

# A NEW BIOMARC TISSUE MARKER FOR BREAST BIOPSY: CLINICAL EVALUATION IN ULTRASOUND, MAMMOGRAPHY, CT SCANNING AND BREAST MRI

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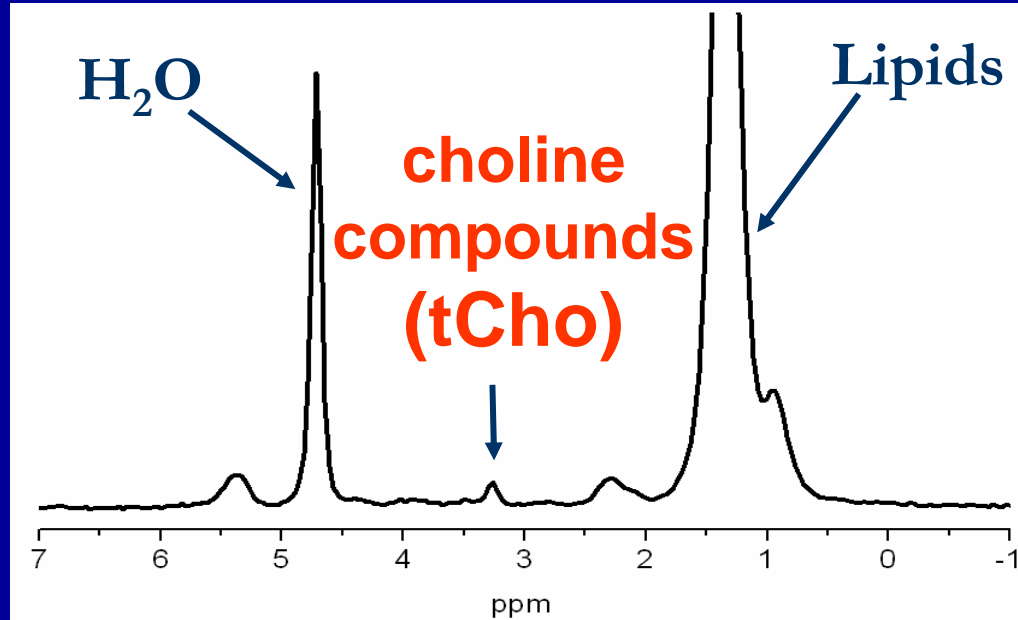
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# Background:

- Breast Radiographic Markers (RMs)
  - Surgical localization after biopsy
  - Follow up – neoadjuvant chemotherapy
  - Marking lesion site for boost field irradiation
- RM composition - Stainless Steel Alloy or Titanium Alloy
- Diagnosis and management of breast cancer
  - Mammography / Ultrasound
  - MRI
  - *in vivo*  $^1\text{H}$  MR Spectroscopy

# Background:

## $^1\text{H}$ MR spectrum



Neoplastic breast tissue produces a signal from tCho

- *Roebuck et al. Anticancer Res 1999*
- *Kvistad et al. J Magn Reson Imaging 1999*
- *Gribbestad et al. Anticancer Res. 1999*
- *Katz-Brull et al. Natl Cancer Inst 2002*
- *Bolan et al. Mag Res Med. 2003*

# Background:

- Stainless Steel and Titanium Alloy RM

- Movement

- Rosen et al Radiology 2001
- Harris et al Radiology 2003
- Birdwell et al Radiology 2003
- Esserman et al Radiographics 2004

- Breast MRI - void artifact

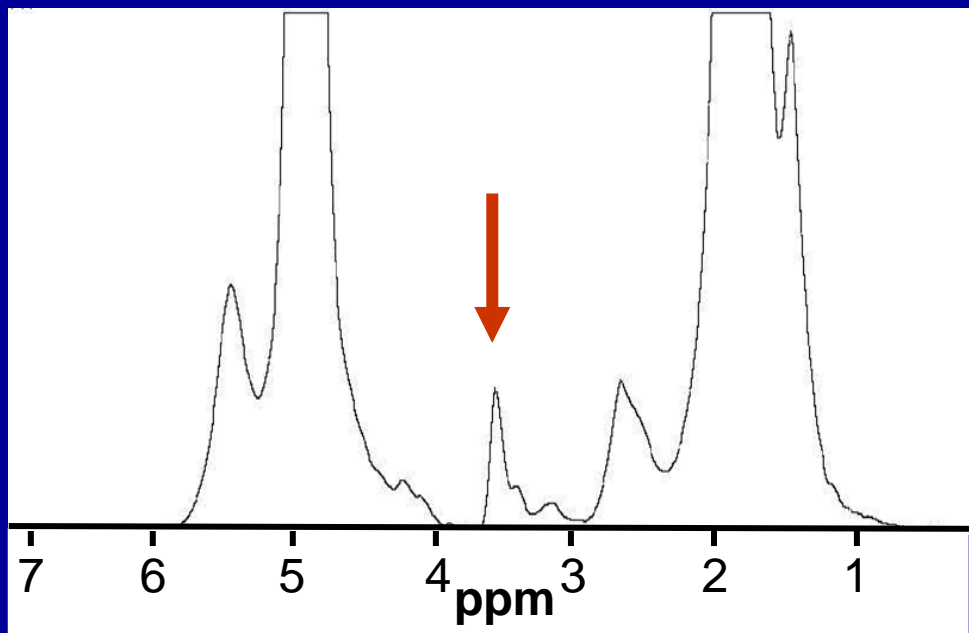
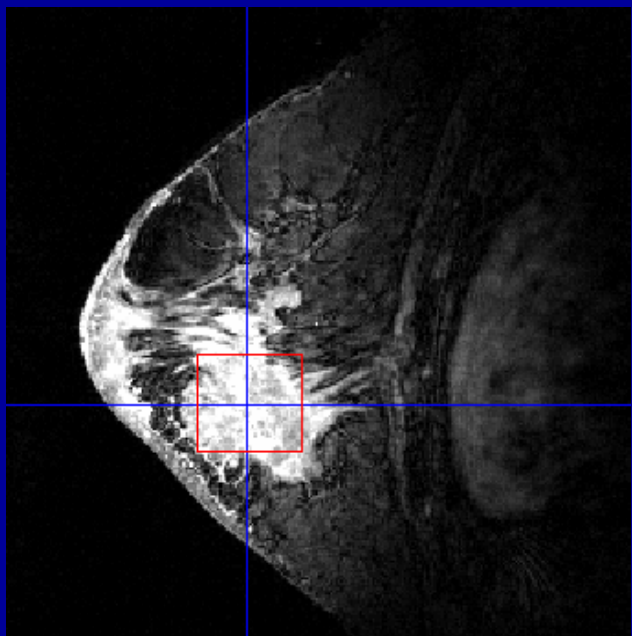
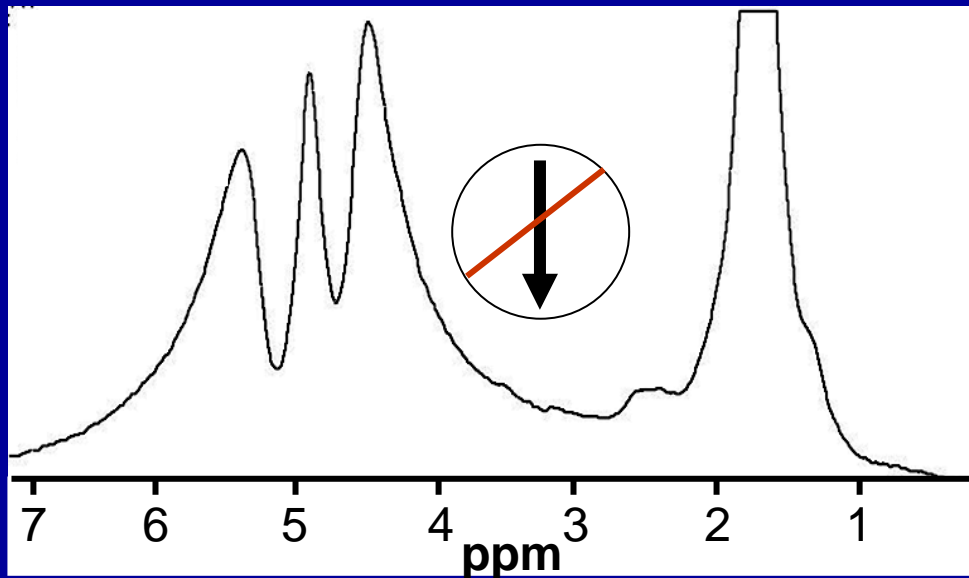
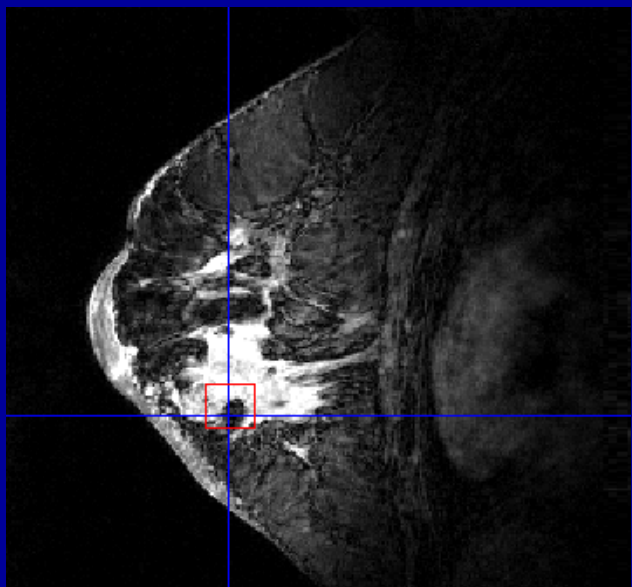
- Lanner et al AJR 2004
- Kubota et al Breast Cancer 2004

