Criteria for Mammographic Image Assessment

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ACR Criteria for Mammographic Image Assessment

Course Topics:

Review of Positioning Criteria for Routine Mammograms

- Medio lateral Oblique (MLO)
  - Assessment of the MLO image by means of:
    - Posterior nipple line
    - Inframammary fold
  - Clinical image evaluation using MLO positioning criteria
  - Evaluation of adequate compression on MLO images
- Cranio-caudal (CC)
  - Assessment of CC image by means of:
    - pectoral muscle
    - posterior medial breast
  - Clinical image evaluation using CC positioning criteria
  - Evaluation of adequate compression on CC images

ACR Criteria for Mammographic Image Assessment

Course Topics:

Review of Technical Aspects with Clinical Image Examples

Positioning* • Compression* • Exposure level • Contrast • Sharpness • Noise • Artifacts • Exam identification

Administrative Concerns

- Labeling

National Statistics (MQSA)

Certified facilities, as of October 1, 2015	8,737
Certification statistics, as of June 1, 2016	
Total certified facilities / Total accredited units	8,740 / 16,155
Certified facilities with FFDM[2] units / Accredited FFDM units	8,506 / 12,508
Certified facilities with DBT[3] units / Accredited DBT units	2,444 / 3,362
FY2016 inspection statistics, as of June 1, 2016	
Facilities inspected	5,271
Total units at inspected facilities	9,257
Percent of inspections where the highest noncompliance was a:	
Level 1 violation	0.6%
Level 2 violation	7.8%
Level 3 violation	3.6%
Percent of inspections with no violation	88%
Total annual mammography procedures reported, as of June 1, 2016[1]	39,298,731

Film Checks

Under MQSA, the ACR is required to conduct "random clinical image reviews of a sample of facilities to monitor and assess their compliance with standards established by the body for accreditation." The ACR uses this review as an opportunity to provide facilities with mid-cycle educational feedback on image quality. The review is conducted by means of a validation film check of approximately 300 randomly selected facilities each year. The ACR validation film check evaluates the following:

- Clinical image quality
- Phantom image quality
- Quality control

The ACR recognizes that the clinical images selected for this evaluation may be drawn from a relatively small sample of images in relation to the total number of mammograms performed at the facility. Furthermore, variations in image quality may be attributed to the natural anatomical differences present in the female population. Reviewers will take this into consideration when evaluating validation film check images. The ACR will provide a report when the review is complete.

Category	Total No. of Failures*	Fatty Breasts (%)†	Dense Breasts (%)†	*P* Value
Positioning	1,250 (20)	26 (164/631)	17 (105/619)	.028
Exposure	944 (15)	12 (34/281)	18 (119/663)	< .001
Compression	887 (14)	13 (41/315)	15 (86/572)	< .001
Sharpness	806 (13)	12 (34/280)	14 (74/526)	.598
Contrast	785 (13)	13 (41/314)	13 (61/471)	.190
Artifacts	703 (11)	13 (41/313)	10 (39/390)	.524
Examination identification	465 (8)	8 (16/195)	7 (19/270)	.463
Noise	288 (5)	4 (3/84)	5 (10/204)	.067
Total‡	6,128 (100)	101	99	. . .

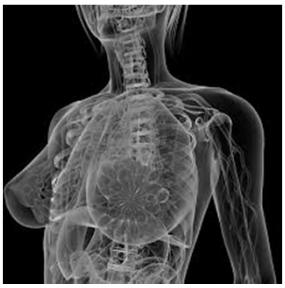
* Numbers in parentheses are percentages.

† Numbers in parentheses are the data used to calculate the percentages.

‡ The total percentage may not equal 100 because of rounding error.

Deficiency	Frequency*
Inadequate pectoralis major muscle on MLO view	733 (22)
Sagging of the breast on MLO view	462 (14)
Poor visualization of posterior tissue on MLO view	459 (14)
Skin folds overlying breast tissue	410 (12)
Poor visualization of posterior tissue on CC view	380 (11)
Posterior nipple line on CC view not within 1 cm of that on MLO view	335 (10)
Excessive lateral or medial exaggeration on CC view	188 (6)
Breast positioned too high on image receptor	126 (4)
Portion of breast cut off	99 (3)
Other	208 (6)
Total	3,400 (100)

Note.—CC = craniocaudal, MLO = mediolateral oblique.
* Numbers in parentheses are percentages.



Mammographic Clinical Image Criteria for Accreditation Submissions

Mammographic images submitted for accreditation review **must be:**

- "Negative" (BI-RADS® Assessment Category 1)
  - No "benign" (Category 2)
  - No "incomplete" (Category 0)
- If the facility only performs diagnostic exams and cannot submit "negative" images, they should call the ACR for assistance
- Cases must be examples of the facility's best work
- Images must be from actual patients and must have been formally interpreted
- Images from models or volunteers are not acceptable

Mammographic Clinical Image Criteria for Accreditation Submissions

Criteria for mammographic images submitted for accreditation review:

- Complete breast **must be** imaged in a single exposure on each projection , any breast tissue missing is considered an automatic failure.
- Digital images **must be** as close to "true size" as possible i.e., with no "minification" or "magnification"
- Both screen-film and digital images **must be** labeled with the MQSA-required identification information
- Lead interpreting physician **must review and approve** the clinical images submitted
- Electronically submitted images **must be** processed marked "For Presentation"

Clinical Images & Image Quality

- **Interpreting Physicians**

Physicians interpreting mammograms for the facility shall follow the facility procedures for corrective action when the images they are asked to interpret are of poor quality. There should be a procedure in place to follow when images do not meet the established clinical standards

Clinical Image Parameters

Percentages are in order of resultant causes of clinical image failure

- Positioning 20%
- Exposure 15%
- Compression 14%
- Sharpness 13%
- Contrast 13%
- Artifacts 11%
- Labeling ID 8%
- Noise 5%

Most Common Positioning Errors

- Poor visualization of posterior tissue
- Sagging breast
- Inadequate amount of pectoralis major muscle on image
- Excessive exaggeration on the craniocaudal view
- Skin folds

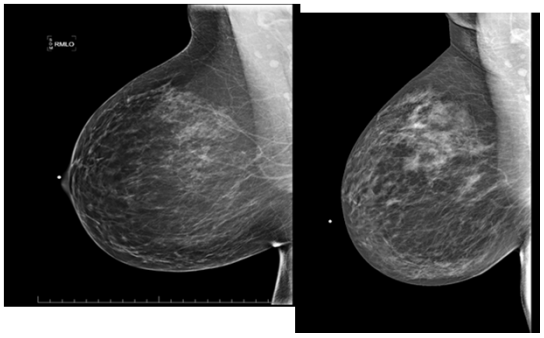
Cranial Caudal View

- Pectoralis muscle is visualized in only 30-40 % of patients according to ACR manual, but with new positioning skills, more like 60 percent.
- When the muscle is not included, the measurement of the PNL should be done
- Medial vs lateral tissue
- Nipple in profile, good to have nipple in profile on all views for ACR
- Look for variation in nipple location, must be centered.

