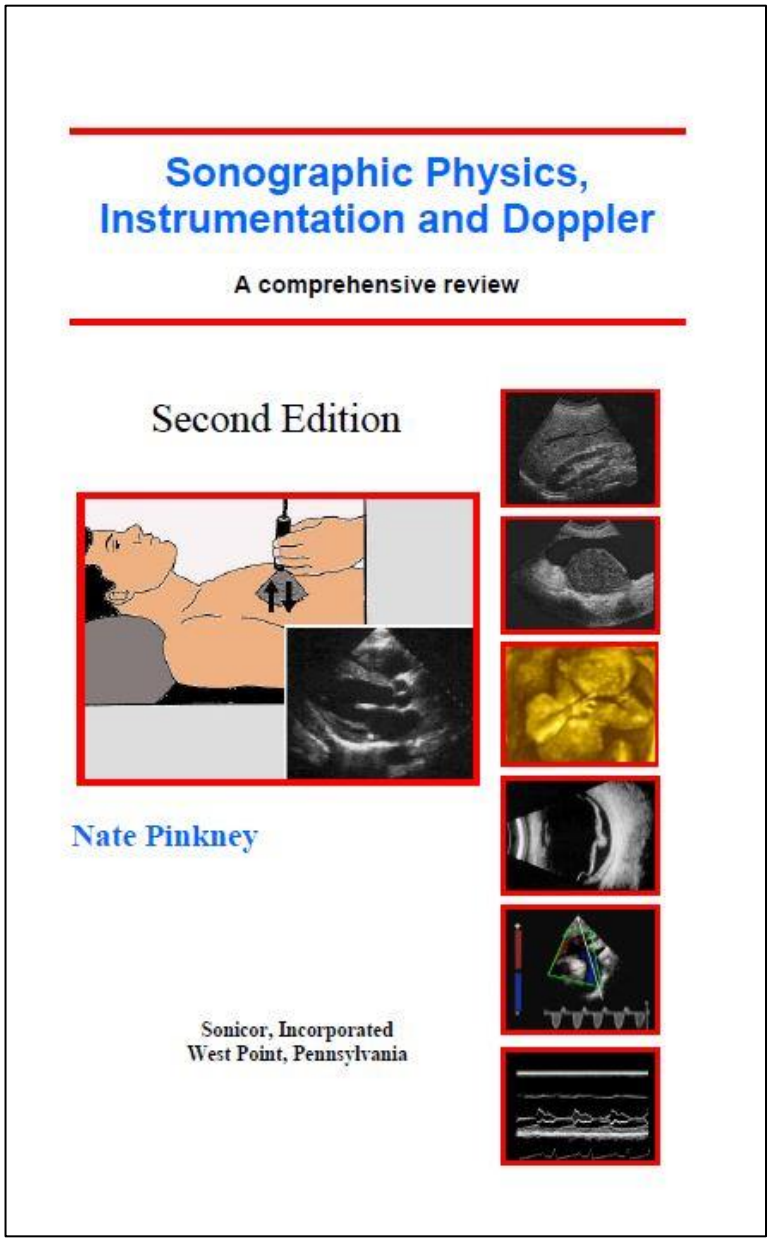
Lesson 05:

Intensity Measurements and Bioeffects

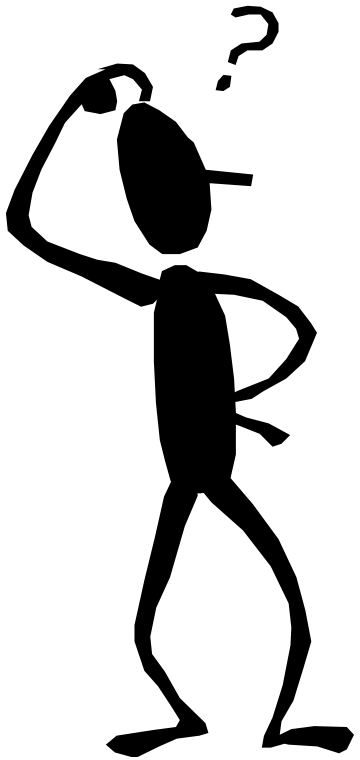
This lesson contains 12 slides plus 6 multiple-choice questions.

Accompanying text for the slides in this lesson can be found on pages 22 through 24 in the textbook:



Intensity Measurements and Bioeffects

How are intensity measurements made?