- Breast  $^1\text{H}$  MRS - spectral artifact

- U of Minnesota / Center for Magnetic Resonance Research

# Background:

## Sample Case – Metallic RM



# Purpose:

Evaluate the effects of a new FDA approved radiographic marker on:

- Mammography
- Ultrasound
- Breast MRI (1.5 T and 4T)
- Breast MRS (1.5 T and 4T)

# Materials and Methods:

- **New FDA approved breast RM**

- Biomarc<sup>®</sup> (Carbon Medical Inc.)
- Composition: Pyrolytic Carbon Zirconium Oxide
- Size: 3 mm X 1 mm and 4 mm x 2 mm
- Color: Black

- **70 Biomarc<sup>®</sup> RM in 55 patients (BIRAD 4/5)**

- 49 – ultrasound guidance (14 gauge trocar)
- 17 – stereotactic guidance (11 gauge needle biopsy)
- 4 – MRI guidance (Daum titanium trocar)

# Materials and Methods:

- All RM evaluated for visibility at time of deployment:
  - Mammography
  - Ultrasound
- 15 RM evaluated for migration and visibility on follow up:
  - 5 – mammography at 6 month follow up
  - 10 – ultrasound at 3 wk, 6wk, and 24 wks
- 5 RM were check for void and spectral artifact at 1.5 T and 4T
  - [tCho] quantified with  $^1\text{H}$  MRS at 4T (*Bolan et al. MRM 2003*)



# BiomarC Pre-loaded Sideport Dry Delivery Device



BiomarC Pre-loaded Sideport Dry Delivery Device  
(1x3 Up-close)



BiomarC Pre-loaded Sideport Dry Delivery Device  
(2x4 Close-up)

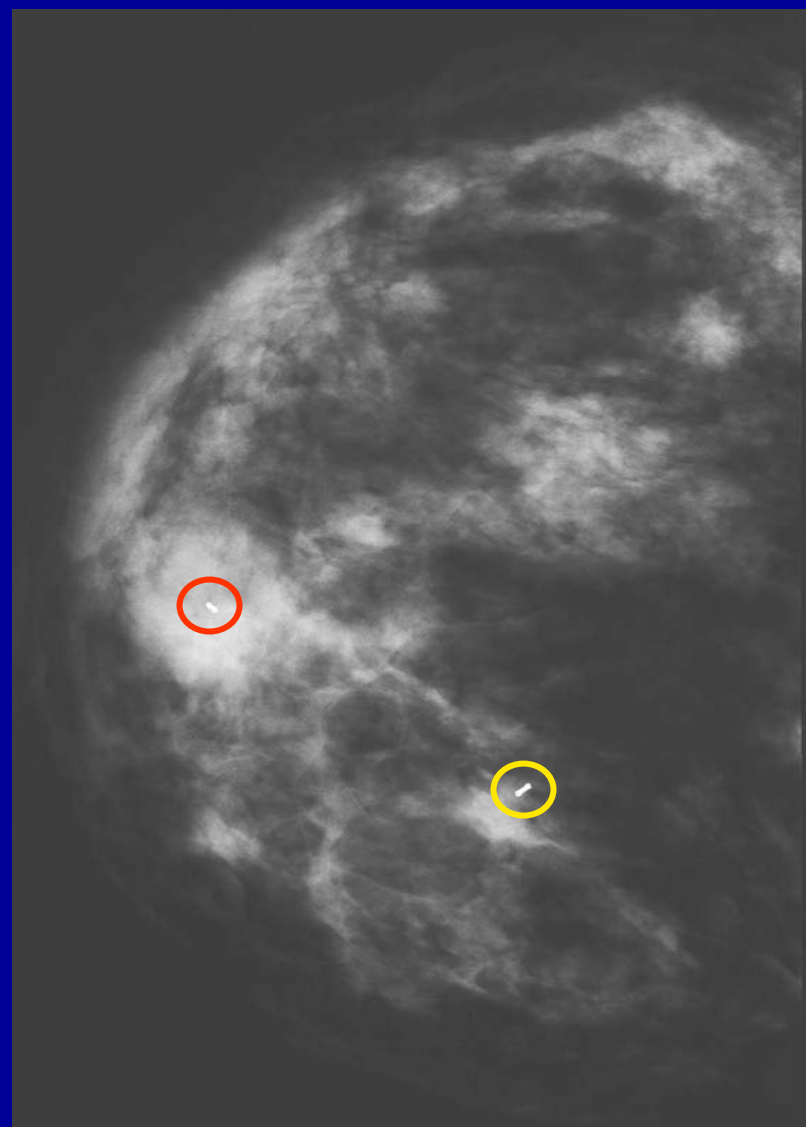
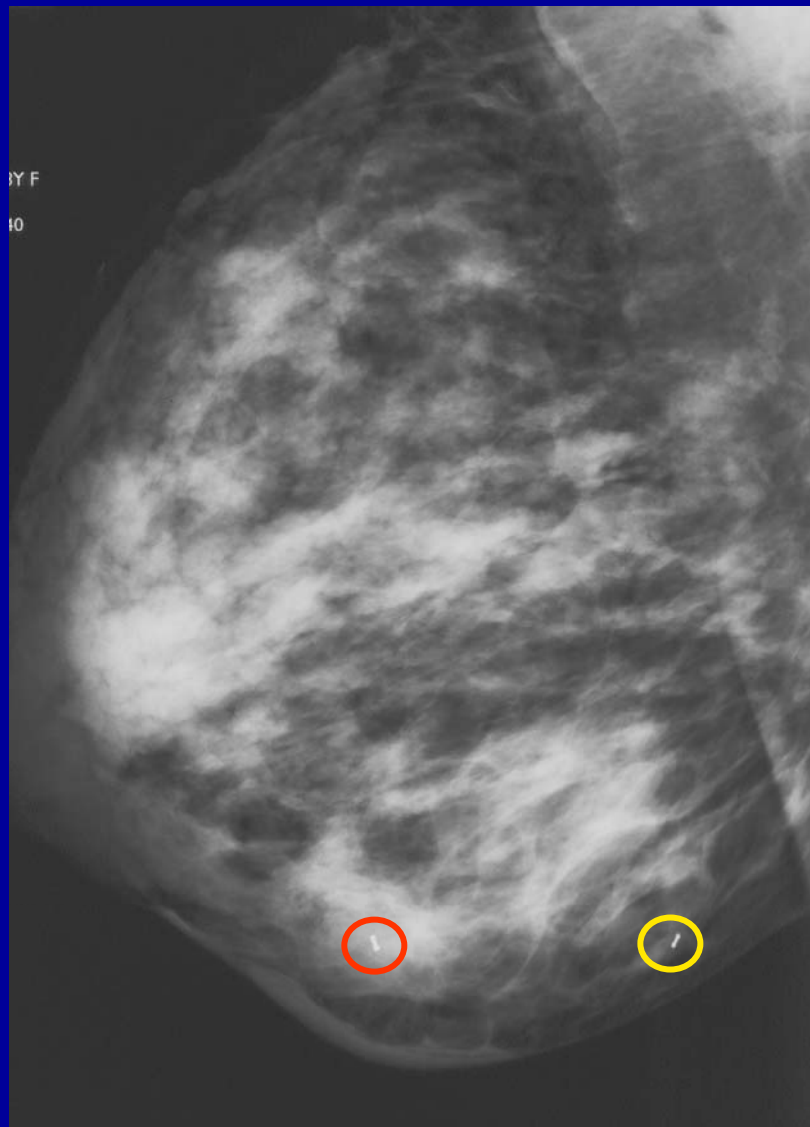


