Ultrasound QC Workshop

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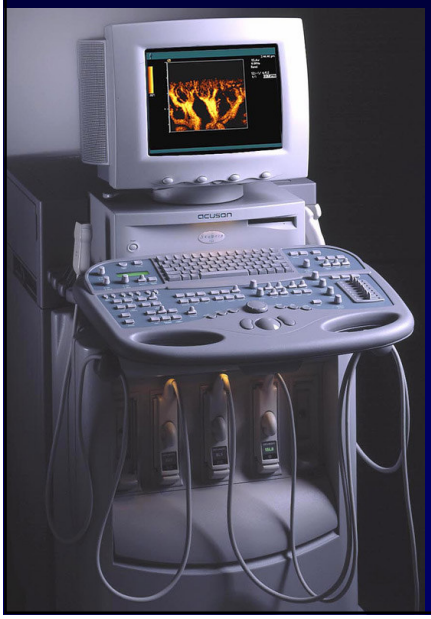
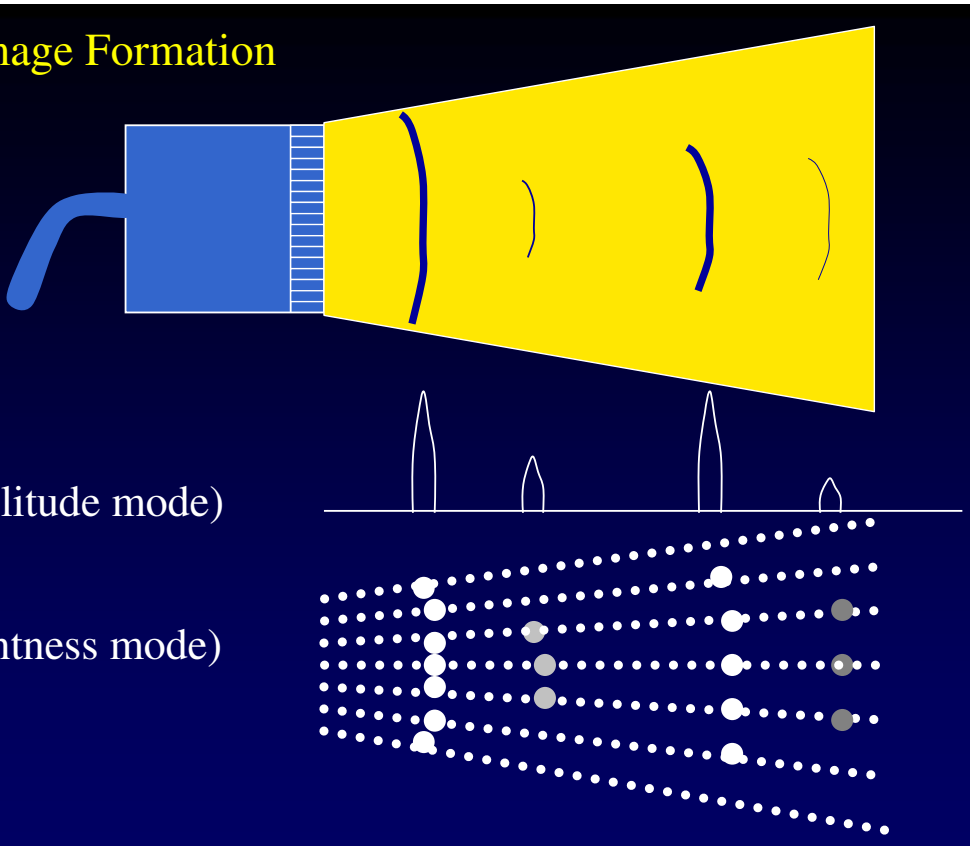


