

**STEREOTACTIC CORE
BIOPSY:
PATIENT POSITIONING AND
TARGETING**

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**STEREOTACTIC BIOPSY:
POSITIONING**

Positioning goals

- Center and visualize the abnormality
- Ensure adequate breast parenchyma to accommodate the biopsy device
- Optimally, to fire the biopsy device within the breast

**STEREOTACTIC BIOPSY:
POSITIONING**

The most important factor in positioning is a skilled and knowledgeable technologist.

**STEREOTACTIC BIOPSY:
POSITIONING**

Motion must be eliminated: the successful performance of the procedure depends on identifying a unique point in space on the stereo images and having it not move

- Contributes to failure to sample the target
- Prolongs the procedure
- Increases patient dose
- If motion has occurred, you must be able to recognize it immediately

**STEREOTACTIC BIOPSY:
POSITIONING**

Preventing motion

- Patient education
- Take the time to ensure as much comfort as possible with positioning
- Mark the breast at all four corners of the compression paddle fenestration as an immediate visual cue to motion

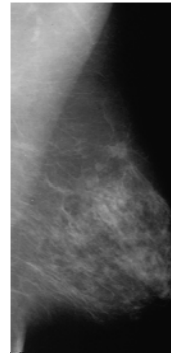
**STEREOTACTIC BIOPSY:
POSITIONING**

Patient comfort

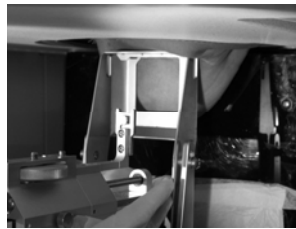
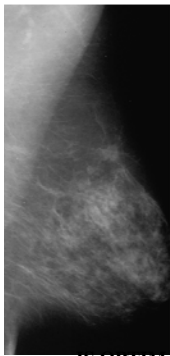
- Use the bathroom
- Remove earrings and glasses
- Support the patient's neck (not her head)
- Sponge or thin cushion between the ribs and the table
- Thin pillow beneath the stomach to relieve pressure on the back
- Support ankles
- Offer a blanket

STEREOTACTIC BIOPSY: POSITIONING

- Standard positioning approach is similar to that used for needle localization
- Obtain orthogonal views
- Determine shortest approach to the lesion (superior, inferior, medial or lateral)
- Position



LESION SEEN
SUPERIORLY
IN THE BREAST....



IS OPTIMALLY APPROACHED FROM THE
SUPERIOR CC APPROACH

STEREOTACTIC BIOPSY: POSITIONING

Compression in positioning

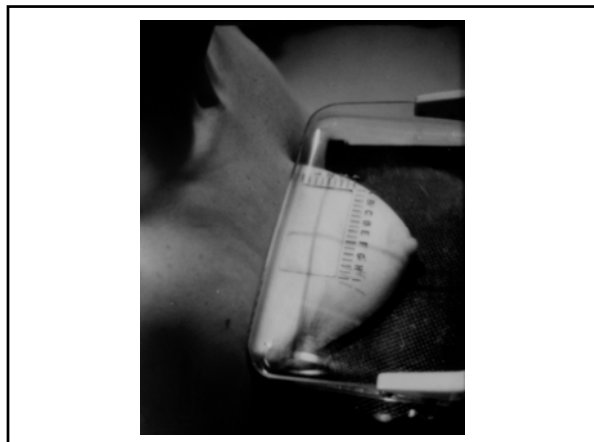
- Holds breast immobile
- Tightens skin to facilitate passage of the biopsy device
- The same degree of compression needed for diagnostic mammography is *not necessary* for stereotactic biopsy (**remember** you need to maintain adequate thickness for accommodation and firing of the biopsy device...)

STEREOTACTIC BIOPSY: POSITIONING

- If the lesion is *much better seen in one projection vs the other*, choose that projection even if it does not represent the shortest distance.
- **REMEMBER:** your overriding goal is to perform the biopsy safely and successfully.
- You should *always have the complete diagnostic mammogram* available to you in the procedure room so that you can easily switch to an alternative approach with the diagnostic imaging as a reference.

