

Development of a New Soft Tissue Breast Radiographic Marker for Breast Biopsy and Other Soft Tissue Tumors

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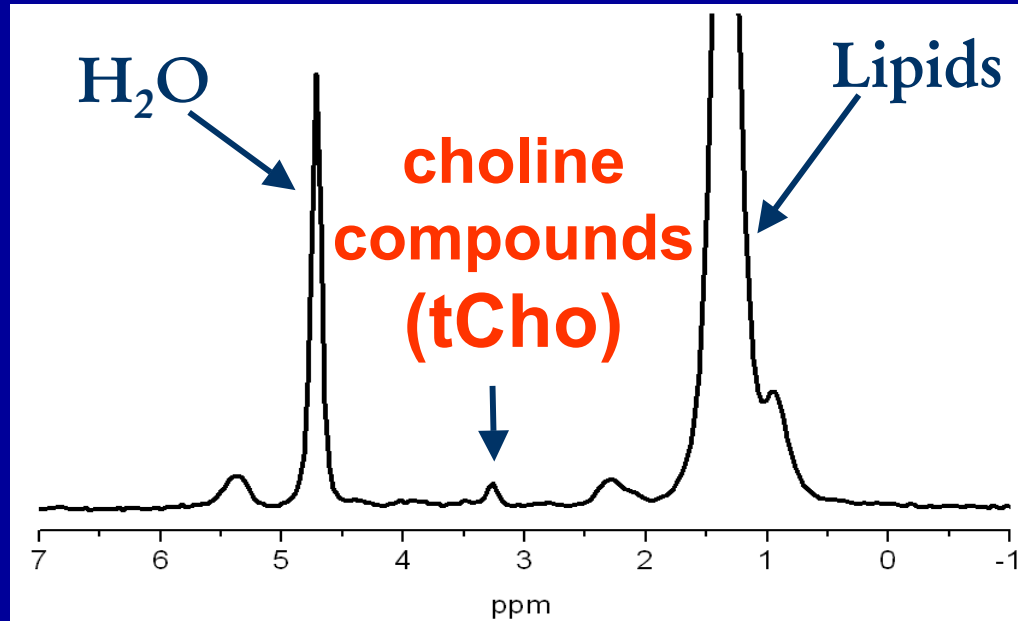
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Background:

- 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* ^1H MR Spectroscopy