# Results:

- All 55 pts with 70 RM – placed within 4 mm of biopsy site
- All 55 pts with 70 RM – visible on mammography / ultrasound - deployment
- 5/5 RM – visible at 6 month follow up on mammography
- 8/10 RM – visible on follow up ultrasound
- 3/5 RM – visible on MRI at 1.5T
- 5/5 RM – visible on MRI at 4T
- 5/5 RM – adequate MRS at 4T

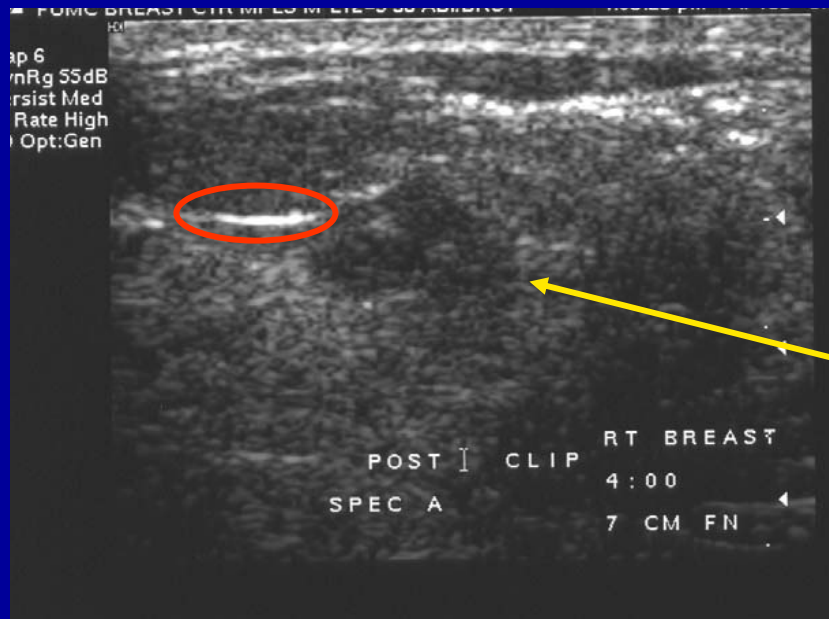
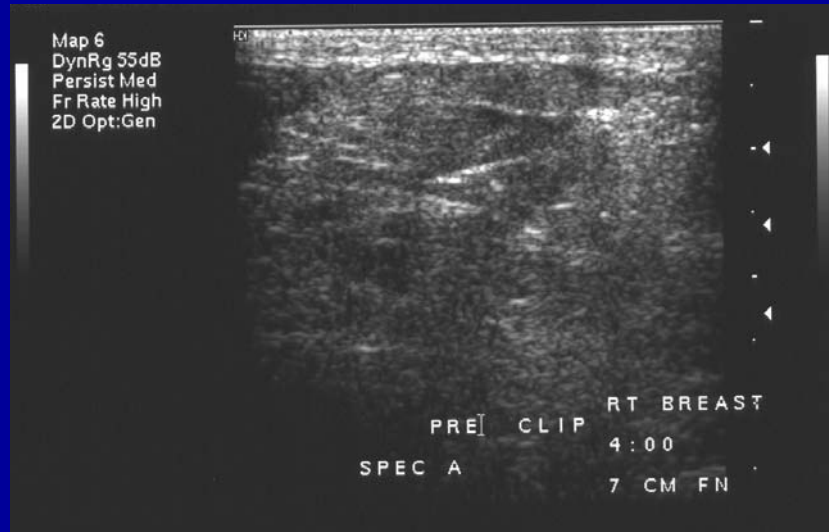
# BiomarC<sup>®</sup> - Mammography

38 year old female with invasive ductal carcinoma



# BiomarC<sup>®</sup> - Ultrasound

38 year old female with invasive ductal carcinoma



IDC

# BiomarC<sup>®</sup> - Ultrasound

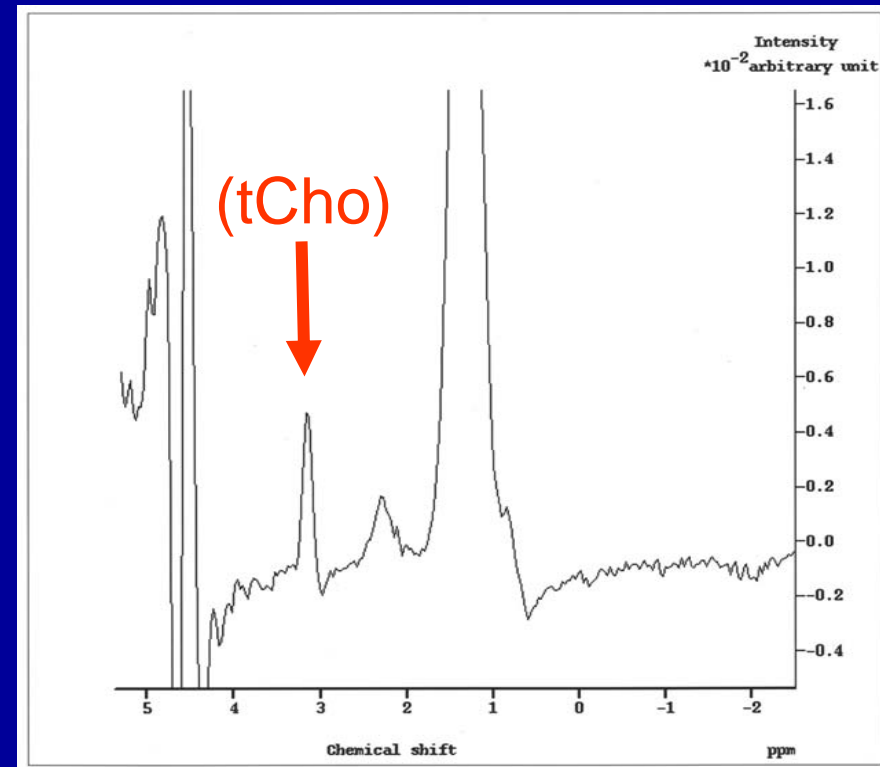
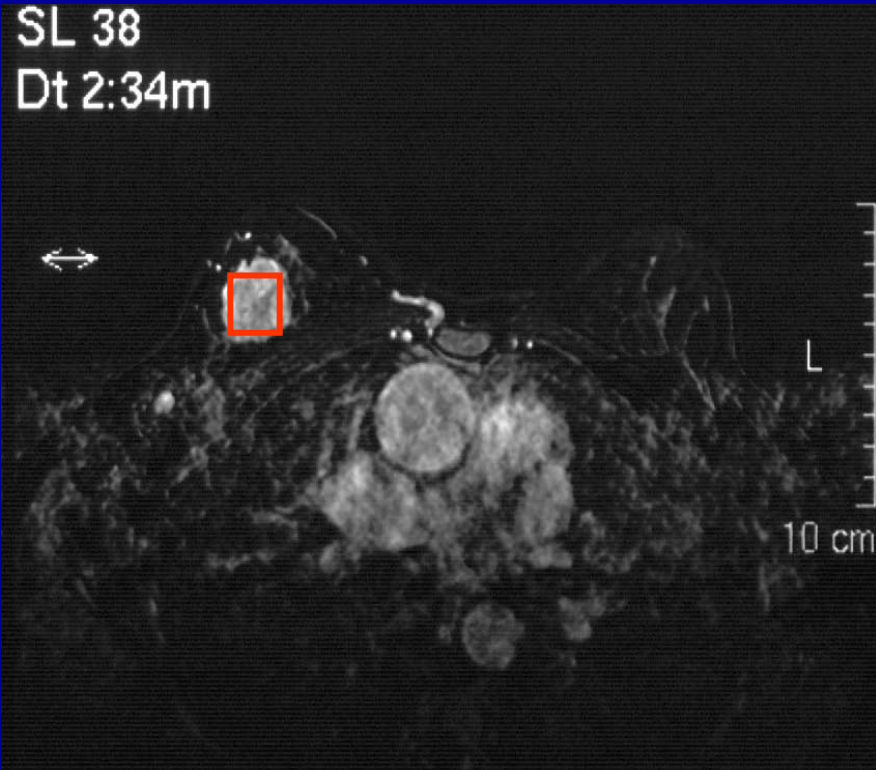
38 year old female with invasive ductal carcinoma  
7 day follow-up





