

# STEREOTACTIC BIOPSY

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## OBJECTIVES

- DEFINING BREAST BIOPSIES
- PRINCIPLES OF STEREOTACTIC BIOPSY
- DIFFERENCES BETWEEN SYSTEMS
- TARGETING ERRORS
- PATIENT PREPARATION
- QUALITY CONTROL
- ACR ACCREDITATION

## What is Image Guided Breast Biopsy

The use of an imaging modality to  
guide a sampling device into the  
breast to remove tissue

## IMAGE GUIDED BREAST BIOPSY TYPES

- Stereotactic Mammography
  - Prone Dedicated Tables
  - Upright Add-on Units
- Ultrasound
- MRI

## Benefits of Core Breast Biopsy

- Reduced complications
- No post-procedure disability
- Improved cosmesis
- Eliminates distortion of breast tissue that might make interpretation of a mammogram difficult.
- Reduced costs
- Permits optimal preoperative planning when there is a definitive diagnosis of cancer.

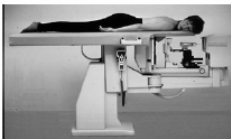
- Can be performed in an outpatient setting or doctor's office.
- Local anesthesia
- No stitches
- Single needle insertion to collect a sufficient amount of breast tissue for an accurate diagnosis (uses vacuum-assistance).
- Ability to mark biopsy site.

## STEREOTACTIC BIOPSY PRONE UNITS



## Stereotactic Equipment Dedicated Prone Systems *Tables*

- Fischer Mammovision
- Lorad Stereoguide



## UPRIGHT UNITS

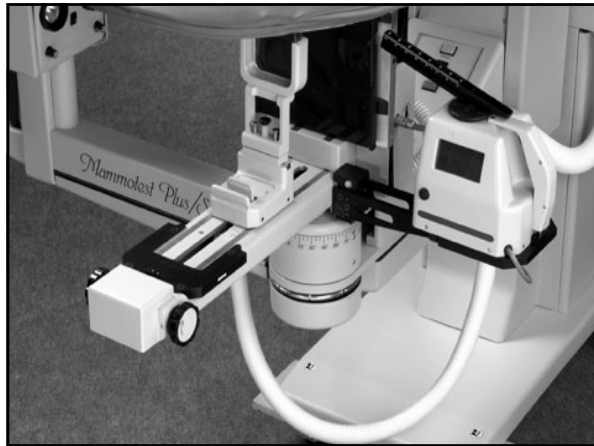


## System Differences

Prone System	Upright System
Requires extra space	No additional Space
Prone	Sitting/recumbent
Radiologist work under (eye level with Pt)	Radiologist next to patient
Procedure Time 30 min	Procedure Time 15 min
Unit costly 140K	Unit cost 20-100K

## System Differences

• 360/270 Access	No limitations
• DICOM Compatible	DICOM Compatible
• Patient Comfort	Patient Comfort
• Less likely for patient to Vasovagal	More likely for patient to vasovagal
• Does not tie up a mammogram unit	Tie up mammogram unit/cause sch.delays



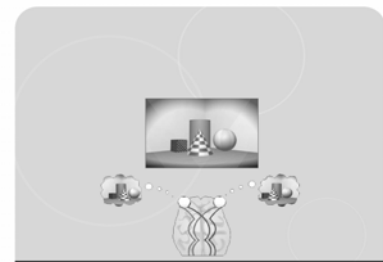
## Principles of Stereotactic

The science of **Stereology** deals with the transformation of 2-D observations to 3-D information using mathematical, statistical and geometrical tools.

## Stereotactic Principles

Through the measurement of the parallax shift of the targeted area from the first to the second stereotactic image, the computer software allows for the calculation of the three dimensional position within the breast- the three axis.

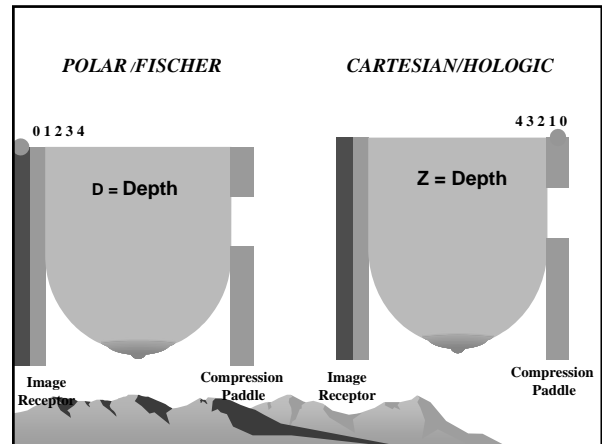
Each eye captures its own view. The two separate images are sent to the brain for processing. The two images arrive simultaneously and are united into one picture.



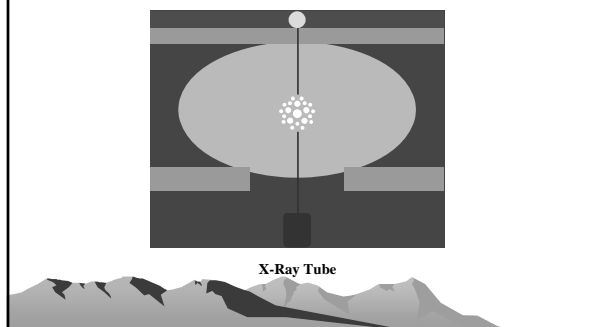
## Reference Point

The coordinates are determined from reference point.

