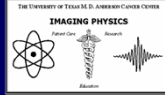


BICOE – Stereotactic Breast Biopsy and Breast Ultrasound Accreditation

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Introduction

- Objectives
- Program Requirements
- Physicists Role
- Testing Requirements

Educational Objectives

- Understand the annual test requirements for stereotactic breast biopsy systems.
- Understand the testing requirements for breast ultrasound systems for BICOE.
- Help facilities obtain the designation of Breast Imaging Center of Excellence.

What is it? - Requirements

- ACR Accreditation in:
 - Mammography – ACR or State Accreditation
 - Stereotactic Breast Biopsy
 - Ultrasound
 - Must include ultrasound guided breast biopsy



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Physicists Role

- Mammography Accreditation
 - Annual testing (required)
 - QC Program Review (required)
 - Dose Measurement (required)
- Stereotactic Breast Biopsy Accreditation
 - Annual Testing (required)
 - QC Program Review (required)
 - Dose Measurement (required)

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Physicists Role

- Ultrasound Accreditation (by June 2014)
 - The ACR strongly recommends that QC be done under the supervision of a qualified medical physicist. The qualified medical physicist may be assisted by properly trained individuals in obtaining data, as well as other aspects of the program
 - Annual testing (required)

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MQSA Physicist

- Initial Requirements
 - Mammography – MQSA
 - Stereotactic Breast Biopsy – ACR
 - Ultrasound - None
- Continuing requirements
 - Mammography – MQSA
 - Stereotactic Breast Biopsy – ACR
 - Ultrasound - None

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Stereotactic Breast Biopsy Physicist

- Initial Qualifications
 - Qualified to perform Mammography surveys under MQSA
 - Perform one (1) hands on survey of a stereotactic breast biopsy unit under a QMP or at least 3 independent surveys prior to 6/1/97
- Continuing Experience
 - Upon renewal 2 SBB surveys over a 24 month period
- Continuing Education
 - Upon renewal 3 CEU's in SBB every three years

Ref: http://www.acr.org/accreditation/stereotactic/stereotactic_breast_reqs.aspx

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What are the minimum continuing experience requirements for the physicist performing stereotactic breast biopsy system surveys for the ACR Accreditation program?

- 0% 1. 1 stereotactic breast biopsy survey over a 12 month period
- 0% 2. 2 stereotactic breast biopsy surveys over a 24 month period
- 0% 3. 3 stereotactic breast biopsy surveys over a 24 month period
- 0% 4. 3 stereotactic breast biopsy surveys over a 36 month period
- 0% 5. 4 stereotactic breast biopsy surveys over a 36 month period

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Answer

2. 2 stereotactic breast biopsy surveys over a 24 month period

Ref: Stereotactic Breast Biopsy Program Requirements:
American College of Radiology
<http://www.acr.org/accreditation/stereotactic.aspx>

Ultrasound - Physicist

- Still no requirements listed!

Stereotactic Breast Biopsy Program Requirements

- Quality Assurance Questionnaire
- Test Image Data Sheet
- Dosimeter
- Clinical Images (on film)
- Phantom Images (on film)
- Medical Physicists Annual Survey Report
- Daily, Weekly Tech QC (one month)
- Monthly, Quarterly, Semi-annual Tech QC records (one year)

Technologist Quality Control

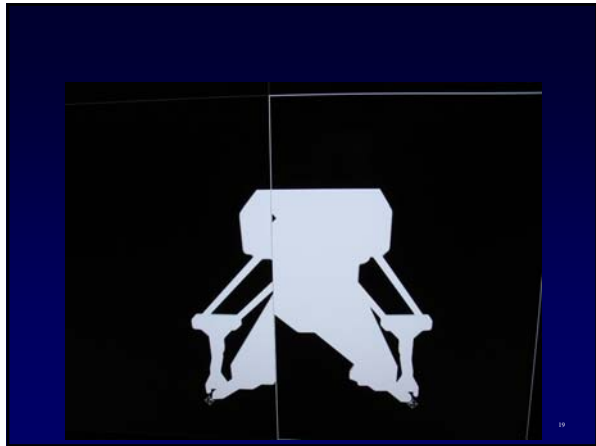
- Daily – Localization Accuracy Test
- Phantom Imaging (weekly)
- Printer QC (monthly)
- Visual Checklist (monthly)
- Compression (semi-annually)
- Repeat Analysis (quarterly)
- Zero Alignment Test (per manufacturer)
- Dark Room Testing (if using film screen)