# BiomarC<sup>®</sup> - 1.5T MRI / MRS

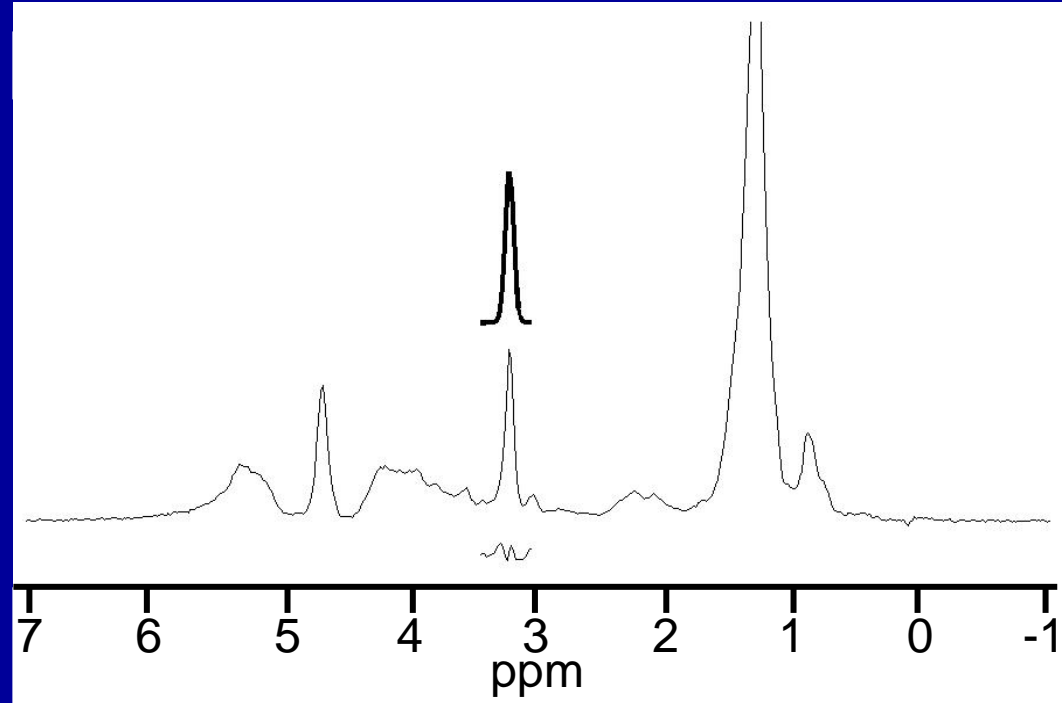
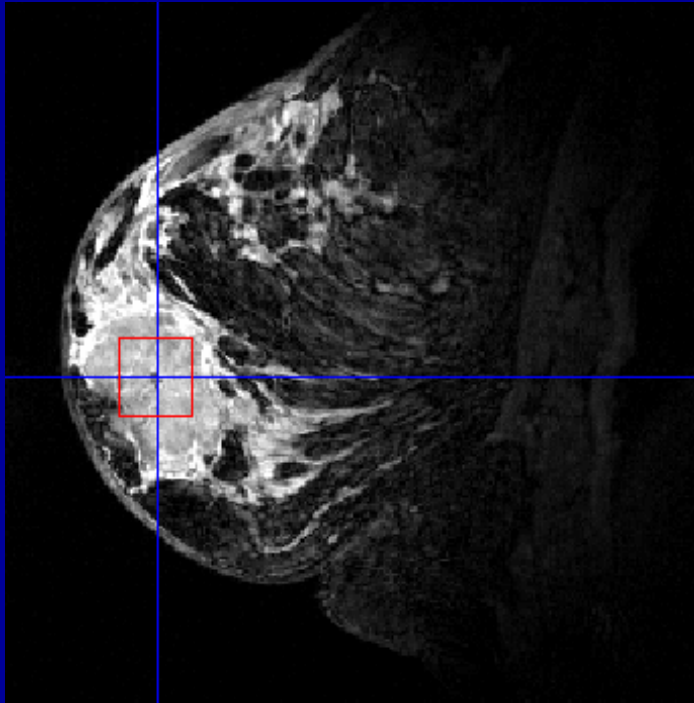
38 year old female with invasive ductal carcinoma





