

Sistema Socio Sanitario



Regione
Lombardia

ATS Brescia



lo *screening* per la diagnosi precoce del
tumore alla mammella:
cosa cambierà con la *tomosintesi*

dr.ssa Malvasi

UO Radiologia 1, ASST Spedali Civili di Brescia

digital breast tomosynthesis (DBT)

- **Principio:**

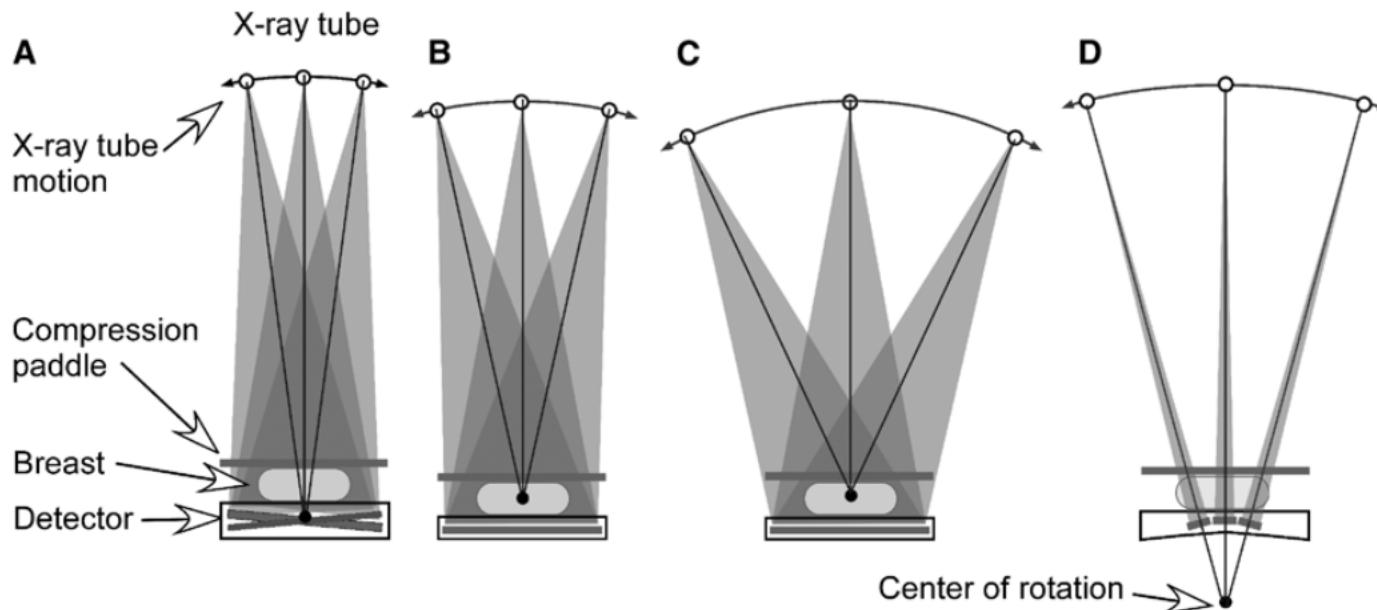
- acquisire multiple proiezioni a bassa dose della mammella mediante un movimento angolare del tubo radiogeno e successivamente determinare una ricostruzione pseudo-tridimensionale della mammella.

- **Scopo:**

- aumentare sensibilità e specificità del test riducendo gli effetti di **sovrapposizione** che possono comportare un mascheramento/misconoscimento delle lesioni eteroplastiche della mammella

acquisizione

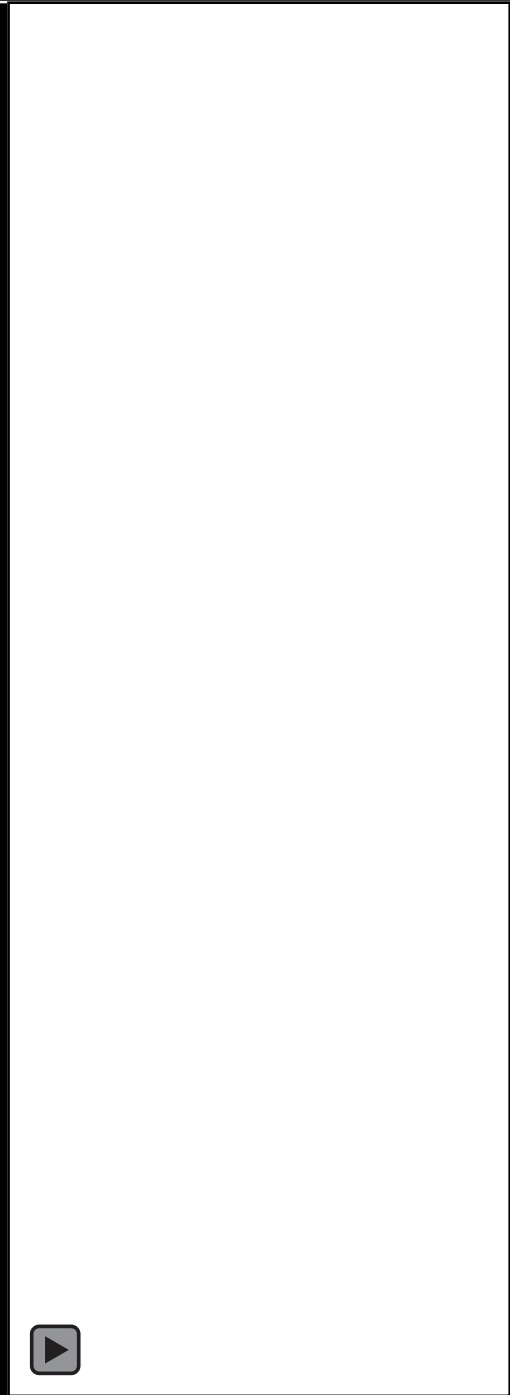
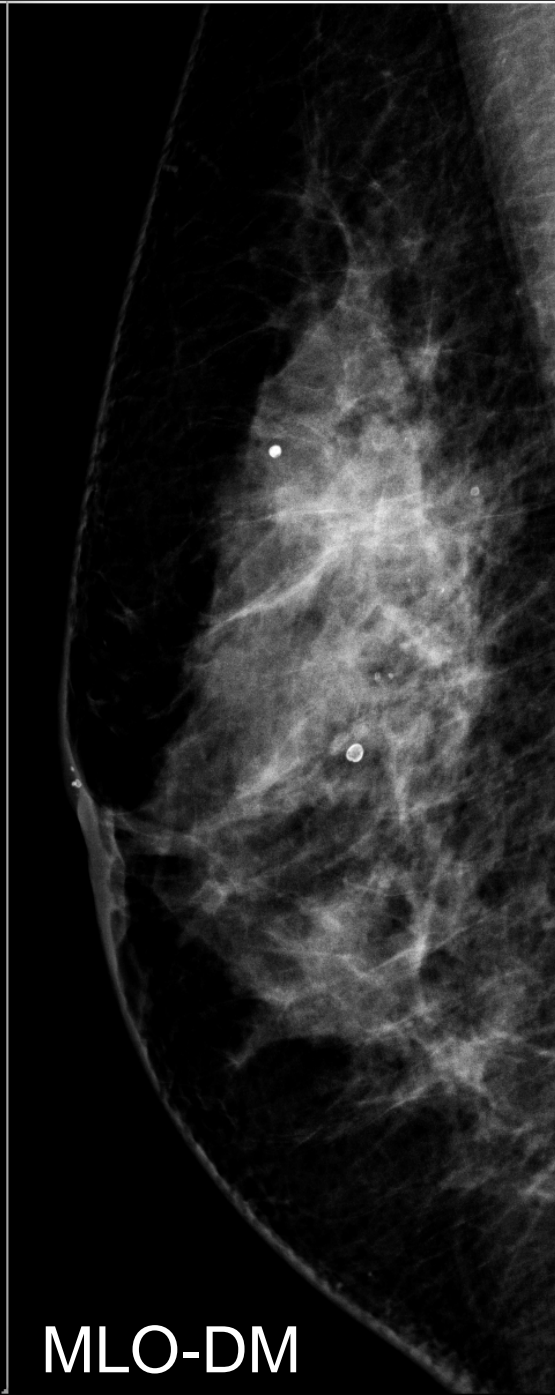
- il tubo radiogeno compie un arco di rotazione (da $\pm 7,5^\circ$ a $\pm 25^\circ$) raccogliendo multiple proiezioni della mammella sotto diversi angoli
- *dataset volumetrico*



