

# DIGITAL BREAST TOMOSYNTHESIS

---

ABBY DUROJAYE, M.D

- CURRENTLY FDA APPROVED ARE FULL FIELD DIGITAL MAMMOGRAPHY SYSTEMS AND FILM SCREEN STILL BEING USED AT SOME INSTITUTIONS
- BOTH HAVE BEEN SHOWN TO BE EFFECTIVE TOOLS

EARLY DETECTION OF BREAST CANCER

BREAST CANCER MORTALITY REDUCTION

- LIMITATIONS OF OUR CURRENT 2D SYSTEMS AND ANALOG

TISSUE OVERLAP HAS SERVED AS SOME  
LEVEL OF AN OBSTACLE TO DIAGNOSIS  
AND DETECTION OF ABNORMALITIES

- FOLLOWING SCREENING EXAMS, DIAGNOSTIC TESTING IS DONE AND INITIAL QUESTIONABLE FINDINGS ARE FREQUENTLY PROVED BENIGN
- RESULTANT PATIENT ANXIETY AND INCREASED INCURRED MEDICAL COSTS



# DBT

- ON FEBRUARY 11, 2011, HOLOGIC ANNOUNCED FDA APPROVAL OF ITS SELENIA DIMENSIONS DBT SYSTEM
- AS AN ADJUNCTIVE TOOL IN PATIENT EVALUATION, DBT COULD HELP SOLVE PROBLEMS OF INTERPRETING MAMMOGRAPHIC FEATURES PRODUCED BY TISSUE OVERLAP

# DBT

- BASED ON ACQUISITION OF THREE DIMENSIONAL DIGITAL IMAGE DATA
- MODIFICATION OF OUR CURRENT 2D DIGITAL UNITS TO ENABLE ACQUISITION OF 3D VOLUME OF THIN SECTION DATA
- SIMILAR RECONSTRUCTION ALGORITHMS UTILIZED IN COMPUTED TOMOGRAPHY

# DBT

- EARLIER ON, EFFORTS TO UTILIZE TOMOSYNTHESIS FOR CLINICAL X RAY IMAGING WERE HAMPERED
- RECENT ADVANCES IN DIGITAL RECEPTORS—HAVE MADE IT POSSIBLE TO USE IT FOR CLINICAL EVALUATION
- CURRENTLY, BEING USED FOR VARIOUS CLINICAL TASKS:

CHEST IMAGING, ORTHOPEDIC IMAGING, DENTAL IMAGING AND ANGIOGRAPHY



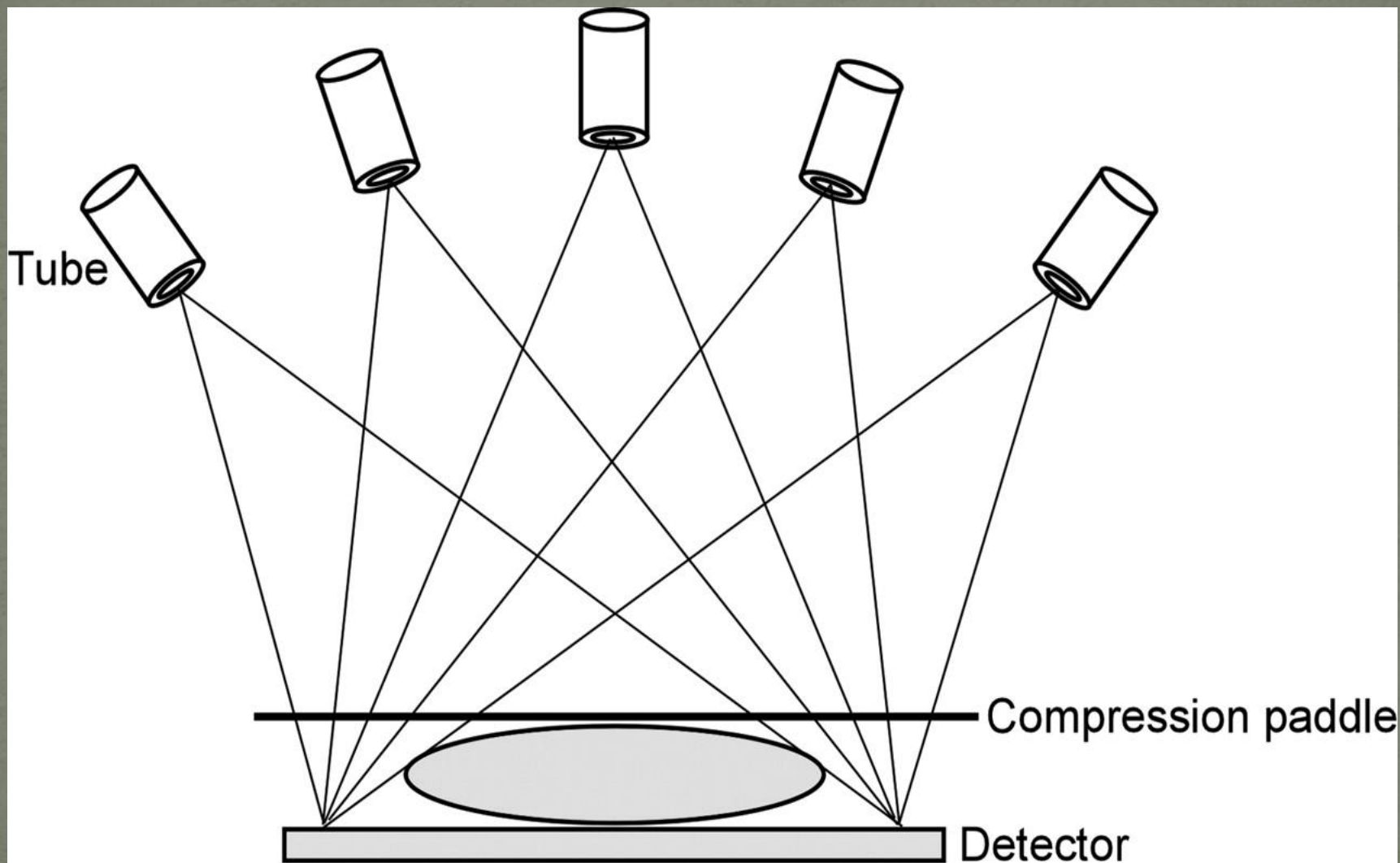
# DBT

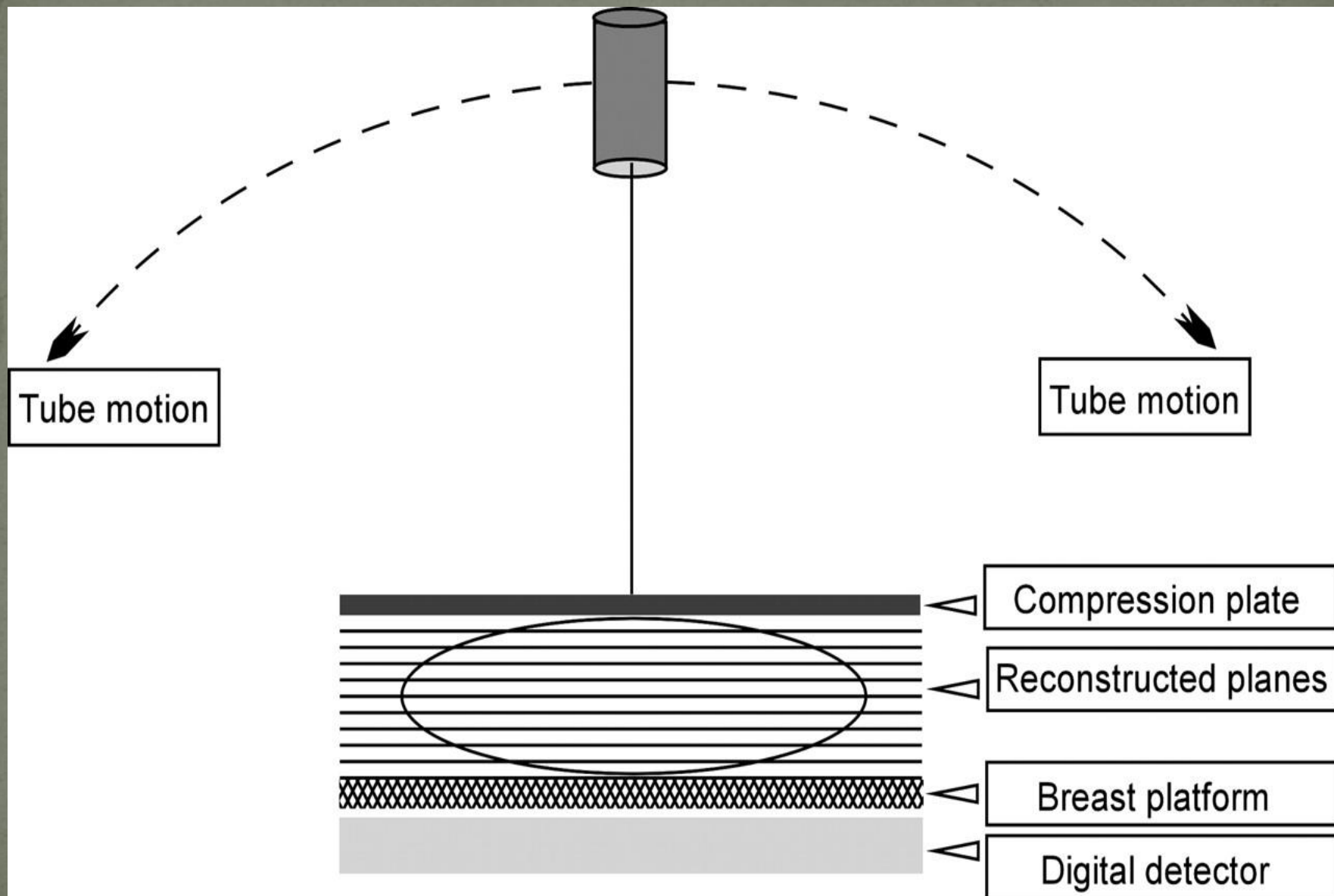
- X RAY SOURCE (MOVING) AND DIGITAL DETECTOR (MOVING OR STATIONARY)
- ACQUISITION METHODS:
  - CONTINUOUS EXPOSURE (PULSED SHORT EXPOSURES DURING MOTION OF THE X RAY SOURCE) ---OBTAIN SHARP IMAGES
  - STEP AND SHOOT METHOD (ONE EXPOSURE DONE AT EACH POSITION OF TUBE BETWEEN MOVEMENTS)

