness	Correction Factor
2 cm	0.71
4 cm	0.94
6 cm	1.30
8 cm	1.71



Stereotactic Breast Biopsy Systems AEC / AEC reproducibility / Image Uniformity Hologic Affirm (Upright) 1) Add 7 "RCC Stereo Scout" Views (Hologic does not use any of the QC views to calibrate the AEC)





Stereotactic Breast Biopsy Systems AEC / AEC reproducibility / Image Uniformity Hologic Affirm (Upright) 2) For 2, 4, 6, and 8 cm of acrylic expose with Auto-Filter, compressing to <2.5, <4.5, <6.5, <8.5 cm





Stereotactic Breast Biopsy Systems AEC / AEC reproducibility / Image Uniformity Hologic Affirm (Upright) 3) Tools / ROI / 128 / click in center of biopsy window to measure Mean Exposure Index for 2, 6, 8 cm







Stereotactic Breast Biopsy Systems AEC / AEC reproducibility / Image Uniformity Hologic Affirm (Upright)

4) With 4 cm repeat the exposure three more times, measuring the Mean Exposure Index in the four corners of the biopsy window as well as the center.



Stereotactic Breast Biopsy Systems AEC / AEC reproducibility / Image Uniformity Hologic Affirm (Upright) - Criteria

- Uniformity < 15% variation from center
- 2D AEC < 10% variation from average EI of 4 cm, after applying correction factors from Appendix D.3.

Thickness	Detector 6xxxxx	Detector 8xxxxx
2 cm	0.91	0.91
4 cm	1.00	1.00
6 cm	1.27	1.32
8 cm	1.76	1.88



Stereotactic Breast Biopsy Systems AEC / AEC reproducibility / Image Uniformity Hologic Affirm (Upright) Use the 2D AEC Exposure Compensation test results from the 2D screening mammography physics evaluation – DONE!



Stereotactic Breast Biopsy Systems AEC / AEC reproducibility / Image Uniformity Hologic Affirm (Upright) Use the DBT AEC test results from the 3D screening mammography physics evaluation – DONE! The system uses the same calibration factors for both Tomo Biopsy and Screening Tomo.



Stereotactic Breast Biopsy Systems Image Quality (mini ACR phantom)

All systems

- 1) Compress mini phantom with wax insert under the biopsy window.
- 2) Expose using clinical techniques (28 kVp, AEC).
- 3) Record post-mAs



Stereotactic Breast Biopsy Systems Image Quality (mini ACR phantom) Lorad Multicare Platinum 4) Repeat with 1024 techniques





Stereotactic Breast Biopsy Systems Image Quality (mini ACR phantom) Hologic Affirm (Prone and Upright) 4) Repeat with clinical Tomo techniques 5) Scroll to slice with sharpest specks (36 or 37)





Stereotactic Breast Biopsy Systems Image Quality (mini ACR phantom) All systems, Criteria: at least 3 fibers at least 3 speck groups at least 2.5 masses



Stereotactic Breast Biopsy Systems Image Quality (ACR phantom)

All systems, by the "book"

- 1) Compress full phantom with UpperLeft quadrant under the biopsy window.
- 2) Expose using clinical techniques
- 3) Record post-mAs





Stereotactic Breast Biopsy Systems Image Quality (ACR phantom) Lorad Multicare Platinum, by the "book" 4) Repeat with 1024 techniques





Stereotactic Breast Biopsy Systems Image Quality (ACR phantom) Hologic Affirm (Prone and Upright), by the "book" 4) Repeat with clinical Tomo techniques 5) Scroll to slice with sharpest specks (36 or 37)





Stereotactic Breast Biopsy Systems Image Quality (ACR phantom)

All systems, by the "book"

 Repeat steps 1-3, 1-4, or 1-3&5, compressing the full phantom with UpperRight, LowerLeft, and LowerRight quadrants under the biopsy window.







Stereotactic Breast Biopsy Systems Image Quality (ACR phantom)

And this is what you get



Stereotactic Breast Biopsy Systems Image Quality (ACR phantom) All systems, 2D Criteria: at least 5 fibers at least 4 speck groups at least 3.5 masses (per ACR) or at least 4 masses (per Dimensions QC manual)



Stereotactic Breast Biopsy Systems Image Quality (ACR phantom) Hologic Affirm (Prone and Upright), Tomo Criteria: at least 4 fibers at least 3 speck groups at least 3 masses



Stereotactic Breast Biopsy Systems Image Quality (ACR phantom)

MultiCare and MammoTest, WWTD = What Would Tom Do?