sistemi-DBT

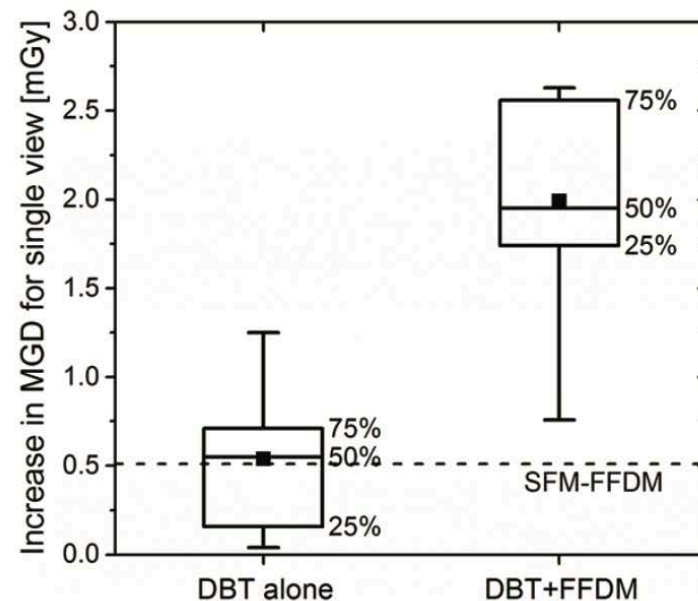
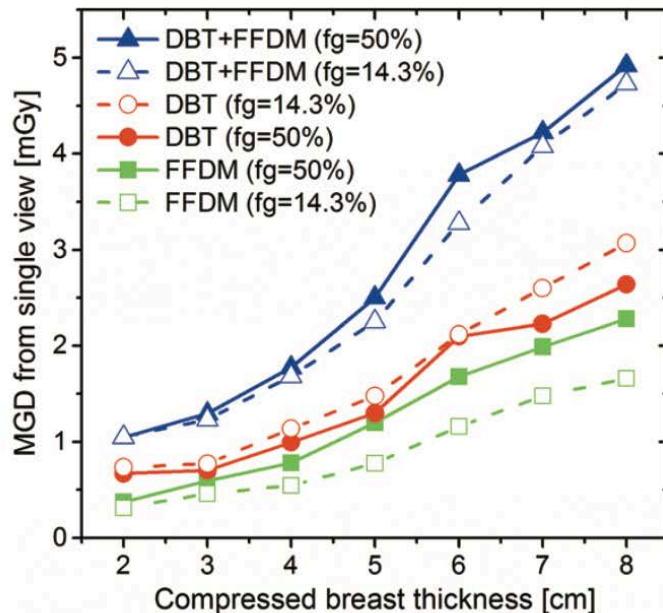
Specifications of Clinical DBT Systems

Manufacturer	General Electric*	Hologic	Internazionale Medico Scientifica	Siemens
Model/platform	SenoClaire/Senographe Essential	Selenia Dimensions	Giotto Tomo	MAMMOMAT Inspiration
Source to detector distance (cm)	66	70	68	65.5
Source to center-of-rotation distance (cm)	62	70	66	60.8
Source to breast support distance (cm)	63.8	67.5	65.8	63.8
X-ray tube angular range	$\pm 12.5^\circ$	$\pm 7.5^\circ$	$\pm 20^\circ$	$\pm 25^\circ$
X-ray tube motion	Step-and-shoot	Continuous	Step-and-shoot	Continuous
Detector angular range	Stationary	$\pm 2.1^\circ$	Stationary	Stationary
X-ray tube target material(s)	Mo/Rh	W	W	W
X-ray filter material(s)	Mo/Rh	Al	Rh/Ag	Rh
No. of projections	9	15	13	25
Equiangular distribution of projections	Yes	Yes	No [†]	Yes
Scan time (sec)	Typically <10	3.7	12	25
Detector type	a-Si indirect conversion	a-Se direct conversion	a-Se direct conversion	a-Se direct conversion
Detector pixel size (μm) [‡]	100	70 (2 × 2 binned)	85	85
Equal milliampere-second/projection	Yes	Yes	No [§]	Yes
Reconstruction method	Iterative (ASiR-DBT)	FBP/Iterative contrast	Iterative	FBP/section thickness filter



dose

- la dose della DBT è comparabile a quella della DM
- l'acquisizione di entrambe (DBT+DM) determina un raddoppio della dose:
 - utilizzo delle “proiezioni sintetiche” (SM)?
- la dose è maggiore per i seni “densi”



DBT: *vantaggi*

- riproducibile - non-operatore dipendente
 - necessaria però una corretta esecuzione!
- poco rumore d'immagine
- pochi artefatti
- qualità costante
- processazione digitale
- *minor sovrapposizione di tessuto*
- *miglior caratterizzazione della lesione (BIRADS)*
- *localizzazione tridimensionale della lesione*
- *staging di nuove lesioni*

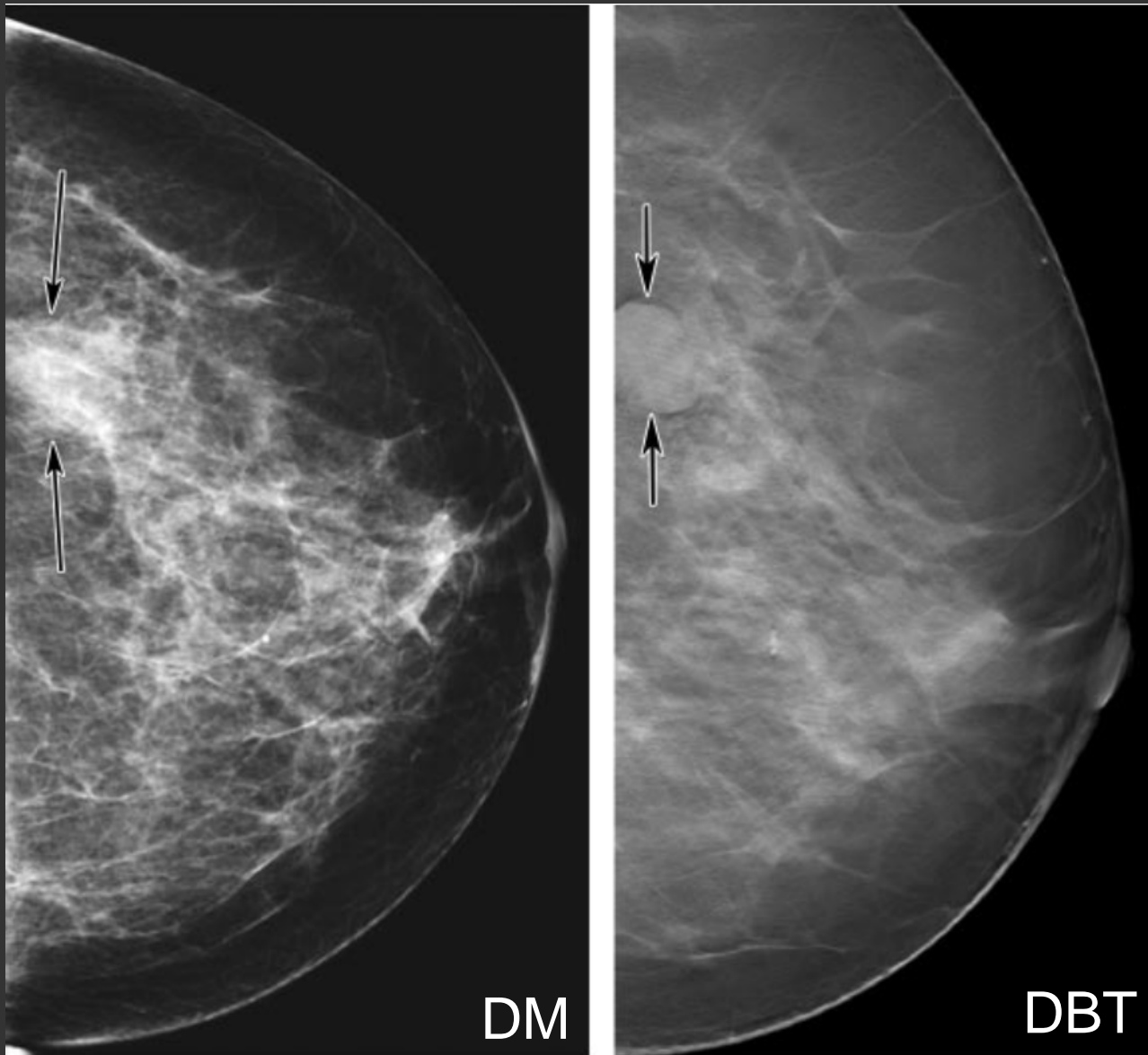
DBT: punti di forza

- incremento di sensibilità, specificità e v. predittivo
 - tumori invasivi occulti: 16% DM, 3% per DBT
- *distorsione architetturale*
 - 74% dei tumori occulti alla DM, si mostravano come distorsioni architetturali alla DBT
 - di questi, 70% erano carcinomi lobulari invasivi e 30% carcinomi duttali invasivi
- *asimmetria focale*
 - discrimina una sovrapposizione di tessuto
 - localizza tridimensionalmente la lesione