Mediolateral Oblique View

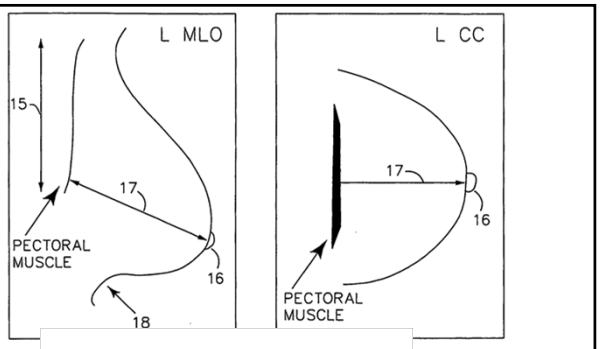
- Pectoralis muscle included to the PNL
- Muscle should be wide and convex
- Inframammary Fold (IMF) seen on image
- Retroglandular fat included
- Look for variation in nipple location

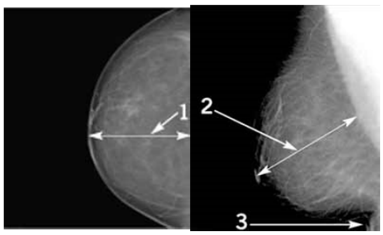
- Sagging breast, cut off bottom of breast on film for RT MLO view



Positioning

- Other body parts projected over breast
- Nonstandard angulation MLO 30-60 degree
- Posterior nipple line on craniocaudal view not within 1 cm of that on the mediolateral oblique view
- Breast positioned too high on image receptor


L MLO
L CC
15
17
16
PECTORAL MUSCLE
18
17
16
PECTORAL MUSCLE


1
2
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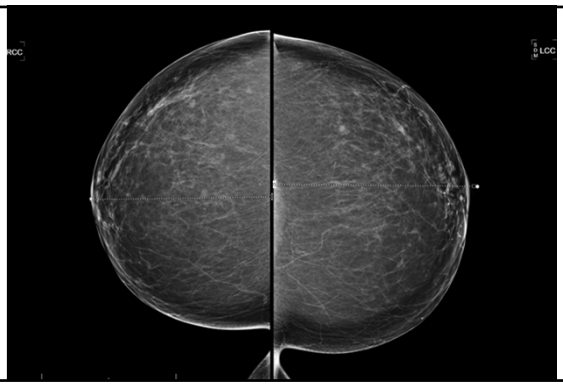
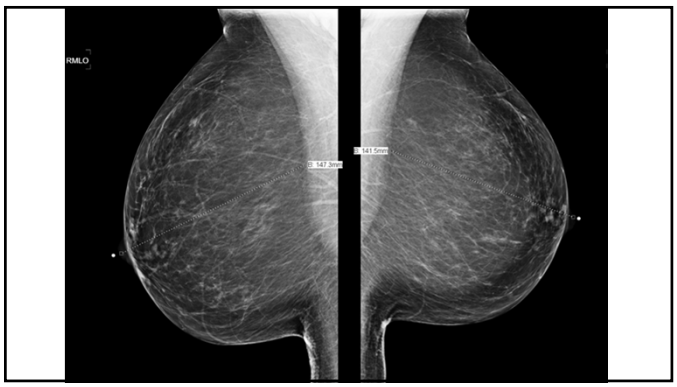
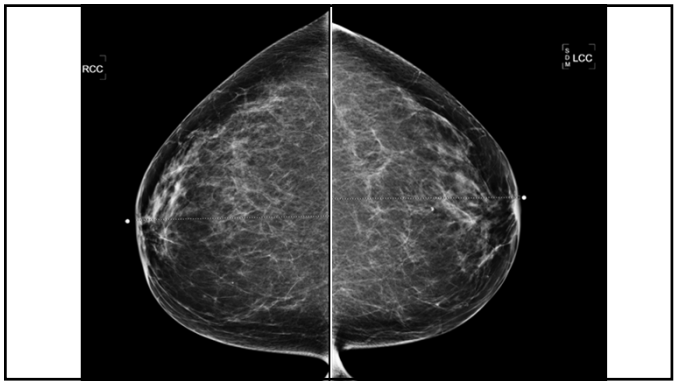
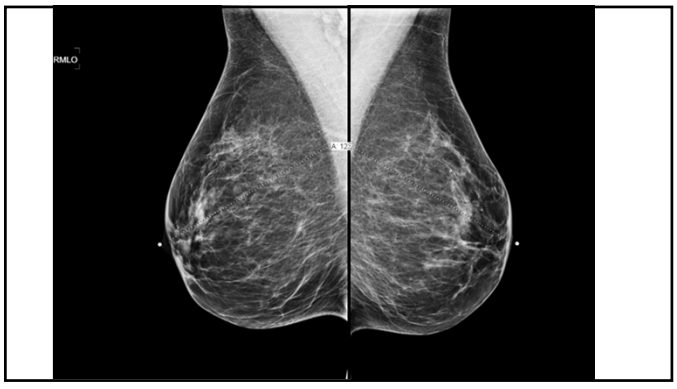
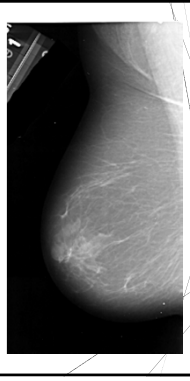

RCC
LCC


RMLO


RCC
LCC


RMLO

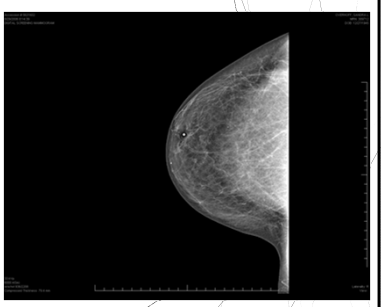
- Inadequate amount of pectoralis major muscle on image

