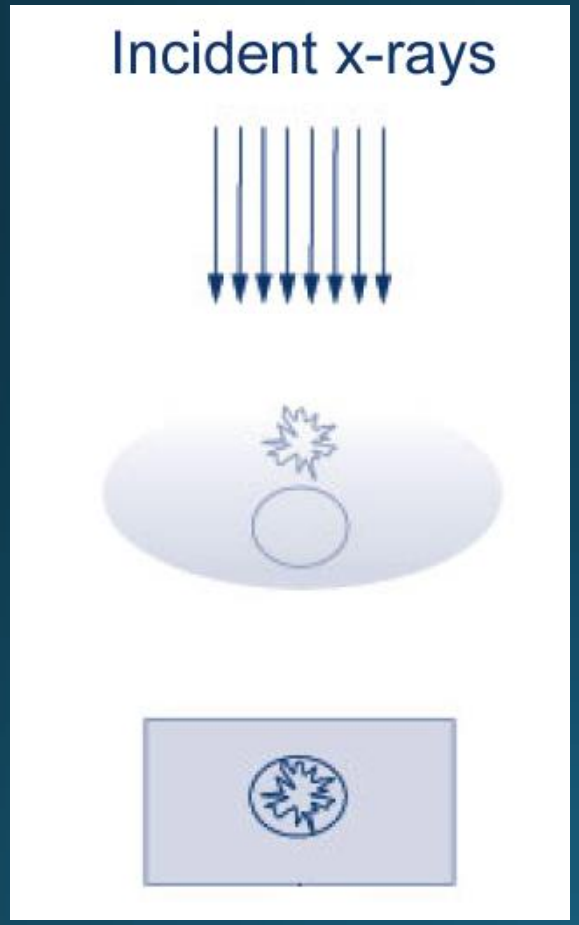
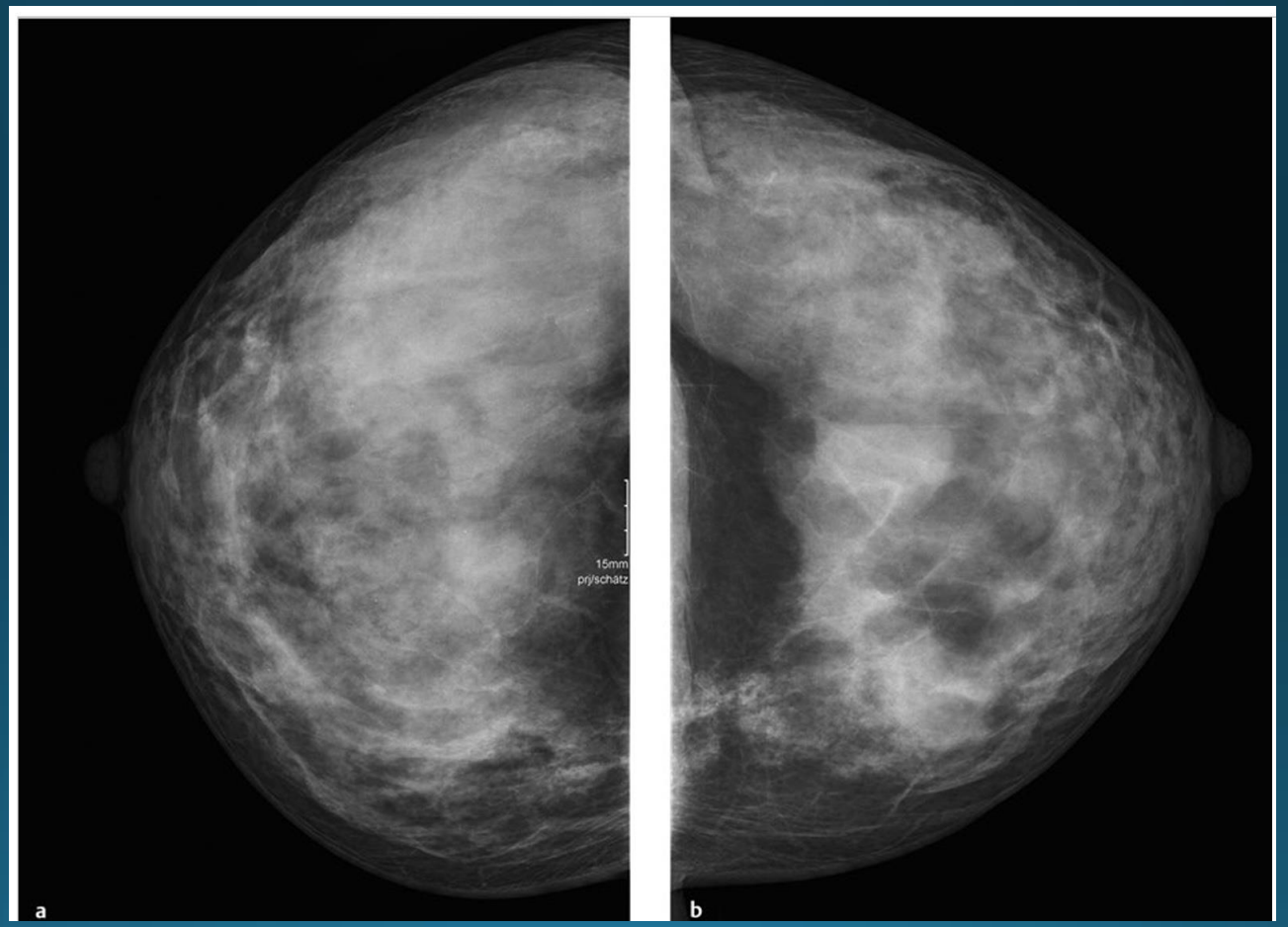
Dr.shahrzad dadgari

Digital breast tomosynthesis (DBT)

