

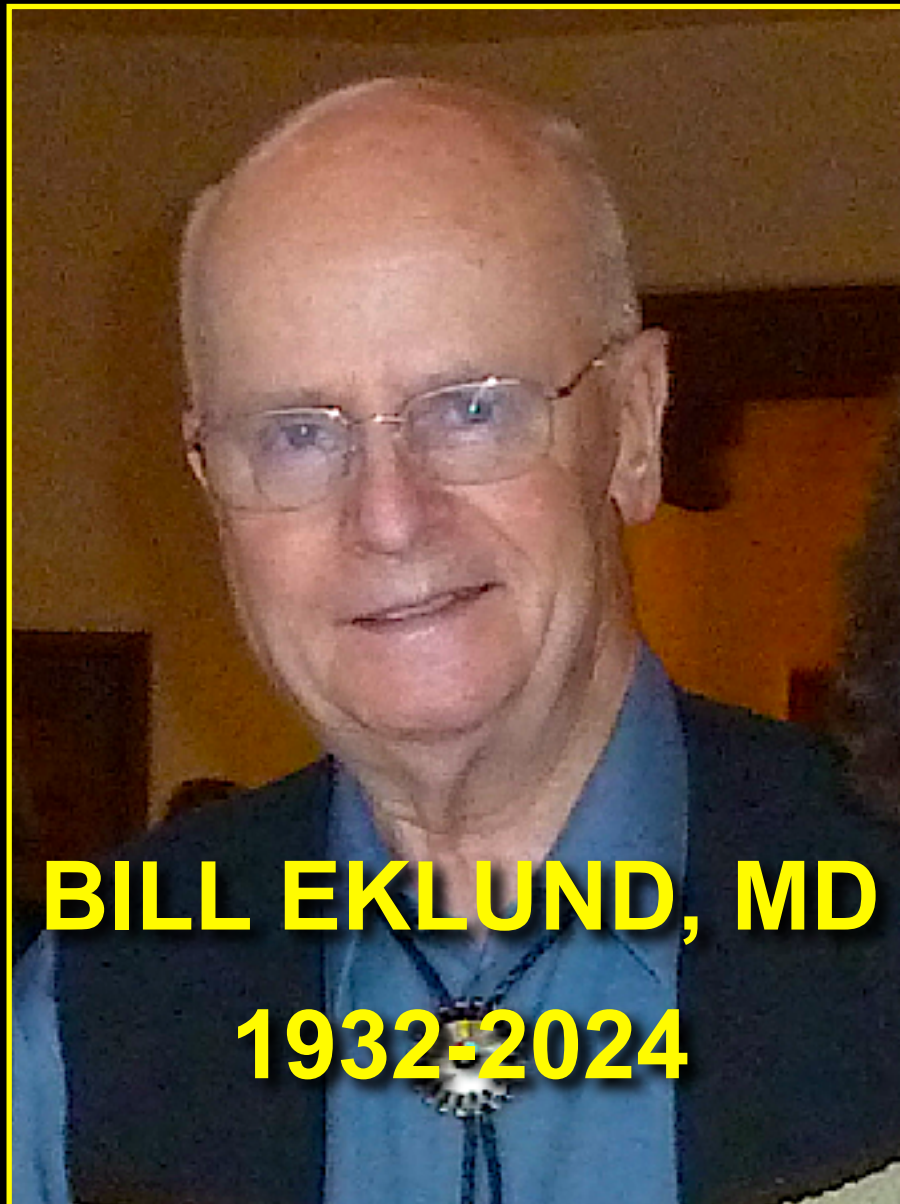


X-Ray Associates of New Mexico, P.C.

LESION LOCATION: TRIANGULATION

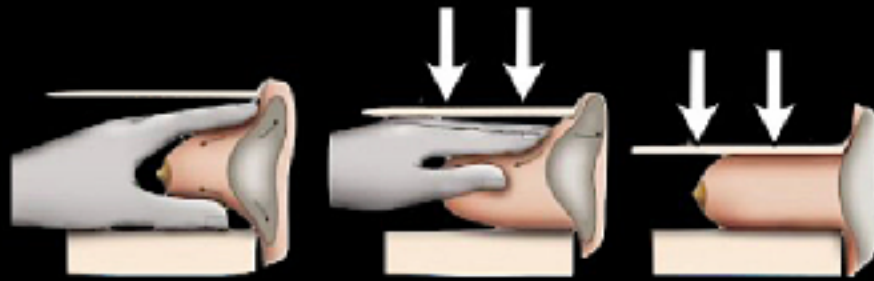
MICHAEL N. LINVER, MD, FACR

IN MEMORIUM



BILL EKLUND, MD

1932-2024



1988

AJR

American Journal of Roentgenology

Search American Journal of Roentgenology

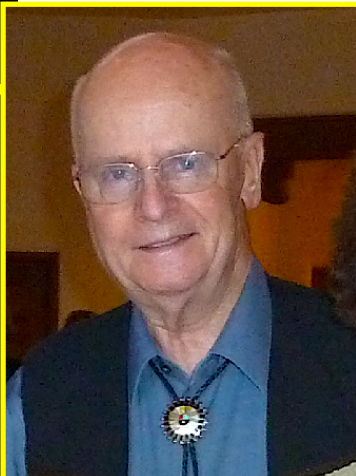
ARTICLES & ISSUES COLLECTIONS INFORMATION AUTHORS REVIEWERS MULTIMEDIA SECTIONS

Other | Articles | September 1988

Improved imaging of the augmented breast

Authors: GW Eklund, RC Busby, SH Miller, and JS Job | [AUTHOR INFO & AFFILIATIONS](#)

Volume 151, Issue 3 | <https://doi.org/10.2214/ajr.151.3.469>

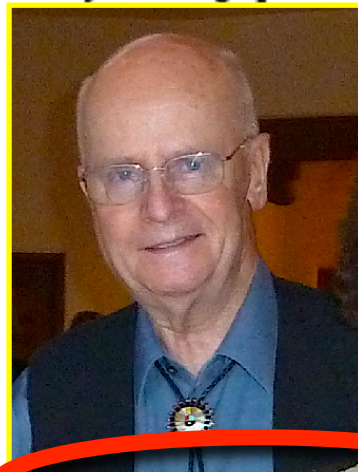


G. W. Eklund, MD • Gilda Cardenosa, MD • Ward Parsons, MD

Assessing Adequacy of Mammographic Image Quality¹

High-quality mammographic images enhance the radiologist's ability to interpret mammograms with high sensitivity for detecting abnormalities and high specificity for classifying lesions suspicious for malignancy. In addition to proper exposure, contrast, resolution, compression, and positioning, high-quality mammographic images must be

ent history on images. To efits of technimograms optimal view-nt attention to very image e to strict technical for main-



phy, quality
hy, technology,

Radiology 1994; 190:297-307

THE word *quality* is derived from the Latin *qualitas*, meaning "of what kind." In the science of quality assurance, modifiers indicate *degrees* of quality: high versus low, good versus poor, and so on. A mammogram is considered "high quality" when it possesses the requisite characteristics to optimize a radiologist's ability to identify abnormalities with a high sensitivity and specificity.

Consistent production of high-quality mammographic images, so critical to early detection of breast cancer, cannot be ensured by establishing "policy" or "mandates." High-quality mammography requires a constant case-by-case, film-by-film, quality assessment with immediate corrective measures and repeat imaging when necessary. A team approach is essential for achieving and maintaining a successful program of continuing quality improvement. Although the technologist and radiologist serve as the nucleus of such a team, the clerical staff, the radiation physicist, and

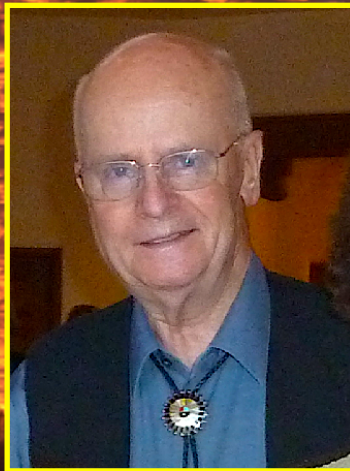
HISTORY AND PREVIOUS IMAGES

An image of a fibroglandular breast that appears technically ideal (Fig 1) might also serve as an excellent example of a classically "inadequate study" when accompanied by pertinent additional information. Consider the adequacy of the images in Figure 1 under the following different circumstances:

History 1.—Patient had an area of equivocal architectural distortion in the upper outer quadrant of the left breast on a mammographic study obtained 6 months earlier. Where are the previous images? Where are the spot compression or magnification views of the area in question? Given such a history, these images do not constitute a high-quality study but rather an incomplete study. We cannot assume the area of concern has been adequately imaged.

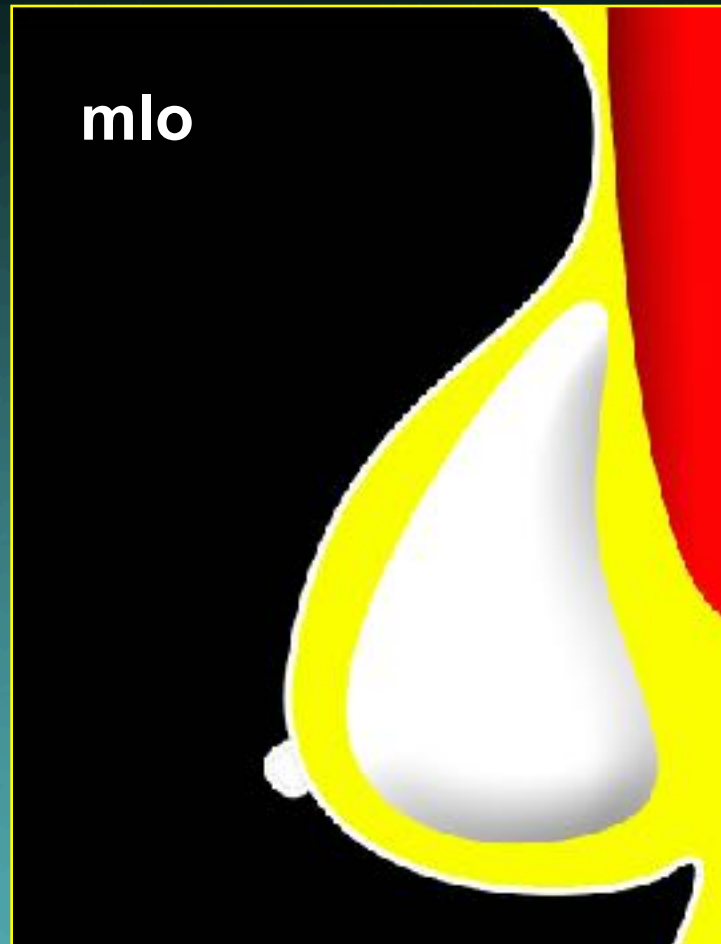
History 2.—Patient has a 1.5-cm palpable mass in the right breast, de-

**I dedicate this lecture to his
memory.**

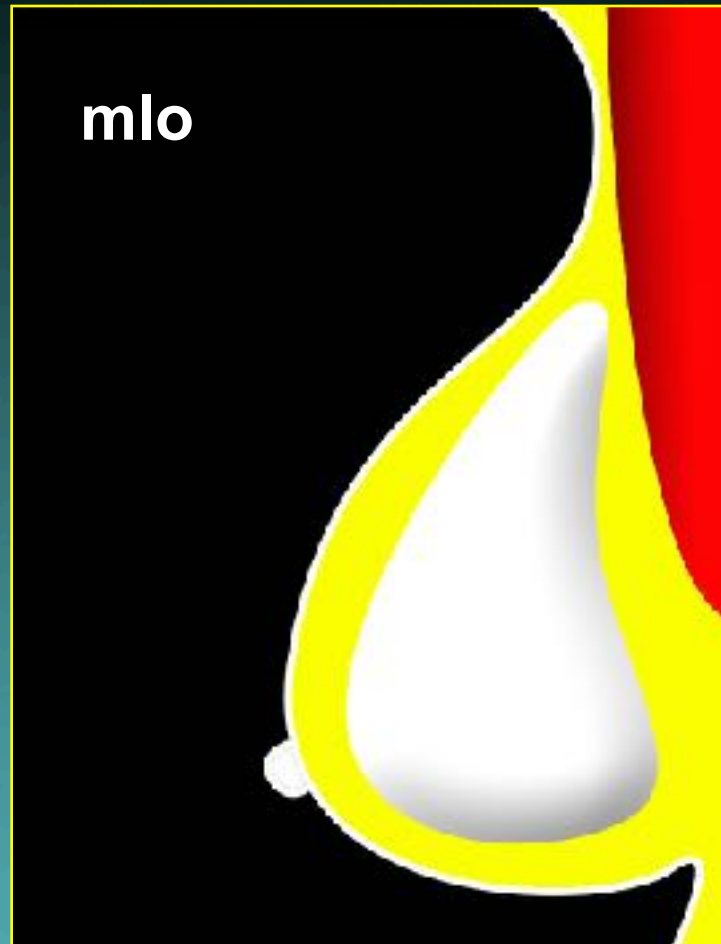


**WE BREAST IMAGERS WILL
MISS YOU, BILL**

THE MLO VIEW, AND ADVENTURES IN TRIANGULATION



WHY AN “ADVENTURE”? - THE MLO VIEW IS NOT ORTHOGONAL TO THE CC VIEW





THE MLO VIEW, & THE VALUE OF THE POSTERIOR NIPPLE LINE (PNL)

- PNL useful in assessing proper positioning
- PNL is of value in locating the distance of a lesion antero-posteriorly (front to back)
- PNL is useful in establishing in which quadrant a lesion is located, despite difficulty presented by the MLO projection.



THE MLO VIEW, & THE VALUE OF THE POSTERIOR NIPPLE LINE (PNL)

- **PNL useful in assessing proper positioning**
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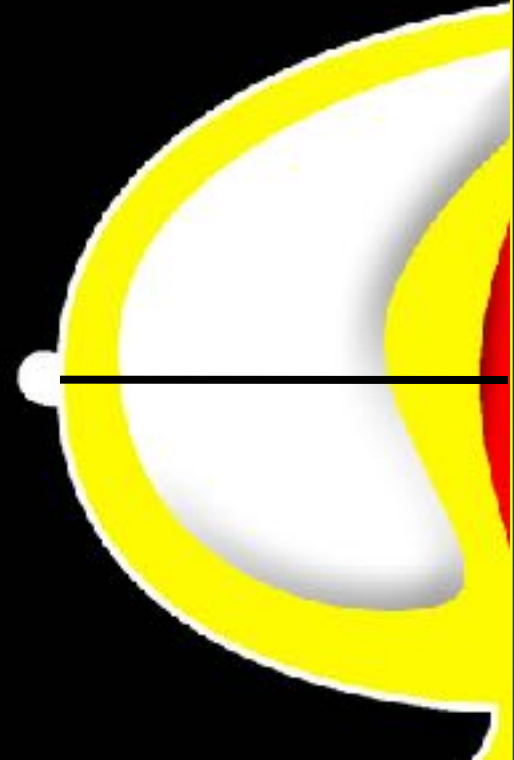
POSTERIOR NIPPLE LINE (PNL) (PNL)

& PROPER POSITIONING

mlo



cc



**No more than 1 cm difference
between the 2 measurements**

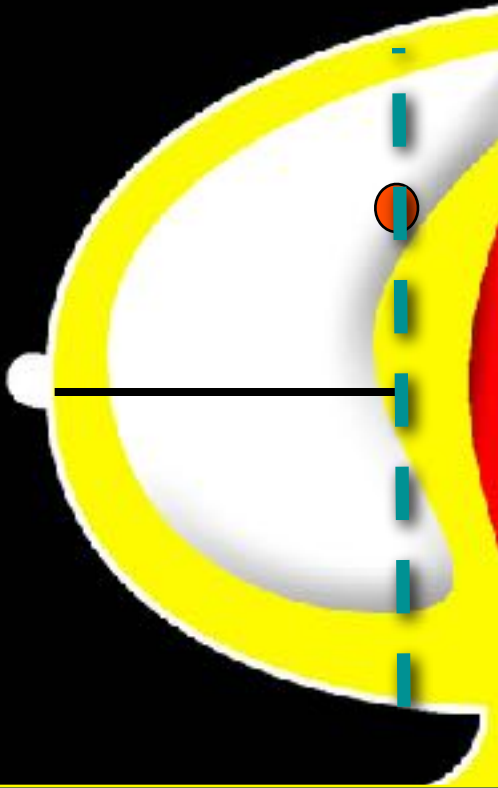


THE MLO VIEW, & THE VALUE OF THE POSTERIOR NIPPLE LINE (PNL)

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- PNL of value in locating the distance of a lesion antero- posteriorly (front to back)
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USING DISTANCE FROM NIPPLE

cc



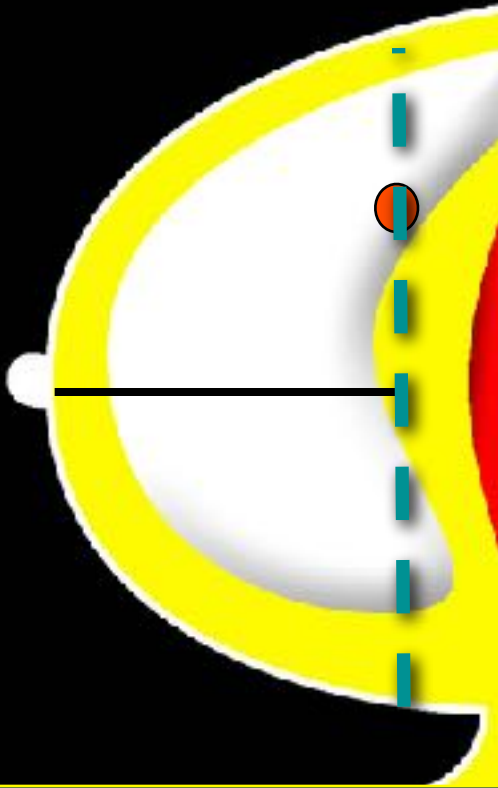
mlo

NO!



USING DISTANCE FROM NIPPLE

cc



mlo

YES!



A-P LOCATION ISSUES

cc



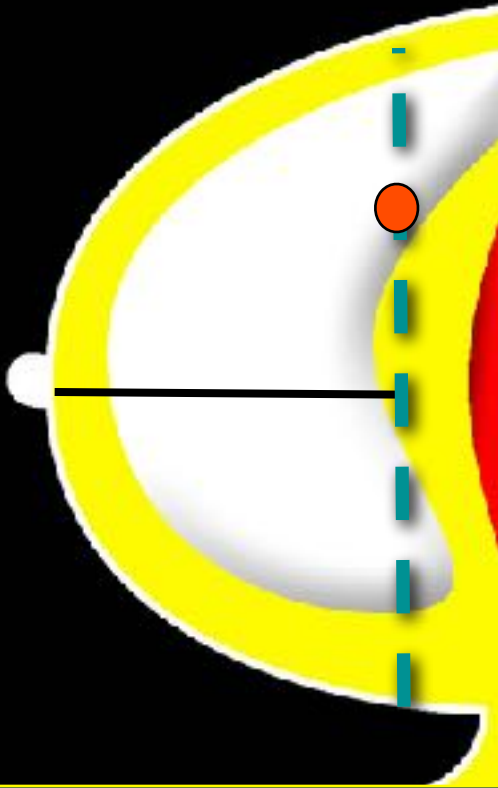
mlo

?



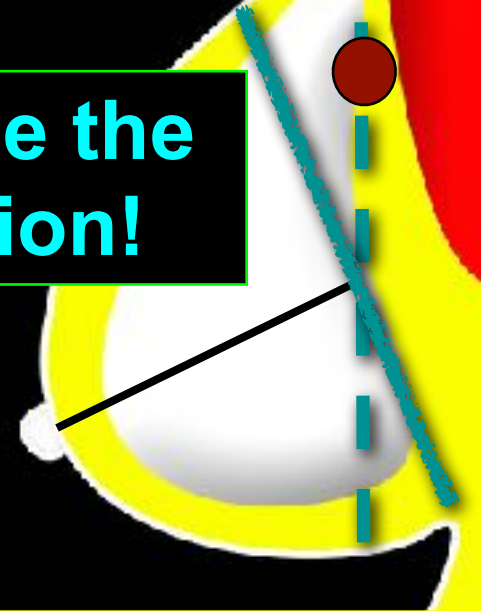
A-P LOCATION ISSUES

cc



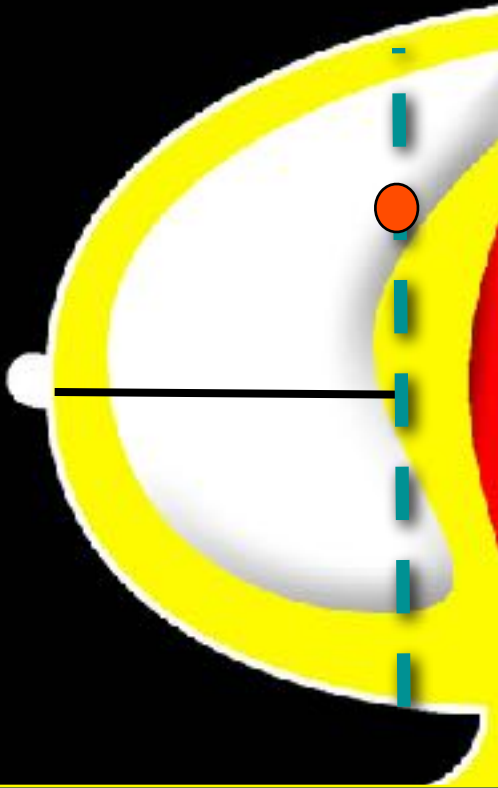
mlo

Cannot be the
same lesion!