STEREOTACTIC BIOPSY: POSITIONING

- The aperture of the biopsy compression plate affords a limited field of view.
- If you are having trouble locating the lesion in the aperture, particularly in a large breast, consider localizing the lesion in a standard mammography unit with the needle localization paddle placing a BB to mark the lesion and marking the skin at the edges of the fenestration. Using these reference points, position the patient in the stereotactic window.



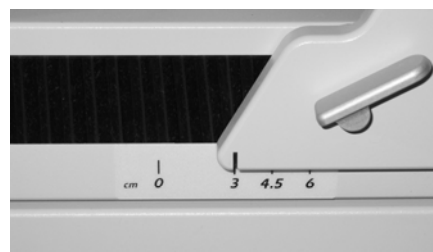
STEREOTACTIC BIOPSY: POSITIONING

- Attempt to center the lesion in the horizontal (“X”) plane within the biopsy window.
- More important in breasts of greater compressed thickness
- Helps minimize chances that the lesion will move out of the field of view when the stereo paired images are obtained and directional shift occurs.

STEREOTACTIC BIOPSY: POSITIONING

To help assist with visualization of a lesion despite directional shift, the breast support should be adjusted to reflect the approximate compressed breast thickness

- 3.0 cm
- 4.5 cm
- 6.0 cm



THE BREAST SUPPORT SHOULD BE ADJUSTED FOR THE APPROXIMATE COMPRESSED BREAST THICKNESS

STEREOTACTIC BIOPSY: POSITIONING

- Centering the lesion in the biopsy window in the vertical (“Y”) plane is not necessary as no directional shift should occur in this direction.
- If it appears that directional shift in the Y direction has occurred, this should alert the operator to check for patient motion between the two stereo paired images or the possibility that the same unique point in space is not being selected on both stereo paired images.

STEREOTACTIC BIOPSY: POSITIONING

Blood vessel projecting over a lesion on the scout image:

- The vessel may only be projecting over the lesion in a given approach to the lesion: correlate with the mammogram
- If in doubt, target the lesion and then target the vessel to determine their relative location
- Roll or reposition the breast as necessary

STEREOTACTIC BIOPSY: POSITIONING

- When positioning, attempt to fill the entire breast biopsy window with tissue
- Compression from all sides helps to stabilize the breast for needle insertion
- Motion is decreased
- Entire x-ray field is covered, reducing scatter and preventing premature cut out of the beam (which results in a digital image with greatly restricted latitude—impairing lesion visualization)

STEREOTACTIC BIOPSY: POSITIONING

X-ray technique

- Recognize that conditions of stereotactic biopsy cannot duplicate the ideal conditions under which the diagnostic imaging was done
- Loss of subject contrast due to decreased compression and increased thickness over the area of interest
- Increased geometric unsharpness due to increased object-to-image receptor distance
- Increased scatter

STEREOTACTIC BIOPSY: POSITIONING

AEC

Automatic Exposure Control

STEREOTACTIC BIOPSY: POSITIONING

Remember:

- You are not restricted to four positioning approaches
- A table that provides 360 degree excursion of the C-arm provides the greatest flexibility for achieving successful positioning.

**STEREOTACTIC BIOPSY:
POSITIONING**

Non-standard positioning approaches should be considered in situations of:

- Non-visualization of the lesion
- Challenging location to access
- Inadequate compression thickness

**STEREOTACTIC BIOPSY:
POSITIONING**

- Use common sense
- Apply technical expertise
- Be creative!