Mammography is a good tool for screening

Limitation of 2D-mammography



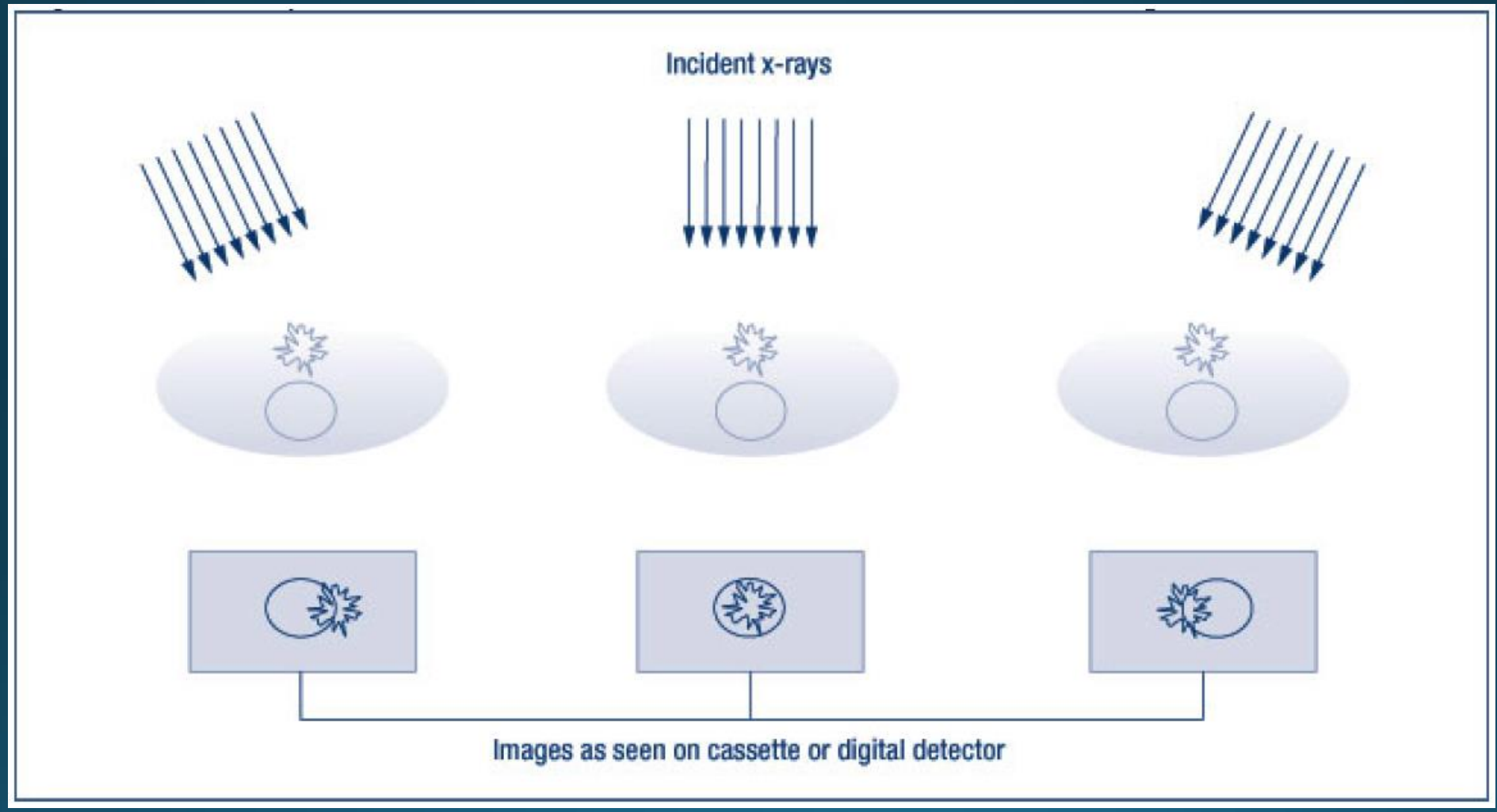


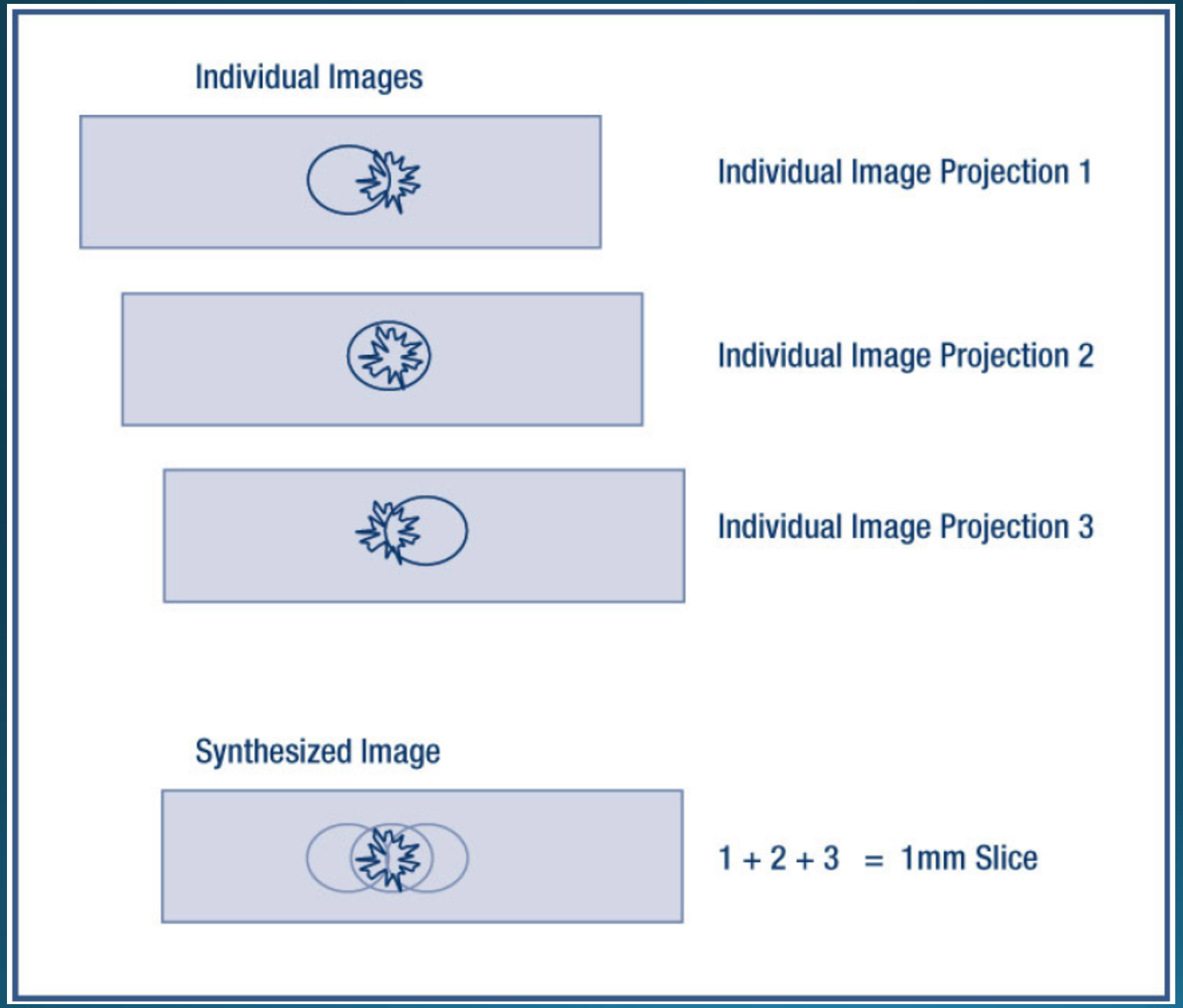
2D-mammography

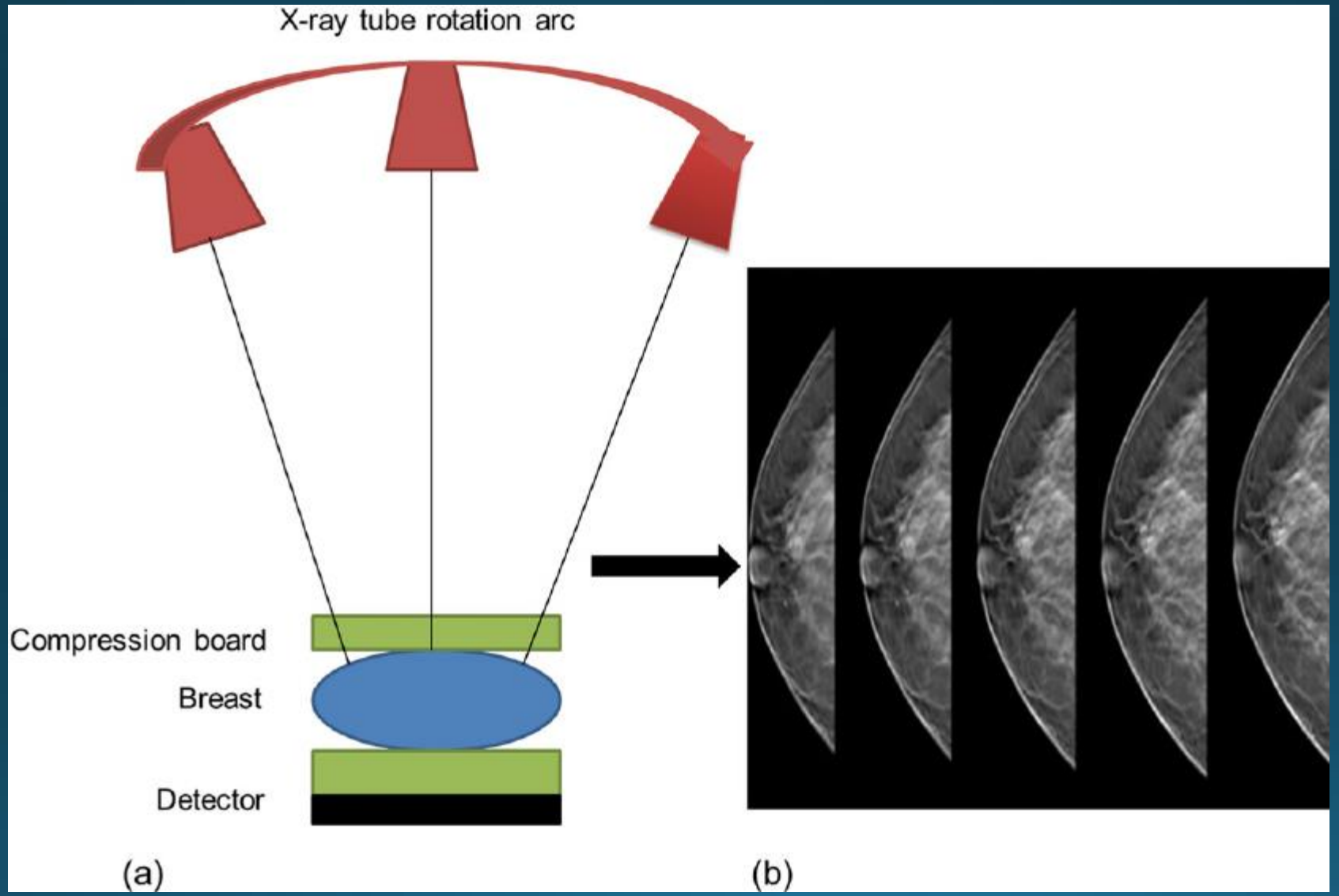
- 20% false negative
- 70% biopsies are benign

Tomosynthesis (3D-mammography)

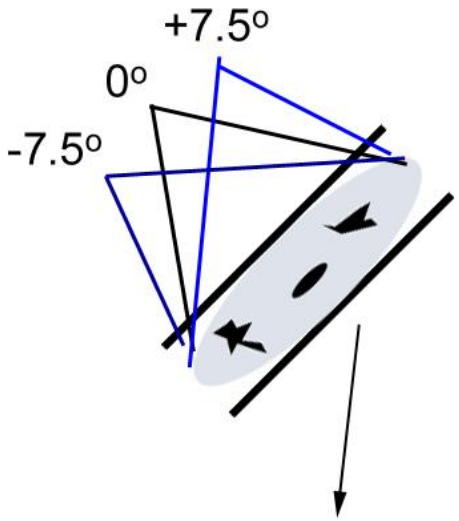
- Tomo : section
- Synthesis : elements form something new
- Three dimensional

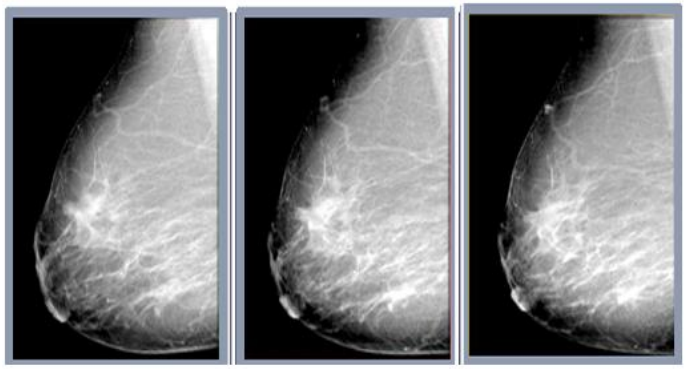

Incident x-rays
Images as seen on cassette or digital detector


Individual Images
Individual Image Projection 1
Individual Image Projection 2
Individual Image Projection 3
Synthesized Image
1 + 2 + 3 = 1mm Slice


X-ray tube rotation arc
Compression board
Breast
Detector
(a)
(b)