A-P LOCATION ISSUES

cc

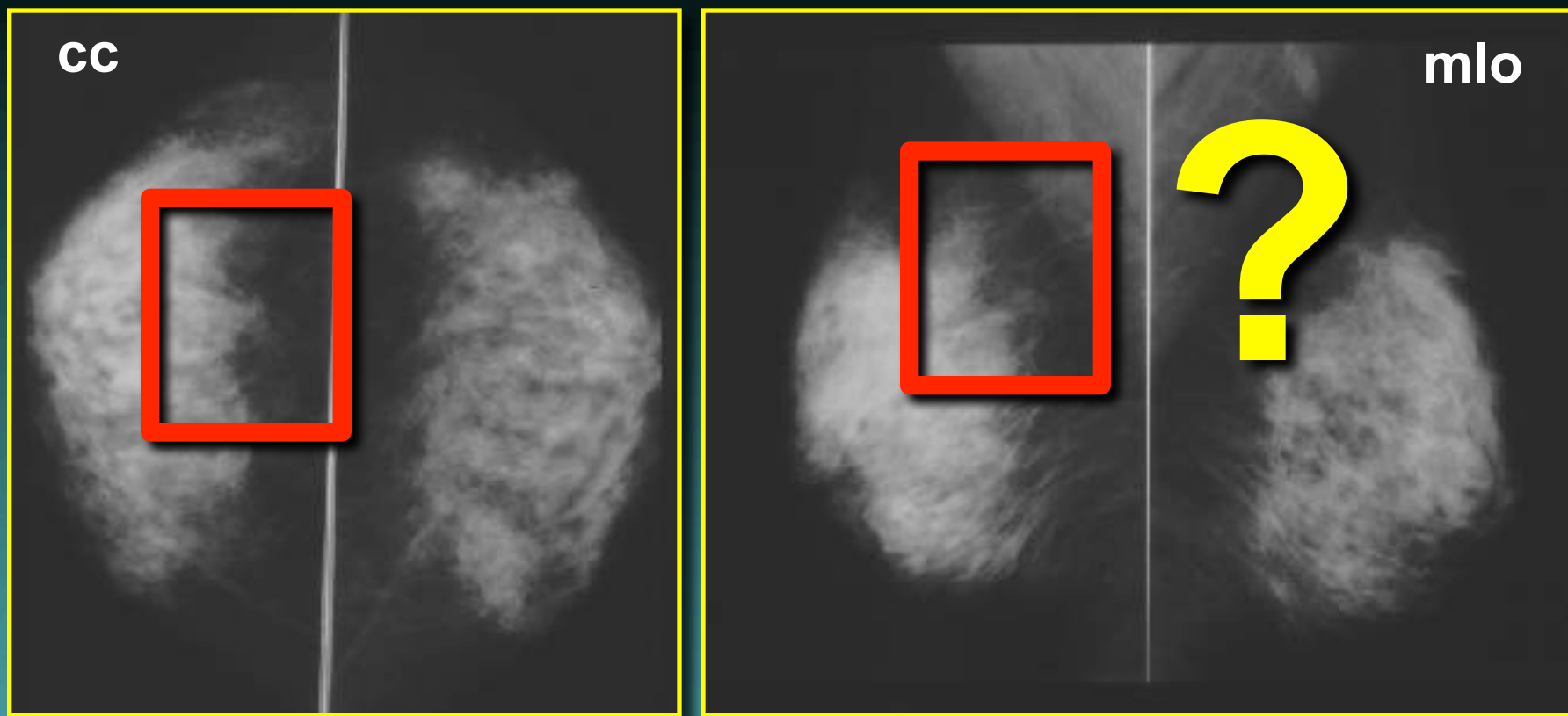


mlo

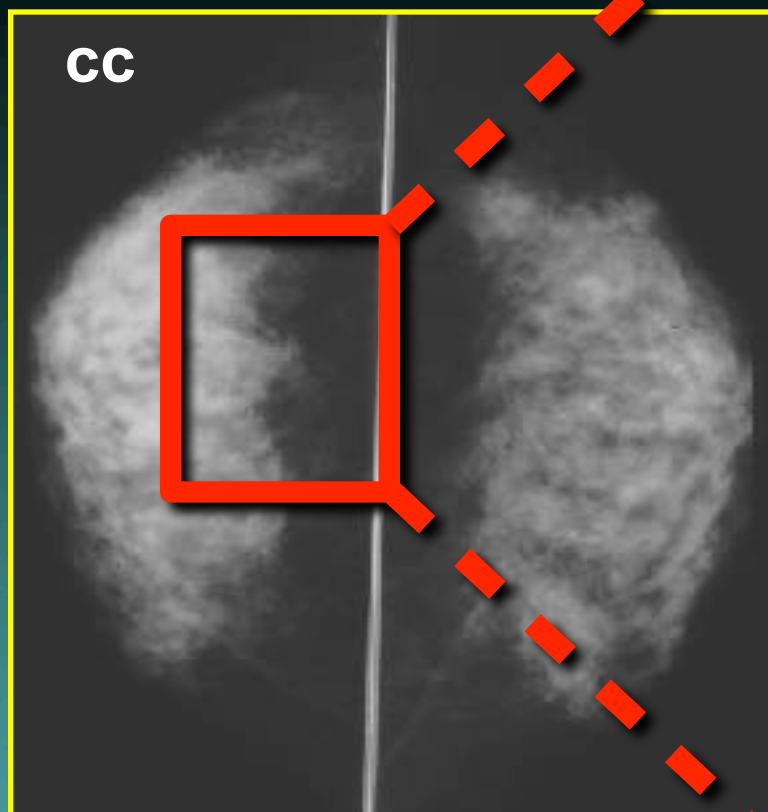
YES!



SCREENING MAMMOGRAM

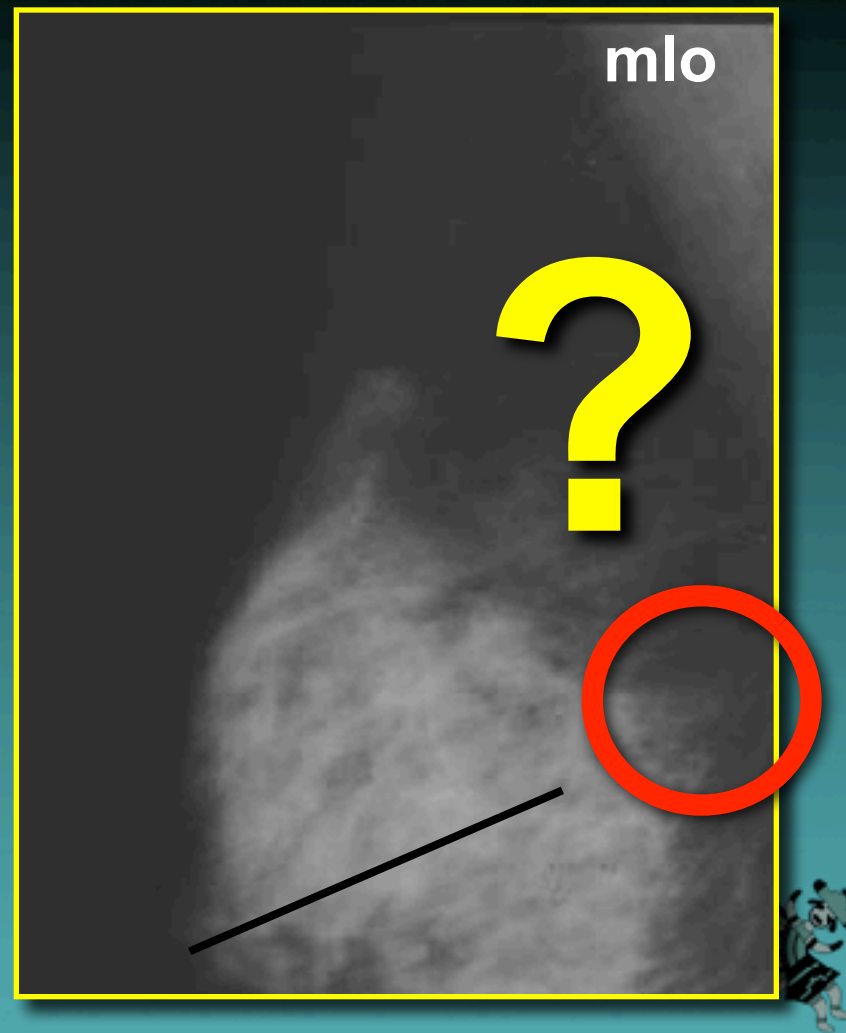


SCREENING

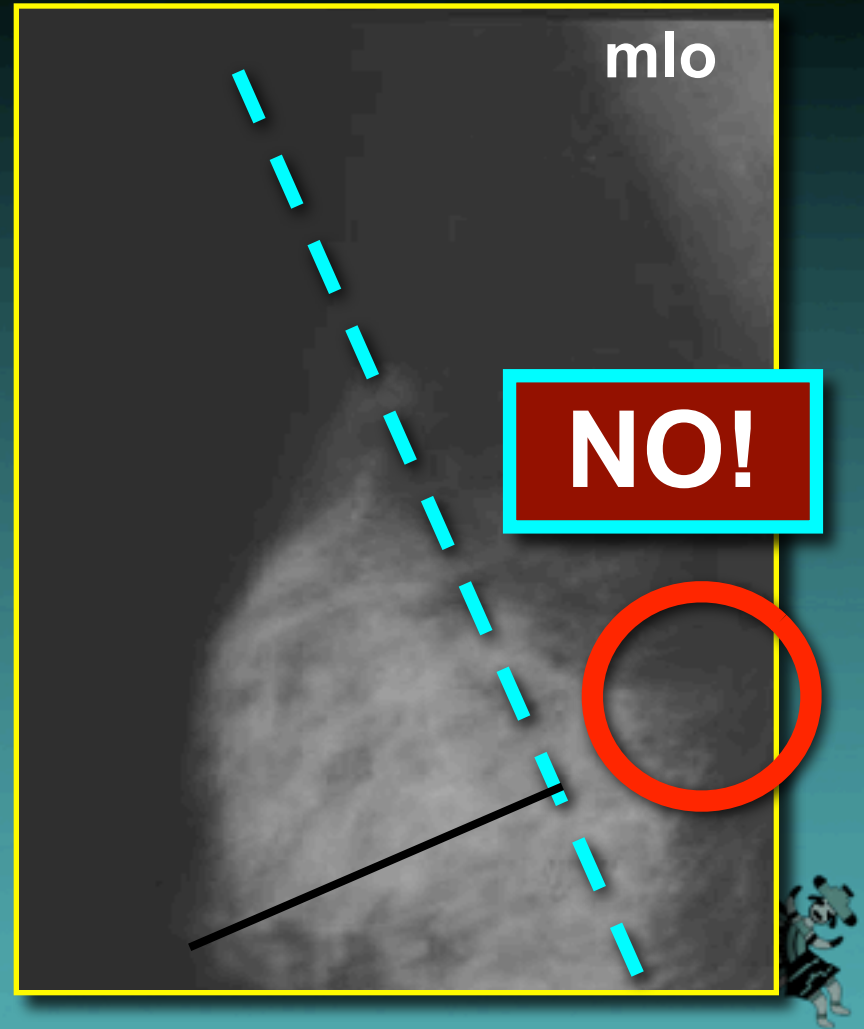


SUSPICIOUS

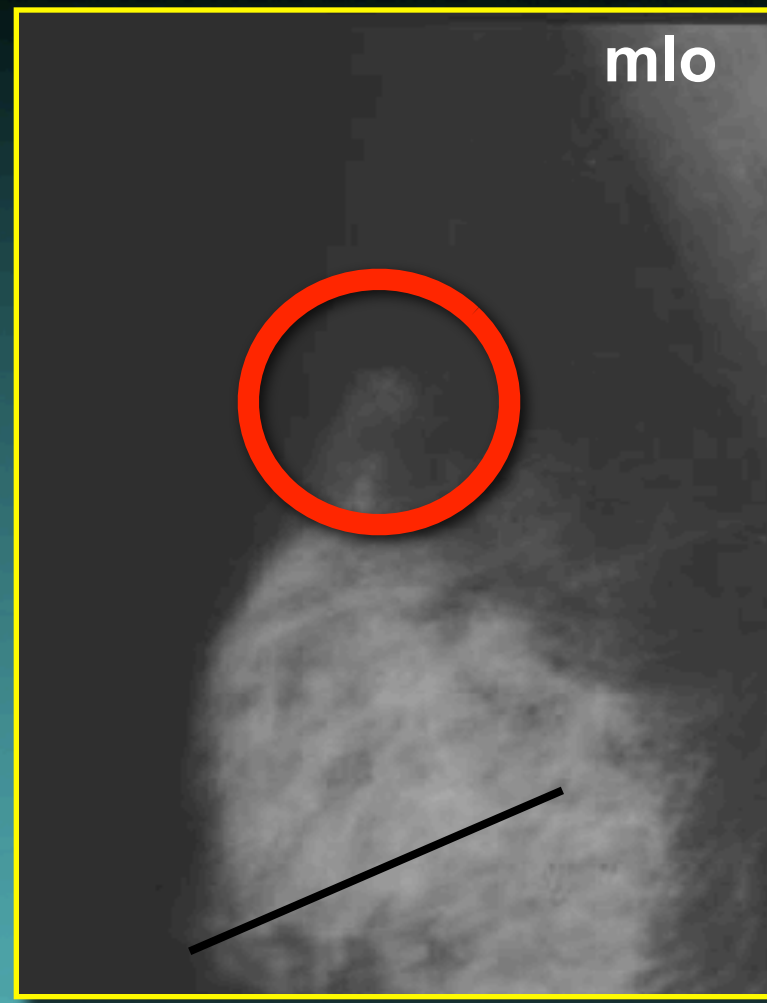
SCREENING MAMMOGRAM



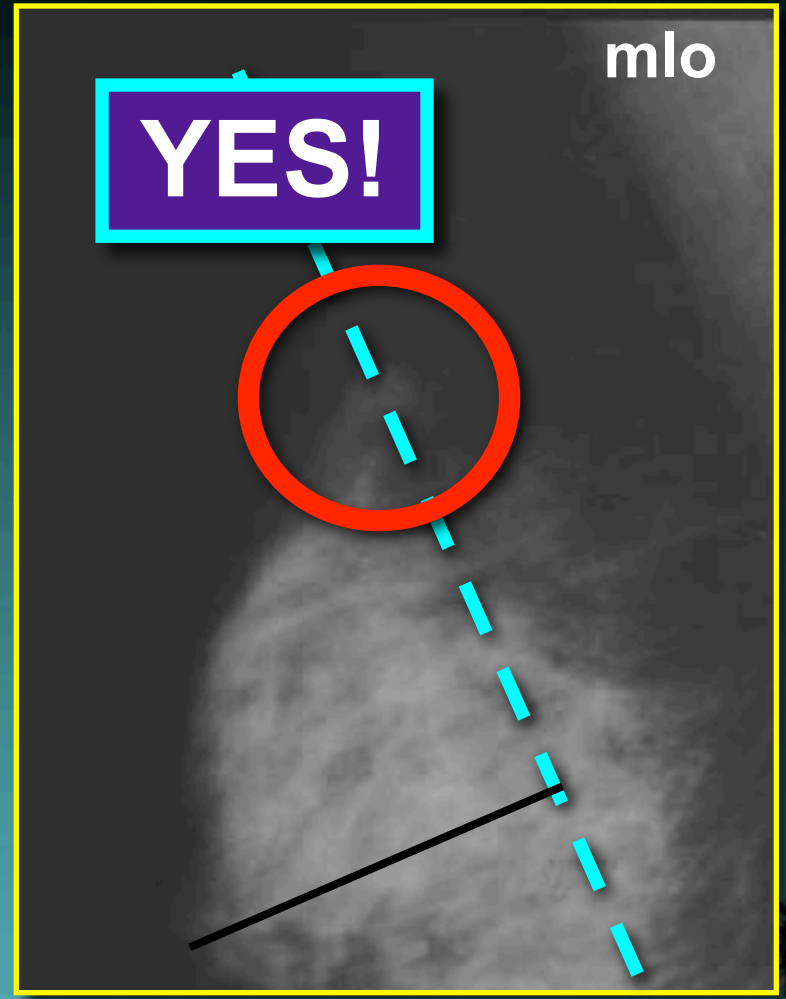
SCREENING MAMMOGRAM



SCREENING MAMMOGRAM



SCREENING MAMMOGRAM





THE MLO VIEW, & THE VALUE OF THE POSTERIOR NIPPLE LINE (PNL)

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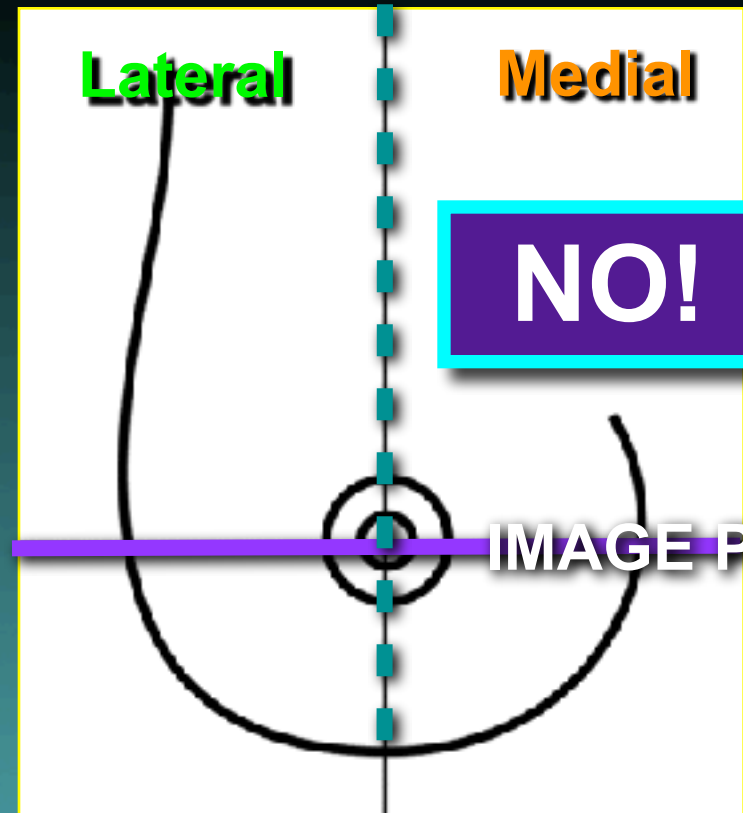
QUADRANT LOCATION ISSUES



IMAGE vs. BREAST PLANE



IMAGE PLANE



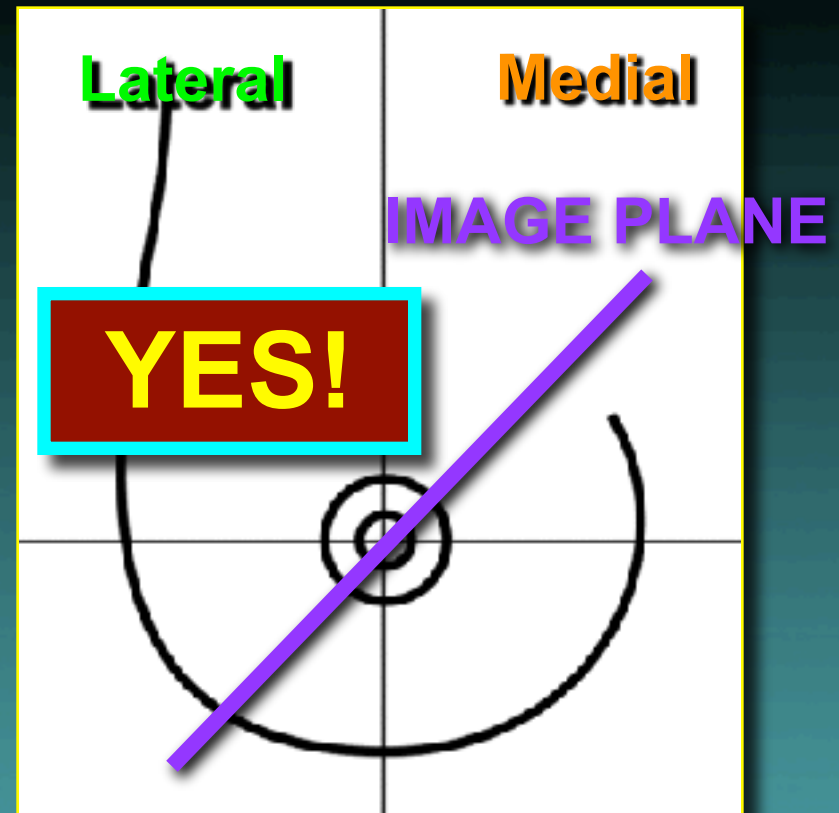
BREAST PLANE



IMAGE vs. BREAST PLANE



IMAGE PLANE



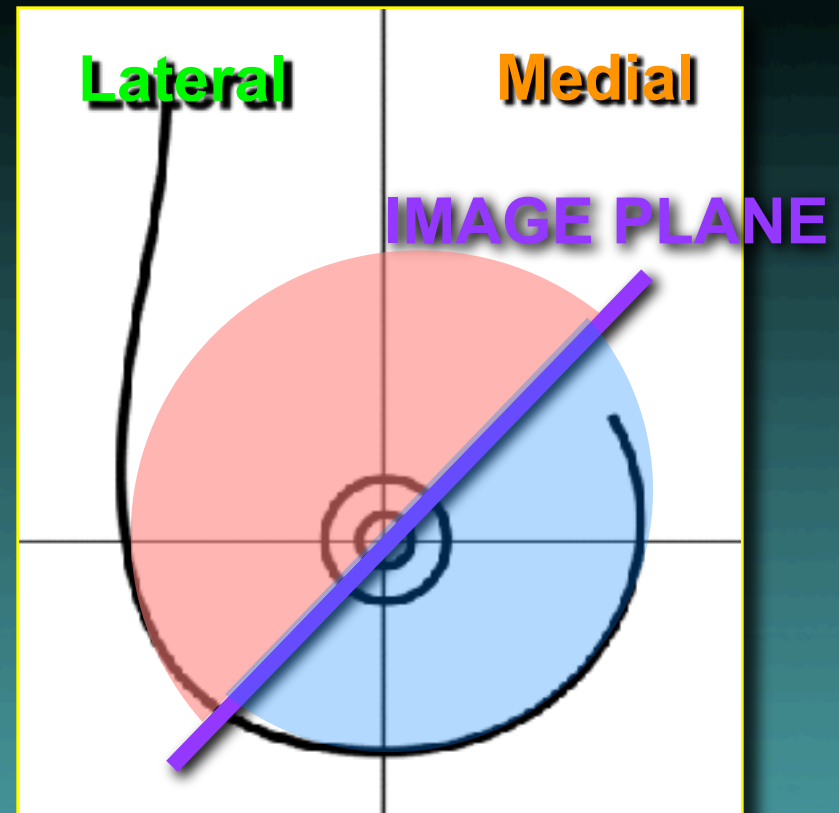
BREAST PLANE



IMAGE vs. BREAST PLANE



IMAGE PLANE



BREAST PLANE



IMAGE vs. BREAST PLANE



IMAGE PLANE

IF A LESION IS ABOVE
THE PNL, IS IT IN THE
UPPER PART OF THE
BREAST?