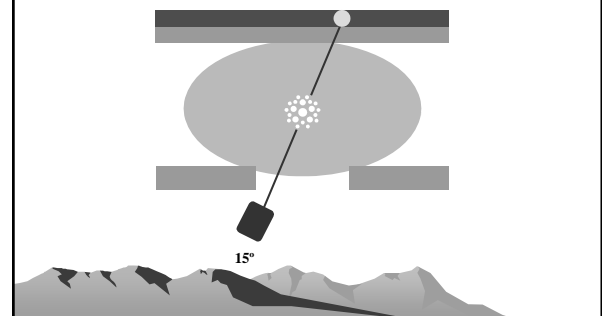
- **Breast Support** (*Polar Coordinates*): Determines the depth from the **distal** aspect of the breast.
- **Compression Paddle** (*Cartesian Coordinates*): Determines the depth from the **proximal** aspect of the breast.



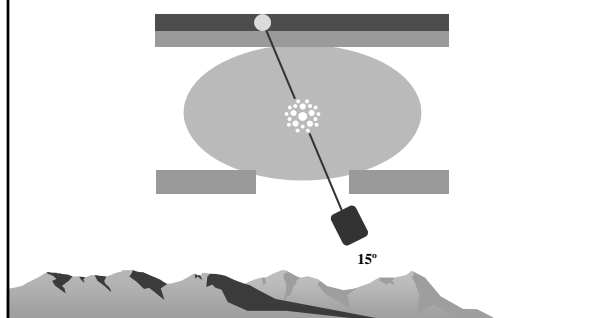
## Scout Image



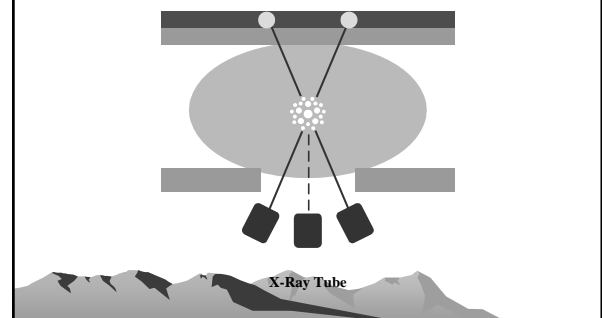
## Parallax Shift

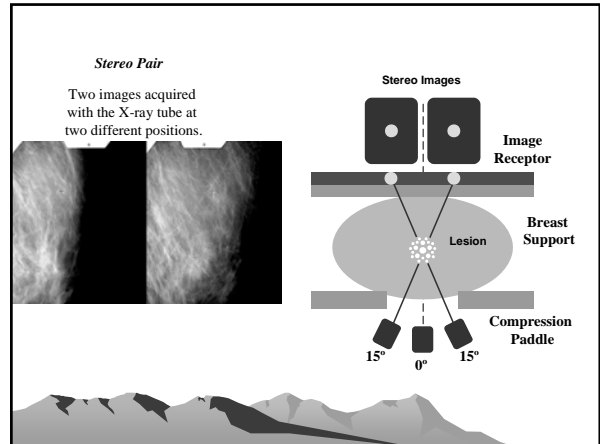
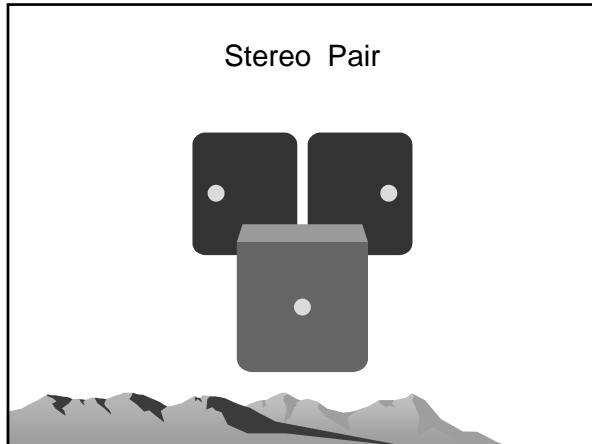


## Parallax Shift



## Parallax Shift





### COORDINATE SYSTEMS PRONE TABLES

Coordinate systems are used to target a precise location in the breast for the biopsy needle. Stereotactic localizations are accurate to within 1mm.