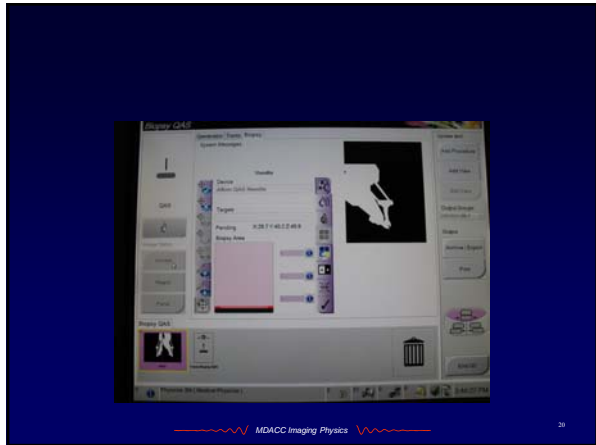


Daily Localization Accuracy Test










Stereotactic Breast Biopsy

- Annual testing required by physicist
- ACR QC Manual available



Ref: Stereotactic Breast Biopsy Quality Control Manual
1999 American College of Radiology

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Stereotactic Breast Biopsy Annual Test – Prone Table

- Unit Assembly Evaluation
- Collimation Assessment
- Focal Spot Performance and System Limiting Spatial Resolution
- kVp Accuracy
- Beam Quality Assessment (Half Value Layer)

Stereotactic Breast Biopsy Annual Test – Prone Table

- Automatic Exposure Control(AEC) or Manual Exposure Assessment
- Uniformity of Screen Speed (Screen Film Systems)
- Digital Receptor Uniformity (For Digital Image Receptors)
- Breast Entrance Exposure, Average Glandular Dose, and Exposure Reproducibility

Stereotactic Breast Biopsy Annual Test – Prone Table

- Image Quality Evaluation
- Artifact Evaluation
- Localization Accuracy Test

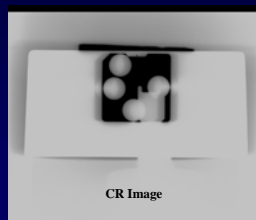
Stereotactic Breast Biopsy Annual Test – Upright Add On

- Unit Assembly Evaluation
- Beam Quality Assessment (Half Value Layer)
 - With paddle and at kVp for stereo phantom
- Breast Entrance Exposure, Average Glandular Dose
- Image Quality Evaluation (with mini phantom)
- Localization Accuracy Test

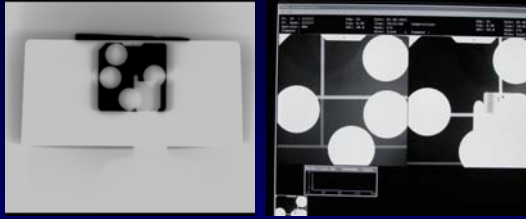
Unit Assembly Evaluation

- Mechanically Stable
- Moving parts
- Locks/Detents
- Image receptor no vibes
- Compressed breast thickness indicator
- No rough edges
- Technique charts
 - 512/1024 modes
- Radiation shielding
- Needle guides support needle

Collimation



Collimation



If any edge of radiation field deviates more than 5 mm from the edge of the image receptor, or if any edge of the compression paddle projects into the X-ray field by more than 5 mm, then seek service adjustment.

What is the maximum allowable alignment deviation of the radiation field edge to the image receptor for a stereotactic breast biopsy system?

- 0% 1. 1 mm
- 0% 2. 2 mm
- 0% 3. 3 mm
- 0% 4. 4 mm
- 0% 5. 5 mm

Answer

- 5. 5 mm

Ref: Stereotactic Breast Biopsy Quality Control Manual 1999, Medical Physicist Section, Collimation Assessment, American College of Radiology

Focal Spot Performance and System Limiting Resolution



Action Limit: Note any significant degradation from previous measurement and seek service.

kVp



Action Limit: If the mean kVp differs from the nominal by more than +/- 5% of the nominal kVp, or if the coefficient of variation exceeds 0.02, then seek service correction