**STEREOTACTIC BIOPSY:
POSITIONING**

**CHALLENGES IN
POSITIONING**

**STEREOTACTIC BIOPSY:
POSITIONING**


Breast compression is not sufficient to accommodate or to permit firing of the device within the breast

- Redistribute the breast parenchyma (roll the breast on itself or use bolsters)
- This technique works best if the patient has a fairly large breast which becomes “pancaked” on compression

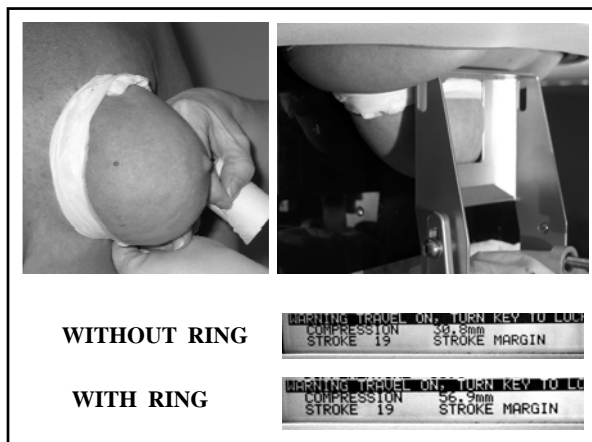
**STEREOTACTIC BIOPSY:
POSITIONING**

Breast compression is not sufficient to accommodate or to permit firing of the device within the breast

- Use the “sling” technique if the lesion is posterior
 - Almost always requires silly putty on the receptor to prevent saturation
- Use the “ring” technique if the lesion is anterior



**SLING TECHNIQUE:
APPROPRIATE FOR POSTERIOR LESIONS
WITH LIMITED BREAST COMPRESSION THICKNESS**



STEREOTACTIC BIOPSY: POSITIONING

Breast compression is not sufficient to accommodate or to permit firing of the device within the breast

- If the breast is small, try rolling the patient more steeply into an RAO or LAO position to allow the side of breast you have selected for your approach to fall into the table aperture
- Support with a positioning wedge to allow rib cage to relax

STEREOTACTIC BIOPSY: POSITIONING

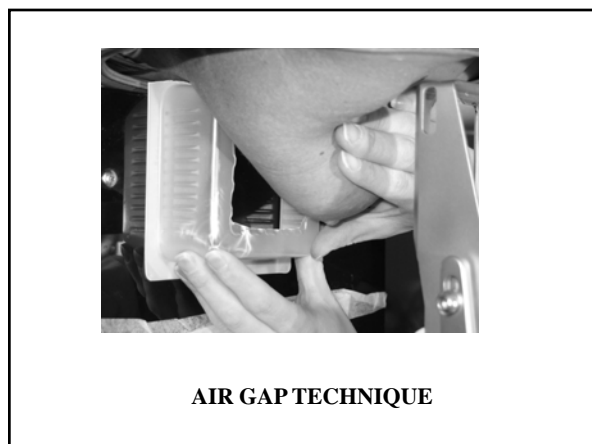
Breast compression is not sufficient to accommodate or to permit firing of the device within the breast

- An oblique approach may provide sufficient thickness, particularly if the breast can be drawn further into the table aperture.

STEREOTACTIC BIOPSY: POSITIONING

Breast compression is not sufficient to accommodate or to permit firing of the device within the breast

- The “air gap” technique can be tried
- Described by Parker: a space is created between the far side of the breast and the breast support (they use a reversed compression paddle) to ensure that the needle will not strike the breast support



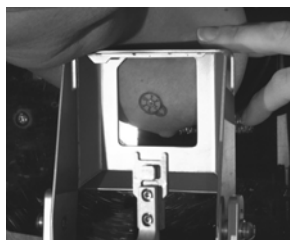


AIR GAP TECHNIQUE

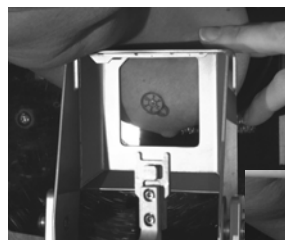
STEREOTACTIC BIOPSY: POSITIONING

Breast compression is not sufficient to accommodate or to permit firing of the device within the breast