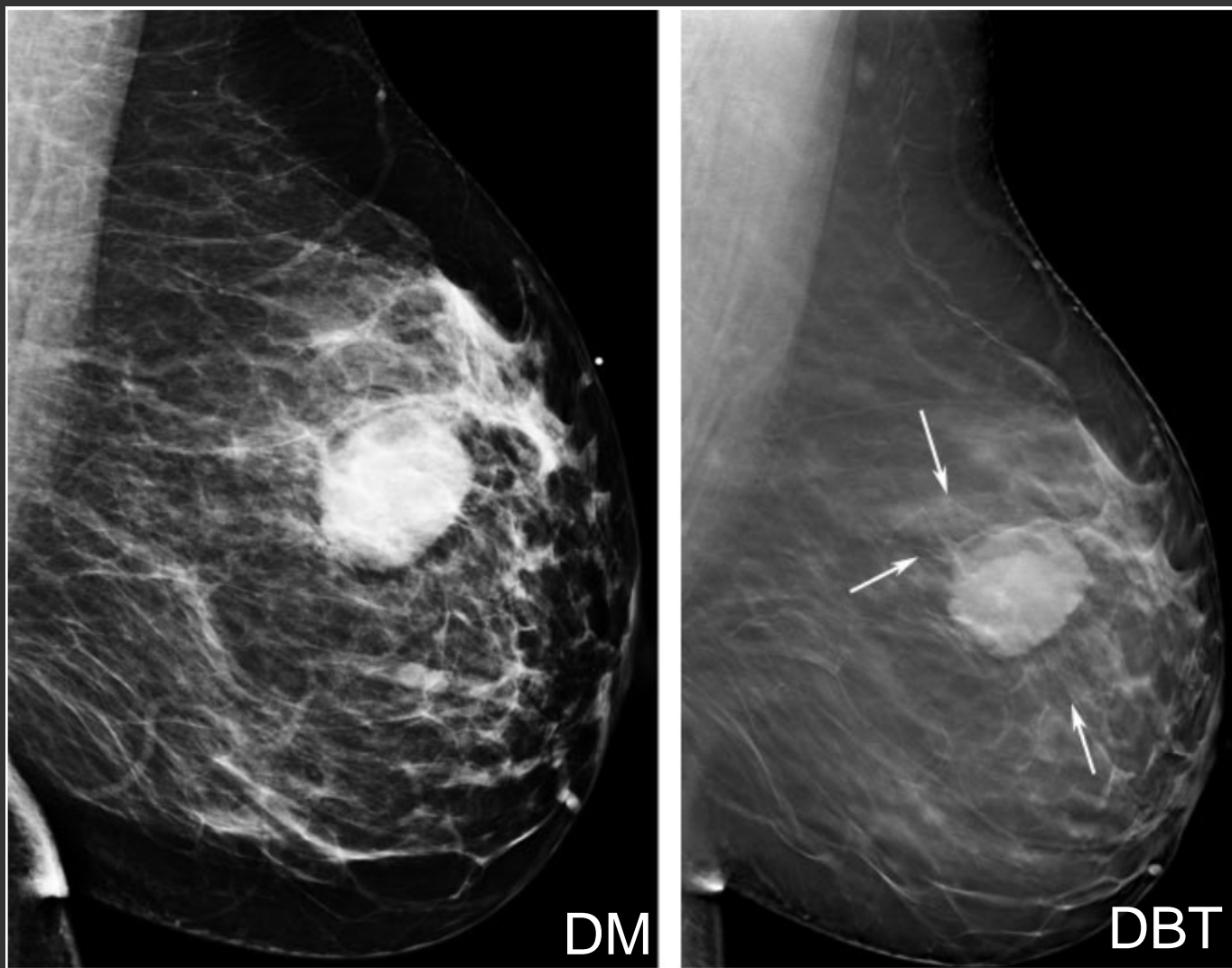
DBT: *svantaggi e controindicazioni*

- microcalcificazioni
 - meglio visualizzabili in SLAB
- dose
- acquisto di macchinari idonei
- tempi di acquisizione
- tempi di refertazione (91s vs 45s)
- training di tecnici e medici
- controindicazioni identiche a quelle della mammografia tradizionale
 - tempo di compressione maggiore
- spessore del seno compresso <2cm

margini: lesione benigna



margini: carcinoma duttale invasivo



margini microlobulati e irregolari

screening: DBT+DM vs DM

- riduzione del tasso di richiami
 - riduzione falsi positivi tra 17% e 37%
- incremento nella sensibilità diagnostica
 - aumento del “cancer detection” tra 0,5 e 2,7 per 1000
- risultati validi per qualsiasi densità mammaria
 - ad eccezione dei seni totalmente adiposi
- particolarmente utile nel primo esame di screening:
 - richiamo da 13,6% a 9.6%
 - “cancer detection” da 4.1 a 7.7 per 1000

screening: *trials*

- “one-view DBT” vs “two-view DM”
 - “cancer detection” aumenta da 6.3 a 8.9 per 1000
 - richiamo da 2,6% a 3.8% (aumentato!): sono aumentati i falsi positivi

Study and Reference No.	Study Design	Key Results
OTST trial (86,95)	Four-arm prospective study comparing FFDM, FFDM-CAD, DBT-FFDM, and DBT-SM. Subjects underwent combined DBT-FFDM examination. Independent reading by four radiologists, one for each arm, followed by arbitration.	DBT-FFDM vs FFDM ($n = 12,621$): DBT-FFDM, <ul style="list-style-type: none"> -reduced prearbitration <u>FPR from 6.1% to 5.3%</u> -increased <u>CDR from 6.1 to 8.0</u> -detected <u>25 additional invasive cancers</u> Paired double-read–(DBT-FFDM; DBT-SM) vs (FFDM; FFDM-CAD) ($n = 12,621$): In DBT arm, <ul style="list-style-type: none"> -Prearbitration FPR reduced from 10.3% to 8.5% -CDR increased from 7.1 to 9.4 -27 additional invasive cancers detected
STORM trial (96)	Prospective study comparing FFDM vs DBT-FFDM. Subjects underwent combined DBT-FFDM examination. Sequential double reading of FFDM followed by DBT-FFDM.	DBT-FFDM vs FFDM ($n = 7292$): In DBT arm, <ul style="list-style-type: none"> -Estimated <u>FPR reduction of 17%</u> -<u>CDR increased from 5.3 to 8.1</u> -<u>20 additional cancers detected</u>
Malmo Breast Tomosynthesis Screening Trial (103)	Prospective study comparing one-view (MLO) DBT vs two-view FFDM. Subjects underwent both examinations. Independent reading for each arm followed by arbitration. (Interim results)	One-view DBT vs two-view FFDM ($n = 7,500$): In DBT arm, <ul style="list-style-type: none"> -<u>CDR increased from 6.3 to 8.9</u> -<u>20 additional cancers detected</u> -<u>Recall rate increased from 2.6% to 3.8%</u>