Projection images

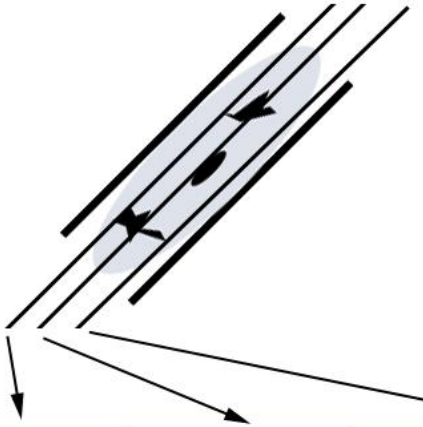


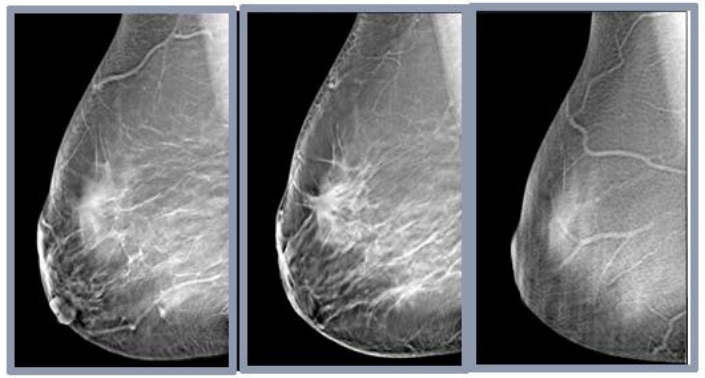


-7.5° 0° +7.5°

Views from different x-ray tube angles

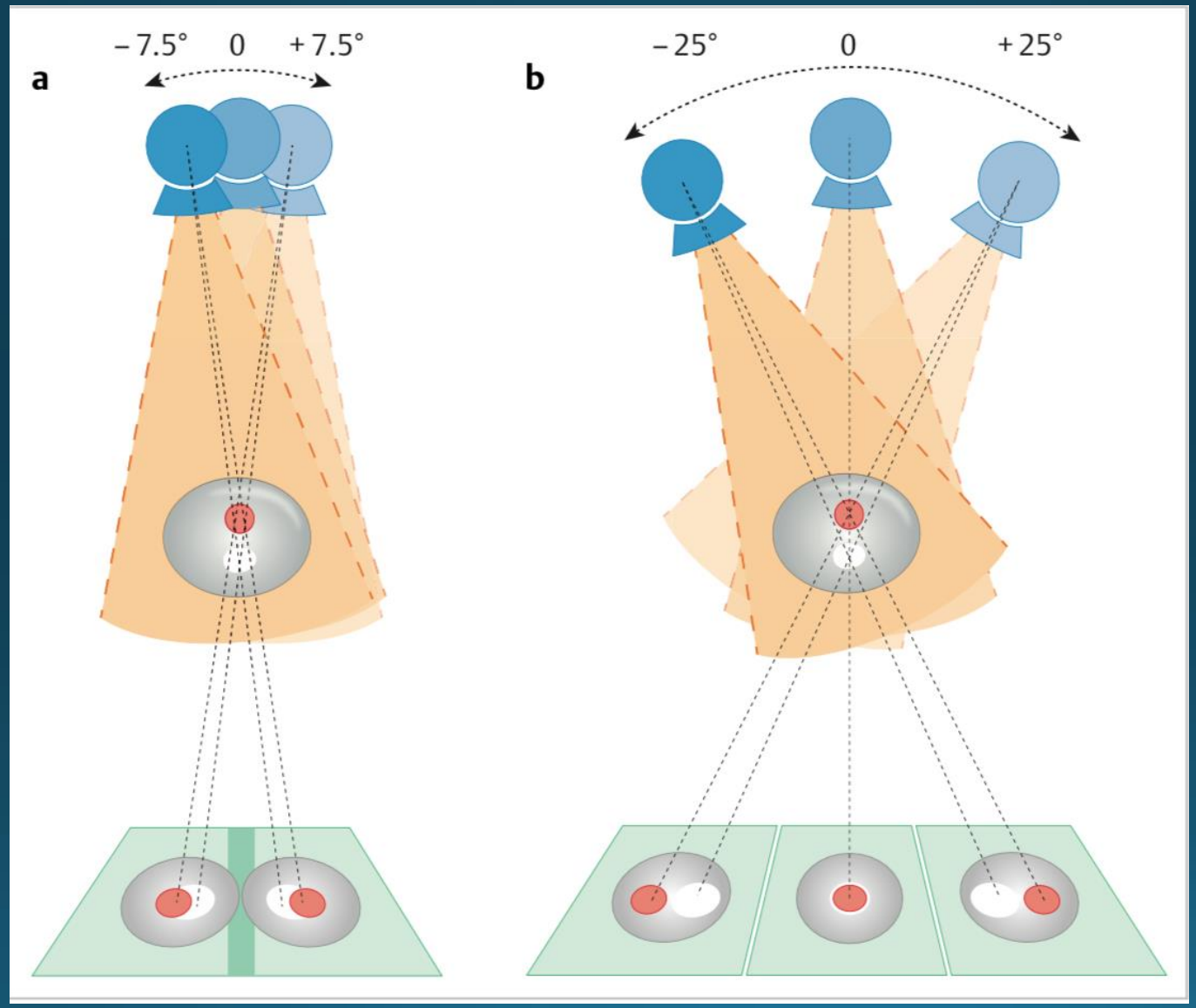
Reconstructed slices





35 mm 25 mm 10 mm

Slices at different heights

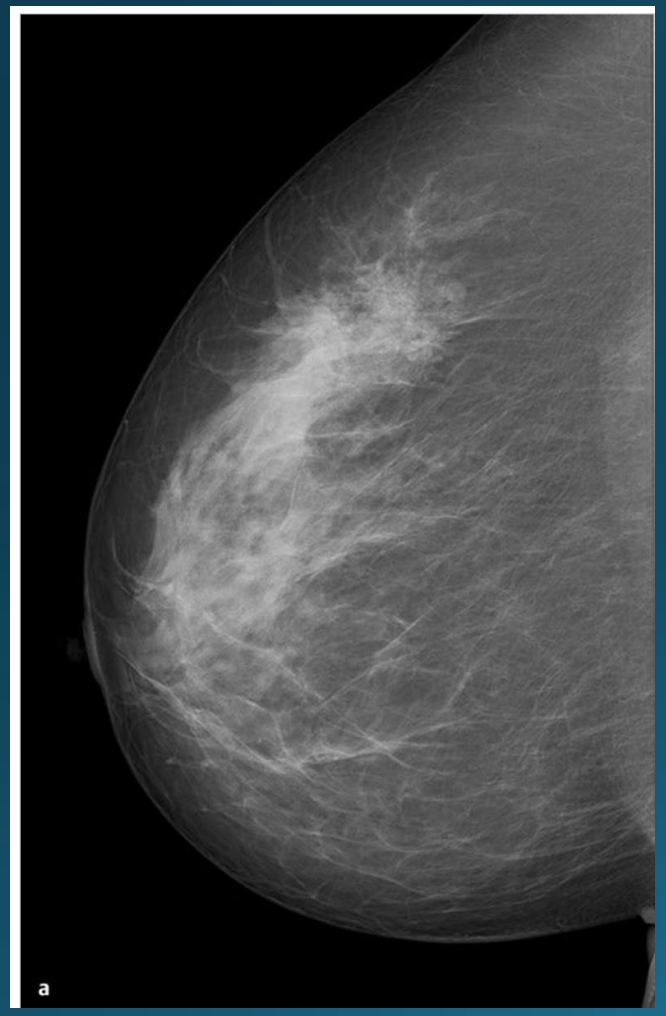

a
– 7.5°
0
+ 7.5°
b
– 25°
0
+ 25°


SIEMENS

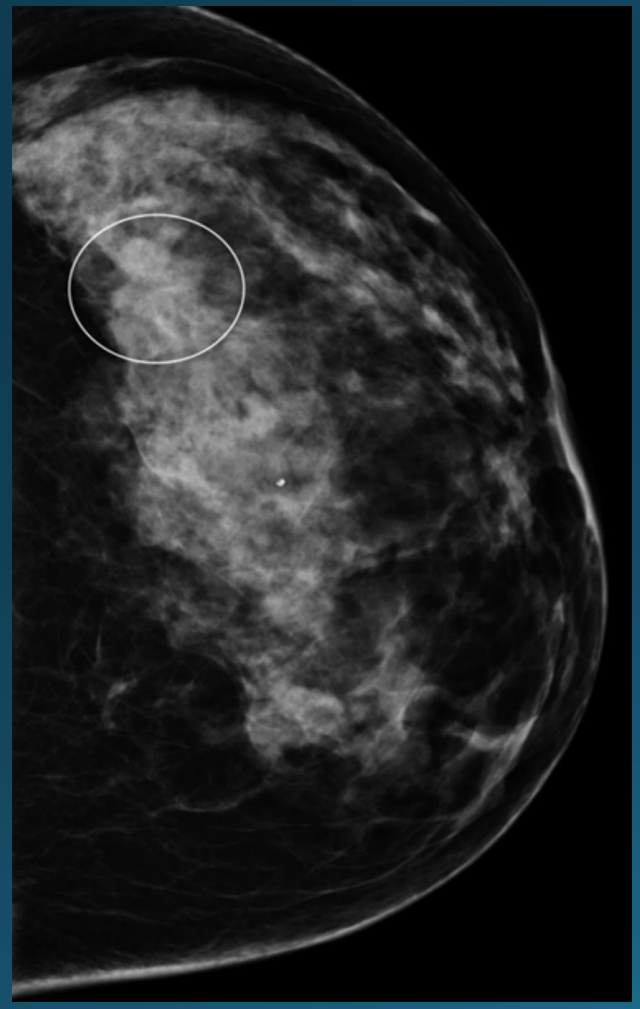
Parameters	GE Healthcare	Hologic Dimensions	IMS Giotto	Philips Microdose	Siemens Mammomat Inspiration
Status	CE-certified	CE-certified	CE-certified	Prototype	CE-certified
Tomosynthesis angle	25°	15°	40°	11°	50°
Number of projections	9	15	13	21	25
Tube motion	Step & shoot	Continuous	Step & shoot	Continuous	Continuous
Scan time (s)	7	4	12	3–10	25
Detector size (cm^2)	24 × 30	24 × 29	24 × 30	Multiple line detectors	24 × 30
Detector pixel (µm)	100	140	85	50	85
X-ray converter	CsI/a-Si	a-Se	a-Se	Si	a-Se
Radiation	Rh/Rh	W/Al	W/Rh	W/Al	W/Rh

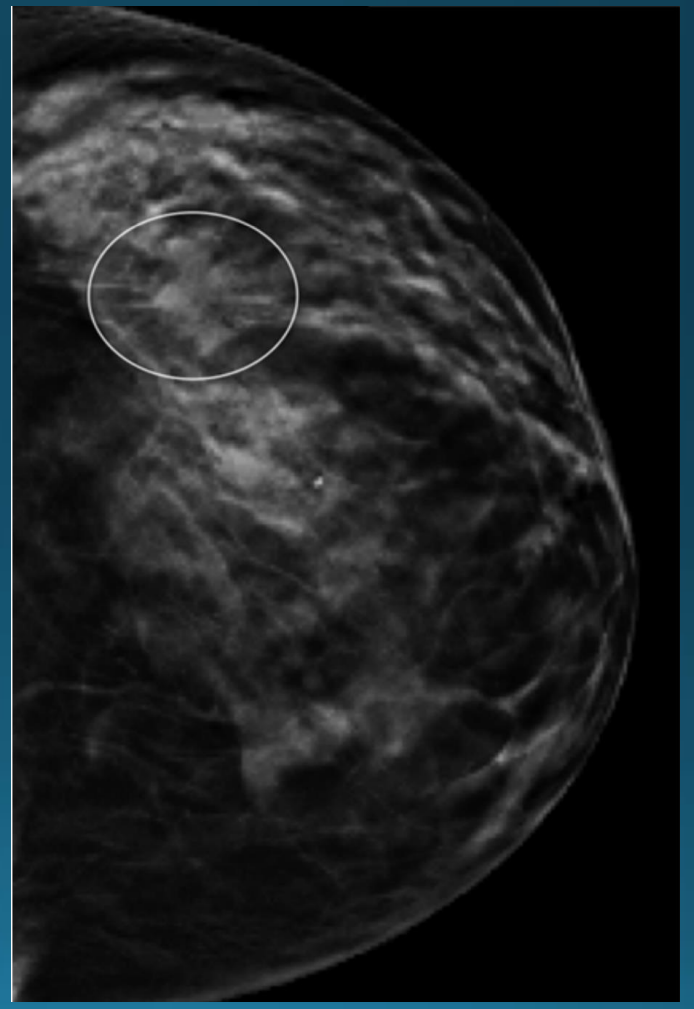
DBT advantage

1-improve sensivity (overlapping tissue)

