



X-Ray Associates of New Mexico, P.C.

MAMMOGRAPHY VIEWING AND INTERPRETATION AND- BI-RADS: CATEGORIES AND LEXICON

MICHAEL N. LINVER, MD, FACR



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MAMMOGRAPHY VIEWING AND INTERPRETATION

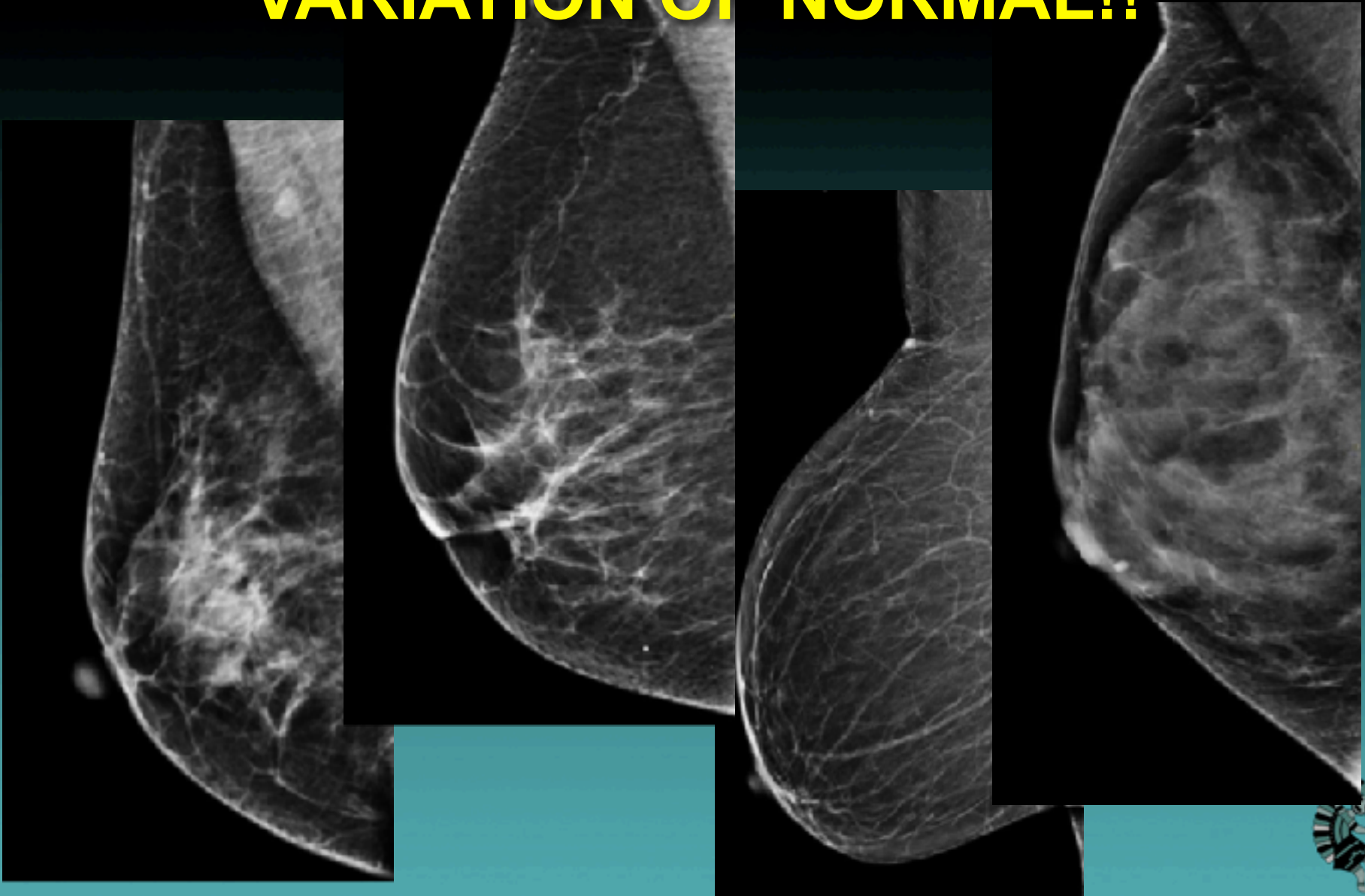


OUR MOST DIFFICULT TASK:

**Finding Early Invasive
Breast Cancer at
Screening**

WHY IS THIS SO DIFFICULT??

**BECAUSE OF THE HUGE
VARIATION OF NORMAL!!**





**SCREENING IS NOT
DIAGNOSIS!**

**SCREENING MAMMOGRAPHY =
PERCEPTION**

**DIAGNOSTIC MAMMOGRAPHY =
ANALYSIS**



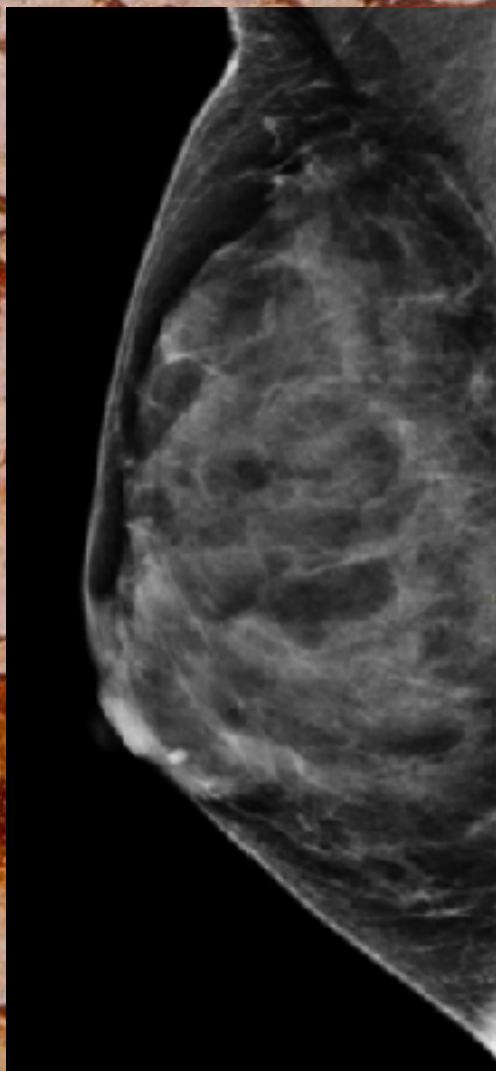


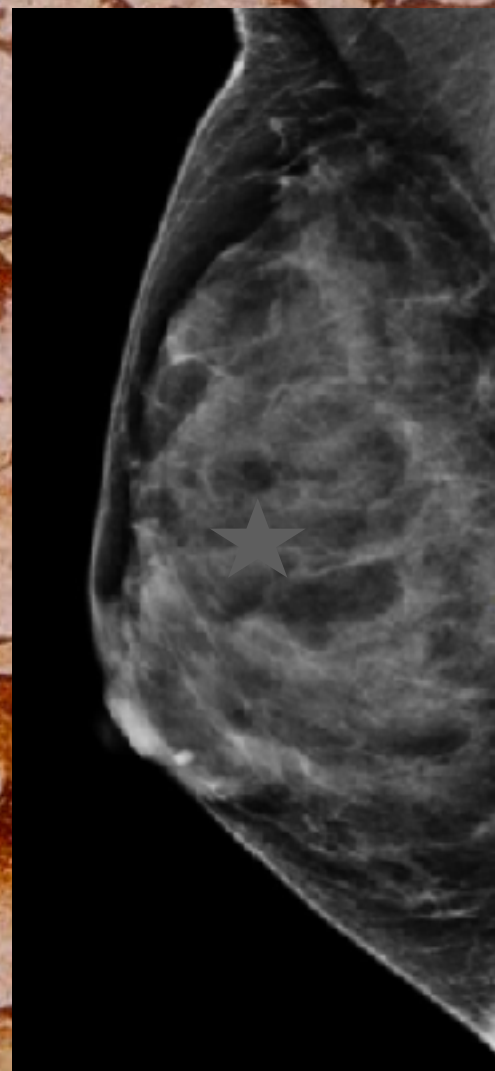


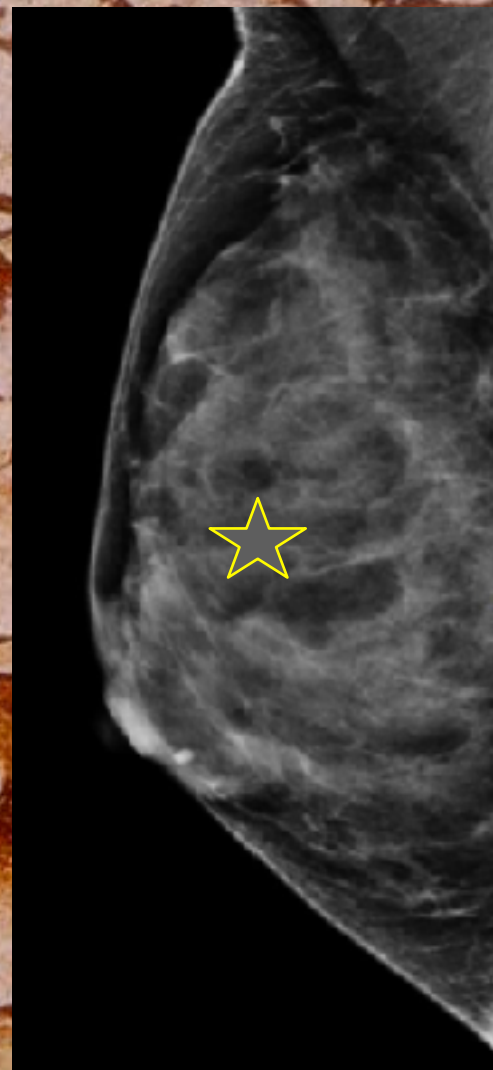






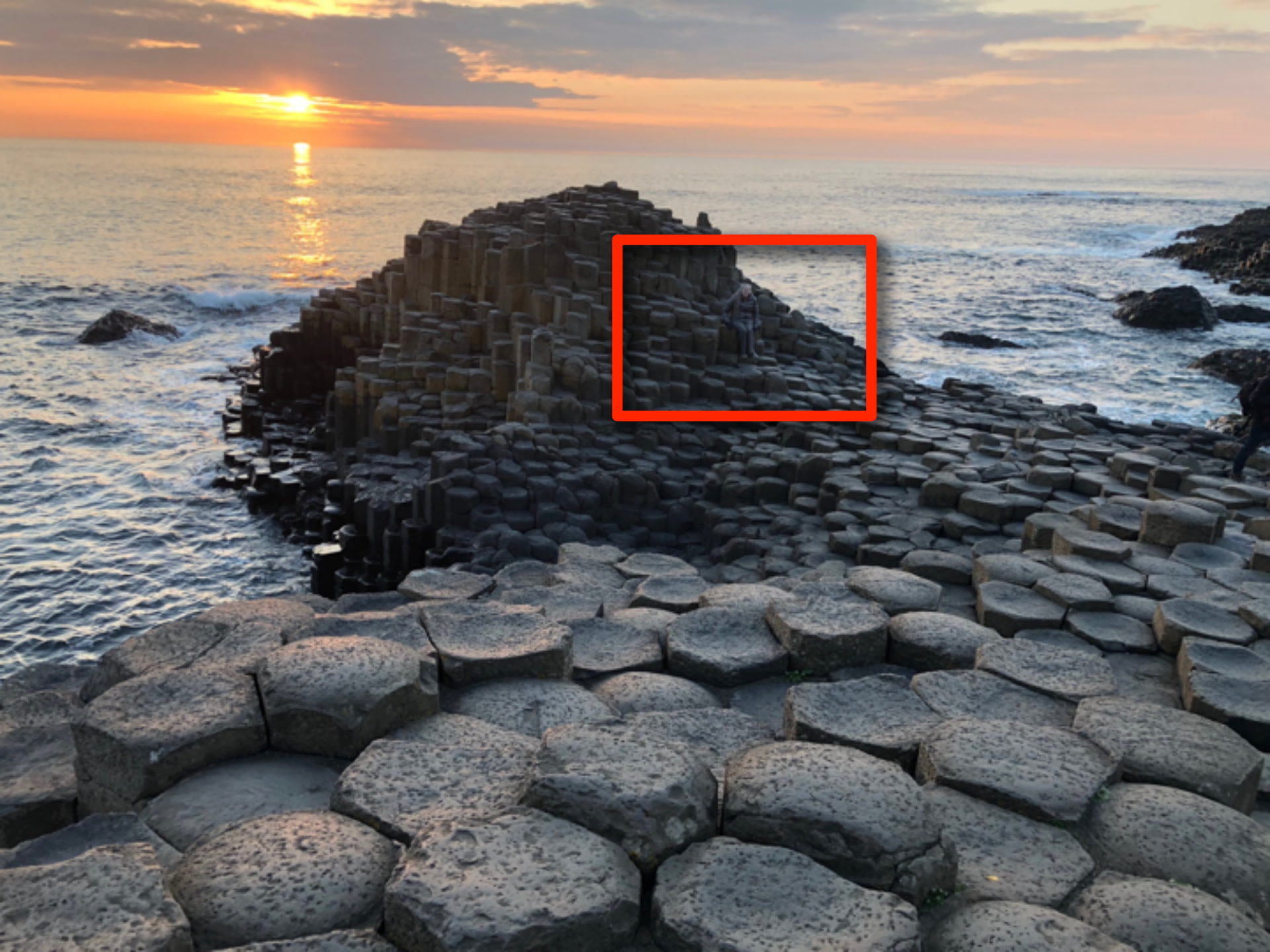


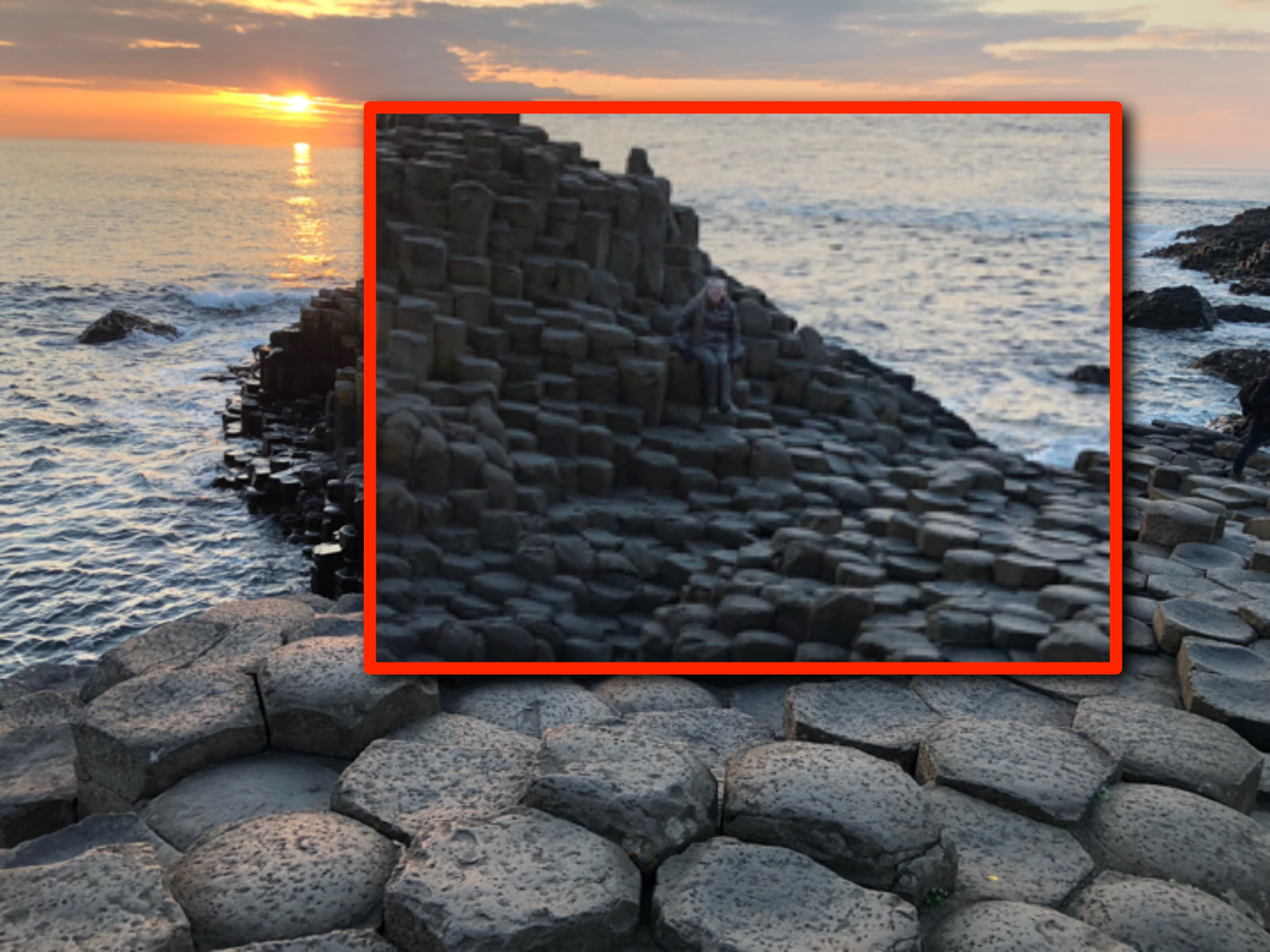














THE NEW ERA OF SCREENING MAMMOGRAPHY



1968



1990



THE NEW ERA OF SCREENING MAMMOGRAPHY



2025



1990





APPROACH TO SCREENING: **VIEWING CONDITIONS**

- **Quiet room, dark, NO INTERRUPTIONS!**
- **Batch-read, if situation allows**
- **Be efficient: DO NOT TAKE EYES OFF STUDY!**
 - ➔ **Have all studies preloaded in computer**
 - ➔ **Dictate while assistant enters report**
 - ➔ **Use form with “normal” & “recall” as only choices**
 - ➔ **Computerize the process**



APPROACH TO SCREENING: READING THE MAMMOGRAM

- **Batch-read: don't take eyes off monitor**
- **Develop a consistent technique, which includes:**
 - ➔ **An overview (arm's length)**
 - ➔ **Side-by-side comparison of each area of the image**
 - ➔ **Careful evaluation with magnifier**
- **Compare to previous studies: look at oldest high-quality study available**

MY APPROACH TO VIEWING A SCREENING MAMMOGRAM



MLO VIEWS

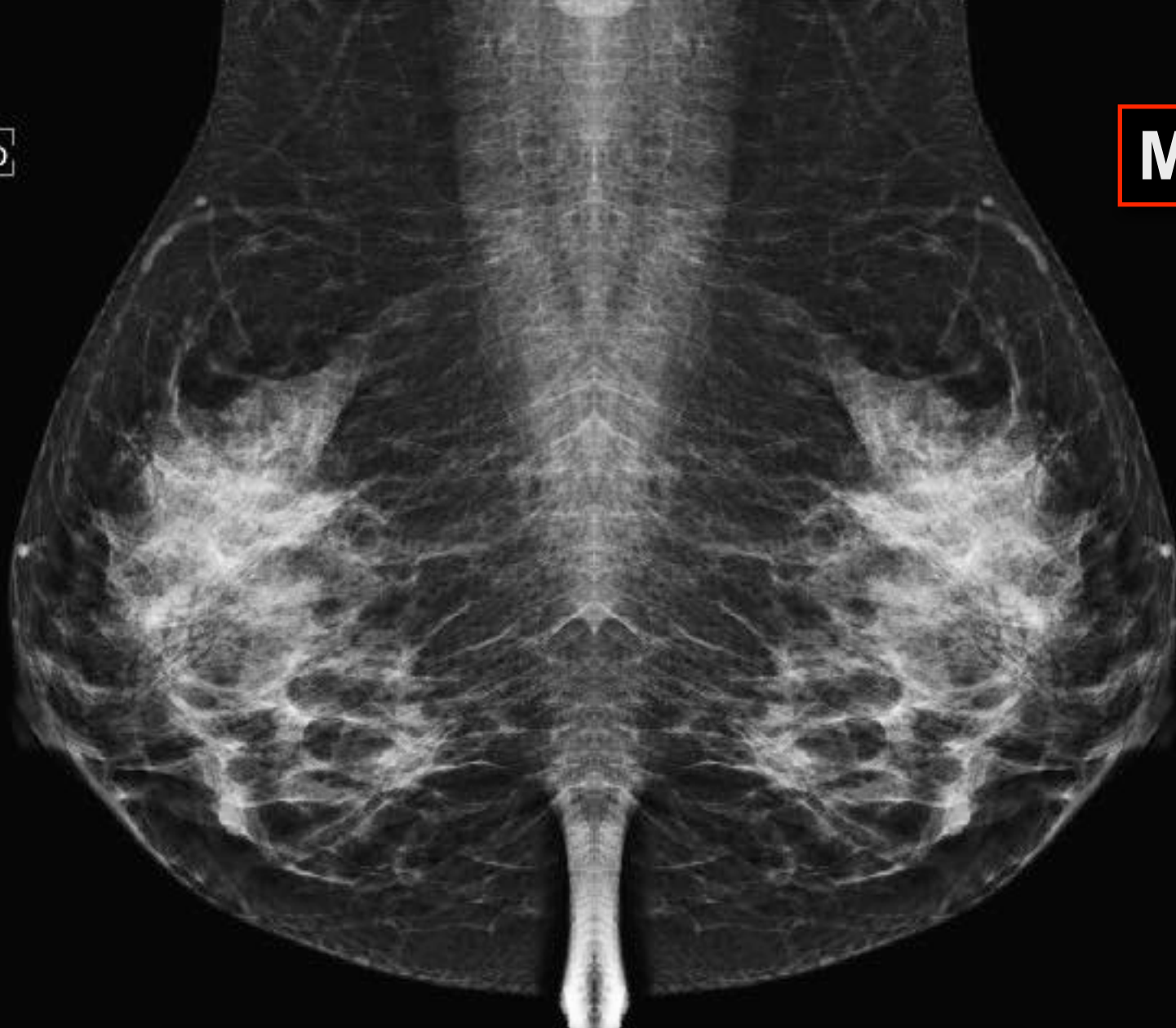


CC VIEWS



T
G RMLO

MLO

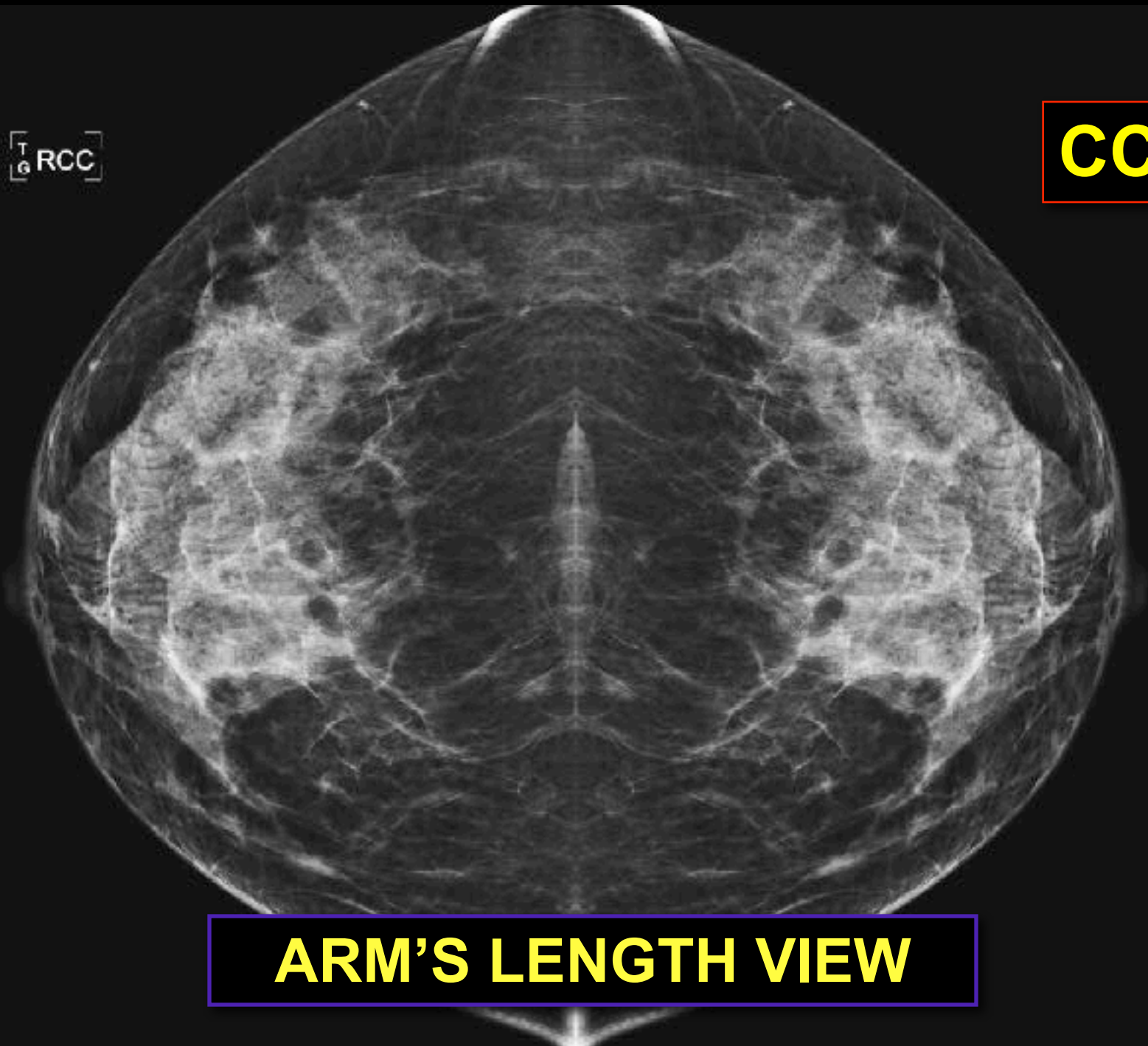


ARM'S LENGTH VIEW

T
G RCC

CC

ARM'S LENGTH VIEW



Side by Side Comparison

T
G RMLO

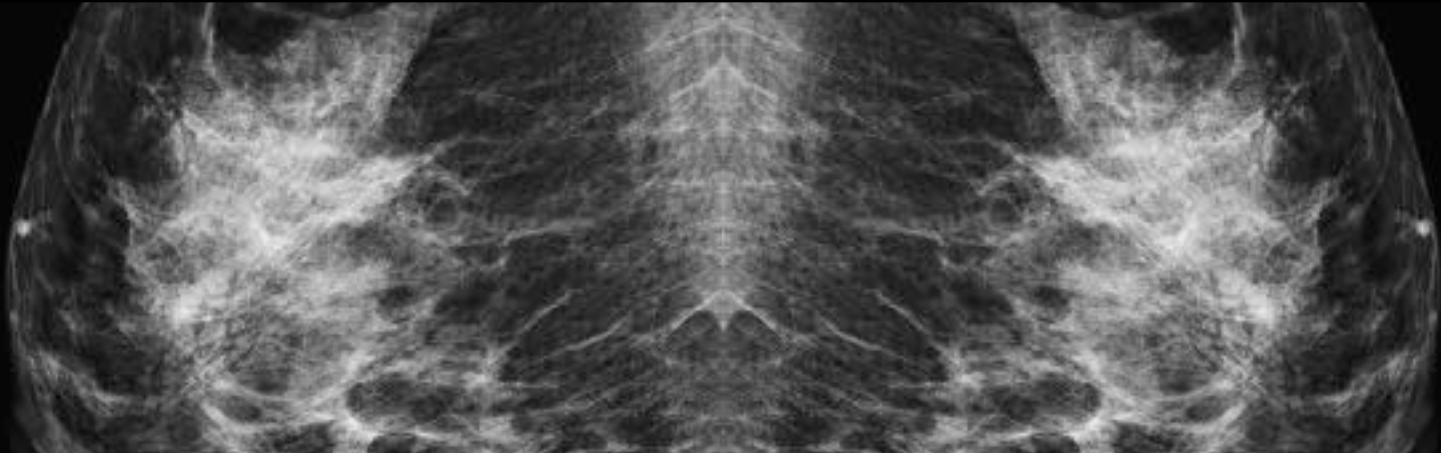
MLO VIEW



Side by Side Comparison

T
G RMLC

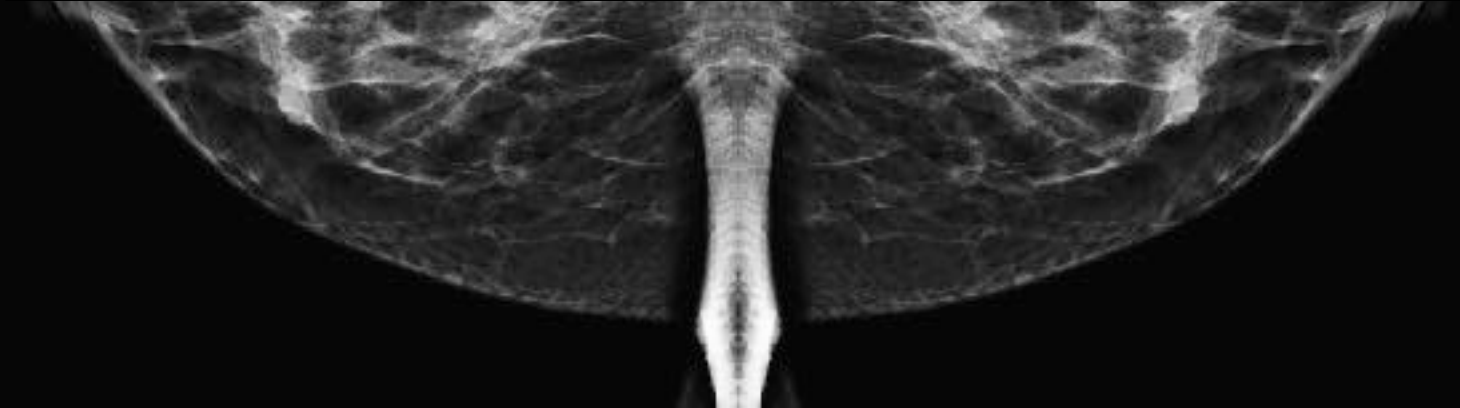
MLO VIEW



Side by Side Comparison

T
G RMLC

MLO VIEW



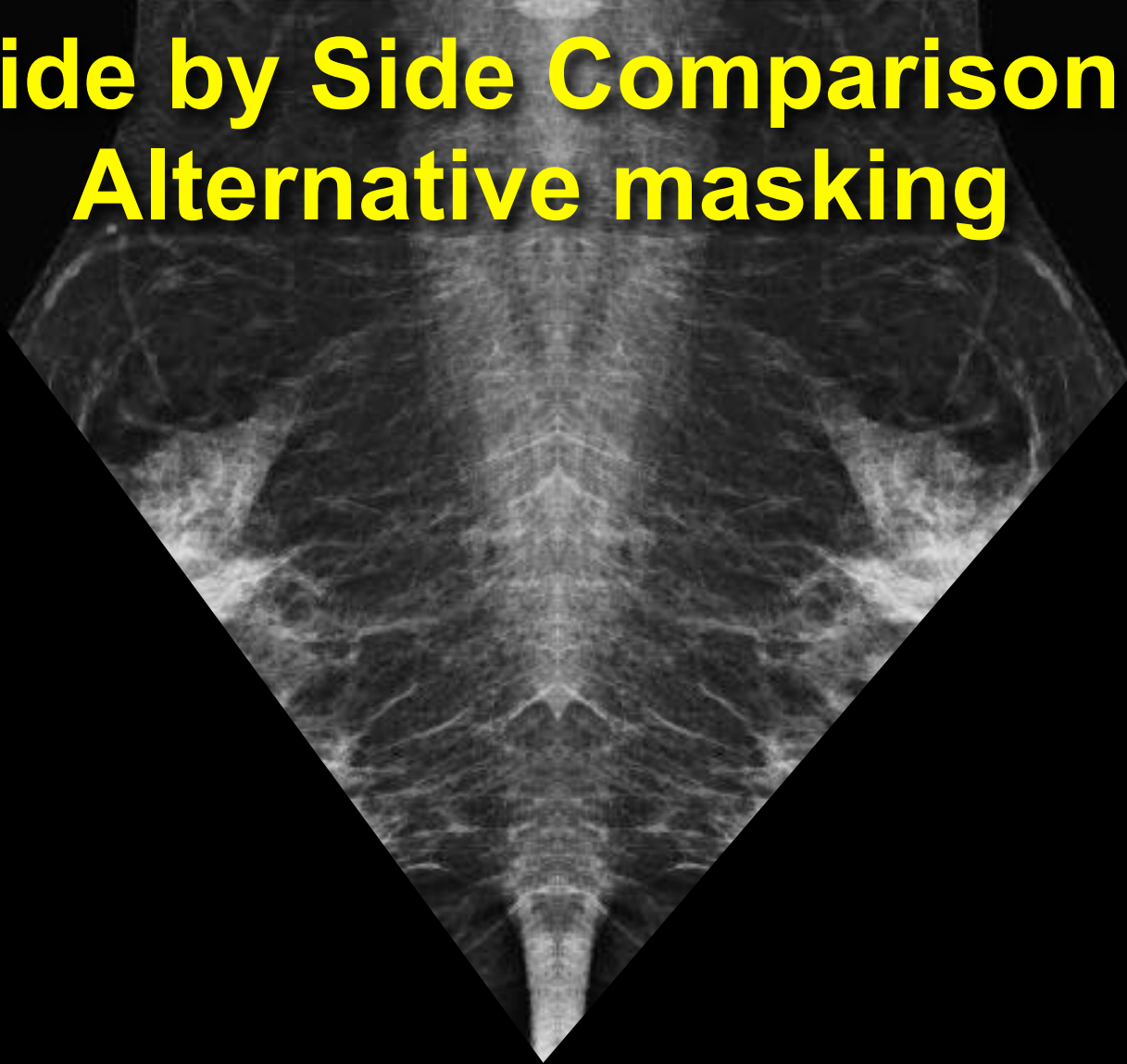
Side by Side Comparison: Alternative masking

MLO

Side by Side Comparison: Alternative masking

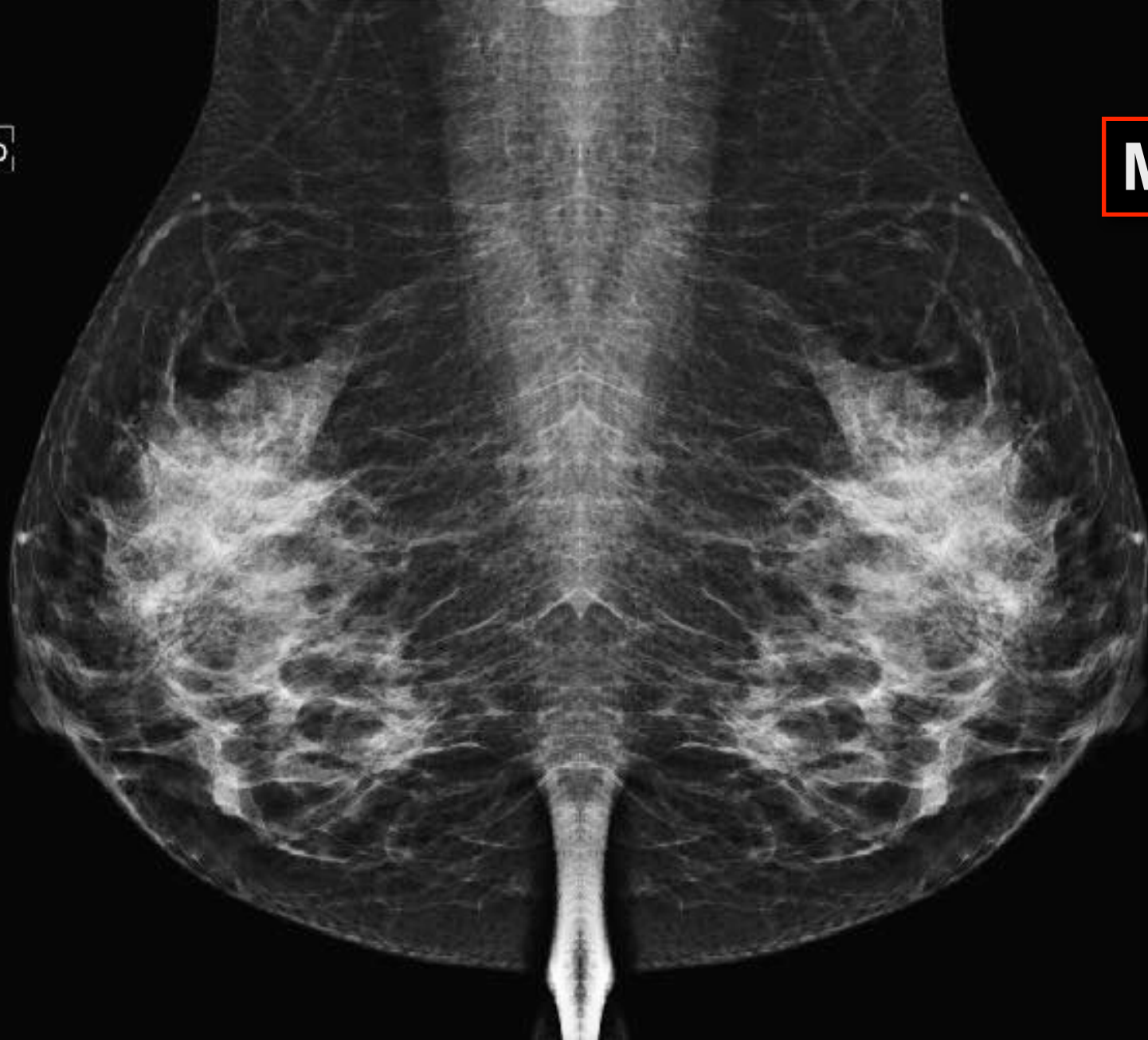
T
G RMLO

MLO



T
G RMLO

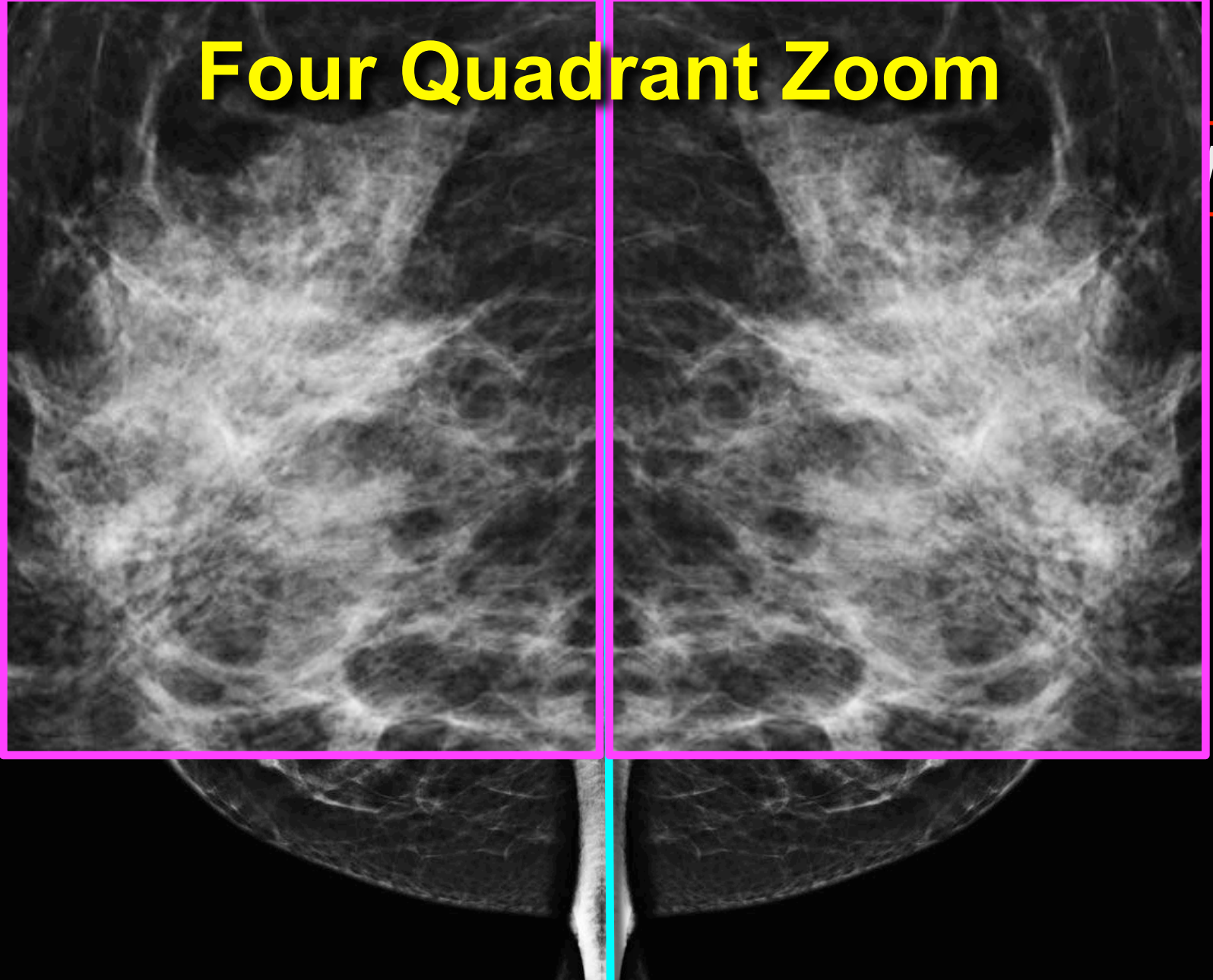
MLO



Four Quadrant Zoom

T
G R

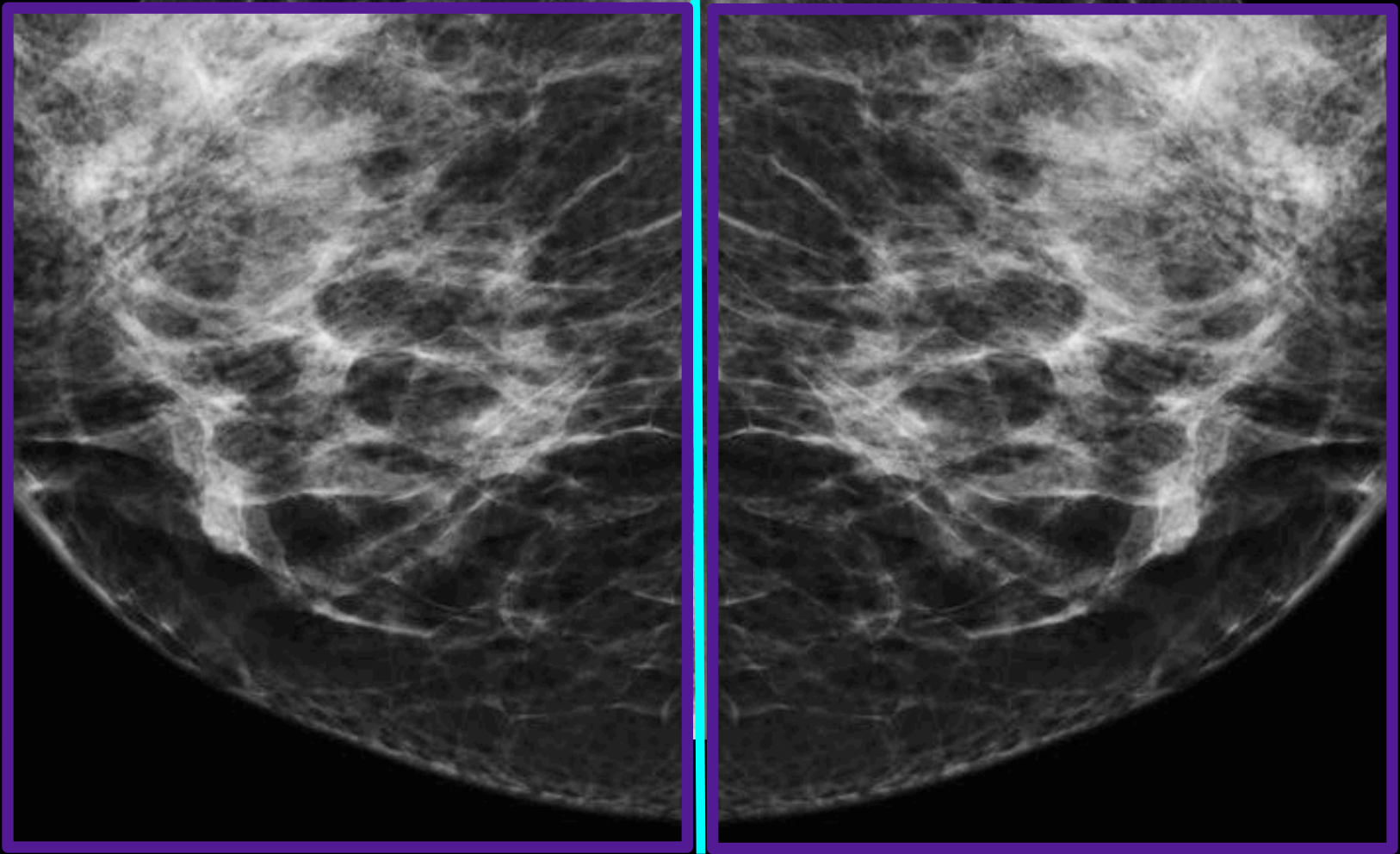
VS



Four Quadrant Zoom

T
G RMLO

MLO VIEWS



Side by Side Comparison

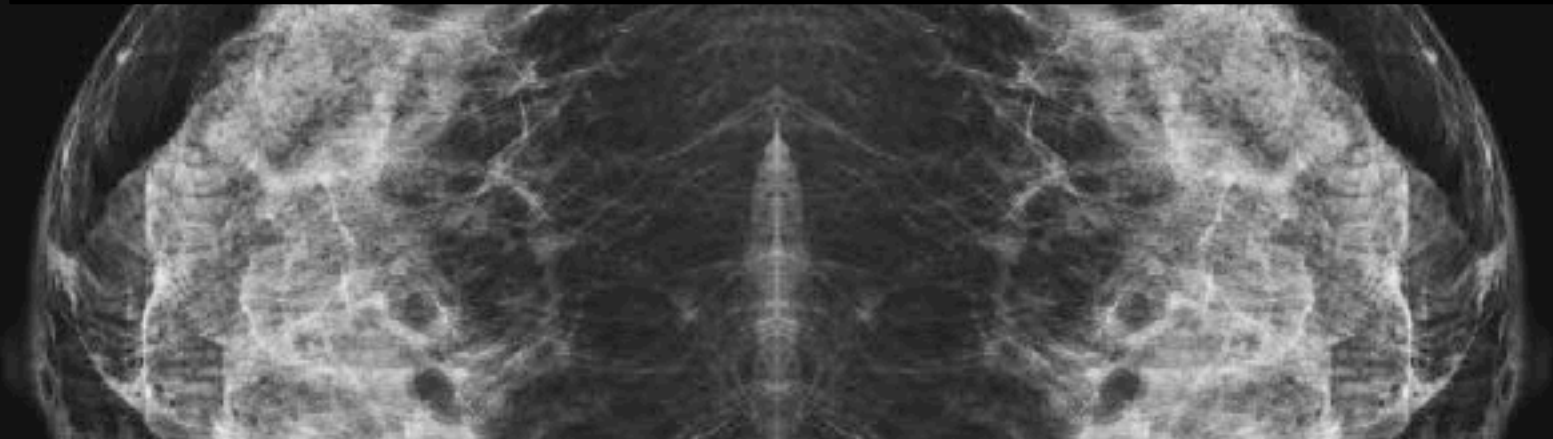
T
G RCC

CC VIEW



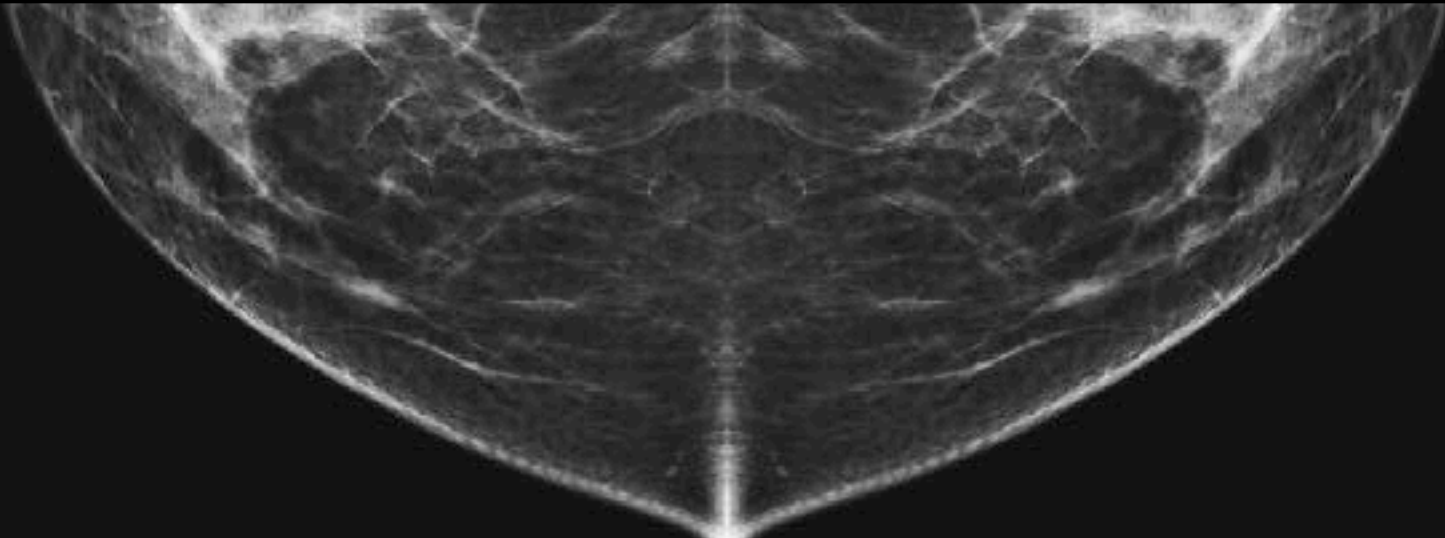
Side by Side Comparison

CC VIEW

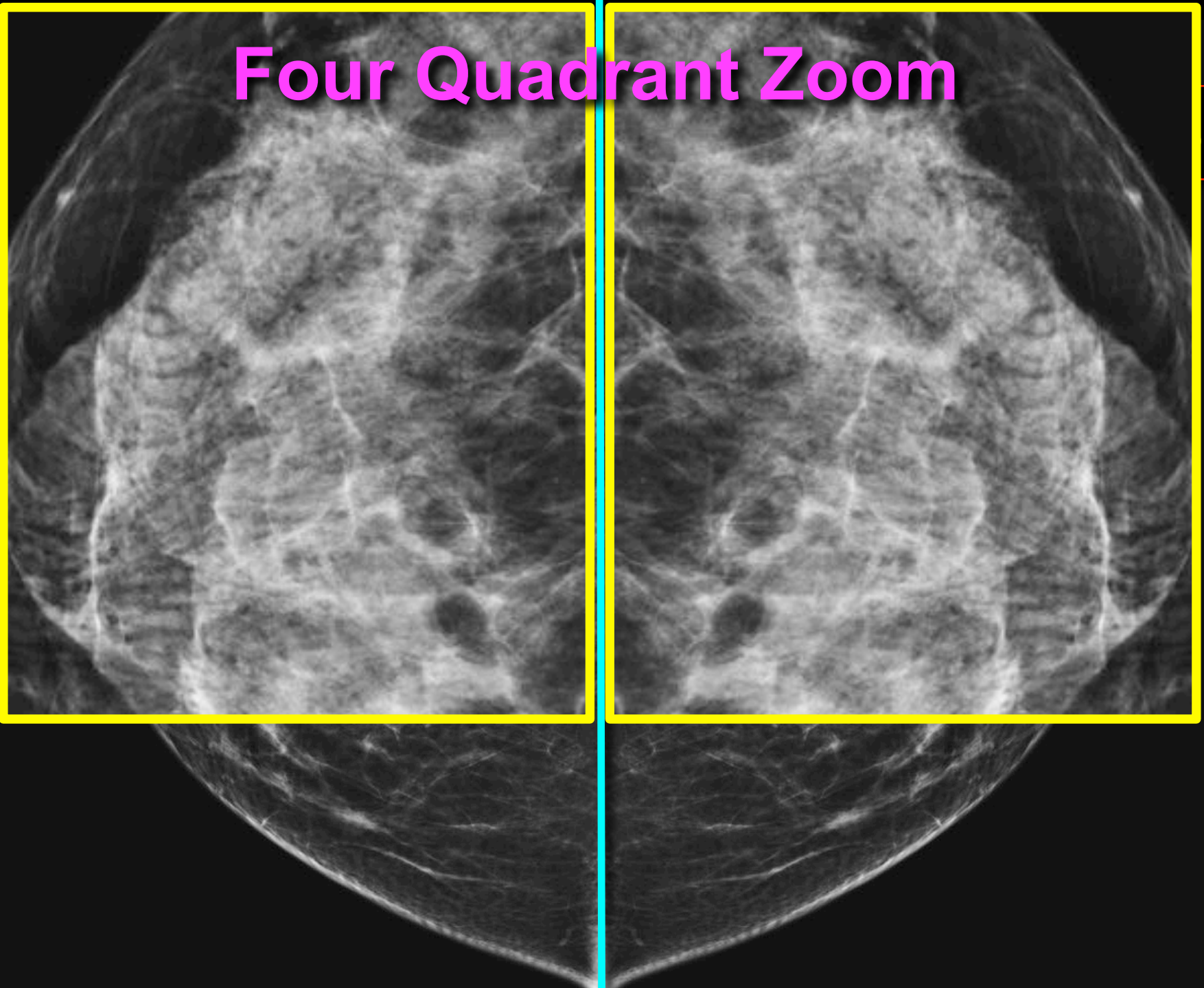


Side by Side Comparison

CC VIEW



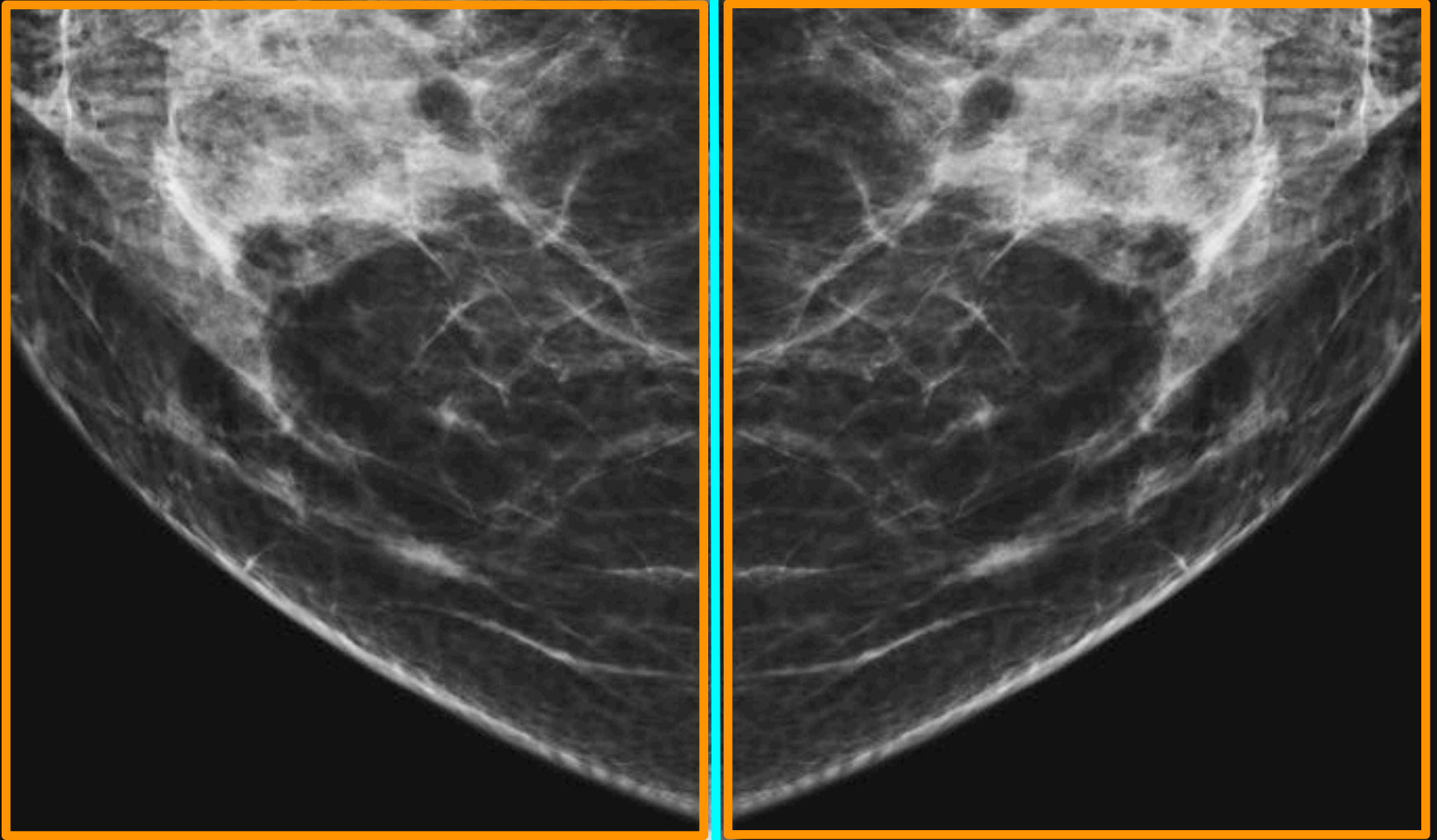
Four Quadrant Zoom



Four Quadrant Zoom

CC VIEWS

T
G RCC



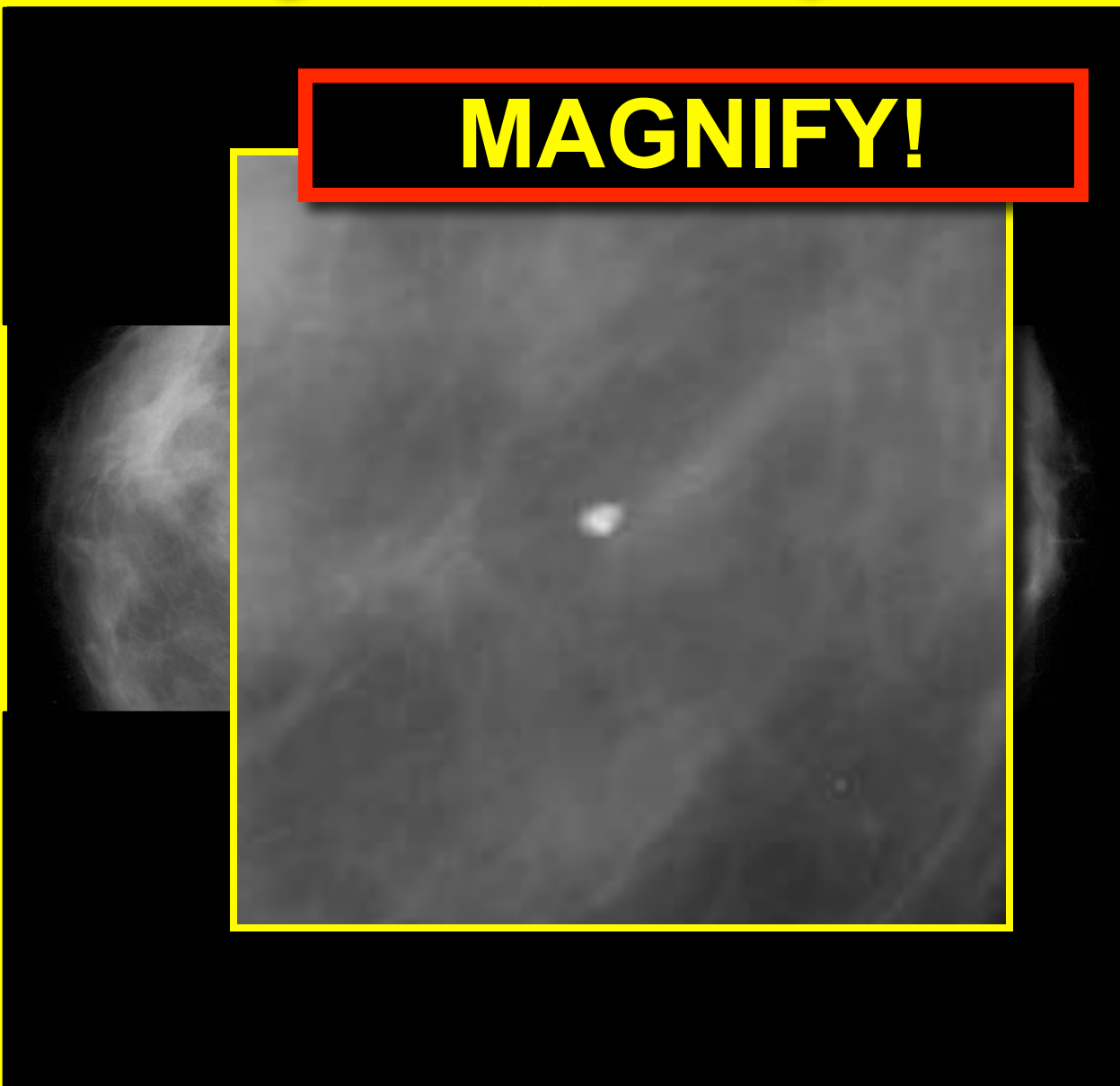
Side by Side Comparison

MAGNIFY!