screening: *il nostro approccio*

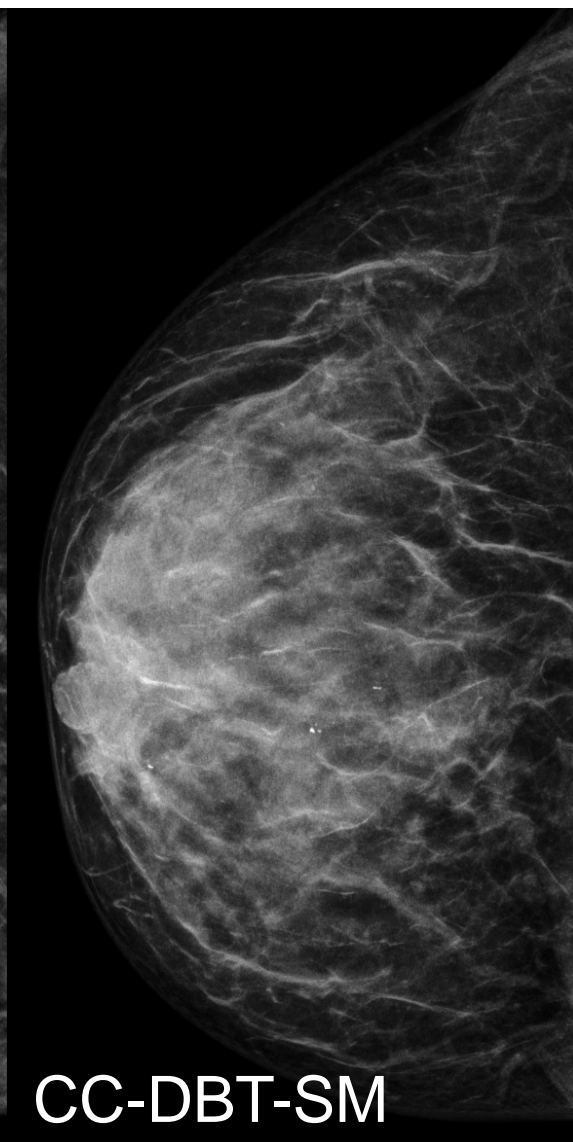
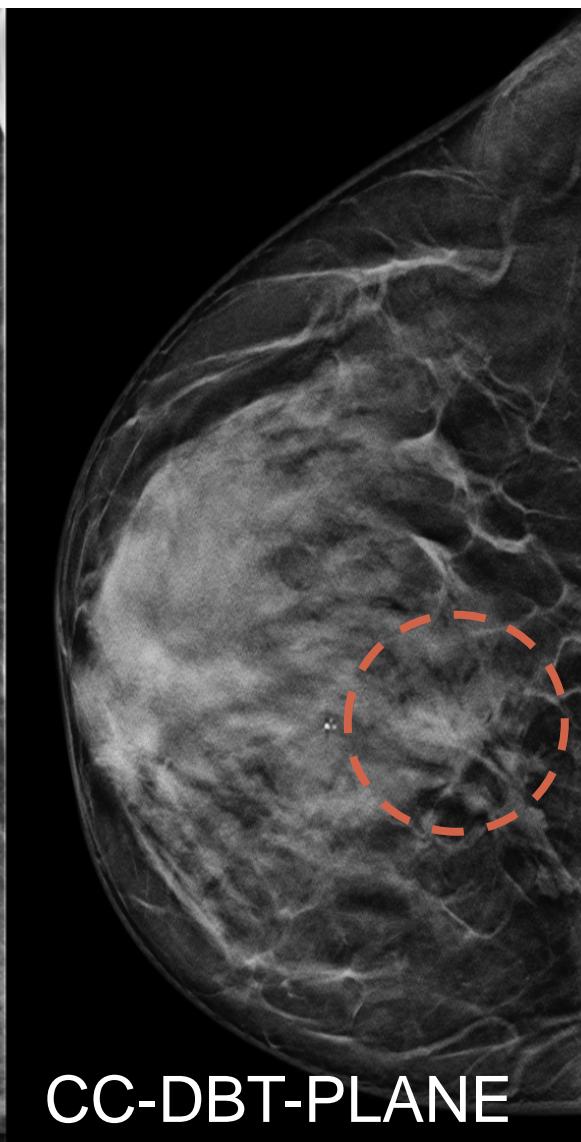
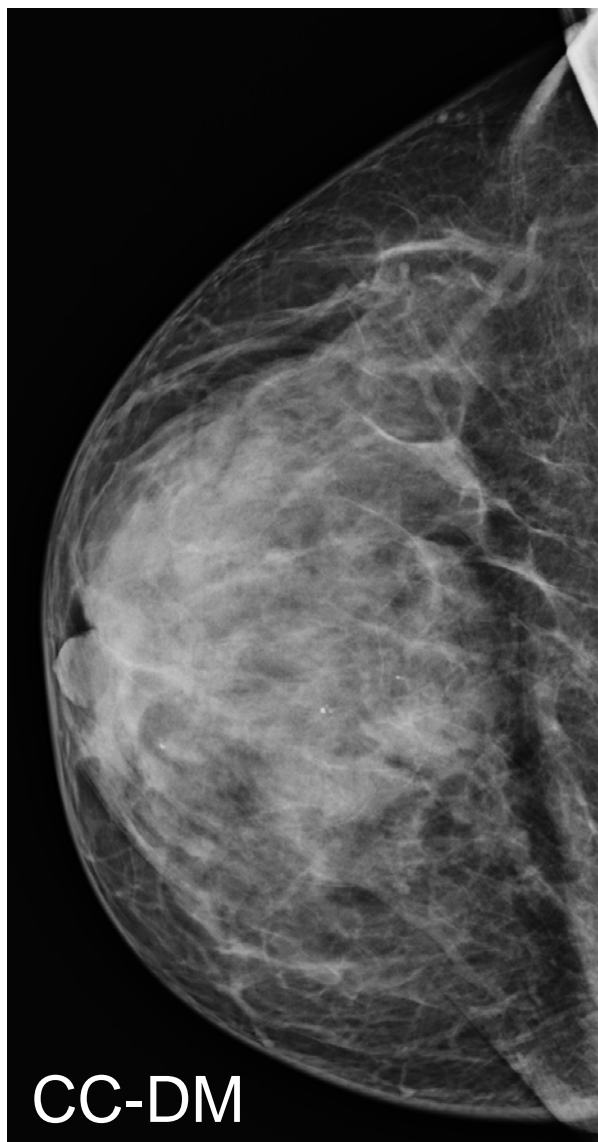
PRIMO LIVELLO

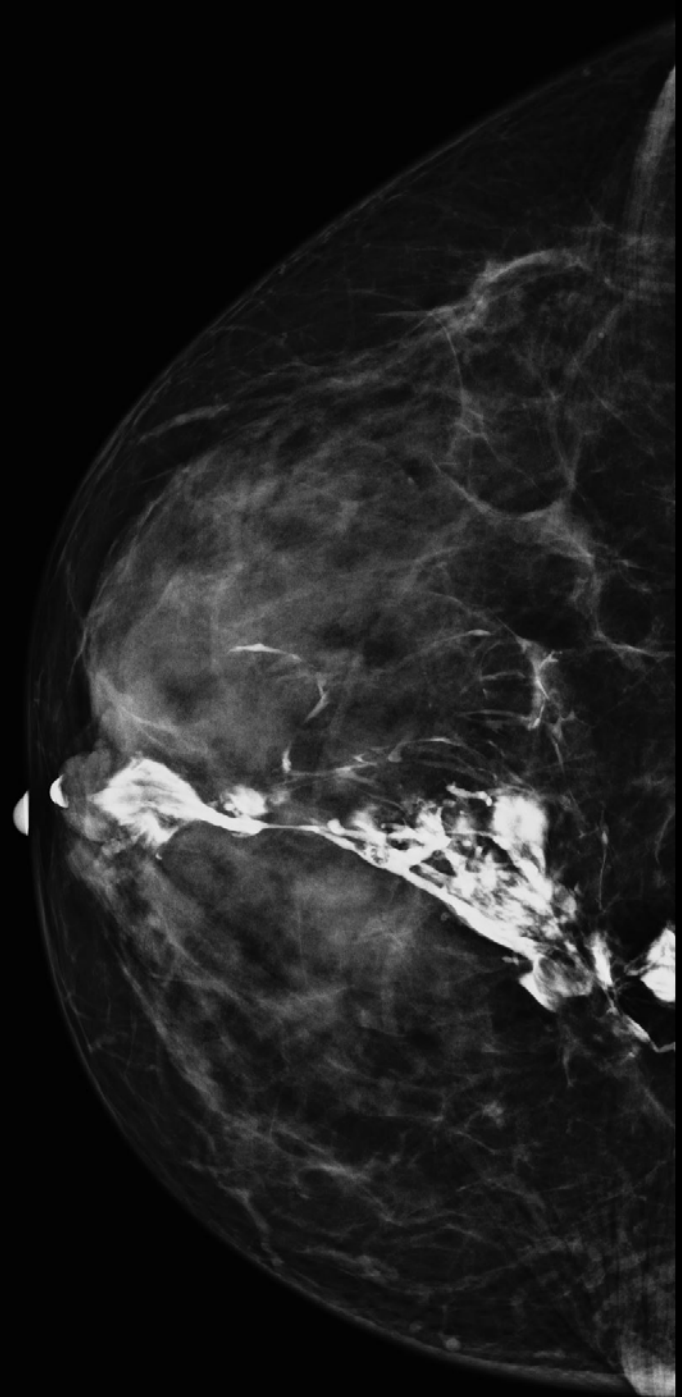
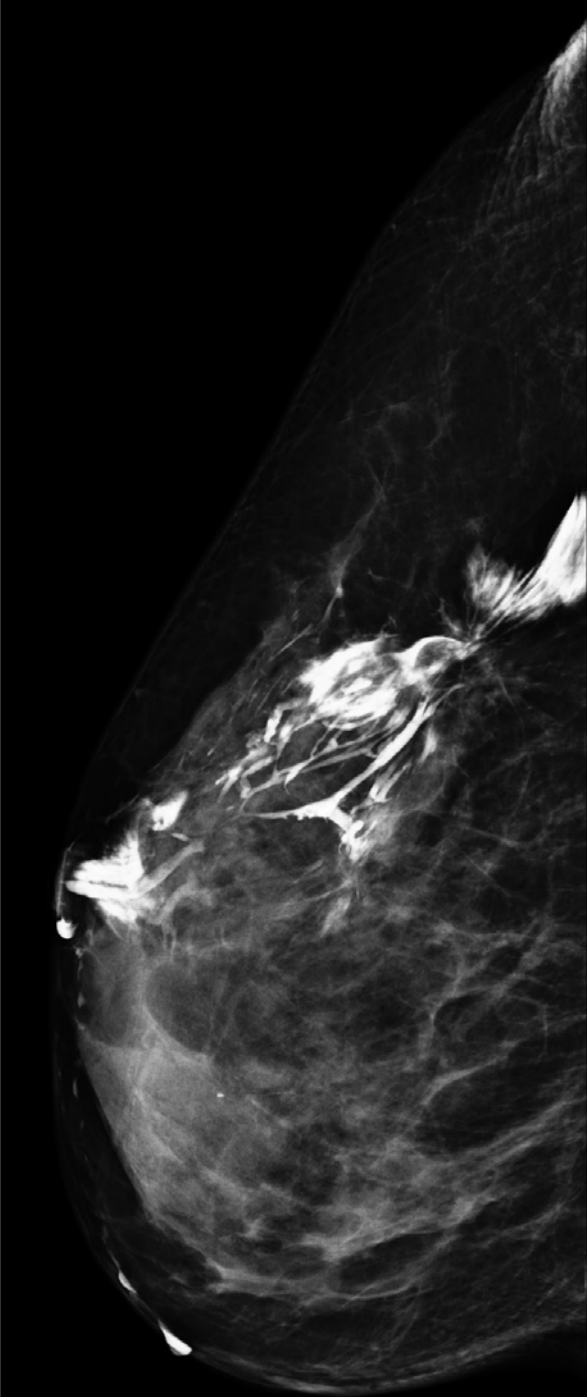
- DM bilaterale in due proiezioni (CC – MLO)
- doppia lettura in cieco