- Basic physics
- Recent developments

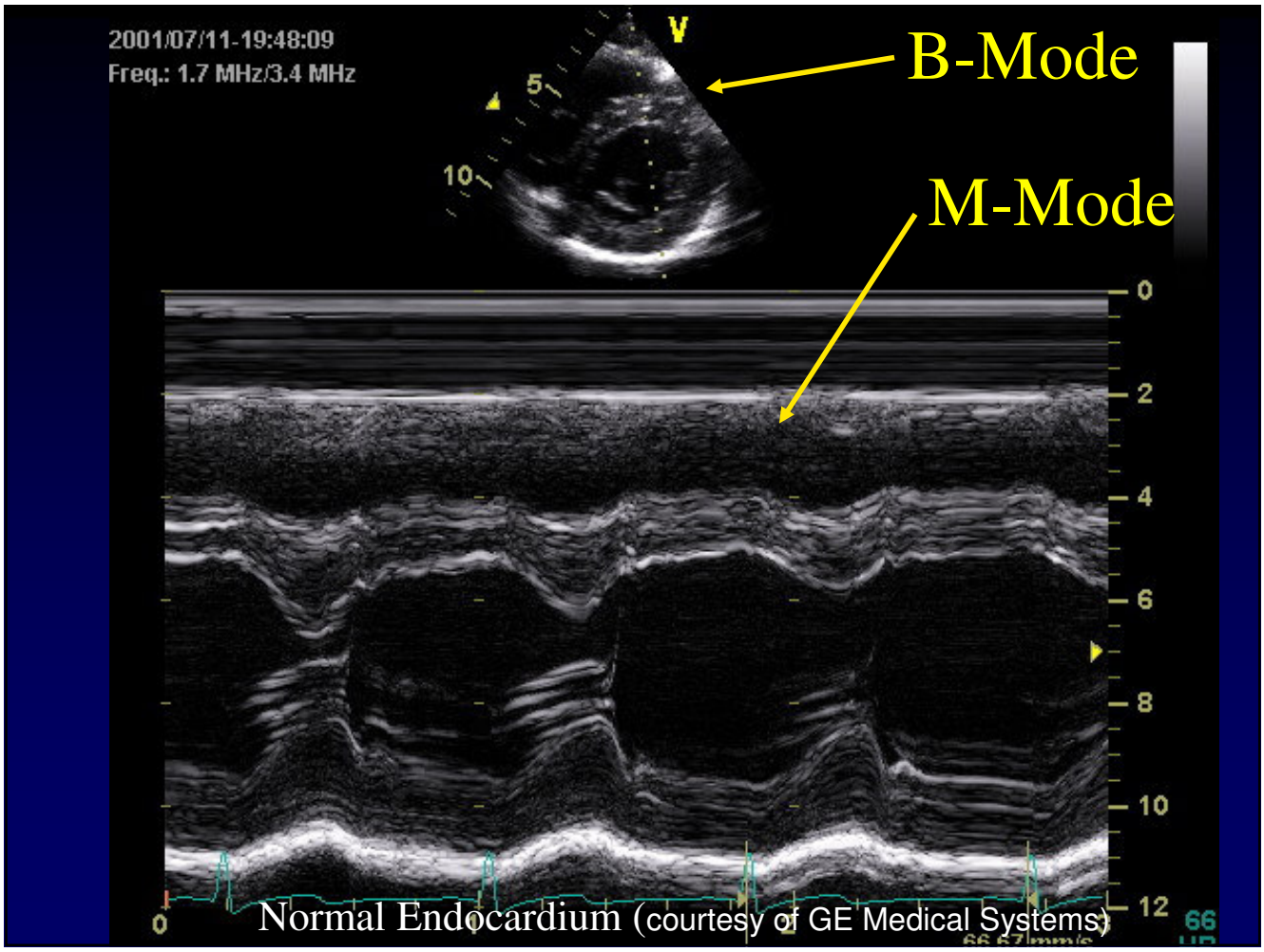
Ultrasound Image Formation



A-mode (Amplitude mode)

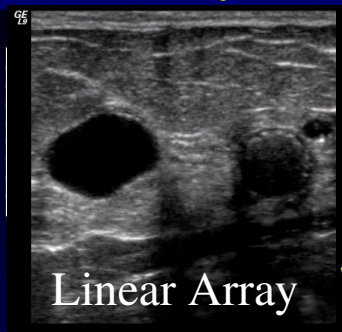
B-mode (Brightness mode)

Range Equation: $D = ct/2$ where $c = 1.54$ mm/μs for soft tissues


2001/07/11-19:48:09
Freq.: 1.7 MHz/3.4 MHz
B-Mode
M-Mode
Normal Endocardium (courtesy of GE Medical Systems)