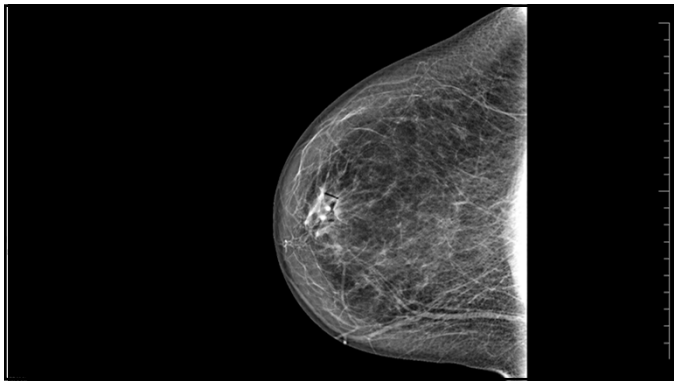


- Skin fold and too much exaggeration on RtCC view

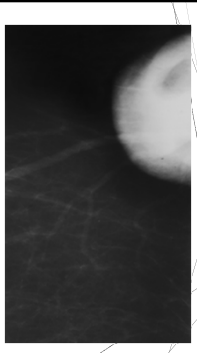
- Skin fold in RT MLO

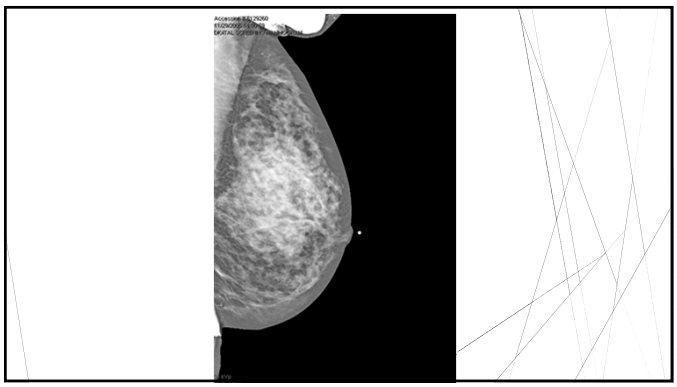
- Nipple not in profile

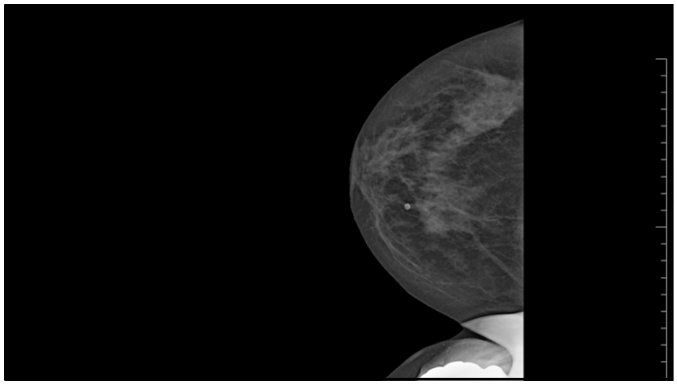




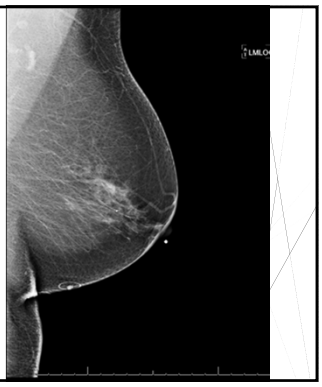
- Other body parts projected over breast area







- Breast too high on image receptor

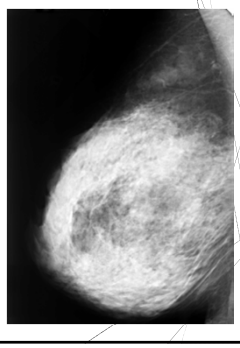


Compression

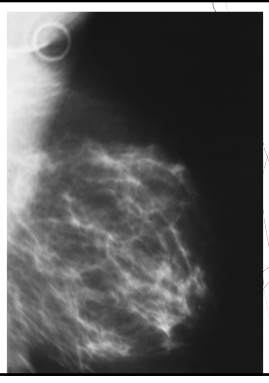
Results of inadequate compression

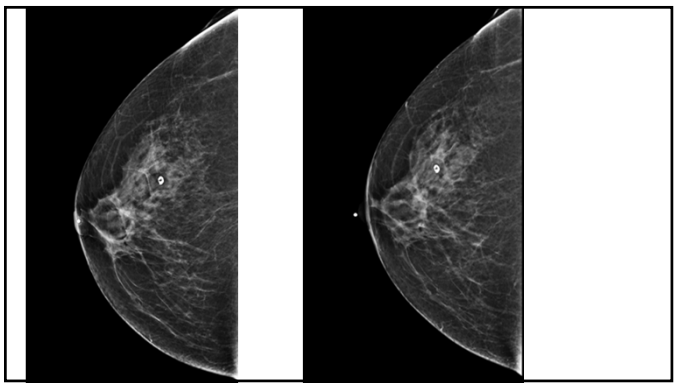
- Poor separation of parenchymal densities
- Non-uniform exposure levels
- Patient motion

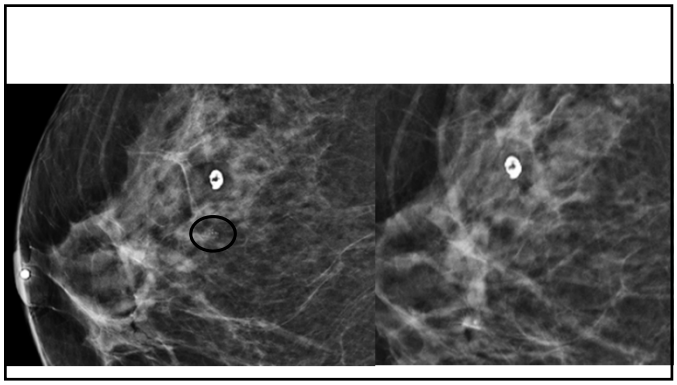
- Poor separation of parenchymal densities