- Compress full phantom with 5th & 6th fibers and 3rd & 4th speck group under the biopsy window.
- 2) Expose using clinical techniques
- 3) Record post-mAs





Stereotactic Breast Biopsy Systems Image Quality (ACR phantom) MultiCare and MammoTest, WWTD 4) Repeat process with 5th speck group and 1st, 4th & 5th mass under the biopsy window.





Stereotactic Breast Biopsy Systems Image Quality (ACR phantom)

Hologic Affirm (Prone and Upright), WWTD

- 1) Compress full phantom with 6 x 7 cm paddle, centered under the biopsy window.
- 2) Expose using clinical techniques
- 3) Record post-mAs
- 4) Repeat for Tomo





Stereotactic Breast Biopsy Systems Image Quality (ACR phantom) Hologic Affirm (Prone and Upright), WWTD

Score by viewing full image, seeing through the paddle for the 1st to 4th fibers, everything else through the window.



Stereotactic Breast Biopsy Systems Generator Tests (kVp, mAs linearity, HVL) Hologic Affirm (Upright)

- Copy kVp accuracy, kVp reproducibility, exposure reproducibility, and mAs linearity from 2D/3D screening machine test results.
- 2) Do NOT copy HVL or exposure output since those were acquired with the paddle in the beam and SBB exposures are without the paddle.



Stereotactic Breast Biopsy Systems Generator Tests (kVp, mAs linearity, HVL) Lorad Multiview Platinum

- 1) Compress meter at chest wall, with lead or steel plate behind to protect detector.
- 2) Un-enable DSM by:





Stereotactic Breast Biopsy Systems Generator Tests (kVp, mAs linearity, HVL) Lorad Multiview Platinum

- 3) Simultaneously press Reset and Right Arrow
- 4) Down Arrow to highlight DSM Receptor



Stereotactic Breast Biopsy Systems Generator Tests (kVp, mAs linearity, HVL) Lorad Multiview Platinum 5) Right Arrow to "Not Selected"

6) Simultaneously press Reset and Left Arrow to exit



Stereotactic Breast Biopsy Systems Generator Tests (kVp, mAs linearity, HVL) Lorad Multiview Platinum 7) When done, DO NOT FORGET to reverse that process to re-enable DSM imaging.



Stereotactic Breast Biopsy Systems Generator Tests (kVp, mAs linearity, HVL) MammoTest, MultiCare Platinum

- kVp and exposure reproducibility (4 exposures) at 28 kVp, 40 mAs. Also record HVL.
- 2) kVp accuracy at 24 to 32 kVp, with 2 kVp increments
- 3) mAs linearity (20 to 200 mAs at 28 kVp)
- 4) Radiation output (200 mAs at 28 kVp) want more than 2400 mR in less than 3 seconds

Same criteria as screening mammo generator tests.



Stereotactic Breast Biopsy Systems Generator Tests (kVp, mAs linearity, HVL) Hologic Affirm (Prone)

- 1) Compress meter at chest wall, with large steel plate behind to protect detector.
- 2) Admin / Quality Control / kVp Accuracy / Start





Stereotactic Breast Biopsy Systems Generator Tests (kVp, mAs linearity, HVL) Hologic Affirm (Prone)

- kVp and exposure reproducibility (4 exposures) at 28 kVp, 65 mAs. Also record HVL.
- 2) kVp accuracy at 26 to 34 kVp, with 2 kVp increments using W/Ag
- kVp accuracy at 26, 27, 31, and 35 kVp with W/Al (0 Degree tomo). Record HVL at 27 kVp.
- 4) mAs linearity (20 to 200 mAs at 28 kVp, W/Ag)
- 5) Radiation output (200 mAs at 28 kVp, W/Ag) want more than 690 mR in less than 3 seconds

Same criteria as screening mammo generator tests.

