

4th International Congress of Breast Disease Centers
Session 3: Development in Breast Cancer Screening
Paris February 6 , 2014

The Impact of Tomosynthesis on Breast Cancer Screening

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Objectives: The Impact of Tomosynthesis on Breast Cancer Screening

- **Tomosynthesis (DBT) in breast imaging**
 - **Potential role of synthetic 2D images i DBT screening**
 - **Results from DBT screening so far**
 - **Conclusions**
-

Disclosure:

Oslo Tomosynthesis Screening Trial

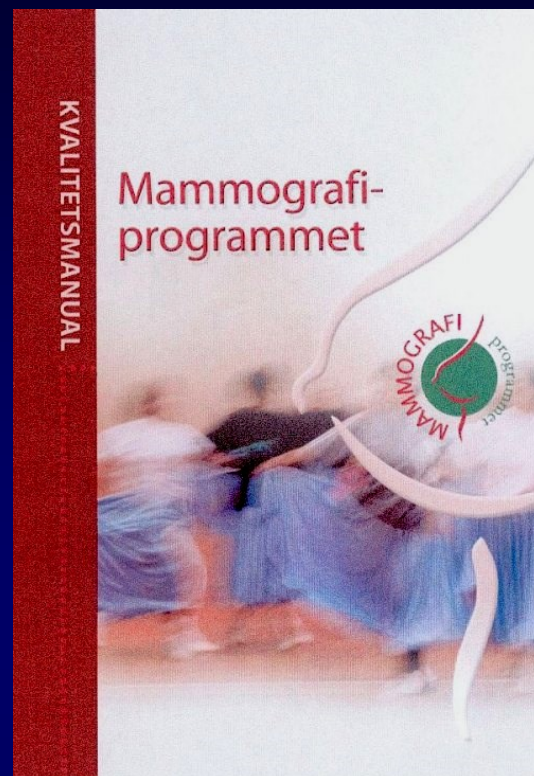
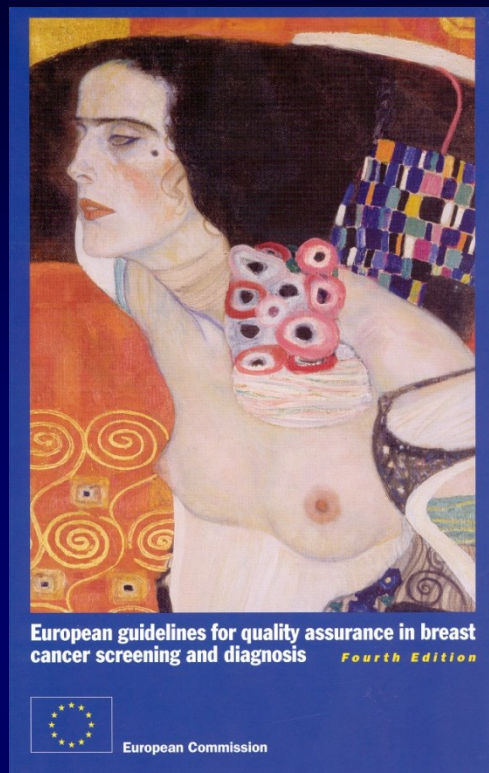
Equipment and support for additional reading provided by Hologic, Inc.

Potential role of Digital Breast Tomosynthesis (DBT)

- **Microcalcifications**: DBT equal/comparable to FFDM
 - Spangler ML: AJR 2011;196:320
 - Kopans D: Breast J 2011;17:638
- **Tumor (cancer) size assessment**: DBT superior to FFDM
 - Fornvik B: Acta Radiol 2010;51:240
 - Mun HS: Clin Radiol 2013;68:1254
- **Specificity**: Increased when used adjunctively with FFDM
 - ➡ - Poplack SP: AJR 2007;189:616
 - Gur D: AJR 2009;193:586
- **Replacement of supplemental diagnostic views**: For non-calcified lesions
 - ➡ - Brandt KR: AJR 2013;200:291
 - Zuley ML: Radiology 2013;266:89
- **Cancer visibility and conspicuity**: DBT superior to FFDM
 - ➡ - Andersson I: Eur Radiol 2008;18:2817
 - Michell MJ: Clin Radiol 2012;67:976

i.e., DBT might have a great potential in mammography screening !!

Quality assurance in mammography screening:



European guidelines for quality assurance in mammography screening

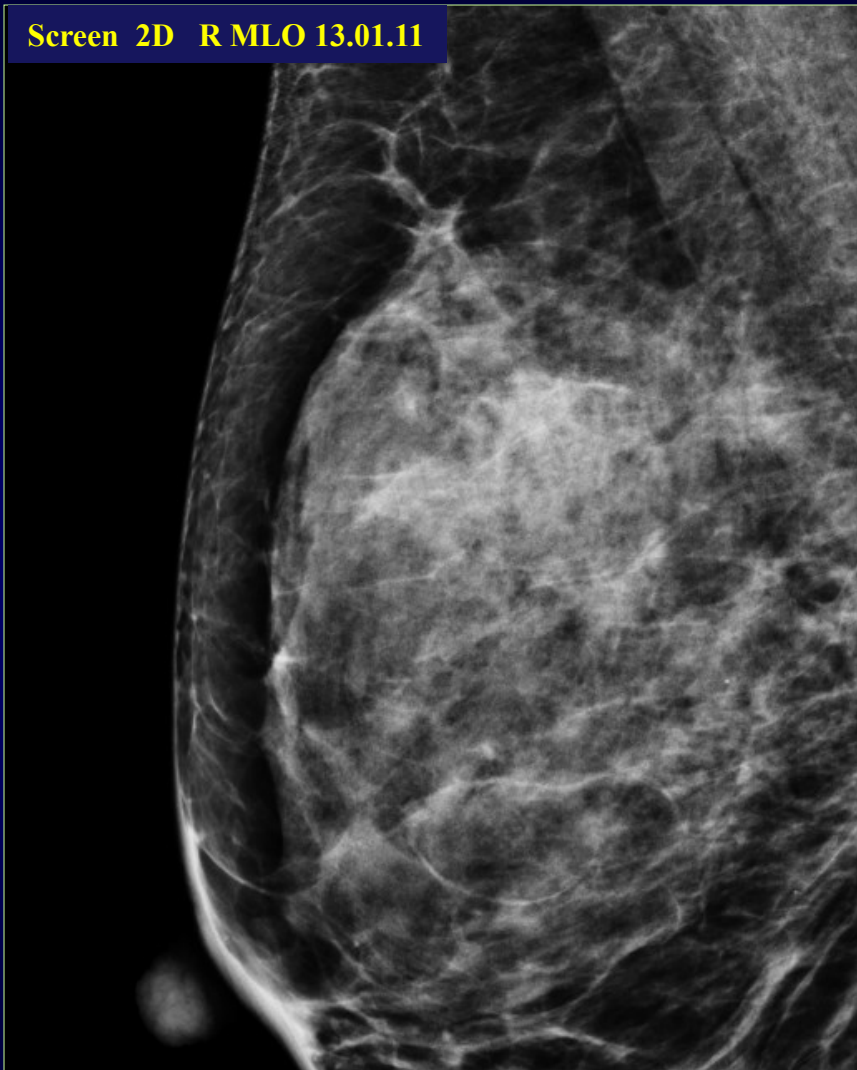
Performance indicator "Recall rate"