- Patient Motion







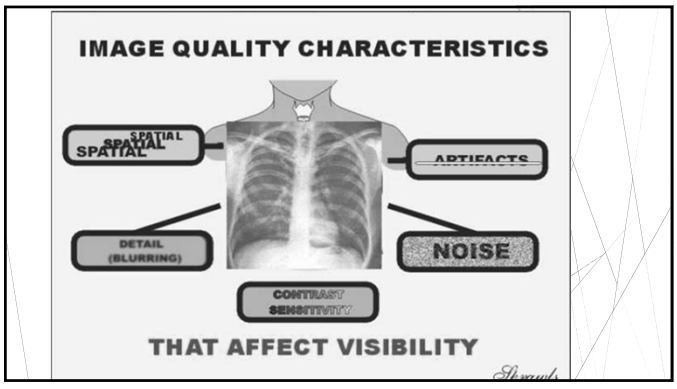
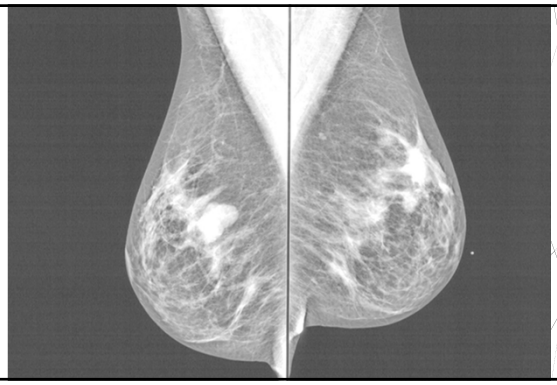


IMAGE QUALITY CHARACTERISTICS
SPATIAL
SPATIAL
ARTIFACTS
DETAIL
(BLURRING)
NOISE
CONTRAST
SENSITIVITY
THAT AFFECT VISIBILITY

Contrast

- Inadequate contrast
- Excessive contrast
- Contrast image shall permit differentiation of subtle tissue density differences
- Must watch Window Leveling and width, especially if you don't you don't have a post processing algorithm e.i. GE has premium view and fine new.



Noise

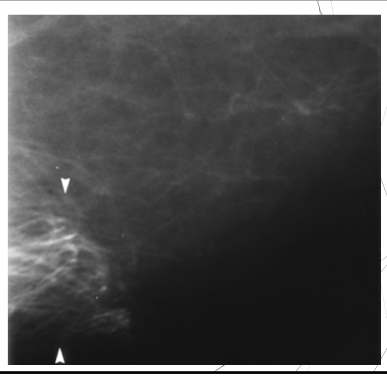
- Visually striking mottle pattern
- Noise-limited visualization of detail
- Noise in the image shall not obscure breast structures or suggest the appearance of structures not actually present.

Artifacts

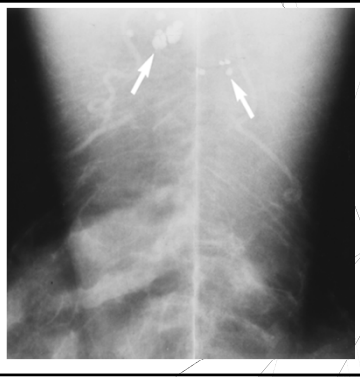
- Punctate or lint with film screen
- Scratches or pickoff with film screen
- Roller marks with film screen
- Grid-related artifacts film screen/digital
- Hair, deodorant film screen/digital
- Image handling film screen
- Image fogging film screen
- Poor screen-film alignment film screen
- Dead pixels artifacts digital
- Lag and/or ghosting digital
- Streaking and misread columns digital

