Surveying and QC of Stereotactic Breast Biopsy Units for ACR Accreditation

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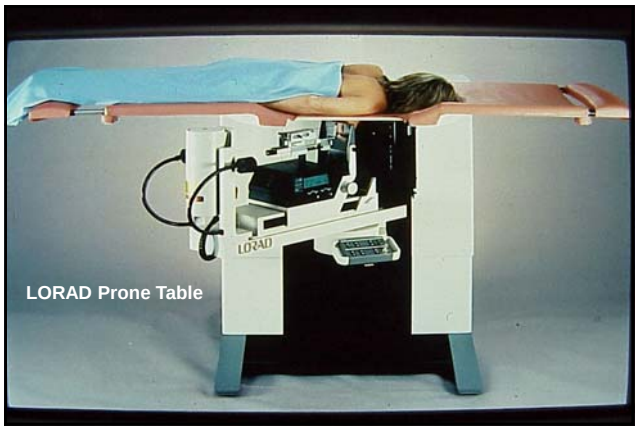
Melissa C. Martin, M.S., FACR, FAAPM, FACMP

LORAD Stereotactic Breast Biopsy System

Learning Objectives

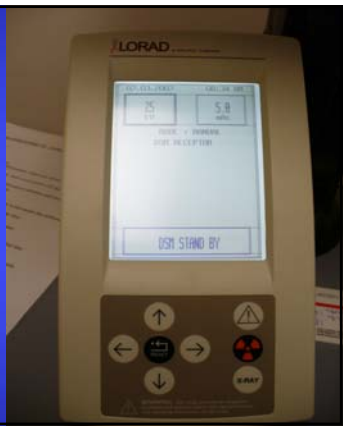
- Become familiar with the recommendations and requirements of the ACR Stereotactic Breast Biopsy Accreditation Program (SBBAP) - 1999 Quality Control Manual Information for image quality, patient dose, and needle placement accuracy
- Become familiar with the operation and performance of SBB systems - both prone table and upright add-on systems

LORAD Stereotactic Breast Biopsy System



LORAD Prone Table

LORAD Stereotactic Breast Biopsy System Control Pendant



Siemens (Fischer)
MammoVision Biopsy System

Siemens Mammomat Inspiration SBB Add-On

It should be noted that the **Siemens MAMMOMAT® Inspiration** digital mammography equipment offers a unique advantage. Siemens has developed the **MAMMOMAT Inspiration** to support the demands of today's medical practice in screening, diagnostics, and biopsy. The optional slip-on biopsy attachment automatically converts the **MAMMOMAT Inspiration** configuration to stereotactic biopsy, which is operable with the patient in the prone or upright position. For those institutions without a dedicated biopsy unit, this option provides an excellent way to include stereotactic breast biopsy in their scope of service as well as meet the needs of the surgeon.

Siemens (Fischer) MammoVision Biopsy System

Affirm™ Biopsy Guidance System
the next generation of breast biopsy

- State-of-the-art solution for upright biopsy procedures
- Advanced ergonomic design
- Novel features to minimize procedure steps and simplify workflow
- Versatile and flexible solution for any setting
- Platform for future advances in biopsy

Advanced, Ergonomic Design
easy to use and install

- Lightweight, compact device
  - ~7 kg (~15lb)
- Balanced design
- Easy grasp handles
- Installs easily, in just seconds

Enhanced Visualization
intuitive targeting

- Uses a novel 10°angle to enter the breast
  - Biopsy device is removed from path of x-ray for unobstructed view of lesions
  - Uses intuitive, Cartesian targeting
    - » Allows user to think in Cartesian space for targeting
    - » Software automatically factors in angle, making adjustments seamless to users

Versatility and Flexibility
wide range of use

- All Selenia Dimensions are biopsy-ready and tomosynthesis capable
  - Dimensions with AWS 5000 may require display upgrade (minimum 2 MP medical grade grayscale monitor)
- Affirm is compatible with wide array of biopsy devices
  - Pre-programmed for Hologic's ATEC and Eviva

Selenia Dimensions with AWS 8000

Selenia Dimensions with AWS 5000

Fully Integrated System
increased efficiency

- Add-on to any Dimensions*
- Utilizes existing detector and compression mechanism
  - Superb image quality
  - Large field of view simplifies positioning
- 70 cm SID – longest in the industry!
  - Provides comfortable working space and better patient access
  - Allows easier, faster installation of biopsy devices
- Allows you to biopsy under the same imaging modality

*Affirm comes standard with a single gantry 2D biopsy license . Additional licenses are available for purchase.