	Acceptable level	Desirable level
Initial screening examinations	< 7 %	< 5 %
Subsequent screening examinations	< 5 %	< 3 %

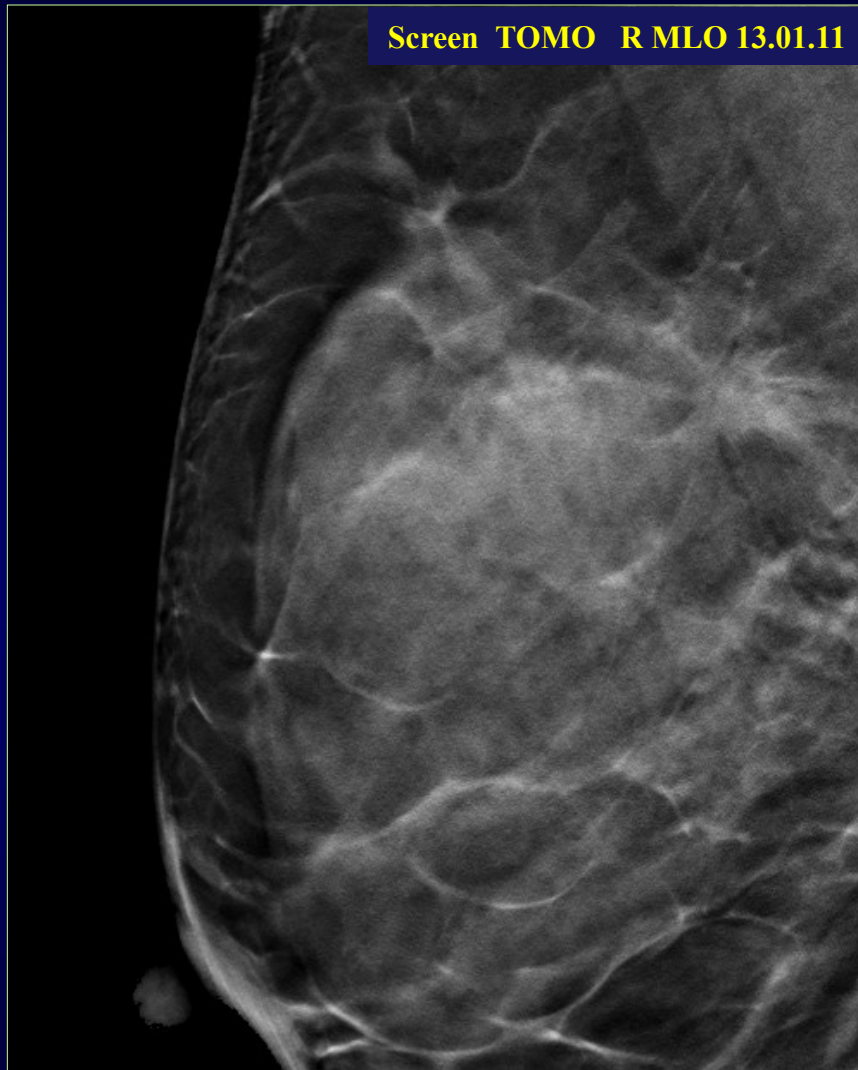
A) Potential role of Tomosynthesis in breast cancer screening:

→ Increased cancer conspicuity

Screen 2D R MLO 13.01.11



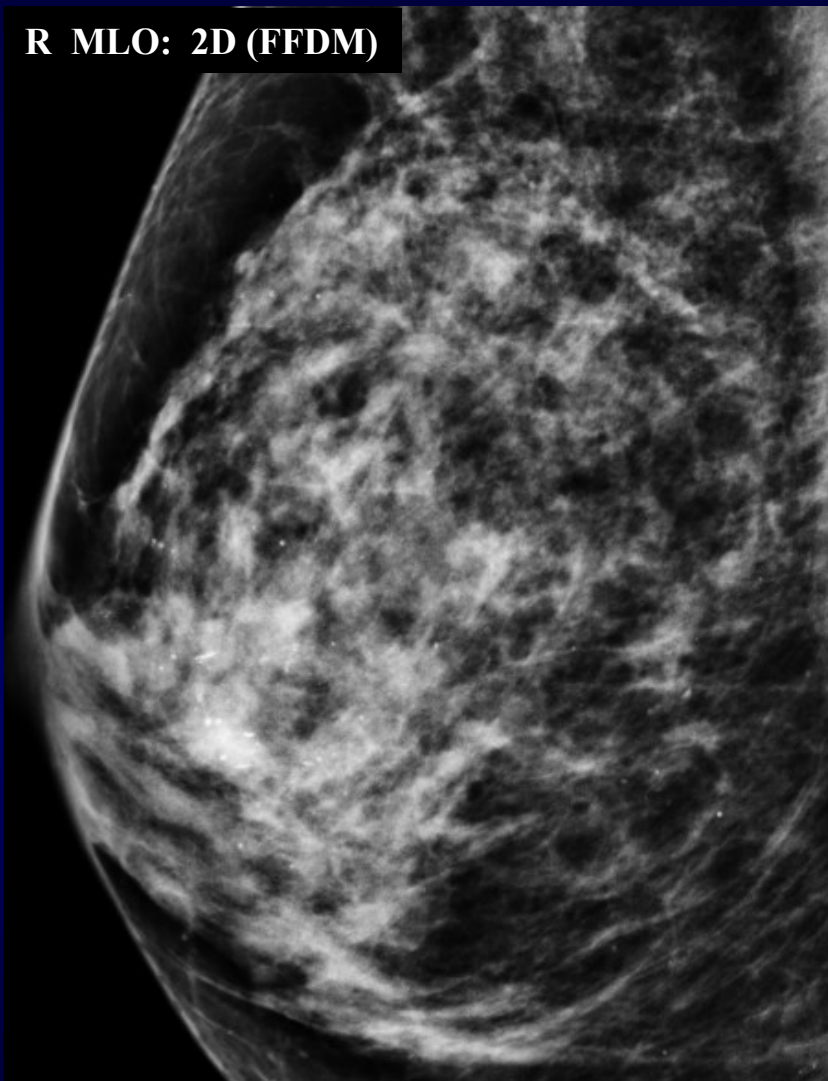
Screen TOMO R MLO 13.01.11



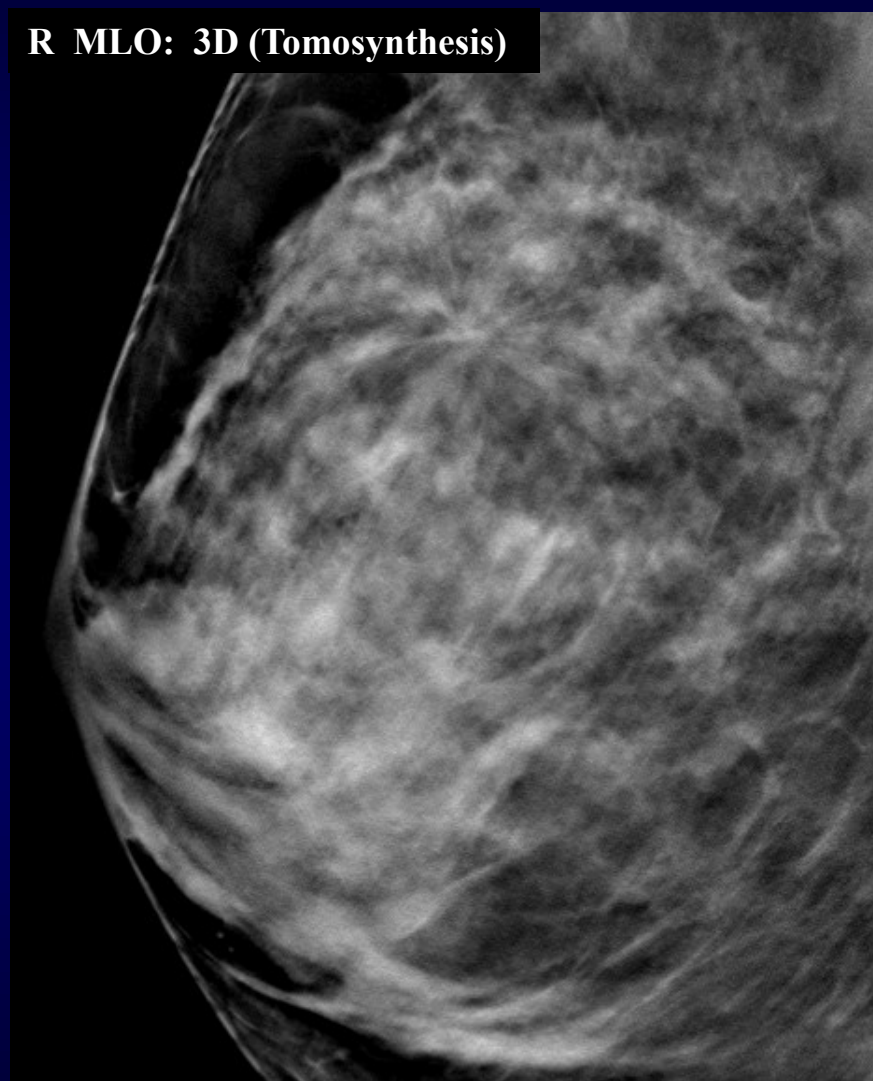
B) Potential role of Tomosynthesis in breast cancer screening:

➡ Visibility of FFDM-occult cancer

R MLO: 2D (FFDM)