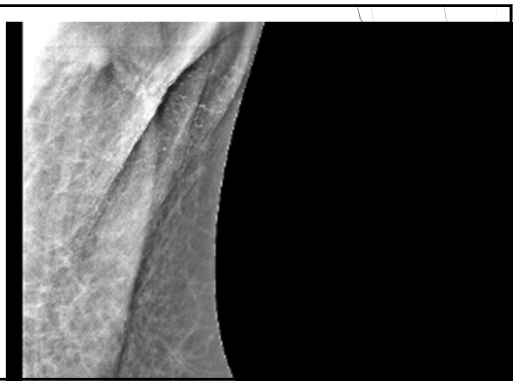
- Grid related artifacts

►Hair

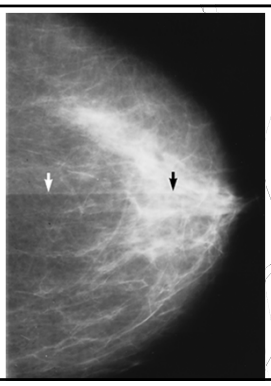


- Deodorant

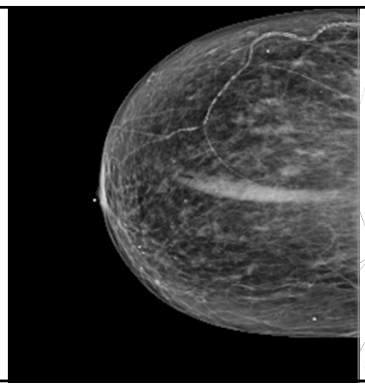




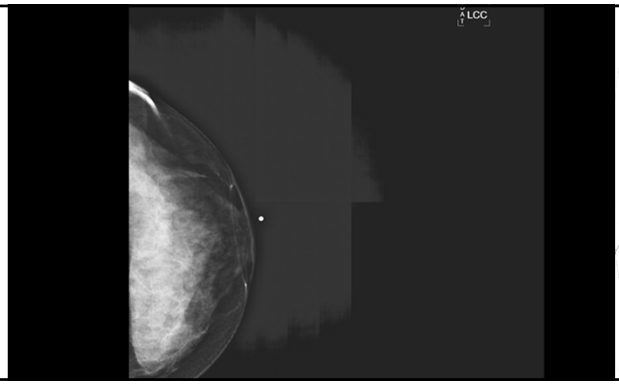
- Image fogging

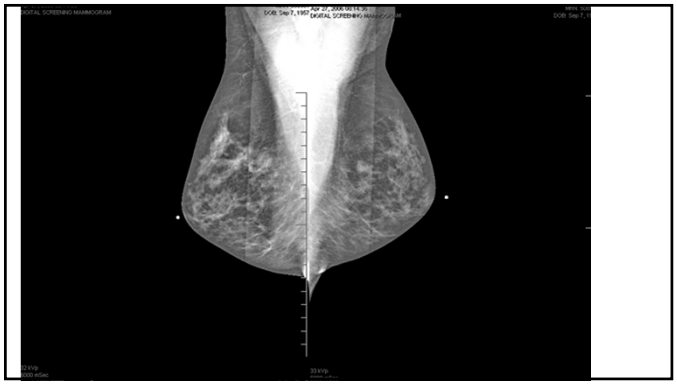


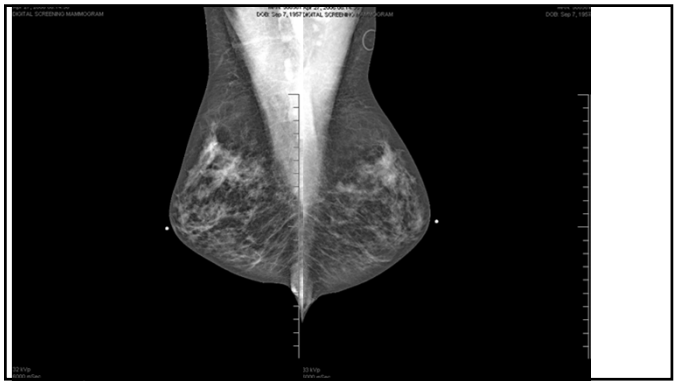
- Skin Folds

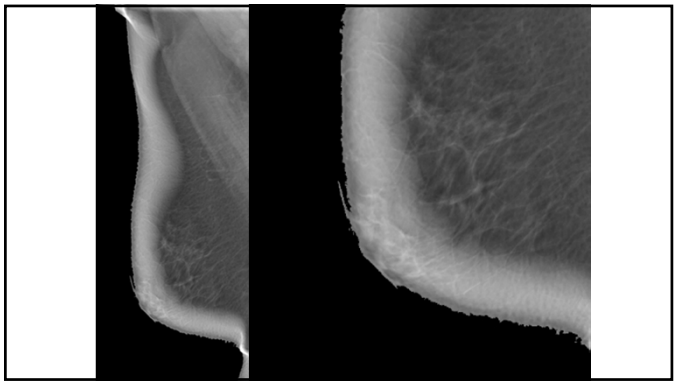


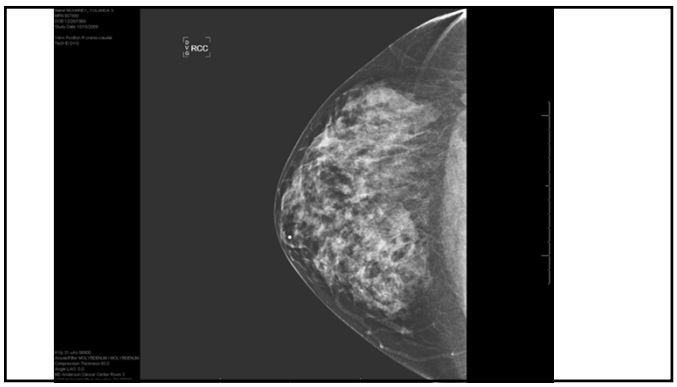
Some FFDM Artifacts

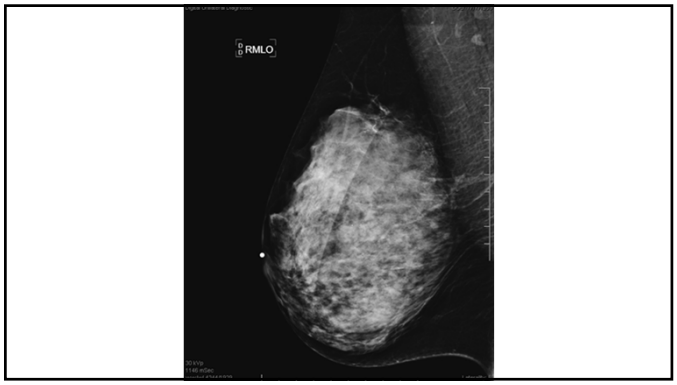


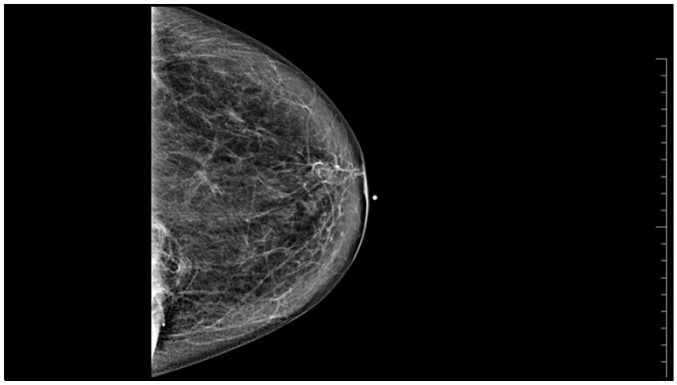


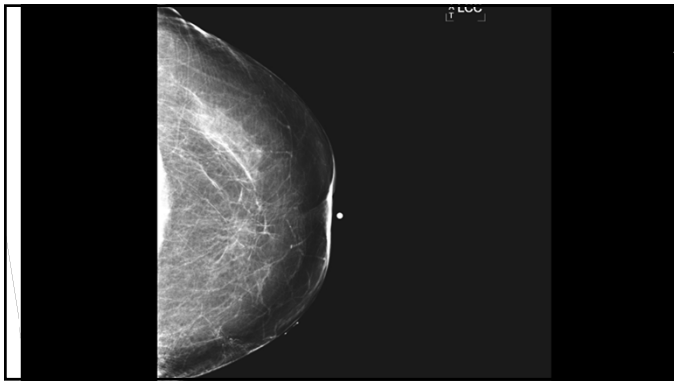


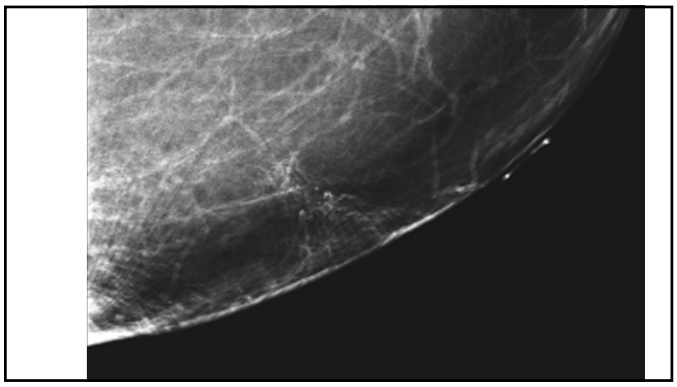



RCC


RMLO



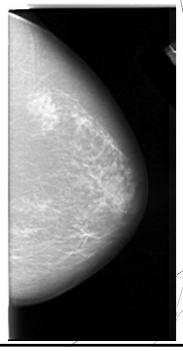




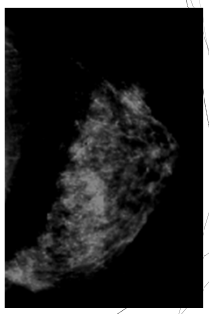
Exposure

- Generalized underexposure
- Generalized overexposure
- Inadequate penetration of dense areas
- Excessive penetration of radiolucent areas
- Exposure level shall be adequate to visualize breast structures.