Side by Side Comparison

MAGNIFY!



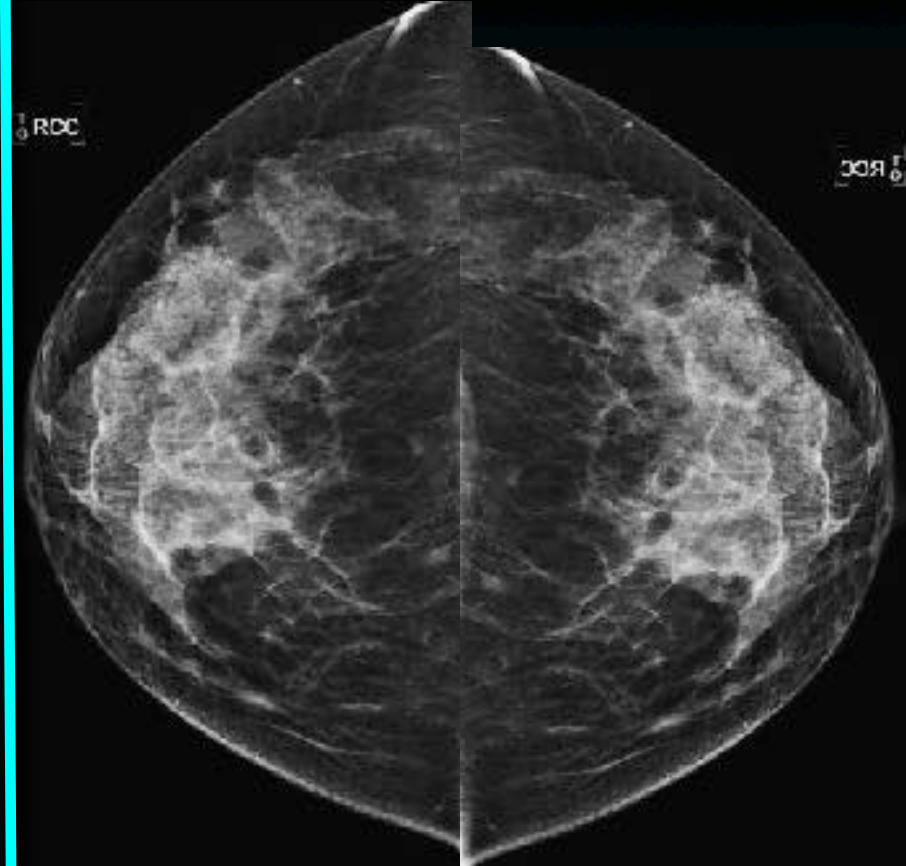
HANGING PROTOCOL FOR SCREENING MAMMOGRAPHY



MLO VIEWS



CC VIEWS



IF NO PREVIOUS

T
6 RMLO

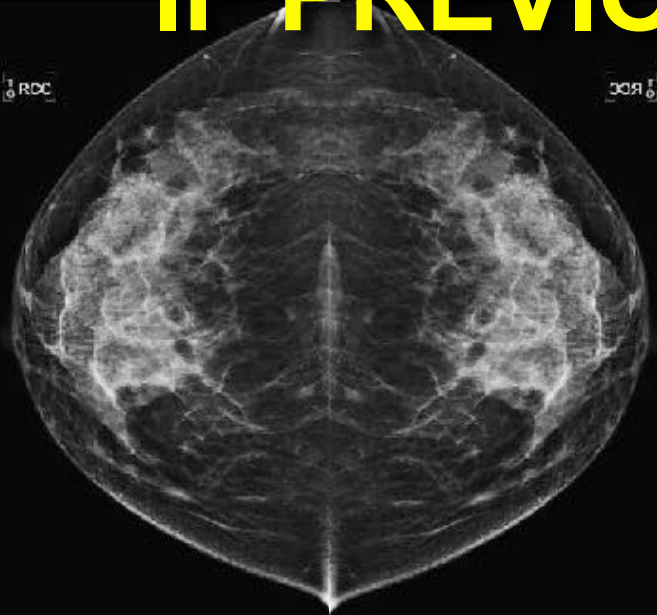
OJMR
7



IF PREVIOUS AVAILABLE

1 RDC

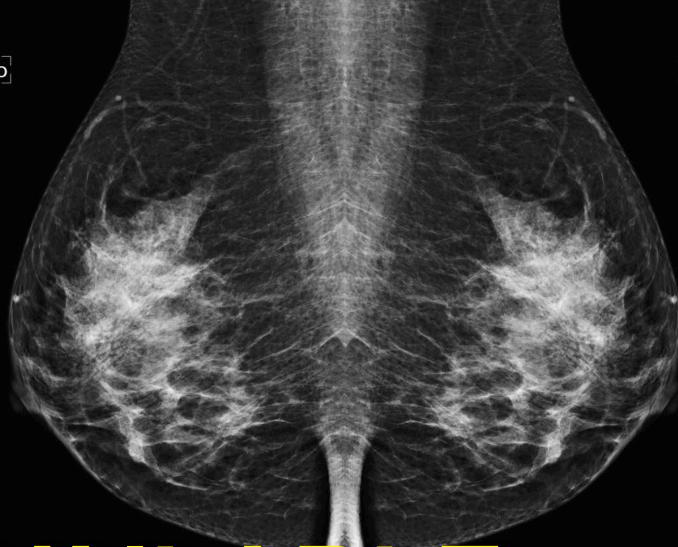
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LAST EXAM

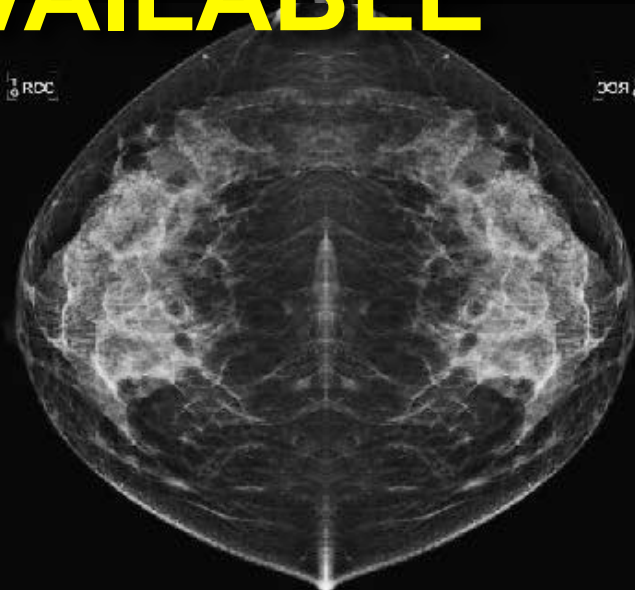
T
6 RMLO

OJMR
7



1 RDC

009 1



CURRENT EXAM

T
G RMLO

OJMR
T

T
G RDC

T
G RDC

LAST EXAM

OR HANG LIKE THIS:

T
G RMLO

OJMR
T

T
G RDC

T
G RDC

CURRENT EXAM

RMLO

RMLO

RMLO

RMLO

OR HANG LIKE THIS:

RDC

RDC

RDC

RDC

LAST
EXAM

CURRENT EXAM

LAST
EXAM

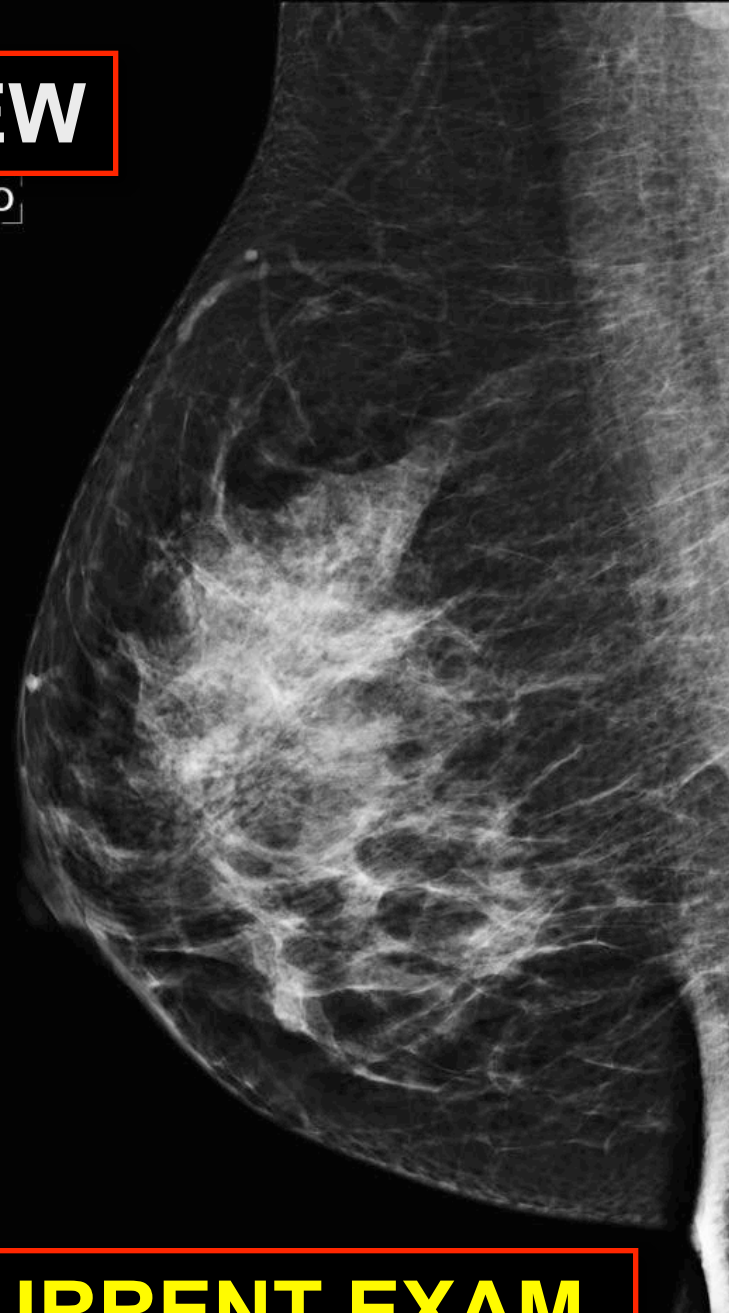
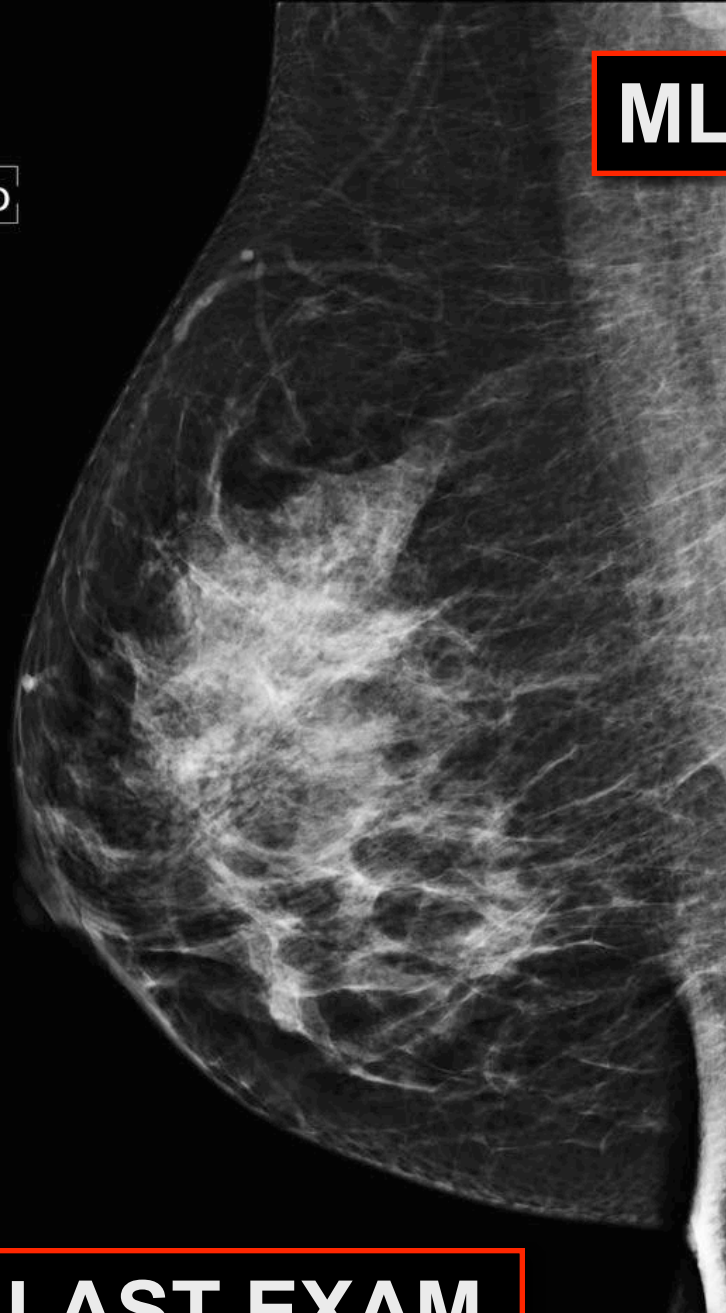
MLO VIEW

$\begin{bmatrix} T \\ G \end{bmatrix}$ RMLO

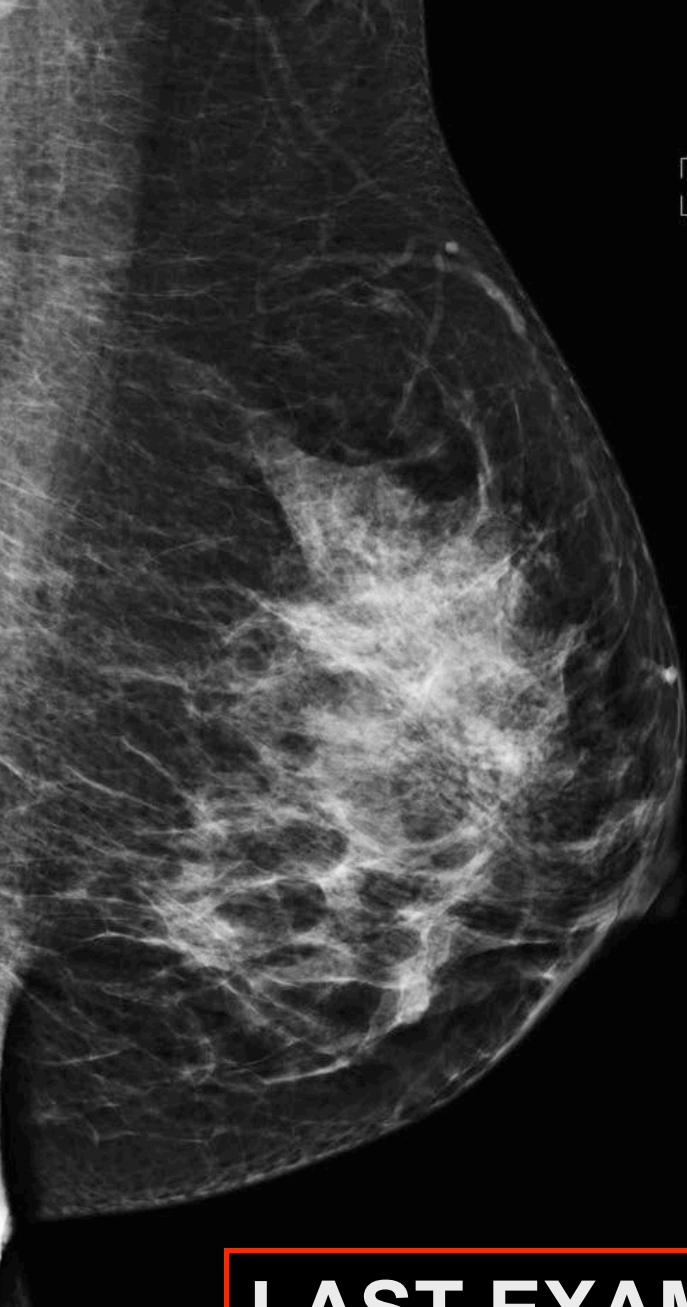
LAST EXAM

$\begin{bmatrix} T \\ G \end{bmatrix}$ RMLO

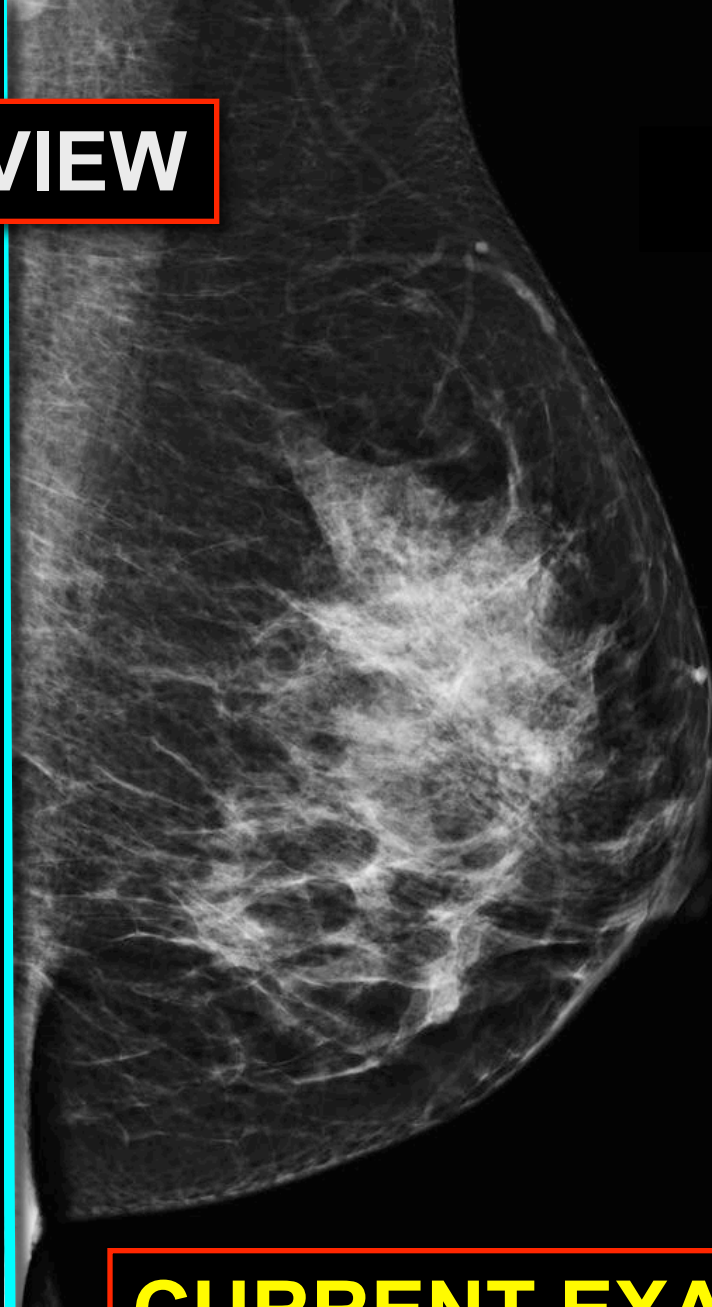
CURRENT EXAM



MLO VIEW



LAST EXAM



CURRENT EXAM

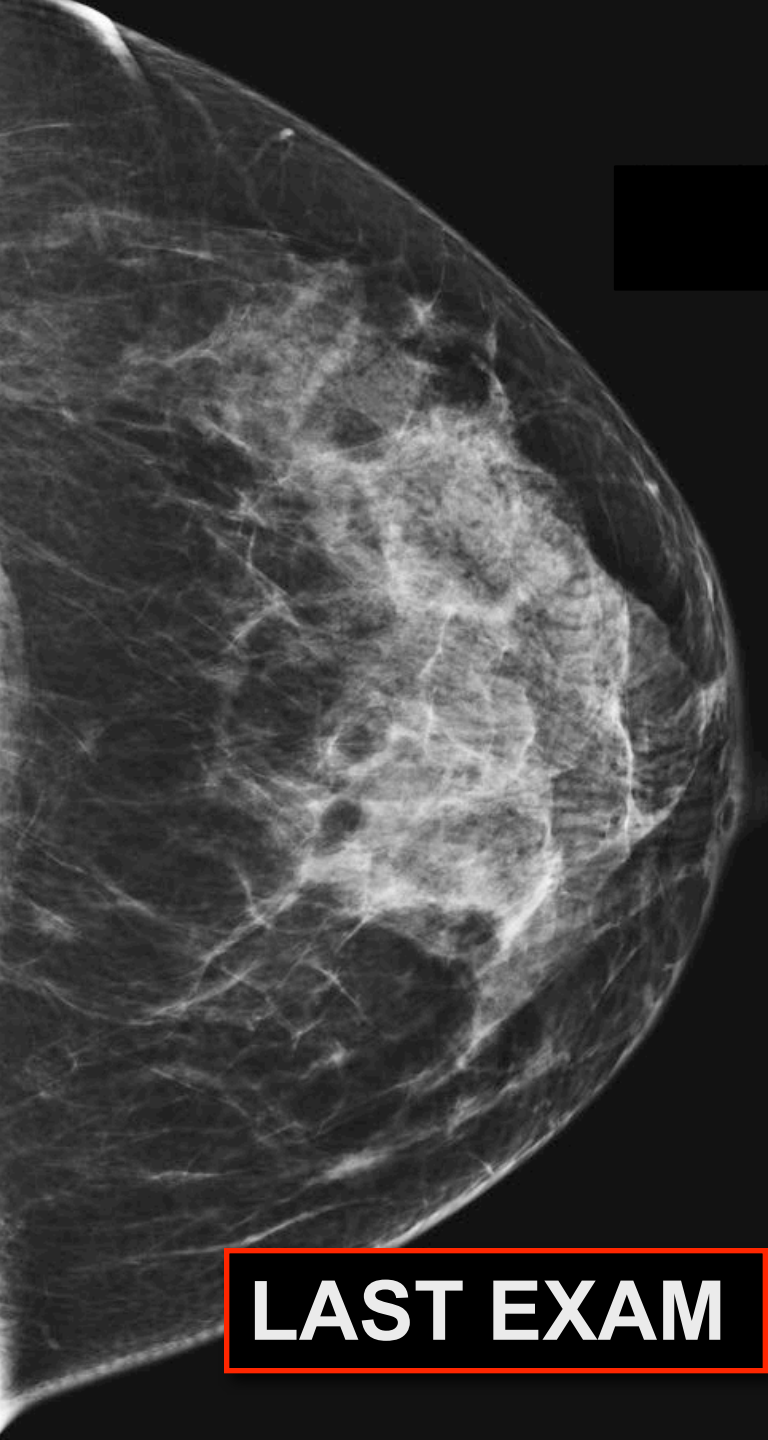
[T
G RCC]

LAST EXAM

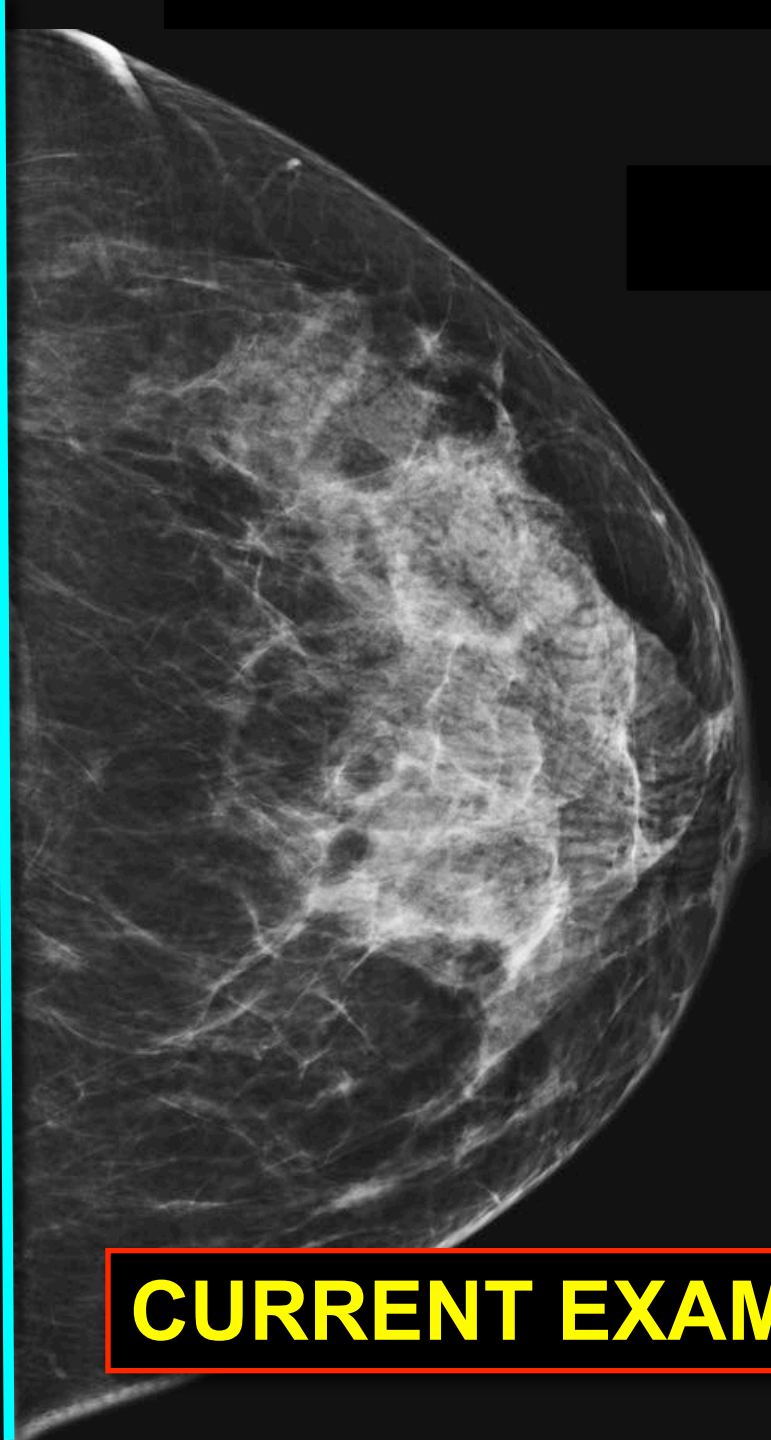
[T
G RCC]

CC VIEW

CURRENT EXAM



LAST EXAM

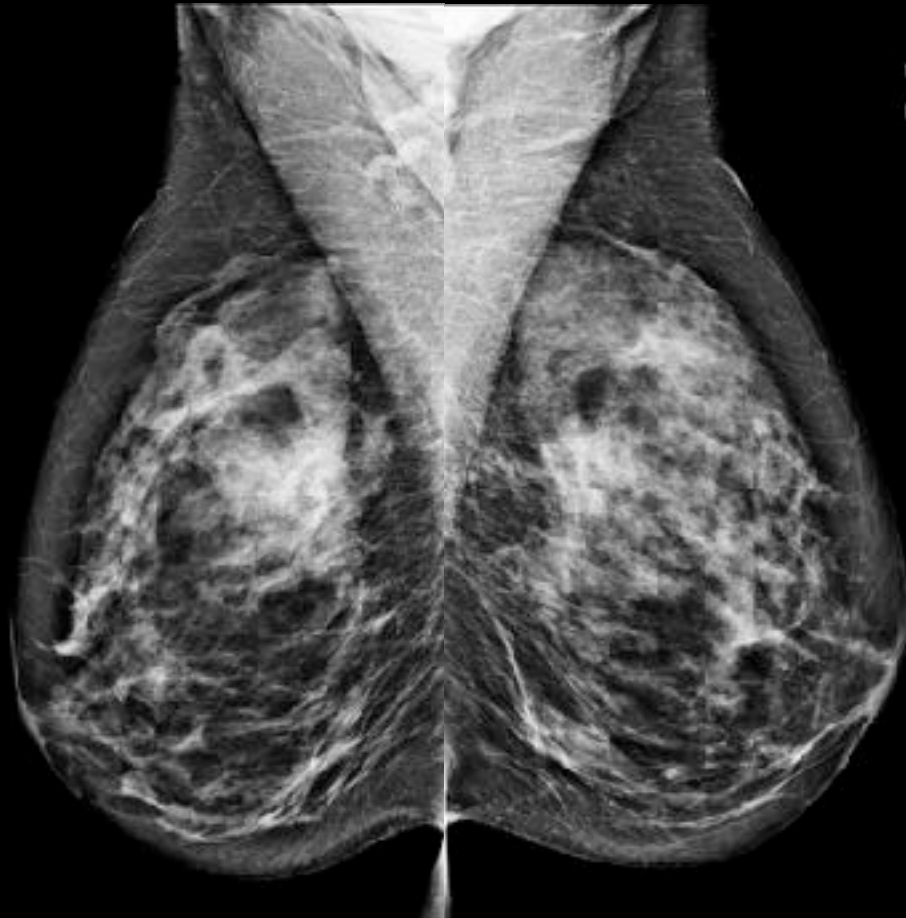


CURRENT EXAM

ANOTHER CASE:



Current Screening Mammogram

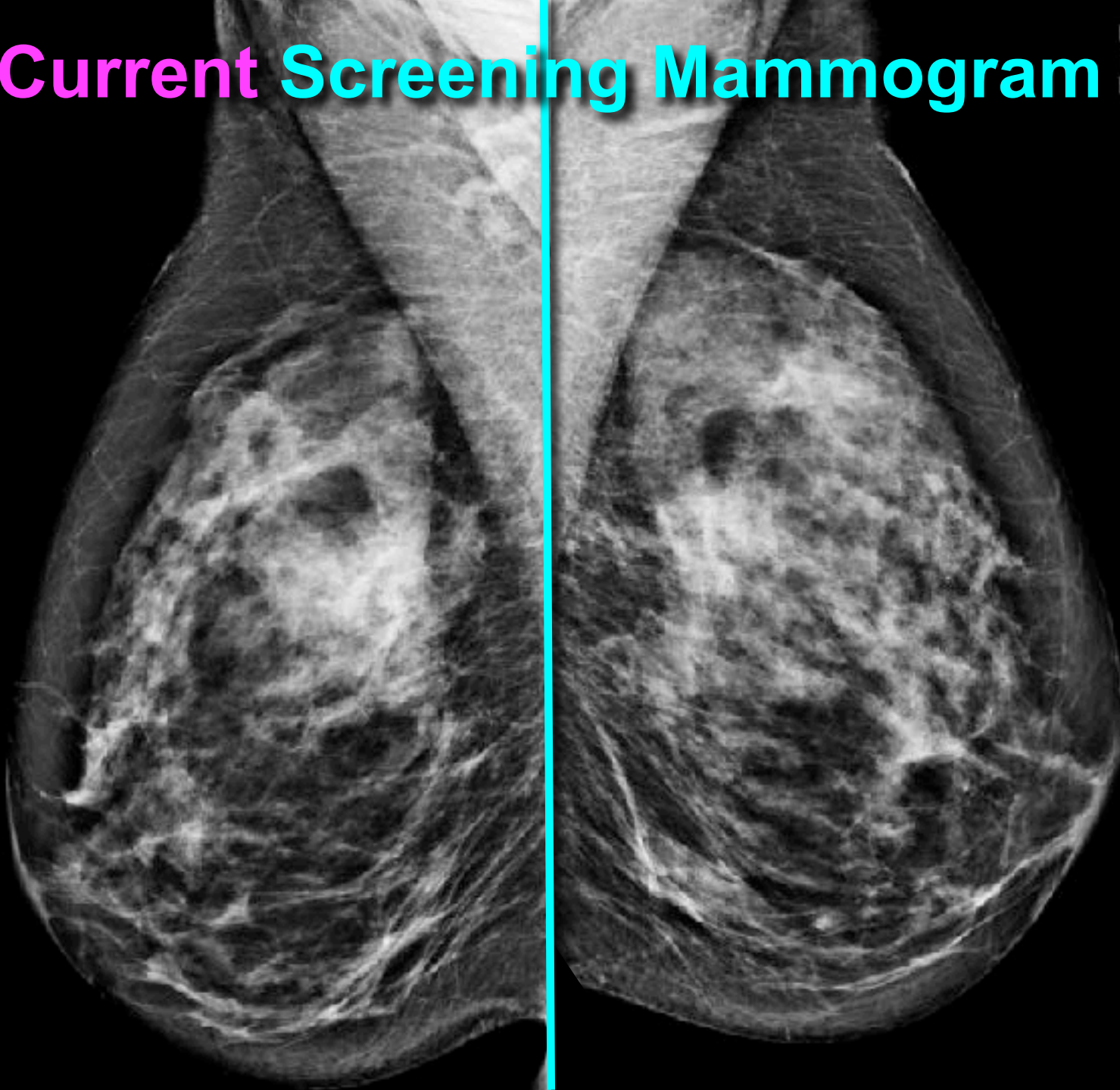


LMLO



LMLO

Current Screening Mammogram



LMLO

LMLO

Current Screening Mammogram

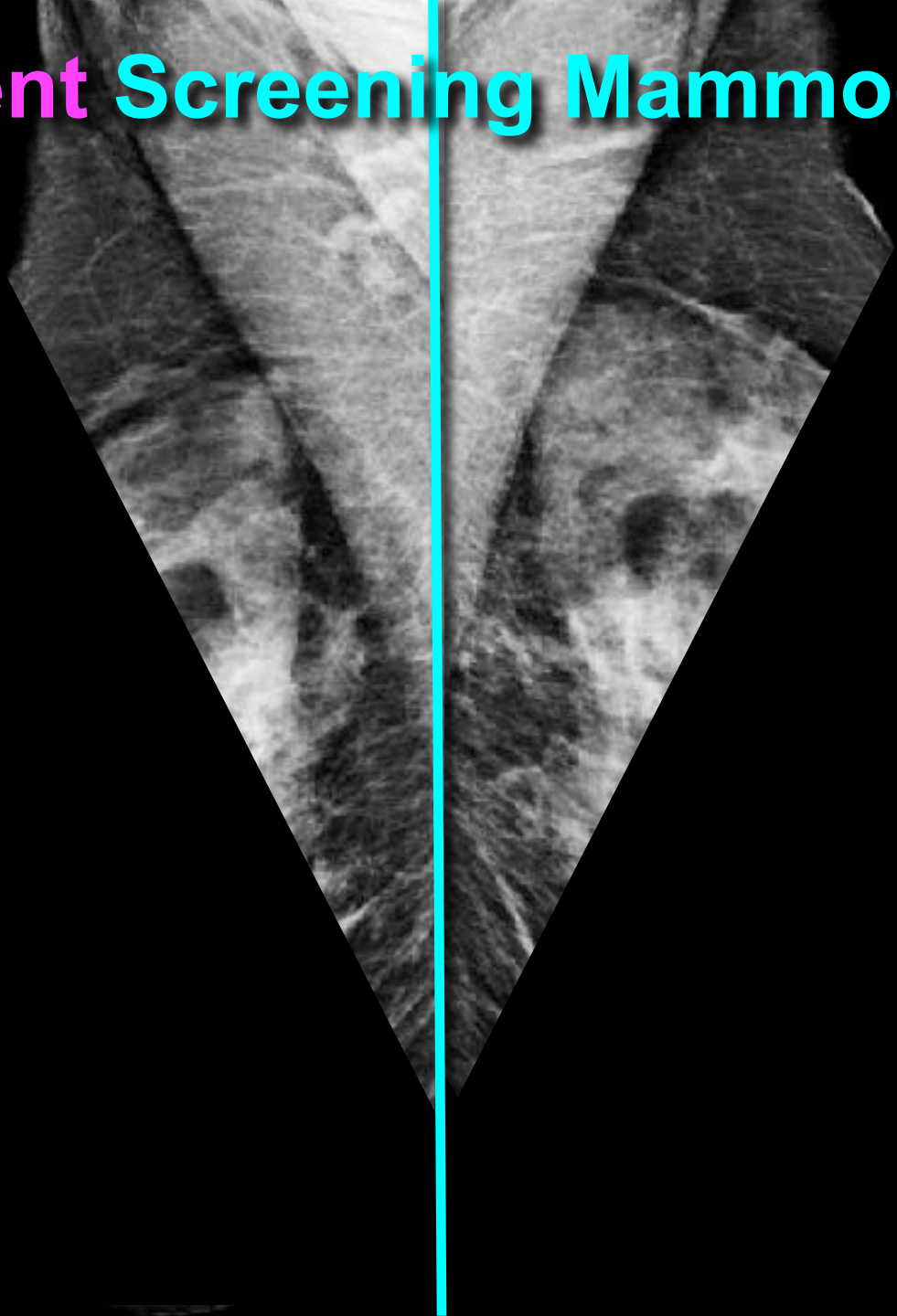
MLO

ML

LMLO

Current Screening Mammogram

LMLO

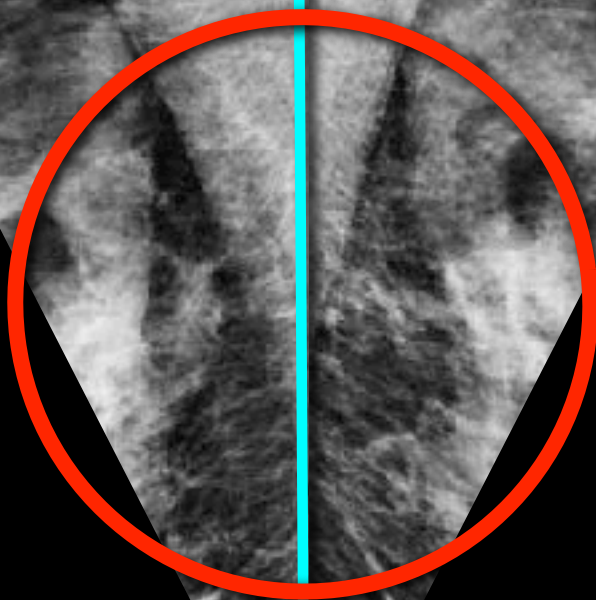


LMLO

Current Screening Mammogram

LMLO

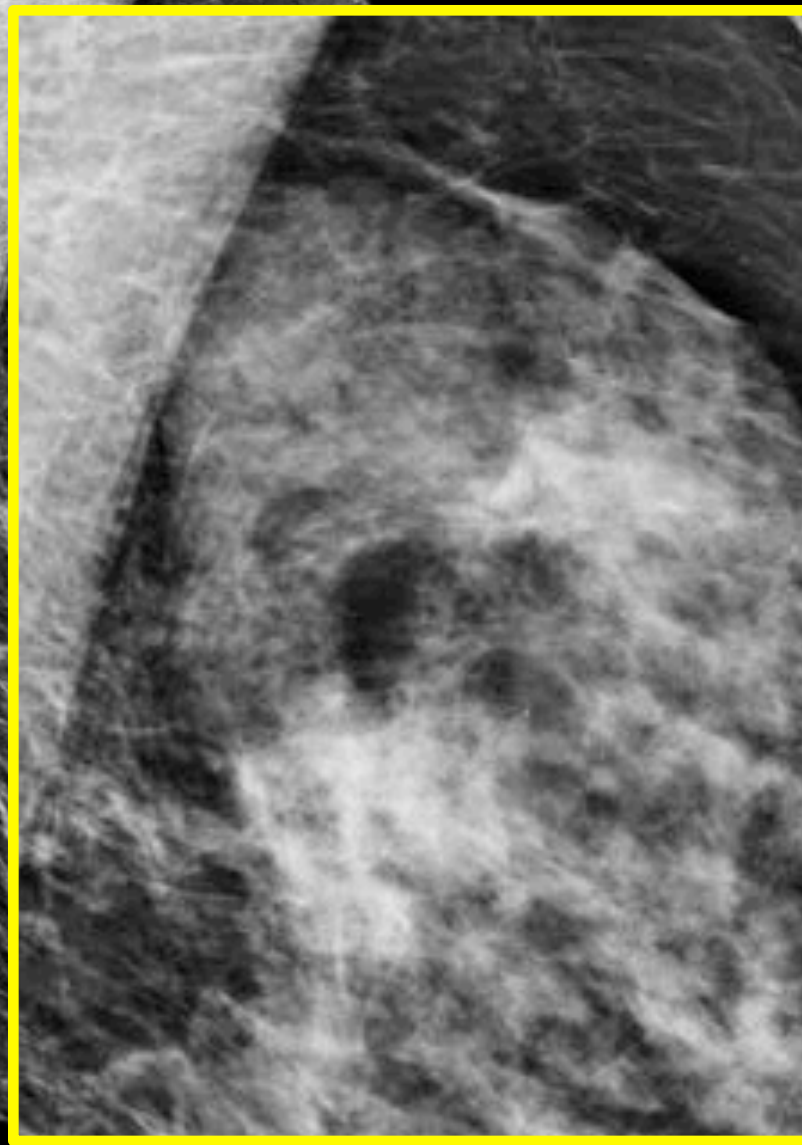
?



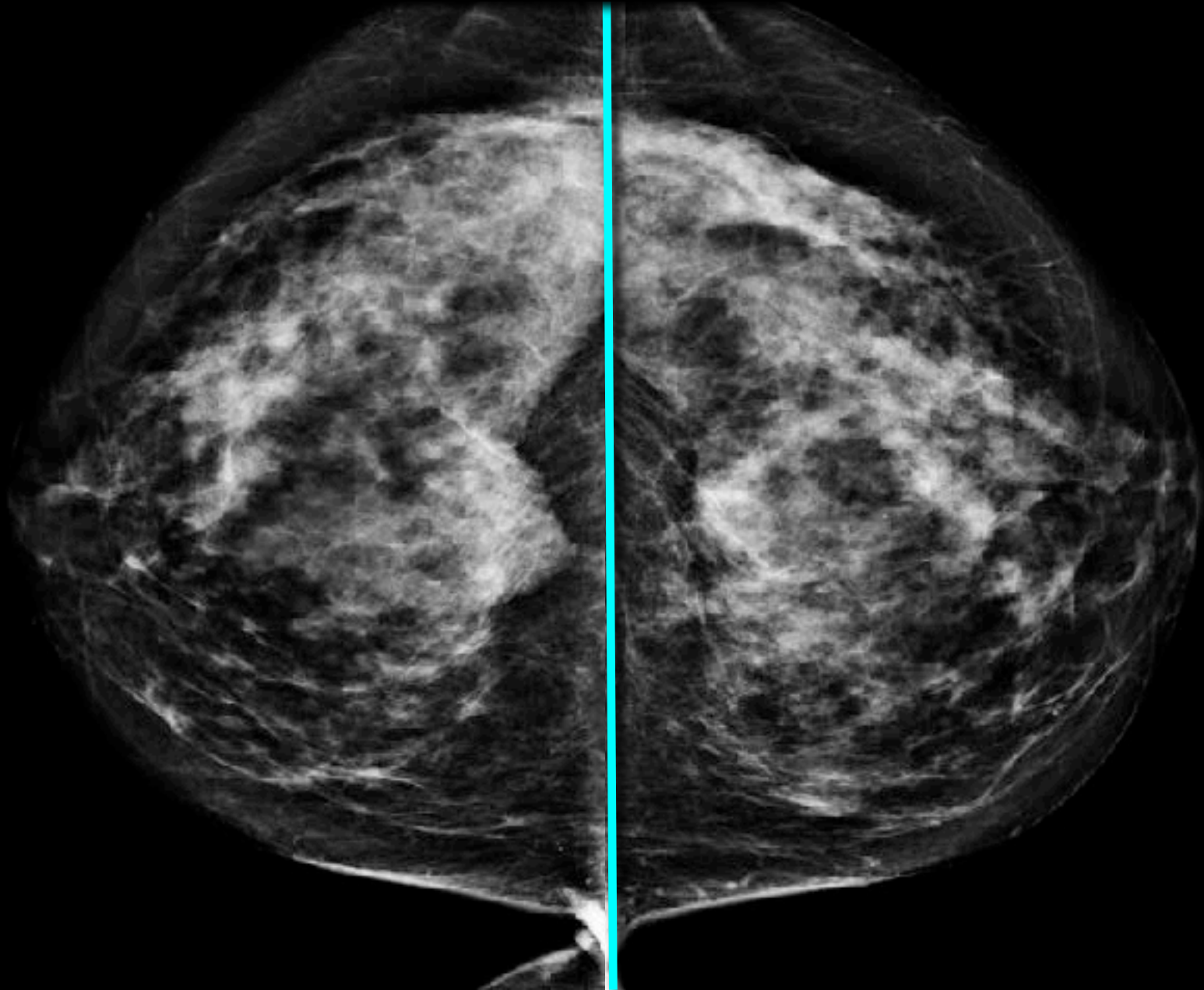
LMLO

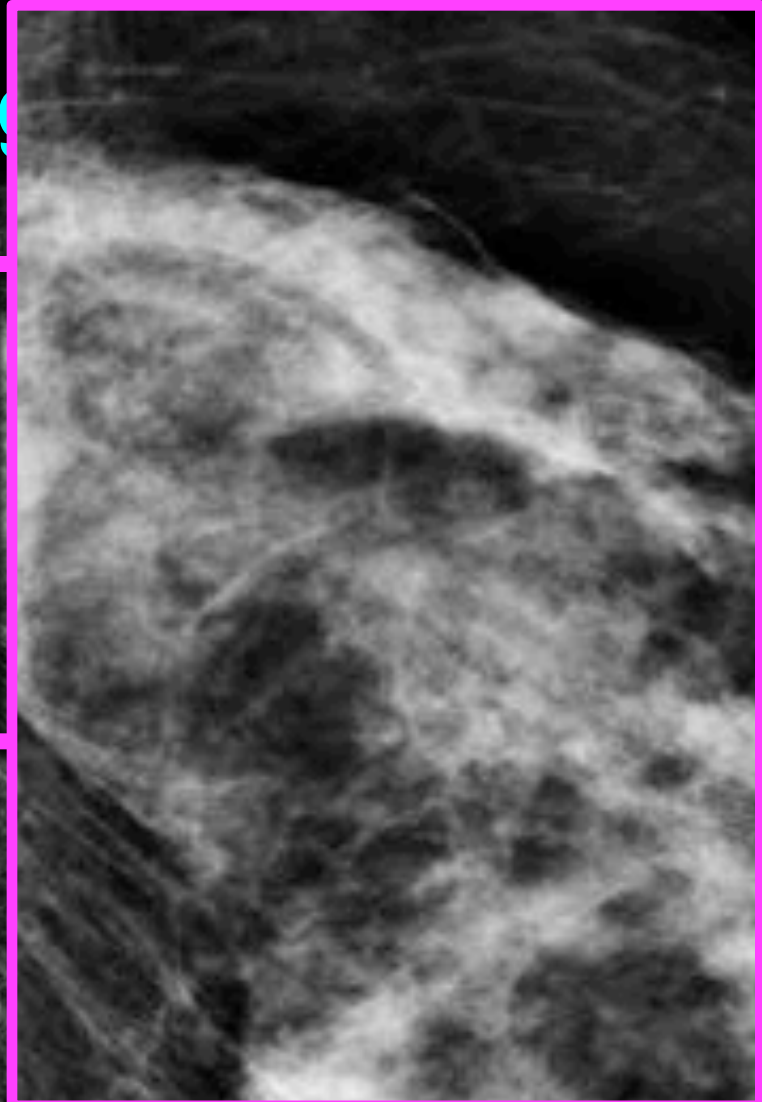
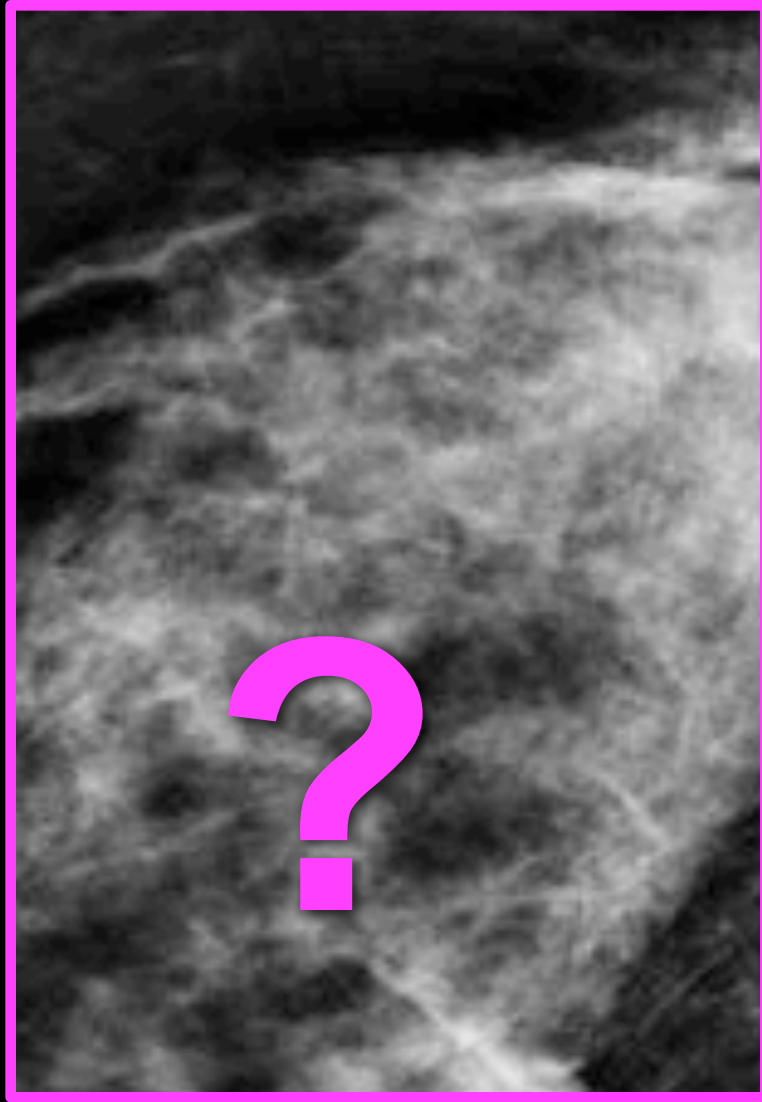
Current Screening Mammogram