Types of Array Transducers

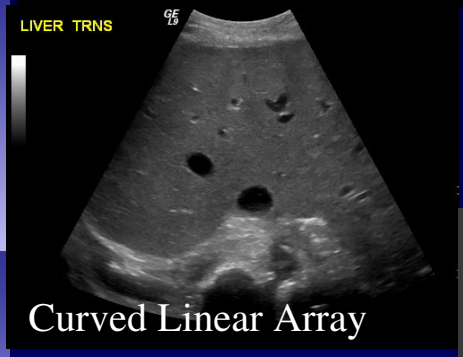
Linear Array



Linear Array

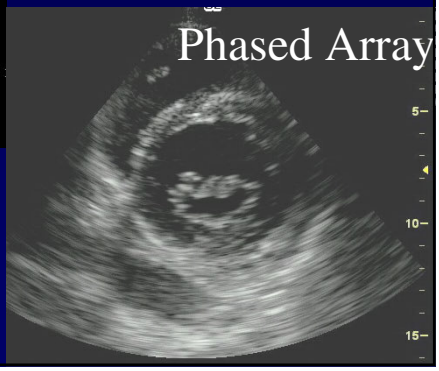
Virtual Convex

Curved Linear Array

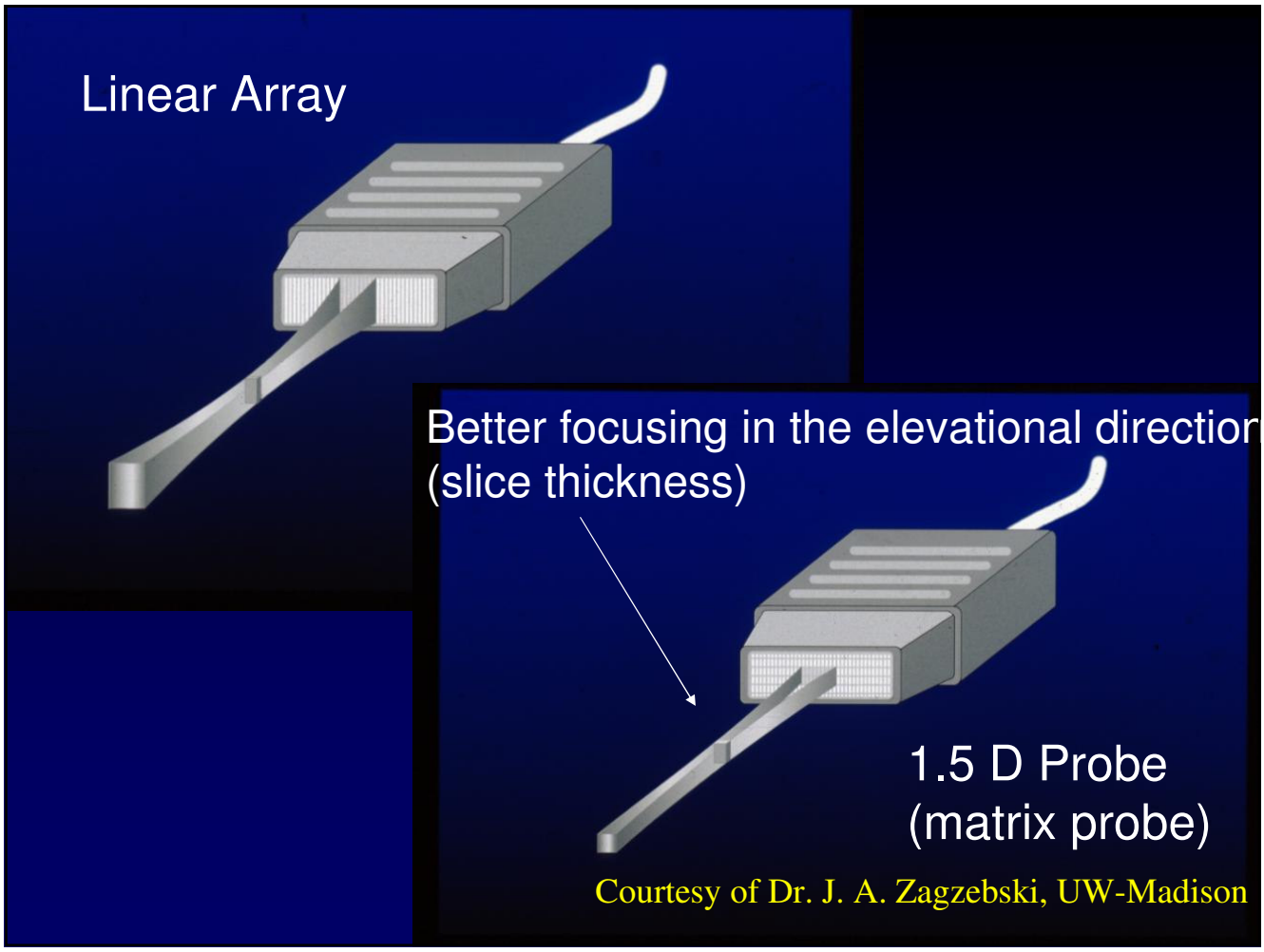


Curved Linear Array

Phased Array

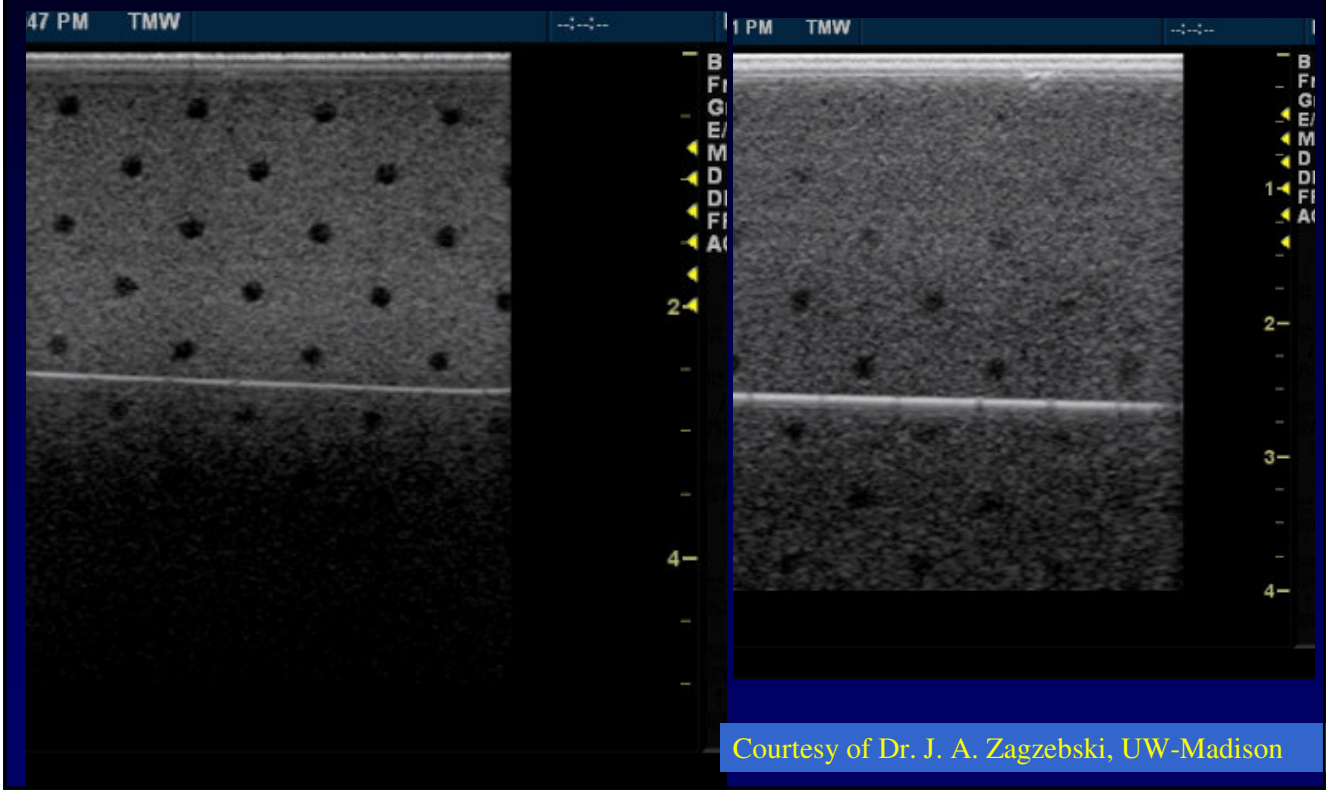


Phased Array


Linear Array
Better focusing in the elevational direction