Background:

¹H 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

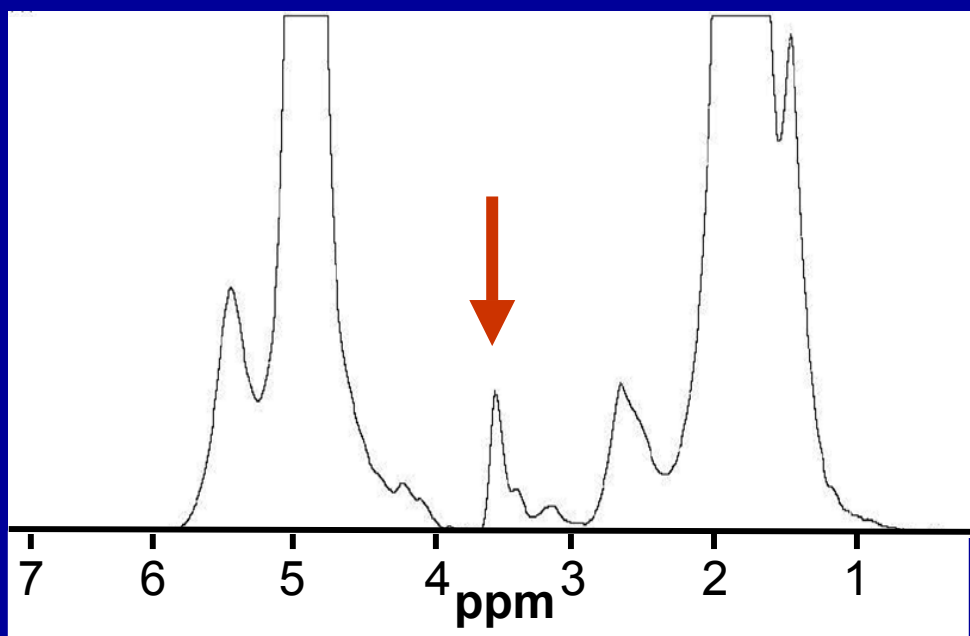
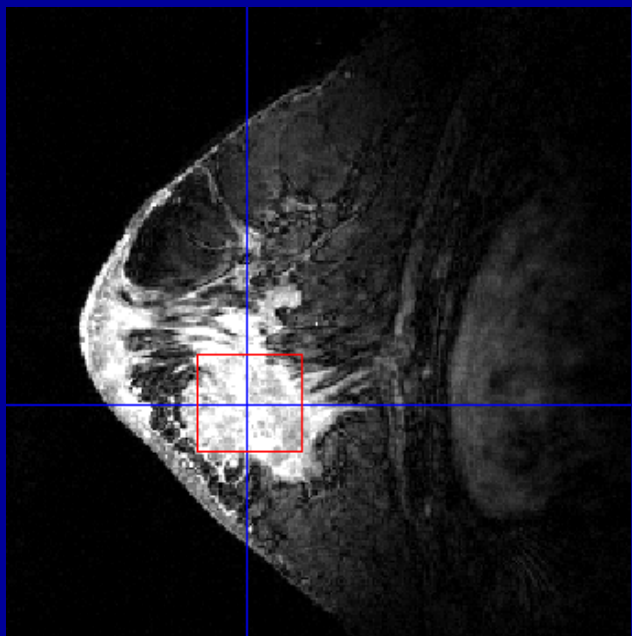
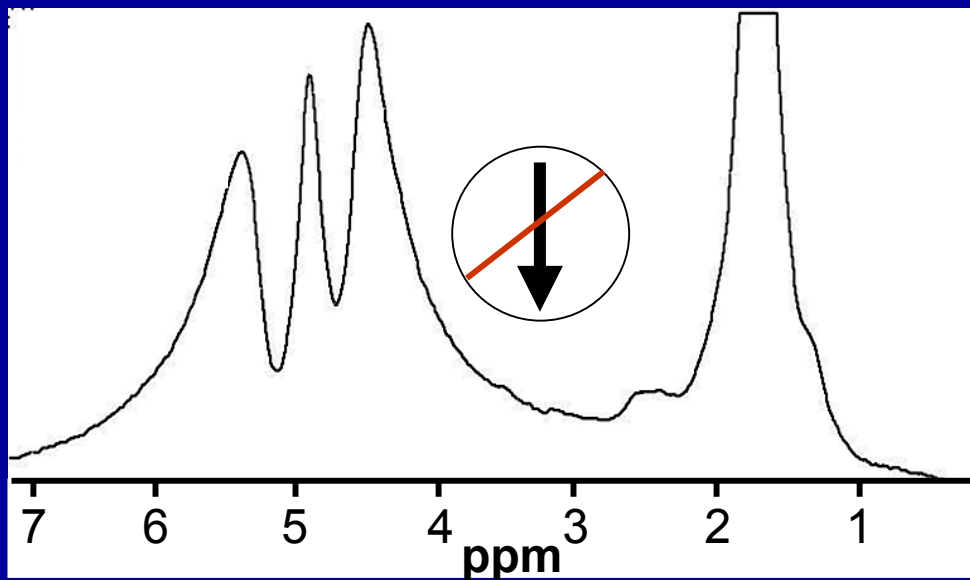
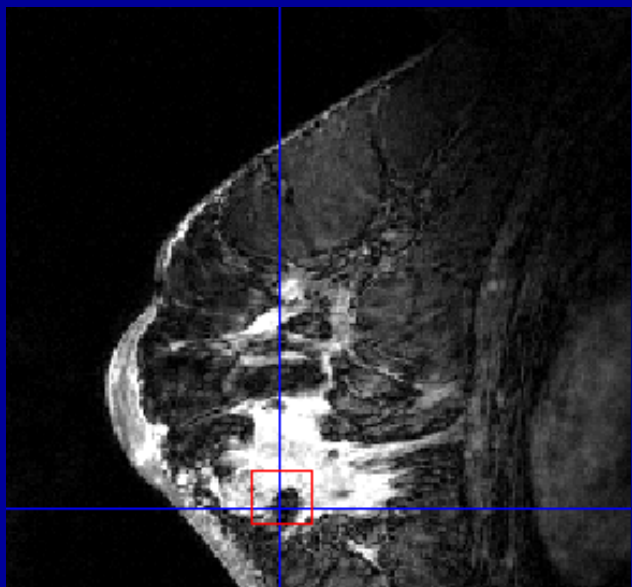
- Lanner et al AJR 2004
- Kubota et al Breast Cancer 2004