- If the lesion is in a subareolar or periareolar location roll the breast onto itself to increase compressed breast thickness and to fill the biopsy window
- The nipple *does not* have to be in profile



PERI-AREOLAR OR SUBAREOLAR LESION



...ROLL THE BREAST

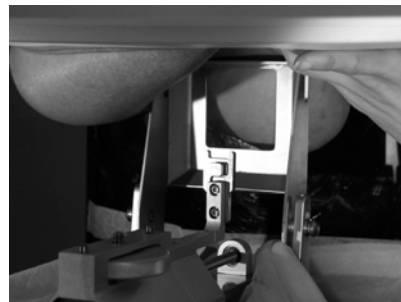
...THE NIPPLE DOES **NOT** HAVE TO BE IN PROFILE



STEREOTACTIC BIOPSY: POSITIONING

The lesion is medial in location

- Pull the contralateral breast partially through the table aperture as well to give increased mobility to the medial aspect of the ipsilateral breast.
- Be careful to protect the nipple-areolar complex of the contralateral breast as you roll it partially through the aperture.



APPROACHING THE MEDIAL LESION

**STEREOTACTIC BIOPSY:
POSITIONING**

The lesion is posterior in location

- A heavy breast will tend to be pulled into the table aperture by gravity as long as the rib cage is relaxed
- Roll the patient into an RAO or LAO position to preferentially dip the medial or lateral aspect of the breast into the aperture. Secure position with positioning wedge

**STEREOTACTIC BIOPSY:
POSITIONING**

The lesion is posterior in location

- If the patient is sufficiently thin, drop her arm and shoulder through the table aperture
- Support the arm with a sling or the handle of a stool to allow the rib cage to relax
- The shoulder may be in the way on one of the stereo paired images: if so, use the “target on scout” technique

**STEREOTACTIC BIOPSY:
POSITIONING**

The lesion is posterior in location

- Try an oblique approach in which the x-ray beam assumes an LMO (sup -> inf or inf -> sup) approach
- This deserves a try particularly if the lesion is in the upper outer quadrant posteriorly
- This approach also tends to give increased compression thickness



UPPER OUTER QUADRANT POSTERIOR LESION



**UPPER OUTER QUADRANT POSTERIOR LESION
INFERIOR->SUPERIOR LMO APPROACH**



UPPER OUTER QUADRANT POSTERIOR LESION

STEREOTACTIC BIOPSY: POSITIONING

The lesion is inferior and posterior in location.

- Pull the abdominal tissue partially through the table aperture to increase the mobility of this region facilitating positioning
- Provides additional compression thickness as well.

STEREOTACTIC BIOPSY: POSITIONING

The breast is slipping in the compression paddle

- If the patient is slipping in the compression paddle, wipe the skin with benzoin solution to help adhere it to the compression paddle
- This will allow you to use the minimal necessary compression to maximize compressed thickness

STEREOTACTIC BIOPSY: POSITIONING

- Use common sense
- Apply technical expertise
- Be creative!

TROUBLESHOOTING

STEREOTACTIC BIOPSY: TROUBLESHOOTING

Attention to patient selection can prevent trouble before it happens:

- Check patient weight
- Check for comorbid conditions precluding prolonged prone positioning
- Check anti-coagulation status
- Ensure that the diagnostic workup has been thorough and complete

STEREOTACTIC BIOPSY: TROUBLESHOOTING

Inability to see the abnormality on the scout image

- tissue in the fenestrated window is not directly compressed
- landmarks may be difficult to identify
- placement of a skin marker in a standard mammographic localization window may be helpful

STEREOTACTIC BIOPSY: TROUBLESHOOTING

Inability to identify the reference point

- You **must** be able to identify the reference markers in order to proceed with the biopsy
- The reference point (in conjunction with the the identification of the lesion on the scout images) allows the computer to perform the mathematical calculation of the parallax shift (and thus determine the Z coordinate)