(slice thickness)
1.5 D Probe
(matrix probe)
Courtesy of Dr. J. A. Zagzebski, UW-Madison

1.5 D (Matrix) Transducer

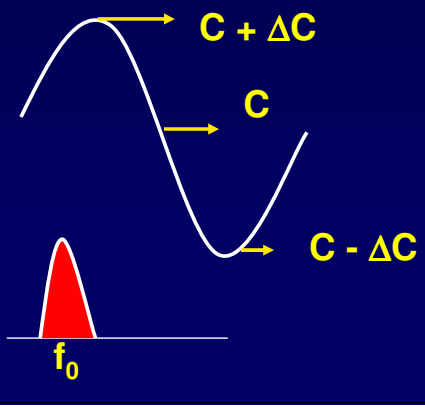
Conventional Linear Array Transducer



Courtesy of Dr. J. A. Zagzebski, UW-Madison

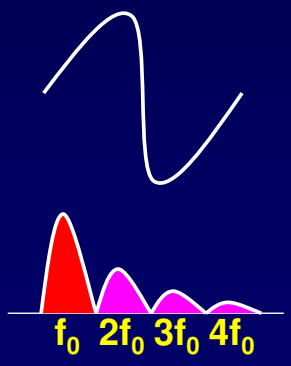
Tissue Harmonic Imaging

Fundamental freq.