ACR SBB Program Statistics

- As of January 1, 2012, ACR has accredited 1052 units at 1020 facilities providing Stereotactic Breast Biopsy Procedures
- In 2011, the first attempt pass rate for new or renewing units was 82%. Almost all facilities pass on their second attempt at accreditation after taking appropriate corrective action to improve image quality

Simplified Workflow
streamlined procedures

- Fully integrated user interface
  - All activities performed on the easy-to-use Dimensions AWS
- Automated image acquisition
  - C-arm moves automatically to the appropriate location for stereo views
  - Requires minimal steps
  - Shortens procedure time
- Accurate and efficient
  - Targeting software removes guesswork
  - Provides visual feedback of needle placement

ACR SBB Program Statistics

- The process typically takes 4 to 6 months.
- The review process takes approximately 90 days after the ACR receives the submitted material.
- There are currently no MQSA requirements for personnel performing SBB procedures but there are training and experience requirements for accreditation by the ACR

ACR Accreditation of SBB Units

- Currently, mammography units used exclusively for SBB procedures are not required to be certified under MQSA
- Facilities must have an accredited SBB program to be named as a Center of Excellence for Breast Care by the ACR

BREAST IMAGING ACCREDITATION PROGRAMS
MEDICAL PHYSICIST QUALIFICATIONS

STEREOTACTIC BREAST BIOPSY ACCREDITATION

	Medical Physicist
Initial	Licensed or approved by a state ***or*** ABR certified ***or*** ABMP certified AND Have a master's degree or higher in a physical science with 20 hours of physics and 20 hours of training conducting mammography surveys ***or*** if qualified under MQSA before 4/28/1999, have a BS in physical science with 10 hours of physics and 40 hours of training conducting mammography surveys AND 1 facility and 10 mammography units, ***or*** if qualified before 4/28/99 with BS in physical science, 1 facility and 20 mammography units AND Performed 1 hands-on stereotactic breast biopsy survey under a qualified medical physicist ***or*** at least 3 independent surveys prior to 6/1/97.
Continuing Experience	1 stereotactic breast biopsy unit physics survey per year
Continuing Education	3 Category 1 CEUs in stereotactic breast biopsy every 3 years

Goals of QC for Stereotactic Breast Biopsy

- To ensure that image quality in Stereotactic Breast Biopsy equals or exceeds that of screening and diagnostic mammography
- To ensure that equipment designed specifically for Stereo Breast Biopsy performs properly
- To ensure that needle localizations are accurate

Quality Control: Medical Physicist's Evaluation

- Acceptance Test Before Patient Use
- Report Required as Part of ACR Application
- Annually Thereafter
- The 1999 ACR SBB Quality Control Manual has a section for the Medical Physicist with suggested Test Procedures, Forms, and Summary Report Format
- Detailed instructions on 11 Required Physicist's tests

General Requirements for SBBAP

- Qualified TEAM: Physicians, Technologist, and *Medical Physicist*
- Equipment: Table or "add-on"; film or digital
- QA Program, Manual, and Committee
- Technologist's QC Testing - daily, weekly, monthly, semi-annual - 6 tests
- Medical Physicist's QC Testing - acceptance and annual - 11 tests

ACR Quality Control Manual

- Mammography QC Manual (1990, 1992, 1994, 1999)
- Stereotactic Breast Biopsy QC Manual (1999)
- Sent free to all facilities in program

- To purchase, call ACR Pubs: (800) 227-7762
- QC forms available to anyone on Web site

Rad Tech QC Tests

Mammo QC Tests Also Apply if Screen-Film Used

- Localization Accuracy - daily
- Phantom Image - weekly
- Hardcopy Output Quality - monthly, if app
- Visual Checklist - monthly
- Compression Force - semi-annually
- Repeat Analysis - semi-annually
- Zero Alignment Test – before ea patient, if app

Stereotactic Unit Assembly Evaluation

1. Stereotactic Breast Biopsy Unit Assembly Evaluation (Y = yes, N = no, or N/A = not applicable)	
Free-standing dedicated unit is mechanically stable.	Y
All moving parts move smoothly, without obstructions to motion.	Y
All locks and detents work properly.	Y
Image receptor holder assembly is free from vibrations.	Y
Image receptor is held securely by assembly in any orientation.	Y
Image receptor slides smoothly into holder assembly (screen-film only).	Y
Compressed breast thickness scale is accurate to 5 mm, reproducible to ±2 mm.	Y
Patient or operator is not exposed to sharp or rough edges, or other hazards.	Y
Operator technique control charts are posted.	Y
Operator protected during exposure by adequate radiation shielding.	Y
Needle holder and needle guides adequately support needle.	Y
Evaluation (Pass or Fail):	**Pass**

Medical Physicist's Quality Control Tests

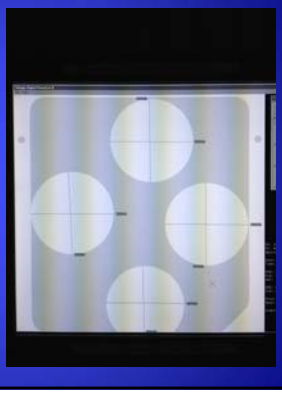
1. Stereotactic Unit Assembly Evaluation
2. Collimation Assessment
3. Focal Spot Performance & Digital System Limiting Resolution
4. kVp Accuracy and Reproducibility
5. Beam Quality Assessment (HVL)
6. AEC or Manual Exposure Performance