Two types of coordinate systems are used in stereotactic guidance

- Cartesian (Hologic)
- Polar (Siemens/mammotest/Fischer)

### CARTESIAN

- The Cartesian coordinate system defines the target using distances from the 3 axes that intersect at the right angles x,y,z.
- X =Horizontal
- Y=Vertical
- Z=Depth

- This system is advantageous because it is intuitive and familiar to operators.
  - It is simple to use
  - The needle position can be easily adjusted
  - Stereo Image Pair along x axis
  - Positive Stereo View (+) is the technologist right
  - Negative Stereo View (-) is the technologist left

### Cartesian

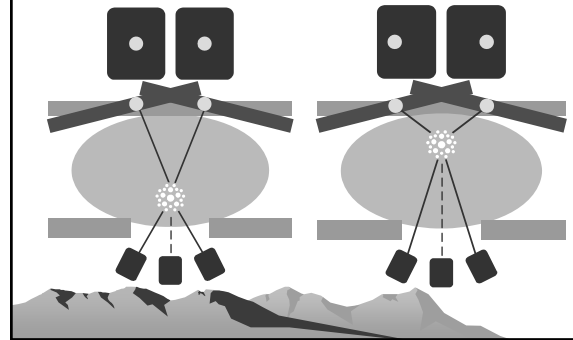
- Non-fixed image receptor
- Lens coupling device
- Bi-directional patient positioning

## Cartesian

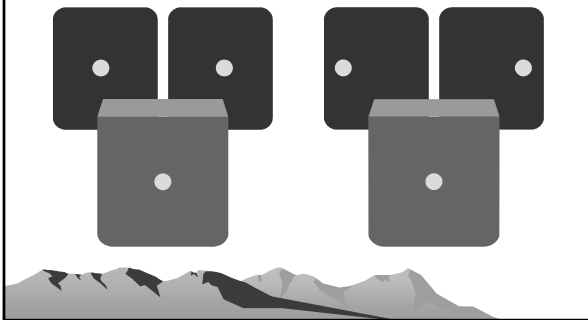
- **Lesion "Shift"**
- If the lesion "shifts" a **small** amount, then the lesion is an anterior lesion.
- If the lesion shifts a **large** amount, then the lesion is a posterior lesion.



## Cartesian Parallax Shift



## Cartesian



## POLAR

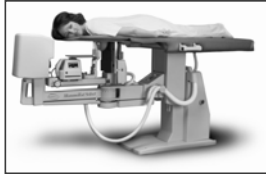
- The polar coordinate system defines a target by distances from a fixed point and the angular distances from a reference line.
- Coordinates are represented by H,V and D.
  - H Horizontal plane
  - V Vertical Plane
  - D Depth



- The polar system is accurate
- More difficult for the user to notice errors
- Needle position not as easily adjusted may required a second set of targets
- The stereo image pair is represented by H (horizontal )
  - Positive (+) stereo image: Technologist's left
  - Negative (-) stereo image: Technologist's right



## Polar System

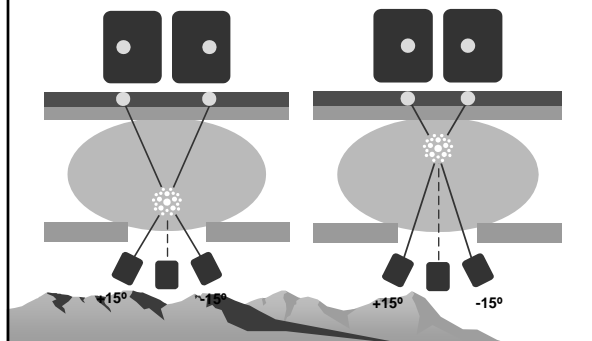


- Fixed image receptor
- Fiber-optic coupling device.
- Uni-directional patient position.

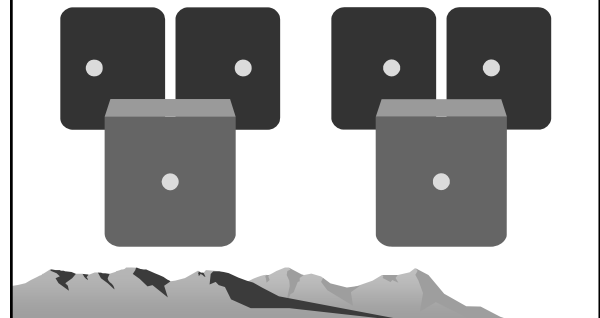
## Polar

- **Lesion "Shift"**
- If the lesion "shifts" a **large** amount, then the lesion is an anterior lesion.
- If the lesion shifts a **small** amount, then the lesion is a posterior lesion.

## Polar Parallax Shift



## Polar Parallax Shift



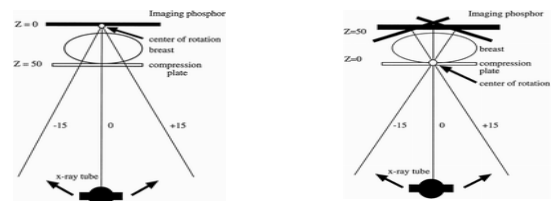
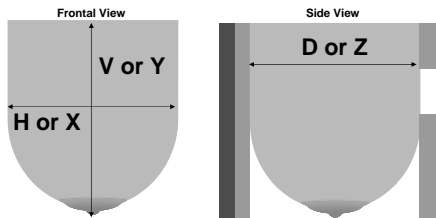
## Two Coordinate Systems