# BiomarC<sup>®</sup> - 4T MRI / MRS

38 year old female with invasive ductal carcinoma

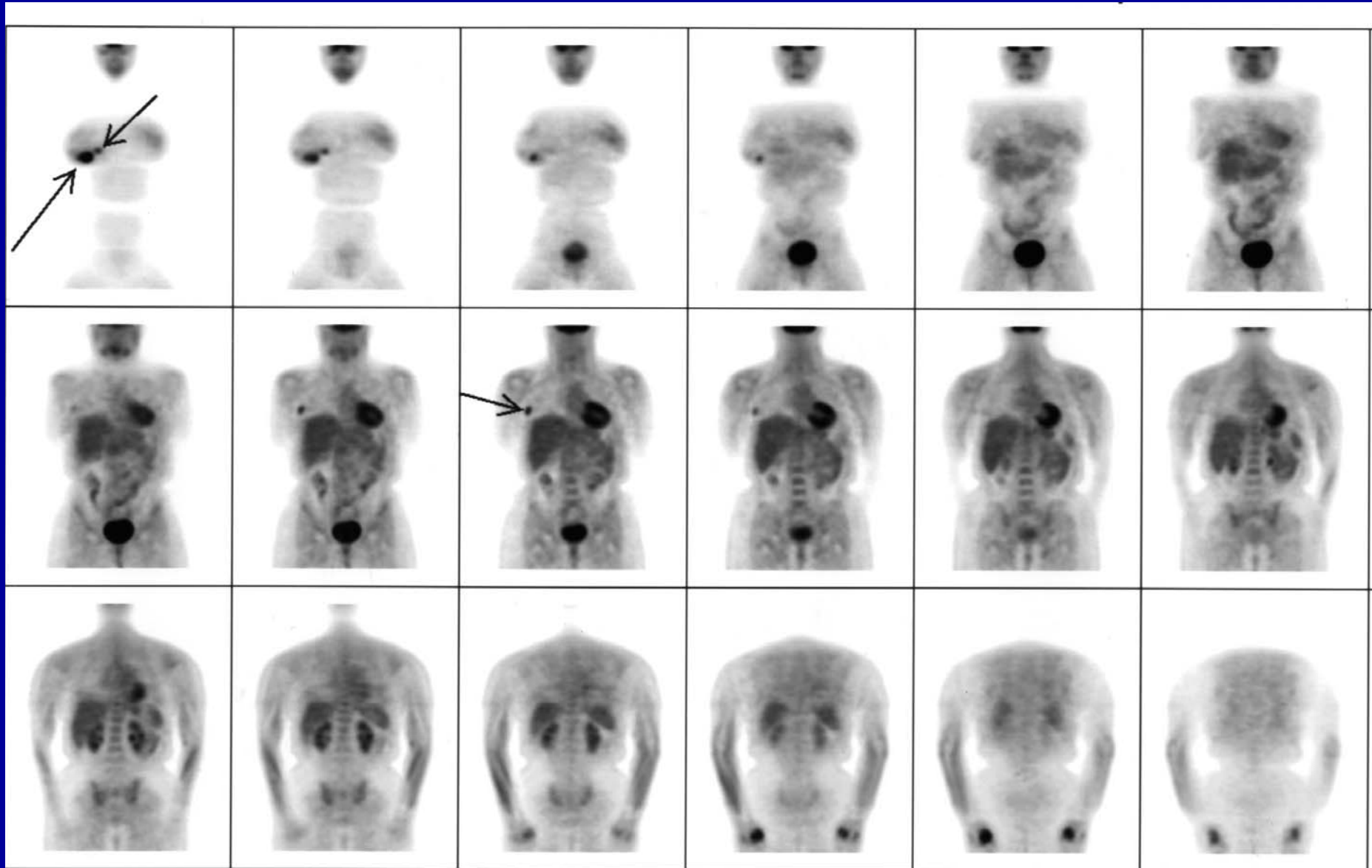


$$[tCho] = 4.85 \pm .07$$

Highly consistent with malignancy

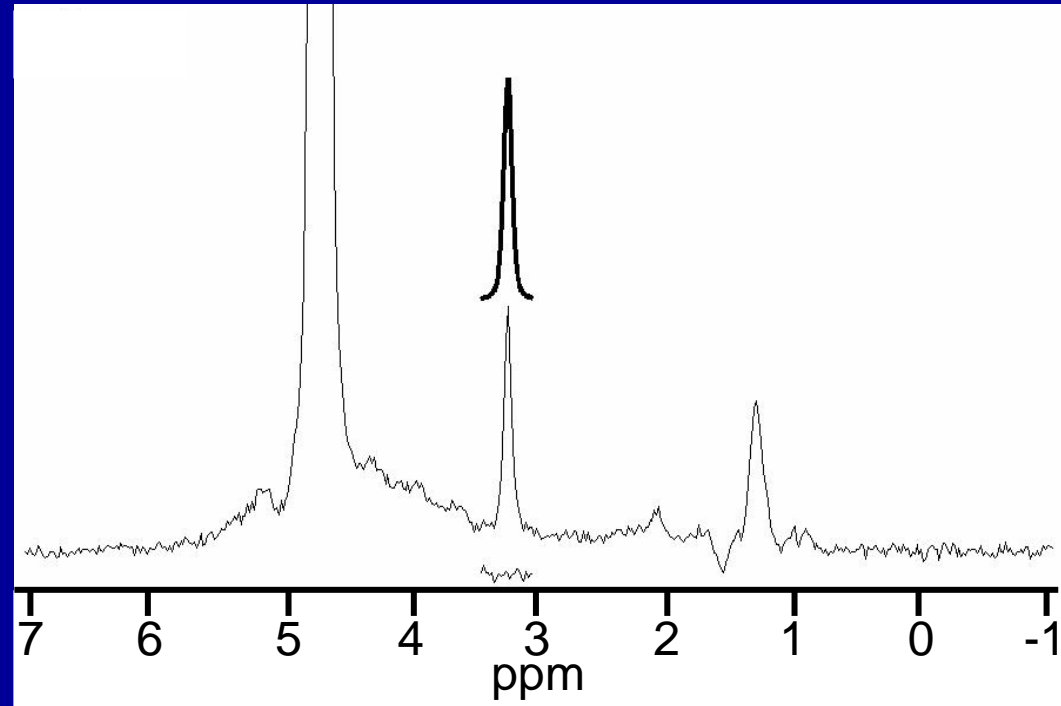
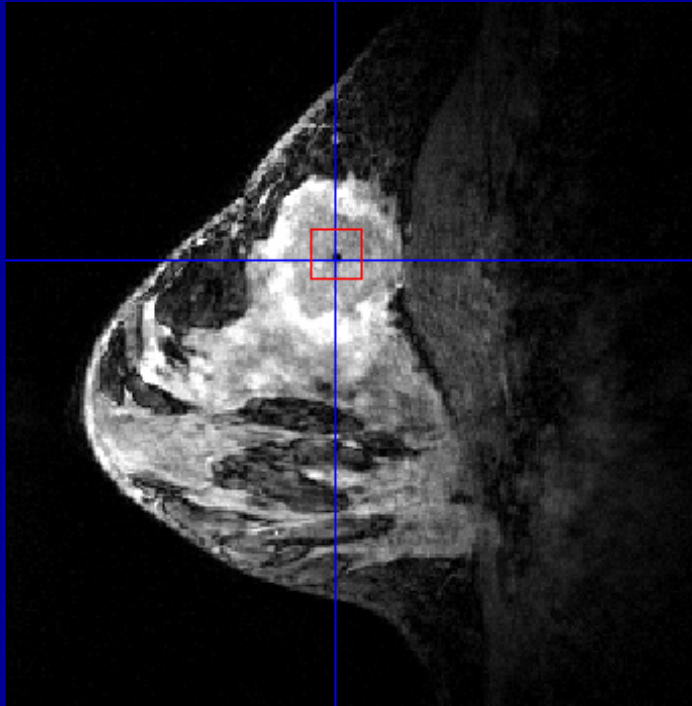
# BiomarC<sup>®</sup> - PET Scan

38 year old female with invasive ductal carcinoma



# BiomarC<sup>®</sup> - 4T MRI / MRS

47 year old female with invasive ductal carcinoma



$$[\text{tCho}] = 7.63 \pm 0.5$$

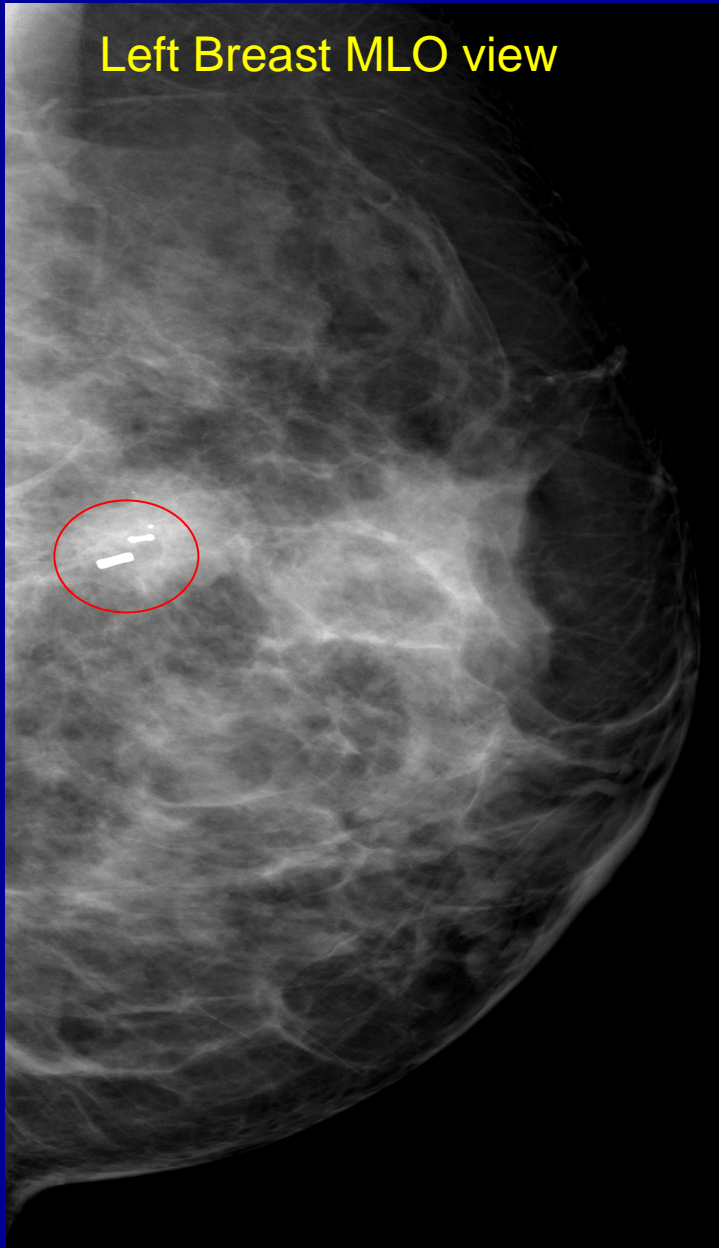
Highly consistent with malignancy

# Large BiomarC Breast Marker

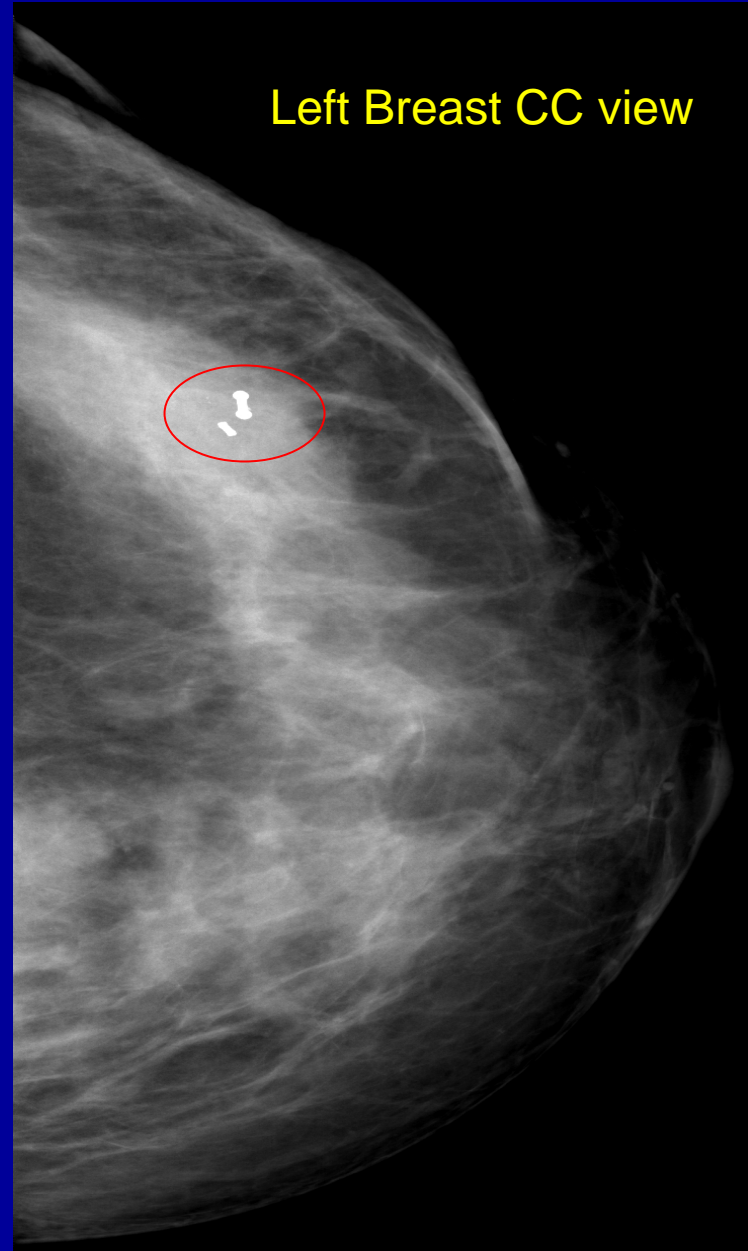
1. 4x 2 mm size
2. 3 x mass versus 1x3 marker
3. Easier to see on
  - Mammography
  - Ultrasound
  - MRI
  - Does not interfere with MR spectroscopy