STEREOTACTIC BIOPSY: TROUBLESHOOTING

Inability to identify the reference point

- usually due to obscuration by chest wall tissue draped over the site of the reference marker: tape the redundant tissue to the undersurface of the table
- Also ensure that the compression paddle is securely seated in a perpendicular fashion and is not angled (visually inspect for angulation)

STEREOTACTIC BIOPSY: TROUBLESHOOTING

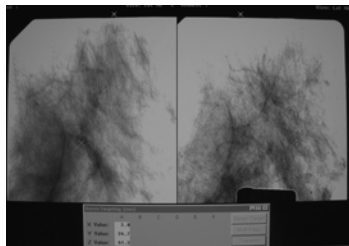
The small breast does not fill the biopsy window and even with digital image manipulation you cannot see parenchymal detail

- If practical, reposition (you almost always get more filling of the window from the lateral approach)
- Apply silly putty (or modeling clay) to any areas of the biopsy window where there is no breast tissue (attenuate the x-ray beam and minimize premature tube cut out)

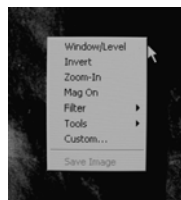
STEREOTACTIC BIOPSY: TROUBLESHOOTING

The lesion is too faint to see

- Is it **really** in the window?
- You *almost never* have to increase the imaging matrix from 512 to 1024 (dose increases significantly when you do)
- Use AEC
- Make use of the digital imaging manipulation features
 - Filter
 - Sharpening
 - Window / Level
 - Image inversion



TAKE ADVANTAGE OF THE FLEXIBILITY
OF DIGITAL IMAGING TO INCREASE
THE VISIBILITY OF THE LESION



STEREOTACTIC BIOPSY: TROUBLESHOOTING

Abnormality seen only on one stereo image:

- may be silhouetted by adjacent parenchyma (release and reposition).
- may be projecting off the lateral edge of the image due to directional movement (check left to right centering). Reposition as needed.

STEREOTACTIC BIOPSY: TROUBLESHOOTING

Abnormality seen only on one stereo image:

- Make sure you have the breast support set at the correct approximate thickness.
- If all else fails, scout from a different position.

STEREOTACTIC BIOPSY: TROUBLESHOOTING

Abnormality seen only on one stereo image:

- You do have the option to “**target on scout**” meaning that you can obtain your coordinates using the scout image and one of the stereo paired images
- Recognize that precision of targeting decreases as the angle of excursion between the reference images being used to target decreases.

STEREOTACTIC BIOPSY: TROUBLESHOOTING

The “Z” coordinate is a negative number

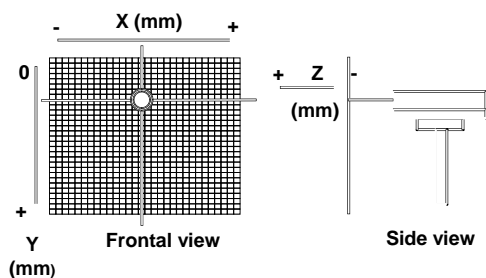
- Was the stereo pair acquired in the wrong order? Retake the stereo pair.
- Did you target the same unique point on both images? Retarget—more than one point, if possible.
- Is the lesion in the skin? Perform a formal skin localization (calcifications) or ultrasound with an offset pad (mass) for confirmation.

STEREOTACTIC BIOPSY: TROUBLESHOOTING

Perform an ongoing “reality check” with the targeting coordinates

- The X and Y coordinates should correspond to the quadrant of the window where you see the lesion
- The Z coordinate should be *less than half* the total compression thickness **if you chose the shortest approach to the lesion**
- The Z coordinate should *never be negative* (X coordinate can be negative)

STEREOTACTIC COORDINATES



STEREOTACTIC BIOPSY: TROUBLESHOOTING

Incorrect Z coordinate leading to sampling error:

- Can be very difficult to recognize on the imaging
- the principle of stereotaxis is predicated on identification of the same point in space on both planar stereo images

STEREOTACTIC BIOPSY: TROUBLESHOOTING

Incorrect Z coordinate leading to sampling error:

- Be familiar with the expected spatial orientation of your biopsy device with respect to the target in the pre-fire and post-fire positions.
- Small targets are often obscured by the larger biopsy devices. Use your target cursors projected over the device as a reference. If the patient and the lesion have not moved, they will accurately reflect the position of the lesion with respect to the sampling chamber of the device.

