ZONE Sonography Technology+ (ZST+) is a revolutionary, software-driven approach to acoustic data acquisition and image formation that breaks the barriers of conventional ultrasound imaging based on innovative channel data processing methods. Introduced in 1999, ZST was the first virtual beamforming method approved for use in clinical practice. Thanks to continuous advances and improvement in this core technology, ZST+ has matured into the premier advanced ultrasound imaging architecture that makes novel and innovative diagnostic applications possible. Traditionally, ultrasound acoustic data was acquired line-by-line and focused with a digital beamformer using only a small fraction of the actual information contained in the data set.

By using larger acoustic zones, instead of line by line formation, ZST+ has the potential to capture and utilize virtually all of the information contained in the larger returning acoustic data set. In so doing, it creates high quality, maximally focused images using far fewer transmit/receive cycles. While it might be intuitive that simultaneously collecting data from these larger zones would be more efficient, it is understandably less intuitive that fewer acquisitions could result in improved image quality. However, ZST+ achieves this performance advantage with its unique Technology Triad. This proprietary approach to advanced ultrasound imaging architecture consists of:

- Advanced Acoustic Acquisition (AAA)
- Dynamic Pixel Focusing (DPF)
- Enhanced Digital Signal Processing (eDSP)

Advanced Acoustic Acquisition (AAA) is a software-based data acquisition method that captures up to 90% of the returning acoustic data and then processes it up to 10x faster by interrogating a relatively smaller number of large zones and extracting more information from each acquisition. Conventional ultrasound systems can capture only a few receive data sets from each transmit event due to processing time requirements for each data set which creates an acoustic acquisition backlog that results in processing constraints. This inherent limitation is overcome by using a flexible, software-based channel domain processor.

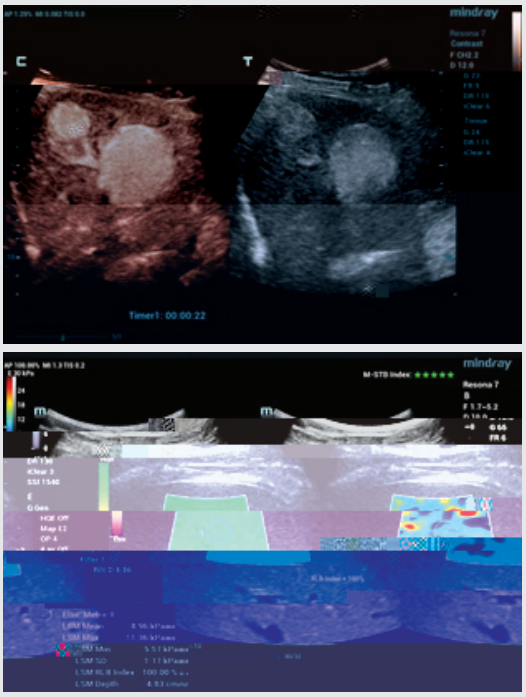
In conventional systems, imaging lines are formed by summing together the contributions of all the channels in the transducer. As soon as each line is formed, the original channel data is discarded. In contrast, ZST+ stores an entire frame of raw channel data in the Channel Domain Memory and this

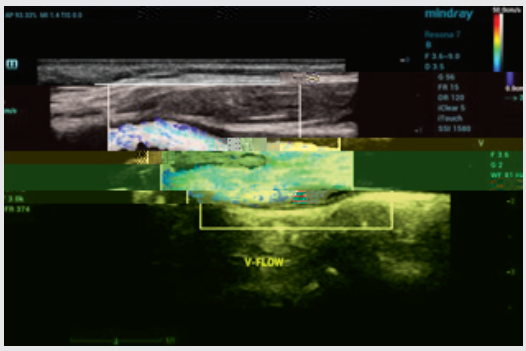
ciently sampled in both the axial and lateral dimensions to prevent several types of imaging artifacts. Dynamic Pixel Focusing permits utilization of the complete channel data set received from multiple, overlapping zones to retrospectively improve the position and focus of each individual data point. Using software algorithms to synthetically focus along every point in the receive beam effectively produces a round-trip beam focused at all depths, eliminating the need for multiple transmit foci. The image is 2-way focused at every point. A typical ZST+ ultrasound image has over 500 range samples, so the net effect is equivalent to a conventional beamformer-based system using 500-600 focal zones.

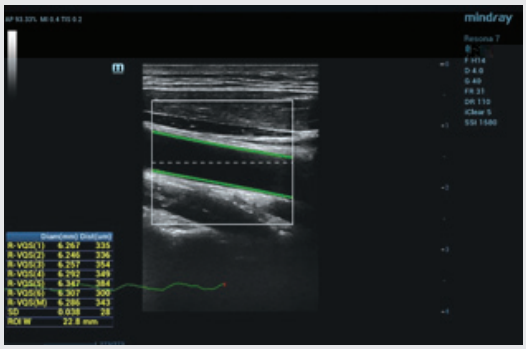
This proprietary method translates into a 2D image that is fully focused from skin line to deepest depth without the need for manual focal zone adjustment. Dynamic Pixel Focusing improves efficiency and the user-experience by reducing need for manual focal zone adjustments and providing a uniform image with improved spatial and contrast resolution throughout the entire field of view. Clinical benefits of Dynamic Pixel Focusing include:

- Full field-of-view focus on transmit and receive
- Use of higher frequency probes for improved image quality at depth
- Improved clinical confidence in imaging neonates to bariatric patients

- Suite of Elastography Methods: Natural Touch Elastography (NTE), Sound Touch Elastography (STE), Sound Touch Elastography Quantitative Analysis (STQ) – *ZST+ increases the amount of data acquired and improves signal to noise ratio compared to conventional beamforming. Ultra-wide beam tracking technology allows for rapid acquisition rates (up to 10KHz) for general imaging depths while using less acoustic power.*







- V Flow – *Vector Flow is an innovative method, based on plane wave acquisition, that analyses the speed and the direction of blood cells flowing through an ROI during an entire cardiac cycle. This Doppler angle independent method of analysis allows for the simultaneous observation of red blood cells moving at low and high velocity in any direction, including reverse.*
- Radio-frequency Vessel Quantitative Stiffness (RVQS) - *proprietary technology that automatically identifies the intimal surface of the artery and tracks changes in vessel diameter over several cardiac cycles. On-board software then calculates the stiffness of the interrogated vessel, a metric useful in cardiovascular risk assessment schema.*

The powerful capabilities of ZST+ provide significant benefits to ultrasound imaging. The acquisition of larger and more robust acoustic data sets coupled with proprietary, industry-first virtual beamforming methods and innovative signal processing techniques translates into a number of unique imaging advantages. These include extremely fast image processing and display for noticeably improved temporal resolution; exceptional image uniformity throughout the field of view with improved spatial and contrast resolution. ZST+ also has the ability to generate novel and exclusive advanced diagnostic applications while improving the performance of established imaging technologies. Virtual beam formation will continue to shape the future of ultrasound imaging in impactful ways, allowing for more powerful technology, improved workflow tools, and the inclusion of more AI-based advancements. ZST+ has paved the way for the future of ultrasound.

-Journal of Diagnostic Medical Sonography

What It Is and How It's Di erent-

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