SECONDO LIVELLO

- DM latero-mediale (LM) e spot-compression
- Tomosintesi sul piano maggiormente informativo
 - più frequentemente CC
- Ecografia

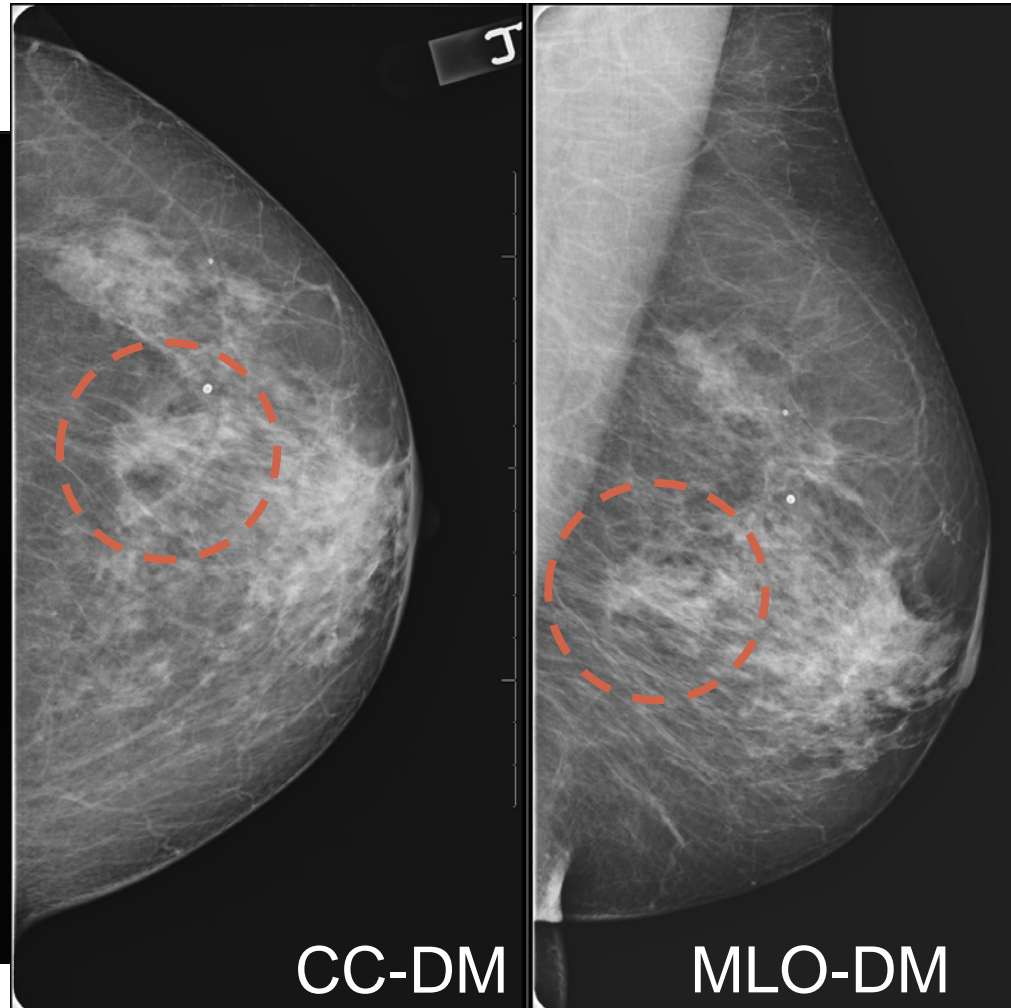
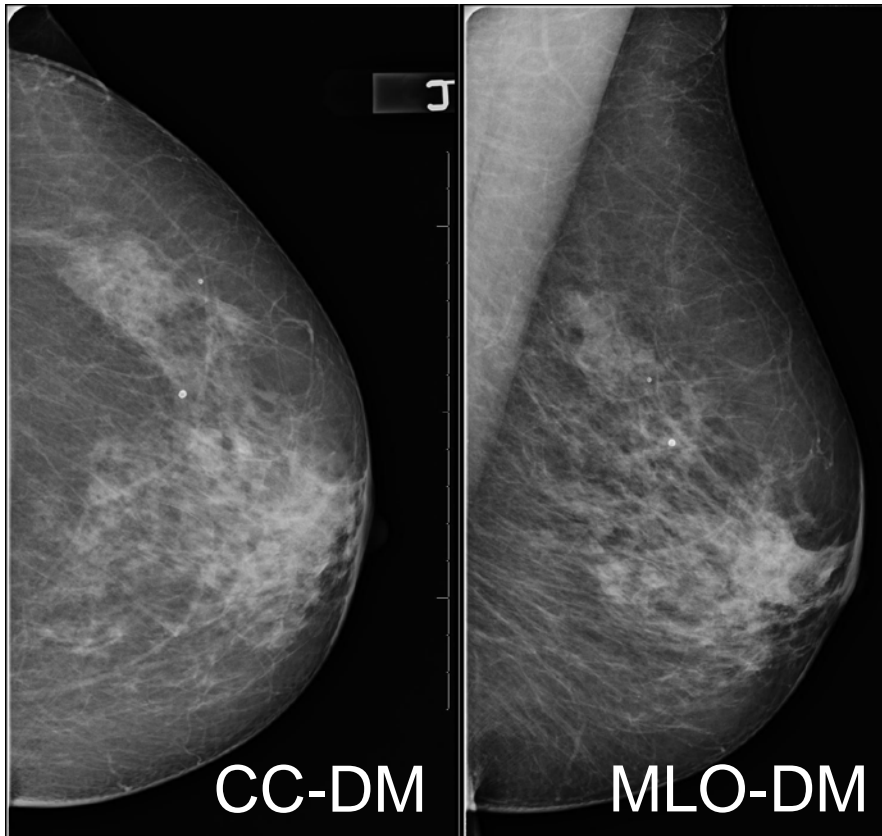
screening: segnalazione del tecnico