LMLO



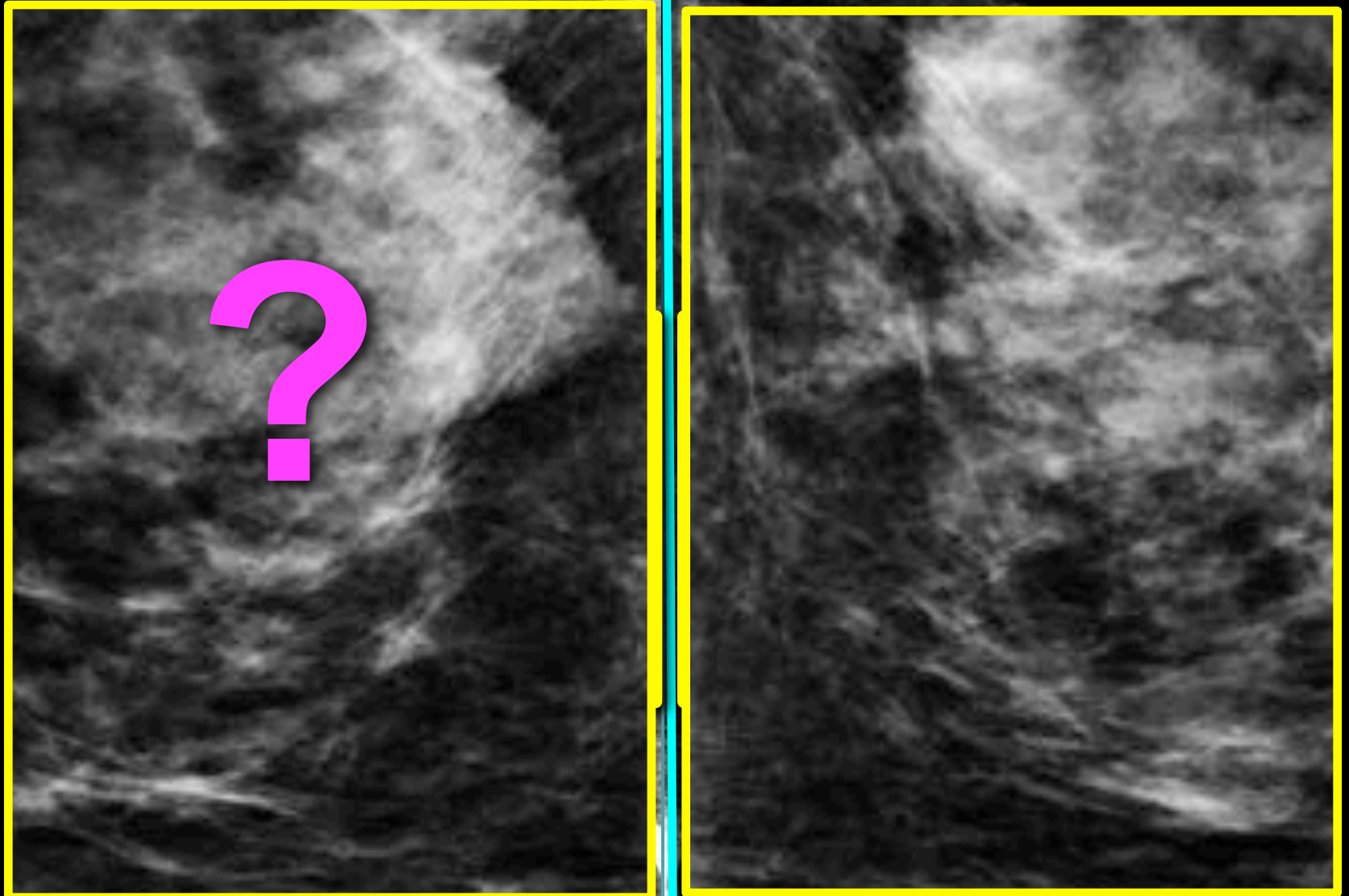
Current Screening Mammogram





ne

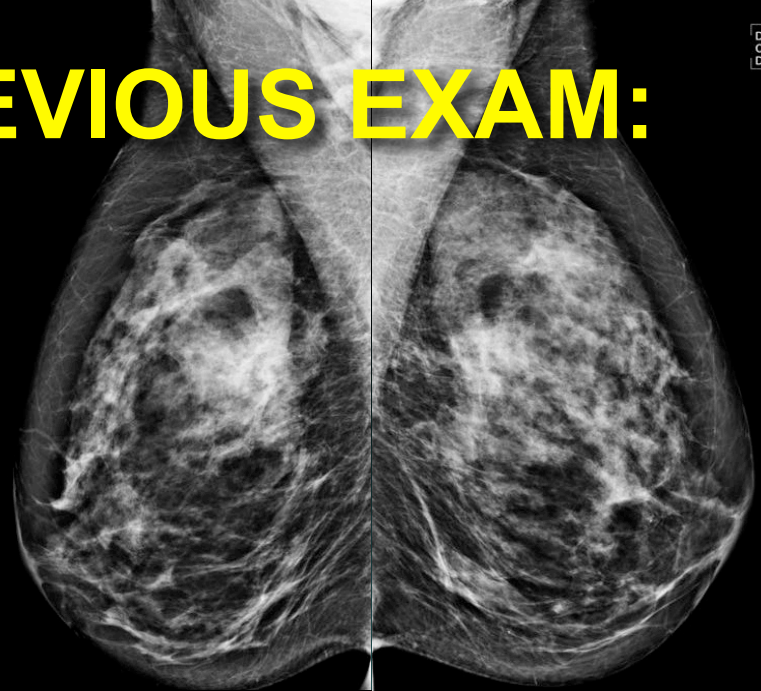
Current Screening Mammogram



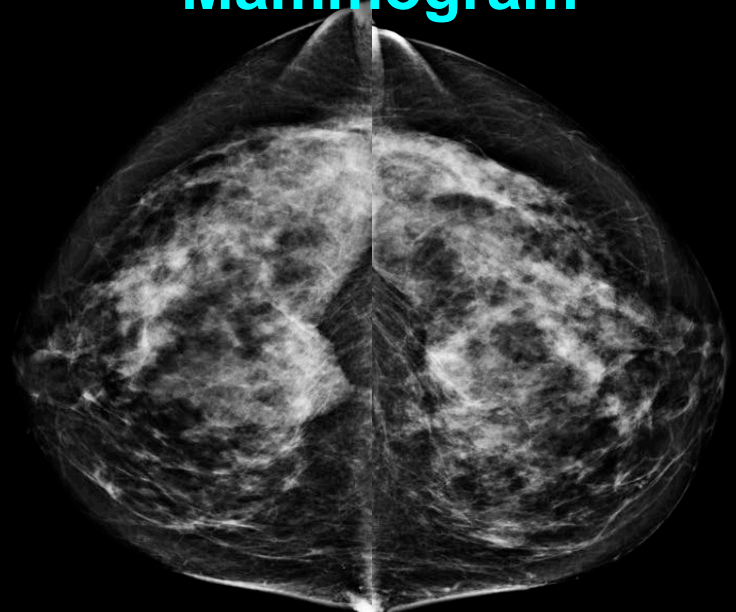
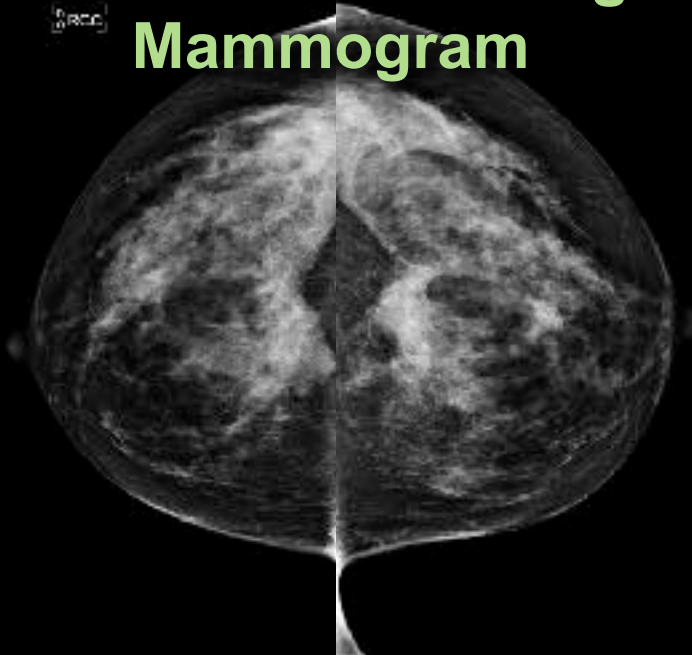
COMPARE TO PREVIOUS EXAM:



Previous Screening Mammogram



Current Screening Mammogram



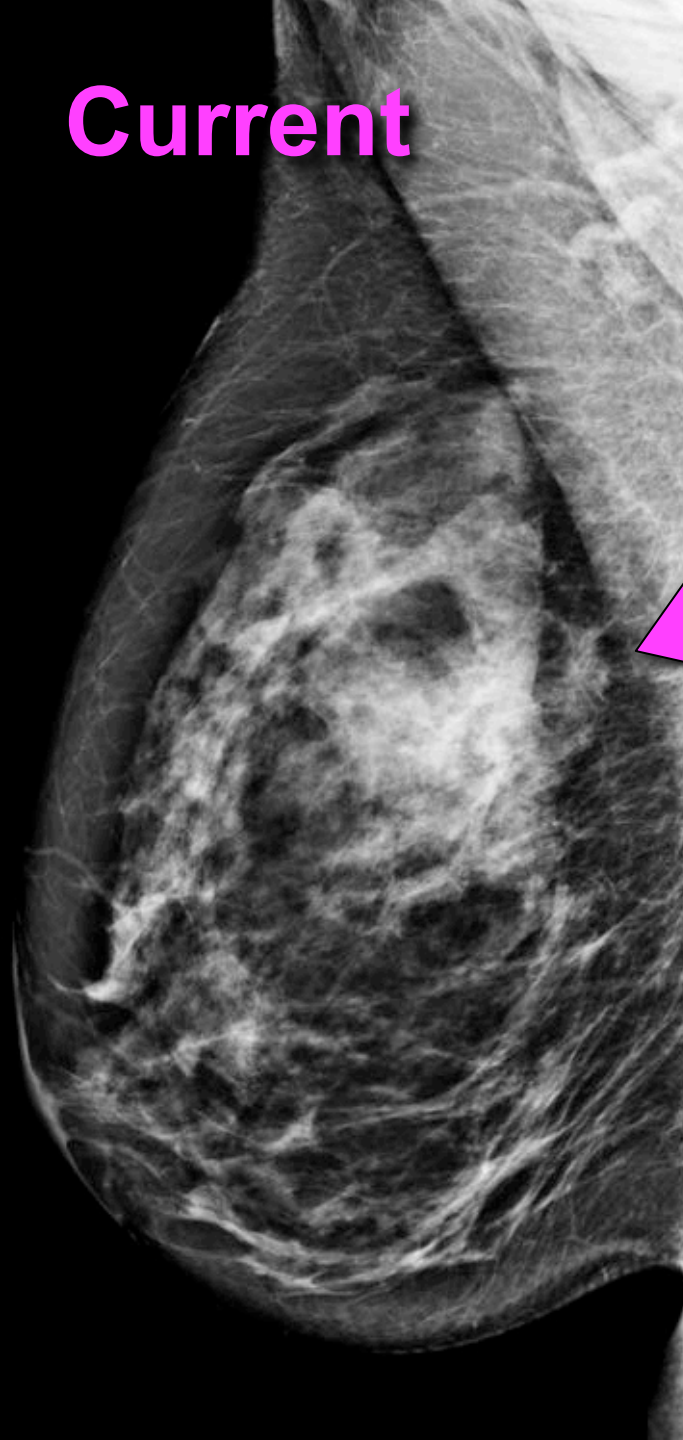
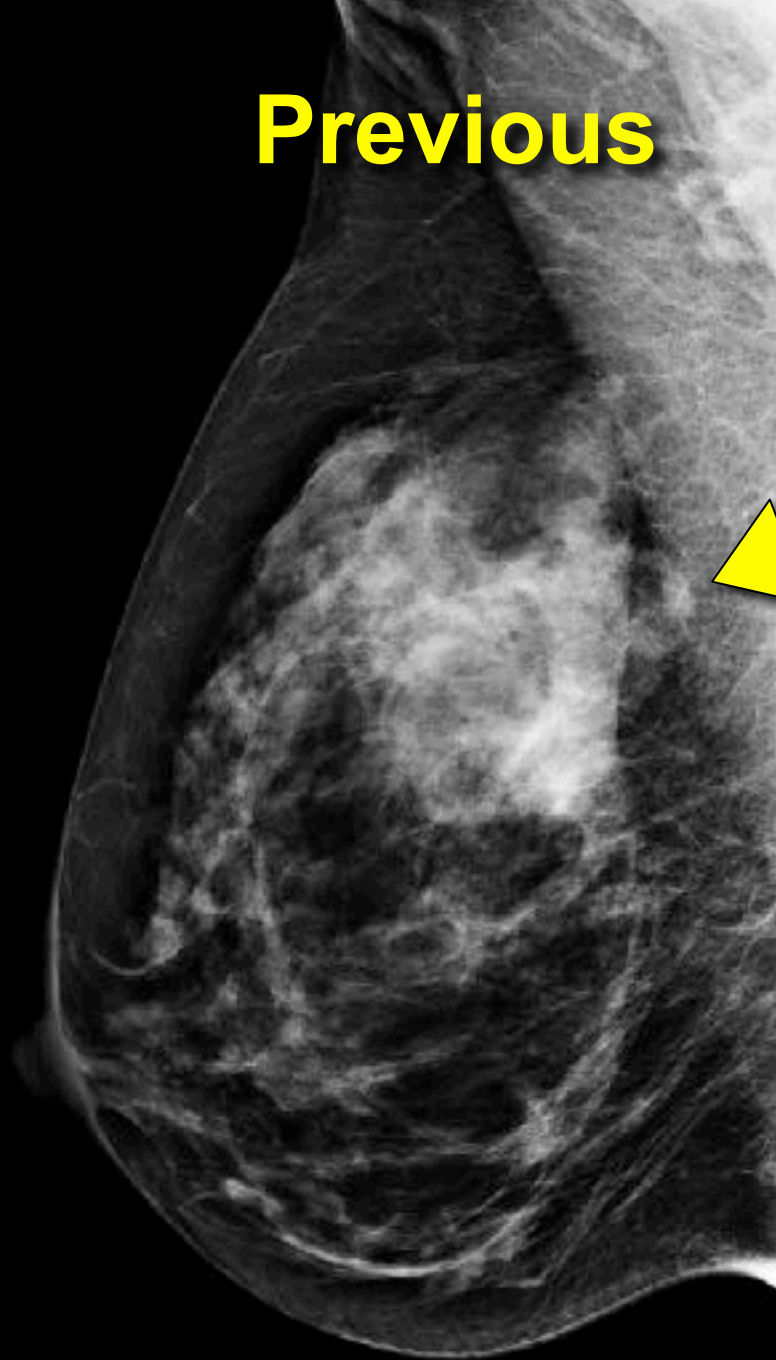
Previous

RMLO

Current



RMLO

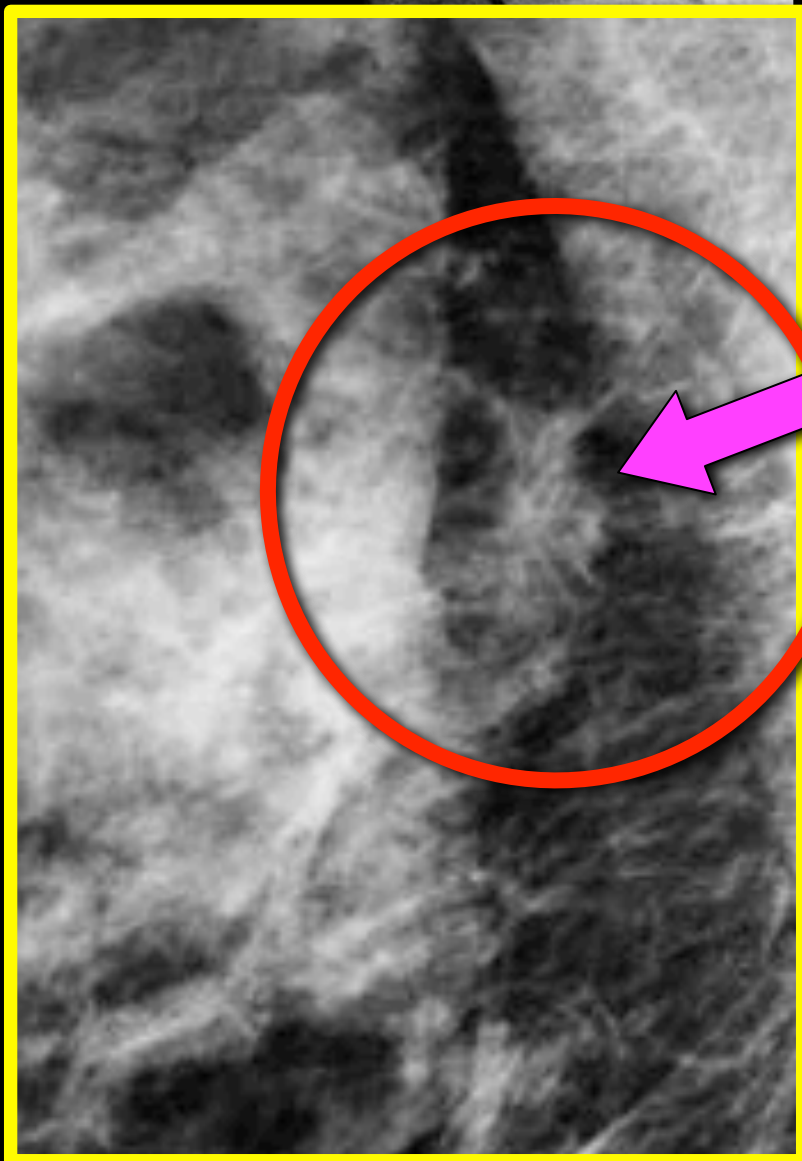
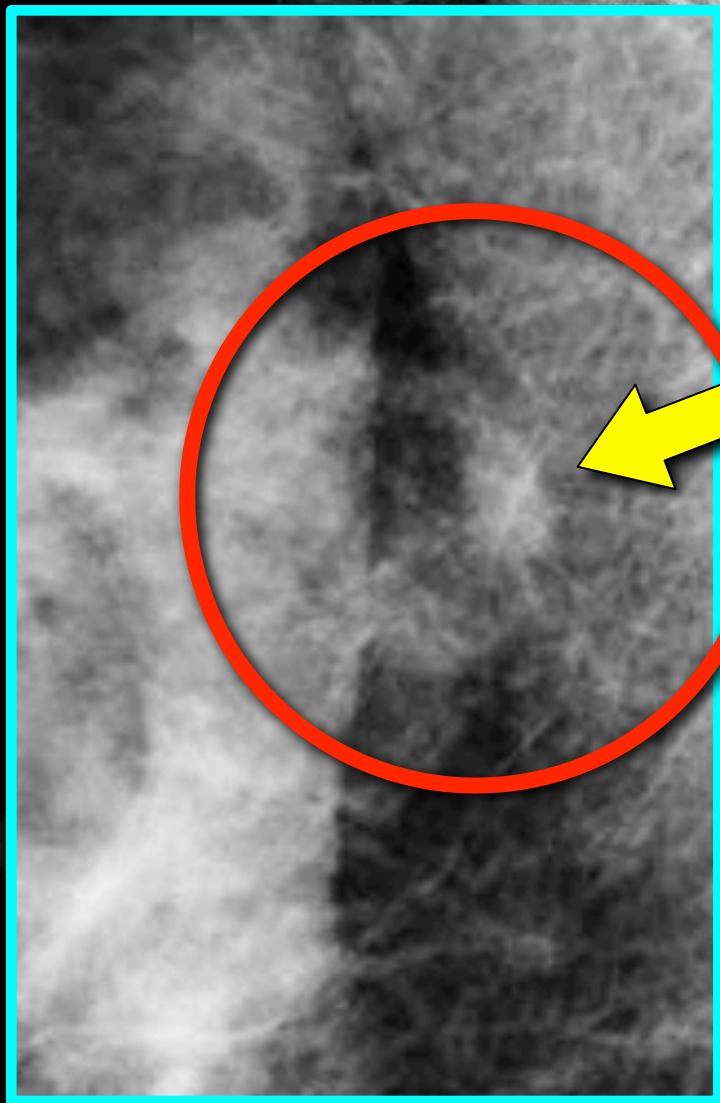


Previous

RMLO

Current

RMLO

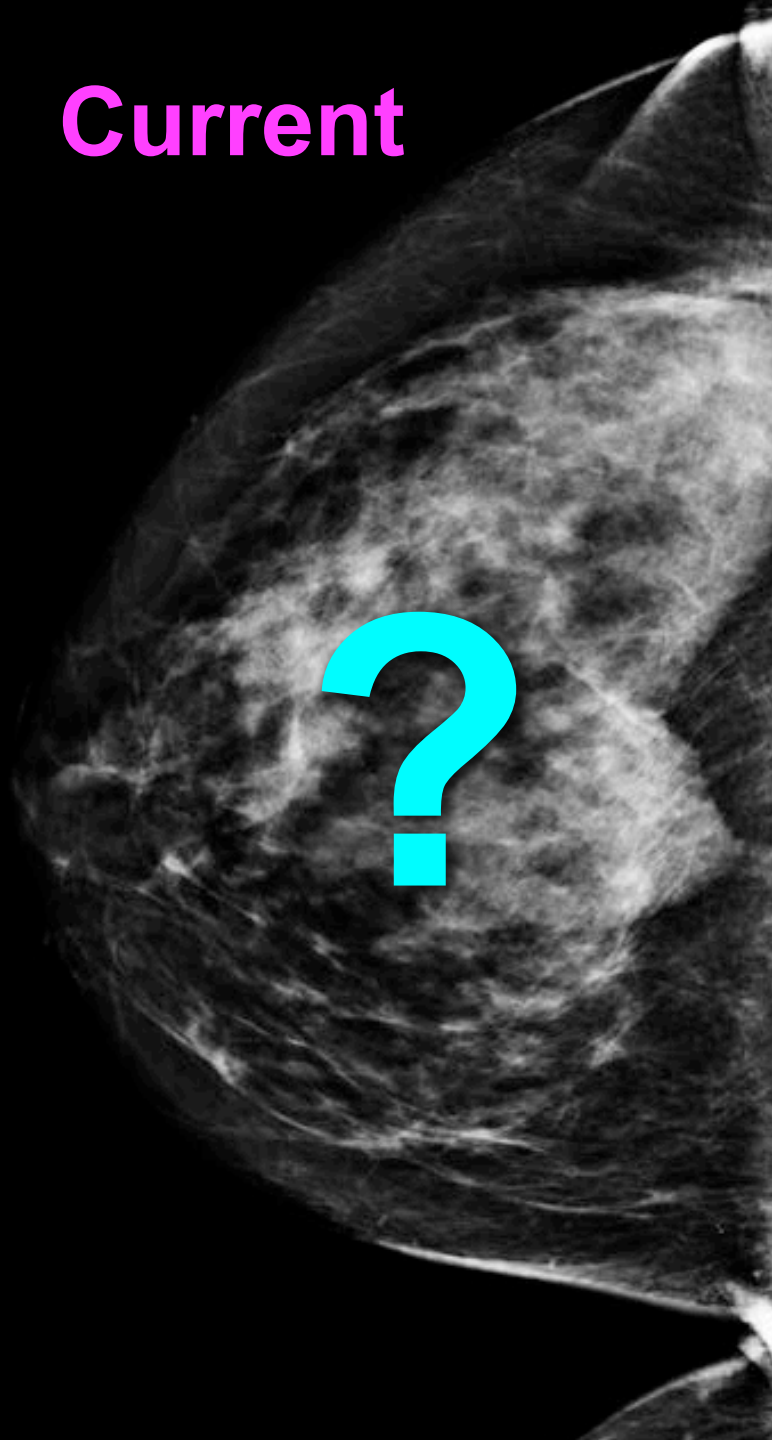
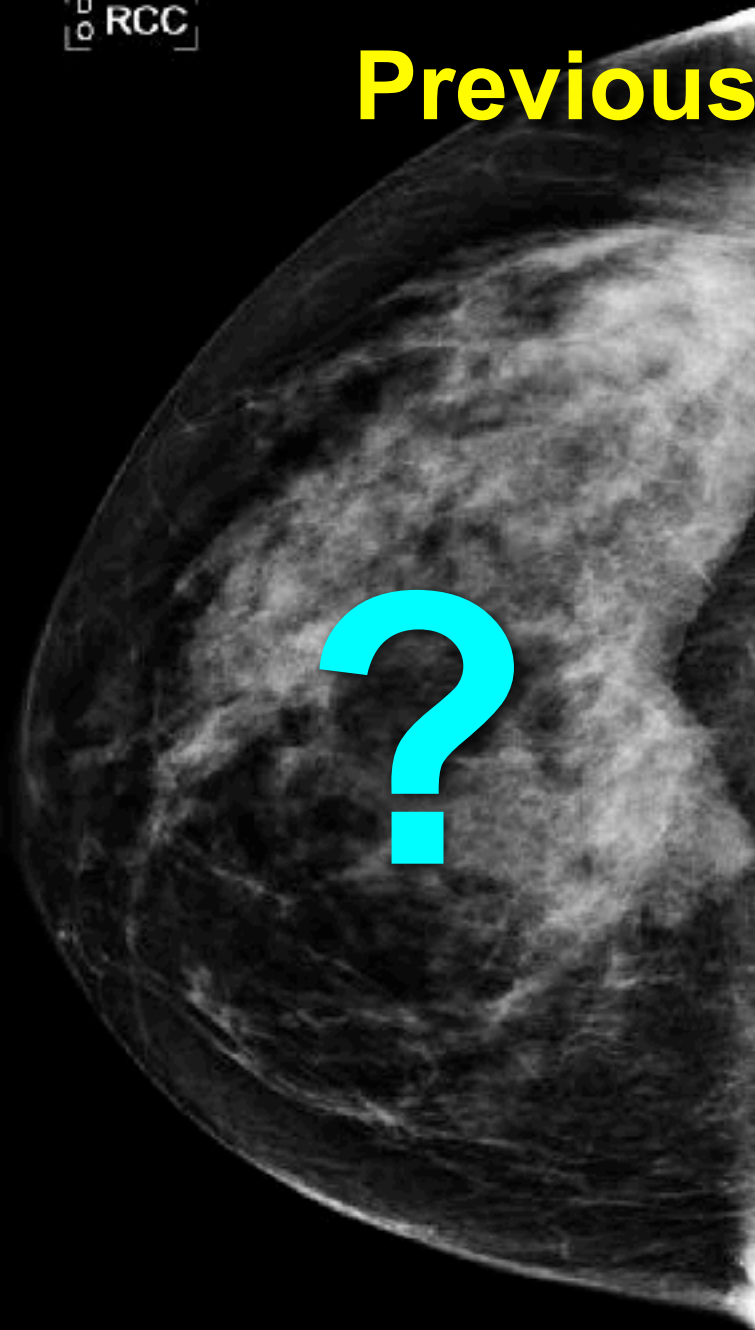


Previous

?

Current

?



Previous

Current

**PATIENT NOW
RECALLED FROM
SCREENING FOR
DIAGNOSTIC WORKUP**

**(WAS FOUND TO BE A
CANCER)**



READING SCREENING MAMMOGRAMS IN THIS TEACHING SET

- This is an **ENRICHED SET OF CASES**, with many more cancers than you will ever see!
- Since you know this, we realize you will **NOT** be reading these as you would at home
- You will be recalling **MANY MORE** cases than you normally would: **THAT IS OK!**

**THE PURPOSE OF THIS TEACHING
SET IS MAINLY TO IMPROVE YOUR
SENSITIVITY, NOT SPECIFICITY**



READING SCREENING MAMMOGRAMS IN THIS TEACHING SET

- As a result, we realize that your **RECALL RATE** will almost certainly go up when you first get home, but will gradually come back down to a more reasonable range
- **At the same time, our GOAL is that you will continue to find many more SUBTLE CANCERS than you did previously**

**DO NOT HESITATE TO CALL ON
ANY OF THE FACULTY TO HELP
YOU ACHIEVE THAT GOAL!**

ACR MAMMOGRAPHY ACCREDITATION PROGRAM (MAP)





MAMMOGRAPHY ACCREDITATION PROGRAM REQUIREMENTS: ACR

- **Personnel Qualifications**
 - Interpreting physicians
 - Technologists
 - Medical physicists/MR scientists (as applicable)
- **Equipment specifications**
- **Clinical images**
- **Phantom images (as applicable)**
- **QA requirements**
- **QC requirements**
- **Accreditation testing**



MAMMOGRAPHY ACCREDITATION PROGRAM REQUIREMENTS: ACR

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CLINICAL IMAGING CATEGORIES

Positioning

Exposure

Compression

Sharpness

Contrast

Artifacts

Labeling

Noise



CLINICAL IMAGING CATEGORIES

Positioning

Exposure

Compression

Sharpness

Contrast

Artifacts

Labeling

Noise





Positioning: MLO



Positioning

MLO VIEW

RMLO

M

F

FG

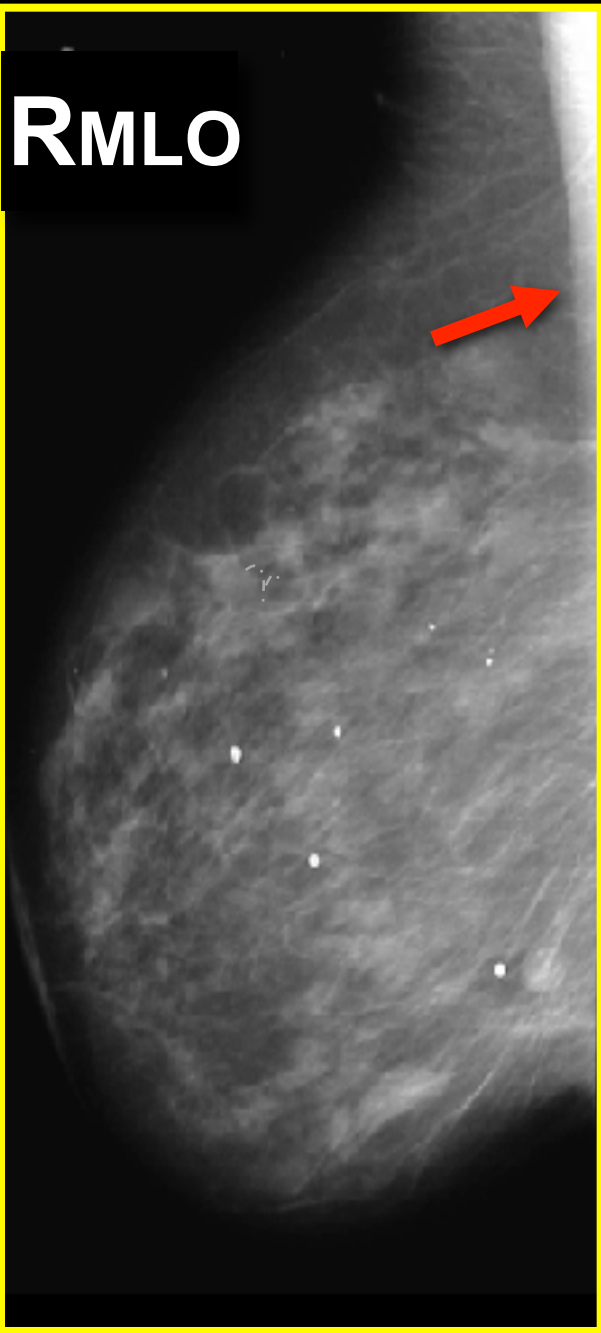
N

IF

FG = fibroglandular tissue; M = Pectoralis muscle;
N = Nipple; IF = inframammary fold; F = Retroglandular fat



RmLO

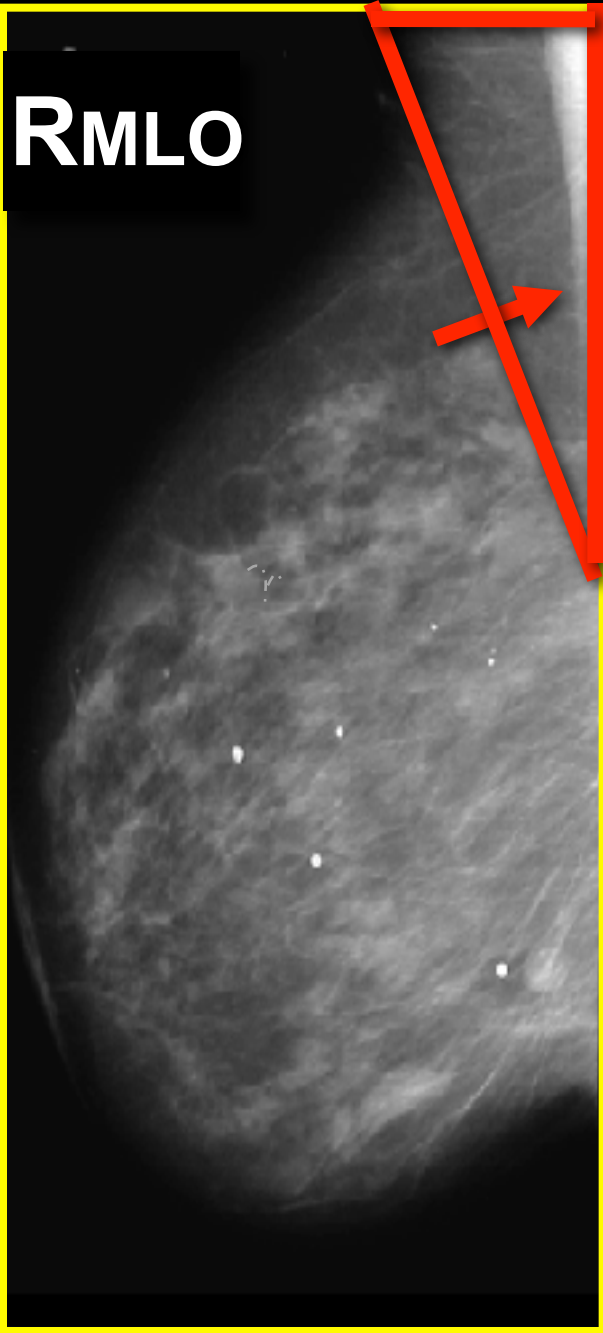


MLO POSITIONING: PECTORAL MUSCLE

- **Inadequate pectoral muscle on this image**



RMLO

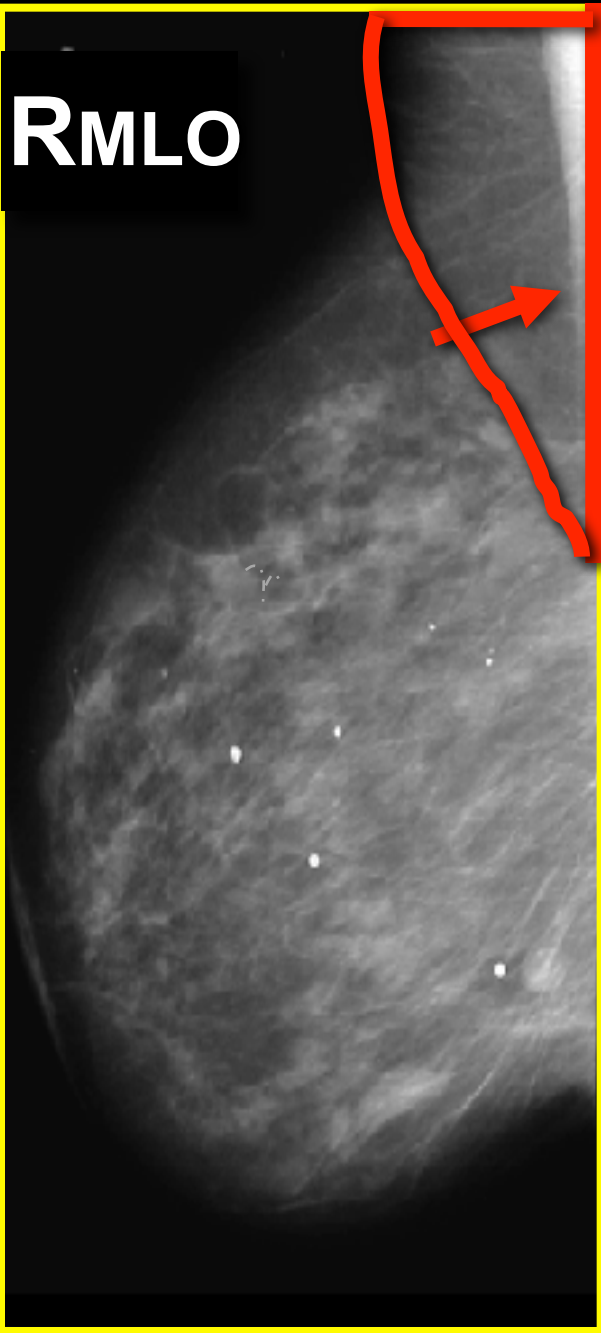


MLO POSITIONING: PECTORAL MUSCLE

- **Inadequate pectoral muscle on this image**
- Should be wider with triangular shape (wider superiorly)
-



RMLO

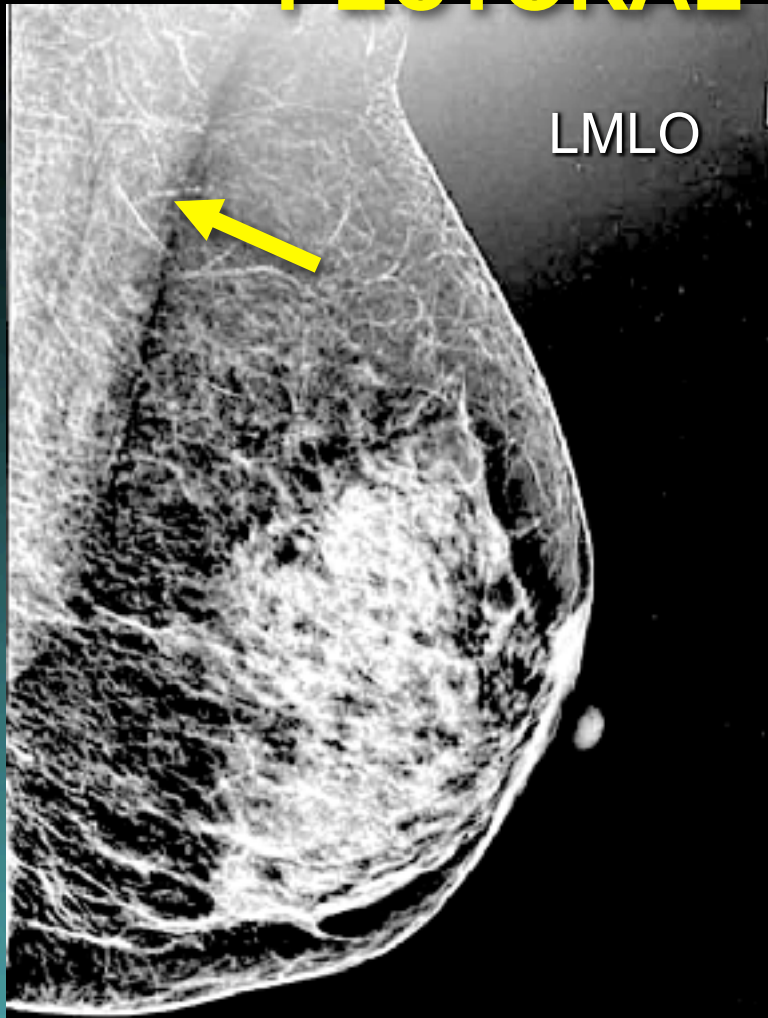


MLO POSITIONING: PECTORAL MUSCLE

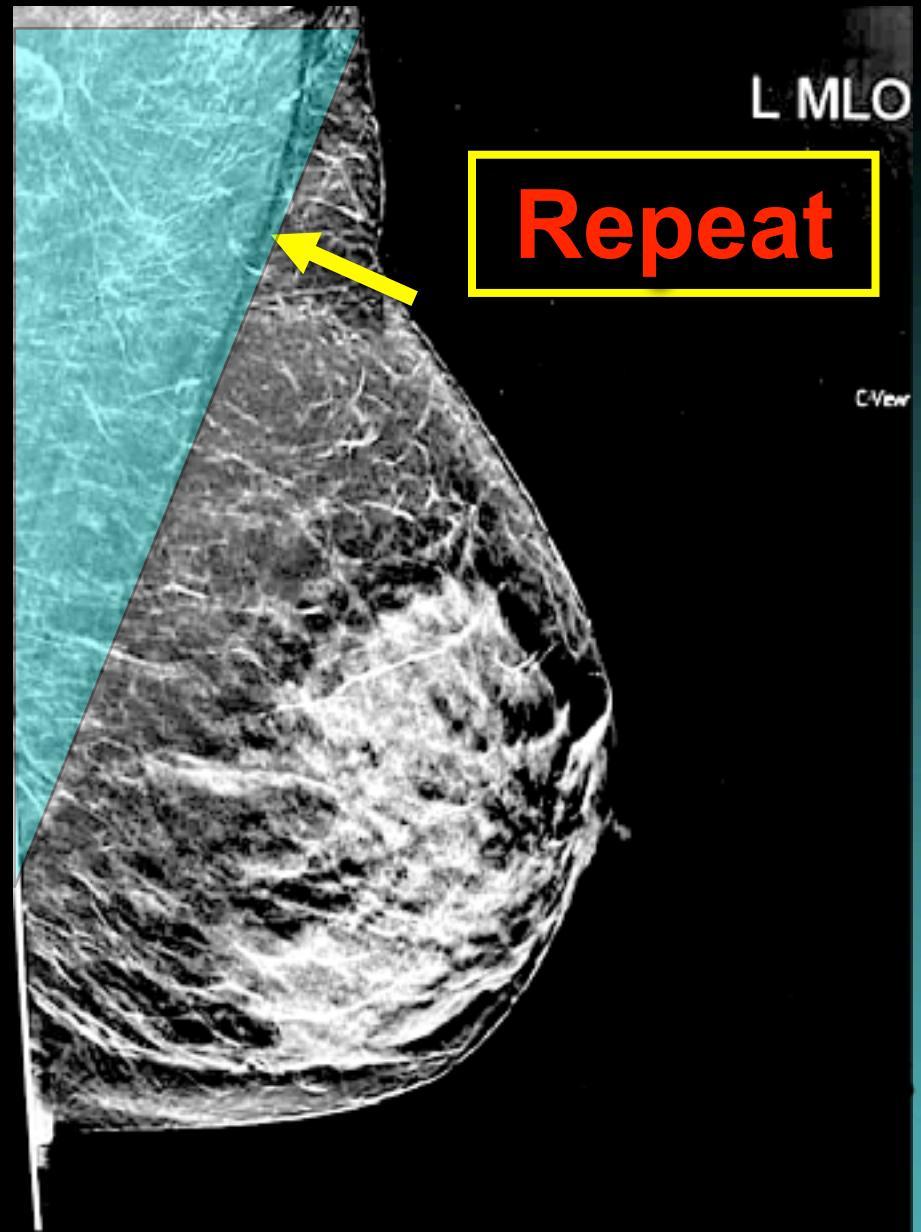
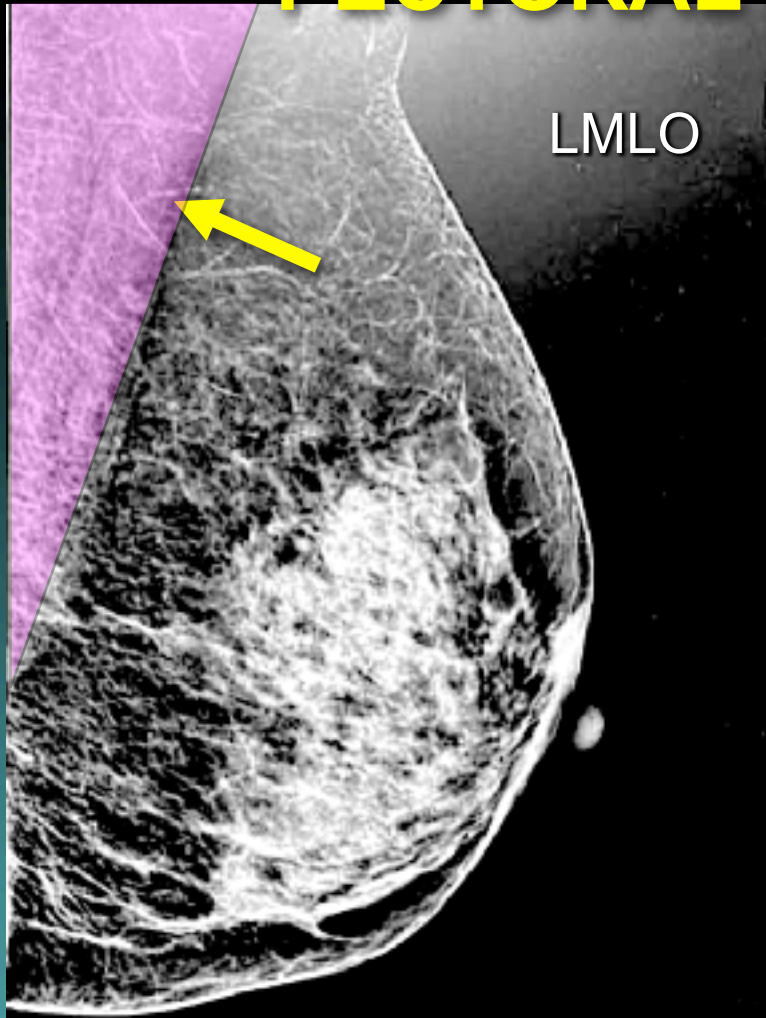
- **Inadequate pectoral muscle on this image**
- **Should be wider with triangular shape (wider superiorly)**
- **Optimally has convex border anteriorly**



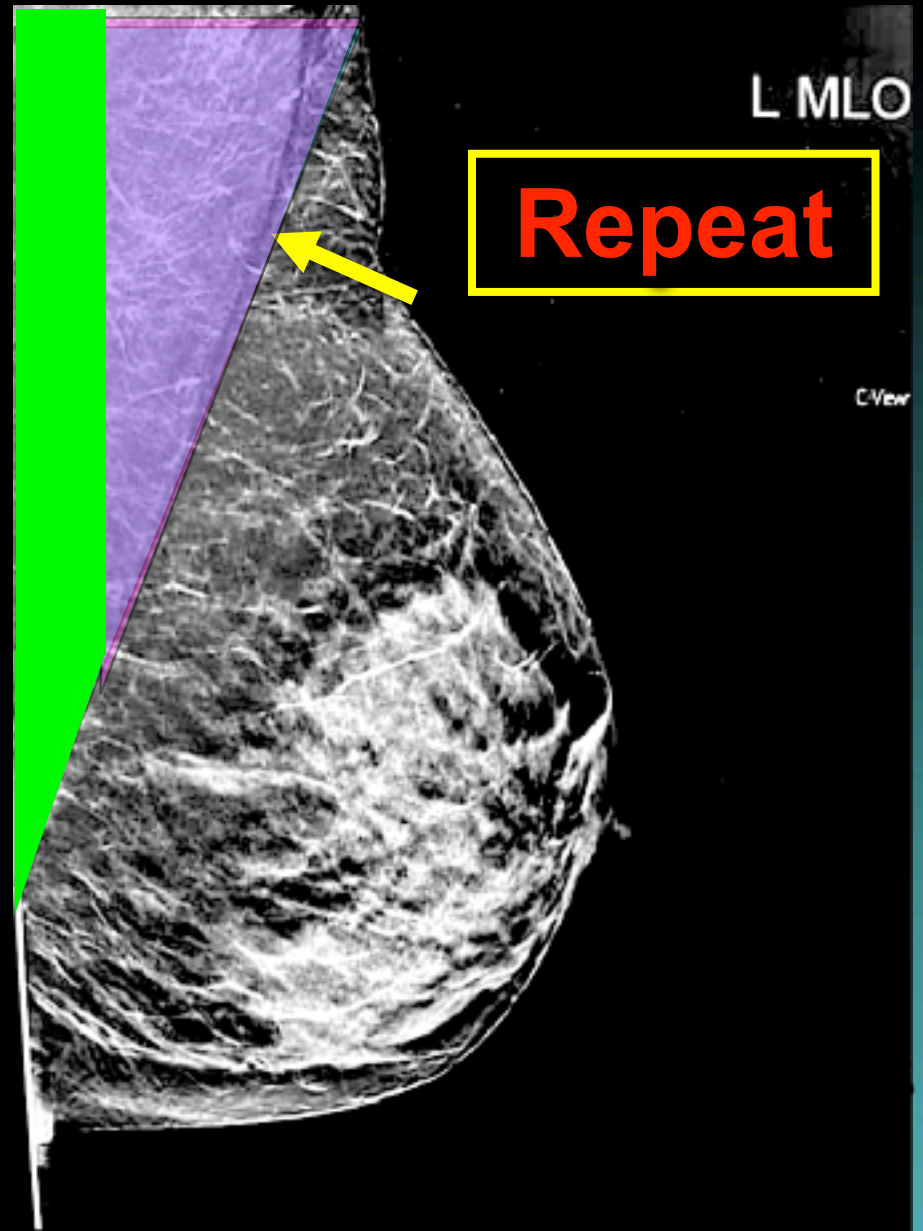
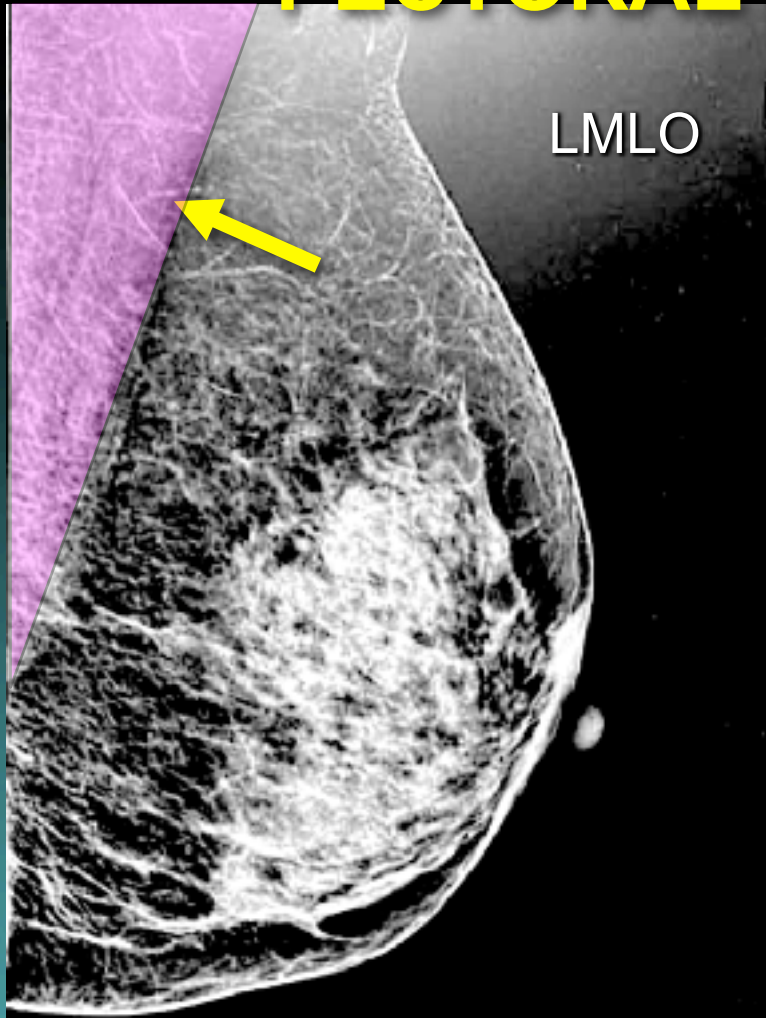
POSITIONING: MUST GET ADEQUATE PECTORAL MUSCLE ON IMAGE!



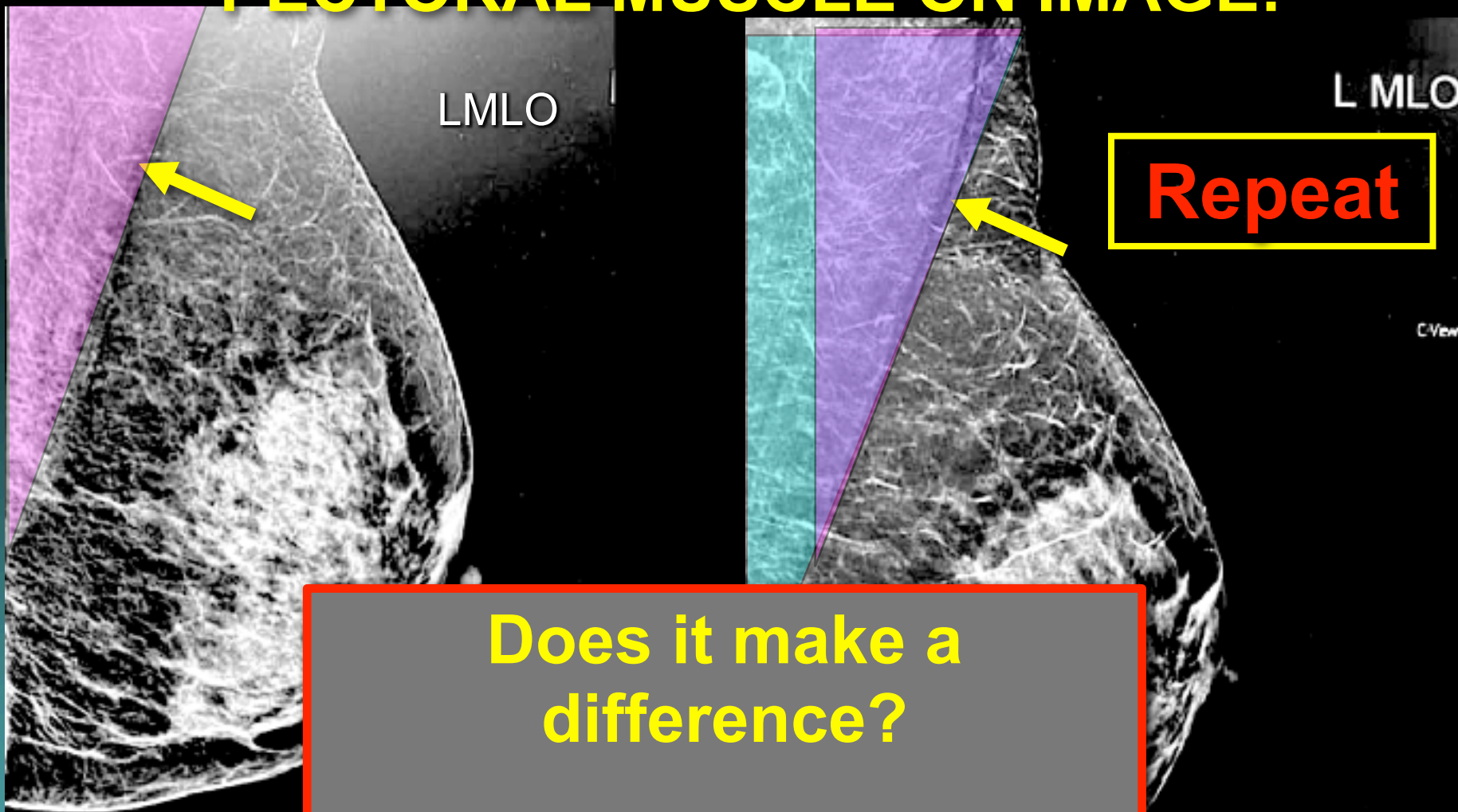
POSITIONING: MUST GET ADEQUATE PECTORAL MUSCLE ON IMAGE!