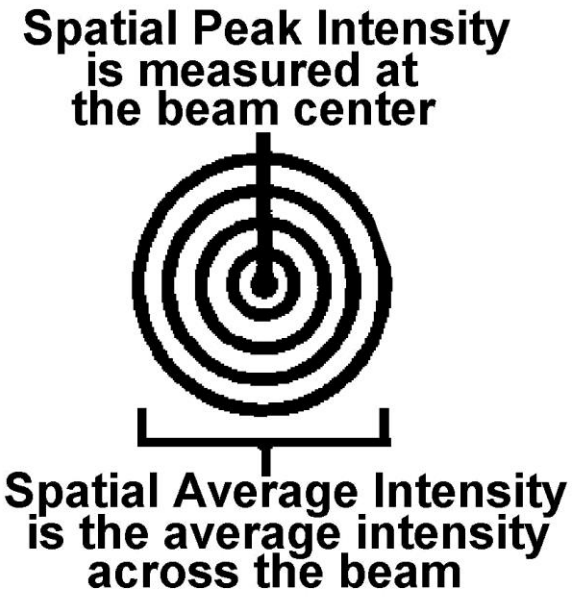
SATA

SPTA

SATP (SAPA)

SPTP (SPPA)

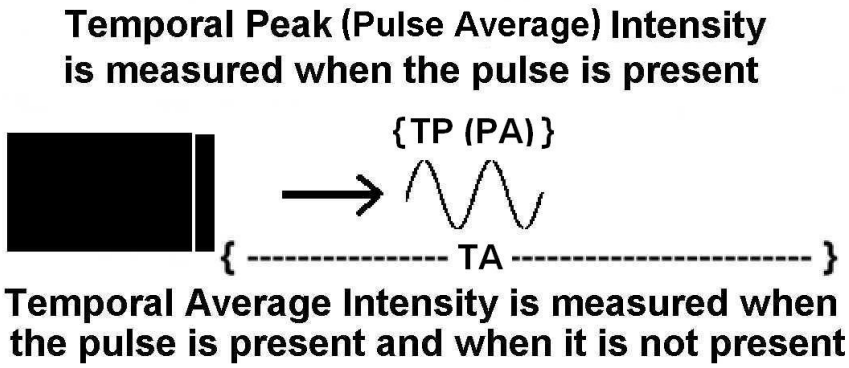
Where in the beam's cross section will the measurement be made?



$I_{SP} > I_{SA}$

The *Beam Uniformity Ratio* (B.U.R.) is the ratio of Spatial Peak to Spatial Average.

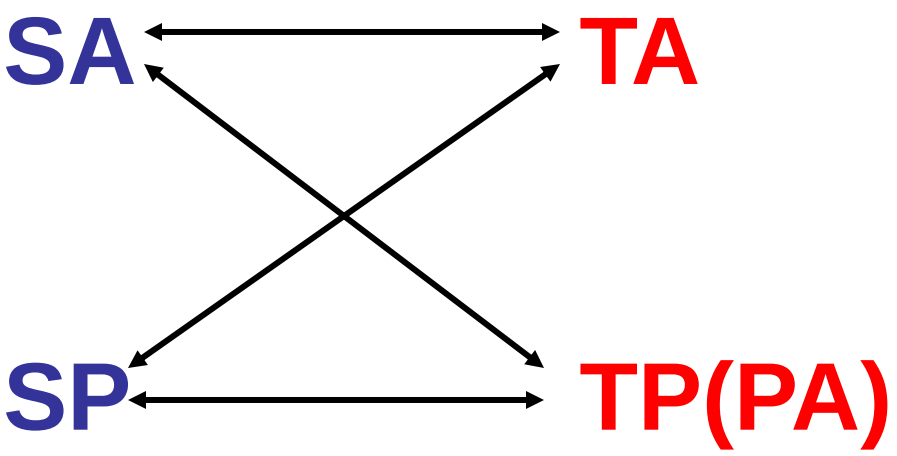
When *(*during the pulse - receive interval) will the measurement be made?



$I_{TP} > I_{PA} > I_{TA}$

For pulse-echo measurements, the result obtained with the TA method is affected by the duty factor

WHERE WHEN



WHERE - WHEN

SATA

SPTA

SATP(PA)

SPTP(PA)

Which method produces the lowest result?

Which method produces the highest result?