45 year-old female with left breast mass on mammography showing atypia

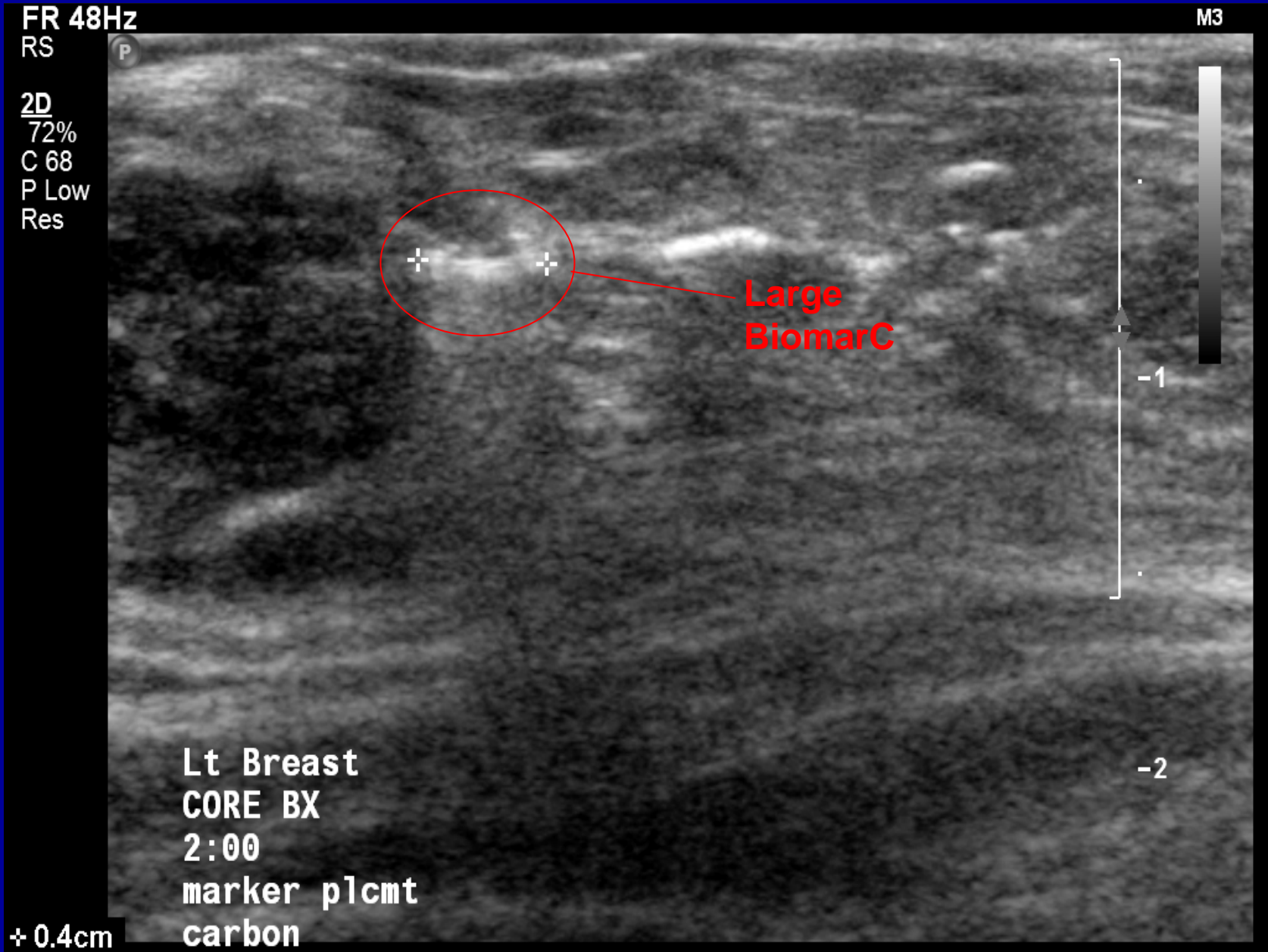
Left Breast MLO view



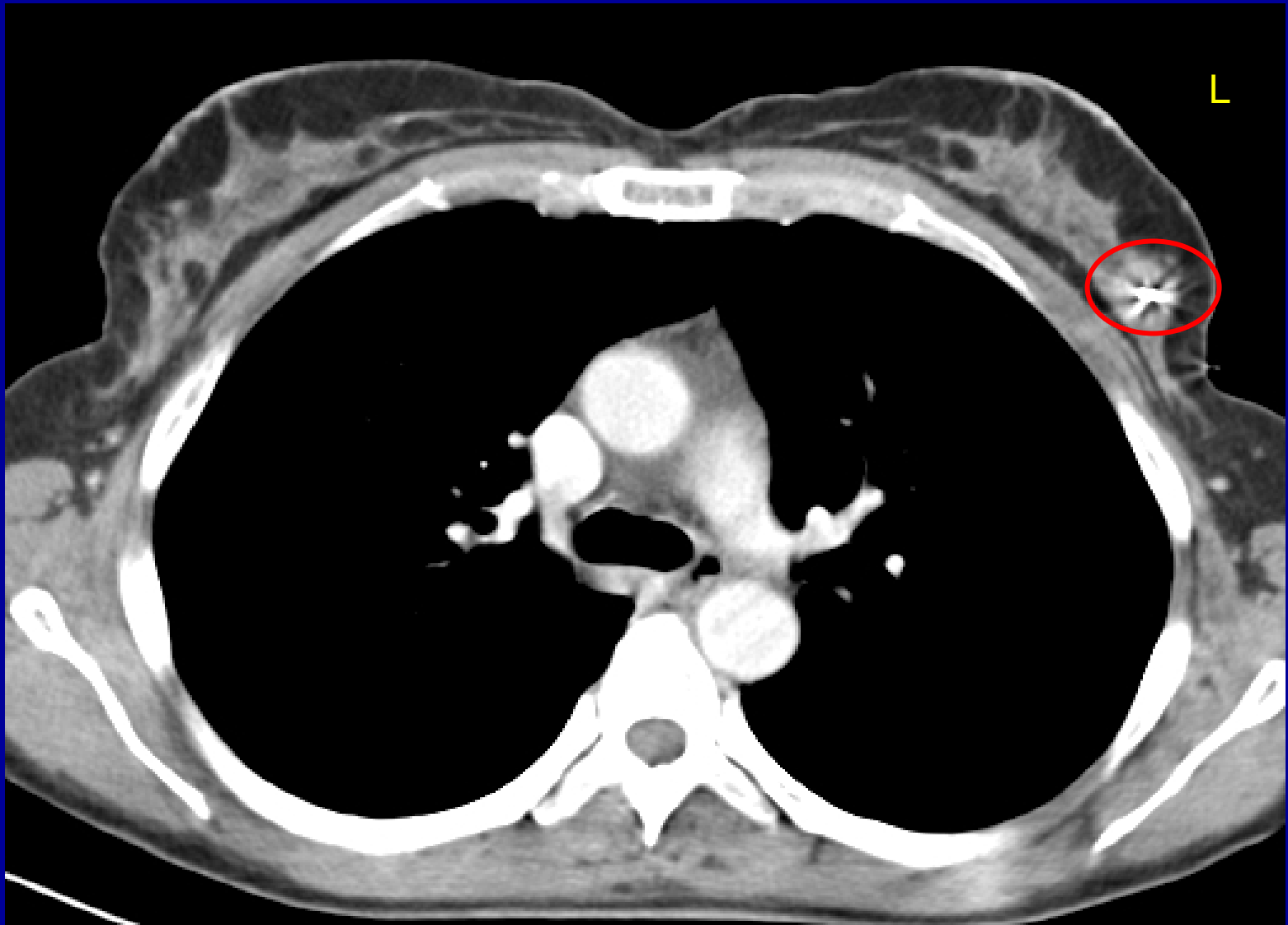
Left Breast CC view



# 45 year-old female with left breast mass on ultrasound showing atypia

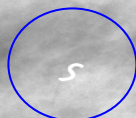
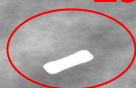