PRE-FIRE IMAGES

-15°

$+15^\circ$

**EXPECTED PROBE POSITION:
PRE-FIRE**

POST-FIRE IMAGES

-15°

$+15^\circ$

Good Position

**EXPECTED PROBE POSITION:
POST-FIRE**

	A	B	C	D	E	F	Stereo Target
X Value:	-3.3						
Y Value:	22.2						
Z Value:	31.7						

STEREO PAIR WITH TARGET CURSORS

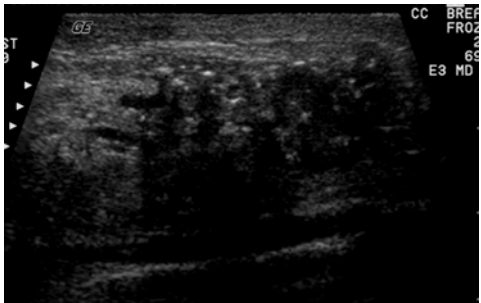
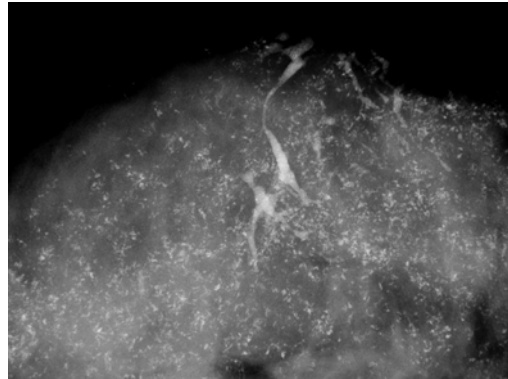
**PRE-FIRE STEREO PAIR
WITH TARGET CURSORS VIEWED**

**POST-FIRE STEREO PAIR
WITH TARGET CURSORS VIEWED**

STEREOTACTIC BIOPSY: TROUBLESHOOTING

Is your target abnormality too diffuse?

- A large or extensive abnormality can be difficult or impossible to sample on stereotactic biopsy. The *same unique point* must be targeted on both stereo pair images in order for the calculated depth to be accurate. An extensive, diffuse abnormality decreases the likelihood that you will target the same unique point on both images.



STEREOTACTIC BIOPSY: TROUBLESHOOTING

Negative stroke margin

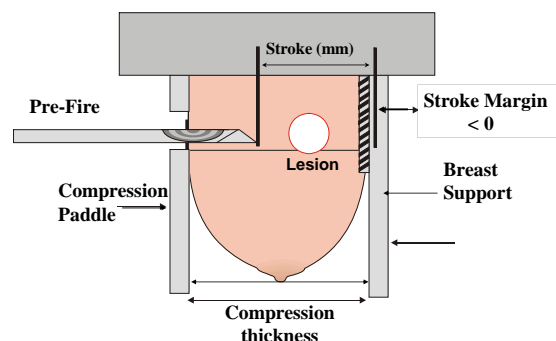
- Make sure your compression is not overly aggressive
- *Redistribute* the breast parenchyma in the Z axis
- Reposition, in particular try an oblique approach

