Learning Objective

- Become familiar with the recommendations and requirements of the ACR Stereotactic Breast Biopsy Accreditation Program (SBBAP) - 1999 Quality Control Manual Information
- By product of conducting Quality Control tests for Stereotactic Breast Biopsy units is greater familiarity with the operation and performance of your SBB system, particularly image quality and the accuracy of needle placement during SBB.
Geometry is reset for each patient.
Siemens (Fischer) MammoVision Biopsy System

Fixed relationship between Autoguide and breast support

Distance
Vertical angle
Horizontal angle

Spherical coordinate system

Don Jacobson 2/07
As of October 1, 2010, ACR has accredited 810 units at 789 facilities providing Stereotactic Breast Biopsy Procedures.

In 2009, the first attempt pass rate for new or renewing units was 81%. Almost all facilities pass on their second attempt at accreditation after taking appropriate corrective action to improve image quality.

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.

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.
**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

**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

**The Quality Assurance Team:**

- Physician
- QC Technologist
- Medical Physicist

**Medical Physicist’s Qualifications for SBBAP: Initial**

- Certification by ABR, ABMP in Diagnostic Medical Physics OR
- Alternate Education, Training and Experience AND
  - >6/1/97: Have Performed 1 SBB Survey Under the Guidance of a Medical Physicist Qualified to Perform SBB Surveys
  - <6/1/97: Have Performed 3 SBB Surveys
Medical Physicist Qualifications for SBBAP: Re-Accreditation After 3 Years

- At Least 1 SBB Physics Survey Per Year
- At Least 3 Hours of Continuing Education in SBB Physics
- Documentation of Above

Quality Control: Medical Physicist’s Evaluation

- Acceptance Test Before Patient Use
- Annually Thereafter
- Report Required as Part of ACR Application

Quality Control: Medical Physicist’s Evaluation

- The 1999 ACR SBB Quality Control Manual has a section for the Medical Physicist
- It has suggested Test Procedures, Forms, and Summary Report Format
- Detailed instructions on 11 Required Physicist’s tests

ACR Quality Control Manuals

- MRI QC Manual (2001)
- 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

- 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

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

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

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

Stereotactic Unit Assembly Evaluation

1. Stereotactic Biopsy Unit Assembly Evaluation
   (Y = yes, N = no, M = may, R = 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
Collimation Assessment

SID = 84 cm

| Digital |  |  |  |  |
|--------|  |  |  |  |
| Target |  |  |  |  |
| Left   |  |  |  |  |
| Right  |  |  |  |  |
| Anterior|  |  |  |  |
| Posterior|  |  |  |  |

Evaluation: Pass

Action Level: If any edge of radiation field deviates more than 2 mm from the edge of the image, adjust or re-center the collimator to ensure that the X-ray field is not larger than the image field.
Hologic requires at least 7 lp/mm resolution.
**Beam Quality Assessment**

<table>
<thead>
<tr>
<th>Nominal kVp setting</th>
<th>20</th>
<th>27</th>
<th>28</th>
<th>29</th>
<th>30</th>
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<tbody>
<tr>
<td>mAs setting</td>
<td>80</td>
<td>80</td>
<td>80</td>
<td>70</td>
<td>70</td>
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<tr>
<td>Time setting (sec)</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
</tbody>
</table>

**Exposure measurements:**
- HVL without aluminum, $E_0$ (mm Al)
- HVL with 0.2 mm of added aluminum, $E_1$
- HVL with 0.3 mm of added aluminum, $E_2$
- HVL with 0.5 mm of added aluminum, $E_3$

**Repeat HVL measurement, $E_H$:**

<table>
<thead>
<tr>
<th>HVL (mm Al)</th>
<th>0.40</th>
<th>0.50</th>
<th>0.60</th>
<th>0.70</th>
<th>0.80</th>
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</thead>
<tbody>
<tr>
<td>$E_1$</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>$E_2$</td>
<td>0.02</td>
<td>0.02</td>
<td>0.02</td>
<td>0.02</td>
<td>0.02</td>
</tr>
<tr>
<td>$E_3$</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>$E_H$</td>
<td>0.70</td>
<td>0.70</td>
<td>0.70</td>
<td>0.70</td>
<td>0.70</td>
</tr>
</tbody>
</table>

**Evaluation (Pass or Fail):**
- Pass

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**Beam Quality Specifications for SBB Units**

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

  **Action**
  - If measured HVL < $\frac{kVp}{100}$ (in mm Al)
  - If measured HVL ≥ $\frac{kVp}{100} + C$ (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.

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**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 due to 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

"Mini" Stereotactic Breast Biopsy Accreditation Phantom

Chest Wall Side

SBBAP Testing Criteria

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

<table>
<thead>
<tr>
<th></th>
<th>MAP Phantom</th>
<th>Mini Phantom</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>F/S Digital</td>
<td>F/S Digital</td>
</tr>
<tr>
<td>Fibers</td>
<td>4.0 5.0</td>
<td>2.0 3.0</td>
</tr>
<tr>
<td>Speck</td>
<td>3.0 4.0</td>
<td>2.0 3.0</td>
</tr>
<tr>
<td>Groups</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Masses</td>
<td>3.0 3.5</td>
<td>2.0 2.5</td>
</tr>
</tbody>
</table>

Image Quality for SBB Units

- RMI 156 or NA 18-220
  - MAP Phantom
NA 18-250 Mini-Phantom

RMI 156 Accreditation Phantom

AEC or Manual Exposure Performance

2 cm Thickness
AEC or Manual Exposure Performance

4 cm Thickness - Also used for Uniformity and Artifacts

6 cm Thickness 8 cm Thickness

Performance Capability

<table>
<thead>
<tr>
<th>Performance Capability</th>
<th>Imaging Mode</th>
<th>Penumbras</th>
<th>x</th>
</tr>
</thead>
<tbody>
<tr>
<td>Action Limit (Digital):</td>
<td>Digital</td>
<td>Large</td>
<td></td>
</tr>
<tr>
<td>Action Limit (Screen-Film):</td>
<td>Screen-Film</td>
<td>Large</td>
<td></td>
</tr>
</tbody>
</table>

- 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 Requirements

For Units with ROI statistics measurement capability:

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

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

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
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**

**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**

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

# Localization Accuracy (Gelatin Phantom) Test

## Object Capture

Was the object captured? **Yes**

Active Limit: If the biopsy needle captures the target lesion, then the unit passes. If not, the needle must be re-positioned.

Type B images (fluoroscopic) attempt to demonstrate the needle tip or sampling catch for a lesion in the gelatin tissue, or the target lesion, if the lesion should be selected.

Evaluation (Pass or Fail): **Pass**
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 *Correct*
- D: 0.43 mm Al

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 #2

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 #3
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

When evaluating the AEC or Manual Exposure Control Performance with a uniform density phantom varying from 2 to 6 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.