POSITIONING: MUST GET ADEQUATE PECTORAL MUSCLE ON IMAGE!



POSITIONING: MUST GET ADEQUATE PECTORAL MUSCLE ON IMAGE!



Does it make a
difference?

YES!!

POSITIONING: MUST GET ADEQUATE PECTORAL MUSCLE ON IMAGE!

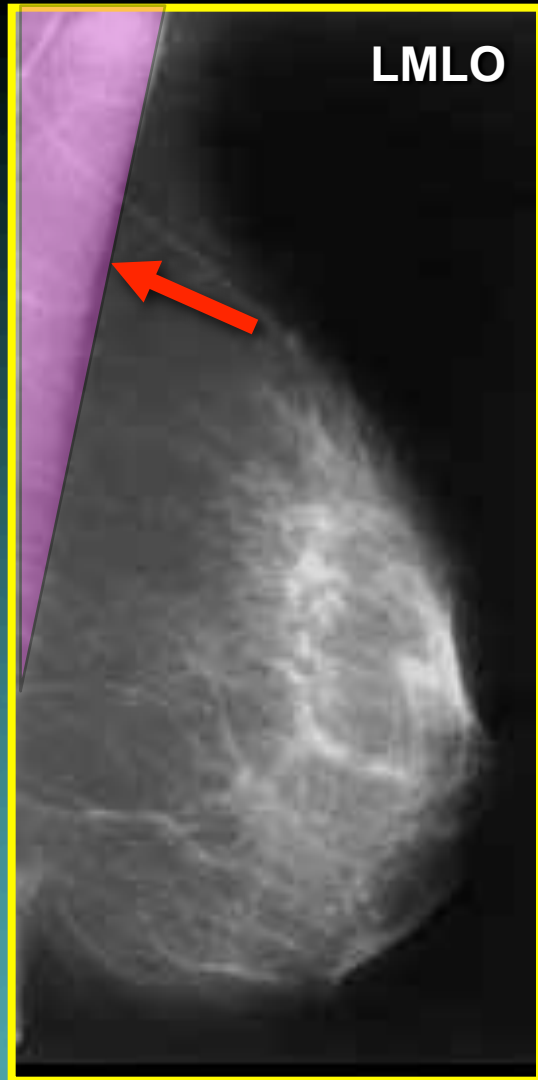


Does it make a
difference?

YES!!



POSITIONING: MUST GET ADEQUATE PECTORAL MUSCLE ON IMAGE!

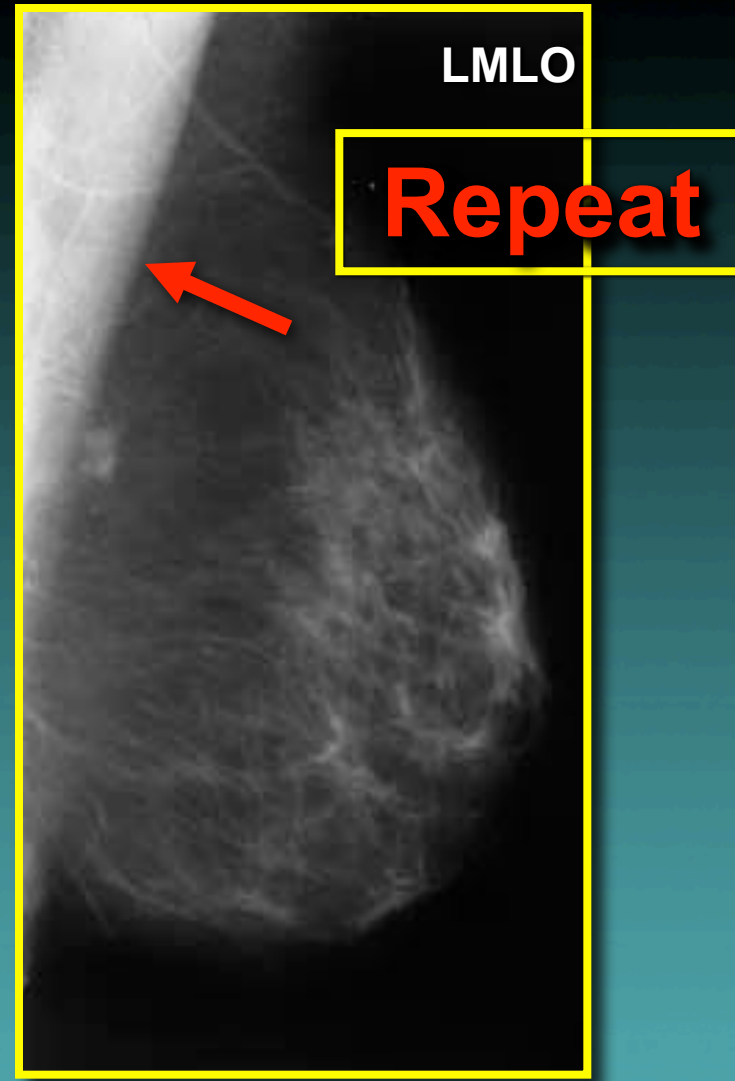
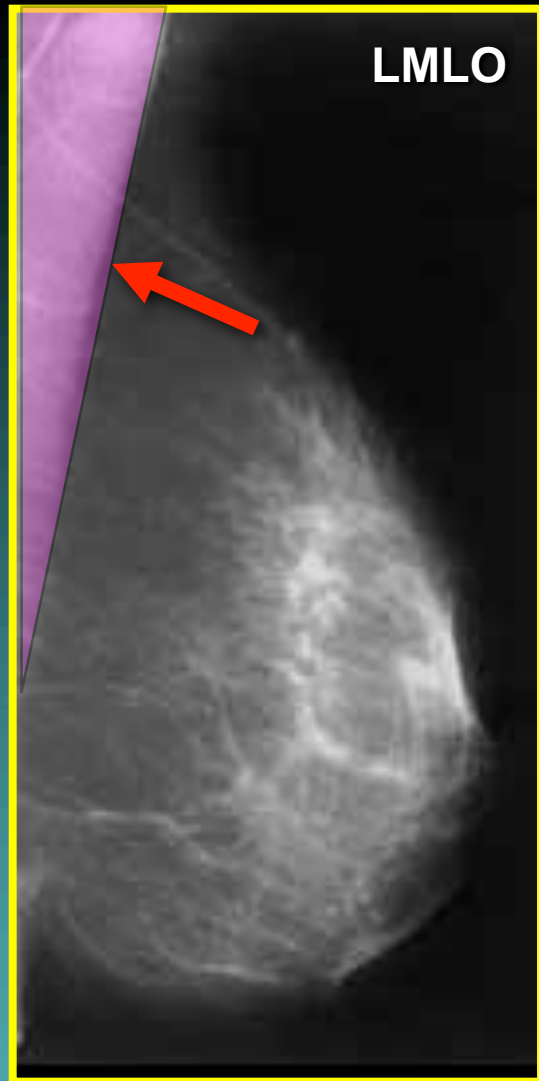


Does it make a
difference?

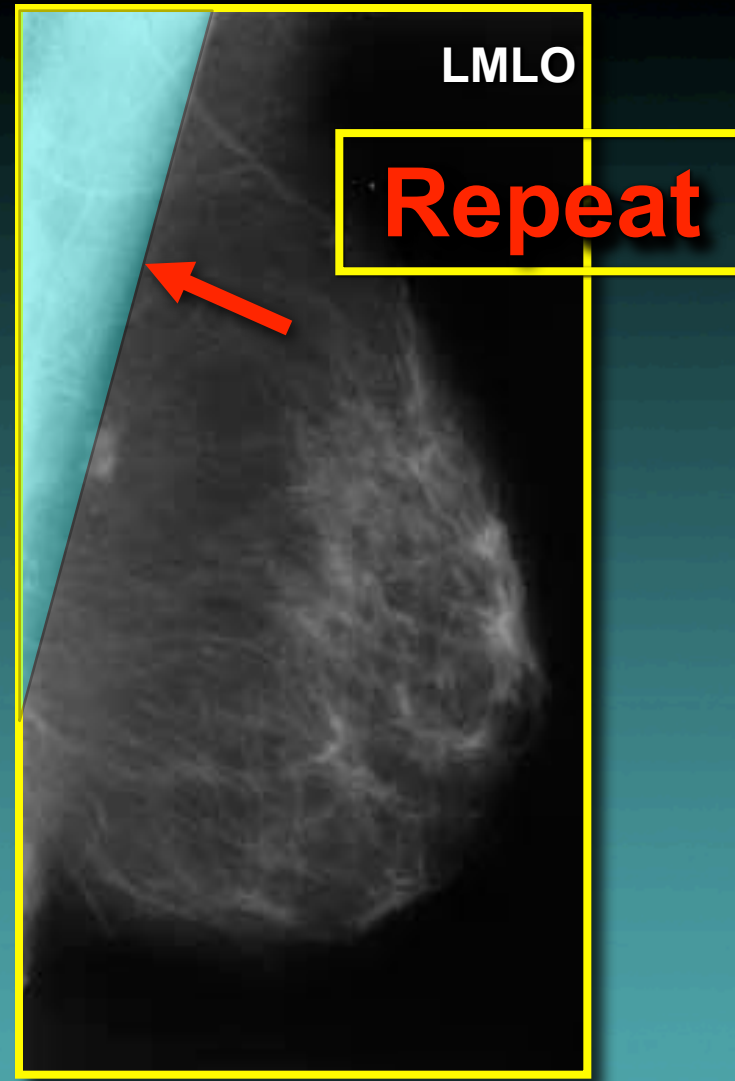
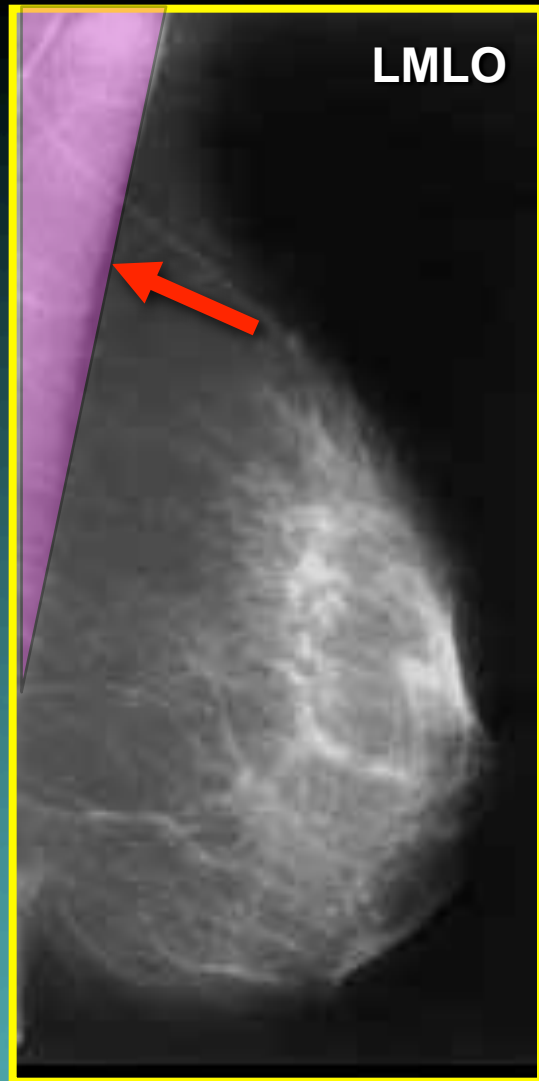
YES!!



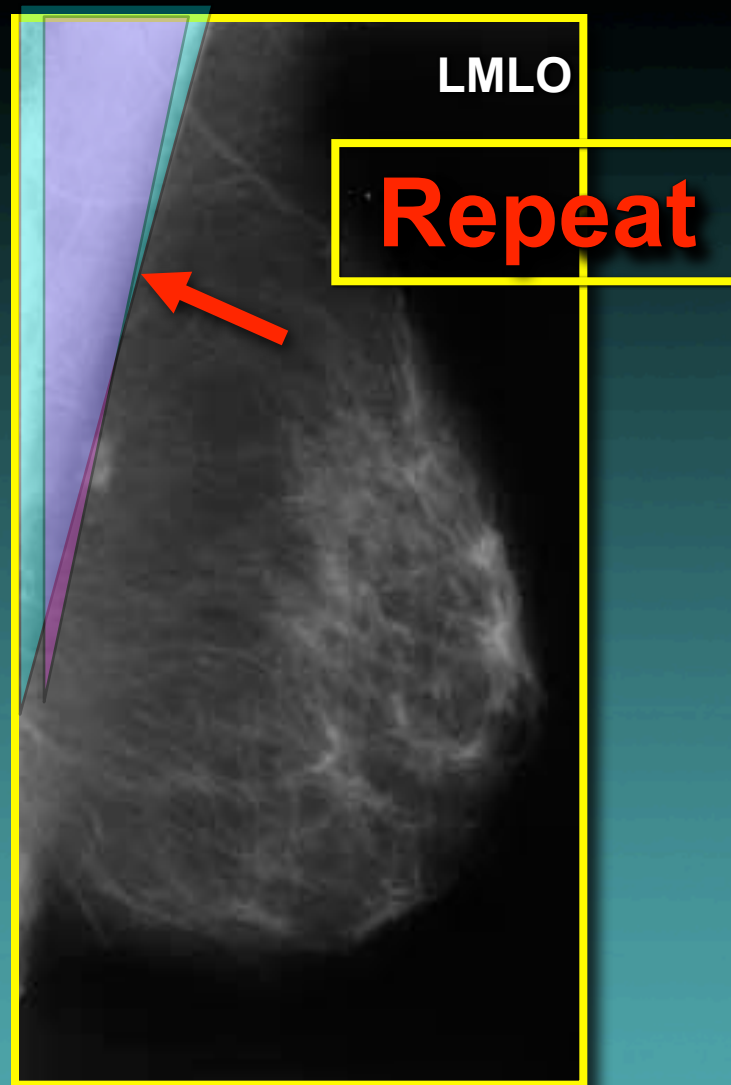
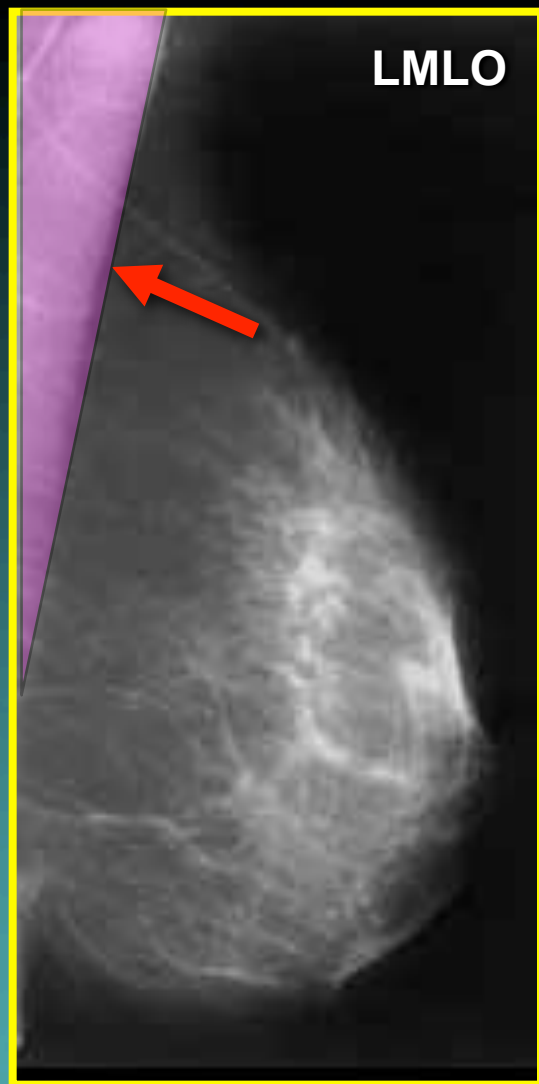
POSITIONING: MUST GET ADEQUATE PECTORAL MUSCLE ON IMAGE!



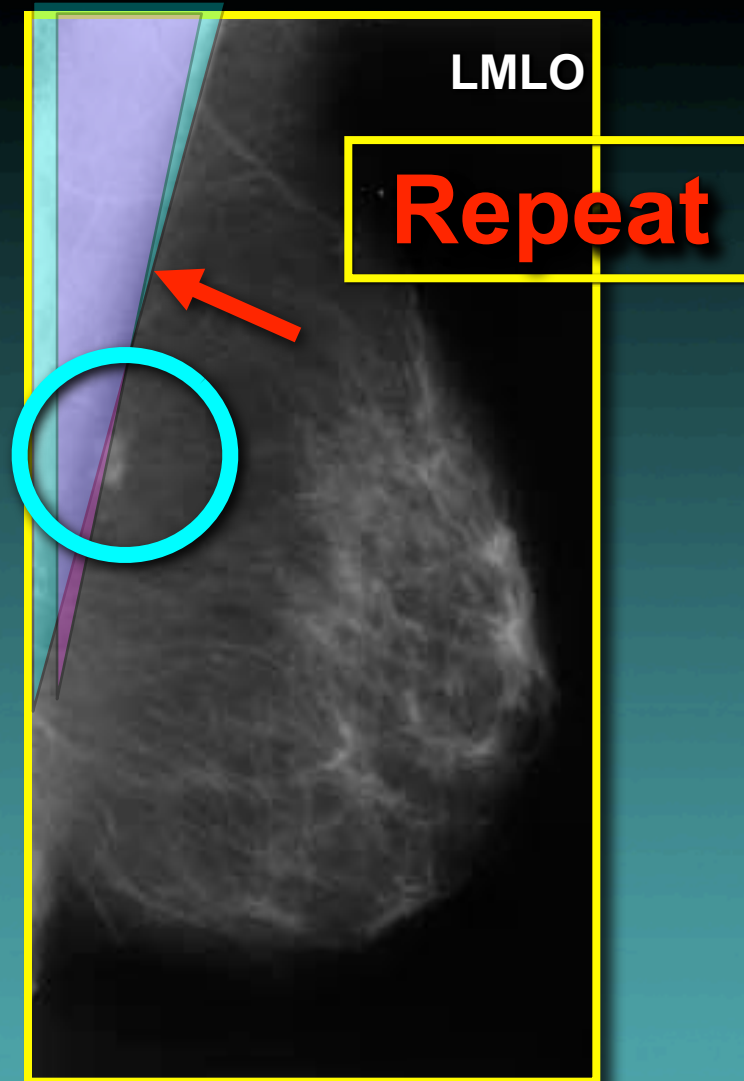
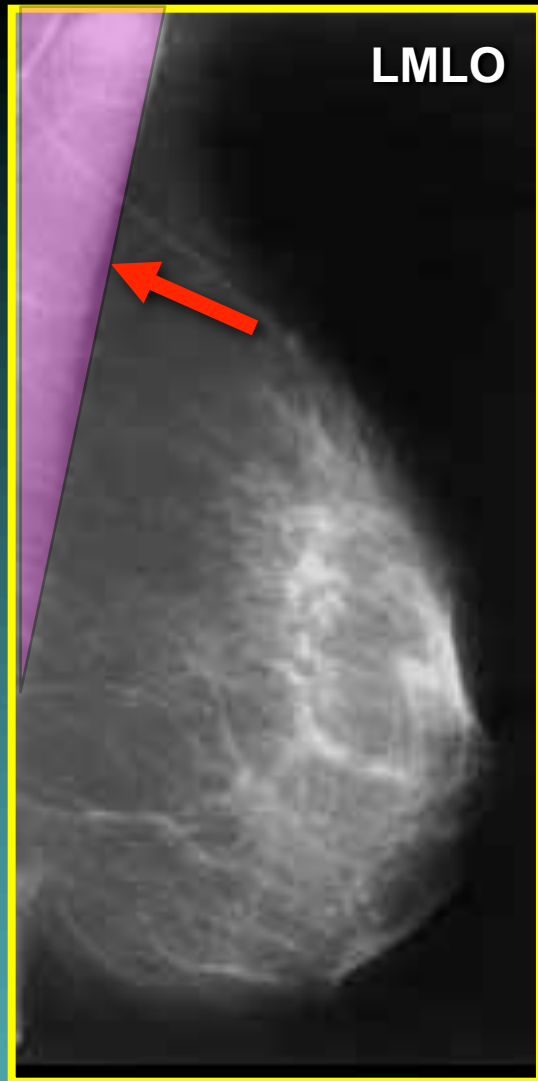
POSITIONING: MUST GET ADEQUATE PECTORAL MUSCLE ON IMAGE!



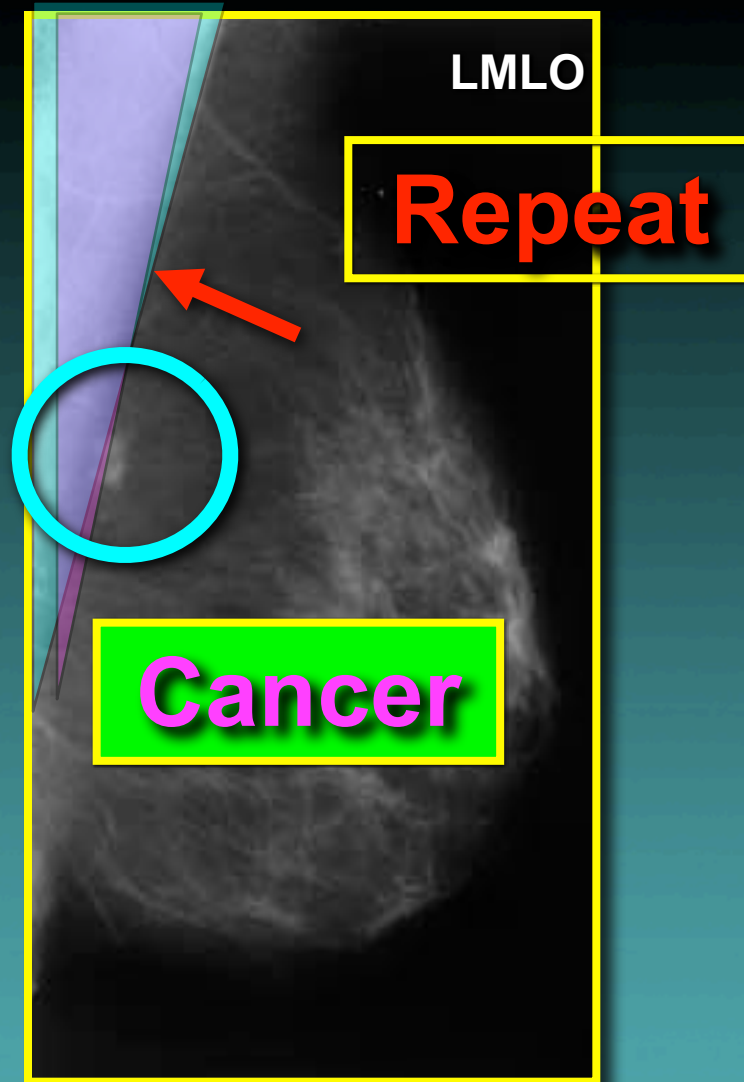
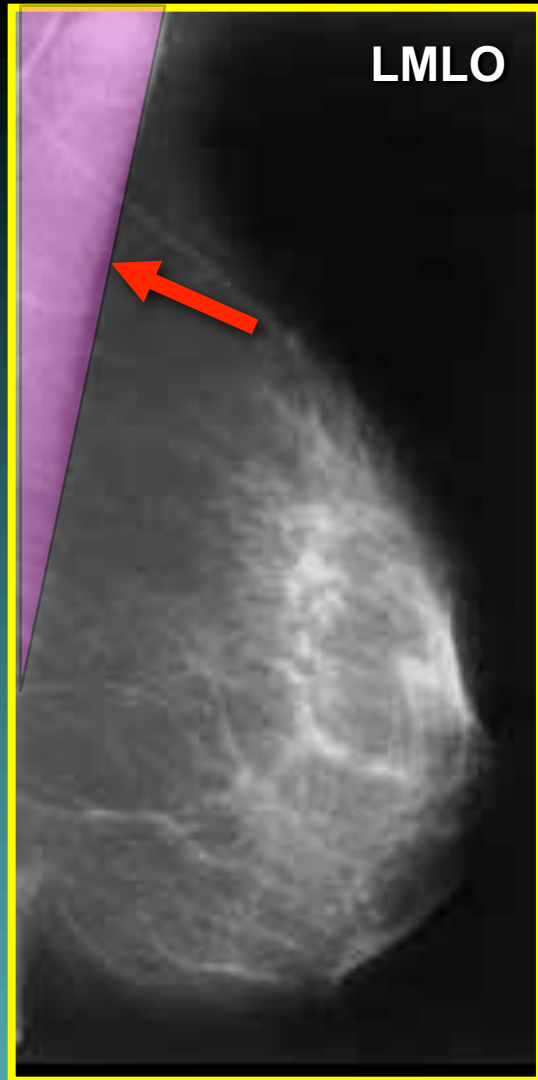
POSITIONING: MUST GET ADEQUATE PECTORAL MUSCLE ON IMAGE!



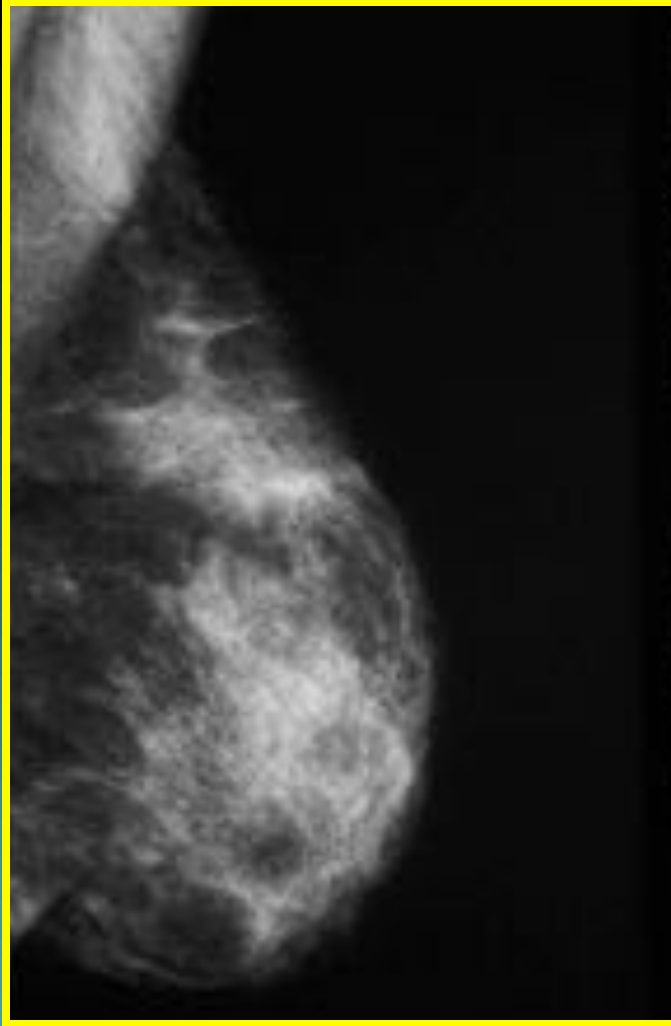
POSITIONING: MUST GET ADEQUATE PECTORAL MUSCLE ON IMAGE!



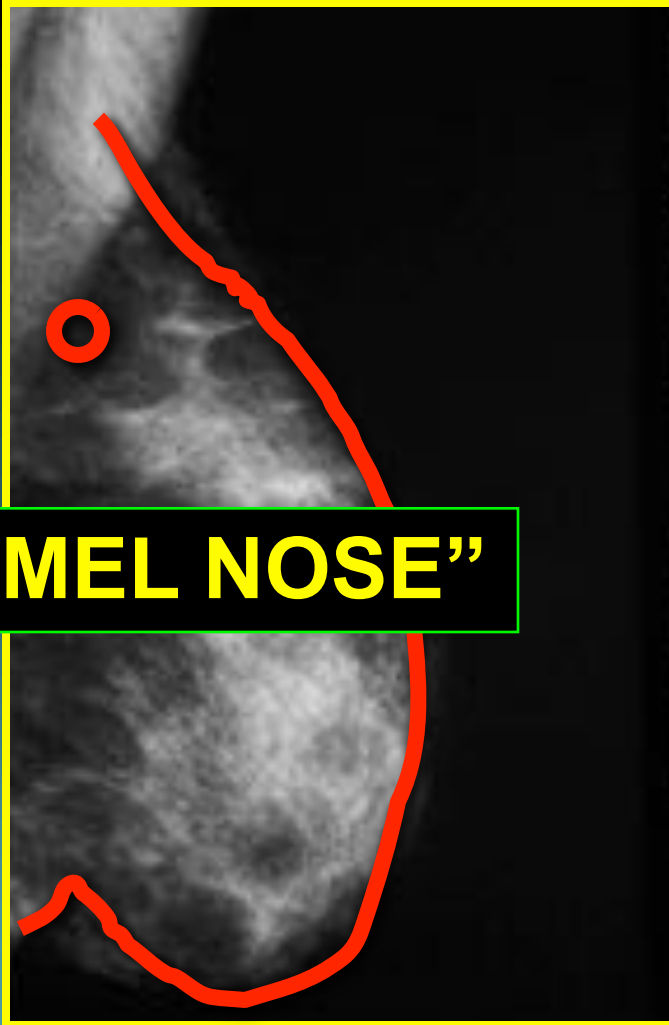
POSITIONING: MUST GET ADEQUATE PECTORAL MUSCLE ON IMAGE!



SAGGING BREAST



SAGGING BREAST



“CAMEL NOSE”



SAGGING BREAST

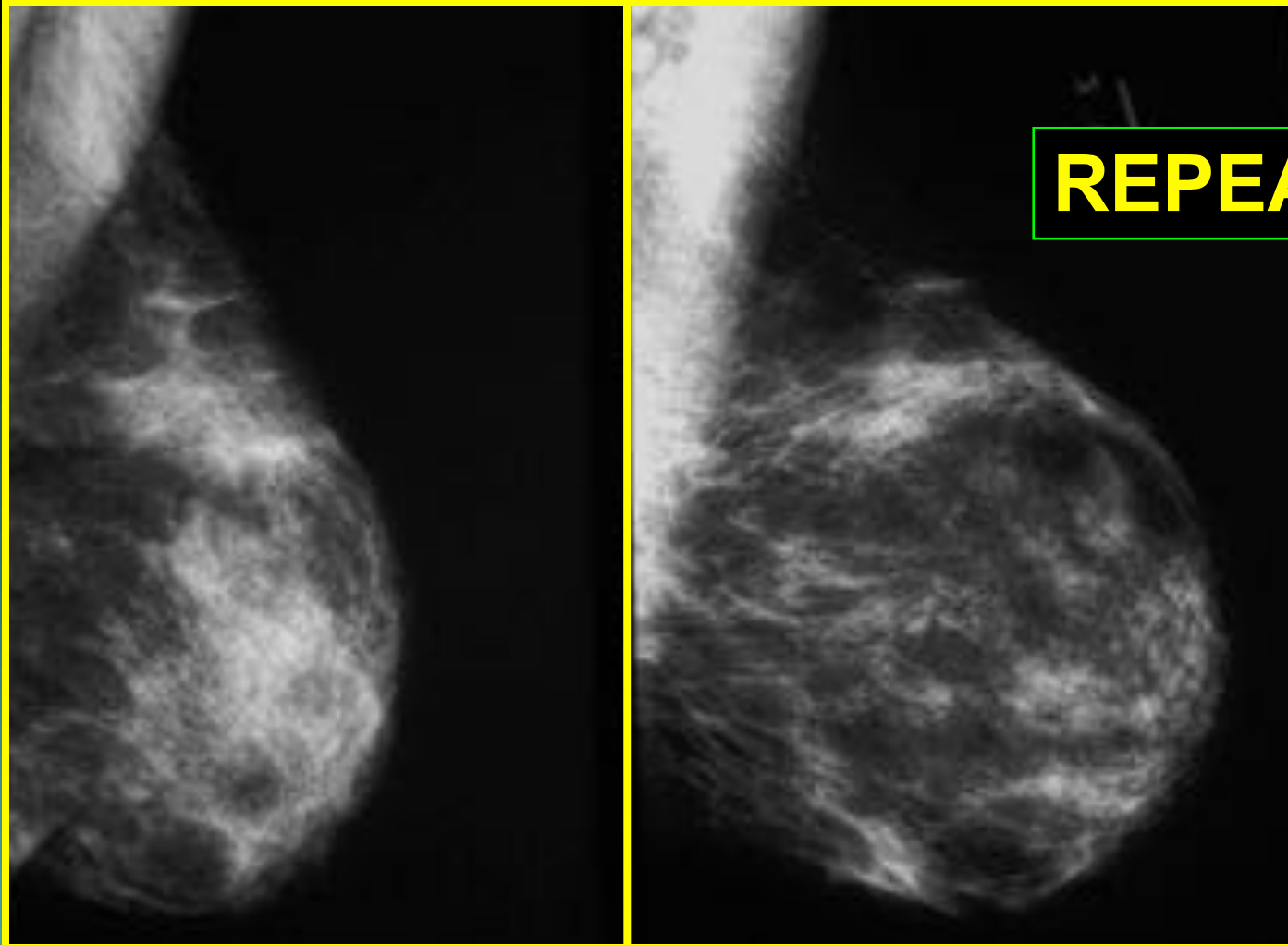


OJM

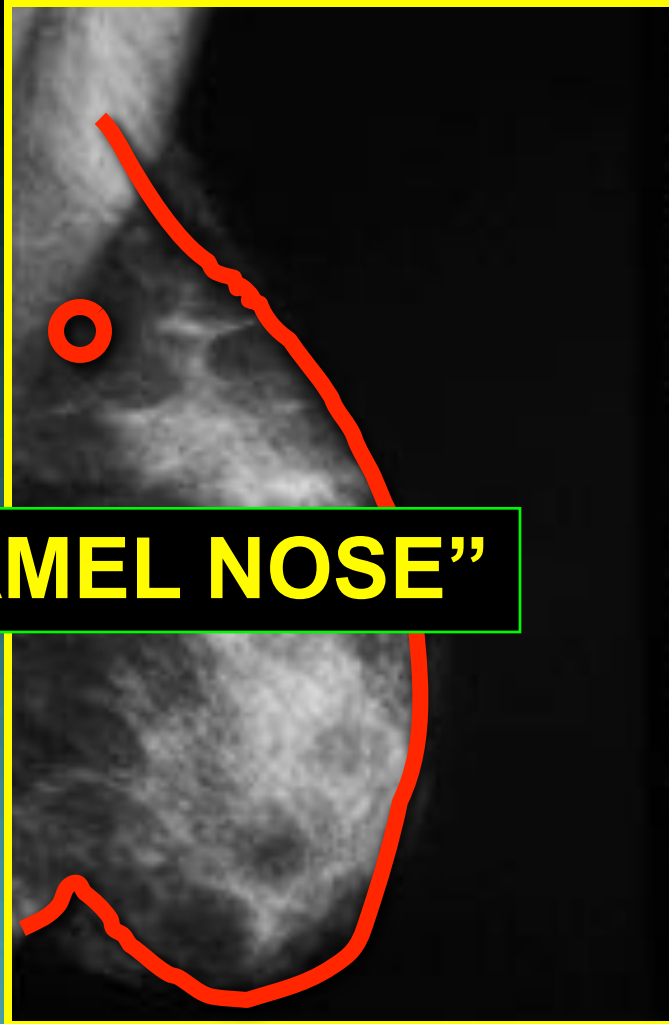
“CAMEL NOSE”



SAGGING BREAST

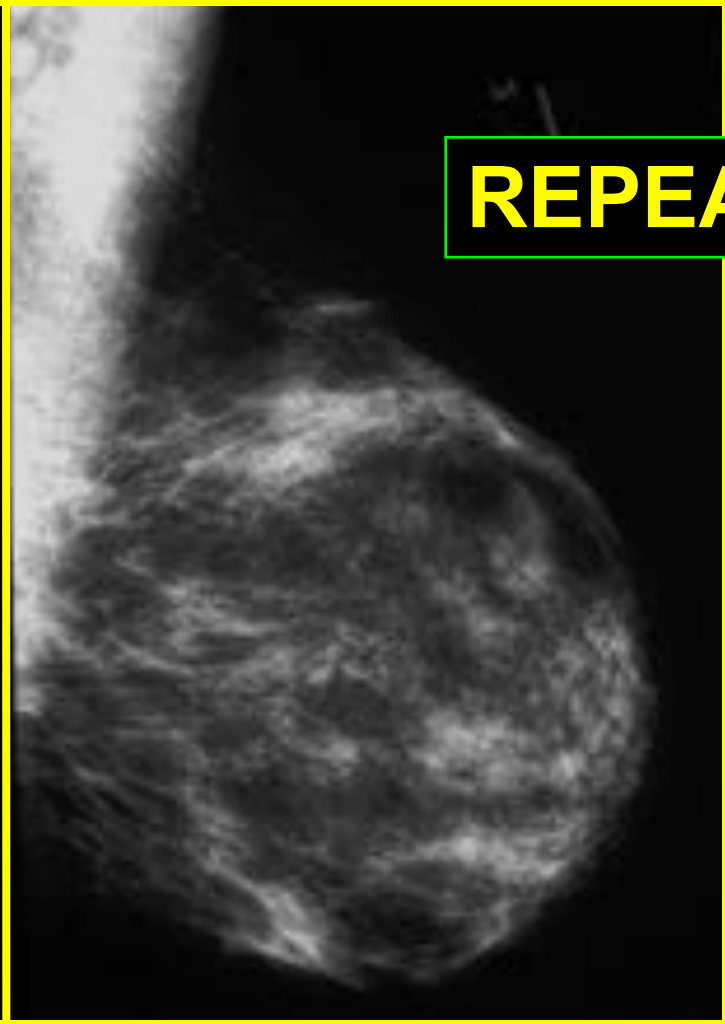


SAGGING BREAST



“CAMEL NOSE”

REPEAT



SAGGING BREAST

NO!

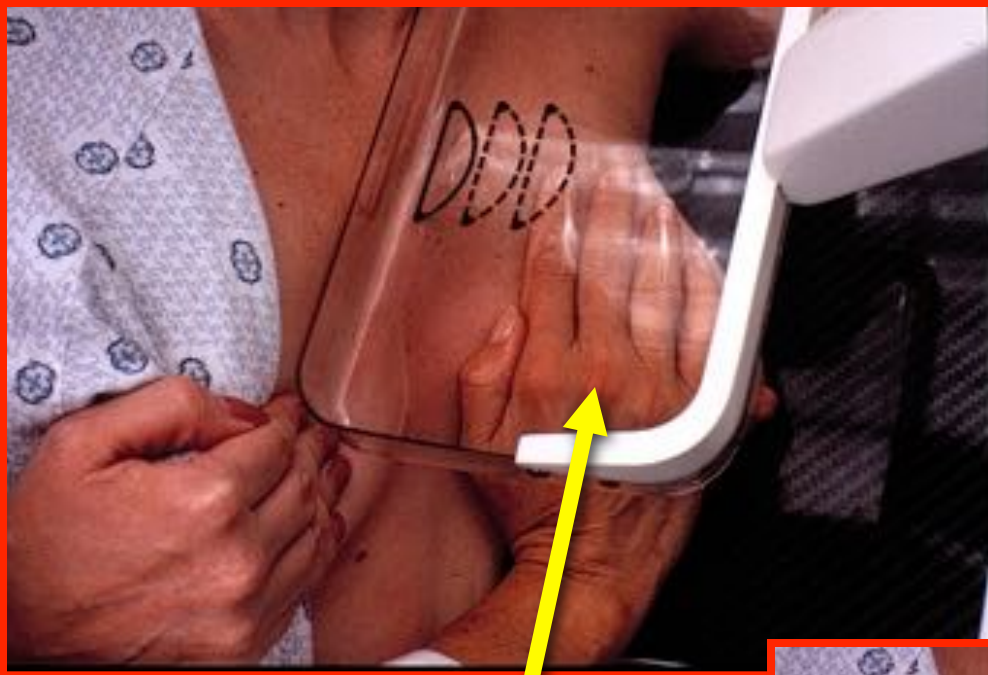


“CAMEL NOSE”

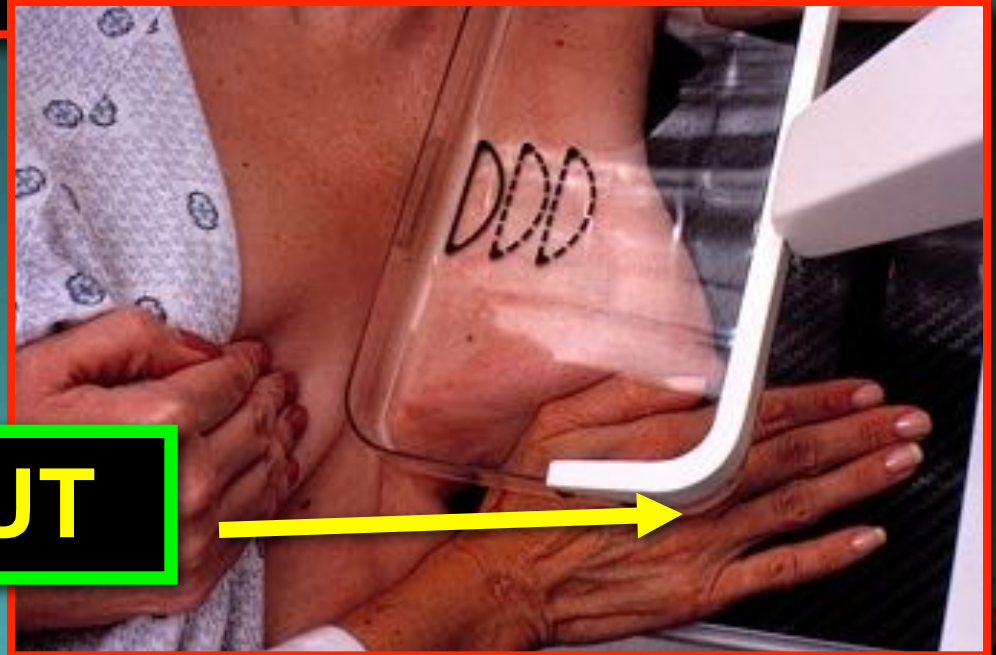
YES!



UP-AND-OUT MANEUVER



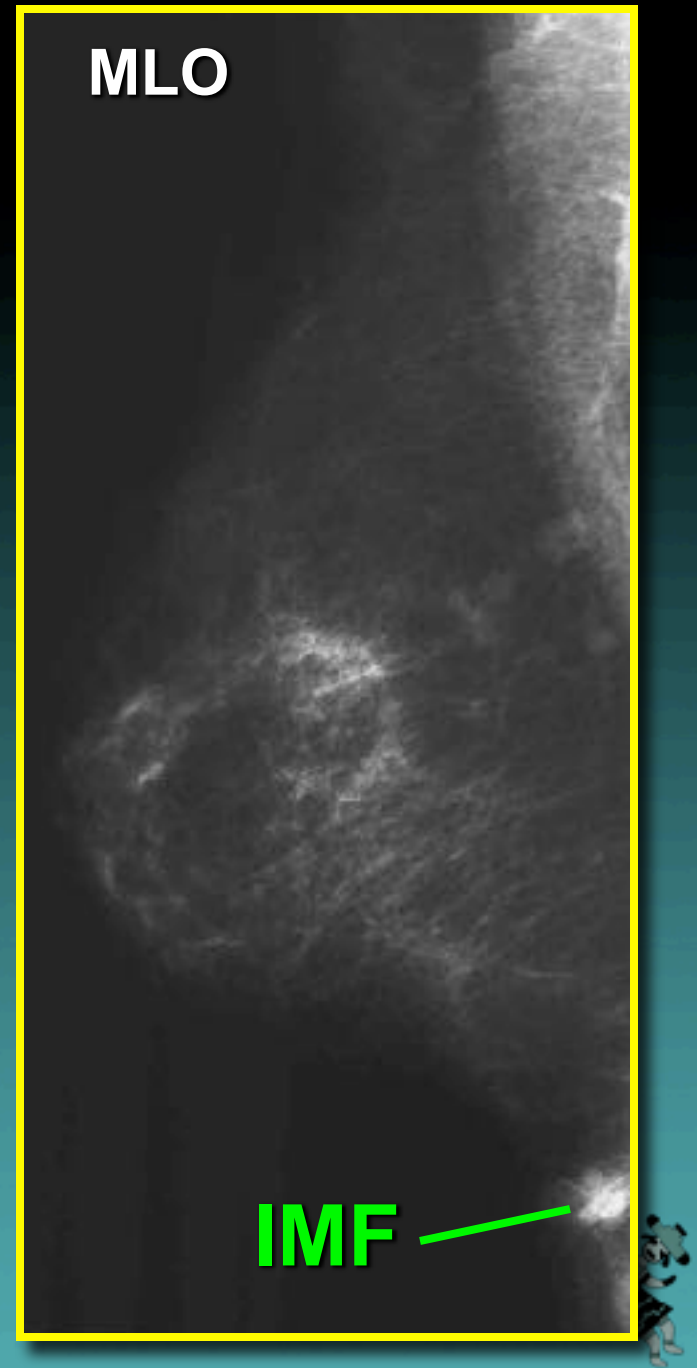
UP



OUT



OPEN INFRAMAMMARY FOLD (NO SKIN FOLD)



OPEN INFRAMAMMARY FOLD (NO SKIN FOLD)



MLO

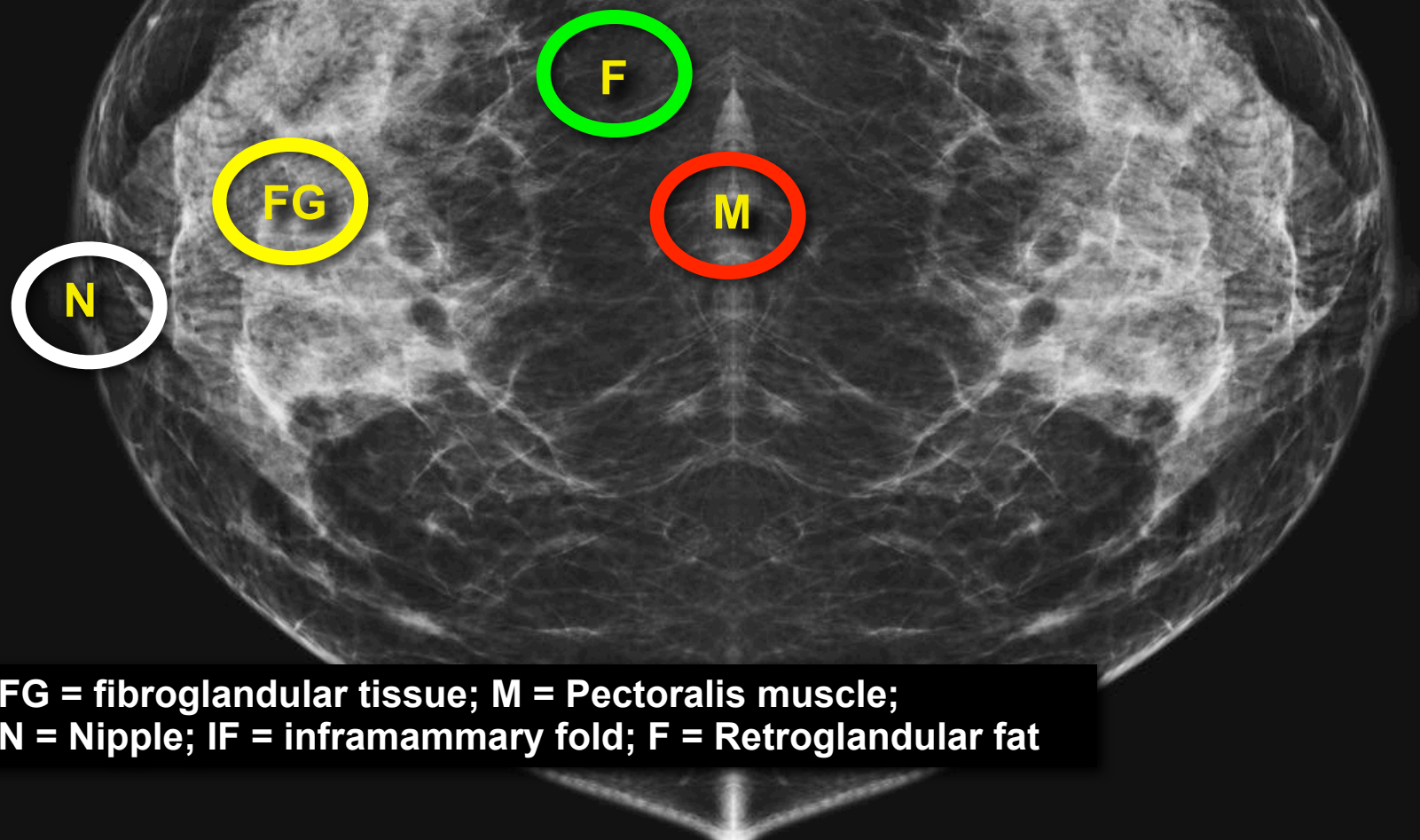
IMF



Positioning

CC VIEW

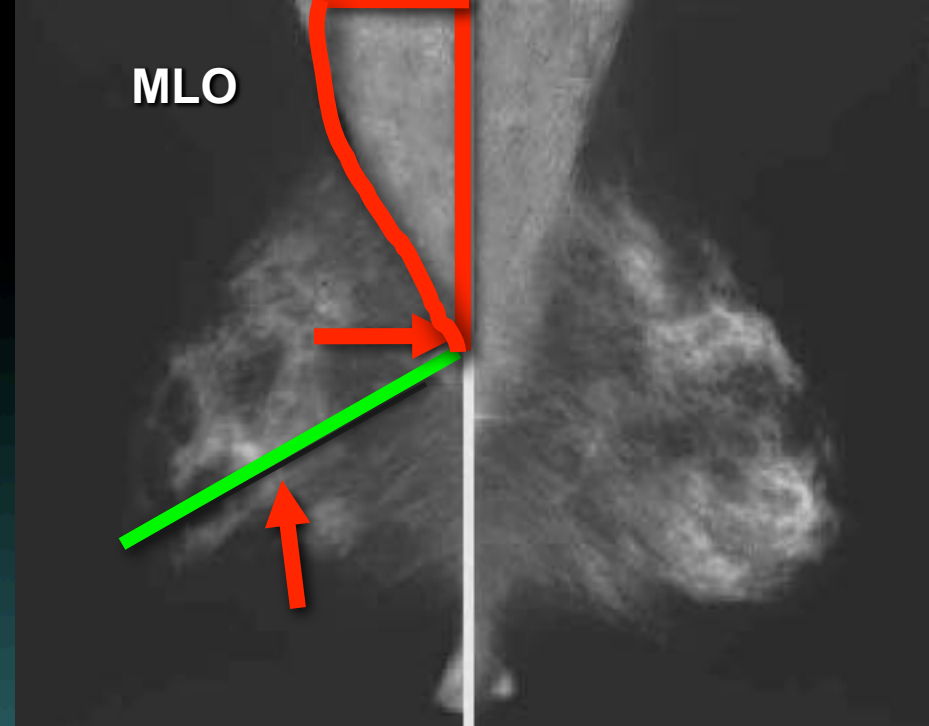
T
G RCC



FG = fibroglandular tissue; M = Pectoralis muscle;
N = Nipple; IF = inframammary fold; F = Retroglandular fat