NOT NECESSARILY!!



IMAGE vs. BREAST PLANE

Rmlo

SOMETIMES:

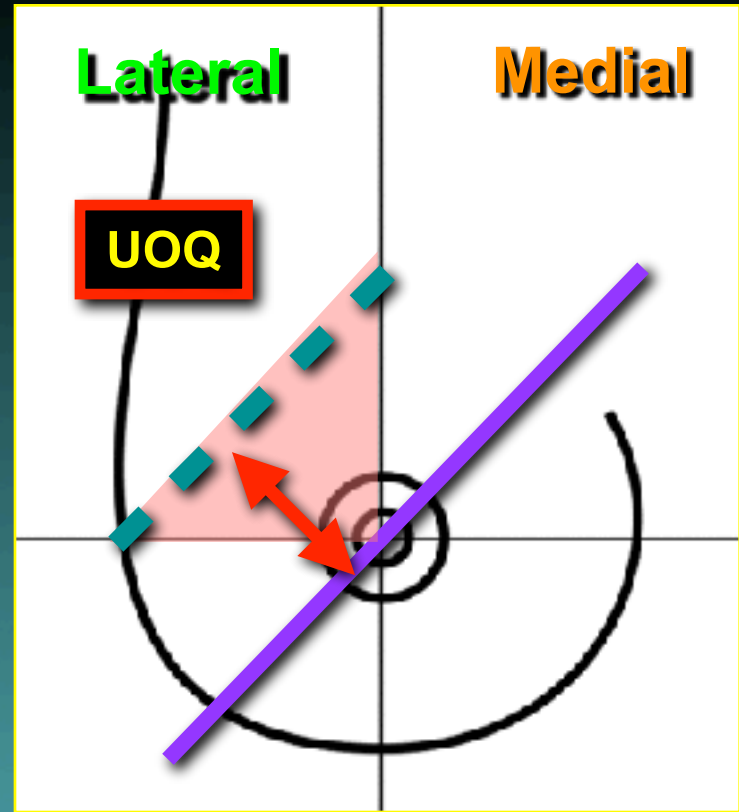


IMAGE PLANE

Lateral

Medial

UOQ



BREAST PLANE

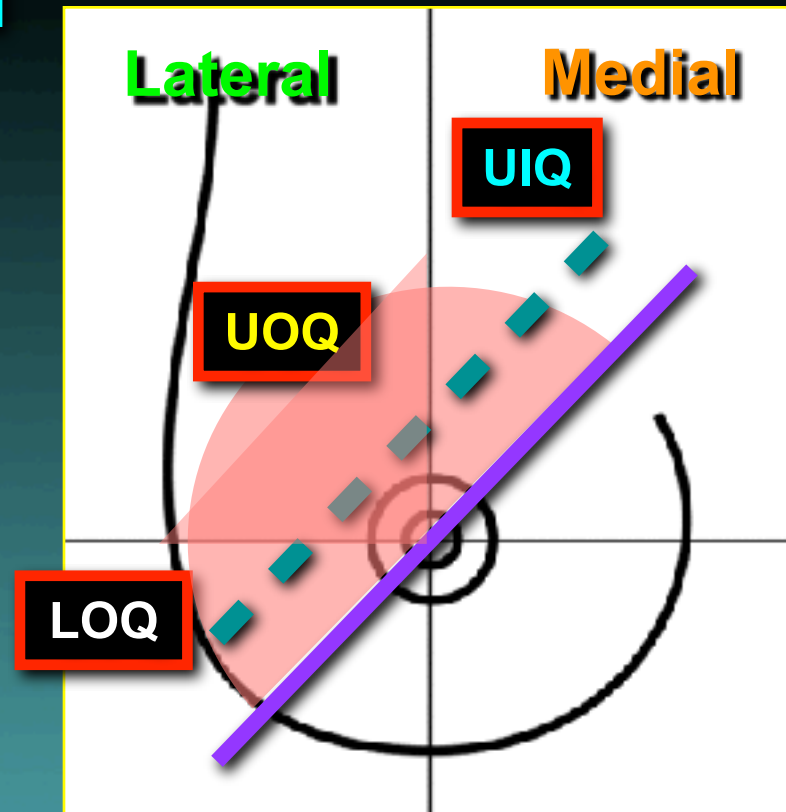


IMAGE vs. BREAST PLANE

BUT NOT ALWAYS:



IMAGE PLANE



BREAST PLANE



“Perceived” vs. “true” halves

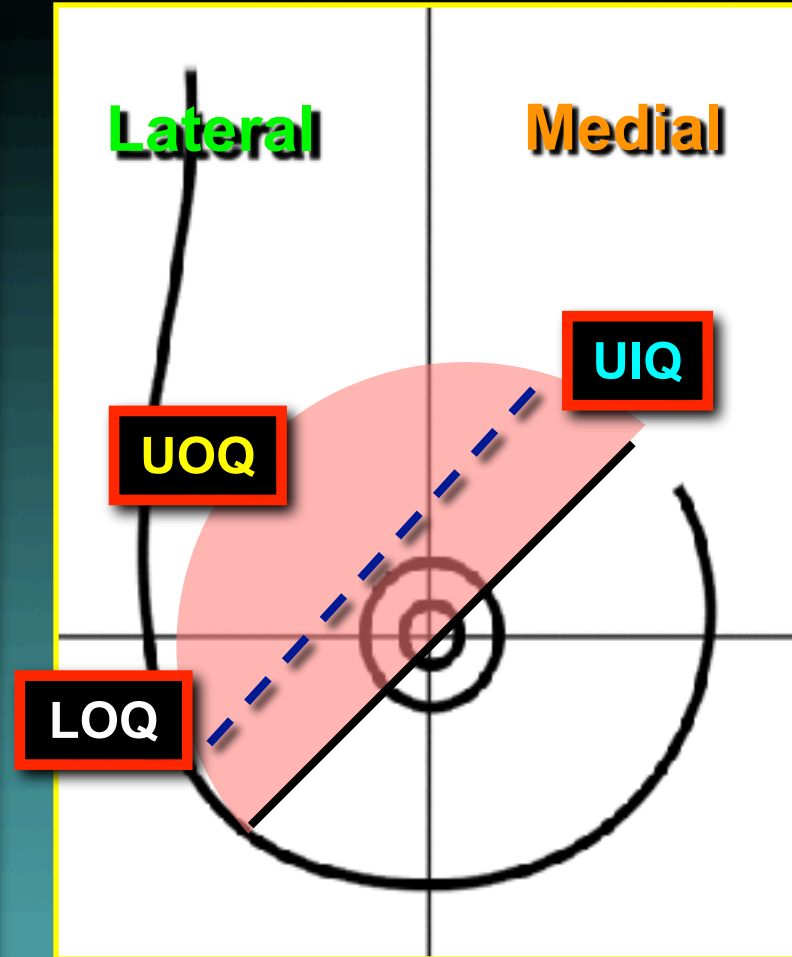
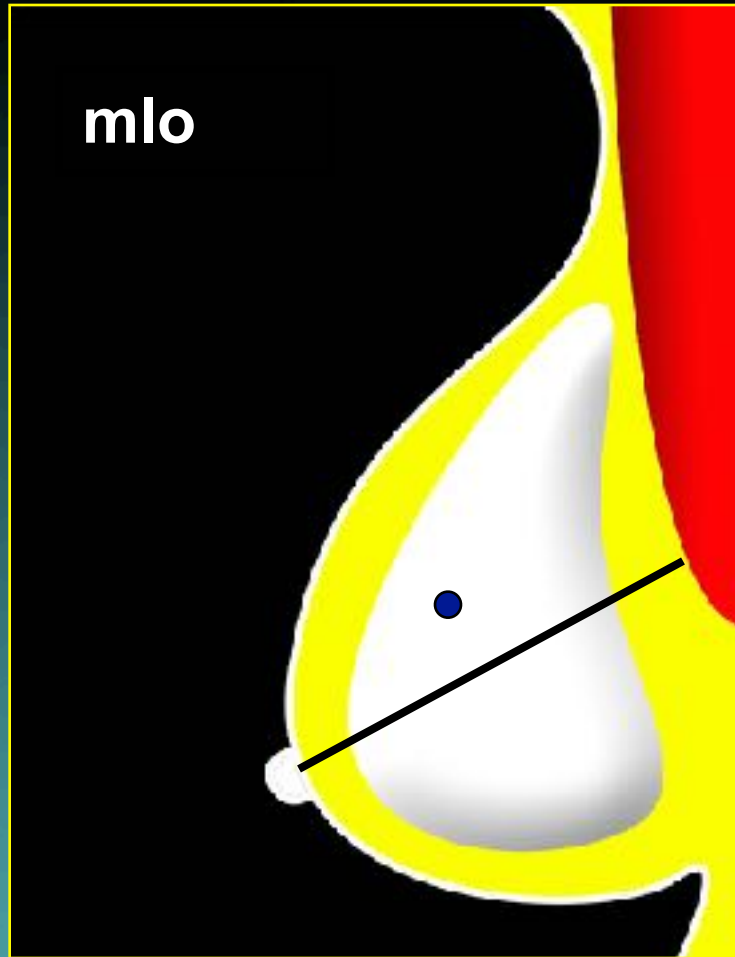


IMAGE vs. BREAST PLANE



IMAGE PLANE

IF A LESION IS BELOW
THE PNL, IS IT IN THE
LOWER PART OF THE
BREAST?



IMAGE vs. BREAST PLANE

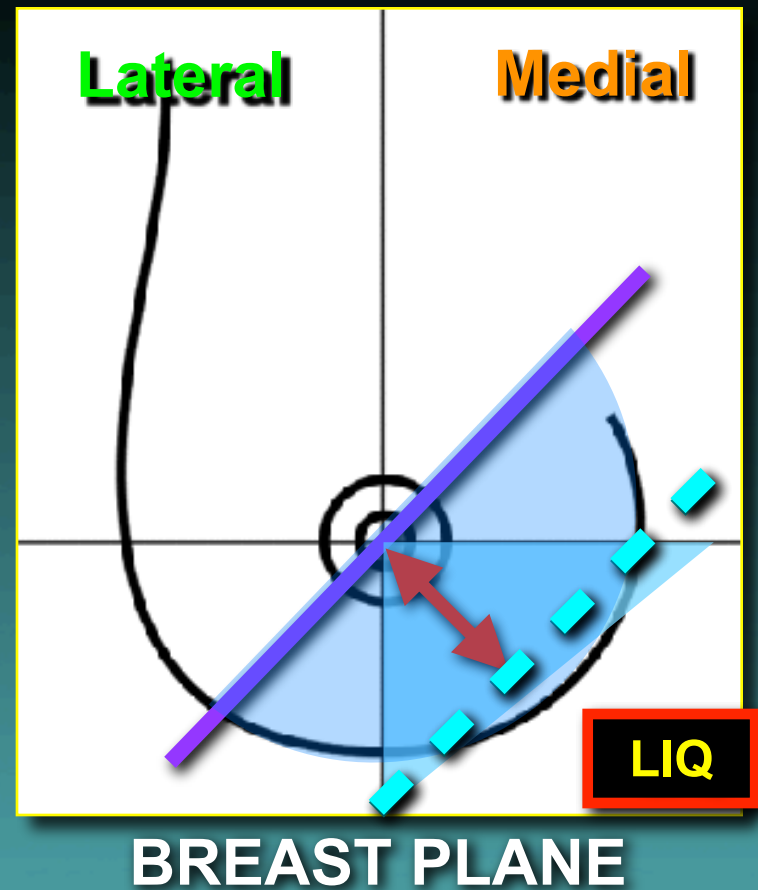
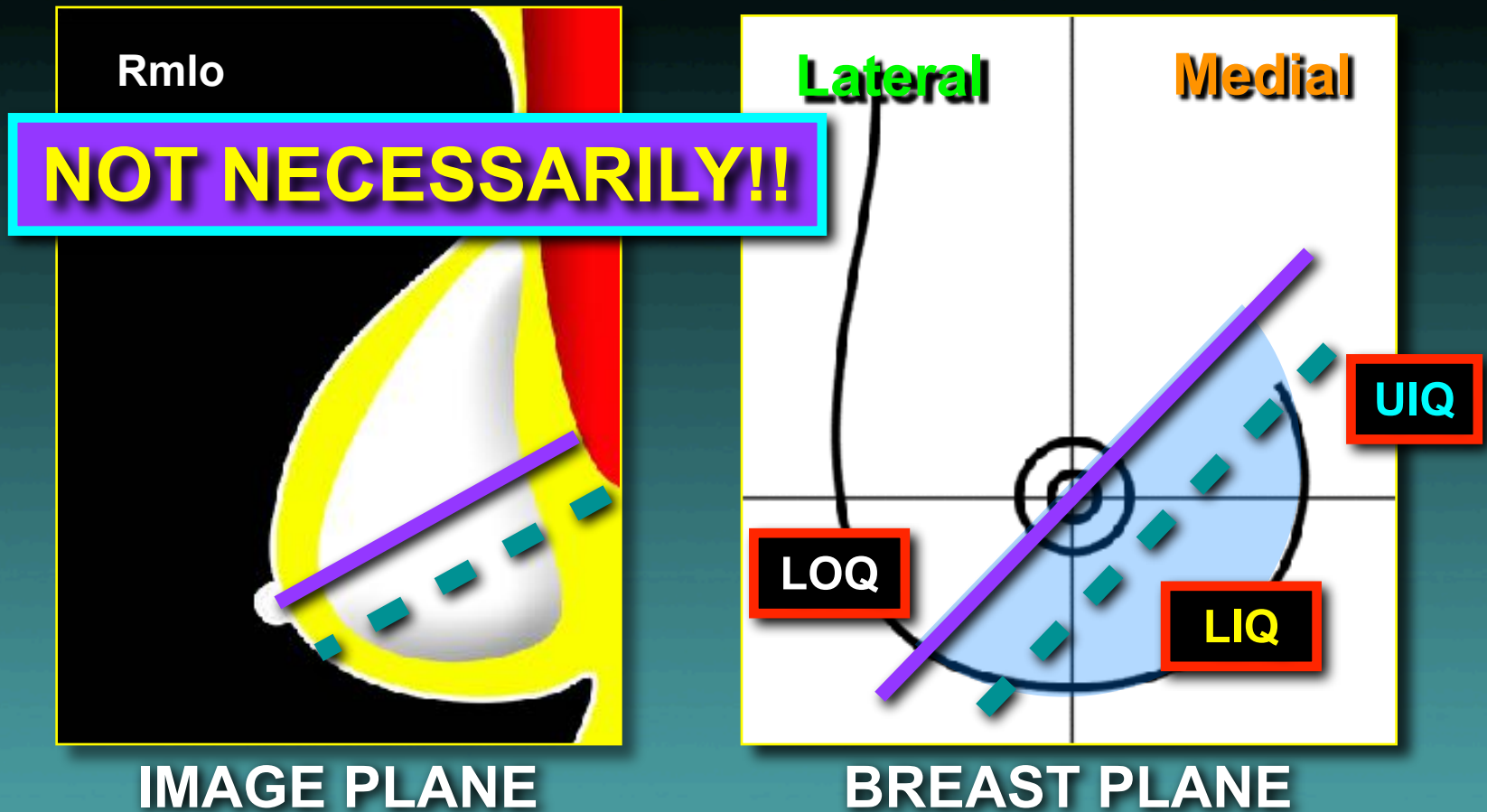
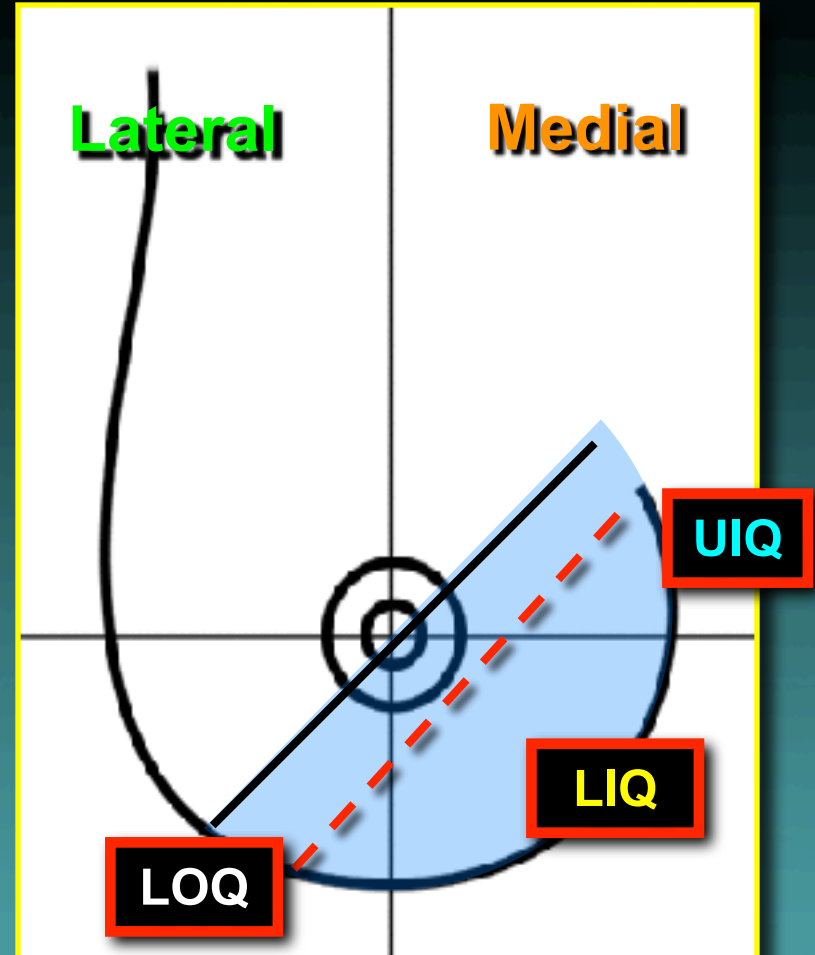
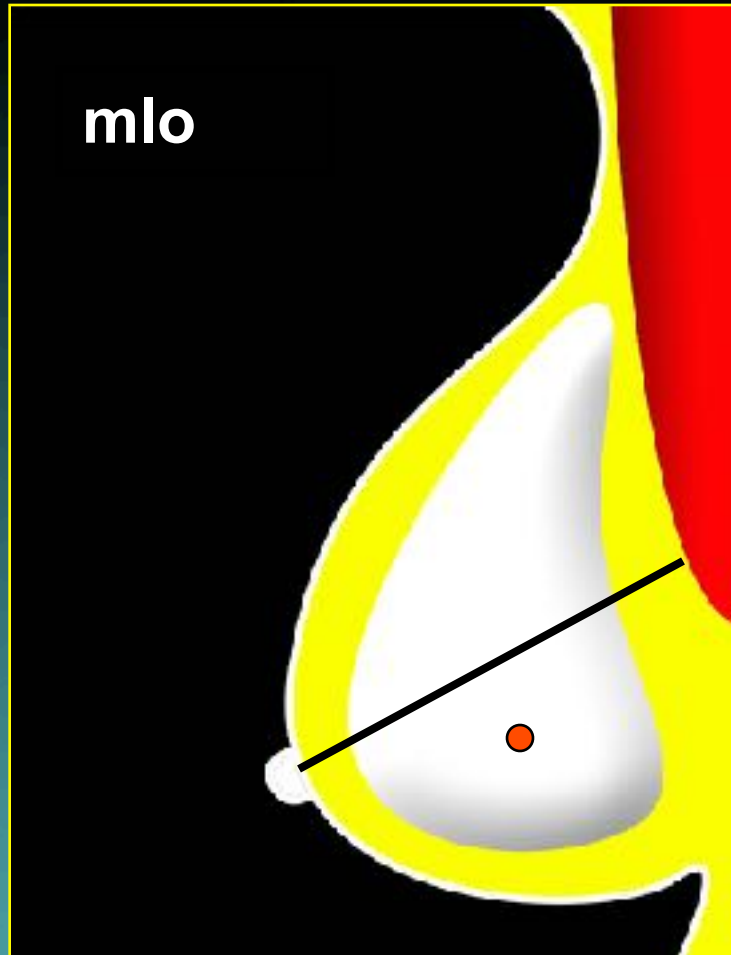