I_{SATA} • I_{SPTA} • I_{SATP} (I_{SAPA}) • I_{SPTP} (I_{SPPA})

Lowest → **Highest**

BIOEFFECTS

HEAT (Thermal)

CAVITATION (Mechanical)

SAFETY INDICES

MECHANICAL INDEX

THERMAL INDEX

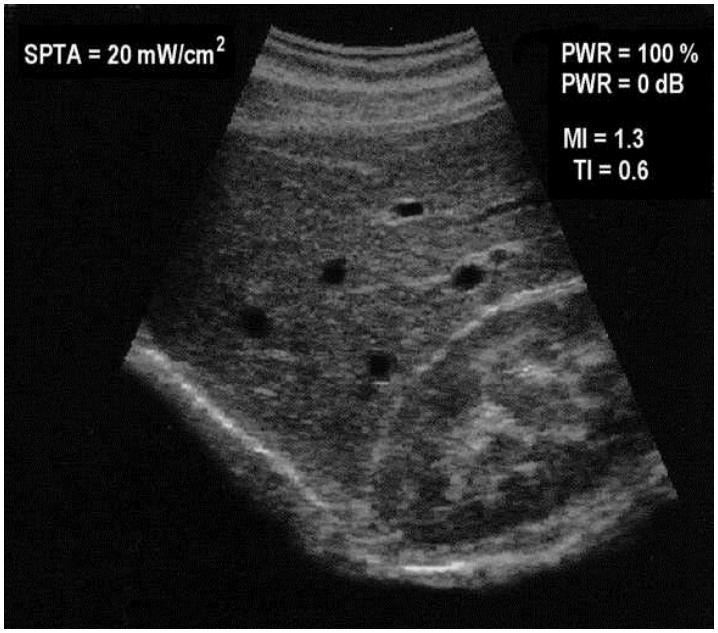
BIOEFFECTS

Nonfocused: SPTA < 100 mW / cm^2

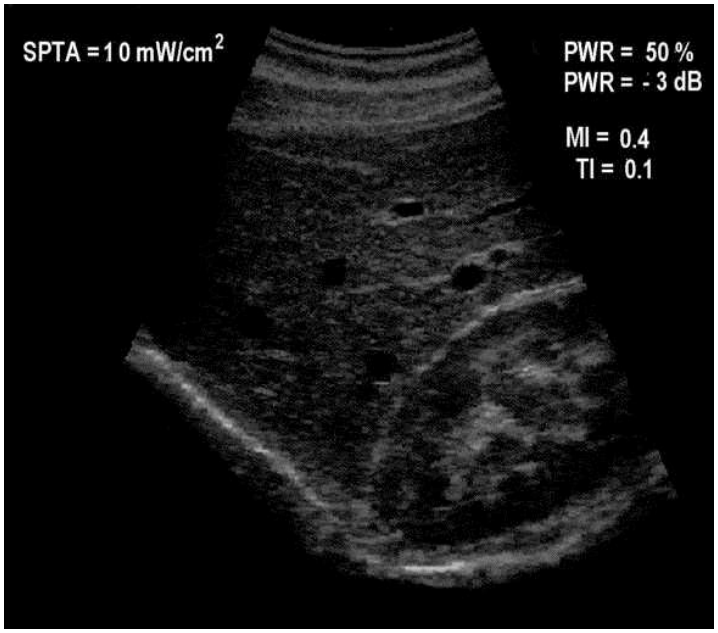
(0.1 Watt per square centimeter)