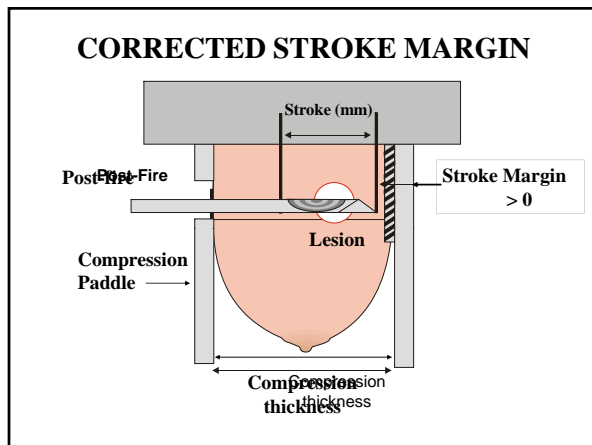
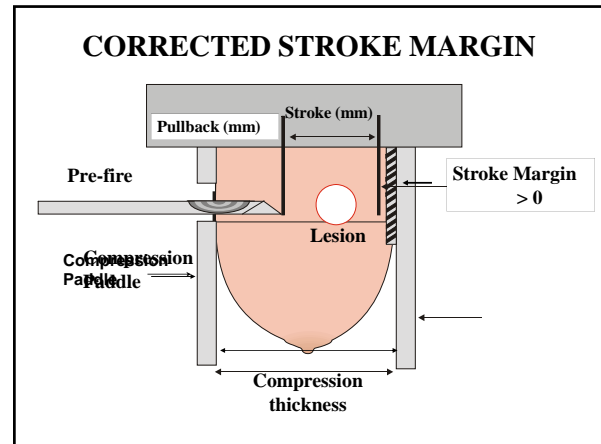
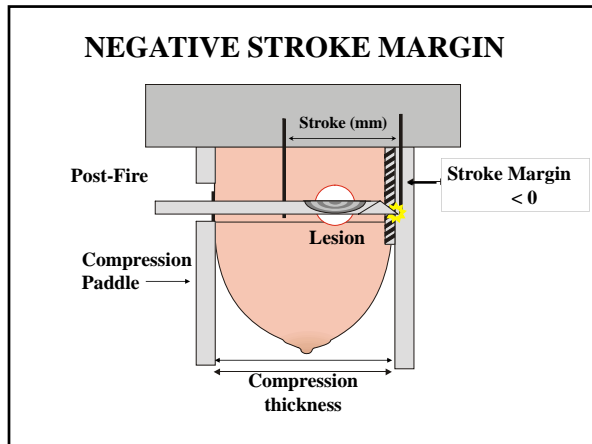
STEREOTACTIC BIOPSY: TROUBLESHOOTING

Negative stroke margin

- Can you fire from an offset position (so that the lesion will overlie the distal aspect of the sampling chamber)? *You must be familiar with your device specifications.*
- Use a device with a shorter stroke (benefits of familiarity with more than one device)

NEGATIVE STROKE MARGIN





STEREOTACTIC BIOPSY: TROUBLESHOOTING

Negative stroke margin

- As a last resort, fire the device outside the breast and advance it into the breast to the post-fire position **BUT BEWARE**
- Failure to retrieve the target lesion increases significantly if the device is fired outside the breast ¹
 - > 1% of cases with device fired within the breast
 - > 12% of cases with device fired outside the breast

¹Liberman et al *Radiology*, July 1998

STEREOTACTIC BIOPSY: TROUBLESHOOTING

Target lesion is superficial

- REMEMBER:** The entire sampling chamber must be covered or the vacuum will not engage and you will retrieve no sample or very scanty samples

STEREOTACTIC BIOPSY: TROUBLESHOOTING

Target lesion is superficial

- Can you target from another approach where the Z will not be too superficial?
- Try to offset the sampling chamber more distally into the breast (*make sure you have adequate compression thickness* as this maneuver effectively increases your stroke by the amount of the offset)
- Some devices have a “half sample” feature or can be adapted with a cuff to cover part of the sampling chamber

STEREOTACTIC BIOPSY: TROUBLESHOOTING

Target lesion is superficial

- Try raising a large skin wheal with the local anesthetic (can add several mm)
- Use as small a skin nick as possible to establish an occlusive seal
- Advance the device deep to the target and then pull back, attempting to tent the skin proximally on the device (can be facilitated with skin hooks if necessary)