- Breast ^1H 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[®] (Carbon Medical Inc.)
- Composition: Pyrolytic Carbon Zirconium Oxide
- Size: 3 mm X 1 mm
- Color: Black

- **40 Biomarc[®] RM in 33 patients (BIRAD 4/5)**

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

Materials and Methods:

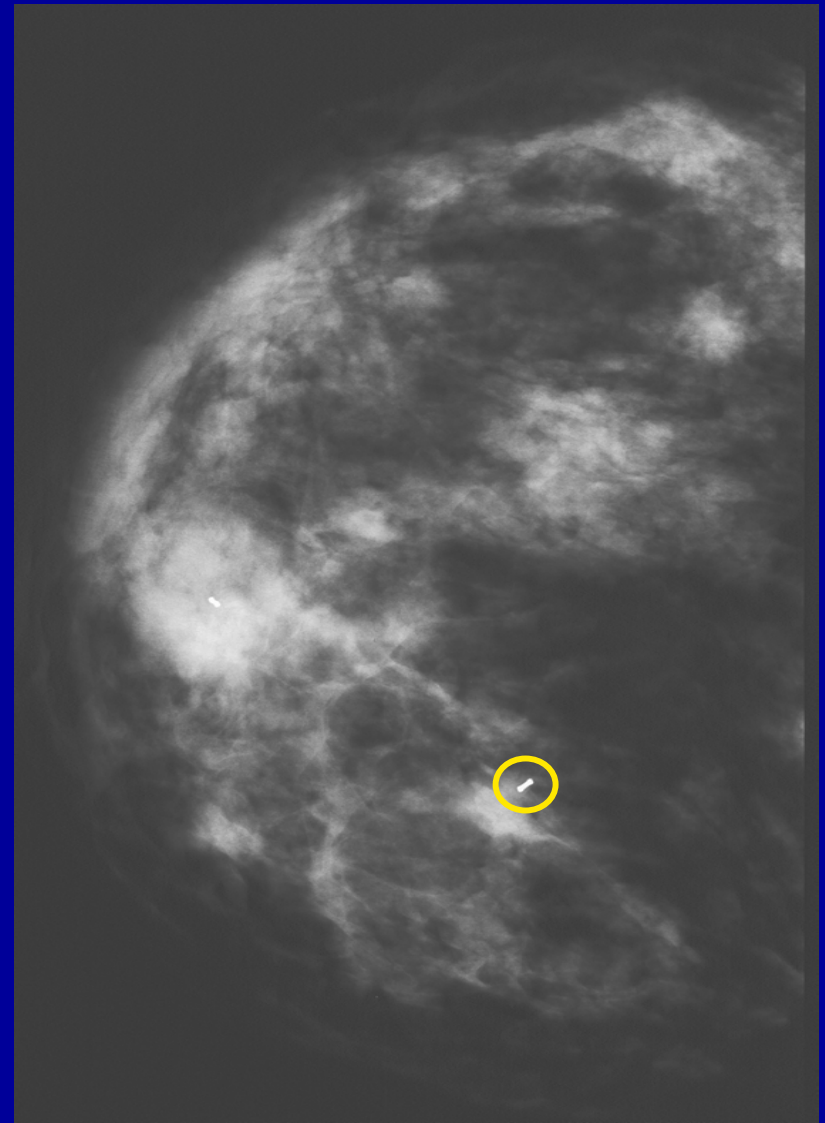
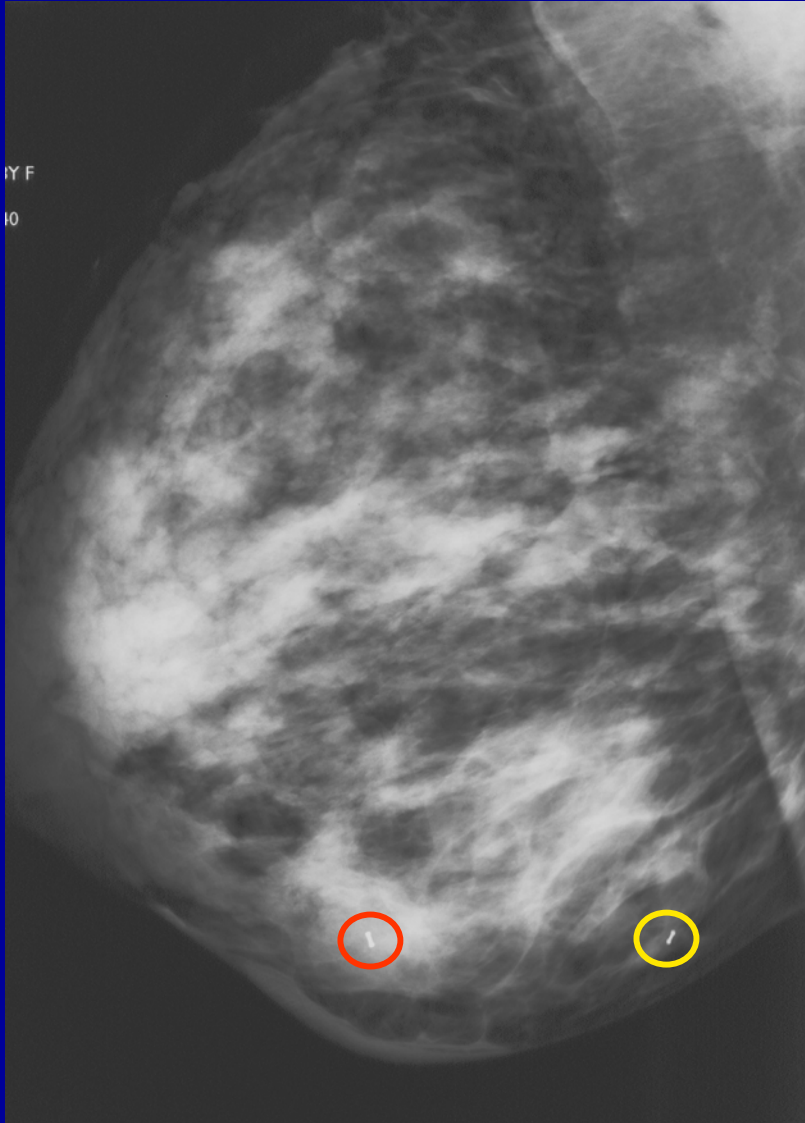
- All RM evaluated for visibility at time of deployment:
 - Mammography
 - Ultrasound
- 15 RM evaluated for migration and visibility on follow up:
 - 5 – mammography at 6 month follow up
 - 10 – ultrasound at 3 wk, 6wk, and 24 wks
- 5 RM were check for void and spectral artifact at 1.5 T and 4T
 - [tCho]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

Results:

- All 32 RM – placed within 4 mm of biopsy site
- All 32 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