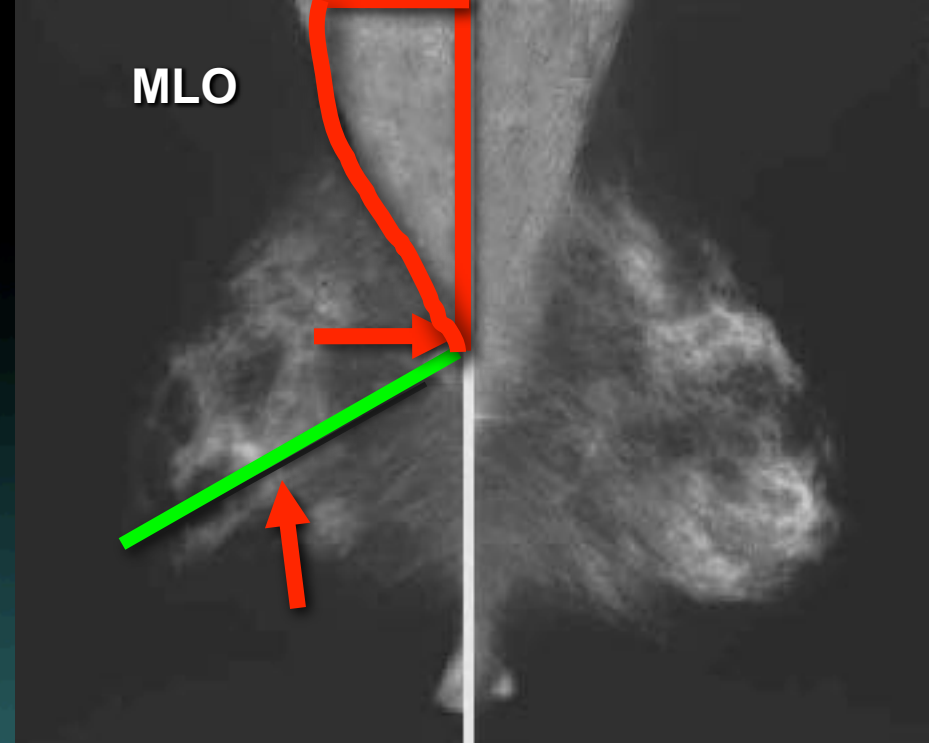
MLO view

- PM visualized to PNL
- PM wide superiorly, convex anteriorly



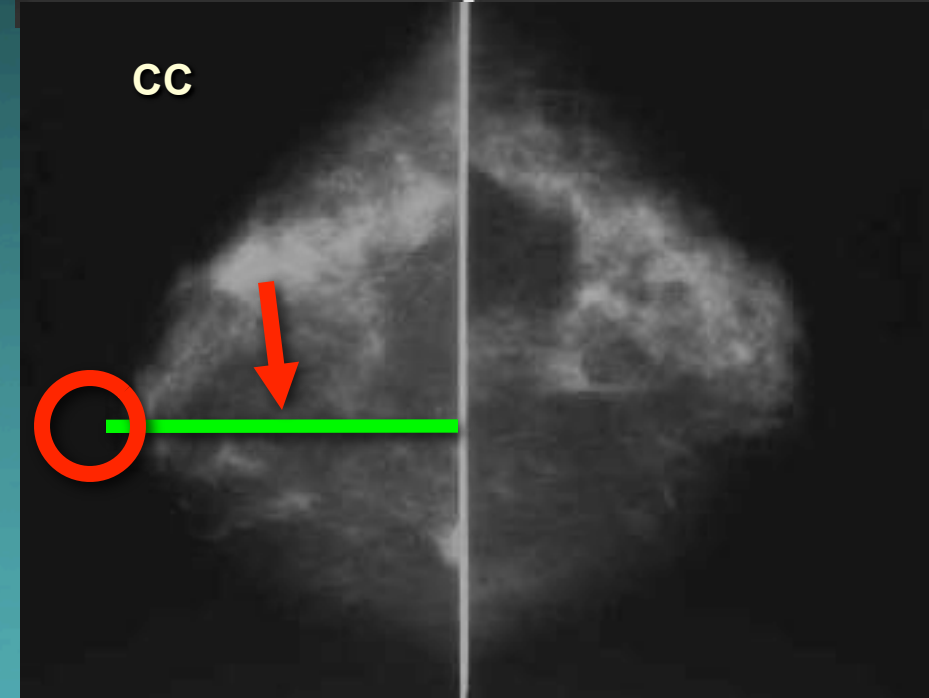
MLO view

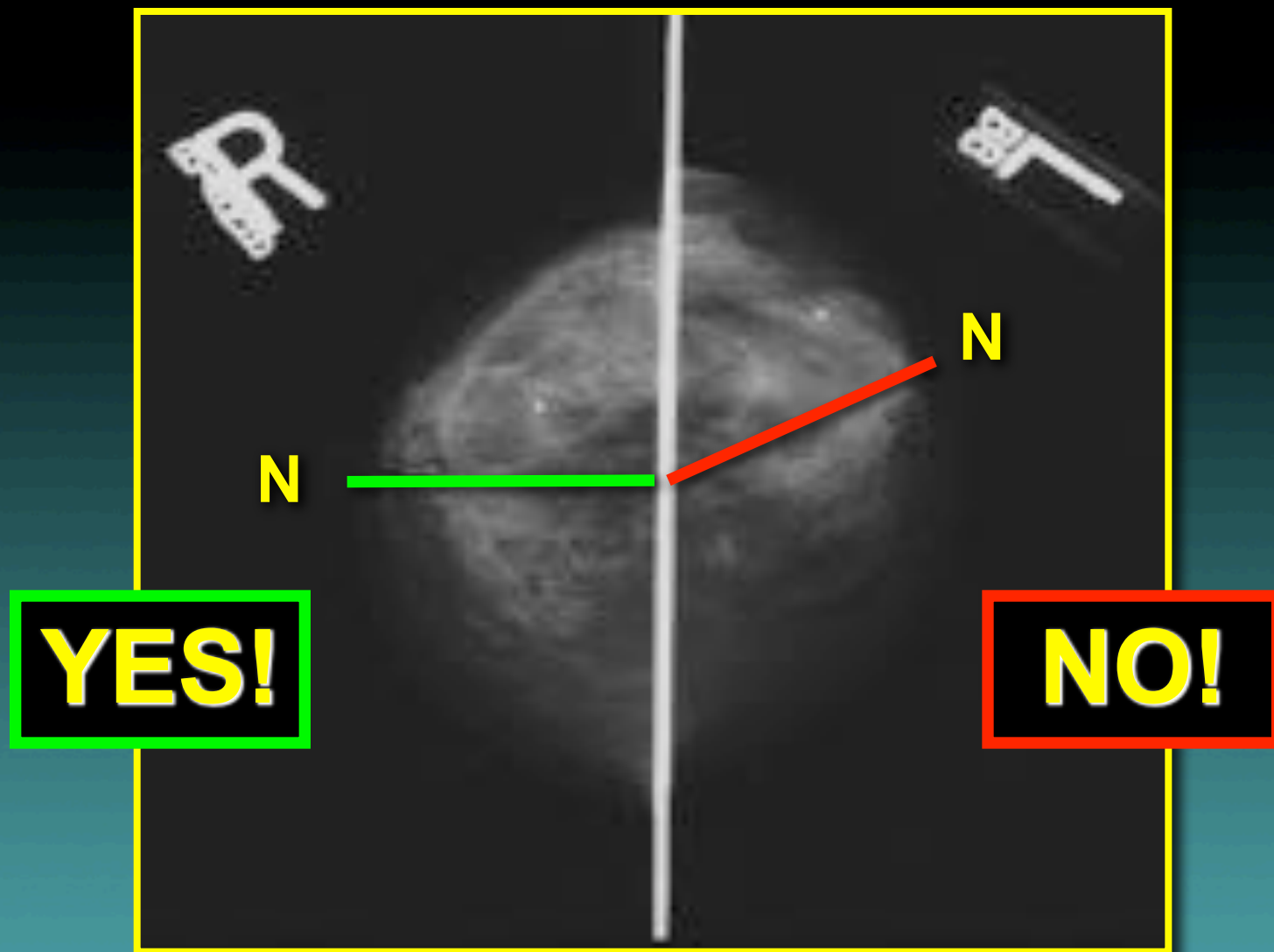
- PM visualized to PNL
- PM wide superiorly, convex anteriorly

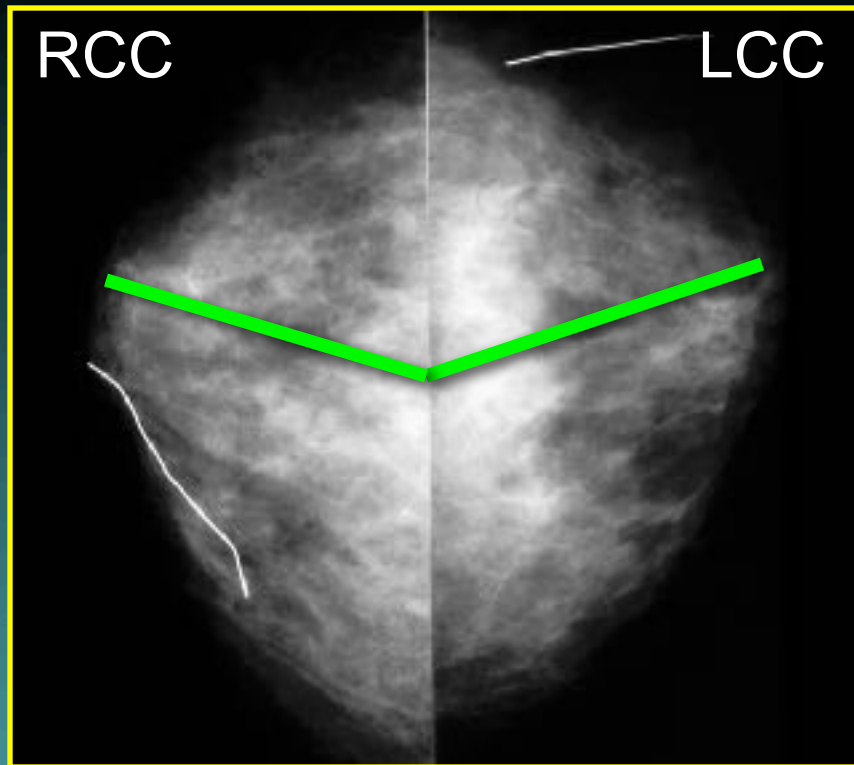


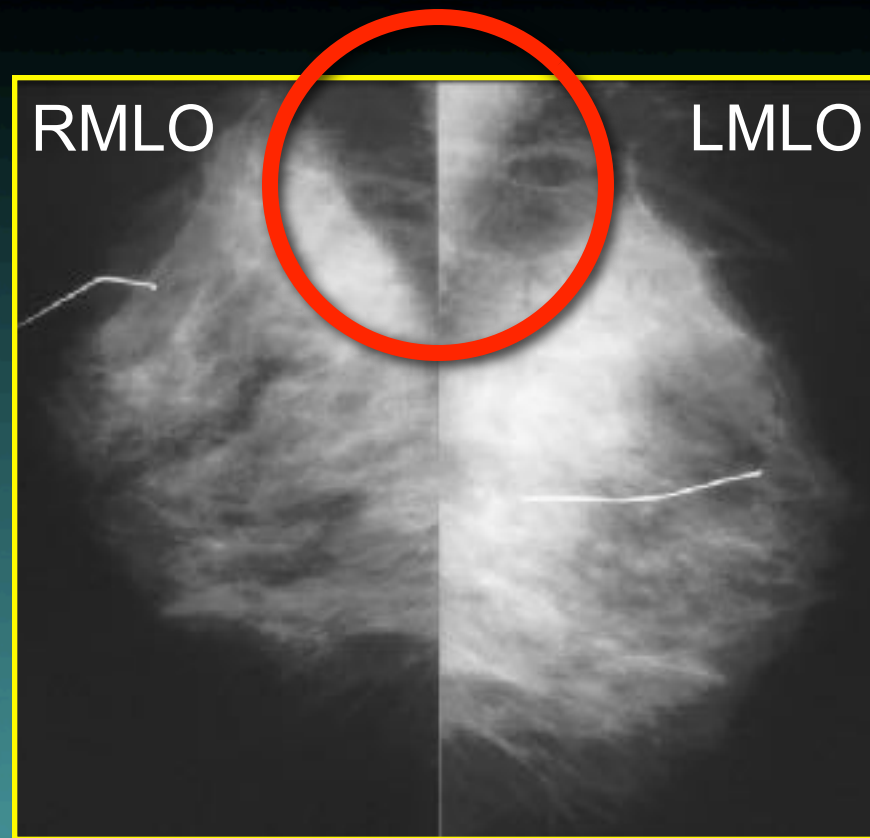
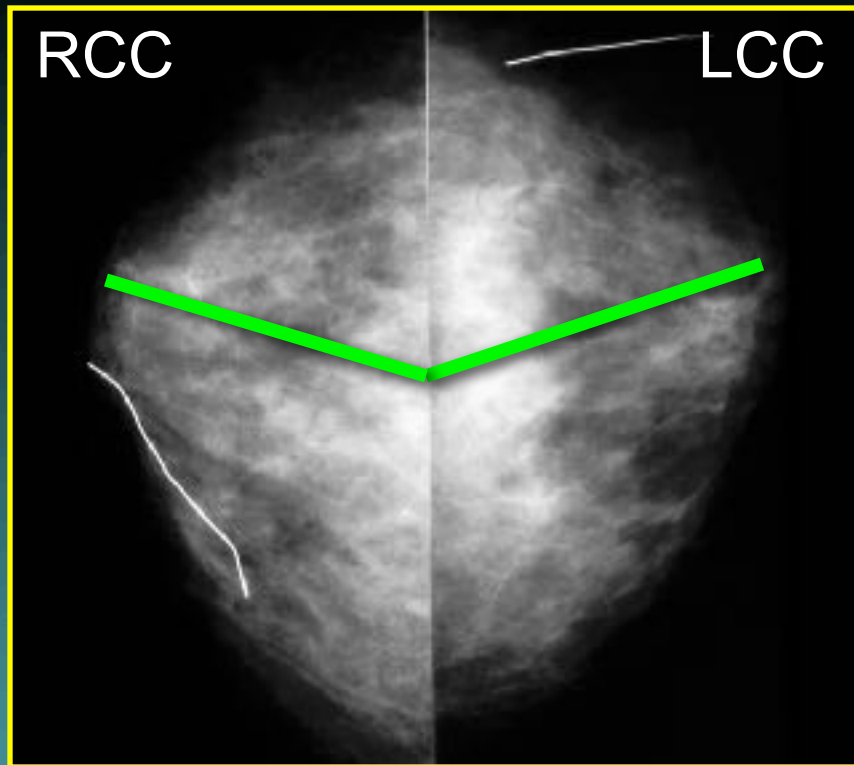
CC view

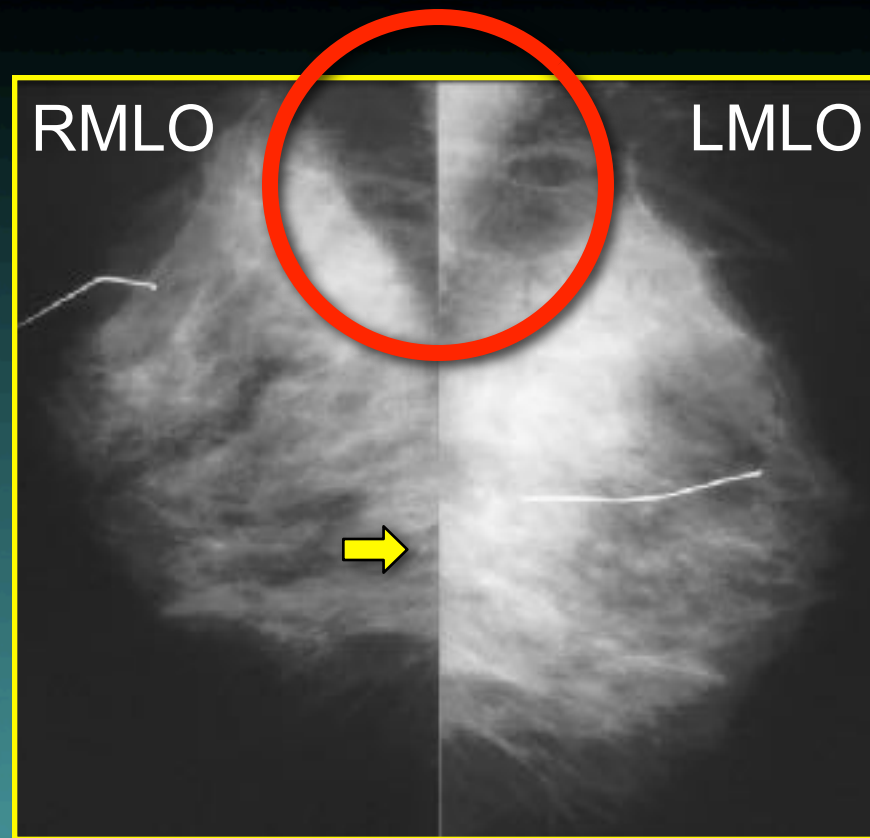
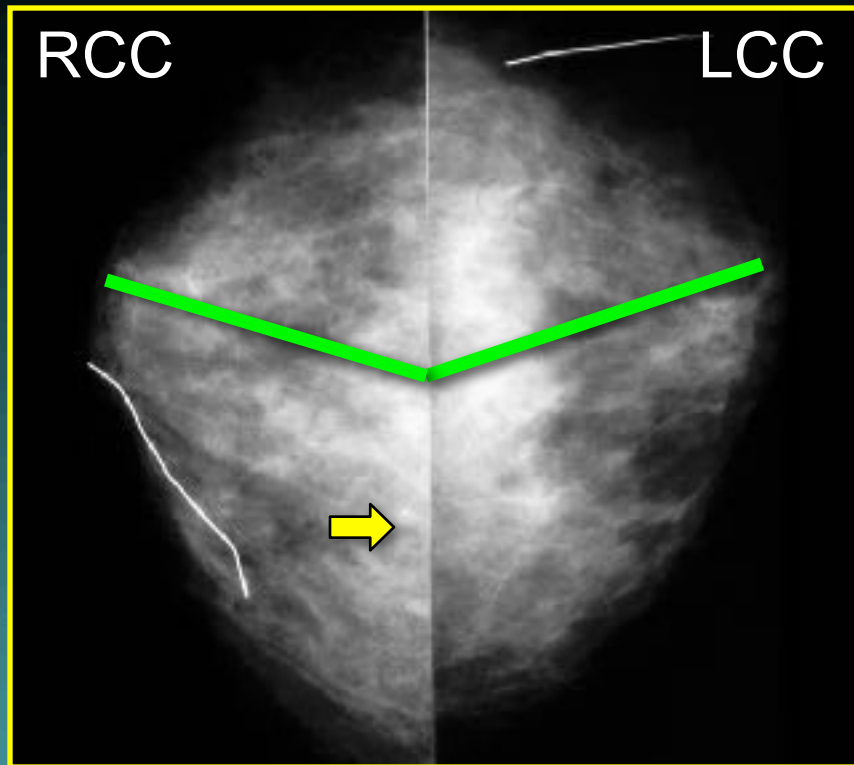
- PNL within 1 cm of MLO measurement
- Nipple in midline: not exaggerated

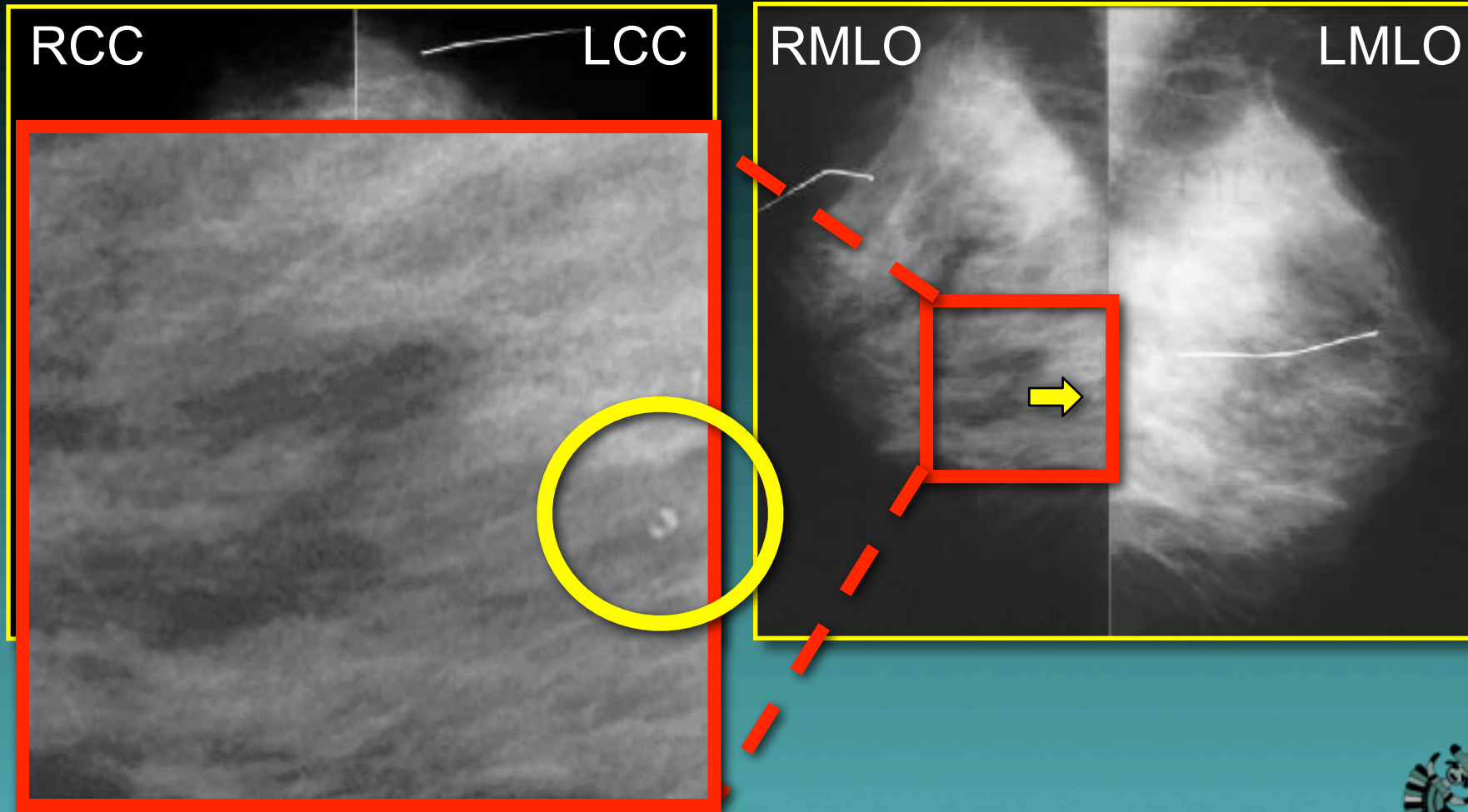




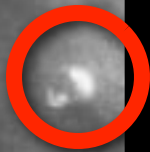




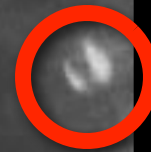




RCC Mag.



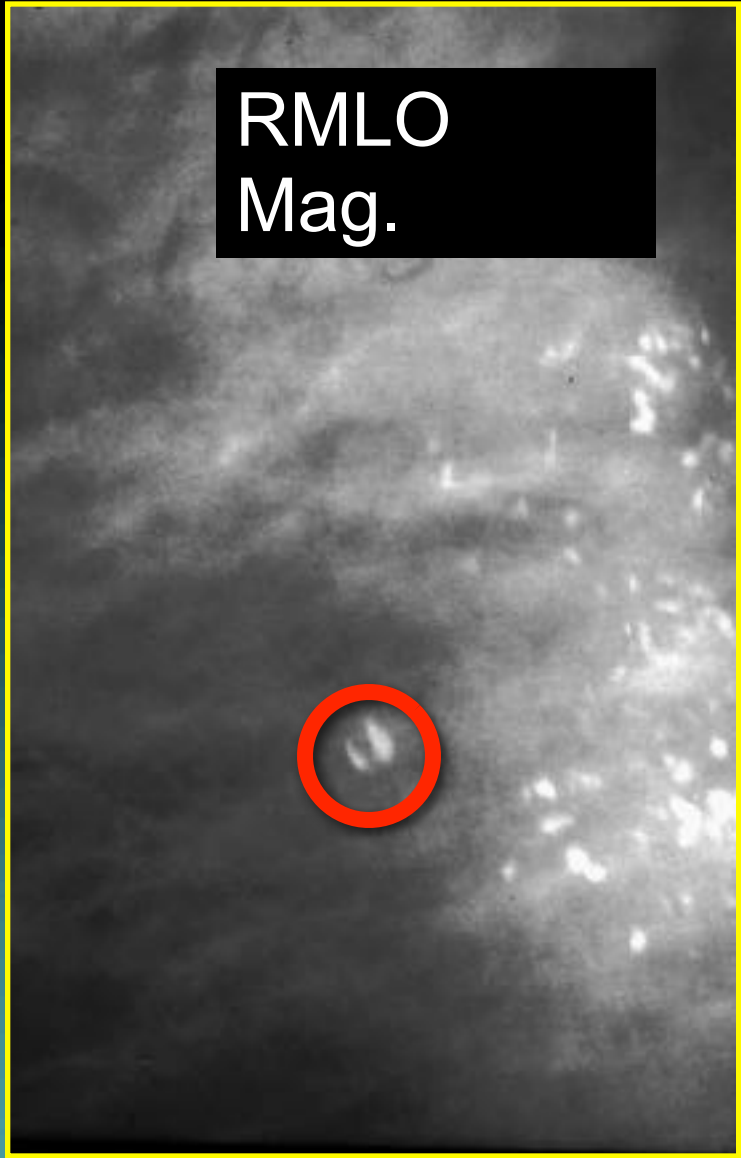
RMLO
Mag.



RCC Mag.

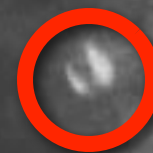
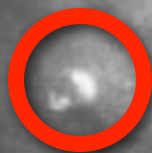


RMLO
Mag.



RCC Mag.

RMLO
Mag.



HIGH GRADE DCIS!



CLINICAL IMAGING CATEGORIES

Positioning

Exposure

Compression

Sharpness

Contrast

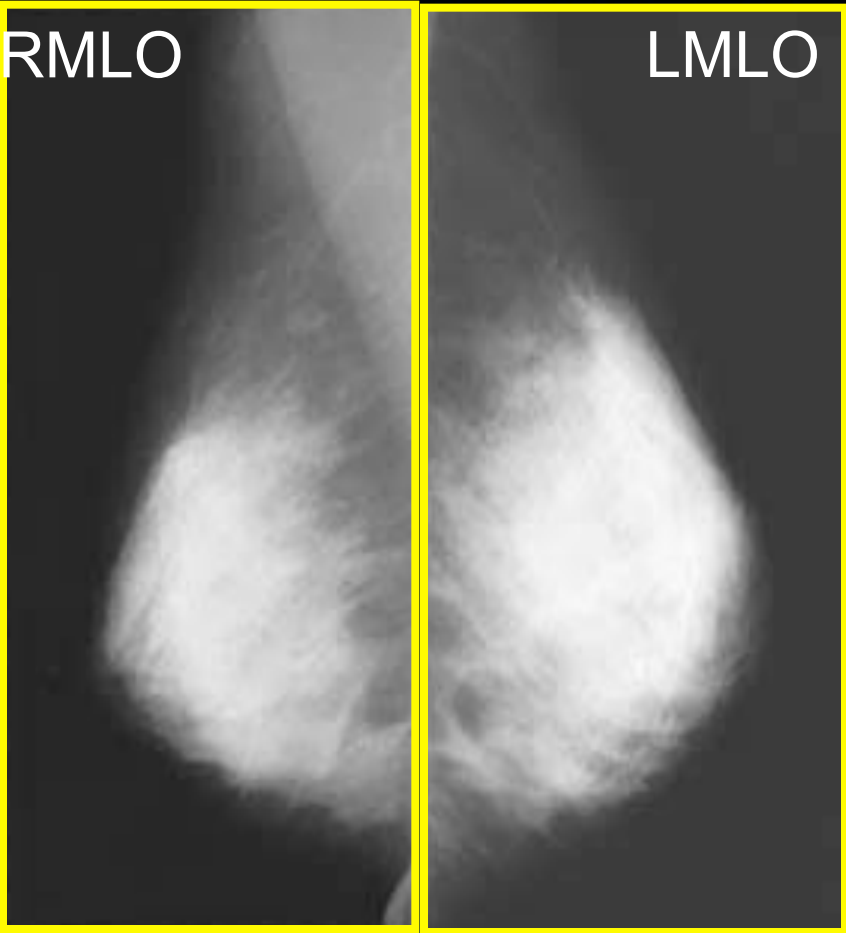
Artifacts

Labeling

Noise

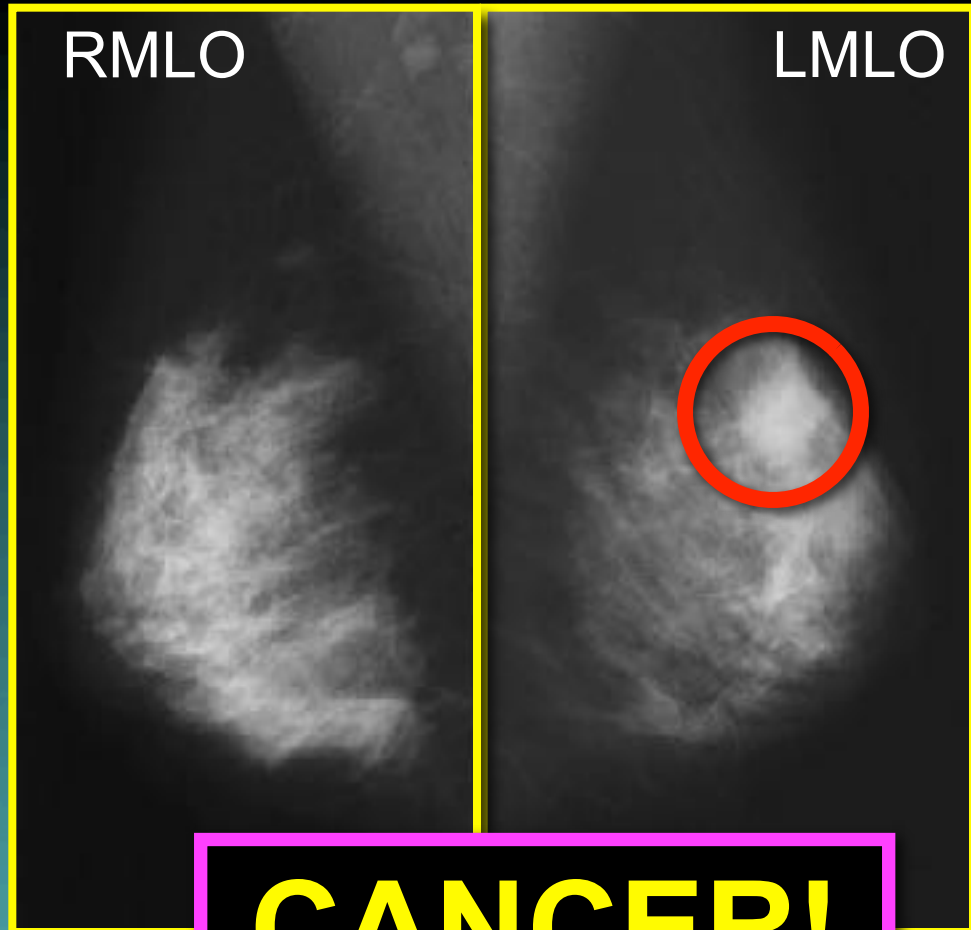
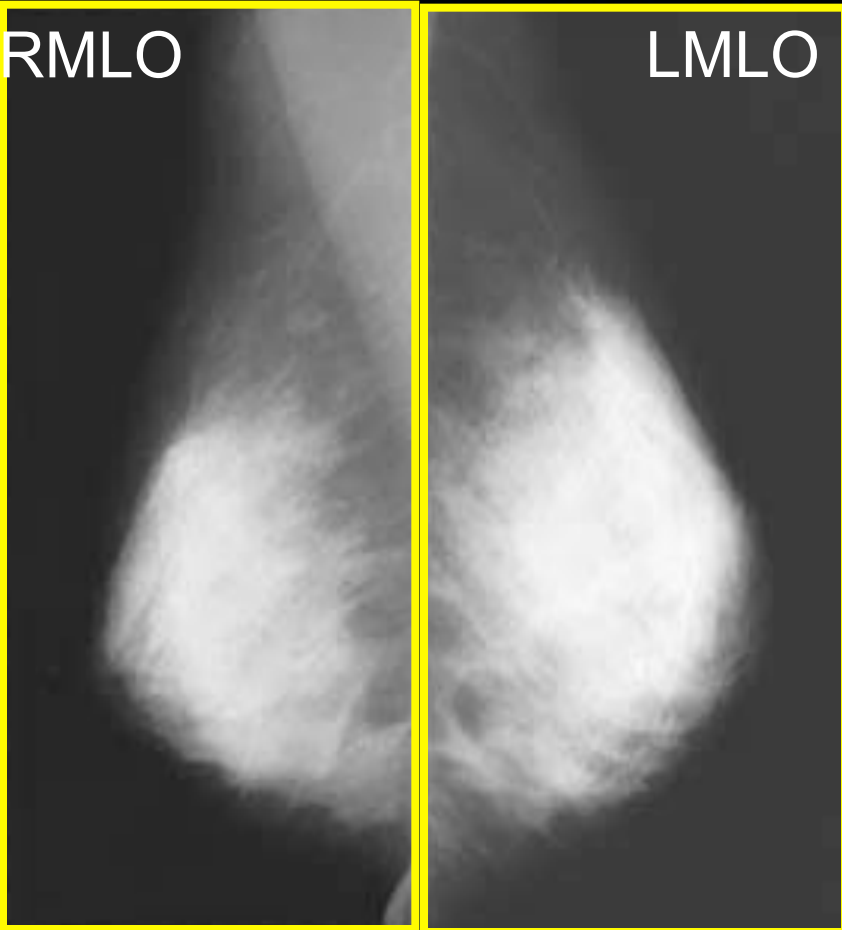


Initial Exam



Initial Exam

6 Months Later



CANCER!



Initial Exam

RCC

LCC



Initial Exam

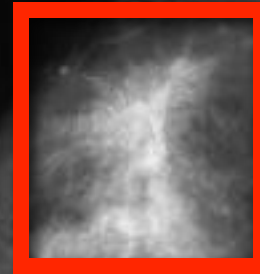
RCC

LCC

6 Months Later

RCC

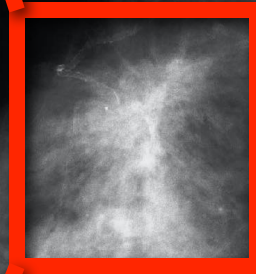
LCC



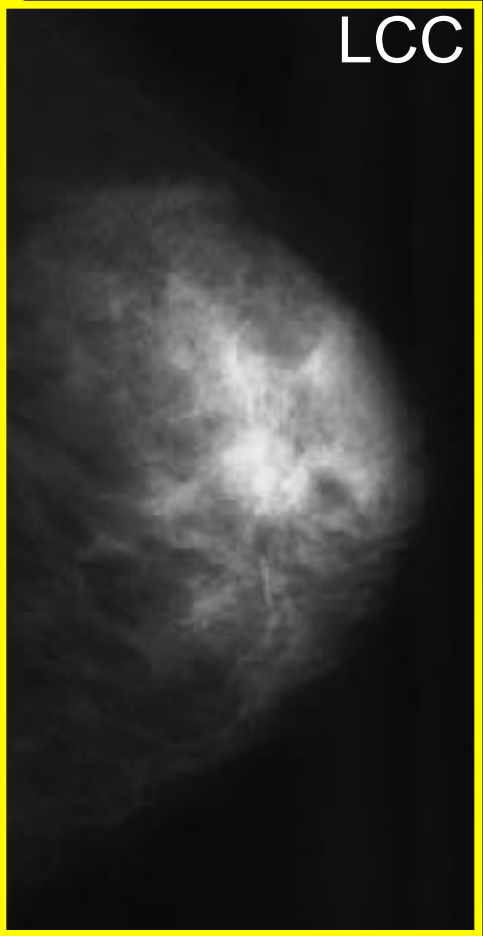
6 Months Later



RCC



LCC



CANCER!



EFFECTS OF VIEWING CONDITIONS AND COLLIMATION ON EXPOSURE FACTORS

Recommended Viewing Conditions, 1968 vs. 2026

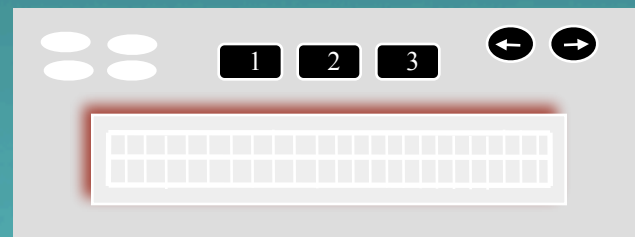
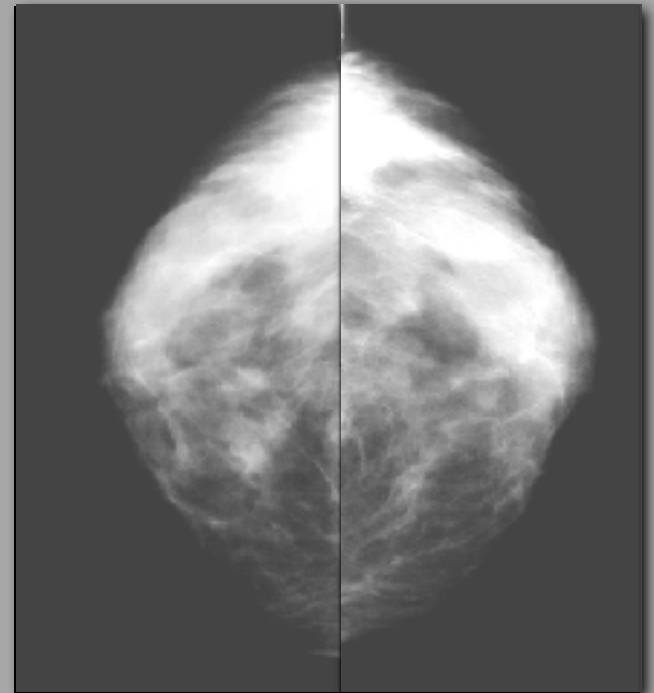
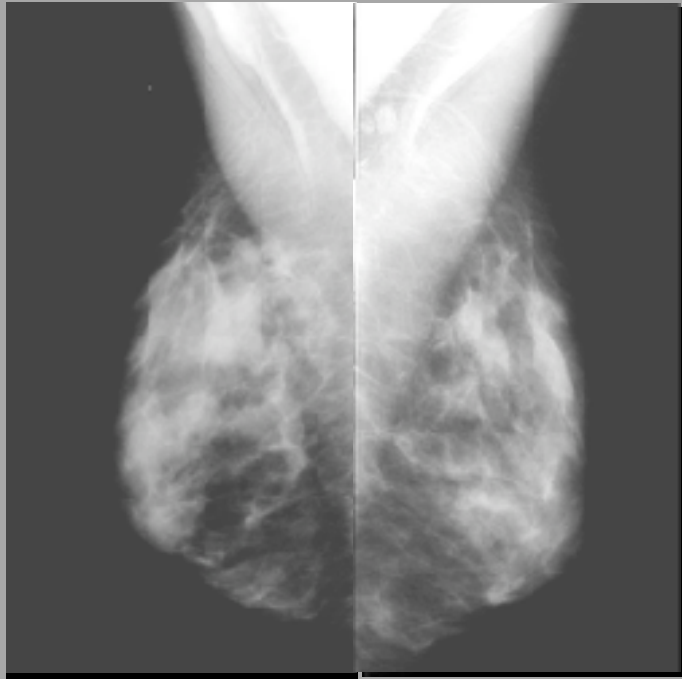
1968



2026



FULL FIELD DIGITAL MONITORS



FULL FIELD DIGITAL MONITORS



CLINICAL IMAGING CATEGORIES

Positioning

Exposure

Compression

Sharpness

Contrast

Artifacts

Labeling

Noise

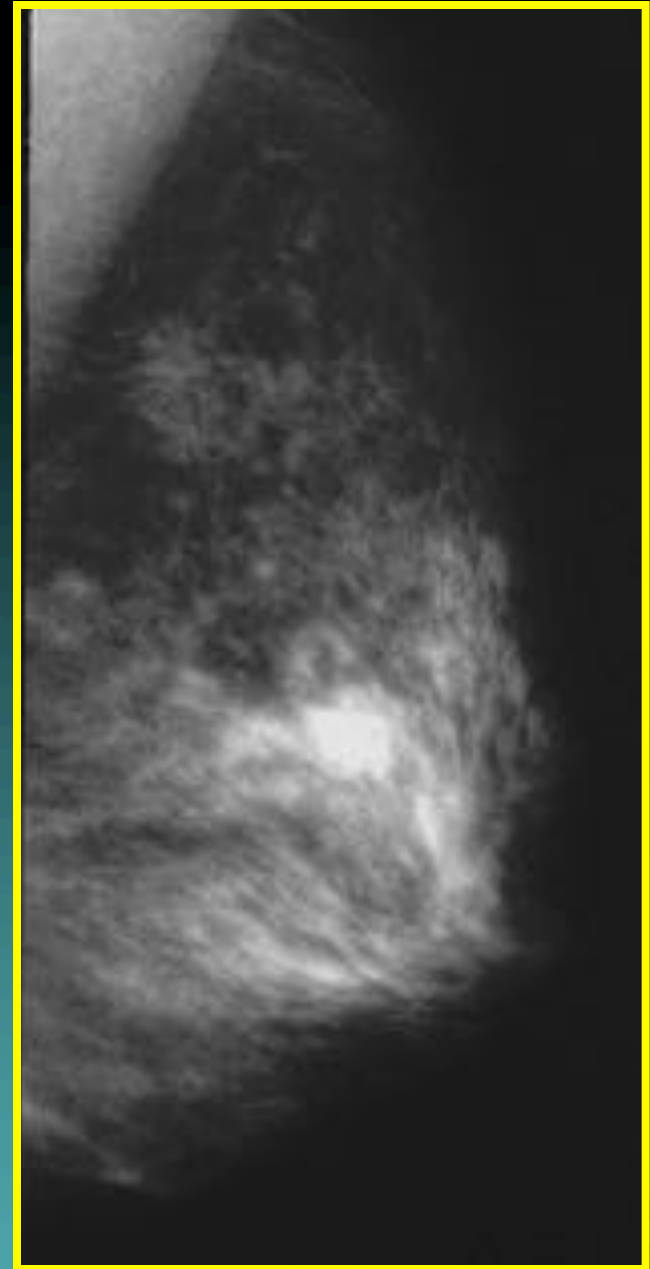


COMPRESSION:

**Poor separation of
fibroglandular
tissues**

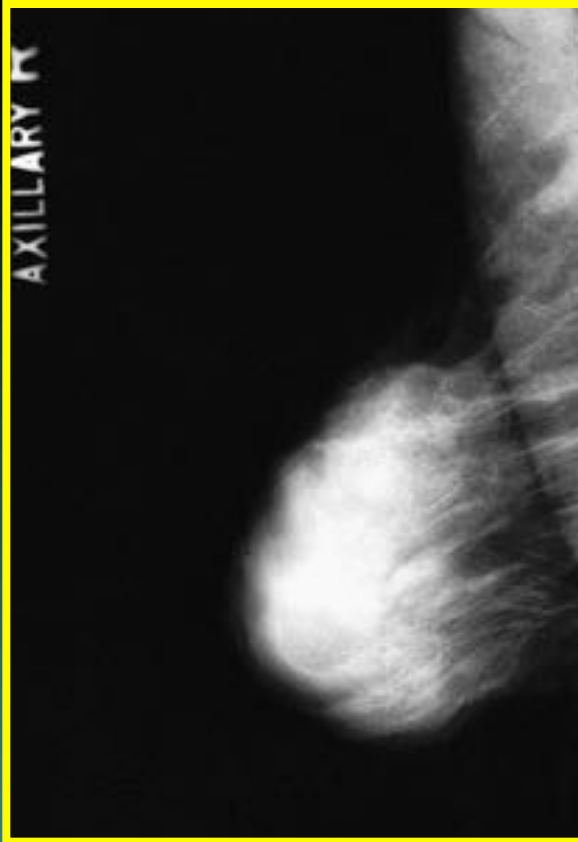
**Unequal exposure of
fibroglandular
tissues**

Motion unsharpness

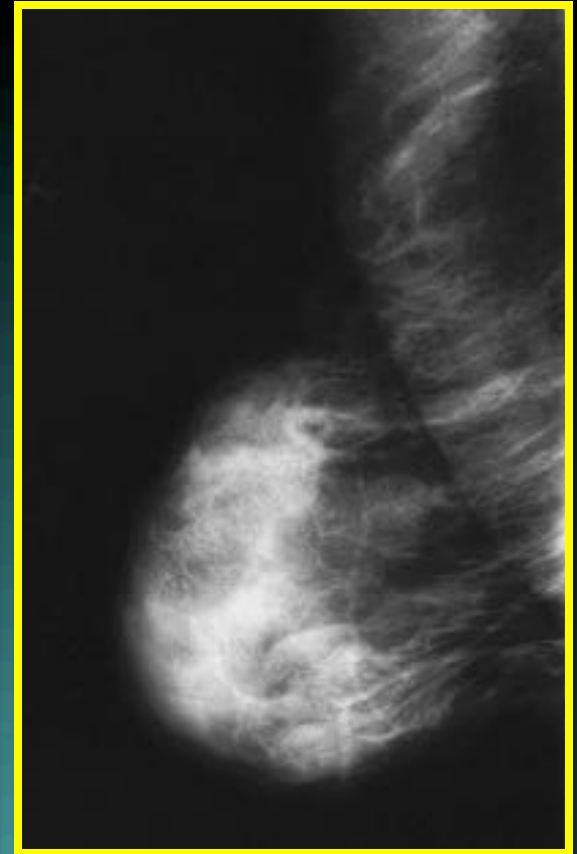




Year 1



Year 2



Year 3



SHARPNESS

DEFICIENCIES:

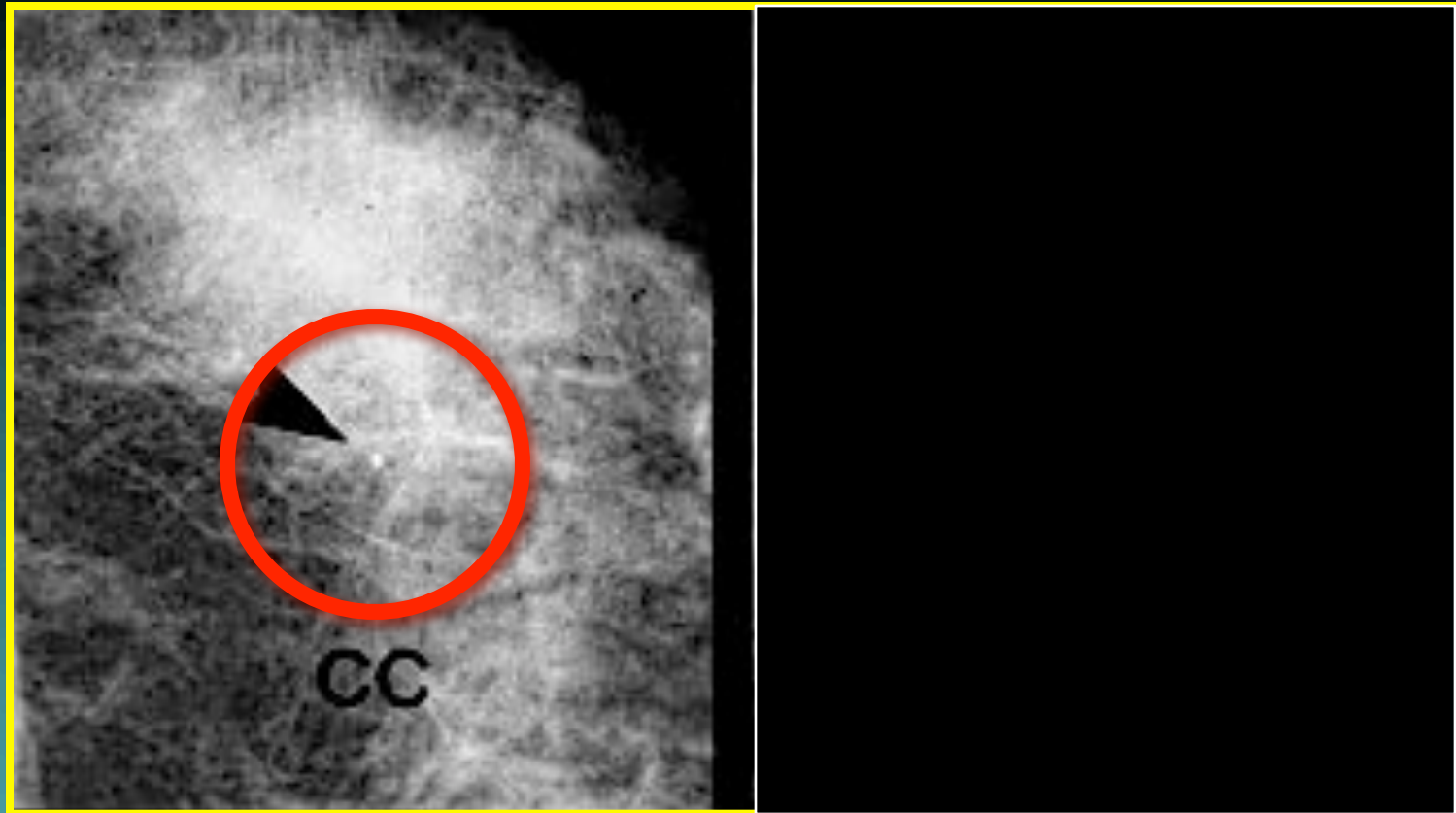
Blurring of linear structures

Blurring of margins of structures

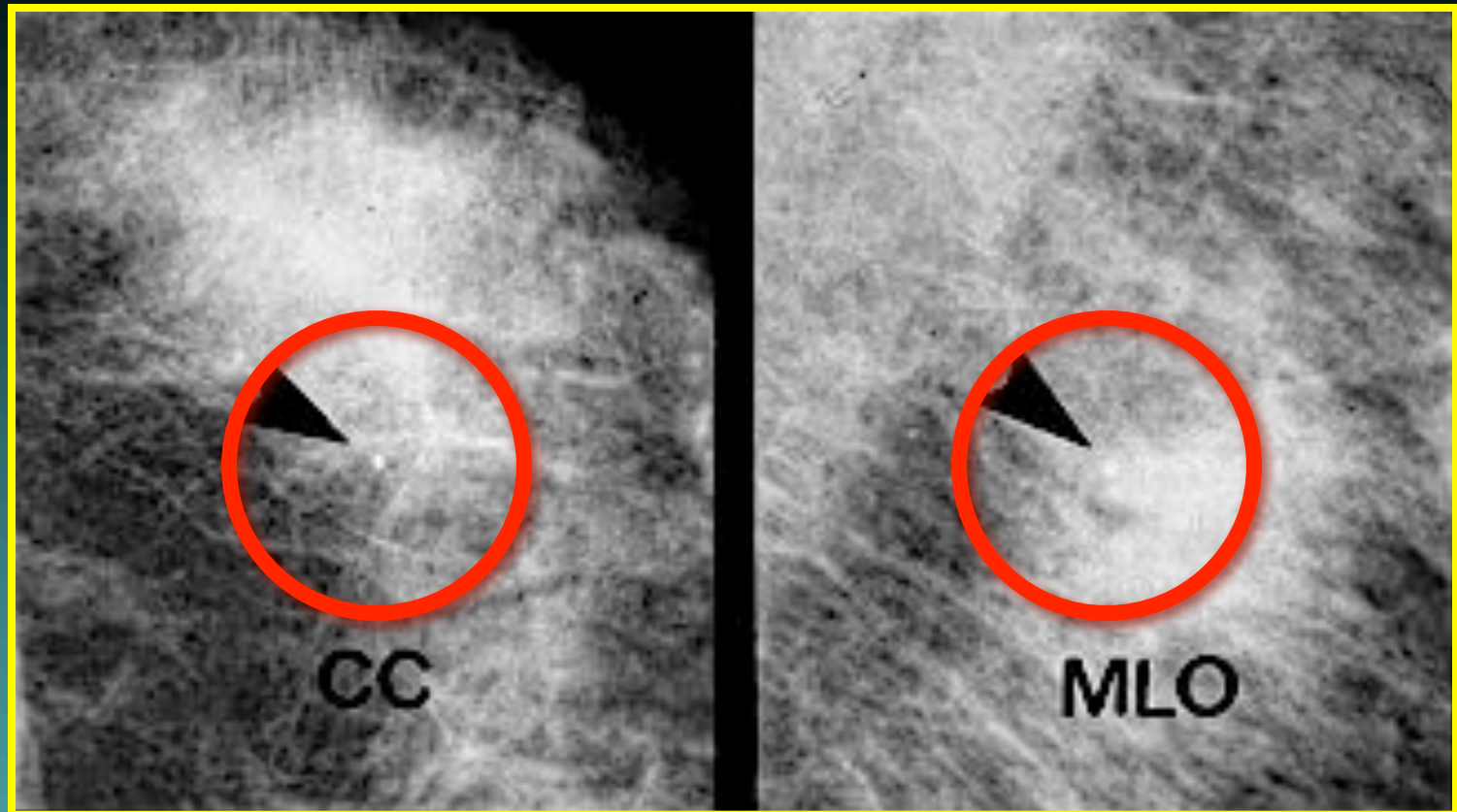
Blurring of calcifications



Unsharpness (blur) related to inadequate compression and motion more likely on MLO



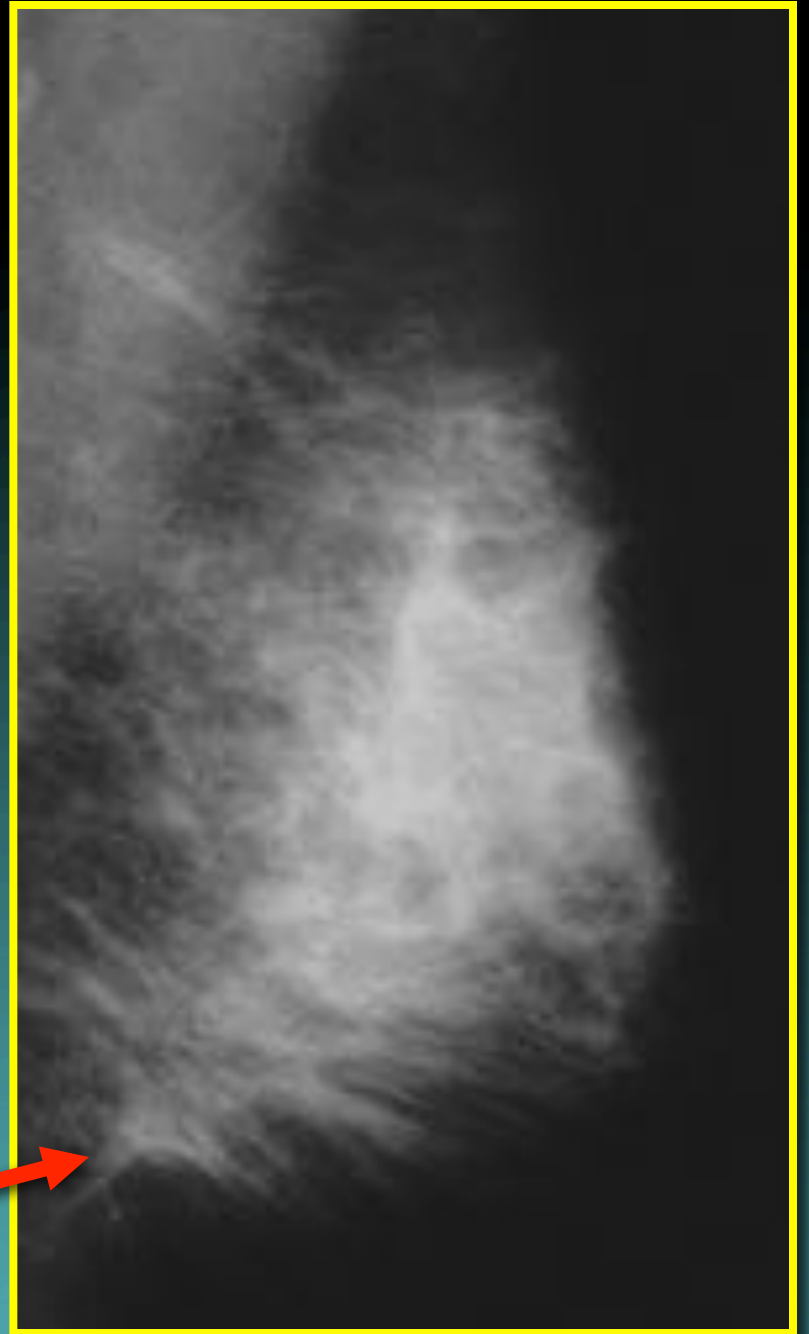
Unsharpness (blur) related to inadequate compression and motion more likely on MLO



INADEQUATE

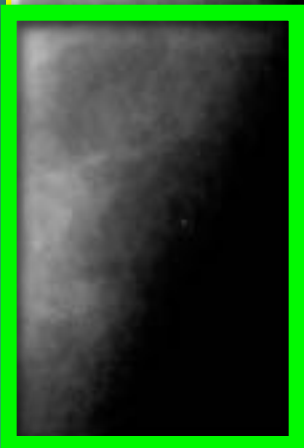
COMPRESSION:

**Motion unsharpness
seen as
poor delineation of
linear structures.**



ROUTINE

CC



ROUTINE

CC

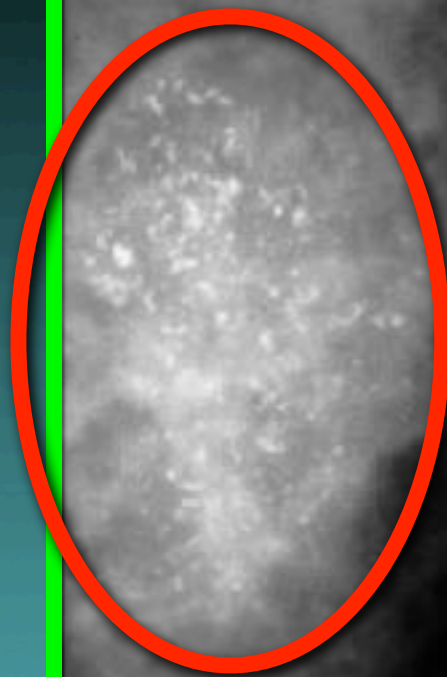
?



**ROUTINE
SCREENING,
MAGNIFIED**



**SPOT
MAGNIFICATION**



**ROUTINE
SCREENING,
MAGNIFIED**

?

**SPOT
MAGNIFICATION**

HIGH GRADE DCIS!