IMAGE vs. BREAST PLANE

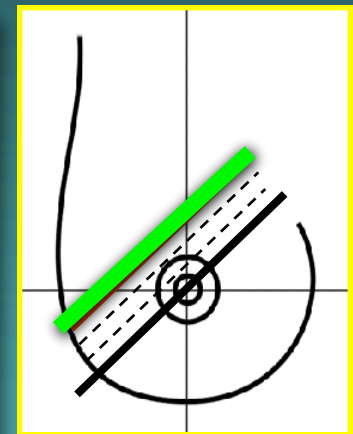
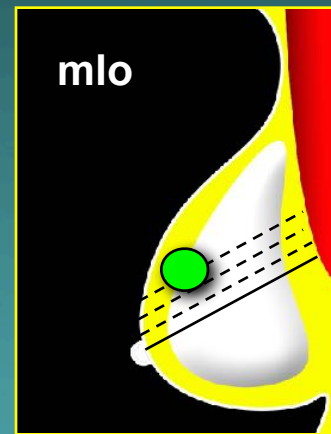


“Perceived” vs. “true” halves



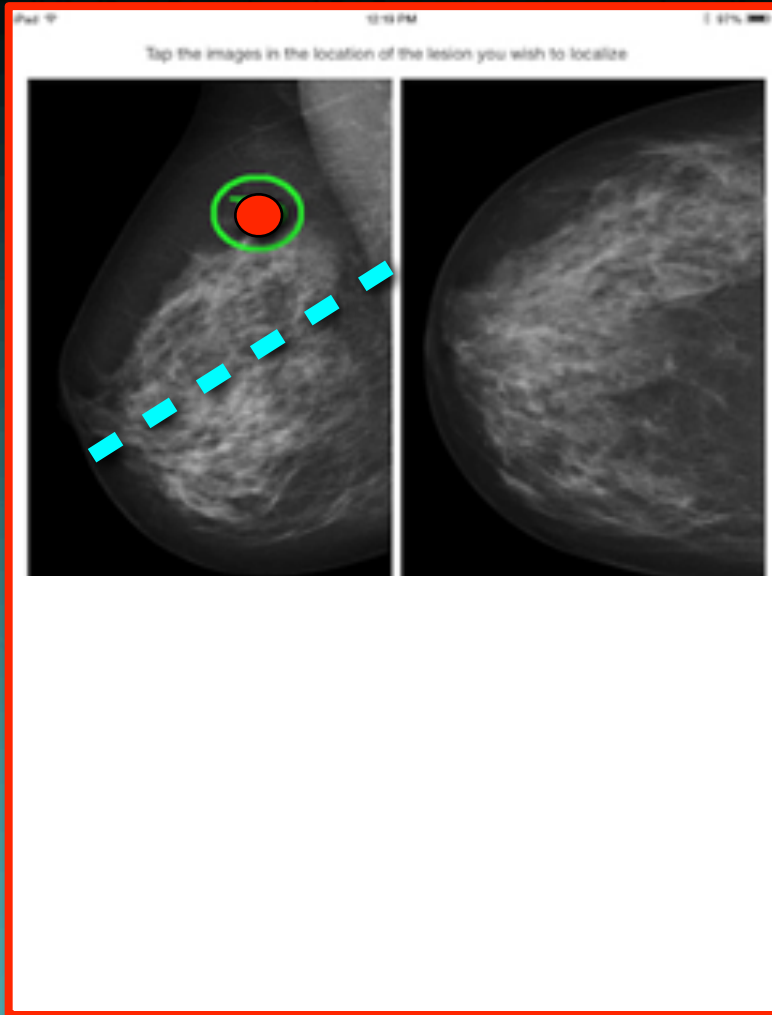
VALUE OF KNOWING THE PLANE OF THE LESION

- Limits the area where the lesion can be within the breast
- Defines a path for directing your search:
 - ➔ Ultrasound
 - ➔ Palpation



MAMMOGRAPHY LOCALIZER:

An iOS app for the ipad!



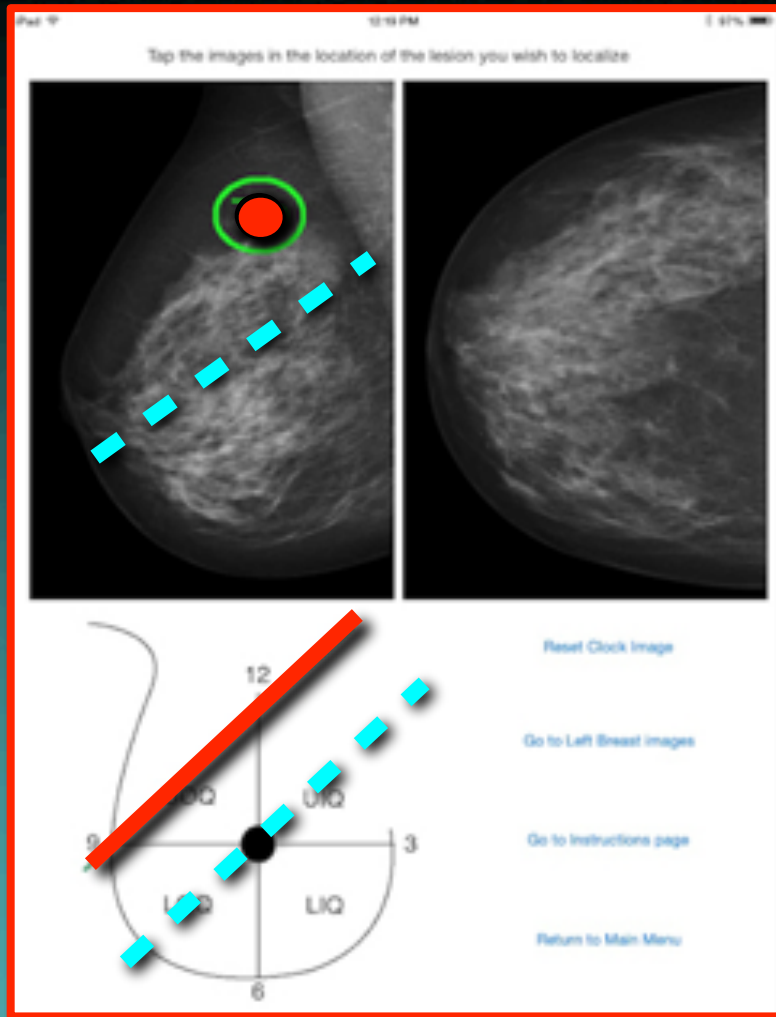
Developed by
Dr. John Bisges,
University of
Mississippi

(As shown on
AuntMinnie.com)



MAMMOGRAPHY LOCALIZER:

An iOS app for the ipad!



Developed by
Dr. John Bisges,
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TRIANGULATION: SOLVING OTHER PROBLEMS CAUSED BY THE MLO VIEW

- **The use of the 90° ML view as a 3rd view**
- **The use of the ROLL view**
- **The value of STEP OBLIQUE views**



TRIANGULATION: SOLVING OTHER PROBLEMS CAUSED BY THE MLO VIEW

- ➔ **The use of the 90° ML view as a 3rd view**
- ➔ The use of the ROLL view
- ➔ The value of STEP OBLIQUE views





USE OF THE THIRD VIEW (90 DEGREE MEDIOLATERAL VIEW)

- **ALLOWS A MORE ACCURATE LOCATION OF A LESION IN THE BREAST**
(WHICH THE MEDIOLATERAL OBLIQUE VIEW DOES **NOT** ACCURATELY PROVIDE)



USE OF THE THIRD VIEW (90 DEGREE MEDIOLATERAL VIEW)

- **ALLOWS A MORE ACCURATE LOCATION OF A LESION IN THE BREAST (WHICH THE MEDIOLATERAL OBLIQUE VIEW DOES NOT ACCURATELY PROVIDE)**
- **If this is the case, you might ask why we are not using the 90 degree view routinely, instead of the MLO view!**
- **The answer is that the 90 degree view cuts off much of the posterior tissue, whereas the MLO view allows for visualization almost all the way back, following the pectoralis plane.**



USE OF THE THIRD VIEW (90 DEGREE MEDIOLATERAL VIEW)

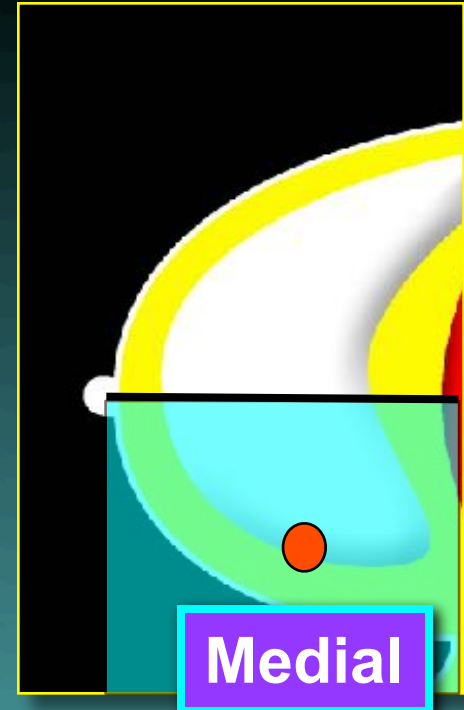
- **ALLOWS A MORE ACCURATE LOCATION OF A LESION IN THE BREAST**
(WHICH THE MEDIOLATERAL OBLIQUE VIEW DOES **NOT** ACCURATELY PROVIDE)
- **IF YOU OBTAIN A THIRD VIEW (THE 90 DEGREE MEDIOLATERAL VIEW),**
YOU CAN EXTRAPOLATE THE MORE ACCURATE LOCATION BY DRAWING A LINE BETWEEN THE LESION ON THE CC & MLO VIEWS, AND THEN **EXTENDING THE LINE TO THE MEDIOLATERAL VIEW**

TRIANGULATION

mlo



cc



Lead sinks, Muffins rise

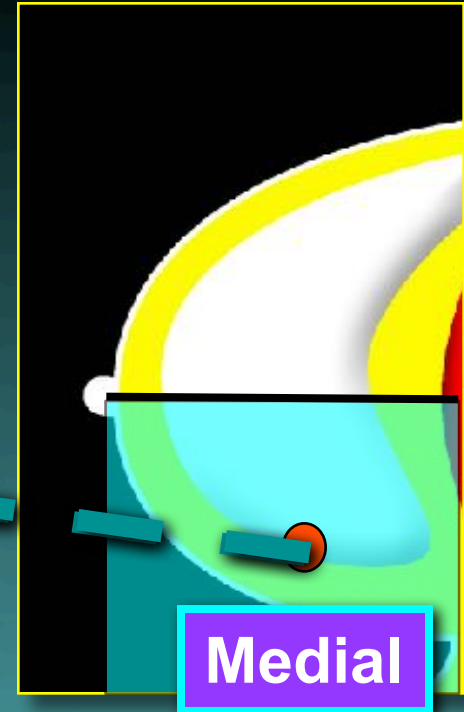
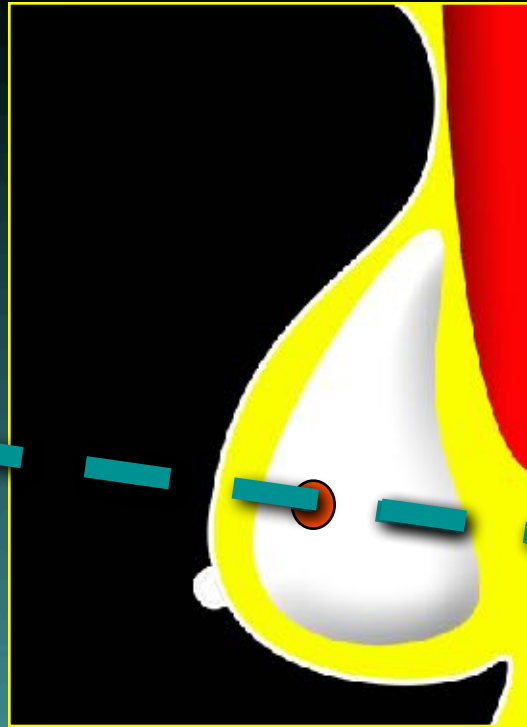


TRIANGULATION

90 degree mediolat.

mlo

cc



Lead sinks, Muffins rise

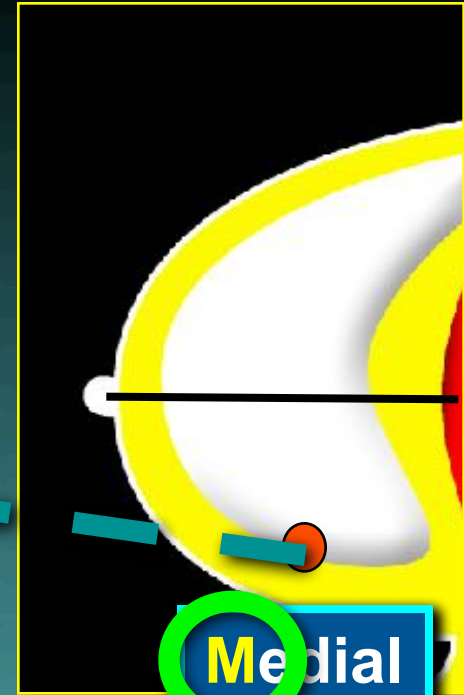
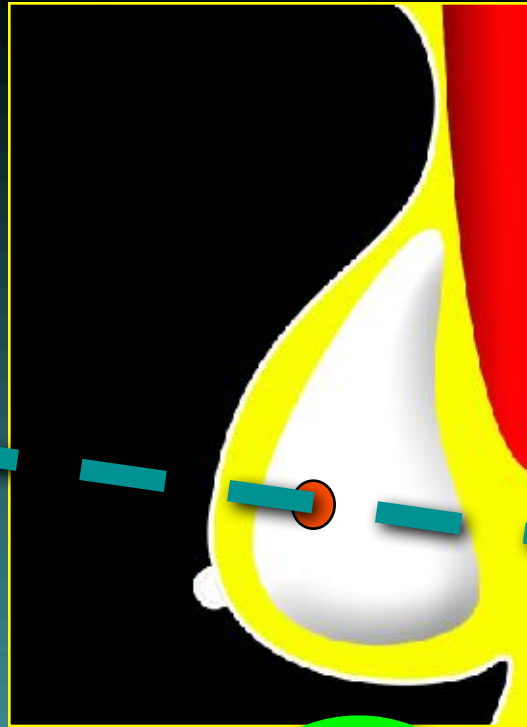
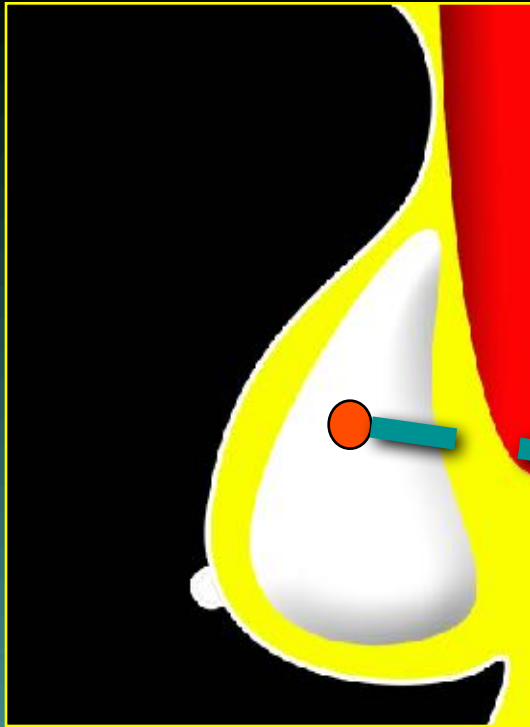


TRIANGULATION

90 degree mediolat.

mlo

cc



Lead sinks, Muffins rise

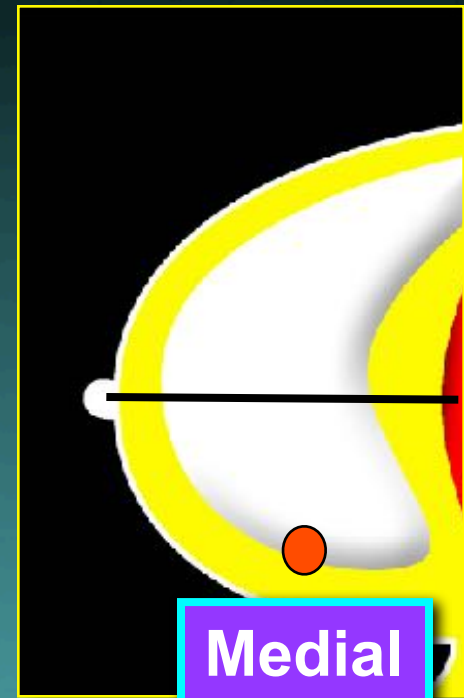


TRIANGULATION 1

90 degree mediolat.

mlo

cc

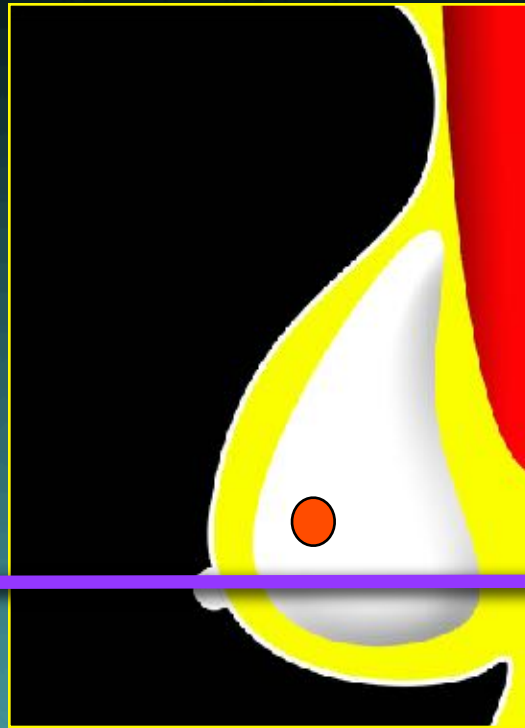
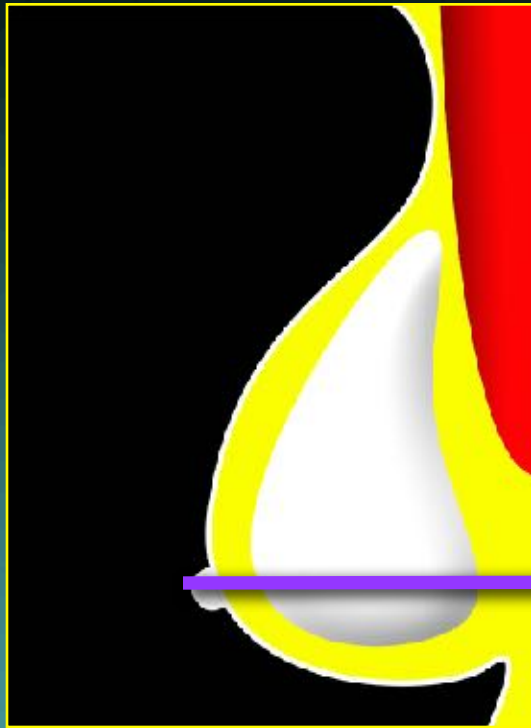


But first, line up the nipples:

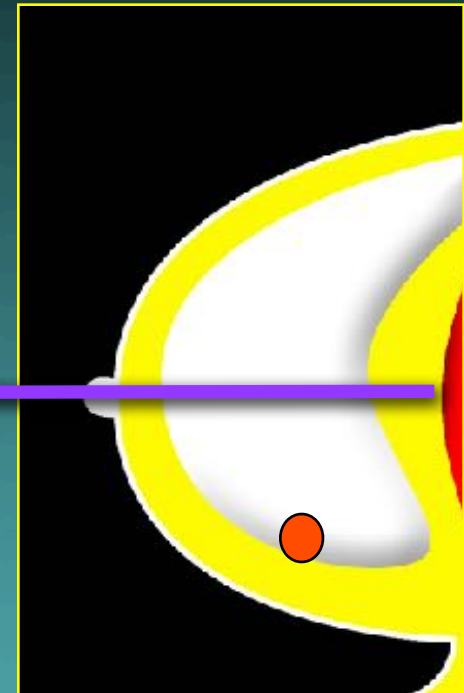


TRIANGULATION 1

90 degree mediolat. mlo

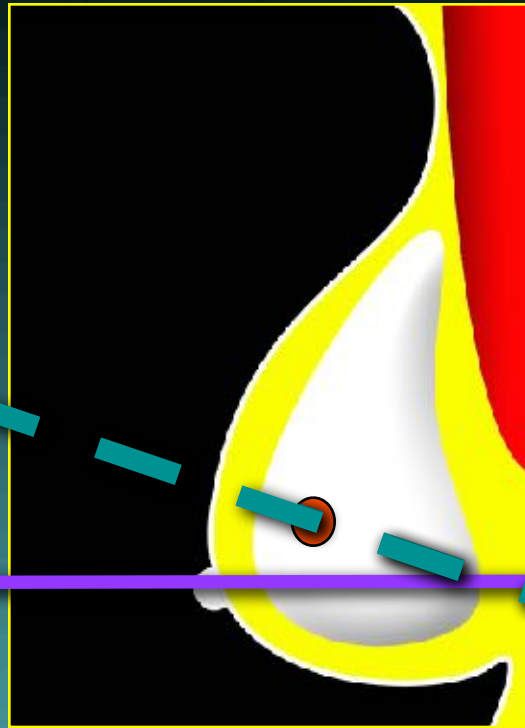
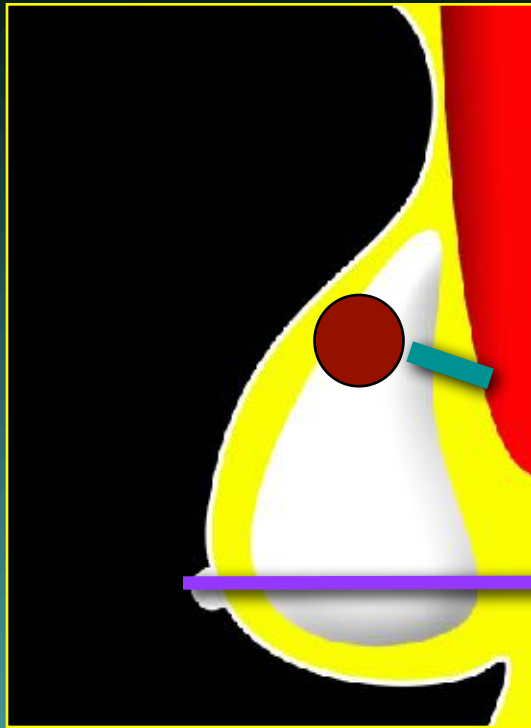


cc

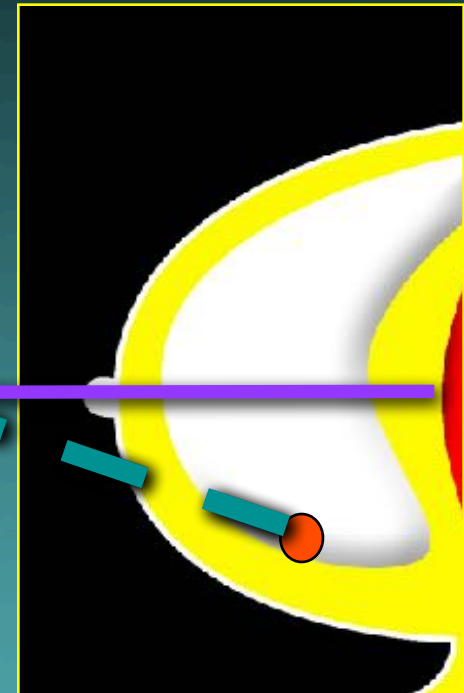


TRIANGULATION 1

90 degree mediolat. mlo

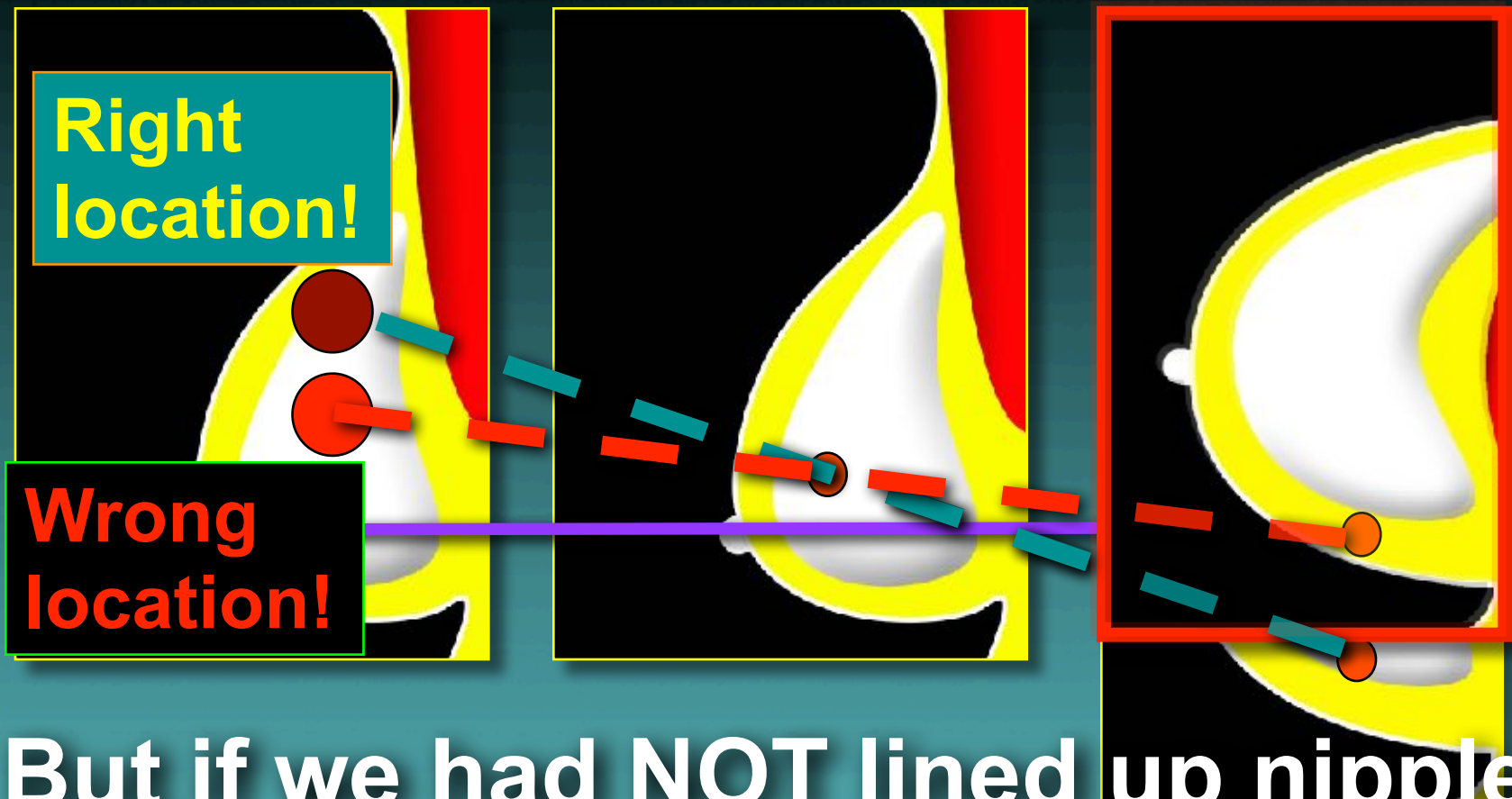


cc



TRIANGULATION 1

90 degree mediolat. mlo



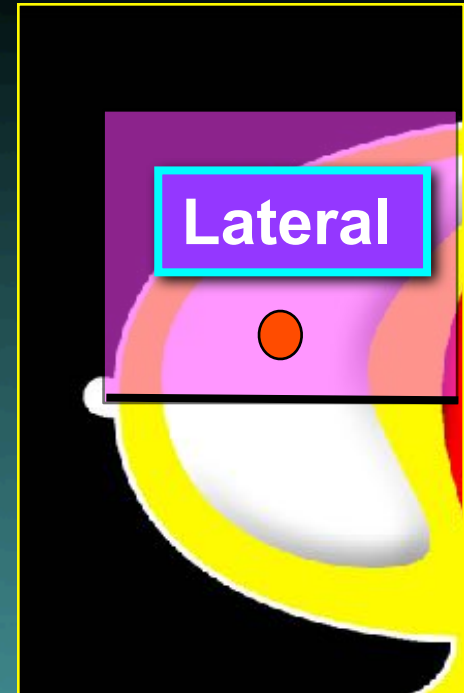
But if we had NOT lined up nipples:

TRIANGULATION

mlo



cc



Lead sinks, Muffins rise

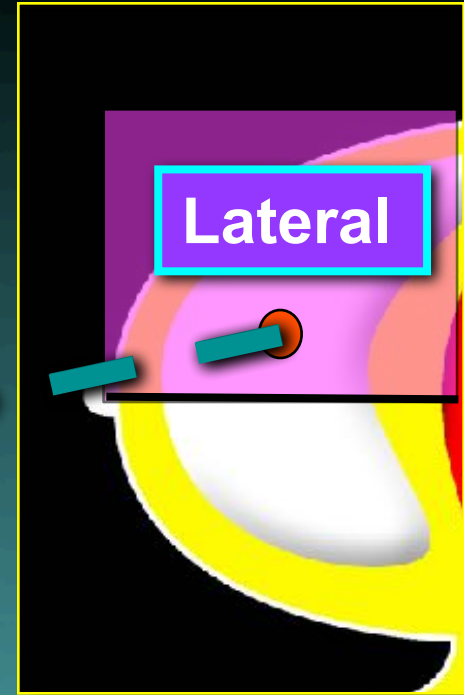


TRIANGULATION

90 degree mediolat.

mlo

cc



Lead sinks, Muffins rise

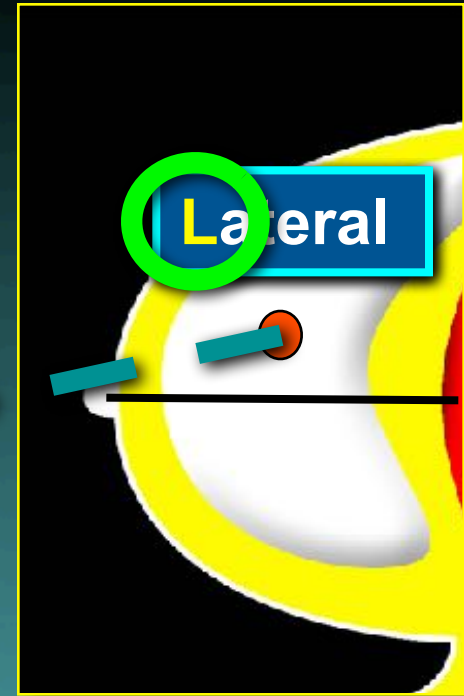
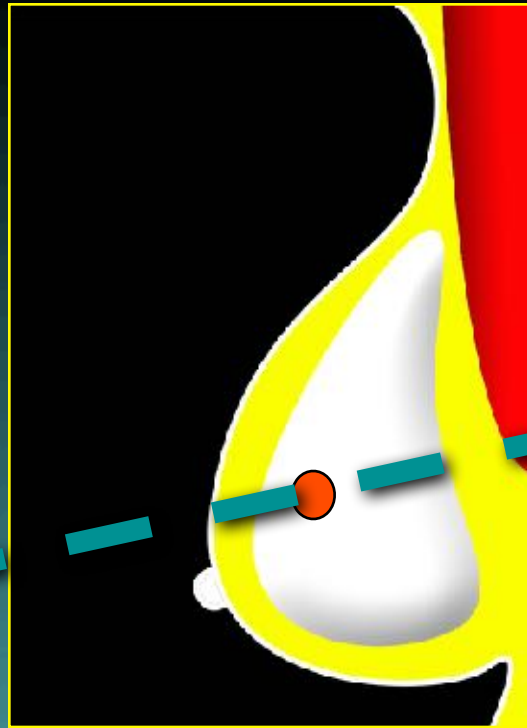
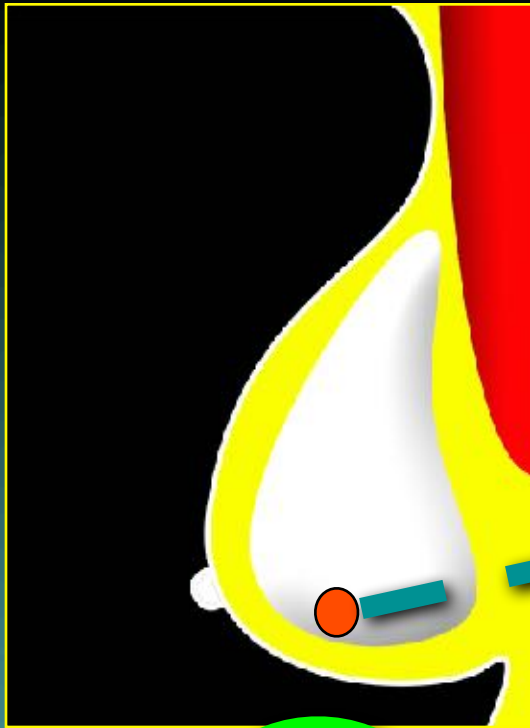


TRIANGULATION

90 degree mediolat.

mlo

cc



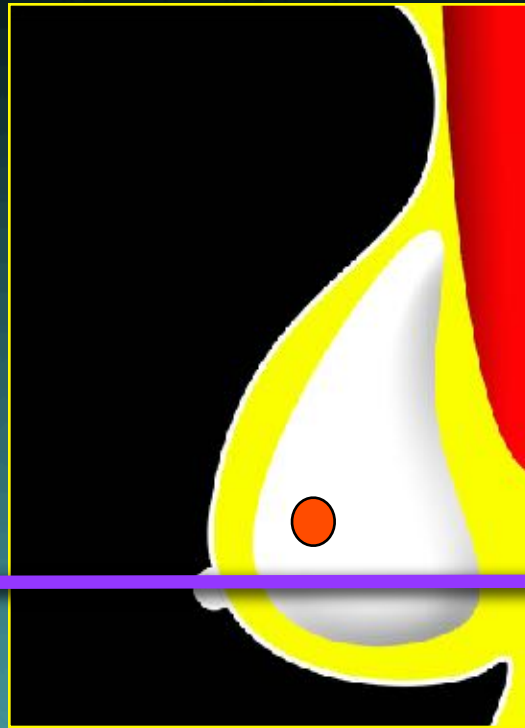
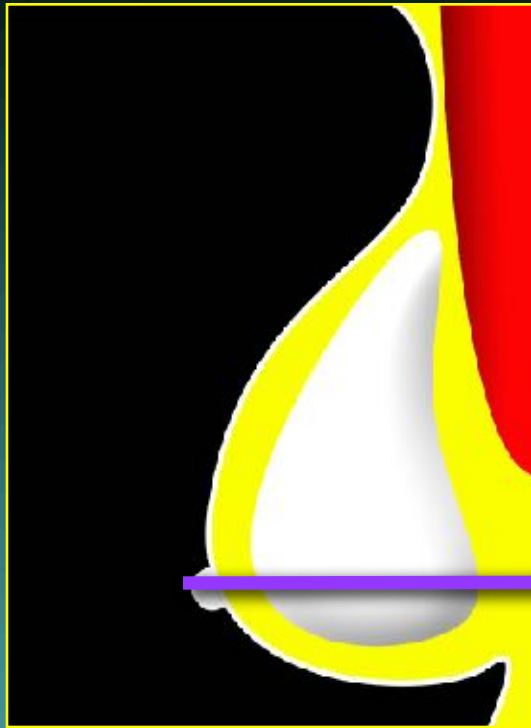
Lead sinks, Muffins rise

But again, line up the nipples:

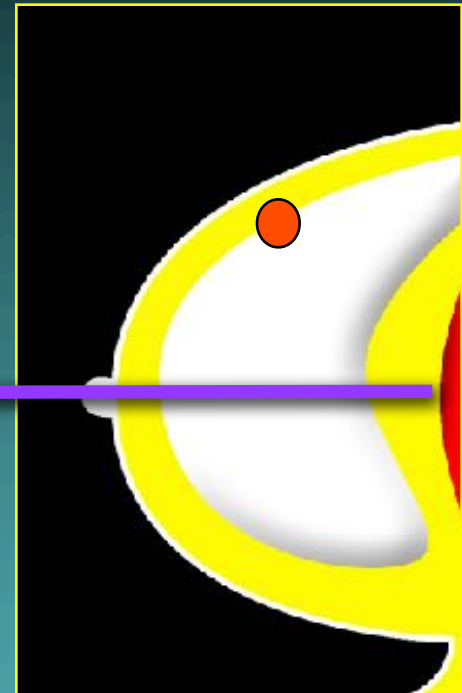


TRIANGULATION 2

90 degree mediolat. mlo

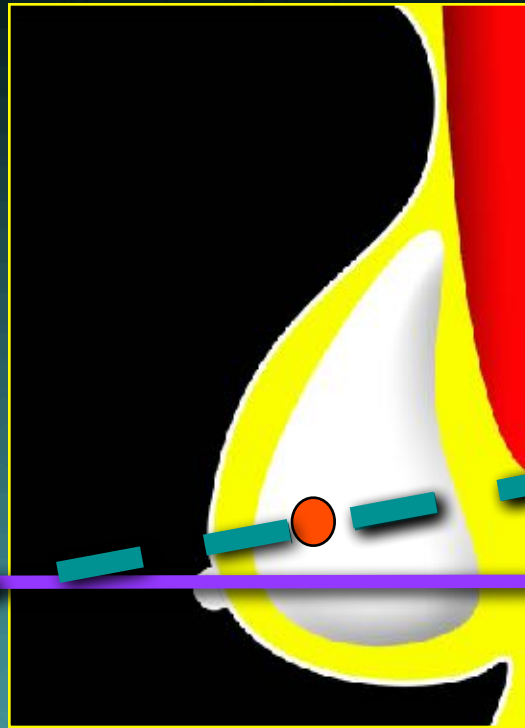


cc

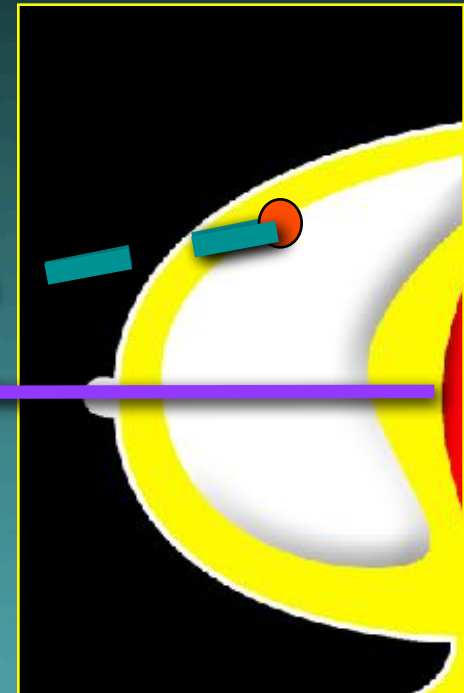


TRIANGULATION 2

90 degree mediolat. mlo

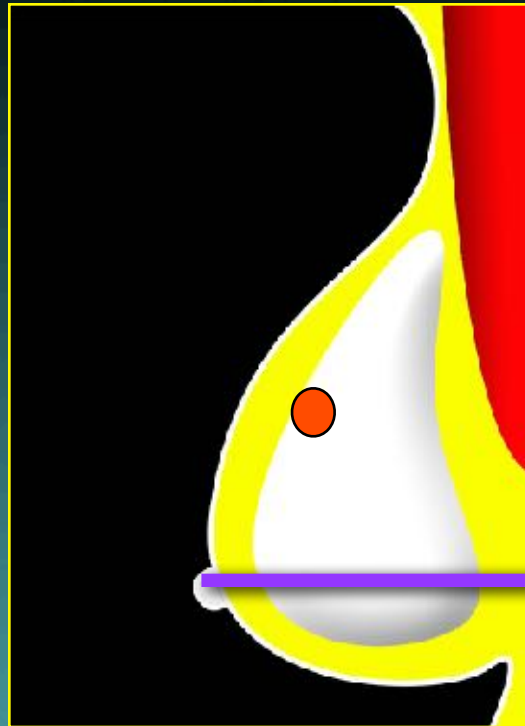


cc

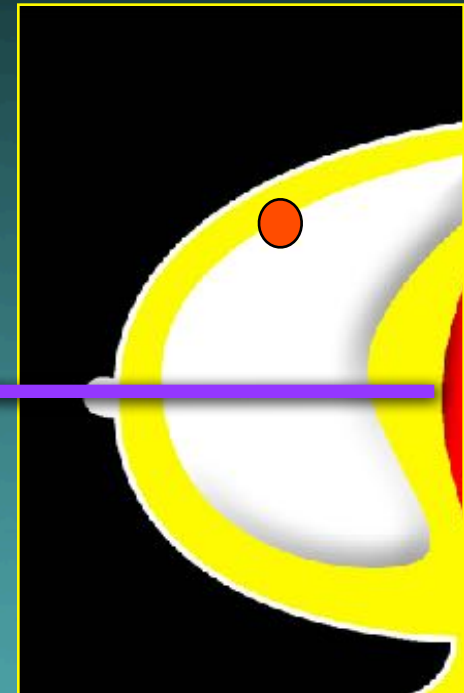


TRIANGULATION 3

mlo

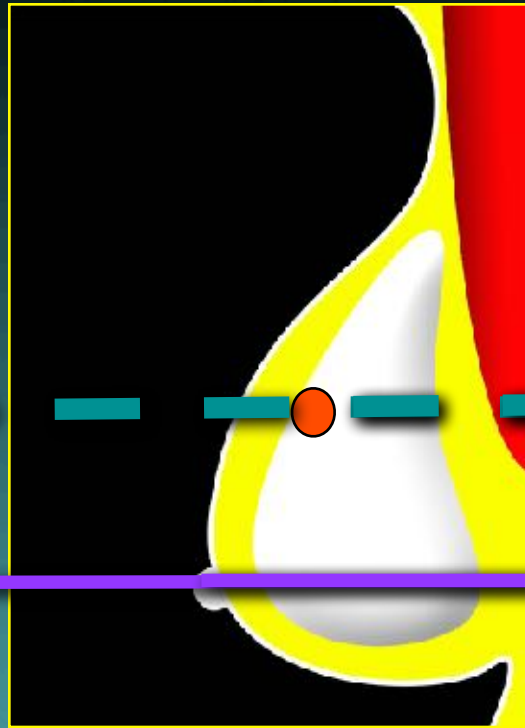
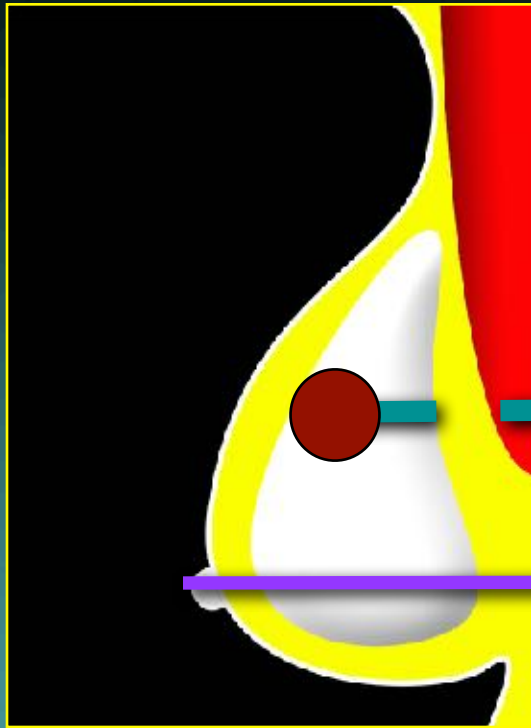


cc

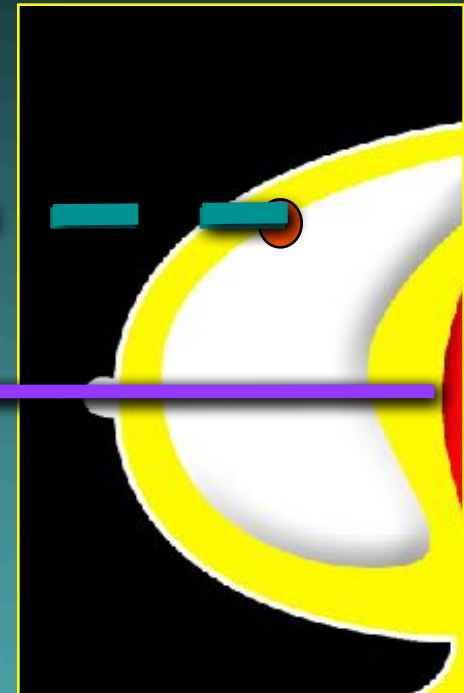


TRIANGULATION 3

90 degree mediolat. mlo



cc

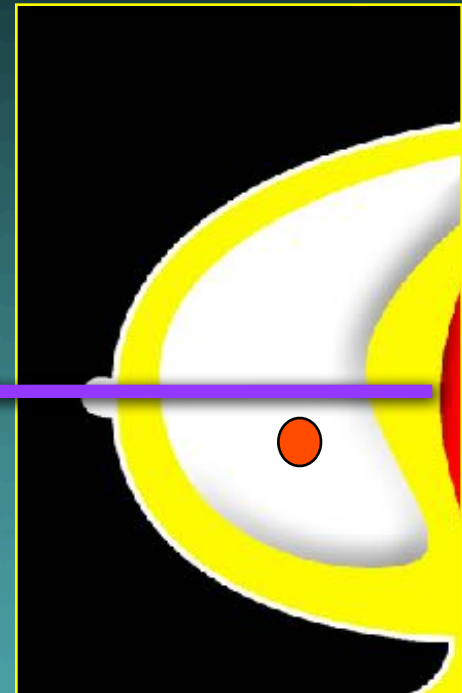


TRIANGULATION 4

mlo



cc

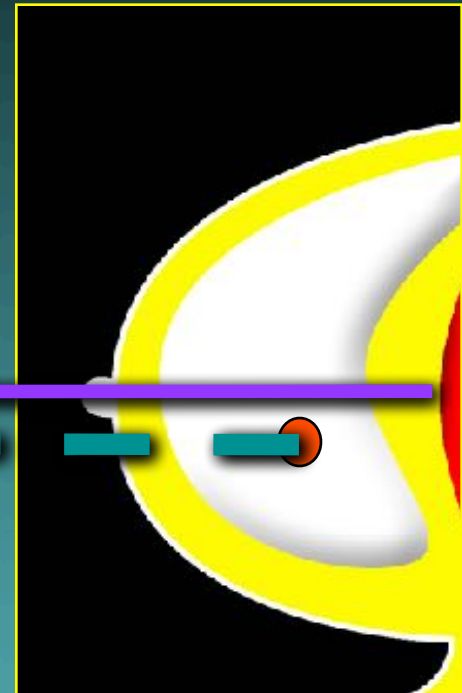


TRIANGULATION 4

90 degree mediolat. mlo



cc





TRIANGULATION

- TRIANGULATION ALSO WORKS WHEN YOU CAN IDENTIFY THE LESION ON ONLY ONE OF THE TWO ROUTINE VIEWS
- AGAIN, IF YOU OBTAIN A THIRD VIEW (THE 90 DEGREE MEDIOLATERAL VIEW), AND YOU SEE THE LESION ON THAT VIEW, DRAW A LINE BETWEEN THE LESION YOU SEE ON WHICHEVER TWO VIEWS YOU SEE IT ON, AND EXTEND THE LINE THROUGH THE THIRD VIEW TO IDENTIFY WHERE THE LESION IS LOCATED ON THAT VIEW.

TRIANGULATION 5

mlo



cc

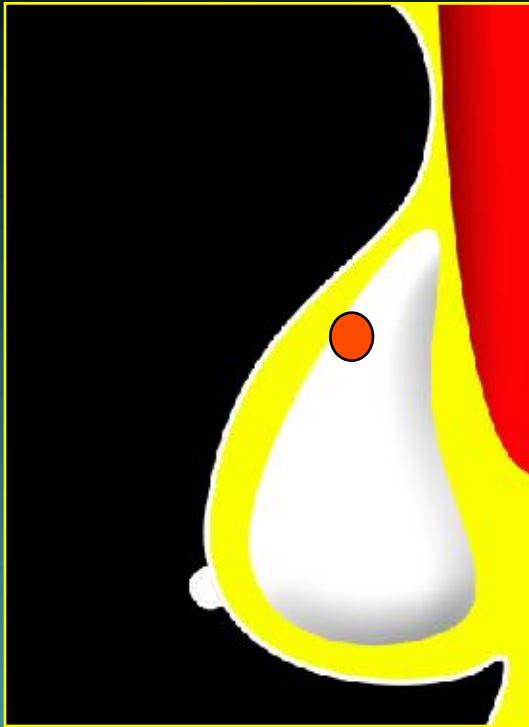


TRIANGULATION 5

90 degree mediolat.

mlo

cc

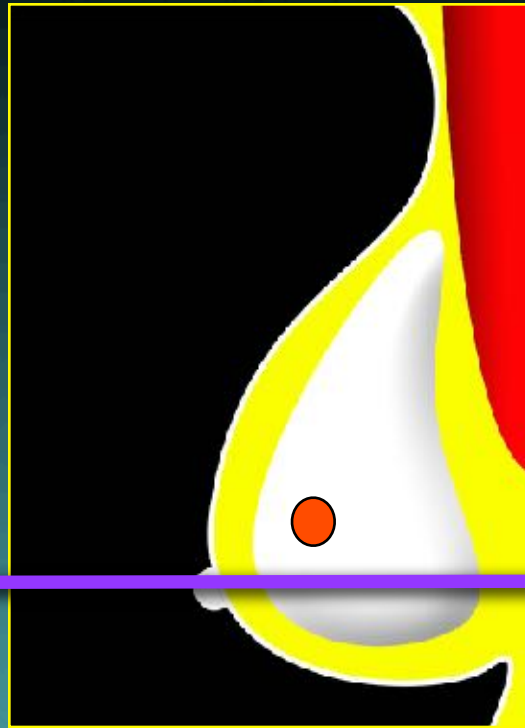
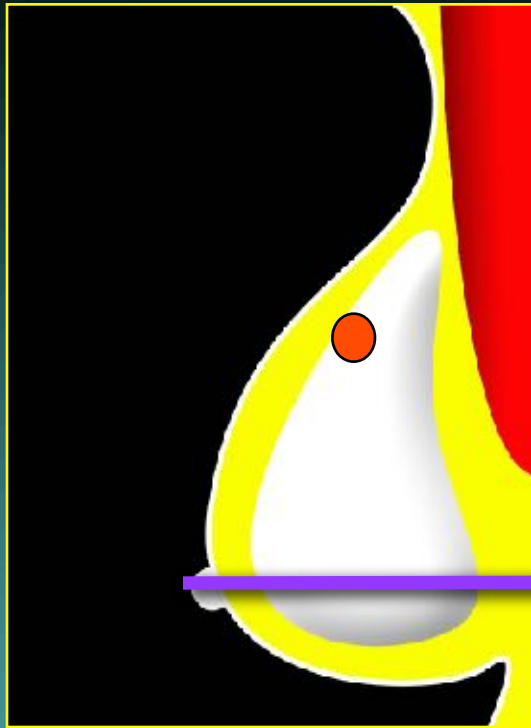


Then line up the nipples:

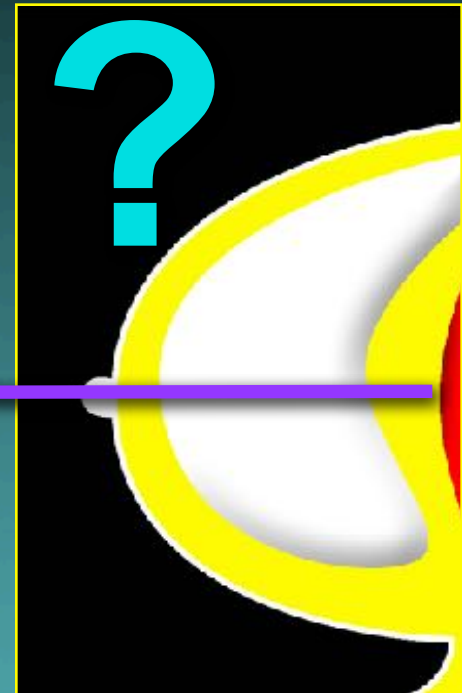


TRIANGULATION 5

90 degree mediolat. mlo



cc

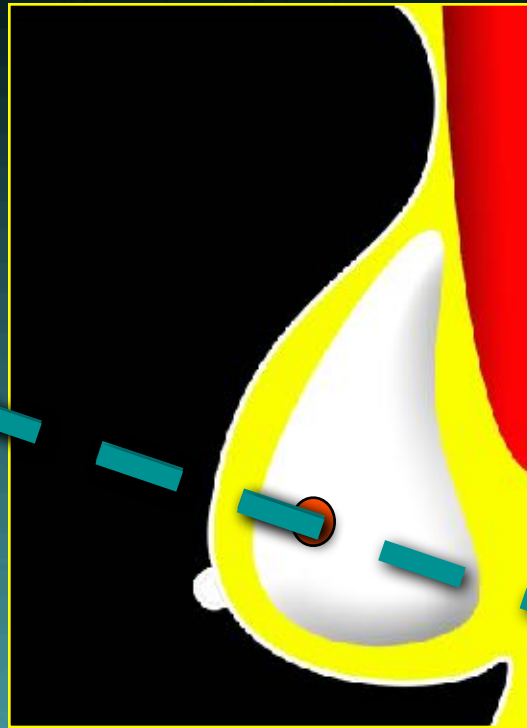


Then draw your line:



TRIANGULATION 5

90 degree mediolat. mlo



cc



Then draw your line:



TRIANGULATION 6

mlo



cc

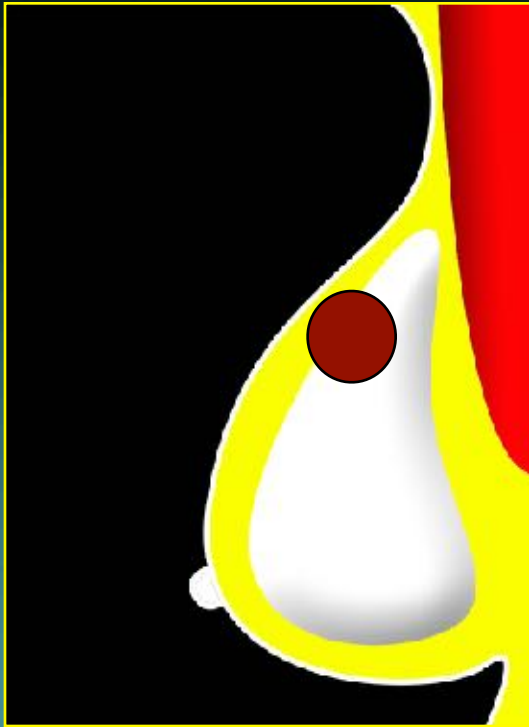


TRIANGULATION 6

90 degree mediolat.

mlo

cc



CC and 90 degree ML are ORTHOGONAL:
Don't need the MLO view!



TRIANGULATION: SOLVING OTHER PROBLEMS CAUSED BY THE MLO VIEW

- The use of the 90° ML view as a 3rd view
- **The use of the ROLL view**
- The value of STEP OBLIQUE views





TRIANGULATION

- IF YOU SEE A LESION ON ONLY ONE OF THE TWO ROUTINE VIEWS, AND YOU CANNOT FIND IT ON THE THIRD VIEW, WHAT CAN YOU DO?
- IF THE LESION SEEN ONLY ON THE CC VIEW, OBTAIN ROLL VIEWS

TRIANGULATION 7

90 degree mediolat.

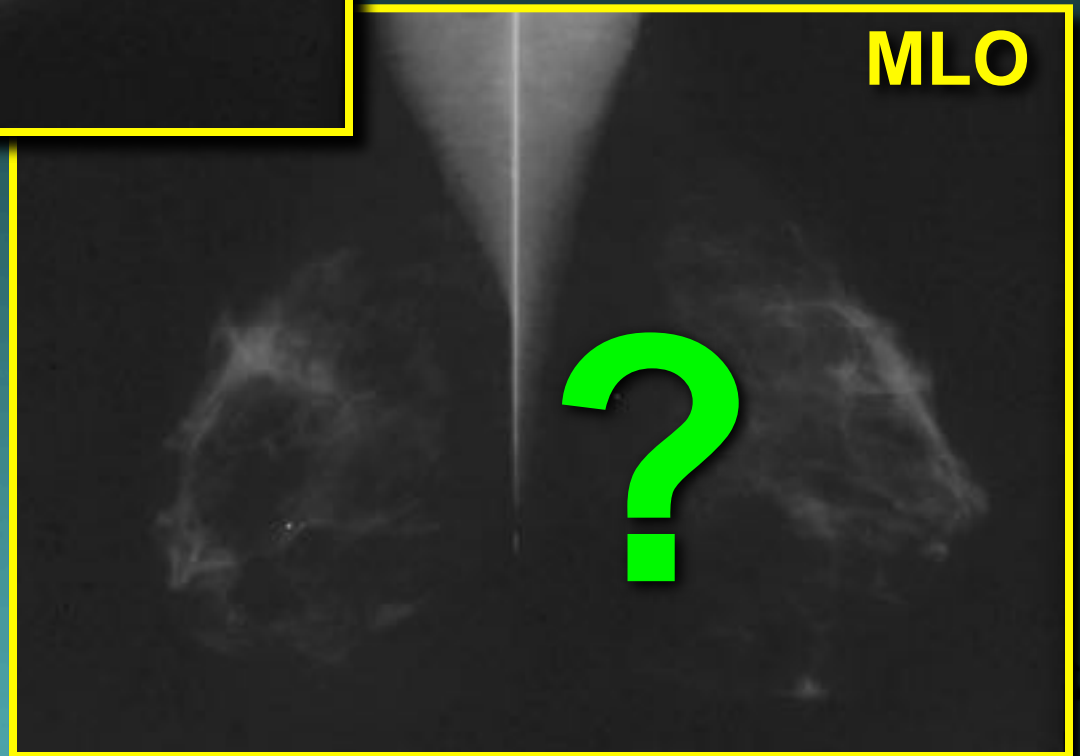
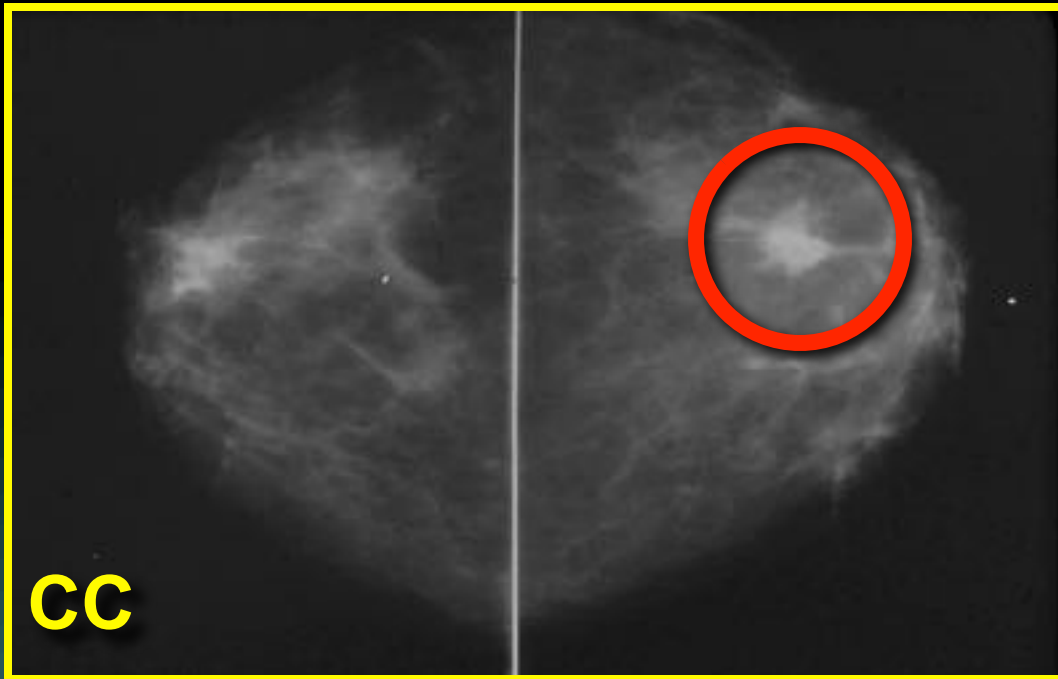
mlo