Beam Quality – Half Value Layer

- $HVL \geq kVp/100$



Automatic Exposure Control (AEC)



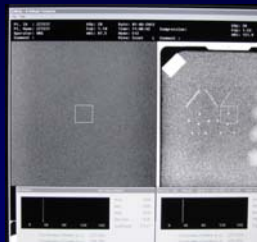
Technique Chart

Breast Thickness	Exposure Mode	kVp Setting	Density Control Setting	Phototimed (Yes or No)
< 3 cm	512	26	N/A	Yes
3 to 5 cm	512	28 - 30	N/A	Yes
5 to 7 cm	512	30 - 32	N/A	Yes
> 7 cm	512	34	N/A	Yes

Breast Thickness	Exposure Mode	kVp Setting	Density Control Setting	Phototimed (Yes or No)
< 3 cm	1024	28	N/A	Yes
3 to 5 cm	1024	30 - 32	N/A	Yes
5 to 7 cm	1024	32 - 34	N/A	Yes
> 7 cm	1024	34	N/A	No - 400 mAs

AEC Performance

- Select kVp
- Use AEC and make exposure
- Measure mean pixel value in center of field
- Meet manufacturers specifications



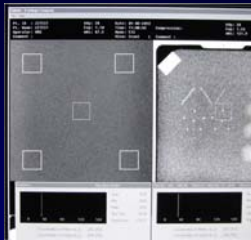
AEC

- Ideally, clinical techniques (whether AEC or manual) should keep exposure times under 2 seconds while meeting manufacturers signal requirements

Ref. Stereotactic Breast Biopsy Quality Control Manual 1999

Digital Field Uniformity

Both 512 and 1024 modes



- Action Limit: If $SNR(I) / SNR(Center)$ is > 1.15 or < 0.85 , seek service correction.

Digital Field Uniformity

- May require manufacturers service manual for procedure.

Dose

- We check both 512 and 1024 modes
- Made change to technique chart to get 1024 mode to be less than 300 mrad
- “The average glandular dose to an average (4.2 cm compressed) breast should not exceed 3 mGy (300 mrad) per view for film-screen or digital image receptors”

Technique Chart

Breast Thickness	Exposure Mode	kVp Setting	Density Control Setting	Phototimed (Yes or No)
< 3 cm	512	26	N/A	Yes
3 to 5 cm	512	28 - 30	N/A	Yes
5 to 7 cm	512	30 - 32	N/A	Yes
> 7 cm	512	34	N/A	Yes

Breast Thickness	Exposure Mode	kVp Setting	Density Control Setting	Phototimed (Yes or No)
< 3 cm	1024	28	N/A	Yes
3 to 5 cm	1024	30 - 32	N/A	Yes
5 to 7 cm	1024	32 - 34	N/A	Yes
> 7 cm	1024	34	N/A	No - 400 mAs

What is the maximum allowable dose per view to a 4.2 cm compressed breast as recommended by the ACR?

- 0% 1. 1.5 mGy
- 0% 2. 2.0 mGy
- 0% 3. 2.5 mGy
- 0% 4. 3.0 mGy
- 0% 5. 3.5 mGy

Answer

4. 3.0 mGy

Ref: Stereotactic Breast Biopsy Quality Control Manual, Medical Physicist Section
Breast Entrance Exposure, Average Glandular Dose, and Exposure Reproducibility

Image Quality Evaluation



Required Minimum Scores-Film Screen

- Mammography Accreditation Phantom
 - 4.0 Fibers
 - 3.0 Specs
 - 3.0 Masses
 - Total: 10.0
- Mini-phantom
 - 2.0 Fibers
 - 2.0 Specs
 - 2.0 Masses
 - Total: 6.0

Required Minimum Scores - Digital Receptor

- Mammography Accreditation Phantom
 - 5.0 Fibers
 - 4.0 Specs
 - 3.5 Masses
 - Total: 12.5
- Mini-phantom
 - 3.0 Fibers
 - 3.0 Specs
 - 2.5 Masses
 - Total: 8.5

What are the minimum scores for a digital receptor when using the mini-phantom?