CLINICAL IMAGING CATEGORIES

Positioning

Exposure

Compression

Sharpness

Contrast

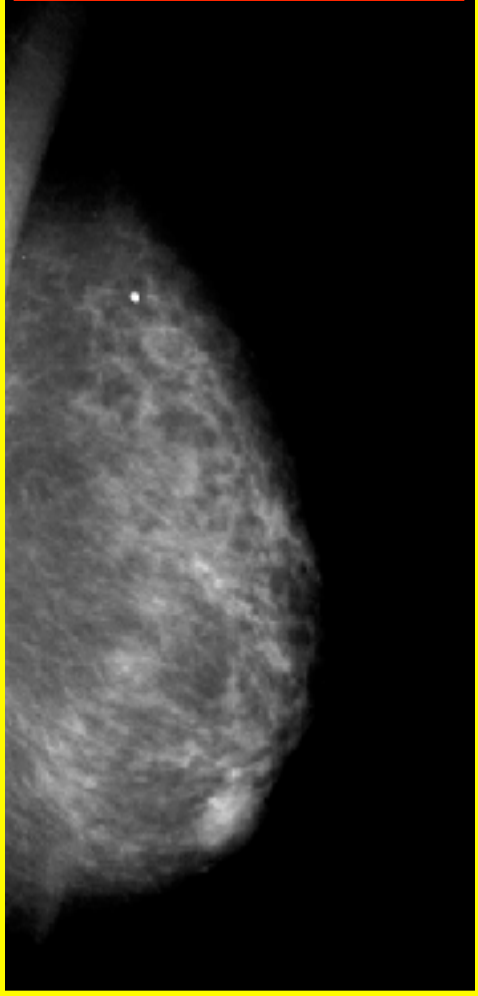
Artifacts

Labeling

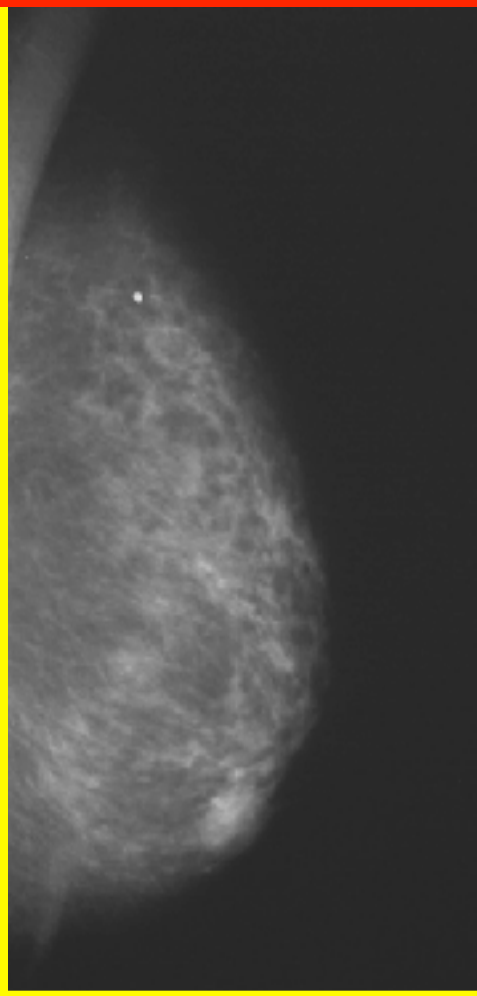
Noise



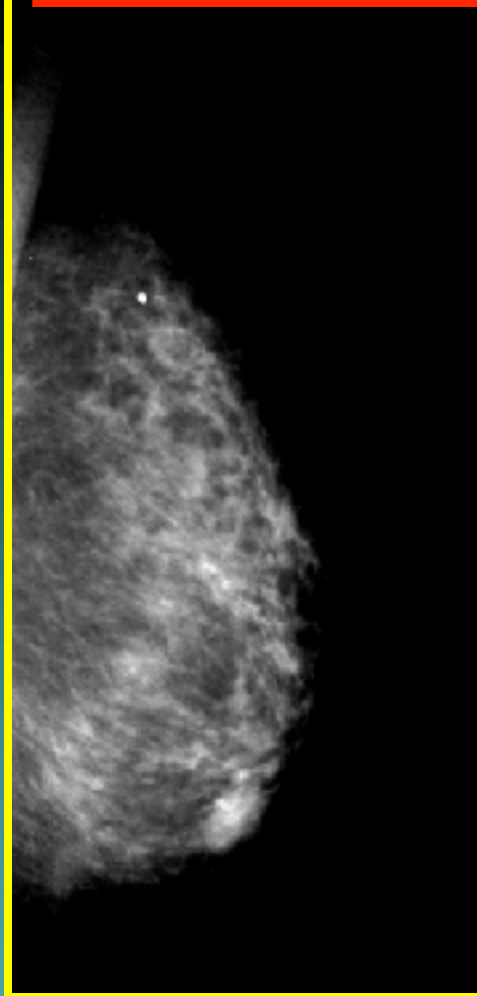
**Adequate
Contrast**



**Inadequate
Contrast**



**Excessive
contrast**



CLINICAL IMAGING CATEGORIES

Positioning

Exposure

Compression

Sharpness

Contrast

Artifacts

Labeling

Noise



ARTIFACTS

Equipment

Film handling

Processing

Patient



ARTIFACTS

Equipment

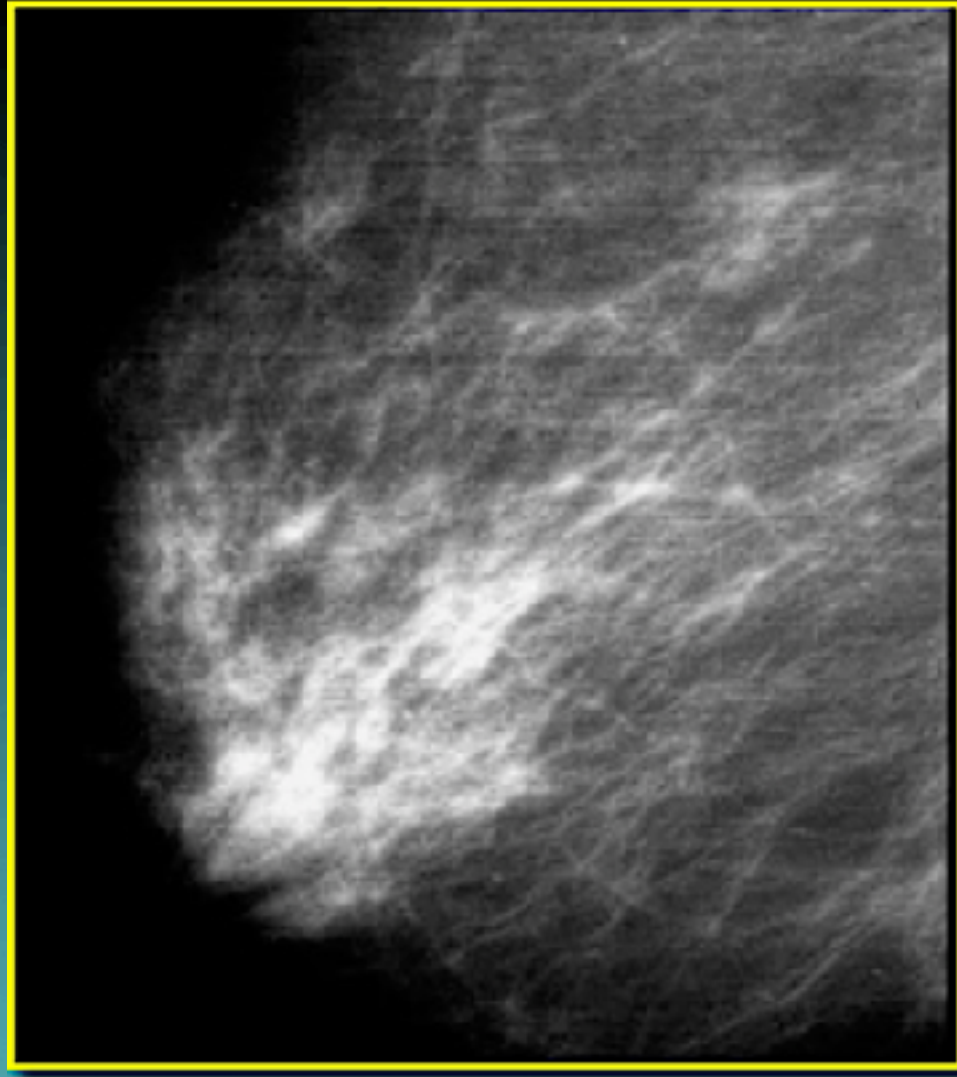
~~Film handling~~

~~Processing~~

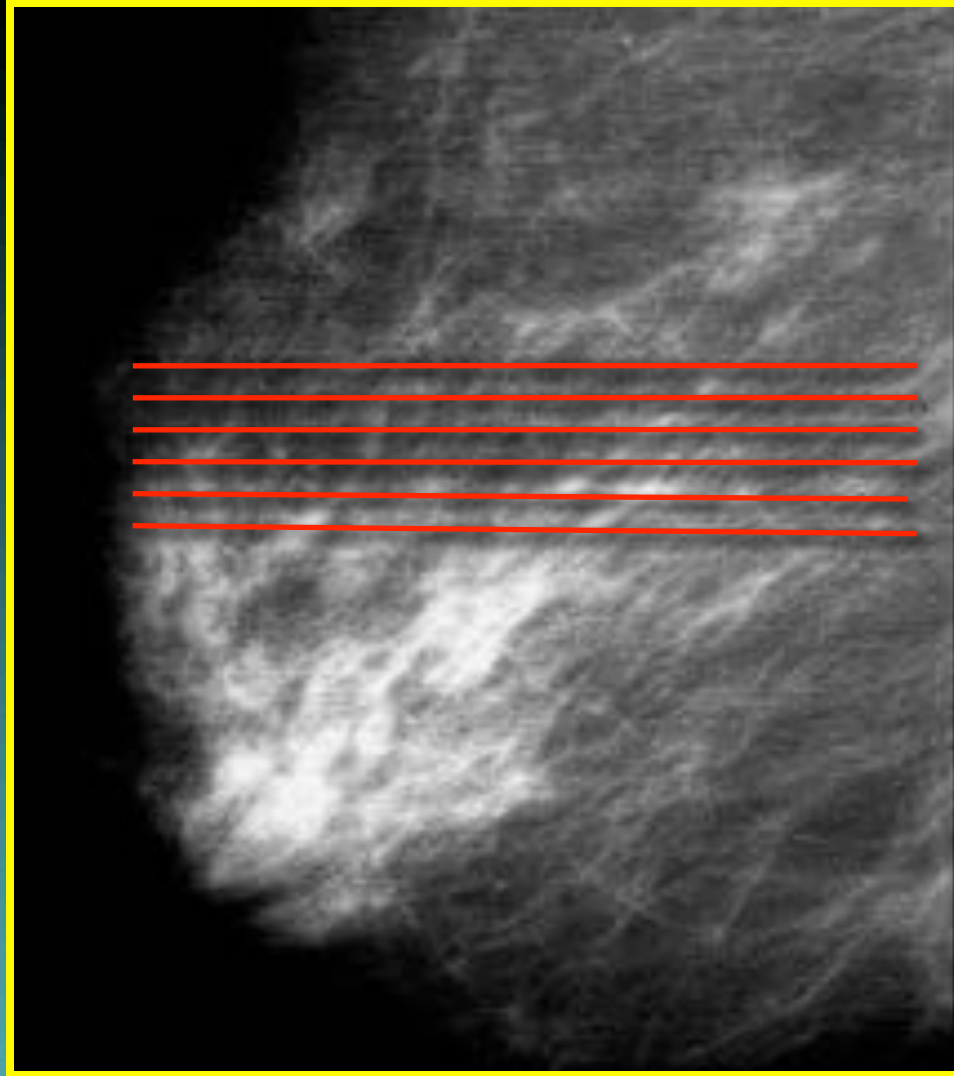
Patient



EQUIPMENT GRID LINES



EQUIPMENT GRID LINES



PATIENT'S FINGER HOLDING OPPOSITE BREAST

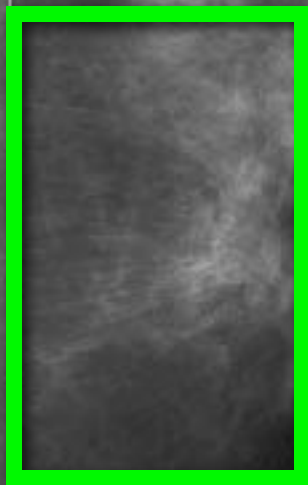


RCC

LCC

RMLO

LMLO

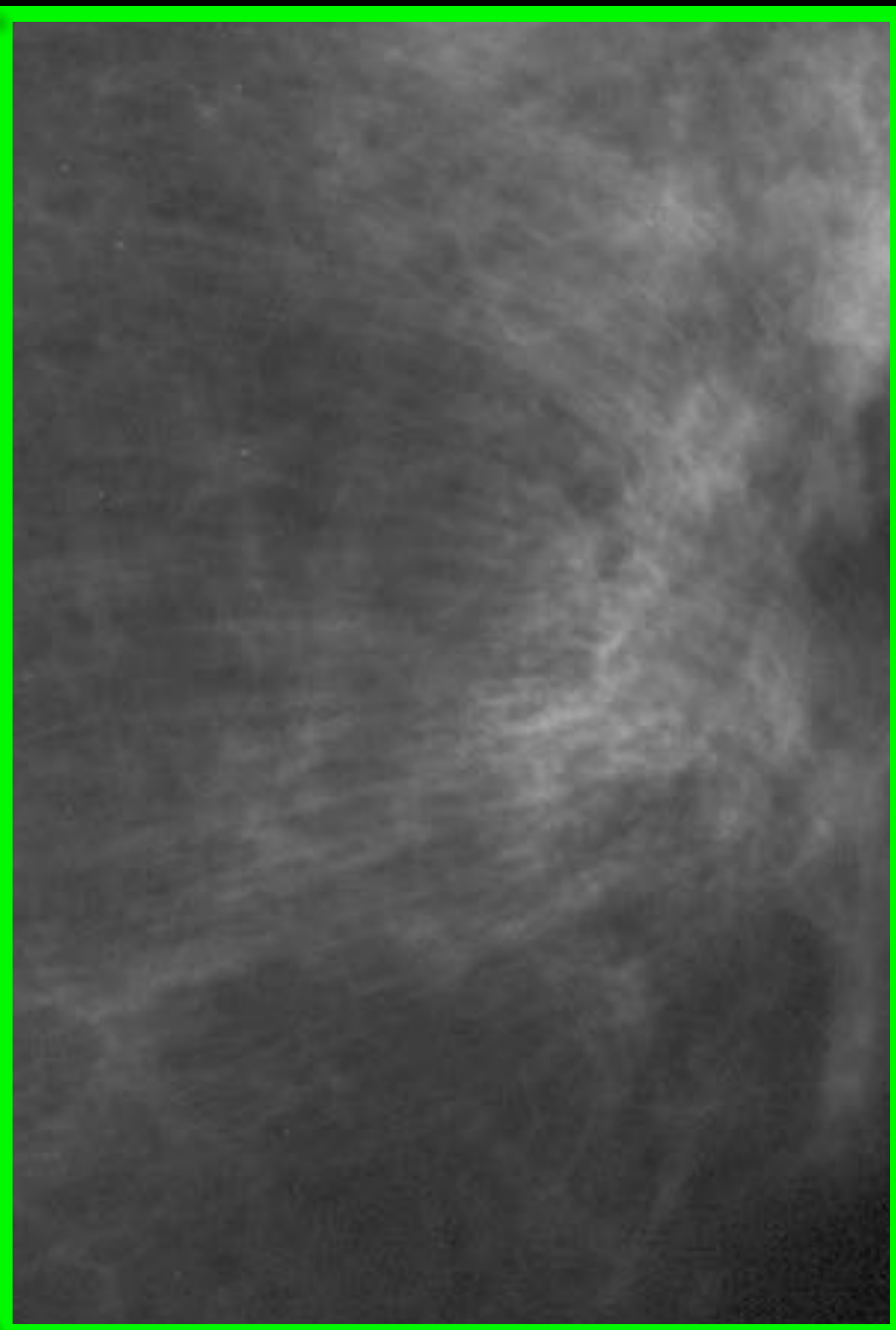
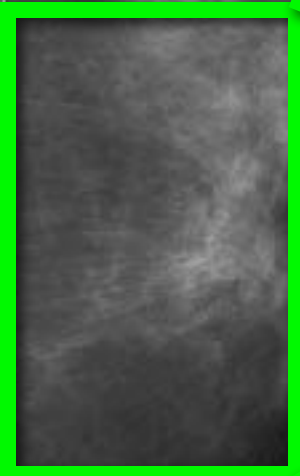


RCC

LCC

R

LO

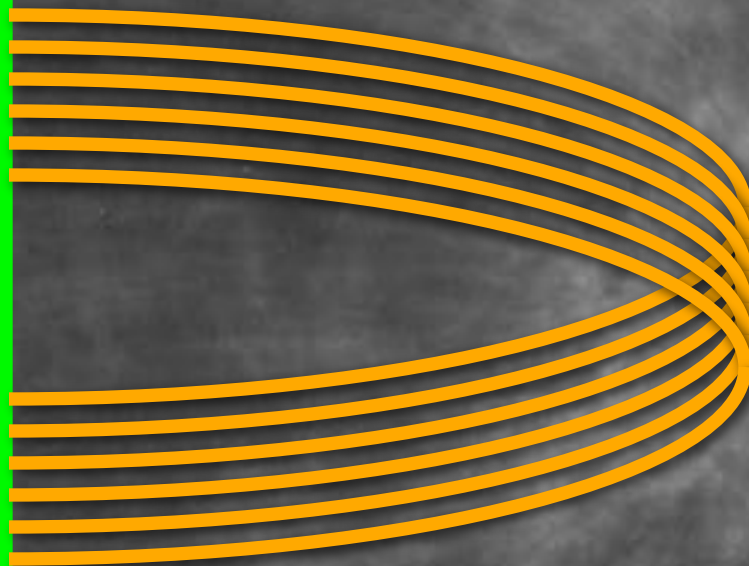
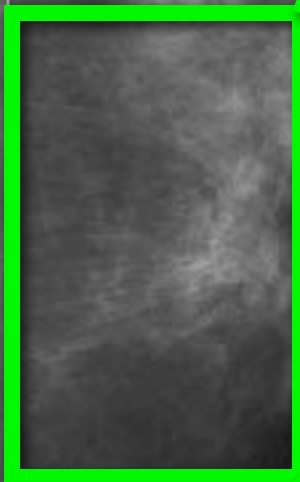


RCC

LCC

F

LO

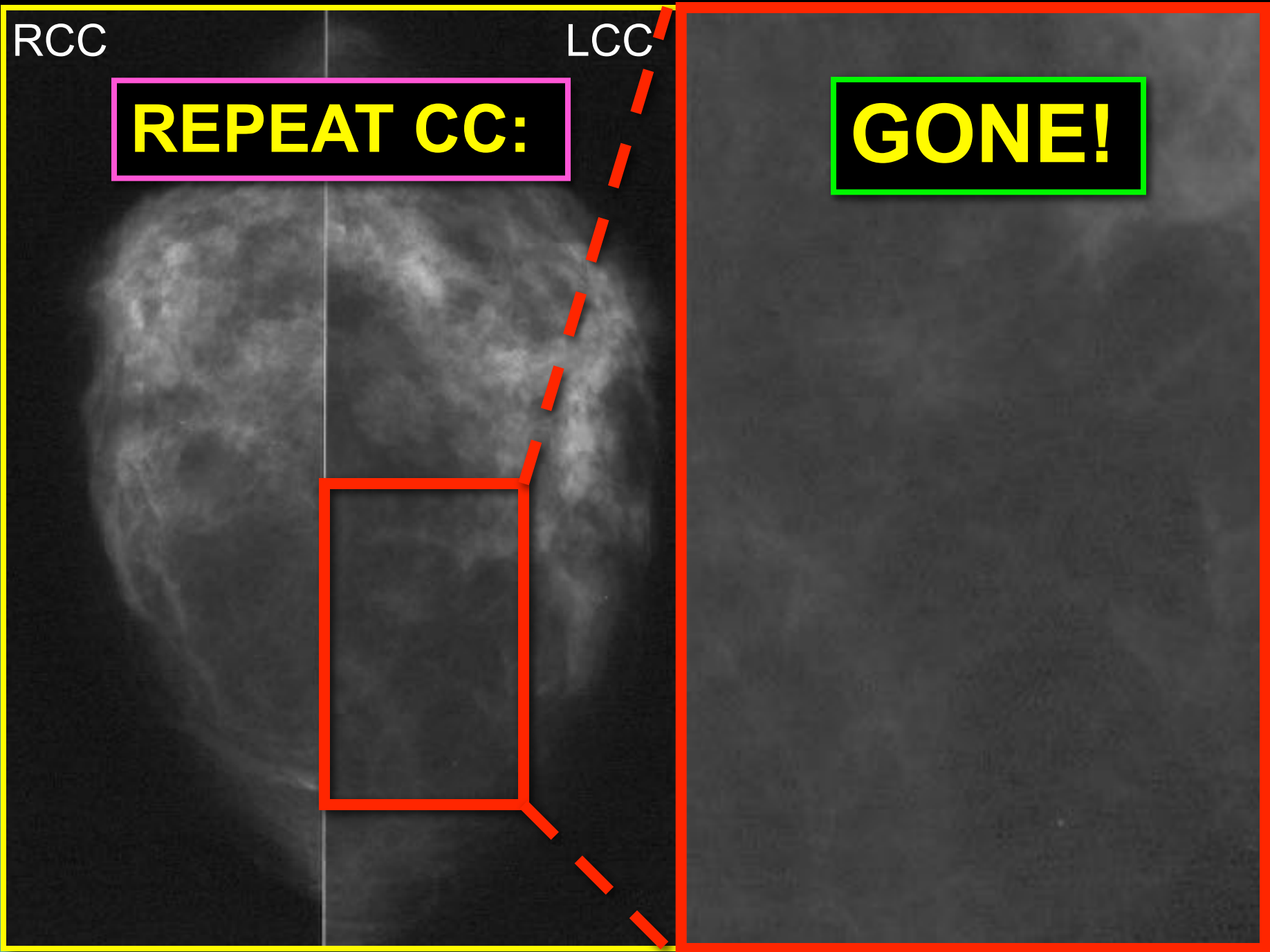


RCC

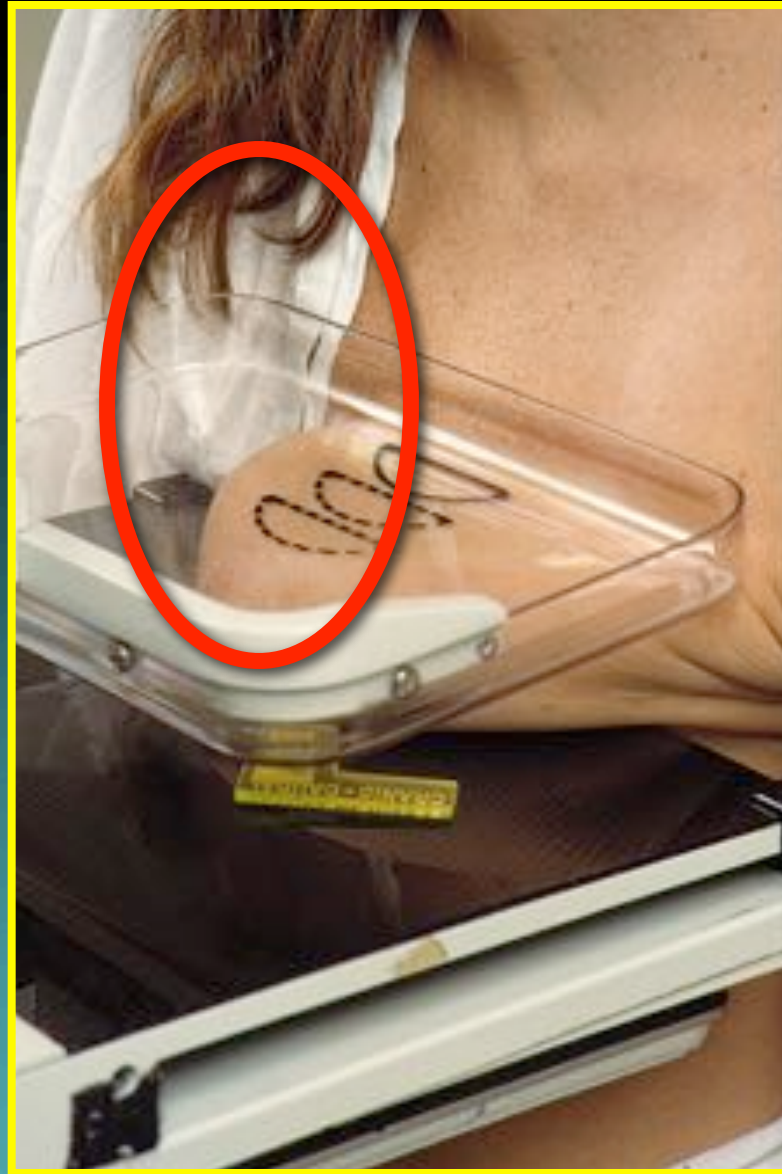
LCC

REPEAT CC:

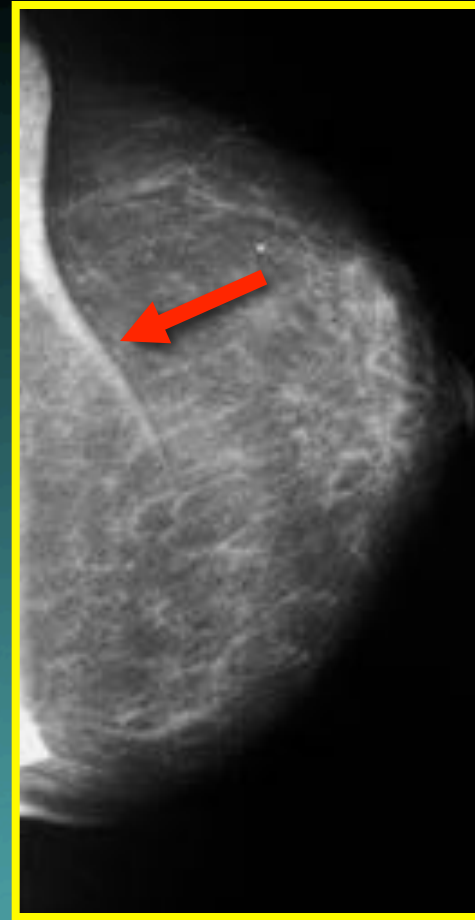
GONE!

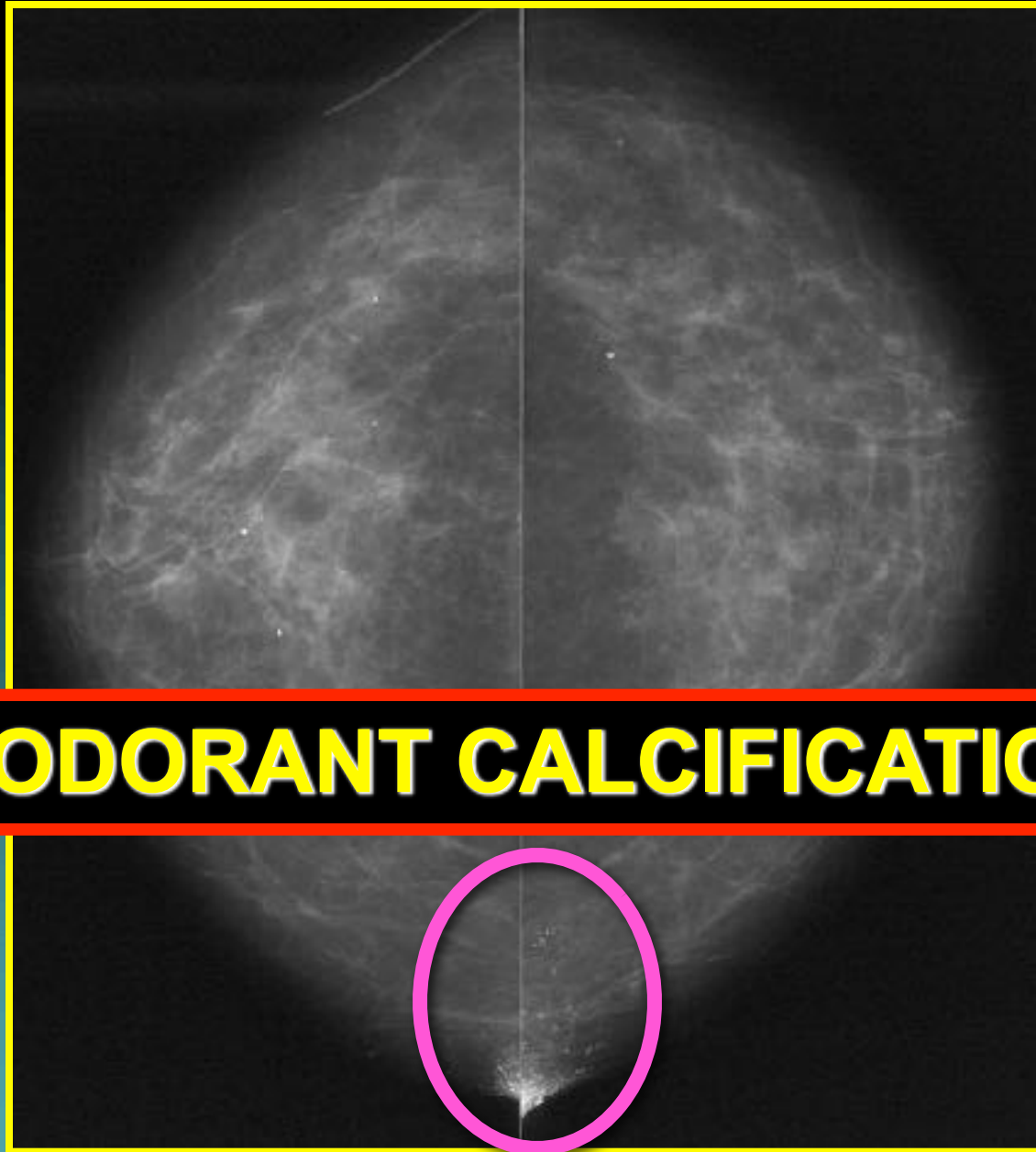


PATIENT'S HAIR OVERLYING X-RAY FIELD



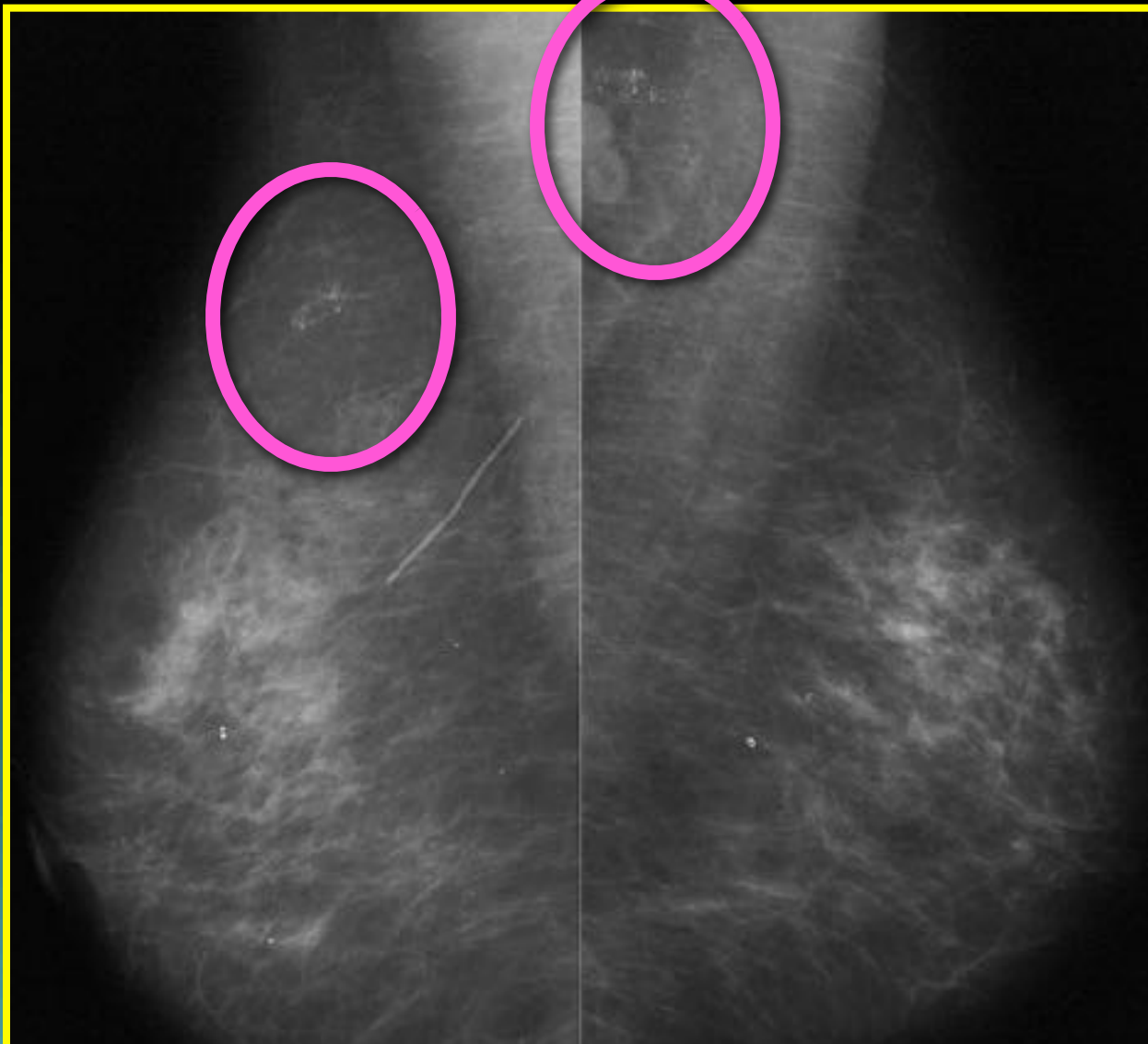
SKIN FOLDS





DEODORANT CALCIFICATIONS





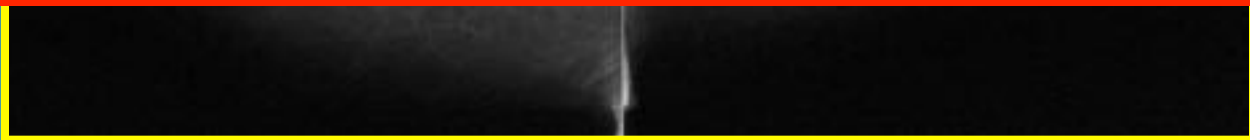
DEODORANT CALCIFICATIONS



DEODORANT CALCIFICATIONS



**DEODORANT CALCIFICATIONS-
GONE ON RETURN 10 DAYS LATER**



CLINICAL IMAGING CATEGORIES

Positioning

Exposure

Compression

Sharpness

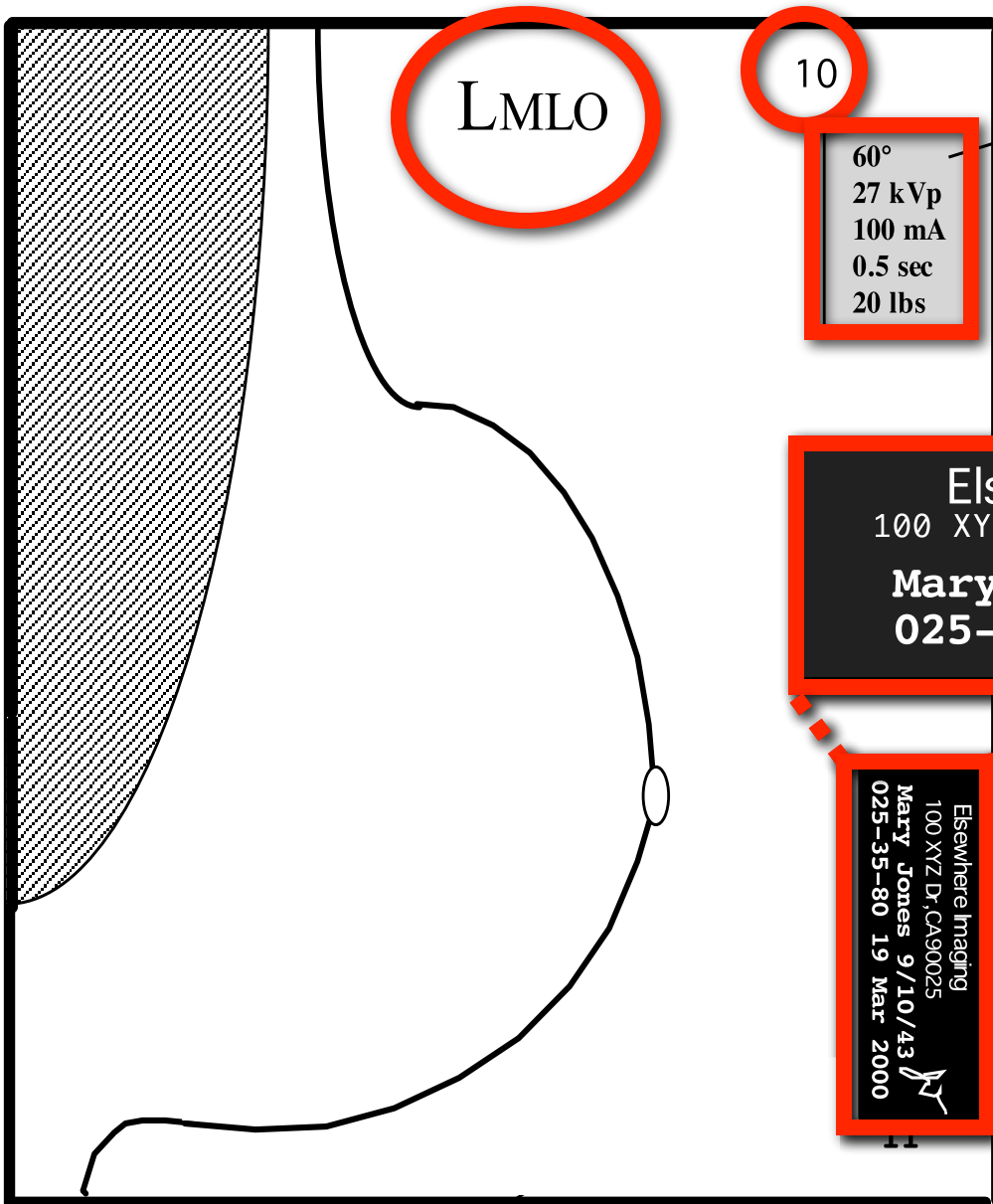
Contrast

Artifacts

Labeling

Noise





LMLO

10

60°
27 kVp
100 mA
0.5 sec
20 lbs

Optional

Elsewhere Imaging
100 XYZ Drive, Palm, CA 90025

Mary Jones 9/10/43
025-35-80 19 Mar 00

Elsewhere Imaging
100 XYZ Drive, CA90025
Mary Jones 9/10/43
025-35-80 19 Mar 2000



SUMMARY:

CLINICAL IMAGE EVALUATION CATEGORIES

- **Positioning**
- **Compression**
- **Exposure**
- **Contrast**
- **Sharpness**
- **Noise**
- **Artifacts**
- **Labeling**

**THE GREAT
EIGHT**





X-Ray Associates of New Mexico, P.C.

BI-RADS: CATEGORIES AND LEXICON

ACR BI-RADS MANUAL, FIFTH EDITION (2014)

ACR BI-RADS® ATLAS

Breast Imaging Reporting and Data System

Mammography

Ultrasound

Magnetic Resonance Imaging

Follow-up and Outcome Monitoring

Data Dictionary



The graphic for the BI-RADS v2025 Manual cover features a dark blue background with white and purple abstract shapes. On the right, there is a stylized white outline of a breast with a purple dot and a white circle. The text "BI-RADS®" is in large, bold, dark blue letters, followed by "v2025 Manual" in black, and "Breast Imaging Reporting and Data System" in purple.

BI-RADS®
v2025 Manual
Breast Imaging Reporting and Data System

**RELEASED:
DECEMBER 1, 2025**





MAMMOGRAPHY

Breast composition	a. The breasts are almost entirely fatty b. There are scattered areas of fibroglandular density c. The breasts are heterogeneously dense, which may obscure small masses d. The breasts are extremely dense, which lowers the sensitivity of mammography
Masses	Shape Oval Round Irregular Margin Circumscribed Obscured Microlobulated Indistinct Spiculated Density High density Equal density Low density Non-containing
Calcifications	Typical benign Skin Vascular Coarse or "popcorn-like" Large rod-like Round Rim Dysplastic Mill of calcium Solitary Subnodular morphology Amorphous Coarse heterogeneous Fine pleomorphic Fine linear or fine-linear branching Distribution Diffuse Asymptomatic Grouped Linear Segmental
Architectural distortion	
Asymmetry	Asymmetry Global asymmetry Focal asymmetry Developing asymmetry
Intramammary lymph nodes	
Skin lesion	
Solitary dilated duct	
Associated features	Skin retraction Nipple retraction Skin thickening Fibrocystic thickening Axiillary adenopathy Architectural distortion Calcifications
Location of lesion	Laterality Quadrant and clock face Depth Distance from the nipple

ULTRASOUND

Tissue composition (screening only)	a. Homogeneous background echotexture = fat b. Homogeneous background echotexture = fibroglandular c. Heterogeneous background echotexture
Masses	Shape Oval Round Irregular Orientations Parallel Not parallel Margin Circumscribed Not circumscribed Indistinct Angular Microlobulated Spiculated Echo pattern Anechoic Hypoechoic Complex cystic and solid Hyperechoic Isoechoic Heterogeneous Posterior features Enhancement Shadowing Combined pattern
Calcifications	Calcifications in a mass Calcifications outside of a mass Intraocular calcifications
Associated features	Architectural distortion Duct changes Skin changes Skin thickening Skin retraction Edema Vascularity Absent Internal vascularity Vessels in rim Distortion Soft Intermediate Hard
Special cases	Simple cyst Clumped microcysts Complex cyst Mass in or on skin Foreign body including implants Lymph nodes – intramammary Lymph nodes – axillary AVMs (arteriovenous malformations/pseudoaneurysms) Mondie disease Festuca-like fluid collection Fat necrosis

MAGNETIC RESONANCE IMAGING

Amount of fibroglandular tissue (fat)	a. Almost entirely fat b. Scattered fibroglandular tissue c. Heterogeneous fibroglandular tissue d. Extensive fibroglandular tissue	Associated features	Nipple retraction Nipple inversion Skin retraction Skin thickening Skin invasion Direct invasion Inflammatory cancer Axiillary adenopathy Pectoralis muscle invasion Chest wall invasion Architectural distortion
Background parenchymal enhancement (BPE)	Level Minimal Mild Moderate Marked Symmetry or asymmetry Symmetric Asymmetric	Nat containing lesions	Lymph nodes Normal Abnormal Fat necrosis Hemorrhage Pseudoaneurysm/vascular malformation with fat Location Depth Initial phase Slow Medium Fast Delayed phase Persistent Plateau Washout
Focus		Location of lesion	
Masses	Shape Oval Round Irregular Margin Circumscribed Not circumscribed Irregular Spiculated Internal enhancement characteristics Homogeneous Heterogeneous Rim enhancement Dark internal septations	Kinetic curve (enhancement) Signal intensity Washout curve description	
Non-mass enhancement (NME)	Distribution Focal Linear Segmental Regional Multiple regions Diffuse Internal enhancement patterns Homogeneous Heterogeneous Clumped Clumped ring	Implants	Implant material and lumen type Saline Silicone Intact Ruptured Other implant material Lumen type Implant location Anteroposterior Retroposterior Abnormal implant contour Focal bulge Intracapsular silicone Radial folds Subcapsular line Rimline sign (beading, ooze) Ungulate sign Extracapsular silicone Breast Lymph nodes Water droplets Peri-implant fluid
Intramammary lymph node			
Skin lesion			
Non-enhancing findings	Ductal precontrast high signal on T1w Cyst Postoperative collections (hematoma/hemorrhage) Post therapy skin thickening and trabecular thickening Non-enhancing mass Architectural distortion Signal void from foreign bodies, clips, etc.		

BI-RADS® ASSESSMENT CATEGORIES

Category 0: Mammography: Incomplete – Need Additional Imaging Evaluation and/or True Mammogram for Comparison
Ultrasound & MRI: Incomplete – Need Additional Imaging Evaluation

Category 1: Negative

Category 2: Benign

Category 3: Probably Benign

Category 4: Suspicious

Mammography
& Ultrasound

Category 4A: Low suspicion for malignancy

Category 4B: Moderate suspicion for malignancy

Category 4C: High suspicion for malignancy

Category 5: Highly Suggestive of Malignancy

Category 6: Known Pre-invasive Malignancy



MAMMOGRAPHY

Findings	a. The breasts are almost entirely fatty b. There are scattered areas of fibroglandular density c. The breasts are heterogeneously dense, which may obscure small masses d. The breasts are extremely dense, which lowers the sensitivity of mammography
Masses	Shape - Oval - Round - Irregular Margin - Circumscribed - Obscured - Microlobulated - Indistinct - Spiculated Density - High density - Equal density - Low density
Calcifications	Typical design - Star - Vascular - Coin-like or "popcorn-like" - Large rod-like - Round - Ring - Cystrophic - Milk of calcium - Solitary Subtle morphology - Amorphous - Coarse heterogeneous - Fine pleomorphic - Fine linear or fine-linear branching Distribution - Diffuse - Asymptomatic - Grouped - Linear - Segmental
Architectural distortion	
Asymmetry	Asymmetry - Global asymmetry - Focal asymmetry - Developing asymmetry
Intramammary lymph nodes	
Skin lesion	
Solitary dilated duct	
Associated features	Skin retraction Nipple retraction Skin thickening Fibular thickening Axillary adenopathy Architectural distortion Calcifications
Location of lesion	Laterality Quadrant and clock face Depth Distance from the nipple

ULTRASOUND

Masses	Shape - Oval - Round - Irregular Orientations - Parallel - Not parallel Margin - Circumscribed - Not circumscribed - Indistinct - Angular - Microlobulated - Spiculated Echo content - Anechoic
Calcifications	Microcalcifications - Complex cystic and solid - Myxoid - Ischaemic - Microcalcifications Posterior features - Enhancement - Shadowing - Combined pattern
Cardiac features	Calcifications in a mass Calcifications outside of a mass Intraocular calcifications
Associated features	Architectural distortion Duct changes Skin changes - Skin thickening - Skintethering Edema Vascularity - Absent - Internal vascularity - Masses in rim Distality involvement - Soft - Intermediate - Hard
Special cases	Single-cyst Clumped microcysts Complex cyst Mass in or on skin Foreign body including implants Lymph nodes – intramammary Lymph nodes – axillary AVMs (arteriovenous malformations/pseudoaneurysms) Mendel disease Festering fluid collection Fat necrosis

MAGNETIC RESONANCE IMAGING

Amount of fibroglandular tissue (fat)	a. Almost entirely fat b. Scattered fibroglandular tissue c. Heterogeneous fibroglandular tissue d. Extensive fibroglandular tissue
Background parenchymal enhancement (BPE)	Level - Minimal - Mild - Moderate - Marked Symmetry or asymmetry - Symmetric - Asymmetric
Focus	
Masses	Shape - Oval - Fused - Irregular Margin - Circumscribed - Not circumscribed - Irregular - Spiculated Internal enhancement characteristics - Homogeneous - Heterogeneous - Rim enhancement - Dark internal septations
Non-mass enhancement (NME)	Distribution - Focal - Linear - Segmental - Regional - Multiple regions - Diffuse Internal enhancement patterns - Homogeneous - Heterogeneous - Clumped - Clumped ring
Intramammary lymph node	
Skin lesion	
Non-enhancing findings	Ductal precontrast high signal on T1w Cyst Postoperative collections (hematoma/hematoma) Post therapy skin thickening and trabecular thickening Non-enhancing mass Architectural distortion Signal void from foreign bodies: coils, etc.
Associated features	Nipple retraction Nipple inversion Skin retraction Skin thickening Skin invasion - Direct invasion - Inflammatory cancer Axillary adenopathy Post-surgical muscle invasion Clavicular invasion Architectural distortion Lymph nodes - Normal - Abnormal Fat necrosis Hematomas Postoperative seroma/hematoma with fat Location Depth Initial phase - Slow - Medium - Fast Delayed phase - Persistent - Plateau - Washout
Implants	Implant material and lumen type - Saline - Silicone - Intact - Ruptured Other implant material Lumen type Implant location - Anteroposterior - Retroposterior Abnormal implant contour - Focal bulge Intracapsular silicone findings - Radial folds - Satrapur line - Keyhole sign (teardrop, ooze) - Ungulate sign Extracapsular silicone - Breast - Lymph nodes Water droplets Peri-implant fluid

BI-RADS® ASSESSMENT CATEGORIES

Category 0: Incomplete – Need Additional Imaging Evaluation and/or True Mammogram for Comparison	Ultrasound & MRI: incomplete – Need Additional Imaging Evaluation
Category 1: Negative	
Category 2: Benign	
Category 3: Probably Benign	
Category 4: Suspicious	Category 4A: Low suspicion for malignancy Category 4B: Moderate suspicion for malignancy Category 4C: High suspicion for malignancy
Category 5: Highly Suggestive of Malignancy	
Category 6: Known Pre-existing Malignancy	



MAMMOGRAPHY

Breast composition	a. The breasts are almost entirely fatty b. There are scattered areas of fibroglandular density c. The breasts are heterogeneously dense, which may obscure small masses d. The breasts are extremely dense, which lowers the sensitivity of mammography	
Masses	Shape	Oval Round Irregular Lobulated
	Margin	Circumscribed Obscured Microlobulated Indistinct Spiculated
	Density	High density Equal density Low density

ULTRASOUND

Tissue composition (screening only)	a. Homogeneous background echotexture – fat b. Homogeneous background echotexture – fibroglandular c. Heterogeneous background echotexture	
Masses	Shape	Oval Round Irregular Lobulated
	Orientation	Parallel Not parallel
	Margin	Circumscribed Not circumscribed - Indistinct - Angular - Microlobulated - Spiculated



MAMMOGRAPHY

Breast composition	a. The breasts are almost entirely fatty b. There are scattered areas of fibroglandular density c. The breasts are heterogeneously dense, which may obscure small masses d. The breasts are extremely dense, which lowers the sensitivity of mammography
Masses	Shape Oval Round Irregular Margin Circumscribed Obscured Microlobulated Indistinct Spiculated Density High density Equal density Low density
Calcifications	Typically benign Skin Vascular Coarse or "popcorn-like" Large rod-like Round Rim Dysplastic Mill of calcium Solitary Subnodular morphology Amorphous Coarse heterogeneous Fine pleomorphic Fine linear or fine-linear branching Distribution Diffuse Asymptomatic Grouped Linear Segmental
Architectural distortion	
Asymmetry	Asymmetry Global asymmetry Focal asymmetry Developing asymmetry
Intramammary lymph nodes	
Skin lesion	
Solitary dilated duct	
Associated features	Skin retraction Nipple retraction Skin thickening Fibular thickening Auxiliary adenopathy Architectural distortion Calcifications
Location of lesion	Laterality Quadrant and clock face Depth Distance from the nipple

ULTRASOUND

Masses	Shape Oval Round Irregular Orientation Parallel Not parallel Margin Circumscribed Not circumscribed Indistinct Angular Microlobulated Spiculated Echo pattern Anechoic Hypoechoic Complex cystic and solid Hyperechoic Isoechoic Heterogeneous Posterior features Enhancement Shadowing Combined pattern
Calcifications	Calcifications in a mass Calcifications outside of a mass Intraocular calcifications
Architectural distortion	Architectural distortion Duct changes Skin changes Skin thickening Skin retraction Edema Vascularity Absent Internal vascularity Vessels in rim Ductility assessment Soft Intermediate Hard
Special cases	Single-cyst Clattered microcysts Complex cyst Mass in or on skin Foreign body including implants Lymph nodes – intramammary Lymph nodes – axillary AVMs (arteriovenous malformations/pseudoaneurysms) Mondie disease Festering fluid collection Fat necrosis

MAGNETIC RESONANCE IMAGING

Amount of fibroglandular tissue (fat)	a. Almost entirely fat b. Scattered fibroglandular tissue c. Heterogeneous fibroglandular tissue d. Extensive fibroglandular tissue
Background parenchymal enhancement (BPE)	Level Minimal Mild Moderate Marked Symmetry or asymmetry Symmetric Asymmetric
Focus	
Masses	Shape Oval Round Irregular Margin Circumscribed Not circumscribed Irregular Spiculated Internal enhancement characteristics Homogeneous Heterogeneous Rim enhancement Dark internal septations
Non-mass enhancement (NME)	Distribution Focal Linear Segmental Regional Multiple regions Diffuse Internal enhancement patterns Homogeneous Heterogeneous Clumped Clumped ring
Intramammary lymph node	
Skin lesion	
Non-enhancing findings	Ductal precontrast high signal on T1w Cyst Postoperative collections (hematoma/hematoma) Post therapy skin thickening and trabecular thickening Non-enhancing mass Architectural distortion Signal void from foreign bodies, clips, etc.
Associated features	Nipple retraction Nipple inversion Skin retraction Skin thickening Skin invasion Direct invasion Inflammatory cancer Auxiliary adenopathy Pectoralis muscle invasion Clavicular invasion Architectural distortion Lymph nodes Normal Abnormal Fat necrosis Hematoma Postoperative seroma/hematoma with fat Location Depth Initial phase Slow Medium Fast Delayed phase Persistent Plateau Washout
Implants	Implant material and lumen type Saline Silicone Intact Ruptured Other implant material Lumen type Implant location Anteroposterior Retroposterior Abnormal implant contour Focal bulge Intracapsular silicone Radial folds Subcapsular line Rimline sign (beading, ooze) Ungulate sign Extracapsular silicone Rimline Lymph nodes Water droplets Peri-implant fluid

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Category 4: Suspicious	Category 4A: Low suspicion for malignancy Category 4B: Moderate suspicion for malignancy Category 4C: High suspicion for malignancy
Category 5: Highly Suggestive of Malignancy	
Category 6: Known Pre-invasive Malignancy	

BI-RADS®

v2025 Manual

Breast Imaging Reporting and Data System



Calcifications

Typically benign

Skin

Vascular

~~Coarse or "popcorn-like"~~

Large rod-like

Round

Rim

~~Dystrophic~~

~~Milk of calcium~~

Layering

Suture

Suspicious morphology

Amorphous

Coarse heterogeneous

Fine pleomorphic

Fine linear or fine-linear branching

Distribution

Diffuse

Regional

Grouped

Linear

Segmental



MAMMOGRAPHY

Overall composition	a. The breasts are almost entirely fatty b. There are scattered areas of fibroglandular density c. The breasts are heterogeneously dense, which may obscure small masses d. The breasts are extremely dense, which lowers the sensitivity of mammography
Masses	Shape Oval Round Irregular Margin Circumscribed Obscured Microlobulated Indistinct Spiculated Density High density Equal density Low density Non-containing
Calcifications	Typical benign Skin Vascular Coarse or "popcorn-like" Large rod-like Round Rim Dysplastic Mill of calcium Solitary Subtle Asymmetric Coarse heterogeneous Fine pleomorphic Fine linear or fine-linear branching Distribution Diffuse Asymptomatic Grouped Linear Segmental

Asymmetry	Asymmetry Global asymmetry Focal asymmetry Developing asymmetry
-----------	--

Sign lesion	Sign lesion
Unilateral dilated duct	Unilateral dilated duct
Associated features	Skin retraction Nipple retraction Skin thickening Fibrous thickening Axiillary adenopathy Architectural distortion Calcifications
Location of lesion	Laterality Quadrant and clock face Depth Distance from the nipple