cc



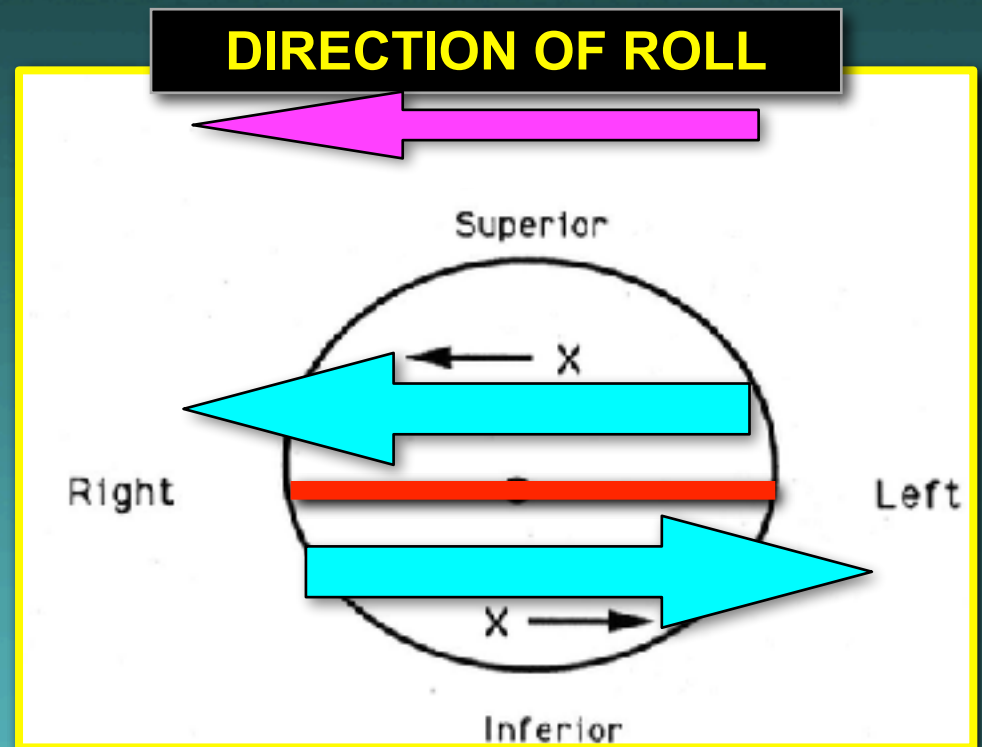
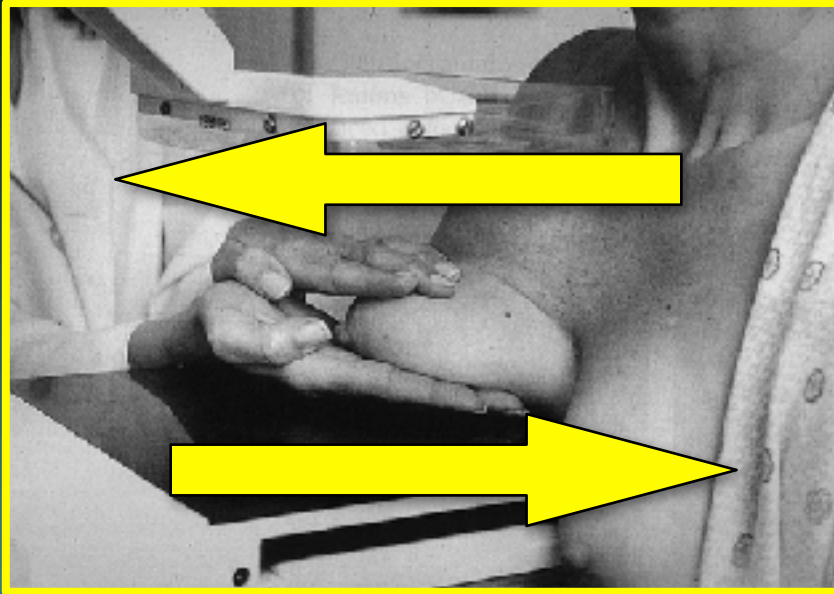
WHAT DO YOU DO NOW?
ROLL VIEWS



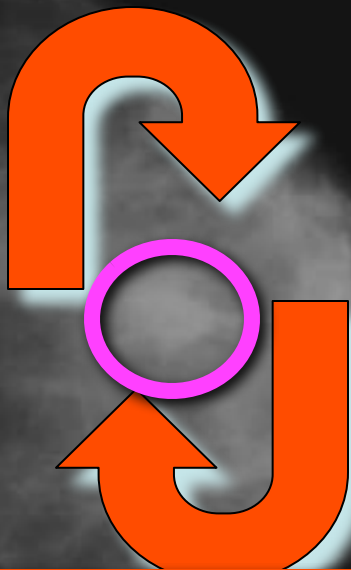




ROLL VIEW



“ROLL” VIEW



**ASYMMETRY DISAPPEARS:
SUMMATION ARTIFACT!**

CC

Rolled CC

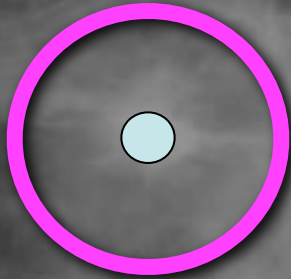


**DETERMINING LESION
LOCATION, IF ASYMMETRY
PERSISTS ON THE ROLL VIEW**

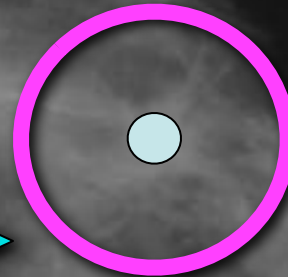


“ROLL” VIEW

Cranial lesion!



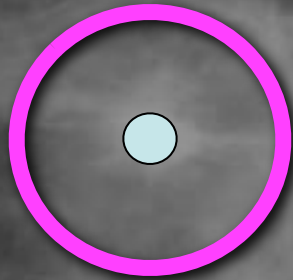
**BB placed on top
CC**



**Top of breast
rolled laterally**



“ROLL” VIEW



**BB placed on top
CC**



**Top of breast
rolled laterally**



Caudal lesion!





TRIANGULATION

- IF YOU SEE A LESION ON ONLY ONE OF THE TWO ROUTINE VIEWS, AND YOU CANNOT FIND IT ON THE THIRD VIEW, WHAT CAN YOU DO?
- IF THE LESION SEEN ONLY ON THE CC VIEW, OBTAIN ROLL VIEWS
- IF THE LESION SEEN ONLY ON THE MLO VIEW, OBTAIN STEP OBLIQUE VIEWS

TRIANGULATION 8

90 degree mediolat.

mlo

cc



WHAT DO YOU DO NEXT?
STEP OBLIQUE VIEWS



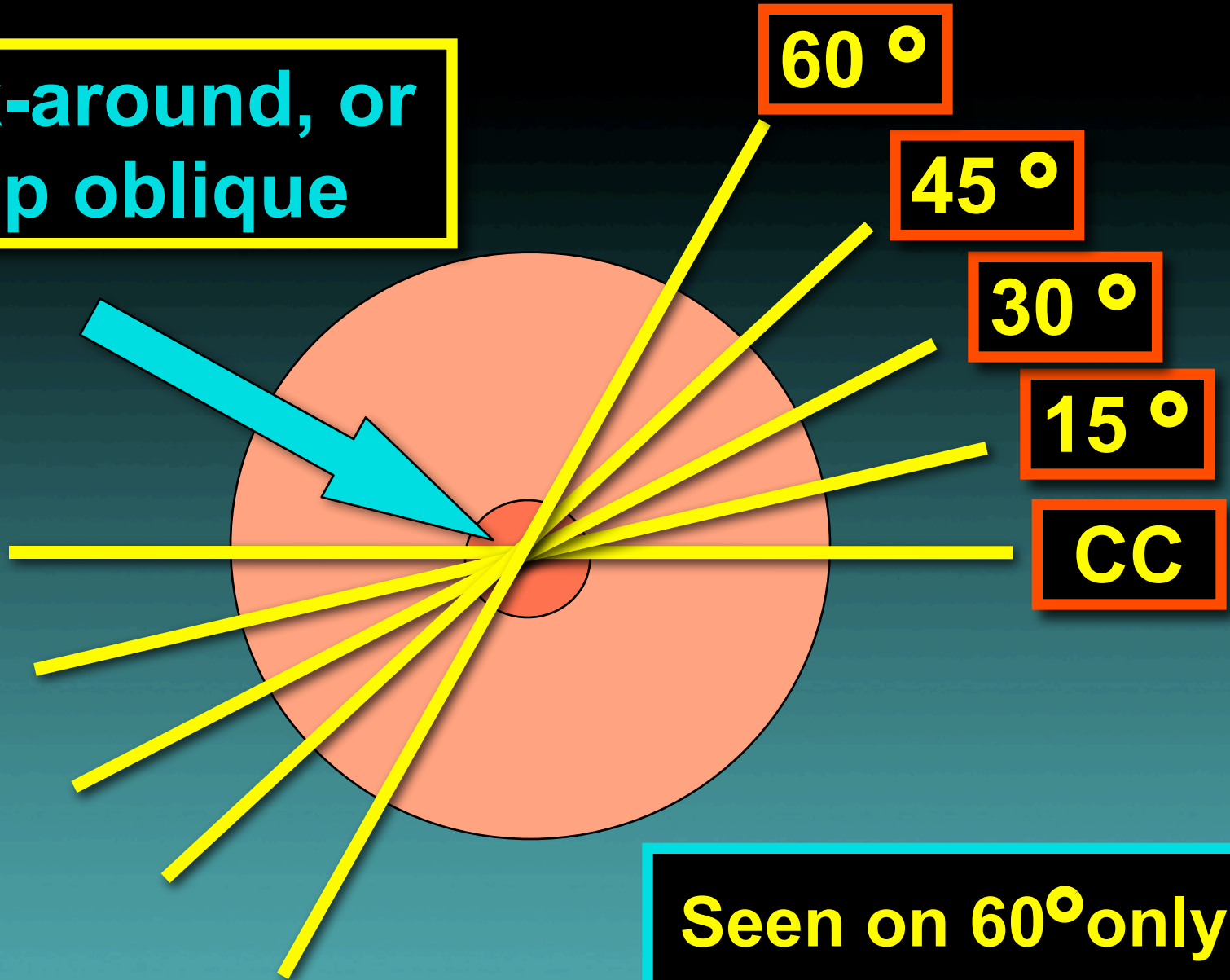


FINDING LESION ON 2 RELATIVELY ORTHOGONAL VIEWS

- **If seen in MLO VIEW INITIALLY, and not seen on CC view:**
 - ➔ **Perform incremental off-axis views (with or without compression), to establish location of lesion in 2 relatively orthogonal planes**

**Pearson KL, Sickles EA, Frankel SD, Leung JW.
Efficacy of step-oblique mammography for
confirmation and localization of densities seen
on only one standard mammographic view.
AJR 2000; 174:745–752**

**Walk-around, or
step oblique**



CC

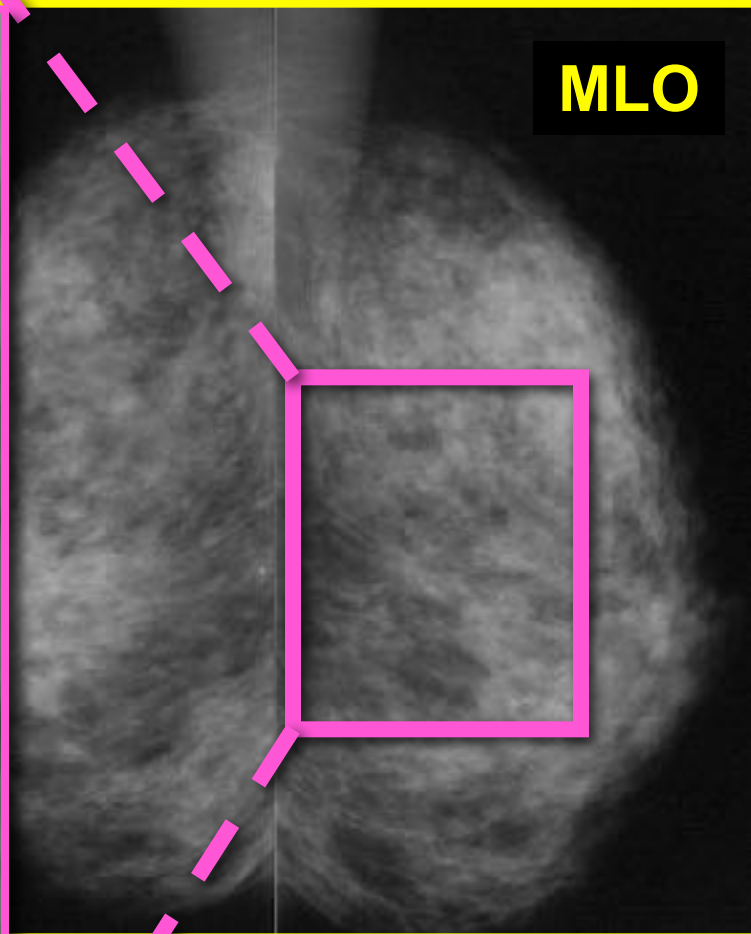
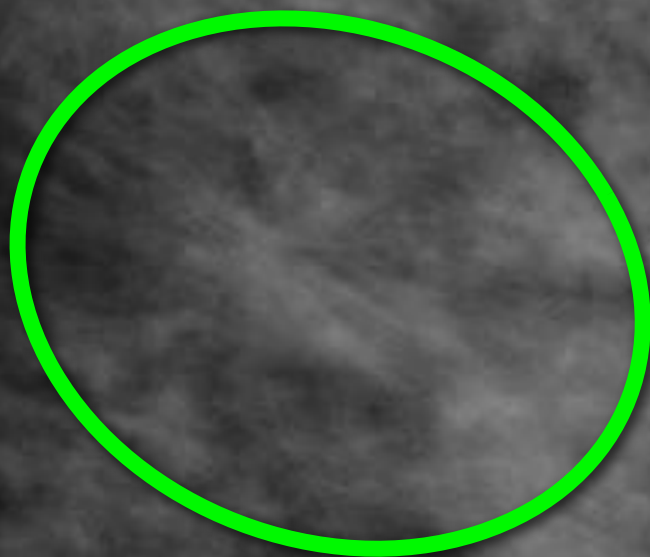


MLO



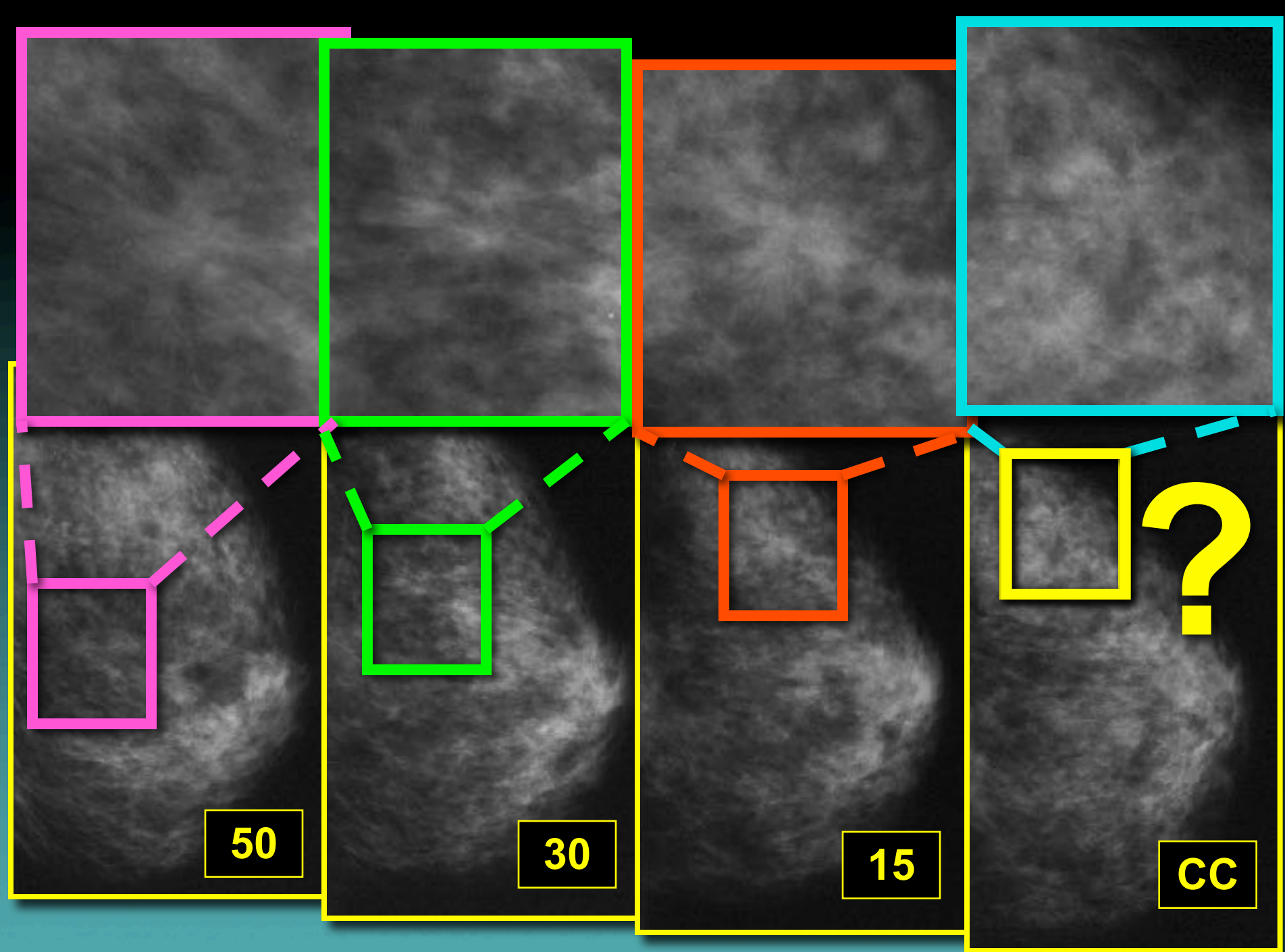
CC

MLO



ALSO NOT SEEN ON 90° ML VIEW





Then line up the nipples:

50

30

15

CC

**Then draw a line through the
lesion, all the way to the view
you did not see it on.**

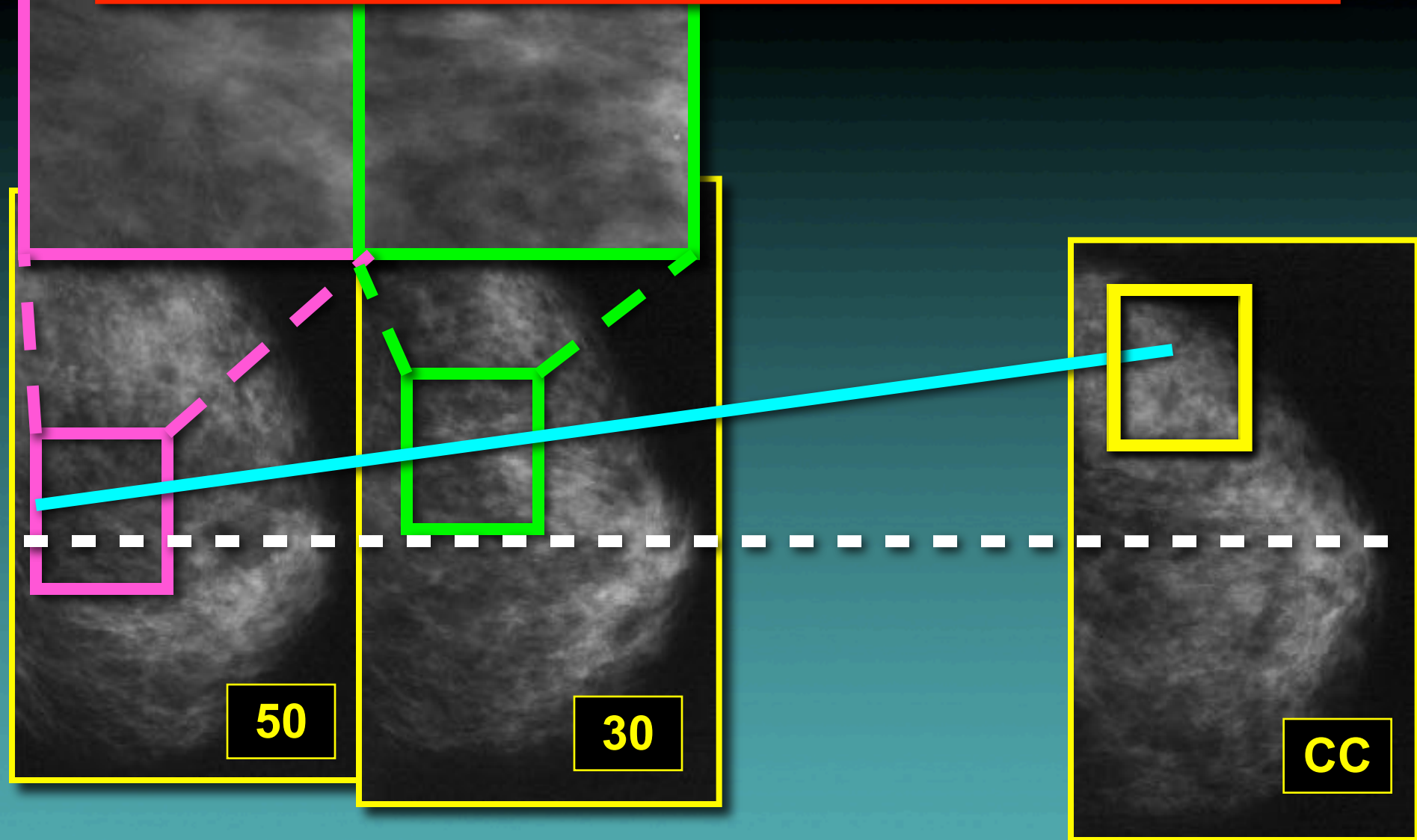
50

30

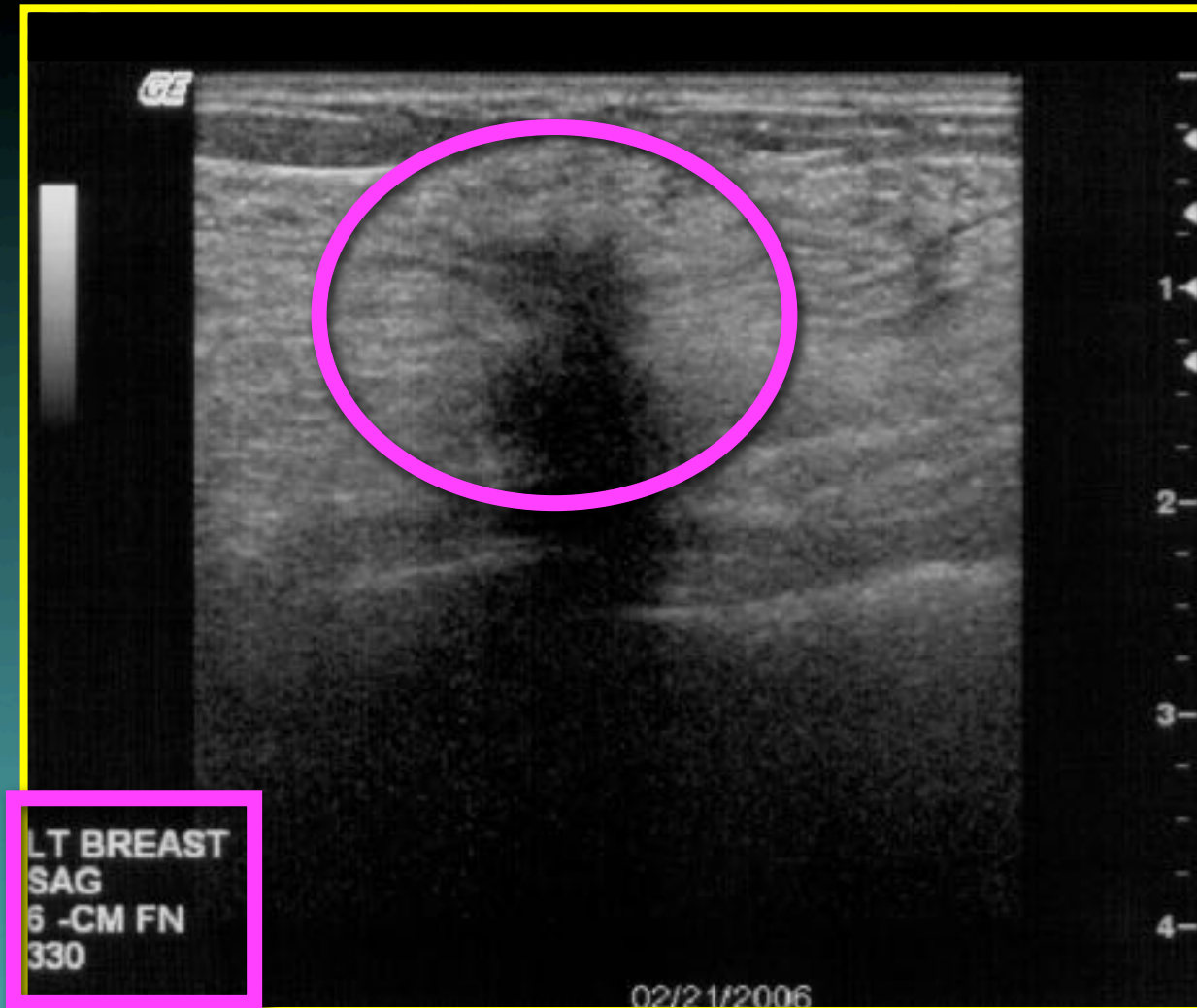
15

CC

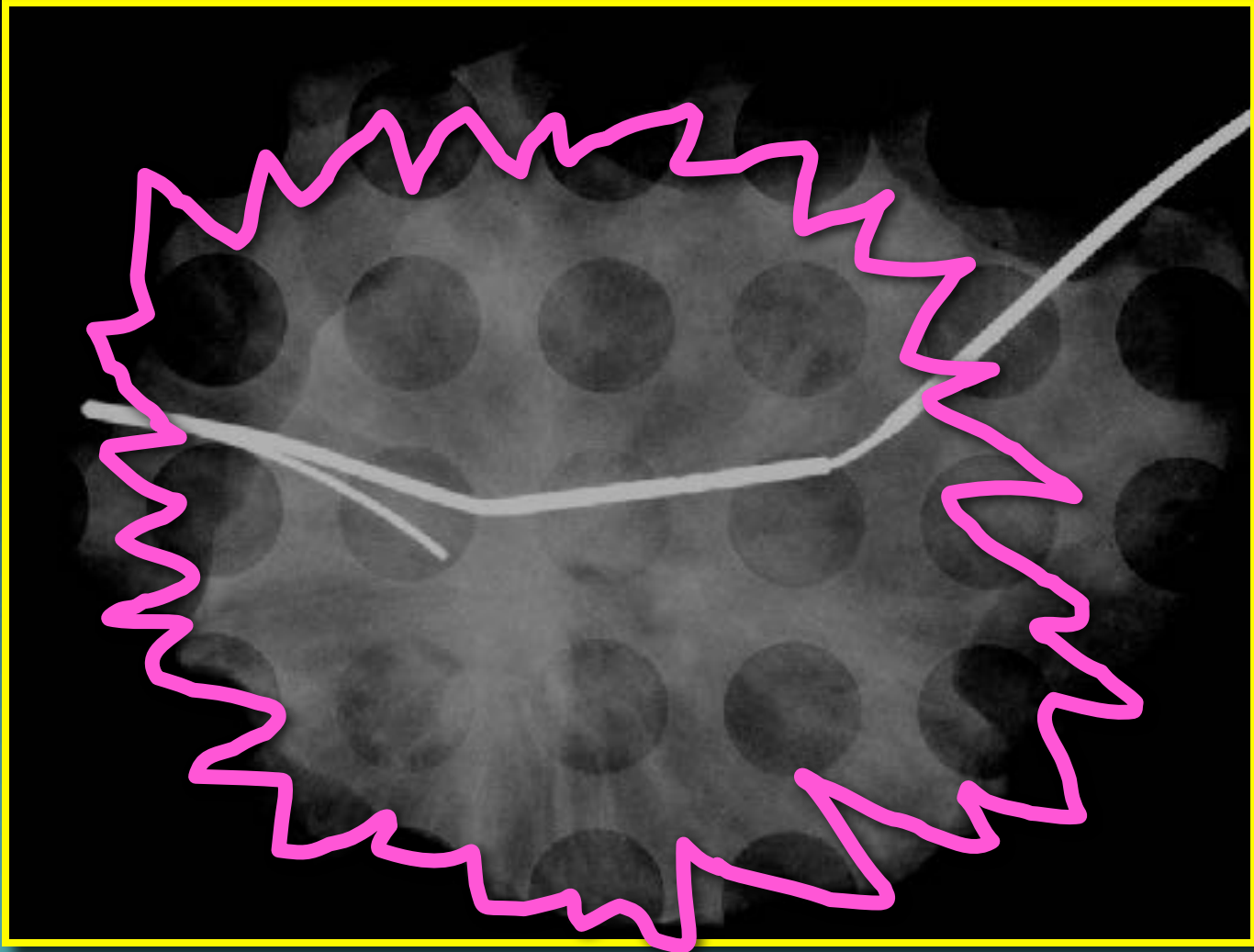
This method will work, even if you see the lesion on only **two views:**



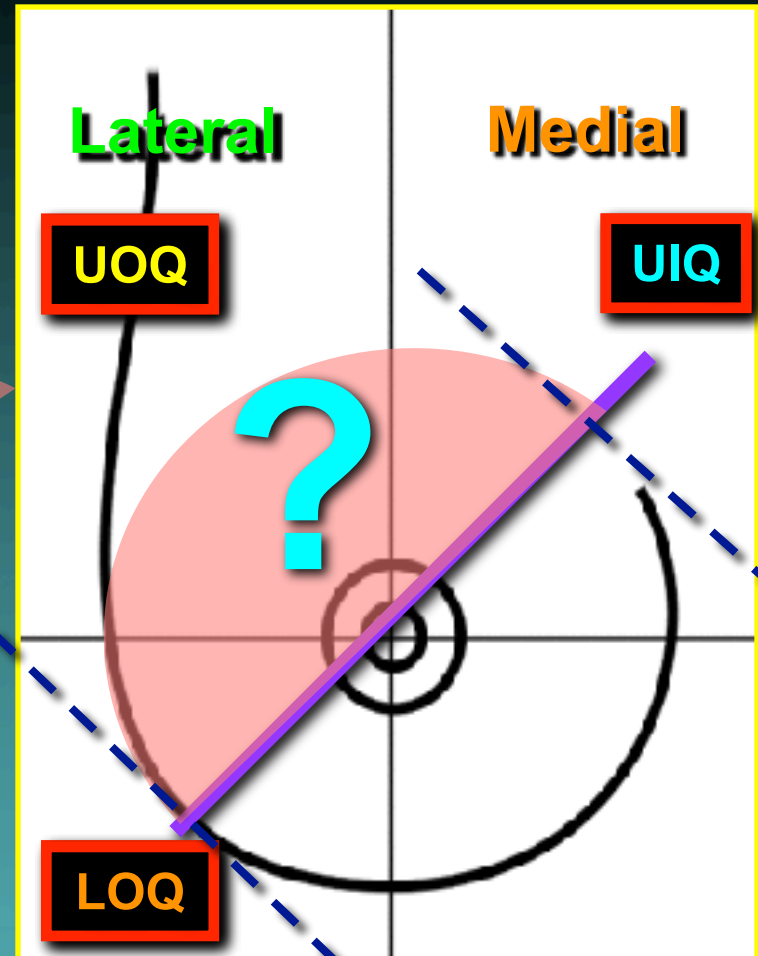
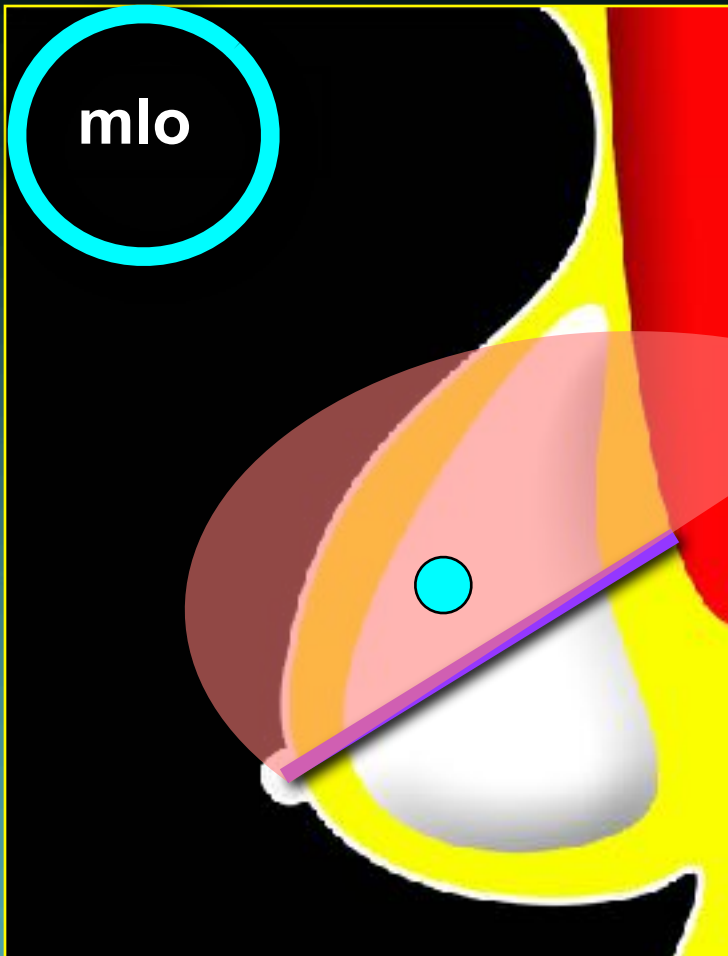
Ultrasound then performed:



INVASIVE LOBULAR CARCINOMA!



ANOTHER HUGE FACTOR WHICH AFFECTS THE PROJECTED LOCATION OF A 1 VIEW FINDING: THE ANGLE OF THE MLO VIEW





A diagram showing a target area for a 10:00 location. The target is a red oval shape. A black circle with a red dot in the center is located within the oval. A blue line with a red dot at the end is also within the oval. The diagram is divided into four quadrants by a vertical and a horizontal line. The top-left quadrant is labeled 'Lateral' in green. The top-right quadrant is labeled 'Medial' in orange. The bottom-left quadrant is labeled 'LOQ' in orange. The bottom-right quadrant is labeled 'UIQ' in cyan. A large black box with the text '10:00 LOCATION' is positioned across the top of the diagram.

10:00 LOCATION

Lateral

Medial

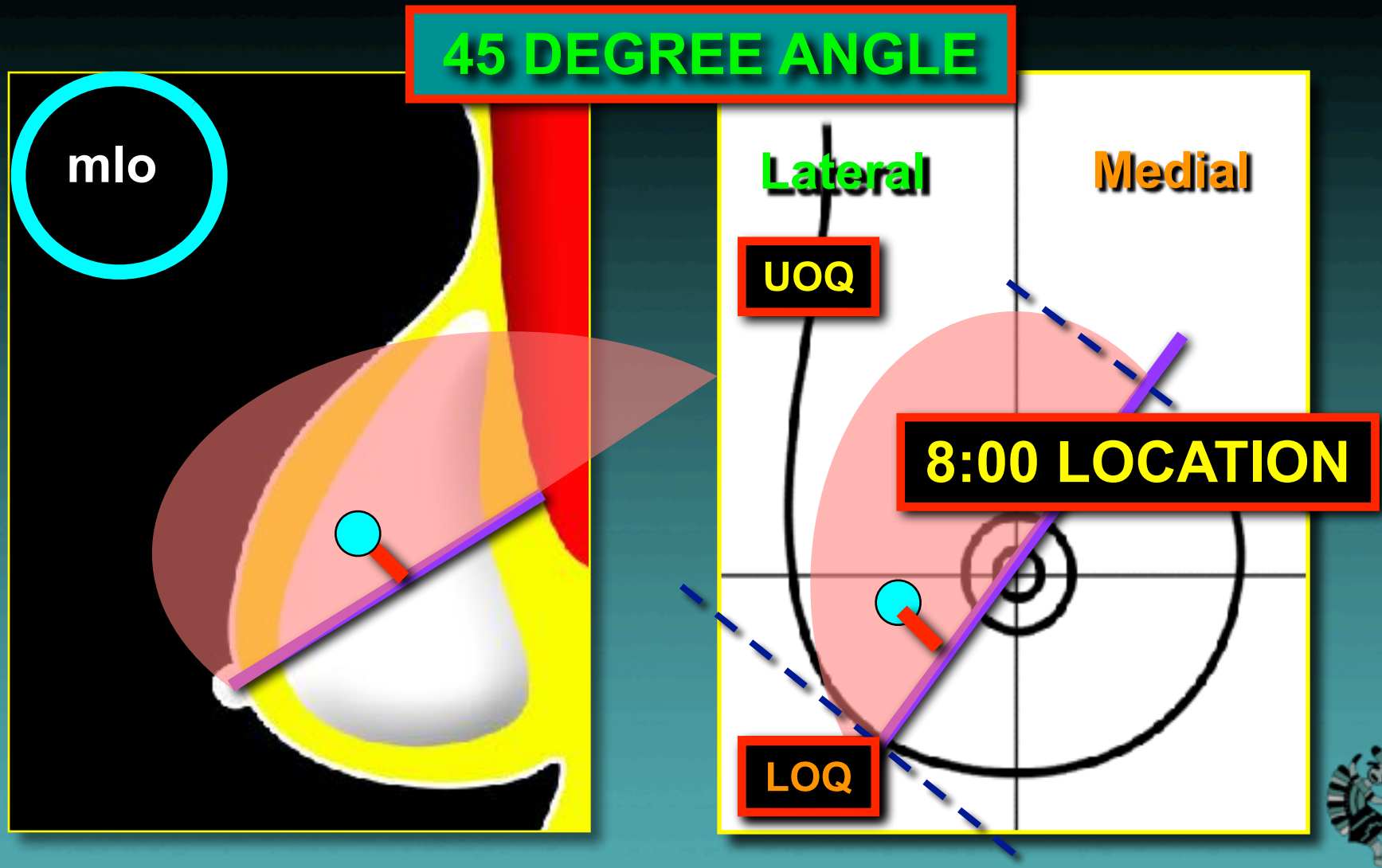
UOQ

UIQ

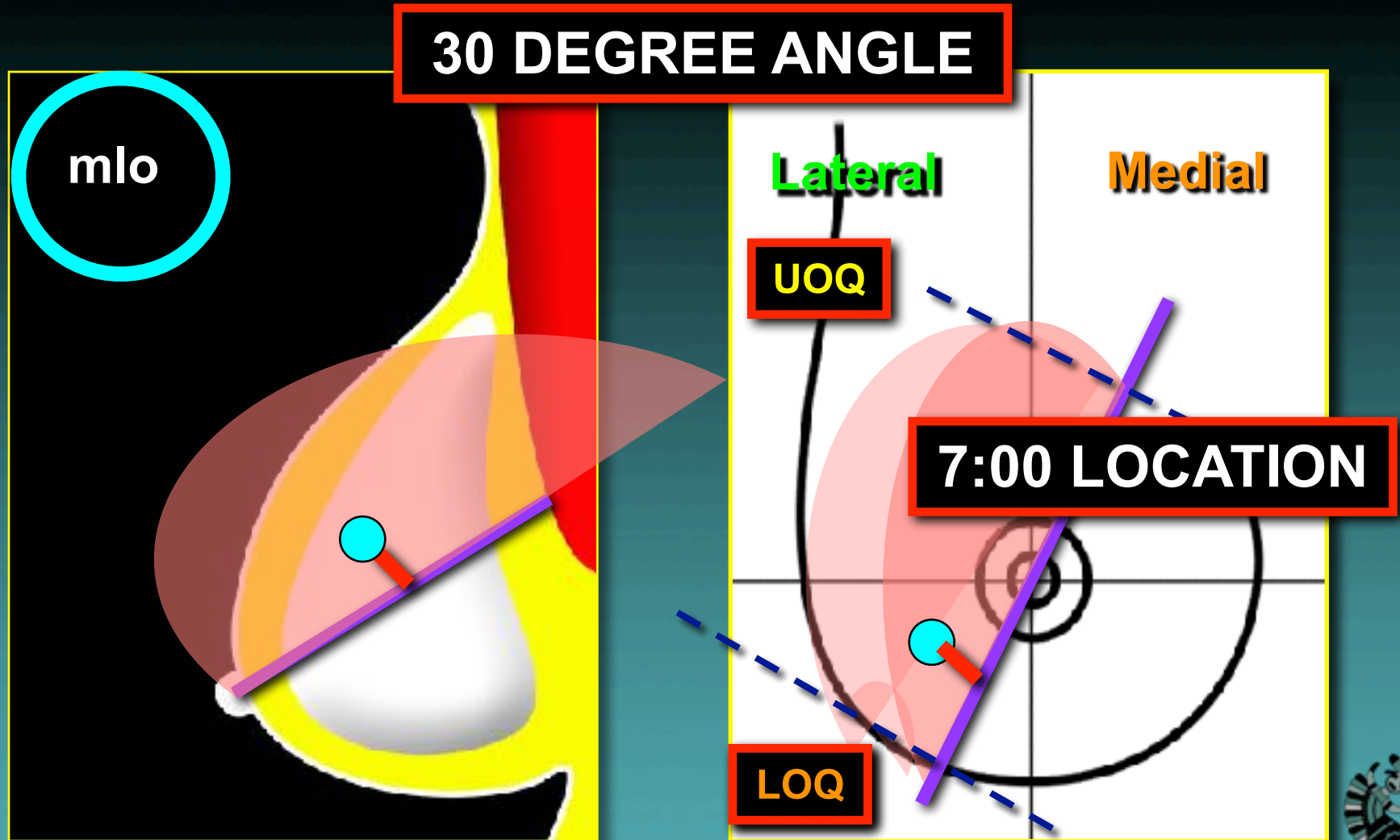
LOQ



THE SAME LESION IS SEEN ON THE MLO, BUT ANGLE IS 45 DEGREES



THE SAME LESION IS SEEN ON THE MLO, BUT ANGLE IS 30 DEGREES



**THEREFORE, A LESION SEEN ON
THE MLO VIEW MAY LIE IN A
DIFFERENT QUADRANT FROM
WHAT YOU WOULD EXPECT,
DEPENDING ON THE DEGREE OF
OBLIQUITY OF THE MLO
PROJECTION!!**



**WOULD TOMOSYNTHESIS HAVE
MADE ALL THESE TRIANGULATION
EXERCISES EASIER?**

YOU BET!



Thank you!