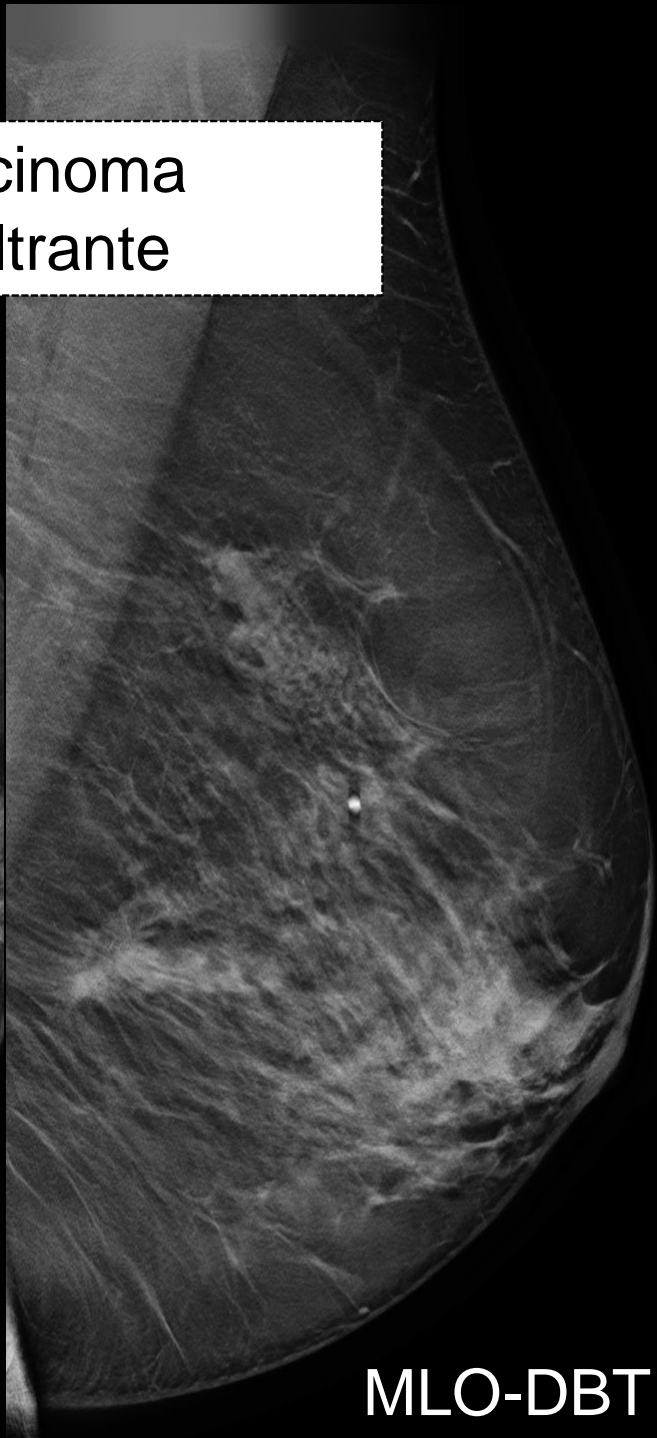
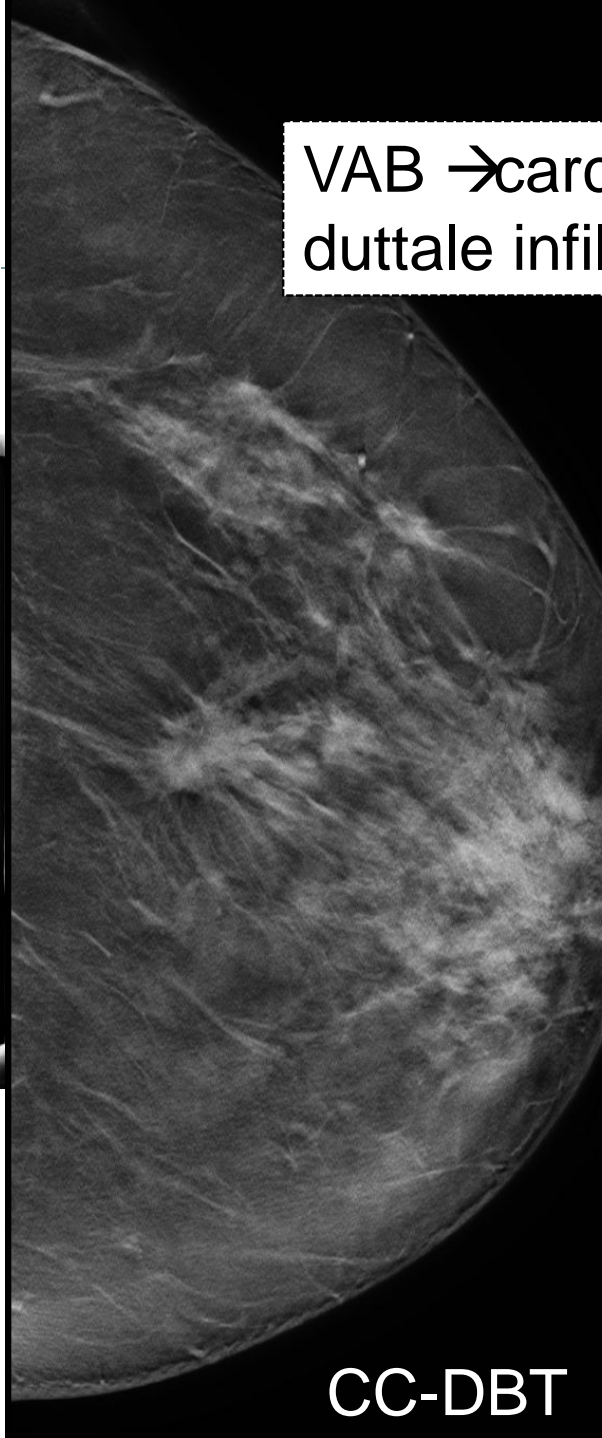
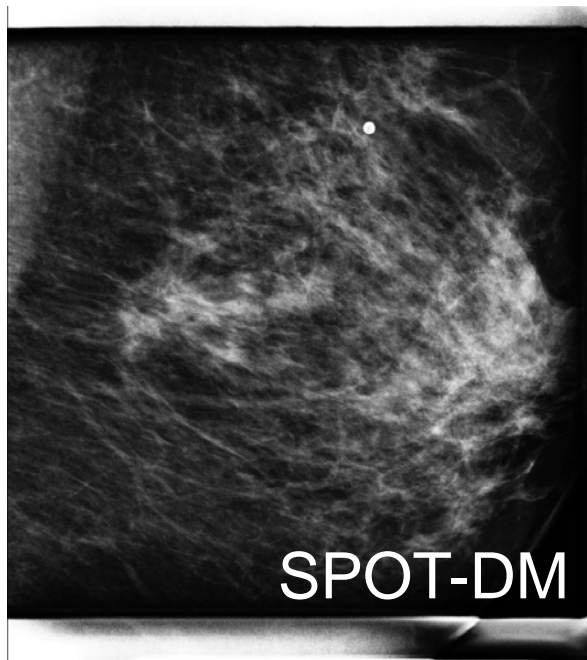
distorsione architetturale