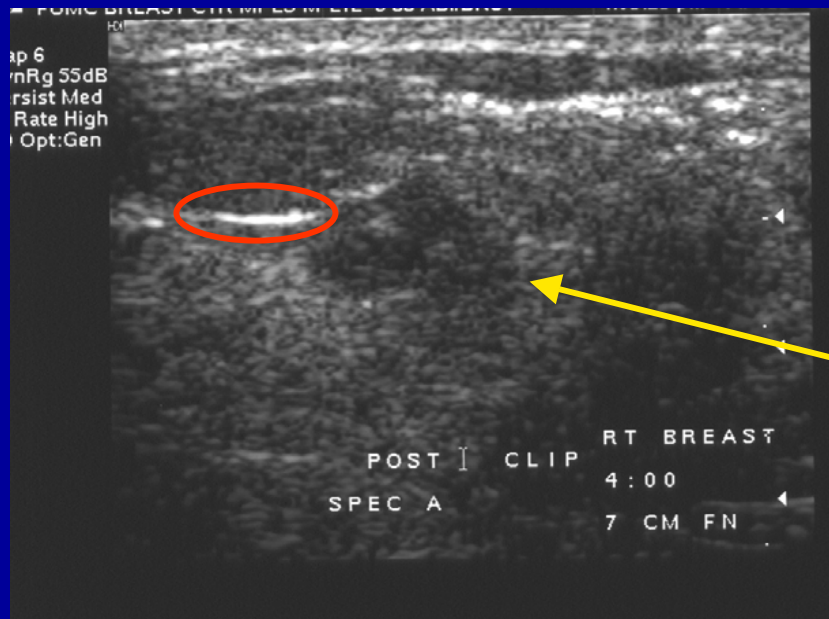
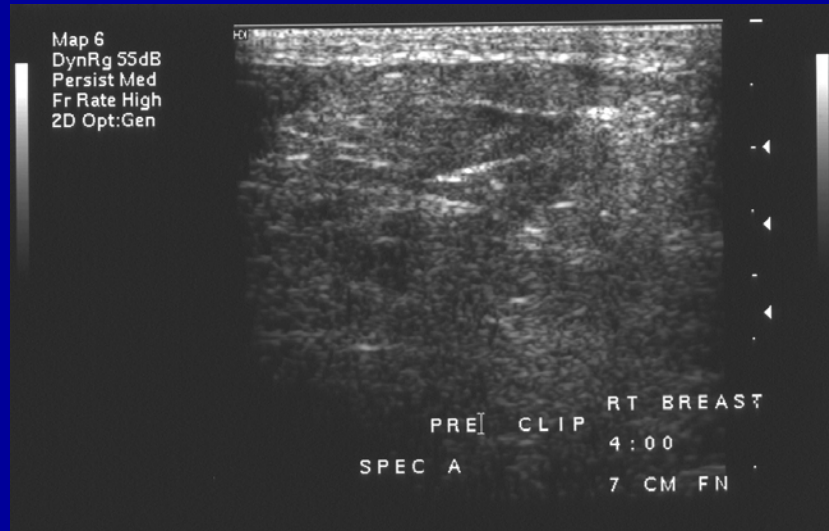
BiomarC[®] - Mammography

38 year old female with invasive ductal carcinoma



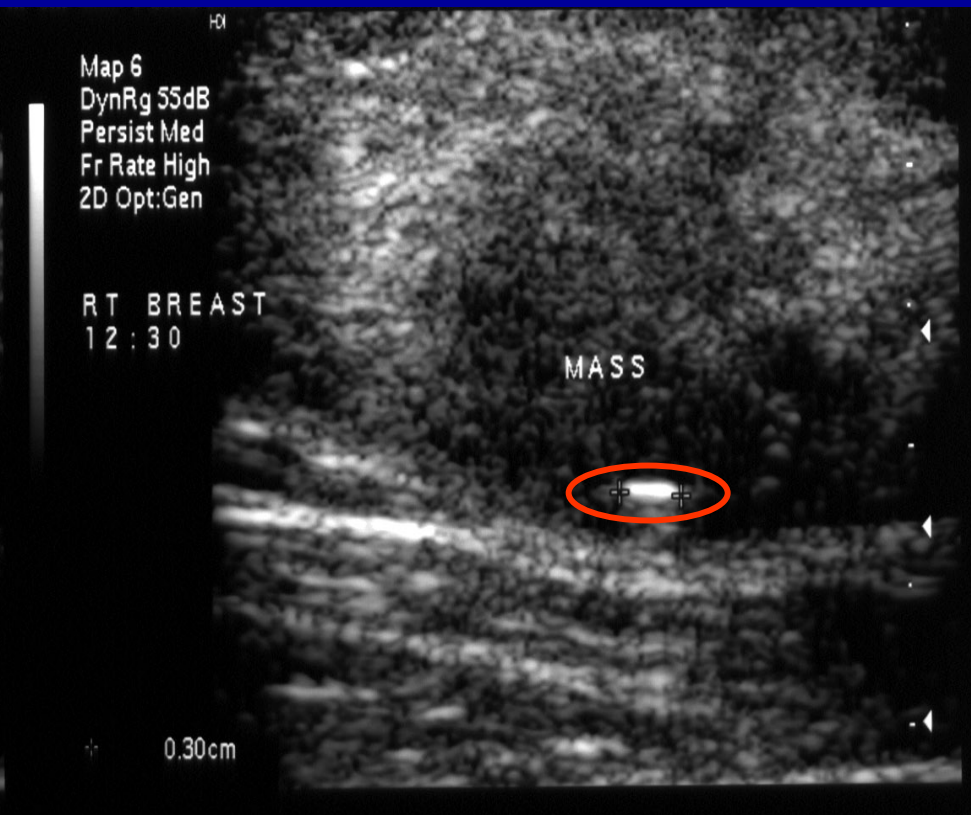
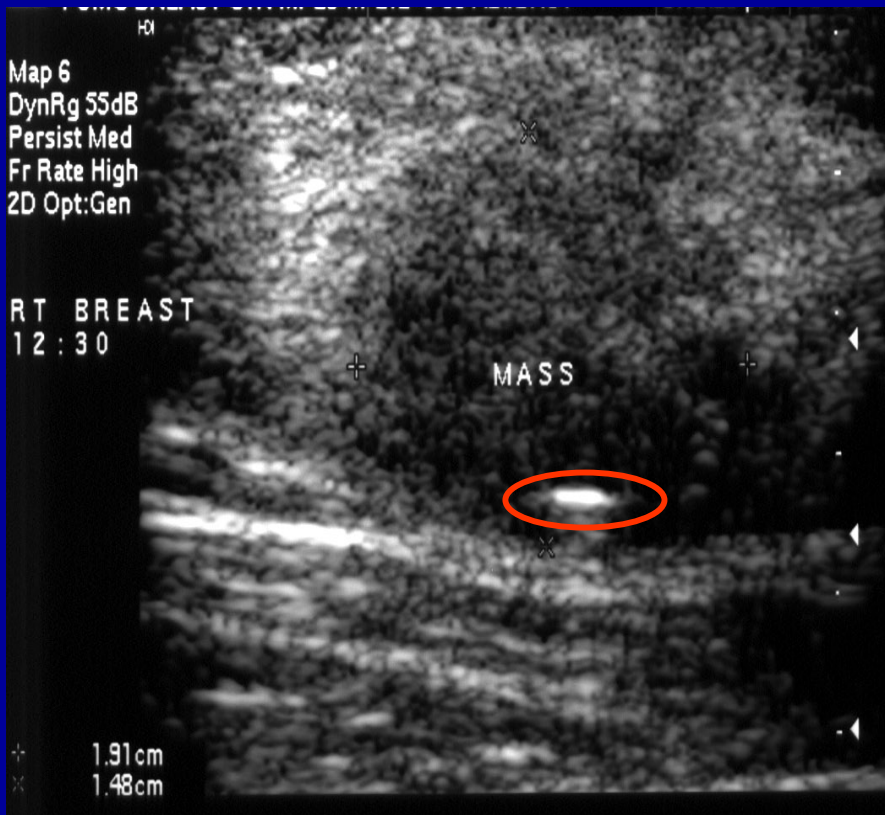
BiomarC[®] - Ultrasound