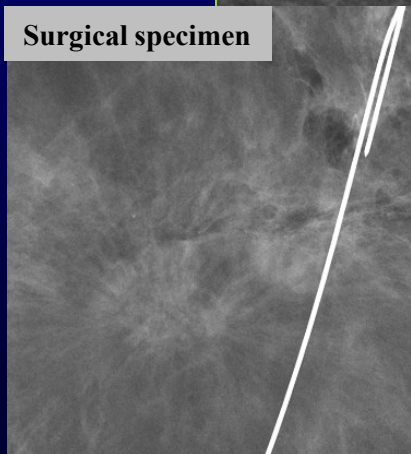
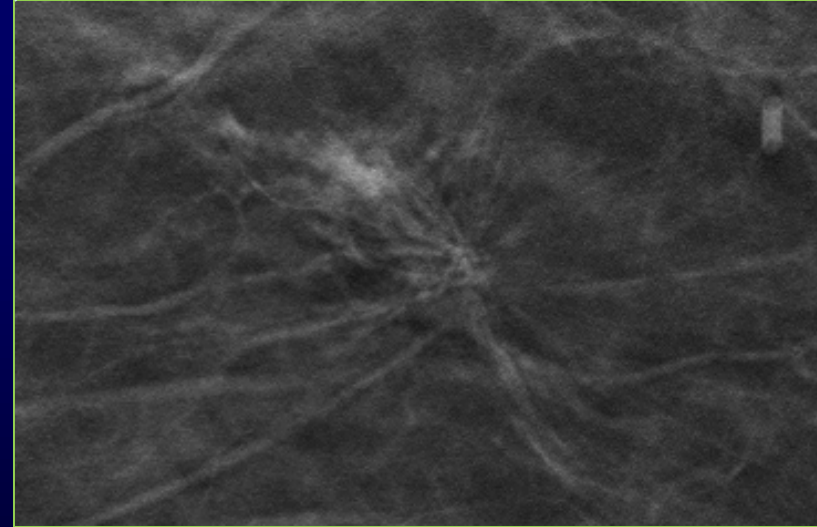
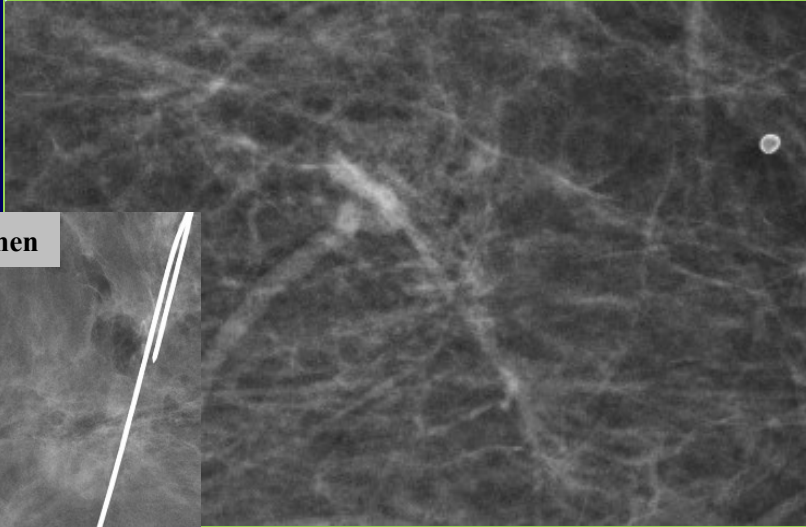
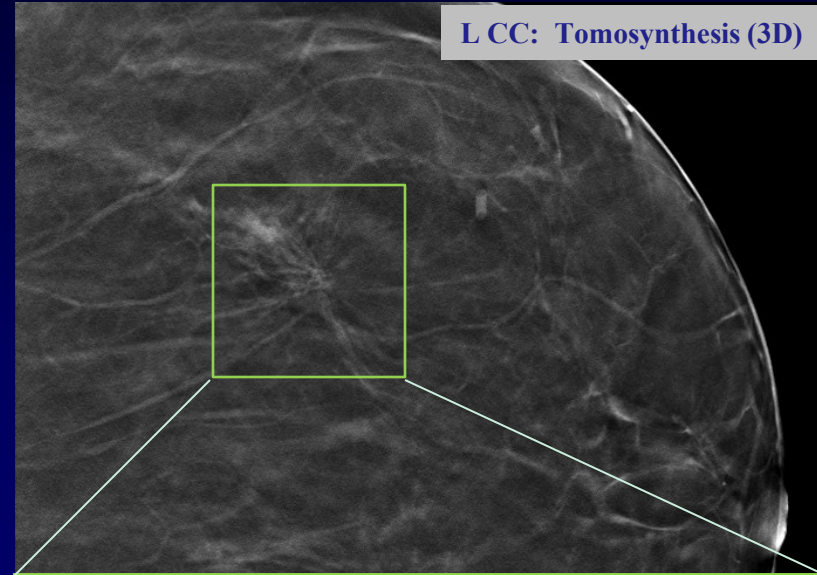
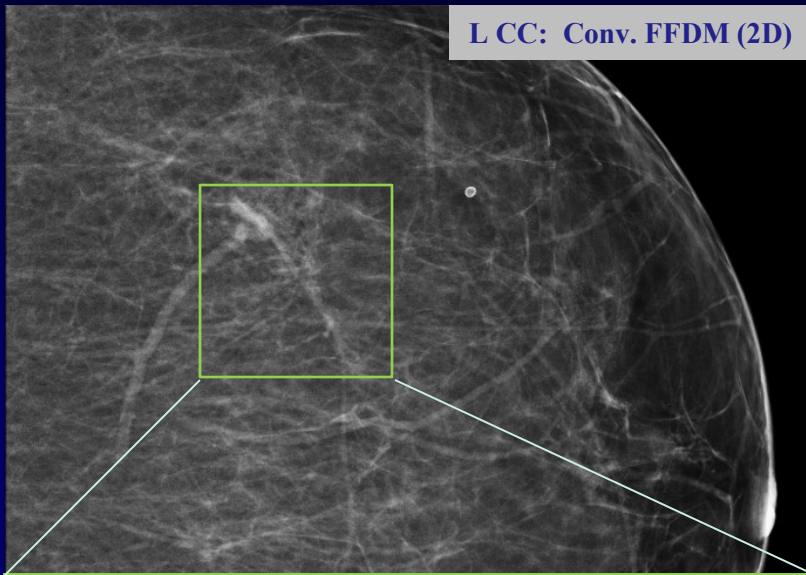


R MLO: 3D (Tomosynthesis)



C) Potential role of Tomosynthesis in breast cancer screening:

➔ **Increased conspicuity occasionally even in fatty breasts**



Tomosynthesis (DBT) in breast cancer screening

Why do we need 2D (FFDM) in addition to tomosynthesis:

- Needs 2D for comparison of priors vs. current exams
 - Needs 2D for comparison right vs left breast
 - Current 2D exam might be requested by other institutions
 - Studies have shown that the combination of 2D + DBT has higher sensitivity (cancer detection) and specificity (lower recall)
-

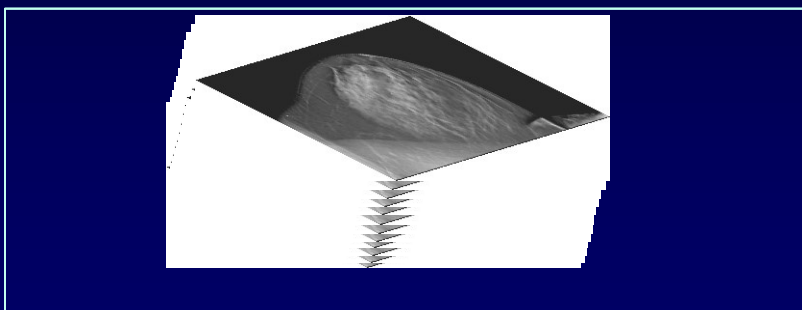
Two view 2D (CC+MLO) plus two view DBT (CC+MLO) means approximately a «doubling» of the radiation dose !