- RE, 66 anni

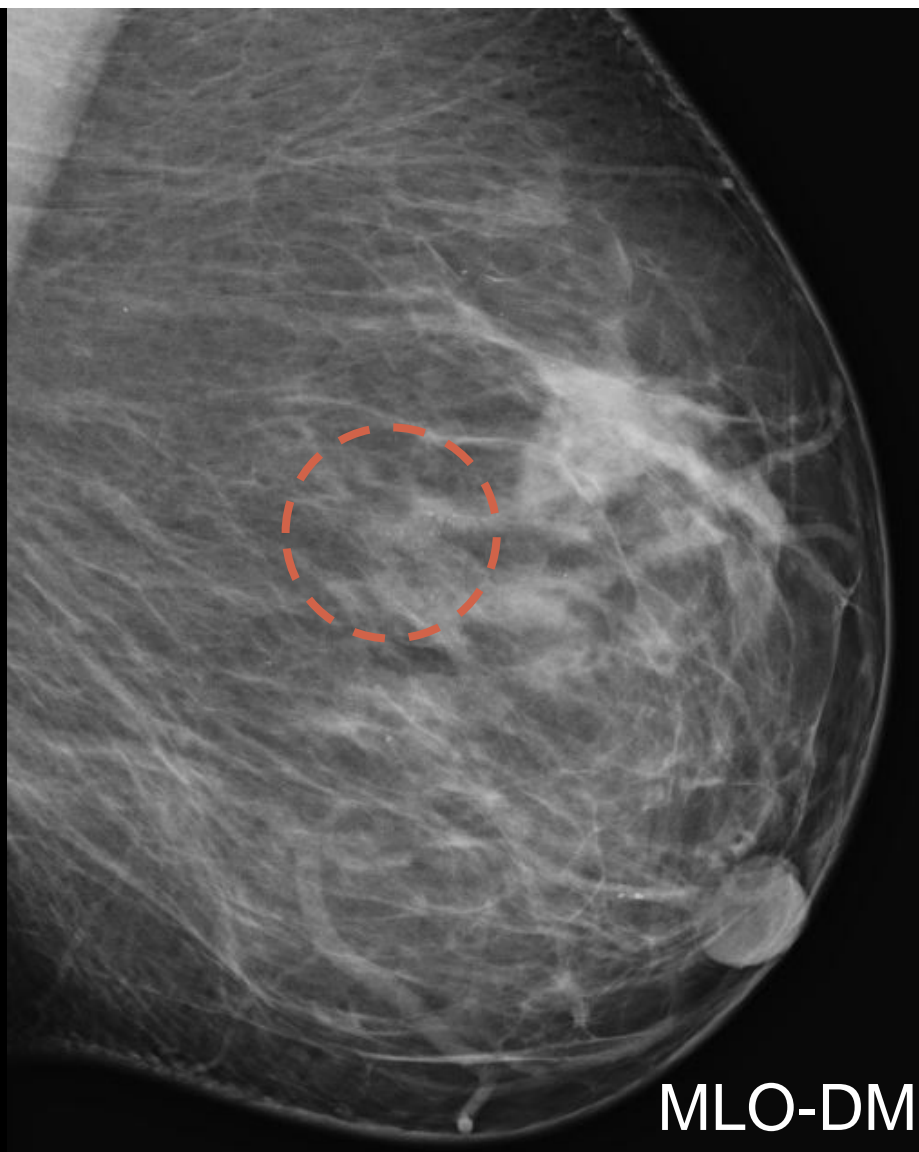
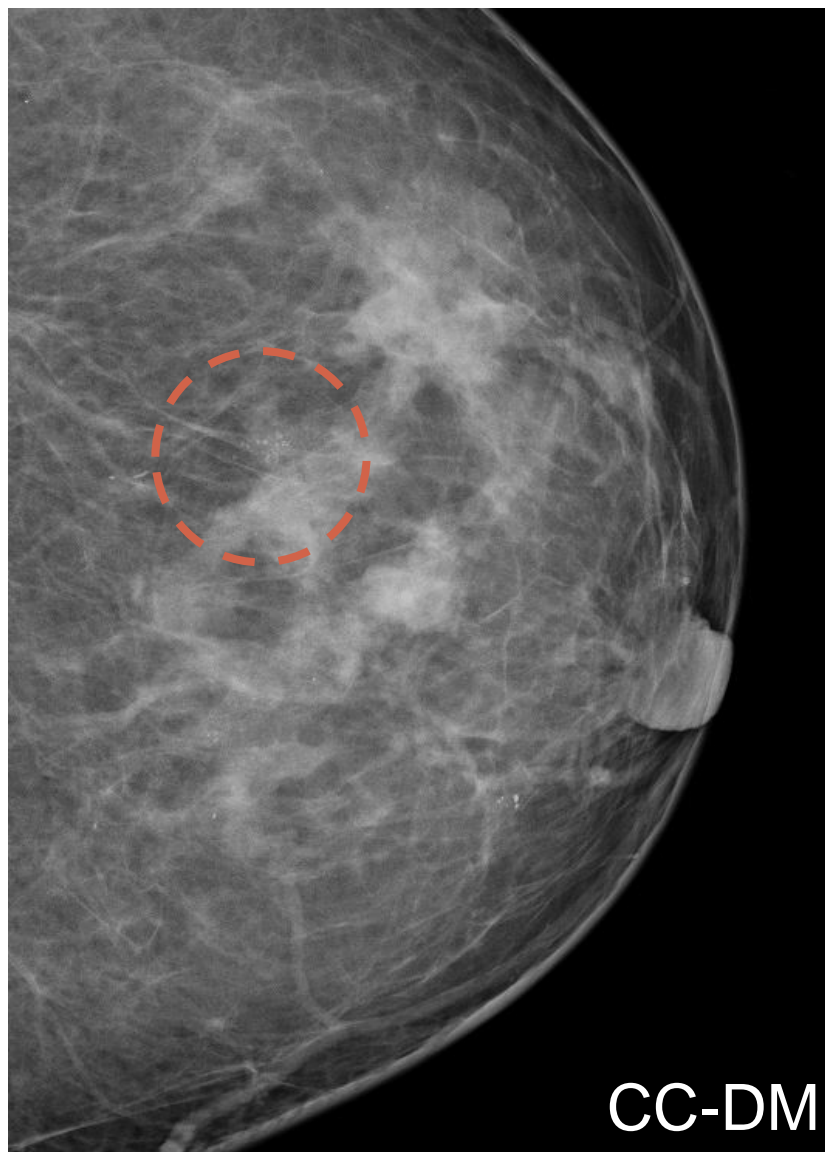


sommazione?

VAB → carcinoma
duttale infiltrante



CF, 69 anni – micro: DBT valore aggiunto?