Stereotactic Breast Biopsy Systems Generator Tests (kVp, mAs linearity, HVL) Hologic Affirm (Upright)

- 1) Compress meter at chest wall, with large steel plate behind to protect detector.
- 2) System Defaults / Compression Release = manual









Stereotactic Breast Biopsy Systems Generator Tests (kVp, mAs linearity, HVL) Hologic Affirm (Upright) 3) Admin / Quality Control / kVp Accuracy / Start



Stereotactic Breast Biopsy Systems Generator Tests (kVp, mAs linearity, HVL) Hologic Affirm (Upright)

- 1) HVL and exposure at 28 kVp, 65 mAs, W/Rh.
- 2) Radiation output (200 mAs at 28 kVp, W/Rh) want more than 690 mR in less than 3 seconds
- 3) HVL and exposure at 30 kVp, 65 mAs, W/Ag
- 4) HVL and exposure at 29 kVp, 65 mAs with W/Al (Zero Degree tomo).

Same criteria as screening mammo generator tests.
Stereotactic Breast Biopsy Systems Average Glandular Dose

All systems

- Use HVL and kVp of phantom images to determine the Dose Conversion Factor (same process as screening)
- 2) Calculate mR/mAs from generator exposure measurements
- 3) Multiply phantom post-mAs by mR/mAs by DCF to calculate AGD.
- 4) Repeat for Tomo for Affirms

Same criteria as screening mammo AGD limits.

Stereotactic Breast Biopsy Systems Clean up

Lorad Multicare Platinum

- 1) Re-enable DSM Image Receptor
- 2) File Manager, select all your images, Erase, without viewing

3) Exit	Pt. Nanc: TEST, PHYSICS FVp: 28 Date	aration Copy of	
Q 1024 Q 1024 Image: Image: <	CORRECT : Conservation of the second	Move PrintFilm Recoll Class Number of images selected: 22 Mew images before perform Source Device: Resid Destination Device: Select All Unselect A	Ing selected operation ent Disk I I I DICOM Query MEDICAL PHYSICS CONSULTANTS, INC.

Stereotactic Breast Biopsy Systems Clean up

Hologic Affirm (Prone)

1) Back / Back / Back / Log Out



Stereotactic Breast Biopsy Systems Clean up

Hologic Affirm (Upright)

- 1) System Defaults / Compression Release = AUTO
- 2) Back / Back / Back / Log Out
- 3) Un-install the Affirm mechanism, re-installing the Tomo shield



Stereotactic Breast Biopsy Systems Technologist QC Review

All systems

- 1) Localization Accuracy Test (daily)
- 2) Phantom Images (weekly)
- 3) Hardcopy Output Quality (if hardcopy images produced not as uncommon as screening)
- 4) Visual Checklist (monthly)
- 5) Compression Force (semi-annual)
- 6) Repeat Analysis much more lenient than mam
- 7) Zero Alignment Test (only some MultiCare)

Stereotactic Breast Biopsy Systems THE END

Things I didn't cover

- 1) Testing Fischer/Siemens MammoTest
- 2) Testing GE Serena Add-On
 - Fortunately, GE has a complete QC manual describing technologist and physicist tests
- 3) Report templates
- 4) Flow Charts for each system
- 5) Funny joke to send you on your way



Stereotactic Breast Biopsy Systems APPENDIX

Fischer/Siemens MammoTest

The following slides step you through the same 10 tests for the MammoTest.

For the most part, only the buttonology changes (dramatically!)



Stereotactic Breast Biopsy Systems Localization Accuracy in Air Fischer/Siemens MammoTest 1) Probably need to perform Daily Calibration 2) Utilities, Daily Calibrate



Stereotactic Breast Biopsy Systems Localization Accuracy in Air Fischer/Siemens MammoTest Mount the flat-field phantom Let it automatically acquire "dark image"







Stereotactic Breast Biopsy Systems Localization Accuracy in Air

Fischer/Siemens MammoTest

5) Set up manual technique exposures per established QC procedure.



Stereotactic Breast Biopsy Systems Localization Accuracy in Air Fischer/Siemens MammoTest 6) Make 8 consecutive exposures as directed.



Please leave the flat-field phantom in position until the daily calibration is completed.

Waiting for flat image #8...