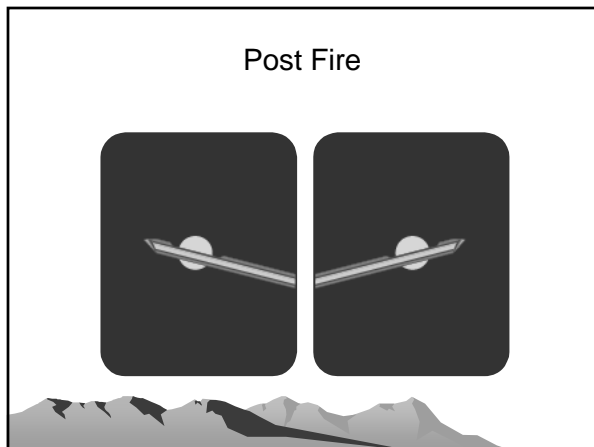
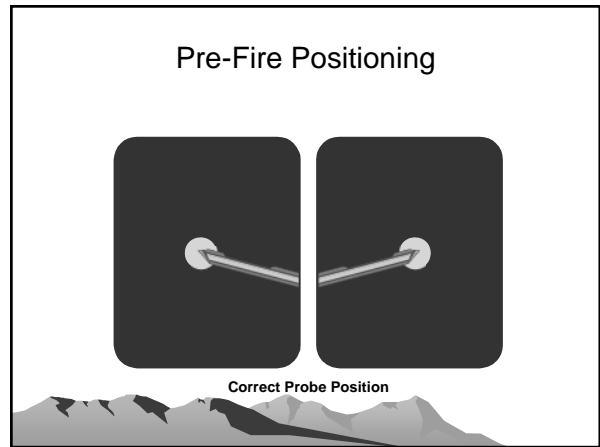
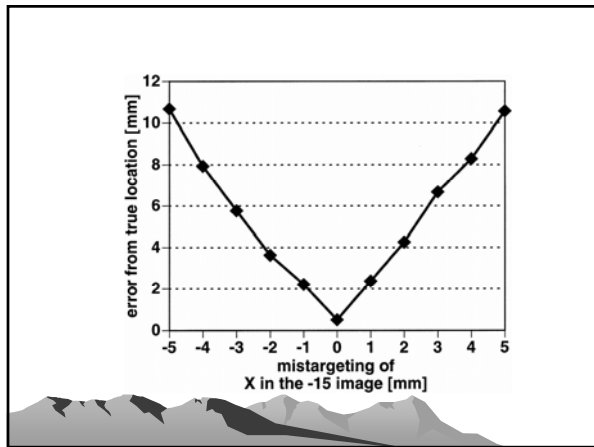
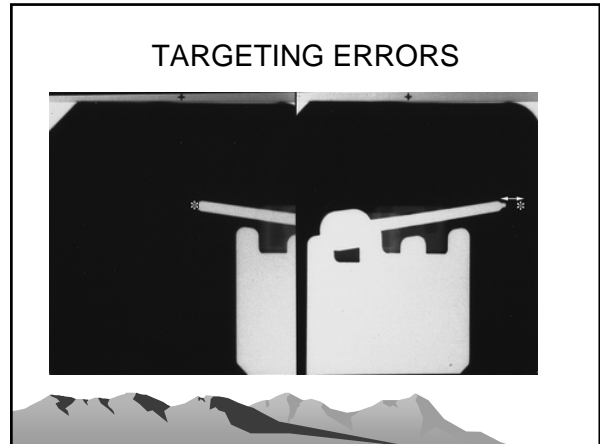
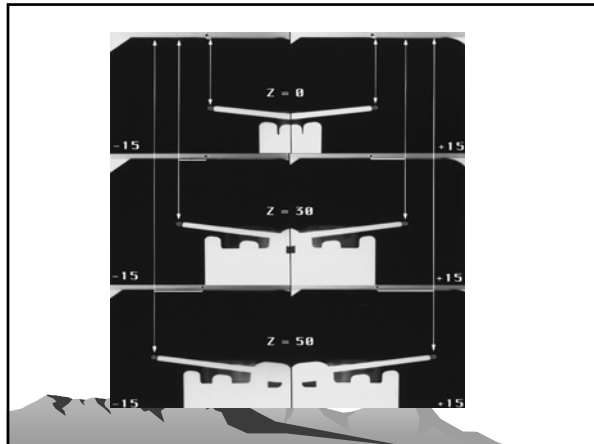
### Polar Coordinates

H=Horizontal  
V=Vertical  
D=Depth

### Cartesian Coordinates

X=Horizontal  
Y=Vertical  
Z=Depth





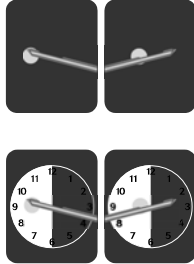
### -X/Horizontal Error

- Probe aperture is to the left of the center of the lesion on both (-) and (+) 150 images. Sampling should be increased
- between 12:00 – 6:00 going through 3:00



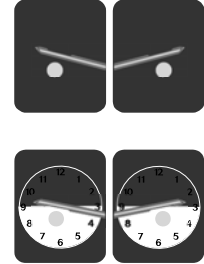
### *+X/Horizontal Error*

- Probe aperture is to the right of the center of the lesion on both the (-) and (+) 15o images.
- Sampling should be increased
- between 12:00 – 6:00 going through 9:00.