However:

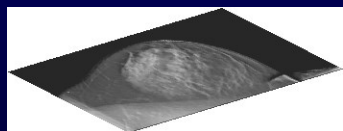
Synthetic 2D views may substitute for FFDM images when combined with tomosynthesis, reducing substantially the radiation dose !

Synthetic 2D generation:

Tomosynthesis reconstructed slices



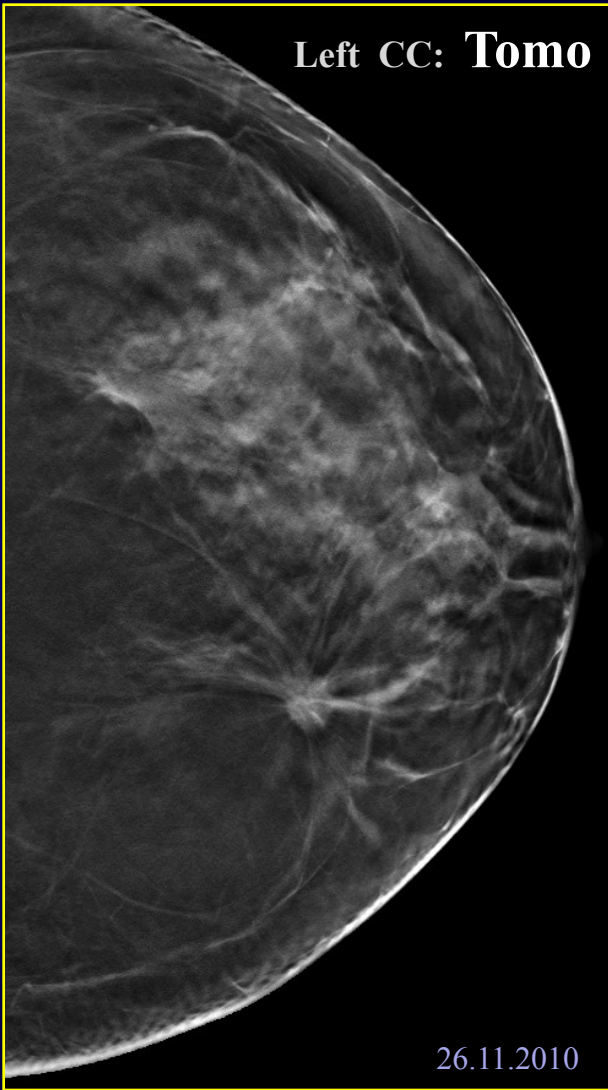
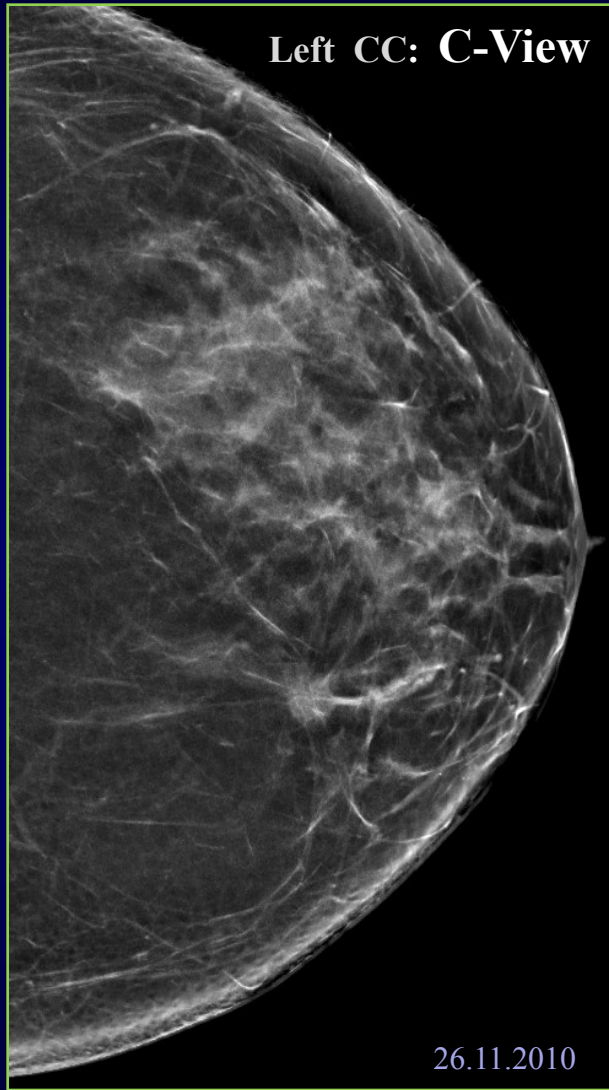
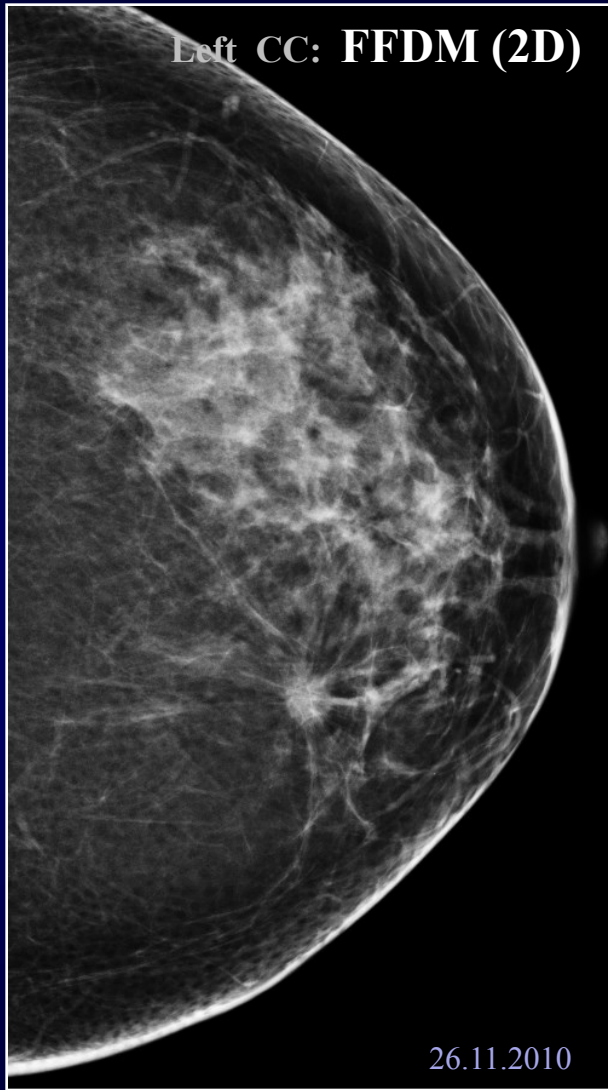
Synthesized Projection