Stereotactic Breast Biopsy Systems Localization Accuracy in Air

- 7) Record Avg and RMS
- 8) Replace flat field phantom with 3 pronged test object





Stereotactic Breast Biopsy Systems Localization Accuracy in Air Fischer/Siemens MammoTest 9) Install the stage, plugging it in 10) Install the needle guide and holder



Stereotactic Breast Biopsy Systems Localization Accuracy in Air

Fischer/Siemens MammoTest

11) Insert needle into guide and press test needle into the holder





Stereotactic Breast Biopsy Systems Localization Accuracy in Air Fischer/Siemens MammoTest 12) Set up a test patient

	St. Nicholas Hospital Mammotome MammoTest ® Procedure	
Patient L4 *:	(first name) Date of procedure: 03-19-2019 Tech's Initials: So: Interainty: View Position:	Please use the keyboa to enter patient data. Click "Done" when you are finished. (Patient Last Name, Patient i.d., Birthdate, Sex and Laterality mus be entered to proceed

Stereotactic Breast Biopsy Systems Localization Accuracy in Air

Fischer/Siemens MammoTest

13) Skip scout image, set up Manual Exposures again since it defaults to AEC mode14) Use 22 kVp, 20 mAs



Stereotactic Breast Biopsy Systems Localization Accuracy in Air Fischer/Siemens MammoTest 14) Move tube to "+15" position (opposite of Lorad) 15) Make first exposure



Stereotactic Breast Biopsy Systems Localization Accuracy in Air Fischer/Siemens MammoTest 16) Move tube to "-15" position 17) Make second exposure



Stereotactic Breast Biopsy Systems Localization Accuracy in Air Fischer/Siemens MammoTest 18) Localize on the center prong



Stereotactic Breast Biopsy Systems Localization Accuracy in Air Fischer/Siemens MammoTest 19) "Home" the stage (hold two buttons at same time) 20) Will need to "Disable Table Movement"



Stereotactic Breast Biopsy Systems Localization Accuracy in Air Fischer/Siemens MammoTest 21) Press Target to acquire Target 22) GoTo needle target (this moves H and V) 23) Slide needle stage out to D position









Stereotactic Breast Biopsy Systems Localization Accuracy in Air

Fischer/Siemens MammoTest

24) Compare needle to prong alignment by manually jogging needle to touch the point of the prong.



Stereotactic Breast Biopsy Systems Localization Accuracy in Air Fischer/Siemens MammoTest

• Criteria: D within 1 mm, H and V within 0.2°



Stereotactic Breast Biopsy Systems Artifact Evaluation

- 1) Compress 4 cm of acrylic
- 2) Expose Digital Scout at 28 kVp, AEC
- 3) Evaluate image for artifacts



Stereotactic Breast Biopsy Systems Spatial Resolution

- 1) Compress mammo resolution test tool
- 2) Expose Digital Scout at 28 kVp, 80 mAs.





Stereotactic Breast Biopsy Systems Spatial Resolution

Fischer/Siemens MammoTest

2) Window & Level and zoom (Full Res)

	Cancel End Procedure Save Soort UNUE UNUE UNUE UNUE UNUE UNUE UNUE UNU
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Stereotactic Breast Biopsy Systems Spatial Resolution

Fischer/Siemens MammoTest

3) Determine the smallest set of 5 white bars visible, both perp. and parallel to anode-cathode axis
 Expect to see 7 lp / mm in both dimensions.







- 1) Compress 4 cm acrylic + white paper to see light field better. Remove plastic paddle.
- 2) Tape GAFchromatic strips in corners of light, marking light field edge with a fine tip Sharpie.







Fischer/Siemens MammoTest

3) Tape doubled paperclips to all four edges of the light field.





- 4) Expose Digital Scout at 28 kVp, 240 mAs
- 5) Repeat three times to darken GAFchromatic strip



- 6) For each edge, measure the light field / x-ray misalignment
- 7) Eyeball the light field to receptor misalignment





Fischer/Siemens MammoTest

6) For each edge, eyeball the light field to receptor misalignment (aim for 1 mm precision)





- 7) For each edge add (keeping the sign) the two "errors" to determine x-ray to receptor alignment Criteria:
- entire biopsy window is exposed
- light to x-ray <= 2% of SID each dimension
- x-ray to detector > 0, $\leq 2\%$ of SID each edge



- 8) Tape one doubled paperclip to chest wall edge of compression paddle, compress 4.5 cm phantom
- 9) Expose Digital Scout at 28 kVp, AEC
- Criteria: paddle to detector > 0, $\leq 1\%$ of SID



- 10) While here, record the Compressed Breast Thickness (off a physical ruler)
- Criteria: ± 5 mm (not really important)





Stereotactic Breast Biopsy Systems Compression Force

- 1) If available, compress "scale" in power drive expect 10 to 15 pounds
- 2) Compress in manual mode, verifying it can reach and hold at 40 pounds


Stereotactic Breast Biopsy Systems AEC / AEC reproducibility / Image Uniformity Fischer/Siemens MammoTest 1) "Cancel" out to the home screen 2) Utilities / Analysis ...