Focused: SPTA < 1 W / cm^2

TYPICAL METHODS FOR DISPLAY OF RELATIVE INTENSITIES



OUTPUT POWER AT MAXIMUM



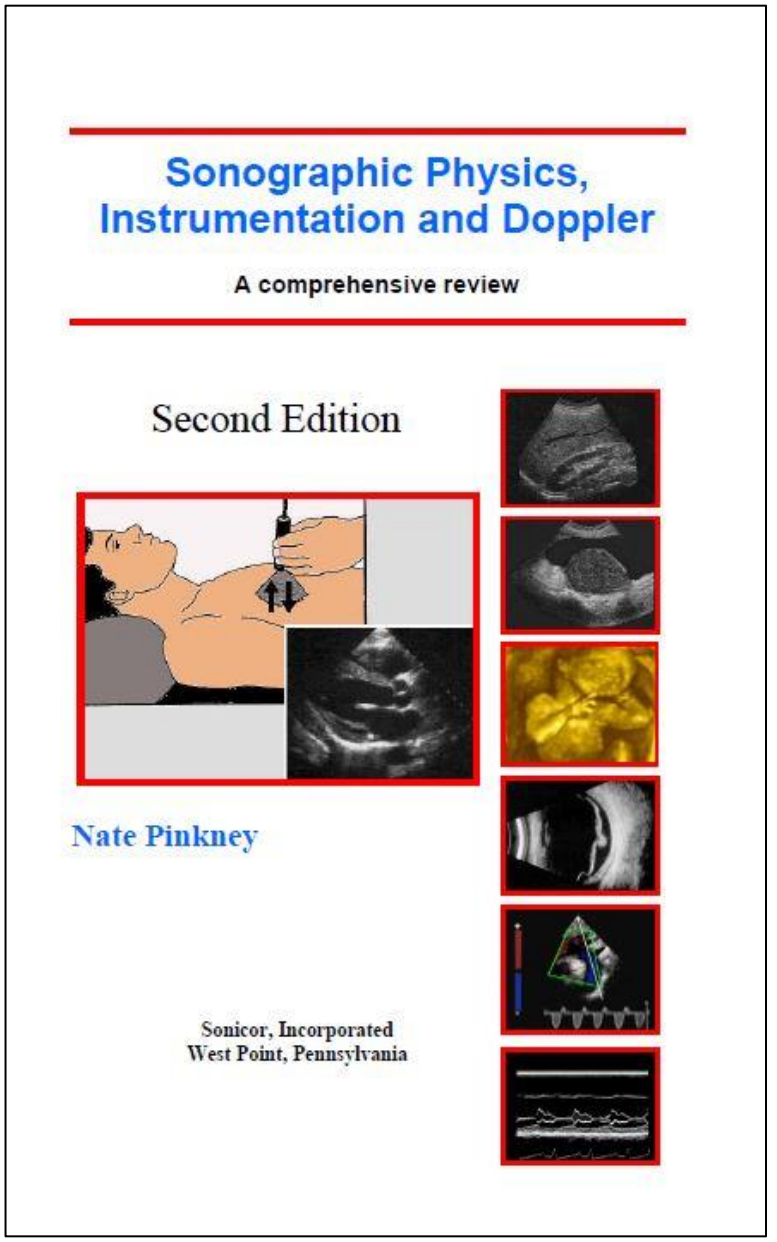
OUTPUT POWER AT ONE - HALF

INTENSITY

INTENSITY = POWER DIVIDED BY AREA

POWER	BEAM DIMENSIONS	AREA	INTENSITY
100 mw	1 cm x 1 cm	1 cm^2	100 mW / cm^2
100 mw	1.414 cm X 1.414 cm	2 cm^2	50 mW / cm^2
100 mw	2 cm x 2 cm	4 cm^2	25 mW / cm^2
50 mw	1.414 cm x 1.414 cm	2 cm^2	25 mW / cm^2

Answers to the following SIX practice questions were derived from material in the textbook:



Question 1

Which intensity measuring method provides the highest result?

- SPTA
- SPTP
- SATA
- SAPA

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- SPTA
- SPTP
- SATA
- SAPA

Question 2

A hydrophone probe can be used to measure the

- ultrasound intensity
- beamformer voltage
- bandwidth
- ultrasound frequency

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Question 3

Thermal bioeffects of ultrasound energy have been determined experimentally by using

- epidemiological and cavitation studies
- cavitation detectors
- animal and in vitro studies
- hydrophones

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Question 4

Potential bioeffects of ultrasound can be minimized by

- using high pulse repetition frequencies
- increasing the mechanical index
- increasing the thermal index
- reducing the time of the examination

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- increasing the thermal index
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Question 5

Since very little is known about bioeffects and assuming that there could be a minimal risk of bioeffects when using diagnostic ultrasound, what would be the best course of action?

- Perform fewer ultrasound examinations but increase the time of each examination
- Perform ultrasound examinations only when a crash cart is available.
- Use pulsed Doppler only for obstetrical studies.
- Use ultrasound when the expected benefit outweighs the potential risk

Question 5

Since very little is known about bioeffects and assuming that there could be a minimal risk of bioeffects when using diagnostic ultrasound, what would be the best course of action?

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Question 6

Sound power is measured in units of

- dB/cm
- mW/cm
- watts/m^3
- watts

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END OF LESSON 05

For information on the accompanying textbook, visit the Website:

www.Sonicorinc.com