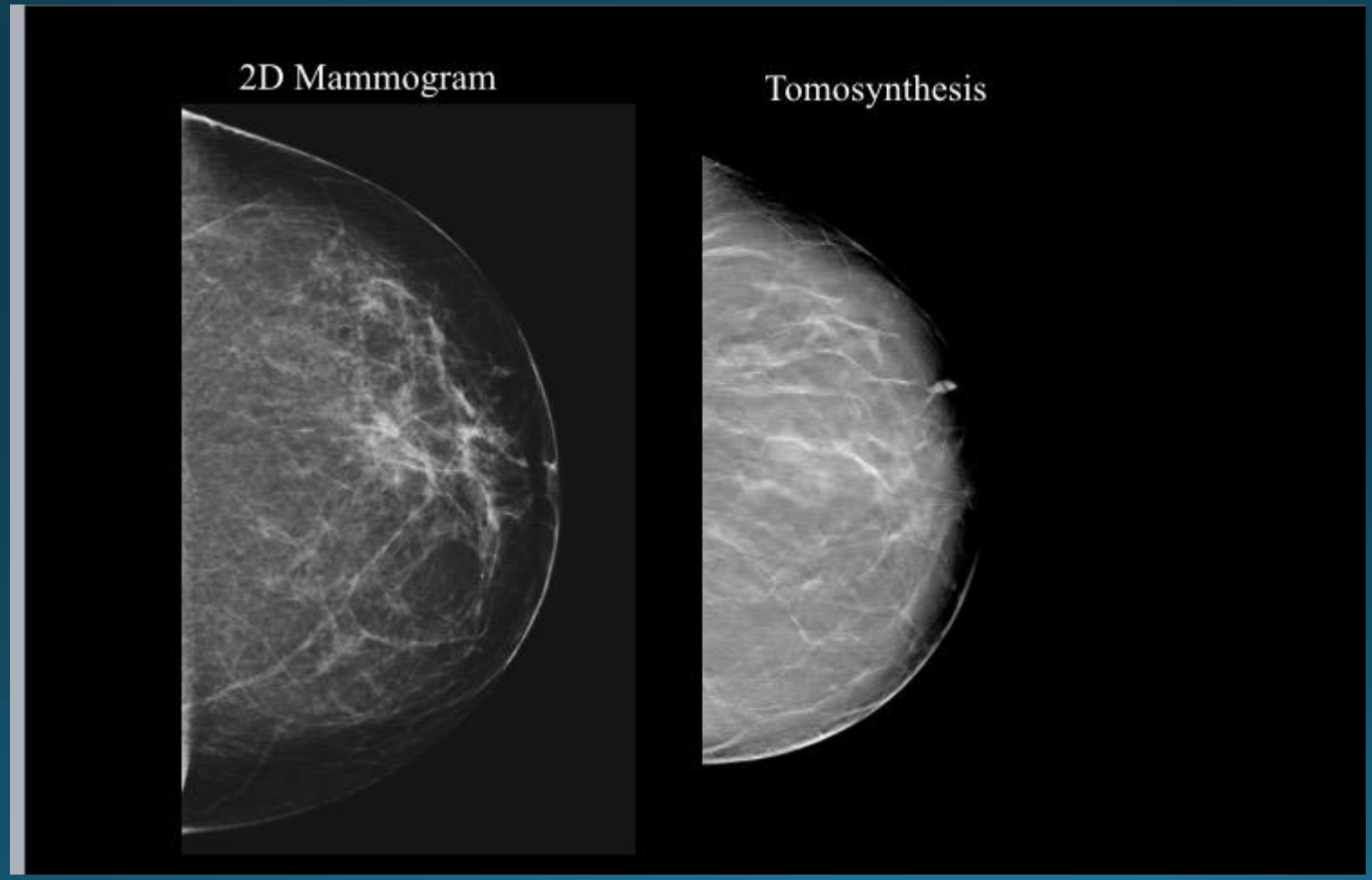


a. Increased cancer detection rate

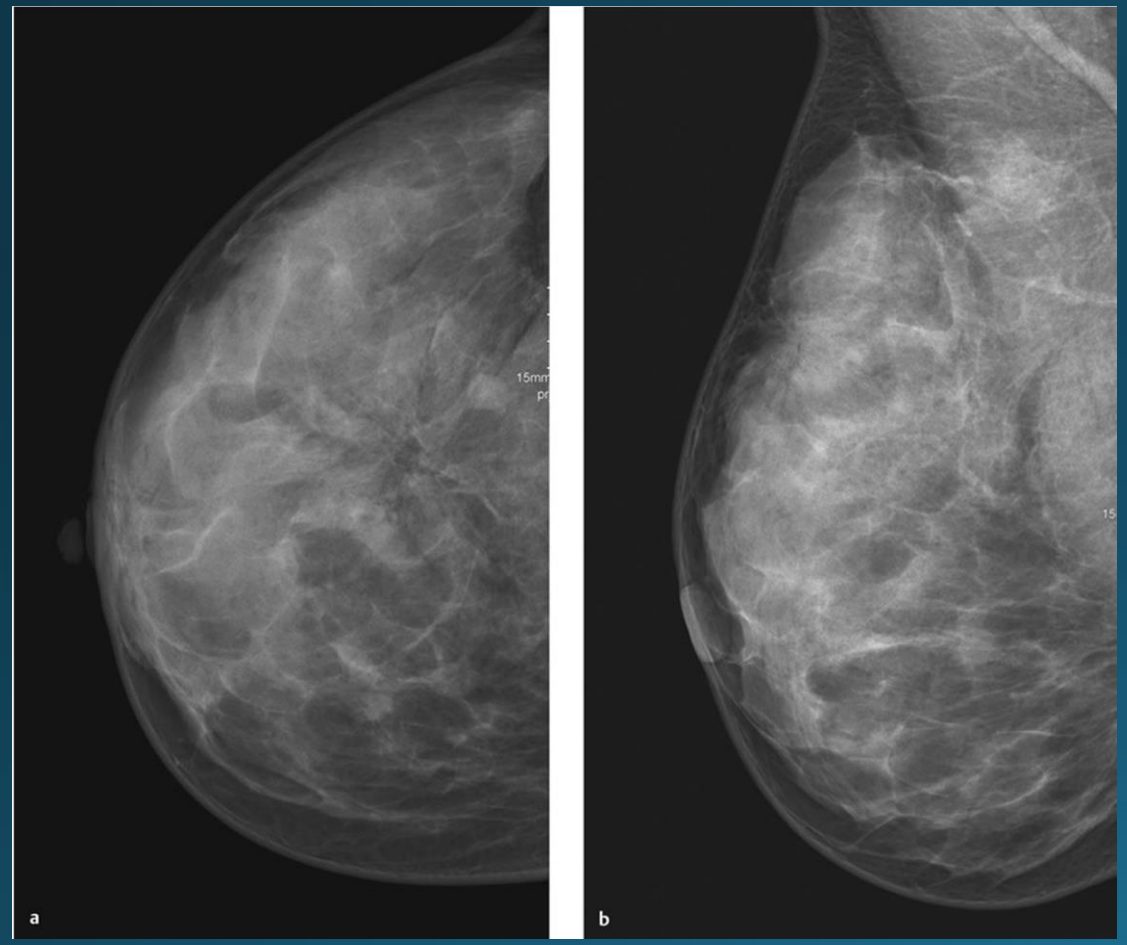


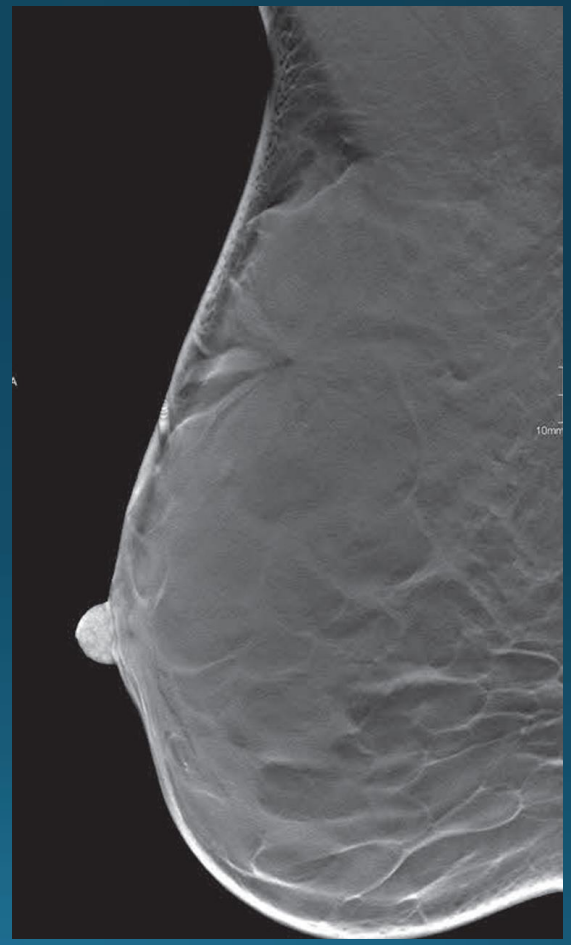


b. Small invasive cancer



c. Increased detection of AD

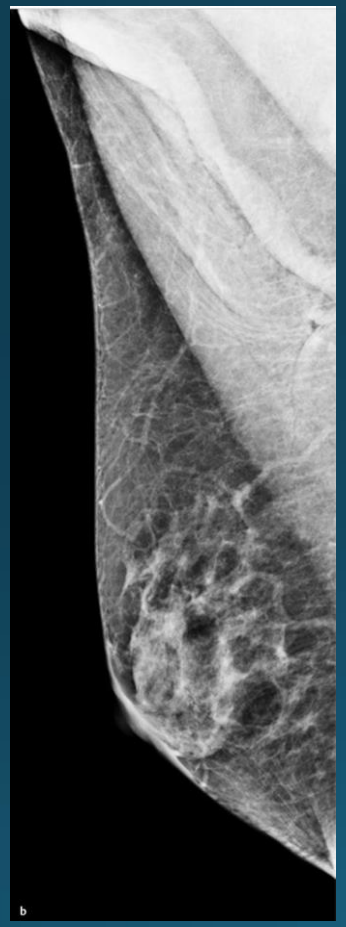




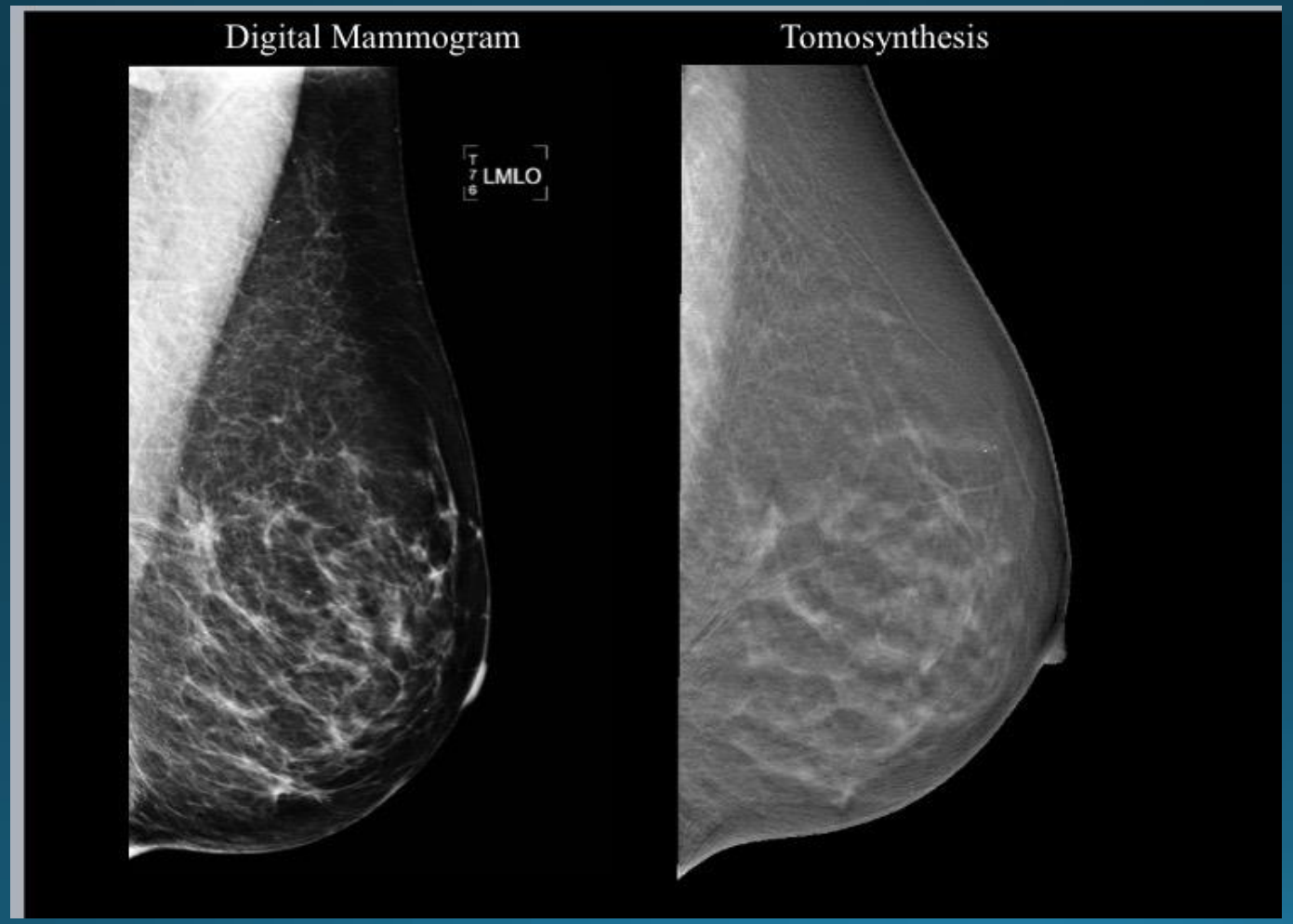