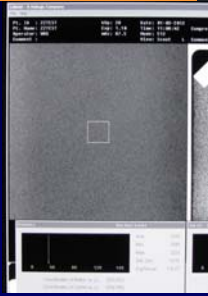
- 0% 1. 1.0 Fibers, 1.0 Spec groups, 1.0 Masses
- 0% 2. 2.0 Fibers, 2.0 Spec groups, 2.5 Masses
- 0% 3. 3.0 Fibers, 3.0 Spec groups, 2.5 Masses
- 0% 4. 3.5 Fibers, 3.5 Spec groups, 3.0 Masses
- 0% 5. 4.0 Fibers, 4.0 Spec groups, 4.0 Masses

Answer

- 3. 3.0 Fibers, 3.0 Spec groups, 2.5 Masses
- Ref: Stereotactic Breast Biopsy Quality Control Manual, Medical Physicist Section Image Quality Evaluation

Artifact Evaluation

- Note any artifacts or non-uniformities in the field.
- Both 512 and 1024 modes



Localization Accuracy Test



Localization - Prefire



Localization - Postfire



Add On Biopsy Systems



Beyond Annual Mammo Testing

- HVL at Phantom kVp with Stereo Paddle
- HVL Measurement for Tomo Biopsy
- Dose Measurement for Phantom for Both
- Image Quality with Stereo Phantom
- Localization

HVL - Upright Stereo Add On



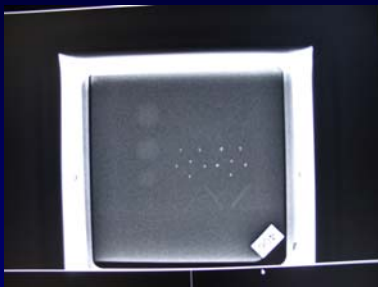
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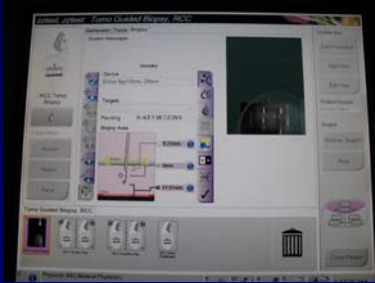
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Tomosynthesis Guided Biopsy



Tomosynthesis Guided Biopsy

- FDA approved
- No ACR Accreditation Program
- No Manufacturers QC Program
 - Do what you think is best

Breast Ultrasound Accreditation



Continuing Quality Control

- A continuous QC program is essential to assure the proper functioning of all ultrasound equipment and to identify problems before the diagnostic utility of the equipment is significantly impacted^{7,8}. Routine QC is typically performed by appropriately trained sonographers or equipment service engineers.
- In addition to testing done for the annual survey, all scanners and all transducers in routine clinical use should be tested quarterly, but must be tested at least semiannually.

- 7. Mårtensson M, Olsson M, Brodin LA. Ultrasound transducer function: annual testing is not sufficient. *Eur J Echocardiogr*. 2010 Oct;11(9):801-5.
- 8. Hangiandreou NJ, Stekel SF, Trudup DJ, Gorny KR, King DM. Four-year experience with a clinical ultrasound quality control program. *Ultrasound Med Biol*. 2011 Aug;37(8):1350-7.

5 Tests for the Technologist

1. Physical and Mechanical Inspection
2. Image Uniformity and Artifact Survey
3. Geometric Accuracy (mechanically scanned transducers only)
4. Ultrasound scanner Electronic Display Performance
5. Primary Interpretation Display Performance*
 - Only required if located at the facility where ultrasound is performed

Annual Survey

- The QC tests listed in the table below **are required** (unless they are designated as optional) and must be performed at least annually on all machines and transducers in routine clinical use.

Program Requirements – Annual Survey

- Physical and Mechanical Inspection
- Image Uniformity and Artifact Survey
- Geometric Accuracy
- System Sensitivity
- Ultrasound Scanner Electronic Image Display Performance
- Primary Interpretation Display Performance*

Program Requirements – Annual Testing

- Contrast Resolution (Optional)
- Spatial Resolution (Optional)
- Evaluation of QC Program

Starting June 2014 what is the recommended frequency for equipment surveys of ultrasound equipment for the ACR's breast ultrasound accreditation program?