Collimation Assessment

Medical Physicist's Quality Control Tests

- 7A. Uniformity of Screen Speed
- 7B. Digital Receptor Uniformity
- 8. Breast Entrance Exposure, Average Glandular Dose, and Exposure Reproducibility
- 9. Image Quality Evaluation
- 10. Artifact Evaluation
- 11. Localization Accuracy Test

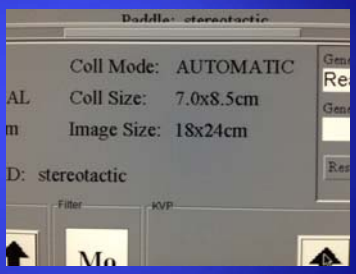
LORAD Upright Biopsy Paddle



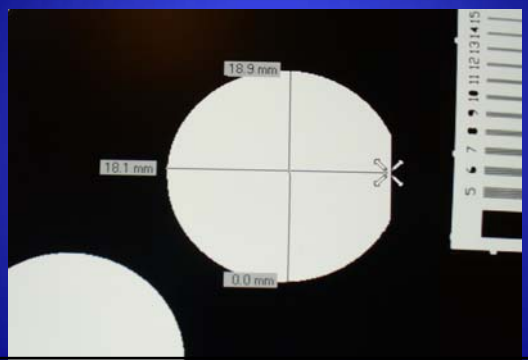
Measurement Tools Available on Screen

Collimator Assessment for Add-On Units

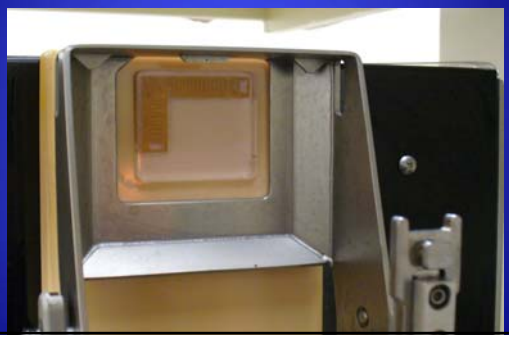
Actual Opening in Metal Compression Plate is 5 x 5 cm area



Collimation Assessment



Digital Limiting Resolution/Focal Spot



Collimation Assessment

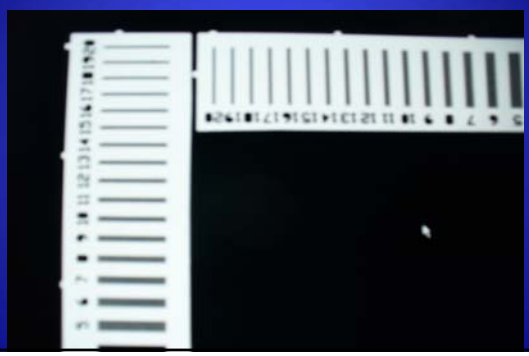
SID = 84 cm for LORAD SBB Tables

Digital Units

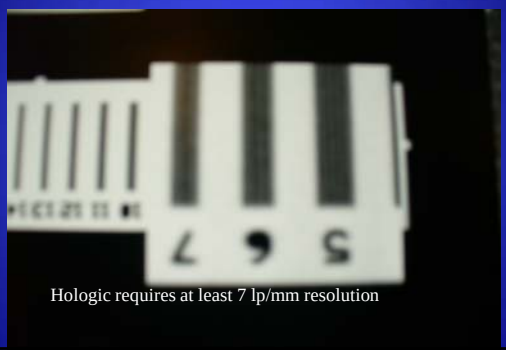
	Collimator (cm x cm):	5 x 5				
Digital Image	Left Edge Deviation (mm):	0				
	Right Edge Deviation (mm):	0				
	Anterior Edge Deviation (mm):	3.5				
	Chest Edge Deviation (mm):	1				
Film Image	Left Edge Deviation (mm):	0				
	Right Edge Deviation (mm):	0				
	Anterior Edge Deviation (mm):	0				
	Chest Edge Deviation (mm):	4				
Evaluation:		Pass				

Action Limit: 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.