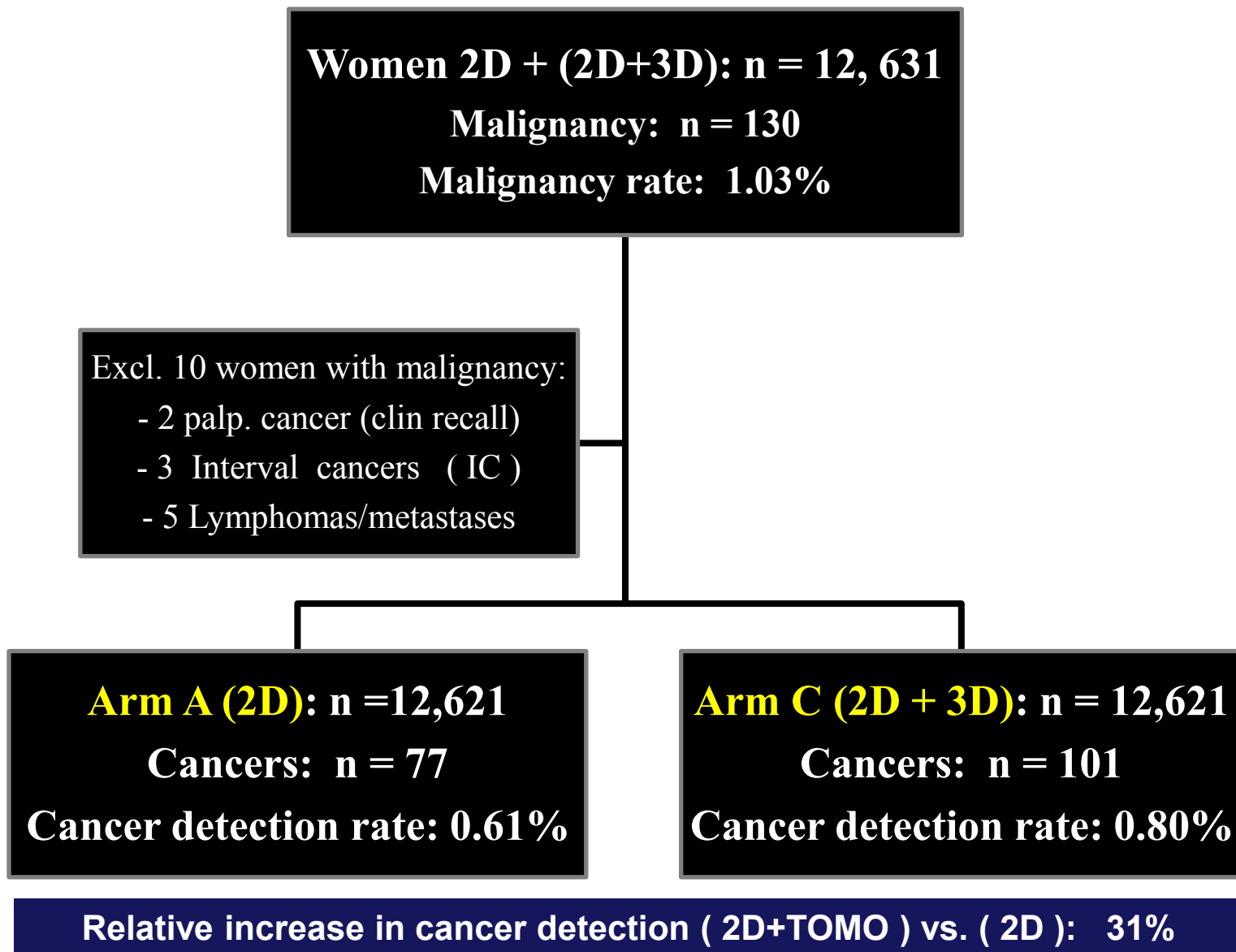
Synthetic 2D image

Synthetic 2D image (called C-View by Hologic) shows a roadmap of the important features from tomosynthesis slices

Synthetic 2D image



Oslo Tomosynthesis Screening Trial (OTST): First year results *



* Skaane P et al.: Radiology 2013; 267: 47-56

Mammography screening: Comparison of conv. 2D vs. 2D + tomo ("combo")*

Parameter	Detected with 2D only	Detected with combo only	Detected with 2D and combo	Total with 2D	Total with combo	Difference combo vs 2D
No. cancer	6	30	71	77	101	24
Inv. Cancer	4	29	52	56	81	25
IDC	2	16	33	35	49	14
IDC+DCIS	0	5	11	11	16	5
ILC	2	7	6	8	13	5
Others	0	1	2	2	3	1
Radiol. finding						
Circ.mass	0	2	7	7	9	2
Spicul.mass	3	12	25	28	37	9
Distortion	0	8	8	8	16	8
Asymm.dens	1	1	3	4	4	0
Mc	0	0	8	6	6	0
Density+mc	0	0	3	3	9	6
DCIS	2	1	19	21	20	-1
Low grade	0	0	4	4	4	0
High grade	2	1	15	17	16	-1