38 year old female with invasive ductal carcinoma



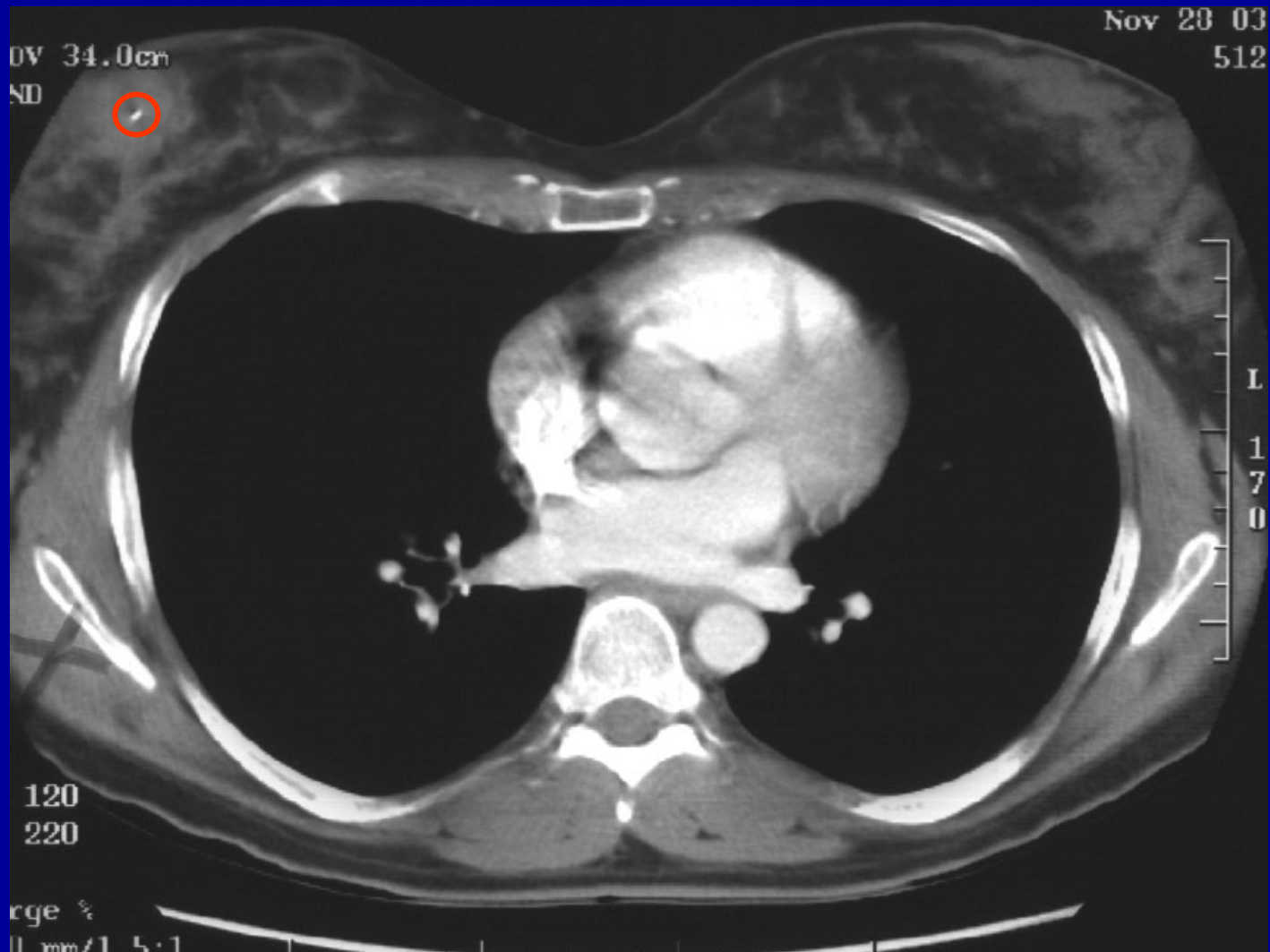
BiomarC[®] - Ultrasound

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



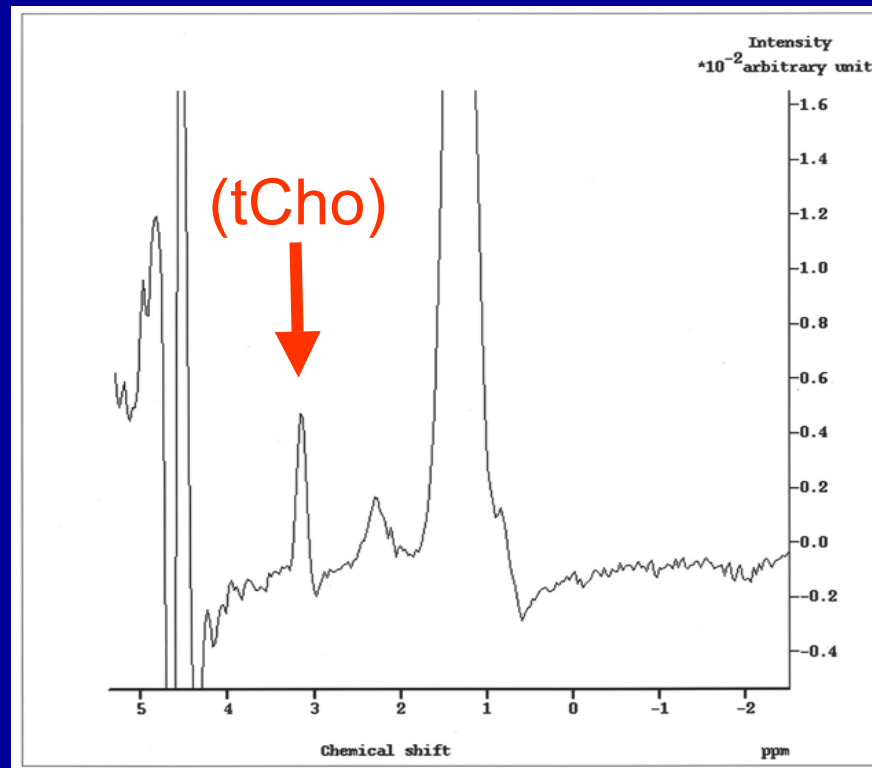
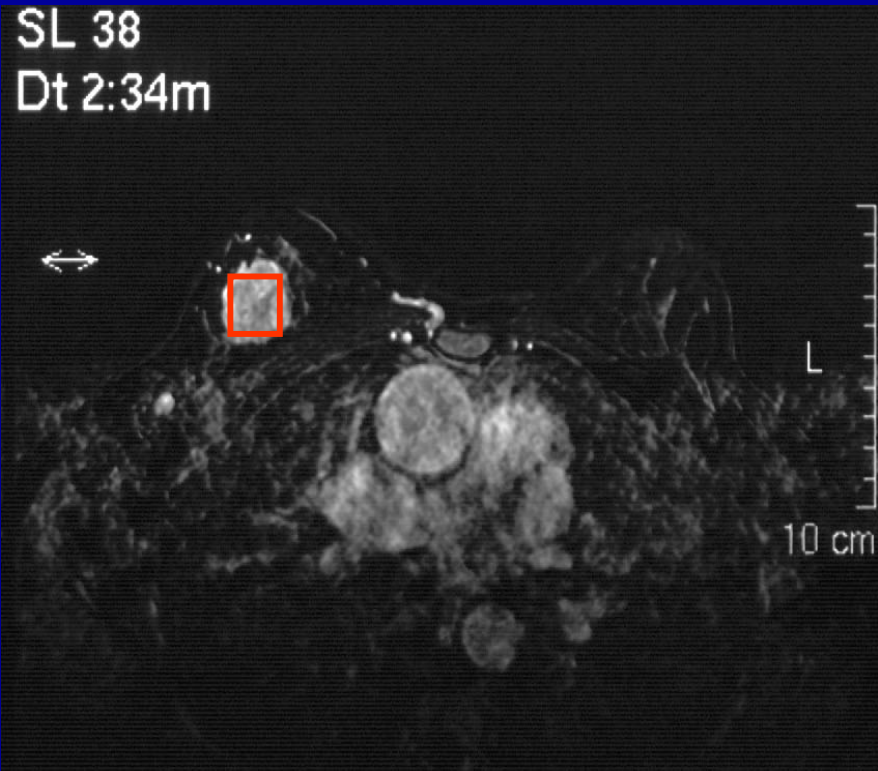
BiomarC[®] - Computed Tomography