Increased detection of AD

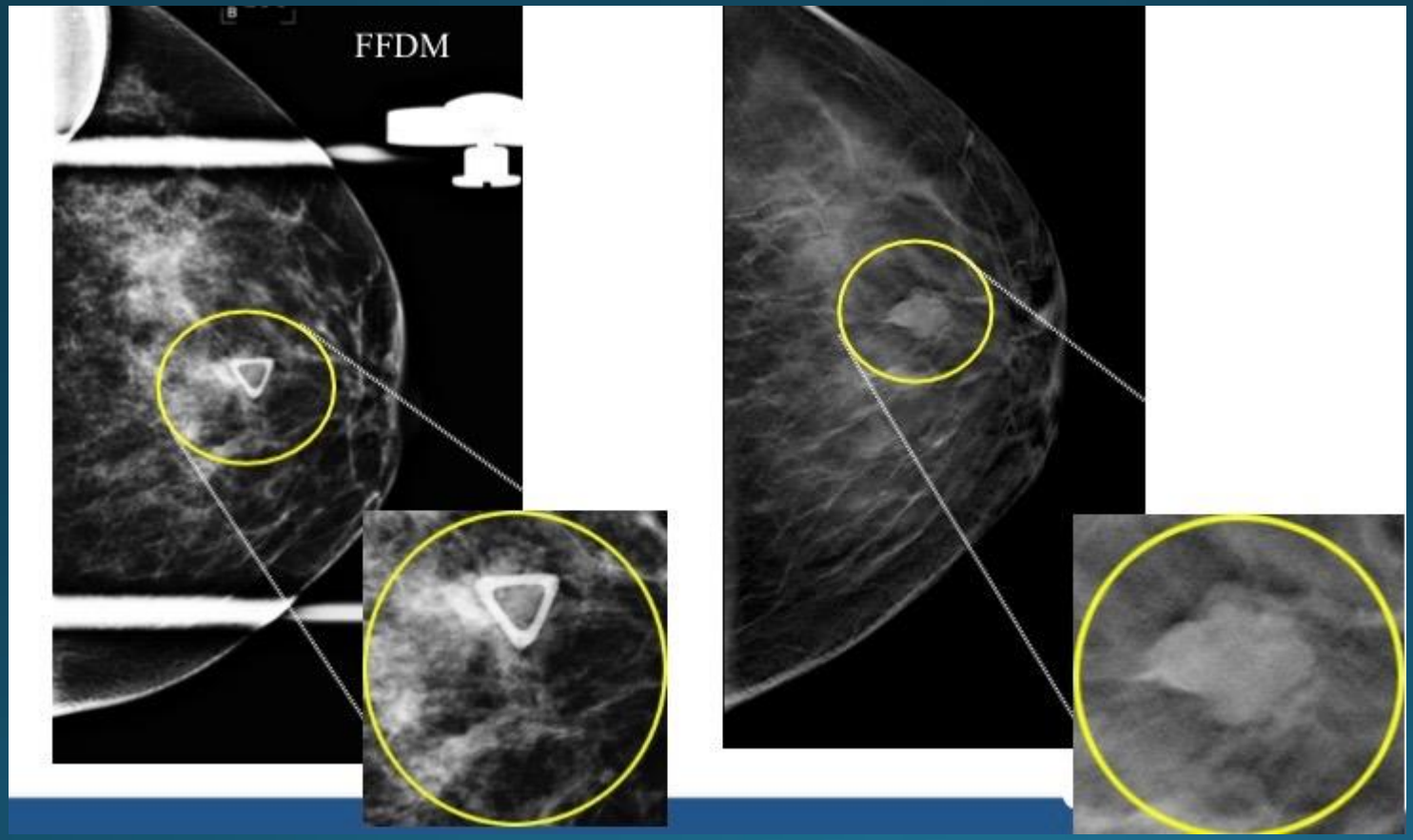
- 100 % better seen on DBT
- 73 % only seen on DBT
- Maybe one view only (CC better than MLO)

2-characterization of lesion

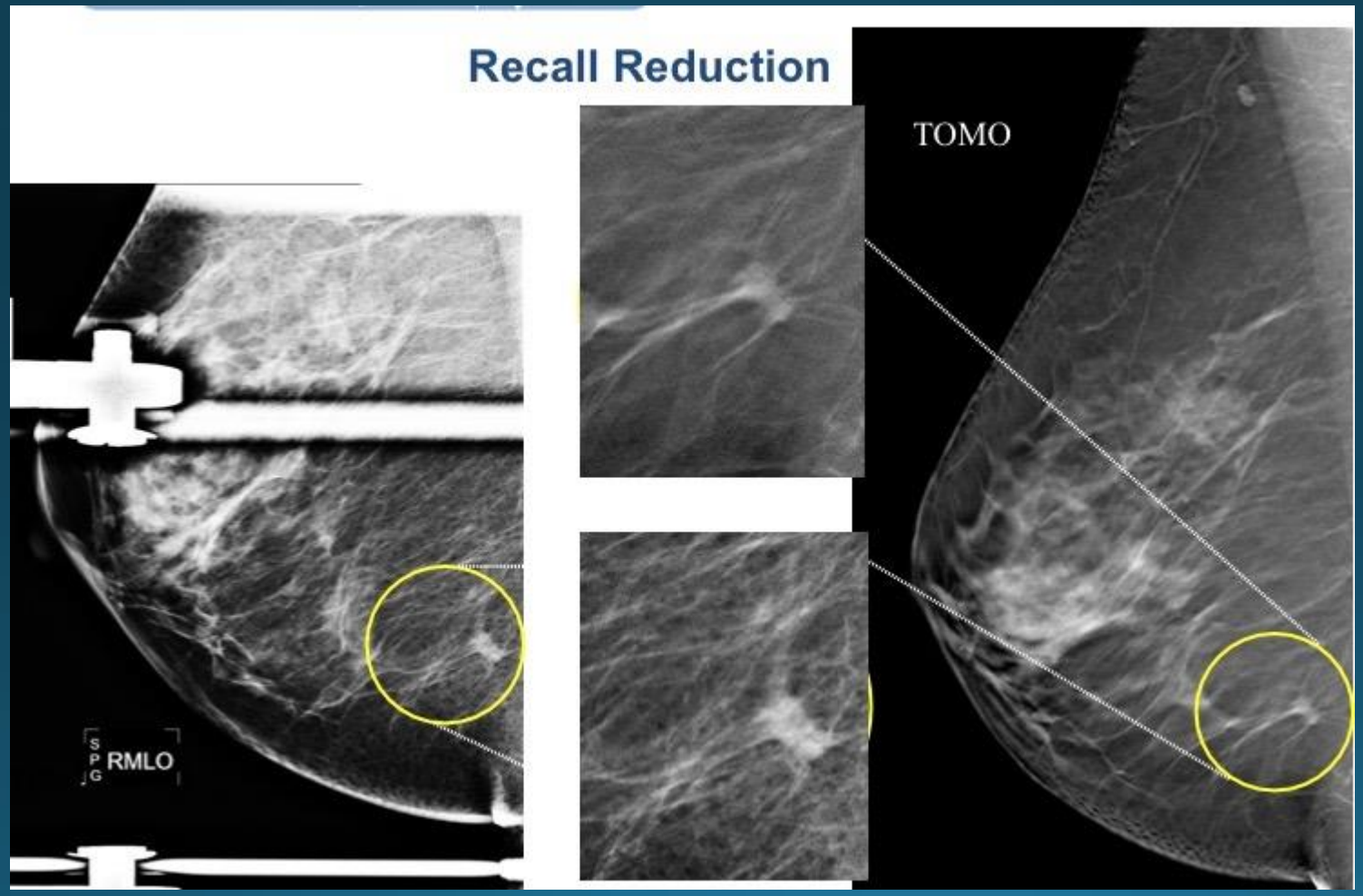


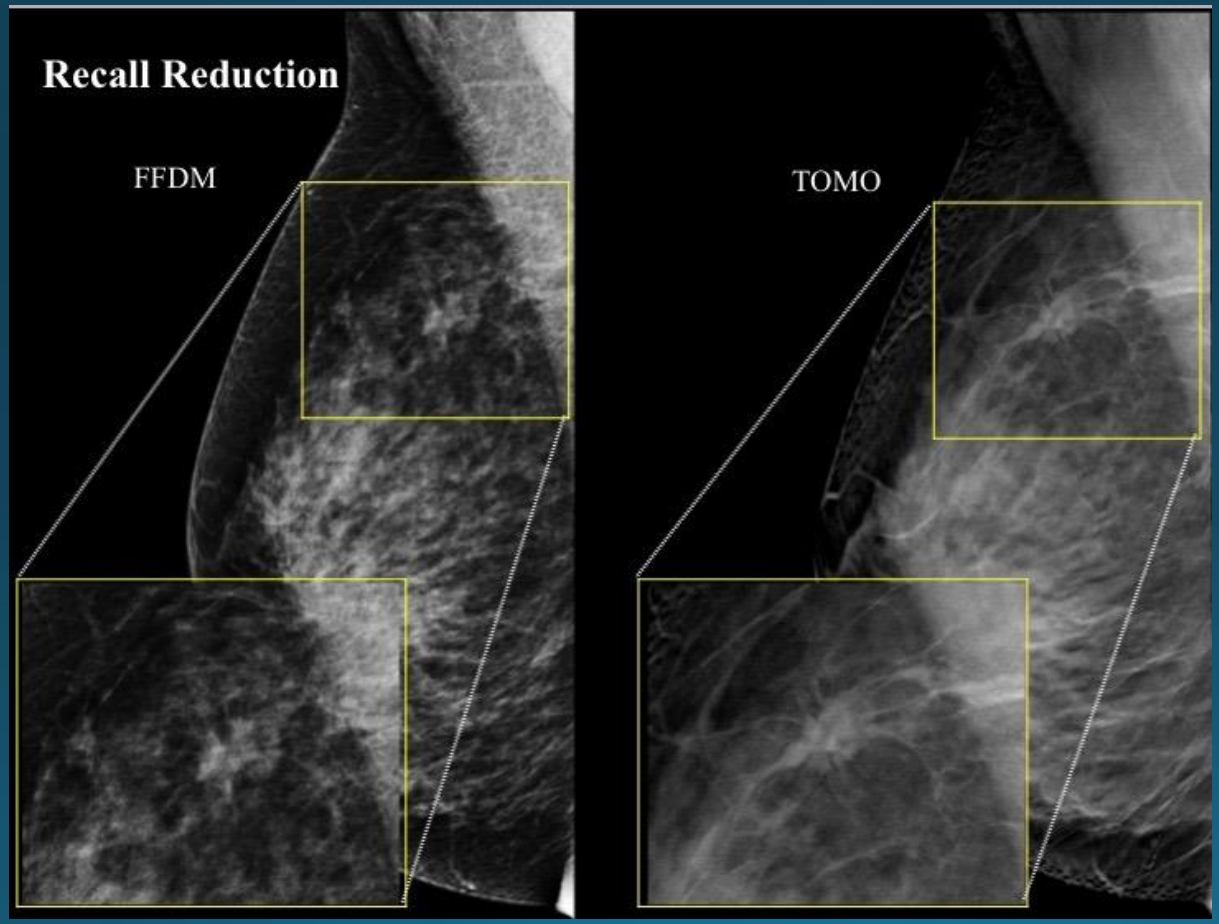
3-reduce call back (30%)