* Skaane P et al.: Radiology 2013; 267: 47-56

Tomosynthesis in breast cancer screening:

Studies comparing FFDM and Digital Breast Tomosynthesis DBT (January 2014)

Study	Population (n)	Study design	Examination mode	Reading mode
Trento/Verona (STORM) ¹	7,292	Prospective; paired	2D: 2-view 3D: 2-view	Double; Sequential
Oslo (OTST) ²	12,631	Prospective; paired	2D: 2-view 3D: 2-view	Double; Independent
TOPS Compr. Breast Center, Houston, TX ³	2D: 13,856 3D: 9,499	Retrospective; non-paired	2D: 2-view 3D: 2-view	Single; Independent
Yale University (New Haven, CT) ⁴	2D: 7,058 3D: 6,100	Retrospective; non-paired	2D: 2-view 3D: 2-view	Single; Independent
Malmö (MBTST) ⁵	5,700	Prospective; paired	2D: 2-view 3D: 1-view	Double; Sequential

- 1) Ciatto S et al.: Lancet Oncol, 2013 (Screening with Tomo OR standard Mammo (STORM))
- 2) Skaane P et al.: Eur Radiol, 2013 (Oslo Tomosynthesis Screening Trial OTST)
- 3) Rose SL et al.: AJR, 2013 (Implementation of breast tomo in a routine screening practice)
- 4) Haas BM et al.: Radiology, 2013 (Comparison of tomo plus 2D and 2D alone for screening)
- 5) Zackrisson S: ECR Vienna, 2013 (Interim analysis; Malmö Breast Tomosynthesis Screening Trial)

Tomosynthesis in breast cancer screening:

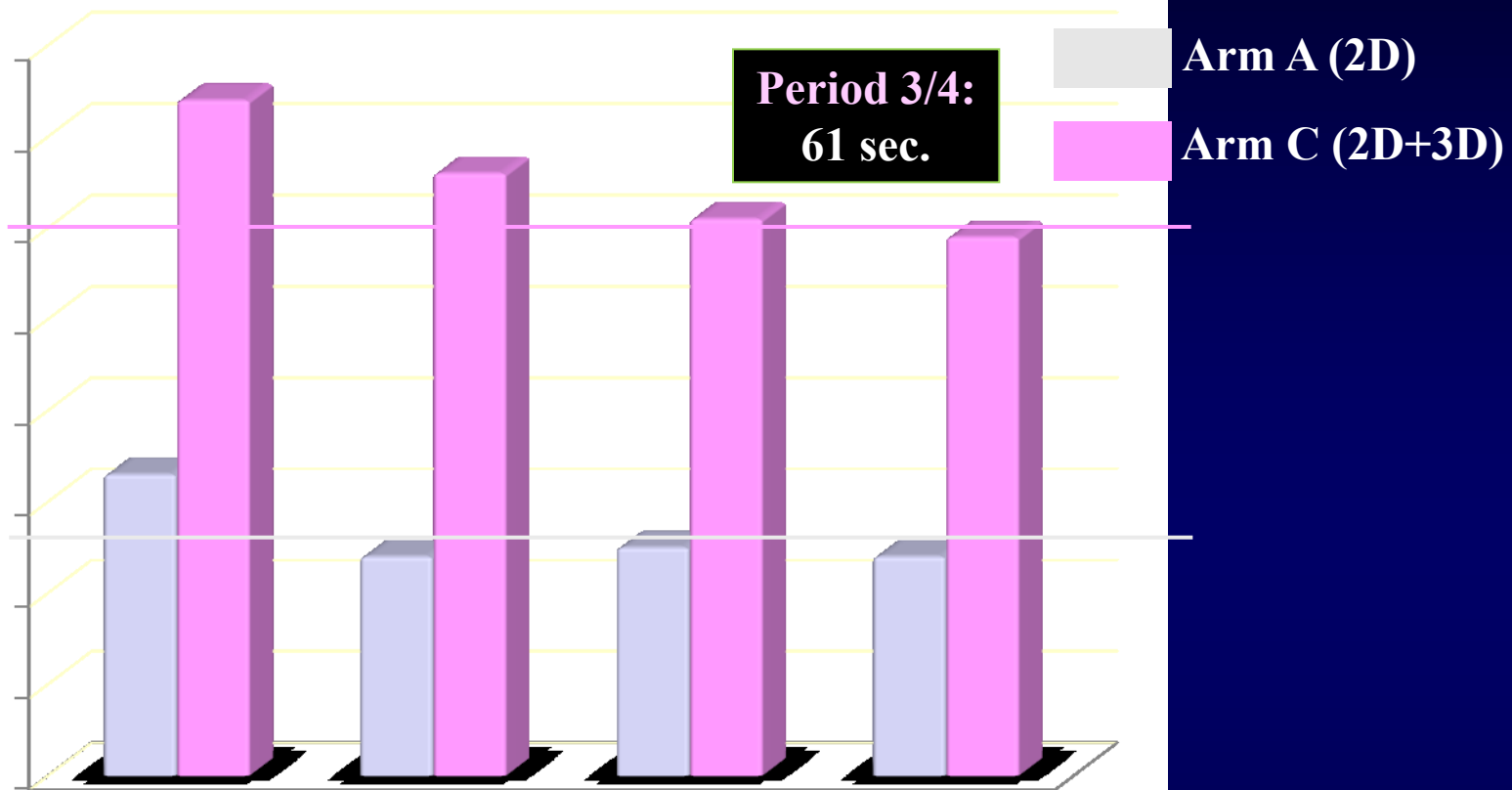
Studies comparing FFDM and Digital Breast Tomosynthesis DBT (January 2014)