Digital Limiting Resolution/Focal Spot



Digital Limiting Resolution/Focal Spot

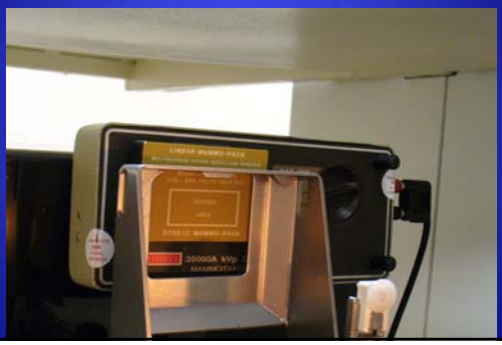


Hologic requires at least 7 lp/mm resolution

Beam Quality Assessment

Nominal kVp setting		26	27	28	29	30
mA setting		80	80	80	70	70
Time setting (seconds)		1.00	1.00	1.00	1.00	1.00
Exposure measurements:						
No aluminum filtration, E_o		0.797	0.892	0.988	0.950	1.041
0.2 mm of added aluminum, E_2						
0.3 mm of added aluminum, E_3						
0.4 mm of added aluminum, E_4						
0.5 mm of added aluminum, E_5						
Repeat Eo measurement, E_o'						
Record thicknesses ($t_a < t_b$)	t_a	0.00	0.00	0.00	0.00	0.00
and exposures	t_b	0.32	0.32	0.32	0.32	0.32
that bracket $E_o/2$: ($E_a > E_b$)	E_a	0.797	0.892	0.988	0.950	1.041
	E_b	0.381	0.436	0.494	0.482	0.539
Calculated HVL:		0.30	0.31	0.32	0.33	0.34
Evaluation (Pass or Fail)		Pass	Pass	Pass	Pass	Pass

kVp Accuracy and Reproducibility



Beam Quality Specifications for SBB Units

- The minimum acceptable Half-Value Layer measurement on a digital or film/screen SBB unit is

Action Limit: If measured HVL < (kVp/100) (in mm Al)

or

if measured HVL ≥ (kVp/100) + C (in mm Al)

where C = 0.12 for Mo/Mo, C = 0.19 for Mo/Rh, and C = 0.22 for Rh/Rh,

then seek service correction.

kVp Accuracy and Reproducibility

4. kVp Accuracy / Reproducibility

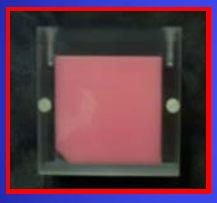
kVp meter used: Keithley Triad Dosimetry System

Nominal kVp setting		26	27	28	29	30
Nominal focal spot size (mm)						
Exposure time (sec)		2.00	1.50	1.00	0.80	0.50
mA setting		80	80	80	70	70
Measured kVp values						
kVp1		26.0	27.1	28.1	28.9	29.9
kVp2		26.2	27.1	28.1	29.0	29.9
kVp3				28.1		
kVp4				28.1		
Mean kVp	< kVp >	26.10	27.10	28.10	28.95	29.90
Standard dev.	σ_{kVp}	0.141	0.000	0.000	0.071	0.000
Additional kVp measurements (if needed)						

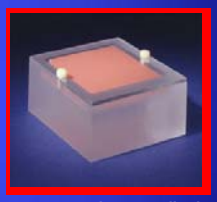
Image Quality Evaluation (Phantom)

- **Objective: Ensure Image Quality for SBB meets or exceeds that of mammography, and to detect temporal changes in image quality**
- **Procedure: Same as for Mammography, except ACR phantom must be imaged in 4 separate quadrants for digital because of small field of view**

Two Types of Approved Phantoms



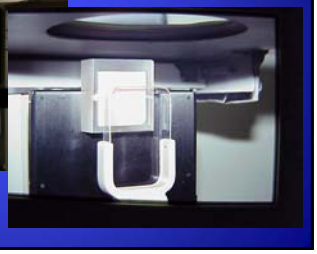
"Mini" Stereotactic Breast Biopsy Accreditation Phantom
Nuclear Associates 18-250



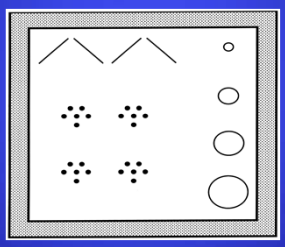
Mammography Accreditation Phantom
RMI 156
Nuclear Associates 18-220

