

Verasonics®

The New Vantage 256 and Vantage 128 Systems

A Revolutionary Approach to Ultrasound System Architecture

Verasonics has developed a revolutionary ultrasound system architecture that provides researchers and developers a unique platform with unparalleled performance and flexibility for medical ultrasound innovation. The system uses proprietary hardware and software technologies to provide direct access to raw ultrasound data, while preserving the ability to perform high quality real-time imaging with custom software, at clinically useful frame rates.

Unparalleled Flexibility and Speed

The system is designed to provide the researcher/developer with broad flexibility in defining each of the system's functional components, using a familiar software interface based on the MATLAB® programming environment. Indeed, a single researcher can conceive, implement, and evaluate a new approach to medical ultrasound imaging, and ultrasound therapy monitoring or delivery, using the Verasonics system. From integration of a custom transducer array to incorporation of a custom beamformer, or adding user-defined image processing algorithms, the researcher can develop their own ultrasound system prototype and evaluate it under clinical conditions with unprecedented speed.

All-Software Beamforming and Sequence Control

The Verasonics architecture provides this flexibility to the researcher by eliminating hardware beamformers, and instead uses patented algorithms to perform image reconstruction with highly optimized software, running on a desktop or laptop computer. Consequently, many new acquisition schemes using unconventional transmit beams and transmit/receive sequences can be readily examined using the Verasonics system, whereas such approaches typically cannot be implemented using conventional data flow architectures that are based on hardware.



Verasonics' Unique Technology Advantages

The Vantage Systems are comprised of 3 fundamental components:

- The Verasonics Data Acquisition system, with state of the art hardware and design, available in several different configurations and optional features
- The Verasonics Data Acquisition SW package provided by Verasonics, including application-level SW, HAL and driver-level SW, installation and test utilities
- The host computer purchased through Verasonics. The host computer must have an appropriate operating system installed, the MATLAB® application, and other libraries and utilities as specified by Verasonics.

Together these provide:

- Open software-based ultrasound research platform
- Fast software beamforming using proprietary Pixel Oriented Processing
- Flash acquisition using plane wave transmit pulses

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- Data acquisition up to 14,000 frames/second into buffer memory
- Extremely rapid RF signal data transfer to host computer over PCI express gen 3, 8 lanes. Sustained data transfer rates up to 6.6 GB/s
- Two triggered inputs and one triggered output for synchronizing external devices
- Thoroughly documented, flexible and easy-to-use programming API
- Familiar MATLAB® scripting for development of custom user interface
- Rapid integration of custom transducers
- Sample script library for image reconstruction, color processing, and spectral Doppler processing suites as needed, or replace each with user-developed novel algorithms.
- Real-time system simulator simplifies development
- Wideband TGC pre-amps with 42 dB programmable gain range
- Support for 1 – 22 MHz probe frequencies. (5 - 37.5 MHz with high frequency option)
- Programmable anti-aliasing filter cutoff - 10, 15, 20, 30 MHz (40, 50 MHz with high frequency option)
- 14 bit A/D converters with programmable sample rate up to 62.5 MHz
- User-programmable, per-channel digital lowpass (21 tap) and bandpass (44 tap) filters
- RF signal averaging up to 1000 acquisitions enables SNR improvement for very weak signals prior to transfer to computer
- Direct compatibility with ATL HDI probes, including HVMux capability
- Optional extended transmit burst to support long pulses
- Optional external power supply to support HIFU investigations
- Optional signal breakout board enables integration of custom transducers
- NEW Verasonics transducers including linear, curved and phased array designs

Key System Specifications of the Vantage Platforms

- 2 standard configurations: 128Tx/128Rx and 256Tx/256Rx
- Center frequency 0.5 MHz to 20 MHz
- Time delay accurate to 4.0 nsec.
- Programmable pulser amplitude, 3 to 190V p-p
- Tri-state drive: + high voltage, - high voltage and ground
- Arbitrary Waveform Generation: Tri-state level can be programmed independently for every individual clock cycle within the waveform, at 250 MHz waveform clock rate
- Transmit apodization using pulse width modulation
- Average power output, over all channels on system, up to 10W (without high power transmit options)
- Single channel power output: up to 100 Watts peak, 8 Watts average (with 50 Ohm element load impedance)

Modes Provided as Examples

All modes and techniques can be performed *in real-time* with clinically useful frame rates. These modes can be interleaved as desired... also in real-time.

B-Mode beamforming methodologies

- Conventional line mode
- Flash imaging (flat phase “plane-wave” imaging)
- Multi-angle flash imaging
- Overlapping beams
- User programmable beamforming techniques

Doppler sampling methodologies

- Very high frame rate imaging (“ultrafast” imaging) color Doppler

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- Conventional color Doppler
- Plane wave color Doppler
- Vector Doppler imaging capable
- Conventional spectral Doppler
- Wide-area, multi-point spectral Doppler

Additional Modes Implemented by Users on Verasonics Systems

- Elastography
- Speckle tracking
- ARFI - radiation force and push techniques
- Low MI contrast imaging
- Photo-acoustics
- Ablative HIFU transmission with interleaved imaging
- Synchronization of multiple systems up to 1024 channels
- Radiation force targeting and displacement of kidney stones
- Cardiac strain imaging



Patent References

1. US 8,287,456 B2 "Ultrasound Imaging System With Pixel Oriented Processing" Pending in: Japan, Korea, China, EU and Canada
2. US Patent Application No. 12/490,780, Pub. No. WO/2009/158399 "High Frame Rate Quantitative Doppler Flow Imaging Using Unfocused Transmit Beams" Also filed in: Japan, Korea, China, EU and Canada
3. International Patent Application No. PCT/US2008/074055, Pub. No. - WO/2009/026534 "Adaptive Ultrasound Image Reconstruction Based on Sensing of Local Media Motion" Also filed in: Korea, Japan, China, EU and Canada
4. International Patent Application No. PCT US2012/036155 "Enhanced Ultrasound Image Formation using Qualified Regions of Overlapping Transmit Beams"
5. PCT Patent Application No. PCT/US2012/061120 "Estimation and Display for Vector Doppler Imaging using Planewave Transmissions"

Notes:

Maximum display frame rates may be limited by MATLAB® display software. MATLAB® is a registered trademark of The MathWorks, Inc.

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