Dynamic focusing was performed at all distances and angles. The broadband transducer facilitates the selection of select bandwidths during analysis, which is beneficial for studying surfaces of varying roughness scales. Sandpaper of 150-, 400-, and 600-grit were examined for this study. The normalized average backscattered power (normalized with 150-grit) for 7–8 MHz frequency band provides well-behaved roughness characteristics. The students t test showed that the backscattering results for the 150- and 400-grit are significantly different with $0.025 < p < 0.05$. We are extending this work to *in vitro* cartilage and will report these results as well. [Research supported by NIH R01-AR42667-01A2.]

3:50

5pBB8. Design and construction of a high frame rate imaging system. Jing Wang, John L. Waugaman, Anjun Liu, and Jian-yu Lu (Ultrasound Lab., Dept. of Bioengineering, The Univ. of Toledo, Toledo, OH 43606, jilu@eng.utoledo.edu)

A new high frame rate imaging method has been developed recently [Jian-yu Lu, "2D and 3D high frame rate imaging with limited diffraction beams," IEEE Trans. Ultrason. Ferroelectr. Freq. Control **44**, 839–856 (1997)]. This method may have a clinical application for imaging of fast moving objects such as human hearts, velocity vector imaging, and low-speckle imaging. To implement the method, an imaging system has been designed. The system consists of one main printed circuit board (PCB) and 16 channel boards (each channel board contains 8 channels), in addition to a set-top box for connections to a personal computer (PC), a front panel board for user control and message display, and a power control and distribution board. The main board contains a field programmable gate array (FPGA) and controls all channels (each channel has also an FPGA). We will report the analog and digital circuit design and simulations, multi-player PCB designs with commercial software (Protel 99), PCB signal integrity testing and system RFI/EMI shielding, and the assembly and construction of the entire system. [Work supported in part by Grant 5RO1 HL60301 from NIH.]

4:05

5pBB9. Logic design and implementation of FPGA for a high frame rate ultrasound imaging system. Anjun Liu, Jing Wang, and Jian-yu Lu (Ultrasound Lab, Dept. of Bioengineering, The Univ. of Toledo, Toledo, OH 43606, jilu@eng.utoledo.edu)

Recently, a method has been developed for high frame rate medical imaging [Jian-yu Lu, "2D and 3D high frame rate imaging with limited diffraction beams," IEEE Trans. Ultrason. Ferroelectr. Freq. Control **44**(4), 839–856 (1997)]. To realize this method, a complicated system [multiple-channel simultaneous data acquisition, large memory in each channel for storing up to 16 seconds of data at 40 MHz and 12-bit resolution, time-variable-gain (TGC) control, Doppler imaging, harmonic imaging, as well as coded transmissions] is designed. Due to the complexity of the system, field programmable gate array (FPGA) (Xilinx Spartn II) is used. In this presentation, the design and implementation of the FPGA for the system will be reported. This includes the synchronous dynamic random access memory (SDRAM) controller and other system controllers, time sharing for auto-refresh of SDRAMs to reduce peak power, transmission and imaging modality selections, ECG data acquisition and synchronization, 160 MHz delay locked loop (DLL) for accurate timing, and data transfer via either a parallel port or a PCI bus for post image processing. [Work supported in part by Grant 5RO1 HL60301 from NIH.]