Image Quality for SBB Units

RMI 156 or NA 18-220
- MAP Phantom

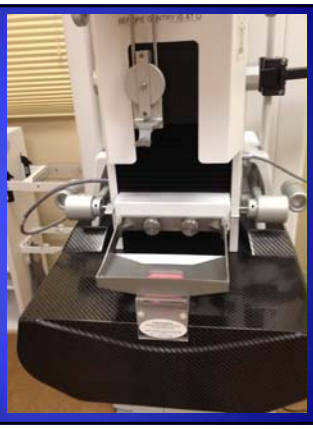


"Mini" Stereotactic Breast Biopsy Accreditation Phantom



Chest Wall Side

LORAD Upright Add-on with Mini-Phantom for Image Quality Test



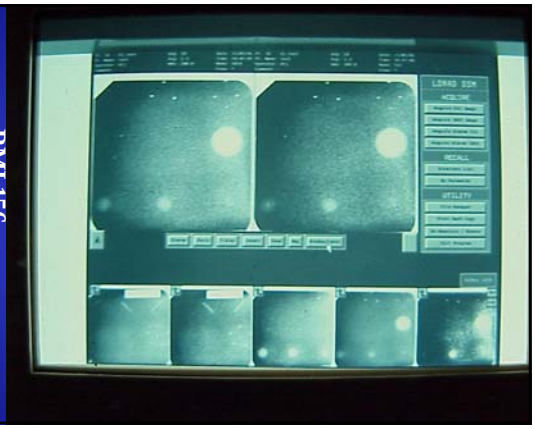
SBBAP Testing Criteria

Dose and Phantom

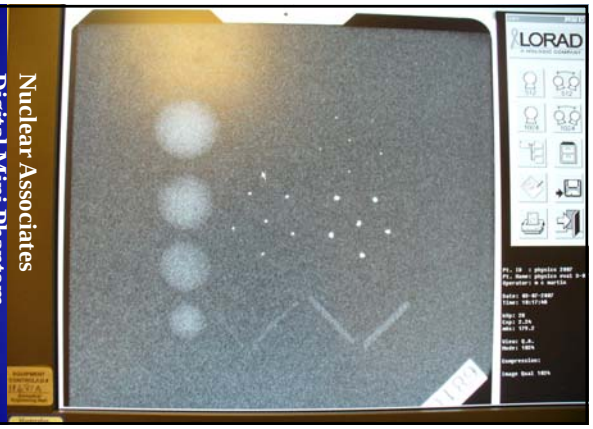
- Dose
  - Must be less than 300 mrads (3 mGy)
- Phantom image quality

	MAP Phantom		Mini Phantom	
	F/S	Digital	F/S	Digital
Fibers	4.0	5.0	2.0	3.0
Speck Groups	3.0	4.0	2.0	3.0
Masses	3.0	3.5	2.0	2.5

RMI 156 Accreditation Phantom



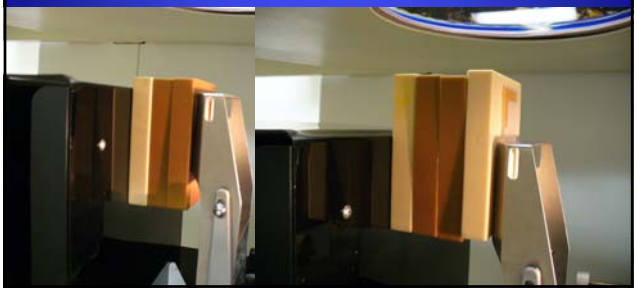
Nuclear Associates
Digital Mini Phantom



AEC or Manual Exposure Performance

6 cm Thickness

8 cm Thickness

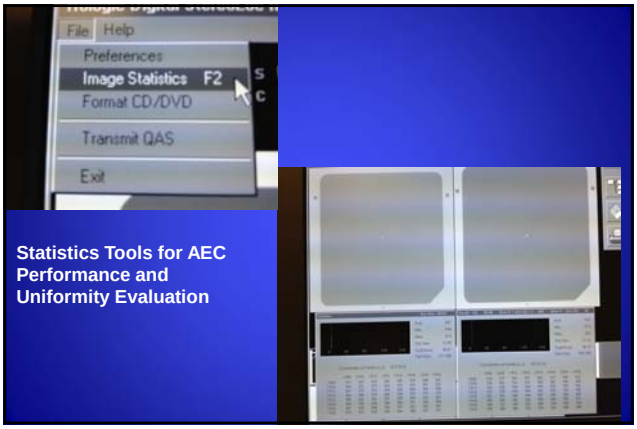


AEC or Manual Exposure Performance

2 cm Thickness

AEC or Manual Exposure Performance

4 cm Thickness - Also used for Uniformity and Artifacts



Statistics Tools for AEC Performance and Uniformity Evaluation

AEC or Manual Exposure Performance

Performance Capability

Thickness Compensation					
Imaging mode:	Digital				
Focal spot:	Large				
mA:	80				
Phantom thickness	Target	Filter	kVp	mAs	Optical Density or Mean Signal Value
2 cm	Mo	Mo	26	40	9310
4 cm	Mo	Mo	28	120	9213
6 cm	Mo	Mo	30	245	8073
8 cm	Mo	Mo	34	350	9340

Mean Density	Density or Signal Range		Allowable Range		Evaluation
8865	8073 to 9310		7370 to 11056		Pass

Action Limit (Screen-Film): If the density range exceeds ±0.15 of mean, revise technique chart.

Action Limit (Digital): If the signal range exceeds ±20% of signal for 4 cm phantom, revise technique chart.