Study	Population (n)	Cancer (n)		Cancer (n / 1,000)		Cancer: Rel. increase (%)
		2D	2D+3D	2D	2D+3D	
Trento/Verona (STORM) ¹	7,292	39	59	5.3	8.1	51 %
Oslo (OTST) ²	12,631	90	119	7.1	9.4	32 %
TOPS Compr. Breast Center, Houston, TX ³	2D: 13,856 3D: 9,499	56	51	4.0	5.4	32 %
Yale University ⁴ (New Haven, CT)	2D: 7,058 3D: 6,100	37	35	5.2	5.7	9.5 %
Malmö (MBTST) ⁵	5,700	-	-	4.7	6.8	45 %

- 1) Ciatto S et al.: Lancet Oncol, 2013 (Screening with Tomo OR standard Mammo (STORM))
- 2) Skaane P et al.: Eur Radiol, 2013 (Oslo Tomosynthesis Screening Trial OTST)
- 3) Rose SL et al.: AJR, 2013 (Implementation of breast tomo in a routine screening practice)
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Median reading time (sec.) for 2D (arm A) and 2D+3D (arm C)



Period 1: 22.11.2010 – 01.07.2011

Period 2: 01.08.2011 - 21.12.2011

Period 3: 01.01.2012 – 01.07.2012

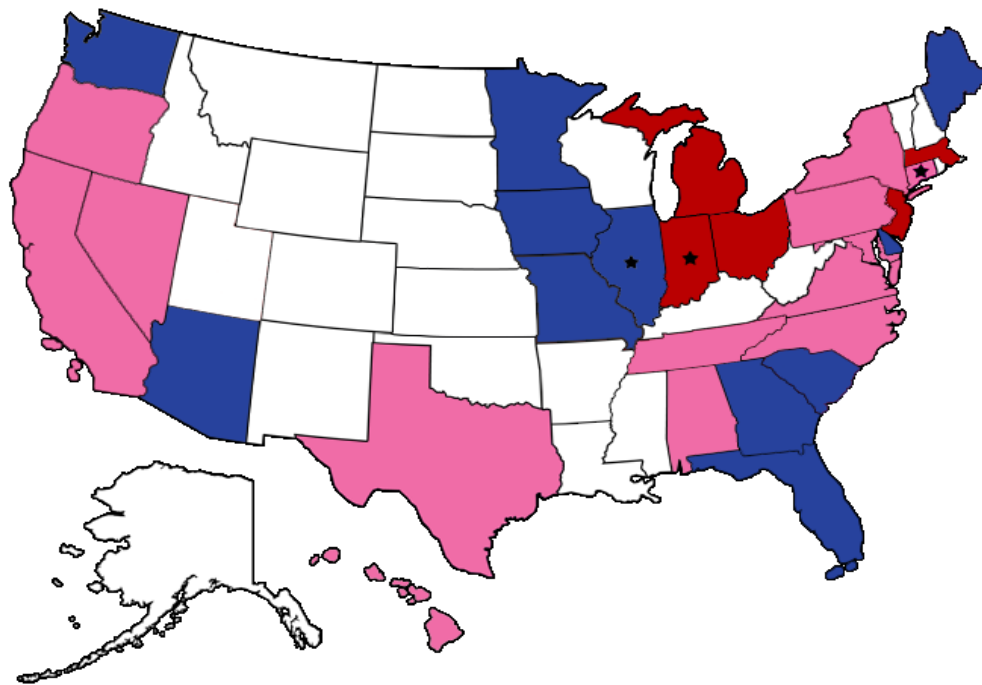
Period 4: 01.08.2012 - 21.12.2012

**Comparison: Bernardi D et al. BJR 2012;85:e1174-8:
2D: 33 sec. vs 2D+3D: 77 sec.**

US: State mandatory Breast Density notification

“Withholding medical information from patients without their knowledge or consent is ethically unacceptable”.

**Am. Med. Assoc.
Ethical Guidelines
(Opinion 8.082**



The addition of breast MRI or ultrasound to mammography increases the detection of small node-negative cancers beyond that achieved with mammography alone.

Berg, 2008

- **PINK: Enacted Law**
- **RED: Introduced Bill**
- **BLUE: Working on Bill**
- **WHITE: No Action**
- **BLACK * : Insurance Coverage Law**

Potential techniques as adjunct to mammography for personalized screening in women with dense breasts:

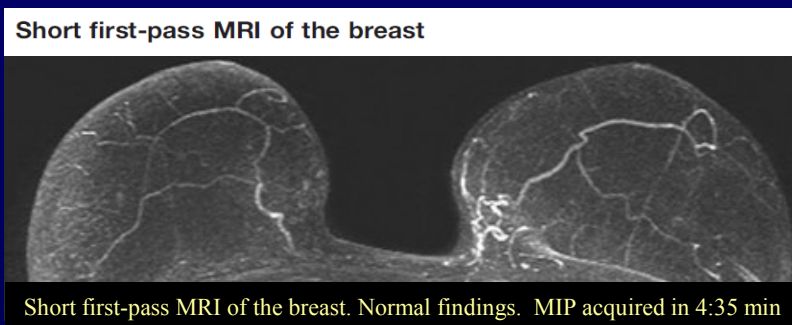
1) Ultrasonography: **ABUS performed by radiographers**



Automated Breast Volume Scanning

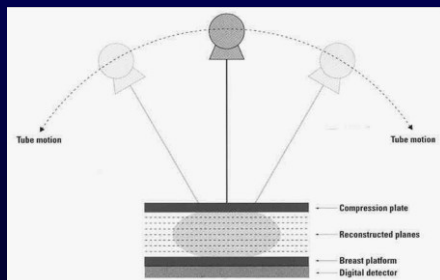
Availability: Favour
Costs: Disfavour
Option: Low-volume screening

2) Breast MRI: **Highest sensitivity**



Availability: Disfavour
Costs: Disfavour
Option: High-risk screening

3) Tomosynthesis: **Not another modality - just «a better mammogram»!**



Availability: Favour
Costs: Favour
Option: High-volume screening

Thank you very much for your time and attention !