Sound propagation

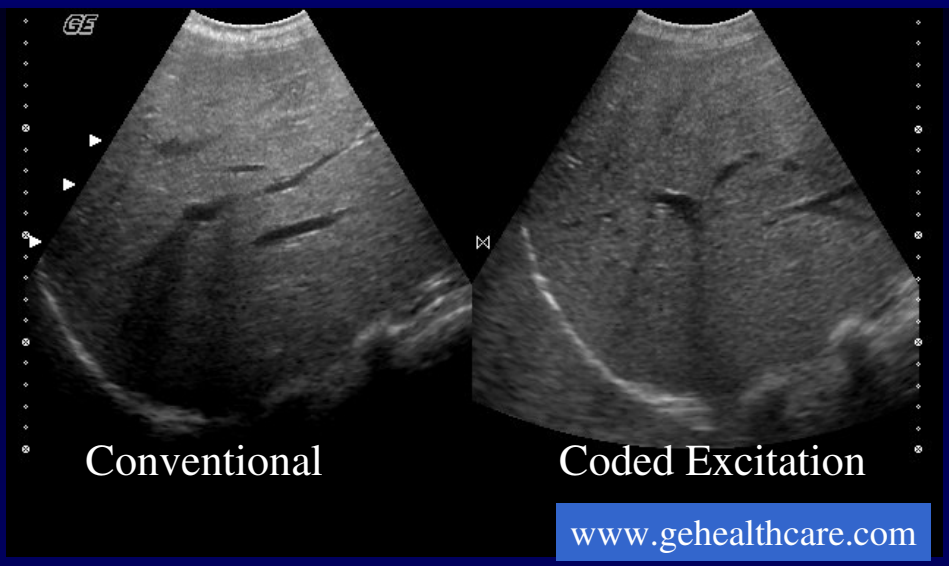
Increasing harmonics



General Benefits of Harmonic Imaging

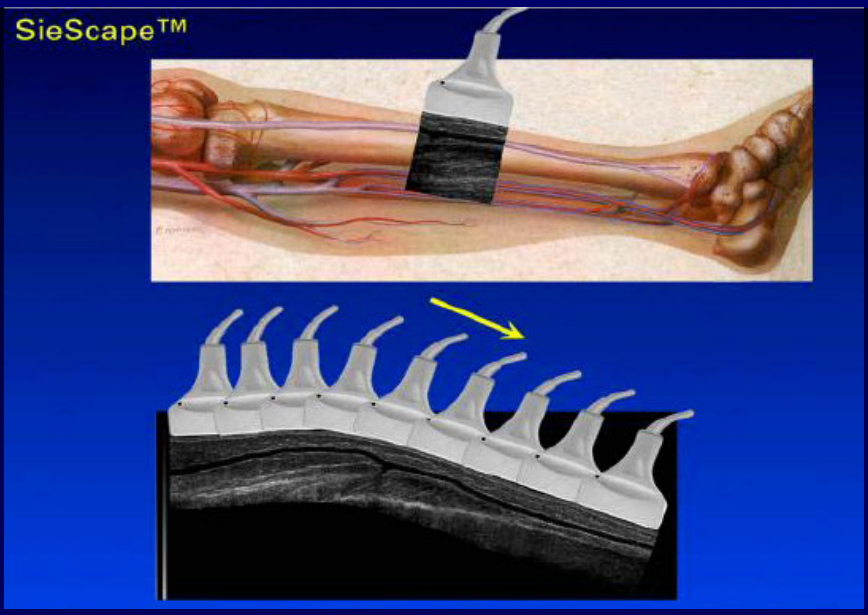
- Less affected by the overlying body wall
- Less reverberation
- Less beam aberration
- Less beam side lobe effect
- Improved contrast resolution
- Improved sharpness

Coded Excitation



- Built-in encoder for the transmitted pulse
- Decoder for the received echo signals
- Improve the signal-to-noise ratio; thus improve the system sensitivity

Extended Field-of-View



- Display better the extended structure of anatomy
- Demonstrate better the spatial relationship among structures
- Provide more accurate quantification of size/volume

Real-time Compound Imaging

- Ultrasound beam is steered into different angles
- Real-time compound: multiple steered frames are rendered
- The resultant image is less speckled and has higher SNR

3D/4D Ultrasound

- 4D is real-time 3D ultrasound
- 3-D acquisition: motor driven scan head,
  2D array,
  free hand.