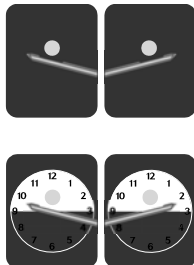
### *-Y/Vertical Error*

- Probe aperture is above the center of the lesion on both the (-) and (+) 15o images.
- Sampling should be increased
- between 9:00 – 3:00 going through 6:00



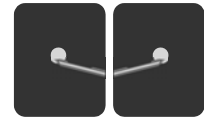
### *+Y/Vertical Error*

- Probe aperture is below the center of the lesion on both the (-) and (+) 15o images.
- Sampling should be increased
- between 9:00 – 3:00 going through 12:00



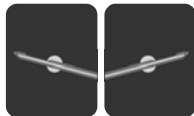
### *-Z/Depth Error*

- Probe aperture is short of the center of the lesion in both the (-) and (+) 15o images.
- Increase depth by pushing in the probe or retarget the lesion.



### *+Z/Depth Error*


- Probe aperture is past the center of the lesion in both the (-) and (+) 15o images.
- Decrease depth by pulling back probe.



### PATIENT PREPARATION

- Scheduling Procedure
  - Anticoagulant Therapy
  - Congenital Heart Problems
  - Prophylatic Antibiotics
  - Allergies

Office (832) 355-8130 Fax (832) 355-8123

  
**ST. LUKE'S**  
 Episcopal Hospital  
**St. Luke's Women's Center**  
**BREAST BIOPSY**  
**PROTOCOL SHEET**

▶ **PATIENT GENERAL INFORMATION**

Patient's Name: \_\_\_\_\_ SLEH Medical Record No: \_\_\_\_\_  
 DOB: \_\_\_\_\_ Age: \_\_\_\_\_ Height: \_\_\_\_\_ Weight: \_\_\_\_\_  
 Home Phone No: \_\_\_\_\_ Work Phone No: \_\_\_\_\_ Cell Phone No: \_\_\_\_\_  
 Clinical Diagnosis: \_\_\_\_\_  
 Hospital (facility) of Previous Mammogram: \_\_\_\_\_  
 Referring Physician: \_\_\_\_\_ Phone/Fax No: \_\_\_\_\_  
 Date Films Received for Approval: \_\_\_\_\_

▶ **APPROVED PROCEDURE**

<input type="checkbox"/> Stereotactic Breast Biopsy/Mammotome	Left	Right	Bilateral
<input type="checkbox"/> Ultrasound Core Biopsy	Left	Right	Bilateral
<input type="checkbox"/> Ultrasound Aspiration/ FNA	Left	Right	Bilateral
<input type="checkbox"/> Ultrasound Breast HH/Mammotome Biopsy	Left	Right	Bilateral
<input type="checkbox"/> MRI Guided Core Biopsy	Left	Right	Bilateral

Please Specify:  Calcifications  Mass No. of Lesions: \_\_\_\_\_

Ultrasound Prior to Procedure:  Yes  No Mammogram Prior to Procedure:  Yes  No  
 Please Specify (re: mammography views): \_\_\_\_\_

▶ **APPROVAL**

Approved by: \_\_\_\_\_ MD. Date: \_\_\_\_\_  
 Scheduled Date/Time: \_\_\_\_\_ Date: \_\_\_\_\_  
 DENIED Reason: \_\_\_\_\_  
 Referring MD Notify/Date: \_\_\_\_\_

• ▶ **ADDITIONAL RADIOLOGIST INSTRUCTIONS:**

\_\_\_\_\_

\_\_\_\_\_

• ▶ **NURSING**

• Responsibilities/ Medication prior to Procedure: \_\_\_\_\_

\_\_\_\_\_

• ▶ **PATIENT HISTORY (To be reviewed by Scheduler, Nurse, Mammographer + Initials: \_\_\_\_\_)**

• Current Medication: \_\_\_\_\_

• Allergies: \_\_\_\_\_

• History of Blood Clots:  Yes  No

• High Blood Pressure:  Yes  No

• Kidney Disease:  Yes  No

• Heart Disease:  Yes  No

• Heart Valve Repair:  Yes  No

• Artificial Valve:  Yes  No

• History of IEC:  Yes  No

• To be communicated to Patient:

• Special Instructions: \_\_\_\_\_

• PLEASE ASK THE PATIENT IF THEY ARE TAKING ANY BLOOD THINNERS; ASPIRIN, PLAVIX, COMADIN, OR ANY OTHER BLOOD THINNING MEDICATIONS.

• IF YES, PLEASE CONSULT WITH THE SUPERVISOR/MANAGER FOR FURTHER INSTRUCTIONS PRIOR TO SCHEDULING.

• Patient will be given additional instructions if they are on Blood Thinning Medication