ULTRASOUND

Overall composition (screening only)	a. Homogeneous background echotexture = fat b. Homogeneous background echotexture = fibroglandular c. Heterogeneous background echotexture
Masses	Shape Oval Round Irregular Orientation Parallel Not parallel Margin Circumscribed Not circumscribed Indistinct Angular Microlobulated Spiculated Echo pattern Anechoic Hypoechoic Complex cystic and solid Hyperechoic Isoechoic Heterogeneous Posterior features Enhancement Shadowing Combined pattern
Calcifications	Calcifications in a mass Calcifications outside of a mass Intercostal calcifications
Associated features	Architectural distortion Duct changes Skin changes Skin thickening Skin retraction Edema Vascularity Absent Internal vascularity Vessels in rim Distality involvement Soft Intermediate Hard
Special cases	Single-cyst Clumped microcysts Complex cyst Mass in or on skin Foreign body including implants Lymph nodes – intramammary Lymph nodes – axillary AVMs (arteriovenous malformations/pseudoaneurysms) Mondie disease Festivals: fluid collection Fat necrosis

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Associated features	Skin retraction Nipple retraction Skin thickening Fibrous thickening Axiillary adenopathy Architectural distortion Calcifications
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Skin lesion	Skin lesion
Non-enhancing findings	Ductal precontrast high signal on T1w Cyst Postoperative collections (hematoma/hematoma) Post therapy skin thickening and trabecular thickening Non-enhancing mass Architectural distortion Signal void from foreign bodies, coils, etc.
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Category 3: Probably Benign	Category 3: Probably Benign
Category 4: Suspicious	Category 4: Suspicious Mammography & Ultrasound Category 4A: Low suspicion for malignancy Category 4B: Moderate suspicion for malignancy Category 4C: High suspicion for malignancy
Category 5: Highly Suggestive of Malignancy	Category 5: Highly Suggestive of Malignancy
Category 6: Known Pre-existing Malignancy	Category 6: Known Pre-existing Malignancy



Asymmetries

Asymmetry

Global asymmetry

Focal asymmetry

~~Developing asymmetry~~



MAMMOGRAPHY

ULTRASOUND

Overall composition	a. The breasts are almost entirely fatty b. There are scattered areas of fibroglandular density c. The breasts are heterogeneously dense, which may obscure small masses d. The breasts are extremely dense, which lowers the sensitivity of mammography
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Architectural distortion	
Asymmetry	Asymmetry Global asymmetry Focal asymmetry Developing asymmetry
Intramammary lymph nodes	
Skin lesion	
Solitary dilated duct	
Associated features	Skin retraction Nipple retraction Skin thickening Fibrocystic thickening Auxiliary adenopathy Vascular abnormalities Architectural distortion Calcifications
Location of lesion	Laterality Quadrant and clock face Depth Distance from the nipple

Overall composition (screening only)	a. Homogeneous background echotexture = fat b. Homogeneous background echotexture = fibroglandular c. Heterogeneous background echotexture
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Background parenchymal enhancement (BPE)	Level Minimal Mild Moderate Marked Symmetry or asymmetry Symmetric Asymmetric
Foci	
Masses	Shape Oval Round Irregular Margin Circumscribed Not circumscribed Irregular Spiculated Internal enhancement characteristics Homogeneous Heterogeneous Rim enhancement Dark internal septations
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Category 2: Benign

Category 3: Probably Benign

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Category 4a: Low suspicion for malignancy
Category 4b: Moderate suspicion for malignancy
Category 4c: High suspicion for malignancy

Category 5: Highly Suggestive of Malignancy



BI-RADS® ASSESSMENT CATEGORIES

Category 0: Mammography: Incomplete – Need Additional Imaging Evaluation and/or Prior Mammograms for Comparison
Ultrasound & MRI: Incomplete – Need Additional Imaging Evaluation

Category 1: Negative

Category 2: Benign

Category 3: Probably Benign

Category 4: Suspicious

Mammography
& Ultrasound:

Category 4A: Low suspicion for malignancy

Category 4B: Moderate suspicion for malignancy

Category 4C: High suspicion for malignancy

Category 5: Highly Suggestive of Malignancy

Category 6: Known Biopsy-Proven Malignancy

For the complete Atlas, visit **[acr.org/birads](https://www.acr.org/birads)**





ACR BI-RADS LEXICON

Category

- 0 Needs Further Evaluation**
- 1 Negative**
- 2 Benign Findings**
- 3 Short-term Follow-up**
- 4 Suspicious Findings**
- 5 Highly Suggestive of Malignancy**
- 6 Known Biopsy-proven Malignancy**



ACR BI-RADS LEXICON: USES FROM SCREENING

Category

- 0 Needs Further Evaluation
- 1 Negative
- 2 Benign Findings

**AT SCREENING, THESE ARE THE
ONLY THREE CATEGORIES WE
SHOULD USE!**



ACR BI-RADS LEXICON: USES FROM SCREENING

Category

- 0 Needs Further Evaluation**
- 1 Negative**
- 2 Benign Findings**



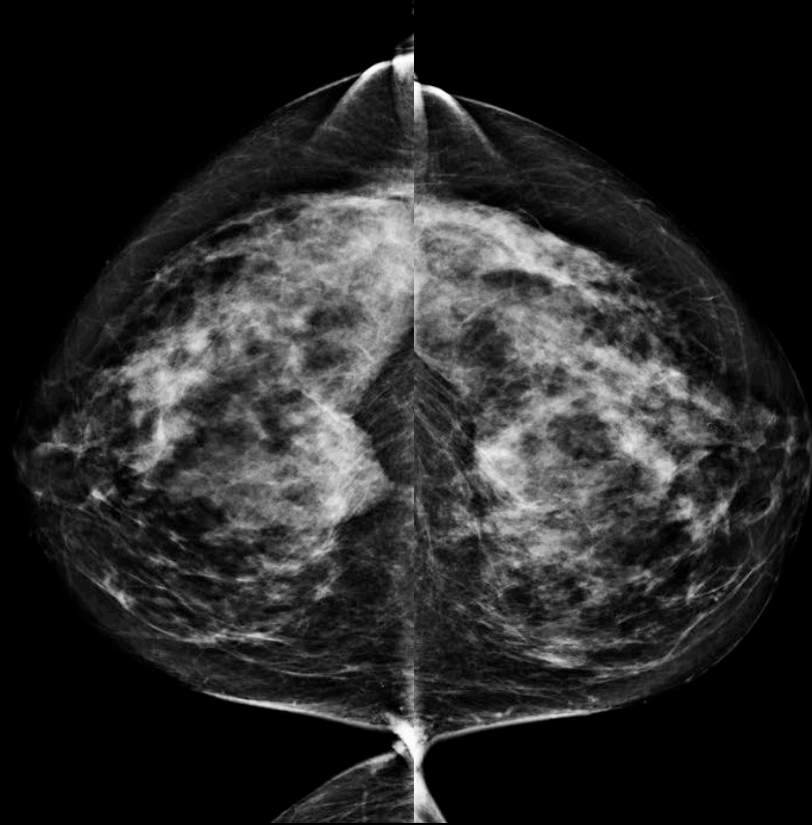
BI-RADS CAT. 0: NEED ADDITIONAL IMAGING &/OR PRIOR MAMMOGRAMS

- Should be used c **SCREENING EXAMS ONLY**
 - ➔ **EXCEPTION:** after dx workup, still need further dx study: ductogram, MRI

Screening Mammogram



LMLO

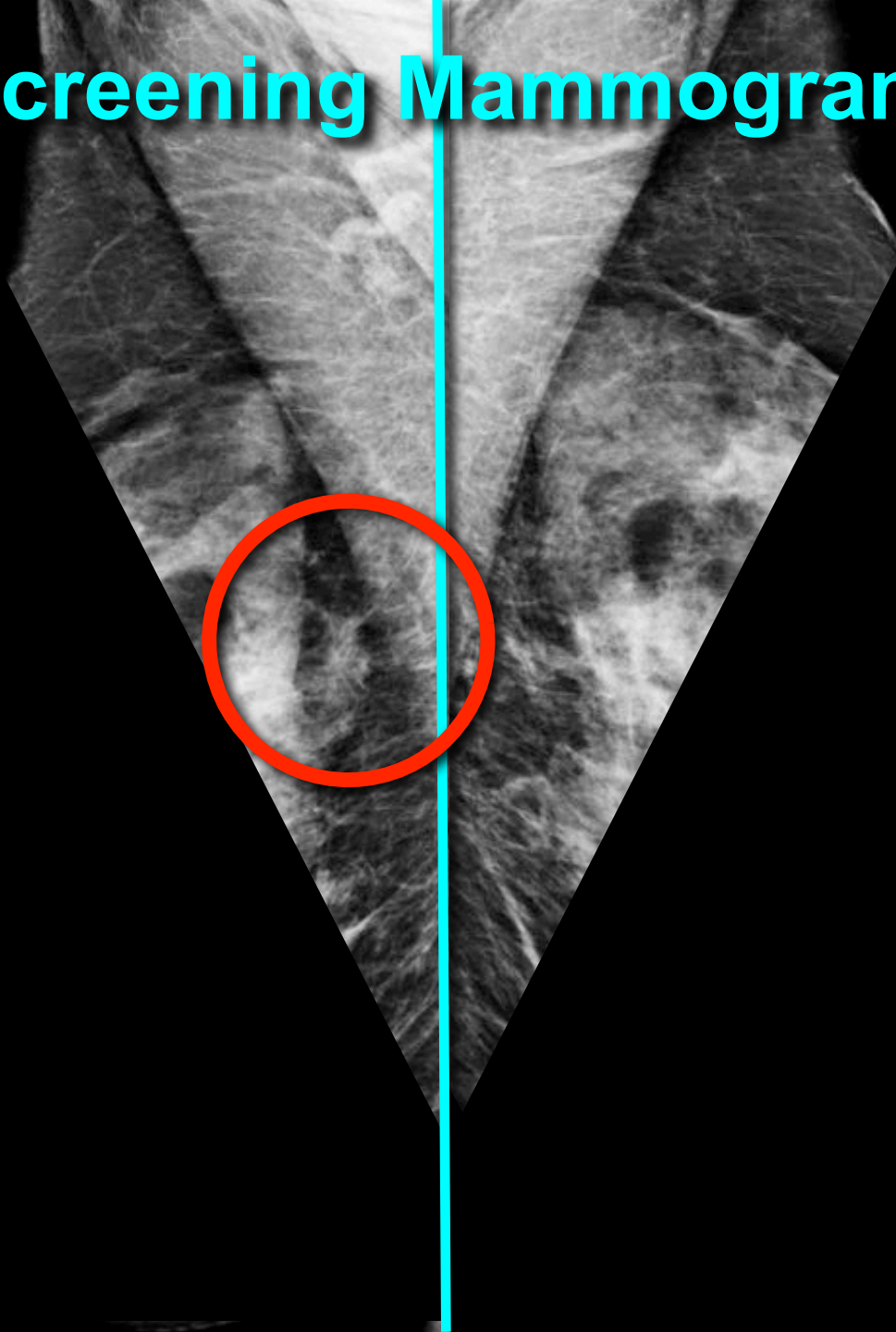


R MLO

Screening Mammogram

CC
D
D
RMLO

LMLO



Screening Mammogram

LMLO





ACR BI-RADS LEXICON: USES FROM SCREENING

Category

- 0 Needs Further Evaluation
- 1 Negative**
- 2 Benign Findings



BI-RADS CATEGORIES 1 AND 2

- **CATEGORY 1: Negative - no findings to comment on**

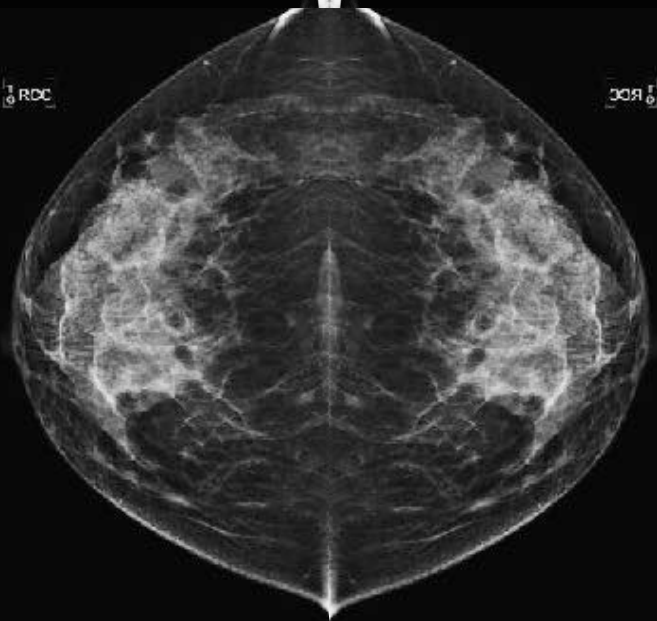
T
6 RMLO

OJMR
7



T
8 RDC

OJMR
8



LAST EXAM

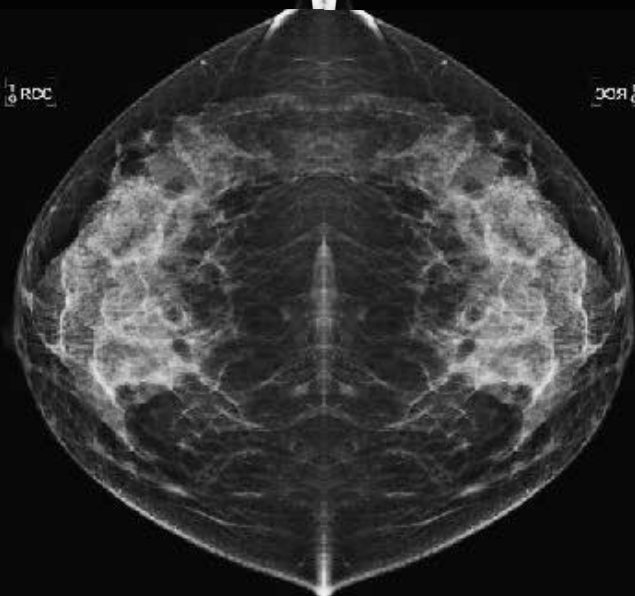
T
6 RMLO

OJMR
7



T
8 RDC

OJMR
8



CURRENT EXAM



ACR BI-RADS LEXICON: USES FROM SCREENING

Category

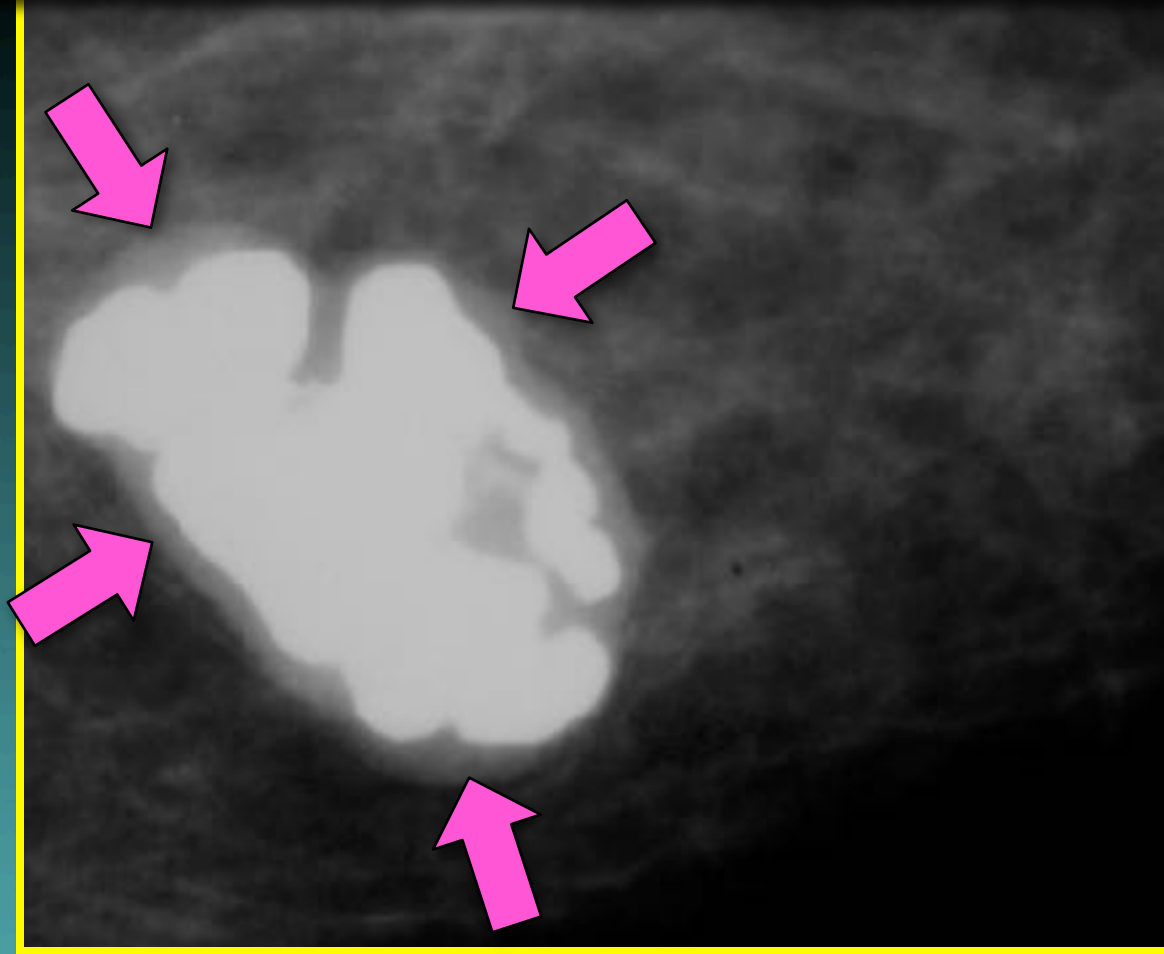
- 0 Needs Further Evaluation
- 1 Negative
- 2 Benign Findings**



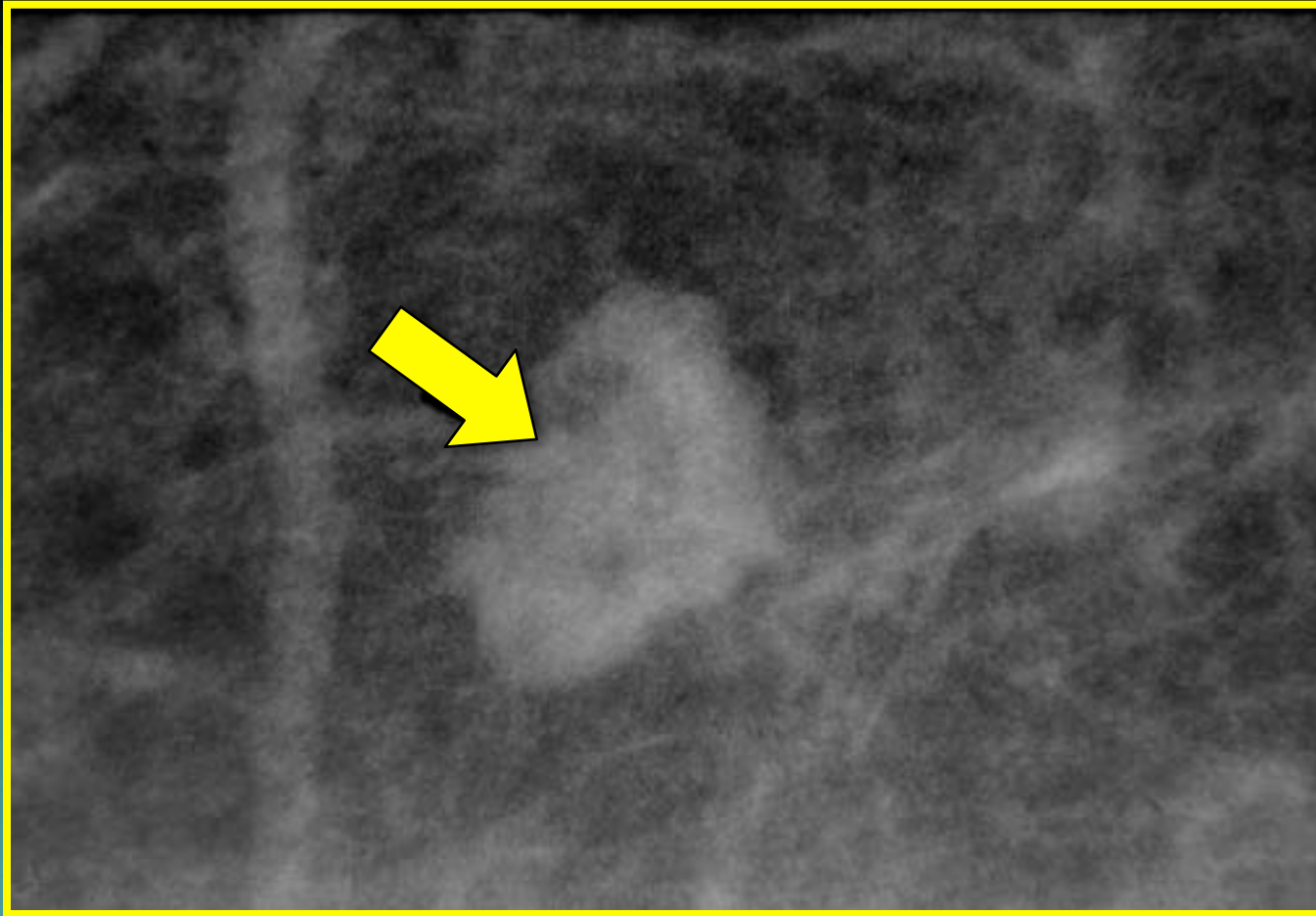
BI-RADS CATEGORIES 1 AND 2

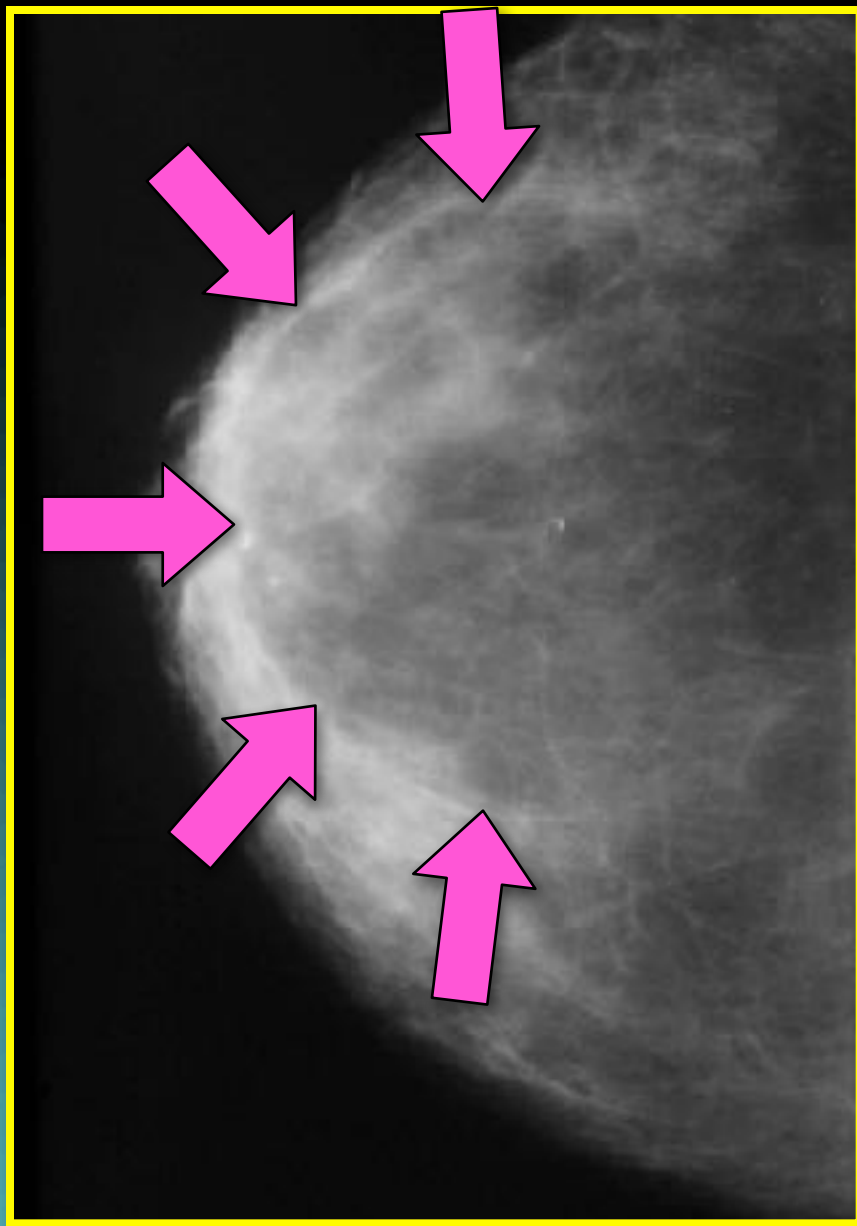
- **CATEGORY 1: Negative- no findings to comment on**
- **CATEGORY 2: Benign finding(s). Normal, with characteristic benign finding(s) on mammogram**

CLASSIC CALCIFIED FIBROADENOMA



INTRAMAMMARY LYMPH NODE

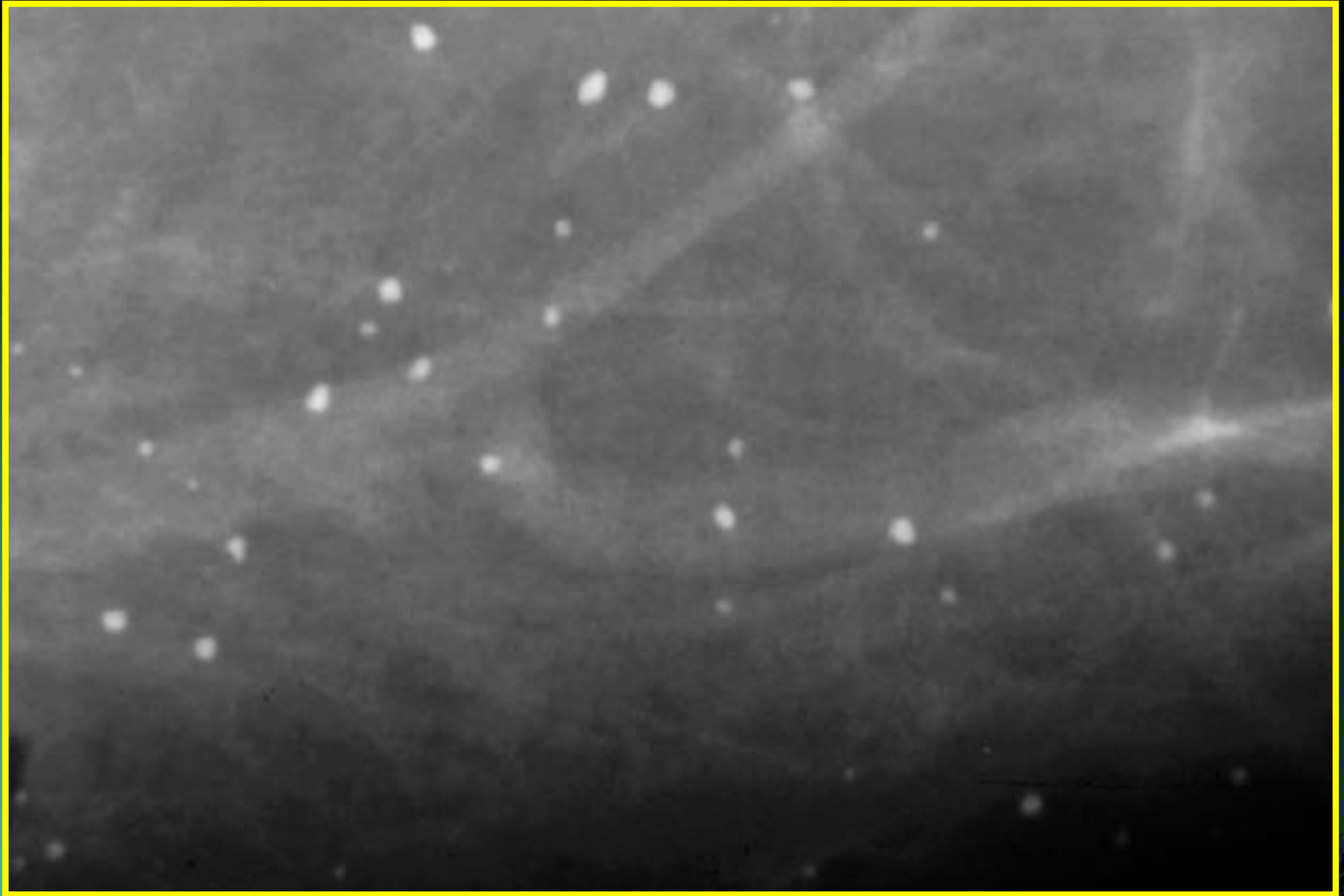




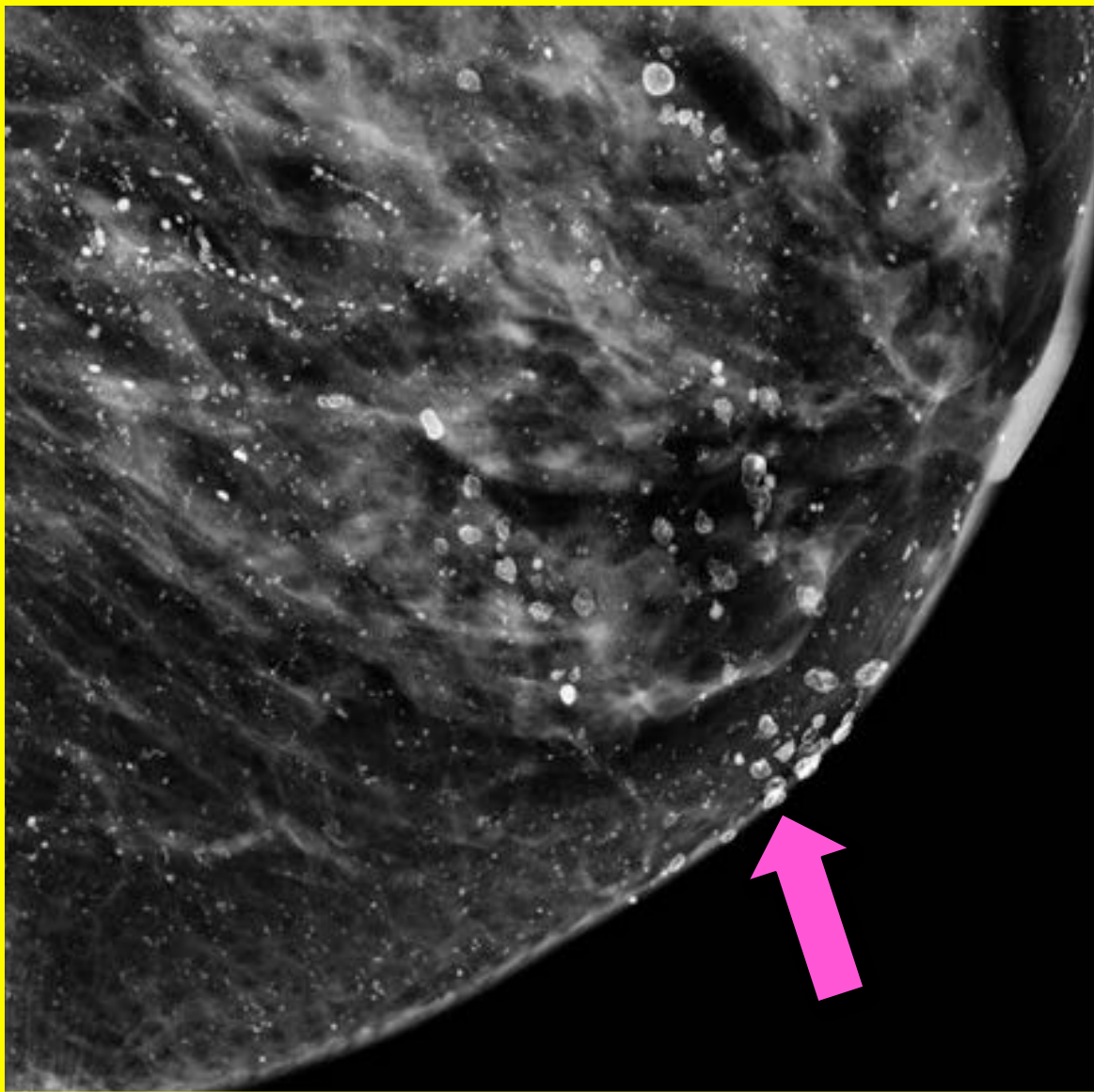
**LARGE
LIPOMA**



SKIN CALCIFICATIONS

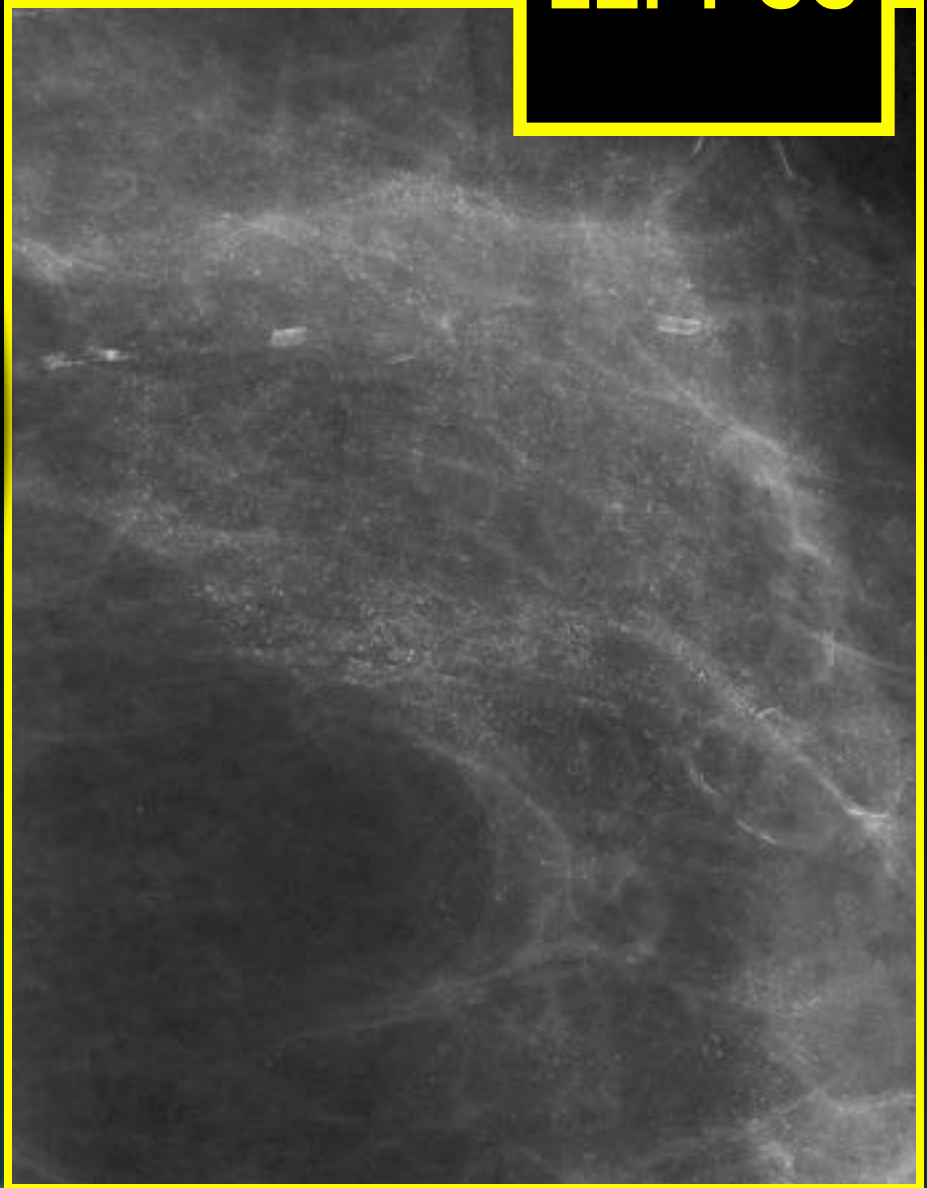
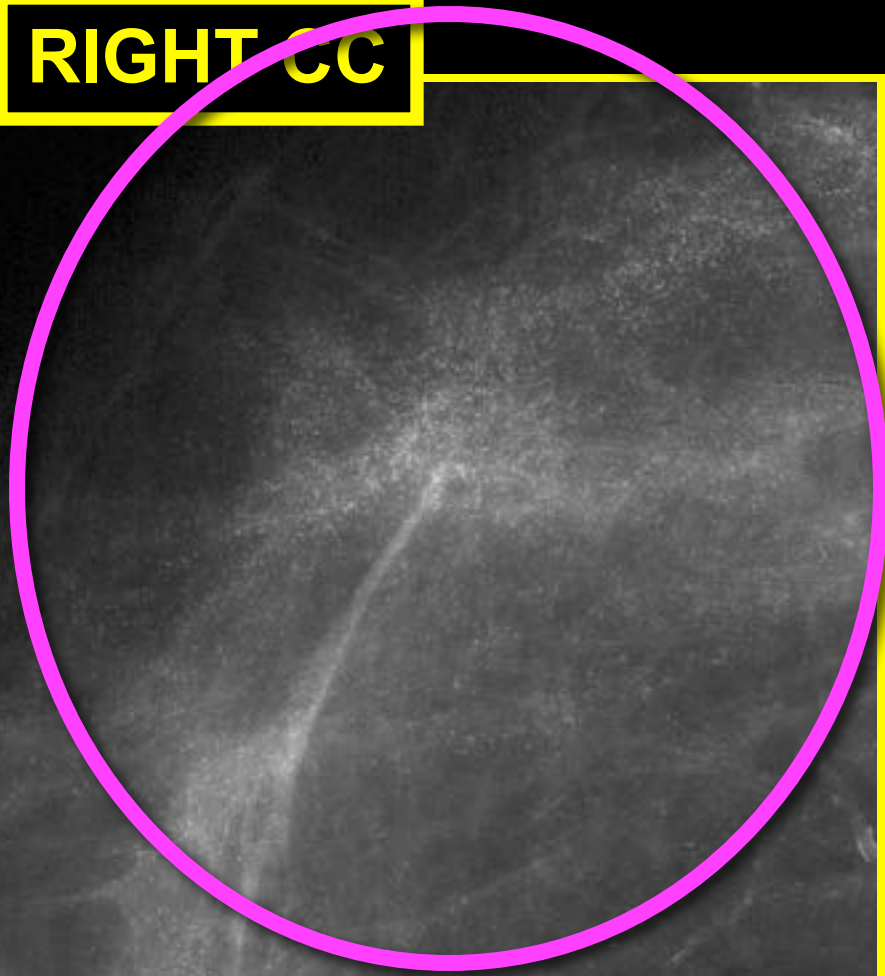


SKIN CALCIFICATIONS

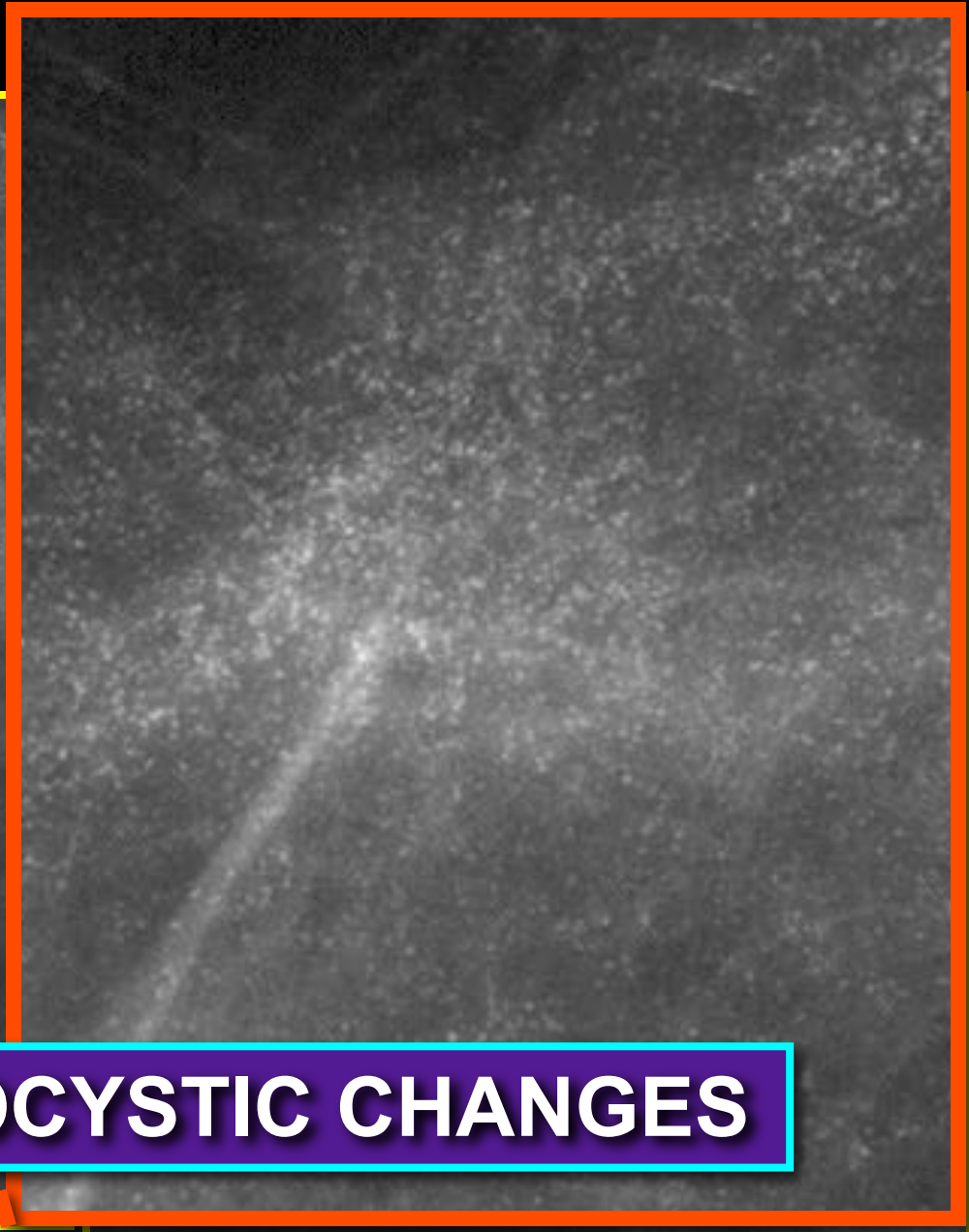


RIGHT CC

LEFT CC

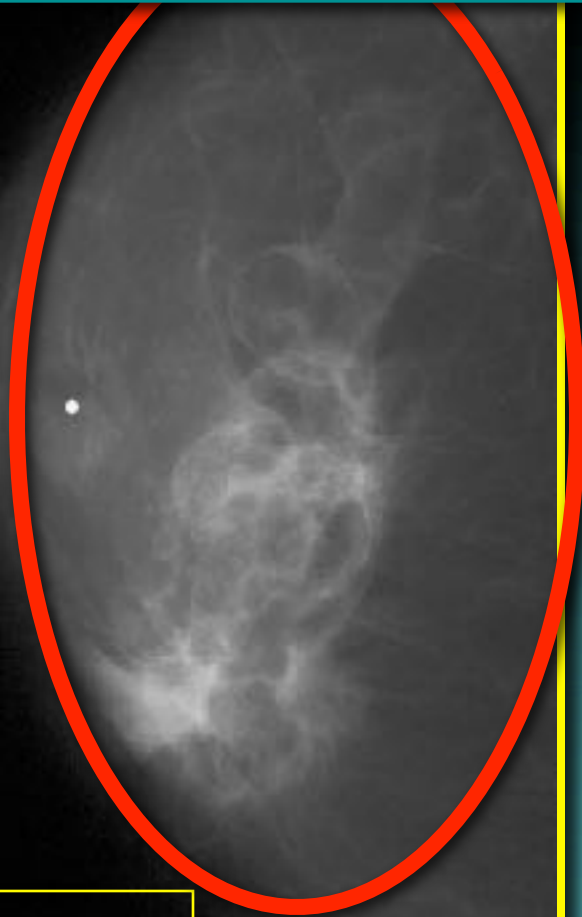


RIGHT CC

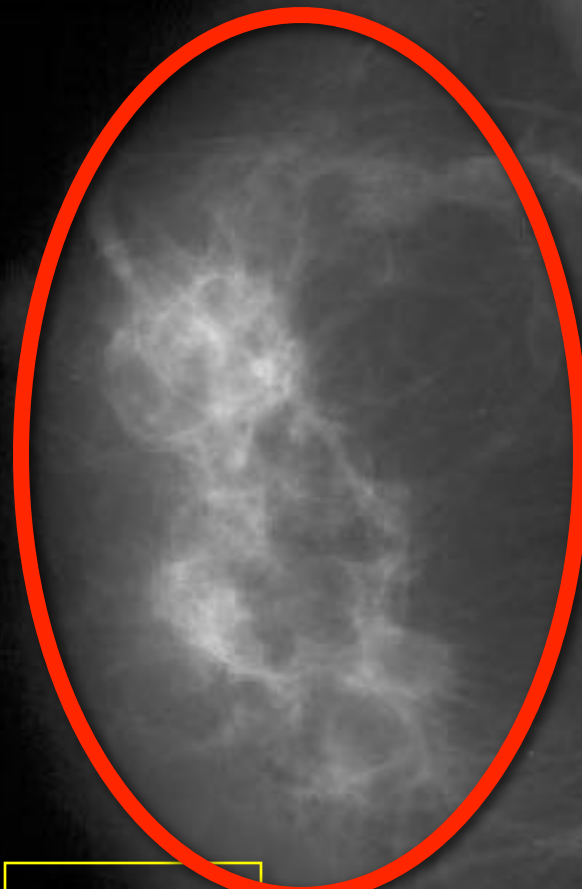


CLASSIC FIBROCYSTIC CHANGES

BENIGN POST SURGICAL OIL CYSTS



CC



MLO





ACR BI-RADS LEXICON: USES FROM SCREENING

Category

- 0 Needs Further Evaluation
- 1 Negative
- 2 Benign Findings

**DO NOT GET HUNG UP ON WHETHER
TO CALL A CASE BIRADS 1 OR 2-
IT DOES NOT MATTER:**

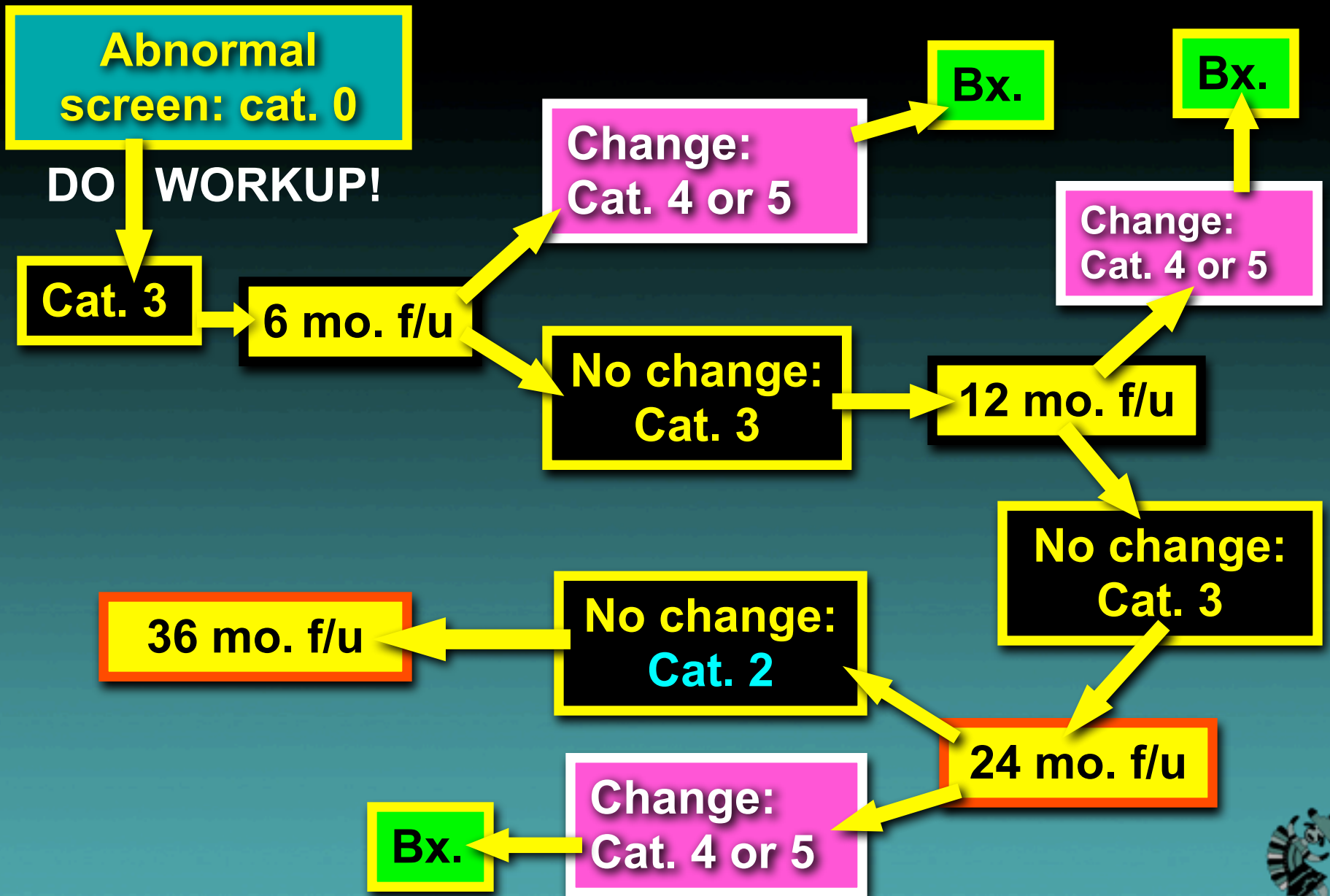
NEITHER IS ACTIONABLE!



BI-RADS CAT. 3: PROB. BENIGN. INITIAL SHORT-INTERVAL FOLLOWUP SUGGESTED

- Has less than 2% risk of malignancy
- Should ONLY be applied after complete evaluation with additional mammo &/or ultrasound, NEVER from screening!
- Recommendation: 6-month protocol →

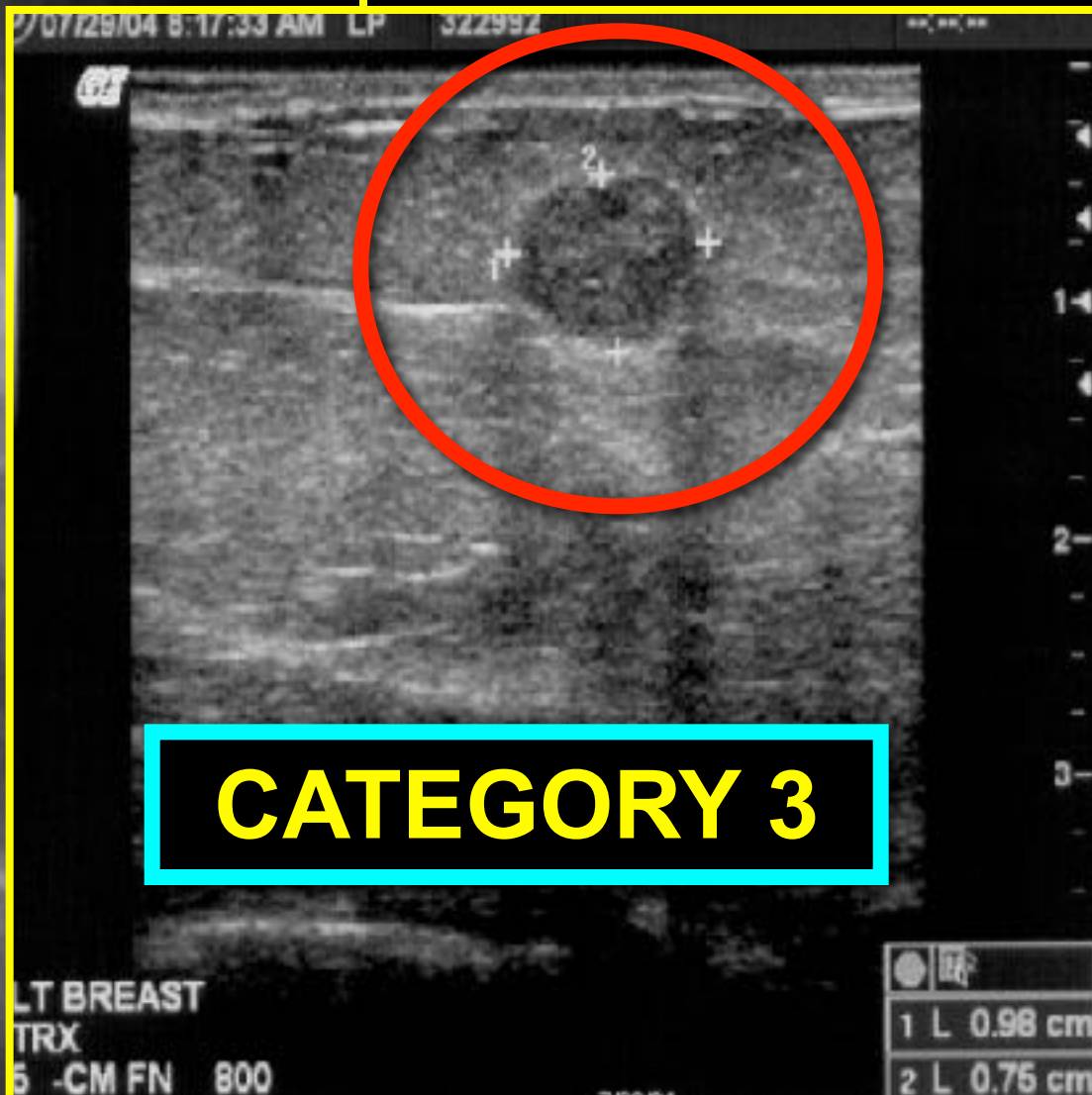
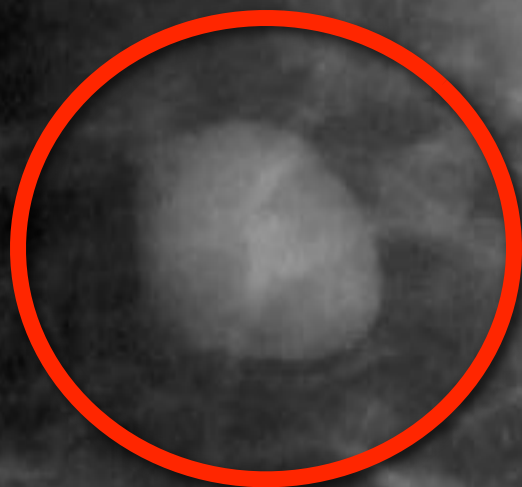
BI-RADS CATEGORY 3 ALGORITHM





BI-RADS CAT. 3: PROB. BENIGN. INITIAL SHORT-INTERVAL FOLLOWUP SUGGESTED

- **MAMMOGRAPHIC category 3 lesions include:**
 - ➔ **Nonpalpable circumscribed mass (if not cyst or LN)**
 - ➔ **Focal asymmetry that thins with spot views**
 - ➔ **Cluster of small round calcifications**



CATEGORY 3



BI-RADS CAT. 3: PROB. BENIGN. INITIAL SHORT-INTERVAL FOLLOWUP SUGGESTED

- If pt. or doc insists on biopsy of Cat. 3 lesion, final assessment is still based on rad's view of risk of malignancy, not management
- For lesions seen ON ULTRASOUND ONLY, same protocol and algorithm apply
- Follow Category 3 lesions in one's AUDIT
 - If $<2\%$ prove malignant, using Cat. 3 OK
 - If $>>2\%$ prove malignant, REASSESS!