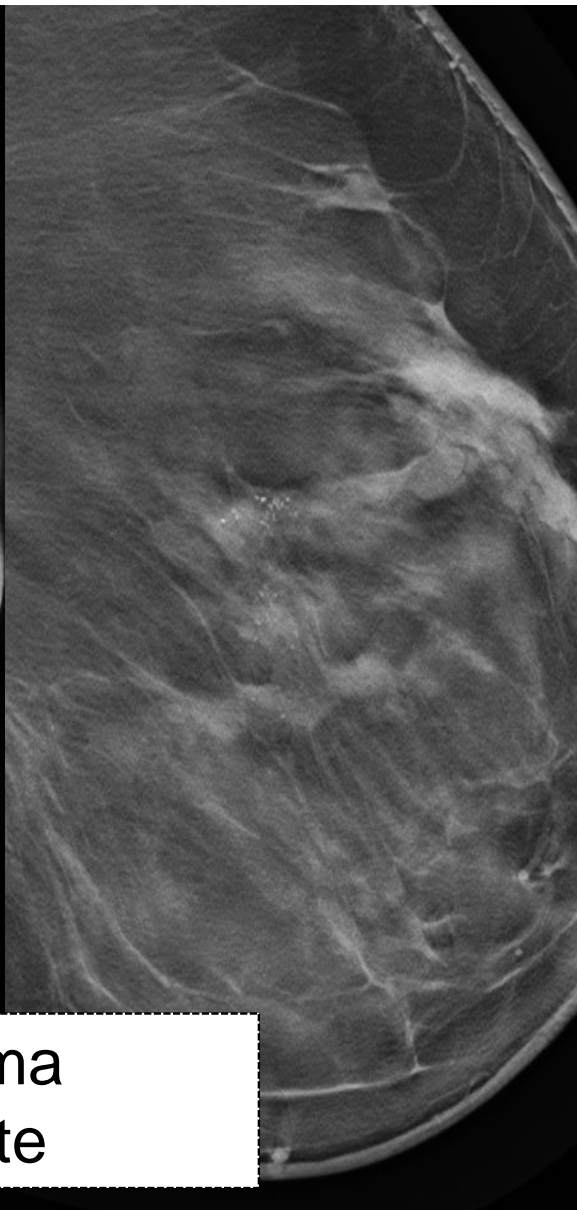
SPOT-DM

DBT → distorsione
architetturale
sospetta



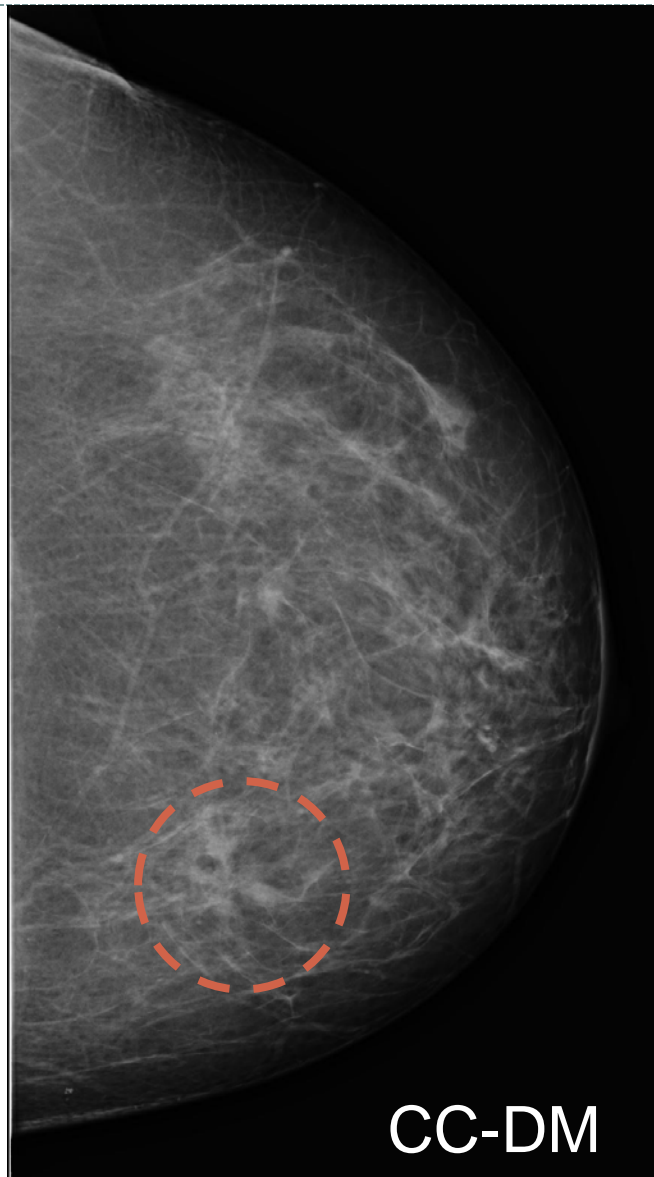
VAB → carcinoma
duttale infiltrante

CC-DBT

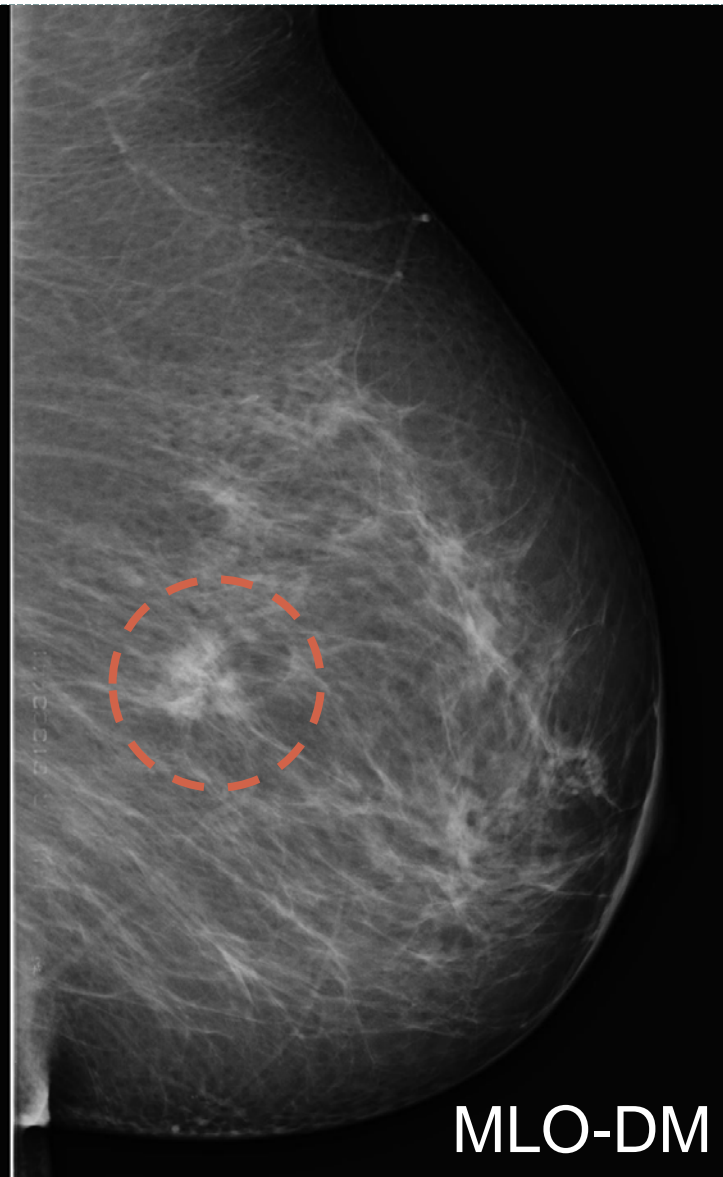


MLO-DBT

GC, 52 anni richiamo da screening

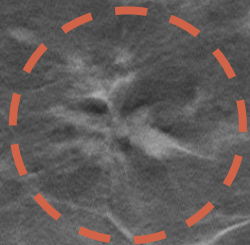


CC-DM

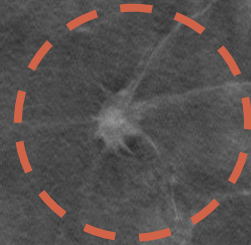


MLO-DM

TRUCUT → carcinoma bifocale B5



CC-DBT



CC-DBT



Grazie per l'attenzione!!!

bibliografia

- 1 Clauser P, Carbonaro LA, Pancot M et al (2015) Additional findings at preoperative breast MRI: the value of second-look digital breast tomosynthesis. *Eur Radiol* 25:2830-2839
- 2 Dang PA, Freer PE, Humphrey KL, Halpern EF, Rafferty EA (2014) Addition of tomosynthesis to conventional digital mammography: effect on image interpretation time of screening examinations. *Radiology* 270:49-56
- 3 Durand MA, Wang S, Hooley RJ, Raghu M, Philpotts LE (2016) Tomosynthesis-detected Architectural Distortion: Management Algorithm with Radiologic-Pathologic Correlation. *Radiographics* 36:311-321
- 4 Fang Q, Selb J, Carp SA et al (2011) Combined optical and X-ray tomosynthesis breast imaging. *Radiology* 258:89-97
- 5 Friedewald SM, Rafferty EA, Rose SL et al (2014) Breast cancer screening using tomosynthesis in combination with digital mammography. *JAMA* 311:2499-2507
- 6 Haas BM, Kalra V, Geisel J, Raghu M, Durand M, Philpotts LE (2013) Comparison of tomosynthesis plus digital mammography and digital mammography alone for breast cancer screening. *Radiology* 269:694-700
- 7 Korhonen KE, Weinstein SP, McDonald ES, Conant EF (2016) Strategies to Increase Cancer Detection: Review of True-Positive and False-Negative Results at Digital Breast Tomosynthesis Screening. *Radiographics* 36:1954-1965
- 8 Lee CI, Cevik M, Alagoz O et al (2015) Comparative effectiveness of combined digital mammography and tomosynthesis screening for women with dense breasts. *Radiology* 274:772-780
- 9 Lei J, Yang P, Zhang L, Wang Y, Yang K (2014) Diagnostic accuracy of digital breast tomosynthesis versus digital mammography for benign and malignant lesions in breasts: a meta-analysis. *Eur Radiol* 24:595-602
- 10 Morra L, Sacchetto D, Durando M et al (2015) Breast Cancer: Computer-aided Detection with Digital Breast Tomosynthesis. *Radiology* 277:56-63
- 11 Park JM, Franken EA, Jr., Garg M, Fajardo LL, Niklason LT (2007) Breast tomosynthesis: present considerations and future applications. *Radiographics* 27 Suppl 1:S231-240
- 12 Patel BK, Garza SA, Eversman S, Lopez-Alvarez Y, Kosiorek H, Pockaj BA (2017) Assessing tumor extent on contrast-enhanced spectral mammography versus full-field digital mammography and ultrasound. *Clin Imaging* 46:78-84
- 13 Peppard HR, Nicholson BE, Rochman CM, Merchant JK, Mayo RC, 3rd, Harvey JA (2015) Digital Breast Tomosynthesis in the Diagnostic Setting: Indications and Clinical Applications. *Radiographics* 35:975-990
- 14 Rafferty EA, Park JM, Philpotts LE et al (2013) Assessing radiologist performance using combined digital mammography and breast tomosynthesis compared with digital mammography alone: results of a multicenter, multireader trial. *Radiology* 266:104-113
- 15 Raghu M, Durand MA, Andrejeva L et al (2016) Tomosynthesis in the Diagnostic Setting: Changing Rates of BI-RADS Final Assessment over Time. *Radiology* 281:54-61
- 16 Roth RG, Maidment AD, Weinstein SP, Roth SO, Conant EF (2014) Digital breast tomosynthesis: lessons learned from early clinical implementation. *Radiographics* 34:E89-102
- 17 Skaane P, Bandos AI, Gullien R et al (2013) Comparison of digital mammography alone and digital mammography plus tomosynthesis in a population-based screening program. *Radiology* 267:47-56
- 18 Vedantham S, Karellas A, Vijayaraghavan GR, Kopans DB (2015) Digital Breast Tomosynthesis: State of the Art. *Radiology* 277:663-684
- 19 Zuley ML, Guo B, Catullo VJ et al (2014) Comparison of two-dimensional synthesized mammograms versus original digital mammograms alone and in combination with tomosynthesis images. *Radiology* 271:664-671