Digital Receptor Uniformity Requirements

- **For Units without ROI statistics measurement capability:**

Action Limits: If geometric pincushioning > 1 cm from edge of image or

If non-uniform areas (w/o black dots) > 10% of image or

If line w/o black dots > 1/4 length of image, seek service correction

AEC or Manual Exposure Control Performance Requirement

- **Action Limit (Digital): If the signal range exceeds ±20% of signal for 4 cm phantom, revise technique chart.**
- **Action Limit (Screen-Film): If the density range exceeds ±0.15 of mean, revise technique chart.**

Digital Receptor Uniformity

7B. Digital Receptor Uniformity - 512 Mode

Image Receptor: DSM-Digital Receptor
Phantom used: 4 cm BR-12

Target-filtration: Mo/Mo
kVp setting: 28
mAs: 120

I. For units with ROI measurement capability

ROI Center	Minimum	8926
	Maximum	9537
	Mean	9213
	SD	72
	SNR (center)	128

ROI Upper Left	Minimum	8862
	Maximum	9539
	Mean	9239
	SD	75
	SNR	123
	SNR (center)	0.96

ROI Upper Right	Minimum	8678
	Maximum	9345
	Mean	8988
	SD	93
	SNR	97
	SNR (center)	0.76

ROI Lower Left	Minimum	8854
	Maximum	9539
	Mean	9247
	SD	75
	SNR	123
	SNR (center)	0.96

ROI Lower Right	Minimum	8737
	Maximum	9382
	Mean	9062
	SD	90
	SNR	100
	SNR (center)	0.78

Evaluation (Pass or Fail): Fail

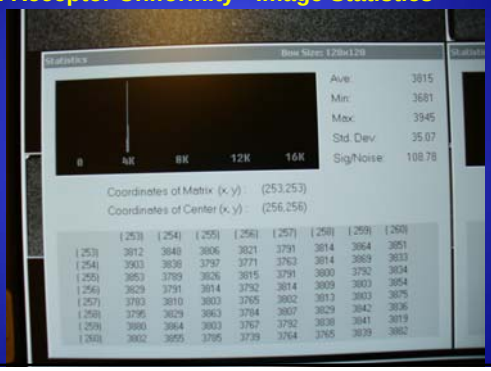
Action Limit: If SNR(I) / SNR (center) is > 1.15 or < 0.85, seek service correction.

Digital Receptor Uniformity Requirements

- **For Units with ROI statistics measurement capability:**

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

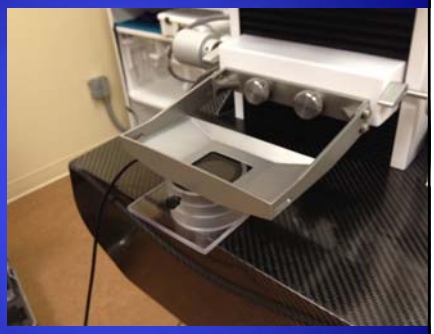
Digital Receptor Uniformity - Image Statistics



Breast Entrance Exposure, Average Glandular Dose, and Exposure Reproducibility

- Same Procedure as for Mammography
- Recommended Signal Level for Digital
- Digital Matrix Sizes
- Performance Criteria:
  a) Coefficient of Variation < 0.05
  b) Av. Glandular Dose < 3 mGy for Screen/Film and for Digital Image Receptors

Entrance Exposure Measurements on LORAD Add-on Units



Entrance Exposure/Mid-Glandular Doses

Entrance Exposure/Mid-Glandular Doses

Dosimetry system used: Keithley Triad — Energy correction factor: 1
Imaging mode: Digital
Image receptor: DGM- CCD System — Size: 5 by 5 (cm)
Field restriction: Biopsy Aperature
SID (cm): 64
Phantom: Digital Mini-Phantom

	512 Mode				1024 Mode	
Nominal kVp setting:	28				28	
Target / Filtration:	Mo/Mo				Mo/Mo	
AEC density control setting:	1.5 sec				3 sec	
mA setting:	80				60	
Measured HVL (mm Al):	0.32				0.32	

Measured entrance exposure:	R	mAs	R	mAs	R	mAs
Exposure #1	1.462	120.0			2.920	240.0
Exposure #2	1.466	120.0				
Exposure #3	1.472	120.0				
Exposure #4	1.472	120.0				
Mean values	1.468	120.00			2.920	240.00
Standard deviations (SD)	0.005	0.000				
Coefficients of variation (CV)	0.003	0.000				
Evaluation (Pass or Fail):	Pass	Pass				
Energy-corrected exposure:	1.468				2.920	
Dose conversion factor from Table 1-3 (mrad/R):	166				166	
Computed average glandular dose (mrad):	244				485	
Evaluation (Pass or Fail):	Pass				Special Purposes Only	

Action Limit: If CV for exposure or mAs exceeds 0.05, seek service correction. If average glandular dose exceeds 300 mrads (3 mGy) for 4.2-cm effective breast thickness, seek service or technique adjustment.

Entrance Exposure/Mid-Glandular Doses

Artifact Evaluation

10. Artifact Evaluation

Type of Attenuator: BR-12 Blocks
Thickness of Attenuator: 4 cm
Target-Filter: Mo/Mo
kVp Setting: 28
Exposure Setting: 120 mAs
Nominal Focal Spot Size: 0.25 mm Mo

Image receptor	Film/Screen	Digital
Image Viewed on	Film	CRT
Resultant film O.D.		
Artifacts visible? (If yes, continue by checking the appropriate boxes.)		No
Processor artifact*		
Equipment artifact**		
Other artifact		
Describe these artifacts		

Film-Screen: * Artifacts parallel in the two films viewed as in Figure 5A.
** Artifacts perpendicular in the two films viewed as in Figure 6B.