38 year old female with invasive ductal carcinoma



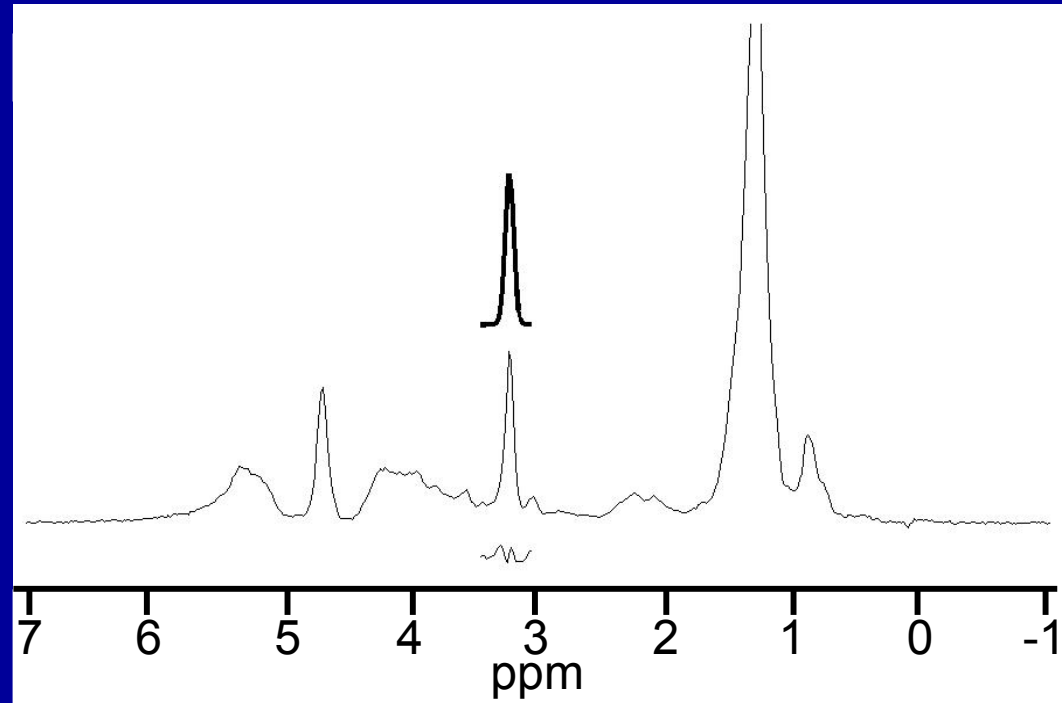
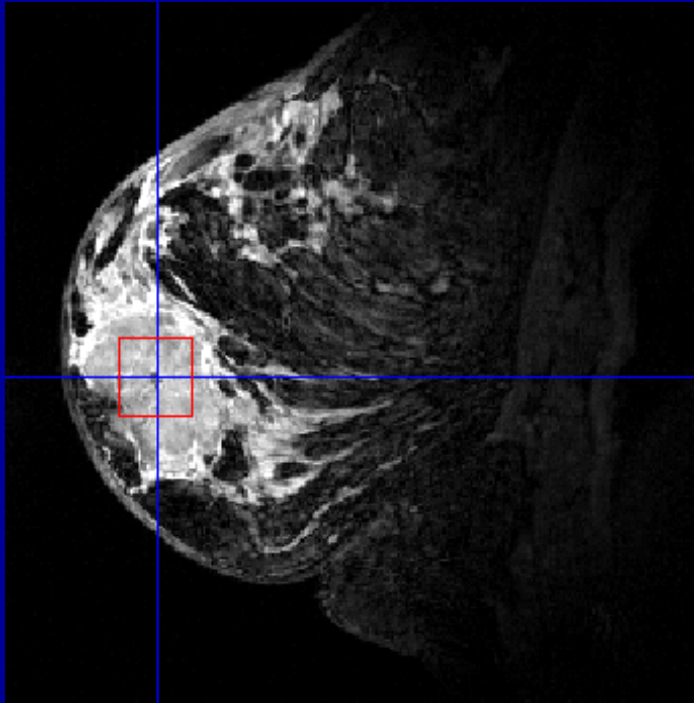
BiomarC[®] - 1.5T MRI / MRS