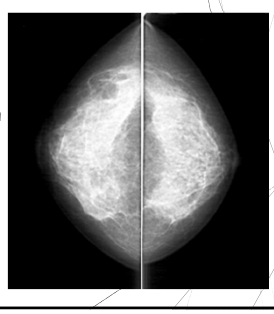
- Underexposed image



- Overexposed image

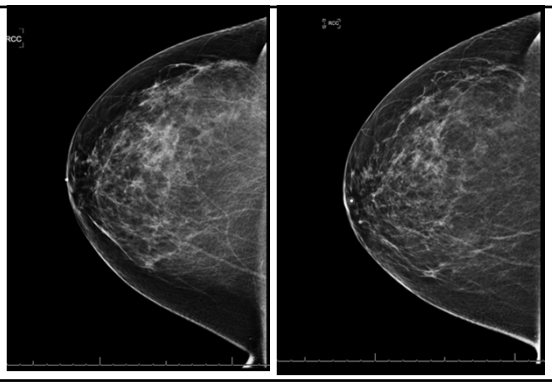


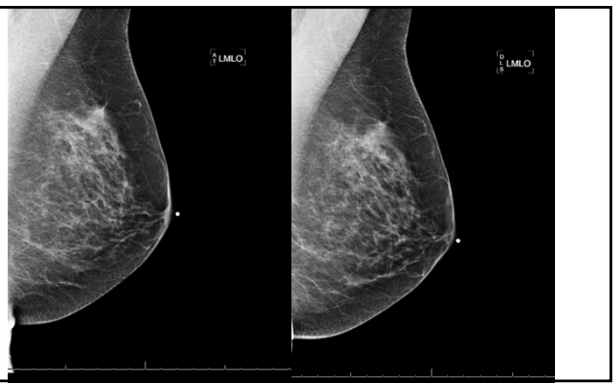
- **Inadequate penetration of dense area**



Compression

- Compression shall be applied in a manner that minimizes the potential obscuring effect of overlying breast tissue and motion artifact

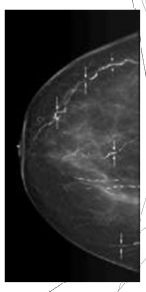




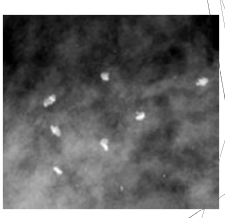
Sharpness

- Poor delineation of linear structures
- Poor delineation of feature margins
- Poor delineation of microcalcifications
- Margins of normal breast structures shall be distinct and not blurred

▶Delineation of linear structures



- **Delineation of calcifications**



Labeling of Mammograms

- Mammography films are medical documents.
- To make sure no misinterpretation of films, label films correctly.

Some information on labeling are required by federal law and some information is recommended.

Required by Federal Law On Name Label

- MQSA-Required Mammographic Image Identification
  1. Name of patient (first and last)
  2. Additional patient identifier (e.g., medical record number or social security number; date of birth is less desirable)
  3. Date of examination
  4. Standardized view and laterality codes placed on the image in a position near the axilla
  5. Facility name and location (must include city, state, and zip code)
  6. Technologist identification
  7. Cassette/screen identification
  8. Mammography unit identification, if more than one unit in the facility

Required by Federal Law

- Radiopaque Markers indicating laterality like Left or Right on film screen/digital must have lt/rt
- Projection view as in CC or MLO, etc...
- The Technologist who performed the examinations, may be technologist initials or a technologist number.

Required by Federal Law

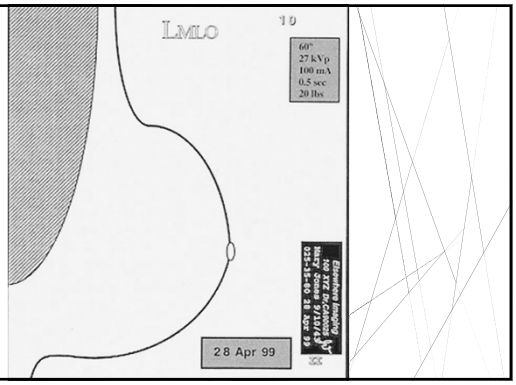
- Cassette/screen identification to identify screens even with CR Mammography.
- Mammography unit number if there is more than one unit in the facility.

Strongly recommended

- A flash card patient ID system for more permanent measures.
- Flash system is not acceptable if any information is illegible, does not fit, or is lobsided, causing cut-off of information.

Recommended

- Separate Date stickers as they allow the for the date to be easily read.
- Technical factors
- Target filters
- KvP
- mAs
- Exposure Time
- Compression force
- Compressed breast thickness
- Degree of obliquity



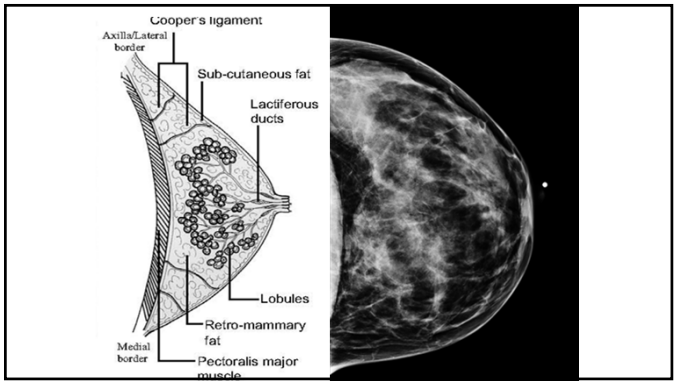
- Remember Full Field Digital Units can submit their ACR Film Accreditations in Hard Copy Format or electronically

