evaluated by imaging a phantom composed of parallel strings. The straightness and parallelism of the string images were used to evaluate geometric image distortion, and a comparison of the image separations to known values was used to evaluate geometric accuracy. Resolution degradation was tested by comparing the full-widths at half-maximum (FWHM) of the string cross-sections in the 3-D image to their 2-D counterparts. *RESULTS:* Distances and volumes measured from the reconstructed 3-D image are accurate and precise to within 2% rms. The string images are straight and parallel to within 1 degree rms, and the FWHM of their cross-sections are increased by less than 5% in going from 2-D to 3-D. *CONCLUSION:* The 3-D image is geometrically accurate, virtually undistorted, and negligibly degraded by the reconstruction process.

0517 Resolution Obtained from One-Dimensional and Two-Dimensional Time-Shift Compensation Using Measurements of Pulses Transmitted Through Tissue

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OBJECTIVE: To compare the focus obtained with one-dimensional and two-dimensional time-shift compensation. *METHODS:* The comparison employed measurements of pulses from a hemispheric transducer in a two-dimensional aperture after propagation through fourteen different specimens of human abdominal wall. An arrival time surface was estimated and a smooth fit was found to correct for geometric path. Corrected wavefronts were averaged in elevation over varying distances to emulate a one-dimensional aperture of different elevation dimensions. Time-shift compensation was performed independently on one-dimensional and two-dimensional data. The one-dimensional waveforms were redistributed over elevation to create a pseudo two-dimensional aperture with the same size as the original aperture. Fourier focusing was used to calculate the focus in the central elevation. *RESULTS:* For a 92.16 mm long aperture, the −20 dB array direction effective width of the focus from one-dimensional compensation averaged 3.88, 5.00, and 5.82 mm for elevations of 11.52, 23.04, and 46.08 mm, respectively, while the corresponding widths from two-dimensional compensation were 3.27, 3.12, and 3.06 mm. *CONCLUSIONS:* Effective widths from one-dimensional and two-dimensional compensation are comparable for an elevation of about 1 cm but the effective width obtained from one-dimensional compensation increases substantially when the elevation dimension is quadrupled while the corresponding width for two-dimensional compensation decreases slightly.

0509 A General-Purpose Real-Time Scanner for Evaluation of Beam Geometry in Medical Imaging

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OBJECTIVE: To construct a general-purpose real-time scanner for evaluation of a wide range of different beams in medical imaging. *METHODS:* We designed and constructed a custom-built transmitter unit interposed between an Interspec APOGEE CX commercial scanner and its associated probe head. The transmitter unit holds up to 8 different waveforms and transmits any one of them on receiving a scan trigger from the APOGEE CX. Received signals from a 14-element 1-inch diameter annular array probe are combined into 6 groups of approximately equal area to interface with the scanner's dynamically focused receiver. The APOGEE CX performs all signal processing, image formation, and display functions. The custom-built transmitter unit consists of a 14-channel digital waveform synthesizer followed by 14 high-voltage linear amplifiers to drive the elements of the transducer. An on-board PC stores the individual waveforms on a floppy disk, downloading them to the synthesizer memories automatically. At a trigger from the APOGEE CX, waveform data for each channel are read out of high-speed memories through 35 MHz D/A converters and amplified by high peak linear power amplifiers. Physicians can examine patients by switching through the 8 beams (marked sequentially with letters) and indicate their preference for the beams. Results will be statistically evaluated and compared. *RESULTS:* The system is now able to produce both limited diffraction beams and conventional focused beams. It will be evaluated in an outpatient service. Images from patients using this system will be shown. *CONCLUSION:* We have constructed a real-time scanner for evaluation of a wide range of beams including limited diffraction beams, Axicon and conventional beams. Physicians can quickly select their preferred beams for each situation. This work was supported in part by CA 43820 and CA 54212 from the National Institutes of Health.

0507 Elastography: Properties and Artifacts

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— problems with terrible resolution

As with every imaging modality, recognition of artifacts in elastograms is an important requisite for understanding the image formation process, and for separating real from artifactual information in the image. In elastography, three separate components contribute to the observed properties of the technique and also to image artifacts. These are the mechanical properties of the target tissue and its boundary conditions, the acoustic properties of the target tissue and the particulars of the ultrasonic instrumentation, and the signal processing algorithms used. (1) Mechanical effects: a. apparent target hardening or softening artifacts; b. bidirectional elastic shadowing of enhancement; and c. apparent softening of the lateral margins of hard inclusions. (2) Acoustical effects: a. the ability to image elasticity in deep acoustic shadows; b. the ability to image elasticity in ultrasonically saturated regions; and c. reveberant phenomena visible only on elastograms. (3) Signal processing effects: a. granularity in elastograms; b. leakage of sonographic amplitude noise into the elastogram; and c. tradeoffs between resolution and signal-to-noise ratio in the elastogram. A demonstration of these effects and an explanation of their causes will be given.

0506 Improvement of Signal-To-Noise Ratio in Elastography

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Elastography is a method for imaging the elastic properties of compliant tissues which produces gray scale elasticity images called elastograms. The elastograms of phantoms with homogenous elastic properties exhibit a noisy appearance. We demonstrate that this noisy appearance of the elastograms is due to the nonstationary relationship between the pre- and postcompression signals that results in an artifictual modulation of the strain estimates by the amplitude variations of the envelope of the rf signal. We have identified a method to reduce the strain modulation artifact. The method consists of reducing the signal amplitude swings within the observation windows by logarithmically or otherwise compressing the rf signal. The sensitivity of this method to amplitude

Journal of
Ultrasound
in Medicine

VOLUME 13, NUMBER 3 (SUPPLEMENT) MARCH 1994

OFFICIAL PROCEEDINGS
38TH ANNUAL CONVENTION

March 20–23, 1994
Baltimore, MD

Official Journal of the American Institute of Ultrasound in Medicine

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March 20, 1994