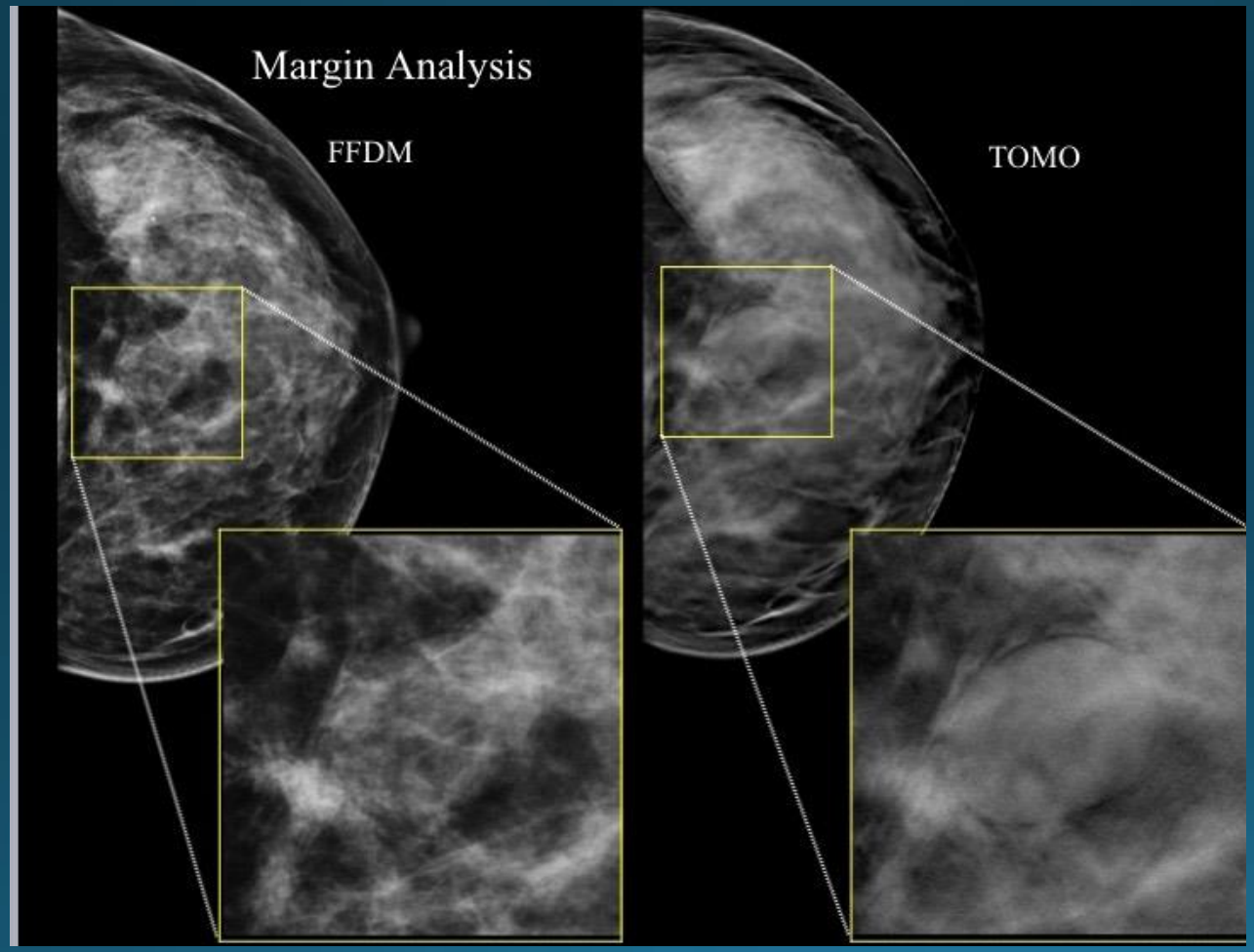



FFDM

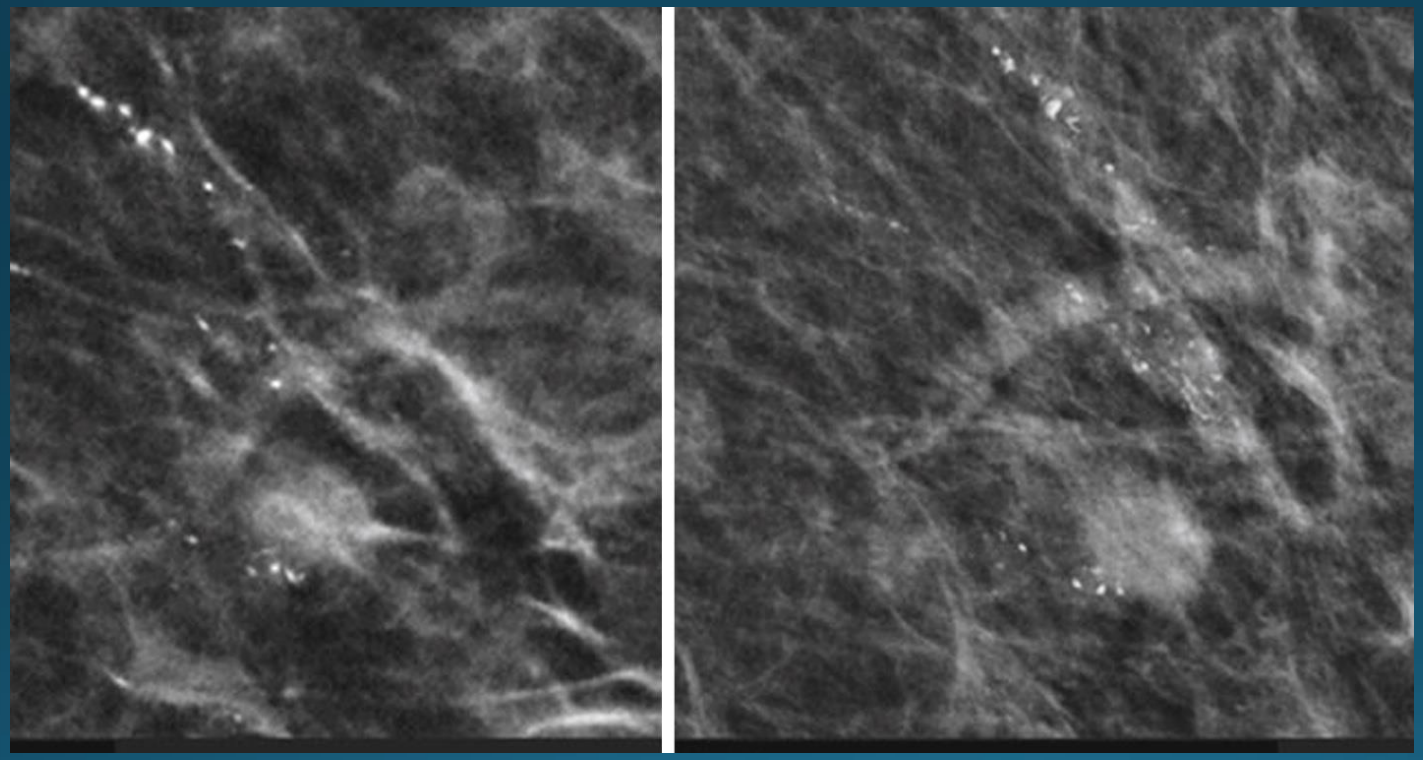
Recall Reduction

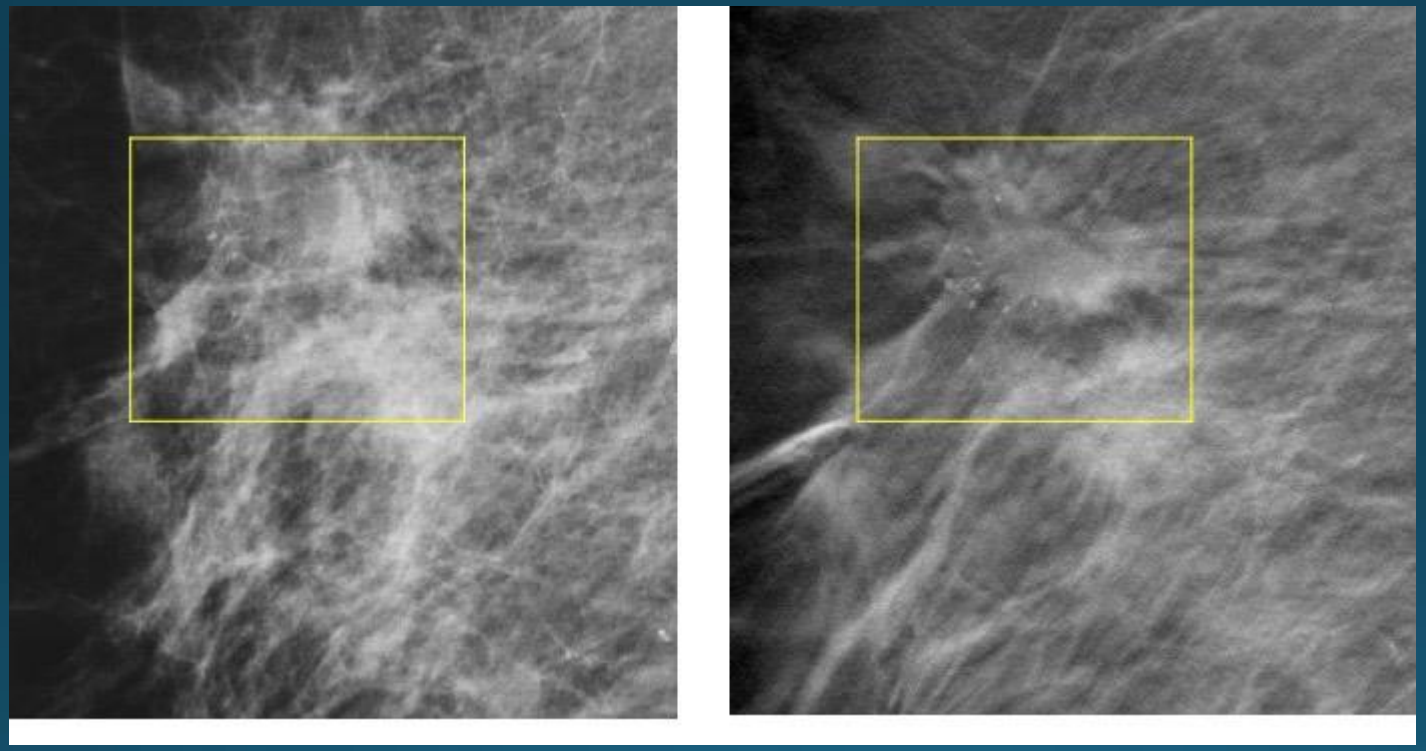



Recall Reduction
FFDM
TOMO

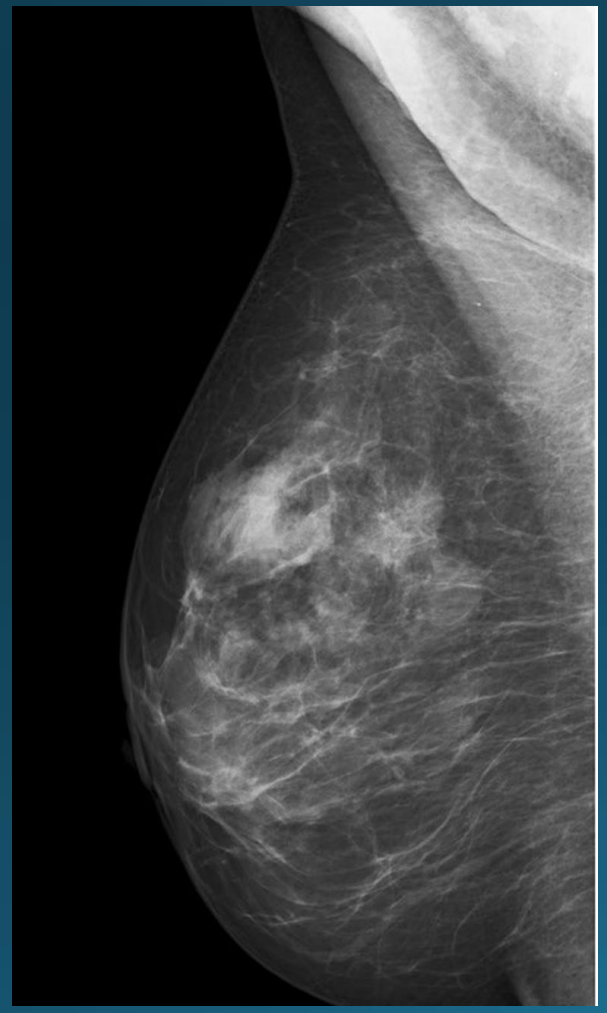

Margin Analysis
FFDM
TOMO

4-calcification in DBT



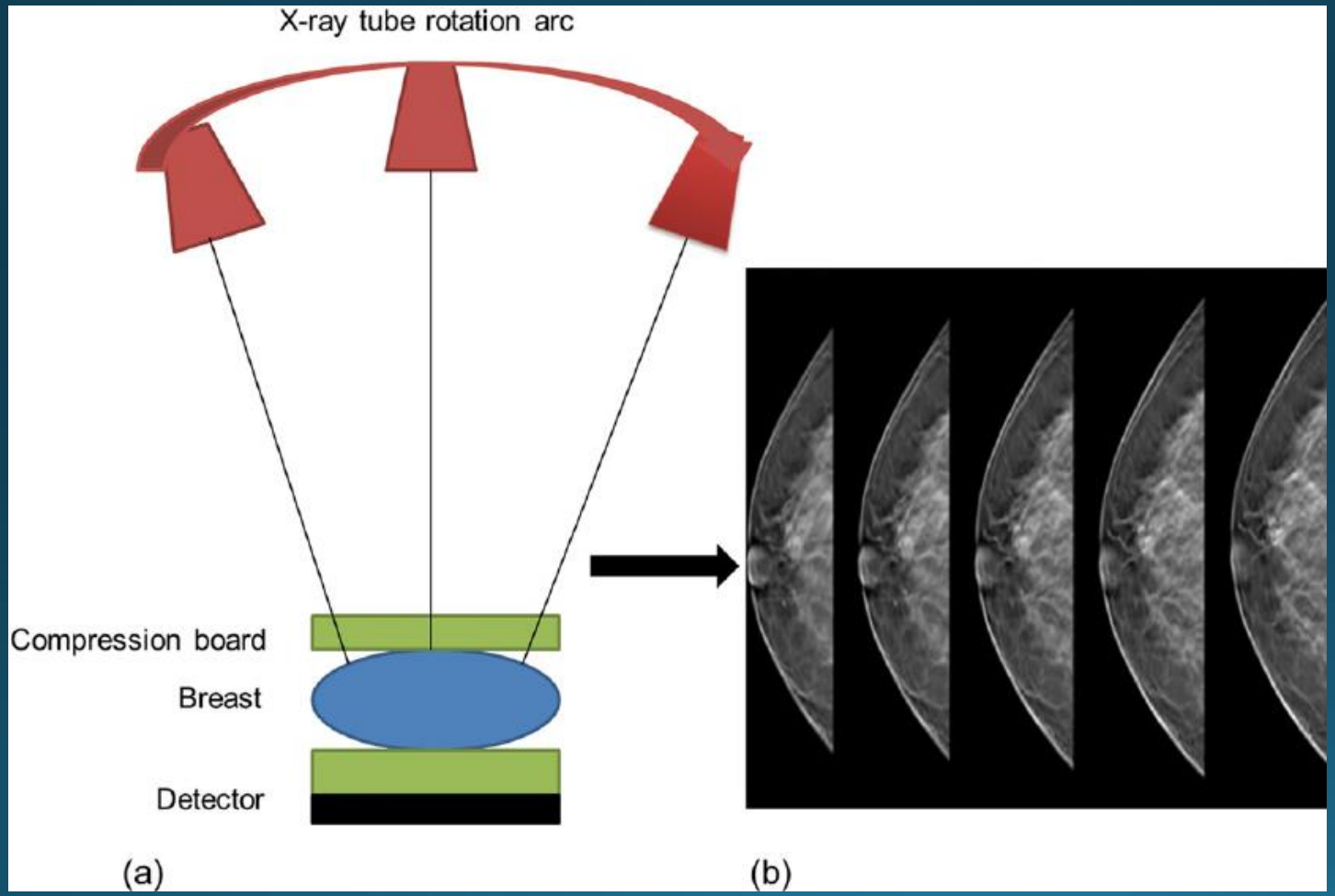


5-better detection of multicenteric cancer



DBT

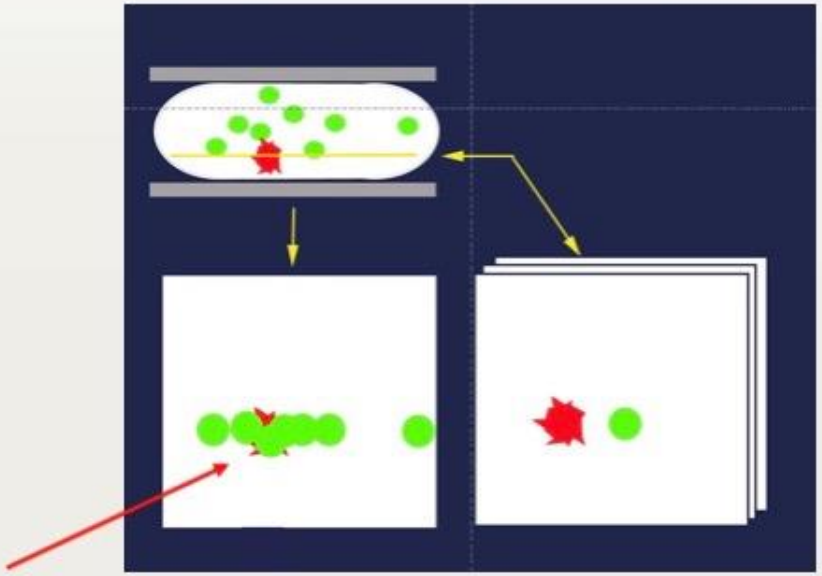
- Multiple low dose digital mammography images are obtain along an arc + reconstruction of image (3D)


X-ray tube rotation arc
Compression board
Breast
Detector
(a)
(b)

Potential for Less Compression

Compression not needed to minimize tissue overlap (structure noise)

Still need compression to reduce patient motion



HOLOGIC

DBT technique