Stereotactic Breast Biopsy Systems AEC / AEC reproducibility / Image Uniformity Fischer/Siemens MammoTest 3) ...Get Images / Acquire Corrected / select A



Stereotactic Breast Biopsy Systems AEC / AEC reproducibility / Image Uniformity Fischer/Siemens MammoTest

- 4) Exposure Control = Standard
- 5) Generator at manual kVp, AEC on, 25 kVp (per technique chart), 750 mAs. Record post-mAs

100





Dolta

Stereotactic Breast Biopsy Systems AEC / AEC reproducibility / Image Uniformity Fischer/Siemens MammoTest 6) Compress 4 cm of acrylic, generator at 27 kVp,

Image B, record post mAs



Stereotactic Breast Biopsy Systems
AEC / AEC reproducibility / Image Uniformity
Fischer/Siemens MammoTest
7) Compress 6 cm of acrylic, generator at 29 kVp,
Image C, record post-mAs



Stereotactic Breast Biopsy Systems AEC / AEC reproducibility / Image Uniformity Fischer/Siemens MammoTest 8) Compress 8 cm of acrylic, generator at 30 kVp (effectially max), Image D, record post mAs



Stereotactic Breast Biopsy Systems AEC / AEC reproducibility / Image Uniformity Fischer/Siemens MammoTest 9) Now that images are acquired, Done / Show Other Image / A ...



Stereotactic Breast Biopsy Systems AEC / AEC reproducibility / Image Uniformity Fischer/Siemens MammoTest 9) ...Done / Image Analysis / Center of Bin Statistic

/ select 20 x 20 bin size



Stereotactic Breast Biopsy Systems AEC / AEC reproducibility / Image Uniformity Fischer/Siemens MammoTest 10) Record Avg / OK 11) Repeat those 7 steps for 4 cm (B), 6 cm (C), and 8 cm (D).

OK

Stereotactic Breast Biopsy Systems
AEC / AEC reproducibility / Image Uniformity
Fischer/Siemens MammoTest
12) Compress 4 cm acrylic
13) Acquire Corrected Images at 27 kVp into A, C, and D, recording post-mAs.
14) Image Analysis / Center of Bin Statistics for Images A, C, D, recording Ave



Stereotactic Breast Biopsy Systems AEC / AEC reproducibility / Image Uniformity

Fischer/Siemens MammoTest

14) Done / Show Other Image / any of the 4 images / Done / Image Analysis / ROI / draw a squarish ROI in the center of the image / Statistic. Record Avg.



Stereotactic Breast Biopsy Systems AEC / AEC reproducibility / Image Uniformity Fischer/Siemens MammoTest 15)Draw a squarish ROI in the four corners of the

image, click Statistic, record Avg.



Stereotactic Breast Biopsy Systems AEC / AEC reproducibility / Image Uniformity

Fischer/Siemens MammoTest

- 16) ...Acquire Corrected Images at 27 kVp, AEC = High Contrast into Image A, AEC = Low Dose into Image C, recording post-mAs.
- 17) ...Image Analysis / Center of Bin Statistics for Images A and C, recording Avg.







Stereotactic Breast Biopsy Systems AEC / AEC reproducibility / Image Uniformity Fischer/Siemens MammoTest

- Performance < ± 20% variation from 4 cm average
- Reproducibility < 5% coefficient of variation
- Uniformity < 15% variation from center



Stereotactic Breast Biopsy Systems Generator Tests (kVp, mAs linearity, HVL)

Fischer/Siemens MammoTest

- 1) Compress meter at chest wall, with lead or steel plate behind to protect detector.
- 2) Utilities, Acquire Corrected, Exposure Control Manual, Image D



Stereotactic Breast Biopsy Systems Generator Tests (kVp, mAs linearity, HVL) Fischer/Siemens MammoTest

- 3) Select kVp, mAs (with AEC off) at control panel
- 4) Acquire Corrected, Image D (two clicks) for each exposure.







D

Stereotactic Breast Biopsy Systems Clean up

Fischer/Siemens MammoTest

- 1) Cancel out to the Home screen
- 2) Exit