STEREOTACTIC BIOPSY: TROUBLESHOOTING

Inaccurate needle position in the pre-fire or post-fire position:

- errors in the X and Y axes are easily discernible
- if only a few mm off: *directed sampling*
- if greater than a few mm off: correct (either manually or by re-targeting) and repeat stereo paired images to ensure accurate positioning

POST-FIRE IMAGES -15° +15°

**PROBE TO THE RIGHT OF THE
LESION: + X ERROR**

POST-FIRE IMAGES -15° +15°

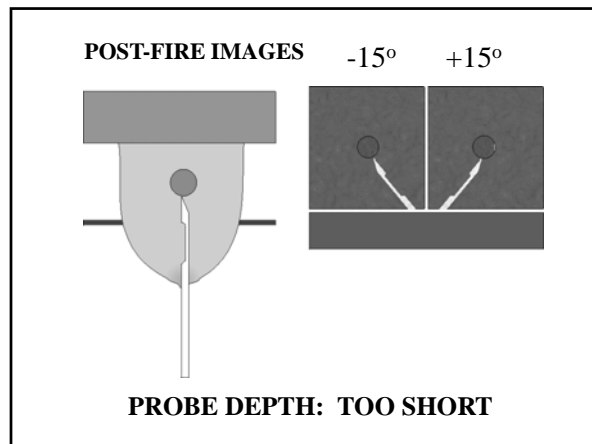
**PROBE TO THE LEFT OF THE
LESION: - X ERROR**

POST-FIRE IMAGES -15° +15°

**PROBE ABOVE THE LESION:
- Y ERROR**

POST-FIRE IMAGES -15° +15°

**PROBE BELOW THE LESION:
+ Y ERROR**



STEREOTACTIC BIOPSY: TROUBLESHOOTING

No target on specimen radiograph: sampling error

- Take and assess post-sampling stereo paired images (back the probe up to facilitate visualization)
 - If you see the lesion, you can *re-target and resample*
 - If you don't see the lesion remove the probe and gently flush it (retrieve and image any tissue)

STEREOTACTIC BIOPSY: TROUBLESHOOTING

Why did you miss it?

- Machine is not properly calibrated
- Non-accurate lesion targeting
- Patient moved: check skin markings at the aperture
- Lesion moved

STEREOTACTIC BIOPSY: TROUBLESHOOTING

Why did you miss it?

- Lesion moved:
 - Displaced by anesthetic (deliver anesthetic in "equal and opposite" fashion)
 - A very firm lesion may be displaced by the needle rather than pierced by it: snowplowing (much more common when device is fired outside the breast)

STEREOTACTIC BIOPSY: TROUBLESHOOTING

The target is on specimen radiograph but the pathologist sees no calcifications in the specimen: ? sampling error

- Calcium may be lost during tissue processing
- The tissue may be incompletely sectioned (radiograph the paraffin blocks)
- Calcium may be in the form of calcium oxalate crystals which may require review with polarized light microscope for visualization

STEREOTACTIC BIOPSY: TROUBLESHOOTING

The clip did not deploy

- Did you make this determination on the post-sampling stereo pair? The clip may be obscured by the sampling device. Dial it back and obtain another stereo pair
- If you still see no clip, deploy another clip (be careful to follow all deployment instructions)

STEREOTACTIC BIOPSY: TROUBLESHOOTING

The clip is not in the right place

- Did you remember to adjust the Z position of the device as recommended by the manufacturer? (amt varies by device)—the “accordion effect”
- Is there any lesion left to target?
- If the lesion is no longer visible on orthogonal mammograms, is there post-procedural change (air or hematoma)? You may be able to see this under ultrasound to deploy a tissue marker



STEREOTACTIC BIOPSY: TROUBLESHOOTING

- The greater your familiarity with your equipment and the fundamentals of the procedure, the better your ability will be to troubleshoot during the procedure
- The ability to troubleshoot enables you to successfully complete that last 10-15% of cases that you would otherwise cancel