- Like tomography in plan structures are in focus , out of plan structures are blurred

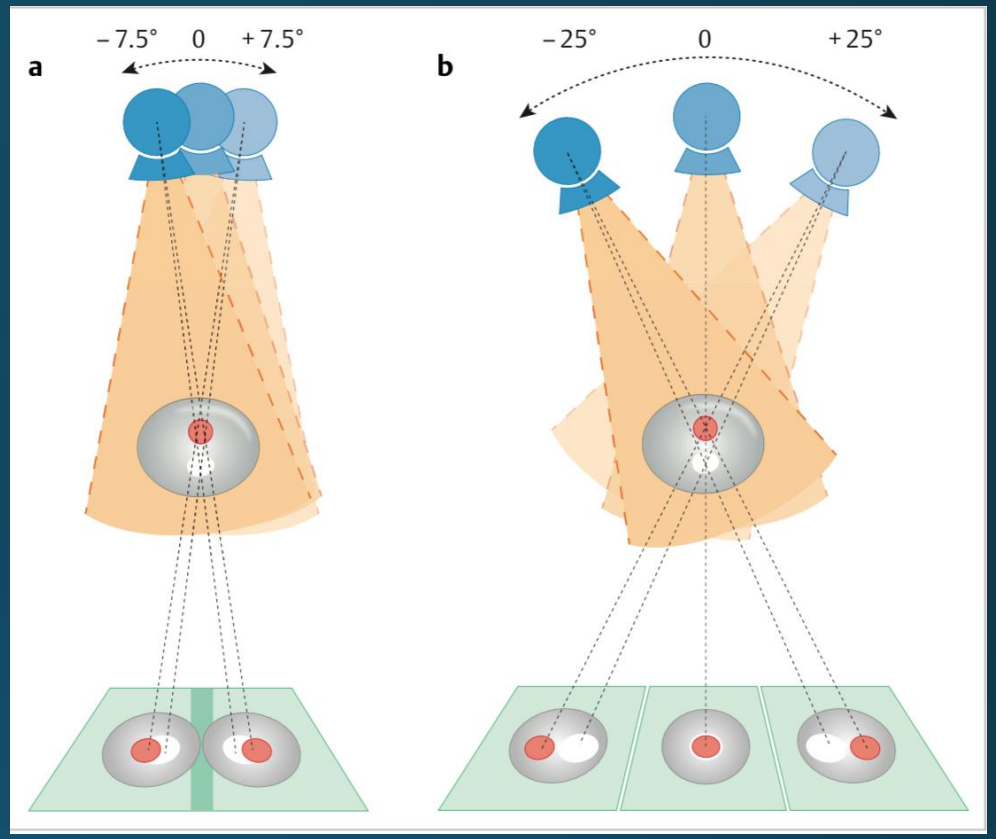
- Unlike tomography , reconstructed a series of image (like CT)

DBT is not CT

- Voxels are not isotropic on DBT
- Can not product 3D reconstruction
- Can not use localizer

Sweep angle

- More exposure : less artifact
- Long scan time : more motion
- Large angle : better slice separation longer time
- Small angle : better focus per slice



Do you need 2D + 3D ?

- No (double dose)

DBT + synthetic 2D mammography (SM) vs digital mammography (2D)

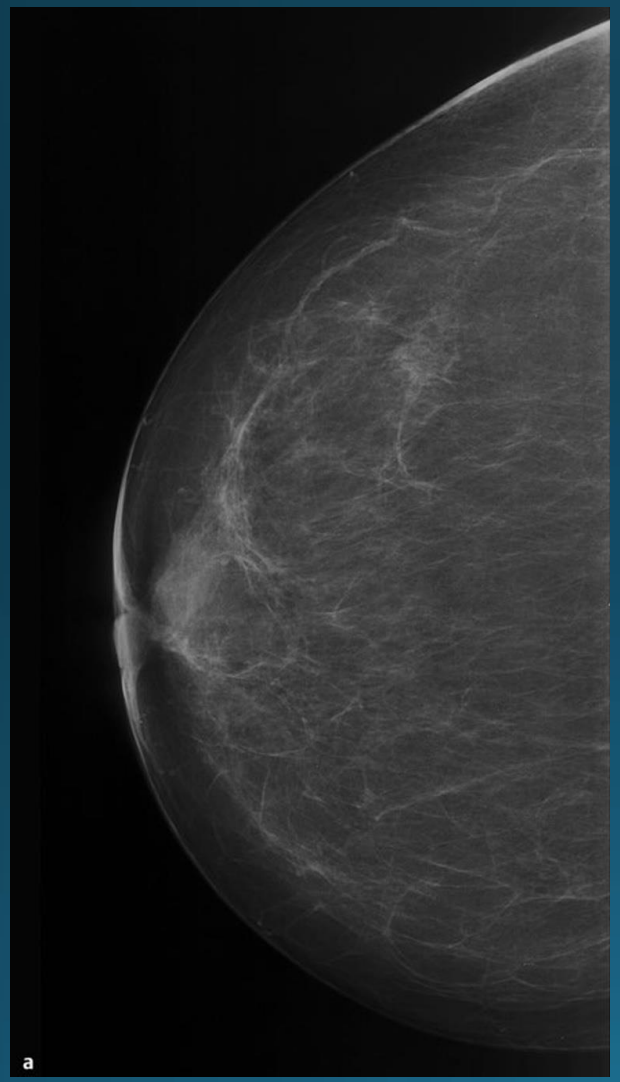
- Do we need two view on DBT ? Yes
- Calcifications on DBT require to magnification view ? Yes
- All PACS are not support DBT