# DBT

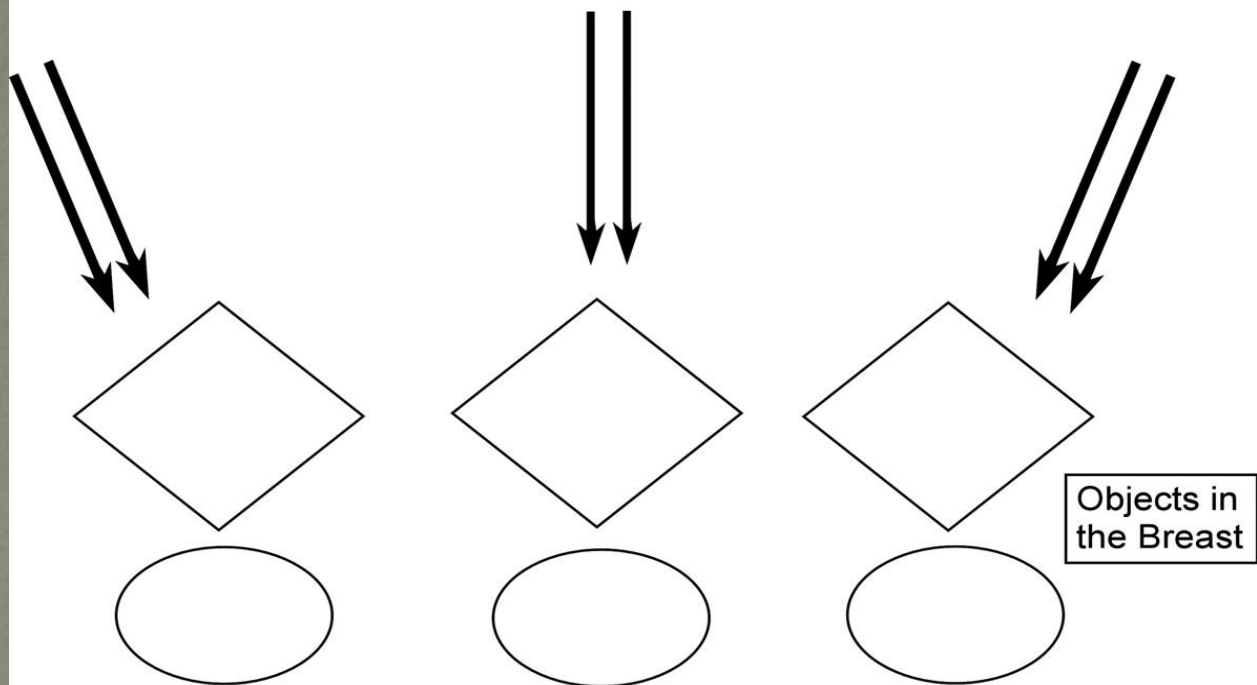
- 3D IMAGE OBTAINED THEN RECONSTRUCTED AS CONVENTIONAL MAMMOGRAPHIC VIEWS:
- CRANIOCAUDAL
- MEDIOLATERAL OBLIQUE
- MEDIOLATERAL







Incident X-rays



Objects in the Breast

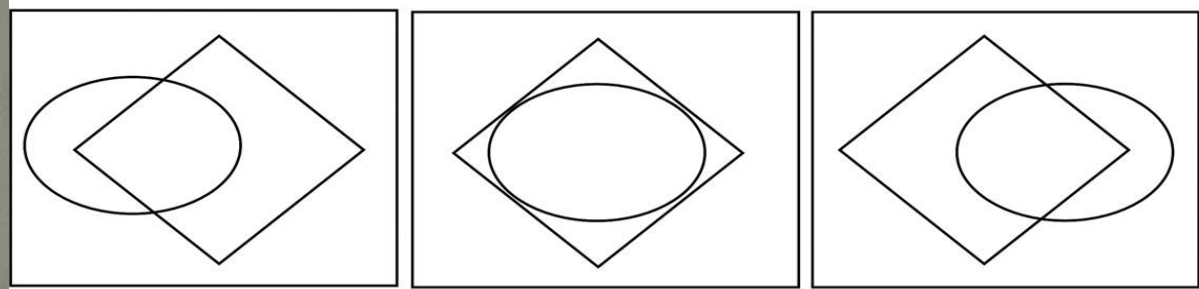
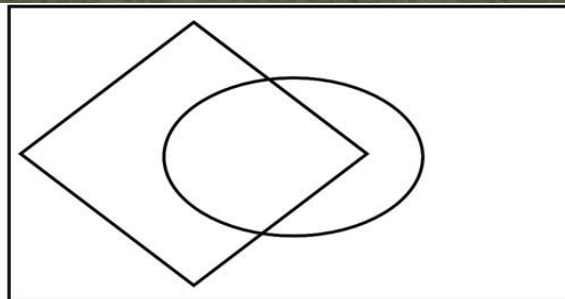
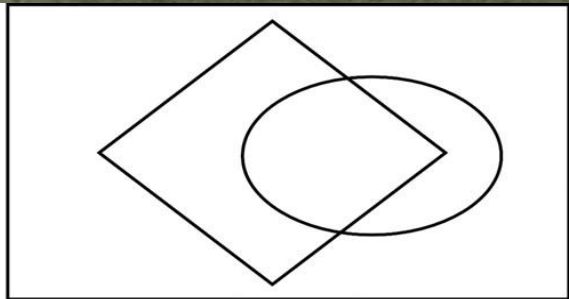
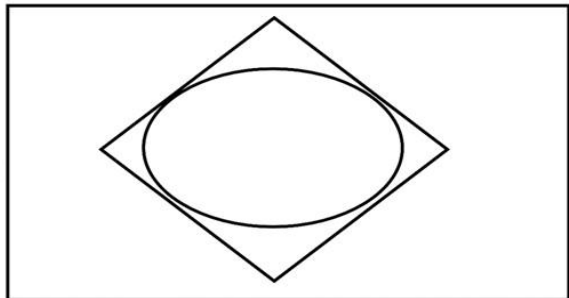