• Scheduler's Initials: \_\_\_\_\_

• Additional Remarks: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

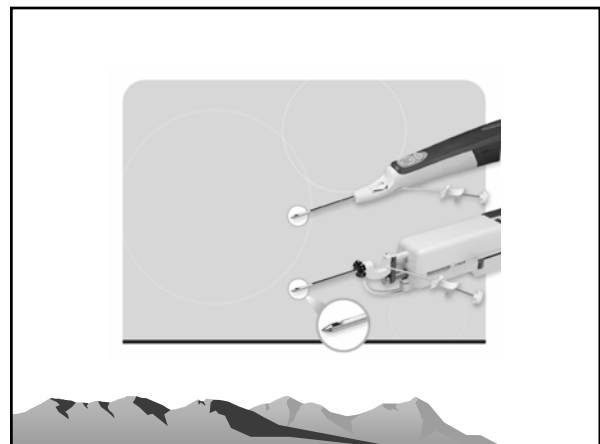
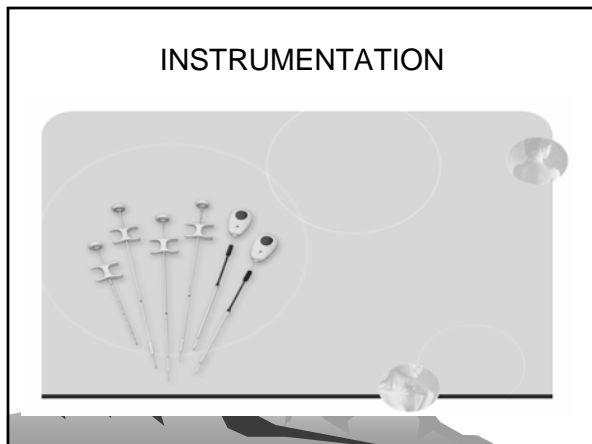
**PATIENT PREPARATION**

Pre-Procedure (nurse)

- Review patient history
- Base line vital Signs
- Consent by Physician
- Prophylactic antibiotics

• Post Procedure

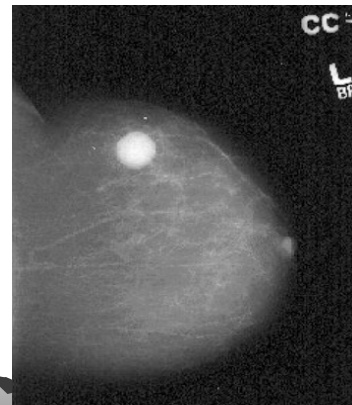
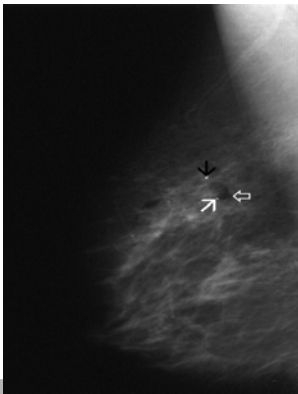
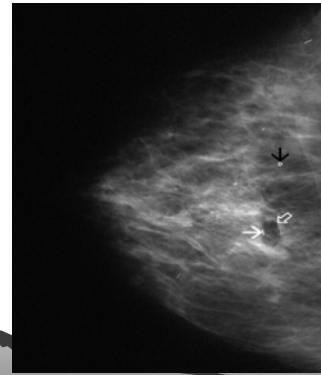
- Wound Care/Pressure Dressing
- Medications
- 24-36 hour check up phone call

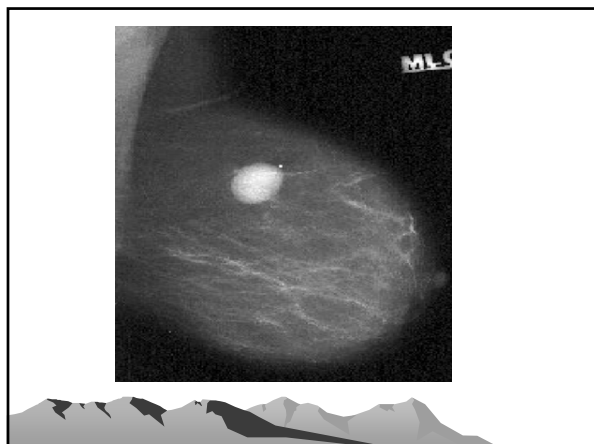


# INSTRUMENTATION



# COMPLICATIONS





## ACR STEREO ACCREDITATION PROCESS

- Established in 1996
- Model after the Mammography Program
- Program assessment:
  - Personnel training/qualification
  - Equipment maintenance/q.c.
  - Clinical Performance

## Personnel Qualifications

- Physicians
  - Radiologist
  - Group Practice
  - Independent Practice
  - Surgeon
  - Group Practice (radiologist)
  - Independent Practice
- Technologists
- Medical Physicist

## Clinical Image Quality

- Stereotactic Biopsy Procedure Only
  - 2 view orthogonal mammogram showing calcifications (one set) (cc/ml or mlo)
  - Stereotactic Procedure
    - Scout image
    - Scout stereo Pair
    - Pre-Fire stereotactic set
    - Post-fire stereotactic set