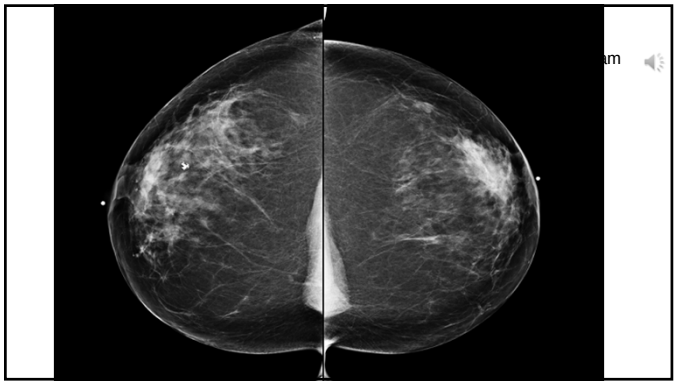
Failure verses Deficiency

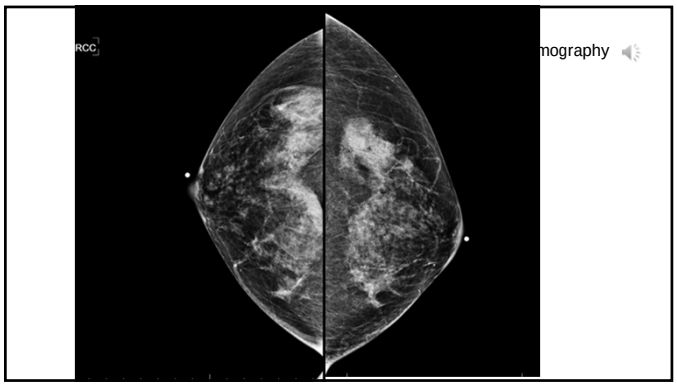
* A first deficiency is not a failure.
  ACR does not notify the FDA.
  You do not have to stop doing mammograms in your facility.
  Take corrective actions on your own.
* Repeat deficient test less than 2 months MQSA
* Reinstate if more than 2 months on MQSA cert.
* Appeal
* Withdraw

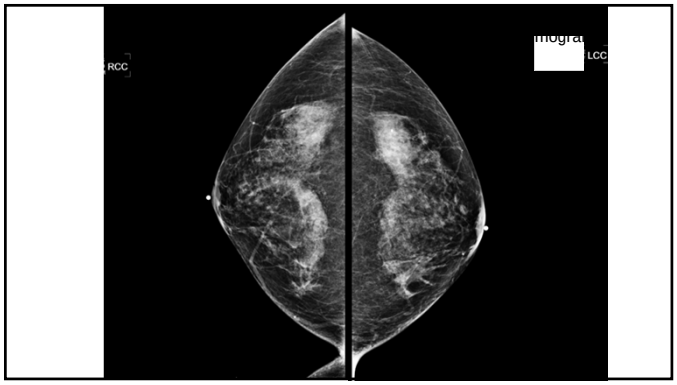
Sum it up

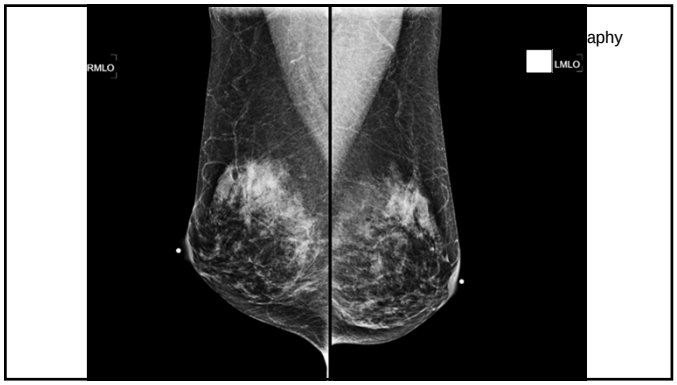
Attempt at Accreditation	Accreditation Result	Facility Options
First	*Not granted* First deficiency Facility may continue performing mammography with the unit as long as it has a valid certificate.	• *Repeat* not acceptable area(s) (only if more than 60 days on MQSA certificate), • *Reinstate* by retesting all areas (if 60 days or less on MQSA certificate), • *Appeal* decision on original images or • *Withdraw*
Second	*Not granted* Second deficiency = first failure ACR strongly recommends that facility cease performing mammography with the unit.	• *Reinstate* by retesting all areas (with corrective action), • *Appeal* decision on original images (may not operate until the appeal is complete) or • *Withdraw*
Third	*Not granted* Third deficiency = second failure ACR strongly recommends that facility cease performing mammography with the unit.	• *Reinstate* after participating in scheduled on-site survey, • *Appeal* decision on original images (may not operate until the appeal is complete) or • *Withdraw*

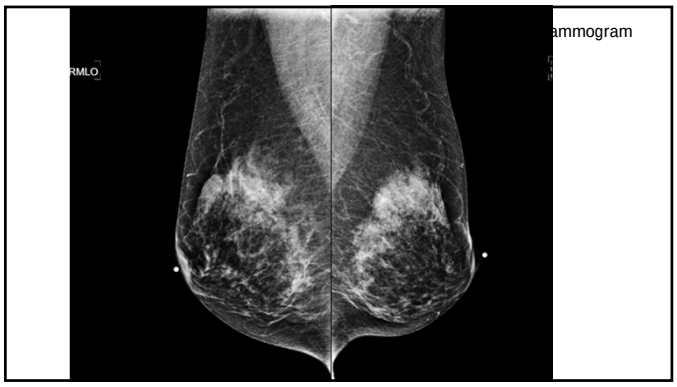

Cooper's ligament
Axilla/Lateral border
Sub-cutaneous fat
Lactiferous ducts
Lobules
Retro-mammary fat
Medial border
Pectoralis major muscle