Image as seen on  
cassette or digital detector

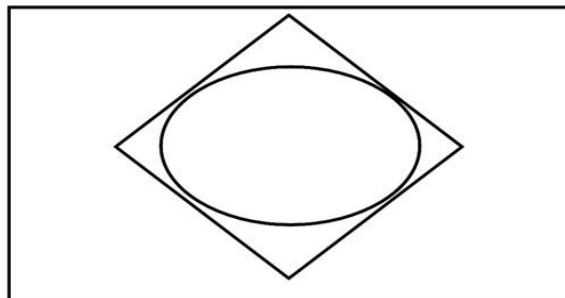




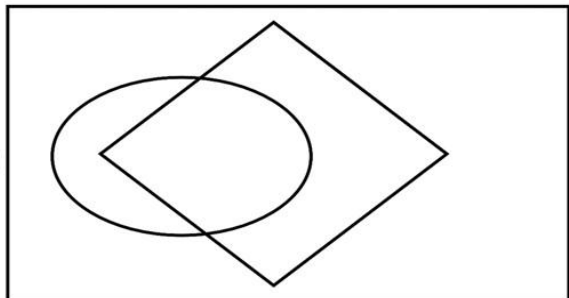
+



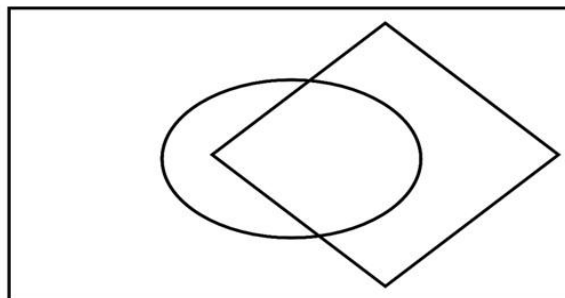
+



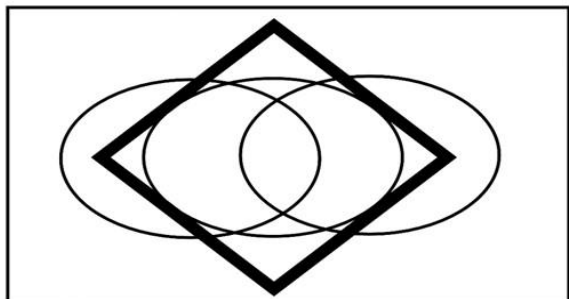
+



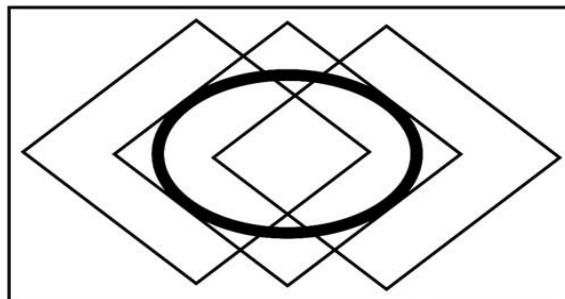
+



=



=



# DBT

- REQUIRES HIGH QUALITY FULL FIELD FLAT PANEL DETECTOR—WITH CAPABILITIES FOR RAPID READOUT AND IMAGE DISTORTION
- SELENIUM-- SUITABLE DETECTOR MATERIAL WITH HIGH DOSE EFFICIENCY
  - 95% X RAY ABSORPTION AT MAMMOGRAPHIC ENERGIES
- DETECTOR PROVIDES WIDER FIELD OF VIEW AND ALLOWS BETTER INCLUSION OF PERIPHERAL BREAST TISSUE

# DBT

- TOTAL ACQUISITION FOR ONE VIEW – APPROX 10 SECONDS
- TOTAL RADIATION DOSE 145 mrad (1.45 mGy) WITH NORMAL BREAST COMPRESSED THICKNESS OF 4.2 CM
- COMPRESSION STILL NECESSARY TO IMMOBILIZE THE BREAST AND REDUCES RADIATION DOSE BY DECREASING BREAST THICKNESS
- REQUIRES LESS COMPRESSION THAN DOES 2D DIGITAL
- TOTAL EXPOSURE FOR 2 VIEW DBT WOULD BE SIMILAR TO OR LESS THAN THAT OF CONVENTIONAL MAMMOGRAPHY



# DBT

- SAME ADVANTAGES AS DIGITAL MAMMOGRAPHY:
- REPRODUCIBILITY
- LESS IMAGE NOISE
- FEWER ARTIFACTS
- CONSISTENT IMAGE QUALITY