## Phantom Image Quality

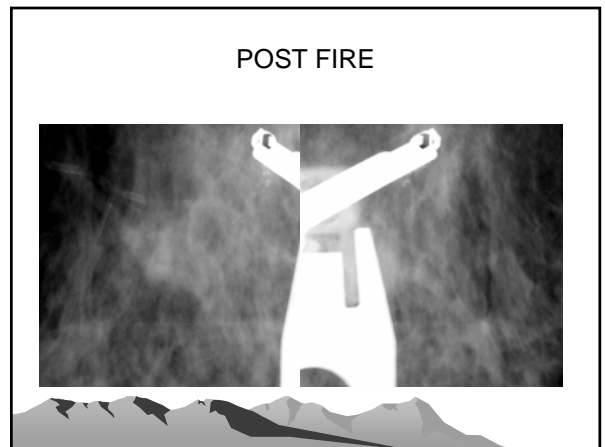
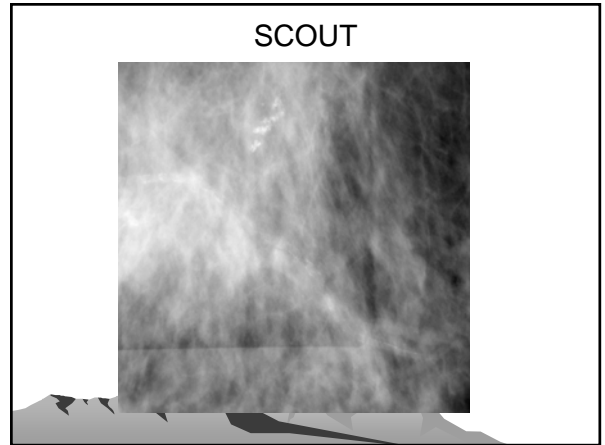
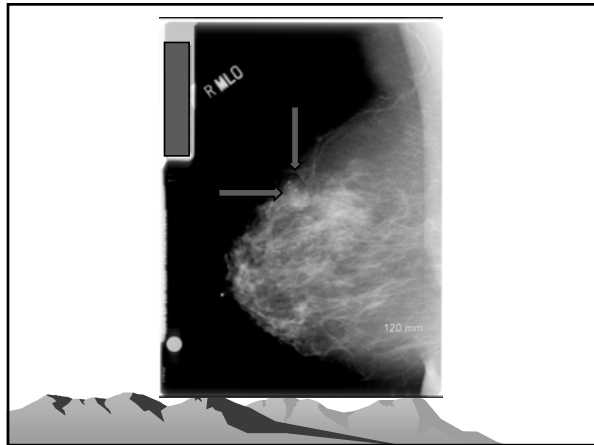
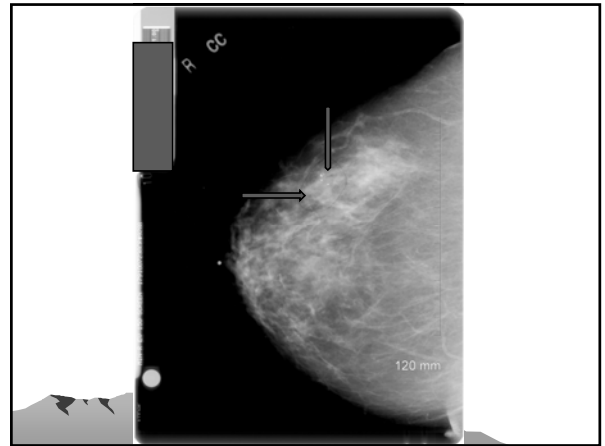
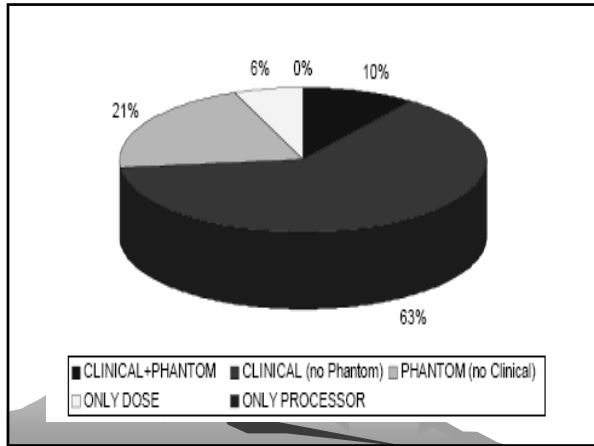
- Phantom Image Criteria
- Screen film
- Digital
  - Mini-Phantom
  - Full size ACR phantom
- Image Dose Criteria
  - Less than 300mrads