CT scan of the chest showing two BiomarCs in left breast in 45-year old female

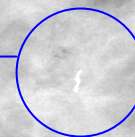


45-year-old female with right breast atypical ductal hyperplasia

Large BiomarC



SenorX, titanium



Right Breast CC view

Right Breast MLO view

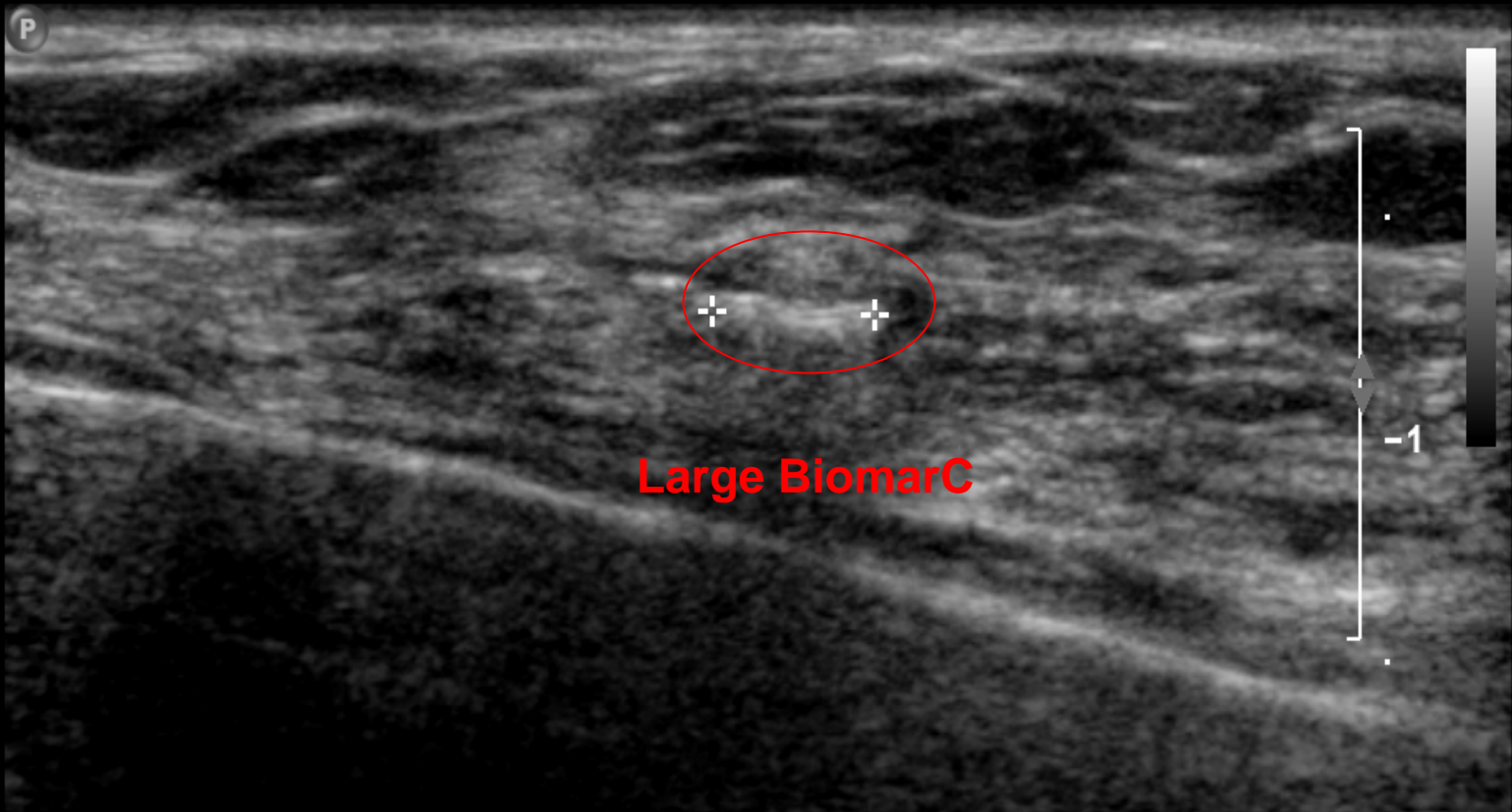


# 45-year-old female right breast atypical ductal hyperplasia seen on ultrasound

FR 45Hz  
RS

M3

2D  
66%  
C 68  
P Low  
Res

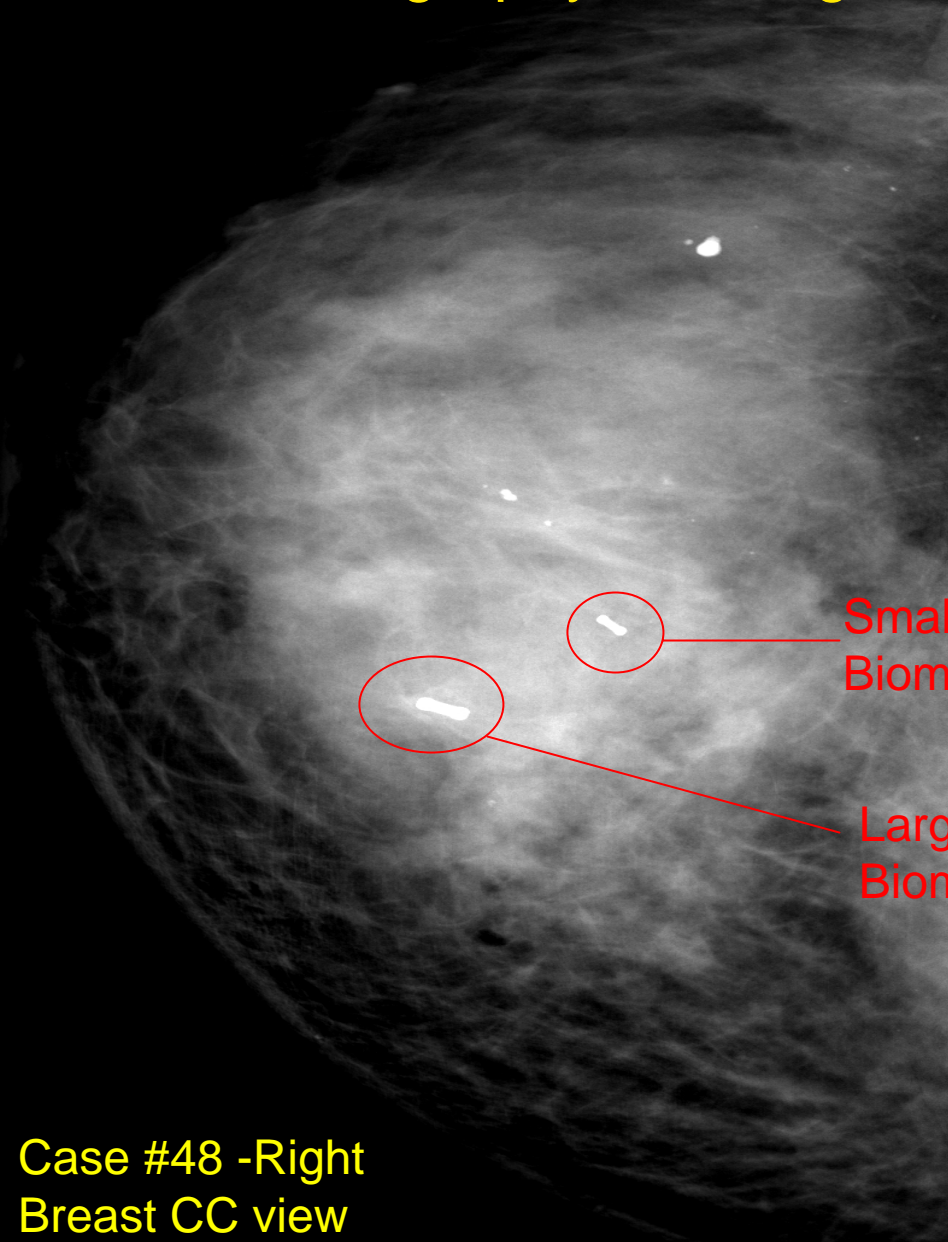


Large BiomarC

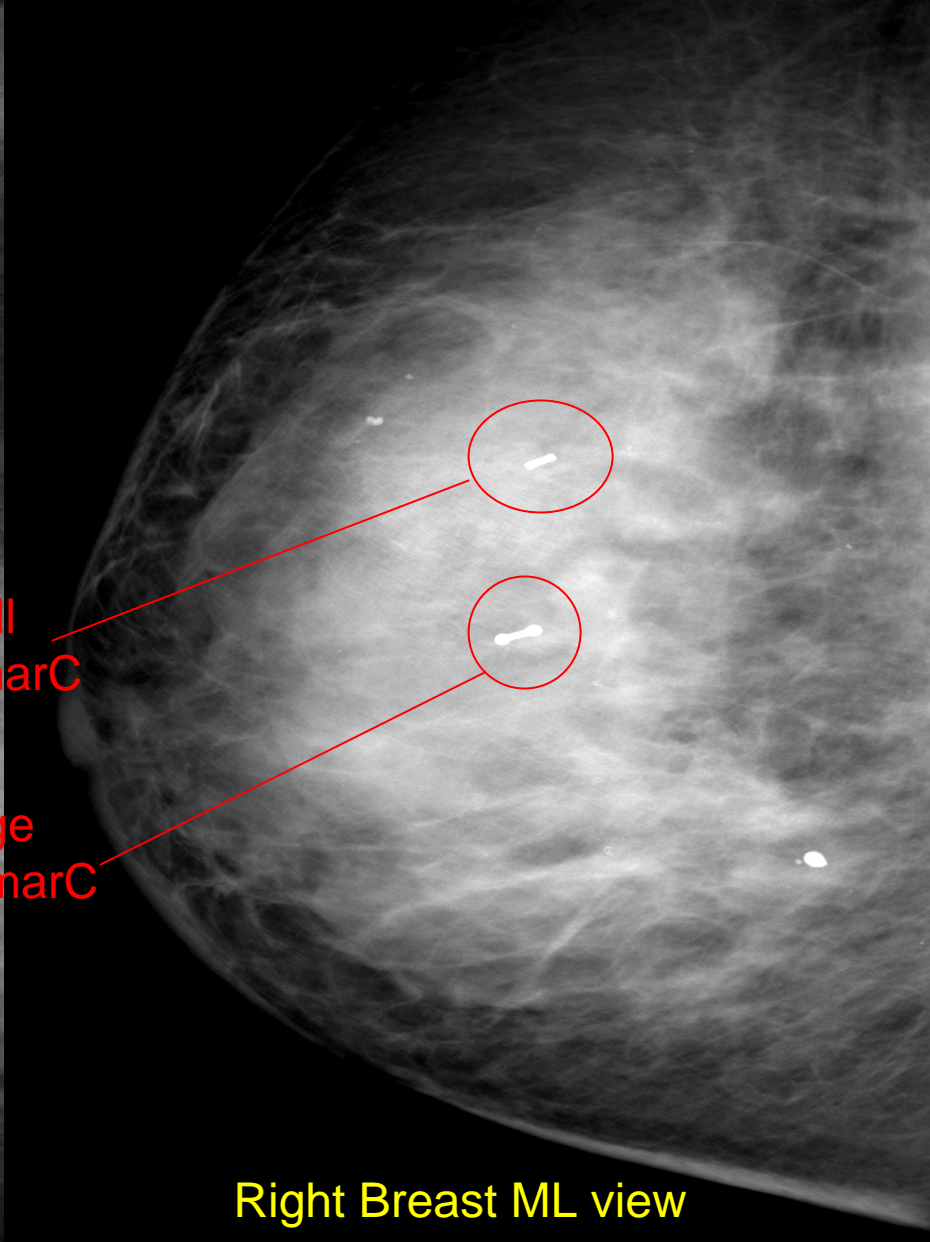
carbon mrkr  
larger  
Rt Breast  
CORE BX  
7:00

+ 0.4cm