- DIGITAL IMAGE PROCESSING

# DBT

- USE IN SCREENING EXAMINATIONS:
- REDUCTION OF RECALL RATE
- HIGHER POSITIVE PREDICTIVE VALUE FOR BIOPSY RECOMMENDATION
- DECREASE # OF UNNECESSARY BIOPSIES
- IMPROVED LESION PERCEPTION AND ANALYSIS---  
THEREFORE HIGHER CANCER DETECTION RATES

# DBT

- DISADVANTAGES:
- SPECIAL TRAINING FOR TECHNOLOGISTS FOR POSITIONING
- INCREASED INTERPRETATION TIME DUE TO LARGE # OF RECONSTRUCTED IMAGES
- ADDITIONAL TRAINING TO INTERPRET 3D IMAGES
- PRIOR FULL FIELD DIGITAL MAMMOGRAPHY
- TRAINING CANNOT BE USED AS A SUBSTITUTE FOR DBT



# DISADVANTAGES

- MOTION ARTIFACTS DUE TO LONGER EXPOSURE TIME
- DOES NOT OFFER MORE INFORMATION FOR LESIONS ALREADY WELL DEMONSTRATED ON 2D

# CONCLUSION

- CERTAIN POOL OF OUR PATIENT POPULATION WILL BENEFIT FROM THIS TECHNOLOGY NOW THAT IT HAS BEEN APPROVED IN THE UNITED STATES
- IMPROVED SENSITIVITY AND SIGNIFICANT GAINS IN SPECIFICITY THAT WE ALREADY HAVE WITH 2D DIGITAL
- CURRENTLY AVAILABLE IN MORE THAN 40 COUNTRIES
- BASICALLY REQUIRE A SOFTWARE ADDITION TO EXISTING 2D SELENIA AND NO NEED FOR NEW HARDWARE

- DIAGRAMS -----COURTESY OF  
RADIOGRAPHICS OCTOBER 2007



• THANK YOU