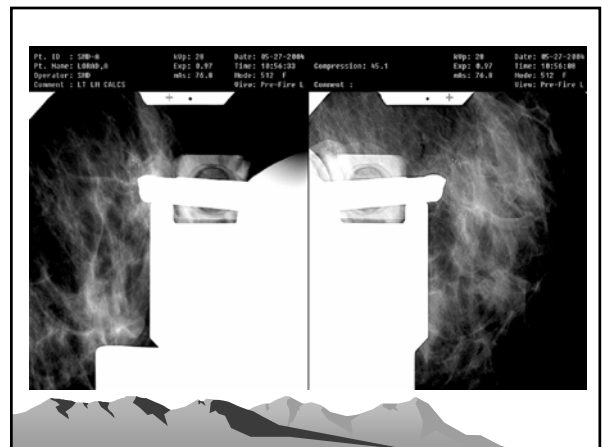
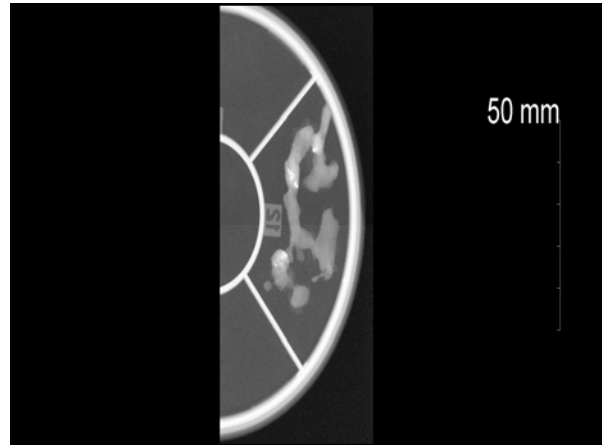
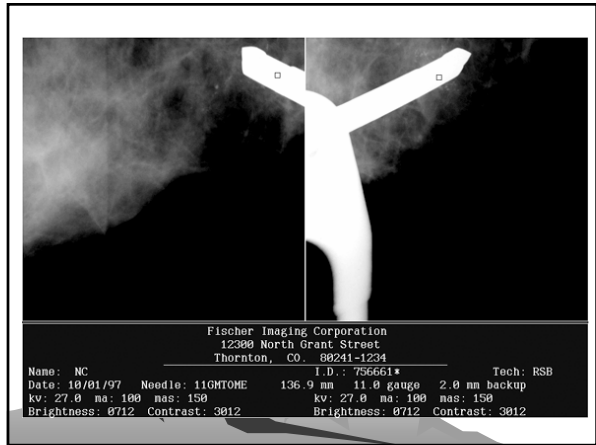
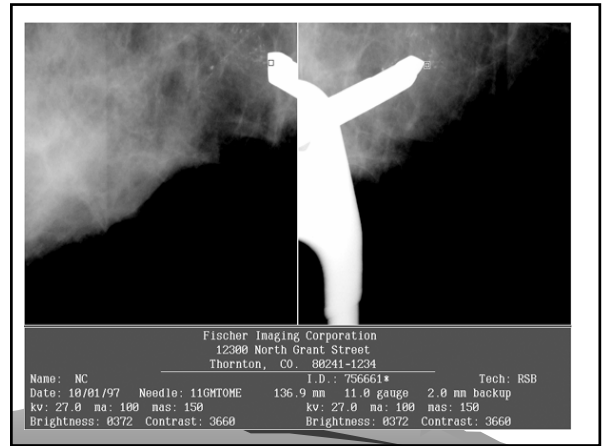
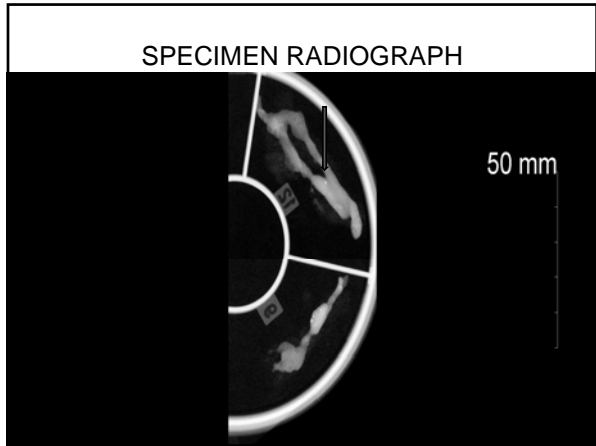
## ASSESSING IMAGE QUALITY

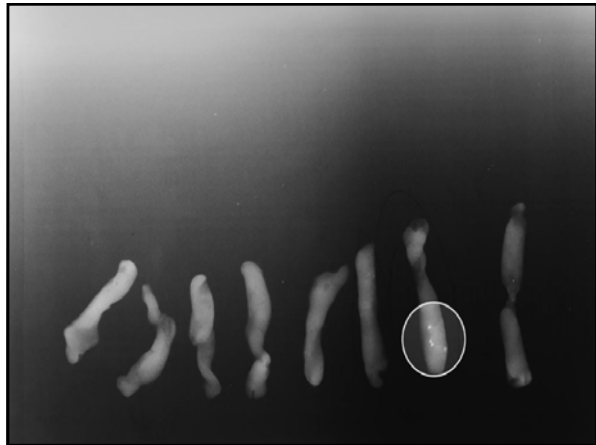
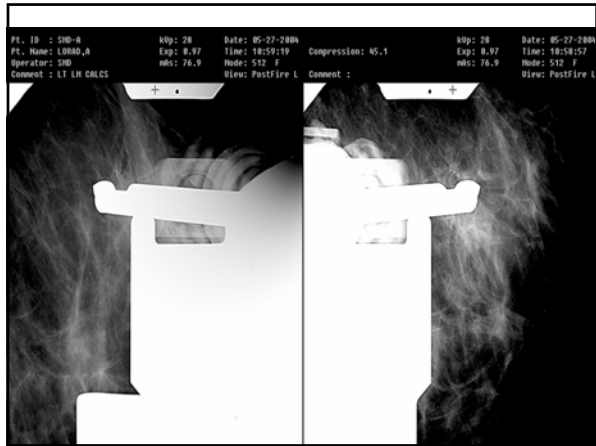
- MAP (Mammography Accreditation Phantom)
 

	S/F	DIGITAL
Fibers	4.0	5.0
Specks	3.0	4.0
Masses	3.0	3.5
- Mini Phantom
 

	S/F	DIGITAL
Fibers	2.0	3.0
Specks	2.0	3.0
Masses	2.0	2.5







## REFERENCES

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- Parker SH. Stereotactic large-core breast biopsy. In: Parker SH, Jobe WE, eds. Percutaneous breast biopsy. New York, NY: Raven, 1993; 61-79
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