Evaluation (Pass or Fail): Pass

11. Localization Accuracy: Gelatin Phantom

- Objective: To assure that the biopsy needle is accurately placed for sampling as directed from the stereotactic scout images
- Technologist to perform test
- Physicist to observe and analyze results
- End-to-End test which supplements the daily in-air positioning accuracy test

Gelatin Phantom Biopsy

Localization Accuracy: Gelatin Phantom Method

- 1. Position Needle:
  - Target Lesion Using Stereo Views
  - Position Core Needle to Proper X, Y, and Z Coordinates
- 2. Verify Needle Position:
  - Acquire Stereo Pre-fire Images
  - Needle Tip should be within Lesion
- 3. Fire Gun

Gelatin Biopsy Images

Localization Accuracy: Gelatin Phantom Method

- 4. Verify Post-Fire Position
  - Acquire Post-Fire Stereo Images
  - Needle Tip should be beyond Center of Lesion
- 5. Verify Sampling of Lesion
  - Examine Contents of Core Sample

Localization Accuracy

11. Localization Accuracy (Gelatin Phantom) Test

Object Capture

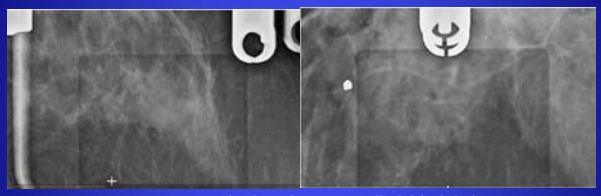
Was the object captured? Y

Action Limit: IF the biopsy needle captures the intended object, then the unit passes. If the unit fails the test, then service should be called.

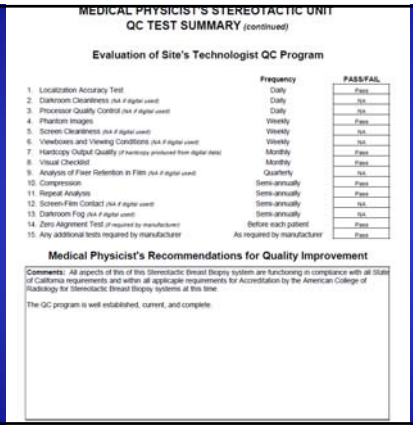
If pre-file images or visual inspection fail to demonstrate needle tip (or sampling notch for suction systems) within (or adjacent to) targeted lession, the service should be called.

Evaluation (Pass or Fail): Pass

Clinical SBB Procedures - Upright System



- Images are acquired on the same Full Field Digital Detector with the same image processing as original screening/diagnostic images
- First step is to acquire a scout image to confirm lesion positioning



MEDICAL PHYSICIST'S STEREOTACTIC UNIT
QC TEST SUMMARY *(continued)*

Evaluation of Site's Technologist QC Program

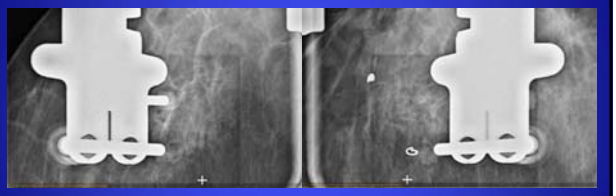
	Frequency	PASS/FAIL
1. Localization Accuracy Test	Daily	Pass
2. Darkroom Cleanliness *(NA if digital used)*	Daily	N/A
3. Processor Quality Control *(NA if digital used)*	Daily	N/A
4. Phantom Images	Weekly	Pass
5. Screen Cleanliness *(NA if digital used)*	Weekly	N/A
6. Viewboxes and Viewing Conditions *(NA if digital used)*	Weekly	N/A
7. Hardcopy Output Quality *(if hardcopy produced from digital data)*	Monthly	Pass
8. Visual Checklist	Monthly	Pass
9. Analysis of Fixer Retention in Film *(NA if digital used)*	Quarterly	N/A
10. Compression	Semi-annually	Pass
11. Repeat Analysis	Semi-annually	Pass
12. Screen-Film Contact *(NA if digital used)*	Semi-annually	N/A
13. Darkroom Fog *(NA if digital used)*	Semi-annually	N/A
14. Zero Alignment Test *(if required by manufacturer)*	Before each patient	Pass
15. Any additional tests required by manufacturer	As required by manufacturer	Pass

Medical Physicist's Recommendations for Quality Improvement

Comments: All aspects of this of this Stereotactic Breast Biopsy system are functioning in compliance with all State of California requirements and within all applicable requirements for Accreditation by the American College of Radiology for Stereotactic Breast Biopsy systems at this time.

The QC program is well established, current, and complete.