38 year old female with invasive ductal carcinoma



BiomarC[®] - 4T MRI / MRS

38 year old female with invasive ductal carcinoma

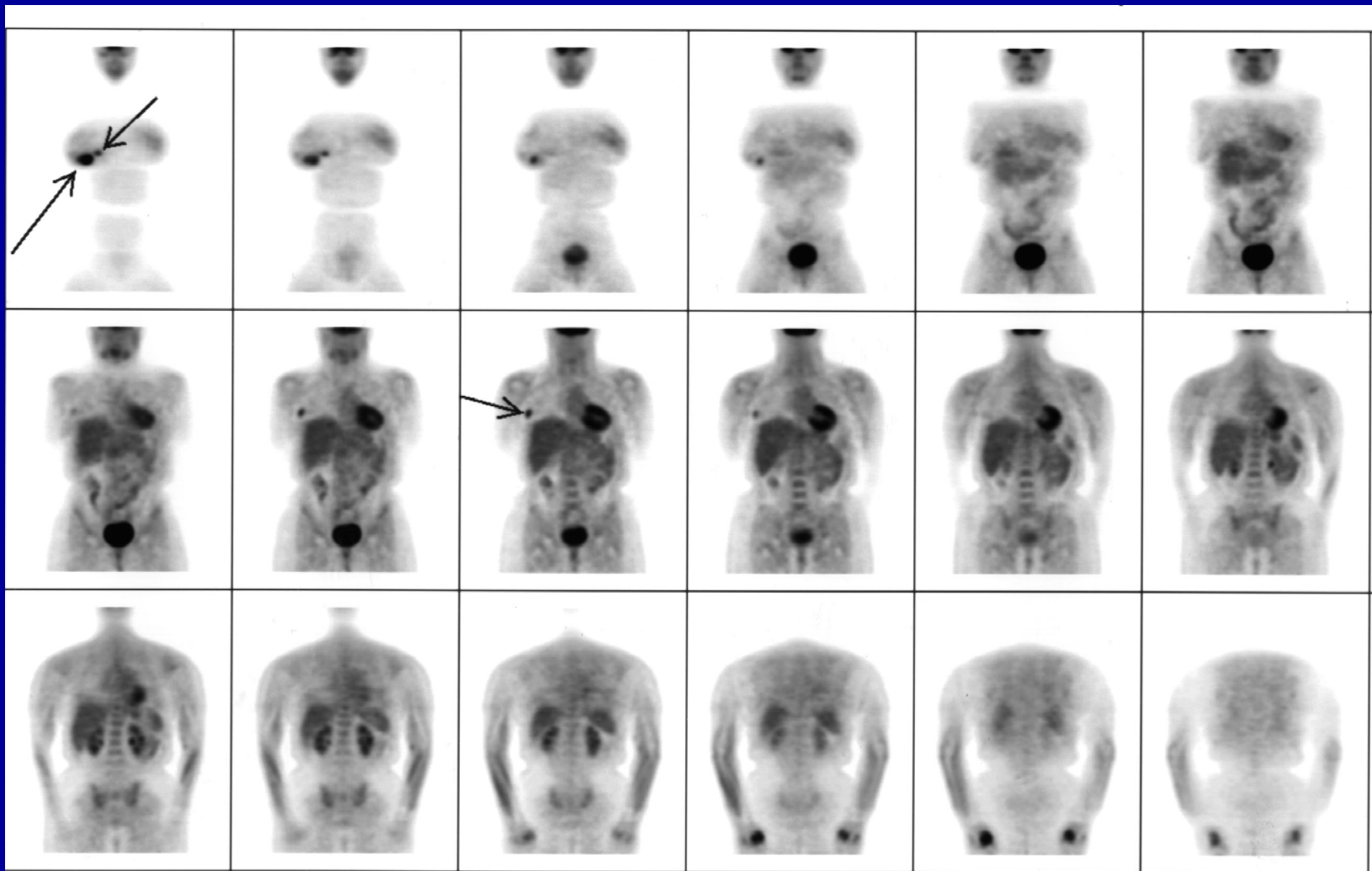


$$[t\text{Cho}] = 4.85 \pm .07$$

Highly consistent with malignancy

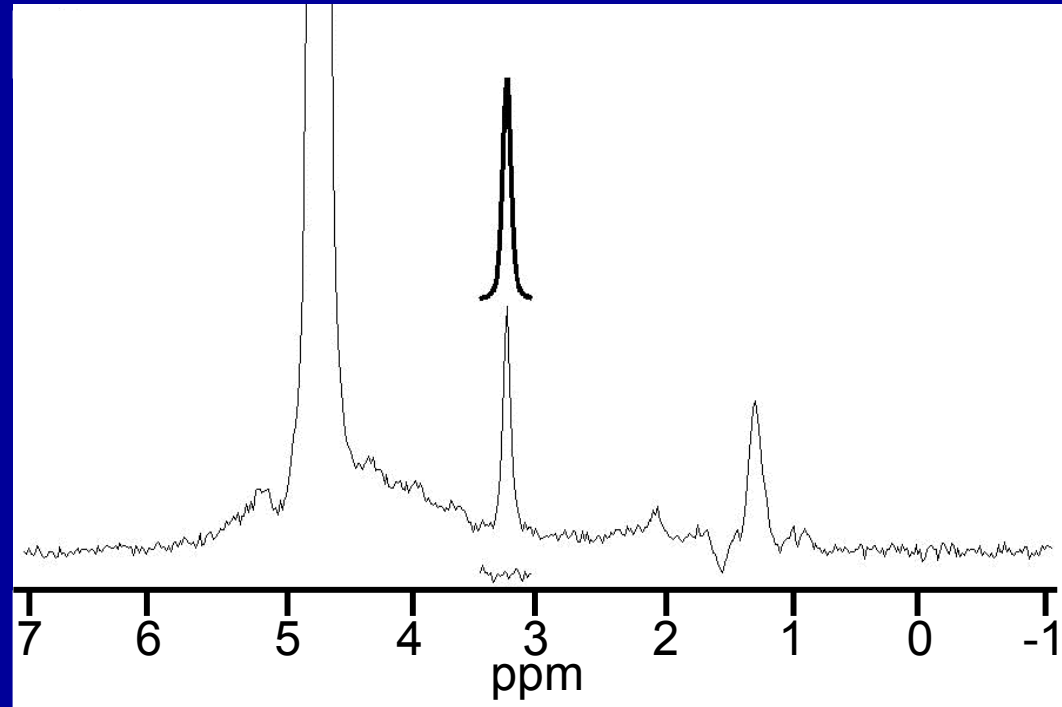
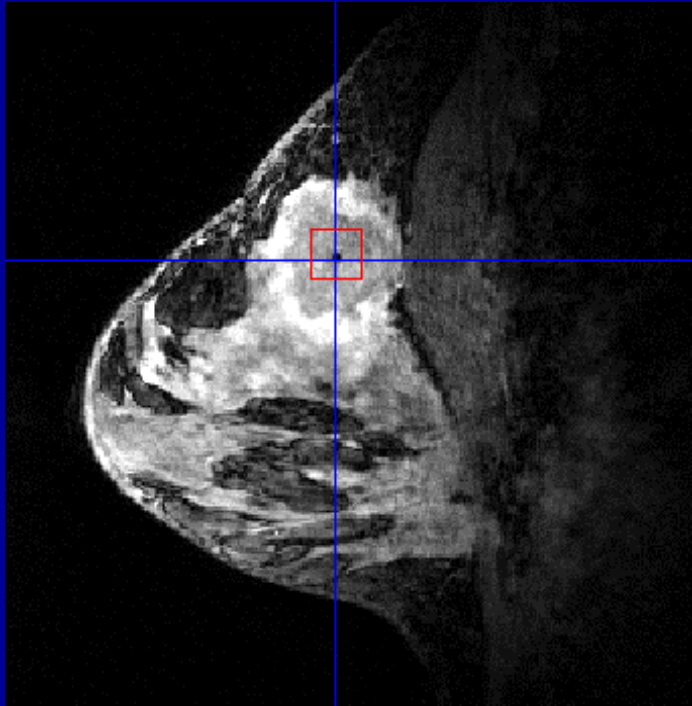
BiomarC[®] - PET Scan

38 year old female with invasive ductal carcinoma



BiomarC[®] - 4T MRI / MRS

47 year old female with invasive ductal carcinoma



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

Highly consistent with malignancy

Conclusion:

- RM (BiomarC[®]) - 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 ¹H MR spectroscopy (1.5 T or 4T) or PET scanning.