- 0% 1. Quarterly
- 0% 2. Semiannually
- 0% 3. Annually
- 0% 4. Every other year
- 0% 5. None

Answer

- 3. Annually

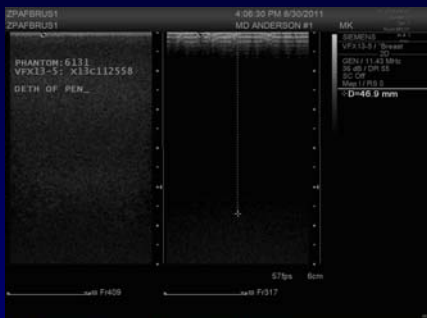
Ref: Stereotactic Breast Biopsy Accreditation Program Requirements

<http://www.acr.org/accreditation/breast.aspx>

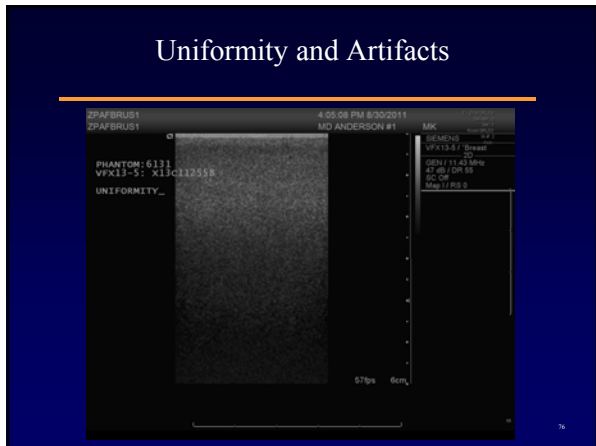
Electrical – Mechanical Condition

- Power cord
- Wheel Locks, Brakes
- Housing
- Scan Head Cable, Plugs
- Scan Head Housing, Window
- Monitor
- Air Filters
- VCR
- Printer Function

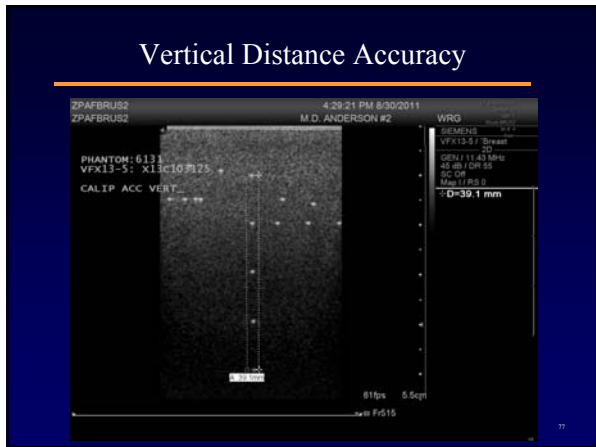
System Sensitivity – Depth of Pen



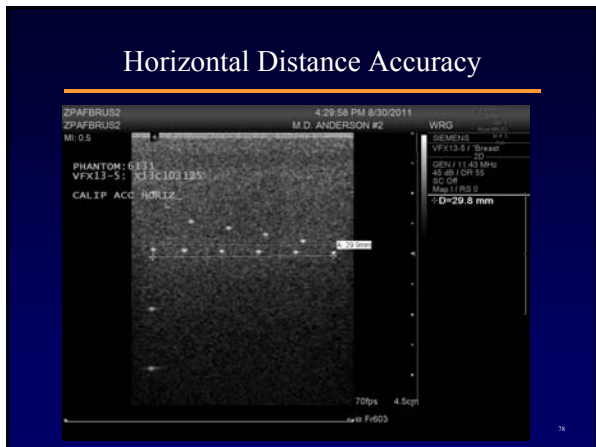
Uniformity and Artifacts



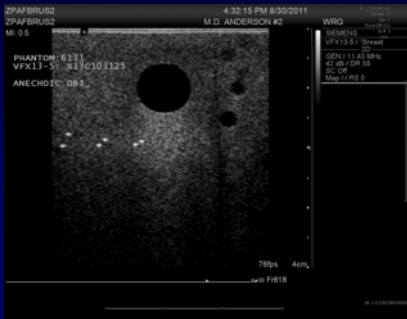
Vertical Distance Accuracy



Horizontal Distance Accuracy



Anechoic Void Perception



Ring Down – Dead Zone



Lateral Resolution



Axial Resolution



Evaluation of Sites QC Program

- Review semiannual QC results

Questions?