61-year-old female with right breast mass seen on mammography showing invasive lobular carcinoma



Case #48 -Right Breast CC view



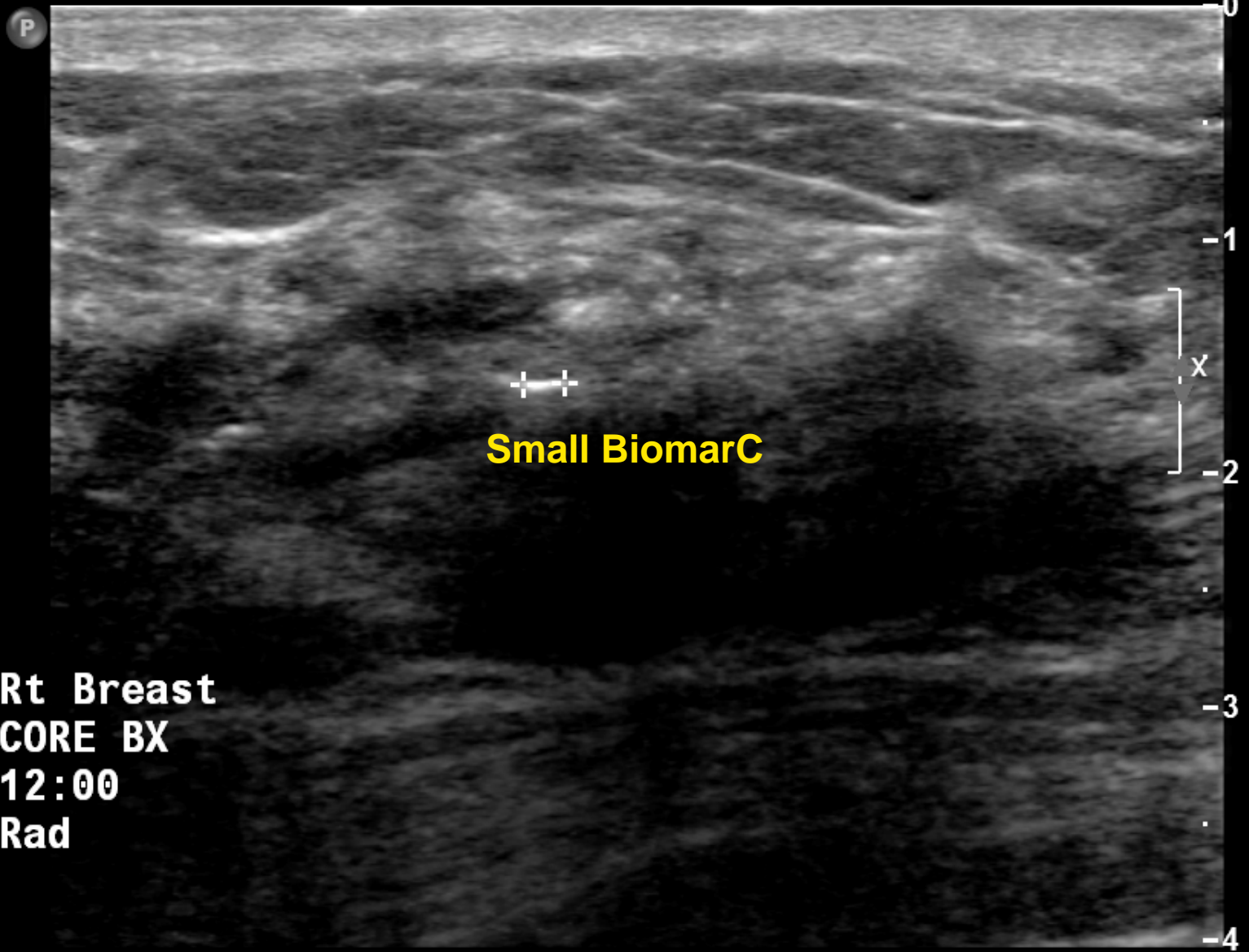
Right Breast ML view

# 61 year old female with invasive lobular carcinoma of the right breast seen on ultrasound

FR 42Hz  
RS

M3

2D  
59%  
C 60  
P Low  
Res



Rt Breast  
CORE BX  
12:00  
Rad

+ 0.2cm

## Conclusion:

- RM (BiomarC<sup>®</sup>) - deployed with accuracy (4mm) and was clearly visible under mammography, ultrasound, and MRI
- Follow up studies after 12 weeks demonstrated no evidence of migration
- RM did not interfere with <sup>1</sup>H MR spectroscopy (1.5 T or 4T) or PET scanning.