Description of lesion on DBT

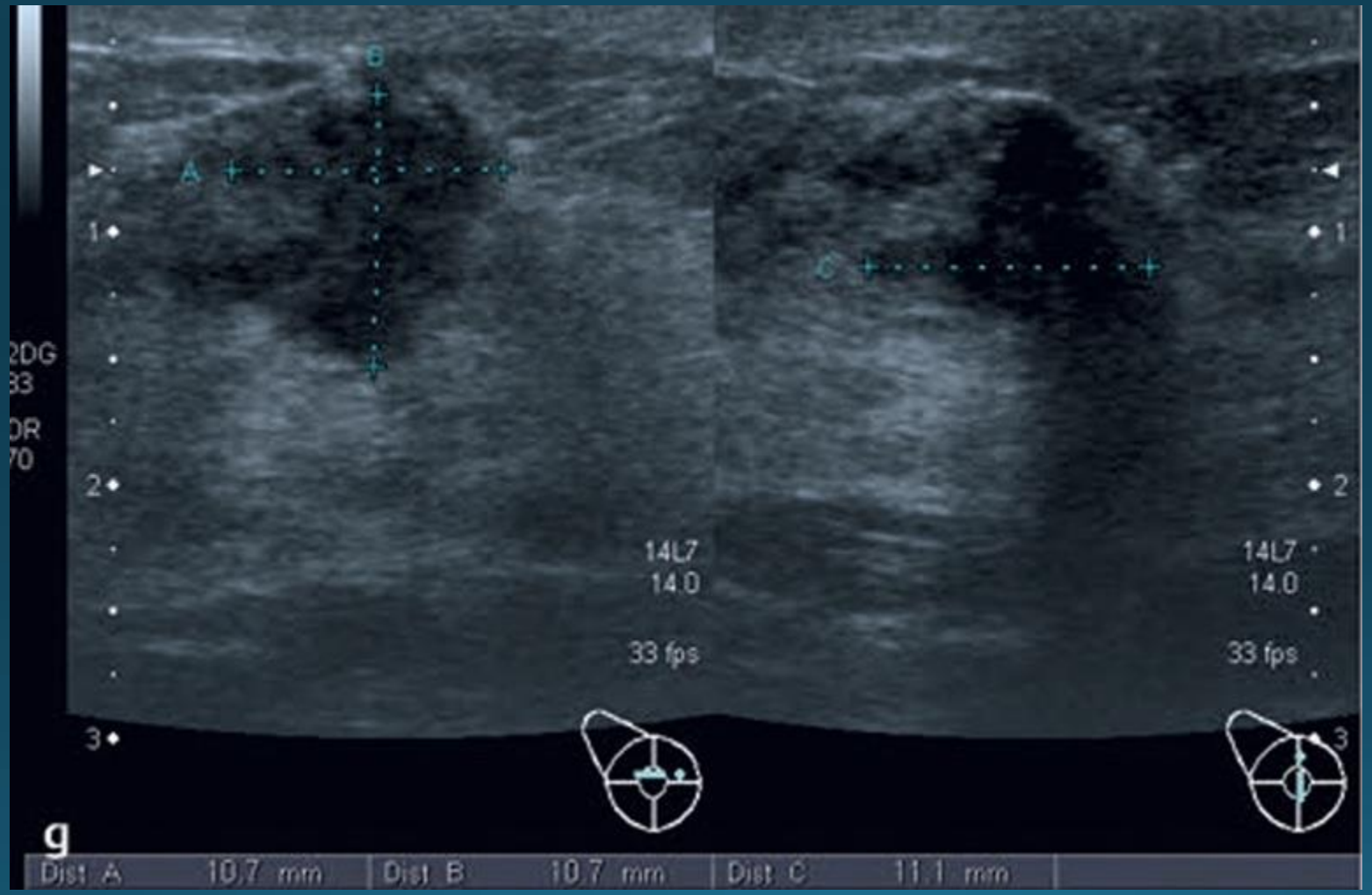
- Side , clock , depth

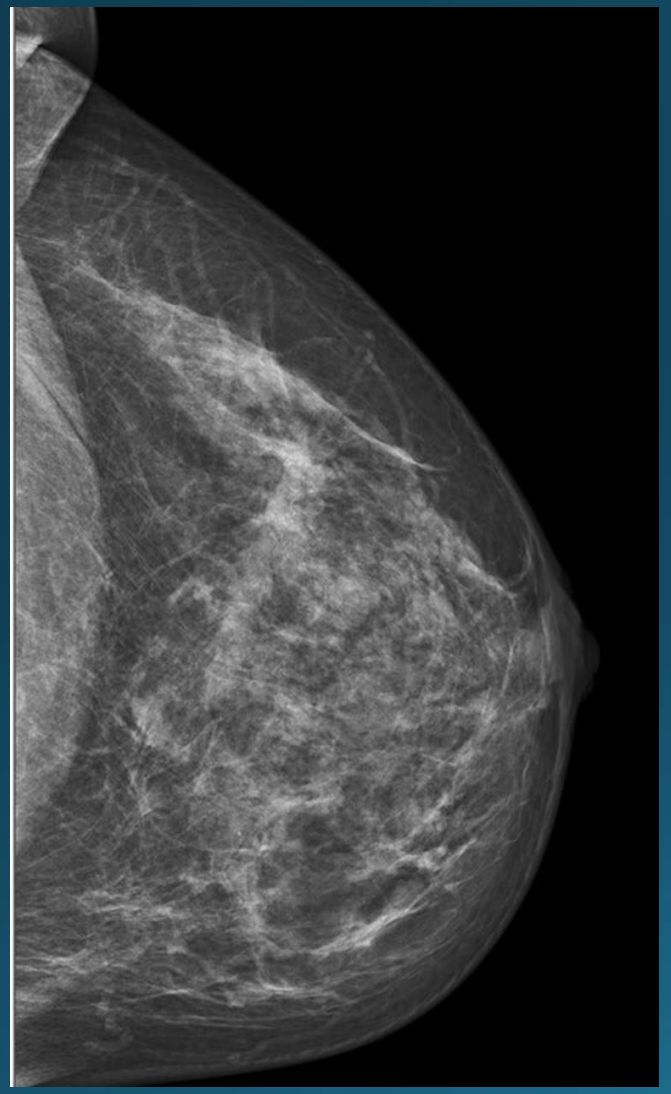
- Slice number

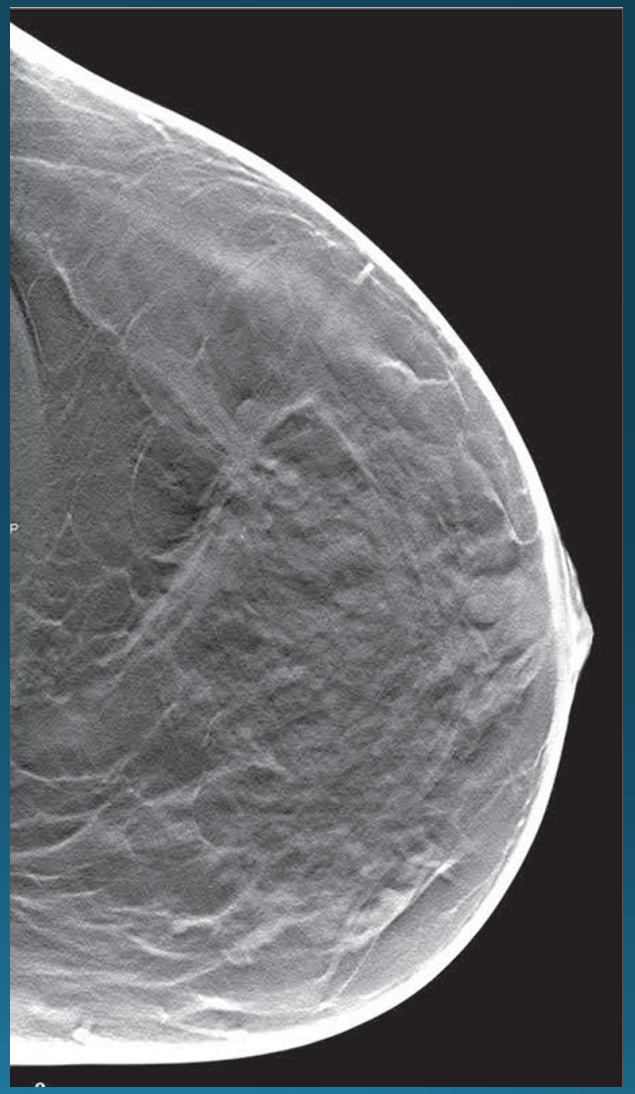
  CC view slice 41/55 MLO view slice 33/55

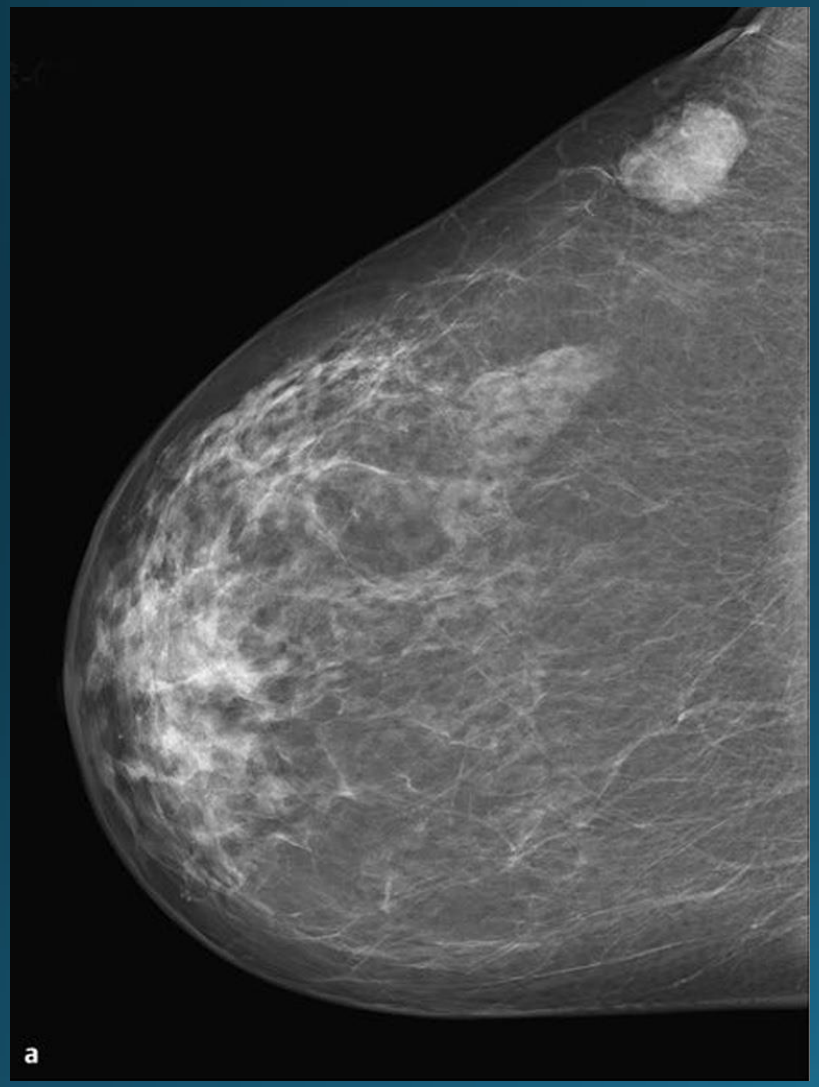

a


A
15mm
e


14L7
14.0
33 fps
14L7
14.0
33 fps
Dist A 10.7 mm
Dist B 10.7 mm
Dist C 11.1 mm






a


THANK
YOU