RCC


RCC
LCC


RMLO
LMLO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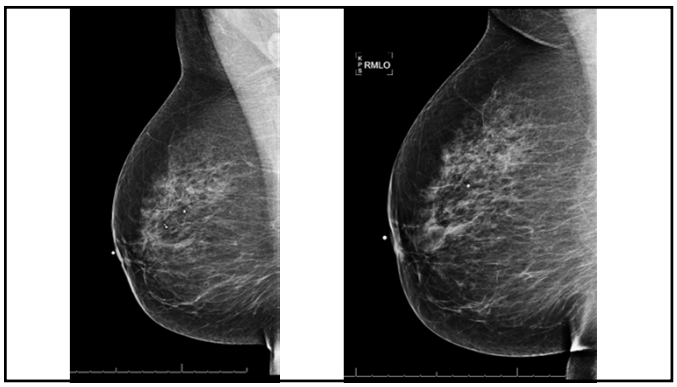
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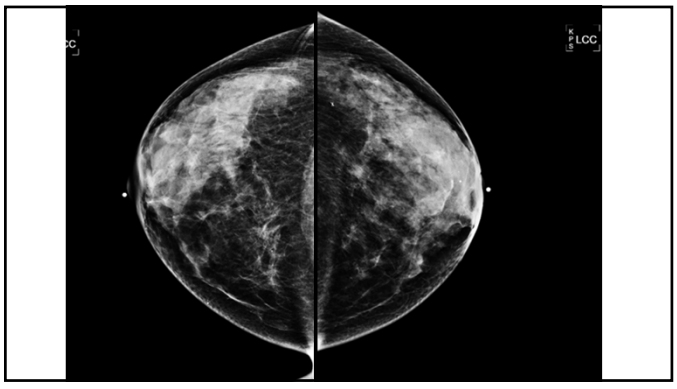
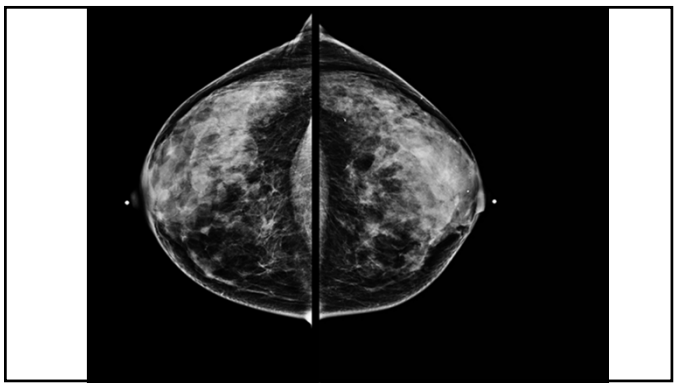
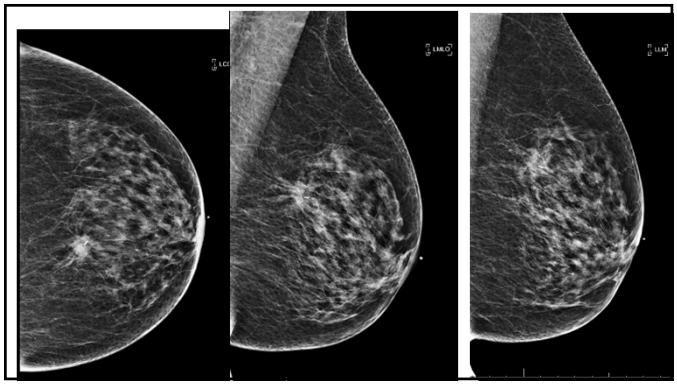
LMLO


LCC




RMLO
LMLO

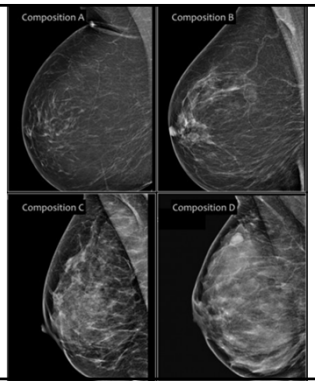


Standard Reporting

1. Indication
2. Breast Composition → Composition: a-b-c-d
3. Important findings → Mass, Asymmetry, Architectural distortion, Calcifications, Associated features
4. Comparison to previous studies
5. Final Assessment Category
6. Give management recommendations
7. Communicate unsuspected findings with the referring clinician

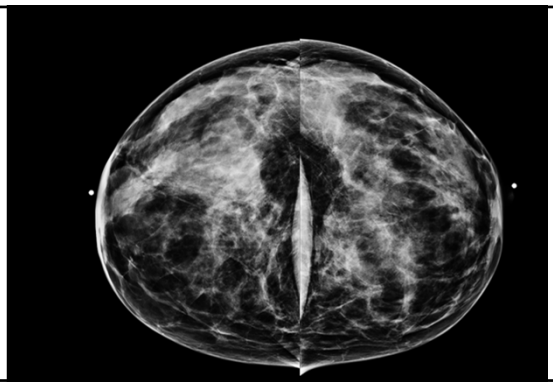
Two Categories
A/B category one
C/D category two

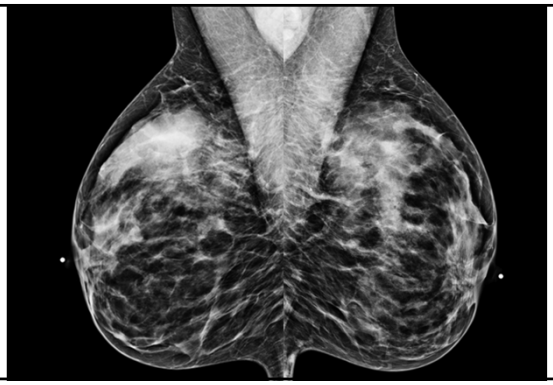
Breast composition	A. entirely fatty B. scattered areas of fibroglandular density C. heterogeneously dense, which may obscure masses D. extremely dense, which lowers sensitivity



Examples of ACR Images

- Remember all has to be the very best images from your facility





Checks on CC

- Posterior tissue/fat and possible muscle
- Nipple perfectly centered
- Nipple in profile
- No folds
- Good compression at least 20lbs or more
- Separation of densities
- Good Contrast

Checklist on MLO

- Tail of breast on image
- Nipple in profile
- Retro glandular Fat from Clavicle to 6th rib where IMF
- PNL line within 1 CM of CC
- IMF must be on image
- Densities are well separated
- Muscle is wide superiorly with a convex border.
- Center of image should be 2 cm above nipple
- Good contrast

FULL RESULT:
CLINICAL INDICATION:
Patient is a 52 year old female and is seen for screening.

BILATERAL DIGITAL SCREENING MAMMOGRAM
Digital Screening Mammogram evaluated with Computer Aided Detection (CAD).

COMPARISON:
The present examination has been compared to prior imaging studies performed at Cancer Center on 03/12/2010, 07/15/2011 and 04/12/2013.

FINDINGS: The breasts are heterogeneously dense. This may lower the sensitivity of mammography.

Repeat views are recommended to include more posterior tissue in the CC projection.

IMPRESSION:
Findings in both breasts require additional evaluation. The following views will need to be repeated for technical reasons; (bilateral craniocaudal).

BI-RADS Category 0:
Additional Imaging Evaluation