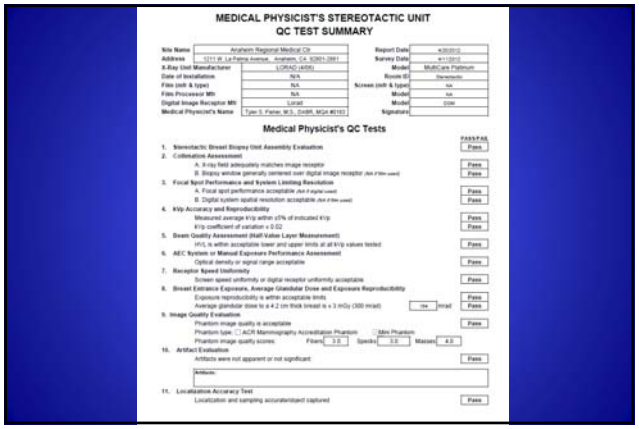
Clinical SBB Procedures - Upright System



Stereotactic image with needle in Pre-Fire Position

Stereotactic image post clip placement

Questions



MEDICAL PHYSICIST'S STEREOTACTIC UNIT
QC TEST SUMMARY

Medical Physicist's QC Tests

Question # 1

The half-value layer acceptable for 28 kVp with a Mo/Mo target/filter on a Stereotactic Breast Biopsy Unit is

- A: 0.25 mm Al
- B: 0.27 mm Al
- C: 0.35 mm Al
- D: 0.43 mm Al

Question # 1

The half-value layer acceptable for 28 kVp with a Mo/Mo target/filter on a Stereotactic Breast Biopsy Unit is

- C: 0.35 mm Al

Ref: ACR QC Manual for Stereotactic Breast Biopsy (1999), p. 68-69.

Question # 3

- Which of the following statements is correct regarding regulatory compliance requirements of SBB units?
- A: All SBB units must meet MQSA requirements
- B: All SBB units must be Accredited by the ACR
- C: All SBB units must meet State Regulatory Requirements
- D: All SBB units are exempt from all MQSA and State Regulatory Requirements

Question # 2:

- The Mean Glandular Dose calculated for a Mo/Mo target/filter combination on a Stereotactic Breast Biopsy Unit for a 512 x 512 matrix may not exceed
- A: 150 mrad
- B: 200 mrad
- C: 250 mrad
- D: 300 mrad

Question # 3

- Which of the following statements is correct regarding regulatory compliance requirements of SBB units?
- C: All SBB units must meet State Regulatory Requirements

Ref: ACR SBB Accreditation FAQ Website

Question # 2

- The Mean Glandular Dose calculated for a Mo/Mo target/filter combination on a Stereotactic Breast Biopsy Unit for a 512 x 512 matrix may not exceed
- D: 300 mrad

Ref: QC Manual for Stereotactic Breast Biopsy (1999), page 80.

Question # 4

- When using the “Mini” phantom for SBB unit image quality evaluation, which of the following options is the minimum acceptable image quality scores when viewed on a digital imaging system?
- A: 3 fibers, 3 speck groups, 2.5 masses
- B: 3 fibers, 3 speck groups, 3 masses
- C: 3 fibers, 3 speck groups, 4 masses
- D: 3.5 fibers, 3 speck groups, 3.5 masses

Question # 4

- When using the "Mini" phantom for SBB unit image quality evaluation, which of the following options is the minimum acceptable image quality scores when viewed on a digital imaging system?

- A: 3 fibers, 3 speck groups, 2.5 masses

Ref: ACR Stereotactic Breast Biopsy Quality Control Manual (1999), page 91.

Melissa C. Martin, M.S., FACR, FAAPM, FACMP

Therapy Physics, Inc.

879 West 190th St., Ste 400, Gardena, CA 90248

Office: 310-217-4114 Cell: 310-612-8127

e-mail: Melissa@TherapyPhysics.com

Question # 5

- When evaluating the AEC or Manual Exposure Control Performance with a uniform density phantom varying from 2 to 8 cm in thickness, the mean signal value range should not exceed which of the following?
- A: For phantoms of 2 to 6 cm thickness, the mean signal should be within +/- 15% of the mean signal value for the 4 cm phantom.
- B: For phantoms of 2 to 6 cm thickness, the mean signal should be within +/- 20% of the mean signal value for the 4 cm phantom.
- C: For phantoms of 4 to 8 cm thickness, the mean signal should be within +/- 15% of the mean signal value for the 4 cm phantom.
- D. For phantoms of 4 to 8 cm thickness, the mean signal should be within +/- 20% of the mean signal value for the 4 cm phantom.

Question # 5

- When evaluating the AEC or Manual Exposure Control Performance with a uniform density phantom varying from 2 to 8 cm in thickness, the mean signal value range should not exceed which of the following? .

- B: For phantoms of 2 to 6 cm thickness, the mean signal should be within +/- 20% of the mean signal value for the 4 cm phantom.

Ref: ACR Stereotactic Breast Biopsy Quality Control Manual (1999), page 71.