BI-RADS CAT. 4: SUSPICIOUS ABNORMALITY- BX CONSIDERED

- Cat. 4 lesions have **2-95%** chance of malign.



BI-RADS CAT. 4: SUSPICIOUS ABNORMALITY- BX CONSIDERED

- Cat. 4 lesions have **2-95%** chance of malign.=
TOO BROAD: should SUBDIVIDE internally
- ➔ **Was entirely internal: NOW approved for MQSA**



NEW CHANGES IN THE BIRADS 4 DEFINITIONS

- **Category 4A:** **Thresholds:** 2-10% PPV
- **Category 4B:** **Thresholds:** 11-50% PPV
- **Category 4C:** **Thresholds:** 51-95% PPV



BI-RADS CAT. 4: SUSPICIOUS ABNORMALITY- BX CONSIDERED

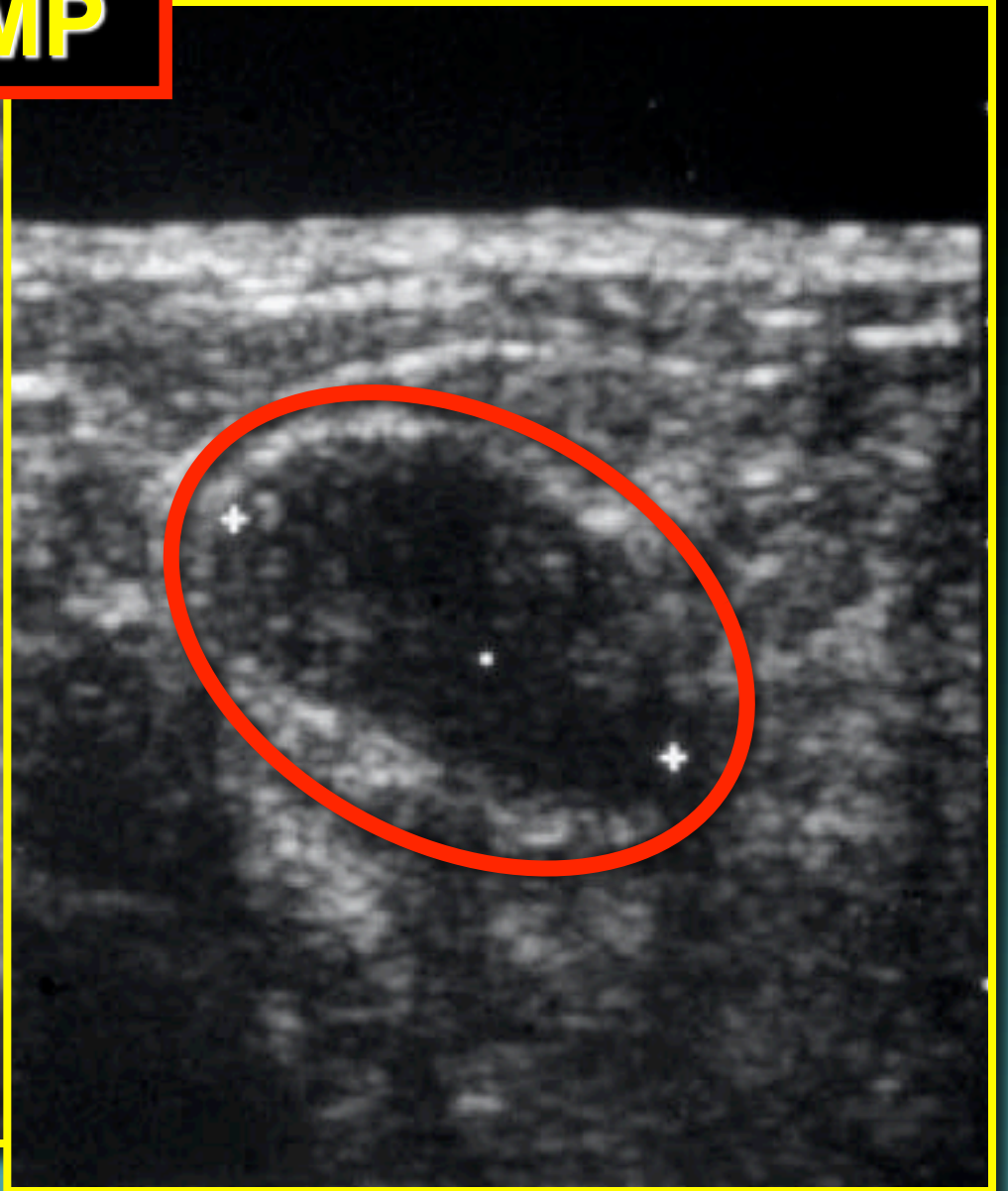
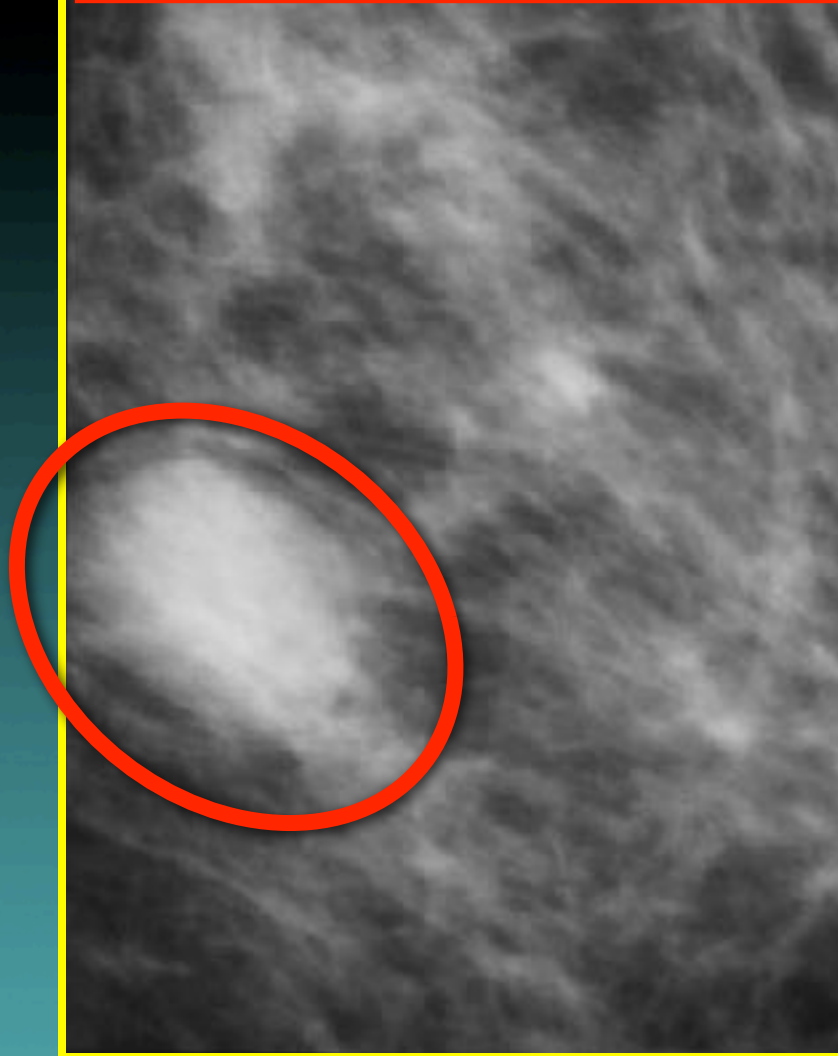
- **CAT. 4 A-** LOW SUSPICION OF MALIGNANCY (2-10%)

➔ Malignant result not expected: if Bx benign, not discordant- do 6 month or routine f/u

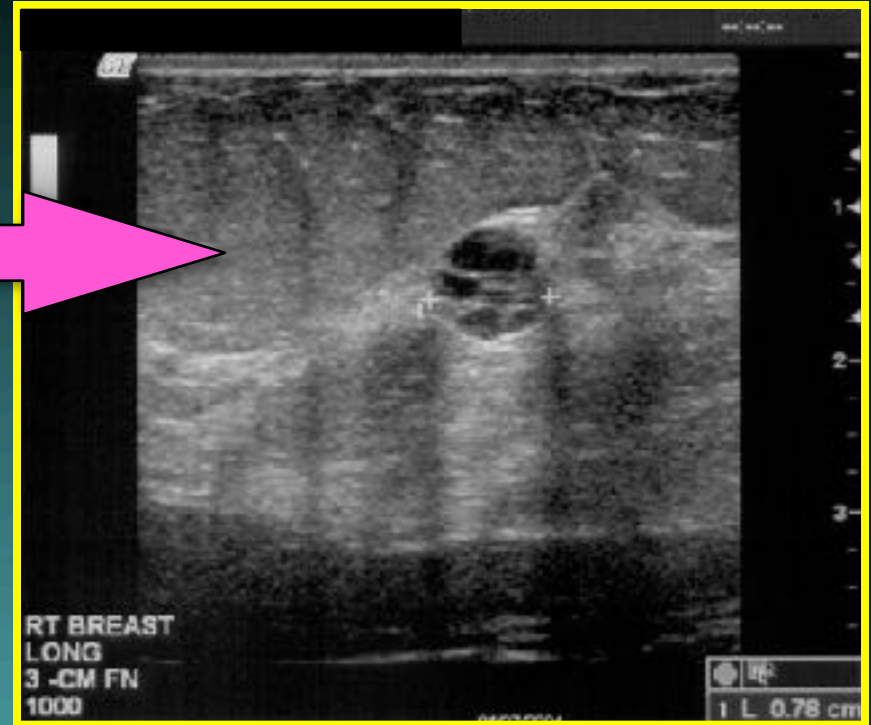
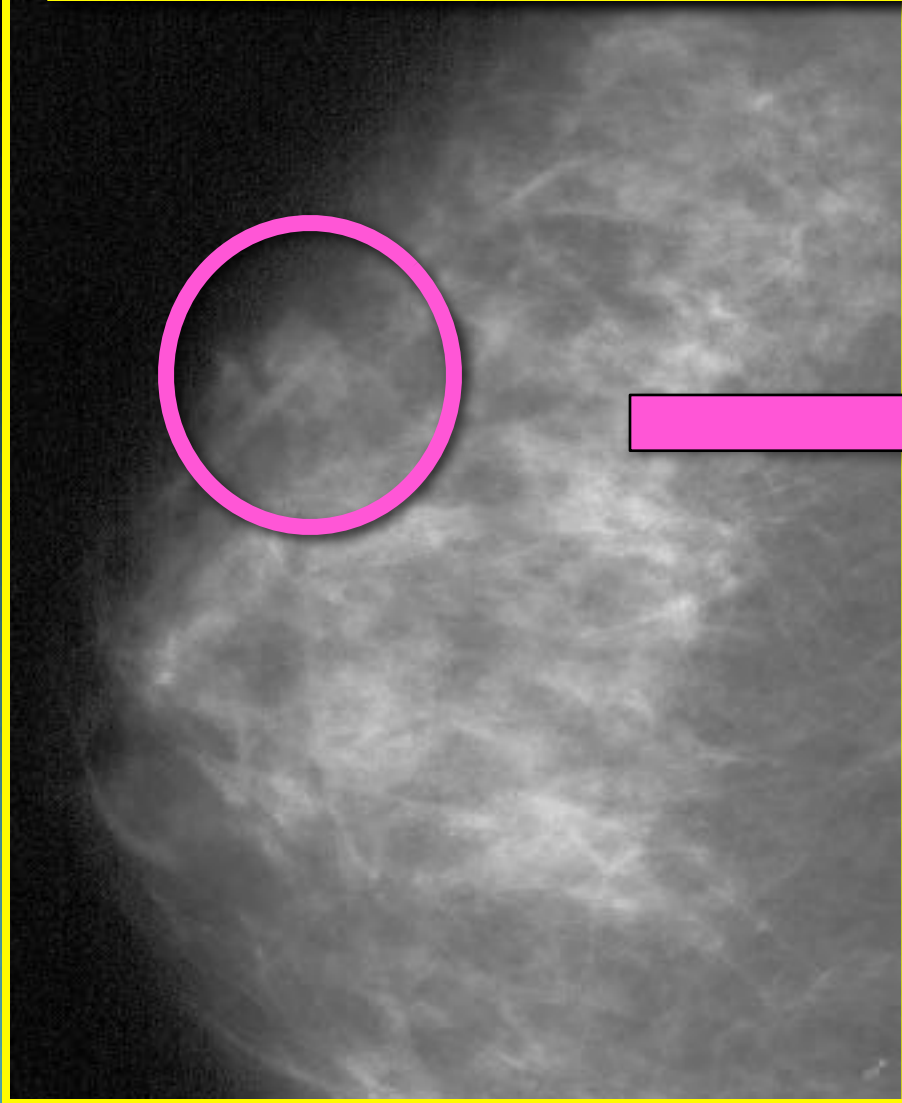
➔ Examples:

- palpable partly circumscribed solid mass c US findings of fibroadenoma
- palpable complicated cyst
- probable abscess

PALPABLE LUMP



BENIGN CYST CLUSTER

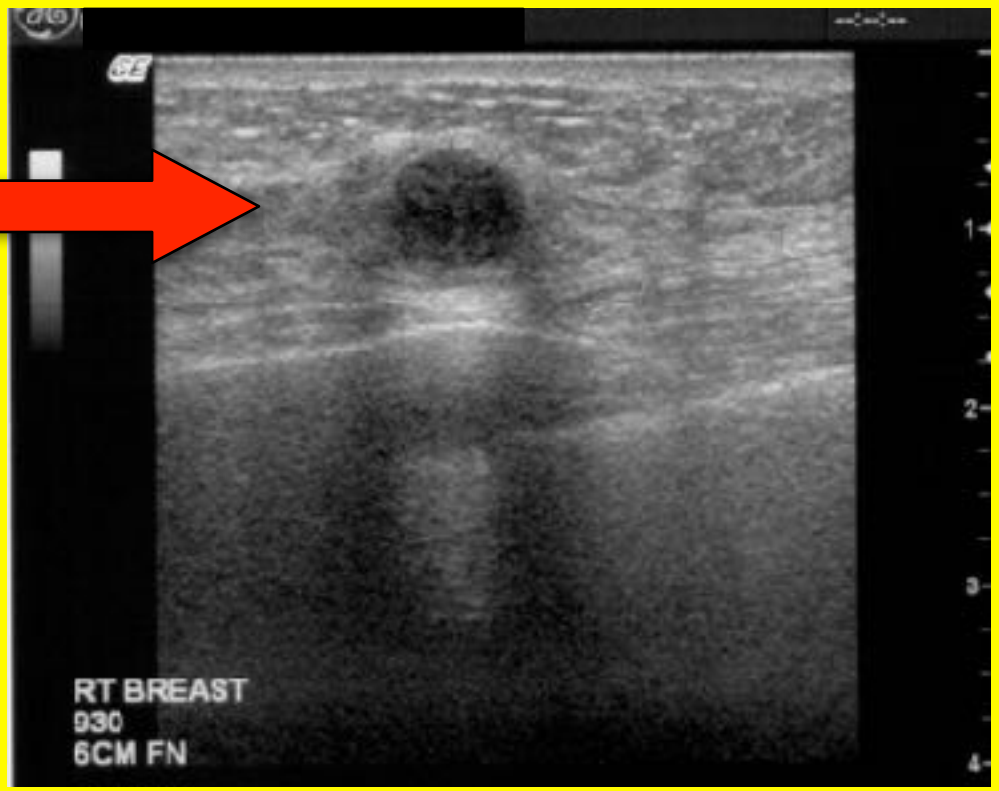
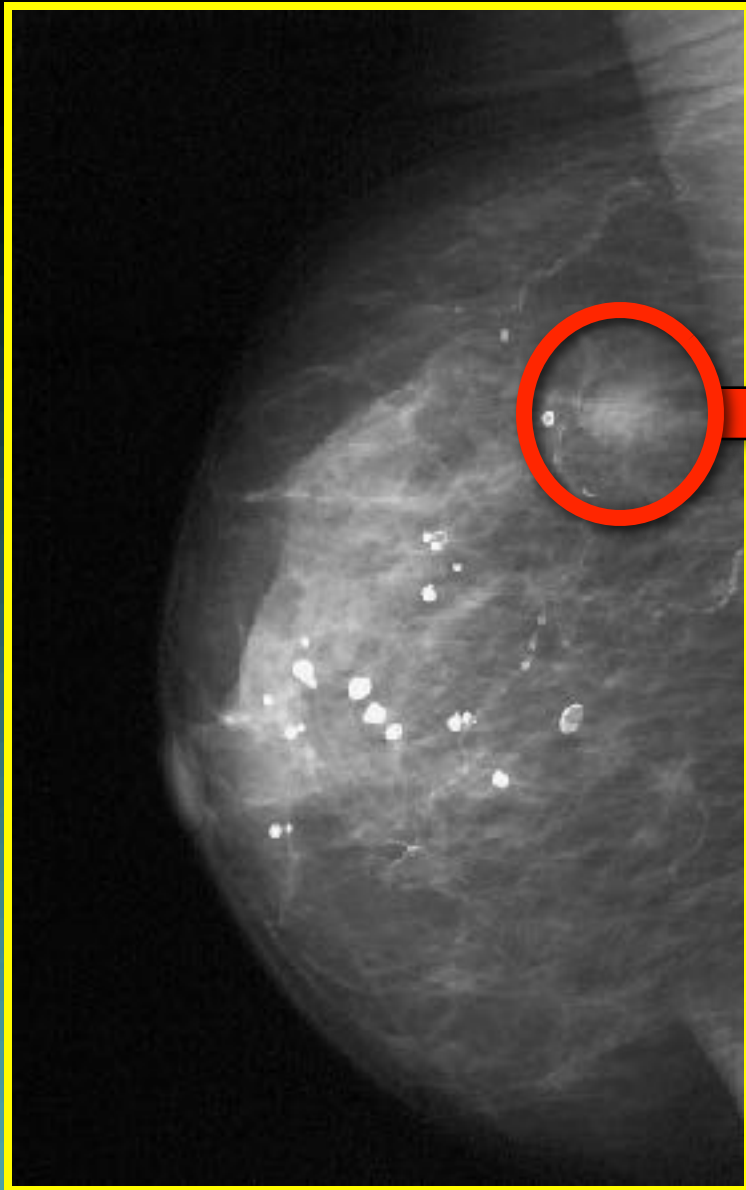




BI-RADS CAT. 4: SUSPICIOUS ABNORMALITY- BX CONSIDERED

- **CAT. 4B- INTERMED. SUSPIC. OF MALIG. (11-50%)**
 - ➔ Here, findings warrant close rad/path correlation. If Bx benign, followup depends on the context
 - ➔ Example: Partly circumscribed & partly indistinct mass
 - If Bx. shows fibroadenoma or fat necrosis: is concordant- routine f/u.
 - BUT- if Bx. showed papilloma, would then do excisional biopsy

HODGKIN'S DISEASE



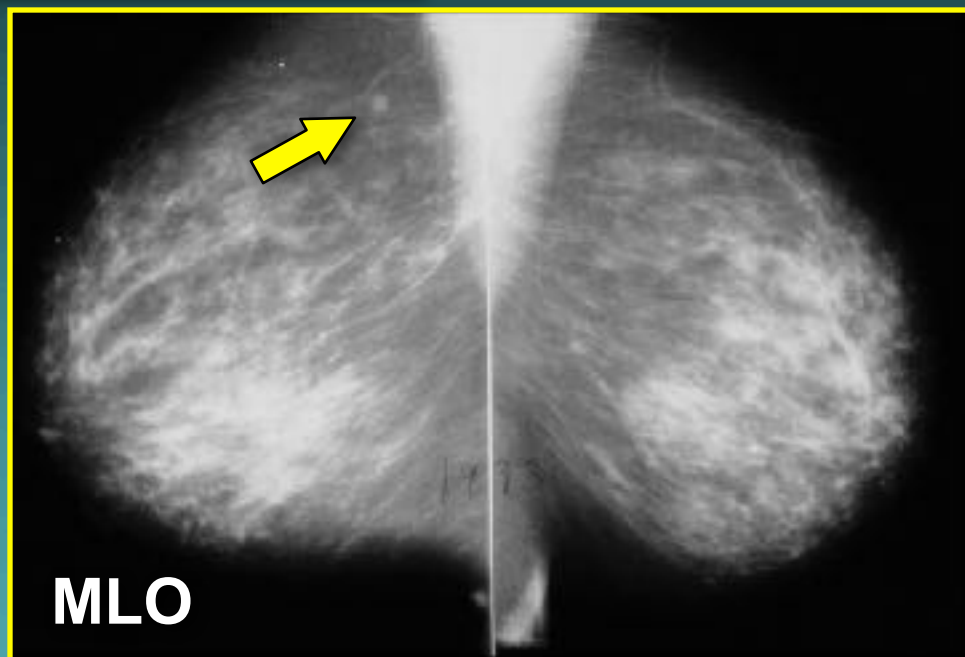
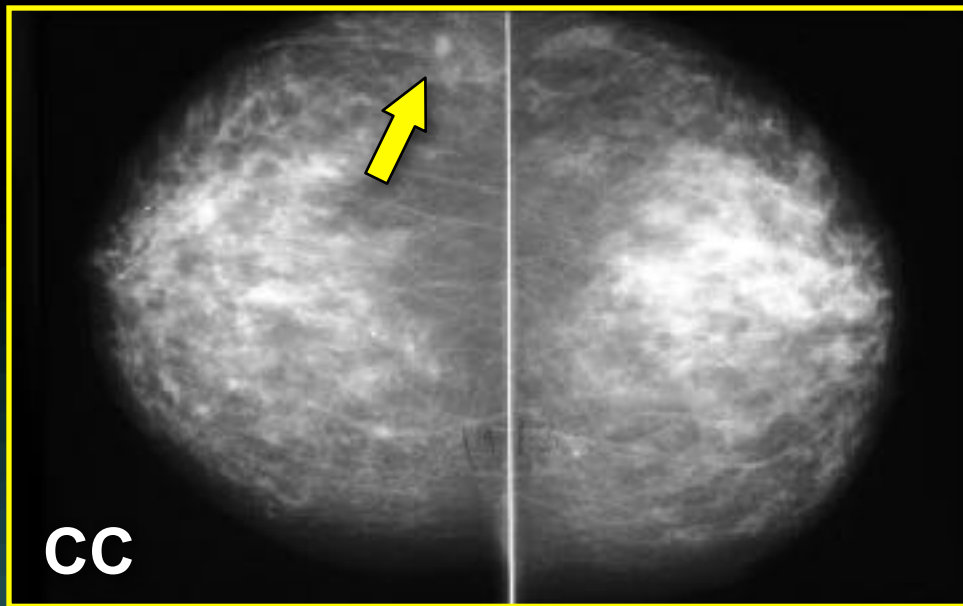
**Sclerosing
adenosis!**

Low grade DCIS



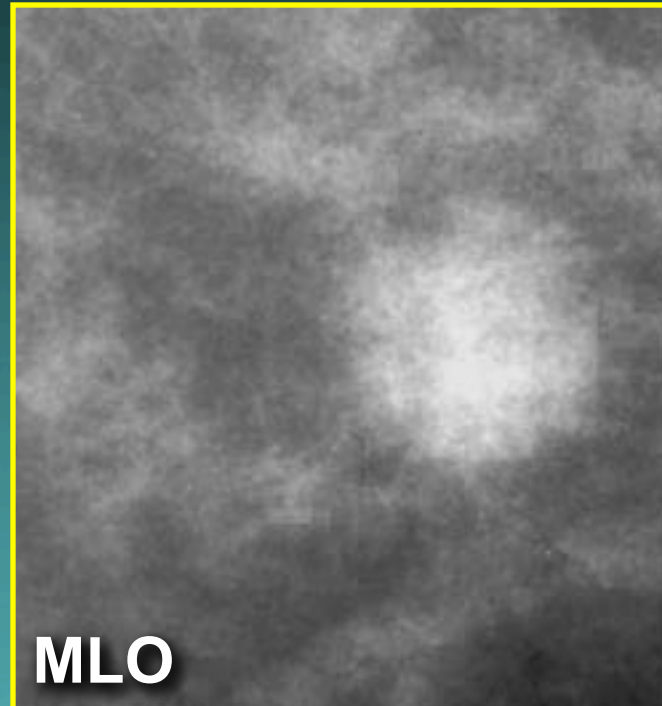
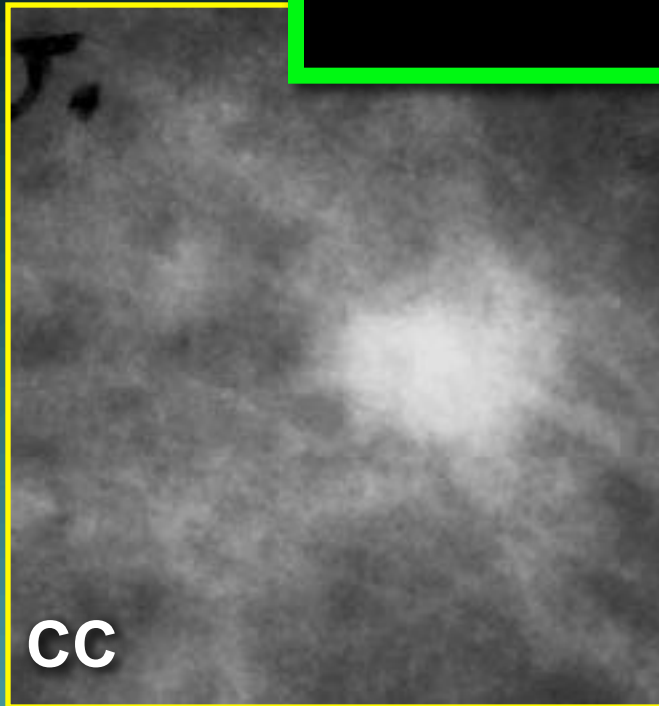
BI-RADS CAT. 4: SUSPICIOUS ABNORMALITY- BX CONSIDERED

- **CAT. 4 C- MODERATE CONCERN, BUT NOT CLASSIC FOR MALIGNANCY (51-95%)**
 - ➔ **Should expect malignant results on Bx**
 - ➔ **If Bx benign, re-Bx or do Excisional Bx**
 - ➔ **This category esp. valuable to clinicians & pathologists: go further if Bx is benign!**
 - ➔ **Examples:**
 - **Ill-defined solid mass**
 - **Cluster of indeterminate calcifications**

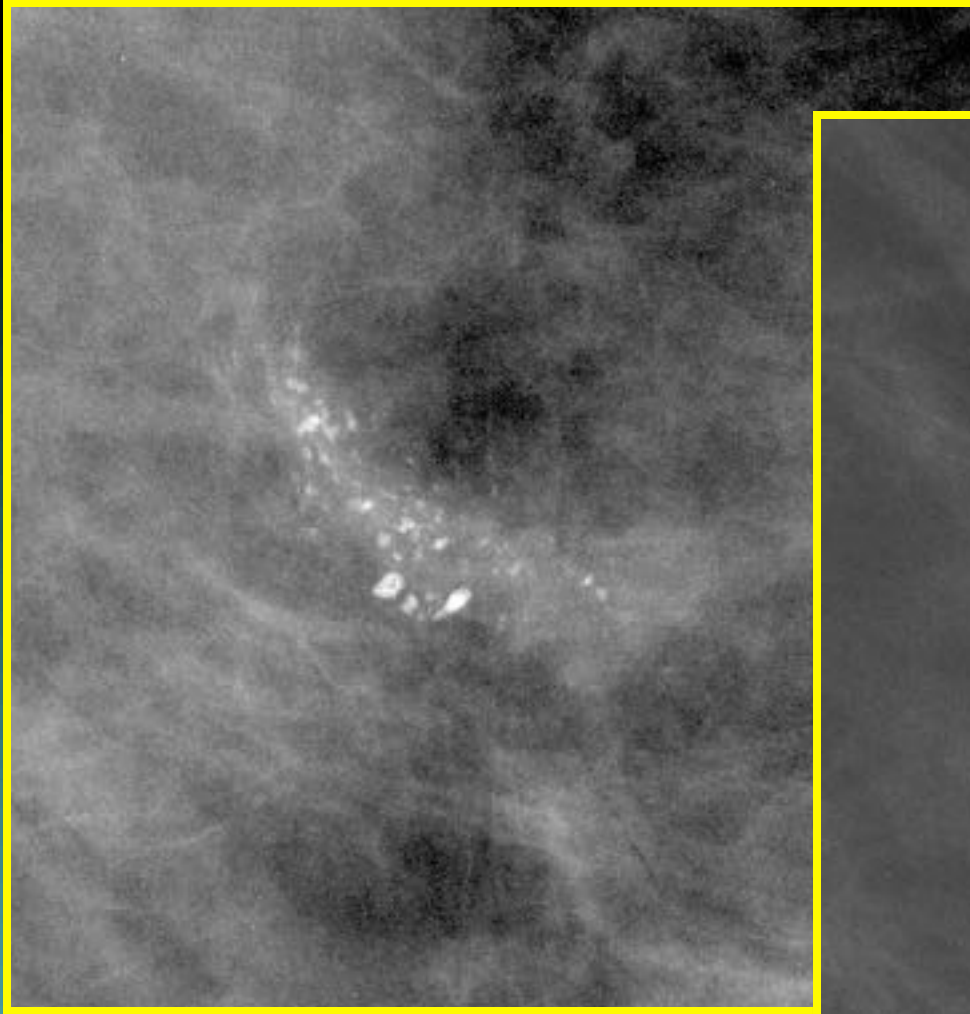


CONED MAGNIFICATION VIEWS

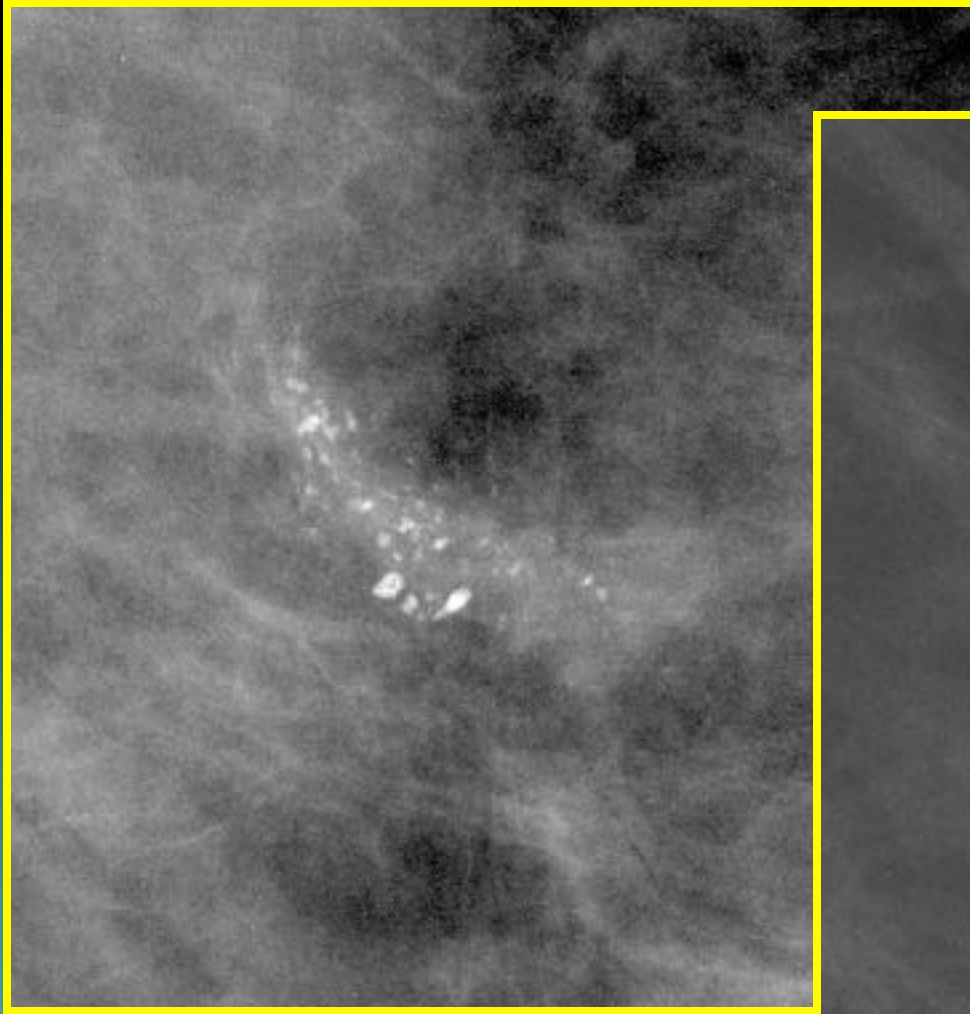
“baby” invasive ductal carcinoma



High Grade DCIS: granular



High Grade DCIS: granular

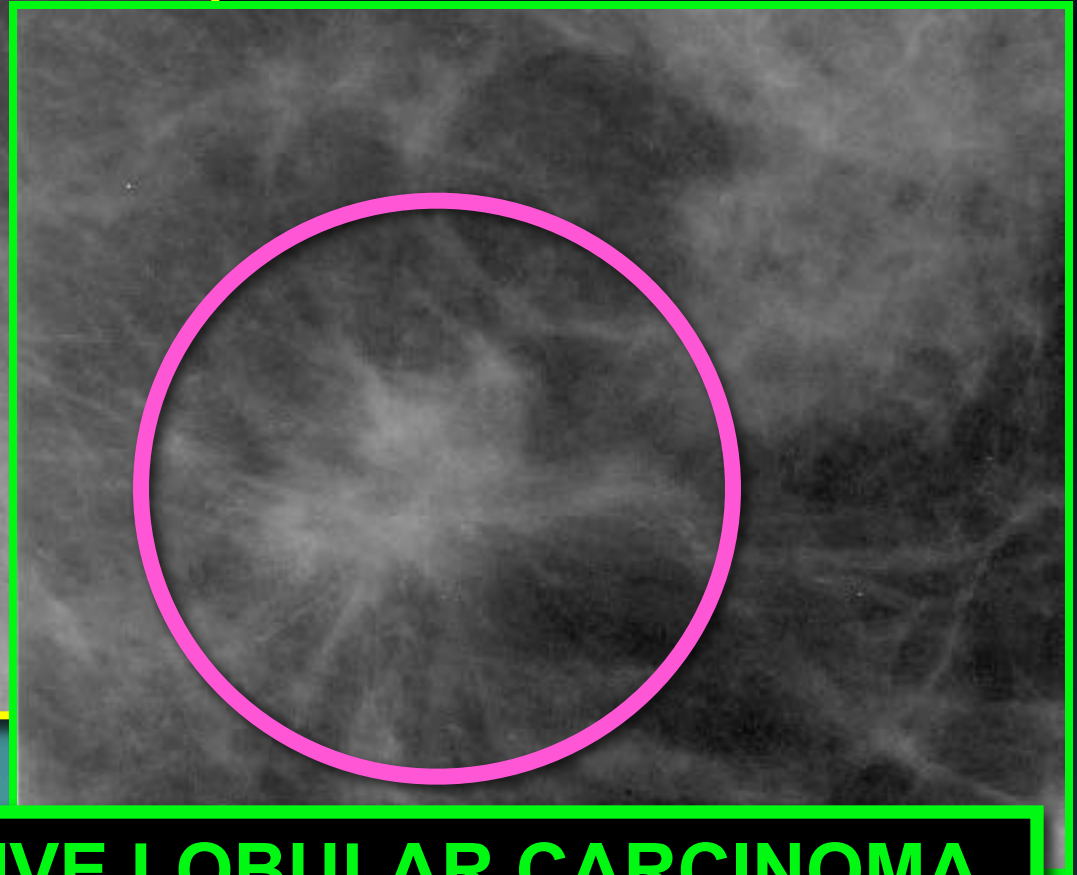
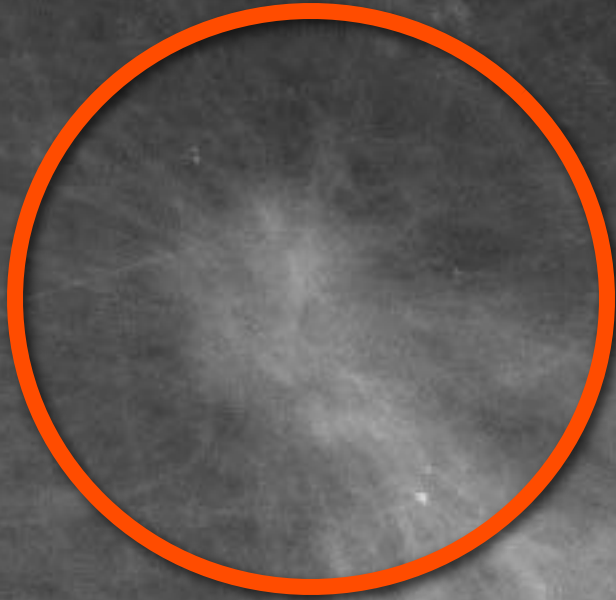




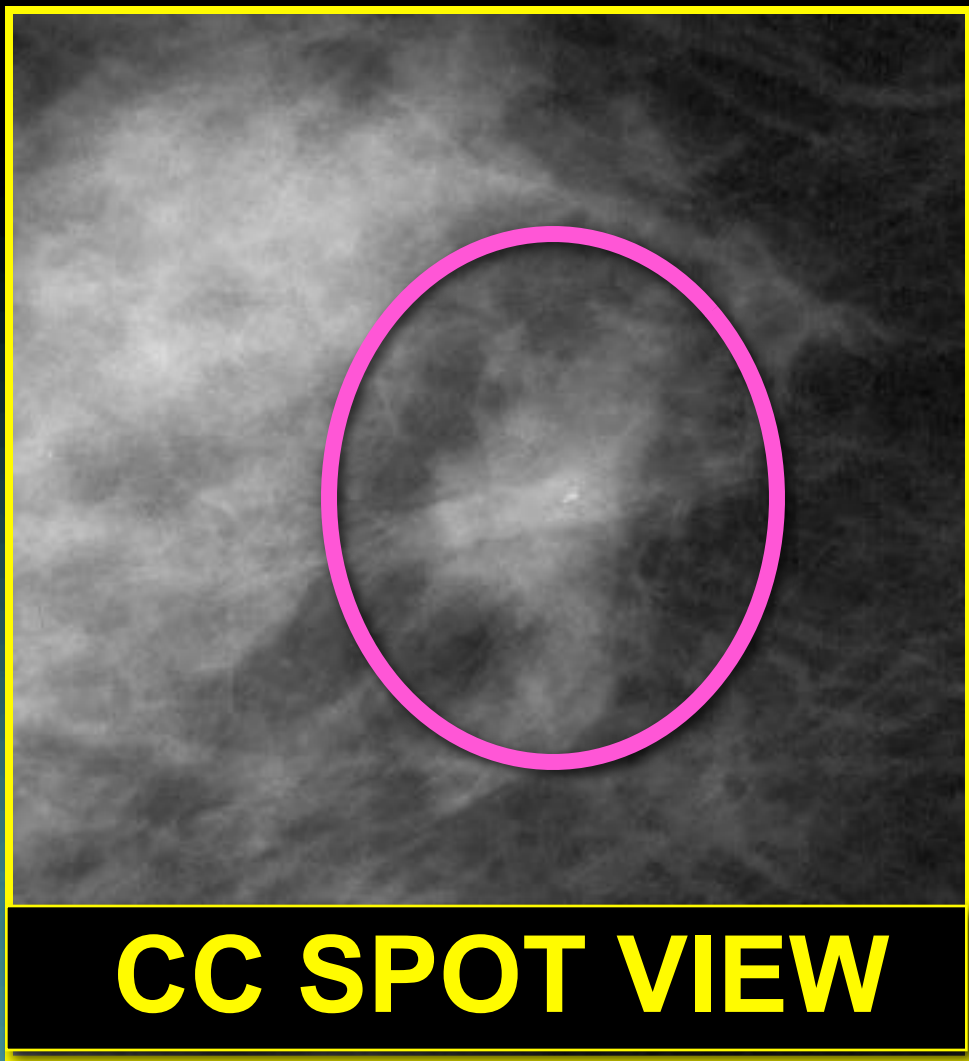
BI-RADS CAT. 5: HIGHLY SUGGEST. OF MALIG.- APPROP. ACTION BE TAKEN

- **Has at least 96% prob. of malignancy-
any benign Bx result is discordant**

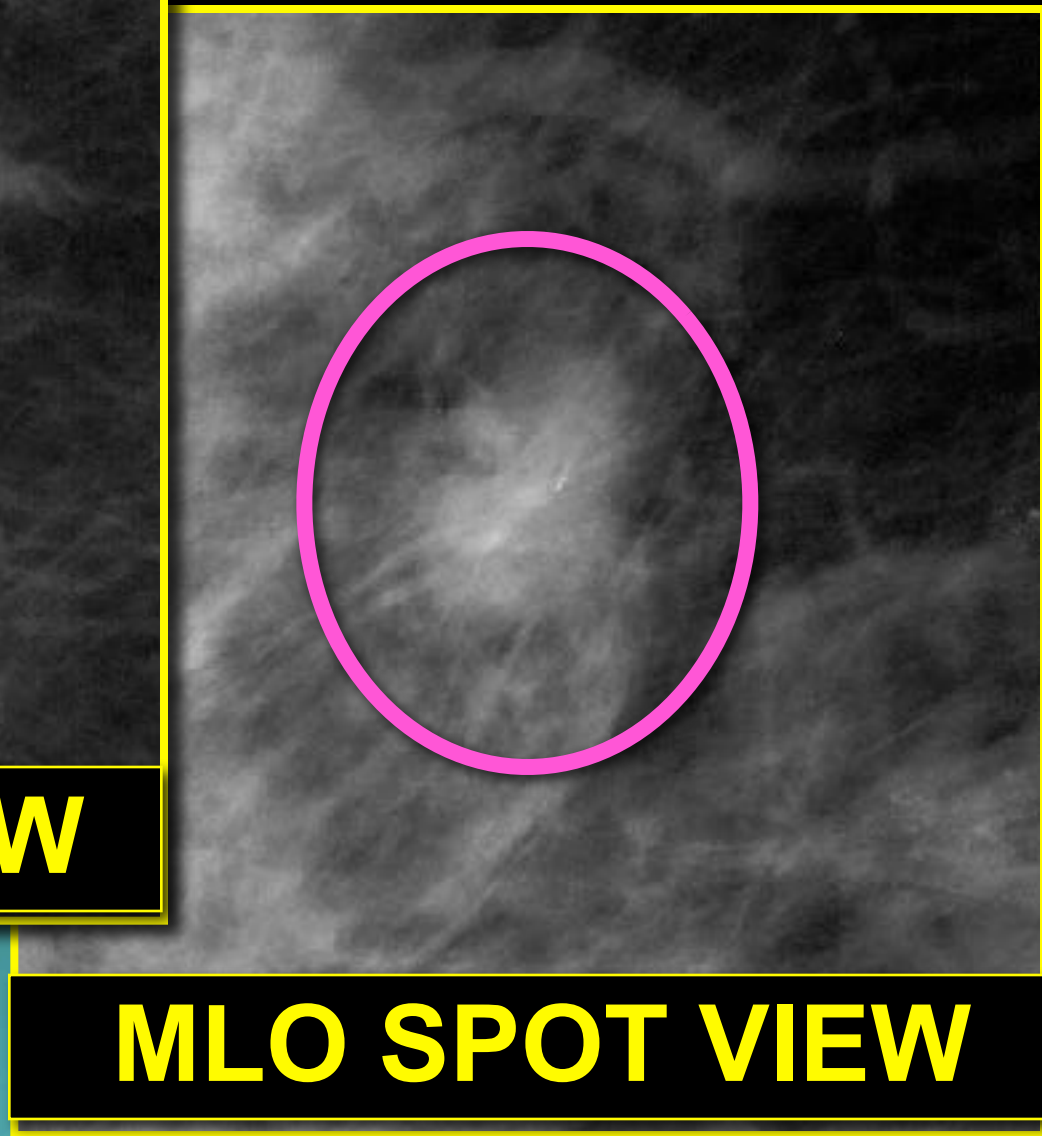
INVASIVE DUCTAL CARCINOMA



INVASIVE LOBULAR CARCINOMA



CC SPOT VIEW

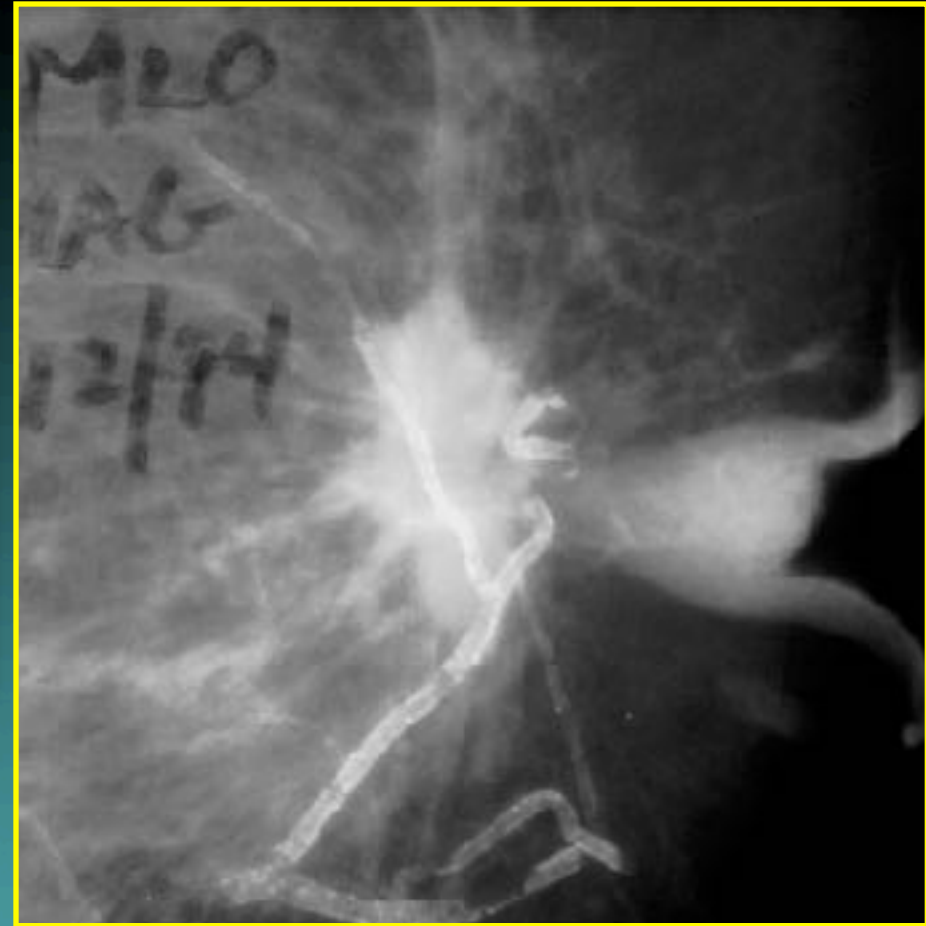


MLO SPOT VIEW

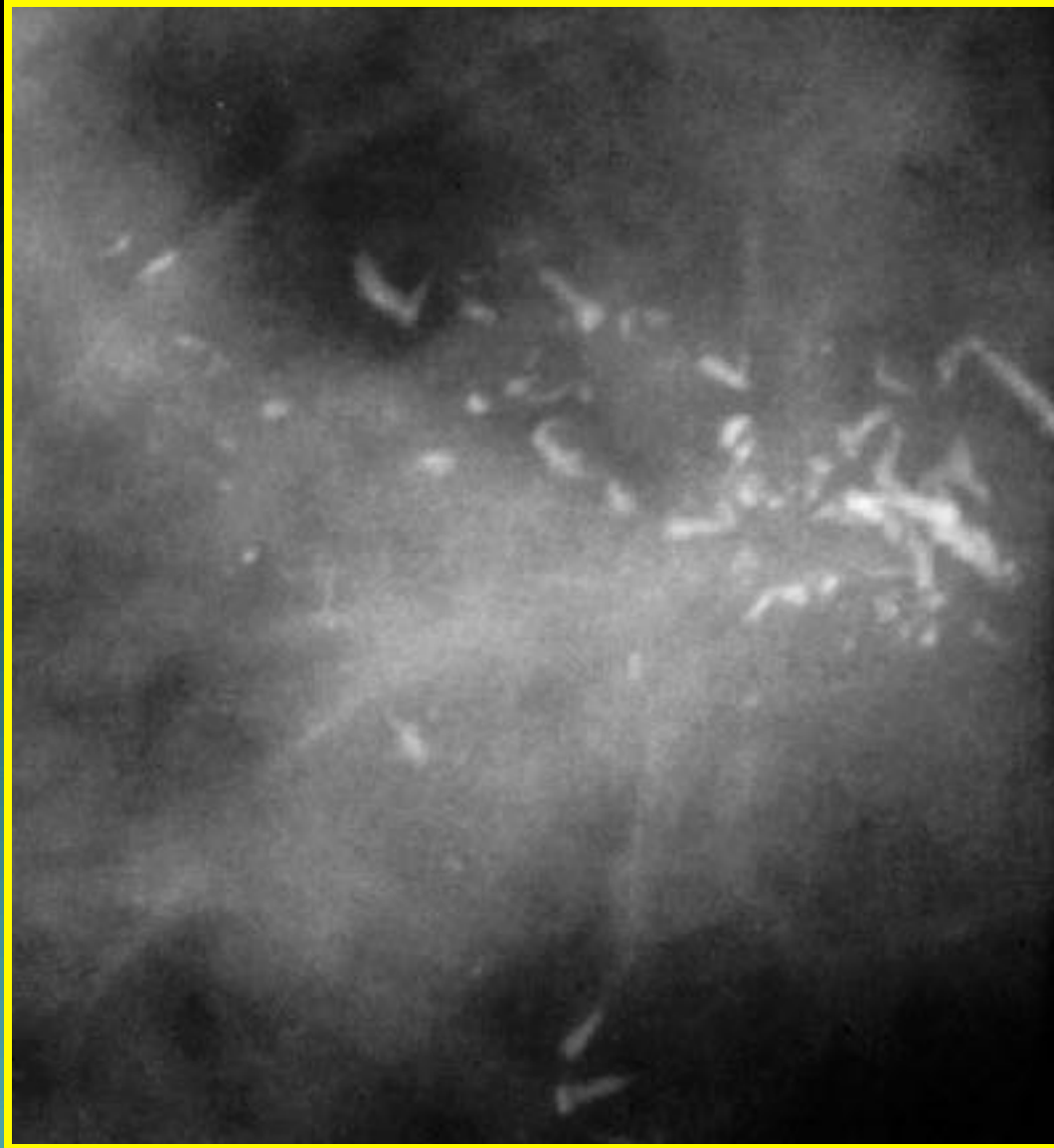


**CC CONED
MAG.**

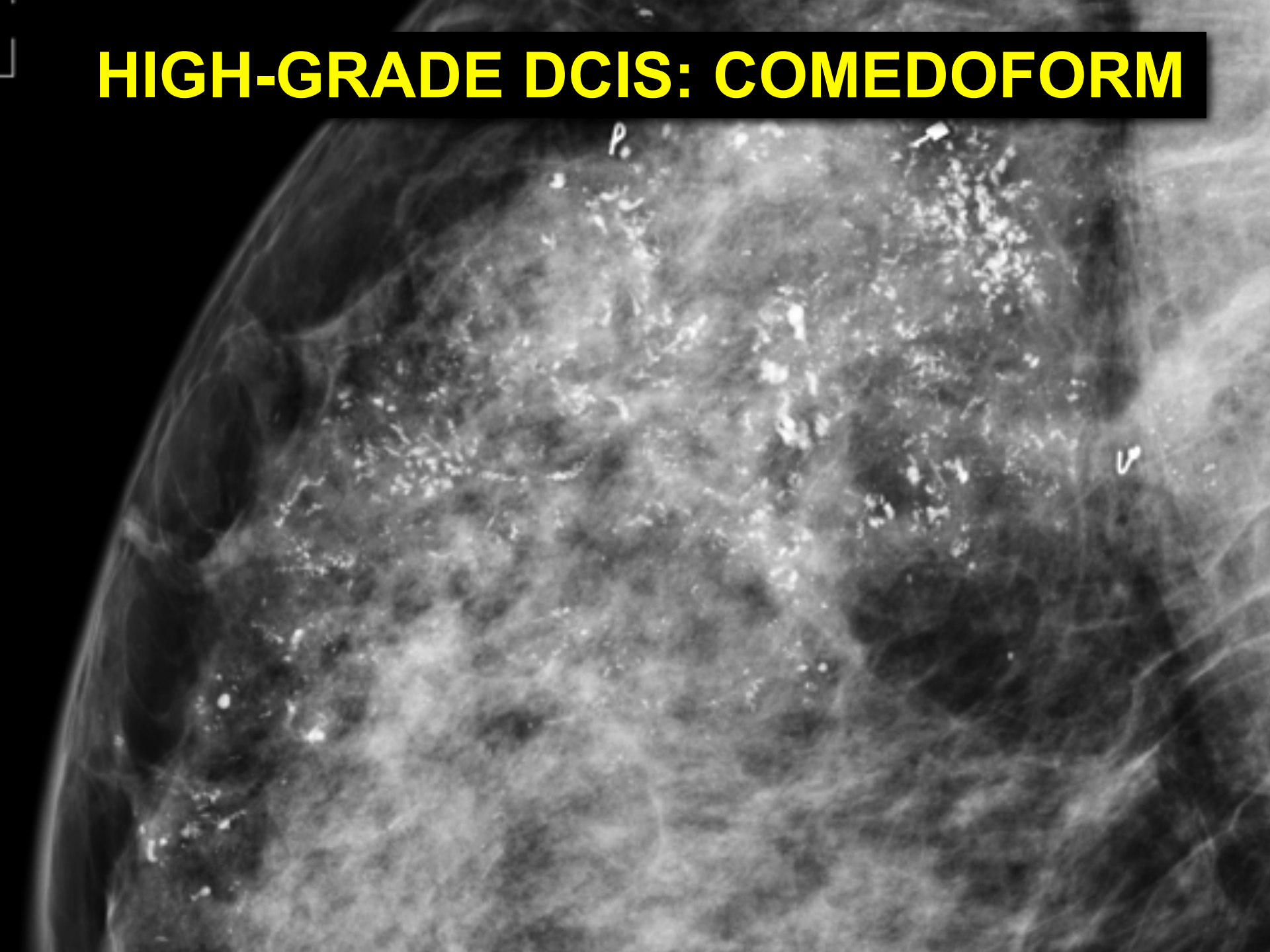
**90 CONED
MAG.**



HIGH-GRADE DCIS: COMEDOFORM



HIGH-GRADE DCIS: COMEDOFORM





BI-RADS CAT. 6: PROVEN MALIGNANCY- APPROP. ACTION SHOULD BE TAKEN

- **ENTIRELY NEW CATEGORY;** not mandated by MQSA
- **Applications:** 2nd opinion on proven cancer, monitoring of response to neoadjuvant chemotherapy prior to definitive surgery



SUMMARY: ACR BI-RADS LEXICON

Category

- 0 Needs Further Evaluation
- 1 Negative
- 2 Benign Findings
- 3 Short-term Follow-up
- 4 Suspicious Findings
- 5 Highly Suggestive of Malignancy
- 6 Known Biopsy-proven Malignancy



Thank
you!